Assembly & Operating Instructions

Linear-Transport-Module

LTM-V-100 ■ LTM-V-180

Translation of the Original Assembly Instructions EN
■ LTM-V-100/180 ⇒ Order no.: 20190611
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-Transport-Module or other options.

We wish you every success with our products!

With kind regards

Your Afag team

© Subject to modifications

The linear transport modules from Afag Automation AG have been built 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.

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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 for a safe and efficient handling of the Linear-Transport-Module (LTM).

Consistent compliance with these assembly instructions will ensure:

- Permanent operational reliability of the linear transport module,
- optimal functioning of the linear transport module,
- timely detection and elimination of defects (thereby reducing maintenance and repair costs),
- extension of the service life of the linear transport module.

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

1.2 Explanation of symbols

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

**DANGER**

Danger!

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

---

**WARNING**

Warning!

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

---

**CAUTION**

Caution!

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

---

**NOTICE**

This safety note points out a potentially dangerous situation which, if not avoided, can cause substantial damage to property and the environment.
This note contains important additional information as well as useful tips for safe, efficient and trouble-free operation of the module.

Further warning signs:

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

<table>
<thead>
<tr>
<th>Warning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Warning" /></td>
<td>Dangerous electrical voltage.</td>
</tr>
<tr>
<td><img src="image2" alt="Warning" /></td>
<td>Risk of injury from contact with hot surfaces.</td>
</tr>
<tr>
<td><img src="image3" alt="Warning" /></td>
<td>Risk of hand and finger injury due to uncontrolled movements of components.</td>
</tr>
<tr>
<td><img src="image4" alt="Warning" /></td>
<td>Magnetic field</td>
</tr>
<tr>
<td><img src="image5" alt="Warning" /></td>
<td>Back injury due to heavy lifting.</td>
</tr>
<tr>
<td><img src="image6" alt="Warning" /></td>
<td>Risk of injury as a result of parts being flung out!</td>
</tr>
<tr>
<td><img src="image7" alt="Warning" /></td>
<td>High noise levels</td>
</tr>
</tbody>
</table>
1.3 Additional symbols

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Instructions (steps ...)</td>
</tr>
<tr>
<td>⇢</td>
<td>Results of actions</td>
</tr>
<tr>
<td>⇢</td>
<td>References to sections</td>
</tr>
<tr>
<td>■</td>
<td>Enumerations not ordered</td>
</tr>
</tbody>
</table>

1.4 Applicable documents

In addition to the assembly instructions, the following documents must be observed:

- Safety data sheets etc.
- Instructions for integrated components (supplier documentation).

Each LTM 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 LTM.

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 (e.g. shock absorbers) are excluded from the warranty.*

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

* However, a customer has a right to a defect-free product. This does also apply to defective accessories and wear parts. Normal wear and tear are excluded from the warranty.

The warranty shall expire in the following cases:

- Improper use of the linear transport modules.
- Non-observance of the instructions regarding assembly, commissioning, operation and maintenance of the linear transport modules.
- 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.
General

- Using the module without shock absorbers or with defective shock absorbers.
- 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 LTM unless described in this instruction 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 LTM and optimal protection of personnel.

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

2.2 Intended use

The linear transport modules of the LTM-V-100 and LTM-V-180 series have been specially designed for fast workpiece carrier transport and continuous operation. The linear transport modules are integrated into automation systems. The linear transport modules series LTM-100-120 and LTM-180-120 are designed for shock-free, linear transport of permanently mounted workpiece carriers in non-explosive atmospheres and in the ambient and operating conditions specifically defined for the respective linear transport module.

In the chemical industry and in potentially explosive areas, the use of LTM is not permitted without additional safety measures. In such cases, please consult with the Afag technical department.

The intended use of the module also includes:

- Observance of all instructions given in this instruction’s 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 improper use of the linear transport module.

Especially the following use is considered a misuse:

- The use for the transport of people and animals.
- Use in potentially explosive atmospheres.
- Use under conditions with increased dirt content should be avoided, as no additional protective measures or covers are available.
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 LTM 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 LTM.

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 LTM.

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 LTM,
- have read and understood these assembly instructions.

The operating company is also required to:

- Make sure that the personnel comply with the health and safety requirements and observes the assembly instructions, ensure that the assembly instructions are always kept at hand on the machine in which the LTM is 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,
- update the related safety data sheets.
2.4.3 Obligations of the personnel

All personnel working with the LTM 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 LTM,
- 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 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 LTM.

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

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:

<table>
<thead>
<tr>
<th>Qualified personnel:</th>
<th>Qualified electrician:</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operator (trained personnel):</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>
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 LTM, 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:

<table>
<thead>
<tr>
<th><strong>Protective clothing</strong></th>
<th>is a close-fitting clothing specifically designed to protect personnel from hazards during work.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protective gloves</strong></td>
<td>are specifically designed to protect the personnel against hand injuries (such as cuts, abrasion, burns).</td>
</tr>
<tr>
<td><strong>Safety shoes</strong></td>
<td>are specifically designed to protect the personnel against foot injuries from crushing, falling objects or slipping on slippery surfaces.</td>
</tr>
<tr>
<td><strong>Hearing protectors</strong></td>
<td>are required to protect the personnel against excessive noise levels to prevent noise-induced hearing loss.</td>
</tr>
</tbody>
</table>
2.7 Safety and protection equipment

Depending on the application, the LTM must be equipped by the customer with the safety and protective devices listed below.

