MOVIDRIVE® MD_60A

Edition

08/2001

System Manual

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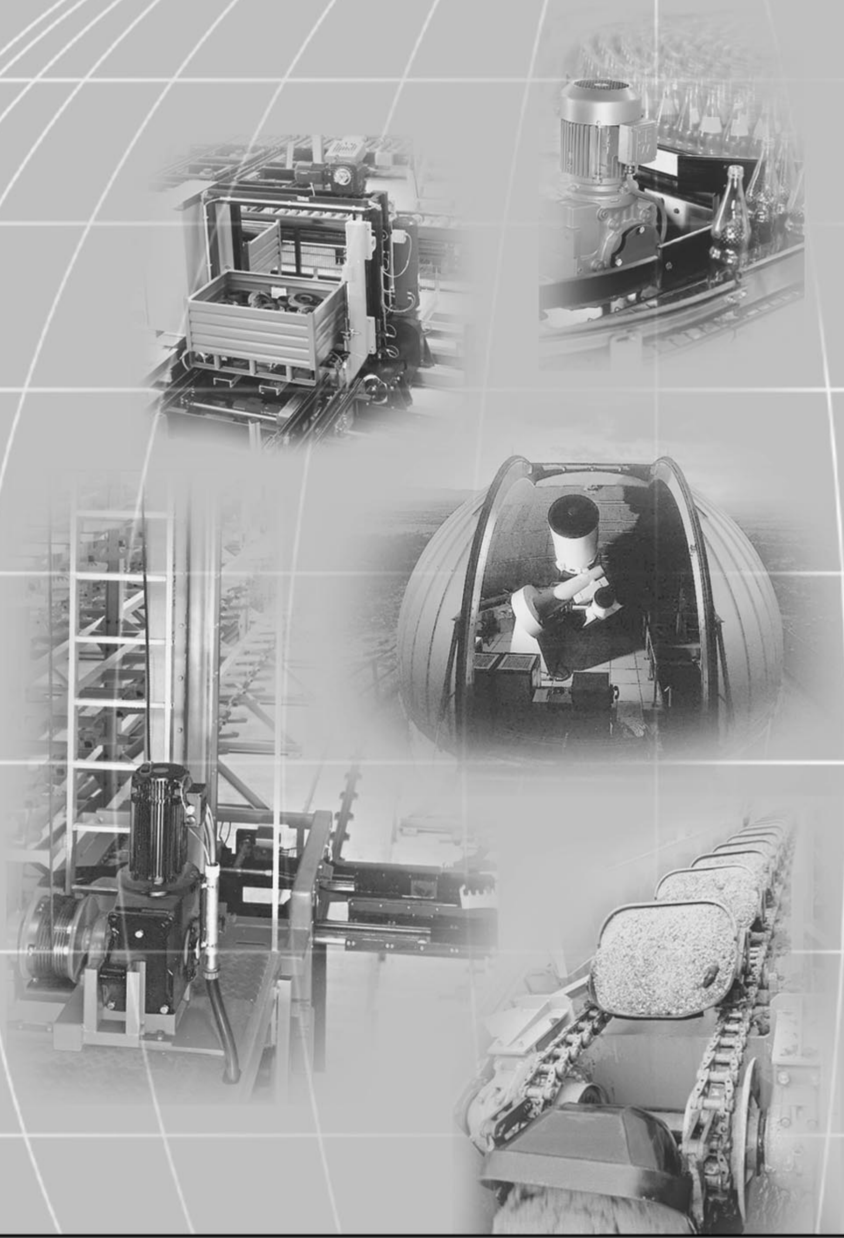

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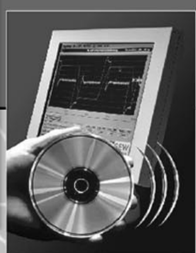
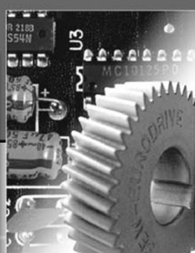

1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions contained in this publication!

	Electrical hazard Possible consequences: Severe or fatal injuries.
	Hazard Possible consequences: Severe or fatal injuries.
	Hazardous situation Possible consequences: Slight or minor injuries.
STOP	**Harmful situation** Possible consequences: Damage to the unit and the environment.
	Tips and useful information.

A requirement of **fault-free operation** and fulfillment of any rights to claim under guarantee is that the information in the **operating instructions** is adhered to. Consequently, **read the operating instructions** before you start working with the unit!

The **operating instructions** contain **important information about servicing**; as a result, they should be kept **in the vicinity of the unit**.

Designated use

STOP

MOVIDRIVE® MD_60A drive inverters are intended for use in industrial and commercial systems for the operation of AC asynchronous motors or permanent-field AC synchronous motors. These motors must be suitable for operation with frequency inverters. No other loads may be connected to the units.

MOVIDRIVE® MD_60A drive inverters are units intended for stationary installation in switch cabinets. All instructions referring to the technical data and the permissible conditions where the unit is operated must be followed.

Do not start up the unit (take it into operation in the designated fashion) until you have established that the machine complies with the EMC Directive 89/336/EEC and that the conformity of the end product has been determined in accordance with the Machinery Directive 89/392/EEC (with reference to EN 60204).

Application environment

The following uses are forbidden unless measures are expressly taken to make them possible:

- Use in explosion-proof 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 shock loads in excess of the requirements in EN 50178

Waste disposal

Please follow the current instructions: Disposal must be carried out in accordance with the material structure and the regulations in force, for instance as:

- Electronics scrap (printed-circuit boards)
- Plastic (housing)
- Sheet metal
- Copper

etc.

2 System Description

2.1 Overview of the system

Power components

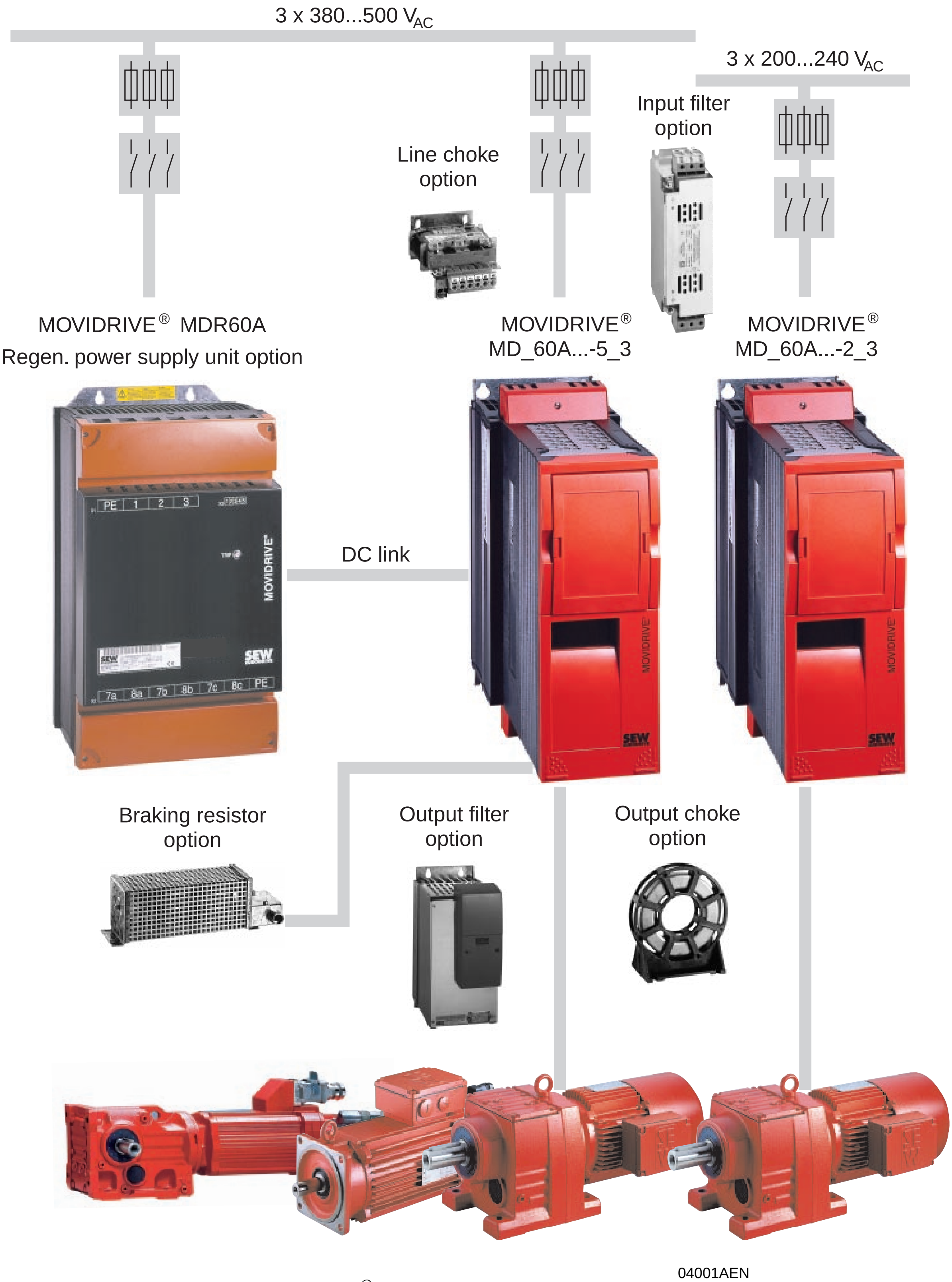

Fig. 1: Overview of the system, MOVIDRIVE® MD_60A power components

Communications and technology components

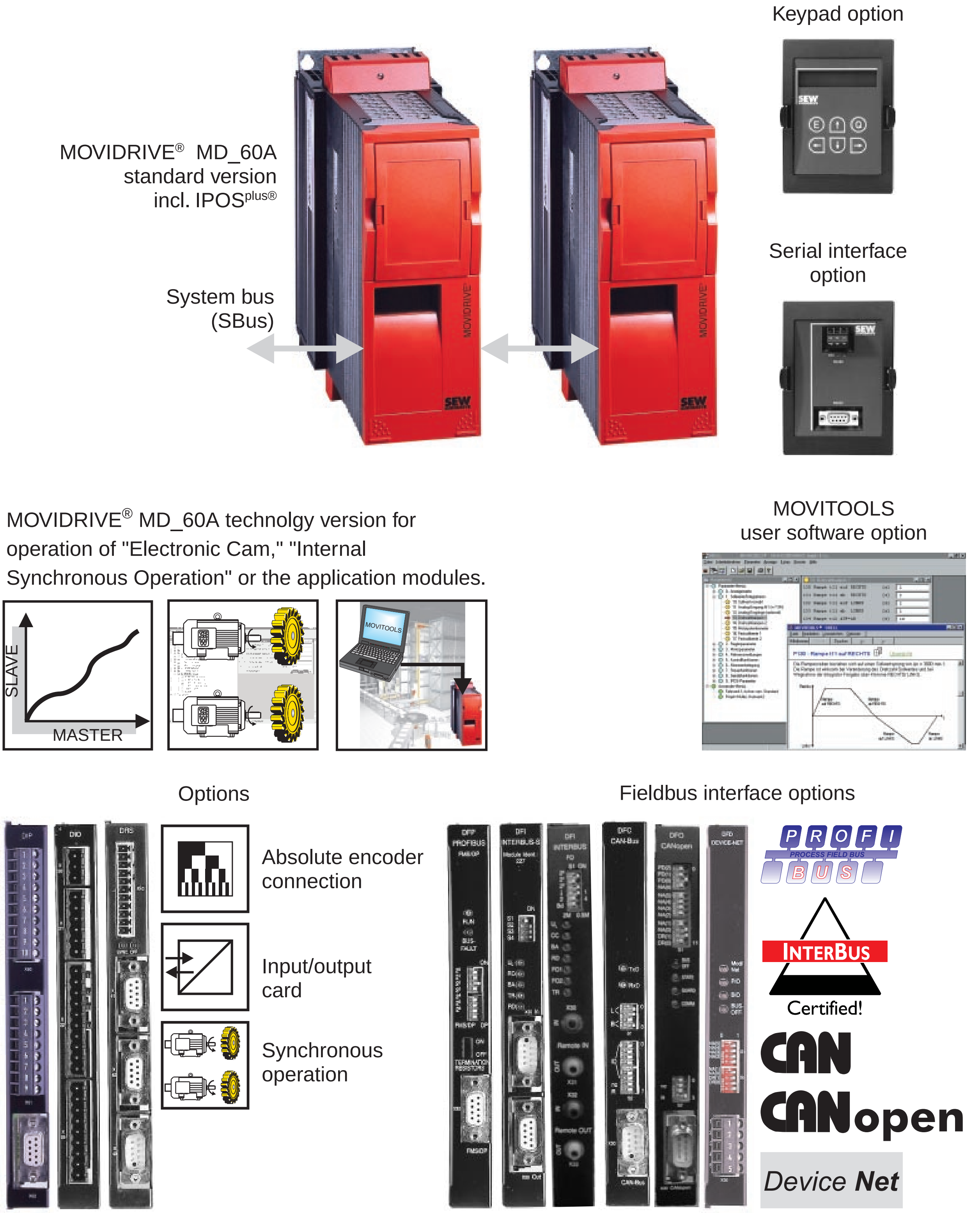

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Fig. 2: Overview of the system, MOVIDRIVE® MD_60A communications and technology components

Overview of the system

General description

MOVIDRIVE® opens up a new dimension in drive inverters from SEW. As a result, AC drives with the latest digital inverter technology can now be used without restrictions in the power range from 1.5 to 90 kW (2.0 to 120 HP). The levels of dynamic performance and control quality that can now be achieved with MOVIDRIVE® for AC asynchronous motors as well, were previously only possible using servo drives or DC motors. The integrated control functions and the possibility of expanding the system with technology and communications options is leading to drive systems that are designed for particularly high levels of efficiency in terms of their broad range of applications, project planning, startup and operation.

Range of units

The **MOVIDRIVE® MD_60A** range of units includes 4 series:

- MOVIDRIVE® MDF60A: Drive inverter for asynchronous AC motors without encoder feedback, VFC control mode
- MOVIDRIVE® MDV60A: Drive inverter for asynchronous AC motors with encoder feedback, either VFC or CFC control mode.
- MOVIDRIVE® MDS60A: Drive inverter for synchronous servomotors with resolver, CFC control mode.
- MOVIDRIVE® MDR60A: Regenerative power supply unit, the energy from MOVIDRIVE® drive inverters (400/500 V units) operating in regenerative mode is fed back into the supply system.

Unit types

MOVIDRIVE® MDF/MDV/MDS60A drive inverters are each available in two types, namely the standard type and the applications version.

Standard type

As standard, the units are equipped with the IPOS$^{plus®}$ integrated positioning and sequence control system. They can also be expanded with the available options.

The standard type is indicated by the "00" digits at the end of the unit designation.

Applications version (from firmware version .11)

In addition to the features of the standard version, these units include the technology functions of "electronic cam disk" and "internal synchronous operation". Furthermore, you can use all the application modules available in the MOVITOOLS software package with the applications units.

The applications version is indicated by the "0T" characters at the end of the unit designation.

Control mode

The new VFC (Voltage Flux Control) and CFC (Current Flux Control) control modes are features of MOVIDRIVE® drive inverters. Continuous calculation of the complete motor model provides the basis for both control modes.

VFC (Voltage Flux Control) control mode	CFC (Current Flux Control) control mode
Voltage-controlled control mode for AC asynchronous motors with and without encoder feedback. • With encoder feedback – At least 150 % torque, even with the motor stopped – Servo-like characteristics • Without encoder feedback – At least 150 % torque up to 0.5 Hz	Current-controlled control mode for AC asynchronous motors and permanent-field AC servomotors. Encoder feedback is always required. • At least 160 % torque, even with the motor stopped • Maximum precision and concentric running characteristics right down to standstill • Servo characteristics and torque control even for asynchronous AC motors • Reacts to load changes within a few milliseconds

System bus (SBus)

The system bus (SBus) is available as standard. It permits several MOVIDRIVE® drive inverters to be networked together. As a result, data can be exchanged rapidly between the units. MOVILINK® – the uniform SEW unit profile – is used for communication via the SBus.

MOVILINK®

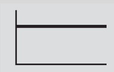
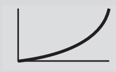
MOVILINK® means the same message structure is always used, irrespective of the interface selected (SBus, RS-232, RS-485, fieldbus interfaces). As a result, the control software is independent of the selected interface.

IPOS$^{plus®}$

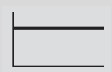
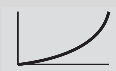
A significant feature of MOVIDRIVE® drive inverters is that the IPOS$^{plus®}$ positioning and sequence control system is integrated as standard. IPOS$^{plus®}$ enables you to control sequences of motion directly in the inverter, right on the plant floor. This takes the load off the master controller and allows modular concepts to be implemented more easily.

The units at a glance

MOVIDRIVE® MD_60A for 3 × 380 – 500 V_{AC} supply voltage (400/500 V units):

Recommended motor power (VFC)		**Continuous output current**	**MOVIDRIVE® type**			**Size**
		**(CFC)**	**MDF60A Asynchronous Without encoder**	**MDV60A Asynchronous With encoder**	**MDS60A Synchronous With resolver**	**(Techn. data)**
1.5 kW (2.0 HP)	2.2 kW (3.0 HP)	4.0 A_{AC}	0015-5A3-4-..	0015-5A3-4-..	0015-5A3-4-..	1 (→ page 22)
2.2 kW (3.0 HP)	3.0 kW (4.0 HP)	5.5 A_{AC}	0022-5A3-4-..	0022-5A3-4-..	0022-5A3-4-..	
3.0 kW (4.0 HP)	4.0 kW (5.0 HP)	7.0 A_{AC}	0030-5A3-4-..	0030-5A3-4-..	0030-5A3-4-..	
4.0 kW (5.0 HP)	5.5 kW (7.5 HP)	9.5 A_{AC}	0040-5A3-4-..	0040-5A3-4-..	0040-5A3-4-..	
5.5 kW (7.5 HP)	7.5 kW (10 HP)	12.5 A_{AC}	0055-5A3-4-..	0055-5A3-4-..	0055-5A3-4-..	2 (→ page 24)
7.5 kW (10 HP)	11 kW (15 HP)	16 A_{AC}	0075-5A3-4-..	0075-5A3-4-..	0075-5A3-4-..	
11 kW (15 HP)	15 kW (20 HP)	24 A_{AC}	0110-5A3-4-..	0110-5A3-4-..	0110-5A3-4-..	
15 kW (20 HP)	22 kW (30 HP)	32 A_{AC}	0150-503-4-..	0150-503-4-..	0150-503-4-..	3 (→ page 26)
22 kW (30 HP)	30 kW (40 HP)	46 A_{AC}	0220-503-4-..	0220-503-4-..	0220-503-4-..	
30 kW (40 HP)	37 kW (50 HP)	60 A_{AC}	0300-503-4-..	0300-503-4-..	0300-503-4-..	
37 kW (50 HP)	45 kW (60 HP)	73 A_{AC}	0370-503-4-..	0370-503-4-..	0370-503-4-..	4 (→ page 28)
45 kW (60 HP)	55 kW (75 HP)	89 A_{AC}	0450-503-4-..	0450-503-4-..	0450-503-4-..	
55 kW (75 HP)	75 kW (100 HP)	105 A_{AC}	0550-503-4-..	0550-503-4-..	0550-503-4-..	5 (→ page 30)
75 kW (100 HP)	90 kW (120 HP)	130 A_{AC}	0750-503-4-..	0750-503-4-..	0750-503-4-..	

MOVIDRIVE® MD_60A for 3 × 200 – 240 V_{AC} supply voltage (230 V units):

Recommended motor power (VFC)		**Continuous output current**	**MOVIDRIVE® type**		**Size**
		**(CFC)**	**MDF60A Asynchronous Without encoder**	**MDV60A Asynchronous With encoder**	**(Technical data)**
1.5 kW (2.0 HP)	2.2 kW (3.0 HP)	7.3 A_{AC}	0015-2A3-4-..	0015-2A3-4-..	1 (→ page 32)
2.2 kW (3.0 HP)	3.7 kW (5.0 HP)	8.6 A_{AC}	0022-2A3-4-..	0022-2A3-4-..	
3.7 kW (5.0 HP)	5.0 kW (6.8 HP)	14.5 A_{AC}	0037-2A3-4-..	0037-2A3-4-..	
5.5 kW (7.5 HP)	7.5 kW (10 HP)	22 A_{AC}	0055-2A3-4-..	0055-2A3-4-..	2 (→ page 34)
7.5 kW (10 HP)	11 kW (15 HP)	29 A_{AC}	0075-2A3-4-..	0075-2A3-4-..	
11 kW (15 HP)	15 kW (20 HP)	42 A_{AC}	0110-203-4-..	0110-203-4-..	3 (→ page 36)
15 kW (20 HP)	22 kW (30 HP)	54 A_{AC}	0150-203-4-..	0150-203-4-..	
22 kW (30 HP)	30 kW (40 HP)	80 A_{AC}	0220-203-4-..	0220-203-4-..	4 (→ page 38)
30 kW (40 HP)	37 kW (50 HP)	95 A_{AC}	0300-203-4-..	0300-203-4-..	

MOVIDRIVE® MDR60A regenerative power supply units for 400/500 V units:

Regenerative power supply units		**MOVIDRIVE® MDR60A**	**Size (technical data)**
1.5 – 37 kW (20 – 50 HP)	I_{system} = 66 A_{AC}, $I_{DC\ link}$ = 70 A_{DC}	0370-503-00	3 (→ Sec. 2.7.2)
15 – 75 kW (20 – 100 HP)	I_{system} = 117 A_{AC}, $I_{DC\ link}$ = 141 A_{DC}	0750-503-00	4 (→ Sec. 2.7.3)

Block circuit diagram

The following block circuit diagram shows the configuration principles and theory of operation of MOVIDRIVE® drive inverters.

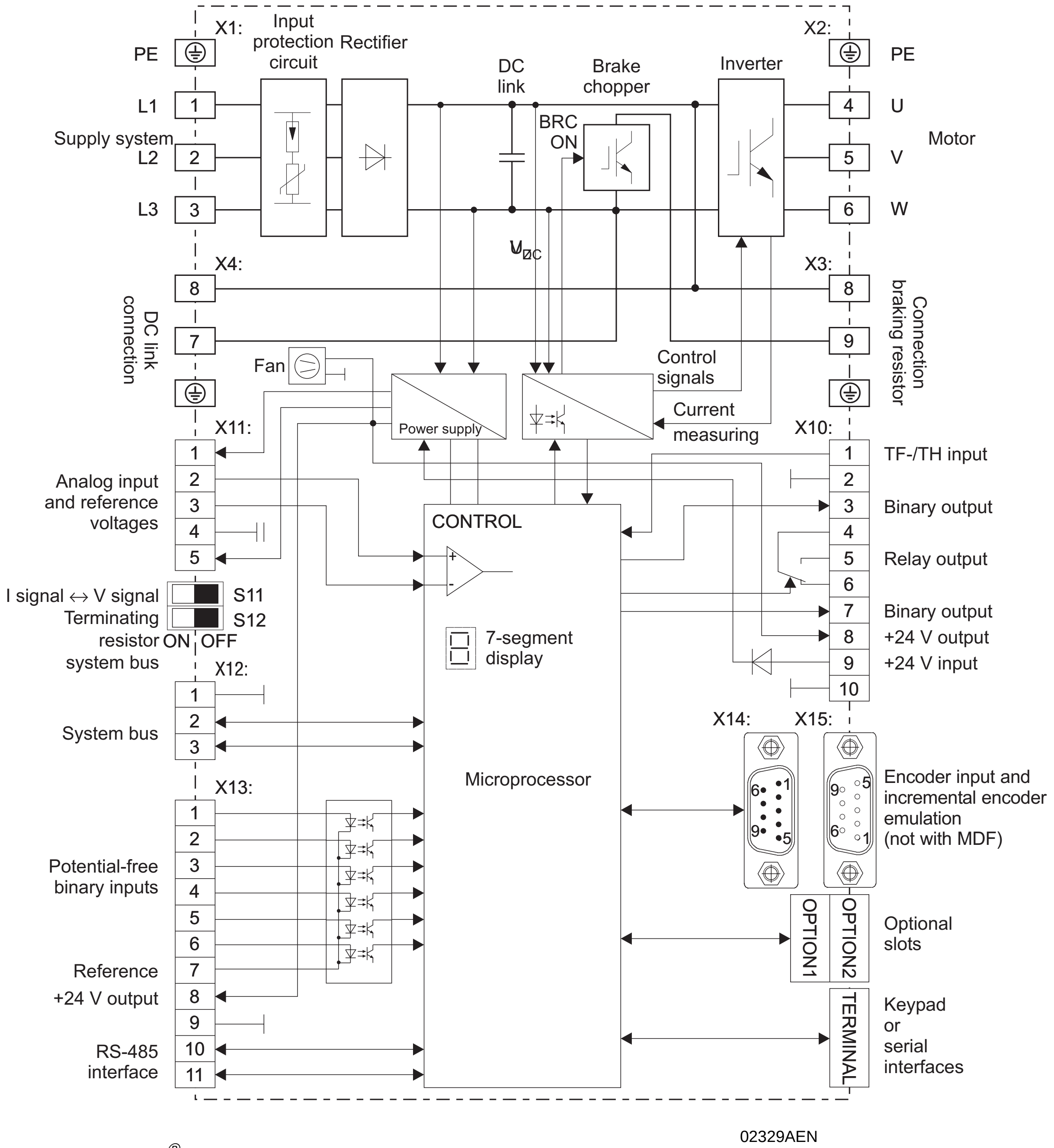


Fig. 3: MOVIDRIVE® block circuit diagram

2.2 Functions / features

Unit properties

- Wide voltage range
  - 400/500 V units for the voltage range 3 × 380 – 500 V_{AC}
  - 230 V units for the voltage range 3 × 200 – 240 V_{AC}
- High overload capacity
  - 150 % I_N for at least 60 s
  - 125 % I_N sustained for operation without overload (pumps, fans)
- In VFC mode and at I_N = 100 % permitted ambient temperature up to ϑ = 50 °C
- 4Q capability thanks to integrated brake chopper fitted as standard
- Compact unit mounting position for minimum switch cabinet space requirement and optimum utilization of switch cabinet volume
- Integrated input filter fitted as standard in sizes 1 and 2, adherence to class A limit on the input side without any additional measures
- 6 isolated binary inputs and 3 binary outputs, one of which is a relay output, programmable inputs/outputs
- 1 TF/TH input for the motor protection involving a PTC thermistor or thermocontact
- 7-segment display for operating and fault states
- Separate 24 V_{DC} voltage input for powering the inverter electronics (parameter setting, diagnosis and data storage even with the supply system switched off)
- Separable electronics terminals
- Power terminals of the size 1 units can be disconnected

Control functionality

- VFC or CFC control processes for field-oriented operation (asynchronous servo)
- IPOS$^{plus®}$ positioning and sequence control system integrated as standard
- 2 complete parameter sets
- Automatic motor calibration
- Automatic brake control by the inverter
- DC braking to decelerate the motor even in 1Q mode
- Slip compensation for high static accuracy of speed, even without encoder feedback
- Flying restart circuit for flying restart of the inverter
- Hoist capability with all motor systems which can be connected
- Motor pull-out protection by sliding current limitation in the field weakening range
- Speed window masking to avoid mechanical resonance ranges
- Heating current to prevent condensation forming in the motor
- Factory settings can be reactivated
- Parameter lock to protect against parameter changes
- Speed controller and encoder input in types MDV (encoder) and MDS (resolver), user-friendly controller setting tool in the user interface
- Protective feature for complete protection of the inverter and motor (short-circuit, overload, overvoltage/undervoltage, ground fault, excess temperature in the inverter, motor pull-out protection, excess temperature in the motor)
- Speed monitoring and monitoring of the motor and regenerative limit power
- Programmable signal range monitoring (speed, current, maximum current)
- Memory for storing x/t diagrams which can be displayed using the SCOPE process data visualization software (4 channels, real-time capable)

- Fault memory (5 memory locations) with all relevant operating data at the moment of the fault
- Elapsed-hour counter for ON-hours (unit connected to supply system or 24 V_{DC}) and enable hours (output stage energized)
- Modular option technology for application-specific unit configuration
- Uniform operation, identical parameter setting and the same unit connection technology for the entire MOVIDRIVE® unit series

Setpoint technology

- Ramp switch mode (total of 4 ramps)
- Motor potentiometer, can be combined with analog setpoint and internal fixed setpoints
- External setpoint selections: 0 – +10 V, ±10 V, 0 – 20 mA, 4 – 20 mA
- S-pattern for jerk-free speed changes
- Programmable input characteristic for flexible setpoint processing
- 6 bipolar fixed setpoints which can be mixed with external setpoints and motor potentiometer function

Communication / operation

- System bus for networking max. 64 MOVIDRIVE® units to one another
- RS-485 interface for communication between one PLC / IPC and up to 31 inverters
- Straightforward startup and parameter setting using keypad or PC

System expansion

- Extensive range of expansion options, for example:
  - Removable plain text keypad with parameter memory
  - RS-232 and RS-485 serial interfaces
  - Fieldbus interface, either PROFIBUS, INTERBUS, INTERBUS with fiber optic cable, CAN, CANopen or DeviceNet
  - Synchronous operation
  - Terminal expansion board
  - Absolute encoder interface
  - Braking resistors, input filters, line chokes, output chokes, output filters
- MOVITOOLS software package with SCOPE process data visualization
- Applications version with access to technology functions and activation of application modules for user-friendly application solutions
- MOVIDRIVE® MDR60A regenerative power supply unit
  - Regenerative energy is fed back into the supply system
  - This reduces the thermal load in the switch cabinet and helps to cut costs

Standards / certificates

- UL, cUL and C-Tick approved
- Safe separation of power and electronic connections according to EN 50178
- Compliance with all the requirements for CE certification of machines and systems equipped with MOVIDRIVE® on the basis of the EC Low-voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC. Compliance with EMC product standard EN 61800-3.

2.3 Additional functions of the applications version

SEW offers additional functions for special applications. You can use these additional functions in the applications versions (...-0T) of the MOVIDRIVE® units.

The following additional functions are available:

- Electronic cam disk
- Internal synchronous operation

Please refer to the "Cam Disk" and "Internal Synchronous Operation" manuals for detailed information about the additional functions. These manuals form part of the "Applications Version" documentation package which you can order from SEW.

Electronic cam disk

You can use the MOVIDRIVE® range of units with the "electronic cam disk" whenever you need to harmonize complex sequences of motion in cyclical machines. This solution gives you much greater flexibility in comparison to the mechanical cam disk, and therefore meets the needs of modern production and processing lines.

A user-friendly cam disk editor helps you during startup. You can also import existing cam data and set application-specific parameters for the engagement and disengagement phases using the cam disk editor as well.

Example

The figure below displays a typical application for the "electronic cam disk". Freshly filled yogurt pots are transported for further processing. The "electronic cam disk" makes it possible for movement to take place smoothly, which is an important requirement for this application.

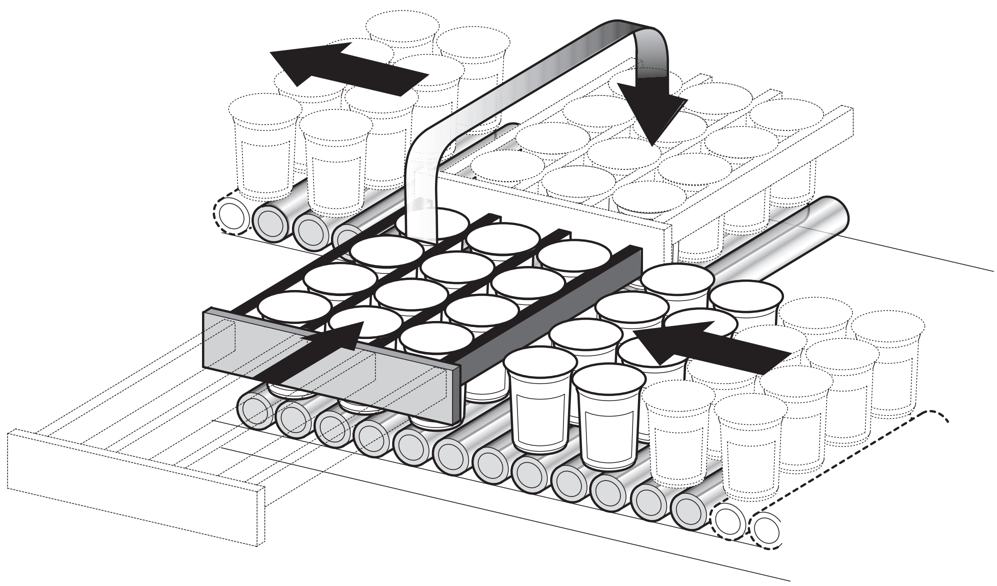


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Fig. 4: Typical application for the "electronic cam disk"

Internal synchronous operation

You can always use the MOVIDRIVE® range of units with "internal synchronous operation" whenever a group of motors have to be operated at a synchronous angle in relation to one another or with an adjustable proportional ratio (electronic gear). A user-friendly monitor helps you during startup.

Example

The figure below displays a typical application for "internal synchronous operation". Extruded material has to be cut to length. The saw receives a start signal and synchronizes itself with the extruded material. The saw moves synchronously to the extruded material as it cuts. The saw returns to its starting position at the end of the sawing operation.

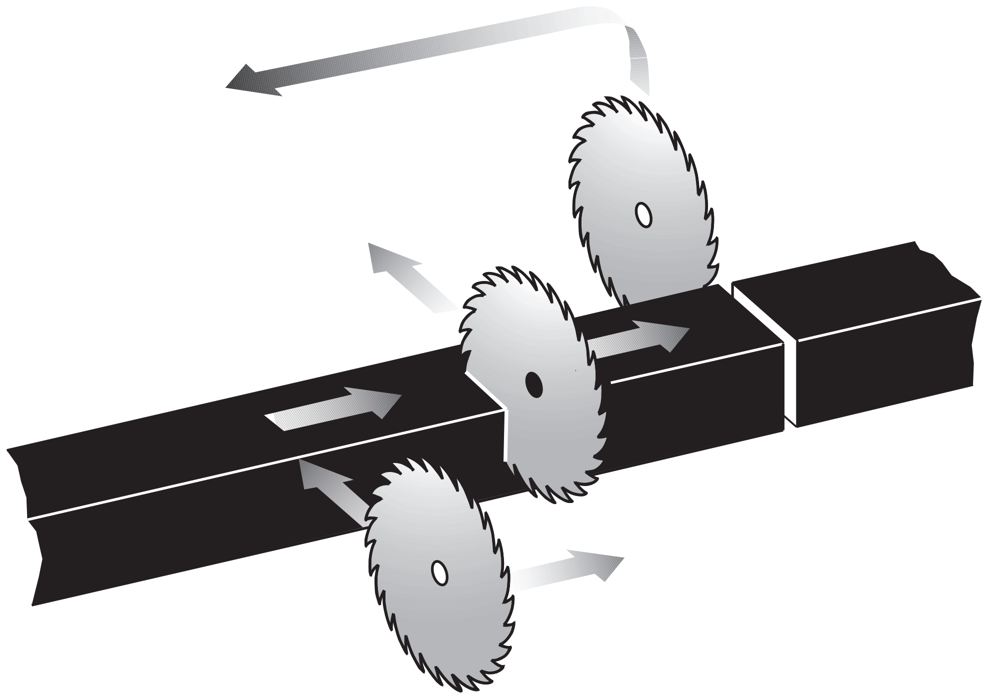

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Fig. 5: Typical application for "internal synchronous operation"

2.4 Application modules

The application

Usually, the application involves more than adjusting the speed of a motor. Often, the inverter is also required to control sequences of motion and undertake typical PLC tasks. More and more complex drive applications have to be carried out without resulting in lengthy project planning and startup routines.

The solution with MOVIDRIVE®

SEW offers various standardized control programs specifically for "positioning", "winding" and "controlling" applications. These programs are called application modules. The application modules form part of the MOVITOOLS software package and can be used with technology type units. A user-friendly interface leads you through the process of setting the parameters. All you have to do is enter the parameters you need for your application. The application modules uses this information to create the control program and loads it into the inverter. MOVIDRIVE® then undertakes all the movement control functions. This takes the load off the master controller and allows decentralized concepts to be implemented more easily.

The benefits at a glance

- Wide range of functions
- User-friendly user interface
- You only have to enter the parameters needed for the application
- User-friendly application programs guide you through the process of setting parameters, so there is no need for complicated programming
- No programming experience necessary
- No lengthy learning curve, therefore quick project planning and startup
- Control of all movement functions is performed directly in MOVIDRIVE®
- Decentralized concepts can be implemented more easily

Available application modules

The currently available application modules are listed below. These application modules are explained in the "Technical Data and Dimensions" chapter.

Positioning

Linear movement, the movement records are administered in the inverter:

- Table positioning
- Table positioning with bus control

Linear movement, the movement records are administered in the PLC:

- Positioning via bus
- Extended positioning via bus
- Absolute value positioning

Rotational movement:

- Rotary axis

Winding

- Central winder
- Winder with jockey roll control

Controlling

- Crane control
- Flying saw

Application

The following figure shows an example for how the various SEW applications modules are used in a block warehouse.

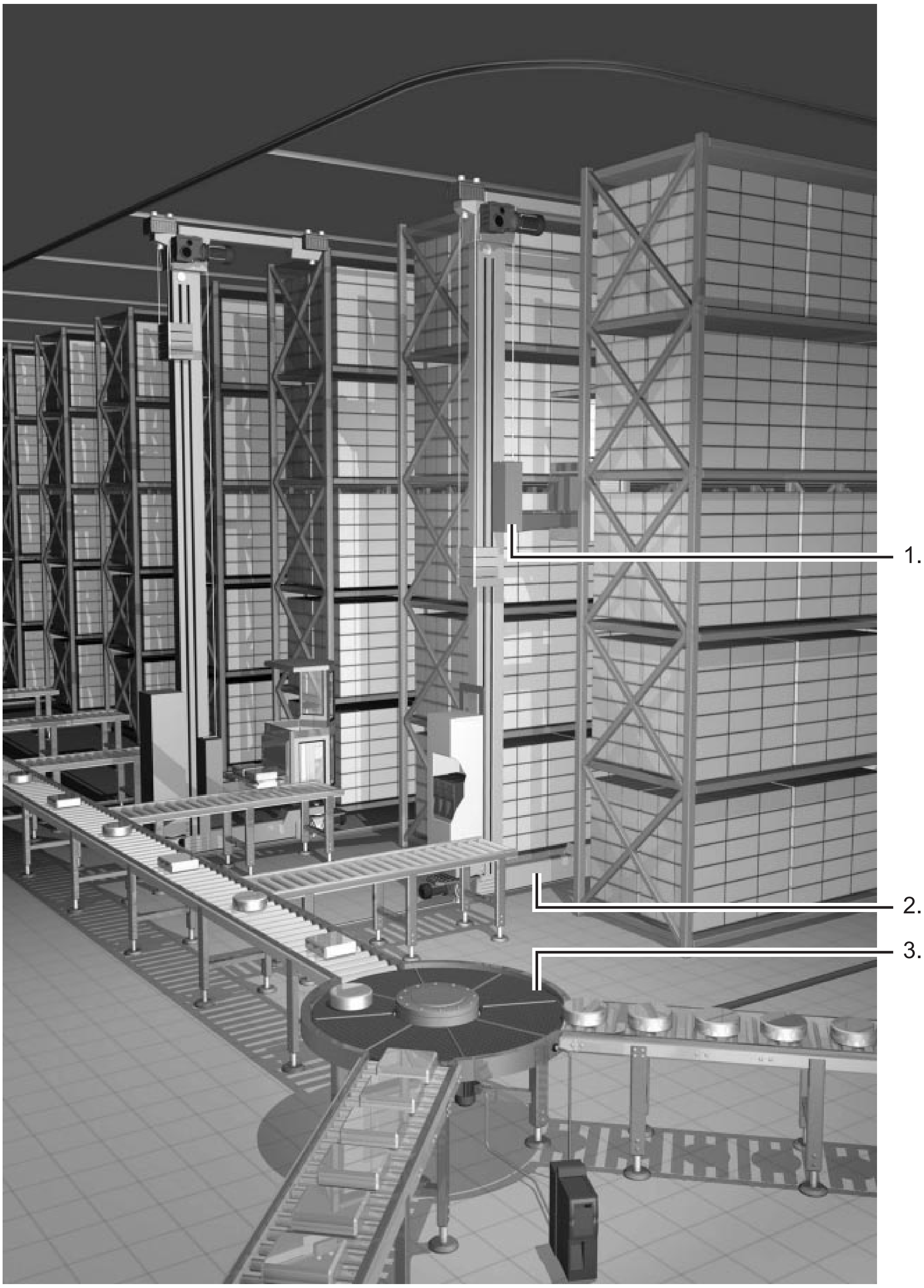

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Fig. 6: Application in a block warehouse

1. Hoist: Table positioning
2. Travel axis: Absolute value or bus positioning
3. Rotary distributor: Rotary axis

3 Technical Data and Dimensions

3.1 CE-marking, UL approval and unit designation

CE-marking

- Low-voltage Directive

  MOVIDRIVE® MD_60A drive inverters comply with the regulations of the Low-voltage Directive 73/23/EEC.
- Electromagnetic compatibility (EMC)

  The designated use of MOVIDRIVE® drive inverters and regenerative power supply units is as components for installation in machinery and systems. They comply with the EMC product standard EN 61800-3 "Variable-speed electrical drives". Provided the installation instructions are complied with, they satisfy the appropriate requirements for CE-marking of the entire machine/system in which they are fitted, on the basis of the EMC Directive 89/336/EEC.

  MOVIDRIVE® MD_60A drive inverters of size 1 and 2 are fitted with an input filter as standard. These units comply with limit value class A to EN 55011 and EN 55014 on the line side without further measures.

The CE-mark on the nameplate indicates conformity with the Low-voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC. We can issue a declaration of conformity to this effect on request.

UL approval

UL and cUL approval has been granted for the entire MOVIDRIVE® range of units. cUL is equivalent to CSA approval.

C-Tick

C-Tick approval has been granted for the entire MOVIDRIVE® range of units. C-Tick certifies conformity with the requirements of the ACA (Australian Communications Authority).

Unit designation

The following example illustrates the unit designation of MOVIDRIVE®:

MOVIDRIVE® MDV 60 A 0055-5A3-4-00

Version	00 = Standard / 0T = Technology
Quadrants	4 = 4Q (with brake chopper)
Type of supply	3 = 3-phase
Input filter	A = installed / 0 = not installed
Rated supply voltage	5 = 380...500 V_{AC} / 2 = 200...240 V_{AC}
Recommended motor power	0055 = 5.5 kW
Version A	
Type series and generation	

Type:
- MDF = flux control mode without encoder for asynchronous motors
  VFC operating modes (VFC = Voltage Flux Control) only
- MDV = field oriented control mode without and with encoder for asynchronous motors
  VFC and CFC operating modes (CFC = Current Flux Control)
- MDS = flux control mode with resolver for synchronous motors
  SERVO operating modes
- MDR = regenerative power supply unit

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3.2 General technical data

The following table lists the technical data applicable to all MOVIDRIVE® MD_60A drive inverters, irrespective of their type, version, size and performance.

MOVIDRIVE® MD_60A	All sizes
Interference immunity	To EN 61800-3
Interference emission with EMC-compliant installation	According to class B limit to EN 55011 and EN 55014 To EN 61800-3 Sizes 1 and 2 on line side according to class A limit to EN 55011 and EN 55014 without further measures
Ambient temperature ϑ_{amb} **Derating ambient temperature** **Climate class**	0 °C – +50 °C at I_D = 100 % I_N and f_{PWM} = 4 kHz (VFC mode) 0 °C – +40 °C at I_D = 125 % I_N and f_{PWM} = 4 kHz (VFC mode) 0 °C –+50 °C at I_D = 100 % I_N and f_{PWM} = 8 kHz (CFC mode) P_N reduction: 3.0 % I_N per K to max. 60 °C EN 60721-3-3, class 3K3
Storage temperature[1] ϑ_S	-25 °C – +70 °C (EN 60721-3-3, class 3K3) DBG keypad: -20 °C – +60 °C
Type of cooling (DIN 51751)	Forced-cooling
Enclosure EN 60529 (NEMA1) **Sizes1 to 3** **Sizes 4 and 5**	IP20 IP00 (power connections); IP10 with Plexiglas cover mounted (supplied as standard)
Operating mode	DB (EN 60149-1-1 and 1-3)
Installation altitude	h ≤ 1000 m (3300 ft) I_N reduction: 1 % per 100 m (330 ft) from 1000 m (3300 ft) to max. 2000 m (6600 ft)

1) Connect to supply voltage for min. 5 minutes every 2 years if stored for long periods, otherwise the unit's service life may be reduced.

MOVIDRIVE® MD_60A range of units

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Fig. 7: MOVIDRIVE® MD_60A range of units

3.3 MOVIDRIVE® MD_60A...-5_3 (400/500 V units)

Size 1

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Fig. 8: Size 1

MOVIDRIVE® MD_60A		0015-5A3-4-0_	0022-5A3-4-0_	0030-5A3-4-0_	0040-5A3-4-0_
INPUT					
Supply voltage	V_{in}	3×380 V_{AC}-10 % – 3×500 V_{AC}+10 %			
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %			
Rated system current[1] I_{in} (at $V_{in} = 3 \times 400$ V_{AC})	**100 %** **125 %**	3.6 A_{AC} 4.5 A_{AC}	5.0 A_{AC} 6.2 A_{AC}	6.3 A_{AC} 7.9 A_{AC}	8.6 A_{AC} 10.7 A_{AC}
OUTPUT					
Output rated power[2] (at $V_{in} = 3 \times 380 – 500$ V_{AC})	P_N	2.8 kVA	3.8 kVA	4.9 kVA	6.6 kVA
Output rated current[1] (at $V_{in} = 3 \times 400$ V_{AC})	I_N	4.0 A_{AC}	5.5 A_{AC}	7.0 A_{AC}	9.5 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization			
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)			
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	68 Ω			
Output voltage	V_{out}	max. V_{in}			
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz			
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range			
GENERAL					
Power loss at P_N	P_{Vmax}	85 W	105 W	130 W	180 W
Cooling air consumption		40 m^3/h (24 ft^3/min)			
Weight		3.5 kg (7.72 lb)			
Dimensions	**W × H × D**	105 × 315 × 273 mm (4.13 × 12.40 × 10.75 in)			

1) The system and output currents must be reduced by 20 % from the nominal values for $V_{in} = 3 \times 500$ V_{AC}.

2) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0015-5A3-4-00	0022-5A3-4-00	0030-5A3-4-00	0040-5A3-4-00
Part number	826 464 3	826 465 1	826 466 X	826 467 8
MDF60A technology type (VFC)	**0015-5A3-4-0T**	**0022-5A3-4-0T**	**0030-5A3-4-0T**	**0040-5A3-4-0T**
Part number	827 322 7	827 323 5	827 324 3	827 325 1
Constant load Rec. motor power P_{Mot}	1.5 kW (2.0 HP)	2.2 kW (3.0 HP)	3.0 kW (4.0 HP)	4.0 kW (5.0 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	2.2 kW (3.0 HP)	3.0 kW (4.0 HP)	4.0 kW (5.0 HP)	5.5 kW (7.5 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 400 V_{AC} and f_{PWM} = 4 kHz)	5.0 A_{AC}	6.9 A_{AC}	8.8 A_{AC}	11.9 A_{AC}

MDV60A standard type (VFC/CFC)	0015-5A3-4-00	0022-5A3-4-00	0030-5A3-4-00	0040-5A3-4-00
Part number	826 481 3	826 482 1	826 483 X	826 484 8
MDV60A technology type (VFC/CFC)	**0015-5A3-4-0T**	**0022-5A3-4-0T**	**0030-5A3-4-0T**	**0040-5A3-4-0T**
Part number	827 336 7	827 337 5	827 338 3	827 339 1
VFC operating mode	Recommended motor power → MDF60A			
CFC operating mode Continuous output current = 100 % $I_N I_D$	4.0 A_{AC}	5.5 A_{AC}	7.0 A_{AC}	9.5 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection			

MDS60A standard type (SERVO)	0015-5A3-4-00	0022-5A3-4-00	0030-5A3-4-00	0040-5A3-4-00
Part number	826 498 8	826 499 6	826 500 3	826 501 1
MDS60A technology type (SERVO)	**0015-5A3-4-0T**	**0022-5A3-4-0T**	**0030-5A3-4-0T**	**0040-5A3-4-0T**
Part number	827 350 2	827 351 0	827 352 9	827 353 7
Continuous output current = 100 % $I_N I_D$	4.0 A_{AC}	5.5 A_{AC}	7.0 A_{AC}	9.5 A_{AC}
Recommended motor power	→ Sec. Project Planning, SERVO motor selection			

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

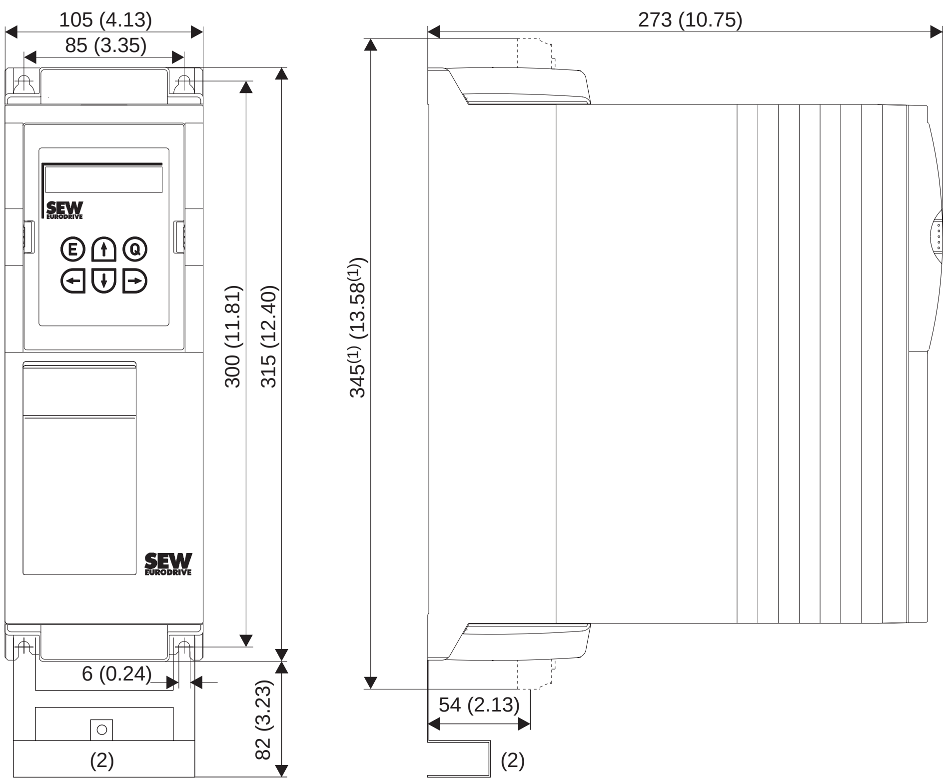


Fig. 9: Dimensions, size 1, in mm (in)

(1) Unit dimension with power terminals attached
(2) Power shield clamp

Size 2

00893AXX

Fig. 10: Size 2

MOVIDRIVE® MD_60A		0055-5A3-4-0_	0075-5A3-4-0_	0110-5A3-4-0_
INPUT				
Supply voltage	V_{in}	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$+10 %		
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %		
Rated system current[1] I_{in} (at $V_{in} = 3 \times 400\ V_{AC}$)	**100 %** **125 %**	11.3 A_{AC} 14.1 A_{AC}	14.4 A_{AC} 18.0 A_{AC}	21.6 A_{AC} 27.0 A_{AC}
OUTPUT				
Output rated power[2] (at $V_{in} = 3 \times 380 - 500\ V_{AC}$)	P_N	8.7 kVA	11.2 kVA	16.8 kVA
Output rated current[1] (at $V_{in} = 3 \times 400\ V_{AC}$)	I_N	12.5 A_{AC}	16 A_{AC}	24 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization		
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)		
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	47 Ω		22 Ω
Output voltage	V_{out}	max. V_{in}		
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz		
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range		
GENERAL				
Power loss at P_N	P_{Vmax}	220 W	290 W	400 W
Cooling air consumption		80 m^3/h (48 ft^3/min)		
Weight		6.6 kg (14.55 lb)		
Dimensions	**W × H × D**	130 × 336 × 325 mm (5.12 × 13.23 × 12.80 in)		

1) The system and output currents must be reduced by 20 % from the nominal values for $V_{in} = 3 \times 500\ V_{AC}$.

2) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0055-5A3-4-00	0075-5A3-4-00	0110-5A3-4-00
Part number	826 468 6	826 470 8	826 472 4
MDF60A technology type (VFC)	**0055-5A3-4-0T**	**0075-5A3-4-0T**	**0110-5A3-4-0T**
Part number	827 326 X	827 327 8	827 328 6
Constant load Rec. motor power P_{Mot}	5.5 kW (7.5 HP)	7.5 kW (10 HP)	11 kW (15 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	7.5 kW (10 HP)	11 kW (15 HP)	15 kW (20 HP)
Continuous output current = 125 % $I_N$$I_D$ (at V_{in} = 3 × 400 V_{AC} and f_{PWM} = 4 kHz)	15.6 A_{AC}	20.0 A_{AC}	30.0 A_{AC}

MDV60A standard type (VFC/CFC)	0055-5A3-4-00	0075-5A3-4-00	0110-5A3-4-00
Part number	826 485 6	826 487 2	826 489 9
MDV60A technology type (VFC/CFC)	**0055-5A3-4-0T**	**0075-5A3-4-0T**	**0110-5A3-4-0T**
Part number	827 340 5	827 341 3	827 342 1
VFC operating mode	Recommended motor power → MDF60A		
CFC operating mode Continuous output current = 100 % $I_N$$I_D$	12.5 A_{AC}	16 A_{AC}	24 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection		

MDS60A standard type (SERVO)	0055-5A3-4-00	0075-5A3-4-00	0110-5A3-4-00
Part number	826 502 X	826 504 6	826 506 2
MDS60A technology type (SERVO)	**0055-5A3-4-0T**	**0075-5A3-4-0T**	**0110-5A3-4-0T**
Part number	827 354 5	827 355 3	827 356 1
Continuous output current = 100 % $I_N$$I_D$	12.5 A_{AC}	16 A_{AC}	24 A_{AC}
Recommended motor power	→ Sec. Project Planning, SERVO motor selection		

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit dimension 315 mm (12.40 in) = contour of the power supply unit. No clearance is required at the sides; the units can be lined up in rows.

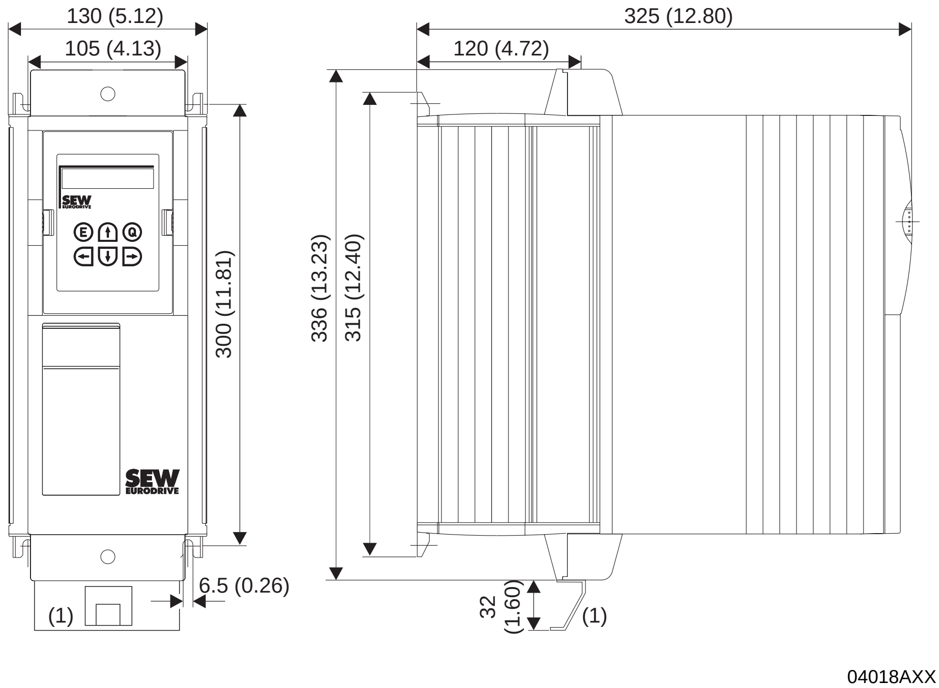


Fig. 11: Dimensions, size 2, in mm (in)

(1) Power shield clamp

Size 3

01246AXX

Fig. 12: Size 3

MOVIDRIVE® MD_60A			0150-503-4-0_	0220-503-4-0_	0300-503-4-0_
INPUT					
Supply voltage	V_{in}		$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$+10 %		
Supply frequency	f_{in}		50 Hz – 60 Hz ±5 %		
Rated system current[1] (at $V_{in} = 3 \times 400\ V_{AC}$)	I_{in}	100 % 125 %	28.8 A_{AC} 36.0 A_{AC}	41.4 A_{AC} 51.7 A_{AC}	54.0 A_{AC} 67.5 A_{AC}
OUTPUT					
Output rated power[2] (at V_{in} = 3×380 – 500 V_{AC})	P_N		22.2 kVA	31.9 kVA	41.6 kVA
Output rated current[1] (at $V_{in} = 3 \times 400\ V_{AC}$)	I_N		32 A_{AC}	46 A_{AC}	60 A_{AC}
Current limitation	I_{max}		Motor and regenerative 150 % I_N, duration depending on the capacity utilization		
Internal current limitation			I_{max} = 0 – 150 % can be set in menu (P303 / P313)		
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}		15 Ω		12 Ω
Output voltage	V_{out}		max. V_{in}		
PWM frequency	f_{PWM}		Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz		
Speed range / resolution	n_A / Δn_A		-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range		
GENERAL					
Power loss at P_N	P_{Vmax}		550 W	750 W	950 W
Cooling air consumption			180 m^3/h (108 ft^3/min)		
Weight			15 kg (33.07 lb)		
Dimensions	W × H × D		200 × 465 × 345 mm (7.87 × 18.31 × 13.58 in)		

1) The system and output currents must be reduced by 20 % from the nominal values for $V_{in} = 3 \times 500\ V_{AC}$.

2) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

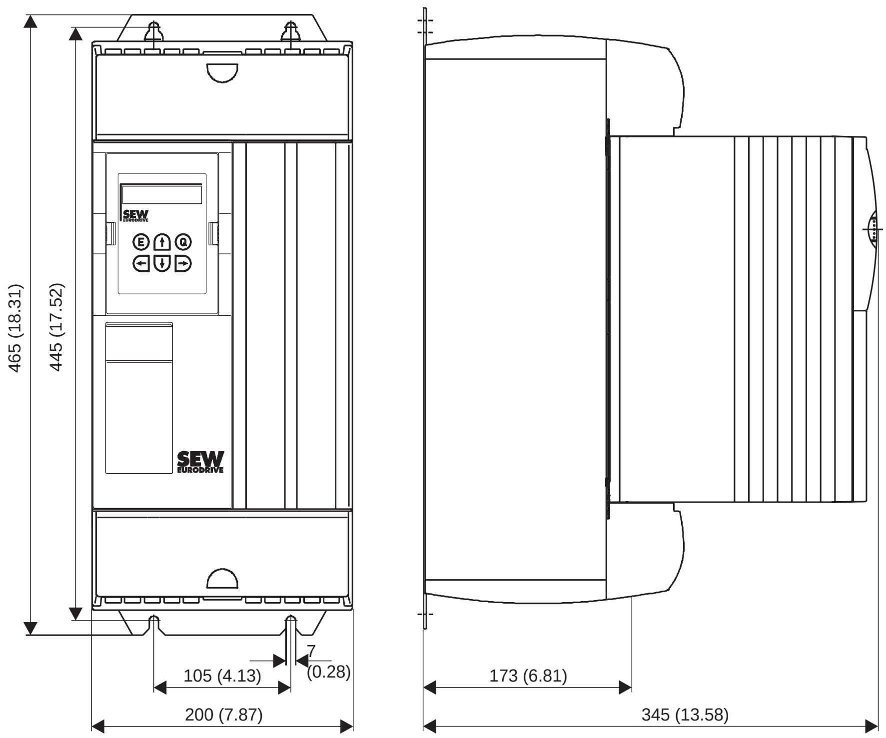
MDF60A standard type (VFC)	0150-503-4-00	0220-503-4-00	0300-503-4-00
Part number	826 474 0	826 475 9	826 476 7
MDF60A technology type (VFC)	0150-503-4-0T	0220-503-4-0T	0300-503-4-0T
Part number	827 329 4	827 330 8	827 331 6
Constant load Rec. motor power P_{Mot}	15 kW (20 HP)	22 kW (30 HP)	30 kW (40 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	22 kW (30 HP)	30 kW (40 HP)	37 kW (50 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 400 V_{AC} and f_{PWM} = 4 kHz)	40.0 A_{AC}	57.5 A_{AC}	75.0 A_{AC}

MDV60A standard type (VFC/CFC)	0150-503-4-00	0220-503-4-00	0300-503-4-00
Part number	826 491 0	826 492 9	826 493 7
MDV60A technology type (VFC/CFC)	0150-503-4-0T	0220-503-4-0T	0300-503-4-0T
Part number	827 343 X	827 344 8	827 345 6
VFC operating mode	Recommended motor power → MDF60A		
CFC operating mode Continuous output current = 100 % $I_N I_D$	32 A_{AC}	46 A_{AC}	60 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection		

MDS60A standard type (SERVO)	0150-503-4-00	0220-503-4-00	0300-503-4-00
Part number	826 508 9	826 509 7	826 510 0
MDS60A technology type (SERVO)	0150-503-4-0_	0220-503-4-0_	0300-503-4-0_
Part number	827 357 X	827 358 8	827 359 6
Continuous output current = 100 % $I_N I_D$	32 A_{AC}	46 A_{AC}	60 A_{AC}
Recommended motor power	→ Sec. Project Planning, SERVO motor selection		

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.



01243BXX

Fig. 13: Dimensions, size 3, in mm (in)

Size 4

01247AXX

Fig. 14: Size 4

MOVIDRIVE® MD_60A		0370-503-4-0_	0450-503-4-0_
INPUT			
Supply voltage	V_{in}	3 × 380 V_{AC}-10 % – 3 × 500 V_{AC}+10 %	
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %	
Rated system current[1] I_{in} (at V_{in} = 3 × 400 V_{AC})	100 % 125 %	65.7 A_{AC} 81.9 A_{AC}	80.1 A_{AC} 100.1 A_{AC}
OUTPUT			
Output rated power[2] (at V_{in} = 3×380 – 500 V_{AC})	P_N	51.1 kVA	62.3 kVA
Output rated current[1] (at V_{in} = 3 × 400 V_{AC})	I_N	73 A_{AC}	89 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization	
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)	
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	6 Ω	
Output voltage	V_{out}	max. V_{in}	
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz	
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range	
GENERAL			
Power loss at P_N	P_{Vmax}	1200 W	1450 W
Cooling air consumption		180 m^3/h (108 ft^3/min)	
Weight		27 kg (59.53 lb)	
Dimensions	W × H × D	280 × 522 × 345 mm (11.02 × 20.55 × 13.58 in)	

1) The system and output currents must be reduced by 20 % from the nominal values for V_{in} = 3 × 500 V_{AC}.

2) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0370-503-4-00	0450-503-4-00
Part number	826 477 5	826 478 3
MDF60A technology type (VFC)	0370-503-4-0T	0450-503-4-0T
Part number	827 332 4	827 333 2
Constant load Rec. motor power P_{Mot}	37 kW (50 HP)	45 kW (60 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	45 kW (60 HP)	55 kW (75 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 400 V_{AC} and f_{PWM} = 4 kHz)	91 A_{AC}	111 A_{AC}

MDV60A standard type (VFC/CFC)	0370-503-4-00	0450-503-4-00
Part number	826 494 5	826 495 3
MDV60A technology type (VFC/CFC)	0370-503-4-0T	0450-503-4-0T
Part number	827 346 4	827 347 2
VFC operating mode	Recommended motor power → MDF60A	
CFC operating mode Continuous output current = 100 % $I_N I_D$	73 A_{AC}	89 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection	

MDS60A standard type (SERVO)	0370-503-4-00	0450-503-4-00
Part number	826 555 0	826 642 5
MDS60A technology type (SERVO)	0370-503-4-0T	0450-503-4-0T
Part number	827 360 X	827 361 8
Continuous output current = 100 % $I_N I_D$	73 A_{AC}	89 A_{AC}
Recommended motor power	→ Sec. Project Planning, SERVO motor selection	

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

Do not install any components which are sensitive to high temperatures within 300 mm (11.81 in) of the top of the unit (e.g. contactors or fuses).

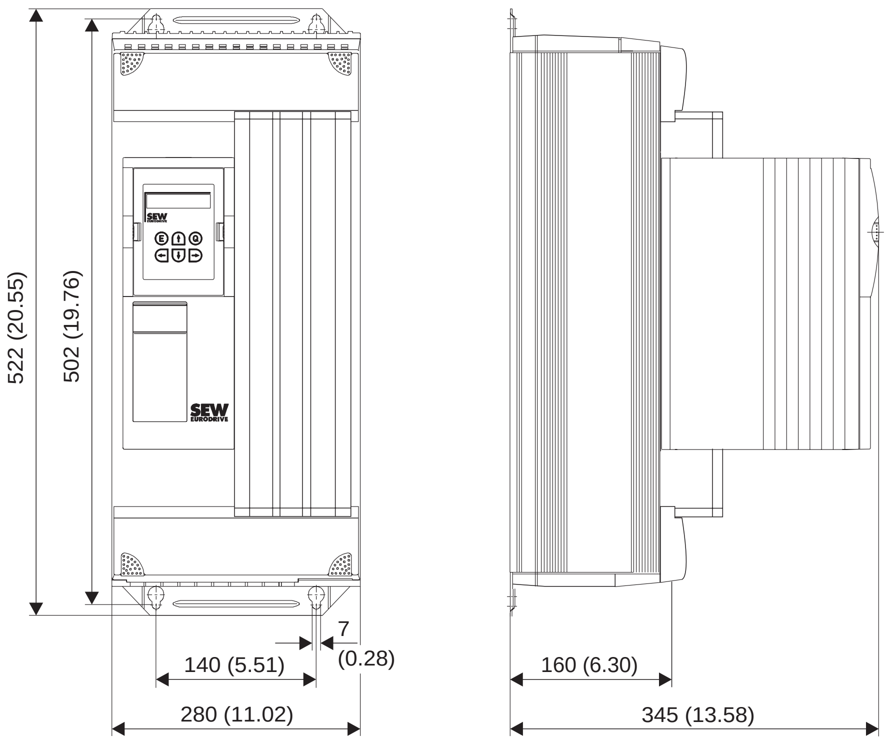


Fig. 15: Dimensions, size 4, in mm (in)

Size 5

00894AXX

Fig. 16: Size 5

MOVIDRIVE® MD_60A		0550-503-4-0_	0750-503-4-0_
INPUT			
Supply voltage	V_{in}	3 × 380 V_{AC}-10 % – 3 × 500 V_{AC}+10 %	
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %	
Rated system current[1] I_{in} (at V_{in} = 3 × 400 V_{AC})	**100 %** **125 %**	94.5 A_{AC} 118.1 A_{AC}	117.0 A_{AC} 146.3 A_{AC}
OUTPUT			
Output rated power[2] (at V_{in} = 3×380 – 500 V_{AC})	P_N	73.5 kVA	91.0 kVA
Output rated current[1] (at V_{in} = 3 × 400 V_{AC})	I_N	105 A_{AC}	130 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization	
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)	
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	6 Ω	4 Ω
Output voltage	V_{out}	max. V_{in}	
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz	
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range	
GENERAL			
Power loss at P_N	P_{Vmax}	1700 W	2000 W
Cooling air consumption		360 m^3/h (216 ft^3/min)	
Weight		35 kg (77.18 lb)	
Dimensions	**W × H × D**	280 × 610 × 345 mm (11.02 × 24.02 × 13.58 in)	

1) The system and output currents must be reduced by 20 % from the nominal values for V_{in} = 3 × 500 V_{AC}.

2) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

3

MDF60A standard type (VFC)	0550-503-4-00	0750-503-4-00
Part number	826 479 1	826 480 5
MDF60A technology type (VFC)	0550-503-4-0T	0750-503-4-0T
Part number	827 334 0	827 335 9
Constant load Rec. motor power P_{Mot}	55 kW (75 HP)	75 kW (100 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	75 kW (100 HP)	90 kW (120 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 400 V_{AC} and f_{PWM} = 4 kHz)	131 A_{AC}	162 A_{AC}

MDV60A standard type (VFC/CFC)	0550-503-4-00	0750-503-4-00
Part number	826 496 1	826 497 X
MDV60A technology type (VFC/CFC)	0550-503-4-0T	0750-503-4-0T
Part number	827 348 0	827 349 9
VFC operating mode	Recommended motor power → MDF60A	
CFC operating mode Continuous output current = 100 % $I_N I_D$	105 A_{AC}	130 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection	

MDS60A standard type (SERVO)	0550-503-4-00	0750-503-4-00
Part number	826 643 3	826 644 1
MDS60A technology type (SERVO)	0550-503-4-0T	0750-503-4-0T
Part number	827 362 6	827 363 4
Continuous output current = 100 % $I_N I_D$	105 A_{AC}	130 A_{AC}
Recommended motor power	→ Sec. Project Planning, SERVO motor selection	

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

Do not install any components which are sensitive to high temperatures within 300 mm (11.81 in) of the top of the unit (e.g. contactors or fuses).

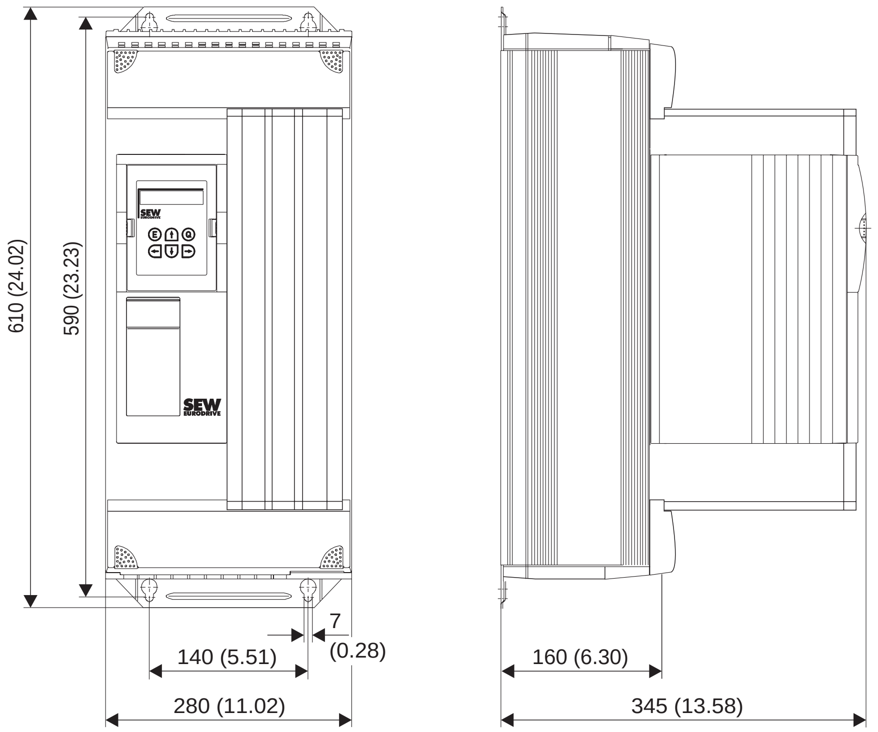


Fig. 17: Dimensions, size 5, in mm (in)

3.4 MOVIDRIVE® MD_60A...-2_3 (230 V units)

Size 1

00892AXX

Fig. 18: Size 1

MOVIDRIVE® MD_60A		0015-2A3-4-0_	0022-2A3-4-0_	0037-2A3-4-0_
INPUT				
Supply voltage	V_{in}	$3 \times 200\ V_{AC}$-10 % – $3 \times 240\ V_{AC}$+10 %		
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %		
Rated system current I_{in} **(at** $V_{in} = 3 \times 230\ V_{AC}$**)**	**100 %** **125 %**	$6.7\ A_{AC}$ $8.4\ A_{AC}$	$7.8\ A_{AC}$ $9.8\ A_{AC}$	$12.9\ A_{AC}$ $16.1\ A_{AC}$
OUTPUT				
Output rated power[1] **(at** $V_{in} = 3 \times 200 - 240\ V_{AC}$**)**	P_N	2.7 kVA	3.4 kVA	5.8 kVA
Output rated current (at $V_{in} = 3 \times 230\ V_{AC}$**)**	I_N	$7.3\ A_{AC}$	$8.6\ A_{AC}$	$14.5\ A_{AC}$
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization		
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)		
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	27 Ω		
Output voltage	V_{out}	max. V_{in}		
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC fixed at 8 kHz		
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range		
GENERAL				
Power loss at P_N	P_{Vmax}	110 W	126 W	210 W
Cooling air consumption		40 m^3/h (24 ft^3/min)		
Weight		3.5 kg (7.72 lb)		
Dimensions	**W × H × D**	105 × 315 × 273 mm (4.13 × 12.40 × 10.75 in)		

1) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0015-2A3-4-00	0022-2A3-4-00	0037-2A3-4-00
Part number	826 719 7	826 720 0	826 721 9
MDF60A technology type (VFC)	0015-2A3-4-0T	0022-2A3-4-0T	0037-2A3-4-0T
Part number	827 364 2	827 365 0	827 366 9
Constant load Rec. motor power P_{Mot}	1.5 kW (2.0 HP)	2.2 kW (3.0 HP)	3.7 kW (5.0 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	2.2 kW (3.0 HP)	3.7 kW (5.0 HP)	5.0 kW (6.8 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 230 V_{AC} and f_{PWM} = 4 kHz)	9.1 A_{AC}	10.8 A_{AC}	18.1 A_{AC}

MDV60A standard type (VFC/CFC)	0015-2A3-4-00	0022-2A3-4-00	0037-2A3-4-00
Part number	826 725 1	826 726 X	826 727 8
MDV60A technology type (VFC/CFC)	0015-2A3-4-0T	0022-2A3-4-0T	0037-2A3-4-0T
Part number	827 373 1	827 374 X	827 375 8
VFC operating mode	Recommended motor power → MDF60A		
CFC operating mode Continuous output current = 100 % $I_N I_D$	7.3 A_{AC}	8.6 A_{AC}	14.5 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection		

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

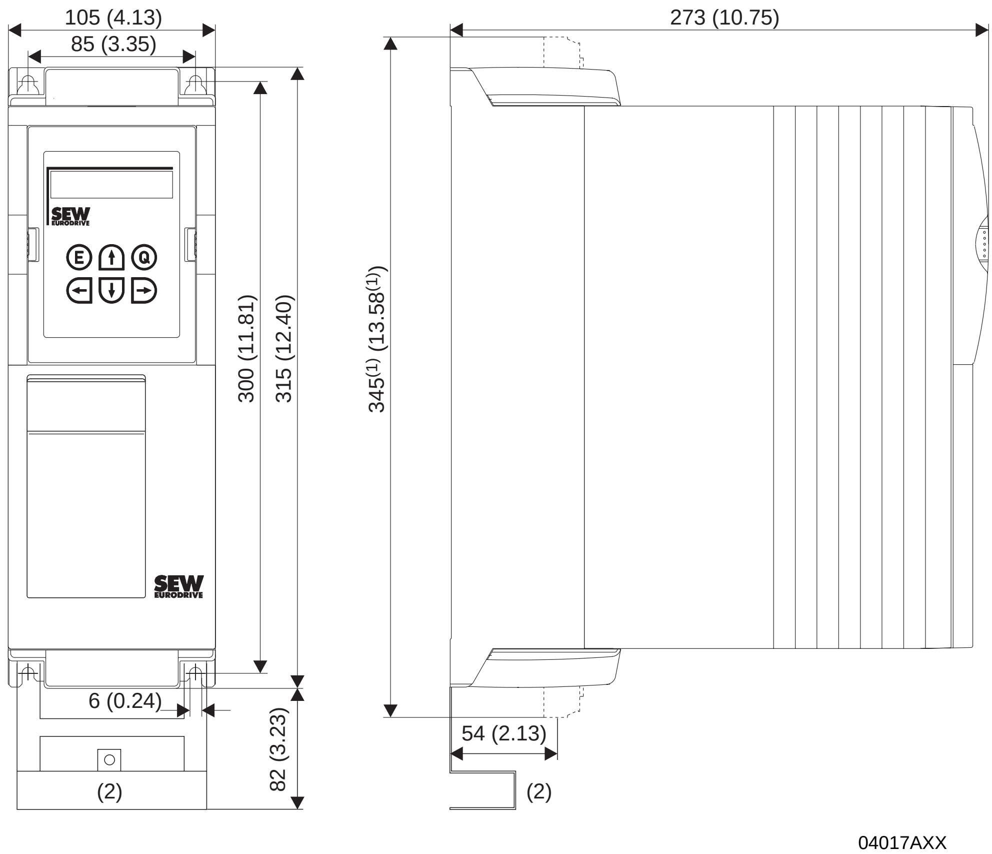


Fig. 19: Dimensions, size 1, in mm (in)

(1) Unit dimension with power terminals attached
(2) Power shield clamp

Size 2

00893AXX

Fig. 20: Size 2

MOVIDRIVE® MD_60A		0055-2A3-4-0_	0075-2A3-4-0_
INPUT			
Supply voltage	V_{in}	$3 \times 200\ V_{AC}$-10 % – $3 \times 240\ V_{AC}$+10 %	
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %	
Rated system current I_{in} (at $V_{in} = 3 \times 230\ V_{AC}$)	**100 % 125 %**	$19.5\ A_{AC}$ $24.4\ A_{AC}$	$27.4\ A_{AC}$ $34.3\ A_{AC}$
OUTPUT			
Output rated power[1)] (at $V_{in} = 3{\times}200 – 240\ V_{AC}$)	P_N	8.8 kVA	11.6 kVA
Output rated current (at $V_{in} = 3 \times 230\ V_{AC}$)	I_N	$22\ A_{AC}$	$29\ A_{AC}$
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization	
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)	
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	12 Ω	
Output voltage	V_{out}	max. V_{in}	
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC fixed at 8 kHz	
Speed range / resolution	$n_A / \Delta n_A$	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range	
GENERAL			
Power loss at P_N	P_{Vmax}	300 W	380 W
Cooling air consumption		$80\ m^3/h\ (48\ ft^3/min)$	
Weight		6.6 kg (14.55 lb)	
Dimensions	**W × H × D**	130 × 336 × 325 mm (5.12 × 13.23 × 12.80 in)	

1) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0055-2A3-4-00	0075-2A3-4-00
Part number	826 722 7	826 723 5
MDF60A technology type (VFC)	0055-2A3-4-0T	0075-2A3-4-0T
Part number	827 367 7	827 368 5
Constant load Rec. motor power P_{Mot}	5.5 kW (7.5 HP)	7.5 kW (10 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	7.5 kW (10 HP)	11 kW (15 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 230 V_{AC} and f_{PWM} = 4 kHz)	27.5 A_{AC}	36.3 A_{AC}

MDV60A standard type (VFC/CFC)	0055-2A3-4-00	0075-2A3-4-00
Part number	826 728 6	826 729 4
MDV60A technology type (VFC/CFC)	0055-2A3-4-0T	0075-2A3-4-0T
Part number	827 376 6	827 377 4
VFC operating mode	Recommended motor power → MDF60A	
CFC operating mode Continuous output current = 100 % $I_N I_D$	22 A_{AC}	29 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection	

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit dimension 315 mm (12.40 in) = contour of the power supply unit. No clearance is required at the sides; the units can be lined up in rows.

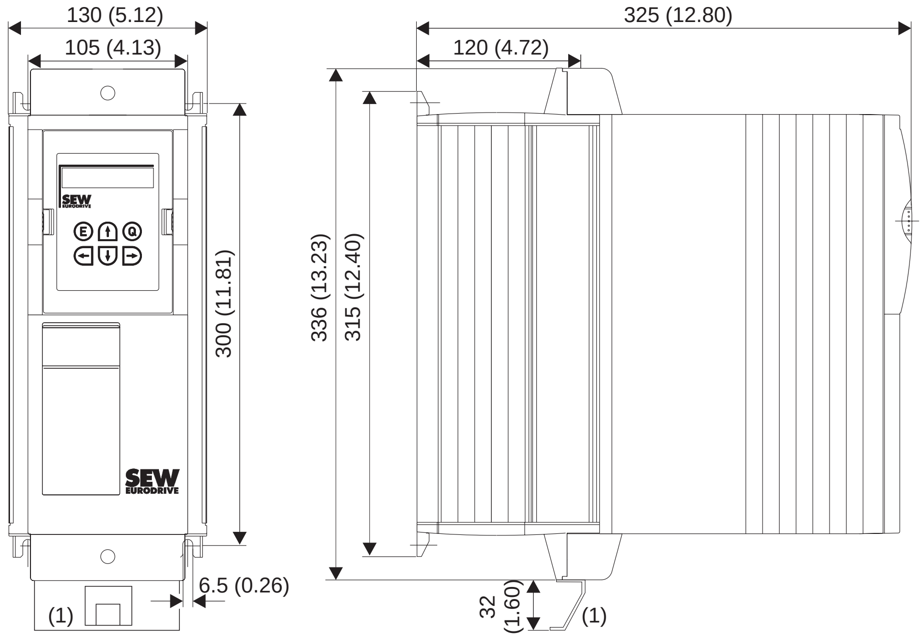


Fig. 21: Dimensions, size 2, in mm (in)

(1) Power shield clamp

Size 3

00893BXX

Fig. 22: Size 3

MOVIDRIVE® MD_60A		0110-203-4-0_	0150-203-4-0_
INPUT			
Supply voltage	V_{in}	3 × 200 V_{AC}-10 % – 3 × 240 V_{AC}+10 %	
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %	
Rated system current I_{in} **(at** V_{in} **= 3 × 230** V_{AC}**)**	100 % 125 %	40.0 A_{AC} 50.0 A_{AC}	49.0 A_{AC} 61.0 A_{AC}
OUTPUT			
Output rated power[1] **(at** V_{in} **= 3×200 – 240** V_{AC}**)**	P_N	17.1 kVA	21.5 kVA
Output rated current (at V_{in} **= 3 × 230** V_{AC}**)**	I_N	42 A_{AC}	54 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization	
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)	
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	7.5 Ω	5.6 Ω
Output voltage	V_{out}	max. V_{in}	
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz	
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range	
GENERAL			
Power loss at P_N	P_{Vmax}	580 W	720 W
Cooling air consumption		180 m^3/h (108 ft^3/min)	
Weight		15 kg (33.07 lb)	
Dimensions	W × H × D	200 × 465 × 345 mm (7.87 × 18.31 × 13.58 in)	

1) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0110-203-4-00	0150-203-4-00
Part number	826 724 3	827 176 3
MDF60A technology type (VFC)	**0110-203-4-0T**	**0150-203-4-0T**
Part number	827 369 3	827 370 7
Constant load Rec. motor power P_{Mot}	11 kW (15 HP)	15 kW (20 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	15 kW (20 HP)	22 kW (30 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 230 V_{AC} and f_{PWM} = 4 kHz)	52.5 A_{AC}	67.5 A_{AC}

MDV60A standard type (VFC/CFC)	0110-203-4-00	0150-203-4-00
Part number	826 730 8	827 260 3
MDV60A technology type (VFC/CFC)	**0110-203-4-0T**	**0150-203-4-0T**
Part number	827 378 2	827 379 0
VFC operating mode	Recommended motor power → MDF60A	
CFC operating mode Continuous output current = 100 % $I_N I_D$	42 A_{AC}	54 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection	

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

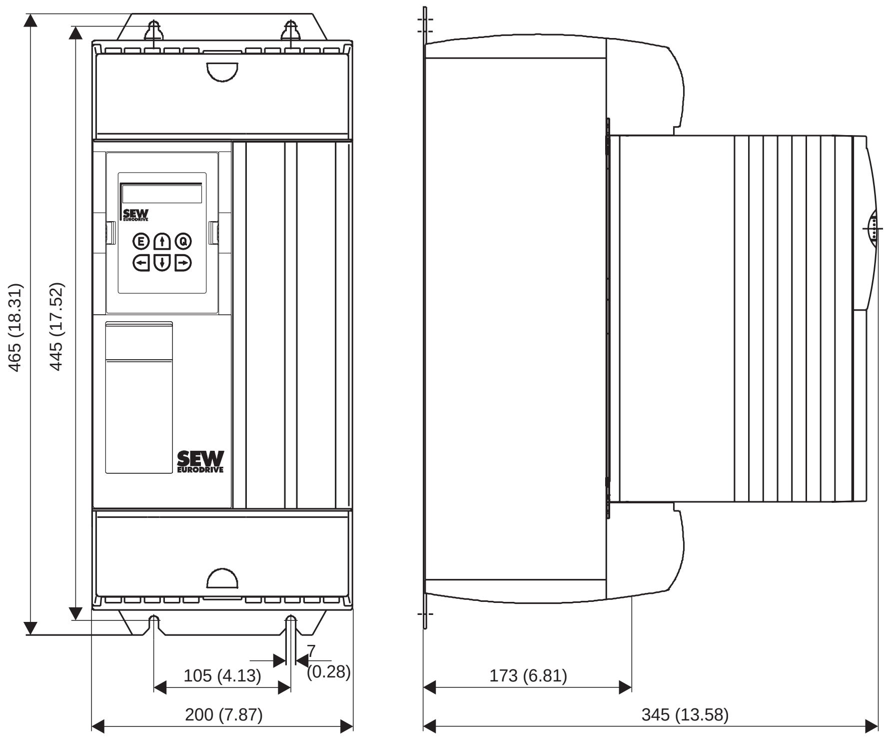


Fig. 23: Dimensions, size 3, in mm (in)

Size 4

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Fig. 24: Size 4

MOVIDRIVE® MD_60A		0220-203-4-0_	0300-203-4-0_
INPUT			
Supply voltage	V_{in}	3 × 200 V_{AC}-10 % – 3 × 240 V_{AC}+10 %	
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %	
Rated system current I_{in} (at V_{in} = 3 × 230 V_{AC})	**100 %** **125 %**	72 A_{AC} 90 A_{AC}	86 A_{AC} 107 A_{AC}
OUTPUT			
Output rated power[1)] **(at V_{in} = 3×200 – 240 V_{AC})**	P_N	31.8 kVA	37.8 kVA
Output rated current (at V_{in} = 3 × 230 V_{AC})	I_N	80 A_{AC}	95 A_{AC}
Current limitation	I_{max}	Motor and regenerative 150 % I_N, duration depending on the capacity utilization	
Internal current limitation		I_{max} = 0 – 150 % can be set in menu (P303 / P313)	
Minimum permitted brake resistance value (4Q operation)	R_{BRmin}	3.0 Ω	
Output voltage	V_{out}	max. V_{in}	
PWM frequency	f_{PWM}	Adjustable with VFC: 4/8/12/16 kHz (P860 / P861); with CFC/SERVO fixed at 8 kHz	
Speed range / resolution	n_A / Δn_A	-5000 – 0 – +5000 rpm / 0.2 rpm across the entire range	
GENERAL			
Power loss at P_N	P_{Vmax}	1100 W	1300 W
Cooling air consumption		180 m^3/h (108 ft^3/min)	
Weight		27 kg (59.53 lb)	
Dimensions	**W × H × D**	280 × 522 × 345 mm (11.02 × 20.55 × 13.58 in)	

1) MDF and MDV units in VFC operating modes: The performance data apply to f_{PWM} = 4 kHz (factory setting).

MDF60A standard type (VFC)	0220-203-4-00	0300-203-4-00
Part number	827 177 1	827 178 X
MDF60A technology type (VFC)	0220-203-4-0T	0300-203-4-0T
Part number	827 371 5	827 372 3
Constant load Rec. motor power P_{Mot}	22 kW (30 HP)	30 kW (40 HP)
Variable torque load or constant load without overload Rec. motor power P_{Mot}	30 kW (40 HP)	37 kW (50 HP)
Continuous output current = 125 % $I_N I_D$ (at V_{in} = 3 × 230 V_{AC} and f_{PWM} = 4 kHz)	100 A_{AC}	118 A_{AC}

MDV60A standard type (VFC/CFC)	0220-203-4-00	0300-203-4-00
Part number	827 261 1	827 262 X
MDV60A technology type (VFC/CFC)	0220-203-4-0T	0300-203-4-0T
Part number	827 380 4	827 381 2
VFC operating mode	Recommended motor power → MDF60A	
CFC operating mode Continuous output current = 100 % $I_N I_D$	80 A_{AC}	95 A_{AC}
Recommended motor power	→ Sec. Project Planning, CFC motor selection	

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

Do not install any components which are sensitive to high temperatures within 300 mm (11.81 in) of the top of the unit (e.g. contactors or fuses).

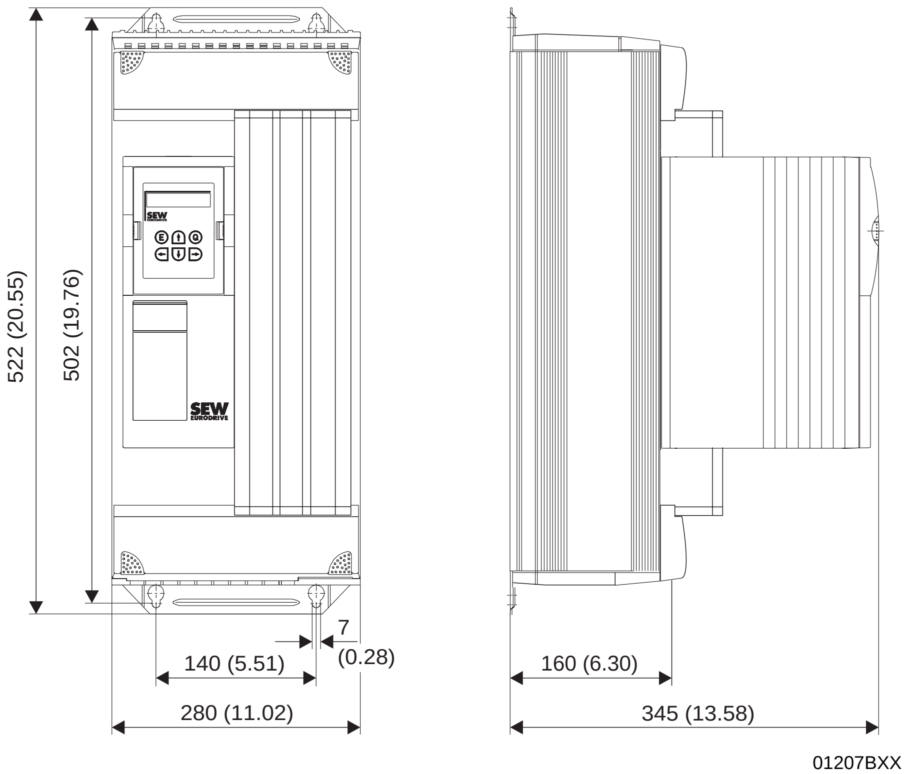
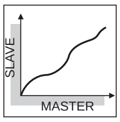


Fig. 25: Dimensions, size 4, in mm (in)

3.5 Additional functions in the applications version

Electronic cam disk



Refer to the "Cam Disk" manual for detailed information. This manual forms part of the "Technology Type" documentation package which you can order from SEW.

Please note the following points:

- The "electronic cam disk" can only be implemented on applications versions (...-0T) of MOVIDRIVE® units.
- It is essential to have encoder feedback. As a result, the "electronic cam disk" can only be implemented with type MDV60A in the CFC operating modes and type MDS60A. The "electronic cam disk" cannot be implemented with type MDV60A in VFC and VFC-n-CONTROL operating modes or with type MDF60A.
- The "electronic cam disk" is only available in parameter set 1.
- The "synchronous operation board type DRS11A" option cannot be used together with the "electronic cam disk".

Motor and encoder

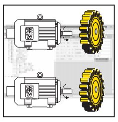
Use the following motor types:

- For operation with MOVIDRIVE® MDV60A...-5_3-4-0T:
  - Asynchronous servomotor CT/CV, high-resolution sin/cos encoder installed as standard.
  - AC motor DT/DV/D with incremental encoder option, preferably high-resolution sin/cos encoder.
- For operation with MOVIDRIVE® MDS60A...-5_3-4-0T:
  - Synchronous servomotor DS/DY, resolver installed as standard.

High-resolution speed detection is required for optimum operation of the cam disk. The encoders installed as standard on CT/CV and DS/DY motors fulfill these requirements. SEW recommends using high-resolution sin/cos encoders ES1S, ES2S or EV1S as incremental encoders if DT/DV/D motors are used.

3

Internal synchronous operation



Refer to the "Internal Synchronous Operation" manual for detailed information. This manual forms part of the "Additional Functions and Application Modules" documentation package which you can order from SEW.

Please note the following points:

- "Internal synchronous operation" can only be implemented in the applications version (...-0T) of MOVIDRIVE® units.
- It is essential to have encoder feedback. As a result, "internal synchronous operation" can only be implemented with type MDV60A in the CFC operating modes and type MDS60A. "Internal synchronous operation" cannot be implemented with type MDV60A in VFC and VFC-n-CONTROL operating modes or with type MDF60A.
- "Internal synchronous operation" is only available in parameter set 1.
- The "synchronous operation board type DRS11A" option cannot be used together with "internal synchronous operation".

Motor and encoder

Use the following motor types:

- For operation with MOVIDRIVE® MDV60A...-5_3-4-0T:
  - Asynchronous servo motor CT/CV, high-resolution sin/cos encoder installed as standard.
  - AC motor DT/DV/D with incremental encoder option, preferably high-resolution sin/cos encoder.
- For operation with MOVIDRIVE® MDS60A...-5_3-4-0T:
  - Synchronous servomotor DS/DY, resolver installed as standard.

High-resolution speed detection is required for optimum operation of internal synchronous operation. The encoders installed as standard on CT/CV and DS/DY motors fulfill these requirements. SEW recommends using high-resolution sin/cos encoders ES1S, ES2S or EV1S as incremental encoders if DT/DV/D motors are used.

3.6 MOVIDRIVE® MD_60A electronics data

MOVIDRIVE® MD_60	General electronics data	
Voltage supply X11:1 for setpoint input X11:5	REF1: +10 V_{DC} +5 % / -0 %, I_{max} = 3 mA REF2: -10 V_{DC} +0 % / -5 %, I_{max} = 3 mA	Reference voltages for setpoint potentiometer
Setpoint input n1 X11:2/X11:3	AI11/AI12: Voltage or current input, can be set with S11 and P11_, sampling interval 1 ms	
(Differential input) Operating mode AI11/AI12 Resolution Internal resistance	Voltage input: n1 = 0 – +10 V or -10 V – 0 – +10 V 12 bits R_i = 40 kΩ (external voltage supply) R_i = 20 kΩ (supply from REF1/REF2)	Current input: n1 = 0 – 20 mA or 4 – 20 mA 11 bits R_i = 250 Ω
Internal setpoints	Parameter set 1: n11/n12/n13 = -5000 – 0 – +5000 rpm Parameter set 2: n21/n22/n23 = -5000 – 0 – +5000 rpm	
Time ranges of speed ramps at Δn = 3000 rpm	1st ramp t11/t21 Up: 0.0 – 2000 s Down: 0.0 – 2000 s 2nd ramp t12/t22 Up = down: 0.0 – 2000 s Stop ramp t13/t23 Down: 0 – 20 s Emergency ramp t14/t24 Down: 0 – 20 s Motor potentiometer t3 Up: 0.2 – 50 s Down: 0.2 – 50 s	
Auxiliary voltage output[1] X10:8/X13:8	VO24: V_{OUT} = 24 V_{DC}, maximum current carrying capacity I_{max} = 200 mA per output	
External voltage supply[1] X10:9	VI24: V_{IN} = 24 V_{DC} -15 % / +20 % (range: 19.2 – 30 V_{DC}) to EN 61131-2	
Binary inputs X13:1 – X13:6 Internal resistance	DIØØ – DIØ5: Isolated (optocoupler), PLC-compatible (EN 61131), sampling interval 5 ms R_i ≈ 3.0 kΩ, I_E ≈ 10 mA	
Signal level	+13 V – +30 V = "1" = Contact made -3 V – +5 V = "0" = Contact not made	To EN 61131
Function X13:1 X13:2 – X13:6	DIØØ: With fixed assignment "/Controller inhibit" DIØ1 – DIØ5: Selection option → Parameter menu P60_	
Binary outputs[1] X10:3/X10:7	DBØØ/DOØ2: PLC compatible (EN 61131-2), response time 5 ms	
Signal level	"0" = 0 V "1" = +24 V **Important:** Do not apply external voltage!	
Function X10:3 X10:7	DBØØ: With fixed assignment "/Brake", I_{max} = 150 mA, short-circuit proof DOØ2: Selection option → Parameter menu P62_, I_{max} = 50 mA, short-circuit proof	
Relay output X10:4 – X10:6	DOØ1: Load capacity of the relay contacts V_{max} = 30 V_{DC}, I_{max} = 800 mA	
Function X10:4 X10:5 X10:6	DOØ1-C: Shared relay contact DOØ2-NO: NO contact DOØ2-NC: NC contact	Selection option → Parameter menu P62_
System bus (SBus) X12:1 X12:2 X12:3	DGND: Reference potential SC11: SBus high SC12: SBus low	CAN bus to CAN specification 2.0, parts A and B, transmission technology to ISO 11898, max. 64 stations, terminating resistor (120 Ω) can be activated using DIP switches
RS-485 interface X13:10 X13:11	ST11: RS-485 + ST12: RS-485 -	EIA standard, 9600 baud, max. 32 stations Max. cable length 200 m (660 ft) in total Dynamic terminating resistor with fixed installation
TF/TH input X10:1	TF1: Response threshold at R_{TF} ≥ 2.9 kΩ ±10 %	
Motor encoder input[1] X15: Not with type MDF60A	Encoder with type MDV60A Permitted encoder types: - sin/cos encoder 1 V_{SS} - 5 V TTL sensor - 24 V HTL sensor Encoder power supply: +24 V, I_{max} = 180 mA	Resolver in type MDS60A 2-pole, 7 $V_{AC\_r.m.s.}$, 7 kHz
Encoder output X14: Simulation or input external encoder[1]	Output encoder simulation: Signal level to RS-422 (5 V TTL) Number of pulses as on X15: (MDV60A) or fixed 1024 pulses/revolution (MDS60A)	Input external encoder (max. 200 kHz): Only encoder with signal level to RS-422 (5 V TTL) should be connected! Encoder power supply: +24 V, I_{max} = 180 mA
Reference terminals X11:4 X10:2/X10:10/X13:9 X13:7	AGND: Reference potential for analog signals and terminals X11:1 and X11:5 (REF1/REF2). DGND: Reference potential for binary signals, system bus (SBus), encoder and resolver. DCOM: Reference potential for binary inputs X13:1 – X13:6 (DIØØ – DIØ5).	
Permitted line cross section	One core per terminal: 0.20 – 2.5 mm^2 (AWG 24 – 12) Two cores per terminal: 0.20 – 1 mm^2 (AWG 24 – 17)	

1) The unit provides a current of I_{max} = 400 mA for the +24 V outputs (VO24, DBØØ, DBØ2, encoder supply). If this value is insufficient, a 24 V_{DC} power supply unit must be connected to X10:9 (VI24).

Types MDF, MDV and MDS

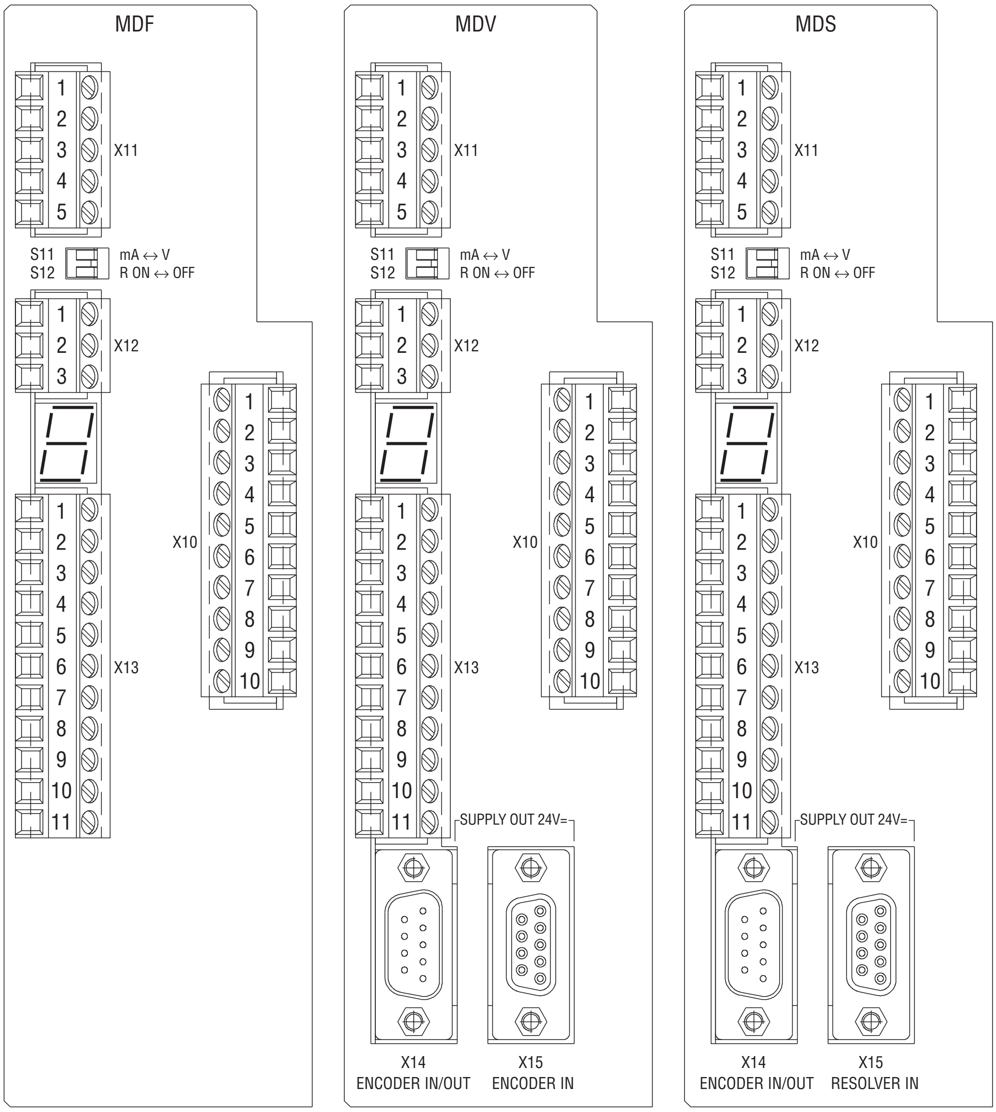


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Fig. 26: Front view of the MOVIDRIVE® MDF/MDV/MDS60A control options

X11	Analog input and reference voltages for setpoint potentiometer
S11	Changeover I-signal or V-signal
S12	Switch system bus terminating resistor on or off
X12	System bus
	7-segment display operating status
X13	Binary inputs, 24 V_{DC} auxiliary supply output and RS-485 interface
X10	TF/TH input, binary outputs, 24 V_{DC} auxiliary supply output and 24 V_{DC} input external voltage supply
X14	Output incremental encoder simulation or input external encoder
X15	Input motor encoder; encoder in type MDV60A and resolver in type MDS60A

3.7 MOVIDRIVE® MDR60A regenerative power supply units

General technical data

In MOVIDRIVE® drive inverters operating in regenerative mode (4Q operation), the MOVIDRIVE® MDR60A regenerative power supply unit can be used as an alternative to braking resistors. The prerequisite for this is a powerful supply system. The "MDR60A Regenerative Power Supply Unit" manual contains detailed information. This manual can be ordered from SEW.

