

Technical Documentation



Motor manual

Explosion-protected stepper
motors

ExRDM39x (ATEX)

Document: 0098441113215

Edition: V1.03, 11.2005

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Important information

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

See safety section for additional critical instructions.

Not all product variants are available in all countries.

Please consult the current catalogue for information on the availability of product variants.

We reserve the right to make changes during the course of technical developments.

All details provided are technical data and not promised characteristics.

In general, product names must be considered to be trademarks of the respective owners, even if not specifically identified as such.

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Writing conventions and symbols

Work steps

If work steps must be carried out in sequence, they are shown as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Important response to this work step
- ▶ Step 2

If a response to a work step is specified, this will inform you that the step has been carried out correctly.

Unless otherwise stated, the individual instruction steps must be carried in the given sequence.

Lists

Lists can be sorted alphanumerically or by priority. Lists are structured as follows:

- Point 1
- Point 2
 - Subpoint to 2
 - Subpoint to 2
- Point 3

Making work easier



Information on making work easier can be found at this symbol:

This offers supplementary information on making work easier.

See the chapter on safety for an explanation of the safety instructions.

1 Introduction

The explosion-protected three-phase stepping motors have a robust design and a high torque in relation to their size.

Type of protection

The motors have the type of protection EEx d IIC T4.
This means:

- Ex-protection as per EN 60079 -0 and EN 60079-1
- Registered under ATEX 94/9/EC
- Type of protection pressure-resistant encapsulation "d"
- Device group II
- Explosion group C
- Temperature class "T4" (135°C)
- Use in potentially explosive atmospheres of zones 1 and 2, device category 2G (Gas)
- Tested thermistor monitoring devices are required for temperature monitoring.

Approval

All information is based exclusively on the ATEX design.

1.1 Name plate

The name plate shows the most important motor data:

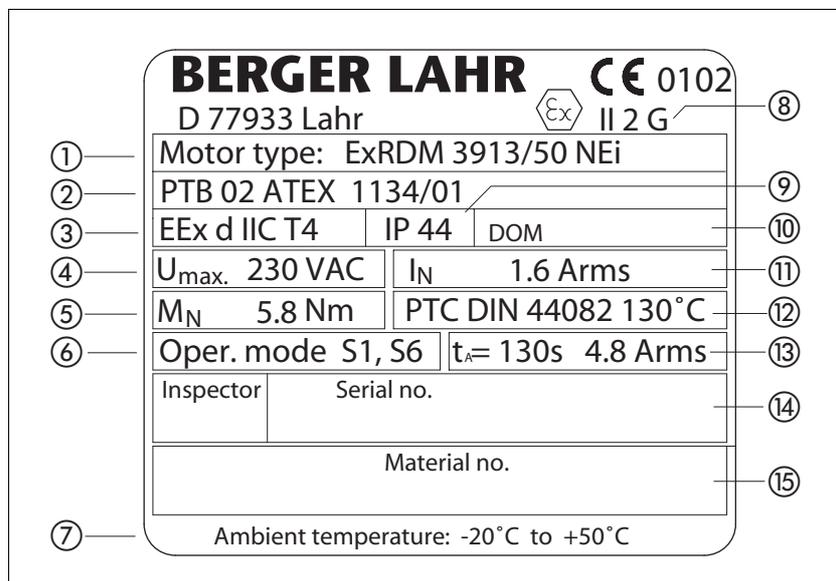


Figure 1.1 Name plate

- (1) Motor type
- (2) ATEX test number
- (3) Product classification
- (4) Maximum supply voltage
- (5) Rated torque
- (6) Approved operating modes
- (7) Min. and max. ambient temperature
- (8) Device category
- (9) IP degree of protection
- (10) Date of manufacture
- (11) Rated current
- (12) Temperature monitoring with PTC thermistor
- (13) Switch-off time t_A
- (14) Serial number
- (15) Material number

1.2 Type code

Example	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Number of phases 3 = 3	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Motor size (flange) 9 = 85 mm	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Motor length 10 = 194 mm 13 = 224 mm	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Pole pair count 50 = 50 N = reserved	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Encoder O = without Encoder E = with Encoder	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Encoder type A = absolut I = incremental	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	5	D4	K	60
Winding (motor voltage) 7 = 230 V _{AC} (325 V _{DC})	ExRDM	3	9	10 /	50	N	E	I	7	O	IP44	O	O	D4	K	60
Approval A = ATEX U = UL (only at motor length 13)	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Degree of protection IP44 = IP44 at shaft exit	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Gearbox type O = without gearbox U = planetary gearbox ATEX	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Gearbox ratio O = without gearbox 3 = 3:1 5 = 5:1	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Shaft diameter D4 = 14 mm DO = with gearbox	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Shaft model front K = disc spring, DIN 6888 O = with gearbox	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60
Centring collar 60 = 60 mm OO = with gearbox	ExRDM	3	9	10 /	50	N	E	I	7	A	IP44	O	O	D4	K	60

1.3 Literature

No recommendation for literatur available.

1.4 Directives and standards

The EC directives define the minimum requirements - particularly safety requirements - applicable to a product and must be complied with by all manufacturers and dealers marketing the product in the member states of the European Union (EU).

The EC directives describe the main requirements for a product. The technical details are laid down in the harmonized standards, which are published in Germany as the DIN EN standards. If there is not yet any EN standard applicable to a particular product area, existing technical standards and regulations will apply.

CE mark With the declaration of conformity and the CE mark on the product the manufacturer certifies that the product complies with the requirements of all relevant EC directives. The drive systems described here can be used anywhere in the world.

EC Machine Directive The drive systems described here are not machines as defined by the EC Machine Directive (98/37/EEC) but components for installation in machines. They do not have moving parts designed for specific purposes. However, they can be components of a machine or system.

The manufacturer must certify that the complete system conforms to the machine directive with the CE mark.

EC EMC Directive The EC Electromagnetic Compatibility Directives (89/336/EEC) applies to products that cause electromagnetic interference or whose operation may be adversely affected by electromagnetic interference.

Conformity with the EMC Directive can only be expected of drive systems after correct installation in the machine. The information on ensuring electromagnetic compatibility given in the chapter on "Installation" must be followed to ensure that the drive system in the machine or system is EMC-compatible and that the product can legally be operated.

EC Low-Voltage Directive The EC Low-Voltage Directive (73/23/EEC) lays down safety requirements for 'electrical apparatus' as protection against the risks that can originate in such devices and can be created in response to external influences.

The drive systems described here comply with the EN 50178 Standard as per the Low-Voltage Directive.

EC directive potentially explosive atmospheres EC directive 94/9 EC on devices and protective systems for designated use in potentially explosive atmospheres.

Standards for safe operation of our drive systems EN 50347 (IEC 60072) Dimensions and output series for rotating electrical machines

EN 50178: Fitting power systems with electronic equipment

EN 60034-ff: Rotating electrical machines

EN 60068-2-ff: Environmental tests

EN 60664: Insulation coordination

EN 60079-0 and EN 60079-1: Electrical equipment for potentially explosive atmospheres

1.5 Manufacturer's Declaration

Manufacturer's Declaration	
 BERGER LAHR GmbH & Co. KG Breslauer Str. 7 D-77933 Lahr	
according to EC Machinery Directive 98/37/EEC, Annex IIB	
We hereby declare that the following product:	
Designation:	3 Phase Motor for the Ex Area
Type:	ExRDM3910/50, ExRDM3913/50
Product number:	05xx51xxxxxx, 005xx49xxxxxx
in the version delivered is intended for installation in a machine. Commissioning is prohibited unless the machine meets the regulations according to the EC directives. Please observe the safety instructions in our technical documentation.	
Applied harmonized standards especially	EN50014: 2000 EN50018: 2000 EN60034-1: 1998 temperature class F EN60034-5 : 2001 protection class IP44
Applied national standards and technical specifications especially	DIN VDE 110-1: 1997 creepage and clearance PTB 02 ATEX 1134 RL 94/9/EG
Company stamp:	Berger Lahr GmbH & Co. KG Postfach 11 80 · D-77901 Lahr Breslauer Str. 7 · D-77933 Lahr
Date/Signature:	4 April 2003 
Name/Department:	Wolfgang Brandstätter/MOM-E

1.6 EC type test certification ATEX

An EC type test certification is available for the ExRDM39x motor series, confirming the design and the compliance with the applicable EN standards.