<table>
<thead>
<tr>
<th>Safety device</th>
<th>Explanation (example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety barrier with service doors</td>
<td>When installing the LTM in an assembly system of the customer, make sure that the substructure is sufficiently stable! In addition, the customer must provide a safety barrier with service doors.</td>
</tr>
<tr>
<td>Enclosure</td>
<td>When the LTM is integrated into an assembly system, the assembly system must be provided with an enclosure, since high acceleration and deceleration values can occur when the system is running at full capacity. Persons may be injured by flying parts ejected from the LTM.</td>
</tr>
<tr>
<td>Cleaning station</td>
<td>Parts lying around on the workpiece carriers can get into the LTM and cause malfunctions or failure of the system. To avoid this, a suitable cleaning station must be provided.</td>
</tr>
</tbody>
</table>

**WARNING**

Danger of injury for the personnel!

Danger of injuries resulting from improperly mounted or inoperable safety and protective devices!

- The LTM may only be put into operation with completely mounted and fully functional safety and protective devices.
- Never remove or disable safety or protective devices!

2.8 Changes and modifications

No changes may be made to the LTM 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 LTM may not be changed or modified in any way, except with the prior written consent of Afag Automation AG.
2.9 General hazards / residual risks

Despite the safe design of the LTM 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 modules.

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.

2.9.1 General hazards at the workplace

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

- Danger to life and limb of the operator or third parties,
- on the LTM itself,
- 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 LTM.

CAUTION

Danger of excessive strain when lifting too heavy objects!

Lifting heavy parts may result in excessive strain and injury.

- When lifting loads heavier than 15 kg use two people or suitable lifting equipment.

CAUTION

Risk of noise-induced hearing loss!

The LTM generates < 70 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.
2.9.2 Danger due to high temperatures

**WARNING**

Danger of injury from hot surfaces.
During continuous operation of the LTM, the surface of the drive motor heats up (up to 100°C).
- Before touching hot surfaces without protective gloves, make sure they have cooled down to ambient temperature.

2.9.3 Danger due to electricity

**WARNING**

Danger! Risk of electric shock!
Work on the electrical system carried out unprofessionally can cause serious or fatal injuries.
- Work on the machine's electrical equipment may only be performed by skilled electrician or properly trained personnel under the supervision of a skilled electrician in accordance with all relevant electrical regulations.

2.9.4 Mechanical hazards

**CAUTION**

Risk of injury in the area of the deflection of the LTM!
Risk of crushing injuries to the fingers and hands, especially at the deflector and drive modules!
- There must be no persons or loose tools in the working area of the LTM.

2.9.5 Danger caused by omitting maintenance work

**CAUTION**

Danger of injury!
Poor or not regularly performed maintenance work may cause malfunction of the components which may result in injuries.
- The due diligence obligations of the operating company include ensuring that the personnel carrying out maintenance work is appropriately trained and qualified.
2.10 Safety signs on the LTM or the working environment

The following symbols and warning signs are attached to the LTM or the working environment depending on the machine type and working process.

Keep all warning signs (e.g. safety and danger information) on the LTM or working environment complete and legible. Replace any illegible warning signs or tags immediately.

2.10.1 Warning signs

<table>
<thead>
<tr>
<th>Warning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Warning Sign" /></td>
<td>Dangerous electrical voltage.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Warning Sign" /></td>
<td>Risk of injury from contact with hot surfaces.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Warning Sign" /></td>
<td>Risk of hand and finger injuries due to uncontrolled movements of components.</td>
</tr>
</tbody>
</table>

2.10.2 Mandatory signs

<table>
<thead>
<tr>
<th>Sign</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Mandatory Sign" /></td>
<td>Observe assembly instructions and other applicable documents!</td>
</tr>
<tr>
<td><img src="image5.png" alt="Mandatory Sign" /></td>
<td>Switch off before starting maintenance or repair work!</td>
</tr>
</tbody>
</table>
### 3 Technical data

#### 3.1 LTM-V-100-XXXX / LTM-V-180-XXXX

<table>
<thead>
<tr>
<th>LTM-V</th>
<th>LTM-V-100-XXXX</th>
<th>LTM-V-180-XXXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>up to 180 cycles/min</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>+/- 0.1 mm</td>
<td></td>
</tr>
<tr>
<td>Feed lengths</td>
<td>10, 20, 30, 40, 60, 80, 90, 120, 180, 240 mm or continuous operation</td>
<td></td>
</tr>
<tr>
<td>Feed time</td>
<td>From 0.1 sec. depending on feed length and workpiece carrier load</td>
<td></td>
</tr>
<tr>
<td>Hole pattern workpiece carrier attachment</td>
<td>Individually according to customer requirements</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>LTM-V-100-XXXX</th>
<th>LTM-V-180-XXXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working length L1 without middle module</td>
<td>720 mm</td>
<td>720 mm</td>
</tr>
<tr>
<td>Working length / middle module</td>
<td>600 mm</td>
<td>600 mm</td>
</tr>
<tr>
<td>Max. Working length</td>
<td>3720 mm</td>
<td>3720 mm</td>
</tr>
<tr>
<td>Max. number of middle modules</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Number of workpiece carrier without middle module</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Additional workpiece carrier/middle module</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Workpiece carrier length</td>
<td>120 mm</td>
<td>120 mm</td>
</tr>
<tr>
<td>Workpiece carrier width A</td>
<td>100 mm</td>
<td>180 mm</td>
</tr>
<tr>
<td>Workpiece carrier height</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>Max. usable workpiece carrier surface</td>
<td>80 x 118 mm</td>
<td>160 x 118 mm</td>
</tr>
<tr>
<td>Max. workpiece carrier nest height</td>
<td>80 mm</td>
<td>80 mm</td>
</tr>
<tr>
<td>Max. payload / workpiece carrier</td>
<td>up to 3 kg depending on total length</td>
<td></td>
</tr>
</tbody>
</table>
Technical data

Max. no. of middle modules | 0 | 1 | 2 | 3 | 4 | 5
--- | --- | --- | --- | --- | --- | ---
Workpiece carrier total | 20 | 30 | 40 | 50 | 60 | 70
Total workstations (L1) | 6 | 11 | 16 | 21 | 26 | 31
Total length L [mm] | 1180 | 1780 | 2380 | 2980 | 3580 | 4180
Usable length L1* [mm] | 720 | 1320 | 1920 | 2520 | 3120 | 3720

* Use length value to which the elongation factor 1.00135 must be applied.

