SIEB & MEYER

AKM-Motors

Technical Manual

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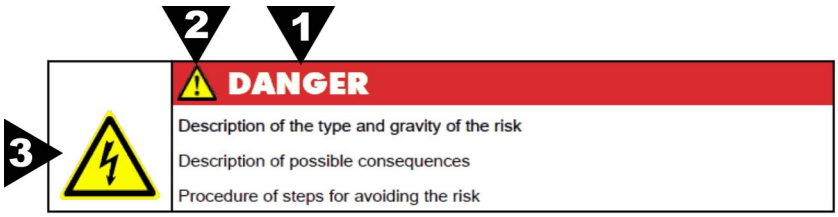
1 About this Manual

This chapter describes symbols, signal words and abbreviations used in this manual.

1.1 Illustration of Warnings

Depending on their degree of risk, warnings are classified into different levels. In the manual, the different levels and types of dangers are represented as follows:



[1] Risk level (signal word/warning color)
Classification of the risk

[2] Safety symbol
Risk of injury

[3] Risk symbol
Graphic representation of the source of risk

Risk levels

Risk Level	Description
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.
NOTICE	Indicates a hazardous situation which, if not avoided, may result in property damage.

Risk symbols

Risk symbol	Description
	General hazardous situation
	Risk of injury due to electric shock
	Risk of injury due to hot surfaces
	Potentially risk of injury when working on machines with open covers/ doors

Risk symbol	Description
	Risk of injury due to flying objects
	Destruction risk of electrostatically sensitive components
	Risk of property damage

1.2 Technical Symbols

Symbol	Description
●	LED indicator: LED on
○	LED indicator: LED off
☼	LED indicator: LED flashes

1.3 Illustration of General Notices

Symbol	Description
	Hint with additional, further information
	Tip with suggestions and useful information

2 Safety Instructions

These safety instructions include important information regarding your safety and must be observed during installation and operation of SIEB & MEYER. Read them carefully and keep them for later use.

Also adhere to safety instructions in the product documentation and on the device.

according to:

- Low-Voltage Directive 2014/35/EU
- Machinery Directive 2006/42/EC
- EMC Directive 2014/30/EU
- DIN EN 60034

DANGER

Risk of injury and material damage due to wrong handling

Read the available documentation before mounting and initial operation. Wrong handling of the motor can cause injury to the operator and material damage. Keep the technical data and information to the connection requirements (refer to the type plate and to the technical documentation.

WARNING

Risk of serious injuries and material damage

Any works regarding installation, initial operation and maintenance must be carried out by trained staff only.Furthermore, electricians which connect feed-in systems must be approved by the local DSO (distribution system operator).

Trained staff, according to this fundamental safety instruction, are persons familiar with the installation, mounting, initial and permanent operation of the product and they are qualified appropriately for the work. The standards DIN VDE 0100 and DIN VDE 0110 as well as the national accident prevention regulations shall be considered!

When installing feed-in systems adhere to all applicable regulations, special safety instructions and technical connection conditions of the local DSO.

DANGER

Risk of burn due to hot surfaces

During operation the motors can have hot surfaces according to their protection system. The surface temperature can exceed 100 °C.

Measure the temperature and wait until the motor has cooled down to 40 °C before touching it.

DANGER

High voltages at the motor connectors

High voltages occur at the motor connectors during the operation of a servo amplifier/frequency converter.

Never operate servo amplifiers/frequency converters without connected plugs. Otherwise, you may seriously be injured when touching the contacts at the motor connectors unintentionally.

DANGER

Risk due to unexpected movement of machine parts

The machine manufacturer must establish a hazard analysis for the machine and take appropriate measures to ensure that unexpected movements do not cause injury to the operator or material damage.

DANGER

Dangerous shock currents

Earthing and shielding measures are required to protect devices and persons. To ensure the safety of the operator earthing must be carried out with low impedance. With respect to the ground connection one of the following actions must be done:

- connect the motor housing to the ground of the machine or
- connect the ground terminal of the motor connector to the central ground point of the machine.

Consider the following with regard to shielding: Always use shielded motor cables!

DANGER

Risk of injury due to high voltages at the power connectors

Power connectors can lead voltages even if the motor is not rotating.

Never unplug the electrical connections of the motors while the motor is energized. This may lead to electric arcs and cause injuries or damage contacts.

DANGER

Risk of injury due to flying parts

A fitted feather key in a free-running motor can fly away from the motor and injure the operator.

Remove or secure any fitted shaft feather key in a free-running motor.

DANGER

Risk of injury when motor holding brake is released

When the motor holding brake is released and the servo drive does not supply power to hanging loads (vertical axes), the load might drop. This may cause personal injury to the machine operator.

Ensure the functional safety of the vertical axes by means of an external mechanical brake.

2.1 Appropriate Use

NOTICE

Risk of damage to the motors due to incorrect wiring

If connected directly to mains, the motor would be demagnetized and the motor winding would be destroyed.

Never connect the motors directly to mains.

The synchronous servo motors of the series AKM are particularla designed for application in industrial robots, textile machines, packaging machines and similar machines with high dynamic requirements.

Never operate the motors under other conditions than defined in this manual.

The AKM-motors are exclusively intended to be driven by servo amplifiers under speed and / or torque control.

The motors are installed in electrical installations or machines and shall only be initially operated as integrated components of an installation or machine.

The thermal contact integrated in the motor windings must be evaluated and monitored.

2.2 Improper Use

Operating the standard motors is forbidden
- when directly connected to mains,
- in areas exposed to explosion hazards,
- in areas where food is stored,
- in contact with etching and/or electrically conducting acids, bases, oils or dusts.

Appropriate use of the motor is forbidden, if the machine in which the motor has been installed
- does not meet the regulations of the EU Machinery Directive,
- does not meet the regulations of the EMC Directive,
- does not meet the regulations of the Low-Voltage Directive.
- Holding brakes (when installed) must not be used solely to ensure the functional safety.

2.3 Transport

NOTICE

Only qualified staff is authorized to transport the motors in the recyclable original packaging of the manufacturer. Avoid impact shocks, especially to the shaft end of the motor.

If the packaging is damaged, check the motor for visible damage. Inform the carrier and, if applicable, the manufacturer.

- climate category: 2K3 according to DIN EN 50178
- temperature during transport: -25°C to +70°C, max. 20K/hour, variable
- humidity during transport: relative humidity 5% - 95%, not condensing

2.4 Packaging

Cardboard packaging with Instapak® foam cushion

Motor type	Cardboard box	Max. stacking height
AKM1	x	10
AKM2	x	10
AKM3	x	6
AKM4	x	6
AKM5	x	5
AKM6	x	1
AKM7	x	1

Tab. 1: AKM-motor types with packaging and max. stacking height

2.5 Storage

- climate category: 1K4 according to DIN EN 50178
- storage temperature -25 °C to +55 °C
- max. 20K/hour, variable
- humidity relative humidity 5% to 95%, not condensing
- Always use the original recyclable packaging of the manufacturer for storage.
- max. stacking height: see table 1 "AKM-motor types with packaging and max. stacking height", page 12
- Storage period: without limitation

2.6 Maintenance / Cleaning

- Only qualified staff is authorized to maintain and clean the motors.
- The ball bearings have a grease lubrication which lasts for 20,000 operating hours under normal conditions..
- The ball bearing shall be replaced after 20,000 operating hours under rated conditions.

- Check the motor for bearing noise every 2,500 operating hours, respectively each year.
- If noise is detected, the motor shall not be operated anymore. Replace the ball bearings before operating the motor again.
- Opening the motor results in the forfeiture of warranty.
- Clean the housing with Isopropanol or similar, **do not immerse or spray**.

3 Unit Assembly Complying EMC

The EU guidelines for electromagnetic compatibility (EMC) must be considered for the initial operation of all SIEB & MEYER devices.

The manual "EMC Guidelines" is available in German and English and includes:

- EMC rules
- information regarding the professional grounding and wiring
- safety-relevant aspects
- extracts from the EMC product standard
- possibilities for the connection to different supply system types

Availability:

- hard copy version directly from SIEB & MEYER
- PDF file undr www.sieb-meyer.de/Service/Downloads

4 General Information

4.1 Technical Characteristics

The synchronous motors of the series AKM are brushless three-phase current motors for demanding servo applications. When combined with SIEB & MEYER servo amplifiers the motors are particularly suitable for positioning tasks in industrial robots, machine tools, transfer lines etc. with high demands for dynamics and stability..

The servo motors are equipped with permanent magnets in the motor. The neodymium magnet material is an important factor for the highly dynamic operation of these motors. A three-phase winding, which is supplied by the servo amplifier, is installed in the stator. The motor does not have any brushes, commutation is done electronically in the servo amplifier.

The winding temperature is monitored via temperature sensors in the stator windings and signaled via a potential-free thermistor (PTC, ≤ 550 Ω / ≥ 1333 Ω).

The default feedback system installed in the motors is a resolver. The alternatively offered feedback systems partly cause a change of the motor length and can not be retrofitted.

The motors are available with or without built-in holding brake. Retrofitting the brake is not possible.

The motors have a matt black varnish (RAL 9005), which is not resistant against solvents (e.g. triclorethylene, nitro-thinners, or similar..

4.2 General Technical Data

Climate category	3K3 according toDIN EN 50178
Ambient temperature (at rated data)	5 °C to +40 °C for site altitudes up to 1,000 m above MSL ⚠ Consult our service department for ambient temperatures above 40 °C and encapsulated installation of the motors.
Admissible humidity (at rated data)	95% relative humidity, not bedewing
Power derating	1% / K in the range of from 40 °C to 50 °C up to altitudes of 1,000 m above MSL (currents and torques) For site altitudes above 1,000 m above MSL and 40 °C ▸ 6% at 2,000 m above MSL ▸ 17% at 3,000 m above MSL ▸ 30% at 4,000 m above MSL ▸ 55% at 5,000 m above MSL No power derating at site altitudes above 1,000 m above MSL and temperature reduction by 10 K / 1,000 m
Service life of all bearings	≥ 20,000 operating hours

4.3 Default Equipment

4.3.1 Types of Construction

The basic type of construction of the synchronous AKM servo motors is IM B5 according to DIN EN 60034-7. The allowed mounting positions are indicated in the technical data.

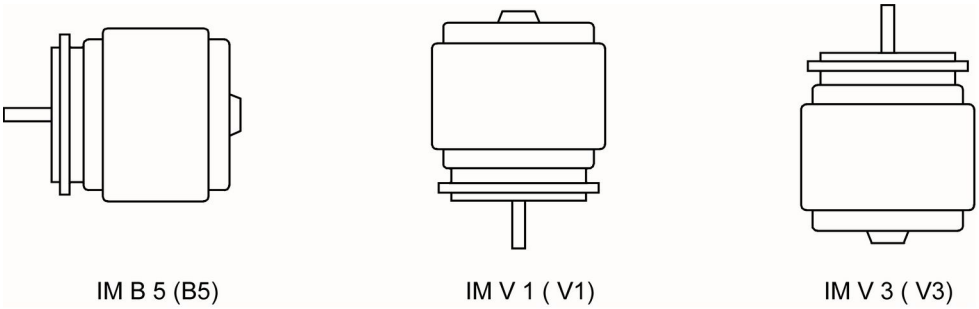


Fig. 1: Construction types of AKM-motors

4.3.2 Shaft End, A-Side

Power is transmitted via the cylindric shaft end A, fit k6 (: h7) with tightening thread, but **without feather key groove**.

Consider that high radial forces occur when the motors drive the shaft via pinion or toothed belt. The permissible values at the shaft end depend on the speed (refer to the diagrams in chapter 10 "Technical Data", page 33. The max. values at speeds of 3,000 rpm are described in the technical data. If the point of application of force is in the middle of the free shaft end, FR can be increased by 10%.

The bearings have a total life of 20,000 operating hours.

NOTICE

Risk of damage to the motor due to exceeded axial forces

An axial force is a force that acts directly on an object's center axis. Axial forces occur in drives with helical gear wheels as a reaction on the induced torques. These forces are absorbed in the gear and have no external effects. The indicated axial force is the max. force allowed to act on the face end of the gear/motor shaft.

The axial force FA must not exceed FR/3!

Double-coned collets, possibly combined with metal bellows couplings, have proved to be ideal free from backlash coupling elements.

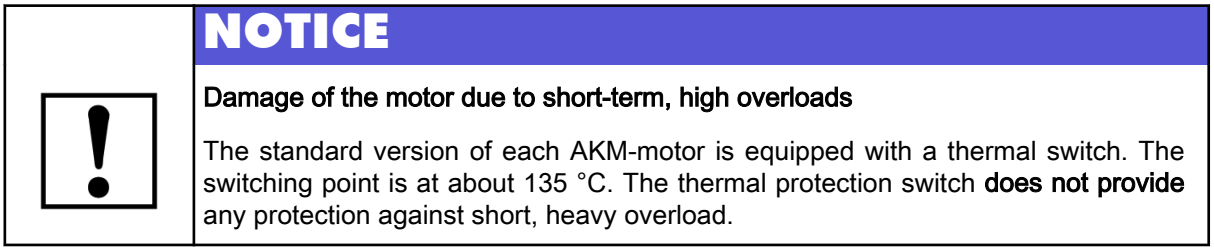
4.3.3 Flange

- Flange dimensions according to IEC standard, fit j6 (AKM1: h7)
- precision according to DIN SPEC 42955
- tolerance class: N

4.3.4 IP Code

Standard motor	Connection code	Shaft sealing ring	IP code
AKM1 to 4	M	with or without	IP20
AKM1	C	without	IP40
AKM1	C	with	IP65
AKM2-AKM7	B, C	without	IP54
AKM2-AKM7	B, C	with	IP65

4.3.5 Device Protection



NOTICE

Damage of the motor due to short-term, high overloads

The standard version of each AKM-motor is equipped with a thermal switch. The switching point is at about 135 °C. The thermal protection switch **does not provide** any protection against short, heavy overload.

4.3.6 Insulation Class

The motors comply with the insulation class F according to IEC IEC 60085.

4.3.7 Vibration Class

The motors comply with the level A according to DIN EN 60034-14.

4.3.8 Connection

AKM-motors are equipped with angular connectors (AKM1: straight connectors at cable ends) or Molex connectors for power supply and resolver signals.

Mating connectors are not part of the delivery.

4.3.9 Feedback System

Standard	Resolver	2-pole, hollow shaft
Optional	Encoder	Incremental encoder with commutation tracks, resolution 4096 lines

Consider that motors with installed motor brake are longer.

4.3.10 Holding Brake

The motors AKM2 to AKM7 are available with installed holding brake. When the spring-operated brake (24 V_{DC}) is de-energized, it blocks the rotor.

DANGER

Risk of injury while activating the motor holding brake

The holding brakes are conceived as standstill brakes and are not suited for continuous operational braking. If the brake is released the rotor may move without residual torque! The motor length increases with an installed holding brake.

The holding brakes can be controlled directly by the servo amplifiers (risk of injury to the operator!); in this case the winding is suppressed in the servo amplifier.

If the holding brake is not controlled directly by the servo amplifier, additional wiring is required (e.g. varistor). Please contact our service department.

To avoid injury to the operator when operating the holding, an additional n/o contact (normally open) must be connected in the brake circuit and an anti-surge device (e.g. varistor) for the brake must be provided.

DANGER

Risk of injury when motor holding brake is released

When the motor holding brake is released and the servo drive does not supply power to hanging loads (vertical axes), the load might drop. This may cause personal injury to the machine operator.

Ensure the functional safety of the vertical axes by means of an external mechanical brake.

4.3.11 Number of Poles

Motor	Number of poles
AKM1	6
AKM2	6
AKM3	8
AKM4	10
AKM5	10
AKM6	10
AKM7	10

4.4 Optional Equipment

Holding brake

- The holding brake is integrated in the motor.
- If a holding brake is installed, the motor length increases.

Radial shaft sealing ring

- Radial shaft sealing ring (Teflon) for sealing against oil mist and oil spray.
- The IP Code results from the connection code and whether or not the motor is equipped with a shaft sealing ring (section 4.3.4 "IP Code", page 19).

Feather key

- The motors are available with feather key groove and inserted feather key.
- The shaft is balanced with a with a short (half) key.

Encoder

- Another feedback system installed in the motor instead of the resolver.

With the exception of the shaft sealing ring all options can not be retrofitted.

Optional equipment like the shaft sealing ring, holding brake or encoder can cause a reduction of the rated data..

4.5 Selection Criteria

The servo amplifier and the servo motor form a closed speed or torque loop control.