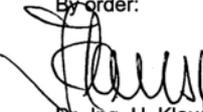
<p>Physikalisch-Technische Bundesanstalt Braunschweig und Berlin</p>	
	
<p>(1) EC-TYPE-EXAMINATION CERTIFICATE (Translation)</p>	
<p>(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC</p> <p>(3) EC-type-examination Certificate Number:</p>	
<p>PTB 02 ATEX 1134</p>	
<p>(4) Equipment:</p> <p>(5) Manufacturer:</p> <p>(6) Address:</p>	<p>Three-phase synchronous and three-phase stepping motor, types Ex RDM 3910, Ex RDM 3913 and Ex RSM 3913</p> <p>Berger Lahr GmbH & Co. KG</p> <p>Breslauer Straße 7, 77933 Lahr, Germany</p>
<p>(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.</p>	
<p>(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.</p>	
<p>The examination and test results are recorded in the confidential report PTB Ex 02-12210.</p>	
<p>(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:</p>	
<p>EN 50 014:1997 + A1 + A2 EN 50 018:2000</p>	
<p>(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.</p>	
<p>(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.</p>	
<p>(12) The marking of the equipment shall include the following:</p>	
<p> II 2G EEx d IIC T4</p>	
<p>Zertifizierungsstelle Explosionsschutz By order:</p>	<p>Braunschweig, 31 January 2003</p>
<p> Dr.-Ing. U. Klaus Regierungsdirektor</p>	
<p>sheet 1/2</p>	
<p><small>EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.</small></p> <p><small>Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38116 Braunschweig • Germany</small></p>	

Figure 1.2 EC type test certification PTB 02 ATEX 1134

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



SCHEDULE

(13)

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1134**

(15) Description of equipment

Three-phase synchronous and three-phase stepping motors of types 3910 and 3913, respectively, are employed for positioning and infeed adjustment purposes at machining and processing equipment. They are designed to Flameproof Enclosure "d" type of protection. To ensure compliance with the temperature class, the three-phase stepping motor is provided with three temperature sensors embedded in the winding as well as a suitable electronic tripping system. The three-phase synchronous motor is protected by three matched fuses.

The housing is made from steel. The unit is cooled by heat exchange for the open cooling circuit by means of thermal radiation and convection between housing and the surrounding cooling medium.

(16) Test report PTB Ex 02-12210

(17) Special conditions for safe use

None

Notes for manufacturing and operation

Due care must be taken that the temperatures that are admitted for the elements used are not exceeded.

The housings may be exempted from routine testing as required in EN 50018, section 16, because the static overpressure test was passed at 4 times the reference pressure.

The electrical motor data, incl. specifications for compliance with the temperature class, are defined on a data sheet attached to the EC type-examination certificate.

The motor shall be designed for ambient temperatures of -20 °C to 40 °C as a minimum.

For delimitation of the flameproof enclosure, screws shall be used that satisfy strength class 8.8 as a minimum.

(18) Essential health and safety requirements

Met by compliance with the aforementioned Standards-

Zertifizierungsstelle Explosionschutz

By order:

Dr.-Ing. U. Klausmeyer
Regierungsdirektor



Braunschweig, 31 January 2003

sheet 2/2

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Figure 1.3 EC type test certification PTB 02 ATEX 1134

2 Safety

2.1 Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by setting parameters, changing parameter values and generally by the mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, regulations and safety regulations that must be observed when working on the drive system.

2.2 Intended use

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

In the system configuration described the drive systems must be used in industrial applications only and must have a fixed connection only.

In all cases the applicable safety regulations and the specified operating conditions, such as environmental conditions and specified technical data, must be observed.

The drive system must not be commissioned and operated until completion of installation in accordance with the EMC regulations and the specifications in this manual.

To prevent personal injury and damage to property damaged drive systems must not be installed or operated.

Changes and modifications of the drive systems are not permitted and if made all no warranty and liability will be accepted.

The drive system must be operated only with the specified wiring and approved accessories. In general, use only original accessories and spare parts.

2.3 Hazard categories

Safety notes and general information are indicated by hazard messages in the manual. In addition there are symbols and instructions affixed to the product that warn of possible hazards and help to operate the product safely.

Depending on the seriousness of the hazard, the messages are divided into three hazard categories.



DANGER!

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.



WARNING!

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.



CAUTION!

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

2.4 Safety instructions



DANGER!

Electric shock, fire or explosion

- Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system.
- Before working on the drive system:
 - Switch off power to all terminals.
 - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent its being switched on.
 - Allow the DC bus capacitors to discharge (see power amplifier manual).
 - Check that there is no power.
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals under voltage.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.



DANGER!

Explosion hazard by incorrect handling!

- Use the drive in the approved ex-zones only.
- Prevent damage to housing components that secure the spark-proof gap. Do not use sharp-edged tools to open the terminal compartment.
- Never open the terminal compartment in the presence of a flammable mixture. Even a movement of the shaft can cause a spark with the terminal compartment open.

3 Technical Data

3.1 ExRDM General

3.1.1 Environmental influences

Ambient operating climate

Temperature (t)	-20°C to +50°C
Humidity	75%rh annual average 95%rh on 30 days (non-condensing)

Ambient climate for transport and storage

The motors must be in a dry, dust-free and vibration-free environment during transport and storage. The storage and transport temperature must remain in the range given below; in case of doubt the storage area must be air-conditioned.

The storage period is primarily determined by the durability of the lubricants in the bearing and should be less than 36 months. Occasional operation of the drive solution is recommended to ensure that it still operates.

Storage and transport temperature	-25°C to +70°C
-----------------------------------	----------------

Service life

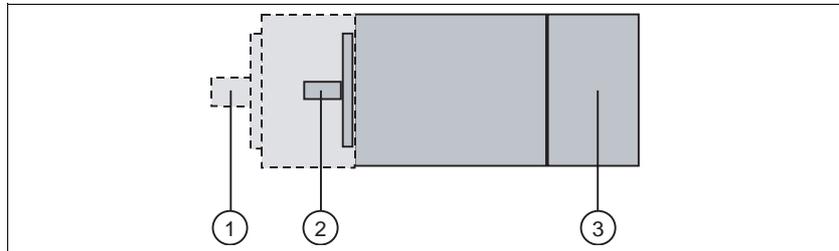
The service life of the motors when operated correctly is limited primarily by the bearing life.

