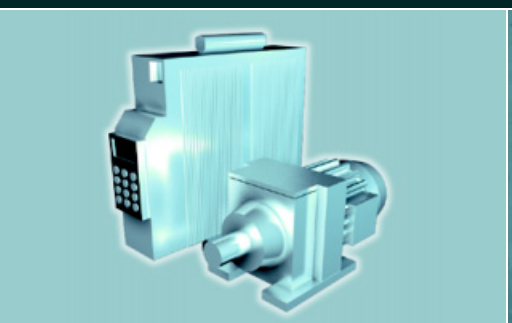
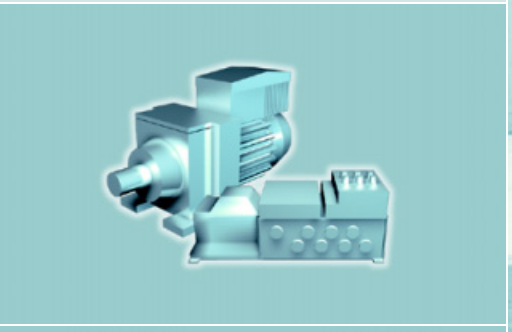
SEW EURODRIVE





MOVIAXIS® MX Multi-Axis Servo Inverter

Edition 03/2007

11536616 / EN

Project Planning Manual

SEW EURODRIVE

1 General Information

1.1 Structure of the safety notes

The safety notes in these operating instructions are structured as follows:

Symbol	⚠ SIGNAL WORD
	Nature and source of hazard. Possible consequence(s) if disregarded. • Measure(s) to avoid the hazard.

Symbol	Signal Word	Meaning	Consequences if disregarded
Example:  General hazard  Specific hazard, e.g. electric shock	⚠ **DANGER**	Imminent hazard	Severe or fatal injuries
	⚠ **WARNING**	Possible hazardous situation	Severe or fatal injuries
	⚠ **CAUTION**	Possible hazardous situation	Minor injuries
	**STOP**	Possible damage to property	Damage to the drive system or its environment
	**NOTE**	Useful information or tip. Simplifies drive system handling	

1.2 Right to claim under warranty

Adhering to the **operating instructions** is **prerequisite for fault-free operation** and the fulfillment of any right to claim under warranty. **You must therefore read the operating instructions** before you start working with the unit.

Make sure that the operating instructions are available to persons responsible for the plant and its operation, as well as to persons who work independently on the unit. You must also ensure that the documentation is legible.

1.3 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of the MOVIAXIS® multi-axis servo inverter and to achieve the specified product characteristics and performance requirements. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

2 Safety Notes

The following basic safety notes are intended to prevent injury to persons and damage to property. The operator must make sure that the basic safety notes are read and observed. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

2.1 General information

Never install or startup damaged products. In the event of damage, submit a complaint to the shipping company immediately.

During operation, drive inverters can have live, bare and movable or rotating parts as well as hot surfaces, depending on their enclosure.

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to property.

Consult the documentation for additional information.

2.2 Target group

Only **qualified personnel** can perform installation, startup, fault repair and servicing (observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE 0110 as well as national accident prevention guidelines).

Qualified personnel in the context of these basic safety notes are persons familiar with installation, assembly, startup and operation of the product who possess the necessary qualifications.

All activity in the other areas of transportation, storage, operation, and disposal must be carried out by persons who are appropriately trained.

2.3 Designated use

MOVIAXIS® MX multi-axis servo inverters are units for use in industrial and commercial systems to operate permanent-field synchronous AC motors and asynchronous AC motors with encoder feedback. These motors must be suitable for operation with servo inverters. Connect other loads to the units only after you have consulted the manufacturer.

MOVIAXIS® MX multi-axis servo inverters are intended for use in metal control cabinets. These metal control cabinets represent the necessary enclosure for the application as well as the grounding over a large area required for EMC purposes.

In case of installation in machines, startup of the multi-axis servo inverter (meaning the start of designated use) is prohibited until it is determined that the machine meets the requirements stipulated in the EC Directive 98/37/EC (machine directive); observe EN 60204.

Startup (i.e. the start of designated use) is only permitted under observance of the EMC directive (89/336/EEC).

The drive inverters meet the requirements stipulated in low voltage guideline 2006/95/EC. The harmonized standards of the EN 61800-5-1/DIN VDE T105 series in connection with EN 60439-1/VDE 0660 part 500 and EN 60146/VDE 0558 are applied to these drive inverters.

Technical data and information on the connection requirements are provided on the nameplate and in the documentation; these must be observed under all circumstances.

Safety functions

MOVIAXIS® multi-axis servo inverters may not take on safety functions without a higher-level safety system. Use higher-level safety systems to ensure protection of equipment and personnel.

For safety applications, refer to the information in the following publications:

- Safe Disconnection for MOVIAXIS® – Conditions
- Safe Disconnection for MOVIAXIS® – Applications

2.4 Installation

The units must be installed and cooled according to the regulations and specifications in the corresponding documentation.

Protect the multi-axis servo inverters from excessive strain. Ensure that components are not deformed and/or insulation spaces are maintained, particularly during transportation. Avoid contact with electronic components and contacts.

Multi-axis servo inverters contain components that can be damaged by electrostatic energy and could be destroyed in case of improper handling. Prevent mechanical damage or destruction of electric components (may pose health risk).

The following applications are prohibited unless the unit is explicitly designed for such use:

- Use in potentially explosive areas.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, radiation, etc.
- Use in non-stationary applications which are subject to mechanical vibration and impact loads in excess of the requirements in EN 61800-5-1.

2.5 Electrical connection

Observe the applicable national accident prevention guidelines when working on live multi-axis servo inverters (for example, BGV A3).

Electrical installation must be carried out according to pertinent regulations (e.g., cable cross-sections, fusing, protective conductor connection). Additional information is contained in the documentation.

You will find notes on EMC-compliant installation, such as shielding, grounding, arrangement of filters and routing of lines, in the documentation of the multi-axis servo inverter. Always observe these notes even with multi-axis servo inverters bearing the CE marking. The manufacturer of the system or machine is responsible for maintaining the limits established by EMC legislation.

Protective measures and protection devices must comply with the regulations in force (e.g. EN 60204 or EN 61800-5-1).

Required protective measures: The unit must be grounded.

2.6 Safe disconnection

The unit meets all requirements for safe disconnection of power and electronic connections in accordance with EN 61800-5-1. All connected circuits must also satisfy the requirements for safe disconnection.

3 Project Planning

3.1 Procedure for project planning

The following describes the procedure for project planning for a MOVIAXIS® MX multi-axis servo inverter. The individual steps are described in detail in the following sections.

	NOTE
	The software tools for configuring the individual modules and units are part of the "SEW Workbench".

1. Application

- Determining the load conditions
  - Moved masses
  - Transmission elements
  - Travel diagrams
- "SEW Workbench" processes these to generate the following values:
  - Speeds
  - Torques
  - Forces acting on the output shaft

2. Project planning for gearmotors

Use the SEW project planning software "SEW Workbench".

For a detailed description of the project planning for geared servomotors, refer to the publication "Drive Engineering – Servo Technology", "Drive Engineering – Project Planning for Drives" and the "Geared Servomotors" catalogs.

The selection of asynchronous and synchronous servomotors is described in section "Motor Selection".

3. Project planning for axis module

The size of an axis module is determined by the

- Maximum operating point.
- The individual utilization curves are:
  - Dynamic utilization
  - Electromechanical utilization
  - Thermal utilization

Utilization is indicated in per cent and has to be < 100 %. Due to the complexity of the curves, the calculation can only be made using software. The software is a tool of the "SEW Workbench".

4. Project planning for power supply module

The size of a power supply module is determined by the

- Maximum operating point: $P_{max} < 250\ \% P_{rated}$.
- Total actual power of all axis modules: $P_{eff} < P_{rated}$, motor and regenerative.
- Continuous power toward the braking resistor. The continuous power must not exceed 50 % or the rated power of the power supply module.
- The sum rule. The total sum of all rated currents of the axis modules must not exceed two times, or under certain circumstances three times, the rated DC link current of the power supply module. Also see section "Selection table for power supply module with / without line choke" on this page.

The rated power of the power supply module refers to the effective power; that is, the magnetization currents of the motors need not be taken into account in this case.

	NOTE
	Important: The total power (DC link power) is the result of the overlapping cycles of the individual connected axis modules. Changing the assignment of cycles with respect to time strongly influences the motor and regenerative load of the power supply module. It is necessary to take a worst-case scenario into account.

A line choke is necessary under certain mains conditions. See the table below.

Due to the complexity, the calculation can only be made using software. The software is a tool of the "SEW Workbench".

Selection table for power supply module with / without line choke

The specified mains conditions require a line choke:

Mains voltage	Project planning to % of the rated axis currents	Applies to power supply module	Line choke required
380 - 400 V ± 10 %	300 %	All	No
> 400 - 500 V ± 10 %	300 %	All	Yes
380 - 500 V ± 10 %	200 %	All	No

5. Project planning for capacitor module

	NOTES
	For project planning for capacitor modules, contact SEW-EURODRIVE.

6. Project planning for buffer module

	NOTES
	For project planning for buffer modules, contact SEW-EURODRIVE.

7. Project planning for braking resistor

A braking resistor is necessary for regenerative travel sections if the power supply module is not provided with a regenerative power supply or a capacitor module.

The braking resistor is selected using the "SEW Workbench".

See "Selecting the braking resistor".

8. Project planning for 24 V supply

An axis module requires a supply voltage of 24 V at two separate connection terminals:

- Supply of electronics
- Supply of motor brakes

A power supply on each side of the axis block might also be required if the current exceeds the limit value of 10 A.

See "Selecting the 24 V supply" for more information.

9. Mains and motor cables

See page 59 for more information.

10. Components for EMC compliant installation

See page 62 for more information.

11. Project planning for DC link discharge module

	NOTE
	For project planning for a DC link discharge module, contact SEW-EURODRIVE.

3.2 SEW Workbench

"SEW Workbench" provides the user with a central interface to compile complex drive systems from individual SEW components. It allows the user to create complex drive systems for "switch cabinet technology" or "decentralized technology" from SEW components such as drives, servo inverters, cables, field distributors, etc. using the drag and drop function.

Basic features of "SEW Workbench":

- Application selection
- Calculation of gear unit and motor
- Price-optimized project planning
- Comparison of different solutions
- Recommendation of "best drive" solution
- Inverter calculation
- Multi-axis optimization
- Configuration of cables and accessories
- Configuration error check
- Parts list generation
- Electronic catalog with all products

The user has the option to access existing functions and programs such as EKAT, SAP Configurator and ProDrive as well as to use new functions.

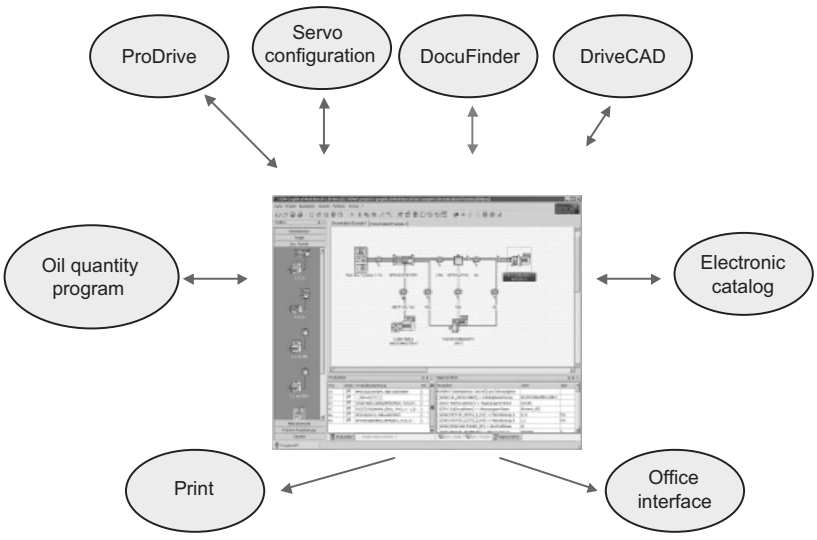


Fig. 1: SEW Workbench project planning software

"SEW Workbench" allows you to perform an initial compatibility check of different components, i.e. to determine whether a servo inverter, cable and drive can be configured and designed for this combination.

SEW Workbench functions

Different catalog functions and project planning functions are available for selecting individual components. Each component is represented in the work area by a graphical object, see figure 2. The result of the total of the objects together is the drive system. A complete check is performed for all products after the user has created the complete drive system.

The "SEW Workbench" generates a drive system including a product list tested and approved according to SEW rules.

The drive systems (product lists) created in the "SEW Workbench" can be saved as a project file and called up again. This allows data exchange and further processing by another "Workbench user".

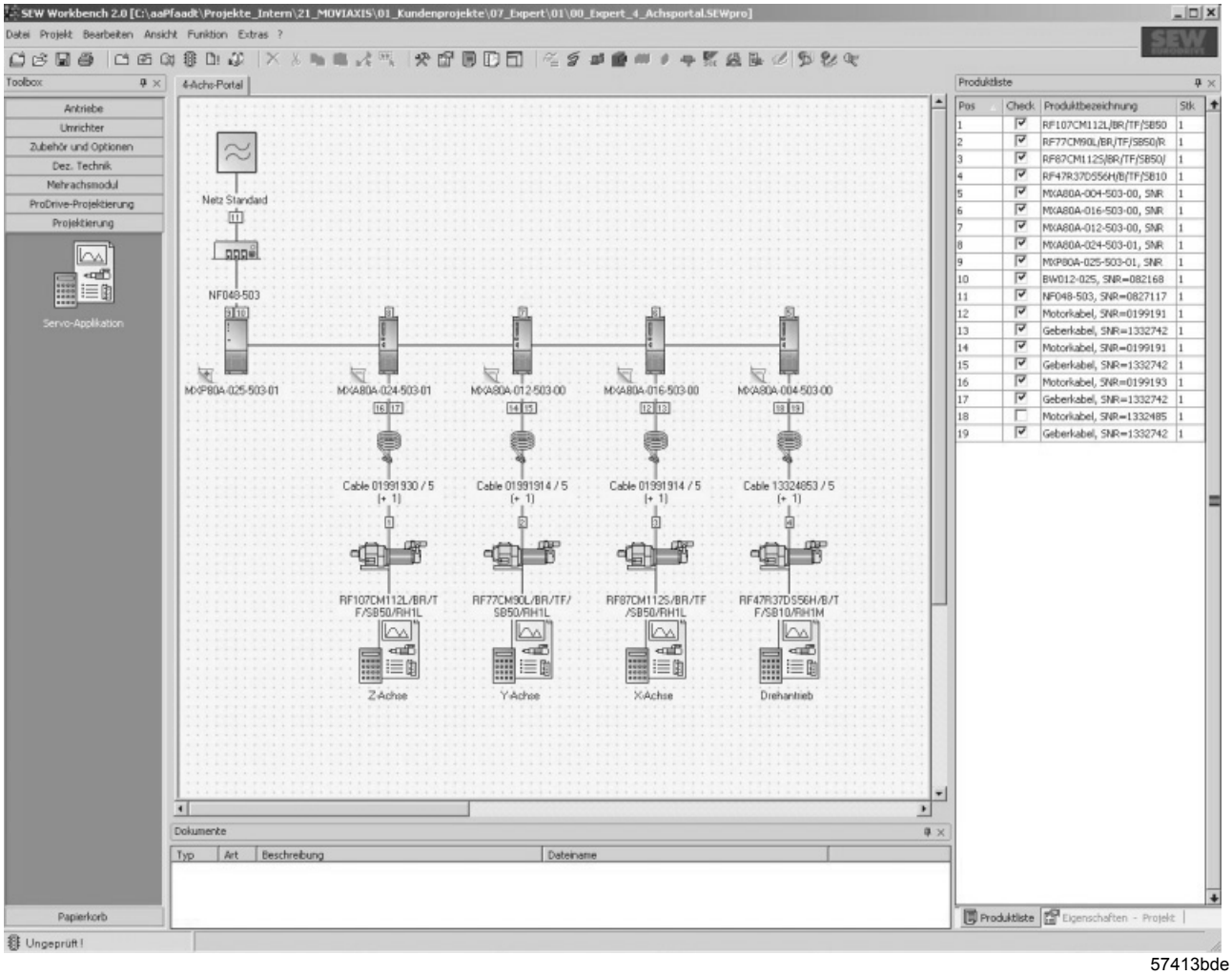


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Fig. 2: SEW Workbench user interface

3.3 Output currents for low rotational field frequencies

The thermal model of MOVIAXIS® dynamically limits the maximum output current. The maximum continuous output current I_{Cont} is dependent on the PWM cycle frequency and the output frequency f_{Output}.

It is particularly important to take output frequencies f_{Output} < 2 Hz into account for:

- Electrically-stopping hoists
- Torque control at low speeds or at a standstill

	NOTE
	The output frequency of the servo inverter when used with asynchronous motors is made up of the rotational frequency (≙ speed) and the slip frequency. With synchronous motors, the output frequency of the servo inverter is the same as the rotational frequency of the synchronous motor.

PWM 4 kHz and 8 kHz

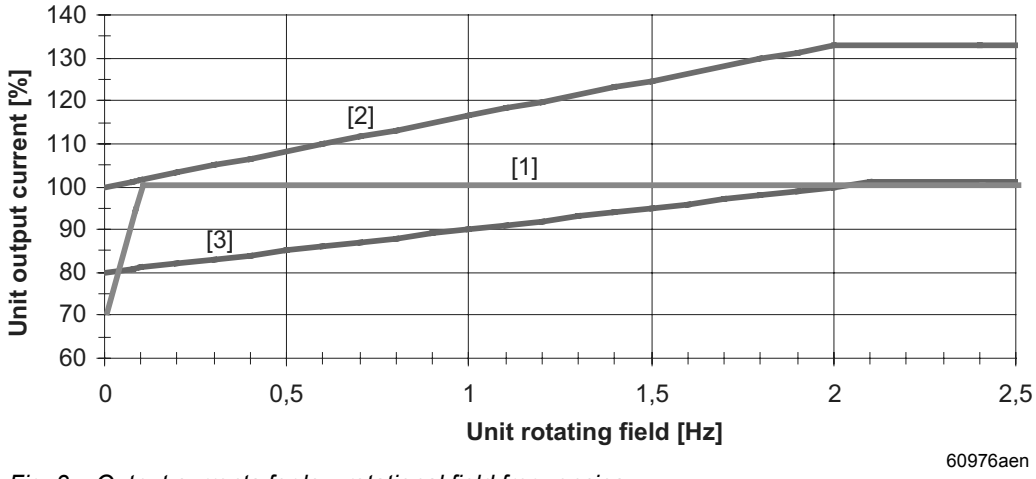

Fig. 3: Output currents for low rotational field frequencies

[1] Axis modules sizes 1 and 2 for PWM 4 kHz and 8 kHz

[2] Axis modules sizes 3, 4, 5, 6 for PWM 4 kHz

[3] Axis modules sizes 3, 4, 5, 6 for PWM 8 kHz

PWM 16 kHz

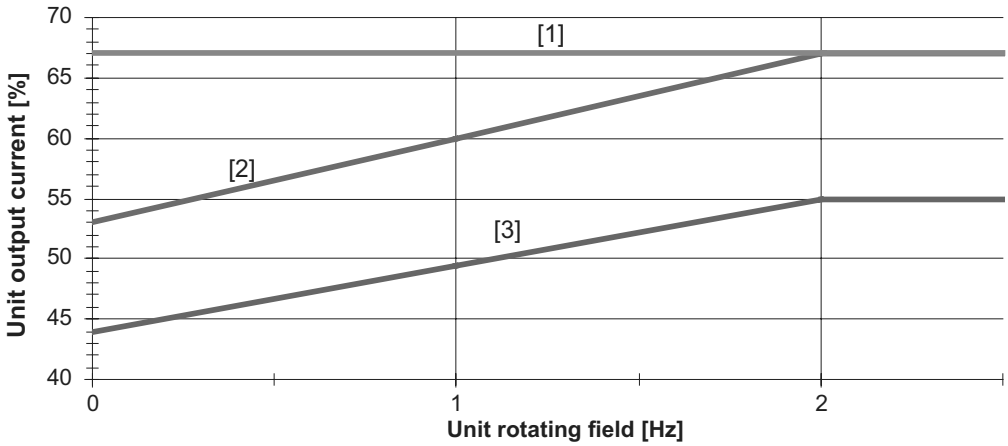

Fig. 4: Output currents for low rotational field frequencies

[1] Axis modules sizes 1 and 2

[2] 24 A (size)

[3] 32 A (size)

3.4 Arrangement of modules in a network of units

Arrangement of axes

STOP	**STOP**
	Note that no more than eight axis modules can be connected in a system.

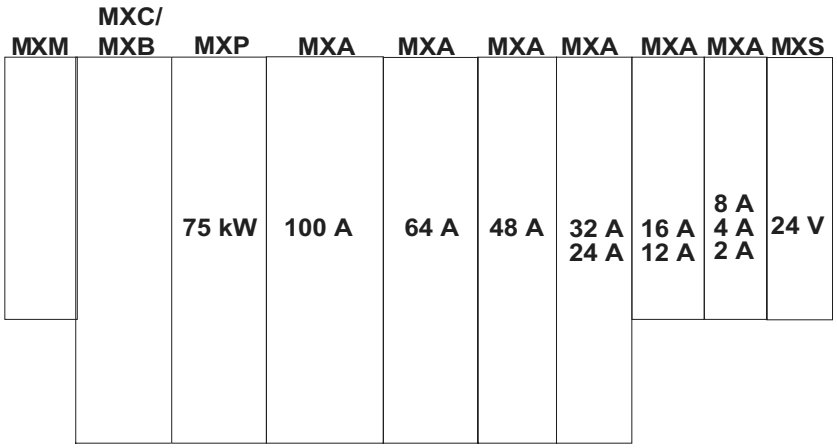

Fig. 5: Example of an axis arrangement

MXM	Master module, component	MXP	Power supply module, BG1-3
MXC	Capacitor module, component	MXA	Axis modules, BG1-6
MXB	Buffer module, component	MXS	24 V switched-mode power supply module, component

MXM master module

Arrange the master module as the first unit in the axis system, see figure 5.

The master module is a component.

MXC capacitor module

Arrange the capacitor module to the left of the power supply module in the axis system, see figure 5.

The capacitor module is a component.

MXB buffer module

Arrange the buffer module to the left of the power supply module in the axis system.

The buffer module is a component.

MXP power supply module

Arrange the power supply module to the left of the axis module in the axis system.

MXA axis modules

	STOP
	Note that the electric performance of the axes has to decrease from left to right. The following applies: $I_{MXA\ 1} \geq I_{MXA\ 2} \geq I_{MXA\ 3} \geq I_{MXA\ 4}$ ... etc.

Arrange the axis modules according to their rated current, starting on the right side of the power supply module so that their rating decreases from left to right, see figure 5.

MXS 24 V switched-mode power supply module

Arrange the 24 V switched-mode power supply module to the right of the last axis module in the axis system, see figure 5.

The 24 V switched-mode power supply is a component.

Power supply

The following schematic sample diagram shows a typical arrangement of MOVIAXIS® components in an axis system. It shows the bus connection of the

- DC link
- Signaling bus
- and the DC 24 V voltage supply.

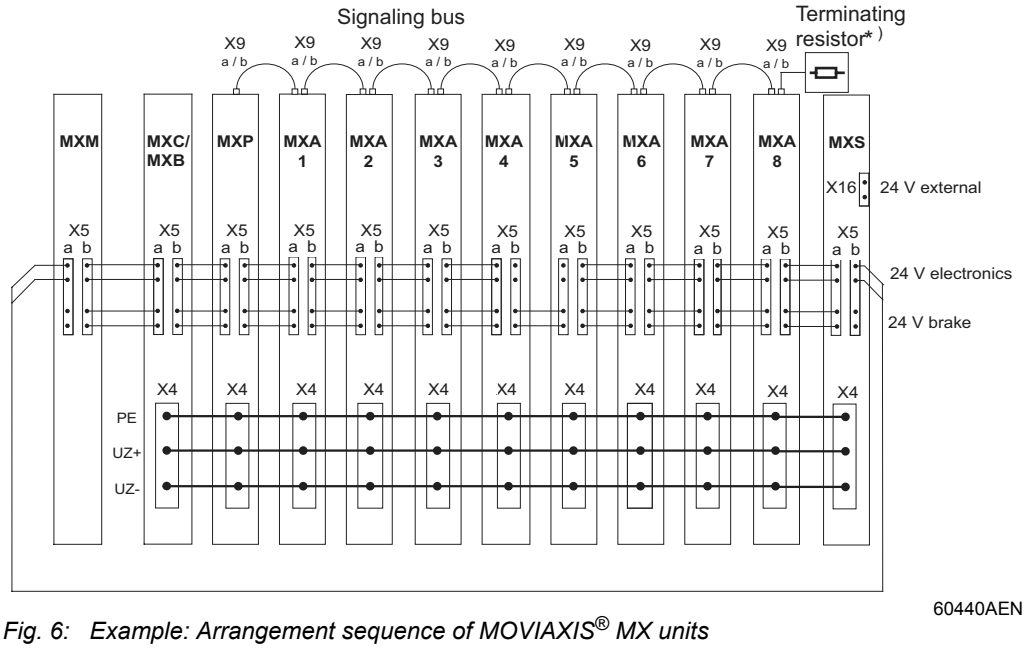

Fig. 6: Example: Arrangement sequence of MOVIAXIS® MX units

*) Terminating resistor: Only for CAN bus unit design.

Key:

MXM	Master module, component
MXC	Capacitor module, component
MXB	Buffer module, component
MXP	Power supply module
MXA 1 ... MXA 8	Axis modules unit 1 to unit 8
MXS	24 V switched-mode power supply module, component

Capacitor module: The 24 V voltage supply of the brake is only conducted.

Buffer module: The 24 V voltage supply of the brake and electronics is only conducted .

3.5 Control characteristics of the axis modules

Characteristic values of the controllers

MOVIAXIS® multi-axis servo inverters achieve excellent control characteristics thanks to their optimally adapted control algorithms. The following features apply for the operation of synchronous servomotors from SEW-EURODRIVE.

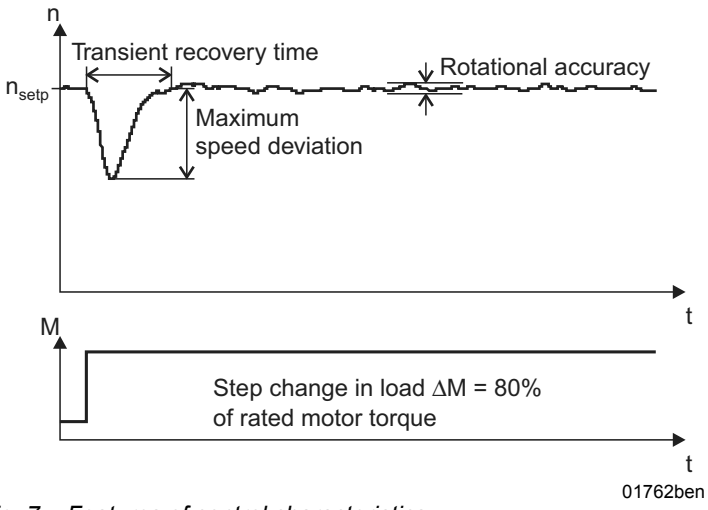

Fig. 7: Features of control characteristics

The following applies to MOVIAXIS® multi-axis servo inverters in combination with powerful motors:

MOVIAXIS® type	Continuous setting range n_{max} = 3000 rpm	Static control accuracy[1] based on n_{max} = 3000 rpm
MXA80A with resolver	> 1:3000	0.01 %
MXA80A with Hiperface encoder	1:5000	0.01 %

1) = Deviation of actual speed value / mean speed value from the speed setpoint

The defined control characteristics are maintained in the specified speed range.

Control response

The following assignment is an example of the different control responses.

Data

- Setpoint speed value n_{Set} = 1000 rpm
- Step change in load ΔM = 80 % of rated motor torque.
- Torsion-free load with mass inertia ratio J_L / J_M = 1.8.

MOVIAXIS® type	Max. speed deviation at ΔM = 80 %, based on n = 3000 rpm	Rotational accuracy at M = const., based on n = 3000 rpm
MXA80A with TTL encoder (1024 increments)	1.0 %	≤ 0.07 %
MXA80A with sin/cos encoder	0.7 %	≤ 0.03 %

3.6 Selecting the safety functions

For more information on these topics, refer to the following manuals:

- "Safe Disconnection for MOVIAXIS® – Conditions".
- "Safe Disconnection for MOVIAXIS® – Applications".

3.7 Motor selection for synchronous servomotors

STOP	**STOP**
	The torque limit (M limit) is set automatically by the startup function of the MOVITOOLS® MotionStudio operating software. **Do not increase this automatically set value.** Setting a torque limit that is too high can damage the servomotor. We recommend always using the latest version of MOVITOOLS® MotionStudio for startup. The latest MOVITOOLS® version can be downloaded from our homepage "www.sew-eurodrive.de".

Motor characteristics

The requirements on a servo drive include speed dynamics, stable speed and positioning accuracy. DS, CM, CMP and CMD motors with MOVIAXIS® meet these requirements.

Technically speaking, these are synchronous motors with permanent magnets on the rotor and an integrated encoder. Required characteristics:

- Constant torque over a broad speed range (up to 6000 rpm)
- High speed and control range
- High overload capacity

This is achieved with MOVIAXIS® control. The mass moment of inertia of the synchronous servomotor is lower than that of the asynchronous motor. For this reason, these motors are optimally suited to applications requiring dynamic speeds.

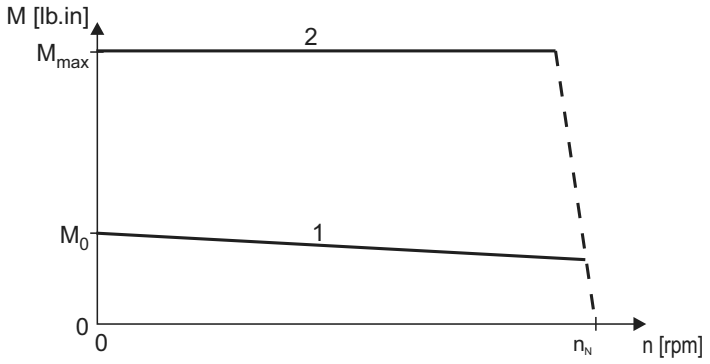

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Fig. 8: Sample speed/torque characteristic curve of DS / CM / CMD servomotors

[1] Continuous torque

[2] Maximum torque

M_0 und M_{max} are determined by the motor. The attainable M_{max} can also be less, depending on the servo inverter.

Refer to the motor tables (DS/CM) for the values for M_0.

Refer to the motor selection tables (DS/CM) for the values for M_{max}.

Basic recommendations

The necessary motor data for the SERVO operating modes are stored in MOVITOOLS® MotionStudio for the SEW motors.

Speed is the correcting variable in the SERVO operating modes with speed control.

Torque is the correcting variable in the SERVO operating modes with torque control.

Project planning

Project planning for a synchronous motor is carried out according to the following requirements:

1. Effective torque requirement at average application speed.

   $M_{eff} < M_{rated\_mot}$

   The operating point must lie below the characteristic curve for the continuous torque (figure 8, curve 1). The continuous torque of the CM series can be increased by 40 % by forced cooling if the operating point lies above the characteristic curve for self-cooling.

2. Maximum torque needed across the speed curve.

   $M_{max} < M_{dyn\_mot}$

   The operating point must lie below the characteristic curve for the maximum torque of the motor-MOVIAXIS® combination (figure 8, curve 2).

3. Maximum speed

   The maximum speed must not be configured higher than the rated speed of the motor. Planetary gear units should be used for speeds greater than 3000 rpm as a result of the high input speed.

   $n_{max} \leq n_{rated}$

Motor selection DS/CM synchronous servomotors

Structure of the data tables for synchronous servomotors DFS/CFM

n_{rated}	Motor	M_0	I_0	M_{DYN}	I_{max}	M_{0VR}	I_{0VR}	J_{mot}	J_{bmot}	M_{B1}	M_{B2}	W_{max1}	W_{max2}
[rpm]		[Nm]	[A]	[Nm]	[A]	[Nm]	[A]	[10^{-4} kgm^2]		[Nm]		[kJ]	
2000	**CFM71S**	5	2.2	16.5	8.8	7.3	3.2	4.89	6.65	10	5	18	22
	CFM71M	6.5	3	21.5	12	9.4	4.2	6.27	8.03	14	7	15	20
	CFM71L	9.5	4.2	31,4	16.8	13.8	6.1	9.02	10.8	14	10	15	18

n_{rated}	Rated speed
M_0	Standstill torque (thermal continuous torque at low speeds).
I_0	Standstill current
M_{DYN}	Dynamic limit torque of the servomotor
I_{max}	Maximum permitted motor current
M_{0VR}	Static torque with forced cooling fan
I_{0VR}	Standstill current with forced cooling fan
J_{mot}	Mass moment of inertia of the motor
J_{bmot}	Mass moment of inertia of the brake motor
M_{B1}	Standard braking torque
M_{B2}	Optional braking torque
W_{max1}	Maximum permitted braking work per braking operation for M_{B1}.
W_{max2}	Maximum permitted braking work per braking operation for M_{B2}.

n_{rated}	Motor	L_1	R_1	$V_{internal}$	m_{mot}	m_{bmot}
[rpm]		[mH]	[mΩ]	[V/1000 rpm]	[kg]	
2000	**CFM71S**	52	7090	151	9.5	11.8
	CFM71M	36	4440	148	10.8	13.0
	CFM71L	24	2500	152	13.0	15.3

L_1	Winding inductance
R_1	Winding ohmic resistance
$V_{internal}$	Internal voltage at 1000 rpm
m_{mot}	Weight of the motor
m_{bmot}	Weight of the brake motor

Synchronous servomotors with 400 V system voltage

n_{rated}	Motor	M_0	I_0	M_{DYN}	I_{max}	M_{0VR}	I_{0VR}	J_{mot}	J_{bmot}	M_{B1}	M_{B2}	W_{max1}	W_{max2}
[rpm]		[Nm]	[A]	[Nm]	[A]	[Nm]	[A]	[10^{-4} kgm^2]		[Nm]		[kJ]	
2000	**CFM71S**	5	2.2	16.5	8.8	7.3	3.2	4.99	6.72	10	5	18	22
	CFM71M	6.5	3	21.5	12	9.4	4.2	6.4	8.13	14	7	15	20
	CFM71L	9.5	4.2	31.4	16.8	13.8	6.1	9.21	10.94	14	10	15	18
	CFM90S	11	4.9	39.6	19.6	16	7.1	18.2	22	28	14	17	24
	CFM90M	14.5	6.9	52.2	28	21	10	23.4	27.2	40	20	10.5	19.5
	CFM90L	21	9.9	75.6	40	30.5	14.4	33.7	37.5	40	28	10.5	17
	CFM112S	23.5	10	82.3	40	34	14.5	68.9	84.2	55	28	32	48
	CFM112M	31	13.5	108.5	54	45	19.6	88.9	104.2	90	40	18	44
	CFM112L	45	20	157.5	80	65	29	128.8	144.1	90	55	18	32
	CFM112H	68	30.5	238.0	122	95	42.5	188.7	204	90	55	18	32
3000	**DFS56M**	1	1.65	3.8	6.6	1.45	2.3	0.48	0.83	2.5	–	–	–
	DFS56L	2	2.4	7.6	9.6	3.2	3.6	0.83	1.18	2.5	–	–	–
	DFS56H	4	2.8	15.2	11.2	6	4	1.53	1.88	5	–	–	–
	CFM71S	5	3.3	16.5	13.2	7.3	4.8	4.99	6.72	10	5	14	20
	CFM71M	6.5	4.3	21.5	17.2	9.4	6.2	6.4	8.13	14	7	11	18
	CFM71L	9.5	6.2	31.4	25	13.8	9	9.21	10.94	14	10	11	14
	CFM90S	11	7.3	39.6	29	16	10.6	18.2	22	28	14	10	20
	CFM90M	14.5	10.1	52.2	40	21	14.6	23.4	27.2	40	20	4.5	15
	CFM90L	21	14.4	75.6	58	30.5	21	33.7	37.5	40	28	4.5	10
	CFM112S	23.5	15	82.3	60	34	22	68.9	84.2	55	28	18	36
	CFM112M	31	20.5	108.5	82	45	30	88.9	104.2	90	40	7	32
	CFM112L	45	30	157.5	120	65	44	128.8	144.1	90	55	7	18
	CFM112H	68	43	238.0	172	95	60	188.7	204	90	55	7	18
4500	**DFS56M**	1	1.65	3.8	6.6	1.45	2.3	0.48	0.83	2.5	–	–	–
	DFS56L	2	2.4	7.6	9.6	3.2	3.6	0.83	1.18	2.5	–	–	–
	DFS56H	4	4	15.2	16	6	5.7	1.53	1.88	5	–	–	–
	CFM71S	5	4.9	16.5	19.6	7.3	7.2	4.99	6.72	10	5	10	16
	CFM71M	6.5	6.6	21.5	26	9.4	9.6	6.4	8.13	14	7	6	14
	CFM71L	9.5	9.6	31.4	38	13.8	14	9.21	10.94	14	10	6	10
	CFM90S	11	11.1	39.6	44	16	16.2	18.2	22	28	14	5	15
	CFM90M	14.5	14.7	52.2	59	21	21.5	23.4	27.2	40	20	3	9
	CFM90L	21	21.6	75.6	86	30.5	31.5	33.7	37.5	40	28	3	5
	CFM112S	23.5	22.5	82.3	90	34	32.5	68.9	84.2	55	25	11	22
	CFM112M	31	30	108.5	120	45	44	88.9	104.2	90	40	4	18
	CFM112L	45	46	157.5	184	65	67	128.8	144.1	90	55	4	11
	CFM112H	68	66	238.0	264	95	92	188.7	204	90	55	4	11
6000	**DFS56M**	1	1.65	3.8	6.6	1.45	2.3	0.48	0.83	2.5	–	–	–
	DFS56L	2	2.75	7.6	11	3.2	4.2	0.83	1.18	2.5	–	–	–
	DFS56H	4	5.3	15.2	21	6	7.6	1.53	1.88	5	–	–	–
	CFM71S	5	6.5	16.5	26	7.3	9.5	4.99	6.72	–	–	–	–
	CFM71M	6.5	8.6	21.5	34	9.4	12.5	6.4	8.13	–	–	–	–
	CFM71L	9.5	12.5	31.4	50	13.8	18.2	9.21	10.94	–	–	–	–
	CFM90S	11	14.5	39.6	58	16	21	18.2	22	–	–	–	–
	CFM90M	14.5	19.8	52.2	79	21	29	23.4	27.2	–	–	–	–
	CFM90L	21	29.5	75.6	118	30.5	43	33.7	37.5	–	–	–	–

Synchronous servomotors with 400 V system voltage

n_{rated}	Motor	L_1	R_1	$V_{internal}$	m_{mot}	m_{bmot}
[rpm]		[mH]	[mΩ]	[V/1000 rpm]	[kg]	
2000	**CFM71S**	52	7090	151	9.5	11.8
	CFM71M	36	4440	148	10.8	13.0
	CFM71L	24	2500	152	13.0	15.3
	CFM90S	18	1910	147	15.7	19.6
	CFM90M	12.1	1180	141	17.8	21.6
	CFM90L	8.4	692	146	21.9	26.5
	CFM112S	10	731	155	26.2	31.8
	CFM112M	7.5	453	153	30.5	36.0
	CFM112L	4.6	240	151	39.3	44.9
	CFM112H	2.6	115	147	54.2	59.8
3000	**DFS56M**	9.7	5700	40	2.8	2.9
	DFS56L	8.8	3700	56	3.5	3.6
	DFS56H	12.7	4500	97	4.8	5.3
	CFM71S	23	3150	101	9.5	11.8
	CFM71M	16	2000	100	10.8	13.0
	CFM71L	11	1120	102	13.0	15.3
	CFM90S	8.1	838	98	15.7	19.6
	CFM90M	5.7	533	96	17.8	21.6
	CFM90L	3.9	324	99	21.9	26.5
	CFM112S	4.6	325	103	26.2	31.8
	CFM112M	3.1	193	99	30.5	36.0
	CFM112L	2	103	101	39.3	44.9
	CFM112H	1.3	57	104	54.2	59.8
4500	**DFS56M**	9.7	5700	40	2.8	2.9
	DFS56L	8.8	3700	56	3.5	3.6
	DFS56H	6.2	2200	67.5	4.8	5.3
	CFM71S	10	1380	66	9.5	11.8
	CFM71M	6.9	828	64	10.8	13.0
	CFM71L	4.9	446	65	13.0	15.3
	CFM90S	3.45	358	64	15.7	19.6
	CFM90M	2.65	249	65	17.8	21.6
	CFM90L	1.73	148	66	21.9	26.5
	CFM112S	2	149	69	26.2	31.8
	CFM112M	1.5	92	68	30.5	36.0
	CFM112L	0.85	44	66	39.3	44.9
	CFM112H	0.54	24	67	54.2	59.8
6000	**DFS56M**	9.70	5700	40	2.8	2.9
	DFS56L	6.80	2800	49	3.5	3.6
	DFS56H	3.50	1200	50.5	4.8	5.3
	CFM71S	5.75	780	50	9.5	–
	CFM71M	3.93	493	49	10.8	–
	CFM71L	2.68	277	50	13.0	–
	CFM90S	2.03	212	49	15.7	–
	CFM90M	1.48	136	48	17.8	–
	CFM90L	0.93	77	48	21.9	–

Assignment of DFS / CFM servomotors with MOVIAXIS® multi-axis servo inverter (AC 400 V system voltage)

1. Rated speed n_{rated} = 2000 rpm

Motor			**Assignment MOVIAXIS® MXA size**									
			1			**2**		**3**		**4**	**5**	**6**
Type	**I_{rated}**	**[A]**	**2**	**4**	**8**	**12**	**16**	**24**	**32**	**48**	**64**	**100**
	I_{max}	**[A]**	**5**	**10**	**20**	**30**	**40**	**60**	**80**	**120**	**160**	**250**
CM71S	I_{max}	% I_{rated}	250	220								
	M_{max}	Nm	10.9	16.5								
CM71M	I_{max}	% I_{rated}		250	150							
	M_{max}	Nm		19.2	21.5							
CM71L	I_{max}	% I_{rated}		250	210							
	M_{max}	Nm		21.6	31.4							
CM90S	I_{max}	% I_{rated}		250	245							
	M_{max}	Nm		22.1	39.4							
CM90M	I_{max}	% I_{rated}			250	229						
	M_{max}	Nm			40.3	51.8						
CM90L	I_{max}	% I_{rated}			250	250	247					
	M_{max}	Nm			41.8	60.6	75.1					
CM112S	I_{max}	% I_{rated}			250	250	250					
	M_{max}	Nm			46.3	66.3	81.9					
CM112M	I_{max}	% I_{rated}				250	250	225				
	M_{max}	Nm				67.4	86.6	108.0				
CM112L	I_{max}	% I_{rated}					250	250	250			
	M_{max}	Nm					88.7	126.9	156.8			
CM112H	I_{max}	% I_{rated}						250	250	250	191	
	M_{max}	Nm						132.0	171.4	234.4	237.0	

2. Rated speed n_{rated} = 3000 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
DFS56M	I_{max}	% I_{rated}	250	165								
	M_{max}	Nm	2.9	3.8								
DFS56L	I_{max}	% I_{rated}	250	240								
	M_{max}	Nm	4.1	7.6								
DFS56H	I_{max}	% I_{rated}	250	250	140							
	M_{max}	Nm	7.1	13.7	15.2							
CM71S	I_{max}	% I_{rated}		250	165							
	M_{max}	Nm		13.8	16.5							
CM71M	I_{max}	% I_{rated}		250	215							
	M_{max}	Nm		14.5	21.5							
CM71L	I_{max}	% I_{rated}			250	208						
	M_{max}	Nm			27.4	31.5						
CM90S	I_{max}	% I_{rated}			250	242						
	M_{max}	Nm			29.1	39.2						
CM90M	I_{max}	% I_{rated}			250	250	250	169				
	M_{max}	Nm			28.3	41.1	51.6	52.0				
CM90L	I_{max}	% I_{rated}				250	250	242				
	M_{max}	Nm				43.1	56.2	75.6				
CM112S	I_{max}	% I_{rated}				250	250	250				
	M_{max}	Nm				46.3	60.1	81.9				
CM112M	I_{max}	% I_{rated}					250	250	250	171		
	M_{max}	Nm					59.7	85.7	106.3	108.0		
CM112L	I_{max}	% I_{rated}						250	250	250		
	M_{max}	Nm						88.7	115.0	156.8		
CM112H	I_{max}	% I_{rated}								250	250	172
	M_{max}	Nm								180.7	225.7	237.0

3. Rated speed n_{rated} = 4500 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
DFS56M	I_{max}	% I_{rated}	250	165								
	M_{max}	Nm	2.9	3.8								
DFS56L	I_{max}	% I_{rated}	250	240								
	M_{max}	Nm	4.1	7.6								
DFS56H	I_{max}	% I_{rated}		250	200							
	M_{max}	Nm		9.8	15.2							
CM71S	I_{max}	% I_{rated}		250	245							
	M_{max}	Nm		9.9	16.5							
CM71M	I_{max}	% I_{rated}			250	221						
	M_{max}	Nm			17.9	21.5						
CM71L	I_{max}	% I_{rated}			250	250	241					
	M_{max}	Nm			19.2	26.8	31.5					
CM90S	I_{max}	% I_{rated}				250	250	185				
	M_{max}	Nm				28.7	36.5	39.5				
CM90M	I_{max}	% I_{rated}				250	250	246				
	M_{max}	Nm				29.2	38.1	52.1				
CM90L	I_{max}	% I_{rated}						250	250	179		
	M_{max}	Nm						56.4	71.5	75.2		
CM112S	I_{max}	% I_{rated}						250	250	188		
	M_{max}	Nm						60.1	75.5	81.9		
CM112M	I_{max}	% I_{rated}						250	250	250		
	M_{max}	Nm						61.1	79.3	108.0		
CM112L	I_{max}	% I_{rated}								250	250	184
	M_{max}	Nm								112.9	142.3	156.8
CM112H	I_{max}	% I_{rated}									250	250
	M_{max}	Nm									160.0	228.5

4. Rated speed n_{rated} = 6000 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
DFS56M	I_{max}	% I_{rated}	250	165								
	M_{max}	Nm	2.9	3.8								
DFS56L	I_{max}	% I_{rated}		250	138							
	M_{max}	Nm		7.0	7.6							
DFS56H	I_{max}	% I_{rated}		250	250	175						
	M_{max}	Nm		7.5	14.4	15.1						
CM71S	I_{max}	% I_{rated}			250	217						
	M_{max}	Nm			14.0	16.5						
CM71M	I_{max}	% I_{rated}			250	250	216					
	M_{max}	Nm			14.5	19.8	21.5					
CM71L	I_{max}	% I_{rated}				250	250	208				
	M_{max}	Nm				21.8	27.3	31.4				
CM90S	I_{max}	% I_{rated}				250	250	242				
	M_{max}	Nm				22.4	29.2	39.4				
CM90M	I_{max}	% I_{rated}					250	250	247			
	M_{max}	Nm					28.9	41.8	51.9			
CM90L	I_{max}	% I_{rated}						250	250	246		
	M_{max}	Nm						42.1	55.0	75.2		

Motor selection for CMP synchronous servomotors

Structure of the data tables for synchronous servomotors CMP

n_{rated}	Motor	M_0	I_0	M_{max}	I_{max}	M_{0VR}	I_{0VR}	J_{mot}	J_{bmot}	M_{B1}	M_{B2}	L_1	R_1	$V_{internal\ cold}$
[rpm]		[Nm]	[A]	[Nm]	[A]	[Nm]	[A]	[kgcm^2]		[Nm]		[mH]	Ω	[V]
3000	CMP40S	0.5	1.2	1.9	6.1	–	–	0.1	0.13	0.95	–	23	11.94	27.5
	CMP40M	0.8	0.95	3.8	6.0	–	–	0.15	0.18	0.95	–	45.5	19.92	56

n_{rated}	Rated speed
M_0	Standstill torque (thermal continuous torque at low speeds)
I_0	Standstill current
M_{max}	Maximum limit torque of the servomotors
I_{max}	Maximum permitted motor current
M_{0VR}	Standstill torque with forced cooling fan
I_{0VR}	Standstill current with forced cooling fan
J_{mot}	Mass moment of inertia of the motor
J_{bmot}	Mass moment of inertia of the brake motor
M_{B1}	Standard braking torque
M_{B2}	Optional braking torque
L_1	Winding inductance
R_1	Winding ohmic resistance
$V_{internal}$ cold	Internal voltage at 1000 rpm

