

Assembly and operating instructions

Telescope spindle axis SA-1 | SA-1-FL



Translation of the Original Assembly Instructions EN

- SA-1-050 ⇒ Order no.: 50249011
- SA-1-050-FL ⇒ Order no.: 50471882
- SA-1-100 ⇒ Order no.: 50249013
- SA-1-100-FL ⇒ Order no.: 50471883
- SA-1-150 ⇒ Order no.: 50249014
- SA-1-150-FL ⇒ Order no.: 50471884

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 telescope spindle axis or other options.

We wish you every success with our products!

With kind regards

Your Afag team

© Subject to modifications

The modules have been designed by Afag Automation AG 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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Afag Automation AG
Luzernstrasse 32
CH-6144 Zell (Switzerland)
Tel.: +41 62 959 86 86
e-mail: sales@afag.com
Internet: www.afag.com

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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 telescope spindle axis SA-1 and SA-1-FL to ensure safe and efficient handling and operation.

Consistent compliance with these assembly instructions will ensure:

- permanent operational reliability of the telescope spindle axis,
- optimal functioning of the telescope spindle axis,
- timely detection and elimination of defects (thereby reducing maintenance and repair costs),
- prolongation of the telescope spindle 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 module.

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 telescope spindle 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 telescope spindle 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 Automation AG.
- 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 telescope spindle axis unless described in this instructions manual or approved in writing by Afag Automation AG.

Afag Automation AG 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 telescope spindle axis and optimal protection of personnel.

Safe handling and trouble-free operation of the telescope spindle axis requires knowledge of the basic safety regulations.

Every person carrying out installation, commissioning, maintenance work or operating the telescope spindle axis 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 telescope spindle axis series SA-1 and SA-1-FL is designed for the shock-free linear movement of permanently mounted loads in **non-explosive environments** and in the ambient and operating conditions defined for these modules (➔ technical data sheet in the handling catalogue).

Any use beyond the described purpose is considered to be 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 telescope spindle 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 telescope spindle axis poses a potential hazard to the personnel.

- The telescope spindle axis may only be used in a technically perfect condition in accordance with its intended use and the instructions in this manual and 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 damages 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 telescope spindle 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 telescope spindle 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 telescope spindle 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 telescope spindle 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 telescope spindle axis 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 telescope spindle 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 assess the risks that may arise from the use of the telescope spindle 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 telescope spindle axis. Persons whose ability to react is restricted due to the intake of medication or the like must not interact with the telescope spindle 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 telescope spindle 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:

	<i>Protective clothing</i> is a close-fitting clothing specifically designed to protect personnel from hazards during work.
	<i>Protective gloves</i> are specifically designed to protect the personnel against hand injuries (such as cuts, abrasion, burns).
	<i>Safety shoes</i> 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 & modifications

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

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



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

2.8 General hazards / residual risks

Despite the safe design of the telescope spindle 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 telescope spindle axis.

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.



The telescope spindle axis is a fine mechanical unit and must be handled with the necessary care and cleanliness during transport and storage as well as when handling, setting up and assembling!

2.8.1 General hazards at the workplace

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

- danger to life and limb of the operator or third parties,
- on the telescope spindle axis themselves,
- property damage.



Always keep the assembly instructions ready at hand at the workplace! Please, also observe:

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

WARNING



Danger - Do not use in unsuitable environment!

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

- Do **not** use the telescope spindle axis in potentially explosive atmospheres!

2.8.1 Mechanical hazards

CAUTION



Risk of injuries by moving parts and unexpected movements!

When operating the telescope spindle axis uncontrolled movements may occur which can cause personal injury or property damage. There is always a risk of injury by moving parts during normal operation.

- Only qualified personnel may work with or on the telescope spindle axis.
- Never reach into the system during normal operation!

2.8.2 Danger due to electricity

WARNING



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.

2.8.3 Noise hazards

CAUTION



Noise hazards!

The telescope spindle axis generates 68 dB(A) during full-load operation. Depending on the add-ons, the environment and the resonance of the protective device these values may be exceeded and expose the operator to a higher noise level.

- It is the responsibility of the operating company to ensure that the permitted noise limit values are not exceeded.
- If the permitted noise levels cannot be met it must be ensured that the operating personnel wears the required hearing protection.

2.8.4 Danger due to high temperatures

CAUTION



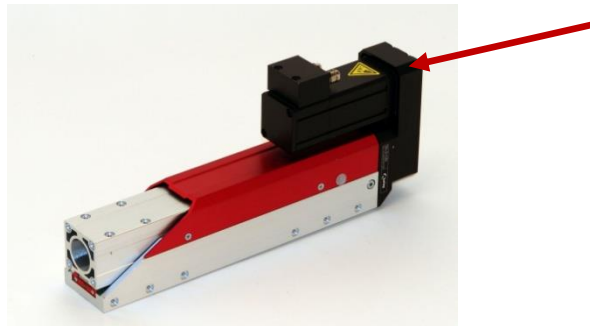
Danger of injury from hot surfaces.

During continuous operation of the telescope spindle axis, the surface of the axis heats up.

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

2.8.5 Safety labels (warning symbols)

Safety labels (warning symbols) are attached at the following places.



Check regularly whether the safety labels (warning symbols) are still present and legible!

3 Technical data

3.1 Dimension drawing SA-1 and SA-1-FL

Type	SA-1-050/-FL	SA-1-100/-FL	SA-1-150/-FL
A	213.5 mm	263.5 mm	313.5 mm
B	74 mm	124 mm	174 mm
C	***79.3 mm ****109.3 mm	***129.3 mm ****159.3 mm	***179.3 mm ****209.3 mm
D	***306 mm ****336 mm	***356 mm ****386 mm	***410 mm ****440 mm
E	4 x	6 x	7 x
H	50 mm	100 mm	150 mm

