

Assembly and operating instructions

Linear Modules

LM 12 | LM 16



Translation of the Original Assembly Instructions EN

- LM 12/30 ⇒ Order No.: 11010377
- LM 12/60 ⇒ Order No.: 11010378
- LM 12/90 ⇒ Order No.: 11010379
- LM 16/30 ⇒ Order No.: 11001864
- LM 16/60 ⇒ Order No.: 11001865
- LM 16/90 ⇒ Order No.: 11001866

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 linear module or other options.

We wish you every success with our products!

With kind regards

Your Afag team

© Subject to modifications

The linear 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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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 linear module to ensure safe and efficient handling of the linear module LM 12 and LM 16.

Consistent compliance with these assembly instructions will ensure:

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

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 linear module 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 linear module and optimal protection of personnel.

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

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

Also observe all rules and regulations regarding accident prevention applicable to the place of installation of the modules.

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 linear module series is designed for the shock-free linear movement of permanently mounted loads in **non-explosive** environments and in the ambient and operating specially conditions defined for these modules (➡ Chapter 3 „Technical data“).

The modules are designed exclusively for the linear movement of loads in **any position**. The maximum admissible loads at the front plate are: LM 12: 0.5 kg, LM 16: 0.8-1.0 kg (➡ Chapter 3 "Technical data").

The LM 12 and LM 16 modules can also be used in combination with other modules as pick and place stations, whereby the admissible loads must not be exceeded.

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/improper use of the linear module.

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 linear module poses a potential hazard to the personnel.

- The linear module may only be used in a technically perfect condition in accordance with their intended use and 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 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 parallel 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 linear module.

2.4.2 Obligations of the operating company

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

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 linear module,
- 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 automation system in which the linear modules have been integrated,
- 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 linear modules are required to:

- read and observe these assembly instructions, especially the chapter on safety,
- observe the occupational safety and accident prevention regulations,
- observe all safety and warning signs on the linear modules,
- 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 linear modules 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 linear modules.

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

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.

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 linear module, 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:

	<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 and modifications

No changes may be made to the linear modules 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 linear modules 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 linear module 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 linear module.

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

2.8.1 General hazards at the workplace

The linear modules have been built according to the state-of-the-art and the applicable health and safety requirements. Nevertheless, improper use of the linear modules may cause the following hazards to the personnel:

- danger to life and limb of the operator or third parties,
- on the linear modules 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.
- Observe the safety information sheet for the linear module.

WARNING



Danger - Do not use in unsuitable environment!

The linear modules are designed for use in **non**-explosive atmospheres.

- Do **not** use the linear module in potentially explosive atmospheres!

2.8.2 Danger due to mechanical hazards

CAUTION



Risk of injuries due to uncontrolled parts movements!

When connecting the linear module to the control unit or when operating the linear module sudden, unexpected movements may occur which can cause personal injury or property damage.

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

2.8.3 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.
-

2.8.4 Danger due to pneumatic system

WARNING



Risks by the pneumatic system!

The pneumatic system can pose various hazards that can cause serious or fatal injuries if the work is carried out improperly.

- Work on pneumatic systems may only be carried out by a specialist or by instructed persons under the direction and supervision of a specialist in accordance with the applicable regulations.
-

2.8.5 Danger due to noise emission

CAUTION



Risk of noise-induced hearing loss!

The linear module generates 68 dB(A) at full load. These decibel levels can be higher depending on the attachments, the environment and the enclosure resonance.

- The operating company is responsible for ensuring that the permissible noise levels are observed.
 - If the noise level exceeds 85 dB(A) in normal operation, the operator must wear hearing protectors at the workplace.
-

3 Technical data

3.1 Linear module LM 12

3.1.1 Dimension drawing LM 12

Type	LM 12/30	LM 12/60	LM 12/90
A	117 mm	147 mm	177 mm
B	107 mm	137 mm	167 mm
H	30 mm	60 mm	90 mm
P	M5	M5	M5

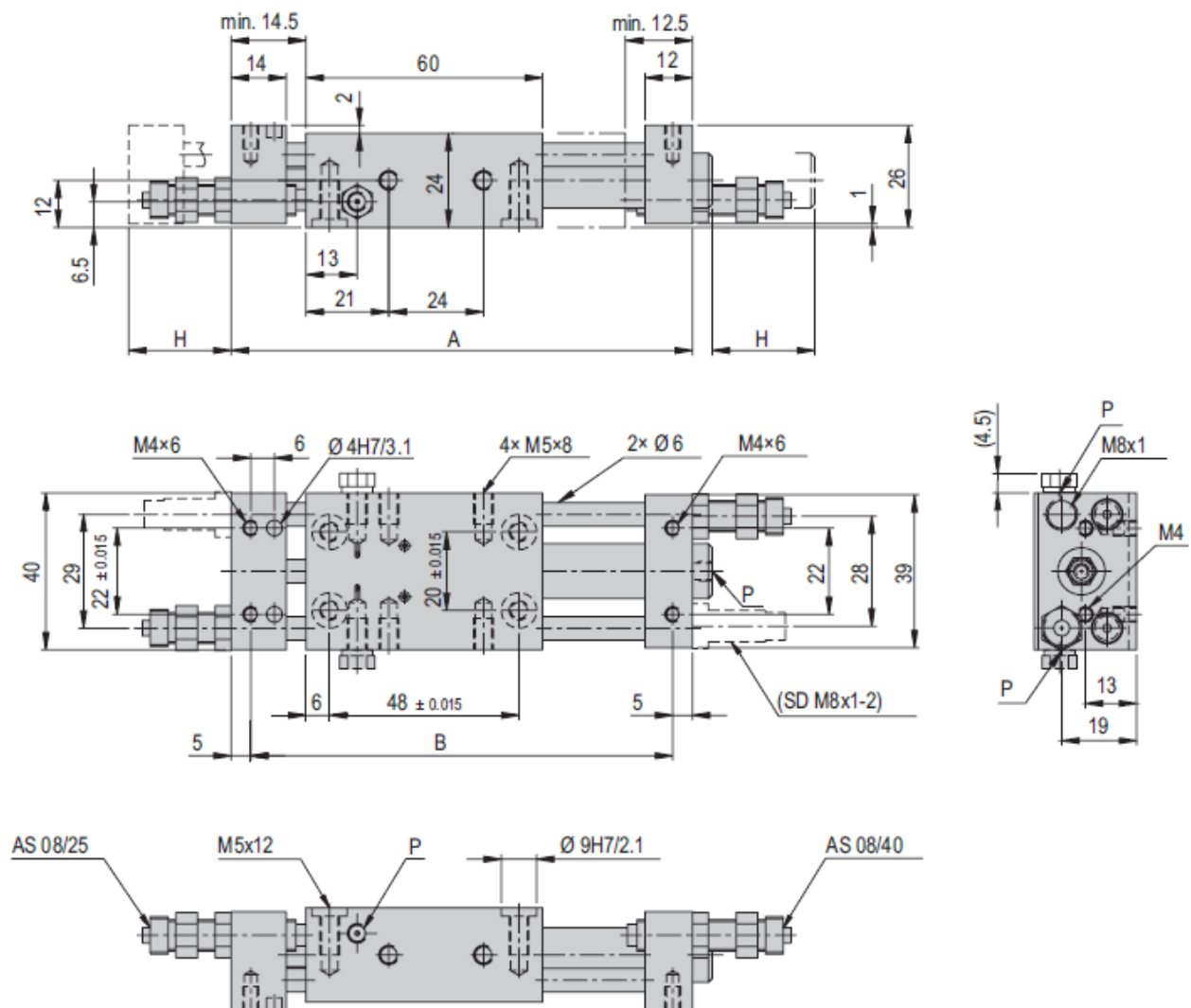


Fig. 1 Dimensional drawing LM 12

Technical data

3.1.2 Technical data LM 12

LM 12	
Attachment grid	20 x 48 mm
Attachment thread	M5
Operating pressure	6 +/- 2 bar
Air connection P	M5
Cylinder Ø	12 mm
Retract piston force	51 N
Extend piston force	68 N
Operating temperature	0 - 50 °C
Storage temperature	0 - 50 °C
Humidity	< 90 %
Medium filtered compressed air	10 - 40 µm

Type	LM 12/30	LM 12/60	LM 12/90
Order number	11010377	11010378	11010379
Stroke H	30 mm	60 mm	90 mm
Stroke limitation	*20 mm	*20 mm	*20 mm
Net weight	0.31 kg	0.34 kg	0.37 kg
Moving weight	0.13 kg	0.16 kg	0.19 kg
Air consumption/cycle	0.019 NL	0.038 NL	0.057 NL
Noise level	60 dB (A)	60 dB (A)	60 dB (A)
Repeat accuracy	+/- 0.02 mm	+/- 0.02 mm	+/- 0.02 mm
Mounting position	✦	✦	✦

The technical data refer to a nominal pressure of 6 bar under Afag standard test conditions.
The module can be operated with lubricated or dry air.
Cleanroom class ISO 14644-1, class ISO 7
*Optional 2 x 20 mm

Included in the delivery (Catalogue HT accessories)

