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Via F.lli Cervi n°3
20063 CERNUSCO SUL NAVIGLIO
Tel .02-92106954 - 6 LINEE R.A.
Fax.02-92107261
E-mail info@atti.it
Sito: www.atti.it



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- *PULEGGE A GOLE*
- *PULEGGE DENTATE*
- *PULEGGE CON BUSSOLE TAPER LOCK*
- *PULEGGE VARIABILI*
- *CINGHIE TRAPEZOIDALI*
- *CINGHIE DENTATE*
- *CINGHIE PER VARIATORI*
- *CATENE VARIE*
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- *COPPIE CONICHE*
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- *SLITTE VARIE*
- *SLITTE MOTORIZZABILI*
- *RUOTE*
- *CALETTATORI*
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- *VITI T.P.N. E RELATIVE CHIOCCIOLE*
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- *RULLI E RELATIVI COMPONENTI*
- *ASPIRATORI E VENTILATORI*
- *PROFILATI IN ALLUMINIO*
- *ADESIVI INDUSTRIALI*
- *SISTEMI DI LUBRIFICAZIONE CENTRALIZZATA*

Realizzazione di trasportatori e macchine speciali con profilati di alluminio

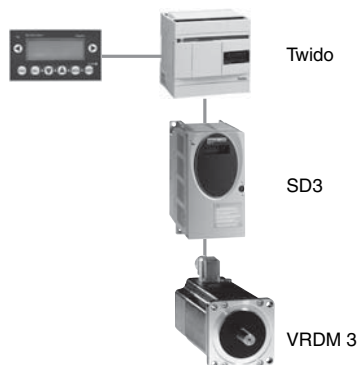
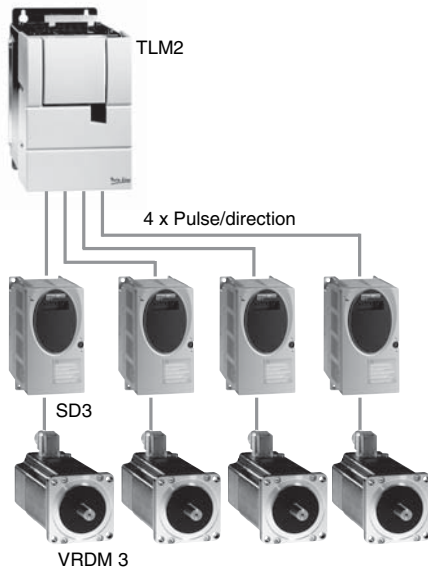
BERGER LAHR

Catalogue

Stepper Motor Drives SD3



Product overview	2
Stepper motor drive SD3 26	
Product description	4
Functions	5
Wiring example	10
Technical data	11
Dimensional drawings	12
Mounting and installation	13
Type code	17
Stepper motors	
Product description	19
Product overview	20
Technical data	21
Dimensional drawings	24
Options	
Holding brake	27
Encoder	28
Gearbox	29
Type code	33
Accessories	
EMC mains filter	36
Adapter plate	38
Order data	39
Appendix	
Conversion tables	40



Product overview

The SD3 26 is a stepper motor drive that can be used for any application. Reference values are prescribed as pulse/direction-signals from a master PLC (programmable logic controller) or a Berger Lahr motion controller (e.g. TLM2) and monitored if necessary.

A very compact and high-performance drive system has been created in combination with the VRDM 3 3-phase stepper motors by Berger Lahr.

Special features

Compactness

With its very small dimensions (H x W x D: 145 mm x 72 mm x 140 mm), the stepper motor drive SD3 26 requires very little space in the switching cabinet.

Simplicity

Easy cabling and parametrisation make fast commissioning possible. Commissioning software is not required.

Flexibility

The SD3 26 is available in the power classes 350 W and 750 W. By default, the SD3 26 is equipped with the following components:

- An opto-isolated signal interface for 5-V and 24-V input signals
- A power supply unit for single-phase mains voltages of 115 V_{AC} and 230 V_{AC}
- Integrated mains filter

The SD3 26 can optionally be shipped with an electronic system for rotation monitoring and brake control.

Application options

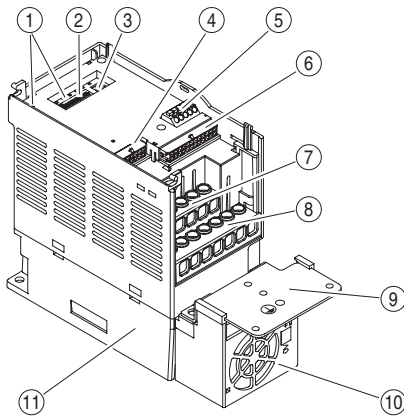
The SD3 stepper motor drive system has very good synchronisation characteristics, which are necessary for scanning or exposure, for example.

Due to the high torque at low speeds, the stepper motor drive is particularly suited for short-distance position movements.

A further advantage is its high holding torque when idle. This means that automation tasks such as "Pick and Place" can be achieved in a very cost-effective way.

Assignment of stepper motors and stepper motor drive SD3 26		
3-phase stepper motors	SD3 26xU25	SD3 26xU28
	115 V / 230 V; 2.5 A; including mains filter	115 V / 230 V; 6.8 A; including mains filter and fan
		
VRDM 368 / 50L W	1.7 Nm / 1.5 Nm ¹⁾	
VRDM 397 / 50L W	2.3 Nm / 2.0 Nm	
VRDM 3910 / 50L W	4.5 Nm / 4.0 Nm	
VRDM 3913 / 50L W	6.8 Nm / 6.0 Nm	
VRDM 31117 / 50L W		13.5 Nm / 12.0 Nm
VRDM 31122 / 50L W		19.7 Nm / 16.5 Nm

¹⁾ The 1st value is the holding torque M_H when the stepper motor is idle; the 2nd value is the nominal torque M_N when operating the motor.



Product description

Device overview

- (1) LEDs for status display
- (2) Parameter switch for configuration of the device
- (3) Rotary switch for adjustment of the motor current
- (4) CN2 rotation monitoring (12-pin female connector, optional)
- (5) 24-V CN3 interface (spring loaded terminals, optional)
 - 24-V controller supply voltage
 - 24-V outputs (holding brake and encoder errors)
- (6) CN1 signal interface (24-pin female connector)
 - Inputs 5 V, opto-isolated
 - Inputs 24 V, opto-isolated
 - Output Readiness
- (7) Screw terminals for connecting the mains supply
- (8) Screw terminals for connecting the motor
- (9) EMC mounting plate (included with the servo drive)
- (10) Fan (in scope of supply for SD326•U68)
- (11) Heat sink

Signal interface CN1

The setpoint position of the stepper motor is set as the pulse by a controller via the CN1 signal interface. A pulse corresponds to one step of the motor.

In addition, the following functions can be activated via input signals:

- Release/disable power amplifier or pulses
- Direction of rotation left/right
- Increase/decrease step count by a factor of 10
- Change motor current

An electronic relay contact reports operating readiness. All input signals can be fed as 5-V or 24-V signals via an optocoupler.

CN2 rotation monitoring (optional)

If the SD3 26 includes electronics for rotation monitoring and the stepper motor has an encoder, the encoder on the CN2 interface can be connected for position monitoring. If the actual position of the motor deviates from the setpoint position, the SD3 26 reports an encoder error via a 24-V output on the CN3 interface. The power for the encoder is supplied via the CN2 interface.

An input signal of the CN2 interface is used to monitor the temperature of the motor.

Holding brake output on CN3 (optional)

If the SD3 26 is equipped with electronics for a holding brake controller, a holding brake on the stepper motor can be controlled via a 24-V output.

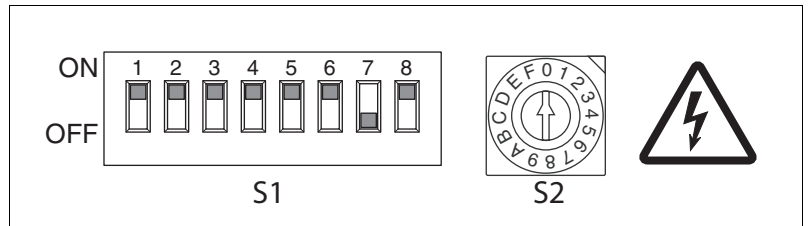
The SD3 26 is only optionally available in combination with the holding brake controller and rotation monitoring. The rotation monitoring can only be activated on a parameter switch.

Functions

Parameter setting

The following functions can be activated via the parameter switch of the SD3 26:

- Motor phase current
- Number of steps
- Current reduction when idle
- "Softstep"
- Rotation monitoring (only for device versions with rotation monitoring SD3 26R...)
- Function of the signal inputs "ENABLE/GATE" and "PULSE/DIR or CW/CCW"



Parameter switches

Setting motor phase current

The motor phase current is set on the rotary switch S2. The motor phase current should not exceed the nominal current of the motor because otherwise there is a danger that the motor can overheat. A low motor phase current produces a low torque.

Setting options via rotary switches

Switch position S2	Motor phase current [A]	
	SD3 26xU25	SD3 26xU68
0 (factory setting)	0.6	1.7
1	0.8	2.0
2	0.9	2.4
3	1.0	2.7
4	1.1	3.1
5	1.3	3.4
6	1.4	3.7
7	1.5	4.1
8	1.6	4.4
9	1.8	4.8
A	1.9	5.1
B	2.0	5.4
C	2.1	5.8
D	2.3	6.1
E	2.4	6.5
F	2.5	6.8

Setting number of steps

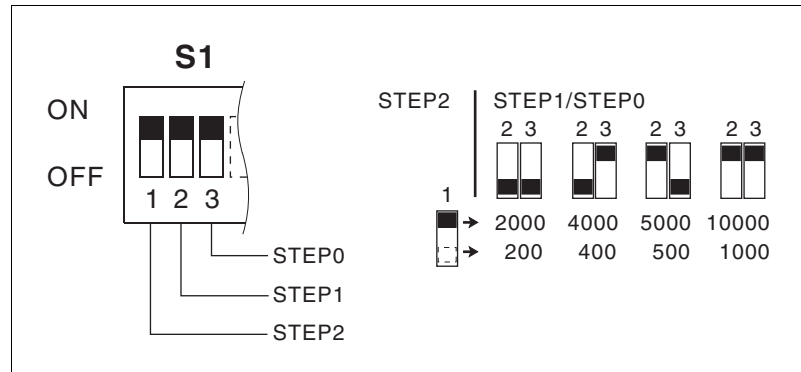
The resolution of the stepper motor drive is set via the step number.

Example:

With a step number of 1000, the stepper motor drive performs exactly one revolution for 1000 pulses. With a pulse frequency of 1 kHz, the result is therefore a speed of rotation of 60 1/min.

Setting options via parameter switches

Step number: 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000 per revolution



Setting number of steps

The switch setting S1.1 "STEP2" can be inverted via the input signal `STEP2_INV`. As a result, the step number is increased or decreased by a factor of 10.

Activate motor phase current reduction when idle

When the full holding torque is not required when idle, it is possible to use the "Motor phase current reduction" function in order to reduce the holding torque. As a result, there is less heating up of the motor and electronics and efficiency is increased. The motor phase current is reduced to approximately 60% of the set current value 100 ms after receiving the last pulse edge.

Setting options via parameter switches

Activate/deactivate motor phase current reduction

Activate "Softstep" function

In the "Softstep" function, reference value is set internally with a higher resolution. The result is a significantly quieter running motor, particularly at low speeds of rotation or an erratic change in the reference value.

The motor accelerates and delays virtually jerk-free. The transitions are smoothed out, i. e. the motor can follow the set reference value significantly better with rapid changes in the frequency.

Setting options via parameter switches

Activate/deactivate "Softstep" function

**Activate "rotation monitoring" function
(only for SD3 26R... with rotation monitoring)**

The "rotation monitoring" function compares the setpoint and actual position of the motor and reports errors if the setpoint position deviates from the actual position. A prerequisite for this is that the SD3 be equipped with electronics for rotation monitoring and the stepper motor has an encoder with a resolution of 1000 increments/rotation.

Setting options via parameter switches
Activate/deactivate "Rotation monitoring" function

Signal inputs

All signal inputs are available as 5-V- or 24-V optocoupler inputs.

The reference value is set via the signal input "PULSE/DIR or CW/CCW"

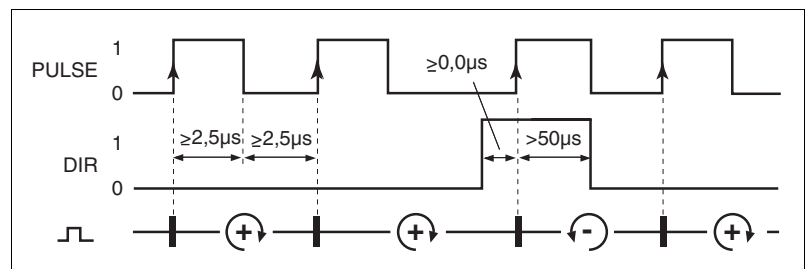
The reference value can alternatively be set via one of the two following interface modes:

- "PULSE/DIR"
- "CW/CCW"

The pulse frequency is 200 kHz.

"PULSE/DIR" interface mode

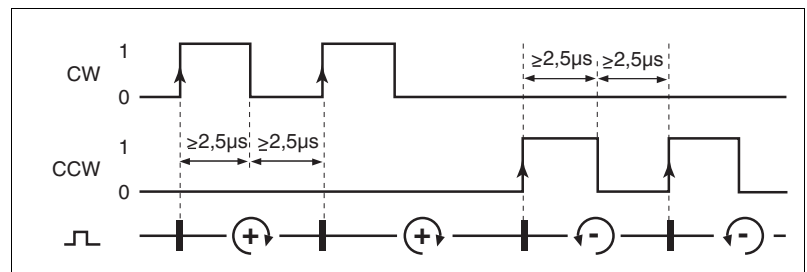
With the rising edge of the signal PULSE, the motor executes an angular step. The direction of rotation is controlled with the signal DIR.



"PULSE/DIR" interface mode

"CW/CCW" interface mode

With the rising edge of the signal CW, the motor executes a positive angular step. With the rising edge of the signal CCW, the motor executes a negative angular step.



"CW/CCW" interface mode

Setting options via parameter switches
Set the function of the signal input "PULSE/DIR or CW/CCW"

Set the function of the signal input "ENABLE/GATE"

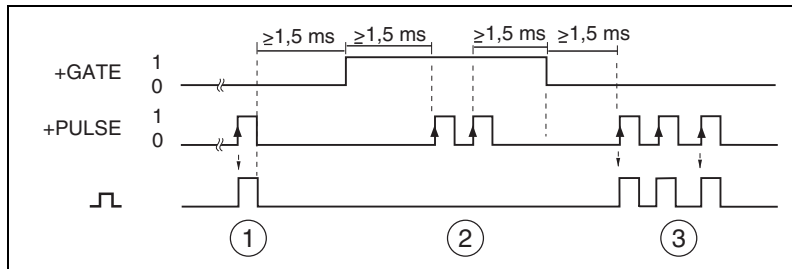
The signal input "ENABLE/GATE" can take over two functions:

"ENABLE" function: Release/disable power amplifier

The "ENABLE" function releases the power amplifier to allow control of the motor.

