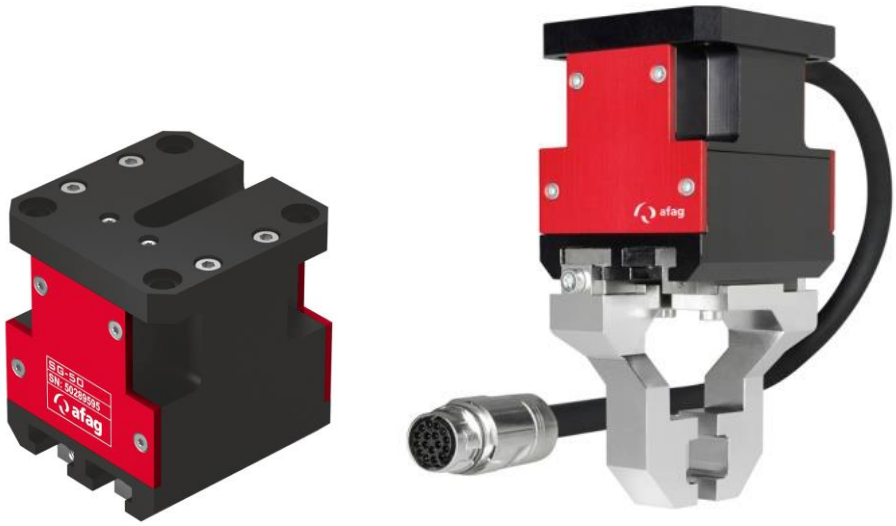
Assembly and operating instructions

Servo Gripper

SG-50



Translation of the Original Assembly Instructions EN

- SG-50 ⇨ Order no.: 50289595
- SG-50-ABq ⇨ Order no.: 50460223

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 servo gripper 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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Table of contents

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 servo gripper to ensure safe and efficient handling and operation.

Consistent compliance with these assembly instructions will ensure:

- permanent operational reliability of the servo gripper,
- optimal functioning of the servo gripper,
- timely detection and elimination of defects (thereby reducing maintenance and repair costs),
- prolongation of the servo grippers' 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 servo gripper.

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 servo gripper 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 servo gripper.

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 servo gripper 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 servo gripper and optimal protection of personnel.

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

Every person carrying out installation, commissioning, maintenance work or operating the servo gripper 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 SG servo gripper is intended for the shock-free gripping movement of loads in **non-hazardous** and in the ambient and operating conditions defined for this module (➲Chapter 3 Technical data).

The servo grippers are intended exclusively for gripping payloads up to 0.5 kg that do not pose any danger to persons, property or the environment during manipulation (see also ➲ Chapter 5.2 Product description).

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 servo gripper.

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 servo gripper poses a potential hazard to the personnel.

- The servo gripper 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 servo gripper 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 servo gripper.

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 servo gripper.

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 servo gripper,
- 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 servo gripper 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 servo gripper,
- 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 0).

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 servo gripper 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 servo gripper.

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

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 servo gripper, 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 are 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 servo gripper 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 servo gripper 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 servo gripper 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 servo gripper.

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

- danger to life and limb of the operator or third parties,
- on the servo grippers 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 servo gripper.

WARNING

Danger - Do not use in unsuitable environment!

The servo grippers are designed for use in **non** explosive atmospheres.

- Do **not** use the servo gripper in potentially explosive atmospheres!

CAUTION

Risk of injuries due to uncontrolled parts movements!

When operating the servo gripper uncontrolled movements may occur which can cause personal injury or property damage.

- Only qualified personnel may work with or on the servo gripper.
- Read the assembly instructions carefully before carrying out any work on or with the servo gripper.

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.

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 50 cm.

2.8.4 Danger due to high temperatures

CAUTION

Danger of injury from hot surfaces.

During continuous operation of the servo gripper, 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 Mechanical hazards

CAUTION

Danger of injury by moving components!

Limbs can be crushed by moving components!

- Work on and with the servo gripper may only be carried out by qualified personnel.
- Never reach into the system during normal operation!

