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# Explosion-protected 3-Phase Stepping Motors

## ExRDM 3910 / ExRDM 3913



**ATTENTION**

*Please read the following description and connection instructions before installing this motor!*

**WARNING**

*To prevent ignition of hazardous atmosphere do not operate the motor in hazardous location with any securing screws or covers removed and do not remove any screws or cover while motor is in a hazardous location!*

**WARNING**

*The conduit seal must be listed for Class I, Zone 1, AExd IIC or Class I, Div. 1, Groups A, B, C, and D hazardous location!*

**ATTENTION**

*For supply connections, use cable rated for at least 90°C.*

**ATTENTION**

*The fuses and the stepping motor power drive must be installed outside of the explosion hazard area!*

**ATTENTION**

*The setted ratings of the power driver must not exceed the specified values for phase current, phase frequency and chopper voltage!*

The new explosion-protected 3-phase stepping motor ExRDM 3913 excels with a robust design, high torque and small dimensions.

The motor is conform to protection type AEx d IIC T4.

The torque of the 3-phase stepping motor ExRDM 3913 is 5.8 Nm.

**Power drives**

The ExRDM 3913 3-phase stepping motor can be driven via a 325 V power drive for 3-phase stepping motors such as the WD3-004.

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### Specifications of the motor

Motor type			ExRDM 3910	ExRDM 3913
Max. torque	$M_m$	Nm	3.6	5.8
Holding torque	$M_H$	Nm	4.0	6.55
Rotor inertia	$J_R$	kgcm <sup>2</sup>	2.2	3.3
Number of steps <sup>1)</sup>	$z$		200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000	
Step angle <sup>1)</sup>	$\alpha$	°	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036	
Systematic angle tolerance per step <sup>2)</sup>	$\Delta\alpha_s$	'	±6	
Max. starting frequency <sup>1)</sup>	$f_{Aom}$ <sup>3)</sup>	kHz	5	5.3
Rated current of incoming cable	$I_W$	A	1.6	
Winding resistance	$R_W$	Ω	7.5	9.3
Current rise constant	$\tau$	ms	~9	~11
Dynamic shaft load	axial radial	N	~60 ~110	
Motor voltage	$U$	V	325	
Protection type			AEx d IIC T4	
Approximate weight	$m$	kg	7.4	9.5

Terms and symbols taken from DIN 42021 part 2

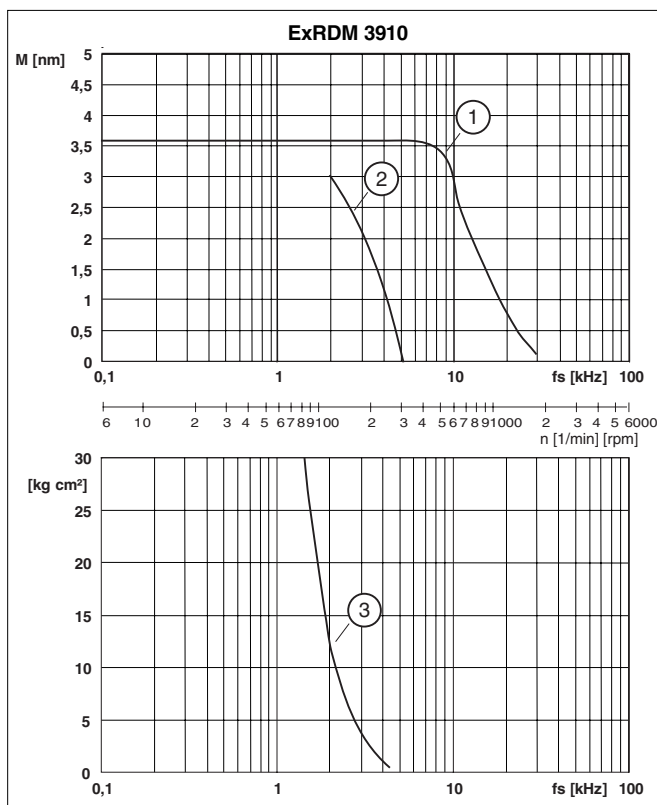
<sup>1)</sup> With suitable power drive    <sup>2)</sup> Measured at 1000 steps / revolution, unit in minutes    <sup>3)</sup>  $f_{Aom}$  = Max. starting frequency at no load

