Stepper motors

User's Manual

Version: **2.0 (10.05.2016)**
Model no.: **MASMOT-ENG**

1 Manual history

Information:

B&R keeps the printed version of user's manuals as current as possible. If there is a newer version available, it can be downloaded as a PDF file from the B&R website at www.br-automation.com.

Version	Date	Comment
2.00	May 2016	Entire manual revised and updated
1.11	April 2013	Additions to technical data (ABR encoder and HIPERFACE)
1.10	March 2013	Entire document revised, new cables and stepper motor options added.
1.06	August 2011	Correction to "Power consumption" technical data for brake option.
1.05	July 2011	Addition of "Max. surface temperature" for motors with brake option: • Standard motors, flange size 60 mm, • Standard motors, NEMA 34, flange size 86 mm,
1.04	February 2011	Additions: • "Areas of application" expanded. • "Operating principle" section added to brake option documentation.
1.03	January 2011	Corrections: • Pinout text corrected from "9-pin DSUB plug (5 pins used)" to "9-pin DSUB plug (8 pins used)" • Text corrected in "Lifespan" section.
1.02	January 2011	Correction of grammar/spelling errors.
1.01	December 2010	Corrections: • The reference to the "Dimensioning" chapter has been expanded to include the "ACOPOSmicro User's Manual". • Notice regarding grounding: only screws intended for this may be used. • Standards and Certifications chapter shortened.
1.00	November 2010	First edition

2 Safety notices

Information:

The following safety notices are used uniformly across user's manuals and are valid for both stepper motors as well as drive systems.

Information:

The safety notices, connection descriptions (type plate and documentation) and limit values listed in the technical data are to be read carefully before installation and commissioning and must be observed.

These safety notices must be retained and included with the device if it is passed on to anyone else (e.g. sold, rented, etc.).

The user is responsible for observing all applicable international and national electrical standards.

2.1 Organization of safety notices

Safety notices in this manual are organized as follows:

Safety notice	Description
Danger!	Disregarding these safety guidelines and notices can be life-threatening.
Warning!	Disregarding these safety guidelines and notices can result in severe injury or substantial damage to equipment.
Caution!	Disregarding these safety guidelines and notices can result in injury or damage to equipment.
Information:	This information is important for preventing errors.

Table 1: Description of the safety notices used in this documentation

2.2 General information

B&R drive systems and motors have been designed, developed and manufactured for conventional use in industrial environments. They were not designed, developed and manufactured for any use involving serious risks or hazards that could lead to death, injury, serious physical damage or loss of any kind without the implementation of exceptionally stringent safety precautions.

In particular, such risks and hazards include the use of these devices to monitor nuclear reactions in nuclear power plants, their use in flight control or flight safety systems as well as in the control of mass transportation systems, medical life support systems or weapons systems.

Danger!

Drive systems and motors can have exposed parts that carry voltage (e.g. terminals) as well as hot surfaces. Additional hazards include moving machine parts. Improperly removing required covers, inappropriate use of the devices or their improper installation or operation can result in severe personal injury or damage to property.

All tasks such as the transport, installation, commissioning and servicing of devices are only permitted to be carried out by qualified personnel. Qualified personnel are those familiar with the transport, mounting, installation, commissioning and operation of of devices who also have the appropriate qualifications (e.g. IEC 60364). National accident prevention regulations must be observed.

The safety notices, connection descriptions (type plate and documentation) and limit values listed in the technical data are to be read carefully before installation and commissioning and must be observed.

Danger!

The improper handling of drive systems and motors can cause severe personal injury or damage to property!

2.3 Intended use

Stepper motors are intended for use in commercial plants and subject to the guidelines and standards listed on page 118.

Danger!

Before applying power, it is necessary to check if the B&R drive system being used is suitable for the respective power system. The specifications and restrictions in the user documentation for the respective device series must be observed completely!

When used in residential areas, commercial areas or small businesses, additional measures must be implemented by the user.

Technical data as well as connection and environmental specifications can be found on the type plate and in this user's manual. Specifications regarding connection and environmental conditions must be observed!

Danger!

Electronic devices are never completely failsafe.

If the drive system fails, the user is responsible for ensuring that any connected motors are brought to a secure state.

2.4 Protection against electrostatic discharge

Electrical components that can be damaged by electrostatic discharge (ESD) must be handled accordingly.

2.4.1 Packaging

Electrical components with a housing do not require any special ESD packaging, but they must still be handled properly.

2.4.2 Guidelines for proper ESD handling

- Do not touch the connector contacts on connected cables.
- Do not touch the contact tips on circuit boards.

2.5 Transport and storage

During transport and storage, devices must be protected against undue stress (mechanical loads, temperature, humidity, aggressive atmospheres, etc.).

Drive systems contain components sensitive to electrostatic charges that can be damaged by inappropriate handling. It is therefore necessary to provide the required protective measures against electrostatic discharge when installing or removing these drive systems.

2.6 Handling and installation

Warning!

B&R drive systems and motors may be very heavy.

During handling and installation of B&R drive systems or motors, there is therefore the danger of personal injury or damage to equipment (through shearing, impacts, cutting or crushing). Suitable protective equipment (e.g. safety glasses, protective gloves, safety shoes, etc.) should be used when necessary!

Installation must be performed according to this documentation using suitable equipment and tools.

Devices may only be installed by qualified personnel without voltage applied. Before installation, voltage to the control cabinet must be switched off and prevented from being switched on again.

General safety guidelines and national accident prevention regulations (e.g. VBG 4) for working with high voltage systems must be observed.

Electrical installation must be carried out according to applicable guidelines (e.g. line cross-section, fuses, protective ground connections, see also the dimensioning chapter of the ACOPOSmicro User's Manual).

2.7 Operation

2.7.1 Protection against touching electrical parts

> **Danger!**
>
> **For drive systems to operate, it is necessary for certain parts to carry hazardous voltages over 42 VDC. Touching one of these parts can result in a life-threatening electric shock. This could lead to death, severe injury or damage to equipment.**

Before turning on a drive system, it is important to ensure that the housing is properly connected to ground (PE rail). Ground connections must be established even when testing or operating the drive system for a short time!

Before turning the device on, all parts that carry voltage must be securely covered. During operation, all covers and control cabinet doors must remain closed.

Control and power connections can still carry voltage even if the motor is not turning. Touching these connections when the device is switched on is prohibited.

Before performing any work on drive systems, they must first be disconnected from the power mains and prevented from being switched on again.

Loosening electrical drive system connections while voltage is applied is never permitted. In some cases, electric arcs may occur that can cause personal injury and/or damage to contacts.

2.7.2 Protection against dangerous movements

> **Danger!**
>
> **Improper control of motors can result in unintended hazardous movements!**
>
> **Some possible causes for this improper control may include:**
>
> - **Incorrect installation or a mistake when handling components**
> - **Improper or incomplete wiring**
> - **Defective devices (drive system, motor, position encoder, cables, brake)**
> - **Incorrect control (e.g. caused by software error)**

Some of the errors listed above can be detected and prevented by the drive system's internal monitoring. Nevertheless, it is still possible for the motor shaft to move any time the device is switched on! For this reason, higher-level safety precautions need to be put in place to ensure that personnel and machines are protected.

The moving parts on machines must be shielded in such a way as to prevent unintentional access by personnel. This type of protection can be achieved by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or light barriers.

Removing, bypassing or circumventing these protective measures and entering the area where movement takes place is prohibited.

A sufficient number of emergency stop switches must be installed in direct proximity to the machine and be easily accessible at all times. This emergency stop equipment must be checked before the machine is commissioned.

On free running motors, the shaft key (if present) must be removed or measures taken to prevent its ejection.

The holding brake built into motors cannot prevent hoisting equipment from dropping hanging loads.

2.7.3 Protection against burns

The surfaces of drive systems and motors can reach very high temperatures during operation.

For this reason, stickers must be placed on drive systems and motors (see the section "Multilingual ACOPOSmicro warning stickers" in the "Technical data" chapter of the ACOPOSmicro User's Manual:

Example of "Hot surface" sticker
(3 stickers included with ACOPOSmicro)

3 System overview

B&R stepper motors are characterized by the following features:

- High torque
- High overload capability
- Cost-effective encoder option
- Operation in parallel and in series
- Optional IP65 protection
- Optional with brake

3.1 Proven technology

Stepper motors are far from getting "a bit long in the tooth". The technology itself is proven and continues to undergo advanced development to reduce costs and size while increasing torque. The construction and control of stepper motors enables high-precision and cost-effective positioning without having to rely on an encoder system.

3.2 Areas of use

More and more stepper motors are being built every year. Although most of these motors are used in very simple applications, they are also seeing increased usage in applications that were handled primarily by DC and BLDC motors in the past. High-performance controllers increasingly make it possible for more complex tasks to be solved. Many applications that were once handled using smaller servo motors can now be handled by a stepper motor outfitted with the corresponding electronics.

Not only have the possibilities involving controllers advanced over the last few years, but the motors themselves are running considerably smoother and with higher torque thanks to improved technology. New, robust position feedback possibilities are becoming much less expensive and are also playing their part in opening up new areas of use for stepper motors.

Of course, stepper motor solutions also have their limitations. High speeds in particular, long achieved easily by servo motors, can often not be handled well by a stepper motor. If implementing a geared solution, however, many opportunities present themselves by using a smaller gear ratio or even no gears at all. The reason for this is the high torque that can be achieved with stepper motors in the low to intermediate speed range.

Stepper motors are primarily used for infeed axes or for positioning tasks with comparatively lengthy idle times.

Due to their technology, stepper motors are limited in their use in applications where the motor runs continuously. In these types of applications, it is important to make sure that the maximum surface temperature is not exceeded.

Suitable countermeasures for this include reducing the current or oversizing the motor. Special attention should be paid to the motor mounting in every case.

3.3 Selecting the proper motor

When selecting a motor, parameters such as concentricity, counter EMF, efficiency, resonance frequencies, etc. must be considered.

Using series-wired stepper motors is preferred because of the corresponding thermal conditions.

3.4 Detent torque and angular precision

A majority of two-phase hybrid stepper motors have a step angle of 1.8°. In addition, there are versions with a step angle of 0.9° and even, less commonly, 0.45°. The smaller stepping angle often results in poorer torque characteristics. Positioning at a higher resolution can only be handled with stepper motor drivers that support microstepping. Moreover, a high step resolution produces excellent concentric properties and reduces potential problems with resonance.

3.5 Position accuracy

The manner in which the desired position is ultimately reached depends on the applied load torque as well as how accurate the stepper motor is when it is manufactured. The position accuracy within one step is always dependent on the load and the resulting angular slip. In practice, however, this is always considerably less than a full step (1.8° on a stepper motor with 200 steps). This load angle is best compensated for by using position feedback. This is why all B&R stepper motors are also available in affordable encoder variations, which achieve a resolution of up to 16 bits. This makes repeat accuracy possible with angle deviations less than 0.1°, even when the load torque changes.

3.6 Ball bearing assembly, high mechanical loads

Tight-fitting seals protect not only against oil loss caused by contamination, as often occurs in the textile industry through clinging fibers, but they are also highly effective at preventing the intrusion of dirt particles. This maintains the full performance of the lubricant. They are also highly effective at preventing the loss of oil at high rotational speeds. In addition, the seals also provide a high level of protection for the bearings against humidity. The low loss of torque caused by the seals has almost no effect on these powerful motors.

B&R has put a lot of time and thought into the selection of these components, applying their own experience in the area of servo drives as well as feedback from many different customers. Because of this, motor suppliers are required to meet strict internal standards.

The bearings used are dimensioned to the best possible size. This helps the motors to handle longitudinal and lateral forces. An additional safety ring in the front bearing holds the ball bearing in position even under high axial loads. This and other mechanical properties of the motor play a major role in significantly increasing reliability and the possible areas of application.

3.7 Documentation

All stepper motors offered by B&R have been measured in a specialized motor laboratory, where all of their relevant characteristics are tested. Results are documented for important values such as detent torque, torque curves at different voltages, concentricity and much more. Torque curves are also recorded for currents that deviate from the specified rated current. Information about possible areas of use and potential limitations for applications with stepper motors is also provided.

This considerably raises the quality of the selection process for a stepper motor application by identifying potential mistakes in selection right from the start. As a result, dimensioning is based on solid principles and allows leeway for new concepts.

3.8 Torque curves

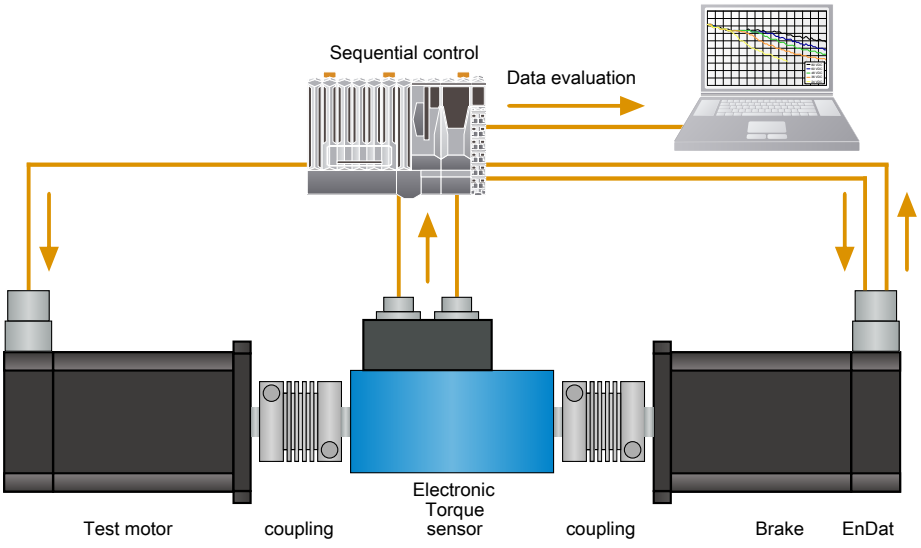


Diagram of motor torque measurement procedure

Comparing torque curves from different manufacturers usually produces differing results, even when the motors share specific comparable properties. This is often caused by differing methods of measurement and how the torque curves are displayed. For example, measuring the motor in full-step mode and with maximum current on

both phases results in a somewhat higher torque, but resonance and motor temperature are also considerably increased. If the resonant points are not shown or if the resolution of the measurement points is simply too low, the result is a completely misrepresented image. Resonance can be counteracted when microstepping by adjusting the phase current in such a way that the same torque is present at every position.

If the torque drops are accounted for in full-step mode and the entire rotational range is observed, then ultimately all disadvantages of microstepping are eliminated, leaving only its benefits. This is why B&R always specifies a microstepping torque curve for their motors.

3.9 Various sizes

	80MPD (NEMA 23, flange size 56.4 mm)	80MPF (flange size 60 mm)	80MPH (NEMA 34, flange size 87.1 mm)
Holding torque	1.1 to 3.0 Nm	1.15 to 3.5 Nm	4.0 to 13.6 Nm
Stall torque	0.8 to 2.2 Nm	0.81 to 2.5 Nm	2.9 to 9.3 Nm
Protection	IP30	IP30	IP40
Page (basic motor)	24	26	28

3.10 Quality features

The aluminum housing used on the new 80MPH motors (NEMA 34, flange size 87.1 mm) makes it possible to disperse dissipated thermal power with the lowest thermal resistance possible.

This minimizes the heating of the motor and considerably increases the service life of the bearings. The ball bearing used in a stepper motor is generally one of the major components that determines reliability under rough conditions.

3.11 Options

3.11.1 IP upgrade / increased protection

B&R offers a solution particularly geared for use in industrial environments. The optional upgrade is installed by the customer, providing them with full freedom with regard to cabling. This upgrade makes it possible to achieve up to IP65 protection.

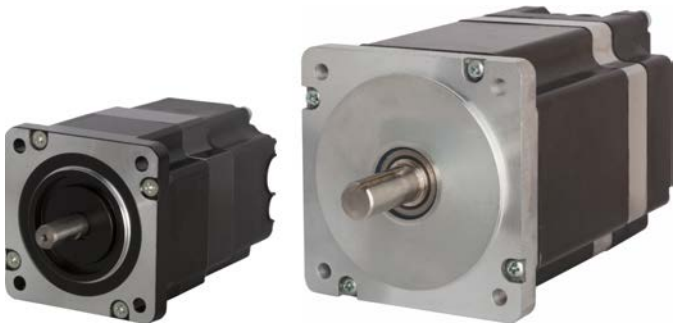
Example: Stepper motor with the IP65 upgrade option / connection terminal provided by the IP65 option

3.11.2 Encoder

B&R stepper motors can be delivered with an optional encoder system. The magnetic encoders that are used are highly robust, which makes them an ideal solution for use in harsh environments.

10-bit ABR incremental encoders, 12-bit SSI encoders and 16-bit Hiperface encoders are available as options.

Stepper motors with an IP20 encoder



Stepper motor with an IP65 encoder option

3.11.3 Holding brake

Brakes are used wherever moving mass must be stopped in a defined manner and whenever braking torque must be maintained if the power supply fails.

Here again with their holding brakes, B&R offers yet another cost-effective and high-performance solution.

Holding brakes are available with up to 2 Nm for the 80MPF motors (flange size 60 mm) and even up to 9 Nm for the 80MPH motors (NEMA 34, flange size 87.1 mm). Braking force is provided by a permanent magnet. A voltage of 24 VDC is required to release the brakes.

Stepper motors with the encoder and brake options

3.12 Extensive stepper motor control

	X20DS1119	X20DS1319	X20SM1426	X20SM1436	X67SM2436	X67SM4320	ACOPOSmicro
							
Channels	1		1		2	4	1/2
Current	Direction/frequency		1 A	3 A	3 A	1 A	10 A
Voltage	5 V	24 V	24	24 to 39 V ±25%	24 to 39 V ±25%	24 V	24 to 64 V ±25%
Encoder	1x incremental encoder 1x SSI encoder		1x incremental encoder		2x incremen-tal encoder	-	Up to 2x incremental encoder 2x SSI encoder or 2x Hiperface encoder
Protection	IP20		IP20		IP67		IP20

4 Useful information

4.1 Torque characteristics and stepping angle of a stepper motor

Holding torque: The torque that the stepper motor can hold without continually rotating the rotor.

Torque (stall torque): The maximum torque that the motor can generate at a standstill (or starting from a standstill).

4.1.1 Full-step mode

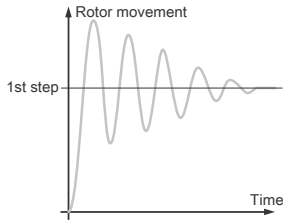
> **Information:**
>
> **In full-step mode, a step corresponds to 1.8°.**

In full-step mode, a stepper motor can achieve more torque because the maximum phase current can always be applied. Because of the natural resonance brought about by the transient effect, however, torque weakens with each full step. This can cause the motor to stall. The strong increase in the motor's noise levels is also a substantial disadvantage of full-step driving.

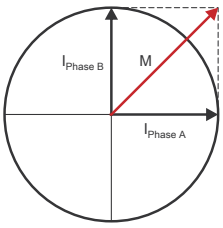
One additional significant disadvantage of full-step mode with maximum phase current is the increased dissipation loss of approximately 50% that leads to a higher motor temperature and a reduction in the motor's service life.

This can be counteracted by reducing the current by a factor of radical 2. Although this reduces the torque by approximately the same factor, it also reduces the motor's natural resonance, which can help reduce the weakening of the motor's torque in some instances.

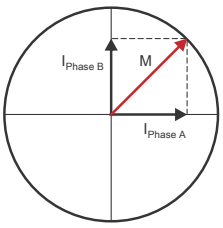
> **Information:**
>
> **In general, full-step mode is possible with the power amplifiers offered by B&R, but due to the disadvantages listed above it is not recommended.**



Transient effect for full step



Full step position without current reduction



Full step position with current reduction

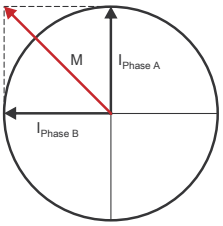
4.1.2 Half-step mode

Note:

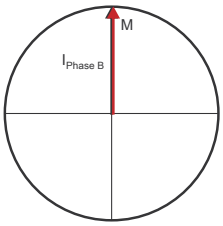
In half-step mode, each step is 0.9°.

Because of an additional intermediate position, the resonance when half stepping is not as pronounced as in full-step operation. In half-step mode, there are two methods that can be used to power the windings.

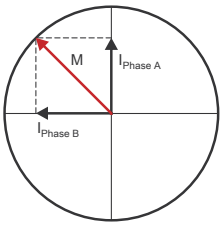
1. The drive alternates between two windings on (supplied with current) and a single winding on. In this variant, it is important that current is reduced in the full-step position; otherwise, an unbalanced torque curve results that can cause torque fluctuations that bring about resonance.
2. Both windings are supplied with current so that a torque vector forms that is offset by 22.5° from the half-step position in the first method. This is a considerably better method since it also mostly compensates for the torque fluctuations caused by the detent torque.



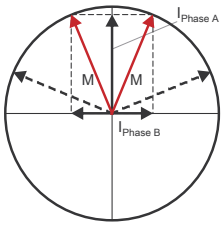
Full-step position without current reduction



Half-step position



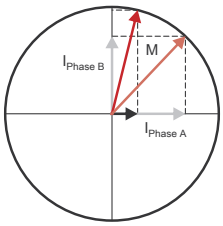
Full step position with current reduction



Half-step position with 22.5° vector

4.1.3 Microstep mode

With microstepping, a step corresponds theoretically to 0.007° when there are 256 microsteps. In microstep mode, the nearly sinusoidal current waveform and the fine resolution of the steps achieves a consistent torque curve. This method results in a high degree of position accuracy, greatly reduced resonance and quieter operation.



Microstep mode

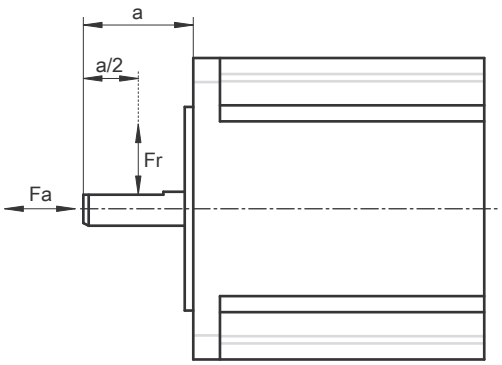
4.2 Reliability of B&R motors

All B&R motors are brushless, have high-quality ball bearings in the front and rear bearing seats and have a life expectancy of over 20,000 operating hours when used in the permitted operating voltage range. This service life is based on the results of testing carried out by well-known ball bearing manufacturers. Calculated L10h values are merely theoretical values at optimal operating conditions that are not valid for warranty claims.

4.2.1 Maximum permissible and radial force (Fa and Fr)

Stepper motor	Radial force (Fr)[1]	Axial force (Fa)
80MPDx (see "Basic motors 80MPD (NEMA 23, flange size 56.4 mm)" on page 24)	73.5 N	≤ motor mass[2]
80MPFx (see "Basic motors 80MPF (flange size 60 mm)" on page 26)	75.0 N	≤ motor mass[2]
80MPHx (see "Basic motors 80MPH (NEMA 34, flange size 87.1 mm)" on page 28)	290.0 N	225.0 N

1) Measured in the middle of the shaft.
2) The permitted axial load may not be larger than the motor mass.



Axial and radial force (Fa and Fr)

4.2.2 Reducing average life expectancy

Negative influences on the average life expectancy L10h value specified by B&R include:

- Impact-related forces
- Excessive radial and axial loads
- Vibration and oscillation, very high cyclic acceleration
- Imprecise angle and centering alignment
- Environmental conditions such as dust, humidity, corrosive gases, etc.
- Insufficient heat dissipation

4.3 Holding brake - Nominal torque M_{2N}

In order for the brakes and couplings to function safely even in extreme conditions, a safety factor must be applied to the required rated torque. This safety factor is derived mainly from the application at hand. The dynamic torque can therefore be considerably less than the rated torque.

$M_{2N} = M_{req} \times K$

M_{req}= required braking torque [Nm]

$K \geq 2$

5 General overview

80MPD (NEMA 23, flange size 56.4 mm)

	Encoder					IP					Technical data	Torque curve	
Model number[1]	Without encoder	ABR	SSI	HIPERFACE	Holding brake	20	30	40	65	Max. temp.	Page	Page	Curve number / Connection
80MPD1.300S000-01 [2]	●						●			100°C	25	65	80MPD1.300xxxx-xx / Series 3 A
	●						●			100°C		65	80MPD1.600xxxx-xx / Parallel 6 A
80MPD1.300S014-01		●				●				95°C	32	65	80MPD1.300xxxx-xx / Series 3 A
80MPD1.600S014-01		●				●				95°C		65	80MPD1.600xxxx-xx / Parallel 6 A
80MPD3.300S000-01 [2]	●						●			100°C	25	67	80MPD3.300xxxx.xx / Series 3 A
	●						●			100°C		67	80MPD3.600xxxx.xx / Parallel 6 A
80MPD3.300S014-01		●				●				95°C	32	67	80MPD3.300xxxx.xx / Series 3 A
80MPD3.600S014-01		●				●				95°C		67	80MPD3.600xxxx.xx / Parallel 6 A
80MPD5.300S000-01 [2]	●						●			100°C	25	69	80MPD5.300xxxx-xx / Series 3 A
	●						●			100°C		69	80MPD5.600xxxx-xx / Parallel 6 A
80MPD5.300S014-01		●				●				95°C	32	69	80MPD5.300xxxx-xx / Series 3 A
80MPD5.600S014-01		●				●				95°C		69	80MPD5.600xxxx-xx / Parallel 6 A

1) For information about the meaning of model numbers, see "Order key" on page 23
2) The stepper motors without an encoder can be wired in either series or parallel. The model numbers for the basic motors are therefore, for logistical reasons, derived from the series connection.

80MPF (flange size 60 mm)

	Encoder					IP					Technical data	Torque curve	
Model number[1]	Without encoder	ABR	SSI	HIPERFACE	Holding brake	20	30	40	65	Max. temp.	Page	Page	Curve number / Connection
80MPF1.250S000-01 [2]	●						●			100°C	27	71	80MPF1.250xxxx-xx / Series 2.5 A
	●						●			100°C		71	80MPF1.500xxxx-xx / Parallel 5 A
80MPF1.250D114-01		●			●				●	90°C	53	71	80MPF1.250xxxx-xx / Series 2.5 A
80MPF1.250S114-01		●							●	95°C	38		
80MPF1.500D114-01		●			●				●	90°C	53	71	80MPF1.500xxxx-xx / Parallel 5 A
80MPF1.500S114-01		●							●	95°C	38		
80MPF3.250S000-01 [2]	●						●			100°C	27	72	80MPF3.250xxxx-xx / Series 2.5 A
	●						●			100°C		72	80MPF3.500xxxx-xx / Parallel 5 A
80MPF3.250D114-01		●			●				●	90°C	53	72	80MPF3.250xxxx-xx / Series 2.5 A
80MPF3.250S114-01		●							●	95°C	38		
80MPF3.500D114-01		●			●				●	90°C	53	72	80MPF3.500xxxx-xx / Parallel 5 A
80MPF3.500S114-01		●							●	95°C	38		
80MPF5.250S000-01 [2]	●						●			100°C	27	73	80MPF5.250xxxx-xx / Series 2.5 A
	●						●			100°C		73	80MPF5.500xxxx-xx / Parallel 5 A
80MPF5.250S113-01			●						●	95°C	44	73	80MPF5.250xxxx-xx / Series 2.5 A
80MPF5.250D114-01		●			●				●	90°C	53		
80MPF5.250S114-01		●							●	95°C	38		
80MPF5.500D113-01			●		●				●	90°C	60	73	80MPF5.500xxxx-xx / Parallel 5 A
80MPF5.500S113-01			●						●	95°C	44		
80MPF5.500D114-01		●			●				●	90°C	53		
80MPF5.500S114-01		●							●	95°C	38		

1) For information about the meaning of model numbers, see "Order key" on page 23
2) The stepper motors without an encoder can be wired in either series or parallel. The model numbers for the basic motors are therefore, for logistical reasons, derived from the series connection.

80MPH (NEMA 34, flange size 87.1 mm)

	Encoder					IP					Technical data	Torque curve	
Model number[1]	Without encoder	ABR	SSI	HIPERFACE	Holding brake	20	30	40	65	Max. temp.	Page	Page	Curve number / Connection
80MPH1.300S000-01 [2]	●							●		100°C	29	75	80MPH1.300xxxx-xx / Series 3 A
	●							●		100°C		75	80MPH1.600xxxx-xx / Parallel 6 A
80MPH1.300S014-01		●				●				95°C	33	75	80MPH1.300xxxx-xx / Series 3 A
80MPH1.300D114-01		●			●				●	85°C	54		
80MPH1.300S114-01		●							●	95°C	39		
80MPH1.600S014-01		●				●				95°C	33	75	80MPH1.600xxxx-xx / Parallel 6 A
80MPH1.600D114-01		●			●				●	85°C	54		
80MPH1.600S114-01		●							●	95°C	39		
80MPH3.300S000-01 [2]	●							●		100°C	29	77	80MPH3.300xxxx-xx / Series 3 A
	●							●		100°C		77	80MPH3.600xxxx-xx / Parallel 6 A
80MPH3.300S014-01		●				●				95°C	33	77	80MPH3.300xxxx-xx / Series 3 A
80MPH3.600S014-01		●				●				95°C		77	80MPH3.600xxxx-xx / Parallel 6 A
80MPH3.600D114-01		●			●				●	85°C	54		
80MPH3.600S114-01		●							●	95°C	39		
80MPH4.101S014-01		●				●				95°C	34	81	80MPH4.101xxxx-xx / Parallel 10 A
80MPH4.101D114-01		●			●				●	85°C	54		
80MPH4.101S114-01		●							●	95°C	39		
80MPH4.300S000-01	●							●		100°C	29	79	80MPH4.300xxxx-xx / Series 3 A
	●							●		100°C		79	80MPH4.600xxxx-xx / Parallel 6 A
80MPH4.300S014-01		●				●				95°C	34	79	80MPH4.300xxxx-xx / Series 3 A
80MPH4.300S114-01		●							●	95°C	40		
80MPH4.500S000-01 [2]	●							●		100°C	29	81	80MPH4.500xxxx-xx / Series 5 A
	●							●		100°C		81	80MPH4.101xxxx-xx / Parallel 10 A
80MPH4.500S014-01		●				●				95°C	34	81	80MPH4.500xxxx-xx / Series 5 A
80MPH4.500S114-01		●							●	95°C	40		
80MPH4.600S014-01		●				●				95°C	34	79	80MPH4.600xxxx-xx / Parallel 6 A
80MPH4.600S111-02				●					●	95°C	48		
80MPH4.600D114-01		●			●				●	85°C	54		
80MPH4.600S114-01		●							●	95°C	40		
80MPH6.101S000-01 [2]	●							●		100°C	29	85	80MPH6.101xxxx-xx / Parallel 10 A
80MPH6.101S014-01		●				●				95°C	34		
80MPH6.101D114-01		●			●				●	85°C	54		
80MPH6.101S114-01		●							●	95°C	40		
80MPH6.300S000-01 [2]	●							●		100°C	29	83	80MPH6.300xxxx-xx / Series 3 A
	●							●		100°C		83	80MPH6.600xxxx-xx / Parallel 6 A
80MPH6.300S014-01		●				●				95°C	34	83	80MPH6.300xxxx-xx / Series 3 A
80MPH6.300D114-01		●			●				●	85°C	54		
80MPH6.300S114-01		●							●	95°C	40		
80MPH6.600S014-01		●				●				95°C	34	83	80MPH6.600xxxx-xx / Parallel 6 A
80MPH6.600D114-01		●			●				●	85°C	54		
80MPH6.600S114-01		●							●	95°C	40		

1) For information about the meaning of model numbers, see "Order key" on page 23

2) The stepper motors without an encoder can be wired in either series or parallel. The model numbers for the basic motors are therefore, for logistical reasons, derived from the series connection.

5.1 Order key

Order Key

80MP	a	b	.	cc	d	ee	ff	-	01

Flange dimensions

D...56,4 mm (NEMA 23)
F ...60 mm
H...87,1 mm (NEMA 34)

Number of stacks (corresponds to the length of the motor)
1... 1 stack
3... 2 stacks
4... 2 stacks - high torque (80MPH)
5... 3 stacks (80MPD und 80MPF)
6... 3 stacks (80MPH)

Current [1)]
cc... Current x 100 mA Example: 30 corresponds to 3.000 mA = 3 A
50 corresponds to 5.000 mA = 5 A

Current multiplier [1)]
d... 10^{d} Example: cc = 10, d = 1
10 x 100 mA x 10^{1} = 10.000 mA = 10 A

Protection type / brake option

S0...Standard
S1...IP65
D1...IP65 + brake

Options

00...No encoder
11...Hiperface
13...SSI absolute encoder
14...ABR incremental encoder

Additional motor options or special motor options must be arranged with B&R.

1) With 8 wire motors (*eeff* = S000), the user can wire the stepper motor for series or parallel operation.
The designation *ccd* in the model number for these motors corresponds to the specified current for series wiring.
If the 8 wire motor is operated with parallel wiring, the specified current *ccd* in the model number must be doubled.

Information:

Not all combinations in the above table are available (see "General overview" on page 20).

6 Stepper motors without options

This chapter describes stepper motors without any options installed (standard motors). The stepper motors with options can be found in chapter 7 "Stepper motors with additional options" on page 31.

6.1 Basic motors 80MPD (NEMA 23, flange size 56.4 mm)

- 6.35 mm shaft
- High torque with respect to length
- High-quality ball bearing with double seals

80MPD1.300S000-01

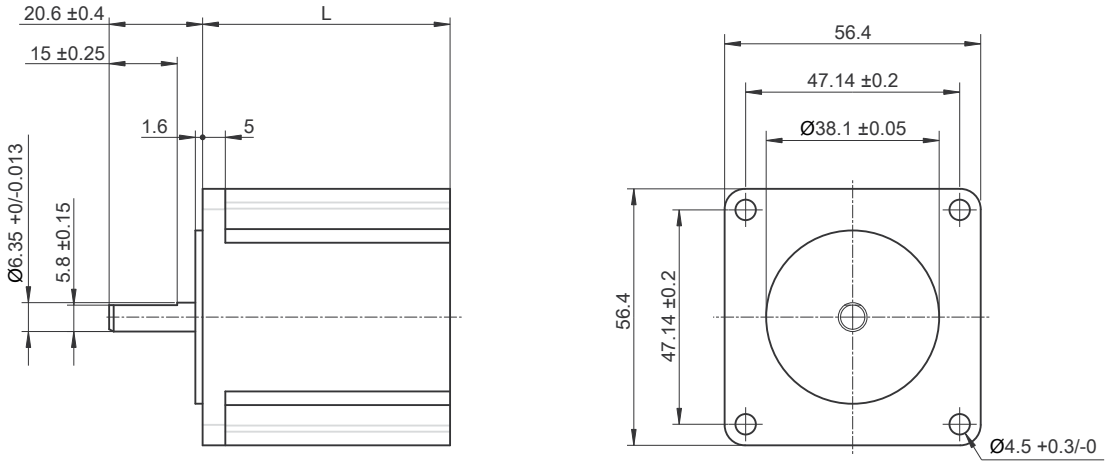
80MPD3.300S000-01

80MPD5.300S000-01

Model number	Short description
	Stepper motors without encoder
80MPD1.300S000-01	2 phase hybrid stepper motor, 56 mm flange, length 45 mm, 3 A series / 6 A parallel, 1.1 Nm holding torque, 0.8 Nm stall torque
80MPD3.300S000-01	2 phase hybrid stepper motor, 56 mm flange, length 57.5 mm, 3 A series / 6 A parallel, 1.8 Nm holding torque, 1.25 Nm stall torque
80MPD5.300S000-01	2 phase hybrid stepper motor, 56 mm flange, length 80.5 mm, 3 A series / 6 A parallel, 3.0 Nm holding torque, 2.2 Nm stall torque
	Optional accessories
	Accessories
80XMPDXRE.W1-10	IP upgrade kit with cable clamp for stepper motors in the 80MPD and 80MPF series, IP40 for 80MPD motors, IP65 for 80MPF motors, 10 units per package

Table 2: 80MPD1.300S000-01, 80MPD3.300S000-01, 80MPD5.300S000-01 - Order data

6.1.1 Dimensions



Stepper motor	Length L [mm]
80MPD1.300S000-01	45.0
80MPD3.300S000-01	57.5
80MPD5.300S000-01	80.5

6.1.2 Technical data

Basic motors 80MPD (NEMA 23, flange size 56.4 mm)

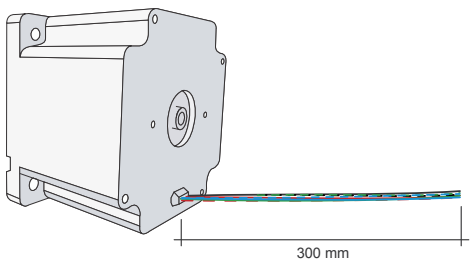
Product ID	80MPD1.300S000-01	80MPD3.300S000-01	80MPD5.300S000-01
Short description			
Stepper motor	Stepper motor flange size 56 mm, length 45 mm	Stepper motor flange size 56 mm, length 57.5 mm	Stepper motor flange size 56 mm, length 80.5 mm
Specific motor data			
Wiring			
Series		True	
Parallel		True	
Current			
Series wiring		3 A	
Parallel wiring		6 A	
Resistance / phase			
Series wiring	1.2 Ω	1.6 Ω	2.4 Ω
Parallel wiring	0.3 Ω	0.4 Ω	0.6 Ω
Inductance / phase			
Series wiring	3.6 mH	5.2 mH	8.8 mH
Parallel wiring	0.9 mH	1.3 mH	2.2 mH
Stall torque	0.8 Nm	1.25 Nm	2.2 Nm
Holding torque [1]	1.1 Nm	1.8 Nm	3.0 Nm
Detent torque	<30 mNm	<50 mNm	<90 mNm
Rotor inertia	Approx. 145 gcm²	Approx. 245 gcm²	Approx. 470 gcm²
General motor data			
Rated protection		IP30	
Stepping angle		1.8°	
Maximum surface temperature		100°C	
Average period of operation between failures		21,000 hours	
Cable length		300 mm	
Cable cross section		AWG 22, UL3266	
Shaft type		Flat-sided (D-cut)	
Insulation class		B (130°C)	
Insulation resistance		100 MΩ min. 500 VDC	
Dielectric resistance		500 VAC for 1 minute	
Driver voltage supply		Max. 80 VDC	
Environmental conditions			
Temperature			
Operation		-20 to 40°C	
Storage		-30 to 85°C	
Transport		-30 to 85°C	
Relative humidity			
Operation		5 to 95%, non-condensing	
Storage		5 to 95%, non-condensing	
Transport		5 to 95%, non-condensing	
Mechanical characteristics			
Maximum radial load [2]		73.5 N	
Maximum axial load		The permitted axial load may not be larger than the motor mass.	
Weight	520 g	720 g	1.110 g
Length	45 mm	57.5 mm	80.5 mm

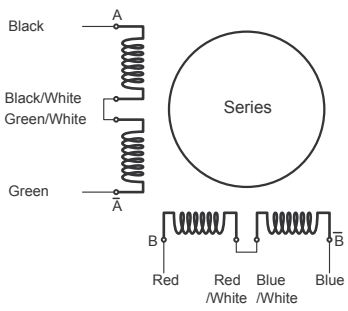
Table 3: 80MPD1.300S000-01, 80MPD3.300S000-01, 80MPD5.300S000-01 - Technical data

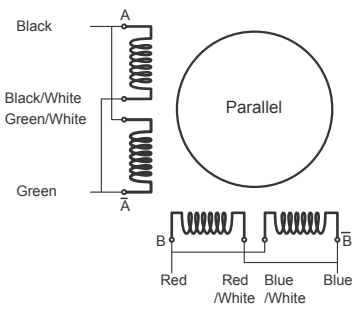
1) Measured with serial wiring
2) Measured in the middle of the shaft

6.1.3 Wiring

The standard delivery for "stepper motors without options" (basic motors) includes 300 mm stranded wires. The customer therefore has the option of either parallel or series wiring.