"GATE" function: Release/disable the pulse input

The "GATE" function disables the pulses on the reference value input without shutting off operating readiness. In a multiple-axle system, you can select the "GATE" function for individual axes.



Signal results when activating via the "GATE" function

- (1) Motor step
- (2) No motor steps
- (3) Motor steps

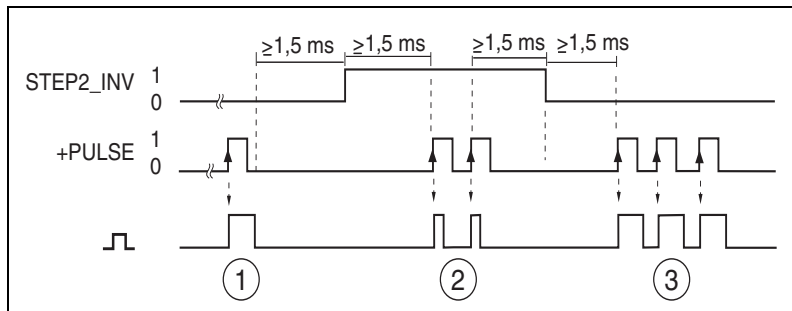
Setting options via parameter switches

Set the function of the signal input "ENABLE/GATE"

Changing the step with signal input "STEP2_INV"

The signal input "STEP2_INV" can be used if a high positioning precision is required but the output frequency of the master controller is limited.

The number of steps can be increased or reduced by a factor of 10 with the signal input "STEP2_INV".



Signal sequences as with switching the signal STEP2_INV

- (1) Large motor step
- (2) Motor steps lower by a factor of 10
- (3) Large motor steps

Control the motor phase current via the signal input "PWM"

Through the pulse-pause ratio of a rectangular signal on the signal input "PWM" (PWM: pulse width modulation), you can change the motor phase current between 0% and 100% of the maximum current set on the rotary switch. The frequency of the rectangular signal must be between 6 kHz and 25 kHz.

At constant 1-level no motor phase current flows (current reset to zero).

At constant 0-level the motor operates at the specified maximum motor phase current.

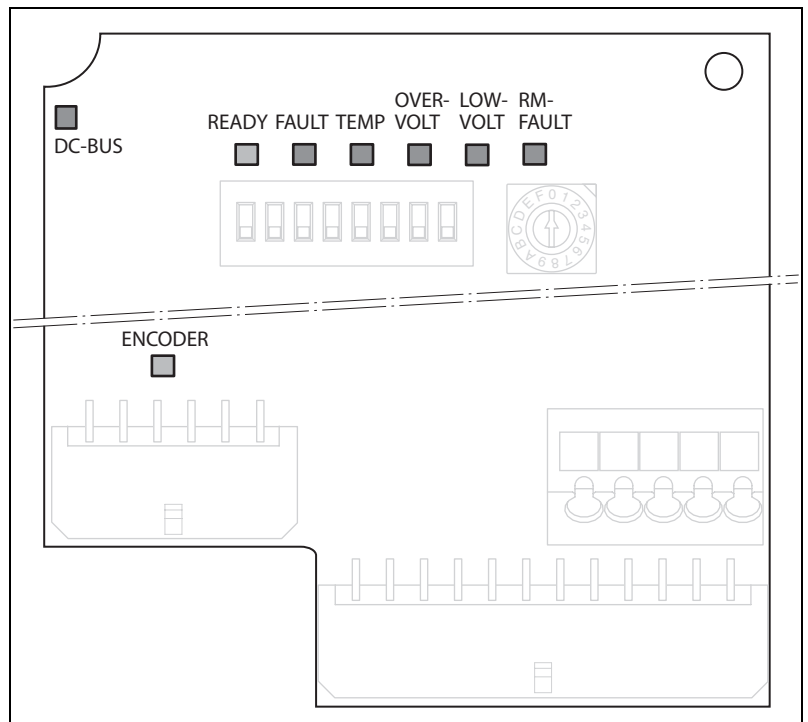
Signal outputs

The following signal outputs are available:

- Electronic relay contact "ACTIVE_OUT" to display operating readiness
- 24-V signal output "+BRAKE_OUT" to control a motor holding brake (optional only for SD3 26R...)
- 24-V signal output "RM-FAULT_OUT" to display an error during rotation monitoring (optionally only for SD3 26R...)

Status display

The LEDs display the current operating status.

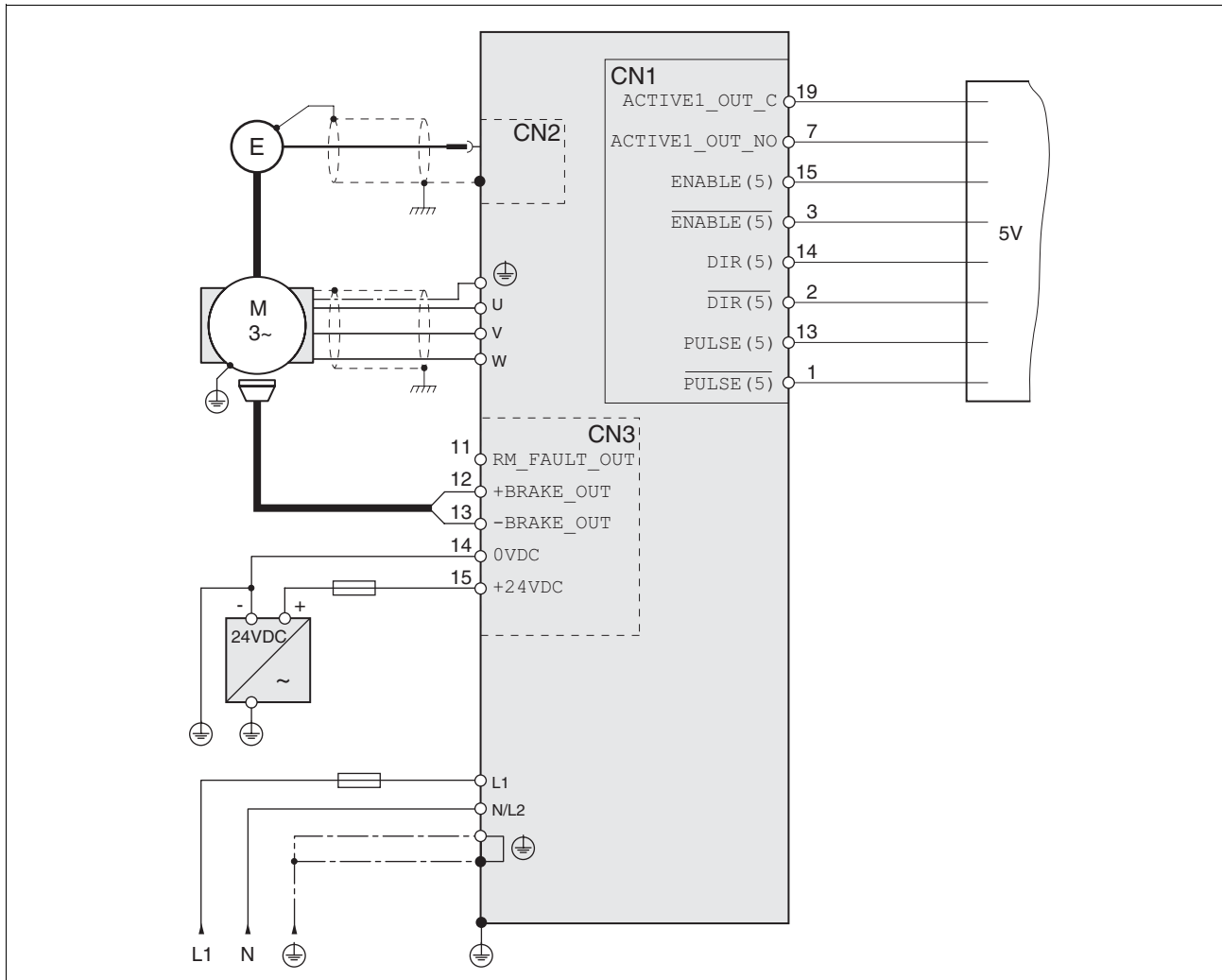


Status display

LED	Description
READY	Ready, power amplifier activated, motor receiving current (1-level on input signal ENABLE)
FAULT	Short circuit between two motor phases or between motor phase against PE
TEMP (static) TEMP (flashing ¹⁾)	Overtemperature power amplifier Overtemperature motor
OVER-VOLT	Overvoltage (>410%)
LOW-VOLT	Undervoltage (<200%)
RM-FAULT ¹⁾	Error message by rotation monitoring
OVER-VOLT, LOW-VOLT	Power amplifier deactivated, motor current-free (0-level on input signal ENABLE)
FAULT, TEMP, OVER-VOLT, LOW-VOLT	Frequency at signal interface too high

¹⁾ Only for SD3 26R...

Wiring example



Wiring example

Technical data			
Mechanical data			
		SD3 26xU25	SD3 26xU68
Dimensions (W x H x D)	mm	72 x 145 x 140	
Weight	kg	1.1	1.2
Type of cooling		Convection	Fan
Max. motor speed	1/min	3000	

Electrical Data			
		SD3 26xU25	SD3 26xU68
Mains supply			
Nominal voltage (switching)	V	115 / 230 (1-)	
Max. rated motor current	A	2.5	6.8
Nominal power (115 V / 230 V)	W	180 / 270	280 / 420
Max. permissible mains short circuit current	kA	0.5	0.5
Line-side fuse (115 V / 230 V)	A	6 / 6	10 / 6
Voltage range and tolerance			
• 115 V _{AC}	V	100 -15% ... 120 + 10%	
• 230 V _{AC}	V	200 - 15% ... 240 + 10%	
Frequency	Hz	47 ... 63	
Transient overvoltage		Overvoltage category III	
Inrush current	A	<60	
Leakage current (as per IEC 60990, Figure 3)	mA	<30	
Signal interface CN1			
5-V optocoupler input signals			
• Logic 1 (U _{high})	V	+2.5 ... +5.25	
• Logic 0 (U _{low})	V	≤0.5	
• Input current	mA	≤25	
• max. input frequency	kHz	≤200	
24-V optocoupler input signals			
• Logic 1 (U _{high})	V	+15 ... +30	
• Logic 0 (U _{low})	V	≤5	
• Input current	mA	≤7	
• Max. input frequency	kHz	≤200	
Signal output "Readiness"			
• Max. switching voltage	V _{DC}	≤30	
• Max. switching current	mA	≤200	
• Voltage drop at 50 mA load	V	≤1	
Rotation monitoring interface CN2 (optional)			
Signal output "ENC+5V_OUT"			
• Supply voltage	V	4.75 ... 5.25	
• Max. output current	mA	≤100	
• Voltage drop at 50 mA	V	≤1	
Signal input "ENC_A/ENC_B"			
• Voltage symmetrical	V	Conforming to RS422	
• Input frequency	kHz	≤400	
24-V interface CN3 (optional)			
24-V control voltage			
• Input voltage	V	24 -15% / +20%	
• Current consumption	A	≤0.2	
• Ripple voltage	%	<5	
24-V output signals			
• Output voltage	V	≤30	
• Max. switching current $\overline{\text{RM-FAULT_OUT}}$	V	≤50	
• Max. switching current $+\text{BRAKE_OUT}$	A	≤1.7	
• Voltage drop at 50 mA load	V	≤1	

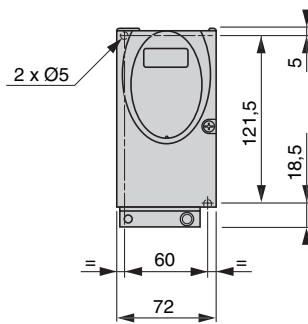
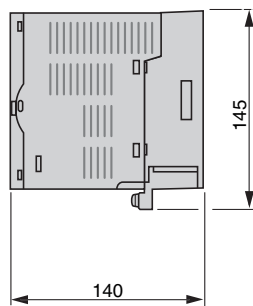
Ambient conditions

Maximum operating temperature ¹⁾	°C	0 ... +50
Ambient temperature	°C	-25 ... +70
Pollution degree		Step 2
Rel. air humidity		As per IEC 60721-3-3, Class 3K3, 5% ... 85%, no condensation permissible
Installation height above mean sea level for 100% power	m	<1000
Installation height	m	<2000 with max. ambient temperature 40 °C, without protective film and a lateral distance >50 mm
Oscillation and vibration		As per IEC/EN 60068-2-6 3 ... 13 Hz: 1.5 mm amplitude 13 ... 150 Hz: 1 g
Shock loading		As per IEC/EN 60068-2-27 15 g during 11 ms
Degree of protection		IP 20 IP 40 restricted: only from above without removal of protective cover

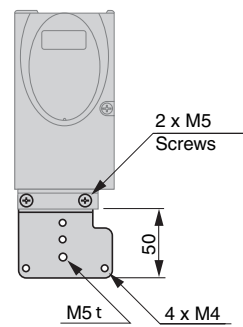
¹⁾ no icing

Dimensional drawings

SD3 26



EMC mounting plate (included in scope of supply)