MOVIDRIVE® MDR60A supplies the DC link circuit of the connected MOVIDRIVE® drive inverter with electrical power from the supply system in motor operation and returns regenerative power to the supply system in regenerative operation.

MOVIDRIVE® MDR60A does not require an auxiliary power supply or control signals. Operational readiness is displayed by a 24 V_{DC} signal output and a ready signal indicator.

MOVIDRIVE® MDR60A	All sizes
Interference immunity	To EN 61800-3
Interference emission with EMC-compliant installation (with NF180-503)	According to class B limit to EN 55011 and EN 55014 To EN 61800-3
Ambient temperature ϑ_{amb} **Derating ambient temperature** **Climate class**	0 °C – +40 °C P_N reduction: 3.0 % I_N per K to max. 60 °C EN 60721-3-3, class 3K3
Storage temperature[1)] ϑ_S	-25 °C – +70 °C (EN 60721-3-3, class 3K3)
Type of cooling (DIN 51751)	Forced-cooling
Enclosure EN 60529 (NEMA1) Size 3 Size 4	IP20 IP00 (power connections); IP10 with Plexiglas cover mounted (supplied as standard)
Operating mode	DB (EN 60149-1-1 and 1-3)
Installation altitude	h ≤ 1000 m (3300 ft) I_N reduction: 1 % per 100 m (330 ft) from 1000 m (3300 ft) to max. 2000 m (6600 ft)

1) Connect to supply voltage for min. 5 minutes every 2 years if stored for long periods, otherwise the unit's service life may be reduced.

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Fig. 27: MOVIDRIVE® MDR60A regenerative power supply units

MDR60A size 3

MOVIDRIVE® MDR60A		0370-503-00
Part number		826 658 1
INPUT		
Supply voltage	V_{in}	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$+10 %
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %
Rated connection power	P_N	37 kW
Rated system current (at $V_{in} = 3 \times 400\ V_{AC}$)	I_{in}	$66\ A_{AC}$
DC LINK		
Output rated power (at $V_{in} = 3 \times 380 – 500\ V_{AC}$)	P_A	51 kVA
DC link voltage	V_{DC}	$560\ V_{DC}$ – $780\ V_{DC}$
Rated DC link current	I_{DC}	$70\ A_{DC}$
Max. DC link current	I_{DC_max}	$105\ A_{DC}$
GENERAL		
Power loss at P_N	P_{Vmax}	950 W
Cooling air consumption		180 m^3/h (108 ft^3/min)
Weight		16 kg (35 lb)
Dimensions	W × H × D	200 × 465 × 221 mm (7.87 × 18.31 × 8.70 in)
Line choke (always necessary)		ND085-013, L_N = 0.13 mH, part number 826 014 1
for MOVIDRIVE®		0015 – 0370

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

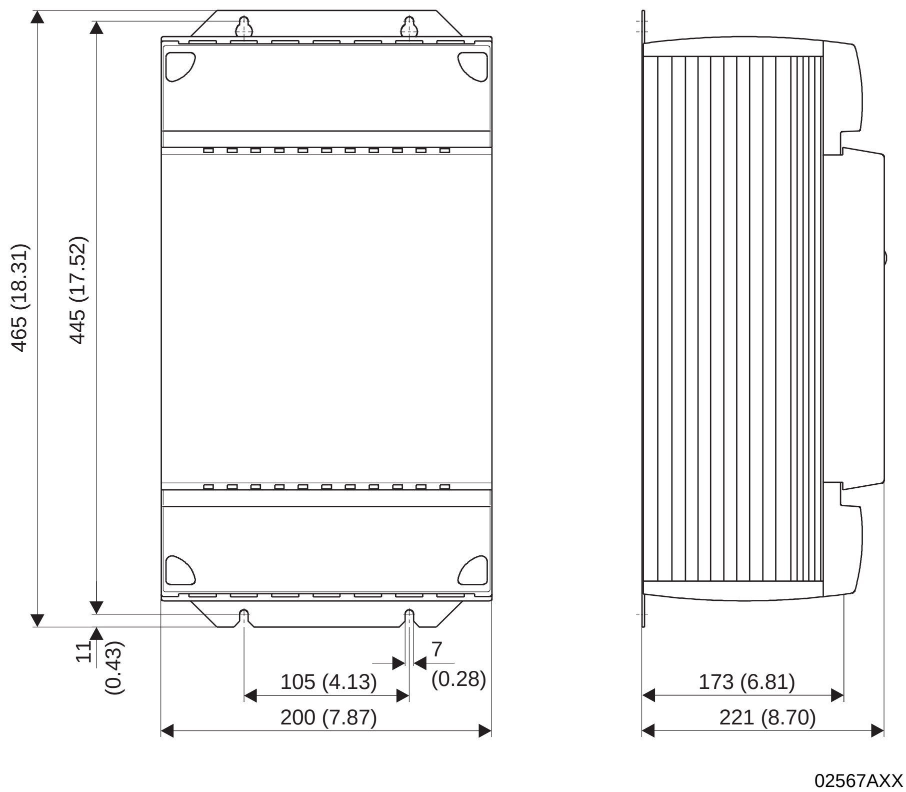


Fig. 28: Dimensions, MDR60A size 3, in mm (in)

MDR60A size 4

MOVIDRIVE® MDR60A		**0750-503-00**
Part number		826 556 9
INPUT		
Supply voltage	V_{in}	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$+10 %
Supply frequency	f_{in}	50 Hz – 60 Hz ±5 %
Rated connection power	P_N	75 kW
Rated system current (at $V_{in} = 3 \times 400\ V_{AC}$)	I_{in}	117 A_{AC}
DC LINK		
Output rated power (at $V_{in} = 3 \times 380 – 500\ V_{AC}$)	P_A	91 kVA
DC link voltage	V_{DC}	560 V_{DC} – 780 V_{DC}
Rated DC link current	I_{DC}	141 A_{DC}
Max. DC link current	I_{DC_max}	212 A_{DC}
GENERAL		
Power loss at P_N	P_{Vmax}	1700 W
Cooling air consumption		360 m^3/h (216 ft^3/min)
Weight		24 kg (53 lb)
Dimensions	**W × H × D**	280 × 522 × 205 mm (11.02 × 20.55 × 8.8.07 in)
Line choke (always necessary)		ND200-0033, L_N = 0.03 mH, part number 826 579 8
for MOVIDRIVE®		0015 – 0750

Dimensions

Provide at least 100 mm (4 in) clearance above and below the unit. No clearance is required at the sides; the units can be lined up in rows.

Do not install any components which are sensitive to high temperatures within 300 mm (11.81 in) of the top of the unit (e.g. contactors or fuses).

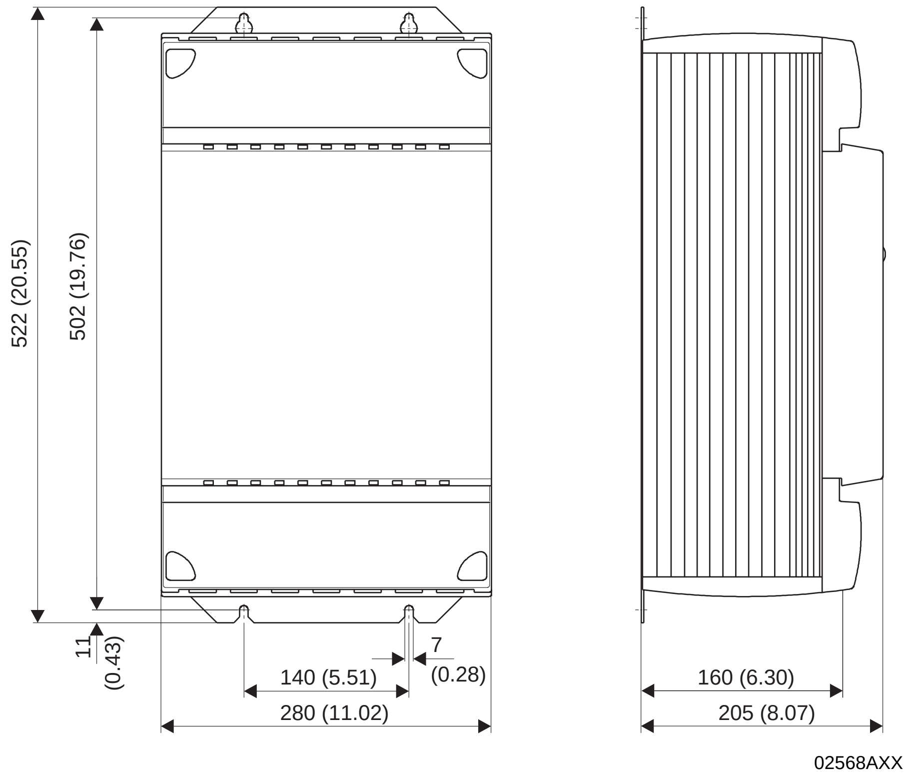


Fig. 29: Dimensions, MDR60A size 4, in mm (in)

DC link circuit connection

SEW highly recommends the use of the following cable sets for the DC link connection of the regenerative power supply unit to the drive inverters. These cable sets offer the necessary dielectric strength and are also color-coded. This is necessary because cross-polarity and ground faults could cause irreparable damage to the connected equipment.

The length of the cables restricts the DC link circuit connection to the permitted 5 m (16.4 ft), whilst they can also be cut to length by the customer for connecting several units. The lugs for connecting to the regenerative power supply unit and an inverter are supplied with the cable set. Use commercial lugs for connecting additional inverters. The inverters must then be connected to the regenerative power supply unit in a star configuration. Use a busbar subdistributor if the DC link terminals of the regenerative power supply unit are not sufficient.

Cable set type	**DCP12A**	**DCP13A**	**DCP15A**
Part number	814 567 9	814 250 5	814 251 3
For connecting MOVIDRIVE®	0015 – 0110	0150 – 0300	0370 – 0750

STOP

Observe the information in the "DC Link Circuit Connection" manual with regard to the DC link circuit connection. This manual can be ordered from SEW.

DCD12A damping module

Part number of damping module type DCD12A: 826 903 3

If more than six MOVIDRIVE® drive inverters are connected via the DC link, a DCD12A damping module must be connected to X4:8 (+V_{DC}) in the group for each unit of size 1 (0015-5A3 – 0040-5A3) and size 2 (0055-5A3 – 0110-5A3).

04810AXX

Fig. 30: DCD12A damping module

STOP

The damping module must not be connected to MOVIDRIVE® drive inverters of sizes 3 to 5 (0150-503 – 0750-503).

Technical data

Type	**Rated throughput current**	**Electrical connection**	**Dimensions W × H × D**	**Weight**
DCD12A	30 A_{DC}	Screw terminal 6 mm^2 (AWG10)	100 × 105 × 44 mm (3.94 × 4.13 × 1.73 in)	0.5 kg (1.1 lb)

3.8 IPOS$^{plus®}$

Description

The IPOS$^{plus®}$ positioning and sequence control system is integrated into every MOVIDRIVE® inverter as standard. With IPOS$^{plus®}$, control functions and positioning tasks can be performed either simultaneously or independently of one another.

The IPOS$^{plus®}$ sequence control system makes it possible to run a user program, irrespective of any encoder feedback or the selected control mode (VFC, CFC, SERVO). In conjunction with encoder feedback (MDV, MDS), the IPOS$^{plus®}$ positioning control provides a high-performance point-to-point positioning capability. The IPOS$^{plus®}$ program is written using the MOVITOOLS software. Commissioning the inverter, accessing parameters and editing variables are possible either with the software or the DBG11A keypad. (Note: The DBG11A can only be used for startup in VFC mode.)

Properties

- Program execution independent of encoder feedback and operating mode.
- The user program is continued even if the unit develops a malfunction (troubleshooting is possible in the user program).
- Two user programs can be run in parallel and independently of one another (task 1, interrupt-capable, and task 2).
- The user programs programmed in assembler can contain up to 800 program lines.
- User-friendly and comprehensive control options for the inverter.
- Access to all available options.
- Extensive options for communication via system bus (SBus), RS-485, RS-232 and fieldbus (direct communication with MOVIMOT® is possible).
- Processing of digital and analog input/output signals.

Only with MDV/ MDS

- Positioning with selectable travel speed and positioning ramp.
- Feedforward for position, speed and torque control loops with minimized lag error.
- Two touch probe inputs.
- LINEAR, SINUSOIDAL and SQUARED ramp functions.
- Status and monitoring functions: Lag error monitoring, position signal, software and hardware limit switches.
- Eight possible reference travel types.
- Possibility of changing the target position, travel speed, positioning ramp and torque whilst movement is in progress.
- "Endless positioning" is possible.
- Override function.

Technical data

Max. program length of task 1 and task 2	**Approx. 800 program lines in total (assembler programming)**
Command processing time per program line	Task 1: 1.0 ms; Task 2: 0.5 ms
Variables	512, of which 128 (0 – 127) can be stored to non-volatile memory; range of values: -2^{31} – $+(2^{31}-1)$
Touch probe inputs	2 inputs, processing time < 100 µs
Sampling interval of digital and analog inputs	1 – 5 ms
Digital inputs/outputs	6 inputs / 3 outputs
Analog inputs/outputs	1 input (0 – 10 V, ±10 V, 0 – 20 mA, 4 – 20 mA) 1 input (0 – 10 V) 1 output (0 – 20 mA, 4 – 20 mA)

3.9 DBG11A keypad option

Description

The keypad is used for startup and for service. The basic version of MOVIDRIVE® does not have a keypad and can be upgraded as an option.

Keypad	Language	Part number
DBG11A-01	DE/EN/FR (German/English/French)	822 688 1
DBG11A-02	ES/EN/PT (Spanish/English/Portuguese)	822 691 1
DBG11A-03	DE/EN/IT (German/English/Italian)	822 692 X
DBG11A-04	SV/EN/DA (Swedish/English/Danish)	822 693 8
DBG11A-05	DE/EN/FI (German/English/Finnish)	823 110 9
DBG11A-06	EN/DE/FR (English/German/French)	823 483 3

Equipment

- Illuminated plain text display, three languages can be set.
- Membrane keypad with 6 keys.
- Selection between the quick menu, detailed parameter menu and startup menu in VFC mode (CFC and SERVO startup is not possible with the DBG11A).
- Can be plugged onto the inverter (TERMINAL option slot).
- Connection possible via FKG11A extension cable (part number 822 101 4).
- Enclosure IP40 (EN 60529)

Note

The DBG11A keypad option and the USS21A serial interface option are connected to the same inverter slot (TERMINAL) and cannot therefore be used at the same time.

Functions

- Displays of process values and status displays.
- Status displays of the binary inputs/outputs.
- Fault memory inquiry and fault reset.
- Displaying and setting the operating parameters and service parameters.
- Saving data and transferring parameter sets to other MOVIDRIVE® units.
- User-friendly startup menu for VFC mode.

Dimensions

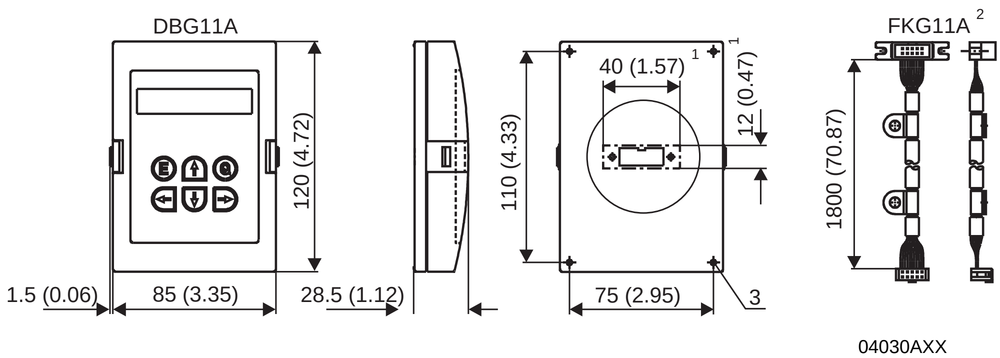


Fig. 31: Dimensions, DBG11A and FKG11A, in mm (in)

1. Cut-out for the plug in the mounting plate
2. DBG11A – MOVIDRIVE® communications cable
3. Holes for tapping screws 3.5 × 9.5 mm (0.14 × 0.37 in)

3.10 Serial interface option type USS21A (RS-232 and RS-485)

Part number 822 914 7

Description MOVIDRIVE® can be equipped with isolated RS-232 and RS-485 interfaces. The RS-232 interface is configured as a 9-pin sub D female connector (EIA standard) and the RS-485 interface as a terminal connection. The interfaces are accommodated in a housing for plugging onto the inverter (TERMINAL option slot). The option can be plugged on during operation. The transmission rate of both interfaces is 9600 baud.

Startup, operation and service are possible from the PC via the serial interface. The SEW MOVITOOLS software is used for this. It is also possible to transfer parameter settings to several MOVIDRIVE® drive inverters via PC.

Note DBG11A and USS21A are connected to the same inverter slot (TERMINAL) and cannot therefore be used at the same time.

RS-232 interface Use a commercially available serial interface cable (shielded!) for connecting a PC to MOVIDRIVE® with the USS21A option.

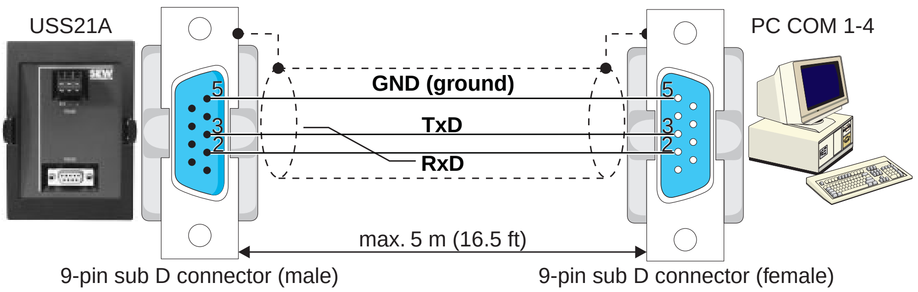


Fig. 32: Connection cable USS21A – PC

RS-485 interface Max. 16 MOVIDRIVE® units can be networked for communications purposes (max. total cable length 200 m (660 ft)) via the RS-485 interface of the USS21A. Dynamic terminating resistors are permanently installed, so do not connect any external terminating resistors.

Unit addresses 0 – 99 are permitted with multipoint connections. In this case, the "point to point connection" must not be selected in MOVITOOLS. The communications address in MOVITOOLS and the RS-485 address of the MOVIDRIVE® unit (P810) must be the same.

Dimensions

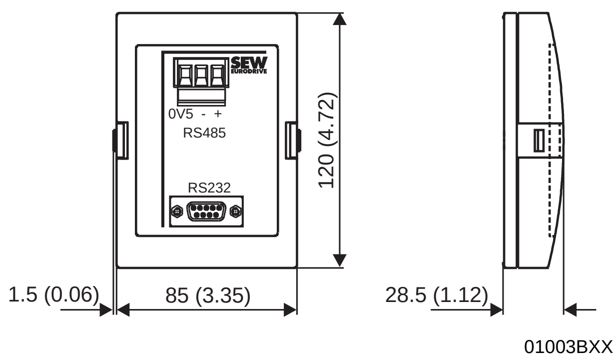


Fig. 33: Dimensions, USS21A, in mm (in)

3.11 Interface converter option type UWS11A

Part number 822 689 X

Description The UWS11A option converts RS-232 signals, for example from the PC, into RS-485 signals. These RS-485 signals can then be routed to the RS-485 interface of the MOVIDRIVE® unit (ST11/ST12).

The UWS11A option requires a 24 V_{DC} voltage supply (I_{max} = 100 mA).

RS-232 interface The connection between the UWS11A and the PC is made using a commercially available serial interface cable (shielded!).

RS-485 interface Max. 32 MOVIDRIVE® units can be networked for communications purposes (max. total cable length 200 m (660 ft)) via the RS-485 interface of the UWS11A. Dynamic terminating resistors are permanently installed, so do not connect any external terminating resistors.

Permitted line cross section: One core per terminal 0.20 – 2.5 mm^2 (AWG 24 – 12)

Two cores per terminal 0.20 – 1 mm^2 (AWG 24 – 17)

Dimensions

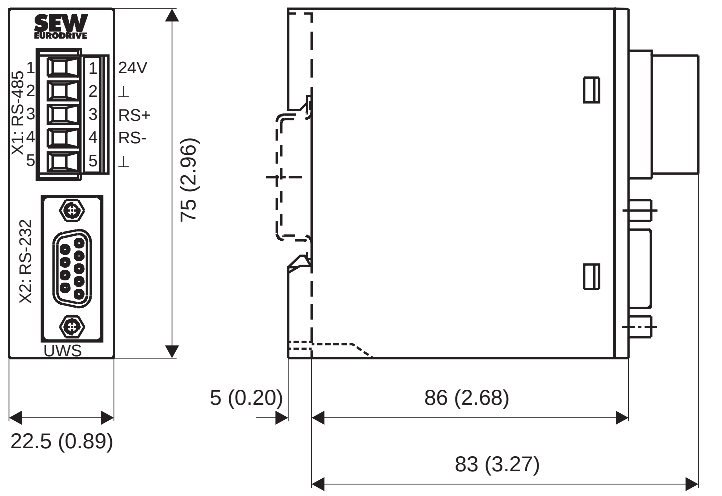


Fig. 34: Dimensions, UWS11A, in mm (in)

The UWS11A is mounted on a support rail (EN 50022-35 × 7.5) in the switch cabinet.

3.12 5 V encoder power supply option type DWI11A

Part number 822 759 4

Description If you are using an incremental encoder with a 5 V_{DC} encoder power supply, install the 5 V encoder power supply option type DWI11A between the inverter and the incremental encoder. This option provides a regulated 5 V_{DC} power supply for the encoder. This involves converting the 24 V_{DC} power supply for the encoder inputs to 5 V_{DC} by means of a voltage controller. The supply voltage on the encoder is measured using a sensor line and the voltage drop along the encoder cable is compensated.

Incremental encoders with 5 V_{DC} encoder power supply must not be connected directly to the encoder inputs X14: and X15:. This would result in irreparable damage to the encoders.

STOP

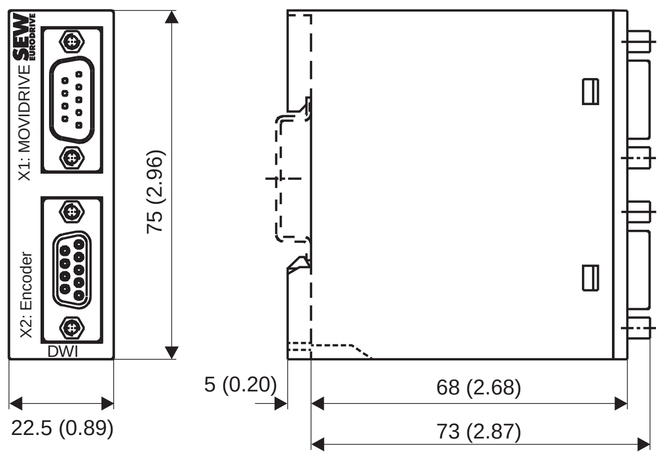
Note that in the event of a short circuit on the sensor line, the connected encoder may be subjected to a voltage in excess of the rated voltage.

Technical data

Option	5 V encoder power supply type DWI11A
Part number	822 759 4
Voltage input	+24 V to EN 61131-2, 18 – 30 V_{DC}, I_{max} = 120 mA
Encoder power supply	+5 V (to $V_{max} \approx$ +10 V), I_{max} = 300 mA
Max. line length which can be connected	100 m (330 ft) total Use a shielded twisted-pair cable (A and $\overline{A}$, B and $\overline{B}$, C and $\overline{C}$) for connecting the encoder to the DWI11A and the DWI11A to MOVIDRIVE®.

Recommendation Use prefabricated cables from SEW for connecting the encoder.

Dimensions



01315BXX

Fig. 35: Dimensions, DWI11A, in mm (in)

The DWI11A option is mounted on a support rail (EN 50022-35 × 7.5) in the switch cabinet.

3.13 Terminal expansion option type DIO11A

Part number 822 726 8

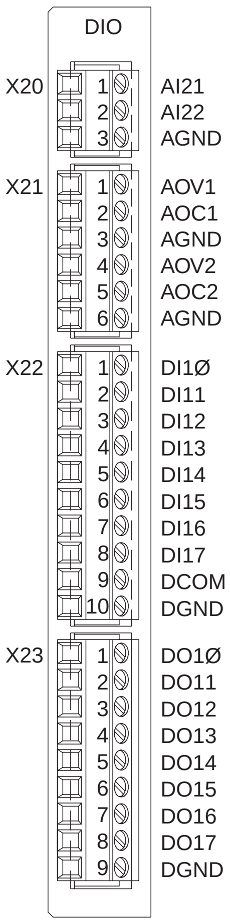
Description The inputs/outputs of the basic MOVIDRIVE® unit can be expanded with the DIO11A option. The DIO11A can either be connected to the OPTION1 slot or the OPTION2 slot. The programmable signal types of the additional binary inputs/outputs are the same as the basic unit (→ parameter group P6__, Terminal assignment).

3

Functions

- 8 binary inputs
- 8 binary outputs
- 1 analog differential input (0 – 10 V, ±10 V, 0 – 20 mA with corresponding load)
- 2 analog outputs (±10 V, 0 – 20 mA, 4 – 20 mA)

Technical data

	Option	**Terminal expansion option type DIO11A**
	Part number	822 726 8
	Setpoint input n2 (differential input) X20:1/X20:2	AI21/AI22: Voltage input 0 – 10 V or ±10 V or current input (0 – 20 mA with load 500 Ω) Sampling interval 5 ms
	Analog outputs X21:1/X21:4 X21:2/X21:5	Voltage outputs AOV1/AOV2: ±10 V Current outputs AOC1/AOC2: 0 – 20 mA or 4 – 20 mA P642/645 sets whether the voltage outputs or current outputs are in effect.
	Function	AOV1/AOV2/AOC1/AOC2: Selection option → Parameter menu P640/P643
	Binary inputs X22:1 – X22:8 Internal resistance	DI1Ø – DI17: Isolated (optocoupler) PLC-compatible (EN 61131), sampling interval 5 ms $R_i \approx 3.0\ k\Omega$, $I_E \approx 10\ mA$
	Signal level	+13 V – +30 V = "1" = Contact made -3 V – +5 V = "0" = Contact not made
	Function	DI1Ø – DI17: Selection option → Parameter menu P61_
	Binary outputs X23:1 – X23:8	DO1Ø – DO17: PLC compatible (EN 61131-2) Response time 5 ms
	Signal level	"0" = 0 V "1" = +24 V **Important:** Do not apply external voltage!
	Function	DO1Ø – DO17: Selection option → Parameter menu P63_, I_{max} = 50 mA, short-circuit proof
	Reference terminals X20:3/X21:3/X21:6 X22:10/X23:9 X22:9	AGND: Reference potential for analog signals DGND: Reference potential for binary signals DCOM: Reference potential of binary inputs X22:1 – X22:8 (DI1Ø – DI17)
	Permitted line cross section	One core per terminal: 0.20 – 2.5 mm^2 (AWG 24 – 12) Two cores per terminal: 0.20 – 1 mm^2 (AWG 24 – 17)
	Weight	0.2 kg (0.44 lb)

3.14 Absolute encoder option type DIP11A

Part number 822 777 2

Description

Absolute encoders with SSI interfaces are connected to the DIP11A option. The "Absolute Encoder Interface Type DIP11A" manual contains detailed information. This manual can be ordered from SEW.

The following benefits result in conjunction with IPOS$^{plus®}$:

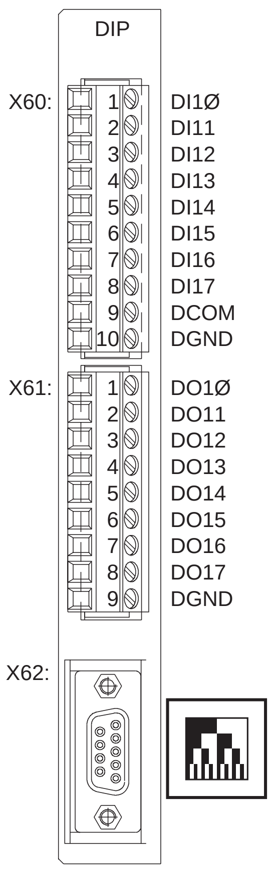
- No reference travel is needed when the system is restarted or after a power failure.
- Positioning either with absolute value encoder or motor encoder (encoder/resolver).
- No position switch is needed on the travel distance even without a motor encoder (MOVIDRIVE® MDF60A).
- Free processing of the absolute position in the IPOS$^{plus®}$ program.

The DIP11A can either be connected to the OPTION1 slot or the OPTION2 slot. The programmable signal types of the additional binary inputs/outputs are the same as the basic unit (→ parameter group P6__, Terminal assignment).

Functions

- 8 binary inputs
- 8 binary outputs
- 1 absolute encoder input (SSI interface)

Technical data



Option	Absolute encoder option type DIP11A
Part number	822 777 2
Binary inputs X60:1 – X60:8	DI1Ø – DI17: Isolated (optocoupler) PLC-compatible (EN 61131), sampling interval 5 ms
Internal resistance	$R_i \approx 3.0$ kΩ, $I_E \approx 10$ mA
Signal level	+13 V – +30 V = "1" = Contact made -3 V – +5 V = "0" = Contact not made
Function	DI1Ø – DI17: Selection option → Parameter menu P61_
Binary outputs X61:1 – X61:8	DO1Ø – DO17: PLC compatible (EN 61131-2) Response time 5 ms
Signal level	"0" = 0 V "1" = +24 V **Important:** Do not apply external voltage!
Function	DO1Ø – DO17: Selection option → Parameter menu P63_, I_{max} = 50 mA, short-circuit proof
Encoder connection X62:1/X62:6 X62:3/X62:8 X62:5 X62:9 X62:2/X62:4/X62:7	Data+/Data- Clock+/Clock- DGND 24 V_{DC} output (max. 500 mA) Not assigned
Absolute encoders which can be selected	VISOLUX EDM, T&R CE65/100MSSI, T&R LE100, T&R LA66K, HEIDENHAIN ROQ424 (AV1Y), Stegmann AG100MSSI, SICK DME-3000-111, STAHLWCS2-LS311
Reference terminals X60:10/X61:9 X60:9	DGND: Reference potential for binary signals DCOM: Reference potential of binary inputs X60:1 – X60:8 (DI1Ø – DI17)
Permitted line cross section	One core per terminal: 0.20 – 2.5 mm² (AWG 24 – 12) Two cores per terminal: 0.20 – 1 mm² (AWG 24 – 17)
Weight	0.2 kg (0.44 lb)

3.15 Synchronous operation type DRS11A

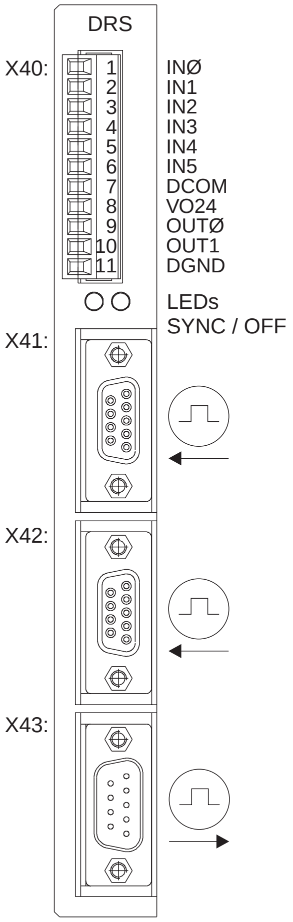
Part number 822 319 X

Description The DRS11A option enables a group of motors to be operated at a synchronous angle in relation to one another or with an adjustable proportional relationship. The "Synchronous Operation Board Type DRS11A" manual contains detailed information. This manual can be ordered from SEW.

The basis of synchronous operation concerns continuously comparing the rotor angle positions of the master and the slave motors. In order to do this, the motors must be equipped with incremental encoders (CT/CV/DT/DV/D motors) or resolvers (DS/DY motors). As a result, the DRS11A option can only be used with MOVIDRIVE® MDV60A and MDS60A, not with MOVIDRIVE® MDF60A (no encoder feedback!).

The DRS11A can either be connected to the OPTION1 slot or the OPTION2 slot.

Technical data



Option		Synchronous operation type DRS11A
Part number		822 319 X
Binary inputs	X40:1 – X40:6	INØ – IN5: Isolated (optocoupler) PLC-compatible (EN 61131), sampling interval 5 ms
Internal resistance		$R_i \approx 3.0$ kΩ, $I_E \approx 10$ mA
Signal level		+13 V – +30 V = "1" = Contact made -3 V – +5 V = "0" = Contact not made
Function		With fixed assignment: • INØ = Freewheel • IN1 = Offset 1 • IN2 = Offset 2 • IN3 = Offset 3 • IN4 = IPOS$^{plus®}$ variable H477.0 • IN5 = IPOS$^{plus®}$ variable H477.1
Binary outputs	X40:9/X40:10	OUTØ/OUT1: PLC compatible (EN 61131-2) Response time 5 ms
Signal level		"0" = 0 V "1" = +24 V **Important:** Do not apply external voltage!
Function		With fixed assignment: • OUTØ = IPOS$^{plus®}$ variable H476.0 • OUT1 = IPOS$^{plus®}$ variable H476.1 I_{max} = 50 mA, short-circuit proof
Synchronous encoder input X41: Encoder power supply		Signal level to RS-422 (5 V TTL), max. 200 kHz +24 V, I_{max} = 180 mA 9-pin sub D socket
Master encoder input Encoder power supply	X42:	Signal level to RS-422 (5 V TTL), max. 200 kHz +24 V, I_{max} = 180 mA 9-pin sub D socket
Encoder output	X43:	Signal level to RS-422 (5 V TTL) 9-pin sub D plug
Reference terminals	X40:11 X40:7	DGND: Reference potential for binary signals DCOM: Reference potential of binary inputs X40:1 – X40:6 (INØ – IN5)
Permitted line cross section		One core per terminal: 0.20 – 0.5 mm^2 (AWG 24 – 20) Two cores per terminal: 0.20 – 0.34 mm^2 (AWG 24/22)
Weight		0.2 kg (0.44 lb)

3.16 PROFIBUS fieldbus interface option type DFP21A (12 Mbaud)

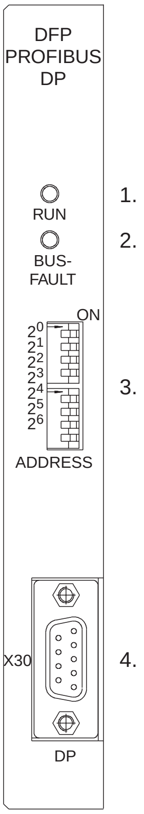
Part number 823 618 6

Description MOVIDRIVE® can be equipped with a 12 Mbaud fieldbus interface for the PROFIBUS-DP serial bus system. The PROFIBUS documentation package contains detailed information. This package can be ordered from SEW. This documentation package contains the GSD files and type files for MOVIDRIVE® in order to help with project planning and to facilitate startup.

PROFIBUS-DP (Decentralized Periphery) is predominantly used in the sensor/actuator role where rapid reaction times are needed. The principal task of PROFIBUS-DP is to transmit data, e.g. setpoints or binary commands, in rapid cycles between central automation equipment (PROFIBUS master) and decentralized peripheral units (e.g. drive inverters). DFP21A supports PROFIBUS-DP. Consequently, MOVIDRIVE® can be controlled by a PLC and PROFIBUS-DP. It goes without saying that MOVIDRIVE® can also be controlled and have its parameters set exclusively using PROFIBUS-DP.

DFP21A must be plugged into the OPTION1 slot.

Technical data



Option	PROFIBUS fieldbus interface type DFP21A
Part number	823 618 6
Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
Protocol option	PROFIBUS-DP to EN 50170 V2 / DIN E 19245 P3
Supported baud rates	Automatic detection of baud rate from 9.6 kbaud – 12 Mbaud.
Connection	9-pin sub D socket Assignment to EN 50170 V2 / DIN 19245 P3
Bus termination	Not integrated, must be implemented via the PROFIBUS connector.
Station address	0 – 125, can be set using DIP switch
GSD file	SEW_6003.GSD
DP identity number	6003_{hex} = 24579_{dec}
Weight	0.2 kg (0.44 lb)

1. Green LED: RUN
2. Red LED: BUS FAULT
3. DIP switch for setting the station address.
4. 9-pin sub D socket: bus connection

3.17 PROFIBUS fieldbus interface option type DFP11A (1.5 Mbaud)

Part number 822 724 1

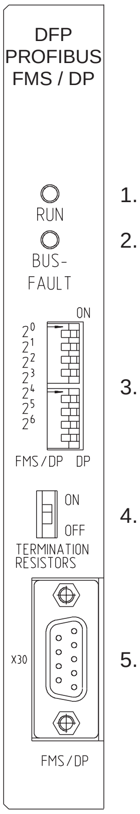
Description

MOVIDRIVE® can be equipped with a fieldbus interface for the PROFIBUS-FMS and PROFIBUS-DP serial bus systems. The PROFIBUS documentation package contains detailed information. This package can be ordered from SEW. This documentation package contains the GSD files and type files for MOVIDRIVE® in order to help with project planning and to facilitate startup.

PROFIBUS-FMS (Fieldbus Message Specification) is suitable for applications in automation engineering where time is not a critical factor. In drive engineering, PROFIBUS-FMS is predominantly used for visualization and for setting drive parameters because it enables large volumes of data to be exchanged in a straightforward manner when time is not a critical factor. PROFIBUS-DP (Decentralized Periphery) is predominantly used in the sensor/actuator role where rapid reaction times are needed. The principal task of PROFIBUS-DP is to transmit data, e.g. setpoints or binary commands, in rapid cycles between central automation equipment (PROFIBUS master) and decentralized peripheral units (e.g. drive inverters). DFP11A is a combination slave and is compatible with both PROFIBUS-FMS and PROFIBUS-DP. Consequently, MOVIDRIVE® can be controlled by a PLC and PROFIBUS-DP. A visualization system can read actual values from MOVIDRIVE® via PROFIBUS-FMS and display them in graphical format at the same time. It goes without saying that MOVIDRIVE® can also be controlled and have its parameters set exclusively using PROFIBUS-DP or exclusively using PROFIBUS-FMS.

DFP11A must be plugged into the OPTION1 slot.

Technical data



Option	PROFIBUS fieldbus interface type DFP11A
Part number	822 724 1
Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
Protocol options	• PROFIBUS-DP to EN 50170 V2 / DIN E 19245 P3 • PROFIBUS-FMS to EN 50170 V2 / DIN E 19245 P3 • Mixed mode PROFIBUS DP/FMS (combi-slave)
Supported baud rates	Automatic detection of baud rate from 9.6 kbaud – 1.5 Mbaud
Connection	9-pin sub D socket Assignment to EN 50170 V2 / DIN 19245 P3
Bus termination	Can be activated for cable type A (up to 1500 kbaud) to EN 50170 V2 / DIN 19245 P3
Station address	0 – 125, can be set using DIP switch
Default bus parameter	Min-T_{SDR} for FMS/DP or DP mode Can be selected via DIP switch
GSD file	SEW_6000.GSD
Weight	0.2 kg (0.44 lb)

1. Green LED: RUN
2. Red LED: BUS FAULT
3. DIP switch for setting the station address and changing from FMS/DP mixed mode to straightforward DP mode.
4. DIP switch for switching the bus terminating resistor on and off
5. 9-pin sub D socket: bus connection

3.18 INTERBUS fieldbus interface option type DFI11A

Part number 822 723 3

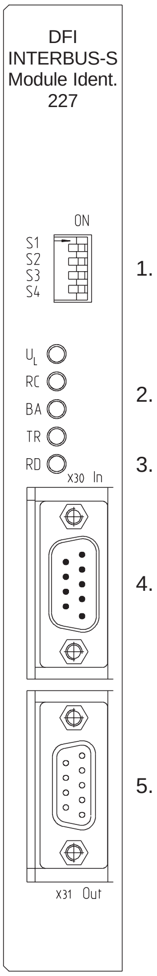
Description MOVIDRIVE® can be equipped with a fieldbus interface for the non-proprietary and standardized INTERBUS sensor/actuator bus system. The INTERBUS documentation package contains detailed information. This package can be ordered from SEW.

INTERBUS is defined in prEN 50254 / DIN 19258 and, as far as its function is concerned, it consists of a process data channel and a parameter data channel. Intelligent actuators such as the MOVIDRIVE® drive inverter can be controlled and parameterized in a user-friendly way.

DFI11A must be plugged into the OPTION1 slot.

Technical data

Option	INTERBUS fieldbus interface type DFI11A
Part number	822 723 3
Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
Connection	Remote bus input: 9-pin sub D plug Remote bus output: 9-pin sub D socket RS-485 transmission technology, 6-core shielded and twisted-pair cable
Module ID	$E3_{hex} = 227_{dec}$
Weight	0.2 kg (0.44 lb)



1. DIP switch for setting the number of process data items
2. 4 × green LEDs: Diagnostic LEDs
3. 1 × red LED: Diagnostic LED
4. 9-pin sub D plug: Remote bus input
5. 9-pin sub D socket: Remote bus output

3.19 *INTERBUS fieldbus interface option type DFI21A (FO)*

Part number 823 093 5

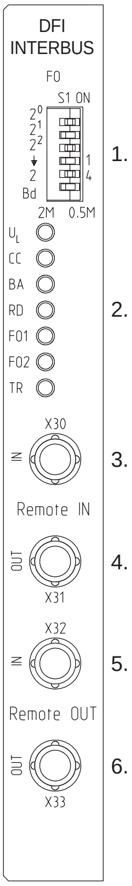
Description MOVIDRIVE® can be equipped with a fieldbus interface for the non-proprietary and standardized INTERBUS sensor/actuator bus system with fiber optic cables (FO). The INTERBUS FO documentation package contains detailed information. This package can be ordered from SEW.

INTERBUS is defined in prEN 50254 / DIN 19258 and, as far as its function is concerned, it consists of a process data channel and a parameter data channel. Intelligent actuators such as the MOVIDRIVE® drive inverter can be controlled and parameterized in a user-friendly way.

DFI21A must be plugged into the OPTION1 slot.

Technical data

Option	INTERBUS fieldbus interface type DFI21A (FO)
Part number	823 093 5
Resources for startup/diagnosis	MOVITOOLS software, DBG11A keypad and CMD tool (Phoenix Contact)
Supported baud rates	500 kbaud and 2 Mbaud, changeover via DIP switch
Connection	Remote bus input: 2 F-SMA plugs Remote bus output: 2 F-SMA plugs Optically regulated FO interface Optical converter (RS-485 → FO) possible
Weight	0.2 kg (0.44 lb)



1. DIP switch for process data length, PCP length and baud rate
2. Diagnostic LEDs
3. FO: Remote IN
4. FO: Incoming remote bus
5. FO: Remote OUT
6. FO: Continuing remote bus

3.20 CAN fieldbus interface option type DFC11A

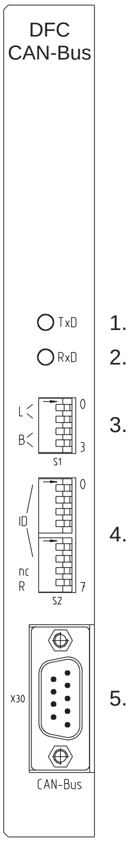
Part number 822 725 X

Description MOVIDRIVE® can be equipped with a fieldbus interface for the CAN (Controller Area Network) serial bus system. The CAN bus documentation package contains detailed information. This package can be ordered from SEW.

The CAN bus uses a very efficient, message-oriented communication protocol. The CAN protocol is defined in the CAN specification 2.0 parts A and B.

DFC11A must be plugged into the OPTION1 slot.

Technical data

	Option	CAN fieldbus interface type DFC11A
	Part number	822 725 X
	Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
	Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud • 1000 kbaud
	Connection	9-pin sub D plug Assignment to CiA standard 2-core twisted cable to ISO 11898
	Bus termination	Can be switched on using DIP switch (120 Ω)
	ID range	3 – 1020 Base ID: 0 – 63, can be selected using DIP switch
	Weight	0.2 kg (0.44 lb)

1. Green LED: TxD
2. Red LED: RxD
3. DIP switch for setting the process data length and baud rate
4. DIP switch for setting the base ID and switching the bus terminating resistor on and off
5. 9-pin sub D plug: bus connection

3.21 CANopen fieldbus interface option type DFO11A

Part number 823 162 1

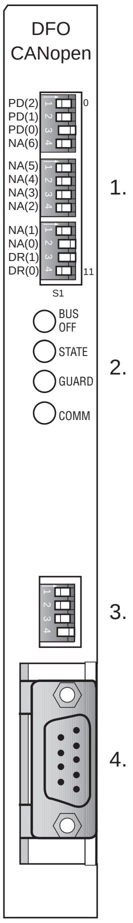
Description MOVIDRIVE® can be equipped with a fieldbus interface for the CANopen serial bus system. The CANopen documentation package contains detailed information. This package can be ordered from SEW.

The CAN bus uses a very efficient, message-oriented communication protocol. The CAN protocol is defined in the CAN specification 2.0 parts A and B.

DFO11A must be plugged into the OPTION1 slot.

Technical data

Option	CANopen fieldbus interface type DFO11A
Part number	823 162 1
Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud • 1000 kbaud
Connection	9-pin sub D plug Assignment to CiA standard 2-core twisted cable to ISO 11898
Bus termination	Can be switched on using DIP switch (120 Ω)
ID range	3 – 1020 Base ID: 0 – 63, can be selected using DIP switch
Weight	0.2 kg (0.44 lb)



1. DIP switch for process data length, module ID and baud rate
2. Display and diagnostic LEDs
3. DIP switch for switching the bus terminating resistor on and off
4. 9-pin sub D plug: bus connection

3.22 DeviceNet fieldbus interface option type DFD11A

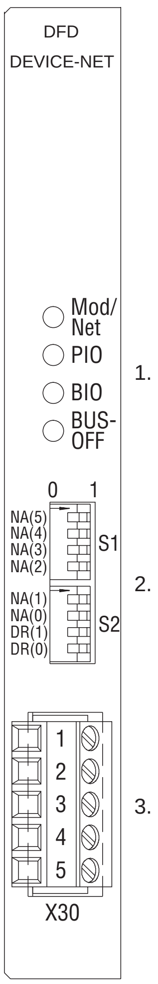
Part number 822 887 6

Description MOVIDRIVE® can be equipped with a fieldbus interface for the DeviceNet serial bus system. The DeviceNet documentation package contains detailed information. This package can be ordered from SEW.

As far as its function is concerned, DeviceNet consists of a process data channel and a parameter data channel. Intelligent actuators such as the MOVIDRIVE® drive inverter can be controlled and parameterized in a user-friendly way.

DFD11A must be plugged into the OPTION1 slot.

Technical data

	Option	DeviceNet fieldbus interface type DFD11A
	Part number	822 887 6
	Resources for startup/diagnosis	MOVITOOLS software and DBG11A keypad
	Supported baud rates	Can be selected via DIP switch: • 125 kbaud • 250 kbaud • 500 kbaud
	Connection	5-pin Phoenix terminal Assignment to DeviceNet specification (Volume I, Appendix B)
	Permitted line cross section	According to DeviceNet specification
	Bus termination	Use of bus connectors with integrated bus terminating resistor (120 Ω) at the start and finish of the bus segment.
	Address range which can be set (MAC-ID)	0 – 63, can be selected using DIP switch
	Weight	0.2 kg (0.44 lb)

1. LED display
2. DIP switch for setting the node address (MAC-ID) and baud rate
3. 5-pin Phoenix terminal: bus connection

3.23 MOVITOOLS software

Part number 0918 5054

Description MOVITOOLS is a program package comprising SHELL, SCOPE, IPOS$^{plus®}$ Compiler and LOGODrive. You can use MOVITOOLS to address either of the three ranges of units MOVIDRIVE® MD_60A, MOVIDRIVE® *compact* or MOVITRAC® 07.

- SHELL can be used for starting up the drive and setting its parameters in a convenient fashion.
- SCOPE provides extensive oscilloscope functions for diagnosis of the drive.
- IPOS$^{plus®}$ Compiler provides a convenient way of writing programs for applications in a high-level language.
- The assembler enables you to write programs directly on the machine.
- LOGODrive allows you to write applications with graphics support.
- Device status shows you the status of the connected unit.

Various application modules, for example table positioning, are stored in MOVITOOLS in advance as IPOS$^{plus®}$ programs and can be activated using the technology type units.

MOVITOOLS is supplied on a CD-ROM and can also be downloaded from the SEW homepage (http://www.sew-eurodrive.de). MOVITOOLS can be used with the following operating systems:

- Windows® 95
- Windows® 98
- Windows NT® 4.0
- Windows® 2000 (from version 2.60)
- Windows® Me (from version 2.60)

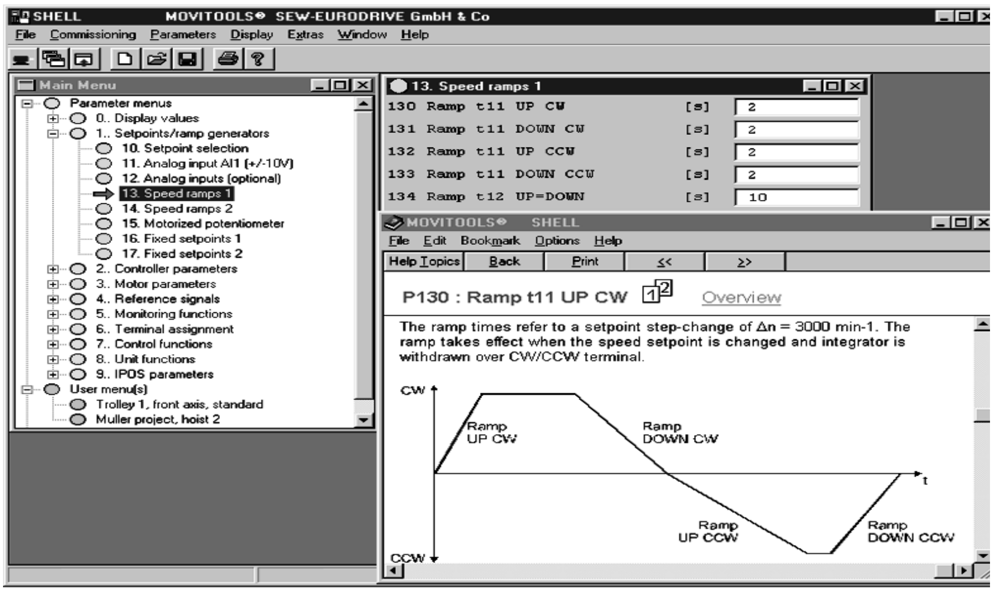


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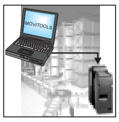
Fig. 36: MOVITOOLS window

3.24 Application modules for MOVIDRIVE® MD_60A



In the past, it was necessary to write complicated control programs for the machine control in order to implement applications such as table positioning. All movements were controlled by the machine control.

IPOS^{plus}®

SEW MOVIDRIVE® MD_60A drive inverters with integrated IPOS^{plus}® positioning and sequence control systems are capable of controlling all the movements themselves. The control program runs in the inverter. The major advantages are:

- Decentralized concepts can be implemented more easily.
- Movements are controlled closer to the machine, so response times are shorter.
- The machine control does not have to perform so many functions.

So that you as the user do not have to go to the trouble of writing the IPOS^{plus}® control program yourself, SEW offers applications modules for MOVIDRIVE® MD_60A units in the technology type. These application modules form part of the MOVITOOLS software package.

Advantages

The application modules offer you the user the following benefits:

- Wide range of functions
- User-friendly user interface
- You only have to enter the parameters needed for the application
- User-friendly application programs guide you through the process of setting parameters, so there is no need for complicated programming
- No programming experience necessary
- Steep learning curve

Scope of supply and documentation

The application modules form part of the MOVITOOLS software package and can be used with technology type units (MOVIDRIVE® MD_60A...-0T). All manuals relating to the application modules are contained in the "Additional Functions and Application Modules" documentation package. You can order this documentation package from SEW.

The individual manuals (files in PDF format) can also be downloaded from the SEW homepage (http://www.sew-eurodrive.de).

Positioning

The application modules for the "Positioning" application are suited to all applications which involve target positions being specified and then movement taking place to those positions. The sequence of motion can be linear or rotational.

These include trolleys, hoists, gantries, rotary tables, swiveling devices and storage and retrieval units for high-bay warehouses.

Linear positioning

In the case of linear positioning application modules, SEW distinguishes between whether the movement records are managed in the inverter or in the master PLC.

Movement records in the inverter

- **Table positioning**
- **Table positioning with bus control**

Up to 32 movement records can be managed in the inverter in these application modules. A movement record is made up of the destination, speed and ramp. The destination to which movement is to take place is selected using binary code, by means of the binary inputs of the inverter or via the virtual terminals (fieldbus, system bus). The application modules come with the following range of features:

- 32 table positions can be defined and selected.
- The travel speed can be selected as required for each positioning movement.
- The ramp can be set separately for each positioning movement.
- Software limit switches can be defined and evaluated.
- Either encoders or absolute encoders can be evaluated as encoders.
- Menu system for startup and diagnosis
  - Freely definable user travel units
  - Calculation of position resolution during positioning via the motor encoder
  - Graphical position display

These application modules are suited to applications in which movement only has to take place to a limited number of different destinations and in which the highest possible degree of independence from the machine control is required.

There are 4 operating modes for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The machine zero is determined automatically with incremental position measurement.
- Teach-in: The stored position can be corrected without a programming unit.
- Automatic mode: Automatic sequence controlled by the master PLC.

Movement records in the PLC

- **Positioning via bus**
- **Extended positioning via bus**

In these application modules, the movement records are managed in the PLC. The destination and travel speed are specified via the fieldbus or system bus. The application modules come with the following range of features:

- Any number of target positions can be defined and selected by means of a fieldbus/ system bus.
- The travel speed can be selected as required via the fieldbus/system bus for each positioning movement.
- Software limit switches can be defined and evaluated.
- Either encoders or absolute encoders can be evaluated as encoders.

- Straightforward connection to the machine control.
- Menu system for startup and diagnosis
  - Freely-definable user travel units
  - Calculation of position resolution during positioning via the motor encoder
  - Jog mode with variable speed
  - Fieldbus monitor

These application modules are suited to applications in which movement has to take place to a large number of different target positions.

There are 3 operating modes for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The machine zero is determined automatically with incremental position measurement.
- Automatic mode: Automatic sequence controlled by the master PLC.

- **Absolute value positioning**

In this application module, the movement records are also managed in the PLC and specified via the fieldbus/system bus. No motor encoder is required for this application module. The absolute encoder mounted on the travel line is used for positioning. The application module comes with the following range of features:

- Any number of target positions can be defined and selected by means of a fieldbus/ system bus.
- A long travel distance is possible, for example 262,144 m in the "mm" travel unit.
- Software limit switches can be defined and evaluated.
- Only absolute encoders are used for position measurement.
- No motor encoder is required, MOVIDRIVE® MDF60A...-0T is sufficient.
- Straightforward connection to the machine control.
- Menu system for startup and diagnosis
  - Freely definable user travel units
  - Calculation of encoder resolution
  - Jog mode with two speeds
  - Fieldbus monitor

These application modules are suitable for applications in which there is a high tendency to vibrate, for example storage and retrieval units for high-bay warehouses or heavy trolleys.

There are 3 operating modes for controlling the machine:

- Jog mode: The machine can be moved manually.
- Automatic mode: Automatic sequence controlled by the master PLC.

Rotational positioning

- **Rotary axis**

Up to 16 movement records can be managed in the inverter in this application module. A movement record is made up of the destination, speed and ramp. The destination to which movement is to take place is selected using binary code, by means of the binary inputs of the inverter or via the virtual terminals (fieldbus, system bus). The position measurement can only take place with incremental encoders. The application module comes with the following range of features:

- 16 table positions can be defined and selected.
- The travel speed can be selected as required for each positioning movement.
- The ramp can be set separately for each positioning movement.
- Flying referencing when using a non-whole number ratio.
- Positioning with position optimization or positioning with a predefined direction or rotation.
- Pulse mode with 16 step widths.
- External encoder for position detection possible.
- Menu system for startup and diagnosis
  - Calculation of position resolution during positioning via the motor encoder
  - Graphical position display

This application module is suited to applications in which rotational movements or similar endless movements are required. These include rotary tables, circular indexing tables, swiveling devices or cyclic belts.

The following operating modes are available for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The machine zero is determined automatically.
- Teach-in: The stored position can be corrected without a programming unit.
- Positioning with position optimization
- Positioning with a fixed direction of rotation
- Cyclical operation

Winding

- **Central winder**

In this application, the web tension is set for winding or unwinding using the setpoints, the mechanical friction values, the winding diameter and the winding characteristics. Control takes place either via the binary inputs of the inverter or the virtual terminals (fieldbus, system bus). The application module comes with the following range of features:

- Control either via fieldbus or terminals.
- Calculation of the reel diameter and the tensile force.
- Material tear monitoring.
- Material length counter.
- Straightforward connection to the machine control.
- Menu system for startup and diagnosis
  - Adjustable winding curve
  - Display of web speed and current diameter

This application module is suitable for applications in which an endless material, for example paper, foil, foam, textiles or strip is wound for further processing.

There are 4 operating modes for controlling the machine:

- Jog mode: The machine can be moved manually.
- Teach-in: The speed-dependent friction values are determined automatically.
- Automatic mode with constant torque.
- Automatic mode with constant web tension.

Controlling

- **Crane control**

In this application module, the sequence of motion is controlled according to specifications. The application module comes with the following range of features:

- 6 fixed setpoints for multi-stage switching
- Variable speed in motor potentiometer mode
- Monitoring of preliminary and main limit switches
- The speed is reduced when the preliminary limit switch is contacted.
- Load detection, i.e. max. speed limitation depending on load.
- Crane control can be implemented in all operating modes.
- Automatic programming of the input/output terminals required.

This application module is suitable for applications in materials handling and logistics technology, for example for trolleys, hoists, trolley traveling winches and construction cranes.

There are 2 operating modes for controlling the machine:

- Motor potentiometer: Infinitely variable adjustment of the travel speed.
- Fixed setpoints: The travel speed is dictated by the selection of fixed setpoints.

- **Flying saw**

In this application module, the sequence of motion is controlled according to specifications. The application module comes with the following range of features:

- Control either via fieldbus or terminals.
- Cut edge protection or singling using the "Draw gap" function.
- Immediate cut function by manual interrupt.
- Material length counter.
- Straightforward connection to the machine control.
- Menu system for startup and diagnosis
  - Display of the current cut length and the material speed
  - Display of the saw drive speed

This application module is suited to applications in which endless material has to be cut, sawn or pressed, for example in diagonal saws or flying punches.

There are 2 operating modes for controlling the machine:

- Jog mode: The machine can be moved manually.
- Reference travel: The reference point of the machine is determined.
- Positioning mode
- Automatic mode

3.25 Braking resistor option type BW...

General information

The braking resistors in the BW... series are adapted to the technical characteristics of MOVIDRIVE® drive inverters.

Flat-type braking resistor

- Shockproof (IP54)
- Internal thermal overload protection (fuse which cannot be replaced)
- Touch guard and rail mounting available from SEW as accessories.

Wire and grid resistors

- Perforated sheet cover (IP20) open towards the mounting surface.
- The short-time load capacity of the wire and grid resistors is greater than in the flat-type braking resistors (→ power diagrams).

SEW recommends also protecting the wire and grid resistors against overload using a bimetallic relay. Set the trip current to the value I_F in the table. Do not use any electronic or electromagnetic fuses since even the brief excess currents which are still permitted may cause them to trip.

The surfaces of the resistors get very hot if loaded with P_N. Bear this aspect in mind when selecting the installation location. As a rule, therefore, braking resistors are mounted on the switch cabinet roof.

The performance data listed in the tables below show the load capacity of the braking resistors according to their cyclic duration factor (cyclic duration factor = cdf of the braking resistor in % in relation to a cycle duration ≤ 120 s).

Parallel connection

Two braking resistors must be connected in parallel in the case of some inverter/resistor combinations. In this case, the trip current must be set on the bimetallic relay to twice the value of I_F entered in the table.

Assignment to 400/500 V units (MD_60A...-5_3)

Braking resistor type		**BW100-005**	**BW100-006**	**BW168**	**BW268**	**BW147**	**BW247**	**BW347**
Part number		826 269 1	821 701 7	820 604 X	820 715 1	820 713 5	820 714 3	820 798 4
Load capacity at	**100 % cdf**	0.45 kW	0.6 kW	0.8 kW	1.2 kW	1.2 kW	2.0 kW	4.0 kW
	50 % cdf[1]	0.60 kW	1.1 kW	1.4 kW	2.2 kW	2.2 kW	3.8 kW	7.6 kW
	25 % cdf	0.83 kW	1.9 kW	2.6 kW	3.8 kW	3.8 kW	6.4 kW	12.8 kW
	12 % cdf	1.11 kW	3.5 kW	4.7 kW	6.7 kW	7.2 kW	12 kW	14.4 kW[2]
	6 % cdf	2.00 kW	5.7 kW	7.6 kW	10 kW[2]	11 kW	14.4 kW[2]	14.4 kW[2]
		Note the **regenerative power limit** of the inverter! (= 150 % of the recommended motor power → Technical Data)						
Resistance value	**R_{BR}**	100 Ω ±10 %		68 Ω ±10 %		47 Ω ±10 %		
Trip current (from F16)	**I_F**	0.8 A_{RMS}	1.8 A_{RMS}	2.5 A_{RMS}	3.4 A_{RMS}	3.5 A_{RMS}	4.9 A_{RMS}	7.8 A_{RMS}
Type		Flat type	Wire resistor on ceramic core					
Connections		Cable	Ceramic terminals 2.5 mm² (AWG12)					
Enclosure		IP 54	IP20 (when mounted)					
Ambient temperature	**ϑ_{amb}**	-20 – +45 °C						
Type of cooling		KS = Self-cooling						
for MOVIDRIVE®		0015/0022	0015 – 0040			0055/0075		

1) cdf = Cyclic duration factor of the braking resistor in relation to a cycle duration T_D ≤ 120 s.

2) Physical power limit due to the DC link voltage and the resistance value.

Braking resistor type	BW039-012	BW039-026	BW039-050	BW018-015	BW018-035	BW018-075
Part number	821 689 4	821 690 8	821 691 6	821 684 3	821 685 1	821 686 X
Load capacity at **100 % cdf** **50 % cdf**[1] **25 % cdf** **12 % cdf** **6 % cdf**	1.2 kW 2.1 kW 3.8 kW 7.0 kW 11.4 kW	2.6 kW 4.6 kW 8.3 kW 15.3 kW 17.3 kW[2]	5.0 kW 8.5 kW 15.0 kW 17.3 kW[2] 17.3 kW[2]	1.5 kW 2.5 kW 4.5 kW 6.7 kW 11.4 kW	3.5 kW 5.9 kW 10.5 kW 15.7 kW 26.6 kW	7.5 kW 12.7 kW 22.5 kW 33.7 kW 37.5 kW[2]
	Note the **regenerative power limit** of the inverter! (= 150 % of the recommended motor power → Technical Data)					
Resistance value R_{BR}	39 Ω ±10 %			18 Ω ±10 %		
Trip current (from F16) I_F	4.2 A_{RMS}	7.8 A_{RMS}	11 A_{RMS}	4.0 A_{RMS}	8.1 A_{RMS}	14 A_{RMS}
Type	Wire resistor		Grid resistor			
Connections	Ceramic terminals 2.5 mm^2 (AWG12)					
Enclosure	IP20 (when mounted)					
Ambient temperature ϑ_{amb}	-20 – +45 °C					
Type of cooling	KS = Self-cooling					
for MOVIDRIVE®	0110			0150/0220 and 2 × parallel with 0370/0450		

1) cdf = Cyclic duration factor of the braking resistor in relation to a cycle duration $T_D \leq 120$ s.

2) Physical power limit due to the DC link voltage and the resistance value.

Braking resistor type	BW915	BW012-025	BW012-050	BW012-100	BW106	BW206
Part number	821 260 0	821 680 0	821 681 9	821 682 7	821 050 0	821 051 9
Load capacity at **100 % cdf** **50 % cdf**[1] **25 % cdf** **12 % cdf** **6 % cdf**	16 kW 27 kW 45 kW[2] 45 kW[2] 45 kW[2]	2.5 kW 4.2 kW 7.5 kW 11.2 kW 19.0 kW	5.0 kW 8.5 kW 15.0 kW 22.5 kW 38.0 kW	10 kW 17 kW 30 kW 45 kW 56 kW[2]	13 kW 24 kW 40 kW 66 kW 102 kW	18 kW 32 kW 54 kW 88 kW 112 kW[2]
	Note the **regenerative power limit** of the inverter! (= 150 % of the recommended motor power → Technical Data)					
Resistance value R_{BR}	15 Ω ±10 %	12 Ω ±10 %			6 Ω ±10 %	
Trip current (from F16) I_F	28 A_{RMS}	6.1 A_{RMS}	12 A_{RMS}	22 A_{RMS}	38 A_{RMS}	42 A_{RMS}
Type	Grid resistor					
Connections	M8 stud	Ceramic terminals 2.5 mm^2 (AWG12)			M8 stud	
Enclosure	IP20 (when mounted)					
Ambient temperature ϑ_{amb}	-20 – +45 °C					
Type of cooling	KS = Self-cooling					
for MOVIDRIVE®	0220	0300			0370 – 0750	

1) cdf = Cyclic duration factor of the braking resistor in relation to a cycle duration $T_D \leq 120$ s.

2) Physical power limit due to the DC link voltage and the resistance value.

Assignment to 230 V units (MD_60A...-2_3)

Braking resistor type		BW039-003	BW039-006	BW039-012	BW039-026	BW027-006	BW027-012	BW018-015	BW018-035
Part number		821 687 8	821 688 6	821 689 4	821 690 8	822 422 6	822 423 4	821 684 3	821 685 1
Load capacity at	100 % cdf	0.3 kW	0.6 kW	1.2 kW	2.6 kW	0.6 kW	1.2 kW	1.5 kW	3.5 kW
	50 % cdf$^{1)}$	0.5 kW	1.1 kW	2.1 kW	4.6 kW	1.2 kW	2.3 kW	2.5 kW	5.9 kW
	25 % cdf	1.0 kW	1.9 kW	3.8 kW	5.9 kW$^{2)}$	2.0 kW	5.0 kW	4.5 kW	10.5 kW
	12 % cdf	1.7 kW	3.5 kW	5.9 kW$^{2)}$	5.9 kW$^{2)}$	3.5 kW	7.5 kW	6.7 kW	15.7 kW
	6 % cdf	2.8 kW	5.7 kW	5.9 kW$^{2)}$	5.9 kW$^{2)}$	6.0 kW	8.5 kW$^{2)}$	11.4 kW	25.6 kW$^{3)}$
		Note the **regenerative power limit** of the inverter! (= 150 % of the recommended motor power → Technical Data)							
Resistance value	R_{BR}	39 Ω ±10 %				27 Ω ±10 %		18 Ω ±10 %	
Trip current (from F16)	I_F	2.0 A_{RMS}	3.2 A_{RMS}	4.2 A_{RMS}	7.8 A_{RMS}	2.5 A_{RMS}	4.4 A_{RMS}	4.0 A_{RMS}	8.1 A_{RMS}
Type		Wire resistor						Grid resistor	
Connections		Ceramic terminals 2.5 mm^2 (AWG12)							
Enclosure		IP20 (when mounted)							
Ambient temperature	ϑ_{amb}	-20 – +45 °C							
Type of cooling		KS = Self-cooling							
for MOVIDRIVE®		0015/0022				0015 – 0037		2 × parallel with 0110	

1) cdf = Cyclic duration factor of the braking resistor in relation to a cycle duration $T_D \leq 120$ s.

2) Physical power limit due to the DC link voltage and the resistance value.

3) Physical power limit due to the DC link voltage and the resistance value.

Braking resistor type		BW018-075	BW915	BW012-025	BW012-050	BW012-100	BW106	BW206
Part number		821 686 X	821 260 0	821 680 0	821 681 9	821 682 7	821 050 0	821 051 9
Load capacity at	100 % cdf	7.5 kW	16.0 kW	2.5 kW	5.0 kW	10 kW	13 kW	18 kW
	50 % cdf$^{1)}$	12.7 kW	27.0 kW	4.2 kW	8.5 kW	17 kW	24 kW	32 kW
	25 % cdf	22.5 kW	30.7 kW$^{2)}$	7.5 kW	15.0 kW	19.2 kW$^{2)}$	38.4 kW$^{2)}$	38.4 kW$^{2)}$
	12 % cdf	25.6 kW$^{2)}$	30.7 kW$^{2)}$	11.2 kW	19.2 kW$^{2)}$	19.2 kW$^{2)}$	38.4 kW$^{2)}$	38.4 kW$^{2)}$
	6 % cdf	25.6 kW$^{2)}$	30.7 kW$^{2)}$	19.0 kW	19.2 kW$^{2)}$	19.2 kW$^{2)}$	38.4 kW$^{2)}$	38.4 kW$^{2)}$
		Note the **regenerative power limit** of the inverter! (= 150 % of the recommended motor power → Technical Data)						
Resistance value	R_{BR}	18 Ω ±10 %	15 Ω ±10 %	12 Ω ±10 %			6 Ω ±10 %	
Trip current (from F16)	I_F	14 A_{RMS}	28 A_{RMS}	10 A_{RMS}	19 A_{RMS}	27 A_{RMS}	38 A_{RMS}	42 A_{RMS}
Type		Grid resistor						
Connections		2.5 mm^2 (AWG12)	M8 stud	Ceramic terminals 2.5 mm^2 (AWG12)			M8 stud	
Enclosure		IP20 (when mounted)						
Ambient temperature	ϑ_{amb}	-20 – +45 °C						
Type of cooling		KS = Self-cooling						
for MOVIDRIVE®		2 × parallel with 0110		0055/0075			0150 and 2 × parallel with 0220/0300	

1) cdf = Cyclic duration factor of the braking resistor in relation to a cycle duration $T_D \leq 120$ s.

3

Touch guard

Touch guard is available for flat-type braking resistors.

Touch guard	**BS005**
Part number	813 152 X
For braking resistor	BW100-005

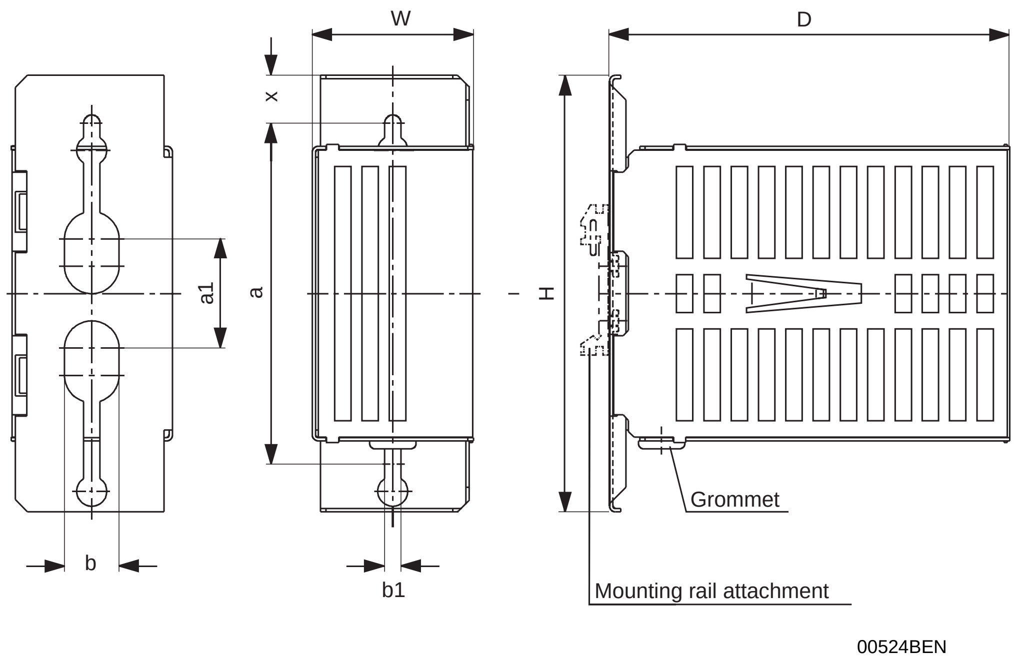


Fig. 37: Dimensions, touch guard

All dimensions in mm (in):

Touch guard	**Main dimensions**			**Fixing dimensions**					**Weight**
	B	**H**	**D**	**a**	**a1**	**b**	**b1**	**x**	**kg (lb)**
BS005	60 (2.36)	160 (6.30)	252 (9.92)	125 (4.92)	40 (1.57)	20 (0.79)	6 (0.24)	17.5 (0.69)	0.5 (1.1)

Mounting rail installation

A mounting rail attachment is available from SEW as an accessory, part number 822 194 4, for mounting the touch guard on a mounting rail.

DKB11A heat sink for brake resistors in flatpack design

Part number 814 345 5

Description The DKB11A heat sink for brake resistors in flatpack design provides a space-saving means of mounting braking resistors in flatpack design (BW100-005) below MOVIDRIVE® size 1 (400/500 V units: 0015 – 0040; 230 V units: 0015 – 0037). The resistor is inserted into the heat sink and attached using the supplied screws (M4 × 20).

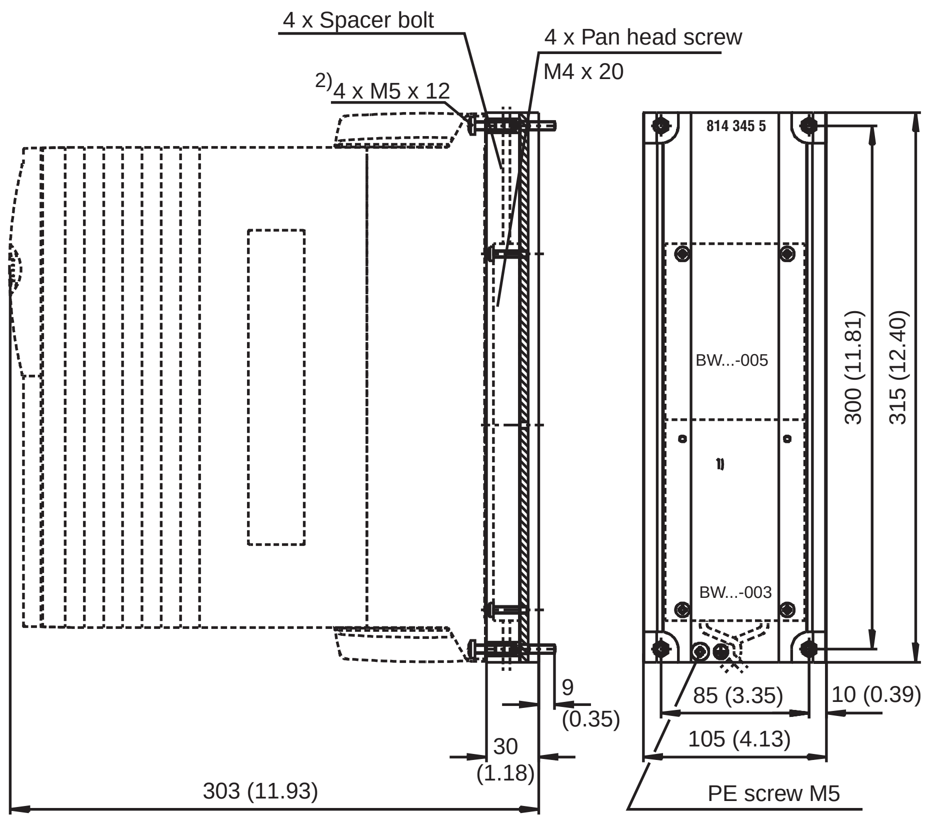


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Fig. 38: Dimensions, DKB11A heat sink for brake resistors in flatpack design, all in mm (in)

1) Mounting surface for the braking resistor

2) Retaining screws, not included in scope of delivery

Dimensions, BW...

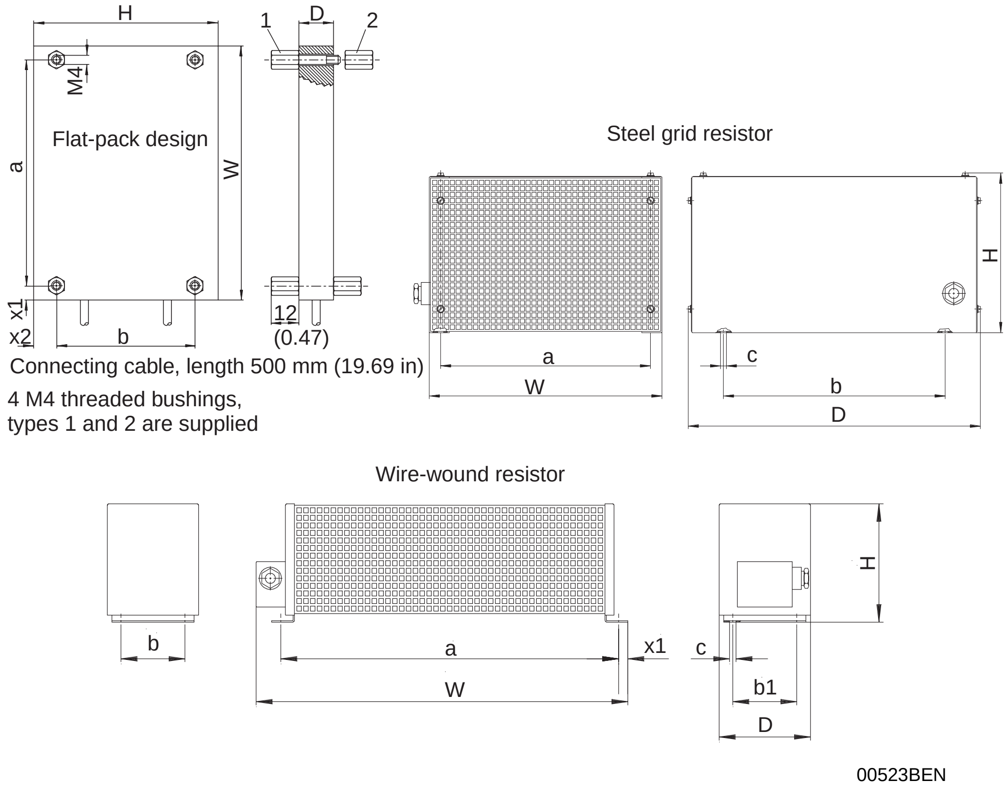

Fig. 39: Dimensions, BW... braking resistors

Mounting position as required

All dimensions in mm (in):

BW... Type	Main dimensions B	H	D	Fixing dimensions a	b/b1	x1	x2	Hole dimension c	Weight kg (lb)
BW100-005	216 (8.50)	80 (3.15)	15 (0.59)	204 (8.03)	60 (2.36)	6 (0.24)	10 (0.39)	4 threaded bushes	0.6 (1.3)
BW100-006	486 (19.13)	120 (4.72)	92 (3.62)	426 (16.77)	64 (2.52)	10 (0.39)	-	5.8 (0.23)	2.2 (4.9)
BW168	365 (14.37)		185 (7.28)	326 (12.83)	150 (5.91)				3.6 (8.0)
BW268	465 (18.31)			426 (16.77)					4.3 (9.5)
BW147									4.3 (9.5)
BW247	665 (26.18)			626 (24.65)					6.1 (13.5)
BW347	670 (26.38)	145 (5.71)	340 (13.39)	630 (24.80)	300 (11.81)				13.2 (29.1)
BW039-012	486 (19.13)	120 (4.72)	185 (7.28)	426 (16.77)	150 (5.91)				4.3 (9.5)
BW039-026	586 (23.07)		275 (10.83)	530 (20.87)	240 (9.45)				7.5 (16.6)
BW039-050	395 (15.55)	260 (10.24)	490 (19.29)	370 (14.57)	380 (14.96)	-		10.5 (0.41)	12 (26.5)
BW018-015	600 (23.62)	120 (4.72)	92 (3.62)	540 (21.26)	64 (2.52)	10 (0.39)		5.8 (0.23)	4.0 (8.8)
BW018-035	295 (11.61)	260 (10.24)	490 (19.29)	270 (10.63)	380 (14.96)	-		10.5 (0.41)	9.0 (19.8)
BW018-075	595 (23.43)			570 (22.44)					21 (46.3)
BW915	795 (31.30)			770 (30.31)					26 (57.3)
BW012-025	295 (11.61)			270 (10.63)					9.0 (19.8)
BW012-050	395 (15.55)			370 (14.57)					12 (26.5)
BW012-100	595 (23.43)			570 (22.44)					21 (46.3)
BW106	795 (31.30)			770 (30.31)					32 (70.5)
BW206	995 (39.17)			970 (38.18)					43 (94.8)

3.26 Line chokes option type ND...

- To increase the overvoltage protection
- To limit the charging current when several inverters are connected together in parallel on the input end with a shared supply system contactor (rated current of line choke = total of inverter rated currents)

Line choke type		ND020-013	ND045-013	ND085-013	ND1503	ND200-0033
Part number		826 012 5	826 013 3	826 014 1	825 548 2	826 579 8
Rated voltage	V_N	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$ +10 %, 50/60 Hz				
Rated current[1]	I_N	20 A_{AC}	45 A_{AC}	85 A_{AC}	150 A_{AC}	200 A_{AC}
Power loss at I_N	P_V	10 W	15 W	25 W	65 W	100 W
Inductance	L_N	0.1 mH				0.03 mH
Ambient temperature	ϑ_{amb}	-25 – +45 °C				
Enclosure		IP 00 (EN 60529)				
Connections		Modular tl. blocks 4 mm^2 (AWG 10)	Modular tl. blocks 10 mm^2 (AWG 8)	Modular tl. blocks 35 mm^2 (AWG 2)	M10 stud / PE: M8 stud	
Assignment to 400/500 V units (MD_60A...-5_3)						
In rated operation (100 %)		0015 – 0075	0110 – 0220	0300 – 0450 and MDR60A0370	0550/0750	MDR60A0750
With increased power (VFC, 125 %)		0015 – 0075	0110/0150	0220 – 0370	0450 – 0750	
Assignment to 230 V units (MD_60A...-2_3)						
In rated operation (100 %)		0015 – 0055	0075/0110	0150/0220	0300	-
With increased power (VFC, 125 %)		0015 – 0037	0055/0075	0110/0150	0220/0300	-

1) If more than one MOVIDRIVE® is connected to a line choke, the **total value of the rated currents** of the connected units **must not exceed the rated current of the line choke**!

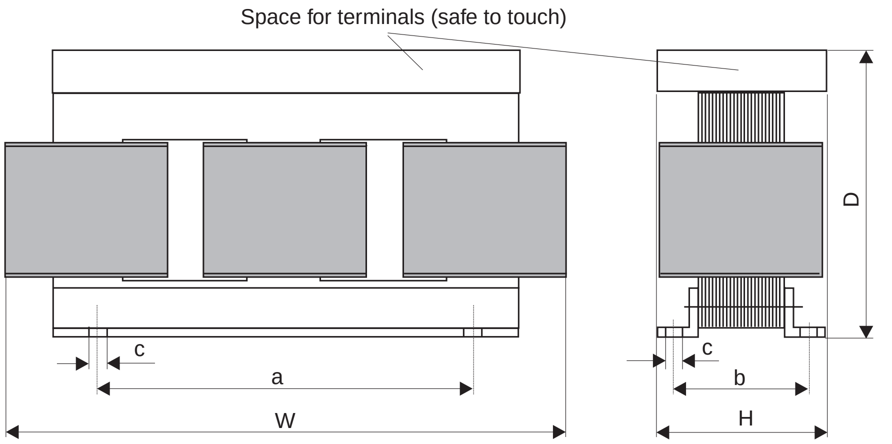

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Fig. 40: Dimensions, ND... line chokes

Mounting position as required

All dimensions in mm (in):

Line ch. type	Main dimensions			Fixing dimensions		Hole dimen.	Weight
	B	H	D	a	b	c	kg (lb)
ND020-013	85 (3.35)	60 (2.36)	120 (4.72)	50 (1.97)	31 (1.22)	5-10 (0.20-0.39)	0.5 (1.1)
ND045-013	125 (4.92)	95 (3.74)	170 (6.69)	84 (3.31)	55-75 (2.17-2.95)	6 (0.24)	2.5 (5.5)
ND085-013	185 (7.28)	115 (4.53)	235 (9.25)	136 (5.35)	56 (2.20)	7 (0.28)	8 (17.6)
ND1503	255 (10.04)	140 (5.51)	230 (9.06)	170 (6.69)	77 (3.03)	8 (0.31)	17 (37.5)
ND200-0033	250 (9.84)	160 (6.30)	230 (9.06)	180 (7.09)	98 (3.86)	8 (0.31)	15 (33.1)

3.27 *NF...-... input filter option*

- To suppress interference emissions on the line side of inverters

Input filter type	NF009-503	NF014-503	NF018-503	NF035-503	NF048-503	NF063-503	NF085-503	NF115-503	NF150-503
Part number	827 412 6	827 116 X	827 413 4	827 128 3	827 117 8	827 414 2	827 415 0	827 416 9	827 417 7
Rated voltage V_{rated}	$3 \times 500\ V_{AC}$ +10 %, 50/60 Hz								
Rated current I_N	9 A_{AC}	14 A_{AC}	18 A_{AC}	35 A_{AC}	48 A_{AC}	63 A_{AC}	85 A_{AC}	115 A_{AC}	150 A_{AC}
Power loss at I_N P_V	6 W	9 W	12 W	15 W	22 W	30 W	35 W	60 W	90 W
Earth-leakage current at V_{rated}	< 25 mA	< 25 mA	< 25 mA	< 25 mA	< 40 mA	< 30 mA	< 30 mA	< 30 mA	< 30 mA
Ambient temperature ϑ_{amb}	-25 – +40 °C								
Enclosure	IP 20 (EN 60529)								
Connections L1-L3/L1'-L3'	4 mm² (AWG 10)		10 mm² (AWG 8)		16 mm² (AWG 6)	35 mm² (AWG 2)	50 mm² (AWG1/0)	95 mm² (AWG4/0)	
PE	M5 stud		M5/M6 stud		M6	M8	M10	M10	
Assignment to 400/500 V units (MD_60A...-5_3)									
In rated operation (100 %)	0015 – 0040	0055/ 0075	-	0110/ 0150	0220	0300	0370/ 0450	0550	0750
With increased power (VFC, 125 %)	0015 – 0030	0040/ 0055	0075	0110	0150	0220	0300/ 0370	0450	0550/ 0750
Assignment to 230 V units (MD_60A...-2_3)									
In rated operation (100 %)	0015/ 0022	0037	-	0055/ 0075	0110	0150	0220	0300	-
With increased power (VFC, 125 %)	0015	0022	0037	0055/ 0075	-	0110/ 0150	-	0220/ 0300	-

The effectiveness of input filters is restricted in IT systems.

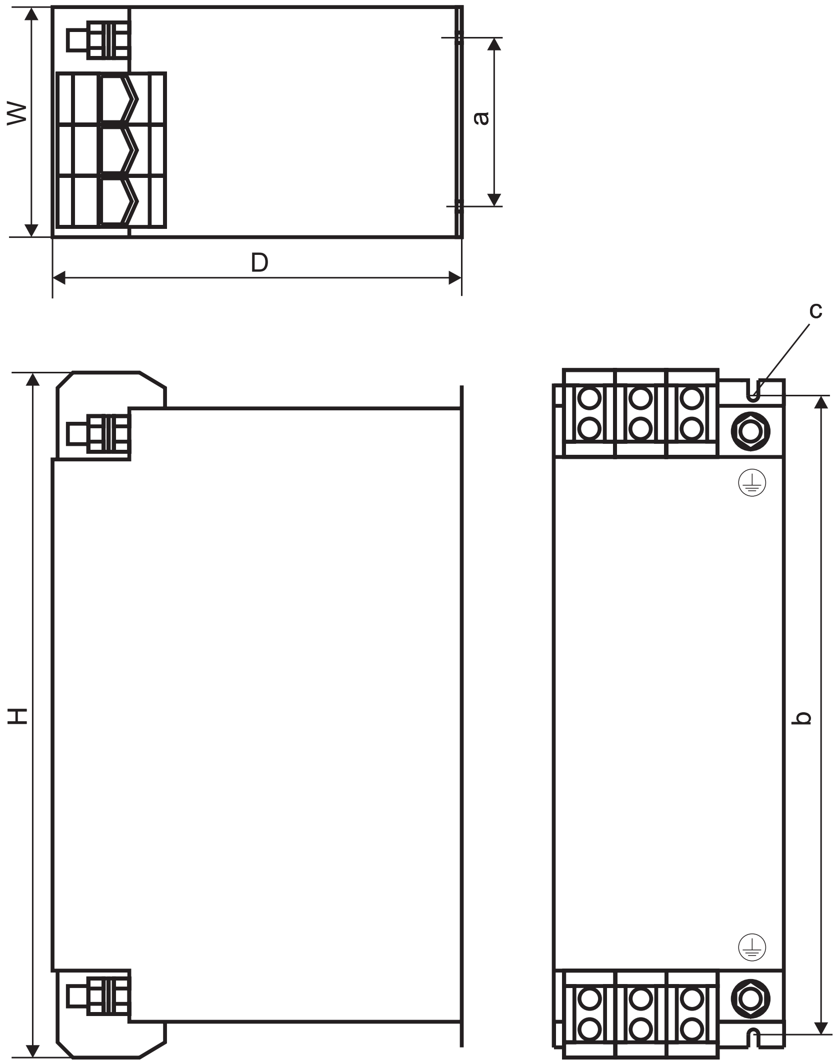

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Fig. 41: Dimensions, NF input filters

Mounting position as required

All dimensions in mm (in):

<table>
<tr><th rowspan="2">Input filter type</th><th colspan="3">Main dimensions</th><th colspan="2">Fixing dimensions</th><th>Hole dimension</th><th rowspan="2">PE connection</th><th>Weight</th></tr>
<tr><th>B</th><th>H</th><th>D</th><th>a</th><th>b</th><th>c</th><th>kg (lb)</th></tr>
<tr><td>NF009-503</td><td rowspan="2">55 (2.16)</td><td>195 (7.67)</td><td rowspan="3">80 (3.15)</td><td rowspan="3">20 (0.79)</td><td>180 (7.09)</td><td rowspan="5">5.5 (0.22)</td><td rowspan="4">M5</td><td>0.8 (1.8)</td></tr>
<tr><td>NF014-503</td><td>225 (8.85)</td><td>210 (8.27)</td><td>0.9 (2.0)</td></tr>
<tr><td>NF018-503</td><td>50 (1.96)</td><td>255 (10.04)</td><td>240 (9.45)</td><td>1.1 (2.4)</td></tr>
<tr><td>NF035-503</td><td rowspan="2">60 (2.36)</td><td>275 (10.83)</td><td rowspan="3">100 (3.93)</td><td rowspan="2">30 (1.18)</td><td>255 (10.04)</td><td>1.7 (3.7)</td></tr>
<tr><td>NF048-503</td><td>315 (12.40)</td><td>295 (11.61)</td><td rowspan="2">M6</td><td>2.1 (4.6)</td></tr>
<tr><td>NF063-503</td><td rowspan="2">90 (3.54)</td><td>260 (10.24)</td><td rowspan="2">60 (2.36)</td><td>235 (9.25)</td><td rowspan="4">6.5 (0.26)</td><td>2.4 (5.3)</td></tr>
<tr><td>NF085-503</td><td>320 (12.60)</td><td>140 (5.51)</td><td rowspan="3">255 (10.04)</td><td>M8</td><td>3.5 (7.7)</td></tr>
<tr><td>NF115-503</td><td rowspan="2">100 (3.93)</td><td rowspan="2">330 (13.00)</td><td rowspan="2">155 (6.10)</td><td rowspan="2">65 (2.56)</td><td rowspan="2">M10</td><td>4.8 (10.6)</td></tr>
<tr><td>NF150-503</td><td>5.6 (12.3)</td></tr>
</table>

3.28 Output choke option type HD...

- To suppress radiated interference from the unshielded motor cable. We recommend routing the motor cable through the output choke with 5 loops. Less than 5 loops are possible if the cable has a large diameter. To make up for this, 2 or 3 output chokes should be connected in series. Two output chokes should be connected in series if there are 4 loops, and three output chokes in series if there are 3 loops.

Output chokes are allocated on the basis of the cable cross sections of the motor feeders. Consequently, there is no separate allocation table for the 230 V units.

Output choke type	HD001	HD002	HD003
Part number	813 325 5	813 557 6	813 558 4
Dimensions W × H × D	121 × 64 × 131 mm (4.76 × 2.52 × 5.16 in)	66 × 49 × 73 mm (2.60 × 1.93 × 2.87 in)	170 × 64 × 185 mm (6.69 × 2.52 × 7.28 in)
Inside diameter d	50 mm (1.97 in)	23 mm (0.91 in)	88 mm (4.46 in)
Max. power loss P_{Vmax}	15 W	8 W	30 W
Weight	0.5 kg (1.1 lb)	0.2 kg (0.44 lb)	1.1 kg (2.42 lb)
For cable cross sections	1.5 – 16 mm^2 (AWG 16 – 6)	≤ 1.5 mm^2 (AWG 16)	≥ 16 mm^2 (AWG 6)

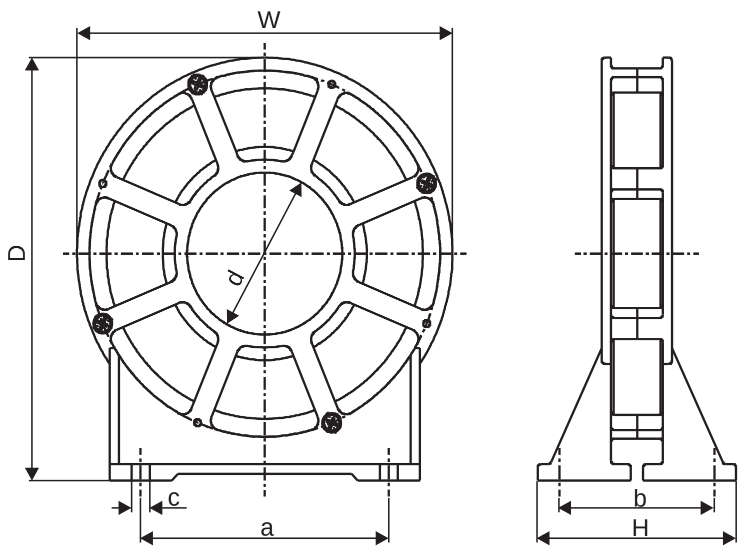

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Fig. 42: Dimensions, HD... output chokes

Mounting position as required

All dimensions in mm (in):

Output choke type	Main dimensions			Fixing dimensions		Inside ∅	Hole dimension
	B	H	D	a	b	d	c
HD001	121 (4.76)	64 (2.52)	131 (5.16)	80 (3.15)	50 (1.97)	50 (1.97)	5.8 (0.23)
HD002	66 (2.60)	49 (1.93)	73 (2.87)	44 (1.73)	38 (1.50)	23 (0.91)	
HD003	170 (6.69)	64 (2.52)	185 (7.28)	120 (4.72)	50 (1.97)	88 (3.46)	7.0 (0.28)

3.29 Output filter option type HF...

Sine filter for smoothing the output voltage of inverters. They are used:

- In group drives (several motor feeders in parallel); the discharge currents in the motor cables are suppressed.
- To protect the motor winding insulation of non-SEW motors which are not suitable for use with PWM inverters and could be damaged by voltage spikes in long motor feeders (> 100 m).

STOP

- Output filters must only be used on 400/500 V units type MDF and type MDV in VFC operating mode. They must not be used on 230 V units, on type MDV in CFC operating modes or on type MDS.
- Output filter must not be used in hoists.

Output filter type	HF015-503	HF022-503	HF030-503	HF040-503	HF055-503
Part number	826 030 3	826 031 1	826 032 X	826 311 6	826 312 4
Rated voltage V_{rated}	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$ +10 %, 50/60 Hz[1]				
Voltage drop at I_N ΔV	< 6.5 % (7.5 %) at 400 V / < 4 % (5 %) at 500 V and f_{Amax} = 50 Hz (60 Hz)				
Rated throughput current[2] $I_{N\ 400\ V}$ (at $V_{in} = 3 \times 400\ V_{AC}$)	$4\ A_{AC}$	$6\ A_{AC}$	$8\ A_{AC}$	$10\ A_{AC}$	$12\ A_{AC}$
Rated throughput current[2] $I_{N\ 500\ V}$ (at $V_{in} = 3 \times 500\ V_{AC}$)	$3\ A_{AC}$	$5\ A_{AC}$	$6\ A_{AC}$	$8\ A_{AC}$	$10\ A_{AC}$
Earth-leakage current at V_{rated} ΔI	0 mA				
Power loss at I_N P_V	35 W	55 W	65 W	90 W	115 W
Emitted interference via unshielded motor lead	According to class B limit to EN 55011 and EN 55014 Complies with EN 50081, parts 1 and 2				
Ambient temperature ϑ_{amb}	0 – +45 °C (reduction: 3.0 % I_N per K to max. 60 °C)				
Enclosure (EN 60529)	IP 20				
Connections	M4 connection studs: 0.5 – 6 mm^2 (AWG 20 – 10)				10 mm^2 (AWG 8)
Weight	4.4 kg (9.68 lb)			10.8 kg (23.76 lb)	
For MOVIDRIVE® MD_60A...-5_3 in rated operation (100 %)	0015	0022	0030	0040	0055
With increased power (125 %)	-	0015	0022	0030	0040

Output filter type	HF075-503	HF450-503	HF023-403	HF033-403	HF047-403
Part number	826 313 2	826 948 3	825 784 1	825 785 X	825 786 8
Rated voltage V_{rated}	$3 \times 380\ V_{AC}$-10 % – $3 \times 500\ V_{AC}$ +10 %, 50/60 Hz[1]				
Voltage drop at I_N ΔU	< 6.5 % (7.5 %) at 400 V / < 4 % (5 %) at 500 V and f_{Amax} = 50 Hz (60 Hz)				
Rated throughput current[2] $I_{N\ 400\ V}$ (at $V_{in} = 3 \times 400\ V_{AC}$)	$16\ A_{AC}$	$90\ A_{AC}$	$23\ A_{AC}$	$33\ A_{AC}$	$47\ A_{AC}$
Rated throughput current[2] $I_{N\ 500\ V}$ (at $V_{in} = 3 \times 500\ V_{AC}$)	$13\ A_{AC}$	$72\ A_{AC}$	$19\ A_{AC}$	$26\ A_{AC}$	$38\ A_{AC}$
Earth-leakage current at V_{rated} ΔI	0 mA				
Power loss at I_N P_V	135 W	400 W	90 W	120 W	200 W
Emitted interference via unshielded motor lead	According to class B limit to EN 55011 and EN 55014 Complies with EN 50081, parts 1 and 2				
Ambient temperature ϑ_{amb}	0 – +45 °C (reduction: 3.0 % I_N per K to max. 60 °C)				
Enclosure (EN 60529)	IP 20	IP 10	IP 20		
Connections	10 mm^2 (AWG 8)	35 mm^2 (AWG 2)	25 mm^2 (AWG 4)		
Weight	10.8 kg (23.76 lb)	32 kg (70.58 lb)	15.9 kg (35.0 lb)	16.5 kg (36.3 lb)	23 kg (50.6 lb)
For MOVIDRIVE® MD_60A...-5_3 in rated operation (100 %)	0075	0370/0450/ 0550[3]/0750[3]	0110	0150/0300[3]	0220
With increased power (125 %)	0055	0300/0370/0450/ 0550/0750	0075	0110/0220[3]	0150

1) A reduction of 6 % I_N per 10 Hz applies above f_{AN} = 60 Hz for the rated throughput current I_N.

2) Only applies to operation without V_{DC} connection.

3) Connect **two HF... output filters together in parallel** for operation with these MOVIDRIVE® units.