6.2 Basic motors 80MPF (flange size 60 mm)

- 8 mm shaft
- Lower current consumption at same or higher torque compared to 56 mm motors.
- Better thermal properties due to the larger surface area compared to 56 mm motors.
- High-quality ball bearing with double seals

80MPF1.250S000-01

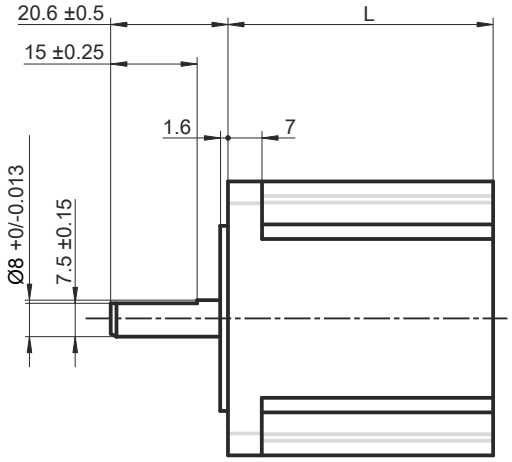
80MPF3.250S000-01

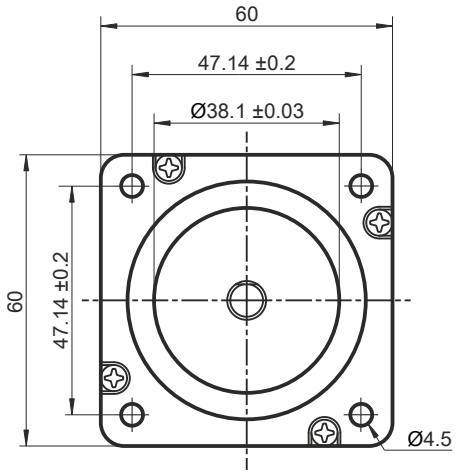
80MPF5.250S000-01

Model number	Short description
	Stepper motors without encoder
80MPF1.250S000-01	2 phase hybrid stepper motor, 60 mm flange, length 51.8 mm, 2.5 A series / 5 A parallel, 1.1 Nm holding torque, 0.8 Nm stall torque
80MPF3.250S000-01	2 phase hybrid stepper motor, 60 mm flange, length 62 mm, 2.5 A series / 5 A parallel, 1.7 Nm holding torque, 1.2 Nm stall torque
80MPF5.250S000-01	2 phase hybrid stepper motor, 60 mm flange, length 93.3 mm, 2.5 A series / 5 A parallel, 3.5 Nm holding torque, 2.5 Nm stall torque
	Optional accessories
	Accessories
80XMPDXRE.W1-10	IP upgrade kit with cable clamp for stepper motors in the 80MPD and 80MPF series, IP40 for 80MPD motors, IP65 for 80MPF motors, 10 units per package

Table 4: 80MPF1.250S000-01, 80MPF3.250S000-01, 80MPF5.250S000-01 - Order data

6.2.1 Dimensions





Stepper motor	Length L [mm]
80MPF1.250S000-01	51.8
80MPF3.250S000-01	62.0
80MPF5.250S000-01	93.3

6.2.2 Technical data

Basic motors 80MPF (flange size 60 mm)

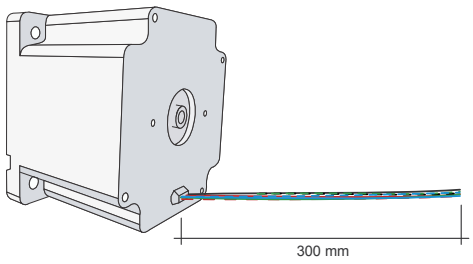
Product ID	80MPF1.250S000-01	80MPF3.250S000-01	80MPF5.250S000-01
Short description			
Stepper motor	Stepper motor flange size 60 mm, length 51.8 mm	Stepper motor flange size 60 mm, length 62 mm	Stepper motor flange size 60 mm, length 93.3 mm
Specific motor data			
Wiring			
Series		True	
Parallel		True	
Current			
Series wiring		2.5 A	
Parallel wiring		5 A	
Resistance / phase			
Series wiring	1.28 Ω	1.52 Ω	2.4 Ω
Parallel wiring	0.32 Ω	0.38 Ω	0.6 Ω
Inductance / phase			
Series wiring	3.4 mH	5.6 mH	11.2 mH
Parallel wiring	0.85 mH	1.4 mH	2.8 mH
Stall torque	0.8 Nm	1.2 Nm	2.5 Nm
Holding torque [1]	1.1 Nm	1.7 Nm	3.5 Nm
Detent torque	<35 mNm	<45 mNm	<75 mNm
Rotor inertia	280 gcm²	440 gcm²	920 gcm²
General motor data			
Rated protection		IP30	
Stepping angle		1.8°	
Maximum surface temperature		100°C	
Average period of operation between failures		21,000 hours	
Cable length		300 mm	
Cable cross section		AWG 22	
Shaft type		Flat-sided (D-cut)	
Insulation class		B (130°C)	
Insulation resistance		100 MΩ min. 500 VDC	
Dielectric resistance		500 VAC for 1 minute	
Environmental conditions			
Temperature			
Operation		-20 to 40°C	
Storage		-30 to 85°C	
Transport		-30 to 85°C	
Relative humidity			
Operation		5 to 95%, non-condensing	
Storage		5 to 95%, non-condensing	
Transport		5 to 95%, non-condensing	
Mechanical characteristics			
Maximum radial load [2]		75 N	
Maximum axial load		The permitted axial load may not be larger than the motor mass.	
Weight	620 g	880 g	1,400 g
Length	51.8 mm	62 mm	93.3 mm

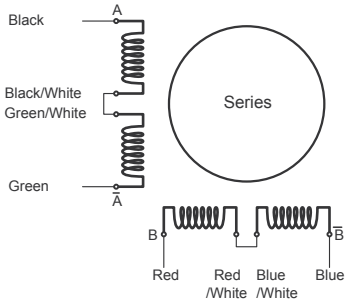
Table 5: 80MPF1.250S000-01, 80MPF3.250S000-01, 80MPF5.250S000-01 - Technical data

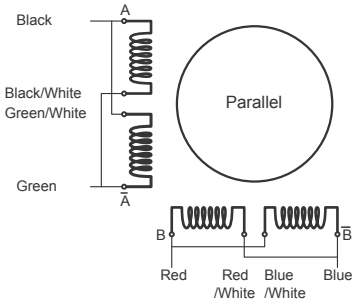
1) Measured with serial wiring
2) Measured in the middle of the shaft

6.2.3 Wiring

The standard delivery for "stepper motors without options" (basic motors) includes 300 mm stranded wires. The customer therefore has the option of either parallel or series wiring.







6.3 Basic motors 80MPH (NEMA 34, flange size 87.1 mm)

- 12.7 mm shaft
- High torque
- High axial load due to the safety ring in the front bearing
- Aluminum housing for better thermal flow
- 10 A variant for higher speeds

80MPH1.300S000-01

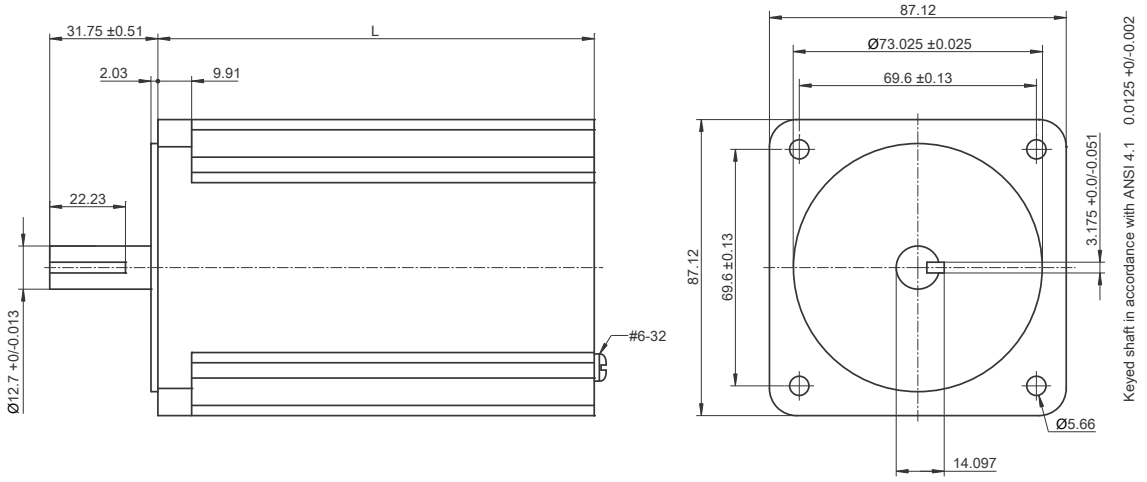
80MPH3.300S000-01

80MPH6.300S000-01

Model number	Short description
	Stepper motors without encoder
80MPH1.300S000-01	2 phase hybrid stepper motor, 86 mm flange, length 66 mm, 3 A series / 6 A parallel, 4.0 Nm holding torque, 2.9 Nm stall torque
80MPH3.300S000-01	2 phase hybrid stepper motor, 86 mm flange, length 98 mm, 3 A series / 6 A parallel, 7.8 Nm holding torque, 5.5 Nm stall torque
80MPH4.300S000-01	2 phase hybrid stepper motor, 86 mm flange, length 98 mm, 3 A series / 6 A parallel, 9.5 Nm holding torque, 6.3 Nm stall torque
80MPH4.500S000-01	2 phase hybrid stepper motor, 86 mm flange, length 98 mm, 5 A series / 10 A parallel, 9.5 Nm holding torque, 6.3 Nm stall torque
80MPH6.101S000-01	2 phase hybrid stepper motor, 86 mm flange, length 130 mm, 10 A parallel, 13.6 Nm holding torque, 9.3 Nm stall torque
80MPH6.300S000-01	2 phase hybrid stepper motor, 86 mm flange, length 130 mm, 3 A series / 6 A parallel, 13.6 Nm holding torque, 9.3 Nm stall torque
	Optional accessories
	Accessories
80XMPHXRE.W1-10	IP upgrade kit with cable clamp for stepper motors from the 80MPH series, IP65, 10 units per package

Table 6: 80MPH1.300S000-01, 80MPH3.300S000-01, 80MPH4.300S000-01, 80MPH4.500S000-01, 80MPH6.101S000-01, 80MPH6.300S000-01 - Order data

6.3.1 Dimensions



Stepper motor	Length L [mm]
80MPH1.300S000-01	66.0
80MPH3.300S000-01	98.0
80MPH4.300S000-01	98.0
80MPH4.500S000-01	98.0
80MPH6.300S000-01	130.0
80MPH6.101S000-01	130.0

6.3.2 Technical data

Basic motors 80MPH (NEMA 34, flange size 87.1 mm)

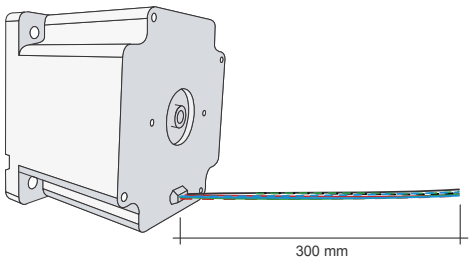
Product ID	80MPH1. 300S000-01	80MPH3. 300S000-01	80MPH4. 300S000-01	80MPH4. 500S000-01	80MPH6. 101S000-01	80MPH6. 300S000-01
Short description						
Stepper motor	Stepper motor flange size 86 mm, length 66 mm	Stepper motor flange size 86 mm, length 98 mm			Stepper motor flange size 86 mm, length 130 mm	
Specific motor data						
Wiring						
Series	True				False	True
Parallel	True					
Current						
Series wiring	3 A			5 A	-	3 A
Parallel wiring	6 A			10 A		6 A
Resistance / phase						
Series wiring	1.7 Ω	2.2 Ω		0.9 Ω	-	2.7 Ω
Parallel wiring	0.4 Ω	0.6 Ω		0.2 Ω	0.24 Ω	0.7 Ω
Inductance / phase						
Series wiring	12.9 mH	17.3 mH		5.6 mH	-	20.0 mH
Parallel wiring	3.2 mH	4.3 mH		1.4 mH	1.6 mH	5.0 mH
Stall torque	2.9 Nm	5.5 Nm	6.3 Nm		9.3 Nm	
Holding torque [1]	4.0 Nm	7.8 Nm	9.5 Nm		13.6 Nm	
Detent torque	<160 mNm	<210 mNm	<320 mNm		<420 mNm	
Rotor inertia	Approx. 1.31 kgcm²	Approx. 2.61 kgcm²			Approx. 3.92 kgcm²	
General motor data						
Rated protection	IP40					
Stepping angle	1.8°					
Maximum surface temperature	100°C					
Average period of operation between failures	20,000 hours					
Cable length	300 mm					
Cable cross section	AWG 22, UL3266					
Shaft type	Keyed					
Insulation class	B (130°C)					
Insulation resistance	100 MΩ min. 500 VDC					
Dielectric resistance	1776 VAC for 1 minute					
Environmental conditions						
Temperature						
Operation	-20 to 40°C					
Storage	-30 to 85°C					
Transport	-30 to 85°C					
Relative humidity						
Operation	5 to 95%, non-condensing					
Storage	5 to 95%, non-condensing					
Transport	5 to 95%, non-condensing					
Mechanical characteristics						
Maximum radial load [2]	290 N					
Maximum axial load	225 N					
Weight	1.8 kg	3.0 kg			4.2 kg	
Length	66 mm	98 mm			130 mm	

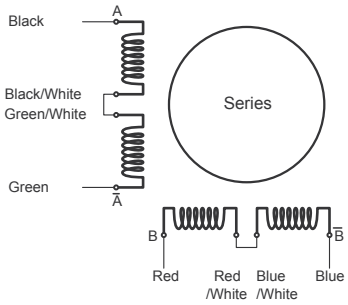
Table 7: 80MPH1.300S000-01, 80MPH3.300S000-01, 80MPH4.300S000-01, 80MPH4.500S000-01, 80MPH6.101S000-01, 80MPH6.300S000-01 - Technical data

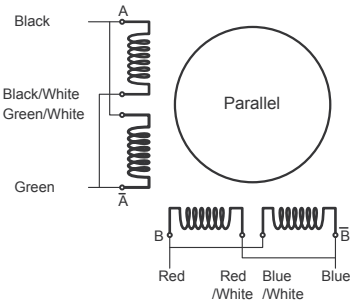
1) Measured with serial wiring
2) Measured in the middle of the shaft

6.3.3 Wiring

The standard delivery for "stepper motors without options" (basic motors) includes 300 mm stranded wires. The customer therefore has the option of either parallel or series wiring.


300 mm


Black
Black/White
Green/White
Green
A
Ā
Series
B
B̄
Red
Red /White
Blue /White
Blue

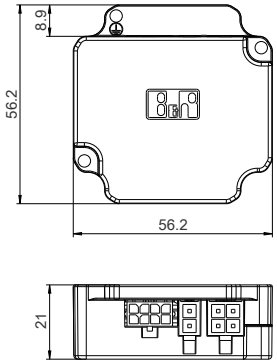

Black
Black/White
Green/White
Green
A
Ā
Parallel
B
B̄
Red
Red /White
Blue /White
Blue

7 Stepper motors with additional options

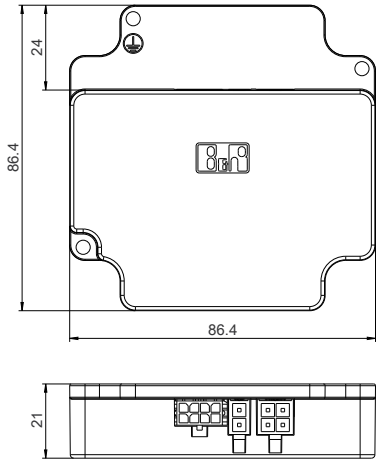
7.1 Motors with the ABR incremental encoder IP20 option

Model number	Short description
80MPxx.xxxS014-01	Option ABR incremental encoder 24 VDC, IP20, for 80MPD and 80MPH motors. For a list of all model numbers and the respective motor data, see the "ABR encoder" and "IP20" columns in "General overview" on page 20.
	Optional accessories (more information in the "Accessories" on page 94 section)
80XMPXAC0.00-01	Accessory set for motors with an encoder, 8-pin and 4-pin connector and crimp contact
80CMxxxxx.xx-01	Motor and encoder cables

7.1.1 Dimensions



80MPD motors
ABR incremental encoder IP20 option



80MPH motors
ABR incremental encoder IP20 option

The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPD (NEMA 23, flange size 56.4 mm)" on page 24

"Basic motors 80MPH (NEMA 34, flange size 87.1 mm)" on page 28

7.1.2 Technical data (80MPD)

Motors with the ABR incremental encoder IP20 option

Product ID	80MPD1. 300S014-01	80MPD1. 600S014-01	80MPD3. 300S014-01	80MPD3. 600S014-01	80MPD5. 300S014-01	80MPD5. 600S014-01
Short description						
Stepper motor	Stepper motor flange size 56 mm, length 66 mm, incremental encoder		Stepper motor flange size 56 mm, length 78.5 mm, incremental encoder		Stepper motor flange size 56 mm, length 101.5 mm, incremental encoder	
Specific motor data						
Current	3 A	6 A	3 A	6 A	3 A	6 A
Resistance / phase	1.2 Ω	0.3 Ω	1.6 Ω	0.4 Ω	2.4 Ω	0.6 Ω
Inductance / phase	3.6 mH	0.9 mH	5.2 mH	1.3 mH	8.8 mH	2.2 mH
Stall torque	0.8 Nm		1.25 Nm		2.2 Nm	
Holding torque	1.1 Nm		1.8 Nm		3.0 Nm	
Detent torque	<30 mNm		<50 mNm		<90 mNm	
Rotor inertia	Approx. 145 gcm^2		Approx. 245 gcm^2		Approx. 470 gcm^2	
General motor data						
Stepping angle	1.8°					
Maximum surface temperature	95°C					
Average period of operation between failures	21,000 hours					
Shaft type	Flat-sided (D-cut)					
Insulation class	B (130°C)					
Insulation resistance	100 MΩ min. 500 VDC					
Dielectric resistance	500 VAC for 1 minute					
Driver voltage supply	Max. 80 VDC					
Operating conditions						
EN 60529 protection [1)]	IP20					
Environmental conditions						
Temperature						
Operation	-20 to 40°C					
Storage	-30 to 85°C					
Transport	-30 to 85°C					
Relative humidity						
Operation	5 to 95%, non-condensing					
Storage	5 to 95%, non-condensing					
Transport	5 to 95%, non-condensing					
Electrical characteristics - Encoder						
Number of outputs	3 A / B / R					
Resolution	1024 increments / 256 positions per rotation					
Output circuit	Push / Pull level, asymmetric					
Output protection	Short circuit protection					
Power consumption	Max. 12 mA + output load					
Supply voltage	18 to 30 VDC					
Max. output current	±10 mA per output					
Mechanical characteristics						
Maximum radial load [2)]	73.5 N					
Maximum axial load	The permitted axial load may not be larger than the motor mass.					
Weight	550 g		750 g		1,140 g	
Length	66 mm		78.5 mm		101.5 mm	

Table 8: 80MPD1.300S014-01, 80MPD1.600S014-01, 80MPD3.300S014-01, 80MPD3.600S014-01, 80MPD5.300S014-01, 80MPD5.600S014-01 - Technical data

1) From the back side of the flange
2) Measured in the middle of the shaft

7.1.3 Technical data (80MPH1, 80MPH3)

Motors with the ABR incremental encoder IP20 option

Product ID	80MPH1.300S014-01	80MPH1.600S014-01	80MPH3.300S014-01	80MPH3.600S014-01
Short description				
Stepper motor	Stepper motor flange size 86 mm, length 87 mm, incremental encoder		Stepper motor flange size 86 mm, length 119 mm, incremental encoder	
Specific motor data				
Current	3 A	6 A	3 A	6 A
Resistance / phase	1.7 Ω	0.4 Ω	2.2 Ω	0.6 Ω
Inductance / phase	12.9 mH	3.2 mH	17.3 mH	4.3 mH
Stall torque	2.9 Nm		5.5 Nm	
Holding torque	4.2 Nm		7.8 Nm	
Detent torque	<160 mNm		<210 mNm	
Rotor inertia	Approx. 1.31 kgcm²		Approx. 2.61 kgcm²	
General motor data				
Stepping angle	1.8°			
Maximum surface temperature	95°C			
Average period of operation between failures	20,000 hours			
Shaft type	Keyed			
Insulation class	B (130°C)			
Insulation resistance	100 MΩ min. 500 VDC			
Dielectric resistance	1776 VAC for 1 minute			
Operating conditions				
EN 60529 protection [1]	IP20			
Environmental conditions				
Temperature				
Operation	-20 to 40°C			
Storage	-30 to 85°C			
Transport	-30 to 85°C			
Relative humidity				
Operation	5 to 95%, non-condensing			
Storage	5 to 95%, non-condensing			
Transport	5 to 95%, non-condensing			
Electrical characteristics - Encoder				
Number of outputs	3 A / B / R			
Resolution	1024 increments / 256 positions per rotation			
Output circuit	Push / Pull level, asymmetric			
Output protection	Short circuit protection			
Power consumption	Max. 12 mA + output load			
Supply voltage	18 to 30 VDC			
Max. output current	±10 mA per output			
Mechanical characteristics				
Maximum radial load [2]	290 N			
Maximum axial load	225 N			
Weight	1,900 g		3,100 g	
Length	87 mm		119 mm	

Table 9: 80MPH1.300S014-01, 80MPH1.600S014-01, 80MPH3.300S014-01, 80MPH3.600S014-01 - Technical data

1) From the back side of the flange
2) Measured in the middle of the shaft

7.1.4 Technical data (80MPH4, 80MPH6)

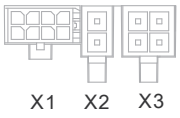
Motors with the ABR incremental encoder IP20 option

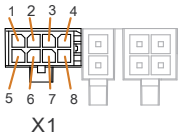
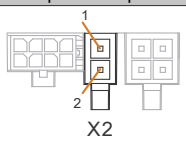
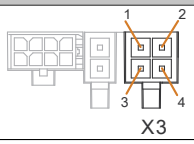
Product ID	80MPH4. 101S014-01	80MPH4. 300S014-01	80MPH4. 500S014-01	80MPH4. 600S014-01	80MPH6. 101S014-01	80MPH6. 300S014-01	80MPH6. 600S014-01
Short description							
Stepper motor	Stepper motor flange size 87.1 mm, length 119 mm, incremental encoder				Stepper motor flange size 87.1 mm, length 151 mm, incremental encoder		
Specific motor data							
Wiring	Parallel	Series		Parallel		Series	Parallel
Current	10 A	3 A	5 A	6 A	10 A	3 A	6 A
Resistance / phase	0.2 Ω	2.2 Ω	0.9 Ω	0.6 Ω	0.24 Ω	2.7 Ω	0.7 Ω
Inductance / phase	1.4 mH	17.3 mH	5.6 mH	4.3 mH	1.6 mH	20.0 mH	5.0 mH
Stall torque	6.3 Nm				9.3 Nm		
Holding torque	9.5 Nm				13.6 Nm		
Detent torque	<320 mNm				<420 mNm		
Rotor inertia	Approx. 2.61 kgcm²				Approx. 3.92 kgcm²		
General motor data							
Stepping angle	1.8°						
Max. surface temperature	95°C						
Average period of operation between failures	20,000 hours						
Shaft type	Keyed						
Insulation class	B (130°C)						
Insulation resistance	100 MΩ min. 500 VDC						
Dielectric resistance	1776 VAC for 1 minute						
Driver voltage supply	Max. 80 VDC						
Operating conditions							
EN 60529 protection [1]	IP20						
Environmental conditions							
Temperature							
Operation	-20 to 40°C						
Storage	-30 to 85°C						
Transport	-30 to 85°C						
Relative humidity							
Operation	5 to 95%, non-condensing						
Storage	5 to 95%, non-condensing						
Transport	5 to 95%, non-condensing						
Electrical characteristics - Encoder							
Number of outputs	3 A / B / R						
Resolution	1024 increments / 256 positions per rotation						
Output circuit	Push / Pull level, asymmetric						
Output protection	Short circuit protection						
Current consumption	Max. 12 mA + output load						
Supply voltage	18 to 30 VDC						
Max. output current	±10 mA per output						
Mechanical characteristics							
Max. radial load [2]	290 N						
Max. axial load	225 N						
Weight	3,100 g				4300 g		
Length	119 mm				151 mm		

Table 10: 80MPH4.101S014-01, 80MPH4.300S014-01, 80MPH4.500S014-01, 80MPH4.600S014-01, 80MPH6.101S014-01, 80MPH6.300S014-01, 80MPH6.600S014-01 - Technical data

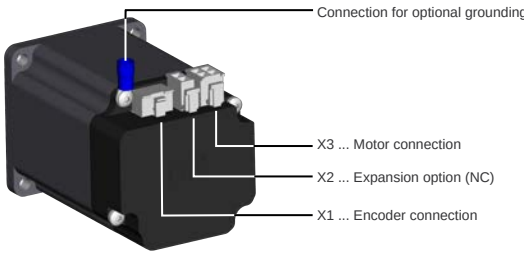
1) From the back side of the flange
2) Measured in the middle of the shaft

7.1.5 Pinout X1 - X3



X1 - ABR incremental encoder	Pinout	
	Pin	Name
	1	A
	2	B
	3	R
	4	NC
	5	NC
	6	24 VDC (encoder supply)
	7	GND
	8	NC
X2 - Optional expansion	Pinout	
	Pin	Name
	1	NC
	2	NC
X3 - Motor connection	Pinout	
	Pin	Name
	1	Motor phase A\
	2	Motor phase B\
	3	Motor phase A
	4	Motor phase B

7.1.6 Arrangement of terminal blocks



Information:

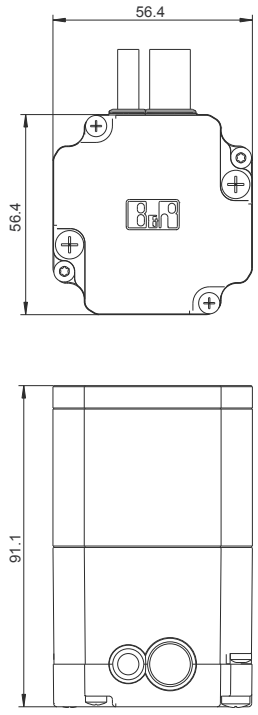
A single screw (M3 x 8 mm) is included with the motor in delivery for the "optional grounding".

The grounding line may only be clamped using this screw. The other screws are only used to mount the mechanical parts and may not be loosened!

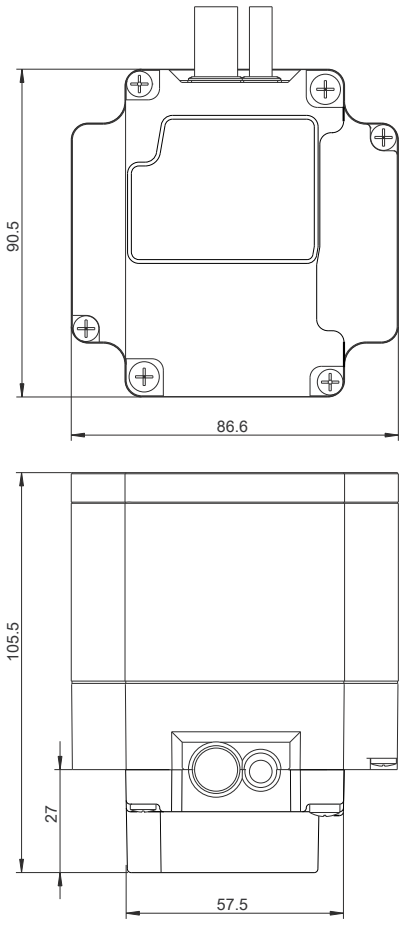
7.2 Motors with the ABR incremental encoder IP65 option

Model number	Short description
80MPxx.xxxx114-01	Option ABR incremental encoder 24VDC, IP65, for 80MPF and 80MPH motors. For a list of all model numbers and the respective motor data, see the "ABR encoder" and "IP65" columns in "General overview" on page 20.
	Optional accessories (more information in the "Accessories" on page 94 section)
80XMPXAC0.00-01	Accessory set for motors with an encoder, 8-pin and 4-pin connector and crimp contact
80CMxxxxx.xx-01	Motor and encoder cables

7.2.1 Dimensions



80MPF motors
ABR incremental encoder IP65 option



80MPH motors
ABR incremental encoder IP65 option

The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPF (flange size 60 mm)" on page 26

"Basic motors 80MPH (NEMA 34, flange size 87.1 mm)" on page 28

7.2.2 Technical data (80MPF)

Motors with the ABR incremental encoder IP65 option

Product ID	80MPF1. 250S114-01	80MPF1. 500S114-01	80MPF3. 250S114-01	80MPF3. 500S114-01	80MPF5. 250S114-01	80MPF5. 500S114-01
Short description						
Stepper motor	Stepper motor flange size 60 mm, length 97.1 mm, incremental encoder		Stepper motor flange size 60 mm, length 107.3 mm, incremental encoder		Stepper motor flange size 60 mm, length 138.6 mm, incremental encoder	
Specific motor data						
Current	2.5 A	5 A	2.5 A	5 A	2.5 A	5 A
Resistance / phase	1.28 Ω	0.32 Ω	1.52 Ω	0.38 Ω	2.4 Ω	0.6 Ω
Inductance / phase	3.4 mH	0.85 mH	5.6 mH	1.4 mH	11.2 mH	2.8 mH
Stall torque	0.8 Nm		1.2 Nm		2.5 Nm	
Holding torque	1.1 Nm		1.7 Nm		3.5 Nm	
Detent torque	<35 mNm				<75 mNm	
Rotor inertia	280 gcm^2		440 gcm^2		920 gcm^2	
General motor data						
Stepping angle	1.8°					
Maximum surface temperature	95°C					
Average period of operation between failures	21,000 hours					
Shaft type	Flat-sided (D-cut)					
Insulation class	B (130°C)					
Insulation resistance	100 MΩ min. 500 VDC					
Dielectric resistance	500 VAC for 1 minute					
Operating conditions						
EN 60529 protection [1]	IP65					
Environmental conditions						
Temperature						
Operation	-20 to 40°C					
Storage	-30 to 85°C					
Transport	-30 to 85°C					
Relative humidity						
Operation	5 to 95%, non-condensing					
Storage	5 to 95%, non-condensing					
Transport	5 to 95%, non-condensing					
Electrical characteristics - Encoder						
Number of outputs	3 A / B / R					
Resolution	1024 increments / 256 positions per rotation					
Output circuit	Push / Pull level, asymmetric					
Output protection	Short circuit protection					
Power consumption	Max. 12 mA + output load					
Supply voltage	18 to 30 VDC					
Max. output current	±10 mA per output					
Mechanical characteristics						
Maximum radial load [2]	75 N					
Maximum axial load	The permitted axial load may not be larger than the motor mass.					
Weight	750 g		1,000 g		1,500 g	
Length	97.1 mm		107.3 mm		138.6 mm	

Table 11: 80MPF1.250S114-01, 80MPF1.500S114-01, 80MPF3.250S114-01, 80MPF3.500S114-01, 80MPF5.250S114-01, 80MPF5.500S114-01 - Technical data

1) From the back side of the flange
2) Measured in the middle of the shaft

7.2.3 Technical data (80MPH1, 80MPH3, 80MPH4)

Motors with the ABR incremental encoder IP65 option

Product ID	80MPH1.300S114-01	80MPH1.600S114-01	80MPH3.600S114-01	80MPH4.101S114-01
Short description				
Stepper motor	Stepper motor flange size 87.1 mm, length 116.4 mm, incremental encoder		Stepper motor flange size 87.1 mm, length 148.4 mm, incremental encoder	
Specific motor data				
Wiring	Series	Parallel		
Current	3 A	6 A		10 A
Resistance / phase	1.7 Ω	0.4 Ω	0.6 Ω	0.2 Ω
Inductance / phase	12.9 mH	3.2 mH	4.3 mH	1.4 mH
Stall torque	2.9 Nm		5.5 Nm	6.3 Nm
Holding torque	4.0 Nm		7.8 Nm	9.5 Nm
Detent torque	<160 mNm		<210 mNm	<320 mNm
Rotor inertia	Approx. 1.31 kgcm²		Approx. 2.61 kgcm²	
General motor data				
Stepping angle	1.8°			
Max. surface temperature	95°C			
Average period of operation between failures	20,000 hours			
Shaft type	Keyed			
Insulation class	B (130°C)			
Insulation resistance	100 MΩ min. 500 VDC			
Dielectric resistance	1776 VAC for 1 minute			
Driver voltage supply	Max. 80 VDC			
Operating conditions				
EN 60529 protection [1]	IP65			
Environmental conditions				
Temperature				
Operation	-20 to 40°C			
Storage	-30 to 85°C			
Transport	-30 to 85°C			
Relative humidity				
Operation	5 to 95%, non-condensing			
Storage	5 to 95%, non-condensing			
Transport	5 to 95%, non-condensing			
Electrical characteristics - Encoder				
Number of outputs	3 A / B / R			
Resolution	1024 increments / 256 positions per rotation			
Output circuit	Push / Pull level, asymmetric			
Output protection	Short circuit protection			
Current consumption	Max. 12 mA + output load			
Supply voltage	18 to 30 VDC			
Max. output current	±10 mA per output			
Mechanical characteristics				
Max. radial load [2]	290 N			
Max. axial load	225 N			
Weight	1,900 g		3,100 g	
Length	116.4 mm		148.4 mm	

Table 12: 80MPH1.300S114-01, 80MPH1.600S114-01, 80MPH3.600S114-01, 80MPH4.101S114-01 - Technical data

1) From the back side of the flange
2) Measured in the middle of the shaft

7.2.4 Technical data (80MPH4, 80MPH6)

Motors with the ABR incremental encoder IP65 option

Product ID	80MPH4. 300S114-01	80MPH4. 500S114-01	80MPH4. 600S114-01	80MPH6. 101S114-01	80MPH6. 300S114-01	80MPH6. 600S114-01
Short description						
Stepper motor	Stepper motor flange size 87.1 mm, length 148.4 mm, incremental encoder			Stepper motor flange size 87.1 mm, length 180.4 mm, incremental encoder		
Specific motor data						
Wiring	Series		Parallel		Series	Parallel
Current	3 A	5 A	6 A	10 A	3 A	6 A
Resistance / phase	2.2 Ω	0.9 Ω	0.6 Ω	0.24 Ω	2.7 Ω	0.7 Ω
Inductance / phase	17.3 mH	5.6 mH	4.3 mH	1.6 mH	20.0 mH	5.0 mH
Stall torque	6.3 Nm			9.3 Nm		
Holding torque [1]	9.5 Nm			13.6 Nm		
Detent torque	<320 mNm			<420 mNm		
Rotor inertia	Approx. 2.61 kgcm²			Approx. 3.92 kgcm²		
General motor data						
Stepping angle	1.8°					
Max. surface temperature	95°C					
Average period of operation between failures	20,000 hours					
Shaft type	Keyed					
Insulation class	B (130°C)					
Insulation resistance	100 MΩ min. 500 VDC					
Dielectric resistance	1776 VAC for 1 minute					
Driver voltage supply	Max. 80 VDC					
Operating conditions						
EN 60529 protection [2]	IP65					
Environmental conditions						
Temperature						
Operation	-20 to 40°C					
Storage	-30 to 85°C					
Transport	-30 to 85°C					
Relative humidity						
Operation	5 to 95%, non-condensing					
Storage	5 to 95%, non-condensing					
Transport	5 to 95%, non-condensing					
Electrical characteristics - Encoder						
Number of outputs	3 A / B / R					
Resolution	1024 increments / 256 positions per rotation					
Output circuit	Push / Pull level, asymmetric					
Output protection	Short circuit protection					
Current consumption	Max. 12 mA + output load					
Supply voltage	18 to 30 VDC					
Max. output current	±10 mA per output					
Mechanical characteristics						
Max. radial load [3]	290 N					
Max. axial load	225 N					
Weight	3,100 g			4300 g		
Length	148.4 mm			180.4 mm		

Table 13: 80MPH4.300S114-01, 80MPH4.500S114-01, 80MPH4.600S114-01, 80MPH6.101S114-01, 80MPH6.300S114-01, 80MPH6.600S114-01 - Technical data

1) Measured with serial wiring
2) From the back side of the flange
3) Measured in the middle of the shaft

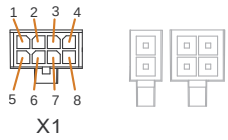
Information:

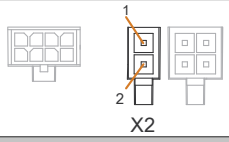
IP65 protection has been tested with pre-assembled cables from B&R only.

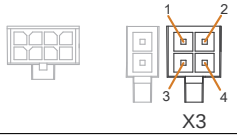
7.2.5 Pinout X1 - X3

80MPF motor

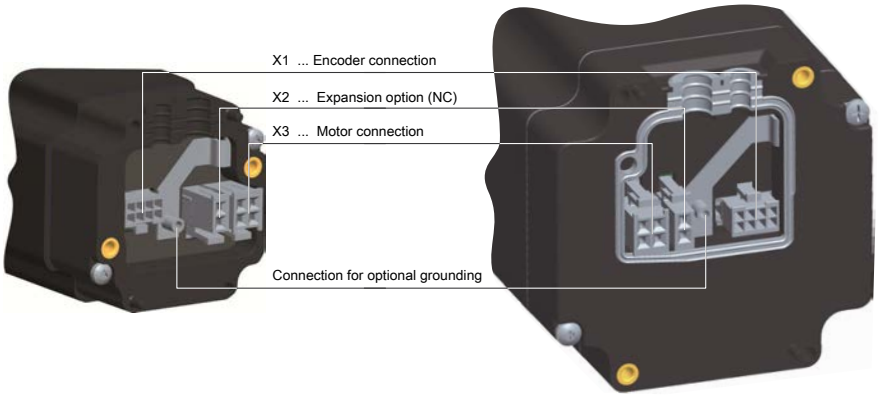
80MPH motor

X1 - ABR incremental encoder	Pinout	
	Pin	Name
	1	A
	2	B
	3	R
	4	NC
	5	NC
	6	24 VDC (encoder supply)
	7	GND
	8	NC

X2 - Optional expansion	Pinout	
	Pin	Name
	1	NC
	2	NC

X3 - Motor connection	Pinout	
	Pin	Name
	1	Motor phase A\
	2	Motor phase B\
	3	Motor phase A
	4	Motor phase B

7.2.6 Arrangement of terminal blocks



80MPF motor

80MPH motor

Information:

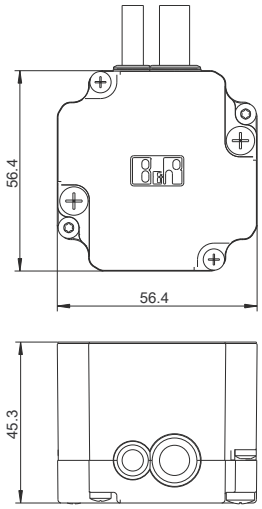
A single screw (M3 x 8 mm) is included with the motor in delivery for the "optional grounding".

The grounding line may only be clamped using this screw. The other screws are only used to mount the mechanical parts and may not be loosened!

7.3 Motors with the SSI absolute encoder IP65 option

Model number	Short description	Figure
80MPF5.xxxS113-01	Option SSI encoder 24 VDC, IP65, for 80MPF motors. For a list of all model numbers and the respective motor data, see the "SSI encoder" and "IP65" columns in "General overview" on page 20.	
	Optional accessories (more information in the "Accessories" on page 94 section)	
80XMPXAC0.00-01	Accessory set for motors with an encoder, 8-pin and 4-pin connector and crimp contact	
80CMxxxxx.xx-01	Motor and encoder cables	

7.3.1 Dimensions



80MPF motors
SSI absolute encoder IP65 option

The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPF (flange size 60 mm)" on page 26

7.3.2 Technical data (80MPF)

Motors with SSI absolute encoder IP65 option

Product ID	80MPF5.250S113-01	80MPF5.500S113-01
Short description		
Stepper motor	Stepper motor flange size 60 mm, length 138.6 mm, SSI encoder	
Specific motor data		
Current	2.5 A	5 A
Resistance / phase	2.4 Ω	0.6 Ω
Inductance / phase	11.2 mH	2.8 mH
Stall torque	2.5 Nm	
Holding torque	3.5 Nm	
Detent torque	<75 mNm	
Rotor inertia	920 gcm²	
General motor data		
Stepping angle	1.8°	
Maximum surface temperature	95°C	
Average period of operation between failures	21,000 hours	
Shaft type	Flat-sided (D-cut)	
Insulation class	B (130°C)	
Insulation resistance	100 MΩ min. 500 VDC	
Dielectric resistance	500 VAC for 1 minute	
Operating conditions		
EN 60529 protection [1]	IP65	
Environmental conditions		
Temperature		
Operation	-20 to 40°C	
Storage	-30 to 85°C	
Transport	-30 to 85°C	
Relative humidity		
Operation	5 to 95%, non-condensing	
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
Electrical characteristics - Encoder		
Number of outputs	4 Data / nData / CLK / nCLK	
Resolution	4096 increments per rotations	
Output circuit	Differential signal	
Output protection	Short circuit protection	
Power consumption	TBD	
Supply voltage	18 to 30 VDC	
Max. output current	±25 mA per output	
Data format	Gray	
Counting direction	Clockwise	
Clock frequency	Max. 400 kHz	
Mechanical characteristics		
Maximum radial load [2]	75 N	
Maximum axial load	The permitted axial load may not be larger than the motor mass.	
Weight	1,500 g	
Length	138.6 mm	

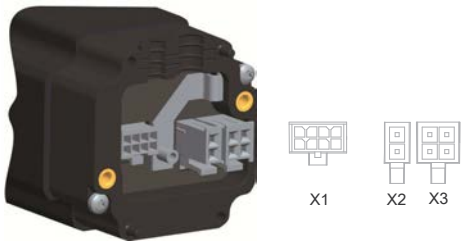
Table 14: 80MPF5.250S113-01, 80MPF5.500S113-01 - Technical data

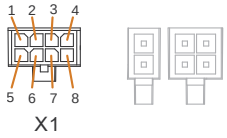
1) From the back side of the flange
2) Measured in the middle of the shaft

Information:

IP65 protection has been tested with pre-assembled cables from B&R only.

