

3-PHASE STEPPING MOTOR

VRDM 311x



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Features common to all motor types

- Test voltage to DIN EN 60034 part 1
- Insulation class F
- Run-out and perpendicularity to DIN 42955 N
- Paint: black RAL 9005

Security

Please observe before installation, set-up, maintenance and repairs of the motors our security tips.

Should you not know these sheets, please ask for the data sheet "Security tips of the motors"

Motor specification

The listed data in this table are motor-specified data.

A breakdown of the individual motors is given under the type code on page 9.

Motor type			VRDM 31117	VRDM 31122
Winding			W	W
Max. voltage	U_{\max}	$V_{AC}^{4)}$	230	230
		$V_{DC}^{5)}$	325	325
Rated torque	M_N	Nm	12	16.5
Holding torque	M_H	Nm	13.5	19.7
Rotor inertia	J_R	kgm ²	$1.05 \cdot 10^{-3}$	$1.6 \cdot 10^{-3}$
Number of steps ¹⁾	z		200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000	
Step angle ¹⁾	α	°	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036	
Systematic angle tolerance per step ²⁾	$\Delta\alpha_s$	'	±6	
Max. starting frequency ¹⁾	f_{Aom}	kHz	4.7	
Rated current	I_N	A _{rms}	4.1	4.75
Resistant / winding	R_W	Ω	1.8	1.9
Current rise constant	τ	ms	~ 22	
Weight ³⁾	m	kg	8	11

Terms and symbols taken from DIN 42021 part 2

¹⁾ With suitable power drive

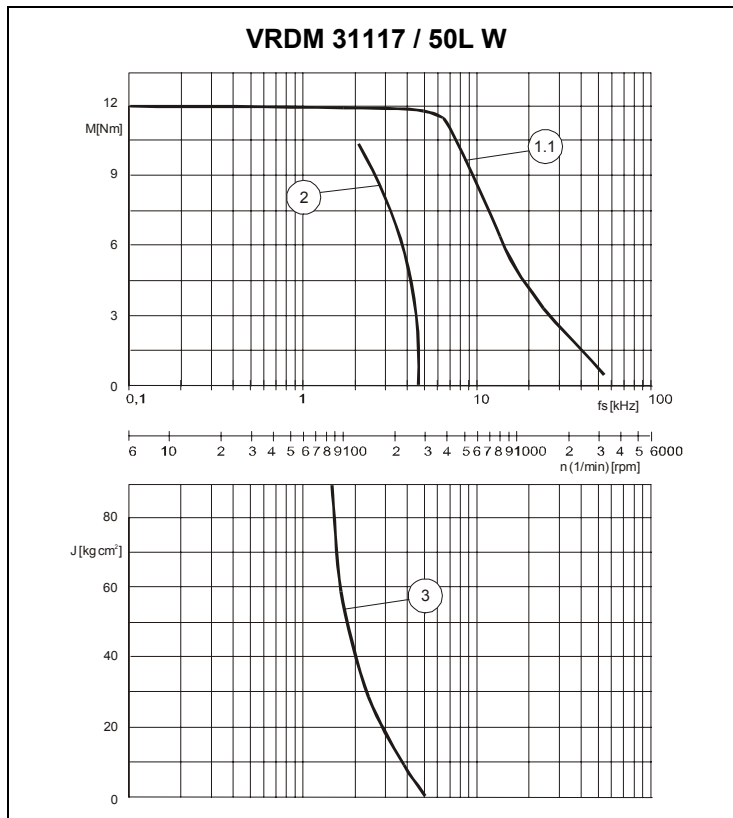
²⁾ Measured at 1000 steps / revolution, units in minutes