The most important selection criteria are listed in the following table:

Standstill torque	M_0	[Nm]
Rated speed at rated connection supply voltage	n_n	[rpm]
Moment of inertia of motor and load	J	[kgcm2]
Effective torque (calculated)	M_{rms}	[Nm]

5 Type Plate and Device Code

5.1 Type Plate

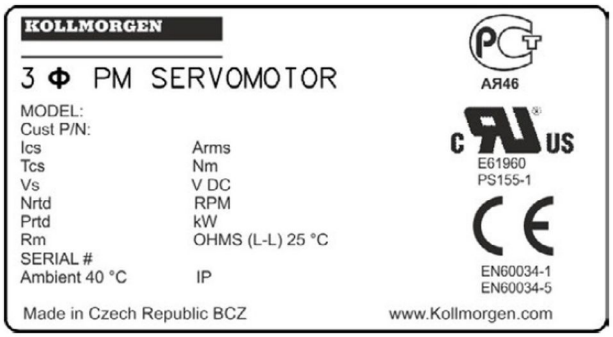
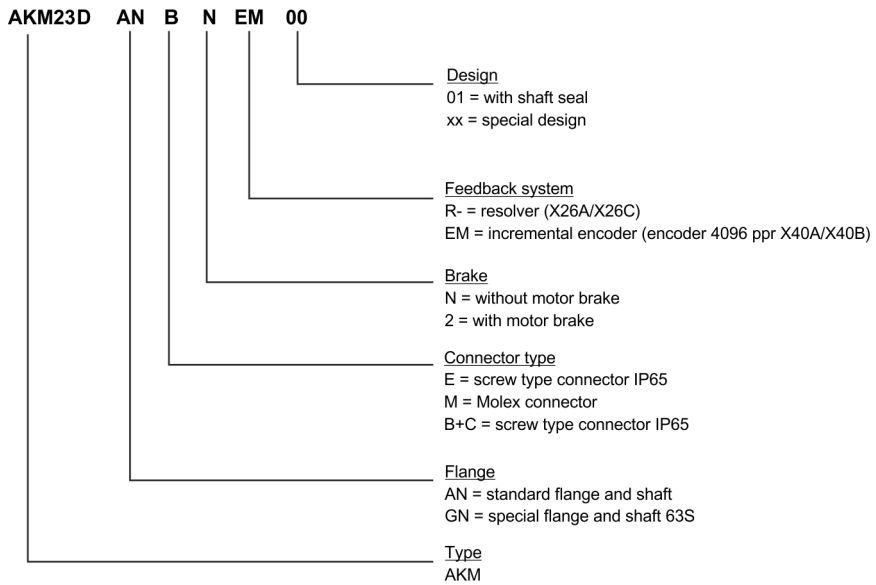


Fig. 2: Type plate for AKM-motors AKM1 to AKM7

MODEL	Motor type designation
CUST P/N	Customer material number
I_{CS}	I0rms (standstill current)
M_{CS}	M0 (standstill torque)
V_S	Un (intermediate circuit voltage)
N_{rtd}	nn (rated speed at Un)
P_{rtd}	Pn (rated power)
R_m	R25 (winding resistance of the motor at 25 °C)
SERIAL	Serial number
AMBIENT 40 °C	Admissible ambient temperature

5.2 Device Code



The following designations are used in this manual to distinguish the different motors:

Motor	Flange Ø [mm]	Standstill torque [Nm]	Technical data
AKM1	40	0,18 - 0,41	page 33
AKM2	58	0,48 - 1,42	page 36
AKM3	70	1,15 - 2,88	page 41
AKM4	84	1,95 - 6,00	page 44
AKM5	108	4,7 - 14,4	page 50
AKM6	138	11,9 - 25,00	page 54
AKM7	188	29,4 - 53,00	page 59

6 Dimensions

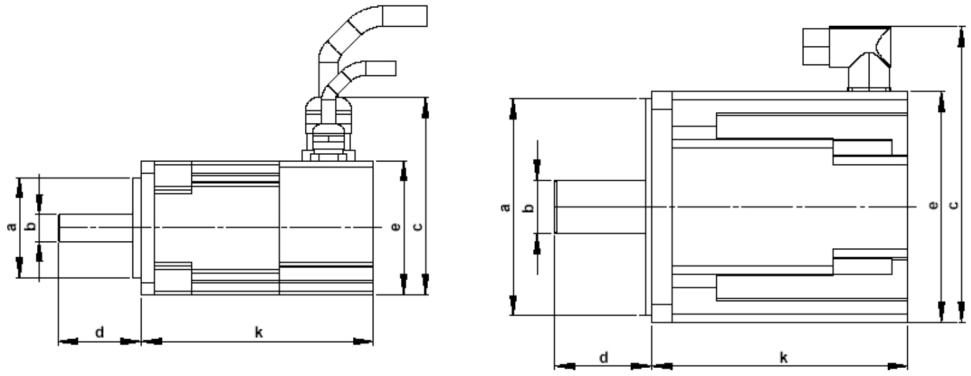


Fig. 3: Dimensions for AKM-motors AKM1 to AKM7

Motor	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	k [mm]
AKM11x	30	8	72	25	40	69,6
AKM12x	30	8	72	25	40	88,6
AKM13x	30	8	72	25	40	107,6
AKM21x	40	9	90	20	58	86,2
AKM22x	40	9	90	20	58	105,2
AKM23x	40	9	90	20	58	124,2
AKM24x	40	9	90	20	58	143,2
AKM31x	60	14	109	30	70	109,8
AKM32x	60	14	109	30	70	140,8
AKM33x	60	14	109	30	70	171,8
AKM41x	80	19	123	40	84	118,8
AKM42x	80	19	123	40	84	147,8
AKM43x	80	19	123	40	84	176,8
AKM44x	80	19	123	40	84	205,8
AKM51x	110	24	147	50	108	127,5
AKM52x	110	24	147	50	108	158,5
AKM53x	110	24	147	50	108	189,5
AKM54x	110	24	147	50	108	220,5
AKM62x	130	32	177	58	138	153,7
AKM63x	130	32	177	58	138	178,7
AKM64x	130	32	177	58	138	203,7
AKM65x	130	32	177	58	138	228,7
AKM72x	180	38	227	80	188	192,5
AKM73x	180	38	227	80	188	226,5
AKM74x	180	38	227	80	188	260,5

7 Mounting

This section described instructions to be observed when mounting the AKM-motors.

⚠ WARNING

Risk of serious injuries and material damage

Any works regarding installation, initial operation and maintenance must be carried out by trained staff only.Furthermore, electricians which connect feed-in systems must be approved by the local DSO (distribution system operator).

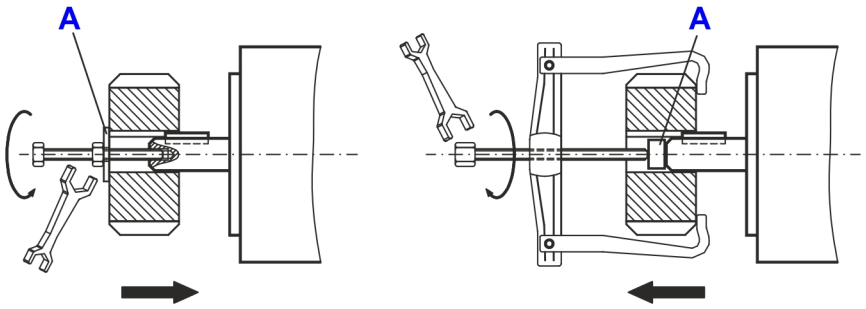
Trained staff, according to this fundamental safety instruction, are persons familiar with the installation, mounting, initial and permanent operation of the product and they are qualified appropriately for the work. The standards DIN VDE 0100 and DIN VDE 0110 as well as the national accident prevention regulations shall be considered!

When installing feed-in systems adhere to all applicable regulations, special safety instructions and technical connection conditions of the local DSO.

- Protect the motors against inadmissible stresses. Take care, especially during transport and handling, that components are not bent and / or insulation distances are not modified.
- The mounting place must be free from conductive and aggressive material. When mounting the motor in V3 position (shaft end upwards), make sure that no liquids can enter the bearings.

  ⚠ For encapsulated mounting, contact our service department beforehand.
- Ensure sufficient ventilation of the motors and consider the admissible ambient and flange temperature.

  ⚠ For ambient temperatures above 40 °C contact our service department before mounting the motor.
- Servo motors are precision devices. The flange and the shaft are especially susceptible to damages during storage and mounting. Consider the following application advice:
  - Avoid application of extreme forces.
  - Always use the provided tightening thread for mounting couplings, toothed belts or pulley wheels and warm up the drive components, if possible.
  - Avoid shocks or other application of force. These will cause damage to the ball bearings and the shaft (A = shim washer)



- If possible, only use backlash-free, frictionally engaged collet or couplings. Make sure that the coupling is aligned correctly. A displacement leads to impermissible vibrations and to the destruction of ball bearings and the coupling.
- Consider the admissible radial forces when mounting toothed belts. Too high radial loads on the shaft cause significant reductions of the motor life..

- Avoid axial loads on the motor shaft as far as possible. Axial loads on the shaft cause significant reductions of the motor life.
- Always avoid a mechanically overload on the motor shaft by using a rigid coupling with external additional bearings (e.g. in a gearbox).
- Consider the number of motor poles and of resolver poles and make sure that the number of poles is set correctly in the connected servo amplifiers. Incorrect settings can lead to the destruction of the motor, particularly of small motors.

8 Connection

This section describes important information to be observed when connecting the AKM-motors.

Refer to the chapter 11 "Connection Examples for AKM-motors", page 65 for detailed information about the connection of different connector types to a SIEB & MEYER CNC 8x.00.

WARNING

Risk of serious injuries and material damage

Any works regarding installation, initial operation and maintenance must be carried out by trained staff only.Furthermore, electricians which connect feed-in systems must be approved by the local DSO (distribution system operator).

Trained staff, according to this fundamental safety instruction, are persons familiar with the installation, mounting, initial and permanent operation of the product and they are qualified appropriately for the work. The standards DIN VDE 0100 and DIN VDE 0110 as well as the national accident prevention regulations shall be considered!

When installing feed-in systems adhere to all applicable regulations, special safety instructions and technical connection conditions of the local DSO.

DANGER

High voltages

Even if the power supply is off (contacts of main contactor open), the motor lines still conduct high voltages!

Wait at least five minutes after having disconnected the servo amplifiers from the supply voltage, before touching energized parts (e.g. contacts, threaded bolts) or unplug connectors.

Capacitors in the servo amplifier carry dangerous voltages for up to five minutes after the supply voltage was turned off. If possible and for safety reasons measure the voltage in the intermediate circuit and wait until the voltage has fallen down under 40 V.

- When mounting and connecting the motor, always ensure that the motor is deenergized, i.e. the operating voltage of all connected devices must be off
  Make sure that the switch cabinet remains turned off (barrier, warning signals etc.). The voltages of the connected devices will be activated again during the initial operation.
- Never unplug the electrical connections of the motors while the motor is energized. Dangerous residual voltages in the capacitors of the servo amplifiers can be present up to 5 minutes after the mains supply was disconnected. Measure the intermediate circuit voltage and wait until it has fallen below.
  Consider that control and power connections may be live even when the motor is not rotating.
- The ground symbol  used in the connection diagrams means that you must provide an electrical connection with a surface as large as possible between the

switch cabinet This connection is intended to suppress HF interference and must not be confused with the PE symbol (protective measure acc. toDIN EN 60204).
Also consider the wiring diagrams in the documentation of the connected servo amplifier.

9 Initial Operation

Important notes for the initial operation of the motors

WARNING

Risk of serious injuries and material damage

Any works regarding installation, initial operation and maintenance must be carried out by trained staff only.Furthermore, electricians which connect feed-in systems must be approved by the local DSO (distribution system operator).

Trained staff, according to this fundamental safety instruction, are persons familiar with the installation, mounting, initial and permanent operation of the product and they are qualified appropriately for the work. The standards DIN VDE 0100 and DIN VDE 0110 as well as the national accident prevention regulations shall be considered!

When installing feed-in systems adhere to all applicable regulations, special safety instructions and technical connection conditions of the local DSO.

DANGER

Risk of injury and material damage due to wrong handling

Read the available documentation before mounting and initial operation. Wrong handling of the motor can cause injury to the operator and material damage. Keep the technical data and information to the connection requirements (refer to the type plate and to the technical documentation.

DANGER

High voltages

Energized parts lead high voltages up to 900 V during the initial operation of the motor which may cause serious injuries or death by electric shock.

Ensure that all energized connected parts are secured against dangers caused when they are touched.

DANGER

Risk of burn due to hot surfaces

During operation the motors can have hot surfaces according to their protection system. The surface temperature can exceed 100 °C.

Measure the temperature and wait until the motor has cooled down to 40 °C before touching it.

DANGER

Risk due to unexpected movement of machine parts

The machine manufacturer must establish a hazard analysis for the machine and take appropriate measures to ensure that unexpected movements do not cause injury to the operator or material damage.

DANGER

High voltages

Even if the power supply is off (contacts of main contactor open), the motor lines still conduct high voltages!

Wait at least five minutes after having disconnected the servo amplifiers from the supply voltage, before touching energized parts (e.g. contacts, threaded bolts) or unplug connectors.

Capacitors in the servo amplifier carry dangerous voltages for up to five minutes after the supply voltage was turned off. If possible and for safety reasons measure the voltage in the intermediate circuit and wait until the voltage has fallen down under 40 V.

9.1 Guide for Initial Operation

This section describes a typical procedure for initial operation. Depending on the application of the devices, other procedures may be appropriate or necessary.

- Check the mounting and the alignment of the motors.
- Check the drive elements (coupling, gear, belt pulley) for correct seat (consider the admissible radial and axial forces).
- Check the wiring of the connections at the motor and at the servo amplifier. Ensure correct grounding.
- Check the function of the holding brake, if available. (Apply 24 V, the brake must be released).
- Check, whether the motor can be rotated freely (release the brake, if available). Listen for grinding noises.
- Check whether all measures against accidental contact with moving and energized parts have been carried out.
- Carry out further checks and tests specifically required for your system.
- Start the initial operation of the drive in accordance with the instructions described in the documentation of the servo amplifier.
- For multi-axis systems, start the initial operation for every drive unit servo amplifier/motor individually..

10 Technical Data

All indicated data apply for ambient temperatures of 40 °C and winding temperatures of 100 K. The tolerance for actual data±10%. All currents are, unless otherwise defined, effective values!

Also refer to the glossary in the appendix of this manual.

10.1 AKM1

Technical data		Symbol	Unit	AKM11x		
				11B	11C	11E
Electrical data						
	Standstill torque (1)	M_0	Nm	0.18	0.18	0.18
	Standstill current	I_{0rms}	A	1.16	1.45	2.91
	Max. rated mains voltage	U_N	VAC	230		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	6000
	Rated torque (1)	M_n	Nm	—	—	0.18
	Rated power	P_n	kW	—	—	0.11
U_N = 115 V	Rated speed	n_n	rpm	4000	6000	—
	Rated torque (1)	M_n	Nm	0.18	0.18	—
	Rated power	P_n	kW	0.08	0.11	—
U_N = 230 V	Rated speed	n_n	rpm	8000	—	—
	Rated torque (1)	M_n	Nm	0.17	—	—
	Rated power	P_n	kW	0.14	—	—
U_N = 400 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 480 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
	Peak current	I_{0max}	A	4.65	5.79	11.6
	Peak torque	M_{0max}	Nm	0.61	0.61	0.61
	Torque constant	K_{Trms}	Nm / A	0.16	0.13	0.06
	Voltage constant	K_{Erms}	mVmin	10.2	8.3	4.1
	Winding resistance Ph-Ph	R25	Ω	18.2	12.1	3.1
	Winding inductance Ph-Ph	L	mH	12.5	8.3	2.0
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.017		
	Number of poles	--	--	6		
	Static friction torque	M_R	Nm	0.0011		
	Thermal time constant	t_{TH}	min	4		
	Weight (standard)	G	kg	0.35		

Technical data		Symbol	Unit	AKM11x		
				11B	11C	11E
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	30		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	12		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM12x	
				12C	12E
Electrical data					
	Standstill torque (1)	M_0	Nm	0.31	0.31
	Standstill current	I_{0rms}	A	1.51	2.72
	Max. rated mains voltage	U_N	VAC		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	3000
	Rated torque (1)	M_n	Nm	—	0.31
	Rated power	P_n	kW	—	0.10
U_N = 115 V	Rated speed	n_n	rpm	4000	8000
	Rated torque (1)	M_n	Nm	0.30	0.28
	Rated power	P_n	kW	0.13	0.23
U_N = 230 V	Rated speed	n_n	rpm	8000	—
	Rated torque (1)	M_n	Nm	0.28	—
	Rated power	P_n	kW	0.23	—
U_N = 400 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 480 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
	Peak current	I_{0max}	A	6.06	10.9
	Peak torque	M_{0max}	Nm	1.08	1.08
	Torque constant	K_{Trms}	Nm / A	0.21	0.11
	Voltage constant	K_{Erms}	mVmin	13.3	7.2
	Winding resistance Ph-Ph	R25	Ω	12.4	3.9
	Winding inductance Ph-Ph	L	mH	9.1	2.7
Mechanical data					
	Rotor moment of inertia	J	kgcm²	0.031	
	Number of poles	--	--	6	
	Static friction torque	M_R	Nm	0.0021	
	Thermal time constant	t_{TH}	min	6	
	Weight (standard)	G	kg	0.49	
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	30	
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	12	

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM13x	
				13C	13E
Electrical data					
	Standstill torque (1)	M_0	Nm	0.41	0.40
	Standstill current	I_{0rms}	A	1.48	2.40
	Max. rated mains voltage	U_N	VAC		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	2000
	Rated torque (1)	M_n	Nm	—	0.40
	Rated power	P_n	kW	—	0.08
U_N = 115 V	Rated speed	n_n	rpm	3000	7000
	Rated torque (1)	M_n	Nm	0.41	0.36
	Rated power	P_n	kW	0.13	0.27
U_N = 230 V	Rated speed	n_n	rpm	8000	—
	Rated torque (1)	M_n	Nm	0.36	—
	Rated power	P_n	kW	0.30	—
U_N = 400 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 480 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
	Peak current	I_{0max}	A	5.93	9.6
	Peak torque	M_{0max}	Nm	1.46	1.44
	Torque constant	K_{Trms}	Nm / A	0.28	0.17
	Voltage constant	K_{Erms}	mVmin	17.9	10.9
	Winding resistance Ph-Ph	R25	Ω	13.5	5.4
	Winding inductance Ph-Ph	L	mH	10.3	3.8
Mechanical data					
	Rotor moment of inertia	J	kgcm²	0.045	
	Number of poles	--	--	6	
	Static friction torque	M_R	Nm	0.0031	
	Thermal time constant	t_{TH}	min	7	
	Weight (standard)	G	kg	0.63	
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	30	
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	12	

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Connections and cables

Connector	AKM1
Power connection:	4 + 4-pole, round, 0.5 m at cable end
Motor cable, shielded	4 x 1
Motor cable with control leads, shielded	4 x 1 + 2 x 0.75
Resolver connection	12-pole, round, 0.5 m at cable end
Resolver cable, shielded	4 x 2 x 0.25 mm²