Motor data of CMP servomotors with 400 V system voltage

n_{rated}	Motor	M_0	I_0	M_{max}	I_{max}	M_{0VR}	I_{0VR}	J_{mot}	J_{bmot}	M_{B1}	M_{B2}	L_1	R_1	$V_{internal\ cold}$
[rpm]		[Nm]	[A]	[Nm]	[A]	[Nm]	[A]	[kgcm^2]		[Nm]		[mH]	Ω	[V]
3000	CMP40S	0.5	1.2	1.9	6.1	–	–	0.1	0.13	0.95	–	23	11.94	27.5
	CMP40M	0.8	0.95	3.8	6.0	–	–	0.15	0.18	0.95	–	45.5	19.92	56
	CMP50S	1.3	0.96	5.2	5.1	1.7	1.25	0.42	0.48	3.1	4.3	71	22.49	86
	CMP50M	2.4	1.68	10.3	9.6	3.5	2.45	0.67	0.73	4.3	3.1	38.5	9.98	90
	CMP50L	3.3	2.2	15.4	13.6	4.8	3.2	0.92	0.99	4.3	3.1	30.5	7.41	98
	CMP63S	2.9	2.15	11.1	12.9	4	3	1.15	1.49	7	9.3	36.5	6.79	90
	CMP63M	5.3	3.6	21.4	21.6	7.5	5.1	1.92	2.26	9.3	7	22	3.57	100
	CMP63L	7.1	4.95	30.4	29.7	10.3	7.2	2.69	3.03	9.3	7	14.2	2.07	100
4500	CMP40S	0.5	1.2	1.9	6.1	–	–	0.1	0.13	0.85	–	23	11.94	27.5
	CMP40M	0.8	0.95	3.8	6.0	–	–	0.15	0.18	0.95	–	45.5	19.92	56
	CMP50S	1.3	1.32	5.2	7.0	1.7	1.7	0.42	0.48	3.1	4.3	37	11.6	62
	CMP50M	2.4	2.3	10.3	13.1	3.5	3.35	0.67	0.73	4.3	3.1	20.5	5.29	66
	CMP50L	3.3	3.15	15.4	19.5	4.8	4.6	0.92	0.99	4.3	3.1	14.6	3.56	68
	CMP63S	2.9	3.05	11.1	18.3	4	4.2	1.15	1.49	7	9.3	18.3	3.34	64
	CMP63M	5.3	5.4	21.4	32.4	7.5	7.6	1.92	2.26	9.3	7	9.8	1.49	67
	CMP63L	7.1	6.9	30.4	41.4	10.3	10	2.69	3.03	9.3	7	7.2	1.07	71
6000	CMP40S	0.5	1.2	1.9	6.1	–	–	0.1	0.13	0.95	–	23	11.94	27.5
	CMP40M	0.8	1.1	3.8	6.9	–	–	0.15	0.18	0.95	–	34	14.95	48.5
	CMP50S	1.3	1.7	5.2	9.0	1.7	2.2	0.42	0.48	3.1	4.3	22.5	7.11	48.5
	CMP50M	2.4	3	10.3	17.1	3.5	4.4	0.67	0.73	4.3	3.1	12	3.21	50.5
	CMP50L	3.3	4.2	15.4	26	4.8	6.1	0.92	0.99	4.3	3.1	8.2	1.91	51
	CMP63S	2.9	3.9	11.1	23.4	4	5.4	1.15	1.49	–	–	11.2	2.1	50
	CMP63M	5.3	6.9	21.4	41.4	7.5	9.8	1.92	2.26	–	–	5.9	0.92	52
	CMP63L	7.1	9.3	30.4	55.8	10.3	13.5	2.69	3.03	–	–	4	0.62	53

Assignment of CMP servomotors with MOVIAXIS® multi-axis servo inverter (AC 400 V system voltage)

1. Rated speed n_{rated} = 3000 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
CMP40S	I_{max}	% I_{rated}	250	153								
	M_{max}	Nm	1.7	1.9								
CMP40M	I_{max}	% I_{rated}	250	150								
	M_{max}	Nm	3.4	3.8								
CMP50S	I_{max}	% I_{rated}	250	128								
	M_{max}	Nm	5.1	5.2								
CMP50M	I_{max}	% I_{rated}	250	240								
	M_{max}	Nm	6.5	10.3								
CMP50L	I_{max}	% I_{rated}	250	250	170							
	M_{max}	Nm	7.2	12.7	15.4							
CMP63S	I_{max}	% I_{rated}	250	250	161							
	M_{max}	Nm	6.2	9.9	11.1							
CMP63M	I_{max}	% I_{rated}		250	250	180						
	M_{max}	Nm		13.2	20.6	21.4						
CMP63L	I_{max}	% I_{rated}		250	250	248						
	M_{max}	Nm		13.8	24	30.8						

2. Rated speed n_{rated} = 4500 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
CMP40S	I_{max}	% I_{rated}	250	153								
	M_{max}	Nm	1.7	1.9								
CMP40M	I_{max}	% I_{rated}	250	150								
	M_{max}	Nm	3.4	3.8								
CMP50S	I_{max}	% I_{rated}	250	175								
	M_{max}	Nm	4.2	5.2								
CMP50M	I_{max}	% I_{rated}	250	250	164							
	M_{max}	Nm	5	8.7	10.3							
CMP50L	I_{max}	% I_{rated}		250	244							
	M_{max}	Nm		9.6	15.4							
CMP63S	I_{max}	% I_{rated}		250	229							
	M_{max}	Nm		8	11.1							
CMP63M	I_{max}	% I_{rated}			250	250	203					
	M_{max}	Nm			15.8	19.4	20.3					
CMP63L	I_{max}	% I_{rated}			250	250	250	173				
	M_{max}	Nm			17.9	23.3	26.8	27.2				

3. Rated speed n_{rated} = 6000 rpm

Motor			Assignment MOVIAXIS® MXA size									
			1			2		3		4	5	6
Type	I_{rated}	[A]	2	4	8	12	16	24	32	48	64	100
	I_{max}	[A]	5	10	20	30	40	60	80	120	160	250
CMP40S	I_{max}	% I_{rated}	250	153								
	M_{max}	Nm	1.7	1.9								
CMP40M	I_{max}	% I_{rated}	250	173								
	M_{max}	Nm	2.9	3.4								
CMP50S	I_{max}	% I_{rated}	250	225								
	M_{max}	Nm	3.5	5.1								
CMP50M	I_{max}	% I_{rated}		250	241							
	M_{max}	Nm		7	9.7							
CMP50L	I_{max}	% I_{rated}		250	250	217						
	M_{max}	Nm		7.4	12.1	13.8						
CMP63S	I_{max}	% I_{rated}		250	250	195						
	M_{max}	Nm		6.9	11.1	12						
CMP63M	I_{max}	% I_{rated}			250	250	250	173				
	M_{max}	Nm			13.9	18.5	21.6	21.9				
CMP63L	I_{max}	% I_{rated}			250	250	250	233				
	M_{max}	Nm			14.6	20.2	24.6	29.3				

Motor selection for CMD synchronous servomotors

Structure of the data tables for synchronous servomotors

n_{rated}	Motor	M_0	I_0	M_{max}	I_{max}	J_{mot}	L_1	R_1	$V_{internal}$	n_{max}	M_{B1}	M_{B2}
[rpm]		[Nm]	[A]	[Nm]	[A]	[kgcm^2]	[mH]	Ω	[V]	[rpm]	[Nm]	[Nm]
3000	CMD70S	0.7	1.04	3	6	0.261	32.3	17.44	43	6000	3.1	4.3
	CMD70M	1.1	1.36	5	8	0.45	25.2	10.89	56	8000	3.1	4.3

n_{rated}	Rated speed
M_0	Standstill torque (thermal continuous torque at low speeds)
I_0	Standstill current
M_{max}	Maximum limit torque of the servomotors
I_{max}	Maximum permitted motor current
R_1	Winding ohmic resistance
L_1	Winding inductance
$V_{internal}$ cold	Internal voltage at 1000 rpm
J_{mot}	Mass moment of inertia of the motor
J_{bmot}	Mass moment of inertia of the brake motor
M_{B1}	Standard braking torque
M_{B2}	Optional braking torque

Motor data of CMD servomotors with 400 V system voltage

Motor type	n_{rated} [1] [rpm]	M_0 [Nm]	I_0 [A]	M_{max} [Nm]	I_{max} [A]	R_1 [Ω]	L_1 [mH]	$V_{internal}$ [rpm]	J_{mot} [2] [kgcm²]	J_{bmot} [2] [kgcm²]	n_{max} [rpm]	M_{B1} [Nm]	M_{B2} [Nm]
CMD 55 S	4500	0.25	0.7	1.2	4	28.65	28.4	26	0.087	0.104	8000 [3]	0.95	–
CMD 55 M		0.45	0.95	2.3	6	18.44	21.6	33	0.148	0.165	8000 [3]	0.95	–
CMD 55 L		0.9	1.5	6	12	10.18	14.8	39	0.267	0.284	8000 [3]	0.95	–
CMD 70 S	3000	0.7	1.04	3	6	17.44	32.3	43	0.26	0.33	6000	3.1	4.3
CMD 70 M		1.1	1.36	5	8	10.89	25.2	56	0.45	0.52	5000	3.1	4.3
CMD 70 L		1.9	1.96	11	18	5.85	17.0	64	0.83	0.89	5000	4.3	3.1
CMD 93 S	800	2.4	1.06	10	5	22.32	91.3	136	1.23	1.58	4000	7	9.3
CMD 93 M		4.2	1.7	22	11	7.4	39.8	159	2.31	2.66	4000	9.3	7
CMD 93 L		6	2	33	16	6.38	37	152	3.38	3.73	4000	9.3	7
CMD 93 S	1200	2.4	1.55	10	8	10.64	43.0	93	1.23	1.58	2750	7	9.3
CMD 93 M		4.2	2.5	22	16	3.63	19.1	110	2.31	2.66	2750	9.3	7
CMD 93 L		6	3.5	33	23	3.14	18.0	106	3.38	3.73	2750	9.3	7
CMD 93 S	3000	2.4	2.32	10	12	4.60	19.2	62	1.23	1.58	4000	7	9.3
CMD 93 M		4.2	3.6	22	23	2.27	9.3	77	2.31	2.66	4000	9.3	7
CMD 93 L		6	6	33	40	1.02	6.0	61	3.38	3.73	4000	9.3	7
CMD 138 S	600	6.7	2.8	17	9	3.81	47.1	161	6.4	9.1	2500	22	–
CMD 138 M		12.1	4.1	39	19	2.40	36.8	198	11.5	14.2	2000	22	–
CMD 138 L		16.5	5	62	25	1.72	30.9	223	16.6	19.3	2000	22	–
CMD 138 S	1200	6.7	3.9	17	13	1.97	25.0	117	6.4	9.1	2500	22	–
CMD 138 M		12.1	5.5	39	26	1.29	20.6	148	11.5	14.2	2000	22	–
CMD 138 L		16.5	8	62	40	0.66	11.8	138	16.6	19.3	2000	22	–
CMD 138 S	2000	6.7	7.4	17	25	0.60	7.0	62	6.4	9.1	3000	22	–
CMD 138 M		12.1	11.4	39	53	0.30	4.8	71	11.5	14.2	2000	22	–
CMD 138 L		16.5	15.1	62	76	0.20	3.3	73	16.6	19.3	2000	22	–

1) n_{rated} = Rated speed [rpm]

2) When installing the encoders AK0H / EK0H, the specified mass moment of inertia is reduced by 0.015 kgcm² in comparison with the resolver version.

3) n_{max} = 6000 rpm for CMD55 with brake

Assignment CMD servomotors for MOVIAXIS® multi-axis servo inverter

Overview of combinations for CMD servomotors, system voltage 400 V, peak torque in Nm.

Rated speed n_{rated} = 600 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD138S	I_{max} [%I_{rated}]		250	165							
	M_{max} [Nm]		16.5	20.5							
CMD138M	I_{max} [%I_{rated}]			250	217						
	M_{max} [Nm]			42.8	46.5						
CMD138L	I_{max} [%I_{rated}]			250	250	250	167				
	M_{max} [Nm]			40.8	59.4	75.2	75.4				

Rated speed n_{rated} = 800 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD93S	I_{max} [%I_{rated}]	250									
	M_{max} [Nm]	9.2									
CMD93M	I_{max} [%I_{rated}]	250	250	138							
	M_{max} [Nm]	12.4	21.1	22.4							
CMD93L	I_{max} [%I_{rated}]	250	250	200							
	M_{max} [Nm]	14.9	27.4	36.6							

Rated speed n_{rated} = 1200 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD93S	I_{max} [%I_{rated}]	250	204								
	M_{max} [Nm]	7	9.6								
CMD93M	I_{max} [%I_{rated}]	250	250	202							
	M_{max} [Nm]	8.6	15.9	22.4							
CMD93L	I_{max} [%I_{rated}]		250	250	191						
	M_{max} [Nm]		16.8	29.9	32.7						
CMD138S	I_{max} [%I_{rated}]		250	165							
	M_{max} [Nm]		14.7	17.4							
CMD138M	I_{max} [%I_{rated}]			250	217						
	M_{max} [Nm]			34.6	39.2						
CMD138L	I_{max} [%I_{rated}]			250	250	250	167				
	M_{max} [Nm]			38.9	52.8	62.3	62.5				

Rated speed n_{rated} = 2000 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD138S	I_{max} [%I_{rated}]			250	208						
	M_{max} [Nm]			15.3	17.4						
CMD138M	I_{max} [%I_{rated}]				250	250	221				
	M_{max} [Nm]				28.1	33.8	38.9				
CMD138L	I_{max} [%I_{rated}]				250	250	250	237			
	M_{max} [Nm]				31.7	40.8	54.9	62.5			

Rated speed n_{rated} = 3000 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD70S	I_{max} [%I_{rated}]	250	145								
	M_{max}/Nm	2.6	2.8								
CMD70M	I_{max} [%I_{rated}]	250	196								
	M_{max}/Nm	3.8	5.2								
CMD70L	I_{max} [%I_{rated}]	250	250	221							
	M_{max} [Nm]	4.7	8.8	11.2							
CMD93S	I_{max} [%I_{rated}]	250	250	152							
	M_{max} [Nm]	5	8.5	9.6							
CMD93M	I_{max} [%I_{rated}]		250	250	193						
	M_{max} [Nm]		11.8	20.3	22.4						
CMD93L	I_{max} [%I_{rated}]			250	250	248					
	M_{max} [Nm]			19.2	26.9	32.7					

Rated speed n_{rated} = 4500 rpm

		MOVIAXIS® MX									
		Size 1			Size 2		Size 3		Size 4	Size 5	Size 6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
Motor	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CMD55S	I_{max} [%I_{rated}]	204									
	M_{max} [Nm]	1.1									
CMD55M	I_{max} [%I_{rated}]	250	152								
	M_{max} [Nm]	2.1	2.3								
CMD55L	I_{max} [%I_{rated}]	250	250	152							
	M_{max} [Nm]	3	5.2	5.9							

3.8 Motor selection for asynchronous servomotors

CT/CV asynchronous servomotors

SEW-EURODRIVE offers CT/CV asynchronous servomotors especially for operation with MOVIAXIS®. These motors have the following characteristics:

High power yield

The optimized winding of CT/CV motors facilitates a high power yield.

Classification into speed classes

CT/CV motors are available in four speed classes. The division into speed classes ensures optimum utilization of torque and speed.

With sin/cos encoder as standard

As standard, CT/CV motors are equipped with a high-resolution sin/cos encoder (ES1S, ES2S, EV1S).

TF or TH motor protection as standard

The winding temperature of the three motor phases is monitored using thermistors (TF). The thermistors are connected via encoder connectors. The temperature is then monitored by MOVIAXIS®; no additional monitoring unit is required.

Bimetallic switches (TH) can also be used instead of thermistors. The bimetallic switches are connected via encoder connectors.

	NOTE
	SEW-EURODRIVE recommends using pre-fabricated cables for the connection of TF/TH and KTY sensors to the encoder connector. The cables are listed in the MOVIAXIS catalog.

Thermal classification 155 (F) as standard

CT/CV motors have thermal classification "155 (F)" as standard.

Reinforced pinion spigot

CT/CV motors can generate up to three times their rated motor torque during dynamic operation. For this reason, these motors are equipped with reinforced pinion spigots for direct mounting to gear units to enable them to transmit the high torque levels reliably.

	NOTE
	Either DT/DV or CT/CV motors can be used with MOVIAXIS®. SEW-EURODRIVE recommends using CT/CV asynchronous motors to achieve optimum benefit from the CFC mode.

Motor selection for asynchronous servomotors (CFC)

STOP	**STOP**
	The torque limit (M limit) is set automatically by the startup function of the MOVITOOLS® MotionStudio operating software. **Do not increase this automatically set value.** Setting a torque limit that is too high can damage the servomotor. We recommend always using the latest version of MOVITOOLS® MotionStudio for startup. The latest MOVITOOLS® version can be downloaded from our homepage (www.sew-eurodrive.de).

Motor characteristics

Drives are characterized by their ability to control torque directly and quickly. This means it achieves a highly dynamic overload capacity (> 3×M_{rated}) and a very high speed and control range (up to 1:5000). Stable speed and positioning accuracy meet the high requirements of servo technology. This behavior is implemented using field-oriented control. The current components for magnetization (I_d) and torque generation (I_q) are controlled separately.

The servo inverter needs to know exact data about the motor connected to calculate the motor model. This data is made available by the MOVITOOLS® MotionStudio operating software with the startup function. The necessary motor data for the SERVO operating modes are stored in MOVITOOLS® MotionStudio for the 4-pole SEW motors.

Typical speed/ torque characteristic curves

M_{rated} is determined by the motor. M_{max} and n_{base} depend on the motor/servo inverter combination. You can refer to the motor selection tables for CFC mode for the values of n_{base}, M_{rated} und M_{max}.

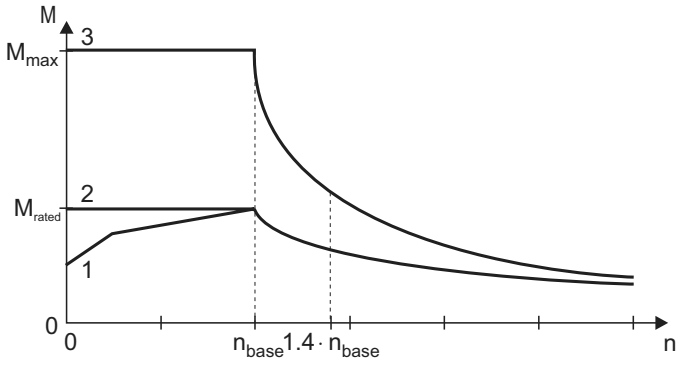

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Fig. 9: Sample speed/torque characteristic curve in CFC operating mode

[1] With integrated cooling

[2] With forced cooling

[3] Maximum torque

Magnetization current

Dynamic drives that have to accelerate without delay are also energized at standstill without load. The magnetizing current I_d flows at standstill. The servo inverter must be able to supply this current constantly in applications in which the output stage is permanently enabled, for example in "Hold control" mode. Particularly in the case of large motors with a slip frequency ≤ 2 Hz, you have to refer to the diagrams in section "Output currents for low rotational field frequencies" to check whether the servo inverter can supply the current. Also check whether the thermal characteristics of the motor are suitable (forced cooling fan) for this. Refer to the motor tables (CT/CV → page 40) or the "SEW Workbench" for the magnetization current I_d.

Basic recommendations

The motor data required for SEW motors is stored in MOVITOOLS® MotionStudio.

Speed control

Project planning for an asynchronous motor is carried out in accordance with the following requirements:

1. Effective torque requirement at average application speed.

   $M_{eff} < M_{rated\_mot}$

   The point must lie below the characteristic curve for the continuous torque (figure 9, curve [2]). No forced cooling is required if this operating point lies below the characteristic curve for integrated cooling (figure 9, curve [1]).

2. Maximum torque needed across the speed curve.

   $M_{max} < M_{dyn\_mot}$

   This operating point must lie below the characteristic curve for the maximum torque of the motor-MOVIAXIS® combination (figure 8, curve [3]).

3. Maximum speed

   Do not configure the maximum speed of the motor higher than 1.4 times the transition speed. The maximum torque available will then still be approx. 110 % of the continuous rated torque of the motor; also, the input speed for the gear unit connected to the motor output will still be less than 3000 rpm with delta connection.

   $n_{max} < 1.4 \times n_{base} < 3000$ rpm

Cooling the motor

Self-cooling of asynchronous motors is based on the integrated fan, which means self-cooling depends on the speed. The integrated fan does not provide cooling for the motor at low speeds and standstill. Forced cooling may be necessary in case of a high static load or a high effective torque.

Motor selection for CT/CV asynchronous servomotors

Structure of the data tables and combination overviews for CT/CV asynchronous servomotors

n_{rated} [rpm]	Motor	M_{rated} [Nm]	I_{rated} [A]	I_{q_rated} [A]	I_{d_rated} [A]	C_T [Nm/A]	V_{rated} [V]	J_{mot} [10^{-4} kgm^2]	J_{bmot} [10^{-4} kgm^2]
1200	CT71D4	3	1.4	1.21	0.69	2.48	360	4.6	5.5
	CT80N4	5	2.1	1.65	1.30	3.0	350	8.7	9.6
	CT90L4	10	3.65	3.13	1.89	3.2	345	34	39.5

n_{rated}	Rated speed
M_{rated}	Rated torque
I_{rated}	Rated current
I_{q_rated}	Torque generating rated current
I_{d_rated}	Magnetizing rated current
C_T	Torque constant
V_{rated}	Rated voltage
J_{mot}	Mass moment of inertia of the motor
J_{bmot}	Mass moment of inertia of the brake motor

Motor		Assignment MOVIAXIS® MXA size									
		1			2		3		4	5	6
Type	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CT71D4 (3000)	M_{max} [Nm]	4.90	7.70								
	n_{base} [rpm]	2566.00	2093.00								

M_{max}	Maximum torque
n_{base}	Transition speed with M_{max} not available above this value due to field weakening.

Motor data of CT/CV servomotors with 400 V system voltage

n_{rated} [rpm]	Motor	M_{rated} [Nm]	I_{rated} [A]	I_{q_rated} [A]	I_{d_rated} [A]	C_T [Nm/A]	V_{rated} [V]	J_{mot} [10^{-4} kgm^2]	J_{bmot} [10^{-4} kgm^2]
	CT71D4	3	1.4	1.21	0.69	2.48	360	4.6	5.5
	CT80N4	5	2.1	1.65	1.30	3.0	350	8.7	9.6
	CT90L4	10	3.65	3.13	1.89	3.2	345	34	39.5
	CV100M4	15	4.7	4.15	2.25	3.61	345	53	59
	CV100L4	26	8.5	7.9	3.21	3.29	320	65	71
	CV132S4	37	11.5	10.4	4.83	3.56	340	146	158
1200	CV132M4	50	15.5	14.2	6.18	3.52	340	280	324
	CV132ML4	61	18.2	16.7	7.43	3.66	345	330	374
	CV160M4	73	22.5	20.3	9.73	3.60	335	400	440
	CV160L4	95	30	26.7	14.2	3.56	330	925	1030
	CV180M4	110	36	30.2	19.7	3.65	330	1120	1226
	CV180L4	125	39.5	33.8	20.5	3.7	345	1290	1396
	CV200L4	200	58	53.2	23.7	3.76	330	2340	2475
	CT71D4	3	1.9	1.67	0.95	2.48	355	4.6	5.5
	CT80N4	5	2.9	2.28	1.79	3.03	350	8.7	9.6
	CT90L4	10	5	4.32	2.61	3.2	345	34	39.5
	CV100M4	15	6.5	5.73	3.10	3.61	345	53	59
	CV100L4	26	11.7	10.86	4.41	3.29	320	65	71
	CV132S4	37	15.8	14.35	6.67	3.56	340	146	158
1700	CV132M4	48	21	19.2	8.7	3.52	335	280	324
	CV132ML4	58	26.5	23.8	11.2	3.66	320	330	374
	CV160M4	71	30.5	27.2	13.4	3.6	340	400	440
	CV160L4	89	39.5	34.5	19.53	3.56	335	925	1030
	CV180M4	105	48	39.7	27.2	3.65	335	1120	1226
	CV180L4	115	56	46.6	30.7	3.7	325	1290	1396
	CV200L4	190	79	71.2	33.4	3.76	325	2340	2475
	CT71D4	3	2.4	2.1	1.20	1.43	345	4.6	5.5
	CT80N4	5	3.65	2.87	2.26	1.74	340	8.7	9.6
	CT90L4	10	6.4	5.44	3.29	1.84	335	34	39.5
	CV100M4	15	8.2	7.23	3.91	2.07	335	53	59
	CV100L4	25	14.3	13.2	5.56	1.9	310	65	71
	CV132S4	37	19.9	18.1	8.41	2.05	335	146	158
2100	CV132M4	48	26	23.7	10.75	2.03	330	280	324
	CV132ML4	58	30.5	27.5	12.9	2.1	340	330	374
	CV160M4	70	38	33.9	16.9	2.07	330	400	440
	CV160L4	88	49.5	43	24.6	2.05	330	925	1030
	CV180M4	100	59	47.7	34.2	2.1	325	1120	1226
	CV180L4	115	64	53.7	35.4	2.14	345	1290	1396
	CV200L4	175	91	80.1	41.2	2.16	325	2340	2475
	CT71D4	3	3.35	2.9	1.65	1.04	350	4.6	5.5
	CT80N4	4.5	4.75	3.6	3.11	1.26	345	8.7	9.6
	CT90L4	9.5	8.4	7.12	4.54	1.33	345	34	39.5
	CV100M4	15	11.3	9.95	5.39	1.51	345	53	59
	CV100L4	21	17	15.2	7.65	1.38	310	65	71
	CV132S4	35	26.5	23.6	11.6	1.49	340	146	158
3000	CV132M4	45	34.5	31.2	15.1	1.44	335	280	324
	CV132ML4	52	41.5	36.9	19.3	1.41	320	330	374
	CV160M4	64	48.5	42.6	23.3	1.50	340	400	440
	CV160L4	85	67	57.2	33.9	1.49	340	925	1030
	CV180M4	93	77	61.1	47.2	1.52	335	1120	1226
	CV180L4	110	94	77	53.1	1.43	325	1290	1396
	CV200L4	145	110	94.1	57.8	1.54	330	2340	2475

Assignment of CT/CV servomotors with MOVIAXIS® multi-axis servo inverter (AC 400 V system voltage)

Rated speed n_{rated} = 1200 rpm

Motor		Assignment MOVIAXIS® MXA size									
		1			2		3		4	5	6
Type	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CT71D4	M_{max} [Nm]	7.70									
	n_{base} [rpm]	429.00									
CT80N4	M_{max} [Nm]	14.60	15.60								
	n_{base} [rpm]	595.00	550.00								
CT90L4	M_{max} [Nm]		30.50	30.50							
	n_{base} [rpm]		685.00	678.00							
CV100M4	M_{max} [Nm]		35.20	45.00							
	n_{base} [rpm]		806,00	678.00							
CV100L4	M_{max} [Nm]			65.00	75.00	75.00					
	n_{base} [rpm]			762.00	666.00	672.00					
CV132S4	M_{max} [Nm]			69.00	105.00	110.00	110.00				
	n_{base} [rpm]			973.00	826.00	826.00	826.00				
CV132M4	M_{max} [Nm]				103.40	139.00	150.00				
	n_{base} [rpm]				947.00	832.00	806.00				
CV132ML4	M_{max} [Nm]					143.90	183.00	183.00			
	n_{base} [rpm]					851.00	774.00	774.00			
CV160M4	M_{max} [Nm]					139.50	213.00	219.00	219.00		
	n_{base} [rpm]					960.00	826.00	845.00	845.00		
CV160L4	M_{max} [Nm]						207.40	280.00	294.00		
	n_{base} [rpm]						992.00	909.00	954.00		
CV180M4	M_{max} [Nm]							282.60	360.00	360.00	
	n_{base} [rpm]							1018.00	1043.00	1075.00	
CV180L4	M_{max} [Nm]							286.40	360.00	360.00	
	n_{base} [rpm]							934.00	998.00	1050.00	
CV200L4[1)]	M_{max} [Nm]								442.20	567.00	567.00
	n_{base} [rpm]								966.00	947.00	1088.00

1) An effective motor utilization is not possible with the drive sizes available.

Rated speed n_{rated} = 1700 rpm

Motor		Assignment MOVIAXIS® MXA size									
		1			2		3		4	5	6
Type	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CT71D4	M_{max} [Nm]	7.70									
	n_{base} [rpm]	889.00									
CT80N4	M_{max} [Nm]		15.60								
	n_{base} [rpm]		992.00								
CT90L4	M_{max} [Nm]		22.40	30.50							
	n_{base} [rpm]		1312.00	1165.00							
CV100M4	M_{max} [Nm]			45.00	45.00						
	n_{base} [rpm]			1158.00	1158.00						
CV100L4	M_{max} [Nm]			46.70	71.00	75.00	75.00				
	n_{base} [rpm]			1395.00	1152.00	1114.00	1114.00				
CV132S4	M_{max} [Nm]				75.40	102.00	110.00				
	n_{base} [rpm]				1402.00	1280.00	1318.00				
CV132M4	M_{max} [Nm]					97.70	148.50	150.00	150.00		
	n_{base} [rpm]					1446.00	1254.00	1299.00	1280.00		
CV132ML4	M_{max} [Nm]						143.70	183.00	183.00		
	n_{base} [rpm]						1395.00	1312.00	1344.00		
CV160M4	M_{max} [Nm]						152.50	206.00	219.00		
	n_{base} [rpm]						1357.00	1248.00	1293.00		
CV160L4	M_{max} [Nm]							200.10	294.00	294.00	
	n_{base} [rpm]							1434.00	1338.00	1420.00	
CV180M4	M_{max} [Nm]								308.90	360.00	360.00
	n_{base} [rpm]								1434.00	1517.00	1606.00
CV180L4	M_{max} [Nm]									360.00	360.00
	n_{base} [rpm]									1485.00	1728.00
CV200L4[1)]	M_{max} [Nm]									417.60	567.00
	n_{base} [rpm]									1427.00	1504.00

1) An effective motor utilization is not possible with the drive sizes available.

Rated speed n_{rated} = 2100 rpm

Motor		Assignment MOVIAXIS® MXA size									
		1			2		3		4	5	6
Type	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CT71D4	M_{max} [Nm]	6.90	7.70								
	n_{base} [rpm]	1427.00	1318.00								
CT80N4	M_{max} [Nm]		15.60	15.60							
	n_{base} [rpm]		1421.00	1402.00							
CT90L4	M_{max} [Nm]			30.50	30.50						
	n_{base} [rpm]			1632.00	1645.00						
CV100M4	M_{max} [Nm]			40.70	45.00	45.00					
	n_{base} [rpm]			1587.00	1626.00	1626.00					
CV100L4	M_{max} [Nm]				56.00	75.00	75.00				
	n_{base} [rpm]				1741.00	1536.00	1536.00				
CV132S4	M_{max} [Nm]					80.00	110.00	110.00			
	n_{base} [rpm]					1805.00	1728.00	1786.00			
CV132M4	M_{max} [Nm]						119.60	150.00	150.00		
	n_{base} [rpm]						1747.00	1664.00	1696.00		
CV132ML4	M_{max} [Nm]						123.50	166.00	183.00	183.00	
	n_{base} [rpm]						1715.00	1581.00	1606.00	1606.00	
CV160M4	M_{max} [Nm]							161.70	219.00	219.00	
	n_{base} [rpm]							1741.00	1690.00	1734.00	
CV160L4	M_{max} [Nm]								240.30	294.00	294.00
	n_{base} [rpm]								1786.00	1792.00	1869.00
CV180M4	M_{max} [Nm]									327.60	360.00
	n_{base} [rpm]									1830.00	2106.00
CV180L4	M_{max} [Nm]									334.30	360.00
	n_{base} [rpm]									1664.00	2022.00
CV200L4[1)]	M_{max} [Nm]										532.00
	n_{base} [rpm]										1728.00

1) An effective motor utilization is not possible with the drive sizes available.

Rated speed n_{rated} = 3000 rpm

Motor		Assignment MOVIAXIS® MXA size									
		1			2		3		4	5	6
Type	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
CT71D4	M_{max} [Nm]	4.90	7.70								
	n_{base} [rpm]	2566.00	2093.00								
CT80N4	M_{max} [Nm]		12.00	15.60							
	n_{base} [rpm]		2406.00	2202.00							
CT90L4	M_{max} [Nm]			26.00	30.50	30.50					
	n_{base} [rpm]			2451.00	2522.00	2522.00					
CV100M4	M_{max} [Nm]			29.00	44.40	45	45				
	n_{base} [rpm]			2528.00	2285.00	2502	2502				
CV100L4	M_{max} [Nm]				40.00	56.90	75.00	75.00			
	n_{base} [rpm]				2746.00	2714.00	2362.00	2368.00			
CV132S4	M_{max} [Nm]					56.90	87.40	110.00	110.00		
	n_{base} [rpm]					2714.00	2541.00	2490.00	2630.00		
CV132M4	M_{max} [Nm]						83.90	113.50	150.00	150.00	
	n_{base} [rpm]						2732.00	2592.00	2528.00	2541.00	
CV132ML4	M_{max} [Nm]							109.60	167.00	183.00	183.00
	n_{base} [rpm]							2714.00	2483.00	2573.00	2573.00
CV160M4	M_{max} [Nm]								176.70	219.00	219.00
	n_{base} [rpm]								2426.00	2406.00	2515.00
CV160L4	M_{max} [Nm]									232.20	294.00
	n_{base} [rpm]									2541.00	2682.00
CV180M4	M_{max} [Nm]									232.70	360.00
	n_{base} [rpm]									2701.00	2618.00
CV180L4	M_{max} [Nm]										349.00
	n_{base} [rpm]										2547.00
CV200L4[1)]	M_{max} [Nm]										
	n_{base} [rpm]										

1) An effective motor utilization is not possible with the drive sizes available.

3.9 Selecting the braking resistor

⚠ DANGER

The connection leads to the braking resistor carry a **high DC voltage of approx. DC 900 V**.

Severe or fatal injuries from electric shock.

- The braking resistor cables must be suitable for this high DC voltage.
- Install the braking resistor cables according to the regulations.

⚠ WARNING

The surfaces of the braking resistors get very hot when the braking resistors are loaded with P_{rated}.

Risk of burns and fire.

- Choose a suitable installation location. Braking resistors are usually mounted on top of the control cabinet.
- Do not touch the braking resistors.

NOTE

- The data in this section applies to the BW... braking resistors .
- The **maximum permitted cable length** between **MOVIAXIS®** and the braking resistor is **100 m**.

Table of external braking resistors.

MOVIAXIS® MX power supply module			**Size 1**	**Size 2**	**Size 3**	
Internal braking resistor			**10 [kW]** **–**	**25 [kW]** **–**	**50 [kW]** **–**	**75 [kW]** **–**
External braking resistor			**Tubular fixed resistor**	• **Tubular fixed resistor** • **Grid resistor**	**Grid resistor**	**Grid resistor**
R [Ω] 1)			**27**	**12**	**5.8**	**3.6**
Braking resistors	**Trip current2)**	**Part number**				
BW027-006	**I_F = 4.7 A_{RMS}**	**822 422 6**	**0.6 kW** cont. 34.8 kW P_{max} 27 Ω			
BW027-012	**I_F = 6.7 A_{RMS}**	**822 423 4**	**1.2 kW** cont. 34.8 kW P_{max} 27 Ω			
BW247	**I_F = 6.5 A_{RMS}**	**820 714 3**	**2 kW** continuous 20 kW Pmax 47 Ω			
BW347	**I_F = 9.2 A_{RMS}**	**820 798 4**	**4 kW** continuous 20 kW P_{max} 47 Ω			
BW039-050	**I_F = 11.3 A_{RMS}**	**820 798 4**	**5 kW** continuous 24 kW P_{max} 39 Ω			

Table continued on next page.

MOVIAXIS® MX power supply module			Size 1	Size 2	Size 3	
			10 [kW]	25 [kW]	50 [kW]	75 [kW]
Internal braking resistor			–	–	–	–
External braking resistor			Tubular fixed resistor	• Tubular fixed resistor • Grid resistor	Grid resistor	Grid resistor
R [Ω] 1)			27	12	5.8	3.6
Braking resistors	**Trip current 2)**	**Part number**				
BW012-015	I_F = 11.2 A_{RMS}	**821 679 7**		**1.5 kW** cont. 78.4 kW P_{max} 12 Ω (Tubular fixed resistor)		
BW012-025	I_F = 14.4 A_{RMS}	**821 680 0**		**2.5 kW** cont. 78.4 kW P_{max} 12 Ω (Grid resistor)		
BW012-050	I_F = 20.4 A_{RMS}	**821 681 9**		**5 kW** continuous 78.4 kW P_{max} 12 Ω (Grid resistor)		
BW012-100	I_F = 28.9 A_{RMS}	**821 682 7**		**10 kW** continuous 78.4 kW P_{max} 12 Ω (Grid resistor)		
BW915	I_F = 31.6 A_{RMS}	**821 260 0**		**16 kW** continuous 62.7 kW P_{max} 15 Ω (Grid resistor)		
BW006-025-01	I_F = 20.76 A_{RMS}	**1 820 011 7**			**2.5 kW** cont. 156 kW P_{max} 6 Ω 3)	
BW006-050-01	I_F = 29.4 A_{RMS}	**1 820 012 5**			**5 kW** continuous 156 kW P_{max} 6 Ω 3)	
BW004-050-01	I_F = 37.3 A_{RMS}	**1 820 013 3**				**5 kW** continuous 235 kW P_{max} 4 Ω 3)
BW012-100	I_F = 28.8 A_{RMS}	**821 682 7**			**10 kW** continuous 78.4 kW P_{max} 12 Ω	**10 kW** continuous 78.4 kW P_{max} 12 Ω
BW106	I_F = 46.5 A_{RMS}	**821 050 0**			**13 kW** continuous 156 kW P_{max} 6 Ω	**13 kW** continuous 156 kW Pmax 6 Ω
BW206	I_F = 54.7 A_{RMS}	**821 051 9**			**18 kW** continuous 156 kW P_{max} 6 Ω	**18 kW** continuous 156 kW Pmax 6 Ω

1) Minimum permitted resistance

2) See note on how to protect the braking resistor in the section "Overload protection of the braking resistor".

3) Braking resistor with 1 Ω central tap

Selection criteria

Selection of the braking resistor is based on the following criteria:

- Peak braking power
- Brake chopper
- Thermal braking power

Peak braking power

The DC link voltage and the braking resistor value determine the maximum braking power that the braking resistor can handle for a short period of time.

The peak braking power is determined as follows:

$$P_{max} = \frac{U^2_{DC}}{R}$$

60327axx

V_{DC} is the maximum DC link voltage that is DC 970 V for MOVIAXIS®.

The peak braking power for each braking resistor is listed in the table of braking resistors on page 46.

Brake chopper

- Peak braking power

  The brake chopper has the same overload characteristics as the power supply module and therefore does not have to be considered for project planning.
- Continuous braking power

  The brake chopper can cope with 50 % of the rated power of the power supply module as continuous braking power. The value $P_{100\%CDF}$ described in the following section "Thermal braking power" is used as the basis of the calculation here.

$$P_{100\%CDF} < \frac{\text{Rated power supply module}}{2}$$

60329aen

Thermal braking power

The thermal braking power must be taken into account when carrying out project planning for the braking resistor.

This condition takes into account the heating of the braking resistor over the entire cycle.

The thermal braking power is calculated using the energy content of the entire cycle.

- **Determining regenerative energy**

$$W_{tot} = P_{gen\ 1} \times t_1 + P_{gen\ 2} \times t_2 + ... + P_{gen\ n} \times t_n$$

57235axx

W_{tot}	Regenerative energy during the entire cycle.
P_{gen}	Power in the regenerative travel section (the constant average value of the peak power can be used for sections with deceleration).
t_n	Duration of the individual travel sections

The motor travel sections and pauses are not taken into account.

- **Determining the virtual braking time**

The virtual braking time is the time during which the regenerative energy W_{tot} is reduced to a braking operation. The power value is based on the maximum occurring regenerative power.

$$t_{vB} = \frac{W_{tot}}{P_{gen\ max}}$$

57239axx

t_{vB}	Virtual braking time
$P_{gen\ max}$	Maximum occurring regenerative power

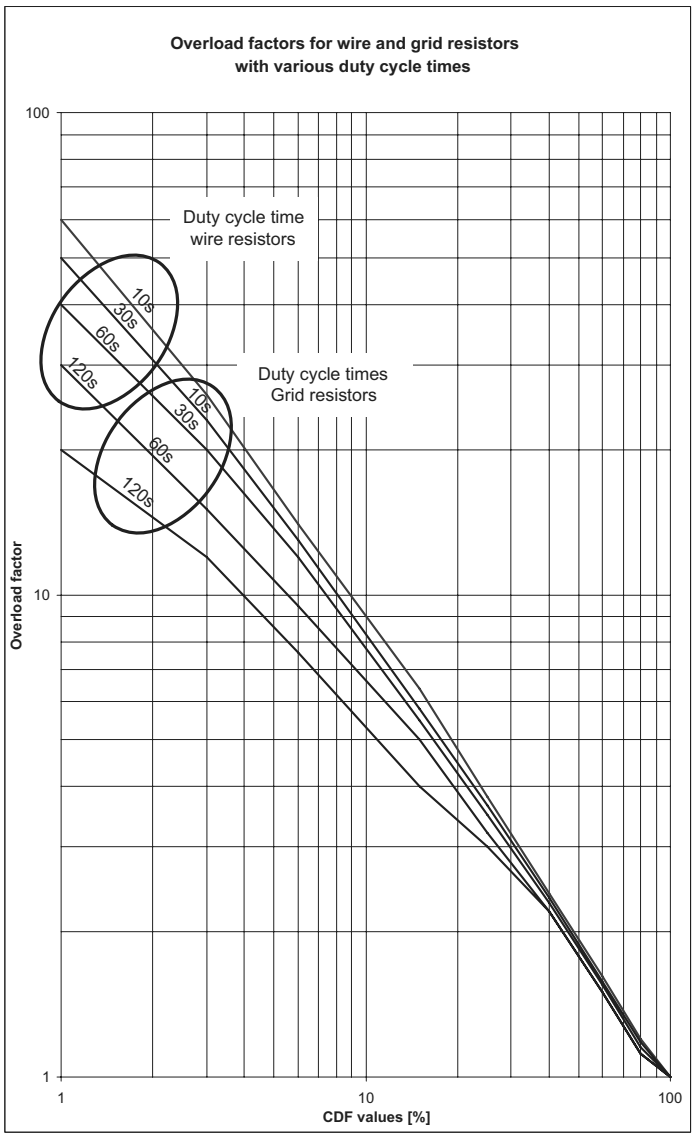
- **Determining the relative regenerative CDF**

$$CDF_{gen} = \frac{t_{vB}}{T}$$

57240aen

CDF_{gen}	Relative regenerative cyclic duration factor with reference on the virtual braking time
T	Cycle time (cycle duration) (pauses and motor travel sections not included in calculation)

- Determining the overload factor



57241aen

Fig. 10: Overload factors for tubular and grid resistors

- **Determining the required braking resistor power**

The overload factor can be used to calculate the required braking resistor power based on 100% CDF (catalog value).

$$P_{100\%CDF} = \frac{P_{gen\ max}}{\text{Overload factor}}$$

57242aen

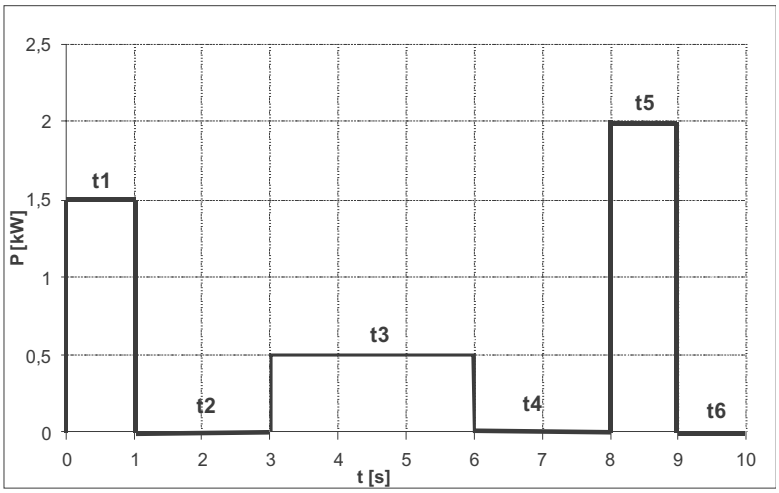
$P_{100\%CDF}$ Braking resistor power based on 100% CDF

- **Selecting the braking resistor from the catalog**

With 100% CDF power, the braking resistor can be selected from the catalog.

Sample calculation for a 10 kW power supply module

- Minimum permitted braking resistance: 27 Ω
- Five braking resistors are assigned to the 10 kW power supply module, see page 46.



57243axx

Fig. 11: Total regenerative power of all axes

Determining the fed back energy

$$W_{tot} = P_{gen\ 1} \times t_1 + P_{gen\ 2} \times t_2 + ... + P_{gen\ n} \times t_n$$

$$W_{tot} = 1.5\ kW \times 1\ s + 0.5\ kW \times 3\ s + 2\ kW \times 1\ s = 5\ kWs$$

57245axx

Determining the virtual braking time

$$t_{vB} = \frac{W_{tot}}{P_{gen\ max}}$$

$$t_{vB} = \frac{5\ kWs}{2\ kW} = 2.5\ s$$

57246axx

Determining the relative regenerative CDF

$$CDF_{gen} = \frac{t_{vB}}{T}$$

$$CDF_{gen} = \frac{2.5\ s}{10\ s} = 25\ \%$$

57247aen

Determining the overload factor

Determining the factor using the "Overload factor" diagram, figure 10.

Overload factor: 4 (with CDF_{gen} = 25 %, laminated resistor and cycle time = 10 s).

Determining the required braking resistor power

$$P_{100\%CDF} = \frac{P_{gen\ max}}{\text{Overload factor}}$$

$$P_{100\%CDF} = \frac{2\ kW}{4} = 500\ W$$

57248aen

Selecting the braking resistor from the catalog

The following braking resistor is selected from the catalog:

BW027-012 with 600 W continuous power.

Overload protection of the braking resistor

	**STOP**
	A thermal overload relay is necessary to protect the braking resistor against overload. These relay types offer a setting option for the trip current. Set the trip current to the rated current of the resistor. No motor protection switches may be used. **Important: Do not open** the power contacts of the braking resistors in case of thermal overload. The connection between braking resistor and DC link may **not be interrupted**. Instead, the control contact of the overload relay opens relay K11 (→ Operating instructions, section 5.5 "Wiring diagrams").

Unit temperature

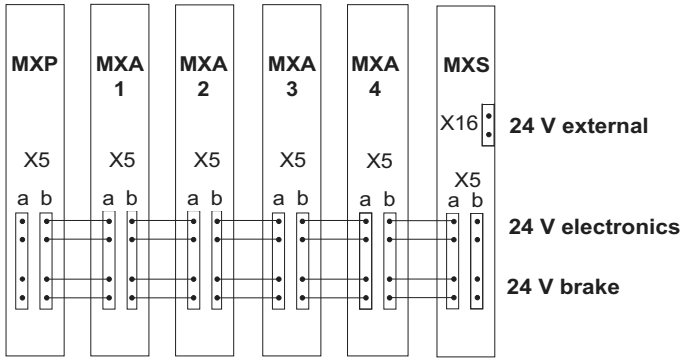
	**⚠ WARNING** The surfaces of the braking resistors get very hot when the braking resistors are loaded with P_{rated}. Risk of burns and fire. • Choose a suitable installation location. Braking resistors are usually mounted on top of the control cabinet. • Do not touch the braking resistors.