³⁾ Weight of the motor with stranded wire connection

⁴⁾ maximal possible rms value

⁵⁾ DC bus voltage

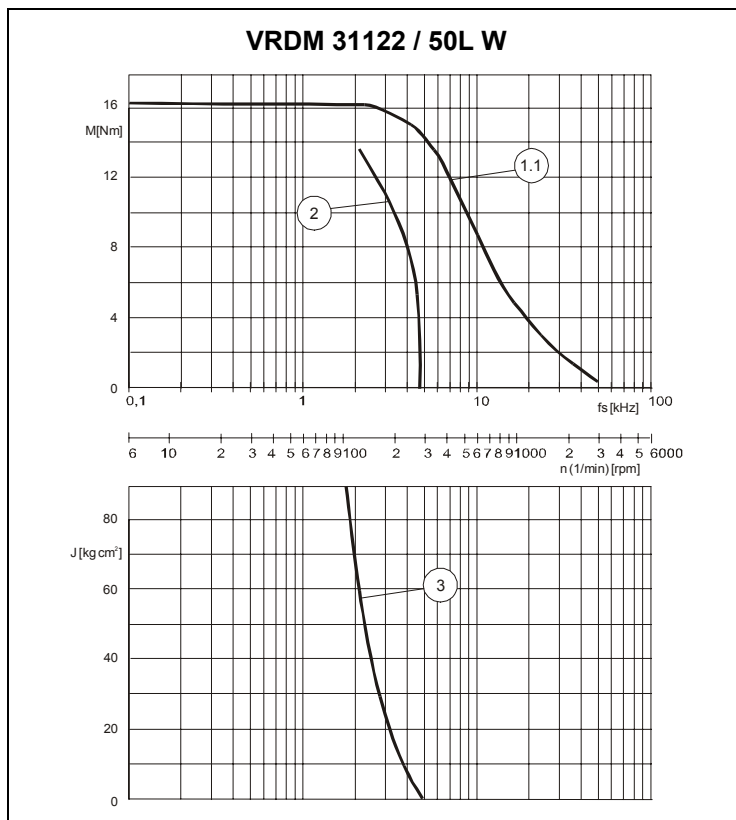
Characteristic curves VRDM 31117



- 1.1** Pull-out torque
 Drive = WDx3-xx8, TLxx12
 $U_N = 325 V_{DC}$
 $I_W = 4,1 A$
- 2** Pull-in torque
- 3** Maximum load inertia

Measuring of characteristic curves with 1000 steps / revolution

Characteristic curves VRDM 31122



- 1.1** Pull-out torque
 Drive = WDx3-xx8, TLxx12
 $U_N = 325 V_{DC}$
 $I_W = 4,75 A$
- 2** Pull-in torque
- 3** Maximum load inertia

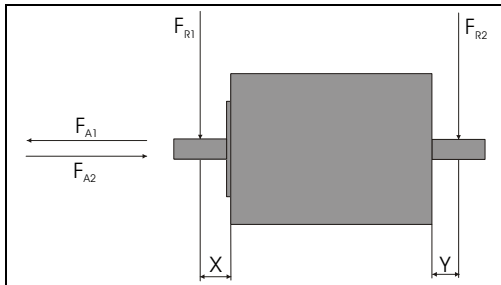
Measuring of characteristic curves with 1000 steps / revolution

Shaft load

The Motor must not be opened by the customer. If it is opened it will be partially demagnetized with a consequent loss of power.

In the case of motors with terminal box, the cover can be opened to connect the terminals!

Please always observe our safety information!



Conditions:

- Nominal bearing life ¹⁾ $L_{10h} = 20.000 \text{ hours}$
- Speed $n = 600 \text{ min}^{-1}$
- Ambient temperature $= 40^\circ\text{C}$
($\approx 80^\circ\text{C}$ bearing temperature)
- Rated torque $= 100 \% \text{ c.d.f.}$
- Point of application of forces $X = 20 \text{ mm}$
 $Y = 20 \text{ mm}$

Motor		VRDM 31117	VRDM 31122
Max. radial force Front F_{R1}	100 % c.d.f.	300 N	
Max. radial force 2nd shaft end F_{R2}	100 % c.d.f.	150 N ²⁾	
Max. axial force Pull F_{A1}	100 % c.d.f.	330 N	
Max. axial force Push F_{A2}	100 % c.d.f.	60 N	