Dimensions, output filter HF...-503, in mm (in)

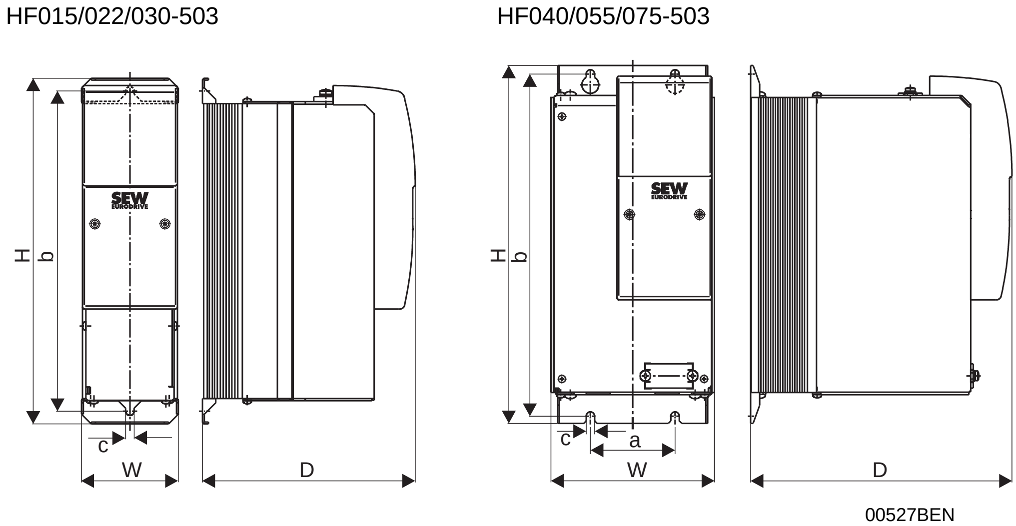

Fig. 43: Dimensions, output filter HF015...075-503

Only the mounting position shown in the dimensions diagram is permitted

Output filter type	Main dimensions			Fixing dimensions		Hole dim.	Ventilation clearances[1)]	
	B	H	D	a	b	c	Above	Below
HF015/022/030-503	80 (3.15)	286 (11.26)	176 (6.93)	-	265 (10.43)	7 (0.28)	100 (3.94)	100 (3.94)
HF040/055/075-503	135 (5.31)	296 (11.65)	216 (8.50)	70 (2.76)	283 (11.14)			

1) No clearance is required at the sides; the units can be lined up in rows.

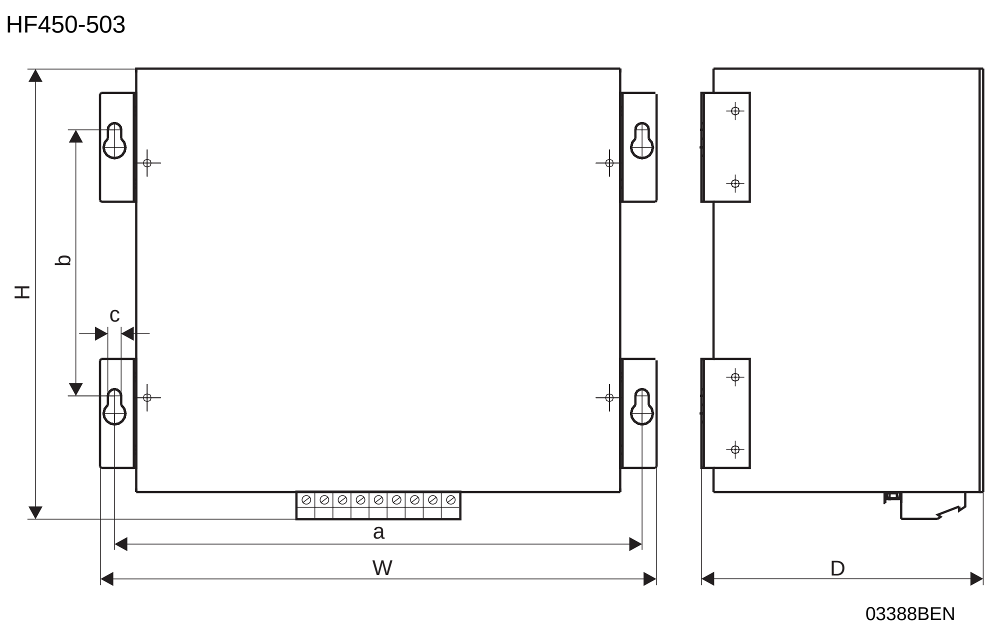

Fig. 44: Dimensions, output filter HF450-503

Only the mounting position shown in the dimensions diagram is permitted

Output filter type	Main dimensions			Fixing dimensions		Hole dim.	Ventilation clearance	
	B	H	D	a	b	c	Above	Below
HF450-503	465 (18.31)	385 (15.16)	240 (9.45)	436 (17.17)	220 (8.66)	8.5 (0.33)	100 (3.94)	100 (3.94)

Dimensions, output filter HF...-403, in mm (in)

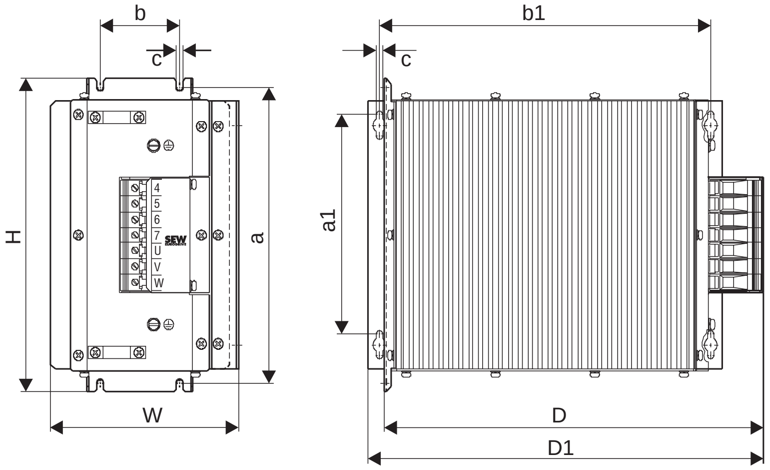

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Fig. 45: Dimensions, output filter HF...-403

<table>
<tr><th rowspan="3">Type</th><th colspan="3" rowspan="2">Main dimensions</th><th colspan="4">Fixing dimensions</th><th rowspan="2">Hole dimen sion</th><th colspan="3" rowspan="2">Ventilation clearance</th></tr>
<tr><th colspan="2">Standard installation</th><th colspan="2">Crossways mounting position</th></tr>
<tr><th>B</th><th>H</th><th>D/D1</th><th>a</th><th>b</th><th>a1</th><th>a2</th><th>c</th><th>Sides</th><th>Above</th><th>Below</th></tr>
<tr><td>HF023-403</td><td rowspan="2">145
(5.71)</td><td rowspan="2">284
(11.18)</td><td rowspan="2">365/390
(14.37/15.35)</td><td rowspan="2">268
(10.55)</td><td rowspan="2">60
(2.36)</td><td rowspan="3">210
(8.27)</td><td rowspan="3">334
(13.15)</td><td rowspan="3">6.5
(0.26)</td><td rowspan="3">30
each
(1.18
ea)</td><td rowspan="3">150
(5.91)</td><td rowspan="3">150
(5.91)</td></tr>
<tr><td>HF033-403</td></tr>
<tr><td>HF047-403</td><td>190
(7.48)</td><td>300
(11.82)</td><td>385/400
(15.16/15.57)</td><td>284
(11.18)</td><td>80
(3.15)</td></tr>
</table>

3.30 Pre-fabricated cables

Overview

SEW offers cable sets and prefabricated cables for straightforward and error-free connection of various system components to MOVIDRIVE®. Specifically, these are:

1. Cable sets for DC link connection MDR → MDF/MDV/MDS
2. Motor cables for connecting CM motors to MDV and MDS
3. Motor cables for connecting DS/DY motors to MDS
4. Resolver cables (plug and terminal box versions) for CM/DS/DY motors
5. Forced-cooling fan cables
6. Brake cables
7. Absolute encoder cables for connecting AV1Y to DIP11A (X62)
8. Absolute encoder cables for connecting AV1Y to encoder input X15 of the MDV basic unit (sine signals for speed control) and to DIP11A (X62: absolute value signals)
9. Encoder cables for connecting the motor encoder to encoder input X15 of the MDV basic unit or to "X2: Encoder" of the 5 V encoder power supply type DWI11A
10. Encoder cable for connecting an external encoder or a control (encoder simulation output) to X14 of the MDV/MDS basic unit
11. Encoder connection (master X14 → slave X14)
12. Encoder connection for:
    - Connection "X1: MOVIDRIVE" of the DWI11A and X15 MDV basic unit
    - Master/slave connection with synchronous operation DRS11A (master X14 → slave X42)

It is necessary to differentiate between whether the cables are intended for fixed routing or for use in cat tracks. The cables are pre-fabricated in 1 m steps for the required length.

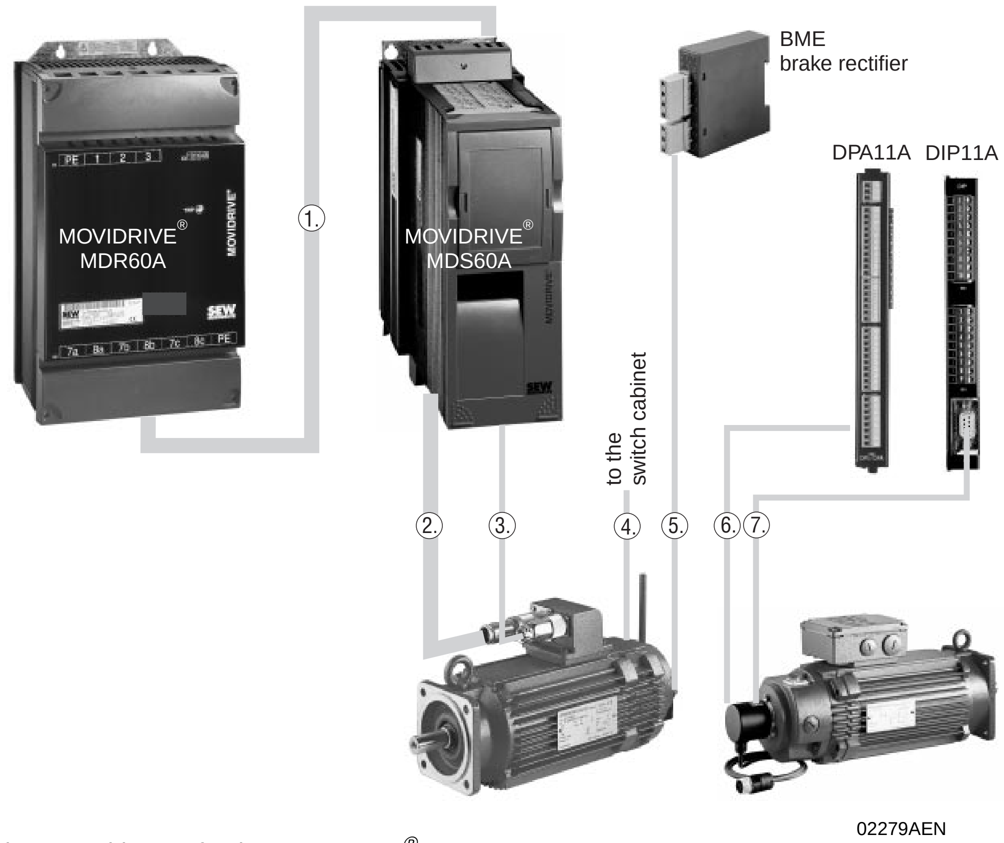

Fig. 46: Cable sets for the MOVIDRIVE® system

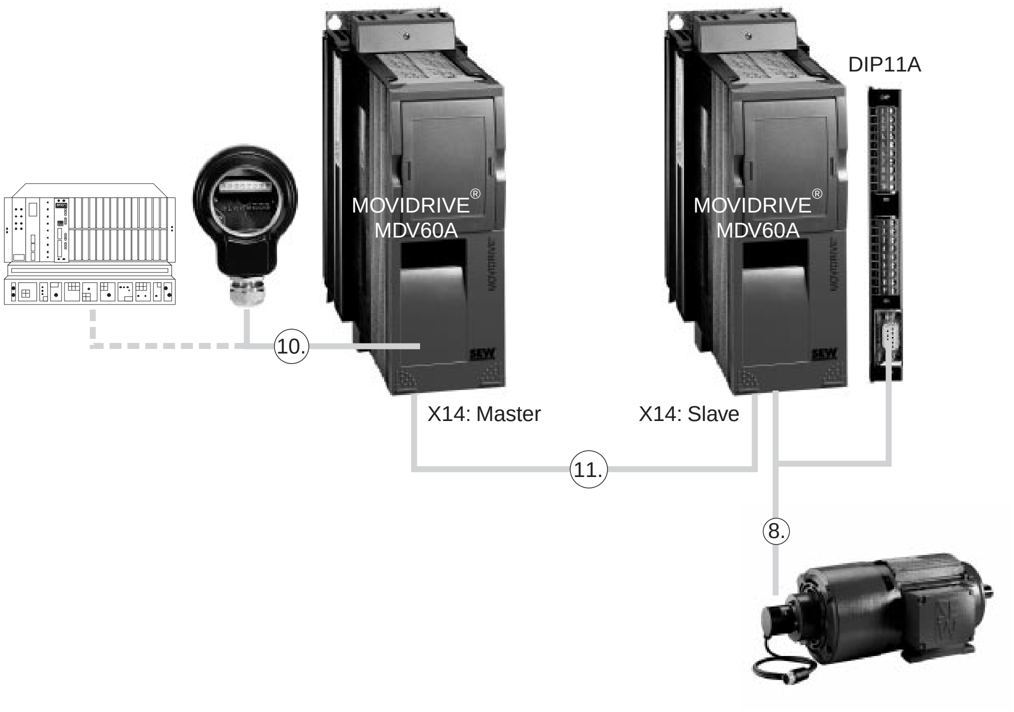

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Fig. 47: Connection of external encoder, combination encoder and master/slave connection

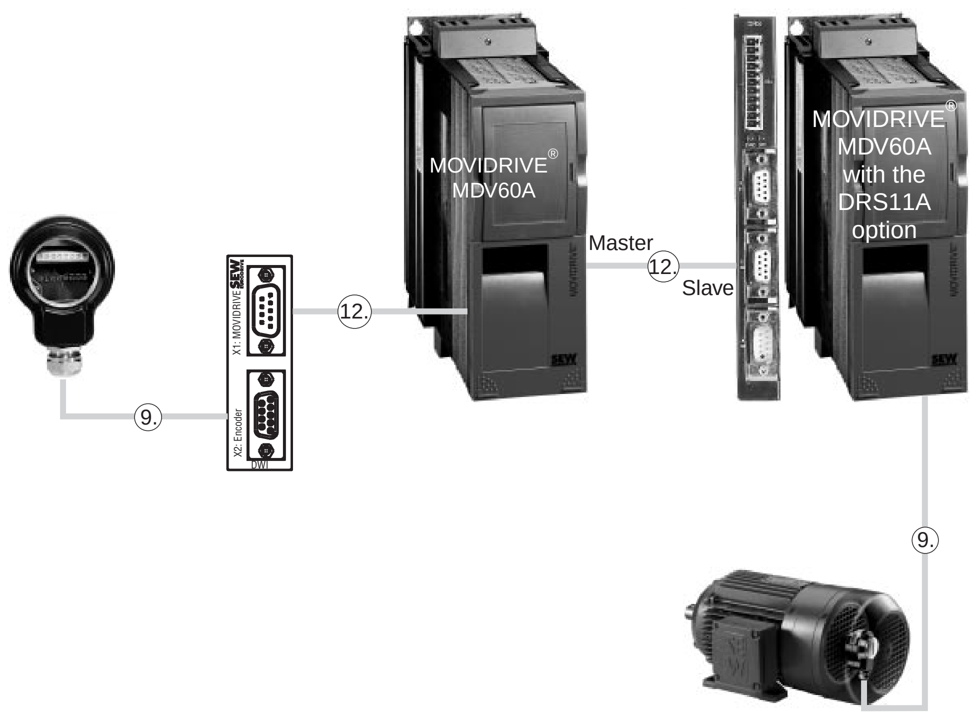

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Fig. 48: Connection of motor encoder and master/slave connection

1. Cable sets for DC link connection MDR → MDF/MDV/MDS

Description

SEW strongly recommends that the cable sets named below are used, because they possess the relevant dielectric strength and are also color-coded. This is necessary because cross-polarity and ground faults could cause irreparable damage to the connected equipment.

The length of the cables restricts the DC link circuit connection to the permitted 5 m (16.4 ft), whilst they can also be cut to length by the customer for connecting several units. The lugs for connecting to the regenerative power supply unit and an inverter are supplied with the cable set. Use commercial lugs for connecting additional inverters. The inverters must then be connected to the regenerative power supply unit in a star configuration. Use a busbar subdistributor if the DC link terminals of the regenerative power supply unit are not sufficient.

Type of routing

Only fixed routing is possible.

Cable set type	DCP12A	DCP13A	DCP15A
Part number	814 567 9	814 250 5	814 251 3
For connecting MOVIDRIVE® MD_60A	0015 – 0110	0150 – 0300	0370 – 0750

2. Motor cables for connecting CM motors to MDV or MDS

Description

The cables are equipped with a plug for the motor connection and conductor end sleeves for the inverter connection.

Number of cores and line cross section	Part number	Type of routing	For motor
4×1.5 mm² (AWG 16)	199 179 5	Fixed routing	CM..SM51
4×1.5 mm² (AWG 16) + 3×1.0 mm² (AWG 17)	199 189 2		CM..BR SB51
4×2.5 mm² (AWG 12)	199 181 7		CM..SM52
4×2.5 mm² (AWG 12) + 3×1.0 mm² (AWG 17)	199 191 4		CM..BR SB52
4×4 mm² (AWG 10)	199 183 3		CM..SM54
4×4 mm² (AWG 10) + 3×1.0 mm² (AWG 17)	199 193 0		CM..BR SB54
4×6 mm² (AWG 10)	199 185 X		CM..SM56
4×6 mm² (AWG 10) + 3×1.5 mm² (AWG 16)	199 195 7		CM..BR SB56
4×10 mm² (AWG 8)	199 187 6		CM..SM59
4×10 mm² (AWG 8) + 3×1.5 mm² (AWG 16)	199 197 3		CM..BR SB59

Number of cores and line cross section	Part number	Type of routing	For motor
4×1.5 mm² (AWG 16)	199 180 9	Cat track routing	CM..SM51
4×1.5 mm² (AWG 16) + 3×1.0 mm² (AWG 17)	199 190 6		CM..BR SB51
4×2.5 mm² (AWG 12)	199 182 5		CM..SM52
4×2.5 mm² (AWG 12) + 3×1.0 mm² (AWG 17)	199 192 2		CM..BR SB52
4×4 mm² (AWG 10)	199 184 1		CM..SM54
4×4 mm² (AWG 10) + 3×1.0 mm² (AWG 17)	199 194 9		CM..BR SB54
4×6 mm² (AWG 10)	199 186 8		CM..SM56
4×6 mm² (AWG 10) + 3×1.5 mm² (AWG 16)	199 196 5		CM..BR SB56
4×10 mm² (AWG 8)	199 188 4		CM..SM59
4×10 mm² (AWG 8) + 3×1.5 mm² (AWG 16)	199 198 1		CM..BR SB59

3. Motor cables for connecting DS/DY motors to MDS

Description The cables are equipped with a plug for the motor connection and conductor end sleeves for the inverter connection.

Number of cores and line cross section	Part number	Type of routing	For motor
4×1.5 mm^2 (AWG 16)	198 669 4	Fixed routing	DS56 / SM11
4×1.5 mm^2 (AWG 16) + 2×0.75 mm^2 (AWG 18)	198 670 8		DS56..B / SM11
4×1.5 mm^2 (AWG 16)	198 683 X		DY71 / SM21
4×2.5 mm^2 (AWG 12)	198 684 8		DS71 / SM22
4×2.5 mm^2 (AWG 12)	198 685 6		DY90/112 / SM32
4×4 mm^2 (AWG 10)	198 686 4		DY90/112 / SM34
4×6 mm^2 (AWG 10)	198 687 2		DY90/112 / SM36
4×6 mm^2 (AWG 10)	198 688 0		DY112 / SM46
4×10 mm^2 (AWG 8)	198 689 9		DY112 / SM41

Number of cores and line cross section	Part number	Type of routing	For motor
4×1.5 mm^2 (AWG 16)	198 741 0	Cat track routing	DS56 / SM11
4×1.5 mm^2 (AWG 16) + 2×0.75 mm^2 (AWG 18)	198 742 9		DS56..B / SM11
4×1.5 mm^2 (AWG 16)	198 734 8		DY71 / SM21
4×2.5 mm^2 (AWG 12)	198 735 6		DS71 / SM22
4×2.5 mm^2 (AWG 12)	198 736 4		DY90/112 / SM32
4×4 mm^2 (AWG 10)	198 737 2		DY90/112 / SM34
4×6 mm^2 (AWG 10)	198 738 0		DY90/112 / SM36
4×6 mm^2 (AWG 10)	198 739 9		DY112 / SM46
4×10 mm^2 (AWG 8)	198 740 2		DY112 / SM41

4. Resolver cables

Resolver cables for CM motors:

Part number	199 214 7	199 215 5
Routing	Fixed routing	Cat track routing
For resolver in motor	CM71 – 112	
Line cross section	6 × 2 × 0.25 mm^2 (AWG 23)	
Conductor colors	Ref.+: Pink (PK) Ref.-: Gray (GY) cos+: Red (RD) cos-: Blue (BU) sin+: Yellow (YE) sin-: Green (GN) TF/TH: Grey/pink (GY-PK) TF/TH: Red/blue (RD-BU)	
Connection to **resolver/motor** **MOVIDRIVE® MDS60A**	With resolver connector (Intercontec, type ASTA021NN00 10 000 5 000) With 9-pin sub D plug	

3

Resolver cables for DS56 motor with plug connection:

Part number	**198 927 8**	**198 928 6**
Routing	Fixed routing	Cat track routing
For resolver in motor	DS56	
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23)	
Conductor colors	Ref.+: Pink (PK) Ref.-: Gray (GY) cos+: Red (RD) cos-: Blue (BU) sin+: Yellow (YE) sin-: Green (GN) TF/TH: White (WH) TF/TH: Brown (BN)	
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection to **resolver/motor** **MOVIDRIVE® MDS60A**	With resolver connector (Intercontec, type ASTA021NN00 10 000 5 000) With 9-pin sub D plug	

Resolver cables for DY71 – 112 motors with plug connection:

Part number	**198 827 1**	**198 812 3**
Routing	Fixed routing	Cat track routing
For resolver in motor	DY71 – 112	
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23)	
Conductor colors	Ref.+: Pink (PK) Ref.-: Gray (GY) cos+: Red (RD) cos-: Blue (BU) sin+: Yellow (YE) sin-: Green (GN) TF/TH: White (WH) TF/TH: Brown (BN)	
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection to **resolver/motor** **MOVIDRIVE® MDS60A**	With resolver connector (Framatome Souriou, type GN-DMS2-12S) With 9-pin sub D plug	

Resolver cables for DS56 and DY71 – 112 motors with terminal box:

Part number	**198 829 8**	**198 828 X**
Routing	Fixed routing	Cat track routing
For resolver in motor	DS56 and DY71 – 112	
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23) + 1 × 0.25 mm^2 (AWG 23)	
Conductor colors	Ref.+: Pink (PK) Ref.-: Gray (GY) cos+: Red (RD) cos-: Blue (BU) sin+: Yellow (YE) sin-: Green (GN) TF/TH: White (WH) TF/TH: Brown (BN)	
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection to **resolver/motor** **MOVIDRIVE® MDS60A**	With conductor end sleeves, cut off the violet (VT) conductor of the cable in the terminal box With 9-pin sub D plug	

5. Forced-cooling fan cables

Part number		198 634 1	198 747 X
Routing		Fixed routing	Cat track routing
Line cross section		3×1 mm^2 (AWG 17)	
Connection	**Fan** **Switch cabinet**	With plug With conductor end sleeves	

6. Brake cables

Part number		198 633 3	198 745 3
Routing		Fixed routing	Cat track routing
Line cross section		4×1.5 mm^2 (AWG 16)	
Connection to	**CM/DY motor** **Brake rectifier**	With plug With conductor end sleeves	

7. Cables for connecting the absolute encoder AV1Y to DIP11A (X62)

Part number		198 929 4	198 930 8
Routing		Fixed routing	Cat track routing
For encoder		AV1Y	
Line cross section		$3 \times 2 \times 0.25$ mm^2 (AWG 23)	
Conductor colors		T+: Pink (PK) T-: Gray (GY) D+: Yellow (YE) D-: Green (GN) GND: Brown (BN) U_S: White (WH)	
Manufacturer and type		Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection	**to encoder/motor** **to DIP11A**	With 17-pin female connector SPUC 17B FRAN With 9-pin sub D plug	

8. Cables for connecting the absolute encoder AV1Y to encoder input X15 and DIP11A (X62)

Part number		198 890 5	198 891 3
Routing		Fixed routing	Cat track routing
For encoder		AV1Y	
Line cross section		$5 \times 2 \times 0.25$ mm^2 (AWG 23)	
Conductor colors		T+: Pink (PK) T-: Gray (GY) D+: Black (BK) D-: Violet (VT) GND: Brown (BN) U_S: White (WH) $\underline{A}$: Yellow (YE) A: Green (GN) $\underline{B}$: Red (RD) B: Blue (BU)	
Manufacturer and type		Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection	**to encoder/motor** **to X15 and DIP11A**	With 17-pin female connector SPUC 17B FRAN with two 9-pin sub D plugs	

3

9. Motor encoder cables, connection to X15

Cables for TTL sensors and sin/cos motor encoders (TTL sensors and sin/cos encoders)

Part number	**198 829 8**	**198 828 X**
Routing	Fixed routing	Cat track routing
For encoder	ES1T, ES2T and EV1T via option DWI11A and cable 814 344 7 ES1S, ES2S, EV1S, ES1R, ES2R and EV1R directly to X15 (MDV)	
Line cross section	$4 \times 2 \times 0.25$ mm^2 (AWG 23) + 1×0.25 mm^2 (AWG 23)	
Conductor colors	$\underline{A}$: Yellow (YE) A: Green (GN) $\underline{B}$: Red (RD) B: Blue (BU) $\underline{C}$: Pink (PK) C: Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor line: Violet (VT)	
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	Lapp, Unitronic FD CP (TP) Helukabel, Super-Paar-Tronic-C-PUR
Connection **to encoder/motor** **to X15 or DWI11A**	With conductor end sleeves On ES1T, ES2T and EV1T, connect the violet conductor (VT) on the encoder to UB On ES1S, ES2S, EV1S, ES1R, ES2R and EV1R, cut off the violet conductor (VT) at the encoder end With 9-pin sub D plug	

Cables for HTL motor encoders (HTL encoders)

Part number	**198 932 4**	**198 931 6**
Routing	Fixed routing	Cat track routing
For encoder	ES1C, ES2C and EV1C	
Line cross section	5×0.25 mm^2 (AWG 23) + 1×0.25 mm^2 (AWG 23)	
Conductor colors	A: Yellow (YE) B: Green (GN) C: Gray (GY) UB: White (WH) ⊥: Brown (BN)	
Manufacturer and type	Lapp, Unitronic LiYCY Helukabel, Tronic-CY	Lapp, Unitronic FD CP Helukabel, Super-Tronic-C-PURö
Connection **to encoder/motor** **to X15**	With conductor end sleeves With 9-pin sub D plug	

10. Cable for external encoder (TTL encoder) or encoder simulation, connection on X14

Part number	**815 354 X**	**-**
Routing	Fixed routing	-
For encoder	ES1R, ES2R and EV1R or evaluation of encoder simulation	
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23) + 1 × 0.25 mm^2 (AWG 23)	
Conductor colors	$\underline{A}$: Yellow (YE) A: Green (GN) $\underline{B}$: Red (RD) B: Blue (BU) $\underline{C}$: Pink (PK) C: Gray (GY) UB: White (WH) ⊥: Brown (BN) Switch mode: Violet (VT)	
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY	-
Connection **to encoder/to the evaluation unit**	With conductor end sleeves External encoder: cut off the violet conductor (VT) at the encoder end Evaluation unit: jumper the violet conductor (VT) with the brown conductor (BN)	
to X14	With 9-pin sub D socket	

11. Encoder connection X14: Master → X14: Slave

Part number	**815 355 8**
Routing	Fixed routing
For master/slave connection	X14: Master → X14: Slave
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23) + 1 × 0.25 mm^2 (AWG 23)
Conductor colors	$\underline{A}$: Yellow (YE) A: Green (GN) $\underline{B}$: Red (RD) B: Blue (BU) $\underline{C}$: Pink (PK) C: Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor line: Violet (VT)
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY
Connection to **X14: Master**[1)]	With 9-pin sub D socket
X14: Slave[1)]	With 9-pin sub D socket

1) **Important:** Connect the socket marked "Master" to X14: Master and the socket marked "Slave" to X14: Slave!

12. Encoder connection

This cable is intended for the following connections:

- MOVIDRIVE® MDV "Encoder In" (X15) → 5 V encoder power supply option type DWI11A
- Master/slave connection with synchronous operation option type DRS11A, master X14 → slave X42 (DRS11A)

Part number	**814 344 7**
Routing	Fixed routing
For encoder with 5 V encoder power supply **For DRS11A master/slave connection**	ES1T, ES2T and EV1T via option DWI11A Master X14 → slave X42 (DRS11A)
Line cross section	4 × 2 × 0.25 mm^2 (AWG 23) + 1 × 0.25 mm^2 (AWG 23)
Conductor colors	A: Yellow (YE) $\overline{A}$: Green (GN) B: Red (RD) $\overline{B}$: Blue (BU) C: Pink (PK) $\overline{C}$: Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor line: Violet (VT)
Manufacturer and type	Lapp, Unitronic Li2YCY (TP) Helukabel, Paar-Tronic-CY
Connection to **DWI11A / master X14** **X15 / slave X42**	With 9-pin sub D socket With 9-pin sub D plug

4 Parameters

Generally speaking, the parameters menu is only required for startup and when servicing is undertaken. Consequently, the basic unit of MOVIDRIVE® is configured without a keypad; it can be supplemented with the appropriate communications facility as an option.

There are various ways of setting MOVIDRIVE® parameters:

- With the optional keypad type DBG11A.
- With the MOVITOOLS PC program (includes SHELL, SCOPE and IPOS programming). PC connection via serial interface USS21A or interface converter UWS11A.
- Using the serial interfaces, programming by the customer.
- Using the fieldbus interfaces, programming by the customer.
- Using IPOS^plus®, programming by the customer.

The latest version of the MOVITOOLS PC program can be downloaded from the SEW homepage (www.sew-eurodrive.de).

4.1 Menu structure

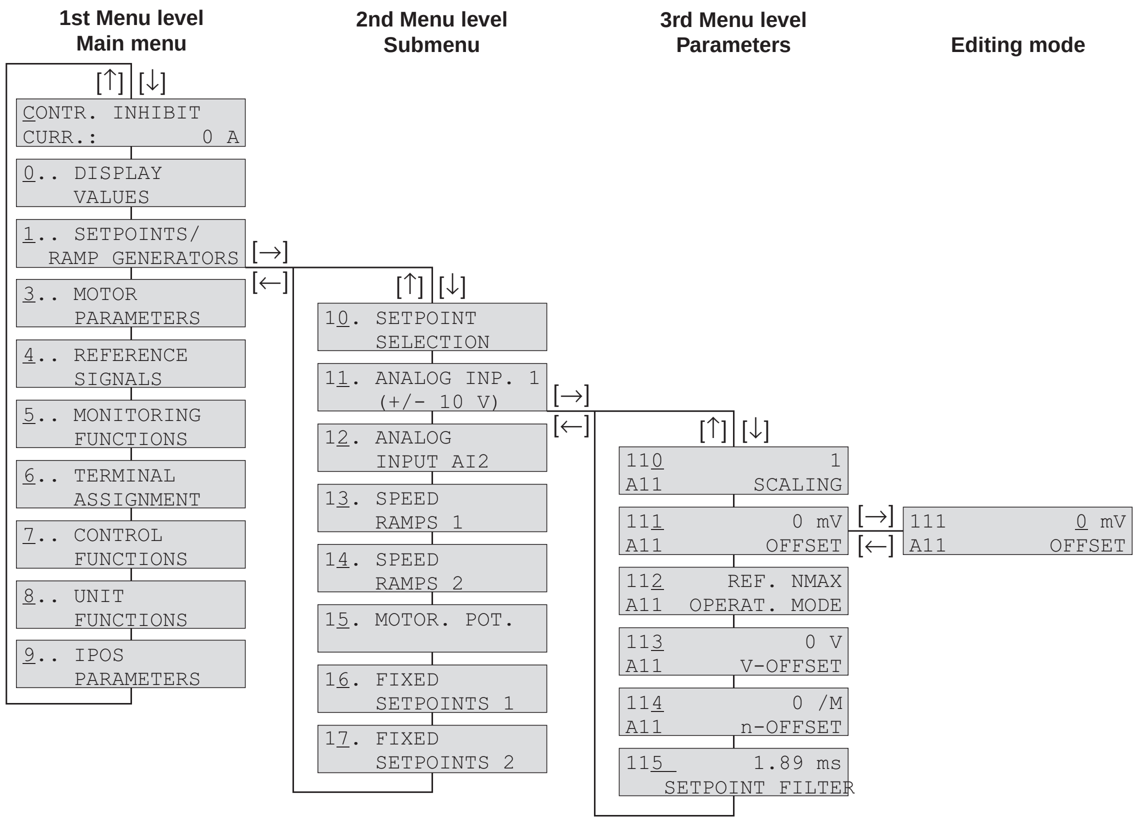

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Fig. 49: Menu structure

4.2 Overview of parameters

The table lists all parameters together with their setting range and the factory settings (in bold):

0__	**DISPLAY VALUES → page 97**	
00_	**Process values**	
000	Speed	
001	User display	
002	Frequency	
003	Actual position	
004	Output current	
005	Active current	
006	Motor utilization 1	
007	Motor utilization 2	
008	DC link voltage	
009	Output current	
01_	**Status displays**	
010	Inverter status	
011	Operational status	
012	Fault status	
013	Active parameter set	
014	Heat sink temperature	
015	Mains ON operation time	
016	Operating time (enabled)	
017	Electrical energy	
02_	**Analog setpoints**	
020/021	Analog input AI1/AI2	
022	Ext. current limitation	
03_	**Binary inputs basic unit**	
030–035	Binary input DIØØ – DIØ5	
036	Status binary inputs	
04_	**Binary inputs option**	
040–047	Binary inputs DI1Ø – DI17	
048	Status binary inputs	
05_	**Binary outputs basic unit**	
050	Binary output DBØØ	
051/052	Binary output DOØ1/DOØ2	
053	Status binary outputs	
06_	**Binary outputs option**	
060–067	Binary outputs DO1Ø–DO17	
068	Status binary outputs	
07_	**Unit data**	
070	Unit type	
071	Unit rated current	
072	Option 1	
073	Option 2	
074	Firmware option 1	
075	Firmware option 2	
076	Firmware basic unit	
077	Technology function	

08_	**Fault memory**	
080–084	Fault t-0 – t-4	
09_	**Bus diagnosis**	
090	PD configuration	
091	Fieldbus type	
092	Fieldbus baud rate	
093	Fieldbus address	
094–096	PO1 – PO3 setpoint	
097–099	PI1 – PI3 actual value	
1__	**SETPOINTS / RAMP GENERATORS → page 100**	
10_	**Setpoint selection**	
100	Setpoint source	**UNIPOL/FIX.SETPT**
101	Control signal source	**TERMINALS**
11_	**Analog input AI1**	
110	AI1 scaling	-10 – -0.1 / 0.1 – **1** – 10
111	AI1 offset	-500 – **0** – 500 mV
112	AI1 operation mode	**Ref. N-MAX**
113	AI1 voltage offset	-10 – **0** – 10 V
114	AI1 speed offset	-5000 – **0** – 5000 rpm
115	Filter setpoint	0 – **5** – 100 ms, 0 = OFF
12_	**Analog inputs (optional)**	
120	AI2 operation mode	**NO FUNCTION**
13_/14_	**Speed ramps 1 / 2**	
130/140	Ramp t11/t21 UP CW	0 – **2** – 2000 s
131/141	Ramp t11/t21 DOWN CW	0 – **2** – 2000 s
132/142	Ramp t11/t21 up CCW	0 – **2** – 2000 s
133/143	Ramp t11/t21 down CCW	0 – **2** – 2000 s
134/144	Ramp t12/t22 UP=DOWN	0 – **2** – 2000 s
135/145	S pattern t12/t22	**0** – 3
136/146	Stop ramp t13/t23	0 – **2** – 20 s
137/147	Emergency ramp t14/t24	0 – **2** – 20 s
138	Ramp limit VFC	NO = 0 / **YES = 1**
15_	**Motorized potentiometer**	
150	Ramp t3 UP	0.2 – **20** – 50 s
151	Ramp t3 DOWN	0.2 – **20** – 50 s
152	Save last setpoint	ON / **OFF**
16_/17_	**Fixed setpoints 1 / 2**	
160/170	Internal setpoint n11/n21	-5000 – **150** – 5000 rpm
161/171	Internal setpoint n12/n22	-5000 – **750** – 5000 rpm
162/172	Internal setpoint n13/n23	-5000 – **1500** – 5000 rpm

2__	**CONTROLLER PARAMETERS → page 113**	
20_	**Speed control**	
200	P gain speed controller	0.1 – **2** – 32
201	Time constant n-control.	0 – **10** – 300 ms
202	Gain accel. feedforward	**0** – 32
203	Filter accel. feedforward	**0** – 100 ms
204	Filter speed act. value	**0** – 32 ms
205	Load feedforward	**0** – 150 %
206	Sample time n-control.	**1 ms = 0** / 0.5 ms = 1
207	Load feedforward VFC	**0** – 150 %
21_	**Hold controller**	
210	P-gain hold controller	0.1 – **2** – 32
22_	**Synchr. oper. control**	
220	P-gain (DRS)	1 – **10** – 200
221	Master gear ratio factor	**1** – 3,999,999,999
222	Slave gear ratio factor	**1** – 3,999,999,999
223	Mode selection	**Mode 1** – Mode 8
224	Slave counter	-99,999,999 – -10/ **10** – 99,999,999
225	Offset 1	-32767 – -10/**10** – 32767
226	Offset 2	-32767 – -10/**10** – 32767
227	Offset 3	-32767 – -10/**10** – 32767
228	Feedforw. filter (DRS)	**0** – 100 ms
23_	**Synchr. oper. w. sync encoder**	
230	Synchronous encoder	**OFF**/EQ.-RANK./CHAIN
231	Factor slave encoder	**1** – 1000
232	Factor slave sync. enc.	**1** – 1000
24_	**Synchr. oper. w. catch up**	
240	Synchronization speed	-5000 – **1500** – 5000 rpm
241	Synchronization ramp	0 – **2** – 50 s
3__	**Motor parameters → page 117**	
30_/31_	**Limits 1 / 2**	
300/310	Start/stop speed 1/2	0 – **60** – 150 rpm
301/311	Minimum speed 1/2	0 – **60** – 5500 rpm
302/312	Maximum speed 1/2	0 – **1500** – 5500 rpm
303/313	Current limit 1/2	0 – **150** %I_N
304	Torque limit	**0** – 150 %
32_/33_	**Motor compensat. 1/2 (asynchr.)**	
320/330	Auto adjustment 1/2	**ON** / OFF
321/331	Boost 1/2	**0** – 100 %
322/332	I×R compensation 1/2	**0** – 100 %
323/333	Premagnetiz. time 1/2	0 – **0.1** – 2 s
324/334	Slip compensation 1/2	**0** – 500 rpm
34_ 1 2	**Motor protection**	
340/342	Motor protection 1/2	ON / **OFF**
341/343	Cooling type 1/2	**FAN** / FORCED
35_ 1 2	**Motor sense of rotation**	
350/351	Change direction of rotation 1/2	ON / **OFF**

36_	**Startup (only available in DBG11A)**	
360	Startup	YES / **NO**
4__	**REFERENCE SIGNALS → page 121**	
40_	**Speed reference signal**	
400	Speed reference value	0 – **1500** – 5000 rpm
401	Hysteresis	0 – **100** – 500 rpm
402	Delay time	0 – **1** – 9 s
403	Signal = "1" if:	**$n < n_{ref}$** / $n > n_{ref}$
41_	**Speed window signal**	
410	Window center	0 – **1500** – 5000 rpm
411	Range width	**0** – 5000 rpm
412	Delay time	0 – **1** – 9 s
413	Signal = "1" if:	**INSIDE** / OUTSIDE
42_	**Speed setp./act. val. comp.**	
420	Hysteresis	0 – **100** – 300 rpm
421	Delay time	0 – **1** – 9 s
422	Signal = "1" if:	$n \neq n_{setpt}$ / $n = n_{setpt}$
43_	**Current reference signal**	
430	Current reference value	0 – **100** – 150 % I_N
431	Hysteresis	0 – **5** – 30 % I_N
432	Delay time	0 – **1** – 9 s
433	Signal = "1" if:	**$I<I_{ref}$** / $I>I_{ref}$
44_	**Imax signal**	
440	Hysteresis	0 – **5** – 50 % I_N
441	Delay time	0 – **1** – 9 s
442	Signal = "1" if:	$I = I_{max}$ / **$I < I_{max}$**
5__	**MONITORING FUNCTIONS → page 124**	
50_ 1 2	**Speed monitoring**	
500/502	Speed monitoring 1/2	**AUS**/MOT/GEN/MOT&GEN
501/503	Delay time 1/2	0 – **1** – 10 s
51_	**Synchr. operation monitoring**	
510	Positioning tol. slave	10 – **25** – 32768 inc
511	Prewarning lag error	**50** – 99,999,999 inc
512	Lag error limit	100 – **4000** – 99,999,999
513	Delay lag error signal	0 – **1** – 99 s
514	Counter LED display	10 – **100** – 32768 inc
515	Delay in-position signal	5 – **10** – 2000 ms
52_	**Mains OFF monitoring**	
520	Mains OFF resp. time	**0** – 5 s
521	Mains OFF response	**CTRL.INHIBIT**/EM. STOP
6__	**TERMINAL ASSIGNMENT → page 126**	
60_	**Binary inputs basic unit**	
600	Binary input DIØ1	**CW/STOP**
601	Binary input DIØ2	**CCW/STOP**
602	Binary input DIØ3	**ENABLE/RAP.STOP**
603	Binary input DIØ4	**n11/n21**
604	Binary input DIØ5	**n12/n22**

61_	**Binary inputs option**	
610–617	Binary input DI1Ø – 17	**NO FUNCTION**
62_	**Binary outputs basic unit**	
620	Binary output DOØ1	**READY**
621	Binary output DOØ2	**/FAULT**
63_	**Binary outputs option**	
630–637	Binary outputs DO1Ø – 17	**NO FUNCTION**
64_	**Analog outputs optional**	
640	Analog output AO1	**ACTUAL SPEED**
641	Scaling AO1	-10 – 0 – **1** – 10
642	Operating mode A01	OFF/±**10 V**/0(4)..20 mA
643	Analog output AO2	**OUTP.CURRENT**
644	Scaling AO2	-10 – 0 – **1** – 10
645	Operating mode AO2	OFF/±**10 V**/0(4)..20 mA
7__	**Control functions → page 130**	
70_ 1 2	**Operating modes**	
700/701	Operating mode 1/2	**VFC 1 / 2**
71_ 1 2	**Current at standstill**	
710/711	Standstill current 1/2	**0** – 50 % I_{Mot}
72_ 1 2	**Setpoint stop function**	
720/723	Setpoint stop function 1/2	ON / **OFF**
721/724	Stop setpoint 1/2	0 – **30** – 500 rpm
722/725	Start offset 1/2	0 – **30** – 500 rpm
73_ 1 2	**Brake function**	
730/733	Brake function 1/2	**ON** / OFF
731/734	Brake release time 1/2	**0** – 2 s
732/735	Brake application time 1/2	0 – **0.2** – 2 s
74_ 1 2	**Speed skip**	
740/742	Skip window center 1/2	0 – **1500** – 5000 rpm
741/743	Skip width 1/2	**0** – 300 rpm
75_	**Master-Slave function**	
750	Slave setpoint	**MASTER-SLAVE OFF**
751	Scaling slave setpoint	-10 – 0 – **1** – 10
8__	**UNIT FUNCTIONS → page 148**	
80_	**Setup**	
800	Quick menu	**ON** / OFF
801	Language	**DE** / EN / FR
802	Factory setting	YES / **NO**
803	Parameter lock	ON / **OFF**
804	Reset statistic data	**NO** / FAULT / KWH / OPERATING HOURS
806	Copy DBG → MDX	YES / **NO**
807	Copy MDX → DBG	YES / **NO**

81_	**Serial communication**	
810	RS485 address	**0** – 99
811	RS-485 group address	**100** – 199
812	RS485 timeout delay	**0** – 650 s
813	SBus address	**0** – 63
814	SBus group address	**0** – 63
815	SBus timeout delay	0 – **0.1** – 650 s
816	SBus baud rate	125/250/**500**/1000 kB
817	SBus synchronization ID	**0** – 1023
818	CAN synchronization ID	0 – **1** – 2047
819	Fieldbus timeout delay	0 – **0.5** – 650 s
82_ 1 2	**Brake operation**	
820/821	4-quadrant operation 1/2	**ON** / OFF
83_	**Fault response**	
830	Response EXT. FAULT	**EMERG.STOP/FAULT**
831	Response FIELDBUS TIMEOUT	**RAPID STOP/FAULT**
832	Response MOTOR OVERLOAD	**EMERG.STOP/FAULT**
833	Response RS485 TIMEOUT	**RAPID STOP/WARNG**
834	Response DRS LAG ERROR	**EMERG.STOP/FAULT**
835	Response TF sensor SIGNAL	**NO RESPONSE**
836	Response SBus TIMEOUT	**EMERG.STOP/FAULT**
84_	**Reset response**	
840	Manual reset	YES / **NO**
841	Auto reset	ON / **OFF**
842	Restart time	1 – **3** – 30 s
85_	**Scaling speed actual value**	
850	Scaling factor numerator	**1** – 65535
851	Scaling factor denominator	**1** – 65535
852	User dimension	**rpm**
86_ 1 2	**Modulation**	
860/861	PWM frequency 1/2	**4**/8/12/16 kHz
862/863	PWM fix 1/2	ON / **OFF**
87_	**Process data description**	
870	Setpoint description PO1	**CTRL. WORD 1**
871	Setpoint description PO2	**SPEED**
872	Setpoint description PO3	**NO FUNCTION**
873	Actual value description PI1	**STATUS WORD1**
874	Actual value description PI1	**SPEED**
875	Actual value description PI1	**OUTP.CURRENT**
876	PO data enable	**ON** / OFF
877	DeviceNet PD configuration	**PARAM+1PD**
88_	**Manual operation**	
880	Manual operation	ON / **OFF**

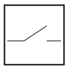
9__	IPOS PARAMETERS → page 157	
90_	**IPOS Reference travel**	
900	Reference offset	$-(2^{31}$-1) – **0** – 2^{31}-1 inc
901	Reference speed 1	0 – **200** – 5000 rpm
902	Reference speed 2	0 – **50** – 5000 rpm
903	Reference travel type	**0** – 7
91_	**IPOS Travel parameter**	
910	Gain X controller	0.1 – **0.5** – 32
911	Positioning ramp 1	0 – **1** – 20 s
912	Positioning ramp 2	0 – **1** – 20 s
913	Travel speed CW	0 – **1500** – 5000 rpm
914	Travel speed CCW	0 – **1500** – 5000 rpm
915	Speed feedforward	-199.99 – 0 – **100** – 199.999 %
916	Ramp type	**LINEAR**/SINE/SQUARED
92_	**IPOS Monitoring**	
920	SW limit switch CW	$-(2^{31}$-1) – **0** – 2^{31}-1 inc
921	SW limit switch CCW	$-(2^{31}$-1) – **0** – 2^{31}-1 inc
922	Position window	0 – **50** – 32767 inc
923	Lag error window	0 – **5000** – 2^{31}-1 inc
93_	**IPOS Special functions**	
930	Override	ON / **OFF**
931	CTRL word task 1	START / **STOP**
932	CTRL word task 2	START / **STOP**
94_	**IPOS Encoder**	
940	IPOS variables edit	ON / **OFF**
941	Source actual position	**MOTOR ENC. (X15)**/ EXTERN.ENC (X14)/ ABSOL.ENC. (DIP)
942	Encoder factor numerator	**1** – 32767
943	Encoder factor denominator	**1** – 32767
944	Encoder scaling ext. encoder	×**1**/×2/×4/×8/×16/×32/×64
95_	**DIP**	
950	Encoder type	**NO ENCODER**
951	Counting direction	**NORMAL**/INVERTED
952	Cycle frequency	**1** – 200 %
953	Position offset	$-(2^{31}$-1) – **0** – 2^{31}-1 inc
954	Zero offset	$-(2^{31}$-1) – **0** – 2^{31}-1 inc
955	Encoder scaling	×**1**/×2/×4/×8/×16/×32/×64
96_	**IPOS Modulo Function**	
960	Modulo function	**OFF**/SHORT/CW/CCW
961	Modulo numerator	**0** – 2^{31}
962	Modulo denominator	**0** – 2^{31}
963	Modulo encoder resolution	0 – **4096** – 20000

4.3 Explanation of the parameters

The parameters are explained below. The parameters are divided into 10 groups. The names of the parameters correspond to their representation in the MOVITOOLS\SHELL PC program. The factory setting is <u>underlined</u> in each case.

Symbols The following symbols are used to assist understanding:

Parameters which can be switched over, i.e. they are available in parameter sets 1 & 2.



Parameters which can only be changed with INHIBITED inverter status (= output stage at high resistance).

Parameter is automatically changed by the startup function.

PARAMETER GROUP 0__, DISPLAY VALUES

This group of parameters contains information about process values and status conditions of the basic unit and the installed options. Furthermore, the fault memory and the fieldbus parameters can be called up.

00_ **Process values**

000 Speed [rpm]

Resolution with DBG11A: ±1 rpm, with MOVITOOLS\SHELL: ± 0.2 rpm

The speed is established by taking the rated speed and the set slip compensation in VFC mode without an encoder connection. The speed is established from the encoder or resolver signals and displayed when there is an encoder connection.

001 User display [text]

Speed value weighted by the scaling factors (→ P850/P851) in the user dimension (→ P852).

002 Frequency [Hz]

Output frequency of the inverter.

003 Actual position [inc] (4096 increments/motor revolution)

Position of the drive as a value in increments observing the signs in the range 0 – $\pm 2^{31}$-1 inc (with encoder connection). The value is zero without an encoder connection.

004 Output current [%In]

Apparent current in the range 0 – 200 % of the rated unit current.

005 Active current [%In]

Active current in the range 0 – 200 %IN. The displayed value is positive when the torque is in the positive sense of rotation; the displayed value is negative when the torque is in the negative sense of rotation.

006 Motor utilization 1 [%] (applies to parameter set 1)

007 Motor utilization 2 [%] (applies to parameter set 2)

Parameters P006 and P007 show the thermal utilization of the connected motor in the range 0 – 200 % (→ P340/P341).

008 DC link voltage [V]

009 Output current [A]

Apparent current, displayed in A_{AC}.

01_	**Status displays**	
010	Inverter status	
		Status of the unit output stage (INHIBITED, ENABLED).
011	Operational status	
		The following operational states are possible:
		24 V OPERATION, CONTROLLER INHIBIT, NO ENABLE, CURRENT AT STANDSTILL, ENABLE (VFC), ENABLE (N-CONTROL), TORQUE OPERATION, HOLD CONTROL, FACTORY SETTING, LIMIT SWITCH, TECHNOLOG.OPTION, FAULT, REFERENCE MODE, FLYING START.
012	Fault status	
		Fault number and fault in plain text. The fault number also appears on the inverter's 7-segment display.
013	Active parameter set	
		Parameter set 1 or 2.
014	Heat sink temperature [°C]	
		Heat sink temperature of the inverter in the range -40 – 0 – 125 °C.
015	Mains ON operation time [h]	
		Total number of hours for which the inverter has been connected to the mains or a 24 V_{DC} external supply. Storage cycle every 15 min.
016	Operating time (enabled) [h]	
		Total number of hours for which the inverter has been at ENABLE operating status. Storage cycle every 15 min.
017	Electrical energy [kWh]	
	Cumulated electrical watt-hours used by the motor. Storage cycle every 15 min.	
02_	Analog setpoints (020 – 022)	
020/021	Analog input AI1 [V] / Analog input AI2 [V]	
		Voltage (0 – 10 V) at analog input AI1 (020) and at the optional analog input AI2 (021). If P112 "AI1 operation mode" is set to "N-MAX, 0(4) – 20mA" and S11 = ON, P020 displays 0(1) – 5 V = 0(4) – 20 mA.
022	External current limit [%]	
		If analog input AI2 is set to the "0..10V I-limit" operation mode (→ P120, 0 – 10 V = 0 – 100 %), 022 displays which external current limit is in effect.
03_	**Binary inputs basic unit (030 – 035)**	
04_	**Binary inputs option (040 – 047)**	
05_	**Binary outputs basic unit (050 – 052)**	
06_	**Binary outputs option (060 – 067)**	
		Status ("0" or "1") of the binary inputs/outputs and programmed function (menu selection → P6__). Note that binary input DIØØ (030) is fixed at /CONTROLLER INHIBIT and binary output DBØØ (050) is fixed at /BRAKE in the programming. They cannot be reprogrammed.

07 **Unit data (070 – 076)**

Unit type, unit rated current, type of options and firmware part numbers (basic unit and options), type (standard or technology).

*08_* **Fault memory (Fault t-0 – t-4)**

There are 5 fault memories (t-0 – t-4). The faults are stored in a chronological sequence with the most recent fault event being held in fault memory t-0. If there are more than 5 faults, the fault event of longest standing, stored in t-4, is deleted (fault response → P83_).

080 – 084 Faults which have occurred t-0 – t-4,

At the time of the fault, the following information is stored and can be displayed using P080 – P084 in the event of a fault:

Status ("0" or "1") of the binary inputs/outputs, operational status of the inverter, inverter status, heat sink temperature [°C], speed [rpm], output current [%In], active current [%], unit utilization [%], DC link voltage [V], mains on operation time [h], operating time (enabled) [h], parameter set [1/2] and motor utilization 1 and 2 [%].

*09_* **Bus diagnosis**

090 Set process data word configuration.

091 Installed fieldbus type

CAN, PROFIBUS FMS/DP, PROFIBUS DP, INTERBUS, INTERBUS with FO, DeviceNet, CAN, CANopen, NO FIELDBUS

092 Active baud rate.

093 Address of the inverter on the fieldbus.

094 – 096 Process data setpoints from the fieldbus master.

097 – 099 Process data actual values to the fieldbus master.

→ P87_ "Process data description" for the meaning of the process data.

PARAMETER GROUP 1, SETPOINTS / RAMP GENERATORS

10_

Setpoint selection

100

Setpoint source

This parameter is used for setting the source from where the inverter obtains its setpoint.

BIPOL./FIX.SETPT

The setpoint comes from the analog inputs (AI1/AI2) or the fixed setpoints (P16_), if these are selected via a binary input (→ P60_/P61_). The setpoints are processed as signed setpoints. A positive setpoint causes CW rotation; a negative setpoint produces CCW rotation.

UNIPOL/FIX.SETPT

The setpoint is provided by the analog inputs or the fixed setpoints. Negative analog setpoints result in a setpoint of zero. The fixed setpoints are processed in accordance with their value. The direction of rotation is specified using binary inputs (→ P 60_).

RS-485

The setpoint comes from the RS-485 interface.

FIELDBUS

The setpoint comes from the fieldbus interface.

MOTOR POTENTIOM. (→ P15_)

The setpoint is defined by the internal motor potentiometer. To enable this, one binary input must be programmed to MOTOR.POT. UP and another binary input to MOTOR.POT. DOWN, and the binary inputs must be activated accordingly. The direction of rotation is specified by the clockwise/stop and counterclockwise/stop binary inputs.

MOT.POT +ANALOG1 (→ P15_)

The setpoint is defined by the total of the motor potentiometer and the setpoint selection at analog input AI1. The analog setpoint is processed as a signed setpoint. n_{min} takes effect if the total is negative. The direction of rotation is specified using binary inputs. The settings of AI1 operation mode also apply (→ P112).

FIX SETP+ANALOG1 (→ P16_)

The setpoint is defined by the total of the selected fixed setpoint and the setpoint selection at analog input AI1. The fixed setpoint is processed without its sign (= according to its value) and the analog setpoint is processed as a signed setpoint. n_{min} is in effect if the total is negative or if no fixed setpoint is selected. The direction of rotation is specified using binary inputs.

FIX SETP*ANALOG1 (→ P16_)

The value at analog input AI1 serves as the evaluation factor (0 – 10 V = 0 – 100 %) for the selected fixed setpoint. The fixed setpoint is processed without its sign (= according to its value). n_{min} is in effect if the voltage at analog input AI1 is negative or if no fixed setpoint is selected. The direction of rotation is specified using binary inputs.

MASTER-SBus (→ P75_)

The setpoint comes from the master in master/slave mode via the system bus.

MASTER-RS-485 (→ P75_)

The setpoint comes from the master in master/slave mode via the RS-485 interface.

SBus (→ IPOS$^{plus®}$ manual)

The setpoint selection is made via the system bus.

101 Control signal source

This sets the source from where the inverter obtains its control commands (CONTROLLER INHIBIT, ENABLE, CW, CCW, etc.). Control via IPOS$^{plus®}$ is taken into account irrespective of P101.

<u>TERMINALS</u>

Control is via the binary inputs.

RS-485

Control is via the RS-485 interface and the binary inputs.

FIELDBUS

Control is via the fieldbus and the binary inputs.

SBus

Control is via the system bus and the binary inputs.

P100 and P101 can also be used for selecting a communications port as the setpoint or control signal source. However, the interfaces are not automatically deactivated with these parameters because the drive inverter must remain ready to receive via all interfaces all the time.

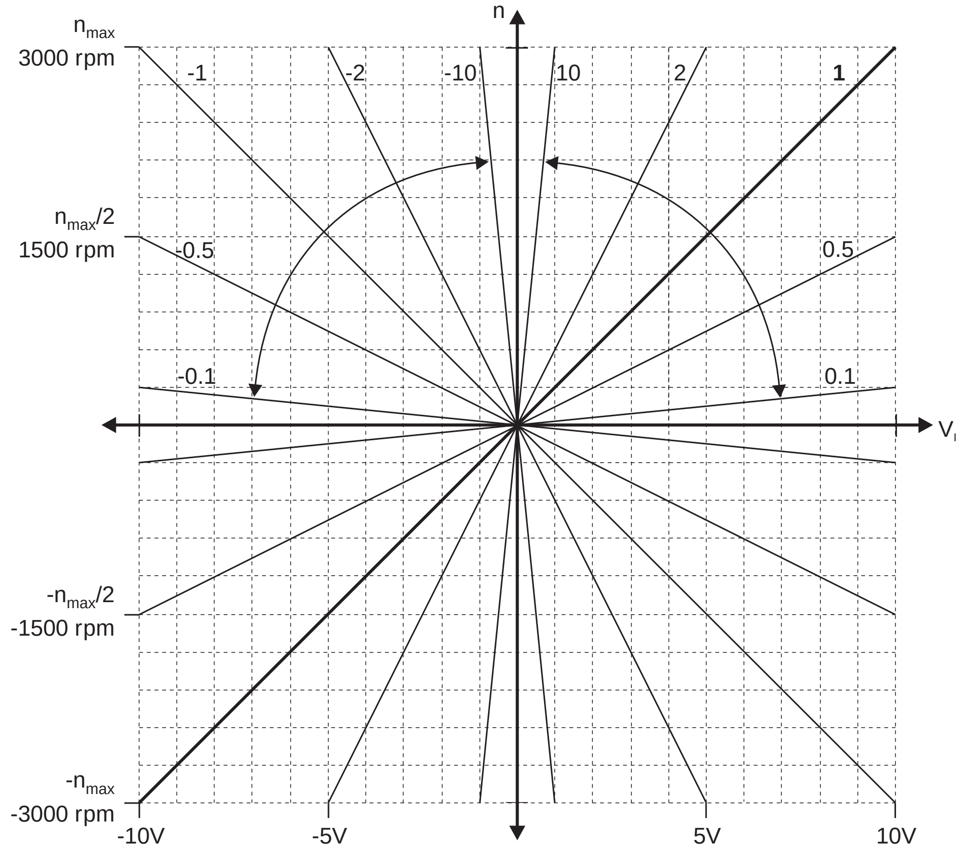
If the drive inverter is in "t = Timeout active" status, please check the timeout times of parameters P812, P815 and P819 and, if necessary, switch off timeout monitoring by entering 0 s or 650 s.

11_ **Analog input AI1**

110 AI1 scaling

Setting range: -10 – 0 – <u>1</u> – 10

The slope of the setpoint characteristic is defined. When AI1 scaling = 1 and the input voltage V_{in} is ±10 V, the setpoint is defined as ±3000 rpm or $\pm n_{max}$ depending on the set operating mode of analog input AI1 (→ P112).



01259BEN

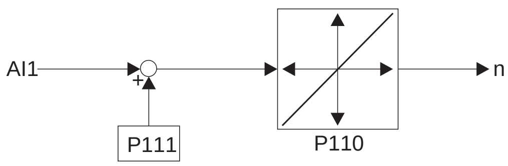
Fig. 50: Slope of the setpoint characteristic

Only the 1st quadrant can be used with a unipolar setpoint source (→ P100); negative setpoint selections then produce the setpoint zero. P110 does not have any effect if current input is set in the AI1 operation mode (→ P112).

111 AI1 offset compensation [mV]

Setting range: -500 – <u>0</u> – 500 mV

When the setpoint selection is made by an external controller, it is possible to compensate for a fault voltage present at analog input AI1 when the setpoint selection is zero. The setting of this parameter causes the co-ordinate zero point in Fig. 50 to be calibrated. This setting is in effect in all AI1 operating modes.



01292BXX

Fig. 51: Effect of the AI1 offset

112 AI1 operation mode

The selection for the AI1 operating mode differentiates between various characteristic curves and voltage/current input.

Ref. N-MAX

Voltage input with reference n_{max} (→ P302/P312). The characteristic can be adapted with AI1 scaling (→ P110). AI1 voltage offset (→ P113) and AI1 speed offset (→ P114) do not have any effect.

Ref. 3000 rpm

Voltage input with reference 3000 rpm. The characteristic can be adapted with AI1 scaling. AI1 voltage offset and AI1 speed offset do not have any effect.

U-Off., N-MAX

Voltage input with reference n_{max}. The characteristic can be adapted with AI1 voltage offset. AI1 scaling and AI1 speed offset do not have any effect.

N-Off., N-MAX

Voltage input with reference n_{max}. The characteristic can be adapted with AI1 speed offset. AI1 scaling and AI1 voltage offset do not have any effect.

Expert charact.

There is a free choice of reference between setpoint voltage and speed. The characteristic can be adapted with AI1 scaling (reference 3000 rpm), AI1 voltage offset and AI1 speed offset (→ Fig. 56). The following structural diagram shows how the speed setpoint is created from the expert characteristic.

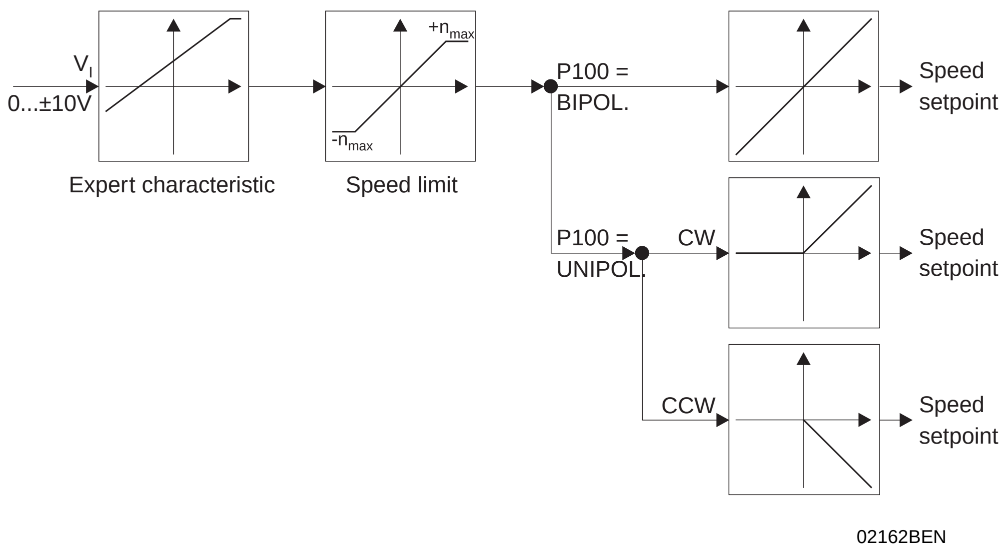


Fig. 52: "Expert characteristic" structural diagram

N-MAX, 0-20mA

Current input 0 – 20 mA = 0 – n_{max}, no setting possibilities (P110 ineffective). Set the internal burden (250 Ω) "S11 = ON".

N-MAX, 4-20mA

Current input 4 – 20 mA = 0 – n_{max}, no setting possibilities (P110 ineffective). Set the internal burden (250 Ω) "S11 = ON".

113 AI1 voltage offset [V]

Setting range: -10 – 0 – 10V

The zero passage of the setpoint characteristic can be moved along the V_{in} axis.

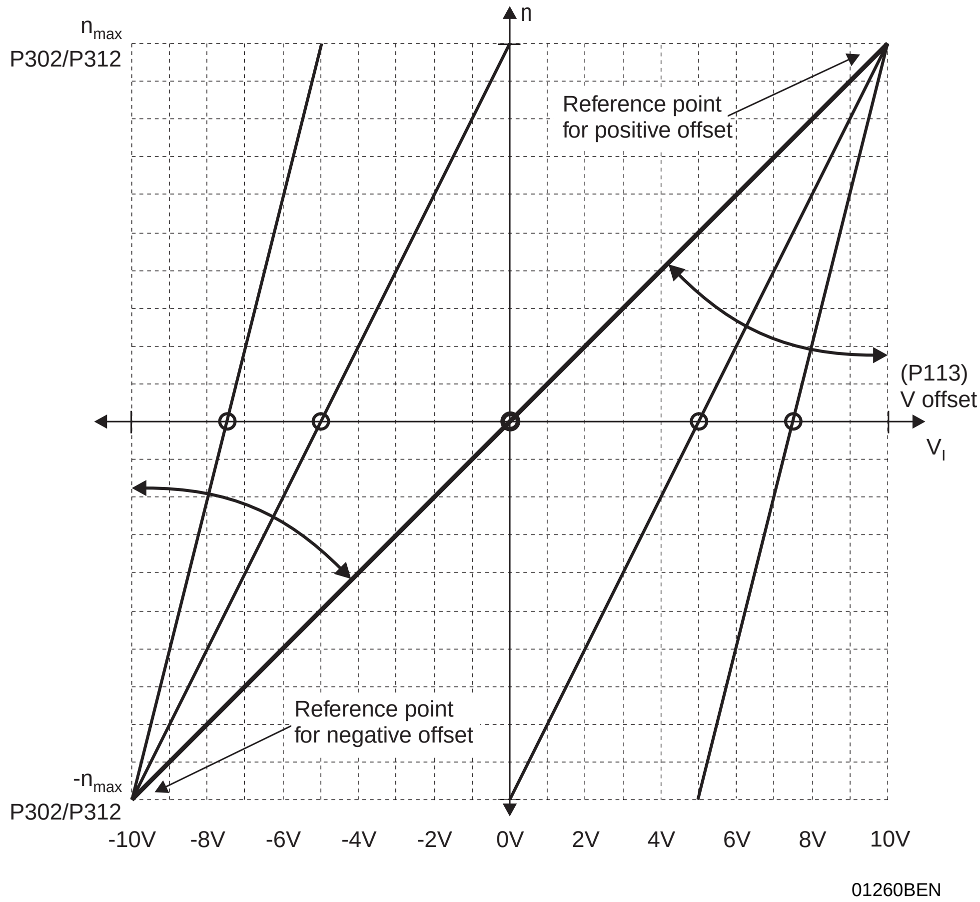


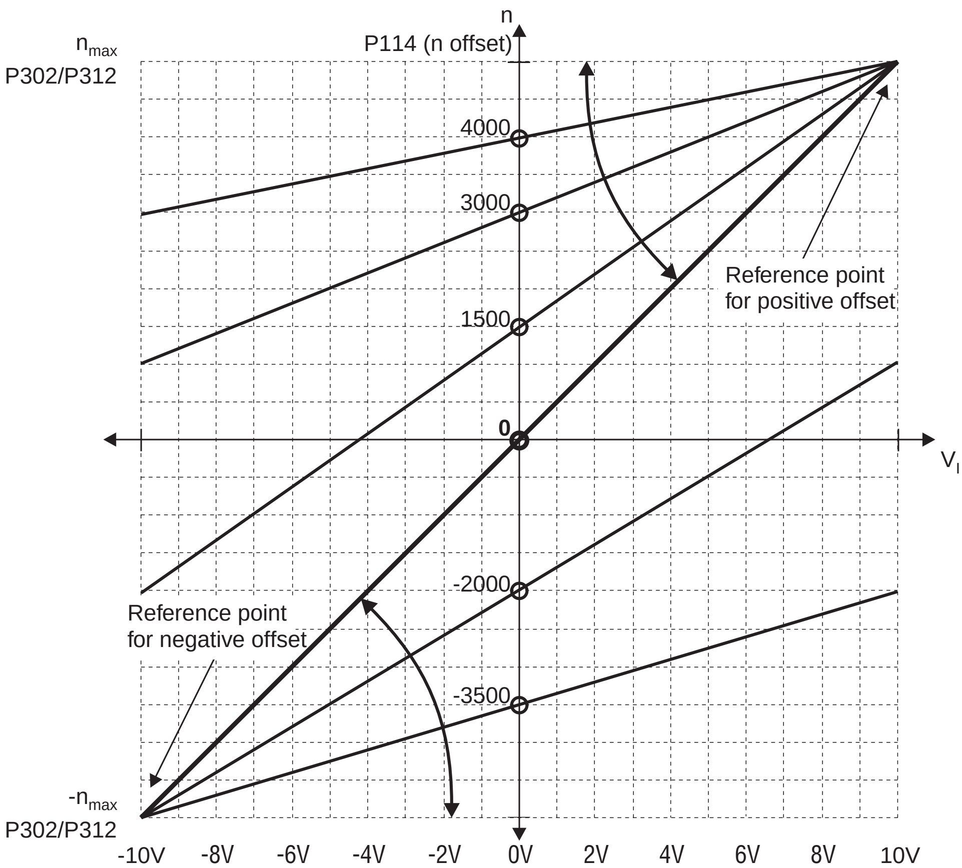
Fig. 53: AI1 voltage offset

4

114 AI1 speed offset [rpm]

Setting range: -5000 – 0 – 5000 rpm

The zero passage of the setpoint characteristic can be moved along the n axis.



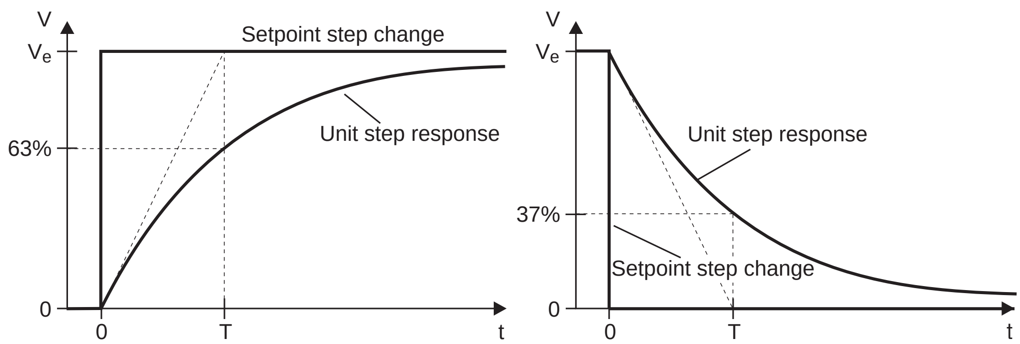
01261BEN

Fig. 54: AI1 speed offset

115 Filter setpoint [ms]

Setting range: T = 0 – 5 – 100 ms (0 = filter setpoint off)

The speed ramp is filtered. This can be used for dampening stepped setpoint selections, e.g. from external controllers, or interference pulses at the analog input. Also effective in torque control.



01265BEN

Fig. 55: Effect of the setpoint filter

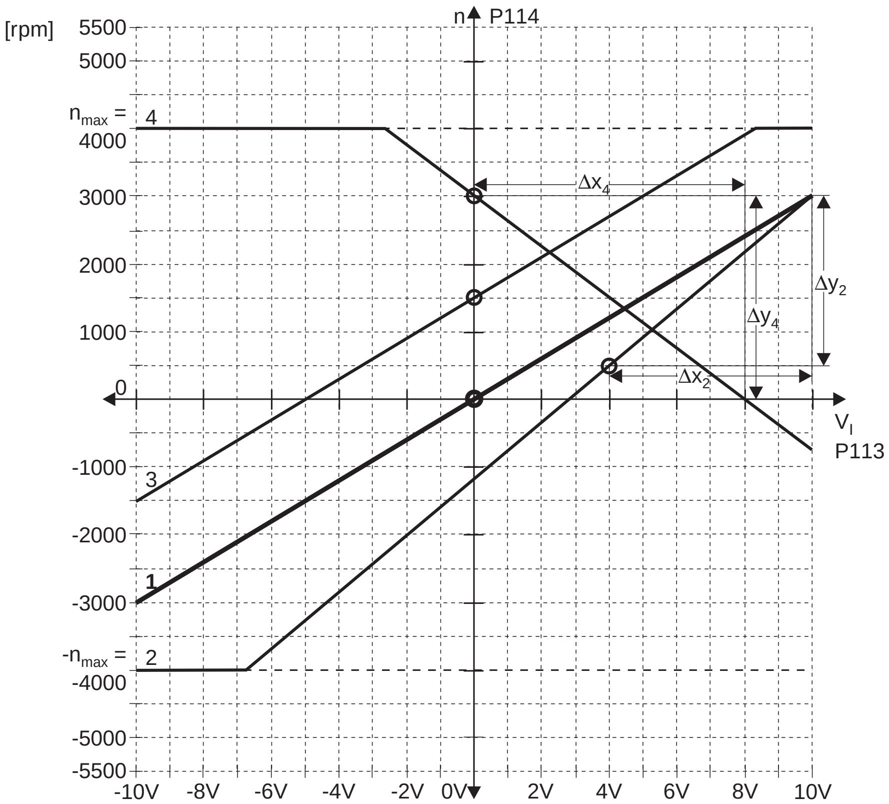
Sample expert characteristics (P112 = Expert charact.):

There is a free choice of reference between setpoint voltage and speed in the expert characteristic. Set parameter P100 "Setpoint source" to "BIPOL./FIX.SETPT" in order to exploit the possibilities of the expert characteristic to the full.

One point on the characteristic (marked by **o** in Fig. 56) is specified by AI1 voltage offset and AI1 speed offset, then the slope is specified with AI1 scaling. Reference 3000 rpm always applies to scaling with the expert characteristic.

The speed range is restricted by P302/P312 "Maximum speed 1/2". P302 is set to 4000 rpm. Setting the maximum speed does not alter the slope.

The voltage value of the x-axis must be converted to a speed value for calculating the slope triangulation function Δy/Δx = slope = setting value for P110 "Scaling". The following applies: 10 V = 3000 rpm.



01264CEN

Fig. 56: Samples of expert characteristics with P100 "Setpoint source" = "BIPOL./FIX.SETPT"

The following slope triangulation functions are calculated for characteristic curves 2 and 4 in Fig. 56 below. This determines the settings for P110 "Scaling".

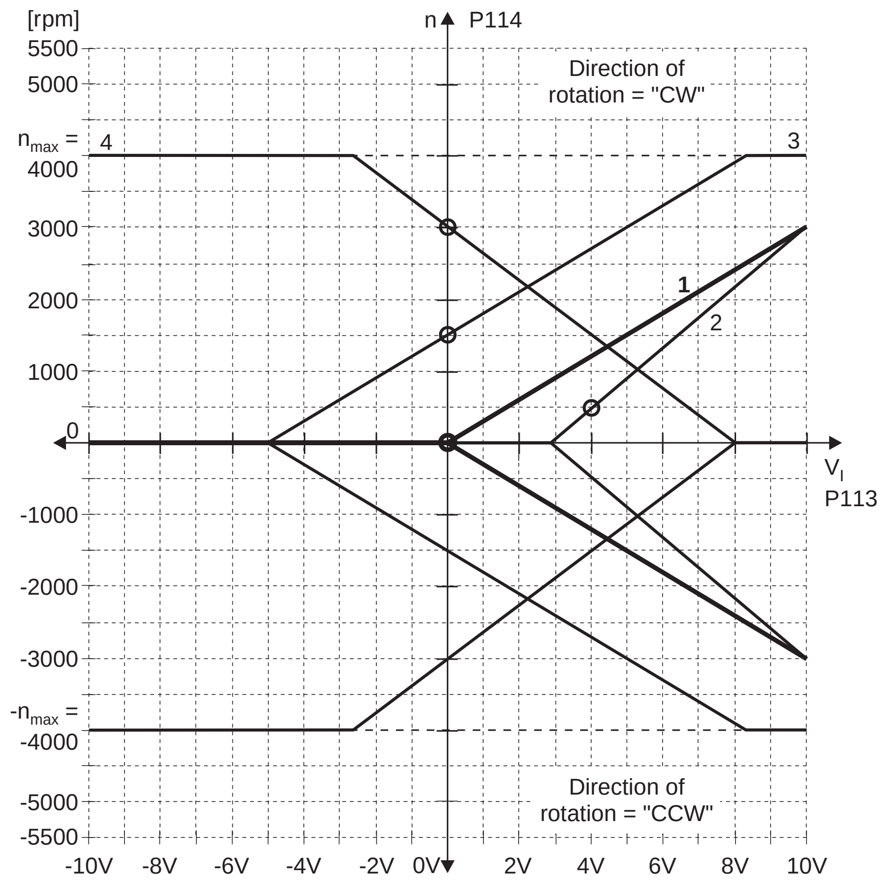
Char. curve 2: Δy_2 = 2500 rpm, Δx_2 = 6 V = 1800 rpm, $\Delta y_2/\Delta x_2$ = 2500/1800 = 1.39

Char. curve 4: Δy_4 = -3000 rpm, Δx_4 = 8 V = 2400 rpm, $\Delta y_4/\Delta x_4$ = -3000/2400 = -1.25

The expert characteristics displayed in Fig. 56 are created as follows:

Charac teristic	P113 AI1 voltage offset [V]	P114 AI1 speed offset [rpm]	P110 AI1 scaling (slope)
1	0	0	1
2	4	500	1.39
3	0	1500	1
4	0	3000	-1.25

The expert characteristic can also be used with P100 "Setpoint source = UNIPOL/ FIX.SETPT". The direction of rotation is then specified using binary inputs. The expert characteristic is mirrored on the x-axis. The section below the x-axis causes the speed setpoint to be 0. If the direction of rotation "CW" is specified, then movement is only possible at speeds in the range 0 – n_{max}, while the range 0 – $-n_{max}$ applies if the direction of rotation "CCW" is specified. Fig. 57 shows the expert characteristics from Fig. 56 with the setting P100 "Setpoint source = UNIPOL/FIX.SETPT".



02143BEN

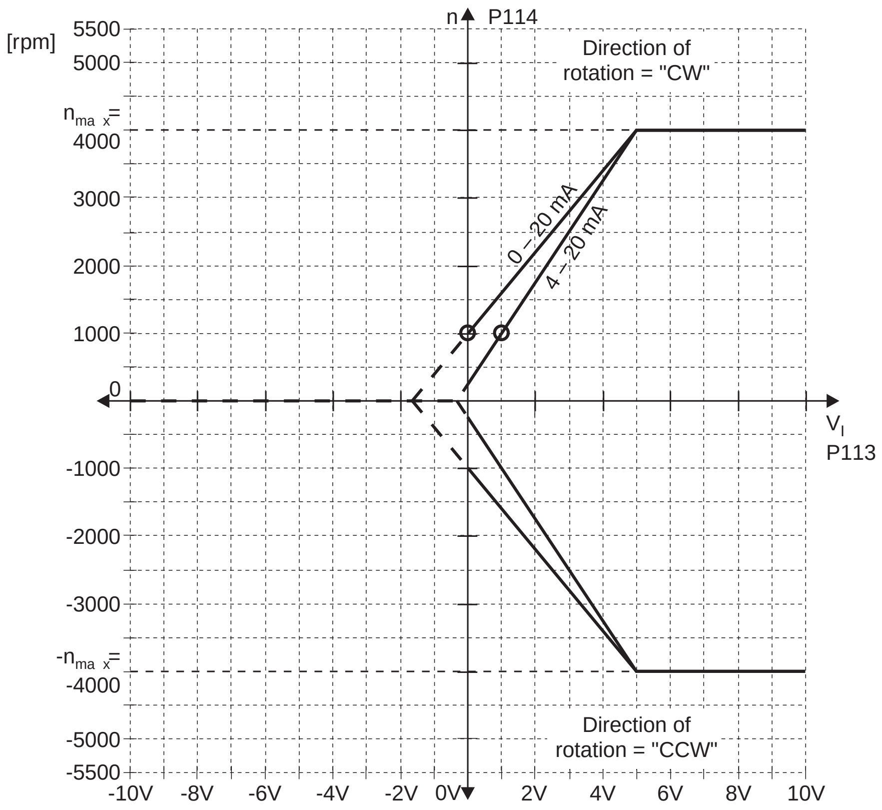
Fig. 57: Samples of expert characteristics with P100 "Setpoint source" = "UNIPOL./ FIX.SETPT"

The expert characteristics displayed in Fig. 57 are created as follows:

Characteristic	P113 AI1 voltage offset [V]	P114 AI1 speed offset [rpm]	P110 AI1 scaling (slope)
1	0	0	1
2	4	500	1.39
3	0	1500	1
4	0	3000	-1.25

Expert characteristic with current setpoints:

Voltage signals are required at the AI11/AI12 analog input for the expert characteristic function. Switch S11 (changeover I-signal ↔ V-signal) must be set to ON and the current signal routed to X11:2 AI11 if an impressed current of 0(4) – 20 mA is available as the setpoint. The internal load (250 Ω) converts the 0(4) – 20 mA setpoints into 0(1) – 5 V voltage signals.



02165BEN

Fig. 58: Samples of expert characteristics with current setpoints

You have to set the expert characteristic as follows if you want to achieve speeds of 1000 – 4000 rpm, for example, with 0(4) – 20 mA:

for 0 – 20 mA:	P110 = 2	P113 = 0 V	P114 = 1000 rpm	P302 (n_{max}) = 4000 rpm
for 4 – 20 mA:	P110 = 2.5	P113 = 1 V	P114 = 1000 rpm	P302 (n_{max}) = 4000 rpm

Set P100 "Setpoint source" to "UNIPOL/FIX.SETPT". The direction of rotation is then specified using binary inputs.

12_ **Analog inputs (optional)**

120 AI2 operation mode (optional)

Analog input AI2 is only available with the optional terminal expansion board (DIO11A).

NO FUNCTION

The setpoint at AI2 is not used; the external current limitation is set to 100 %.

0 – 10 V+Setpt1

The setpoint at AI2 is added to setpoint 1 (=AI1) observing the signs; the external current limitation is set to 100 %. ±10 V = $\pm n_{max}$ (reference n_{max}).

0 – 10 V I-limit

The input is used as an external current limitation. 0 – 10 V = 0 – 100 % of the internal set current limit (→ P303/P313).

ACTUAL VALUE INPUT CONTROLLER

Not yet implemented; function as with "NO FUNCTION".

13_/14_ 1 2 **Speed ramps 1 (parameter set 1) / Speed ramps 2 (parameter set 2)**

130/140 Ramp t11 UP CW [s] / Ramp t21 UP CW [s]

131/141 Ramp t11 DOWN CW [s] / Ramp t21 DOWN CW [s]

132/142 Ramp t11 up CCW [s] / Ramp t21 up CCW [s]

133/143 Ramp t11 down CCW [s] / Ramp t21 down CCW [s]

Setting range: 0 – 2 – 2000 s

The ramp times refer to a setpoint step change of Δn = 3000 rpm. The ramp takes effect when the speed setpoint is changed and the enable is withdrawn via the CW/CCW terminal.

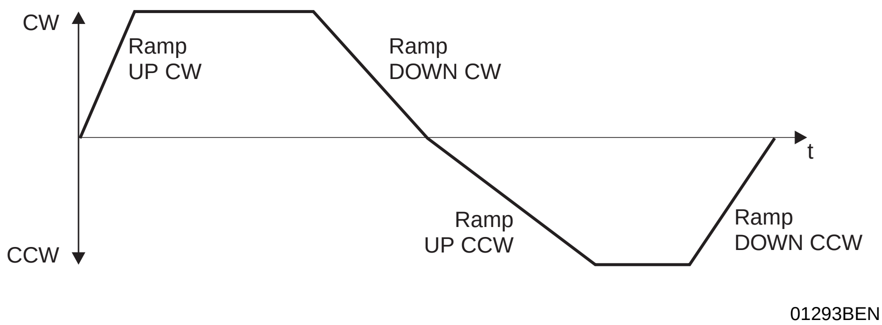


Fig. 59: Separately adjustable speed ramps

134/144 Ramp t12 UP=DOWN [s] / Ramp t22 UP=DOWN [s] (2nd ramp of parameter set 1/2)

Setting range: 0 – 10 – 2000 s

The following applies to this ramp: UP = DOWN and CW = CCW.

135/145 S pattern t12 / S pattern t22

Setting range: 0/1/2/3 (0 = off, 1 = weak, 2 = medium, 3 = strong)

The 2nd ramp of parameter set 1 and 2 can be rounded with 3 pattern grades in order to achieve a smoother acceleration of the drive.

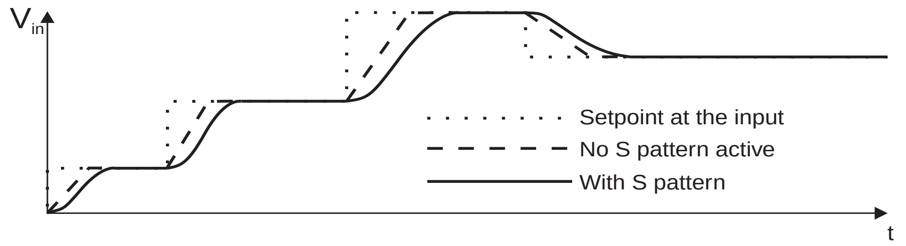


Fig. 60: Effect of the S pattern

STOP

A started S pattern is interrupted by the stop ramp t13/t23 and a changeover to ramp t11/t12. Withdrawing the setpoint or a stop via the input terminals causes the started S curve to be completed. This means the drive can still accelerate in spite of the withdrawal of the setpoint.

136/146 Stop ramp t13 [s] / Stop ramp t23 [s]

Setting range: 0 – 2 – 20 s

The stop ramp is activated by withdrawing the ENABLE terminal or by a fault (→ P83_).

137/147 AUTO Emergency ramp t14 [s] / Emergency ramp t24 [s]

Setting range: 0 – 2 – 20 s

The emergency ramp is activated by a fault (→ P83_). The system monitors whether the drive reaches zero speed in the set time. The output stage is inhibited and the brake is applied after the set time has elapsed; this is the case even if zero speed has not yet been reached.

138 Ramp limit VFC

Setting range: NO = 0 / YES = 1

The ramp limit restricts the smallest possible ramp time to 100 ms in VFC operation modes (→ P700, reference: Δn = 3000 rpm). Settings less than 100 ms are ignored and the ramp time 100 ms applies. The ramp limit limits the maximum output current to 185 % of the rated output current. An active pull-out protection for the connected motor is implemented using the current limiting controller when ramp limitation is activated.

STOP

There is no active pull-out protection for the connected motor when ramp limitation is deactivated and ramp times of less than 100 ms are used. Parameters P303/313 "Current limit 1/2" are not effective then. If a maximum output current of 185 % of the rated output current is exceeded for more than 60 ms, the inverter switches off with fault message F01 "Overcurrent" and the "Immediate switch-off" fault response.

15_ 1 2

Motorized potentiometer (parameter set 1 and 2)

The ramp times refer to a setpoint change of Δn = 3000 rpm.

150/151 Ramp t3 UP / Ramp t3 DOWN

Setting range: 0.2 – 20 – 50 s

The ramp is active when the setpoint source (→ P100) is set to MOTOR POT or MOT.POT. +AI1 and an input terminal programmed to MOTOR POT UP or MOTOR POT DOWN (→ P6__) has a "1" signal.

152 Save last setpoint

ON

If MOTOR POT UP and MOTOR POT DOWN = "0", the last applicable motorized potentiometer setpoint is stored in the permanent memory 2 s afterwards. The last motorized potentiometer setpoint is reactivated following mains power off/power on.

OFF

The inverter starts with n_{min} (→ P301/P311) following a mains power off/power on or after withdrawal of the enable.

The motorized potentiometer function is used for **continuous speed control**. Consequently, set **P152 to OFF** otherwise the EEPROM fault message may appear after about 100,000 storage procedures.

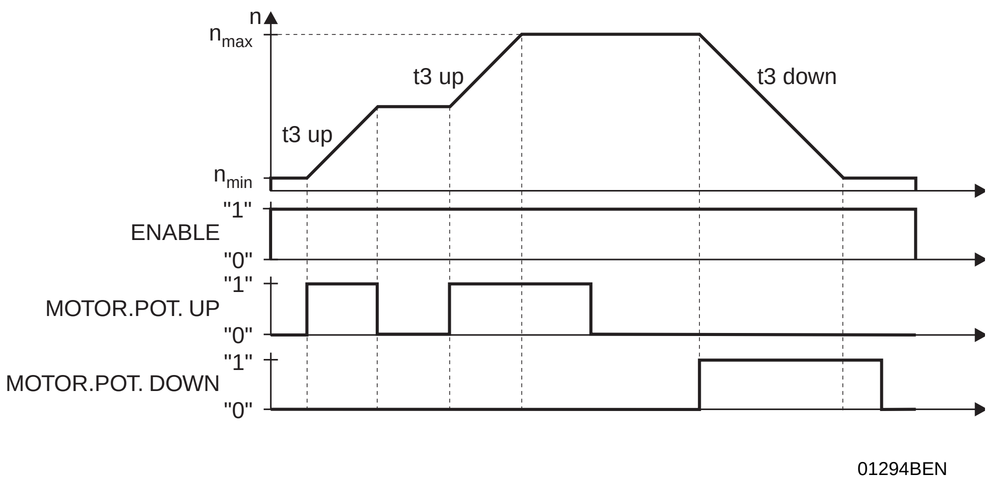


Fig. 61: Motorized potentiometer function

16_/17_ 1 2 **Fixed setpoints 1 (parameter set 1) / Fixed setpoints 2 (parameter set 2)**

160/170 Internal setpoint n11 (parameter set 1) / n21 (parameter set 2)

161/171 Internal setpoint n12 (parameter set 1) / n22 (parameter set 2)

162/172 Internal setpoint n13 (parameter set 1) / n23 (parameter set 2)

Setting range: 0 – 5000 rpm

Factory setting: n11/n21 = 150 rpm, n12/n22 = 750 rpm, n13/n23 = 1500 rpm

3 internal setpoints (= fixed setpoints) can be set separately for each of parameter sets 1 and 2. The internal setpoints are active when the setpoint source (→ P100) is set to BIPOL./FIX.SETPT, UNIPOL/FIX.SETPT, FIX SETP+AI1 or FIX SETP*AI1 and an input terminal programmed to n11/n21 or n12/n22 (→ P6__) has a "1" signal.

Response	Terminal			
	n11/n21	n12/n22	Enable/rapid stop	Parameter set 1/2
Rapid stop	X	X	"0"	X
Fixed setpoint not active	"0"	"0"	"1"	"0"
n11 in effect	"1"	"0"	"1"	"0"
n12 in effect	"0"	"1"	"1"	"0"
n13 in effect	"1"	"1"	"1"	"0"
n21 in effect	"1"	"0"	"1"	"1"
n22 in effect	"0"	"1"	"1"	"1"
n23 in effect	"1"	"1"	"1"	"1"

The fixed setpoints of the currently inactive parameter set come into effect when this terminal is actuated (= "1") if an input terminal is programmed to FIX SETPT SW.OV. This changeover is possible whether the unit is inhibited or enabled.

PARAMETER GROUP 2__, CONTROLLER PARAMETERS

*20_* **Speed control (only parameter set 1)**

The speed controller of the MOVIDRIVE® is a PI-controller and is active when the following operating modes are set:

- All operating modes with VFC-n-CONTROL
- CFC operating modes: The speed controller is only active in "CFC & M-CONTROL" when speed limiting is active (→ P70_)
- Servo operating modes: The speed controller is only active in "SERVO & M-CONTROL" when speed limiting is active (→ P70_).

The setting of all parameters relevant for speed control is supported by the startup functions of the MOVITOOLS\SHELL or the DBG11A keypad (VFC only). Direct alterations to individual controller parameters are reserved for optimization by specialists.

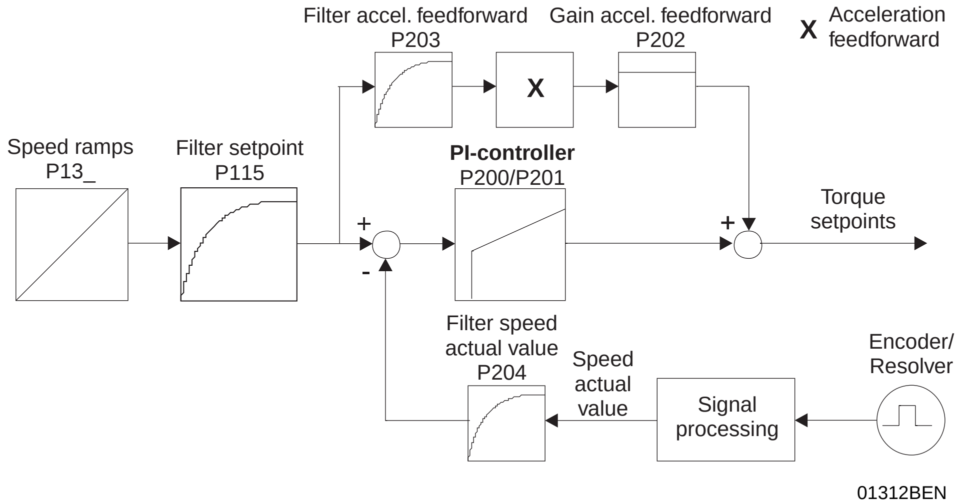


Fig. 62: Structural principles of the speed control loop

200 AUTO P gain speed controller

Setting range: 0.1 – 2 – 32

Gain factor of the P-component of the speed controller.

201 AUTO Time constant n-control.

Setting range: 0 – 10 – 300 ms (0 = no I-component)

Integration time constant of the speed controller. The I-component reacts inversely proportionate to the time constant, i.e. a large numerical value results in a small I-component, although 0 = no I-component.

202 AUTO Gain accel. feedforward

Setting range: 0 – 32

Gain factor of the acceleration feedforward. It influences the control response of the speed controller.

203 AUTO Filter accel. feedforward

Setting range: 0 – 100 ms

Filter time constant of the acceleration feedforward. It influences the control response of the speed controller. The differentiator is fixed in the programming.

204 AUTO Filter speed actual value

Setting range: 0 – 32 ms

Filter time constant of the speed actual value filter.

205 Load feedforward CFC (only effective in CFC and SERVO operating modes)

Setting range: -150 – 0 – 150 %

This parameter determines the initial value of the torque setpoint on enable. The parameter must be set if an increased initial torque is required after the enable. For example, setting the value to greater than 0 % makes it possible to prevent the unwanted sagging of hoists when the brake is released.

Recommended setting: Value of the active current (P005 [% In]) when n = 0 is specified.

206 Sample time n-control (only effective in CFC and SERVO operating modes)

Setting range: 1 ms = 0 / 0.5 ms = 1

The setting 0.5 s improves speed control in dynamic drives with a low inherent moment of inertia.

207 Load feedforward VFC (only effective in VFC-n-CTRL operating modes)

Setting range: -150 – 0 – 150 %

This parameter determines the initial value of slip control on enable. A setting greater than 0 % causes slip control to be presetting, which means the motor develops more torque when enabled. For example, this makes it possible to prevent the unwanted sagging of hoists when the brake is released.

Setting values greater than 150 % switches off the function (no presetting).

In VFC & HOIST mode and with a value greater than 150 % set, presetting of $0.5 \times s_N$ is in effect.

Recommended setting: $I_{act} \times I_N / I_{Mot\_N} \times \cos phi$

I_{act}	= Value of the active current (P005 [% In])
I_N	= Rated output current (P071 [A])
I_{Mot_N}	= Rated motor current (motor nameplate [A])
cos phi	= Power factor (motor nameplate)

*21_* Hold controller (only parameter set 1)

The hold control function is used for drift-free standstill control of the drive and can only be activated in operating modes with speed control (encoder feedback). Hold control is active when an input terminal programmed to /HOLD CONTROL (→ P6__) has a "0" signal. The unit then performs a stop using the t11 DOWN or t21 DOWN ramp. The position applicable at the moment when the speed of the drive reaches zero is held. The gain factor setting is supported in the **startup function** of the speed controller in MOVITOOLS\SHELL or in the DBG11A keypad. The 7-segment display shows status "7" when hold control is active.

210 AUTO P gain hold controller

Setting range: 0.1 – 0.5 – 32

The parameter corresponds to the proportional gain of a position controller and is only effective in conjunction with the activated "Hold control" function.

22_ **Synchronous operation control (only in parameter set 1 and with the DRS11A option)**

(→ "Synchronous Operation Type DRS11A" manual for a detailed description.)

220 P-gain (DRS)

Setting range: 1 – 10 – 200

Gain of the synchronous operation controller in the slave. This determines the control response of the slave depending on the angle differentials in relation to the master.

221/222 Master gear ratio factor / Slave gear ratio factor

Setting range: 1 – 3,999,999,999

These settings are only required with the slave inverter. These parameters set the position measurement ratio between the master and the slave. Note that position measurement of the master and slave can only occur using the motor encoders if there is **positive power transmission (without slip)**. Position measurement has to be via an **extra encoder** in all applications in which power transmission between the motor shaft and the machine is **by friction** and thus slip is to be expected. This encoder must be mounted on the moved machine component using a positive connection.

223 Mode selection

Setting range: 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8

Mode selection determines how the slave reacts to a free running signal.

224 Slave counter [Inc]

Setting range: -99,999,999 – -10 / 10 – 99,999,999

The angular misalignment in relation to the master which can be activated in mode 3, 4, 5 and 8 is referred to as the slave counter. In contrast to the offset, this angular misalignment can be set using the "Teach-in" function. Depending on the mode, it functions as a limit value for free running or specifies a permanent angular misalignment for the slave in relation to the master (= a new reference point).

225/226/227 Offset 1 [Inc] (X40:2) / Offset 2 [Inc] (X40:3) / Offset 3 [Inc] (X40:4)

Setting range: -32767 – -10 / 10 – 32767 inc; only effective in mode 6 or mode 7!

Three separately adjustable angle differentials to which the slave sets itself for the duration of the "1" signal on X40:2 / X40:3 / X40:4.

228 Feedforward filter (DRS)

Setting range: 0 – 100 ms

Setpoint filter for feedforward of synchronous operation control DRS11A.

23_ **Synchr. oper. w. sync. encoder (only in parameter set 1 and with the DRS11A option)**

(→ "Synchronous Operation Type DRS11A" manual for a detailed description.)

Position measurement has to be via an external encoder (=synchronous encoder) in all applications in which power transmission between the motor shaft and the machine is by friction and thus slip is to be expected.

230 Synchronous encoder

OFF

Synchronous operation control with the signals on X15: "Motor encoder". P231 and P232 have no effect.

EQUAL-RANKING

Forwarding of the X42: "Master encoder" signals to X43: "Incremental encoder output". Evaluation of P231 and P232.

CHAIN

Forwarding of the X41: "Synchronous encoder input" signals to X43: "Incremental encoder output". Evaluation of P231 and P232.

231/232 Factor slave encoder / Factor slave sync. encoder

Setting range: 1 .. 1000

In most cases, there is a mechanical ratio between both encoders. This ratio must be set with the parameters.

24_ **Synchr. oper. w. catch up (only in parameter set 1 and with the DRS11A option)**

(→ "Synchronous Operation Type DRS11A" manual for a detailed description.)

Depending on the set operating mode, the current angle offset in respect of the master is reduced to zero when the slave is switched from free running to synchronous operation. In order for this catch up procedure to be performed in a controlled fashion, it is possible to set parameters for both the synchronisation speed and the synchronisation ramp.

240 Synchronisation speed [rpm]

Setting range: 0 – 1500 – 5500 rpm

This parameter specifies the speed of the catch up procedure.

241 Synchronisation ramp [s]

Setting range: 0 – 2 – 50 s

Value for the accelerating ramp for synchronizing the slave with the master. Zero setting means maximum possible acceleration.

PARAMETER GROUP 3, MOTOR PARAMETERS

This group of parameters is used for adapting the inverter to the motor. The parameters can be set separately for parameter set 1 and 2. This means two different motors can be operated alternately on the same inverter without any new setting having to be made.

30_/31_ 1 2 **Limits 1 (parameter set 1) / Limits 2 (parameter set 2)**

300/310 AUTO Start/stop speed 1/2

Setting range: 0 – 60 – 150 rpm

Only in effect in VFC mode, without function in CFC and SERVO mode. This entry defines the smallest speed request which the inverter sends to the motor when enabled. The transition to the speed determined in the setpoint selection is made using the active acceleration ramp.

When a stop command is performed, this setting also defines the slowest speed at which the motor energization is switched off or at which post-magnetization takes effect and the brake is applied, if appropriate.

301/311 AUTO Minimum speed 1/2 (n_{min})

Setting range: 0 – 60 – 5500 rpm

The lowest possible speed, even when zero is selected as the setpoint. The minimum speed also applies when $n_{min} < n_{start/stop}$ has been set.

Important: The slowest speed is 15 rpm when the hoist function is active, even if n_{min} has been set to a lower value.

302/312 AUTO Maximum speed 1/2 (n_{max})

Setting range: 0 – 1500 – 5500 rpm

The value set here cannot be exceeded by a setpoint selection. n_{max} applies if n_{min} is set > n_{max}.

303/313 AUTO Current limit 1/2

Setting range: 0 – 150%I_N

The internal current limitation refers to the apparent current. It is superordinate to the external current limitation (→ P120). Consequently, the entry determines the 100 % value within which the external current limitation can take effect. The current limit is automatically reduced in the field weakening range above the frequency of 1.15 × f_{trans}. This provides protection against the motor pulling out.