	NOTES
	Braking resistors can become very hot during operation. The high temperatures can heat up the cage of the braking resistor to over 100 °C. This means that the ventilation, size of the installation site and distance to components and parts at risk must be provided accordingly. The braking resistor usually delivers its rated power for an extended period of time.

3.10 Selecting the 24 V supply

The axis modules require a supply voltage of 24 V at two separate connection terminals:

- Supply of electronics
- Supply of brakes



59025aen

Fig. 12: Sample arrangement sequence of MOVIAXIS® MX units

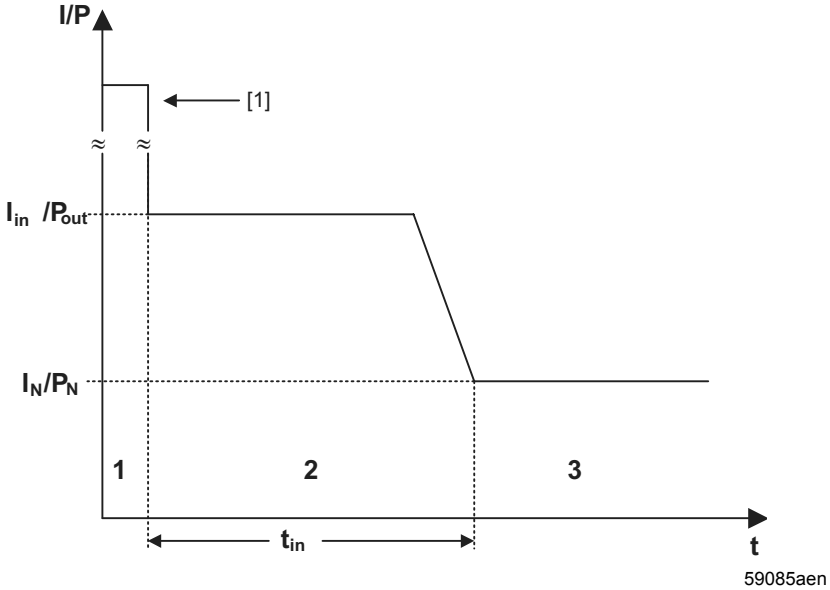
Key:

24 V	DC 24 V voltage supply
MXP	MOVIAXIS® power supply module
MXA 1 ... MXA 4	MOVIAXIS® axis modules unit 1 to unit 8
MXS	24 V switched-mode power supply

Project planning for 24 V supply power

The current path and power ratios present when switching on the 24 V voltage supply are shown in figure 13.

The current path is basically divided into three time ranges.



59085aen

Fig. 13: Current and power characteristics when switching on supply power

[1] Charging current due to internal input capacitance C_{input}

1. Describes the charging process of the input capacitors in each unit. A time period cannot be specified because the charging time is significantly influenced by the property of the power supply and the line dimensioning. You therefore have to calculate the total of all unit capacitances using the table below. Manufacturers of switched-mode power supplies usually specify technical data about the loadable capacitances.
   Charging time 1 is very short in comparison with time range 2.
   The SEW switched-mode power supply module MXS is capable of reliably activating the combination of units with the highest possible capacitance.
2. This is the time interval when the unit's internal switched-mode power supplies start up. The total of the maximum power consumption must be calculated for this time period. The power supply must be capable of providing this total power for at least 100 ms.
   The SEW switched-mode power supply module MXS meets this requirement.
3. Rated power range. The required rated power of the supply source results from the total rated power of all connected devices.

Table for project planning according to points 1 – 3.

Unit type	Supply voltage electronics [V]	Rated current I_{rated} [A] / rated power P_{rated} [W]	Max. switch-on current [A] / power P_{on} [W]	Switch-on pulse duration t_{on} [ms]	Input capacitance C_{input} [µF]
MXA BG1	18 – 30	0.7 / 17	2 / 48	60	600
MXA BG2		0.95 / 23	2.2 / 53	70	600
MXA BG3		1.3 / 23	2.1 / 50	90	600
MXA BG4		2.2 / 53	2 / 48	80	700
MXA BG5		2.3 / 55	2 / 48	80	700
MXA BG6		3.2 / 77	2.5 / 60	60	1000
MXP BG1	18 – 30	0.5 / 12	0.3 / 7	40	100
MXP BG3		0.8 / 19	0.6 / 14	60	500
MXZ	18 – 30	0.1 / 2.5	0.3 / 7	60	50
MXC		1 / 24	2.7 / 65	400	300
MXM[1)]	18 – 30	0.1 / 2.5	0.2 / 5	30	50

		P [W]	
XFE	is part of the basic unit		
XFP	Power supply via basic unit	3	is taken into account in the specifications of the basic unit
XFA		2	
XIO		1	
XIA		1	
XGH[2)]		2	
XGS[2)]		2	

1) Valid in combination with DHP11B

2) Specifications without connected encoder. Maximum power that can be connected: 12 W

Single and two-bus supply

The figure shows the separation of the 24 V electronics supply between the MXA 4 axis module and the MXA 5 axis module and is a sample application for the current load at plug-in contacts > 10 A. If the anticipated current load >10 A, you must install the two-bus supply.

The breakpoint of the electronics supply with two-bus supply must be arranged so that the current loads of the two segments are split evenly.

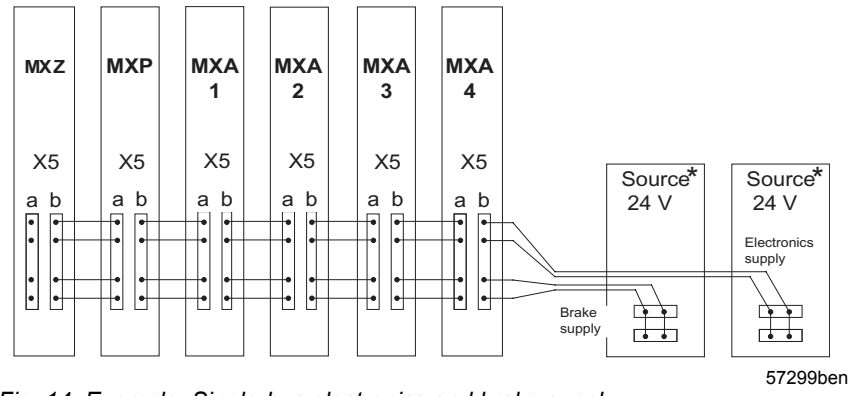


Fig. 14: Example: Single-bus electronics and brake supply

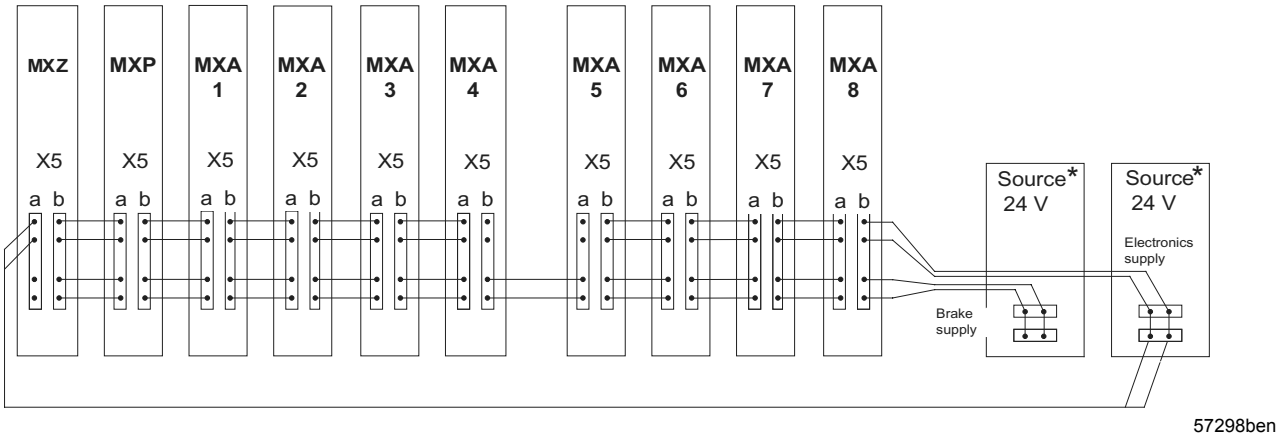


Fig. 15: Example: Two-bus electronics supply

* We recommend the 24 V switched-mode power supply module MXS from SEW-EURODRIVE

Requirements on the voltage tolerance of the 24 V supply

Three cases have to be distinguished when carrying out project planning for the 24 V voltage supply.

1. Only the following servo brake motors are connected to the MOVIAXIS® axis system unless in the case of combined operation with the motors mentioned in example 2.
   - CMP40/50/63,
   - DS56.
2. The brake output is used as control output (e.g. brake is activated via a BMK, BME brake rectifier); that is, only the following servo brake motors are part of the MOVIAXIS® axis system:
   - CT/CV
   - CM
   - DS56 if the brake cable is longer than 25 m, also see page 59.
   - CMP40 / 50 / 63 if the brake cable is longer than 25 m, also see page 59.
3. No motor with brake connected.

Voltage supply	Example 1	Example 2[1)]	Example 3
Electronics voltage supply	24 V ± 25 %	24 V ± 25 %	24 V ± 25 %
Brake voltage supply	24 V +10% / - 0 %		None

1) Use a common voltage source

Activating the brake

Motor brakes must only be controlled with binary output X6, DB00 on the MOVIAXIS® axis module and not with other electronic devices, such as controllers.

Connecting AC brake motors

For detailed information about the SEW brake system, refer to the "Gearmotors" catalog, which you can order from SEW-EURODRIVE.

3.11 Selecting 24 V safety technology

For project planning information refer to the following publications:

- Safe Disconnection for MOVIAXIS® – Conditions
- Safe Disconnection for MOVIAXIS® – Applications

3.12 Selecting a capacitor module

	NOTES
	For project planning for capacitor modules, contact SEW-EURODRIVE.

3.13 Selecting a buffer module

	NOTES
	For project planning for buffer modules, contact SEW-EURODRIVE.

3.14 Selecting a DC link discharge module

	NOTES
	For project planning for a DC link discharge module, contact SEW-EURODRIVE.

3.15 Cables for mains connection, motor, motor brake, braking resistor, and fuses

Special regulations

When selecting and fusing line cross-sections, you must comply with **country-specific and system-specific** regulations. Also comply with the instructions for **UL-compliant installation** as applicable.

Motor cable length

The maximum motor cable length is

- 50 m shielded,
- 100 m unshielded (observe EMC regulations).

An exception from this rule is the **2 A axis module**. Its maximum motor cable length is

- 25 m shielded,
- 50 m unshielded (observe EMC regulations).

Motor brake cable

The motor brake cable has an influence on the tolerance requirement for the 24 V brake supply. The cross-section of the brake cable must not be under 1 mm² for the 24 V supply voltage. Internal control via brake rectifier is required if the line length exceeds 25 m. The motor brake cables must always be shielded. SEW-EURODRIVE recommends using pre-fabricated motor brake cables.

Line cross-sections and fusing

SEW-EURODRIVE proposes the following line cross-sections and fusing for single-core copper cables with PVC insulation laid in cable ducts, an ambient temperature of 40 °C and rated system currents of 100 % of the rated unit current:

MOVIAXIS® MXP power supply modules:

MOVIAXIS® MXP	**Size 1**	**Size 2**	**Size 3**	
Rated output power [kW]	10	25	50	75
Mains connection				
Rated mains current AC [A]	15	36	72	110
Fuses F11/F12/F13 I_{rated}	Design according to rated mains current			
Supply system cable L1/L2/L3	1.5 – 6 mm²	10 – 16 mm²	16 – 50 mm²	35 – 50 mm²
PE conductor	1 × 10 mm²	1 × 16 mm²	1 × 50 mm²	1 × 50 mm²
Cross-section and contacts mains connection	COMBICON PC4 pluggable, max. 4 mm²	COMBICON PC6 pluggable, max. 6 mm²	Screw bolt M8 max. 50 mm²	
Cross-section and contacts on shield clamp	max. 4 × 4 mm²	max. 4 × 6 mm²	max. 4 × 50 mm² unshielded	
Braking resistor connection				
Brake line +R/-R	Design according to rated current of braking resistor			
Cross-section and contacts on connections	COMBICON PC4 pluggable, max. 4 mm²	COMBICON PC6 pluggable, max. 6 mm²	M6 screw bolts max. 16 mm²	
Cross-section and contacts on clamp	max. 4 × 4 mm²	max. 4 × 6 mm²	max. 4 × 16 mm²	
Cross-section and contacts on braking resistor	→ Technical data of braking resistors			

MOVIAXIS® MXA axis modules:

MOVIAXIS® MXA	Size 1			Size 2	
Rated output mains current AC [A]	2	4	8	12	16
Motor cable U/V/W	1.5 – 4 mm²				
Motor connection to the connection panel	COMBICON PC4 pluggable, max. 4 mm²				
Motor connection to the power shield clamp	max. 4 × 4 mm²				

MOVIAXIS® MXA	Size 3		Size 4	Size 5	Size 6
Rated output mains current AC [A]	24	32	48	64	100
Motor cable U/V/W	4 – 6 mm²	6 mm²	10 – 16 mm²	16 mm²	25 – 50 mm²
Motor connection to terminals	COMBICON PC6 pluggable, one conductor per terminal: 0.5...16 mm², two conductors per terminal: 0.5...6 mm²		M6 screw bolts max. 16 mm²		max. 4 × 50 mm²
Motor connection to the power shield clamp	max. 4 × 6 mm²		max. 4 × 16 mm²		max. 4 × 50 mm²

Voltage drop via motor cable

The cross-section of the motor cable should be selected so that the **voltage drop is as small as possible**. If the voltage drop is too great, the full motor torque is not achieved.

The expected voltage drop can be determined with reference to the following tables (the voltage drop can be calculated in proportion to the length if the cables are shorter or longer). This information applies in case of core lines made of copper with PVC insulation at 40 °C ambient temperature and installation type "E" according to EN60204-1 1998-11 table 5.

Line cross-section	Load with I [A] =															
	4	**6**	**8**	**10**	**13**	**16**	**20**	**25**	**30**	**40**	**50**	**63**	**80**	**100**	**125**	**150**
Copper	Voltage drop ΔU [V] with length = 100 m (330 ft) and ϑ = 70 °C															
1.5 mm²	5.3	8	10.6	13.3	17.3	21.3	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
2.5 mm²	3.2	4.8	6.4	8.1	10.4	12.8	16	1)	1)	1)	1)	1)	1)	1)	1)	1)
4 mm²	1.9	2.8	3.8	4.7	6.5	8.0	10	12.5	1)	1)	1)	1)	1)	1)	1)	1)
6 mm²					4.4	5.3	6.4	8.3	9.9	1)	1)	1)	1)	1)	1)	1)
10 mm²						3.2	4.0	5.0	6.0	8.2	10.2	1)	1)	1)	1)	1)
16 mm²								3.3	3.9	5.2	6.5	7.9	10.0	1)	1)	1)
25 mm²									2.5	3.3	4.1	5.1	6.4	8.0	1)	1)
35 mm²											2.9	3.6	4.6	5.7	7.2	8.6
50 mm²														4.0	5.0	6.0

1) Not recommended design range, excessive voltage drop.

Line Cross-section	Load with I [A] =															
	4	6	8	10	13	16	20	25	30	40	50	63	80	100	125	150
Copper	Voltage drop ΔU [V] with length = 100 m (330 ft) and ϑ = 70 °C															
AWG16	7.0	10.5	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
AWG14	4.2	6.3	8.4	10.5	13.6	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
AWG12	2.6	3.9	5.2	6.4	8.4	10.3	12.9	1)	1)	1)	1)	1)	1)	1)	1)	1)
AWG10					5.6	6.9	8.7	10.8	13.0	1)	1)	1)	1)	1)	1)	1)
AWG8						4.5	5.6	7.0	8.4	11.2	1)	1)	1)	1)	1)	1)
AWG6								4.3	5.1	6.9	8.6	10.8	13.7	1)	1)	1)
AWG4									3.2	4.3	5.4	6.8	8.7	10.8	13.5	1)
AWG3									2.6	3.4	4.3	5.1	6.9	8.6	10.7	12.8
AWG2											3.4	4.2	5.4	6.8	8.5	10.2
AWG1												3.4	4.3	5.4	6.8	8.1
AWG1/0												2.6	3.4	4.3	5.4	6.8
AWG2/0													2.7	3.4	4.3	5.1

1) More than 3 % voltage drop in relation to V_{Mains} = 460 V_{AC} (not recommended)

3.16 Permitted voltage supply systems

NOTES

MOVIAXIS® is intended for operation on voltage supply systems with a directly grounded star point (TN and TT power systems). Operation on voltage supply systems with a non-grounded star point (for example IT power systems) is also permitted.

In such cases, SEW-EURODRIVE recommends using earth-leakage monitors employing pulse-code measurement. Use of such devices prevents the earth-leakage monitor mis-tripping due to the earth capacitance of the servo inverter.

3.17 Mains contactors and mains fuses

Mains contactor

- Only use mains contactors in utilization category AC-3 (IEC 158-1).
- Do not use the K11 relay for jog mode, but only for switching the servo inverter on/off. Use the FCB "Jog" for jog mode.

STOP

- Observe a minimum switch-off time of 10 s for the relay K11.
- Do **not** turn the mains on or off **more than once** per minute.
- The mains contactor must always be positioned before the line filter.

Mains fuse types

Line protection types in operating classes gL, gG:

- Rated fusing voltage ≥ rated mains voltage

Line protection switches with characteristics B, C and D:

- Circuit breaker rated voltage ≥ rated mains voltage
- Rated line protection currents must be 10 % above the rated mains current power supply module.

3.18 Components for EMC compliant installation

MOVIAXIS® servo inverters are designed for use as components for installation in machinery and systems. The components comply with the EMC product standard EN 61800-3 "Variable-speed electrical drives". Provided the information relating to EMC compliant installation is observed, they satisfy the appropriate requirements for CE-marking of the entire machine/system in which they are installed, on the basis of the EMC Directive 89/336/EEC.

Interference immunity

With regard to interference immunity, MOVIAXIS® meets all the requirements stipulated in EN 61000-6-2 and EN 61800-3.

Interference emission

Higher levels of interference are permitted in industrial environments than in residential environments. In industrial environments, it may be possible to dispense with the measures listed below depending on the situation of the supply system (mains) and the system configuration.

Limit value class A

Compliance with limit class A to EN 55011 has been tested on a typical drive system with the following characteristics:

- Installation of the servo inverters in a control cabinet with galvanized mounting plate according to the rules for EMC compliant installation.
- A NF line filter is used.
- Shielded SEW motor cables are used.

IT systems

STOP	**STOP**
	No EMC limits are specified for interference emission in voltage supply systems without a grounded star point (IT systems). The efficiency of line filters is severely limited.

Cable lengths of the line filter for MOVIAXIS®

STOP	**STOP**
	If no shield is used for the connecting cables between the power supply module and line filter or between the line filter and K11 contactor, the length of these cables must not exceed 600 mm.

Block diagram of limit value class A

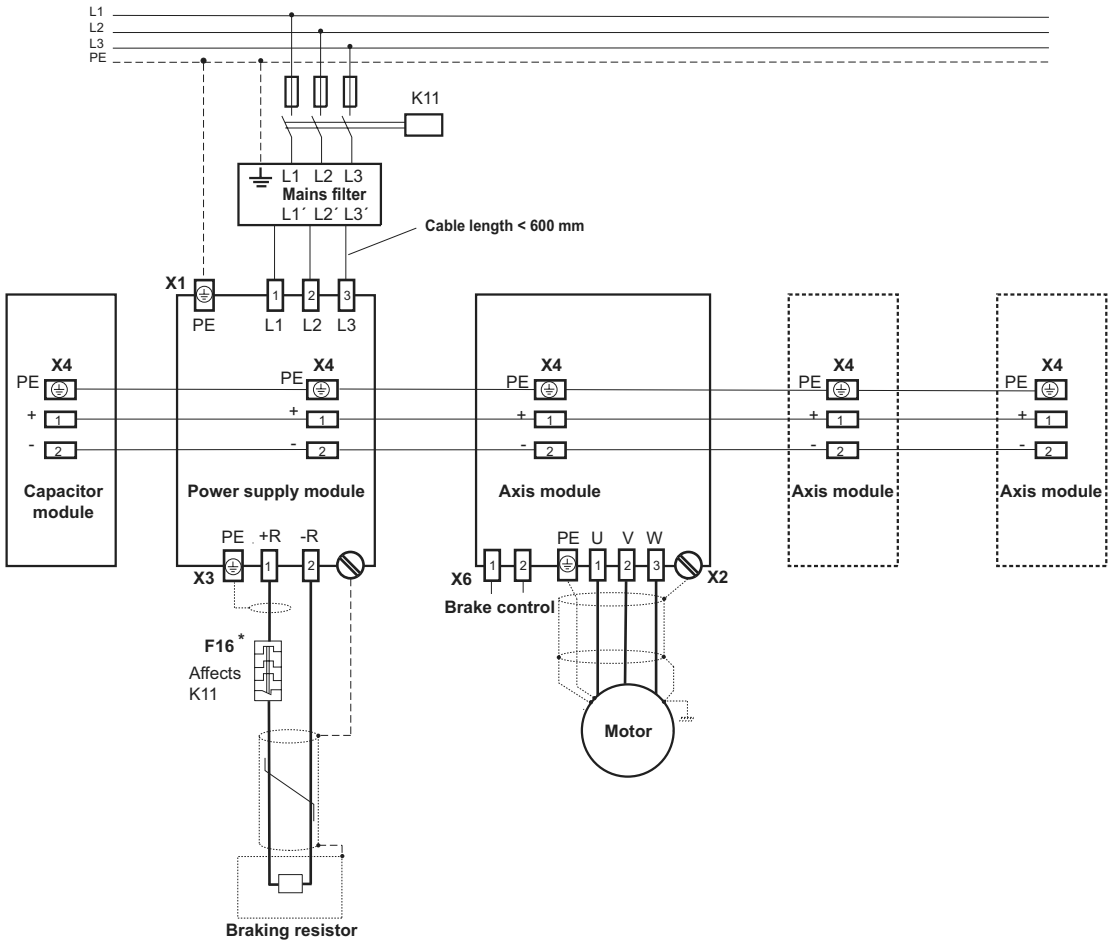


Fig. 16: Sample wiring diagram for EMC-compliant installation

For detailed information about this topic, refer to the MOVIAXIS® operating instructions, section 5.8.

4 Parameter Description

Section 5 "Index" provides a list with parameters sorted in ascending index order with reference to the page with the relevant parameter description.

Default values are underlined.

4.1 Parameter description for display values

Process values active drive

10120.1 Velocity

Unit: User-defined unit (default: rpm)
Resolution: 10^{-3}
Value range: –2147483648...0...2147483647, step 1
Current actual velocity in user-defined units.

9704.1 Position

Unit: User-defined unit (default: rev)
Resolution: 1/65536
Value range: –2147483648...0...2147483647, step 1
Current actual position in user-defined units.

9839.1 Position Modulo

Unit: User-defined unit (default: rev)
Resolution: 1/65536
Value range: –2147483648...0...2147483647, step 1
Current Modulo actual position in user-defined units with the set Modulo limits:

- Parameter "9594.10 Modulo overflow"
- Parameter "9594.1 Modulo underflow"

9985.1 Torque

Unit: User-defined unit (default: % rated motor torque)
Resolution: 10^{-3}
Value range: –2147483648...0...2147483647, step 1
Current torque in user-defined units.

9980.1 Speed

Unit: rpm
Resolution: 10^{-3}
Value range: –2147483648...0...2147483647, step 1
Current actual speed (system unit).

10068.1 Position

Unit: Increments
Resolution: 1/65536
Value range: –2147483648...0...2147483647, step 1
Current actual position in increments (system unit).

9784.1
Torque

Unit: % Rated motor torque

Resolution: 10^{-3}

Value range: –2147483648...0...2147483647, step 1

Current motor torque (system unit).

9951.1
Effective minimum torque

Unit: %

Resolution: 10^{-3}

Value range: –2147483648...0...2147483647, step 1

Effective minimum torque (system unit).

This parameter indicates the currently effective negative torque limit. This limit can be the

- system limit
- application limit
- current limit
- or one of the FCB limits

depending on which limit would apply first.

9951.2
Effective maximum torque

Unit: %

Resolution: 10^{-3}

Value range: –2147483648...0...2147483647, step 1

Effective maximum torque (system unit).

This parameter indicates the currently effective positive torque limit. This limit can be the

- system limit
- application limit
- current limit
- or one of the FCB limits

depending on which limit would apply first.

9872.255
KTY temperature motor

Unit: °C

Resolution: 10^{-3}

KTY motor temperature of the current parameter set.

This is the temperature of the sensor, which may deviate from the motor temperature depending on the dynamics.

Remedy: Motor utilization with calculated motor model.

The KTY sensor has a tolerance of ± 5 %.

9874.255
Motor utilization, maximum KTY model

Unit: %

Resolution: 10^{-3}

Motor utilization of the current parameter set.

The motor utilization uses a motor model to calculate the temperature transition of the motor to the KTY sensor. The injected current is also taken into account. The display is output in % and starts at a motor model temperature of 40 °C = 0 % and a shutdown temperature = 100 %.

Process values output stage

MOVIAXIS® monitors a number of internal values to prevent overloading in the axis module. These values include

- Chip hub
- Chip temperature
- Heat sink temperature
- Load on electromechanics

The customer benefits lie in the predictable behavior of MOVIAXIS®, which for example, prevents unwanted or unexpected machine failure and ensures reproducible behavior.

9793.1
Output frequency

Unit: Hz
Resolution: 10^{-3}
Displays the current output frequency present at the motor in Hz.

9786.1
Output current

Unit: % rated axis current
Resolution: 10^{-3}
Displays the current output current in % of the rated axis current.

9787.1
Torque current

Unit: % rated axis current
Resolution: 10^{-3}
Displays the torque-generating q current in % of the rated axis current.

9788.1
Magnetization current

Unit: % rated axis current
Resolution: 10^{-3}
Displays the magnetization-generating d current in % of the rated axis current.

8326.0
Output current

Unit: A
Resolution: 10^{-3}
Displays the current output current in A (output current).

9853.1
Torque current

Unit: A
Resolution: 10^{-3}
Displays the torque-generating q current in A.

9855.1
Magnetization current

Unit: A
Resolution: 10^{-3}
Displays the magnetization-generating d current in A.

8325.0
DC link voltage

Unit: V
Resolution: 10^{-3}
Displays the current DC link voltage in V.

9706.1
Output voltage

Unit: V

Resolution: 10^{-3}

Displays the current output voltage in V.

9791.1
Torque voltage

Unit: V

Resolution: 10^{-3}

Displays the torque-generating q current in V.

9792.1
Magnetization voltage

Unit: V

Resolution: 10^{-3}

Displays the magnetization-generating d voltage in V.

9859.1
Thermal current limit

Unit: % rated axis current

Resolution: 10^{-3}

Displays the current thermal current limit in % of the rated axis current.

The axis has a brief overload capacity up to this maximum limit (maximum operating point). The thermal current limit is dynamically adjusted according to the utilization of the axis. It starts at 250 % and becomes smaller according to utilization.

9811.5
Total utilization

Unit: %

Resolution: 10^{-3}

Total utilization of the axis in percentage.

The highest value of the 4 utilization calculations

- Chip hub
- Chip absolute
- Heat sink
- and electro mechanics

is displayed.

The axis is deactivated at 100 %.

The parameter is filtered for display as utilization can change very dynamically specifically for the chip.

9811.1
Dynamic utilization chip hub

Unit: %

Resolution: 10^{-3}

Dynamic utilization of the chip hub in percentage (Ixt utilization).

The parameter is unfiltered.

9811.2
Dynamic utilization chip absolute

Unit: %

Resolution: 10^{-3}

Dynamic utilization of the chip absolute in percentage (Ixt utilization).

The parameter is unfiltered.

9811.4 Heat sink utilization

Unit: %

Resolution: 10^{-3}

Heat sink utilization in percentage (Ixt utilization).

The parameter is unfiltered.

9795.1 Heat sink temperature

Unit: °C

Resolution: 10^{-3}

Temperature of the heat sink in °C.

9811.3 Electromechanical utilization

Unit: %

Resolution: 10^{-3}

Electromechanical utilization in percentage (Ixt utilization).

The parameter is unfiltered.

Unit status

9702.2 Axis status

Value range:

- 0 = Not ready
- 1 = Ready, output stage inhibited
- 2 = Ready, output stage enabled

Displays axis status.

9702.3 Current FCB

Displays currently active FCB.

9702.6 Current FCB instance

Display of the current FCB instance (only for FCB 09 Positioning).

9702.4 Active parameter set

Displays current parameter set.

9873.1 Active factory setting

Value range:

- 0 = No factory setting (can not be selected via the parameter tree)
- 1 = Basic initialization
- 2 = Delivery status
- 3 = Factory setting
- 4 = Customer set 1
- 5 = Customer set 2

This parameter indicates whether and what type of initialization is currently active.

For a description of the individual initialization options, see section "Unit functions / Setup".

9702.1
Status display

- Bit 0 Output stage enabled

  "Output stage enabled" is a subset of "Ready for operation" which is set to "1" in all FCBs except for FCB 01 Output stage inhibit.

- Bit 1 Ready

  0 signal: The axis is currently not ready for operation. Reasons can be error states or operating states outside FCB processing (supply voltage off, power supply module not ready).

  1 signal: The axis is in FCB processing. If no FCB is selected, the default FCB 13 Stop at application limits will be active. The 7-segment display will show the number "13".

- Bit 2 Setpoints active

  This message is active in all setpoint processing FCBs when setpoints are being processed. This is FCB 05 – FCB 10. The message is set to "0" in all stop FCBs as well as in the default FCB.

  The message is still 0 during the brake release time.

- Bit 5 Error response display only

  This message is a subset of "Fault" and displays error responses that are configured to "Display fault". The drive continues to operate normally.

- Bit 6 Error response is not equal to output stage inhibit

  This signal is a subset of "Fault" and indicates that the drive can be decelerated using a ramp (motor does not coast to a halt / mechanical brake is not applied). This bit is also set when "Message displayed error is set".

- Bit 7 Error response output stage inhibit

  This message is a subset of "Fault" and indicates that the motor coasts to a halt or, if installed, the mechanical brake is applied.

- Bit 8 24 V standby mode

  Is set when the supply voltage is removed.

- Bit 9 Supply module not ready for operation.

  If the power supply module does not send a ready signal, e.g. due to brake resistor overload or power supply underload.

- Bit 10 Axis module not ready

  This parameter is a subset of "Bit 1 Ready" and refers only to the axis module.

- Bit 11 Safe stop 1

  Indicates whether a safety relay 1 has detected a safe stop. Only active in conjunction with optional safety relay (unit type MXA81A..... or MXA82A.....).

- Bit 12 Safe stop 2

  Indicates whether a safety relay 2 has detected a safe stop. Only active in conjunction with two optional safety relays (MXA82A.....).

- Bit 13 Process data not ready "C3"

  Is displayed when one of the 16 "In buffers" is set to communication and the corresponding PDO has never been received. This message is not generated any longer once the PDO was received once. Instead, a timeout error is generated when the communication is disconnected.

- Bit 19 Encoder not ready

  Displays whether the encoder is communicating. No communication means the encoder or wiring might be defective or that motor startup was not executed.
- Bit 20 Parameter download active

  Indicates whether parameters are currently being downloaded.

9950.1
Final error status

Displays the currently pending error status:

- Bit 0 Displaying

  The axis only displays the error in the 7-segment display. The axis continues to run in normal operation.
- Bit 1 Waiting

  The axis waits for a manual reset. The error is reset and operation is continued without boot reset of the firmware.
- Bit 2 Locked

  The axis waits for a manual reset. The axis then reboots (like when it is switched on).

9702.5
Error code

Displays the pending error code. See also list of errors in section 7 of the MOVIAXIS® operating instructions.

10071.1
Sub error code

Displays the pending sub error code. See also list of errors in section 7 of the MOVIAXIS® operating instructions.

8617.0
Manual reset

Value range:

- 0 = No
- 1 = Yes

Manual reset to reset the error.

Unit data

9701.1 – 5
Axis type

Displays the order designation of the unit, e.g. MXA-80A-004-503-00.

9701.10
Unit series

Displays the unit series, e.g. MOVIAXIS.

9701.11
Unit version

Displays the unit version.

9701.13
Rated unit voltage

Unit: mV

Value range: 0...2000000, step 1

Displays the rated unit voltage.

9701.14
Number of input phases

Value range:
- 1 = single phase
- 3 = three phase

Displays the number of input phases.

9701.15
Radio interference suppression on mains end

Value range:
- 1 = none
- 2 = A
- 3 = B

Displays the implemented radio interference suppression compliant with the EMC product standard EN 61800-3.

9617.1
Maximum possible output speed

Unit: 10^{-3} rpm

Value range: 0...1000000, step 1

Maximum possible output speed the axis module can control.

9617.6
Rated unit current

Unit: mA

Value range: 0...30000...1000000, step 1

Rated unit current, RMS value.

9617.2
Maximum output current

Unit: mA

Value range: 0...12000...1000000, step 1

Maximum possible output current, RMS value

9701.17
Standard encoder system

Value range:
- 13 = Hiperface / Resolver

Displays the SEW standard encoder for the unit.

9701.18
Device serial number

Value range: 0...4294967295, step 1

Displays the serial number.

9823.1 – 5
Device signature

Display and entry of the unit signature. You can assign a name to the unit to have the unit displayed in the hardware tree and the visualization components.

9701.30
Firmware part number basic unit

Displays the firmware part number of the basic unit.

9701.31
Firmware status basic unit

Displays firmware status of basic unit.

9701.32 *Firmware version number of basic unit*	Displays the firmware version number of the basic unit.
9880.3 *Initial Boot Loader part number*	Value range: 0...4294967295, step 1 Initial Boot Loader part number.
9880.5 *Initial Boot Loader status*	Value range: 0...4294967295, step 1 Initial Boot Loader status.
9881.3 *Boot Loader part number*	Value range: 0...4294967295, step 1 Boot Loader part number.
9881.5 *Boot Loader status*	Value range: 0...4294967295, step 1 Boot Loader status.
9701.33 *DSP firmware part number*	Value range: 0...4294967295, step 1 DSP firmware part number.
9701.34 *DSP firmware status*	Value range: 0...4294967295, step 1 DSP firmware status.
9701.35 *DSP firmware version number*	Value range: 0...4294967295, step 1 DSP firmware version number.
9701.37 *FPGA status*	Value range: 0...4294967295, step 1 FPGA firmware status.
9701.38 *FPGA version number*	Value range: 0...4294967295, step 1 Firmware version number FPGA.
9701.41 *Signal electronics*	Value range: 0...4294967295, step 1 Status hardware (computer card).

9701.50
Option in slot 1

Value range:
- 0 = No option
- 1 = Unknown option
- 2 = XIO11A (Digital I/O)
- 3 = XIA11A (Analog-Digital I/O)
- 4 = XHE41A (Plug-in control)
- 5 = XHC41A (Plug-in control)
- 6 = XHA41A (Plug-in control)
- 7 = XGS11A (multi-encoder card)
- 8 = XGH11A (multi-encoder card)
- 9 = XFE24A (EtherCAT card)
- 13 = XFA11A (K-Net)

9701.60
Option in slot 2

Value range:
See parameter 9701.50 "Option in slot 1"

9701.70
Option in slot 3

Value range:
See parameter 9701.50 "Option in slot 1"

9701.53
Option in slot 1, firmware part number

Displays firmware part number of option 1.

9701.63
Option in slot 2, firmware part number

Displays firmware part number of option 2.

9701.73
Option in slot 3, firmware part number

Displays firmware part number of option 3.

9701.54
Option in slot 1, firmware status

Displays firmware status of option 1.

9701.64
Option in slot 2, firmware status
Displays firmware status of option 2.

9701.74
Option in slot 3, firmware status
Displays firmware status of option 3.

Unit nameplate
The electronic motor nameplate with the corresponding motor data is supported.

9701.110
Status 1
Delivery state unit status field 1: Unit firmware.

9701.111
Status 2
Delivery state unit status field 2: FPGA/DSP firmware.

9701.113
Status 4
Delivery state unit status field 4: Control electronics.

9701.114
Status 5
Delivery state unit status field 5: Power section.

9701.115
Status 6
Delivery state unit status field 6: Switch-mode power supply.

9701.116
Status 7
Delivery state unit status field 7: Attenuation.

9701.117
Status 8
Delivery state unit status field 8: Safe technology.

9701.118
Status 9
Delivery state unit status field 9: Reserve.

9701.125
Option 1 software status
Delivery state option 1: Status field 1 software.

9701.126 *Option 1 hardware status*	Delivery state option 1: Status field 2 hardware.
9701.135 *Option 2 software status*	Delivery state option 2: Status field 1 software.
9701.136 *Option 2 hardware status*	Delivery state option 2: Status field 2 hardware.
9701.145 *Option 3 software status*	Delivery state option 3: Status field 1 software.
9701.146 *Option 3 hardware status*	Delivery state option 3: Status field 2 hardware.
9701.155 *Option 4 software status*	Delivery state option 4: Status field 1 software.
9701.156 *Option 4 hardware status*	Delivery state option 4: Status field 2 hardware.
9701.165 *Option 5 software status*	Delivery state option 5: Status field 1 software.
9701.166 *Option 5 hardware status*	Delivery state option 5: Status field 2 hardware.

Error history 0 – 5

MOVIAXIS® stores the last 6 error states in a ring memory. A certain number of parameters are "frozen" here. The parameter 9626.1 "Pointer to error memory t0" shows the last error saved. Another index range is described each time an error is saved.

The parameter tree adapts the interface so that the error ring memory 0 – 5 is always sorted chronologically. Error ring memory 0 is the last one saved.

9626.1
Pointer error memory

Value range: 0...5, step 1

Pointer to error memory t0.

9628.1
Inputs

Value range: 0...4294967295, step 1

Displays binary inputs basic unit t5.

9630.1
Outputs

Value range: 0...4294967295, step 1

Displays binary outputs basic unit t5.

9629.1
Inputs

Value range: 0...4294967295, step 1

Displays binary inputs option 1 t5.

9631.1
Outputs

Value range: 0...4294967295, step 1

Displays binary outputs option 1 t5.

9629.2
Inputs

Value range: 0...4294967295, step 1

Display binary inputs option 2 t5.

9631.2
Outputs

Value range: 0...4294967295, step 1

Displays binary outputs option 2 t5.

9508.1
Resolution

Value range: 0...4294967295, step 1

User-defined unit position resolution t0 – 5.

9509.10
Denominator

Value range: 0...4294967295, step 1

User-defined unit position denominator t0 – 5.

9509.1
Numerator

Value range: 0...4294967295, step 1

User-defined unit position numerator t0 – 5.

9507.50
Position

Value range: 0...4294967295, step 1

User-defined unit position t5.

9502.1
Resolution
Value range: 0...4294967295, step 1
User-defined unit velocity resolution t0 – 5.

9503.10
Denominator
Value range: 0...4294967295, step 1
User-defined unit velocity denominator t0 – 5.

9503.1
Numerator
Value range: 0...4294967295, step 1
User-defined unit velocity numerator t0 – 5.

9501.50
Velocity
Value range: 0...4294967295, step 1
User-defined unit velocity characters 0 – 3 t5.

9501.51
Velocity
Value range: 0...4294967295, step 1
User-defined unit velocity characters 4 – 7 t5.

9501.52
Velocity
Value range: 0...4294967295, step 1
User-defined unit velocity characters 8 – 11 t5.

9501.53
Velocity
Value range: 0...4294967295, step 1
User-defined unit velocity characters 12 – 15 t5.

9812.1
Rel.
Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Dynamic utilization relative t0 – 5.

9623.1
Abs.
Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Dynamic utilization absolute t0 – 5.

10069.1
Model
Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Motor utilization current motor model t0 – 5.

9538.1
KTY

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Motor utilization current motor KTY t0 – 5.

9622.1
Heat exchanger

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Heat exchanger utilization t0 – 5.

9624.1
Thermal

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Thermal utilization t0 – 5.

9635.1
Unit

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Unit utilization t5.

9627.1
Error

Value range: 0 – 99, step 1
Displays error code t5.

10072.1
Sub error

Value range: 0...32767, Step 1
Sub error code t0 – 5.

9636.1
DC link voltage

Unit: mV
Value range: 0...1000000, step 1
DC link voltage t5.

9505.1
Output voltage

Unit: mV
Value range: 0...1000000, step 1
Output voltage t0 – 5.

9500.6
Actual speed

Unit: 10^{-3} rpm
Value range: –11000000...11000000, step 1
Displays actual velocity current parameter set in t5.

10070.1
Model

Unit: °C
Resolution: 10^{-3}
Value range: –2147483648...0...2147483647, step 1
Motor temperature current motor model t0 – 5.

9545.1
KTY

Unit: °C
Resolution: 10^{-3}
Value range: –2147483648...0...2147483647, step 1
Motor temperature current motor KTY t0 – 5.

9632.1
Unit status

Value range: 0...4294967295, step 1
Displays unit status t5.

9506.6
Actual position

Unit: U
Resolution: 1/65536
Value range: –2147483648...0...2147483647, step 1
Actual position t5.

9633.1
Output current

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Output current t5.

9852.1
Phase failure detection

Value range: See index 8617.0.
Mains phase failure t0 – 5.

9504.1
Frequency

Unit: Hz
Resolution: 10^{-3}
Value range: 0...1000000, step 1
Frequency t0 – 5.

9634.1
Active current

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Active current t5.

9626.1
Pointer error memory

Value range: 0...5, step 1
Pointer to error memory t0.

8371.0 Inputs
Value range: 0...4294967295, step 1
Displays binary inputs basic device t0 – 4.

8381.0 Outputs
Value range: 0...4294967295, step 1
Displays binary outputs basic device t0 – 4.

8376.0 Inputs
Value range: 0...4294967295, step 1
Displays binary inputs option 1 t0 – 4.

8386.0 Outputs
Value range: 0...4294967295, step 1
Displays binary outputs option 1 t0 – 4.

9710.1 Inputs
Value range: 0...4294967295, step 1
Displays binary inputs option 2 t0 – 4.

9711.1 Outputs
Value range: 0...4294967295, step 1
Displays binary outputs option 2 t0 – 4.

9508.1 Resolution
Value range: 0...4294967295, step 1
User-defined unit position resolution t0 – 5.

9509.10 Denominator
Value range: 0...4294967295, step 1
User-defined unit position denominator t0 – 5.

9509.1 Numerator
Value range: 0...4294967295, step 1
User-defined unit position numerator t0 – 5.

9507.1 Position
Value range: 0...4294967295, step 1
User-defined unit position t0.

9502.1 Resolution
Value range: 0...4294967295, step 1
User-defined unit velocity resolution t0 – 5.

9503.10 Denominator
Value range: 0...4294967295, step 1
User-defined unit velocity denominator t0 – 5.

9503.1 Numerator
Value range: 0...4294967295, step 1
User-defined unit velocity numerator t0 – 5.

9501.1
Velocity

Value range: 0...4294967295, step 1
User-defined unit velocity characters 0 – 3 t0.

9501.2
Velocity

Value range: 0...4294967295, step 1
User-defined unit velocity characters 4 – 7 t0.

9501.3
Velocity

Value range: 0...4294967295, step 1
User-defined unit velocity characters 8 – 11 t0.

9501.4
Velocity

Value range: 0...4294967295, step 1
User-defined unit velocity characters 12 – 15 t0.

9812.1
Rel.

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Dynamic utilization relative t0 – 5.

9623.1
Abs.

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Dynamic utilization absolute t0 – 5.

10069.1
Model

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Motor utilization current motor model t0 – 5.

9538.1
KTY

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Motor utilization current motor KTY t0 – 5.

9622.1
Heat exchanger

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Heat exchanger utilization t0 – 5.

9624.1
Thermal

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Thermal utilization t0 – 5.

8416.0
Unit

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Unit utilization t0 – 4.

8366.0
Error

Value range: 0...99, step 1
Displays error code t0 – 4.

10072.1
Sub error

Value range: 0...32767, Step 1
Sub error code t0 – 5.

8421.0
DC link voltage

Unit: mV
Value range: 0...1000000, step 1
DC link voltage t0 – 4.

9505.1
Output voltage

Unit: mV
Value range: 0...1000000, step 1
Output voltage t0 – 5.

9500.1
Actual speed

Unit: 10^{-3} rpm
Value range: –11000000...11000000, step 1
Displays actual velocity current parameter set in t0.

10070.1
Model

Unit: °C
Resolution: 10^{-6}
Value range: –2147483648...0...2147483647, step 1
Motor temperature current motor model t0 – 5.

9545.1
KTY

Unit: °C
Resolution: 10^{-6}
Value range: –2147483648...0...2147483647, step 1
Motor temperature current motor KTY t0 – 5.

9712.1
Unit status

Value range: 0...4294967295, step 1
Displays Unit status t0 – 4.

9506.1
Actual position

Unit: U
Resolution: 1/65536
Value range: –2147483648...0...2147483647, step 1
Actual position t0.

8406.0
Output current

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Output current t0 – 4.

9852.1
Phase failure detection

Value range: See index 8617.0.
Mains phase failure t0 – 5.

9504.1
Frequency

Unit: Hz
Resolution: 10^{-3}
Value range: 0...1000000, step 1
Frequency t0 – 5.

8411.0
Active current

Unit: %
Resolution: 10^{-3}
Value range: 0...300000, step 1
Active current t0 – 4.

4.2 Parameter description of drive data

	NOTE
	Sections that contain "P1/P2/P3" apply to all 3 parameter sets.

MOVIAXIS® operates with the CFC control modes for asynchronous and synchronous motors with encoder feedback. MOVIAXIS® can be operated in the basic control types torque, speed and position control. This means that the customer can activate closed-loop control circuits where they are most suitable for the application. Furthermore, MOVIAXIS® can be implemented in a wide range of applications and, in many cases, can take on all the tasks of a Motion Controller.

Controller parameter P1/P2/P3

8537.0 Reversal direction of rotation

Value range:

- <u>0 = OFF</u>
- 1 = ON

Change direction of rotation P1.

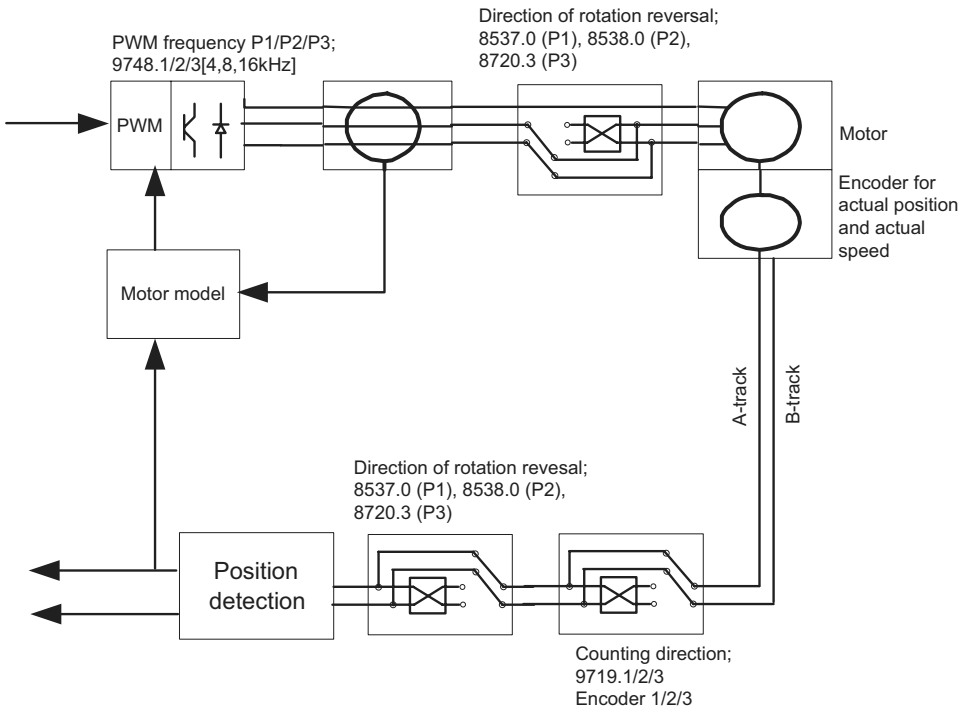


Fig. 17: Behavior of direction of rotation and counting direction

The SEW standard defines that the motor rotates in clockwise direction (right) when the speed is positive and with increasing positions when viewed onto the motor shaft. Reversing the direction of rotation changes the sense of rotation of the motor without having to reverse the setpoint. Activating a reversal of the direction of rotation will invert the direction of rotation of the motor phases and encoder evaluation.