¹⁾ In operation hours with a 10% probability of failure

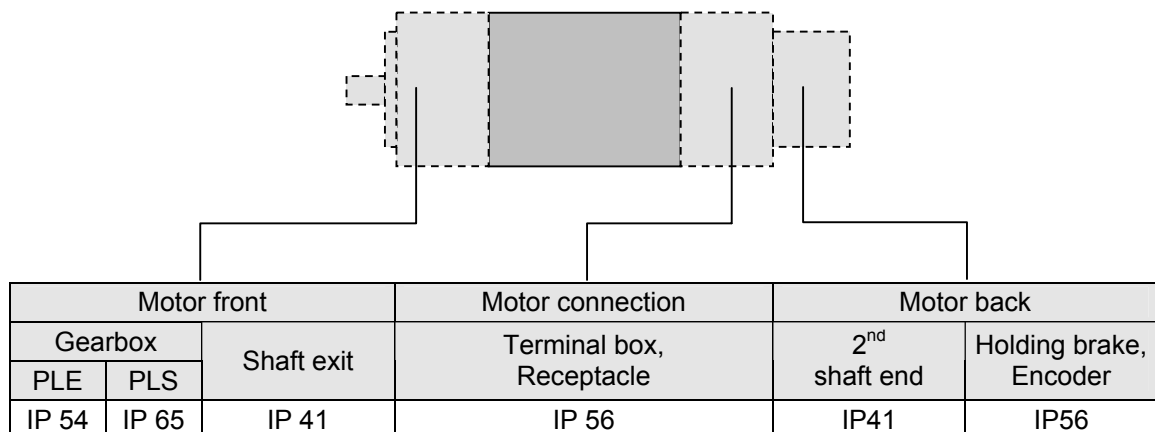
²⁾ Motors with terminal box, receptacle or encoder



- Axial and radial loading must not occur simultaneously.
- The shaft must be supported if components are pressed onto the shaft ends.

Degree of protection

The degree of protection of your motor version is shown in the following diagramm.



Ambient conditions

Climate:

(with reference to DIN 50019-R14)

Temperature (t): -25°C to +40°C

Atmospheric humidity (U): ≤ 75 % RH annual average / 95 % RH on 30 days / without condensation

Storage and transportation temperature:

-25°C to +70°C

Motor service life

Where motors are operated under technically correct conditions, the service life is largely depend on the service life of the bearing.

The following operating conditions may significantly reduce the service life of the motor:

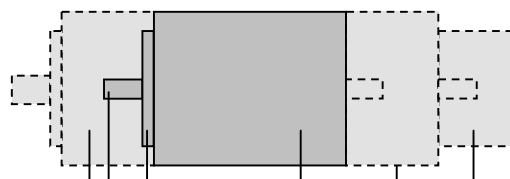
- Installation at altitudes over 1000 m above mean sea level
- Continuous operating temperatures greater than 80°C
- Angular travel less than 100°
- Operation with very high rotation accelerations
- Operation und vibration loads greater than 20 m/s²
- High cyclic frequencies
- Running with dry sealing rings
- Wetting seals with aggressive media

Motor versions

Our flexible modular system and the latest version management techniques enable us to supply the following versions. The dimensions and a detailed information are shown in the variants section on page 10.

Pease also see thy type code on page 9.

Schematic representation



Gearbox	Shaft version		Centring collar	Motor type VRDM 3xx			Motor connection	Options
				Size	Length	Winding		
3:1	Feather Key	Ø 19	Ø 56 mm	110	17 22	W	Terminal box ¹⁾ Receptacle	2 nd shaft end ²⁾
5:1								Holding brake ²⁾
8:1								Encoder ³⁾

¹⁾ Terminal strip inside the motor, sealed with a cable gland, EMC-tested

²⁾ Choice between 2nd shaft end or holding brake. Both cannot be fitted simultaneously

³⁾ Motors with receptacle only (2nd shaft end or a holding brake is also possible)

Encoder

3-phase stepping motors can optionally be fitted with an encoder. This system of measurement returns the actual position if the power drive is equipped with a rotation monitoring circuit. The rotation monitoring circuit compares the setpoint and actual positions of the motor and signals an error if the difference between the two exceeds a certain limit (contouring error limit). This will detect overloading of the motor, for example.



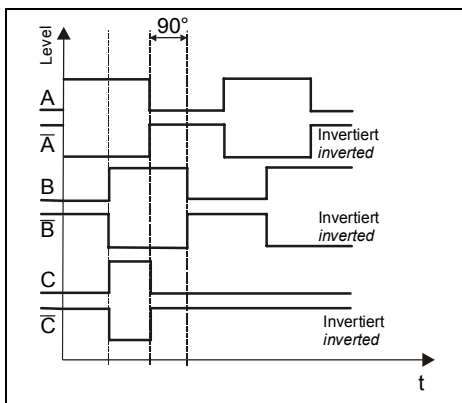
An Encoder can only be fitted on motors equipped with a receptacle. A second shaft end or a holding brake can also be used.