- 2x Centering bushing Ø9x4
- 1x Stop screw AS 08/25
- 1x Stop screw AS 08/40

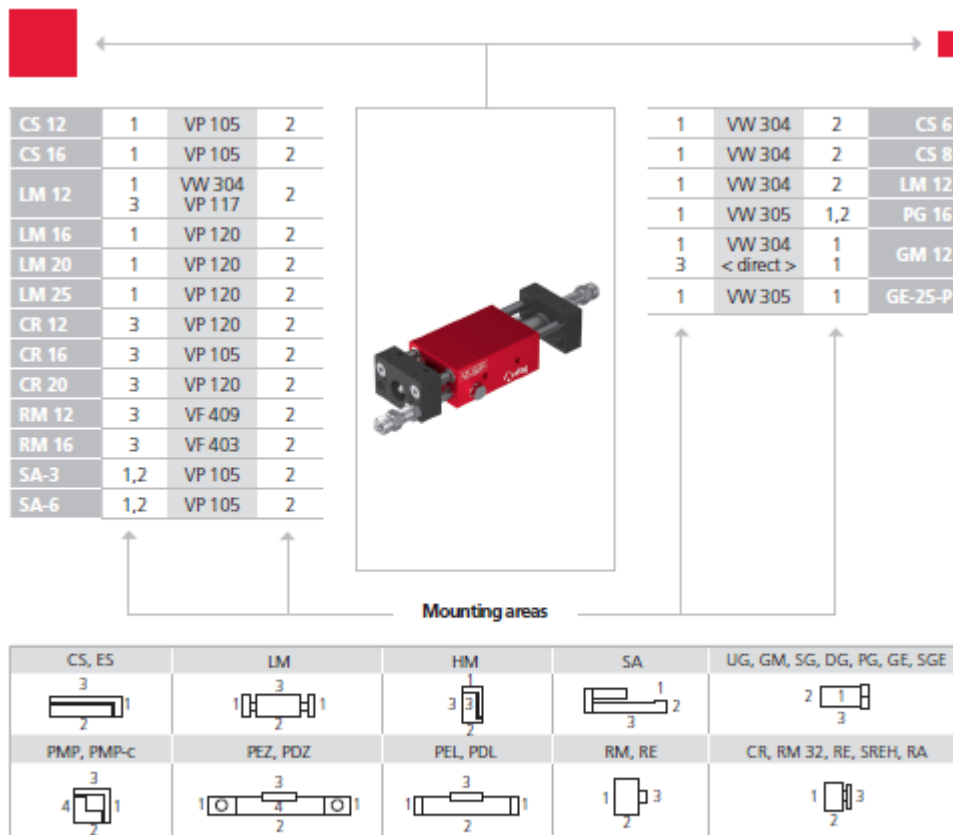
Accessories

- Base plate LM 12 [p. 105]
 - Stop L-bar LM 12/LM 16 [p. 105]
- (Catalogue HT accessories)
- Adjusting stop pin M8x1/40
 - Adjusting stop pin M8x1/25
 - Stop screw AS 08/80
 - Shock absorber SD M8x1 -2
 - INI d6.5x44-Sn1.5-PNP-NO-M8x1

Alternative accessories (Catalogue HT accessories)

- INI d6.5x35-Sn1.5-PNP-NO-M8x1

3.1.3 Preferred combinations LM 12



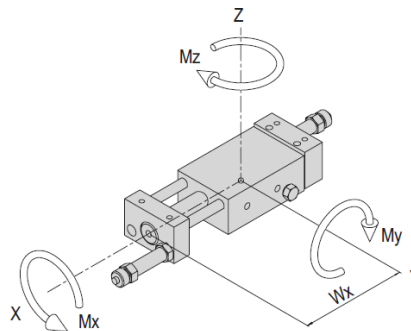
Note that there might be different mounting positions from one module to another one.

The required connection elements and the range of support columns are depicted in the catalogue HT accessories.

Technical data

3.1.4 Module loads LM 12

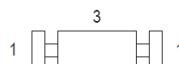
Type	LM 12/30	LM 12/60	LM 12/90
Max. static torque Mx	5.6 Nm	5.6 Nm	5.6 Nm
Max. static torque My	9.6 Nm	9.6 Nm	9.6 Nm
Max. static torque Mz	9.6 Nm	9.6 Nm	9.6 Nm
Max. dynamic torque Mx	2.5 Nm	2.5 Nm	2.5 Nm
Max. dynamic torque My	4.3 Nm	4.3 Nm	4.3 Nm
Max. dynamic torque Mz	4.3 Nm	4.3 Nm	4.3 Nm
Effective distance Wx	68 mm	68 mm	68 mm



Maximum payload/type	LM 12/30	LM 12/60	LM 12/90
Installation position (horizontal) for mounting side 1	0.5 kg	0.5 kg	0.5 kg
Installation position (horizontal) for mounting side 3	0.5 kg	0.5 kg	0.5 kg
Installation position (vertical) for mounting side 1	0.5 kg	0.5 kg	0.5 kg
Installation position (vertical) for mounting side 3	0.5 kg	0.5 kg	0.5 kg

Assembly sides
module mounting

horizontal:

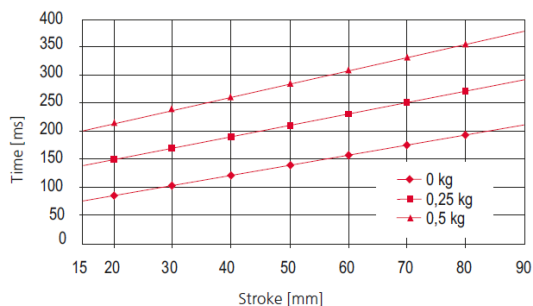


vertical:

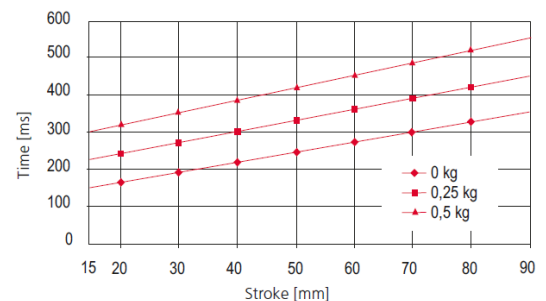


Operation time diagrams

Stroke time LM 12 with shock absorber



Stroke time LM 12 without shock absorber



3.2 Linear module LM 16

3.2.1 Dimensional drawing LM 16

Type	LM 16/30	LM 16/60	LM 16/90
A	122.5 mm	152.5 mm	182.5 mm
B	104.5 mm	134.5 mm	164.5 mm
H	30 mm	60 mm	90 mm
P	M5	M5	M5

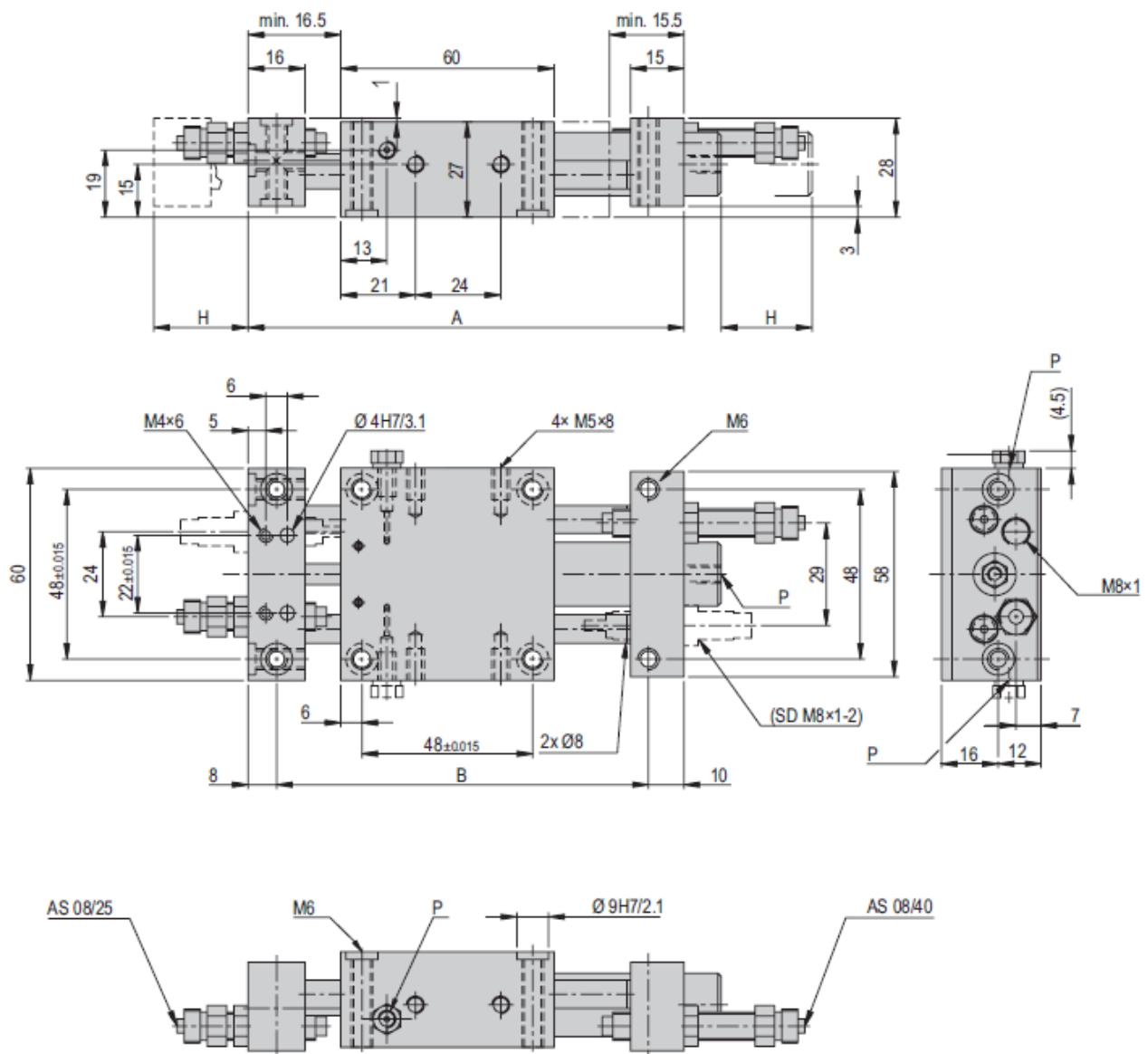


Fig. 2 Dimensional drawing LM 16

Technical data

3.2.2 Technical data LM 16

LM 16	
Attachment grid	48 x 48 mm
Attachment thread	M6
Operating pressure	6 +/- 2 bar
Air connection P	M5
Cylinder Ø	16 mm
Retract piston force	104 N
Extend piston force	121 N
Operating temperature	0 - 50 °C
Storage temperature	0 - 50 °C
Humidity	< 90 %
Medium filtered compressed air	10 - 40 µm

