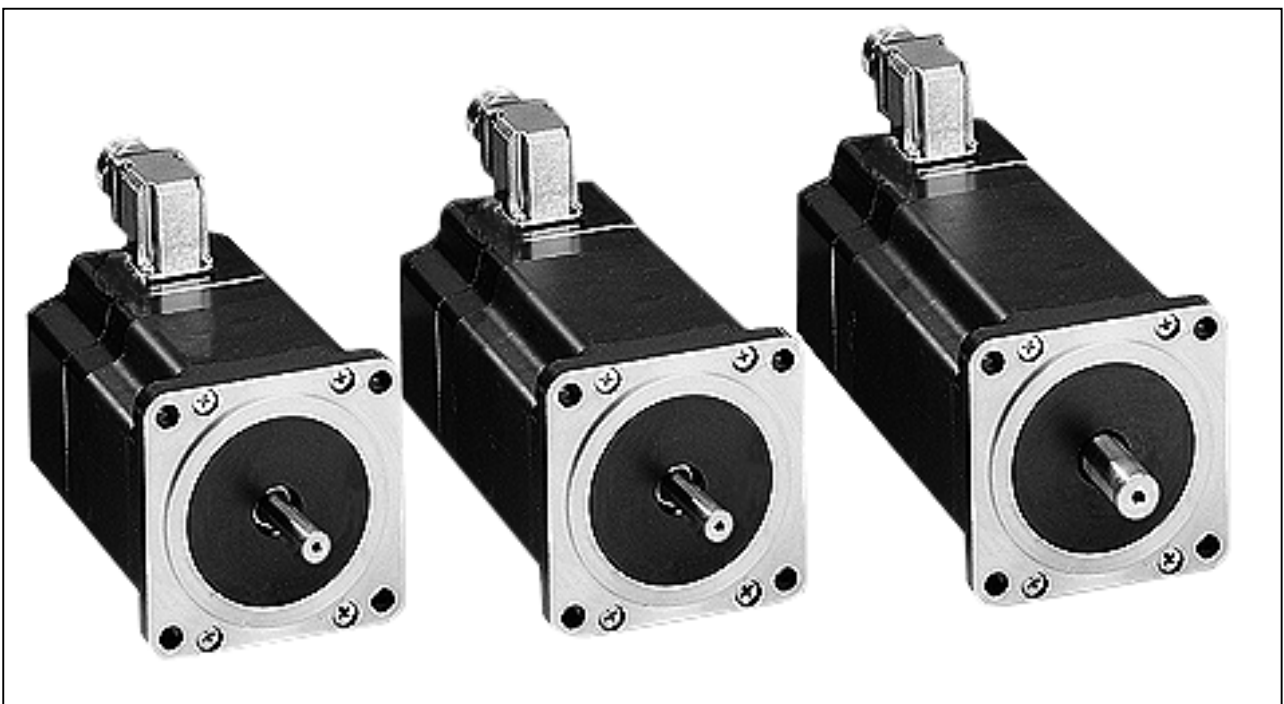


# 3-PHASEN STEPPING MOTOR

## VRDM39x



09/99 EDITION

**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, operation, 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 specifications**

The motor type specification is largely made up of the size and length.

For example: VRDM 397 = 3-phase stepping motor of size 90 (i.e. the length of the connecting flange is approximately 90 mm) and of length 70 (i.e. the length of the motor [stator package and flanges] is approximately 70 mm)