3 Technical data

3.1 Dimensional drawing SG-50

Type	SG-50
A	Jaws in middle position (+/- 5 mm)
B	12-pole industrial plug M17

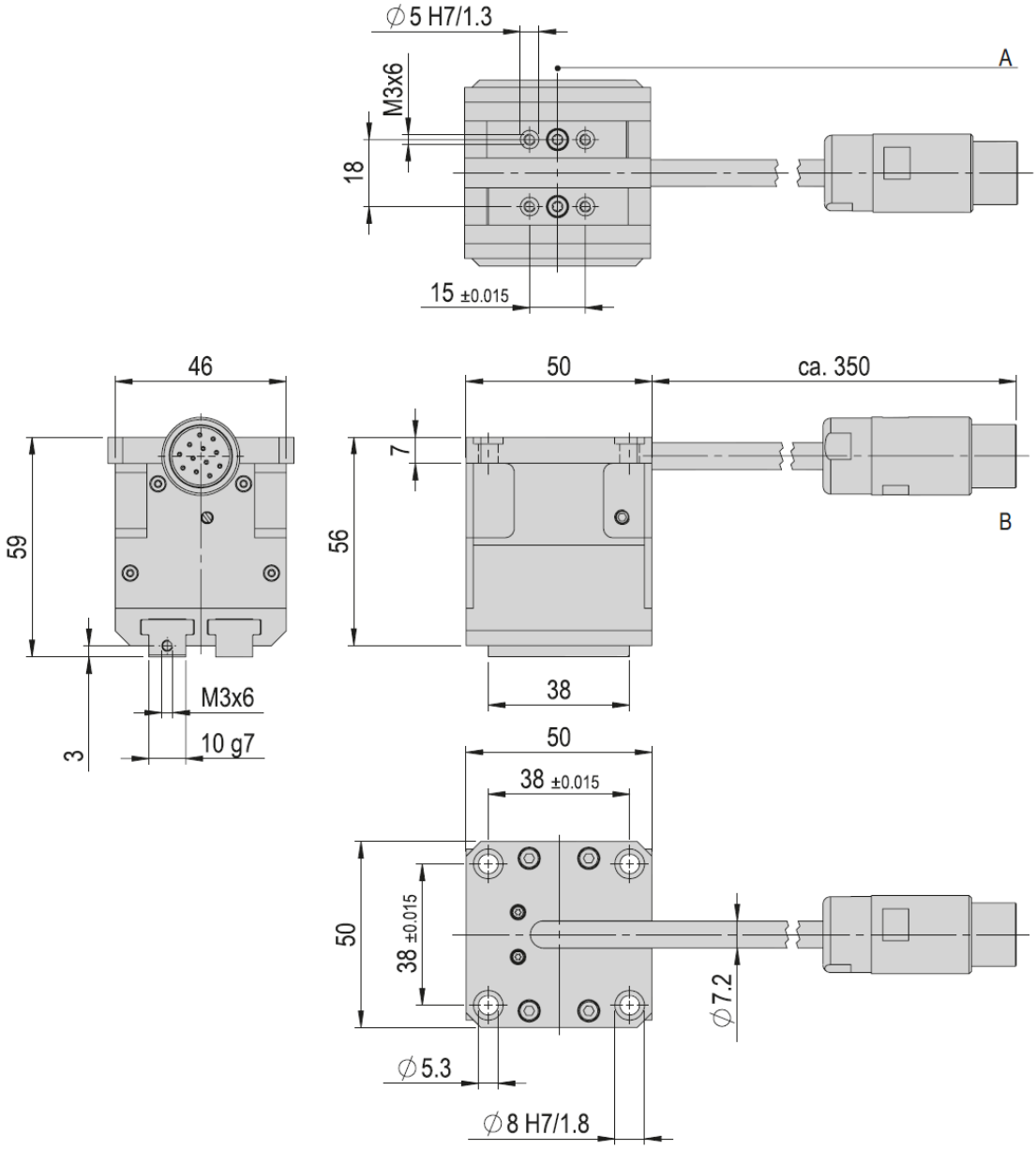


Fig. 1 Dimensional drawing SG-50

3.2 Technical data SG-50

SG-50	
Attachment grid	38 x 38 mm
Attachment grid alternative	Jaws: 15 mm
Attachment thread	M5
Attachment thread alternative	Jaws: M3
Operating temperature	0- 40 °C
Storage temperature	-20 - 50 °C
Humidity	20 - 80 %