Type	LM 16/30	LM 16/60	LM 16/90
Order number	11001864	11001865	11001866
Stroke H	30 mm	60 mm	90 mm
Stroke limitation	*20 mm	*20 mm	*20 mm
Net weight	0.478 kg	0.515 kg	0.554 kg
Moving weight	0.138 kg	0.175 kg	0.214 kg
Air consumption/cycle	0.036 NL	0.072 NL	0.108 NL
Noise level	60 dB (A)	60 dB (A)	60 dB (A)
Repeat accuracy	+/- 0.02 mm	+/- 0.02 mm	+/- 0.02 mm
Mounting position	✦	✦	✦

The technical data refer to a nominal pressure of 6 bar under Afag standard test conditions.
The module can be operated with lubricated or dry air.
Cleanroom class ISO 14644-1, class ISO 7
*Optional 2 x 20 mm

Included in the delivery (Catalogue HT accessories)

- 2x Centering bushing Ø9x4
- 1x Stop screw AS 08/25
- 1x Stop screw AS 08/40

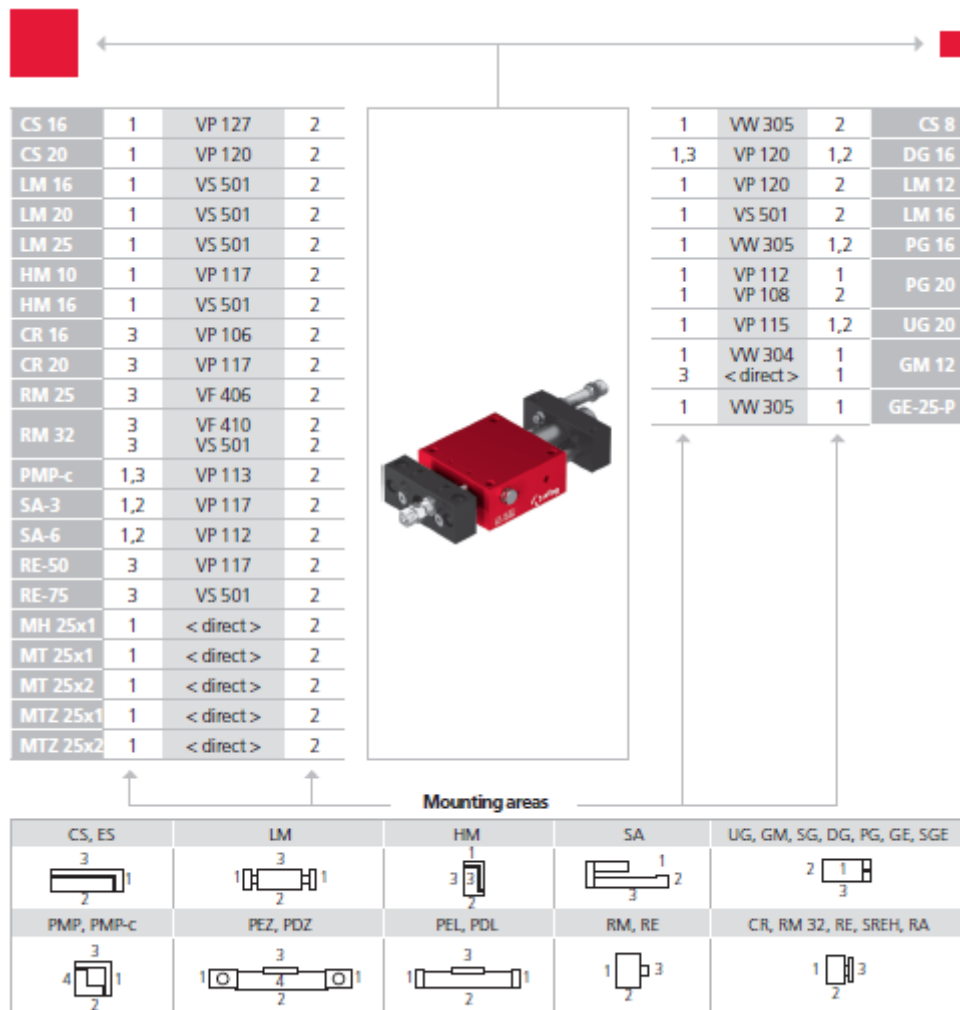
Accessories

- Base plate LM 16 [p. 105]
 - Stop L-bar LM 12/LM 16 [p. 105]
- (Catalogue HT accessories)
- Shock absorber SD M8x1 -2
 - Stop screw AS 08/80
 - INI d6.5x44-Sn1.5-PNP-NO-M8x1

Alternative accessories

- (Catalogue HT accessories)
- INI d6.5x35-Sn1.5-PNP-NO-M8x1

3.2.3 Preferred combinations LM 16

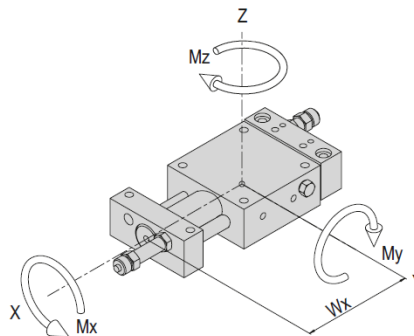


Note that there might be different mounting positions from one module to another one.

The required connection elements and the range of support columns are depicted in the catalogue HT accessories.

3.2.4 Module loads LM 16

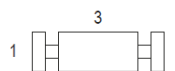
Type	LM 16/30	LM 16/60	LM 16/90
Max. static torque M_x	11 Nm	11 Nm	11 Nm
Max. static torque M_y	18 Nm	18 Nm	18 Nm
Max. static torque M_z	18 Nm	18 Nm	18 Nm
Max. dynamic torque M_x	5 Nm	5 Nm	5 Nm
Max. dynamic torque M_y	8 Nm	8 Nm	8 Nm
Max. dynamic torque M_z	8 Nm	8 Nm	8 Nm
Effective distance W_x	71 mm	71 mm	71 mm



Maximum payload/type	LM 16/30	LM 16/60	LM 16/90
Installation position (horizontal) for mounting side 1	1 kg	1 kg	0.8 kg
Installation position (horizontal) for mounting side 3	1 kg	1 kg	0.8 kg
Installation position (vertical) for mounting side 1	1 kg	1 kg	0.8 kg
Installation position (vertical) for mounting side 3	1 kg	1 kg	0.8 kg

Assembly sides
module mounting

horizontal:

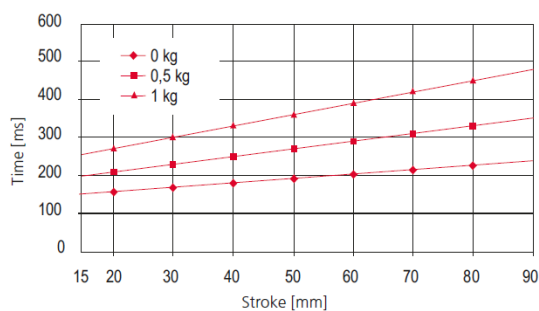


vertical:

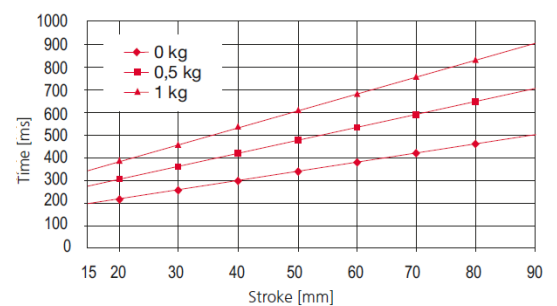


Operation time diagrams

Stroke time LM 16 with shock absorber



Stroke time LM 16 without shock absorber



4 Transport, packaging and storage

4.1 Safety instructions for transport



The linear module is a precision mechanical device and must be handled with the necessary care and cleanliness during transport and storage as well as during handling, adjustment and assembly!

CAUTION



Risk of injury when unpacking by falling out of the linear modules!

The linear modules are packed in the original cardboard box. If incorrectly handled, the modules may fall out during unpacking and injure limbs.

- Pack and unpack the linear module carefully.



