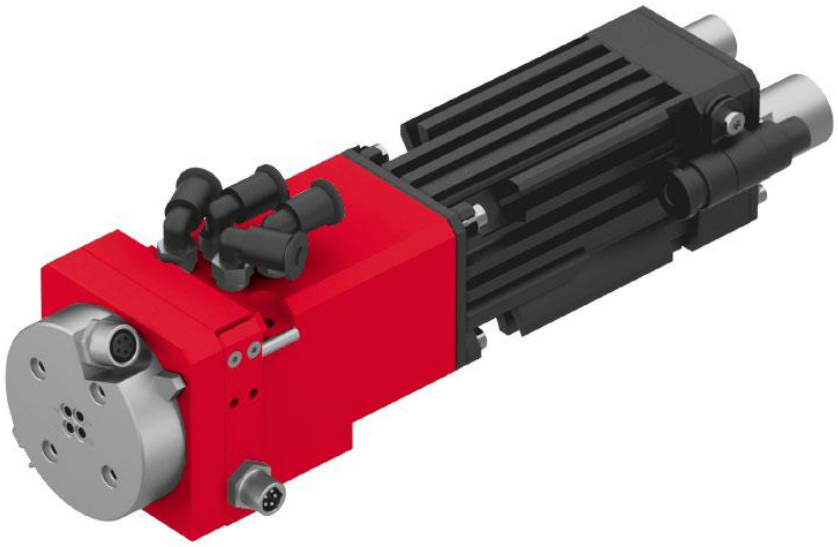
Assembly and operating instructions

Rotational axis

RA-40



Translation of the Original Assembly Instructions EN

- RA-40-2F
- RA-40-4F

Dear Customer

Thank you for choosing our products and placing your trust and confidence in our company!

These assembly and operating instructions contain all essential information you need about your product. Our aim is to provide the required information as concisely and clearly as possible. If, however, you still have any questions on the contents or suggestions, please do not hesitate to contact us. We are always grateful for any feedback.

Our team will also be glad to answer any further question you may have regarding the rotational axis or other options.

We wish you every success with our products!

With kind regards

Your Afag team

© Subject to modifications

The rotational axes have been designed by Afag according to the state of the art. Due to the constant technical development and improvement of our products, we reserve the right to make technical changes at any time.

Updates of our documentations

Unlike the printed documents, our digital instructions manuals, product data sheets and catalogues are being continuously updated on our website.

Please keep in mind that the digital documents on our website are always the latest versions.

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1 General

1.1 Contents and purpose of these assembly instructions

These assembly instructions contain important information on assembly, commissioning, functioning and maintenance of the rotational axis RA-40 to ensure safe and efficient handling and operation.

Consistent compliance with these assembly instructions will ensure:

- permanent operational reliability of the rotational axis,
- optimal functioning of the rotational axis,
- timely detection and elimination of defects (thereby reducing maintenance and repair costs)
- Prolonging of the rotational axis service life.

The illustrations in this manual shall provide you with a basic understanding of the module and may vary from the actual design of your module.

1.2 Explanation of symbols

The safety notes are marked by a pictogram and a signal word. The safety notes describe the extent of the hazard.

DANGER

Danger!

This safety note indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Warning!

This safety note points out a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Caution!

This safety note points out a potentially dangerous situation which, if not avoided, can result in minor or slight injuries.

NOTICE

This safety note points out a potentially dangerous situation which, if not avoided, can cause substantial damage to property and the environment.

This note contains important additional information as well as useful tips for safe, efficient and trouble-free operation of the rotational axis.

Further warning signs:

Where applicable, the following standardised symbols are used in this manual to point out the various potential health risks.

	Warning - Dangerous electrical voltage.
	Warning - Risk of injury from contact with hot surfaces.
	Warning - Risk of hand and finger injury due to uncontrolled movements of components.
	Warning - Magnetic field
	Warning - back injury due to heavy lifting.
	Warning - Risk of injury as a result of parts being flung out!
	Warning -high noise levels

1.3 Additional symbols

In these assembly instructions the following symbols are used to highlight instructions, results, references, etc.

Symbol	Description
1.	Instructions (steps ...)
⇨	Results of actions
➲	References to sections
■	Enumerations not ordered

1.4 Applicable documents

Each rotational axis is accompanied by a safety information sheet. This information sheet must be read carefully by every person who carries out work on and with the rotational axis.

1.5 Warranty

The warranty terms for Afag handling components and handling systems are the following:

- 24 months from initial operation and up to a maximum of 27 months from delivery.
- Wear parts are excluded from the warranty (The customer is entitled to a product free of defects. *This does also apply to defective accessories and wear parts. Normal wear and tear are excluded from the warranty.*

The warranty covers the replacement or repair of defective Afag parts. Further claims are excluded.

The warranty shall expire in the following cases:

- Improper use of the module.
- Non-observance of the instructions regarding assembly, commissioning, operation and maintenance of the module.
- Improper assembly, commissioning, operation and maintenance.
- Repairs and design changes carried out without prior technical instructions of Afag.
- Removing the serial number from the product.
- Inadequate checking of wear parts.
- Non-observance of the EC Machinery Directive, the Accident Prevention Regulations, the Standards of the German Electrotechnology Association (VDE) and these safety and assembly instructions.

1.6 Liability

No changes shall be made to the rotational axis unless described in this instructions manual or approved in writing by Afag.

Afag accepts no liability for unauthorized changes or improper assembly, installation, commissioning, operation, maintenance or repair work.

2 Safety instructions

2.1 General

This chapter provides an overview of all important safety aspects to ensure safe and proper use of the rotational axis and optimal protection of personnel.

Safe handling and trouble-free operation of the module requires knowledge of the basic safety regulations.

Every person carrying out installation, commissioning, maintenance work or operating the module must have read and understood the complete user manual, especially the chapter on safety instructions.

Beyond this, there are rules and regulations regarding accident prevention that are applicable to the place of installation which must be observed.

Improper use may result in danger to life and limb of the user or third parties or in damage to the automation system or other material assets.

Failure to follow the directions and safety instructions given in this instructions manual may result in serious hazards.

2.2 Intended use

The rotary axes are used in automation systems and are used to move workpieces in non-hazardous environments and in the ambient and operating conditions defined for these modules (➲Chapter 3 Technical data).

The rotational axes are designed exclusively for gripping payloads that do not pose any danger to persons, property, or the environment during manipulation. In combination with other modules the modules can be used as a pick & place station.

Any use beyond the described purpose is not in accordance with the intended use.

The intended use of the module also includes:

- observance of all instructions given in this instructions manual.
- compliance with the inspection and maintenance work and the specifications in the data sheets,
- using only original spare parts.

2.3 Foreseeable misuse

Any use other than or beyond the intended use described above is considered a misuse of the rotational axis.

Especially the following use is considered a misuse:

- Use in potentially explosive atmospheres

WARNING

Risk of injury if the module is not used as intended!

The improper use of the rotational axis poses a potential hazard to the personnel.

- The rotational axes may only be used in a technically perfect condition in accordance with its intended use and the instructions in this manual as well as in compliance with the safety requirements!
- Any malfunctions, particularly those that could impair safety, must be eliminated immediately!

Risks can occur if the module is not used as intended. In the event of damages caused by improper use the following shall apply:

- the operating company shall be solely responsible for such damage, and
- Afag does not accept any liability for damage caused by improper use.

2.4 Obligations of the operator and the personnel

2.4.1 Observe the assembly instructions

A basic prerequisite for safe and proper handling of the rotational axis is a good knowledge of the basic safety instructions.

These assembly instructions, in particular the safety instructions contained therein, must be observed by all persons working with the rotational axis.

2.4.2 Obligations of the operating company

In addition to the safety instructions given in this manual, the operating company must comply with the safety, accident prevention and environmental protection regulations valid for the field of application of the rotational axis.

The operating company is required to use only personnel who:

- have the necessary professional qualifications and experience,
- are familiar with the basic rules regarding occupational safety and accident prevention,
- have been instructed in the correct handling of the rotational axis,
- have read and understood these assembly instructions.

The operating company is also required to:

- monitor on an ongoing basis that the personnel work safely considering any potential hazard involved and the assembly instructions are observed,
- ensure that the assembly instructions are always kept at hand at the installation in which the modules are mounted,
- observe and communicate universally applicable laws and regulations regarding accident prevention and environmental protection,
- provide the necessary personal protective equipment (e.g., protective gloves) and instruct the personnel to wear it.

2.4.3 Obligations of the personnel

All personnel working with the modules are required to:

- read and observe these assembly instructions, especially the chapter on safety,
- observe the occupational safety and accident prevention regulations,
- observe all safety and warning signs on the rotational axis,
- refrain from any activity that might compromise safety and health.

In addition, the personnel must wear the personal protective equipment required for carrying out their work. (➲Chapter 2.6).

2.5 Personnel requirements

2.5.1 Personnel qualification

The activities described in the assembly instructions require specific requisites at the level of professional qualifications of the personnel.

Personnel not having the required qualification will not be able to asses the risks that may arise from the use of the rotational axis thus exposing himself and others to the risk of serious injury. Therefore, only qualified personnel may be permitted to carry out the described activities on the rotational axis.

Persons whose ability to react is restricted due to the intake of medication or the like must not interact with the rotational axis.

These installation instructions are intended for skilled personnel (installers, system integrators, maintenance personnel, technicians), electricians and operating personnel.

The following is a description of the professional skills (qualifications) required for carrying out the different activities:

Qualified personnel:
Qualified personnel with appropriate training who are qualified due to their special know-how and fully familiar with the machine and who have been given instructions on how to carry out the task entrusted to them safely.

Qualified electrician:
Persons who have obtained their electrical qualifications through appropriate professional training and complementary courses that enables them to identify risks and prevent possible hazards resulting from electricity.

Operator (trained personnel):
Authorized persons who due to their specialized professional training, expertise and experience are capable of identifying risks and preventing possible hazards arising from the use of the machine.

2.6 Personal protective equipment (PPE)

The personal protective equipment serves to protect the personnel from hazards affecting their safety and health at work.

When working on/with the rotational axis, the personnel must wear the personal protective equipment assigned by the safety officer of the operating company or as required by safety regulations. In addition, the personnel is required to:

- wear the personal protective equipment provided by the operating company (employer),
- check the personal protective equipment for proper condition, and
- immediately notify the person responsible on site of any defects found on the personal protective equipment.

Personal protective equipment and the respective mandatory signs:

	*Protective clothing* is a close-fitting clothing specifically designed to protect personnel from hazards during work.
	*Protective gloves* are specifically designed to protect the personnel against hand injuries (such as cuts, abrasion, burns).
	*Safety shoes* are specifically designed to protect the personnel against foot injuries from crushing, falling objects or slipping on slippery surfaces.
	*Hearing protectors* are required to protect the personnel against excessive noise levels to prevent noise-induced hearing loss.

2.7 Changes and modifications

No changes may be made to the rotational axis which have not been described in these assembly instructions or approved in writing by Afag.

Afag accepts no liability for unauthorised changes or improper assembly, installation, commissioning, maintenance or repair work.

The rotational axis may not be changed or modified in any way, except with the prior written consent of Afag.

2.8 General hazards / residual risks

Despite the safe design of the rotational axis and the technical protective measures taken, there still remain residual risks that cannot be avoided, and which present a non-obvious residual risk when operating the module.

Observe the safety instructions in this chapter and in the other sections of this manual to avoid damage to property and dangerous situations for the personnel.

2.8.1 General hazards at the workplace

The rotational axis has been built according to the state-of-the-art and the applicable health and safety requirements. However, improper use of the rotational axis may cause the following hazards to the personnel:

- danger to life and limb of the operator or third parties,
- on the rotational axes themselves,
- property damage.

Always keep the assembly instructions ready at hand at the workplace! Furthermore, the following apply:

- the general and local regulations on accident prevention and environmental protection,
- the safety information sheet for the rotational axis.

WARNING

Danger - Do not use in unsuitable environment!

The rotational axes are designed for use in **non** explosive atmospheres.

- Do **not** use the modules in potentially explosive atmospheres!

WARNING

Risk of injuries due to uncontrolled parts movements!

When connecting and operating the rotational axes, unexpected movements can lead to serious injuries and/or damage to property.

- Only qualified personnel may work with or on the rotational axis.

CAUTION

Risk of injury due to high noise exposure!