The following operating conditions can in some cases significantly reduce the service life:

- Installation altitude above 1000 m over sea level. See EN 60034 in relation to this.
- Continuous operating temperatures greater than 80°C
- Rotary movement exclusively within an angle $\leq 100^\circ$
- Operation with very high angular accelerations
- Operation under vibration stress greater than 20 m/s²
- High cycle frequencies
- Allowing sealing rings to run dry
- Wetting gaskets with aggressive media

3.1.2 Degree of protection

IP degree of protection The motors meet the following IP degrees of protection in accordance with EN 60034-5:



Item	Degree of protection
1 Gearbox	IP54
2 Shaft outlet at front	IP44
3 Terminal box	IP56

For the permissible installation positions see page 4-4

Overview of IP protection

First digit	Second digit
Protection against foreign bodies	Protection against water
0 no protection	0 no protection
1 foreign body > 50mm	1 vertically falling drops
2 foreign body > 12mm	2 diagonally falling drops (75°-90°)
3 foreign body > 2.5mm	3 spray water
4 foreign body > 1mm	4 splashing water
5 dust-protected	5 jet water
6 dust-proof	6 heavy sea
	7 immersion
	8 continuous immersion

Type of protection

The motors have the type of protection EEx d IIC T4. This means:

- Ex-protection as per EN 60079 -0 and EN 60079-1
- Registered under ATEX 94/9/EC
- Type of protection pressure-resistant encapsulation "d"
- Device group II
- Explosion group C
- Temperature class "T4" (135°C)
- Use in potentially explosive atmospheres of zones 1 and 2, device category 2G (Gas)
- Tested thermistor monitoring devices are required for temperature monitoring.

3.2 ExRDM39x

3.2.1 Motor-specific data

Motor type			ExRDM3910N ExRDM3910NEi	ExRDM3913N ExRDM3913NEi	ExRDM3913NEa
Rated voltage		[V _{AC}] ¹⁾	230	230	230
		[V _{DC}] ²⁾	325	325	325
Max. voltage against PE		[V _{AC}]	250	250	250
Rated current S1 operation	I _N	[A]	1.6	1.6	1.6
Rated current S6 operation ³⁾ 40% duty cycle 60% duty cycle	I _N	[A]	2.7	2.7	2.7
			1.6	1.6	1.6
Resistance / winding	R _W	[Ω]	7.5	9.3	9.3
Rated torque	M _N	[Nm]	4.0	5.8	5.8
Holding torque	M _H	[Nm]	4.5	6.55	6.55
Rotor inertia	J _R	[kgm ²]	2.2 * 10 ⁻⁴	3.3 * 10 ⁻⁴	3.3 * 10 ⁻⁴
Steps per revolution ⁴⁾	z		200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000		
Step angle ⁴⁾	α	[°]	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036		
Systematic angle tolerance per step ⁵⁾	Δα _S	[']	±6	±6	±6
Max. starting frequency ⁴⁾	f _{A0m}	[kHz]	5.3	5.3	5.3
Rate-of-current rise time constant	τ	[ms]	~9	~11	~11
Type of protection			EEx d IIC T4	EEx d IIC T4	EEx d IIC T4
Total length			194	224	250
ground	m	[kg]	7.4	9.5	9.8

1) Maximum possible rms value

2) DC bus voltage

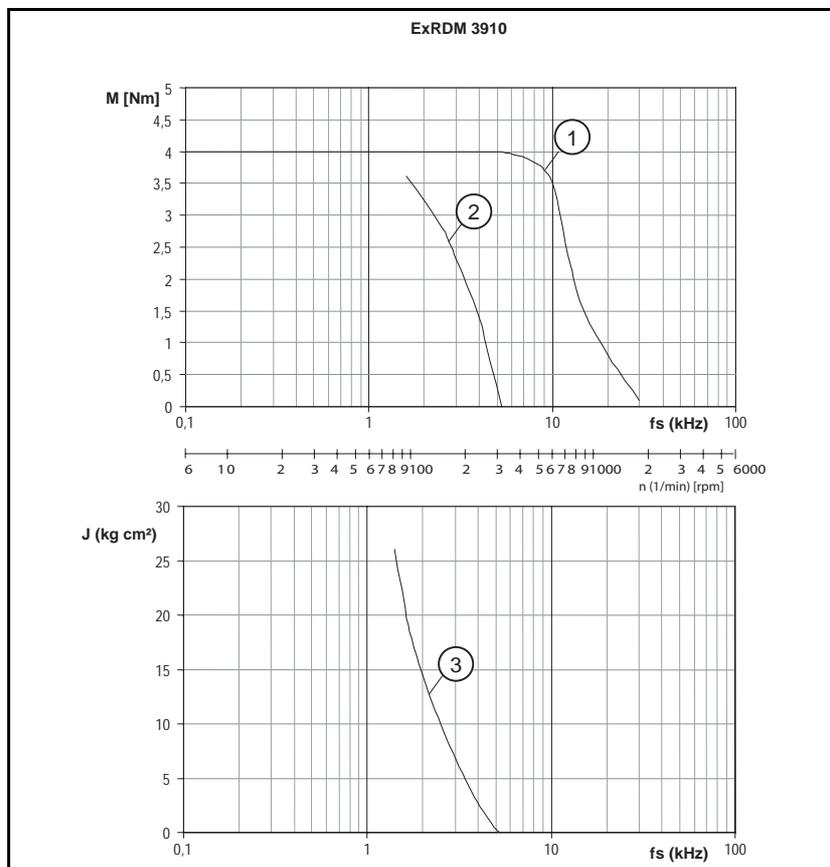
3) At a period duration of 10 minutes. Operating mode not approved for motors with gearbox.

4) with suitable activation

5) measured at 1000 steps per revolution; units in angular minutes

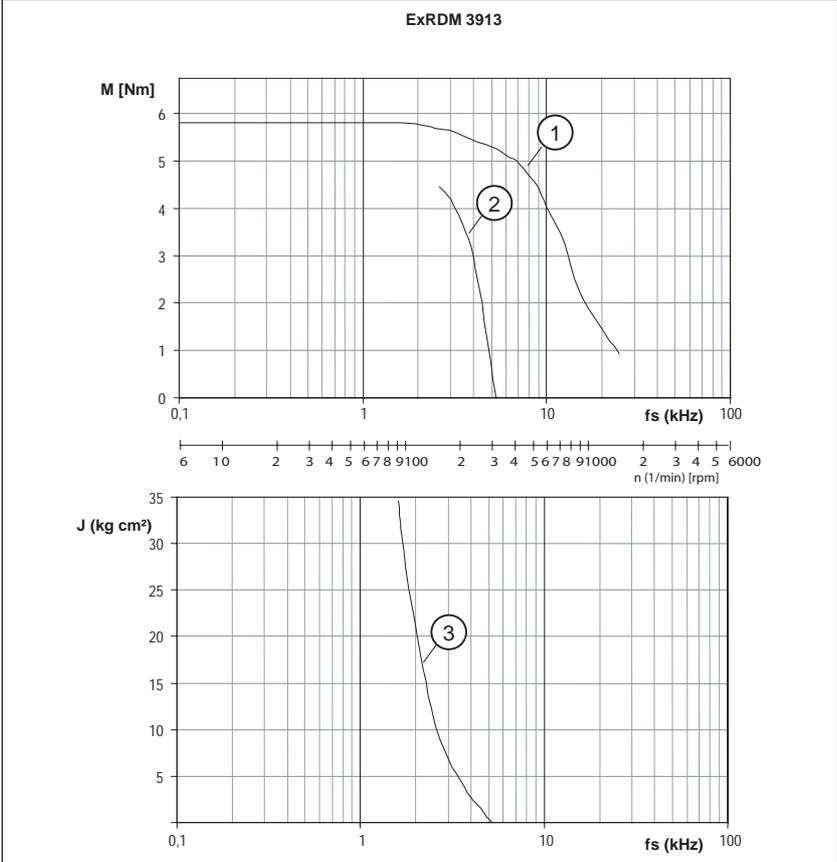
3.2.2 Characteristic curves

ExRDM3910



- (1) Slew M_{Bm}
- (2) Starting limit torque M_{Am}
- (3) Maximum load inertia J_{Lm}

ExRDM3913



- (1) Slew M_{Bm}
- (2) Starting limit torque M_{Am}
- (3) Maximum load inertia J_{Lm}