The current limit in effect in the field weakening range can be calculated using the following formula:

Current limit [%] = (1.15 × f_{trans} / f_{act}) × Setting value of P303/P313 [%]

f_{act} is the current rotating field frequency.

304 AUTO Torque limit (only effective in CFC and SERVO operating modes)

Setting range: 0 – 150 %

The parameter limits the maximum torque of the motor. The entry acts on the setpoint of the motor torque ($k_T \times I_{N\_inverter}$). Refer to the "Project Planning" chapter for detailed information about calculating the setpoint torque (Motor selection for asynchronous servomotors (CFC) and Motor selection for synchronous servomotors (SERVO)).

The current limit comes into effect before the torque limit is reached if the current limit (P303) is set to a lower value than the torque limit.

32_/33_ 1 2
320/330

Motor compensat. 1 (asynchr.) / Motor compensat. 2 (asynchr.)

Automatic adjustment 1/2

This is only in effect in VFC mode. The function only makes sense with single motor operation. The inverter sets P322/P332 "I×R 1/2" automatically at each enable and stores the value. The inverter thereby determines a basic setting which is suitable for many different drive tasks. The connected motor is calibrated during the last 20 ms of the pre-magnetization phase. The motor is **not** calibrated if

- P320/P330 = OFF,
- Operating mode (P700/P701) VFC & GROUP or VFC &FLY.START selected,
- Pre-magnetization time (P323/P333) ≤ 100 ms set,
- Operating mode VFC-n-CONTROL selected and brake function P730 = OFF set.

In such cases, the set I×R value is used for calculating the winding resistance.

ON

Automatic adjustment

OFF

No automatic calibration

321/331

Boost 1/2

Setting range: 0 – 100 %

With VFC & GROUP: Manual setting for increasing the starting torque by increasing the output voltage in the range below the transition speed.

With VFC: Manual setting normally not required. In exceptional cases, manual setting may be necessary to increase the breakaway torque. In this case set to **max. 10 %**.

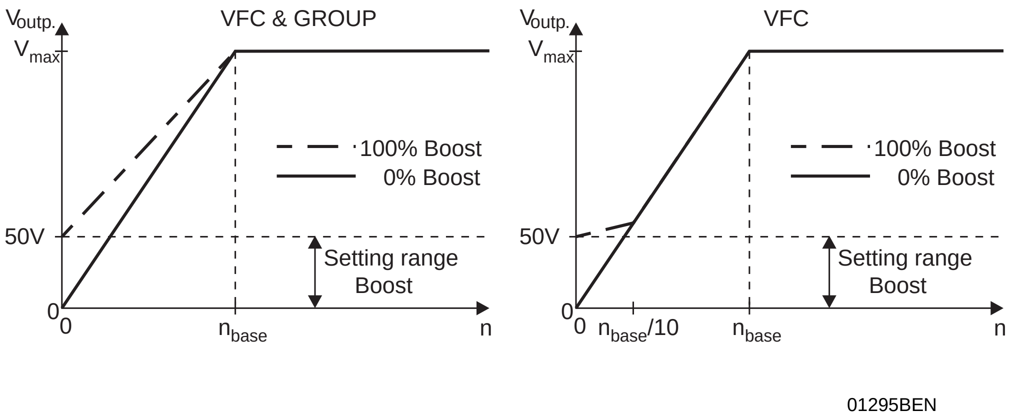


Fig. 63: Working principle of boost (drawing not to scale)

322/332 AUTO

I×R compensation 1/2

Setting range: 0 – 100 %

In VFC operating mode, this parameter acts on the parameters of the calculated motor model which establish the torque. Automatic setting takes place when P320/P330 = ON. Manual alterations to this parameter are reserved for optimization by specialists.

323/333 AUTO

Premagnetizing time 1/2

Setting range: 0 – <u>0.1</u> – 2 s. Pre-magnetization serves to establish a high motor torque and it starts when the inverter is enabled.

Pre-magnetization is in effect in VFC with encoder feedback operating mode when

- the brake function is active (→ P730/P733),
- the standstill current is switched off (→ P710/P711).

324/334

Slip compensation 1/2

Setting range: <u>0</u> – 500 rpm

Slip compensation increases the speed accuracy of the motor. The rated slip of the connected motor should be entered if the entry is made manually. A setting range of 20 % of the rated slip is permitted if a value other than the rated slip is entered in order to compensate for fluctuations between various motors.

34_ 1 2

Motor protection

340/342

Motor protection 1/2

Recommendation: Only use in VFC modes. Ensure motor protection through the project planning in CFC and SERVO operating modes.

When this function is activated, MOVIDRIVE® takes over the thermal protection of the connected motor by electronic means. In most cases, the motor protection function is comparable to standard thermal protection (motor protection switch) and, furthermore, it takes account of speed-dependent cooling by the integral fan. The motor utilization is determined on the basis of the inverter output current, the type of cooling, the motor speed and the time. The thermal motor model is based on the motor data entered during commissioning (MOVITOOLS\SHELL, DBG11A) and on maintaining the operating conditions specified for the motor. If the motor also has to be protected against failure of the ventilation, blockage of air ducts, etc., it is also necessary to employ protection in the form of a positive temperature coefficient thermistor TF or bimetallic switch TH.

The following signaling and indication functions are available in conjunction with motor protection:

P006/P007 Motor utilization 1/2	Display of the motor utilization for parameter set 1/2
P832 Response MOTOR OVERLOAD	Fault response of the inverter when 110 % of motor utilization 1/2 (P006/007) is reached. Factory setting: <u>EMERG.STOP/FAULT</u>
Binary output programmable to: /Motor utilization 1 /Motor utilization 2	Prewarning if motor utilization 1/2 (P006/007) exceeds a value of 100 %. In this case, the programmed output is set to "0" = 0 V.

STOP

Isolating the inverter (mains and 24 V external) always resets the motor utilization to zero, i.e. any motor heating existing when the motor is switched back on is not taken into account. The motor protection function processes the utilization of the connected motors separately for both sets of parameters. The motor protection function must not be used if only one motor is permanently connected to the inverter and the "parameter set changeover" function is only used for control purposes. Equally, the motor protection function must not be used with group drives since it is not possible to protect each individual motor reliably.

ON

Motor protection function is active.

<u>OFF</u>

Motor protection function is not active.

341/342 Cooling type 1/2

Setting range: FAN-COOLED / FORCED-COOLING

It is necessary to know what is the cooling type of the motor in order to be able to calculate the thermal load on the motor as exactly as possible, as described in P340/P342.

35_ **Motor sense of rotation**

SEW-EURODRIVE defines the sense of rotation looking onto the drive side of the motor. A clockwise turn (positive) is defined as to the right and a counterclockwise turn as to the left. This definition is implemented in the configuration of the motor connection in accordance with the SEW designation.

350/351 Change direction of rotation 1/2

Change direction of rotation	Positive setpoint (positive travel direction)	Negative setpoint (negative travel direction)
OFF	Motor turns CW	Motor turns CCW
ON	Motor turns CCW	Motor turns CW

ON

The above definition is reversed. The assignment of limit switches is maintained in all cases. When the sense of rotation is CW, the drive is stopped properly if movement results in contact with the right limit switch. It is necessary to check carefully that the limit switches are connected correctly and also that the reference point and the travel positions are defined correctly during the use of and just after the changeover of this parameter.

Altering the "Change direction of rotation" parameter after the system has been moved to its reference point causes the system to lose its reference point for the absolute position. This may result in undesirable travel movements of the axis.

OFF

The SEW definition applies.

35_ **Startup (only available in DBG11A)**

360 Startup

YES

Begins the startup function with the DBG11A keypad.

With P360, MOVIDRIVE® can only be started up in VFC operating modes. Startup in CFC and SERVO operating modes requires MOVITOOLS/SHELL.

NO

The startup function is not begun.

PARAMETER GROUP 4__, REFERENCE SIGNALS

The following reference values are used for recording and signaling certain operational states. All signals in parameter group 4__ can be output via binary outputs (→ P62_/ P63_).

Important: The signals are only valid if the inverter has signaled "ready" after switch-on and there is no fault display.

40_ **Speed reference signal**

Signal if the speed is less than or greater than the set reference speed.

400 Speed reference value

Setting range: 0 – 1500 – 5000 rpm

401 Hysteresis

Setting range: 0 – 100 – 500 rpm

402 Delay time

Setting range: 0 – 1 – 9 s

403 Signal = "1" if:

n < n ref / n > n ref

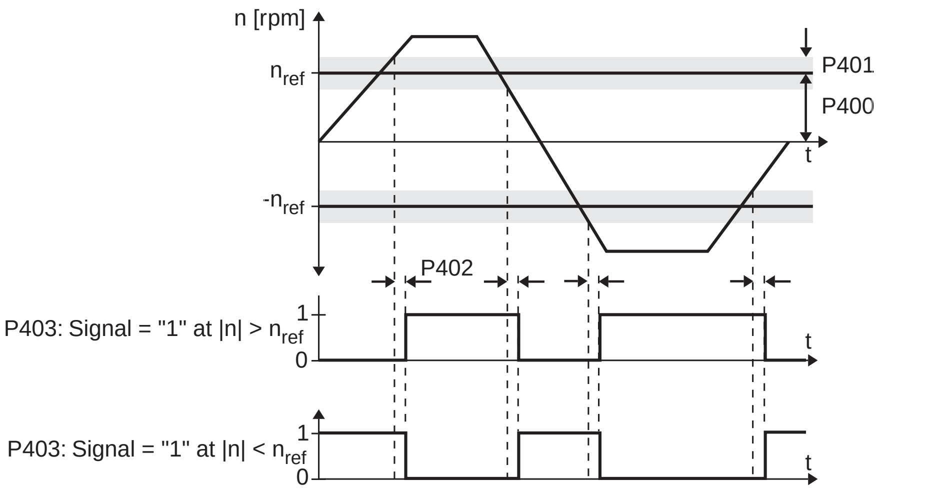


Fig. 64: Speed reference signal

41_ **Speed window signal**

Signal if the speed is within or outside the set window range.

410 Window center

Setting range: 0 – 1500 – 5000 rpm

411 Range width

Setting range: 0 – 5000 rpm

412 Delay time

Setting range: 0 – 1 – 9 s

413 Signal = "1" if:

INSIDE / OUTSIDE

42_ **Speed setp./act. val. comp.**

Signal if the speed is equal to or not equal to the setpoint speed.

420 Hysteresis

Setting range: 0 – 100 – 300 rpm

421 Delay time

Setting range: 0 – 1 – 9 s

422 Signal = "1" if:

n = n setpt / n <> n setpt

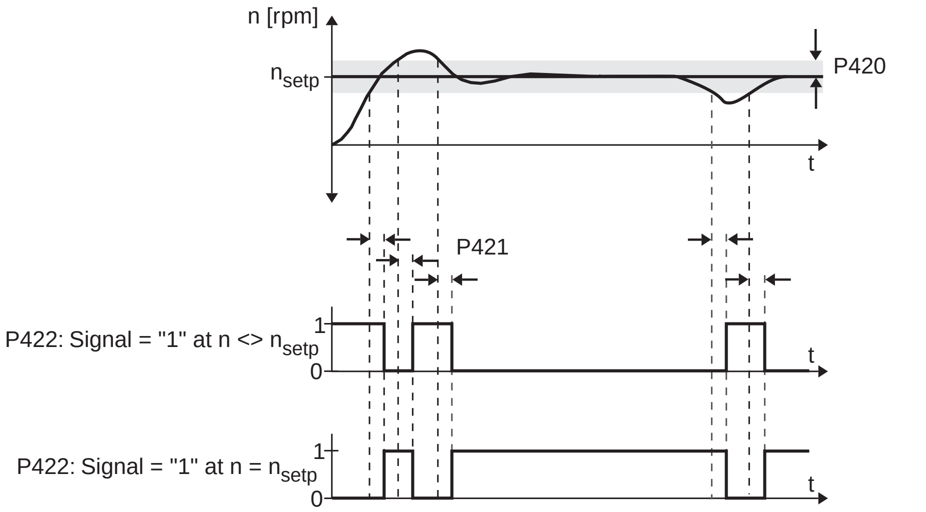


Fig. 65: Speed setpoint/actual value comparison

43_ **Current reference signal**

Signal if the output current is greater than or less than the reference value.

430 Current reference value

Setting range: 0 – 100 – 150 %I_N

431 Hysteresis

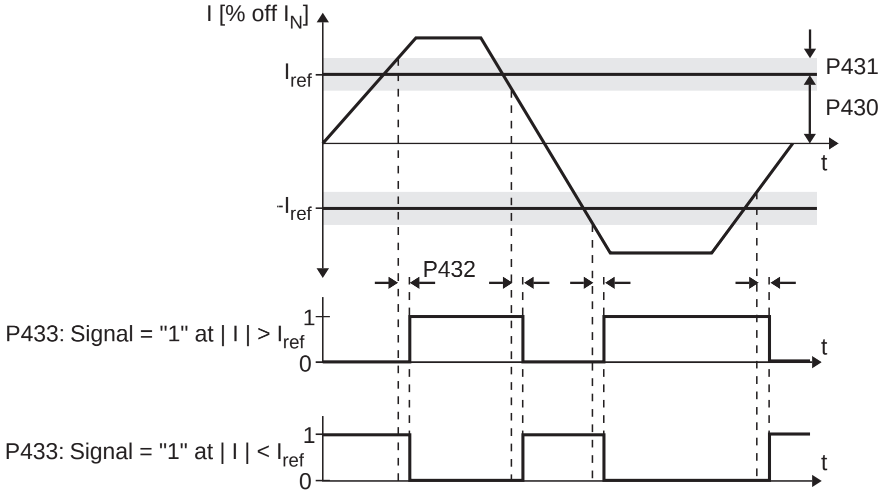
Setting range: 0 – 5 – 30 %I_N

432 Delay time

Setting range: 0 – 1 – 9 s

433 Signal = "1" if:

I < I ref / I > I ref



01623BEN

Fig. 66: Current reference signal

44_	**Imax signal**
	Signal if the inverter has reached the current limitation
440	Hysteresis
	Setting range: 0 – 15 – 50 %I_N
441	Delay time
	Setting range: 0 – 1 – 900 s
442	Signal = "1" if:
	I<Imax / I=Imax

PARAMETER GROUP 5__, MONITORING FUNCTIONS

The following monitoring functions have been implemented in order to monitor what happens to drive-specific parameters in the specific application and to be able to react in case of impermissible deviations. Some of the monitoring functions are available separately in both parameter sets. It is possible to set the reaction to the triggering of monitoring functions using the parameters in group P83_ (Fault response).

50_ **Speed monitoring**

500/502 Speed monitoring 1/2

Setting range: OFF / MOTOR MODE / REGENERAT. MODE / MOT.& REGEN.MODE

The speed required by the setpoint can only be achieved if there is sufficient torque available to meet the load request. If the set current limit (P303 and external current limitation) is reached, MOVIDRIVE® assumes that the torque has reached the maximum limit and the desired speed cannot be attained. Speed monitoring is triggered if this situation persists for the duration specified in P501/P503.

501/503 Delay time 1/2

Setting range: 0 – 1 – 10 s

The set current limit may be reached briefly during acceleration and deceleration procedures or when load peaks occur. An unintentionally sensitive response by the speed monitoring function can be prevented by setting the delay time accordingly. The current limit must be maintained for the duration of the delay time before the monitoring function responds.

504 Encoder monitoring (from firmware version 822 660 0.18 for sin/cos encoders and from firmware version 823 854 5.10 for TTL sensors and sin/cos encoders)

Setting range: ON / OFF

TTL sensors and sin/cos encoders are monitored for function and voltage supply. The encoder monitoring is triggered in the event of a malfunction or if there is no voltage supply. Fault F14 "Encoder" is generated. The drive is stopped with a rapid stop.

STOP Encoder monitoring is not a safety function!

51_ **Synchr. operation monitoring** (only parameter set 1 and when the DRS11A option is used): (→ "Synchronous Operation Type DRS11A" manual for a detailed description.)

510 Positioning tol. slave

Setting range: 10 – 25 – 32768 inc

Various conditions must be met in order for precise positioning of the slave to take place. The brake of the slave drive is applied if all of the following conditions are met:

- Master at standstill
- Master is de-energised (= inverter status INHIBITED)
- Slave is at standstill and is located within the positioning window (P510)

511 Prewarning lag error

Setting range: 50 – 99,999,999 inc

A prewarning is issued if the angle offset exceeds the value set here. This is irrespective of the operating mode of the slave drive.

512 Lag error limit

Setting range: 100 – 4000 – 99,999,999 inc

Error message F42 "Lag error" is issued if the angular misalignment exceeds the value set here. This is irrespective of whether the slave is operating in free running or synchronous operation mode.

513 Delay lag error signal

Setting range: 0 – 1 – 99 s

It is possible to suppress the "Prewarning lag error" and "Lag error limit" signals from being output as an error message or onto a binary output for an adjustable skip time when switching over from free running to synchronous operation.

514 Counter LED display

Setting range: 10 – 100 – 32768 inc

LED V1 (green) lights up if the angle offset exceeds the value set here. This permits an immediate visual display when the maximum differential between master and slave during operation is reached. This is helpful during commissioning.

515 Delay in-position signal

Setting range: 5 – 10 – 2000 ms

The DRS SLAVE IN POS binary output signal is not issued unless the master and slave are located within the "Positioning tol. slave" (P510) for the time set here.

52_ **Mains OFF monitoring**

The setting of P520/P521 is significant when a binary input is programmed to "MAINS ON" and MOVIDRIVE® regenerative mode is used (→ MOVIDRIVE® regenerative power unit MDR manual).

520 Mains OFF response time

Setting range: 0 – 5 s

521 Mains OFF response

CONTROL.INHIBIT / EMERGENCY STOP

PARAMETER GROUP 6__, TERMINAL ASSIGNMENT

60_	**Binary inputs basic unit**
	Binary input DIØØ with fixed assignment "/CONTROLLER INHIBIT"
600 – 604	Binary inputs DIØ1 – DIØ5
61_	**Binary inputs option**
610 – 617	Binary inputs DI1Ø – DI17

The binary inputs can be programmed to the following functions:

Function	Effect in		Effect in inverter status		Factory setting	See also
	"0" signal	"1" signal	inhibit	enabled		
NO FUNCTION	-	-	-	-		
ENABLE/RAP.STOP	Rapid stop on t13/t23	Enable		•	DIØ3	P13_/ P14_
CW/STOP	Stop on t11/t21 or t12/t22	Enable CW running		•	DIØ1	
CCW/STOP	Stop on t11/t21 or t12/t22	Enable CCW running		•	DIØ2	
n11/n21 n13/n33	External setpoints only	n11/n21 n13/n23		•	DIØ4	P16_/ P17_
n12/n22	External setpoints only	n12/n22		•	DIØ5	
FIXED SETP. SELECT	Fixed setpoints of active parameter set selected	Fixed setpoints of inactive parameter set selected	•	•		
PAR. SWITCHOVER	Parameter set 1	Parameter set 2	•			
RAMP SWITCHOVER	1st ramp (t11/t21) active	2nd ramp (t12/t22) active	•	•		P13_/ P14_
MOTOR POT UP	-	Increase setpoint		•		P15_
MOTOR POT DOWN	-	Reduce setpoint		•		
/EXT. FAULT	External fault	-		•		
FAULT RESET	Reset on positive edge ("0" → "1")		•	•		
/HOLD CONTROL	Hold control active	-		•		P210
/LIM. SWITCH CW	CW limit switch reached	Not reached		•		
/LIM. SWITCH CCW	CCW limit switch reached	Not reached		•		
IPOS INPUT	Function depends on IPOS program					IPOS$^{plus®}$ manual
REFERENCE CAM	Not actuated	Actuated		•		
REF.TRAVEL START	-	Start of reference travel for IPOS		•		
SLAVE FREE RUNN.	Master/slave mode	Slave free running	•	•		
SETPOINT HOLD	Do not take over	Take over setpoint		•		
MAINS ON	→ P521	Ext. signal MAINS ON	•	•		P52_
DRS SET ZERO PT.	"1" → "0": Sets new zero point	Delete angular misalignment	•	•		Synchronous Operation manual
DRS SLAVE START	No enable	Enable		•		
DRS TEACH-IN	-	Take on position	•	•		
DRS MAST.STOPPED	Master turning	Master at standstill	•	•		

62_ **Binary outputs basic unit**

Binary output DBØØ with fixed assignment "/BRAKE"

620/621 Binary outputs DOØ1-NO/DOØ1-NC/DOØ2

63_ **Binary outputs option**

630 – 637 Binary outputs DO1Ø – DO17

The binary outputs can have the following functions assigned to them:

Function	Binary output has		Factory setting	See also
	"0" signal	"1" signal		
NO FUNCTION	Always "0" signal	-		
/FAULT	Collective fault signal	-	DOØ2	
READY	Not ready	Ready	DOØ1	
OUTP. STAGE ON	Unit inhibited	Unit enabled and motor is energized		
ROT. FIELD ON	No rotating field	Rotating field		
BRAKE RELEASED[1)]	Brake is applied	Brake is released		
BRAKE APPLIED[1)]	Brake is released	Brake is applied		
MOTOR STANDSTILL	Motor turning	Motor at standstill		
PARAMETER SET	Parameter set 1 active	Parameter set 2 active		
SPEED REFERENCE P403 = $n < n_{ref}$ ($n > n_{ref}$)	$n > n_{ref}$ ($n < n_{ref}$)	n < n ref (n > n ref)		P40_
SPEED WINDOW P413 = INSIDE (OUTSIDE)	Speed is outside (inside) speed window	Speed is inside (outside) speed window		P41_
SP/ACT.VAL.COMP. P422 = $n = n_{setpt}$ ($n <> n_{setpt}$)	$n <> n_{setpt}$ ($n = n_{setpt}$)	n = n setpt (n <> n setpt)		P42_
CURR. REFERENCE P433 = $I < I_{ref}$ ($I > I_{ref}$)	$I > I_{ref}$ ($I < I_{ref}$)	I < I ref (I > I ref)		P43_
Imax-SIGNAL P442 = $I = I_{max}$ ($I < I_{max}$)	$I < I_{max}$ ($I = I_{max}$)	I=Imax (I<Imax)		P44_
/MOTOR UTILIZ.1	100 % prewarning of motor protection in parameter set 1	-		P34_
/MOTOR UTILIZ.2	100 % prewarning of motor protection in parameter set 2	-		
/DRS PREWARN.	Value for prewarning lag error (P511) exceeded	-		Synchronous Operation manual
/DRS LAG ERROR	Lag error limit (P512) exceeded	-		
DRS SLAVE IN POS	Position not reached	Position reached		
IPOS IN POSITION	Position not reached	Position reached		IPOS$^{plus®}$ manual
IPOS REFERENCE	No reference travel	Reference travel completed		
IPOS OUTPUT	Depends on IPOS program			
/IPOS FAULT	Fault signal IPOS program	-		

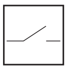
1) Use binary output DBØØ (T. X10:3) for activating the brake. This binary output has the fixed assignment of the "/BRAKE" function. The "BRAKE RELEASED" and "BRAKE APPLIED" signals are intended to be passed on to a master controller.

The binary signals are only valid if the inverter has signaled "READY" after switch-on and there is no fault display. Binary signals have "0" status while MOVIDRIVE® is being initialized.

Several terminals can be programmed with the same function.

*64_* **Analog outputs optional**

640/643 Analog output AO1/AO2



Depending on the set operating mode (→ P642/P645), the signal range will be -10 – 0 – 10 V (AOV1/AOV2) or 0 (4) – 20 mA (AOC1/AOC2).

The analog outputs can have the following functions assigned to them:

Function	Scaling (at P641/P644 = 1) Ref. value	Output value	Explanation	Factory setting
NO FUNCTION	Always 0 V or 0 mA		-	
RAMP INPUT	±3000 rpm	±10 V or 20 mA	Setpoint speed at input of internal ramp generator	
SPEED SETPOINT	±3000 rpm	±10 V or 20 mA	Valid setpoint speed (output ramp generator or correcting variable of master controller)	
ACTUAL SPEED	±3000 rpm	±10 V or 20 mA	Actual speed	AO1
ACTUAL FREQUENCY	±100 Hz	±10 V or 20 mA	Rotating field frequency	
OUTPUT CURRENT	150 % I_N	10 V or 20 mA	Apparent current	AO2
ACTIVE CURRENT	±150 % I_N	±10 V or 20 mA	Active current, pos. with torque in pos. direction of rotation, neg. with torque in neg. direction of rotation.	
RELATED TORQUE	±150 % I_N	±10 V or 20 mA	Active current which forms the torque; the value "0" is always output in VFC operating modes.	
UNIT UTILIZATION	150 %	10 V or 20 mA	Momentary unit utilization	
IPOS OUTPUT	±10,000 digits	±10 V or 20 mA	Internal IPOS values (→ IPOS$^{plus®}$ manual)	
IPOS OUTPUT 2	±10,000 digits	±10 V or 20 mA	Internal IPOS values (→ IPOS$^{plus®}$ manual)	

641/644 Scaling AO1/AO2

Setting range: -10 – 0 – <u>1</u> – 10

The slope of the characteristic for the analog outputs is defined.

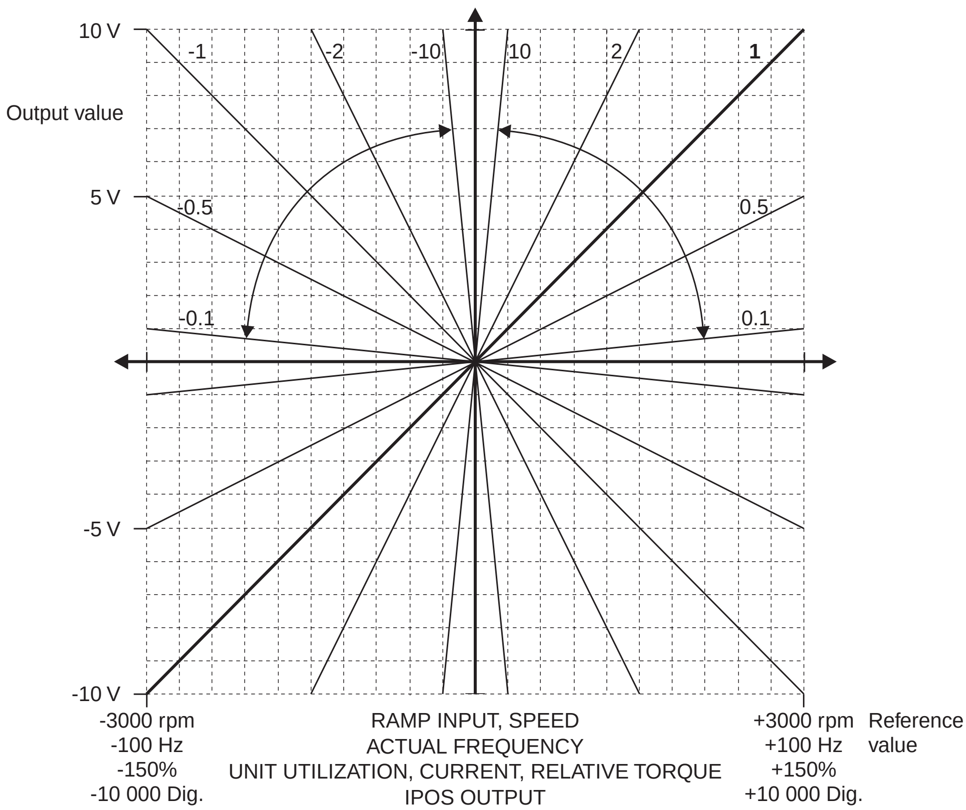


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Fig. 67: Slope of the characteristic for the analog outputs

642/645 Operating mode AO1/AO2

OFF

The value zero is always output.

-10 – 0 – 10 V

Output of the reference value with the correct signs as voltage values on AOV1/AOV2; the current outputs AOC1/AOC2 are not valid.

0 – 20 mA

Output of the value of the reference values as current values 0 – 20 mA on AOC1/AOC2; the voltage outputs AOV1/AOV2 are not valid. The scaling AO1/AO2 (P641/P644) is evaluated on the basis of the value.

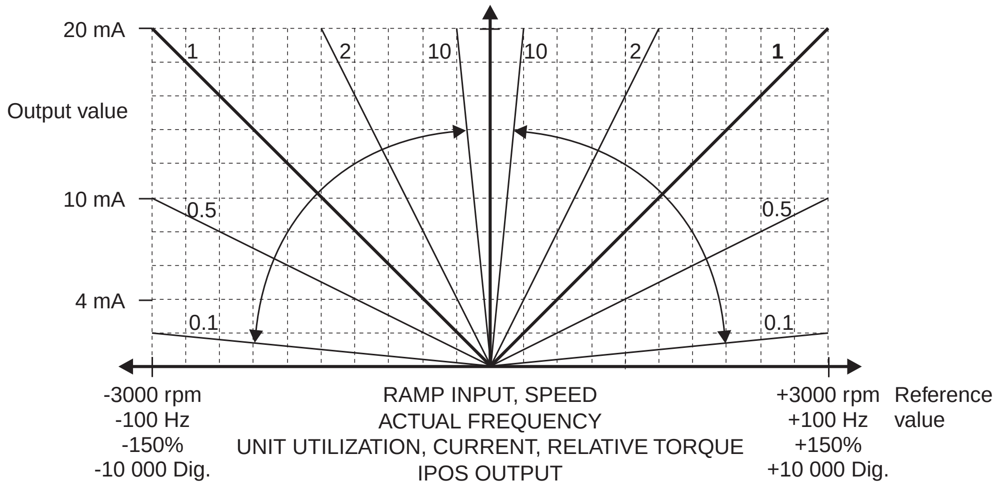

Fig. 68: Characteristic of 0 – 20 mA operating mode

4 – 20 mA

Output of the value of the reference values as current values 4 – 20 mA on AOC1/AOC2; the voltage outputs AOV1/AOV2 are not valid. The slope of the characteristics is flatter than in 0 – 20 mA operating mode. The characteristic has an offset of 4 mA and the value of the scaling AO1/AO2 (P641/P644) refers to the value range of 16 mA.

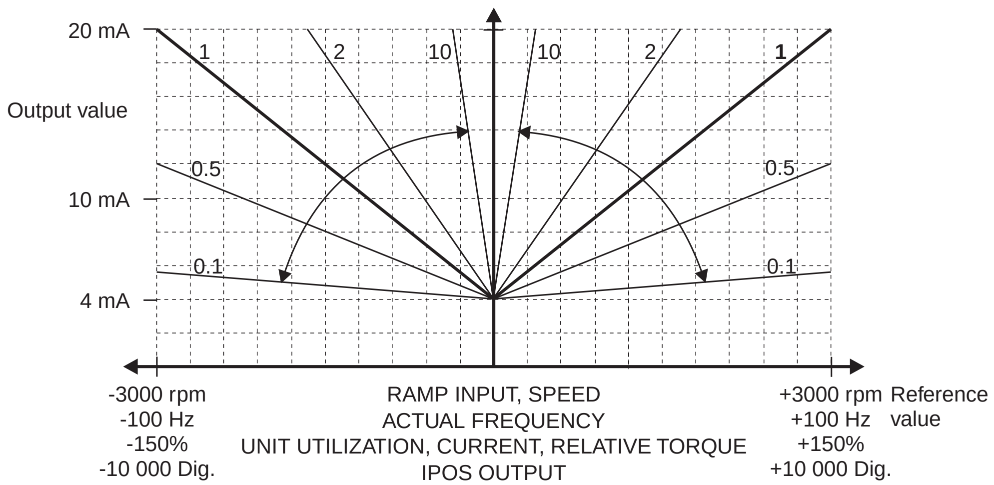

Fig. 69: Characteristic of 4 – 20 mA operating mode

PARAMETER GROUP 7__, CONTROL FUNCTIONS

All settings with regard to the fundamental control properties of the inverter are defined within parameter group 7__. These are all functions which the inverter performs automatically upon activation and which influence its behavior in certain operating modes.

70_ **Operating modes**

700/701 1 2 Operating mode 1/2

This parameter sets the basic operating mode of the inverter for parameter set 1 and 2. In particular, this comprises defining the motor system, the encoder feedback and corresponding control functions. When MOVIDRIVE® inverters are delivered, their parameters are set to the specific motor which matches the power of the motor.

All operating modes can be set for parameter set 1. Only operating modes without encoder feedback can be set for parameter set 2 (→ following table).

Parameter set 1/2 700/701 Operating mode 1/2	Unit type and option	Motor
VFC 1 / 2 VFC 1/2 & GROUP VFC 1/2 & HOIST VFC 1/2 & DC BRAK. VFC 1/2 &FLY.START	MDF or MDV, no option required	DT/DV/D without incremental encoder
VFC-n-CONTROL VFC-n-CTRL&GROUP VFC-n-CTRL&HOIST	MDV, no option required	DT/DV/D with incremental encoder
VFC-n-CTRL.&SYNC	MDV + DRS11A	
VFC-n-CTRL& IPOS	MDV, no option required	
VFC-n-CTRL.&DPx	MDV + DPA11A/DPI11A	
CFC CFC & M-CONTROL CFC & IPOS	MDV, no option required	DT/DV/D with incremental encoder or CT/CV (incremental encoder installed as standard)
CFC&SYNC.	MDV + DRS11A	
CFC&DPx	MDV + DPA11A/DPI11A	
SERVO SERVO & M-CTRL. SERVO & IPOS	MDS, no option required	DFY (Resolver installed as standard)
SERVO & SYNC.	MDS + DRS11A	
SERVO & DPx	MDS + DPA11A/DPI11A	

700/701 1 2 <u>VFC 1 / 2</u>

Default setting for asynchronous motors without encoder feedback. Suited to general applications such as conveyor belts, trolleys and hoists with a counterweight. A flux-oriented motor model is used. This is optimally adapted to the motor after the commissioning function in MOVITOOLS or in the DBG11A keypad has been carried out. It is necessary to enter the motor type (SEW motor) or the nameplate data (motor from another manufacturer) as part of the startup function. The following parameters are preset (parameter set 1/2):

Settings after the startup function	
P303/P313 Current limit 1/2	I_{max} (inverter) = 150 % I_{N_mot}
P302/P312 Maximum speed 1/2	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301/P311 Minimum speed 1/2	15 rpm
P130 – P133/P140 – P143 Ramp t11/t21	2 s
P136/P146 Stop ramp t13 / t23	2 s
P137/P147 Emergency ramp t14 / t24	2 s
P500/P502 Speed monitoring 1/2	MOT.& REGEN.MODE
P501/P503 Delay time 1/2	1 s
P100 Setpoint source	UNIPOL/FIX.SETPT

Settings after the startup function	
P101 Control signal source	TERMINALS
P730/P733 Brake function 1/2	ON
P731/P734 Brake release time 1/2	With SEW motors: Setting in accordance with motor data. **With non-SEW motors: Set the correct value by hand!**
P732/735 Brake application time 1/2	
P300/P310 Start/stop speed 1/2	15 rpm
P820/P821 4-quadrant operation 1/2	ON
P324/P334 Slip compensation 1/2	Setting in accordance with specified motor data
P321/P331 Boost 1/2	0
P322/P332 IxR compensation 1/2	Setting in accordance with specified motor data
P320/P330 Automatic adjustment 1/2	ON
P323/P333 Premagnetizing time 1/2	Setting in accordance with specified motor data

- SEW recommends using the P320/P330 "Automatic adjustment" parameter activated in the factory setting. This means the P322/P332 "IxR compensation 1/2" parameter is set automatically during the pre-magnetization time through the calibration of the motor.
- SEW recommends not changing the P321/P331 "Boost 1/2" parameter from its factory setting (=0).

700/701 1 2

VFC 1/2 & GROUP

Set this if a group of asynchronous motors is to be operated on one inverter. All motors in the group must have the same rated voltage and rated frequency. The brake is controlled in accordance with P730/P733. Set the data for the largest motor in the group during startup (→ VFC 1). Once startup is finished, adapt the current limit P303/P313 to the total current of all connected motors. We recommend a basic setting of P321/P331 "Boost 1/2" to the same value as P322/P332 "IxR compensation 1/2".

Settings after the startup function	
P303/P313 Current limit 1/2	I_{max} (inverter) = 150 % ΣI_{N_mot}
P302/P312 Maximum speed 1/2	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301/P311 Minimum speed 1/2	15 rpm
P130 – P133/P140 – P143 Ramp t11/t21	2 s
P136/P146 Stop ramp t13 / t23	2 s
P137/P147 Emergency ramp t14 / t24	2 s
P500/P502 Speed monitoring 1/2	MOT.& REGEN.MODE
P501/P503 Delay time 1/2	1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730/P733 Brake function 1/2	ON
P731/P734 Brake release time 1/2	With SEW motors: Setting in accordance with motor data. **With non-SEW motors: Set the correct value by hand!**
P732/P735 Brake application time 1/2	
P300/P310 Start/stop speed 1/2	Setting in accordance with specified motor data
P820/P821 4-quadrant operation 1/2	ON

- Do not use this operating mode for hoist applications!
- The pre-magnetization current is adapted to the largest motor in the group during startup. Whenever motors are taken out of the group by being switched off, it may be necessary to reduce the current limitation to a current appropriate to the remaining combination of motors.
- Slip compensation is not in effect. This means load-dependent speeds are established on the motors.

700/701 VFC 1/2 & HOIST

700 VFC-n-CTRL&HOIST (only parameter set 1)

The hoist function automatically provides all functions required for operating a non-balanced hoist. In particular, monitoring functions are activated for safety reasons. These may prevent the drive from starting. They are in particular:

- Monitoring the output current during the pre-magnetization phase.
- Avoiding sag when the brake is released by load feedforward.
- Monitoring that the pre-magnetization time is set to an adequate value

Constellations which can be recognized as incorrect	Fault triggered
2 or 3-phase motor phase interruption	F82 = Output open
Pre-magnetization time too short, or incorrect motor/ inverter combination.	F81 = Fault start condition
Failure of a motor phase through active speed monitoring (factory setting) P500/501, P502/503	F08 = Fault n-monitoring

- A single-phase motor phase failure cannot always be reliably detected.
- SEW strongly recommends activating speed monitoring (factory setting).
- Correct performance of the hoist function requires the motor brake to be controlled via the inverter.

700/701 VFC 1/2 & DC BRAK.

The DC braking function permits the asynchronous motor to be braked using a current injection. In this case, the motor can be braked on the inverter without a braking resistor.

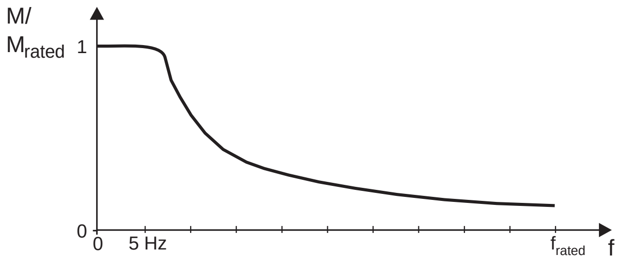

Fig. 70: DC braking: Braking torque profile

A constant current with a rotating field frequency of 5 Hz is impressed during the braking process. The braking torque equals 0 at a standstill. A greater braking torque acts at a slower speed; the braking torque drops as the speed increases. The braking time, and thus the duration of the braking current, depends on the load on the motor. If the rotating field frequency of the motor reaches 5 Hz, DC braking is cancelled and the motor is stopped with the rapid stop ramp. The current injection occurs at rated motor current in accordance with the startup function. In all cases, the inverter limits the current to max. 125 $\%I_N$. See the brake function regarding activation of the brake.

It is not possible to enable a directed stop or to observe a certain ramp using DC braking. The principal application is to drastically reduce the coasting of motors.

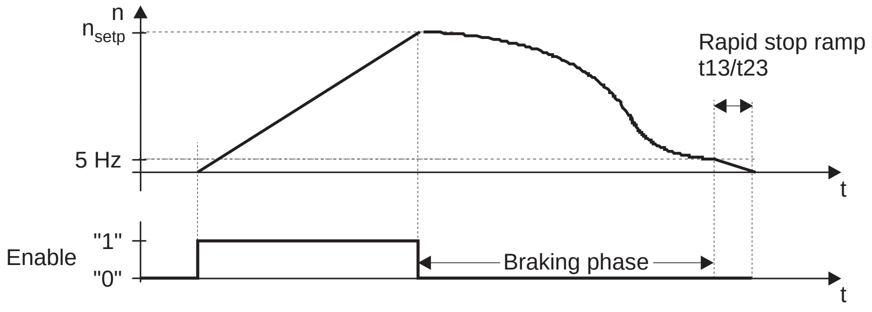

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Fig. 71: DC braking: Braking profile

- The **braking procedure is interrupted** if the "Enable" binary input receives a "1" signal again during the braking phase. DC braking is completed and the drive is only accelerated afterwards.
- The drive stops with ramp t11/t21 or t12/t22 if a binary input is programmed to the "CW/STOP" ("CCW/STOP") function in "VFC 1/2 & DC BRAK." operating mode and "CW/STOP" ("CCW/STOP") receives a "0" signal. The stop is continued and **no DC braking initiated** if the "Enable" binary input is switched from "1" to "0" during the ramp time.

  To **start DC braking**, it is **first necessary for "Enable" to be switched from "1" to "0"**, and this must happen at least 10 ms prior to "CW/STOP" ("CCW/STOP") is switched from "1" to "0".

700/701 1 2

VFC 1/2 &FLY.START (from firmware version .15)

The flying restart circuit makes it possible to lock the inverter onto a rotating motor. This applies in particular to drives which are not braked actively, which run on for a long time or which are turned by a flowing medium, e.g. pumps and fans. The maximum flying start time is approx. 200 ms.

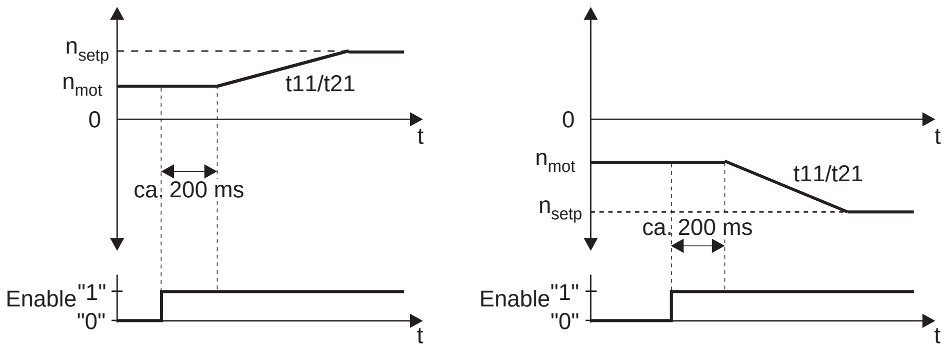

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Fig. 72: VFC & flying start function

The flying restart circuit does not function if there is an output filter connected to the inverter.

Never use the flying restart circuit with hoist applications!

700 VFC-n-CONTROL (only parameter set 1)

This operating mode builds on VFC mode to make it possible to have speed-controlled operation with an incremental encoder mounted on the motor shaft. The following encoders can be used as incremental encoders:

1. RS-422 / TTL incremental encoder
2. HTL incremental encoder
3. High resolution incremental encoder with sinusoidal tracks 1 V_{SS}

SEW recommends the use of encoders with 1024 increments/revolution by default. The following properties derive from the speed feedback:

- Increase in the static control accuracy and greater control dynamics.
- Hold control: Programming a binary input to "/Hold control" (P60_/P61_) enables the motor to be brought to a standstill with position control even when under load. Set the hold controller (gain) using P210.
- Positioning mode is possible with IPOS$^{plus®}$ or DPA11A/DPI11A.
- Synchronous operation is possible with DRS11A.

The startup function of MOVITOOLS/SHELL not only supports motor startup (VFC) but also the additional controller setting of the speed controller. The following parameters are set which are relevant to n-control:

Settings after the startup function	
P303 Current limit 1	I_{max} (inverter) = 150 % I_{motor}
P302 Maximum speed 1	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301 Minimum speed 1	0 rpm
P500 Speed monitoring 1	MOT.& REGEN.MODE
P501 Delay time 1	0.1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730 Brake function 1	ON
P731 Brake release time 1	With SEW motors: Setting in accordance with motor data. **With non-SEW motors: Set the correct value by hand!**
P732 Brake application time 1	
P323 Premagnetizing time 1	Setting in accordance with specified motor data

Settings after the startup function of the speed controller	
P200 P gain speed controller	Setting in accordance with specified data
P201 Time constant n-control.	
P202 Gain accel. feedforward	
P204 Filter speed actual value	
P115 Filter setpoint	
P203 Filter accel. feedforward	
P210 P gain hold controller	Position controller gain for the hold control function
P910 Gain X controller	Position controller gain for IPOS$^{plus®}$ (positioning mode)
P130 – P133/P140 – P143 Ramp t11/t21	Setting in accordance with specified data
P136/P146 Stop ramp t13 / t23	
P137/P147 Emergency ramp t14 / t24	

The setting of the 4-quadrant operation (P820) is ignored; 4-quadrant operation is always active.

700 VFC-n-CTRL&GROUP (only parameter set 1)

Set this if a group of asynchronous motors is to be operated on one inverter. All motors in the group must have the same rated voltage, rated frequency and rated power. One motor in the group is operated with speed control and must be equipped with an incremental encoder connected to X15. The following encoders can be used as incremental encoders:

1. RS-422 / TTL incremental encoder
2. HTL incremental encoder
3. High resolution incremental encoder with sinusoidal tracks 1 V_{SS}

SEW recommends the use of encoders with 1024 increments/revolution by default. The other motors in the group follow the speed-controlled motor in a slip-dependent function.

The startup function of MOVITOOLS not only supports motor startup (VFC) but also the additional controller setting of the speed controller. The following parameters are set which are relevant to n-control:

Settings after the startup function	
P303 Current limit 1	I_{max} (inverter) = 150 % ΣI_{N_mot}
P302 Maximum speed 1	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301 Minimum speed 1	0 rpm
P500 Speed monitoring 1	MOT.& REGEN.MODE
P501 Delay time 1	0.1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730 Brake function 1	ON
P731 Brake release time 1	With SEW motors: Setting in accordance with motor data. **With non-SEW motors: Set the correct value by hand!**
P732 Brake application time 1	
P323 Premagnetizing time 1	Setting in accordance with specified motor data

Settings after the startup function of the speed controller	
P200 P gain speed controller	Setting in accordance with specified data
P201 Time constant n-control.	
P202 Gain accel. feedforward	
P204 Filter speed actual value	
P115 Filter setpoint	
P203 Filter accel. feedforward	
P210 P gain hold controller	Position controller gain for the hold control function
P910 Gain X controller	Position controller gain for IPOS$^{plus®}$ (positioning mode)
P130 – P133/P140 – P143 Ramp t11/t21	Setting in accordance with specified data
P136/P146 Stop ramp t13 / t23	
P137/P147 Emergency ramp t14 / t24	

The setting of the 4-quadrant operation (P820) is ignored; 4-quadrant operation is always active.

700 VFC-n-CTRL& SYNC (only parameter set 1)

Must be set on the slave drives if a group of asynchronous motors should be operated at a synchronous angle in relation to one another or with an adjustable proportional ratio. Refer to the "Synchronous Operation Type DRS11A" manual for detailed descriptions of synchronous operation. This manual is available from SEW.

700 VFC-n-CTRL& IPOS (only parameter set 1)

Must be set if IPOS$^{plus®}$ positioning commands are to be processed. Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for detailed descriptions of IPOS$^{plus®}$. This manual can be obtained from SEW.

700 VFC-n-CTRL& DPx (only parameter set 1)

Set if the DPA12/DPI12 option is being used and single-axis positioning control should be activated. Refer to the "Single-Axis Positioning Control DPA12/DPI12" manual for detailed descriptions. This manual can be obtained from SEW.

700 CFC (only parameter set 1)

CFC operating mode makes it possible to operate an asynchronous motor with real servo properties, i.e. high control dynamics, excellent smooth running properties and controlled operation even when at a standstill. This is achieved because the CFC procedure enables direct control over the magnetic flux in the motor and, therefore, over the torque. Operation in conjunction with speed feedback via incremental encoder is obligatory. The following encoders can be used as incremental encoders:

1. RS-422 / TTL incremental encoder
2. HTL incremental encoder
3. High resolution incremental encoder with sinusoidal tracks 1 V_{SS}

SEW recommends using type 3 encoders with a resolution of 1024. These encoders achieve the best possible control characteristics.

The following parameters do not have any effect: slip compensation (P324), boost (P321) and IxR compensation (P322).

The MOVITOOLS startup function requires the motor type to be entered (SEW motor). No startup can be performed with the DBG11A keypad in CFC mode. The following parameters are set by default (parameter set 1):

Settings after the startup function	
P303 Current limit 1	I_{max} (inverter) = 150 % I_{motor}
P302 Maximum speed 1	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301 Minimum speed 1	0 rpm
P500 Speed monitoring 1	MOT.& REGEN.MODE
P501 Delay time 1	0.1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730 Brake function 1	ON
P731 Brake release time 1	Setting in accordance with specified motor data
P732 Brake application time 1	
P323 Premagnetizing time 1	Setting in accordance with specified motor data

CFC always requires the speed controller to be started up as well.

Settings after the startup function of the speed controller	
P200 P gain speed controller	Setting in accordance with specified data
P201 Time constant n-control.	
P202 Gain accel. feedforward	
P204 Filter speed actual value	
P115 Filter setpoint	
P203 Filter accel. feedforward	
P210 P gain hold controller	Position controller gain for the hold control function
P910 Gain X controller	Position controller gain for IPOS$^{plus®}$ (positioning mode)
P130 – P133/P140 – P143 Ramp t11/t21	Setting in accordance with specified data
P136/P146 Stop ramp t13 / t23	
P137/P147 Emergency ramp t14 / t24	

The setting of the 4-quadrant operation (P820) is ignored; 4-quadrant operation is always active.

700 CFC & M-CONTROL (only parameter set 1) → Sec. 4.5

This operating mode allows the torque of the asynchronous motor to be controlled directly. The setpoint is standardized on the following torque:

3000 rpm = 150 % output current × torque constant.

The torque values should be entered directly as fixed setpoints in the unit [%In] (P 16_, P 17_). The set processing (P11_) also applies to the torque control if the setpoint selection is made by way of an analog input.

The torque constant (motor-specific parameter) is defined by: $k_T = M_N / I_{q\_n}$

- If P500 "Speed monitoring 1" is active, the drive is monitored according to the P500 parameter description (→ page 124).
- If P500 "Speed monitoring 1" = OFF is set, the drive reacts as follows if its speed is faster or slower than n_{max} (P302) and $-n_{max}$:
  – Motor mode: The available motor torque is reduced to zero with a linear function above n_{max} and below $-n_{max}$. As a result, there is no active speed control.
  – Regenerative mode: No response; the master drive must prevent the drive losing position.
- M-control is also in effect in the range $-n_{min}$ – n – n_{min}.
- The current is always limited to the set current limit (P303).

Settings after the startup function	
P303 Current limit 1	I_{max} (inverter) = 150 % I_{motor}
P302 Maximum speed 1	Depending on number of poles and rated motor frequency e.g. 2-pole / 50 Hz → 3000 rpm e.g. 4-pole / 60 Hz → 1800 rpm
P301 Minimum speed 1	0 rpm
P500 Speed monitoring 1	MOT.& REGEN.MODE
P501 Delay time 1	0.1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730 Brake function 1	ON
P731 Brake release time 1	Setting in accordance with specified motor data.
P732 Brake application time 1	
P323 Premagnetizing time 1	Setting in accordance with specified motor data

Settings after the commissioning function of the torque controller	
P200 P gain speed controller	Setting in accordance with specified data
P201 Time constant n-control.	
P202 Gain accel. feedforward	
P204 Filter speed actual value	
P115 Filter setpoint	
P203 Filter accel. feedforward	
P210 P gain hold controller	Position controller gain for the hold control function
P910 Gain X controller	Position controller gain for IPOS$^{plus®}$ (positioning mode)
P130 – P133/P140 – P143 Ramp t11/t21	Setting in accordance with specified data
P136/P146 Stop ramp t13 / t23	
P137/P147 Emergency ramp t14 / t24	

The setting of the 4-quadrant operation (P820) is ignored; 4-quadrant operation is always active.

700 CFC & IPOS (only parameter set 1)

Must be set if IPOS$^{plus®}$ positioning commands are to be processed. Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for detailed descriptions of IPOS$^{plus®}$. This manual can be obtained from SEW.

700 CFC & SYNC. (only parameter set 1)

Set on the slave drives if a group of asynchronous motors should be operated at a synchronous angle in relation to one another or with an adjustable proportional ratio. Refer to the "Synchronous Operation Type DRS11A" manual for detailed descriptions of synchronous operation. This manual is available from SEW.

700 CFC & DPx (only parameter set 1)

Set if the DPA11/DPI11 option is being used and single-axis positioning control should be activated. Refer to the "Single-Axis Positioning Control DPA11/DPI11" manual for detailed descriptions. This manual can be obtained from SEW.

700 SERVO (only parameter set 1)

SERVO operating mode makes it possible to operate a synchronous motor (servomotor) with a permanent field. The motor must be equipped with a resolver.

The MOVITOOLS startup function requires the motor type to be entered (SEW motor). No startup can be performed with the DBG11A keypad in SERVO mode. The following parameters are set by default (parameter set 1):

Settings after the startup function	
P303 Current limit 1	I_{max} (inverter) = 3 × motor current at standstill
Torque limit	The value of the motor torque can be limited. The maximum value (= 3 × motor standstill torque) is determined by the motor type. Do not alter P303 "Current limit"!
P302 Maximum speed 1	Rated motor speed (2000 rpm, 3000 rpm, 4500 rpm)
P301 Minimum speed 1	0 rpm
P500 Speed monitoring 1	MOT.& REGEN.MODE
P501 Delay time 1	0.1 s
P100 Setpoint source	UNIPOL/FIX.SETPT
P101 Control signal source	TERMINALS
P730 Brake function 1	ON
P731 Brake release time 1	Setting in accordance with specified motor data
P732 Brake application time 1	

SERVO always requires the speed controller to be started up as well.

Settings after the startup function of the speed controller	
P200 P gain speed controller	Setting in accordance with specified data
P201 Time constant n-control.	
P202 Gain accel. feedforward	
P204 Filter speed actual value	
P115 Filter setpoint	
P203 Filter accel. feedforward	
P210 P gain hold controller	Position controller gain for the hold control function
P910 Gain X controller	Position controller gain for IPOS$^{plus®}$ (positioning mode)
P130 – P133/P140 – P143 Ramp t11/t21	Setting in accordance with specified data
P136/P146 Stop ramp t13 / t23	
P137/P147 Emergency ramp t14 / t24	

The setting of the 4-quadrant operation (P820) is ignored; 4-quadrant operation is always active.

700 SERVO & M-CTRL. (only parameter set 1) → Sec. 4.6

This operating mode allows the torque of the servomotor to be controlled directly. The setpoint is standardized on the following torque:

3000 rpm = 150 % output current × torque constant

The torque values should be entered directly as fixed setpoints in the unit [%In] (P 16_, P 17_). The set processing (P11_) also applies to the torque control if the setpoint selection is made by way of an analog input.

The torque constant (motor-specific parameter) is defined by: $k_e = M_0 / I_0$

- If P500 "Speed monitoring 1" is active, the drive is monitored according to the P500 parameter description (→ page 124).
- If P500 "Speed monitoring 1" = OFF is set, the drive reacts as follows if its speed is faster or slower than n_{max} (P302) and $-n_{max}$:
  – Motor mode: The available motor torque is reduced to zero with a linear function above n_{max} and below $-n_{max}$. As a result, there is no active speed control.
  – Regenerative mode: No response; the master drive must prevent the drive losing position.
- M-control is also in effect in the range $-n_{min} – n – n_{min}$.
- The current is always limited to the set current limit (P303).

700 SERVO & IPOS (only parameter set 1)

Must be set if IPOS$^{plus®}$ positioning commands are to be processed. Refer to the "IPOS$^{plus®}$ Positioning and Sequence Control System" manual for detailed descriptions of IPOS$^{plus®}$. This manual can be obtained from SEW.

700 SERVO & SYNC. (only parameter set 1)

Set on the slave drives if a group of servomotors should be operated at a synchronous angle in relation to one another or with an adjustable proportional ratio. Refer to the "Synchronous Operation Type DRS11A" manual for detailed descriptions of synchronous operation. This manual is available from SEW.

700 SERVO & DPx (only parameter set 1)

Set if the DPA11/DPI11 option is being used and single-axis positioning control should be activated. Refer to the "Single-Axis Positioning Control DPA11/DPI11" manual for detailed descriptions. This manual can be obtained from SEW.

71_ **Standstill current (parameter set 1/2)**

710/711 Current at standstill

Setting range: <u>0</u> – 50 % I_{mot}

The standstill current is used for injecting an adjustable current into the motor when the motor is at a standstill and the brake is applied. The standstill current can be switched off by /CONTROLLER INHIBIT = 0. This allows the following functions to be carried out:

- At low ambient temperatures of the motor, it is possible to prevent the danger of condensation formation and freezing (in particular of the disc brake). Setting the current level avoids overheating of the motor. **Recommendation:**The motor housing should be hand-hot.
- It is possible to perform a rapid motor start when standstill current is activated because the motor is kept in an excited state. This means the motor can be started without having to wait for the premagnetizing time. **Recommendation:** Set to 45 – 50 % for hoists.

The standstill current function is deactivated by P710/P711 = 0. The setting is made in % of the rated motor current. The standstill current is monitored for current limit 1/2 (P303/P313) in every case.

In CFC mode, the amount of magnetization current injected is always at least that required on the basis of the motor model. The higher value applies if P710 is set higher. This function does not have any effect in SERVO (MDS) operating mode.

72_ **Setpoint stop function (parameter set 1/2)**

The setpoint stop function allows the inverter to automatically generate an enable function which is dependent on the main setpoint. There is an enable with all required functions such as pre-magnetization, brake control system, etc. In all cases, there must be an additional enable provided via terminals.

720/723 Setpoint stop function 1/2

Setting range: ON / <u>OFF</u>

721/724 Stop setpoint 1/2

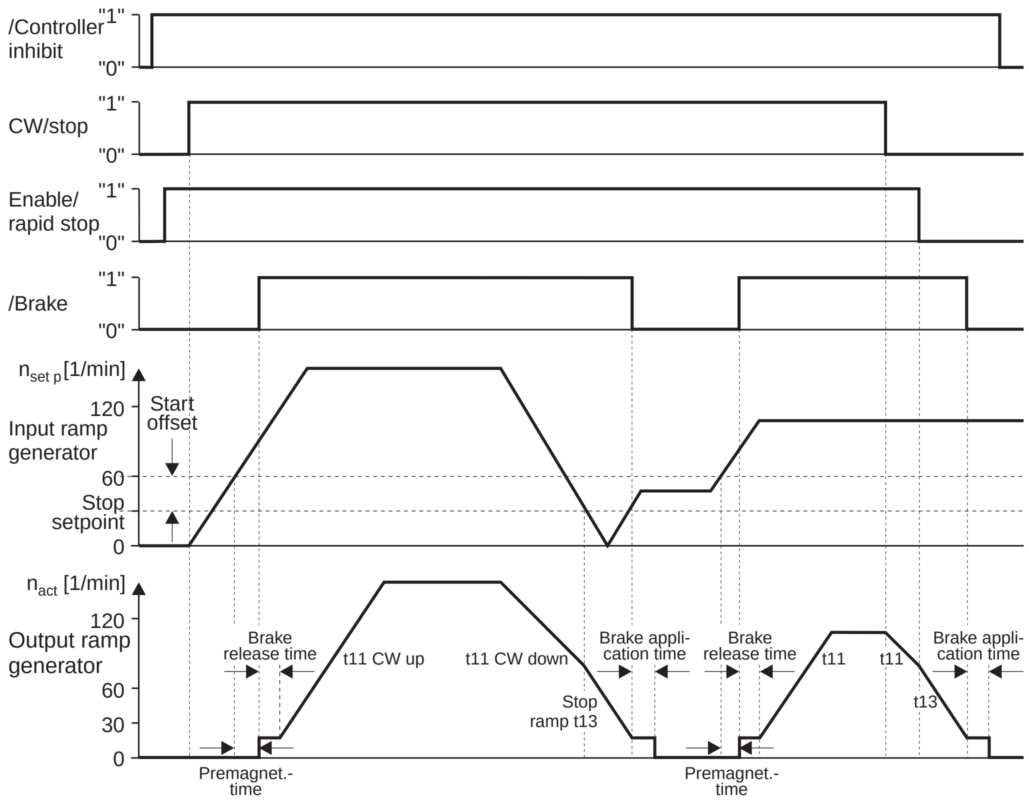
Setting range: 0 – <u>30</u> – 50 rpm

722/725 Start offset 1/2

Setting range: 0 – <u>30</u> – 50 rpm

There is no enable if stop setpoint + start offset (start setpoint) > n_{max}.

Movement with n_{min} is never possible if the stop setpoint is > n_{min}.



01638BEN

Fig. 73: Setpoint stop function

73_ 1 2

Brake function (parameter set 1/2)

MOVIDRIVE® inverters are capable of controlling a brake fitted on the motor. The brake function acts on the binary output DBØØ (X10.3) which has the fixed assignment of the "/BRAKE" function (24 V = brake released). In drives with encoder feedback (speed control), this makes it possible to select between electrical holding of the load and mechanical application of the brake in halt condition.

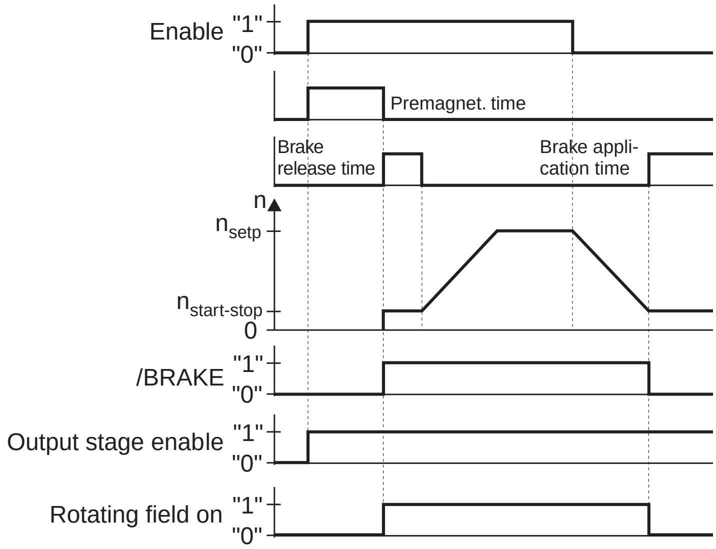
→ Sec. 7.11.1 for wiring of the brake control system.

Operating mode P700 (The same applies to parameter set 2 /P701, however in this case VFC operating modes are possible without encoder feedback)	**Brake function P730 (P733) ON/OFF**
1) VFC, VFC & GROUP, VFC & DC BRAK., VFC &FLY.START	P730 = ON Brake control in accordance with Fig. 74. Effective parameters: P300/P310 Start/stop speed 1/2 P323/P333 Premagnetizing time 1/2 P731/P734 Brake release time 1/2 P732/P735 Brake application time 1/2 P730 = OFF In this case too, post-magnetization takes place with the set brake application time in order to improve positioning of the drive.
2) VFC & HOIST	See 1) The brake function is automatically always active when the hoist function is activated, even if P730 = OFF.

Operating mode P700 (The same applies to parameter set 2 /P701, however in this case VFC operating modes are possible without encoder feedback)	Brake function P730 (P733) ON/OFF
3) VFC-n-CONTROL VFC-n-CTRL&GROUP VFC-n-CTRL&HOIST VFC-n-CTRL&GROUP	P730 = ON See 1) P730 = OFF The speed setpoint of 0 rpm is specified in the inverter when the start/stop speed is reached. See "HOLD CONTROL" if real hold control (position control) is required.
4) CFC	See 3): Pre-magnetization is carried out.
5) SERVO	See 3)
6) CFC & M-CONTROL	The brake is controlled in accordance with P730.
7) SERVO & M-CTRL.	The brake is controlled in accordance with P730.
8) VFC/CFC/ Servo-n-ctrl. & IPOS & SYNC & DPx	See IPOS$^{plus®}$ manual See Synchronous Operation DRS11A manual. See Positioning Control DPA11A/DPI11A manual.

STOP

The brake is **always** applied when /CONTROLLER INHIBIT = 0.



01316BEN

Fig. 74: Inverter response when the brake function is activated

74_ 1 2

Speed skip (parameter set 1/2)

The "Speed skip" function makes it possible to prevent the motor speed from remaining within a certain speed window. This suppresses vibration and noise, in particular in machines with pronounced mechanical resonances.

740/742 Skip window center 1/2

Setting range: 0 – <u>1500</u> – 5000 rpm

741/743 Skip width 1/2

Setting range: 0 – 300 rpm

The skip window center and skip width are values and automatically have an effect on positive and negative setpoints when activated. The function is deactivated by setting skip width = 0.

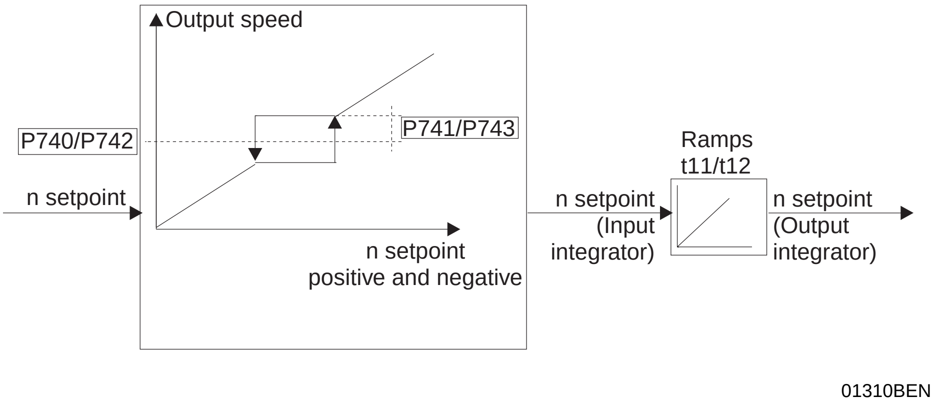


Fig. 75: Speed skip

75_ **Master-Slave function**

Master-slave function offers the opportunity to implement functions such as synchronous speed running, load share and torque control (slave). The RS-485 interface (X13:10/X13:11) or the system bus interface (SBus X10:2/X10:3) can be used as the communications link. P100 "Setpoint source" must then be set to MASTER-SBus or MASTER-RS-485. By programming a binary input to "SLAVE FREE RUNN." (P60_/P61_), it is possible to separate the slave from the master setpoint of the master and switch it to a local control mode.

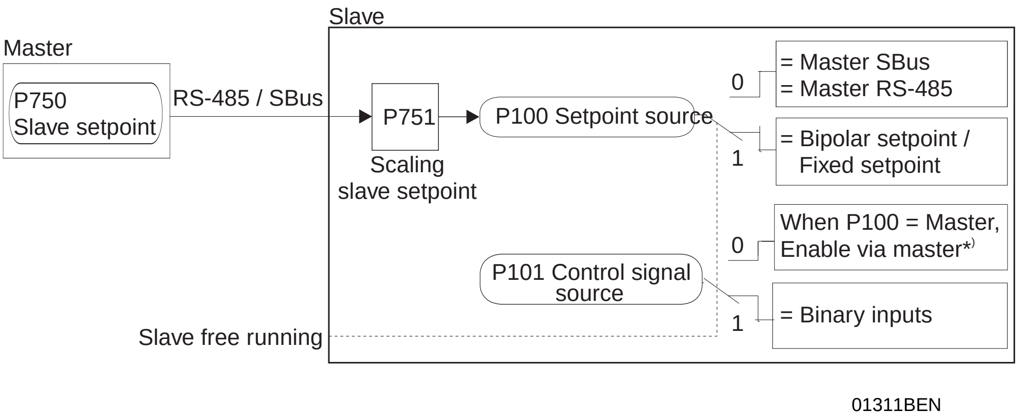


Fig. 76: Master-Slave function

*) DIØØ "/Controller inhibit" and the programmed binary inputs Enable, CW and CCW must also get a "1" signal.

RS-485 group addresses (P811) and SBus group addresses (P814) must be set to the same value in the master and the slave. Set a group address (P811) greater than 100 for master/slave operation via the RS-485 interface. Activate the bus terminating resistors on the master and slave (S12 = ON) for master/slave operation via the system bus.

Connection check

System bus (SBus):

Parameter P815 "SBus timeout delay" is in effect when there is a communications link via the SBus (X10:2/X10:3). If P815 is set to "0", there is no monitoring of data transmission via the SBus.

RS-485 interface:

A connection check is always in effect if the communications link is via the RS-485 interface (X13:10/X13:11), parameter P812 "RS-485 timeout delay" does not have any function. The slave inverters must receive a valid RS-485 telegram within the fixed time interval of t = 500 ms. If the time is exceeded, the slave drives are stopped with the emergency stop ramp and fault message F43 "RS-485 timeout" is signaled.

Important: The fault is automatically reset and the drives are enabled when the slave inverters once again receive a valid telegram.

The connection check is in effect on both RS-485 interfaces (TERMINAL and X13:10/X13:11). If you have connected a PC using TERMINAL and the USS21A option, every telegram from the PC resets the fault.

Overview of functions, master/slave mode

Function	**Master**		**Slave**	
	Slave setpoint P750	**Operating mode P700**	**Setpoint source P100**	**Operating mode P700**
Synchronous speed running: Master controlled Slave controlled	SPEED (485+SBus)	VFC, VFC & GROUP, VFC & HOIST	MASTER SBus MASTER RS-485	VFC, VFC & GROUP, VFC & HOIST
Synchronous speed running: Master speed controlled Slave controlled	SPEED (485+SBus)	VFC-n-CONTROL VFC-n-CTRL. & ... CFC CFC/SERVO & IPOS CFC/SERVO & SYNC CFC/SERVO & DPx	MASTER SBus MASTER RS-485	VFC, VFC & GROUP, VFC & HOIST
Synchronous speed running: Master speed controlled Slave speed controlled Drives without rigid mechanical connection!	SPEED (485+SBus)	VFC-n-CONTROL VFC-n-CTRL. & ... CFC CFC/SERVO & IPOS CFC/SERVO & SYNC CFC/SERVO & DPx	MASTER SBus MASTER RS-485	VFC-n-CONTROL VFC-n-CTRL&GROUP VFC-n-CTRL&HOIST CFC SERVO
Synchronous speed running: Master controlled Slave speed controlled Drives without rigid mechanical connection!	SPEED (485+SBus)	VFC, VFC & GROUP VFC & HOIST	MASTER SBus MASTER RS-485	VFC-n-CONTROL VFC-n-CTRL&GROUP VFC-n-CTRL&HOIST CFC SERVO
Load share: Master controlled Slave controlled	LOAD SHAR (485+SBus)	VFC, VFC & GROUP VFC & HOIST	MASTER SBus MASTER RS-485	VFC, VFC & GROUP VFC & HOIST
Load share: Master speed controlled Slave controlled	LOAD SHAR (485+SBus)	VFC-n-CONTROL VFC-n-CTRL. & ... CFC CFC/SERVO & IPOS CFC/SERVO & SYNC CFC/SERVO & DPx	MASTER SBus MASTER RS-485	VFC, VFC & GROUP VFC & HOIST VFC & FLYING START
Load share: Master speed controlled Slave speed controlled	Not possible in control system			
Load share: Master controlled Slave speed controlled	Not possible in control system			
Torque control of slave: Master speed controlled Slave torque controlled	TORQUE (485+SBus)	CFC/SERVO CFC/SERVO & IPOS CFC/SERVO & SYNC CFC/SERVO & DPx	MASTER SBus MASTER RS-485	CFC/SERVO & M-CONTROL

750 Slave setpoint

The setpoint which is sent to the slave is set on the master. The "MASTER-SLAVE OFF" setting must be retained on the slave.

MASTER-SLAVE OFF

SPEED (RS-485)

SPEED (SBus)

SPEED (485+SBus)

TORQUE (RS-485)

TORQUE (SBus)

TORQUE(485+SBus)

LOAD SHAR (RS485)

LOAD SHAR (SBus)

LOAD SHAR (485+SBus)

751 Scaling slave setpoint

Setting range: -10 – 0 – 1 – 10

The setpoint sent from the master is multiplied by this factor which is set in the slave.

Speed synchronization (SPEED (RS-485) / SPEED (SBus) / SPEED (485+SBus)):

The speed of the inverter which is parameterized as the slave follows the speed of the master inverter. Set the speed ratio using parameter P751 "Scaling slave setpoint" on the slave inverter. The slip compensation (P324/P334) of the slave should be left at the startup setting. Example:

Parameter	Setting on master	Setting on slave
P100 Setpoint source	E.g. UNIPOL/FIX.SETPT	MASTER SBus
P101 Control signal source	E.g. TERMINALS	Not effective
P700 Operating mode	VFC-n-CONTROL	VFC 1
P750 Slave setpoint	SPEED (SBus)	MASTER-SLAVE OFF
P751 Scaling slave setpoint	Not effective	1 (then 1:1)
P811 RS-485 group address	Not effective	
P814 SBus group address	Set the same value (0 – 63)	
P816 SBus baud rate	Set the same value (125, 250, 500 or 1000 kbaud)	

Load division (LOAD DIV. (RS-485) / LOAD DIV. (SBus) / LOAD DIV. (485+SBus)):

This function allows two inverters to operate at the same load. It is assumed in this case that the shafts of the motors corresponding to the master and the slave are rigidly connected together. You are recommended to use the same motors with the same gear ratios, otherwise different delays may result during starting/stopping due to the pre-magnetizing time and the brake release/application time. Set the speed ratio (recommendation: 1) using parameter P751 "Scaling slave setpoint".

STOP

The slip compensation (P324 / P334) of the slave must be set to 0.

Example:

Parameter	Setting on master	Setting on slave
P100 Setpoint source	E.g. BIPOL./FIX.SETPT	MASTER-RS485
P101 Control signal source	E.g. TERMINALS	Not effective
P324 Slip compensation 1	Do not alter	0
P700 Operating mode	VFC 1	VFC 1
P750 Slave setpoint	LOAD SHAR (RS485)	MASTER-SLAVE OFF
P751 Scaling slave setpoint	Not effective	1 (then 1:1)
P811 RS-485 group address	Set the same value (101 – 199)	
P814 SBus group address	Not effective	
P816 SBus baud rate	Not effective	

Torque control of the slave (TORQUE (RS-485) / TORQUE (SBus) / TORQUE (485+SBus)):

The slave inverter receives the torque setpoint of the master directly (the correcting variable of the speed controller). This also enables a high quality load share to be achieved, for example. This setting should be preferred over "Load division" if the drive configuration permits it. Set the torque ratio using parameter P751 "Scaling slave setpoint". Example:

Parameter	Setting on master	Setting on slave
P100 Setpoint source	E.g. UNIPOL/FIX.SETPT	MASTER-RS485
P101 Control signal source	E.g. TERMINALS	Not effective
P700 Operating mode	CFC	VFC 1
P750 Slave setpoint	TORQUE (RS-485)	MASTER-SLAVE OFF
P751 Scaling slave setpoint	Not effective	1 (then 1:1)
P811 RS-485 group address	Set the same value (101 – 199)	
P814 SBus group address	Not effective	
P816 SBus baud rate	Not effective	

PARAMETER GROUP 8__, UNIT FUNCTIONS

80_ **Setup**

800 Quick menu (only with DBG11A)

Setting range: ON / OFF

P800 enables the DBG11A keypad to be changed over between the factory-set quick menu and the detailed parameter menu. The fact that the quick menu is activated is indicated by a slash following the parameter number. The parameters contained in the quick menu are identified by a "/" in the parameter list. The previously selected menu is active after MOVIDRIVE® has been switched off and on again.

801 Language (only with DBG11A)

Setting range: DE / EN / FR (DE = German, EN = English, FR = French)

P801 enables the DBG11A keypad to be changed over between various languages. The language setting is not altered by the factory setting.

802 Factory setting

Setting range: YES / NO

P802 can be used to reactivate the factory settings for almost all parameters; these are stored in the EPROM. Startup data, statistical data and language are not reset. The statistical data must be reset separately using P804. The factory settings are restored if the parameter is set to "YES". An "8" appears on the 7-segment display during this time. The previous operating status of the inverter appears on the display after the factory settings have been restored. P802 automatically reverts to "NO".

STOP

Almost all parameter values are overwritten when the factory setting is activated. However, the unit is not returned to its original delivery condition. Store the set parameter values (MOVITOOLS) before you activate the factory setting. The startup parameters are not altered by activating the factory setting, which means the startup procedure for the drive does not have to be repeated. We recommend checking the following parameters after activating the factory setting and setting them again if necessary:

- P100 Setpoint source
- P101 Control signal source
- P13_/P14_ Speed ramps
- P16_/P17_ Fixed setpoints
- P5__ Monitoring functions
- P6__ Terminal assignment

803 Parameter lock

Setting range: ON / OFF

Setting parameter 803 to "ON" makes it possible to prevent any change to the parameters (except for parameter 841 "Manual reset" and the parameter lock itself). This makes sense, for example, after the MOVIDRIVE® setting has been optimized. Parameter 803 must be restored to "OFF" in order to permit changes to parameters again.

Important: The parameter lock also acts on the RS-485, fieldbus and SBus interfaces and on IPOS$^{plus®}$.

804 Reset statistic data (only with MOVITOOLS/Shell)

Setting range: NO / FAULT MEMORY / KWH-METER / OPERATING HOURS

P804 permits the statistical data stored in the EEPROM, namely the fault memory, kilowatt-hour meter and operating hours counter, to be reset. These data are not affected when the factory setting function is activated.

806 Copy DBG → MDX (only with DBG11A)

Setting range: YES / NO

The parameter data in the DBG11A are transferred to MOVIDRIVE®.

807 Copy MDX → DBG (only with DBG11A)

Setting range: YES / NO

The parameter data set in MOVIDRIVE® are transferred to the DBG11A keypad.

*81_* Serial communication

810 RS485 address

Setting range: 0 – 99

P810 sets the address by means of which communication can take place with MOVIDRIVE® via the two serial interfaces (USS11A, UST11A, USS21A, ST11/ ST12). Max. 32 participants can be networked together.

On delivery, the MOVIDRIVE® address is always 00. You are recommended not to use the 00 address in order to avoid collisions during data transfer when several inverters are involved in serial communication.

811 RS-485 group address

Setting range: 100 – 199

P811 makes it possible to group together several MOVIDRIVE® units for communication via the serial interface. All MOVIDRIVE® units with the same RS-485 group address can thus be addressed using a multicast telegram via this address. The data received via the group address are not acknowledged by MOVIDRIVE®. For example, the RS-485 group address makes it possible to send setpoint selections to a group of MOVIDRIVE® inverters simultaneously. Group address 100 means that the inverter is not assigned to any group.

812 RS485 timeout delay

Setting range: 0 – 650 s

P812 sets the monitoring time for data transmission via the serial interface. MOVIDRIVE® performs the fault response set in P833 if there is no cyclical process data exchange via the serial interface for the period set in parameter 812. No monitoring of serial data transmission takes place when P812 is set to the value 0. Monitoring is activated with the first cyclical data exchange.

813 SBus address

Setting range: 0 – 63

P813 sets the system bus address of MOVIDRIVE®. The MOVIDRIVE® unit can communicate with other MOVIDRIVE® units using the system bus (SC11/SC12) by means of the address set here.

814 SBus group address

Setting range: 0 – 63

P814 sets the system bus group address (for multicast telegrams) of MOVIDRIVE®.

815 SBus timeout delay

Setting range: 0 – 0.1 – 650 s

P815 sets the monitoring time for data transmission via the system bus. MOVIDRIVE® performs the fault response set in P836 if there is no data traffic via the system bus for the period set in P815. No monitoring of data transmission via the system bus takes place when P815 is set to the value 0.

816 SBus baud rate

Setting range: 125 / 250 / 500 / 1000 kbaud

P816 sets the transmission speed of the system bus.

817 SBus synchronization ID

Setting range: 0 – 2047

A synchronization between the drives can take place for transmitting process data and parameter data via the system bus. To do this, the master controller has to send a synchronization telegram to the connected inverters at specific intervals. Thus, the inverters synchronize themselves with the master controller. P817 is used for setting the identifier (address) of the synchronization signal in the inverter for the internal system bus. Make sure there is no overlap between the identifiers for the process data or parameter data telegrams.

818 CAN synchronisation ID

Setting range: 0 – 1 – 2047

A synchronization between the drives can take place for transmitting process data and parameter data via the optional CAN bus. To do this, the master controller has to send a synchronization telegram to the connected inverters at specific intervals. Thus, the inverters synchronize themselves with the master controller. P818 is used for setting the identifier (address) of the synchronization signal in the inverter for the optional CAN bus. Make sure there is no overlap between the identifiers for the process data or parameter data telegrams.

819 Fieldbus timeout delay

Setting range: 0 – 0.5 – 650 s

P819 sets the monitoring time for data transmission via whichever fieldbus is implemented in each specific case (DFP11A, DFP21A, DFI11A, DFI21A, DFC11A, DFO11A or DFD11A). MOVIDRIVE® performs the fault response set in P831 if there is no data traffic via the fieldbus for the period set in P819. No monitoring of data transmission via the fieldbus takes place when P819 is set to the value 0 or 650. The timeout time is automatically specified by the DP master with PROFIBUS-DP. Changing this parameter does not have any effect and it is overwritten whenever the PROFIBUS-DP is started up again.

*82_* **Brake operation**

820/821 4-quadrant operation 1/2

Setting range: ON / OFF

This is only taken into account in VFC operating mode without encoder feedback; 4-quadrant operation is assumed in all other operating modes. P820 enables 4-quadrant operation to be switched on and off for parameter set 1/2. 4-quadrant operation is possible if a braking resistor or a regenerative power supply unit is connected to MOVIDRIVE® (CCW/CW; motor/regenerative). P820/P821 must be set to "NO" if there is neither a braking resistor nor a regenerative power supply unit connected to MOVIDRIVE®, which means regenerative operation is not possible. In this operating mode, MOVIDRIVE® attempts to extend the deceleration ramp so the generated power is not too great, and the DC link voltage remains below the switch-off threshold.

Despite the fact that the deceleration ramps are automatically extended by MOVIDRIVE®, it is possible that the generated power during braking may be too great, leading to MOVIDRIVE® switching itself off and issuing fault message F07 (DC link overvoltage). In such a case, the deceleration ramps must be extended manually.

*83_* **Fault response**

830 Response EXT. FAULT

The fault is only triggered in the ENABLED inverter status. P830 programs the fault response which is triggered by an input terminal programmed to "/EXT. FAULT". The following responses can be programmed:

Response	Description
NO RESPONSE	No fault is displayed and no fault response is undertaken. The fault which is signaled is completely ignored.
DISPLAY FAULT	The fault is displayed (on the 7-segment display and MOVITOOLS), although the unit does not implement any other fault response. The fault can be reset (terminal, RS-485, fieldbus, auto-reset).
IMM. STOP/ FAULT	The inverter performs an immediate switch-off and a fault is signaled. The output stage is inhibited and the brake is applied. The ready signal is revoked and the fault output is set, if programmed. A restart is only possible after a fault reset has been performed during which the inverter is reinitialized.
EMERG. STOP/ FAULT	The drive is braked with the set emergency stop ramp. Once the stop speed is reached, the output stage is inhibited and the brake is applied. The fault is signaled immediately. The ready signal is revoked and the fault output is set, if programmed. A restart is only possible after a fault reset has been performed during which the inverter is reinitialized.
RAPID STOP/ FAULT	The drive is braked with the set rapid stop ramp. Once the stop speed is reached, the output stage is inhibited and the brake is applied. The fault is signaled immediately. The ready signal is revoked and the fault output is set, if programmed. A restart is only possible after a fault reset has been performed during which the inverter is reinitialized.
IMM. STOP/ WARNG	The inverter performs an immediate switch-off and a fault is signaled. The output stage is inhibited and the brake is applied. A fault message is issued via the terminal, if programmed. The ready signal is not revoked. The drive restarts without a unit re-initialization if the fault is rectified by an internal procedure or by a fault reset.
EMERG.STOP/ WARNG	The drive is braked with the set emergency stop ramp. Once the stop speed is reached, the output stage is inhibited and the brake is applied. The fault is signaled immediately. A fault message is issued via the terminal, if programmed. The ready signal is not revoked. The drive restarts without a unit re-initialization if the fault is rectified by an internal procedure or by a fault reset.
RAPID STOP/ WARNG	The drive is braked with the set rapid stop ramp. Once the stop speed is reached, the output stage is inhibited and the brake is applied. The fault is signaled immediately. A fault message is issued via the terminal, if programmed. The ready signal is not revoked. The drive restarts without a unit re-initialization if the fault is rectified by an internal procedure or by a fault reset.

831 Response FIELDBUS TIMEOUT

See P830 for the responses which can be programmed. Factory setting: <u>RAPID STOP/WARNG</u>

The fault is only triggered in the ENABLED inverter status. P831 programs the fault response which is triggered by the fieldbus timeout monitoring. The reaction time for the monitoring can be set using P819 (see P819 and the "Fieldbus Unit Profile" manual for a more detailed description of the "Fieldbus timeout").

832 Response MOTOR OVERLOAD

See P830 for the responses which can be programmed. Factory setting: <u>EMERG.STOP/FAULT</u>

P832 programs the fault response which is triggered by the motor protection function (see P340 for a more detailed description of "Motor overload").

833 Response RS-485 TIMEOUT

See P830 for the responses which can be programmed. Factory setting: <u>RAPID STOP/WARNG</u>

The fault is only triggered in the ENABLED inverter status. P833 programs the fault response which is triggered by the RS-485 timeout monitoring. The reaction time for the monitoring can be set using P812 (see P812 for a more detailed description of the "RS-485 timeout").

834 Response DRS LAG ERROR (DRS11A and IPOS$^{plus®}$)

See P830 for the responses which can be programmed. Factory setting: <u>EMERG.STOP/FAULT</u>

P834 programs the fault response which is triggered by the lag error monitoring of the synchronous operation option (DRS11A) and of positioning mode with IPOS$^{plus®}$. It is possible to make various settings for this in parameter group 51_.

835 Response TF sensor SIGNAL

See P830 for the responses which can be programmed. Factory setting: <u>NO RESPONSE</u>

P835 programs the fault response which is triggered by the temperature sensor monitoring of the TF which may be incorporated in the motor winding.

836 Response SBus TIMEOUT

See P830 for the responses which can be programmed. Factory setting: <u>EMERG.STOP/FAULT</u>

P836 programs the fault response which is triggered by the system bus timeout monitoring. The reaction time for the monitoring can be set using P815 (see P815 for a more detailed description of the "SBus timeout").

84_ Reset response

840 Manual reset

YES

The fault in MOVIDRIVE® is reset. In case of a fault, it is possible to press the [E] key on the DBG11A to access P840 directly.

Also, P840 is listed in the "Main menu" under "Parameters" in MOVITOOLS as well. P840 automatically reverts to NO following a reset. Activating the manual reset does not have any effect if there is no fault present.

<u>NO</u>

No reset.

841 Auto reset

ON

The auto-reset function is activated. In the event of a fault, this function automatically resets the unit after an adjustable restart time (P842). Up to five auto-resets are possible in one auto-reset phase. Should five faults occur which are reset by an auto-reset, no more auto-resets are possible until:

– a manual reset is performed using the input terminal,
– a manual reset is performed using the serial interface (MOVITOOLS/Shell, DBG11A, master controller),
– there is a transition to 24 V backup mode or the inverter is completely switched off.

Following this, five auto-resets are possible once again.

Do not use auto-reset with drives where an automatic restart could represent a danger to people or units.

OFF

No auto-reset.

842 Restart time

Setting range: 1 – 3 – 30 s

P842 sets the waiting time which has to elapse after a fault occurs before an auto-reset is performed.

85_ Scaling speed actual value

Scaling speed actual value defines a user-specific display parameter (→ P001 User display). For example, the user display is to be shown in 1/s. A scaling factor of 1/60 is required for this. The scaling factor numerator must therefore be set to 1 and the scaling factor denominator to 60. The scaling unit 1/s is entered in P852.

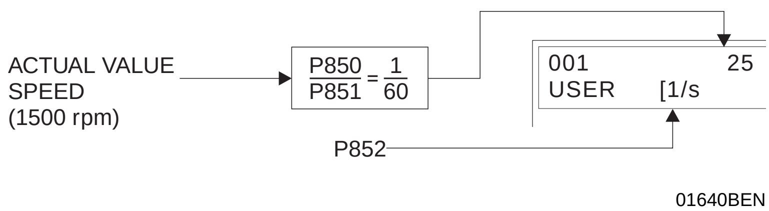


Fig. 77: Scaling speed actual value (example)

850 Scaling factor numerator (can only be set using MOVITOOLS/Shell)

Setting range: 1 – 65535

851 Scaling factor denominator (can only be set using MOVITOOLS/Shell)

Setting range: 1 – 65535

852 User dimension (can only be set using MOVITOOLS/Shell)

Factory setting: 1 rpm

Up to eight ASCII characters; is displayed in P001 "User display".

86_ **Modulation**

860/861 PWM frequency 1/2 (parameter set 1/2)

Setting range: 4/8/12/16 kHz

P860/P861 can be used in VFC mode to set the switching frequency at the inverter output for parameter set 1/2. The inverter automatically switches back to lower switching frequencies when the unit utilization reaches a specific level if the clock frequency for parameter set 1/2 is not fixed to the set value using P862/P863. This reduces switching losses in the output stage and, consequently, unit utilization.

P860/P861 do not have any effect in CFC and SERVO operating modes. In these cases, the switching frequency is fixed at 8 kHz.

862/863 PWM fix 1/2 (parameter set 1/2)

ON

P862/P863 = ON for parameter set 1/2 enables the PWM frequency set in P860/ P861 to be fixed when an automatic reduction in the PWM frequency is undesirable (e.g. when output filters are used).

OFF

MOVIDRIVE® automatically reduces the set output frequency (down to minimum 4 kHz) when there is a high level of thermal load on the output stage, in order to avoid a switch-off with the "Unit utilization" fault.

87_ **Process data description**

870 Setpoint description PO1; Factory setting: CTRL. WORD 1

871 Setpoint description PO2; Factory setting: SPEED

872 Setpoint description PO3; Factory setting: NO FUNCTION

P870/P871/P872 define the content of the process output data words PO1/PO2/ PO3. This is necessary so MOVIDRIVE® can allocate the appropriate setpoints. The following process output assignments are available:

Assignment	Description
NO FUNCTION	The content of the process output data word is ignored.
SPEED	Speed setpoint selection in rpm.
CURRENT	Current setpoint selection (for torque control)
POSITION LO	Position setpoint low word
POSITION HI	Position setpoint high word
MAX. SPEED	Maximum system speed (P302/P312)
MAX. CURRENT	Current limitation in % of I_N of the inverter (P303/P313)
SLIP	Slip compensation (P324/P334)
RAMP	Ramp time for setpoint selection
CTRL. WORD 1	Control signals for start/stop, etc.
CTRL. WORD 2	Control signals for start/stop, etc.
SPEED [%]	Selection of a speed setpoint in % of n_{max}
IPOS PO data	Specification of a 16-bit-coded value for IPOS$^{plus®}$

→ "Fieldbus Unit Profile" manual for additional explanations

873 Actual value description PI1; Factory setting: STATUS WORD1

874 Actual value description PI2; Factory setting: SPEED

875 Actual value description PI3; Factory setting: NO FUNCTION

P873/P874/P875 define the content of the process input data words PI1/PI2/PI3. This is necessary so MOVIDRIVE® can allocate the appropriate actual values. The following process input assignments are available:

Assignment	Description	
NO FUNCTION	The content of the process input data word is 0000_{hex}	
SPEED	Current actual speed value of the drive in rpm.	
OUTP.CURRENT	Momentary output current of the system in % of I_N	
ACTIVE CURR.	Momentary active current of the system in % of I_N: Positive sign = Positive torque Negative sign = Negative torque	
POSITION LO*	Current actual position low word	The actual position is read from: P941 "Source actual position"
POSITION HI*	Current actual position high word	
STATUS WORD1	Status information of the inverter	
STATUS WORD2	Status information of the inverter	
SPEED [%]	Current actual speed value in % of n_{max}.	
IPOS PI-DATA	Checkback of a 16-bit-coded value for IPOS$^{plus®}$	

* Both assignments must always be set.

→ "Fieldbus Unit Profile" manual for additional explanations

876 PO data enable

ON

The process output data sent most recently by the fieldbus controller come into effect.

OFF

The process output data which were most recently valid remain in effect.

877 DeviceNet PD configuration

Setting range: 1 – 24 PD / Param + 1 – 24 PD

This parameter sets the process data configuration for the DFD11A DeviceNet interface.

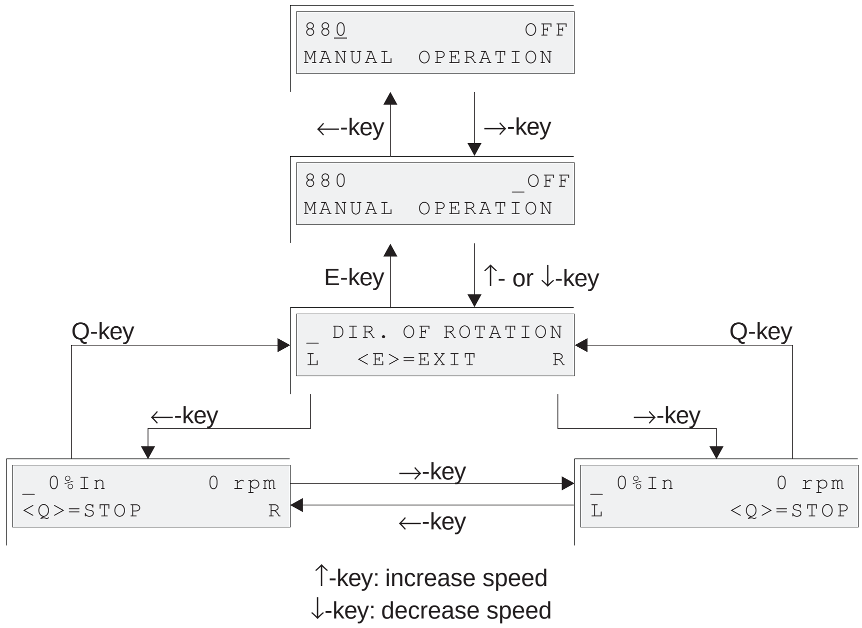
88_ Manual mode (only available in DBG11A keypad)

The inverter can be controlled using the DBG11A keypad using the manual operation function. The 7-segment display on the unit shows "H" during manual mode.

In order for manual operation to be started, there must be a "0" signal sent to binary inputs X13:2 (DIØ1) "CW/stop", X13:3 (DIØ2 "CCW/stop") and X13:4 (DIØ3 "Enable/ rapid stop"), if programmed. The binary inputs are then without any functions for the duration of manual operation, with the exception of X13:1 (DIØØ "/Controller inhibit"). Binary input X13:1 (DIØØ "/Controller inhibit") must get a "1" signal to enable the drive to be started in manual operation. The drive can also be stopped in manual operation by X13:1 = "0".

The direction of rotation is not determined by the "CW/stop" or "CCW/stop" binary inputs. Instead, you select the direction of rotation using the keypad (→ Fig. 78).

Manual operation remains active even after the supply system power has been switched off/on. The inverter is then inhibited, however. A change of direction command using the → or ← key produces an enable and a start in the selected sense of rotation at n_{min}. The speed is increased and decreased using the ↑ and ↓ keys. The modification speed is 150 rpm per second.



02406AEN

Fig. 78: Manual mode with DBG11A

The signals at the binary inputs take effect as soon as manual operation is finished. Binary input X13:1 (DIØØ) /Controller inhibit does not have to be switched from "1" to "0" and back to "1". The drive can start according to the signals at the binary inputs and the setpoint sources.

Connection check

In manual mode, a connection check is always active between the DBG11A and the inverter or between the USS21A and the inverter. Parameter P812 "RS-485 timeout delay" does not have any function. The inverter must receive a valid RS-485 telegram within the fixed time interval of t = 500 ms. If the time is exceeded, the drive is stopped with the emergency stop ramp and fault message F43 "RS-485 timeout" is signaled.

Important: The fault is automatically reset and the drive is enabled when the inverter once again receives a valid telegram.

880

Manual operation

ON

Manual mode is activated.

OFF

No manual mode.

PARAMETER GROUP 9__, IPOS PARAMETERS

The IPOS parameters are described in detail in the IPOS[plus®] manual.

Be aware that modifying these parameters without knowledge of the IPOS program which may be active can give rise to unexpected movements and place undesirable loads on the mechanical driveline. Knowledge of the IPOS[plus®] manual is an essential prerequisite for setting these parameters.

90_ **IPOS Reference travel**

The purpose of reference travel is to establish a **machine zero** to which all absolute positioning commands refer. It is possible to select from various strategies, referred to as reference travel strategies, for this purpose (→ **P903 Reference travel type**). These define appropriate travel modes, for example to search for a reference cam. Starting from the **reference point** located using reference travel, **P900 Reference offset** permits the machine zero point to be moved in accordance with the following equation:

Machine zero = Reference position + Reference offset

The speeds of the travel movements required on the basis of the **reference travel type** are set using **P901 Reference speed 1** and **P902 Reference speed 2**.

4

91_ **IPOS Travel parameter**

910 P910 Gain X controller

Setting range: 0.1 – 0.5 – 32

Setting value for the P controller of the position control loop in IPOS[plus®]. The value from P210 (P gain hold controller) is adopted here in the default setting.

911/912 Positioning ramp 1/2

Setting range: 0.01 – 1 – 20 s

Setting value for the ramp which is used during the positioning operation. The same ramp (positioning ramp 1) is always used for acceleration and deceleration when the ramp type setting (P916) is SINE and SQUARED. Deceleration takes place in accordance with positioning ramp 2 when a LINEAR ramp type is set.

913/914 Travel speed CW / CCW

Setting range: 0 – 3000 – 5000 rpm

Specifies the speed with which positioning should occur. The setting must be matched to the maximum motor speed.

P302/P312 limit P913/P914, so consequently always set P302/P312 greater than P913/P914 (by approx. 10 %). Otherwise, there may be a lag error!

915 Speed feedforward

Setting range: -199.99 – 0 – 100 – 199.99 %

With a value of 100 %, the drive operates with a linear speed profile optimized in respect of time. If a value less than 100 % is specified, a larger gap between position setpoint and actual position occurs (lag distance) during a positioning operation. This results in a "soft" run-in to the target position for the acceleration procedure.

This function is inoperative with "sine" and "squared" acceleration types!

916 Ramp type

This parameter specifies the type of positioning ramp. This has an effect on the speed or acceleration characteristic during positioning.

Ramp type	Positioning performance
LINEAR	Optimum time, however block-shaped acceleration characteristic
SQUARED	Smoother acceleration characteristic than LINEAR
SINE	Very smooth acceleration characteristic; higher torque requirement than with SQUARED
BUSRAMP	Setpoint interpolation for SBus.
CAM-CONTROL	Only available in the technology version.
I-SYNCHR.OPERAT.	

92_ **IPOS Monitoring**

920/921 SW limit switch CW/CCW

Setting range: $-(2^{31}-1)$ – 0 – $2^{31}-1$ inc

The software limit switches permit the user to restrict the range in which travel commands are accepted. This is done via the software. The limits of the movement range are specified using these two parameters (software limit switches). If P941 "Source actual position" is set to MOTOR ENC. (X15) or EXTERN.ENC (X14), then these do not take effect until after performance of a reference travel. If P941 "Source actual position" is set to ABSOL.ENC. (DIP), then these are effective immediately without reference travel. If the software limit switches are in effect, the system checks whether the target position (H492) of the current movement command is beyond the software limit switches. The movement command is not performed if the target position is beyond. If a drive is already in motion, it is decelerated using the emergency stop ramp. Fault message F78 (IPOS SW limit switch) is generated. The fault response is an emergency stop followed by an inhibit. The drive no longer has a reference point after the fault is reset!

Reset options:

- 1-signal at the "reset" input
- Mains power OFF / ON (not in 24 V backup mode)
- Manual reset via MOVITOOLS/Shell
- Reset using IPOS$^{plus®}$ control word (H484)

Following a fault reset (F78), the monitoring function for the software limit switches is not reactivated until the drive has been moved to its reference point again!

Deactivation: Set both parameter values to 0 during uni-directional operation. This deactivates the software limit switch function.

922 Position window

Setting range: 0 – 5 – 32767 inc

The parameter defines a distance range (position window) around the target position of a travel or STOP command. The "Axis in position" = YES condition applies if a drive is inside the position window around the current target position (H492). The "Axis in position" information is used as a final condition for waiting positioning commands. It can be used further as an output terminal function.

923 Lag error window

Setting range: 0 – 5000 – 2^{31}-1 inc

The lag error window defines a permitted difference in values between the setpoint and actual positions. A lag error message or lag error response is triggered if the limit is exceeded. You can set the responses with P834 "Response DRS LAG ERROR".

Deactivation: Setting value = 0 deactivates lag error monitoring

*93_* IPOS Special functions

930 Override

Setting range: ON / OFF

The override function makes it possible to change the travel speed for positioning operations which is programmed in the IPOS^plus®^ program. The speed can be altered within the range from 0 to 150 % of the specifically programmed speed. The analog input (X11:2/3) is used for this purpose. As such, 0 to 150 % corresponds to 0 – 10 V on the analog input. However, the maximum value for the speed is always restricted by P302, "Maximum speed".

931 CTRL word Task 1 (only in the DBG11A keypad, not in MOVITOOLS)

Setting range: START / STOP

Task 1 of the IPOS^plus®^ program is started or stopped.

932 CTRL word Task 2 (only in the DBG11A keypad, not in MOVITOOLS)

Display parameter, cannot be set using DBG11A.

Indicating range: START / STOP

START = Task 2 of the IPOS^plus®^ program is currently being processed.

STOP = Task 2 of the IPOS^plus®^ program is stopped.

*94_* IPOS Encoder

940 IPOS Variables edit (only in the DBG11A keypad, not in MOVITOOLS)

Setting range: ON / OFF

The IPOS variables can be altered if P940 is set to "ON".