The noise level of the rotational axis at full load operation is below 78 dB(A). Depending on the add-ons, the environment and the resonance of the protective device theses values may be exceeded and expose the operator to a higher noise level.

- The operating company is responsible for ensuring that the permissible noise levels are observed.

CAUTION

Risk of injury from being caught!

Rotative movements of the module can catch pieces of clothing, hair or materials and injure people.

- Maintenance and care should only be carried out by qualified personnel.
- Wear personal protective equipment!

2.8.2 Danger due to electricity

DANGER

Danger! Risk of electric shock!

If work on electrical components is required, ensure that the work is carried out properly, failure to do so will cause serious or fatal injuries.

- Work on the machine's electrical equipment may only be performed by skilled electrician or trained personnel under the supervision of a skilled electrician in accordance with all relevant electrical regulations.
- Only work on electrical systems when they are de-energised!

2.8.3 Danger due to strong magnetic fields.

DANGER

Danger due to strong magnetic fields.

Due to the strong magnetic fields, electronic devices such as pacemakers can be disturbed or their function impaired.

- Persons with a pacemaker must keep a safety distance of at least 0.2 [m] cm.
- The system must be provided with appropriate warning signs.
- The personnel shall be instructed accordingly

2.8.4 Danger due to high temperatures

CAUTION

Danger of injury from hot surfaces.

During operation, maintenance and repair of the rotational axis, the surface heats up to 60°C.

- Wear protective gloves!
- Before touching hot surfaces without protective gloves, make sure they have cooled down to ambient temperature.

2.8.5 Mechanical hazards

CAUTION

Danger of injury by moving components!

Limbs can be injured by moving components (bruises, contusions, broken bones)!

- Work on and with the rotational axis may only be carried out by qualified personnel.
- Never reach into the system during normal operation!
- Provide suitable protective enclosure.

3 Technical data

3.1 Rotational axis RA-40-2F

3.1.1 Dimensional drawing RA-40-2F

Type	RA-40-2F	RA-40-2F (ZE)
A	141 mm	159 mm

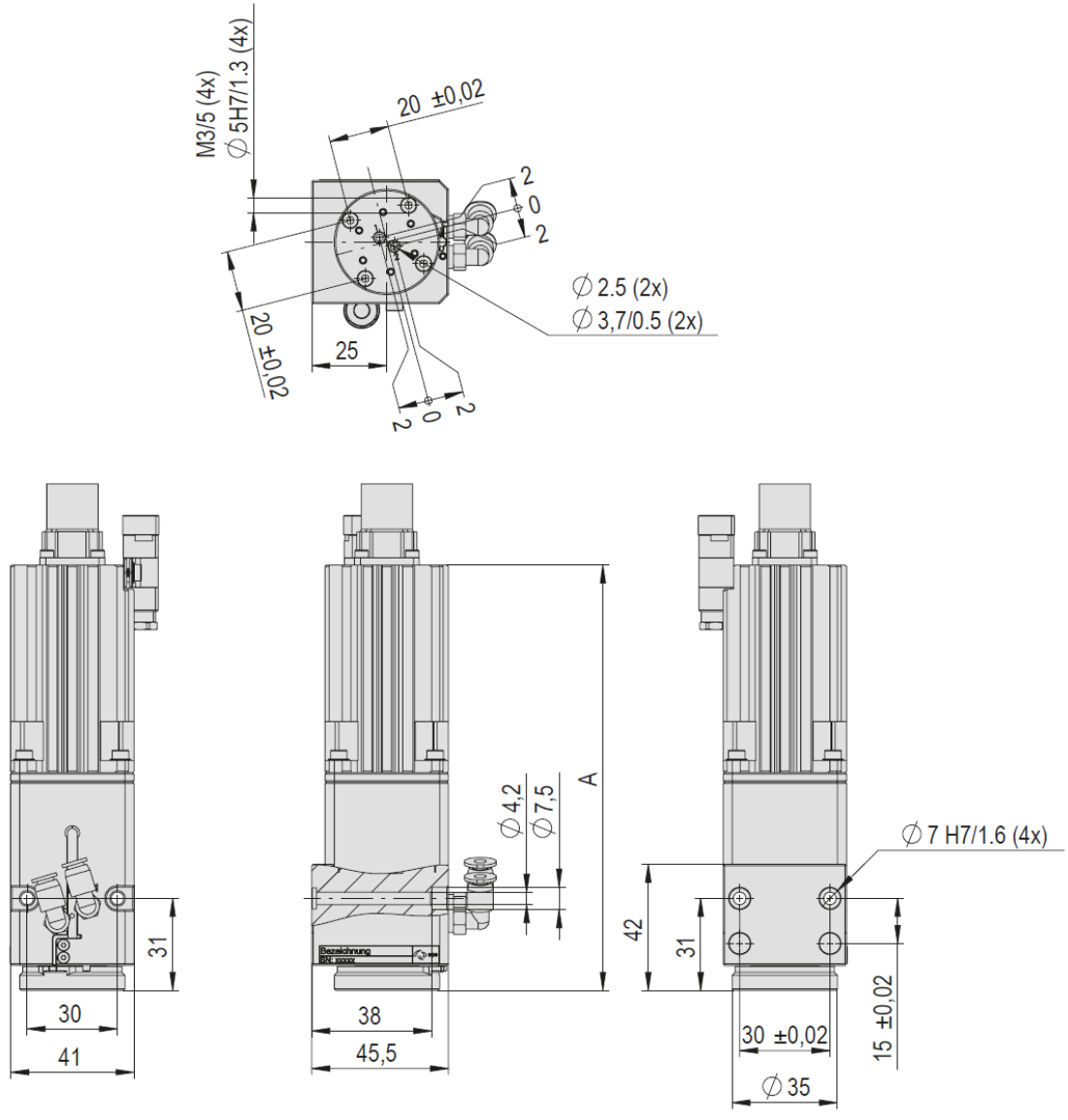

Fig. 1 Dimensional drawing rotational axis RA-40-2F

3.1.2 Technical data RA-40-2F

RA-40-2F	
Operating temperature	0 - 50 °C
Storage temperature	0 - 50 °C
Humidity	< 90 %

Type	RA-40-2F-30-G	RA-40-2F-30-W	RA-40-2F-30-G-ZE	RA-40-2F-30-W-ZE
Order number	**50473180**	**50473182**	**50473183**	**50473184**
Net weight	0.69 kg	0.69 kg	0.74 kg	0.74 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	280 rpm	280 rpm	280 rpm	280 rpm
Fluid passages	2	2	2	2
Continuous torque	1.2 Nm	1.2 Nm	1.2 Nm	1.2 Nm
Max. output torque	2.4 Nm	2.4 Nm	2.4 Nm	2.4 Nm
Ratio	30:1	30:1	30:1	30:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 61440 Inc/U	SV-TLL ABZ, 61440 Inc/U
Mounting position	✣	✣	✣	✣

Type	RA-40-2F-50-G	RA-40-2F-50-W	RA-40-2F-50-G-ZE	RA-40-2F-50-W-ZE
Order number	**50473185**	**50473186**	**50473187**	**50473188**
Net weight	0.69 kg	0.69 kg	0.74 kg	0.74 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	140 rpm	140 rpm	140 rpm	140 rpm
Fluid passages	2	2	2	2
Continuous torque	2 Nm	2 Nm	2 Nm	2 Nm
Max. output torque	4 Nm	4 Nm	4 Nm	4 Nm
Ratio	50:1	50:1	50:1	50:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 102400 Inc/U	SV-TLL ABZ, 102400 Inc/U
Mounting position	✣	✣	✣	✣

The technical data pertains to Afag standard test conditions.
Air purity class 5 (ISO 14644-1)
Cleanroom class: 10 000 (Federal Standard 209E)

In the article description of a rotary axis the "F" stands for fluid passages and the "E" for electrical feed-through. There are two version of motor plugs. A „G" in the article description of the rotary axis stand for a straight and the „W" for an angular plug. Also see order key for RA-40.

Inlcuded in the delivery
(Catalogue HT accessories)
- 2x Centering bushing Ø7x3
- 2x O-ring 2.5x0.62 mm

Accessories
(Product-specific accessories)
- Adapters

(Catalogue HT accessories)
- Motor cable-M16
- Controller C1xxx-1S
- Plug kit for C1xxx-1S
- USB-RS232 Converter for controllers
- Power supply S01-72/500, 1-phase

Alternative accessories
(Catalogue HT accessories)
- Additional motor cables
- Additional controllers
- Additional power supplies

3.1.3 Dimensional drawing RA-40-2F-5E

Type	RA-40-2F-5E	RA-40-2F-5E (ZE)
A	155 mm	173 mm

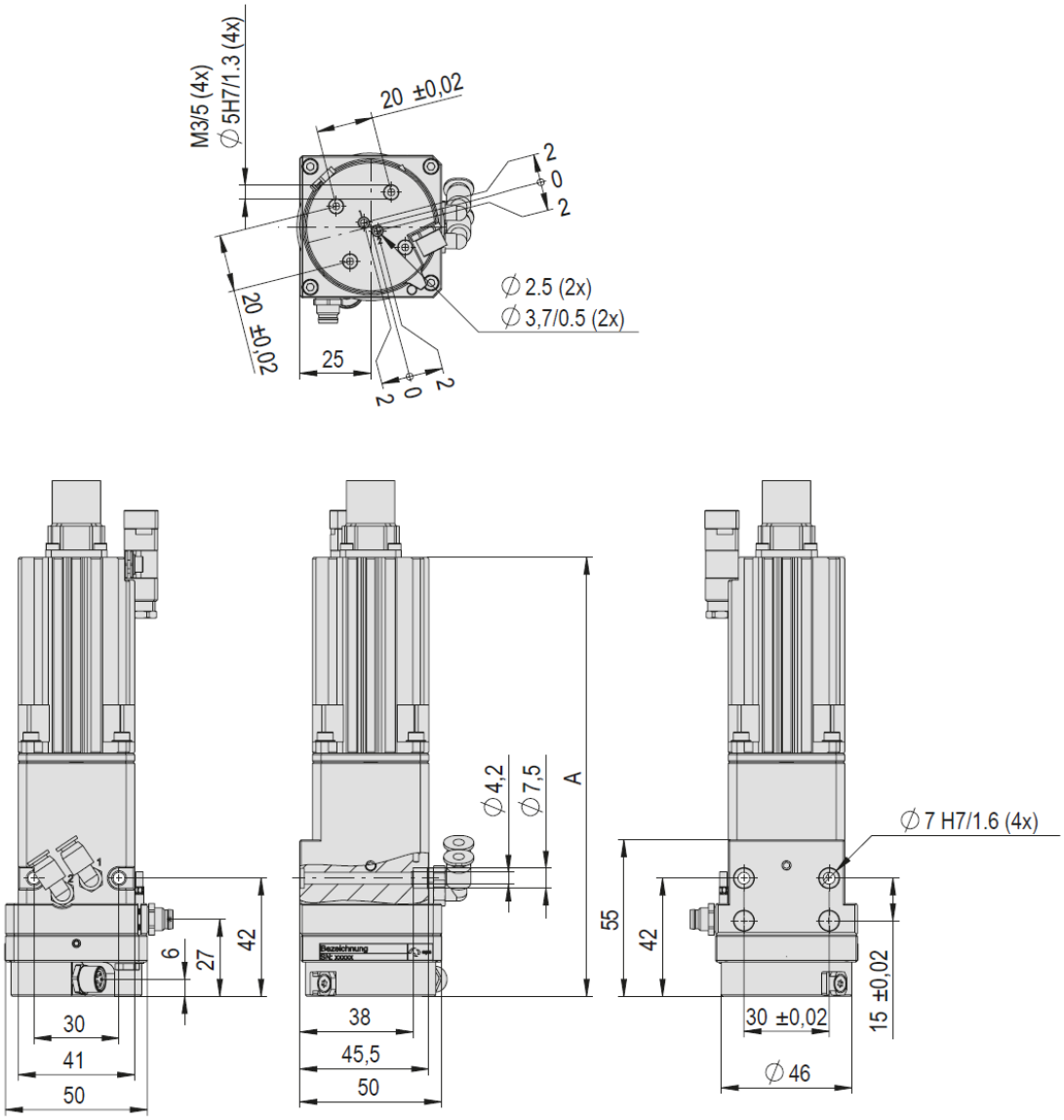

Fig. 2 Dimensional drawing rotational axis RA-40-2F-5F

3.1.4 Technical data RA-40-2F-5F

RA-40-2F-5E	
Operating temperature	0 - 50 °C
Storage temperature	0 - 50 °C
Humidity	< 90 %