3.2.3 Shaft load

The following conditions apply:

- nominal storage life in operating hours at a failure probability of 10%
 $l_{10h} = 20000h$
- speed n
 $= 600 \text{ min}^{-1}$
- ambient temperature = 40° C
- nominal torque = 100% ED

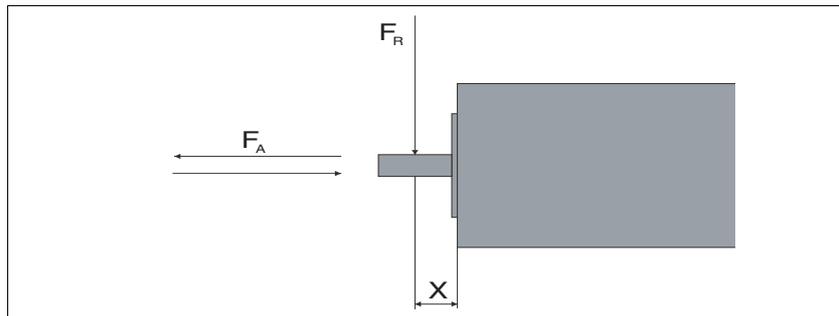


Figure 3.1 Points of attack of forces

Maximum shaft forces

When these conditions apply the maximum forces shown in the table below can act on the shaft:

		ExRDM3910	ExRDM1913
max. radial force F_R [N] $X = 10 \text{ mm}$	100% ED	110	110
max. axial force F_A [N] tensile force	100% ED	170	170
pressure		30	30
press-on force [N]		80	80

Axial and radial limit loads must not be applied simultaneously

Maximum press-on force

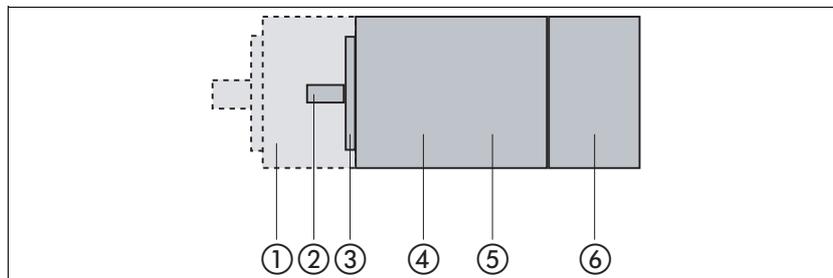
The maximum press-on force is related to the loading ratio of the bearing. The use of assembly paste (e.g. Klüberpaste 46 MR 401) on the shaft and drive element simplifies pressing on.

If the output shaft is threaded, we advise you to push the output element onto the output shaft. This prevents any axial force from acting on the bearing.

Alternatively the output shaft may be also shrunk on, clamped or glued.

3.2.4 Motor models

The flexible modular system and a modern model management offer the models described below. Under the schematic view the type code shows all the models that can be ordered for this motor size.



Item	Type
1	Gearbox: - 3:1 - 5:1
2	Shaft model: - \varnothing 14 mm
3	Centring collar: - \varnothing 60 mm
4	Size: - 90
5	Length: - 10 - 13
6	Options: - without encoder- with incremental encoder- with absolute encoder (ExRDM3913 only)

3.2.5 Dimensional drawing

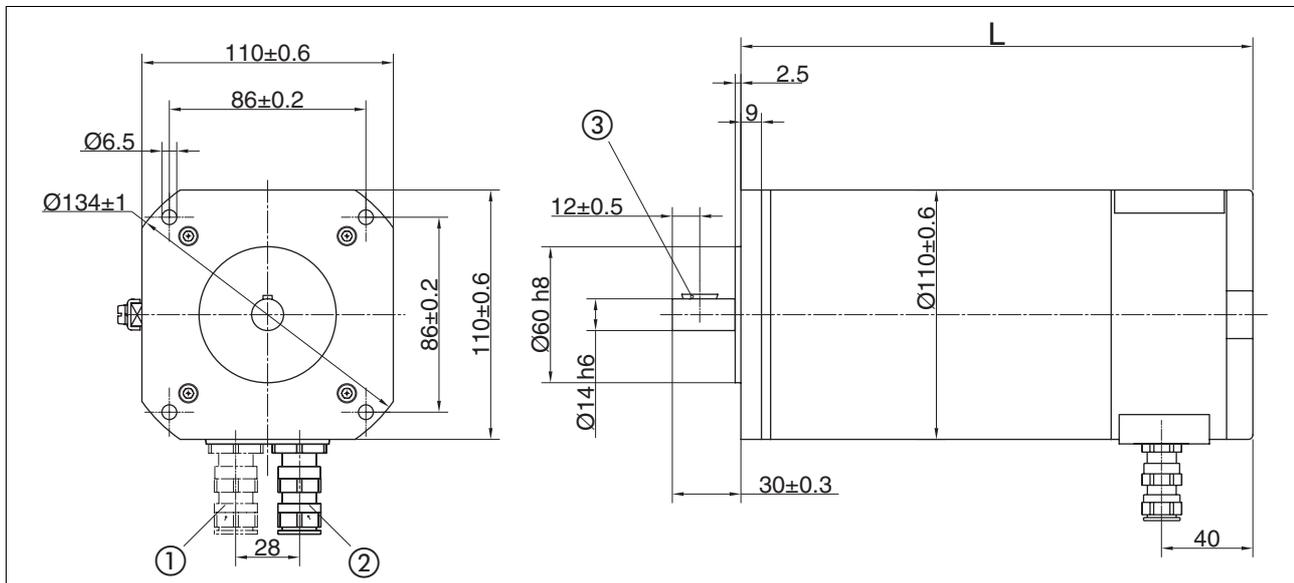


Figure 3.2 ExRDM39xN and ExRDM39xNEi dimensions

- (1) Encoder cable entry
- (2) Motor cable entry
- (3) Disc spring 5x6.5 EN60034-7