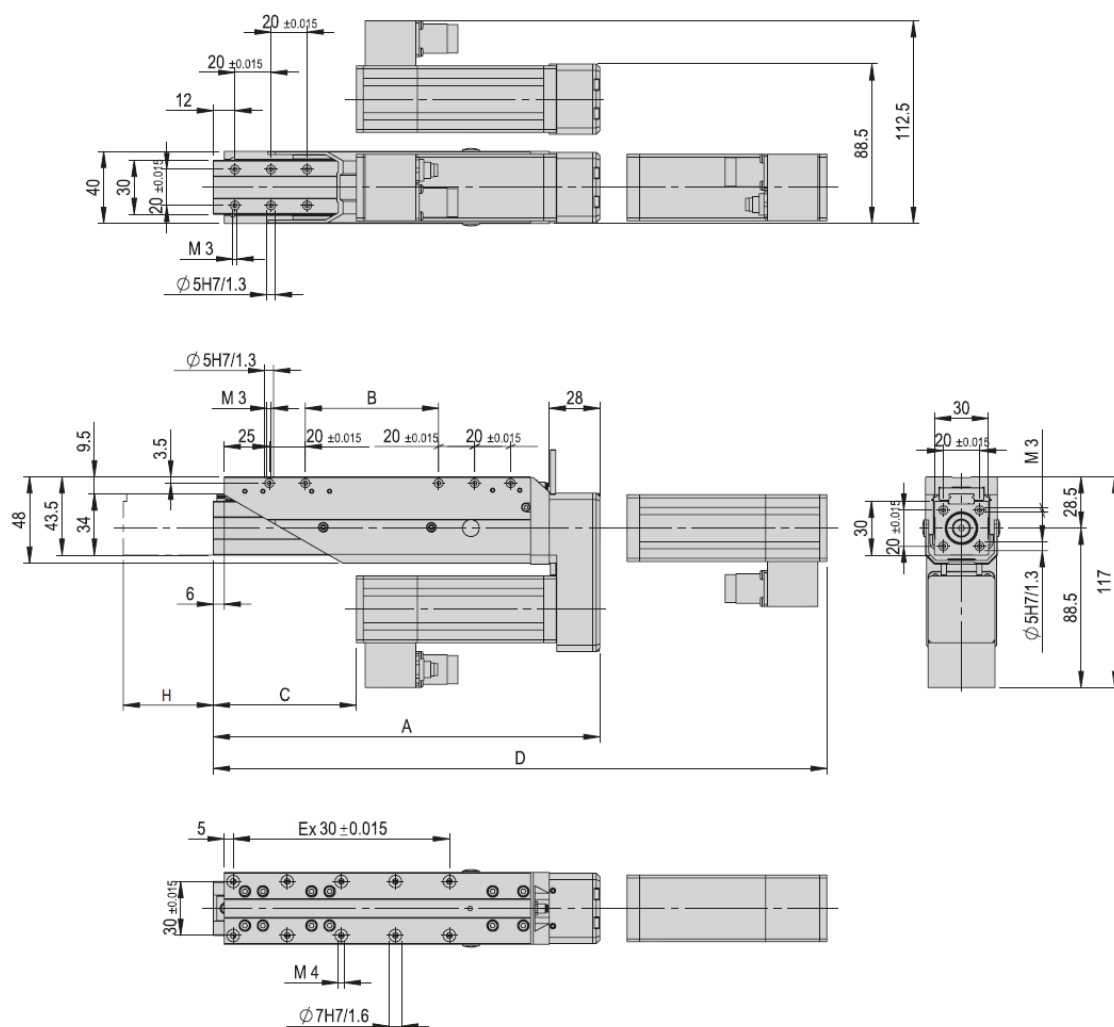


Fig. 1 Dimension drawing telescope spindle axis

3.2 Technical data SA-1 and SA-1-FL

Type	SA-1-xxx	SA-1-xxx-FL
Spindle Ø	8 mm	8 mm
Spindle pitch (mm/1 turn)	12 mm	4 mm
Drive shaft Ø	5 mm	5 mm
Operating temperature	10 - 40 °C	10 - 40 °C
Storage temperature	0 - 50 °C	0 - 50 °C
Humidity	< 90 %	< 90 %

Type	SA-1-050	SA-1-050-FL	SA-1-100	SA-1-100-FL	SA-1-150	SA-1-150-FL
Order number	50249011	50471882	50249013	50471883	50249014	50471884
Stroke H	50 mm	50 mm	100 mm	100 mm	150 mm	150 mm
Net weight	0.8 kg	0.8 kg	1.0 kg	1.0 kg	1.2 kg	1.2 kg
Moving weight	**0.45 kg	**0.45 kg	**0.55 kg	**0.55 kg	**0.65 kg	**0.65 kg
Weight, gear	**0.15 kg	**0.15 kg	**0.15 kg	**0.15 kg	**0.15 kg	**0.15 kg
Weight, motor	**0.45 kg	**0.45 kg	**0.45 kg	**0.45 kg	**0.45 kg	**0.45 kg
Noise level	65 dB (A)	65 dB (A)	65 dB (A)	65 dB (A)	65 dB (A)	65 dB (A)
Max. drive torque	0.07 Nm	0.07 Nm	0.07 Nm	0.07 Nm	0.07 Nm	0.07 Nm
Inertia, spindle	3.08 gcm ²	3.08 gcm ²	4.65 gcm ²	4.65 gcm ²	6.22 gcm ²	6.22 gcm ²
Drive	AC Servo	AC Servo	AC Servo	AC Servo	AC Servo	AC Servo
Protection type	IP 30	IP 30	IP 30	IP 30	IP 30	IP 30
Max. speed v	*1.2 m/s	*0.3 m/s	*1.2 m/s	*0.3 m/s	*1.2 m/s	*0.3 m/s
Max. acceleration a	*25 m/s ²	*25 m/s ²	*25 m/s ²	*25 m/s ²	*25 m/s ²	*25 m/s ²
Peak force F _x	50 N	150 N	50 N	150 N	50 N	150 N
Measuring system	Resolver	Resolver	Resolver	Resolver	Resolver	Resolver
Repeat accuracy	+/- 0.01 mm	+/- 0.01 mm	+/- 0.01 mm	+/- 0.01 mm	+/- 0.01 mm	+/- 0.01 mm
Mounting position	✚	✚	✚	✚	✚	✚

The technical data pertains to Afag standard test conditions.
 Note: The inductive reference sensor is integrated within the SA axis.
 Cleanroom class ISO 14644-1, class ISO 7

*The maximum values listed above depend on the application and must not be combined. In case of doubt, please contact your Afag partner.

**Total weight = gross weight + slide + gear + motor

***Without brakes

****With brakes

Included in the delivery

(Catalogue HT accessories)

- 2x Centering bushing Ø5x2.5
- 2x Centering bushing Ø7x3

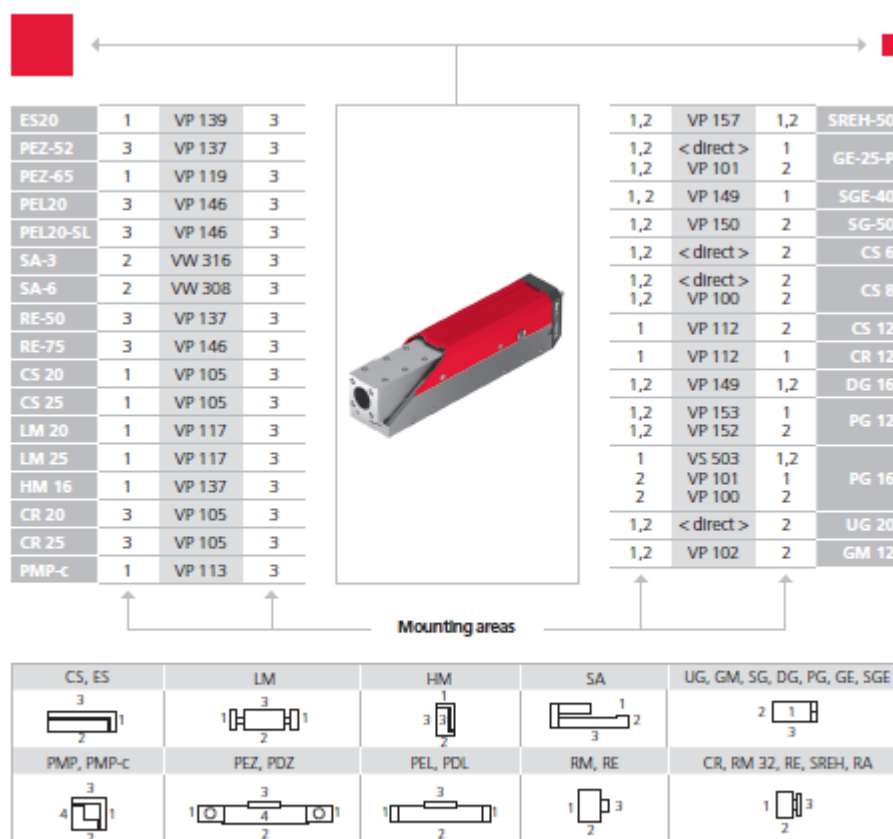
Accessories

- Toothed belt drive SA-1
- Coupling flange SA-1
- Coupling flange SA-1 without motor
- Grease press attachment SA

(Catalogue HT accessories)

- Servo motor-11-72VDC-060W
- Servo controller-11-320VDC-060W
- Servo controller C1xxx -15
- Servo controller E12xx
- Servo controller SE-Power

3.3 Preferred combinations SA-1 and SA-1-FL



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.



AFAG accepts no liability for the attachment of third-party modules to the telescope spindle axis.

Modules for attachment shall be selected to withstand full load operation of the telescope spindle axis and not exceed the payload.