| Motor type  |                                |                   | VRDM 397  | VRDM 3910 | VRDM 3913 |      |
|---|--------------------------------|-------------------|---|-----------|-----------|------|
| Max. torque                                       | M <sub>m</sub>                 | Nm                | LN <sup>5)</sup>                                      | 2         | 4         | 6    |
|   |                                |                   | LW <sup>7)</sup>                                      |           |           |      |
|   |                                |                   | LH <sup>6)</sup>                                      | 1,7       | 3,7       | -    |
| Holding torque                                    | M <sub>H</sub>                 | Nm                | LN <sup>5)</sup>                                      | 2,26      | 4,52      | 6,78 |
|   |                                |                   | LW <sup>7)</sup>                                      |           |           |      |
|   |                                |                   | LH <sup>6)</sup>                                      | 1,92      | 4,18      | -    |
| Rotor inertia                                     | J <sub>R</sub>                 | kgcm <sup>2</sup> | 1,1   | 2,2       | 3,3       |      |
| Number of steps <sup>1)</sup>                     | z                              |                   | 200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000   |           |           |      |
| Step angle <sup>1)</sup>                          | α                              | °                 | 1,8 / 0,9 / 0,72 / 0,36 / 0,18 / 0,09 / 0,072 / 0,036 |           |           |      |
| Systematic angle tolerance per step <sup>2)</sup> | Δα <sub>s</sub>                | '                 | ±6  |           |           |      |
| Max. starting frequency <sup>1)</sup>             | f <sub>Aom</sub> <sup>4)</sup> | kHz               | LN <sup>5)</sup>                                      | 5,3       |           |      |
|   |                                |                   | LW <sup>7)</sup>                                      |           |           |      |
|   |                                |                   | LH <sup>6)</sup>                                      | 5         | 4,8       | -    |
| Rated current of incoming cable                   | I <sub>w</sub>                 | A                 | LN <sup>5)</sup>                                      | 4,4       | 5,0       | 5,0  |
|   |                                |                   | LH <sup>6)</sup>                                      | 5,5       | 5,5       | -    |
|   |                                |                   | LW <sup>7)</sup>                                      | 1,75      | 2,0       | 2,25 |
| Winding resistance                                | R <sub>w</sub>                 | Ω                 | LN <sup>5)</sup>                                      | 1,0       | 1,2       | 1,3  |
|   |                                |                   | LH <sup>6)</sup>                                      | 0,35      | 0,55      | -    |
|   |                                |                   | LW <sup>7)</sup>                                      | 6,5       | 5,8       | 6,5  |
| Current rise constant                             | τ                              | ms                | ~ 7   | ~ 9       | ~ 10      |      |
| Shaft load  |                                |                   | See page 4  |           |           |      |
| Motor voltage                                     | U                              | V                 | LN <sup>5)</sup>                                      | 130       |           |      |
|   |                                |                   | LH <sup>6)</sup>                                      | 40        |           |      |
|   |                                |                   | LW <sup>7)</sup>                                      | 325       |           |      |
| Approximate weight <sup>3)</sup>                  | m                              | kg                | 1,65 / 2,05   | 2,7 / 3,1 | 3,8 / 4,2 |      |

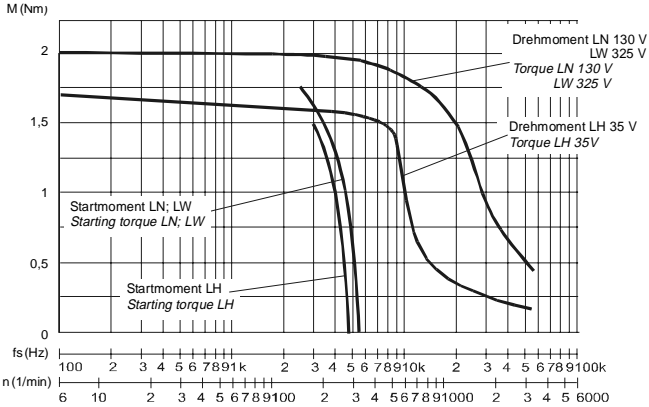
Terms and symbols taken from DIN 42021 part 2

- <sup>1)</sup> With suitable power drive
- <sup>2)</sup> Measured at 1000 steps / revolution, unit in minutes
- <sup>3)</sup> Weight of the motor with stranded wire connection
- <sup>4)</sup> f<sub>Aom</sub> = Starting frequency at no load
- <sup>5)</sup> LN = Normal winding
- <sup>6)</sup> LH = Heavy-current winding (operated with D 920; up to 40 V is possible)
- <sup>7)</sup> LW = Wall-mounted winding