	ExRDM3910	ExRDM3913
Overall length L [mm]	194 1 ±	224 1 ±

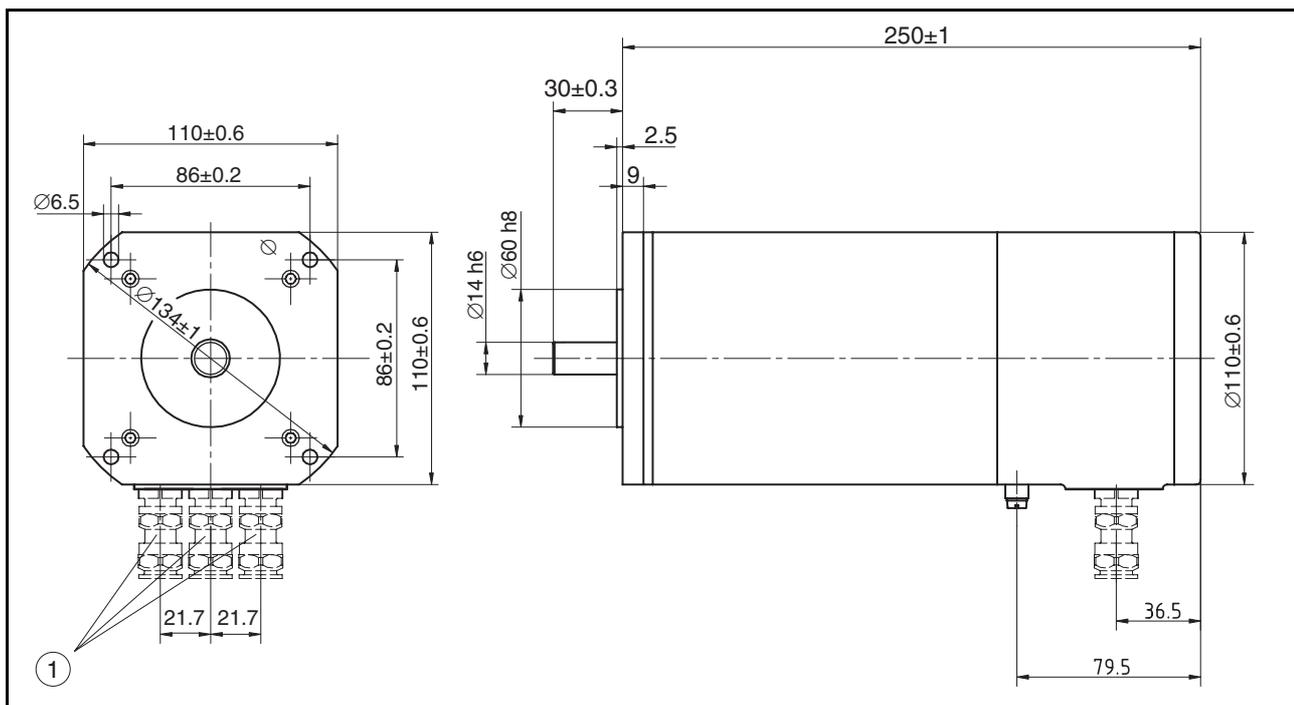


Figure 3.3 ExRDM39xNEa dimensions

- (1) Cable entry (motor and encoder)

3.2.6 Position capture

Three-phase stepping motors can be fitted with an optional encoder. This measuring system reports the actual position if the power controller is fitted with rotary speed monitoring electronics. The rotation monitoring compares the setpoint and actual position of the motor and reports an error if the difference exceeds a specified limit (following error limit). For example, this enables detection of mechanical overload of the motor.

Incremental encoder

Resolution	1000 increments per revolution
Index pulse	1 increment per revolution
Output	RS422
Signals	A, B, I
Pulse shape	Rectangular
Supply voltage	5V \pm 10%
Supply current	max. 0.125 A

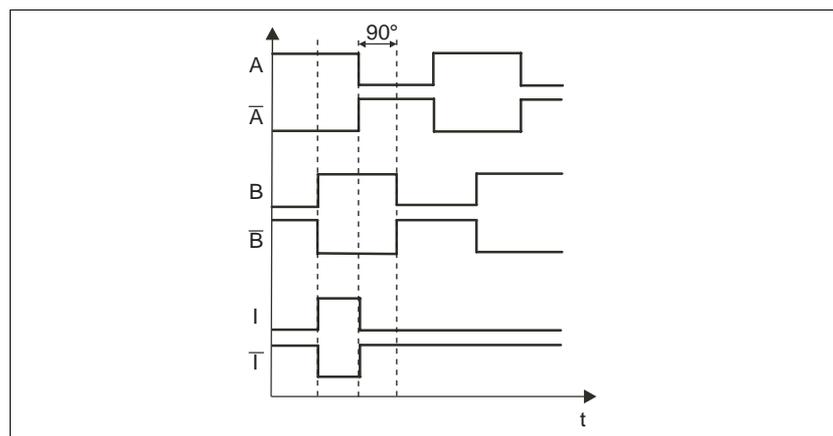


Figure 3.4 Pulse diagram valid in clockwise rotation

Absolute encoder

Encoder variant: ECE-BA

The absolute encoder is a product of TR Electronic GmbH. The documentation is available for download at <http://www.schneider-motion.com/doku>.

Direction of rotation

Rotation of the motor shaft in a positive or negative direction of rotation. A positive direction of rotation is defined as the motor shaft rotating clockwise as the observer faces the end of the protruding shaft.

3.2.7 Temperature monitoring

If a fault occurs the power to the power amplifier must be positively disconnected by a thermistor monitoring device.

A temperature sensor (PTC as per DIN 44082) is integrated in the motor winding. The temperature sensor does not have a safe insulation and is separated from the motor winding only by the basic insulation.

3.3 PL 50 gearbox

The three-phase ex-stepping motors can be fitted with the PL 50 gearbox.

The available torques depend on the ratio and the efficiency of the gearbox.

The actual torques must be calculated with the given actuation frequency f_s from the characteristic torque curves. The gearbox inertia must be added to the rotor inertia and the external moment of inertia to calculate the maximum start/stop frequency from the characteristic start/stop curve.

When the PL50 gearbox is used the operating mode S6 is not permissible.

The gearbox is a product of Neugart GmbH. The documentation is available for download at

<http://www.schneider-motion.com/doku>.

4 Installation



DANGER!

Electric shock, fire or explosion

- Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system.
- Before working on the drive system:
 - Switch off power to all terminals.
 - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent its being switched on.
 - Allow the DC bus capacitors to discharge (see power amplifier manual).
 - Check that there is no power.
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals under voltage.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.



WARNING!

Strong electromagnetic fields may cause injury and interference.

Motors can generate strong localised electrical and magnetic fields. This can cause interference in sensitive devices.

- Keep persons with implants such as pacemakers away from the motor.
- Do not place any sensitive devices close to the motor.

4.1 Before installation...

- Read this manual carefully, particularly the chapter on safety and follow all safety instructions. Familiarise yourself with the power controller manual also. This will minimise the accident risk and prevent damage to the drive and to your system.
- Before assembly obtain all required tools, instruments, testing aids and equipment.
- Before assembly check the drive system for visible damage caused by incorrect transport or storage. Damaged drive systems must not be installed to prevent any danger to persons or the machine.
- Check the name plate to ensure that the motor is actually suitable for the intended application (ATEX).
- Check the required accessories (for example cable entries).
- Make sure that the required environmental conditions for operation will be maintained.
- Make sure that the attachment for the motor flange is stable, clean, free of chips and does not oscillate or vibrate. Check that the system side conforms with all dimensions and tolerances.

4.2 Electromagnetic compatibility, EMC



WARNING!

Interference with signals and devices may cause injury

Distorted signals can cause unexpected device responses.

- Install the wiring in accordance with the EMC requirements.
- Check compliance with the EMC requirements, particularly in an environment subject to strong interference.

EMC requirement: Run motor cable alone

When planning the cabling make sure that the motor cable is laid separately. It must never be laid in a conduit together with power, control or sensor lines or fastened parallel with cable ties.

EMC requirement: motor and motor sensor cable

Motor leads and motor sensor cables are especially critical signal lines. Use the cables recommended by your local representative. They must be tested for EMC safety and must be suitable for trailing cables.

The motor cable and the motor sensor cable on the drive system must be laid out over a wide area with low resistance on the unit, the switch cabinet output and on the motor.

- ▶ Lay out motor and motor sensor cable without interruption (do not install switch components) from the motor and sensor to the unit. If a line has to be interrupted, shielded connections and metal casing must be used to prevent interference.
- ▶ Lay the motor cable at least 20 cm from the signal cable. If the distance is less than this, the motor cable and signal cables must be separated by grounded screening plates.
- ▶ For long lines equipotential bonding conductors with a suitable cross section must be used

EMC requirement:Mains and motor connection

Great care is required when connecting the mains power and the motor to the power controller, because the danger of uncontrolled overcoupling is greatest here.

- ▶ Lay mains and motor cable well apart(> 25 cm).
- ▶ Keep motor cable as short as possible.
- ▶ Keep unshielded braided wires of the motor cable (e.g. U,V,W) on the device and motor as short as possible.

This is the only way to prevent the formation of active and passive antennas.

EMC requirement:Earth band

Connect the motor to earth with an earth band > 8mm² to ensure correct function without interference.