Type	RA-40-2F-5E-30-G	RA-40-2F-5E-30-W	RA-40-2F-5E-30-G-ZE	RA-40-2F-5E-30-W-ZE
Order number	**50473197**	**50473198**	**50473200**	**50473201**
Net weight	0.84 kg	0.84 kg	0.89 kg	0.89 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	280 rpm	280 rpm	280 rpm	280 rpm
Electrical feed-through	5 x 2 A	5 x 2 A	5 x 2 A	5 x 2 A
Fluid passages	2	2	2	2
Continuous torque	1.2 Nm	1.2 Nm	1.2 Nm	1.2 Nm
Max. output torque	2.4 Nm	2.4 Nm	2.4 Nm	2.4 Nm
Ratio	30:1	30:1	30:1	30:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 61440 Inc/U	SV-TLL ABZ, 61440 Inc/U
Mounting position	✣	✣	✣	✣

Type	RA-40-2F-5E-50-G	RA-40-2F-5E-50-W	RA-40-2F-5E-50-G-ZE	RA-40-2F-5E-50-W-ZE
Order number	**50473202**	**50473203**	**50473204**	**50473205**
Net weight	0.84 kg	0.84 kg	0.89 kg	0.89 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	140 rpm	140 rpm	140 rpm	140 rpm
Electrical feed-through	5 x 2 A	5 x 2 A	5 x 2 A	5 x 2 A
Fluid passages	2	2	2	2
Continuous torque	2 Nm	2 Nm	2 Nm	2 Nm
Max. output torque	4 Nm	4 Nm	4 Nm	4 Nm
Ratio	50:1	50:1	50:1	50:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 102400 Inc/U	SV-TLL ABZ, 102400 Inc/U
Mounting position	✣	✣	✣	✣

The technical data pertains to Afag standard test conditions.
Air purity class 5 (ISO 14644-1)
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In the article description of a rotary axis the "F" stands for fluid passages and the "E" for electrical feed-through. There are two version of motor plugs. A „G" in the article description of the rotary axis stand for a straight and the „W" for an angular plug. Also see order key for RA-40.

Inlcuded in the delivery
(Catalogue HT accessories)
- 2x Centering bushing Ø7x3
- 2x O-ring 2.5x0.62 mm

Accessories
(Product-specific accessories)
- Adapters
- Proximity switch cables/-extensions

(Catalogue HT accessories)
- Motor cable-M16
- Controller C1xxx-1S
- Plug kit for C1xxx-1S
- USB-RS232 Converter for controllers
- Power supply S01-72/500, 1-phase

Alternative accessories
(Catalogue HT accessories)
- Additional motor cables
- Additional controllers
- Additional power supplies

3.2 Rotational axis RA-40-4F

3.2.1 Dimensional drawing RA-40-4F

Type	RA-40-4F	RA-40-4F (ZE)
A	151 mm	169 mm

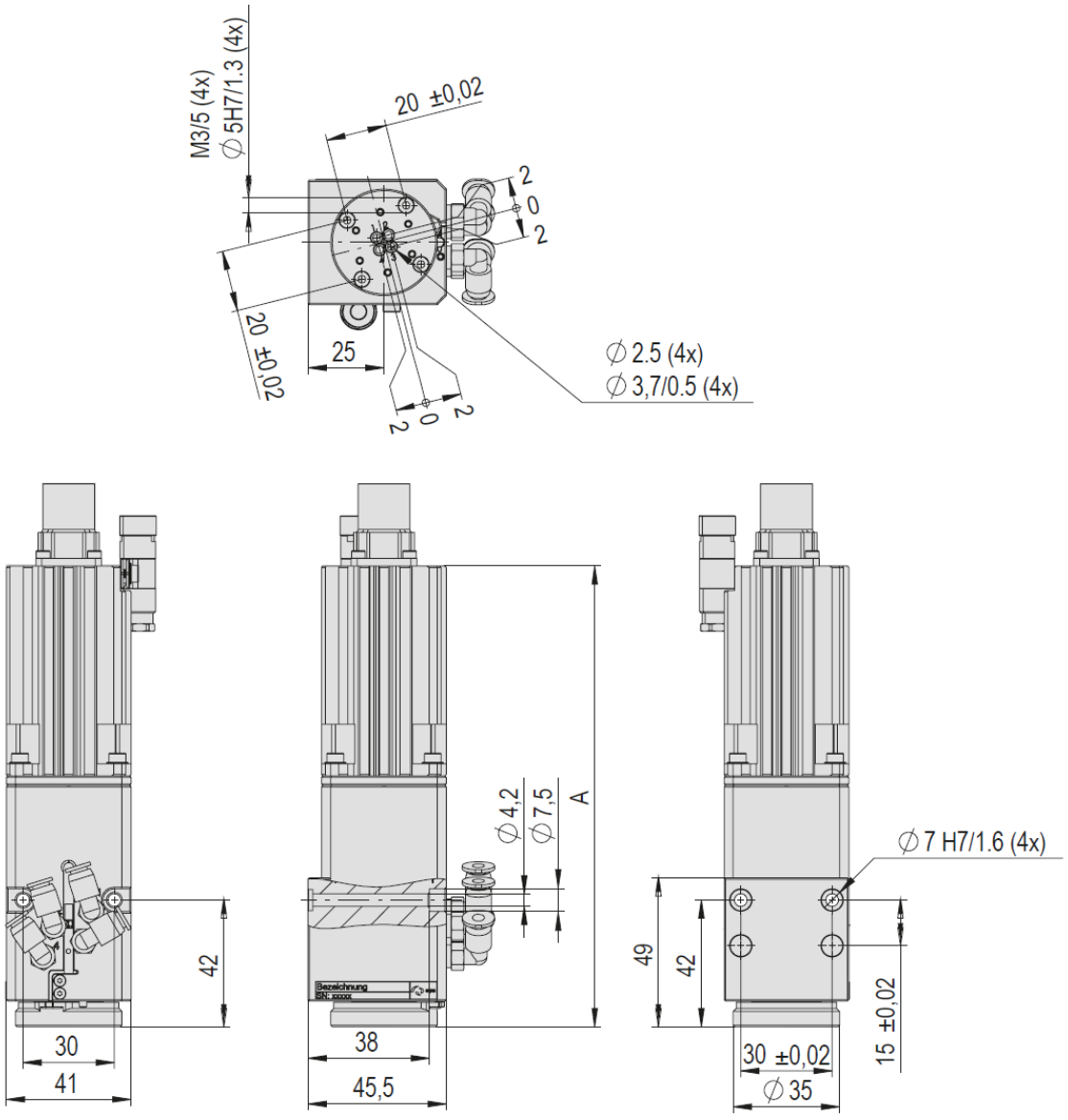

Fig. 3 Dimensional drawing rotational axis RA-40-4F

3.2.2 Technical data RA-40-4F

RA-40-4F	
Operating temperature	0 - 50 °C
Storage temperature	0 - 50 °C
Humidity	< 90 %

Type	RA-40-4F-30-G	RA-40-4F-30-W	RA-40-4F-30-G-ZE	RA-40-4F-30-W-ZE
Order number	**50473189**	**50473190**	**50473191**	**50473192**
Net weight	0.74 kg	0.74 kg	0.79 kg	0.79 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	280 rpm	280 rpm	280 rpm	280 rpm
Fluid passages	4	4	4	4
Continuous torque	1.2 Nm	1.2 Nm	1.2 Nm	1.2 Nm
Max. output torque	2.4 Nm	2.4 Nm	2.4 Nm	2.4 Nm
Ratio	30:1	30:1	30:1	30:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 61440 Inc/U	SV-TLL ABZ, 61440 Inc/U
Mounting position	✣	✣	✣	✣

Type	RA-40-4F-50-G	RA-40-4F-50-W	RA-40-4F-50-G-ZE	RA-40-4F-50-W-ZE
Order number	**50473193**	**50473194**	**50473195**	**50473196**
Net weight	0.74 kg	0.74 kg	0.79 kg	0.79 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	140 rpm	140 rpm	140 rpm	140 rpm
Fluid passages	4	4	4	4
Continuous torque	2 Nm	2 Nm	2 Nm	2 Nm
Max. output torque	4 Nm	4 Nm	4 Nm	4 Nm
Ratio	50:1	50:1	50:1	50:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 102400 Inc/U	SV-TLL ABZ, 102400 Inc/U
Mounting position	✣	✣	✣	✣

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Air purity class 5 (ISO 14644-1)
Cleanroom class: 10 000 (Federal Standard 209E)

In the article description of a rotary axis the "F" stands for fluid passages and the "E" for electrical feed-through. There are two version of motor plugs. A „G" in the article description of the rotary axis stand for a straight and the „W" for an angular plug. Also see order key for RA-40.

Inlcuded in the delivery
(Catalogue HT accessories)
- 2x Centering bushing Ø7x3
- 4x O-ring 2.5x0.62 mm

Accessories
(Product-specific accessories)
- Adapters

(Catalogue HT accessories)
- Motor cable-M16
- Controller C1xxx-1S
- Plug kit for C1xxx-1S
- USB-RS232 Converter for controllers
- Power supply S01-72/500, 1-phase

Alternative accessories
(Catalogue HT accessories)
- Additional motor cables
- Additional controllers
- Additional power supplies

3.2.3 Dimensional drawing RA-40-4F-5E

Type	RA-40-4F-5E	RA-40-4F-5E (ZE)
A	165 mm	183 mm

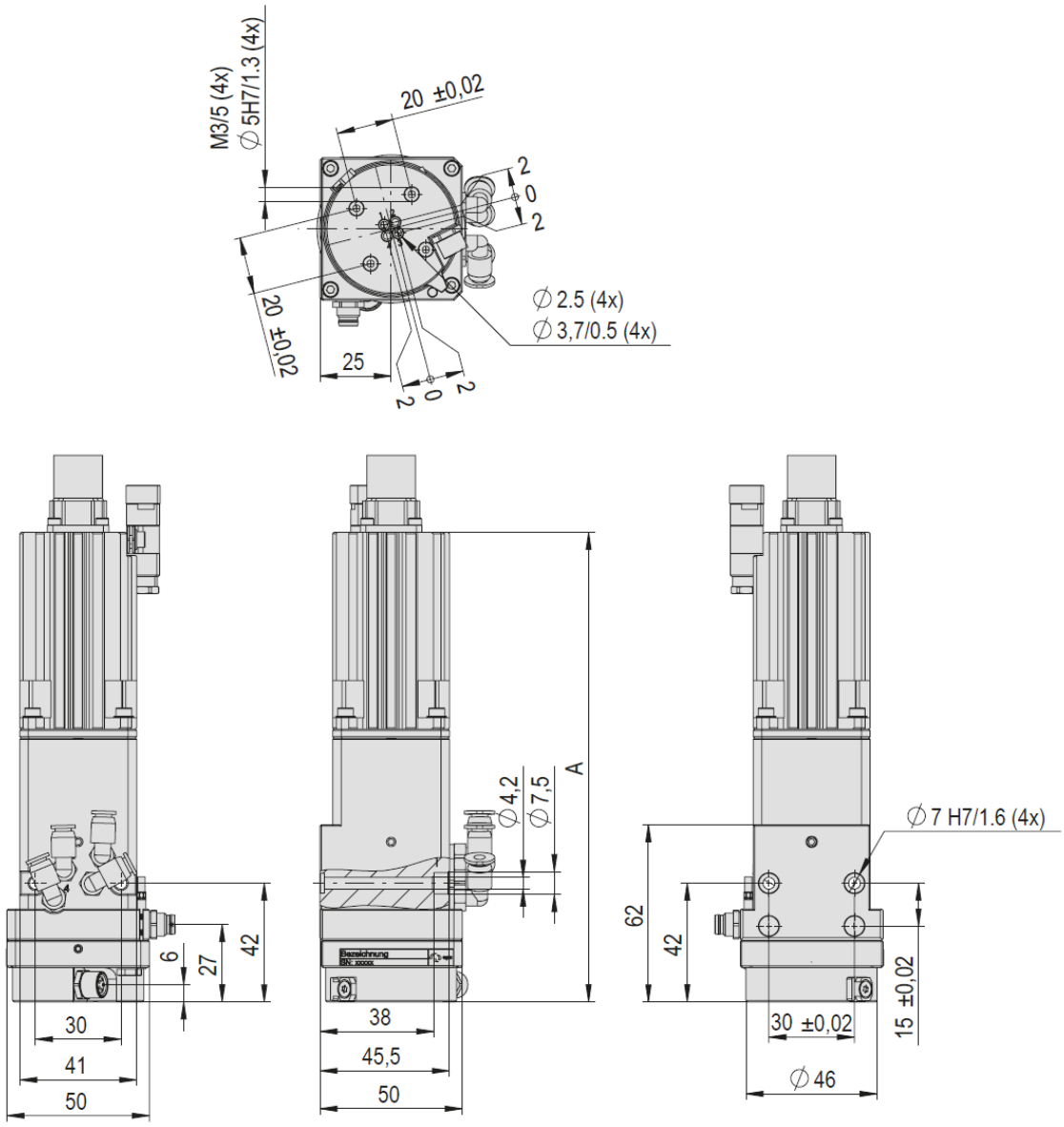


Fig. 4 Dimensional drawing rotational axis RA-40-4F-5F

3.2.4 Technical data RA-40-4F-5F

RA-40-4F-5E				
Operating temperature			0 - 50 °C	
Storage temperature			0 - 50 °C	
Humidity			< 90 %	