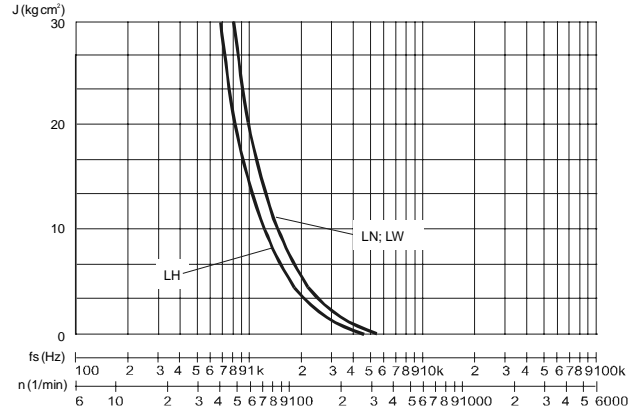


Characteristic curves

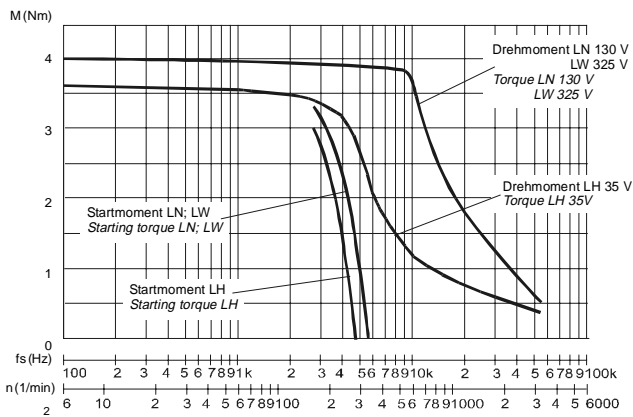
**Torque characteristics of VRDM 397/50**  
 (LH 35V operation with D 920; 35VDC; In = 5,5A; 1000SpR)  
 (LN 130V operation with D 900; 130VDC; In = 4,4A; 1000SpR)  
 (LW 325V operation with WDP-004; 325VDC; In = 1,8A; 1000SpR)



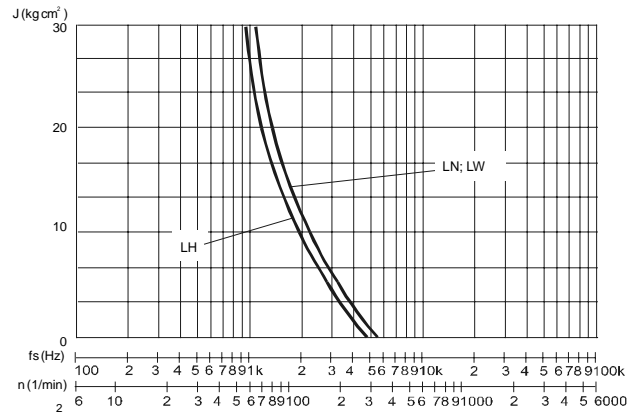
**Starting / stopping characteristics of VRDM 397/50**  
 (in relation of the load inertia)



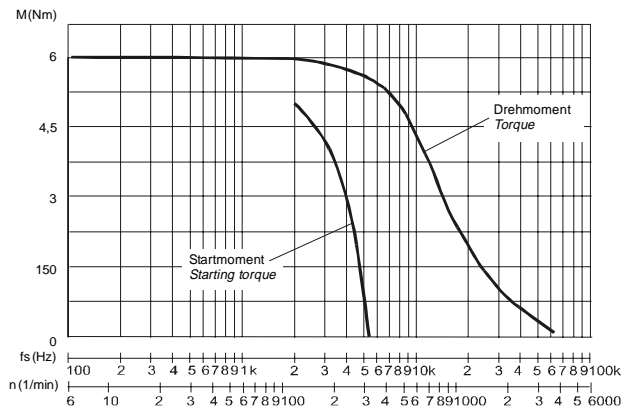
**Torque characteristics of VRDM 3910/50**  
 (LH 35V operation with D 920; 35VDC; In = 5,5A; 1000SpR)  
 (LN 130V operation with D 900; 130VDC; In = 5A; 1000SpR)  
 (LW 325V operation with WDP-004; 325VDC; In = 2A; 1000SpR)



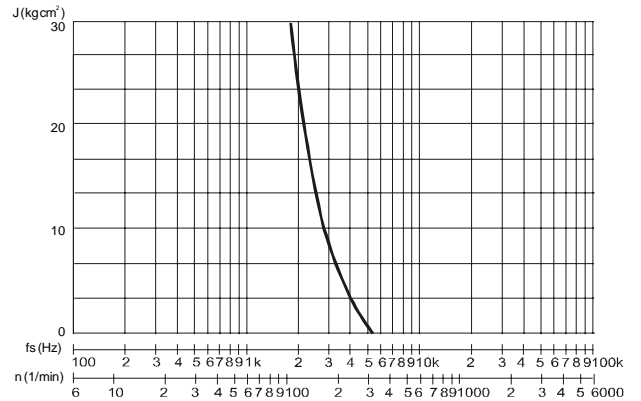
**Starting / stopping characteristics of VRDM 3910/50**  
 (in relation of the load inertia)



**Torque characteristics of VRDM 3913/50**  
 (LN 130V operation with D 900; 130VDC; In = 5A; 1000SpR)  
 (LW 325V operation with WDP-004; 325VDC; In = 2,3A; 1000SpR)