Technical data

Resolution	1000 Increments / revolution
Index pulse	1 increment / revolution
Output	RS 422
Signals	A; B; I
Pulse waveshape	Rechteck
Supply voltage	5V \pm 5%
Current	Up to 0.15 A



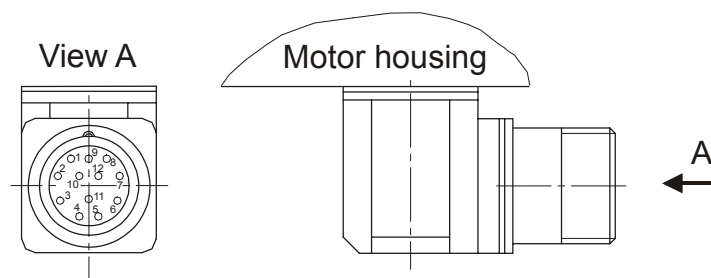
Timing diagram



Notes:

- A Temperature sensor is integrated.
- The shield must be connected to both the motor and the device.

Connection



PIN Designation

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



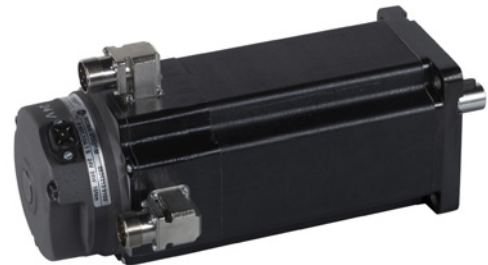
Any strands that are not used must be separately insulated (to prevent the risk of short-circuits)

Holding brake

The holding brake is an electromagnetic spring-pressure brake which holds the motor shaft in position when there is no current to the motor (e.g. in the event of a power failure or emergency stop). This holding function is needed for applications in which weight on the shaft can cause excessive torque, e.g. the Z axes of handling equipment.

Technical data

Rated voltage	24 V
Holding torque	16 Nm
Power consumption	28 W
Moment of inertia	0.35 kgcm ²
ON time (disengage brake)	60 ms
OFF time (engage brake)	30 ms
Weight	Approx. 2 kg



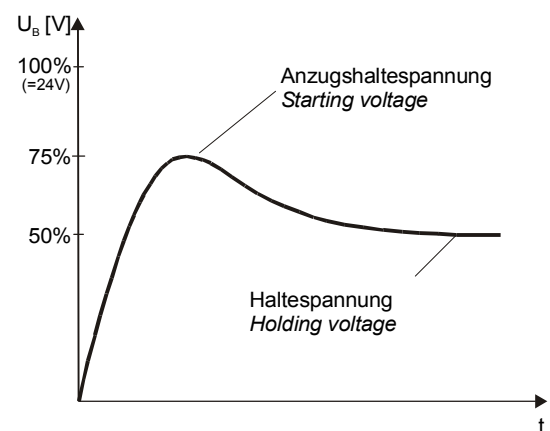
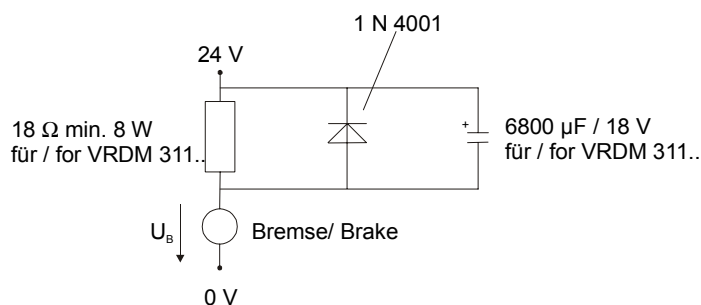
VRDM 31122 with encoder and brake



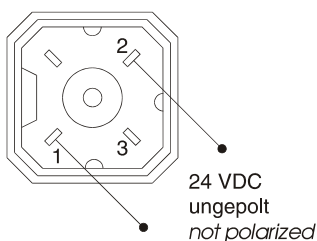
For the brake to work reliably on Z axes with a holding brake the static load torque must not exceed 25% of the motor's holding torque.

Drive circuit

The drive circuit must be electrically excited in order to disengage the brake. To prevent overheating, the excitation current should be reduced as soon as the brake is disengaged. The recommended circuit arrangement is shown in the following diagram.



Connection



The plug is supplied with the motor.