Dimension of workp. carrier |
--- | --- | ---
A | 100 | 180
B | 118 | 118
C | 142 | 222
Bw | 82 | 162
H | 305 | 305
Hw | 300 | 300
### 3.2 Workpiece carrier load

<table>
<thead>
<tr>
<th>Type</th>
<th>LTM-V-100</th>
<th>LTM-V-180</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Moment Mx</td>
<td>50 Nm</td>
<td>50 Nm</td>
</tr>
<tr>
<td>Max Moment My</td>
<td>50 Nm</td>
<td>50 Nm</td>
</tr>
<tr>
<td>Max Moment Mz</td>
<td>100 Nm</td>
<td>100 Nm</td>
</tr>
<tr>
<td>Max forces Fx</td>
<td>100 N</td>
<td>100 N</td>
</tr>
<tr>
<td>Max forces Fy</td>
<td>500 N</td>
<td>500 N</td>
</tr>
<tr>
<td>Max forces Fz</td>
<td>5000 N</td>
<td>5000 N</td>
</tr>
</tbody>
</table>

![Diagram of workpiece carrier load](image-url)
4 Transport, packaging and storage

4.1 General

This chapter provides information regarding proper transport, packaging and storage of the LTM.

4.2 Safety instructions for transport

**NOTICE**

Damage due to improper transport!

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

- The LTM must only be transported by qualified personnel who have received appropriate training.

**WARNING**

There is a risk of the LTM falling during packing, unpacking and transport!

Transport activities carried out improperly can cause considerable material damage and serious injury.

- Use only suitable lifting equipment.
- Do not step under the lifted load.
- Maintain enough safety distance from suspended loads.
- Wear personal protective equipment!
- Observe load suspension points and instructions for correct handling.

**CAUTION**

Risk of injury (back damage) when unpacking and packing the LTM.

The weight of the LTM can be between 50 and 400 kg depending on the type.

- The LTM must not be lifted or carried by persons.
- Only lift the LTM with a suitable lifting device (crane, forklift).

Also observe the safety instructions in chap. 2 „Safety instructions“ in this manual.
4.3 Scope of delivery and accessories

The standard scope of delivery consists of the following components:

- Linear transport module (Fig. 1, 1)
- Drive system (Fig. 1, 2)

![Fig. 1 Accessories for linear transport module](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attachment kit</td>
</tr>
<tr>
<td>2</td>
<td>Planetary gear</td>
</tr>
<tr>
<td>3</td>
<td>Servo motor</td>
</tr>
<tr>
<td>4</td>
<td>Servo controller SE-Power</td>
</tr>
</tbody>
</table>

You will find more information on the accessories for the LTM on our website www.afag.com.

The reference sensor is already mounted on the LTM on delivery. The reference sensor scans the window in the toothed belt pulley. This is the zero position of each workpiece carrier. The reference sensor is already mounted at factory for the delivery test.
4.4 Transport

When transporting the LTM, use a suitable lifting device with sufficient lifting capacity (e.g. crane, forklift).

To lift the LTM with a crane, proceed as follows:

1. Provide lifting gear (Figs. 2, 1) and slings (Figs. 2, 2) that are suitable for carrying the load and carry out a visual inspection of the slings.
2. Pass the lifting straps (Fig. 2, 2) through the recesses provided in the side cheeks (Fig. 2, 3) and fasten them securely.
3. Move the crane hook vertically above the centre of gravity of the load.
4. Attach the listing straps to the crane hook properly.
5. Leave danger area.
6. Lift the load and transport it to the unloading point.

⇒ Transport by crane is completed.

To incorporate the LTM into an assembly system, proceed in the same way.
4.5 Packaging

The LTM is packaged in the most appropriate way.

Standardized symbols for packages

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Note</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>Top</td>
<td>The package shall be transported, handled and stored with the arrows always pointing upwards (top side of the package).</td>
</tr>
<tr>
<td><img src="image2" alt="Symbol" /></td>
<td>Fragile</td>
<td>Products marked with this symbol shall be handled with care and may never be turned upside down or tied up.</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>Protect against moisture</td>
<td>The packages shall be protected against moisture and kept dry (keep covered during storage).</td>
</tr>
<tr>
<td><img src="image4" alt="Symbol" /></td>
<td>Attachment points</td>
<td>The hosting equipment (chain, etc.) may only be attached to the points marked by this symbol.</td>
</tr>
<tr>
<td><img src="image5" alt="Symbol" /></td>
<td>Centre of gravity</td>
<td>This symbol marks the centre of gravity of the packages (pay attention to the position of the centre of gravity).</td>
</tr>
</tbody>
</table>

**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.

4.6 Storage

If the LTM are stored for an extended period of time, observe the following:

- Do not store the LTM outdoors or expose them to weather conditions.
- The storage space must be dry and dust free.
- Room temperature of the storage space: +5 °C to +35 °C.
- Relative air humidity: 30% to 60%.
- Store the LTM on a level, even and solid ground (secure against tipping).
- Clean the LTM and protect the blank metal parts against corrosion using the appropriate means.
- Cover the LTM completely and protect against dirt and dust.
5 Structure and description

This chapter provides an overview of the structure and functioning of the LTM.