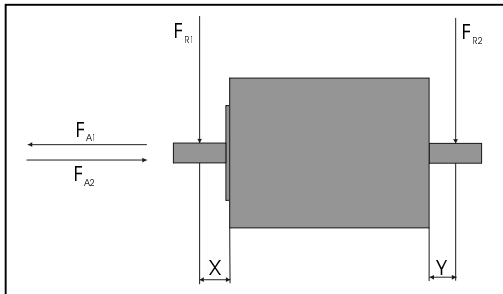
**Starting / stopping characteristics of VRDM 3913/50**  
 (in relation of the load inertia)



\* 1000 SpR = 1000 Steps / revolution

### Shaft load

Even when the motors are used perfectly correctly, their service life is still limited by the service life of the bearing. The bearing must not be changed by the customer because this operation partially demagnetises the motor, causing it to loose power.



Conditions:

- Nominal bearing life <sup>3)</sup>  $L_{10h} = 20,000$  hours
- Speed  $n = 600$  rpm
- Ambient temperature  $= 40$  °C  
( $\approx 80$ °C bearing temperature)
- Rated torque  $= 100$  % c.d.f.
- Point of application of forces  $X = 15$  mm  
 $Y = 15$  mm

| Motor   |              | VRDM 397; VRDM 3910 | VRDM 3913          |
|---|--------------|---------------------|--------------------|
| <b>Max. radial force</b><br>Front<br>$F_{R1}$         | 100 % c.d.f. | 100 N               | 110 N              |
| <b>Max. radial force</b><br>2nd shaft end<br>$F_{R2}$ | 100 % c.d.f. | 75 N <sup>1)</sup>  | 50 N <sup>2)</sup> |
| <b>Max. axial force</b><br>Pull<br>$F_{A1}$           | 100 % c.d.f. | 170 N               |                    |
| <b>Max. axial force</b><br>Push<br>$F_{A2}$           | 100 % c.d.f. | 30 N                |                    |

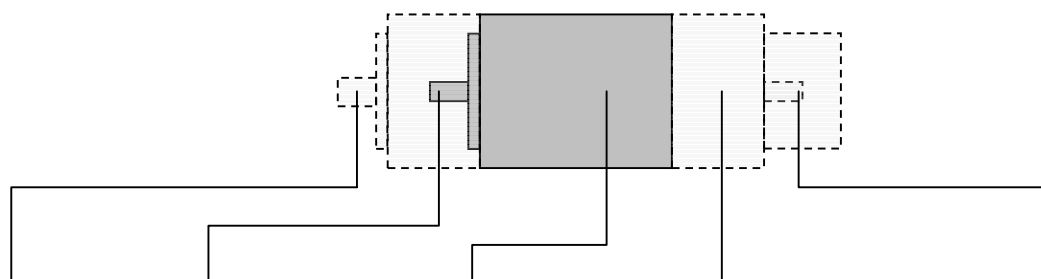
<sup>1)</sup> Stranded wire version  
<sup>2)</sup> Version with terminal or plug and encoder  
<sup>3)</sup> In operating hours with a 10% probability of failure



**Warning:**  
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 diagram:



| Gearbox | Front shaft exit | Type of connection |                  | Options       |                        |
|---------|------------------|--------------------|------------------|---------------|------------------------|
|         |                  | Stranded wire      | Terminal or plug | 2nd shaft end | Holding brake, encoder |
| IP 54   | IP 41            | IP 41              | IP 56            | IP 41         | IP 56                  |

**Ambient conditions**

**Climate:**

(with reference to DIN 50019 R14)

Temperature t: -25°C.....+40°C

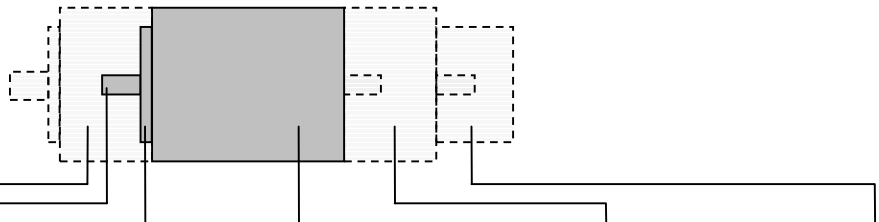
Atmospheric humidity U: ≤ 75 % RH annual average / 95 % RH on 30 days without condensation