LM 12

LM 16

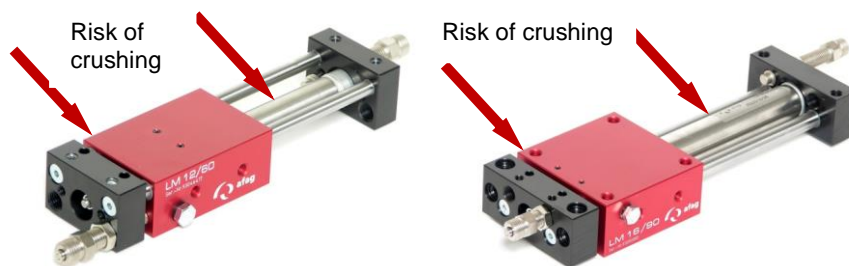



Fig. 3 Linear modules in original packaging and unpacked



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 linear module.

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

Pcs	LM 12 und LM 16
1 x	Linear module
1 x	Stop screws AS 08/25
2 x	Stop screws AS 08/40
2 x	Centering bushing Ø 9x4 mm
1 x	Assembly instructions

Variants of the linear modules:

The standard equipment includes two stop screws, one AS 08/40 (Fig. 4, 1) and one AS 08/25 (Fig. 4, 2) for end position adjustment.

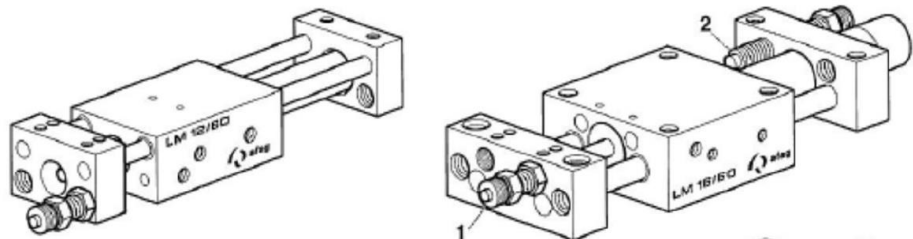


Fig. 4 Linear module (example)

The base plate can be used to create a portal module. The base plate is also used for stabilisation and can be machined by the customer.

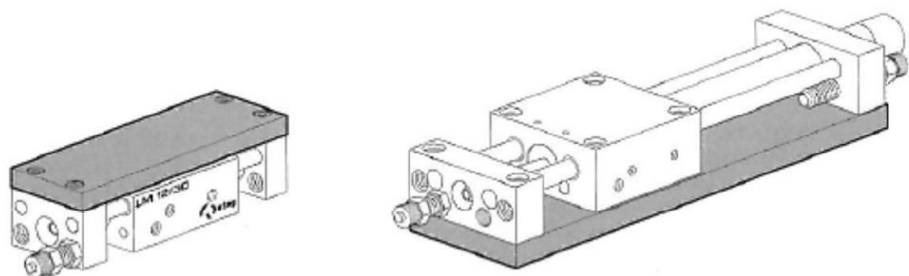


Fig. 5 Base plate LM 12 / LM 16 (example)

The stop L-bar brackets (Fig. 6, 3) enable stop screws or stop pins (Fig. 6, 4) as well as shock absorbers to be transferred to the rear of the module (only possible for LM 16).

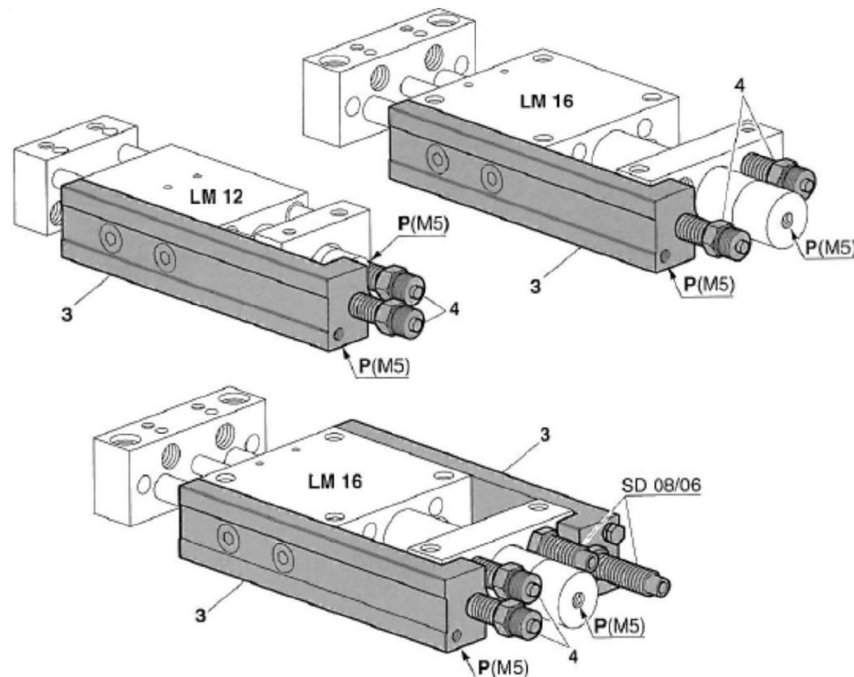


Fig. 6 Stop angle LM 12 / LM 16 (example)

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 linear modules are transported in the transport packaging of AFAG Automation AG. If no AFAG packaging used, the linear module must be packed so that they are protected against shock and dust.

NOTICE

Risk to the environment due to incorrect disposal of 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 linear modules are stored for an extended period of time, observe the following:

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

5 Structure and description

5.1 Design of linear module

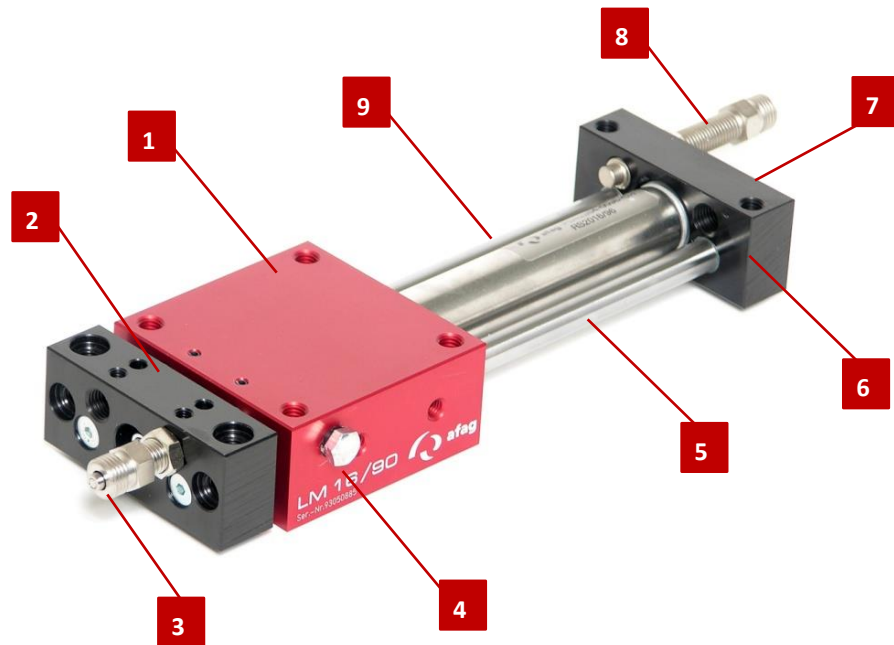


Fig. 7 Design of the linear module (example illustration)

- | | |
|----------------------|----------------------|
| 1. Housing | 6. Back plate |
| 2. Front plate | 7. Air connection M5 |
| 3. Stop screw | 8. Stop screw |
| 4. Air connection M5 | 9. Cylinder |
| 5. Guide shaft | |

The linear module consists of the main housing (Fig. 7, 1) with connections (Fig. 7, 4 & 7), a cylinder (Fig. 7, 9), the movable front plate (Fig. 7, 2) and the rear plate (Fig. 7, 6). The end positions are set with a stop screw (Fig. 7, 4).

For sensing the end positions, the stop screw can be fitted with an initiator holder and an initiator (6.5 mm) (not included in the scope of delivery ➡ Section 5.3 Accessories).

5.2 Product description

The linear modules LM 12 and LM 16 are pneumatically operated devices for longitudinal movements with a stroke of 0 - 90 mm. All modules are delivered ready for installation according to customer order.

A double-acting piston driven by compressed air generates the longitudinal movement. Two guide shafts in the housing with bearing bushes lubricated for life connect the front and rear plates.

The infinitely adjustable stop screws limit the stroke. The shock absorbers are not included in the scope of delivery in (➡ Section 5.3 Accessories).

5.3 Accessories

5.3.1 Accessories LM 12

No.	Denomination	Order number
1	Base plate	➡ Technical catalogue
2	Stop L-bar	➡ Technical catalogue
3	Angle plate	➡ Technical catalogue
4	Connection plates	➡ Technical catalogue
5	Stop pins	➡ Technical catalogue
6	Proximity switch INI d6.5x44-Sn1.5-PNP-NO-M8x1	11005439
7	Holder proximity switch 6.5 mm	11004995
8	Proximity switch INI 8x8x38.5-Sn1.5-PNP-NO-M8x1	50428013
9	Holder proximity switch 8x8 mm	11004997
10	Shock absorber SD M8x1-2	11004990

5.3.2 Accessories LM 16

No.	Denomination	Order number
1	Base plate	➡ Technical catalogue
2	Stop L-bar	➡ Technical catalogue
3	Angle plate	➡ Technical catalogue
4	Connection plates	➡ Technical catalogue
5	Stop pins	➡ Technical catalogue
6	Proximity switch INI d6.5x44-Sn1.5-PNP-NO-M8x1	11005439
7	Holder proximity switch 6.5 mm	11004995
8	Proximity switch INI 8x8x38.5-Sn1.5-PNP-NO-M8x1	50428013
9	Holder proximity switch 8x8 mm	11004997
10	Shock absorber SD M8x1-2	11004990

6 Installation, assembly & setting



The customer is responsible for the installation of the linear module into the automation system!