5.1 Structure of the linear transport module

Fig. 3 Linear transport module (exemplary illustration)

1. Linear transport module
2. Drive module
3. Middle module
4. Deflector module
5. Workpiece carriers
6. Cover of clamping device
7. Maintenance opening
8. Attachment kit
9. Planetary gear
10. Motor
11. Recess for fastening and lifting straps
5.2 Product description

The linear transport modules are designed for quickly cycling, linear movements. The workpiece carriers are mounted on a high-precision toothed belt and move in linear motion in predefined step lengths.

The drive unit including the gear adapter (Figs. 4, 8), the gear unit (Figs. 4, 9) and the motor (Figs. 4, 10) is permanently mounted and is therefore not considered part of the moving mass of the system. Depending on the design, the linear transport modules consist of a drive module (Fig. 4, 1) with up to five middle modules (Fig. 4, 2), a deflector module (Fig. 4, 3), workpiece carriers (Fig. 4, 4) and a drive (Fig. 4, 5).

The modules (Fig. 4, 1+2+3) have high-precision plastic guides in which the workpiece carriers are laterally guided. The plastic guides are inserted into the side cheeks (Fig. 4, 1+2+3). The high-precision toothed belt is mounted (Fig. 4, 6) is mounted inside the LTM (Fig. 4, 1+2+3)

The toothed belt deflection pulleys are located on the drive and deflector modules (Fig. 4, 7). The workpiece carriers are firmly bolted to the toothed belt. The clamping device (Fig. 4, 12) is located near the deflector module (Fig. 4, 3).

Planetary gears are used for transmission. The backlash-free connection between output shaft and deflection pulley is ensured by a clamping set. The reference switch is an inductive sensor (Fig. 4, 11) that detects the zero position of the workpiece carrier during the reference run.
5.3 Fields of application

Typical areas of application for linear transport modules are listed below:
- Integration into an assembly system where high cycle rates are required
- As stand-alone machine for high output
- For use in the food industry (after consultation with Afag)

Fig. 5 Example of application linear transport module on assembly line
6 Installation, assembly & setting

This chapter contains information and safety instructions for the proper installation/assembly of the LTM and for connecting the related components to the supply units.

The mounting position of the linear transport modules is horizontal.

6.1 Safety Instructions for installation & assembly

Each LTM 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 LTM.

**NOTICE**

Damage to property due to improper installation!

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

**CAUTION**

Risk of injury when operating the LTM without safety devices!

Operation of the LTM without the required safety devices can result in personal injury.

- The LTM must be operated with the required safety devices.

**CAUTION**

Risk of injury when installing and removing the LTM!

Careless handling of the LTM may result in personal injury.

- Only qualified personnel may work with or on the modules!
- The linear transport module may only be installed and removed with a suitable lifting device.
- Use suitable assembly and transport equipment.

Also observe the safety instructions in chap. 2 „Safety instructions“ in this manual.
6.2 Views of the LTM (general view and engine/gearbox installation)

Fig. 6 General view linear transport module
1. Linear transport module
2. Drive module
3. Middle module
4. Deflector module
5. Workpiece carriers
6. Cover of clamping device
7. Maintenance opening
8. Attachment kit
9. Planetary gear
10. Motor
11. Recess for fastening and lifting straps

Fig. 7 Overview motor and gearbox installation
Assembly kit consisting of:
- Gear adapter and clamping set
- Multi-stage planetary gear unit
- Servo motor
6.3 Attachment and tightening torque

6.3.1 Attachment instructions for LTM

The standard assembly area is on the bottom of the LTM.

Fig. 8 Attachment of the LTM (exemplary illustration)
1. Side cheeks
2. Attachment screw M10

Fig. 9 Bottom view of the LTM

The through bores (ø 10.5 mm) for mounting the linear transport module are located on the bottom of the side cheeks!
6.3.2 Tightening torques for screws

For assembly use screws with the following minimum specifications:

<table>
<thead>
<tr>
<th>Value</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>VDI 2230</td>
</tr>
<tr>
<td>Strength</td>
<td>Category 8.8</td>
</tr>
<tr>
<td>Surface</td>
<td>Galvanized blue, oiled or greased</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>Tightening torques</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>2.6 – 3.3 Nm</td>
</tr>
<tr>
<td>M5</td>
<td>5.2 – 6.5 Nm</td>
</tr>
<tr>
<td>M6</td>
<td>9.0 – 11.3 Nm</td>
</tr>
<tr>
<td>M8</td>
<td>21.6 – 27.3 Nm</td>
</tr>
<tr>
<td>M10</td>
<td>43.0 – 54.0 Nm</td>
</tr>
</tbody>
</table>
6.4 Integration of the linear transport module

6.4.1 Integration of the LTM into an assembly system

The linear transport module can be integrated into the assembly system of the customer.

**NOTICE**

**Danger due to unstable substructure!**

There is a danger of injury and material damage if the LTM is mounted on an unstable substructure provided by the customer!

- The substructure for the assembly of the LTM must be sufficiently stable.
- A safety barrier with service doors must be installed by the customer.

**CAUTION**

**Danger from parts lying around on the workpiece carriers!**

Parts lying around on the workpiece carriers can get into the LTM and cause malfunctions or failure of the system.

- A suitable cleaning station must be provided by the customer!

**CAUTION**

**Danger of injury due to improper work!**

Setting work carried out can cause injuries and material damage.