Mounting and installation

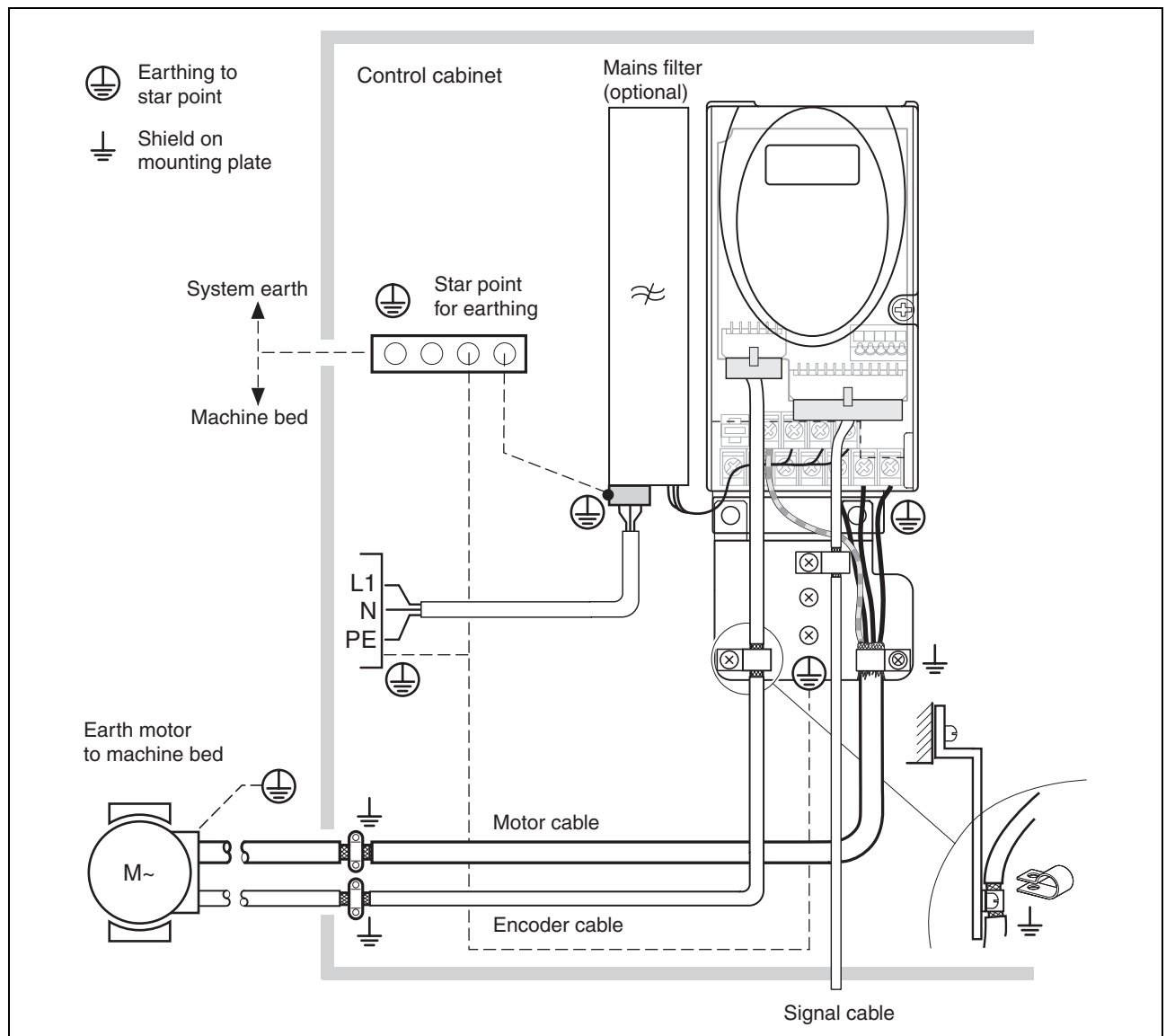
EMC-compliant installation

The stepper motor drive SD3 26 meets the EMC requirements for the second environment as per IEC 61800-3.

A prerequisite for maintaining the indicated limit values is a construction that has EMC-conformity. Depending on the application, better results can be achieved depending on the application:

- Using mains reactors upstream. Information on current distortions is available on request.
- Upstream external mains filters, particularly to maintain limit values for the first environment (living area, category C2)
- Particularly EMC-compliant design, e.g. in an enclosed switching cabinet with 15 dB damping of radiated interference

EMC-measures for stepper motor drive SD3



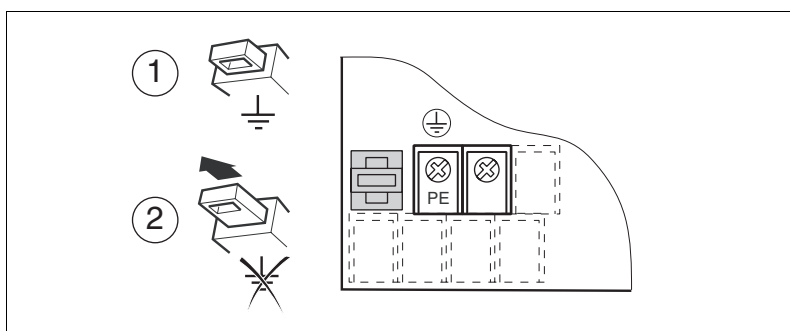
EMC measures

Operation in IT mains

An IT mains sets itself apart through an insulated or a high impedance grounded neutral conductor. If you use permanent insulation monitoring, it must be suitable for non-linear loads (e. g. type XM200 by Merlin Gerin). If an error is still reported despite proper wiring, you can separate the earthing connection of Y-capacitors (deactivate Y-capacitors) for products with a built-in mains filter.

With all other networks except for IT mains the earth connection via the Y-capacitors must be maintained.

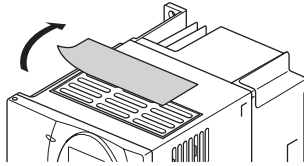
When the earthing connection of the Y-capacitors is disconnected, the information on the transmission of electrical magnetic malfunctions is no longer followed! Compliance with national regulations and standards should be safeguarded by other measures.



Operation in an IT mains

Insulation monitoring error

- (1) Y-capacitors of the internal filter effective (standard)
- (2) Y-capacitors of the internal filter disabled (IT mains)

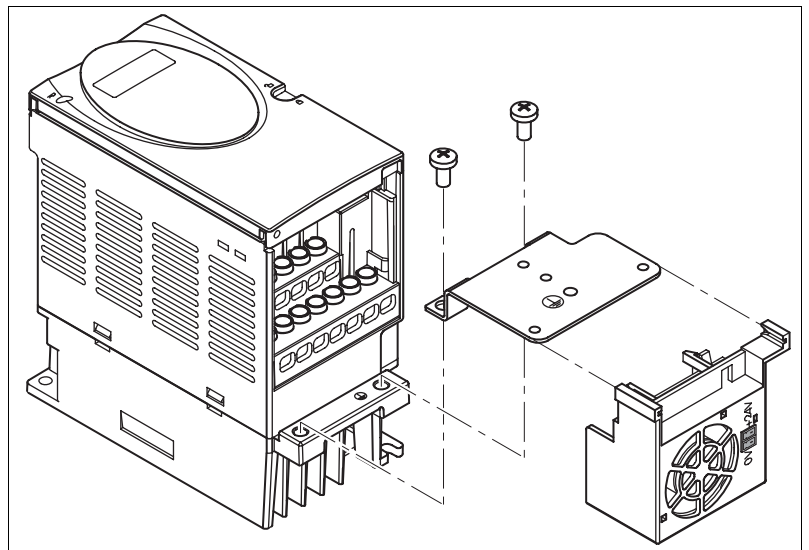


Installation clearances and ventilation

Stepper motor drives SD3 26xU25 are ventilated by air circulation from below to above. With the stepper motor drive SD3 26xU68 a fan is included in the scope of supply which is to be mounted at the bottom of the device.

When selecting the position of the device in the switching cabinet, note the following instructions:

- The device must be adequately cooled by compliance with the minimum installation distances. Avoid heat accumulation.
- The device must not be installed close to heat sources or mounted on flammable materials.
- The warm airflow from other devices and components must not heat the air used for cooling the device.
- The drive will switch off as a result of overtemperature when operated above the thermal limits.



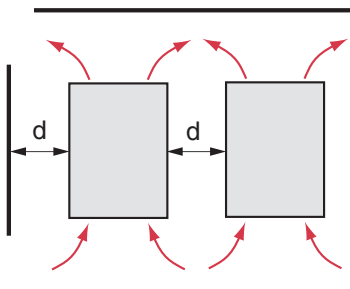
Mounting fans

Ambient temperature	Mounting distances ¹⁾	Measures without protective film ²⁾	Measures with protective film
0 °C ... +40 °C	d > 50 mm	None	None
	d < 50 mm	None	d > 10 mm
+40 °C ... +50 °C	d > 50 mm	None	Reduce nominal current and constant current ³⁾
	d < 50 mm	Reduce nominal current and constant current	Operation not possible

¹⁾ Distance in front of device: 10 mm, top: 50 mm, bottom: 200 mm

²⁾ Recommendation: Remove protective film after installation

³⁾ by 2.2% for each °C above 40 °C

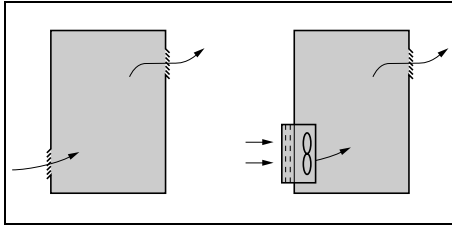


At least 10 mm of free space is required in front of the device.

At least 50 mm of free space is required above the device.

The connection cables are fed downward out of the housing. Under the device, there must be at least 200 mm clearance to guarantee bend-free cable laying.

As an alternative to directly connecting to the switching cabinet mounting plate, there is an adaptor plate as an accessory for top-hat rail snap-on assembly. Mains filters can no longer be mounted directly next to or behind the device.



Installation in housing or switching cabinet

Please read the instructions on assembly in the section "Assembly distances and ventilation".

Proceed as follows to ensure adequate device ventilation:

- Provide ventilation openings on the housing.
- The air inlet vents must guarantee an air throughput of at least 0.3 m³/min (SD3 26xU25S2) or 0.55 m³/min (SD3 26xU68S2) per device. If the air throughput becomes less due to the air inlet vents, external ventilation must be used.
- Use special IP 54 filter.
- Remove the top cover on the device.
- The throughput of the fan should be at least 0.3 m³/min.

Sheetmetal housing and switching cabinet (degree of protection IP 54)

The stepper motor drive SD3 should be installed in a thick housing under the following ambient conditions: dust, corrosive gases, high air humidity with the danger of condensation and surface water accumulation...

In this case, the SD3 can be installed in a housing with an internal temperature of up to 50 °C.

Calculation of housing dimensions

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

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

q = maximum temperature (°C) in interior of housing

q_e = maximum outside temperature (°C)

P = total power loss (W) in the housing

Power loss in the stepper motor drive, see chapter "Technical data".

Consider the power loss of the other components.

Usable heat dissipation area of housing A in m²

(For wall mounting: side surfaces + top + front)

$$A = K / R_{th}$$

K = heat resistance, based on the housing area

Sheet metal housing: $K = 0.12$ with fan, $K = 0.15$ without fan

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

Type code					
Example	SD3	26	D	U25	S2
Product designation SD3 = Stepper drive 3-phase	SD3	26	D	U25	S2
Product type 26 = Standard stepper motor drive	SD3	26	D	U25	S2
Interfaces D = Pulse /direction without rotation monitoring R = Pulse/direction with rotation monitoring and holding brake connection	SD3	26	D	U25	S2
Max. rated motor current U25 = 2.5 A U68 = 6.8 A	SD3	26	D	U25	S2
Power amplifier supply voltage S2 = 1~, 115 V _{AC} / 230 V _{AC} (switchable)	SD3	26	D	U25	S2

Possible order numbers	
Type	Order number
SD3 26D U25 S2	063711110100
SD3 26D U68 S2	063711110101
SD3 26R U25 S2	063711110200
SD3 26R U68 S2	063711110201



Stepper motors

Product description

The 3-phase stepper motors from Berger Lahr are extremely robust, service-free motors. They carry out precise, incremental movements which are prescribed by control electronics. A stepper motor drive system consists of a stepper motor and the matching control electronics. The maximum power can only be achieved if the motor and electronics are optimally inter-coordinated.

The 3-phase stepper motors can be operated at high resolutions depending on the control electronics.

Options such as rotation monitoring and holding brake with robust, low-play planetary gears extend the application options.

There are also 3-phase stepper motors by Berger Lahr in normal and explosion-proof types (explosion protection type EEx d IIC T4).

Special features

Quiet

Due to the sinus-commutation of the drive and the special mechanical construction of the motors, the result is a very quiet stepper motor that runs virtually resonance-free.

Strong

The optimised internal geometry of the motor offers a high power density; i.e. up to 50% greater torque compared to conventional stepper motors of comparable size.

Flexible

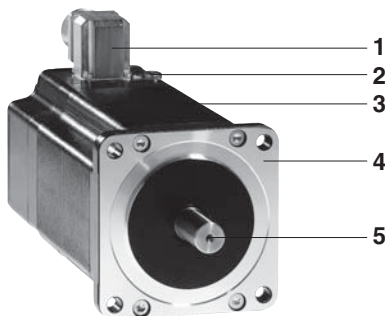
It is possible to manufacture and supply a wide variety of motor types due to their flexible modular system and modern version management.

Design


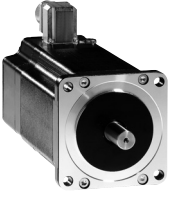
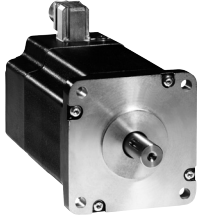
- (1) Motor connection, here versions with an offset connector
- (2) Additional terminal for ground wire
- (3) Housing, with black protective coating
- (4) Axial flange with four mounting points as per DIN 42918
- (5) Smooth shaft end as per DIN 42918



Stepper motor drive system

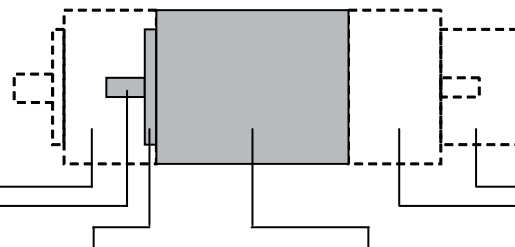


Product overview

3-phase stepper motors		VRDM 36x	VRDM 39x	VRDM 311x
				
Size		6	9	11
Max. torque M_{max}	Nm	1.50	2.0 ... 6.0	12.0 ... 16.5
Holding torque M_H	Nm	1.70	2.26 ... 6.78	13.5 ... 19.7
Steps per revolution $z^{1)}$		200 / 500 / 1000 / 2000 / 4000 / 5000 / 10000		
Step angle $\alpha^{1)}$	°	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036		

¹⁾ with suitable activation

Motor types



Gear ¹⁾	Shaft model		Centring collar	Size (flange dimension)	Length (dimension without shaft)	Winding	Motor connection	Options ²⁾
VRDM 36x	smooth shaft	Ø 8 mm	Ø 38.1 mm	6 (57.2 mm)	8 (79 mm)	W	Terminal box Plug	2nd shaft end Holding brake Encoder
PLE 60 PLS 70								
VRDM 39x	smooth shaft with woodruff key	Ø 9.5 mm ³⁾	Ø 60 mm	9 (85 mm)	7 (68 mm)	W	Terminal box Plug	2nd shaft end Holding brake Encoder
PLE 80		Ø 12 mm	Ø 73 mm	10 (98 mm)				
PLE 90		Ø 14 mm		13 (128 mm)				
VRDM 311x	with parallel key	Ø 19 mm	Ø 56 mm	11 (110 mm)	17 (180 mm)	W	Terminal box Plug	2nd shaft end Holding brake Encoder
PLE 120 PLS 115					22 (228 mm)			

¹⁾ Planetary gear each available in the gear ratios 3:1, 5:1 and 8:1

²⁾ The options 2. shaft end and holding brake cannot be selected together. An encoder is only possible in combination with a motor connection connector.