Plug designation: Hirschmann type G4 A 5M



The holding torque of the brake is reduced by approximately 50% at an operating temperature of 120°C.

Gearbox options

The following tables show available combinations of motor and gearbox.

Refer to gearbox datasheet for further information.

Gearbox type PLE

Economic precision planetary gearbox (Single-stage gearbox)

Configuration options

Grey highlighted	recommended types
Bold highlighted	Limiter of torque by gear box or motor
x	gearbox over or under-sized or uneconomic

M _{d0} [Nm]	Motor	Gearbox	3:1		5:1		8:1	
			M _{dG} ¹⁾	M _{maxG} ²⁾	M _{dG} ¹⁾	M _{maxG} ²⁾	M _{dG} ¹⁾	M _{maxG} ²⁾
			[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
12	VRDM 31117	with PLE 120	80	36	110	60	120	96
17,5	VRDM 31122		80	52,5	110	87,5	120	140
17,5	VRDM 31122	with PLE 160	x	x	x	x	450	140

Index G (M_{xxG}) -> in relation to gearbox output shaft

- 1) M_{dG} continuous gearbox output torque
 2) M_{maxG} max. output torque with this motor
 (theoretical value calculated from: max. motor torque M_{max} x gear ratio)

i

The continuous gearbox output torque M_{dG} may not be continuously exceeded.
 For a short period, e.g. in an emergency shutdown situation, twice this torque is permitted.

Gearbox type PLS

High-quality, low-backlash, planetary gearbox (Single-stage gearbox)

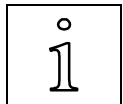
Configuration options

Grey highlighted	recommended types
Bold highlighted	Limiter of torque by gear box or motor
x	gearbox over or under-sized or uneconomic

M_{d0} [Nm]	Motor	Gearbox	3:1		5:1		8:1	
			$M_{dG}^{1)}$	$M_{maxG}^{2)}$	$M_{dG}^{1)}$	$M_{maxG}^{2)}$	$M_{dG}^{1)}$	$M_{maxG}^{2)}$
			[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
12	VRDM 31117	with PLS 115	150	36	210	60	148	96
17,5	VRDM 31122		150	52,2	210	87,5	148	140

Index G (M_{xxG}) -> in relation to gearbox output shaft

- 1) M_{dG} gearbox output torque (continuous)
 2) M_{maxG} max. output torque with this motor
 (theoretical value calculated from: max. motor torque M_{max} x gear ratio)



*The continuous gearbox output torque M_{dG} may not be continuously exceeded.
 For a short period, e.g. in an emergency shutdown situation, twice this torque is permitted.*

Type code

Example:

VRDM 3 11 22 / 50 L W C E B IP 41

VRDM	X	X	X	/	50	L	X	X	X	X	IP	X
------	---	---	---	---	----	---	---	---	---	---	----	---

Number of phases

3

Size (flange)

11 (approx. 110 mm)

Length

17 overall approx. 180 mm
22 overall approx. 230 mm

Number of pairs of poles

50

Laminated rotor

L

Winding identification

W 230 V_{AC} (325 V_{DC})
S special modell

Motor connection

B terminal box
C receptacle, straight connector
T receptacle, right-angled

System of measurement

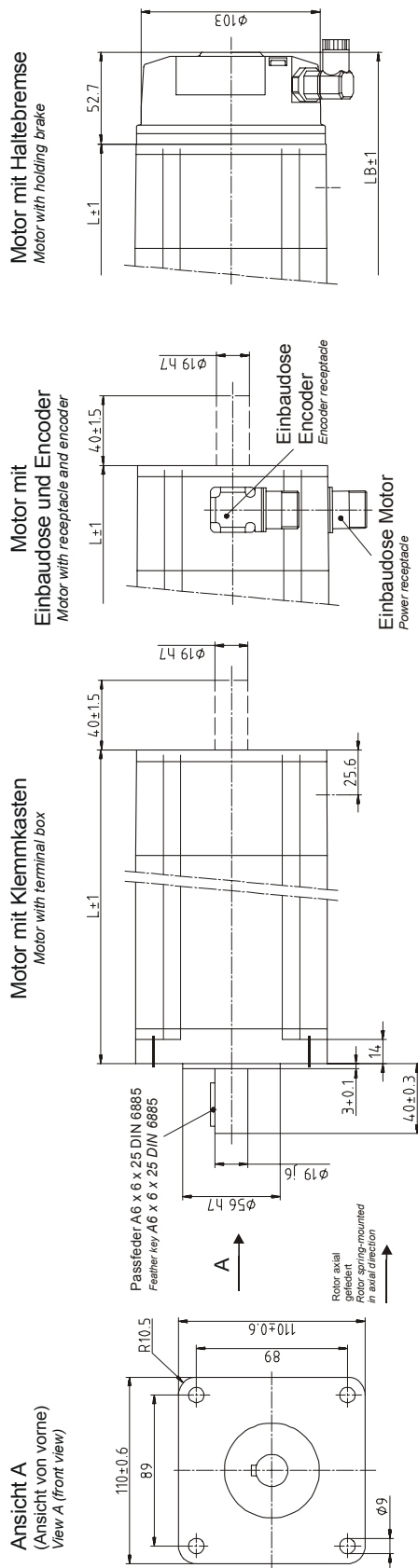
E with encoder (1000 increments / revolution)
O without encoder