4.3 Mechanical installation

**WARNING!**

Electrostatic discharges may cause injury and damage to the drive.

In rare cases electrostatic discharges (ESD) at the shaft caused by a fault in the sensor system may cause unexpected motions of the drive and damage the system.

- Use conductive components (e.g. antistatic belts) or other suitable measures for preventing charge separation by motion

**CAUTION!**

Failure of the drive by mechanical damage.

If the maximum allowable forces on the shaft are exceeded, this will result in accelerated bearing wear or shaft breakage.

- Do not exceed the maximum allowable axial and radial forces.
- Protect the shaft against impact.
- Do not exceed the maximum allowable axial force even when pressing on output components.

**CAUTION!****Hot surfaces can cause burns and damage to system components!**

The drive temperature can exceed 100°C in some conditions.

- Avoid contact with the hot drive.
- Do not place combustible or heat-sensitive components in immediate vicinity.
- Follow the actions described for heat dissipation.
- Check the temperature of the drive during the test run.

**WARNING!****Violations and system damage by falling loads during start-up.**

When the brake is released on stepping motor drives with external forces (vertical axes), the load may fall if the friction is low.

- Restrict the load in these applications to a maximum of 25% of the static holding torque.

Mounting position

The following mounting positions are defined and approved under EN 60034-7:

- IM B5 drive shaft horizontal
- IM V1 drive shaft vertical, shaft end down

Mounting

When attaching the motor to the mounting flange, make sure that the motor is carefully aligned and has an even contact. Carefully tighten all fastening screws to the specified torque and ensure that there is no tension. For information on data and dimensions see 3-1.

Attaching output components

Attach output components such as pulleys, clutch etc. with suitable equipment and tools. The maximum effective axial and radial forces on the shaft must not exceed the values specified for the maximum shaft load. If the output component is incorrectly attached, the sensor for position capture may be damaged.

Follow the installation directions of the manufacturer of the output component. Both motor and output component must be precisely aligned both axially and radially. Neglect will result in noisy running, bearing damage and fast wear.

Installing control

Power amplifier, switches, fuses or thermistor monitoring devices must be installed outside the ex-zone.

4.4 Electrical installation



DANGER!

Explosion hazard by incorrect handling!

- Use the drive in the approved ex-zones only.
- Prevent damage to housing components that secure the spark-proof gap. Do not use sharp-edged tools to open the terminal compartment.
- Never open the terminal compartment in the presence of a flammable mixture. Even a movement of the shaft can cause a spark with the terminal compartment open.



DANGER!

Explosion hazard by incorrect handling!

- Never use the drive without a thermistor monitoring device approved for ATEX.



WARNING!

Unexpected motion may cause injury and damage to the system

When the drive is operated for the first time there is a high risk of unexpected motion because of possible wiring faults or unsuitable parameters.

- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the drive.
- Make sure that the system is free and ready for the motion before starting the function.



WARNING!

Danger of injury and damage to system components by loss of degree of protection

Foreign bodies, deposits or humidity can cause unexpected device responses.

- Prevent any foreign bodies from entering the terminal device.
- Check that seals and cable entries are correctly seated.

4.4.1 Cable connection

Cable specifications The cables must have the following construction according to EN 60079-14:

- shielded motor cable with 4 x 1.5 mm² and 2 x 0.5 mm² braided wires, separate shielding of control lines
- shielded encoder cable for incremental encoder with 5 (2*0.25 mm²) and 1 (2*0.5 mm²) braided wires twisted in pairs
- CAN cable on request
- Continuous temperature resistance: -20°C to 110°C
- The cable diameter must be between 6 mm and 12 mm (terminal area of cable bush)

Starting torques

Starting torque of motor terminals	[Nm]	0.6
Starting torque of encoder terminals	[Nm]	0.25
Starting torque for housing screws	[Nm]	5.8
Strength class for housing screws		8.8

4.4.1.1 ExRDM39xN- and ExRDM39xNEi

Terminal assignment

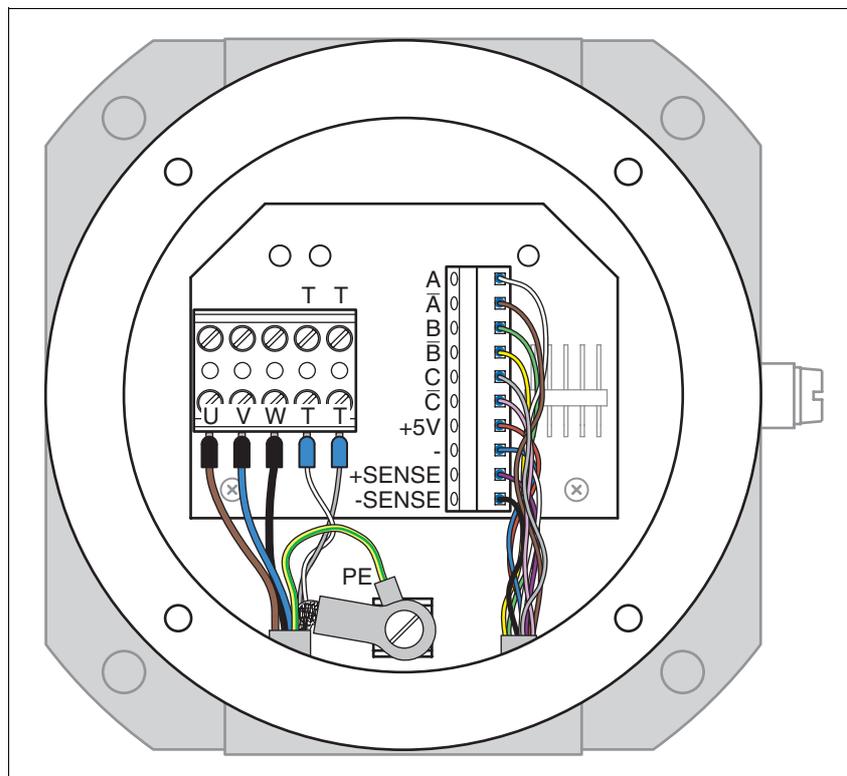


Figure 4.1 Connections with wiring for incremental encoder

Motor connection The motors are not designed for direct connection to mains power; they must be operated with an approved power amplifier only.

Ring tabs are recommended for connecting the protective conductor and the shield to the PE.

For information on mounting the cable bushing see the cable bushing attachment and Kapitel „Cable entries - EEx d“, Seite 4-10.

CN1 pin	Meaning	Cable colour (IEC 757)
U	Motor lead	brown (BN)
V	Motor lead	blue (BU)
W	Motor lead	black (BK)
PE	Protective conductor	green/yellow (GN/YE)
	external cable shield at PE	
T	Thermistor	white (WH)
T	Thermistor	grey (GY)
	internal cable shield around T at PE	

Incremental encoder connection

- ▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.
- ▶ Check whether the power supply has a suitable current limiting or must be separately fused.