941 Source actual position

Setting range: MOTOR ENC. (X15) / EXTERN.ENC (X14) / ABSOL.ENC. (DIP)

Defines the encoder to which IPOS^plus®^ positions.

942/943 Encoder factor numerator/denominator

Setting range: 1 – 32767

In the event of positioning to an external encoder (X14) or an absolute encoder (DIP), then these two parameters for used for adapting the resolution to the motor encoder (X15).

944 Encoder scaling ext. encoder

Setting range: ×1 / ×2 / ×4 / ×8 / ×16 / ×32 / ×64

The significance of the travel resolution of the external encoder (incremental encoder on basic unit:X14 or absolute encoder on DIP11A:X62) is adapted using this parameter.

95_ **DIP**

The DIP parameters are described in detail in the "Positioning with Absolute Encoder and Absolute Encoder Interface DIP11A" manual.

950 Encoder type

The absolute encoder connected to X62 of the DIP11A is selected. At present, encoders can be selected from the following list:

- NO ENCODER
- VISOLUX EDM
- T&R CE65, CE100 MSSI
- T&R LE100
- T&R LA66K
- AV1Y / ROQ424
- STEGMANN AG100 MSSI
- SICK DME-3000-111
- STAHLWCS2-LS311

951 Counting direction

Setting range: NORMAL/INVERTED

Defines the counting direction of the absolute encoder. The setting must be made so the counting directions of the motor encoder (X15) and the absolute encoder (X62) match.

952 Cycle frequency

Setting range: 1 – 200 %

Defines the cycle frequency at which absolute encoder information is transmitted from the encoder to the inverter. A cycle frequency of 100 % corresponds to the nominal frequency of the encoder in relation to a 100 m cable length.

953 Position offset

Setting range: $-(2^{31}-1) – 0 – 2^{31}-1$

This parameter adapts the encoder registration range to the working range of the machine.

954 Zero offset

Setting range: $-(2^{31}-1) – 0 – 2^{31}-1$

The zero point of the encoder display is specified with this parameter.

955 Encoder scaling

Setting range: ×1 / ×2 / ×4 / ×8 / ×16 / ×32 / ×64

The significance of the travel resolution of the motor encoder and absolute encoder is adapted with this parameter.

96_ **IPOS Modulo Function**

The IPOS modulo function is used for endless positioning, for example with circular indexing tables or chain conveyors. Refer to the IPOS manual for detailed information.

960 Modulo function

OFF

The modulo function is switched off.

SHORT

The "short travel" modulo function is active. The drive moves from its actual position to the target position by the shortest possible route. Both directions of rotation are possible.

CW

The "clockwise" modulo function is active. The drives moves from its actual position to the target position with the "CW" direction of rotation, even if this means moving a longer distance. The "CCW" direction of rotation is not possible.

CCW

The "counterclockwise" modulo function is active. The drives moves from its actual position to the target position with the "CCW" direction of rotation, even if this means moving a longer distance. The "CW" direction of rotation is not possible.

961 Modulo numerator

Setting range: 0 – 2^{31}

Numerator value for simulating the ratio (gear unit + additional gear).

962 Modulo denominator

Setting range: 0 – 2^{31}

Denominator value for simulating the ratio (gear unit + additional gear).

963 Modulo encoder resolution

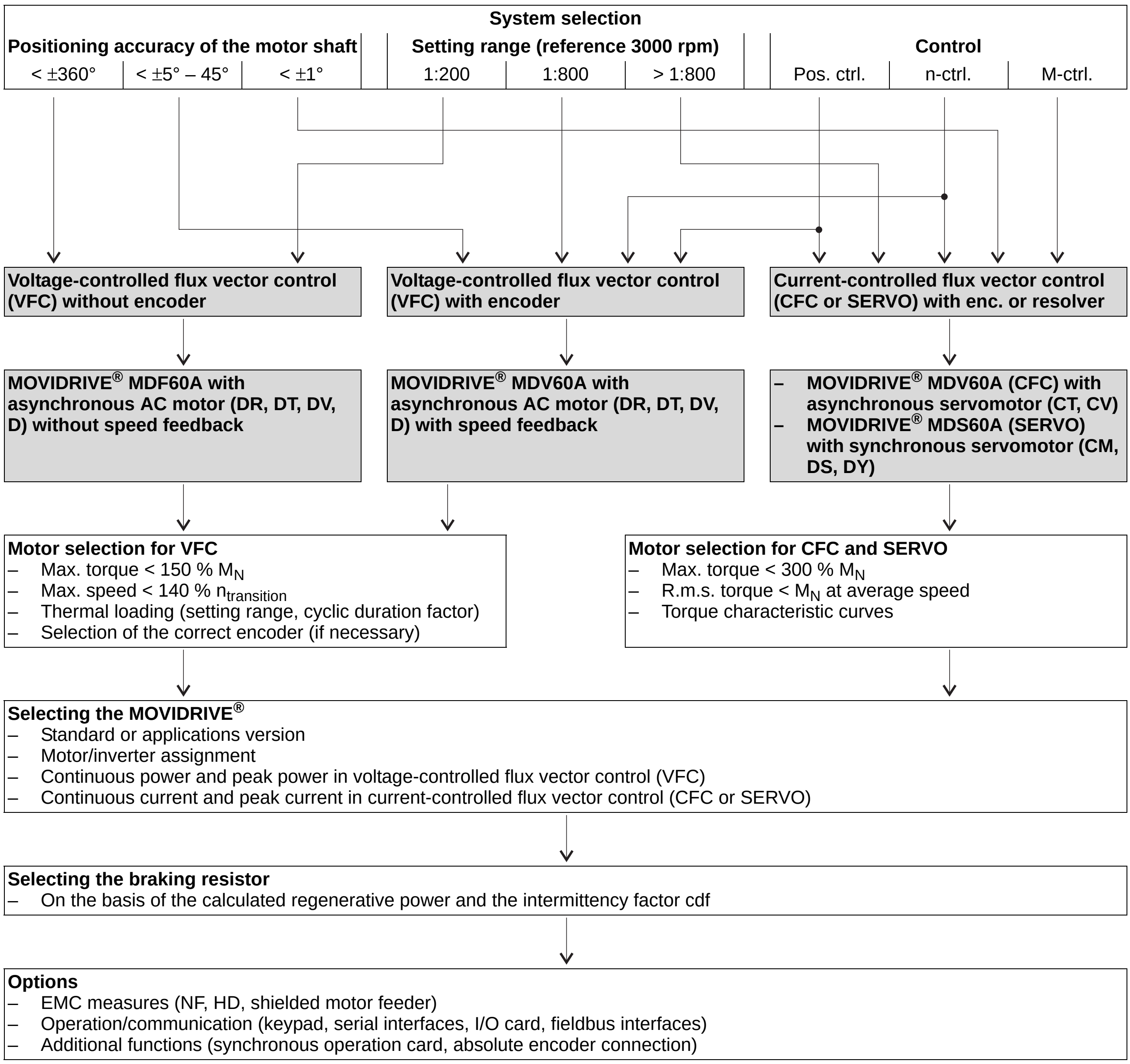
Setting range: 0 – 4096 – 20000

Resolution of the selected IPOS encoder system in increments.

5 Project Planning

5.1 Schematic procedure

Drive properties The required drive properties are the chief factors determining the selection of the inverter. The following figure is intended to provide assistance.



Key

Pos. ctrl.	= Positioning control
n-ctrl.	= Speed control
M-ctrl.	= Torque control
VFC	= Voltage-controlled flux vector control (voltage flux control)
CFC	= Current-controlled flux vector control (current flux control) for asynchronous servomotors
SERVO	= Current-controlled flux vector control for synchronous servomotors
M_N	= Rated torque of the motor
n_{trans}	= Rated speed (transition speed) of the motor

5.2 Control characteristics

Characteristic parameters

MOVIDRIVE® drive inverters achieve excellent control characteristics thanks to their optimally adapted control algorithms. The following characteristic parameters apply to operation with two and four-pole SEW motors and synchronous SEW servomotors.

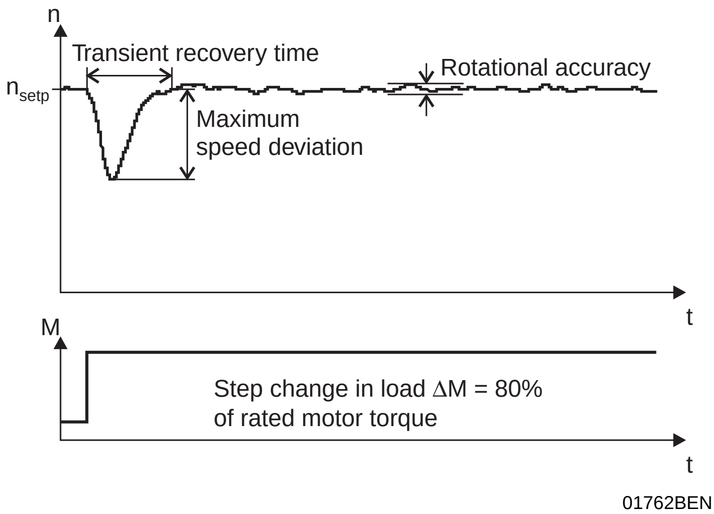


Fig. 79: Characteristic parameters for the control characteristics

The following values apply to MOVIDRIVE® inverters in combination with motors of the same power:

MOVIDRIVE® type	Continuous speed range n_{max} = 3000 rpm	Static control accuracy[1)] with ref. to n_{max} = 3000 rpm
MDF, VFC without encoder	1:200	0.30 %
MDF, VFC with encoder (1024 inc)	1:800	0.01 %
MDV, CFC with encoder (1024 inc)	1:3000	0.01 %
MDV, CFC with sin/cos encoder	1:5000	0.01 %
MDS, SERVO with resolver	> 1:3000	0.01 %

1) = Deviation from speed actual value - speed mean value to setpoint speed

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

Control response

By way of example, the following table shows the differences in control characteristics between the MDF and MDV MOVIDRIVE® types.

Settings

- Set speed 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

MOVIDRIVE® type	Transient recovery time in relation to the value of MDF	Max. speed deviation at ΔM = 80 %, with reference to n = 3000 rpm	True-running accuracy at M = const. in relation to n = 3000 rpm
MDF, VFC Without encoder	100 %	1.8 %	≤ 0.20 %
MDF, VFC with encoder (1024 increments)	90 %	1.5 %	≤ 0.17 %
MDV, CFC with encoder (1024 increments)	35 %	1.0 %	≤ 0.07 %
MDV, CFC with sin/cos encoder	25 %	0.7 %	≤ 0.03 %

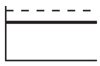
5.3 Description of applications

Inverter selection

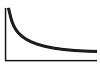
The large number of different drive applications can be divided up into five categories. The five categories are listed below and the suitable SEW inverter recommended. This assignment is based on the required setting range and the resulting control process.

1. Drives with a base load and a speed-dependent load, e.g. conveyor belt drives.
   - Low requirements with regard to the setting range (motor without encoder)
     – MOVIDRIVE® MDF60A (VFC)
   - High requirements with regard to the setting range (motor with encoder)
     – MOVIDRIVE® MDV60A (VFC-n-CONTROL)

2. Dynamic load, e.g. trolleys; brief high torque demand for acceleration followed by low load.
   - Low requirements with regard to the setting range (motor without encoder)
     – MOVIDRIVE® MDF60A (VFC)
   - High requirements with regard to the setting range (motor with encoder)
     – MOVIDRIVE® MDV60A (VFC-n-CONTROL)
   - High dynamic requirements (asynchronous or synchronous servomotor)
     – MOVIDRIVE® MDV60A (CFC)
     – MOVIDRIVE® MDS60A (SERVO)

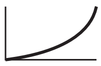


3. Static load, e.g. hoists; chiefly steady high static load with overload peaks.
   - Low requirements with regard to the setting range (motor without encoder)
     – MOVIDRIVE® MDF60A (VFC)
   - High requirements with regard to the setting range (motor with encoder)
     – MOVIDRIVE® MDV60A (VFC-n-CONTROL)
     – MOVIDRIVE® MDV60A (CFC)
     – MOVIDRIVE® MDS60A (SERVO)



4. Load falling in inverse proportion to speed, e.g. winding or coil drives.

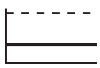
- Torque control (asynchronous or synchronous servomotor).
  – MOVIDRIVE® MDV60A (CFC&M-CONTROL)
  – MOVIDRIVE® MDS60A (SERVO&M-CTRL.)



5. Variable torque load, e.g. fans and pumps.

- Low load at low speed and no load peaks, 125 % utilization (I_D = 125 % I_N) (motor without encoder)
  – MOVIDRIVE® MDF60A (VFC)

Project planning for trolleys



The motor load in the dynamic sections determines the peak motor power according to which the dimensions are to be set. The thermal load determines the required continuous power of the motor. The thermal load is determined on the basis of the movement cycle, with the load from acceleration and deceleration as well as the standstill times. The speed characteristic is a significant factor in determining the self-cooling of the motor. See also "Motor selection examples" on page 169.

Project planning for hoists

In practice, the question of setting the size of hoists is addressed with regard to special thermal and safety-critical criteria.

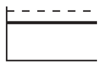
Thermal considerations

In contrast to trolleys, hoists require approx. 70 – 90 % of the rated motor torque assuming constant speed upwards or downwards and the standard configuration.

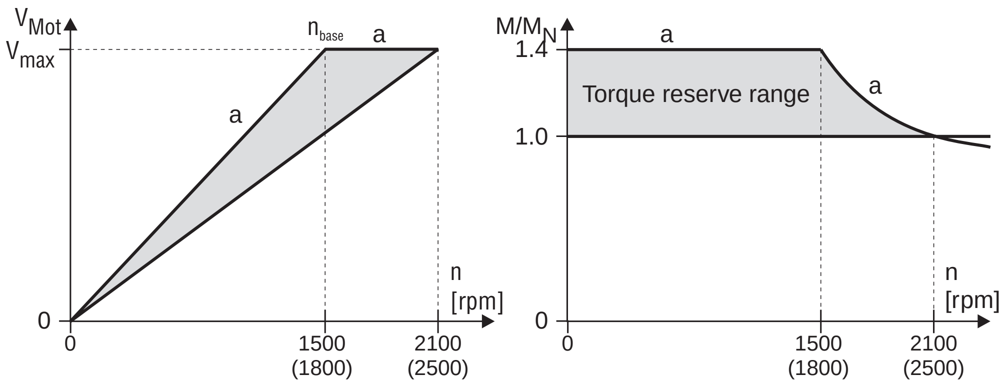
Starting torque

The highest operating torque is required in the event of acceleration with maximum load in the UPWARDS hoisting direction.

VFC&HOIST



The 4-pole geared motor should always be designed for a maximum speed of 2100 rpm (70 Hz) with a transition speed of 1500 rpm (50 Hz) and 2500 rpm (83 Hz) at a transition speed of 1800 rpm (60 Hz). This means the gear unit input speed is increased by a factor of 1.4. Consequently, it is also necessary to choose a gear ratio which is higher by a factor of 1.4. This measure means that no torque is lost on the output shaft in the field weakening range (50 – 70 Hz or 60 – 83 Hz), since the higher gear ratio compensates for the inversely proportionate fall in torque in relation to speed (frequency). Furthermore, the start-up torque is 1.4 times greater in the range from 0 – 1500 rpm (0 – 50 Hz) or 0 – 1800 rpm (0 – 60 Hz). Other advantages are that the speed range is greater and the self-cooling of the motor more powerful.



04949AEN

Fig. 80: a = Recommended voltage/speed characteristic curve and resultant torque characteristic

The motor power for hoists is selected according to the load type.

- S1 (100 % c.d.f.): Motor power 1 level higher than the selected inverter power, e.g. for lengthy upwards travel or continuous elevators.
- S3 (40 % c.d.f.): Motor power according to the selected inverter power.

The hoist function on the inverter should be activated irrespective of the above guidelines. See also "Motor selection examples" on page 169.

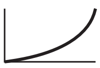
Encoder monitoring

MOVIDRIVE® from firmware version .11 has encoder monitoring for TTL sensors and sin/cos encoders. There is no encoder monitoring for HTL sensors.

SEW recommends using TTL sensors or sin/cos encoders for speed-controlled hoist drives and activating encoder monitoring.

Avoid using an HTL encoder if possible.

Variable torque load (pumps, fans)



In these applications, there is no chance of the motor suffering a thermal overload at low speeds. The maximum load occurs at the maximum speed; there are no overload peaks. As a result, the dimensions of MOVIDRIVE® and the motor can be selected so the continuous motor current is less than or equal to the continuous output current (VFC operating mode, 125 % of the nominal output current at f_{PWM} = 4 kHz) of the MOVIDRIVE®. This means MOVIDRIVE® can operate a motor whose power is one level greater. See also "Motor selection examples" on page 169.

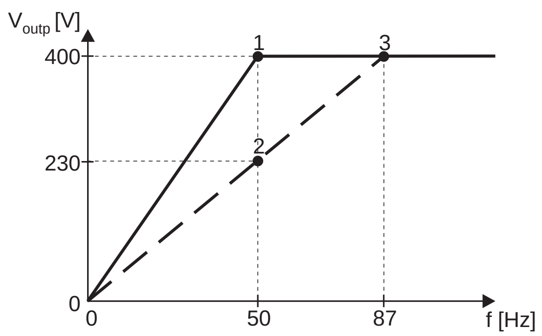
5.4 Motor selection for asynchronous AC motors (VFC)

Basic recommendations

- Only use motors with a thermal classification of F at least.
- Use TF thermistor sensors or TH winding thermostats. TH should be preferred in the case of multi-motor drives on one inverter. The series connection of TH contacts (NC contacts) is not subject to any restriction if joint monitoring is provided.
- For multi-motor drives, we recommend that the motors should not differ from one another by more than 3 type levels.
- 4-pole motors should be preferred. This particularly applies to geared motors which are operated with a high oil filling level as a result of their vertical mounting position.
- Generally speaking, the motor can be operated at its listed power without forced-cooling if the operating conditions differ from S1-mode, e.g. positioning drive with 1:20 speed range in S3-mode.
- Avoid selecting a motor which is too large, especially in case of a delta connection. Otherwise, the inverter may trigger a short circuit detection function due to the small winding resistance of the motor (1/3 that of a star connection).
- A MOVIDRIVE® MDV60A (with encoder connection) is required for speed control. The motor must then be equipped with an incremental encoder, preferably with 1024 increments/revolution.

Voltage/ frequency characteristic

The asynchronous motor follows a load-dependent voltage/frequency characteristic in VFC operating mode. It is possible to achieve full motor torque down to minimum speeds because the motor model is continuously calculated. This characteristic curve is set by entering the rated motor voltage and the rated frequency of the motor in the startup function. The setting determines the speed-dependent torque and power characteristics of the asynchronous motor.



01650BEN

Fig. 81: Voltage/frequency characteristic of the asynchronous motor

Sample asynchronous motor 230/400 V, 50 Hz

1 Star connection; 400 V, 50 Hz

2 Delta connection: 230 V, 50 Hz

3 Delta connection: 400 V, 87 Hz

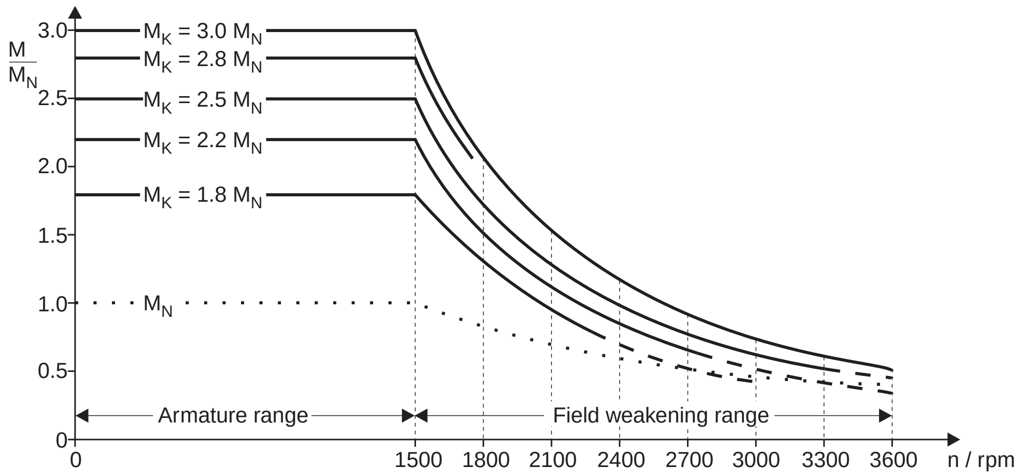
The inverter output voltage V_{out} is limited by the supply voltage which is connected. The "nominal system voltage" input value in the startup function limits the effective value of the maximum output voltage. This restriction is used whenever the connected motor has a lower design voltage than the power supply of the inverter. The maximum permitted motor voltage should be entered. Furthermore, make sure that the "nominal system voltage" input value is less than or equal to the supply voltage of the inverter.

Speed/torque characteristic

The field weakening range starts when the set maximum output voltage of the inverter is reached. As the speed increases, the motor generates:

- constant torque with increasing power in the basic speed range,
- constant power with an inversely proportionate decrease in torque in the field weakening range.

When determining the maximum speed in the field weakening range, note that the rated torque M_N (in relation to the rated speed, e.g. n_N = 1500 rpm) falls in inverse proportion and the breakdown torque M_K is reduced in an inverse quadratic relationship. The M_K/M_N ratio is a motor-specific parameter. The MOVIDRIVE® pull-out protection limits the speed when the maximum possible torque is reached.



01729BEN

Fig. 82: Quadratically falling breakdown torque

With geared motors, the maximum motor speed is dependent on the size and mounting position of the gear unit. The speed should not exceed 3000 rpm due to the resulting noise and oil churning losses.

Dynamic applications ($P_{inverter}$ greater than P_{motor})

- The startup function sets the current limit of the inverter (P303/P313) to 150 % of the rated motor current. The value of the current limit refers to the rated inverter current. As a result, 150 % of the rated motor current is less than 150 % of the rated inverter current (value of P303/P313). This parameter must be set to a higher value manually for dynamic applications.
- The startup function sets the slip compensation parameter (P324/P334) to the nominal slip of the motor. In the case of VFC-n-CONTROL, the internal slip limiting function allows the slip to reach max. 150 % of this setting. Consequently, the motor develops at most 150 % of the nominal motor torque. The slip compensation parameter (P324) must be increased accordingly for greater torques.

Set parameter P324 "Slip compensation" to **max. 130 % of the nominal slip of the motor** for **stable operation**.

Combinations with $P_{inverter}$ greater than $4 \times P_{motor}$

The large difference between the inverter rated current and the motor rated current means that these combinations cannot be started up without taking special measures:

- Project planning for connecting the motor in a delta connection. This means the motor current is increased by a factor $\sqrt{3}$ and the unfavorable ratio is reduced.
- The motor must be started up in VFC & GROUP operating mode if this measure does not suffice. In this operating mode, the inverter operates without slip compensation and simulates a constant-voltage constant-frequency system (system with a constant V/f ratio).

Motor selection in delta/star circuit type (230/400 V_{AC} / 50 Hz)

Motors for 380 V_{AC} / 60 Hz can also be allocated on the basis of this selection table.

P_{max} [kW (HP)] for operation on MOVIDRIVE® MDF/MDV 60A...-5_3 (400/500 V units)				
Connection	⅄ / 400 V_{AC} 1)		Δ / 230 V_{AC} 2)	
Cooling	Self-cooling	Forced	Self-cooling	Forced
f_{min} – f_{max} [Hz]	10 - 50 6 - 60 5 - 70 / 5.5 - 80	≤ 2.5 - 50 / ≤ 3 - 60 3)	9 - 87	≤ 2.5 - 87 3)
n_{min} – n_{max} [rpm]	300 - 1500 180 - 1800 150 - 2100 / 165 - 2400	≤ 75 - 1500 / ≤ 90 - 1800	270 - 2610	≤ 75 - 2610
Setting range	1:5 1:10 1:15	≥ 1:20	1:10	≥ 1:20

Motor type 4)	**Rated power P_n [kW (HP)]**		**P = $P_{reduced}$** [kW (HP)]		**With MDF/MDV** 6) **60A...-5_3**	**P = P_n** [kW (HP)]		**With MDF/MDV** 6) **60A...-5_3**	**P = $P_{increased}$** 5) [kW (HP)]		**With MDF/MDV** 6) **60A...-5_3**
DT71D4	**0.37**	**(0.5)**	0.25	(0.33)	**0015**	0.37	(0.5)	**0015**	0.55	(0.75)	**0015**
DT80K4	**0.55**	**(0.75)**	0.37	(0.5)		0.55	(0.75)		0.75	(1.0)	
DT80N4	**0.75**	**(1.0)**	0.55	(0.75)		0.75	(1.0)		1.1	(1.5)	
DT90S4	**1.1**	**(1.5)**	0.75	(1.0)		1.1	(1.5)		1.5	(2.0)	
DT90L4	**1.5**	**(2.0)**	1.1	(1.5)		1.5	(2.0)		2.2	(3.0)	**0022**
DV100LS4	**2.2**	**(3.0)**	1.5	(2.0)		2.2	(3.0)	**0022**	3.0	(4.0)	**0030**
DV100L4	**3.0**	**(4.0)**	2.2	(3.0)	**0022**	3.0	(4.0)	**0030**	4.0	(5.4)	**0040**
DV112M4	**4.0**	**(5.4)**	3.0	(4.0)	**0030**	4.0	(5.4)	**0040**	5.5	(7.5)	**0055**
DV132S4	**5.5**	**(7.5)**	4.0	(5.4)	**0040**	5.5	(7.5)	**0055**	7.5	(10)	**0075**
DV132M4	**7.5**	**(10)**	5.5	(7.5)	**0055**	7.5	(10)	**0075**	9.2	(12.5)	**0110**
DV132ML4	**9.2**	**(12.5)**	7.5	(10)	**0075**	9.2	(12.5)	**0110**	11	(15)	
DV160M4	**11**	**(15)**	9.2	(12.5)	**0110**	11	(15)		15	(20)	**0150**
DV160L4	**15**	**(20)**	11	(15)		15	(20)	**0150**	18.5	(25)	**0220**
DV180M4	**18.5**	**(25)**	15	(20)	**0150**	18.5	(25)	**0220**	22	(30)	
DV180L4	**22**	**(30)**	18.5	(25)	**0220**	22	(30)		30	(40)	**0300**
DV200L4	**30**	**(40)**	22	(30)		30	(40)	**0300**	37	(50)	**0370**
DV225S4	**37**	**(50)**	30	(40)	**0300**	37	(50)	**0370**	45	(60)	**0450**
DV225M4	**45**	**(60)**	37	(50)	**0370**	45	(60)	**0450**	55	(75)	**0550**
D250M4	**55**	**(75)**	45	(60)	**0450**	55	(75)	**0550**	75	(100)	**0750**
D280S4	**75**	**(100)**	55	(75)	**0550**	75	(100)	**0750**	-		
D280M4	**90**	**(120)**	75	(100)	**0750**	-					

1) Also applies to motors with rated voltage 460 V or 500 V and to 400 V / 690 V motors with Δ connection.

2) Also applies to motors with rated voltage 266 V or 290 V.

3) The following applies to MDF and MDV without speed control: f_{min} = 0.5 Hz

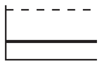
4) In load type S3 (40 % c.d.f.), the motor must not be operated at its listed power ($P = P_n$) even without forced-cooling. Example: P_{stat} = 2 kW, P_{dyn} = 2.5 kW → selected motor DV100LS4 (P_n = 2.2 kW).

5) $P_{increased}$ means that the motor is operated at the power of the next larger motor (1 frame size), rather than with the $\sqrt{3}$-fold power.

6) The devices listed here permit intermittent loads of up to 1.5 times the nominal load in the specific application. With variable torque load and constant load without overload, each inverter can also be operated with an increased continuous output power (→ Sec. Technical Data). The continuous output current of 125 % of the unit rated current is only available at f_{PWM} = 4 kHz in the VFC operating modes.

Examples for motor selection delta/star 230/400 V

Trolley drive



Constant load with overload (acceleration) and low load when in motion:

- P_{travel} = 1.3 kW
- P_{max} = 13 kW
- n_{min} = 270 rpm, setting range 1:10
- n_{max} = 2610 rpm

In inverter mode with adapted power ($P = P_n$), the motor can output 150 % of its listed power during the acceleration phase. Consequently:

$P_{Mot} = P_{max} : 1.5 = 13\ kW : 1.5 = 8.67\ kW$

A DV132M4 with delta connection (P_n = 9.2 kW) is selected.

The selection table (→ page 168) allocates a MOVIDRIVE® MDF60A0110 ($P = P_n$).

Hoist drive

High constant load with intermittent overload (acceleration):

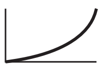
- P_{max} = 26 kW
- $P_{sustained}$ = 20 kW
- Speed range 1:15, low speed only for positioning
- Brake applied when stationary
- Load type S3 (40 % c.d.f.)

The inverter can yield 150 % of its rated current during acceleration. Consequently, a MOVIDRIVE® MDF60A0220 is selected.

In view of the load type (S3, 40 % c.d.f.), the selection table allocates motor type DV180L4 (P_n = 22 kW) in a star connection.

→ Sec. Project planning for hoists on page 165 for more information.

Fan/pump



Variable torque load with the following power values:

- P_{max} = 4.8 kW
- n_{max} = 1400 rpm, continuous duty with n_{max}

The motor can be operated at its listed power ($P = P_n$) even without forced-cooling due to the quadratically falling torque. This means the DV132S4 motor type with star connection (P_n = 5.5 kW) is adequate.

The selection table allocates a MOVIDRIVE® MDF60A0055 ($P = P_n$). However, the inverter can be operated with an increased output power because this case involves a variable torque load without overload. Consequently, a MOVIDRIVE® MDF60A0040 is sufficient.

Motor selection in double-star/star circuit type (230/460 V_{AC} / 60 Hz)

P_{max} [kW (HP)] for operation on MOVIDRIVE® MDF/MDV 60A...-5_3 (400/500 V units)							
Connection		⅄ / 460 V_{AC}				⅄⅄ / 230 V_{AC}	
Cooling		Self-cooling		Self-cooling	Forced	Self-cooling	Forced
$f_{min} – f_{max}$ [Hz]		6 - 90		10 - 60	0 - 60[1]	10 - 120	0 - 120[1]
$n_{min} – n_{max}$ [rpm]		180 - 2700		200 - 1800	0 - 1800	200 - 3600	0 - 3600
Setting range		1:15		1:6	≥ 1:15	1:12	≥ 1:20
		P = $P_{reduced}$		**P = P_n**		**P = $P_{increased}$[2]**	
Motor type	**Rated power P_n [kW (HP)]**	**[kW (HP)]**	**With MDF/MDV[3] 60A...-5_3**	**[kW (HP)]**	**With MDF/MDV[3] 60A...-5_3**	**[kW (HP)]**	**With MDF/MDV[3] 60A...-5_3**
DT71D4	**0.37 (0.5)**	0.25 (0.33)	**0015**	0.37 (0.5)	**0015**	0.75 (1.0)	**0015**
DT80K4	**0.55 (0.75)**	0.37 (0.5)		0.55 (0.75)		1.1 (1.5)	
DT80N4	**0.75 (1.0)**	0.55 (0.75)		0.75 (1.0)		1.5 (2.0)	
DT90S4	**1.1 (1.5)**	0.75 (1.0)		1.1 (1.5)		2.2 (3.0)	**0022**
DT90L4	**1.5 (2.0)**	1.1 (1.5)		1.5 (2.0)		3.0 (4.0)	**0030**
DV100LS4	**2.2 (3.0)**	1.5 (2.0)		2.2 (3.0)	**0022**	4.0 (5.4)	**0040**
DV100L4	**3.7 (5.0)**	2.2 (3.0)	**0022**	3.0 (4.0)	**0030**	5.5 (7.5)	**0055**
DV112M4	**4.0 (5.4)**	3.0 (4.0)	**0030**	4.0 (5.4)	**0040**	7.5 (10)	**0075**
DV132S4	**5.5 (7.5)**	4.0 (5.4)	**0040**	5.5 (7.5)	**0055**	9.2 (12.5)	**0110**
DV132M4	**7.5 (10)**	5.5 (7.5)	**0055**	7.5 (10)	**0075**	11 (15)	
DV132ML4	**9.2 (12.5)**	7.5 (10)	**0075**	9.2 (12.5)	**0110**	15 (20)	**0150**
DV160M4	**11 (15)**	9.2 (12.5)	**0110**	11 (15)		18.5 (25)	**0220**
DV160L4	**15 (20)**	11 (15)		15 (20)	**0150**	22 (30)	
DV180M4	**18.5 (25)**	15 (20)	**0150**	18.5 (25)	**0220**	30 (40)	**0300**
DV180L4	**22 (30)**	18.5 (25)	**0220**	22 (30)		37 (50)	**0370**
DV200L4	**30 (40)**	22 (30)		30 (40)	**0300**	45 (60)	**0450**
DV225S4	**37 (50)**	30 (40)	**0300**	37 (50)	**0370**	55 (75)	**0550**
DV225M4	**45 (60)**	37 (50)	**0370**	45 (60)	**0450**	75 (100)	**0750**
D250M4	**55 (75)**	45 (60)	**0450**	55 (75)	**0550**	-	
D280S4	**75 (100)**	55 (75)	**0550**	75 (100)	**0750**		
D280M4	**90 (120)**	75 (100)	**0750**	-			

1) The following applies to MDF and MDV without speed control: f_{min} = 0.5 Hz

2) $P_{increased}$ means that the motor is operated at the power of the next larger motor (1 frame size), rather than with the $\sqrt{3}$-fold power.

3) The devices listed here permit intermittent loads of up to 1.5 times the nominal load in the specific application. With variable torque load and constant load without overload, each inverter can also be operated with an increased continuous output power (→ Sec. Technical Data). The continuous output current of 125 % of the unit rated current is only available at f_{PWM} = 4 kHz in the VFC operating modes.

Motor selection with the delta connection type (230 V_{AC} / 50 Hz)

P_{max} [kW (HP)] for operation on MOVIDRIVE® MDF/MDV 60A...-2_3 (230 V units)								
Connection			Δ / 230 V_{AC}					
Cooling			Self-cooling			Forced		
f_{min} – f_{max} [Hz]			10 - 50 6 - 60 5 - 70 / 5.5 - 80			≤ 2.5 - 50 / ≤ 3 - 60[1)]		
n_{min} – n_{max} [rpm]			300 - 1500 180 - 1800 150 - 2100 / 165 - 2400			≤ 75 - 1500 / ≤ 90 - 1800		
Setting range			1:5 1:10 1:15			≥ 1:20		
			P = $P_{reduced}$			**P = P_n**		
Motor type[2)]	**Rated power P_n [kW (HP)]**		**[kW (HP)]**		**With MDF/MDV[3)] 60A...-2_3**	**[kW (HP)]**		**With MDF/MDV[3)] 60A...-2_3**
DT71D4	**0.37**	**(0.5)**	0.25	(0.33)	**0015**	0.37	(0.5)	**0015**
DT80K4	**0.55**	**(0.75)**	0.37	(0.5)		0.55	(0.75)	
DT80N4	**0.75**	**(1.0)**	0.55	(0.75)		0.75	(1.0)	
DT90S4	**1.1**	**(1.5)**	0.75	(1.0)		1.1	(1.5)	
DT90L4	**1.5**	**(2.0)**	1.1	(1.5)		1.5	(2.0)	
DV100LS4	**2.2**	**(3.0)**	1.5	(2.0)		2.2	(3.0)	**0022**
DV100L4	**3.0**	**(4.0)**	2.2	(3.0)	**0022**	3.0	(4.0)	**0030**
DV112M4	**4.0**	**(5.4)**	3.0	(4.0)	**0030**	4.0	(5.4)	**0040**
DV132S4	**5.5**	**(7.5)**	4.0	(5.4)	**0040**	5.5	(7.5)	**0055**
DV132M4	**7.5**	**(10)**	5.5	(7.5)	**0055**	7.5	(10)	**0075**
DV132ML4	**9.2**	**(12.5)**	7.5	(10)	**0075**	9.2	(12.5)	**0110**
DV160M4	**11**	**(15)**	9.2	(12.5)	**0110**	11	(15)	
DV160L4	**15**	**(20)**	11	(15)		15	(20)	**0150**
DV180M4	**18.5**	**(25)**	15	(20)	**0150**	18.5	(25)	**0220**
DV180L4	**22**	**(30)**	18.5	(25)	**0220**	22	(30)	
DV200L4	**30**	**(40)**	22	(30)		30	(40)	**0300**
DV225S4	**37**	**(50)**	30	(40)	**0300**	-		

1) The following applies to MDF and MDV without speed control: f_{min} = 0.5 Hz

2) In load type S3 (40 % c.d.f.), the motor must not be operated at its listed power (P = P_n) even without forced-cooling. Example: P_{stat} = 2 kW, P_{dyn} = 2.5 kW → selected motor DV100LS4 (P_n = 2.2 kW).

3) The devices listed here permit intermittent loads of up to 1.5 times the nominal load in the specific application. With variable torque load and constant load without overload, each inverter can also be operated with an increased continuous output power (→ Sec. Technical Data). The continuous output current of 125 % of the unit rated current is only available at f_{PWM} = 4 kHz in the VFC operating modes.

Motor selection with the double-star connection type (230 V_{AC} / 60 Hz)

P_{max} [kW (HP)] for operation on MOVIDRIVE® MDF/MDV 60A...-2_3 (230 V units)								
Connection			⅄⅄ / 230 V_{AC}					
Cooling			Self-cooling			Self-cooling		Forced
f_{min} – f_{max} [Hz]			6 - 90			10 - 60		0 - 60[1]
n_{min} – n_{max} [rpm]			180 - 2700			200 - 1800		0 - 1800
Setting range			1:15			1:6		≥ 1:15
			P = $P_{reduced}$			**P = P_n**		
Motor type	**Rated power P_n [kW (HP)]**		**[kW (HP)]**		**With MDF/MDV[2] 60A...-2_3**	**[kW (HP)]**		**With MDF/MDV[3] 60A...-2_3**
DT71D4	**0.37**	**(0.5)**	0.25	(0.33)	**0015**	0.37	(0.5)	**0015**
DT80K4	**0.55**	**(0.75)**	0.37	(0.5)		0.55	(0.75)	
DT80N4	**0.75**	**(1.0)**	0.55	(0.75)		0.75	(1.0)	
DT90S4	**1.1**	**(1.5)**	0.75	(1.0)		1.1	(1.5)	
DT90L4	**1.5**	**(2.0)**	1.1	(1.5)		1.5	(2.0)	
DV100LS4	**2.2**	**(3.0)**	1.5	(2.0)		2.2	(3.0)	**0022**
DV100L4	**3.7**	**(5.0)**	2.2	(3.0)	**0022**	3.0	(4.0)	**0030**
DV112M4	**4.0**	**(5.4)**	3.0	(4.0)	**0030**	4.0	(5.4)	**0040**
DV132S4	**5.5**	**(7.5)**	4.0	(5.4)	**0040**	5.5	(7.5)	**0055**
DV132M4	**7.5**	**(10)**	5.5	(7.5)	**0055**	7.5	(10)	**0075**
DV132ML4	**9.2**	**(12.5)**	7.5	(10)	**0075**	9.2	(12.5)	**0110**
DV160M4	**11**	**(15)**	9.2	(12.5)	**0110**	11	(15)	
DV160L4	**15**	**(20)**	11	(15)		15	(20)	**0150**
DV180M4	**18.5**	**(25)**	15	(20)	**0150**	18.5	(25)	**0220**
DV180L4	**22**	**(30)**	18.5	(25)	**0220**	22	(30)	
DV200L4	**30**	**(40)**	22	(30)		30	(40)	**0300**
DV225S4	**37**	**(50)**	30	(40)	**0300**	-		

1) The following applies to MDF and MDV without speed control: f_{min} = 0.5 Hz

2) The devices listed here permit intermittent loads of up to 1.5 times the nominal load in the specific application. With variable torque load and constant load without overload, each inverter can also be operated with an increased continuous output power (→ Sec. Technical Data). The continuous output current of 125 % of the unit rated current is only available at f_{PWM} = 4 kHz in the VFC operating modes.

5.5 Motor selection for asynchronous servomotors (CFC)

The torque limit (M limit) is set automatically by the startup function of the MOVITOOLS software package. Do not alter this automatically set value!

We recommend always using the latest version of MOVITOOLS (2.70 or later) for startup. The latest MOVITOOLS version can be downloaded from our homepage (www.sew-eurodrive.de).

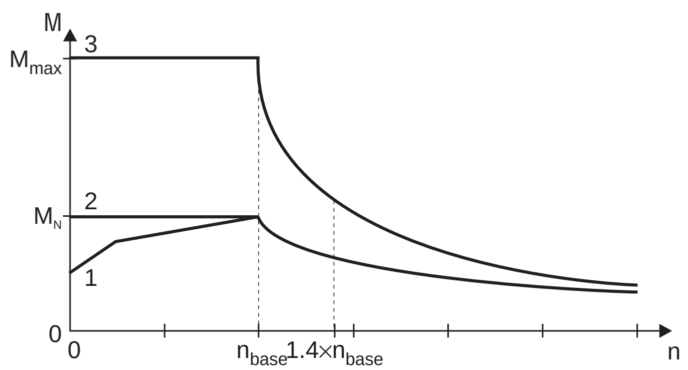
Motor characteristics

The drive in CFC operating modes is characterized by its ability to control torque directly and rapidly. This means it achieves a high level of dynamic overload capacity (up to 3 × M_N) and a very high speed and control range (up to 1:5000). Smooth running at speed and positioning accuracy fulfill the exacting requirements of servo systems. This behavior is achieved by the field-oriented control function. The current components for magnetization (I_d) and torque generation (I_q) are controlled separately. A feature of the CFC operating modes is that there must always be an encoder on the motor.

The inverter needs to know exact data about the motor which is connected, in order to calculate the motor model. These data are made available by the MOVITOOLS software with the startup function. CFC operating modes are only possible with 4-pole SEW-motors (CT/CV or DT/DV/D), not with the other SEW motors or non-SEW motors. The necessary motor data for the CFC operating modes are stored in MOVIDRIVE® for the 4-pole SEW motors.

Typical speed-torque characteristic

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



01651BEN

Fig. 83: Speed/torque characteristic curve in CFC operating mode

1 With integrated cooling
2 With forced-cooling
3 Maximum torque

Magnetization current

Dynamic drives which are supposed to accelerate without a time lag are also energized when at a standstill without load. This means the magnetization current I_d is flowing. The inverter must be able to supply this current constantly in applications in which the output stage is permanently enabled, e.g. in CFC & M-CONTROL mode. In particular in the case of large motors with a slip frequency ≤ 2 Hz, you must refer to the diagrams showing the load capacity of the units (→ page 201, Sec. Temperature/time characteristic) to check whether the inverter can supply the current. Also check whether the thermal characteristics of the motor are suitable for this (forced-cooling fan). Refer to the motor tables (CT/CV → page 177, DT/DV/D → page 181) for the magnetization current I_d.

Basic recommendations

CFC operating modes are only possible with SEW-motors (series CT/CV or DT/DV/D), not with non-SEW motors. The necessary motor data for the CFC operating modes are stored in MOVIDRIVE® for the SEW motors.

Speed is the correcting variable in the CFC modes with speed control. Torque is the correcting variable in the CFC modes with torque control (CFC & M-CONTROL).

CFC mode with speed control

There is no reason to differentiate between quadratic, dynamic and static load types when configuring a system for CFC mode. Project planning for an asynchronous motor in CFC mode is undertaken in accordance with the following requirements:

1. Effective torque demand at the average speed of the application.

   $M_{r.m.s.} < M_{n\_mot}$

   The point must lie below the characteristic curve for the continuous torque (Fig. 83, curve 2). No forced-cooling is required if this operating point lies below the characteristic curve for forced-cooling (Fig. 83, curve 1).

2. Maximum torque required across the speed characteristic.

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

   This operating point must lie below the characteristic curve for the maximum torque of the motor-MOVIDRIVE® combination (Fig. 83, curve 3).

3. Maximum speed

   The maximum speed of the motor should not be configured higher than 1.4 times the transition speed. The maximum torque available will then still be approx. 100 % 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

Motor cooling

Self-cooling of asynchronous motors is based on the integrated fan, and consequently depends on the speed. The integrated fan does not provide any cooling at low speeds and when the motor is stopped. Forced-cooling may be required in case of a high static load or a high effective torque.

CFC mode with torque control (CFC & M-CONTROL)

This operating mode permits direct torque control of the asynchronous motor in the basic speed range ($n \leq n_{base}$). The setpoint sources of the speed-controlled CFC mode can also be used for torque control. All speed setpoint sources are interpreted as current setpoint sources. The settings for evaluating the analog input (→P11_, parameter description) also remain in effect. The fixed setpoints (P16_, P17_) can be entered either in the unit [rpm] or [$\%I_{N\_inverter}$] (→ MOVITOOLS).

The following relationship applies between the units:

3000 rpm = 150 % inverter rated current

The torque on the output shaft can then be calculated for the basic speed range ($n \leq n_{base}$) using the following formulae:

Specification of a setpoint for the motor torque in $\%I_{n\_inverter}$:

$$M = k_T \times I_{n\_inverter} \times Setpoint$$

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Specification of a setpoint for the motor torque in rpm:

$$M = k_T \times 1.5 \times I_{n\_inverter} \times \frac{Setpoint}{3000\ rpm}$$

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$I_{n\_inverter}$ = Output rated current of the inverter

k_T = Torque constant = M_n / I_{q_n}

M_n and I_{q_n} are motor-specific parameters. Refer to the motor tables (DT/DV/D → page 181, CT/CV → page 177) for the values of the torque constants k_T and the motor-specific parameters M_n and I_{q_n}.

As well as the current I_q for creating the torque, the inverter also needs to supply the magnetization current I_d. The inverter output current I_{tot} which actually flows can be calculated using the following formulae:

Specification of a setpoint for the motor torque in $\%I_{n\_inverter}$:

$$I_{tot} = \sqrt{\left(Setpoint \times I_{n\_inverter}\right)^2 + I_{d\_N}^2}$$

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Specification of a setpoint for the motor torque in rpm:

$$I_{tot} = \sqrt{\left(Setpoint \times 1.5 \times I_{n\_inverter} \times \frac{1}{3000\ rpm}\right)^2 + I_{d\_N}^2}$$

04975AEN

I_{q_n} = Nominal value for the current which generates the torque, according to the motor table

I_{d_n} = Nominal value for the magnetization current, according to the motor table

CT/CV asynchronous servomotors

SEW offers series CT/CV asynchronous servomotors especially for operating with MOVIDRIVE® in the CFC operating modes. These motors have the following characteristics:

High transition speeds and a high power yield

Due to optimum winding, the transition speeds of CT/CV motors in ⅄ connection are in the region of 1400 – 1500 rpm and 2500 – 2600 rpm in Δ connection. This results in a high power yield of the motors.

With sin/cos encoder as standard

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

With motor protection TF as standard

The winding temperature of the three motor phases is monitored using thermistor sensors. The thermistor sensor can be connected to the TF input (X10:1/2) of MOVIDRIVE®. Thermal monitoring is then undertaken by MOVIDRIVE®; no additional monitoring unit is required.

Thermal classification F as standard

CT/CV motors have thermal classification F as standard. The maximum permitted temperature rise is therefore 105 K.

Reinforced pinion spigot

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

Either DT/DV/D motors or CT/CV motors can be used in CFC mode. SEW recommends using CT/CV motors in order to achieve optimum benefit from the advantages of CFC mode.

<table>
<tr><th></th><th>Advantage</th><th>Disadvantage</th></tr>
<tr><td rowspan="4">CFC mode with DT/DV/D motor
Motor selection → page 184</td><td rowspan="4">Standard version of motor</td><td>Slower transition speed than the CT/CV motor.</td></tr>
<tr><td>The power yield of the motor is less than the motor rated power.</td></tr>
<tr><td>In terms of the power yield, the mass inertia is greater than the CT/CV motors.</td></tr>
<tr><td>In some inverter/motor combinations, the maximum torque is limited by the mechanical strength.</td></tr>
<tr><td rowspan="4">CFC mode with CT/CV motor
Motor selection → page 178</td><td>Faster transition speed than DT/DV/D motor.</td><td rowspan="2">Not an IEC standard motor</td></tr>
<tr><td>Usually with a power yield one level higher.</td></tr>
<tr><td>Lower mass inertia in relation to the power yield.</td><td rowspan="2">High current consumption</td></tr>
<tr><td>Motor is designed for dynamic operation.</td></tr>
</table>

Motor table CT/CV

Characteristic values for delta/star 167/290 V / 50 Hz

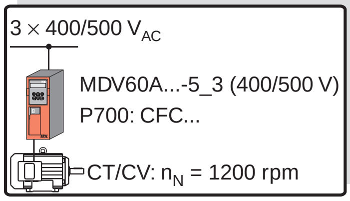
Motor	M_N	Mass moment of inertia J_M		Star ⅄ (290 V)				Delta Δ (167 V)			
		Without brake	With brake	I_n	I_{q_n} 1)	I_{d_n} 1)	k_T 1)	I_n	I_{q_n} 1)	I_{d_n} 1)	k_T 1)
	[Nm (lb.in)]	[10^{-4} kgm^2 (10^{-3} lb.ft^2)]		[A]	[A]	[A]	[Nm/A (lb.in/A)]	[A]	[A]	[A]	[Nm/A (lb.in/A)]
CT71D4	2.6 (23)	4.6 (10.9)	5.5 (13.1)	-	-	-	-	3.0	2.47	1.70	1.05 (9.28)
CT80N4	5.2 (46)	8.7 (20.6)	9.6 (22.8)	2.9	2.36	1.69	2.20 (19.4)	5.0	4.10	2.86	1.26 (11.1)
CT90L4	10.1 (89)	34.0 (80.7)	39.5 (93.7)	4.9	4.38	2.20	2.31 (20.4)	8.5	7.61	3.79	1.33 (11.8)
CT100LS4	15.0 (133)	43.0 (102)	48.5 (115)	6.8	6.03	3.14	2.49 (22.0)	11.8	10.4	5.57	1.44 (12.7)
CT100L4	20.4 (180)	53.0 (126)	58.5 (140)	9.1	8.12	4.11	2.51 (22.2)	15.8	14.1	7.13	1.45 (12.8)
CV112M4	26.9 (238)	98.0 (233)	110 (261)	12.0	10.8	5.23	2.49 (22.0)	21.0	18.8	9.36	1.43 (12.6)
CV132S4	36.7 (324)	146 (346)	158 (375)	15.2	14.2	5.42	2.58 (22.8)	26.5	24.7	9.60	1.49 (13.2)
CV132M4	⅄50.0 (442) Δ48.0 (424)	280 (664)	324 (769)	21.5	19.6	8.84	2.55 (22.5)	36.0	32.7	15.1	1.47 (13.0)
CV132ML4	⅄61.0 (539) Δ58.0 (512)	330 (783)	374 (888)	25.0	23.6	8.25	2.58 (22.8)	41.0	36.7	18.3	1.58 (14.0)
CV160M4	⅄73.0 (645) Δ67.0 (592)	400 (949)	440 (1044)	30.5	28.0	12.1	2.61 (23.1)	50.0	44.2	23.4	1.52 (13.4)
CV160L4	⅄95.0 (839) Δ90.0 (795)	925 (2195)	1030 (2444)	40.0	34.9	19.5	2.72 (24.0)	65.0	55.4	34.0	1.62 (14.4)
CV180M4	⅄110 (972) Δ100 (883)	1120 (2658)	1226 (2909)	47.0	38.4	27.1	2.86 (25.3)	75.0	58.2	47.3	1.72 (15.2)
CV180L4	⅄120 (1061) Δ110 (972)	1290 (3060)	1396 (3313)	50.0	40.3	29.6	2.98 (26.3)	80.0	61.2	51.5	1.80 (15.9)

1) Applies in the basic speed range up to n_{base}.

CT/CV motor selection with the delta/star connection type (167/290 V_{AC} / 50 Hz)

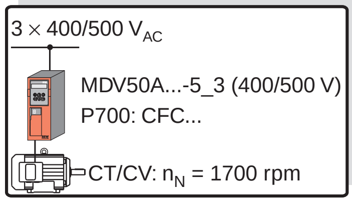
1. Star connection ⅄ 290 V / 50 Hz

Motor			MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
⅄ 290 V / 50 Hz			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
CT80N4	M_{max}	[Nm]	12.6	15.6												
		([lb.in])	(111)	(138)												
	n_{base}	[rpm]	1150	880												
CT90L4	M_{max}	[Nm]		18	23.5	30.5										
		([lb.in])		(159)	(208)	(270)										
	n_{base}	[rpm]		1400	1280	1090										
CT100LS4	M_{max}	[Nm]		19	25	34.5	45									
		([lb.in])		(167)	(221)	(305)	(398)									
	n_{base}	[rpm]		1400	1400	1250	1080									
CT100L4	M_{max}	[Nm]				34	46	59								
		([lb.in])				(301)	(407)	(522)								
	n_{base}	[rpm]				1460	1335	1190								
CV112M4	M_{max}	[Nm]					44.5	58	81							
		([lb.in])					(393)	(513)	(712)							
	n_{base}	[rpm]					1365	1280	1065							
CV132S4	M_{max}	[Nm]						59	91	110						
		([lb.in])						(522)	(804)	(972)						
	n_{base}	[rpm]						1470	1330	1175						
CV132M4	M_{max}	[Nm]							89	121	150					
		([lb.in])							(787)	(1070)	(1326)					
	n_{base}	[rpm]							1440	1330	1125					
CV132ML4	M_{max}	[Nm]							89	121	176	183				
		([lb.in])							(787)	(1070)	(1556)	(1617)				
	n_{base}	[rpm]							1445	1360	1205	1055				
CV160M4	M_{max}	[Nm]								120	176	219				
		([lb.in])								(1061)	(1556)	(1936)				
	n_{base}	[rpm]								1420	1310	1195				
CV160L4	M_{max}	[Nm]									170	226	277	294		
		([lb.in])									(1503)	(1998)	(2450)	(2600)		
	n_{base}	[rpm]									1470	1400	1330	1240		
CV180M4	M_{max}	[Nm]									168	226	278	343	360	
		([lb.in])									(1485)	(1998)	(2457)	(3032)	(3182)	
	n_{base}	[rpm]									1550	1510	1455	1400	1335	
CV180L4	M_{max}	[Nm]										217	267	332	393	429
		([lb.in])										(1918)	(2360)	(2935)	(3474)	(3791)
	n_{base}	[rpm]										1450	1420	1370	1320	1250



2. Delta connection Δ 167 V / 50 Hz

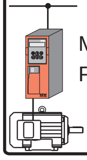
Motor Δ 167 V / 50 Hz			MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700) 0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
CT71D4	M_{max}	[Nm]	6.2	7.7												
		([lb.in])	(55)	(68)												
	n_{base}	[rpm]	2280	2100												
CT80N4	M_{max}	[Nm]		9.7	12.5	15.5										
		([lb.in])		(86)	(110)	(137)										
	n_{base}	[rpm]		2560	2350	2010										
CT90L4	M_{max}	[Nm]			13	18	24	30.5								
		([lb.in])			(115)	(159)	(270)	(270)								
	n_{base}	[rpm]			2770	2650	2490	2300								
CT100LS4	M_{max}	[Nm]				19	25.5	33.5	45							
		([lb.in])				(167)	(225)	(296)	(398)							
	n_{base}	[rpm]				2750	2630	2490	2150							
CT100L4	M_{max}	[Nm]					25	33	51	61						
		([lb.in])					(220)	(292)	(450)	(539)						
	n_{base}	[rpm]					2880	2770	2540	2290						
CV112M4	M_{max}	[Nm]						32	50	67	81					
		([lb.in])						(282)	(442)	(592)	(716)					
	n_{base}	[rpm]						2640	2490	2340	2060					
CV132S4	M_{max}	[Nm]							51	69	101	110				
		([lb.in])							(450)	(610)	(893)	(972)				
	n_{base}	[rpm]							2740	2645	2450	2250				
CV132M4	M_{max}	[Nm]								67	99	131	150			
		([lb.in])								(592)	(875)	(1158)	(1326)			
	n_{base}	[rpm]								2750	2600	2450	2295			
CV132ML4	M_{max}	[Nm]									99	132	161	183		
		([lb.in])									(875)	(1167)	(1423)	(1618)		
	n_{base}	[rpm]									2590	2475	2360	2210		
CV160M4	M_{max}	[Nm]									98	131	161	198	219	
		([lb.in])									(866)	(1158)	(1423)	(1750)	(1936)	
	n_{base}	[rpm]									2630	2550	2470	2365	2250	
CV160L4	M_{max}	[Nm]										124	157	192	228	285
		([lb.in])										(1095)	(1388)	(1697)	(2015)	(2519)
	n_{base}	[rpm]										2720	2680	2610	2545	2430
CV180M4	M_{max}	[Nm]											150	192	228	287
		([lb.in])											(1325)	(1697)	(2015)	(2537)
	n_{base}	[rpm]											2790	2745	2700	2635
CV180L4	M_{max}	[Nm]												182	229	276
		([lb.in])												(1608)	(2024)	(2440)
	n_{base}	[rpm]												2620	2580	2540



CT/CV motor selection with delta connection (167 V_{AC} / 50 Hz)

Motor			**MOVIDRIVE® MDV60A...-2_3 (230 V units) in CFC operating modes (P700)**								
Δ 167 V / 50 Hz			**0015**	**0022**	**0037**	**0055**	**0075**	**0110**	**0150**	**0220**	**0300**
CT80N4	M_{max}	[Nm (lb.in)]	13.3 (117)	15.8 (139)							
	n_{base}	[rpm]	1115	975							
CT90L4	M_{max}	[Nm (lb.in)]		16.2 (143)	28.5 (251)	43.7 (386)					
	n_{base}	[rpm]		1440	1180	850					
CT100LS4	M_{max}	[Nm (lb.in)]			30.2 (266)	46.7 (412)					
	n_{base}	[rpm]			1320	1070					
CT100L4	M_{max}	[Nm (lb.in)]			29.6 (261)	46.7 (412)	62.2 (550)				
	n_{base}	[rpm]			1515	1330	1160				
CV112M4	M_{max}	[Nm (lb.in)]				45.5 (402)	61.0 (539)	89.3 (789)			
	n_{base}	[rpm]				1365	1255	1055			
CV132S4	M_{max}	[Nm (lb.in)]					62.4 (551)	92.2 (814)			
	n_{base}	[rpm]					1460	1320			
CV132M4	M_{max}	[Nm (lb.in)]						90.3 (798)			
	n_{base}	[rpm]						1435			
CV132ML4	M_{max}	[Nm (lb.in)]						90.2 (797)			
	n_{base}	[rpm]						1445			
CV160M4	M_{max}	[Nm (lb.in)]									
	n_{base}	[rpm]									
CV160L4	M_{max}	[Nm (lb.in)]									
	n_{base}	[rpm]									
CV180M4	M_{max}	[Nm (lb.in)]									
	n_{base}	[rpm]									

3 × 400/500 V_{AC}



MDV60A...-5_3 (400/500 V)
P700: CFC...
CT/CV: n_N = 2100 rpm

DT/DV/D motor tables

Characteristic values for delta/star 230/400 V / 50 Hz

Motor	M_N	Mass moment of inertia J_M		Star ⅄ (400 V)				Delta Δ (230 V)			
		Without brake	With brake	I_n	I_{q_n}[1]	I_{d_n}[1]	k_T[1]	I_n	I_{q_n}[1]	I_{d_n}[1]	k_T[1]
	[Nm (lb.in)]	[10^{-4} kgm^2 (10^{-3} $lb.ft^2$)]		[A]	[A]	[A]	[Nm/A]	[A]	[A]	[A]	[Nm/A]
DT71D4	2.6 (23)	4.6 (10.4)	5.5 (12.5)	-	-	-	-	2.15	1.82	1.14	1.43
DT80K4	3.9 (34)	6.6 (15.6)	7.5 (17.7)	-	-	-	-	3.03	2.53	1.67	1.54
DT80N4	5.2 (46)	8.7 (20.7)	9.6 (22.8)	2.15	1.72	1.29	3.02	3.72	2.99	2.21	1.74
DT90S4	7.5 (66)	25 (59.4)	31 (72.2)	2.80	2.39	1.46	3.13	4.85	4.17	2.48	1.80
DT90L4	10.2 (90)	34 (78.9)	40 (93.6)	3.7	3.18	1.89	3.21	6.41	5.51	3.28	1.85
DV100M4	15.0 (133)	42 (101)	48 (114)	4.95	4.37	2.32	3.43	8.57	7.57	4.02	1.98
DV100L4	20.5 (181)	53 (126)	59 (139)	6.7	5.89	3.19	3.48	11.6	10.2	5.52	2.01
DV112M4	26.9 (238)	98 (233)	110 (262)	8.7	7.85	3.75	3.43	15.2	13.6	6.79	1.98
DV132S4	36.7 (324)	146 (416)	158 (445)	11.4	10.3	4.89	3.56	19.8	17.9	8.46	2.05
DV132M4	50.1 (443)	280 (655)	330 (769)	15.5	14.2	6.21	3.53	27.0	24.6	11.1	2.04
DV132ML4	61.0 (539)	330 (769)	380 (887)	18.7	17.1	7.57	3.57	32.5	29.6	13.4	2.06
DV160M4	72.9 (644)	398 (945)	448 (1049)	22.5	20.3	9.70	3.59	39.0	35.1	17.0	2.08
DV160L4	98.1 (867)	925 (2197)	1060 (2449)	31.0	27.6	14.1	3.55	54.0	47.8	25.1	2.05
DV180M4	121 (1070)	1120 (2660)	1255/1520[2] (2912/3164[2])	38.5	33.1	19.7	3.66	67.0	57.3	34.7	2.11
DV180L4	143 (1264)	1290 (3064)	1425/1520[2] (3316/3567[2])	46.0	40.7	21.4	3.51	80.0	70.4	38.0	2.03
DV200L4	195 (1724)	2340 (5558)	2475/2570[2] (5809/6061[2])	57.0	51.8	23.8	3.76	99.0	89.8	41.7	2.17
DV225S4	240 (2122)	3010 (7149)	3145/3240[2] (7400/7652[2])	70.0	64.5	27.2	3.72	122	112	48.4	2.14
DV225M4	292 (2581)	3570 (8479)	3705/3800[2] (8730/8982[2])	86.0	77.6	37.1	3.76	149	134	65.2	2.18
D250M4	356 (3147)	7300 (17323)	[3]	98.0	91.6	34.8	3.89	-	-	-	-
D280S4	483 (4270)	12000 (28476)	[3]	130	123	42.1	3.93	-	-	-	-
D280M4	580 (5127)	14500 (34409)	[3]	155	147	49.2	3.95	-	-	-	-

1) Applies in the basic speed range up to n_{base}.

2) Double disk brake

3) On request

Characteristic values for double-star/star 230/460 V / 60 Hz

(according to MG1, NEMA design B up to DT80K4, NEMA design C from DT80N4)

Motor	Mass moment of inertia J_M		Star ⅄ (460 V)					Double-star ⅄⅄ (230 V)				
	Without brake	With brake	M_N at 1000 rpm	I_n	I_{q_n} [1]	I_{d_n} [1]	k_T [1]	M_N at 2400 rpm	I_n	I_{q_n} [1]	I_{d_n} [1]	k_T [1]
	[10^{-4} kgm^2 (10^{-3} lb.ft^2)]		[Nm (lb.in)]	[A]	[A]	[A]	[Nm/A (lb.in/A)]	[Nm (lb.in)]	[A]	[A]	[A]	[Nm/A (lb.in/A)]
DT71D4	4.6 (10.4)	5.5 (12.5)	2.60 (23.0)	1.15	0.95	0.65	2.74 (24.2)	2.60 (23.0)	2.30	1.90	1.30	1.37 (12.1)
DT80K4	6.6 (15.6)	7.5 (17.7)	3.90 (34.5)	1.67	1.35	0.98	2.89 (27.3)	3.90 (34.5)	3.34	2.70	1.96	1.44 (12.8)
DT80N4	8.7 (20.7)	9.6 (22.8)	5.20 (46.0)	2.11	1.72	1.22	3.03 (26.8)	5.20 (46.0)	4.21	3.44	2.44	1.51 (13.4)
DT90S4	25 (59.4)	31 (72.2)	7.50 (66.3)	2.94	2.33	1.80	3.21 (28.4)	7.50 (66.3)	5.89	4.66	3.60	1.61 (14.2)
DT90L4	34 (78.9)	40 (93.6)	10.2 (90.2)	3.57	3.06	1.84	3.35 (29.6)	10.2 (90.2)	7.13	6.11	3.68	1.67 (14.8)
DT100LS4	42 (101)	48 (114)	15.0 (133)	5.00	4.47	2.25	3.34 (29.5)	15.0 (133)	10.1	9.00	4.50	1.66 (14.7)
DT100L4	53 (126)	59 (139)	20.5 (181)	7.92	7.32	3.02	3.45 (30.5)	20.5 (181)	15.8	14.6	6.05	1.72 (15.2)
DV112M4	98 (233)	110 (262)	26.9 (238)	8.20	7.47	3.37	3.60 (31.8)	26.9 (238)	16.4	14.9	6.74	1.80 (15.9)
DV132S4	146 (416)	158 (445)	36.7 (324)	11.0	10.3	3.77	3.55 (31.4)	36.7 (324)	22.0	20.7	7.54	1.78 (15.7)
DV132M4	280 (655)	330 (769)	50.0 (442)	15.9	14.3	6.87	3.46 (30.5)	50.1 (443)	31.8	28.7	13.7	1.77 (15.3)
DV132ML4	330 (769)	380 (887)	61.0 (539)	18.6	16.9	7.69	3.61 (31.7)	61.0 (539)	37.2	33.9	15.4	1.80 (15.8)
DV160M4	398 (945)	448 (1049)	71.0 (628)	22.7	20.4	9.93	3.47 (30.7)	71.0 (628)	45.4	40.8	19.9	1.74 (15.4)
DV160L4	925 (2197)	1060 (2449)	96.0 (849)	30.7	27.4	13.7	3.51 (31.0)	96.0 (849)	61.3	54.8	27.5	1.75 (15.5)
DV180M4	1120 (2660)	1255/1520[2] (2912/3164[2])	120 (1060)	36.5	33.6	14.3	3.57 (31.6)	120 (1060)	72.9	67.1	28.6	1.79 (15.8)
DV180L4	1290 (3064)	1425/1520[2] (3316/3567[2])	130 (1150)	42.7	37.6	20.2	3.46 (30.6)	130 (1150)	85.4	75.1	40.5	1.73 (15.3)
DV200L4	2340 (5558)	2475/2570[2] (5809/6061[2])	190 (1680)	54.6	52.1	16.2	3.65 (32.3)	190 (1680)	109	104	32.5	1.82 (16.2)
DV225S4	3010 (7149)	3145/3240[2] (7400/7652[2])	235 (2078)	67.9	64.5	21.0	3.64 (32.3)	235 (2078)	136	129	42.0	1.83 (16.2)
DV225M4	3570 (8479)	3705/3800[2] (8730/8982[2])	280 (2475)	78.8	74.1	27.0	3.78 (33.5)	260 (2300)	148	138	54.0	1.89 (16.8)
D250M4	7300 (17323)	[3]	356 (3147)	102	95.6	36.4	3.73 (33.0)	-	-	-	-	-
D280S4	12000 (28476)	[3]	483 (4270)	135	128	45.2	3.77 (33.3)	-	-	-	-	-
D280M4	14500 (34409)	[3]	580 (5128)	162	153	51.7	3.79 (33.5)	-	-	-	-	-

1) Applies in the basic speed range up to n_{base}.

2) Double disk brake

3) On request

Characteristic values for JEC motors

Motor	M_N [Nm (lb.in)]	Mass moment of inertia J_M [10^{-4} kgm² (10^{-3} lb.ft²)]		400 V / 60 Hz 440 V / 60 Hz 400 V / 50 Hz				200 V / 60 Hz 220 V / 60 Hz 200 V / 50 Hz			
		Without brake	With brake	I_n [A]	I_{q_n}[1] [A]	I_{d_n}[1] [A]	k_T[1] [Nm/A (lb.in/A)]	I_n [A]	I_{q_n}[1] [A]	I_{d_n}[1] [A]	k_T[1] [Nm/A (lb.in/A)]
DT80K4	2.71 (24)	6.55 (15.5)	7.45 (17.7)	1.35 (⅄)	0.96	0.95	2.82 (24.9)	2.70 (⅄⅄)	1.92	1.90	1.41 (12.5)
DT80N4	4.97 (44)	8.7 (20.6)	9.6 (22.8)	2.20 (⅄)	1.72	1.37	2.88 (25.5)	4.40 (⅄⅄)	3.45	2.73	1.44 (12.7)
DT90L4	10.0 (88)	34 (80.7)	39.4 (93.5)	3.85 (⅄)	3.29	2.00	3.04 (26.9)	7.70 (⅄⅄)	6.58	3.99	1.52 (13.4)
DV100M4	14.9 (131)	53 (126)	58.4 (139)	4.70 (⅄)	4.13	2.25	3.60 (31.8)	9.40 (⅄⅄)	8.25	4.50	1.80 (15.9)
DV112M4	24.4 (215)	98 (233)	110.2 (262)	8.50 (⅄)	7.55	3.93	3.24 (28.6)	17.0 (⅄⅄)	15.1	7.85	1.62 (14.3)
DV132S4	36.7 (324)	146 (346)	158.0 (375)	12.0 (Δ)	10.9	5.10	3.38 (29.9)	24.0 (ΔΔ)	21.7	10.2	1.69 (14.9)
DV132M4	48.8 (431)	280 (664)	323.7 (768)	16.0 (Δ)	14.6	6.50	3.34 (29.5)	32.0 (ΔΔ)	29.2	13.0	1.67 (14.8)
DV160M4	70.4 (622)	398 (944)	441.7 (1048)	23.0 (Δ)	20.6	10.3	3.42 (30.2)	46.0 (ΔΔ)	41.2	20.5	1.71 (15.1)
DV160L4	96.6 (854)	925 (2195)	1031 (2447)	32.3 (Δ)	28.6	14.9	3.38 (29.9)	64.5 (ΔΔ)	57.2	29.8	1.69 (14.9)
DV180M4	120 (1060)	1120 (2658)	1226/1332[2] (2909/3160[2])	40.5 (Δ)	34.8	20.7	3.46 (30.6)	81.0 (ΔΔ)	69.6	41.4	1.73 (15.3)
DV180L4	140 (1237)	1290 (3060)	1396/1502[2] (3313/3564[2])	47.8 (Δ)	42.0	22.7	3.34 (29.5)	95.5 (ΔΔ)	84.1	45.3	1.67 (14.8)
DV200L4	194 (1714)	2340 (5553)	2446/2552[2] (5804/6056[2])	60.0 (Δ)	54.5	24.9	3.56 (31.5)	120 (ΔΔ)	109	49.9	1.78 (15.7)
DV225S4	234 (2068)	3010 (7143)	3116/3222[2] (7394/7645[2])	72.0 (Δ)	66.0	28.7	3.54 (31.3)	144 (ΔΔ)	132	57.3	1.77 (15.6)
DV225M4	284 (2510)	3570 (8472)	3676/3782[2] (8723/8975[2])	88.5 (Δ)	79.5	38.9	3.58 (31.6)	177 (ΔΔ)	159	77.9	1.79 (15.8)

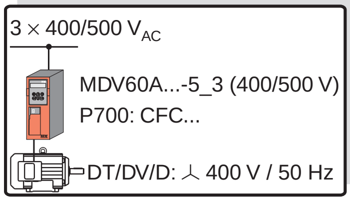
1) Applies in the basic speed range up to n_{base}.

2) Double disk brake

DT/DV/D motor selection with delta/star connection (230/400 V_{AC} / 50 Hz)

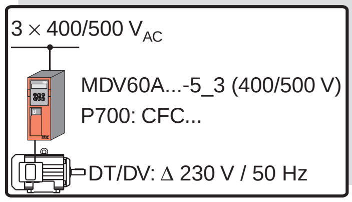
1. Star connection ⅄ 400 V / 50 Hz or 400/690 V / 50 Hz motors in Δ connection:

Motor			MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
⅄ 400 V / 50 Hz			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
DT80N4	M_{max}	[Nm]	9.3													
		([lb.in])	(82)													
	n_{base}	[rpm]	908													
DT90S4	M_{max}	[Nm]	13.5	13.5												
		([lb.in])	(120)	(120)												
	n_{base}	[rpm]	1011	1011												
DT90L4	M_{max}	[Nm]	18.2	18.3	18.3											
		([lb.in])	(161)	(162)	(162)											
	n_{base}	[rpm]	928	1049	1056											
DV100M4	M_{max}	[Nm]		26.8	26.8	26.8										
		([lb.in])		(236)	(236)	(236)										
	n_{base}	[rpm]		940	1043	1056										
DV100L4	M_{max}	[Nm]			36.8	36.8	36.8									
		([lb.in])			(325)	(325)	(325)									
	n_{base}	[rpm]			889	1004	1011									
DV112M4	M_{max}	[Nm]				47.1	48.4	48.4								
		([lb.in])				(416)	(427)	(427)								
	n_{base}	[rpm]				915	1030	1062								
DV132S4	M_{max}	[Nm]					64.4	66.1	66.1							
		([lb.in])					(569)	(584)	(584)							
	n_{base}	[rpm]					992	1132	1196							
DV132M4	M_{max}	[Nm]						81.7	90.2	90.2						
		([lb.in])						(722)	(797)	(797)						
	n_{base}	[rpm]						1011	1145	1152						
DV132ML4	M_{max}	[Nm]							110	110						
		([lb.in])							(972)	(972)						
	n_{base}	[rpm]							1043	1132						
DV160M4	M_{max}	[Nm]							124	131	131					
		([lb.in])							(1096)	(1157)	(1157)					
	n_{base}	[rpm]							986	1132	1196					
DV160L4	M_{max}	[Nm]								163	177	177				
		([lb.in])								(1440)	(1565)	(1565)				
	n_{base}	[rpm]								1043	1248	1312				
DV180M4	M_{max}	[Nm]									217	217	217			
		([lb.in])									(1917)	(1917)	(1917)			
	n_{base}	[rpm]									1164	1395	1465			
DV180L4	M_{max}	[Nm]									230	258	258	258		
		([lb.in])									(2033)	(2280)	(2280)	(2280)		
	n_{base}	[rpm]									1017	1152	1299	1369		
DV200L4	M_{max}	[Nm]										325	351	351	351	
		([lb.in])										(2873)	(3100)	(3100)	(3100)	
	n_{base}	[rpm]										1011	1126	1299	1420	
DV225S4	M_{max}	[Nm]											395	433	433	433
		([lb.in])											(3490)	(3826)	(3826)	(3826)
	n_{base}	[rpm]											947	1030	1164	1312
DV225M4	M_{max}	[Nm]												482	526	526
		([lb.in])												(4260)	(4648)	(4648)
	n_{base}	[rpm]												1030	1100	1299
D250M4	M_{max}	[Nm]													597	640
		([lb.in])													(5276)	(5656)
	n_{base}	[rpm]													1062	1177
D280S4	M_{max}	[Nm]														750
		([lb.in])														(6628)
	n_{base}	[rpm]														1100
D280M4	M_{max}	[Nm]														745
		([lb.in])														(6583)
	n_{base}	[rpm]														1107



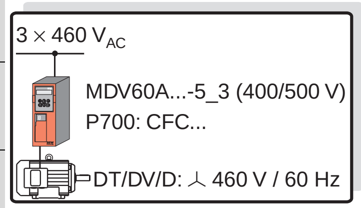
2. Delta connection Δ 230 V / 50 Hz:

Motor Δ 230 V / 50 Hz			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
			MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
DT71D4	M_{max}	[Nm] ([lb.in])	4.6 (40.5)													
	n_{base}	[rpm]	1958													
DT80K4	M_{max}	[Nm] ([lb.in])	6.9 (61)	6.9 (61)												
	n_{base}	[rpm]	1849	1868												
DT80N4	M_{max}	[Nm] ([lb.in])	9.3 (82)	9.3 (82)	9.3 (82)											
	n_{base}	[rpm]	1817	2054	2054											
DT90S4	M_{max}	[Nm] ([lb.in])		13.5 (120)	13.5 (120)	13.5 (120)										
	n_{base}	[rpm]		1971	2246	2304										
DT90L4	M_{max}	[Nm] ([lb.in])			18.3 (162)	18.3 (162)	18.3 (162)									
	n_{base}	[rpm]			1843	2240	2329									
DV100M4	M_{max}	[Nm] ([lb.in])				26.8 (236)	26.8 (236)	26.8 (236)								
	n_{base}	[rpm]				1862	2214	2297								
DV100L4	M_{max}	[Nm] ([lb.in])					36.8 (325)	36.8 (325)	36.8 (325)							
	n_{base}	[rpm]					1779	2080	2188							
DV112M4	M_{max}	[Nm] ([lb.in])						45.5 (402)	48.4 (427)	48.4 (427)						
	n_{base}	[rpm]						1779	2163	2195						
DV132S4	M_{max}	[Nm] ([lb.in])							66.1 (584)	66.1 (584)	66.1 (584)					
	n_{base}	[rpm]							1996	2374	2444					
DV132M4	M_{max}	[Nm] ([lb.in])								90.2 (797)	90.2 (797)					
	n_{base}	[rpm]								1939	2310					
DV132ML4	M_{max}	[Nm] ([lb.in])									110 (972)	110 (972)				
	n_{base}	[rpm]									2105	2246				
DV160M4	M_{max}	[Nm] ([lb.in])									131 (1157)	131 (1157)	131 (1157)			
	n_{base}	[rpm]									1894	2246	2348			
DV160L4	M_{max}	[Nm] ([lb.in])										177 (1565)	177 (1565)	177 (1565)	177 (2496)	
	n_{base}	[rpm]										1881	2208	2451	2496	
DV180M4	M_{max}	[Nm] ([lb.in])											217 (1917)	217 (1917)	217 (1917)	217 (1917)
	n_{base}	[rpm]											1952	2336	2611	2809
DV180L4	M_{max}	[Nm] ([lb.in])												258 (2280)	258 (2280)	258 (2280)
	n_{base}	[rpm]												1836	2131	2457
DV200L4	M_{max}	[Nm] ([lb.in])													329 (2908)	351 (3100)
	n_{base}	[rpm]													1830	2092
DV225S4	M_{max}	[Nm] ([lb.in])														405 (3580)
	n_{base}	[rpm]														1708



DT/DV/D motor selection with the double-star/star connection type (230/460 V_{AC} / 60 Hz)

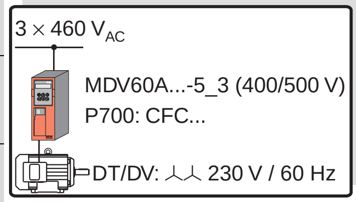
1. Star connection ⅄ 460 V / 60 Hz:



Motor			**MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)**													
⅄ 460 V / 60 Hz			**0015**	**0022**	**0030**	**0040**	**0055**	**0075**	**0110**	**0150**	**0220**	**0300**	**0370**	**0450**	**0550**	**0750**
DT80N4	M_{max}	[Nm]	9.3													
		([lb.in])	(82)													
	n_{base}	[rpm]	1145													
DT90S4	M_{max}	[Nm]	13.5													
		([lb.in])	(120)													
	n_{base}	[rpm]	1312													
DT90L4	M_{max}	[Nm]	18.3	18.3												
		([lb.in])	(162)	(162)												
	n_{base}	[rpm]	1152	1318												
DT100LS4	M_{max}	[Nm]		26.5	27.0											
		([lb.in])		(234)	(238)											
	n_{base}	[rpm]		1100	1222											
DT100L4	M_{max}	[Nm]			28.2	36.8	36.8									
		([lb.in])			(250)	(325)	(325)									
	n_{base}	[rpm]			1171	1075	1120									
DV112M4	M_{max}	[Nm]			35.8	48.4	48.4									
		([lb.in])			(316)	(427)	(427)									
	n_{base}	[rpm]			1196	1139	1312									
DV132S4	M_{max}	[Nm]				48.7	65.1	66.1								
		([lb.in])				(430)	(575)	(584)								
	n_{base}	[rpm]				1068	992	1100								
DV132M4	M_{max}	[Nm]						80.0	90.2							
		([lb.in])						(705)	(797)							
	n_{base}	[rpm]						1088	1222							
DV132ML4	M_{max}	[Nm]							110	110						
		([lb.in])							(972)	(972)						
	n_{base}	[rpm]							1196	1299						
DV160M4	M_{max}	[Nm]							120.3	131	131					
		([lb.in])							(1062)	(1157)	(1157)					
	n_{base}	[rpm]							1132	1260	1318					
DV160L4	M_{max}	[Nm]								161	177					
		([lb.in])								(1422)	(1565)					
	n_{base}	[rpm]								1158	1370					
DV180M4	M_{max}	[Nm]								164	217	217				
		([lb.in])								(1448)	(1917)	(1917)				
	n_{base}	[rpm]								1140	1177	1350				
DV180L4	M_{max}	[Nm]									228	258	258			
		([lb.in])									(2015)	(2280)	(2280)			
	n_{base}	[rpm]									1081	1196	1324			
DV200L4	M_{max}	[Nm]										323	351	351		
		([lb.in])										(2845)	(3100)	(3100)		
	n_{base}	[rpm]										1024	1107	1248		
DV225S4	M_{max}	[Nm]										318	391	433	433	
		([lb.in])										(2815)	(3456)	(3826)	(3826)	
	n_{base}	[rpm]										1100	1075	1145	1286	
DV225M4	M_{max}	[Nm]											401	494	526	526
		([lb.in])											(3542)	(4364)	(4648)	(4648)
	n_{base}	[rpm]											1081	1056	1139	1324
D250M4	M_{max}	[Nm]													570	640
		([lb.in])													(5040)	(5656)
	n_{base}	[rpm]													1300	1395
D280S4	M_{max}	[Nm]														717
		([lb.in])														(6335)
	n_{base}	[rpm]														1345
D280M4	M_{max}	[Nm]														712
		([lb.in])														(6290)
	n_{base}	[rpm]														1337

2. Double-star connection ⅄⅄ 230 V / 60 Hz:

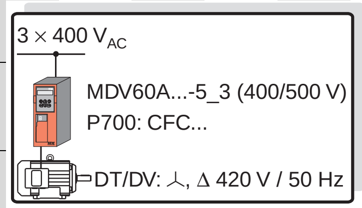
Motor			MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
⅄⅄ 230 V / 60 Hz			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
	M_{max}	[Nm]	4.6													
DT71D4		([lb.in])	(40.5)													
	n_{base}	[rpm]	2988													
	M_{max}	[Nm]	7.0	7.0												
DT80K4		([lb.in])	(62)	(62)												
	n_{base}	[rpm]	2688	2822												
	M_{max}	[Nm]	8.3	9.3	9.3											
DT80N4		([lb.in])	(73)	(82)	(82)											
	n_{base}	[rpm]	2585	2873	2969											
	M_{max}	[Nm]		11.9	13.5	13.5										
DT90S4		([lb.in])		(105)	(120)	(120)										
	n_{base}	[rpm]		2636	2931	3462										
	M_{max}	[Nm]			16.4	18.3	18.3									
DT90L4		([lb.in])			(145)	(162)	(162)									
	n_{base}	[rpm]			2604	3014	3353									
	M_{max}	[Nm]				22.5	27.0	27.0								
DT100LS4		([lb.in])				(200)	(238)	(238)								
	n_{base}	[rpm]				2592	2732	3104								
	M_{max}	[Nm]						32.5	36.8							
DT100L4		([lb.in])						(287)	(325)							
	n_{base}	[rpm]						2592	2912							
	M_{max}	[Nm]						41.4	48.4							
DV112M4		([lb.in])						(365)	(427)							
	n_{base}	[rpm]						2534	2988							
	M_{max}	[Nm]							62.4	66.1						
DV132S4		([lb.in])							(550)	(585)						
	n_{base}	[rpm]							2233	2572						
	M_{max}	[Nm]								80.0	90.2					
DV132M4		([lb.in])								(705)	(797)					
	n_{base}	[rpm]								2348	2707					
	M_{max}	[Nm]									110	110				
DV132ML4		([lb.in])									(972)	(972)				
	n_{base}	[rpm]									2566	2944				
	M_{max}	[Nm]									115	131	131			
DV160M4		([lb.in])									(1015)	(1157)	(1157)			
	n_{base}	[rpm]									2451	2688	2963			
	M_{max}	[Nm]										150	177	177		
DV160L4		([lb.in])										(1325)	(1565)	(1565)		
	n_{base}	[rpm]										2457	2512	2918		
	M_{max}	[Nm]											189	217	217	217
DV180M4		([lb.in])											(1670)	(1917)	(1917)	(1917)
	n_{base}	[rpm]											2355	2457	2771	3040
	M_{max}	[Nm]												220	258	258
DV180L4		([lb.in])												(1943)	(2280)	(2280)
	n_{base}	[rpm]												2284	2291	2720
	M_{max}	[Nm]													281	350
DV200L4		([lb.in])													(2482)	(3092)
	n_{base}	[rpm]													2208	2163
	M_{max}	[Nm]														346
DV225S4		([lb.in])														(3056)
	n_{base}	[rpm]														2291
	M_{max}	[Nm]														354
DV225M4		([lb.in])														(3127)
	n_{base}	[rpm]														2278



DT/DV/D motor selection with the double-star/star or double-delta/delta connection type ($200/400\ V_{AC}$ / 50 Hz)

1. Star connection ⅄ or delta connection Δ 400 V / 50 Hz:

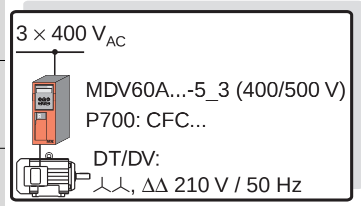
Motor		MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
⅄, Δ 400 V / 50 Hz[1)]		0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
DT80K4	M_{max} [Nm]	6.9													
	([lb.in])	(61)													
	n_{base} [rpm]	748													
DT80N4	M_{max} [Nm]	9.3													
	([lb.in])	(82)													
	n_{base} [rpm]	985													
DT90L4	M_{max} [Nm]	17.2	18.3	18.3											
	([lb.in])	(152)	(162)	(162)											
	n_{base} [rpm]	1011	1120	1145											
DV100M4	M_{max} [Nm]		26.8	26.8	26.8										
	([lb.in])		(236)	(236)	(236)										
	n_{base} [rpm]		940	1043	1056										
DV112M4	M_{max} [Nm]				44.5	48.4	48.4								
	([lb.in])				(393)	(427)	(427)								
	n_{base} [rpm]				992	1088	1145								
DV132S4	M_{max} [Nm]					61.0	66.1	66.1							
	([lb.in])					(540)	(584)	(584)							
	n_{base} [rpm]					1068	1177	1280							
DV132M4	M_{max} [Nm]						77.3	90.2	90.2						
	([lb.in])						(683)	(797)	(797)						
	n_{base} [rpm]						1088	1210	1228						
DV160M4	M_{max} [Nm]							118	131	131					
	([lb.in])							(1042)	(1157)	(1157)					
	n_{base} [rpm]							1056	1177	1273					
DV160L4	M_{max} [Nm]								154	177	177				
	([lb.in])								(1363)	(1565)	(1565)				
	n_{base} [rpm]								1113	1292	1401				
DV180M4	M_{max} [Nm]									217	217	217			
	([lb.in])									(1917)	(1917)	(1917)			
	n_{base} [rpm]									1177	1440	1561			
DV180L4	M_{max} [Nm]									218	258	258	258		
	([lb.in])									(1930)	(2280)	(2280)	(2280)		
	n_{base} [rpm]									1088	1177	1344	1452		
DV200L4	M_{max} [Nm]										308	351	351	351	
	([lb.in])										(2730)	(3100)	(3100)	(3100)	
	n_{base} [rpm]										1075	1139	1331	1472	
DV225S4	M_{max} [Nm]											374	433	433	433
	([lb.in])											(3307)	(3826)	(3826)	(3826)
	n_{base} [rpm]											1004	1043	1190	1363
DV225M4	M_{max} [Nm]												456	526	526
	([lb.in])												(4037)	(4648)	(4648)
	n_{base} [rpm]												1094	1113	1324



1) The values also apply to 400 V / 60 Hz and 440 V / 60 Hz.

2. Double-star connection ⅄⅄ or double-delta ΔΔ 200 V / 50 Hz:

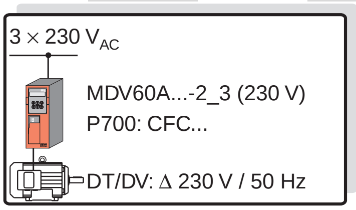
Motor		MOVIDRIVE® MDV60A...-5_3 (400/500 V units) in CFC operating modes (P700)													
⅄⅄, ΔΔ 200 V / 50 Hz[1]		0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
DT80K4	M_{max} [Nm] ([lb.in])	6.9 (61)	6.9 (61)												
	n_{base} [rpm]	2035	2112												
DT80N4	M_{max} [Nm] ([lb.in])		9.3 (82)	9.3 (82)	9.3 (82)										
	n_{base} [rpm]		2483	2624	2624										
DT90L4	M_{max} [Nm] ([lb.in])				18.3 (162)	18.3 (162)	18.3 (162)								
	n_{base} [rpm]				2521	2924	2963								
DV100M4	M_{max} [Nm] ([lb.in])				24.4 (215)	26.8 (236)	26.8 (236)								
	n_{base} [rpm]				2124	2419	2732								
DV112M4	M_{max} [Nm] ([lb.in])							48.4 (427)	48.4 (427)						
	n_{base} [rpm]							2457	2796						
DV132S4	M_{max} [Nm] ([lb.in])							58.3 (515)	66.1 (585)	66.1 (585)					
	n_{base} [rpm]							2355	2656	3052					
DV132M4	M_{max} [Nm] ([lb.in])								77.3 (683)	90.2 (797)	90.2 (797)				
	n_{base} [rpm]								2361	2688	2886				
DV160M4	M_{max} [Nm] ([lb.in])									112 (995)	131 (1157)	131 (1157)	131 (1157)		
	n_{base} [rpm]									2265	2470	2784	2918		
DV160L4	M_{max} [Nm] ([lb.in])											177 (1565)	177 (1565)	177 (1565)	177 (1565)
	n_{base} [rpm]											2316	2726	2995	3084
DV180M4	M_{max} [Nm] ([lb.in])												217 (1917)	217 (1917)	217 (1917)
	n_{base} [rpm]												2406	2803	3251
DV180L4	M_{max} [Nm] ([lb.in])													252 (2233)	258 (2280)
	n_{base} [rpm]													2240	2662
DV200L4	M_{max} [Nm] ([lb.in])														336 (2975)
	n_{base} [rpm]														2233
DV225S4	M_{max} [Nm] ([lb.in])														330 (2917)
	n_{base} [rpm]														2112



1) The values also apply to 200 V / 60 Hz and 220 V / 60 Hz.

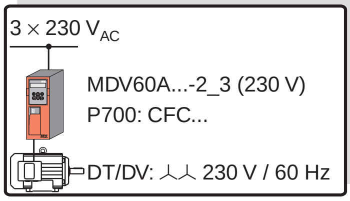
DT/DV motor selection with delta connection (230 V_{AC} / 50 Hz)

Motor			MOVIDRIVE® MDV60A...-2_3 (230 V units) in CFC operating modes (P700)								
Δ 230 V / 50 Hz			0015	0022	0037	0055	0075	0110	0150	0220	0300
DT80K4	M_{max}	[Nm]	6.9								
		([lb.in])	(61)								
	n_{base}	[rpm]	812								
DT80N4	M_{max}	[Nm]	9.3								
		([lb.in])	(82)								
	n_{base}	[rpm]	908								
DT90S4	M_{max}	[Nm]	13.5	13.5							
		([lb.in])	(120)	(120)							
	n_{base}	[rpm]	1011	1011							
DT90L4	M_{max}	[Nm]	18.3	18.3	18.3						
		([lb.in])	(162)	(162)	(162)						
	n_{base}	[rpm]	953	1024	1056						
DV100M4	M_{max}	[Nm]		25.5	26.8						
		([lb.in])		(225)	(236)						
	n_{base}	[rpm]		921	1056						
DV100L4	M_{max}	[Nm]			36.8	36.8					
		([lb.in])			(325)	(325)					
	n_{base}	[rpm]			972	1011					
DV112M4	M_{max}	[Nm]				48.4	48.4				
		([lb.in])				(427)	(427)				
	n_{base}	[rpm]				1036	1062				
DV132S4	M_{max}	[Nm]				65.3	66.1	66.1			
		([lb.in])				(577)	(584)	(584)			
	n_{base}	[rpm]				992	1152	1196			
DV132M4	M_{max}	[Nm]					85.4	90.2	90.2		
		([lb.in])					(755)	(797)	(797)		
	n_{base}	[rpm]					998	1152	1152		
DV132ML4	M_{max}	[Nm]						110	110	110	
		([lb.in])						(972)	(972)	(972)	
	n_{base}	[rpm]						1050	1132	1132	
DV160M4	M_{max}	[Nm]						126	131	131	
		([lb.in])						(1110)	(1157)	(1157)	
	n_{base}	[rpm]						980	1120	1196	
DV160L4	M_{max}	[Nm]							158	177	177
		([lb.in])							(1395)	(1565)	(1565)
	n_{base}	[rpm]							1050	1248	1312
DV180M4	M_{max}	[Nm]								217	217
		([lb.in])								(1917)	(1917)
	n_{base}	[rpm]								1165	1325
DV180L4	M_{max}	[Nm]								231	258
		([lb.in])								(2042)	(2280)
	n_{base}	[rpm]								1017	1068
DV200L4	M_{max}	[Nm]									295
		([lb.in])									(2605)
	n_{base}	[rpm]									1025



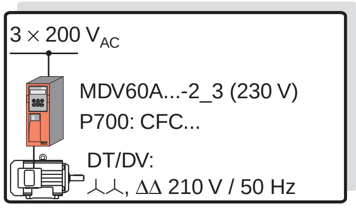
DT/DV motor selection with double-star connection (230 V_{AC} / 60 Hz)

Motor			**MOVIDRIVE® MDV60A...-2_3 (230 V units) in CFC operating modes (P700)**								
⅄⅄ 230 V / 60 Hz			**0015**	**0022**	**0037**	**0055**	**0075**	**0110**	**0150**	**0220**	**0300**
DT80K4	M_{max}	[Nm]	7.0								
		([lb.in])	(62)								
	n_{base}	[rpm]	1100								
DT80N4	M_{max}	[Nm]	9.3								
		([lb.in])	(82)								
	n_{base}	[rpm]	1145								
DT90S4	M_{max}	[Nm]	13.5	13.5							
		([lb.in])	(120)	(120)							
	n_{base}	[rpm]	1267	1337							
DT90L4	M_{max}	[Nm]	17.2	18.3	18.3						
		([lb.in])	(152)	(162)	(162)						
	n_{base}	[rpm]	1145	1210	1325						
DT100LS4	M_{max}	[Nm]		20.1	27.0						
		([lb.in])		(178)	(238)						
	n_{base}	[rpm]		1190	1228						
DT100L4	M_{max}	[Nm]			29.2	36.8	36.8				
		([lb.in])			(258)	(325)	(325)				
	n_{base}	[rpm]			1158	1113	1120				
DV112M4	M_{max}	[Nm]			37.2	48.4	48.4				
		([lb.in])			(328)	(427)	(427)				
	n_{base}	[rpm]			1190	1248	1337				
DV132S4	M_{max}	[Nm]				57.0	66.1	66.1			
		([lb.in])				(504)	(585)	(585)			
	n_{base}	[rpm]				1030	1062	1120			
DV132M4	M_{max}	[Nm]					71.7	90.2	90.2		
		([lb.in])					(633)	(797)	(797)		
	n_{base}	[rpm]					1113	1165	1222		
DV132ML4	M_{max}	[Nm]						109	110		
		([lb.in])						(970)	(972)		
	n_{base}	[rpm]						1100	1260		
DV160M4	M_{max}	[Nm]						104	131	131	
		([lb.in])						(920)	(1157)	(1157)	
	n_{base}	[rpm]						1165	1145	1318	
DV160L4	M_{max}	[Nm]							133	177	177
		([lb.in])							(1178)	(1565)	(1565)
	n_{base}	[rpm]							1190	1267	1395
DV180M4	M_{max}	[Nm]								208	217
		([lb.in])								(1840)	(1917)
	n_{base}	[rpm]								1100	1203
DV180L4	M_{max}	[Nm]									236
		([lb.in])									(2087)
	n_{base}	[rpm]									1075
DV200L4	M_{max}	[Nm]								210	253
		([lb.in])								(1860)	(2235)
	n_{base}	[rpm]								1080	1062



DT/DV motor selection with double-star or double-delta connection (200 V_{AC} / 50 Hz)

Motor			MOVIDRIVE® MDV60A...-2_3 (230 V units) in CFC operating modes (P700)								
⅄⅄, ΔΔ 200 V / 50 Hz[1]			0015	0022	0037	0055	0075	0110	0150	0220	0300
	M_{max}	[Nm]	6.9								
DT80K4		([lb.in])	(61)								
	n_{base}	[rpm]	748								
	M_{max}	[Nm]	9.3								
DT80N4		([lb.in])	(82)								
	n_{base}	[rpm]	985								
	M_{max}	[Nm]	15.5	18.3	18.3						
DT90L4		([lb.in])	(137)	(162)	(162)						
	n_{base}	[rpm]	1049	998	1145						
	M_{max}	[Nm]			26.8	26.8					
DV100M4		([lb.in])			(236)	(236)					
	n_{base}	[rpm]			1050	1056					
	M_{max}	[Nm]				48.4	48.4	48.4			
DV112M4		([lb.in])				(427)	(427)	(427)			
	n_{base}	[rpm]				1017	1132	1145			
	M_{max}	[Nm]					66.1	66.1			
DV132S4		([lb.in])					(585)	(585)			
	n_{base}	[rpm]					1107	1280			
	M_{max}	[Nm]						90.2	90.2	90.2	
DV132M4		([lb.in])						(797)	(797)	(797)	
	n_{base}	[rpm]						1139	1228	1228	
	M_{max}	[Nm]							131	131	
DV160M4		([lb.in])							(1157)	(1157)	
	n_{base}	[rpm]							1050	1273	
	M_{max}	[Nm]								177	177
DV160L4		([lb.in])								(1565)	(1565)
	n_{base}	[rpm]								1177	1312
	M_{max}	[Nm]								195	217
DV180M4		([lb.in])								(1723)	(1917)
	n_{base}	[rpm]								1145	1216
	M_{max}	[Nm]									226
DV180L4		([lb.in])									(2000)
	n_{base}	[rpm]									1080



1) The values also apply to 200 V / 60 Hz and 220 V / 60 Hz.

5.6 Motor selection for synchronous servomotors (SERVO)

The torque limit (M limit) is set automatically by the startup function of the MOVITOOLS software package. Do not alter this automatically-set value!

We recommend always using the latest version of MOVITOOLS (2.70 or later) for startup. The latest MOVITOOLS version can be downloaded from our homepage (www.sew-eurodrive.de).

Motor characteristics

The requirements made of a servo drive include speed dynamics, stable speed and positioning accuracy. CM/DFS/DFY motors with MOVIDRIVE® meet these requirements.

Technically speaking, these are synchronous motors with permanent magnets on the rotor and an integrated resolver. The required characteristics, namely a constant torque over a wide speed range (up to 4500 rpm), a high speed and control range (up to 1:3000) and a high overload capacity ($3 \times M_0$), are achieved using control by MOVIDRIVE®. The servomotor has a lower mass moment of inertia than the asynchronous motor. This means it is optimally suited to applications requiring dynamic speeds.

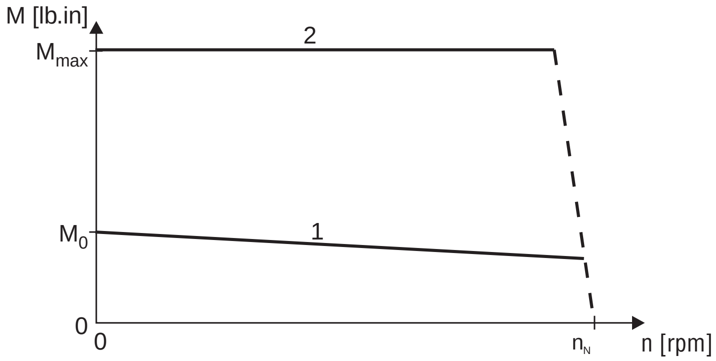


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Fig. 84: Speed/torque characteristic curve of the DFY servomotor

1 Continuous torque

2 Maximum torque

M_0 is determined by the motor. M_{max} is $3 \times M_0$ of the motor. The attainable M_{max} may also be less, depending on the inverter.

Refer to the motor table (CM → page 195, DFS/DFY → page 198) for the values for M_0.

Refer to the motor selection tables (CM → page 196, DFS/DFY → page 199) for the values for M_{max}.

Basic recommendations

SERVO operating modes are only possible with SEW motors (CM/DFS/DFY), not with non-SEW motors. The necessary motor data for the SERVO operating modes are stored in MOVIDRIVE® for the SEW motors.

Speed is the correcting variable in the SERVO modes with speed control. Torque is the correcting variable in the SERVO modes with torque control (SERVO & M-CONTROL).

SERVO mode with speed control

There is no reason to differentiate between quadratic, dynamic and static load types when configuring a system for SERVO mode. Project planning for a synchronous motor is undertaken in accordance with the following requirements:

1. Effective torque demand at the average speed of the application.

   $M_{r.m.s.} < M_{n\_mot}$

   The point must lie below the characteristic curve for the continuous torque (Fig. 84, curve 1). The continuous torque of the DFY series can be increased by 60 % by forced-cooling if this operating point lies above the characteristic curve for self-cooling.

2. Maximum torque required across the speed characteristic.

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

   This operating point must lie below the characteristic curve for the maximum torque of the motor-MOVIDRIVE® combination (Fig. 84, 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.

   $n_{max} \leq n_N$

SERVO mode with torque control (SERVO & M-CONTROL)

This operating mode allows the torque of the servomotor to be controlled directly. The setpoint sources of the speed controlled SERVO mode can also be used for torque control. All speed setpoint sources are interpreted as current setpoint sources. The settings for evaluating the analog input (→ P11_, parameter description) also remain in effect. The fixed setpoints (P16_, P17_) can be entered either in the unit [rpm] or [%$I_{N\_inverter}$] (→ MOVITOOLS).