4 Transport, Packaging and Storage

4.1 Safety instructions for transport

CAUTION



Risk of injury when unpacking the telescope spindle axis!

The telescope spindle axis can be moved back and forth when it is not fastened, causing crushing injuries to the fingers.

- Carefully pack or unpack the telescope spindle axis.

The module can extend independently!



Fig. 2 Telescope spindle axis



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

4.2 Scope of supply

The scope of delivery depends on the order of the telescope spindle axis according to the order key in the technical catalogue or in the website.

Gearbox and motor must be ordered according to the order key.



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

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

[Unt]	SA-1	SA-1-FL
1 x	Module SA -1	Module SA-1-FL
2 x	Centering bushing \varnothing 5x2.5	Centering bushing \varnothing 5x2.5
2 x	Centering bushing \varnothing 7x3	Centering bushing \varnothing 7x3
1 x	Assembly & operat. instructions	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 telescope spindle axis is transported in the Afag Automation AG transport packaging. If no Afag packaging is used, the telescope spindle axis must be packed in such a way that it is protected against shocks and dust.

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.
-

4.5 Storage

If the telescope spindle axes are stored for an extended period of time, observe the following:

- Store the telescope spindle axis in the transport packaging.
- Do not store the telescope spindle axes outdoors or expose them 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 telescope spindle axis and protect the blank metal parts against corrosion using the appropriate means.
- Protect the telescope spindle axis from dirt and dust.

5 Structure and description

5.1 Structure telescope spindle axis

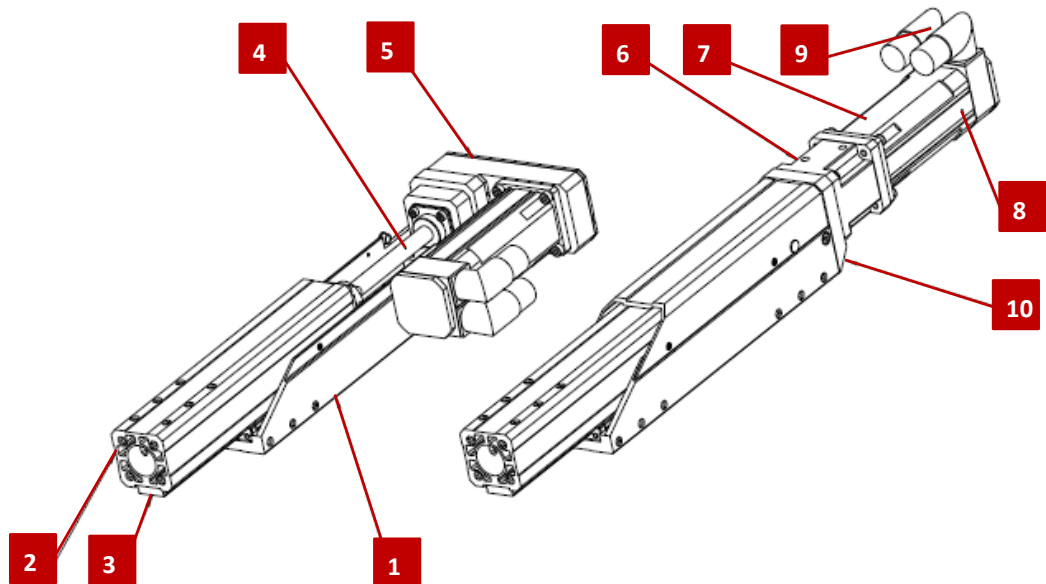


Fig. 3 Structure of telescope spindle axis (example)

- | | |
|-------------------------|--------------------------------|
| 1. Base body | 6. Coupling housing |
| 2. Bracket | 7. Servo motor |
| 3. Linear guide | 8. Holding brake |
| 4. Ball screw axis | 9. Motor/Encoder connector |
| 5. Toothed belt housing | 10. Reference switch connector |

5.2 Product description

The modules of the SA series are telescope spindle axis whose movable part is designed as bracket. Compared with the usual slide model this type series offers the advantage to “dip” into the working area and to leave it again completely.

The bracket (Fig. 3, 2) is moved along a linear guide (Fig. 3, 3) vis-à-vis the base body (Fig. 3, 1). A ball-type linear drive (Fig. 3, 4) with a spindle nut mounted on the bracket (Fig. 3, 2) transforms the rotary movement in a linear movement.

The spindle is driven by a servomotor (Fig. 3, 7) via a toothed belt back gear (Fig. 3, 5) or a torsionally stiff coupling (Fig. 3, 6). The reference switch (Fig. 3, 10) is an inductive sensor which recognizes the home position of the bracket during the reference run. The servomotor (Fig. 3, 7) can also be equipped with an integrated brake system (Fig. 3, 8). The brake secures the bracket position when the module is not energized.



This brake system is required by all means in case of vertical applications!

Structure and description

The telescope spindle axis SA-1 and SA-1-FL is available in the following versions (➡ Chapter 3 “Technical data”).

Type	Nominal stroke
SA-1-50 and SA-1-50-FL	50 mm
SA-1-100 and SA-1-100-FL	100 mm
SA-1-150 and SA-1-150-FL	150 mm

5.3 Accessories

Cr.	Designation	Order Number
1	Servomotor-11-72VDC-060W-60-B-I-x-x	50485433
2	Servomotor-11-72VDC-060W-60-x-I-x-x	50495876
3	Servomotor-11-320VDC-060W-60-B-R-x-x	50495879
4	Servomotor-11-320VDC-060W-60-x-R-x-x	50495878
5	Encoder cable-G6 -5m-0-0 (SE-Power)	50100693
6	Encoder cable-G12-3m-0-0	50332416
7	Encoder cable-G12-5m-0-0	50338975
8	Encoder cable-M10-5m-0-Open (SE-Power)	50219768
9	Motor cable-M11-3m-0-0 (SE24/48)	50338982
10	Motor cable-M11-5m-0-0 (SE24/48)	50338983
11	Programming cable SE-Power, 3m	50038526
12	Proximity switch cable-R8-5m-0-Open (SE-Power)	50265807
13	Proximity switch cable-R9-5m-0-0 (SE-24)	50341478
14	Power cable SE-24	50118124
15	Centering bushing Ø 5x2.5	50035831
16	Centering bushing Ø 7x3	11016850
17	MSDN for grease Klüber Microlube GBU-Y-131	On request
18	Grease gun attachment SA	11012190

6 Installation, assembly & setting



The system operator is responsible for the installation of the telescope spindle axis in a system!

6.1 Safety Instructions for Installation & Assembly

The telescope spindle axis is an incomplete machine.

For safe operation, the telescope spindle axes must be integrated into the safety concept of the system in which they are installed.

During normal operation, it must be ensured that the user cannot interfere with the working area of the telescope spindle axis.



When integrating a telescope spindle axis into an assembly system, the customer must provide an appropriate enclosure or safety barrier.

CAUTION



Risk of injury when installing the telescope spindle axis in a system!

Improperly performed work can lead to injuries and damage to property.

- The installation may only be carried out by a qualified specialist!

CAUTION



Risk of injuries due to uncontrolled parts movements!

When the control system is switched on, the telescope spindle axis can make unpredictable movements and cause injury or damage to property.

- The telescope spindle axis may only be installed in a system when the controller is switched off and secured.
- Cables may only be disconnected or connected when the controller is switched off!



No liability for damages can be assumed for damages caused by improper installation/assembling work on the part of the operator.



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

6.2 Assembly & attachment

The telescope spindle axis can be installed in any position.



In the case of vertical installation, the servomotor must have a **holding brake** that prevents the axle from falling when de-energised! The telescope spindle axis must be earthed when installed in a system!

6.2.1 Fastening the module

The telescope spindle axis mounting holes (M4) are located on the back of the housing. The centring bushings included in the scope of delivery must be used for fastening the module (➡ Chapter 6.2.3).