Type	SG-50	SG-50-ABq
Order number	**50289595**	**50460223**
Net weight	0.42 kg	0.42 kg
Max. payload	0.5 kg	0.5 kg
Gripping time	2x2 mm: <100 ms	2x2 mm: <100 ms
Gripping force	max. 50 N	max. 50 N
Opening stroke	2 x 10 mm	2 x 10 mm
Noise level	< 65 dB (A)	< 65 dB (A)
Dimensions W x H x D	50 x 50 x 59 mm	50 x 50 x 59 mm
Nominal current	2.4 A	2.4 A
Peak current	3.6 A	3.6 A
Protection type	IP 40	IP 40
Intermediate circuit voltage	24 VDC	24 VDC
Reverse play	< 0.2 mm	< 0.2 mm
Incremental encoder type	Digital A+B	Digital with A/A- ; B/B- and Z/Z- track
Incremental encoder voltage	5 VDC	5 VDC
Number of increments	4096	4096
Reference switch type	NC (normally closed)	NC (normally closed)
Reference switch voltage	24 VDC	24 VDC
Control	SE-24	C11xx
Repeat accuracy	+/- 0.05 mm	+/- 0.05 mm
Handling accuracy	< 0.1 mm	< 0.1 mm
Absolute accuracy	0.1 mm	0.1 mm
Mounting position		

The technical data pertains to Afag standard test conditions.
Note: The electrical data for the operation with alternative servo controllers is available upon request
Cleanroom class ISO 14644-1, class ISO 7

*The gripping force depends on the selected finger length, the power and the current speed. Observe the gripping force diagrams.

Inlcuded in the delivery
(Catalogue HT accessories)
- 2x Centering bushing Ø8x3.5
- 8x Mounting screw M5x16

Accessories
(Catalogue HT accessories)
- SG-50 only: Motor cable-M14
- SG-50 only: Servocontroller SE-24
- SG-50 ABq only: Motor cable-M19
- SG-50 only: Servocontroller C1xx

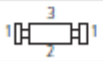
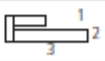
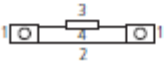
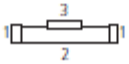
Alternative accessories
(Catalogue HT accessories)
- Additional motor cables
- Additional controllers
- Additional power supplies

3.3 Preferred combinations SG-50

ES20	1	VP 150	2
ES30	1	VP 150	2
SA-1	1,2	VP 150	2
SA-3	1,2	VP 150	2
SA-6	1,2	VP 150	2
PEZ-65	3	VP 150	2
RE-50	3	< direct >	2
RE-75	3	VP 150	2*
SREH-50	3	VP 157	2
CS 16	1,3	VP 150	2
CS 20	1,3	VP 150	2
LM 20	1,3	VP 150	2
LM 25	1,3	VP 150	2
HM 10	1	VP 150	2
HM 16	1	VP 150	2
CR 16	3	VP 150	2
CR 20	3	VP 150	2
PMP-c	1,3	VP 150	2

* Offset mounting

Mounting areas

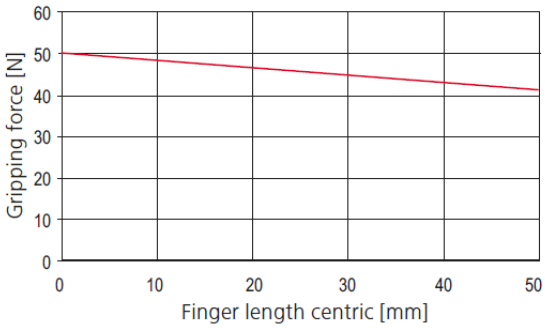
CS, ES	LM	HM	SA	UG, GM, SG, DG, PG, GE, SGE
				
PMP, PMP-c	**PEZ, PDZ**	**PEL, PDL**	**RM, RE**	**CR, RM 32, RE, SREH, RA**
				

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.

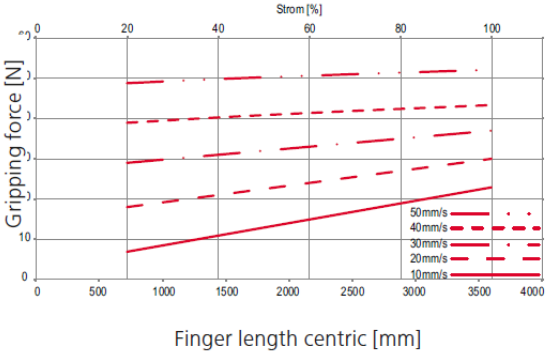
3.4 Gripping force diagram

Gripping force diagrams per jaw

Gripping force depends on finger length

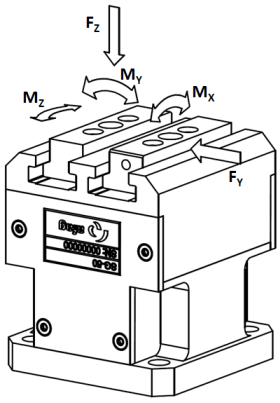


Gripping force depends on power



3.5 Gripper jaws maximum loads SG-50

The values given are static values related to one jaw - starting from the centre of gravity of the jaw.