Type	RA-40-4F-5E-30-G	RA-40-4F-5E-30-W	RA-40-4F-5E-30-G-ZE	RA-40-4F-5E-30-W-ZE
Order number	**50473206**	**50473207**	**50473208**	**50473209**
Net weight	0.89 kg	0.89 kg	0.94 kg	0.94 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	280 rpm	280 rpm	280 rpm	280 rpm
Electrical feed-through	5 x 2 A	5 x 2 A	5 x 2 A	5 x 2 A
Fluid passages	4	4	4	4
Continuous torque	1.2 Nm	1.2 Nm	1.2 Nm	1.2 Nm
Max. output torque	2.4 Nm	2.4 Nm	2.4 Nm	2.4 Nm
Ratio	30:1	30:1	30:1	30:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 61440 Inc/U	SV-TLL ABZ, 61440 Inc/U
Mounting position	✣	✣	✣	✣

Type	RA-40-4F-5E-50-G	RA-40-4F-5E-50-W	RA-40-4F-5E-50-G-ZE	RA-40-4F-5E-50-W-ZE
Order number	**50473210**	**50473211**	**50473212**	**50473213**
Net weight	0.89 kg	0.89 kg	0.94 kg	0.94 kg
Angle of rotation	∞	∞	∞	∞
Max. rotational speed	140 rpm	140 rpm	140 rpm	140 rpm
Electrical feed-through	5 x 2 A	5 x 2 A	5 x 2 A	5 x 2 A
Fluid passages	4	4	4	4
Continuous torque	2 Nm	2 Nm	2 Nm	2 Nm
Max. output torque	4 Nm	4 Nm	4 Nm	4 Nm
Ratio	50:1	50:1	50:1	50:1
Repeat accuracy	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °	+/- 0.0017 °
Encoder (optional)			SV-TLL ABZ, 102400 Inc/U	SV-TLL ABZ, 102400 Inc/U
Mounting position	✣	✣	✣	✣

The technical data pertains to Afag standard test conditions.
Air purity class 5 (ISO 14644-1)
Cleanroom class: 10 000 (Federal Standard 209E)

In the article description of a rotary axis the "F" stands for fluid passages and the "E" for electrical feed-through. There are two version of motor plugs. A „G" in the article description of the rotary axis stand for a straight and the „W" for an angular plug. Also see order key for RA-40.

Inlcuded in the delivery
(Catalogue HT accessories)
- 2x Centering bushing Ø7x3
- 4x O-ring 2.5x0.62 mm

Accessories
(Product-specific accessories)
- Adapters
- Proximity switch cables/-extensions

(Catalogue HT accessories)
- Motor cable-M16
- Controller C1xxx-1S
- Plug kit for C1xxx-1S
- USB-RS232 Converter for controllers
- Power supply S01-72/500, 1-phase

Alternative accessories
(Catalogue HT accessories)
- Additional motor cables
- Additional controllers
- Additional power supplies

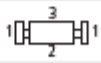
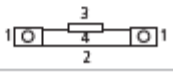
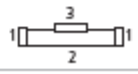
3.2.5 Preferred combinations RA-40

ES20	1,3	direct	2
ES30	1	direct	2
	3	VP 112	2
ES40	1	direct	2
	3	VP 112	2
SA-3	1,2	direct	2
SA-6	1,2	direct	2
PEZ-52	3	direct	2
PEZ-65	3	direct	2
PEL20	3	direct	2
PEL20-SL	3	direct	2
PEL30	3	direct	2
CS 16	1,3	direct	2
CS 20	1	direct	2
	3	VP 112	2
CS 25	1,3	VP 112	2
HM 16	1	direct	2
HM 25	1	VP 112	2
PMP	1,3	VP 112	2
PMP-c	1,3	VP 112	2
MTZ 25x2 b	1	direct	2
MT 45x2 c	1	direct	2

* Verbindungskabel
/ Câble de connexion
/ Connection cable

3	VP 50486393 *50596647	1,2	GE-25-P
3	VP 50486392	2	PG 12
3	VP 50486393	2	PG 16
3	VP 50486394	2	PG 20
3	VP 50486391	2	UG 20
3	VP 50486391	2	UG 25

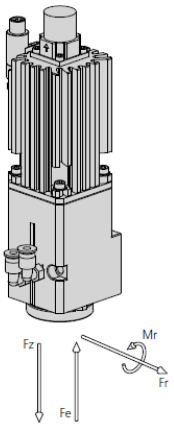
Mounting areas

CS, ES	LM	HM	SA	UG, GM, SG, DG, PG, GE, SGE
				
PMP, PMP-c	**PEZ, PDZ**	**PEL, PDL**	**RM, RE**	**CR, RM 32, RE, SREH, RA**
				

Note that there might be different mounting positions from one module to another one.
The required connection elements and the range of support columns are depicted in the catalogue HT accessories.

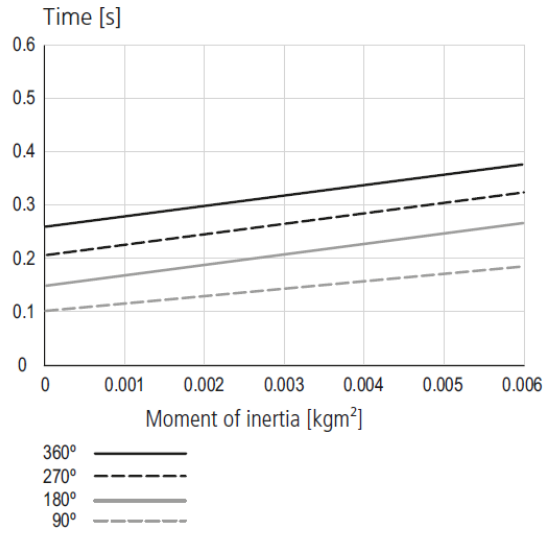
3.3 Module stresses

Type	RA-40
Max. torque Mr	10 Nm
Max. press-in force Fe	800 N
Max. radial force	±700 N
Max. pulling force Fz	350 N

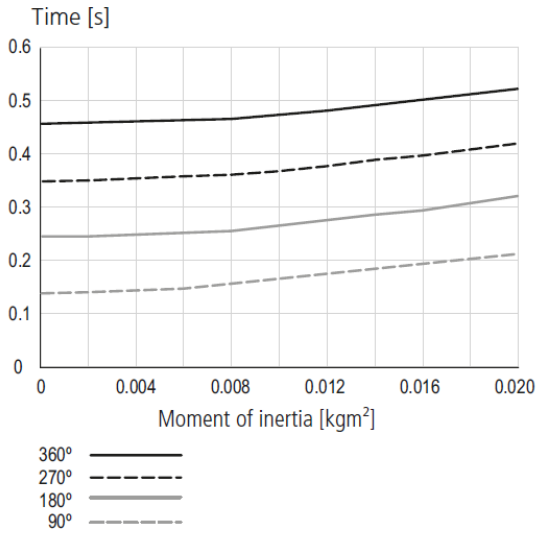


Rotation time diagrams

RA-40 with 30:1-gear



RA-40 with 50:1-gear



The times refer to break times of 600 ms.

4 Transport, packaging and storage

4.1 Safety instructions for transport

CAUTION

Risk of injury when unpacking the rotational axis!

The rotational axes are packed in the original packaging (cardboard box). If handled incorrectly, the module may fall out of the box when unpacked and cause limb injuries.

- Carefully unpack the rotational axes.

Also observe the safety instructions in chapter 2 „Safety instructions“ in this manual.

4.2 Scope of supply

In addition to the assembly and operating instructions, a safety information sheet is enclosed with each rotational axis.

This information sheet must be read by every person who carries out work with and on the rotational axis!

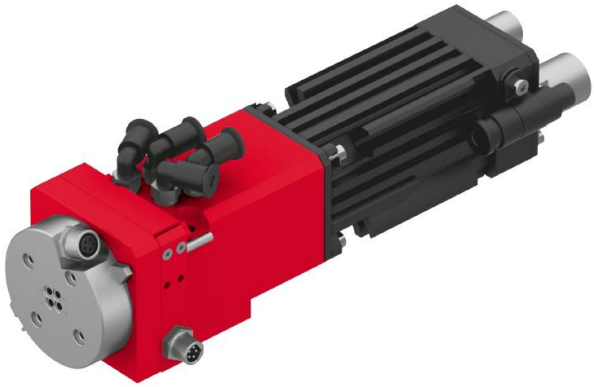


Fig. 5 Scope of delivery rotational axis

[Unt]	RA-40
1 x	Rotational axis RA-40
2 x	Centering bushing ø 7x3 mm
4 x	O-Ring 2.5x0.62 mm
1 x	Assembly & operating instructions

4.3 Transport

No liability can be assumed for damages caused by improper installation on the part of the operating company.

The following conditions must be complied with for transport and storage:

- Storage temperature: 0-50 °C
- Relative air humidity: < 90%, non condensing

4.4 Packaging

The rotational axis is transported in the Afag transport packaging. If no Afag packaging is used, the rotational axis must be packed in such a way that it is protected against shocks and dust.

The packaging materials used are mainly cardboard and paper or PE film.

NOTICE

Risk to the environment due to incorrect disposal of the packaging material

Environmental damage can be caused by incorrect disposal of the packaging material.

- Dispose of the packaging material in an environmentally sensitive way in accordance with the local environmental regulations (➲ chapter 10.3).

4.5 Storage

If the rotational axis is stored for an extended period, observe the following:

- Store the rotational axis in the transport packaging.
- Do not store the rotational axis outdoors or expose it to weather conditions.
- The storage space must be dry and dust free.
- Room temperature of the storage space: 0-50 °C.
- Relative air humidity: < 90% non condensing.
- Clean the rotational axis and protect the blank metal parts against corrosion using the appropriate means.
- Protect the rotational axis from dirt and dust.

5 Design and description

5.1 Structure rotational axis

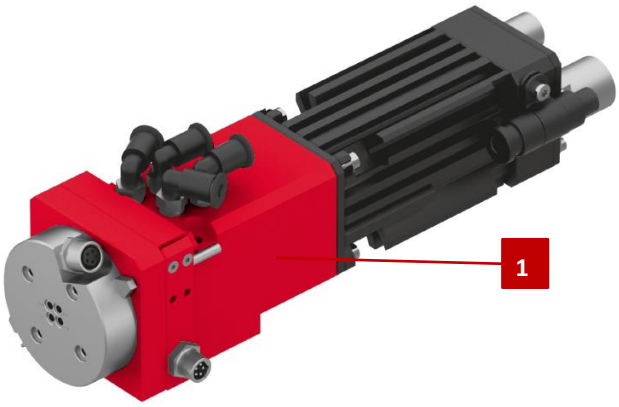


Fig. 6 Dimensional drawing rotational axis RA-40-4F

5.2 Product description

The rotational axis RA is a precision-engineered, highly compact electric axis for rotating payloads.

Further technical information can be found in the chapter 3 Technical data in these installation instructions.

In vacuum applications, grease may possibly occur when blowing off.