Change direction of rotation	Speed setpoint	Direction of rotation motor shaft (looking onto the drive-end bearing shield)	Position	Actual speed value	Actual acceleration value
0=Off; standard	Positive	Clockwise, "right"	Increases	Positive	Derived from the actual speed value
	Negative	Counterclockwise, "left"	Decreases	Negative	Derived from the actual speed value
1=On; inverted	Positive	Counterclockwise, "left"	Increases	Positive	Derived from the actual speed value
	Negative	Clockwise, "right"	Decreases	Negative	Derived from the actual speed value

The assignment of limit switches to the system is maintained.

It is important to carefully check that the limit switch is connected properly and the reference point and travel positions are defined correctly when using this parameter.

Changing direction of rotation and limit switch evaluation

Example: **Change direction of rotation 8537.0=0 (off)**

When the motor turns in **clockwise** direction, the drive will be properly stopped once it reaches the **positive** limit switch. If it reaches the negative limit switch, the drive will respond with error code "27" (limit switches reversed).

Example: **Change direction of rotation 8537.0=1 (ON)**

When the motor turns in **counterclockwise** direction, the drive will be properly stopped once it reaches the **positive** limit switch. If it reaches the negative limit switch, the drive will respond with error code "27" (limit switches reversed).

Do not mistake the parameter "**Change direction of rotation P1; P8537.0**" for the parameter "**Counting direction encoder 1; P9719.1**", see section "Encoder".

Current controller

9813.1
Activate Ixt current reduction

Value range:

- 0 = OFF
- 1 = ON

The parameter cannot be edited in the parameter tree.

A current limit is set using the parameter setting "On" to ensure reliable operation of the axes even in the case of an overload.

The switch is only implemented in "Controller inhibit active" status.

Function	Property	Result
"On" default setting	Current is reduced before heat sink or power semiconductor triggers shutdown. Maximum available current < 250 %	Possibility of compensating load peaks that occur once. Might trigger subsequent errors because the required torque is not delivered any longer (e.g. lag error).
"Off"	Maximum available current = 250 %	Immediate switch-off if an overload occurs (leads to controller inhibit). The entire device performance can be utilized.

9748.1 / 2 / 3
PWM frequency

Value range:

- 0 = 4 kHz
- 1 = 8 kHz
- 2 = 16 kHz

PWM frequency P1/P2/P3

The **PWM frequency** is used to set the switching frequency at the inverter output. The cycle frequency is set to a fixed value and is not automatically reduced with high unit utilization.

A smaller modulation frequency reduces the switching losses in the output stage and, consequently, unit utilization. The motor noise, however, will increase.

Control structures

The FCBs use different controller structures.

The following table gives an overview of control structures activated by the FCBs.

FCB no.	Name	Torque control "MXDrehmomentStromreglerV1_5.vsd"	Speed control	Position control	external profile generation	internal profile generation
0	no FCB selected (starts FCB 13)		X			
1	Output stage inhibit	Output stage inhibited				
5	Speed control		X			Var1+4
6	Speed control interpolated		X		Var1+4	
7	Torque control	X				Var 4
8	Torque control interpolated	X			Var4	
9	Positioning			X		Var2+4
10	Positioning interpolated			X		
11	Referencing		Referencing	Basic setting		
12	Stop (application limits)		X			Var1+4
13	Stop (emergency stop limit)		X			Var1+4
14	Stop (system limits)		X			Var1+4
15	Electronic cam			X		Var2+4
16	Sychronous operation			X		Var2+4
17	Encoder adjustment	Current control				
18	Hold control		Stop	Hold		
19	Jog			X		Var2+4
20	Brake test	Mode 1		Mode 2-4		
21	Dual drive		X			

The variants "Var 1 – 4" are depicted in figure 18.

Control structure overview

The control structure is cascaded (position, speed, current-torque controller). The diagram in figure 18 shows an overview of the control structures described in detail on the following pages.

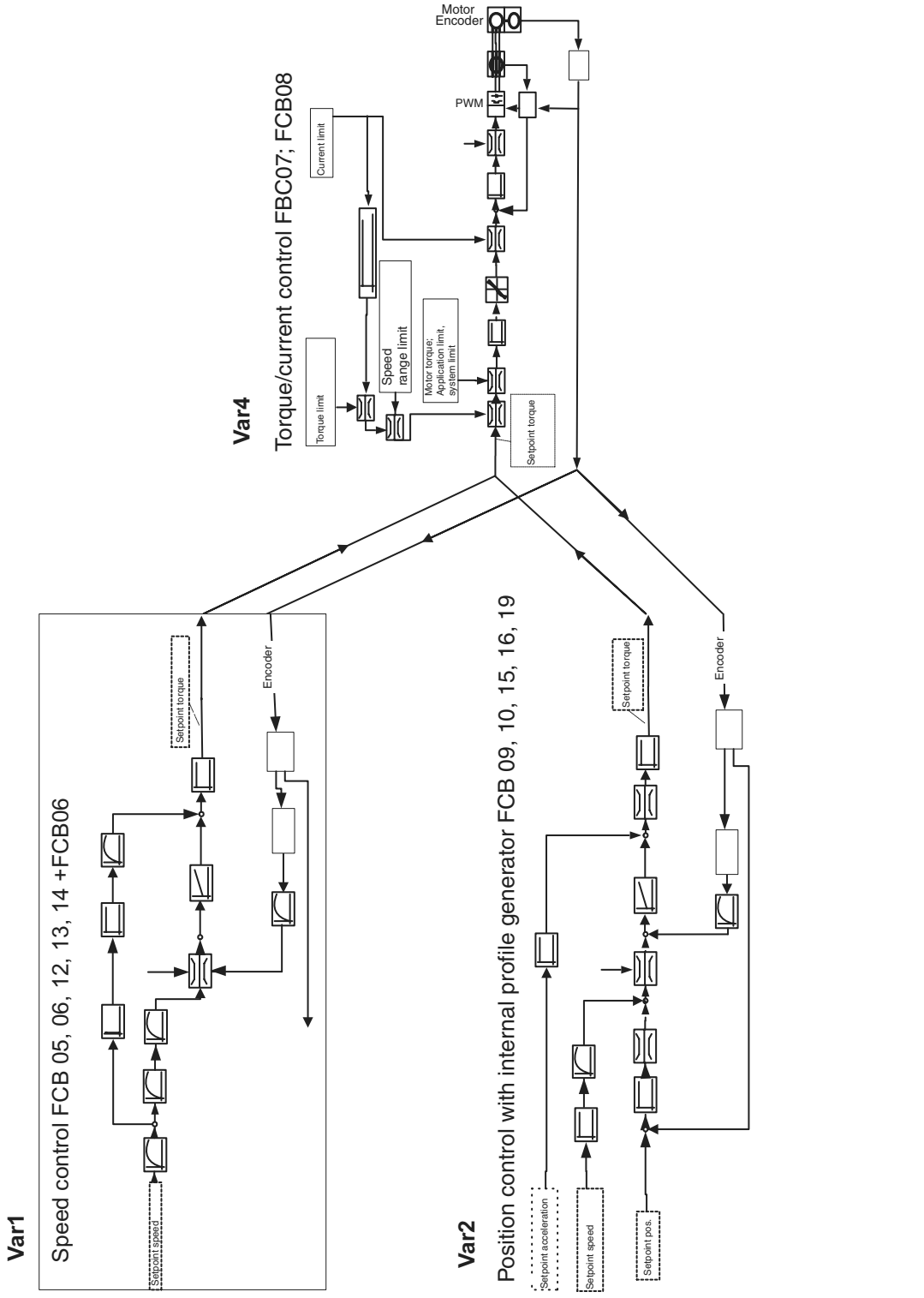


Fig. 18: Overview of control structures

See also the control structure table on page 86.

Speed control FCB 05, 06, 12, 13, 14

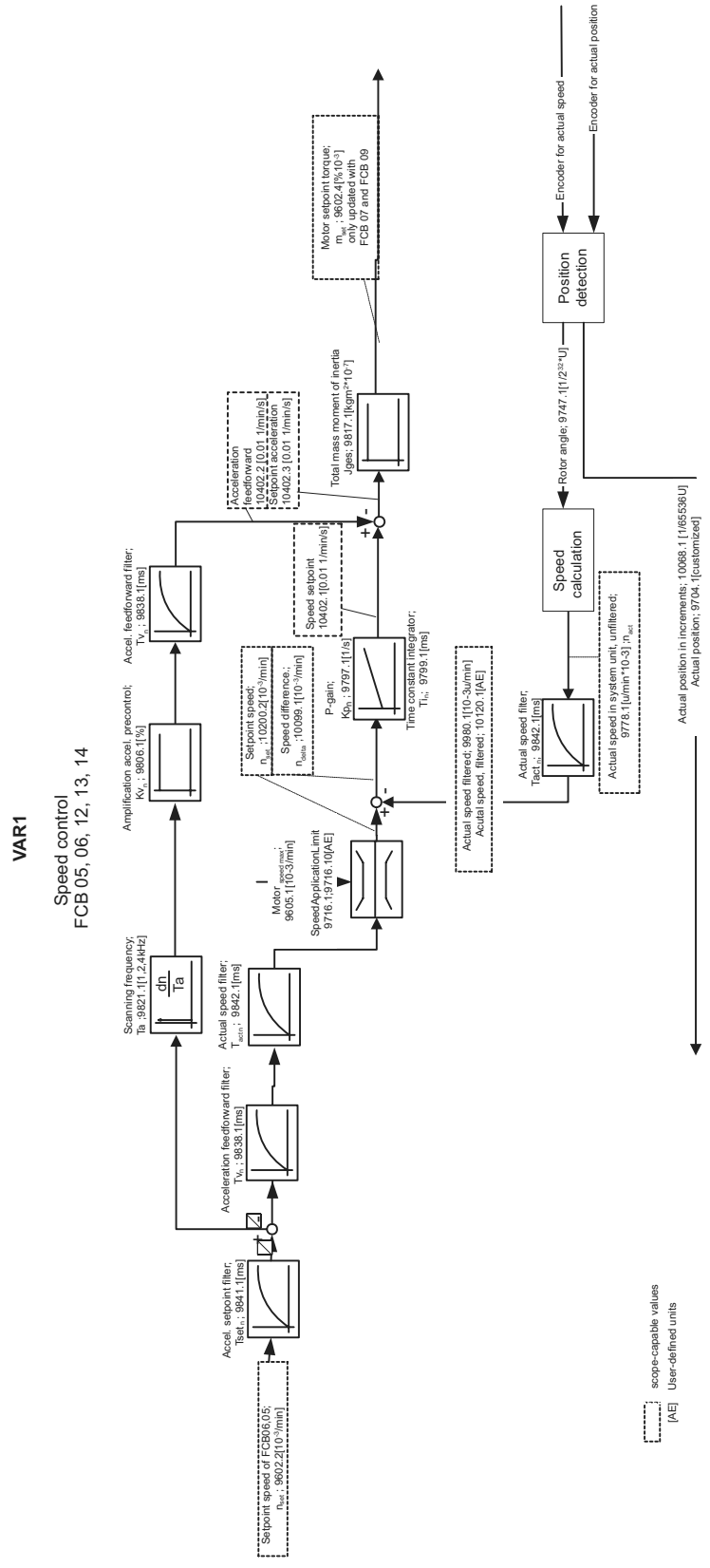


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Fig. 19: Speed control

Speed control with internal profile generator FCB 09, 10, 15, 16, 19

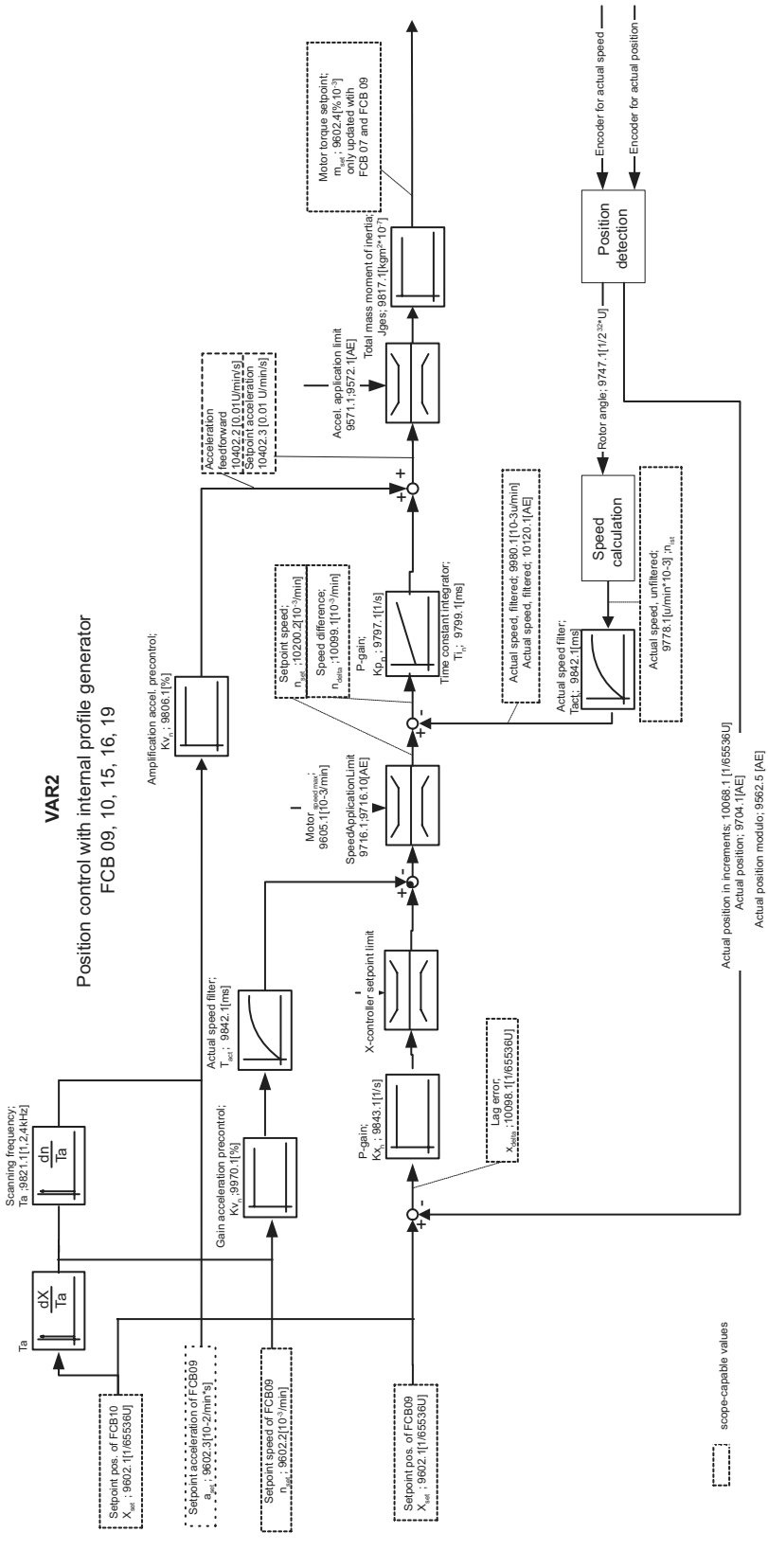

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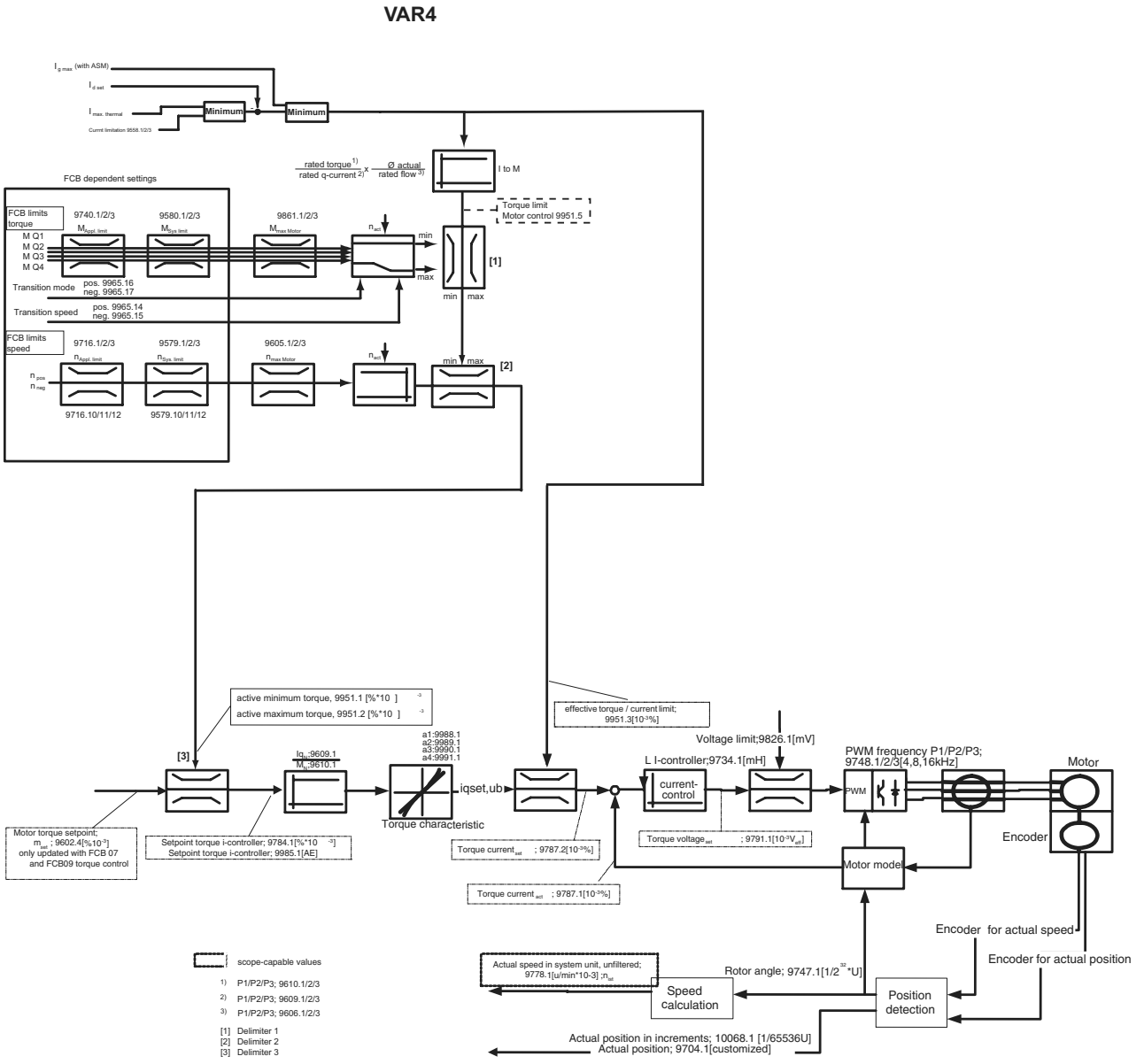
Fig. 20: Position control with internal profile generator

Torque/current controller



58594aen

Fig. 21: Torque/current controller

For activated delimiters, refer to figure 21.

The relationship between the min/max delimiters 1-3 and the specific limit statement is listed in the following table.

Significance "1" means that this delimiter limits the input parameters and sets the limit values to its output. Vice versa with "0".

The speed limits are then clearly implemented using the limited torque specifications.

Delimiter 1	Delimiter 2	Delimiter 3	Limitation information
0	0	0	No M_{Set} limit
0	0	1	M_{Set} is limited by the specified speed
0	1	0	No M_{Set} limit
0	1	1	M_{Set} is limited by motor control (max. motor current, $I_{Max\ thermal}$, current limit, ...)
1	0	0	No M_{Set} limit
1	0	1	M_{Set} is limited by the specified speed
1	1	0	No M_{Set} limit
1	1	1	M_{Set} is limited by the torque limit

9734.1
LI controller

Unit: H

Resolution: 10^{-7}

Value range: 0...214748367, step 1

Branch inductance of the motor.

Is used to set the parameters of the current controller (I controller) (P1/P2/P3). The integrative time and the gain are set using this parameter.

9558.1 / 2 / 3
current limit

Unit: mA

Value range: 0...2000000, step 1

Current limit P1/P2/P3.

The current limit indirectly limits the torque generating current (q-current), see figure 21. This is the only value in MOVIAXIS® that is directly entered in [mA]. All other "current" values refer to the rated current of the device.

9826.1 / 2 / 3
voltage limit

Unit: mV

Value range: 0...230000...1000000, step 1

Control limit output voltage P1 / P2 /P3

The value V_{eff} is the phase unit, the default value is 230 V.

This parameter limits the maximum output voltage, see figure 21.

Scanning frequency

9821.1 / 2 / 3 Scanning frequency

Value range:

- 0 = 1 ms
- 1 = 0.5 ms
- 2 = 0.25 ms

Scanning frequency n/X control P1 / P2 /P3

Is used to set the scanning frequency of the speed and position controller.

A high scanning frequency is only needed when the desired dynamic response require it. This is only needed for drives with fast cycle times (<100 ms positioning time).

A higher scanning frequency results in a rougher actual speed value resolution. This means that the scanning frequency should be set to a lower value for applications that require very even speed.

These effects are more likely to occur in encoder systems with unfavorable resolution. See encoder resolution, section "Encoder".

With the same stiffness and clearance settings, the scanning frequency has no influence on the gain, integrative time and control technology filter settings that are suggested at startup.

9797.1 / 2 / 3 P-gain

Unit: 10^{-3}/s

Value range: 0...100000...10000000, step 1

P-gain n controller P1/P2/P3

The unit of the gain is chosen in such a way that the velocity difference (speed set-point/actual speed value) results in acceleration.

Controller configuration is independent of the used inverter and connected mass moment of inertia because the control operates in SI units (revolution; rpm; rpm/s). Of course, you need to enter the current total mass moment of inertia "9817.1 / 2 / 3" to ensure the conversion of acceleration into torque.

9970.1 / 2 / 3 Speed forward control gain

Unit: %

Resolution: 10^{-3}

Value range: 0...100000...10000000, step 1

Gain velocity precontrol P1/P2/P3

100 % is the optimum value. This gain multiplies the theoretically calculated velocity precontrol values.

9806.1 / 2 / 3 Gain acceleration precontrol

Unit: %

Resolution: 10^{-3}

Value range: 0...100000...10000000, step 1

Gain acceleration precontrol P1/P2/P3

100 % is the optimum value. This gain multiplies the theoretically calculated acceleration precontrol values.

9841.1 / 2 / 3
Filter speed setpoint

Unit: µs

Value range: 0...10000000, step 1

FCB 05 Speed control speed setpoint filter P1/P2/P3

Is only active in all speed controlled operating modes. It filters the received speed setpoint.

It is important that the "time interval of the external controller" is set to "0 ms" at startup if the internal speed profile generator is used.

9842.1
Filter actual speed value

Unit: µs

Value range: 0...1000...10000000, step 1

Filter actual speed value P1/P2/P3.

This is active in the actual speed branch and also in the speed precontrol branch to smoothen the noise of the actual speed value information.

9838.1
Filter acceleration precontrol

Unit: µs

Value range: 0...5000...10000000, step 1

Filter acceleration precontrol P1/P2/P3.

Filter acceleration precontrol P1/P2/P3 is only active in all speed controlled FCBs.

It is important that the "time interval of the external controller" is set to "0 ms" at startup if the internal speed profile generator is used.

10058.1 / 2 / 3
Switched integrator

Value range:

- 0 = Switched

  The integrator is stopped when the setting limit is reached to achieve a low overshoot of the actual speed value when reentering the setting range.

- 1 = Not switched

  Is required for the control specification "dual drive".

Closed-loop speed controller switched integrator P1/P2/P3

The setting limit can be achieved with very large setpoint changes to the speed control input. The setting limit is characterized by various specified limits that are calculated online (current limit, acceleration limits, motor limits, inverter limits, voltage limit, etc.).

9994.1 / 2 / 3 Integrator mode

Value range:

- 0 = Hold
- 1 = Delete
- 2 = "Initialize" using the source of parameter 9995. "Integrator initialization".

Speed control integrator mode P1/P2/P3.

The start value of the integrator behavior can be influenced by this parameter.

The changes are naturally very much dependent on the "Integrator integrative time; P9799.1". The higher the integrative time, the longer the adjustment of the start value to the actual disturbance variable lasts.

Integrator behavior depends on the selected parameter set.

Hold: The contents of the integrator is maintained when the speed control loop opens. When the speed control loop closes again, the torque previously contained in the integrator is directly adjusted at the motor shaft again. This operating mode is particularly useful in hoists to prevent the load from sagging when the brake is released.

The speed control loop can be closed by selecting FCB 05 speed control or any other FCB (e.g. FCB 09 Positioning) that activates the speed controller.

With a software reset, the contents of the integrator is stored in non-volatile memory from where it is loaded again. With a software cold start (after power off/on), the integrator will always be cleared because the values are not saved when switching the power supply off.

Delete: The content of the integrator is set to zero when the speed control loop is opened. When the speed control loop closes once again, the integral component is set to zero and adjusted to a torque of "zero".

Initialize: This setting lets you set the I component of the speed controller (torque) to a predefined value. The source of this value is defined using parameter 9995.1 "Integrator initialization". This value takes effect when the speed control loop closes.

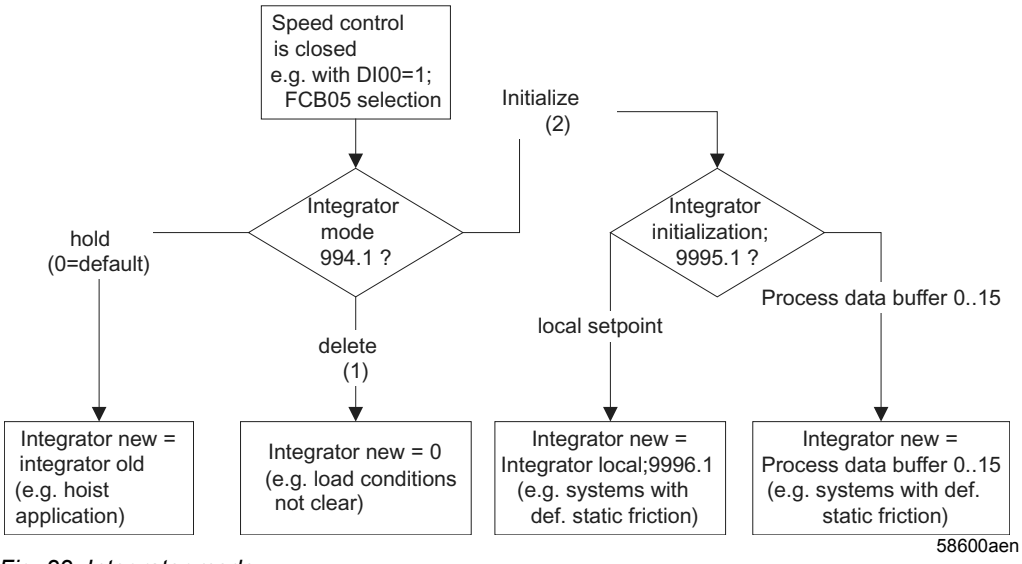


Fig. 22: Integrator mode

9995.1 / 2 / 3
Integrator initialization

Value range:

- 0 = Local setpoint

from parameter 9996.1 "Local integrator".

- 1 ... 16 = Process data buffer, channel 0 … 15

Speed control integrator initialization source P1/P2/P3.

Takes effect when parameter 9994.1 "Integrator module" is set to "Initialize".

9996.1 / 2 / 3
Local integrator

Unit: %

Resolution: 10^{-3}

Value range: –1000000...0...1000000, step 1

Speed control integrator initialization local P1/P2/P3.

When the speed control loop closes, the torque of parameter 9996.1 "Local integrator" is directly adjusted at the motor shaft.

It only takes effect if parameter 9994.1 "Integrator mode" is set to "Initialize" and parameter 9995.1 "Integrator initialization" is set to "local".

This parameter must also be specified in the user-defined unit.

For default setting of the user-defined unit torque

- Parameter "9555.1 Torque resolution" = 10E-3
- Parameter "9556.1 Torque numerator" = 1

the unit is [10E-03 × % × rated torque; parameter 9610.1].

This setting can also be made using the bus, see the description on setting the torque, parameter 9555.1; parameter 9556.1; parameter 9557.1.

9817.1
Total moment of inertia

Unit: kgm^2

Resolution: 10^{-7}

Value range: 0...2147483647, step 1

Total mass moment of inertia P1.

Position controller

9843.1 / 2 / 3
P-gain

Unit: $10^{-3}/s$

Value range: 0...50000...10000000, step 1

Gain X controller P1/P2/P3.

10201.1 / 2 / 3
Setpoint limit position control

Value range:

- 0 = switched off
- 1 = switched on

Equalizing controller

10060.1 NMin source

Value range: See parameter "9995.1 / 2 / 3 Integrator initialization".
Equalizing controller NMin source P1.
For details, see FCB 22 Dual drive.

10062.1 NMin local

Unit: 10^{-3} rpm
Value range: 1 – 2147483647, step 1
Equalizing controller NMin local P1.
For details, see FCB 22 Dual drive.

10059.1 NMax source

Value range: See parameter "9995.1 / 2 / 3 Integrator initialization".
Equalizing controller NMax source P1.
For details, see FCB 22 Dual drive.

10061.1 NMax local

Unit: 10^{-3} rpm
Value range: –2147483648...2147483647, step 1
Equalizing controller NMax local P1.
For details, see FCB 22 Dual drive.

Motor parameter P1/P2/P3

9820.1 / 2 / 3
Motor type

Value range:
- 0 = Asynchronous motor
- 1 = Synchronous motor

Motor type P1/P2/P3.

9732.1 / 2 / 3
Number of pole pairs

Value range: 1...3...64, step 1
Number of pole pairs P1/P2/P3.
The number of motor pole pairs is set here.

9610.1 / 2 / 3
Rated torque

Unit: Nm
Resolution: 10^{-5}
Value range: 0...100000...2147483647, step 1
Rated motor torque P1/P2/P3.
The values specified in "Torque" in MOVIAXIS® refer to this rated torque value.
All values specified in "Current" in MOVIAXIS® refer to the rated current of the device.

9861.1 / 2 / 3
Maximum torque

Unit: Nm
Resolution: 10^{-5}
Value range: 0...2147483647, step 1
Maximum motor torque P1/P2/P3.

9605.1 / 2 / 3
Maximum speed

Unit: 10^{-3} rpm
Value range: 0...3000000...10000000, step 1
Maximum permitted motor speed P1/P2/P3.

9987.1 / 2 / 3
Maximum current

Unit: mA
Value range: 0...2000000, step 1
Maximum motor current P1/P2/P3.

9609.1 / 2 / 3
Rated current I_q

Unit: mA
Value range: 0...2000000, step 1
I_q rated current P1/P2/P3.

9819.1 / 2 / 3
Rated current I_d

Unit: mA
Value range: 0...2000000, step 1
I_d rated current P1/P2/P3.

9606.1 / 2 / 3
Rated flow

Unit: µVs
Value range: 0...2147483647, step 1
Rated flow P1/P2/P3.

9736.1 / 2 / 3
Leakage inductance

Unit: H
Resolution: 10^{-7}
Value range: 0...2147483647, step 1
CFC LSigma P1/P2/P3.

9738.1 / 2 / 3
Rotor resistance

Unit: µOhm
Value range: 0...2147483647, step 1
Rotor resistance P1/P2/P3.

9737.1 / 2 / 3
Flow time constant

Unit: µs
Value range: 0...10000000, step 1
Time constant flow P1/P2/P3.

9816.1 / 2 / 3
Rotor time constant

Unit: µs
Value range: 0...4294967295, step 1
Time constant rotor P1/P2/P3.

9834.1 / 2 / 3
Encoder offset

Unit: U
Resolution: $1/2^{32}$
Value range: 0...2147483647, step 1
Encoder offset P1/P2/P3 is indicated in angular degrees in MotionStudio (2^{32} = 360.000 degrees).
The encoder offset refers to the mechanical revolution of the motor. A mechanical revolution is the electrical revolution multiplied by the number of poles specified in parameter "9732.1".

Encoder

9597.1 / 2 / 3 Source actual speed

Value range:

- 0 = No encoder
- 1 = Encoder 1
- 2 = Encoder 2
- 3 = Encoder 3

Source actual speed P1/P2/P3

The parameter is set in the parameter tree folder "Motor data".

This parameter is used to select the encoder that provides the information for the speed controller, current controller and commutation of the motor control.

The source of the actual speed may **not** be switched to another source during controller enable.

Only the encoder assigned to the parameter set number can be chosen as source. This is verified when activating controller enable.

See also parameter 9595.2 "Connected to drive no." in section "Encoder".

9744.1 / 2 / 3 Source actual position

Value range:

- 0 = No encoder
- 1 = Encoder 1
- 2 = Encoder 2
- 3 = Encoder 3

Source actual position P1/P2/P3.

The parameter is set in the parameter tree folder "Motor data".

This parameter is used to select the encoder that provides the actual position information for the position controller of the motor control.

The source of the actual position may be switched to another source during controller enable.

Only the encoder assigned to the parameter set number can be chosen as source. This is verified as long as the controller is enabled.

See also parameter 9595.2 "Connected to drive no." in section "Encoder".

Brake

Brake control

The parameters for the brake function are usually set by the startup process when the connected motor is entered or the data is read from the electronic nameplate.

The brake control is an independent function that is called up directly after the FCBs. It processes the requests of the FCB currently used and controls the control terminal for the brake accordingly.

The brake terminal is monitored for supply voltage and control signal level during the same time interval and depends on the relevant requirements of the FCBs on brake control.

⚠ CAUTION

When output stage enable is revoked or output stage inhibit is set, the brake signal is immediately set to "close" and the output stage is disabled => A moving motor makes an emergency stop using the installed brake, or coasts to a halt.

CMP, CMD, DS motors can be equipped with a servo holding brake. In this case, only a very limited number of emergency stops is possible.

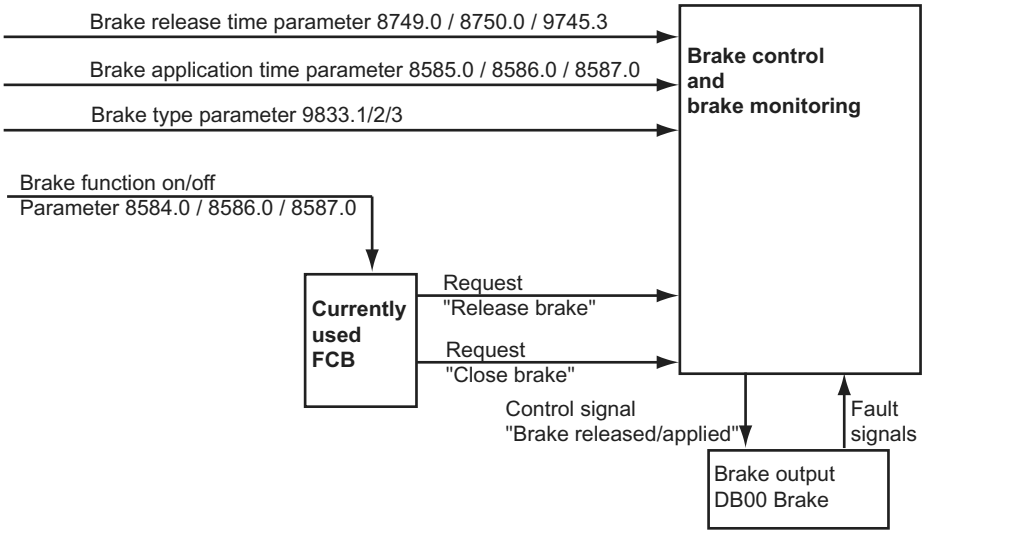


Fig. 23: Brake control

9833.1 /2 / 3
Brake type

Value range:

- 0 = None
- 1 = Brake connected to brake rectifier
- 2 = Brake directly connected

Brake type P1.

The control terminal and supply voltage for the brake are monitored:

1. Supply voltage within the specified tolerances or not => Error message "E13 Brake supply". Monitoring is only active when the brake is released or while the brake is being released.
2. No brake connected or brake control output overloaded => Error message "E12 Brake output". The brake message signal is monitored with a delay of t = 150 ms after the signal to release the brake has been given. The current rise time is bridged until the required brake current is reached. Monitoring is active as long as the brake is released.

CAUTION

Monitoring is only active when the brake type parameter is set to "Brake directly connected".

There is **no** monitoring for the two-wire or three-wire SEW brake (setting: "Brake connected to brake rectifier" or "None").

NOTE

If parameter "9833.1 / 2 / 3 Brake type" is set to "No brake", the brake output is set to "Brake applied".

This means that the setting of parameter "8584.0/8586.0/8587.0 Brake function" has no effect on the brake output.

8749.0 / 8750.0 / 9745.3
Brake release time

Unit: ms

Value range: 0… 2000, step 1

Brake release time P1/P2/P3.

During the brake release time, the drive is moved with speed control at the setpoint speed "zero", for example to prevent the load from sagging.

8585.0 / 8586.0 / 8587.0
Brake application time

Unit: ms

Value range: 0...200...2000, step 1

Brake application time P1/P2/P3

During the brake application time, the output stage is enabled and speed control with the set value "zero" is active, for example to prevent the load from sagging.

Temperature sensor

10046.11 / 12 / 13 Temperature sensor type

Value range:

- <u>0 = No sensor</u>
- 1 = TF / TH
- 2 = KTY(84 – 130)

Temperature sensor type P1/P2/P3.

This parameter is used to set the temperature sensor to ensure it is evaluated properly.

Control functions P1/P2/P3

Speed monitoring

8557.0 Speed monitoring

Value range:

- 0 = OFF
- 1 = Motor mode
- 2 = Regenerative mode
- <u>3 = Motor / regenerative mode</u>

Speed monitoring P1/P2/P3

Is set by the motor startup procedure.

If speed monitoring is not set to "off", an error will be issued if the set limits are exceeded. If a certain adjustable delay time is set for parameter "8558.0 Delay time", an error response will be triggered. Events where the set limit is reached for a short time period when the drive is accelerating or decelerating can be hidden using the appropriate setting in parameter "8558.0 Delay time".

The set limit is specified by all acceleration limit sizes. This includes data such as system limits, application limits, FCB limits, maximum motor torque limits as well as maximum axis current and thermally limited axis current.

See figure 21.

Motor / regenerative modes are distinguished as follows:

- Sign of (speed × torque) = positive => motor speed limit -> results in E08: sub error code 1.
- Sign of (speed × torque) = negative => regenerative speed limit -> results in E08: sub error code 2.

Monitoring is always activated at speeds lower than 10 rpm (if parameter 88557<>0). This is independent of whether the cause is regenerative or associated with the motor. This is because the actual speed value information is distorted by noise during resolver evaluations and at small actual speeds. In this way, it can not be clearly defined whether a motor or regenerative load is present.

	NOTE
	If the actual speed exceeds the maximum permitted system limits of parameter 9579.1 "positive" and parameter 9579.10 "negative", a unit fault will be triggered. Unlike for limit monitoring, this type of monitoring cannot be deactivated or limited by setting speed monitoring = "off".

8558.0 / 8560.0 / 9722.3
Speed monitoring delay time

Unit: ms

Value range: 0...50...1000, step 1

n monitoring delay time P1/P2/P3.

Is set by the motor startup procedure.

When the setting limit of the speed controller is reached, a timer responsible for the delay time is started. When the delay time is exceeded, a unit fault is triggered. If the speed controller leaves the setting limit before the delay time expires, the timer will be decremented until "zero" is reached.

See figure 24

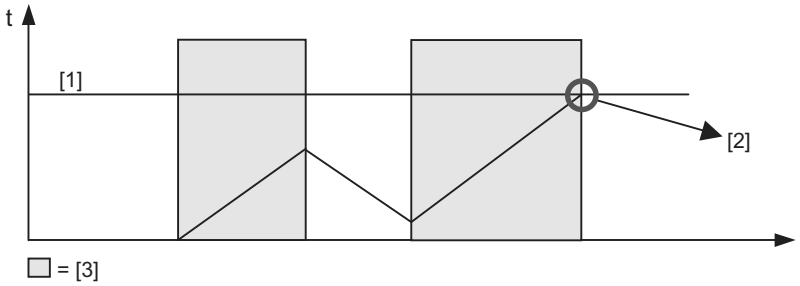


Fig. 24: Speed monitoring delay time

[1] Parameter "8558.0 Delay time"
[2] Trigger error E08
[3] Setting limit

9718.1 / 2 / 3
Speed monitoring reset time factor

Unit: ms

Value range: 0...1000, step 1

n-monitoring reset time factor P1/P2/P3.

Is set by the motor startup procedure.

Use the "Speed monitoring reset time" factor to set how fast the timer decrements when leaving the setting limit compared to the delay time. Usually this factor is equal to 1. For example, a factor of 3 means the counter decrements three times faster.

Brake function

8584.0 / 8586.0 / 8587.0
Brake function

Value range:

- 0 = OFF
- 1 = ON

Brake function P1.

This parameter has an effect when stopping in STOP FCBs 14, 13 and 12, and when starting in the other FCBs (for example, FCB 05, 09...)

See figure 23.

This parameter can be used to activate or deactivate the brake function regardless of whether a brake is connected (parameter "98833.1/2/3 Brake type").

- **0=Off**

When the drive is stopped, the brake is not applied if motor standstill is detected. The output stage remains enabled and the drive adjusts to the speed setpoint "zero", unless hold control is active.

Upon enable, the drive starts running without delay caused by a brake release time.

- **1=On**

When the drive is stopped, the brake is applied if motor standstill is detected. The brake application time is taken into account. The output stage is blocked and the drive is electrically connected with no torque if this brake application time has expired.

Premagnitization occurs for enabling when the motor brake is applied for asynchronous motors.

If synchronous motors are connected, the output stage and control will be activated.

Next the brake is applied by taking account of the brake release time with activated control. Once the brake release time has elapsed, the selected FCB is activated using the set setpoint.

	NOTE
	The "Brake function" parameter has no effect on the brake output if parameter "98833.1/2/3 Brake type" is set to "no brake". This way, the brake output is permanently set to the status "Apply brake".

Limit switch evaluation

A certain travel range of a drive can be monitored using hardware limit switches. Software limit switch monitoring can be activated if there are no hardware limit switches or for early detection purposes. Each limit switch (left or right software limit switch) can be activated/deactivated independently of one another.

Furthermore, the source of the software limit switch (encoder1 – encoder3) can also be set. A prerequisite for software limit switch monitoring is that the selected encoder is referenced.

The acknowledgement behavior applies both to software and hardware limit switches. You can set whether acknowledgement is required in the error response. You can choose between "Autoreset" or "Waiting".

If a limit switch was reached, the error must be acknowledged depending on the programmed limit switch response before the drive moves clear of the limit switch. The acknowledgement is accepted even if the drive has not yet reached standstill. In this case, movement clear of the limit switch will be triggered immediately once the axis stop was detected.

Limit switch processing checks the sign of the currently present setpoint (e.g. target position of positioning). The drive moves along with the currently set ramp of the currently set FCB if this setpoint results in leaving the limit switch.

If the setpoint makes the drive move further into the limit switch, the drive will remain stopped. This "moving clear" is caused by FCB 11 Limit switch.

Once the drive has moved clear of the limit switch, the currently selected FCB is chosen and the drive continues to move using the setpoints and limits of this FCB.

	NOTE
	For influencing limit switches by reversing the direction of rotation, see parameter "8537.0 Change direction of rotation".

The limit switch signals are debounced by the software (debouncing time 200 ms).

Move clear of hardware limit switches

A certain travel range of a drive can be monitored using hardware limit switches.

If hardware limit switches are not used or, for example, an early warning alarm should be activated when a specific position is exceeded, the software limit switches integrated in MOVIAXIS® can be activated.

Each limit switch (left or right software limit switch) can be activated/deactivated independently of one another. Furthermore, the source of the software limit switch (encoder1 – encoder3) can also be set. If the drive hits one of the two software or hardware limit switches, it reacts using one of the responses set by the user.

Software and hardware limit switches basically react in the same way. In order to enable the monitoring function, the appropriate encoder must be referenced.

9729.6 / 7 / 8 Hardware limit switch response

Value range:

- 0 = No response
- 6 = Emergency stop / waiting
- 10 = Stop at system limit / waiting
- 18 = Emergency stop / autoreset
- 19 = Stop at system limit / autoreset

Hardware limit switch response P1/P2/P3.

The hardware limit switch response sets the error response when a hardware limit switch is reached.

- **No response**

Error is ignored

- **Emergency stop / waiting**

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at system limit / waiting**

The motor is stopped at the system limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Emergency stop / autoreset**

The motor is stopped at the emergency stop ramp. No reset is expected.

- **Stop at system limit / autoreset**

The motor is stopped at the system limit. No reset is expected.

For detailed information about this topic, refer to the operating instructions in the section "Operation".

9824.1 / 2 / 3 Source software limit switch monitoring

Value range: See parameter "9744.1 Source actual speed"

Source software limit switch monitoring P1/P2/P3

9729.13 / 14 / 15 Software limit switch response

Value range: see parameter "9729.6 Hardware limit switch response".

Software limit switch response P1/P2/P3

9798.1 / 2 / 3 Monitor software limit switch negative

Value range:

- 0 = OFF
- 1 = ON

Monitor software limit switch negative P1/P2/P3.

- Off

Software limit switch is not monitored.

- On

Software limit switch is monitored.

9961.1 / 2 / 3 Software limit switch negative

Unit: U

Resolution: 1/65536

Value range: –2147483648...2147483647, step 1

Software limit switch left P1/P2/P3.

9801.1 / 2 / 3 Monitor software limit switch positive

Value range:

- 0 = OFF
- 1 = ON

Monitor software limit switch positive P1/P2/P3.

- Off

Software limit switch is not monitored.

- On

Software limit switch is monitored.

10064.1 / 2 / 3 Software limit switch positive

Unit: U

Resolution: 1/65536

Value range: –2147483648...2147483647, step 1

Software limit switch right P1/P2/P3.

"Motor at standstill" message

10056.1 / 2 / 3 Velocity threshold "Motor at standstill" – status bit

Unit: 10^{-3} rpm

Value range: 10000...50000, step 1

Velocity threshold motor at standstill P1/P2/P3

If the actual velocity is lower than this value, the "Motor at standstill" bit is set once the filter time of parameter "100057.1" has expired. If the velocity threshold is exceeded during the filter time, the filter will be reset to "zero" and starts again when the actual velocity drops below the velocity threshold again.

10057.1 / 2 / 3 Filter time "Motor at standstill" – status bit

Unit: ms

Value range: 0...25, step 1

Filter time motor at standstill P1/P2/P3

See parameter "10056.1 Velocity threshold motor at standstill".

Motor protection

When MOVIAXIS® detects that the max. temperature of the motor is exceeded, it can react in five different ways. These reactions can be configured at startup. The reactions range from "No response", through "Display", to different stop types.

MOVIAXIS® has a total of four different types / options to monitor the thermal properties of a motor and protect it from overload / irreparable damage. These types differ in quality and response capability.

1. Motor monitoring with TF / TH sensor

With this method, the configured action is executed when the limit temperature is exceeded.