³⁾ Ø 9.5 mm and Ø 12 mm at VRDM 397 and VRDM 3910; Ø 14 mm at VRDM 3913

Technical data							
Motor type VRDM...		368	397	3910	3913	31117	31122
Max. supply voltage U_{\max}	V _{AC}	230					
Nominal voltage DC bus U_N	V _{DC}	325					
Nominal torque M_N	Nm	1.50	2	4	6	12	16.5
Holding torque M_H	Nm	1.70	2.26	4.52	6.78	13.5	19.7
Rotor inertia J_R	kgcm ²	0.38	1.1	2.2	3.3	10.5	16
Steps per revolution z		200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000					
Step angle α	°	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036					
Systematic angular tolerance $\Delta\alpha_s$ ¹⁾	'	±6					
Max. starting frequency f_{Aom}	kHz	8.5	5.3			4.7	
Phase current I_N	A _{rms}	0.9	1.75	2	2.25	4.1	4.75
Winding resistance R_W	Ω	25	6.5	5.8	6.5	1.8	1.9
Rate-of-current rise time constant τ	ms	4.6	~7	~9	~10	~22	~22
Ground m ²⁾	kg	2.0	2.1	3.2	4.3	8.2	11.2
Shaft load ³⁾							
• Max. radial force 1st shaft end ⁴⁾	N	50	100		110	300	
• Max. radial force 2nd shaft end (optional) ⁵⁾	N	25	50			150	
• Max. axial force pull	N	100	175			330	
• Max. axial force compression	N	8.4	30			60	
• Nominal bearing life L_{10h} ⁶⁾	h	20000	20000			20000	

1) Measured at 1000 steps/revolution, unit in angular minutes

2) Frame of the motor version with cable retaining screws and connector

3) Conditions for shaft load: speed of rotation 600 1/min, 100% ED at nominal torque, ambient temperature 40 °C (storage temperature ≈ 80 °C)

4) Point of attack of radial force: 10.5 mm distance to flange

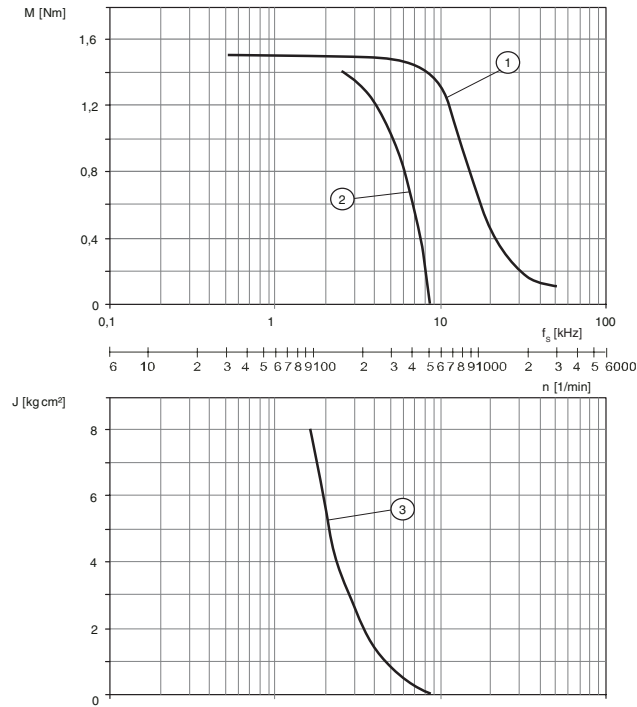
5) Point of attack of radial force: 10 mm distance to flange

6) Operating hours at a failure probability of 10%

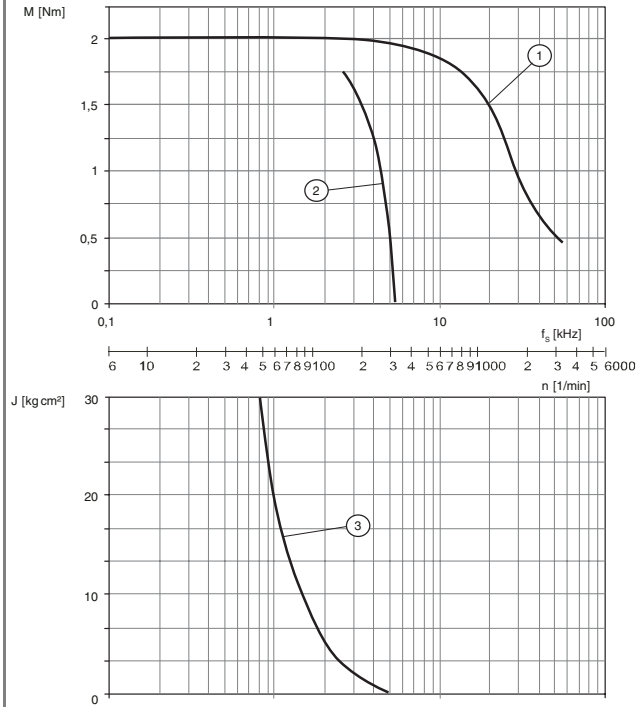
Ambient conditions		
Ambient temperature	°C	-25 ... +40
Installation height without power reduction	m a. MSL	<1000
Transport and storage temperature	°C	-25 ... +70
Relative humidity	%	75 (on annual average), 95 (in 30 days, not dewing)
Vibration severity in operation as per DIN EN 60034-14		A
Max. vibration load	m/s ²	20
Degree of protection as per DIN EN 60034-5		
• Total except shaft bushing		IP 56
• Shaft bushing		IP 41
Heat class		155 (F)
Shaft wobble and axial precision		DIN EN 50 347 (IEC 60072-1)
Max. rotary acceleration	Wheel/s ²	200000

Characteristic curves

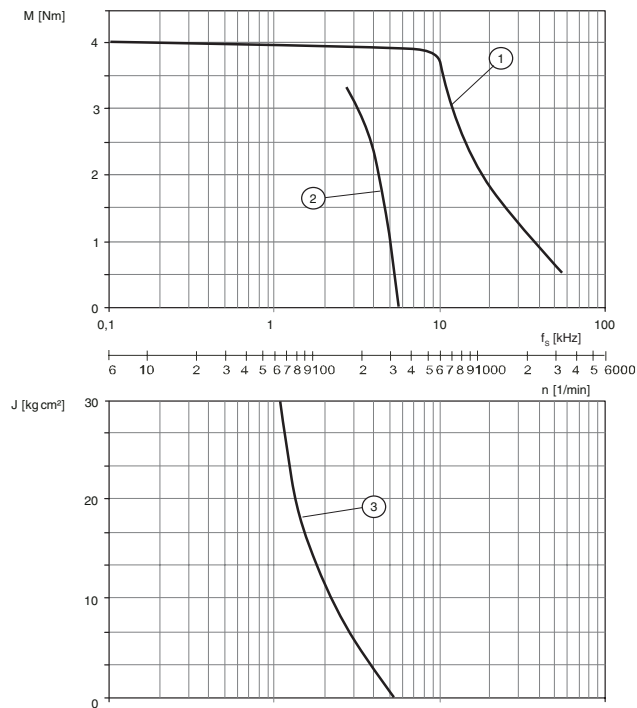
VRDM 368 / 50L W



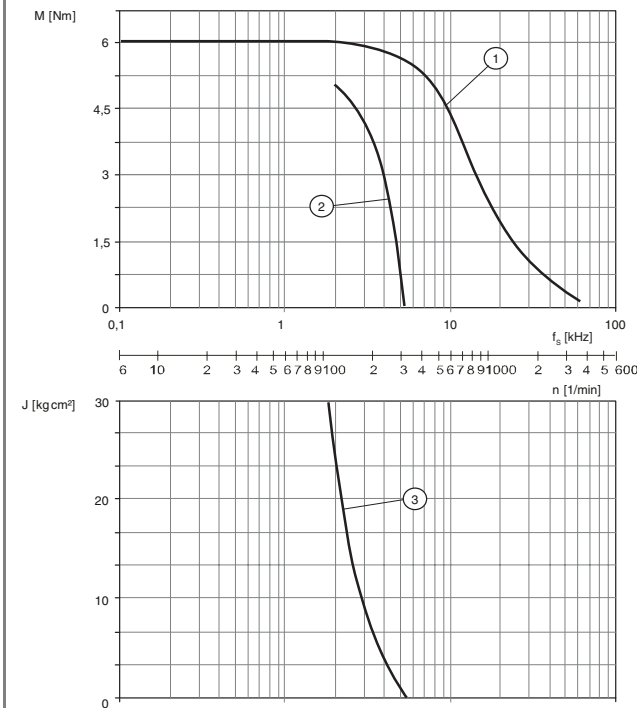
VRDM 397 / 50L W



VRDM 3910 / 50L W



VRDM 3913 / 50L W

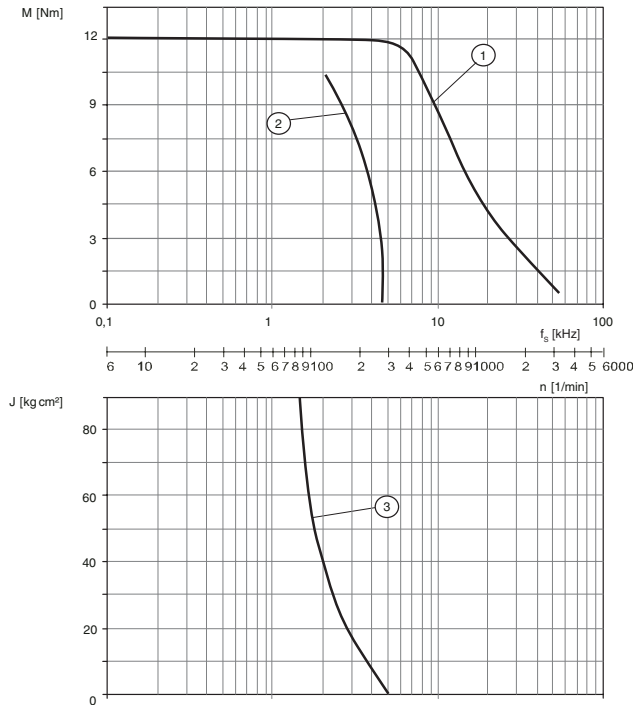


Measurement at 1000 steps/revolution, nominal voltage DC bus U_N and phase current I_N

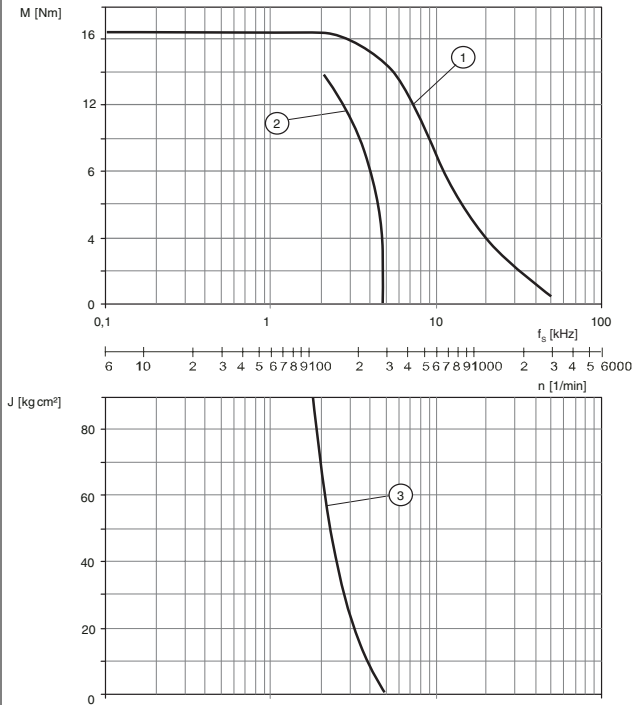
- (1) Pull-out torque
- (2) Start limit torque
- (3) Maximum load inertia