The following relationship applies between the units:

3000 rpm = 150 % inverter rated current

You can calculate the torque at the output shaft of the servomotor using the following formula:

$$M = \frac{M_0}{I_0} \times \frac{150\% \times I_{n\_inverter} \times n_{setp}}{3000\ rpm}$$

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M_0	Continuous static torque according to the motor table DFS/DFY (→ page 198)
I_0	Continuous static current according to the motor table DFS/DFY (→ page 198)

Motor table CM

Additional project planning notes and information about the type CM synchronous servomotors can be found in the "Geared Servo Motors" catalog. This can be ordered from SEW.

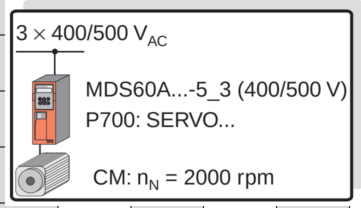
Characteristic values at V_{max} = 400 V_{AC}

n_N [rpm]	Motor	Without forced-cooling fan M_0 [Nm (lb.in)]	I_0 [A]	I_{max} [A]	Mass moment of inertia J_M Without brake [10^{-4} kgm^2 (10^{-3} lb.ft^2)]	With brake
2000	**CM71S**	5.0 (44)	2.2	8.8	4.85 (11.4)	6.89 (16.2)
	CM71M	6.5 (57)	3.0	12.0	6.27 (14.7)	8.31 (19.5)
	CM71L	9.5 (84)	4.2	16.8	9.1 (21.4)	11.1 (26.1)
	CM90S	11.0 (97)	4.9	20.0	14.3 (33.6)	19.8 (46.5)
	CM90M	14.5 (128)	6.7	27.0	18.6 (43.7)	24.1 (56.7)
	CM90L	21.0 (185)	9.4	38.0	27.1 (63.7)	32.6 (76.7)
	CM112S	23.5 (207)	9.5	38.0	67.4 (159)	87.5 (206)
	CM112M	31.0 (274)	12.7	51.0	87.4 (206)	108 (254)
	CM112L	47.0 (415)	19.1	76.0	128 (301)	148 (348)
3000	**CM71S**	5.0 (44)	3.3	13.2	4.85 (11.4)	6.89 (16.2)
	CM71M	6.5 (57)	4.4	17.6	6.27 (14.7)	8.31 (19.5)
	CM71L	9.5 (84)	6.3	25.0	9.1 (21.4)	11.1 (26.1)
	CM90S	11.0 (97)	7.4	30.0	14.3 (33.6)	19.8 (46.5)
	CM90M	14.5 (128)	9.9	40.0	18.6 (43.7)	24.1 (56.7)
	CM90L	21.0 (185)	13.8	55.0	27.1 (63.7)	32.6 (76.7)
	CM112S	23.5 (207)	14.3	57.0	67.4 (159)	87.5 (206)
	CM112M	31.0 (274)	19.6	78.0	87.4 (206)	108 (254)
	CM112L	47.0 (415)	28.7	115	128 (301)	148 (348)
4500	**CM71S**	5.0 (44)	5.1	20.5	4.85 (11.4)	6.89 (16.2)
	CM71M	6.5 (57)	6.8	27.0	6.27 (14.7)	8.31 (19.5)
	CM71L	9.5 (84)	9.8	39.0	9.1 (21.4)	11.1 (26.1)
	CM90S	11.0 (97)	11.2	45.0	14.3 (33.6)	19.8 (46.5)
	CM90M	14.5 (128)	14.5	58.0	18.6 (43.7)	24.1 (56.7)
	CM90L	21.0 (185)	20.7	83.0	27.1 (63.7)	32.6 (76.7)
	CM112S	23.5 (207)	21.4	86.0	67.4 (159)	87.5 (206)
	CM112M	31.0 (274)	28.3	113	87.4 (206)	108 (254)
	CM112L	47.0 (415)	44.0	176	128 (301)	148 (348)

CM motor selection

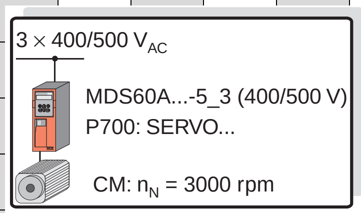
1. Rated speed n_N = 2000 rpm:

Motor			MOVIDRIVE® MDS60A...-5_3 (400/500 V units) in SERVO operating modes (P700)													
			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
CM71S	M_{max}	[Nm] ([lb.in])	13.0 (115)	16.0 (141)	16.5 (145)											
CM71M	M_{max}	[Nm] ([lb.in])	13.0 (115)	16.9 (149)	19.8 (175)	21.5 (190)										
CM71L	M_{max}	[Nm] ([lb.in])		18.5 (163)	22.8 (201)	28.5 (252)	31.4 (278)									
CM90S	M_{max}	[Nm] ([lb.in])		18.5 (163)	23.3 (206)	30.8 (272)	38.0 (336)	39.6 (350)								
CM90M	M_{max}	[Nm] ([lb.in])			22.5 (199)	30.5 (269)	39.2 (346)	47.9 (423)	52.2 (461)							
CM90L	M_{max}	[Nm] ([lb.in])				31.9 (282)	41.4 (366)	52.5 (464)	72.5 (640)	75.6 (668)						
CM112S	M_{max}	[Nm] ([lb.in])				35.3 (312)	45.8 (405)	57.3 (506)	77.6 (686)	81.1 (717)						
CM112M	M_{max}	[Nm] ([lb.in])					45.9 (405)	58.3 (515)	84.3 (745)	102.3 (904)	107.0 (945)					
CM112L	M_{max}	[Nm] ([lb.in])							87.4 (772)	112.8 (997)	150.4 (1329)	161.2 (1425)				



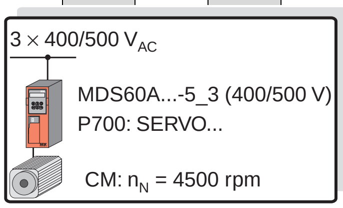
2. Rated speed n_N = 3000 rpm:

Motor			MOVIDRIVE® MDS60A...-5_3 (400/500 V units) in SERVO operating modes (P700)													
			0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450	0550	0750
CM71S	M_{max}	[Nm] ([lb.in])	9.0 (80)	11.9 (105)	14.3 (126)	16.5 (145)	16.5 (145)									
CM71M	M_{max}	[Nm] ([lb.in])		12.2 (107)	14.8 (130)	18.9 (167)	21.5 (190)	21.5 (190)								
CM71L	M_{max}	[Nm] ([lb.in])			15.8 (140)	20.6 (182)	26.1 (230)	30.5 (270)	31.4 (278)							
CM90S	M_{max}	[Nm] ([lb.in])				21.2 (187)	27.0 (238)	33.6 (297)	39.6 (350)							
CM90M	M_{max}	[Nm] ([lb.in])					27.4 (242)	34.4 (304)	48.1 (425)	52.2 (461)						
CM90L	M_{max}	[Nm] ([lb.in])						36.5 (322)	53.1 (469)	67.6 (597)	75.0 (663)					
CM112S	M_{max}	[Nm] ([lb.in])						39.0 (344)	56.6 (500)	71.7 (633)	80.6 (712)					
CM112M	M_{max}	[Nm] ([lb.in])							55.8 (493)	72.9 (644)	98.0 (866)	106.3 (940)				
CM112L	M_{max}	[Nm] ([lb.in])								77.6 (686)	109.0 (963)	137.2 (1213)	157.5 (1392)	162.6 (1437)		



3. Rated speed n_N = 4500 rpm:

Motor			MOVIDRIVE® MDS60A...-5_3 (400/500 V units) in SERVO operating modes (P700)													
			0015	**0022**	**0030**	**0040**	**0055**	**0075**	**0110**	**0150**	**0220**	**0300**	**0370**	**0450**	**0550**	**0750**
CM71S	M_{max}	[Nm] ([lb.in])		8.0 (70)	10.0 (88)	13.0 (115)	15.7 (138)	16.5 (145)								
CM71M	M_{max}	[Nm] ([lb.in])			9.9 (87)	13.3 (117)	16.7 (147)	19.8 (175)	21.5 (190)							
CM71L	M_{max}	[Nm] ([lb.in])					18.1 (160)	22.1 (195)	29.8 (263)	31.4 (277)						
CM90S	M_{max}	[Nm] ([lb.in])					18.4 (162)	23.1 (204)	33.6 (297)	39.6 (350)	39.6 (350)					
CM90M	M_{max}	[Nm] ([lb.in])						24.1 (213)	34.9 (308)	45.2 (400)	52.2 (461)					
CM90L	M_{max}	[Nm] ([lb.in])							36.5 (322)	47.9 (423)	65.5 (580)	75.6 (668)	75.6 (668)			
CM112S	M_{max}	[Nm] ([lb.in])							39.2 (346)	51.2 (452)	70.0 (618)	81.1 (716)	81.1 (716)			
CM112M	M_{max}	[Nm] ([lb.in])								52.7 (465)	73.5 (650)	90.5 (800)	104.2 (921)	107.0 (945)		
CM112L	M_{max}	[Nm] ([lb.in])									73.8 (652)	94.0 (830)	112.8 (997)	133.0 (1175)	150.4 (1330)	162.2 (1434)



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Motor table DFS/DFY

Additional project planning notes and information about the type DFS/DFY synchronous servomotors can be found in the "Geared Servo Motors" catalog. This can be ordered from SEW.

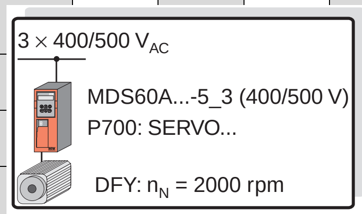
Characteristic values at V_{max} = 400 V_{AC}

n_N [rpm]	Motor	Without forced-cooling fan M_0 [Nm (lb.in)]	Without forced-cooling fan I_0 [A]	With forced-cooling fan VY M_{0_VY} [Nm (lb.in)]	With forced-cooling fan VY I_{0_VY} [A]	I_{max} [A]	Mass moment of inertia J_M Without brake [10^{-4} kgm² (10^{-3} lb.ft²)]	Mass moment of inertia J_M With brake [10^{-4} kgm² (10^{-3} lb.ft²)]
2000	DFY71S	2.5 (22)	1.25	4.0 (35)	2.0	3.75	3.42 (8.12)	5.46 (13.0)
	DFY71M	3.7 (33)	1.8	5.9 (52)	2.9	5.4	4.85 (11.5)	6.89 (16.3)
	DFY71ML	5.0 (44)	2.5	8.0 (71)	4.0	7.5	6.27 (14.9)	8.31 (19.7)
	DFY71L	7.5 (66)	3.7	12 (106)	5.9	11.1	9.1 (21.6)	11.1 (26.3)
	DFY90S	9.0 (80)	4.0	14.4 (127)	6.4	12	14.3 (34.0)	19.8 (47.0)
	DFY90M	12 (106)	5.3	19.2 (170)	8.5	15.9	18.6 (44.1)	24.1 (57.2)
	DFY90L	18 (159)	8.0	28.9 (255)	12.9	24	27.1 (64.3)	32.6 (77.4)
	DFY112S	12 (106)	5.5	19.2 (170)	8.8	16.5	47.2 (112)	67.4 (160)
	DFY112M	17.5 (155)	8.0	28 (248)	12.8	24	67.4 (160)	87.5 (208)
	DFY112ML	24 (212)	11	38.5 (340)	17.6	33	87.4 (207)	108 (256)
	DFY112L	35 (309)	16	56 (495)	25.5	48	128 (304)	148 (351)
3000	DFS56M	1.0 (8.8)	1.55	-	-	4.65	0.47 (1.12)	0.85 (2.02)
	DFS56L	2.0 (18)	2.22	-	-	6.66	0.82 (1.95)	1.2 (2.85)
	DFY71S	2.5 (22)	1.85	4.0 (35)	3.0	5.55	3.42 (8.12)	5.46 (13.0)
	DFY71M	3.7 (33)	2.7	5.9 (52)	4.3	8.1	4.85 (11.5)	6.89 (16.3)
	DFY71ML	5.0 (44)	3.8	8.0 (71)	6.1	11.4	6.27 (14.9)	8.31 (19.7)
	DFY71L	7.5 (66)	5.5	12 (106)	8.8	16.5	9.1 (21.6)	11.1 (26.3)
	DFY90S	9.0 (80)	5.9	14.4 (127)	9.4	17.7	14.3 (34.0)	19.8 (47.0)
	DFY90M	12 (106)	7.9	19.2 (170)	12.6	23.7	18.6 (44.1)	24.1 (57.2)
	DFY90L	18 (159)	12	29 (256)	19.7	36	27.1 (64.3)	32.6 (77.4)
	DFY112S	12 (106)	8.0	19.2 (170)	12.8	24	47.2 (112)	67.4 (160)
	DFY112M	17.5 (155)	12	28 (248)	19.2	36	67.4 (160)	87.5 (208)
	DFY112ML	24 (212)	16.5	38.5 (340)	26.5	49.5	87.4 (207)	108 (256)
	DFY112L	35 (309)	24	56 (495)	38	72	128 (304)	148 (351)
4500	DFS56M	1.0 (8.8)	1.55	-	-	4.65	0.47 (1.12)	0.85 (2.02)
	DFS56L	2.0 (18)	2.22	-	-	6.66	0.82 (1.95)	1.2 (2.85)
	DFY71S	2.5 (22)	2.8	4.0 (35)	4.5	8.4	3.42 (8.12)	5.46 (13.0)
	DFY71M	3.7 (33)	4.1	5.9 (52)	6.6	12.3	4.85 (11.5)	6.89 (16.3)
	DFY71ML	5.0 (44)	5.8	8.0 (71)	9.3	17.4	6.27 (14.9)	8.31 (19.7)
	DFY71L	7.5 (66)	8.2	12 (106)	13.1	24.6	9.1 (21.6)	11.1 (26.3)
	DFY90S	9.0 (80)	9.0	14.4 (127)	14.4	27	14.3 (34.0)	19.8 (47.0)
	DFY90M	12 (106)	11.6	19.2 (170)	18.6	34.8	18.6 (44.1)	24.1 (57.2)
	DFY90L	18 (159)	18	29 (256)	29	54	27.1 (64.3)	32.6 (77.4)
	DFY112S	12 (106)	11.7	19.2 (170)	18.7	35.1	47.2 (112)	67.4 (160)
	DFY112M	17.5 (155)	18	28 (248)	28.8	54	67.4 (160)	87.5 (208)
	DFY112ML	24 (212)	24.5	38.5 (340)	39.2	73.5	87.4 (207)	108 (256)
	DFY112L	35 (309)	36.5	56 (495)	58.4	109	128 (304)	148 (351)

DFS/DFY motor selection

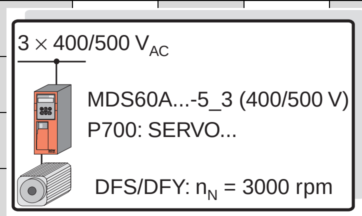
1. *Rated speed n_N = 2000 rpm:*

Motor		MOVIDRIVE® MDS60A...-5_3 (400/500 V units) in SERVO operating modes (P700)										
		0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370
DFY71S	M_{max} [Nm] ([lb.in])	7.5 (66.3)										
DFY71M	M_{max} [Nm] ([lb.in])	11.1 (98.1)										
DFY71ML	M_{max} [Nm] ([lb.in])	12.0 (106)	15.0 (133)									
DFY71L	M_{max} [Nm] ([lb.in])	12.2 (108)	16.7 (148)	21.3 (188)	22.5 (199)							
DFY90S	M_{max} [Nm] ([lb.in])	13.5 (119)	18.6 (164)	23.6 (209)	27.0 (238)							
DFY90M	M_{max} [Nm] ([lb.in])		18.7 (165)	23.7 (210)	32.2 (285)	36.0 (318)						
DFY90L	M_{max} [Nm] ([lb.in])				32.1 (284)	42.2 (373)	54.0 (477)					
DFY112S	M_{max} [Nm] ([lb.in])		18.0 (159)	22.9 (202)	31.1 (275)	36.0 (318)						
DFY112M	M_{max} [Nm] ([lb.in])				31.2 (276)	41.0 (362)	52.5 (464)					
DFY112ML	M_{max} [Nm] ([lb.in])					40.9 (362)	52.3 (462)	72.0 (636)				
DFY112L	M_{max} [Nm] ([lb.in])						52.5 (464)	78.8 (697)	105 (928)			



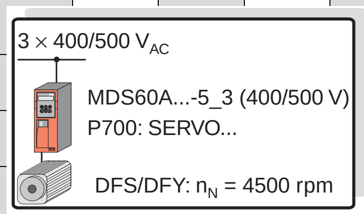
2. *Rated speed n_N = 3000 rpm:*

Motor		MOVIDRIVE® MDS60A...-5_3 (400/500 V units) in SERVO operating modes (P700)										
		0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370
DFS56M	M_{max} [Nm] ([lb.in])	3.0 (26.5)										
DFS56L	M_{max} [Nm] ([lb.in])	5.0 (44.2)	6.0 (53.2)									
DFY71S	M_{max} [Nm] ([lb.in])	7.5 (66.4)										
DFY71M	M_{max} [Nm] ([lb.in])	8.2 (72.7)	11.1 (97.9)									
DFY71ML	M_{max} [Nm] ([lb.in])	7.9 (69.8)	10.9 (96.0)	13.8 (122)	15.0 (133)							
DFY71L	M_{max} [Nm] ([lb.in])		11.2 (99.4)	14.3 (127)	19.4 (172)	22.5 (199)						
DFY90S	M_{max} [Nm] ([lb.in])			16.0 (142)	21.7 (192)	27.0 (238)						
DFY90M	M_{max} [Nm] ([lb.in])				21.6 (191)	28.5 (252)	36.0 (318)					
DFY90L	M_{max} [Nm] ([lb.in])					28.1 (249)	36.0 (318)	54.0 (477)				
DFY112S	M_{max} [Nm] ([lb.in])				21.4 (189)	28.1 (249)	36.0 (318)					
DFY112M	M_{max} [Nm] ([lb.in])					27.3 (242)	35.0 (309)	52.5 (464)				
DFY112ML	M_{max} [Nm] ([lb.in])							52.4 (463)	69.8 (617)	72.3 (639)		
DFY112L	M_{max} [Nm] ([lb.in])							52.4 (463)	70.0 (619)	100 (890)	105 (928)	



3. Rated speed n_N = 4500 rpm:

Motor		MOVIDRIVE® MDS50A...-5_3 (400/500 V units) in SERVO operating modes (P700)										
		0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370
DFS56M	M_{max} [Nm] ([lb.in])	3.0 (26.5)										
DFS56L	M_{max} [Nm] ([lb.in])	5.0 (44.2)	6.0 (53.2)									
DFY71S	M_{max} [Nm] ([lb.in])	5.4 (47.4)	7.4 (65.1)	7.5 (66.3)								
DFY71M	M_{max} [Nm] ([lb.in])		7.4 (65.8)	9.5 (83.8)	11.1 (97.8)							
DFY71ML	M_{max} [Nm] ([lb.in])			9.1 (80.0)	12.3 (109)	15.0 (132)						
DFY71L	M_{max} [Nm] ([lb.in])				13.0 (115)	17.1 (152)	22.0 (194)	22.5 (199)				
DFY90S	M_{max} [Nm] ([lb.in])				14.3 (126)	18.8 (166)	24.0 (212)	27.0 (238)				
DFY90M	M_{max} [Nm] ([lb.in])					19.4 (171)	24.8 (219)	36.0 (318)				
DFY90L	M_{max} [Nm] ([lb.in])							36.0 (318)	48.0 (424)	53.8 (576)		
DFY112S	M_{max} [Nm] ([lb.in])					19.2 (170)	24.6 (218)	36.0 (318)				
DFY112M	M_{max} [Nm] ([lb.in])							35.0 (309)	46.7 (413)	52.3 (463)		
DFY112ML	M_{max} [Nm] ([lb.in])								47.0 (416)	67.6 (598)	71.7 (634)	
DFY112L	M_{max} [Nm] ([lb.in])									66.2 (585)	86.3 (763)	105 (928)



5.7 Overload capacity of the inverter

Continuous output current

MOVIDRIVE® drive inverters permanently calculate the load on the inverter output stage (unit utilization). Consequently, they enable the maximum possible power to be produced in each operating status. The permitted continuous output current depends on the ambient temperature, heat sink temperature, supply voltage and PWM frequency.

If "P860/P861 PWM frequency 1/2" > 4 kHz is set in VFC mode and "P862/P863 PWM fix 1/2" is set to off, the inverter automatically reduces the PWM frequency in the event of a unit overload. The inverter reacts to a higher than permitted load with the "F44 Unit utilization" fault message and immediate switch-off.

Overload capacity

Overload capacity at rated data $\vartheta \leq 40$ °C and $V_{in} \leq 400$ V_{AC}:

Operating mode	Cycle frequency	Continuous output current	Peak output current
VFC (MDF and MDV)	4 kHz	125 % I_N	150 % I_N
CFC (MDV) and SERVO (MDS)	Fixed at 8 kHz	100 % I_N	150 % I_N

Temperature/time characteristic

The following diagrams show the thermal changes in the units over time and the permitted output currents at V_{in} = 400 V and V_{in} = 500 V with various ambient temperatures:

ϑ_{amb} = 40 °C

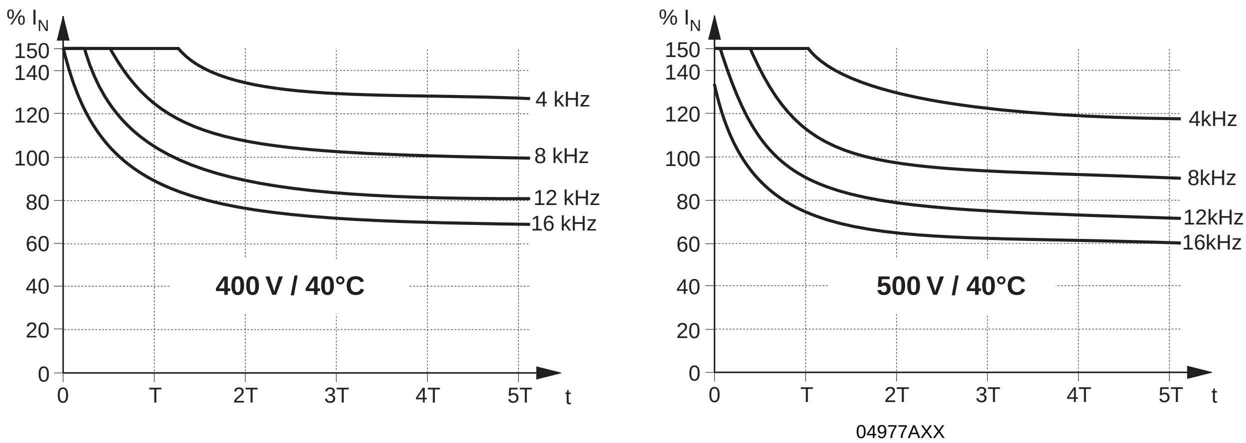


Fig. 85: Overload capacity at ϑ_{amb} = 40 °C

% I_N	= Inverter output current as percentage of rated output current
t	= Load duration
Size 1: T	= 3.5 min
Size 2: T	= 5 min
Size 3: T	= 4 min
Size 4: T	= 9 min
Size 5: T	= 5 min

STOP

The 230 V units (...-2_3) have the same overload behavior as the 400/500 V units (...-5_3) at V_{in} = 400 V.

ϑ_{amb} = 25 °C

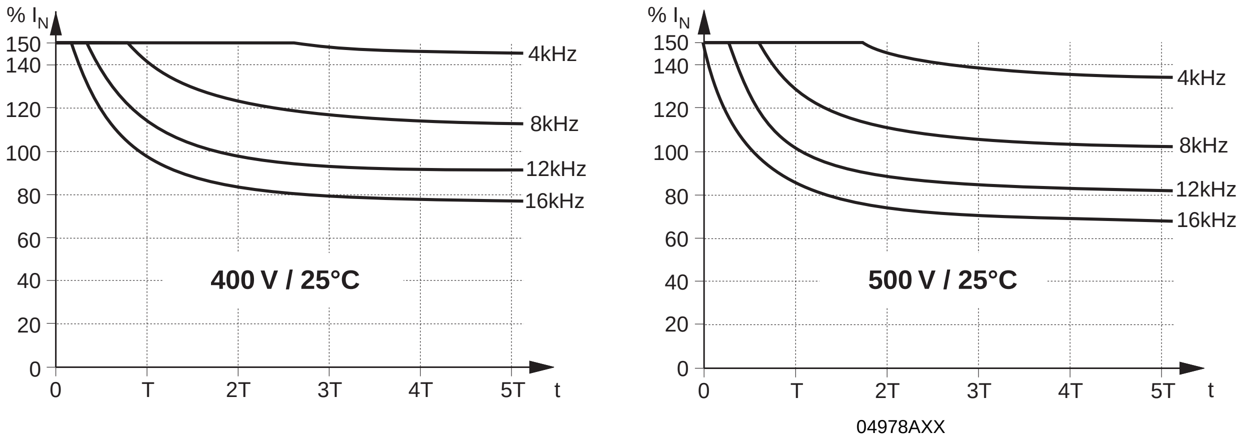


Fig. 86: Overload capacity at ϑ_{amb} = 25 °C

% I_N	=	Inverter output current as percentage of rated output current
t	=	Load duration
Size 1: T	=	3.5 min
Size 2: T	=	5 min
Size 3: T	=	4 min
Size 4: T	=	9 min
Size 5: T	=	5 min

STOP

The 230 V units (...-2_3) have the same overload behavior as the 400/500 V units (...-5_3) at V_{in} = 400 V.

5.8 Load capacity of the units at low output frequencies

The thermal model in MOVIDRIVE® implements dynamic limiting of the maximum output current. Consequently, the thermal model only permits less than 100 % output current at output frequencies less than 2 Hz if the capacity utilization is high.

This can occur in the case of:

- electrically stopping hoists,
- torque control at low speeds or when stopped.

Under such operating conditions, the average output current of the inverter should be configured at max. 70 % $I_{n\_inverter}$.

Continuous output currents

Guaranteed continuous output currents of the 400/500 V units (...-5_3) as a function of the output frequency:

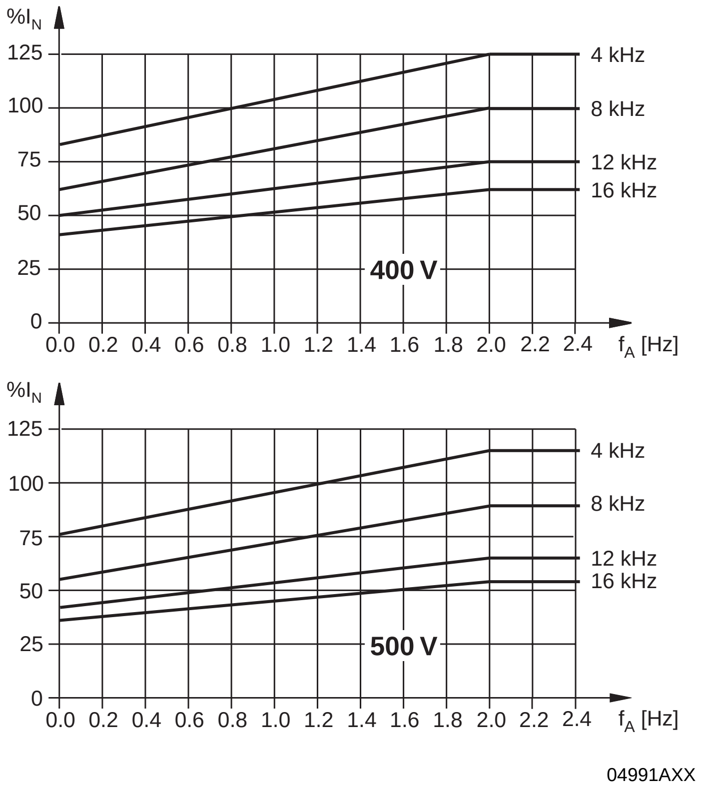


Fig. 87: Continuous output currents for low output frequencies

$\% I_N$ = Inverter output current as percentage of rated output current

f_A = Inverter output frequency

$I_N = I_{rated}$ $f_A = f_{output}$

The same continuous output currents apply to the 230 V units (...-2_3) as to the 400/500 V (...-5_3) units at V_{in} = 400 V.

5.9 Selecting the braking resistor

High voltage

The connection leads to the braking resistor carry a **high DC voltage (approx. 900 V)**. The braking resistor lines must be suitable for this high DC voltage.

Line length

The **maximum permitted line length** between MOVIDRIVE® and the braking resistor is **100 m (330 ft)**.

Parallel connection

Two braking resistors must be connected in parallel in the case of some inverter/resistor combinations. In this case, the **trip current** must be set on the bimetallic relay to twice the value of I_F entered in the table.

Peak braking power

The DC link voltage and the resistance value mean the peak braking power may be less than the load capacity of the braking resistor. This peak braking power is calculated as follows:

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

04994AXX

U = V

V_{DC} is the switch-in threshold of the brake chopper. Its value is

– with MOVIDRIVE® MD_60A...-5_3 (400/500 V units) V_{DC} = 822 V_{DC} and

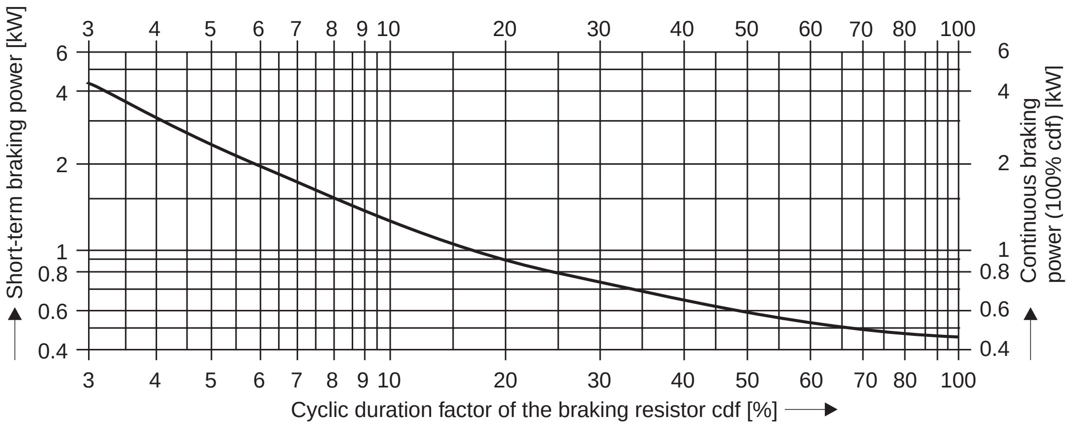
– with MOVIDRIVE® MD_60A...-2_3 (230 V units) V_{DC} = 480 V_{DC}.

The following table lists the peak braking power levels which are possible for the different resistance values.

Resistance value	Peak braking power	
	MD_60A...-5_3 (400/500 V units)	MD_60A...-2_3 (230 V units)
100 Ω	6.7 kW	-
68 Ω	10.0 kW	-
47 Ω	14.4 kW	-
39 Ω	17.3 kW	5.9 kW
27 Ω	-	8.5 kW
18 Ω	37.5 kW	-
15 Ω	45 kW	-
12 Ω	56 kW	19.2 kW
9 Ω (2 × BW018 parallel)	75 kW	25.6 kW
7.5 Ω (2 × BW915 parallel)	-	30.7 kW
6 Ω	112 kW	38.4 kW
3 Ω (2 × BW106/206 parallel)	-	76.8 kW

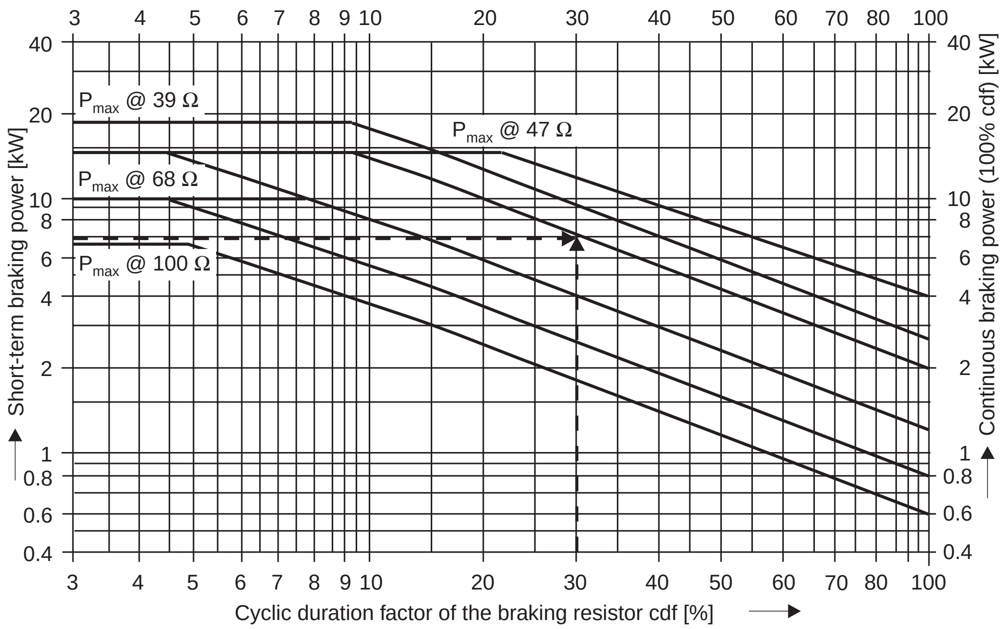
Power diagrams In the case of braking operations within the cycle duration T_D (standard: $T_D \leq 120$ s), the cdf braking power can be used to ascertain the resulting continuous resistor dissipation (100 % cdf power) with reference to the power diagrams. The right-hand y axis shows the 100 % cdf power.

Power diagrams for MOVIDRIVE® MD_60A...-5_3 (400/500 V units):



01043BEN

Fig. 88: Power diagram for flat-type braking resistor 400/500 V units (BW100-005)



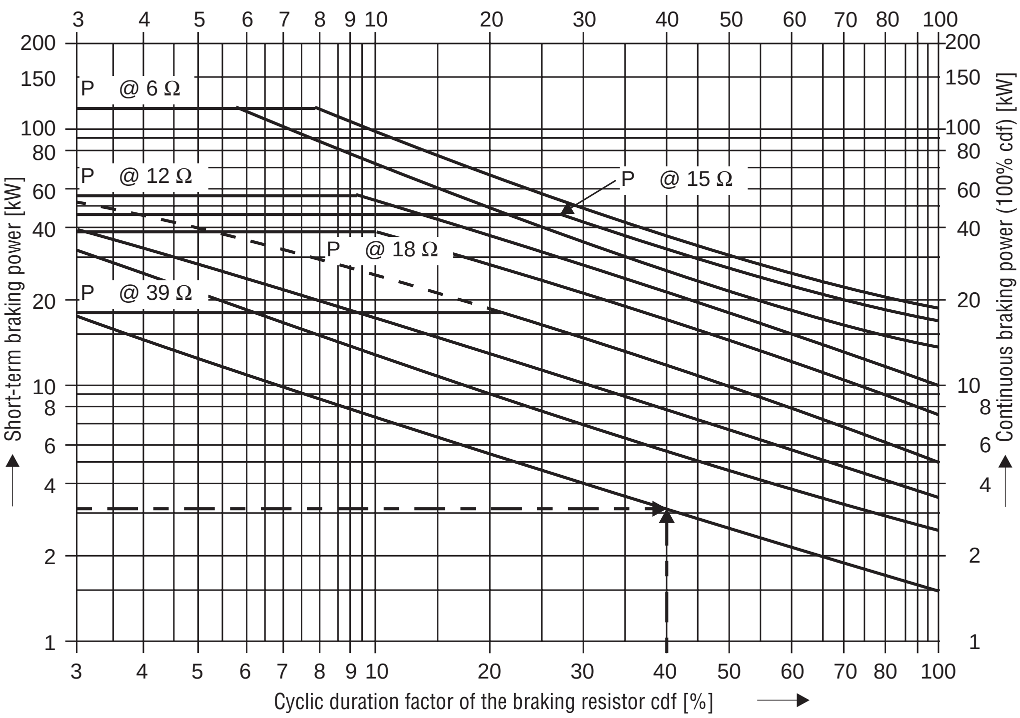
01042BEN

Fig. 89: Power diagram for wire resistors 400/500 V units

Example When an intermittent braking power of 7 kW is needed with a cyclic duration factor of 30 %, this requires a braking resistor with a continuous power of 2 kW, for example BW247.

Braking resistor type		**BW100-005**	**BW100-006**	**BW168**	**BW268**	**BW147**	**BW247**	**BW347**
Load capacity	**100 % cdf**	0.45 kW	0.6 kW	0.8 kW	1.2 kW	1.2 kW	2.0 kW	4.0 kW
Resistance value	R_{BR}	100 Ω ±10 %		68 Ω ±10 %		47 Ω ±10 %		
Trip current of F16	I_F	0.8 A_{RMS}	1.8 A_{RMS}	2.5 A_{RMS}	3.4 A_{RMS}	3.5 A_{RMS}	4.9 A_{RMS}	7.8 A_{RMS}
Enclosure		IP 54	IP20 (when mounted)					

Braking resistor type	BW100-005	BW100-006	BW168	BW268	BW147	BW247	BW347
For MOVIDRIVE® MD_60A...-5_3	0015/0022	0015 – 0040			0055/0075		



01516BEN

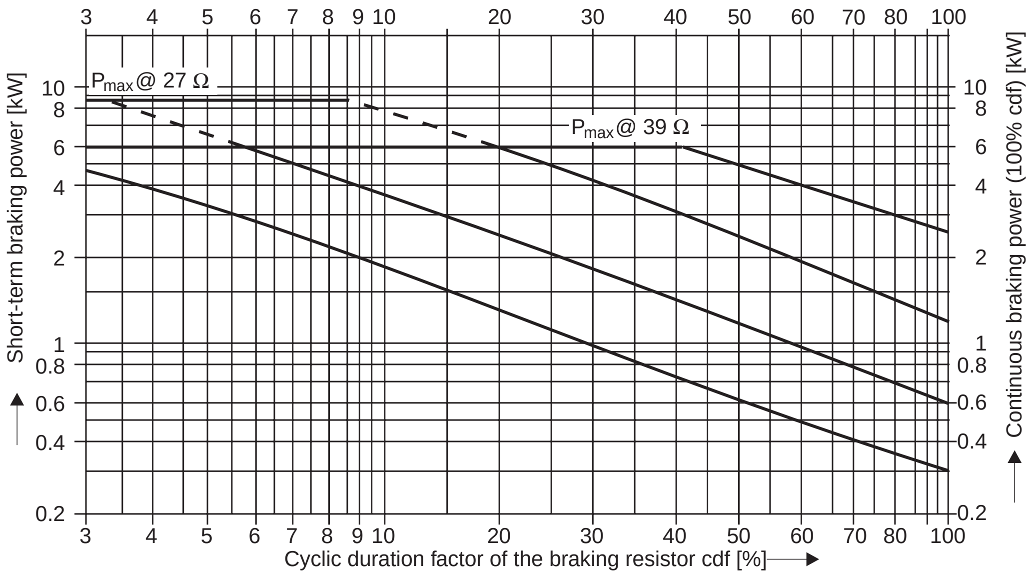
Fig. 90: Power diagram for grid resistors 400/500 V units

Example When an intermittent braking power of 3 kW is needed with a cyclic duration factor of 40 %, this requires a braking resistor with a continuous power of 1.5 kW, for example BW018-015.

Braking resistor type	BW039-012	BW039-026	BW039-050	BW018-015	BW018-035	BW018-075
Load capacity 100 % cdf	1.2 kW	2.6 kW	5.0 kW	1.5 kW	3.5 kW	7.5 kW
Resistance value R_{BR}	39 Ω ±10 %			18 Ω ±10 %		
Trip current of F16 I_F	4.2 A_{RMS}	7.8 A_{RMS}	11 A_{RMS}	4.0 A_{RMS}	8.1 A_{RMS}	14 A_{RMS}
Enclosure	IP20 (when mounted)					
For MOVIDRIVE® MD_60A...-5_3	0110			0150/0220 and 2 × parallel with 0370/0450		

Braking resistor type	BW915	BW012-025	BW012-050	BW012-100	BW106	BW206
Load capacity 100 % cdf	16 kW	2.5 kW	5.0 kW	10 kW	13 kW	18 kW
Resistance value R_{BR}	15 Ω ±10 %	12 Ω ±10 %			6 Ω ±10 %	
Trip current of F16 I_F	28 A_{RMS}	6.1 A_{RMS}	12 A_{RMS}	22 A_{RMS}	38 A_{RMS}	42 A_{RMS}
Enclosure	IP20 (when mounted)					
For MOVIDRIVE® MD_60A...-5_3	0110	0300			0370 – 0750	

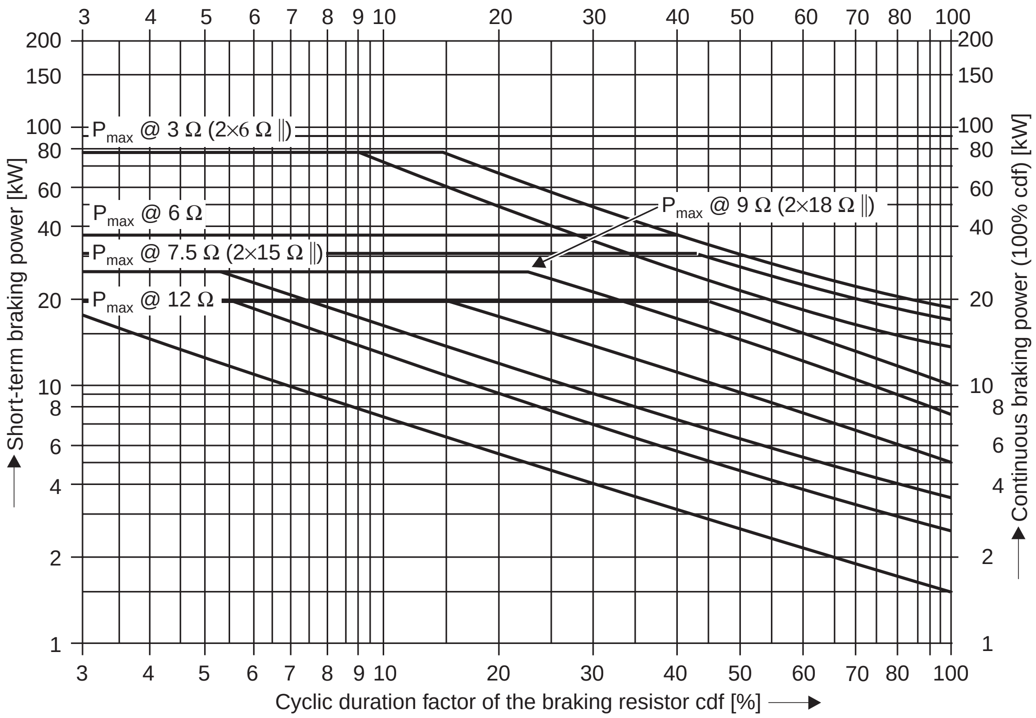
Power diagrams for MOVIDRIVE® MD_60A...-2_3 (230 V units):



02773BEN

Fig. 91: Power diagram for wire resistors 230 V units

Braking resistor type		**BW039-003**	**BW039-006**	**BW039-012**	**BW039-026**	**BW027-006**	**BW027-012**
Load capacity	**100 % cdf**	0.3 kW	0.6 kW	1.2 kW	2.6 kW	0.6 kW	1.2 kW
Resistance value	**R_{BR}**	39 Ω ±10 %				27 Ω ±10 %	
Trip current of F16	**I_F**	2.0 A_{RMS}	3.2 A_{RMS}	4.2 A_{RMS}	7.8 A_{RMS}	2.5 A_{RMS}	4.4 A_{RMS}
Enclosure		IP20 (when mounted)					
For MOVIDRIVE® MD_60A...-2_3		0015/0022				0015 – 0037	



02774BEN

Fig. 92: Power diagram for grid resistors 230 V units

Braking resistor type		BW018-015	BW018-035	BW018-075	BW915
Load capacity	**100 % cdf**	1.5 kW	3.5 kW	7.5 kW	16 kW
Resistance value	R_{BR}	18 Ω ±10 %		18 Ω ±10 %	15 Ω ±10 %
Trip current of F16	I_F	4.0 A_{RMS}	8.1 A_{RMS}	14 A_{RMS}	28 A_{RMS}
Enclosure		IP20 (when mounted)			
For MOVIDRIVE® MD_60A...-2_3		2 × parallel with 0110			

Braking resistor type		BW012-025	BW012-050	BW012-100	BW106	BW206
Load capacity	**100 % cdf**	2.5 kW	5.0 kW	10 kW	13 kW	18 kW
Resistance value	R_{BR}	12 Ω ±10 %			6 Ω ±10 %	
Trip current of F16	I_F	10 A_{RMS}	19 A_{RMS}	27 A_{RMS}	38 A_{RMS}	42 A_{RMS}
Enclosure		IP20 (when mounted)				
For MOVIDRIVE® MD_60A...-2_3		0055/0075			0150 and 2 × parallel with 0220/0300	

5.10 Connecting AC brake motors

Refer to the "Geared Motors" catalog for detailed information about the SEW brake system. This can be ordered from SEW.

SEW brake systems are DC operated disc brakes which are released electromagnetically and applied by spring force. A brake rectifier supplies the brake with DC voltage.

The brake rectifier must have its own supply system cable for inverter operation; supply from the motor voltage is not permitted!

Switching off the brake rectifier

The brake rectifier can be switched off – thereby causing the brake to be applied – in two ways:

1. Cut-off in the AC circuit
2. Cut-off in the DC and AC circuit (faster cut-off)

Always switch off the brake on the DC and AC sides under the following conditions:

– all hoist applications,
– in CFC (MDV) and SERVO (MCS) operating modes.

Activating the brake

Always activate the brake via DBØØ (X10:3), not using the PLC!

The binary output DBØØ (X10:3) "/Brake" is configured as an output for operating a relay with a control voltage of +24 V / max. 150 mA / 3.6 W. This means a power contactor can be controlled directly with a 24 V_{DC} coil voltage. The brake is switched using this power contactor.

The startup function in the DBG11A keypad and in the MOVITOOLS software sets the brake parameters for the 2 and 4-pole SEW motors. The brake parameters (P73_) must be set manually in the case of SEW motors with a higher number of poles.

Brake parameters

The brake parameters are adapted to the brake activation arrangement shown in the wiring diagram. Hoists may sag, for example, if the brake release and application time is set too short, e.g. in the event of long response times in the brake control system.

5.11 *Thermal monitoring of the motor via TF/TH connection*

The default setting for parameter P835 "Response TF sensor SIGNAL" is NO RESPONSE, which means thermal monitoring is inactive. To activate thermal monitoring, set parameter P835 "Response TF sensor SIGNAL" ≠ NO RESPONSE.

There is a TF/TH input (X10:1) on MOVIDRIVE® MDF and MDV, while MOVIDRIVE® MDS also has a second TF/TH input (X15:9). When thermal monitoring is active (P835 "Response TF sensor SIGNAL" ≠ NO RESPONSE), an open TF/TH input triggers the response set in parameter P835. If the TF/TH input X15:9 is used on MOVIDRIVE® MDS, the TF/TH input X10:1 must be connected to DGND (jumper X10:1 – X10:2).

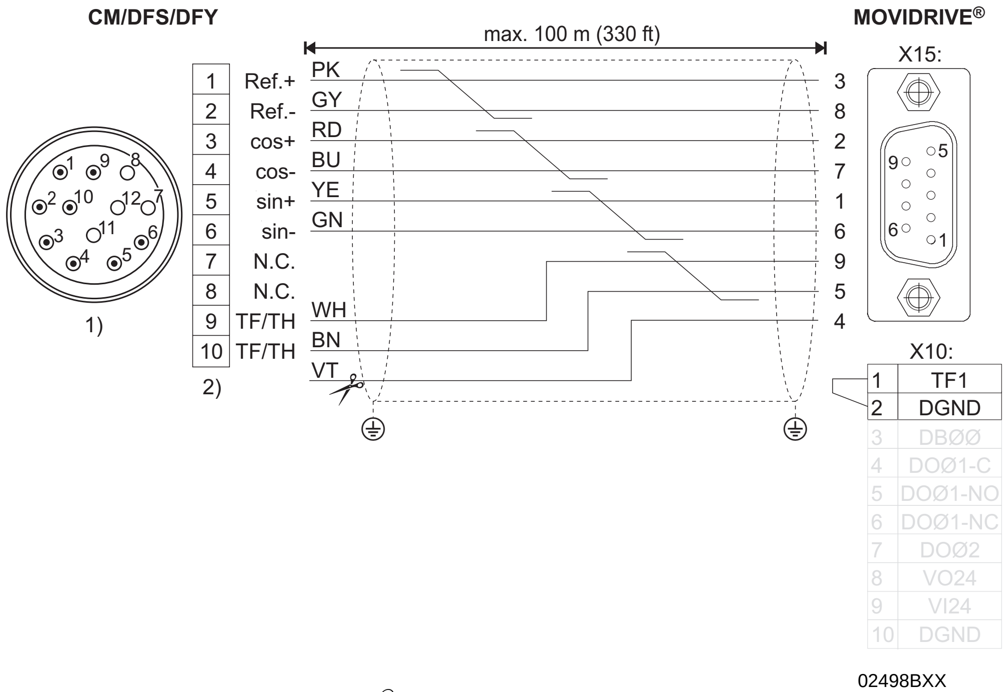


Fig. 93: TF/TH inputs in MOVIDRIVE® MDS60A

1) Plug connection

2) Terminal strip in motor terminal box

The specified conductor colors correspond to the pre-fabricated SEW cables.

Thermal monitoring of the motor via the TF/TH input:

MOVIDRIVE®	**Parameter P835 "Response TF sensor SIGNAL"**	**Wiring from**		**Remark**
		X10:1	**X15:9**	
MDF / MDV / MDS	NO RESPONSE	Open	Only with MDS: Open	Thermal monitoring is not active (factory setting).
MDF/MDV	≠ NO RESPONSE	Via TF/TH to DGND (X10:2)	-	Thermal monitoring is active.
MDS[1)]	≠ NO RESPONSE	Jumper to DGND (X10:2)	Via TF/TH to DGND (X15:5)	Thermal monitoring is active. TF/TH input of X15 is used.
MDS[1)]	≠ NO RESPONSE	Via TF/TH to DGND (X10:2)	Jumper to DGND (X15:5)	Thermal monitoring is active. TF/TH input of X10 is used.

1) SEW recommends using the X15 TF/TH input on MOVIDRIVE® MDS.

5.12 Permitted voltage systems for MOVIDRIVE®

MOVIDRIVE® is intended to be operated 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 permitted. In such a case, SEW recommends using earth-leakage monitors employing pulse-code measurement. This avoids mis-tripping of the earth-leakage monitor due to the earth capacitance of the inverter.

5.13 Supply system contactor and fuses

Supply system contactor

- Only use supply system contactors in utilization category AC-3 (IEC 158-1).
- Do not use the K11 supply system contactor for setup mode, but only for switching the inverter on and off. Use the "Enable/RAPID STOP", "CW/STOP" or "CCW/STOP" commands for jog mode.

Observe a minimum switch-off time of 10 s for the supply system contactor K11.

Supply system fuse types

Line protection types in utilization categories gL, gG:

- Fuse rated voltage ≥ Power supply voltage
- Rated fuse currents must be configured to 100 % or 125 % of the rated inverter currents depending on the inverter capacity utilization.

Circuit breakers with characteristics B, C:

- Circuit breaker rated voltage ≥ Power supply voltage
- Rated circuit breaker currents must be 10 % above the rated inverter current.

5.14 Supply system leads and motor cables

Special regulations

Comply with the **regulations issued by specific countries and for specific machines** regarding fusing and the selection of line cross sections. Also comply with the instructions for **UL-compliant installation** if necessary.

Line cross sections and fusing

SEW proposes the following line cross sections and fusing, assuming the use of single-core copper cables with PVC insulation laid in cable ducts, an ambient temperature of 25 °C and rated system currents of 100 % of the rated inverter current:

400/500 V units metric, V_{in} = 3×400 V_{AC}:

MOVIDRIVE® MD_60A...-5A3	0015	0022	0030	0040	0055	0075	0110
Size	1				2		
Fuses F11/F12/F13 I_N	16 A				16 A		25 A
Supply system lead L1/L2/L3	1.5 mm²				1.5 mm²		4 mm²
PE conductor	2 × 1.5 mm² 1 × 10 mm²				2 × 1.5 mm² 1 × 10 mm²		2 × 4 mm² 1 × 10 mm²
Motor cable U/V/W	1.5 mm²				1.5 mm²	2.5 mm²	4 mm²
Unit terminal cross section of the power supply unit	Disconnectable terminal strip 4 mm² conductor end sleeve DIN 46228				Screw and washer assembly M4 with tl. clip 4 mm² conductor end sleeve DIN 46228 6 mm² crimp cable connector DIN 46234		

MOVIDRIVE® MD_60A...-503	0150	0220	0300	0370	0450	0550	0750
Size	3			4		5	
Fuses F11/F12/F13 I_N	35 A	50 A	63 A	80 A	100 A		125 A
Supply system lead L1/L2/L3	6 mm²	10 mm²	16 mm²	25 mm²	35 mm²		50 mm²
PE conductor	2 × 6 mm² 1 × 10 mm²	1 × 10 mm²	1 × 16 mm²	1 × 16 mm²			
Motor cable U/V/W	6 mm²	10 mm²	16 mm² 1)	25 mm² 1)	35 mm²		50 mm²
Unit terminal cross section of the power supply unit	Screw and washer assembly M6 with washer max. 25 mm² Crimp cable connector DIN 46234			Bolt M10 with nut max. 70 mm² Crimp cable connector DIN 46235			

1) Use a motor feeder with a 10 mm² cross section with MDS (SERVO) due to the connector on the DFY motor!

230 V units metric, V_{in} = 3×230 V_{AC}:

MOVIDRIVE® MD_60A...-2_3	0015	0022	0037	0055	0075
Size	1			2	
Fuses F11/F12/F13 I_N	16 A		25 A	25 A	35 A
Supply system lead L1/L2/L3	1.5 mm²		4 mm²	4 mm²	6 mm²
PE conductor	2 × 1.5 mm² 1 × 10 mm²		2 × 4 mm² 1 × 10 mm²	2 × 4 mm² 1 × 10 mm²	2 × 6 mm² 1 × 10 mm²
Motor cable U/V/W	1.5 mm²		4 mm²	4 mm²	6 mm²
Unit terminal cross section of the power supply unit	Disconnectable terminal strip 4 mm² conductor end sleeve DIN 46228			Screw and washer assembly M4 with terminal clip 4 mm² conductor end sleeve DIN 46228 6 mm² crimp cable connector DIN 46234	

MOVIDRIVE® MD_60A...-2_3	0110	0150	0220	0300
Size	3		4	
Fuses F11/F12/F13 I_N	50 A	63 A	80 A	100 A
Supply system lead L1/L2/L3	10 mm²	16 mm²	25 mm²	35 mm²
PE conductor	1 × 10 mm²	1 × 16 mm²	1 × 16 mm²	1 × 16 mm²
Motor cable U/V/W	10 mm²	16 mm²	25 mm²	35 mm²
Unit terminal cross section of the power supply unit	Screw and washer assembly M6 with washer max. 25 mm² Crimp cable connector DIN 46234		Bolt M10 with nut max. 70 mm² Crimp cable connector DIN 46235	

400/500 V units to USA NEC, $V_{in} = 3 \times 460\ V_{AC}$:

<table>
<tr><th>MOVIDRIVE® MD_60A...-5A3</th><th>0015</th><th>0022</th><th>0030</th><th>0040</th><th>0055</th><th>0075</th><th>0110</th></tr>
<tr><td>Size</td><td colspan="4">1</td><td colspan="3">2</td></tr>
<tr><td>Fuses F11/F12/F13 I_N</td><td>6 A</td><td colspan="2">10A</td><td>15 A</td><td colspan="2">20 A</td><td>30 A</td></tr>
<tr><td>Supply system lead L1/L2/L3</td><td colspan="4">AWG14</td><td colspan="2">AWG12</td><td>AWG10</td></tr>
<tr><td>PE conductor</td><td colspan="4">AWG14</td><td colspan="2">AWG12</td><td>AWG10</td></tr>
<tr><td>Motor cable U/V/W</td><td colspan="4">AWG14</td><td colspan="2">AWG12</td><td>AWG10</td></tr>
<tr><td>Unit terminal cross section of the power supply unit</td><td colspan="4">Disconnectable terminal strip
AWG10 conductor end sleeve</td><td colspan="3">Screw and washer assembly M4 with terminal clip
AWG10 conductor end sleeve
AWG10 crimp cable connector</td></tr>
</table>

<table>
<tr><th>MOVIDRIVE® MD_60A...-503</th><th>0150</th><th>0220</th><th>0300</th><th>0370</th><th>0450</th><th>0550</th><th>0750</th></tr>
<tr><td>Size</td><td colspan="3">3</td><td colspan="2">4</td><td colspan="2">5</td></tr>
<tr><td>Fuses F11/F12/F13 I_N</td><td>40 A</td><td>60 A</td><td>80 A</td><td>90 A</td><td>110 A</td><td>150 A</td><td>175 A</td></tr>
<tr><td>Supply system lead L1/L2/L3</td><td>AWG8</td><td>AWG6</td><td>AWG4</td><td>AWG4</td><td>AWG3</td><td>AWG1</td><td>AWG2/0</td></tr>
<tr><td>PE conductor</td><td colspan="2">AWG10</td><td>AWG8</td><td>AWG8</td><td>AWG6</td><td colspan="2">AWG6</td></tr>
<tr><td>Motor cable U/V/W</td><td>AWG8</td><td>AWG6 1)</td><td>AWG4 1)</td><td>AWG4 1)</td><td>AWG3</td><td>AWG1</td><td>AWG2/0</td></tr>
<tr><td>Unit terminal cross section of the power supply unit</td><td colspan="3">Screw and washer assembly M6 with washer
max. AWG4 crimp cable connector</td><td colspan="4">Bolt M10 with nut
max. AWG2/0 crimp cable connector</td></tr>
</table>

1) Use a motor feeder with an AWG8 cross section with MDS (SERVO) due to the connector on the DFY motor!

230 V units to USA NEC, $V_{in} = 3 \times 230\ V_{AC}$:

<table>
<tr><th>MOVIDRIVE® MD_60A...-2_3</th><th>0015</th><th>0022</th><th>0037</th><th>0055</th><th>0075</th></tr>
<tr><td>Size</td><td colspan="3">1</td><td colspan="2">2</td></tr>
<tr><td>Fuses F11/F12/F13 I_N</td><td colspan="2">16 A</td><td>25 A</td><td>25 A</td><td>35 A</td></tr>
<tr><td>Supply system lead L1/L2/L3</td><td colspan="2">AWG14</td><td>AWG12</td><td colspan="2">AWG10</td></tr>
<tr><td>PE conductor</td><td colspan="2">AWG14</td><td>AWG12</td><td colspan="2">AWG10</td></tr>
<tr><td>Motor cable U/V/W</td><td colspan="2">AWG14</td><td>AWG12</td><td colspan="2">AWG10</td></tr>
<tr><td>Unit terminal cross section of the power supply unit</td><td colspan="3">Disconnectable terminal strip
AWG10 conductor end sleeve</td><td colspan="2">Screw and washer assembly M4 with terminal clip
AWG10 conductor end sleeve
AWG10 crimp cable connector</td></tr>
</table>

<table>
<tr><th>MOVIDRIVE® MD_60A...-2_3</th><th>0110</th><th>0150</th><th>0220</th><th>0300</th></tr>
<tr><td>Size</td><td colspan="2">3</td><td colspan="2">4</td></tr>
<tr><td>Fuses F11/F12/F13 I_N</td><td>50 A</td><td>60 A</td><td>80 A</td><td>90 A</td></tr>
<tr><td>Supply system lead L1/L2/L3</td><td>AWG6</td><td>AWG4</td><td>AWG4</td><td>AWG3</td></tr>
<tr><td>PE conductor</td><td>AWG10</td><td>AWG8</td><td>AWG8</td><td>AWG6</td></tr>
<tr><td>Motor cable U/V/W</td><td>AWG6</td><td>AWG4</td><td>AWG4</td><td>AWG3</td></tr>
<tr><td>Unit terminal cross section of the power supply unit</td><td colspan="2">Screw and washer assembly M6 with washer
max. AWG4 crimp cable connector</td><td colspan="2">Bolt M10 with nut
max. AWG2/0 crimp cable connector</td></tr>
</table>

AWG = American Wire Gauge

Permitted motor lead lengths

The **maximum motor lead length** is dependent on:

- cable type,
- voltage drop in the cable,
- only in VFC operating mode: Set PWM frequency P860/P861.
- only in VFC operating mode: Connecting an HF... output filter.
- with an encoder connected: the maximum line length for the encoder connection is 100 m (330 ft) with a capacitance per unit length of ≤ 120 nF/km (193 nF/mile).

The following information provides approximate values:

MOVIDRIVE® MD_60A...-5_3:

MOVIDRIVE® MD_60A...-5_3 at V_{in} = 3 × 400 V_{AC}	**0015**	**0022**	**0030**	**0040**	**0055**	**0075 – 0750**
	Recommended maximum motor lead length [m (ft)]					
	Shielded cable					
VFC operating mode[1)] PWM frequency (P860/P861): 4 kHz / 8 kHz / 12 kHz / 16 kHz	120 (396) 80 (264) 50 (165) 40 (132)	200 (660) 120 (396) 80 (264) 60 (198)	250 (825) 150 (495) 120 (396) 100 (330)	300 (990) 250 (825) 200 (660) 150 (495)	300 (990) 250 (825) 200 (660) 150 (495)	400 (1320) 300 (990) 250 (825) 200 (660)
CFC and SERVO mode PWM frequency fixed at 8 kHz	100 (330)					
	Unshielded cable					
VFC operating mode[1)] PWM frequency (P860/P861): 4 kHz / 8 kHz / 12 kHz / 16 kHz	360 (1188) 240 (792) 150 (495) 120 (396)	600 (1980) 360 (1188) 240 (792) 180 (594)	750 (2475) 450 (1485) 360 (1188) 300 (990)	900 (2970) 750 (2475) 600 (1980) 450 (1485)	900 (2970) 750 (2475) 600 (1980) 450 (1485)	1200 (3960) 900 (2970) 750 (2475) 600 (1980)
CFC and SERVO mode PWM frequency fixed at 8 kHz	100 (330)					

1) An output filter is only permitted in VFC mode and with an unshielded motor feeder. If an HF... output filter is connected, the cable length is not restricted by these limiting values, but exclusively by the voltage drop along the motor feeder.

MOVIDRIVE® MD_60A...-2_3:

MOVIDRIVE® MD_60A...-2_3 at V_{in} = 3 × 230 V_{AC}	**0015**	**0022**	**0037**	**0055**	**0075**	**0110 – 0300**
	Recommended maximum motor lead length [m (ft)]					
	Shielded cable					
VFC operating mode[1)] PWM frequency (P860/P861): 4 kHz / 8 kHz / 12 kHz / 16 kHz	120 (396) 80 (264) 50 (165) 40 (132)	200 (660) 120 (396) 80 (264) 60 (198)	250 (825) 150 (495) 120 (396) 100 (330)	300 (990) 250 (825) 200 (660) 150 (495)	300 (990) 250 (825) 200 (660) 150 (495)	400 (1320) 300 (990) 250 (825) 200 (660)
CFC operating mode PWM frequency fixed at 8 kHz	100 (330)					
	Unshielded cable					
VFC operating mode[1)] PWM frequency (P860/P861): 4 kHz / 8 kHz / 12 kHz / 16 kHz	360 (1188) 240 (792) 150 (495) 120 (396)	600 (1980) 360 (1188) 240 (792) 180 (594)	750 (2475) 450 (1485) 360 (1188) 300 (990)	900 (2970) 750 (2475) 600 (1980) 450 (1485)	900 (2970) 750 (2475) 600 (1980) 450 (1485)	1200 (3960) 900 (2970) 750 (2475) 600 (1980)
CFC operating mode PWM frequency fixed at 8 kHz	100 (330)					

1) No output filter is allowed to be connected to MOVIDRIVE® MD_60A...-2_3!

Voltage drop

The line cross section of the motor lead should be selected so the **voltage drop is as small as possible**. An excessively high voltage drop means that 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).

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) Loading not permitted, in accordance with VDE 0100 part 430

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_{in} = 460 V_{AC}.

5.15 Group drive in VFC mode

In VFC & GROUP operating mode, a group of asynchronous motors can be operated on one inverter. In this operating mode, the inverter operates without slip compensation and with a constant U/f ratio. The motors are operated without encoder feedback.

The parameter settings apply to all connected motors.

Motor currents The total of the motor currents must not exceed the output rated current of the inverter.

Motor lead The permitted length of all motor leads connected in parallel is determined as follows:

$$l_{ges} \leq \frac{l_{max}}{n}$$

04999AXX

l_{ges} = Total length of the motor leads connected in parallel

l_{max} = Recommended maximum motor lead length (→ page 214)

n = Number of motors connected in parallel

Only use unshielded motor leads.

Motor size The motors in a group must not be more than three levels apart.

Output filter Usually, there is no need for an output filter with small groups of 2 to 3 motors. An output filter HF... is required if the maximum motor lead length (l_{max}) given in the table is not adequate. This may be the case in large groups (n) or when there are long motor lead lengths connected in parallel (l_{ges}). The maximum motor lead length is then no longer restricted by the limit given in the table, but instead by the voltage drop on the motor lead. The total value of the rated motor currents must not exceed the rated throughput current of the output filter.

No flying restart circuit is possible with an output filter!

5.16 Connecting explosion-proof AC motors

Comply with the following instructions when connecting explosion-proof AC motors to MOVIDRIVE® drive inverters:

- The inverter must be installed outside the potentially explosive atmosphere.
- Comply with regulations specific to the industry and country.
- Comply with the regulations and instructions issued by the motor manufacturer with regard to operation on a frequency inverter, e.g. requirement for a sine filter.
- In future, all tools and fixtures in the potentially explosive atmosphere must comply with directive 94/9/EC (ATEX 100a).
- The TF/TH input on the MOVIDRIVE® must not be used for thermal monitoring of the motor. Use a TF/TH trip switch which is approved for use in potentially explosive atmospheres for thermal monitoring.
- In the case of motors with speed feedback, the tachometer must also be approved for use in potentially explosive atmospheres. The tachometer can be directly connected to MOVIDRIVE®.

5.17 Components for EMC compliant installation

The designated use of MOVIDRIVE® drive inverters and regenerative power supply units is as components for installation in machinery and systems. They comply with the EMC product standard EN 61800-3 "Variable-speed electrical drives". Provided the information relating to EMC-compliant installation is complied with, they satisfy the appropriate requirements for CE-marking of the entire machine/system in which they are fitted, on the basis of the EMC Directive 89/336/EEC.

MOVIDRIVE® MD_60A drive inverters of size 1 and 2 are fitted with an input filter as standard. These units comply with limit value class A to EN 55011 and EN 55014 on the line side without further measures.

Interference immunity

With regard to interference immunity, MOVIDRIVE® meets **all** the requirements stipulated in EN 50082-2 and EN 61800-3.

Interference emission

Higher levels of interference are permitted in industries. In such an environment, it may be possible to dispense with the measures described below depending on the situation of the supply system and the machine configuration.

Limit value class A

Two options are available for EMC-compliant installation in accordance with EN 55011, **limit value class A**, depending on the machine configuration:

Limit value class A	On the motor	On the power system	
	Sizes 1 to 5	Sizes 1 and 2	Sizes 3 to 5
1st option	HD... output choke	No action needed	NF...-... input filter
2nd option	Shielded motor feeder	No action needed	NF...-... input filter

Limit value class B

Two options are available for EMC compliant installation in accordance with EN 55011, **limit value class B**, depending on the machine configuration:

Limit value class B	On the motor	On the power system
	Sizes 1 to 5	Sizes 1 to 5
1st option	HD... output choke	NF...-... input filter
2nd option	Shielded motor feeder	NF...-... input filter

IT systems

STOP

No EMC limits are specified for interference emission in voltage supply systems without an earthed star point (IT systems). The effectiveness of input filters is severely limited.

Block diagram of limit value class B

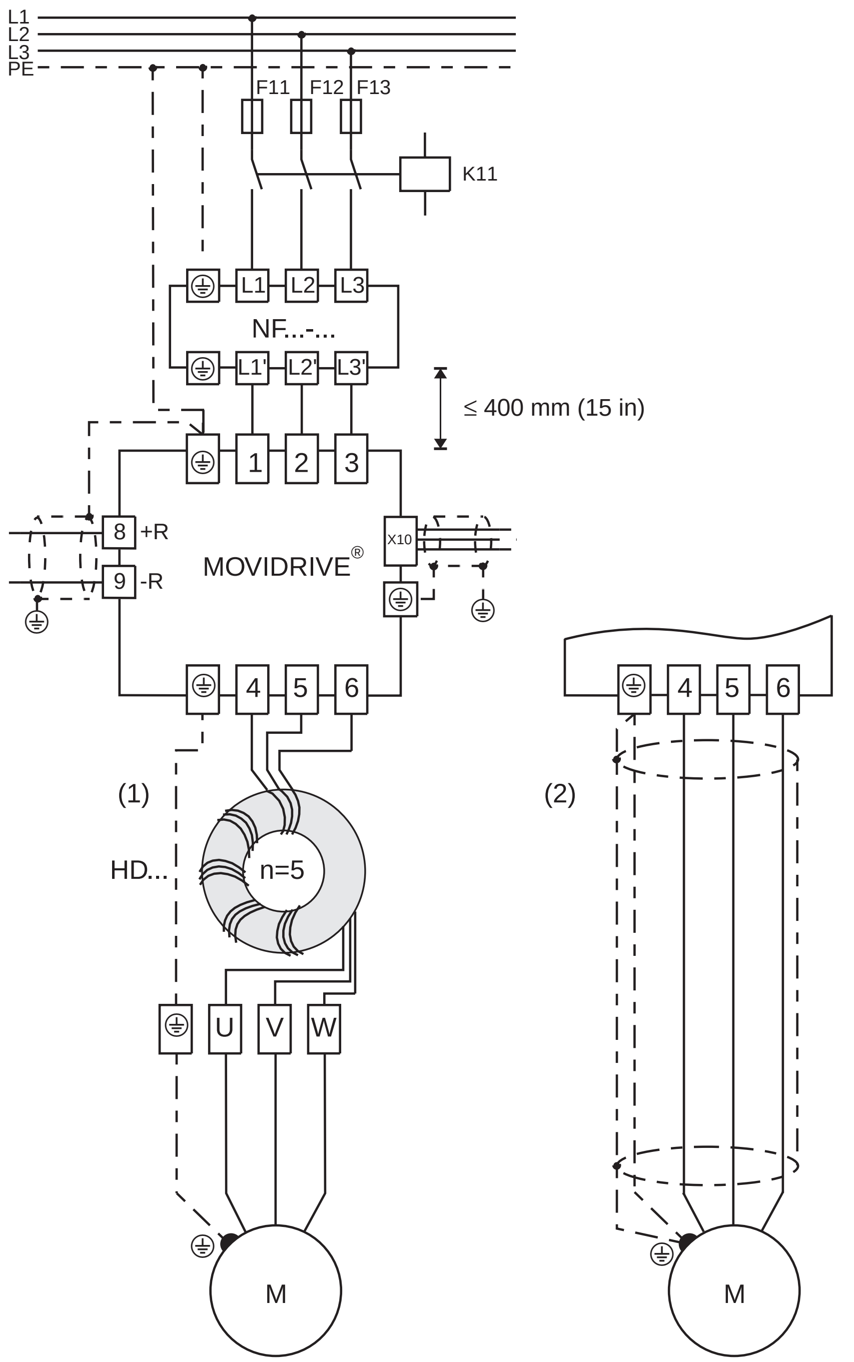


Fig. 94: Installation with consideration for EMC, in accordance with limit value class B

(1) = 1st possible solution with HD... output choke

(2) = 2nd possible solution with shielded motor lead

Refer to the publication entitled "Drive Engineering - Practical Implementation, Electromagnetic Compatibility" for more information. This can be ordered from SEW.

5.18 Connecting the optional power components

Series ND... line choke

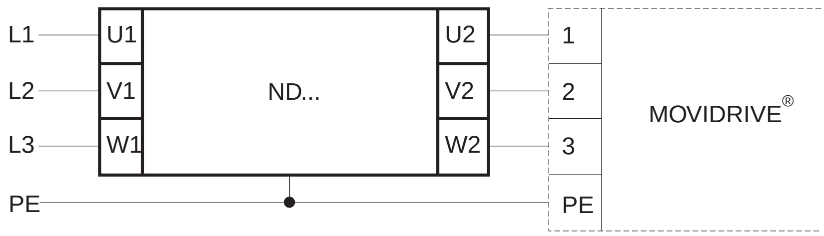


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Fig. 95: Connecting ND... line chokes

Series NF...-... input filters

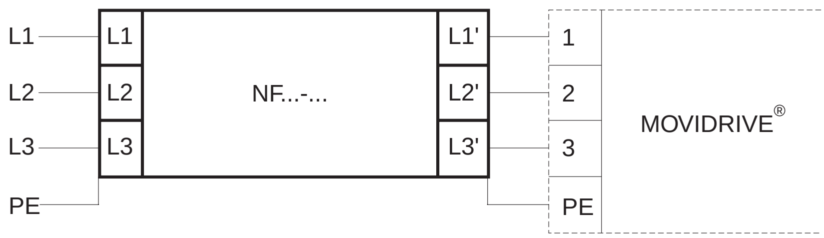

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Fig. 96: Connecting NF...-... input filters

Series HD... output chokes

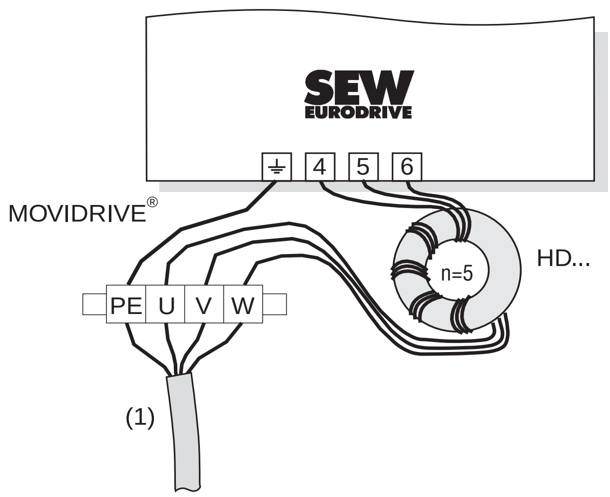

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Fig. 97: Connecting HD... output chokes

(1) = Motor cable

STOP

Only route the 3 phases U, V and W through the output choke! Do not route the PE conductor through the output choke!

Output choke type	**HD001**	**HD002**	**HD003**
For cable cross sections	1.5 – 16 mm^2 (AWG16 – 6)	≤ 1.5 mm^2 (≤ AWG16)	≥ 16 mm^2 (≥ AWG6)

Series HF... output filters

- Output filters are only permitted with MOVIDRIVE® MDF and MDV in the VFC operating modes. Do not connect output filters with MDV in CFC and MDS mode!
- Install output filters next to the corresponding inverter. Leave a ventilation space of at least 100 mm (4 in) below and above the output filter. No clearance is required on either side.
- Restrict the length of the cable between the inverter and the output filter to the absolute minimum needed. Maximum 1 m (3.3 ft) with an unshielded cable and 10 m (33 ft) for a shielded cable.

STOP

- Only an unshielded motor feeder may be connected when an output filter is used. A shielded motor lead leads to impermissibly high heating of the output filter.

STOP

- Several motors can be connected jointly to one output filter when multiple motors are operated on one inverter. The total value of the rated motor currents must not exceed the rated throughput current of the output filter.
- It is acceptable for two identical output filters to be connected in parallel to one inverter output in order to double the rated through current. To do this, all connections with the same name should be connected to the output filters in parallel.
- Output filter connection V5 (with HF...-503) or 7 (with HF...-403) must not be connected when the inverter is operated with f_{PWM} = 4 or 8 kHz.

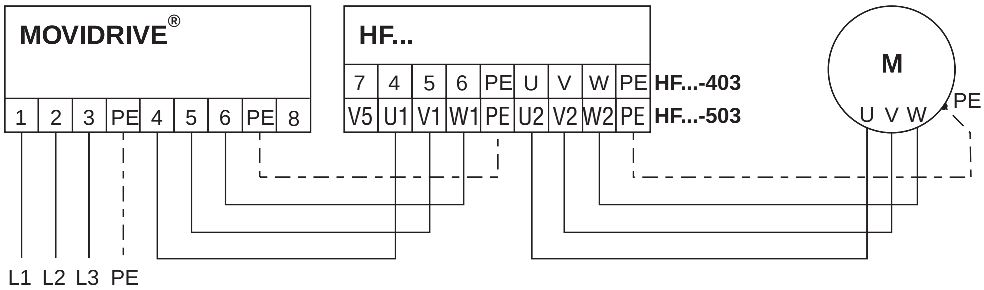

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Fig. 98: Connecting HF...-... output filters

DC link

Operation without DC link (standard):

- Permitted for all PWM frequencies (4, 8, 12, 16 kHz).

STOP

Operation with DC link
(Connection of inverter tl. 8 to HF...-503 tl. V5 or HF...-403 tl. 7):

- Improved filter effect in the low-frequency range (≤ 150 kHz).
- Only permitted for PWM frequencies 12 kHz and 16 kHz. Note the power reduction of units as a function of the PWM frequency!
- Set P862/P863 "PWM fix" = ON!
- With HF...-403: Only permitted with $V_{in} \leq 400\ V_{AC}$.

The DC link connection increases the required inverter output current in relation to the rated output current of the inverter in accordance with the following table.

f_{PWM}	$V_{in} = 3 \times 400\ V_{AC}$	$V_{in} = 3 \times 500\ V_{AC}$
12 kHz	12 %	15 %
16 kHz	8 %	12 %

Failure to comply with this may result in the inverter shutting down due to an overload.

5.19 Electronics cables and signal generation

- The electronics terminals are suitable for the following cross sections:

  Single core 0.20 – 2.5 mm^2 (AWG24 – 12)

  Double core 0.20 – 1 mm^2 (AWG24 – 17)

  Route electronics cables separately from power cables and contactor control cables or braking resistor cables. If using shielded electronics cables, earth the shield at both ends.

- Use a setpoint potentiometer with R = 5 kΩ.

- If necessary, potentiometer setpoints are switched using the 10 V voltage rather than via the wiper lead.

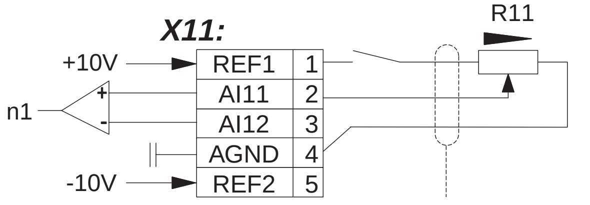

Fig. 99: Switching the potentiometer setpoint

- 0 V cables (AGND, DGND, DCOM) are never connected for generating signals. The 0 V cables of several electrical units which are connected together should not be looped from unit to unit, but rather wired up in a star configuration. This means:
  - Install the units in adjacent switch cabinet compartments rather than distributing them widely.
  - Lay the 0 V cables with 1.5 mm^2 (AWG16) cross section from a central point to each individual unit by the shortest possible route.

- If coupling relays are used, they should always be ones with encapsulated, dust-protected electronics contacts, which are suitable for switching small voltages and currents (5 – 20 V, 0.1 – 20 mA).

- Binary inputs/outputs

  The binary inputs are electrically isolated by optocouplers. Binary input commands can also be issued directly as a 0/1 command from the PLC instead of using a coupling relay (signal level → electronics data).

  The binary outputs are short-circuit proof, although they are not interference-voltage-proof. Applying an external voltage to the binary outputs may destroy them!

- The inverter starts a self-test (approx. 3 s) when the power system or the 24 V supply is switched on. All signal outputs have the level "0" throughout the self-test.

- 24 V voltage supply VI24 on X10:9

  To EN 61131-2, V_N = +24 V -10 %/+20 %. A total AC voltage component with a peak value of 5 % of the rated voltage (+24 V) is permitted in addition to the specified voltage tolerances.

5.20 External 24 V_{DC} voltage supply

General information

The internal 24 V_{DC} power supply of MOVIDRIVE® has a maximum power of 29 W. An external 24 V_{DC} power supply unit must be connected to terminal X10:9 (VI24) if a higher power level is needed due to options installed on the 24 V_{DC} level. This power supply unit then takes over the complete 24 V_{DC} power supply for MOVIDRIVE®.

The following tables show the power demand of the MOVIDRIVE® units with no options and the power demand of the individual options. MOVIDRIVE® units without options do not need an external 24 V_{DC} power supply.

The following conditions apply to the information about the power demand without options:

- For MDV/MDS: The motor encoder/resolver is supplied from MOVIDRIVE®.
- For MDV/MDS: No external encoder is connected. An external encoder increases the power demand by about 5 W.
- The 24 V_{DC} outputs (VO24) are not loaded.
- Binary outputs DBØØ and DOØ2 are loaded with 100 mA in total.

The power values of the options are maximum values given full load on the inputs/outputs.

MDF

24 V_{DC} power demand of MOVIDRIVE® MDF60A:

Size	Without option	Additional 24 V_{DC} power demand with option					
		Fieldbus options1)	DIO11A	DIP11A	DRS11A	DPA11A	DPI11A
1	20 W	3 W	17 W	25 W	-2)	-2)	-2)
2	20 W						
3	26 W						
4	28 W						
5	20 W						

1) Fieldbus options are: DFP21A, DFP11A, DFI11A, DFI21A, DFC11A, DFO11A, DFD11A

2) Not possible with type MDF.

Example

MOVIDRIVE® MDF60A0022-503-4-00 (size 1) with the fieldbus interface option type DFI21A:

20 W + 3 W = 23 W

The power demand is less than 29 W, which means no external 24 V_{DC} power supply unit is needed.

MOVIDRIVE® MDF60A0110-503-4-00 (size 2) with the options fieldbus interface type DFP21A and input/output card type DIO11A:

20 W + 3 W + 17 W = 40 W

A 24 V_{DC} power supply unit with a power of at least 40 W must be connected to VI24.

MDV

24 V_{DC} power demand of MOVIDRIVE® MDV60A:

Size	Without option	Additional 24 V_{DC} power demand with option					
		Fieldbus options[1)]	DIO11A	DIP11A	DRS11A	DPA11A	DPI11A
1	26 W	3 W	17 W	25 W	22 W	120 W[2)]	120 W[2)]
2	26 W						
3	29 W						
4	29 W						
5	26 W						

1) Fieldbus options are: DFP21A, DFP11A, DFI11A, DFI21A, DFC11A, DFO11A, DFD11A

2) Power demand when the binary outputs of the option are loaded with I = 500 mA. The 24 V_{DC} power supply unit must be connected to the VI24 input of the option (X50:30/X50:31).

Example

MOVIDRIVE® MDV60A0550-503-4-00 (size 5) with the synchronous operation card option type DRS11A:

26 W + 22 W = 48 W

A 24 V_{DC} power supply unit with a power of at least 48 W must be connected to VI24.

MDS

24 V_{DC} power demand of MOVIDRIVE® MDS60A:

Size	Without option	Additional 24 V_{DC} power demand with option					
		Fieldbus options[1)]	DIO11A	DIP11A	DRS11A	DPA11A	DPI11A
1	24 W	3 W	17 W	25 W	22 W	120 W[2)]	120 W[2)]
2	24 W						
3	29 W						
4	29 W						
5	24 W						

1) Fieldbus options are: DFP21A, DFP11A, DFI11A, DFI21A, DFC11A, DFO11A, DFD11A

2) Power demand when the binary outputs of the option are loaded with I = 500 mA. The 24 V_{DC} power supply unit must be connected to the VI24 input of the option (X50:30/X50:31).

Example

MOVIDRIVE® MDS60A0150-503-4-00 (size 3) with the absolute encoder interface option type DIP11A:

29 W +25 W = 54 W

A 24 V_{DC} power supply unit with a power of at least 54 W must be connected to VI24.

5.21 Parameter set switchover

This function allows two motors to be operated with two different parameter sets on the same inverter in the VFC modes without speed control (→ P700).

The parameter set switchover occurs by means of a binary input. A binary input must be programmed to the "PARAM. SWITCHOVER" function (→ P60_/P61_) for this purpose. It is possible to switch between parameter set 1 and 2 in the BLOCKED inverter status.

Function	Effect of	
	"0" signal	"1" signal
PAR. SWITCHOVER	Parameter set 1 active	Parameter set 2 active

STOP

A changeover contactor should be provided for each of the two motor leads when two motors are operated alternately on the same inverter with the parameter set switchover function in use (→ P60_/P61_ PARAM. SWITCHOVER). Do not switch the switchover contacts unless the unit is inhibited!

Only VFC operating modes without speed control are possible with parameter set 2. Speed control or CFC and SERVO operating modes are not possible.

5.22 *Priority of operating states and interrelations between control signals*

Priority of operating states

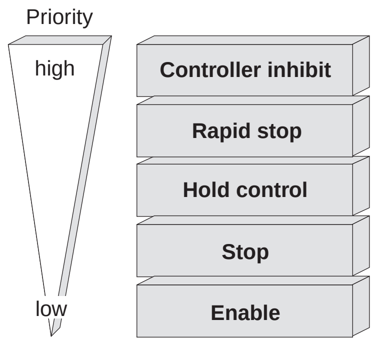

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Fig. 100: Priority of operating states

Interrelations between control signals

The following table shows the interrelations between control signals. "/Controller inhibit" is programmed to binary input DIØØ and cannot be changed. The other control signals are only in effect if a binary input is programmed to this function (→ parameter P60_).

/Controller inhibit (DIØØ)	Binary input is programmed to				Inverter status
	Enable/rapid stop	/Hold control	CW/STOP	CCW/STOP	
"0"	1)	1)	1)	1)	Inhibit
"1"	"0"	2)	2)	2)	
"1"	"1"	"0"	3)	3)	
"1"	"1"	"1"	"1"	"0"	CW running enabled
"1"	"1"	"1"	"0"	"1"	CCW running enabled

1) Not relevant if "/Controller inhibit (DIØØ)" = "0"

2) Not relevant if "Enable/Rapid stop" = "0"

3) Not relevant if "/Hold control" = "0"

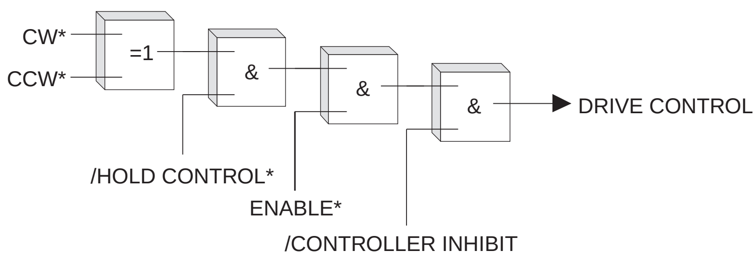

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Fig. 101: Interrelations between control signals

* If a binary input is programmed to this function.

5.23 Limit switches

Limit switch processing

Limit switch processing ensures that a drive does not move outside its travel range. To do this, it is possible to program the binary inputs to the functions /LIM. SWITCH CW and /LIM. SWITCH CCW. The limit switches are connected to these binary inputs. The limit switches must be "0" active and continuously actuated in the limit switch area (= movement up to limit switch).

"0" active means:

- Limit switch not contacted (= not actuated) → 24 V signal
- Limit switch contacted (= actuated) → 0 V signal

Limit switch contacted ("0" signal)

- The drive is stopped with the emergency ramp t14/t24.
- The brake is then applied if the brake function is activated.
- In IPOS operating modes, contacting a limit switch generates a fault message. A reset is then required in order to move clear (→ IPOS manual).

Moving the drive clear

- The inverter must be enabled via the binary inputs.
- Hold control must not be active.
- The inverter receives a setpoint from the setpoint source leading in the direction for moving clear.
- If the setpoint stop function is activated: setpoint > start setpoint

Behavior of the drive when moving clear

- When the brake function is activated, the brake is first released and then the drive is moved clear ("0" → "1" signal). The limit switches must supply a "1" signal continuously in the travel range.

If movement clear of the limit switch area takes place without a move-clear phase, for example by moving the drive manually, then it is possible to continue moving in normal operating status.

Limit switch monitoring

- The inverter monitors whether the limit switches are missing, if there is an open circuit or if the limit switches have been swapped over. If this is the case, the inverter triggers an emergency stop and displays fault F27, "Limit switches missing".

6 Serial Communication

MOVILINK® protocol

The MOVILINK® profile enables the uniform transmission of user data between SEW motor controllers as well as via various communications interfaces to higher-level automation equipment. Consequently, MOVILINK® guarantees a control and parameterization concept which can be used irrespective of the fieldbus for all current bus systems, such as:

- PROFIBUS-FMS
- PROFIBUS-DP
- INTERBUS
- INTERBUS with fiber optic cable
- CAN
- CANopen
- DeviceNet
- RS-232
- RS-485

The MOVILINK® profile is based on the proven fieldbus unit profile of the MOVITRAC® 31C frequency inverter and the MOVIDYN® servo controller. The interface protocol has been simplified and optimized for straightforward reproduction on the RS-232 and RS-485 serial interfaces.

The MOVILINK® protocol for serial interfaces in the new SEW range of inverters, MOVIDRIVE® and MOVIMOT®, enables you to set up a serial bus connection between a higher-level master and several SEW inverters. For example, masters may take the form of programmable logic controllers, PCs or even SEW inverters with PLC functions (IPOS^plus®). Generally speaking, the SEW inverters function as slaves in the bus system.

The MOVILINK® protocol allows both of the following applications to be implemented: automation tasks such as control and parameterization of the drives by means of cyclical data exchange; startup and visualization tasks.

Features

The principal features of the MOVILINK® protocol are:

- Support for the master/slave structure via RS-485 with one master (single master) and at most 31 slave stations (SEW inverters).
- Support for point-to-point connection via RS-232.
- User-friendly implementation of the protocol in a straightforward and reliable telegram structure with fixed telegram lengths and a unique start identifier
- Data interface to the basic unit in accordance with the MOVILINK® profile. This means the user data sent to the drive are transmitted to the inverter in the same way as via the other communications interfaces (PROFIBUS, INTERBUS, CAN, CANopen, DeviceNet, etc.).
- Access to all drive parameters and functions, therefore can be used for startup, service, diagnosis, visualization and automation tasks
- Startup and diagnostic tools on the basis of MOVILINK® for PC (e.g. MOVITOOLS/SHELL and MOVITOOLS/SCOPE).

Please refer to the "Serial Communication and System Bus (SBus)" manual for a detailed description of the MOVILINK® protocol. This manual can be ordered from SEW.

7 Safety Notes

Installation and startup

- **Never install damaged products or take them into operation.**Please submit a complaint to the transport company immediately in the event of damage.
- **Installation, startup and service work** only by **trained personnel** observing applicable accident prevention regulations and operating instructions! The regulations in force (e.g. EN 60204, VBG 4, DIN-VDE 0100/0113/0160) must also be complied with.
- Follow the **specific instructions** during **installation** and **startup** of the motor and the brake!
- Make sure that **preventive measures** and **protection devices** correspond to the **applicable regulations** (e.g. EN 60204 or EN 50178).

  Required preventive measures: Grounding the unit

  Required protection device: Overcurrent protection devices
- **The unit meets all requirements for reliable isolation** of power and electronics connections in accordance with EN 50178. **All connected circuits** must also **satisfy the requirements for reliable isolation** so as to guarantee reliable isolation.
- Take **suitable measures** (e.g. disconnecting the electronics terminal block) to ensure that the connected **motor does not start up automatically** when the inverter **is switched on**.

Operation and servicing

- **Disconnect the unit from the supply system** prior to **removing the protective cover. Dangerous voltages** may still be present for up to **10 minutes after mains disconnection**.
- The unit has **IP 00** enclosure with the **protective cover removed**. **Dangerous voltages** are present on all subassemblies except for the control electronics. The unit must be closed during operation.
- **Dangerous voltages** are present at the **output terminals** and the **cables and motor terminals connected to them when the unit is switched on**. This also applies even when the unit is inhibited and the motor at a standstill.
- Just because the **operation LED and other display elements** have gone out **does not mean** that the unit has been disconnected from the supply system and is **de-energized**.
- **Safety functions inside the unit** or a **mechanical blockage** may cause the **motor to stop**. The **removal of the source of the malfunction** or a **reset** can result in an **automatic restart of the drive**. If, for safety reasons, this is **not permissible** for the driven machine, the **unit must be disconnected from the supply system** before correcting the fault. In such cases, it is also forbidden for the **"Auto reset" function (P841)** to be activated.
- The inverter output may only be **switched when the output stage is inhibited**.

8 Unit Design

8.1 Unit designation, nameplates and scope of supply

Sample unit designation

MOVIDRIVE® MDV 60 A 0055-5A3-4-00

- Version: 00 = Standard / 0T = Applications
- Quadrants: 4 = 4Q (with brake chopper)
- Type of supply: 3 = 3-phase
- Input filter: A = implemented / 0 = not implemented
- Rated supply voltage: 5 = 380...500 V_{AC} / 2 = 200...240 V_{AC}
- Recommended motor power: 0055 = 5.5 kW
- Version A
- Type series
- Type: MDF = flux control mode without encoder for asynchronous motors only VFC operating modes (VFC = Voltage Flux Control)
  MDV = field-oriented control mode without and with encoder for asynchronous motors VFC and CFC operating modes (CFC = Current Flux Control)
  MDS = flux control mode with resolver for synchronous motors SERVO operating modes
  MDR = regenerative power supply unit

00880BEN

Fig. 102: Unit designation

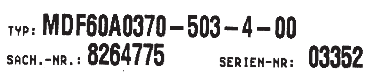
Sample nameplate

The overall nameplate is attached to the side of the unit.

01318AXX

Fig. 103: Overall nameplate

Furthermore, a type label is attached to the front of the control unit (above the TERMINAL option slot).



01322AXX

Fig. 104: Type label

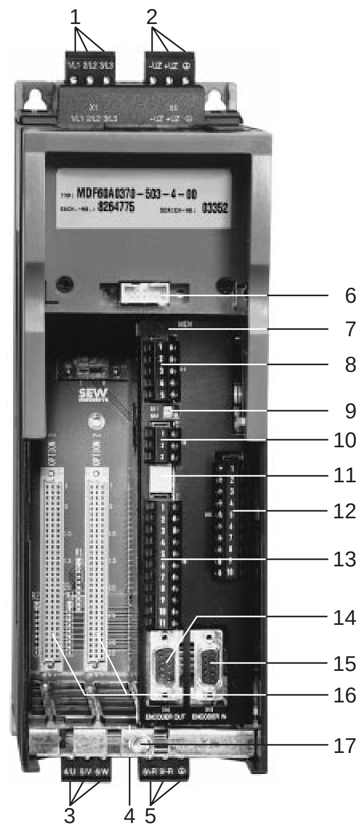
Scope of delivery

- All sizes: Connector housing for signal terminals (X10 – X13), connected.
- In addition, with size 1: Plug housing for the power terminals (X1 – X4), connected.
- In addition, with sizes 1 and 2: Power shield clamp.
- In addition, with sizes 4 and 5: Touch guard for the power terminals.

8.2 Unit design, size 1

MD_60A-5A3 (400/500 V units): 0015 – 0040

MD_60A-2A3 (230 V units): 0015 – 0037



01245BXX

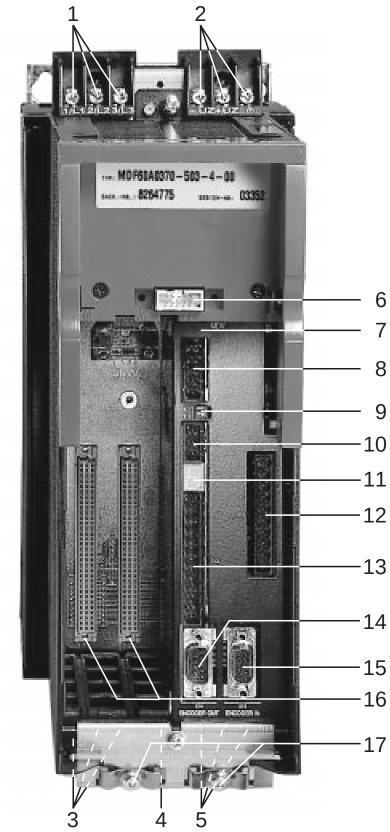
Fig. 105: Unit design, MOVIDRIVE® size 1

1. X1: Mains connection L1 (1) / L2 (2) / L3 (3), separable
2. X4: DC link connection -U_Z / +U_Z and PE connection, separable
3. X2: Motor connection U (4) / V (5) / W (6), separable
4. Connection for power shield clamp (not visible)
5. X3: Braking resistor connection R+ (8) / R- (9) and PE connection, separable
6. TERMINAL: Option slot for DBG11A keypad or USS21A serial interface
7. Control pcb on CONTROL option slot
8. X11: Electronics terminal strip (setpoint input AI1 and 10 V reference voltage)
9. Switch S11 (signal type AI1) and switch S12 (system bus terminating resistor)
10. X12: Electronics terminal strip system bus (SBus)
11. 7-segment display
12. X10: Electronics terminal strip binary outputs and TF/TH input
13. X13: Electronics terminal strip binary inputs and RS-485 interface
14. Only MDV/MDS, X14: Incremental encoder simulation or external encoder input (9-pin sub D plug)
15. Only MDV/MDS, X15: Motor encoder input (9-pin sub D socket)
16. OPTION1 and OPTION2: Option slots 1 and 2
17. Connection for electronics shield clamps

8.3 Unit design, size 2

MD_60A-5A3 (400/500 V units): 0055 – 0110

MD_60A-2A3 (230 V units): 0055 / 0075



00895BXX

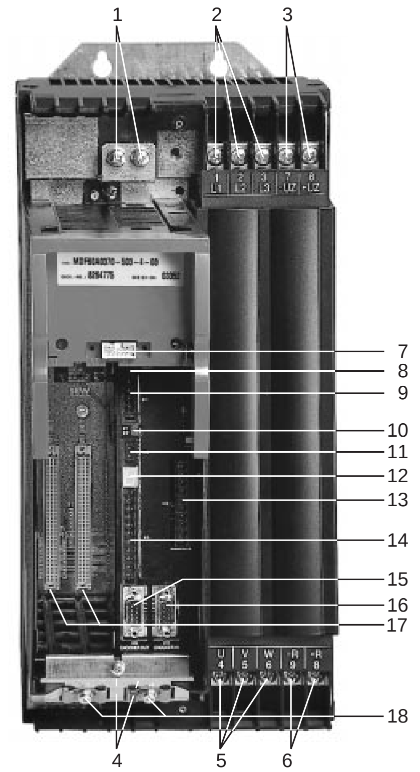
Fig. 106: Unit design, MOVIDRIVE® size 2

1. X1: Mains connection L1 (1) / L2 (2) / L3 (3)
2. X4: DC link connection -U_Z / +U_Z and PE connection
3. X2: Motor connection U (4) / V (5) / W (6) (not visible)
4. Connection for power shield clamp (not visible)
5. X3: Braking resistor connection R+ (8) / R- (9) and PE connection (not visible)
6. TERMINAL: Option slot for DBG11A keypad or USS21A serial interface
7. Control pcb on CONTROL option slot
8. X11: Electronics terminal strip (setpoint input AI1 and 10 V reference voltage)
9. Switch S11 (signal type AI1) and switch S12 (system bus terminating resistor)
10. X12: Electronics terminal strip system bus (SBus)
11. 7-segment display
12. X10: Electronics terminal strip binary outputs and TF/TH input
13. X13: Electronics terminal strip binary inputs and RS-485 interface
14. Only MDV/MDS, X14: Incremental encoder simulation or external encoder input (9-pin sub D plug)
15. Only MDV/MDS, X15: Motor encoder input (9-pin sub D socket)
16. OPTION1 and OPTION2: Option slots 1 and 2
17. Connection for electronics shield clamps

8.4 Unit design, size 3

MD_60A-503 (400/500 V units): 0150 – 0300

MD_60A-203 (230 V units): 0110 / 0150



01248BXX

Fig. 107: Unit design, MOVIDRIVE® size 3

1. PE connections
2. X1: Mains connection L1 (1) / L2 (2) / L3 (3)
3. X4: DC link connection $-U_Z$ / $+U_Z$
4. PE connections (not visible)
5. X2: Motor connection U (4) / V (5) / W (6)
6. X3: Braking resistor connection R+ (8) / R- (9)
7. TERMINAL: Option slot for DBG11A keypad or USS21A serial interface
8. Control pcb on CONTROL option slot
9. X11: Electronics terminal strip (setpoint input AI1 and 10 V reference voltage)
10. Switch S11 (signal type AI1) and switch S12 (system bus terminating resistor)
11. X12: Electronics terminal strip system bus (SBus)
12. 7-segment display
13. X10: Electronics terminal strip binary outputs and TF/TH input
14. X13: Electronics terminal strip binary inputs and RS-485 interface
15. Only MDV/MDS, X14: Incremental encoder simulation or external encoder input (9-pin sub D plug)
16. Only MDV/MDS, X15: Motor encoder input (9-pin sub D socket)
17. OPTION1 and OPTION2: Option slots 1 and 2
18. Connection for electronics shield clamps

8.5 Unit design, size 4

MD_60A-503 (400/500 V units): 0370 / 0450

MD_60A-203 (230 V units): 0220 / 0300

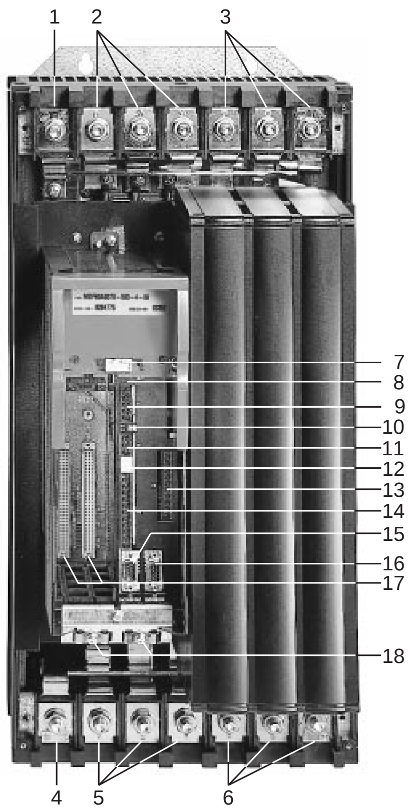


Fig. 108: Unit design, MOVIDRIVE® size 4

1. X2: PE connection
2. X1: Mains connection L1 (1) / L2 (2) / L3 (3)
3. X4: DC link connection $-U_Z$ / $+U_Z$ and PE connection
4. X2: PE connection
5. X2: Motor connection U (4) / V (5) / W (6)
6. X3: Braking resistor connection R+ (8) / R- (9) and PE connection
7. TERMINAL: Option slot for DBG11A keypad or USS21A serial interface
8. Control pcb on CONTROL option slot
9. X11: Electronics terminal strip (setpoint input AI1 and 10 V reference voltage)
10. Switch S11 (signal type AI1) and switch S12 (system bus terminating resistor)
11. X12: Electronics terminal strip system bus (SBus)
12. 7-segment display
13. X10: Electronics terminal strip binary outputs and TF/TH input
14. X13: Electronics terminal strip binary inputs and RS-485 interface
15. Only MDV/MDS, X14: Incremental encoder simulation or external encoder input (9-pin sub D plug)
16. Only MDV/MDS, X15: Motor encoder input (9-pin sub D socket)
17. OPTION1 and OPTION2: Option slots 1 and 2
18. Connection for electronics shield clamps

8.6 Unit design, size 5

MD_60A-503 (400/500 V units): 0550 / 0750

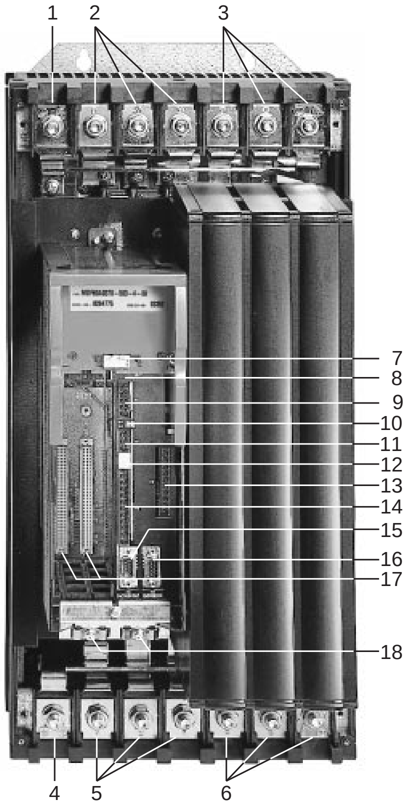


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Fig. 109: Unit design, MOVIDRIVE® size 5

1. X2: PE connection
2. X1: Mains connection L1 (1) / L2 (2) / L3 (3)
3. X4: DC link connection $-U_Z$ / $+U_Z$ and PE connection
4. X2: PE connection
5. X2: Motor connection U (4) / V (5) / W (6)
6. X3: Braking resistor connection R+ (8) / R- (9) and PE connection
7. TERMINAL: Option slot for DBG11A keypad or USS21A serial interface
8. Control pcb on CONTROL option slot
9. X11: Electronics terminal strip (setpoint input AI1 and 10 V reference voltage)
10. Switch S11 (signal type AI1) and switch S12 (system bus terminating resistor)
11. X12: Electronics terminal strip system bus (SBus)
12. 7-segment display
13. X10: Electronics terminal strip binary outputs and TF/TH input
14. X13: Electronics terminal strip binary inputs and RS-485 interface
15. Only MDV/MDS, X14: Incremental encoder simulation or external encoder input (9-pin sub D plug)
16. Only MDV/MDS, X15: Motor encoder input (9-pin sub D socket)
17. OPTION1 and OPTION2: Option slots 1 and 2
18. Connection for electronics shield clamps

9 Installation

9.1 Installation instructions for basic unit

It is essential to comply with the safety notes during installation!