When installing a linear module in a system, the system operator must provide the system with a protective device with a locked door safety circuit!

6.1 Safety Instructions for installation & assembly

The linear module is an incomplete machine.

For safe operation, the linear module must be integrated into the safety concept of the automation system in which they are installed.

During normal operation it must be ensured that the user cannot interfere with the working area of the linear module.

CAUTION



Danger of injury when installing the linear module in a system!

Improperly performed work can lead to injuries and material damage.

- Installation may only be carried out by a qualified specialist!

CAUTION



Risk of injury due to unforeseeable movements!

When the controller is switched on, the linear module can execute unforeseeable movements and cause injury or damage to property.

- When connecting the compressed air for the first time, make sure that all air throttles are closed.
- Apply pressure to the pneumatic system slowly!



No liability can be assumed for damages caused by improper installation/assembling work carried out by the operator.



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

6.2 Assembly & attachment



The linear modules can be installed in **any position** with all modules of the AFAG components!

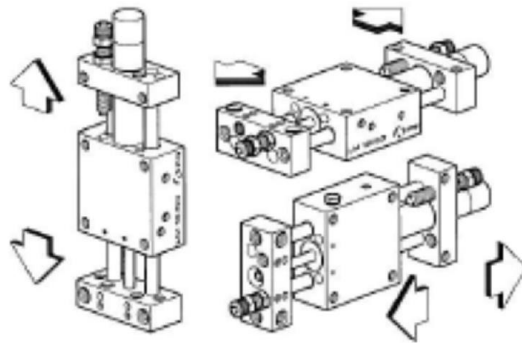


Fig. 8 Linear module – installation in different positions

6.2.1 Mounting options

The LM 12 is mounted on the base housing (M6 thread) from below. Mounting of the LM 16 can be realized from below and from above.

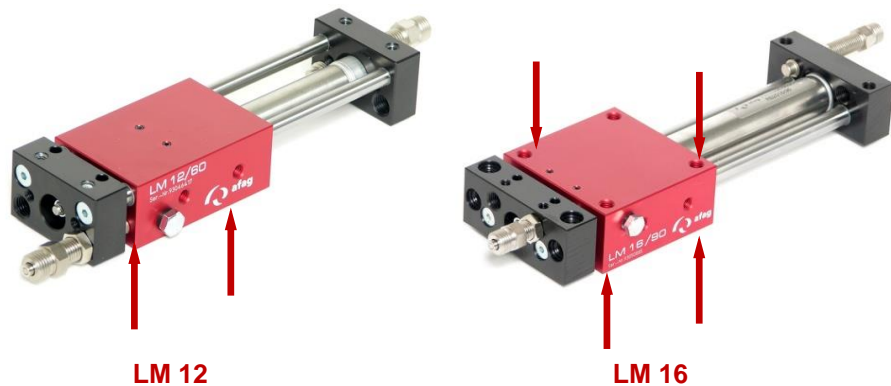


Fig. 9 Fastening options of the linear module

CAUTION



Danger of injury from sudden movements when installed in vertical position!

When installed in vertical position, sudden mass movements can occur if the carriage is not in its lowest position.

- Always move the carriage to the lowest position before mounting!



Use the centering bushings included in the scope of delivery for positioning. To do this, insert the centering bushings in two diagonally opposite holes of the mounting grid.

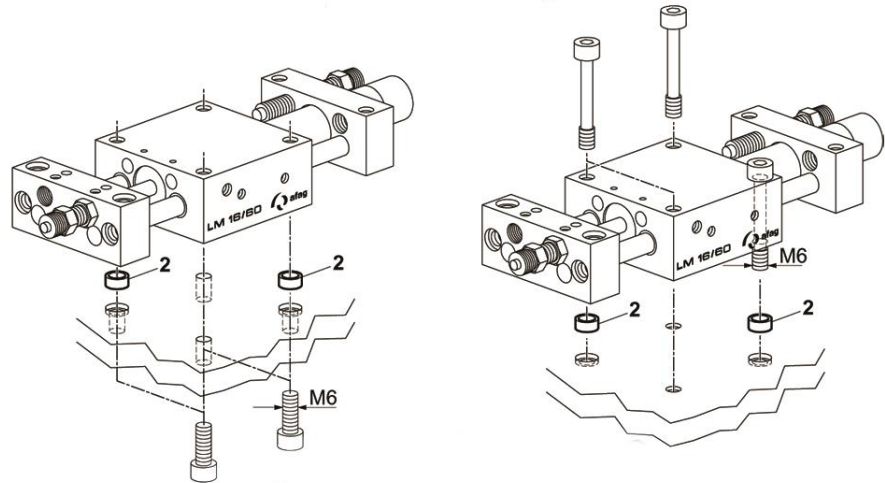


Fig. 10 Mounting base from below Mounting base from above



If the basic body is used as a slide, it is mounted on the front plates (M6 thread).

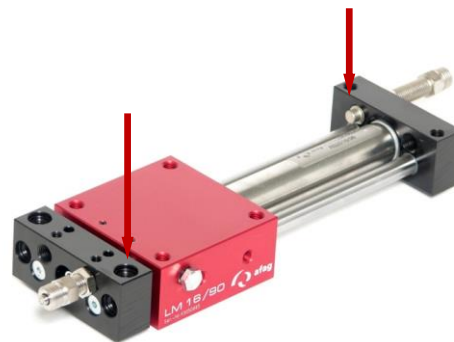


Fig. 11 Linear module - mounting on the end plates (example LM 16)

6.2.2 Tightening torques

For assembling use screws with the following minimum specifications:

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

Thread	Tightening torque
M3	1.1 ... 1.3 Nm
M4	2.5 ... 2.9 Nm
M5	4.9 ... 5.8 Nm
M6	8.5 ... 9.9 Nm

6.3 Pneumatic connections

On the basic housing of the LM module, there is one M5 pneumatic connection each on the right and left side and one M5 connection at the rear of the cylinder.



Pneumatic connections that are not used must be closed airtight with the locking screws included in the scope of supply.

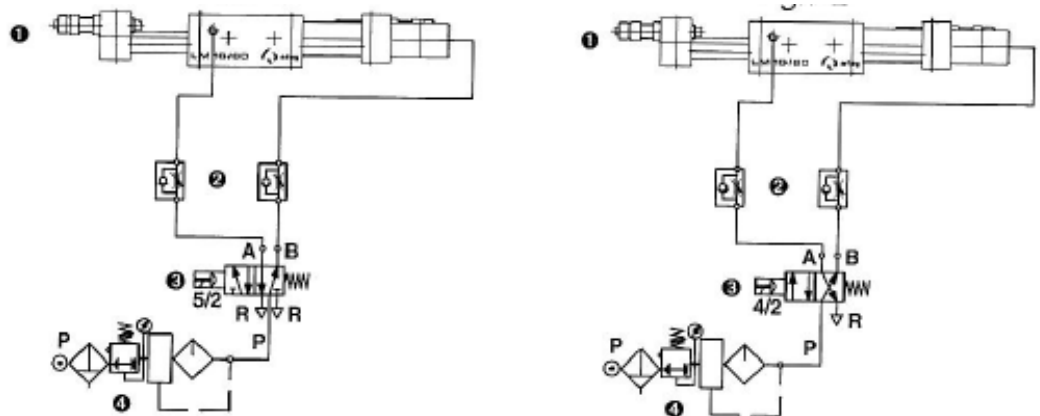


Fig. 12 Pneumatic connection of the linear module

- 1. Linear module
- 2. Throttle check valve
- 3. Way valve (standard 5/2)
- 5. Maintenance unit
- P. Air connection



Minimum compressed air quality according to ISO 8573-1:2010 (7.4.4)!

6.4 Proximity switch assembly

WARNING

Danger of explosion!

The proximity switches must not be used in a potentially explosive environment!

- Use linear modules and proximity switches **only** in a **non-hazardous area (non-explosive environment)**!