Connector	AKM1
Encoder connection (option)	17-pole, round, 0.5 m at cable end

Radial forces / axial forces at the shaft end

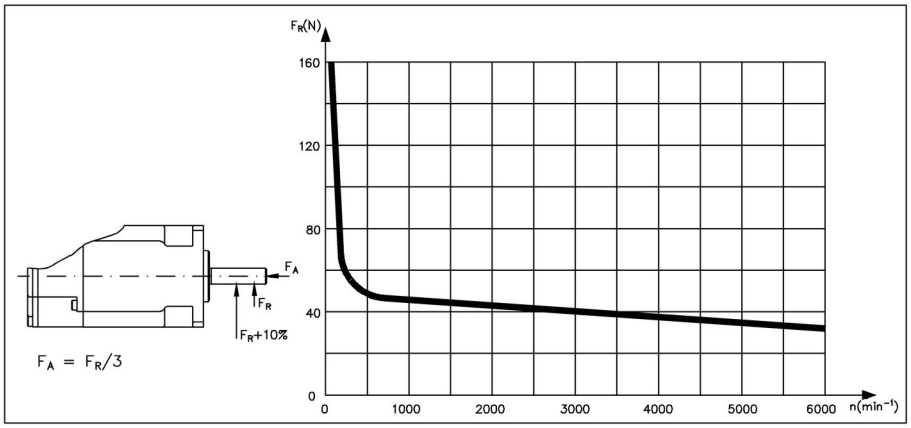


Fig. 4: Radial forces / axial forces at the shaft endAKM1

10.2 AKM2

Technical data		Symbol	Unit	AKM21x		
				21C	21E	21G
Electrical data						
	Standstill torque (1)	M_0	Nm	0.48	0.50	0.50
	Standstill current	I_{0rms}	A	1.58	3.11	4.87
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	2000	4000
	Rated torque (1)	M_n	Nm	—	0.48	0.46
	Rated power	P_n	kW	—	0.10	0.19
U_N = 115 V	Rated speed	n_n	rpm	2500	7000	—
	Rated torque (1)	M_n	Nm	0.46	0.41	—
	Rated power	P_n	kW	0.12	0.30	—
U_N = 230 V	Rated speed	n_n	rpm	8000	—	—
	Rated torque (1)	M_n	Nm	0.39	—	—
	Rated power	P_n	kW	0.32	—	—
U_N = 400 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 480 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
	Peak current	I_{0max}	A	6.3	12.4	19.5
	Peak torque	M_{0max}	Nm	1.47	1.49	1.51
	Torque constant	K_{Trms}	Nm / A	0.30	0.16	0.10

Technical data		Symbol	Unit	AKM21x		
				21C	21E	21G
	Voltage constant	K_{Erms}	mVmin	19.5	10.2	6.6
	Winding resistance Ph-Ph	R25	Ω	13.0	3.42	1.44
	Winding inductance Ph-Ph	L	mH	19	5.2	2.18
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.11		
	Number of poles	--	--	6		
	Static friction torque	M_R	Nm	0.002		
	Thermal time constant	t_{TH}	min	8		
	Weight (standard)	G	kg	0.82		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	145		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	60		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM22x		
				22C	22E	22G
Electrical data						
	Standstill torque (1)	M_0	Nm	0.84	0.87	0.88
	Standstill current	I_{0rms}	A	1.39	2.73	4.82
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	1000	2500
	Rated torque (1)	M_n	Nm	—	0.85	0.83
	Rated power	P_n	kW	—	0.09	0.22
U_N = 115 V	Rated speed	n_n	rpm	1000	3500	7000
	Rated torque (1)	M_n	Nm	0.83	0.81	0.74
	Rated power	P_n	kW	0.09	0.30	0.54
U_N = 230 V	Rated speed	n_n	rpm	3500	8000	—
	Rated torque (1)	M_n	Nm	0.78	0.70	—
	Rated power	P_n	kW	0.29	0.59	—
U_N = 400 V	Rated speed	n_n	rpm	8000	—	—
	Rated torque (1)	M_n	Nm	0.68	—	—
	Rated power	P_n	kW	0.57	—	—
U_N = 480 V	Rated speed	n_n	rpm	8000	—	—
	Rated torque (1)	M_n	Nm	0.68	—	—
	Rated power	P_n	kW	0.57	—	—
	Peak current	I_{0max}	A	5.6	10.9	19.3
	Peak torque	M_{0max}	Nm	2.73	2.76	2.79
	Torque constant	K_{Trms}	Nm / A	0.61	0.32	0.18
	Voltage constant	K_{Erms}	mVmin	39	20.4	11.7
	Winding resistance Ph-Ph	R25	Ω	20	5.22	1.69
	Winding inductance Ph-Ph	L	mH	35.5	9.7	3.19
Mechanical data						

Technical data		Symbol	Unit	AKM22x		
				22C	22E	22G
	Rotor moment of inertia	J	kgcm²	0.16		
	Number of poles	--	--	6		
	Static friction torque	M_R	Nm	0.005		
	Thermal time constant	t_{TH}	min	9		
	Weight (standard)	G	kg	1.1		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	145		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	60		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM23x		
				23C	23D	23F
Electrical data						
	Standstill torque (1)	M_0	Nm	1.13	1.16	1.18
	Standstill current	I_{0rms}	A	1.41	2.19	4.31
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	1500
	Rated torque (1)	M_n	Nm	—	—	1.15
	Rated power	P_n	kW	—	—	0.18
U_N = 115 V	Rated speed	n_n	rpm	1000	1500	4500
	Rated torque (1)	M_n	Nm	1.11	1.12	1.07
	Rated power	P_n	kW	0.12	0.18	0.50
U_N = 230 V	Rated speed	n_n	rpm	2500	5000	8000
	Rated torque (1)	M_n	Nm	1.08	1.03	0.94
	Rated power	P_n	kW	0.28	0.54	0.79
U_N = 400 V	Rated speed	n_n	rpm	5500	8000	—
	Rated torque (1)	M_n	Nm	0.99	0.92	—
	Rated power	P_n	kW	0.57	0.77	—
U_N = 480 V	Rated speed	n_n	rpm	7000	8000	—
	Rated torque (1)	M_n	Nm	0.95	0.92	—
	Rated power	P_n	kW	0.70	0.77	—
	Peak current	I_{0max}	A	5.6	8.8	17.2
	Peak torque	M_{0max}	Nm	3.77	3.84	3.88
	Torque constant	K_{Trms}	Nm / A	0.80	0.52	0.27
	Voltage constant	K_{Erms}	mVmin	51.8	33.8	17.6
	Winding resistance Ph-Ph	R25	Ω	21.2	8.77	2.34
	Winding inductance Ph-Ph	L	mH	40.7	17.3	4.68
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.22		
	Number of poles	--	--	6		
	Static friction torque	M_R	Nm	0.007		
	Thermal time constant	t_{TH}	min	10		

Technical data		Symbol	Unit	AKM23x		
				23C	23D	23F
	Weight (standard)	G	kg	1.38		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	145		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	60		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM24x		
				24C	24D	24F
Electrical data						
	Standstill torque (1)	M_0	Nm	1.38	1.41	1.42
	Standstill current	I_{0rms}	A	1.42	2.21	3.89
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	1000
	Rated torque (1)	M_n	Nm	—	—	1.39
	Rated power	P_n	kW	—	—	0.15
U_N = 115 V	Rated speed	n_n	rpm	—	1500	3000
	Rated torque (1)	M_n	Nm	—	1.36	1.33
	Rated power	P_n	kW	—	0.21	0.42
U_N = 230 V	Rated speed	n_n	rpm	2000	4000	8000
	Rated torque (1)	M_n	Nm	1.32	1.29	1.12
	Rated power	P_n	kW	0.28	0.54	0.94
U_N = 400 V	Rated speed	n_n	rpm	4500	8000	—
	Rated torque (1)	M_n	Nm	1.25	1.11	—
	Rated power	P_n	kW	0.59	0.93	—
U_N = 480 V	Rated speed	n_n	rpm	5500	8000	—
	Rated torque (1)	M_n	Nm	1.22	1.11	—
	Rated power	P_n	kW	0.70	0.93	—
	Peak current	I_{0max}	A	5.7	8.8	15.6
	Peak torque	M_{0max}	Nm	4.73	4.76	4.82
	Torque constant	K_{Trms}	Nm / A	0.97	0.63	0.36
	Voltage constant	K_{Erms}	mVmin	62.4	40.8	23.4
	Winding resistance Ph-Ph	R25	Ω	20.4	9.02	2.77
	Winding inductance Ph-Ph	L	mH	43.8	18.7	6.16
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.27		
	Number of poles	--	--	6		
	Static friction torque	M_R	Nm	0.01		
	Thermal time constant	t_{TH}	min	11		
	Weight (standard)	G	kg	1.66		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	145		

Technical data		Symbol	Unit	AKM24x		
				24C	24D	24F
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	60		

(1) --Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	1.42
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	8.4
Moment of inertia	J_{BR} [kgcm²]	0.011
Release delay time	t_{BRH} [ms]	20
Application delay time	t_{BRL} [ms]	18
Weight of the brake	G_{BR} [kg]	0.27
Typical backlash	[°mech.]	0.46

Connections and cables

Connector	AKM2
Power connection:	4 + 4-pole, round, angular
Motor cable, shielded	4 x 1
Motor cable with control leads, shielded	4 x 1 + 2 x 0.75
Resolver connection	12-pole, round, angular
Resolver cable, shielded	4 x 2 x 0.25 mm²
Encoder connection (option)	17-pole, round
Encoder cable, shielded	8 x 2 x 0.25 mm²

10

Radial forces / axial forces at the shaft end

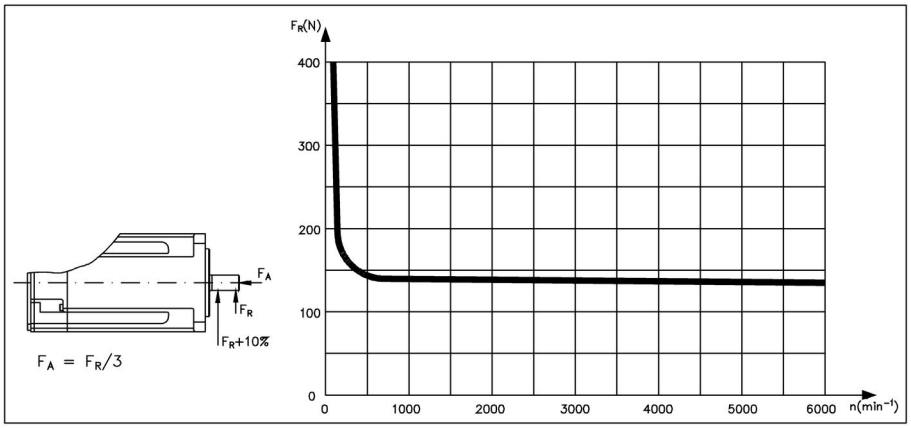


Fig. 5: Radial forces / axial forces at the shaft endAKM2

10.3 AKM3

Technical data		Symbol	Unit	AKM31x		
				31C	31E	31H
Electrical data						
	Standstill torque (1)	M_0	Nm	1.15	1.20	1.23
	Standstill current	I_{0rms}	A	1.37	2.99	5.85
	Max. rated mains voltage	U_N	VAC		480	
U = 75 V_{DC}	Rated speed	n_n	rpm	—	750	2000
	Rated torque (1)	M_n	Nm	—	1.19	1.20
	Rated power	P_n	kW	—	0.09	0.25
U_N = 115 V	Rated speed	n_n	rpm	—	2500	7000
	Rated torque (1)	M_n	Nm	—	1.17	0.97
	Rated power	P_n	kW	—	0.31	0.61
U_N = 230 V	Rated speed	n_n	rpm	2500	6000	—
	Rated torque (1)	M_n	Nm	1.12	0.95	—
	Rated power	P_n	kW	0.29	0.60	—
U_N = 400 V	Rated speed	n_n	rpm	5000	—	—
	Rated torque (1)	M_n	Nm	1.00	—	—
	Rated power	P_n	kW	0.52	—	—
U_N = 480 V	Rated speed	n_n	rpm	6000	—	—
	Rated torque (1)	M_n	Nm	0.91	—	—
	Rated power	P_n	kW	0.57	—	—
	Peak current	I_{0max}	A	5.5	12.0	23.4
	Peak torque	M_{0max}	Nm	3.88	4.00	4.06
	Torque constant	K_{Trms}	Nm / A	0.85	0.41	0.21
	Voltage constant	K_{Erms}	mVmin	54.5	26.1	13.7
	Winding resistance Ph-Ph	R25	Ω	21.4	4.74	1.29
	Winding inductance Ph-Ph	L	mH	37.5	8.6	2.4
Mechanical data						
	Rotor moment of inertia	J	kgcm²		0.33	
	Number of poles	--	--		8	
	Static friction torque	M_R	Nm			
	Thermal time constant	t_{TH}	min		0.014	
	Weight (standard)	G	kg		1.55	
	Admissible radial load at shaft end at 8,000 rpm	F_R	N		195	
	Admissible axial load at shaft end at 8,000 rpm	F_A	N		65	

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM32x		
				32C	32D	32H
Electrical data						
	Standstill torque (1)	M_0	Nm	2.00	2.04	2.10

Technical data		Symbol	Unit	AKM32x		
				32C	32D	32H
	Standstill current	I_{0rms}	A	1.44	2.23	5.50
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	1200
	Rated torque (1)	M_n	Nm	—	—	2.06
	Rated power	P_n	kW	—	—	0.26
U_N = 115 V	Rated speed	n_n	rpm	—	1000	3000
	Rated torque (1)	M_n	Nm	—	2.00	1.96
	Rated power	P_n	kW	—	0.21	0.62
U_N = 230 V	Rated speed	n_n	rpm	1500	2500	7000
	Rated torque (1)	M_n	Nm	1.95	1.93	1.45
	Rated power	P_n	kW	0.31	0.51	1.06
U_N = 400 V	Rated speed	n_n	rpm	3000	5500	—
	Rated torque (1)	M_n	Nm	1.86	1.65	—
	Rated power	P_n	kW	0.58	0.95	—
U_N = 480 V	Rated speed	n_n	rpm	3500	6000	—
	Rated torque (1)	M_n	Nm	1.83	1.58	—
	Rated power	P_n	kW	0.67	0.99	—
	Peak current	I_{0max}	A	5.7	8.9	22.0
	Peak torque	M_{0max}	Nm	6.92	7.05	7.26
	Torque constant	K_{Trms}	Nm / A	1.40	0.92	0.39
	Voltage constant	K_{Erms}	mVmin	89.8	59.0	24.8
	Winding resistance Ph-Ph	R25	Ω	23.8	10.3	1.69
	Winding inductance Ph-Ph	L	mH	46.5	20.1	3.55
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.59		
	Number of poles	--	--	8		
	Static friction torque	M_R	Nm	0.02		
	Thermal time constant	t_{TH}	min	17		
	Weight (standard)	G	kg	2.23		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	195		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	65		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM33x		
				33C	33E	33H
Electrical data						
	Standstill torque (1)	M_0	Nm	2.71	2.79	2.88
	Standstill current	I_{0rms}	A	1.47	2.58	5.62
	Max. rated mains voltage	U_N	VAC	480		

Technical data		Symbol	Unit	AKM33x		
				33C	33E	33H
$U = 75\ V_{DC}$	Rated speed	n_n	rpm	—	—	800
	Rated torque (1)	M_n	Nm	—	—	2.82
	Rated power	P_n	kW	—	—	0.24
$U_N = 115\ V$	Rated speed	n_n	rpm	—	—	2500
	Rated torque (1)	M_n	Nm	—	—	2.66
	Rated power	P_n	kW	—	—	0.70
$U_N = 230\ V$	Rated speed	n_n	rpm	1000	2000	5500
	Rated torque (1)	M_n	Nm	2.64	2.62	2.27
	Rated power	P_n	kW	0.28	0.55	1.31
$U_N = 400\ V$	Rated speed	n_n	rpm	2000	4500	—
	Rated torque (1)	M_n	Nm	2.54	2.34	—
	Rated power	P_n	kW	0.53	1.10	—
$U_N = 480\ V$	Rated speed	n_n	rpm	2500	5000	—
	Rated torque (1)	M_n	Nm	2.50	2.27	—
	Rated power	P_n	kW	0.65	1.19	—
	Peak current	I_{0max}	A	5.9	10.3	22.5
	Peak torque	M_{0max}	Nm	9.76	9.96	10.2
	Torque constant	K_{Trms}	Nm / A	1.86	1.10	0.52
	Voltage constant	K_{Erms}	mVmin	120	70.6	33.4
	Winding resistance Ph-Ph	R25	Ω	22.6	9.01	1.96
	Winding inductance Ph-Ph	L	mH	53.6	18.5	4.1
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.85		
	Number of poles	--	--	8		
	Static friction torque	M_R	Nm	0.026		
	Thermal time constant	t_{TH}	min	20		
	Weight (standard)	G	kg	2.9		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	195		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	65		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	2.5
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	10.1
Moment of inertia	J_{BR} [kgcm²]	0.011
Release delay time	t_{BRH} [ms]	25
Application delay time	t_{BRL} [ms]	10
Weight of the brake	G_{BR} [kg]	0.35
Typical backlash	[°mech.]	0.46

Connections and cables

Connector	AKM3
Power connection:	4 + 4-pole, round, angular
Motor cable, shielded	4 x 1
Motor cable with control leads, shielded	4 x 1 + 2 x 0.75
Resolver connection	12-pole, round, angular
Resolver cable, shielded	4 x 2 x 0.25 mm²
Encoder connection (option)	17-pole, round
Encoder cable, shielded	8 x 2 x 0.25 mm²

Radial forces / axial forces at the shaft end

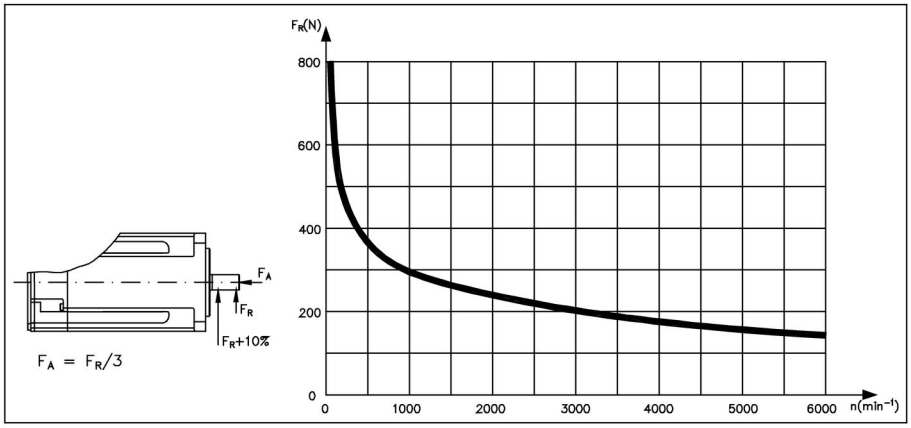


Fig. 6: Radial forces / axial forces at the shaft endAKM3

10.4 AKM4

10

NOTICE

Risk of damage to the motor

Notes for AKM-motors with standstill currents of I_0 > 6 A_{rms}

Motors with a standstill current of I_0 > 6 A_{rms} shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