6 Installation, assembly and setting

The rotational axis is an incomplete machine. For safe operation, the module must be integrated into the safety concept of the system in which it is installed.

During normal operation, it must be ensured that the user cannot interfere with the working area of the rotational axis. This can be achieved through suitable protective measures (e.g., enclosure, light grid).

When the system is running in special operating modes, it must be ensured that there is no danger to the operator.

NOTICE

Risk of damage due to incorrect installation!

Incorrect installation can damage the module RA-40.

- Only use original LinMot cables for the connection.
- Mount the rotational axis only up to an outer dimension of max. 600 mm above the end plates.
- Recommendation to achieve higher accuracy: Fix the axle with fixing blocks (approx. every 100 mm).

The system operator is responsible for the installation of the rotational axis in a system! No warranty will be granted for damage caused by improper installation on the part of the operating company.

6.1 Safety instructions for installation and assembly

Also observe the safety instructions in ➲ chapter 2 „Safety instructions“ in this manual.

6.2 Assembly and attachment

6.2.1 Mounting material

The accessories depend on the rotational axis used as well as the adapter and weight.

Module	Recommended mounting material
RA-40	▪ 2/4x O-ring 2.5x0.62 NBR70 ▪ 2x Ø7x3 mm centering bushing ▪ 2x Ø5x2.5 mm centering bushing

Fig. 7 Accessories (mounting material)

6.2.2 Tightening torques

For assembling use screws with the following minimum specifications:

Standard	VDI 2230
Screw strength	Category 8.8
Surface:	Galvanized blue, oiled or greased

Thread	Tightening torque
M3	1.1 … 1.4 Nm
M4	2.6 … 3.3 Nm
M5	5.2 … 6.5 Nm
M6	9.0 … 11.3 Nm
M8	21.6 … 27.3 Nm

6.3 Connection

6.3.1 Power supplies

The following is an overview of the technical data of the power supply units. For further information on installation, please refer to the respective operating instructions for the power supply unit.

Fig. 8 Overview of power supply units

Technical data	SPH500-7207	SPH1013-7214	NT01-72/1500Multi
Type	primary switched power supply	primary switched power supply	primary switched power supply
Primary voltage	90-132VAC, 50/60Hz or 180-264VAC, 50/60Hz (automatic switching)	3x340 – 550 VAC, 50/60 Hz	3x230/400/480 VAC, 50/60 Hz
Secondary voltage	54-80 VDC adjustable	54-80 VDC adjustable	DC 72 V
Output power	480 W	960 W	1140 W
Peak output current (>0.5 s)	10 A	27 A	50 A
Efficiency	88%	91.5%	85% (at nominal power)
Protect. class	IP 20	IP 20	IPXXB
Operating temperature	-25…70 °C	-25…70 °C	0…40 °C
Ground	1 kg	2 kg	19 kg
Dimension (HxWxD)	125x62x121mm	230x66x177mm	275x280x165mm
External fuse	6 A (C, D, K type)	16-32 A (C, D, K Type)	6 A (C, D, K type)

6.3.2 Servo controller

Modules	SE-24	SE-Power 1kVA	SE-Power 3kVA	SE-Power 6kVA	C11xx	C12xx	E12xx	E14xx	Third party controllers
	Catalogue HT linear								
ES12					■				
ES20					■				
ES30					■				
ES40/-HP					■				
SA-1/-FL		■							
SA-3/-FL		■							
SA-6/-FL		■							
PEZ-52		■							
PEZ-65		■							
PEZ-80			■						
PEZ-100				■					
PDZ-128		■							
PDZ-160			■						
PDZ-200				■					
PEL20/-SL					■				
PDL30					■				
PDL40/-HP					■				
	Catalogue HT gripping & turning								
RE-50		■							
RE-50 18-100V					■				
RE-75		■							
RE-75 18-100V A					■				
SE20					■				
SE30					■				
RA-40					■				
SG-50	■								
SG-50-ABq					■				

The servo controllers (except the third party controllers) are servo position controllers that are specifically tailored to all Afag modules and axes. They provide you, the user, with extremely short commissioning times and simple, practical handling. The effort required for system integration is reduced to a minimum because all modules and axes are parametrised ex works, and processed to ensure optimal operation.

Note: In order to be connected to third party controllers, all cables are also available with open ends.
If you have any questions, please contact your sales partner.

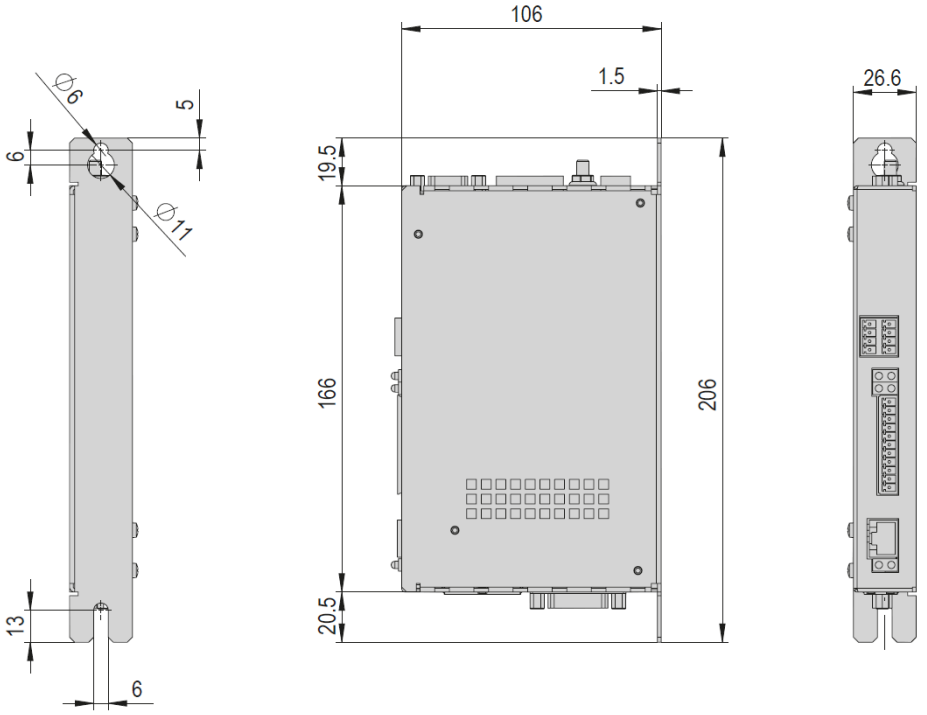
■ Standard
■ Alternative

Fig. 9 Overview servo controller

6.3.3 Axis controller C11x0

The following is an overview of the controller's interfaces. For more information on the C11x0 controller, please refer to the data sheet.

The controllers are pre-configured so that, as a rule, no software adjustments are necessary. If adjustments are to be made, the software "LinMot-Talk" can be obtained free of charge from the website"www.linmot.com".



Technical data

C11xx

C11xx	
Operating temperature	0 - 40 °C
Bearing temperature	-25 - 70 °C
Humidity	< 90 %

Type	C1100 CanOpen STO	C1150 EtherCat STO	C1150 Profinet PN STO
Order number	**50419402**	**50419403**	**50419404**
Net weight	0.7 kg	0.7 kg	0.7 kg
Dimensions W x H x D	26.6x206x106 mm	26.6x206x106 mm	26.6x206x106 mm
Nominal output current	25 A	25 A	25 A
Supply voltage	24 - 72 VDC	24 - 72 VDC	24 - 72VDC
Control voltage	24 VDC	24 VDC	24 VDC
Protection type	IP 20	IP 20	IP 20
Intermediate circuit voltage	24 - 80 VDC	24 - 80 VDC	24 - 80 VDC
Programming interface	RS 232	RS 232	RS 232

Inlcuded in the delivery
- 1x Plug kit for C1xxx-1S

Accessories
- Power supply S01-72/500, 1-phase
- Motor plug for controller C1x00
- USB-RS232 Converter for controllers

Alternative Accessories
- Additional power supplies

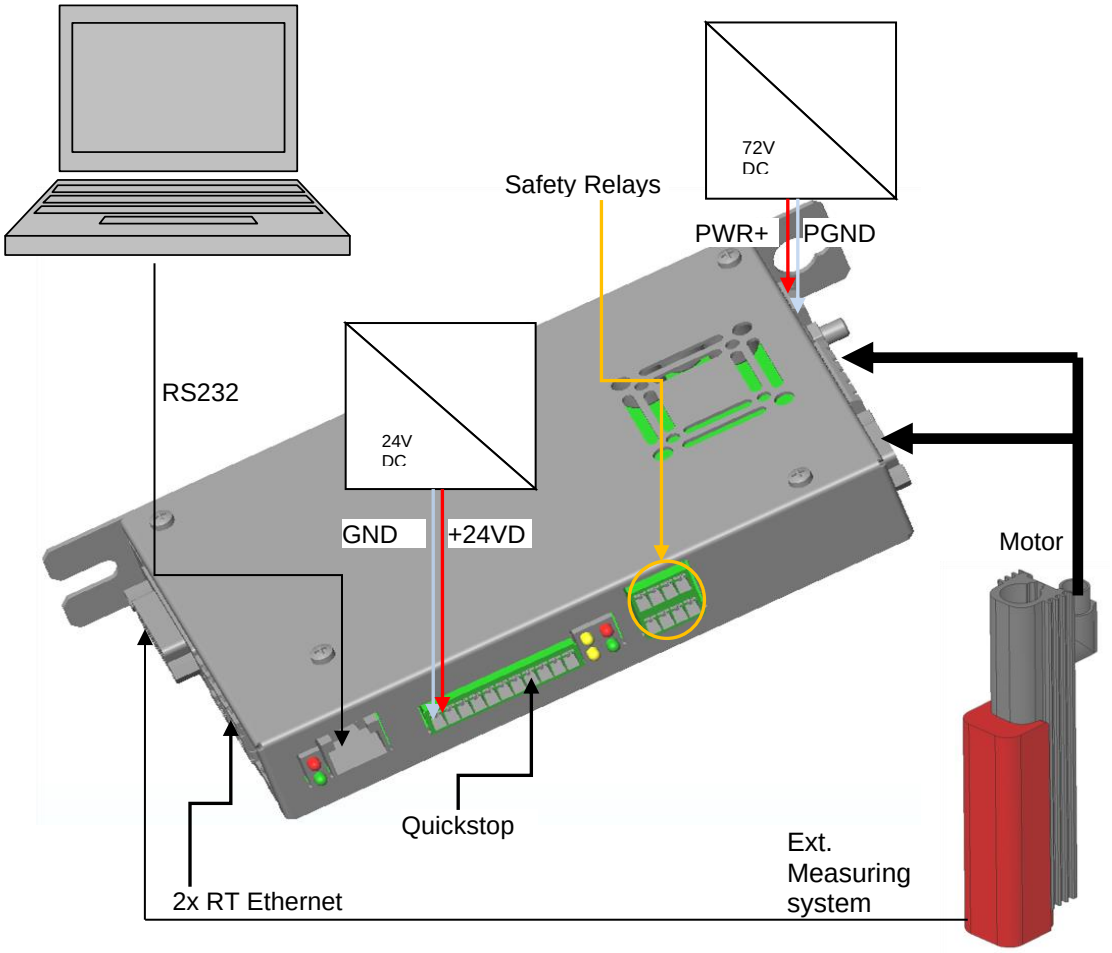


Fig. 10 Axis controller C11x0

Connection	Description
X1 PWR+	Motor power supply +72VDC
X1 PGND	Motor power supply GND
X2	Motor phases
X3	Motor Signals
X33	Safety relay (optional for -S1 version)
X4.8	Quickstop
X4.7	Reference sensor (optional)
X4.2	Logic power supply 24VDC
X4.1	Logic voltage supply GND

DANGER

Danger from electric shock when the safety door is open!