- The LTM may only be integrated into the assembly system of the customer by a qualified specialist.
- Switch the control unit off before starting work and lock to prevent access by unauthorized personnel.
- Only connect or disconnect the cables when the control is switched off.
6.4.2 Integration of the LTM into an assembly system

Fig. 11 Linear transport module (exemplary illustration)

**NOTICE**

Danger due to unstable substructure!
When installing the LTM in an assembly system of the customer, make sure that the substructure is sufficiently stable!
- The customer’s applications must be designed to fit the technical possibilities of the LTM.

**CAUTION**

Risk of injury when assembling the linear transport modules!
Careless handling of the LTM can cause injuries.
- Use a suitable lifting device to mount the LTM on the assembly system.

**CAUTION**

Danger of injury due to improper work practices!
Setting work carried out can cause injuries and material damage.
- The LTM may only be integrated into the assembly system of the customer by a qualified specialist.
- Switch the control unit off before starting work and lock to prevent access by unauthorized personnel.
- Only connect or disconnect the cables when the control is switched off.

**CAUTION**

Risk of injury due to flying parts ejected from the LTM!
When operated at full capacity the LTM achieves high acceleration and deceleration values. Without an additional safety device, personnel may be injured by flying parts ejected from the LTM.
- When integrating a LTM into an assembly system, the customer must provide an appropriate enclosure or safety barrier.
6.5 Gearbox change and motor attachment

**WARNING**

Risk of injury due to electric shock!

There is a risk of injury from electrical energy when changing the gear unit or attaching the motor!

- The LTM must be disconnected from the electrical mains supply before changing the gearbox or attaching the motor.
- Afterwards, the LTM must be referenced again!

6.5.1 Dismounting of the gear / motor

To dismount the gear/motor proceed as follows:

1. Make sure that the LTM is **de-energized**!
2. Remove the connecting cable from the LTM.
3. Remove the adapter, the gearbox and the motor as a single unit.
4. Loosen the 4 screws (Fig. 12, 1) on the clamping set.
5. Turn 2 x screws into the forcing threads until the clamping set is released.
6. Turn the screws back into the clamping threads.
7. Remove the 4 screws (Fig. 12, 2).
8. Remove the gear adapter including gear and motor.

⇒ The gear/motor is disassembled
6.5.2 Assembly of the gear / motor

To dismount the gear/motor proceed as follows:

1. For size 3 only: First push the adapter sleeve (Fig. 12, 3), then the clamping set onto the gear shaft as far as it will go.
2. Push the gear shaft with the clamping set on the opposite side into the hollow shaft.
3. Fasten the gear adapter with the 4 x screws only so far that the adapter rests firmly on the mounting surface (do not tighten yet!).

<table>
<thead>
<tr>
<th>LTM-V-100</th>
<th>4 x M8</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTM-V-180</td>
<td>4 x M8</td>
</tr>
</tbody>
</table>

4. Tighten the clamping set in the following order:
   - Tighten the clamping screws crosswise with 1/3 TA (Fig. 13)
   - Tighten the clamping screws crosswise with 2/3 TA (Fig. 13)
   - Tighten the clamping screws crosswise with TA 10 Nm (Fig. 13)
   - Tighten the clamping screws clockwise with TA 10 Nm (Fig. 13)
5. Tighten the gear adapter with the 4 screws.
6. Connect the motor, encoder and the reference sensor plug.

The gear/motor is assembled

**Final steps:** Reference the LTM’s as described in chapter 7.3.

6.6 Attachment of external drives

The linear transport module can be fitted with a drive concept other than that offered by Afag Automation.

For this purpose, the following prerequisites must be met:

- The diameter of the gear drive shaft must be 40 mm. This value is based on the size of the appropriate attachment set.
- A suitable adapter for the mounting surface (see illustration below) must be manufactured.

![Gear adapter](image)

**Fig. 14**  *Mounting of external drives*

Use only external drives that are suitable for operating the LTM and meet the requirements!

### 6.7 Motor control

**Electrical interfaces for LTM-V-100 and LTM-V-180**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U</td>
<td>1</td>
<td>S1</td>
<td>1</td>
<td>5 ... 24 V DC</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
<td>2</td>
<td>S3</td>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>W</td>
<td>3</td>
<td>S4</td>
<td>4</td>
<td>Signal, PNP</td>
</tr>
<tr>
<td>3</td>
<td>GND Motor</td>
<td>4</td>
<td>S2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Brake +</td>
<td>5</td>
<td>R1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Brake -</td>
<td>6</td>
<td>R2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Thermo switches</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Thermo switches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 15*  *Electrical interfaces*

If you are using a third-party controller or an Afag SE-Power servo controller, please read the accompanying documentation.
We recommend the use of the Afag standard cables listed in the accessories list.

**The motor plugs are turned as follows:**
1. Loosen the screws (Fig. 16, 1) on the plug.
2. Turn the plug.
3. Tighten the screws (Fig. 16, 1).

**Fig. 16 Turn the motor plug**

The peak torque of the motor may be higher than the max. permissible shaft torque due to mechanical loss (approx. 10%).

If you use an external motor and the values mentioned above cannot be met, please contact our customer service!

**6.8 Setting and retrofitting**

This chapter provides information on proper setting and retrofitting of the LTM.

**NOTICE**

No liability can be assumed for damages caused by improper work carried out on the LTM on the part of the operator.
6.8.1 General safety instructions for adjustment and retrofitting work

**WARNING**

Danger of injury due to uncontrolled movements of the LTM!
Uncontrolled movements of the LTM may cause injuries or property damage.
- Make sure that there are no persons or tools in the working area of LTM.