Characteristic curves

VRDM 31117 / 50L W



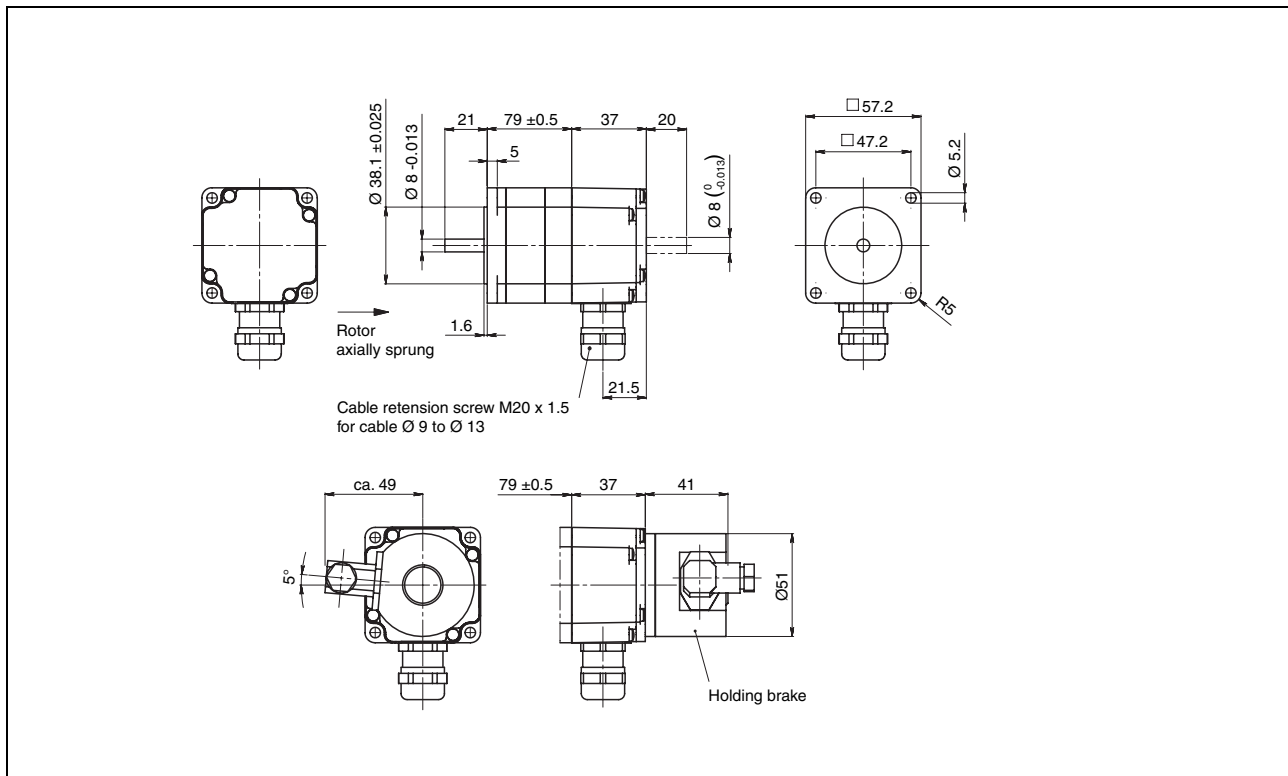
VRDM 31122 / 50L W



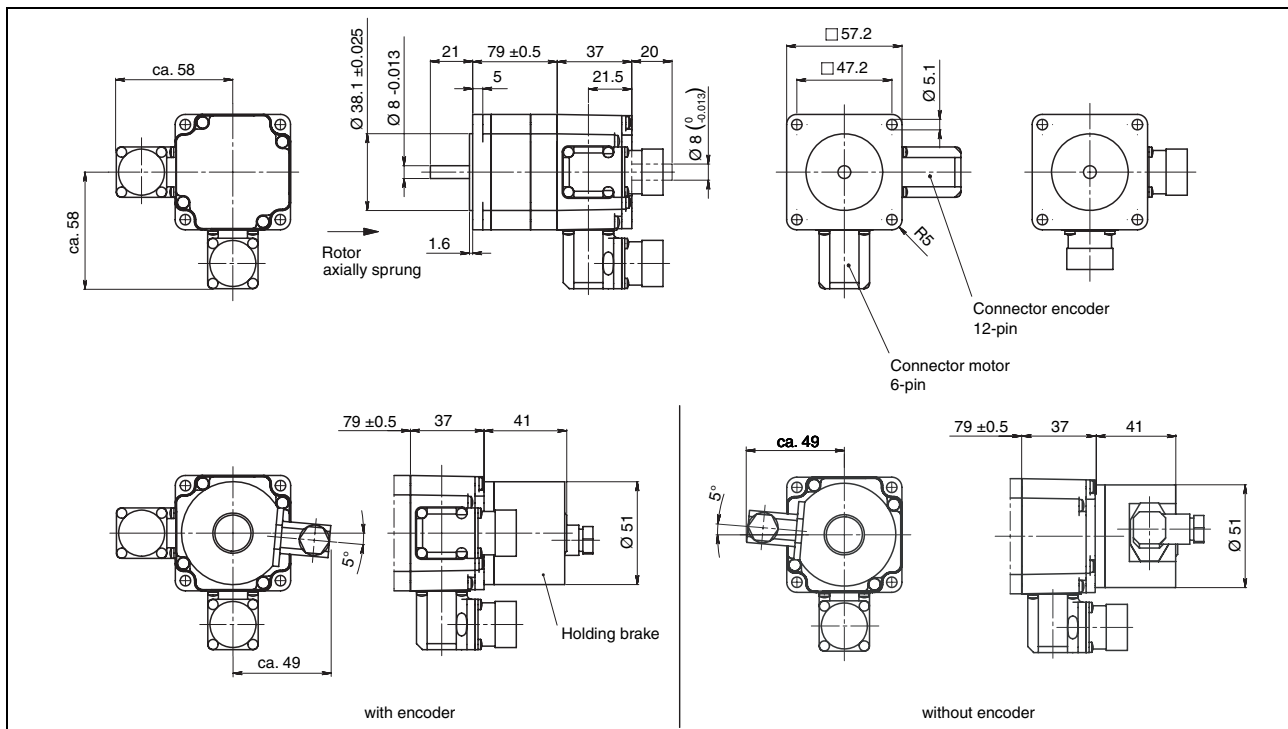
Measurement at 1000 steps/revolution, nominal voltage DC bus U_N and phase current I_N