Type	Maximum load
Mx	22 Nm
My	9 Nm
Mz	17 Nm
Fz	150 N
Fy	100 N

Fig. 2 Maximum loads on gripper jaws

For multiple loads, the following also applies:

$$\frac{M_X}{M_{Xmax}} + \frac{M_Y}{M_{Ymax}} + \frac{M_Z}{M_{Zmax}} < 1$$

When parametrizing the force and dynamic values, observe the ➲chapter 7.5 Setup & retrofitting - Parametrization of the positions!

4 Transport, Packaging and Storage

4.1 Safety instructions for transport

CAUTION

Risk of injury when unpacking the servo gripper!

The servo grippers 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 servo grippers.

Also observe the safety instructions in chap. 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 servo gripper.

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

Fig. 3 The servo gripper has a weight of < 1 kg

Unt.	SG-50
1 x	Module SG -50
2 x	Centering bushing ø 8x3.5
4 x	Fastening screws M5x16
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 servo gripper is transported in the Afag Automation AG transport packaging. If no Afag packaging is used, the servo gripper 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 servo gripper is stored for an extended period of time, observe the following:

- Store the servo gripper in the transport packaging.
- Do not store the servo gripper 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 servo gripper and protect the blank metal parts against corrosion using the appropriate means.
- Protect the servo gripper from dirt and dust.

5 Design and description

5.1 Design of servo gripper

Fig. 4 Design of the servo gripper

1. Drive housing
2. Jaw guide
3. Connection cable
4. Gripper finger **(not** included in delivery!)

The servo gripper SG-50 consists of the base body (Fig. 4, 1) in which the electric motor is integrated. The precise gripper guide system is integrated in the transition piece (Fig. 4, 2). The gripper drive is designed with a connection cable (length 0.35 m) with 12-pin industrial plug.

The gripper fingers (Fig. 4) are not included in the scope of delivery, they are made individually by the customer (➲ Chapter 6.3)!

5.2 Product description

The servo gripper SG-50 is a highly compact parallel gripper with object recognition for gripping payloads weighing up to 0.5 kg.

The servo gripper is equipped with a 12-pin industrial connector (M17 or M19) and is designed for operation with the AFAG servo controller SE-24, C11xx or C12 xx.

Operation with other controllers is also possible. When using third-party controllers, it must be ensured that the maximum gripping force of the servo grippers is not exceeded.

In combination with other modules the servo grippers can be used as a pick & place Station.

Due to its integrated measuring function, the servo gripper can measure parts during the gripping process. This function can be used for quality control or sorting of parts.

5.3 Accessories

No.	Designation	Order Number
1	Centering bushing Ø 5x2.5mm	50035831
2	Centering bushing Ø 8x3.5mm	50263565
3	Servo controller C1100 CanOpen STO	50419402
4	Servo controller C1150 EtherCat STO	50419403
5	Servo controller C1150 Profinet PN STO	50419404
6	Servo controller SE-24 I/O	50315434
7	Servo controller SE-24 Profibus	50315435
8	Servo controller SE-24 EtherCAT	50315436
9	Servo controller SE-24 CANopen	50315437
10	Motor cable M14-3m-0-0	50311491
11	Motor cable M14-5m-0-0	50341510
12	Power cable SE-24/SE-48, 5m	50118124
13	Power cable SE-24/SE-48, 10m	50235739
14	Programming cable SE-24, 3m	50315431
15	I/O Cable SE-24, 5m	50312913
16	I/O Cable SE-24, 10m	50342940
17	SE-24 Stick	50315432

6 Installation, assembly & setting

The system operator is responsible for the installation of the servo gripper in a system!

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

6.1 Safety Instructions for Installation & assembly

The servo gripper is an incomplete machine. For safe operation, the servo grippers 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 servo gripper. This can be achieved by suitable protective measures such as enclosures, light grids or disconnecting the drive from the power supply.