Tightening torques

- Only use **genuine connection elements**. Note the **permitted tightening torques** of MOVIDRIVE® power terminals.
  - Size 1 → 0.6 Nm (5.3 lb.in)
  - Size 2 → 1.5 Nm (13.3 lb.in)
  - Size 3 → 3.5 Nm (31 lb.in)
  - Sizes 4 and 5 → 14 Nm (124 lb.in)

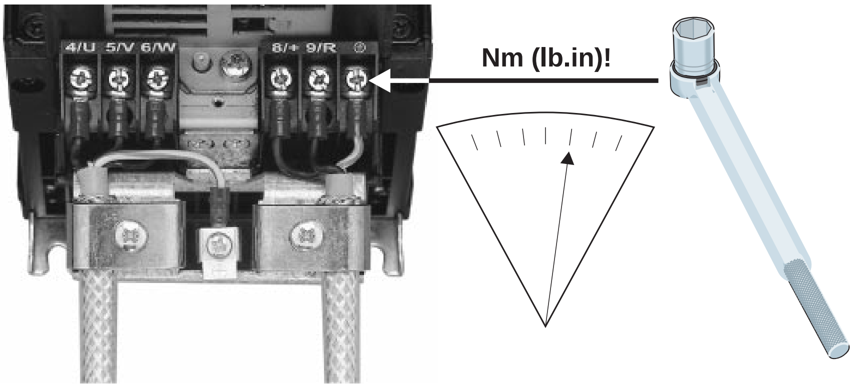

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Fig. 110: Note the tightening torques

Minimum clearance and mounting position

- Leave **100 mm (4 in) clearance at the top and bottom** for optimum cooling. No lateral clearance required; the units can be lined up side-by-side. With sizes 4 and 5, do not install any components which are sensitive to high temperatures within 300 mm (11.81 in) of the top of the unit. Only install the units **vertically**. You must not install them horizontally, tilted or upside down.

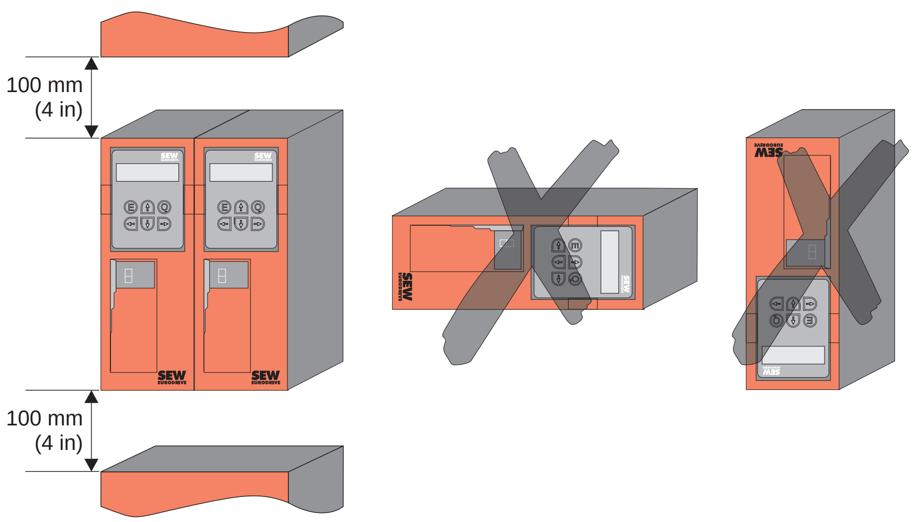

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Fig. 111: Minimum clearance and installation position of the units

Separate cable ducts

- Route **power cables** and **electronics cables** in **separate cable ducts**.

Input fuses and earth-leakage circuit breakers

- Install the **input fuses at the beginning of the supply system lead** behind the supply bus junction (→ Wiring diagram for basic unit, power section and brake).
- Using an **earth-leakage circuit breaker** as **the sole protection device** is **not permitted**. **Earth-leakage currents > 3.5 mA** can arise during normal operation of the inverter.

Supply system and brake contactors

- **Only use contactors in utilization category AC-3** (IEC 158-1) as supply system and brake contactors.

PE mains connection (→ EN 50178)

- With a **supply system lead < 10 mm^2 (AWG 8)**: Lay a **second PE conductor with the cross section of the supply system lead** in parallel to the protective earth via separate terminals or use a **copper protective earth with a cross section of 10 mm^2 (AWG 8)**.
- With a **supply system lead** ≥ **10 mm^2 (AWG 8)**: Lay a **copper protective earth with the cross section of the supply system lead**.

IT systems

- SEW recommends using **earth-leakage monitors with a pulse code measuring process** in voltage supply systems with a non-earthed star point **(IT systems)**. This avoids mis-tripping of the earth-leakage monitor due to the earth capacitance of the inverter.

Cross sections

- Supply system lead: **Cross section according to nominal input current** I_{in} at rated load.
- Motor lead: **Cross section according to output rated current** I_N.
- Electronics cables:
  – One core per terminal 0.20 – 2.5 mm^2 (AWG 24 – 12)
  – Two cores per terminal 0.20 – 1 mm^2 (AWG 24 – 17)

Unit output

- **Only connect ohmic/inductive loads (motors).** Never connect capacitive loads!

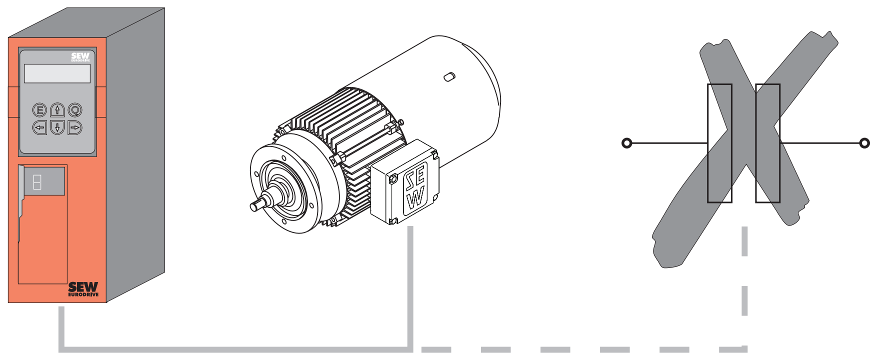

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Fig. 112: Only connect ohmic/inductive loads; do not connect capacitive loads

Connecting braking resistors

- Use **two closely twisted cables or a 2-core shielded power cable**. Cross section according to the output rated current of the inverter.
- Protect the braking resistor with a **bimetallic relay** (→ Wiring diagram for basic unit, power section and brake). Set the **trip current** according to the **technical data of the braking resistor**.

Operating braking resistors

- The connection leads to the braking resistors carry a **high DC voltage (approx. 900 V)** during rated operation.
- The **surfaces** of the braking resistors get **very hot** when the braking resistors are loaded with P_N. Select a **suitable installation position**. As a rule, braking resistors are mounted on the switch cabinet roof.
- Install the **flat-type braking resistors** together with the appropriate **touch guard**.

Binary inputs / binary outputs

- The **binary inputs** are **electrically isolated** by optocouplers.
- The **binary outputs** are **short-circuit proof**, although they are **not interference-voltage-proof** (exception: relay output DOØ1). External voltage can cause irreparable damage to the binary outputs.

Shielding and earthing

- Only use **shielded control cables**.
- Connect the **shield by the shortest possible route and make sure it is earthed over a wide area at both ends**. You can ground one end of the shield via a suppression capacitor (220 nF / 50 V) to avoid ground loops. If using double-shielded cables, ground the outer shield on the inverter end and the inner shield on the other end.

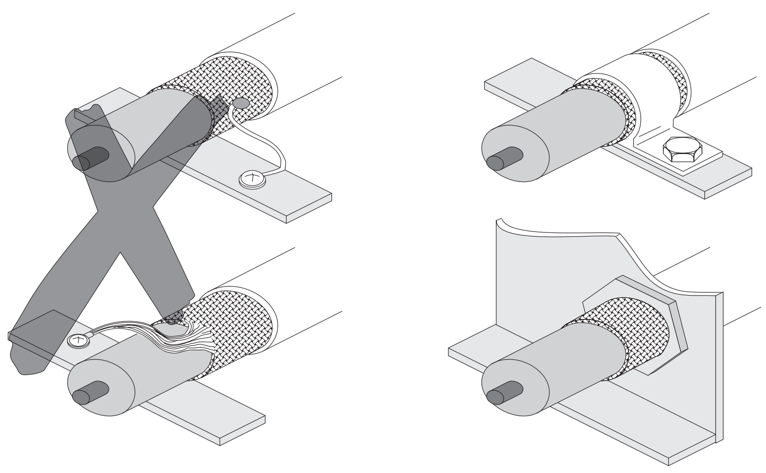

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Fig. 113: Example of correct shield connection with metal clamp (shield clamp) or metal cable gland

- **Shielding** can also be achieved by laying the cables in **grounded sheet metal ducts or metal pipes**. In this case, the **power cables and control cables** should be **laid separately**.
- Provide **high frequency compatible grounding** for the **inverter** and **all additional units** (wide area metal-on-metal contact between the unit housing and ground, e.g. unpainted switch cabinet mounting panel).

Input filter

- **Sizes 1 and 2** are fitted with an **input filter** as standard. This input filter ensures that **limit value class A is maintained on the supply side**. Use an NF...-... input filter as an option to maintain the class B limit.
- The **NF...-... input filter option** is required for **sizes 3 to 5** to maintain class A and B limits.
- Install the **input filter close to the inverter**, but outside the minimum clearance area for cooling.
- Restrict the **cable between the input filter and the inverter to the absolute minimum length required**, and never more than 400 mm (15.8 in). Unshielded, twisted cables are sufficient. Also use unshielded cables for the supply system lead.
- This input filter must be mounted either **directly at the entry point into the switch cabinet or in the immediate vicinity of the inverter** if **several inverters are connected to the same input filter**. The input filter must be chosen on the basis of the total current of the connected inverters.
- No **EMC limits are specified for interference emission** in **voltage supply systems without an earthed star point** (IT systems). The **effectiveness of input filters** in IT systems is **severely limited**.

Interference emission

SEW recommends the following **EMC measures on the motor side to maintain the class A and B limits**:

- Shielded motor cable
- HD... output choke option

HD... output choke

- Install the **output choke close to the inverter**, but outside the minimum clearance for cooling.
- Route **all three phases together through the output choke**. **Do not route the PE conductor through the output choke!**

9

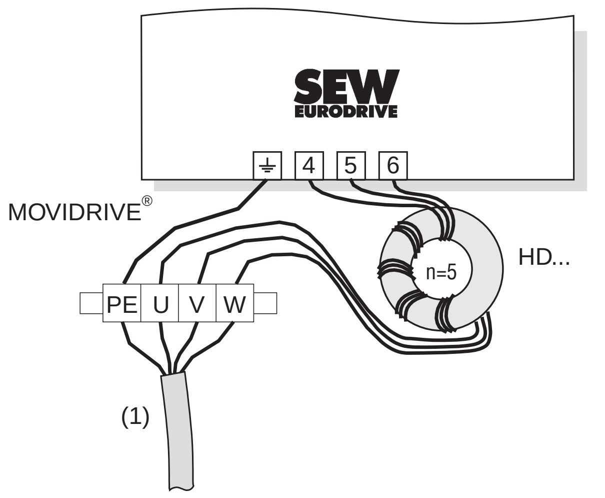

Fig. 114: Connecting HD... output chokes

(1) = Motor cable

9.2 UL compliant installation

Please note the following points for UL compliant installation:

- Only use copper cables with the **following temperature ranges** as connection leads:
  - For MOVIDRIVE® MD_60A0015 – 0300 temperature range 60/75 °C
  - For MOVIDRIVE® MD_60A0370 – 0750 temperature range 75/90 °C
- The **permitted tightening torques** for MOVIDRIVE® power terminals are:
  - Size 1 → 0.6 Nm (5.3 lb.in)
  - Size 2 → 1.5 Nm (13.3 lb.in)
  - Size 3 → 3.5 Nm (31 lb.in)
  - Sizes 4 and 5 → 14 Nm (124 lb.in)
- MOVIDRIVE® drive inverters are **suitable for operation in voltage power systems with an earthed star point** (TN and TT systems) which can supply a max. current in accordance with the following tables and which have a max. voltage of 500 V_{AC} for MOVIDRIVE® MD_60A...-5_3 (400/500 V units) and 240 V_{AC} for MOVIDRIVE® MD_60A...2_3 (230 V units). The performance data of the fuses must not exceed the values in the tables.

400/500 V units

MOVIDRIVE® MD_60A...5_3	Max. supply current	Max. supply voltage	Fuses
0015/0022/0030/0040	10000 A_{AC}	500 V_{AC}	30 A / 600 V
0055/0075/0110	10000 A_{AC}	500 V_{AC}	30 A / 600 V
0150/0220	5000 A_{AC}	500 V_{AC}	175 A / 600 V
0300	5000 A_{AC}	500 V_{AC}	225 A / 600 V
0370/0450	10000 A_{AC}	500 V_{AC}	350 A / 600 V
0550/0750	10000 A_{AC}	500 V_{AC}	500 A / 600 V

230 V units

MOVIDRIVE® MD_60A...2_3	Max. supply current	Max. supply voltage	Fuses
0015/0022/0037	5000 A_{AC}	240 V_{AC}	30 A / 250 V
0055/0075	5000 A_{AC}	240 V_{AC}	30 A / 250 V
0110	5000 A_{AC}	240 V_{AC}	175 A / 250 V
0150	5000 A_{AC}	240 V_{AC}	225 A / 250 V
0220/0300	10000 A_{AC}	240 V_{AC}	350 A / 250 V

- Only use tested units with a **limited output voltage** (V_{max} = 30 V_{DC}) and **limited output current** (I ≤ 8 A) as an **external 24 V_{DC} voltage source**.

UL certification does not apply to operation in voltage supply systems with a non-earthed star point (IT systems).

9.3 Power shield clamp

For size 1

A power shield clamp is supplied as standard with MOVIDRIVE® size 1. Install this power shield clamp together with the retaining screws of the unit.

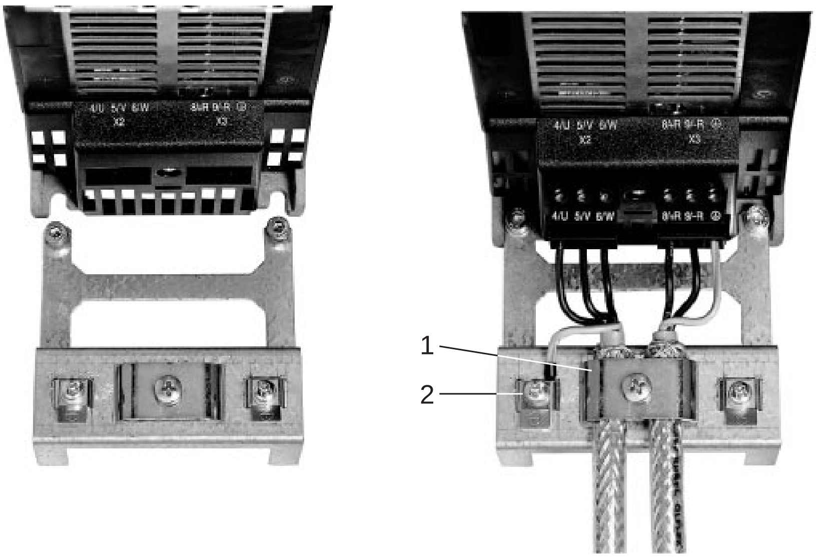

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Fig. 115: Power shield clamp for MOVIDRIVE® size 1

1. Shield clamp
2. PE connection (⏚)

For size 2

A power shield clamp with 2 retaining screws is supplied as standard with MOVIDRIVE® size 2. Install this power shield clamp together with the two retaining screws on X6.

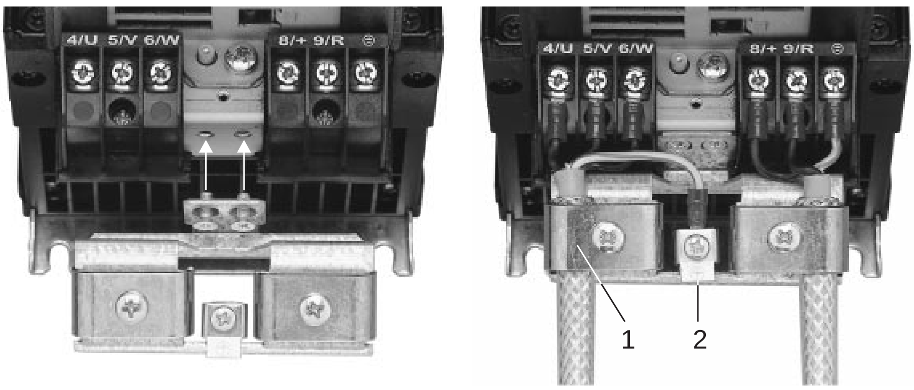

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Fig. 116: Power shield clamp for MOVIDRIVE® size 2

1. Shield clamp
2. PE connection (⏚)

Power shield clamps provide you with a very convenient way of installing the shield for the motor and brake leads. Fit the shield and PE conductor as shown in the figures.

9.4 Touch guard

Two touch guards and eight retaining screws are supplied as standard with MOVIDRIVE® size 4 (500 V units: MD_60A0370/0450; 230 V units: MD_60A0220/0300) and size 5 (MD_60A0550/0750). Install the touch guard on the two hood covers for the power section terminals.

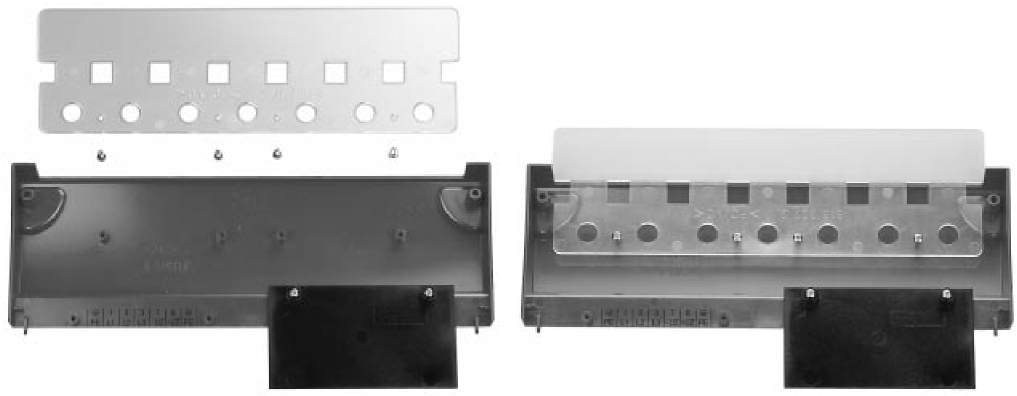

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Fig. 117: Touch guard for MOVIDRIVE® sizes 4 and 5

With installed touch guard, MOVIDRIVE® size 4 and 5 units achieve IP10 enclosure, IP00 without touch guard.

9.5 Wiring diagram, basic unit

Connection of the power section and brake

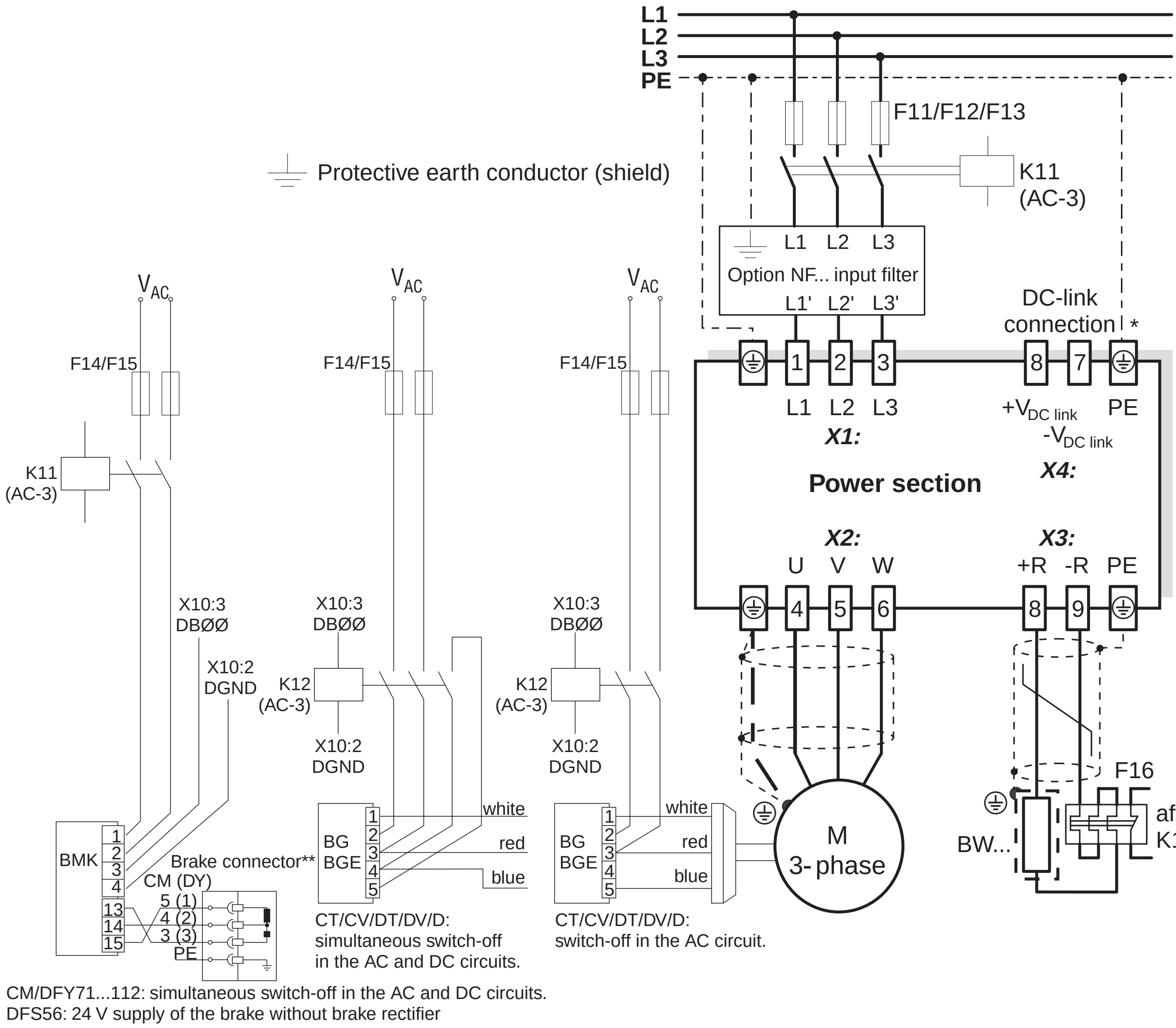

Fig. 118: Wiring diagram, power section and brake

* With sizes 1 and 2, there is no PE connection next to the mains connection terminals. In this case, use the PE terminal next to the DC link connection.

** **Important:** It is essential to adhere to the sequence of connections. Incorrect connection will lead to irreparable damage to the brake.

STOP

A separate supply system lead is required for connecting the brake rectifier. Powering it from the motor voltage is not permitted!

Always switch off the brake on the DC and AC sides under the following conditions:

– all hoist applications,
– drives which require a rapid brake reaction time and
– in CFC and SERVO operating modes.

Brake rectifier in switch cabinet

Route the connection cables between the brake rectifier and the brake separately from other power cables when installing the brake rectifier in the switch cabinet. Joint routing is only permitted if the power cables are shielded.

Control unit connection

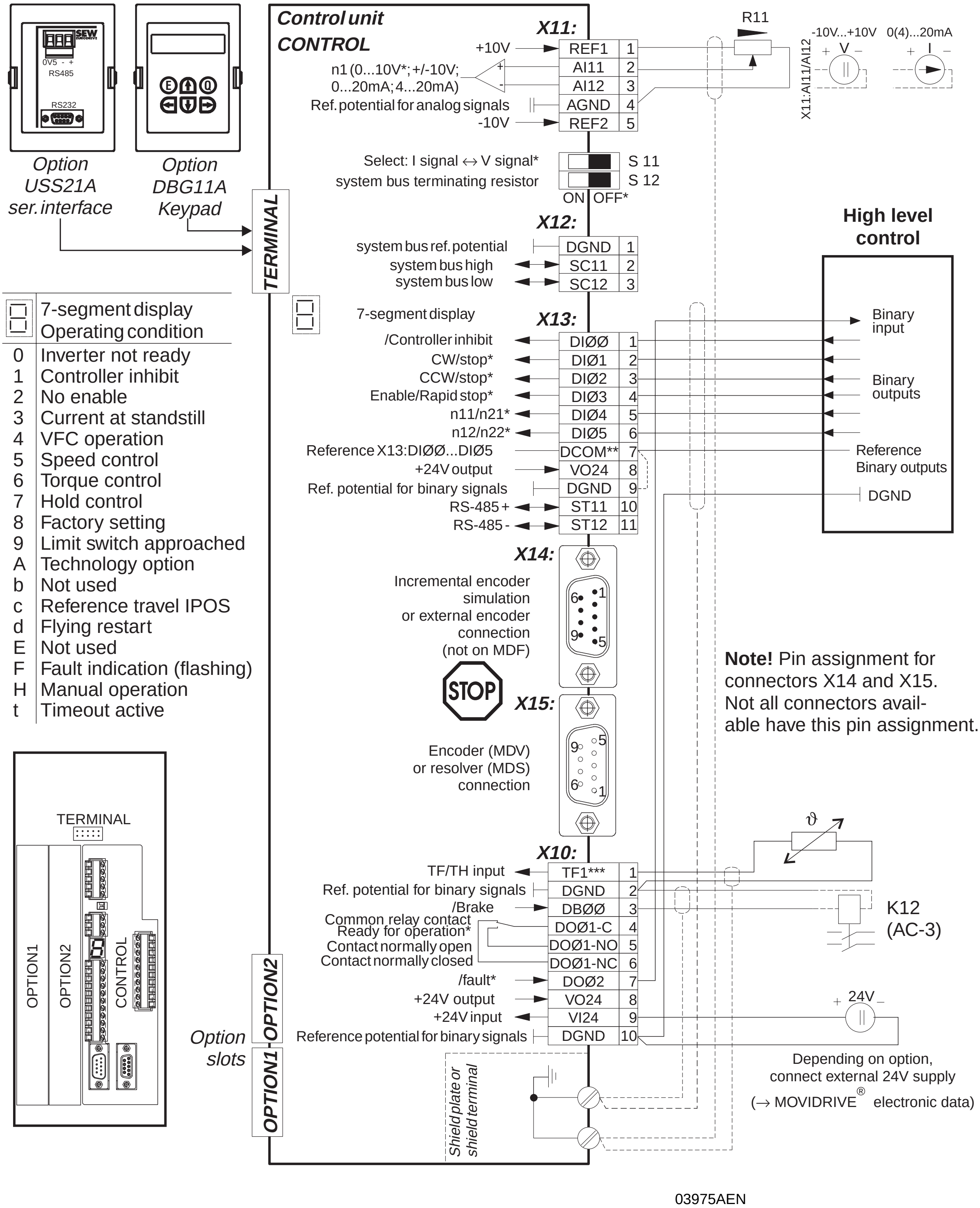

Fig. 119: Wiring diagram, control unit

*	Factory setting
**	If the binary inputs are connected to the 24 V_{DC} voltage supply X13:8 "VO24", then jumper X13:7 to X13:9 (DCOM to DGND) on MOVIDRIVE®.
***	Factory setting: X10:1 (TF1) is jumpered to X10:2 (DGND). The jumper must be removed if a TF or TH is connected to X10:1 and X10:2.

Functional description of the terminals of the basic unit (power section and control unit)

Terminal		Function
X1:1/2/3 **X2:4/5/6** **X3:8/9** **X4:**	**L1/L2/L3** **U/V/W** **+R/-R** **$+U_Z/-U_Z$**	Mains connection Motor connection Braking resistor connection DC link connection
X11:1 **X11:2/3** **X11:4** **X11:5**	**REF1** **AI11/12** **AGND** **REF2**	+10 V (max. 3 mA) for setpoint potentiometer Setpoint input n1 (differential input or input with AGND reference potential), signal form → P11_ / S11 Reference potential for analog signals (REF1, REF2, AI.., AO..) -10 V (max. 3 mA) for setpoint potentiometer
S11: **S12:**		Switch mode I signal (0(4) – 20 mA) ↔ U signal (-10 V – 0 – 10 V, 0 – 10 V), factory setting: V signal Switch system bus terminating resistor on or off, factory setting: switched off
X12:1 **X12:2/3**	**DGND** **SC11/12**	Reference potential system bus System bus high/low
X13:1 **X13:2** **X13:3** **X13:4** **X13:5** **X13:6**	**DIØØ** **DIØ1** **DIØ2** **DIØ3** **DIØ4** **DIØ5**	Binary input 1, with fixed assignment "/Controller inhibit" Binary input 2, factory setting "CW/stop" Binary input 3, factory setting "CCW/stop" Binary input 4, factory setting "Enable/rapid stop" Binary input 5, factory setting "n11/n12" Binary input 6, factory setting "n12/n22" • The binary inputs are electrically isolated by optocouplers. • Selection options for binary inputs 2 to 6 (DIØ1 – DIØ5) → Parameter menu P60_
X13:7	**DCOM**	Reference for binary inputs X13:1 to X13:6 (DIØØ – DIØ5) • Switching of binary inputs with +24 V external voltage: X13:7 (DCOM) must be connected to the reference potential of the external voltage. – Without jumper X13:7 – X13:9 (DCOM – DGND) → Isolated binary inputs – With jumper X13:7 – X13:9 (DCOM – DGND) → Non-isolated binary inputs • The binary inputs must be switched with +24 V from X13:8 or X10:8 (VO24) → Jumper required X13:7 – X13:9 (DCOM – DGND).
X13:8 **X13:9** **X13:10** **X13:11**	**VO24** **DGND** **ST11** **ST12**	Auxiliary supply output +24 V (max. 200 mA) for external command switches Reference potential for binary signals RS-485+ RS-485 -
X14:1 **X14:2** **X14:3** **X14:4** **X14:5** **X14:6** **X14:7** **X14:8** **X14:9**	**Not with MDF60A**	Signal track A (K1) Signal track B (K2) Signal track C (K0) Switchover Ref. potential DGND Signal track $\overline{A}$ ($\overline{K1}$) Signal track $\overline{B}$ ($\overline{K2}$) Signal track $\overline{C}$ ($\overline{K0}$) +24 V (max. 180 mA) Output incremental encoder simulation or input external encoder. Only encoders with a signal level according to RS-422 (5 V TTL) are allowed as external encoders. If X14: is used as an incremental encoder simulation output, X14:4 must be jumpered with X14:5 (switchover – DGND). Signal level of incremental encoder simulation to RS-422 (5 V TTL). Pulse count of the incremental encoder simulation: • With MDV60A as on X15: Motor encoder input • With MDS60A 1024 pulses/revolution
X15:1 **X15:2** **X15:3** **X15:4** **X15:5** **X15:6** **X15:7** **X15:8** **X15:9**	**Not with MDF60A**	Signal track A (K1) Signal track B (K2) Signal track C (K0) NC Reference potential DGND Signal track $\overline{A}$ ($\overline{K1}$) Signal track $\overline{B}$ ($\overline{K2}$) Signal track $\overline{C}$ ($\overline{K0}$) +24 V (max. 180 mA) Motor encoder input With MDV60A Permitted encoders: - sin/cos enc. 1 V_{SS} - 5 V TTL encoder - 24 V HTL encoder — sin+ (S2) cos+ (S1) Ref.+ (R1) NC DGND sin- (S4) cos- (S3) Ref.- (R2) TF/TH connection (connect to X15:5 via TF/TH) Resolver input With MDS60A Permitted resolver: 2-pole, 7 V_{AC_rms}, 7 kHz
X10:1 **X10:2** **X10:3** **X10:4** **X10:5** **X10:6** **X10:7**	**TF1** **DGND** **DBØØ** **DOØ1-C** **DOØ1-NO** **DOØ1-NC** **DOØ2**	TF/TH connection (connect to X10:2 via TF/TH), factor setting: "No response" (→ P835) Reference potential for binary signals Binary output 0, with fixed assignment "/Brake", load capacity max. 150 mA (short-circuit proof) Shared contact binary output 1, factory setting: "Ready" Normally open contact binary output 1, load capacity of the relay contacts max. 30 V_{DC} and 0.8 A NC contact binary output 1 Binary output 2, factory setting: /Fault", load capacity max. 50 mA (short-circuit proof) Selection options for binary outputs 1 and 2 (DOØ1 and DOØ2) → Parameter menu P62_ **Do not apply an external voltage to binary outputs X10:3 (DBØØ) and X10:7 (DOØ2)!**
X10:8 **X10:9** **X10:10**	**VO24** **VI24** **DGND**	Auxiliary supply output +24 V (max. 200 mA) for external command switches Input +24 V voltage supply (backup voltage depending on options, unit diagnosis when supply system off) Reference potential for binary signals
TERMINAL		Option slot for DBG11A keypad or serial port USS21A (RS-232 and RS-485)
OPTION1/OPTION2		2 slots for option pcbs

9.6 Assignment of braking resistors, chokes and filters

400/500 V units, sizes 1 and 2

MOVIDRIVE® MD_60A...-5A3			0015	0022	0030	0040	0055	0075	0110
Size					1			2	
Braking resistors	**Trip current**	**Part number**							
BW100-005	I_F = 0.8 A_{RMS}	826 269 1							
BW100-006	I_F = 1.8 A_{RMS}	821 701 7							
BW168	I_F = 2.5 A_{RMS}	820 604 X							
BW268	I_F = 3.4 A_{RMS}	820 715 1							
BW147	I_F = 3.5 A_{RMS}	820 713 5							
BW247	I_F = 4.9 A_{RMS}	820 714 3							
BW347	I_F = 7.8 A_{RMS}	820 798 4							
BW039-012	I_F = 4.2 A_{RMS}	821 689 4							
BW039-026	I_F = 7.8 A_{RMS}	821 690 8							
BW039-050	I_F = 11 A_{RMS}	821 691 6							
Line chokes		**Part numbers**							
ND020-013	ΣI_{system} = 20 A_{AC}	826 012 5							
ND045-013	ΣI_{system} = 45 A_{AC}	826 013 3							
Input filters		**Part number**							
NF009-503	V_{max} = 550 V_{AC}	827 412 6				A			
NF014-503		827 116 X				B		A	
NF018-503		827 413 4						B	
NF035-503		827 128 3							
Output chokes	**Inside diameter**	**Part number**							
HD001	d = 50 mm (1.97 in)	813 325 5	For cable cross sections 1.5 – 16 mm² (AWG 16 – 6)						
HD002	d = 23 mm (0.91 in)	813 557 6	For cable cross sections ≤ 1.5 mm² (AWG 16)						
HD003	d = 88 mm (4.46 in)	813 558 4	For cable cross sections > 16 mm² (AWG 6)						
Output filters (only in VFC mode)		**Part number**							
HF015-503		826 030 3	A						
HF022-503		826 031 1	B	A					
HF030-503		826 032 X		B	A				
HF040-503		826 311 6			B	A			
HF055-503		826 312 4				B	A		
HF075-503		826 313 2					B	A	
HF023-403		825 784 1						B	A
HF033-403		825 785 X							B

A In rated operation (100 %)

B With variable torque load in VFC mode (125 %)

400/500 V units, sizes 3 to 5

MOVIDRIVE® MD_60A...-503			0150	0220	0300	0370	0450	0550	0750
Size				3		4		5	
Braking resistors	**Trip current**	**Part number**							
BW018-015	I_F = 4.0 A_{RMS}	821 684 3				C	C		
BW018-035	I_F = 8.1 A_{RMS}	821 685 1				C	C		
BW018-075	I_F = 14 A_{RMS}	821 686 X				C	C		
BW915	I_F = 28 A_{RMS}	821 260 0							
BW012-025	I_F = 6.1 A_{RMS}	821 680 0							
BW012-050	I_F = 12 A_{RMS}	821 681 9							
BW012-100	I_F = 22 A_{RMS}	821 682 7							
BW106	I_F = 38 A_{RMS}	821 050 0							
BW206	I_F = 42 A_{RMS}	821 051 9							
Line chokes		**Part numbers**							
ND045-013	ΣI_{system} = 45 A_{AC}	826 013 3		A					
ND085-013	ΣI_{system} = 85 A_{AC}	826 014 1		B			A		
ND1503	ΣI_{system} = 150 A_{AC}	825 548 2					B		
Input filters		**Part number**							
NF035-503	V_{max} = 550 V_{AC}	827 128 3	A						
NF048-503		827 117 8	B	A					
NF063-503		827 414 2		B	A				
NF085-503		827 415 0			B		A		
NF115-503		827 416 9					B	A	
NF150-503		827 417 7						B	
Output chokes	**Inside diameter**	**Part number**							
HD001	d = 50 mm (1.97 in)	813 325 5	For cable cross sections 1.5 – 16 mm^2 (AWG 16 – 6)						
HD003	d = 88 mm (4.46 in)	813 558 4	For cable cross sections > 16 mm^2 (AWG 6)						
Output filters (only in VFC mode)		**Part number**							
HF033-403		825 785 X	A	B / D	A / D				
HF047-403		825 786 8	B	A					
HF450-503		826 948 3			B		E	D	D

A In rated operation (100 %)

B With variable torque load in VFC mode (125 %)

C Connect two braking resistors in parallel and set twice the trip current on F16 ($2 \times I_F$)

D Connect two output filters in parallel

E In rated operation (100 %): One output filter
With variable torque load (125 %): Connect two output filters in parallel

230 V units, sizes 1 to 4

MOVIDRIVE® MD_60A...-2_3			0015	0022	0037	0055	0075	0110	0150	0220	0300
Size			1			2		3		4	
Braking resistors	**Trip current**	**Part number**									
BW039-003	I_F = 2.0 A_{RMS}	821 687 8									
BW039-006	I_F = 3.2 A_{RMS}	821 688 6									
BW039-012	I_F = 4.2 A_{RMS}	821 689 4									
BW039-026	I_F = 7.8 A_{RMS}	821 690 8									
BW027-006	I_F = 2.5 A_{RMS}	822 422 6									
BW027-012	I_F = 4.4 A_{RMS}	822 423 4									
BW018-015	I_F = 4.0 A_{RMS}	821 684 3						C	C	C	C
BW018-035	I_F = 8.1 A_{RMS}	821 685 1						C	C	C	C
BW018-075	I_F = 14 A_{RMS}	821 686 X						C	C	C	C
BW915	I_F = 28 A_{RMS}	821 260 0						C	C	C	C
BW012-025	I_F = 10 A_{RMS}	821 680 0									
BW012-050	I_F = 19 A_{RMS}	821 681 9									
BW012-100	I_F = 27 A_{RMS}	821 682 7									
BW106	I_F = 38 A_{RMS}	821 050 0								C	C
BW206	I_F = 42 A_{RMS}	821 051 9								C	C
Line chokes		**Part numbers**									
ND020-013	ΣI_{system} = 20 A_{AC}	826 012 5				A					
ND045-013	ΣI_{system} = 45 A_{AC}	826 013 3				B		A			
ND085-013	ΣI_{system} = 85 A_{AC}	826 014 1						B		A	
ND1503	ΣI_{system} = 150 A_{AC}	825 548 2								B	
Input filters		**Part number**									
NF009-503	V_{max} = 550 V_{AC}	827 412 6		A							
NF014-503		827 116 X		B	A						
NF018-503		827 413 4			B						
NF035-503		827 128 3									
NF048-503		827 117 8						A			
NF063-503		827 414 2						B			
NF085-503		827 415 0								A	
NF115-503		827 416 9								B	
Output chokes	**Internal diameter**	**Part number**									
HD001	d = 50 mm (1.97 in)	813 325 5	For cable cross sections 1.5 – 16 mm^2 (AWG 16 – 6)								
HD002	d = 23 mm (0.91 in)	813 557 6	For cable cross sections ≤ 1.5 mm^2 (AWG 16)								
HD003	d = 88 mm (4.46 in)	813 558 4	For cable cross sections > 16 mm^2 (AWG 6)								

A In rated operation (100 %)

B With variable torque load in VFC mode (125 %)

C Connect two braking resistors in parallel and set twice the trip current on F16 (2 × I_F)

9.7 System bus (SBus) connection

Max. 64 CAN bus stations can be interconnected using the system bus (SBus). The SBus supports transmission systems compliant with ISO 11898.

The "System Bus (SBus)" manual contains detailed information about the system bus. This manual can be obtained from SEW.

SBus wiring diagram

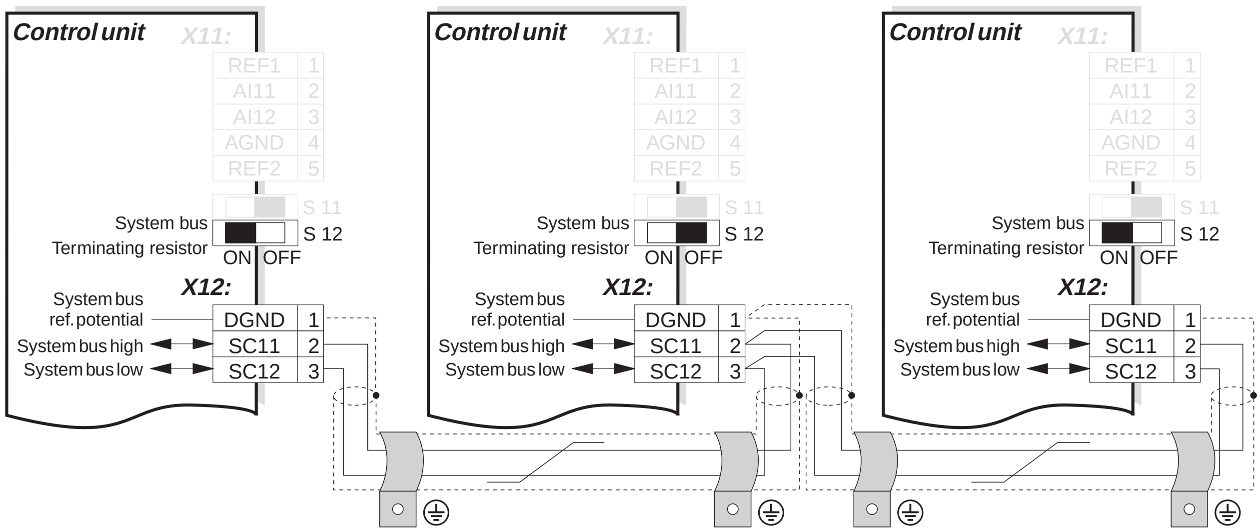

Fig. 120: System bus connection

Cable specification
- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  – Conductor cross section 0.75 mm^2 (AWG 18)
  – Cable resistance 120 Ω at 1 MHz
  – Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

  Suitable cables are CAN bus or DeviceNet cables, for example.

Shield contact
- Connect the shield at either end to the electronics shield clamp of the inverter or the master control and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

Line length
- The permitted total cable length depends on the baud rate setting of the SBus (P816):
  – 125 kbaud → 320 m (1056 ft)
  – 250 kbaud → 160 m (528 ft)
  – **500 kbaud** → **80 m (264 ft)**
  – 1000 kbaud → 40 m (132 ft)

Terminating resistor
- Switch on the system bus terminating resistor (S12 = ON) at the beginning and end of the system bus connection. Switch off the terminating resistor on the other units (S12 = OFF).

STOP

- There must not be any potential displacement between the units which are connected together using the SBus. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead.

9.8 RS-485 interface connection

The RS-485 interface can be used for connecting max. 32 MOVIDRIVE® units, e.g. for master/slave operation, or 31 MOVIDRIVE® units and a CAN machine control (PLC).

Wiring diagram, RS-485 interface

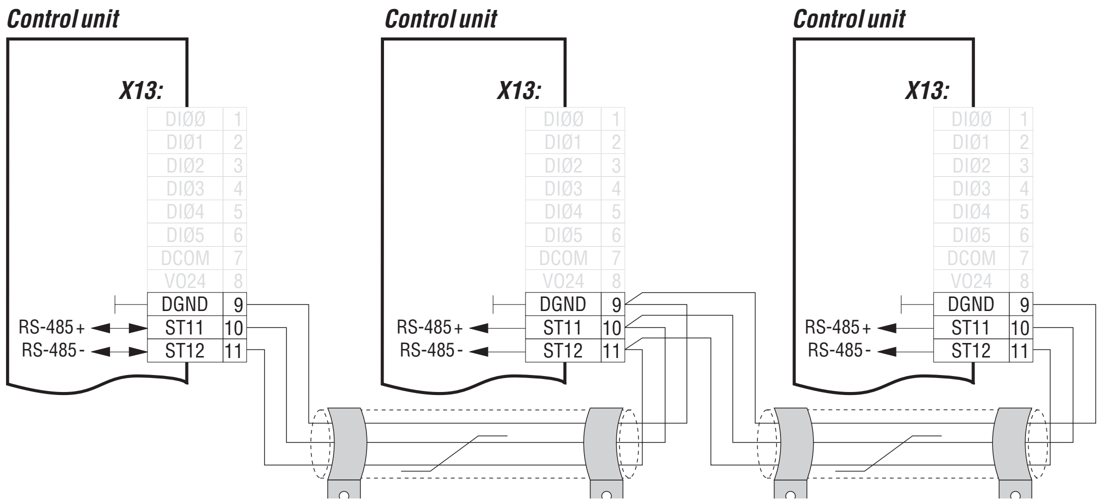

Fig. 121: RS-485 connection

Cable specification

- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  - Conductor cross section 0.5 – 0.75 mm^2 (AWG 20 – 18)
  - Cable resistance 100 – 150 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

  The following cable is suitable, for example:
  - BELDEN (www.belden.com), data cable type 3105A

Shield contact

- Connect the shield at either end to the electronics shield clamp of the inverter or the machine control and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

Line length

- The permitted total line length is 200 m (660 ft).

Terminating resistor

- Dynamic terminating resistors are fitted. Do not connect **any external terminating resistors**!

- There must not be any potential displacement between the units which are connected together using the RS-485. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead.

9.9 Connection option USS21A (RS-232 and RS-485)

Part number USS21A: 822 914 7

RS-232 connection

- Use a shielded standard interface cable for connecting to the RS-232 interface.

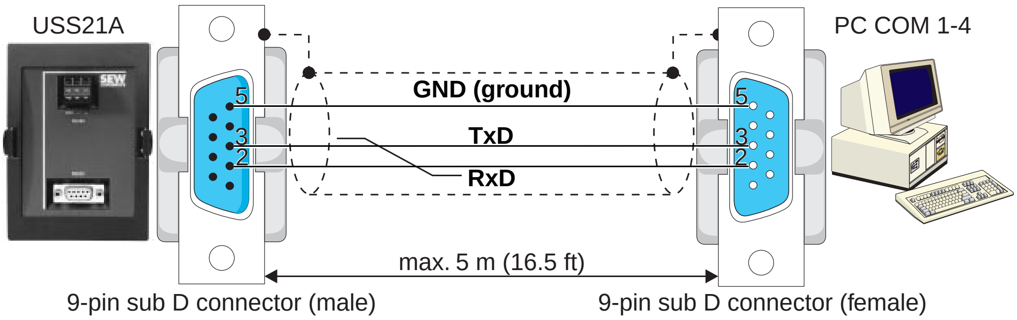

Fig. 122: Connection cable USS21A – PC

RS-485 connection

Please observe the following connection instructions:

- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  – Conductor cross section 0.5 – 0.75 mm^2 (AWG 20 – 18)
  – Cable resistance 100 – 150 Ω at 1 MHz
  – Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

  The following cable is suitable, for example:

  – BELDEN (www.belden.com), data cable type 3105A
- Connect the shield at either end to the electronics shield clamp of the inverter and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

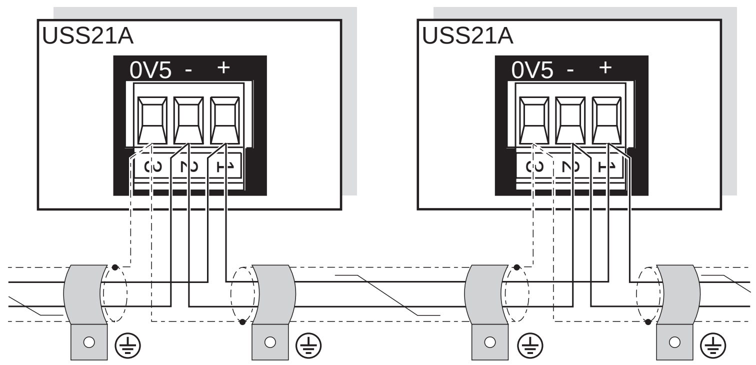

Fig. 123: RS-485 interface of the USS21A

EIA standard

The RS-485 interface of the USS21A corresponds to the EIA standard:

- Max. transmission rate 9600 baud
- Max. 32 participants (each unit with USS21A counts as 2 participants)
- Max. cable length 200 m (660 ft) in total
- Dynamic terminating resistor with fixed installation

9.10 Combinations of options

The following tables show the possible combinations of options in the status as supplied. The meaning of the individual table entries is as follows:

-	The options cannot be used in conjunction with one another.
L | R	Connect the option in the first column (↓) to the OPTION1 slot. Connect the option in the title row (→) to the OPTION2 slot.
R | L	Connect the option in the first column (↓) to the OPTION2 slot. Connect the option in the title row (→) to the OPTION1 slot.

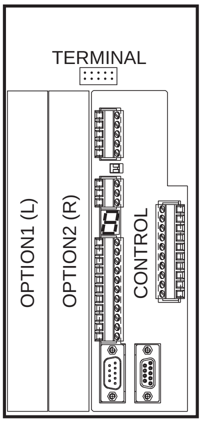

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Fig. 124: Configuration of option slots

MDF / MDV / MDS Combinations of options, applies to all MOVIDRIVE® units[1]:

↓ →	DIP11A	DFP11A DFP21A	DFI11A DFI21A	DFC11A DFO11A	DFD11A	DIO11A	DRS11A[1]	No 2nd option
DIP11A	-	R | L	R | L	R | L	R | L	R | L[2]	R | L	R
DFP11A DFP21A	L | R	-	-	-	-	L | R	L | R	L
DFI11A DFI21A	L | R	-	-	-	-	L | R	L | R	L
DFC11A DFO11A	L | R	-	-	-	-	L | R	L | R	L
DFD11A	L | R	-	-	-	-	L | R	L | R	L
DIO11A	L | R[2]	R | L	R | L	R | L	R | L	L | R[3]	R | L	R
DRS11A	L | R	R | L	R | L	R | L	R | L	L | R	-	R

1) Exception for DRS11A: MOVIDRIVE® MDV or MDS is required for this option.

2) Only the binary terminals of the DIO11A can be set using parameters P6__. The binary terminals of the DIP11A are only available via the IPOS^{plus}® system variables (→ IPOS manual).

3) The "input/output card type DIO11A" option can be connected in pairs. In this case, when the DIO11A is connected to "OPTION2 (R)", bear in mind that the analog inputs/outputs cannot be used and the binary terminals cannot be set using parameters P6__. The binary terminals of the DIO11A on "OPTION2 (R)" are only available via the IPOS^{plus}® system variables (→ IPOS manual).

Example If a MOVIDRIVE® MDV or MDS is equipped with the fieldbus interface PROFIBUS type DFP11A and synchronous operation card type DRS11A options, then the DFP11A must be connected to the OPTION1 (L) slot and the DRS11A to the OPTION2 (R) slot.

9.11 Installing and removing option pcbs

Before you begin

- Take suitable measures to dissipate any electrical charge in your body before you touch the option pcb (discharge strap, conductive shoes, etc.).
- Keep the option pcb in its original packaging and do not remove it until just before installing it.
- Do not touch the option pcb more than necessary. Only hold it by the edge of the board and do not touch any components.

Installing the option pcb

- Disconnect inverter from the supply system, switch off supply system and 24 V_{DC}.
- Remove the keypad, serial interface or blank panel.
- Remove the lower hood cover from the control unit.
- Unscrew the electronics shield clamp.
- Use a suitable screwdriver to lever out and remove the black cover plate.
- Insert the option pcb into the guide rails of the OPTION1 or OPTION2 slot and push it in.
- Apply moderate pressure to the front panel to push on the option pcb. The option pcb has been clipped in correctly when it is flush with the control pcb.
- Replace the electronics shield clamp and draw on retainer screws.
- Put the hood cover of the control unit back on.
- It may not be possible to fit the hood cover, depending on the option pcb and which sub D connector is used. This does not impair the enclosure of the unit.
- Put the keypad, serial interface or blank panel back on.

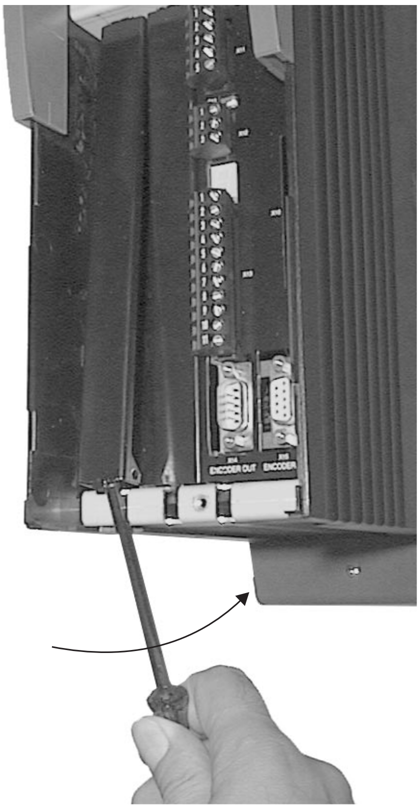

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Fig. 125: Lever out the cover plate

Removing the option pcb

- Disconnect inverter from the supply system, switch off supply system and 24 V_{DC}.
- Remove the keypad, serial interface or blank panel.
- Remove the lower hood cover from the control unit.
- Unscrew the electronics shield clamp.
- Use a suitable screwdriver to lever out the option pcb and pull it out.
- Insert another option pcb or a black cover plate in the place of the option pcb.
- Replace the electronics shield clamp and draw on retainer screws.
- Put the hood cover of the control unit back on.
- Put the keypad, serial interface or blank panel back on.

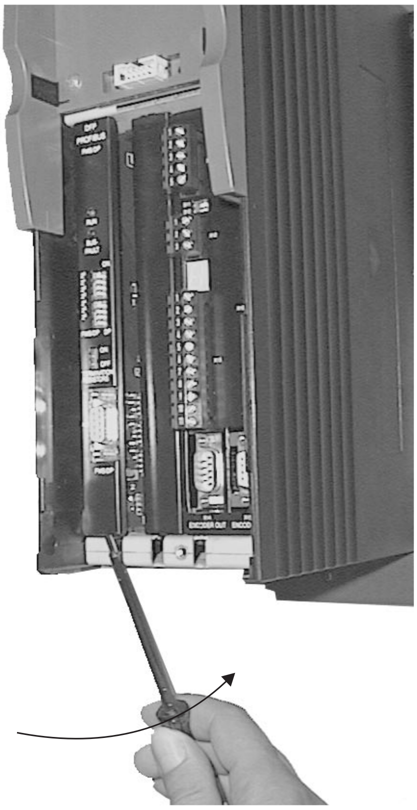

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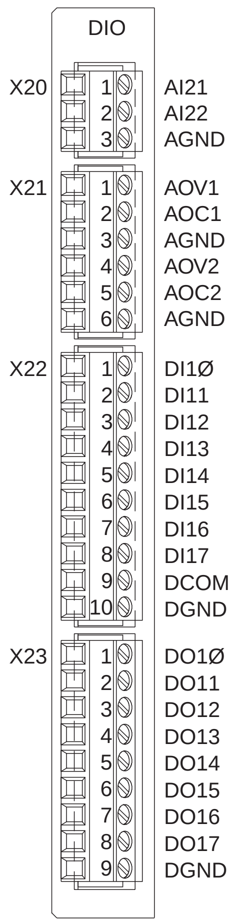
Fig. 126: Lever out the option pcb

9.12 Connection and terminal description of the DIO11A option

Part number Terminal expansion board option type DIO11A: 822 726 8

Front view of DIO11A	Terminal		Function
	**X20:1/2** **X20:3**	**AI21/22** **AGND**	Setpoint input n2, -10 V – 0 – 10 V or 0 – 10 V (Differential input or input with AGND reference potential) Reference potential for analog signals (REF1, REF2, AI.., AO..)
	X21:1 **X21:4** **X21:2** **X21:5** **X21:3/6**	**AOV1** **AOV2** **AOC1** **AOC2** **AGND**	Analog voltage output V1, factory setting: actual speed Analog voltage output V2, factory setting: output current Load capacity of the analog voltage outputs: I_{max} = 10 mA Analog current output C1, factory setting: actual speed Analog current output C2, factory setting: output current P642/645 "Operating mode AO1/2" sets whether the voltage outputs V1/2 (-10 V – 0 – 10 V) or the current outputs C1/2 (0(4) – 20 mA) are in effect. Selection options for the binary outputs → Parameter menu P640/643 Max. permitted cable length: 10 m (33 ft) Reference potential for analog signals (REF1, REF2, AI.., AO..)
	X22:1 – 8 **X22:9** **X22:10**	**DI1Ø – 17** **DCOM** **DGND**	Binary inputs 1 – 8, factory setting: no function The binary inputs are electrically isolated by optocouplers. Selection options for the binary outputs → Parameter menu P61_ Reference potential for the binary inputs DI1Ø – 17 Reference potential for binary signals – Without jumper X22:9 – X22:10 (DCOM – DGND) → Isolated binary inputs – With jumper X22:9 – X22:10 (DCOM – DGND) → Non-isolated binary inputs
	X23:1 – 8 **X23:9**	**DO1Ø – 17** **DGND**	Binary outputs 1 – 8, factory setting: no function Load capacity of the binary outputs: I_{max} = 50 mA (short-circuit proof) **Do not apply external voltage to the binary outputs!** Reference potential for binary signals

Voltage input The analog setpoint input n2 (AI21/22) can be used as a differential input or as an input with AGND reference potential.

Differential input / Input with AGND reference potential

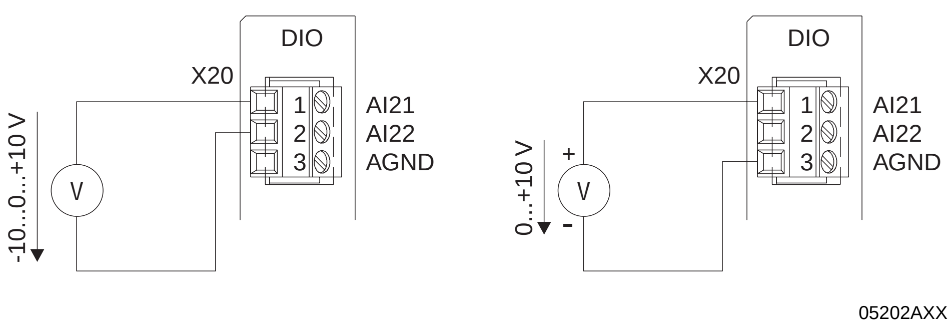
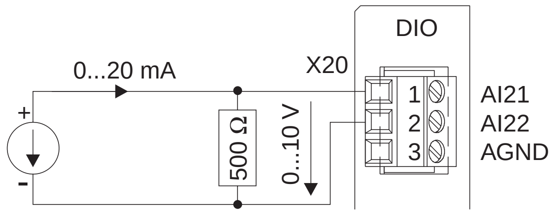


Fig. 127: Setpoint input n2

Current input

You must use an external load if the analog setpoint input n2 (AI21/22) should be used as a current input.

For example $R_B = 500\ \Omega \rightarrow 0 - 20\ mA = 0 - 10\ V$

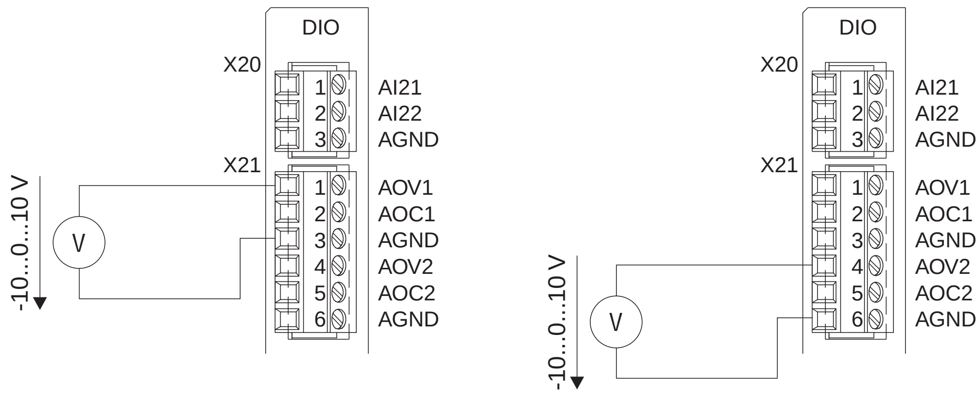


01671BXX

Fig. 128: Current input with external load

Voltage outputs

Analog voltage outputs AOV1 and AOV2 must be assigned as shown in the following diagram:

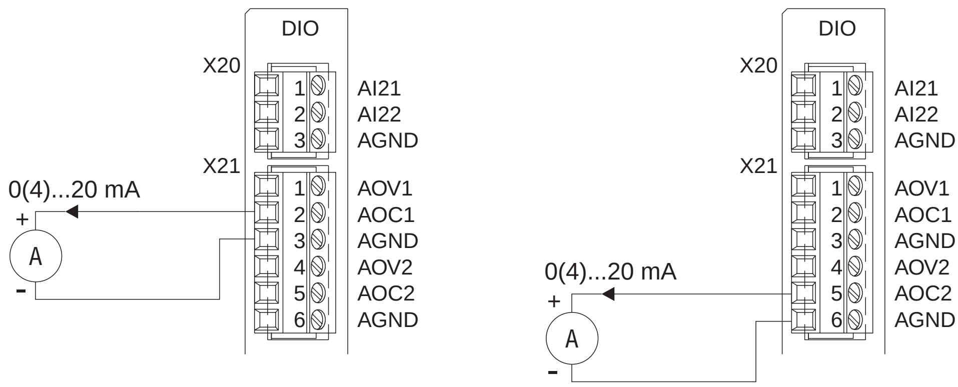


05203AXX

Fig. 129: Voltage outputs AOV1 and AOV2

Current outputs

Analog current outputs AOC1 and AOC2 must be assigned as shown in the following diagram:



05204AXX

Fig. 130: Current outputs AOC1 and AOC2

9.13 Encoder and resolver connection

The "SEW Encoder Systems" manual contains detailed information. This manual can be obtained from SEW.

General installation notes

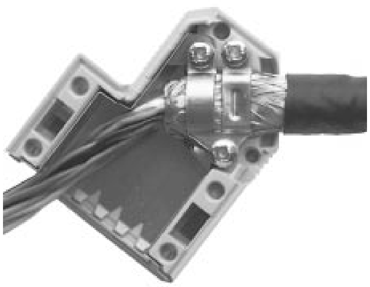
- Max. line length of inverter – encoder/resolver: 100 m (330 ft) with a capacitance per unit length ≤ 120 nF/km (193 nF/mile).
- Core cross section: 0.20 – 0.5 mm^2 (AWG 24 – 20)
- If you cut off a core of the encoder/resolver cable: Isolate the cut-off end of the core.
- Use shielded twisted pair cables (exception: cables for HTL sensors) and connect the shield over a wide area at both ends:
  - to the encoder in the cable screw fitting or in the encoder plug
  - to the inverter in the housing of the sub D plug
- Route the encoder/resolver cable separately from the power cables.

Shield contact

Connect the shield of the encoder/resolver cable over a large area.

On the inverter

Connect the shield on the inverter end in the housing of the sub D plug.



01939BXX

Fig. 131: Connect the shield in the sub D plug

On the encoder/ resolver

Connect the shield on the encoder/resolver end in the cable screw fitting or in the encoder plug.

01948AXX

Fig. 132: Connect the shield in the cable screw fitting of the encoder

Pre-fabricated cables

- SEW offers pre-fabricated cables for connecting encoders/resolvers. We recommend using these pre-fabricated cables.
- The conductor colors specified in the connection figures are in accordance with IEC 757 and correspond to the conductor colors used in the pre-fabricated cables from SEW.

STOP

Motor encoder

The following motor encoders may be connected to X15: of MOVIDRIVE® MDV60A units:

- High-resolution sin/cos encoders with signal voltage 1 V_{SS}
- 5 V TTL sensors with signal level to RS-422
- 24 V HTL sensors

01936AXX

Fig. 133: Connection terminals of SEW motor encoders

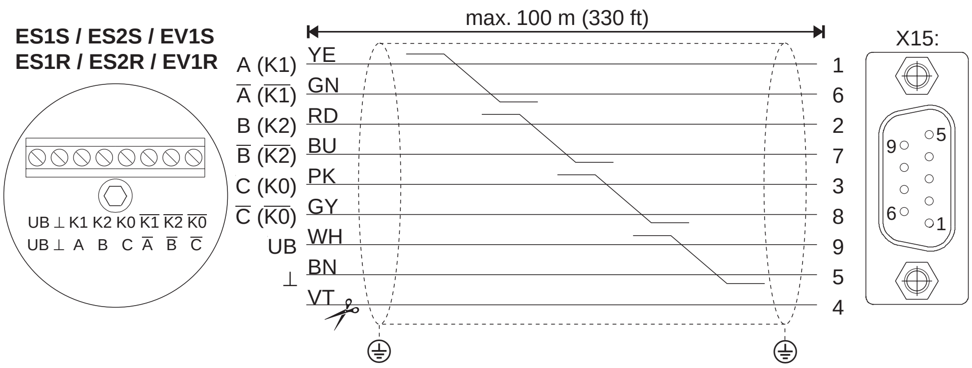
Voltage supply

Encoders with 24 V_{DC} voltage supply (max. 180 mA) are connected directly to X15:. These encoders are then powered by the inverter.

Encoders with a 5 V_{DC} voltage supply must be connected via the "5 V encoder power supply type DWI11A" option (part number 822 759 4).

sin/cos encoders

High-resolution sin/cos encoders ES1S, ES2S or EV1S are recommended for operation with MOVIDRIVE® MDV60A. These encoders are powered with 24 V_{DC} and do not need a sensor cable. Connect the sin/cos encoder as follows:



03021AXX

Fig. 134: Connecting the sin/cos encoder

Cut off the violet conductor (VT) of the cable at the encoder end.

Part numbers of the pre-fabricated cables

For fixed routing:	198 829 8
For cat track routing:	198 828 X

5 V TTL sensors

5 V TTL sensors from SEW are available with a 24 V_{DC} voltage supply and a 5 V_{DC} voltage supply.

24 V_{DC} voltage supply

Connect 5 V TTL sensors to the 24 V_{DC} voltage supply ES1R, ES2R or EV1S in the same way as the high-resolution sin/cos encoders.

5 V_{DC} voltage supply

5 V TTL sensors with a 5 V_{DC} voltage supply ES1T, ES2T or EV1T must be connected via the "5 V encoder power supply type DWI11A" option (part number 822 759 4). The sensor cable must be connected as well in order to correct the supply voltage of the encoder. Connect these encoders as follows:

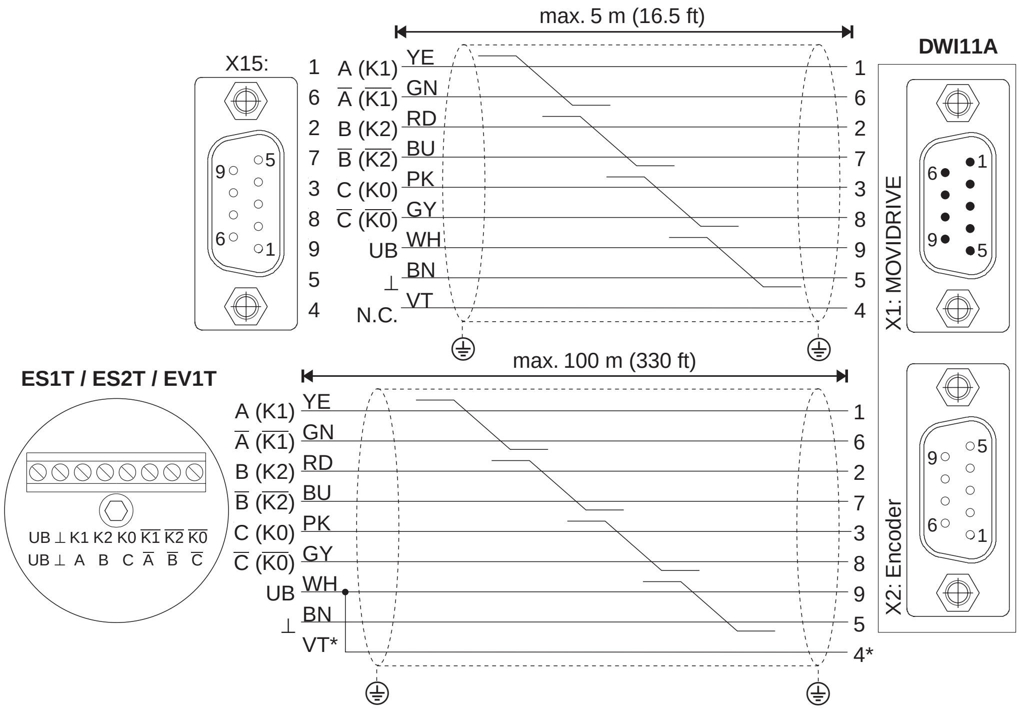


Fig. 135: Connecting TTL sensors via DWI11A

* Connect the sensor line (VT) on the encoder to UB, do not jumper on the DWI11A!

Part numbers of the pre-fabricated cables

MOVIDRIVE® X15: → DWI11A X1:MOVIDRIVE

Only fixed routing: 814 344 7

Encoder ES1T /ES2T / EV1T → DWI11A X2: encoder

For fixed routing: 198 829 8

For cat track routing: 198 828 X

HTL sensors

If you are using a **24 V HTL sensor ES1C, ES2C or EV1C**, you are not allowed to connect the **negated channels** $\overline{A}$ (K1), $\overline{B}$ (K2) and $\overline{C}$ (K0).

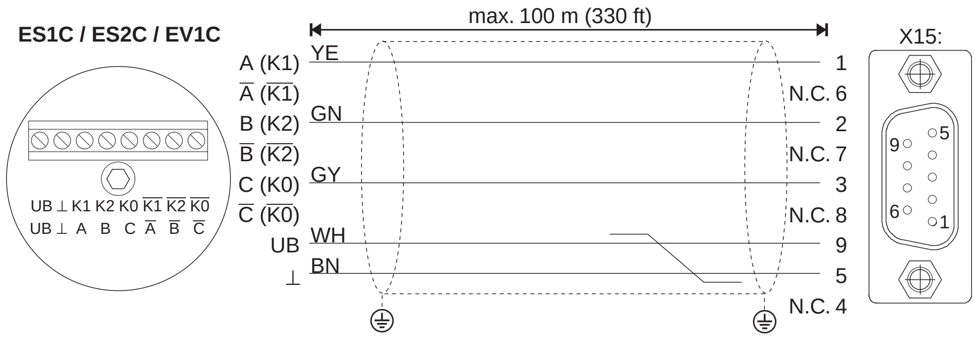


Fig. 136: Connecting HTL sensors

Part numbers of the pre-fabricated cables

For fixed routing: 198 932 4

For cat track routing: 198 931 6

Absolute encoder

The absolute encoder AV1Y has a fixed connection cable 1 m (3.3 ft) in length with a 17-pin round connector plug suitable for the SPUC 17B FRON female connector made by Interconnectron. The plug has the following pin assignment:

Pin	Description		Conductor color in pre-fabricated cable	
			6-core cable	10-core cable
7	Supply voltage V_S	+10 – **15** – **24** – 30 V_{DC}, polarity reversal protected	White (WH)	White (WH)
10	Supply voltage GND	Electrically isolated from AV1Y housing	Brown (BN)	Brown (BN)
14	Serial data output D+	"1" = High signal	Yellow (YE)	Black (BK)
17	Serial data output D-	"0" = High signal	Green (GN)	Violet (VT)
8	Clock line, current loop T+	7 mA towards T+ = "1"	Pink (PK)	Pink (PK)
9	Clock line, current loop T-	7 mA towards T- = "0"	Gray (GY)	Gray (GY)
15	Incremental encoder signal A	1 V_{SS} sin/cos	-	Yellow (YE)
16	Incremental encoder signal $\overline{A}$			Green (GN)
12	Incremental encoder signal B			Red (RD)
13	Incremental encoder signal $\overline{B}$			Blue (BU)

Connection to the DPA11A option

Connect the absolute encoder AV1Y to the DPA11A option as follows:

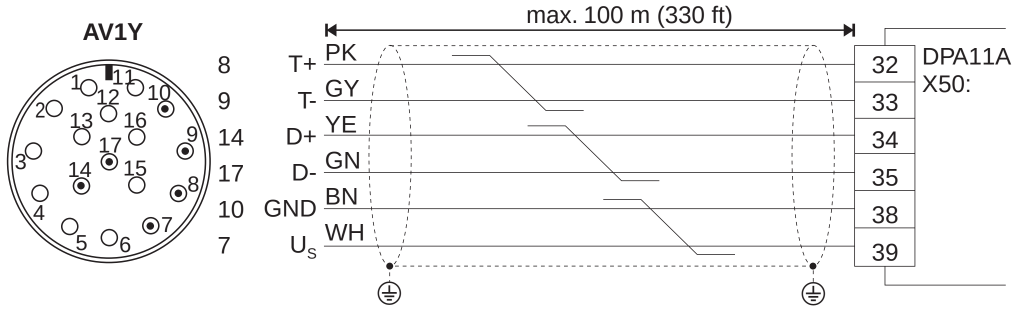
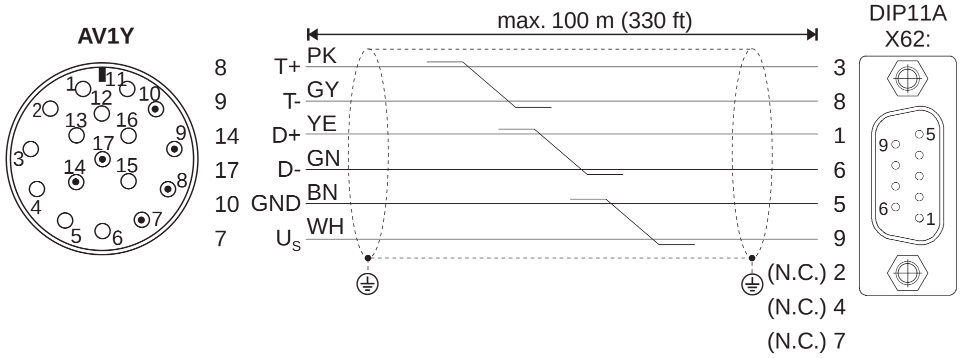


Fig. 137: Connecting AV1Y to DPA11A

Connection to the DIP11A option

Connect the absolute encoder AV1Y to the DIP11A option as follows:

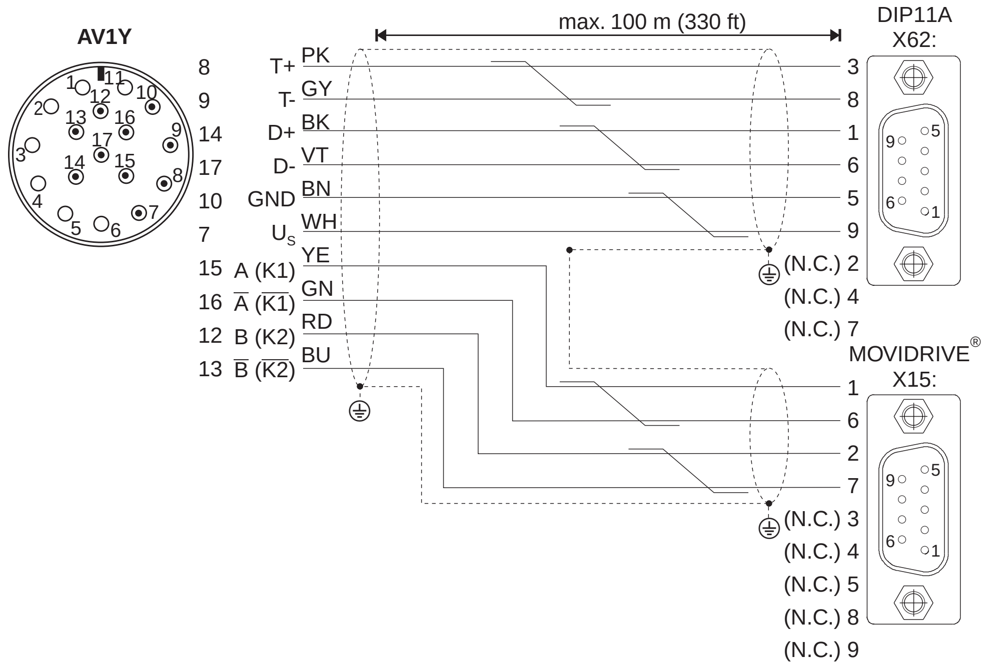


03978AXX

Fig. 138: Connecting AV1Y to DIP11A

Connecting as a combination encoder

You can also use the AV1Y absolute encoder on MOVIDRIVE® MDV60A as a combination encoder (absolute and incremental). The encoder is then connected to X62: of the DIP11A option and X15: of the MOVIDRIVE® MDV60A basic unit.



03979AXX

Fig. 139: Connecting as a combination encoder

Part numbers of the pre-fabricated cables

Encoder AV1Y→ DPA11A X50: (Fig. 137)

For fixed routing:	198 887 5
For cat track routing:	198 888 3

Encoder AV1Y→ DIP11A X62: (Fig. 138)

For fixed routing:	198 929 4
For cat track routing:	198 930 8

Encoder AV1Y as combination encoder → DIP11A X62: & MOVIDRIVE® X15: (Fig. 139)

For fixed routing:	198 890 5
For cat track routing:	198 891 3

Resolver

SEW offers the following pre-fabricated cables for connecting resolvers to MOVIDRIVE® MDS60A:

For motor type		Part number	
		Fixed routing	Cat track routing
CM71 – 112	**with pl. connection**	199 214 7	199 215 5
DFS56	**with terminal box**	198 829 8	198 828 X
	with pl. connection	198 927 8	198 928 6
DFY71 – 112	**with terminal box**	198 829 8	198 828 X
	with pl. connection	198 827 1	198 812 3

Terminal/pin assignment

CM motors: The resolver connections are housed in a plug connection.

DS/DY motors: Depending on the motor type, the resolver connections in the terminal box are either accommodated on a 10-pin Phoenix terminal strip or in the plug connection.

Plug connection CM, DS56: Intercontec, type ASTA021NN00 10 000 5 000

Plug connection DY71 – 112: Framatome Souriou, type GN-DMS2-12S

Terminal/pin	Description		Conductor color in pre-fabricated cable
1	Ref.+	Reference	Pink (PK)
2	Ref.-		Gray (GY)
3	cos+	Cosine signal	Red (RD)
4	cos-		Blue (BU)
5	sin+	Sine signal	Yellow (YE)
6	sin-		Green (GN)
9	TF/TH	Motor protection	White (WH)
10	TF/TH		Brown (BN)

The resolver signals have the same numbering on the 10-pin Phoenix terminal strip and in the plug connections.

Connection

Connect the resolver as follows:

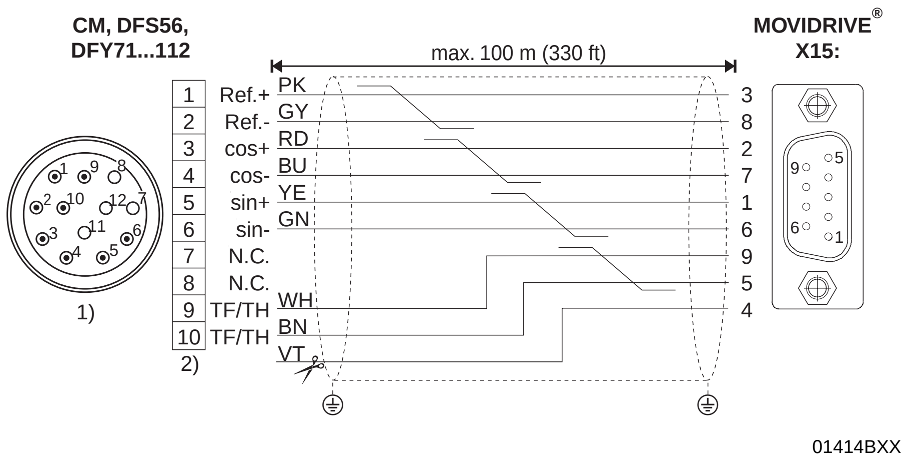


Fig. 140: Connecting the resolver

1) Plug connection

2) Terminal strip

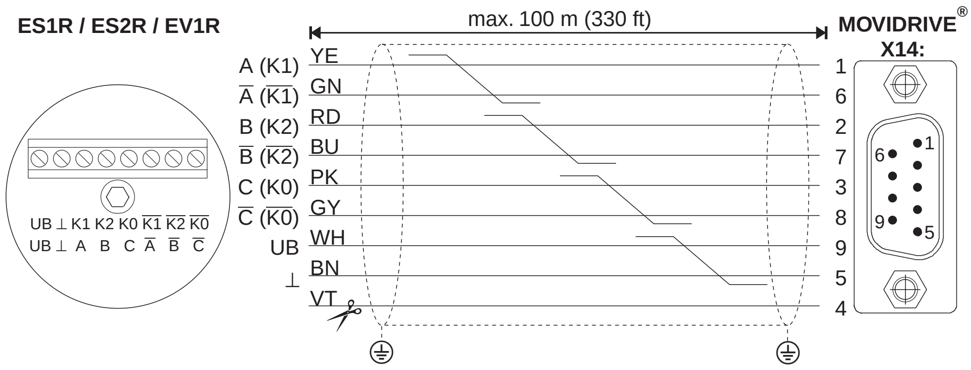
If using the pre-fabricated cable with conductor end sleeves, cut off the violet conductor (VT) of the cable in the motor terminal box.

External encoders **Only encoders with a signal level according to RS-422 (5 V-TTL)** are allowed to be connected to X14: of MOVIDRIVE® MDV/MDS units.

Voltage supply Encoders with 24 V_{DC} voltage supply (max. 180 mA) are connected directly to X14:. These encoders are then powered by the inverter.

Encoders with a 5 V_{DC} voltage supply must be connected via the "5 V encoder power supply type DWI11A" option (part number 822 759 4).

Connection External encoder with 24 V_{DC} voltage supply:

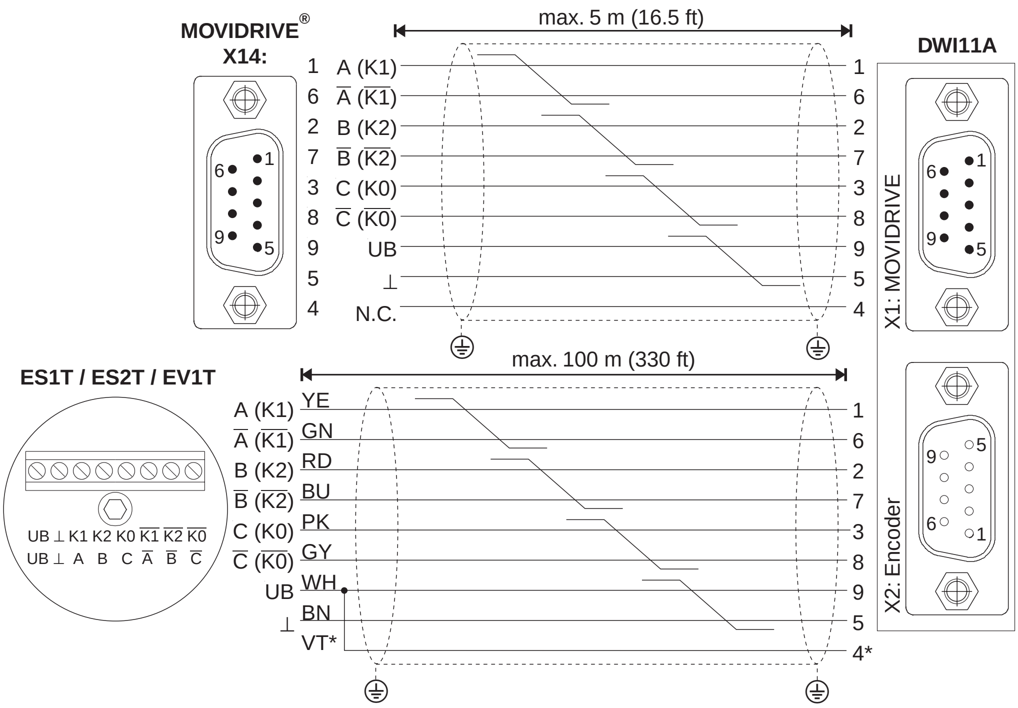


03776AXX

Fig. 141: External encoder direct to X14:

Cut off the violet conductor (VT) of the cable at the encoder end.

External encoder with 5 V_{DC} voltage supply:



03777AXX

Fig. 142: Connect via DWI11A

* Connect the sensor line (VT) on the encoder to UB, do not jumper on the DWI11A!

Part numbers of the pre-fabricated cables

Encoder ES1R / ES2R EV1R → MOVIDRIVE® X14: (Fig. 141)

Only fixed routing: 815 354 X

Encoder ES1T /ES2T / EV1T → DWI11A X2: encoder (Fig. 142)

For fixed routing: 198 829 8

For cat track routing: 198 828 X

Incremental encoder simulation

You can also use X14: as an incremental encoder simulation output. To do this, you must jumper X14:4 with X14:5 (switchover – DGND). X14: the supplies incremental encoder signals with a signal level according to RS-422 (5 V TTL). The number of pulses is as follows:

- With MDV60A as on X15: Motor encoder input
- With MDS60A 1024 pulses/revolution

Connection

Connect the evaluation for the incremental encoder simulation as follows:

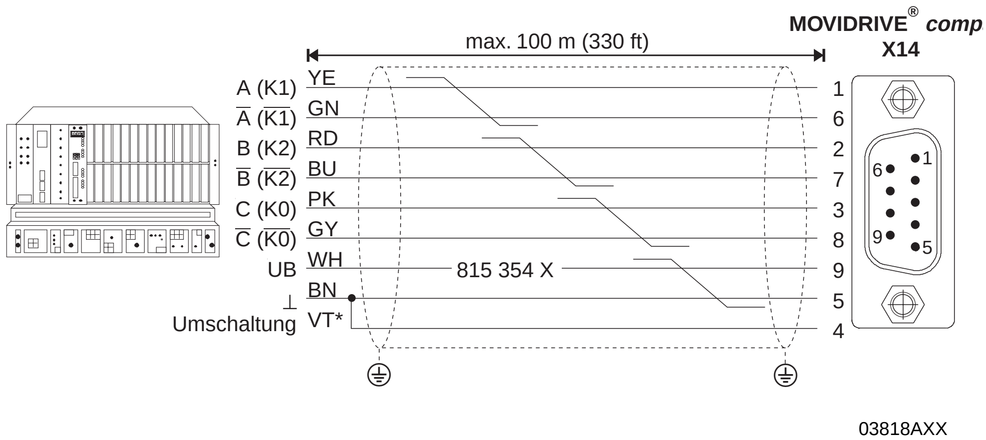


Fig. 143: Connection of incremental encoder simulation

Part number of the pre-fabricated cable

Only fixed routing: 815 354 X

Master/slave connection

X14 – X14 connection (= master/slave connection) of two MOVIDRIVE® units.

Connection

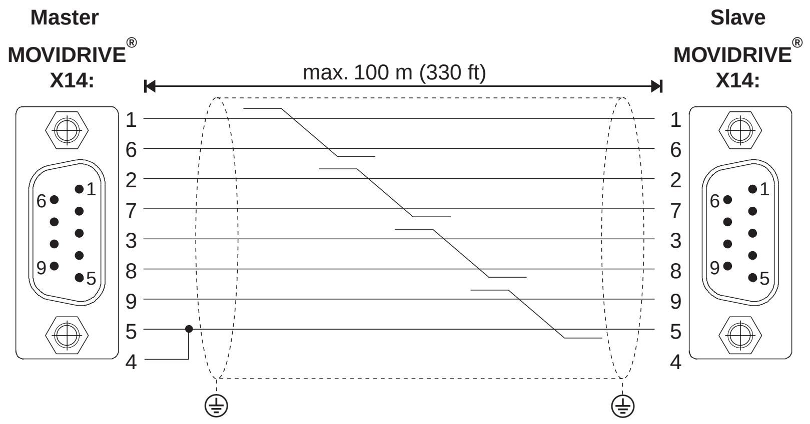


Fig. 144: X14 – X14 connection

Part number of the pre-fabricated cable

Only fixed routing: 815 355 8

The sub D sockets on the ends of the cable are marked with "MASTER" and "SLAVE". Make sure that you connect the socket marked "MASTER" to X14: of the master unit and the socket marked "SLAVE" to X14: of the slave unit.

9

10 Startup

10.1 General startup instructions

It is essential to comply with the safety notes during startup!

Requirements

Correct project planning of the drive is the pre-requisite for successful startup. Refer to the MOVIDRIVE® system manual for detailed project planning instructions and an explanation of the parameters (chapters 4 and 5).

VFC operating modes without speed control

MOVIDRIVE® MD_60A drive inverters are factory set for operation with the SEW motor (MD_60A...-5_3: 4-pole and rated voltage $3 \times 400\ V_{AC}$ / 50 Hz or MD_60A...-2_3: 4-pole and rated voltage $3 \times 230\ V_{AC}$ / 60 Hz) which has been adjusted to the correct power level. The motor can be connected and the drive started immediately in accordance with Sec. "Starting the motor" (→ page 277).

Inverter/motor combinations

400/500 V units

The following tables indicate which inverter/motor combinations this applies to.

MOVIDRIVE® MDF60A or MDV60A in VFC mode	SEW motor
0015-5A3-4	DT90L4
0022-5A3-4	DV100LS4
0030-5A3-4	DV100L4
0040-5A3-4	DV112M4
0055-5A3-4	DV132S4
0075-5A3-4	DV132M4
0110-5A3-4	DV160M4
0150-503-4	DV160L4
0220-503-4	DV180L4
0300-503-4	DV200L4
0370-503-4	DV225S4
0450-503-4	DV225M4
0550-503-4	D250M4
0750-503-4	D280S4

230 V units

MOVIDRIVE® MDF60A or MDV60A in VFC mode	SEW motor
0015-2A3-4	DT90L4
0022-2A3-4	DV100LS4
0037-2A3-4	DV100L4
0055-2A3-4	DV132S4
0075-2A3-4	DV132M4
0110-203-4	DV160M4
0150-203-4	DV180M4
0220-203-4	DV180L4
0300-203-4	DV225S4

STOP

The startup functions described in this section are used for setting the inverter so it is optimally adapted to the motor which is actually connected and to the given boundary conditions. It is essential to perform a startup as described in this section for the VFC operating modes with speed control, all CFC operating modes and SERVO operating modes.

10.2 Preliminary work and resources

- Check installation.
- Take suitable measures to prevent the motor starting up inadvertently, for example by removing the electronics terminal block X13:. Furthermore, additional safety precautions must be taken depending on the application in order to avoid endangering people and machinery.
- For **startup with the DBG11A keypad**:

  Connect the DBG11A keypad to the TERMINAL option slot.
- For **startup with a PC and MOVITOOLS**:

  Connect the USS21A option to the TERMINAL option slot and use an interface cable (RS-232) to connect it to the PC. MOVIDRIVE® and the PC must be de-energized when you do this, otherwise undefined states may be adopted. Then switch on both units. Install MOVITOOLS on the PC if you have not already done so. Start the program.
- Switch on the power system and, if necessary, the 24 V supply.

  If you are using the DBG11A keypad, the following message appears for about 13 s:

```
SELFTEST
MOVIDRIVE
```

- Undertake the correct preliminary parameter setting (e.g. factory setting).
- Check the terminal assignment which has been set (→ P60_ / P61_).

STOP

Startup **automatically changes a group of parameter values**. The parameter description P700 "Operating modes" explains which parameters are affected by this. Refer to the MOVIDRIVE® system manual, Sec. 4 "Parameters", for the **parameter description**.

10.3 Startup with the DBG11A keypad

General information

Startup with the DBG11A keypad is **only possible with MDF and MDV in VFC operating modes.** Startup in CFC and SERVO operating modes is only possible using the MOVITOOLS software.

Data required

The following data are required for successful startup:

- Motor type (SEW motor or non-SEW motor)
- Motor data
  - Rated voltage and rated frequency.
  - In addition, with a non-SEW motor: Rated current, rated power, power factor cosφ and rated speed.
- Power supply voltage

The following information is also required for the startup of the speed controller:

- Incremental encoder type
- Encoder type and resolution of the incremental encoder:

SEW encoder type	Startup parameters	
	Encoder type	Encoder resolution
ES1S, ES2S, EV1	SINE ENCODER	1024
AV1Y	SINE ENCODER	512
ES1R, ES2R, EV1R ES1T[1], ES2T[1], EV1T[1]	INCREM. TTL SENSOR	1024
ES1C, ES2C, EV1C	INCREM. HTL SENSOR	1024

1) 5 V TTL sensors ES1T, ES2T and EV1T must be connected via the DWI11A option (→ Sec. Installation).

- Motor data
  - SEW motor: Brake yes or no and flywheel fan (Z fan) yes or no
  - Non-SEW motor: Mass moment of inertia [10^{-4}kgm^2] of the motor, brake and fan
- Rigidity of the closed-loop control system (factory setting = 1; applies to most applications)

  If the drive is tending to oscillate → setting < 1

  If the transient recovery time is too long → setting > 1

  Recommended setting range: 0.90 – 1 – 1.10
- Mass moment of inertia [10^{-4}kgm^2] of the load (gear unit + driven machine) extrapolated for the motor shaft.
- Time for the shortest required ramp.

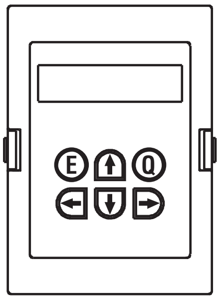
If you are using a TTL encoder (encoder type INCREM. TTL SENSOR) or a sin/cos encoder (encoder type SINE ENCODER):

- Activate encoder monitoring (P504 = "ON") after completing the startup. The function and voltage supply of the encoder are then monitored.

Important: Encoder monitoring is not a safety function!

Startup functions of the DBG11A

Detailed description of the keypad → Sec. "Operating displays":



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← and → at the same time		Commence startup.
↑	key	Next menu command or increase value in edit mode.
↓	key	Previous menu command or decrease value in edit mode.
→	key	One menu level down or activate edit mode for the menu command.
←	key	One menu level up or deactivate edit mode for the menu command.
Q	key	Cancel startup and return to main display.
E	key	Cancel startup and return to main display.

Language change on DBG11A keypad

- The main display of the keypad is in German.

```
REGLERSPERRE
STROM:           0   A
```

- Press the ↓ key twice to display parameter group 8...

```
8..    GERAETE-
       FUNKTIONEN
```

- Press the → key twice and the ↑ key once to display parameter 801 "Language". Press the → key to activate edit mode. Press the ↓ or ↑ key to select the language you want and then press the ← key to exit edit mode.

```
801    DEUTSCH
       SPRACHE
```

- Press the Q key to return to the main display.

Structure of the startup menu

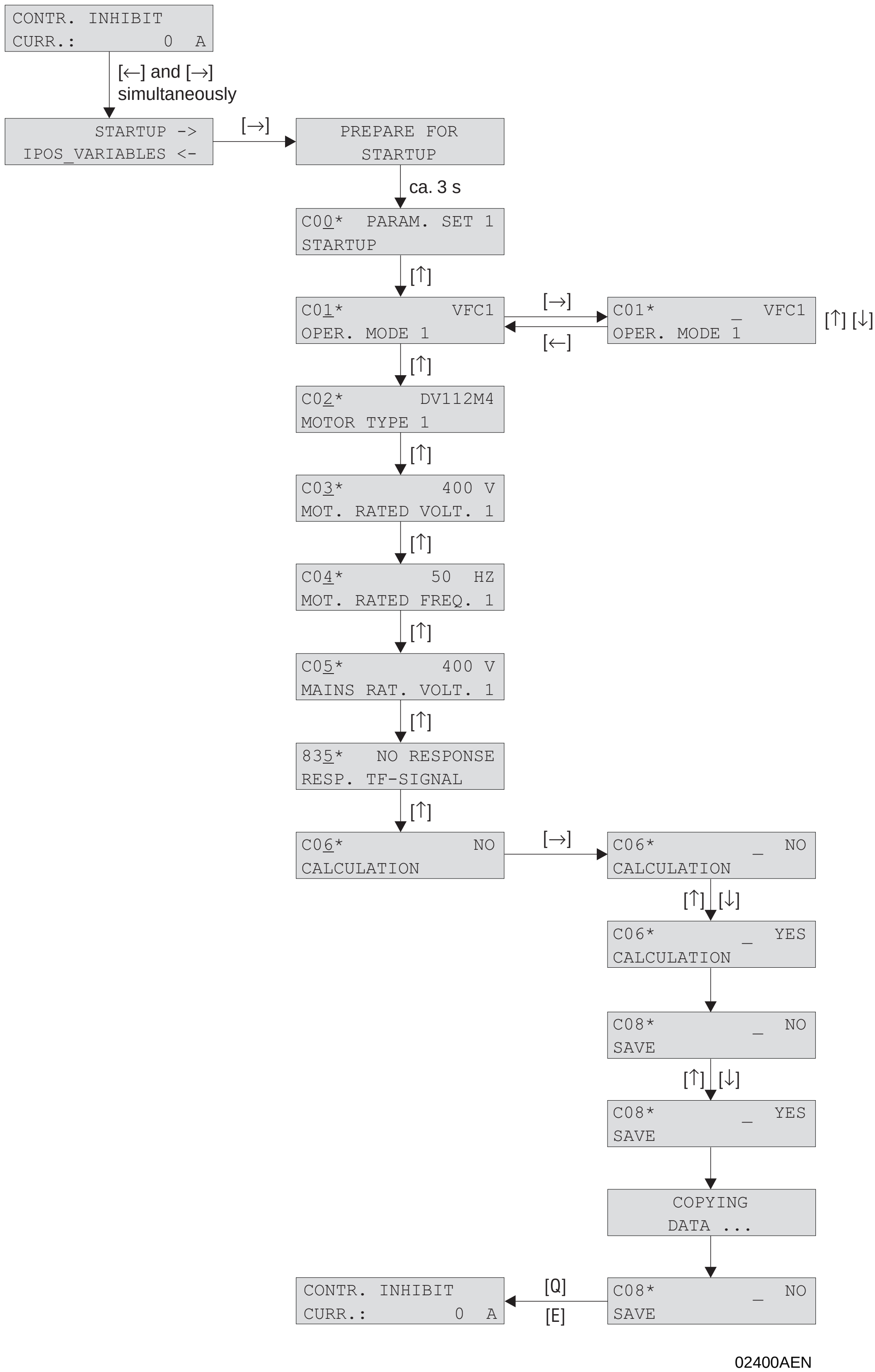

Fig. 145: Structure of the startup menu

Startup procedure

1. "0" signal at terminal X13:1 (DIØØ "/CONTROL.INHIBIT"), e.g. by disconnecting the electronics terminal block X13.

```
CONTROL.INHIBIT
CURRENT:       0   A
```

2. Activate the startup menu by pressing the ← and → keys on the DBG11A at the same time.

```
   STARTUP →
 IPOS_VARIABLES ←
```

3. Press the → key to commence the startup. The first window of the startup menu appears. The menu commands are identified by an * in the 4th position. Menu commands which only appear in the startup menu start with "C", the other menu commands have the number in the parameter list (page 280). Press the ↑ key to jump to the next menu command when you have worked through a menu command.

```
  STARTUP IS
 BEING PREPARED
```

4. Select a parameter set, e.g. parameter set 1.

```
C00*  PARAM. SET 1
STARTUP
```

5. Set the operating mode, e.g. VFC1.

```
C01*          VFC1
OPER. MODE 1
```

6. Select the connected motor. If a 2 or 4-pole SEW motor is connected, select the correct motor from the list. In the case of a non-SEW motor or an SEW motor with more than four poles, choose "NON-SEW MOTOR" in the selection list.

```
C02*       DV112M4
MOT. TYPE 1
```

```
C02*     NON-SEW
MOTOR
MOT. TYPE 1
```

7. Refer to the nameplate of the motor and enter the rated motor voltage for the selected connection type.

   Example: Nameplate 230Δ/400⅄ 50 Hz
   ⅄ connection → Enter 400 V.
   Δ connection, transition point at 50 Hz → Enter 230 V.
   Δconnection, transition point at 87 Hz → Also enter 230 V. After startup, first set parameter P302 "MAXIMUM SPEED 1" to the value for 87 Hz and then start the drive.