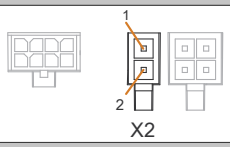
7.3.3 Pinout X1 - X3

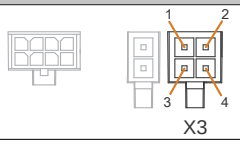


X1 - Encoder connection	Pinout	
	Pin	Name
	1	DATA
	2	nDATA
	3	CLK
	4	nCLK
	5	NC
	6	24 VDC (encoder supply)
	7	GND
	8	NC

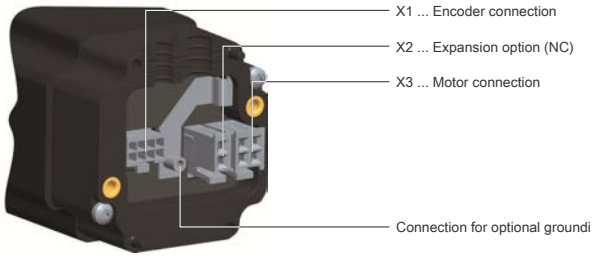
Information:

Pins 5 and 8 (NC) must remain free and may not be used.

X2 - Motor brake	Pinout	
	Pin	Name
	1	NC
	2	NC

X3 - Motor connection	Pinout	
	Pin	Name
	1	Motor phase A\
	2	Motor phase B\
	3	Motor phase A
	4	Motor phase B

7.3.4 Arrangement of terminal blocks



Information:

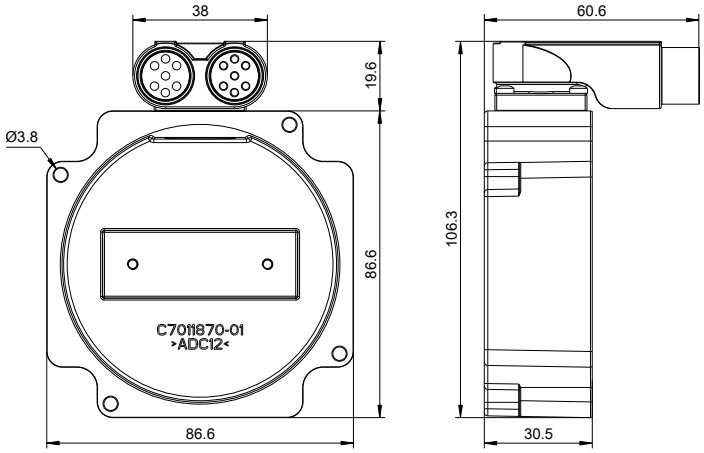
A single screw (M3 x 8 mm) is included with the motor in delivery for the "optional grounding".

The grounding line may only be clamped using this screw. The other screws are only used to mount the mechanical parts and may not be loosened!

7.4 Motors with the HIPERFACE IP65 option

Model number	Short description	Figure
80MPH4.xxxS111-02	Option HIPERFACE, IP65, for 80MPH motors. For a list of all model numbers and the respective motor data, see the "HIPERFACE" and "IP65" columns in "General overview" on page 20.	
	Optional accessories (more information in the "Accessories" on page 94 section)	
80CMxxxxx.xx-01	Motor and encoder cables	

7.4.1 Dimensions

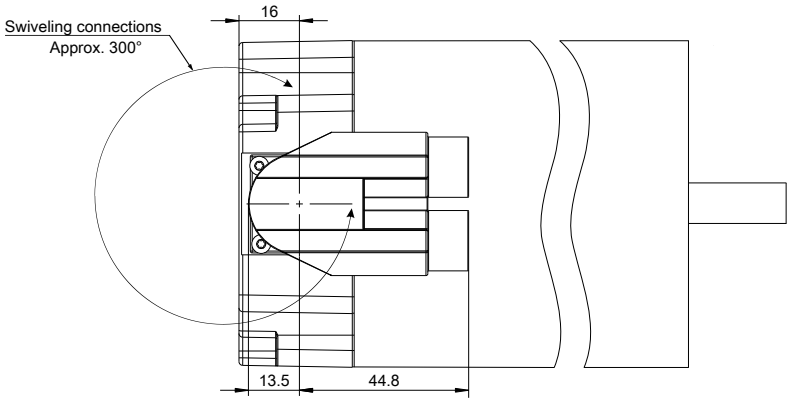


80MPH motors
HIPERFACE encoder IP65 option

The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPH (NEMA 34, flange size 87.1 mm)" on page 28



The motor/encoder connections can be rotated up to 300°.

7.4.2 Technical data (80MPH)

Motors with the Hiperface IP65 option

Product ID	80MPH4.600S111-02
Short description	
Stepper motor	Stepper motor flange size 86 mm, length 128.5 mm, Hiperface encoder
Specific motor data	
Current	6 A
Resistance / phase	0.6 Ω
Inductance / phase	4.3 mH
Stall torque	6.3 Nm
Holding torque	9.5 Nm
Detent torque	<320 mNm
Rotor inertia	Approx. 2.61 kgcm^2
General motor data	
Stepping angle	1.8°
Maximum surface temperature	95°C
Average period of operation between failures	20,000 hours
Shaft type	Keyed
Insulation class	B (130°C)
Insulation resistance	100 MΩ min. 500 VDC
Dielectric resistance	1776 VAC for 1 minute
Operating conditions	
Protection in accordance with EN 60529 1)	IP65
Environmental conditions	
Temperature	
Operation	-20 to 40°C
Storage	-30 to 85°C
Transport	-30 to 85°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Electrical characteristics - Encoder	
Encoder type	Hiperface Multiturn, 4096 rotations measurable
Integral nonlinearity	±300 angular seconds
Supply voltage	10 VDC
Sine, cosine signals	
Periods per revolution	16
Peak-to-peak signal voltage	0.8 to 1.2 Vss
Signal offset	2.2 to 2.8 V
Digital interface	
Address	64
Total width of the position value	21-bit
Width of the multi-turn information	12-bit
Width of the single-turn information	9-bit
Mechanical characteristics	
Maximum radial load 2)	290 N
Maximum axial load	225 N
Weight	3,400 g
Length	128.5 mm

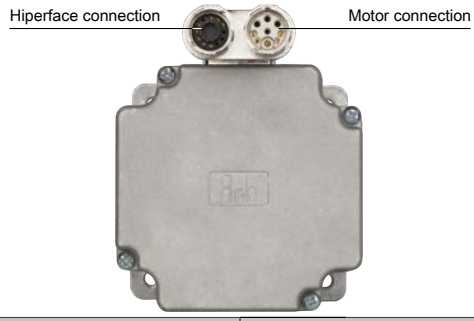
Table 15: 80MPH4.600S111-02 - Technical data

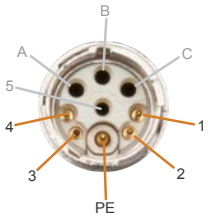
1) From the back side of the flange
2) Measured in the middle of the shaft

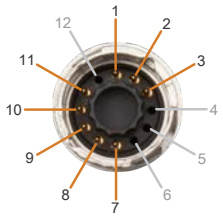
Information:

IP65 protection has been tested with pre-assembled cables from B&R only.

7.4.3 Pinout X1 - X3



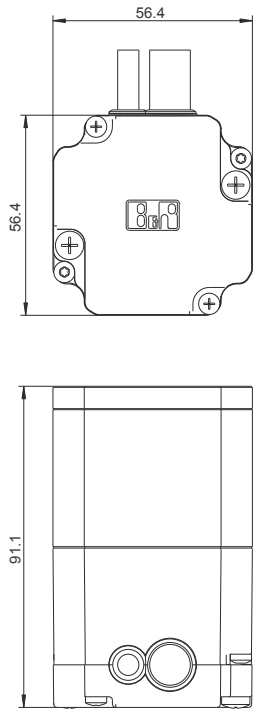
Motor connection	Pinout	
	Pin	Name
	1	A
	2	A\
	3	B
	4	B\
	5	NC
	A	NC
	B	NC
	C	NC
	PE	PE lead / shielding

Hiperface connection	Pinout	
	Pin	Name
	1	10 VDC
	2	D
	3	D\
	4	NC
	5	NC
	6	NC
	7	COM
	8	SIN
	9	REF SIN
	10	COS
	11	REF COS
	12	NC

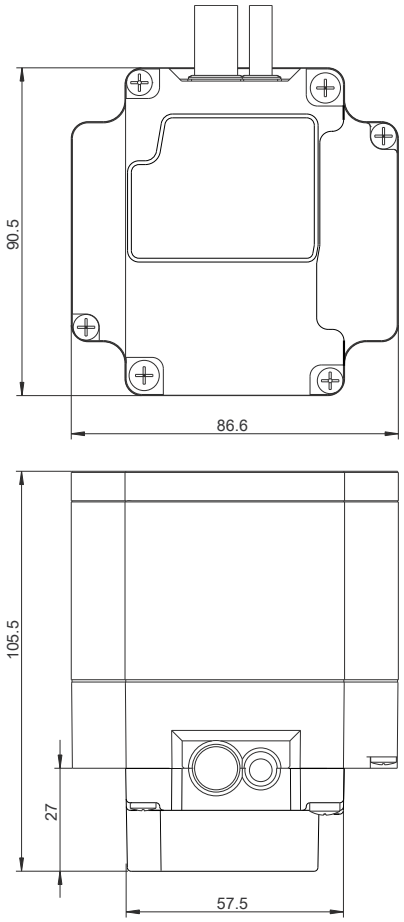
7.5 Motors with the ABR incremental encoder IP65 and brake options

Model number	Short description
80MPxx.xxxD114-01	Brake option, IP65, for 80MPF and 80MPH motors. For a list of all model numbers and the respective motor data, see the "ABR encoder" and "Brake" columns in "General overview" on page 20.
	Optional accessories (more information in the "Accessories" on page 94 section)
80XMPXAC0.00-02	Accessory set for motors with encoder and brake, 8-pin, 4-pin and 2-pin connector and crimp contact
80CMxxxxx.xx-01	Motor and encoder cables

7.5.1 Dimensions



80MPF motors
ABR incremental encoder IP65 and brake options



80MPH motors
ABR incremental encoder IP65 and brake options

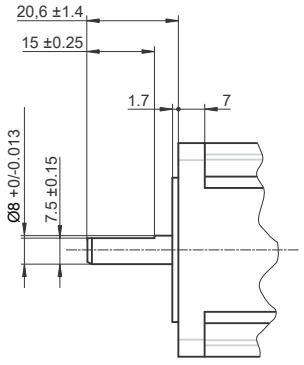
The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPF (flange size 60 mm)" on page 26

"Basic motors 80MPH (NEMA 34, flange size 87.1 mm)" on page 28

The following dimensions apply for the 80MPF motor as opposed to the standard motor:



7.5.2 Technical data (80MPF)

Motors with the ABR incremental encoder IP65 and brake options

Product ID	80MPF1. 250D114-01	80MPF1. 500D114-01	80MPF3. 250D114-01	80MPF3. 500D114-01	80MPF5. 250D114-01	80MPF5. 500D114-01
Short description						
Stepper motor	Stepper motor flange size 60 mm, length 142.9 mm, incremental encoder and brake		Stepper motor flange size 60 mm, length 153.1 mm, incremental encoder and brake		Stepper motor flange size 60 mm, length 184.4 mm, incremental encoder and brake	
Specific motor data						
Wiring	Series	Parallel	Series	Parallel	Series	Parallel
Current	2.5 A	5 A	2.5 A	5 A	2.5 A	5 A
Resistance / phase	1.28 Ω	0.32 Ω	1.52 Ω	0.38 Ω	2.4 Ω	0.6 Ω
Inductance / phase	3.4 mH	0.85 mH	5.6 mH	1.4 mH	11.2 mH	2.8 mH
Stall torque	0.8 Nm		1.2 Nm		2.5 Nm	
Holding torque	1.1 Nm		1.7 Nm		3.5 Nm	
Detent torque	<35 mNm		<45 mNm		<75 mNm	
Rotor inertia	280 gcm²		440 gcm²		920 gcm²	
General motor data						
Stepping angle	1.8°					
Max. surface temperature	90°C					
Average period of operation between failures	21,000 hours					
Shaft type	Flat-sided (D-cut)					
Insulation class	B (130°C)					
Insulation resistance	100 MΩ min. 500 VDC					
Dielectric resistance	500 VAC for 1 minute					
Driver voltage supply	Max. 80 VDC					
Operating conditions						
EN 60529 protection [1]	IP65					
Environmental conditions						
Temperature						
Operation	-20 to 40°C					
Storage	-30 to 85°C					
Transport	-30 to 85°C					
Relative humidity						
Operation	5 to 95%, non-condensing					
Storage	5 to 95%, non-condensing					
Transport	5 to 95%, non-condensing					
Electrical characteristics - Encoder						
Number of outputs	3 A / B / R					
Resolution	1024 increments per revolution					
Output circuit	Push / Pull level, asymmetric					
Output protection	Short circuit protection					
Current consumption	Max. 12 mA + output load					
Supply voltage	18 to 30 VDC					
Max. output current	±10 mA per output					
Electrical characteristics - Brake						
Supply voltage	24 VDC +6% / -10%					
Braking torque [2]	2 Nm / 1.5 Nm / 1.8 Nm					
Coil resistance	52.36 Ω ±7%					
Inductance	0.7 H					
Power consumption	Typ. 11 W					
Connection time [3]	6 ms					
Response delay [4]	2 ms					
Cutoff time [5]	25 ms					
Mechanical characteristics						
Max. radial load [6]	75 N					
Max. axial load	The permitted axial load must not be larger than the motor mass					
Weight	1,020 g		1,280 g		1,800 g	
Length	142.9 mm		153.1 mm		184.4 mm	

Table 16: 80MPF1.250D114-01, 80MPF1.500D114-01, 80MPF3.250D114-01, 80MPF3.500D114-01, 80MPF5.250D114-01, 80MPF5.500D114-01 - Technical data

1) From the back side of the flange
2) Braking torque M_{2N} / mean dynamic braking torque 20°C / M stat. at 100°C
3) Time from switching off the current until the rated torque is reached
4) Time from switching off the current until the torque increases
5) Time from switching on the current until the torque begins decreasing
6) Measured in the middle of the shaft

7.5.3 Technical data (80MPH)

Motors with the ABR incremental encoder IP65 and brake options

Product ID	80MPH1. 300D114-01	80MPH1. 600D114-01	80MPH3. 600D114-01	80MPH4. 101D114-01	80MPH4. 600D114-01	80MPH6. 300D114-01	80MPH6. 600D114-01	80MPH6. 101D114-01
Short description								
Stepper motor	Stepper motor flange size 87.1 mm, length 171.5 mm, incremental encoder and brake		Stepper motor flange size 87.1 mm, length 203.5 mm, incremental encoder and brake			Stepper motor flange size 87.1 mm, length 235.5 mm, incremental encoder and brake		
Specific motor data								
Wiring	Series	Parallel				Series	Parallel	
Current	3 A	6 A		10 A	6 A	3 A	6 A	10 A
Resistance / phase	1.7 Ω	0.4 Ω	0.6 Ω	0.2 Ω	0.6 Ω	2.7 Ω	0.7 Ω	0.24 Ω
Inductance / phase	12.9 mH	3.2 mH	4.3 mH	1.4 mH	4.3 mH	20.0 mH	5.0 mH	1.6 mH
Stall torque	2.9 Nm		5.5 Nm	6.3 Nm		9.3 Nm		
Holding torque	4.0 Nm		7.8 Nm	9.5 Nm		13.6 Nm		
Detent torque	<160 mNm		<210 mNm	<320 mNm		<420 mNm		
Rotor inertia	Approx. 1.31 kgcm²		Approx. 2.61 kgcm²			Approx. 3.92 kgcm²		
General motor data								
Stepping angle	1.8°							
Max. surface temperature	85°C							
Average period of operation between failures	20,000 hours							
Shaft type	Keyed							
Insulation class	B (130°C)							
Insulation resistance	100 MΩ min. 500 VDC							
Dielectric resistance	1776 VAC for 1 minute	500 VAC for 1 minute	1776 VAC for 1 minute					500 VAC for 1 minute
Driver voltage supply	Max. 80 VDC							
Operating conditions								
EN 60529 protection [1]	IP65							
Environmental conditions								
Temperature								
Operation	-20 to 40°C							
Storage	-30 to 85°C							
Transport	-30 to 85°C							
Relative humidity								
Operation	5 to 95%, non-condensing							
Storage	5 to 95%, non-condensing							
Transport	5 to 95%, non-condensing							
Electrical characteristics - Encoder								
Number of outputs	3 A / B / R							
Resolution	1024 increments per revolution							
Output circuit	Push / Pull level, asymmetric							
Output protection	Short circuit protection							
Current consumption	Max. 12 mA + output load							
Supply voltage	18 to 30 VDC							
Max. output current	±10 mA per output							
Electrical characteristics - Brake								
Supply voltage	24 VDC +6% / -10%							
Braking torque [2]	9 Nm / 7.5 Nm / 8.0 Nm							
Coil resistance	32.00 Ω ±7%							
Inductance	0.83 H							
Power consumption	Typ. 18 W							
Connection time [3]	7 ms							
Response delay [4]	2 ms							
Cutoff time [5]	40 ms							
Mechanical characteristics								
Max. radial load [6]	290 N							
Max. axial load	225 N							
Weight	2,500 g		3,700 g			4,900 g		
Length	171.5 mm		203.5 mm			235.5 mm		

Table 17: 80MPH1.300D114-01, 80MPH1.600D114-01, 80MPH3.600D114-01, 80MPH4.101D114-01, 80MPH4.600D114-01, 80MPH6.300D114-01, 80MPH6.600D114-01, 80MPH6.101D114-01 - Technical data

1) From the back side of the flange
2) Braking torque M_{2N} / mean dynamic braking torque 20°C / M stat. at 100°C
3) Time from switching off the current until the nominal torque is reached
4) Time from switching off the current until the torque increases
5) Time from switching on the current until the torque begins decreasing
6) Measured in the middle of the shaft

Important!

These brakes are not certified safety brakes!

Information:

IP65 protection has been tested with pre-assembled cables from B&R only.

7.5.4 Operating principle

The holding brake uses permanent magnets that are demagnetized when 24 VDC is applied to a magnet winding. This releases the brake.

The brake is designed as a holding brake. It is not permitted to be used for operational braking!

Warning!

The holding brake is not intended for normal braking.

The holding brake does not provide protection for personnel.

The maximum motor torque can exceed the holding torque for the brake.

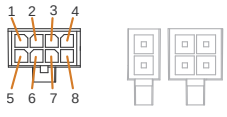
Warning!

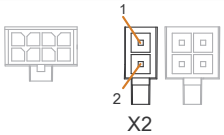
If the holding brake is not used regularly for a long period of time, we recommend periodically checking the holding brake because the holding brake could fail in certain environmental conditions (e.g. humidity, oil vapor).

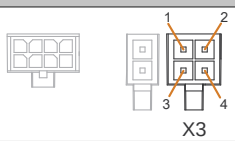
7.5.5 Pinout X1 - X3

80MPF motor

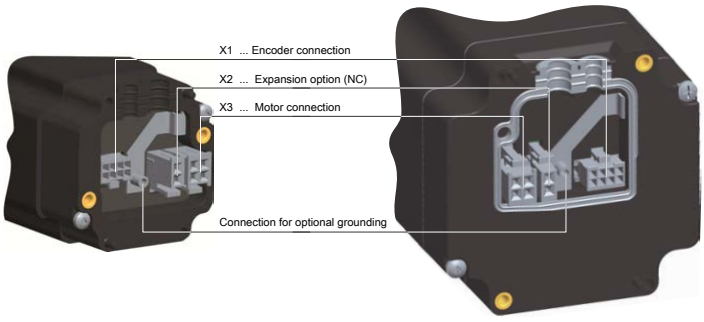
80MPH motor

X1 - Encoder connection	Pinout	
 X1	Pin	Name
	1	A
	2	B
	3	R
	4	NC
	5	NC
	6	24 VDC (encoder supply)
	7	GND
	8	NC

X2 - Motor brake	Pinout	
 X2	Pin	Name
	1	24 VDC (brake)
	2	GND

X3 - Motor connection	Pinout	
 X3	Pin	Name
	1	Motor phase A\
	2	Motor phase B\
	3	Motor phase A
	4	Motor phase B

7.5.6 Arrangement of terminal blocks



80MPF motor 80MPH motor

Information:

A single screw (M3 x 8 mm) is included with the motor in delivery for the "optional grounding".

The grounding line may only be clamped using this screw. The other screws are only used to mount the mechanical parts and may not be loosened!

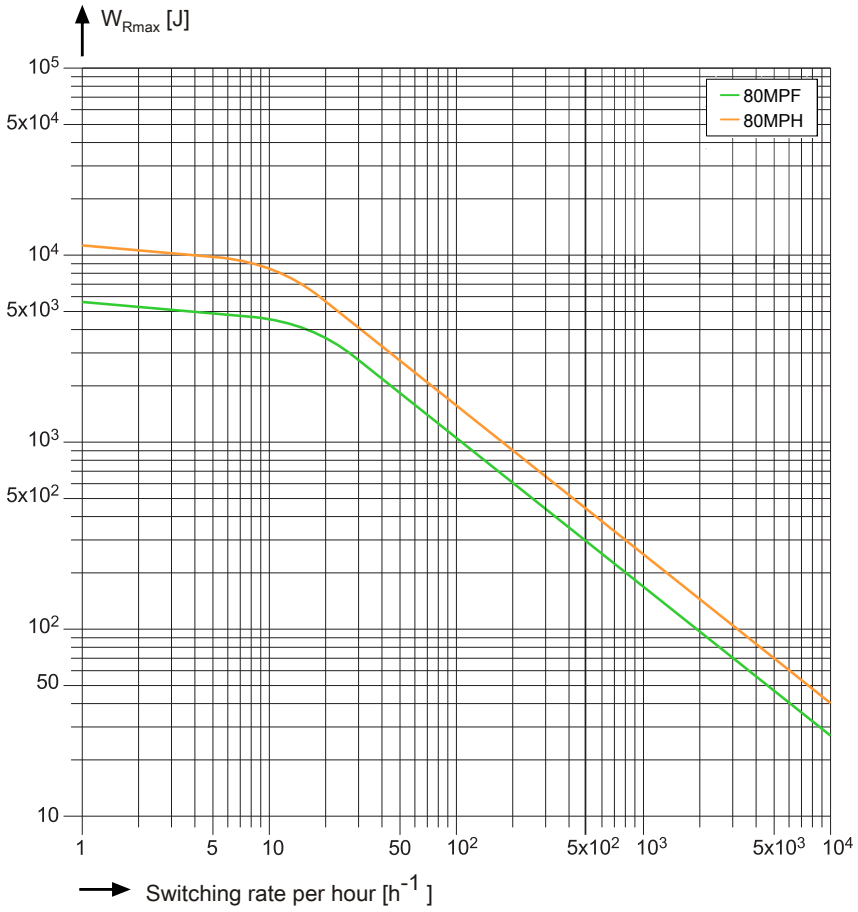
7.5.7 Holding brake

Maximum switching rate

The switching rate depends on the speed of rotation as well as the inertia. It can be taken from the image or calculated using the following formulas:

The permissible friction work $W_{R\text{-}max}$ [J] work in dependence on the switching rate.

The values for W_{Rmax} are valid for a rotary speed of 3000 rpm. Depending on the application at hand, these values can be exceeded int he positive and negative directions.



The necessary braking torque, thermal load, braking time and service life are important aspects when sizing brakes.

Nominal torque M_{2N}

In order for the brakes and couplings to function safely even in extreme conditions, a safety factor must be applied to the required rated torque. The chosen safety factor depends substantially on the application at hand.

The dynamic torque can be considerably less than the rated torque.

$M_{2N} = M_{req} \cdot K$ $K \geq 2$ M_{req}= required braking torque [Nm]

The required braking torque is frequently a mix of the dynamic and static loads. When choosing the sign to use (plus or minus), it is important to determine whether the load torque contributes to the deceleration or works against it.

$$M_{req} = M_a \pm M_L \qquad M_a = J \cdot \alpha$$

If the drive power is known but the mass moment of inertia is not, the required braking torque can be calculated as follows:

$$M_{req} = 9500 \cdot \frac{P}{n}$$

Dimensioning solely according to the required braking torque is permissible only in a very few instances. When braking the load and the mass moment of inertia reduced to the brake shaft, the kinetic energy J is converted into heat (friction work of the brake). The permissible friction work in dependence on the switching frequency may not be exceeded.

Note that the maximum permissible friction work is valid only up to the corresponding speed. When emergency stopping at maximum speed, the maximum permissible friction work lies considerably below the values specified here:

$$W_R = \frac{J \cdot n^2}{182.5} \cdot \frac{M_{2n}}{M_{2n} \pm M_L} \qquad WR \leq WRmax$$

Slip time refers to the time the torque begins increasing until the moment of synchronization is reached:

$$t_3 = 104.6 \cdot \frac{J \cdot \Delta n}{M_{2n} \pm M_L} + t_{11}$$

Service life depends greatly on the peak temperature during braking. This is a function of the speed, deceleration and the current braking torque.

For this reason, it is not possible to specify a universally valid service life that applies under all operating conditions. Reliable conclusions can only be made for particular applications when all operating conditions are known.

$$t = \frac{J \cdot \omega}{M_{2n} \pm M_L} + t_1$$

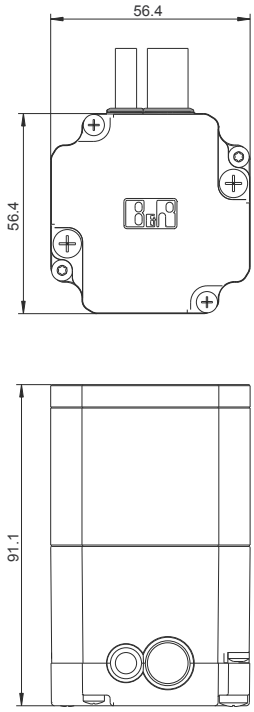
- α ... Angular acceleration [s^{-2}]
- J ... Moment of inertia [kgm^2]
- K ... Safety factor (K ≥2)
- M_{2N} ... Rated torque [Nm]
- M_a ... dynamic torque [Nm]
- M_{req} ... required braking torque [Nm]
- M_L ... Load torque [Nm]
- n ... Speed [s^{-1}]
- Δn ... Differential speed [s^{-1}]
- P ... Drive power [W]
- t ... Acceleration/Braking time [ms]
- t_1 ... Turn-on time [ms]
- t_{11} ... Response delay[1)] [ms]
- t_3 ... Slip time[2)] [ms]
- ω ... Angular speed [s^{-1}]
- W_R ... Friction [J]
- W_{Rmax} ... maximum friction [J]

1) Time from switching off the current until the torque increases
2) Refers to the time the torque begins increasing until the moment of synchronization is reached

7.6 Motors with the SSI absolute encoder IP65 and brake options

Model number	Short description	Figure
80MPF5.500D113-01	Brake option, IP65, for 80MPF motors For a list of all model numbers and the respective motor data, see the "SSI encoder" and "Brake" columns in "General overview" on page 20.	
	Optional accessories (more information in the "Accessories" on page 94 section)	
80XMPXAC0.00-02	Accessory set for motors with encoder and brake, 8-pin, 4-pin and 2-pin connector and crimp contact	
80CMxxxxx.xx-01	Motor and encoder cables	

7.6.1 Dimensions



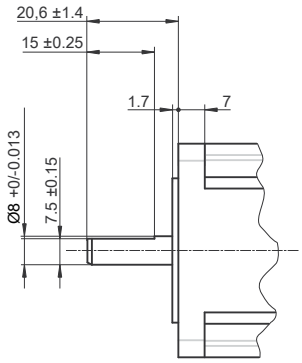
80MPF motors
SSI absolute encoder IP65 and brake options

The effective length of the motor is calculated from the length of the standard motor plus the length of the encoder option.

See basic motor:

"Basic motors 80MPF (flange size 60 mm)" on page 26

The following dimensions apply for the 80MPF motor as opposed to the standard motor:



7.6.2 Technical data (80MPF)

Motors with the SSI absolute encoder IP65 and brake options

Product ID	80MPF5.500D113-01
Short description	
Stepper motor	Stepper motor flange size 60 mm, length 184.4 mm, SSI encoder and brake
Specific motor data	
Wiring	Parallel
Current	5 A
Resistance / phase	0.6 Ω
Inductance / phase	2.8 mH
Stall torque	2.5 Nm
Holding torque	3.5 Nm
Detent torque	<75 mNm
Rotor inertia	920 gcm²
General motor data	
Stepping angle	1.8°
Max. surface temperature	90°C
Average period of operation between failures	21,000 hours
Shaft type	Flat-sided (D-cut)
Insulation class	B (130°C)
Insulation resistance	100 MΩ min. 500 VDC
Dielectric resistance	500 VAC for 1 minute
Driver voltage supply	Max. 80 VDC
Operating conditions	
EN 60529 protection [1]	IP65
Environmental conditions	
Temperature	
Operation	-20 to 40°C
Storage	-30 to 85°C
Transport	-30 to 85°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Electrical characteristics - Encoder	
Number of outputs	4 Data / nData / CLK / nCLK
Resolution	4096 increments per revolution
Output circuit	Differential signal
Output protection	Short circuit protection
Current consumption	Max. 16 mA + output load
Supply voltage	18 to 30 VDC
Max. output current	±25 mA per output
Electrical characteristics - Brake	
Supply voltage	24 VDC +6% / -10%
Braking torque [2]	2 Nm / 1.5 Nm / 1.8 Nm
Coil resistance	52.36 Ω ±7%
Inductance	0.7 H
Power consumption	Typ. 11 W
Connection time [3]	6 ms
Response delay [4]	2 ms
Cutoff time [5]	25 ms
Mechanical characteristics	
Max. radial load [6]	75 N
Max. axial load	The permitted axial load must not be larger than the motor mass
Weight	1,800 g
Length	184.4 mm

Table 18: 80MPF5.500D113-01 - Technical data

1) From the back side of the flange
2) Braking torque M_{2N} / mean dynamic braking torque 20°C / M stat. at 100°C
3) Time from switching off the current until the nominal torque is reached
4) Time from switching off the current until the torque increases
5) Time from switching on the current until the torque begins decreasing
6) Measured in the middle of the shaft

Information:

IP65 protection has been tested with pre-assembled cables from B&R only.

7.6.3 Operating principle

The holding brake uses permanent magnets that are demagnetized when 24 VDC is applied to a magnet winding. This releases the brake.

The brake is designed as a holding brake. It is not permitted to be used for operational braking!

Warning!

The holding brake is not intended for normal braking.

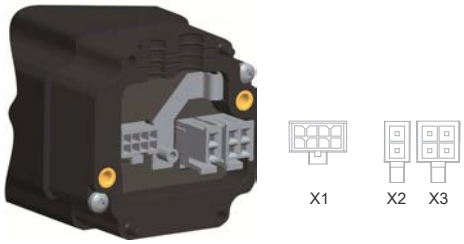
The holding brake does not provide protection for personnel.

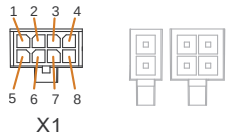
The maximum motor torque can exceed the holding torque for the brake.

Warning!

If the holding brake is not used regularly for a long period of time, we recommend periodically checking the holding brake because the holding brake could fail in certain environmental conditions (e.g. humidity, oil vapor).

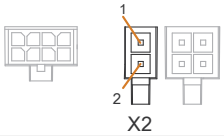
7.6.4 Pinout X1 - X3

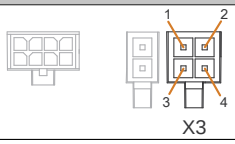


X1 - Encoder connection	Pinout	
	Pin	Name
	1	DATA
	2	nDATA
	3	CLK
	4	nCLK
	5	NC
	6	24 VDC (encoder supply)
	7	GND
	8	NC

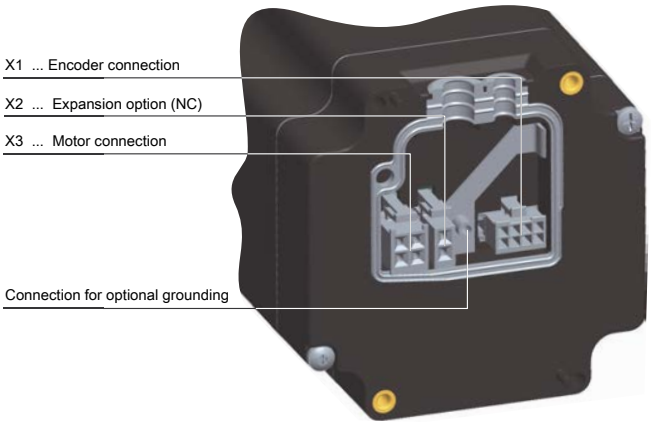
Information:

Pins 5 and 8 (NC) must remain free and may not be used.

X2 - Motor brake	Pinout	
	Pin	Name
	1	24 VDC (brake)
	2	GND

X3 - Motor connection	Pinout	
	Pin	Name
	1	Motor phase A\
	2	Motor phase B\
	3	Motor phase A
	4	Motor phase B

7.6.5 Arrangement of terminal blocks



80MPH motor

Information:

A single screw (M3 x 8 mm) is included with the motor in delivery for the "optional grounding".

The grounding line may only be clamped using this screw. The other screws are only used to mount the mechanical parts and may not be loosened!

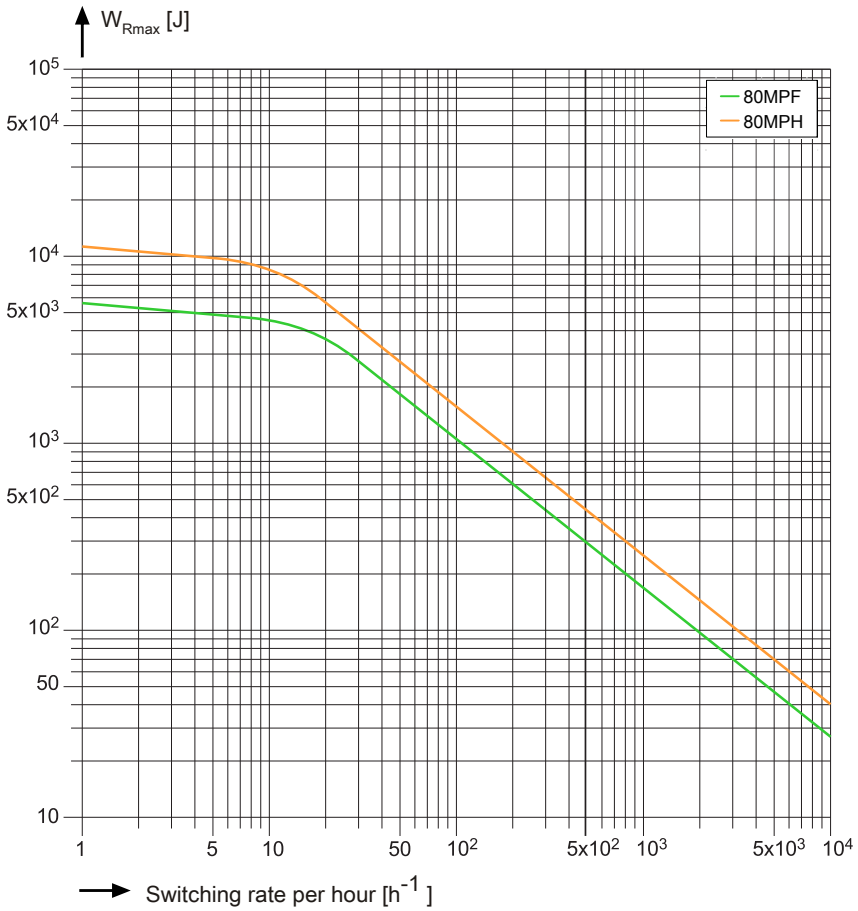
7.6.6 Holding brake

Maximum switching rate

The switching rate depends on the speed of rotation as well as the inertia. It can be taken from the image or calculated using the following formulas:

The permissible friction work $W_{R\text{-}max}$ [J] work in dependence on the switching rate.

The values for W_{Rmax} are valid for a rotary speed of 3000 rpm. Depending on the application at hand, these values can be exceeded int he positive and negative directions.



The necessary braking torque, thermal load, braking time and service life are important aspects when sizing brakes.

Nominal torque M_{2N}

In order for the brakes and couplings to function safely even in extreme conditions, a safety factor must be applied to the required rated torque. The chosen safety factor depends substantially on the application at hand.

The dynamic torque can be considerably less than the rated torque.

$M_{2N} = M_{req} \cdot K$ $\quad K \geq 2$ $\quad M_{req}$= required braking torque [Nm]

Required braking torque M_{req}

The required braking torque is frequently a mix of the dynamic and static loads. When choosing the sign to use (plus or minus), it is important to determine whether the load torque contributes to the deceleration or works against it.

$M_{req} = M_a \pm M_L$ $\quad M_a = J \cdot \alpha$

Estimating the required braking torque

If the drive power is known but the mass moment of inertia is not, the required braking torque can be calculated as follows:

$$M_{req} = 9500 \cdot \frac{P}{n}$$

Thermal load

Dimensioning solely according to the required braking torque is permissible only in a very few instances. When braking the load and the mass moment of inertia reduced to the brake shaft, the kinetic energy J is converted into heat (friction work of the brake). The permissible friction work in dependence on the switching frequency may not be exceeded.

Note that the maximum permissible friction work is valid only up to the corresponding speed. When emergency stopping at maximum speed, the maximum permissible friction work lies considerably below the values specified here:

$$W_R = \frac{J \cdot n^2}{182.5} \cdot \frac{M_{2n}}{M_{2n} \pm M_L} \qquad WR \leq WRmax$$

Slip time t_3 [ms]

Slip time refers to the time the torque begins increasing until the moment of synchronization is reached:

$$t_3 = 104.6 \cdot \frac{J \cdot \Delta n}{M_{2n} \pm M_L} + t_{11}$$

Service life

Service life depends greatly on the peak temperature during braking. This is a function of the speed, deceleration and the current braking torque.

For this reason, it is not possible to specify a universally valid service life that applies under all operating conditions. Reliable conclusions can only be made for particular applications when all operating conditions are known.

Acceleration/Braking time

$$t = \frac{J \cdot \omega}{M_{2n} \pm M_L} + t_1$$

Overview of formula variables

- α ... Angular acceleration [s^{-2}]
- J ... Moment of inertia [kgm^2]
- K ... Safety factor (K ≥2)
- M_{2N} ... Rated torque [Nm]
- M_a ... dynamic torque [Nm]
- M_{req} ... required braking torque [Nm]
- M_L ... Load torque [Nm]
- n ... Speed [s^{-1}]
- Δn ... Differential speed [s^{-1}]
- P ... Drive power [W]
- t ... Acceleration/Braking time [ms]
- t_1 ... Turn-on time [ms]
- t_{11} ... Response delay[1)] [ms]
- t_3 ... Slip time[2)] [ms]
- ω ... Angular speed [s^{-1}]
- W_R ... Friction [J]
- W_{Rmax} ... maximum friction [J]

1) Time from switching off the current until the torque increases
2) Refers to the time the torque begins increasing until the moment of synchronization is reached

8 Torque curves

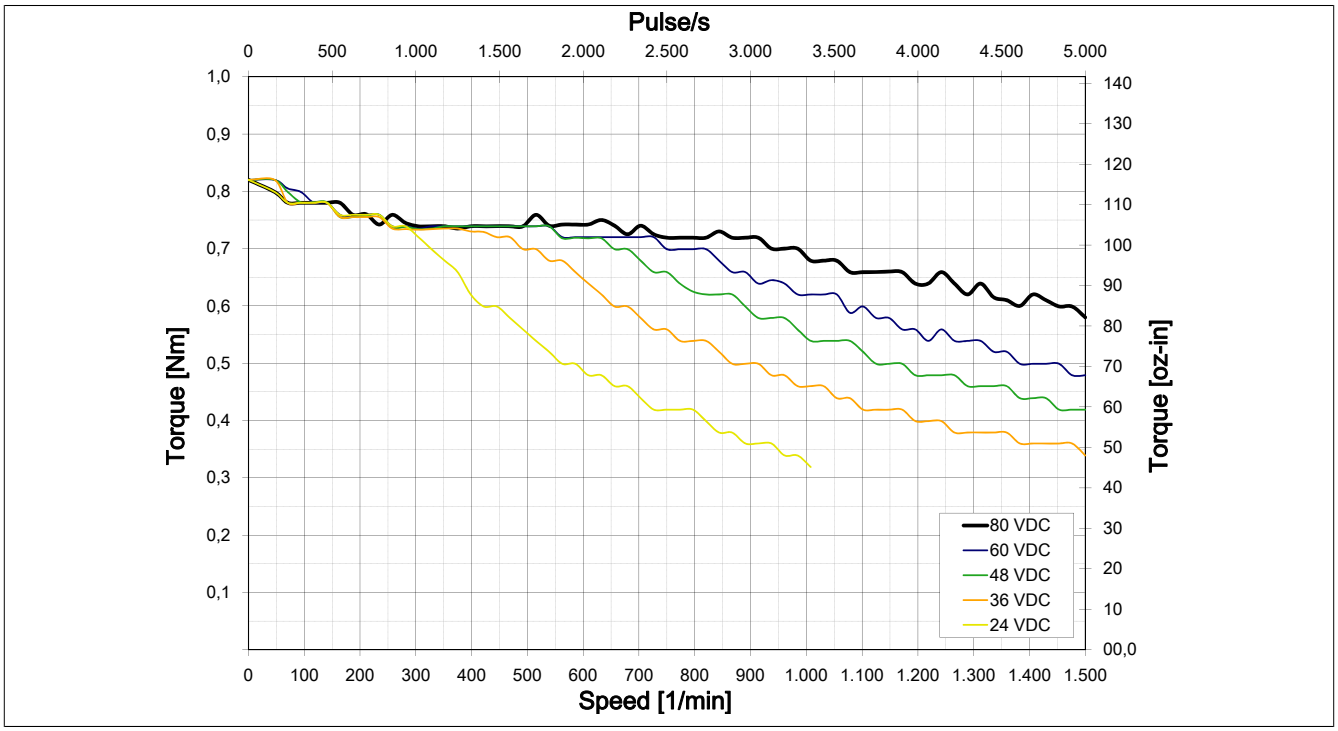
This chapter shows all torque curves for B&R stepper motors. A list of all stepper motors and the corresponding torque curves can be found in the "General overview" on page 20.