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

CAUTION

Risk of injury due to mounted components!

The jaws of the servo grippers are controlled electrically. Attachments can restrict the free movement of the jaws of the servo gripper and cause injuries such as crushing.

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

CAUTION

Risk of injuries due to uncontrolled parts movements!

Signals from the control system can trigger unintentional movements of the servo gripper, which can cause injury.

- When working on the servo gripper, switch off the controller and secure it against unintentional restart.

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

6.2 Assembly & attachment

The servo grippers can be mounted both in horizontal and vertical position.

6.2.1 Mounting holes

The module is attached to the rear of the housing plate.

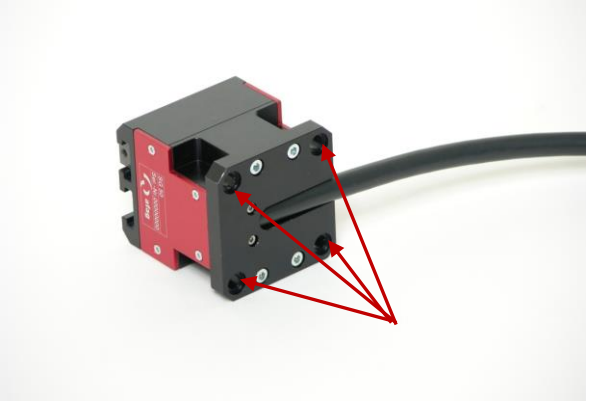


Fig. 5 Mounting holes on the housing - 4 x Ø 5.3 mm

Use the centring bushings (Chapter 4.2) included in the scope of delivery for positioning.

Insert the centering bushings into two diagonally opposite holes of the attachment grid.

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
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

6.3 Manufacture of the gripper fingers

For most applications the gripper fingers' design can be symmetrical.

Example for the manufacturing of a gripper finger:

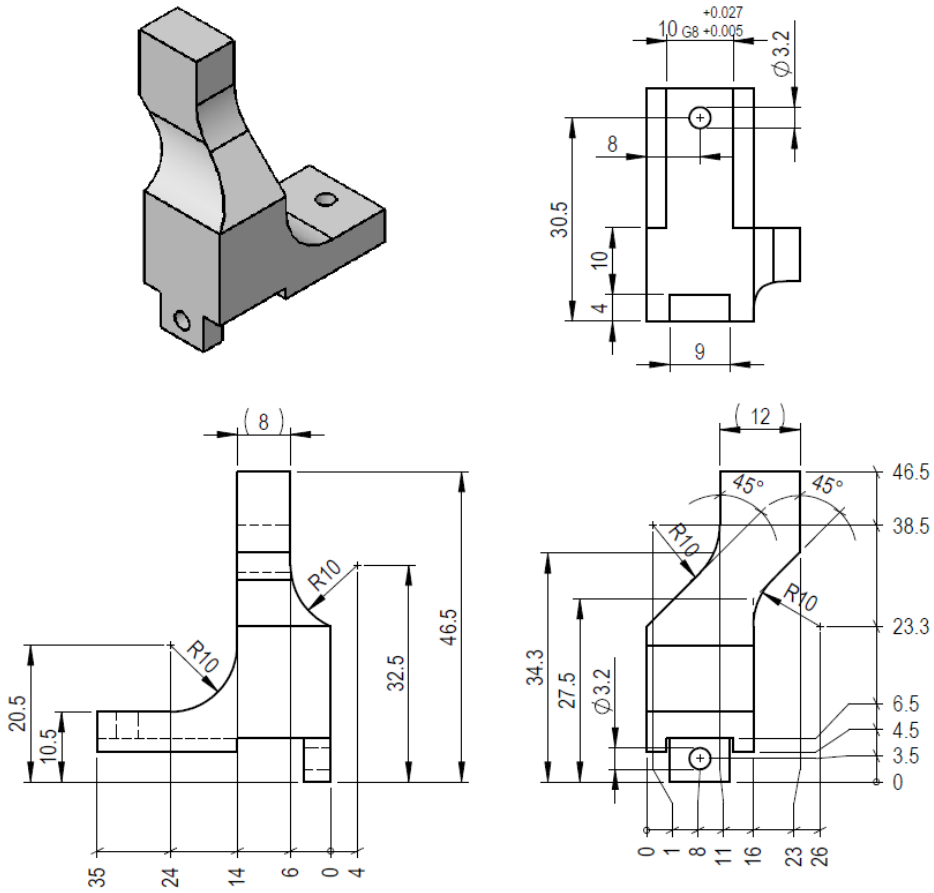


Fig. 6 Example for manufacturing the gripper fingers

AFAG does not manufacture standard gripper fingers. Gripping fingers are therefore not included in the scope of delivery.