### Characteristics for ExRDM391x stepping motor

The following characteristics are shown:

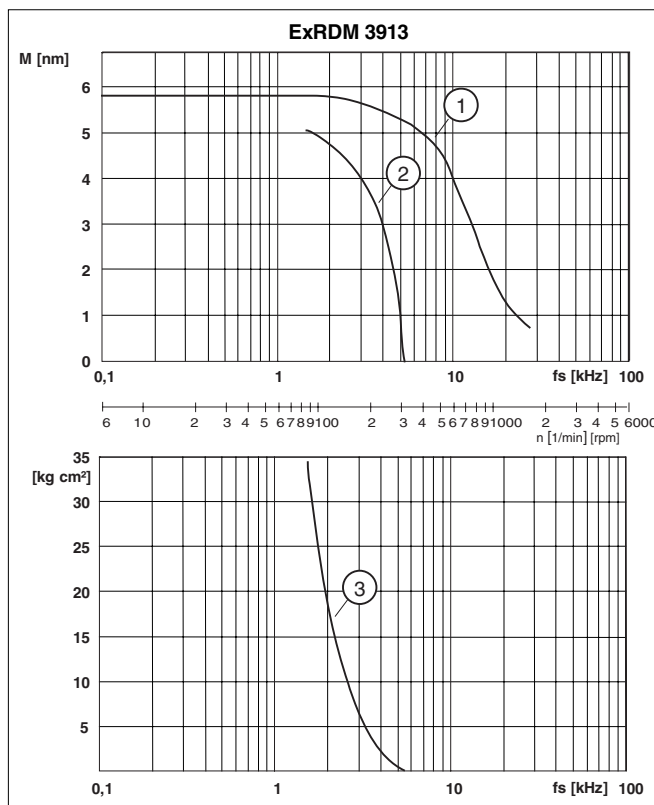
- maximum operating torque
- start-stop characteristic
- moment of inertia of the load (start/stop operation)

For determining the characteristics, the motors were driven with the WD3-004. The phase current was set to 1.6 A, the number of steps to 1000 steps/revolution.



(1) Pull-out torque  $M_{Bm}$

(2) Pull-in torque  $M_{Am}$



(3) Maximum load inertia  $J_{Lm}$

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### Motor ExRDM 391x with PL 50/100 gearbox

The ExRDM 3-phase stepping motor can be equipped with the PL 50 gearbox. The torque available during operation depends on the reduction ratio and on the efficiency of the gearbox. The table below shows the maximum torque and the moments of inertia of the gearbox.

Motor type		ExRDM 3910			ExRDM 3913		
Reduction		3:1	5:1	10:1	3:1	5:1	10:1
Max. torque	Nm	9.2	15.3	30.6	14.8	24.6	41.9
Moment of inertia of gearbox	Kgcm <sup>2</sup>	0.33	0.21	0.16	0.33	0.21	0.16

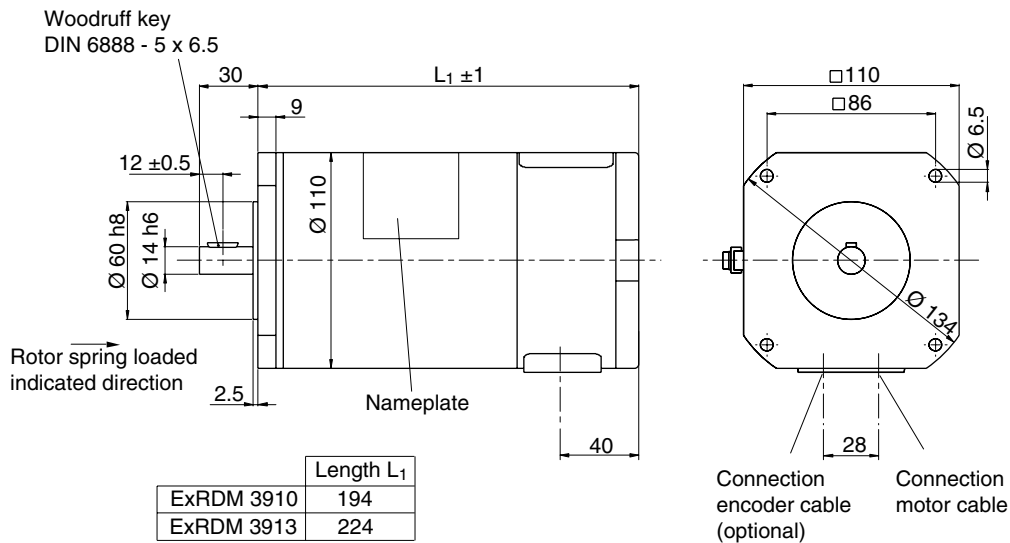
The actual torque of the ExRDM 3913 3-phase stepping motor at a given driving frequency  $f_s$  must be determined on the basis of the torque characteristic. The moment of inertia of the gearbox must be added to the moment of inertia of the rotor and the external moment of inertia in order to determine the maximum start/stop frequencies on the basis of the start/stop characteristic.