**Storage and transportation temperature:**

-25°C to 70°C

**Motor 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 9.



| Gearbox            | Shaft version    |   | Centring collar    | Motor type VRDM 3xx |               | Connection             |   | Options   |
|--------------------|------------------|---|--------------------|---------------------|---------------|------------------------|---|---|
|                    | Size             | Length  |                    | Voltage             | Type          |                        |   |   |
| 3:1<br>5:1<br>10:1 | Surface-finished | ∅ 9,5 <sup>1)</sup><br>∅ 12 <sup>1)</sup><br>∅ 14 <sup>1)</sup> | ∅ 60 mm<br>∅ 73 mm | 90                  | 7<br>10<br>13 | 40 V<br>130 V<br>325 V | Stranded wire<br>Terminal <sup>2)</sup><br>Plug | 2nd shaft end <sup>3)</sup><br>Holding brake <sup>3)</sup><br>Encoder <sup>4)</sup> |

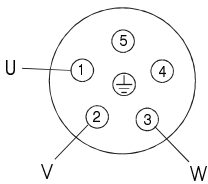
<sup>1)</sup> ∅ 9.5 mm and ∅ 12 mm for VRDM 397; ∅ 14 mm for VRDM 3913

<sup>2)</sup> Terminal strip inside the motor, sealed with a cable gland, EMC-tested

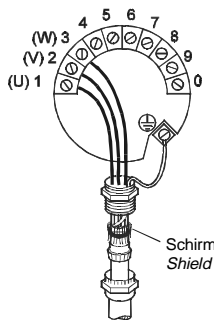
<sup>3)</sup> Choice between 2nd shaft end or holding brake. Both cannot be fitted simultaneously

<sup>4)</sup> With plug connection only (2nd shaft end or a holding brake is also possible)

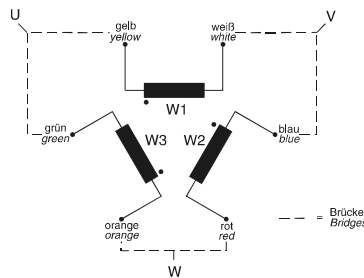
**Motor connection**



Motor with plug



Motor with terminals



Motor with stranded wires

**Notes:**

In motors with stranded wire connections, the wires shown in the diagram must be bridged.

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

| Pin | Designation       | Cable colour |
|-----|-------------------|--------------|
| 1   | U                 | Brown        |
| 2   | V                 | Blue         |
| 3   | W                 | Black        |
| 4   | Not assigned      |              |
| 5   | Not assigned      |              |
| ⊕   | Shield drain wire |              |

**Notes:**

- Connect shield wire to both motor and device
- Protective earth is connected to the motor cable
- Outer terminal is the EMC terminal

**Warning:**

If the cables are connected in a terminal box, simply unscrew the four Phillips screws on the box. Do not remove the brake.

These cable colours apply to SIG BERGER LAHR motor cables

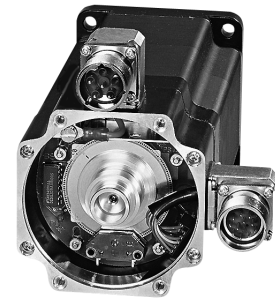
**Encoder**

3-phase stepping motors can optionally be fitted with encoders. The encoder 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.

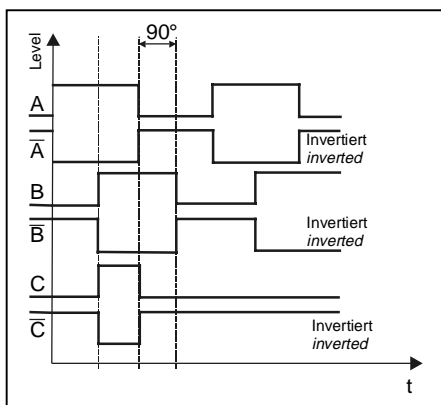
Motors fitted with an encoder normally have a plug connection, although a second shaft end or a holding brake can also be supplied.