Series-wired stepper motors are preferred because of the corresponding thermal conditions.

The motor performance is highly dependent on thermal conditions, so it is important to ensure that motor losses and the resulting heat is properly dissipated.

8.1 80MPD1.x00xxxx-xx[1)]

8.1.1 Series wiring 3 A (80MPD1.300xxxx-xx)



8.1.2 Parallel wiring 6 A (80MPD1.600xxxx-xx)

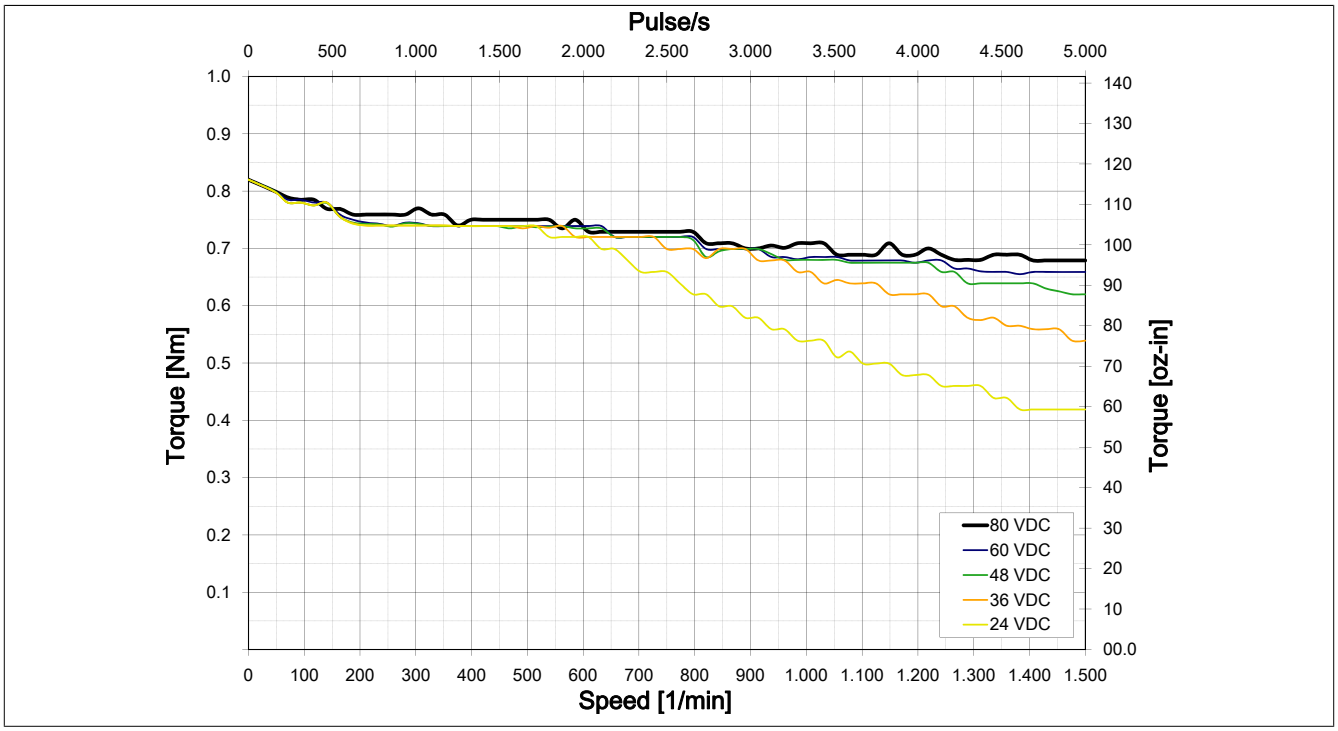


Figure 1: 80MPD1.300S000-01 torque curves, parallel 6 A

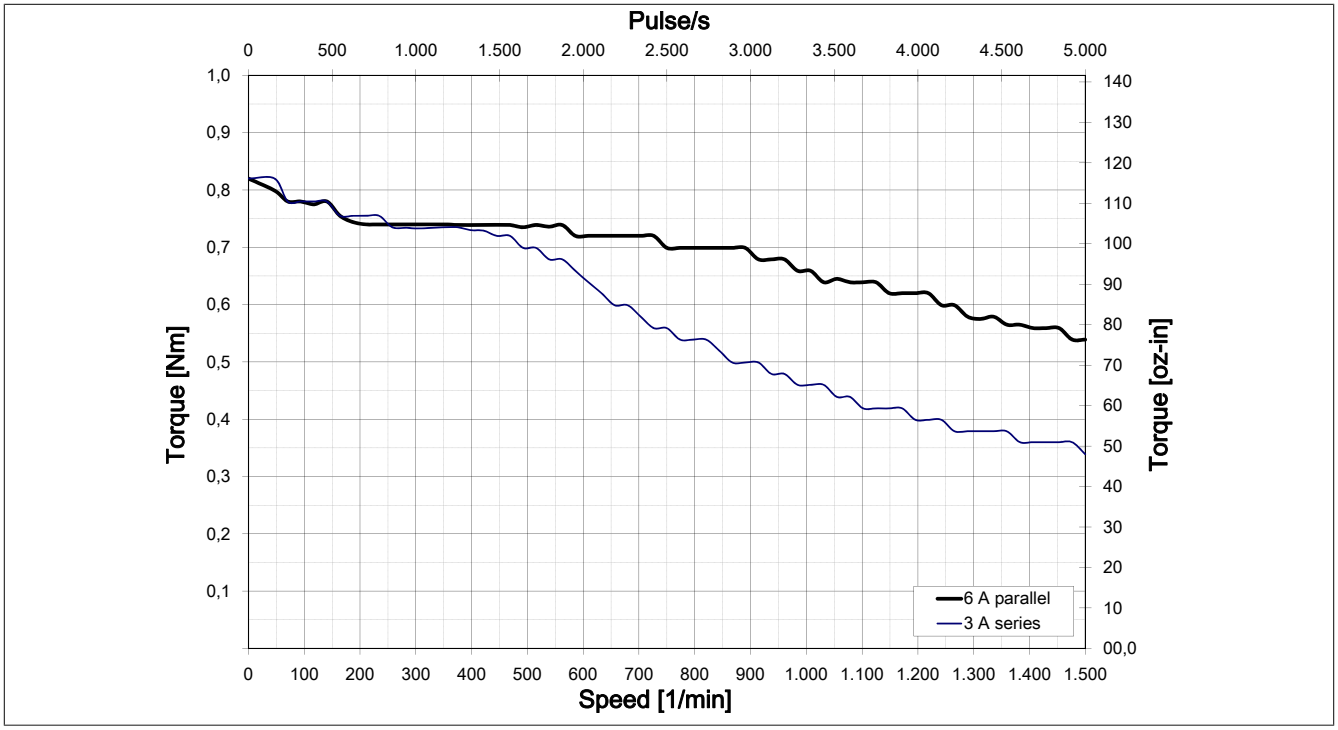
[1)] The torque curve is represented in microsteps.

8.1.3 Selecting the suitable connection type[2)]

The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPD1.300xxxx-xx / 80MPD1.600xxxx-xx

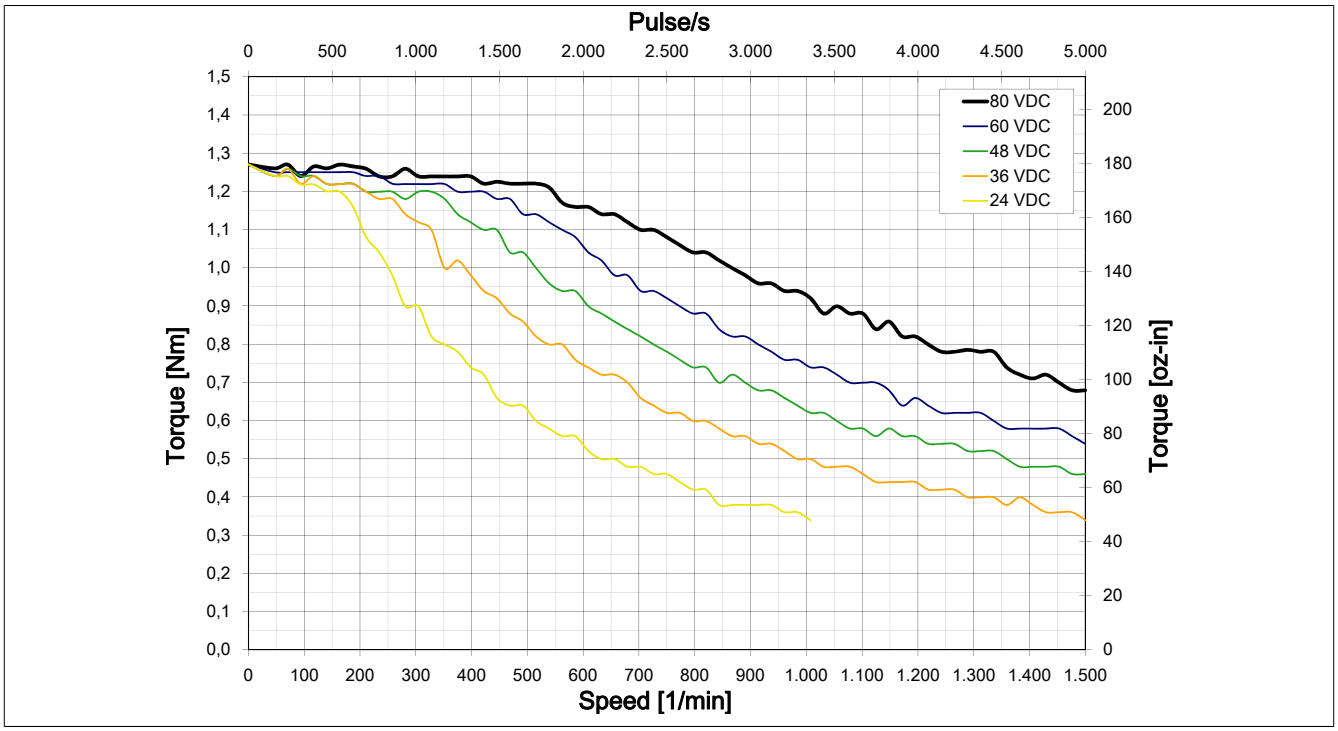
Comparison: series / parallel wiring at 36 V



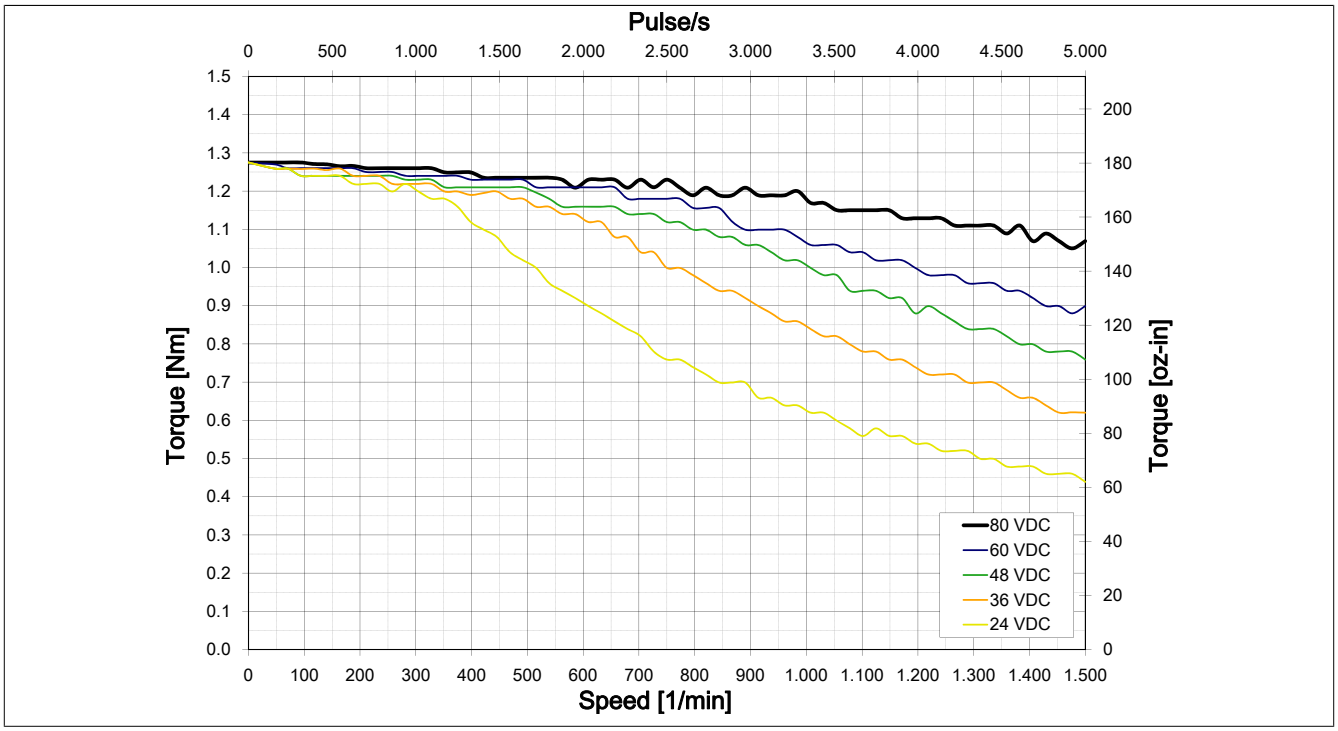
[2)] The torque curve is represented in microsteps.

8.2 80MPD3.x00xxxx-xx[3)]

8.2.1 Series wiring 3 A (80MPD3.300xxxx-xx)



8.2.2 Parallel wiring 6 A (80MPD3.600xxxx-xx)



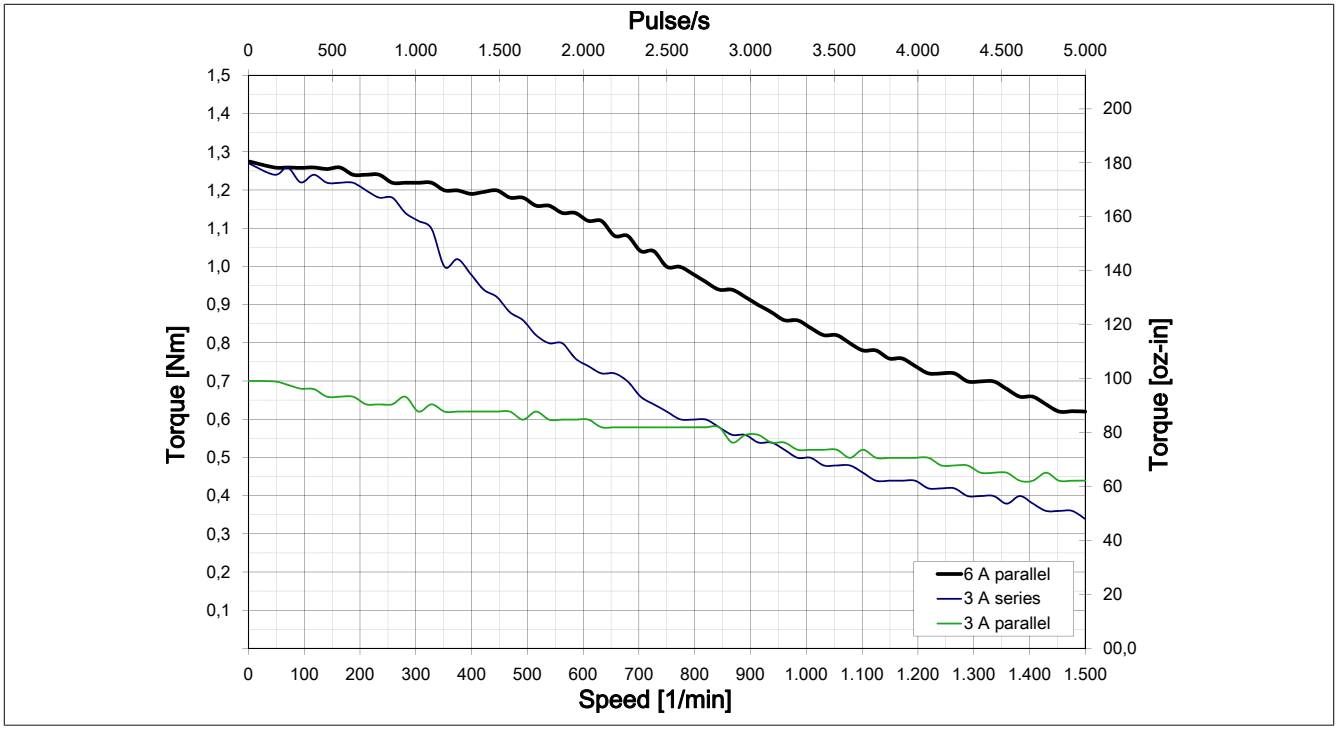
[3)] The torque curve is represented in microsteps.

8.2.3 Selecting the suitable connection type[4)]

The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPD3.300xxxx-xx / 80MPD3.600xxxx-xx

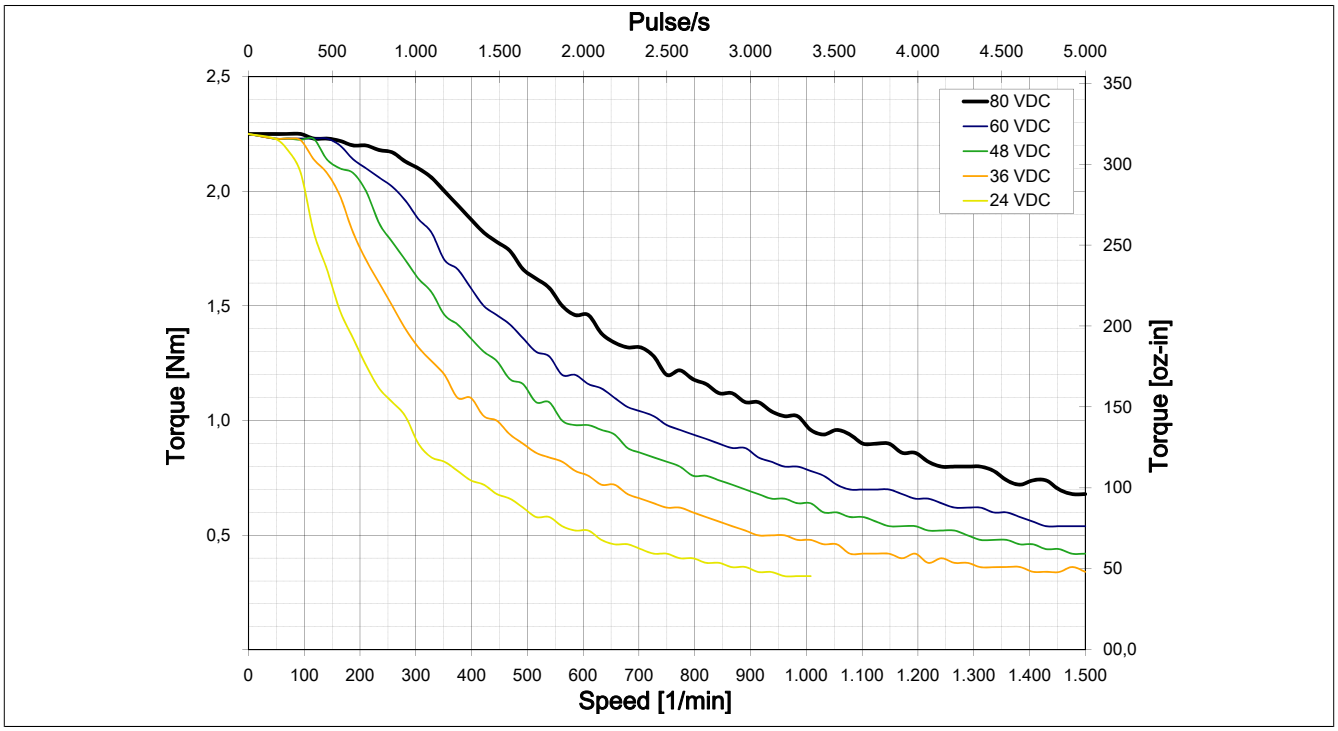
Comparison: series / parallel wiring at 36 V



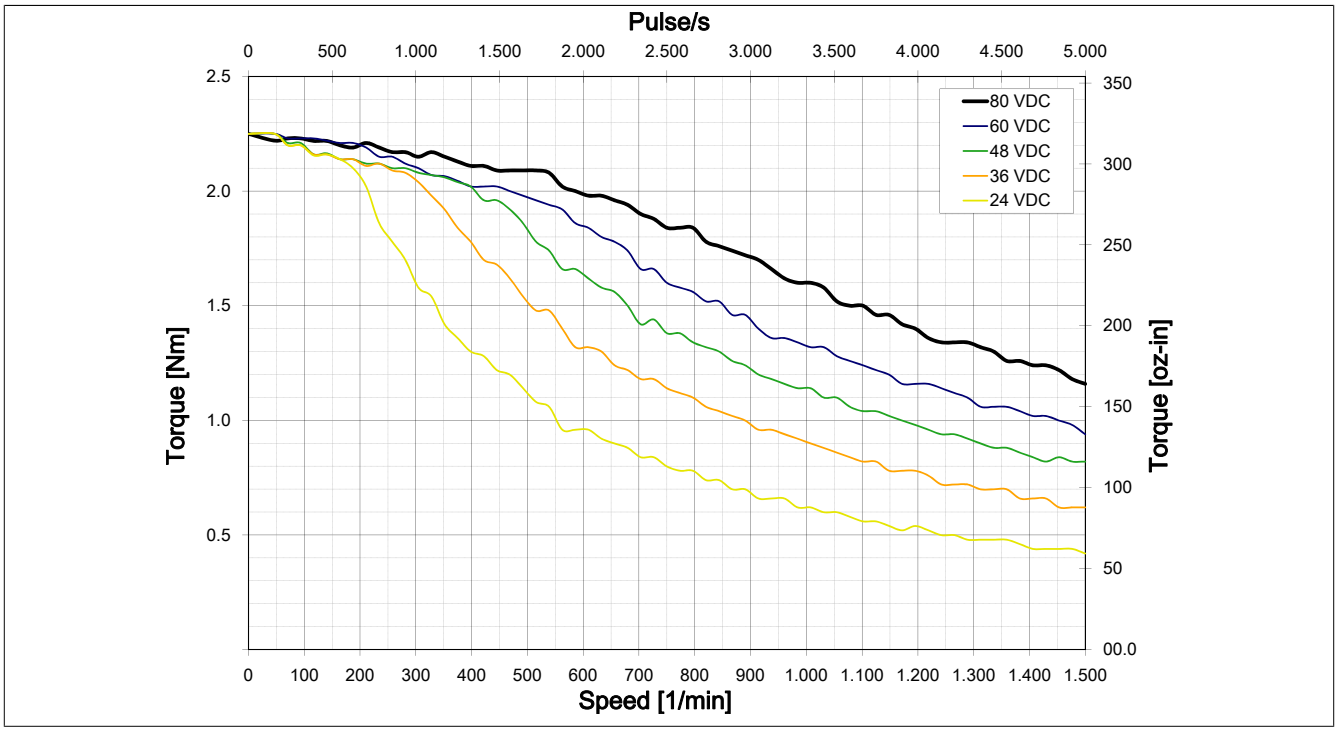
[4)] The torque curve is represented in microsteps.

8.3 80MPD5.x00xxxx-xx[5)]

8.3.1 Series wiring 3 A (80MPD5.300xxxx-xx)



8.3.2 Parallel wiring 6 A (80MPD5.600xxxx-xx)



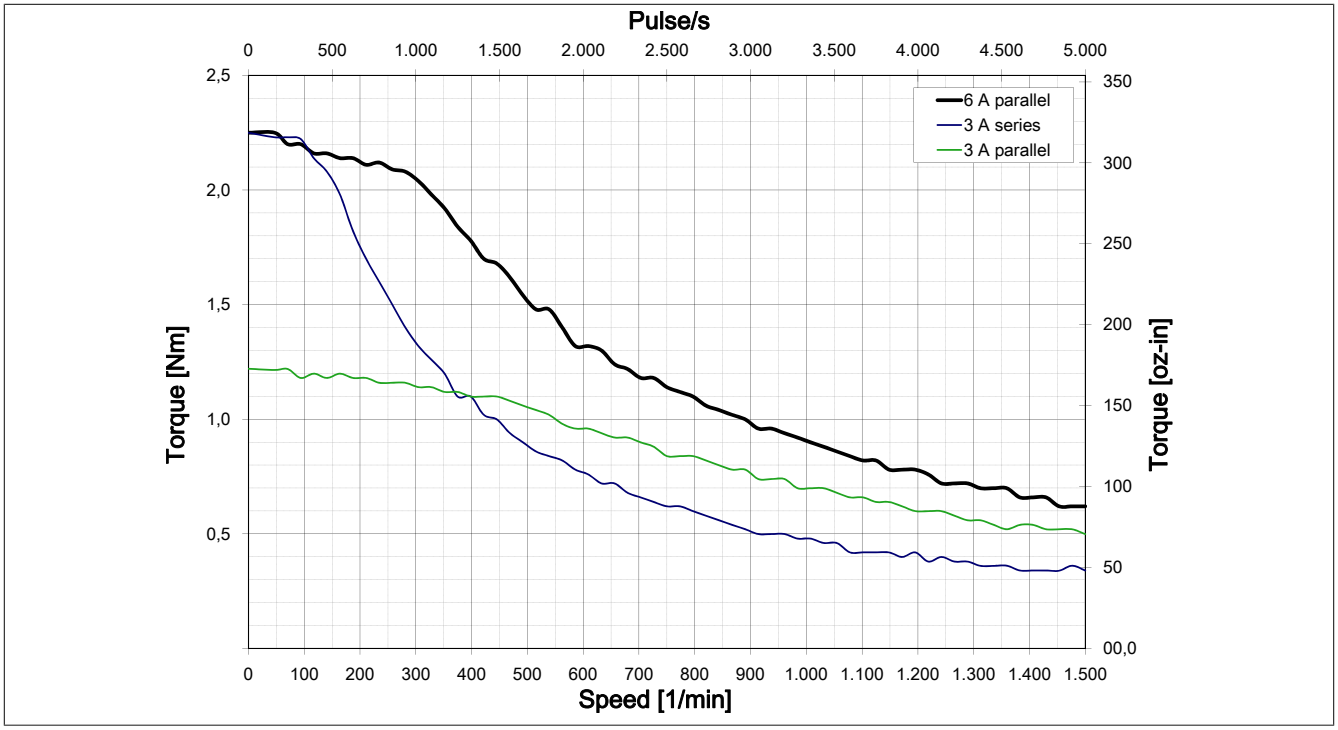
[5)] The torque curve is represented in microsteps.

8.3.3 Selecting the suitable connection type[6)]

The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPD5.300xxxx-xx / 80MPD5.600xxxx-xx

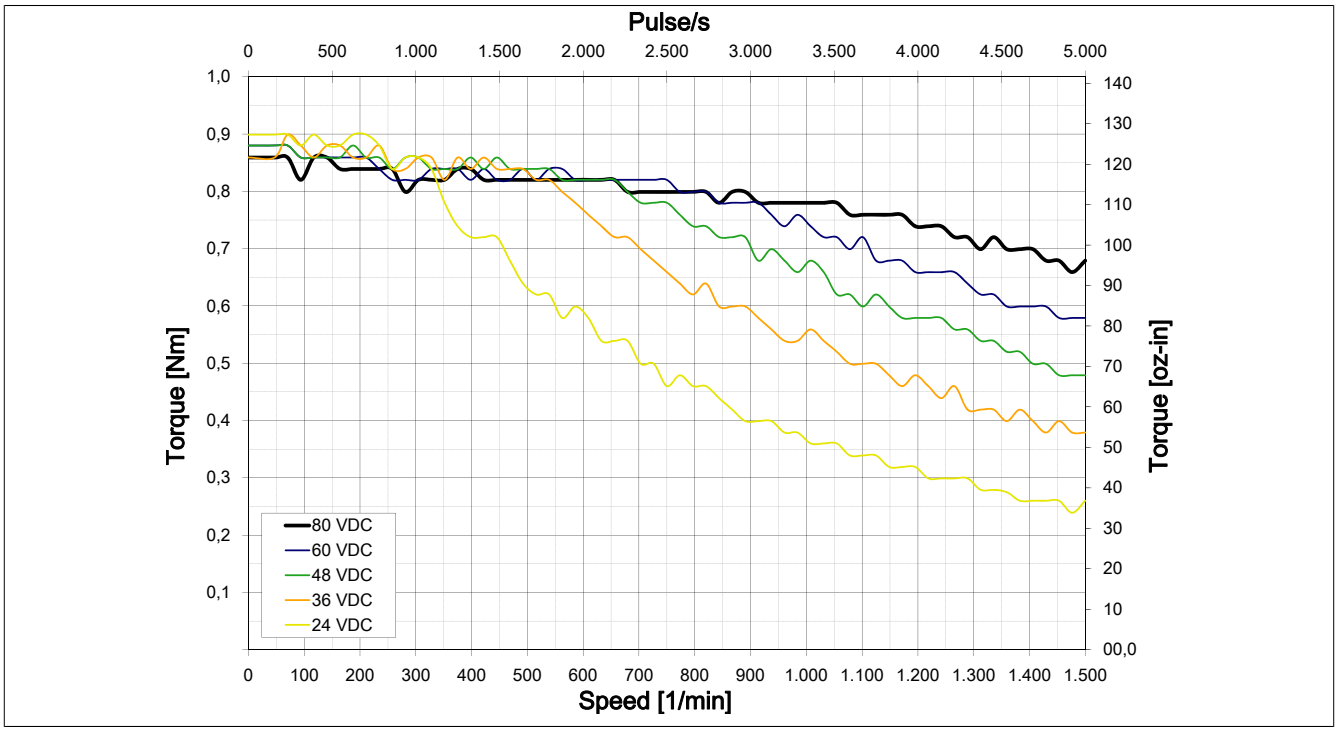
Comparison: series / parallel wiring at 36 V



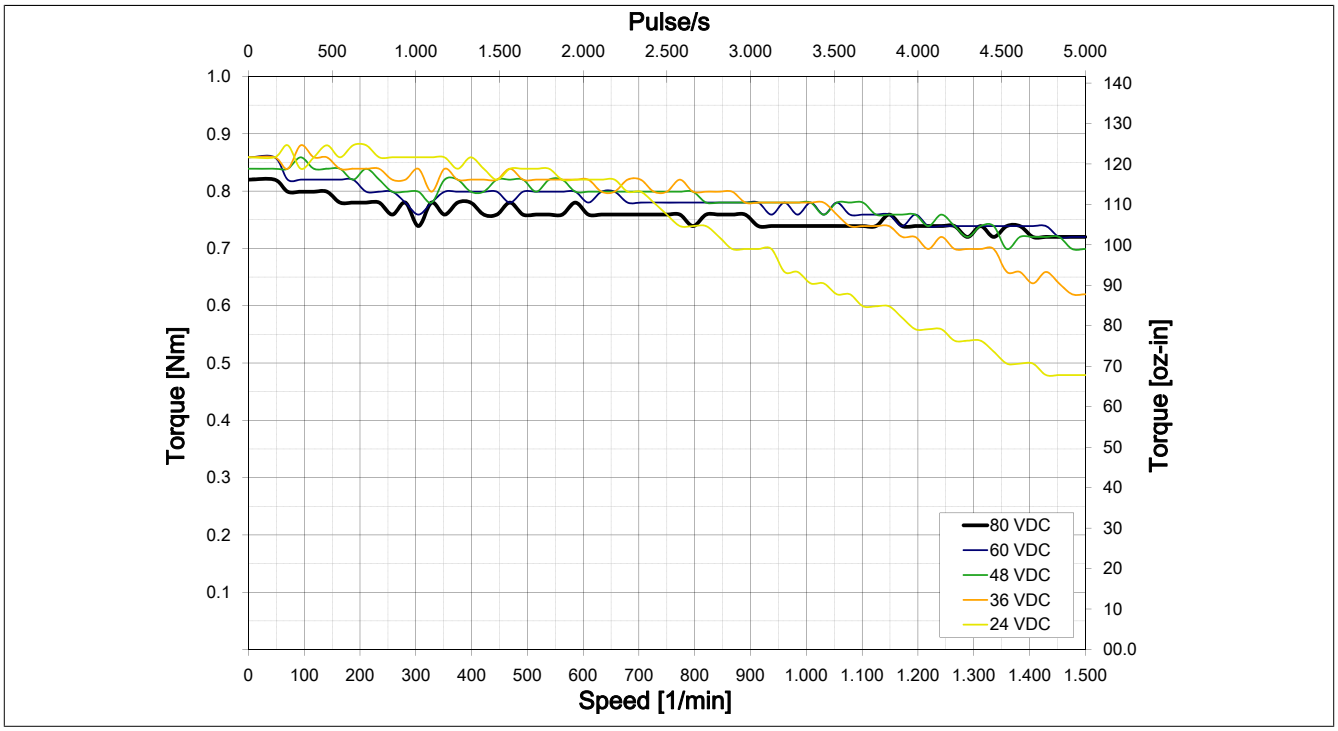
[6)] The torque curve is represented in microsteps.

8.4 80MPF1.xx0xxxx-xx[7)]

8.4.1 Series wiring 2.5 A (80MPF1.250xxxx-xx)



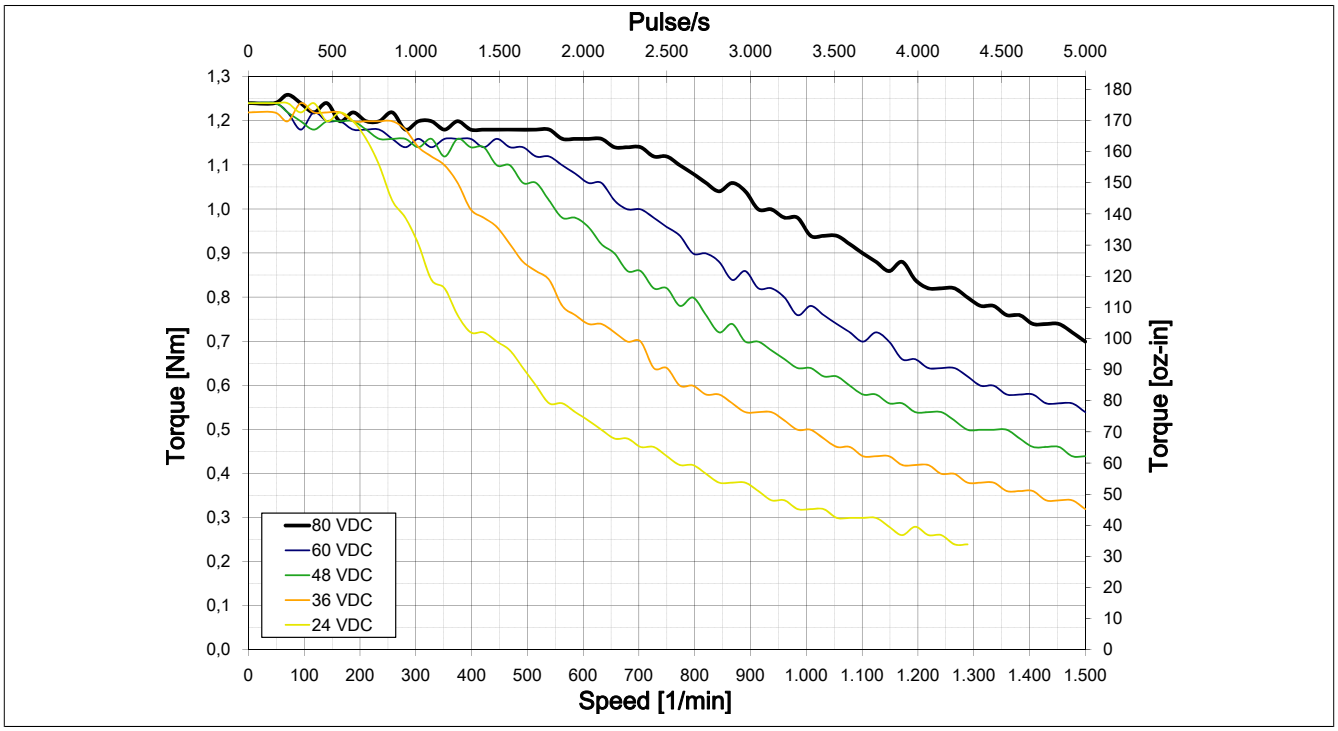
8.4.2 Parallel wiring 5 A (80MPF1.500xxxx-xx)



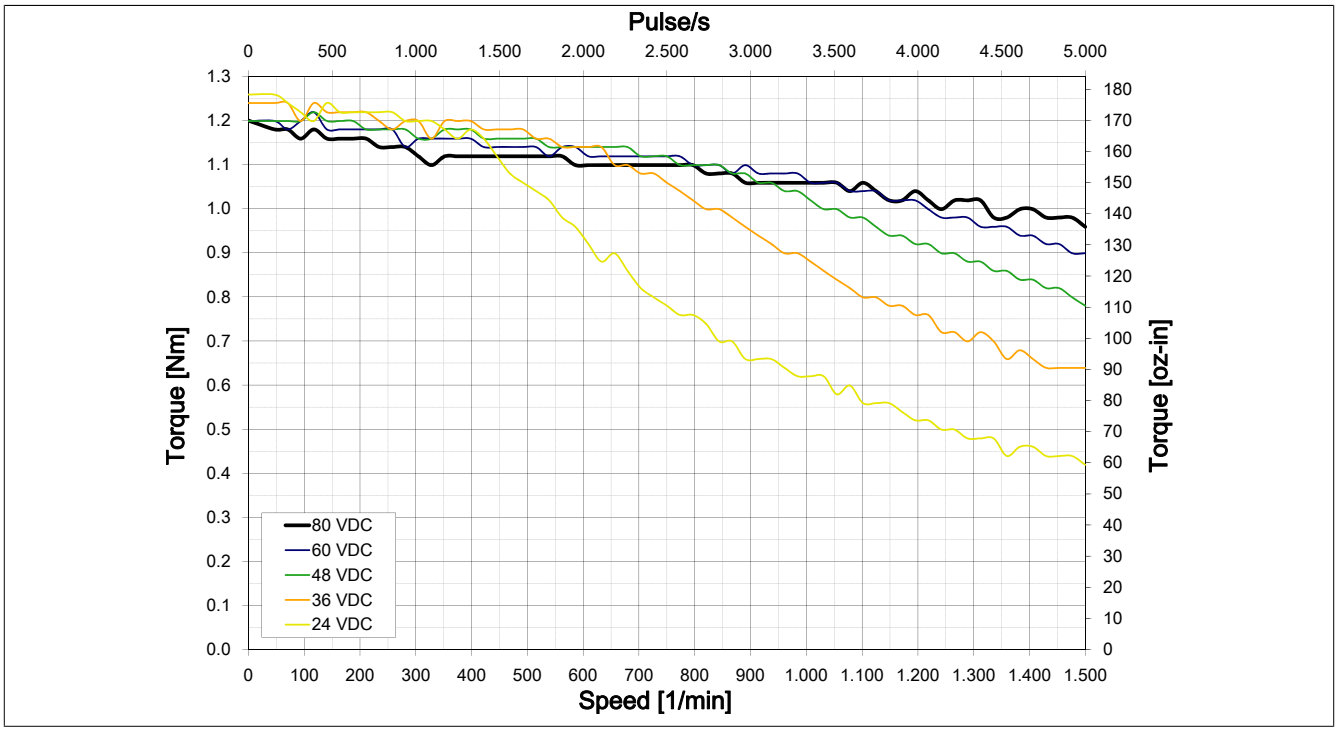
[7)] The torque curve is represented in microsteps.