### Specifications of PL 50 / 100 gearbox

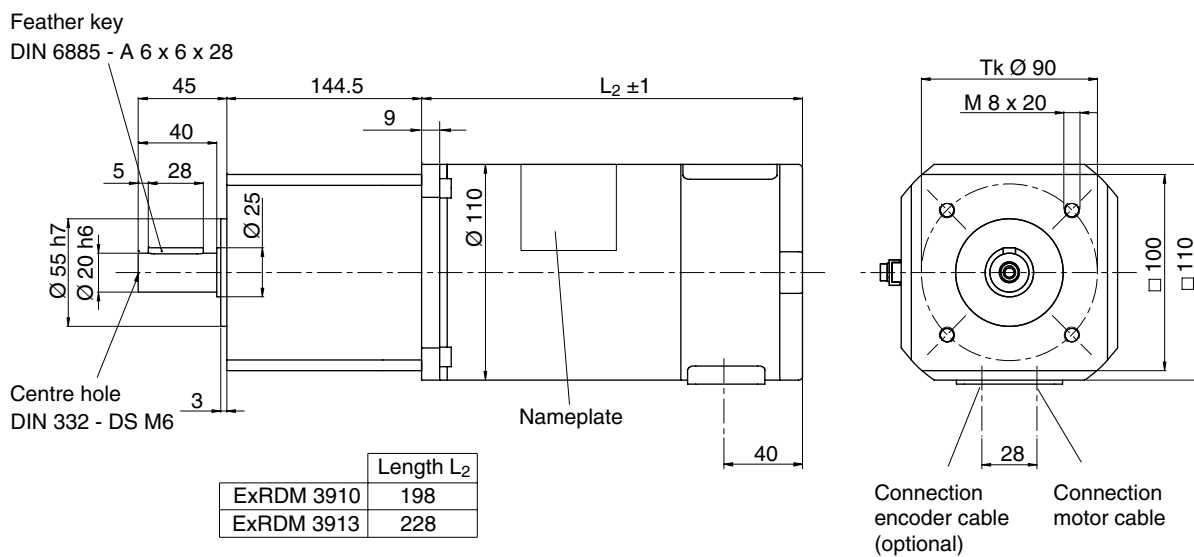
For motor type	ExRDM 3910 and ExRDM 3913
Gearbox type	Planetary gearbox; single-stage 3:1, 5:1; double-stage 10:1
Max. continuous load	50 Nm
Max. radial load	500 N
Max. axial load	250 N
Standard circumferential backlash	Gearbox shaft < 15'
Standard reduction ratios	3:1, 5:1, 10:1
Efficiency	~ 0.85/stage
Housing material	Aluminum
Surface	black eloxed
Shaft material	C 45
Bearing	Roller bearings
Sealing at shaft	Shaft sealing ring
Lubrication	Life-time lubrication
Weight	~ 3,3 kg

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**Specifications of the motor**



Dimensions of ExRDM 393x 3-phase stepping motor



Dimensions of ExRDM 393x 3-phase stepping motor with Gearbox

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## Installation of the motor