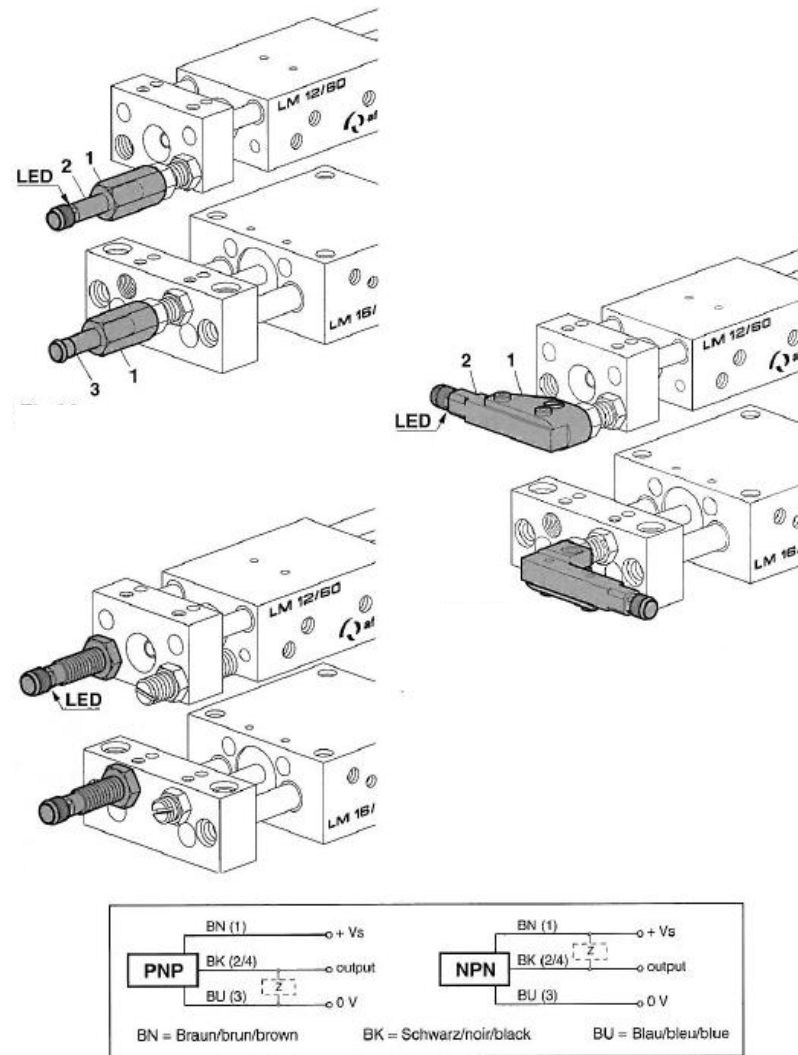


Fig. 13 Assembly of proximity switch

For end position detection of the linear module pluggable proximity switches of D 6.5 mm (Fig. 13, 1) or 8x8 mm (Fig. 13, 2) with holders (Fig. 13, 3) are used.

A LED on the proximity switch is used for function monitoring during end position detection. If the LED does not change its switching state during end position detection, the proximity switch is defective and must be replaced!

Depending on the type of control, the switching type PNP or NPN of the proximity switches must be determined.



The 6.5 mm and 8x8 mm proximity switches may only be used with the AS series stop screws!

Technical data for mounting the proximity switches:

- Operating voltage range 10-30 VDC
- Operating distance 1,5 mm
- Short circuit and reverse polarity protected

6.4.1 Mounting of the proximity switch 6.5 mm

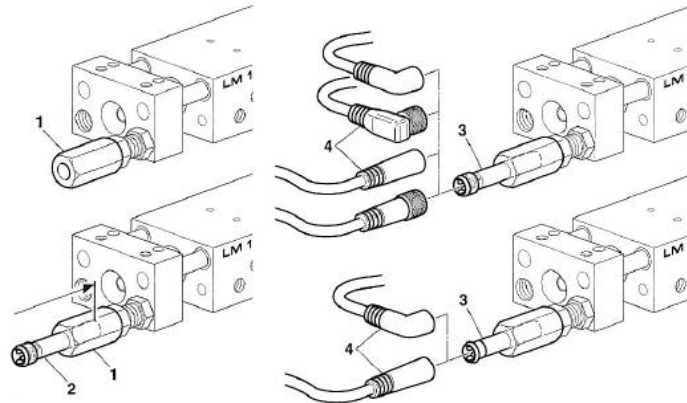


Fig. 14 Mounting of the proximity switch 6.5 mm

For mounting the 6.5 mm proximity switch proceed as follows:

1. Screw the proximity switch holder (Fig. 14, 1) on the stop screw.
2. Insert the proximity switch (Fig. 14, 2) into the holder up to the stop.
3. Tighten the proximity switch holder (Fig. 14, 1) slightly.
4. Fit the plug (Fig. 14, 4).
5. Perform a function check.

⇒ The proximity switch 6.5 mm is mounted.

6.4.2 Mounting of the proximity switch 8x8 mm

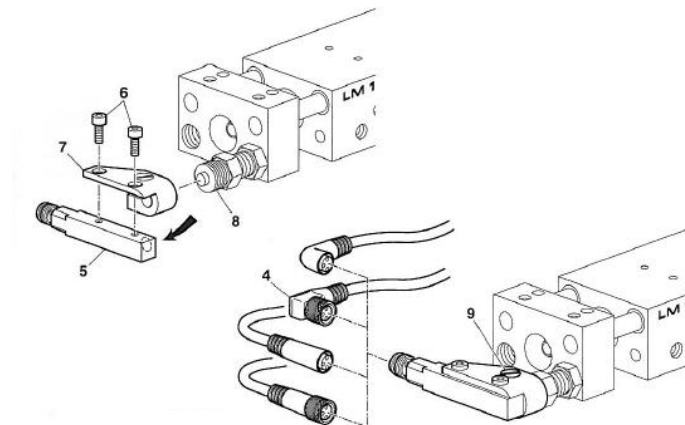


Fig. 15 Mounting of the proximity switch 8x8 mm

For mounting the 8x8 mm proximity switch proceed as follows:

1. Screw the proximity switch (Fig. 15, 5) to the holder (7) with screws (6).
2. Push the holder (7) with the proximity switch on the stop screw (Fig. 15, 8) up to the stop.
3. Tighten with screw (Fig. 15, 9).
4. Fit the plug (Fig. 15, 4).
5. Perform a function check.

⇒ The proximity switch 8x8 mm is mounted.



The switching point of the proximity switch must cover the hole of the proximity switch holder (see arrow)!

6.5 Mounting of the angle plate / connection plate

The angle plate allows the combination of two LM 12 modules.

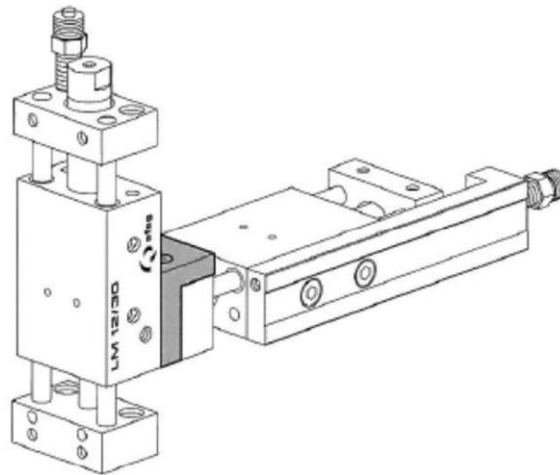


Fig. 16 Mounting of the angle plate

The connection plate allows the combination of an LM 16 with a gripper module GM 20.

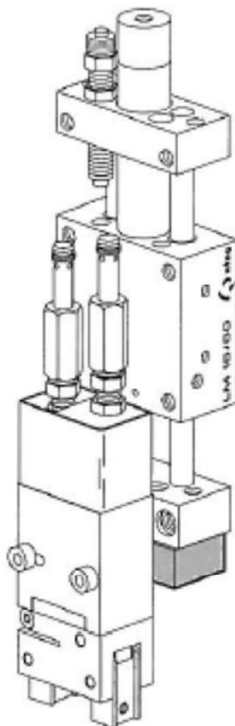


Fig. 17 Mounting of the connection plate LM 16-GM 20

7 Commissioning

After connection, the linear modules are put into operation for the first time via the control.

7.1 Safety instructions for commissioning

CAUTION



Risk of injuries due to uncontrolled parts movements!

When the control unit is switched on, signals from the control unit can lead to unintentional movements of the linear module and cause serious injuries or material damage.

- When working on the linear module, make sure that the control unit is switched off and that it cannot be switched on again unintentionally.
- Only connect or disconnect the cables when the control unit is switched off.
- Ensure that there are no persons/tools in the working area!

CAUTION



Risk of injury by reaching into the working area!

In normal operation it must be ensured that the user cannot reach into the working area of the linear modules.

- The operator must provide suitable protective measures such as enclosures, light barriers or de-energising the drive!

CAUTION



Danger due to missing safety devices!

Operating the linear module without appropriate protective devices can lead to considerable material damage and injuries.

- The user must provide protective hoods, safety doors or other appropriate safety measures for operation!
- These safety devices must comply with the usual safety guidelines and safety standards and prevent people from being in the working area of the linear module in an appropriate manner.
- The linear modules may only be put into operation with closed and functioning safety devices!



Observe the safety instructions in ➞ Chapter 2 "Safety instructions" of these mounting instructions!

7.2 Preparatory activities for commissioning



Before commissioning, adjust the shock absorber and the lifting/stop screw so that the intended stroke is correctly damped.

7.2.1 Adjusting the shock absorbers (shock absorber SD 08/06)

In order to achieve a smooth movement sequence, the lifting movement (H) is stopped in end position against the stop screws by means of shock absorbers.