8.5 80MPF3.xx0xxxx-xx[8)]

8.5.1 Series wiring 2.5 A (80MPF3.250xxxx-xx)



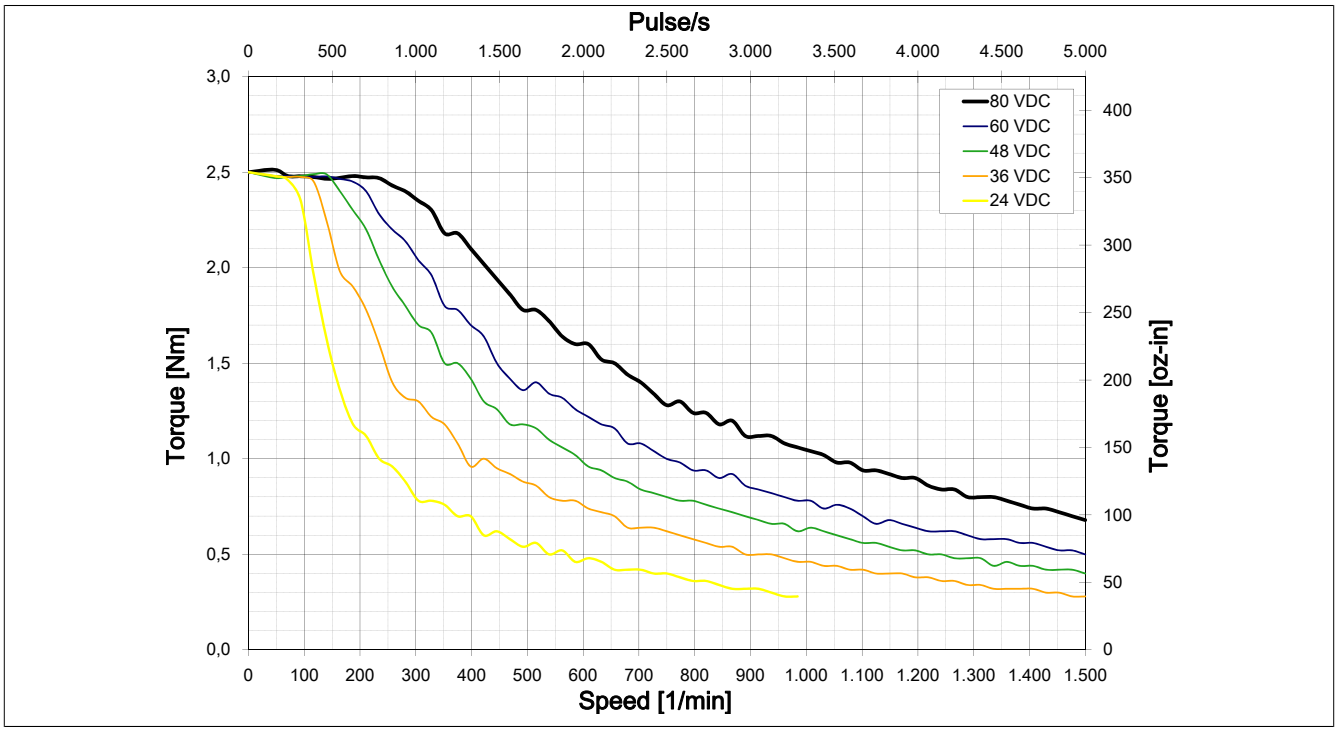
8.5.2 Parallel wiring 5 A (80MPF3.500xxxx-xx)



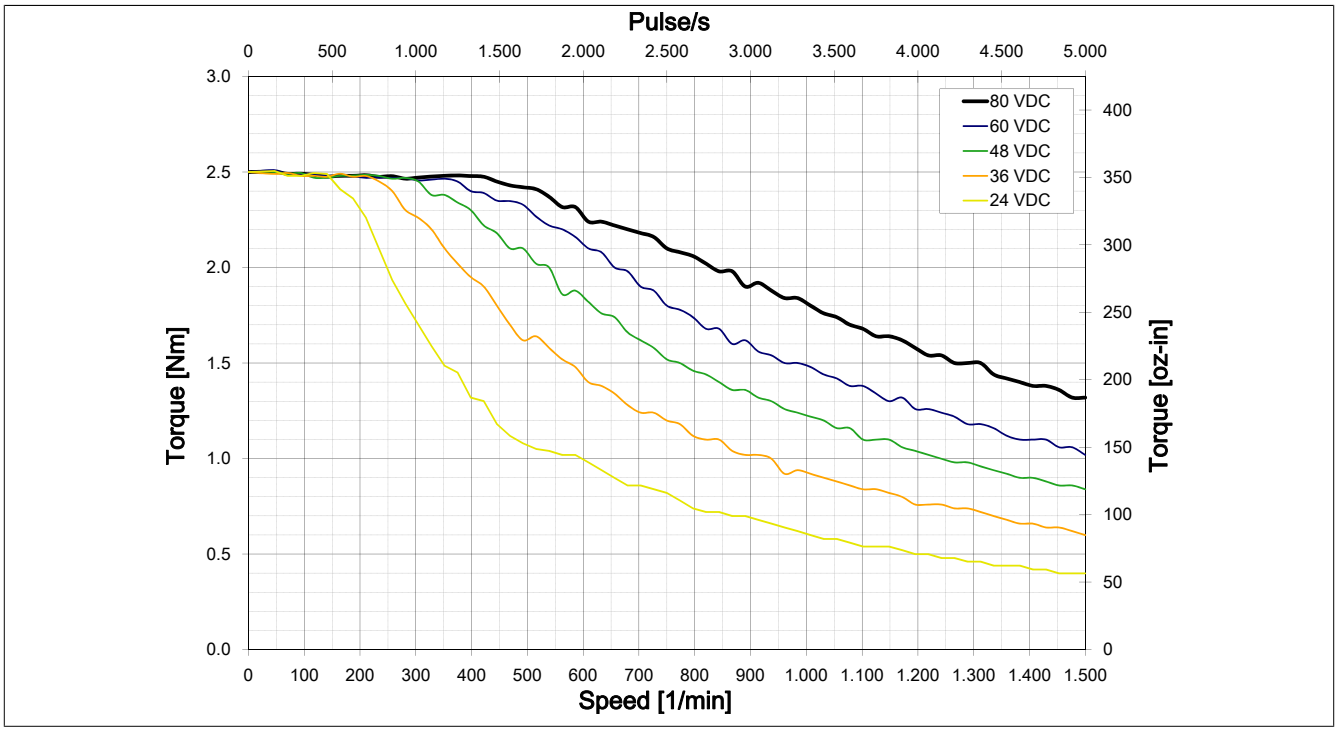
[8)] The torque curve is represented in microsteps.

8.6 80MPF5.xx0xxxx-xx[9)]

8.6.1 Series wiring 2.5 A (80MPF5.250xxxx-xx)



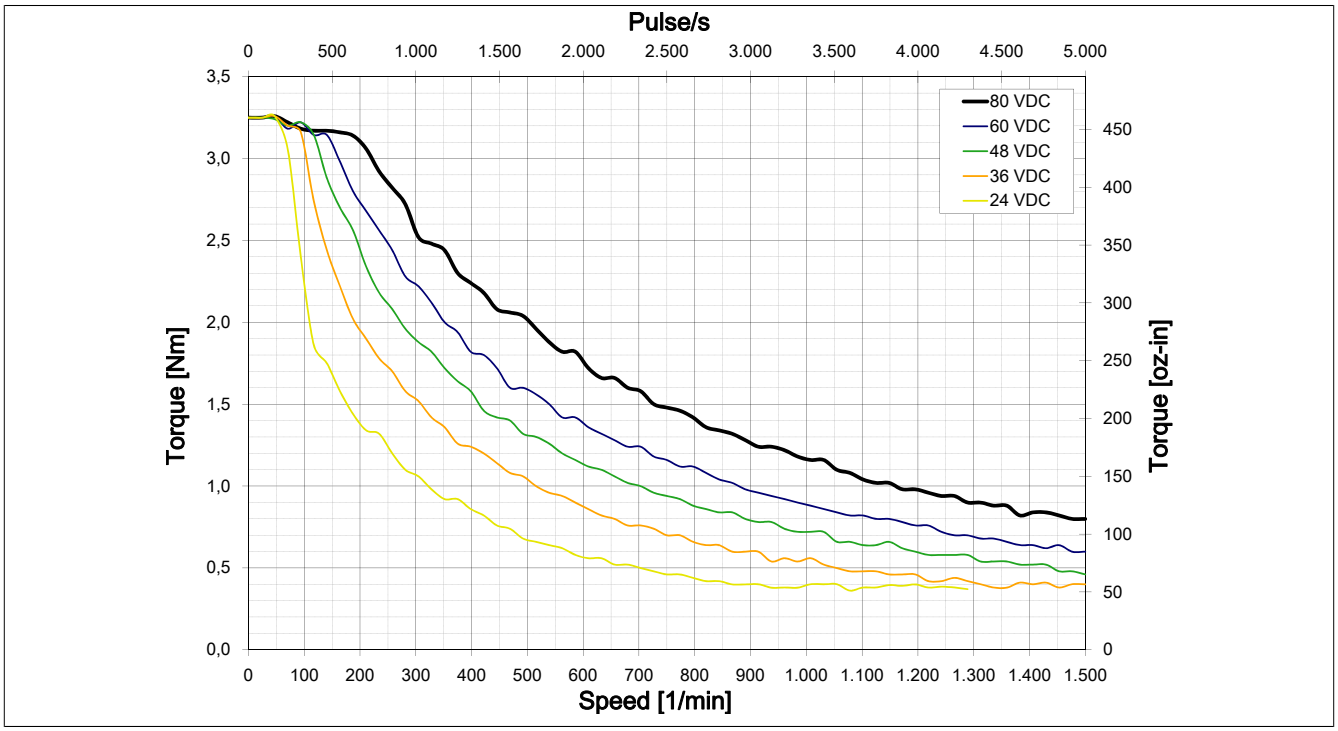
8.6.2 Parallel wiring 5 A (80MPF5.500xxxx-xx)



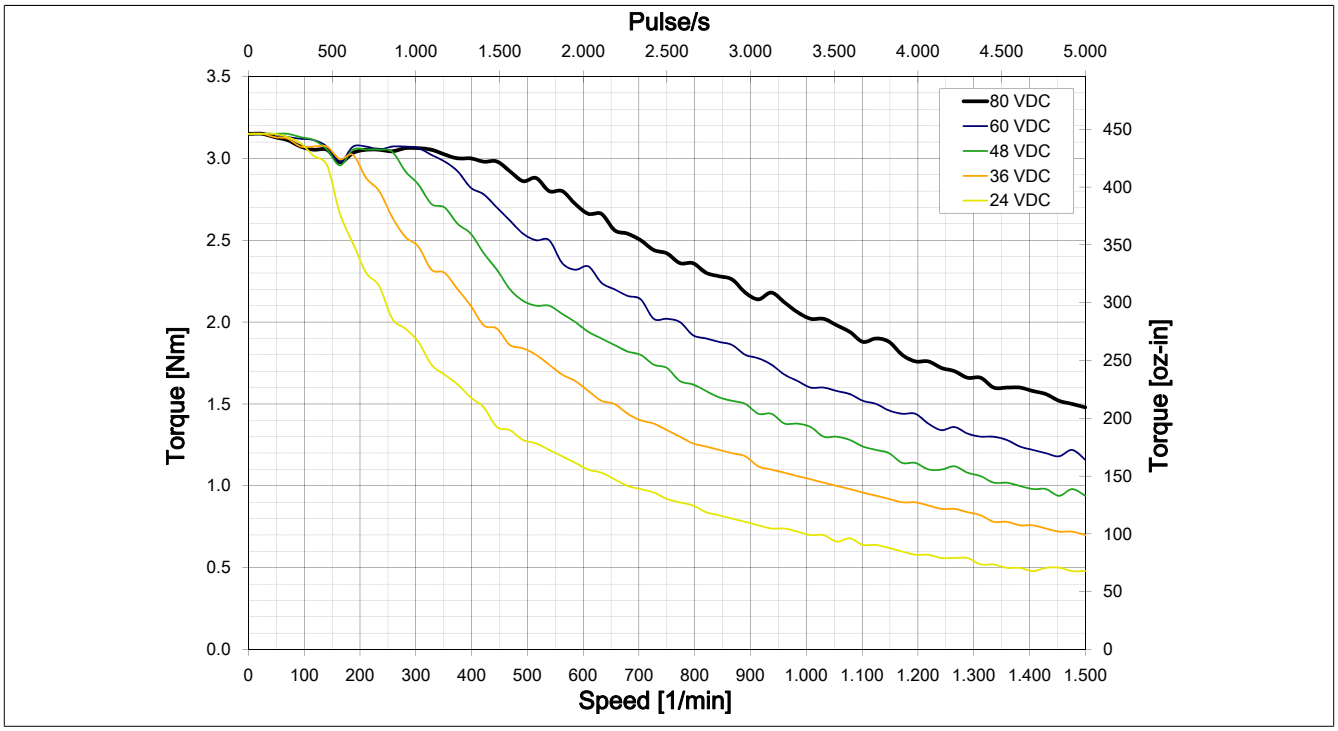
9) The torque curve is represented in microsteps.

8.7 80MPH1.x00xxxx-xx[10)]

8.7.1 Series wiring 3 A (80MPH1.300xxxx-xx)



8.7.2 Parallel wiring 6 A (80MPH1.600xxxx-xx)



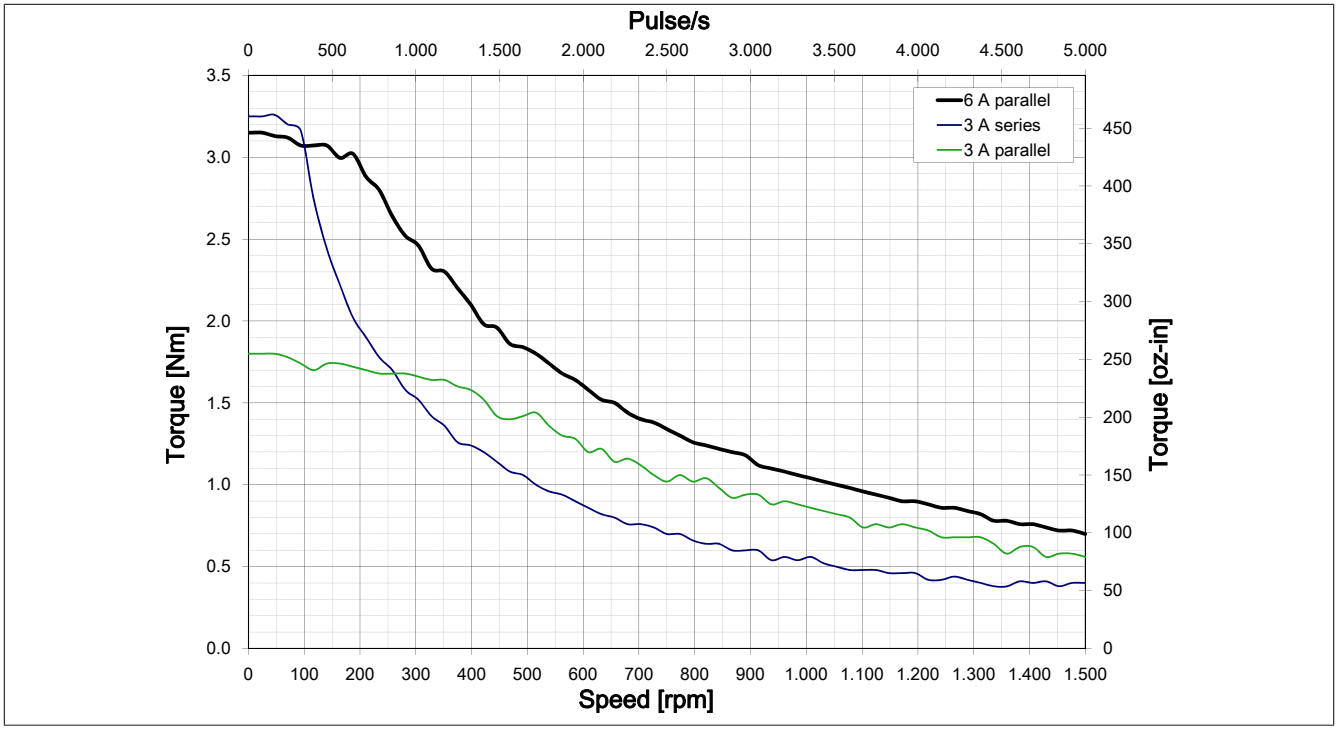
[10)] The torque curve is represented in microsteps.

8.7.3 Selecting the suitable connection type[11)]

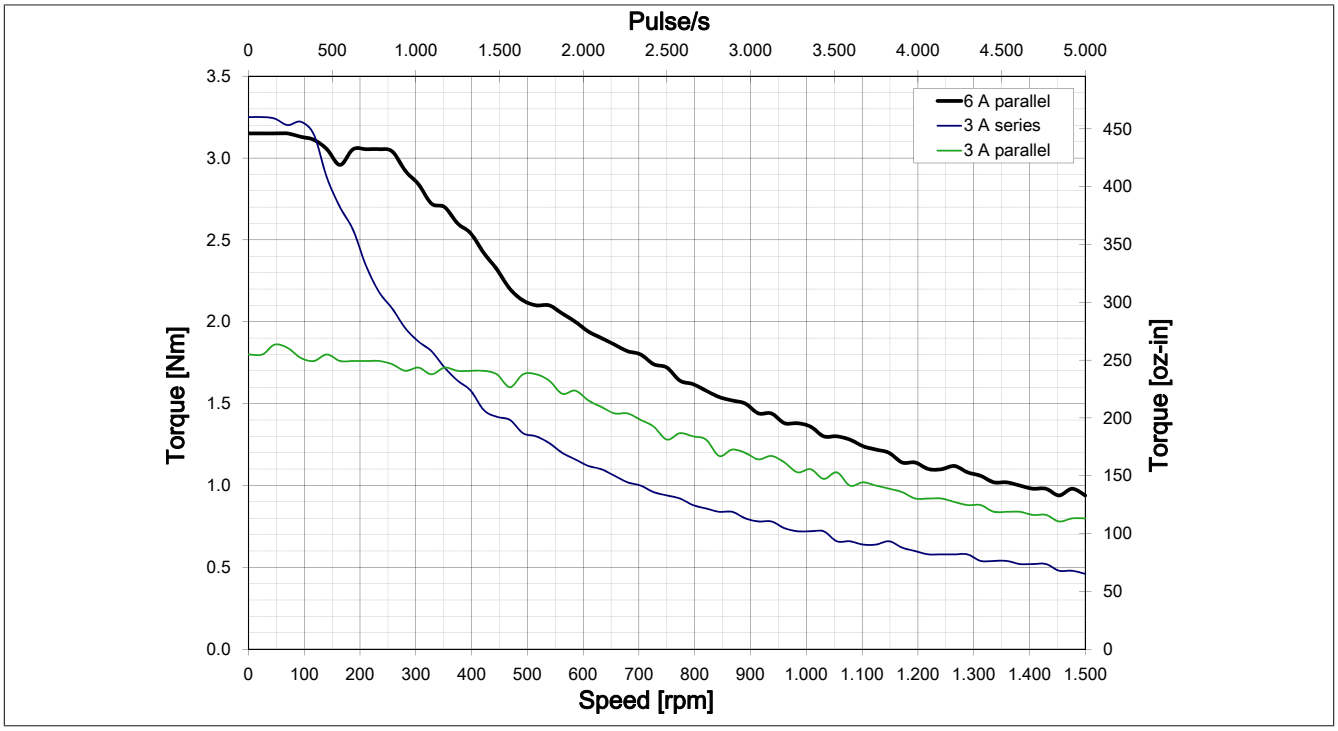
The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPH1.300xxxx-xx / 80MPH1.600xxxx-xx

Comparison: series / parallel wiring at 36 V



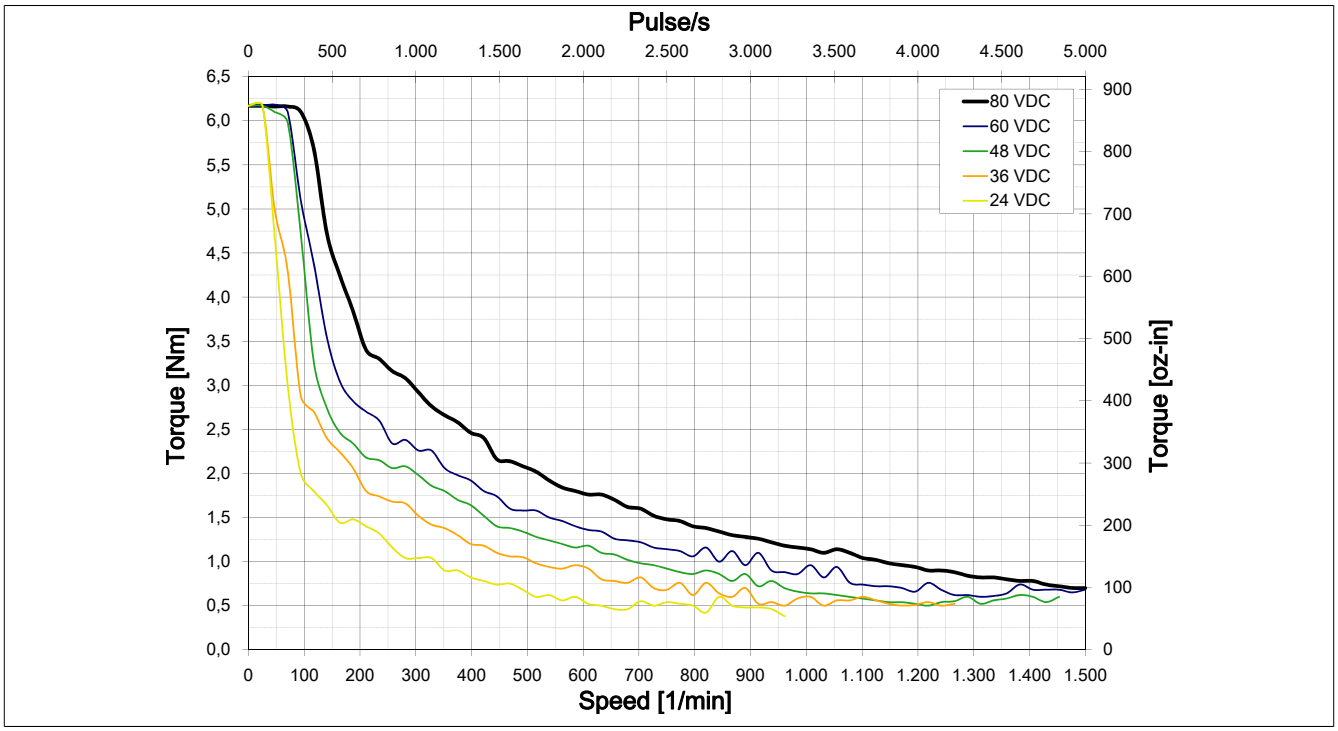
Comparison: series / parallel wiring at 48 V



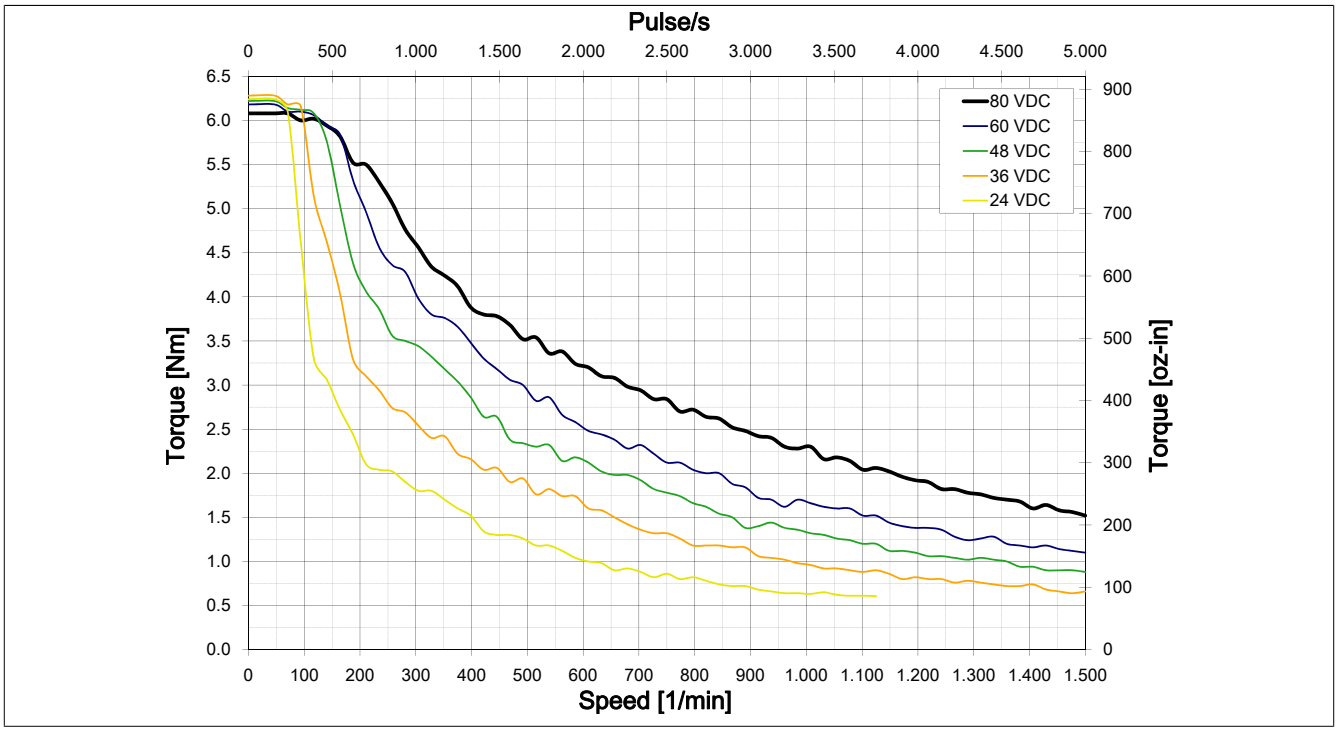
[11)] The torque curve is represented in microsteps.

8.8 80MPH3.x00xxxx-xx[12)]

8.8.1 Series wiring 3 A (80MPH3.300xxxx-xx)



8.8.2 Parallel wiring 6 A (80MPH3.600xxxx-xx)



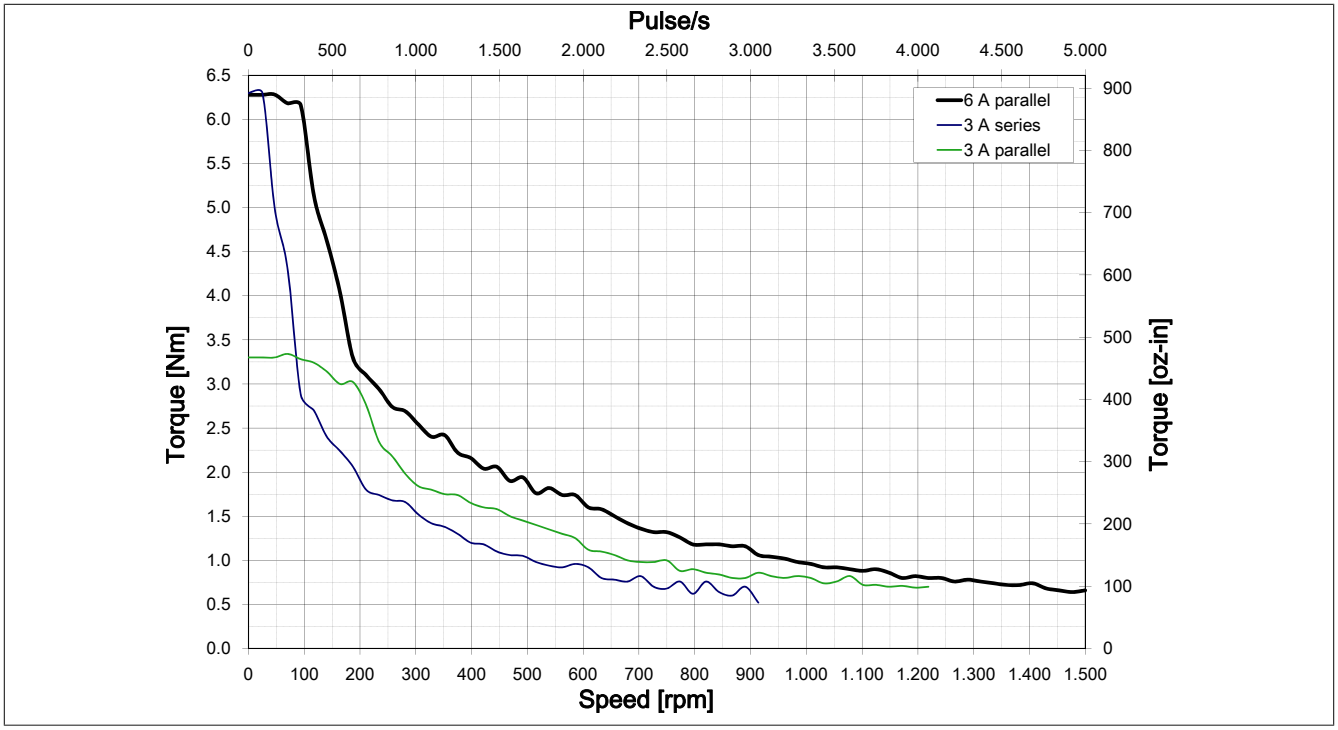
[12)] The torque curve is represented in microsteps.

8.8.3 Selecting the suitable connection type[13)]

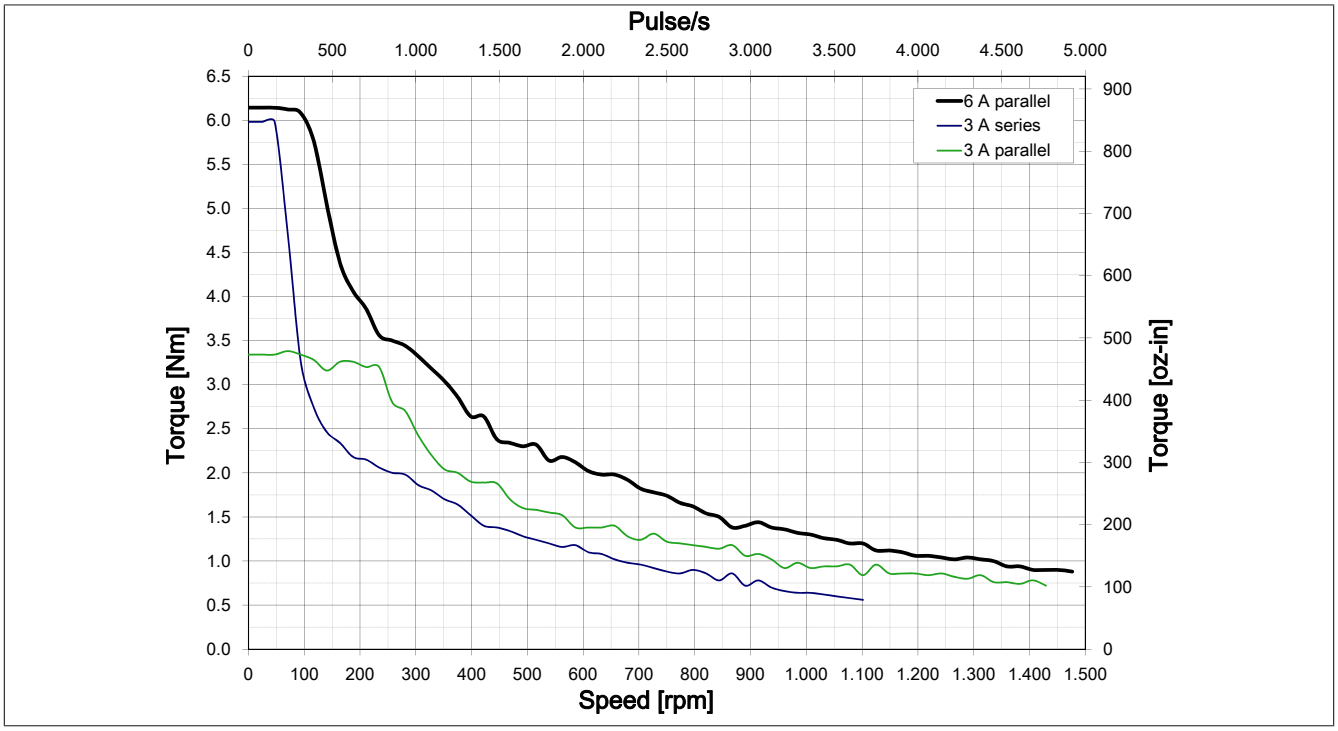
The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPH3.300xxxx-xx / 80MPH3.600xxxx-xx

Comparison: series / parallel wiring at 36 V



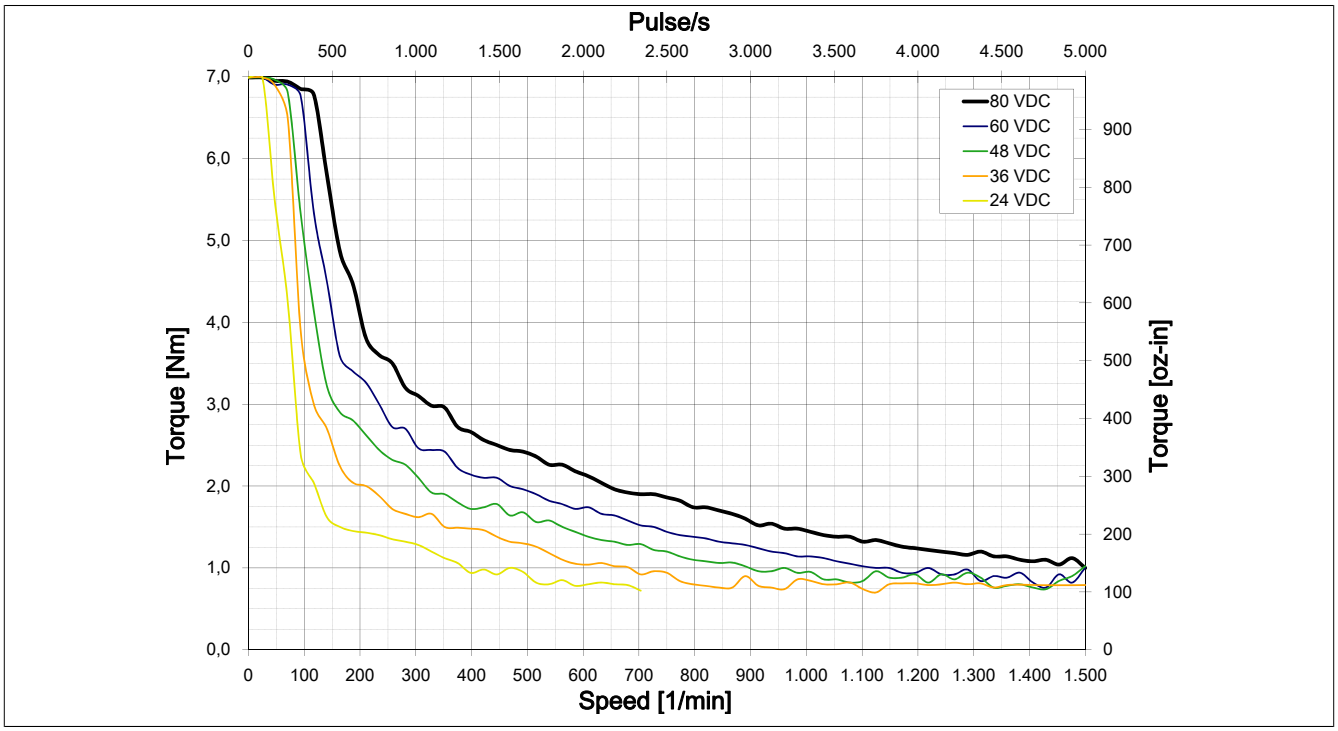
Comparison: series / parallel wiring at 48 V



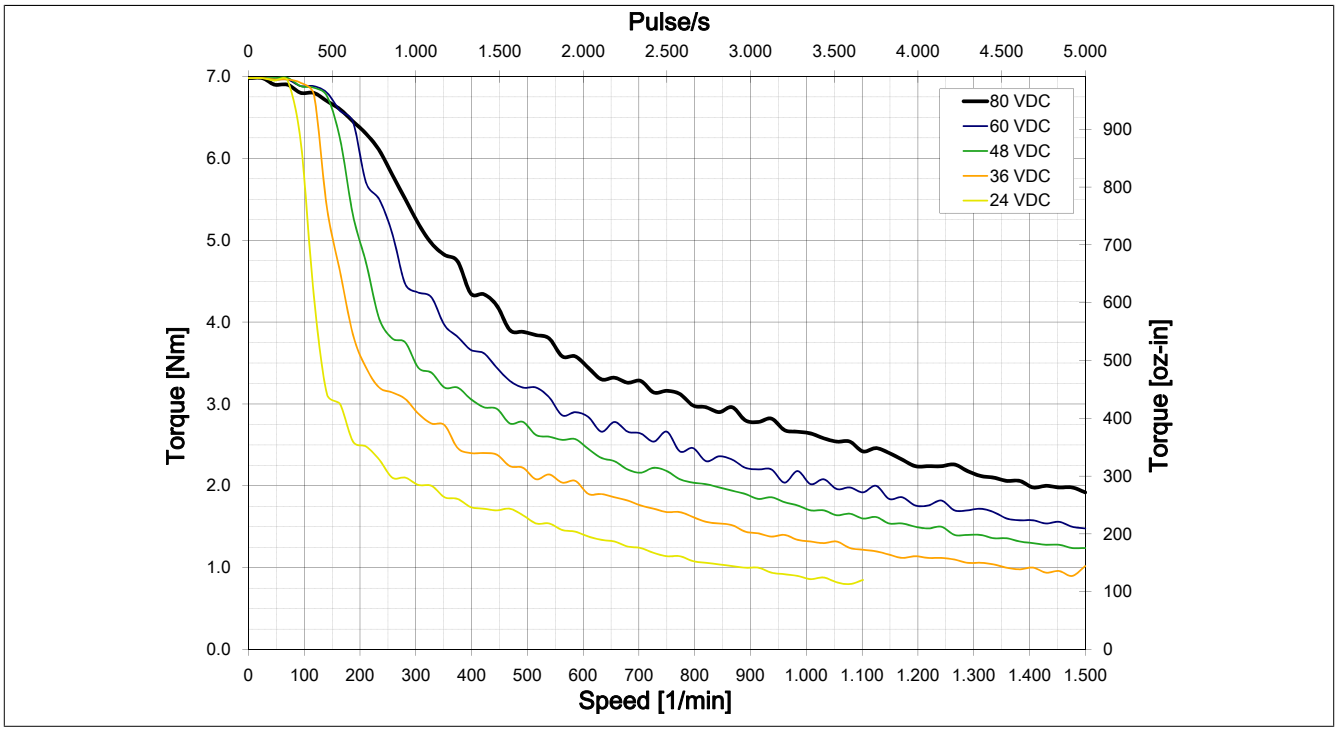
[13)] The torque curve is represented in microsteps.

8.9 80MPH4.x0xxxxx-xx[14)]

8.9.1 Series wiring 3 A (80MPH4.300xxxx-xx)



8.9.2 Parallel wiring 6 A (80MPH4.600xxxx-xx)



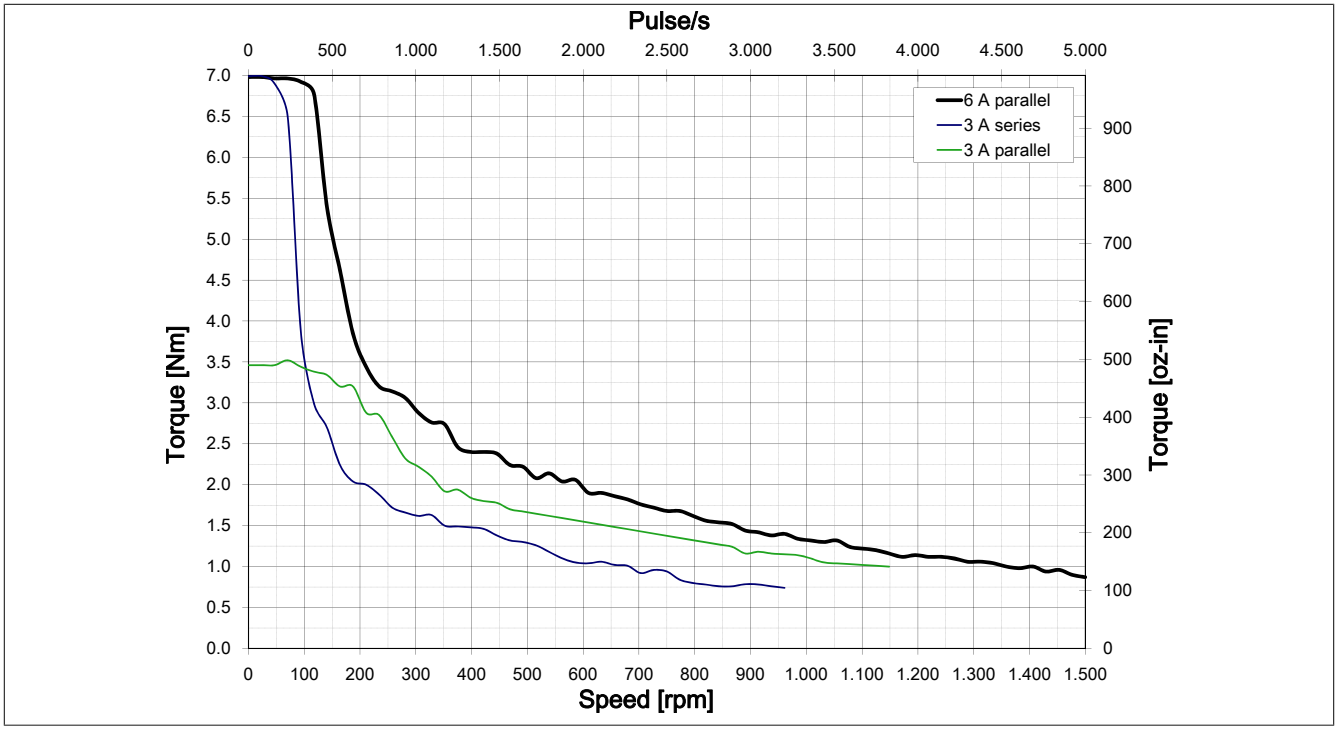
[14)] The torque curve is represented in microsteps.