**CAUTION**

Danger of injury from uncontrolled restarting of the system/equipment!
Unintentional restarting of the controller or the LTM can cause injuries and material damage.
- When working on the LTM, make sure that the control unit is switched off and use lockout device to make sure it cannot be switched on again.

**CAUTION**

Danger arising from work carried out improperly!
Improper setting or retrofitting work can cause injuries and material damage.
- Adjustment and conversion work may only be carried out by qualified personnel!

Also observe the safety instructions in chap. 2 „Safety instructions“ in this manual.
6.8.2 Toothed belt tension

A) Elongation of the toothed belt during the tensioning process

The toothed belt of the linear transport module is pre-tensioned at the factory. This pre-tension leads to a constant elongation of the toothed belt. The elongation factor is $= 1.00135$.

Example: Calculation of toothed belt elongation

The distance between a station for pallet holder 1 and a station for pallet holder 5 is 480 mm (i.e. $4 \times 120$ mm). Due to the elongation factor of 1.00135, however, the distance between the stations is increased by this elongation factor, i.e. the stations are further apart. In the example the actual distance is $480 \times 1.00135 = 480.648$ mm.

B) Adjust toothed belt tension

![Fig. 17 Tension screw (1) for toothed belt - sticker (2) with adjustment dimension](image)

To ensure that operation of the system remains the same as with the factory setting, the procedure for setting the toothed belt tension described below must be strictly followed!

**Tension the toothed belt:**

1. Make sure that all workpiece carriers are mounted on the toothed belt (toothed belt is pre-tensioned at the factory).
2. Search for the setting dimension on the clamping device (Fig. 17, 2).
3. Tension the toothed belt with the tensioning screw (Fig. 17, 1), observing the adjustment dimension. Perform the operation on both sides of the LTM.

⇒ The tension of the toothed belt is adjusted.
6.8.3 Changing the workpiece carrier

For the removal and installation of the workpiece carriers, please contact Afag Customer Service. You will receive instructions on how to proceed.

A) Precision of the LTM

Before delivery, all LTMs are measured using a camera system. The measured data are recorded in a measurement report. This measurement report shows the accuracy of the individual workpiece carriers.

Due to the design and the belt pitch, the toothed belts are subject to a certain inaccuracy which also affects the accuracy of the workpiece carriers. An improvement in accuracy is achieved by a correction lock which compensates for the inaccuracy. This correction lock achieves a repeat accuracy of +/- 0.05 mm in running direction. The correction locks each have a special marking and colouring.

![Correction lock with offset 0.05 - 0.11](image)

B) Example measuring protocol

The following measurement curve shows the deviation of the actual position from the nominal position in the direction of movement of the workpiece carriers. The measurement was carried out with an optical instrument pointing the crosshairs at the workpiece carriers.

Setting and measuring of the LTM was carried out with the Afag standard drive. The measuring curve shows the deviation from the target position in running direction, measured optically on the crosshairs on the workpiece carrier. When aligning the stations, it is recommended to refer to workpiece carriers whose deviation is located within the range of the 0-line.

![Example measurement report](image)

As a reference point to align the stations we recommend using the workpiece carriers that are at the zero line.
7 Commissioning

This chapter contains information on how to commission the LTM.
Commissioning of the LTM may only be carried out by qualified and authorised specialists.

7.1 Safety instructions for commissioning

**WARNING**

Danger! Risk of electric shock!
There is a risk of injury from electrical current, if work on the control unit or the control cabinet is carried out by personnel without the required qualification and authorization.

- Work on the machine's electrical equipment may only be performed by skilled electrician or properly trained personnel under the supervision of a skilled electrician in accordance with all relevant electrical regulations.

**WARNING**

Danger from unexpected movements of the LTM!
Fast or unintentional movements of the LTM can cause serious injury and material damage.

- The linear transport module with attachments and superstructures may only be commissioned in setup or jog mode.

**CAUTION**

Risk of injury in the area of the deflection of the LTM!
Risk of crushing injuries to the fingers and hands, especially at the deflector and drive modules!

- Commissioning must only be carried out in setup/jog mode.
- Ensure that there are no persons or loose tools in the danger area.
7.2 Commissioning procedure

For commissioning the LTM proceed as follows:
1. Switch off the control and use a lockout device to make sure that the control cannot be started up again.
2. Connect the encoder cable properly.
3. Connect the motor cable to the servomotor.
4. Connect the reference switch cable.
5. Switch on the control unit.
6. Check that the reference sensor is functioning correctly.
7. Perform the reference run (☞ Chapter 7.3)
8. Then, perform a test run
   - Start with slow movements
   - Then continue under normal operating conditions
     ☐ Commissioning is completed.

7.3 Reference run

A reference sensor is attached to the linear transfer module to carry out the movement to the reference position.

To return to the LTM is reference position proceed as follows:
1. Start in search direction until the signal from the sensor changes.
2. Switch the direction of rotation and move away from the sensor until the signal changes again.
3. At this position, the actual position is set to "zero" or assigned an offset.
   ☐ Return to reference position of the LTM is completed.

The reference offset value can be saved in the servo-controller or the programmable logic controller (PLC).

The servo-controller Afag SE-Power offers the possibility to save the offset value in the controller via the PLC.

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

CAUTION
Risk of injury to third parties during commissioning!

To avoid injury to third parties, the area of installation must be closed off during commissioning and marked with warning signs.
- Unauthorised personnel may not enter the closed off area.
7.4 Programming

For programming the controller, please refer to the programming instructions of the controller used in the LTM.

When using the Afag SE-Power servo-controller, please refer to the enclosed quick installation guide.

You will also find the quick installation guide on the Internet at www.afag.com.

CAUTION

Risk of injury due to flying parts ejected from the LTM!