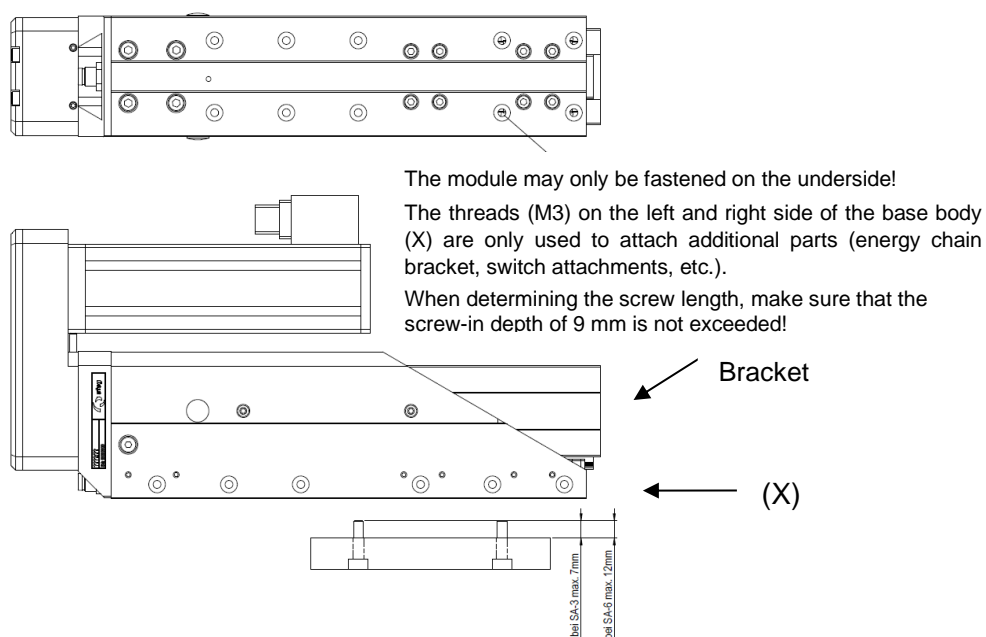


Fig. 4 Mounting holes (M4) on the back of the housing

6.2.2 Tightening torques

Use screws with the following minimum specifications for mounting:

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

Thread	Tightening torque
M2	0.3 ... 0.35 Nm
M2.5	0.5 ... 0.73 Nm
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

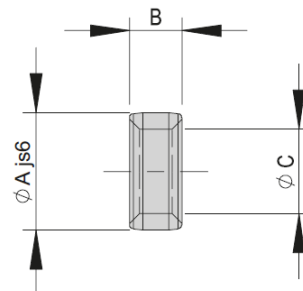
6.2.3 Attachment grid and centering bushings



Use the centring bushings included in the scope of delivery for positioning. Insert the centering bushings in two diagonally opposite holes of the attachment grid.

SA-1 and SA-1 FL	Base body	Bracket
Hole grid	30 x 30 mm	20 x 30 mm
Thread / Bore	M4	M3
Centering bushing (H7)	Ø 7x3 mm	Ø 5x2.5 mm

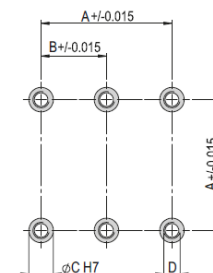
Centering bushings	Ø4x2	Ø5x2.5	Ø7x3	Ø8x3.5	Ø9x4	Ø12x4.8	Ø19x5.8
Order number	50332257	50035831	11016850	50263565	11004942	50187424	50189497
Net weight	0.001 kg	0.001 kg	0.001 kg	0.001 kg	0.001 kg	0.002 kg	0.006 kg
A	4 mm	5 mm	7 mm	8 mm	9 mm	12 mm	19 mm
B	2 mm	2.5 mm	3 mm	3.5 mm	4 mm	4.8 mm	5.8 mm
C	2.6 mm	3.2 mm	4.3 mm	5.4 mm	6.5 mm	8.5 mm	13 mm



Attachment grid	16x16 mm	20x20 mm	30x30 mm	38x38 mm	48x48 mm	60x60 mm	75x75 mm	96x96 mm
A	16 mm	20 mm	30 mm	38 mm	48 mm	60 mm	75 mm	96 mm
B	8 mm	10 mm	15 mm	19 mm	24 mm	30 mm	35 mm	48 mm
C	4x1.1 mm	5x1.3 mm	7x1.6 mm	8x1.8 mm	9x2.1 mm	12x2.5 mm	15x2.7 mm	19x3 mm
D	M2.5	M3	M4	M5	M6	M8	M10	M12

Module-centering, centering bushings

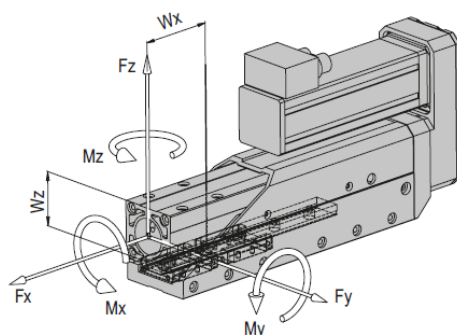
In order to guarantee a high and repetitive fit accuracy during installation, operation or replacement of a module, all components of the entire program are consequently provided with a precise module centering. Centering bushings or pins are supplied as standard with each module.



6.2.4 Load on the telescope spindle axis

The following telescope spindle axis loads apply to assembly:

Type	SA-1-050	SA-1-050-FL	SA-1-100	SA-1-100-FL	SA-1-150	SA-1-150-FL
Max. torque Mx	6 Nm	6 Nm	6 Nm	6 Nm	6 Nm	6 Nm
Max. torque My	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm
Max. torque Mz	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm
Effective distance Wx	41 mm	41 mm	41 mm	41 mm	41 mm	41 mm
Effective distance Wy	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Effective distance Wz	32 mm	32 mm	32 mm	32 mm	32 mm	32 mm
Peak force Fx	50 N	150 N	50 N	150 N	50 N	150 N



$$\frac{M_x}{M_{x \max}} + \frac{M_y}{M_{y \max}} + \frac{M_z}{M_{z \max}} < 1$$

Maximum payload/type	SA-1-050	SA-1-050-FL	SA-1-100	SA-1-100-FL	SA-1-150	SA-1-150-FL
Installation position (horizontal) for mounting side 1/2	4 kg	4 kg	4 kg	4 kg	4 kg	4 kg
Installation position (vertical) for mounting side 1/2	4 kg	4 kg	4 kg	4 kg	4 kg	4 kg

Assembly sides module
mounting

horizontal:



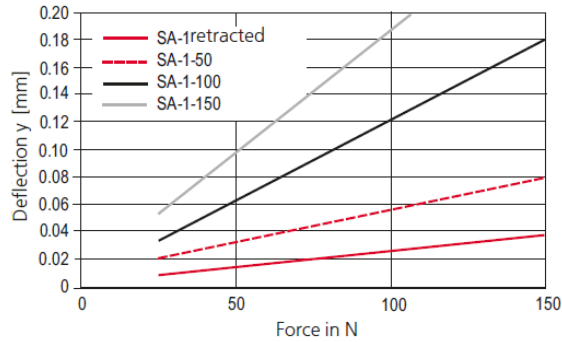
vertical:



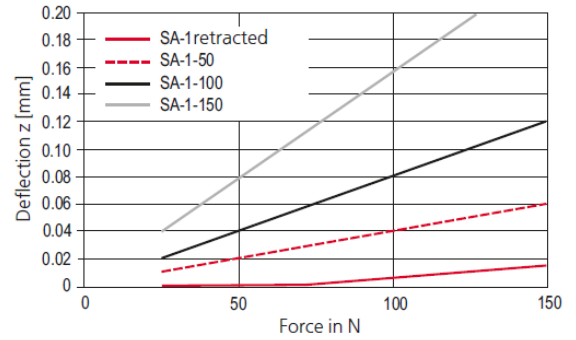
6.2.5 Load diagrams

Load diagrams

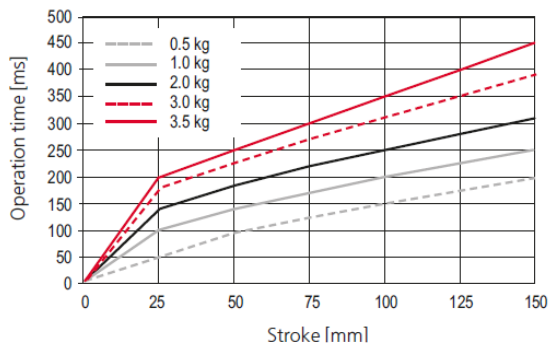
Deflection in Y direction



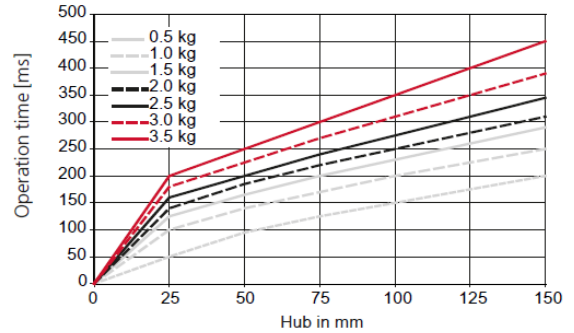
Deflection in Z direction



Operation time SA-1



Operation time SA-1-FL



6.3 Motor layout



The motor arrangement can be either front, left, right or axial.

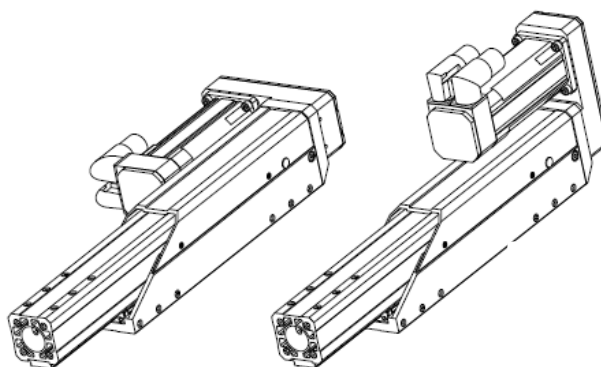


Fig. 5 Possible arrangement of the servomotor

6.3.1 Arrangement options

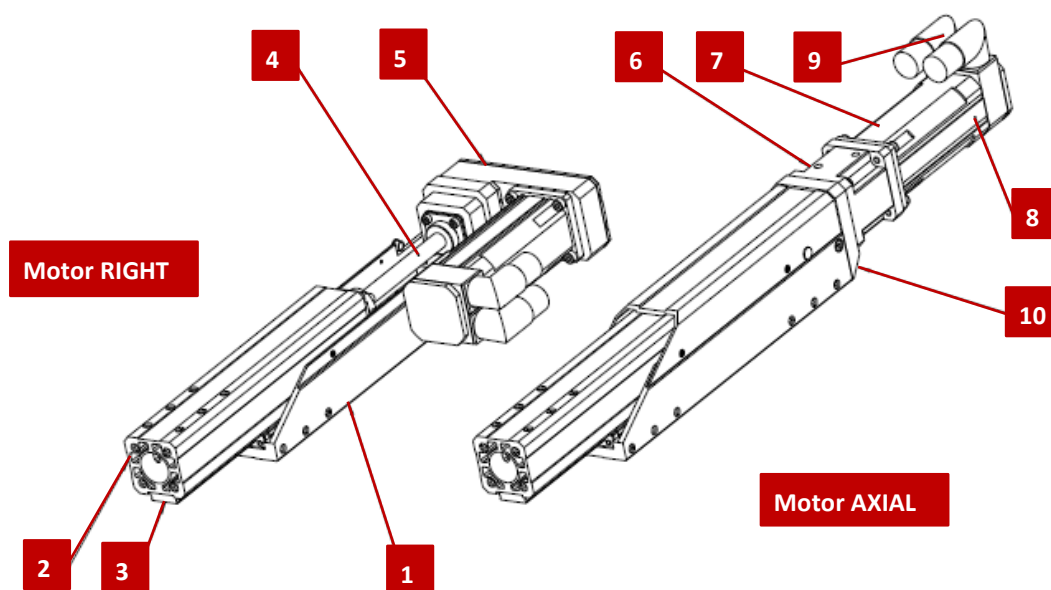


Fig. 6 Mounting the motor RIGHT / AXIAL

- | | |
|-------------------------|--------------------------------|
| 1. Base body | 6. Coupling housing |
| 2. Bracket | 7. Servo motor |
| 3. Linear guide | 8. Holding brake |
| 4. Ball screw axis | 9. Motor/Encoder connector |
| 5. Toothed belt housing | 10. Reference switch connector |

6.3.2 Adjusting the motor position

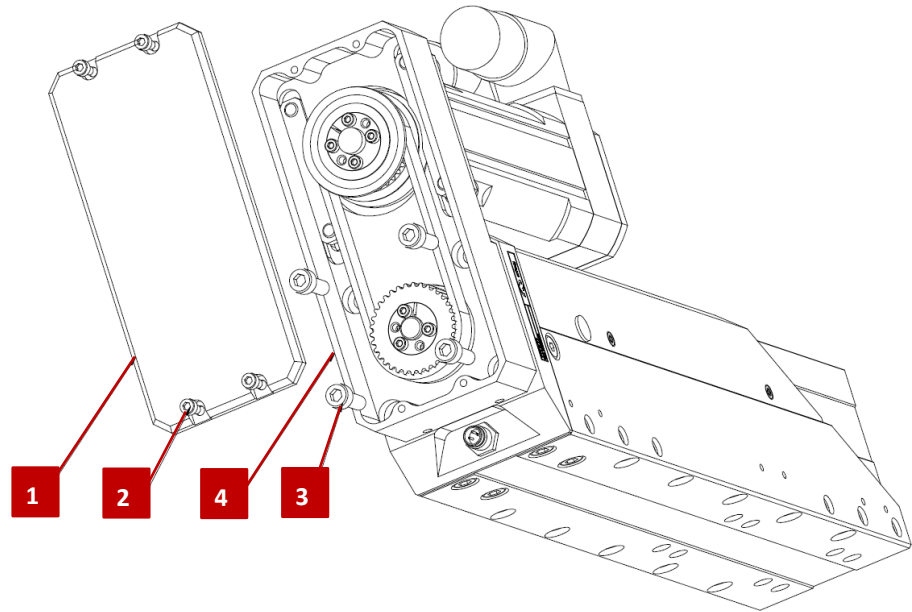


Fig. 7 Adjusting the motor position

1. Cover
2. 1 x Screw M3x6
3. 4 x Screws M3x6
4. Housing

Procedure for changing the position of the motor:

1. Switch off the controller of the module.
2. Remove the screws M3x6 (Fig. 7, 2) and dismount the cover (Fig. 7, 1).
3. Loosen the 4 x screws M3x6 (Fig. 7, 3).
4. Rotate the housing (Fig. 7, 4) 90° to the left or right (swivel).
5. Tighten 4 x screws (Fig. 7, 3) M3x6 with a tightening torque of 1.4 Nm.
6. Mount and fasten the cover (Fig. 7, 1).
7. Reassemble all necessary cables.
8. Connect the controller unit.

⇒ The adjustment of the motor position is completed.