The gripper fingers must be designed and manufactured by the operator!

6.4 Reference position

The gripper fingers and attachments of the servo gripper must be designed so that the reference position can be approached.

This is only guaranteed if the jaw side with chamfer and the lateral fastening thread can move up to the housing edge of the gripper.

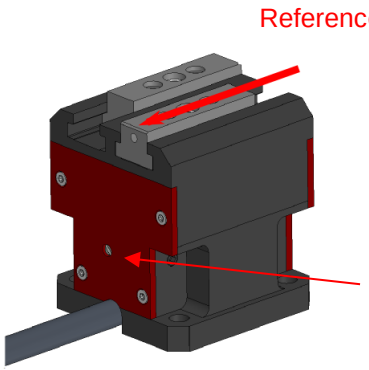


Fig. 7 Reference position servo gripper

6.5 Pin assignment SG-50

Pin	Value
1	GND
2	VDD 5 V
3	B
4	A
5	PE
6	Z
7	Sensor GND
8	Sensor V+ 24 V
9	Sensor NC
10	U
11	V
12	W

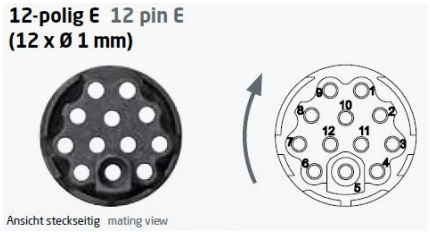


Fig. 8 Pin assignment servo gripper SG-50

7 Commissioning

After connection, the servo grippers are put into operation for the first time via the system controller.

7.1 Safety instructions for commissioning

CAUTION

Risk of injury due to mounted components!

The jaws of the servo grippers are controlled electrically. Attachments can restrict the free movement of the jaws of the servo gripper and cause injuries such as crushing.

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

CAUTION

Danger of injury in the working area of the servo gripper!

Due to the decentralised control system, the operator of the servo gripper 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 servo gripper, 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!

Signals from the control system can trigger unintentional movements of the servo gripper, which can cause injury.

- When working on the servo gripper, switch off the controller and secure it against unintentional restart.

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

7.2 Preparatory activities for commissioning

The servo gripper is designed for operation with the AFAG servo controller SE-24. However, the servo gripper can also be operated with other controllers. The required characteristic data will be provided on request.

The operation of the SE-24 servo controller is described in a separate manual.

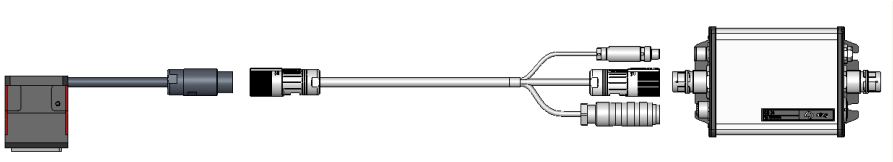


Fig. 9 Servo gripper SG-50 with cable and servo controller SE-24

To prepare for commissioning proceed as follows:

1. Connect the servo gripper to the SE-24 servo controller using the M14 motor cable (Fig. 9).
   - Motor cable contains motor conductors, encoder conductors and ref. conductors.
2. Connect the servo controller to the power supply.
   - A supply cable is available for the AFAG Se-24 servo controller (➲ Section 5.3 Accessories).
3. For test operation, connect the servo controller to a computer (operating software must be installed on the computer). Observe the operating instructions for the servo controller.

- If the SG-50 servo gripper is supplied in combination with an AFAG servo controller, the operating parameters are already stored in the servo controller. The servo gripper can be operated immediately.
- If the SG-50 servo gripper is operated with an alternative servo controller, the operator must make special cables and determine the appropriate operating parameters.

- For gripping the parts to be handled, the gripper fingers must be manufactured by the operator (➲ Chap. 6.3 Manufacturing the gripper fingers).