Technical data	Symbol	Unit	AKM41x		
			41C	41E	41H
Electrical data					
Standstill torque (1)	M_0	Nm	1.95	2.02	2.06
Standstill current	I_{0rms}	A	1.46	2.85	5.60
Max. rated mains voltage	U_N	VAC	480		

Technical data		Symbol	Unit	AKM41x		
				41C	41E	41H
$U = 75\ V_{DC}$	Rated speed	n_n	rpm	—	—	1000
	Rated torque (1)	M_n	Nm	—	—	1.99
	Rated power	P_n	kW	—	—	0.21
$U_N = 115\ V$	Rated speed	n_n	rpm	—	1200	3000
	Rated torque (1)	M_n	Nm	—	1.94	1.86
	Rated power	P_n	kW	—	0.24	0.58
$U_N = 230\ V$	Rated speed	n_n	rpm	1200	3000	6000
	Rated torque (1)	M_n	Nm	1.88	1.82	1.62
	Rated power	P_n	kW	0.24	0.57	1.02
$U_N = 400\ V$	Rated speed	n_n	rpm	3000	6000	—
	Rated torque (1)	M_n	Nm	1.77	1.58	—
	Rated power	P_n	kW	0.56	0.99	—
$U_N = 480\ V$	Rated speed	n_n	rpm	3500	6000	—
	Rated torque (1)	M_n	Nm	1.74	1.58	—
	Rated power	P_n	kW	0.64	0.99	—
	Peak current	I_{0max}	A	5.8	11.4	22.4
	Peak torque	M_{0max}	Nm	6.12	6.28	6.36
	Torque constant	K_{Trms}	Nm / A	1.34	0.71	0.37
	Voltage constant	K_{Erms}	mVmin	86.3	45.6	23.7
	Winding resistance Ph-Ph	R25	Ω	21.3	6.02	1.56
	Winding inductance Ph-Ph	L	mH	66.1	18.4	5.0
Mechanical data						
	Rotor moment of inertia	J	kgcm²	0.81		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.014		
	Thermal time constant	t_{TH}	min	13		
	Weight (standard)	G	kg	2.44		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	450		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	180		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

NOTICE

Risk of damage to the motor

Notes for AKM-motors with standstill currents of $I_0 > 6\ A_{rms}$

Motors with a standstill current of $I_0 > 6\ A_{rms}$ shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

Technical data		Symbol	Unit	AKM42x			
				42C	42E	42G	42J
Electrical data							
	Standstill torque (1)	M_0	Nm	3.35	3.42	3.53	3.56
	Standstill current	I_{0rms}	A	1.40	2.74	4.80	! 8.40
	Max. rated mains voltage	U_N	VAC	480			
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—	3000
	Rated torque (1)	M_n	Nm	—	—	—	3.03
	Rated power	P_n	kW	—	—	—	0.95
U_N = 230 V	Rated speed	n_n	rpm	—	1800	3500	6000
	Rated torque (1)	M_n	Nm	—	3.12	2.90	2.38
	Rated power	P_n	kW	—	0.59	1.06	1.50
U_N = 400 V	Rated speed	n_n	rpm	1500	3500	6000	—
	Rated torque (1)	M_n	Nm	3.10	2.81	2.35	—
	Rated power	P_n	kW	0.49	1.03	1.48	—
U_N = 480 V	Rated speed	n_n	rpm	2000	4000	6000	—
	Rated torque (1)	M_n	Nm	3.02	2.72	2.35	—
	Rated power	P_n	kW	0.63	1.14	1.48	—
	Peak current	I_{0max}	A	5.61	11.0	19.2	33.7
	Peak torque	M_{0max}	Nm	11.1	11.3	11.5	11.6
	Torque constant	K_{Trms}	Nm / A	2.40	1.26	0.74	0.43
	Voltage constant	K_{Erms}	mVmin	154	80.9	47.5	27.5
	Winding resistance Ph-Ph	R25	Ω	27.5	7.78	2.51	0.80
	Winding inductance Ph-Ph	L	mH	97.4	26.8	9.2	3.1
Mechanical data							
	Rotor moment of inertia	J	kgcm²	1.5			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.026			
	Thermal time constant	t_{TH}	min	17			
	Weight (standard)	G	kg	3.39			
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	450			
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	180			

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

NOTICE

Risk of damage to the motor

Notes for AKM-motors with standstill currents of I_0 > 6 A_{rms}

Motors with a standstill current of I_0 > 6 A_{rms} shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

Technical data		Symbol	Unit	AKM43x		
				43E	43G	43K
Electrical data						
	Standstill torque (1)	M_0	Nm	4.70	4.80	4.90
	Standstill current	I_{0rms}	A	2.76	4.87	! 9.60
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	2500
	Rated torque (1)	M_n	Nm	—	—	1.08
	Rated power	P_n	kW	—	—	1.07
U_N = 230 V	Rated speed	n_n	rpm	1500	2500	6000
	Rated torque (1)	M_n	Nm	4.24	4.00	2.62
	Rated power	P_n	kW	0.67	1.05	1.65
U_N = 400 V	Rated speed	n_n	rpm	2500	5000	—
	Rated torque (1)	M_n	Nm	3.92	3.01	—
	Rated power	P_n	kW	1.03	1.58	—
U_N = 480 V	Rated speed	n_n	rpm	3000	6000	—
	Rated torque (1)	M_n	Nm	3.76	2.57	—
	Rated power	P_n	kW	1.18	1.61	—
	Peak current	I_{0max}	A	11.0	19.5	38.3
	Peak torque	M_{0max}	Nm	15.9	16.1	16.3
	Torque constant	K_{Trms}	Nm / A	1.72	0.99	0.52
	Voltage constant	K_{Erms}	mVmin	111	63.9	33.2
	Winding resistance Ph-Ph	R25	Ω	8.61	2.61	0.74
	Winding inductance Ph-Ph	L	mH	32.6	10.8	2.9
Mechanical data						
	Rotor moment of inertia	J	kgcm²	2.1		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.038		

Technical data		Symbol	Unit	AKM43x		
				43E	43G	43K
	Thermal time constant	t_{TH}	min	20		
	Weight (standard)	G	kg	4.35		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	450		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	180		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

NOTICE

Risk of damage to the motor

Notes for AKM-motors with standstill currents of I_0 > 6 A_{rms}

Motors with a standstill current of I_0 > 6 A_{rms} shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

Technical data		Symbol	Unit	AKM44x		
				44E	44G	44J
Electrical data						
	Standstill torque (1)	M_0	Nm	5.76	5.88	6.00
	Standstill current	I_{0rms}	A	2.90	5.00	! 8.80
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	1200	2000	4000
	Rated torque (1)	M_n	Nm	5.22	4.90	3.84
	Rated power	P_n	kW	0.66	1.03	1.31
U_N = 400 V	Rated speed	n_n	rpm	2000	4000	6000
	Rated torque (1)	M_n	Nm	4.80	3.76	2.75
	Rated power	P_n	kW	1.01	1.57	1.73
U_N = 480 V	Rated speed	n_n	rpm	2500	5000	6000
	Rated torque (1)	M_n	Nm	4.56	3.19	2.75
	Rated power	P_n	kW	1.19	1.67	1.73
	Peak current	I_{0max}	A	11.4	20.0	35.2
	Peak torque	M_{0max}	Nm	19.9	20.2	20.4

Technical data		Symbol	Unit	AKM44x		
				44E	44G	44J
	Torque constant	K_{Trms}	Nm / A	2.04	1.19	0.69
	Voltage constant	K_{Erms}	mVmin	132	76.6	44.2
	Winding resistance Ph-Ph	R25	Ω	8.08	2.80	0.94
	Winding inductance Ph-Ph	L	mH	33.9	11.5	3.8
Mechanical data						
	Rotor moment of inertia	J	kgcm²	2.7		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.05		
	Thermal time constant	t_{TH}	min	24		
	Weight (standard)	G	kg	5.3		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	450		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	180		

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	6
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	12.8
Moment of inertia	J_{BR} [kgcm²]	0.068
Release delay time	t_{BRH} [ms]	35
Application delay time	t_{BRL} [ms]	15
Weight of the brake	G_{BR} [kg]	0.63
Typical backlash	[°mech.]	0.37

Connections and cables

Connector	AKM4
Power connection:	4 + 4-pole, round, angular
Motor cable, shielded	4 x 1.5
Motor cable with control leads, shielded	4 x 1.5 + 2 x 0.75
Resolver connection	12-pole, round, angular
Resolver cable, shielded	4 x 2 x 0.25 mm²
Encoder connection (option)	17-pole, round
Encoder cable, shielded	8 x 2 x 0.25 mm²

Radial forces / axial forces at the shaft end

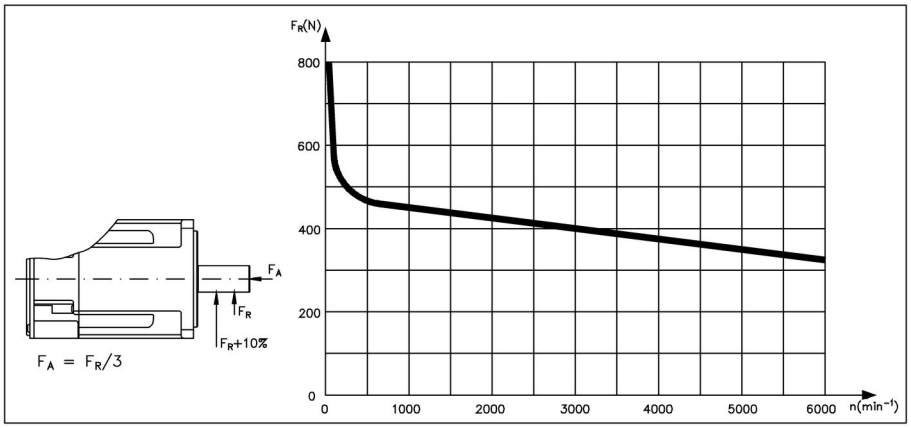


Fig. 7: Radial forces / axial forces at the shaft endAKM4

10.5 AKM5

Technical data		Symbol	Unit	AKM51x		
				51E	51G	51K
Electrical data						
	Standstill torque (1)	M_0	Nm	4.70	4.75	4.90
	Standstill current	I_{0rms}	A	2.75	4.84	9.40
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	2500
	Rated torque (1)	M_n	Nm	—	—	4.15
	Rated power	P_n	kW	—	—	1.09
U_N = 230 V	Rated speed	n_n	rpm	1200	2500	5500
	Rated torque (1)	M_n	Nm	4.41	4.02	2.35
	Rated power	P_n	kW	0.55	1.05	1.35
U_N = 400 V	Rated speed	n_n	rpm	2500	5000	—
	Rated torque (1)	M_n	Nm	3.98	2.62	—
	Rated power	P_n	kW	1.04	1.37	—
U_N = 480 V	Rated speed	n_n	rpm	3000	6000	—
	Rated torque (1)	M_n	Nm	3.80	1.94	—
	Rated power	P_n	kW	1.19	1.22	—
	Peak current	I_{0max}	A	8.24	14.5	28.3
	Peak torque	M_{0max}	Nm	11.6	11.7	12.0
	Torque constant	K_{Trms}	Nm / A	1.72	0.99	0.52
	Voltage constant	K_{Erms}	mVmin	110	63.6	33.5
	Winding resistance Ph-Ph	R25	Ω	8.98	2.75	0.75
	Winding inductance Ph-Ph	L	mH	36.6	12.1	3.40

Technical data		Symbol	Unit	AKM51x		
				51E	51G	51K
Mechanical data						
	Rotor moment of inertia	J	kgcm²	3.4		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.022		
	Thermal time constant	t_{TH}	min	20		
	Weight (standard)	G	kg	4.2		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	450		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	180		

(1) Reference flange of aluminum 305 mm * 305 mm * 12.7 mm

Technical data		Symbol	Unit	AKM52x			
				52E	52G	52K	52M
Electrical data							
	Standstill torque (1)	M_0	Nm	8.34	4.43	8.60	8.60
	Standstill current	I_{0rms}	A	2.99	4.72	9.3	13.1
	Max. rated mains voltage	U_N	VAC	480			
$U = 75\ V_{DC}$	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
$U_N = 115$ V	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
$U_N = 230$ V	Rated speed	n_n	rpm	—	1500	3000	4500
	Rated torque (1)	M_n	Nm	—	7.69	6.80	5.20
	Rated power	P_n	kW	—	1.21	2.14	2.45
$U_N = 400$ V	Rated speed	n_n	rpm	1500	2500	5500	—
	Rated torque (1)	M_n	Nm	7.61	7.06	3.90	—
	Rated power	P_n	kW	1.20	1.85	2.25	—
$U_N = 480$ V	Rated speed	n_n	rpm	2000	3000	6000	—
	Rated torque (1)	M_n	Nm	7.28	6.66	3.25	—
	Rated power	P_n	kW	1.52	2.09	2.04	—
	Peak current	I_{0max}	A	9.00	14.2	27.8	39.4
	Peak torque	M_{0max}	Nm	21.3	21.5	21.9	21.9
	Torque constant	K_{Trms}	Nm / A	2.79	1.79	0.93	0.66
	Voltage constant	K_{Erms}	mVmin	179	115	60.1	42.4
	Winding resistance Ph-Ph	R25	Ω	8.96	3.70	0.96	0.49
	Winding inductance Ph-Ph	L	mH	44.7	18.5	5.00	2.50
Mechanical data							
	Rotor moment of inertia	J	kgcm²	6.2			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.04			

Technical data		Symbol	Unit	AKM52x			
				52E	52G	52K	52M
	Thermal time constant	t_{TH}	min	24			
	Weight (standard)	G	kg	5.8			
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	450			
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	180			

(1) Reference flange of aluminum 305 mm * 305 mm * 12.7 mm

Technical data		Symbol	Unit	AKM53x			
				53G	53K	53M	53P
Electrical data							
	Standstill torque (1)	M_0	Nm	11.4	11.6	11.4	11.4
	Standstill current	I_{0rms}	A	4.77	9.4	13.4	19.1
	Max. rated mains voltage	U_N	VAC	480			
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	1000	2000	3000	5000
	Rated torque (1)	M_n	Nm	10.7	10.1	8.72	5.86
	Rated power	P_n	kW	1.12	2.12	2.74	3.08
U_N = 400 V	Rated speed	n_n	rpm	2000	4000	—	—
	Rated torque (1)	M_n	Nm	9.85	7.65	—	—
	Rated power	P_n	kW	2.06	3.20	—	—
U_N = 480 V	Rated speed	n_n	rpm	2400	4500	—	—
	Rated torque (1)	M_n	Nm	9.50	6.85	—	—
	Rated power	P_n	kW	2.39	3.23	—	—
	Peak current	I_{0max}	A	14.3	28.1	40.3	57.4
	Peak torque	M_{0max}	Nm	29.7	30.1	29.8	29.8
	Torque constant	K_{Trms}	Nm / A	2.39	1.24	0.85	0.60
	Voltage constant	K_{Erms}	mVmin	154	79.8	54.7	38.4
	Winding resistance Ph-Ph	R25	Ω	3.97	1.06	0.51	0.28
	Winding inductance Ph-Ph	L	mH	21.3	5.70	2.70	1.30
Mechanical data							
	Rotor moment of inertia	J	kgcm²	9.1			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.058			
	Thermal time constant	t_{TH}	min	28			
	Weight (standard)	G	kg	7.4			
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	450			

Technical data		Symbol	Unit	AKM53x			
				53G	53K	53M	53P
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	180			

(1) Reference flange of aluminum 305 mm * 305 mm * 12.7 mm

Technical data		Symbol	Unit	AKM54x			
				54G	54K	54L	54N
Electrical data							
	Standstill torque (1)	M_0	Nm	14.3	14.4	14.1	14.1
	Standstill current	I_{0rms}	A	5.0	9.7	12.5	17.8
	Max. rated mains voltage	U_N	VAC	480			
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	—	1800	2500	3500
	Rated torque (1)	M_n	Nm	—	12.7	11.5	9.85
	Rated power	P_n	kW	—	2.39	3.00	3.61
U_N = 400 V	Rated speed	n_n	rpm	1500	3500	4500	—
	Rated torque (1)	M_n	Nm	12.9	10.0	8.13	—
	Rated power	P_n	kW	2.03	3.68	3.83	—
U_N = 480 V	Rated speed	n_n	rpm	2000	4000	—	—
	Rated torque (1)	M_n	Nm	12.3	9.25	—	—
	Rated power	P_n	kW	2.57	3.87	—	—
	Peak current	I_{0max}	A	14.9	29.2	37.5	53.4
	Peak torque	M_{0max}	Nm	37.8	38.4	37.5	37.6
	Torque constant	K_{Trms}	Nm / A	2.88	1.50	1.13	0.80
	Voltage constant	K_{Erms}	mVmin	185	96.6	72.9	51.3
	Winding resistance Ph-Ph	R25	Ω	4.08	1.08	0.65	0.33
	Winding inductance Ph-Ph	L	mH	22.9	6.20	3.50	1.80
Mechanical data							
	Rotor moment of inertia	J	kgcm²	12			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.077			
	Thermal time constant	t_{TH}	min	31			
	Weight (standard)	G	kg	9			
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	450			
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	180			

(1) Reference flange of aluminum 305 mm * 305 mm * 12.7 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	14.5
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	19.5
Moment of inertia	J_{BR} [kgcm²]	0.173
Release delay time	t_{BRH} [ms]	80
Application delay time	t_{BRL} [ms]	15
Weight of the brake	G_{BR} [kg]	1.1
Typical backlash	[°mech.]	0.31

Connections and cables

Connector	AKM5	
Power connection:	4 + 4-pole, round, angular	
Motor cable, shielded	4 x 1.5	4 x 2.5
Motor cable with control leads, shielded	4 x 1.5 + 2 x 0.75	4 x 2.5 + 2 x 1
Resolver connection	12-pole, round, angular	
Resolver cable, shielded	4 x 2 x 0.25 mm²	
Encoder connection (option)	17-pole, round	
Encoder cable, shielded	8 x 2 x 0.25 mm²	