2. Motor monitoring for types CMP, CM, CMD with KTY sensor

With this method, the configured action is triggered using temperature recording (in °C) and evaluation of the warning threshold of the motor when a limit temperature is exceeded. For all specified SEW motors, a KTY is used as a temperature sensor (initial values) to calculate the amount and time of the motor currents (history and course) in a motor-specific, thermal motor model in MOVIAXIS®.

The KTY also protects motors, e.g. CMP40, for which a purely mechanical temperature recording function would be too slow, which would allow damage to the motor. This functionality is only available for the specified SEW motors. It is the best way to ensure thermal protection for SEW servomotors.

3. Motor monitoring with KTY sensor

With this method, the configured action is executed when the limit temperature is exceeded.

4. Motor monitoring with KTY sensor and I^2t table

This method uses the KTY sensor to read initial temperature values. A torque / speed curve point table (max. 8 curve points) supplied by the motor manufacturer can be used to adjust the dynamic behavior, or the values can be calculated in the inverter.

The combination of the two values can be used to provide better protection for the motor than is available with a KTY alone.

This is the best way to protect a non-SEW motor connected to MOVIAXIS®.

The motor protection / connected motor temperature sensor is set at startup.

KTY is set: The implementation monitors open circuit (>1767 Ω; approx. 196 °C with KTY84-130) and short circuit (<305 Ω; approx. –52 °C with KTY).

TF/TH is set: Implementation switched at 1725 Ω (approx. 117 mV).

8904.0 / 8905.0 / 10046.1 (not in parameter tree)

Value range:

- 0 = No sensor
- 1 = TF / TH
- 2 = KTY84 - 130

Temperature sensor type TMU1/TMU2/TMU3.

10063.1 / 2 / 3 (not in parameter tree)

Value range:

- 0 = TMU1
- 1 = TMU2
- 2 = TMU3

Used thermal motor monitoring in parameter set P1/P2/P3.

Three thermal monitoring functions are available for operating three motors alternately on one inverter. As default, parameter set 1 is assigned monitoring 1 and parameter set 2 is assigned monitoring 2, etc.

For example, the used thermal monitoring in parameter set 2 should be set to "1" if the same motor as in parameter set 1 is used in parameter set 2. This is important when models are used, as it prevents heat from being drawn into the motor and being distributed to several models and distorting the model values.

9872.1 / 2 / 3
Temperature KTY sensor

Unit: °C

Resolution: 10^{-6}

KTY temperature sensor TMU1/TMU2/TMU3.

Temperature of the sensor TMUx accurate within ±5.7 °C.

9800.1
Thermal motor model temperature

Unit: °C

Resolution: 10^{-6}

Winding temperature model P1/P2/P3

Temperature of the thermal motor model P1/P2/P3

9705.1 / 2 / 3
KTY sensor motor utilization

Unit: %

Resolution: 10^{-3}

KTY TMU1/TMU2/TMU3 motor utilization

The following applies to the relative utilization values:

$$\text{Motor utilization KTY sensor} = \frac{\text{Temperature KTY sensor - 40 °C}}{T_{Motor\_max} \text{ - 40 °C}}$$

A temperature of 40 °C corresponds to a utilization of 0 %.

9874.1
Thermal motor model motor utilization

Unit: %

Resolution: 10^{-3}

Motor utilization model P1/P2/P3.

The motor utilization uses a motor model to calculate the temperature transition of the motor to the KTY sensor. The injected current is also taken into account. The display is output in % and starts at a motor model temperature of 40 °C = 0 % and a shutdown temperature = 100 %.

$$\text{Motor utilization thermal model} = \frac{\text{Thermal motor model - 40 °C}}{T_{Motor\_max} \text{ - 40 °C}}$$

9962.1 / 2 / 3 Prewarning threshold motor utilization

Unit: %

Resolution: 10^{-3}

Value range: 0...80000...100000, step 1

Prewarning threshold motor utilization TMU1/TMU2/TMU3

The prewarning threshold refers to the parameter "9705.1 KTY sensor motor utilization" and parameter "9874.1 Thermal motor model motor utilization" (if calculated). If one of the parameters exceeds this threshold, an error is triggered with the error response "Display only".

The 7-segment display shows the "E69" status but the axis does not respond (continues to operate).

- E69.1 KTY: Warning threshold exceeded
- E69.2 Synchronous model: Warning threshold exceeded
- E69.3 I^2t model: Warning threshold exceeded

The function "Prewarning motor temperature (KTY)" can be applied to a status word and consequently also to an output to allow a timely response in the machine controller.

9729.9 TF / TH / KTY message response

Value range:

- 0 = No response
- 1 = Display only
- 2 = Output stage inhibit / locked
- 3 = Stop at emergency stop limit / locked
- 5 = Output stage inhibit / waiting
- 6 = Stop at emergency stop limit / waiting
- 8 = Stop at application limit / waiting
- 9 = Stop at application limit / locked
- 10 = Stop at system limit / waiting
- 11 = Stop at system limit / locked

If the parameters "9705.1 KTY sensor motor utilization" and "9874.1 Thermal motor model motor utilization" (if calculated) exceed 100 %, error message E31.x will be issued. The error response to this message is set in response TF/TH/KTY message.

- **No response**

Error is ignored

- **Display only**

The 7-segment display shows the "E031" status but the axis does not respond (continues to operate).

- **Output stage inhibit / locked**

The axis changes to the controller inhibit state and applies the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a reset, the axis performs a system restart.

- **Stop at emergency stop limit / locked**

The motor is stopped at the emergency stop ramp. After a reset, the axis performs a system restart.

- **Output stage inhibit / waiting**

The axis changes to the controller inhibit state and applies the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at emergency stop limit / waiting**

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / waiting**

The motor is stopped at the application limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / locked**

The motor is stopped at the application limit. After a reset, the axis performs a system restart.

- **Stop at system limit / waiting**

The motor is stopped at the system limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at system limit / locked**

The motor is stopped at the system limit. After a reset, the axis performs a system restart.

For detailed information about this topic, refer to the operating instructions in the section "Operation".

Limit values P1/P2/P3

System values can only be changed for disabled controllers.

Application limits can be changed for enabled controllers.

Moving clear of limit switches

9577.1 Acceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Acceleration limit switch moving clear in user-defined units.

9578.1 Velocity

Unit: 10^{-3} rpm

Value range: –10000000...10000000, step 1

Clear velocity limit switch in user-defined units.

9581.1
Jerk limit

Unit: 1 rpm/s^2

Value range: 1...2147483647, step 1

Maximum jerk limit moving clear of limit switch.

System limits

9573.1
Maximum acceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Maximum velocity within the system limits in user-defined units.

Special handling with FCB 00, 05, 11, 12, 13, 14, 15, 20 for system limit acceleration = 0: The value 0 completely deactivates the acceleration limit. The application or emergency stop limits as well as local values are **not effective**.

9574.1
Maximum deceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Maximum deceleration within the system limits in user-defined units.

Special handling with FCB 00, 05, 11, 12, 13, 14, 15, 20 for system limit acceleration = 0: The value 0 completely deactivates the acceleration limit. The application or emergency stop limits as well as local values are **not effective**.

9579.1
Maximum positive velocity

Unit: 10^{-3} rpm

Value range: 0...10000000, step 10

Maximum positive speed within the system limits in user-defined units.

9579.10
Maximum negative velocity

Unit: 10^{-3} rpm

Value range: 0...10000000, step 10

Maximum negative speed within the system limits in user-defined units.

9580.1
Maximum torque

Unit: %

Resolution: 10^{-3}

Value range: 0...100000...100000, step 1

Torque limit within the system limits in user-defined units.

9583.1
Maximum jerk

Unit: 1 rpm/s^2

Value range: 1...2147483647, step 1

Maximum jerk limit within the system limits.

Special handling with FCB 00, 07, 13, 14, 15 for jerk = 0: The value 0 completely deactivates the acceleration limit. Application or emergency stop limits as well as local values are **not effective**.

Emergency stop

9576.1
Emergency stop deceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Emergency stop delay in user-defined units.

Application limits

9571.1
Maximum acceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Maximum acceleration within the application limits in user-defined units.

9572.1
Maximum deceleration

Unit: 10^{-2} rpm/s

Value range: 0...300000...2147483647, step 1

Maximum deceleration within the application limits in user-defined units.

9716.1
Maximum positive velocity

Unit: 10^{-3} rpm

Value range: 0...10000000, step 10

Maximum positive speed within the application limits in user-defined units.

9716.10
Maximum negative velocity

Unit: 10^{-3}rpm

Value range: 0...10000000, step 10

Maximum negative speed within the application limits in user-defined units.

9740.4
Maximum torque

Unit: %

Resolution: 10^{-3}

Value range: 0...100000...100000, step 1

Torque limit within the application limits in user-defined units.

9582.1
Maximum jerk

Unit: 1 rpm/s^2

Value range: 1...2147483647, step 1

Maximum jerk limit within the application limits.

Modulo limits

9594.10
Modulo overflow

Unit: U

Resolution: 1/65536

Value range: –2147483648...2147483647, step 1

Modulo overflow is needed in all modulo operating modes, e.g. in FCB 09 Positioning.

Modulo overflow specifies the position at which an overflow takes place. The parameter is set in the user-defined units and has residual management for infinite gear ratios (set using the user-defined unit numerator / denominator factor at motor startup), for example.

Parameter "9981.1 Positioning mode" should be set to "ON". This means endless positioning in one direction without losing positions within the modulo travel range.

9594.1
Modulo underflow

Unit: U

Resolution: 1/65536

Value range: –2147483648...2147483647, step 1

Modulo underflow is the opposite of modulo overflow. This is the start of the Modulo travel range. In many applications it is "0" but can also range between –180° and + 180°.

User-defined units P1/P2/P3

MOVIAXIS® offers customers the option of using the controller to send process output data for the position, speed, acceleration and torque to MOVIAXIS® in user-defined units.

In the axis, this process data is converted into internal units (basis: increments) in the setpoint cycle of a minimum of 500 µs.

The same process applies to the process input data returned from MOVIAXIS® to the controller – the data for position, speed or acceleration are converted into the customer's user-defined units.

The big advantage for customers / PLC programmers is that they do not have to convert the complex physical conditions in the machine into SEW-specific units in their programs. Customers can simply select the units most suitable for their applications and send them as specifications to MOVIAXIS®.

For example, customers can make the following entries:

- For position
  - "Compartments", "Packages", "Bottles", etc.
- For velocity
  - "Bottles / minute", "Pouches / second", etc.
- For acceleration
  - "Bottles / seconds", "Pouches / min*s", etc.

Position

9539.1 – 9539.4
Position unit text

Displays the unit text on the position entered by the user. The text consists of a maximum of 16 characters and is set to "Rev." as default, which corresponds to one motor revolution. It is set at motor startup.

9542.1
Position resolution

Value range:

- 0 = 0
- 1 = 1
- 2 = 2
- 3 = 3
- 4 = 4
- 5 = 5
- 6 = 6

The position resolution interprets the decimal places because communication buses communicate using integers only.

Example: The position resolution is "3", the user-defined unit is millimeters. This means that the number "1000" is interpreted via the bus as 1.000 mm.

The parameter tree in MotionStudio already displays all values with decimal point.

9543.1 Numerator position

Value range: 1...65536...16777215, step 1

The numerator / denominator factor is used for converting user-defined units into MOVIAXIS® basic units. The basic unit is "revolution" with four decimal places. It is set at motor startup.

9544.1 Denominator position

See parameter "9543.1 Numerator position". Default value: 1000.

Velocity

9532.1 – 9532.4 Velocity unit text

Displays the unit text of the velocity entered by the user. The text consists of a maximum of 16 characters and is set to "rpm". It is set at motor startup.

9535.1 Velocity resolution

Value range:

- 0 = 0
- 1 = 1
- 2 = 2
- 3 = 3
- 4 = 4
- 5 = 5
- 6 = 6

The velocity resolution interprets the decimal places because communication buses communicate using integers only.

Example: The velocity resolution is "3" and the user-defined unit is "rpm". This means that the number "1000" is interpreted via the bus as "1.000 rpm".

The parameter tree in MotionStudio already displays all values with a decimal point.

9536.1 Velocity numerator

Value range: 1...16777215, step 1

The numerator / denominator factor is used for converting user-defined units into MOVIAXIS® basic units. The basic unit is "rpm" with three decimal places. It is set at motor startup.

9537.1 Velocity denominator

See parameter "9536.1 Velocity numerator".

Acceleration

9546.1 – 9546.4 Acceleration unit text

Displays the unit text for the acceleration entered by the user. The text consists of a maximum of 16 characters and is set to "rpm". It is set at motor startup.

9549.1 Acceleration resolution

Value range:

- 0 = 0
- 1 = 1
- 2 = 2
- 3 = 3
- 4 = 4
- 5 = 5
- 6 = 6

The acceleration resolution interprets the decimal places because communication buses communicate using integers only.

Example: The acceleration resolution is "3" and the user-defined unit is "rpm*s". This means that the number "1000" is interpreted via the bus as "1.000 rpm*s".

The parameter tree in MotionStudio already displays all values with a decimal point.

9550.1 Acceleration numerator

Value range: 1...16777215, step 1

The numerator / denominator factor is used for converting user-defined units into MOVIAXIS® basic units. The basic unit is "rpm*s" with three decimal places. This means one speed change per second. It is set at motor startup.

9551.1 Acceleration denominator

See parameter "9550.1 Acceleration numerator".

Torque

Torque setting:

The default setting displays the torque in "%" of the rated motor torque selected at startup.

- Torque resolution = 3
- Torque numerator = 1
- Torque denominator = 1
- Torque unit text = "%"

Example:

Set user-defined unit "Newton meter":

- Torque parameter "9552.1 – 4 unit text" = "Nm",
- Torque parameter "9555.1 Resolution" = 3.

$$\frac{\text{Parameter "9556.1 torque numerator"}}{\text{Parameter "9557.1 torque denominator"}} = \frac{100}{\text{Parameter "9610.1 rated torque}}$$

→ In the parameter tree, torques are entered in "Nm" with three decimal places.

→ The torque has the unit [10E-3 Nm] via the bus to the PDOs.

9552.1 – 9552.4
Torque unit text

Displays the customer's unit text for torque. The text consists of a maximum of 16 characters and is set to "%" as default. It is set at motor startup.

9555.1
Torque resolution

Value range:

- 0 = 0
- 1 = 1
- 2 = 2
- 3 = 3
- 4 = 4
- 5 = 5
- 6 = 6

The torque resolution interprets the decimal places only for the MotionStudio user interface because communication buses communicate using integers only.

Example: The acceleration resolution is "3" and the user-defined unit is Nm. This means that the number "1000" is interpreted via the bus as "1 Nm".

The parameter tree in MotionStudio already displays all values with a decimal point.

9556.1
Torque numerator

Value range: 1...16777215, step 1

The numerator / denominator factor is used for converting user-defined units into MOVIAXIS® basic units. The basic unit is "%" of the motor torque with three decimal places. It is set at motor startup.

9557.1
Torque denominator

See parameter "9550.1 Acceleration numerator".

Reference travel

MOVIAXIS® also offers a number of options for reference travel. The new reference travel type "Reference to fixed stop" is now available.

The aim of reference travel is to reference / match the drive and its position data with the machine design. Referencing is used to identify the real zero point of the drive. This value is then used to define distances necessary for positioning processes.

MOVIAXIS® offers the following reference travel types:

- Left zero pulse
- Left end reference cam
- Right end reference cam
- Right limit switch
- Left limit switch
- No reference travel I
- Reference cam flush with right limit switch
- Reference cam flush with left limit switch.
- No reference travel II.
- High-precision referencing to right fixed stop.
- High-precision referencing to left fixed stop.

The reference travel types differ according to the first search direction or the switching contact (reference cam, limit switch or fixed stop) used for referencing. Reference travel can apply to all three encoders.

Using the reference point determined by reference travel, the machine zero point can be changed using the reference offset according to the following equation.

Machine zero = reference position – reference offset

9658.2
Reference travel type

Value range:

- 0 = Deactivated
- 1 = Left zero pulse
- 2 = Left end reference cam
- 3 = Right end reference cam
- 4 = Right limit switch
- 5 = Left limit switch
- 6 = No reference travel
- 7 = Reference cam flush with right limit switch
- 8 = Reference cam flush with left limit switch
- 9 = Right fixed dead stop
- 10 = Left fixed dead stop

Reference travel types:

- **General information about reference travel**

For applications using absolute positioning commands, you must define the reference point (machine zero). The reference point must be defined once at initial startup when using absolute encoders. With all other encoder types, machine zero must be defined each time the machine is switched on.

MOVIAXIS® supports 10 different reference travel types that are set via the parameter "9658.2 Reference travel type".

If referencing is set to the hardware limit switches and / or the reference cam, these must be set as binary inputs in the control word.

If a hardware limit switch is reached during reference travel with type 1 or type 2 and the reference point has not yet been found, the drive turns and continues reference travel in the other direction.

Machine zero = reference point + reference offset.

The status "Referenced" is reset when the servo inverter is switched off or if error messages relating to the position measuring system occur.

An exception are absolute encoders, see below note. For Hiperface and SSI absolute encoders, the status "Referenced" is always set and is only reset during reference travel. The status "Not referenced" remains if the reference travel is canceled.

When deciding whether to reference to the reference cam or zero pulse, note the following points:

- The zero pulse moves when the motor is replaced.
- The reference cam could become inaccurate as a result of age, wear or switching hysteresis.
- If the reference point is determined using the zero pulse and reference cam, and the zero pulse is located exactly at the end of the reference cam, the switching transition of the reference cam may be detected before or after the zero pulse (switching hysteresis). The result may be a reference position which varies by a motor revolution from one time to the next. The situation can be remedied by shifting the reference cam by about half a motor revolution.
- Unidirectional drives can only be referenced using a reference cam. Additionally, note that there is not a defined interval between the reference cam and zero pulse of the encoder for non-integer ratios. This means that in this case only the end of the reference cam can be selected as the reference point.
- The length of the reference cam and the reference speeds must be selected so the drive can reliably decelerate to the slower reference speed (reference speed 2) on the reference cam. The end of the reference cam or the closest zero pulse of the encoder system can be used as reference point.
- The zero pulse can only be used as a reference point when the encoder has a zero pulse and the zero track is connected to the servo inverter.

As an option, a basic setting travel can be selected after the reference procedure for each reference travel type using the parameter "9656.1 Approach basic setting". This allows you to freely define the drive position regardless of the reference point using FCB 12 Reference travel. This dispenses with the controller performing a positioning travel procedure. The basic setting is set using parameter "9730.2 Basic setting". The travel speed to the basic setting is set using parameter 9731.1 "Basic setting velocity".

Explanation of symbols for the figures "Reference travel types"

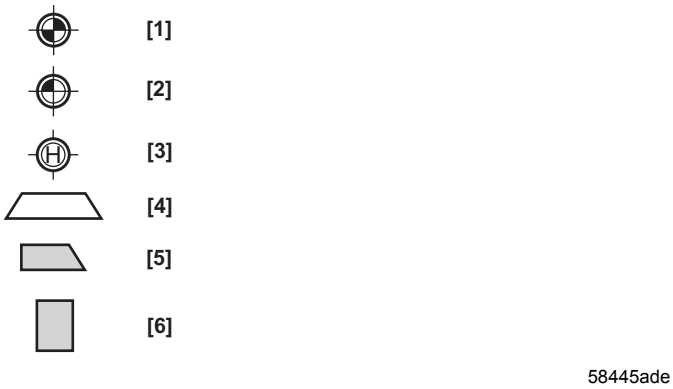


Fig. 25: Explanation of symbols

[1] Reference point
[2] Machine zero
[3] Stop position after basic setting travel (optional)
[4] Reference cams
[5] Hardware limit switch
[6] Dead stop

- **Left zero pulse**

For this reference travel type, it is mandatory to set parameter "9750.1 Reference to zero pulse" to "YES".

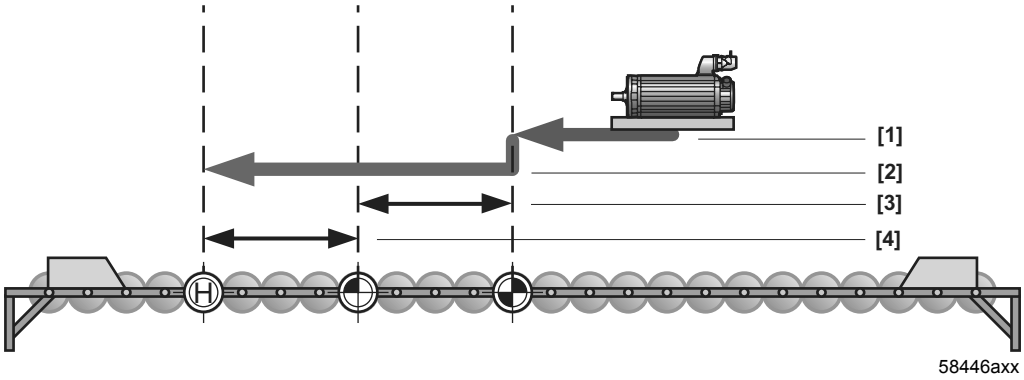


Fig. 26: Reference travel left zero pulse

[1] 9731.2 Clear velocity
[2] 9731.1 Basic setting velocity
[3] 9730.1 Reference offset
[4] 9730.2 Basic setting

The reference position is the first zero pulse left of the starting position of reference travel. A reference cam is not required. Only parameter "9731.2 Clear velocity (reference velocity 2)" is used for reference travel.

- **Left end reference cam**

Parameter "9750.1 Reference to zero pulse" is set to "YES".

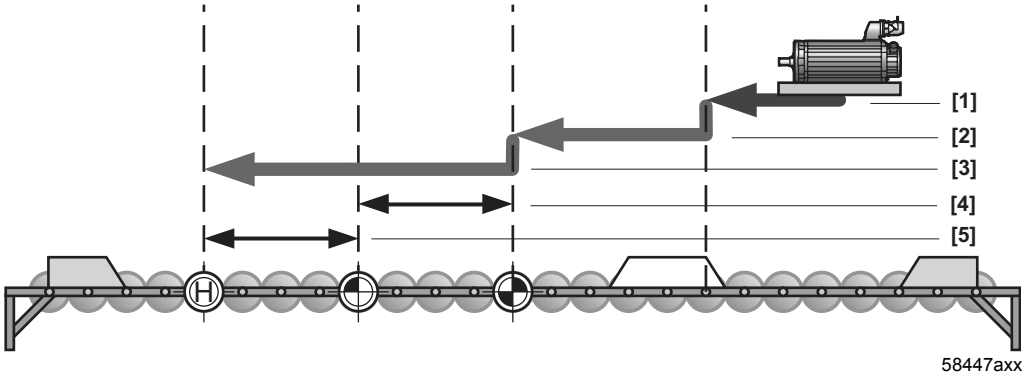


Fig. 27: Reference travel left end reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9750.1 Reference to zero pulse" is set to "NO".

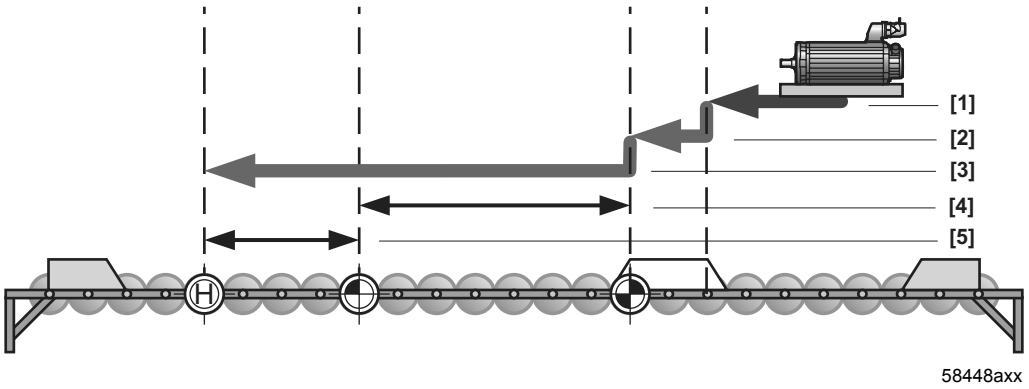


Fig. 28: Reference travel left end reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

The reference position is the left end of the reference cam or the first zero pulse to the left after the end of the reference cam.

A bit in control word 0 – 3 must be set to "REFERENCE CAM".

The reference travel starts with the search velocity in a negative rotational direction up to the first positive edge of the reference cam. Search velocity changes to clear velocity once the reference cam is detected.

The reference point will then be the falling edge (left end) of the reference cam without "Referencing to zero pulse". If "Reference to zero pulse = yes", the reference point will be the first zero pulse after the falling edge of the reference cam.

Parameter "9657.1 Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- **Right end reference cam**

Parameter "9750.1 Reference to zero pulse" is set to "YES".

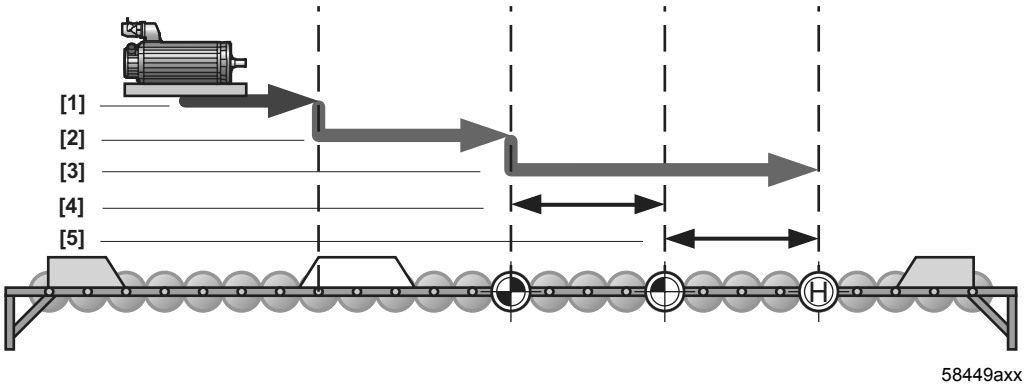


Fig. 29: Reference travel left end reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9750.1 Reference to zero pulse" is set to "NO".

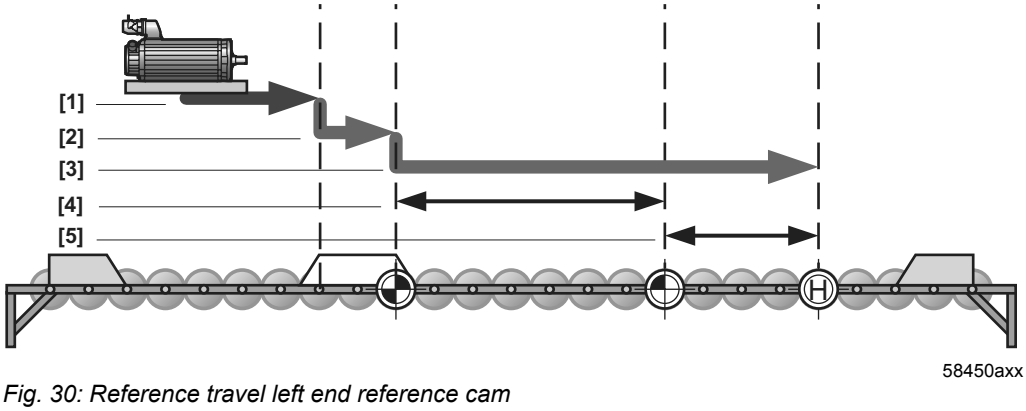


Fig. 30: Reference travel left end reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

The reference position is the left end of the reference cam or the first zero pulse to the left after the end of the reference cam.

A bit in control word 0 – 3 must be set to "REFERENCE CAM".

Reference travel starts in positive direction. The search velocity is used up to the first positive edge of the reference cam. Search velocity changes to clear velocity once the reference cam is detected.

The reference point will then be the falling edge (right end) of the reference cam without "Referencing to zero pulse". If "Reference to zero pulse = yes", the reference point will be the first zero pulse after the falling edge of the reference cam.

Parameter "9657.1 Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- **Right limit switch**

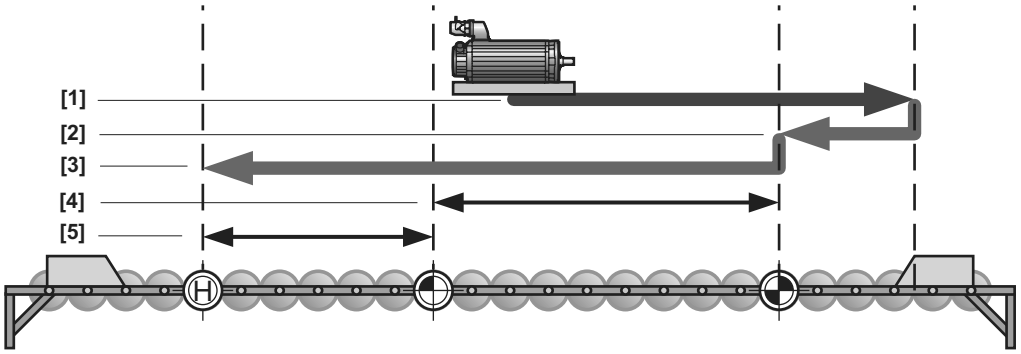


Fig. 31: Reference travel to right limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

The reference point is the first zero pulse to the left of the right limit switch.

Reference travel starts in positive direction. Search velocity is used up to the falling edge of the right limit switch, then clear velocity is used.

Parameter 9657.1 "Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- **Left limit switch**

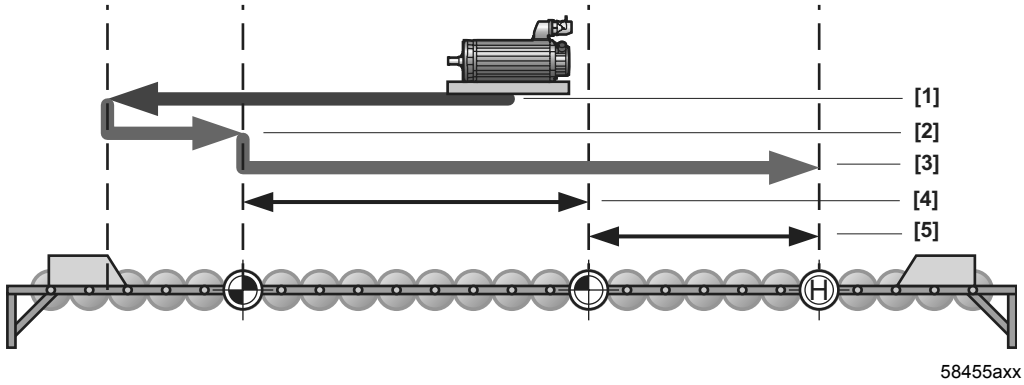


Fig. 32: Reference travel to left limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

The reference point is the first zero pulse to the right of the left limit switch.

Reference travel starts in negative direction. Search velocity is used up to the falling edge of the left limit switch, then clear velocity is used.

Parameter 9657.1 "Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- **No reference travel**

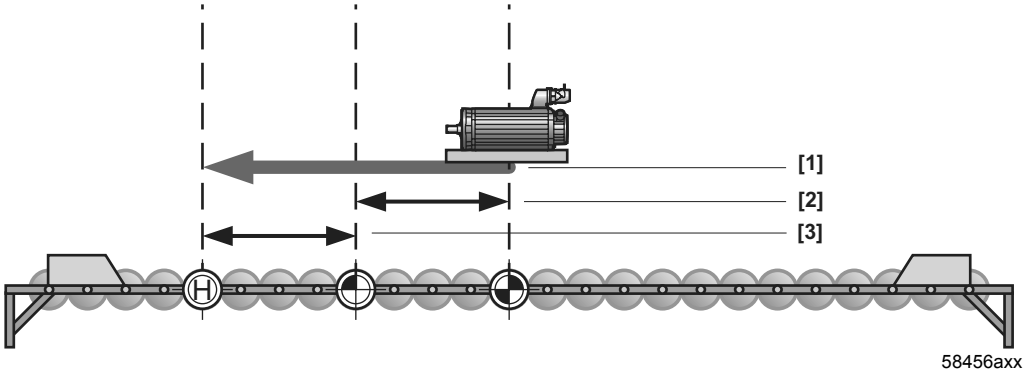


Fig. 33: No reference travel

[1] 9731.1 Basic setting velocity
[2] 9730.1 Reference offset
[3] 9730.2 Basic setting

The reference position is the current position. It makes sense to use this type of reference travel with absolute encoders and for drives that are to be referenced in standstill. For example, the position of a feed axis can be set to "zero" when the drive is at a standstill. In this way, the machine operator can tell where the drive is located within each feed movement.

- **Reference cam flush with right limit switch**

Parameter "9750.1 Reference to zero pulse" is set to "YES".

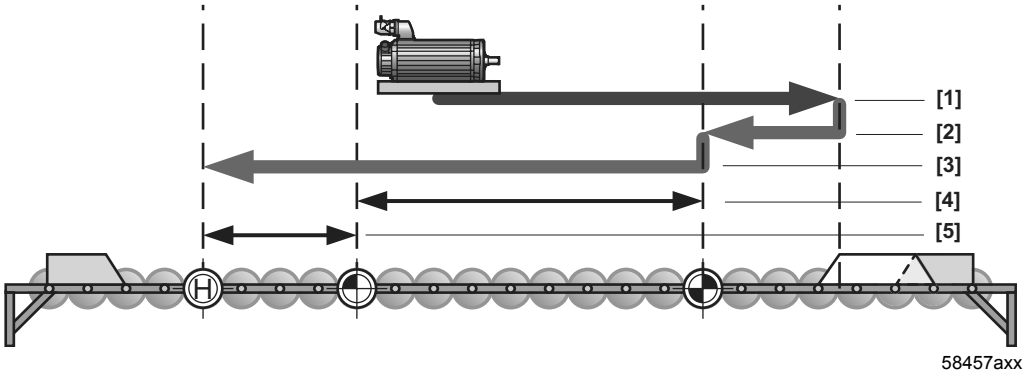


Fig. 34: Reference travel reference cam flush with right limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9750.1 Reference to zero pulse" is set to "NO".

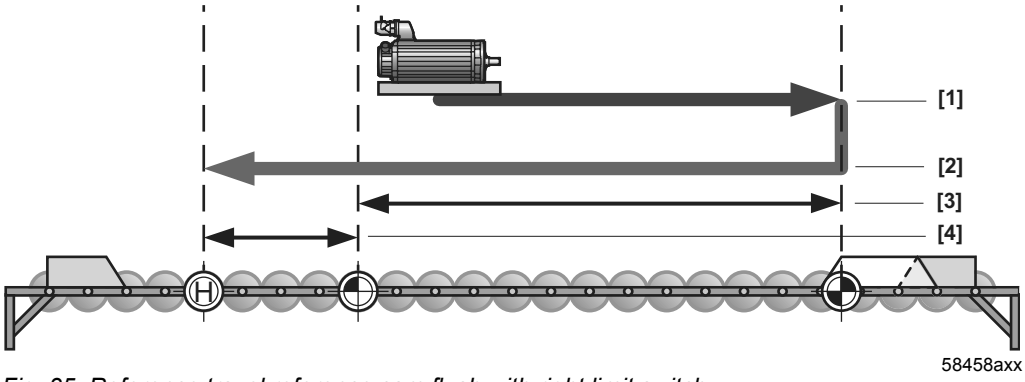


Fig. 35: Reference travel reference cam flush with right limit switch

[1] 9731.3 Search velocity
[2] 9731.1 Basic setting velocity
[3] 9730.1 Reference offset
[4] 9730.2 Basic setting

The reference position is the left end of the reference cam or the first zero pulse to the left after the end of the reference cam.

A bit in control word 0 – 3 must be set to "REFERENCE CAM".

Reference travel starts in positive direction. Search velocity is used up to the first positive edge of the reference cam, then clear velocity is used. In contrast to the type "Left end reference cam", the drive starts in a CW (right) direction and turns at the reference cam.

Depending on the setting "Reference to zero pulse", referencing takes place to the falling edge of the reference cam or to the zero pulse following the falling edge of the reference cam.

The reference cam must start just before or in line with the right hardware limit switch and must project into the limit switch. This ensures that no hardware limit switch is approached during reference travel. Parameter 9657.1 "Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- Reference cam flush with left limit switch

Parameter "9750.1 Reference to zero pulse" is set to "YES".

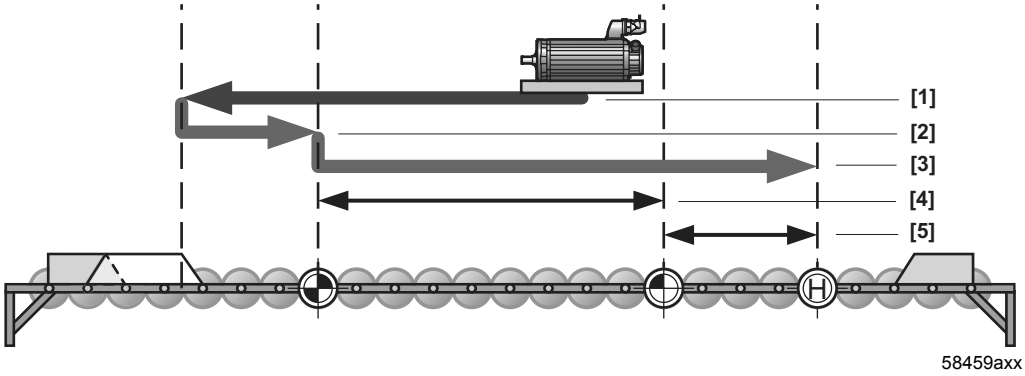


Fig. 36: Reference travel reference cam flush with left limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9750.1 Reference to zero pulse" is set to "NO".

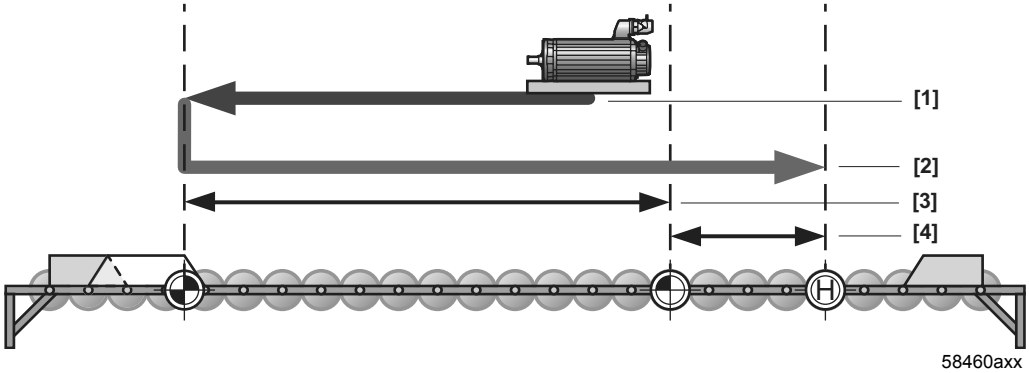


Fig. 37: Reference travel reference cam flush with left limit switch

[1] 9731.3 Search velocity

[2] 9731.1 Basic setting velocity

[3] 9730.1 Reference offset

[4] 9730.2 Basic setting

The reference position is the right end of the reference cam or the first zero pulse to the right after the end of the reference cam.

A bit in control word 0 – 3 must be set to "REFERENCE CAM".

Reference travel starts in negative direction. Search velocity is used up to the first positive edge of the reference cam, then clear velocity is used. In contrast to the type "Right end reference cam", the drive starts in a CCW direction (left) and turns at the reference cam.

Depending on the setting "Reference to zero pulse", referencing takes place to the falling edge of the reference cam or to the zero pulse following the falling edge of the reference cam.

The reference cam must start just before or in line with the right hardware limit switch and must project into the limit switch. This ensures that no contact is made with the hardware limit switch during reference travel.

Parameter 9657.1 "Hardware limit switch for velocity changeover" is not relevant for this reference travel type.

- **Right fixed stop**

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "Hardware limit switch".

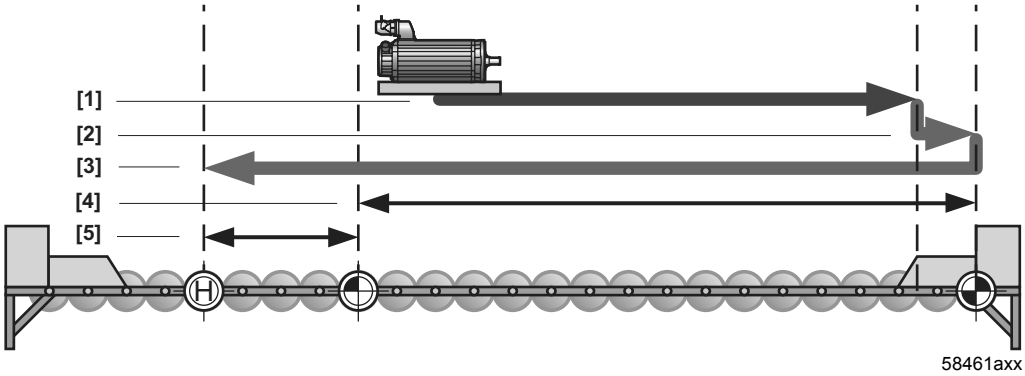


Fig. 38: Reference travel type right fixed stop with hardware limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "Reference cam".

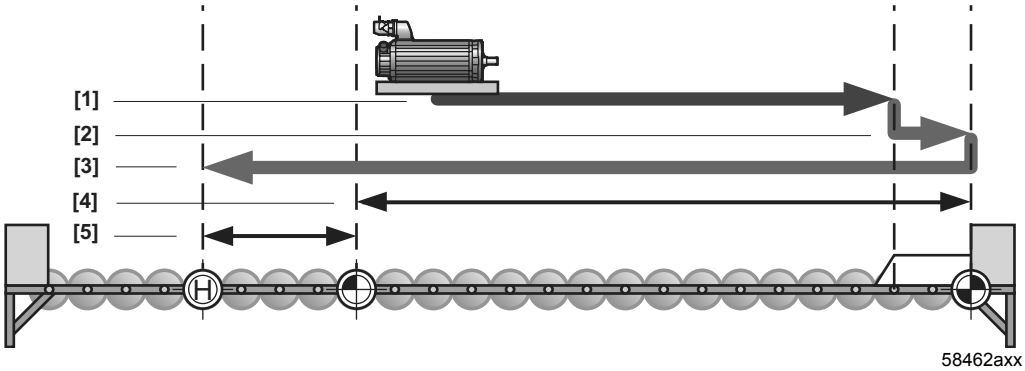


Fig. 39: Reference travel type right fixed stop with reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "without".

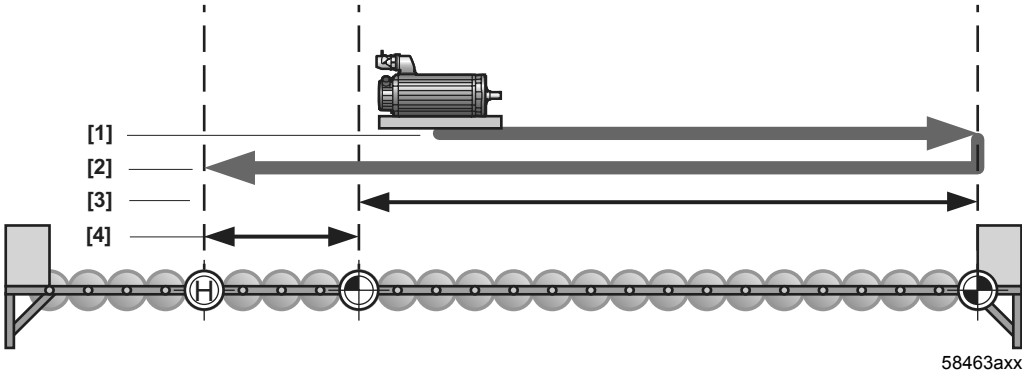


Fig. 40: Reference travel type right fixed stop

[1] 9731.2 Clear velocity

[2] 9731.1 Basic setting velocity

[3] 9730.1 Reference offset

[4] 9730.2 Basic setting

The reference position is the right fixed stop. The machine must be designed so that the fixed stop withstands impact at the corresponding speed without any damage.

Reference travel starts in positive direction. If parameter "9657.1 Hardware limit switch for velocity changeover" is set to "without", reference travel will start with clear velocity.

With the setting "Hardware limit switch" or "Reference cam", the reference travel starts with the search speed and reduces to the clear velocity when coming into contact with the hardware switch or reference cam.

Parameter "9655.1 Reference dwell time" can be used to set the duration for which the torque (parameter "9654.4 Torque reference travel") is maintained on the fixed stop until referencing.

- **Left fixed stop**

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "Hardware limit switch".

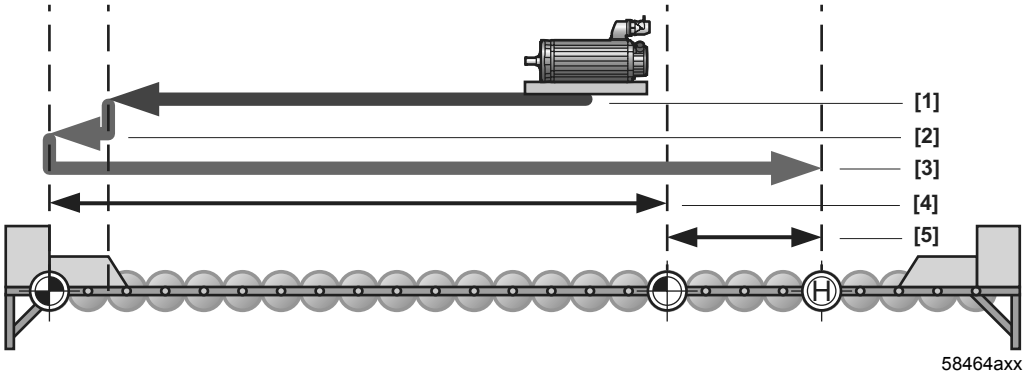


Fig. 41: Reference travel type left fixed stop with hardware limit switch

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "Reference cam".

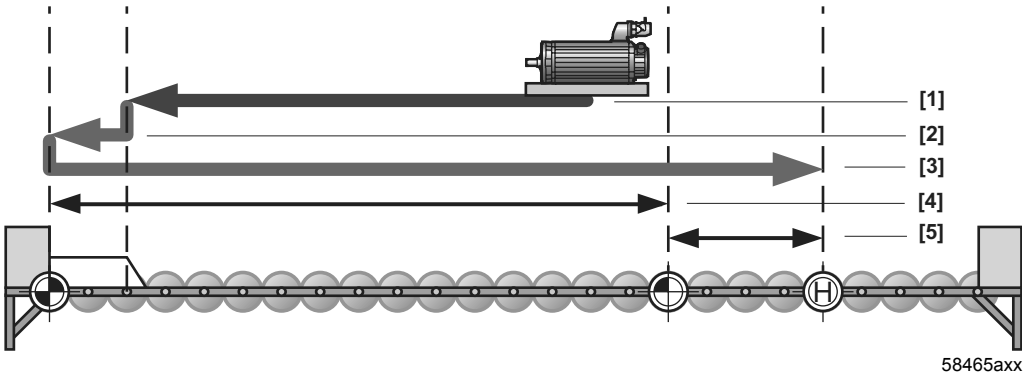


Fig. 42: Reference travel type left fixed stop with reference cam

[1] 9731.3 Search velocity
[2] 9731.2 Clear velocity
[3] 9731.1 Basic setting velocity
[4] 9730.1 Reference offset
[5] 9730.2 Basic setting

Parameter "9657.1 Hardware limit switch for velocity changeover" is set to "without".