There is a risk of injury from flying parts ejected from the LTM, if incorrect acceleration and deceleration values are entered into the PLC.

- The settings on the PLC may only be carried out by qualified and authorised specialists.

CAUTION

Danger of injury due to uncontrolled movements of the LTM!

A failure of the stroke measuring system can lead to unexpected movements of the LTM and thus to injuries.

- If the stroke measuring system fails, switch off the LTM immediately and eliminated the fault cause!

7.5 Incorrect operation of the system

Commissioning of the LTM may only be carried out by qualified and authorised specialists.

CAUTION

Risk of injury due to unintentional starting of the LTM!

Incorrect operation when setting up the system can cause the LTM to start unintentionally and injure persons working on the machine.

- The operating company or the integrator of the LTM shall ensure that the personnel integrating the LTM into an open system do not perform any operating errors and thereby start the LTM unintentionally.
8 Fault elimination

8.1 General Notes

This chapter contains general information and safety instructions for troubleshooting.

8.2 Safety instructions for troubleshooting

**WARNING**

 Danger of injury due to improper work!

Improper fault elimination can lead to serious injuries and material damage.
- The due diligence obligations of the user include ensuring that the personnel working on eliminating faults appropriately trained and qualified.

**NOTICE**

Risk of damage to the LTM due to strong oscillations!

If the workpiece carrier of the LTM oscillates very strongly after switching on the control (vibrations at the drive), the LTM can be damaged.
- Switch off the LTM immediately!

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

8.3 Measures to be taken in the event of faults

1. In the event of a malfunction that poses an immediate hazard to personnel or property, immediately switch off the LTM.
2. Determine the cause of the fault and, if necessary, inform the responsible person at the place about the fault.
3. If troubleshooting requires work on the LTM, the LTM must be switched off at the control unit and a lockout device used to make sure that it cannot be switch on again.
4. Depending on the fault type, the fault can be eliminated by an authorized machine operator or by authorized qualified personnel.
5. Do not put the LTM back into operation until the fault has been eliminated.
6. After the fault, check whether the LTM is still functional and whether there are any other hazards.
8.4 Tables fault causes and remedy

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

A) Malfunctions when returning to reference position

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Workpiece carrier oscillates (very strong vibrations at the drive)</td>
<td>• Control parameters poorly adjusted</td>
<td>• Readjust the parameters on the controller</td>
</tr>
<tr>
<td>Toothed belt moves over the workpiece carrier length and stops with an error at the servo controller (&quot;End of search distance&quot; or &quot;Timeout&quot;)</td>
<td>• Reference sensor incorrectly connected</td>
<td>• Check terminal assignment and correct if necessary</td>
</tr>
<tr>
<td>Toothed belt moves endlessly without errors on the servo controller (servo controller monitoring not active)</td>
<td>• Reference sensor disconnection</td>
<td>• Check sensor cable</td>
</tr>
<tr>
<td>Workpiece carrier does not move</td>
<td>• Reference sensor defective</td>
<td>• Replace reference sensor according to repair instructions</td>
</tr>
<tr>
<td></td>
<td>• Drive incorrectly connected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Motor disconnection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Drive defective</td>
<td></td>
</tr>
</tbody>
</table>
## B) Malfunction during operation

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece carrier oscillates (very strong vibration at the drive)</td>
<td>▪ Control parameters poorly adjusted</td>
<td>▪ Readjust the parameters on the servo controller</td>
</tr>
<tr>
<td>Standstill of the workpiece carrier after a short stroke</td>
<td>▪ Significant contouring error ▪ Encoder disconnected</td>
<td>▪ Reduce values for acceleration and speed ▪ Check whether the toothed belt is mechanically blocked ▪ Check encoder cable ▪ Check functioning of the encoder Function check according to chapter &quot;Commissioning&quot;.</td>
</tr>
<tr>
<td>Increased toothed belt noise</td>
<td>▪ Toothed belt tension not correct ▪ Normal operating noise due to material combination polyurethane-aluminium ▪ Toothed belt defective</td>
<td>▪ Check toothed belt tension and, if necessary, tighten toothed belt according to instructions ▪ Apply lubricant or silicone spray on toothed belts ▪ Replace damaged toothed belt according to instructions or have it replaced by Afag service technicians</td>
</tr>
<tr>
<td>Excessive play</td>
<td>▪ Marked play in the side guides</td>
<td>▪ Have Afag AG service technicians replace the guides</td>
</tr>
<tr>
<td>Ball bearing</td>
<td>▪ Ball bearing of drive shaft or deflection rollers defective</td>
<td>▪ Have ball bearings replaced by Afag AG service technicians</td>
</tr>
<tr>
<td>Gear</td>
<td>▪ Gearbox is defective</td>
<td>▪ Replace gearbox</td>
</tr>
</tbody>
</table>
Maintenance and repair

9 Maintenance and repair

9.1 General notes

In this chapter you will find a description of the maintenance work necessary to ensure an optimum and trouble-free operation of the LTM.

Each LTM 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 LTM.

9.2 Safety instructions for maintenance and repair

**DANGER**

Risk of serious injury due to unauthorised restart!

Danger of injury if the power supply is switched on by unauthorised personnel during maintenance of the LTM.

- Before starting any work on the LTM, switch off the power supply/control unit and use a lockout device to make sure that it cannot be switched on again.

**WARNING**

Danger of injury!

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

- The operator must exercise due care and only use trained maintenance personnel to carry out the activities.
- Always wear personal protective equipment when carrying out maintenance and repair work!

**WARNING**

Danger from fast or unintentional movements of the LTM!

Fast or unintentional movements of the LTM may cause injury or material damage.