Radial forces / axial forces at the shaft end

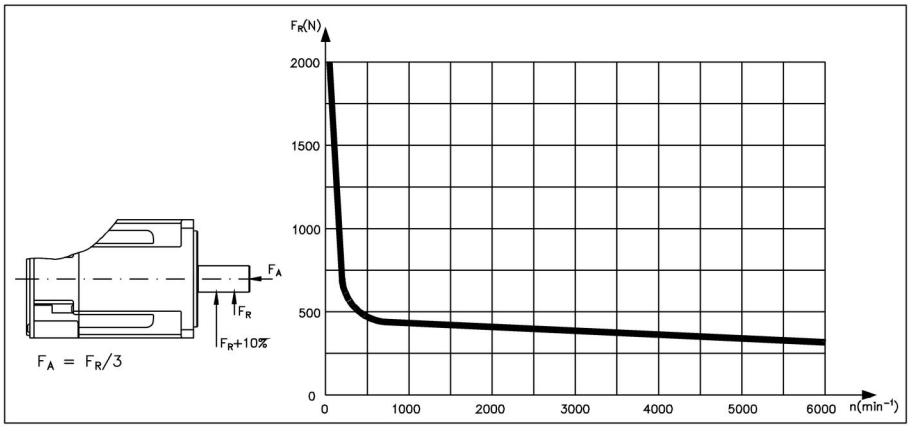


Fig. 8: Radial forces / axial forces at the shaft endAKM5

10.6 AKM6

Technical data	Symbol	Unit	AKM62x			
			62G	62K	62M	62P
Electrical data						
Standstill torque (1)	M_0	Nm	11.9	12.2	12.2	12.3
Standstill current	I_{0rms}	A	4.9	9.6	13.4	18.8
Max. rated mains voltage	U_N	VAC	230-480			

Technical data		Symbol	Unit	AKM62x			
				62G	62K	62M	62P
$U = 75\ V_{DC}$	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
$U_N = 115$ V	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
$U_N = 230$ V	Rated speed	n_n	rpm	—	2000	3000	4500
	Rated torque (1)	M_n	Nm	—	10.4	9.50	8.10
	Rated power	P_n	kW	—	2.18	2.98	3.82
$U_N = 400$ V	Rated speed	n_n	rpm	1800	3500	6000	—
	Rated torque (1)	M_n	Nm	10.4	9.00	5.70	—
	Rated power	P_n	kW	1.96	3.30	3.58	—
$U_N = 480$ V	Rated speed	n_n	rpm	2000	4500	6000	—
	Rated torque (1)	M_n	Nm	10.2	8.00	5.70	—
	Rated power	P_n	kW	2.14	3.77	3.58	—
	Peak current	I_{0max}	A	14.6	28.7	40.3	56.5
	Peak torque	M_{0max}	Nm	29.8	30.1	30.2	30.4
	Torque constant	K_{Trms}	Nm / A	2.47	1.28	0.91	0.66
	Voltage constant	K_{Erms}	mVmin	159	82.1	58.8	42.2
	Winding resistance Ph-Ph	R25	Ω	4.13	1.08	0.57	0.30
	Winding inductance Ph-Ph	L	mH	31.7	8.5	4.4	2.2
Mechanical data							
	Rotor moment of inertia	J	kgcm²	17			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.05			
	Thermal time constant	t_{TH}	min	20			
	Weight (standard)	G	kg	8.9			
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	770			
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	280			

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM63x				
				63G	63K	63M	63N	63S
Electrical data								
	Standstill torque (1)	M_0	Nm	16.5	16.8	17.0	17.0	16.7
	Standstill current	I_{0rms}	A	4.5	9.9	13.8	17.4	22.4
	Max. rated mains voltage	U_N	VAC	230-480				

Technical data		Symbol	Unit	AKM63x				
				63G	63K	63M	63N	63S
$U = 75\ V_{DC}$	Rated speed	n_n	rpm	—	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—	—
	Rated power	P_n	kW	—	—	—	—	—
$U_N = 115\ V$	Rated speed	n_n	rpm	—	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—	—
	Rated power	P_n	kW	—	—	—	—	—
$U_N = 230\ V$	Rated speed	n_n	rpm	—	1500	2000	3000	4000
	Rated torque (1)	M_n	Nm	—	14.9	14.3	13.0	11.0
	Rated power	P_n	kW	—	2.34	2.99	4.08	4.66
$U_N = 400\ V$	Rated speed	n_n	rpm	1200	3000	4000	5000	—
	Rated torque (1)	M_n	Nm	14.9	12.9	11.3	9.60	—
	Rated power	P_n	kW	1.87	4.05	4.73	5.03	—
$U_N = 480\ V$	Rated speed	n_n	rpm	1500	3500	4500	6000	—
	Rated torque (1)	M_n	Nm	14.6	12.0	10.5	7.00	—
	Rated power	P_n	kW	2.29	4.40	4.95	4.40	—
	Peak current	I_{0max}	A	13.4	29.7	41.4	52.2	50.0
	Peak torque	M_{0max}	Nm	41.8	42.6	43.0	43.0	36.0
	Torque constant	K_{Trms}	Nm / A	3.70	1.71	1.24	0.98	0.744
	Voltage constant	K_{Erms}	mVmin	238	110	79.9	63.3	48.3
	Winding resist-ance Ph-Ph	R25	Ω	5.50	1.14	0.61	0.39	0.25
	Winding induc-tance Ph-Ph	L	mH	43.5	9.3	4.9	3.1	1.8
Mechanical data								
	Rotor moment of inertia	J	kgcm²	24				
	Number of poles	--	--	10				
	Static friction torque	M_R	Nm	0.1				
	Thermal time constant	t_{TH}	min	25				
	Weight (standard)	G	kg	11.1				
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	770				
	Adm. radial load at shaft	F_A	N	280				

10

Technical data		Symbol	Unit	AKM63x				
				63G	63K	63M	63N	63S
	end at 8,000 rpm							

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM64x			
				64K	64L	64P	64S
Electrical data							
	Standstill torque (1)	M_0	Nm	20.8	21.0	20.4	20.6
	Standstill current	I_{0rms}	A	9.2	12.8	18.6	20.7
	Max. rated mains voltage	U_N	VAC	230-480			
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—	—
	Rated power	P_n	kW	—	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	1200	1500	2500	3000
	Rated torque (1)	M_n	Nm	18.8	18.4	16.0	13.0
	Rated power	P_n	kW	2.36	2.89	4.19	4.79
U_N = 400 V	Rated speed	n_n	rpm	2000	3000	4500	—
	Rated torque (1)	M_n	Nm	17.2	15.6	11.9	—
	Rated power	P_n	kW	3.60	4.90	5.61	—
U_N = 480 V	Rated speed	n_n	rpm	2500	3500	5500	—
	Rated torque (1)	M_n	Nm	16.3	14.4	9.00	—
	Rated power	P_n	kW	4.27	5.28	5.18	—
	Peak current	I_{0max}	A	27.5	38.4	55.9	52.2
	Peak torque	M_{0max}	Nm	53.5	54.1	52.9	57.0
	Torque constant	K_{Trms}	Nm / A	2.28	1.66	1.10	0.916
	Voltage constant	K_{Erms}	mVmin	147	107	71.0	64.4
	Winding resistance Ph-Ph	R25	Ω	1.41	0.75	0.36	0.29
	Winding inductance Ph-Ph	L	mH	11.8	6.2	2.8	2.3
Mechanical data							
	Rotor moment of inertia	J	kgcm²	32			
	Number of poles	--	--	10			
	Static friction torque	M_R	Nm	0.15			
	Thermal time constant	t_{TH}	min	30			
	Weight (standard)	G	kg	13.3			
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	770			
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	280			

(1) Reference flange of aluminum 254 mm * 254 mm * 6.35 mm

Technical data		Symbol	Unit	AKM65x		
				65K	65N	65N
Electrical data						
	Standstill torque (1)	M_0	Nm	24.8	25.0	24.3
	Standstill current	I_{0rms}	A	9.8	13.6	17.8
	Max. rated mains voltage	U_N	VAC	230-480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	1000	1500	2000
	Rated torque (1)	M_n	Nm	22.8	21.9	19.8
	Rated power	P_n	kW	2.39	3.44	4.15
U_N = 400 V	Rated speed	n_n	rpm	2000	2500	3500
	Rated torque (1)	M_n	Nm	20.2	19.2	16.0
	Rated power	P_n	kW	4.23	5.03	5.86
U_N = 480 V	Rated speed	n_n	rpm	2200	3000	4000
	Rated torque (1)	M_n	Nm	19.7	18.1	14.7
	Rated power	P_n	kW	4.54	5.69	6.16
	Peak current	I_{0max}	A	29.4	40.9	53.3
	Peak torque	M_{0max}	Nm	64.5	65.2	63.7
	Torque constant	K_{Trms}	Nm / A	2.54	1.85	1.38
	Voltage constant	K_{Erms}	mVmin	164	119	88.8
	Winding resistance Ph-Ph	R25	Ω	1.35	0.73	0.43
	Winding inductance Ph-Ph	L	mH	11.4	6.1	3.4
Mechanical data						
	Rotor moment of inertia	J	kgcm²	40		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.2		
	Thermal time constant	t_{TH}	min	35		
	Weight (standard)	G	kg	15.4		
	Adm. radial load at shaft end at 8,000 rpm	F_R	N	770		
	Adm. radial load at shaft end at 8,000 rpm	F_A	N	280		

(1) Reference flange of aluminum 457 mm * 457 mm * 12.7 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	25
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	25.7
Moment of inertia	J_{BR} [kgcm²]	0.61

Technical data	Symbol [unit]	Value
Release delay time	t_{BRH} [ms]	105
Application delay time	t_{BRL} [ms]	20
Weight of the brake	G_{BR} [kg]	2
Typical backlash	[°mech.]	0.24

Connections and cables

Connector	AKM6
Power connection:	4 + 4-pole, round, angular
Motor cable, shielded	4 x 2.5
Motor cable with control leads, shielded	4 x 2.5 + 2 x 1
Resolver connection	12-pole, round, angular
Resolver cable, shielded	4 x 2 x 0.25 mm²
Encoder connection (option)	17-pole, round
Encoder cable, shielded	8 x 2 x 0.25 mm²

Radial forces / axial forces at the shaft end

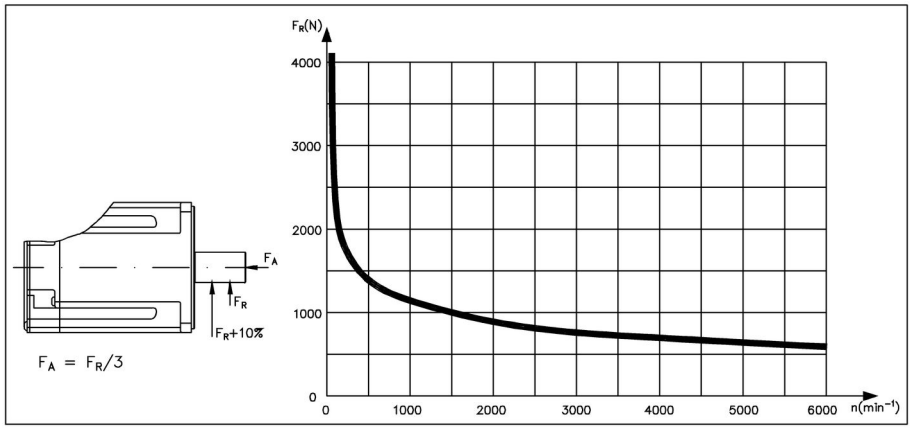


Fig. 9: Radial forces / axial forces at the shaft endAKM6

10.7 AKM7

Technical data		Symbol	Unit	AKM72x		
				72K	72M	72P
Electrical data						
	Standstill torque (1)	M_0	Nm	29.7	30.0	29.4
	Standstill current	I_{0rms}	A	9.3	13.0	18.7
	Max. rated mains voltage	U_N	VAC	480		
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—
	Rated power	P_n	kW	—	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—	—
	Rated torque (1)	M_n	Nm	—	—	—

Technical data		Symbol	Unit	AKM72x		
				72K	72M	72P
	Rated power	P_n	kW	—	—	—
U_N = 230 V	Rated speed	n_n	rpm	—	—	1800
	Rated torque (1)	M_n	Nm	—	—	23.8
	Rated power	P_n	kW	—	—	4.49
U_N = 400 V	Rated speed	n_n	rpm	1500	2000	3000
	Rated torque (1)	M_n	Nm	25.1	23.6	20.1
	Rated power	P_n	kW	3.94	4.94	6.31
U_N = 480 V	Rated speed	n_n	rpm	1800	2500	3500
	Rated torque (1)	M_n	Nm	24.0	22.1	18.2
	Rated power	P_n	kW	4.52	5.79	6.67
	Peak current	I_{0max}	A	27.8	38.9	56.1
	Peak torque	M_{0max}	Nm	79.2	79.7	78.5
	Torque constant	K_{Trms}	Nm / A	3.23	2.33	1.58
	Voltage constant	K_{Erms}	mVmin	208	150	102
	Winding resistance Ph-Ph	R25	Ω	1.36	0.69	0.35
	Winding inductance Ph-Ph	L	mH	20.7	10.8	5.0
Mechanical data						
	Rotor moment of inertia	J	kgcm²	65		
	Number of poles	--	--	10		
	Static friction torque	M_R	Nm	0.16		
	Thermal time constant	t_{TH}	min	46		
	Weight (standard)	G	kg	19.7		
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	1300		
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	5000		

(1) Reference flange of aluminum 457 mm * 457 mm * 12.7 mm

Technical data		Symbol	Unit	AKM73x	
				73M	73P
Electrical data					
	Standstill torque (1)	M_0	Nm	53.0	52.5
	Standstill current	I_{0rms}	A	12.9	18.5
	Max. rated mains voltage	U_N	VAC	480	
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 230 V	Rated speed	n_n	rpm	—	1300
	Rated torque (1)	M_n	Nm	—	34.7
	Rated power	P_n	kW	—	4.72

Technical data		Symbol	Unit	AKM73x	
				73M	73P
U_N = 400 V	Rated speed	n_n	rpm	1500	2400
	Rated torque (1)	M_n	Nm	33.8	28.5
	Rated power	P_n	kW	5.31	7.16
U_N = 480 V	Rated speed	n_n	rpm	1800	2800
	Rated torque (1)	M_n	Nm	32.1	26.3
	Rated power	P_n	kW	6.05	7.71
	Peak current	I_{0max}	A	40.8	58.6
	Peak torque	M_{0max}	Nm	113	111
	Torque constant	K_{Trms}	Nm / A	3.10	2.13
	Voltage constant	K_{Erms}	mVmin	200	137
	Winding resistance Ph-Ph	R25	Ω	0.76	0.38
	Winding inductance Ph-Ph	L	mH	12.4	5.9
Mechanical data					
	Rotor moment of inertia	J	kgcm²	92	
	Number of poles	--	--	10	
	Static friction torque	M_R	Nm	0.24	
	Thermal time constant	t_{TH}	min	53	
	Weight (standard)	G	kg	26.7	
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	1300	
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	500	

(1) Reference flange of aluminum 457 mm * 457 mm * 12.7 mm

Technical data		Symbol	Unit	AKM74x	
				74L	74P
Electrical data					
	Standstill torque (1)	M_0	Nm	53.0	52.5
	Standstill current	I_{0rms}	A	12.9	18.5
	Max. rated mains voltage	U_N	VAC	480	
U = 75 V_{DC}	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 115 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 230 V	Rated speed	n_n	rpm	—	—
	Rated torque (1)	M_n	Nm	—	—
	Rated power	P_n	kW	—	—
U_N = 400 V	Rated speed	n_n	rpm	1200	1800
	Rated torque (1)	M_n	Nm	43.5	39.6
	Rated power	P_n	kW	5.47	7.46

Technical data		Symbol	Unit	AKM74x	
				74L	74P
U_N = 480 V	Rated speed	n_n	rpm	1400	2000
	Rated torque (1)	M_n	Nm	41.5	35.9
	Rated power	P_n	kW	6.08	7.52
	Peak current	I_{0max}	A	38.7	55.5
	Peak torque	M_{0max}	Nm	143	142
	Torque constant	K_{Trms}	Nm / A	4.14	2.84
	Voltage constant	K_{Erms}	mVmin	266	183
	Winding resistance Ph-Ph	R25	Ω	0.93	0.47
	Winding inductance Ph-Ph	L	mH	16.4	7.7
Mechanical data					
	Rotor moment of inertia	J	kgcm²	120	
	Number of poles	--	--	10	
	Static friction torque	M_R	Nm	0.33	
	Thermal time constant	t_{TH}	min	60	
	Weight (standard)	G	kg	33.6	
	Admissible radial load at shaft end at 8,000 rpm	F_R	N	1300	
	Admissible axial load at shaft end at 8,000 rpm	F_A	N	500	

(1) Reference flange of aluminum 457 mm * 457 mm * 12.7 mm

Technical data of the brake:

Technical data	Symbol [unit]	Value
Holding torque at 120 °C	M_{BR} [Nm]	53
Mains voltage	U_{BR} [VDC]	24 ±10%
Electric power	P_{BR} [W]	36.5
Moment of inertia	J_{BR} [kgcm²]	1.64
Release delay time	t_{BRH} [ms]	110
Application delay time	t_{BRL} [ms]	35
Weight of the brake	G_{BR} [kg]	2.1
Typical backlash	[°mech.]	0.2

Connections and cables

Connector	AKM7
Power connection:	4 + 4-pole, round, angular
Motor cable, shielded	4 x 2.5
Motor cable with control leads, shielded	4 x 2.5 + 2 x 1
Resolver connection	12-pole, round, angular
Resolver cable, shielded	4 x 2 x 0.25 mm²
Encoder connection (option)	17-pole, round
Encoder cable, shielded	8 x 2 x 0.25 mm²

Radial forces / axial forces at the shaft end

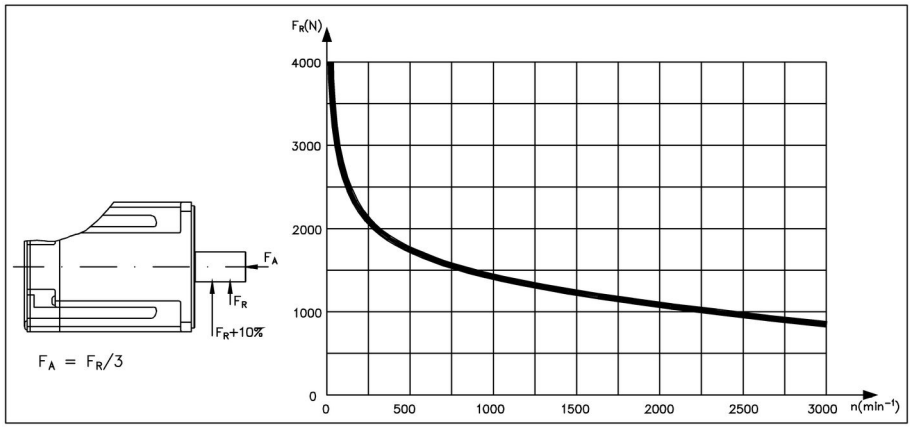


Fig. 10: Radial forces / axial forces at the shaft endAKM7

11 Connection Examples for AKM-motors

This chapter describes examples for the connection of AKM-motors to a SIEB & MEYER CNC 8x.00.