Signal	Cable colour (IEC 757)
A	white (WH)
\bar{A}	brown (BN)
B	green (GN)
\bar{B}	yellow (YE)
C	grey (GY)
\bar{C}	pink (PK)
+5V	red (RD)
-5VGND	blue (BU)
+SENSE	violet (VT)
-SENSE	black (BK)
	external cable shield at PE

4.4.1.2 ExRDM39xNEa

Terminal assignment

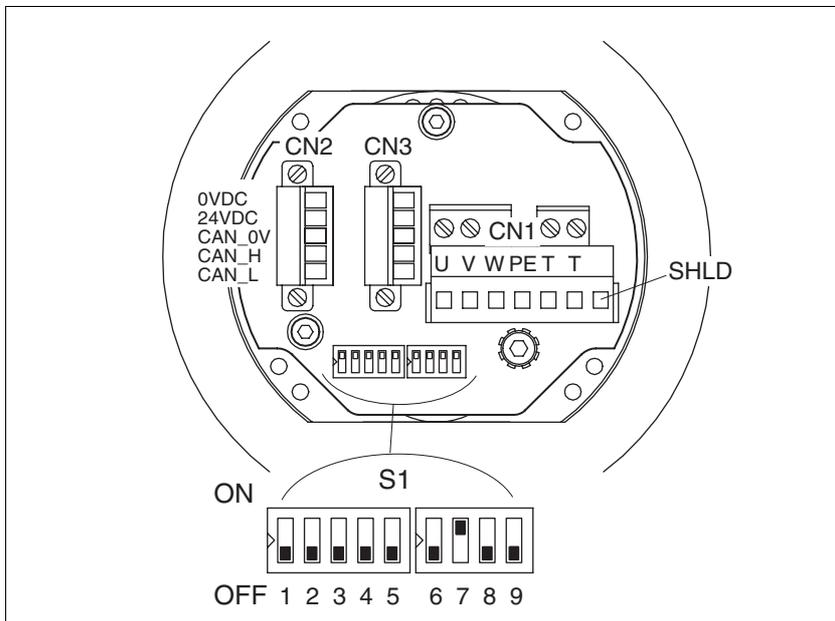


Figure 4.2 Terminal assignment for absolute encoder

S1 (DIP switch)	Meaning
1-5	Base ID
6	Memory function 0: all parameters are saved 1: no parameter is saved. After Power Off/On the former values are valid again.
7	Baud rate 0: 250 kbaud 1: 500 kbaud
8	Count direction 0: bus parameter index 6000 is valid 1: bus parameter index 6000 is reversed:
9	CAN bus termination (terminating resistor 120 Ω ±5%) 0: switched off 1: switched on

Switch S1 is evaluated once after Power On. If a DIP switch is changed after that it has no effect.

Encoder variant: ECE-BA

The absolute encoder is a product of TR Electronic GmbH. The documentation is available for download at <http://www.schneider-motion.com/doku>.

Connections with wiring

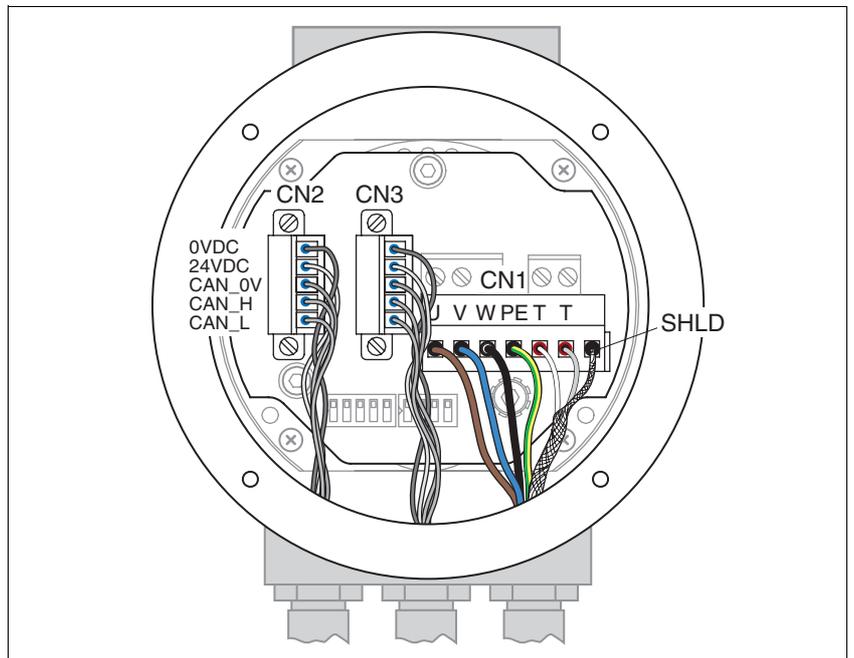


Figure 4.3 Connections with wiring for absolute encoder

Motor connection

The motors are not designed for direct connection to mains power; they must be operated with a suitable power amplifier only.

For information on mounting the cable bushing see the cable bushing attachment and Kapitel „Cable entries - EEx d“, Seite 4-10.

CN1 pin	Meaning	Cable colour (IEC 757)
U	Motor lead	brown (BN)
V	Motor lead	blue (BU)
W	Motor lead	black (BK)
PE	Protective conductor	green/yellow (GN/YE)
	external cable shield on shield connection in the cable entry	
T	Thermistor	white (WH)
T	Thermistor	grey (GY)
SHLD	internal cable shield around T	

- ▶ Make sure that the shield cannot contact switch S1.
- ▶ The distance of the connections to the cover. The wires must not be damaged by the cover.

Absolute encoder connection



CAUTION!

Destruction of unit components and loss of control!

Excessive currents can be created at the signal connections if the negative connection to the controller supply voltage is interrupted.

- Do not interrupt the negative connection between power supply unit and load with a fuse or switch
- Check for correct connection before switching on.
- Never connect the controller supply voltage or change its wiring while there is supply voltage present.



Connect the centre cable bushing first, because this is difficult to access otherwise.

- ▶ Make sure that the wiring, the cables and the connected interfaces meet the requirements for PELV.
- ▶ Check whether the power supply has a suitable current limiting or must be separately fused.

CN2/CN3	Signal	Meaning	Type (I/O)
1	0VDC	Encoder reference potential	
2	24VDC	Encoder power supply	I
3	CAN_OV	CAN reference potential	
4	CAN_H	data wire	CAN level
5	CAN_L	data wire, inverted	CAN level
external cable shield on shield connection in the cable entry			

4.4.2 Cable entries - EEx d

Only the following cable entries are approved for this product and only these may be used:

Type	Thread	Notes
CAPRI ADE4F	M20*1.5	with shield connection, included in scope of supply
CAPRI ADE4F	M16*1.5	with shield connection, separate accessories for ExRDM 3913 NEa

When tightening the sleeve nut the motor or sensor cable must be prevented from turning with it.

If the motor is operated with trailing cable, the lines near the motor must be fastened so as to prevent any bending forces acting on the cable entry.

For more information on mounting the cable bushing see the "cable bushing" attachment.

4.4.3 Temperature monitoring



DANGER!

Explosion hazard by incorrect handling!

- Never use the drive without a thermistor monitoring device approved for ATEX.

If a fault occurs the power to the power amplifier must be positively disconnected by a thermistor monitoring device.

The temperature sensors integrated in the motor winding (PTC as per DIN 44082) are accessible through the terminals on the motor connection board.

The following products are recommended:

- Berger Lahr BLS242 with power amplifier I902
Available from your local dealer
- Dold MK 9003.12/11120 ATEX 230 VAC
Available at: www.dold.com
- Möller EMT 6 DBK
Available at www.moeller.net

5 Commissioning



DANGER!

Electric shock, fire or explosion

- Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system.
- Before working on the drive system:
 - Switch off power to all terminals.
 - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent its being switched on.
 - Allow the DC bus capacitors to discharge (see power amplifier manual).
 - Check that there is no power.
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals under voltage.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.

5.1 Preparing for commissioning

Before commissioning check

- ▶ the correct mechanical installation: take particular note of correctly installed screws at the flange and tension-free alignment of the motor.
- ▶ the correctly conducted electrical installation: in particular check the PE conductor connections and earth connections. Make sure that all connections on the motor and to the power controller are correctly made and connected and that cable fasteners are tight.
- ▶ the environmental and operation conditions: make sure that the specified environmental conditions are maintained and that the drive solution matches the operating conditions as specified on the name plate.
- ▶ the output components: check that the output components, which may be already installed, are balanced and precisely aligned.