Holding brake

B with holding brake
O without holding brake

Degree of protection

Variants



Motoranschluss

Motor connection

- ☐

Motor mit Klemmkasten
Motor with terminal box

☐

Kabelverschraubung
Pg 16 für Kabel ø 9 bis ø 13
Cable gland PG 16 for cable diameter 9 to 13

☐

**Motor mit Einbaudose
gerader Abgang**
*Power receptacle
straight connector*

☐

**Motor mit Einbaudose
90° abgewinkelt**
Power receptacle, right-angled

☐

nach hinten zeigend
Pointing to the back

☐

nach vorne zeigend
Pointing to the front

☐

nach links zeigend
Pointing to the left

☐

nach rechts zeigend
Pointing to the right

Messsystem

System of measurement

- ☐ ohne Encoder
Without encoder

☐ mit Encoder
With encoder

☐ Einbaudose
gerader Abgang
Signal receptacle, straight connector

☐ Einbaudose
90° abgewinkelt
Signal receptacle, right-angled

☐ nach hinten zeigend
Pointing to the back

☐ nach vorne zeigend
Pointing to the front

☐ nach links zeigend
Pointing to the left

☐ nach rechts zeigend
Pointing to the right

Optionen

- | | | |
|--|---|---|
| <p>2. Wellenende
2nd shaft end</p> | <p>ohne 2. Wellenende
Without 2nd shaft end</p> | <p>mit 2. Wellenende
With 2nd shaft end</p> |
| <p>Haltebremse
Holding brake</p> | <p>ohne Haltebremse
Without holding brake</p> | <p>mit Haltebremse
With holding brake</p> |

Getriebe
Gearbox

- | | | | |
|--------------------------|---|------------------------------|------------------------------|
| <input type="checkbox"/> | ohne Getriebe
<i>Without gearbox</i> | | |
| <input type="checkbox"/> | mit Getriebe
<i>With gearbox</i> | <input type="checkbox"/> PLE | <input type="checkbox"/> 3:1 |
| <input type="checkbox"/> | | <input type="checkbox"/> PLS | <input type="checkbox"/> 5:1 |
| <input type="checkbox"/> | | | <input type="checkbox"/> 8:1 |

Dear Customer

This page shows the motor variants that can be supplied as standart.