8.9.3 Selecting the suitable connection type[15)]

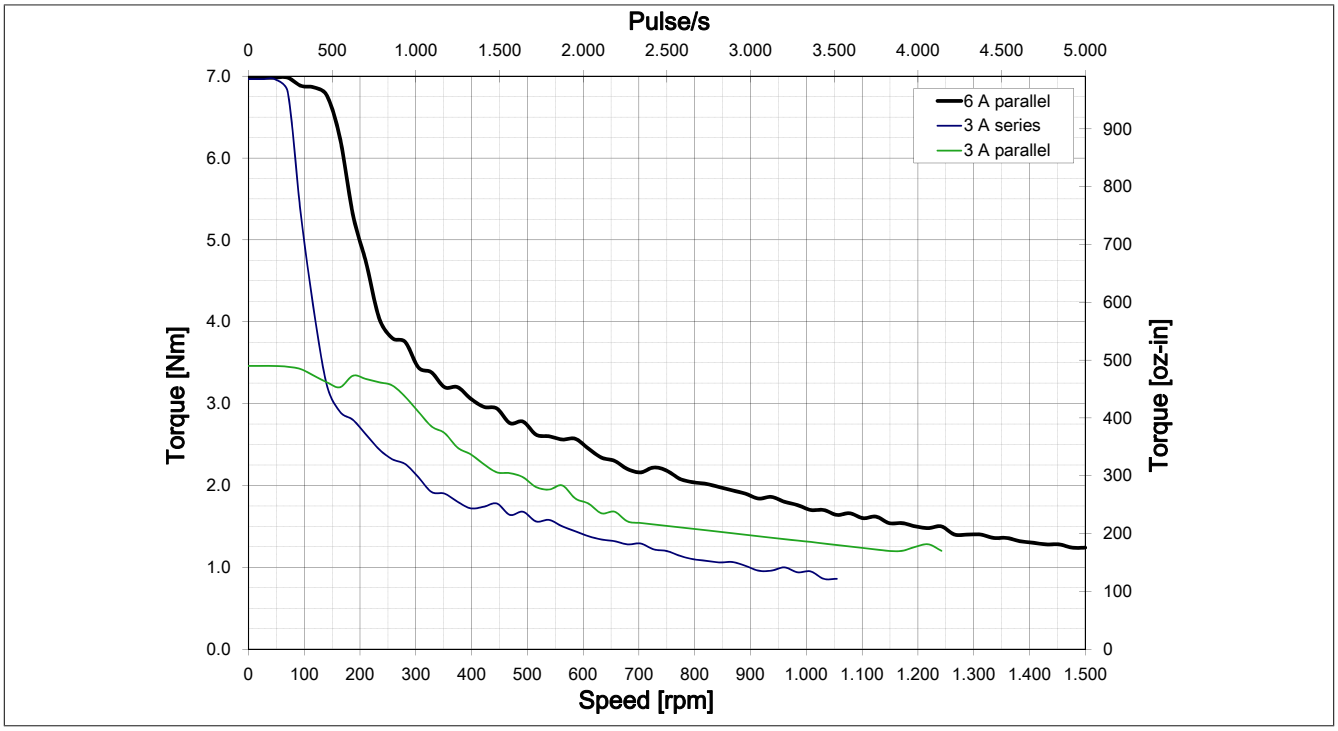
The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPH4.300xxxx-xx / 80MPH4.600xxxx-xx

Comparison: series / parallel wiring at 36 V

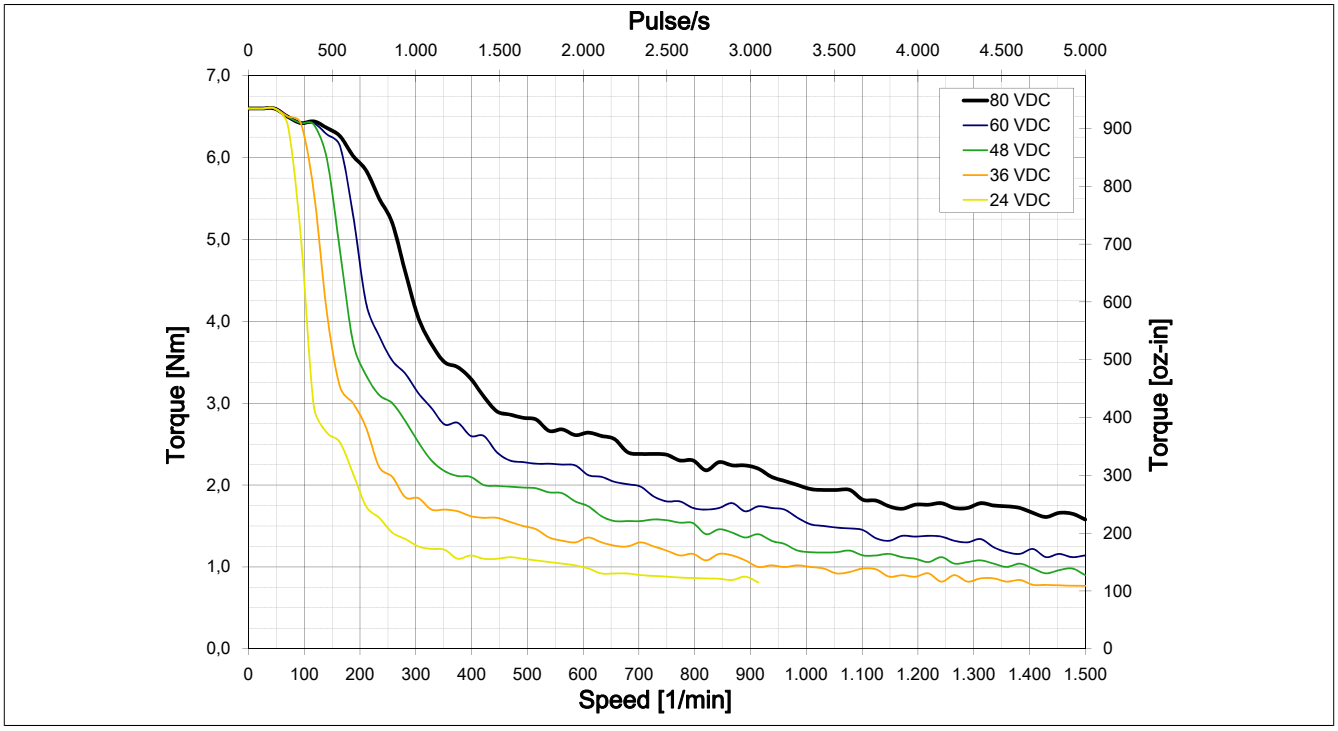


Comparison: series / parallel wiring at 48 V

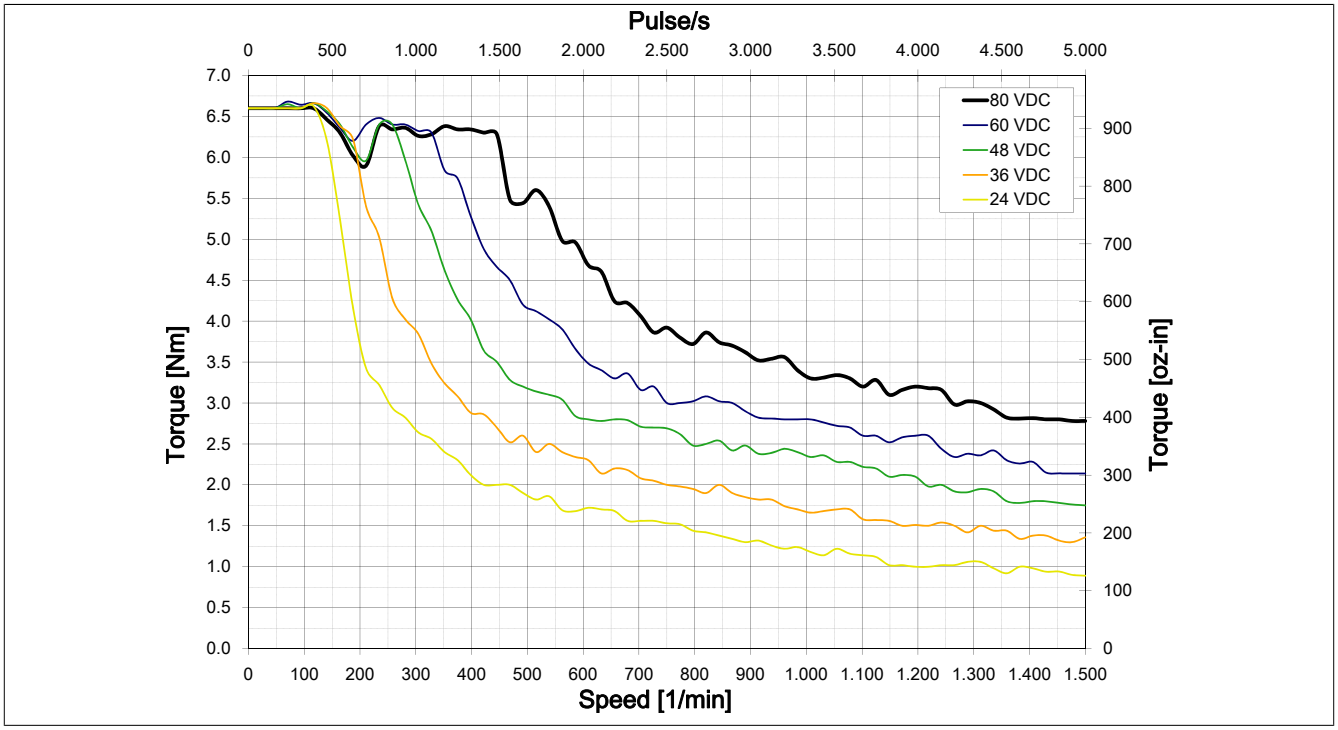


[15)] The torque curve is represented in microsteps.

8.9.4 Series wiring 5 A (80MPH4.500xxxx-xx)[16)]



8.9.5 Parallel wiring 10 A (80MPH4.101xxxx-xx + 80MPH4.500S000-01)[17)]



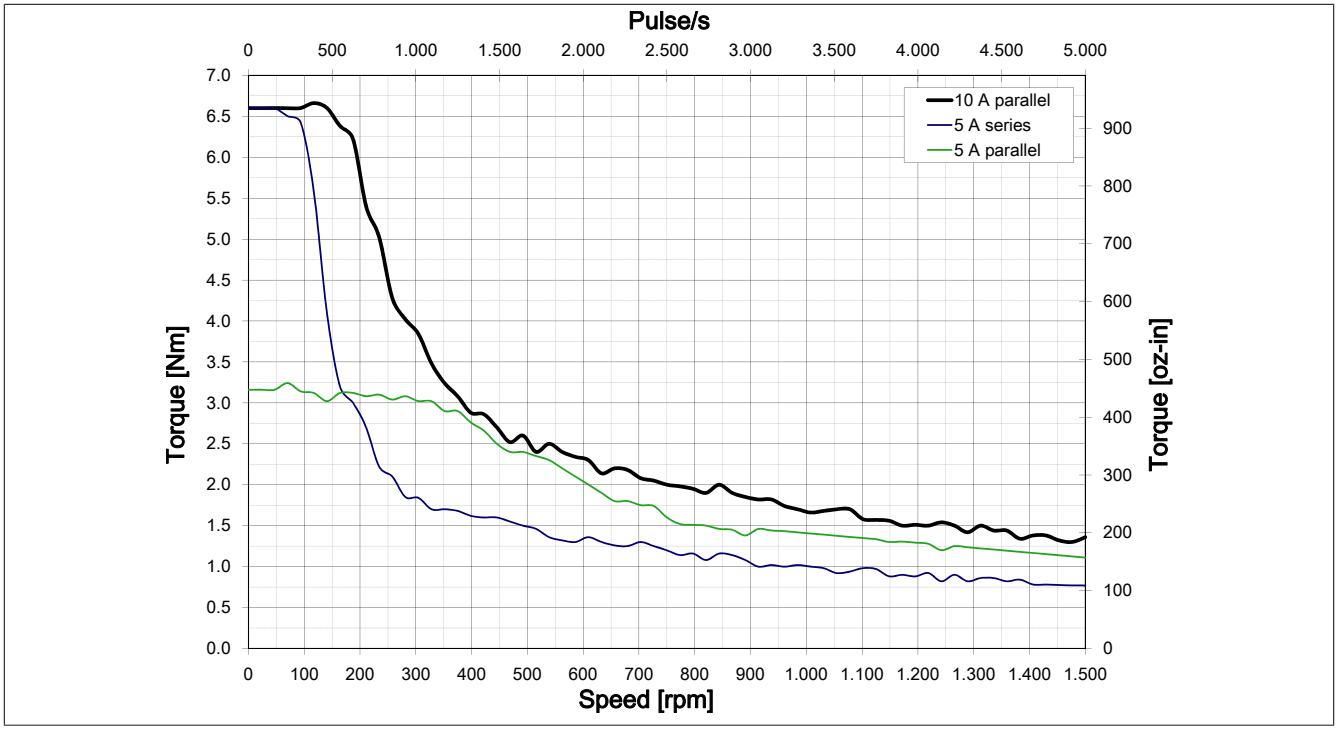
[16)] The torque curve is represented in microsteps.
[17)] The torque curve is represented in microsteps.

8.9.6 Selecting the suitable connection type[18)]

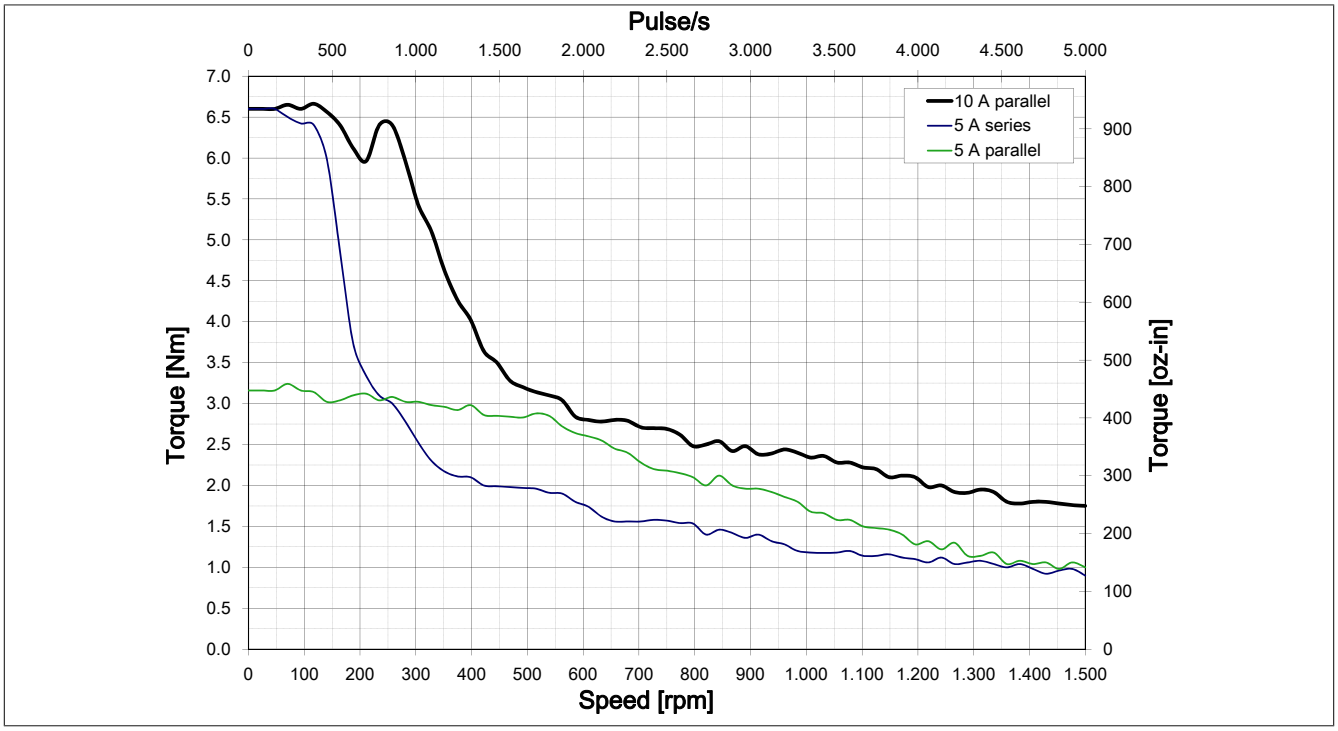
The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPH4.101xxxx-xx + 80MPH4.500S000-01

Comparison: series / parallel wiring at 36 V



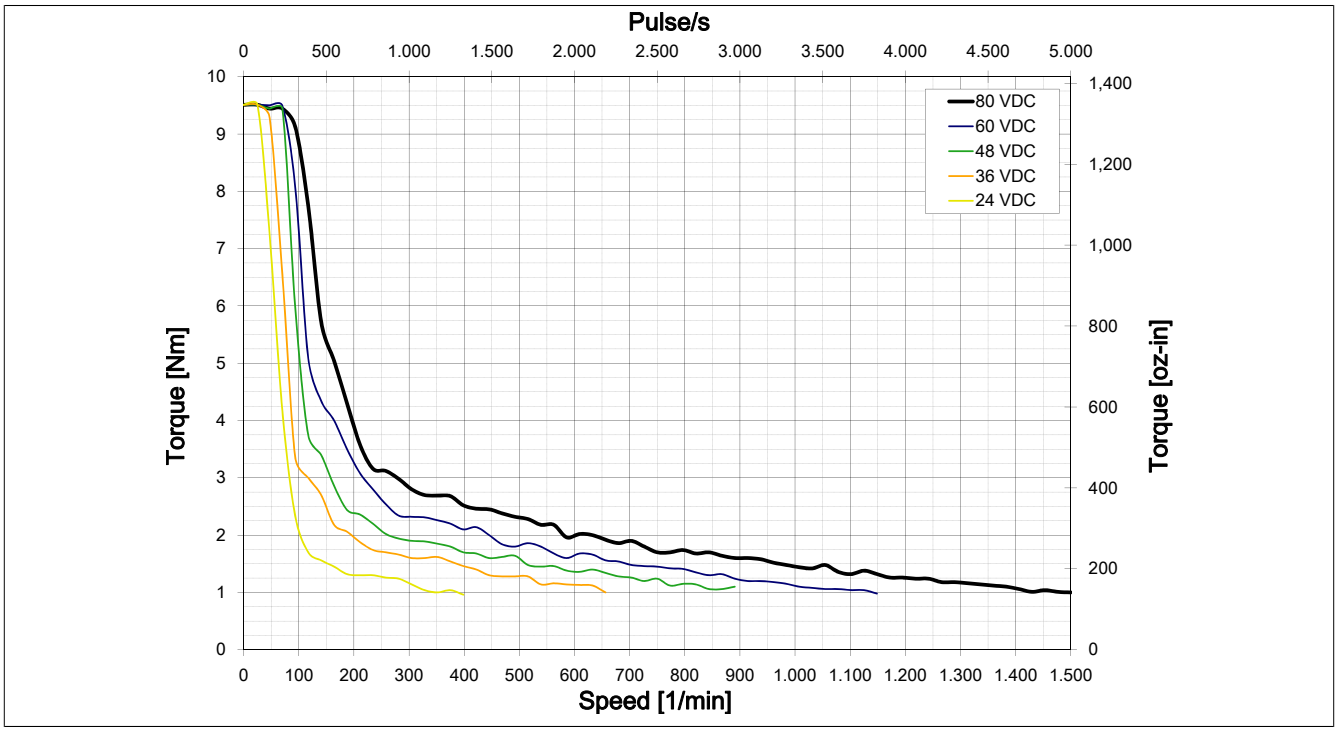
Comparison: series / parallel wiring at 48 V



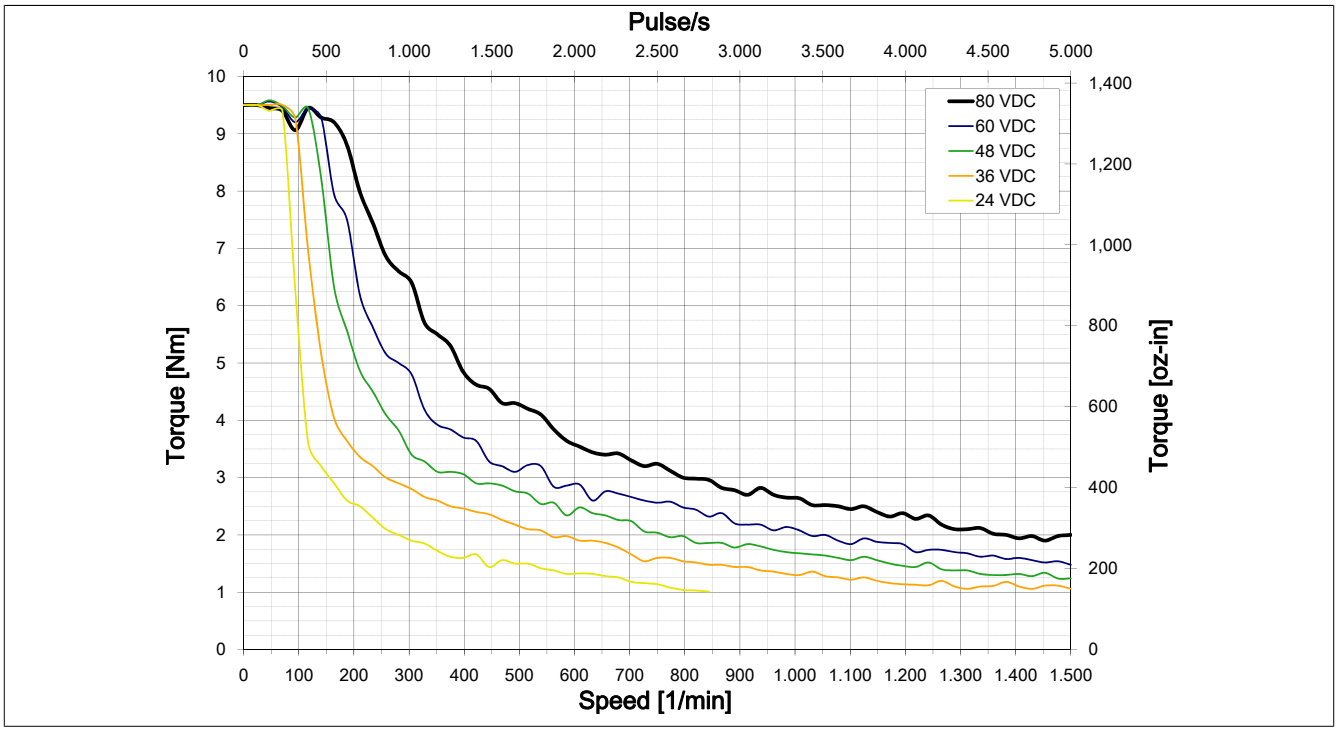
[18)] The torque curve is represented in microsteps.

8.10 80MPH6.x00xxxx-xx[19)]

8.10.1 Series wiring 3 A (80MPH6.300xxxx-xx)



8.10.2 Parallel wiring 6 A (80MPH6.600xxxx-xx)



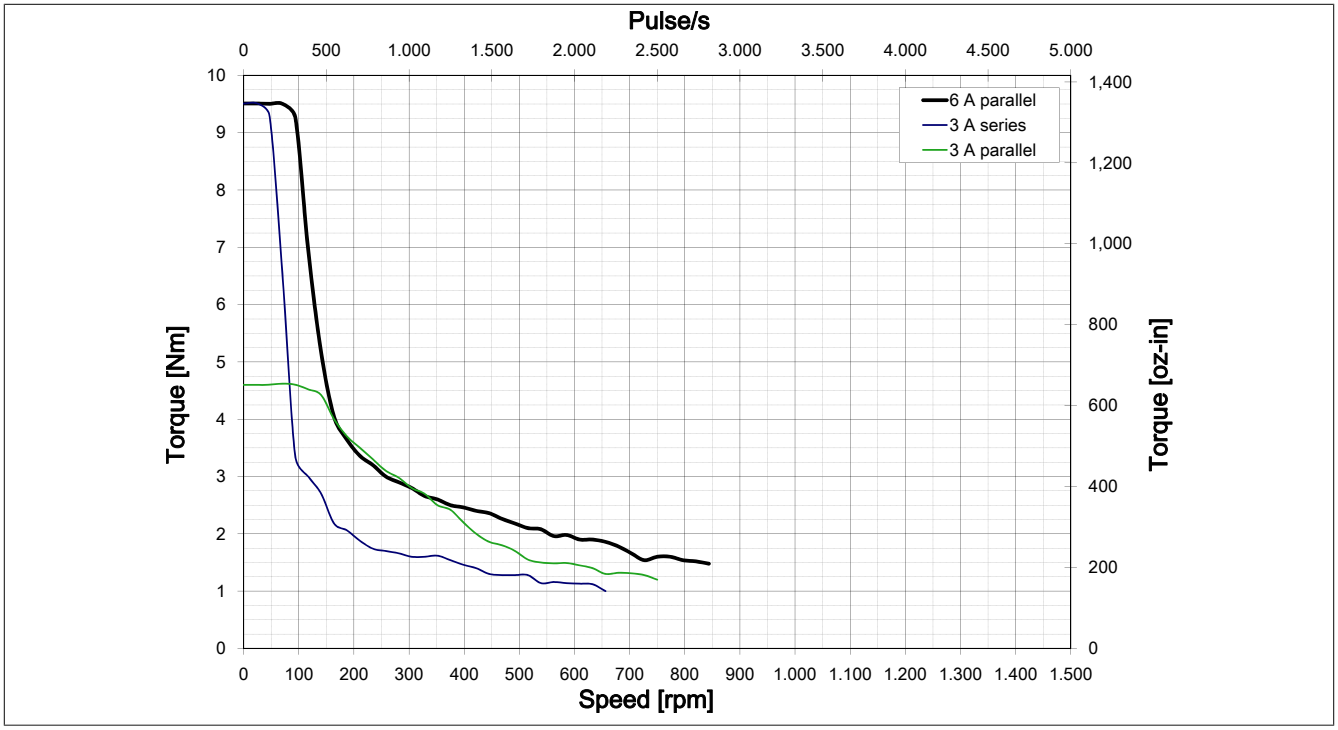
[19)] The torque curve is represented in microsteps.

8.10.3 Selecting the suitable connection type[20)]

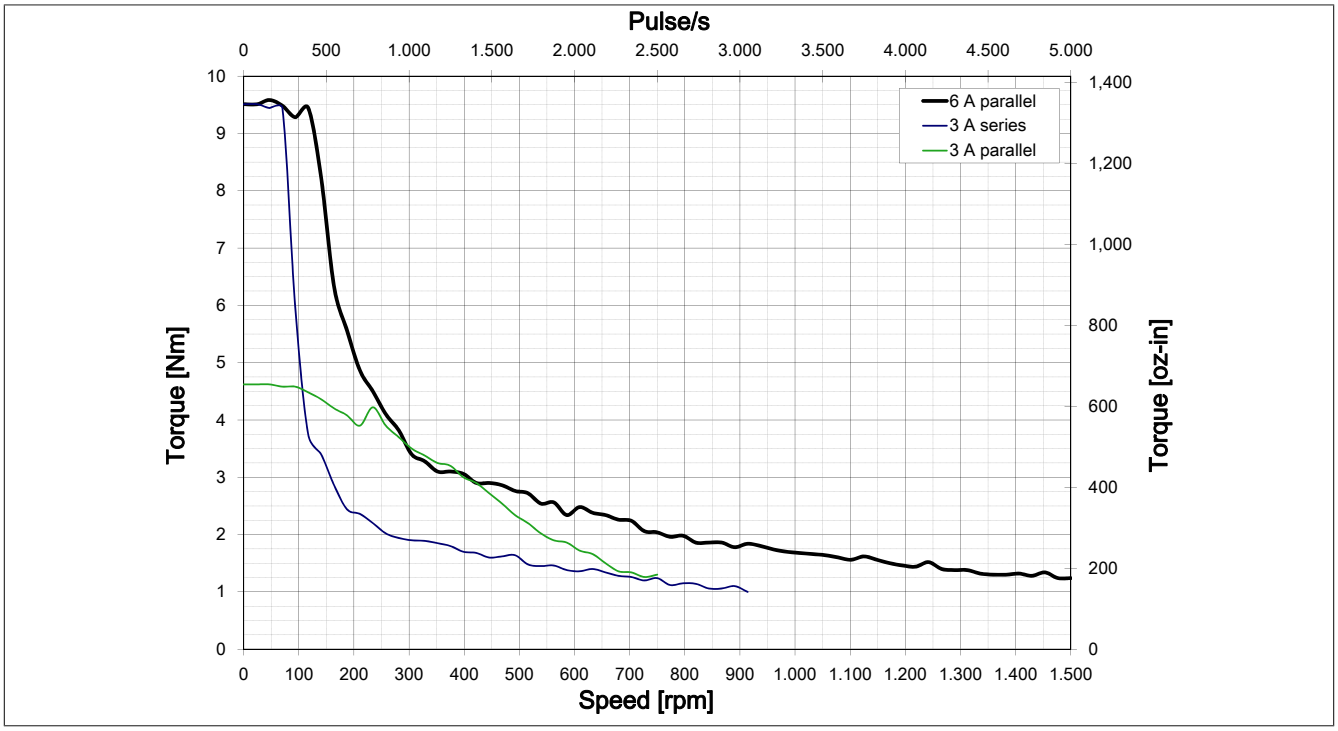
The 8-line design of the motor provides the customer with the option of either parallel or series wiring.

80MPH6.300xxxx-xx / 80MPH6.600xxxx-xx

Comparison: series / parallel wiring at 36 V



Comparison: series / parallel wiring at 48 V



[20)] The torque curve is represented in microsteps.

8.11 80MPH6.101xxxx-xx[21)]

8.11.1 Parallel wiring 10 A

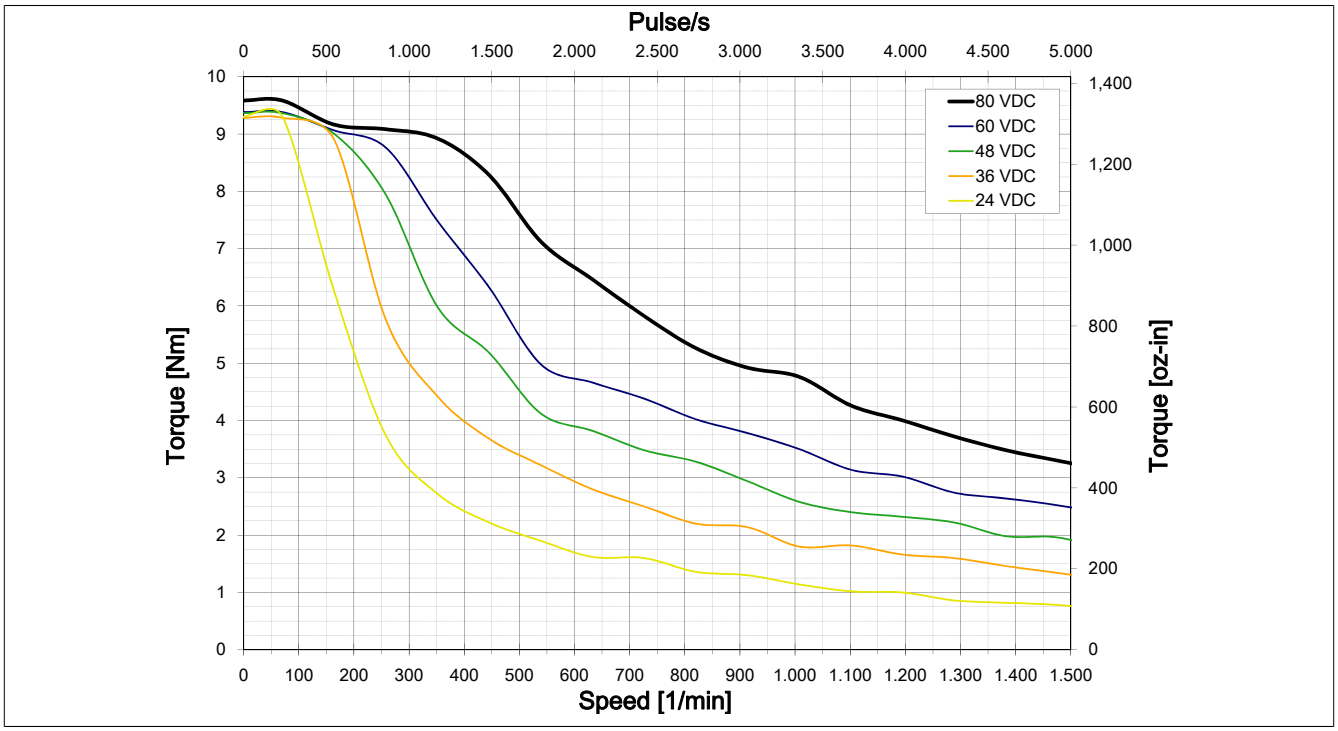


Figure 2: 80MPH6.101S000-01 torque curves, parallel 10 A

[21)] The torque curve is represented in microsteps.

9 Installation

9.1 General information

Caution!

Stepper motors must be mounted on the cooling surface (flange) in order to ensure heat dissipation.

Caution!

Free convection on the motor housing must be guaranteed!

9.1.1 Installing drive elements

Information:

To connect pinion gears, belt disks or similar drive elements, be sure to use suitable clamping sets, pressure sleeves or other fastening elements.

Drive elements must be protected against unintentional removal. Caution!

Caution!

The bearing elements are not to be subjected to shocks or impacts! Incorrect handling will cause the lifespan of the bearings to be reduced or the bearing to be damaged.

9.2 Note: Connecting the motor/encoder cable for IP65 variants

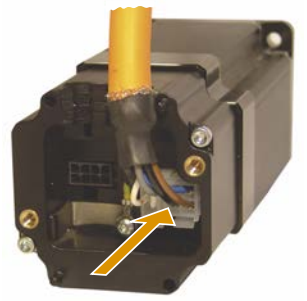
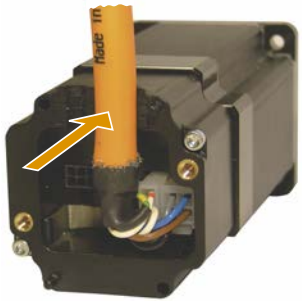
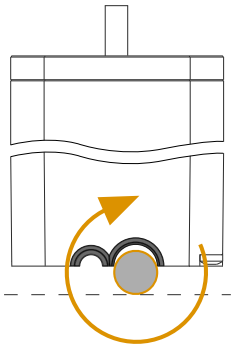
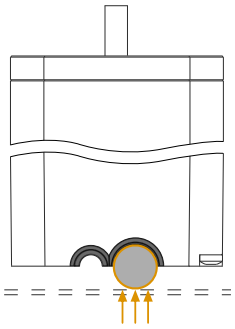
9.2.1 Pre-assembled cables from B&R

Information:

IP65 protection has been tested with pre-assembled cables from B&R only. (see Cables).

9.2.2 Installing the motor cables

The motor cable takes up quite a bit of space. Rotating the cable minimizes the space needed and makes it easier to mount the cover.

Connecting the cables	Rotate cable	Press cable against gasket
		
		

Information:

Failure to follow the installation procedure shown in these images (plug in - rotate - press against gasket) can cause the motor to malfunction.

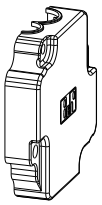
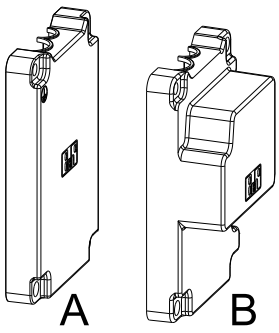
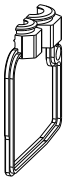
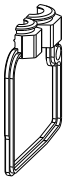
Caution!

The heat shrink tubing must not be inside the gasket!

9.2.3 Mounting the encoder housing cover IP65

Content of delivery

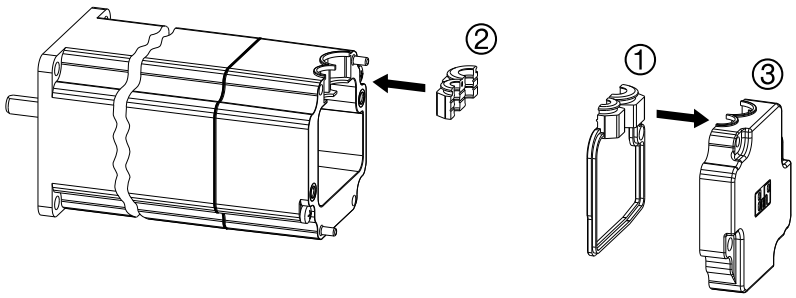
The following covers, gaskets and screws for the encoder housing are packaged separately and delivered along with the motor:

Pos.	Accessory part	Amount	Figure	80MPF Motors	80MPF with brake	80MPH Motors	80MPH with brake
3	Cover for 80MPF motor (flange size 60 mm)	1		•	•		
4	Cover for 80MPH motor (NEMA 34, flange size 87.1 mm) (In very few exceptional cases when the space is critical, cover A can also be installed. Cover B is however the current standard.)	2				•	•
1	Gasket Cable grommets: 8.2 to 8.8 mm / 5.6 to 6.6 mm (motor)	1		•		•	
1	Gasket Cable grommets: 10.4 to 11.2 mm / 5.6 to 6.6 mm (motor+brake)	1			•		•
2	Gasket Cable grommets: 8.2 to 8.8 mm / 5.6 to 6.6 mm (motor)	1		•		•	
2	Gasket Cable grommets: 10.4 to 11.2 mm / 5.6 to 6.6 mm (motor+brake)	1			•		•
5	M4x12 mm screw, galvanized, ISO7045 (tightening torque = 1 Nm)	2		•	•	•	•
6	M3x50 mm screw, galvanized, ISO7045 (tightening torque = 0.5 Nm)	2		•	•		
7	UNC6-32x 1.5" screw, galvanized (tightening torque = 0.7 Nm)	2				•	
7	M3x40 mm screw, galvanized, ISO7045 (tightening torque = 0.7 Nm)	2					•

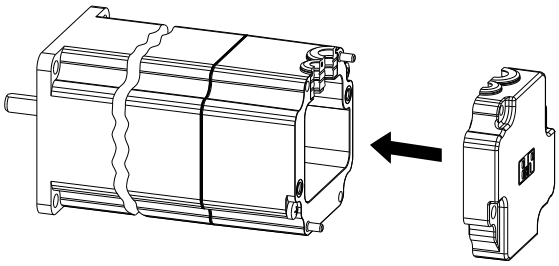
9.2.3.1 80MPF (flange size 60 mm)

The cover, gaskets and screws are installed on an 80MPF motor as follows:

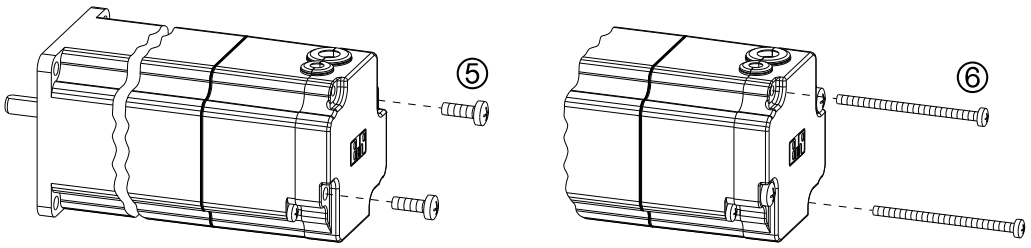
Insert gasket (2) into the motor and press to secure. Insert gasket (1) into the cover (3) and press to secure. Install the cable. Install the motor cable as described on page 87.



Place the cover with gasket on the motor (two pins are used for alignment). Hold the motor cable in the proper position.



Fasten the cover in place using screws 5 and 6 (tightened to the correct tightening torque).