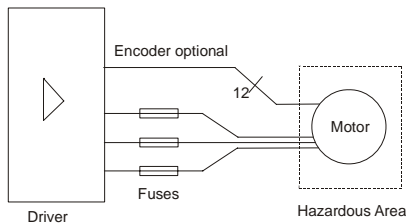
### ATTENTION

*Please read the following instructions before installing this motor.*

#### General safety instructions

- Do not disassemble the 3-phase stepping motor!
- A protective conductor with AWG 12 max. can be connected to the exterior terminal on the terminal box. The use of this terminal must be permitted by the local authority.
- Stepping motors heat up during operation. Provide for efficient heat dissipation. Caution when touching the motor!
- When pressing on a pinion, pulley or similar onto the motor shaft, pad the shaft from behind!
- The motor shall be connected through a conduit seal within 18 inches distance. Box and fittings shall be threaded for connection to conduit or cable termination and shall be explosionproof, listed for Class I, Division 1, Groups A, B, C, and D; or Class I, Zone 1, AEx d IIC. Threaded joint shall be made up with at least five threads fully engaged.

#### Wiring diagram



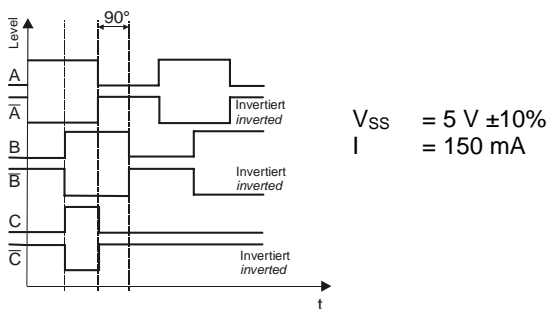
#### External fuses for the motors

Three fuses, 2.5 A, 250 V, breaking capacity H (=1500 A), must be inserted in the power supply cable to the explosion proof stepping motor ExRDM 391x.

### ATTENTION

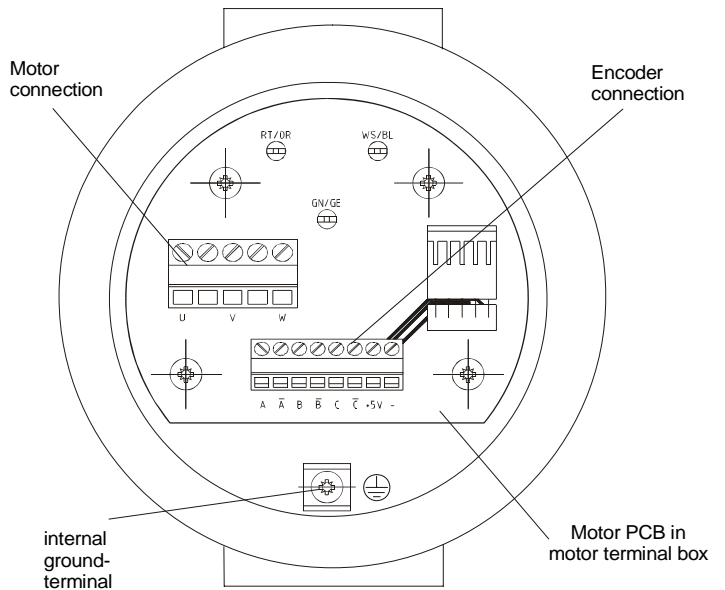
*The fuses and the stepping motor power drive must be installed outside of the explosion hazard area.*

#### Encoder signals



#### Wiring

1. Release the four Allen screws on the back of the motor and remove the cover of the terminal box.
2. Mount a conduit seal directly at the cable entry points.
3. Install the conduit system according the documentation of the manufacturer and screw the wires to the terminals on the motor PCB (see figure).



BERGERLAHR motor cable

- U brown
- V blue
- W black
- ⊕ protective ground

BERGERLAHR encoder cable

- A white
- A-bar brown
- B green
- B-bar yellow
- C grey
- C-bar pink
- +5V red
- 5V GND blue

The symbol ⊕ IEC earthground terminal marks terminal for equipment grounding.

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### Current-time diagram