The following types of connectors exist for AKM-motors:
- screw connector IP65 (connector type E)
- Molex connector (connector type M)
- screw connector IP65 (connector type E)

The connector type can be read out at the motor designation. Examples:
- AKM23D-AN**E**NEM00 → connector type E
- AKM23D-AN**M**NEM00 → connector type M
- AKM23D-AN**B**NEM00 → connector type B
- AKM23D-AN**C**NEM00 → connector type C

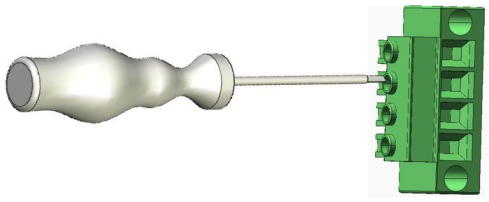
11.1 Operation of the Terminal Connectors

SIEB & MEYER uses terminal blocks by Phoenix Contact (www.phoenixcontact.com).

In this manual you find the following supplementary notes for connection via terminal blocks:
- Phoenix Contact name of the terminal block (e.g."MC", "PC4")
- min. conductor cross-section of the terminals according to the rated current of the SIEB & MEYER device
- max. conductor cross-section according to the specification of the manufacturer Phoenix Contact
- max. tigthening torque of the screws for screw terminals according to the specification of the manufacturer Phoenix Contact

11.1.1 Screw Terminals

Terminal connectors with screw connection can be operated intuitively and offer reliable protection against unwanted loosening of the screw connection.
- To fix a conductor in a clamp, loosen the screw connection, insert the conductor into the clamp and close the screw conection.
- To unplug the connector from the clamp, loosen the screw connection.

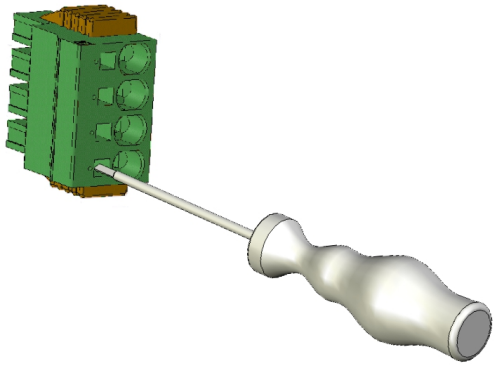


11.1.2 Push-in Technology

Terminals using the push-in connection technology (PIT) work on the pressure spring principle:

The contact spring presses the cable against the conducting copper bar. The special spring profile allows direct and tool-free wiring of solid and stranded cables previously assembled with ferrule or compressed conductor ends.

- When the cable is inserted into the clamping unit the spring opens automatically.
- To open the clamp and loosen the cable use a screw driver.



11.2 Connector Type E

Connector on the MD84		Function	Connector on the SMM motor	Cables	SIEB & MEYER order number for connector set	
					35512204	35512211
X26A	15-male submin D connector	Resolver connection	12-pole resolver connector	X26A	x	
X40	9-male submin D connector	Commutation meas-uring system	17-pole encoder connector	X40A		x
X64	2-pole Power-Combicon connector	Thermal contact				
X63	4-pole Power-Combicon connector	Machine connection of MD84	6-pole	X63A	x	x

Tab. 2: AKM-motors with screw connector IP65 (connector type E)

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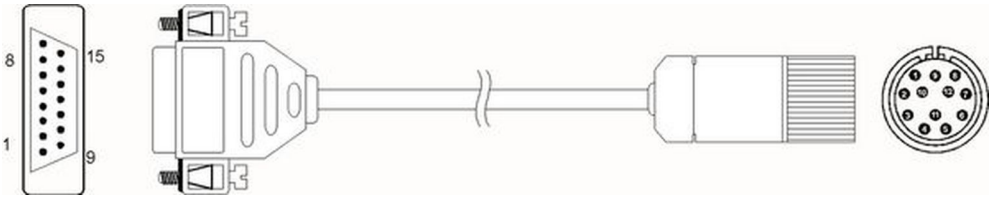
11.2.1 X26A – Resolver (Connector Type E)

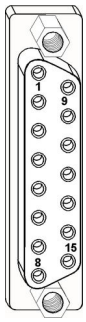
Connecting cable for resolvers

- shielded round cable
- twisted-pair
- 15-pole male submin D connector ↔ 12-pole female resolver connector
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



Pin assignment on the servo amplifier / motor

- 15-pole female submin D connector ↔ 12-pole female resolver connector (connector type E)
- view looking into female connector and round connector

MD84				Description	AKM-motor		
15-pole female submin D con.	Pin	I/O	Designation		Designation	Pin	12-pole male resolver con.
	1	I/O	0 V	GND	0 V		
	2	I	S1	Sine	S1	1	
	3	O	0 V		0 V		
	4	I	S4	Cosine	S4	3	
	5	O	0 V		0 V		
	6	O	R2	Rotor	R2	6	
	7	I	Thermal contact		Thermal contact	7	
	8	O	0 V		0 V		
	9	I	S3	Sine	S3	2	
	10	O					
	11	I	S2	Cosine	S2	4	
	12	O					
	13	O	R1	Rotor	R1	5	
	14	O	0 V		0 V		
	15	O	+24 V	Voltage supply	+24 V	8	

In order to ensure the proper functioning of the device, consider the following information.

Rotary motors (thermal contact)

If no thermal contact is connected at rotary motors, you must connect pin 1 and pin 2 of connector X64 at the servo amplifier by a wire strap!

Rotary motors: resolvers and limit switches

If no linear measuring systems are required, machines driven by rotary AC motors can use the resolver integrated in the motor as measuring system.

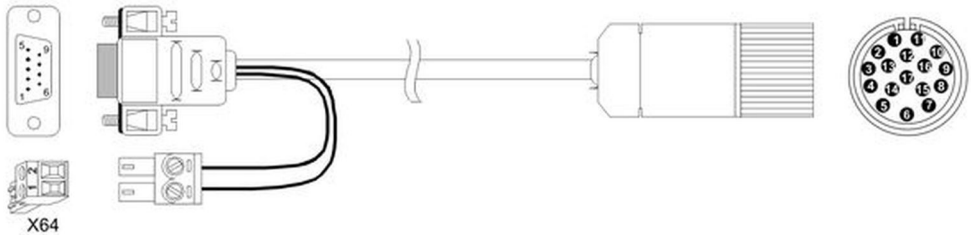
The resolver provides 4,096 pulses per motor revolution. This value is entered in the parameter editor and merged with the entered spindle pitch.

If machines are driven by rotary AC motors and equipped with linear measuring systems connect the resolvers to the connectors 26A and the measuring systems via X27. The signals of the measuring system **must** have TTL level!

11.2.2 X40A – Commutation Measuring System (Connector Type E)

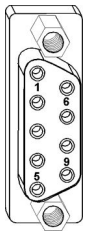
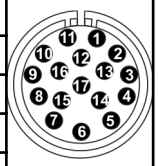
Connecting cable

- twisted-pair
- 9-pole male submin D connector ↔17-pole female encoder connector
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



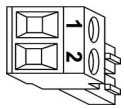
Pin assignment on the servo amplifier / motor

- 9-pole female submin D connector ↔ 17-pole encoder connector
- view looking into female connector / round connector

MD84				Description	AKM-motor		
9-pole fem. submin D con.	Pin	I/O	Designation		Designation	Pin	17-pole encoder con.
	1	I	Ua1	Pulses 0°	O	10	
	2	I	Ua1 inv.	Pulses 0° inv.	A inv.	11	
	3	I	Ua0	Zero pulse	Z	14	
	4	I	Ua0 inv.	Zero pulse inv.	Z inv.	15	
	5	I/O	GND	Ground	GND	3	
	6	I	Ua2	Pulses 90°	B	12	
	7	I	Ua2 in.	Inverted pulses 90°	B inv.	13	
	8	O	+5 V	+5 V measuring system	VCC	1	
	9	I	UaS	Dirt signal		n.c.	

Pin assignment X64

- 2-pole mini Combicon connector at separate line at cable X40A (MD84)
- Notes for terminal connections (MD84):
  - **MC (Phoenix)**
    - max. cross-section (solid/stranded cables) = 1.5 mm²
    - max. tightening torque = 0.25 Nm
- 17-pole male encoder connector (motor)

MD84		Description	AKM-motor	
2-pole male Mini Combicon con.	Pin		Pin	17-pole encoder con.
	1	+24 V for thermal contact	2	
	2	Thermal contact of motor	17	

11.2.3 X63A – Motor Connection MD84 (Connector Type E)

DANGER

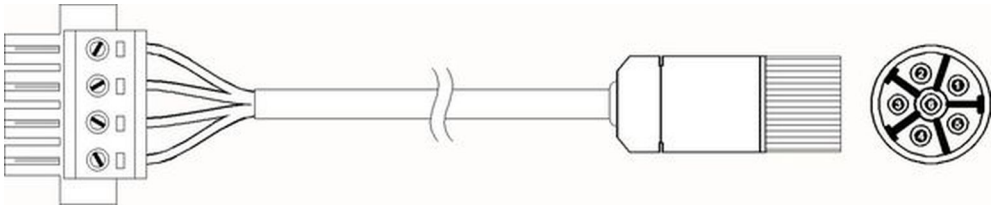
High voltages at the motor connectors

High voltages occur at the motor connectors during the operation of a servo amplifier/frequency converter.

Never operate servo amplifiers/frequency converters without connected plugs. Otherwise, you may seriously be injured when touching the contacts at the motor connectors unintentionally.

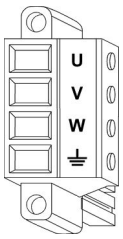
Connecting cable

- shielded round cable
- 4-pole Power Combicon connector ↔ 6-pole female motor connector
- The cable shield is connected to the busbar.

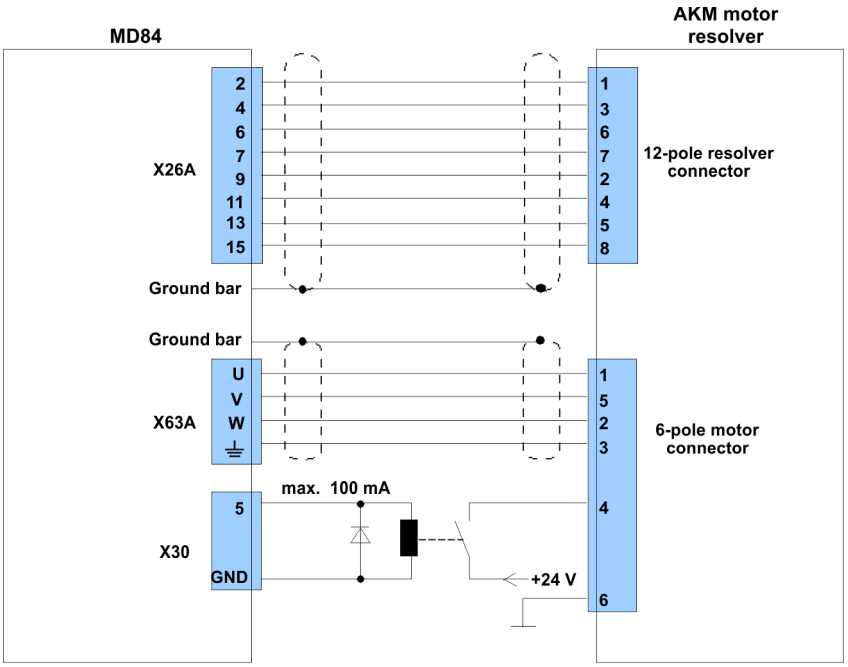


Pin assignment on the servo amplifier / motor

- The cable shield is connected to the connector shell and to the busbar.
- 6-pole motor connector
- 4-pole Power Combicon connector (MD84)
  Consider the notes for terminal connections, section 12.A "Notes for Terminal Connections", page 85.

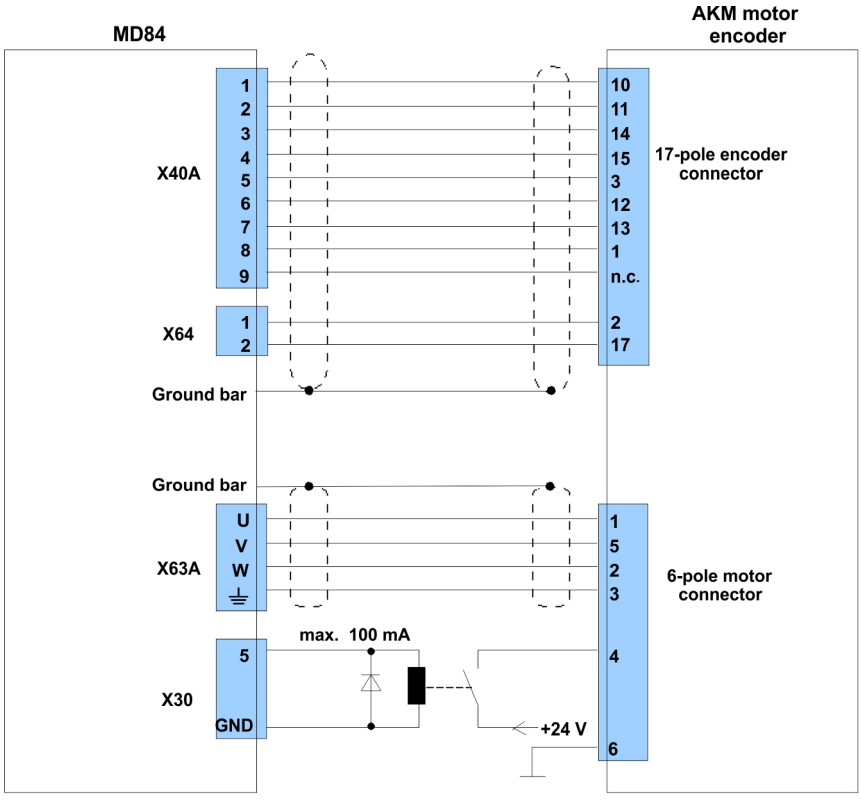
MD84		Designation	AKM-motor	
4-pole Power Combicon con.	Connector		Pin	6-pole motor connector
	Busbar at the chassis	Shield	Housing	
	U	Motor phase U	1	
	V	Motor phase V	5	
	W	Motor phase W	2	
	⏚	Ground the motor housing in the machine	3	
	Brake+	X30 pin 5 (connect via relay)	4	
	Brake-	GND	6	

11.2.4 Connection Diagrams (Connector Type E)



SM order number for connector set (resolver/motor connector): 355 12 204

Fig. 11: Connection diagram for AKM-motors with resolver (connector type E)



SM order number for connector set (encoder/motor connector): 355 12 211

Fig. 12: Connection diagram for AKM-motors with incremental encoder (connector type E)

11.3 Connector Type M

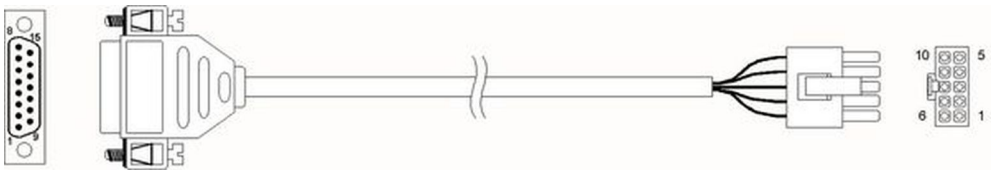
Connector on the MD84		Function	Connector on the SMM motor	Cables
X26A	15-male submin D connector	Resolver connection	10-pole Molex connector	X26C
X40	9-male submin D connector	Commutation measuring system	18-pole Molex connector	X40B
X64	2-pole Power-Combicon connector	Thermal contact		
X63	4-pole Power-Combicon connector	Machine connection of MD84	5-pole Molex connector (without brake)	X63B or
X63	4-pole Power-Combicon connector		8-pole Molex connector (with brake)	X63C

Tab. 3: AKM-motors with Molex connector (connector type M)

11.3.1 X26C – Resolver (Connector Type M)

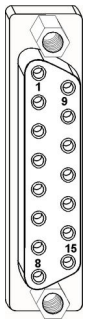
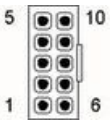
Connecting cable

- shielded round cable
- twisted-pair
- 15-pole male submin D connector ↔ 10-pole female Molex connector (art. No. 35512207)
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



Pin assignment on the servo amplifier / motor

- 15-pole female submin D connector ↔ 10-pole Molex connector
- view looking into female connector ↔ male connector

MD84				Description	AKM-motor		
15-pole female submin D con.	Pin	I/O	Designation		Designation	Pin	10-pole Molex con.
	1	O	0 V	GND	0 V		
	2	I	S1	Sine	S1	8	
	3	O	0 V		0 V		
	4	I	S4	Cosine	S4	3	
	5	O	0 V		0 V		
	6	O	R3	Rotor	R2	5	
	7	I	Thermal contact		Thermal contact	2	
	8	O	0 V		0 V		

MD84				Description	AKM-motor		
15-pole female submin D con.	Pin	I/O	Designation		Designation	Pin	10-pole Molex con.
	9	I	S3	Sine	S3	4	
	10	O					
	11	I	S2	Cosine	S2	7	
	12	O					
	13	O	R1	Rotor	R1	9	
	14	O	0 V		0 V		
	15	O	+24 V	+24 V for thermal contact	+24 V	6	

To ensure proper functioning of the device, consider the following information.