7.3 First commissioning

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

1. Observe the permissible technical values (➲ Chapter 3).
   - Payload, movement frequency and moment load
2. First, make sure that there are no persons or tools in the working area.
3. Perform test run:
   - Start with slow movements
   - Then continue under normal operating conditions

   ⇨ Commissioning is completed.

7.4 Manual operation

The manual control is used to pre-set the gripper fingers or the gripper position.

In addition, the manual control is used to release the blocked gripper jaws in the open-end position.

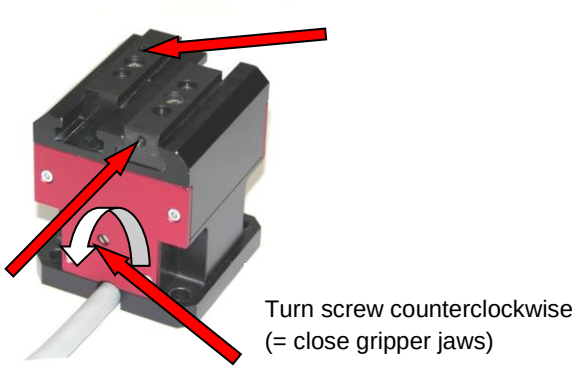


Fig. 10 Manual operation servo gripper

Adjustment of the manual control only in de-energized state!

7.5 Setup & retrofitting - Parametrization of the positions

When carrying out set-up work on the servo gripper, the controller enable must be deactivated and only switched on again after the work has been completed!

Observe safety instructions!

7.5.1 Basics of gripping movements

Basically, two different modes can be selected for each individual movement on the gripper:

- Positioning mode and
- current or force mode

Each mode is optimized for one movement. The current mode must always be used when gripping and the positioning mode when opening the gripper.

Due to the self-locking spindle, which prevents displacement of the gripper jaws in the de-energized state, the dynamics of the gripping/opening movement must be coordinated.

7.5.2 Positioning mode

The positioning mode is used when moving to a specific position. This is typically the case when a part is released, or the gripper fingers are pre-positioned.

The positioning mode is active if the hook for current [%] is **not** set or the "Mode" signal via the bus is **not** activated (Fig. 11).

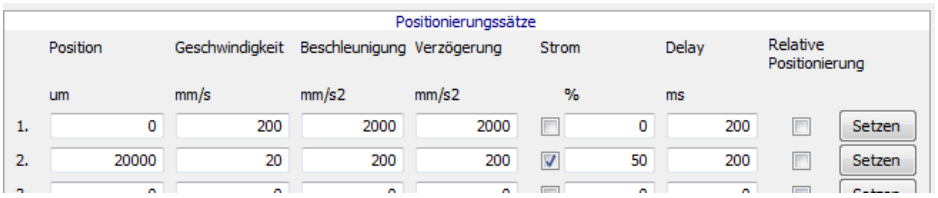


Fig. 11 Positioning mode servo gripper

The following must always be observed in positioning mode:

- The position must always be within the maximum position limits (between 1000 and 21,000 µm).
- If possible, the module should not be displaced to the position limits.

A position selection between 0 µm and 20,000 µm is recommended.

7.5.3 Current mode

Current mode is used when driving on block. This is typically the case when a part is gripped.

The current mode is active when the check mark for current [%] is **set** or the "Mode" signal is **activated** via the bus (Fig. 12).

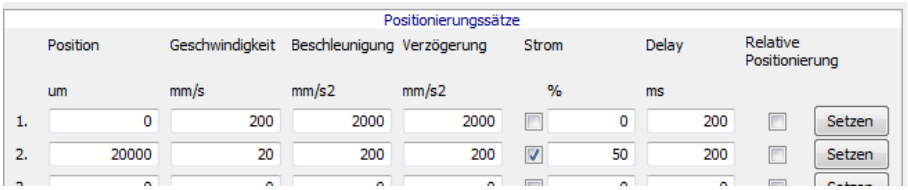


Fig. 12 Current mode servo gripper

The following should always be observed in the current mode:

- The setting range for the current is between 20% and 100%.
- After the gripping movement, you can see whether a part has been gripped. For this purpose, the target position of the gripping movement must be selected in such a way that the fingers do not close completely when no part is present.
- If a part is gripped and thus the parametrized current value is reached, the controller sets the signal "move_ok".
- If no part is present, the gripper reaches the parametrized target position, but not the parametrized current value.
  - The controller does not set the signal "move_ok".