**Technical data**

|                 |                              |
|-----------------|------------------------------|
| Resolution      | 1000 increments / revolution |
| Index pulse     | 1 pulse / revolution         |
| Output          | RS 422                       |
| Signals         | A, B, I                      |
| Pulse waveshape | Square-wave                  |
| Supply voltage  | 5 V ± 5%                     |
| Current         | Up to 0.15 A                 |

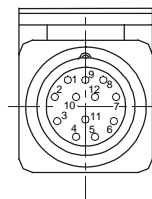


**Timing diagram**

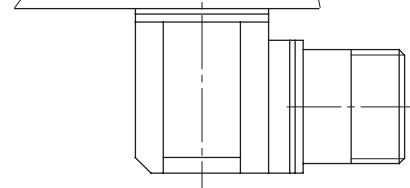


**Connection**

View A



Motor housing



← A

| Pin | Designation        |
|-----|--------------------|
| 1   | A                  |
| 2   | A (-)              |
| 3   | B                  |
| 4   | B (-)              |
| 5   | C, I               |
| 6   | C (-), I (-)       |
| 7   | 5 VGND             |
| 8   | + 5                |
| 9   | - SENSE            |
| 10  | + SENSE            |
| 11  | Temperature sensor |
| 12  | Not assigned       |

**Notes:**

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



**Warning:**

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

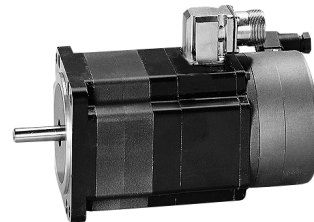


### Holding brake

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

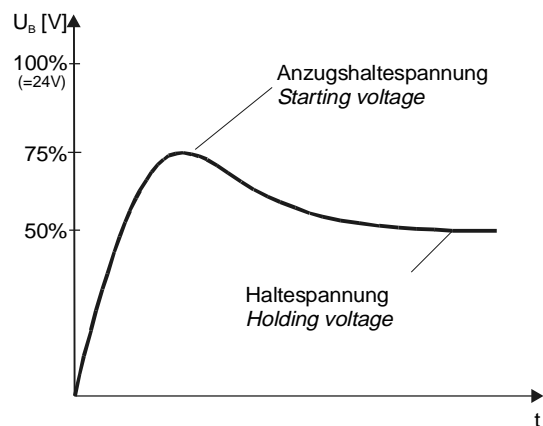
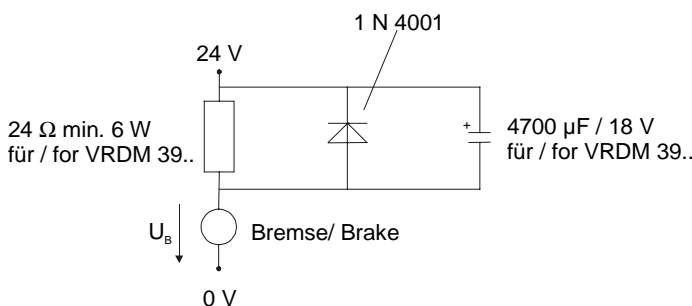
|                           |                       |
|---------------------------|-----------------------|
| Rated voltage             | 24 V                  |
| Holding torque            | 6 Nm                  |
| Power consumption         | 24 W                  |
| Moment of inertia         | 0.2 kgcm <sup>2</sup> |
| ON time (disengage brake) | 40 ms                 |
| OFF time (engage brake)   | 20 ms                 |
| Weight                    | Approx. 1.5 kg        |