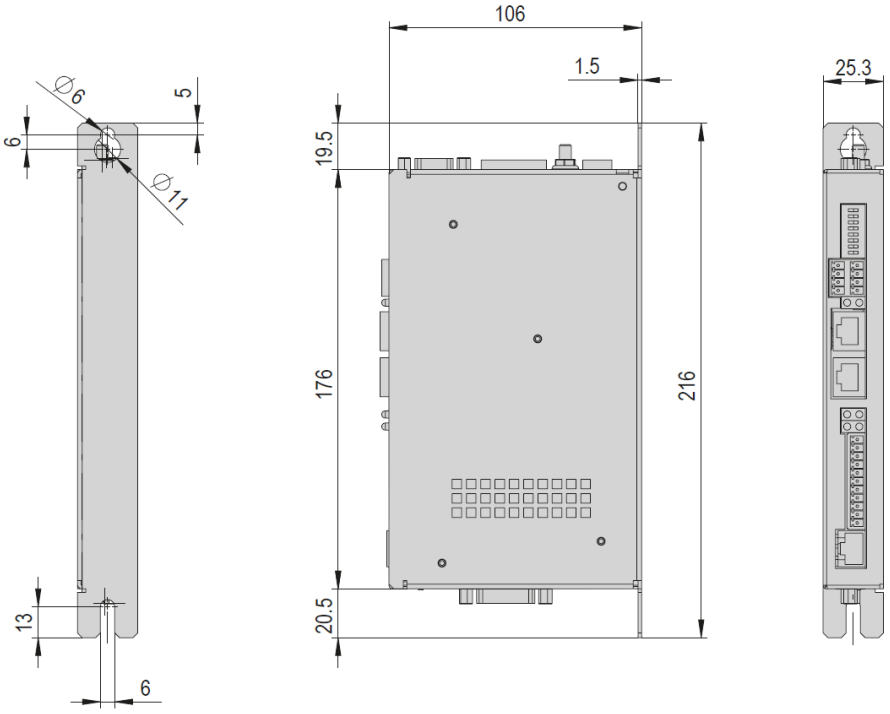
Work on the electrical system carried out unprofessionally can cause serious or fatal injuries.

- Safely disconnect the power supply unit (72V) on the primary side at the controller C11x0 or switch off the input "Safety Relay" (X33).

6.3.4 Axis controller C12x0

The following is an overview of the controller's interfaces. For more information on the C12x0 controller, please refer to the data sheet.

The controllers are pre-configured so that, as a rule, no software adjustments are necessary. If adjustments are to be made, the software "LinMot-Talk" can be obtained free of charge from the website"www.linmot.com".



Technical data

C12xx

C12xx	
Operating temperature	0 - 40 °C
Bearing temperature	-25 - 70 °C
Humidity	< 90 %

Type	C1250 EtherCat STO	C1250 Profinet PN STO
Order number	**50419400**	**50419401**
Net weight	0.7 kg	0.7 kg
Dimensions W x H x D	25.3x216x106 mm	25.3x216x106 mm
Nominal output current	25 A	25 A
Supply voltage	24 - 72 VDC	24 - 72 VDC
Control voltage	24 VDC	24 VDC
Protection type	IP 20	IP 20
Intermediate circuit voltage	24 - 80 VDC	24 - 80 VDC
Programming interface	RS 232	RS 232

Inlcuded in the delivery
- 1x Plug kit for C1xxx-1S

Accessories
- Power supply S01-72/500, 1-phase
- Motor plug for controller C1x00
- USB-RS232 Converter for controllers

Alternative Accessories
- Additional power supplies

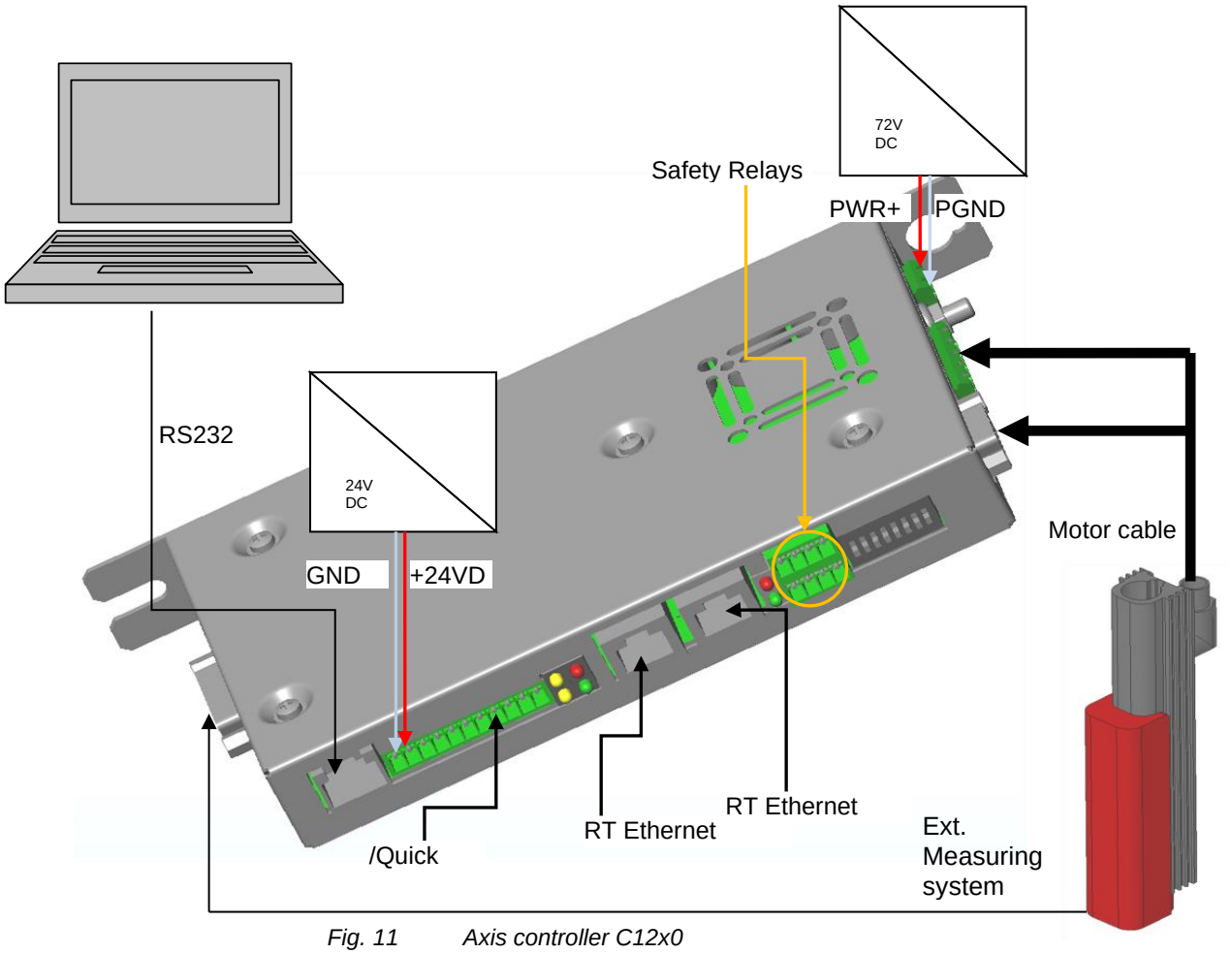


Fig. 11 Axis controller C12x0

Connection	Description
X1 PWR+	Motor power supply +72VDC
X1 PGND	Motor power supply GND
X2	Motor phases
X3	Motor Signals
X33	Safety relay (optional for -S1 version)
X4.8	Quickstop
X4.7	Reference sensor (optional)
X4.2	Logic power supply 24VDC
X4.1	Logic voltage supply GND

DANGER

Danger from electric shock when the safety door is open!

Work on the electrical system carried out unprofessionally can cause serious or fatal injuries.

- Safely disconnect the power supply unit (72V) on the primary side at the controller C11x0 or switch off the input "Safety Relay" (X33).

6.3.5 Axis controller E12x0

The following is an overview of the controller's interfaces. For more information on the E12x0 controller, please refer to the data sheet.

The controllers are pre-configured so that, as a rule, no software adjustments are necessary. If adjustments are to be made, the software "LinMot-Talk 1100" can be obtained free of charge from the website"www.linmot.com".

Technical data	E1230-DP-UC	E1250-DP-UC	E1250-PL-UC	E1250-SE-UC
Logistics supply	24V DC	24V DC	24V DC	24V DC
Motor power supply	24…80V DC	24…80V DC	24…80V DC	24…80V DC
Max. motor output current (at 72 V)	Standard version: 32 A	Standard version 32 A	Standard version 32 A	Standard version 32 A
Bus systems Interfaces	Profibus, CANopen, DeviceNet, RS485/232m, Digital I/Os, Master Encoder	EtherCat, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder	PowerLink, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder	Sercos over Ether-cat, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder
Max. power consumption	30 W	30 W	30 W	30 W
Protect. class	IP 20	IP 20	IP 20	IP 20
Operating temperature	0…40 °C	0…40 °C	0…40 °C	0…40 °C
Ground	1.5 kg	1.5 kg	1.5 kg	1.5 kg
Distance between controllers	20mm left/right 50mm bottom/top	20mm left/right 50mm bottom/top	20mm left/right 50mm bottom/top	20mm left/right 50mm bottom/top
Fuse protection 72 V supply	20 AT	20 AT	20 AT	20 AT
Fuse protection 24 V supply	2 AT	2 AT	2 AT	2 AT

Technical data	E1250-IP-UC	E1250-PN-UC	C1250-SC-UC
Logistics supply	24V DC	24V DC	24V DC
Motor power supply	24…80V DC	24…80V DC	24…80V DC
Max. motor output current (at 72 V)	Standard version: 32 A	Standard version 32 A	Standard version 32 A
Bus systems Interfaces	Ethernet IP, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder	Profinet, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder	Sercos III, CANopen, DeviceNet, RS485/232, Digital I/Os, Master Encoder
Max. power consumption	30 W	30 W	30 W
Protect. class	IP 20	IP 20	IP 20
Operating temperature	0…40 °C	0…40 °C	0…40 °C
Ground	1.5 kg	1.5 kg	1.5 kg
Distance between controllers	20 mm left/right 50 mm bottom/top	20 mm left/right 50 mm bottom/top	20 mm left/right 50 mm bottom/top
Fuse protection 72 V supply	20 AT	20 AT	20 AT
Fuse protection 24 V supply	2 AT	2 AT	2 AT

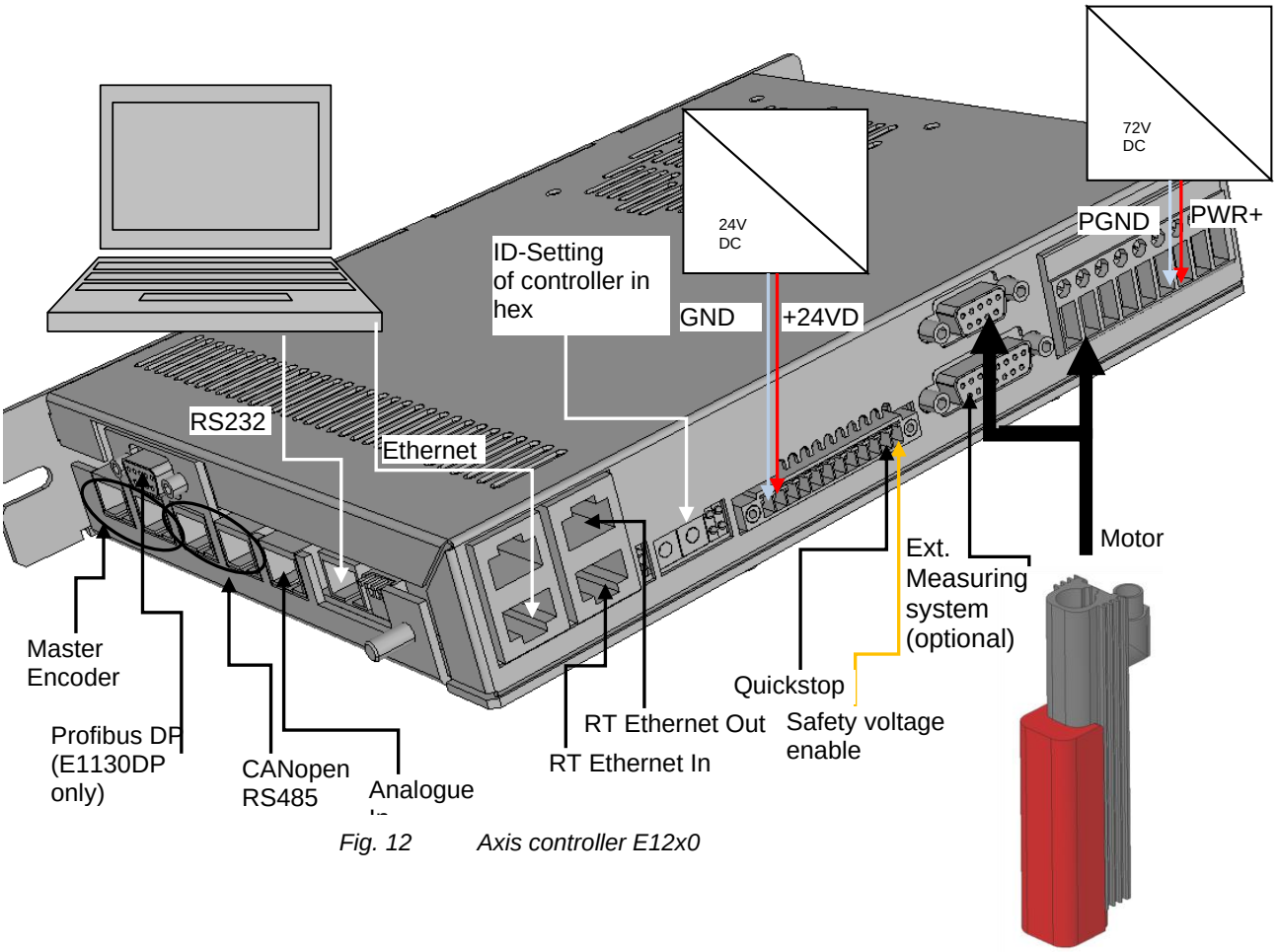


Fig. 12 Axis controller E12x0

Connection	Description
X1 PWR+	Motor power supply +72VDC
X1 PGND	Motor power supply GND
X2	Motor phases
X3	Motor Signals
X4.12	Safety voltage enable
X4.11	Quickstop
X4.7	Reference sensor (optional)
X14.2	Logic power supply 24VDC
X14.1	Logic voltage supply GND