Absolute encoder

Encoder variant: ECE-BA

The absolute encoder is a product of TR Electronic GmbH. The documentation is available for download at <http://www.schneider-motion.com/doku>.

5.2 Running commissioning



WARNING!

Unexpected motion may cause injury and damage to the system

Drives can make unexpected movements if incorrectly connected or because of other faults.

- Operate the motor with approved power amplifiers only. Even if power amplifiers are similar, different adjustment of the sensor system may be a source of danger.
- Check the wiring. Compatibility is not assured even with matching connectors for power connections and sensor system from a different manufacturer.
- Only start the system if there are no persons or materials in the danger zone and the system can be operated safely.
- Conduct test runs first without coupled loads.
- Do not touch the shaft of the motor or the attached output components.



WARNING!

Rotating parts may cause injury and damage to the system.

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are unbalanced may be thrown clear.

- After installation check all rotating parts (parallel keys, clutch, ..).
- Use a guard as protection against rotating parts.



WARNING!

Danger of injury from falling parts.

The motor may move as a result of the reaction torque, tip and fall.

- Fasten the motor securely to prevent it from breaking loose during strong acceleration.

**CAUTION!**

Hot surfaces can cause burns and damage to system components!

The drive temperature can exceed 100°C in some conditions.

- Avoid contact with the hot drive.
- Do not place combustible or heat-sensitive components in immediate vicinity.
- Follow the actions described for heat dissipation.
- Check the temperature of the drive during the test run.

6 Diagnostics and troubleshooting

6.1 Mechanical faults

Error	Cause	Troubleshooting
whistling or knocking noise	defective bearing	contact service
grinding noise	rotating output component is grinding	align output component
radial oscillation	output component incorrectly aligned	align output component
	output component unbalanced	balance output component
	shaft bent	contact service
	resonance in fastening	check stiffness of motor fastening
axial oscillation	output component incorrectly aligned	align output component
	output component impacts	check output component
	resonance in fastening	check stiffness of motor fastening

6.2 Electrical faults

Error	Cause	Troubleshooting
Motor does not start	Overload	Reduce load
	error in power controller	check power controller
	connection line fault or not connected, phase/interturn fault	check connection lines

7 Accessories and spare parts

7.1 Accessories

Designation	Ordering number
Ex motor cable, unassembled (for all motors), 5m	0062501331005
Ex motor cable, unassembled (for all motors), 10m	0062501331010
Ex motor cable, unassembled (for all motors), 15m	0062501331015
Ex motor cable, unassembled (for all motors), 20m	0062501331020
Ex motor cable, unassembled (for all motors), 30m	0062501331030
Ex motor cable, unassembled (for all motors), 50m	0062501331050
Ex motor cable, unassembled (for all motors), 75m	0062501331075
Ex motor cable, unassembled (for all motors), 100m	0062501331100
Ex motor cable, unassembled (for all motors), 200m	0062501331200
Ex sensor cable, unassembled (for ...NEi), 5m	0062501486005
Ex sensor cable, unassembled (for ...NEi), 10m	0062501486010
Ex sensor cable, unassembled (for ...NEi), 15m	0062501486015
Ex sensor cable, unassembled (for ...NEi), 20m	0062501486020
Ex sensor cable, unassembled (for ...NEi), 30m	0062501486030
Ex sensor cable, unassembled (for ...NEi), 50m	0062501486050
Ex sensor cable, unassembled (for ...NEi), 75m	0062501486075
Ex sensor cable, unassembled (for ...NEi), 100m	0062501486100
Ex sensor cable, unassembled (for ...NEi), 200m	0062501486200
Cable entry M16*1.5 (1 unit) (for ...NEa)	0098050010164
Sealing screw and seal M16*1.5 (1 unit) (for ...NEa)	0098132210015
Double power amplifier I902 with ATEX BLS242, CANopen slave	0086200237001

8 Service, maintenance and disposal



DANGER!

Electric shock, fire or explosion

- Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system.
- Before working on the drive system:
 - Switch off power to all terminals.
 - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent its being switched on.
 - Allow the DC bus capacitors to discharge (see power amplifier manual).
 - Check that there is no power.
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals under voltage.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- AC voltages may jump over unused wires in the motor cable. Isolate unused wires at both ends of the motor cable.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system. Extend the earth through the motor cable with an additional earth at the motor housing.



DANGER!

Explosion hazard by incorrect handling!

- Use the drive in the approved ex-zones only.
- Prevent damage to housing components that secure the spark-proof gap. Do not use sharp-edged tools to open the terminal compartment.
- Never open the terminal compartment in the presence of a flammable mixture. Even a movement of the shaft can cause a spark with the terminal compartment open.

8.1 Service address



If you have any questions please contact your local dealer. Your dealer will be happy to give you the name of a customer service outlet in your area.

Have any repairs to our drive systems conducted only by a repair service that we have certified. Do not make any mechanical or electrical modifications to the drive components. We will not honour the warranty or accept any liability if unauthorised modifications are made or the system is opened.

Repairs cannot be made with the device installed.

8.2 Maintenance



Before all work on the drive system consult the chapters on Installation and Commissioning to see what precautions and processes must be observed.

Connections and fastening

- ▶ Check all connection lines and plug connectors regularly for damage. Replace damaged lines immediately.
- ▶ Check that all drive elements are firmly seated
- ▶ Tighten all mechanical and electrical threaded connections to the specified torque. Check the screw caps on the connection lines.

Cleaning



WARNING!

Unexpected motion and destruction of the drive may cause injury.

If the environmental conditions are other than those approved, foreign material from the environment may enter the drive and cause unexpected reactions.

- Check the environmental conditions.
- If the seals run dry occasionally, make sure that there are no liquids on the end of the shaft. (For example in the IM V3 installation position).
- Protect the shaft seals and cable glands from the spray of a pressure cleaner.

Clean dust and dirt off the motor, otherwise the heat dissipation of the motor will be less effective. Insufficient heat dissipation to the ambient air may increase the temperature in the bearings excessively and adversely affect the bearing lubricant. In addition, the temperature monitor may stop the drive unit even though all other conditions are within limits.

Motors with degree of protection IP56 are not suitable for cleaning with a high-pressure cleaner. The high pressure may force water into the motor.

When using solvents or cleaning agents, make sure that the motor and sensor line, cable entry seals, O-rings and motor paint are not damaged.

Bearing replacement The bearings are not designed to be replaced by the customer, because this procedure partially demagnetises the motor and it loses power.

8.3 Changing the motor

When replacing the motor please follow the directions in 4-1.

8.4 Shipping, storage, disposal

Shipping The product must be protected against shocks during transport. Use the original packaging for this purpose.

Storage Store the product only under the specified, approved environmental conditions for room temperature and humidity. Protect the product against dust and dirt.

Disposal The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations

9 Glossary

9.1 Terms and Abbreviations

<i>Axial forces</i>	Tension or compression forces acting longitudinally on the shaft
<i>Size</i>	defined by the flange size in the type code
<i>Length</i>	length of motor without optional equipment (such as brake or gearbox)
<i>EMC</i>	Electromagnetic compatibility
<i>Encoder</i>	Sensor for recording the angular position of a rotating element. The encoder is mounted on the motor and signals the angular position of the rotor.
<i>PTC</i>	resistance with positive temperature coefficient. Resistance value is increased as the temperature rises.
<i>Protection class</i>	The protection class is a standardised specification for electrical equipment that describes the protection against the ingress of foreign bodies and water (for example, IP20).
<i>Radial forces</i>	forces that act radially on the shaft
<i>Centring collar</i>	centric protrusion on the motor flange to ensure precise assembly.

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