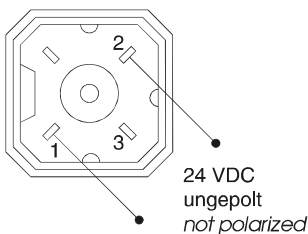
VRDM 397 encoder and break

### 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.

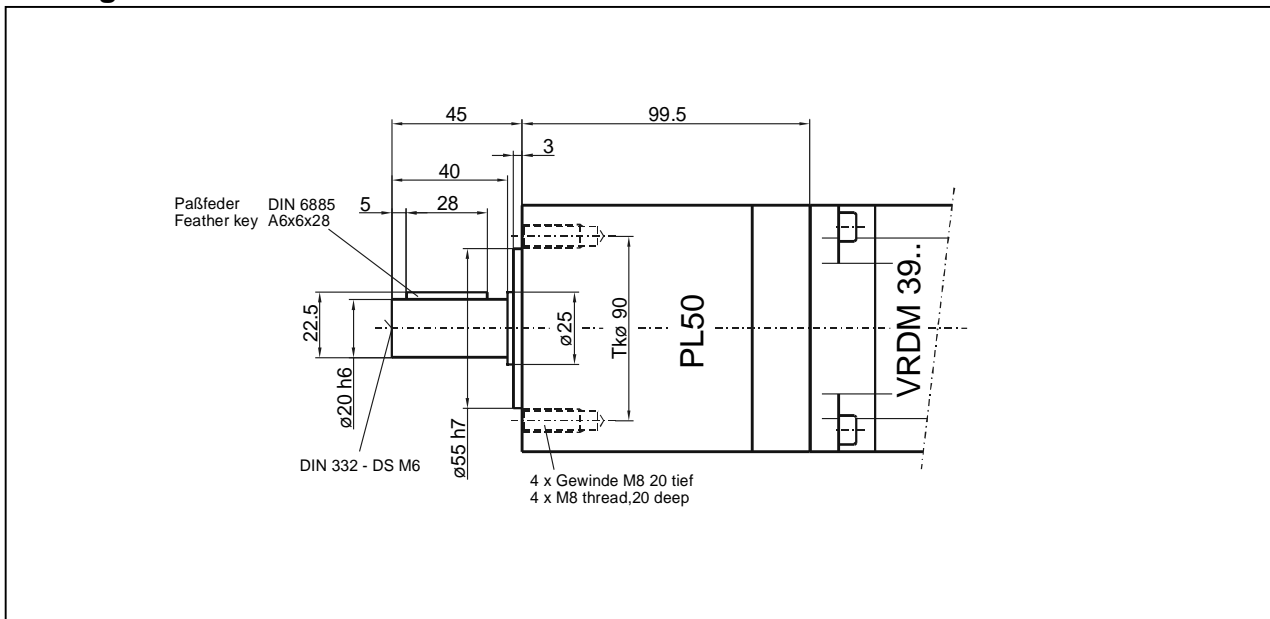
Plug designation: Hirschmann type G4 A 5M



### Warning

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.

**PL 50 gearbox**



**Technical data**

|   |   |
|---|---|
| <b>PL 10 planetary gearbox</b>            |   |
| Suitable for motors                       | VRDM 397, VRDM 3910, VRDM 3913  |
| Gear type                                 | Single-stage spur-toothed planetary gearbox   |
| Nominal bearing life <sup>2</sup>         | L <sub>10h</sub> = 20,000 hours   |
| Max. admissible radial load <sup>1)</sup> | 690 N bei n <sub>2</sub> <sup>5)</sup> = 200 min <sup>-1</sup> / 550 N bei n <sub>2</sub> <sup>5)</sup> = 400 min <sup>-1</sup> |
| Max. admissible axial load <sup>1)</sup>  | 730 N bei n <sub>2</sub> <sup>5)</sup> = 200 min <sup>-1</sup> / 580 N bei n <sub>2</sub> <sup>5)</sup> = 400 min <sup>-1</sup> |
| Max. admissible pressing force            | 1000 N  |
| Torsional backlash                        | <12'  |
| Reduction ratio                           | 3:1 , 5:1 , 10:1  |
| Efficiency                                | 90 % at rated load  |
| Housing material                          | Aluminium   |
| Surface finish                            | Black anodised  |
| Shaft material                            | C 45  |
| Bearing                                   | Roller bearing  |
| Shaft seal                                | IP 54   |
| Lubrication                               | Greased for life  |
| Temperature range                         | -20 °C to +80 °C  |
| Weight                                    | Approx. 2.3kg   |

| <b>Gearbox variants (reduction ratio)</b>                        | <b>3:1</b>           | <b>5:1</b>           | <b>10:1</b>         |
|--|----------------------|----------------------|---------------------|
| Moment of inertia  | 63 kgmm <sup>2</sup> | 14 kgmm <sup>2</sup> | 7 kgmm <sup>2</sup> |
| Continuous output torque <sup>3)</sup>                           | 38 Nm                | 50 Nm                | 41 Nm               |
| Maximum torque in relation to the gearbox variant and motor type |                      |                      |                     |
| VRDM 397 LN, LW / LH   | 6 Nm / 5,1 Nm        | 10 Nm / 8,5 Nm       | 20 Nm / 17 Nm       |
| VRDM 3910 LN, LW / LH  | 12 Nm / 11,1 Nm      | 20 Nm / 8,5 Nm       | 40 Nm / 37 Nm       |
| VRDM 3913 LN, LW / LH  | 18 Nm / -            | 30 Nm / -            | 60 Nm / -           |

<sup>1)</sup> Related to the centre of the shaft or half the shaft length. Axial and radial loading must not occur simultaneously  
<sup>2)</sup> In operating hours with a 10% probability of failure, 100 % c.d.f. for continuous output torque, operating mode S1 (continuous operation); Bearing temperature = 30 °C  
<sup>3)</sup> The output torque of the gearbox falls within the fatigue strength range of the gearing parts (not including the motor); twice the specified torque is possible temporarily when an emergency stop is triggered.  
<sup>4)</sup> The output torque of the gearbox either limits the torque or makes this variant impractical.  
<sup>5)</sup> Output speed of the gearbox