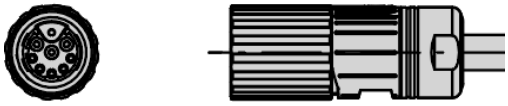
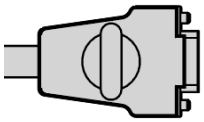
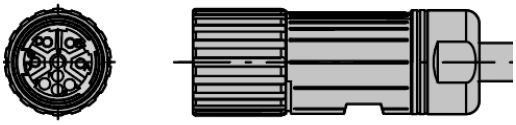
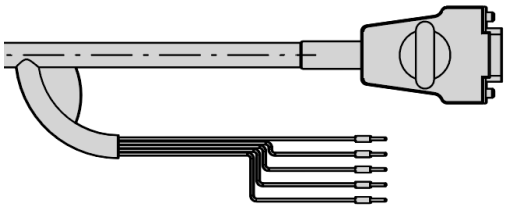
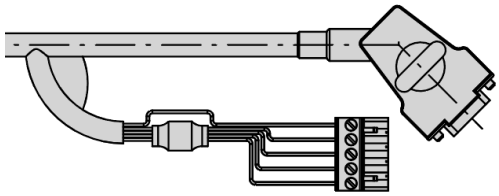
DANGER

Danger from electric shock when the safety door is open!

Work on the electrical system carried out unprofessionally can cause serious or fatal injuries.

- Safely disconnect the power supply unit (72V) on the primary side at the E12x0 controller.

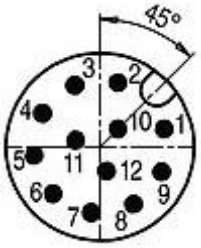
6.3.6 Motor connector

Combination (connector on axle)	Combination (connector on controller)
R connector:  Insert: - Electric slide ES20 - Portal axis PEL20 - Rotational axis SE20	D connector:  Insert: - Controller E11x0 Standard
C connector:  Insert: - Electric slide ES30 - Portal axis PEL30 - Portal axis PDL30 - Portal axis PDL40 - Portal axis PDL40-HP - Rotational axis SE30	W connector:  Insert: - Controller E11x0 Standard, HC and XC - Controller E12x0 UC
	Y-Stecker:  Einsatz: - Regler C11x0 XC - Regler C1210 XC

6.4 Pin assignment (encoder)

6.4.1 Round plug on the module

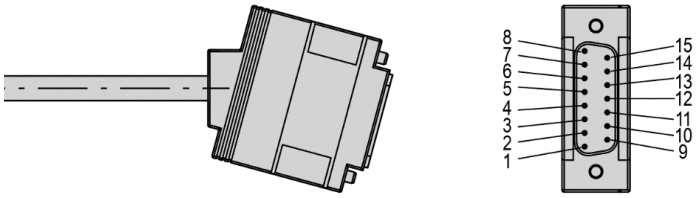
Cable connector S713 12-pole M12x1



PIN	Function	Colour
1	Free	-
2	Z+	Grey 10
3	Z-	Grey 9
4	Free	-
5	+5V	Grey 2
6	A-	Grey 5
7	A+	Grey 6
8	B-	Grey 7
9	B+	Grey 8
10	Free	-
11	Free	-
12	GND	Grey 3
Housing	Screen	outer screen
	NC	Red 1
	NC	Grey 4

6.4.2 SUB-D connector on the controller

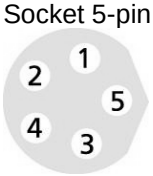
Controller C11xxx



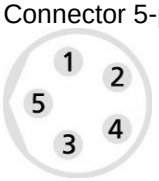
PIN	Function	Colour
1	+5V	Pink
2	A- / sin-	Yellow
3	B- / cos-	Grey
4	Z- / data -	White
5	GND	Red/blue+violet
6	Free	-
7	Free	-
8	Clock-	Green
9	A+ / sin+	Black
10	B+ / cos+	Red
11	Z+ / Data+	Blue
12	Free	-
13	Free	-
14	Free	-
15	Clock+	Grey/pink
Housing	Screen	Outer screen

6.4.3 Electrical feedthrough/initiator cable extension R11

Socket 5-pin M8x1

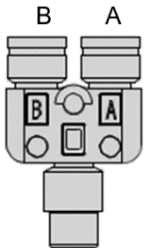


Connector 5-pole M8x1



PIN	Colour
1	Brown
2	White
3	Blue
4	Black
5	Grey
Housing	Outer screen

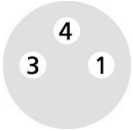
6.4.4 Y-distribution connector R12



PIN on C	PIN on A	PIN on B	Function	Colour
1	1	1	24VDC	Brown
2	4	-	Signal A	White
3	3	3	GND	Blue
4	-	4	Signal B	Black
5	-	-	NC	Grey
Housing				Outer screen

6.4.5 Reference sensor

Connector 3-pole M8x1e



PIN on A	Function	Colour
1	24VDC	Brown
2	Signal	White
3	GND	Blue

6.5 Programming

CAUTION

Risk of injuries due to uncontrolled parts movements!

Incorrect programming can cause the rotational axis to make rapid or uncontrolled movements or to drive into the stop without braking and cause serious injuries or damage to property.

- Ensure that the enclosure is closed and that there are no persons or loose parts/objects in the working area.
- Have programming carried out by qualified personnel only.

Programming is done differently depending on the controller used. Observe the respective manuals of the controller manufacturers!

6.6 Settings

6.6.1 Speed electric axes

The speeds of the electric axes are usually specified by the higher-level control system. Sample programmes are available for various control systems. This allows the maximum speed, acceleration and target position to be set. The programmes are supplied on a CD or are available on the following page: https://www.afag.com/de/service/support-tools/linmot.html.

When using the B1100-PP or E1100-GP controller with EasyStep firmware, these travel profiles are stored in the controller.

NOTICE

Risk of property damage in case of excessive speed/acceleration

Excessive speed or acceleration can cause damage to the unit or peripherals.

- Observe the reference values (speed, acceleration, deceleration) in the following tables.

DANGER

Danger! Risk of electric shock!

Work on the electrical system carried out unprofessionally can cause serious or fatal injuries.

- With the C1xx0 controller, the safety inputs X33 must be safely disconnected, or the power supply unit (72 V) must be disconnected on the primary side!

The standard parameters may not meet the requirements of your application. The parameters depend on the load mass and the mechanical structure of the system.

First, the drive must be referenced. The options listed below are then available.

Possibility 1: Manual shifting

Move axes manually into position (logic voltage ON, power motors OFF) and then read values from the controller for transfer to the Pick&Place movement.

Possibility 2: Jog mode

- Add or subtract value to the current position.
- Can be programmed via relative command. The existing module for absolute positioning can be converted into a module for relative positioning by changing a variable.

Possibility 3: Set up with safely reduced speed

Please observe the associated instructions for safely reduced speed.

Type	Max. speed [m/s]	Max. Accel. [m/s^2]	Max. Delay [m/s^2]	Std. Speed [m/s]	Std. Accel. [m/s^2]	Std. Delay [m/s^2]	Max. Item [mm]	Max. Item [mm]
RA-40-x-50-x	0.84	30	30	0.84	20	20	-	-
RA-40-x-30-x	1.7	20	20	1.7	15	15	-	-

6.6.2 Switching distance - reference sensor for electric axes

The reference sensor of the rotational axes is mounted with a feeler gauge at a distance of 0.1 mm parallel to the switching lug. The positions can be found in the respective drawings (note the axle types).

7 Commissioning

After connection, the rotational axes are put into operation for the first time via the system controller.

Only commission the rotational axes with attachments and superstructures in setup or jog mode!

7.1 Safety instructions for commissioning

WARNING

Risk of injuries due to uncontrolled parts movements!

Incorrect programming can trigger uncontrolled movements of the rotational axis and cause serious or fatal injuries and material damage.

- Make sure that there are no persons or tools in the working area of the rotational axis.

CAUTION

Risk of injury due to mounted components!

Attachments can be a risk in conjunction with moving parts.

- Take appropriate measures to ensure safe operation!

Also observe the safety instructions in ➲ chapter 2 „Safety instructions“ in this manual.

Please also observe the installation instructions for the control unit used!

7.2 Commissioning of the modules

Proceed carefully and follow the instructions step by step when commissioning the modules for the first time:

1. Switch off the control and use a lockout device to make sure that the control cannot be started up again.
2. Connect the encoder cable.
3. Connect the motor cable.
4. Connect the reference switch cable.
5. Switch on the controller unit and check the correct function of the encoder and the reference switch.
6. Perform test run:
   - Start with slow movements
   - Subsequently under normal operating conditions

   ⇨ Commissioning is completed.

8 Fault elimination

8.1 Safety instructions for troubleshooting

WARNING

Danger of injury due to faulty troubleshooting!

Poorly performed troubleshooting work can lead to serious injuries and damage to property.

- Only use trained specialist personnel for troubleshooting.
- All work on the modules must be carried out with the power supply cut off!

WARNING

Risk of injuries due to uncontrolled parts movements!

Signals from the control system can trigger unintentional movements of the rotational axis, which can cause injury.

- Switch off the control unit before starting work on the module.
- Observe the operating instructions of the controller used!

Also observe the safety instructions in ➲ chapter 2 „Safety instructions“ in this manual.

NOTICE

Risk of material damage due to strong oscillations!

Very strong oscillations of the rotational axis (vibrations at the drive) can damage the module as well as the attached components.

- In case of strong oscillations, switch off the rotational axis immediately!

8.2 Fault causes and remedy

Fault	Possible cause	Remedy:
Module oscillates (strong vibrations at the drive)	▪ Controller parameters incorrectly adjusted	▪ Readjust the parameters on the controller
Module does not move	Drive incorrectly connected	▪ Check connection, correct if necessary ▪ Carry out function check according to commissioning
	▪ Motor disconnection	▪ Check motor cable
	▪ Drive defective	▪ Have drive replaced by Afag

9 Maintenance and repair

9.1 General notes

The rotational axis is almost maintenance-free. Nevertheless, some maintenance work must be carried out to ensure an optimum operating condition of the rotational axis.

9.2 Safety instructions for maintenance and repair

WARNING

Danger of injury due to improper maintenance!

Improperly carried out maintenance activities can cause considerable damage to property and serious injury.

- Only use trained specialist personnel to carry out the activities.
- Always wear personal protective equipment when carrying out maintenance and repair work!

WARNING

Risk of injuries due to uncontrolled parts movements!

Incorrect programming can trigger uncontrolled movements of the rotational axis. Fast or unintentional movements of the rotational axis may cause injury or material damage.