Rotary motors (thermal contact)

If no thermal contact is connected at rotary motors, you must connect pin 1 and pin 2 of connector X64 at the servo amplifier by a wire strap!

Rotary motors: resolvers and limit switches

If no linear measuring systems are required, machines driven by rotary AC motors can use the resolver integrated in the motor as measuring system.

The resolver provides 4,096 pulses per motor revolution. This value is entered in the parameter editor and merged with the entered spindle pitch.

If machines are driven by rotary AC motors and equipped with linear measuring systems connect the resolvers to the connectors 26A and the measuring systems via X27. The signals of the measuring system **must** have TTL level!

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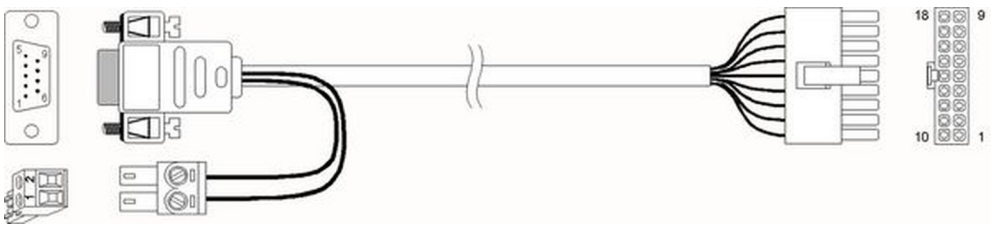
11.3.2 X40B – Commutation Measuring System (Connector Type M)

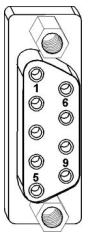
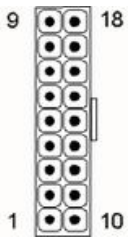
Connecting cable

- shielded round cable
- twisted-pair
- 9-pole male submin D connector ↔ 18-pole female Molex connector (art. No. 35512209)
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



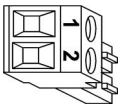
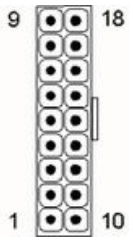
Pin assignment on the servo amplifier / motor

- 9-pole female submin D connector ↔ 18-pole Molex connector
- view looking into female connector ↔ male connector

MD84				Description	AKM-motor			
9-pole fem. submin D con.	Pin	I/O	Designation		Designa-tion	Pin	Wire color	18-pole Molex con.
	1	I	Ua1	Pulses 0°	O	3	Blue	
	2	I	Ua1 inv.	Pulses 0° inv.	A inv.	4	Blue/black	
	3	I	Ua0	Zero pulse	Z	5	Lilac	
	4	I	Ua0 inv.	Zero pulse inv.	Z inv.	6	Lilac/black	
	5	I/O	GND	Ground	GND	7	Black	
	6	I	Ua2	Pulses 90°	B	1	Green	
	7	I	Ua2 in.	Inverted pulses 90°	B inv.	2	Green/ black	
	8	O	+5 V	+5 V measuring system	VCC	10	Red	
	9	I	UaS	Dirt signal	n.c.			
	Shield					18	Black	

Pin assignment X64

- 2-pole mini Combicon connector at separate line at cable X40B (MD84)
- Notes for terminal connections (MD84):
  - **MC (Phoenix)**
    - max. cross-section (solid/stranded cables) = 1.5 mm²
    - max. tightening torque = 0.25 Nm
- 17-pole male encoder connector (motor)

MD84		Description	AKM-motor		
2-pole Mini Combicon con.	Pin		Pin	Wire color	18-pole Molex connector
	1	+24 V for thermal contact	8	Orange	
	2	Thermal contact of motor	9	Orange/ white	

11.3.3 X63B – Motor Connection MD84 (Connector Type M without Motor Brake)

DANGER

High voltages at the motor connectors

High voltages occur at the motor connectors during the operation of a servo amplifier/frequency converter.

Never operate servo amplifiers/frequency converters without connected plugs. Otherwise, you may seriously be injured when touching the contacts at the motor connectors unintentionally.

NOTICE

Risk of damage to the motor

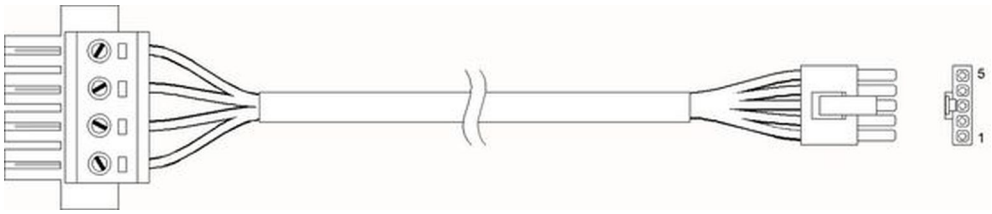
Notes for AKM-motors with standstill currents of I_0 > 6 A_{rms}

Motors with a standstill current of I_0 > 6 A_{rms} shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

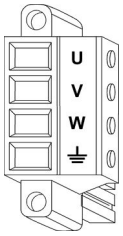
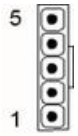
Connecting cable

- 4-pole male Power Combicon D connector ↔ 5-pole female Molex connector (art. No. 35512206)
- The cable shield is connected to the busbar.



Pin assignment on the servo amplifier / motor

- The cable shield is connected to the connector shell and to the busbar.
- 5-pole Molex connector
- 4-pole Power Combicon connector (MD84)
  Consider the notes for terminal connections, section 12.A "Notes for Terminal Connections", page 85.

MD84		Designation	AKM-motor		
4-pole Power Combicon con.	Connector		Pin	Wire color	5-pole motor con.
	Busbar at the chassis	Shield	5	Black	
	U	Motor phase U	1	Blue	
	V	Motor phase V	2	Brown	
	W	Motor phase W	3	Lilac	
	⏚	Ground the motor housing in the machine	4	Green	

11.3.4 X63C – Motor Connection MD84 (Connector Type M with Motor Brake)

DANGER

High voltages at the motor connectors

High voltages occur at the motor connectors during the operation of a servo amplifier/frequency converter.

Never operate servo amplifiers/frequency converters without connected plugs. Otherwise, you may seriously be injured when touching the contacts at the motor connectors unintentionally.

NOTICE

Risk of damage to the motor

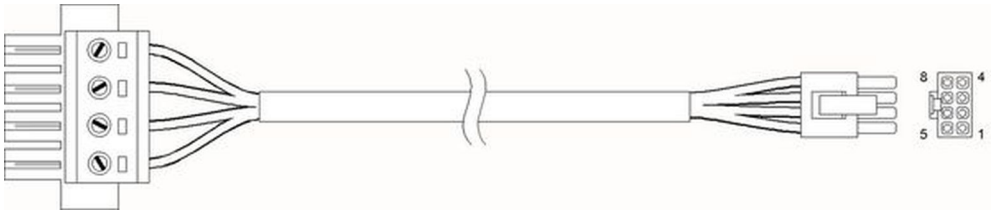
Notes for AKM-motors with standstill currents of I_0 > 6 A_{rms}

Motors with a standstill current of I_0 > 6 A_{rms} shall **not** be operated with connected Molex connectors.

Cut the Molex connector (5-pole without brake or 8-pole with brake) from the motor and connect the motor with the cable to the servo amplifier. The signal connectors for the resolver signals (10-pole) or the encoder signals (18-pole) can be connected.

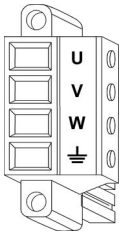
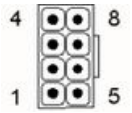
Connecting cable

- 4-pole male Power Combicon D connector ↔ 8-pole female Molex connector (art. No. 35512208)
- The cable shield is connected to the busbar.



Pin assignment on the servo amplifier / motor

- The cable shield is connected to the connector shell and to the busbar.
- 8-pole Molex connector
- 4-pole Power Combicon connector (MD84)
  Consider the notes for terminal connections, section 12.A "Notes for Terminal Connections", page 85.

MD84		Designation	AKM-motor	
4-pole Power Combicon con.	Connector		Pin	8-pole motor connector
	Busbar at the chassis	Shield	5	
	U	Motor phase U	1	
	V	Motor phase V	2	
	W	Motor phase W	3	
	⏚	Ground the motor housing in the machine	4	
	Brake+	X30 pin 5 (connect via relay)	6	
	Brake-	GND	7	

11.3.5 Connection Diagrams (Connector Type M)

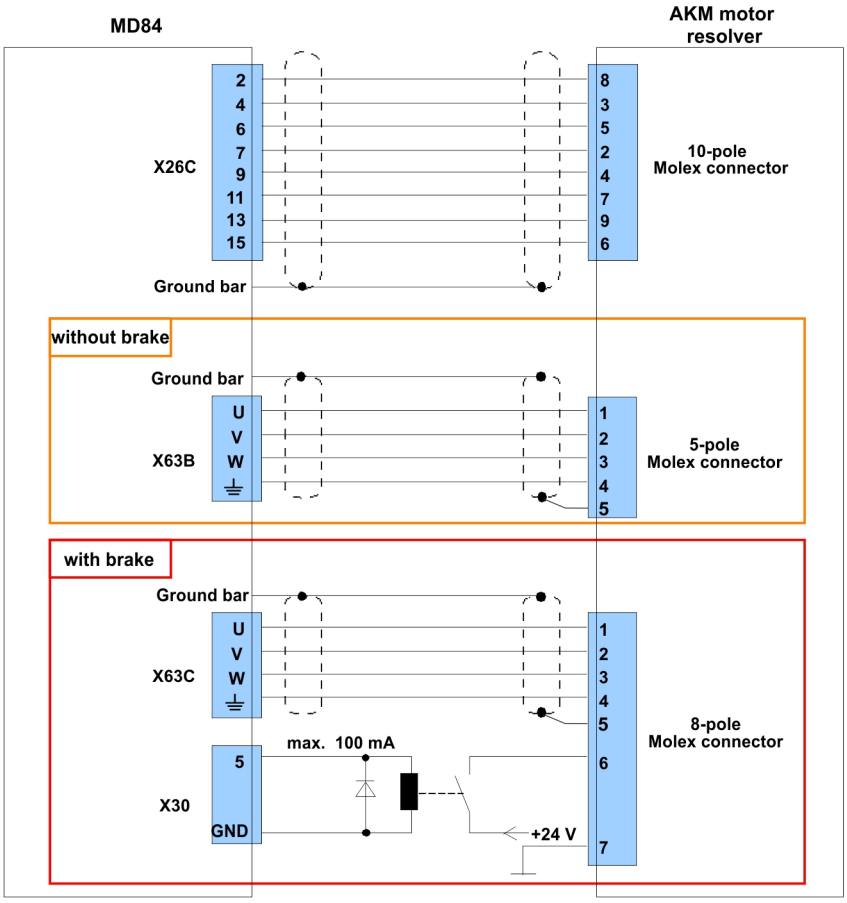


Fig. 13: Connection diagram for AKM-motors with resolver (connector type M)

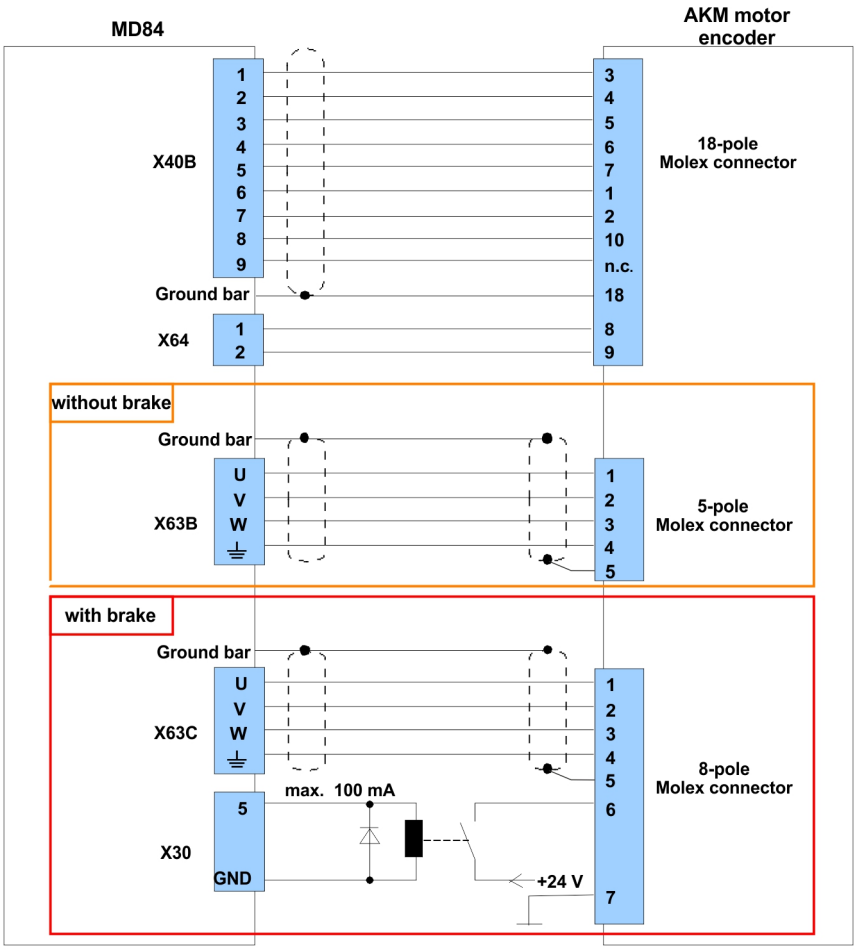


Fig. 14: Connection diagram for AKM-motors with incremental encoder (connector type M)

11.4 Connector Type B and C

11

Connector on the MD84		Function	Connector on the SMM motor	Cables	SIEB & MEYER order number for connector set	
					35512205	35512210
X26A	15-male submin D connector	Resolver connection	12-pole resolver connector	X26D	x	
X40	9-male submin D connector	Commutation meas-uring system	17-pole encoder connector	X40C		x
X64	2-pole Power-Combicon connector	Thermal contact				
X63	4-pole Power-Combicon connector	Machine connection of MD84	8-pole motor connector	X63D	x	x

Tab. 4: AKMscrew connector IP65 (connector type E)

Notes:

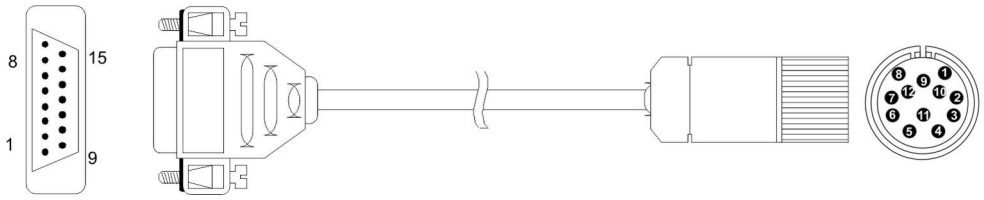
1. AKM1 are only available with 0.5 m long cables.
2. **Connector type B:**
   - The connector type B is only available the motors AKM2.
   - For motors with connector type B the angular conector is fixed to the motor.
3. **Connector type C:**

- Connector type C at the motor AKM2 means that the motor connector is fixed to a 0.5 m long cable.
- For motor type AKM3 and higher connector type B means that the angular connector is fixed to the motor.

11.4.1 X26D – Resolver (Connector Type B+C)

Connecting cable for resolvers

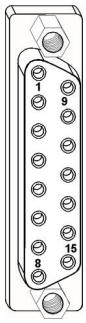
- shielded round cable
- twisted-pair
- 15-pole male submin D connector ↔ 12-pole female resolver connector
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



Pin assignment on the servo amplifier / motor

Consider that the pin assignment of the 12-pole resolver connector for connector type B and C is mirror-inverted compared to connector type E!

- 15-pole female submin D connector ↔ 12-pole female resolver connector (connector type B+C)
- view looking into female connector and round connector

MD84				Description	AKM-motor		
15-pole female submin D con.	Pin	I/O	Designation		Designation	Pin	12-pole male resolver con.
	1	I/O	0 V	GND	0 V		
	2	I	S1	Sine	S1	8	
	3	O	0 V		0 V		
	4	I	S4	Cosine	S4	3	
	5	O	0 V		0 V		
	6	O	R2	Rotor	R2	5	
	7	I	Thermal contact		Thermal contact	2	
	8	O	0 V		0 V		
	9	I	S3	Sine	S3	4	
	10	O					
	11	I	S2	Cosine	S2	7	
	12	O					
	13	O	R1	Rotor	R1	9	
	14	O	0 V		0 V		

MD84				Description	AKM-motor		
15-pole female submin D con.	Pin	I/O	Designation		Designation	Pin	12-pole male resolver con.
	15	O	+24 V	Voltage supply	+24 V	6	

To ensure proper functioning of the device, consider the following information.

Rotary motors (thermal contact)

If no thermal contact is connected at rotary motors, you must connect pin 1 and pin 2 of connector X64 at the servo amplifier by a wire strap!

Rotary motors: resolvers and limit switches

If no linear measuring systems are required, machines driven by rotary AC motors can use the resolver integrated in the motor as measuring system.

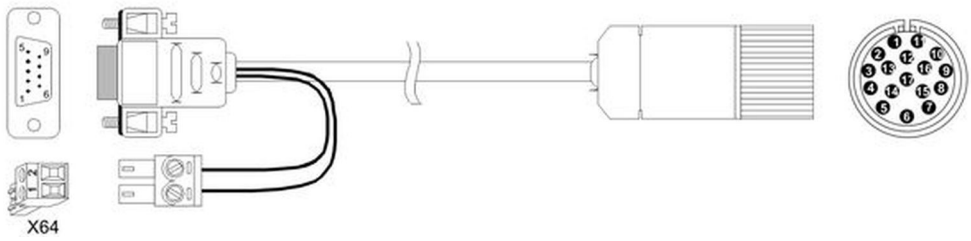
The resolver provides 4,096 pulses per motor revolution. This value is entered in the parameter editor and merged with the entered spindle pitch.