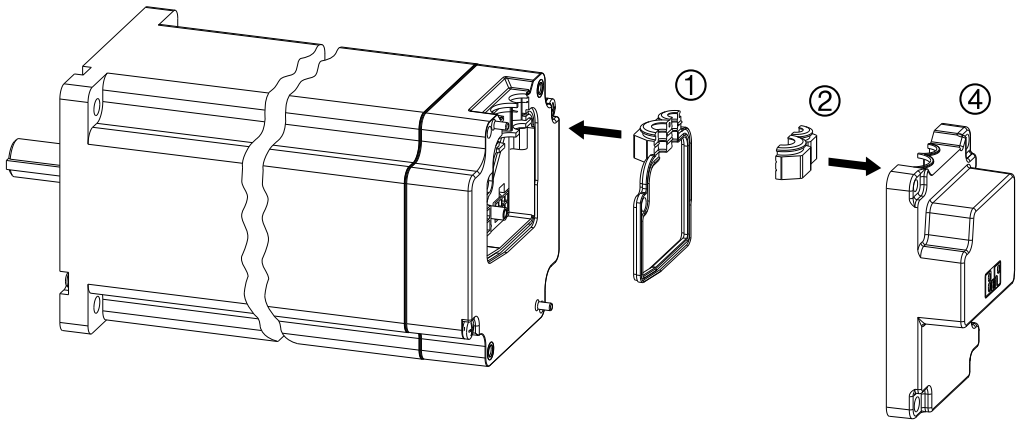
Tightening torque

Pos.	Screws	Tightening torque	Amount	80MPF	80MPF with brake
5	M4x12 mm, galvanized, ISO7045	1 Nm	2	•	•
6	M3x50 mm screw, galvanized, ISO7045	0.5 Nm	2	•	•

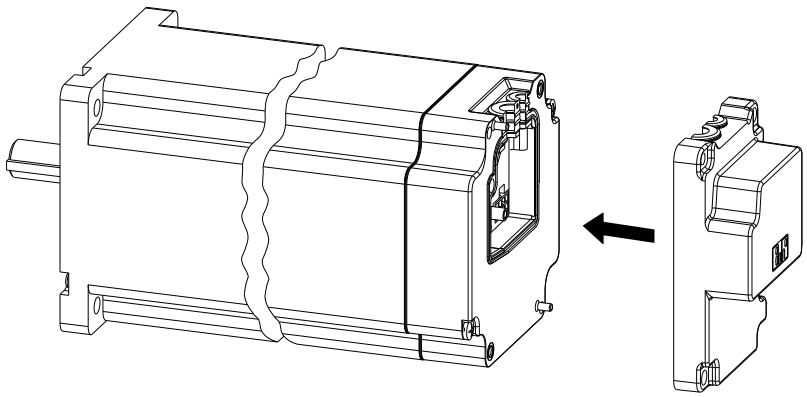
9.2.3.2 80MPH (NEMA 34, flange size 87.1 mm)

The cover, gaskets and screws are installed on an 80MPH motor as follows:

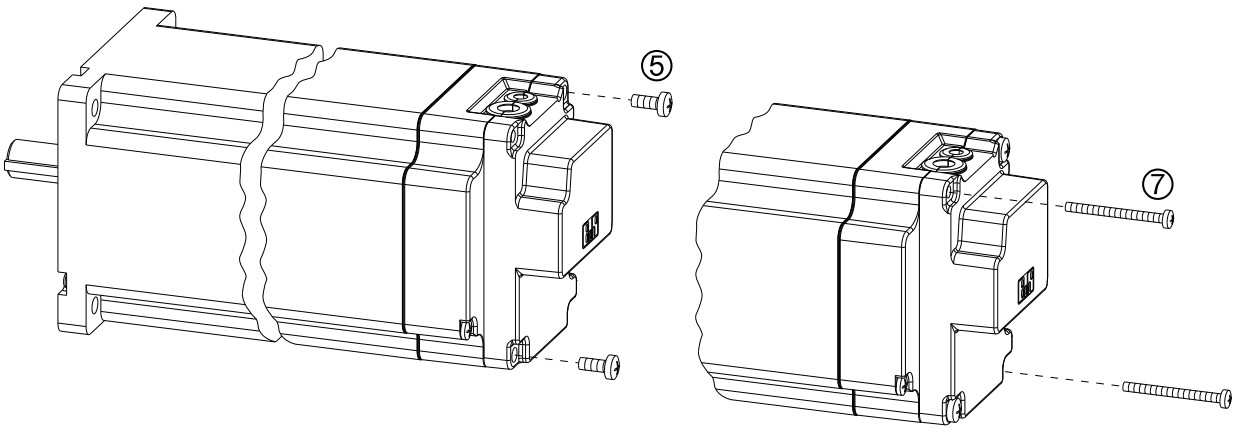
Insert gasket (1) into the motor and press to secure. Insert gasket (2) into the cover (4) and press to secure. Install the cable. Install the motor cable as described on page 87.



Place the cover with gasket on the motor (two pins are used for alignment). Hold the motor cable in the proper position.



Fasten the cover in place using screws 5 and 7 (tightened to the correct tightening torque).

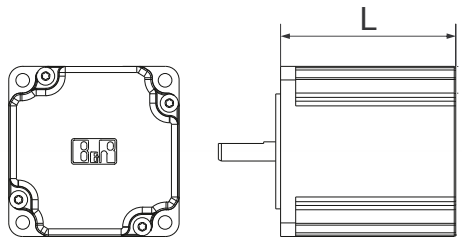
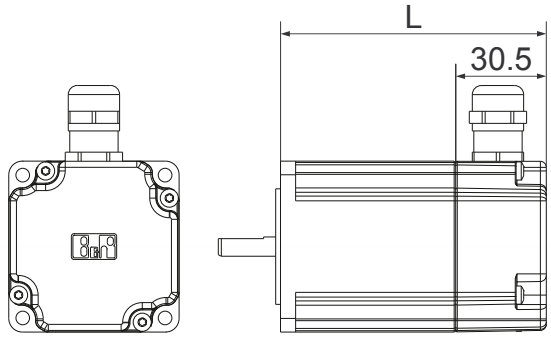
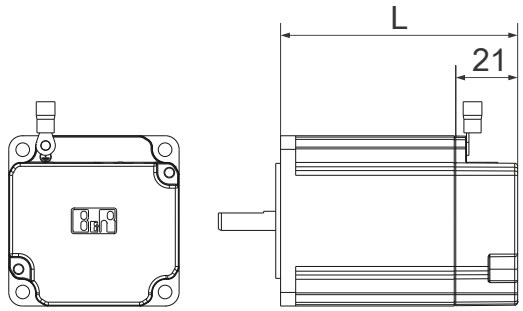


Tightening torque

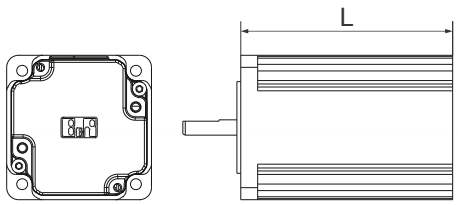
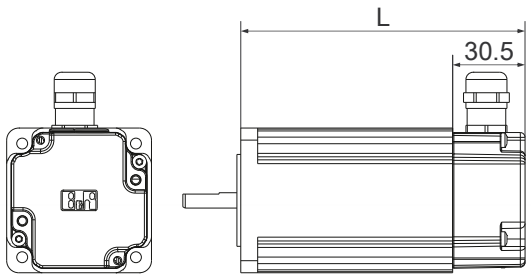
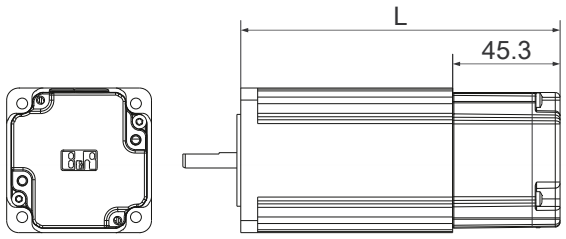
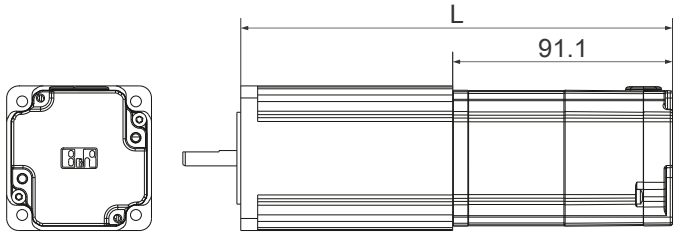
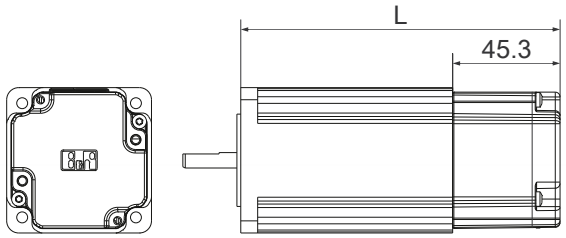
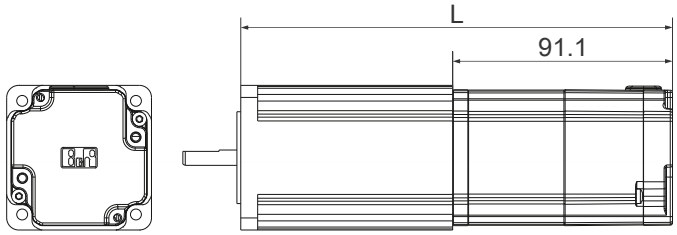
Pos.	Screws	Tightening torque	Amount	80MPH	80MPH with brake
5	M4x12 mm, galvanized, ISO7045	1 Nm	2	•	•
7	UNC6-32x 1.5" screw, galvanized	0.7 Nm	2	•	
7	M3x40 mm screw, galvanized, ISO7045	0.7 Nm	2		•

9.3 Motor-specific mounting data

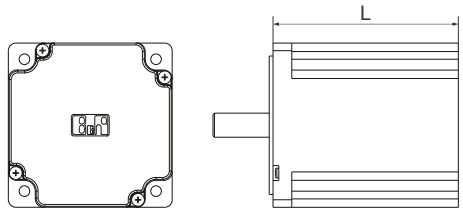
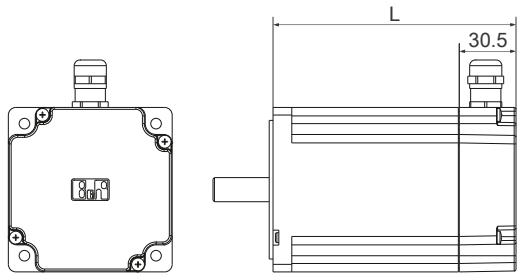
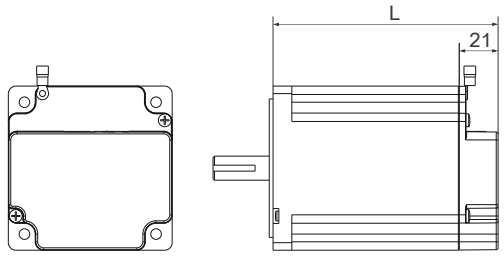
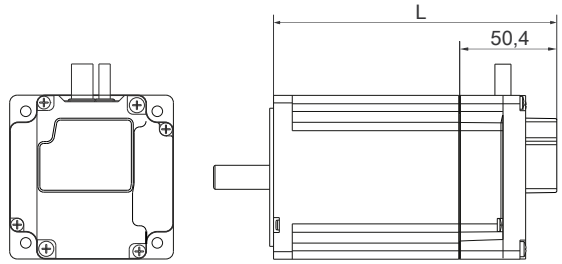
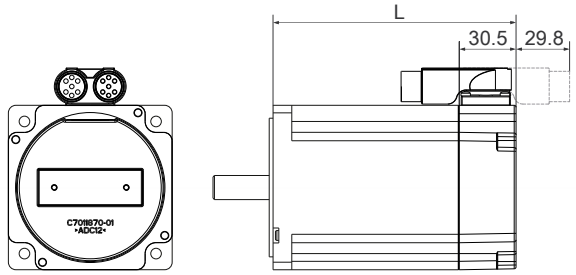
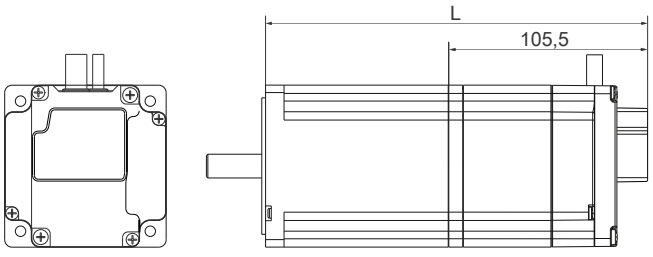
9.3.1 80MPD (NEMA 23, flange size 56.4 mm)

	Length / Weight		
Standard motor	80MPD1	80MPD3	80MPD5
	45.0 mm 0.52 kg	57.5 mm 0.72 kg	80.5 mm 1.11 kg
Standard motor + IP upgrade kit IP40	80MPD1	80MPD3	80MPD5
	75.5 mm 0.65 kg	88.0 mm 0.85 kg	111.0 mm 1.25 kg
Standard motor + IP20 ABR incremental encoder	80MPD1	80MPD3	80MPD5
	66.0 mm 0.55 kg	78.5 mm 0.75 kg	101.5 mm 1.14 kg

9.3.2 80MPF (flange size 60 mm)

	Length / Weight		
Standard motor	80MPF1	80MPF3	80MPF5
	51.8 mm 0.62 kg	62.0 mm 0.88 kg	93.3 mm 1.40 kg
Standard motor + IP upgrade kit IP65	80MPF1	80MPF3	80MPF5
	82.3 mm 0.75 kg	92.5 mm 1.00 kg	123.8 mm 1.55 kg
Standard motor + IP20 ABR incremental encoder	80MPF1	80MPF3	80MPF5
	97.1 mm 0.75 kg	107.3 mm 1.00 kg	138.6 mm 1.50 kg
Standard motor + ABR incremental encoder + brake IP65	80MPF1	80MPF3	80MPF5
	142.9 mm 1.02 kg	153.1 mm 1.28 kg	184.4 mm 1.80 kg
Standard motor + SSI encoder IP65	80MPF1	80MPF3	80MPF5
	-	-	138.6 mm 1.50 kg
Basic motor + SSI encoder + brake IP65	80MPF1	80MPF3	80MPF5
	-	-	184.4 mm 1.80 kg

9.3.3 80MPH (NEMA 34, flange size 87.1 mm)

	Length / Weight			
Standard motor	80MPH1	80MPH3	80MPH4	80MPH6
	66.0 mm 1.80 kg	98.0 mm 3.00 kg	98.0 mm 3.00 kg	130.0 mm 4.20 kg
Standard motor + IP upgrade kit IP65	80MPH1	80MPH3	80MPH4	80MPH6
	96.5 mm 2.10 kg	128.5 mm 3.30 kg	128.5 mm 3.30 kg	160.5 mm 4.50 kg
Standard motor + IP20 ABR incremental encoder	80MPH1	80MPH3	80MPH4	80MPH6
	87.0 mm 1.90 kg	119.0 mm 3.10 kg	119.0 mm 3.10 kg	151.0 mm 4.30 kg
Standard motor + ABR incremental encoder IP65	80MPH1	80MPH3	80MPH4	80MPH6
	116.4 mm 1.90 kg	148.4 mm 3.10 kg	148.4 mm 3.10 kg	180.4 mm 4.30 kg
Standard motor + Hiperface encoder IP65	80MPH1	80MPH3	80MPH4	80MPH6
	-	-	128.5 mm 3.40 kg	-
Standard motor + ABR incremental encoder + brake IP65	80MPH1	80MPH3	80MPH4	80MPH6
	171.5 mm 2.50 kg	203.5 mm 3.70 kg	203.5 mm 3.70 kg	235.5 mm 4.90 kg

10 Accessories

10.1 Overview

Model number	Short description	Page
IP expansions		
80XMPDXRE.W1-10	IP upgrade kit with cable clamp for stepper motors from the 80MPD and 80MPF series, IP40 for 80MPD motors and IP65 for 80MPF motors, 10 units per package	94
80XMPHXRE.W1-10	IP upgrade kit with cable clamp for stepper motors from the 80MPH series, IP65, 10 units per package	94
Motor/Encoder cables		
80CMxx001.21-01	Motor cable, 5x 0.75 mm², 4-pin Molex connector on the motor side, can be used in cable drag chains, UL/CSA listed	98
80CMxx001.26-01	Motor cable with M12 connector, 5x 0.34 mm², 4-pin Molex connector on the motor side	100
80CMxx001.61-01	HIPERFACE motor cable, 5x 0.75 mm², 8-pin female springtec connector on the motor side, wire tip sleeves on the drive side, can be used in cable drag chains, UL/CSA listed	102
80CMxx002.21-01	Motor cable, 5x 0.75 mm², 2x 0.5mm², 4-pin Molex connector on the motor side, 2-pin Molex connector for brake, can be used in cable drag chains, UL/CSA listed	104
80CMxx003.25-01	Incremental encoder cable, 4x 0.14 mm², 2x 0.35 mm², 8-pin Molex connector on the motor side, 9-pin DSUB connector on the drive side, can be used in cable drag chains, UL listed	106
80CMxx003.26-01	Incremental encoder cable with M12 connector, 5x 0.34 mm², 8-pin Molex connector on the motor side	108
80CMxx004.25-01	Incremental encoder cable, 4x 0.14 mm², 4x 0.34 mm², 8-pin Molex connector on the motor side, 9-pin DSUB connector on the drive side, can be used in cable drag chains, UL listed	110
80CMxx005.65-01	HIPERFACE encoder cable, 5x 2x 0.14 mm², 2x 0.5 mm², 12-pin female springtec connector on the motor side, 9-pin DSUB connector on the drive side, can be used in cable drag chains, UL listed	112
80CMxx013.21-01	Hybrid cable, 4x 0.5 ,mm², 2x 0.35 mm², 3x 0.14 mm², Molex connector on the motor side, wire tip sleeves on the drive side	114
Accessory sets for motors		
80XMPXAC0.00-01	Accessory set for motors with an encoder, 8-pin and 4-pin connector and crimp contact	117
80XMPXAC0.00-02	Accessory set for motors with encoder and brake, 8-pin, 4-pin and 2-pin connector and crimp contact	117
80XMPXAC1.00-10	Accessory set for motors with IP65 option Gaskets for IP65 stepper motors for use with 80CMxxxxx.26-01 cables, 10 units per package	101

Table 19: Accessories - Overview

10.2 IP expansion

Model number	Short description
80XMPDXRE.W1-10 (10 pcs. per package)	IP40 cover and cable clamp for 80MPD-series stepper motors
	IP65 cover and cable clamp for 80MPF-series stepper motors
80XMPHXRE.W1-10 (10 pcs. per package)	IP65 cover and cable clamp for 80MPH-series stepper motors

	Content of delivery per unit
	1x IP cover with adhesive gasket
	1x cable guide M16 x 1.5 mm
	1x cable lug
	1x terminal strip
	3x screws M3 x 8 mm
	4x screws M3 x 25 mm

80XMPDXRE.W1-10
80MPD / 80MPF

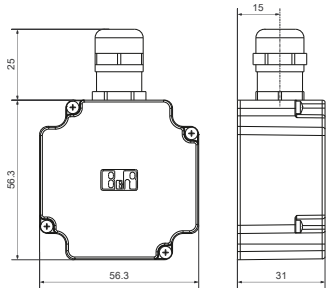
80XMPHXRE.W1-10
80MPH

10.2.1 Technical data

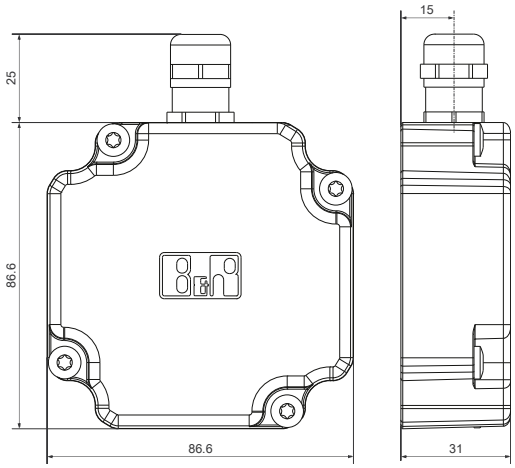
Model number	80XMPDXRE.W1-10		80XMPHXRE.W1-10
General information			
Standard motor	80MPD	80MPF	80MPH
Protection[1)]	IP40	IP65	IP65
Fastening torque of the mounting screws	1 Nm	1 Nm	1 Nm

1) Except front-side fastening flange and motor shaft

10.2.2 Dimensions

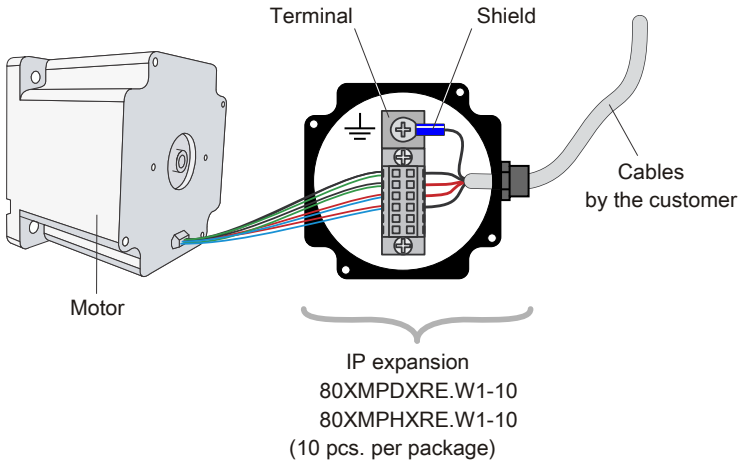


IP upgrade kit for stepper motors
80MPD (NEMA 23, flange size 56.4 mm) and 80MPF (flange size 60 mm)



IP upgrade kit for stepper motors
80MPH (NEMA 34, flange size 87.1 mm)

10.2.3 Connection



10.3 Cables

10.3.1 Order data

Length	MOTOR CABLE			
	Standard motor cables	Motor cables with male M12 connector	HIPERFACE motor cable	Motor cable (incl. brake lines)
	80CMxx001.21-01 Page 98	80CMxx001.26-01 Page 100	80CMxx001.61-01 Page 102	80CMxx002.21-01 Page 104
				
1 m	80CM**01**001.21-01	-	80CM**01**001.61-01	80CM**01**002.21-01
2 m	80CM**02**001.21-01	80CM**02**001.26-01	80CM**02**001.61-01	80CM**02**002.21-01
3 m	80CM**03**001.21-01	80CM**03**001.26-01	80CM**03**001.61-01	80CM**03**002.21-01
5 m	80CM**05**001.21-01	80CM**05**001.26-01	80CM**05**001.61-01	80CM**05**002.21-01
10 m	80CM**10**001.21-01	80CM**10**001.26-01	80CM**10**001.61-01	80CM**10**002.21-01
15 m	80CM**15**001.21-01	-	80CM**15**001.61-01	80CM**15**002.21-01
20 m	80CM**20**001.21-01	-	80CM**20**001.61-01	80CM**20**002.21-01
25 m	80CM**25**001.21-01	-	-	-

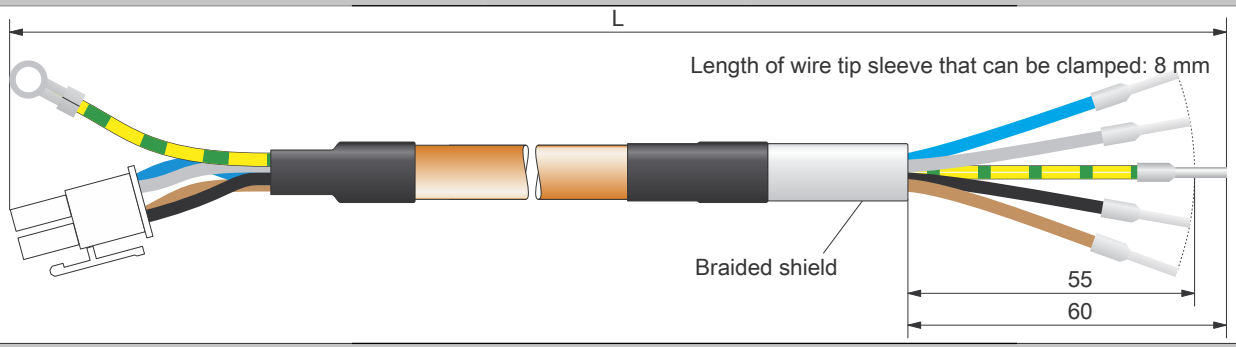
Length	EENCODER CABLE			
	ABR incremental encoder cable	ABR incremental encoder cable M12	SSI encoder cable	HIPERFACE encoder cable
	80CMxx003.25-01 Page 106	80CMxx003.26-01 Page 108	80CMxx004.25-01 Page 110	80CMxx005.65-01 Page 112
				
1 m	80CM**01**003.25-01	-	80CM**01**004.25-01	80CM**01**005.65-01
2 m	80CM**02**003.25-01	80CM**02**003.26-01	80CM**02**004.25-01	80CM**02**005.65-01
3 m	80CM**03**003.25-01	80CM**03**003.26-01	80CM**03**004.25-01	80CM**03**005.65-01
5 m	80CM**05**003.25-01	80CM**05**003.26-01	80CM**05**004.25-01	80CM**05**005.65-01
10 m	80CM**10**003.25-01	80CM**10**003.26-01	80CM**10**004.25-01	80CM**10**005.65-01
15 m	80CM**15**003.25-01	-	80CM**15**004.25-01	80CM**15**005.65-01
20 m	80CM**20**003.25-01	-	80CM**20**004.25-01	80CM**20**005.65-01
25 m	80CM**25**003.25-01	-	-	-

Length	HYBRID CABLE
	80CMxx013.21-01 Page 114
	
1 m	80CM**01**013.21-01
2 m	80CM**02**013.21-01
3 m	80CM**03**013.21-01
5 m	80CM**05**013.21-01
10 m	80CM**10**013.21-01

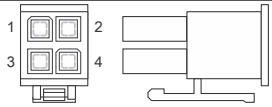
10.3.2 80CMxx001.21-01 - Motor cables

Pinout

Dimensions

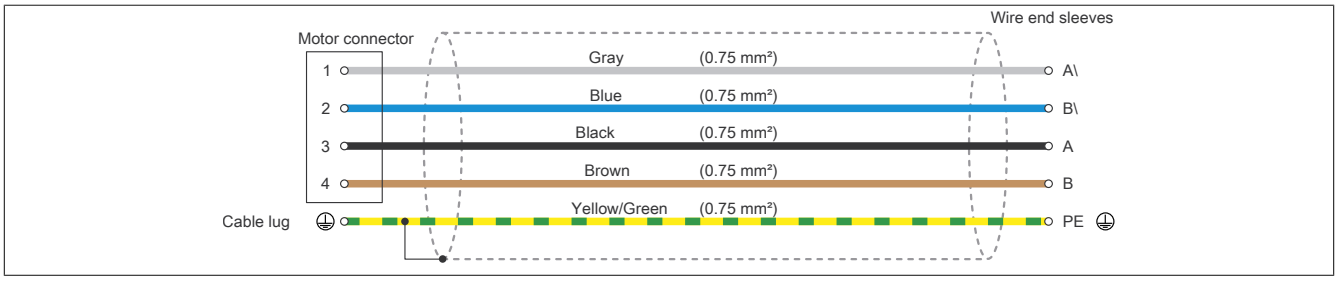


Pinout

4-pin terminal block	Pin	Name	Wire colors	Open
	1	A\	Gray	For custom wiring Connection to drive system
	2	B\	Blue	
	3	A	Black	
	4	B	Brown	
Cable lug	**Pin**	**Name**	**Wire colors**	
	-	PE wire / Shield	Yellow/Green	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**001.21-01	1
80CM**02**001.21-01	2
80CM**03**001.21-01	3
80CM**05**001.21-01	5
80CM**10**001.21-01	10
80CM**15**001.21-01	15
80CM**20**001.21-01	20
80CM**25**001.21-01	25

Cable diagram



10.3.2.1 Technical data

Product ID	80CM01001.21-01	80CM02001.21-01	80CM03001.21-01	80CM05001.21-01	80CM10001.21-01	80CM15001.21-01	80CM20001.21-01	80CM25001.21-01
General information								
Cable cross section	5x 0.75 mm²							
Durability	Oil resistance according to VDE 0472 part 803 as well as standard hydraulic oil							
Listed	UL AWM Style 20234, 80°C, 1000 V, E63216 and CSA AWM I/II A/B, 90°C, 1000 V, FT2 LL46064							
Certification								
cULus	Yes							
Cable construction								
Power lines								
Quantity	5							
Wire insulation	Special thermoplastic material							
Wire colors	Black, brown, blue, green, yellow/green							
Design	Tinned copper stranded wire							
Diameter	0.75 mm²							
Stranding	No							
Cable stranding	With filler elements and foil banding							
Complete shielding	Tinned copper braiding, optical coverage >85% and wrapped in isolating film							
Outer sheathing								
Material	PUR							
Color	Orange, similar to RAL 2003 flat							
Labeling	BERNECKER + RAINER 5x 0.75 FLEX UL AWM STYLE 20234 80°C 1000 V E63216 CSA AWM I/II A/B 90°C 1000 V FT2 LL46064							
Electrical characteristics								
Test voltage								
Wire/Wire	3 kV							
Wire/Shield	3 kV							
Conductor resistance								
Power lines	≤29 Ω/km							
Insulation resistance	>200 MΩ/km							
Max. current load in accordance with IEC 60364-5-523 by installation type								
Wall mounting	13 A							
Installed in conduit or cable duct	11.5 A							
Installed in cable tray	13.5 A							
Environmental conditions								
Temperature								
Moving	-10 to 70°C							
Static	-20 to 90°C							
Mechanical characteristics								
Dimensions								
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m	25 m
Diameter	8.5 mm ±0.3 mm							
Flex radius								
Single bend	>34 mm							
Moving	≥85 mm							
Drag chain data								
Acceleration	<60 m/s²							
Flex cycles [1]	≥3,000,000							
Speed	≤4 m/s							
Weight	0.128 kg/m							

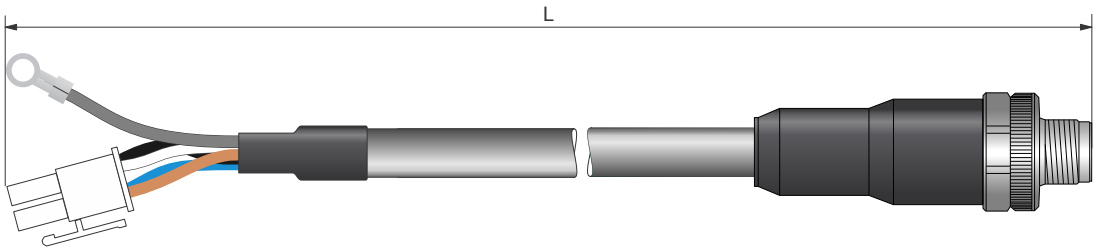
Table 20: 80CM01001.21-01, 80CM02001.21-01, 80CM03001.21-01, 80CM05001.21-01, 80CM10001.21-01, 80CM15001.21-01, 80CM20001.21-01, 80CM25001.21-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 125 mm.

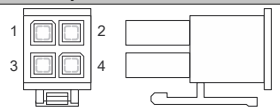
10.3.3 80CMxx001.26-01 Motor cables with M12 plug

Pinout

Dimensions

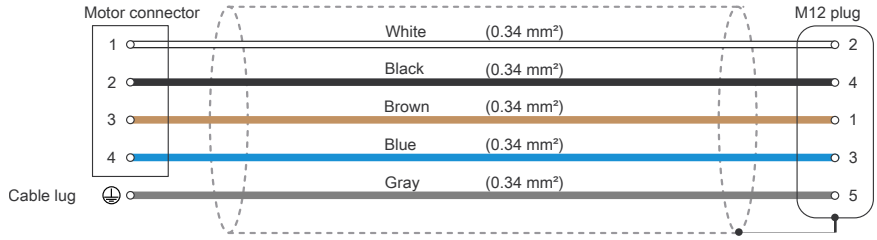


Pinout

4-pin terminal block	Pin	Name	Pin	M12 circular connector
	1	A\	2	
	2	B\	4	
	3	A	1	
	4	B	3	
Cable lug	**Pin**	**Name**	**Pin**	
	-	PE wire / Shield	5	

Cable lengths (L)	
Model number	**Length [m]**
80CM**02**001.26-01	2
80CM**05**001.26-01	5
80CM**10**001.26-01	10

Cable diagram



10.3.3.1 Technical data

Product ID	80CM02001.26-01	80CM03001.26-01	80CM05001.26-01	80CM10001.26-01
General information				
Cable cross section	5x 0.34 mm²			
Certification				
cULus	Yes			
Cable construction				
Power lines				
Quantity	5			
Wire insulation	PVC			
Wire colors	Black, brown, blue, green, white			
Diameter	0.34 mm²			
Shield	Yes			
Stranding	Yes			
Cable stranding	With filler elements and foil banding			
Complete shielding	Tinned Cu mesh, optical coverage >85% and wrapped in isolating film			
Outer sheathing				
Material	PUR/PVC			
Electrical characteristics				
Nominal current	Max. 4 A / contact			
Connection voltage	Max. 60 V AC/DC		-	Max. 60 V AC/DC
Environmental conditions				
Temperature				
Moving	-10 to 70°C			
Static	-20 to 90°C			
Mechanical characteristics				
Dimensions				
Length	2 m	3 m	5 m	10 m
Diameter	6.4 mm ±0.2 mm			
Bend radius	≥10x outer diameter			

Table 21: 80CM02001.26-01, 80CM03001.26-01, 80CM05001.26-01, 80CM10001.26-01 - Technical data

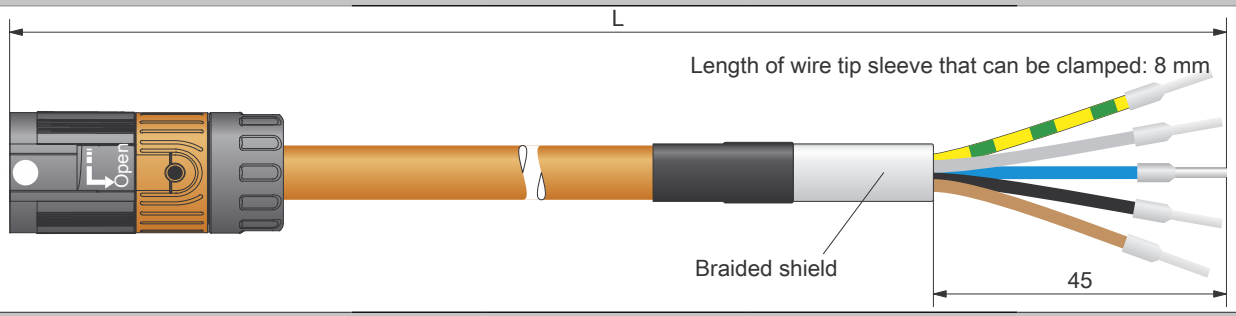
When using motors with IP65 protection, an adapted gasket is required that can be ordered in an accessory set.

Accessory set for motors with IP65 option	Model number
Gaskets for IP65 stepper motors for use with 80CMxxxxx.26-01 cables Cable grommets 5.6 to 6.6 / 5.6 to 6.6 mm	80XMPXAC1.00-10 (10 pcs. per package)

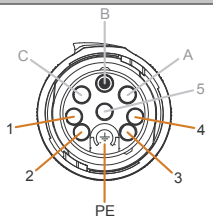
10.3.4 80CMxx001.61-01 - HIPERFACE motor cables

Pinout

Dimensions

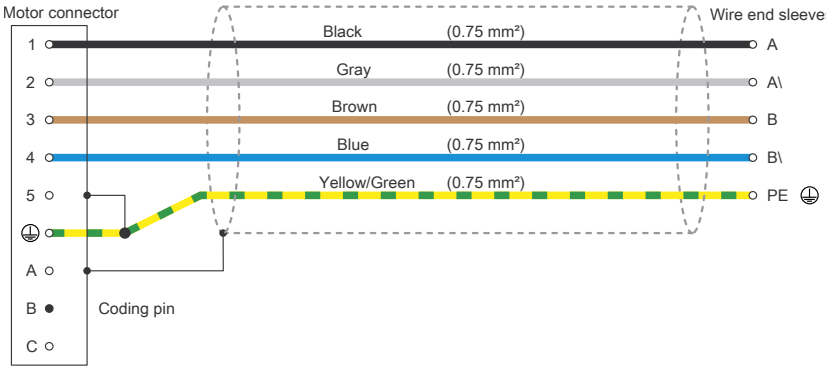


Pinout

9-pin circularfemale connector	Pin	Name	Wire colors	Open
	1	A	Black	For custom wiring Connection to drive system
	2	A\	Gray	
	3	B	Brown	
	4	B\	Blue	
	5	NC	-	
	A	NC	-	
	B	Used for coding purposes and to prevent improper connections.		
	C	NC	-	
	PE	PE wire / Shield	Yellow/Green	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**001.61-01	1
80CM**02**001.61-01	2
80CM**03**001.61-01	3
80CM**05**001.61-01	5
80CM**10**001.61-01	10
80CM**15**001.61-01	15
80CM**20**001.61-01	20

Cable diagram



10.3.4.1 Technical data

Product ID	80CM01001.61-01	80CM02001.61-01	80CM03001.61-01	80CM05001.61-01	80CM10001.61-01	80CM15001.61-01	80CM20001.61-01
General information							
Cable cross section	5x 0.75 mm²						
Durability	Oil resistance according to VDE 0472 part 803 as well as standard hydraulic oil						
Listed	UL AWM Style 20234, 80°C, 1000 V, E63216 and CSA AWM I/II A/B, 90°C, 1000 V, FT2 LL46064						
Certification							
cULus	Yes						
Cable construction							
Power lines							
Quantity	5						
Wire insulation	Special thermoplastic material						
Wire colors	Black, brown, blue, green, yellow/green						
Design	Tinned copper stranded wire						
Diameter	0.75 mm²						
Shield	No						
Stranding	No						
Cable stranding	With filler elements and foil banding						
Complete shielding	Tinned copper braiding, optical coverage >85% and wrapped in isolating film						
Outer sheathing							
Material	PUR						
Color	Orange, similar to RAL 2003 flat						
Labeling	BERNECKER + RAINER 5x 0.75 FLEX UL AWM STYLE 20234 80°C 1000 V E63216 CSA AWM I/II A/B 90°C 1000 V FT2 LL46064						
Electrical characteristics							
Test voltage							
Wire/Wire	3 kV						
Wire/Shield	3 kV						
Conductor resistance							
Power lines	≤29 Ω/km						
Insulation resistance	>200 MΩ/km						
Max. current load in accordance with IEC 60364-5-523 by installation type							
Wall mounting	13 A						
Installed in conduit or cable duct	11.5 A						
Installed in cable tray	13.5 A						
Environmental conditions							
Temperature							
Moving	-10 to 70°C						
Static	-20 to 90°C						
Mechanical characteristics							
Dimensions							
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m
Diameter	8.5 mm ±0.3 mm						
Flex radius							
Single bend	>34 mm						
Moving	≥85 mm						
Drag chain data							
Acceleration	<60 m/s²						
Flex cycles [1]	≥3,000,000						
Speed	≤4 m/s						
Weight	0.128 kg/m						

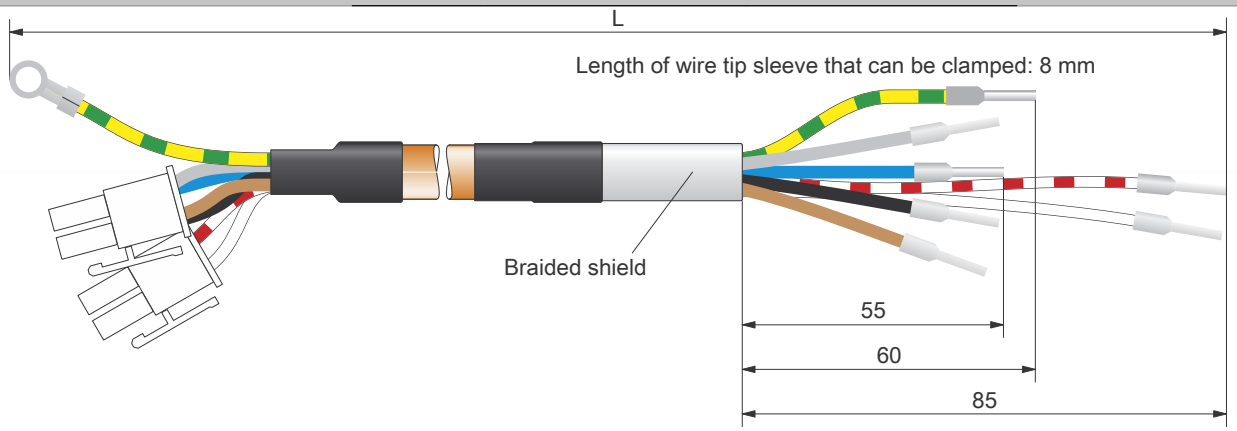
Table 22: 80CM01001.61-01, 80CM02001.61-01, 80CM03001.61-01, 80CM05001.61-01, 80CM10001.61-01, 80CM15001.61-01, 80CM20001.61-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 125 mm.