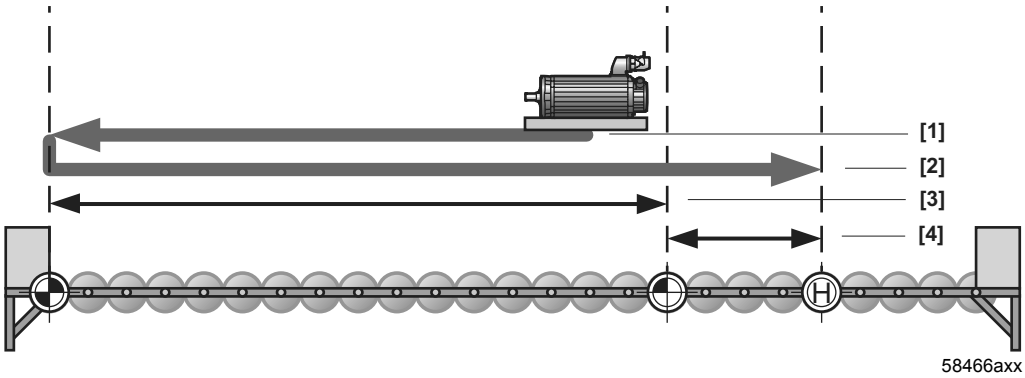


Fig. 43: Reference travel type left fixed stop

[1] 9731.2 Clear velocity

[2] 9731.1 Basic setting velocity

[3] 9730.1 Reference offset

[4] 9730.2 Basic setting

The reference position is the left fixed stop. The machine must be designed so that it is not damaged when the fixed stop is reached with impact at the corresponding speed.

Reference travel starts in negative direction. If parameter "9657.1 Hardware limit switch for velocity changeover" is set to "without", reference travel will start with clear velocity.

With the setting "Hardware limit switch" or "Reference cam", the reference travel starts with the search speed and reduces to the clear velocity when coming into contact with the hardware switch or reference cam.

Parameter 9655.1 "Reference dwell time" can be used to set the duration for which the torque (parameter "9654.4 Torque reference travel") is maintained on the fixed stop until referencing.

9750.1
Referencing to zero pulse

Value range:

- No
- Yes

Reference to zero pulse, see reference travel type parameter "9658.2".

9656.1
Approach basic setting

Value range:

- No
- Yes

Set whether the function "Approach basic setting" is required here.

9657.1
HW limit switch for velocity change

Value range:

- 0 = without
- 1 = Hardware limit switches
- 2 = Reference cam

Hardware switch for velocity change during reference travel, see reference travel type parameter "9658.2".

9730.2
Basic setting

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Basic setting in user-defined units, see reference travel type parameter "9658.2".

9730.1
Reference offset

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Reference offset in user-defined units, see reference travel type parameter "9658.2".

9730.3
Reference offset modulo

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Reference offset Modulo

Limit values

9731.3
Search velocity reference speed 1

Unit: 10^{-3} rpm.

Value range: 0 ... 10000000, step 1.

Search velocity in user-defined units (reference velocity 1), see reference travel type parameter "9658.2".

9731.2
Clear velocity reference speed 2

Unit: 10^{-3} rpm.

Value range: 0 ... 10000000, step 1.

Clear velocity in user-defined units (reference velocity 2), see reference travel type parameter "9658.2".

9731.1
Basic setting velocity reference speed 3

Unit: 10^{-3} rpm.

Value range: 0 ... 10000000, step 1.

Basic setting velocity in user-defined units (reference velocity 3), see reference travel type parameter "9658.2".

9654.1
Acceleration reference travel

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 ... 2147483647, step 1.

Acceleration reference travel in user-defined units.

9654.2
Deceleration reference travel

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 ... 2147483647, step 1.

Deceleration reference travel in user-defined units.

9654.3
Jerk reference travel

Unit: 1 rpm/s^2.

Value range: 1 ... 2147483647, step 1.

Maximum jerk reference travel.

9654.4
Torque reference travel

Unit: %.

Resolution: 10^{-3}.

Value range: 0 ... 100000 ... 1000000, step 1.

Torque limit reference travel in user-defined units.

9655.1
Reference dwell time fixed stop

Unit: ms.

Value range: 0 ... 100000, step 1.

Reference dwell time fixed stop.

4.3 Communication parameter description

PDO Editor
Process Data Object Editor

The PDO Editor is the central, graphical software tool for editing and configuring FCBs and the entire unit functionality.

The tool can be used to determine where and which data packages should be taken from buses or I/Os, how they should be interpreted (control/process data) and how they are used in the unit functions and, in the same way, to determine how this data is output (buses or I/O).

This feature makes for maximum flexibility when using the MOVIAXIS® functions without the user having to perform any programming. The graphical structure makes it easy for users to familiarize themselves with the tool using the intuitive interface.

Basic settings

9831.1
Stop process data

Value range:

- No
- Yes

Parameter changes that affect communication (all parameters described in the "Communication" section) will trigger error 66 and stop the process data. The parameter "Stop process data" = "YES" is also used to stop process data but no error message is generated.

The parameter and error 66 cause the drive to first be enabled again when all parameter settings are complete and the drive does not rotate in an uncontrolled way at the upper speed limit.

9603.1
Response PDO timeout

Value range:

- 0 = No response
- 1 = Display only
- 5 = Output stage inhibit / waiting
- 6 = Emergency stop / waiting
- 8 = Stop at application limit / waiting
- 10 = Stop at system limit / waiting
- 17 = Stop at application limit / autoreset
- 18 = Emergency stop / autoreset
- 19 = Stop at system limit / autoreset
- 20 = Output stage inhibit / autoreset
- 21 = Stop at application limit / autoreset without error memory
- 22 = Emergency stop / autoreset without error memory
- 23 = Stop at system limit / autoreset without error memory
- 24 = Output stage inhibit / autoreset without error memory

The PDO timeout response sets the error response for the case that the IN buffer does not receive an expected process data. The process data was already received and is then absent before the error message comes up. The axis is in state C3 "Waiting for process data" after a reset. This is not an error message; it is a state.

0 = No response:

Error is ignored

1 = Display only:

The 7-segment display shows the error but the axis does not respond (continues to operate).

5 = Output stage inhibit / waiting:

The axis changes to the state controller inhibit and activates the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

6 = Emergency stop / waiting:

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

8 = Stop at application limit / waiting (default):

The motor is stopped at the application limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

10 = Stop at system limit / waiting:

The motor is stopped at the system limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

17 = Stop at application limit / autoreset

The motor is stopped at the application limit. The axis runs again without a reset when the error is no longer present.

18 = Emergency stop / autoreset

The motor is stopped at the emergency stop limit. The axis runs again without a reset when the error is no longer present.

19 = Stop at system limit / autoreset

The motor is stopped at the system limit. The axis runs again without a reset when the error is no longer present.

20 = Output stage inhibit / autoreset

The motor is stopped by the output stage inhibit. The axis runs again without a reset when the error is no longer present.

21 = Stop at application limit / autoreset without error memory

The motor is stopped at the application limit. The axis runs again without a reset when the error is no longer present. Furthermore, no entry is generated in the error memory.

22 = **Emergency stop / autoreset** without error memory

The motor is stopped at the emergency stop limit. The axis runs again without a reset when the error is no longer present. Furthermore, no entry is generated in the error memory.

23 = Stop at system limit / autoreset without error memory

The motor is stopped at the system limit. The axis runs again without a reset when the error is no longer present. Furthermore, no entry is generated in the error memory.

20 = Output stage inhibit / autoreset without error memory

The motor is stopped by the output stage inhibit. The axis runs again without a reset when the error is no longer present. Furthermore, no entry is generated in the error memory.

For more information, refer to the operating instructions section "Operation and service".

9729.16
Response external error

Value range:

- No response
- Display only
- Output stage inhibit / waiting
- Stop at application limit / waiting
- Stop at system limit / waiting

Descriptive text see parameter "9603.1 Response PDO timeout"

If a bit was set to "External error" in the control word 0-3, then this parameter sets the corresponding response.

Standard communication

8937.0
CAN1 protocol selection

Value range:

- 0=MoviLink
- CANopen (in preparation)

CAN1 protocol selection.

8938.0
CAN2 protocol selection

Value range:

- 0=MoviLink
- CANopen (in preparation)

CAN2 protocol selection.

8603.0
CAN1 baud rate

Value range:
- 0=125 kBaud
- 1=250 kBaud
- 2=500 kBaud
- 3=1 MBaud

Baud rate CAN1. This is only a display value. It is set using the automatic addressing function of the power supply module.

8939.0
CAN2 baud rate

Value range:
- 0=125 kBaud
- 1=250 kBaud
- 2=500 kBaud
- 3=1 MBaud

CAN2 baud rate.

8600.0
CAN1 address

Value range: 0...63, step 1

Current address CAN1. This is only a display value. It is set using the automatic addressing function of the power supply module.

8932.0
CAN2 address

Value range: 0...99, step 1

CAN2 address

9825.1
Scope-ID CAN1

Value range: 0...120...1073741823, step 1

This CAN message ID is used for all axis scope recordings (multi-axis scope).

9883.1
Synchronization ID CAN1

Value range: 0...128...1073741823, step 1

This synchronization ID is used for CAN1 for sending and receiving.

9882.1
Synchronization ID CAN2

Value range: 0...128...1073741823, step 1

This synchronization ID is used for CAN2 for sending and receiving.

9877.5
Setpoint cycle CAN1

You have the option of handling poorer sync messages (with large jitter) by increasing the CAN setpoint cycle. This is especially needed for baud rates below 500 kBaud.

The maximum sync jitter can be ± (setpoint cycle CAN/4). Long-term deviation must not exceed an average of ± 0.4 % of the setpoint cycle CAN.

The CAN setpoint cycle can be increased if the controller cannot maintain the tolerance of the sync. The value must be a multiple of the sync cycle.

The default value of "1 ms" is the optimum setting for axis-axis communication within MOVIAXIS® and a minimum baud rate of 500 kBaud.

9878.5
Setpoint cycle CAN2

Descriptive text see parameter "9877.5 Setpoint cycle CAN1"

10118.1
Sync mode CAN1

Value range:

- 0=Consumer
- 1=Producer

Is used to set whether the axis receives (consumes) or sends (produces) a synchronization protocol on CAN1.

Observe the parameter "9836.1 Synchronization source" when setting "Consumer".

Observe the parameter "9877.1 Sync period, 9877.2 Sync offset and 9877.3 Sync start mode" when setting "Producer".

10118.2
Sync mode CAN2

Value range:

- 0=Consumer
- 1=Producer

Is used to set whether the axis receives (consumes) or sends (produces) a synchronization protocol on CAN2.

Observe the parameter "9836.1 Synchronization source" when setting "Consumer".

Observe the parameter "9878.1 Sync period, 9878.2 Sync offset and 9878.3 Sync start mode" when setting "Producer".

9877.1
Sync period CAN1

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync period CAN1.

Only if 10118.1 Sync mode CAN1 is set to "Producer".

9878.1
Sync period CAN2

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync period CAN2.

Only if 10118.2 Sync mode CAN2 is set to "Producer".

9877.2
Sync offset CAN1

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync offset CAN1.

Only if 10118.1 Sync mode CAN1 is set to "Producer".

The offset causes a start delay on the parameter "9877.3 Sync start mode CAN1".

9878.2
Sync offset CAN2

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync offset CAN2.

Only if 10118.2 Sync mode CAN2 is set to "Producer".

9877.3
Sync start mode CAN1

Value range:

- 0 = OFF
- 1 = when receiving PDO00
- 2 = PDO01
- 3 = PDO02
- 4 = PDO03
- 5 = PDO04
- 6 = PDO05
- 7 = PDO06
- 8 = PDO07
- 9 = PDO08
- 10 = PDO09
- 11 = PDO10
- 12 = PDO11
- 13 = PDO12
- 14 = PDO13
- 15 = PDO14
- 16 = PDO15
- 100 = Direct

The sync start mode CAN1 describes when the axis should start with the sync protocols.

OFF

No sync protocols are sent. The module is disabled.

PDO00 to PDO15

The synchronization protocols are started if the corresponding PDO00 to PDO15 was received once.

Direct

The synchronization protocols are started immediately after booting.

9878.3
Sync start mode CAN2

Sync start mode CAN2.

See parameter "9877.3 Sync start mode CAN1".

9992.1
Sync jitter compensation CAN1

Value range:

- No
- Yes

The sync jitter compensation function informs the sync protocol how much later it can place the sync protocol on the CAN. There are always delays if another protocol is being processed during sync (approx. 200 µs).

The receiver will process this offset.

This is a SEW particularity and always has to be set when MOVIAXIS® units are sync master and sync slave in relation to one another. In this case, the sync jitter compensation for the two other units must be set to "YES".

With external sync master, the sync jitter compensation must be set to "NO".

9993.1
Sync jitter compensation CAN2

Value range:

- No
- Yes

CAN2 sync jitter compensation.

See parameter "9992.1 Sync jitter compensation CAN1"

Communication option

8453.0
Fieldbus baud rate

Value range: 0 ... 4294967295, step 1

The baud rate of the fieldbus is specified by the master depending on the fieldbus type. In some cases this is only a display value (e.g. Profibus) or an input value.

8454.0
Fieldbus address

Value range: 0 ... 4294967295, step 1

Current fieldbus address (e.g. for Profibus this is a hardware setting on the option card). In some cases this is only a display value (e.g. Profibus) or an input value like the baud rate fieldbus.

8606.0
Timeout

Unit: ms

Value range: 0 ... 500 ... 650000, step 10

Fieldbus timeout delay.

An error will be triggered after this timeout delay if the fieldbus is interrupted.

9729.17
Response Fieldbus timeout

Value range: See parameter "9729.16 Response external fault".

Response fieldbus timeout.

For a description of the setting options, see parameter "9603.1 Response PDO timeout".

Gateway

9879.1
Sync period gateway

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync period gateway.

This value is used for transferring the sync signal from the fieldbus to the system bus. This currently works only with the K-Net fieldbus. If you have any questions, please contact SEW-EURODRIVE.

9879.2
Sync offset gateway

Unit: µs

Value range: 0...5000...100000000, step 1000

Sync offset gateway.

This value is used for transferring the sync signal from the fieldbus to the system bus. This currently works only with the K-Net fieldbus. If you have any questions, please contact SEW-EURODRIVE.

9879.3
Sync start mode gateway

Value range: See parameter "9877.3 Sync start mode CAN1"

Sync start mode gateway.

This value is used for transferring the sync signal from the fieldbus to the system bus. This currently works only with the K-Net fieldbus. If you have any questions, please contact SEW-EURODRIVE.

Synchronization

9836.1
Synchronization source

Value range:

- 0=No source
- 1=CAN2
- 2=CAN1
- 3=Communication option

If the CAN1 or CAN2 sync mode is set to consumer, this parameter sets the source of the sync signal.

9835.1
Period interval sync signal

Unit: µs

If the axis is the consumer of a sync signal, all incoming signals will be recorded with respect to time and displayed here.

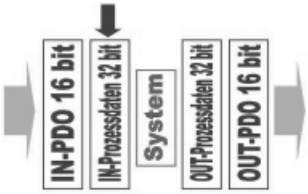
9951.4
Period length of base period

Value range: –2147483648 ... 0 – 2147483647, step 1

For in-house use only!

The period length of the base period is a display value for internal error diagnostics purposes. All other tasks are derived from the base period.

Control words 0 – 3



9510.1 Source current value

Displays the current value of control word 0.

Control word 0

9512.1 Source control word 0

Value range:

- 0=No source
- 8334=Standard binary inputs
- 75339=Local control word
- 730515=Opt 1 DI
- 730521=Opt 2 DI
- or "IN 0-15" word 0-15

Several sources can be set for control word 0:

- **No source**

The control word is inactive.

- **Standard binary inputs**

The binary inputs on the basic unit are transferred to the control word. All FCBs 1 = active via bus communication (1 on FCB 13 triggers a stop at the application limits). To now implement open circuit protection via the binary inputs, the following FCBs or functions are 0 = active:

  - FCB 01 Output stage inhibit
  - FCB 13 Stop at application limits
  - FCB 14 Emergency stop
  - FCB 15 Stop at system limits
  - External error (no FCB but message)
  - Right limit switch
  - Left limit switch (0 on FCB 13 triggers a stop at the application limits). This only applies to source standard binary inputs.

- **Local control word**

Parameter 9803.1 Local value specifies the control word.

- **Opt 1 DI**

If a digital terminal expansion XIO or XIA is plugged in option slot 1, the control word is specified by the option.

- **Opt 2 DI**

If a digital terminal expansion XIO or XIA is plugged in option slot 3, the control word is specified by the option.

- **IN**

If you want to specify the control word via bus, set IN 0-15 and word 0-15.

This parameter is usually set in the PDO Editor.

9803.1
Local value

Value range: 0 ... 4294967295, step 1

If the source control word 0 is set to "local control word", this parameter will be control word 0.

This parameter is usually set in the PDO Editor.

9513.1
Layout

Value range:

- 0=No layout
- 1=Programmable layout
- 2 = FCB/ instance
- 3 = Programmable layout / FCB / instance

Layout control word 0

- **No layout**

The control word is inactive.

- **Programmable layout**

Each bit of the control word is freely configurable.

- **FCB instance**

The control word has a fixed assignment. The 8 low bits (low byte) are used for selecting the FCB and the 8 high bits (high byte) for selecting the instance. See also parameter "9804.1 Select FCB with instance".

- **Programmable layout / FCB / instance**

The control word has partial fixed assignment. Bit 0 to 4 is freely configurable: Bit 5 to Bit 9 selects the FCB. Bit 10 to Bit 15 selects the instance.

This parameter is usually set in the PDO Editor.

9513.10
Bit 0

Value range:

- 0 = No function
- 1 = FCB final stage lock
- 2 = FCB stop at system limits
- 3 = FCB emergency stop
- 4 = FCB stop at application limits
- 5 = FCB reference travel
- 6 = FCB limit switch
- 7 = FCB jog mode
- 8 = FCB hold control
- 9 = FCB brake test
- 10 = Calibrate FCB encoder
- 11 = FCB electronic gear unit
- 12 = FCB electronic cam
- 13 = FCB Interpolated position control
- 14 = FCB positioning
- 15 = FCB Interpolated speed control
- 16 = FCB speed control
- 17 = FCB Interpolated torque control
- 18 = FCB torque control
- 19 = FCB electronic gear unit
- 31 = Limit switch 1 right
- 32 = Limit switch 1 left
- 33 = External error
- 34 = Error reset
- 35 = Reference cam
- 36 = Parameter selection bit 0
- 37 = Parameter selection bit 1
- 38 = IEC input
- 39 = Jog left
- 40 = Jog right
- 41 = Feed enable
- 42 = Accept position
- 46 = Limit switch 2 right
- 47 = Limit switch 2 left
- 48 = Limit switch 3 right
- 49 = Limit switch 3 left
- 50 = Engage synchronous operation
- 51 = Touch probe

Programmable control word 0 layout bit 0.

Determines the function of bit 0 of control word 0.

- **No function**

The bit is inactive.

- **FCBs**

Activating the bit selects the corresponding FCB. The corresponding FCB is active if "1" is present. The only exception is if binary inputs are the source of the control word. The stop FCB 0 is then active for open circuit protection reasons. See also parameter "9512.1 Source control word 0".

- **Limit switch**

Via binary inputs:

Signal 0 → Right limit switch approached

Signal 1 → Limit switch not approached

Via IN buffer:

Signal 0 → Limit switch not approached

Signal 1 → Right limit switch approached

- **External error**

Signal 0 → External error is present

Signal 1 → External error not present → enable

- **Error reset**

The axis is performing an error reset. A CPU reset, system restart or warm start is performed depending on the type of error. An error of the type display only (warning) will also be reset.

- **Reference cams**

Is required for reference travel.

- **Parameter selection bit 0**

Selecting another parameter set switches to a second or third connected motor. For this purpose, the motors have to be specified in the startup routine.

Bit 0 = 0 and bit 1 = 0 → motor 1

Bit 0 = 1 and bit 1 = 0 → motor 2

Bit 0 = 0 and bit 1 = 1 → motor 3

- **Parameter selection bit 1**

See parameter selection bit 0

- **IEC input**

This bit can be used for a master MOVI-PLC®.

- **Jog left**

This bit is only active in conjunction with FCB 20 Jog active and jogging occurs in the corresponding direction when a "1" is present at the input.

- **Jog right**

This bit is only active in conjunction with FCB 20 Jog active and jogging occurs in the corresponding direction when a "1" is present at the input.

- **Feed enable**

This bit is only active in conjunction with FCB 09 Positioning. The feed enable must have a "1" when it was selected over the complete positioning procedure. Revoking feed enable lets the axis decelerate using the maximum delay of FCB 09 Positioning. Another enable continues the positioning travel to the last target at the acceleration specified in FCB 09 Positioning. Feed enable must be activated in parameter "9885.1 Use control bit" "feed enable"".

- **Accept position**

This input is only active in conjunction with FCB 09 Positioning and is particularly useful for relative operating modes. This bit must have received a positive edge once in order to trigger the positioning process. This can be used to relatively synchronize forward without changing the target. This function is also effective in absolute operating modes. Accepting the position must be activated in parameter "9885.2 Control bit" "accept position"".

- **Engage synchronous operation**
- **Touch probe**

This parameter is usually set in the PDO Editor.

9513.11
Bit 1

Value range: See parameter "9513.10 Bit 0".

Default: 16 = FCB speed control.

Programmable control word 0 layout bit 1.

This parameter is usually set in the PDO Editor.

9513.12
Bit 2

Value range: See parameter "9513.10 Bit 0".

Default: 5 = FCB reference travel.

Programmable control word 0 layout bit 2.

This parameter is usually set in the PDO Editor.

9513.13
Bit 3

Value range: See parameter "9513.10 Bit 0".

Default: 18 = FCB torque control.

Programmable control word 0 layout bit 3.

This parameter is usually set in the PDO Editor.

9513.14
Bit 4

Value range: See parameter "9513.10 Bit 0".

Default: 34 = FCB error reset.

Programmable control word 0 layout bit 4.

This parameter is usually set in the PDO Editor.

9513.15 Bit 5
Value range: See parameter "9513.10 Bit 0".
Default: 35 = FCB reference cam.
Programmable control word 0 layout bit 5.
This parameter is usually set in the PDO Editor.

9513.16 Bit 6
Value range: See parameter "9513.10 Bit 0".
Default: 0 = No function
Programmable control word 0 layout bit 6.
This parameter is usually set in the PDO Editor.

9513.17 Bit 7
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 7.
This parameter is usually set in the PDO Editor.

9513.18 Bit 8
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 8.
This parameter is usually set in the PDO Editor.

9513.19 Bit 9
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 9.
This parameter is usually set in the PDO Editor.

9513.20 Bit 10
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 10.
This parameter is usually set in the PDO Editor.

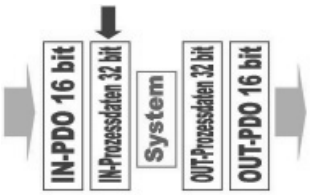
9513.21 Bit 11
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 11.
This parameter is usually set in the PDO Editor.

9513.22 Bit 12
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 12.
This parameter is usually set in the PDO Editor.

9513.23 Bit 13
Value range: See parameter "9513.10 Bit 0".
Programmable control word 0 layout bit 13.
This parameter is usually set in the PDO Editor.

9513.24 *Bit 14*	Value range: See parameter "9513.10 Bit 0". Programmable control word 0 layout bit 14. This parameter is usually set in the PDO Editor.
9513.25 *Bit 15*	Value range: See parameter "9513.10 Bit 0". Programmable control word 0 layout bit 15. This parameter is usually set in the PDO Editor.
9510.1 *Source current value*	Displays the current control word 0.
Control word 1	
9512.2 *Source control word 1*	See parameter 9512.1 "Source control word 0".
9803.1 *Local value*	See parameter 9803.1. "Local value"
9513.2 *Layout control word 1*	See parameter 9513.1 "Layout control word 0".
9848.1 *Bit 0 – 15*	See parameter 9512.1 "Source control word 0".
9510.2 *Source current value*	See parameter 9512.1 "Source control word 0".
Control word 2	See control word 0 for description of the parameter.
Control word 3	See control word 0 for description of the parameter.

Error message words



	NOTE
	The error message words are in preparation and so are not yet enabled.

9979.1
Source error message word 0

Value range:
- 0=No source
- 8334=Standard binary inputs
- 75339=Local control word
- 730515=Option 1
- 730521=Option 2
- or "IN buffer 0-15" word 0-15

Parameter in preparation

This parameter is usually set in the PDO Editor.

9977.1
Response error message word 0

Parameter in preparation

This parameter is usually set in the PDO Editor.

9978.1
Response error message word 0

Parameter in preparation

This parameter is usually set in the PDO Editor.

9979.2
Response error message word 0

Parameter in preparation

This parameter is usually set in the PDO Editor.

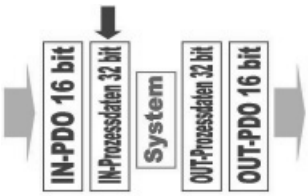
9977.2
Response error message word 0

Parameter in preparation

This parameter is usually set in the PDO Editor.

9978.2 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9979.3 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9977.3 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9978.3 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9979.4 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9977.4 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9978.4 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9979.5 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9977.5 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9978.5 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9979.6 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9977.6 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.
9978.6 *Response error message word 0*	Parameter in preparation This parameter is usually set in the PDO Editor.

IN process data



Channel 0

9822.1
Source process data channel 0

Value range:

- 0=No source
- 8334=Standard binary inputs
- 75339=Local control word
- 730515=Option 1
- 730521=Option 2
- or "IN buffer 0-15" word 0-15

Source of the IN process data channel 0

This parameter is usually set in the PDO Editor.

9530.1
Access channel 0 32 bit

Value range:

- 0=16-bit
- 1=32 Bit Big Endian
- 2=32 Bit Little Endian

IN process data channel 0 access 32 bit.

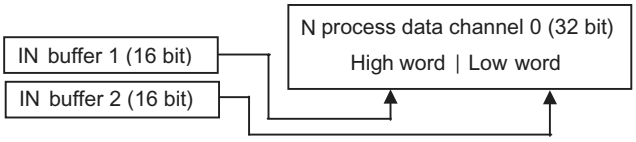
- **16 bit**

Access to the value set in parameter "9822.1 Source process data channel 0" is accepted.

- **32 Bit Big Endian**

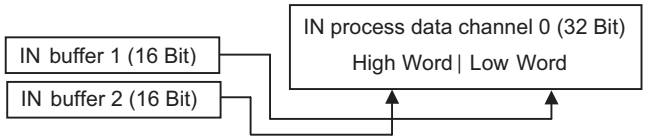
The access to the value set in parameter "9822.1 Source process data channel 0" is accepted as high word (16 high bits) and source +1 as low word.

For example: IN BUFFER 1 set as source.



- **32 Bit Little Endian**

The access to the value set in parameter "9822.1 Source process data channel 0" is accepted as low word (16 high bits) and source +1 as high word.



This parameter is usually set in the PDO Editor.

9531.1 Channel 0 system unit

Value range:

- 0=Position
- 1=Speed
- 2=Acceleration
- 3=Torque
- 4=Not interpreted
- 5=System position

The system unit selection has to be set to specify the interpretation of channel 0 (what numerator / denominator factor should be used) so that the IN process data channels can be processed as user-defined units in the system.

This parameter is usually set in the PDO Editor.

9876.1 Current value channel 0

Value range: –2147483648 ... 0 ... 2147483648, step 1.

The current value of the IN process data channel 0 has a size of 32 bits in user-defined units.

This parameter is usually set in the PDO Editor.

Channel 1 – 15

9822.2 – 16 Source process data channel 1

Value range: See parameter "9822.1 Source process data channel 0".

9530.2 – 16 Access channel 1 – 15 32 bit

Value range: See parameter "9530.1 Access channel 0 32 bit".

9531.2 – 16 Channel 1 – 15 system unit

Value range: See parameter "9531.1 Channel 0 system unit".

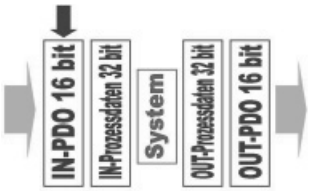
9876.2 – 16 Current value

Value range: –2147483648 ... 0 ... 2147483647, step 1.

The current value of the IN process data channel 1 has a size of 32 bits in user-defined units.

This parameter is usually set in the PDO Editor.

IN buffer



IN buffer 0

Basic settings

9514.1
Data source

Value range:

- 0=No source
- 1=CAN2
- 2=CAN1
- 3=Communication option

The setting in the data source defines the bus system responsible for reading the data.

9514.3
Data block start

The data block start describes from which data block within a message the IN buffer is loaded. Whether a value unequal to 0 may be entered depends on the bus system (e.g. the data block start for CAN is always 0).

9514.4
Data block length

Value range: 0 ... 4 ... 16, step 1.

The data block length also depends on the bus system, e.g. for CAN = maximum 4.

9514.19
Timeout interval

Unit: µs

Value range: 0 ... 100000000, step 1000.

Timeout interval IN buffer 0.

9514.5
Update

Value range:

- 1=ON
- 0=OFF

The update indicates whether the value in the IN buffer is updated with the values from the bus or not. This parameter can be used to separate the PDO from the bus.

9514.16
Configuration error

Value range: 0 ... 4294967295, step 1

- 0=No error

The Config error indicates any error.

Specific CAN parameters

9514.2 Message ID

Value range: 0 ... 1073741823, step 1

The message ID is a CAN-specific parameter. It numbers or prioritizes the messages.

9514.14 Data acceptance with sync.

Value range:

- 1=No
- 0=Yes

Here you can set whether the data is transferred to the IN buffer after receiving the first sync message. This is a CAN-specific parameter.

	NOTE
	The sync must be sent exactly as often as the process data when set to "Yes".

9514.20 Endianess IN buffer 0

Value range:

- 0=Big Endian
- 1=Little Endian

This parameter is used to set whether the first of the two bytes from the bus is interpreted as high or low byte.

- **Big Endian**

The first byte from the bus is interpreted as high byte.

- **Little Endian**

The first byte from the bus is interpreted as low byte.

This is a CAN-specific parameter.

Specific parameters communication option

9514.18 Address sender IN buffer 0

Value range: 0 ... 255, step 1.
This parameter only applies to the K-Net bus system and sets the PDO address.
This parameter is usually set in the PDO Editor.

9514.17 PDO-ID

Value range: 0 ... 255, step 1.
K-Net IN buffer ID 0.

Data

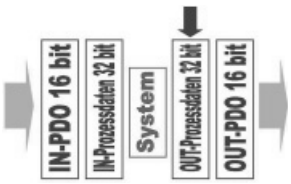
9754.1 – 16 Data word 0 – 15

Value range: 0 ... 65535, step 1.
Data word 0 – 15 IN buffer 0.
Displays the current data in the IN buffer 0 – 15.

IN buffer 1 – 15

See IN buffer 0 for description of the parameter.

Status words 0 – 3



Status word 0

9511.1
Current value

Value range: 0 ... 4294967295, step 1.

Displays the current value of status word 0.

Basic settings

9851.1
Source

Value range:

- 0=No source
- 1=System
- 2=Local status word

Several sources can be set for status word 0:

- **No source**

The status word is inactive.

- **System**

The status word is built from system values that are formed from the parameter 9856.1 "Layout and function".

- **Local control word**

Parameter "9844.1 Local value" specifies the status word.

This parameter is usually set in the PDO Editor.

9844.1
Local value

Value range: 0 ... 65535, Step 1.

If the source status word 0 is set to "local control word", this parameter will be status word 0.

This parameter is usually set in the PDO Editor.

9856.1 Layout

Value range:

- 0 = Programmable layout
- 1 = FCB/ instance
- 2 = FCB / error code
- 3 = Programmable layout / error code

Layout status word 0

- **No layout**

The status word is inactive

- **Programmable layout**

Each bit of the status word is freely configurable.

- **FCB/instance**

The status word has a fixed assignment. The 8 low bits (low byte) are used for displaying the currently active FCB and the 8 high bits (high byte) for displaying the currently active instance.

- **FCB/Fault code**

The status word has a fixed assignment. The 8 low bits (low byte) are used for displaying the currently active FCB and the 8 high bits (high byte) for displaying the current fault. If the axis is not in error status, a 0 will be displayed in the upper error byte.

- **Programmable layout / error code**

The status word only has partial fixed assignment. The lower 8 bits (low byte) are freely configurable. The upper 8 bits (high byte) have fixed assignment with the error code in the event of a fault.

This parameter is usually set in the PDO Editor.

Programmable layout

9559.1 Bit 0

Value range:

- 0=No function
- 1=Ready for operation
- 2=Output stage ON
- 3=Brake released
- 4=Brake applied
- 5=Motor standstill
- 6=Limit switch left
- 7=Limit switch right
- 8=Drive 1 referenced
- 9=Drive 2 referenced
- 10=Drive 3 referenced
- 11=Active drive referenced

- 12=In position
- 13=Parameter set bit 0
- 14=Parameter set bit 1
- 15=Setpoints active
- 16=Torque limit reached
- 17=Current limit reached
- 18=Error IEC control
- 19=IEC output
- 20=Fault
- 21=Displayed fault signal
- 22=Error without immediate output stage inhibit
- 23=Error with immediate output stage inhibit
- 24=FCB speed control active
- 25=FCB interpolated speed control active
- 26=FCB torque control active
- 27=FCB interpolated torque control active
- 28=FCB positioning active
- 29=FCB interpolated positioning active
- 30=FCB electronic gear unit
- 31=FCB hold control active
- 32=FCB jog mode active
- 33=FCB brake test function active
- 34=Calibrate FCB encoder
- 36=FCB electronic cam active
- 37= FCB output stage inhibit active
- 38=FCB system stop active
- 39=FCB emergency stop active
- 40=FCB application stop active
- 41=FCB standard (FCB13)
- 42=Safe stop 1
- 43=Safe stop 2
- 44=Prewarning motor temperature (KTY)
- 45=FCB dual drive active
- 46=External error reset
- 47=Software limit switch right
- 48=Software limit switch left
- 49=Process data valid
- 51=Brake tested OK
- 52=Brake tested NOK
- 53=DI-00 output stage enable

Programmable status word 0 layout bit 0.

- **No function**

The bit is inactive.

- **Ready for operation**

Signal 0 → The axis is currently not ready for operation. Reasons can be error states or operating states outside FCB processing (supply voltage off, power supply module not ready).

Signal 1 → The axis is in FCB processing. If no FCB is selected, the default FCB 13 Stop at application limits will be active. The 7-segment display will show the number 13.

- **Output stage on**

"Output stage enabled" is a subset of "Ready for operation" which is set to "1" in all FCBs except for FCB 01 Output stage inhibit.

- **Brake released**

Signal 0 → Brake output activated

Signal 1 → Brake output not activated

- **Brake applied**

Signal 0 → Brake output not activated

Signal 1 → Brake output activated

- **Motor standstill**

Signal 0 → Motor is turning

Signal 1 → Motor at standstill

The threshold from which motor standstill is indicated as such is set in the following parameters:

– "10056.1 Velocity threshold motor at standstill – status bit"

– "10057.1 Filter time motor at standstill – status bit"

- **Left limit switch**

Signal 0 → Limit switch not contacted

Signal 1 → Limit switch contacted

- **Right limit switch**

Signal 0 → Limit switch not contacted

Signal 1 → Limit switch contacted

- **Axis 1 referenced**

This bit indicates whether axis 1 (parameter set 1) is referenced. Incremental encoders, resolvers and single-turn Hiperface encoders lose their reference with each power-off. Absolute encoders must be referenced only once after delivery (parameter "9727.3 Delivery status d1"). An additional function is integrated in motors with Hiperface encoders. In case of service, a new motor is recognized and the referenced bit is also reset.

- **Axis 2 referenced**

This bit indicates whether axis 2 (parameter set 2) is referenced. Incremental encoders, resolvers and single-turn Hiperface encoders lose their reference with each power-off. Absolute encoders must be referenced only once after delivery (parameter "9727.3 Delivery status d1"). An additional function is integrated in motors with Hiperface encoders. In case of service, a new motor is recognized and the referenced bit is also reset.

- **Axis 3 referenced**

This bit indicates whether axis 3 (parameter set 3) is referenced. Incremental encoders, resolvers and single-turn Hiperface encoders lose their reference with each power-off. Absolute encoders must be referenced only once after delivery (parameter "9727.3 Delivery status d1"). An additional function is integrated in motors with Hiperface encoders. In case of service, a new motor is recognized and the referenced bit is also reset.

- **Active drive referenced**

This bit indicates whether the active axis is referenced. Incremental encoders, resolvers and single-turn Hiperface encoders lose their reference with each power-off. Absolute encoders must be referenced only once after delivery (parameter "9727.3 Delivery status d1"). An additional function is integrated in motors with Hiperface encoders. In case of service, a new motor is recognized and the referenced bit is also reset.

- **In position**

The "In position message" must only be used in conjunction with FCB 09 Positioning.

Signal from 0 to 1 → The axis is "In position" when it enters within the parameter 9885.3 "Window width for in position message" relative to the specified target. If a travel command was aborted with an FCB changeover but still arrives in the position window accidentally, then **no** "In position "message will be generated.

Signal 1 to 1 → The axis **loses** "In position" when it is outside parameter 9885.3 "Window width for in position message" + parameter 9885.4 Hysteresis range relative to the specified target. This prevents the bit from bouncing.

The In position message does not disappear when changing from FCB09 Positioning as long as you are in the position window + hysteresis. However, the In position message is only set within FCB 09 Positioning.

FCB change

When changing to another FCB (e.g. FCB 13 Stop at application limits to activate the brake), the "In position" message at standstill will **not** get lost. When re-entering the FCB 09 Positioning, the bit has remained unchanged.

The message is only removed when the position window + hysteresis range is exceeded relative to the last target. This applies to all FCBs. This means that the message can **only** be generated within FCB 09 Positioning. The message is only removed when the position window + hysteresis range is left regardless of the current FCB.

- **Parameter set bit 0**

This bit is used for parameter set changeover (see also "Parameter set bit 1").

Bit 0 = 0 and bit 1 = 0 → Parameter set 1 active

Bit 0 = 1 and bit 1 = 0 → Parameter set 2 active

Bit 0 = 0 and bit 1 = 1 → Parameter set 3 active

MOVIAXIS® supports 3 physically connected motors with encoder feedback. An additional "XGK11A encoder card" option is required each for the second and third motor to connect the additional encoder feedback systems. The motor power cables must be distributed through a changeover switch (not within the SEW scope of delivery) to the individual motors. The individual motors / parameter sets must first be entered in the startup routine.

- **Parameter set bit 1**

See "Parameter set bit 0"

- **Active setpoints**

This message is active in all setpoint processing FCBs when setpoints are being processed. This is FCB 05- FCB 10. The message is set to 0 in all stop FCBs as well as in the default FCB. The message is still 0 during the brake release time.

- **Torque limit reached**

This message indicates when the torque limit is reached: 9580.1 System limit maximum torque 9740.1 Application limit maximum torque or maximum torque of the respective FCB.

- **Error IEC control**

This message is in preparation.

- **IEC output**

This message is in preparation.

- **Problem**

This message is issued when the MOVIAXIS® is in error status. It is not relevant for the error bit whether the output stage is inhibited immediately or not.

- **Message displayed error**

This message is a subset of "Fault" and displays error responses that are configured to "Display fault". The drive continues to operate normally.

- **Error without immediate output stage inhibit**

This signal is a subset of "Fault" and indicates that the drive can be decelerated using a ramp (motor does not coast to a halt / mechanical brake is not applied). This bit is also set when "Message displayed error".

- **Error with immediate output stage inhibit**

This message is a subset of "Fault" and indicates that the motor coasts to a halt or, if installed, the mechanical brake is applied.

- **FCBs**

The relevant message is set to 1 if the corresponding FCB is active.

- **Brake tested OK**

The FCB has successfully tested the brake and found it to be good according to the basic conditions set in FCB. See FCB brake test.

- **Brake tested NOK**

The FCB brake test has assessed the brake as faulty. The higher-level controller now decides on the measures to be introduced. See FCB brake test.

- **Output stage enable DI-00**

Displays the current status of the terminal DI00.

This parameter is usually set in the PDO Editor.

9559.2 – 16
Bit 1 – 15

Value range: See parameter "9559.1 Programmable layout".

Programmable status word 0 layout bits 1 – 15.

Status word 1 – 3

9511.2 – 4
Current value

Value range: See parameter "9559.1 Programmable layout".

Programmable status word 0 – 3.

Basic settings

9851.2 – 4
Source

Value range: See parameter "9559.1 Programmable layout".

Source status word 1 – 3.

9844.2 – 4
Local value

Value range: See parameter "9559.1 Programmable layout".

Local status word 0 – 3.

9856.2 – 4
Layout

Value range: See parameter "9559.1 Programmable layout".

Layout status word 1 – 3.

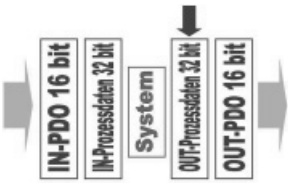
Programmable layout

9845.1 – 16 – 9847.1 – 16
Bit 0 – 15

Value range: See parameter "9559.1 Programmable layout".

Programmable status word 1 – 3 layout bit 0 – 15.

OUT process data



Channel 0

9560.1
Channel 0 system unit

Value range:

- 0=No quantity
- 1=Actual speed
- 2=Position
- 3=Acceleration
- 4=Torque
- 5=Apparent current
- 6=Active current
- 7=Net torque
- 8=Virtual encoder position
- 9=System position

- **No quantity**

The channel is not assigned.

- **Actual speed**

Displays the current actual acceleration.

- **Position**

Displays the current actual position.

- **Acceleration**

Displays the current actual acceleration.

- **Torque**

Displays the torque that is present at the moment.

- **Apparent current**

Displays the apparent current that is present at the moment.

- **Active current**

Displays the active current that is present at the moment.

- **Net torque**

In preparation.

- **Virtual encoder position**

In preparation.

- **System position**

Position in increments.

Unit: U.

Resolution: 1/65536.

- **Position Modulo**

Displays the current Modulo position.

This parameter is usually set in the PDO Editor.

9561.1
Current value high word channel 0

Value range: –32768 ... 0 ... 32767, step 1.

OUT process data buffer (16 bit, high) 0 – 15.

9562.1
Current value low word channel 0

Value range: –32768 ... 0 ... 32767, step 1.

OUT process data buffer (16 bit, low) 0 – 15.

Channel 1 – 15

9560.2 – 9560.16
Channel 1 – 15 system unit

Value range: See parameter "9560.1 Channel 0 system unit".

System size OUT process data buffer 1 – 15.

9561.2 – 9561.16
Current value high word channel 1 – 15

Value range: –32768 ... 0 ... 32767, step 1.

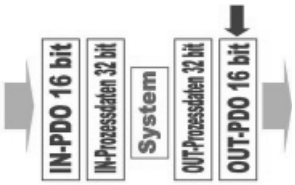
OUT process data buffer (16 bit, high) 0 – 15.

9562.2 – 9562.16
Current value low word channel 1 – 15

Value range: –32768 ... 0 ... 32767, step 1.

OUT process data buffer (16 bit, low) 0 – 15.

OUT buffer 0 – 7



OUT buffer 0

Basic settings

9563.3
Data sink OUT buffer 0

Value range:

- 0=No sink
- 1=CAN2
- 2=CAN1
- 3=Communication option

The data sink is used to set the bus system on which the data is to be written.

This parameter is usually set in the PDO Editor.

9563.5
Data block start

Data block start describes as of which word data is to be written to the bus. Whether a value unequal to 0 may be entered depends on the bus system (e.g. the data block start for CAN is always 0).

This parameter is usually set in the PDO Editor.

9563.6
Data block length

Value range: 0 ... 4 ... 16, step 1.

The data block length also depends on the bus system, e.g. for CAN = maximum 4.

This parameter is usually set in the PDO Editor.

9563.16
Config error

Value range: 0 ... 4294967295, step 1.

The Config error indicates any error.

This parameter is usually set in the PDO Editor.

Specific CAN parameters

9563.4
Message ID

Value range: 0 ... 1073741823, step 1.

The message ID is a CAN-specific parameter. It numbers or prioritizes the messages.

This parameter is usually set in the PDO Editor.

9563.1
Send PDO to sync.

Value range:

- 0=No
- 1=Yes

This parameter allows for cyclical sending of PDOs that will be sent connected to the sync. For this purpose, parameter 9563.22 "Send PDO to n syncs" needs to know after how many syncs a new PDO is to be sent.

9563.17
Blocking time

Unit: µs

Value range: 0 ... 100000000, step 1000.

This parameter applies in conjunction with parameter "9563.23 Send PDO following change"; if the PDO changes permanently, the blocking time will still be maintained and the PDO will not be sent more often.

This parameter is usually set in the PDO Editor.

9563.21
Endianess

Value range: See parameter "9514.20 Endianess IN buffer 0".

This parameter is used to set whether the first of the two bytes from the bus is interpreted as high or low byte.

- **Big Endian**

The first byte is interpreted as high byte.

- **Little Endian**

The first byte is interpreted as low byte. This is a CAN-specific parameter.

This parameter is usually set in the PDO Editor.

9563.2
Send PDO cyclically

Unit: µs

Value range: 0 ... 65535000, step 1000.

This parameter sets the cycle time if the PDO is to be sent cyclically when parameter "9563.23 Send PDO following change" is set to No.

This parameter is usually set in the PDO Editor.

9563.22
Send PDO to n syncs

Value range: 0 ... 255, step 1.

See parameter "9563.1 Send PDO to sync".

This parameter is usually set in the PDO Editor.

9563.23 Send PDO following change

Value range:

- 0=No
- <u>1=Yes</u>

The setting "Yes" means PDOs are only sent following a change, see also parameter "9563.17 Blocking time".

This parameter is usually set in the PDO Editor.

9563.19 Send PDO following change of IN buffer

Value range:

- <u>0=No RxPDO</u>
- 1=from IN PDO1
- 2=from IN PDO1
- 3=from IN PDO2
- 4=from IN PDO3
- 5=from IN PDO4
- 6=from IN PDO5
- 7=from IN PDO6
- 8=from IN PDO7
- 9=from IN PDO8
- 10=from IN PDO9
- 11=from IN PDO10
- 12=from IN PDO11
- 13=from IN PDO12
- 14=from IN PDO13
- 15=from IN PDO14
- 16=from IN PDO15

This parameter allows for sending a PDO only if the IN PDO has changed. Parameter 9563.17 "Blocking time" can be used to prevent that PDOs are sent permanently.

This parameter is usually set in the PDO Editor.

Specific parameters communication option

9563.18 PDO-ID

Value range: 0 ... 255, step 1.

This parameter only applies to the K-Net bus system and sets the PDO address.

This parameter is usually set in the PDO Editor.

9563.24 Transmission cycle

Value range:

- 0=Bus cycle
- 1=Gateway cycle

In preparation.

This parameter is usually set in the PDO Editor.

Data sources

9770.1 Data source word 0

This parameter is usually set in the PDO Editor because of the many setting options.

9864.1 – 9864.16 Current value word 0 – 15

Value range: 0 ... 65535, step 1.

Current data word 0 – 15 OUT buffer 0.

9770.2 – 9770.16 Data source word 1 – 15

Value range: See parameter "9770.1 Data source word 0".

OUT buffer 1 – 7

Basic settings

9564.3 – 9570.3 Data sink	See parameter "9563.3 Data sink OUT buffer 0".
9564.5 – 9570.5 Data block start	See parameter "9563.5 Data block start buffer 0".
9564.6 – 9570.6 Data block length	See parameter "9563.6 Data block length buffer 0".
9564.16 – 9570.16 Config error	See parameter "9563.16 Config error buffer 0".

Specific CAN parameters

9564.4 – 9570.4 Message ID	See parameter "9563.4 Message ID OUT buffer 0".
9564.1 – 9570.1 Send PDO to sync	Value range: See parameter "9563.1 Send PDO to sync".
9564.17 – 9570.17 Blocking time	See parameter "9563.17 Blocking time OUT buffer 0"
9564.21 – 9570.21 Endianess	Value range: See parameter "9514.20 Endianess IN buffer 0". See parameter "9563.21 Endianess OUT buffer 0".
9564.2 – 9570.2 Send PDO cyclically	See parameter "9563.2 Send PDO cyclically OUT buffer 0".
9564.22 – 9570.22 Send PDO to n syncs	See parameter "9563.22 Send PDO to n syncs OUT buffer 0".
9564.23 – 9570.23 Send PDO following change	See parameter "8617.0 Manual reset". See parameter "9563.23 Send PDO following change OUT buffer 0".
9564.19 – 9570.19 Send PDO following change of IN buffer	Value range: See parameter "9563.19 Send PDO following change of IN buffer".