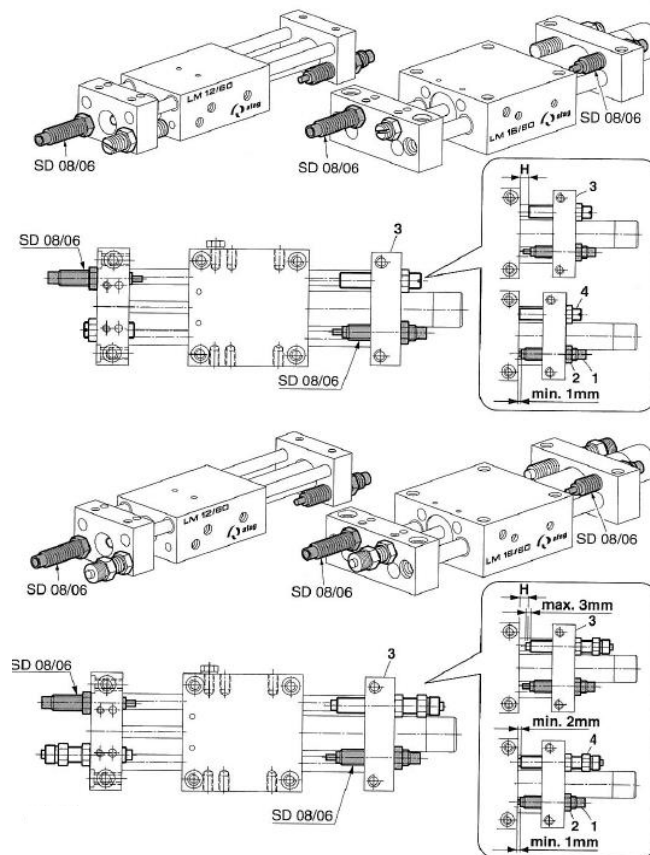


Fig. 18 Adjusting the shock absorbers

Procedure for adjusting the shock absorbers:

1. For the stop screw AS 08/25 and AS 80/40, press the stop pin (max. 3 mm) completely in (min. 2 mm).
 2. Screw in the shock absorber (Fig. 18, 1) until the pin protrudes at least 1 mm.
 3. Fasten the shock absorber with the fixing nut (Fig. 18, 2).
 - Das The maximum tightening torque of the nut must not exceed 1.7 Nm!
- ⇒ The adjustment of the shock absorbers is completed.



The stroke (H) must be limited by the stop (Fig. 18, 4) - not by the shock absorber!

If the shock absorber is used as a stop the shock absorber can be damaged and become unusable!

7.2.2 Setting of the lifting and stop screws

Stroke adjustment with stop pin (M8x1/25 and M8x1/40)

1. Adjust the stroke (H) by adjusting the stop pin (Fig. 19, 1).
 - 1 x turn = 1 mm
2. Fasten the stop pin with the lock nut (Fig. 19, 2).
 - ⇒ The stroke with stop pin is adjusted.

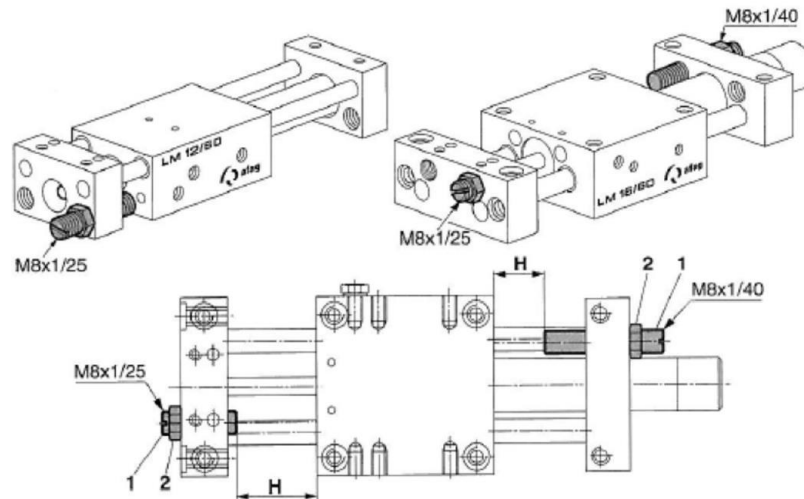


Fig. 19 Stroke adjustment with stop pin

Stroke adjustment with stop screws (AS08/25 and AS 08/40)

1. Adjust the stroke (H) by adjusting the stop screw (Fig. 20, 3).
2. Fasten the stop screw with the lock nut (Fig. 20, 4).
 - Stopping accuracy 1 - 0.01 mm.
 - ⇒ The stroke with stop screws is adjusted.

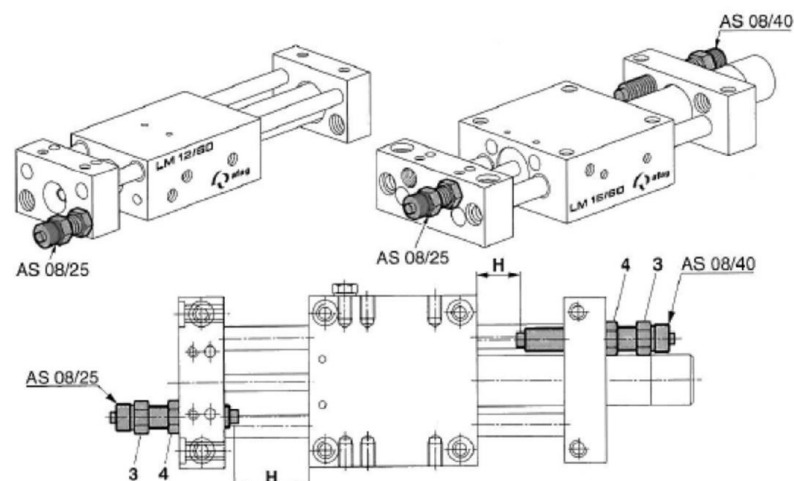


Fig. 20 Stroke adjustment with stop screws



These stop screws can be combined with a proximity switch holder and a proximity switch D 6.5 mm or with an angular proximity switch holder 8x8 mm proximity switch for end position sensing.

7.3 Commissioning of the modules

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 Technical data).
 - Load
 - Movement frequency
 - Momentary load
2. Make sure that there are no persons or tools in the working area.
3. Connect the cable to the linear module and the system control.
4. Perform test run:
 - Start with slow movements,
 - then continue under normal operating conditions,

⇒ commissioning is completed.

8 Fault elimination

8.1 Safety instructions for troubleshooting



WARNING

Danger of injury due to faulty troubleshooting!

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

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

NOTICE

Risk of material damage due to unexpected movements!

There is a risk of material damage if unusual movement of the linear module (e.g. hard shocks) is detected during normal operation.

- Stop the system immediately and eliminate the cause!



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

8.2 Fault causes and remedy

Fault	Possible cause	Remedy
Module does not retract or extend	<ul style="list-style-type: none"> ▪ No compressed air ▪ Module incorrectly connected 	<ul style="list-style-type: none"> ▪ Check connections ▪ Check connections
End position signal not available	<ul style="list-style-type: none"> ▪ Stop screw incorrectly adjusted ▪ Proximity switch defective ▪ Cable break in sensor cable 	<ul style="list-style-type: none"> ▪ Adjusting the stop screw ▪ Replace proximity switch ▪ Replace proximity switch cable
Module strikes in end positions	<ul style="list-style-type: none"> ▪ Shock absorber incorrectly adjusted ▪ Shock absorber defective ▪ No shock absorber available ▪ Exhaust air throttle defective ▪ Lifting speed too high 	<ul style="list-style-type: none"> ▪ Readjust shock absorber ▪ Replace shock absorber ▪ Retrofitting shock absorber ▪ Replace exhaust air throttle ▪ Setting the exhaust air throttle
Load swings in the end position	<ul style="list-style-type: none"> ▪ Lifting speed too high ▪ Suboptimal damping ▪ Unfavourable installation position ▪ Unfavourable LM type 	<ul style="list-style-type: none"> ▪ Setting the exhaust air throttle ▪ Optimise damper type and stroke ▪ Adaptation of the construction ▪ Use larger LM type

Note: Replace defective components only with original spare parts.

9 Maintenance and repair

9.1 General notes

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

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

CAUTION



Risk of injury due to pneumatic system!

When pneumatic systems are switched on, unpredictable movements may occur, causing injury or damage to property.

- Only carry out work on the linear module when the system is depressurized and deactivated!



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

9.3 Maintenance activities and maintenance intervals




9.3.1 Overview of the maintenance points



Observe the specified maintenance and care intervals. The intervals apply for normal conditions of use and must be shortened accordingly in case of heavy conditions.



Fig. 21 Maintenance points of linear module LM 12 and LM 16

No.	Maintenance point	Maintenance work	Interval	System [On/Off]	Remarks
1	Shock absorbers and stop screws	Checking 	Regularly	[Off]	-
			<ul style="list-style-type: none"> Check function and replace if necessary. Replace after max. 5 Mio. load changes recommended 		
2	Linear module	Cleaning 	If required	[Off]	- Pay attention to cleanliness of tape and profile surface!
			<ul style="list-style-type: none"> Clean with a lint-free, dry cloth Do not rinse off, do not use aggressive cleaning agents 		
3	Guideways and piston rods	Cleaning and lubricating 	Monthly	[Off]	Only for use in ionised air environment! Afag-standard: - Staburax NBU8EP (flat guideways) - Blasolube 301 (piston rods)

NOTICE

Material damage due to incorrectly adjusted, defective or missing shock absorbers!

Incorrectly adjusted, missing or defective shock absorbers impair the function of the linear module and can lead to its destruction!

- Always operate the linear module with shock absorbers.
- Check shock absorbers for correct setting and function!

NOTICE

Risk of corrosion due to ionized air environment

If the linear modules are used in an ionised air environment, there is a risk that exposed parts could corrode.

- Always grease exposed guides and piston rod regularly.
- Recommendation monthly lubrication (➡ 9.3.1).

9.3.2 Compressed air specifications

The linear modules are lifetime lubricated and can be operated with oil-lubricated or non oil-lubricated compressed air.