- (1) Pull-out torque
- (2) Start limit torque
- (3) Maximum load inertia

Dimensional drawings

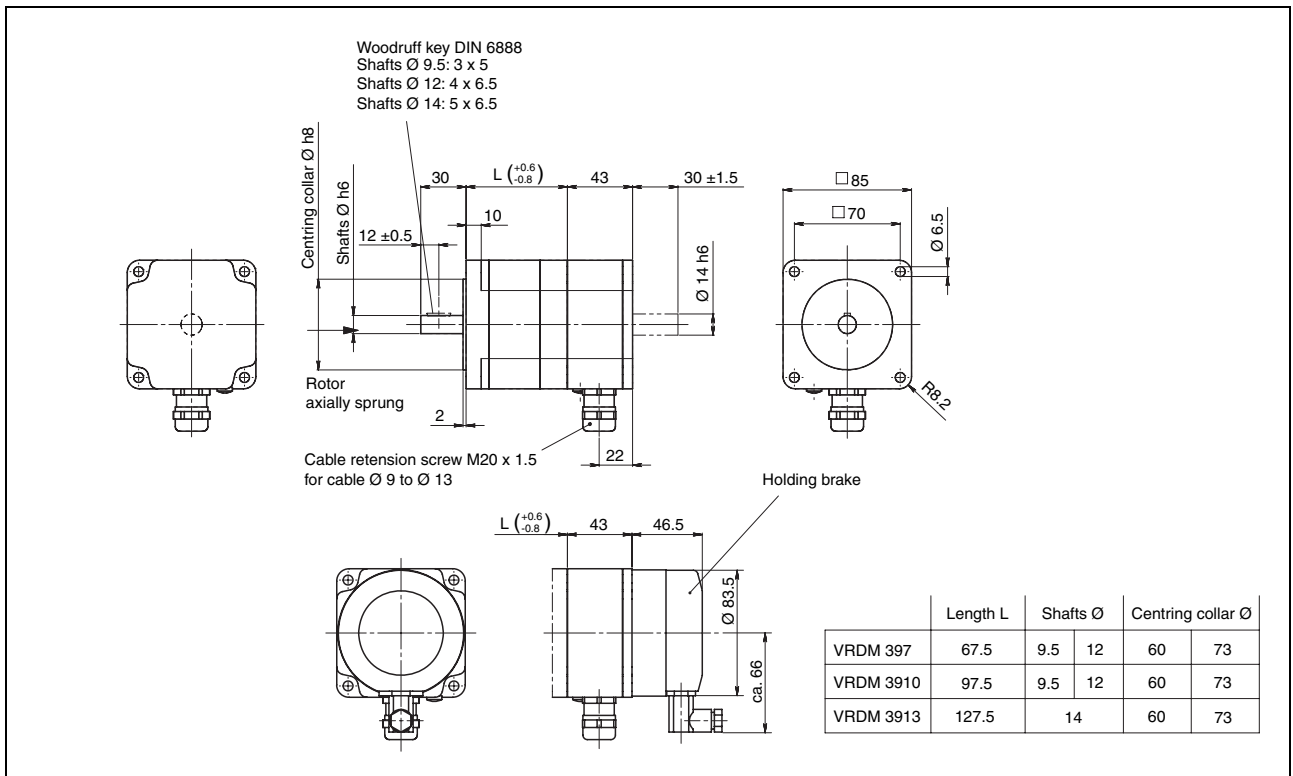


3-phase stepper motor VRDM 368 in terminal box version

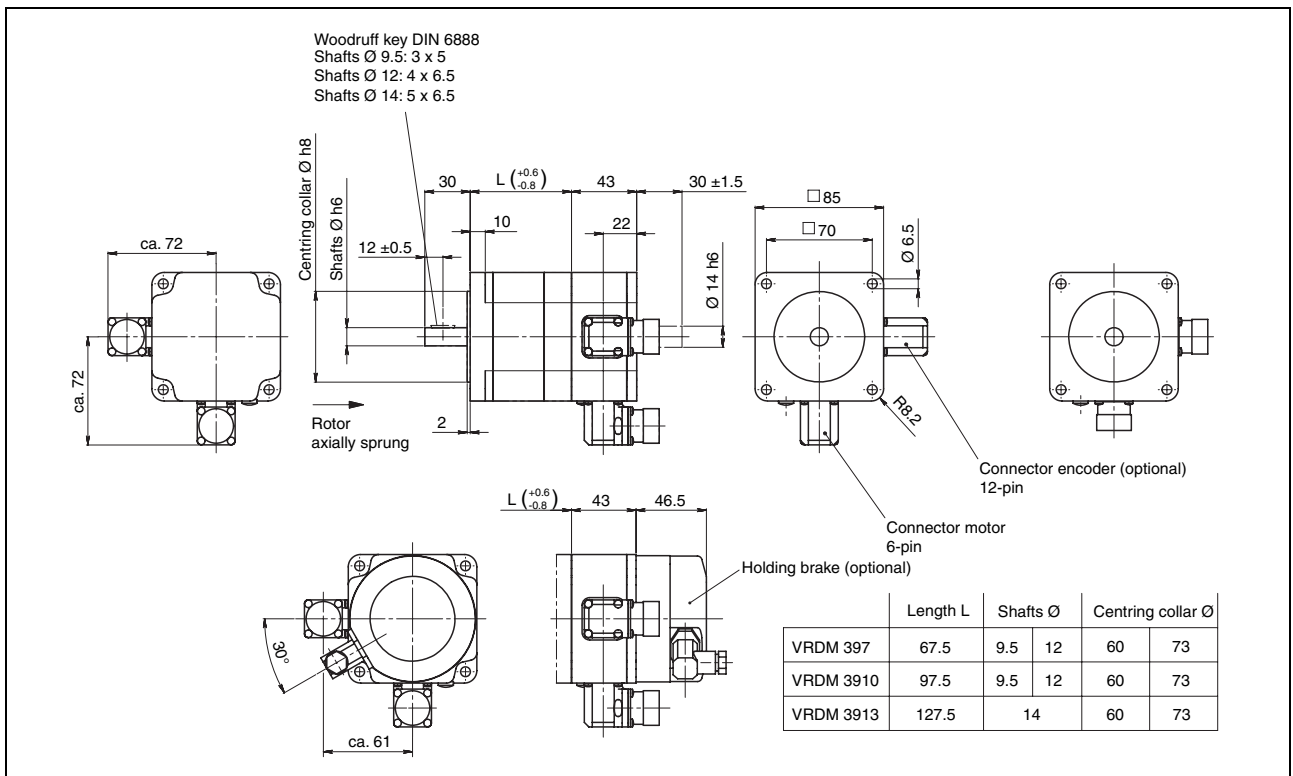


3-phase stepper motor VRDM 368 in connector version

Dimensional drawings

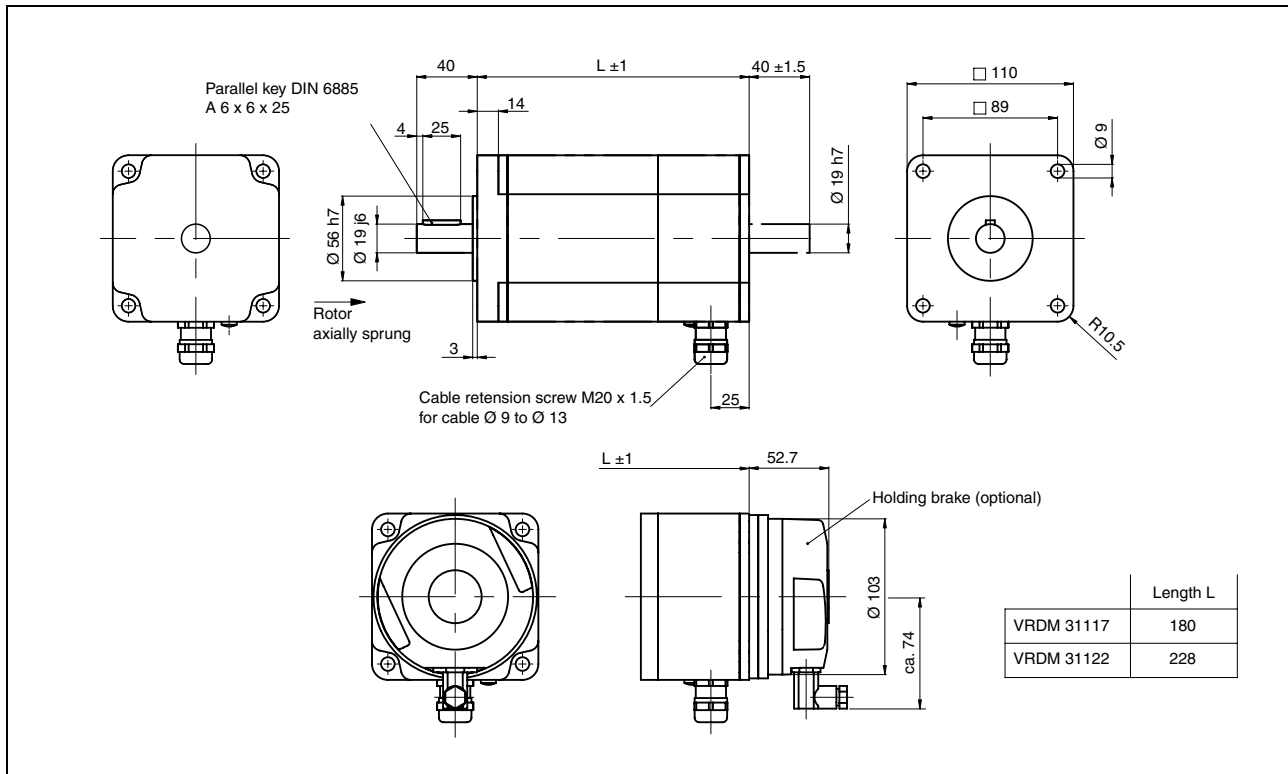


3-phase stepper motor VRDM 39x in terminal box version

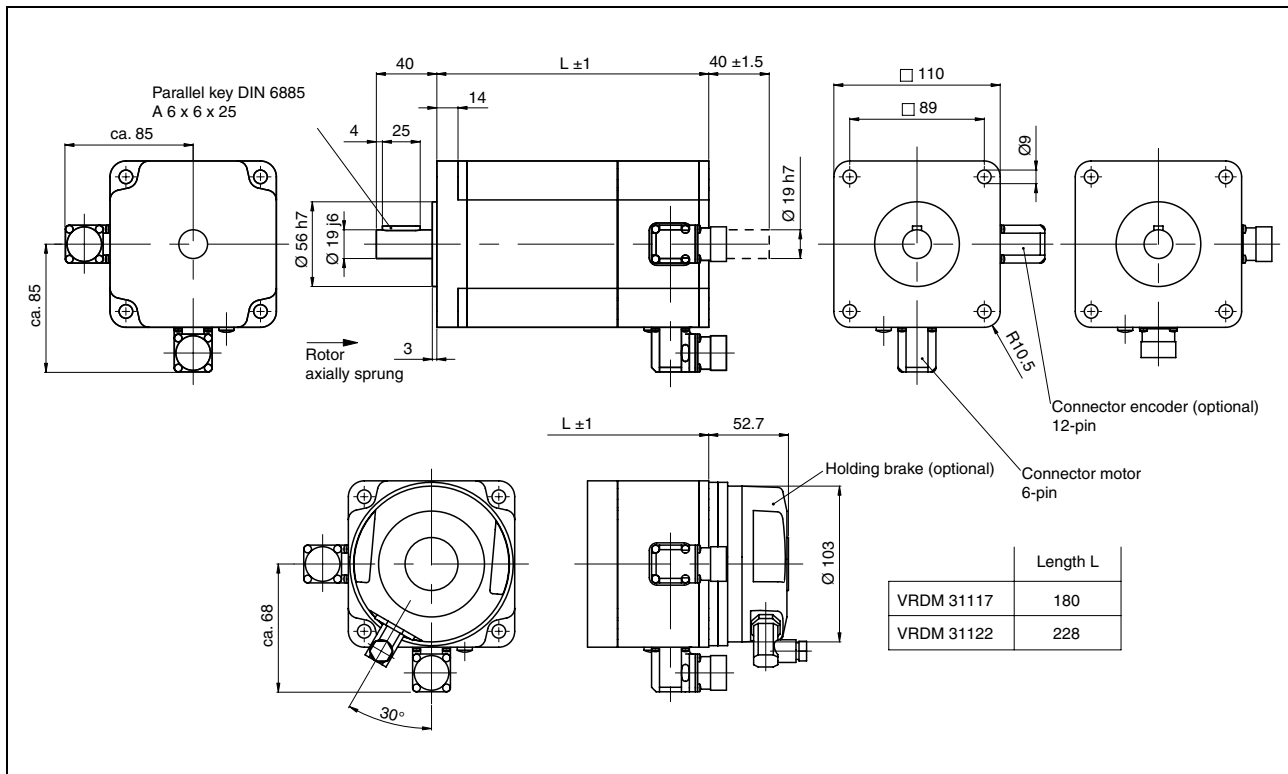


3-phase stepper motor VRDM 39x in connector version

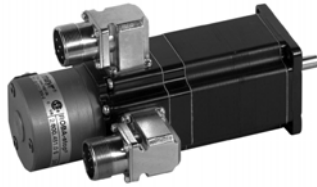
Dimensional drawings



3-phase stepper motor VRDM 311x in terminal box version



3-phase stepper motor VRDM 311x in connector version



Options

Holding brake

The holding brake is an electromagnetic sprung brake and is used to mount the motor axis after switching off the motor current (e. g. in the even of a power failure or EMERGENCY SHUT-DOWN). Mounting is required for torque loads from weight forces, e. g. with Z-axes using the handling method.

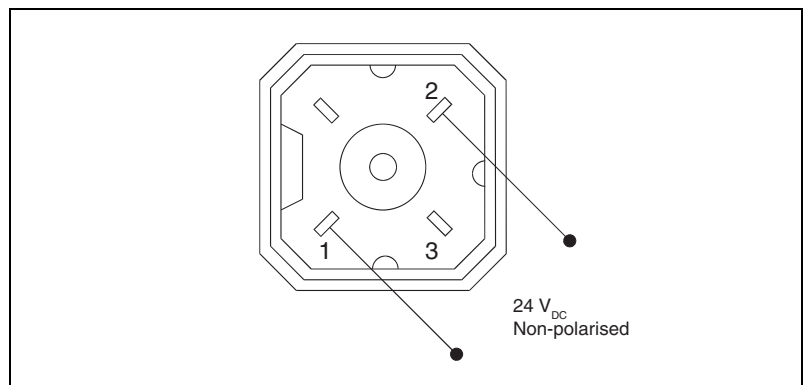
Technical Data

Holding brake for motor type		VRDM 36x	VRDM 39x	VRDM 311x
Nominal voltage	V	24	24	24
Holding torque	Nm	1	6	16
Pull-in power	W	8	24	28
Moment of inertia	kgcm ²	0.016	0.2	0.35
Energise time (release brake)	ms	58	40	60
De-energise time (Apply brake)	ms	14	20	30
Weight	kg	approx. 0.5	approx. 1.5	approx. 2.0

Note: In order to ensure the secure function of the holding brake for Z-axes, the static load torque can be maximum 25% of the holding torque of the motor.

Wiring diagram

The connector is part of the scope of supply.
Connector name: Hirschmann type G4 5M



Wiring diagram of the connector for the holding brake



Encoder

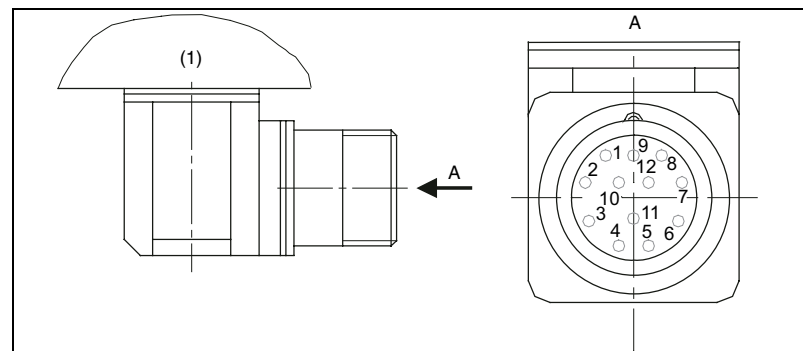
The 3-phase stepper motors from Berger Lahr can be equipped with an encoder. If the stepper motor drive is equipped with rotation monitoring electronics, the encoder is used as a measurement system to acknowledge the actual position of the rotor. Rotation monitoring compares the setpoint and actual position of the motor and reports errors if the actual position deviates from the setpoint position. For example, a mechanical overload of the motor can thereby be recorded.

Note: An encoder can only be used in motors with a connector. A temperature sensor is integrated, which protects the encoder from high temperatures.

Technical Data

Resolution	Inc/rev.	1,000
Index plus	Inc/rev.	1
Output		RS 422
Signals		A; B; I
Signal shape		Rectangular
Supply voltage	V	5 ± 5%
Supply current	A	max. 0.125

Wiring diagram



Wiring diagram encoder plug on VRDM 3xx

(1) Motor housing

Pin	Designation
1	A
2	A negated
3	B
4	B negated
5	C, I
6	C negated, negated
7	5 V _{GND}
8	+ 5
9	- SENSE
10	+ SENSE
11	Temperature sensor
12	Not assigned

Gearbox



Stepper motors from Berger Lahr can also be supplied with a built-in planetary gear. The PLE gears are cost-effective planetary gears, which are sufficient to meet most precision requirements. The PLS gears are high-quality gears with a very low torsional backlash.

These gears can be supplied with one of three gear ratios: 3:1, 5:1 and 8:1.

The output torque of the gearbox is determined by multiplying the torque of the motor with the gear ratio and efficiency of the gearbox (0.96).

The following table shows the preferred gearboxes for the motors.

Motor type	Gearbox type	
VRDM 368	PLE 60	PLS 70
VRDM 39x	PLE 80	PLS 90
VRDM 31117	PLE 120	PLS 115
VRDM 31122		PLS 115

Technical data PLE gearboxes

PLE-gearbox general

Gear stages		1
Service life ¹⁾	h	10000
Efficiency at full load	%	96
Housing material		aluminium
Surface		black anodised
Shaft material		C 45
Bearings		roller bearing
Operating temperature ²⁾	°C	-25 ... +90, shortly +120
Degree of protection ³⁾		IP 54
Lubrication		life lubrication

¹⁾ Life time with an output shaft speed at 100 1/min and T = 30 °C

²⁾ Referring to the housing surface

³⁾ With mounting position IM V3 (drive shaft vertical, shaft end upward) only protection class IP 41 is guaranteed

Size of PLE		60	80	120
Max. radial force ^{1) 2)}	N	500	950	2000
Max. axial force ¹⁾	N	600	1200	2800
Torsional play	arcmin	<20	<12	<8
Max. drive speed	1/min	13000	7000	6500
Recommended drive speed	1/min	4000	4000	3500
Torsional stiffness	Nm/arcmin	2.3	6	12
Weight	kg	0.9	2.1	6.0

¹⁾ The information refers to min. 20,000 h life time with an output shaft speed of 100 1/min and application factor K = 100 min and S1-operating mode for electrical machines and T = 30°C

²⁾ Refers to the centre of the drive shaft and 50% ED

Attention: the actual output torque must be less than the nominal output torque of the gearbox, otherwise the gearbox may be destroyed.

Technical data PLS gearboxes**PLS-gearbox general**

Gear stages		1
Service life ¹⁾	h	20000
Efficiency at full load	%	98
Housing material		aluminium
Surface		black anodised
Shaft material		C 45
Bearings		tapered roller bearings
Operating temperature ²⁾	°C	-25 ... +100, shortly +124
Degree of protection ³⁾		IP 65
Lubrication		life lubrication

¹⁾ Life time with an output shaft speed at 100 1/min and T = 30 °C

²⁾ Referring to the housing surface

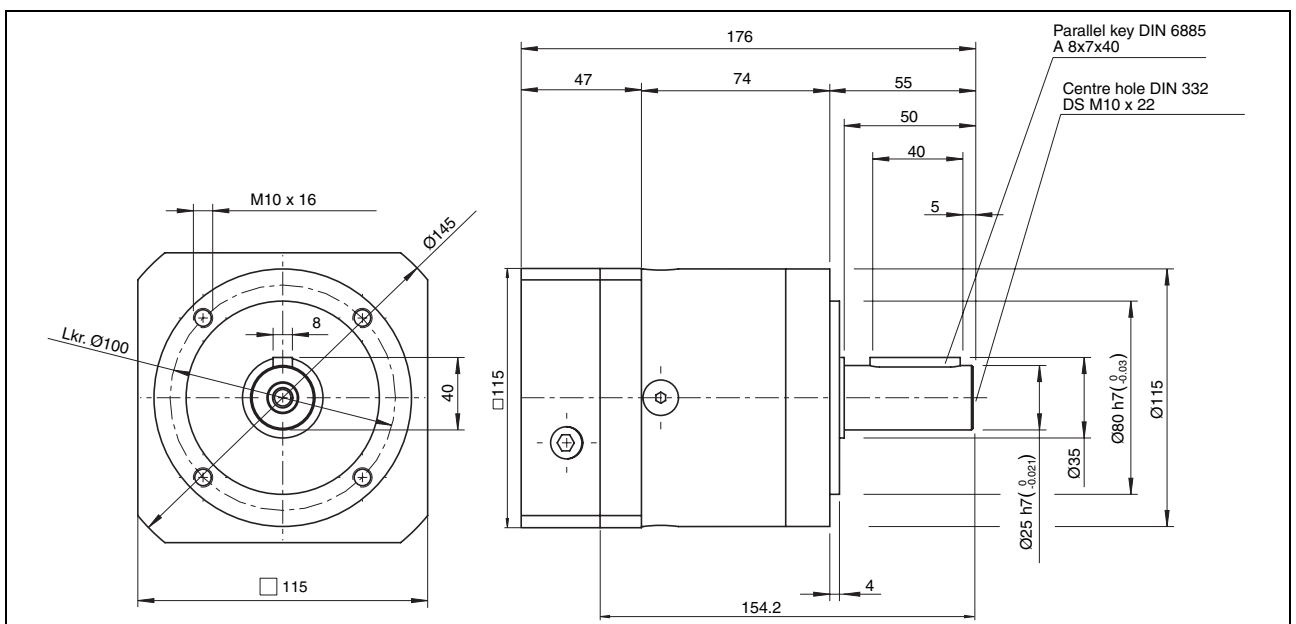
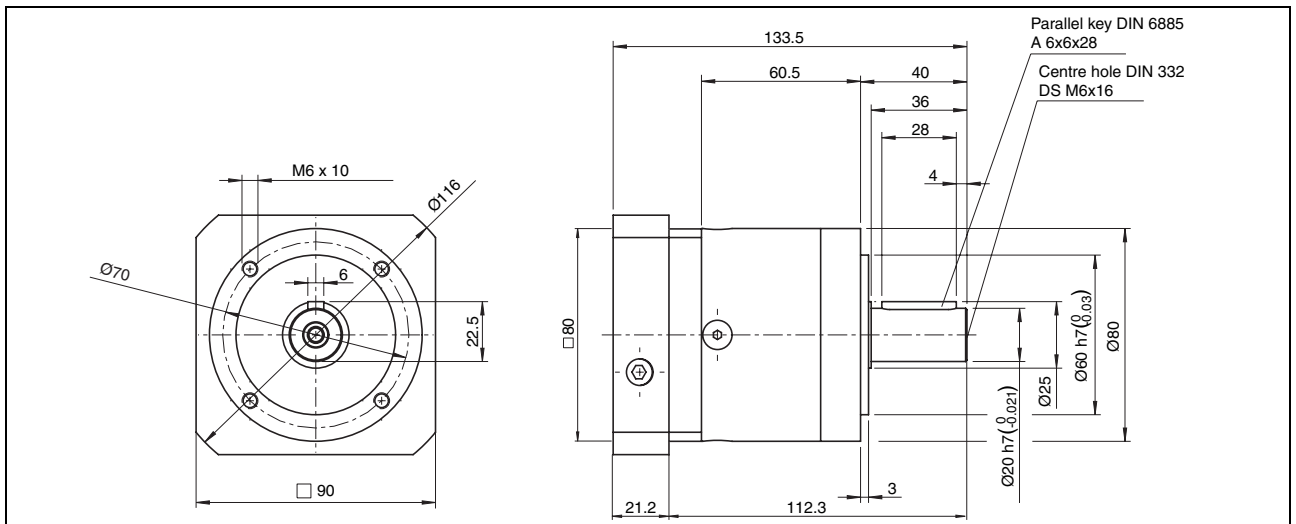
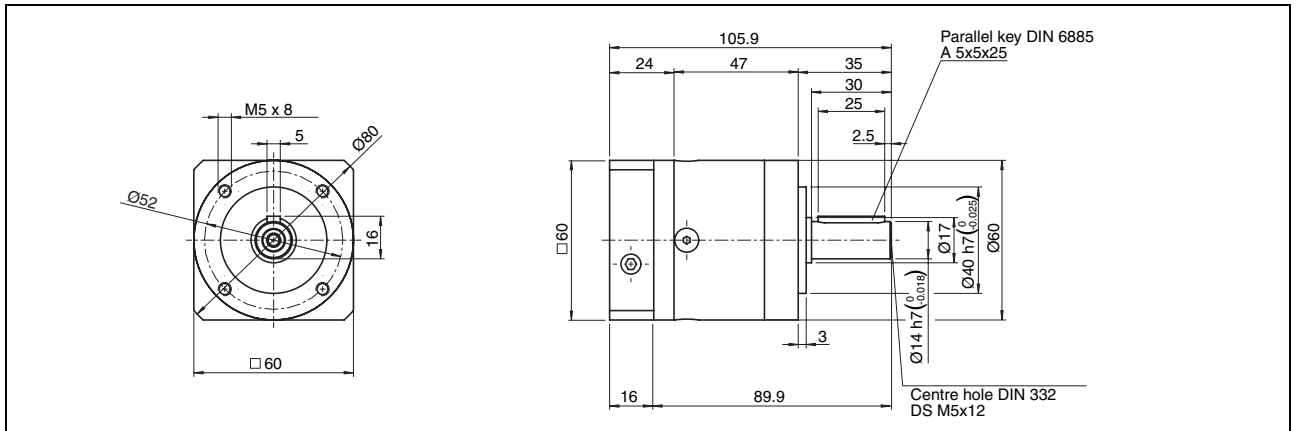
³⁾ With mounting position IM V3 (drive shaft vertical, shaft end upward) only protection class IP 41 is guaranteed