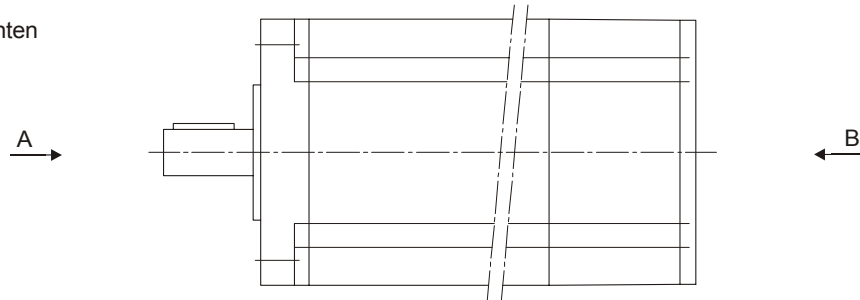
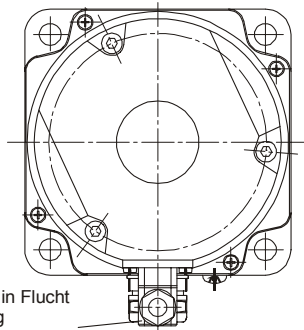
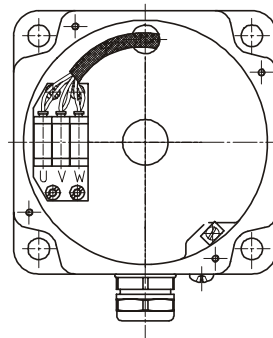
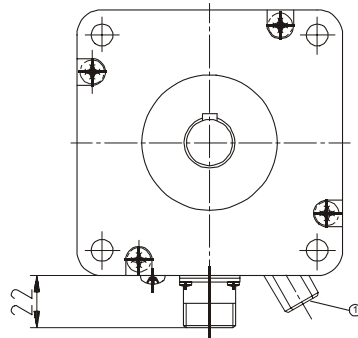
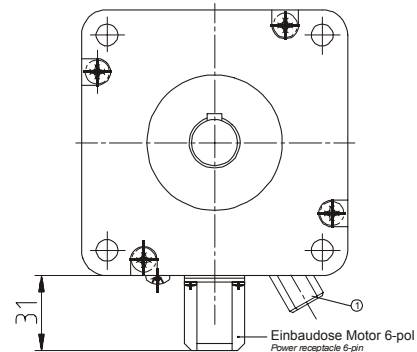
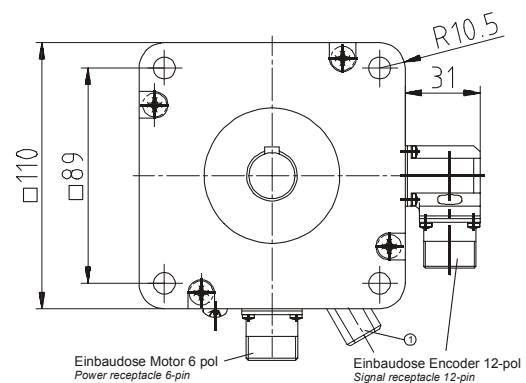
Baugröße - Wicklung

Size - Winding version

Motor-Type	Motor winding	
Motor-type	L	W
VRDM 31117	180	○
VRDM 31122	228	○


○ Variante möglich / Variants possible
 --- Variante in Vorbereitung / Variants in preparation

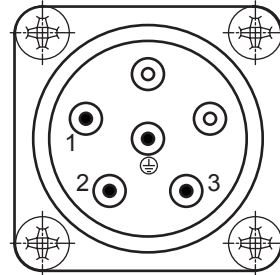
Variants

Vorder- und Rückansichten der Motorvarianten
Views from the motor versionsAnsichten
ViewsMotor mit Klemmkasten
Motor with terminal boxAnsicht B
View BHaltebremsenstecker in Flucht
der PG Verschraubung
Brake plug position behind the cable glandAnsicht B
ohne Haltebremse
View A, without holding brakeMotor mit Einbaudose
Motor with receptacleAnsicht A
Einbaudose, gerader Abgang
View A
Receptacle, straight connectorAnsicht A
Einbaudose, 90° abgewinkelt
View A
Receptacle, right-angledMotor mit Encoder
Motor with encoderAnsicht A
Ansicht der Standardeinbaudosen
View A
View with standard receptacles① Steckerposition der Haltebremse (wenn vorhanden)
brake plug positionEinbaudose Motor 6-pol
Power receptacle 6-pinEinbaudose Encoder 12-pol
Signal receptacle 12-pin

Motor connection

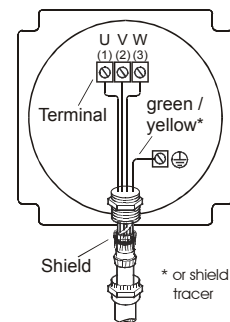
Motor with receptacle

Pin	Designation
1	U
2	V
3	W
	PE



Motor with terminal box (symbolic)

Cable colours	Designation
brown	U
blue	V
black	W
green / yellow	PE



Notes:

- The protective earth (or shield tracer) must be connected to both the motor and the device
- If the cables are connected in a terminal box, simply unscrew the four Phillips screws on the box. Do not remove the brake!
- Outer terminal is the EMC terminal



The direction of rotation of the motor shaft can be inverted by swapping over two terminals (e.g. U, V or V, W).