Specific parameter communication options

9564.18 – 9570.18 PDO ID
See parameter "9563.18 PDO ID OUT buffer 0".

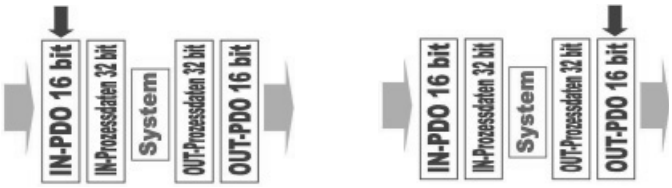
9564.24 – 9570.24 Transmission cycle
Value range: See parameter "9563.24 Transmission cycle"

Data sources

9771.1 – 16 – 9777.1 – 16 Data source 1 – 15
Value range: See parameter "9770.1 Data source word 0".

9865.1 – 16 – 9871.1 – 16 Current value word 0 – 15
Current data word 0 – 15 OUT buffer 1 – 7.

I/O basic unit



9585.1
Source

Value range: This parameter is usually set in the PDO Editor because of the many setting options.

Source binary outputs basic unit.

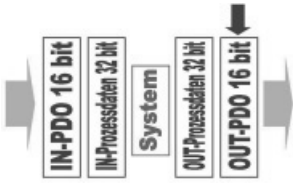
8334.0
Current value digital inputs

Current value digital inputs.

8349.0
Current value digital outputs

Current value digital outputs.

I/O option 1



9619.1
I/O PDO 1 slot

Value range:

- 0=Not connected
- 1=Option 1
- 2=Option 2
- 3=Option 3

I/O PDO 1 slot

9619.111
PDO source

Value range: This parameter is usually set in the PDO Editor because of the many setting options.

I/O PDO 1 PDO 1 source

Analog inputs

9619.21
AI0 Input voltage

Unit: mV

IO PDO 1 AI0 input voltage.

9619.31
AI1 Input voltage

Unit: mV

I/O PDO 1 AI1 input voltage.

9619.22
AI0 offset

Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 1 AI0 offset

9619.32
AI1 offset

Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 1 AI1 offset

9619.23
AI0 Scaling numerator

Value range: 1 ... 2097151, step 1.
IO PDO 1 AI0 scaling numerator.

9619.33
AI1 Scaling numerator

Value range: 1 ... 2097151, step 1.
I/O PDO 1 AI1 scaling numerator.

9619.24
AI1 scaling denominator

Value range: 1 ... 2097151, step 1.
I/O PDO 1 AI1 scaling denominator.

9619.34
AI2 scaling denominator

Value range: 1 ... 2097151, step 1.
I/O PDO 1 AI2 scaling denominator.

9619.25
AI1 scaled value 32 bit

I/O PDO 1 AI1 scaled value 32 bit.

9619.35
AI2 scaled value 32 bit

I/O PDO 1 AI2 scaled value 32 bit.

9619.27
AI1 scaled value high word

I/O PDO 1 AI1 scaled value high word.

9619.37
AI2 scaled value high word

I/O PDO 1 AI2 scaled value high word.

9619.26
AI1 scaled value low word

I/O PDO 1 AI1 scaled value low word.

9619.36
AI2 scaled value low word

I/O PDO 1 AI2 scaled value low word.

Analog outputs

9619.122
AO1 high word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 1 AO1 high word source.

9619.132
AO2 high word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 1 AO2 high word source.

9619.121
AO1 low word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 1 AO1 low word source.

9619.131
AO2 low word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 1 AO2 low word source.

9619.123
AO1 value source 32 bit
I/O PDO 1 AO1 current value 32 bit.

9619.133
AO2 value source 32 bit
I/O PDO 1 AO2 current value 32 bit.

9619.124
AO1 scaling to V numerator
Value range: 1 ... 2097151, step 1.
I/O PDO 1 AO1 scaling numerator.

9619.134
AO2 scaling to V numerator
Value range: 1 ... 2097151, step 1.
I/O PDO 1 AO2 scaling numerator.

9619.125
AO1 scaling to V denominator
Value range: 1 ... 2097151, step 1.
I/O PDO 1 AO1 scaling denominator.

9619.135
AO2 scaling to V denominator
Value range: 1 ... 2097151, step 1.
I/O PDO 1 AO2 scaling denominator.

9619.126
AO1 offset
Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 1 AO1 offset

9619.136
AO2 offset

Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 1 AO2 offset

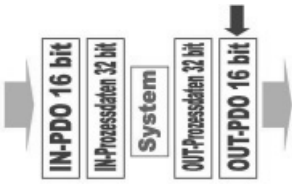
9619.127
AO1 output voltage

Unit: mV
I/O PDO 1 AO1 output voltage.

9619.137
AO2 output voltage

Unit: mV
I/O PDO 1 AO2 output voltage.

I/O option 2



9625.1
I/O PDO 2 slot

Value range: See parameter "9585.1 Source IO basic unit".
I/O PDO 2 slot

9625.111
PDO source

Value range: This parameter is usually set in the PDO Editor because of the many setting options.
I/O PDO 2 PDO 2 source

Analog inputs

9625.21
AI1 input voltage

Unit: mV
I/O PDO 2 AI1 input voltage.

9625.31
AI2 input voltage

Unit: mV
I/O PDO 2 AI2 input voltage.

9625.22
AI1 offset

Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 2 AI1 offset

9625.32
AI2 offset

Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 2 AI2 offset

9625.23
AI1 scaling numerator

Value range: 1 ... 2097151, step 1.
I/O PDO 2 AI1 scaling numerator.

9625.33
AI2 scaling numerator

Value range: 1 ... 2097151, step 1.
I/O PDO 2 AI2 scaling numerator.

9625.24
AI1 scaling denominator

Value range: 1 ... 2097151, step 1.
I/O PDO 2 AI1 scaling denominator.

9625.34
AI2 scaling denominator

Value range: 1 ... 2097151, step 1.
I/O PDO 2 AI2 scaling denominator.

9625.25
AI1 scaled value 32 bit
I/O PDO 2 AI1 scaled value 32 bit.

962535
AI2 scaled value 32 bit
I/O PDO 2 AI2 scaled value 32 bit.

9625.27
AI1 scaled value high word
I/O PDO 2 AI1 scaled value high word.

9625.37
AI2 scaled value high word
I/O PDO 2 AI2 scaled value high word.

9625.26
AI1 scaled value low word
I/O PDO 2 AI1 scaled value low word.

9625.36
AI2 scaled value low word
I/O PDO 2 AI2 scaled value low word.

Analog outputs

9625.122
AO1 high word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 2 AO1 high word source.

9625.132
AO2 high word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 2 AO2 high word source.

9625.121
AO1 low word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 2 AO1 low word source.

9625.131
AO2 low word source
Value range: See parameter "9770.1 Data source word 0".
I/O PDO 2 AO2 low word source.

9625.123
AO1 value source 32 bit
I/O PDO 2 AO1 current value 32 bit.

9625.133
AO2 value source 32 bit
I/O PDO 2 AO2 current value 32 bit.

9625.124
AO1 scaling to V numerator
Value range: 1 ... 2097151, step 1.
I/O PDO 2 AO1 scaling numerator.

9625.134
AO2 scaling to V numerator
Value range: 1 ... 2097151, step 1.
I/O PDO 2 AO2 scaling numerator.

9625.125
AO1 scaling to V denominator
Value range: 1 ... 2097151, step 1.
I/O PDO 2 AO1 scaling denominator.

9625.135
AO2 scaling to V denominator
Value range: 1 ... 2097151, step 1.
I/O PDO 2 AO2 scaling denominator.

9625.126
AO1 offset
Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 2 AO1 offset

9625.136
AO2 offset
Unit: mV
Value range: –10000 ... 0 ... 10000, step 1.
I/O PDO 2 AO2 offset

9625.127
AO1 output voltage
Unit: mV
I/O PDO 2 AO1 output voltage.

9625.137
AO2 output voltage
Unit: mV
I/O PDO 2 AO2 output voltage.

4.4 Encoder parameter description

The following encoders can be evaluated using the encoder evaluation function integrated in the MOVIAXIS® basic unit:

- Hiperface encoder
- Sin/cos encoder
- TTL sensor
- Resolver (2-12 pole pairs)

With resolver, sin/cos and TTL encoders, MOVIAXIS® monitors the failure of track signals caused by faults or cable problems (amplitude monitoring).

If MOVIAXIS® detects an error, the output stage inhibit and brake are activated.

With the "Encoder calibration and alignment" function, a fixed rotating field space vector is impressed in the motor. If the rotor aligns itself according to this space vector, the encoder angle is "0" with the SEW encoder setting.

If this is not the case, the encoder offset can be calibrated with MOVIAXIS® and / or

- entered in the encoder offset parameter
- the encoder is aligned accordingly (resolver)
- the encoder offset is entered in the encoder (Hiperface).

9818.34 / 24 / 20 Encoder part number/encoder name

Value range: 0 ... 2^{32} step 1

Encoder part number; encoder 1 / encoder 2 / encoder 3

The part number of the selected encoder is displayed in parameter 9818.34.

MotionStudio generates the encoder name from this. Encoders that are not from SEW are assigned a part number smaller than 8 digits.

9733.1 / 2 / 3 Encoder type

Value range:

- 0 = No encoder
- 1 = RS422
- 3 = Sin / cos XXXS
- 4 = Hiperface XXXH
- 5 = Resolver RHXX

Type encoder 1 / encoder 2 / encoder 3.

With encoder 1 (encoder input X13 on the axis module), only settings 0...5 are possible.

The multi encoder card (MGK) can select all settings except for the Resolver (5) setting.

9719.1 / 2 / 3
Counting direction

Value range:

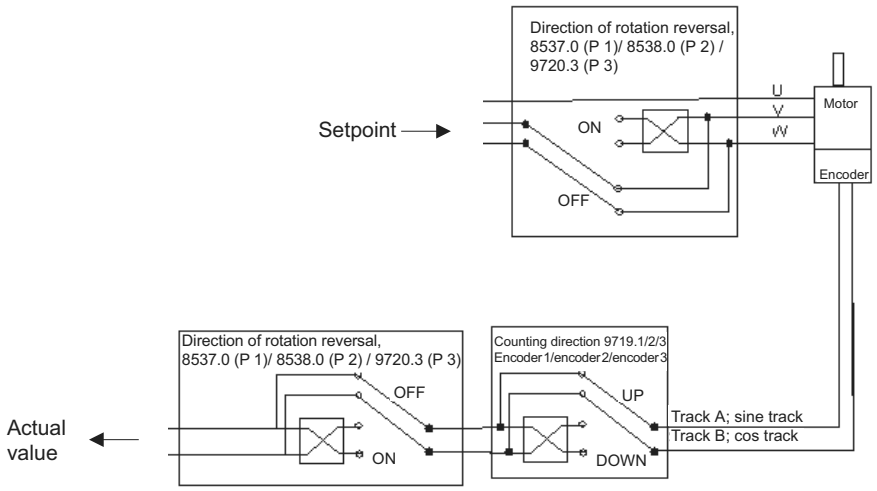
- 0 = up
- 1 = down

Counting direction encoder 1 / encoder 2 / encoder 3.

The parameter depends on the installation position of the encoder and is independent of the setting of parameter "8537.0 Change direction of rotation". It must not be confused with this. The counting direction of the encoder is reversed which means also the actual values of position, speed and acceleration for this encoder are reversed.

This parameter can be used to support encoders that are installed other than the standard installation. Changing the counting direction generally causes dereferencing of the drive.

The encoder system is reinitialized when this parameter is changed.



58625aen

Fig. 44: Behavior of direction of rotation and counting direction

- **Setting the parameter**

The following notes for setting the parameters apply provided that the parameter "Change direction of rotation, 8537.0" is set to "OFF". If the parameter for changing the direction of rotation is set to ON, the direction of rotation of the motor shaft is inverted.

- **Setting for rotating motors**
  - If the encoder provides a positive increasing position when the motor shaft turns in CW (right) direction (SEW definition as viewed onto the motor shaft), then the counting direction must be set to "UP" (default setting).
  - If the encoder provides a negative decreasing position when the motor shaft turns in CW (right) direction, then the counting direction must be set to "DOWN".
- **Setting for linear motors**
  - If the encoder provides a positive increasing position when the motor moves in a positive direction (SEW definition: first movement for commutation travel according to configuration of the motor), the counting direction must be set to "UP" (default setting).
  - If the encoder provides a negative increasing position when the motor moves in a positive direction (SEW definition: first movement for commutation travel according to configuration of the motor), the counting direction must be set to "DOWN" (default setting).

9749.11 / 12 / 13 Encoder monitoring

Value range:

- 0 = OFF
- 1 = ON

Monitoring Encoder 1/2/3.

- **SIN / COS signal:**

The C track is not monitored in the MOVIAXIS® unit.

Monitoring responds when the amplitude falls below 10 % of the measuring range. Cable-break monitoring is not completely possible when the motor is at standstill. The error criterion is not fulfilled if the undamaged track has a high positive or negative value. Monitoring will always trigger if both tracks are damaged.

- **TTL signal:**

The track signals are monitored by measuring the differential voltages of the two tracks A and B.

Cable-break monitoring is not completely possible when the motor is at standstill if only one wire pair of a track is damaged.

- **Hiperface signal:**

During operation, a positioning request is sent to the HIPERFACE encoder every second. The position value in the response message is compared with a TTL track signal. If the position deviates by more than 20 increments, an error ("error 15") will be issued. The encoder status is queried after every position request (see section "Encoder status").

A check is still made to assess whether an encoder is physically present when the encoder setting "0 = OFF".

9593.1 Factor numerator

Value range: 0 ... 1024 ... 2147483647, step 1.

Factor numerator encoder 1 encoder 2 / encoder 3.

Numerator / denominator factor

This factor determines the encoder resolution. Enter the value in parameter "9733.1 Encoder type":

- Encoder (encoder type = 1, 3, 4)

$$\frac{\text{Factor num. encoder 1}}{\text{Factor denom. encod. 1}} = \frac{\text{Encoder resolution}}{\text{Revolution}}$$

Example: SinCos AS1H encoder

Factor numerator encoder 1 = 1024

Factor denominator encoder 1 = 1

- Resolver (encoder type = 5)

$$\frac{\text{Factor num. encoder 1}}{\text{Factor denom. encod. 1}} = \frac{\text{No. pole pairs resolver}}{1}$$

Example: Resolver, number of pole pairs = 1

Factor numerator encoder 1 = 1

Factor denominator encoder 1 = 1

- Linear motor (encoder type = 1, 3, 4)

$$\frac{\text{Factor num. encoder 1}}{\text{Factor denom. encod. 1}} = \frac{\text{Signal period [mm]}}{\text{Pole pair width [mm]}}$$

Example: AL1H (Lincoder, signal period 5 mm), with SL2 motor (pole distance 32 mm)

Factor numerator encoder 1 = 32

Factor denominator encoder 1 = 5

9593.10 / 11 / 12 Factor denominator

Value range: 1 ... 2147483647, step 1.

Factor denominator encoder 1 / encoder 2 / encoder 3.

See parameter "9593.1 Factor numerator".

9828.2 / 3 Numerator emulation

Value range: 0 ... 1024 ... 2147483647, step 1.

Numerator emulation encoder 2 / encoder 3.

9829.2 / 3 Denominator emulation

Value range: 1 ... 2147483647, step 1.

Denominator emulation encoder 2 / encoder 3.

Settings to position mode

9998.1 Position mode

Value range:

- 0 = without overflow counter
- 1 = with overflow counter

Position mode

The reset behavior of parameter 9998.1 Position mode in conjunction with absolute encoders depends on the following settings:

- If set to "**without overflow counter**", the unit will always be positioned in the absolute range of the encoder following a CPU reset and system restart, e.g. with Hiperface 4096 motor revolutions. This means a position loss in the event of encoder overflow. If the position range of the absolute encoder is not exceeded, no reference travel is required when replacing MOVIAXIS® because no overflows can be stored in the MOVIAXIS®. Reference travel is only required when the motor is replaced. With this setting, the parameter "9999.11 Relative position of reference point" must be set.
- When set to "**with overflow counter**", the complete ± 32768 motor revolutions are utilized despite overflow. MOVIAXIS® internally stores absolute encoder overflows. This also functions when the axis is moved to overflow without electrical current. This is ensured by checking the travel range. Reference travel must always be performed when replacing MOVIAXIS® or the motor.

  The maximum target position must not exceed the total from the current target position ±16000 revolutions.

9999.11 / 12 / 13 Relative position of the reference point

Value range: 0 ... 50000 ... 100000, step 1.

Relative position of reference point encoder 1/2/3.

The parameter is required if parameter "9998.1 Position mode" is set to "without overflow counter".

With parameter "Relative position of reference point", the position of the reference point (e.g. reference cam) should be specified in relation to the required total travel range in per cent.

The valid travel range depends on the absolute encoder range and the relative position of the reference point.

Leaving the valid travel range is reported for 24 V supply MOVIAXIS®.

- **Required travel range < 50 % absolute encoder range:**

You can use the default setting (50 %) if the required travel range is less than half the absolute range of the encoder.

- **Required travel range > 50 % absolute encoder range:**

If the reference point is located within the first quarter of the travel distance, then the value should be set to 25 %. Never set the value to 0 % or 100 % even if the reference point is located at the beginning / end of the travel distance as this might result in travel range monitoring errors. In this case, the values should be set to 5 % or 95 %.

Actual values

9596.1 / 2 / 3 Referenced (encoder status bit 7)

Reference status encoder 1/2/3.

The encoder status bit 7 indicates whether an encoder is referenced or not. This value is read only and is set when reference travel is complete. The status bit is cleared when 24 V supply is off and no multi-turn encoder is used.

The status is also cleared in the event of write access to parameters that have an influence on the positions.

These are:

- Encoder type
- Direction of rotation of the motor
- Counting direction of the encoder
- Machine zero offset
- Position detection mode (encoder referencing only for multi-turn absolute encoder)
- Position offset (only if position detection mode 1 is active and the encoder is a multi-turn absolute encoder).
- Numerator factor (system unit) / denominator factor (system unit)
- Numerator factor (system unit) / denominator factor (system unit) for encoder emulation
- Numerator factor (user-defined unit) / denominator factor (user-defined unit)
- Modulo overflow / underflow value.

9595.1 / 2 / 3 Connected to drive no.

Value range: 0 ... 1 ... 7, Step 1.

Parameter set selection for encoder 1/2/3.

This parameter is used to assign a parameter set number to encoder 1/2/3. This means that the user-defined unit for this encoder information is also defined.

	NOTES
	The parameter "9744.1/2/3 Source actual speed" and "9597.1/2/3 Source actual position" can only be switched to the encoder that was assigned to the parameter set.

9782.1 / 2 / 3 Encoder identification

Value range: 0 ... 4294967295, step 1.

Encoder identification of encoder 1/2/3.

The encoder identification is read from the electronic nameplate for Hiperface encoders.

The number identifies the encoder type and is described in the Hiperface documentation from SICK Stegmann.

9751.11 / 12 / 13 Offset machine zero

Value range: –2147483648 ...0 ... 2147483647, Step 1.

Zero point correction encoder 1/2/3.

When using multi-turn encoders, another offset value (machine zero offset) has to be calculated and stored non-volatile following referencing. This offset allows for recovering all positions after a power failure. No reference travel is necessary in this case.

The controller sets this parameter by itself during referencing.

9704.1 Actual position

Displays the actual position in user defined units for the position controller.

Is suited for output in the scope but is not consistent with the motor control parameters.

Corresponds to parameter "9704.2/3 or 4" according to which one was switched with parameter "9744.1 Source actual position" for the position controller.

10444.1 / 2 / 3 Actual position

Displays actual position encoder 1/2//3 in user-defined units.

Is suited for output in the scope but is not consistent with the motor control parameters.

9704.2 / 3 / 4 Actual position

Display actual position encoder 1/2/3 in user-defined units.

Is suited for output in the scope but is not consistent with the motor control parameters.

9839.2 / 3 / 4
Actual position modulo

Value range: –2147483648 ...0 ... 2147483647, step 1.

Display of Modulo position encoder 1/2/3 in user-defined units.

The display is filtered in the MotionStudio.

9744.1 / 2 / 3
Source actual position

Value range:

- 0 = No encoder
- 1 = Encoder 1
- 2 = Encoder 2
- 3 = Encoder 3

Source actual position P1/P2/P3.

The parameter is set in the parameter tree folder "Motor data".

This parameter is used to select the encoder that provides the actual position information for the position controller of the motor control.

The source of the actual position can also be switched to another source **during** controller enable.

Only the encoder assigned to the parameter set number can be chosen as source.

This is verified as long as the controller is enabled.

See also parameter "9595.2 Connected to drive no".

9597.1 / 2 / 3
Source actual speed

Value range:

- 0 = No encoder
- 1 = Encoder 1
- 2 = Encoder 2
- 3 = Encoder 3

Source actual speed P1/P2/P3

The parameter is set in the parameter tree folder "Motor data".

This parameter is used to select the encoder that provides the information for the speed controller, current controller and commutation of the motor control.

The source of the actual speed can **not** be switched to another source **during** controller enable.

Only the encoder assigned to the parameter set number can be chosen as source.

This is verified when activating controller enable.

See also parameter "9595.2 Connected to drive no".

10068.1
Actual position

Displays the actual position of motor control for the position controller.

Is suited for output in the scope and is consistent with the motor control parameters.

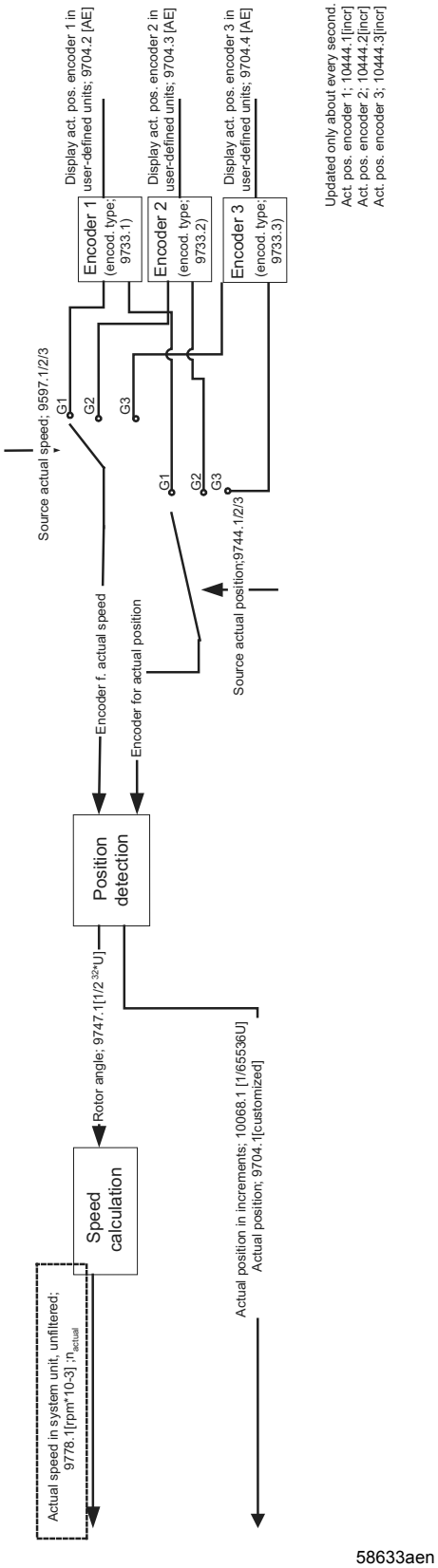


Fig. 45: Encoder selection

4.5 Parameter description FCB parameter setting

FCB Function Control Block

The term "FCB concept" describes the modular firmware design of MOVIAXIS®. This feature ensures that a wide range of functions can be selected or deselected quickly and easily using control words – without having to perform any programming.

All primary functions, i.e. functions that move or control the motors, are designed as individual FCBs that only have to be selected, for example, to perform positioning tasks.

The user can switch between FCBs at any time depending on the requested function.

Basic settings

9702.3 Current FCB

Currently active FCB number.

9702.6 Current FCB instance

Currently active FCB instance.

9804.1 Select FCB with instance

Definition low word (bits 0-15)

- 0 = FCB 00 Standard
- 1 = FCB 01 Output stage inhibited
- 5 = FCB 05 Speed control
- 6 = FCB 06 Speed control interpolated
- 7 = FCB 07 Torque control
- 8 = FCB 08 Torque control interpolated
- 9 = FCB 09 Position control instance 00
- 10 = FCB 10 Interpolated position control
- 11 = FCB 11 Limit switch operation
- 12 = FCB 12 Reference travel
- 13 = FCB 13 Stop
- 14 = FCB 14 Emergency stop
- 15 = FCB 15 Stop at system limits
- 16 = FCB 16 Electronic cam
- 17 = FCB 17 Synchronous operation
- 18 = FCB 18 Calibrate encoder
- 19 = FCB 19 Hold control
- 20 = FCB 20 Jog mode
- 21 = FCB 21 Brake test function

Definition high word (bits 16-31).

Instance 0 – 63 is selected in the high word.

Direct selection of FCB number and FCB instance.

This parameter is one of several ways to select an FCB or instance. If several FCBs are selected at the same time, the FCB with highest priority will be activated.

The FCBs have the following priorities (starting from the highest priority):

- FCB 01 Output stage inhibited
- FCB 15 Stop at system limits
- FCB 14 Emergency stop
- FCB 13 Stop at application limits
- FCB 12 Reference travel
- FCB 11 Limit switch operation
- FCB 20 Jog mode
- FCB 19 Hold control
- FCB 21 Brake test function
- FCB 18 Calibrate encoder
- FCB 17 Synchronous operation
- FCB 16 Electronic cam
- FCB 10 Position control interpolated
- FCB 09 Position control
- FCB 06 Speed control interpolated
- FCB 05 Speed control
- FCB 08 Torque control interpolated
- FCB 07 Torque control
- FCB 00 Standard (-> FCB 13 Stop at application limits)

If two instances are selected at the same time, the higher instance will be activated.

The following FCBs can be assigned to an instance:

- FCB 09 Positioning

This parameter is reset to "FCB 00 Standard" at a CPU reset or system restart, which is equivalent with "FCB 13 Stop at application limits". At warm start, the set parameter is maintained.

FCB 05 Speed control

MOVIAXIS® can be run as a speed-controlled axis.

The user can specify limit values for acceleration, deceleration and jerk as the basic conditions for speed control. The actual speed setpoint for the drive controller is generated in the controller cycle by a ramp generator integrated in MOVIAXIS® using the specified limit values.

The user can configure several data sets (instances – and therefore "speed controllers" with different settings) for the "Speed control" function. Users can switch between the instances using process data or parameter access.

In this way, for example, a process, in which speed controllers with different settings are used, is simple to implement using the instance switchover function.

Setpoints

9598.1 Setpoint source velocity

Value range:

- 0 = Local setpoint
- 1 = Process data buffer channel 0
- 2 = Process data buffer channel 1
- 3 = Process data buffer channel 2
- 4 = Process data buffer channel 3
- 5 = Process data buffer channel 4
- 6 = Process data buffer channel 5
- 7 = Process data buffer channel 6
- 8 = Process data buffer channel 7
- 9 = Process data buffer channel 8
- 10 = Process data buffer channel 9
- 11 = Process data buffer channel 10
- 12 = Process data buffer channel 11
- 13 = Process data buffer channel 12
- 14 = Process data buffer channel 13
- 15 = Process data buffer channel 14
- 16 = Process data buffer channel 15

This parameter sets the source for the setpoint speed of FCB speed control.

If the parameter is set to "Local setpoint", the setpoint source will be parameter "9598.2 Setpoint velocity local".

9598.2 Local setpoint velocity

Unit: 10^{-3} rpm.

Value range: –10000000 ... 0 ... 10000000, step 1.

If the parameter "9598.1 Setpoint source velocity" is set to "Local setpoint", this parameter will be the setpoint speed for FCB 05 Speed control.

Limit values

9598.3
Source torque limit

Value range: See parameter "9598.1 Setpoint source velocity".

This parameter sets the source for the torque limit of FCB speed control.

If the parameter is set to "Local setpoint", the torque limit will be parameter "9598.4 Torque limit local".

9598.4
Local setpoint torque limit

Unit: %.

Resolution: 10^{-3}.

Value range: 0 ... 10000 ... 1000000, step 1.

If the parameter "9598.3 Torque limit source" is set to "Local setpoint", this parameter will be the torque limit for FCB 05 Speed control.

9598.5
Source acceleration

Value range: See parameter "9598.1 Setpoint source velocity".

This parameter sets the source for the acceleration of FCB speed control.

If the parameter is set to "Local setpoint", the acceleration ramp will be parameter "9598.6 Acceleration local".

9598.6
Local setpoint acceleration

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 ... 2147483647, step 1.

If the parameter "9598.5 Acceleration source" is set to "Local setpoint", this parameter will be the acceleration ramp for FCB 05 Speed control.

9598.7
Source deceleration

Value range: See parameter "9598.1 Setpoint source velocity".

This parameter sets the source for the deceleration of FCB speed control.

If the parameter is set to "Local setpoint", the deceleration ramp will be parameter "9598.8 Deceleration local".

9598.8
Local setpoint deceleration

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 ... 2147483647, step 1.

If the parameter "9598.7 Deceleration source" is set to "Local setpoint", this parameter will be the deceleration ramp for FCB 05 Speed control.

9598.9
Source jerk

Value range: See parameter "9598.1 Setpoint source velocity".

This parameter sets the source for the maximum jerk of FCB speed control.

If the parameter is set to "Local setpoint", the maximum jerk will be parameter "9598.10 Jerk local".

9598.10
Local setpoint jerk

Unit: 1 rpm/s^2.

Value range: 0 ... 2147483647, step 1.

If the parameter "9598.9 Source jerk" is set to "Local setpoint", this parameter will be the maximum jerk for FCB 05 Speed control.

Actual values

9703.1
Velocity

Unit: 10^{-3} rpm

Current actual velocity (in user-defined units, filtered for the display).

FCB 06 Interpolated speed control

The FCB 06 interpolated speed control is used for cyclic preselected speed setpoints of higher-level controllers. The higher-level controller is responsible for the following limits:

- Jerk
- Acceleration
- Speed

Only the system limits speed and torque take effect in MOVIAXIS®.

Prerequisite is a synchronized bus system. This means that incoming process data has a fixed time reference for the control system of the axis.

The new process data from the controller is sent within a fixed cycle time. This time must be a multiple of the cycle time of the speed control loop (parameter "9821.1 Scanning frequency n/X control"; 250 µs, 500 µs or 1 ms).

MOVIAXIS® now has the task of forwarding the incoming speed setpoints with a rough time reference to the speed controller that operates with the shortest time reference. Intermediate values must be interpolated for this purpose. The setpoint flow is delayed by one communication cycle to carry out this interpolation.

The incoming position over two process data is interpreted in user-defined units.

General parameters

9963.1
Setpoint cycle control

Unit: µs.

Value range: 500 ... 20000, Step 500.

The setpoint cycle of the controller indicates the time intervals used by the higher-level controller to send speed setpoints. This time must be a multiple of the cycle time of the speed control loop (parameter "9821.1 Scanning frequency n/X control").

Setpoints

9965.1
Setpoint speed source

This parameter sets the source for the speed setpoint of FCB 06 Interpolated speed control.

If the parameter is set to "Local setpoint", the source will be parameter "9965.2 Setpoint speed local".

9965.2
Local speed setpoint

Unit: 10^{-3} rpm

Value range: –10000000 ... 0 ... 10000000, step 1.

If the parameter "9965.1 Setpoint source speed" is set to "Local setpoint", this parameter will be the setpoint speed for FCB 06 Interpolated speed control.

Limit values

9965.5
Torque limit mode

Value range:

- 0 = single channel
- 1 = two channels
- 2 = four channels

The following modes can be set for limiting the torque:

- **0 = single channel**

A limit value for all quadrants of the n-M diagram ("parameter "9965.6 Torque limit Q1 abs. source").

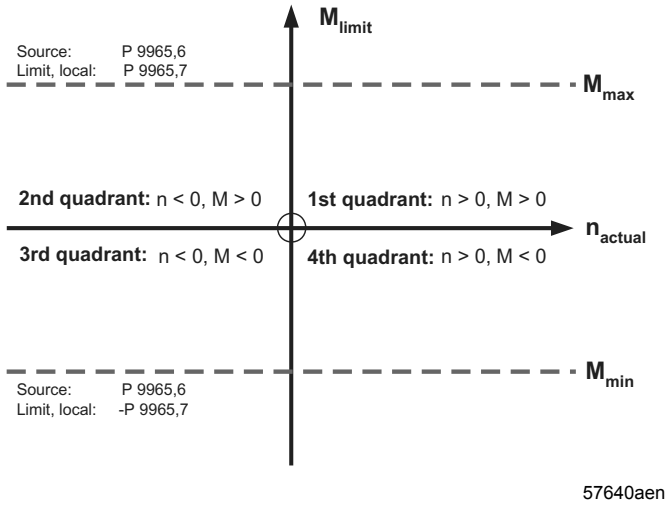


Fig. 46: Torque limits for mode 0 (9965.5)

- **1 = two channels**

One value each for regenerative and motor range (parameter "9965.6 Torque limit Q1 abs. source and parameter "9965.8 Torque limit Q2 abs. source").

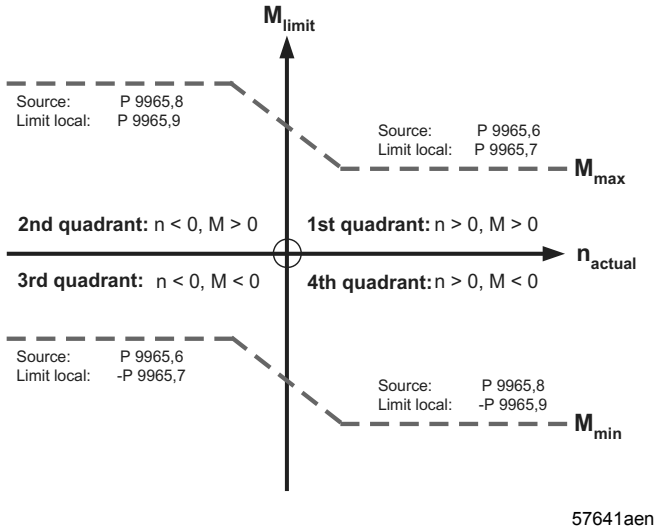


Fig. 47: Torque limits for mode 1 (9965.5)

- **2 = four channels**

Every quadrant, whether regenerative, motor, positive or negative direction of rotation receives its own limit value.

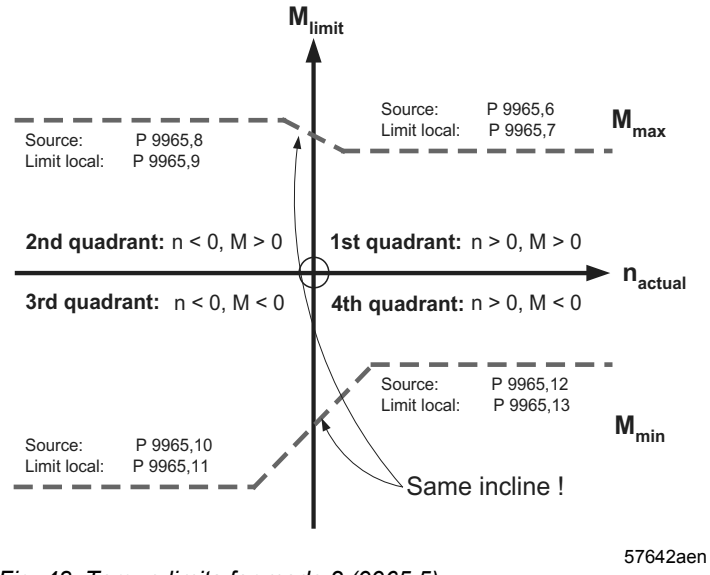


Fig. 48: Torque limits for mode 2 (9965.5)

9965.6
Abs. source torque limit Q1

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the torque limit of the first quadrant (positive direction of rotation, motor mode) of FCB 06 Interpolated speed control.

If the parameter is set to "Local setpoint", the source will be parameter "9965.7 Torque limit Q1 abs. local".

9965.7
Abs. local torque limit Q1

Unit: %

Resolution: 10^{-3}.

Value range: 0 ... 10000 ... 1000000, step 1.

If the parameter "9965.6 Torque limit Q1 abs. source" is set to "Local setpoint", this parameter will be the torque limit for FCB 06 Interpolated speed control in the relevant quadrant.

9965.8
Abs. Source torque limit Q2

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the torque limit of the second quadrant (negative direction of rotation, motor mode) of FCB 06 Interpolated speed control.

If the parameter is set to "Local setpoint", the source will be parameter "9965.9 Torque limit Q2 abs. local".

9965.9
Abs. local torque limit Q2

Unit: %

Resolution: 10^{-3}.

Value range: 0 ... 10000 ... 1000000, step 1.

If the parameter "9965.8 Torque limit Q2 abs. source" is set to "Local setpoint", this parameter will be the torque limit for FCB 06 Interpolated speed control in the relevant quadrant.

9965.10
Abs. Source torque limit Q3

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the torque limit of the third quadrant (negative direction of rotation, regenerative) of FCB 06 Interpolated speed control.

If the parameter is set to "Local setpoint", the source will be parameter "9965.11 Torque limit Q3 abs. local".

9965.11
Abs. local torque limit Q3

Unit: %

Resolution: 10^{-3}.

Value range: 0 ... 10000 ... 1000000, step 1.

If the parameter "9965.10 Torque limit Q3 abs. source" is set to "Local setpoint", this parameter will be the torque limit for FCB 06 Interpolated speed control in the relevant quadrant.

9965.12
Abs. Source torque limit Q4

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the torque limit of the fourth quadrant (positive direction of rotation, regenerative) of FCB 06 Interpolated speed control.

If the parameter is set to "Local setpoint", the source will be parameter "9965.13 Torque limit Q4 abs. local".

9965.13
Abs. local torque limit Q4

Unit: %

Resolution: 10^{-3}.

Value range: 0 ... 10000 ... 1000000, step 1.

If the parameter "9965.12 Torque limit Q4 abs. source" is set to "Local setpoint", this parameter will be the torque limit for FCB 06 Interpolated speed control in the relevant quadrant.

9965.16 Positive transition mode

- 0 = Center
- 1 = Motor mode
- 2 = Regenerative mode

The transition cannot take place suddenly between quadrants 1 and 2, or 3 and 4. For this reason, a linear transition is used with the slope of the P-component of the speed controller, see formula on page 196.

The transition will usually take place between quadrants 1 and 2, or 3 and 4 with speed 0. The effective limit torque for speed 0 is the average of the set limit torques of the adjacent quadrants (central transition mode and transition speed 0).

It may be required not to place the transition in the center with speed zero. In this case, the speeds can be set using parameters for which the limit torques merge. The parameter "**9965.14 Transition speed positive**" defines the transition speed for the positive torque limit, which means between quadrants 1 and 2. Parameter "**9965.15 Transition speed negative**" is used to set the transition speed for the negative torque limit between quadrants 3 and 4.

The specified transition speed can refer to the center of the transition area or to the motor or generative transition point of the transition area. The parameter "**9965.16 Positive transition mode**" determines the mode for the transition of the positive torque limit between quadrants 1 and 2. "**9965.17 Negative transition mode**" refers to the transition between quadrants 3 and 4.

You can leave one of the two transition points at a specified speed by changing the amount of the torque limits and the resulting change of width of the transition area.

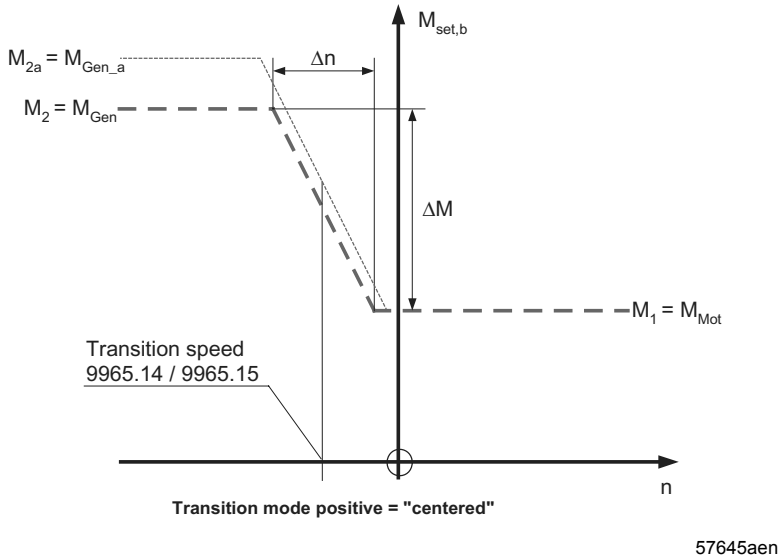


Fig. 49: Positive transition mode – center

When increasing from M2 to M2a, the transition line moves up (∆n becomes larger), while the slope remains the same.

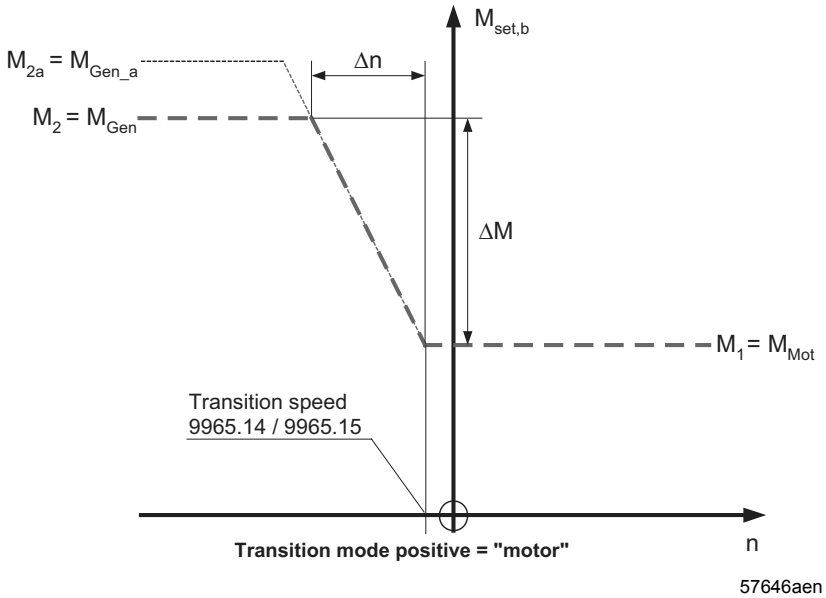


Fig. 50: Positive transition mode – motor

When increasing from M2 to M2a, only the transition curve is extended (∆n also becomes larger) while the slope remains the same.

Calculating ∆n:

$$\Delta n = \frac{(M_1 - M_2) \times Z \times M_{Motor\_rated}}{N \times 200 \times \pi \times J_{tot} \times P_{gain}}$$

57647aen

M1 = Parameter "9965.6 Torque limit Q1 abs. source" or parameter "9965.12 Torque limit Q4 abs. source" taking the decimal places into account.

M2 = Parameter "9965.8 Torque limit Q2 abs. source" or parameter "9965.10 Torque limit Q3 abs. source" taking the decimal places into account.

Z = Parameter "9556.1 Torque numerator" (conversion of user-defined units into rated motor torque)

M_{Motor_rated} = Parameter "9610.1 Rated motor torque"

N = Parameter "9557.1 Torque denominator" (conversion of user-defined units into rated motor torque)

J_{tot} Parameter "9817.1 Total moment of inertia"

P_{gain} = Parameter "9797.1 P-gain speed controller"

9965.14
Positive transition speed

Unit: 10^{-3} rpm
Value range: –10000000 ... 0 ... 10000000, step 1.
Positive transition speed (quadrants 1 and 2).

9965.17
Negative transition mode

Value range: See parameter "9965.16 Positive transition mode".
Negative transition mode (quadrants 3 and 4).

9965.15
Negative transition speed

Unit: 10^{-3} rpm
Value range: –10000000 ... 0 ... 10000000, step 1.
Negative transition speed (quadrants 3 and 4).

Actual values

9703.1
Velocity

Unit: 10^{-3} rpm
Current actual velocity; in user-defined units, filtered for the display.

FCB 07 Torque control

MOVIAXIS® can be run as a torque-controlled axis.

The user can specify limit values for speed, acceleration and jerk as the basic conditions for torque control. The actual torque setpoint for the drive controller is generated in the controller cycle by a ramp generator integrated in MOVIAXIS® using the specified limit values.

The maximum speed can be limited during torque control. The speed limit can be changed dynamically using process data.

Setpoints

9599.1 Setpoint source torque

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the setpoint torque of FCB torque control.

If the parameter is set to "Local setpoint", the source will be parameter "9599.2 Setpoint torque local".

9599.2 Local setpoint torque

Unit: %

Resolution: 10^{-3}.

Value range: –1000000 ... 0 ... 1000000, step 1.

If the parameter "9599.1 Setpoint source torque" is set to "Local setpoint", this parameter will be the setpoint torque for FCB 07 Torque control.

Limit values

9599.3 Source velocity limit

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the setpoint velocity of FCB 07 Torque control.

If the parameter is set to "Local setpoint", the torque limit will be parameter "9594.4 Velocity limit local".

9599.4 Local velocity limit

Unit: 10^{-3} rpm.

Value range: 0 ... 1000000, step 1.

If the parameter "9599.3 Source velocity limit" is set to "Local setpoint", this parameter will be the velocity limit for FCB 07 Torque control.

9599.5 Source jerk

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the maximum jerk of the FCB 07 torque control.

If the parameter is set to "Local setpoint", the maximum jerk will be parameter "9599.6 Jerk local".

9599.6
Local jerk

Unit: 1 rpm/s^2.

Value range: 0 ... 2147483647, step 1.

If the parameter "9599.5 Source jerk" is set to "Local setpoint", this parameter will be the maximum jerk for FCB 07 Torque control.

Actual values

9985.1
User-defined unit torque

Unit: %

Resolution: 10^{-3}.

Value range: –2147483648 ... 2147483647, step 1.

Current torque; in user-defined units, filtered for the display.

FCB 08 Interpolated torque control

For applications with a higher-level (motion control) controller, this controller usually calculates a track profile (x, y, z) for several drive axes. The axis is then assigned one setpoint (position, speed, torque) that it has to follow. MOVIAXIS® only limits the setpoints using the unit's internal system limits. The application limits for speed, acceleration and jerk must be taken from the track curve and are then controlled by the controller.

The cycle in which the controller sends the setpoints to the axes does not usually correspond with the setpoint processing cycle of MOVIAXIS® (500 µs). If MOVIAXIS® were to see the same controller setpoint for several cycles, a step-shaped actual torque value would result. To prevent this from happening, the axis can calculate intermediate values (interpolate) if it knows the controller cycle – interpolated speed control. MOVIAXIS® can be set to different cycles of higher-level controllers.

The FCB 08 interpolated torque control is used for cyclic preselected speed setpoints of higher-level controllers. The higher-level controller is responsible for the following limits:

- Jerk
- Acceleration
- Speed

Only the speed and torque system limit takes effect in MOVIAXIS®. Prerequisite is a synchronized bus system. This means that incoming process data has a fixed time reference for the control system of the axis.

The new process data from the controller is sent within a fixed cycle time. This time must be a multiple of the cycle time of the speed control loop (parameter "9821.1 Scanning frequency n/X control"; 250 µs, 500 µs or 1 ms).

MOVIAXIS® now has the task of forwarding the incoming torque setpoints with a rough time reference to the speed controller that operates with the shortest time reference. Intermediate values must be interpolated for this purpose. The setpoint flow is delayed by one communication cycle to carry out this interpolation.

The incoming position over two process data is interpreted in user-defined units.

General parameters

9963.1 Setpoint cycle control

Unit: µs.

Value range: 500 ... 20000, Step 500.

The setpoint cycle of the controller indicates the time invervals used by the higher-level controller to send torque setpoints. This time must be a multiple of the cycle time of the speed control loop (parameter "9821.1 Scanning frequency n/X control").

Setpoints

9964.1
Setpoint torque source

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the setpoint torque of FCB 08 Interpolated torque control.

If the parameter is set to "Local setpoint", the source will be parameter "9964.2 Setpoint torque local".