Size of PLS		70	90	115
Max. radial force ^{1) 2)}	N	3000	4000	5000
Max. axial force ¹⁾	N	6000	9000	12000
Torsional play	arcmin	<3	<3	<3
Max. drive speed	1/min	14000	10000	8500
Recommended drive speed	1/min	5000	4500	4000
Torsional stiffness	Nm/arcmin	6	9	20
Weight	kg	3.0	4.3	9.0

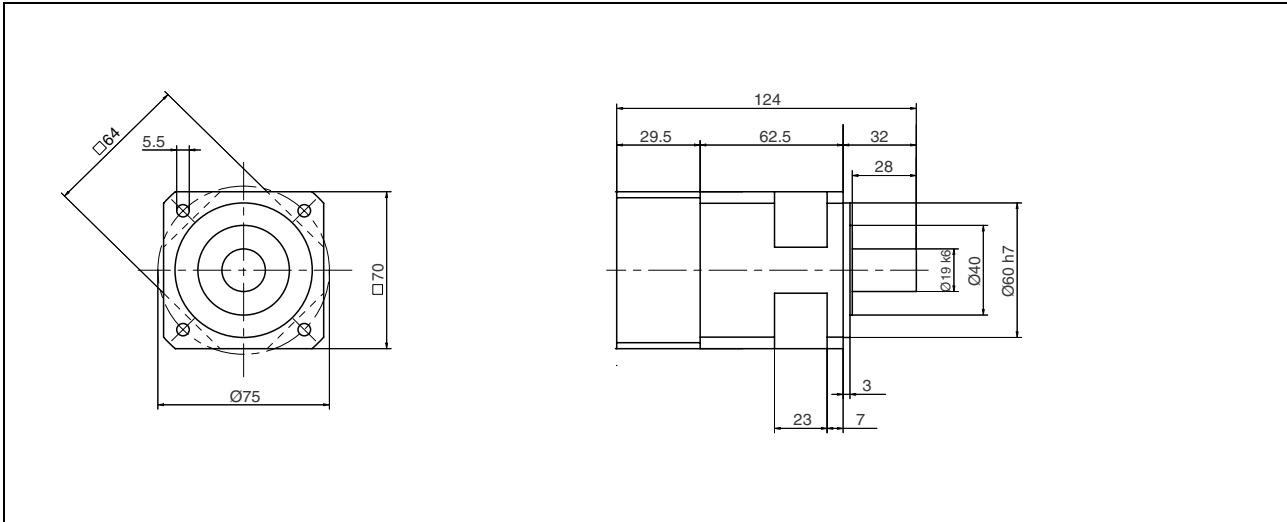
¹⁾ The information refers to min. 20,000 h life time with an output shaft speed of 100 1/min and application factor K = 100 min and S1-operating mode for electrical machines and T = 30 °C

²⁾ Refers to the centre of the drive shaft and 50% ED

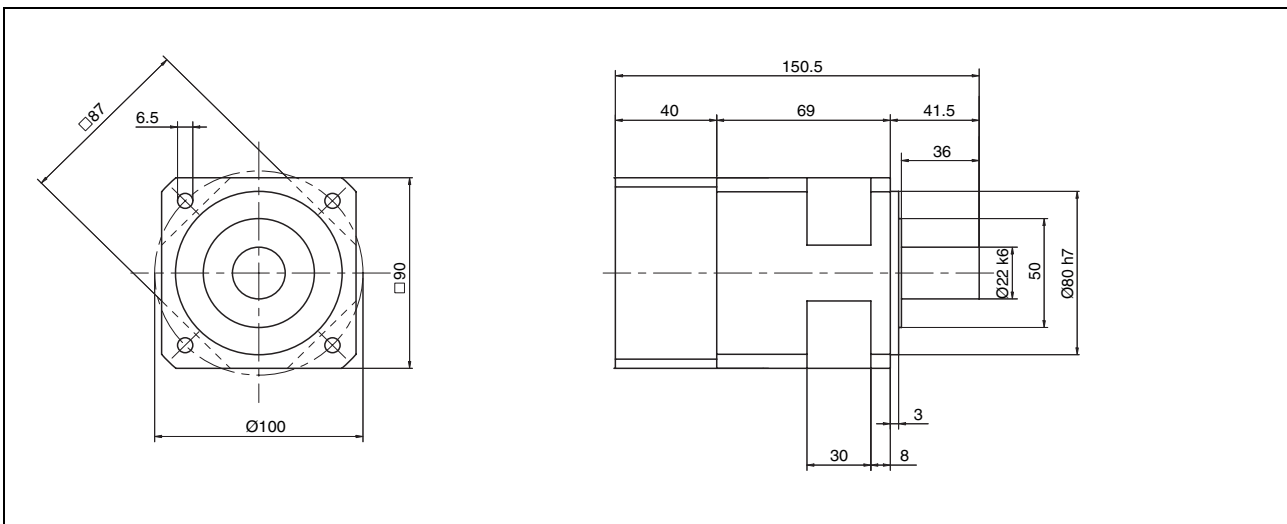
Dimensional drawings



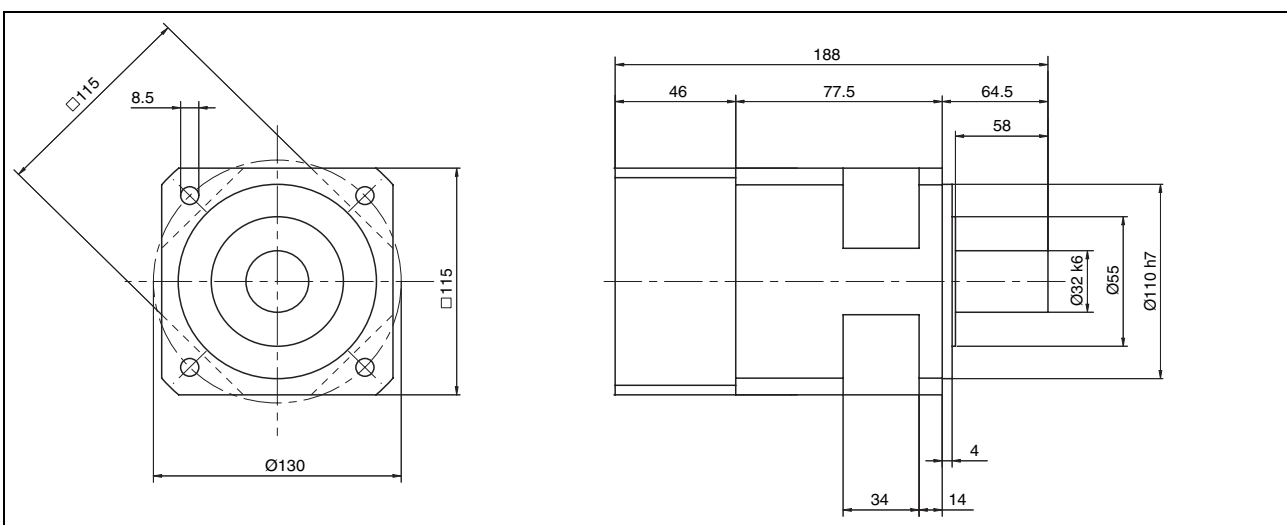
Dimensional drawings



PLS 70 gearbox



PLS 90 gearbox



PLS 115 gearbox

Type code	
VRDM 368	
Example:	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Phase count 3	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Size (flange) 6 = 57.2 mm	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Length 8 = 79 mm	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Number of pole pairs 50	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B B 000
Rotor L = Laminated rotor plate	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Maximum voltage W = 230 V _{AC} (325 V _{DC})	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B B 000
Connection type B = Terminal box C = Connector	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Position capture E = Encoder (1000 increments/revolution) O = Without encoder	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Holding brake B = Brake O = Without brake	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Degree of protection IP41 = IP 41 on shaft bushing	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Gearbox type O = Without gearbox 2 = PLE 60 A = PLS 70	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Gear ratio O = Without gearbox 3 = 3:1 5 = 5:1 8 = 8:1	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Shaft diameter D8 = 8 mm DO = With gearbox	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Shaft model front O = Smooth shaft or gearbox	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Centring collar 38 = 38.10 mm OO = with gearbox	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Second shaft: O = Without 2 = With	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Connection direction motor plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Connection direction encoder plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Braided wire output O = Without	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000
Braided wire length OOO = Without	VRDM 3 6 8 / 50 L W C E O IP41 1 5 DO O OO 2 B B O 000

Note:

Please note the description of the possible motor types on page 20.

Type code																						
VRDM 39x																						
Example:	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Phase count 3	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Size (flange) 9 = 85 mm	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Motor length 7 = 68 mm 10 = 98 mm 13 = 128 mm	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Number of pole pairs 50	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	B	OOO
Rotor L = Laminated rotor plate	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Maximum voltage W = 230 V _{AC} (325 V _{DC})	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	B	OOO
Connection type B = Terminal box C = Connector	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Position capture E = Encoder (1000 increments/revolution) O = without encoder	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Holding brake B = Brake O = Without brake	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Degree of protection IP41 = IP 41 on shaft bushing IP56 = IP 56 on shaft bushing front	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Gearbox type O = Without gearbox 3 = PLE 80 B = PLS 90	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Gear ratio O = Without gearbox 3 = 3:1 5 = 5:1 8 = 8:1	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Shaft diameter D9 = 9.5 mm D2 = 12 mm D4 = 14 mm DO = With gearbox	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Shaft model front O = Smooth gearbox K = Woodruff key per DIN 6888	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Centring collar 60 = 60 mm 73 = 73 mm OO = With gearbox	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Second shaft O = Without 2 = With	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Connection direction motor plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Connection direction encoder plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Braided wire output O = Without	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO
Braided wire length OOO = Without	VRDM	3	9	10	/	50	L	W	C	E	O	IP41	3	5	DO	O	OO	2	B	B	O	OOO

Note:

Please note the description of the possible motor types on page 20.

Type code	
VRDM 311x	
Example:	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Phase count 3	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Size (flange) 11 = 110 mm	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Length 17 = 180 mm 22 = 228 mm	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Number of pole pairs 50	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B B 000
Rotor L = Laminated rotor plate	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Maximum voltage W = 230 V _{AC} (325 V _{DC})	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B B 000
Connection type B = Terminal box C = Connector	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Recording of position E = Encoder (1000 increments/revolution) O = Without encoder	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Holding brake B = Brake O = Without brake	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Degree of protection IP41 = IP 41 on shaft bushing IP56 = IP 56 on shaft bushing front	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Gearbox type O = Without gearbox 4 = PLE 120 C = PLS 115	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Gear ratio O = Without gearbox 3 = 3:1 5 = 5:1 8 = 8:1	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Shaft diameter D9 = 19 mm DO = With gearbox	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Shaft model Front O = Smooth shaft or gearbox K = Parallel key as per DIN 6885	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Centring collar 56 = 56 mm OO = With gearbox	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Second shaft O = Without 2 = With	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Connection direction motor plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Connection direction encoder plug O = Without, L = Left, R = Right B = Back, F = Front, S = Straight	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Braided wire output O = Without	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000
Braided wire length OOO = Without	VRDM 3 11 17 / 50 L W C E O IP41 4 5 DO O OO 2 B B O 000

Note:

Please note the description of the possible motor types on page 20.



Accessories

EMC mains filter

Function

In the SD3, a mains filter is integrated by default in order to meet the standards IEC/EN 61800-3 on electromagnetic compatibility (EMC). Compliance with these standards is the deciding factor for a CE mark in the sense of the EMC guideline. The additional mains filter makes it possible to meet stricter requirements. This drive system meets the EMC requirements for the second environment according to the standard IEC 61800-3, if the described measures are taken into account during installation. The following note should be taken into account outside of the application area:

Better values can be achieved depending on the specific device, the application and the construction, e. g. during assembly in a closed switching cabinet. If limit values are required for the first environment (public mains, category C2), external mains filters must be added upstream.

The following limiting values for wiring-related interference quantities are met by EMC compatible designs:

Without external mains filter	C3 up to 10 m motor cable length
With external mains filter	C2 up to 20 m motor cable length, device installed in an enclosed switching cabinet with 15 dB damping. C3 up to 40 m motor cable length

The operator must ensure that the EMC directives are observed.

Usage depending on the power network type

This mains filter can only be used in TN networks (connection to neutral conductor) and TT networks (neutral conductor connected to earth).

The filters cannot be used in IT mains (isolated or over a high impedance earthed neutral conductor).

Standard IEC 61800-3, Annex D2.1 states that the mains filters may not be used for this mains type because correct operation of the insulation monitoring devices cannot be guaranteed.

In addition, the efficiency of the mains filters for this mains type depends on the type of impedance between the neutral conductor and frame. The efficiency consequently cannot be predicted.

An isolating transformer is required for machines that must be installed on an IT mains to allow the machine to be operated locally as on a TN or TT system.