   Example: Nameplate 400Δ/690⅄ 50 Hz
   Only Δ connection possible → Enter 400 V.
   ⅄ connection is not possible.

```
C03*       400   V
RATED MOT. VOLT. 1
```

8. Enter the rated frequency specified on the motor nameplate.
   Example: 230Δ/400⅄ 50 Hz
   Enter 50 Hz in a ⅄ and Δ connection.

```
C04*       50    Hz
RATED MOT. FREQ. 1
```

WITH SEW MOTORS

9. The motor values are stored for SEW 2 and 4-pole motors and do not have to be entered.

WITH NON-SEW MOTORS

9. Enter the following data from the motor nameplate:
   - Rated motor current, note the connection type (⅄ or Δ).
   - Rated power of the motor
   - Power factor cos φ
   - Rated speed of the motor

10. Enter the rated voltage of the supply system

```
C05*       400   V
RATED SYS. VOLT. 1
```

11. If no TF/TH is connected to X10:1 and X10:2 → Set "NO RESP.". Set the required fault response if a TF/TH is connected.

```
835*  NO RESP.
RESP. TF sens SIGNAL
```

12. Commence the startup calculation by selecting "YES".

```
C06*          NO
CALCULATION
```

WITH SEW MOTORS

13. The calculation is performed.

WITH NON-SEW MOTORS

13. The calculation for non-SEW motors requires a calibration procedure:
    - When prompted, give a "1" signal on terminal X13:1 (DIØØ "/CONTROL.INHIBIT").
    - Give a "0" signal on terminal X13:1 again after the calibration is complete.
    - The motor parameters are estimated if it is not possible to calibrate (energize) the motor.

14. The "SAVE" menu command appears automatically. The keypad is already in edit mode.

```
C08*           _NO
SAVE
```

15. Set "SAVE" to "YES". The data (motor parameters) are copied into the non-volatile memory of MOVIDRIVE®.

```
   DATA ARE BEING
      COPIED...
```

16. This completes the startup. Press the E or Q key to exit the startup menu. The main display then appears.

```
CONTROL.INHIBIT
CURRENT:    0   A
```

STOP

- Copy the parameter set from MOVIDRIVE® into the DBG11A keypad after completing the startup (P807 "MDX → DBG"). In this way, it is possible to use the DBG11A to transfer the parameter set to other MOVIDRIVE® units (P 806 "DBG → MDX").
- Enter any parameter settings which differ from the factory settings in the parameter list (→ page 280).
- In the case of non-SEW motors, set the correct brake reaction time (P732 / P735).
- Refer to the information in Sec. "Starting the motor" (→ page 277) for starting the motor.
- With Δ connection and transition point at 87 Hz → Set parameter P302/312 "Maximum speed 1/2" to the value for 87 Hz.

Startup of speed controller

Startup without the speed controller is performed first.

Important: Set VFC-n-CONTROL operating mode.

```
C01*  VFC-n-CTRL
OPER. MODE 1
```

Structure

Structure of the startup menu for the speed controller:

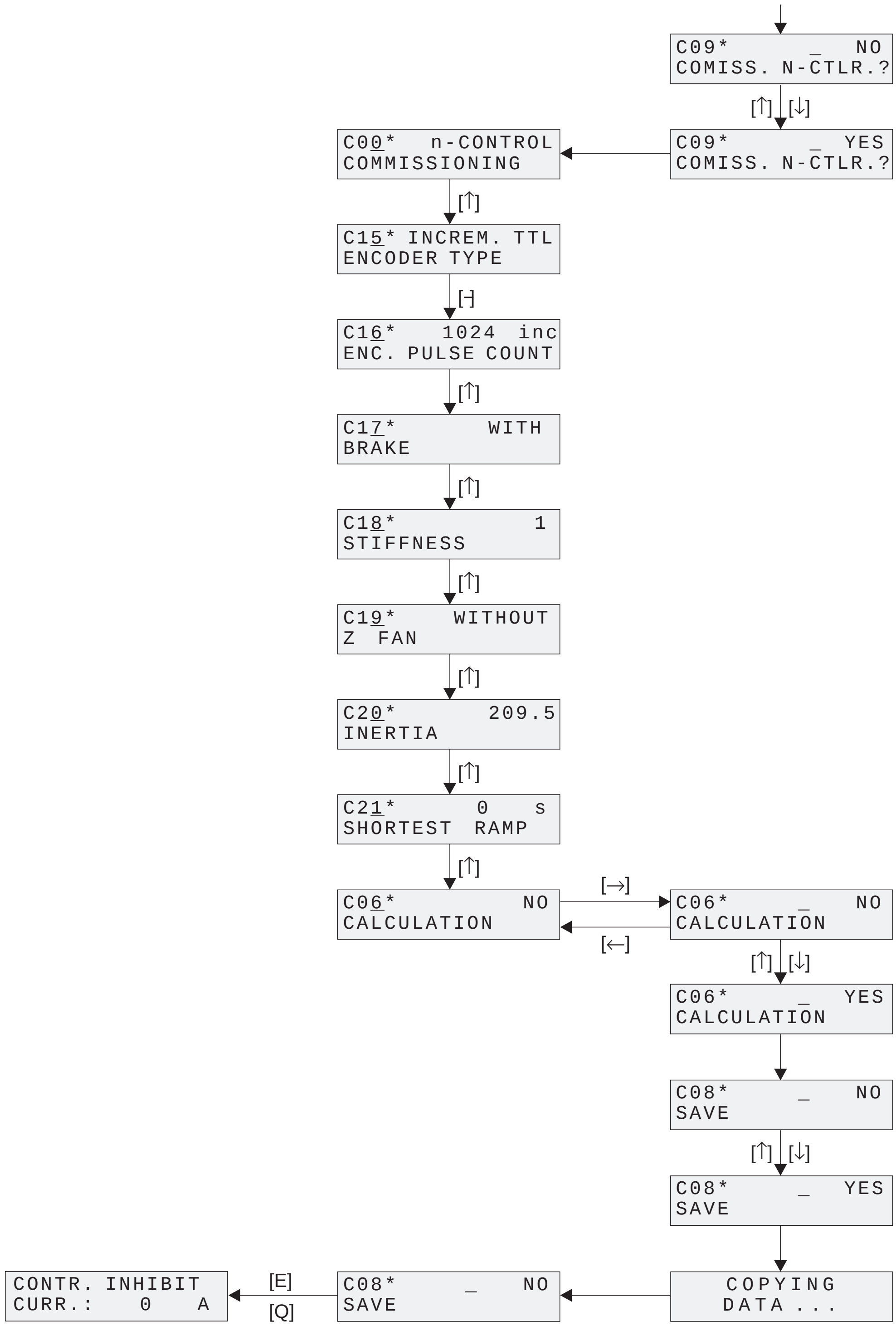

Fig. 146: Structure of startup with the speed controller

Startup procedure

1. Press "YES" to commence the speed controller startup. All mass moments of inertia must be entered in the unit [10^{-4} kgm^2].
2. Press the ↑ key to move on to the next menu item each time.
3. Enter the correct encoder type.
4. Enter the correct encoder resolution.

WITH SEW MOTORS

5. Enter whether the motor has a brake.
6. Set the rigidty of the closed-loop control system.
7. Enter whether the motor has a flywheel fan (Z fan).

WITH NON-SEW MOTORS

5. Enter the moment of inertia of the motor.
6. Set the rigidity of the closed-loop control system.
7. Set the moment of inertia of the brake and the fan.

8. Enter the mass moment of inertia of the load (gear unit + driven machine) extrapolated for the motor shaft.
9. Enter the time for the shortest ramp.
10. Commence the speed controller startup calculation by selecting "YES".
11. The "SAVE" menu command appears automatically. Set "SAVE" to "YES". The data are copied into the non-volatile memory of MOVIDRIVE®.
12. The "SAVE" menu command appears again. Press the E or Q key to exit the startup menu. The main display then appears.

STOP

- Copy the parameter set from MOVIDRIVE® into the DBG11A keypad after completing the startup (P807 "MDX → DBG"). In this way, it is possible to use the DBG11A to transfer the parameter set to other MOVIDRIVE® units (P 806 "DBG → MDX").
- Enter any parameter settings which differ from the factory settings in the parameter list (→ page 280).
- In the case of non-SEW motors, set the correct brake reaction time (P732 / P735).
- Refer to the information in Sec. "Starting the motor" (→ page 277) for starting the motor.
- With Δ connection and transition point at 87 Hz → Set parameter P302/312 "Maximum speed 1/2" to the value for 87 Hz.
- Activate encoder monitoring for TTL sensors and sin/cos encoders (P504 = "ON").

10.4 Startup with a PC and MOVITOOLS

General information

- Terminal X13:1 (DIØØ "/CONTROL.INHIBIT") must get a "0" signal!
- Start the MOVITOOLS program.
- Set the language.
- Select the PC port (PC COM) to which the inverter is connected.
- Select <Update> to display the connected inverter.

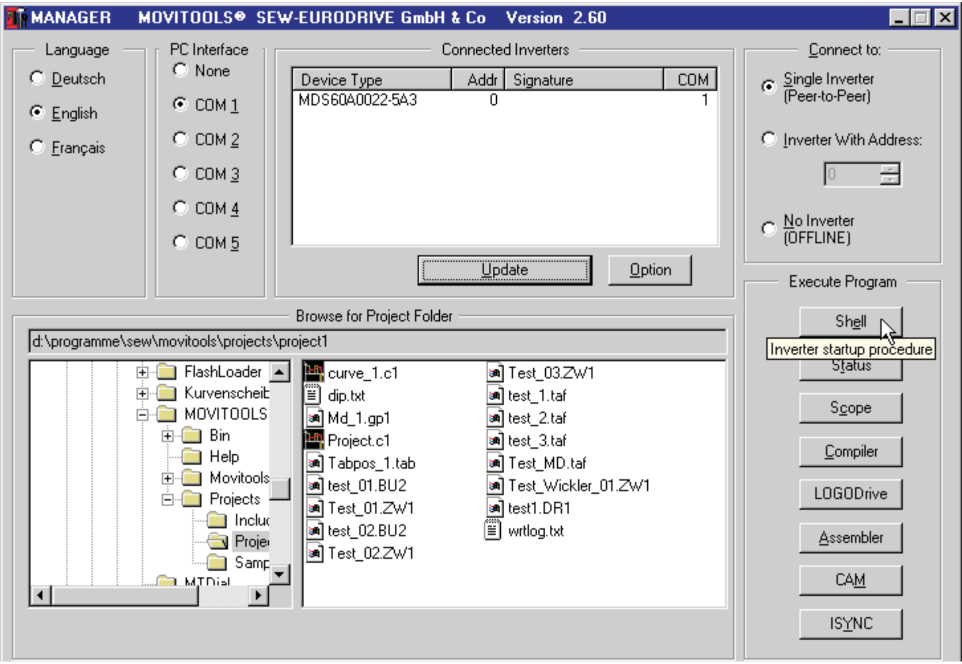

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Fig. 147: MOVITOOLS startup window

Commencing startup

- Click on <Shell> in "Execute Program". The Shell program is started.
- Select the [Startup] / [Startup...] menu command. MOVITOOLS opens the startup menu.
- Select asynchronous or synchronous as the motor type.
- Select parameter set 1 or 2. With speed-controlled drives, the speed controller can be selected separately when startup is repeated. When startup is repeated, the startup functions of the DIP11A absolute encoder interface, if installed, can also be selected separately.
- Set the operating mode.
- Select an SEW motor (2 or 4-pole) or a non-SEW motor. SEW motors with more than four poles are set as non-SEW motors.
- Enter the motor type data and, if speed control is being used, the speed controller data as well.
- Press <Finish> to complete the startup.
- Make any necessary parameter settings using the main menu or the user menu.
- Save the parameter set. The parameter set can be transferred to other MOVIDRIVE® units.
- Print out the set parameters using [File] / [Print Data].
- Refer to the information in Sec. "Starting the motor" (→ page 277) for starting the motor.

10.5 Starting the motor

Analog setpoint specification The following table shows which signals must be present on terminals X11:2 (AI1) and X13:1 – X13:4 (DIØØ – DIØ3) when the "UNIPOL/FIX.SETPT" setpoint is selected (P100), in order to operate the drive with an analog setpoint entry.

Function	X11:2 (AI11) Analog input n1	X13:1 (DIØØ) /Controller inhibit	X13:2 (DIØ1) CW/STOP	X13:3 (DIØ2) CCW/STOP	X13:4 (DIØ3) Enable/rapid stop
Controller inhibit	X	"0"	X	X	X
Rapid stop	X	"1"	X	X	"0"
Enable and stop	X	"1"	"0"	"0"	"1"
Clockwise at 50 % n_{max}	5 V	"1"	"1"	"0"	"1"
Clockwise at n_{max}	10 V	"1"	"1"	"0"	"1"
C-clockw. at 50 % n_{max}	5 V	"1"	"0"	"1"	"1"
Counterclockw. at n_{max}	10 V	"1"	"0"	"1"	"1"

The following travel cycle shows by way of example how the motor is started with the wiring of terminals X13:1 – X13:4 and analog setpoints. Binary output X10:3 (DBØØ "/Brake") is used for switching brake contactor K12.

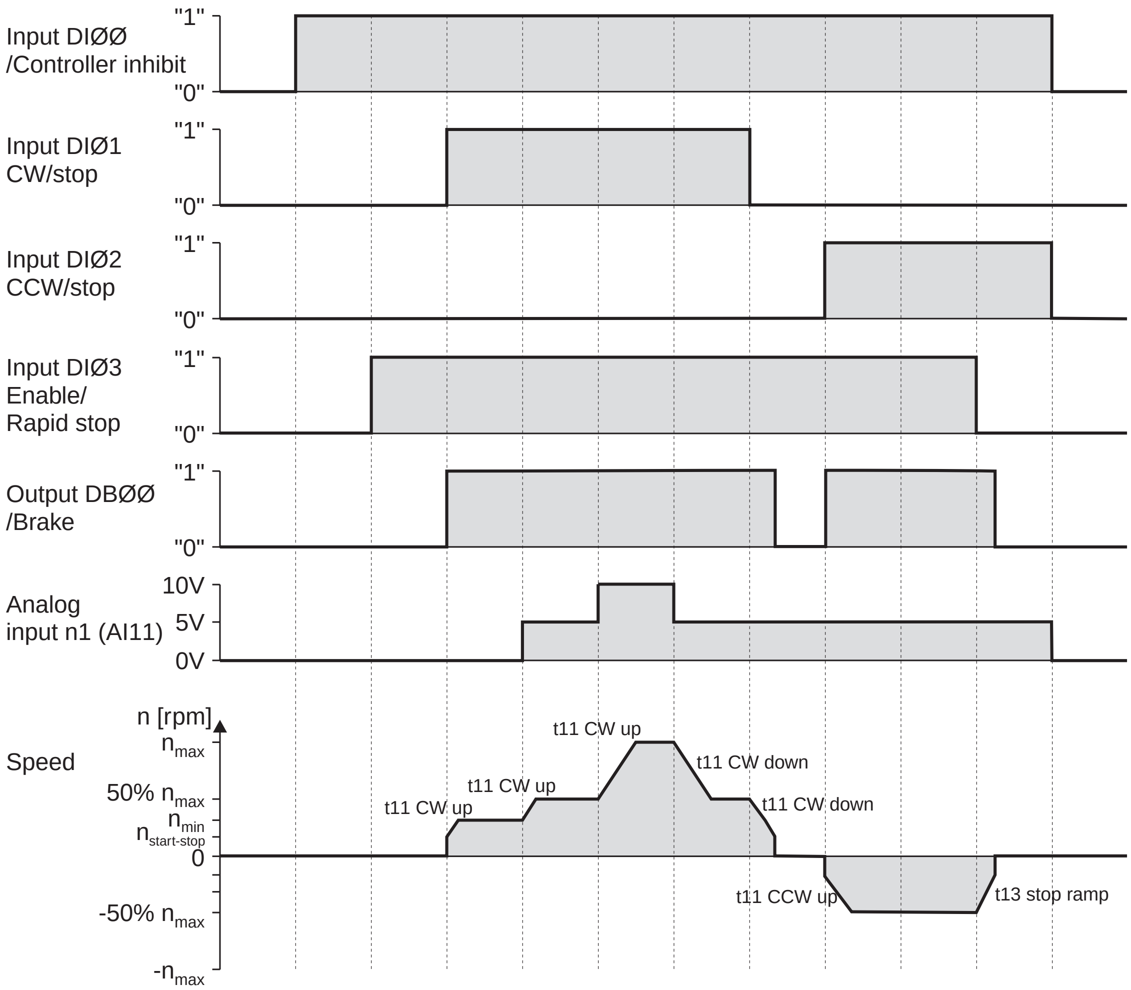

Fig. 148: Travel cycle with analog setpoints

STOP

The motor is not energized in the event of controller inhibit (DIØØ = "0"). A motor without a brake then coasts to a halt.

Fixed setpoints

The following table shows which signals must be present on terminals X13:1 – X13:6 (DIØØ – DIØ5) when the "UNIPOL/FIX.SETPT" setpoint is selected (P100), in order to operate the drive with the fixed setpoints.

Function	X13:1 (DIØØ) /Ctrler inhibit	X13:2 (DIØ1) CW/STOP	X13:3 (DIØ2) CCW/STOP	X13:4 (DIØ3) Enable/rapid stop	X13:5 (DIØ4) n11/n21	X13:6 (DIØ5) n12/n22
Controller inhibit	"0"	X	X	X	X	X
Rapid stop	"1"	X	X	"0"	X	X
Enable and stop	"1"	"0"	"0"	"1"	X	X
Clockwise at n11	"1"	"1"	"0"	"1"	"1"	"0"
Clockwise at n12	"1"	"1"	"0"	"1"	"0"	"1"
Clockwise at n13	"1"	"1"	"0"	"1"	"1"	"1"
C-clockw. at n11	"1"	"0"	"1"	"1"	"1"	"0"

The following travel cycle shows by way of example how the drive is started with the wiring of terminals X13:1 – X13:6 and the internal fixed setpoints. Binary output X10:3 (DBØØ "/Brake") is used for switching brake contactor K12.

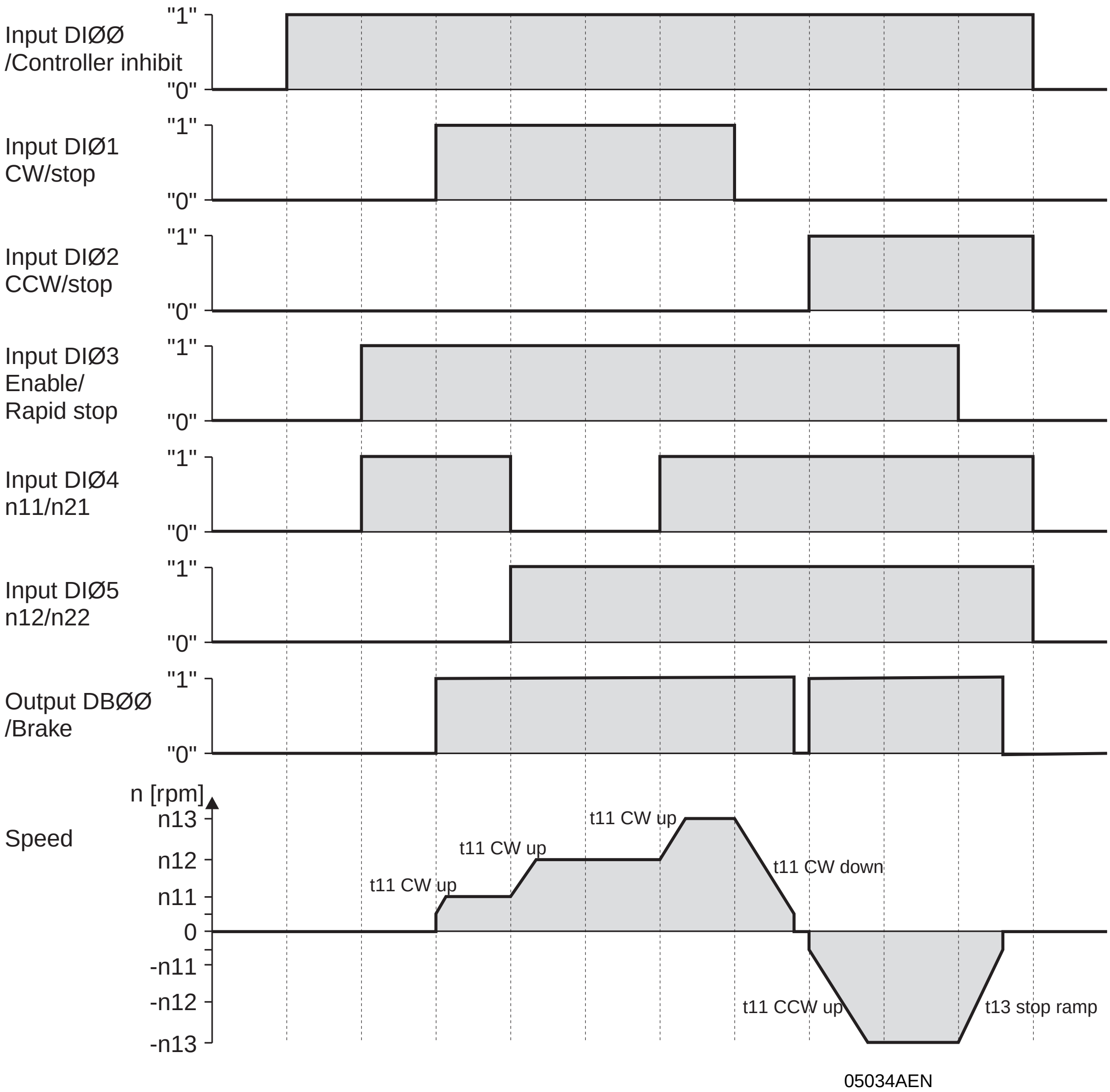

Fig. 149: Travel cycle with internal fixed setpoints

STOP

The motor is not energized in the event of controller inhibit (DIØØ = "0"). A motor without a brake then coasts to a halt.

Manual operation

The inverter can be controlled using the DBG11A keypad using the manual operation function. The 7-segment display on the unit shows "H" during manual mode.

In order for manual operation to be started, there must be a "0" signal sent to binary inputs X13:2 (DIØ1) "CW/stop", X13:3 (DIØ2 "CCW/stop") and X13:4 (DIØ3 "Enable/ rapid stop"), if programmed. The binary inputs are then without any functions for the duration of manual operation, with the exception of X13:1 (DIØØ "/Controller inhibit"). Binary input X13:1 (DIØØ "/Controller inhibit") must get a "1" signal to enable the drive to be started in manual operation. The drive can also be stopped in manual operation by X13:1 = "0".

The direction of rotation is not determined by the "CW/stop" or "CCW/stop" binary inputs. Instead, you select the direction of rotation using the keypad (→ Fig. 150).

Manual operation remains active even after the supply system power has been switched off/on. The inverter is then inhibited, however. A change of direction command using the → or ← key produces an enable and a start in the selected sense of rotation at n_{min}. The speed is increased and decreased using the ↑ and ↓ keys. The modification speed is 150 rpm per second.

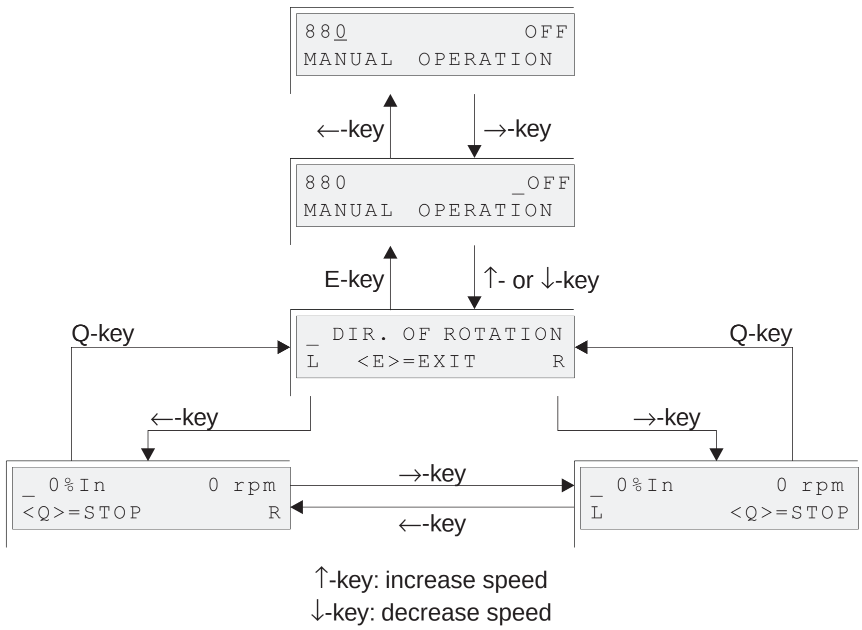

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Fig. 150: Manual mode with DBG11A

The signals at the binary inputs take effect as soon as manual operation is finished. Binary input X13:1 (DIØØ) /Controller inhibit does not have to be switched from "1" to "0" and back to "1". The drive can start according to the signals at the binary inputs and the setpoint sources.

10.6 Complete parameter list

The parameters of the short menu are identified by a "/" (= displayed on the DBG11A keypad).

Par.	Name	Value range
DISPLAY VALUES		
00_	**Process values**	
000	Speed	-5000 – 0 – 5000 rpm
001/	User display	[Text]
002	Frequency	0 – 400 Hz
003	Actual position	0 – 2^{31}-1 inc
004	Output current	0 – 200 % I_N
005	Active current	-200 – 0 – 200 % I_N
006/	Motor utilization 1	0 – 200 %
007	Motor utilization 2	0 – 200 %
008	DC link voltage	0 – 1000 V
009	Output current	A
01_	**Status displays**	
010	Inverter status	
011	Operational status	
012	Fault status	
013	Active parameter set	1/2
014	Heat sink temperature	-20 – 0 – 100 °C
015	Mains ON operation time	0 – 25000 h
016	Operating time (enabled)	0 – 25000 h
017	Electrical energy	kWh
02_	**Analog setpoints**	
020	Analog input AI1	-10 – 0 – 10 V
021	Analog input AI2	-10 – 0 – 10 V
022	External current limit	0 – 100 %
03_	**Binary inputs basic unit**	
030	Binary input DIØØ	/CONTROL.INHIBIT
031	Binary input DIØ1	
032	Binary input DIØ2	
033	Binary input DIØ3	
034	Binary input DIØ4	
035	Binary input DIØ5	
036/	Status binary inputs basic unit	
04_	**Binary inputs option**	
040	Binary input DI1Ø	
041	Binary input DI11	
042	Binary input DI12	
043	Binary input DI13	
044	Binary input DI14	
045	Binary input DI15	
046	Binary input DI16	
047	Binary input DI17	
048/	Status binary inputs option	
05_	**Binary outputs basic unit**	
050	Binary output DBØØ	/BRAKE
051	Binary output DOØ1	
052	Binary output DOØ2	
053/	Status binary outputs basic unit	

Par.	Name	Value range
06_	**Binary outputs option**	
060	Binary output DO1Ø	
061	Binary output DO11	
062	Binary output DO12	
063	Binary output DO13	
064	Binary output DO14	
065	Binary output DO15	
066	Binary output DO16	
067	Binary output DO17	
068/	Status binary outputs option	
07_	**Unit data**	
070	Unit type	
071	Unit rated current	
072	Option 1	
073	Option 2	
074	Firmware option 1	
075	Firmware option 2	
076	Firmware basic unit	
077	Technology function	
08_	**Fault memory**	
080/	Fault t-0	
081	Fault t-1	
082	Fault t-2	
083	Fault t-3	
084	Fault t-4	
09_	**Bus diagnosis**	
090	PD configuration	
091	Fieldbus type	
092	Fieldbus baud rate	
093	Fieldbus address	
094	PO1 setpoint	
095	PO2 setpoint	
096	PO3 setpoint	
097	PI1 actual value	
098	PI2 actual value	
099	PI3 actual value	

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
1__	**SETPOINTS / RAMP GENERATORS**						
10_	**Setpoint selection**						
100/	Setpoint source	**UNIPOL/FIX.SETPT**					
101	Control signal source	**TERMINALS**					
11_	**Analog input AI1**						
110	AI1 scaling	-10 – -0.1 / 0.1 – **1** – 10					
111	AI1 offset	-500 – **0** – 500 mV					
112	AI1 operation mode	**Ref. N-MAX**					
113	AI1 voltage offset	-10 – **0** – 10 V					
114	AI1 speed offset	-5000 – **0** – 5000 rpm					
115	Filter setpoint	0 – **5** – 100 ms 0 = Filter off					
12_	**Analog inputs (optional)**						
120	AI2 operation mode	**NO FUNCTION**					
13_	**Speed ramps 1**			**14_**	**Speed ramps 2**		
130/	Ramp t11 UP CW	0 – **2** – 2000 s		140	Ramp t21 UP CW	0 – **2** – 2000 s	
131/	Ramp t11 DOWN CW	0 – **2** – 2000 s		141	Ramp t21 DOWN CW	0 – **2** – 2000 s	
132/	Ramp t11 UP CCW	0 – **2** – 2000 s		142	Ramp t21 UP CCW	0 – **2** – 2000 s	
133/	Ramp t11 DOWN CCW	0 – **2** – 2000 s		143	Ramp t21 DOWN CCW	0 – **2** – 2000 s	
134/	Ramp t12 UP=DOWN	0 – **2** – 2000 s		144	Ramp t22 UP=DOWN	0 – **2** – 2000 s	
135	S pattern t12	**0** – 3		145	S pattern t22	**0** – 3	
136/	Stop ramp t13	0 – **2** – 20 s		146	Stop ramp t23	0 – **2** – 20 s	
137/	Emergency ramp t14	0 – **2** – 20 s		147	Emergency ramp t24	0 – **2** – 20 s	
15_	**Motorized potentiometer (parameter set 1 and 2)**						
150	Ramp t3 UP	0.2 – **20** – 50 s					
151	Ramp t3 DOWN	0.2 – **20** – 50 s					
152	Save last setpoint	ON / **OFF**					
16_	**Fixed setpoints 1**			**17_**	**Fixed setpoints 2**		
160/	Internal setpoint n11	-5000 – 0 – **150** – 5000 rpm		170	Internal setpoint n21	-5000 – 0 – **150** – 5000 rpm	
161/	Internal setpoint n12	-5000 – 0 – **750** – 5000 rpm		171	Internal setpoint n22	-5000 – 0 – **750** – 5000 rpm	
162/	Internal setpoint n13	-5000 – 0 – **1500** – 5000 rpm		172	Internal setpoint n23	-5000 – 0 – **1500** – 5000 rpm	

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
2__	**CONTROLLER PARAMETERS**						
20_	**Speed control (only parameter set 1)**						
200	P gain speed controller	0.1 – **2** – 32					
201	Time constant n-control.	0 – **10** – 300 ms					
202	Gain accel. feedforward	**0** – 32					
203	Filter accel. feedforward	**0** – 100 ms					
204	Filter speed actual value	**0** – 32 ms					
205	Load feedforward	**0** – 150 %					
206	Sample time n-control.	**1 ms = 0** / 0.5 ms = 1					
207	Load feedforward VFC	**0** – 150 %					
21_	**Hold controller**						
210	P gain hold controller	0.1 – **2** – 32					
22_	**Synchr. oper. control (only parameter set 1)**						
220	P-gain (DRS)	1 – **10** – 200					
221	Master gear ratio factor	**1** – 3,999,999,999					
222	Slave gear ratio factor	**1** – 3,999,999,999					
223	Mode selection	**Mode 1** Mode 2 Mode 3 Mode 4 Mode 5 Mode 6 Mode 7 Mode 8					
224	Slave counter	-99,999,999 – -10 / **10** – 99,999,999 inc					
225	Offset 1	-32767 – -10 / **10** – 32767 inc					
226	Offset 2	-32767 – -10 / **10** – 32767 inc					
227	Offset 3	-32767 – -10 / **10** – 32767 inc					
228	Feedforward filter (DRS)	**0** – 100 ms		Only with MOVITOOLS. Not visible on the DBG11A keypad.			
23_	**Synchr. oper. w. sync. encoder**						
230	Synchronous encoder	**OFF** / EQUAL-RANKING / CHAIN					
231	Factor slave encoder	**1** – 1000					
232	Factor slave sync. encoder	**1** – 1000					
24_	**Synchr. oper. w. catch up**						
240	Synchronization speed	-5000 – 0 – **1500** – 5000 rpm					
241	Synchronization ramp	0 – **2** – 50 s					

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
3__	**MOTOR PARAMETERS**						
30_	**Limits 1**			**31_**	**Limits 2**		
300/	Start/stop speed 1	0 – **60** – 150 rpm		310	Start/stop speed 2	0 – **60** – 150 rpm	
301/	Minimum speed 1	0 – **60** – 5500 rpm		311	Minimum speed 2	0 – **60** – 5500 rpm	
302/	Maximum speed 1	0 – **1500** – 5500 rpm		312	Maximum speed 2	0 – **1500** – 5500 rpm	
303/	Current limit 1	0 – **150**% I_N		313	Current limit 2	0 – **150**% I_N	
304	Torque limit	**0** – 150 %					
32_	**Motor compensat. 1 (asynchr.)**			**33_**	**Motor compensat. 2 (asynchr.)**		
320/	Automatic adjustment 1	**ON** / OFF		330	Automatic adjustment 2	**ON** / OFF	
321	Boost 1	**0** – 100 %		331	Boost 2	**0** – 100 %	
322	IxR compensation 1	**0** – 100 %		332	IxR compensation 2	**0** – 100 %	
323	Premagnetizing time 1	0 – **0.1** – 2 s		333	Premagnetizing time 2	0 – **0.1** – 2 s	
324	Slip compensation 1	**0** – 500 rpm		334	Slip compensation 2	**0** – 500 rpm	
34_	**Motor protection**						
340	Motor protection 1	ON / **OFF**		342	Motor protection 2	ON / **OFF**	
341	Cooling type 1	**FAN COOLED** / forced-cooling		343	Cooling type 2	**FAN-COOLED** / forced-cooling	
35_	**Motor sense of rotation**						
350	Change direction of rotation 1	ON / **OFF**		351	Change direction of rotation 2	ON / **OFF**	
360	Startup	YES / **NO**		Only available in DBG11A, not in MOVITOOLS/SHELL!			
4__	**REFERENCE SIGNALS**						
40_	**Speed reference signal**						
400	Speed reference value	0 – **1500** – 5000 rpm					
401	Hysteresis	0 – **100** – 500 rpm					
402	Delay time	0 – **1** – 9 s					
403	Signal = "1" if:	**$n < n_{ref}$** / $n > n_{ref}$					
41_	**Speed window signal**						
410	Window center	0 – **1500** – 5000 rpm					
411	Range width	**0** – 5000 rpm					
412	Delay time	0 – **1** – 9 s					
413	Signal = "1" if:	**INSIDE** / OUTSIDE					
42_	**Speed setp./act. val. comp.**						
420	Hysteresis	1 – **100** – 300 rpm					
421	Delay time	0 – **1** – 9 s					
422	Signal = "1" if:	**$n <> n_{setpt}$** / $n = n_{setpt}$					
43_	**Current reference signal**						
430	Current reference value	0 – **100** – 150 % I_N					
431	Hysteresis	0 – **5** – 30 % I_N					
432	Delay time	0 – **1** – 9 s					
433	Signal = "1" if:	**$I<I_{ref}$** / $I>I_{ref}$					
44_	**Imax signal**						
440	Hysteresis	0 – **5** – 50 % I_N					
441	Delay time	0 – **1** – 9 s					
442	Signal = "1" if:	$I = I_{max}$ / **$I < I_{max}$**					

Par.	**Name** **Variable par.** **Parameter set 1**	**Setting range** **Factory setting**	**After startup**	Par.	**Name** **Parameter set 2**	**Setting range** **Factory setting**	**After startup**
5__	**MONITORING FUNCTIONS**						
50_	**Speed monitoring**						
500	Speed monitoring 1	**OFF** / MOTOR MODE / REGENERAT. MODE / MOT.& REGEN.MODE		502	Speed monitoring 2	**OFF** / MOTOR MODE / REGENERAT. MODE / MOT.& REGEN.MODE	
501	Delay time 1	0 – **1** – 10 s		503	Delay time 2	0 – **1** – 10 s	
504	Encoder monitoring	ON / **OFF**					
51_	**Synchr. operation monitoring**						
510	Positioning tol. slave	10 – **25** – 32768 inc					
511	Prewarning lag error	**50** – 99,999,999 inc					
512	Lag error limit	100 – **4000** – 99,999,999 inc					
513	Delay lag error message	0 – **1** – 99 s					
514	Counter LED display	10 – **100** – 32768 inc					
515	Delay in-position signal	5 – **10** – 2000 ms					
52_	**Mains OFF monitoring**						
520	Mains OFF response time	**0** – 5 s					
521	Mains OFF response	**CONTROL.INHIBIT** EMERGENCY STOP					
6__	**TERMINAL ASSIGNMENT**						
60_	**Binary inputs basic unit**						
-	Binary input DIØØ	With fixed assignment: **/ CONTROL.INHIBIT**					
600	Binary input DIØ1	**CW/STOP**		The following functions can be programmed: NO FUNCTION• ENABLE/RAP.STOP • CW/STOP •CCW/STOP • n11(n13) • n21(n23) • n12(n13) • n22(n23) •FIX SETPT SW.OV. • PAR. SWITCHOVER •RAMP SWITCHOVER • MOTOR POT UP • MOTOR POT DOWN • /EXT. FAULT • FAULT RESET • /HOLD CONTROL • /LIM. SWITCH CW • /LIM. SWITCH CCW • IPOS INPUT •REFERENCE CAM • REF. TRAVEL START •SLAVE FREE RUNN. • SETPOINT HOLD • MAINS ON •DRS SET ZERO PT. • DRS SLAVE START • DRS TEACH IN •DRS MAST.STOPPED			
601	Binary input DIØ2	**CCW/STOP**					
602	Binary input DIØ3	**ENABLE/RAP.STOP**					
603	Binary input DIØ4	**n11/n21**					
604	Binary input DIØ5	**n12/n22**					
61_	**Binary inputs option**						
610	Binary input DI1Ø	**NO FUNCTION**					
611	Binary input DI11	**NO FUNCTION**					
612	Binary input DI12	**NO FUNCTION**					
613	Binary input DI13	**NO FUNCTION**					
614	Binary input DI14	**NO FUNCTION**					
615	Binary input DI15	**NO FUNCTION**					
616	Binary input DI16	**NO FUNCTION**					
617	Binary input DI17	**NO FUNCTION**					
62_	**Binary outputs basic unit**						
-	Binary output DBØØ	With fixed assignment: **/BRAKE**					
620	Binary output DOØ1	**READY**		The following signals can be programmed: NO FUNCTION • /FAULT • READY • OUTP. STAGE ON • ROT. FIELD ON • BRAKE RELEASED • BRAKE APPLIED • MOTOR STANDSTILL • PARAMETER SET • SPEED REFERENCE • SPEED WINDOW • SP/ACT.VAL.COMP. • CURR. REFERENCE • Imax-SIGNAL • /MOTOR UTILIZ.1 • /MOTOR UTILIZ.2 • DRS PREWARN. • /DRS LAG ERROR • DRS SLAVE IN POS • IPOS IN POSITION • IPOS REFERENCE • IPOS OUTPUT • /IPOS FAULT			
621	Binary output DOØ2	**/FAULT**					
63_	**Binary outputs option**						
630	Binary output DO1Ø	**NO FUNCTION**					
631	Binary output DO11	**NO FUNCTION**					
632	Binary output DO12	**NO FUNCTION**					
633	Binary output DO13	**NO FUNCTION**					
634	Binary output DO14	**NO FUNCTION**					
635	Binary output DO15	**NO FUNCTION**					
636	Binary output DO16	**NO FUNCTION**					
637	Binary output DO17	**NO FUNCTION**					

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
64_	**Analog outputs optional**						
640	Analog output AO1	**ACTUAL SPEED**			The following functions can be programmed: NO FUNCTION • RAMP INPUT • SPEED SETPOINT • ACTUAL SPEED • ACTUAL FREQUENCY • OUTPUT CURRENT • ACTIVE CURRENT • UNIT UTILIZATION • IPOS OUTPUT • RELATED TORQUE		
641	Scaling AO1	-10 – 0 – **1** – 10					
642	Operating mode A01	OFF / **-10 – +10V** / 0 – 20mA / 4 – 20mA					
643	Analog output AO2	**OUTP.CURRENT**					
644	Scaling AO2	-10 – 0 – **1** – 10					
645	Operating mode AO2	OFF / **-10 – +10V** / 0 – 20mA / 4 – 20mA					
7__	**CONTROL FUNCTIONS**						
70_	**Operating Modes**						
700	Operating mode 1	**VFC 1** VFC 1 & GROUP VFC 1 & HOIST VFC 1 & DC BRAK. VFC 1 &FLY.START VFC-n-CONTROL VFC-n-CTRL.&GROUP VFC-n-CTRL&HOIST VFC-n-CTRL& SYNC VFC-n-CTRL& IPOS VFC-n-CTRL&DPx CFC CFC&M-CONTROL CFC& IPOS CFC& SYNC. CFC& DPx SERVO SERVO & M-CTRL. SERVO & IPOS SERVO & SYNC. SERVO & DPx		701	Operating mode 2	**VFC 2** VFC 2 & GROUP VFC 2 & HOIST VFC 2 & DC BRAK. VFC 2 &FLY.START	
71_	**Current at standstill**						
710	Standstill current 1	**0** – 50 % I_{Mot}		711	Standstill current 2	**0** – 50 % I_{Mot}	
72_	**Setpoint stop function**						
720	Setpoint stop function 1	ON / **OFF**		723	Setpoint stop function 2	ON / **OFF**	
721	Stop setpoint 1	0 – **30** – 500 rpm		724	Stop setpoint 2	0 – **30** – 500 rpm	
722	Start offset 1	0 – **30** – 500 rpm		725	Start offset 2	0 – **30** – 500 rpm	
73_	**Brake function**						
730	Brake function 1	**ON** / OFF		733	Brake function 2	**ON** / OFF	
731	Brake release time 1	**0** – 2 s		734	Brake release time 2	**0** – 2 s	
732	Brake application time 1	0 – **0.2** – 2 s		735	Brake application time 2	0 – **0.2** – 2 s	
74_	**Speed skip**						
740	Skip window center 1	0 – **1500** – 5000 rpm		742	Skip window center 2	0 – **1500** – 5000 rpm	
741	Skip width 1	**0** – 300 rpm		743	Skip width 2	**0** – 300 rpm	
75_	**Master-Slave function**						
750	Slave setpoint	**MASTER-SLAVE OFF** SPEED (RS-485) SPEED (SBus) SPEED (485+SBus) TORQUE (RS-485) TORQUE (SBus) TORQUE(485+SBus) LOAD SHAR(RS-485) LOAD SHARE (SBus) LOAD S(485+SBus)					
751	Scaling Slave setpoint	-10 – 0 – **1** – 10					

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
8__	**UNIT FUNCTIONS**						
80_	**Setup**						
802/	Factory setting	YES / **NO**					
803/	Parameter lock	ON / **OFF**					
804	Reset statistic data	**NO** FAULT MEMORY KWH-METER OPERATING HOURS					
800/	Quick menu	**ON** / OFF		These parameters are only available in the DBG11A keypad, not in MOVITOOLS!			
801/	Language	**DE** / EN / FR					
806	Copy DBG → MDX	YES / **NO**					
807	Copy MDX → DBG	YES / **NO**					
81_	**Serial communication**						
810	RS485 address	**0** – 99					
811	RS-485 group address	**100** – 199					
812	RS485 timeout delay	**0** – 650 s					
813	SBus address	**0** – 63					
814	SBus group address	**0** – 63					
815	SBus timeout delay	0 – **0.1** – 650 s					
816	SBus baud rate	125/250/**500** / 1000 kbaud					
817	SBus synchronization ID	**0** – 1023					
818	CAN synchronization ID	0 – **1** – 2047					
819	Fieldbus timeout delay	0 – **0.5** – 650 s					
82_	**Brake operation**						
820/	4-quadrant operation 1	**ON** / OFF		821	4-quadrant operation 2	**ON** / OFF	
83_	**Fault response**						
830	response EXT. FAULT	**EMERG.STOP/FAULT**		The following fault responses can be programmed: NO RESPONSE • DISPLAY FAULT • IMM. STOP/FAULT • EMERG.STOP/FAULT • RAPID STOP./FAULT • IMM. STOP/WARNG • EMERG. STOP/WARNG • RAPID STOP/WARNG			
831	Response FIELDBUS TIMEOUT	**RAPID STOP/WARNG**					
832	Response MOTOR OVERLOAD	**EMERG.STOP/FAULT**					
833	Response RS485 TIMEOUT	**RAPID STOP/WARNG**					
834	Response DRS LAG ERROR	**EMERG.STOP/FAULT**					
835/	Response TF sensor SIGNAL	**NO RESPONSE**					
836	Response SBus TIMEOUT	**EMERG.STOP/FAULT**					
84_	**Reset response**						
840/	Manual reset	YES / **NO**					
841	Auto reset	ON / **OFF**					
842	Restart time	1 – **3** – 30 s					
85_	**Scaling speed actual value**						
850	Scaling factor numerator	**1** – 65535		Can only be set using MOVITOOLS			
851	Scaling factor denominator	**1** – 65535					
852	User dimension	**1 rpm**					

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
86_	**Modulation**						
860	PWM frequency 1	**4**/8/12/16 kHz		861	PWM frequency 2	**4**/8/12/16 kHz	
862	PWM fix 1	ON / **OFF**		863	PWM fix 2	ON / **OFF**	
87_	**Process data description**						
870	Setpoint description PO1	**CTRL. WORD 1**					
871	Setpoint description PO2	**SPEED**					
872	Setpoint description PO3	**NO FUNCTION**					
873	Actual value description PI1	**STATUS WORD1**					
874	Actual value description PI2	**SPEED**					
875	Actual value description PI3	**OUTP.CURRENT**					
876	PO data enable	**ON** / OFF					
877	DeviceNet PD configuration	1 – 24 PD / PARAM + 1 – 24 PD					
88_	**Manual operation**						
880	Manual operation	ON / **OFF**					
9__	**IPOS PARAMETERS**						
90_	**IPOS Reference travel**						
900	Reference offset	-2^{31} – **0** – 2^{31}-1 inc					
901	Reference speed 1	0 – **200** – 5000 rpm					
902	Reference speed 2	0 – **50** – 5000 rpm					
903	Reference travel type	**0** – 7					
91_	**IPOS Travel parameter**						
910	Gain X controller	0.1 – **0.5** – 32					
911	Positioning ramp 1	0 – **1** – 20 s					
912	Positioning ramp 2	0 – **1** – 20 s					
913	Travel speed CW	0 – **1500** – 5000 rpm					
914	Travel speed CCW	0 – **1500** – 5000 rpm					
915	Speed feedforward	-199.99 – 0 – **100** – 199.99 %					
916	Ramp type	**LINEAR** / SINE / SQUARED / BUSRAMP					
92_	**IPOS Monitoring**						
920	SW limit switch CW	-2^{31} – **0** – 2^{31}-1 inc					
921	SW limit switch CCW	-2^{31} – **0** – 2^{31}-1 inc					
922	Position window	0 – **50** – 32767 inc					
923	Lag error window	0 – **5000** – 2^{31}-1 inc					
93_	**IPOS Special functions**						
930	Override	ON / **OFF**					
931	CTRL word task 1	START / **STOP**		Only available in DBG11A, not in MOVITOOLS/SHELL!			
932	CTRL word task 2	START / **STOP**		Only available in DBG11A, not in MOVITOOLS/SHELL! Display parameter, cannot be edited using DBG11A.			

Par.	Name Variable par. Parameter set 1	Setting range Factory setting	After startup	Par.	Name Parameter set 2	Setting range Factory setting	After startup
94_	**IPOS Variables/Encoder**						
940	IPOS variables edit	ON / **OFF**		This parameter is only available in the DBG11A keypad, not in MOVITOOLS!			
941	Source actual position	**MOTOR ENC. (X15)** EXTERN.ENC (X14) ABSOL.ENC. (DIP)					
942	Encoder factor numerator	**1** – 32767					
943	Encoder factor denominator	**1** – 32767					
944	Encoder scaling ext. encoder	**x1**/x2/x4/x8/x16/x32/x64		Only with MOVITOOLS. Not visible on the DBG11A keypad.			
95_	**DIP**						
950	Encoder type	**NO ENCODER**					
951	Counting direction	**NORMAL**/INVERTED					
952	Cycle frequency	**1** – 200 %					
953	Position offset	$-(2^{31}-1)$ – **0** – $2^{31}-1$					
954	Zero offset	$-(2^{31}-1)$ – **0** – $2^{31}-1$					
955	Encoder scaling	**x1**/x2/x4/x8/x16/x32/x64					
96_	**IPOS Modulo Function**						
960	Modulo function	**OFF** / SHORT / CW / CCW					
961	Modulo numerator	**0** – 2^{31}					
962	Modulo denominator	**0** – 2^{31}					
963	Modulo encoder resolution	0 – **4096** – 20000					

11 Operation and Servicing

11.1 Operating displays

7-segment display

The 7-segment display shows the operating status of MOVIDRIVE® in hexadecimal notation and, in the event of a fault, a fault or warning code.

Display	Meaning
0	Inverter not ready
1	Controller inhibit active
2	No enable
3	Current at standstill
4	VFC mode
5	n-control
6	M-control
7	Hold control
8	Factory setting
9	Limit switch reached
A	Technology option
b	Free
C	IPOS reference travel
d	Flying start
E	Free
F	Fault display (flashing) → page 294
H	Manual operation
t	Timeout active → page 293

DBG11A keypad

Basic displays:

```
CONTROL.INHIBIT
CURRENT:    0   A
```

Display when X13:1 (DIØØ "/CONTROL.INHIBIT") = "0".

```
NO ENABLE
CURRENT:    0   A
```

Display when X13:1 (DIØØ "/CONTROL.INHIBIT") = "1" and inverter is not enabled ("ENABLE/RAPID STOP" = "0").

```
SPEED     942 rpm
CURRENT:     2.51 A
```

Display when inverter enabled.

```
NOTE XX
XXXXXXXXXXXXXXXXXXX
```

Information message

```
FAULT           XX
XXXXXXXXXXXXXXXXXXX
```

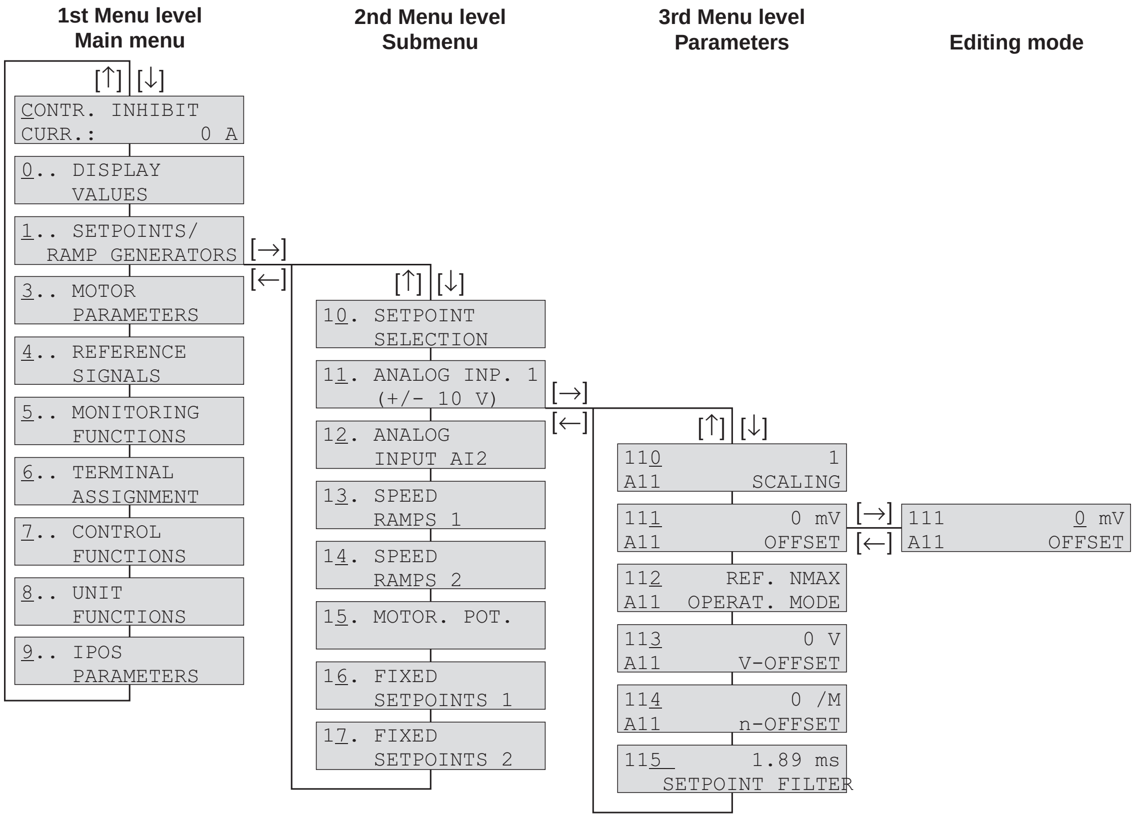
Fault indication

Copy function of the DBG11A

The DBG11A keypad can be used for copying complete parameter sets from one MOVIDRIVE® unit to another MOVIDRIVE®. To do this, copy the parameter set onto the keypad using P807 (MD_ → DBG). Connect the keypad to another MOVIDRIVE® unit and copy the parameter set onto the MOVIDRIVE® using P 806 (DBG → MD_). The keypad can be disconnected and plugged in during operation.

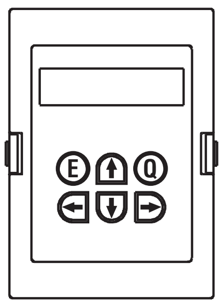
The COMMUNIC. ERROR NO SERIAL LINK fault message appears on the display if no communication can be established with the inverter after the supply system or the 24 V power supply is switched on and the DBG11A is connected. Try to establish the connection by connecting the DBG11A again.

Selected via menu



02407AEN

Fig. 151: Menu structure



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← or → key	Change menu level, in 3rd menu level (parameter) entry to (→) or exit from (←) edit mode. The parameter can only be changed in edit mode. Startup is commenced if the ← and → keys are pressed at the same time (→ Sec. "Startup").	
↑ or ↓ key	Select menu command, increase or decrease value in edit mode. The new value comes into effect in edit mode when the ↑ or ↓ key is released.	
Q key	Back to main display; in startup mode, cancel startup.	
E key	Startup:	Cancel startup
	Normal operation:	Signature display; the signature can only be entered or edited with MOVITOOLS/SHELL and is used for identifying the parameter set or the unit.
	Manual mode:	Exit manual mode
	Malfunction:	Call up reset parameter P840

Quick menu of the DBG11A

The DBG11A keypad has a detailed parameter menu and a clearly structured quick menu with the most frequently used parameters. It is possible to switch between both menus using P800 ("Quick menu"). This can be done in any operating status. The default setting is for the quick menu to be active. The quick menu is shown on the display by a "/" after the parameter number. The parameters in the quick menu are identified by a "/" in the parameter list.

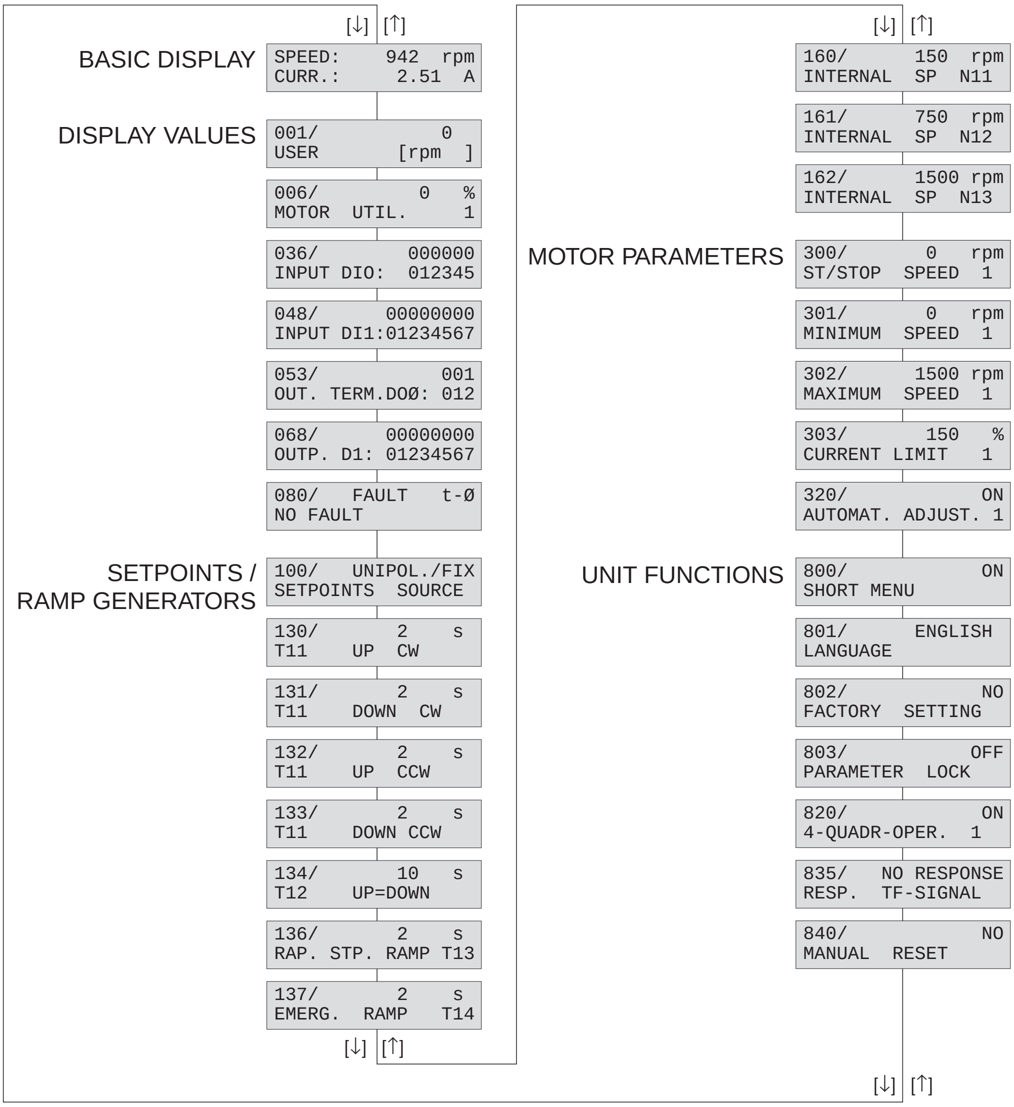

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Fig. 152: DBG11A quick menu

IPOS$^{plus®}$

MOVITOOLS is required for programming IPOS$^{plus®}$. The DBG11A keypad only makes it possible to edit and modify IPOS$^{plus®}$ parameters (P9__).

The IPOS$^{plus®}$ program is also stored in the DBG11A keypad when it is saved. It is transferred as well when the parameter set is copied to another MOVIDRIVE® unit.

Parameter P931 can be used for starting and stopping the IPOS$^{plus®}$ program from the DBG11A keypad.

Information messages

Information messages on the DBG11A (approx. 2 s in duration) or in MOVITOOLS/ SHELL (message which can be acknowledged):

No.	Text DBG11A/SHELL	Description
1	ILLEGAL INDEX	Index addressed via interface is not available.
2	NOT IMPLEMENTED	• Attempt to execute a non-implemented function. • An incorrect communication service has been selected. • Manual mode selected via impermissible interface (e.g. fieldbus).
3	READ ONLY VALUE	Attempt to edit a read only value.
4	PARAM. LOCKED	Parameter lock P803 = "ON". Parameter cannot be altered.
5	SETUP ACTIVE	Attempt to alter parameters during active factory setting.
6	VALUE TOO LARGE	Attempt to enter a value which is too large.
7	VALUE TOO SMALL	Attempt to enter a value which is too small.
8	REQ. PCB MISSING	The option pcb required for the selected function is missing.
-		
10	ONLY VIA ST1	Manual mode must be completed using X13:ST11/ST12 (RS-485).
11	TERMINAL ONLY	Manual mode must be completed using TERMINAL (DBG11A or USS21A).
12	NO ACCESS	Access to selected parameter refused.
13	NO CTRLER. INHIBIT	Set terminal DIØØ "/Controller inhibit" = "0" for the selected function.
14	INVALID VALUE	Attempt to enter an invalid value.
--		
16	PARAM. NOT SAVED	EEPROM buffer overrun, e.g. due to cyclical write accesses. Parameter is saved in EEPROM and is not protected against loss following POWER OFF.

11.2 Fault information

Fault memory

The fault memory (P080) stores the last five fault messages (faults t-0 – t-4). The fault message of longest standing is deleted whenever more than five fault messages have occurred. The following information is stored when a malfunction takes place:

Fault which occurred • Status of the binary inputs/outputs • Operational status of the inverter • Inverter status • Heat sink temperature • Speed • Output current • Active current • Unit utilization • DC link circuit voltage • ON hours • Enable hours • Parameter set • Motor utilization.

Switch-off responses

There are three switch-off responses depending on the fault; the inverter is inhibited when in fault status:

Immediate switch-off

The unit can no longer brake the drive; the output stage goes to high resistance in the event of a fault and the brake is applied immediately (DBØØ "/Brake" = "0").

Rapid stop

The drive is braked with the stop ramp t13/t23. Once the stop speed is reached, the brake is applied (DBØØ "/Brake" = "0"). The output stage goes to high-resistance after the brake reaction time has elapsed (P732 / P735).

Emergency stop

The drive is braked with the emergency ramp t14/t24. Once the stop speed is reached, the brake is applied (DBØØ "/Brake" = "0"). The output stage goes to high-resistance after the brake reaction time has elapsed (P732 / P735).

Reset

A fault message can be acknowledged by:

- Switching the supply system off and on again.

  Recommendation: Observe a minimum switch-off time of 10 s for the supply system contactor K11.
- Reset via input terminals, i.e. via an appropriately assigned binary input (DIØ1 – DIØ5 with the basic unit, DI1Ø – DI17 with the DIO11A option).
- Manual reset in SHELL (P840 = "YES" or [Parameter] / [Manual reset]).
- Manual reset using the DBG11A (pressing the <E> key in the event of a fault gives direct access to parameter P840).
- Auto reset performs up to five unit resets with an adjustable restart time. Not to be used with drives where an automatic restart represents a risk of injury to people or damage to equipment.

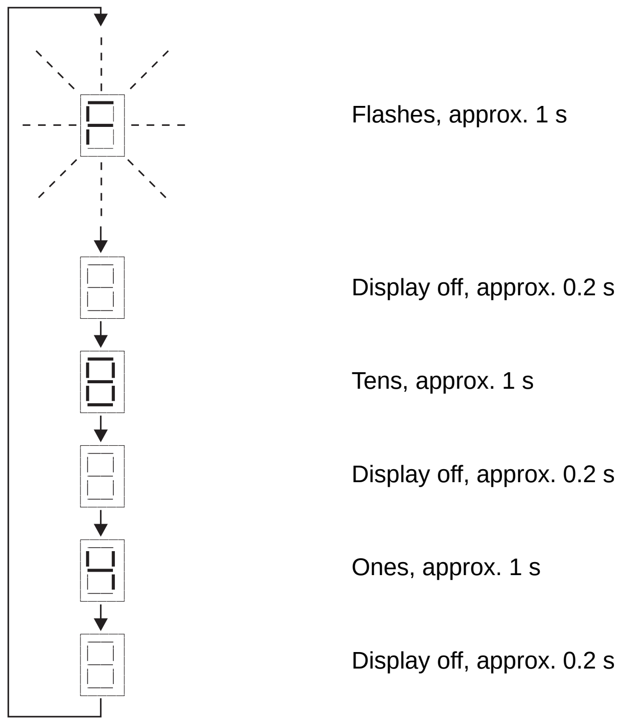
Timeout active

If the inverter is controlled via a communications interface (fieldbus, RS-485 or SBus) and the power was switched off and back on again or a fault reset was performed, then the enable remains ineffective until the inverter once again receives valid data via the interface which is monitored with a timeout.

11.3 Fault messages and list of faults

Fault message on 7-segment display

The fault or warning code is displayed in BCD format. The following display sequence is adhered to (e.g. fault code 84):



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The display switches over to the operating display following a reset or if the fault or warning code once more resumes the value "0".

List of faults

A dot in the "P" column means that the response is programmable (P83_ Fault response). The factory set fault response is listed in the "Response" column.

Fault code	Description	Reaction	P	Possible cause	Measure
00	No fault	-			
01	Over-current	Immediate shut-off		• Short circuit on output • Motor too large • Defective output stage	• Rectify the short circuit • Connect a smaller motor • Contact SEW Service for advice if the output stage is defective
03	Ground fault	Immediate shut-off		Ground fault • in the connecting harness • in the inverter • in the motor	• Eliminate ground fault • Contact SEW Service for advice
04	Brake chopper	Immediate switch-off		• Regenerative power excessive • Braking resistor circuit interrupted • Short circuit in braking resistor circuit • Excessively high braking resistance • Brake chopper defective	• Extend deceleration ramps • Check feeder to braking resistor • Check technical data of braking resistor • Fit a new MOVIDRIVE® if the brake chopper is defective
07	DC link overvoltage	Immediate switch-off		DC link voltage too high	• Extend deceleration ramps • Check connecting harness for braking resistor • Check technical data of braking resistor

Fault code	Description	Reaction	P	Possible cause	Measure
08	n-monitoring	Immediate switch-off		• Speed controller or current controller (in VFC operating mode without encoder) operating at setting limit due to mechanical overload or phase fault in the power system or motor • Encoder not connected correctly or incorrect direction of rotation • n_{max} is exceeded during torque control	• Reduce load • Increase deceleration time setting (P501 or P503) • Check encoder connection, swap over A/A and B/B pairs if necessary • Check encoder voltage supply • Check current limitation • Extend ramps if appropriate • Check motor feeder and motor • Check supply system phases
09	Startup	Immediate switch-off		Inverter startup not yet performed for selected operating mode.	Perform startup for appropriate operating mode.
10	IPOS-ILLOP	Emergency stop		• Incorrect command detected during running of IPOS program. • Incorrect conditions during command execution.	• Check program memory content and correct if necessary. • Load correct program into program memory. • Check program sequence (→ IPOS manual)
11	Excessive temperature	Emergency stop		Thermal overload of inverter.	Reduce load and/or ensure adequate cooling.
12	Resolver 14 bits	Emergency stop		**Only with MDS:** 14-bit resolver evaluation is active and the actual speed is greater than or equal to 3600 rpm.	Set P302 "Maximum speed 1" to max. 3000 rpm.
13	Control signal source	Immediate switch-off		Control signal source not defined or defined incorrectly.	Set correct control signal source (P101).
14	Encoder	Immediate switch-off		• Encoder cable or shield not connected correctly • Short circuit/open circuit in encoder cable • Encoder defective	Check encoder cable and shield for correct connection, short circuit and open circuit.
15	24 V internal	Immediate switch-off		No internal 24 V supply voltage.	Check the mains connection. Contact SEW Service for advice if this reoccurs.
17-24	System fault	Immediate switch-off		Inverter electronics disrupted, possibly due to effect of EMC.	Check ground connections and shields; improve them if necessary. Contact SEW Service for advice if this reoccurs.
25	EEPROM	Rapid stop		Fault when accessing EEPROM	Call up default setting, perform reset and set parameters again. Contact SEW Service for advice if this reoccurs.
26	External terminal	Emergency stop	•	Read in external fault signal via programmable input.	Eliminate specific cause of fault; reprogram terminal if appropriate.
27	Limit switches missing	Emergency stop		• Open circuit/both limit switches missing • Limit switches are swapped over in relation to direction of rotation of motor	• Check wiring of limit switches • Swap over limit switch connections • Reprogram terminals
28	Fieldbus timeout	Rapid stop	•	No master-slave communication took place within the configured response monitoring period.	• Check master communication routine • Extend fieldbus timeout time (P819) or switch off monitoring
29	Limit switch reached	Emergency stop		Limit switch was reached in IPOS operating mode.	• Check travel range • Correct user program.
30	Emergency stop timeout	Immediate switch-off		• Drive overloaded • Emergency stop ramp too short	• Check project planning • Extend emergency stop ramp
31	TF sensor	No response	•	• Motor too hot, TF sensor has tripped • TF sensor of motor not connected or not connected properly • MOVIDRIVE® connection and TF connection on motor interrupted • No link between X10:1 and X10:2. With MDS: X15:9 – X15:5 connection missing.	• Let motor cool down and reset fault • Check connections/link between MOVIDRIVE® and TF. • If no TF is connected: Jumper X10:1 to X10:2. With MDS: Jumper X15:9 to X15:5. • Set P835 to "NO RESPONSE".
32	IPOS index overrun	Emergency stop		Basic programming rules violated causing stack overflow in system.	Check IPOS user program and correct if necessary (→ IPOS manual).
33	Setpoint source	Immediate switch-off		Setpoint source not defined or defined incorrectly	Set correct setpoint source (P100).
35	Operating mode	Immediate switch-off		Operating mode not defined or defined incorrectly	Use P700 or P701 to set correct operating mode

Fault code	Description	Reaction	P	Possible cause	Measure
36	No option	Immediate switch-off		• Type of option pcb not allowed • Setpoint source, control source or operating mode not permitted for this option pcb • Incorrect encoder type set for DIP11A.	• Use correct option pcb • Set correct setpoint source (P100) • Set correct control signal source (P101) • Set correct operating mode (P700 or P701) • Set the correct encoder type
37	System watchdog	Immediate switch-off		Fault in system software procedure	Contact SEW Service for advice.
38	System software	Immediate switch-off		System fault	Contact SEW Service for advice.
39	Reference travel	Immediate switch-off		• Reference cam missing or does not switch • Limit switches not connected correctly • Reference travel type changed during reference travel	• Check reference cam • Check connection of limit switches • Check reference travel type setting and the parameters required for it
40	Boot synchronizatio n	Immediate switch-off		**Only with DIP11A, DPx11A or DRS11A:** Fault during boot synchronization between inverter and option.	Fit a new option pcb if this reoccurs.
41	Watchdog option	Immediate switch-off		Fault during communication between system software and option software.	Contact SEW Service for advice.
42	Lag error	Immediate switch-off	•	• Incremental encoder connected incorrectly • Accelerating ramps too short • P-component of positioning controller too small • Speed controller parameters set incorrectly • Value of lag error tolerance too small	• Check rotary encoder connection • Extend ramps • Set P-component to higher value • Set speed controller parameters again • Increase lag error tolerance • Check encoder, motor and mains phase wiring • Check mechanical components can move freely, possibly blocked up
43	RS-485 timeout	Rapid stop	•	Communication between inverter and PC interrupted	Check connection between inverter and PC. Contact SEW Service for advice if necessary.
44	Unit utilization	Immediate switch-off		Unit utilization (IxT value) exceeds 125 %	• Reduce power output • Extend ramps • Use a larger inverter if the specified points are not possible.
45	Initialization	Immediate switch-off		• No parameters set for EEPROM in power section or parameters set incorrectly. • Option pcb not in contact with backplane bus.	• Restore factory settings. Call SEW Service for advice if the fault still cannot be reset. • Insert the option pcb correctly.
47	System bus timeout	Rapid stop	•	Fault during communication via system bus.	Check system bus connection.
48	Hardware DRS	Immediate switch-off		**Only with DRS11A:** • Encoder signal for master faulty. • Hardware required for synchronous operation is missing.	• Check encoder wiring. • Fit a new synchronous operation board.
50	Pos. HW limit switch	No response		**Only with DPx11A:** • Drive has reached position of CW limit switch. • Interruption in line between inverter and CW limit switch.	• Move out of limit switch range using sense of rotation "CCW". • Check cabling.
51	Neg. HW limit switch	No response		**Only with DPx11A:** • Drive has reached position of CCW limit switch. • Interruption in line between inverter and CW limit switch.	• Move out of limit switch range using sense of rotation "CW". • Check cabling.
52	Positive software limit switch	No response		**Only with DPx11A:** Travel command to a position outside travel range delimited by CW software limit switch.	• Check travel program and correct if necessary. • Correct position of CW software limit switch. • Deactivate CW software limit switch by entering "0" position.
53	Negative software limit switch	No response		**Only with DPx11A:** Travel command to a position outside travel range delimited by CCW software limit switch.	• Check travel program and correct if necessary. • Correct position of CCW software limit switch. • Deactivate CCW software limit switch by entering "0" position.

Fault code	Description	Reaction	P	Possible cause	Measure
54	No reference travel	No response		**Only with DPx11A:** Reference travel not performed with "GO0" or "SET0" command.	Perform reference travel.
55	Machine parameters	No response		**Only with DPx11A:** Incorrect input of a machine parameter (e.g. incorrect value range).	Check machine parameter and correct it.
56	Missing required HW	No response		**Only with DPx11A:** User program addresses a hardware item which is not fitted.	Correct user program or insert necessary hardware into inverter.
57	No program	No response		**Only with DPx11A:** Attempt was made to call up a non-existent user program.	• Modify program call • Load program to be called into program memory.
58	No record number	No response		**Only with DPx11A:** Attempt was made to jump to a non-existent record number in user program.	Correct user program.
59	No subroutine	No response		**Only with DPx11A:** Attempt was made to call up a non-existent subroutine in user program.	• Correct subroutine call in user program. • Make subroutine to be called available.
60	Target position outside	No response		**Only with DPx11A:** Travel command was transmitted in user program which targets a position outside travel range.	• Correct user program. • Adapt travel range.
61	Prog. speed > Vmax	No response		**Only with DPx11A:** Speed entered in user program is faster than maximum speed specified in machine parameters.	• Adapt travel speed in user program. • Adapt maximum speed in machine parameters.
62	FLASH-EPROM DPx	No response		**Only with DPx11A:** Fault during write access to flash-EPROM of DPx11A.	Contact SEW Service for advice if this reoccurs.
63	Division by zero	No response		**Only with DPx11A:** Division by zero was performed in user program using calculation operation SET Hxx/ Hyy.	Correct user program.
64	Subroutine nesting	No response		**Only with DPx11A:** • Maximum nesting depth for subroutines reached. • Recursive subroutine call (program is calling itself).	• Alter program structure. • Correct user program.
65	LM628 command	No response		**Only with DPx11A:** Incorrect command to position controller component.	Inform SEW Service if fault cannot be reset or if it occurs frequently.
66	Prog. memory full	No response		**Only with DPx11A:** Maximum capacity of program memory has been exceeded.	• Delete programs from program memory that are no longer required. • If all programs in program memory are needed then optimize program contents.
67	DPx remote time	No response		**Only with DPx11A:** Communication interruption during PC-controlled mode.	Check connection between PC and inverter.
68	Not at target position	No response		**Only with DPx11A:** Specified target position was not reached within 5 seconds. • P-component set too small. • Position window too small. • Drive has encountered obstacle.	• Check setting of P-component and position window and set larger values if appropriate. • Check mechanical components can move freely.
69	No feed enable	No response		**Only with DPx11A:** No "Feed enable" signal at terminal X11:6.	Check wiring and signal level at terminal X11:6.

Fault code	Description	Reaction	P	Possible cause	Measure
70	**Timeout DPx-SSI**	No response		Coded fault; only with DPA11A.	
	Code 1: SSI interface fault.			SSI module defective.	Inform SEW Service if fault cannot be reset or if it occurs frequently.
	Code 2: Communication fault of SSI interface.			SSI module defective.	
	Code 3: Parity or power failure fault from SSI encoder.			• Encoder cable disrupted • Electrical power supply disrupted • Incorrect setting of machine parameters	• Check encoder cable • Check electrical power supply • Check machine parameters and correct if necessary
	Code 4: Lag error in SSI module			Data transfer between encoder and DPA11A disrupted.	Check connection cable and associated shield.
71	**Timeout DPx-CAN**	No response		Coded fault; only with DPA11A.	
	Code 1: Timeout CAN.			CAN bus communication interrupted.	Check the CAN bus connection.
	Code 2: CAN receive buffer full.			Systematic program error caused by excessively frequent writing of CAN bus interface of an inverter.	Reduce write accesses to inverter concerned in user program.
	Code 3: CAN controller overflow.			CAN controller malfunction.	Inform SEW Service if fault cannot be reset or if it occurs frequently.
	Code 4: CAN controller error.			Malfunction on the CAN bus. Possibly, no nodes are present.	Check wiring and user program.
72	Index overrun	No response		**Only with DPx11A:** Fault with indexed variable index. Offset variable Cxx greater than C99 selected.	Correct user program.
73	Unauthorized command	No response		**Only with DPx11A:** Command was transmitted which cannot be carried out in current status of inverter. For example, transmitting the SAVE command during a positioning process.	Check user program.
74	Range limit	No response		**Only with DPx11A:** Calculated setpoint position in increments greater than 230 and therefore located outside range limit.	Check user program.
77	IPOS control word	No response		**Only in IPOS operating mode:** • Attempt was made to set an invalid automatic mode (via external control). • P916 = BUSRAMP set.	• Check serial connection to external control. • Check write values of external control. • Set P916 correctly.
78	IPOS SW limit switches	No response		**Only in IPOS operating mode:** Programmed target position is outside travel range delimited by software limit switches.	• Check user program • Check position of software limit switches
81	Start condition	Immediate switch-off		**Only in "VFC hoist" operating mode:** Current during premagnetization phase could not be injected into motor at a high enough level: • Motor rated power too small in relation to inverter rated power. • Motor cable cross section too small.	• Check startup data and repeat startup procedure if necessary. • Check connection between inverter and motor. • Check cross section of motor cable and increase if necessary.
82	Output open	Immediate switch-off		**Only in "VFC hoist" operating mode:** • Two or all output phases interrupted. • Motor rated power too small in relation to inverter rated power.	• Check connection between inverter and motor. • Check startup data and repeat startup procedure if necessary.
84	Motor protection	Emergency stop	•	Motor utilization too high.	• Reduce load. • Extend ramps. • Observe longer pause times.
85	Copy	Immediate switch-off		Fault when copying parameters.	Check connection between inverter and PC.
88	Flying start	Immediate switch-off		**Only in "VFC n-CTRL" operating mode:** Actual speed > 5000 rpm when inverter enabled.	Enable only at actual speed ≤ 5000 rpm.
92	DIP work area	Emergency stop		**Only with DIP11A option:** Drive has moved beyond the permitted work area of the absolute encoder. Setting of encoder type/work area DIP parameters may be incorrect.	Check position offset and zero offset parameters.

Fault code	Description	Reaction	P	Possible cause	Measure
93	DIP encoder fault	Emergency stop		**Only with DIP11A option:** The encoder signals a fault, e.g. power failure. • Connection cable between the encoder and DIP does not meet the requirements (twisted pair, shielded) • Cycle frequency too high for cable length • Permitted max. speed/acceleration of encoder exceeded • Encoder defective	• Check absolute encoder connection • Check motor leads • Set correct cycle frequency • Reduce max. traveling velocity or ramp • Fit new absolute encoder
94	EEPROM checksum	Immediate switch-off		Inverter electronics disrupted, possibly due to effect of EMC or a defect.	Send the unit in for repair.
95	DIP plausibility error	Emergency stop		**Only with DIP11A option:** Unable to determine a plausible position. • Incorrect encoder type set • IPOS travel parameter set incorrectly. • Numerator/denominator factor set incorrectly • Zero adjustment performed • Encoder defective	• Set the correct encoder type • Check IPOS travel parameter • Check traveling velocity • Correct numerator/denominator factor • Reset after zero adjustment • Fit new absolute encoder
99	IPOS ramp calculation fault	Immediate switch-off		**Only in IPOS operating mode:** Attempt made to alter ramp times and traveling velocities when the inverter is enabled, with a sine or squared positioning ramp.	Rewrite the IPOS program so that ramp times and traveling velocities can only be altered when the inverter is inhibited.

11.4 SEW electronics service

Send in for repair

Please contact the **SEW electronics service if a fault cannot be rectified** (→ "Customer and spare parts service").

When contacting the SEW electronics service, please always quote the digits of your service code to enable our service personnel to assist you more effectively.

Please provide the following information if you are sending the unit in for repair:

- Serial number (→ nameplate)
- Unit designation
- Standard type or technology type
- Digits of the service code
- Brief description of the application (application, control via terminals or serial)
- Connected motor (motor type, motor voltage, ⅄ or Δ circuit)
- Nature of the fault
- Peripheral circumstances
- Your own presumption of what has happened
- Any unusual events, etc. preceding the fault

Service label

MOVIDRIVE® units have service labels attached to them; one for the power section and another for the control unit. These are located on the side next to the nameplate.

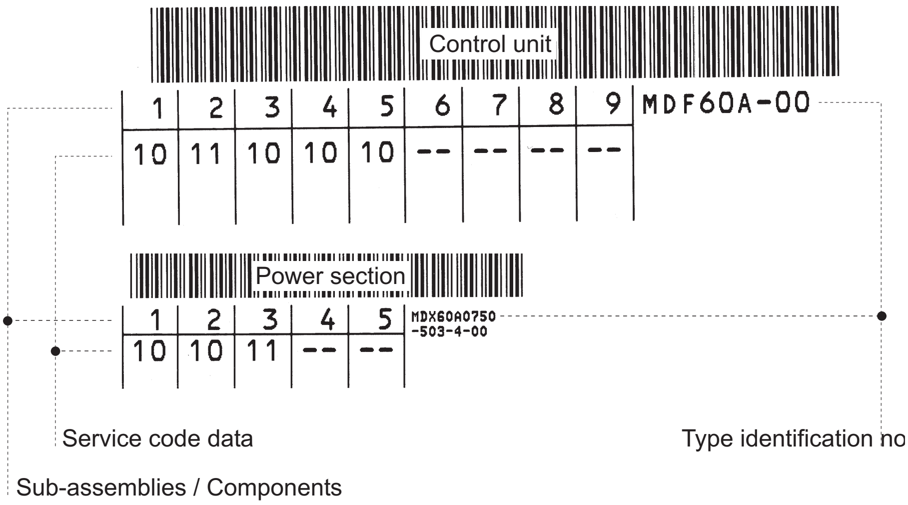

Fig. 153: Service label

12 Revisions Index

This edition of the MOVIDRIVE® MD_60A system manual is based on Edition 03/2000 which has been revised and updated to include additional information on the following:

- In the "System description" section, the MOVIDRIVE® inverter functions are now illustrated by a block circuit diagram.
- MOVIDRIVE® MD_60A inverters are now available in two different versions:
  - The standard version; the inverter in the design as known to date.
  - The applications version; a design featuring additional technological functions and integrated activation of the applications modules.
- The technological functions "Electronic Cam Disc" and "Internal Synchronous Operation", integrated into the application version of the inverter.
- Applications modules for "Positioning", "Winding" and "Control" applications, can be activated in the application version of the inverter.
- The 230 V units (MOVIDRIVE® MD_60A...-2_3) are now available up to 30 kW (40 HP).
- The following new options:
  - Fieldbus interface PROFIBUS, type DFP21A, 12 MBaud maximum baud rate.
  - Fieldbus interface INTERBUS, type DFI21A, fiber optic cable.
  - Fieldbus interface CANopen, type DFO11A.
- New prefabricated cable. For instance for CM motor connection and MOVIDRIVE® Master-Slave connection.
- The following new parameters:
  - P138 "Ramp limit"
  - P205 "Load feedforward"
  - P206 "Sample time n-control"
  - P207 "Load feedforward VFC"
  - P304 "Torque limit"
  - P96_ "IPOS Modulo function"
- The DT/DV motors from SEW are also available in JEC design. The "Project planning" section contains a JEC motor table and motor selection table.
- The new synchronous SEW servomotors in the CM series can be connected to MOVIDRIVE® MDS60A. The "Project planning" section contains a CM motor table and motor selection table.

13 Abbreviation Key and Index

13.1 Abbreviation Key

cosφ	Power factor of motor	
F_A	Axial force acting on the output shaft	[N]
f_{in}	Supply frequency	[Hz]
H	Installation altitude	[m ü. NN]
η	Efficiency	
I_d	Magnetizing current	[A]
I_{in}	Input current	[A]
I_F	Trip current	[A]
$I_N = I_n$	Rated current	[A]
I_q	Torque-forming current	[A]
I_{tot}	Current in total	[A]
IP..	Enclosure	
i_{tot}	Gear ratios in total	
ϑ_{amb}	Ambient temperature	[°C]
J_{Last}	Mass moment of inertia to be driven	[10^{-4} kgm^2]
J_{Mot}	Mass moment of inertia of motor	[10^{-4} kgm^2]
J_X	Mass moment of inertia reduced to motor shaft	[10^{-4} kgm^2]
J_Z	Mass moment of inertia of heavy fan	[10^{-4} kgm^2]
k_T	Torque constant	[Nm/A]
M_a	Output torque	[Nm]
M_B	Braking torque	[Nm]
M_H/M_N	Ratio acceleration torque / rated torque motor	
M_S	Starting torque	[Nm]
n_A	Output speed	[1/min]
n_{base}	Base speed	[1/min]
n_E	Input speed	[1/min]
n_M	Motor speed	[1/min]
n_{setp}	Rated speed	[1/min]
P_a	Output power	[kW]
P_e	Mathematical input power of gear unit	[kW]
P_N	Rated power	[kW]
$P_{reduced}$	Power reduced in relation to rated power	[kW]
$P_v = P_{loss}$	Power loss	[kW]
R_{BWmin}	Minimum braking resistance value for 4Q operation	[Ω]
S.., %ED	Duty type and relative cyclic duration factor cdf	
T	Cycle duration	[min]
t1	Response time of motor brake	[10^{-3} s]
t2	Reaction time of motor brake	[10^{-3} s]
V_{in}	Supply voltage	[V]
V_{rated}	Rated voltage	[V]
V_{out}	Output voltage	[V]
Z	Starting frequency	[1/h], [c/h]
Z_0	No-load starting frequency	[1/h], [c/h]

13.2 Index

U

V

W

Wiring the control unit

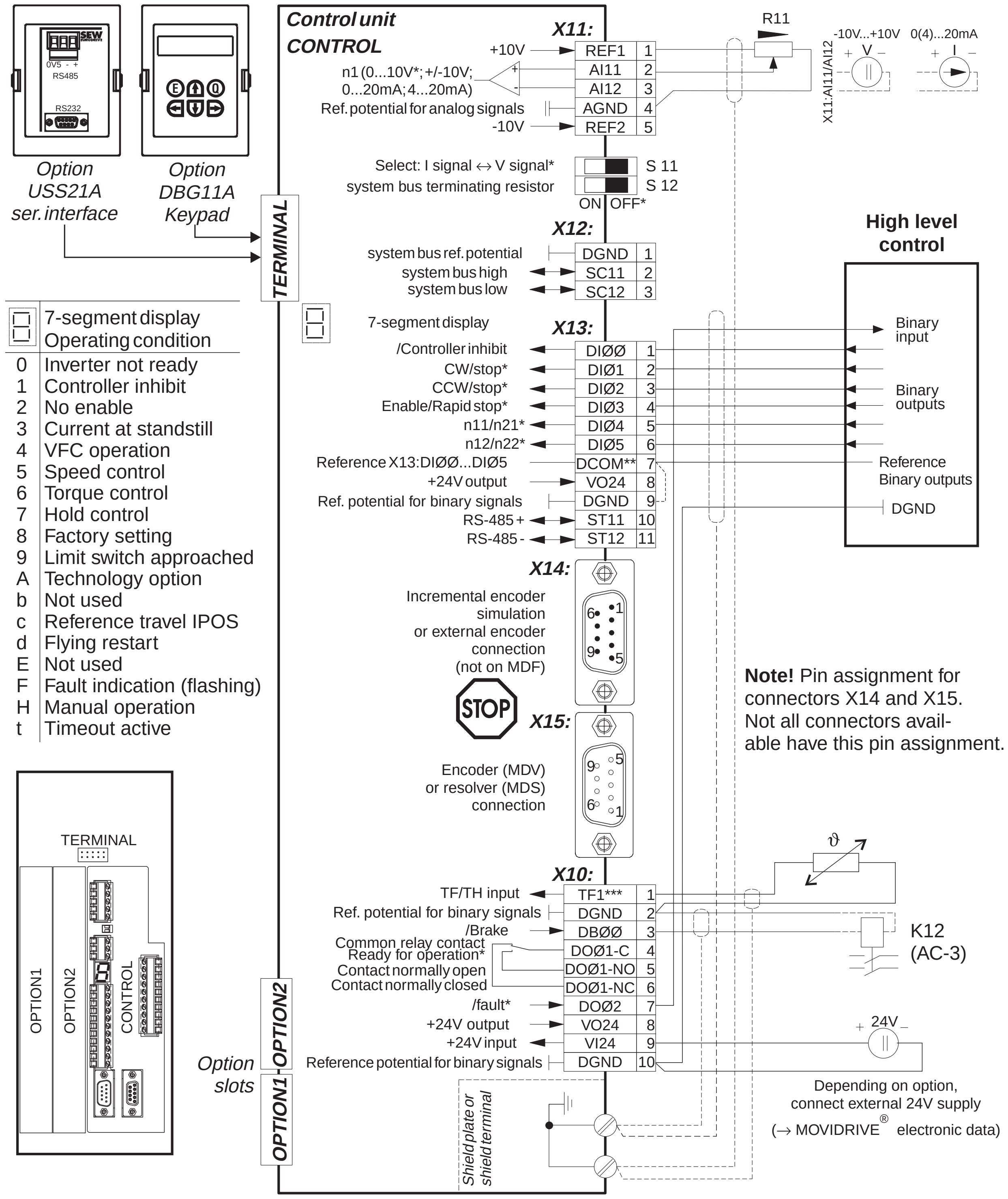

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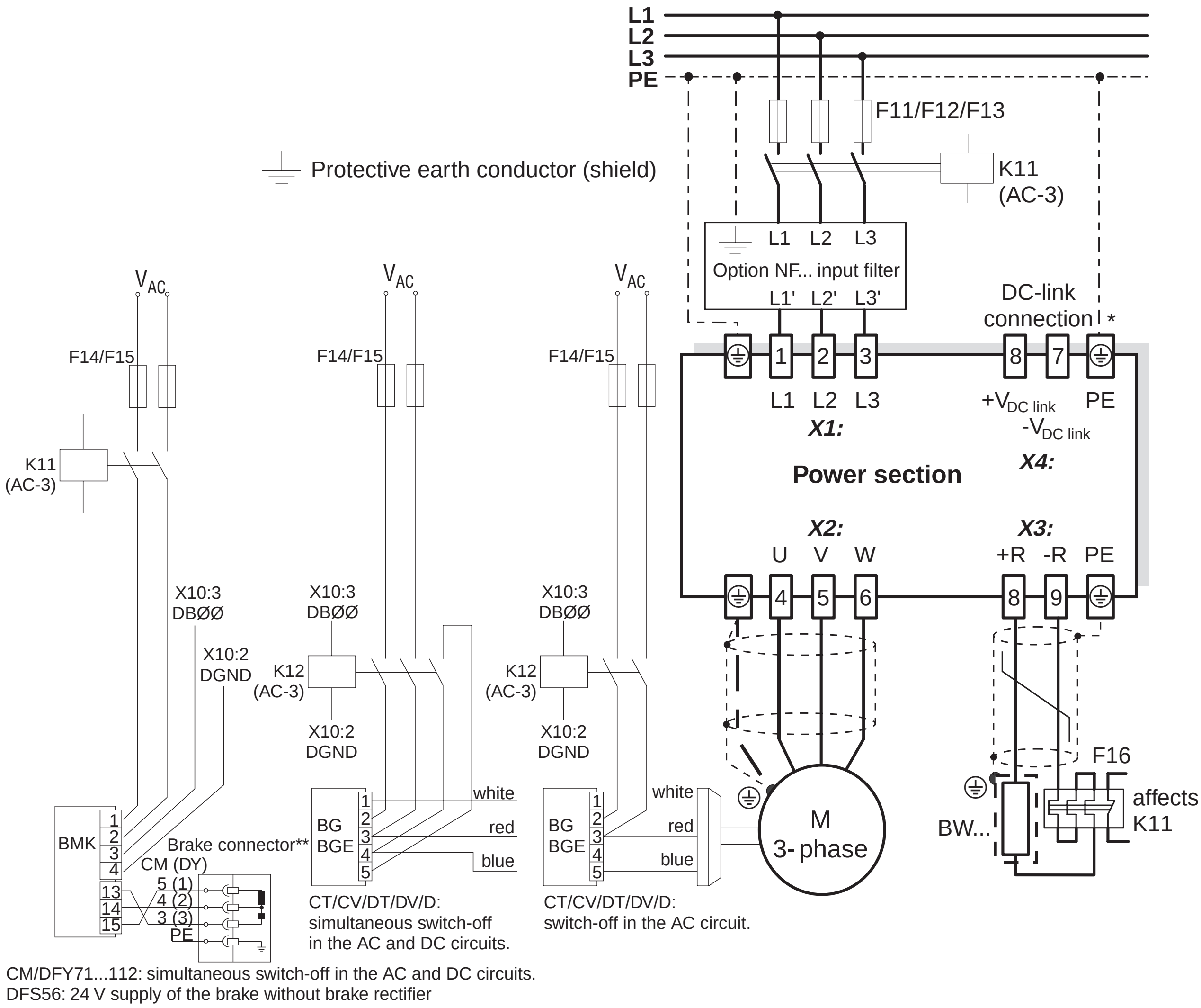
Bild 154: Wiring diagram for control unit

*	Factory setting
**	It the binary inputs are connected to the 24 V_{DC} X13:8 "VO24" voltage supply, it is necessary to install a jumper between X13:7 - X13:9 (DCOM - DGND) on the MOVIDRIVE®.
***	X10:1 (TF1) is jumpered to X10:2 (DGND) in the factory. If a TF or TH is connected to X10:1 and X10:2, the jumper must be removed.

Functions assigned to the terminals of the basis unit (power and control sections)

Terminal		Functions	
X1:1/2/3 **X2:4/5/6** **X3:8/9** **X4:**	**L1/L2/L3** **U/V/W** **+R/-R** **$+U_Z/-U_Z$**	Supply system connection Motor cable Connection for brake resistor DC link connection	
X11:1 **X11:2/3** **X11:4** **X11:5**	**REF1** **AI11/12** **AGND** **REF2**	+10 V (max. 3 mA) for setpoint potentiometer Setpoint input n1 (differential input or input with AGND reference potential), signal form → P11_ / S11 reference potential for analog signals (REF1, REF2, AI.., AO..) -10 V (max. 3 mA) for setpoint potentiometer	
S11: **S12:**		Switching I-signal (0(4)...20 mA) ↔ V-signal (-10 V...0...10 V, 0...10 V), factory setting to V-Signal, switching system bus terminating resistor on/ off, switched off in factory	
X12:1 **X12:2/3**	**DGND** **SC11/12**	Reference potential system bus System bus High/Low	
X13:1 **X13:2** **X13:3** **X13:4** **X13:5** **X13:6**	**DIØØ** **DIØ1** **DIØ2** **DIØ3** **DIØ4** **DIØ5**	Binary input 1, fixed assignment to "/controller inhibit" Binary input 2, factory set to "CW/Stop" Binary input 3, factory set to "CCW/Stop" Binary input 4, factory set to "Enable/Rapid stop" Binary input 5, factory set to "n11/n21" Binary input 6, factory set to "n12/n22"	• The binary inputs are electrically isolated by opto-couplers • Selection posssibilities for binary inputs 2 to 6 (DIØ1...DIØ5) → Parameter menu P60_
X13:7	**DCOM**	Reference for binary inputs X13:1 to X13:6 (DIØØ...DIØ5) • Switching binary inputs with +24 V external voltage: Connection of X13:7 (DCOM) with reference potential of the external voltage required. – without jumper X13:7-X13:9 (DCOM-DGND) → isolated binary inputs – with jumper X13:7-X13:9 (DCOM-DGND) → non-isolated binary inputs • Switching binary inputs +24 V of X13:8 or X10:8 (VO24) → jumper X13:7-X13:9 (DCOM-DGND) required.	
X13:8 **X13:9** **X13:10** **X13:11**	**VO24** **DGND** **ST11** **ST12**	Auxiliary supply output +24 V (max. 200 mA) for external command switches Reference voltage for binary signals RS-485+ RS-485-	
X14:1 **X14:2** **X14:3** **X14:4** **X14:5** **X14:6** **X14:7** **X14:8** **X14:9**	**Not in MDF60A**	Signal track A (K1) Signal track B (K2) Signal Spur C (K0) Switchover Reference potential DGND Signal Spur A (K1) Signal Spur B (K2) Signal Spur C (K0) +24 V (max. 180 mA)	Output for incremental encoder simulation or input for external encoder. Only encoders with a signal level according to RS-422 (5 V TTL) are permissible. If X14: is used as an output for incremental encoder simulation, X14:4 must be jumpered to X14:5 (switchover DGND). Signal level of the incremental encoder simulation according to RS-422 (5 V TTL). No. of pulses of incremental encoder simulation: • in MDV60A as for X15: input motor encoder • in MDS60A 1024 pulses/revolution
X15:1 **X15:2** **X15:3** **X15:4** **X15:5** **X15:6** **X15:7** **X15:8** **X15:9**	**Not in MDF60A**	Signal track A (K1) Signal track B (K2) Signal track C (K0) N.C. Reference potential DGND Signal Spur A (K1) Signal Spur B (K2) Signal Spur C (K0) +24 V (max. 180 mA) input motor encoder in MDV60A permissible encoders: - sin/cos encoder $1V_{SS}$ - 5 V TTL encoder - 24 V HTL encoder	Sin+ (S2) Cos+ (S1) Ref.+ (R1) N.C. DGND Sin- (S4) Cos- (S3) Ref.- (R2) TF-/TH connection (connect with X15:5 via TF/TH) input resolver in MDS60A permissible resolver: 2-pole, 7 V_{AC_eff}, 7 kHz
X10:1 **X10:2** **X10:3** **X10:4** **X10:5** **X10:6** **X10:7**	**TF1** **DGND** **DBØØ** **DOØ1-C** **DOØ1-NO** **DOØ1-NC** **DOØ2**	TF-/TH connection (connect with X10:2 via TF/TH), factory setting to "No Reaction" (→ P835) Reference potential for binary signals Binary output 0, fixed assignment to "/Brake", max. load 150 mA (short-circuit proof) Shared contact binary output 1, factory setting "/Ready" Normally open contact 1, max. load of relay contacts 30 V_{DC} and 0.8 A Normally closed contact binary output 1 Binary output 2, factory setting to /Fault, max. load 50 mA (short-circuit proof)) Selection possibilities for the binary outputs 1 and 2 (DOØ1 and DOØ2) → Parameter menu P62_ **Do not connect external voltage over binary outputs X10:3 (DBØØ) and X10:7 (DOØ2)!**	
X10:8 **X10:9** **X10:10**	**VO24** **VI24** **DGND**	Auxilliary voltage output +24 V (max. 200 mA) for external command switch Input +24 V voltage supply (support voltage depending on options, unit diagnosis for supply OFF) Reference potential for binary signals	
TERMINAL		Option slot for DBG11A keypad or USS21A serial interface (RS-232 and RS-485)	
OPTION1/OPTION2		2 slots for option pcbs	

Wiring of power section and brake



Wiring diagram for power section and brake

* There is no PE connection next to the system supply terminals in Sizes 1 and 2. Use the PE terminal next to the DC link connection.

** **Caution:** It is essential to observe the connection sequence. Incorrect connection will destroy the brake.

The connection of the brake rectifier requires a separate supply system cable; supply from the motor voltage is not permissible!

Always switch off in AC and DC circuits of the brake for:

– all hoist applications,

– drives requiring a short brake response time,

– in CFC and SERVO operating modes.

Brake rectifier in switch cabinet

If the brake rectifier is installed in the switch cabinet, the connecting cable between the brake rectifier and the brake must be routed separately from other power cables. Routing together with other cables is only permitted if the other cables are shielded.

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