Variants

**Wellenausführung / Zentrierbund**  
Shaft key / Centring collar

**Zentrierbund**  
Centring collar

$\phi$  60 h8

$\phi$  73 h8

Rotor axial gelagert  
Rotor spring-mounted in axial direction

**Wellendurchmesser**  
Shaft diameter  
VRDM 397 / 3910 :  $\phi$  9,5 h6 oder  $\phi$  12 h6  
VRDM 3913 :  $\phi$  14 h6

**Wellendurchmesser**  
Shaft diameter  
 Welle  $\phi$  9,5  
shaft diameter  
 Welle  $\phi$  12  
shaft diameter

**Wellenausführung**  
 ohne Bearbeitung  
unfinished  
 Scheibfeder DIN 6888  
Woodruff key DIN 6888  
Wellen- $\phi$   
Shaft diameter  
 $\phi$  9,5 : 3 x 5 DIN 6888  
 $\phi$  12 : 4 x 6,5 DIN 6888  
 $\phi$  12 : 5 x 6,5 DIN 6888

**Fläche**  
Surface-finished  
  $\pm 0,1$   
 $2,5 \pm 0,5$

**Wellen- $\phi$**   
Shaft diameter  
 $\phi$  9,5 : 8,5  
 $\phi$  12 : 11  
 $\phi$  12 : 13

**Querbohrung**  
Cross-drilled hole  
 $\phi$  .....  $\pm 0,2$   
H11

**Motor mit Litzen**  
Motor with stranded wire connection

VRDM 397 = 67,5 — +0,6  
VRDM 3910 = 97,5 — -0,8  
VRDM 3913 = 127,5 — 30  $\pm$  1,5

Welle hinten  
Shaft at back

**Litzenaustritt**  
Wire exit  
 hinten / at back  
 seitlich / at side

bei Wellenaustritt hinten,  
nur Litzen seitlich möglich  
The wires must exit at the back if the shaft exits at the back

Litzenzlänge  
Wire length  
Standard 400 mm  
Sonderlänge  
Other length  
< 400 mm: .....

**Motor mit Klemmen**  
Motor with terminal connection

**Motor mit Stecker**  
Motor with plug connection

VRDM 397 = 110,5 — +0,7  
VRDM 3910 = 140,5 — -1,0  
VRDM 3913 = 170,5 — 30  $\pm$  1,5

Welle hinten  
Shaft at back

**Motor mit Klemmen :**  
Motor with terminal connection:  
Kabelverschraubung  
Cable gland PG 16 for cable diameter 9 to 13

**Motorstecker**  
Motor plug  
 ohne Winkel  
Straight entry  
 Abgewinkelt  
Angle-entry

**Motor von vorn gesehen**  
Viewing motor from the front  
nach hinten zeigend  
Pointing to the back  
nach vorn zeigend  
Pointing to the front  
nach rechts zeigend  
Pointing to the right  
nach links zeigend  
Pointing to the left

**Motor mit Encoder**  
Motor with encoder

VRDM 397 = 110,5 — +0,7  
VRDM 3910 = 140,5 — -1,0  
VRDM 3913 = 170,5 — 30  $\pm$  1,5

Encoderstecker  
Encoder plug

Welle hinten  
Shaft at back

**Motorstecker**  
Motor plug  
 Motor von vorn gesehen  
Viewing motor from the front

nach hinten zeigend  
Pointing to the back  
nach vorn zeigend  
Pointing to the front  
nach rechts zeigend  
Pointing to the right  
nach links zeigend  
Pointing to the left  
ohne Winkel  
Straight entry

**Encoderstecker**  
Encoder plug  
 nach hinten zeigend  
Pointing to the back  
 nach vorn zeigend  
Pointing to the front  
 nach rechts zeigend  
Pointing to the right  
 nach links zeigend  
Pointing to the left  
 ohne Winkel  
Straight entry

**Motor mit Bremse**  
Motor with brake

**Klemmen-, Stecker- oder Encoderausführung**  
Terminal plug or encoder version

VRDM 397 = 110 — +0,7  
VRDM 3910 = 140 — -1,0  
VRDM 3913 = 170 — 4,6,5

**Ansicht A**  
View A

**Motor mit Getriebe**  
Motor with gearbox

**Untersetzung / Reduction ratio**

3:1

5:1

10:1

Dear Customer

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

The next page contains the side views.

**VRDM 39x**

Variants