Compressed air specification

Dry (condensation-free)
Filtered (40 µm filter for oil-lubricated air)
Filtered (5 µm filter for oil-lubricated air)

If the linear modules are operated with lubricated compressed air, we recommend that you use the following types of oil:

oil type

Festo Special Oil
Avia Avilub RSL 10
BP Energol HPL 10
Esso Spinesso 10
Shell Tellus Oel C 10
Mobil DTE 21
Blaser Blasol 154

Oil quantity: 5-10 drops of oil per 1000 ltr. Compressed air

Viscosity range: 9-11 mm²/s (= cST) at 40°C, ISO class VG 10 acc. ISO 3448

NOTICE

Risk of damage to property!

The operation of the linear modules with oil-lubricated compressed air causes the factory primary lubrication to be washed out. Therefore, it is absolutely essential that the linear modules continue to be operated with oil-lubricated compressed air in order to avoid damage to the linear modules.

- Once the modules have been operated with oil-lubricated compressed air, they **may never** be operated without oil-lubricated compressed air.

9.3.3 Further maintenance

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

- Clean working area
- No use of splash water
- No abrasive or process dust and vapours
- Ambient 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.

CAUTION



Risk of injury when dismantling the linear modules!

When dismantling the linear modules from the machine, there is a danger of uncontrolled movements.

- Only remove the linear module when the control system is switched off and secured!
- Only disconnect cables when the controller is switched off!



Damaged linear module may only be repaired by AFAG AG!

Please note that AFAG cannot accept any warranty for modules that have not been repaired by AFAG.

9.4.1 Replacing of wear parts (at LM 12 and LM 16)

After expiry of the official warranty, wearing parts can also be replaced by the customer himself using the corresponding wearing parts set (➡ 9.4.1, 9.4.2 "Wear parts set").

When replacing the wear parts, all wear parts should be replaced together and properly so that the functional parts are not damaged.

Depending on the module stroke, the wear part sets are different. Make sure that the correct wear part set is ordered and used!



Other defective components are replaced exclusively by Afag AG.

The instructions for the replacement of wear parts are given without guarantee, as Afag uses special assembly aids for the replacement.

9.4.2 Replacing of wear parts - LM 12

Denomination	Supplier	Qty	Order no. LM 12/30	Order no. LM 12/60	Order no. LM 12/90
*Wear parts	Afag	1	11011232	11011233	11011231

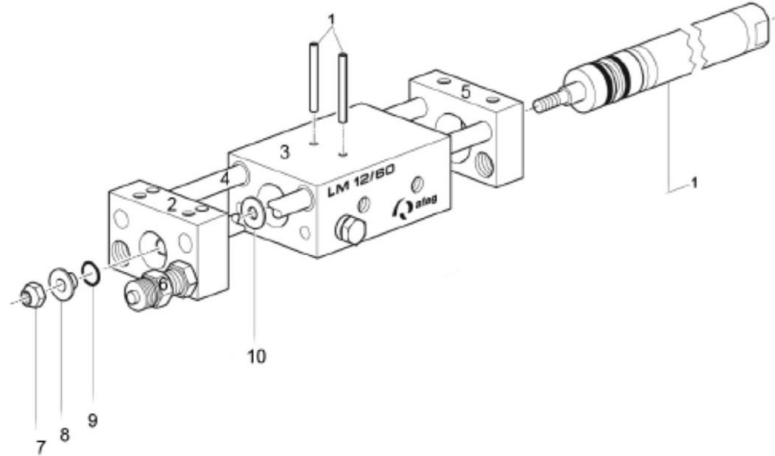


Fig. 22 Replacing wear parts - LM 12

- | | |
|--------------------|---------------|
| 1. *Wear parts set | 6. Stop screw |
| 2. Front plate | 7. Locknut |
| 3. Housing | 8. Washer |
| 4. Guide shafts | 9. O-ring |
| 5. Back plate | 10. Washer |

A) Disassembly:

1. Fasten the housing (Fig. 22, 3) in a vice and loosen the lock nut (Fig. 22, 7) - while holding the piston rod.
2. Remove the washer (Fig. 22, 8) and O-ring (Fig. 22, 9).
3. Press out the two dowel pins (Fig. 22, 1) on the hand press.
4. Remove the cylinder (Fig. 22, 1) to the rear from the housing (Fig. 22, 3).
5. Clean the housing (Fig. 22, 3).

B) Replacing wear parts:

1. Insert the new cylinder (Fig. 22, 1) into the housing (Fig. 22, 3).
2. Press 2x dowel pins (Fig. 22, 1) into the housing (3) using a hand press.
3. Insert the piston rod into the front plate (Fig. 22, 2) and put on the washer.
4. Hold the piston rod and screw the nut (Fig. 22, 7) on the piston rod.
5. Move the module by hand (no great resistance should be detectable).
6. Insert the module, connect and put into operation.
7. Carry out a final check before installing the module: The guide shafts (Fig. 22, 4) must be movable in the housing (Fig. 22, 3).
8. Carry out a leak test on the module with compressed air before installation!
 - ⇒ The wear parts have been replaced.

9.4.3 Replacing of wear parts - LM 16

Denomination	Supplier	Qty	Order no. LM 16/30	Order no. LM 16/60	Order no. LM 16/90
*Wear parts	Afag	1	11002499	11002500	11002501

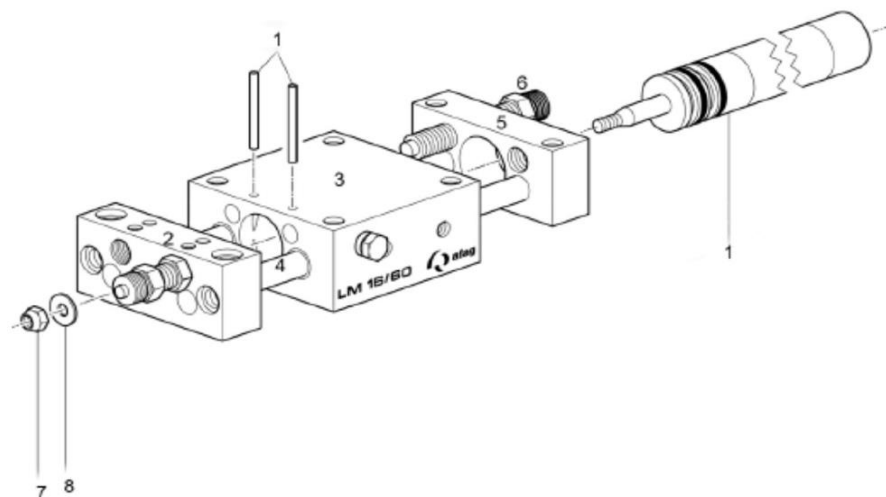


Fig. 23 Replacing wear parts - LM 16

- | | |
|---------------------|---------------|
| 1. * Wear parts set | 5. Back plate |
| 2. Front plate | 6. Stop screw |
| 3. Housing | 7. Locknut |
| 4. Guide shafts | 8. Washer |

A) Disassembly:

1. Fasten the housing (Fig. 23, 3) in a vice and loosen the lock nut (Fig. 23, 7) - while holding the piston rod.
2. Remove the washer (Fig. 23, 8).
3. Press out the two dowel pins (Fig. 23, 1) on the hand press.
4. Remove the cylinder (Fig. 23, 1) to the rear from the housing (Fig. 23, 3).
5. Clean the housing (Fig. 23, 3).

B) Replacing wear parts:

1. Insert the new cylinder (Fig. 23, 1) into the housing (Fig. 23, 3).
 2. Press 2x dowel pins (Fig. 23, 1) into the housing (3) using a hand press.
 3. Insert the piston rod into the front plate (Fig. 23, 2) and put on the washer.
 4. Hold the piston rod and screw the nut (Fig. 23, 7) on the piston rod.
 5. Move the module by hand (no great resistance should be detectable).
 6. Insert the module, connect and put into operation.
 7. Carry out a final check before installing the module: The guide shafts (Fig. 23, 4) must be movable in the housing (Fig. 23, 3).
 8. Carry out a leak test on the module with compressed air before installation!
- ⇒ The wear parts have been replaced.

10 Decommissioning, dismantling and disposal

The linear modules must be properly dismantled after use and disposed of in an environmentally friendly manner.

10.1 Safety instructions

WARNING



Risk of injury from improper decommissioning and disposal!

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

- Use only qualified personnel to carry out the activities.
- Disconnect the media supply (electrics) before removing the grippers!
- Only remove the linear module when the control system is switched off and secured!



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

10.2 Decommissioning

If the linear modules are not used for a longer period of time, they must be properly decommissioned and stored as described in ➡ Section 4.5.

10.3 Disposal

The linear modules 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 linear modules must not be disposed of as a complete unit. Dismantle the linear module and separate the various components according to type of material and dispose of 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 from incorrect disposal of the linear modules.

Environmental damage can be caused by improper disposal of the module.

- 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	Linear module LM 12, LM 16
Type:	LM 12/30, LM 12/60, LM 12/90, LM 16/30, LM 16/60, LM 16/90

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; 1.2.3; 1.3.3; 1.3.5; 1.3.6; 1.3.7; 1.3.9; 1.4.1; 1.5; 1.6; 1.6.1; 1.6.3; 1.6.4; 1.7; 1.7.4; 1.7.4.1; 1.7.4.2.

Harmonised standards applied, in particular:	
EN ISO 12100:2010	Safety of machinery - General design principles - Risk assessment and risk reduction

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, Germany

Zell, 31.05.2023

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