9964.2
Local torque setpoint

Unit: %

Resolution: 10^{-3}.

Value range: –1000000 ... 0 ... 1000000, step 1.

If the parameter "9964.1 Setpoint torque speed" is set to "Local setpoint", this parameter will be the setpoint torque for FCB 06 Interpolated speed control.

Actual values

9985.1
User-defined unit torque

Unit: %

Resolution: 10^{-3}.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Current torque; in user-defined units, filtered for the display.

FCB 09 Positioning

MOVIAXIS® has a number of positioning mode types. These types are described briefly in the following section. FCB "Positioning" can be instanced to a maximum of 64 times.

Absolute positioning

The position setpoint in user-defined units is interpreted as an absolute target and is converted and executed in system units.

The travel range in system units is ± (2^{31} -2). If this travel range is exceeded after the conversion, the FCB issues an error.

Relative positioning

The position setpoint in user-defined units is interpreted as the offset for the last setpoint that was transferred. After it has been converted into system units, it is added to the last setpoint.

If the time calculated in system units is outside the travel range of ± (2^{32} –2), the FCB issues an error.

Modulo in positive direction with absolute position specification

The position setpoint in user units is interpreted as the absolute position. It must be within the Modulo range of the active drive:

Lower limit = "Modulo underflow"

Upper limit = "Modulo overflow"

If the position setpoint is outside this range, an error is issued. The drive always turns in a positive direction to reach the specified position.

Modulo in positive direction with relative position specification

The position setpoint in user units is interpreted as the offset for the last setpoint that was transferred. After it has been converted into system units, it is added to the last setpoint.

The position setpoint must be **positive**, otherwise an error is issued.

The drive always turns in a positive direction to reach the new position.

Modulo in negative direction with absolute position specification

The position setpoint in user units is interpreted as the absolute position. It must be within the Modulo range of the active drive:

Lower limit = "Modulo underflow"

Upper limit = "Modulo overflow"

If the position setpoint is outside this range, an error is issued. The drive always turns in a negative direction to reach the new position.

Modulo in negative direction with relative position specification

The position setpoint in user-defined units is interpreted as the offset for the last setpoint that was transferred. After it has been converted into system units, it is added to the last setpoint.

The position setpoint must be **negative**, otherwise an error is issued.

The drive always turns in a negative direction to reach the new position.

Modulo with shortest distance with absolute position specification

The position setpoint in user-defined units is interpreted as the absolute position. It must be within the Modulo range of the active drive:

Lower limit = "Modulo underflow"

Upper limit = "Modulo overflow"

If the position setpoint is outside this range, an error is issued.

The direction of the drive is determined using the last setpoint position (= current actual position after activation without an "In position" message) and the current setpoint position. This value is used to determine the shortest distance and, therefore, the direction of rotation for positioning.

Modulo with relative position specification

The position setpoint in user-defined units is interpreted as the offset for the last setpoint that was transferred. After it has been converted into system units, it is added to the last setpoint.

The sign of the position setpoint determines the direction of rotation of the drive.

General parameters valid for all instances.

9885.1 Use control bit "Feed enable"

Value range:

- 0 = No
- 1 = Yes

This parameter specifies whether "Feed enable" is to be used in the control word or not.

If this parameter is set to "Yes", a "Feed enable" bit must also be set in the layout of the control word. If the control word does not contain such a bit, this parameter must be set to "No", else the drive will not start.

The "Feed enable" bit in the control word must be set during the entire positioning distance. Deactivating feed enable results in standstill of the drive with the maximum deceleration of FCB 09 Positioning (index 9886.8 – 9949.8, depending on the instance). FCB 09 remains here. The positioning procedure is continued with a resetting of feed enable.

9885.2 Control bit "Accept position"

Value range:

- 0 = No
- 1 = Yes

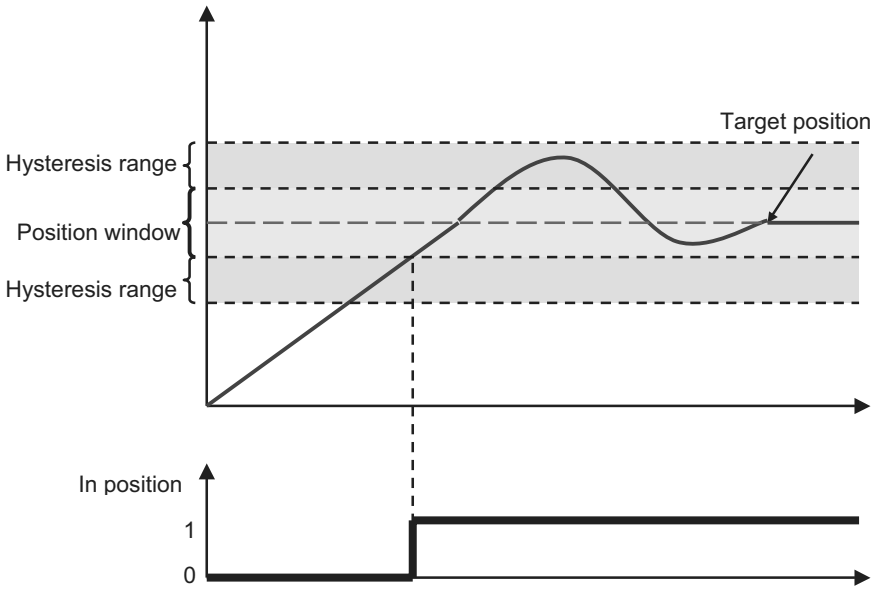
This parameter specifies whether the "Accept position" bit is to be used in the control word or not.

If this parameter is set to "Yes", an "Accept position" bit must also be set in the layout of the control word. If the control word does not contain such a bit, this parameter must be set to "No", else the drive will not start.

The "Accept position" bit must receive a positive edge for each new positioning procedure to accept the position. This is especially advantageous in the relative operating modes (index operating mode 9886.1 – 9949.1) → Relative cycles of the same position widths. The number of positive edges is saved and immediately processed. Example: Setpoint position relative to 100 revolutions. 220 revolutions are traveled by two quick successive changeovers (toggle) of the "Accept position" bit in the control word.

9885.3
In Position window

The window width for the "In position" message specifies when MOVIAXIS® reports back that the target position is reached in the status word of the PLC. The position window can now also be provided with a hysteresis using the parameter "Hysteresis range In position" message. The actual position can dip into the hysteresis range when it has entered the position window without losing the "In position". This prevents the bit from "bouncing".



The "In position" message operates in the FCB according to the following rules:

- It is only set by FCB 09 Positioning or FCB 12 Referencing when traveling to basic setting.
- It will not be lost if there is a change from FCB09 to any other FCB, e.g. have brake applied with FCB 13 Stop at application limit. The change must occur within the position window and the hysteresis range.
- Goes to "0" when:
  - Leaving the position window and the hysteresis range
  - There is a new travel instruction within FCB 09
  - There is a change to another FCB and it leaves the window

9885.4
In Position hysteresis

See parameter "9885.3 In Position window".

9885.5
Setpoint deviation window positioning

Setpoint deviation window positioning specifies as of which lag distance (offset of setpoint position to actual position) an error should be triggered. The maximum lag distance is then divided by 2 in the setpoint deviation window. The parameter only takes effect in FCB09 Positioning.

9729.18 Response setpoint deviation positioning

Value range:

- 0 = No response
- 1 = Display only
- 5 = Output stage inhibit / waiting
- 6 = Stop at emergency stop limit / waiting
- 8 = Stop at application limit / waiting
- 10 = Stop at system limit / waiting

- **No response**

Error is ignored

- **Display only**

The 7-segment display shows the status but the axis does not respond.

- **Output stage inhibit / waiting**

The axis changes to the state output stage inhibited and applies a mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a restart, the axis performs a warm start and is ready to operate again without delay.

- **Stop at emergency stop limit / waiting**

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start and is ready to operate again without delay.

- **Stop at application limit / waiting**

The motor is stopped at the application limit. After a restart, the axis performs a warm start and is ready to operate again without delay.

- **Stop at system limit / waiting**

The motor is stopped at the system limit. After a restart, the axis performs a warm start and is ready to operate again without delay.

The response is set to setpoint deviation window positioning exceeded.

Instance data

FCB Positioning can be assigned to an instance 64 times, e.g. for table positioning. Each instance can be then selected in the control word. This means all subsequent parameters exist 64 times in ascending order sorted by index.

This means that the

- instance 0 has the basic index 9886
- instance 63 has the basic index 9949.

9886.1 – 9949.1
Operating mode

Value range:

- 0 = Absolute
- 1 = Relative
- 2 = Modulo absolute positive direction
- 3 = Modulo relative positive direction
- 4 = Modulo absolute negative direction
- 5 = Modulo relative negative direction
- 6 = Modulo shortest distance absolute
- 7 = Modulo shortest distance relative

Absolute: In this operating mode, an incoming setpoint position is approached in an absolute manner. In this case, the maximum travel range is ± 32768 motor revolutions. If higher values are specified, MOVIAXIS® will issue error 18 (internal software error).

Relative: In this operating mode, an incoming setpoint position is approached in a relative manner. It is recommended to use the "Accept position" bit on the control word. In this way, the position is approached in a relative manner for each edge even when the relative setpoint position does not change.

In this case, the maximum travel range is ± 32768 motor revolutions. If higher absolute values are specified, MOVIAXIS® will issue error 18 (internal software error). The maximum relative setpoint position that can be specified in a travel command is 32768 motor revolutions.

Modulo operating modes: The Modulo operating modes represent a travel range of "9594.1 Modulo underflow" to "9594.10 Modulo overflow" for the parameter "9839.1 Position Modulo".

Using the user-defined units (see motor startup routine), odd-numbered ratios can be represented infinitely, e.g. a turntable with infinite gear ratio that always moves in one direction. The modulo absolute position is always maintained between overflow and underflow independent of the drive revolutions. Reference travel must always be performed when replacing MOVIAXIS® or the motor.

- **Modulo absolute positive direction:** In this operating mode, an incoming setpoint position is approached in an absolute manner within the Modulo travel range. The travel direction is always positive (looking onto the motor shaft: positive direction of rotation). The setpoint position is only valid within the Modulo limits. If higher or lower values are specified, MOVIAXIS® will issue error 18 (internal software error). No more than one revolution per travel command can be moved in this operating mode. This is not a complete revolution but a revolution minus the resolution of the set user-defined unit.
- **Modulo relative positive direction:** In this operating mode, an incoming setpoint position is approached in a relative manner within the Modulo travel range. The travel direction is always positive (looking onto the motor shaft: Positive direction of rotation for parameter "8537.0 Change direction of rotation" set to "OFF"). Several Modulo travel ranges can be specified here (up to a maximum ± 32768 motor revolutions).

- **Modulo absolute negative direction:** Like the "Modulo absolute positive direction" operating mode, but in negative direction.
- **Modulo relative negative direction:** Like the "Modulo relative positive direction" operating mode, but in negative direction.
- **Modulo absolute shortest distance:** In this operating mode, the drive always travels the shortest distance within the Modulo travel range. This can mean a positive or negative direction. The setpoint position is only valid within the Modulo limits. If higher or lower values are specified, MOVIAXIS® will issue error 18 (internal software error).
- **Modulo relative shortest distance**

The following settings apply to all operating modes.

The reset behavior of parameter "9998.1 Position mode" in conjunction with absolute encoders depends on the following settings:

- If set to "**without overflow counter**", the unit will always be positioned in the absolute range of the encoder following a CPU reset and system restart, e.g. with Hiperface 4096 motor revolutions. This means a position loss in the event of encoder overflow. If the position range of the absolute encoder is not exceeded, no reference travel is required when replacing MOVIAXIS® because no overflows can be stored in the MOVIAXIS®. Reference travel is only required when the motor is replaced.
- When set to "**with overflow counter**", the complete ± 32768 motor revolutions are utilized. MOVIAXIS® internally stores absolute encoder overflows. This also functions when the axis is moved to overflow without electrical current. This is ensured by checking the travel range. Reference travel must always be performed when replacing MOVIAXIS® or the motor.

9886.2 – 9949.2 Positioning setpoint source

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the positioning setpoint of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.3-9949.3 Positioning setpoint local".

9886.3 – 9949.3 Local positioning setpoint

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

If the parameter "9886.2-9949.2 Positioning setpoint source" is set to "Local setpoint", this parameter will be the positioning setpoint for FCB 09 Positioning.

9886.4 – 9949.4 Max. positioning velocity positive source

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the positioning velocity positive of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.5 – 9949.5 Positioning".

9886.5 – 9949.5 Local. max. positioning velocity positive

Unit: 10^{-3} rpm.

Value range: 0 ... 10000000, step 1.

If the parameter "9886.4 – 9949.4 Positioning velocity positive source" is set to "Local setpoint", this parameter will be the positive velocity for FCB 09 Positioning.

9886.12 – 9949.12 Source max. positioning velocity negative

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the positioning velocity negative of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.13 – 9949.13 Positioning velocity negative local".

9886.13 – 9949.13 Local max. positioning velocity negative

Unit: 10^{-3} rpm.

Value range: 0 ... 10000000, step 1.

If the parameter "9886.12-9949.12 Positioning velocity negative source" is set to "Local setpoint", this parameter will be the negative velocity for FCB 09 Positioning.

9886.6 – 9949.6 Source max. acceleration

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the acceleration positive of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.7-9949.7 Acceleration positive local".

9886.7 – 9949.7 Local max. velocity

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 .. 2147483647, step 1.

If the parameter "9886.6 – 9949.6 Max. acceleration source" is set to "Local setpoint", this parameter will be the positive acceleration for FCB 09 Positioning.

9886.8 – 9949.8
Source max. deceleration

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the deceleration of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.9 – 9949.9 Max. deceleration local".

9886.9 – 9949.9
Local max. deceleration

Unit: 10^{-2} rpm/s

Value range: 0 ... 300000 .. 2147483647, step 1.

If the parameter "9886.8-9949.8 Deceleration source" is set to "Local setpoint", this parameter will be the deceleration for FCB 09 Positioning.

9886.10 – 9949.10
Source jerk

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the jerk of FCB 09 Positioning.

If set to "Local setpoint", the source will be parameter "9886.11- 9949.11 Jerk local".

9886.11 – 9949.11
Local jerk

Unit: 1 rpm/s^2.

Value range: 1 ... 2147483647, step 1.

If the parameter "9886.10-9949.10" Jerk source" is set to "Local setpoint", this parameter will be the jerk for FCB 09 Positioning.

9704.1
Position

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Current actual position in user-defined units, filtered for the display.

9839.1
Position Modulo

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Current actual Modulo position in user-defined units, filtered for the display.

FCB 10 Interpolated positioning

The FCB 10 Interpolated positioning is used for cyclic preselected position setpoints of higher-level controllers, e.g. MotionControl.

The higher-level controller is responsible for the following limits:

- Jerk
- Acceleration
- Speed

Only the system limits speed and torque take effect in MOVIAXIS®.

Prerequisite is a synchronized bus system. This means that incoming process data has a fixed time reference for the control system of the axis.

The new process data from the controller are sent within a fixed cycle time. This time must be a multiple of the cycle time of the speed control loop (parameter "9821.1 Scanning frequency n/X control"; 250 µs, 500 µs or 1 ms).

MOVIAXIS® now has the task of forwarding the incoming positions with a rough time reference to the operating position controller with the shortest time reference. Intermediate values must be interpolated for this purpose. The setpoint flow is delayed by one communication cycle to carry out this interpolation.

The incoming position over two process data is interpreted in user-defined units.

9963.1 Setpoint cycle control

Unit: µs.

Value range: 500 ... 20000, step 500.

The setpoint cycle of the controller indicates the time intervals used by the higher-level controller to send position setpoints. This time must be a multiple of the cycle time of the position control loop (parameter "9821.1 Scanning frequency n/X control").

9966.1 Source setpoint position

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the positioning setpoint of FCB 10 Interpolated positioning.

If the parameter is set to "Local setpoint", the source will be parameter "9966.2 Setpoint position local".

9966.2 Local setpoint position

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

If the parameter "Setpoint position source" is set to "Local setpoint", this parameter will be the position setpoint for FCB 10 Interpolated positioning.

9966.4
Setpoint deviation window positioning

Unit: U.

Resolution: 1/65536.

Value range: 0 ... 65536 ... 2147483647, step 1.

The setpoint deviation window for positioning specifies the allowed dynamic deviation of the setpoint from the actual value in user-defined units until an error is triggered. The error response is set in parameter "9729.18 Response setpoint deviation positioning".

9729.18
Response setpoint deviation positioning

- 0 = No response
- 1 = Display only
- 2 = Output stage inhibit / locked
- 3 = Stop at emergency stop limit / locked
- 5 = Output stage inhibit / waiting
- 6 = Stop at emergency stop limit / waiting
- 8 = Stop at application limit / waiting
- 9 = Stop at application limit / locked
- 10 = Stop at system limit / waiting
- 11 = Stop at system limit / locked

The response is set to setpoint deviation window positioning exceeded.

9966.3
Setpoint deviation positioning

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Displays the setpoint deviation positioning in user-defined units.

9704.1
Position

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Current actual position in user-defined units, filtered for the display.

9839.1
Position Modulo

Unit: U.

Resolution: 1/65536.

Value range: –2147483648 ... 0 ... 2147483647, step 1.

Current Modulo actual position in user-defined units, filtered for the display.

FCB 12 Reference travel

Actual values

9857.1 Reference travel status	Indicates the state that the reference travel is currently in.
9703.1 Velocity	Unit: 10^{-3} rpm. Current actual velocity in user-defined units, filtered for the display.
9704.1 Position	Unit: U. Resolution: 1/65536. Value range: –2147483648 ... 0 ... 2147483647, step 1. Current actual position in user-defined units, filtered for the display.
9839.1 Position Modulo	Current Modulo actual position in user-defined units, filtered for the display. Unit: U. Resolution: 1/65536. Value range: –2147483648 ... 0 ... 2147483647, step 1.

FCB 18 Encoder adjustment

FCB 18 Encoder adjustment is used for commutation of asynchronous AC motors. The drive must be disconnected from the load and gear units. The motor must first be started up.

When changing to FCB 18 Encoder adjustment, the calibration procedure is immediately started and runs through the following states:

0. **Inactive**: FCB is not selected.
1. **Current build-up**: Adjustment is started by selecting the FCB. Parameter "10054.1 Write control encoder adjustment" is set to "inactive".
2. **Wait 1**: The motor waits until the mechanical transient process at the motor shafts is finished.
3. **Turn forward**: The drive now rotates forward one revolution (as viewed from the motor shaft, positive direction of rotation). The revolution in positive direction of rotation is very important, else the wiring may be incorrect and parameter "10054.3 Encoder adjustment status" changes to status 10 error. The parameter "8537.0 Change direction of rotation" reverses the direction of rotation (first negative then positive direction of rotation).
4. **Wait 2**: The motor waits until the mechanical transient process at the motor shaft is finished.
5. **Turn backward:** The motor shaft turns back to the old position.
6. **Wait 3**: The motor waits until the mechanical transient process at the motor shaft is finished.
7. **Copy**: Depending on the connected motor, MOVIAXIS® now waits for a response from the user or higher-level controller. In the meantime, the parameter "10054.1 Measured encoder offset" is continually compared with the position of the motor shaft. Parameter "10054.2 Write position encoder offset" now contains the result of the measurement. There are several ways to adjust the encoder:

- **Resolver motors**
  - **Mechanical rotation of the resolver:** The resolver must now be rotated against the motor shaft until reading of parameter "10054.1 Measured encoder offset" issues zero. Depending on the parameter set, you have to set parameter "9834.1; 9834.2; 9834.3 Encoder offset" to zero.
  - **Saving an encoder offset in MOVIAXIS®:** Depending on the parameter set, directly enter parameter "10054.1 Measured encoder offset" in parameter "9834.1; 9834.2; 9834.3 Encoder offset".
- **Hiperface motors**
  - **Writing the encoder (zeroing):** For writing the encoder, you have to set parameter "10054.4 Write control encoder adjustment" to "Write". Parameter "10054.1 Measured encoder offset" is then written to the Hiperface encoder. To check afterwards, a new measurement is automatically started again from point 1. Parameter "10054.1 Measured encoder offset" must display zero afterwards. Depending on the parameter set, you have to set parameter "9834.1; 9834.2; 9834.3 Encoder offset" to zero.
  - **Saving an encoder offset in MOVIAXIS®:** Depending on the parameter set, directly enter parameter "10054.1 Measured encoder offset" in parameter "9834.1; 9834.2; 9834.3 Encoder offset".

Encoder adjustment is now finished. The motor is ready for operation when the FCB is changed. The individual states can be queried using parameter "10054.3 Status encoder adjustment".

For special purposes, an expert function can be used to write an arbitrary encoder offset to the Hiperface encoder.

To do this, the parameter "10054.4 Write control encoder adjustment" must be set to "Do not copy" in the state "7 Copy". Next, enter the required encoder offset in parameter "10054.1 Measured encoder offset". The required encoder offset will be written in the encoder by setting parameter "10054.4 Write control encoder adjustment" to "Write".

STOP

Note that under normal circumstances the encoder is not correctly adjusted after this action.

10054.4 Write control encoder adjustment

Value range:

- 0 = Inactive
- 1 = Do not copy
- 2 = Write

Inactive: The FCB starts with this setting. If the parameter is set to another setting, it will be reset to "inactive".

Do not copy: This setting is only used for special purposes to write an arbitrary encoder offset to the Hiperface encoder.

Write: With this setting, the parameter "10054.1 Measured encoder offset" will be written to the Hiperface encoder.

Setpoints

10054.2 Write position encoder adjustment

Unit: U.

Resolution: 1/65536.

Value range: 0 ... 4294967295, step 1.

This value is written for "Write control encoder adjustment = Write" in a Hiperface encoder. The inaccuracy of "0" is determined by the friction compensation.

10054.5 Measuring current

Unit: %.

Resolution: 10^{-3}.

Value range: 0 ... 100000 ... 1000000, step 1.

The measuring current must be set in the user-defined units of the torque. The measuring current must not exceed the rated motor torque.

Actual values

10054.1
Measured encoder offset

Unit: U.

Resolution: $1/2^{32}$.

Current measured encoder offset for which the encoder shaft has an incorrect setpoint setting.

10054.3
Encoder adjustment status

Value range:

- 0 = Inactive
- 1 = Current generation
- 2 = Waiting 1
- 3 = Rotate forward
- 4 = Waiting 2
- 5 = Rotate backwards
- 6 = Waiting 3
- 7 = Copy
- 8 = Do not copy
- 9 = Finished
- 10 = Error

FCB 18 Status encoder adjustment.

FCB 20
Jog mode

MOVIAXIS® has a position-controlled jog mode function; this means that it is possible to move an axis in positive or negative direction, for example, for alignment purposes, in **position-controlled** mode using two adjustable speeds for each. The advantage of this function is that it can be used with hoist applications for which the position is not permitted to change when a change in load occurs when the drive is at a standstill.

Setpoints

9604.1
Positive speed setpoint

Resolution: 10^{-3}.

Value range: 0 ... 1000000, step 1.

Positive speed setpoint in user-defined units (as seen onto the motor shaft, positive direction of rotation).

9604.2
Negative speed setpoint

Resolution: 10^{-3}.

Value range: 0 ... 1000000, step 1.

Negative speed setpoint in user-defined units (as seen onto the motor shaft, negative direction of rotation).

Limit values

9604.5
Acceleration

Resolution: 10^{-2} rpm/s

Value range: 0 ... 300000 ... 2147483647, step 1.

Jog acceleration in user-defined unit.

9604.6
Deceleration

Resolution: 10^{-2} rpm/s
Value range: 0 ... 300000 ... 2147483647, step 1.
Jog acceleration in user-defined unit.

9604.7
Jerk

Resolution: 10^{-2} rpm/s^2.
Value range: 1 ... 2147483647, step 1.
Jerk in user-defined unit for jog mode.

Actual values

9703.1
Velocity

Unit: 10^{-3} rpm
Current actual velocity in user-defined units, filtered for the display.

9704.1
Position

Unit: U.
Resolution: 1/65536.
Current actual position in user-defined units, filtered for the display.

9839.1
Position Modulo

Unit: U.
Resolution: 1/65536.
Value range: –2147483648 ... 0 ... 2147483647, step 1.
Current Modulo actual position in user-defined units, filtered for the display.

FCB 21
Brake test

This function is used to check the braking capability of a brake connected to MOVIAXIS®. A test torque is applied electrically via the motor when the brake is applied.

Even when the brake has passed the brake test, it does not take on any safety functions as far as machine safety is concerned in combination with MOVIAXIS®.

The brake is only tested in accordance with the set brake test torque. The actual "brake breakaway torque" is not measured.

MOVIAXIS® supports four test modes:

1. A higher-level controller provides the setpoints and monitoring function for the test.
2. MOVIAXIS® performs a check in both directions compared to the set limit torques.
3. MOVIAXIS® only performs a check in positive direction compared to the set limit torques.
4. MOVIAXIS® only performs a check in negative direction compared to the set limit torques.

The test torque, test time and the direction of rotation of the test can be set. If a test is not passed, the breakaway torque is documented.

The brake is considered to be "ok" when the motor shaft does not move more than 10°. This is a fixed value.

IMPORTANT: The function does not check whether a brake is actually installed. If the brake test is activated when a brake is not installed, the drive will move depending on the brake test mode.

The FCB 21 brake test is used to check the function of a brake connected to MOVIAXIS®. A parameterized test torque is applied in this test, which means the motor starts running with applied brake.

	NOTES
	When the brake has passed the brake test, it does not take on any safety functions as far as machine safety is concerned in combination with MOVIAXIS®. A check is not made to determine whether a brake is physically present. This means that the brake test would also be performed without a brake. This allows for the testing of external brakes.

9600.1
Test

Value range:

- 1 = External setpoint selection
- 2 = Bipolar torque
- 3 = Positive torque
- 4 = Negative torque

External setpoint selection

In this mode, the brake test is completely evaluated by a higher-level controller / PLC. The brake test is running as long as the FCB is active. Possible travel movements are not monitored.

Only the parameters for the speed setpoint "9600.4 and 9600.5" and test torque "9600.2 and 9600.3" are used. All other parameters are used in test modes 2 to 4 only.

Bipolar, positive and negative torque mode

In this mode, the brake test is completely evaluated and reported back by MOVIAXIS®.

Brake slipping, even when minimal, generates axle movement in the test direction. When this movement exceeds one motor revolution, the brake is output as an error type in parameter "9600.8 Status". Only the system limits are effective for the FCB brake test.

Use the test mode "bipolar", "positive" or "negative" depending on the application.

The duration of the set test torque can be set using parameter "9600.6 Test duration". The test result is stored in parameter "9600.8 Status" after successful completion of the test.

Parameter "9600.4 Setpoint speed" is not effective here.

If an ongoing brake test is interrupted, an error message is issued. Speed monitoring is deactivated for the duration of the brake test.

- Bipolar: Positive and negative test torque (brake test is performed twice)
- Positive: Only operated with a positive test torque
- Negative: Only operated with a negative test torque

9600.7 Error response

Value range: See parameter "9729.16 Response external error"

This parameter is used to set the error response for the axis after a faulty brake test.

9600.8 Status

Value range: 0 ... 4294967295, step 1.

The following states can be displayed:

- No calibration.
- Calibration in progress.
- Calibration was aborted.
- Brake OK.
- Brake faulty.

Brake "ok" or "faulty" can also be read in the status word.

Setpoints

9600.4 Setpoint speed source

Only mode 1.

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the speed setpoint of the FCB 21 brake test.

If the parameter is set to "Local setpoint", the source will be parameter "9600.4 Setpoint speed local".

9600.5
Local speed setpoint

Only mode 1.

Resolution: 10^{-3}.

Value range: –1000000 ... 0 ... 1000000, step 1.

If the parameter "9600.8 Setpoint speed source" is set to "Local setpoint", this parameter will be the setpoint speed for the FCB 21 brake test.

Limit values

9600.2
Test torque source

Value range: See parameter "9598.1 Setpoint source velocity" FCB speed control.

This parameter sets the source for the test torque of the FCB 21 brake test.

If the parameter is set to "Local setpoint", the source will be parameter "9600.3 Test torque local".

The test moment can not be changed during the test run. The test moment should be based on the brake moment on the nameplate –10%.

9600.3
Local test torque

Unit: %.

Resolution: 10^{-3}.

Value range: 0 ... 100000 ... 1000000, step 1.

If the parameter "9600.2 Test torque source" is set to "Local setpoint", this parameter will be the test torque for the FCB 21 brake test in user-defined units.

9600.6
Test time

Only modes 2 – 4.

Unit: ms.

Value range: 0 ... 1000 ... 5000, step 1.

The test time is in mode 2 – 4 for the duration of the test. Afterwards "ok" or "faulty" is displayed in the status brake.

SEW-EURODRIVE recommends a test time of 10 seconds.

9600.9
Protocol torque

Only modes 2 – 4.

Unit: %.

Resolution: 10^{-3}.

Value range: 0 ... 1000000, step 1.

If the brake is faulty, the protocol torque shows the slip torque in user-defined units in mode 2 – 4.

Actual values

9985.1
User-defined unit torque

Unit: %.

Resolution: 10^{-3}.

Value range: –2147483648 ... 2147483647, step 1.

Current torque in user-defined units, filtered for the display.

FCB 22
Dual drive

The FCB 22 dual drive is suited for the following application:

- Two drives are rigidly and mechanically connected to each other
- The setpoint is to be transferred as speed.

Both drives operate with their own speed controller, which transfers and receives various parameters via bus communication. Both drives are equivalent. The purpose is to achieve a higher dynamics than with a master/slave arrangement because the slave does not "wait" for the deviation from the master.

In terms of hardware, both axes must be equipped with a K-Net card as option. The higher-level controller must also be fitted with a K-net master connection.

General parameters

9963.1
Setpoint cycle control

Unit: µs

Value range: 500...20000, step 500

Setpoint cycle control.

Communication

10052.1
Setpoint cycle lateral communication for position balancing

Unit: µs

Value range: 500...20000, step 500

Setpoint cycle lateral communication for position balancing function.

10052.2
P-gain position balancing controller

Unit: 10^{-3}/s

Value range: 0...20000...10000000, step 1

P-gain position balancing controller.

Initialization

10052.27
Maximum synchronizing speed

Unit: 10^{-3} rpm

Value range: –10000000...0...10000000, step 1

FCB position balance maximum synchronizing speed.

10052.25
Threshold position adjustment

Unit: U

Resolution: 1/65536

Value range: 1...32768...2147483647, step 1.

Threshold position adjustment.

10052.26
Threshold position adjustment

Unit: U

Resolution: 1/65536

Value range: 1...131072...2147483647, step 1.

Setpoint deviation window dual drive adjustment phase.

Setpoints

10052.3
Speed setpoint source

Value range: See parameter "9995.1 Integrator initialization".
FCB Position balancing function speed setpoint source.

10052.4
Speed setpoint local

Unit: 10^{-3} rpm
Value range: –10000000...0...10000000, step 1
FCB Position balancing function speed setpoint local.

10052.5
Position balancing setpoint source

Value range: See parameter "9995.1 Integrator initialization".
FCB Position balancing setpoint source.

10052.6
Position balancing function setpoint local

Unit: U
Resolution: 1/65536
Value range: –2147483647...0...2147483647, step 1.
Local position balancing function setpoint local.

10052.7
Position difference

Unit: U
Resolution: 1/65536
Value range: –2147483647...0...2147483647, step 1
Position difference.

Limit values

10052.8
Setpoint deviation response

Value range: See parameter "9729.18 Response setpoint deviation positioning"
Setpoint deviation response "dual drive".

10052.9
Setpoint deviation window

Unit: U
Resolution: 1/65536
Value range: 0...65536...2147483647, step 1
Setpoint deviation windows "dual drive".

10052.10
Current setpoint deviation

Unit: U
Resolution: 1/65536
Value range: –2147483647...0...2147483647, step 1
Setpoint deviation dual drive.

10052.11
Torque limit mode

Value range: See parameter "9965.5 Torque limit mode"
FCB Position balance torque limit mode.

10052.12/14/16/18
Torque limit Q1/2/3/4 source

Value range: See parameter "9995.1 Integrator initialization".
FCB Position balancing torque limit Q1/2//3/4 source.

10052.13/15/17/19
Torque limit Q1/2/3/4 local

Unit: %
Resolution: 10^{-3}
Value range: 0...10000...10000000, step 1
FCB Position balancing torque limit Q1/2//3/4 local.

10052.22
Positive transition mode

Value range: See parameter "9965.16 Positive transition mode"
FCB Position balance transition mode positive.

10052.20
Transition speed positive

Unit: 10^{-3} rpm
Value range: –10000000...0...10000000, step 1
FCB Position balance transition speed positive.

10052.23
Negative transition mode

Value range: See parameter "9965.16 Positive transition mode"
FCB Position balance transition mode negative.

10052.21
Negative transition speed

Unit: 10^{-3} rpm
Value range: –10000000...0...10000000, step 1
FCB Position balance transition speed negative.

Actual values

9703.1
Velocity

Unit: 10^{-3} rpm
Actual speed in user-defined unit, filtered for display.

4.6 Parameter description for unit functions

Setup

9702.4
Active parameter set

Value range:
- 0 = None
- 1 = Parameter set 1
- 2 = Parameter set 2
- 3 = Parameter set 3

Displays current parameter set.

10065.1
Select parameter set

Value range:
- 0 = No action
- 1 = Data set 1
- 2 = Data set 2
- 3 = Data set 3

Select parameter set.

9982.1
Software enable

Value range:
- 0 = Standard
- 1 = Special function

Software enable.

This parameter is currently without function. It is in preparation to differentiate between different software functions in the future.

The aim is to switch functions that require a lot of computer processor power on and off.

Reset unit parameters

9873.1
Active factory setting

Value range:
- 0 = None
- 1 = Basic initialization
- 2 = Delivery status
- 3 = Factory setting
- 4 = Customer set 1
- 5 = Customer set 2

Active factory setting.

The currently processed reset settings are displayed in this parameter.

9727.1
Basic initialization "d0"

Value range:

- 0 = No
- 1 = Yes

Basic initialization

	**STOP**
	SEW staff only The axis must be returned to SEW after performing this basic initialization.

9727.3
Delivery status "d1"

Value range:

- 0 = No
- 1 = Yes

Delivery status

Activating this function will restore the delivery status of all parameters.

9727.4
Factory setting "d2"

Value range:

- 0 = No
- 1 = Yes

Factory setting.

Same as parameter "9727.3 Delivery status d1" however, the parameters set at motor startup are not set to default values.

The factory setting does not include:

- Motor data (for example, inductances)
- Both lists of the customer-specific factory setting, see parameter "9727.4 Factory setting d3/d4".

The setting can be used to dispense with starting up the motor again.

9727.2
Customer-specific factory setting "d3/d4"

Value range:

- 0 = None
- 1 = Set 1
- 2 = Set 2

Customized factory setting

Parameter 9727.2 can be used to trigger a factory setting with user-defined parameter values. You can choose between two parameter sets which you can combine independently of one another.

A setting of parameter "9727.4 Factory setting d2" always precedes a customized factory setting. The combination of parameters (set 1 or set 2) is then overwritten with customized reset values. The reset is cancelled when index 0 from list 9587.x or 9589.x is read or 50 values have been set.

Each combination of customized reset values (set 1 or set 2) consists of up to 50 parameter number reset value pairs that are accessed using the following parameters:

- Set 1: parameter 9587.1 – 9587.50 = parameter number
- Parameter 9588.1 – 9588.50 = Reset value for parameter number

- Set 2: parameter 9589.1 – 9589.50 = parameter number
- Parameter 9590.1 – 9590.50 = Reset value for parameter number

Passwords

MOVIAXIS® offers a range of access levels for access to the unit parameters. These levels include write and read authorization or, for example, only read authorization. The different levels can be protected by passwords.

The passwords can be changed, for example, to allow end customers access to specific parameters only.

At present, the following access levels are available:

1. Observer

   The parameters can only be read and displayed.

2. Planning engineer

   A PLANNING ENGINEER is a specialist who has complete access to all unit functions.

3. OEM

   The authorization level OEM-SERVICE can be used, for example, to reset internal counters, program serial numbers or import new firmware.

9591.50 Current password level

Value range: 0 ... 4294967295, step 1.

- 20 = lowest (observer)

  Is activated if the planning engineer password is active, see parameter "9591.20 Change password planning engineer".

- 40 = medium level (operator = planning engineer)

  If the "planning engineer" password is not activated or the "planning engineer" password was entered after a reset.

- 60 = highest (OEM service)

  Is reached by entering the OEM password. The OEM password can also be used to change a forgotten "planning engineer" password, see parameter "9591.20 Change planning engineer password".

Current password level.

This level is used to influence the write capability of parameters. When the product leaves the plant, the "planning engineer" password is deactivated. This means that the password level is automatically set to "40" = "planning engineer".

9591.40 – 43 Password for level selection

Password level selection

Once you have entered the password, the current password level is set according to the password. After a reset, the highest level is selected that is not password protected.

9591.20 – 23 Change "planning engineer" password

The "planning engineer" password can only be written when the current password level of parameter 9591.50 is ≥ 40. This means that the "planning engineer" password can only be set if parameter "9591.50 Password level" is at least set to "planning engineer" using the password selection parameter 9591.40.

The "planning engineer" password is deactivated by entering an empty field.

Error response output stage

Axis module

9729.1 Overtemperature response

Value range:

- 2 = Output stage inhibit / locked
- 3 = Stop at emergency stop limit / locked
- 5 = Output stage inhibit / waiting
- 6 = Stop at emergency stop limit / waiting
- 8 = Stop at application limit / waiting
- 9 = Stop at application limit / locked
- 10 = Stop at system limit / waiting
- 11 = Stop at system limit / locked

The overtemperature error of the axis will be triggered if parameter "9811.4 Total utilization" exceeds 100%.

Overtemperature response of the axis module.

- **Output stage inhibit / locked**

The axis changes to the state controller inhibit and activates the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a reset, the axis performs a system restart.

- **Stop at emergency stop limit / locked**

The motor is stopped at the emergency stop ramp. After a reset, the axis performs a system restart.

- **Output stage inhibit / waiting**

The axis changes to the state controller inhibit and activates the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at emergency stop limit / waiting**

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / waiting**

The motor is stopped at the application limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / locked**

The motor is stopped at the application limit. After a reset, the axis performs a system restart.

- **Stop at system limit / waiting**

The motor is stopped at the system limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at system limit / locked**

The motor is stopped at the system limit. After a reset, the axis performs a system restart.

For more information, refer to the operating instructions section "Operation and service".

Power supply module

9729.2 Temperature prewarning response

Value range:

- 0 = No response
- 1 = Display only
- 2 = Output stage inhibit / locked
- 3 = Stop at emergency stop limit / locked
- 5 = Output stage inhibit / waiting
- 6 = Stop at emergency stop limit / waiting
- 8 = Stop at application limit / waiting
- 9 = Stop at application limit / locked
- 10 = Stop at system limit / waiting
- 11 = Stop at system limit / locked

Response temperature prewarning power supply module.

The temperature prewarning error is triggered when the temperature of the power supply module exceeds 85 °C.

The cut-off threshold is reached at 95 °C.

- **No response**

Error is ignored

- **Display only**

The 7-segment display shows the error but the axis does not respond (continues to operate).

- **Output stage inhibit / locked**

The axis changes to the state controller inhibit and activates the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a reset, the axis performs a system restart.

- **Stop at emergency stop limit / locked**

The motor is stopped at the emergency stop ramp. After a reset, the axis performs a system restart.

- **Output stage inhibit / waiting**

The axis changes to the state controller inhibit and activates the mechanical brake, if installed. If no brake is installed, the motor will coast to a halt. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at emergency stop limit / waiting**

The motor is stopped at the emergency stop ramp. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / waiting**

The motor is stopped at the application limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at application limit / locked**

The motor is stopped at the application limit. After a reset, the axis performs a system restart.

- **Stop at system limit / waiting**

The motor is stopped at the system limit. After a restart, the axis performs a warm start. This means that the axis is immediately ready to operate again (without delay).

- **Stop at system limit / locked**

The motor is stopped at the system limit. After a reset, the axis performs a system restart.

For more information, refer to the operating instructions section "Operation and service".

9729.5 Response Ixt prewarning

Value range see parameter "9729.2 Response temperature prewarning"

Response Ixt prewarning power supply module.

The prewarning level is reached when the "current DC link current" ×"time" equals 80% of the product "rated DC link current" ×"time".

	NOTES
	The error threshold is reached when the "current DC link current" ×"time" equals 110 % of the product "rated DC link current" ×"time".

9729.12 Response Ixt prewarning internal braking resistor

Value range see parameter "9729.9 Response TF / TH / KTY message response".

Response Ixt prewarning of the integrated braking resistor (with 10kW power supply module).

9729.4 Response mains phase failure

Value range see parameter "9729.9 Response TF / TH / KTY message response".

Response on mains phase failure.

9746.1 Response Mains OFF

Value range:

- 0 = DC link evaluation
- 1 = Mains control with controller inhibit
- 2 = Mains control and stop
- 3 = Mains control and application stop
- 4 = Mains control and system stop
- 5 = Mains control and emergency stop
- 6 = DC link control and no response
- 7 = Rapid mains control with output stage inhibit
- 8 = Rapid mains control with stop
- 9 = Rapid mains control with application stop
- 10 = Rapid mains control and system stop
- 11 = Rapid mains control and emergency stop
- 12 = Rapid mains control and internal response

Mains OFF response.

General definition of terms:

DC link control (ignore supply system failures):

See error response "0 = DC link evaluation" and "6 = DC link control and no response"

'Normal' mains control:

The "Power on" signal of the power supply module is set when the DC link voltage is 240V for the duration of 200 ms.

The "Power on" signal of the power supply module is deleted when 2 half waves of the mains supply are absent. This will cause a delay of > 10 ms.

Rapid mains control:

As the DC link will lose nearly the entire load within milliseconds in the event of mains disconnection and full motor load, you have the option to use rapid mains control.

Rapid mains control directly refers to the threshold parameter "9973.1 Mains off limit value". The set response will be triggered immediately if the minimum value falls below the limit. The response will take effect within 0.5 ms.

- **0 = DC link evaluation**

If the DC link voltage drops below the limit value 80V and the unit is in "MAINS_ON" state, the DC link voltage will be averaged during 100 ms.

If the averaged DC link voltage reaches the limit value of 240 V after expiry of 100 ms, the state will revert to "MAINS_ON". A system failure was compensated in this way.

If the averaged DC link voltage drops below the limit value of 240 V after expiry of 100 ms, the state will change to "MAINS_OFF".

The ready signal changes to "not ready" when the "Mains on" signal of the power supply module is not present any longer and the "MAINS_OFF" state is detected.

The output stage is also inhibited as response to MAINS_OFF.

- **1 = Mains control with controller inhibit**

Once the "Mains on" signal of the power supply module disappears, the brake applies and the output stage is inhibited immediately. The ready signal changes to "not ready".

- **2 = Mains control and stop**

When the "Mains on" signal of the power supply module disappears, the drive is stopped immediately at the set normal limits for torque and deceleration of the active FCB. The ready signal is removed when the drive has come to a stop.

If the "Mains on" signal of the supply module appears again while the drive decelerates to a stop, the stopping process will not be continued. The drive remains in "READY" state and the current FCB will be active again.

- **3 = Mains control and application stop**

When the "Mains on" signal of the power supply module disappears, the drive is stopped immediately at the set application limits for torque and deceleration. The ready signal is removed when the drive has come to a stop.

If the "Mains on" signal of the power supply module appears again while the drive decelerates to a stop, the stopping process will not be continued. The drive remains in "READY" state and the current FCB will be active again.

- **4 = Mains control and system stop**

When the "Mains on" signal of the power supply module disappears, the drive is stopped immediately at the set system limits for torque and deceleration. The ready signal is removed when the drive has come to a stop.

If the "Mains on" signal of the power supply module appears again while the drive decelerates to a stop, the stopping process will not be continued. The drive remains in "READY" state and the current FCB will be active again.

- **5 = Mains control and emergency stop**

When the "Mains on" signal of the power supply module disappears, the drive is stopped immediately at the set emergency stop delay for torque and deceleration. The ready signal is removed when the drive has come to a stop.

If the "Mains on" signal of the power supply module appears again while the drive decelerates to a stop, the stopping process will not be continued. The drive remains in "READY" state and the current FCB will be active again.

- **6 = DC link control and no response**

The DC link voltage is monitored as described under "0 = DC link evaluation". However, the level 80 V is not used for mains off detection but a level of 20 V. The monitoring type can be used when the mains off detection is to occur for a DC link that is almost empty.

- **7 = Rapid mains control with output stage inhibit**

The output stage is inhibited immediately if the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value".

- **8 = Rapid mains control and stop**

If the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value", the drive will be stopped immediately using the set limit for torque and deceleration of the active FCB. The ready signal is removed when the drive has come to a stop.

- **9 = Rapid mains control and application stop**

If the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value", the drive will be stopped immediately using the set application limit. The ready signal is removed when the drive has come to a stop.

- **10 = Rapid mains control and system stop**

If the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value", the drive will be stopped immediately using the set system limit. The ready signal is removed when the drive has come to a stop.

- **11 = Rapid mains control and emergency stop**

If the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value", the drive will be stopped immediately using the deceleration set for emergency stop. The ready signal is removed when the drive has come to a stop.

- **12 = Rapid mains control and internal response**

There will not be a direct response if the DC link voltage falls below the value set in parameter "9973.1 Mains off limit value". The response must occur due to another system function. For example, by a virtual encoder. The current active FCB remains active. The ready signal is removed when the drive has come to a stop.

9973.1 Mains-OFF limit value "U_z-threshhold for rapid mains control"

Resolution: 10^{-3}.

Value range: 0 ... <u>450</u> ... 2048.

Rapid mains control is triggered at the set value.

See response parameter "9746.1 Mains OFF".

Reset behavior

8617.0
Manual reset

Value range:

- 0 = No
- 1 = Yes

The current error is acknowledged when manual reset is set to Yes.

The error response of this current error defines the response to be triggered after a reset.

The error response can be "warm start", "system restart" and "CPU reset". For a detailed description of these responses, refer to the operating instructions.

Automatically reset to "No" after performing reset (by setting to "Yes").

5 Index

Address List

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service **Competence Center**	**Central** Gear units / Motors	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte-gm@sew-eurodrive.de
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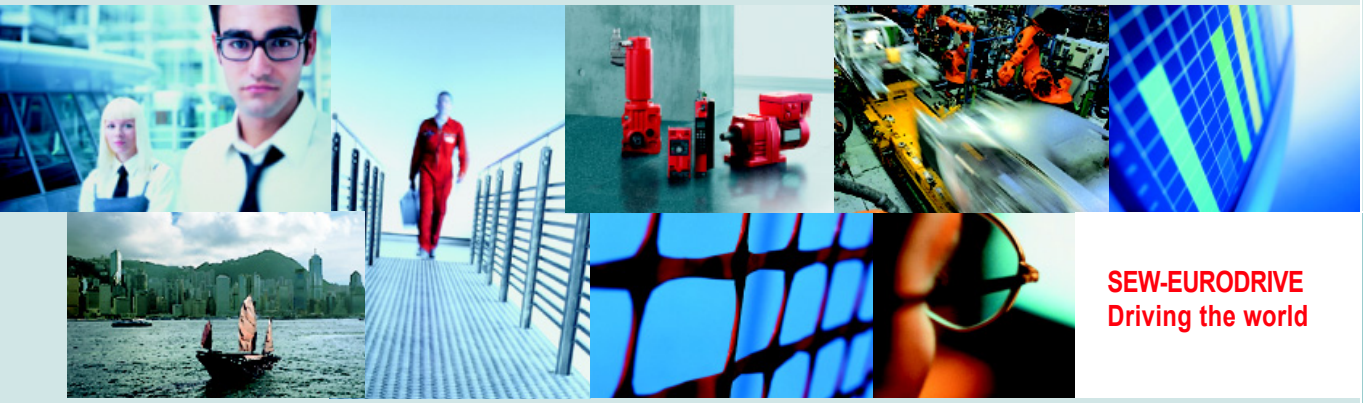

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