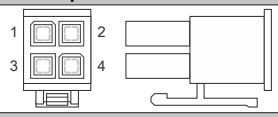
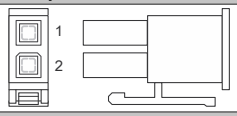
10.3.5 80CMxx002.21-01 - Motor cables (incl. brake lines)

Pinout

Dimensions

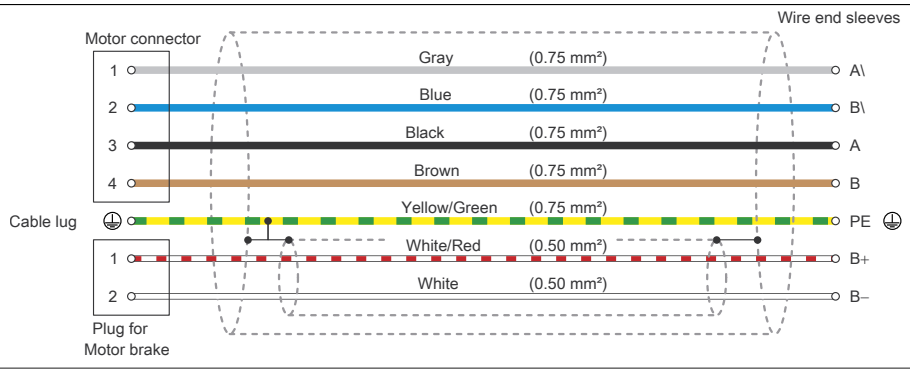


Pinout

4-pin terminal block	Pin	Name	Wire colors	Open
	1	A\	Gray	For custom wiring Connection to drive system
	2	B\	Blue	
	3	A	Black	
	4	B	Brown	
2-pin terminal block	**Pin**	**Name**	**Wire colors**	
	1	24 VDC brake	White / red	
	2	GND	White	
Cable lug	**Pin**	**Name**	**Wire colors**	
	-	PE wire / Shield	Yellow/Green	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**002.21-01	1
80CM**02**002.21-01	2
80CM**03**002.21-01	3
80CM**05**002.21-01	5
80CM**10**002.21-01	10
80CM**15**002.21-01	15
80CM**20**002.21-01	20

Cable diagram



10.3.5.1 Technical data

Product ID	80CM01002.21-01	80CM02002.21-01	80CM03002.21-01	80CM05002.21-01	80CM10002.21-01	80CM15002.21-01	80CM20002.21-01
General information							
Cable cross section	5x 0.75 mm² + 1x 2x 0.5 mm²						
Durability	Oil resistance according to VDE 0472 part 803 as well as standard hydraulic oil						
Listed	UL AWM Style 20234, 80°C, 1000 V, E63216 and CSA AWM I/II A/B, 90°C, 1000 V, FT2 LL46064						
Certification							
cULus	Yes						
Cable construction							
Power lines							
Quantity	5						
Wire insulation	Special thermoplastic material						
Wire colors	Black, brown, blue, green, yellow/green						
Design	Tinned copper stranded wire						
Diameter	0.75 mm²						
Shield	-	No					
Stranding	No						
Signal lines							
Quantity	2						
Wire insulation	Special thermoplastic material						
Wire colors	White, white/red						
Design	Tinned copper stranded wire						
Diameter	0.5 mm²						
Shield	Separate shielding for pairs, tinned copper braiding, optical coverage >85% and foil banding						
Stranding	White with white/red						
Cable stranding	With filler elements and foil banding						
Complete shielding	Tinned copper braiding, optical coverage >85% and wrapped in isolating film						
Outer sheathing							
Material	PUR						
Color	Orange, similar to RAL 2003 flat						
Labeling	BERNECKER + RAINER 5x0,75+1x2x0,5 FLEX UL AWM STYLE 20234 80°C 1000 V E63216 CSA AWM I/II A/B 90°C 1000 V FT2 LL46064						
Electrical characteristics							
Test voltage							
Wire/Wire	3 kV						
Wire/Shield	3 kV						
Conductor resistance							
Power lines	≤29 Ω/km						
Signal lines	≤39 Ω/km						
Insulation resistance	>200 MΩ/km						
Max. current load in accordance with IEC 60364-5-523 by installation type							
Wall mounting	13 A						
Installed in conduit or cable duct	11.5 A						
Installed in cable tray	13.5 A						
Environmental conditions							
Temperature							
Moving	-10 to 70°C						
Static	-20 to 90°C						
Mechanical characteristics							
Dimensions							
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m
Diameter	10.8 mm ±0.4 mm						
Flex radius							
Single bend	>34 mm						
Moving	≥85 mm						
Drag chain data							
Acceleration	<60 m/s²						
Flex cycles [1]	≥3,000,000						
Speed	≤4 m/s						
Weight	0.26 kg/m						

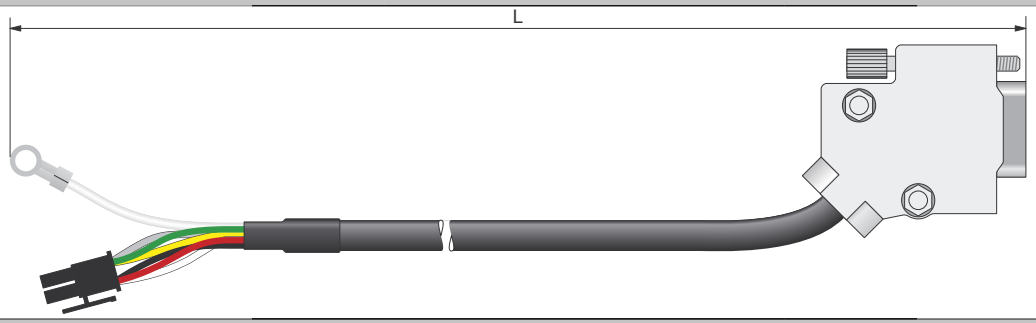
Table 23: 80CM01002.21-01, 80CM02002.21-01, 80CM03002.21-01, 80CM05002.21-01, 80CM10002.21-01, 80CM15002.21-01, 80CM20002.21-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 125 mm.

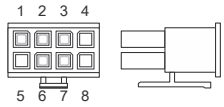
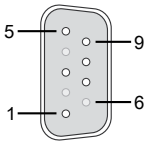
10.3.6 80CMxx003.25-01 - ABR incremental encoder cables

Pinout

Dimensions

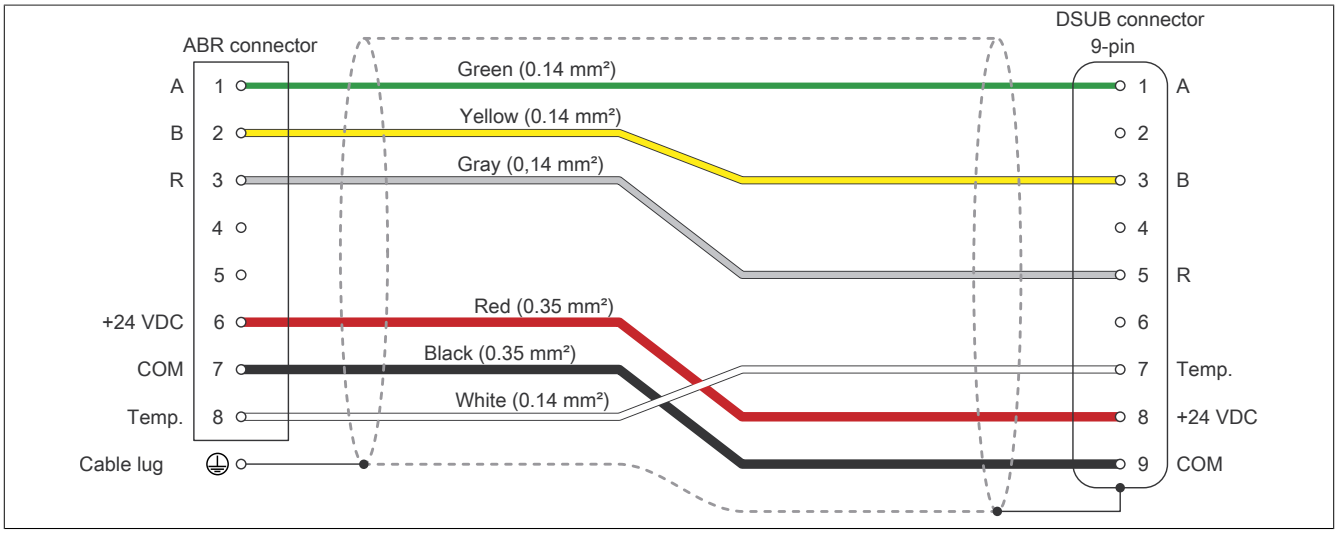


Pinout

8-pin terminal block	Pin	Name		Pin	DSUB male 9-pin connector (6 pins used)
	1	A	A	1	
	2	B	B	3	
	3	R	R	5	
	4	-	NC		
	5	-	NC		
	6	+24 VDC	Encoder supply +24 V	8	
	7	COM	Encoder supply 0 V	9	
	8	Temp	Temperature	7	
	Wire colors / wiring, see cable diagram.				
Cable lug	**Pin**	**Name**		**Pin**	
	-	PE wire / Shield		-	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**003.25-01	1
80CM**02**003.25-01	2
80CM**03**003.25-01	3
80CM**05**003.25-01	5
80CM**10**003.25-01	10
80CM**15**003.25-01	15
80CM**20**003.25-01	20
80CM**25**003.25-01	25

Cable diagram



10.3.6.1 Technical data

Product ID	80CM01003.25-01	80CM02003.25-01	80CM03003.25-01	80CM05003.25-01	80CM10003.25-01	80CM15003.25-01	80CM20003.25-01	80CM25003.25-01
General information								
Cable cross section	4x 0.14 mm² + 2x 0.35 mm²							4 x 0.14 mm² + 2 x 0.35 mm²
Durability	Oil resistance according to VDE 0472 part 803 as well as standard hydraulic oil							
Listed	UL AWM Style 20963, 80°C, 30 V, E63216							
Certification								
cULus	Yes							
Cable construction								
Supply lines								
Quantity	2							
Wire insulation	Special thermoplastic material							
Wire colors	Red, black							
Design	Tinned copper stranded wire							
Diameter	0.35 mm²							
Shield	No							
Stranding	No							
Signal lines								
Quantity	4							
Wire insulation	Special thermoplastic material							
Wire colors	Gray, yellow, green, white							
Design	Tinned copper stranded wire							
Shield	No							
Stranding	All 4 wires together							
Cable stranding	With foil shield							
Complete shielding	Copper braiding, optical coverage ≥85% and wrapped in isolating film							Copper braiding, optical coverage ≥85% and wrapped in foil shield
Outer sheathing								
Material	PUR							
Color	RAL 6018							
Labeling	BERNECKER + RAINER 4x0,14+2x0,35 FLEX UL AWM STYLE 20963 80°C 30 V E63216							
Electrical characteristics								
Test voltage								
Wire/Wire	1.5 kV							
Wire/Shield	0.8 kV							
Conductor resistance								
0.14 mm²	≤134 Ω/km							
0.34 mm²	>55 Ω/km							
Insulation resistance	>200 MΩ/km							
Environmental conditions								
Temperature								
Moving	-10 to 50°C							
Static	-20 to 80°C							
Mechanical characteristics								
Dimensions								
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m	25 m
Diameter	5.8 mm ±0.2 mm							
Flex radius								
Single bend	≥20 mm							
Moving	≥50 mm							
Drag chain data								
Acceleration	<60 m/s²							
Flex cycles [1]	≥3,000,000							
Speed	≤4 m/s							
Weight	0.045 kg/m							

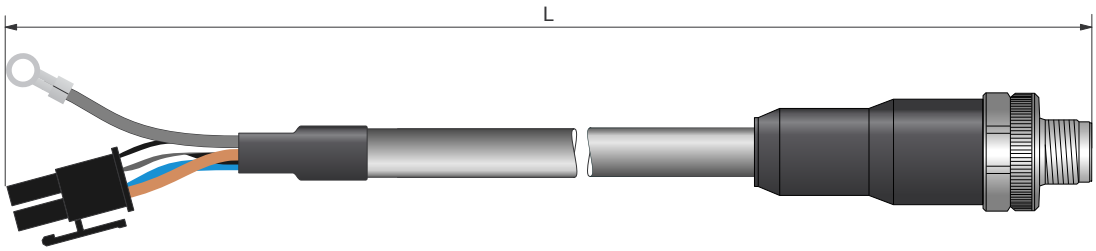
Table 24: 80CM01003.25-01, 80CM02003.25-01, 80CM03003.25-01, 80CM05003.25-01, 80CM10003.25-01, 80CM15003.25-01, 80CM20003.25-01, 80CM25003.25-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 65 mm.

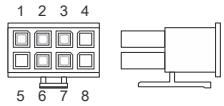
10.3.7 80CMxx003.26-01 - ABR incremental encoder cables with M12 connector

Pinout

Dimensions



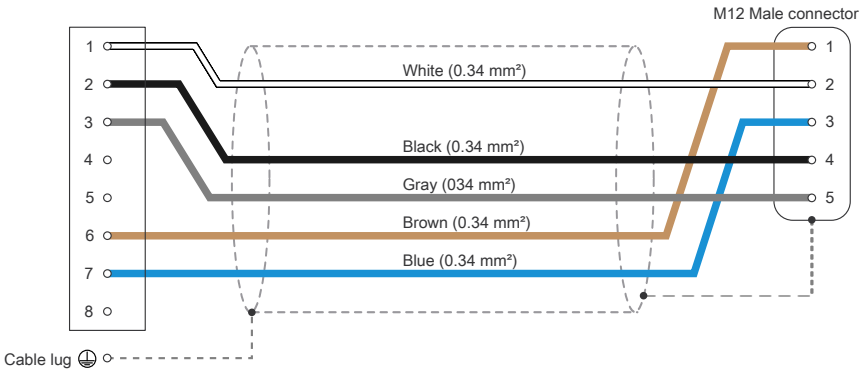
Pinout

8-pin terminal block	Pin	Name		Pin	M12 circular connector
	1	A	A	2	
	2	B	B	4	
	3	R	R	5	
	4	-	NC		
	5	-	NC		
	6	+24 VDC	Encoder supply +24 V	1	
	7	COM	Encoder supply 0 V	3	
	8	-	NC		
	Wire colors / wiring, see cable diagram.				
Cable lug	**Pin**	**Name**		**Pin**	
	-	PE wire / Shield		-	

Cable lengths (L)	
Model number	**Length [m]**
80CM**02**003.26-01	2
80CM**03**003.26-01	3
80CM**05**003.26-01	5
80CM**10**003.26-01	10

Accessory for M12 connector	
Model number	**Description**
80XMPXAC1.00-10	10x gasket for cable with M12 connector

Cable diagram



10.3.7.1 Technical data

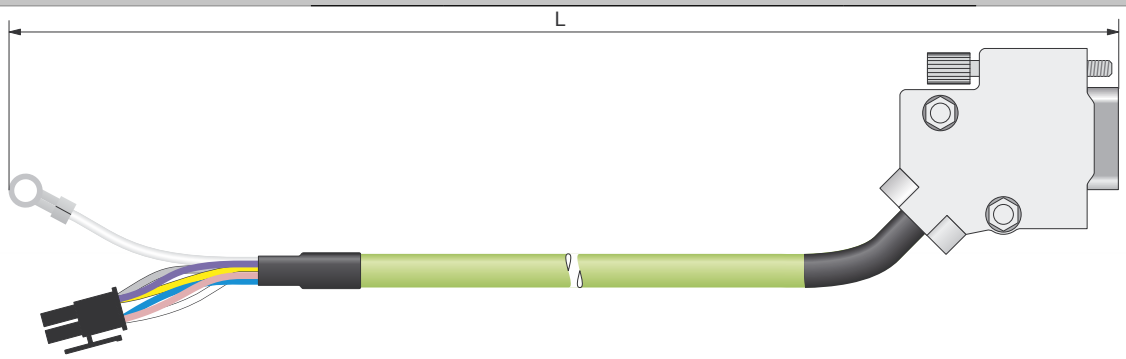
Product ID	80CM02003.26-01	80CM03003.26-01	80CM05003.26-01	80CM10003.26-01
General information				
Cable cross section	5x 0.34 mm²			
Certification				
cULus	Yes			
Cable construction				
Power lines				
Quantity	5			
Wire insulation	PVC			
Wire colors	Black, brown, blue, gray, white			
Diameter	0.34 mm²			
Shield	Yes			
Stranding	Yes			
Cable stranding	With filler elements and foil shield			
Complete shielding	Tinned copper braiding, optical coverage >85% and wrapped in foil shield			
Outer sheathing				
Material	PUR/PVC			
Electrical characteristics				
Nominal current	Max. 4 A / contact			
Connection voltage	Max. 60 V AC/DC			
Environmental conditions				
Temperature				
Moving	-10 to 70°C			
Static	-20 to 90°C			
Mechanical characteristics				
Dimensions				
Length	2 m	3 m	5 m	10 m
Diameter	6.4 mm ±0.2 mm			
Flex radius	≥10x outer diameter			

Table 25: 80CM02003.26-01, 80CM03003.26-01, 80CM05003.26-01, 80CM10003.26-01 - Technical data

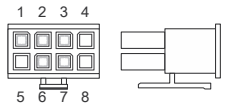
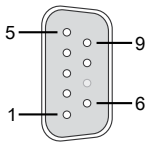
10.3.8 80CMxx004.25-01 - SSI absolute encoder cables

Pinout

Dimensions

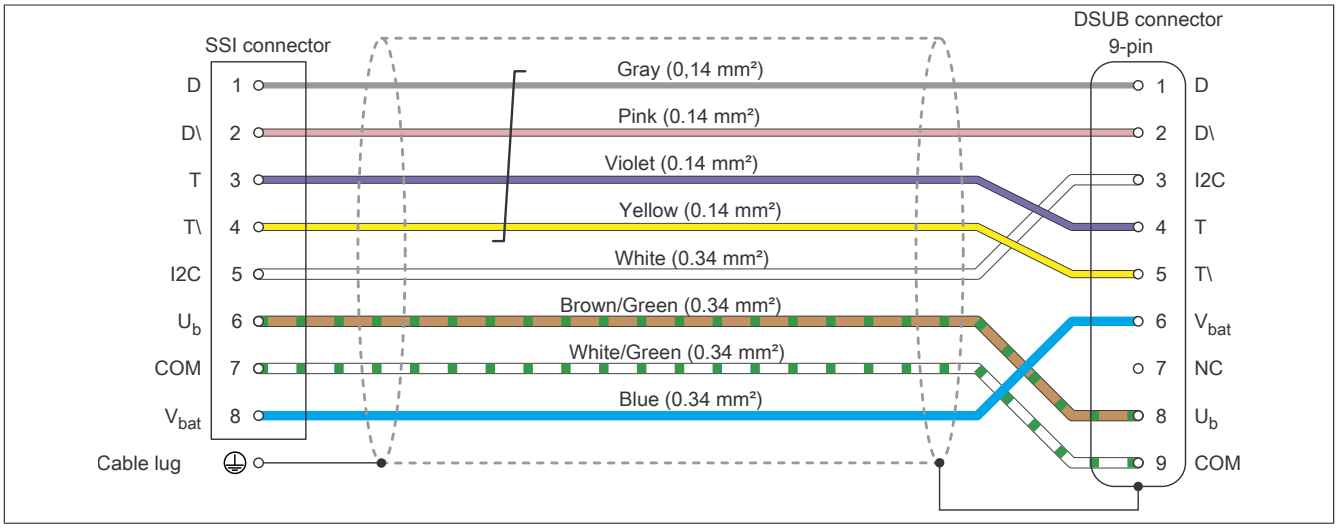


Pinout

8-pin terminal block	Pin	Name		Pin	DSUB male 9-pin connector (8 pins used)
	1	D	Data input	1	
	2	D\	Data input inverted	2	
	3	T	Clock output	4	
	4	T\	Clock output inverted	5	
	5	I2C	I2C	3	
	6	$+U_b$	Encoder supply +24 V	8	
	7	COM	Encoder supply 0 V	9	
	8	V_{bat}	Battery-backed 3 V	6	
	Wire colors / wiring, see cable diagram.				
Cable lug	**Pin**	**Name**		**Pin**	
	-	Shield		-	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**004.25-01	1
80CM**02**004.25-01	2
80CM**03**004.25-01	3
80CM**05**004.25-01	5
80CM**10**004.25-01	10
80CM**15**004.25-01	15
80CM**20**004.25-01	20

Cable diagram



10.3.8.1 Technical data

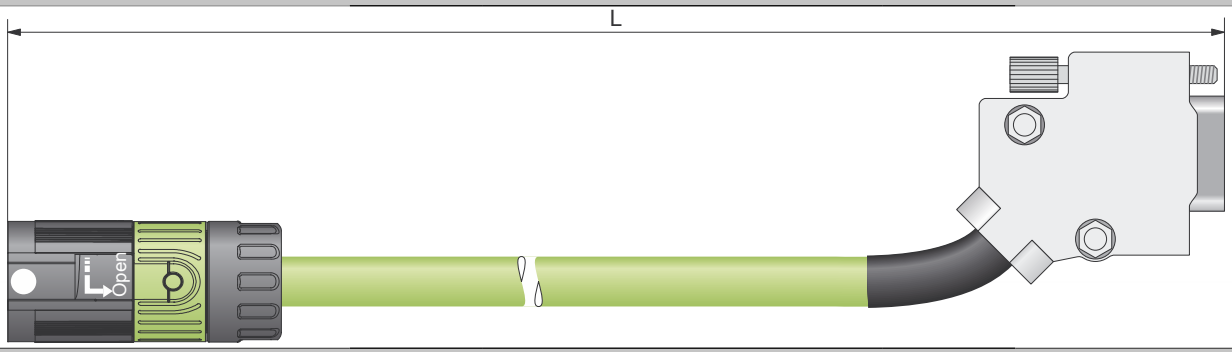
Product ID	80CM01004.25-01	80CM02004.25-01	80CM03004.25-01	80CM05004.25-01	80CM10004.25-01	80CM15004.25-01	80CM20004.25-01
General information							
Cable cross section	1x 4x 0.14 mm² + 4x 0.34 mm²						
Durability	Oil resistance according to VDE 0472 part 803 test type B						
Listed	UL AWM Style 20963, 80°C, 30 V, E63216						
Certification							
cULus	Yes						
Cable construction							
Supply lines							
Quantity	4						
Wire insulation	Special thermoplastic material						
Wire colors	White/Green, brown/green, blue, white						
Design	Tinned copper stranded wire						
Diameter	0.34 mm²						
Shield	No						
Stranding	No						
Signal lines							
Quantity	4						
Wire insulation	Special thermoplastic material						
Wire colors	Yellow, gray, pink, violet						
Design	Tinned copper stranded wire						
Diameter	0.14 mm²						
Shield	No						
Stranding	All 4 wires together						
Cable stranding	With foil shield						
Complete shielding	Copper/tin braiding						
Outer sheathing							
Material	PUR						
Color	Black						
Labeling	Heidenhain UR AWM Style 20963 80°C 30V E63216						
Electrical characteristics							
Test voltage							
Wire/Wire	0.5 kV						
Wire/Shield	0.5 kV						
Conductor resistance							
Supply lines	≤55 Ω/km						
Signal lines	≤134 Ω/km						
Insulation resistance	>200 MΩ/km						
Environmental conditions							
Temperature							
Moving	-10 to 80°C						
Static	-40 to 80°C						
Mechanical characteristics							
Dimensions							
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m
Diameter	6 mm ±0.25 mm						
Flex radius							
Single bend	≥20 mm						
Moving	≥75 mm						
Drag chain data							
Acceleration	<60 m/s²						
Flex cycles	≥3,000,000						
Speed	≤4 m/s						
Weight	0.08 kg/m						

Table 26: 80CM01004.25-01, 80CM02004.25-01, 80CM03004.25-01, 80CM05004.25-01, 80CM10004.25-01, 80CM15004.25-01, 80CM20004.25-01 - Technical data

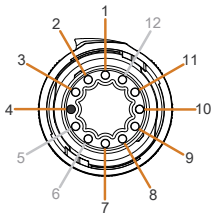
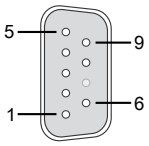
10.3.9 80CMxx005.65-01 - HIPERFACE encoder cables

Pinout

Dimensions

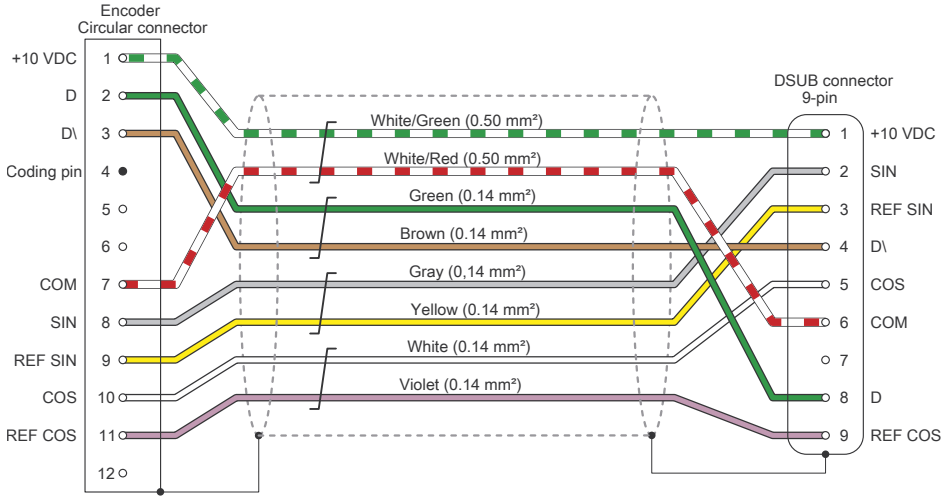


Pinout

12-pin circular female connector	Pin	Name		Pin	DSUB male 9-pin connector (8 pins used)
	1	+10 VDC	Encoder supply	1	
	2	D	Data input	8	
	3	D\	Data input inverted	4	
	4	Used for coding purposes and to prevent improper connections.		-	
	7	COM	Encoder supply 0 V	6	
	8	SIN	Channel SIN	2	
	9	REF SIN	REF SIN channel	3	
	10	COS	Channel COS	5	
	11	REF COS	REF COS channel	9	
	Wire colors / wiring, see cable diagram. Each shield connected to housing on connector side				

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**005.65-01	1
80CM**02**005.65-01	2
80CM**03**005.65-01	3
80CM**05**005.65-01	5
80CM**10**005.65-01	10
80CM**15**005.65-01	15
80CM**20**005.65-01	20

Cable diagram



10.3.9.1 Technical data

Product ID	80CM01005.65-01	80CM02005.65-01	80CM03005.65-01	80CM05005.65-01	80CM10005.65-01	80CM15005.65-01	80CM20005.65-01
General information							
Cable cross section	5x 2x 0.14 mm² + 1x 2x 0.50 mm²						
Durability	Oil resistance according to VDE 0472 part 803 as well as standard hydraulic oil						
Listed	UL AWM Style 20963, 80°C, 30 V, E63216 and CSA AWM I/II A/B, 90°C, 30 V, FT1 LL46064						
Certification							
cULus	Yes						
Cable construction							
Supply lines							
Quantity	2						
Wire insulation	Special thermoplastic material						
Wire colors	White/Green, white/red						
Design	Tinned copper stranded wire						
Diameter	0.5 mm²						
Shield	No						
Stranding	White/Red with white/green and filler elements						
Signal lines							
Quantity	10						
Wire insulation	Special thermoplastic material						
Wire colors	Blue, brown, yellow, gray, green, pink, red, black, violet, white						
Design	Tinned copper stranded wire						
Diameter	0.14 mm²						
Shield	No						
Stranding	Green with brown, gray with yellow, white with violet, black with red, pink with blue						
Cable stranding	With foil shield						
Complete shielding	Copper braiding, optical coverage >85% and wrapped in foil shield						
Outer sheathing							
Material	PUR						
Color	RAL 6018						
Labeling	BERNECKER + RAINER 10x0.14+2x0.50 FLEX UL AWM STYLE 20963 80°C 30 V E63216 CSA AWM I/II A/B 90°C 30 V FT1 LL46064						
Electrical characteristics							
Test voltage							
Wire/Wire	1 kV						
Wire/Shield	0.8 kV						
Conductor resistance							
Supply lines	≤40 Ω/km						
Signal lines	≤140 Ohm/km						
Insulation resistance	>200 MΩ/km						
Environmental conditions							
Temperature							
Moving	-10 to 80°C						
Static	-40 to 90°C						
Mechanical characteristics							
Dimensions							
Length	1 m	2 m	3 m	5 m	10 m	15 m	20 m
Diameter	7.85 mm ±0.2 mm						
Flex radius							
Single bend	≥24 mm						
Moving	≥60 mm						
Drag chain data							
Acceleration	<60 m/s²						
Flex cycles [1]	≥3,000,000						
Speed	≤4 m/s						
Weight	0.08 kg/m						

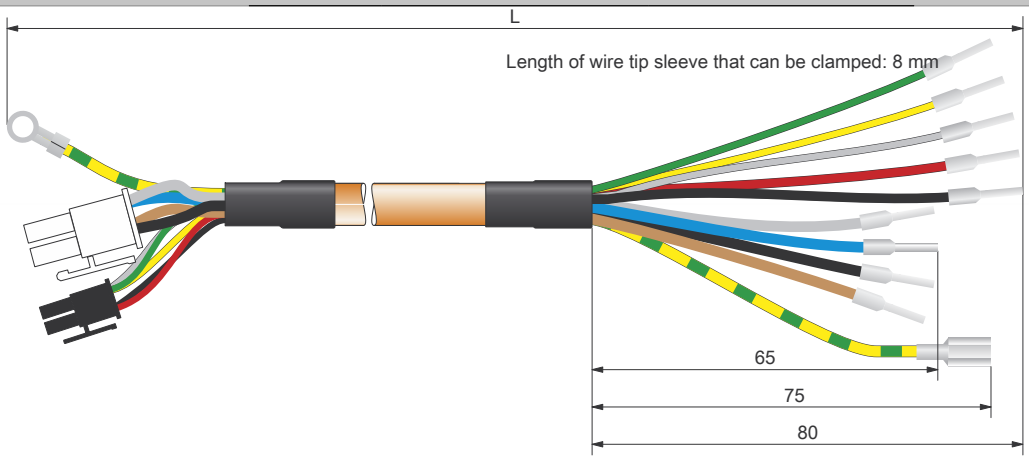
Table 27: 80CM01005.65-01, 80CM02005.65-01, 80CM03005.65-01, 80CM05005.65-01, 80CM10005.65-01, 80CM15005.65-01, 80CM20005.65-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 65 mm.

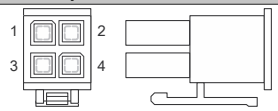
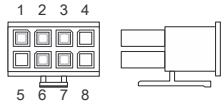
10.3.10 80CMxx013.21-01 - Hybrid cables

Pinout

Dimensions

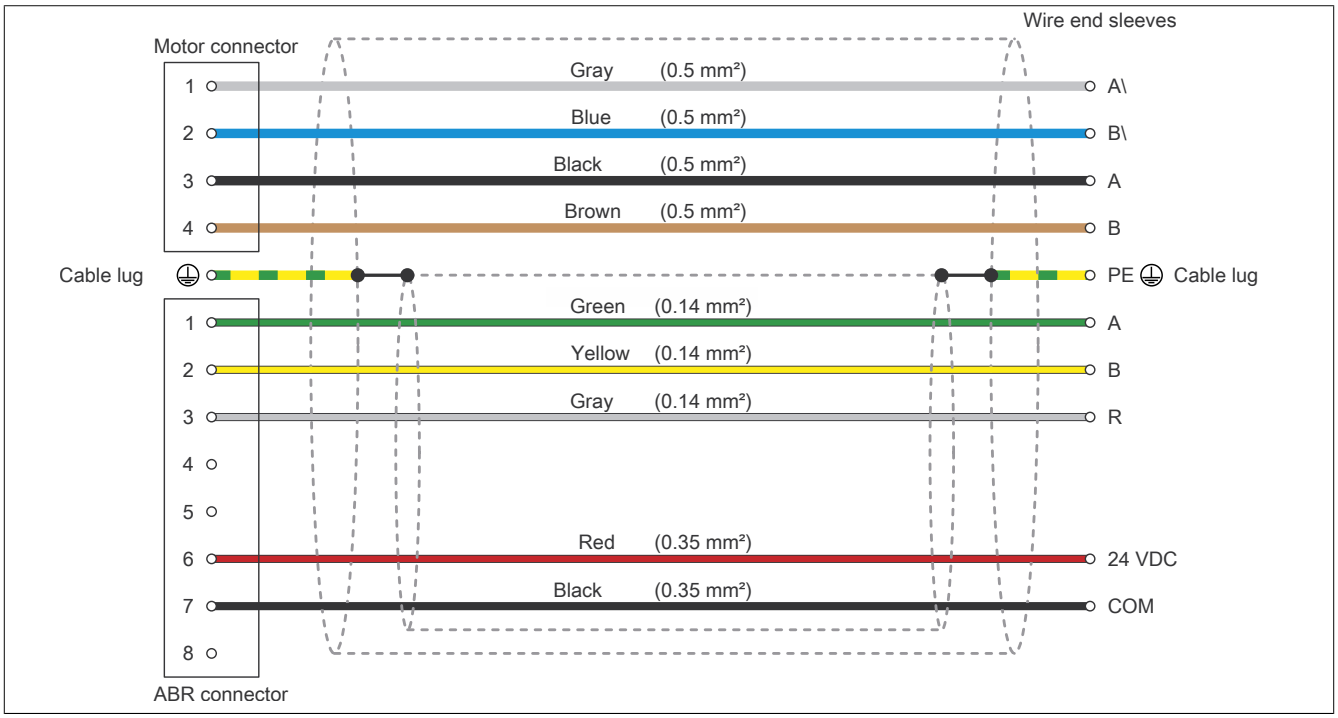


Pinout

4-pin terminal block	Pin	Name	Wire colors	Open
	1	A\	Gray	For custom wiring Connection to drive system
	2	B\	Blue	
	3	A	Black	
	4	B	Brown	
8-pin terminal block	**Pin**	**Name**	**Wire colors**	
	1	A	Green	
	2	B	Yellow	
	3	R	Gray	
	4	NC	-	
	5	NC	-	
	6	24 VDC	Red	
	7	COM	Black	
	8	NC	-	
Cable lug	**Pin**	**Name**	**Wire colors**	**Cable lug**
	-	PE wire / Shield	Yellow/Green	

Cable lengths (L)	
Model number	**Length [m]**
80CM**01**013.21-01	1
80CM**02**013.21-01	2
80CM**03**013.21-01	3
80CM**05**013.21-01	5
80CM**10**013.21-01	10

Cable diagram



10.3.10.1 Technical data

Product ID	80CM01013.21-01	80CM02013.21-01	80CM03013.21-01	80CM05013.21-01	80CM10013.21-01
General information					
Cable cross section	4x 0.5 mm² + 2x 0.35 mm² + 3x 0.14 mm²				
Listed	UL AWM Style 20963, 80°C, 30 V, E63216 and CSA AWM I/II A/B, 90°C, 30 V, FT2 LL46064				
Certification					
cULus	Yes				
Cable construction					
Power lines					
Quantity	4				
Wire insulation	Special thermoplastic material				
Wire colors	Black, gray, brown, blue				
Design	Tinned copper stranded wire				
Diameter	0.5 mm²				
Supply lines					
Quantity	2				
Wire insulation	Special thermoplastic material				
Wire colors	Red, black				
Design	Tinned copper stranded wire				
Diameter	0.35 mm²				
Shield	-	Yes			
Stranding	Yes				
Signal lines					
Quantity	3				
Wire insulation	Special thermoplastic material				
Wire colors	Gray, yellow, green				
Design	Tinned copper stranded wire				
Diameter	0.14 mm²				
Shield	Yes				
Stranding	Yes				
Cable stranding	Yes				
Complete shielding	Tinned copper wire braiding, optical coverage ≥ 85%				
Outer sheathing					
Material	PUR				
Labeling	BERNECKER + RAINER 4x0.50+1x(2x0.35+3x0.14 C) FLEX UL AWM STYLE 20963 80°C 30 V E63216 CSA AWM I/II A/B 90°C 30V FT2 LL46064				
Electrical characteristics					
Test voltage					
Wire/Wire	1.0 kV				
Wire/Shield	0.5 kV				
Conductor resistance					
0.14 mm²	≤134 Ω/km				
0.35 mm²	≤55 Ω/km				
0.50 mm²	≤39 Ω/km				
Insulation resistance	>200 MΩ/km				
Environmental conditions					
Temperature					
Moving	-10 to 50°C				
Static	-20 to 80°C				
Mechanical characteristics					
Dimensions					
Length	1 m	2 m	3 m	5 m	10 m
Diameter	72 mm ±0.25 mm				
Flex radius					
Single bend	≥20 mm				
Moving	≥50 mm				
Drag chain data					
Acceleration	<60 m/s²				
Flex cycles [1]	≥3,000,000				
Speed	≤4 m/s				
Weight	0.085 kg/m				

Table 28: 80CM01013.21-01, 80CM02013.21-01, 80CM03013.21-01, 80CM05013.21-01, 80CM10013.21-01 - Technical data

1) At an ambient temperature of 20°C and a flex radius of 65 mm.

10.4 Accessory set for motors with encoder / holding brake

10.4.1 Order data

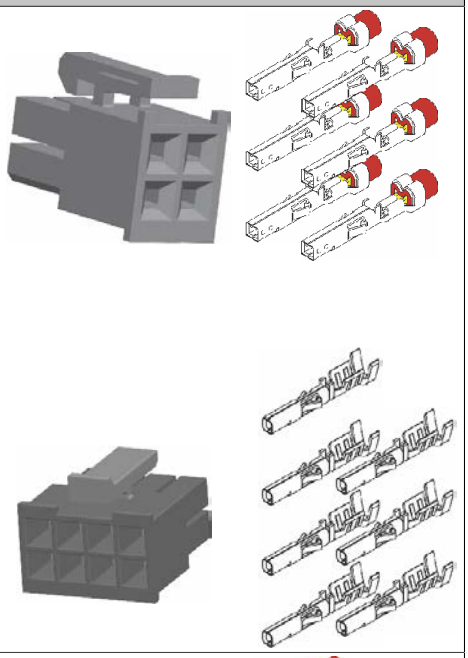
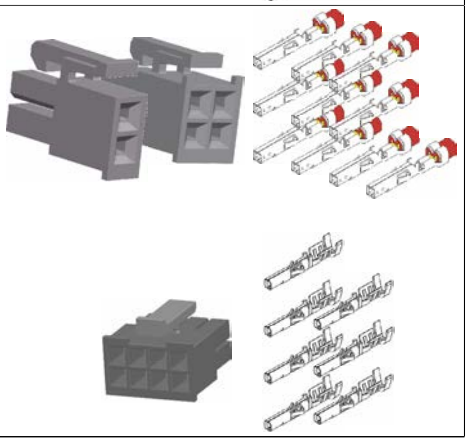
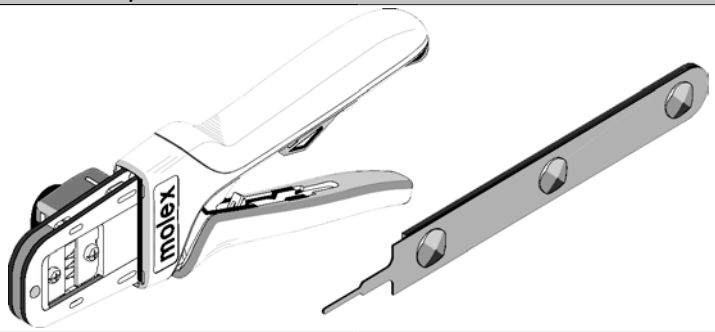
Model number	Short description	
80XMPXAC0.00-01	Accessory set for motors with an encoder, 8-pin and 4-pin connector and crimp contact **Contents** 1x 8-pin plug 1x 4-pin plug 7x crimp contact (for 8-pin plug) 6x crimp contact (for 4-pin plug)	
80XMPXAC0.00-02	Accessory set for motors with encoder and brake, 8-pin, 4-pin and 2-pin connector and crimp contact **Contents** 1x 8-pin plug 1x 4-pin plug 1x 2-pin plug 7x crimp contact (for 8-pin plug) 10x crimp contact (for 2-pin or 4-pin plug)	

Table 29: Accessory sets for motors with encoder / holding brake

Special crimping tools are required to install/dismantle the crimp contacts:

Molex parts number		
		
	Crimping pliers	**Release tool**
2-pin or 4-pin plugs	0638190900	0011030044
8-pin plugs	0638190000	0011030043

11 Appendix

11.1 Standards and Certifications

11.1.1 Applicable European directives

- EMC directive 2004/108/EC
- Low voltage directive 2006/95/EC [1)]
- RoHS directive 2011/65/EU

The EU declarations of conformity for B&R products can be downloaded from the B&R website www.br-automation.com.

11.1.2 Applicable standards

Standard	Description
EN 60034-1	Rotating electrical machines • Part 1: Measurement and operational behavior

Table 30: Applicable standards

11.2 Abbreviations

11.2.1 General information

Abbreviations appear throughout the User's Manual, for example in data tables or descriptions of pinouts.

11.2.2 Overview

Abbreviation	Stands for	Description
NC	Normally closed	A normally closed (N.C.) relay contact.
	Not connected	Used in pinout descriptions if a terminal or pin is not connected to a module
ND	Not defined	In data tables, this stands for a value that has not been defined. This may be because a cable manufacturer does not provide certain technical data, for example.
NO	Normally open	A normally open relay contact

Table 31: Abbreviations used in this user's manual

[1)] Valid for equipment used with a nominal voltage between 50 and 1000 VAC and between 75 and 1500 VDC

A

B

C

D

E

F

H

I

M

O

P

R

S

T

W