- Maintenance work on the linear transport module with attachments and superstructures may only be carried out in set-up or jog mode.
- Make sure that there are no persons or tools in the working area of LTM.
9.3 Maintenance activities and maintenance intervals

Regular maintenance can ensure an optimum operating state of the LTM and significantly reduce system breakdowns.

Observe the specified maintenance and care intervals.

The intervals refer to a normal operating environment.

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

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

WARNING
Risk of injury by using unauthorized spare parts!

The use of unauthorized spare parts may pose a hazard to the personnel and cause material damage.

- Only use approved spare parts.
9.3.1 Overview maintenance plan

The following symbols are used in the maintenance schedule to illustrate the activities.

![Fig. 20 LTM maintenance points](image)

|-----|-----------------------------------|--------------------|-------------------------------------------------------------------------------|--------------|----------------|------------------------------------------------------------------------------------------|
| 1   | Linear transport module           | Cleaning           | • Clean the entire LTM with a dry, lint-free cloth  
**Note:** Do not spray the LTM with water, do not use aggressive cleaning agents | As required  | [Off]          |                                                                                           |
| 2   | Toothed belt                     | Check              | • Visually inspect the toothed belt for possible damage, replace if necessary  | Monthly      | [Off]          |                                                                                           |
| 3   | Plastic guides                   | Check              | • Visually inspect the plastic guides for possible damage, replace guides if necessary | Monthly      | [Off]          |                                                                                           |
| 4   | Gear                             | Check (oil loss)   | • Check gearbox for oil loss, fill up oil if necessary. **Note:** Observe the information regarding oil type and quality. | Monthly      | [Off]          |                                                                                           |
| 5   | Total LTM                        | Excessive noise    | • Check LTM for excessive noise levels, if necessary, determine cause and eliminate | Monthly      | [Off]          |                                                                                           |
| 6   | Safety signs (warning symbols)    | Check              | • Check the safety label for good legibility and possible damage, replace if necessary | Monthly      | [Off]          |                                                                                           |
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 abrasive or process dust and vapours
- Climate and temperature as specified in the technical data

9.4 Measures to be taken after maintenance work

After finishing maintenance work and before switching on the LTM proceed as follows:

1. Check, if all released screw fittings have been properly fastened again.
2. Check, if all protective devices and guards removed for maintenance work have been properly mounted again.
3. Check that the safety devices are functioning correctly.
4. Ensure that all tools and equipment used have been removed from the machine area.
5. Ensure that the machine area has been cleaned and any spilled substances have been removed.

9.5 Repair work

Afag Automation AG offers a reliable repair service. We recommend that you have any repairs carried out by Afag Ag service technicians.

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

9.6 spare and wear parts lists

This chapter contains a brief description of the spare and wear parts of the LTM and information on how to order them.

The toothed belt, workpiece carrier, correction lock and side guides are wearing parts which can be obtained from Afag.
9.6.1 Toothed belt

Description:
The toothed belt of the LTM is made of heavy-duty polyurethane elastomer with steel cord tension members.
The toothed belt ensures high rigidity, minimal elongation and minimum backlash. The toothed belt material does not produce any abrasion and is maintenance-free.
Tensioning of the toothed belt is not necessary. After a short running-in phase a constant belt tension is guaranteed.

The toothed belts are not covered by the Afag Automation AG warranty!

CAUTION

Danger of injury!
Risk of injury from improperly performed work when replacing the timing belt.
- Toothed belt replacement may only be carried out by trained Afag Automation AG personnel!

Ordering the toothed belt:

When ordering the toothed belt, please specify the LTM type for which the spare parts are intended.
Please be sure to observe the delivery times of Afag Automation AG!
9.6.2 Side guides

Description
The side guides of the LTM are made of highly resistant polyethylene (UHMW-PE). The side guides ensure high abrasion resistance.

The side guides are not covered by the Afag Automation AG warranty!

CAUTION

Danger of injury!
Risk of injury from improperly performed work when replacing the side guides.

- The side guides may only be replaced by trained Afag Automation AG personnel!

Ordering the side guides:

When ordering the side guides, please specify the LTM type for which the spare parts are intended.

Please be sure to observe the delivery times of Afag Automation AG!
10 Decommissioning, disassembly, disposal

The LTM must be properly disassembled after use and disposed of in an environmentally friendly manner.

10.1 Safety instructions for decommissioning, dismantling and disposal

**WARNING**

Risk of injury due to improper decommissioning, disassembly and disposal!

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

- The operator must exercise due care and only use specially trained and qualified personnel for this work.
- The disassembly of the electrical system must be carried out by qualified electricians.

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

10.2 Decommissioning

If the LTM is not used for a longer period of time, it must be properly decommissioned and stored as described in Chapter 4.6.

10.3 Disassembly

The LTM may only be disassembled by qualified personnel.

**CAUTION**

Risk of injury due to uncontrolled movements of the LTM!

The linear transport modules may only be removed from a system when the control is switched off and secured with a lockout device.

- Before disassembly unplug the cables of the motor!
10.4 Disposal

The LTM 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 LTM must not be disposed of as a complete unit. Dismantle the LTM 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 LTM!**

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

- 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, Fiechtenstrasse 32, CH-4950 Huttwil

that the partly completed machine:

<table>
<thead>
<tr>
<th>Product description:</th>
<th>Linear transport module</th>
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<tr>
<td>Type:</td>
<td>LTM-V-100, LTM-V-180</td>
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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; 1.1.5; 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:


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 was 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-4950 Huttwil, Germany

Place/Date: Huttwil, 01.03.2020

Siegfried Egli
Managing director
Afag Automation AG

Niklaus Röthlisberger
Product manager
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