In current mode, it is important that the current default value is set as low as possible. This enables a higher dynamic in the positioning mode.

In addition, it saves electricity and protects the mechanics, which also leads to an extension of the service life.

- For positive gripping, a current value of 20% is usually sufficient.
- A higher current value may be necessary for force-locking gripping.
  - This should be chosen as low as possible (20%).

7.5.4 Further notes on settings

A more sensitive response and a greater process reliability of the force evaluation can be achieved by lower displacement speeds. This applies in particular to small gripping forces.

For time-critical applications, fast pre-positioning outside the maximum dimensions of the gripping part and subsequent gripping at low speed is recommended.

The gripping force corresponding to the percentage default value can change over time due to changing friction and wear influences. This must therefore be checked regularly and readjusted if necessary.

When operating with alternating internal and external gripping, the existing backlash must be taken into account for more accurate measurement. This may increase slightly over time due to wear.

Excessive and long holding of the force (in force mode) overheats the servo gripper!

The maximum forces can only be applied for a short time!

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 servo gripper must be carried out with the power supply cut off!

CAUTION

Risk of injury due to mounted components!

The jaws of the servo grippers are controlled electrically. Attachments can restrict the free movement of the jaws of the servo gripper and cause injuries such as crushing.

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

CAUTION

Danger of injury in the working area of the servo gripper!

Due to the decentralised control system, the operator of the servo gripper 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 servo gripper, ensure a good overview of the entire working area.
- Unauthorized persons must not stay within the working area during operation.

Also observe the safety instructions in chap. 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.

Fault	Possible cause	Remedy:
Jaws do not move	▪ Servo gripper incorrectly connected	▪ Check the connection of the servo gripper to the controller
	▪ Jaws in mechanical end stop blocked by the spindles	▪ Releasing the jaws using the servo gripper manual adjustment (➲ chapter 7.5.3)
	▪ Controller not connected to power supply	▪ Check the power supply of the controller
	▪ Communication error to the controller	▪ Check bus connection / I/O connection of the controller
Gripping force decreases / servo gripper opens and closes abruptly	▪ Dirt deposits/ dry running of the guides	▪ Clean servo gripper / lubricate sliding guides with suitable grease

9 Maintenance and Repair

9.1 General notes

The servo grippers are almost maintenance-free. Nevertheless, some maintenance work must be carried out to ensure an optimum operating condition of the modules.

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!

Signals from the control system can trigger unintentional movements of the servo grippers, which can cause injury.

- Before starting any work on the servo gripper, switch off the control unit and secure to prevent it from being switched on.
- Observe the operating instructions of the controller used!

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

9.3 Maintenance activities and maintenance intervals

- Observe the specified maintenance and care intervals. The intervals refer to a normal operating environment.

9.3.1 Overview of the maintenance points

Fig. 13 Servo gripper maintenance points SG-50

No.	Maintenance point	Maintenance work	Interval	System [On/Off]	Remarks
1	Servo gripper module	Cleaning and checking 	As required	[Off]	-
			▪ Clean the servo gripper with a dry, lint-free cloth. - Do not spray the module with water, do not use aggressive cleaning agents. - Perform a visual inspection of the servo gripper.		

9.3.2 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 and repair work

Afag Automation AG offers a reliable repair service. Defective modules can be sent to Afag for warranty repair within the warranty period. After the warranty period has expired, the customer can 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

Danger of injury when dismounting the servo gripper!

When disassembling the servo grippers from a system, there is a danger of uncontrolled movements.

- Only remove the SG when the control unit is switched off and secured!
- Only remove the SG when the control unit is switched off and secured!

10 Decommissioning, disassembly, disposal

The servo gripper 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 servo gripper when the control unit is switched off and secured!

10.2 Decommissioning

If the servo grippers 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 servo gripper 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 servo gripper must not be disposed of as a complete unit. Dismantle the servo gripper 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 servo gripper!

Environmental damage can be caused by improper disposal of the servo gripper.

- 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	Servo gripper SG
Type:	SG-50, SG-50 ABq

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.

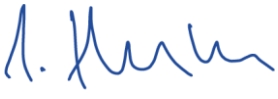
The manufacturer undertakes to transmit, in response to a reasoned request by the national authorities, relevant technical documentation for the partly completed machinery.

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



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