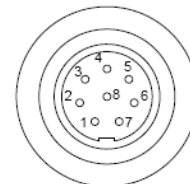
After adjusting the motor position, the telescope spindle axis must be re-referenced (see instructions of the controller manufacturer).

The correct toothed belt tension must be maintained and must **NOT** be changed!

6.3.3 Motor control

Electrical interfaces of the telescope spindle axis

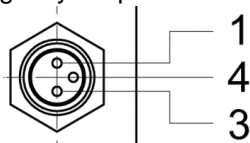
Pin assignment motor connection Pin assignment encoder connection
(motor side view) (motor side view).



SA-1 & SA-1 FL	Base body
A 1	U
B 5	V
C 2	W
D 3	GND Motor
+ 6	Brake +
- 4	Brake -

SA-1 & SA-1 FL	Base body
1	S1
2	S3
3	S4
4	S2
5	R1
6	R2
7	Thermo switches
8	Thermo switches

Pin assignment reference or
Emergency Stop switch



Pin	Signal
1	5 ... 24 V DC
3	GND
4	Signal, PNP



We recommend using the Afag standard cables specified in the accessories.

The motor connectors can be rotated 180°. Proceed as described below.

1. Loosen the screws.
2. Rotate the motor connectors.
3. Tighten the screws again.

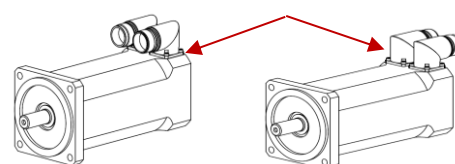


Fig. 8 Adjusting the motor position

6.4 Afag standard controllers



Further information on the control units can be found in the technical product catalogue (➔ Chapter “Controller”) or in the respective instructions on our website (www.afag.com).

6.4.1 SE-Power for control cabinet mounting

SE-Power			
Operating temperature	0 - 40 °C		
Bearing temperature	-25 - 70 °C		
Humidity	< 90 %		
Encoder evaluation	Resolver, incr., SinCos, Hiperface, en Dat		

Type	SE-Power 1kVA	SE-Power 3kVA	SE-Power 6kVA
Order number	50036337	50162993	50183996
Net weight	2.1 kg	3.7 kg	3.7 kg
Dimensions W x H x D	54x201x200 mm	69x250x240 mm	69x250x240 mm
Nominal output current	5 A	5 A	10 A
Supply voltage	48 - 230 VAC	3 x 400 VAC	3 x 400 VAC
Voltage supply, alternative	60 - 380 VDC		
Control voltage	24 VDC	24 VDC	24 VDC
Protection type	IP 20	IP 20	IP 20
Intermediate circuit voltage	320 VDC	560 VDC	560 VDC
Output power	1 kVA	3 kVA	6 kVA
Programming interface	USB/RS 232	USB/RS 232	USB/RS 232
Standard interfaces for higher-level control	CANopen DSP 402	CANopen DSP 402	CANopen DSP 402
Number of position data records via Onboard I/Os	16	16	16
Number of position data records with option I/O interface	250	250	250
Analog	+/- 10 V	+/- 10 V	+/- 10 V

Accessories

- Programming cable USB SE power FS
- Programming cable RS232 SE power
- I/O Interface
- Profibus Interface
- EtherCAT Interface
- FS Safety Module FSM 2.0

Fig. 9 Overview table - SE-Power for control cabinet mounting

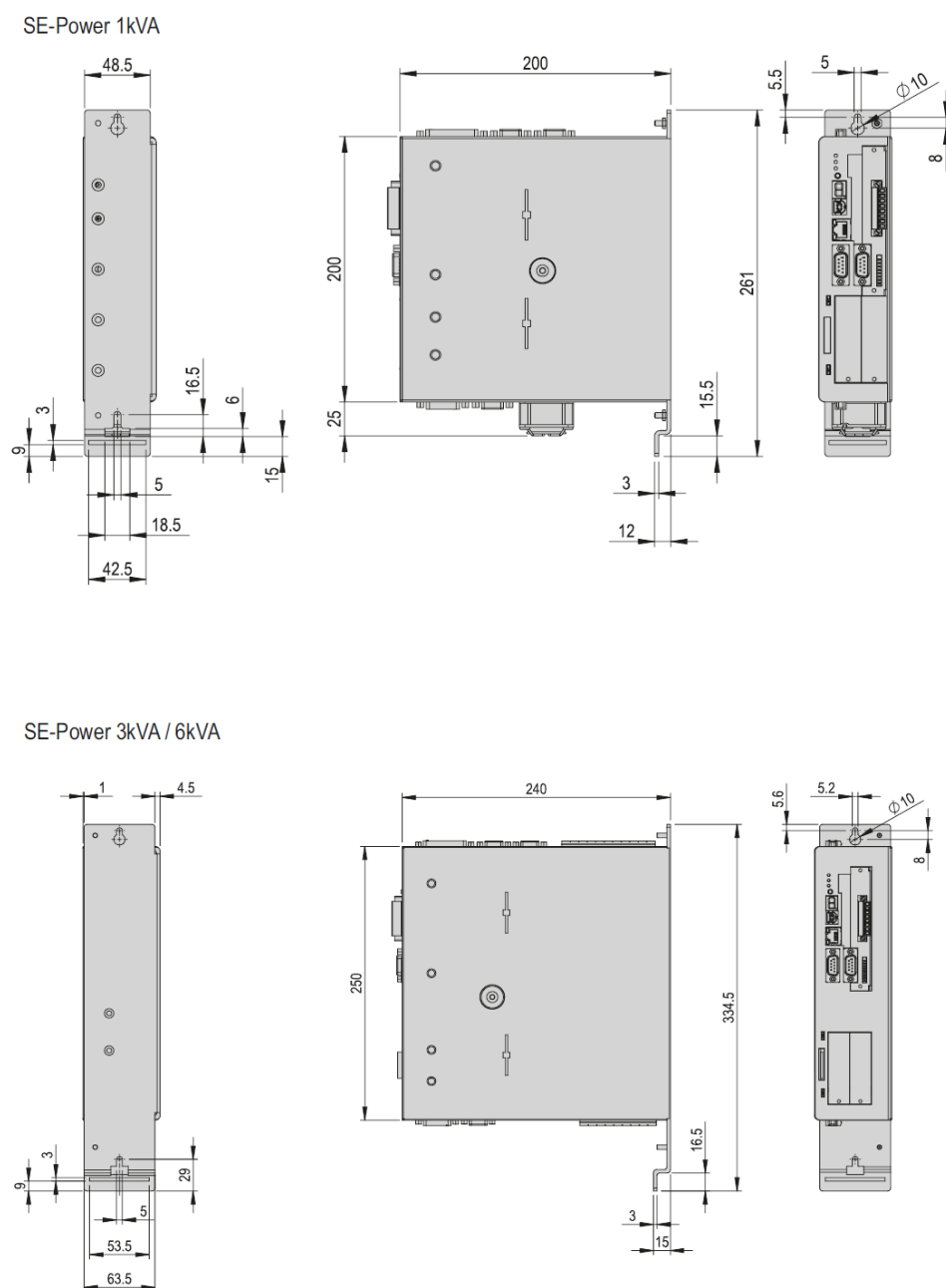


Fig. 10 Installation - SE-Power for control cabinet mounting

6.4.2 Servo controller

Modules	SE-24	SE-Power 1kVA	SE-Power 3kVA	SE-Power 6kVA	C11xx	C12xx	E12xx	E14xx	Third party con- trollers
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 parameterised 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

6.5 Programming of the telescope spindle axis

6.5.1 Safety instructions for programming



WARNING

Risk of injury from unexpected movements and ejected parts due to incorrect programming!

Incorrect programming can cause uncontrolled movements of the telescope spindle axis, resulting in injury and damage to property. The telescope spindle axis can also drive into the stop without braking, so that people can be injured by ejected parts.