- Before starting any activities, switch off the media supply and lock to prevent it from being switched on again!
- Disconnect the control cable from the axle before starting work!

Also observe the safety instructions in ➲ chapter 2 „Safety instructions“ in this manual.

9.3 Maintenance activities and maintenance intervals

The maintenance intervals must be strictly observed. The intervals apply to normal operating conditions and are to be shortened accordingly for other conditions.

If the system is to be operated in an environment with abrasive dusts or corrosive or aggressive vapours, gases or liquids, the approval of Afag must be obtained in advance.

9.3.1 Overview of the maintenance points

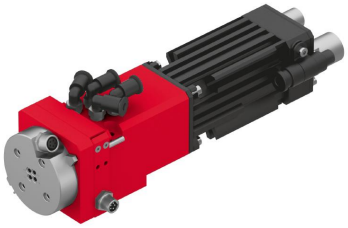


Fig. 13 Maintenance of rotational axis (exemplary RA-40-4F)

No.	Maintenance point	Maintenance work	Interval	System [On/Off]	Remarks
1	Rotational axis	Cleaning and checking 	As required	[Off]	-
		▪ Clean the rotational axis with a dry, lint-free cloth. - Do not spray the rotational axis with water, do not use aggressive cleaning agents. - Perform a visual inspection of the axis. ▪ Check screws for tight fit.			
2	Total rotational axis	check 	As required	[On]	
		- Acoustic check for unusual noise development (in case of unusual displacement movements or hard knocks, eliminate malfunction immediately).			
3	Lubrication points	Lubricating 	Every year	[Off]	➲ Chap 9.3.2
		▪ Lubrication. At all lubrication points, if necessary, press in grease of type Klübersynth UH1 14-31 with a grease gun.			

9.3.2 Lubrication

NOTICE

Risk of damage due to improper lubricants!

Do not use lubricants with additives such as MoS_2, graphite or PTFE. These lubricants can damage the module!

- Only use the lubricants recommended by Afag in the maintenance table ➲ chapter 9.3.1 or equivalent lubricants!

9.3.3 Further maintenance

Further maintenance is not required, if the ambient conditions listed below are complied with:

- Clean working area
- No use of splash water
- No abrasion or process dusts
- Environmental conditions as specified in the technical data

9.4 Spare parts lists

9.4.1 Servo controller

Designation		Article no.
Controller E1250-EC	for EtherCAT	16080243
Controller E1250-PL	for PowerLink	50465787
Controller C1250-SE-XC-1S	For Sercos over EtherCAT	16080409
Controller C1250-SC-XC-1S	for Sercos III	16080417
Controller C1250-PN-XC-1S	for Profinet	16080415
Controller C1250-PL-XC-1S	for PowerLink	16080413
Controller C1250-PD-XC-1S	for Profidrivet	16080763
Controller C1250-LU-XC-1S	for LinUDP	16080741
Controller C1250-IP-XC-1S	for Ethernet IP	16080411
Controller C1250-EC-XC-1S	for EtherCat	16080405
Controller C1200-GP-XC-1S	for General Purpose	16080407
Controller C1150-SE-XC-1S	For Sercos over EtherCAT	16080768
Controller C1150-PN-XC-1S	for Profinet	16080429
Controller C1150-EC-XC-1S	for EtherCat	16080434
Controller C1100-GP-XC-1S	for CANopen	16080432

9.4.2 Encoder

Designation		Article no.
Encoder cable-G18-10m-0-0-1	-	50468310
Encoder cable-G18-10m-90-0-1	-	50468311
Extension-G18-2m-0-0-1	-	50468312
Extension-G18-5m-0-0-1	-	50468313
Encoder cable-G19-10m-0-0-1	-	50468314
Encoder cable-G19-10m-90-0-1	-	50468315

9.4.3 Overview motor cable (axis controller application)

Designation			Module/axis									Servo controller				Application		
Manufac-turer's designation		Afag denomination	ES20	SE20	RA-40	PEL20	ES30	SE30	PxL30	PxL40	PxL40-HP	C1xxx	B1100	E11x0	E12xx	Static installation	Dynamic installation	Robot installation
K05-D/R-8	<->	Motor cable-M21-8m-0-0-X	x	x	x	x							x	x		**X**		
KS05-D/R-8	<->	Motor cable-M21-8m-0-0-1	x	x	x	x							x	x		x	**X**	
KR05-D/R-8	<->	Motor cable-M21-8m-0-0-2	x	x	x	x							x	x		x	x	**X**
K05-W/R-8	<->	Motor cable-M20-8m-0-2-X	x	x	x	x							x	x	x	**X**		
KS05-W/R-8	<->	Motor cable-M20-8m-0-2-1	x	x	x	x							x	x	x	x	**X**	
KR05-W/R-8	<->	Motor cable-M20-8m-0-2-2	x	x	x	x							x	x	x	x	x	**X**
K05-Y/R-8	<->	Motor cable-M16-8m-0-1-X	x	x	x	x						x				**X**		
KS05-Y/R-8	<->	Motor cable-M16-8m-0-1-1	x	x	x	x						x				x	**X**	
KR05-Y/R-8	<->	Motor cable-M16-8m-0-1-2	x	x	x	x						x				x	x	**X**
K15-W/C-8	<->	Motor cable-M24-8m-0-2-X					x	x	x	x	x		x	x	x	**X**		
KS10-W/C-8	<->	Motor cable-M22-8m-0-2-1					x	x	x	x	x		x	x	x	x	**X**	
KR10-W/C-8	<->	Motor cable-M22-8m-0-2-2					x	x	x	x	x		x	x	x	x	x	**X**
K15-Y/C-8	<->	Motor cable-M23-8m-0-1-X					x	x	x	x	x	x				**X**		
KS10-Y/C-8	<->	Motor cable-M17-8m-0-1-1					x	x	x	x	x	x				x	**X**	
KR10-Y/C-8	<->	Motor cable-M17-8m-0-1-2					x	x	x	x	x	x				x	x	**X**
KS05-R/R-8	<->	Motor cable extension-M16-8m-0-0-1	x	x	x	x						x	x	x	x	**X**	**X**	
KR05-R/R-8	<->	Motor cable extension-M16-8m-0-0-2	x	x	x	x						x	x	x	x	x	x	**X**
K15-C/C-8	<->	Motor cable extension-M23-8m-0-0-X					x	x	x	x	x	x	x	x	x	**X**		
KS10-C/C-8	<->	Motor cable extension-M17-8m-0-0-1					x	x	x	x	x	x	x	x	x	x	**X**	
KR10-C/C-8	<->	Motor cable extension-M17-8m-0-0-2					x	x	x	x	x	x	x	x	x	x	x	**X**
Note: **X** = preferred variant; x = application possible																		

9.4.4 Motor cable

Designation		Article no.
Motor cable 4m EDM2x/ES20/SE20/PEL20 carrier	-	080,685
Motor cable-M16-4m-0-1-X	-	50463073
Motor cable-M16-6m-0-1-X	-	50463076
Motor cable-M16-8m-0-1-X	-	50463078
Motor cable-M16-4m-0-1-1	-	50437168
Motor cable-M16-6m-0-1-1	-	50437167
Motor cable-M16-8m-0-1-1	-	50427023
Extension-M16-2m-0-0-1	-	50450944
Extension-M16-4m-0-0-1	-	50427026
Extension-M16-6m-0-0-1	-	50463082
Extension-M16-2m-0-0-2	-	50463081
Motor cable-M17-4m-0-1-1	-	50437170
Motor cable-M17-6m-0-1-1	-	50437169
Motor cable-M17-8m-0-1-1	-	50427021
Extension-M17-2m-0-0-1	-	50463084
Extension-M17-4m-0-0-1	-	50427024
Extension-M17-6m-0-0-1	-	50463087
Extension-M17-2m-0-0-2	-	50463085
Extension-M17-4m-0-0-2	-	50463086
Motor cable-M20-4m-0-2-X	-	50463088
Motor cable-M20-6m-0-2-X	-	50463090
Motor cable-M20-8m-0-2-X	-	50463092
Motor cable-M20-4m-0-2-1	-	50463089
Motor cable-M20-6m-0-2-1	-	50463091
Motor cable-M20-8m-0-2-1	-	50463093
Motor cable-M21-4m-0-0-X	-	50463094
Motor cable-M21-6m-0-0-X	-	50463096
Motor cable-M21-8m-0-0-X	-	50463098
Motor cable-M21-4m-0-0-1	-	50463095
Motor cable-M21-6m-0-0-1	-	50463097
Motor cable-M21-8m-0-0-1	-	50463099
Motor cable-M22-4m-0-2-1	-	50463100
Motor cable-M22-6m-0-2-1	-	50463101
Motor cable-M22-8m-0-2-1	-	50463103
Motor cable-M23-4m-0-1-X	-	50463104
Motor cable-M23-6m-0-1-X	-	50463105
Motor cable-M23-8m-0-1-X	-	50463106
Motor cable-M24-4m-0-2-X	-	50463107
Motor cable-M24-6m-0-2-X	-	50463108
Motor cable-M24-8m-0-2-X	-	50463109

9.5 Repair and overhaul

Afag offers a reliable repair service. Defective modules can be sent to Afag for warranty repair within the warranty period.

After expiry of the warranty period, the customer may replace or repair defective modules or wear parts himself or send them to the Afag repair service.

Please note that Afag does not assume any warranty for modules that have not been replaced or repaired by Afag!

CAUTION

Risk of injuries due to uncontrolled parts movements!

Risk of injury when removing the rotational axis due to uncontrolled movements of the modules!

- Only remove the module when the control unit is switched off and secured!
- Only connect or disconnect the cables when the control unit is switched off!

10 Decommissioning, disassembly, disposal

The rotational axis must be properly dismounted after use and disposed of in an environmentally friendly manner.

10.1 Safety instructions for decommissioning and disposal

WARNING

Risk of injury due to improper decommissioning and disposal!

Improperly carried out activities can result in considerable material damage and serious injury.

- Only use trained specialist personnel to carry out the activities.
- Disconnect the media supply before dismounting the module!
- Only dismount the rotational axis when the control unit is switched off and secured!

10.2 Decommissioning

If the rotational axes are not used for a longer period of time, they must be properly commissioned and stored as described in ➲ chapter 4.5.

10.3 Disposal

The rotational axis must be disposed of properly at the end of their service life and the raw materials used must be recycled. Observe the legal regulations and company requirements.

The rotational axis must not be disposed of as a complete unit. Dismantle the rotational axis and separate the various components according to type of material and dispose of them properly:

- Scrap metals (such as axles, modules, adapter plates).
- Hand over plastic parts for recycling.
- Sort the rest of the components by their material properties and dispose of them accordingly.

NOTICE

Risk to the environment due to incorrect disposal of the packaging material of the rotational axis!

Environmental damage can be caused by improper disposal of the rotational axis.

- Electronic parts, electrical scrap, auxiliary and operating materials must be disposed of by approved specialist companies.
- Information on proper disposal can be obtained from the responsible local authorities.

11 Declaration of incorporation

Declaration of incorporation

for partly completed machinery according to the Machinery Directive 2006/42/EC, Annex II, 1.B

The manufacturer hereby declares:

Afag Engineering GmbH, Gewerbestraße 11, DE-78739 Hardt

that the partly completed machine:

Product description	Rotational axis RA-40
Type:	RE-40, RE-75, RE-50 18-100 V, RE-75 18-100 V

complies with the following essential health and safety requirements of the Machinery Directive 2006/42/EC at the time of declaration: 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 and 1.5.1

Harmonised standards applied, in particular:	
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2014/35/EU	Low Voltage Directive (LVD)
EN ISO 12100:2010	Safety of machinery - General design principles - Risk assessment and risk reduction.
DIN EN 60204-1:2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Note: The partly completed machinery must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of Machinery Directive 2006/42/EC.

The manufacturer undertakes to transmit, in response to a reasoned request by the national authorities, relevant technical documentation for the partly completed machinery.

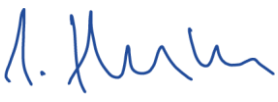
The relevant technical documentation were created according to Annex VII, Part B of the above-mentioned Directive.

Authorised representative for compiling the technical documentation:

Niklaus Röthlisberger, Product-Manager, Afag Automation AG, CH-6144 Zell

Zell, 31.05.2023

Adrian Fuchser



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