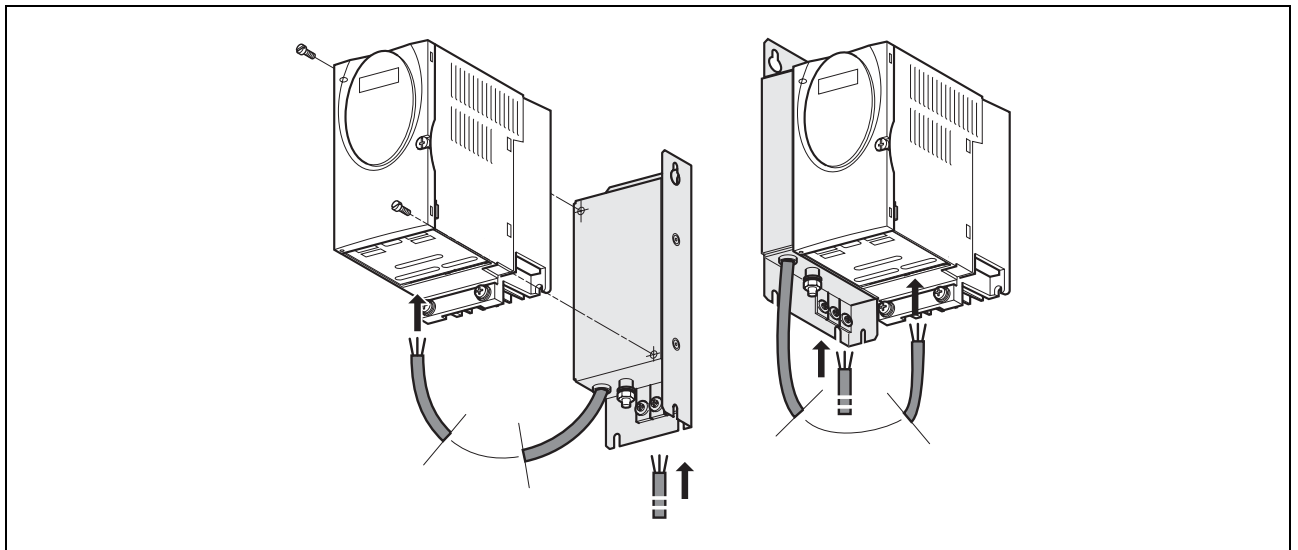
Technical data on the external mains filter

Compliance with the standards		EN 133200
Degree of protection		IP 21 and IP 41 on the top part
Maximum relative humidity		93% without condensation and surface water accumulation as per IEC 68-2-3
Ambient temperature		
• Operating temperature	°C	-10 ... +60
• Transport and storage temperature	°C	-5 ... +70
Maximum installation height	m	1000 (Over 1000 m decrease the current by 1% per additional 100 m)
Oscillation strain as per IEC 80068-2-6		1.5 mm peak at 3 ... 13 Hz 1 g peak at 13 ... 150 Hz
Shock stress as per IEC 60068-2-27		15 g for 11 ms
Maximum rated voltage		
• 50/60 Hz, 1-phase	V	240 + 10%
• 50/60 Hz, 3-phase	V	240 + 10% 500 + 10% 600 + 10%

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

Order data			
Accessories	Description	Designation	Order number
EMC mains filter	EMC mains filter 1-phase, 9 A, 115/230 V _{AC}	VW3A31401	0087500001235

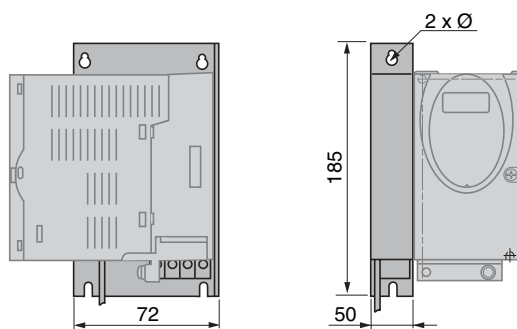
Mounting



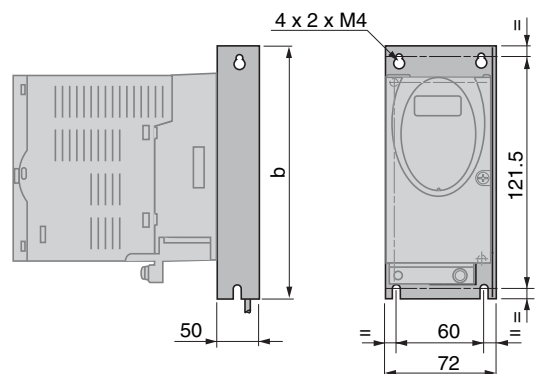
Mounting mains filters

Dimensional drawings

Assembly of the mains filter next to the stepper motor drive



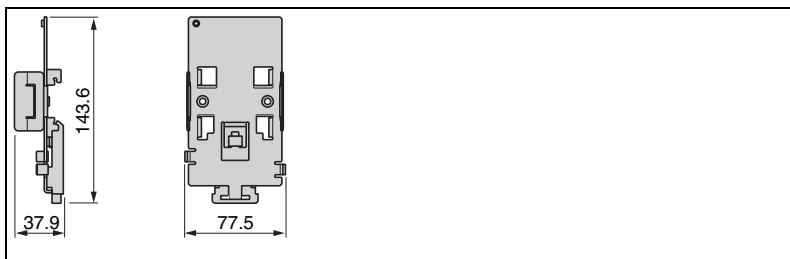
Assembly of the mains filter behind the stepper motor drive



Adapter plate

The adapter plate is used for the assembly of the SD3 on a top-hat rail.

Dimensional drawing



Adapter plate

Order data

Accessories	Description	Designation	Order number
Adapter plate	For assembly on top-hat rail	VW3A11851	0087500001654

Order data					
Accessories	Description		Designation	Order number	
EMC mains filter					
EMC mains filter	EMC mains filter 1-phase, 9 A, 115/230 V _{AC}		VW3A31401	0087500001235	
Motor cable					
Motor cable	Motor cable manufactured for stepper motors 4 x 1.5 mm, shielded; motor-side with 6-pole round connector, other cable end open	3 m	VW3S5101R30	0162503003003	
		5 m	VW3S5101R50	0162503003005	
		10 m	VW3S5101R100	0162503003010	
		15 m	VW3S5101R150	0162503003015	
		20 m	VW3S5101R200	0162503003020	
		Motor cable loose for stepper motor 4 x 1.5 mm, shielded; both motor cables open	3 m	VW3S5102R30	0162503004003
			5 m	VW3S5102R50	0162503004005
			10 m	VW3S5102R100	0162503004010
			15 m	VW3S5102R150	0162503004015
			20 m	VW3S5102R200	0162503004020
Encoder cable					
Encoder cable	Encoder cable designed for stepper motor 4 x 1.5 mm, shielded; motor-side with 12-pin encoder-connector, round, inserted; device side with 12-pin Molex connector	3 m	VW3S8101R30	0162503101003	
		5 m	VW3S8101R50	0162503101005	
		10 m	VW3S8101R100	0162503101010	
		15 m	VW3S8101R150	0162503101015	
		20 m	VW3S8101R200	0162503101020	
Pulse/direction cable					
Pulse/direction cable	5 V, shielded; device-side with 24-pin Molex connector; other cable end open	0.5 m	VW3S8201R05	0162503210005	
		1.5 m	VW3S8201R15	0162503210015	
		3 m	VW3S8201R30	0162503210030	
		5 m	VW3S8201R50	0162503210050	
		24 V, shielded; device-side with 24-pin Molex connector; other cable end open	0.5 m	VW3S8202R05	0162503211005
			1.5 m	VW3S8202R15	0162503211015
			3 m	VW3S8202R30	0162503211030
			5 m	VW3S8202R50	0162503211050
Pulse/direction connector cable on Schneider Premium CFY	device-side with 24-pin Molex connector; CFY-side with 15-pole SubD-connector	1.5 m	VW3S8204R15	0162503222015	
		3.0 m	VW3S8204R30	0162503222030	
Pulse/direction connector cable on Siemens S7-300 FM353	device-side with 24-pin Molex connector; FM353-side with SubD15 female connector	1.5 m	VW3S8206R15	0162503223015	
		3.0 m	VW3S8206R30	0162503223030	
Connection cable pulse/direction to TLM2 or WP/WPM 311	device-side with 24-pin Molex connector; other cable end with SubD15 female connector	0.5 m	VW3S8208R05	0162503224005	
		1.5 m	VW3S8208R15	0162503224015	
		3 m	VW3S8208R30	0162503224030	
		5 m	VW3S8208R50	0162503224050	
Other accessories					
Adapter plate	for assembly on top-hat rail		VW3A11851	0087500001654	
Connector set	with 5 12-pin Molex connectors, with crimp contacts		VW3M8213	0162501532007	
	with 5 24-pin Molex connectors, with crimp contacts		VW3S8212	0162501532011	
Fan set	24 V _{DC}		VW3S3101	0162501532012	
SD3 2x, Technical documentation, multi-lingual	CD-ROM		ACC1RDBAM00XX	0098441113307	

Conversion tables

Rotor inertia

	lb-in ²	lb-ft ²	lb-in-s ²	lb-ft-s ² slug-ft ²	kg-cm ²	kg-cm-s ²	g-cm ²	g-cm-s ²	oz-in ²	oz-in-s ²
lb-in ²	–	6.94 x 10 ⁻³	2.59 x 10 ⁻³	2.15 x 10 ⁻⁴	2.926	2.98 x 10 ⁻³	2.92 x 10 ³	2.984	16	4.14 x 10 ⁻²
lb-ft ²	144	–	0.3729	3.10 x 10 ⁻²	421.40	0.4297	4.21 x 10 ⁵	429.71	2304	5.967
lb-in-s ²	386.08	2.681	–	8.33 x 10 ⁻²	1.129 x 10 ³	1.152	1.129 x 10 ⁶	1.152 x 10 ³	6.177 x 10 ³	16
lb-ft-s ² slug-ft ²	4.63 x 10 ³	32.17	12	–	1.35 x 10 ⁴	13.825	1.355 x 10 ⁷	1.38 x 10 ⁴	7.41 x 10 ⁴	192
kg-cm ²	0.3417	2.37 x 10 ⁻³	8.85 x 10 ⁻⁴	7.37 x 10 ⁻⁶	–	1.019 x 10 ⁻³	1000	1.019	5.46	1.41 x 10 ⁻²
kg-cm-s ²	335.1	2.327	0.8679	7.23 x 10 ⁻²	980.66	–	9.8 x 10 ⁵	1000	5.36 x 10 ³	13.887
g-cm ²	3.417 x 10 ⁻⁴	2.37 x 10 ⁻⁶	8.85 x 10 ⁻⁷	7.37 x 10 ⁻⁸	1 x 10 ⁻³	1.01 x 10 ⁻⁶	–	1.01 x 10 ⁻³	5.46 x 10 ⁻³	1.41 x 10 ⁻⁶
g-cm-s ²	0.335	2.32 x 10 ⁻³	8.67 x 10 ⁻⁴	7.23 x 10 ⁻⁵	0.9806	1 x 10 ⁻³	980.6	–	5.36	1.38 x 10 ⁻²
oz-in ²	0.0625	4.3 x 10 ⁻⁴	1.61 x 10 ⁻⁶	1.34 x 10 ⁻⁶	0.182	1.86 x 10 ⁻⁴	182.9	0.186	–	2.59 x 10 ⁻³
oz-in-s ²	24.13	0.1675	6.25 x 10 ⁻²	5.20 x 10 ⁻³	70.615	7.20 x 10 ⁻²	7.06 x 10 ⁴	72	386.08	–

Torque

	lb-in	lb-ft	oz-in	Nm	kg-m	kg-cm	g-cm	dyne-cm
lb-in	–	8.333 x 10 ⁻²	16	0.113	1.152 x 10 ⁻²	1.152	1.152 x 10 ³	1.129 x 10 ⁶
lb-ft	12	–	192	1.355	0.138	13.825	1.382 x 10 ⁴	1.355 x 10 ⁷
oz-in	6.25 x 10 ⁻²	5.208 x 10 ⁻³	–	7.061 x 10 ⁻³	7.200 x 10 ⁻⁴	7.200 x 10 ⁻²	72.007	7.061 x 10 ⁴
Nm	8.850	0.737	141.612	–	0.102	10.197	1.019 x 10 ⁴	1 x 10 ⁷
kg-m	86.796	7.233	1.388 x 10 ³	9.806	–	100	1 x 10 ⁵	9.806 x 10 ⁷
kg-cm	0.8679	7.233 x 10 ⁻²	13.877	9.806 x 10 ⁻²	10 ⁻²	–	1000	9.806 x 10 ⁵
g-cm	8.679 x 10 ⁻⁴	7.233 x 10 ⁻⁶	1.388 x 10 ⁻²	9.806 x 10 ⁻⁶	1 x 10 ⁻⁵	1 x 10 ⁻³	–	980.665
dyne-cm	8.850 x 10 ⁻⁷	7.375 x 10 ⁻⁸	1.416 x 10 ⁻⁵	10 ⁻⁷	1.019 x 10 ⁻⁸	1.0197 x 10 ⁻⁶	1.019 x 10 ⁻⁶	–

Power

	H.P.	W
H.P.	–	745.7
W	1.31 x 10 ⁻³	–

Length

	in	ft	yd	m	cm	mm
in	–	0.0833	0.028	0.0254	2.54	25.4
ft	12	–	0.333	0.3048	30.48	304.8
yd	36	3	–	0.914	91.44	914.4
m	39.37	3.281	1.09	–	100	1000
cm	0.3937	0.03281	1.09 x 10 ⁻²	0.01	–	10
mm	0.03937	0.00328	1.09 x 10 ⁻³	0.001	0.1	–

Rotation

	1/min (rpm)	rad/sec	deg./sec
1/min (rpm)	–	0.105	6.0
rad/sec	9.55	–	57.30
deg./sec	0.167	1.745 x 10 ⁻²	–

Weight

	lb	oz	slug	kg	g
lb	–	16	0.0311	0.453592	453.592
oz	6.35 x 10 ⁻²	–	1.93 x 10 ⁻³	0.028349	28.35
slug	32.17	514.8	–	14.5939	1.459 x 10 ⁴
kg	2.20462	35.274	0.0685218	–	1000
g	2.205 x 10 ⁻³	3.527 x 10 ⁻³	6.852 x 10 ⁻⁵	0.001	–

Temperature

	°F	°C
°F	–	(9 - 32) · ⁵ / ₉
°C	9 · ⁹ / ₅ + 32	–

Force

	lb	oz	gf	dyne	N
lb	–	16	453.592	4.448 x 10 ⁵	4.4482
oz	0.0625	–	28.35	2.780 x 10 ⁴	0.27801
gf	2.205 x 10 ⁻³	0.03527	–	980,665	N.A.
dyne	2.248 x 10 ⁻⁶	3.59 x 10 ⁻⁶	1.02 x 10 ⁻³	–	0.0001
N	0.22481	3.5967	N.A.	100,000	–

Example for conversion:

Conversion of a 10 inch length measurement into metres. Look for the entry “in” (= inch) in the “Length” table in the left column and the entry “m” (= metre) in the header. The table cell at the point of intersection of the column and the row will show the conversion factor: “0.0254”. Multiply 10 inches by 0.0254 and you will get the value in metres: 10 in x 0.0254 = 0.254 m.



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