- Have programming carried out by qualified personnel only.
- Observe the programming instructions of the controller used!



CAUTION

Risk of injury due to defective components

Failure of the encoder or limit switch cable may cause unexpected movement of the telescope spindle axis, which could result in injury.

- Immediately replace a defective encoder or limit switch cable.



When using an AFAG Se-Power controller, the information in the corresponding operating instructions must be observed.

The associated operating instructions are additionally available on the AFAG website www.afag.com.

6.5.2 Programming



Programming depends on the controller unit used. For programming, follow the instructions of the controller unit manufacturer!

7 Commissioning

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

7.1 Safety instructions for commissioning

WARNING



Risk of injury during commissioning due to incorrect programming!

Incorrect programming can trigger uncontrolled movements of the telescope spindle axis, which can lead to serious injuries as well as damage to property.

- Commissioning must only be carried out in setup/jog mode.
- Before working on the telescope spindle axis, make sure that the control unit is switched off and secured against being switched on again.

CAUTION



Danger of injury in the working area of the telescope spindle axis!

Due to the decentralised control system, the operator of the telescope spindle axis must not necessarily stand next to the module during operation so that he may not have a complete view of the working area. Persons in the working area may be injured.

- When operating the telescope spindle axis, ensure a good overview of the entire working area.
- Unauthorized persons must not stay within the working area during operation.

CAUTION



Risk of injuries due to uncontrolled parts movements!

Fast or unintentional movements of the telescope spindle axis may cause injury or material damage.

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



Observe the safety instructions in ➡ Chapter 2 „Safety instructions“ of these assembly instructions!

7.2 Preparatory activities for commissioning



An insulation test must be carried out before the telescope spindle axis is put into operation!

CAUTION



Danger due to missing protective devices!

Operating the telescope spindle axis without suitable safety devices can lead to considerable damage to property and injuries.

- Protective covers, safety doors or other safety devices must be provided by the user for operation!
- These safety devices must comply with the usual safety guidelines and safety standards and suitably prevent people from being in the working area of the telescope spindle axis.
- As a matter of principle, the telescope spindle axis may only be put into operation with closed and functioning protective devices!

7.3 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 controller.
 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
 - Then continue under normal operating conditions.
- ⇒ Commissioning is completed.

7.4 Setting up & retrofitting

CAUTION



Risk of injury due to incorrect operation of the system!

Incorrect operation during set-up work on the system can lead to unintentional start-up of the telescope spindle axis and cause injuries.

- Adjusting and maintenance work may only be carried out by qualified personnel.
- The system operator must ensure that no faulty operations can be executed in an open system.
- Observe the operating instructions!

CAUTION



Risk of injury in case of power failure!

In the event of a power failure during installation and setup work, the telescope spindle axis can slide down without a motor brake and injure people.

- The system operator must ensure that no employees are in the danger zone during installation and set-up work!

CAUTION



Risk of injury due to mounted components!

The telescope spindle axis is electrically controlled. Attachments can restrict the free movement of the telescope spindle axis and lead to injuries.

- Make sure that the movement of the telescope spindle axis is not restricted by mounted attachments.
- Take appropriate measures to ensure safe operation!

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 telescope spindle axis must be carried out with the power supply cut off!

NOTICE

Danger of material damage due to vibrations on the drive!

Risk of damage to the telescope spindle axis and attached components if the moving part of the module oscillates very strongly after switching on the controller (strong vibrations at the drive).

- Switch off the telescope spindle axis immediately!



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

8.2 Fault causes and remedy

The following table contains an overview of possible fault causes and how to proceed to eliminate them.

Malfunctions when returning to reference position

Fault	Possible cause	Remedy:
The telescope spindle axis oscillates (very strong vibrations at the drive)	<ul style="list-style-type: none"> Control parameters incorrectly adjusted 	<ul style="list-style-type: none"> Readjust the parameters on the controller
Telescope spindle axis moves to retracted end position and stops	<ul style="list-style-type: none"> Reference sensor incorrectly connected Reference sensor disconnection Reference sensor defective 	<ul style="list-style-type: none"> Check terminal assignment and correct if necessary Check reference sensor cable Send telescope spindle axis to manufacturer AFAG!!
Telescope spindle axis moves to end position and stops	<ul style="list-style-type: none"> Incorrect homing (reference) direction 	<ul style="list-style-type: none"> Check homing (reference) direction and change if necessary
Telescope spindle axis does not move	<ul style="list-style-type: none"> Drive incorrectly connected Motor disconnection Drive defective 	<ul style="list-style-type: none"> Check terminal assignment and correct if necessary Carry out function check Check motor cable Have the drive replaced by AFAG

Malfunction during operation

Fault	Possible cause	Remedy:
The telescope spindle axis oscillates (very strong vibrations at the drive)	<ul style="list-style-type: none"> Control parameters incorrectly adjusted 	<ul style="list-style-type: none"> Readjust the parameters on the controller
Telescope spindle axis stops after short stroke	<ul style="list-style-type: none"> Significant contouring error Interruption in the resolver connection 	<ul style="list-style-type: none"> Reduce values for acceleration and speed Check if telescope spindle axis is mechanically blocked Check encoder cable Check encoder for function
Increased toothed belt noise	<ul style="list-style-type: none"> Toothed belt tension incorrect Toothed belt defective 	<ul style="list-style-type: none"> Check toothed belt tension and retighten toothed belt if necessary Replace damaged toothed belt
Increased running noises on the module	<ul style="list-style-type: none"> Spindle lubrication not OK Axial play in the spindle gear Marked play in the guide of the module 	<ul style="list-style-type: none"> Re-lubricate the spindle Have spindle gear replaced by AFAG! Have the telescope spindle axis replaced by AFAG!

9 Maintenance and Repair

9.1 General notes

The following maintenance activities can ensure optimum operating condition of the telescope spindle 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!

When the control system is switched on, the telescope spindle axis can make unpredictable movements and cause injury or damage to property.

- Before starting any work on the telescope spindle axis, switch off the control unit and secure it from being switched on again.
- Observe the operating instructions of the controller used!
- Before starting any activities, switch off the media supply and secure it from being switched on again!



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

9.3 Maintenance activities and maintenance intervals







Observe the specified maintenance and care intervals. The intervals apply to normal operating conditions and are to be shortened accordingly for other conditions.



Fig. 11 Telescope spindle axis

9.3.1 Overview of the maintenance points

No.	Maintenance point	Maintenance work	Interval	System [On/Off]	Remarks
1	Safety labels (warning symbols)	check 	1 x Month	[Off]	- ▪ Check for damage, legibility, cleanliness
2	Module	Cleaning 	As required	[Off]	- - With lint-free, dry cloth - Do not spray module with water, do not use aggressive cleaning agents.
3	Spindle gear	Lubricating 	Every 4 million load cycles	[Off]	Recommended lubricant: Klüber Microlube GBU-Y-131 Alternatively: Type KP-1, N (51502) Type NLGI-Class 1 (DNI 51818)
4	Linear guide	Lubricating 	Every 10 million load cycles	[Off]	Recommended lubricant: Klüber STABRAGS NBU 8 EP Alternatively: Type KP2K NLGI-Class 2 (DNI 51818)

NOTICE

Risk of property damage if unsuitable lubricants are used!

Certain lubricants with additives can cause damage to the linear unit.

- Lubricants with additives (e.g. **MoS₂**, **Graphite** or **PTFE**) must not be used for maintenance of the linear unit!

9.3.2 Lubrication of spindle gear

The spindle gear must be lubricated every 4 million load changes (strokes). The module has a grease nipple on the right and left.