If machines are driven by rotary AC motors and equipped with linear measuring systems connect the resolvers to the connectors 26A and the measuring systems via X27. The signals of the measuring system **must** have TTL level!

11.4.2 X40C - Commutation Measuring System (Connector Type B+C)

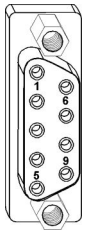
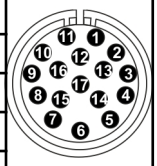
Connecting cable

- twisted-pair
- 9-pole male submin D connector ↔17-pole female encoder connector
- The cable shield is connected to the busbar.
- The maximum tigthening torque for bolts at submin D connectors is 0.7 Nm.



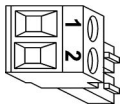
Pin assignment on the servo amplifier / motor

- 9-pole female submin D connector ↔ 17-pole encoder connector
- view looking into female connector / round connector

MD84				Description	AKM-motor		
9-pole fem. submin D con.	Pin	I/O	Designation		Designation	Pin	17-pole encoder con.
	1	I	Ua1	Pulses 0°	A	3	
	2	I	Ua1 inv.	Pulses 0° inv.	A inv.	4	
	3	I	Ua0	Zero pulse	Z	5	
	4	I	Ua0 inv.	Zero pulse inv.	Z inv.	6	
	5	I/O	GND	Ground	GND	7	
	6	I	Ua2	Pulses 90°	B	1	
	7	I	Ua2 in.	Inverted pulses 90°	B inv.	2	
	8	O	+5 V	+5 V measuring system	VCC	10	
	9	I	UaS	Dirt signal		n.c.	

Pin assignment X64

- 2-pole mini Combicon connector at separate line at cable X40C (MD84)
- Notes for terminal connections (MD84):
  - **MC (Phoenix)**
    - max. cross-section (solid/stranded cables) = 1.5 mm²
    - max. tightening torque = 0.25 Nm
- 17-pole male encoder connector (motor)

MD84		Description	AKM-motor	
2-pole male Mini Combicon con.	Pin		Pin	17-pole encoder con.
	1	+24 V for thermal contact	8	
	2	Thermal contact of motor	9	

11.4.3 X63D – Motor Connection of MD84 (Connector Type B+C)

DANGER

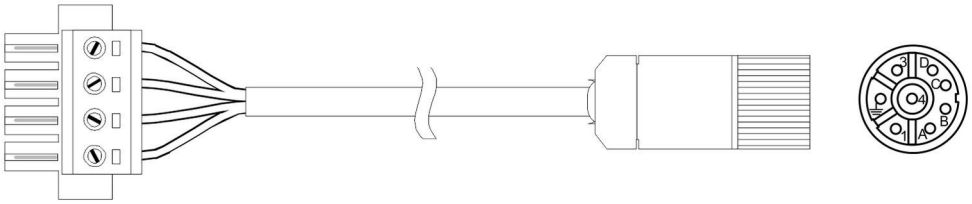
High voltages at the motor connectors

High voltages occur at the motor connectors during the operation of a servo amplifier/frequency converter.

Never operate servo amplifiers/frequency converters without connected plugs. Otherwise, you may seriously be injured when touching the contacts at the motor connectors unintentionally.

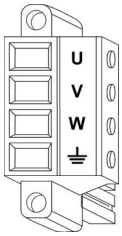
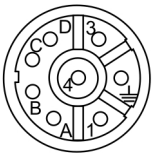
Connecting cable

- shielded round cable
- 4-pole Power Combicon connector ↔ 8-pole female motor connector
- The cable shield is connected to the busbar.

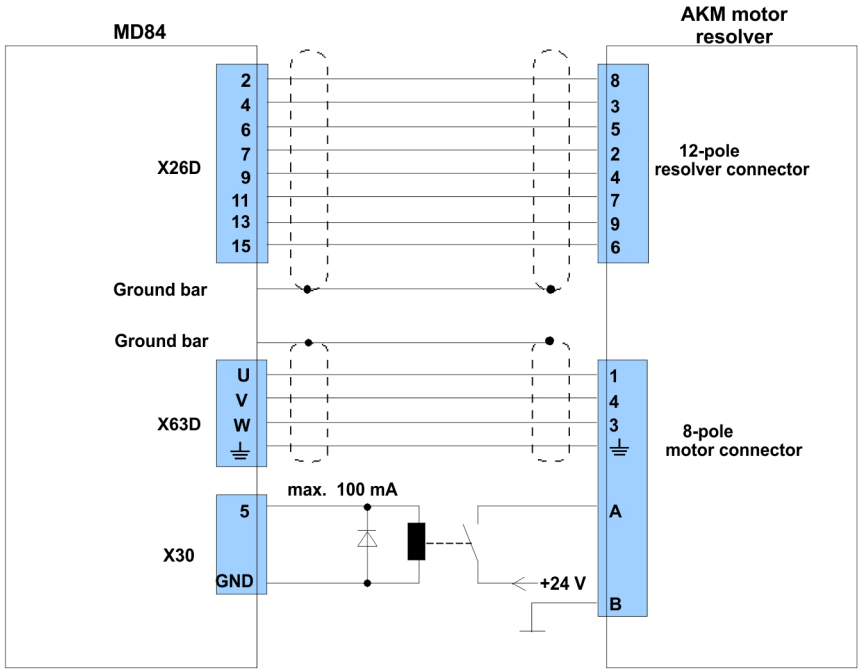


Pin assignment on the servo amplifier / motor

- The cable shield is connected to the connector shell and to the busbar.
- 6-pole motor connector
- 4-pole Power Combicon connector (MD84)
  Consider the notes for terminal connections, section 12.A "Notes for Terminal Connections", page 85.

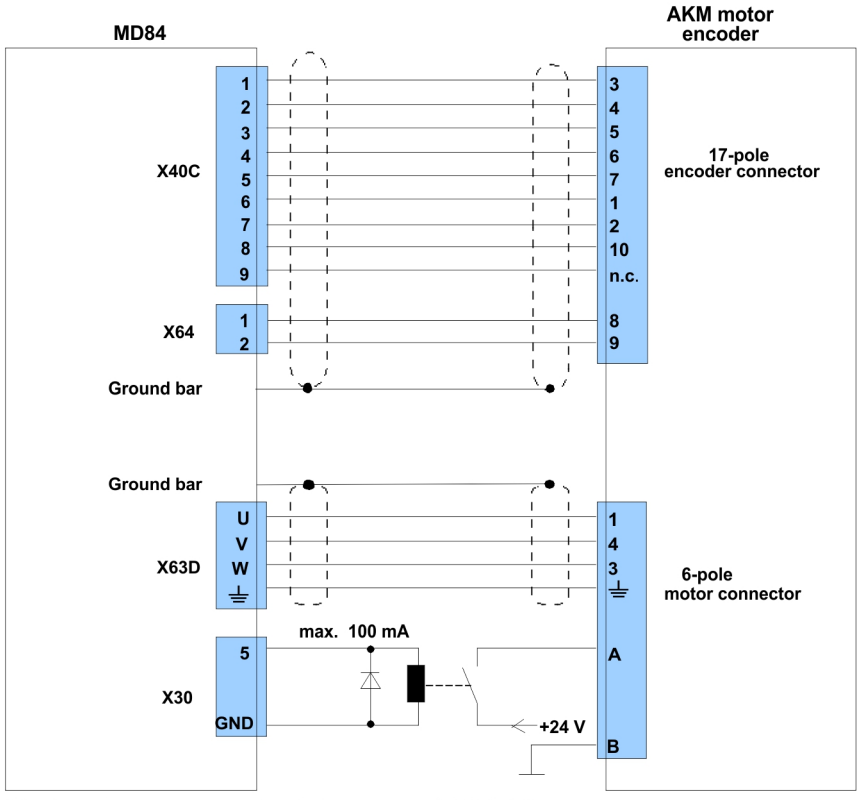
MD84		Designation	AKM-motor	
4-pole Power Combicon con.	Connector		Pin	8-pole motor connector
	Busbar at the chassis	Shield	Housing	
	U	Motor phase U	1	
	V	Motor phase V	4	
	W	Motor phase W	3	
	⏚	Ground the motor housing in the machine	⏚	
	Brake+	X30 pin 5 (connect via relay)	AO	
	Brake-	GND	B	
	n.c.		C	
	n.c.		D	

11.4.4 Connection Diagrams (Connector Type B+C)



SM order number for connector set (resolver /motor connector): 355 12 205

Fig. 15: Connection diagram for AKM-motors with resolver (connector type B+C)



SM order number for connector set (encoder/motor connector): 355 12 210

Fig. 16: Connection diagram for AKM-motors with incremental encoder (connector type B+C)

12 Appendix

12.A Notes for Terminal Connections

12.A.1 Terminal Connections of MD84 (First Generation)

The following table shows the connector types used on the MD84 of the first generation with the corresponding conductor cross-sections and tigthening torques for screw connections.

MD84	Width	Connector (Phoenix)	Min. conductor cross-section(1)	Max. conductor cross section(2)	Max. tigthening torque(3)
0268421/31DC 0268421/31GC	12 WU	PC4	1.5 mm²	4 mm² (solid/stranded cables)	0.6 Nm
0268421/31ZC	12 WU	PC4	2.5 mm²	4 mm² (solid/stranded cables)	0.6 Nm
0268421/31KC 0268421/31LC	12 WU	PC4	4 mm²	4 mm² (solid/stranded cables)	0.6 Nm
0268422/32IC 0268422/32QC 0268422/32UC 0268422/32WC	16 WU	PC6	6 mm²	10 mm² (solid cables) 6 mm² (stranded cables)	1.5 Nm
02684120/130DDC 02684120/130EEC 02684200/220/250/270EEC	16 WU	PC4	1.5 mm²	4 mm² (solid/stranded cables)	0.6 Nm

(1) The values for the min. conductor cross-section are indicated acc. to the rated current of the SIEB & MEYER device.

(2) The values for the max. conductor cross-section are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

(3) The values for the max. tightening torque of the screws on the terminals with screw connections are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

12.A.2 Terminal Connections of MD84 (Second Generation)

The following table shows the connector types used on the MD84 of the second generation with the corresponding conductor cross-sections and tigthening torques for screw connections.

MD84	Width	Connector (Phoenix)	Min. conductor cross-section(1)	Max. conductor cross section(2)	Max. tigthening torque(3)
0268451GC	12 WU	PC4	1.5 mm²	4 mm² (solid/stranded cables)	0.6 Nm
0268451LC	12 WU	PC4	4 mm²	4 mm² (solid/stranded cables)	0.6 Nm
0268452IC 0268452UC	16 WU	PC6	6 mm²	10 mm² (solid cables)	1.5 Nm

MD84	Width	Connector (Phoenix)	Min. conductor cross-section(1)	Max. conductor cross section(2)	Max. tigthening torque(3)
0268452WC				6 mm² (stranded cables)	
02684150EEC 02684150DDC 02684350EEC 02684360EEC	16 WU	PC4	1 mm²	4 mm² (solid/stranded cables)	0.6 Nm

(1) The values for the min. conductor cross-section are indicated acc. to the rated current of the SIEB & MEYER device.

(2) The values for the max. conductor cross-section are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

(3) The values for the max. tightening torque of the screws on the terminals with screw connections are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

12.A.3 Terminal Connections of MD84 (Third Generation)

The following table shows the connector types used on the MD84 Nano of the third generation with the corresponding conductor cross-sections and tigthening torques for screw connections.

MD84 Nano	Width	Connector (Phoenix)	Min. conductor cross-section(1)	Max. conductor cross section(2)	Max. tigthening torque(3)
0268461/71GC	12 WU	PC6	1.5 mm²	10 mm² (solid cables) 6 mm² (stranded cables)	1.5 Nm
0268462/72IC 0268462/72WC	16 WU	PC6	6 mm²	10 mm² (solid cables) 6 mm² (stranded cables)	1.5 Nm
02684160/170YYC	16 WU	SPC5	1 mm²	6 mm² (solid/stranded cables)	-
02684170ZZC	16 WU	SPC5	1.5 mm²	6 mm² (solid/stranded cables)	-
02684172IIC	16 WU	SPC5	6 mm²	6 mm² (solid/stranded cables)	-
02684180DDC 02684180DDDC	16 WU	SPC5	1 mm²	6 mm² (solid/stranded cables)	-
02684402IC	22 WU	SPC5	6 mm²	6 mm² (solid/stranded cables)	-
02684402ZC	16 WU	SPC5	1.5 mm²	6 mm² (solid/stranded cables)	-
02684403DC	16 WU	SPC5	1 mm²	6 mm² (solid/stranded cables)	-
02684404ZC	22 WU	SPC5	1 mm²	6 mm² (solid/stranded cables)	-

MD84 Nano	Width	Connector (Phoenix)	Min. conductor cross-section(1)	Max. conductor cross section(2)	Max. tigthening torque(3)
02684406DC	22 WU	SPC5	1.5 mm²	6 mm² (solid/stranded cables)	-

(1) The values for the min. conductor cross-section are indicated acc. to the rated current of the SIEB & MEYER device.

(2) The values for the max. conductor cross-section are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

(3) The values for the max. tightening torque of the screws on the terminals with screw connections are indicated acc. to the specification of the manufacturer of the connector (Phoenix Contact).

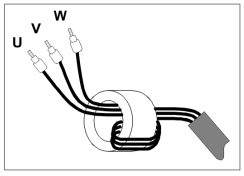
12.A

12.B Ferrite Cores at X63

The following table lists all device variants of the with information on ferrite cores and the connector type.

Meaning of the words in the table:

- *Internal* = Ferrite cores are equipped on the output stage of the device. Guiding the line at X63 trough a ferrite core is **not** necessary.
- *External* = **No** ferrite cores are equipped on the output stage of the device. Therefore, the line at X63 must be guided as shown in the figure twice through one ferrite core (1-axis modules), two ferrite cores (2-axis modules) and three ferrite cores (3-, 4- and 6-axis modules).



12.B.1 Ferrite Cores at X63 (MD84 of the First Generation)

MD84	Variant	Ferrite core	
		Connection	Type
0268421	DC	Internal	1 x R28
	GC	Internal	1 x R28
	ZC	Internal	1 x R28
0268421	KC	External	1 x R63
	LC	External	1 x R63
0268422	IC	External	1 x R63
	QC	External	1 x R63
	UC	External	1 x R63
	WC	External	1 x R63
0268431	DC	Internal	1 x R28
	GC	Internal	1 x R28
	ZC	Internal	1 x R28
0268432	IC	External	1 x R63
	QC	External	1 x R63
	UC	External	1 x R63
	WC	External	1 x R63
02684120	DDC	Internal	2 x R28
	EEC	Internal	2 x R28
02684130	DDC	Internal	2 x R28
	EEC	Internal	2 x R28
02684200	EEC	Internal	2 x R28
02684220	EEC	Internal	2 x R28
02684250	EEC	Internal	2 x R28
02684270	EEC	Internal	2 x R28

12.B.2 Ferrite Cores at X63 (MD84 of the Second Generation)

MD84	Variant	Ferrite core	
		Connection	Type
0268451	GC	Internal	1 x R28
	LC	External	1 x R63
0268452	IC	External	1 x R63
	UC	External	1 x R63
	WC	External	1 x R63
02684150	DDC	Internal	2 x R28
	EEC	Internal	2 x R28
02684350	EEC	Internal	2 x R28
02684360	EEC	Internal	2 x R28

12.B.3 Ferrite Cores at X63 (MD84 Nano)

MD84 Nano	Variant	Ferrite core	
		Connection	Type
0268461	GC	External	1 x R63
0268462	IC	External	1 x R63
0268462	WC	External	1 x R63
0268471	GC	External	1 x R63
0268472	IC	External	1 x R63
0268472	WC	External	1 x R63
02684160	YYC	Internal	2 x R28
02684170	YYC	Internal	2 x R28
02684170	ZZC	Internal	2 x R28
02684172	IIC	External	2 x R63
02684180	DDC	Internal	2 x R28
02684180	DDDC	Internal	3 x R28
02684402	IC	External	2 x R63
02684402	ZC	Internal	2 x R28
02684403	DC	Internal	3 x R28
02684404	ZC	Internal	4 x R28
02684406	DC	Internal	6 x R28

13 Glossary

Peak current (pulse current) I_{0max} [A]

The peak current (effective sinusoidal value) is approximately equivalent to 4 times the standstill current. The peak current of the connected servo amplifier must be smaller.

Rated torque M_n [Nm]

rated torque is produced when the motor is drawing the rated current at the rated speed. The rated torque can be produced indefinitely in continuous operation (S1) at the rated speed.

Release delay time t_{BRH} [ms] / application delay time t_{BRH} [ms] of a motor brake

These constants define the reaction times of the holding brake during operation with rated voltage ate the servo amplifier.

Rotor moment of inertia J [kgcm^2]

The constant J is a measure for the acceleration capability of the motor. For instance, at I_0 the acceleration time t_b from 0 to 3,000 rpm is (with M_0 in Nm and J in kgcm2):

$$t_{b(s)} = \frac{3000 \times 2\pi}{M0 \times 60s} \times \frac{m^2}{10^4 \times cm^2} \times J$$

Standstill current I_{0rms} [A]

The standstill current is the effective sinusoidal current drawn by the motor at a speed of n<100 rpm in order to produce the stillstand torque.

Standstill torque M_0 [Nm]

The standstill torque can be maintained indefinitely at a speed of n<100 min^{-1} and rated ambient temperatures.

Thermal time constant t_{th} [min]

The constant t_{th} defines the time for the cold motor, under a load of I_0 to heat up to an overtemperature of $_0$.63 × 100 K. When loaded with peak current, the motor is heated up in a much shorter time

Torque constant K_{Trms} [Nm/A]

The torque constant defines the torque in Nm generated by the motor per 1 A sine RMS current. The following applies: M = I × K_T (to max. I = 2 × I_0)

Voltage constant K_{Erms} [mVmin]

The voltage constant determines the induced motor EMF as effective sinusoidal current between two terminals, per 1,000 rpm.

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