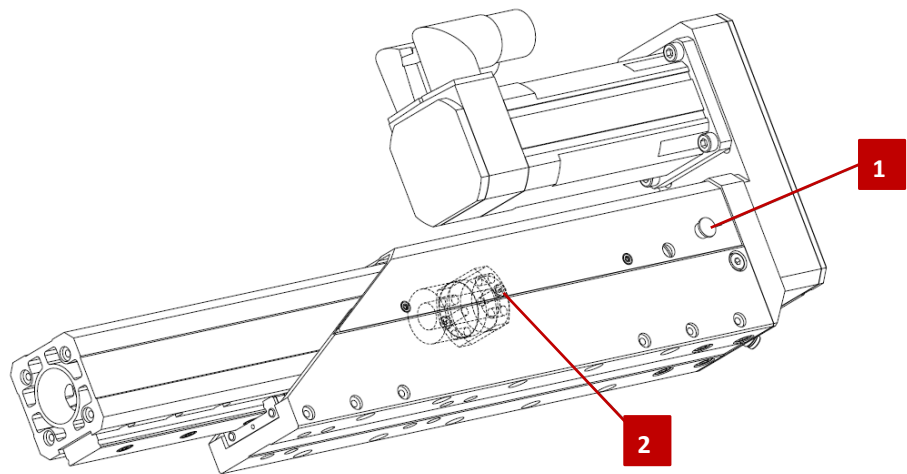


Fig. 12 Telescope spindle axis - grease nipple spindle gearbox

1. Dummy plug
2. Lubrication nipple

Procedure for lubricating the spindle gear:

1. Move the axis to the reference position.
2. Switch off the control and use a lockout device to make sure that the control cannot be started up again.
3. Remove the blind plug (Fig. 12, 1) from the spindle cover.
4. Screw the grease gun attachment (see accessories) to the grease gun.
5. Lubricate the spindle with the grease gun (1 - 1.5 g).
 - Recommended lubricant: Klüber Microlube GBU-Y-131
 - Alternative: Type KP-1, N (DIN 51502)/Type NLGI-Class 1 (DIN 51818)
6. Refit the blind plug.
 - ⇒ The lubrication is completed.



After lubrication, perform 2-3 strokes at low speed to distribute the lubricant optimally.

9.3.3 Lubrication of linear guide

The linear guide is initially lubricated with the special long-life grease on delivery. The linear guide must be lubricated every 10 million load changes (strokes).

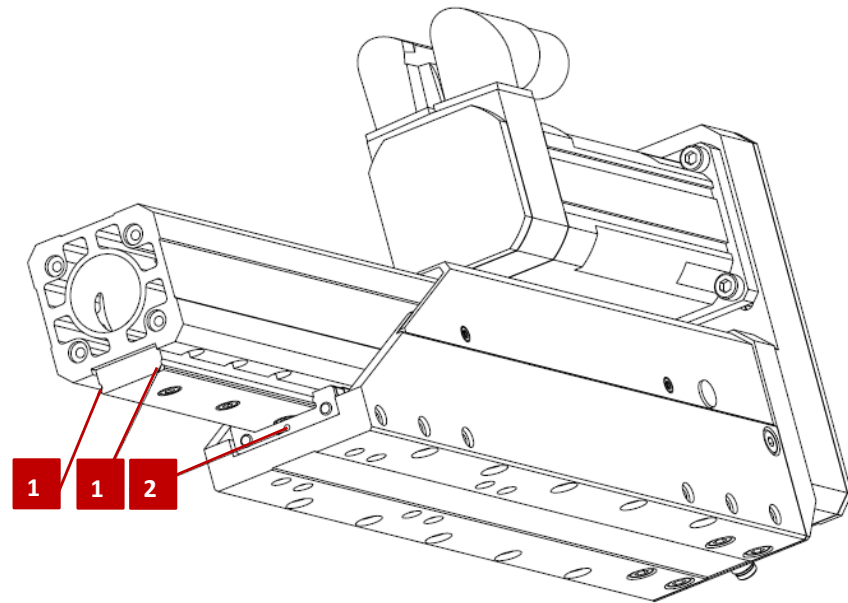


Fig. 13 Telescope spindle axis - grease nipple linear guide

1. Guideways of linear guides
2. Lubrication hole of carriage

Procedure for lubricating the linear guide:

1. Move the axis to the front-end position (= max. stroke).
 2. Switch off the control and use a lockout device to make sure that the control cannot be started up again.
 3. Remove grease residues or dirt from the guide rail.
 4. Lubricate the guideways of the linear guide (Fig. 13, 1) so that an even lubricating film is applied.
 5. Lubricate the carriage with the grease gun (0.2 - 0.4 g).
 - Recommended lubricant: Klüber STABURAG S NBU 8 EP.
- ⇒ The lubrication is completed.



After lubrication, perform 2-3 strokes at low speed to distribute the lubricant optimally.

NOTICE

Danger of corrosion damage when used in an ionized air environment!

When used in an ionized air environment (e.g. coronising in high-voltage processors), open guides and the spindle can corrode.

- Coat all uncovered guides and the spindle with grease.
 - Recommendation: Monthly cleaning and greasing
 - Afag standard: - Staburax NBU8EP (flat guides)
- Blasolube 301 (piston rods)
-

9.3.4 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 abrasive or process dust and vapours
- Environmental conditions as specified in the technical data

9.4 Spare parts and repair work

AFAG Automation AG offers a reliable repair service. Defective electric slides can be sent to AFAG for 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 provide any warranty for modules that have not been replaced or repaired by AFAG!

CAUTION



Danger of injury when dismantling the telescope spindle axis!

When disassembling the telescope spindle axis from a system, there is a danger of uncontrolled movements.

- Only remove the telescope spindle axis 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 telescope spindle axis must be properly dismantled 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 (electrics, pneumatics) before removing the modules!
- Only remove the module when the control unit is switched off and secured!

10.2 Decommissioning

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

- Scrap the metallic materials.
- 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 telescope spindle axis!

Environmental damage can be caused by improper disposal of the telescope spindle 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 Automation AG, Luzernstrasse 32, CH-6144 Zell

that the partly completed machine:

Product description	Telescope spindle axis SA-1
Type:	SA-1-50, SA-1-100, SA-1-150, SA-1-50-FL, SA-1-100-FL, SA-1-150-FL

complies with the following essential health and safety requirements of the Machinery Directive 2006/42/EC at the time of declaration: 1.1; 1.1.1; 1.1.2; 1.2; 1.2.1; 1.2.3; 1.2.4.4; 1.2.5; 1.3; 1.3.3; 1.3.5; 1.3.6; 1.3.7; 1.3.8.1; 1.3.8.2; 1.3.9; 1.4; 1.4.1; 1.5; 1.5.1; 1.6; 1.6.1; 1.6.3; 1.6.4; 1.7; 1.7.1; 1.7.4.; 1.7.4.1; 1.7.4.2; 1.7.4.3; 3.3.5; 3.4.1.

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 has been 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



CEO Afag Gruppe

Klaus Bott



CTO Afag Gruppe

Afag Automation AG
Luzernstrasse 32
6144 Zell
Switzerland
T +41 62 959 86 86
sales@afag.com

Afag GmbH
Wernher-von-Braun-Straße 1
92224 Amberg
Germany
T +49 9621 650 27-0
sales@afag.com

Afag Engineering GmbH
Gewerbestraße 11
78739 Hardt
Germany
T +49 7422 560 03-0
sales@afag.com

Afag Automation Americas
Schaeff Machinery & Services LLC.
883 Seven Oaks Blvd, Suite 800
Smyrna, TN 37167
USA
T +1 615 730 7515
nashville@afag.com

Afag Automation APAC
Afag Automation Technology (Shanghai) Co., Ltd.
Room 102, 1/F, Bldg. 56, City Of Elite
No.1000, Jinhai Road, Pudong New District
Shanghai, 201206
China
T +86 021 5895 8065
shanghai@afag.com