Linear Transport Module
LTM-V-100
LTM-V-180

- Declaration of Incorporation
- Module Data
- Installation Manual
- Maintenance Instructions

Translation of the original installation manual
© Copyright by Afag Automation AG
This installation manual is valid for:

**Linear Transport Module**  
LTM

Version of this documentation: **Linear Transport Modules**  
LTM-V-100  LTM-V-180 BA vers. 1.9 en 20190903

Symbols:
Installation and commissioning only by qualified personnel in accordance with the installation manual.

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
<th>Designates a directly threatening danger. If the information is not observed, death or most severe injury (invalidity) will be the consequence.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
<th>Designates a possible dangerous situation. If the information is not observed, death or most severe injury (invalidity) will be the consequence.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
<th>Designates a potentially dangerous situation. If the information is not observed, property damage or light to moderate injury will be the consequence.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>NOTE</strong></th>
<th>Draws attention to general notes, useful tips for the operator and working recommendations, but which have no influence on the health and safety of the personnel.</th>
</tr>
</thead>
</table>

Here, the current serial number is glued in upon delivery of the machine.
Table of Contents:

1.0.0 Declaration of Incorporation (Original document) ............................................. 5
1.10 Machinery Directive: 2006/42/EC ................................................................. 5

2.0.0 Module Information ......................................................................................... 6
2.1.0 Transport and Storage (Packing and Unpacking) ............................................. 6
2.1.1 Overview of the Linear Transport Module ....................................................... 9
2.1.2 Overview for motor and gear attachment ...................................................... 10
2.1.3 Attachment Provisions for the Linear Transport Module ............................... 11
2.1.4 Tightening Torques for Screws .................................................................. 12
2.1.5 Safety Notes ............................................................................................... 12
2.1.6 Installation of the Linear Transport Module in a System ................................. 13
2.1.7 Procedure at Gear Change and Motor Attachment ........................................... 14
2.1.8 Attachment of External Drives ..................................................................... 16
2.1.9 Installation of the LTM in a Mounting System ................................................. 17
2.2.0 Information for the Installation of the LTM in a Mounting System .................. 17
2.2.1 Motor Control ............................................................................................. 18
2.2.2 Wrong Operation of the System .................................................................... 20
2.2.3 Noise Emissions ......................................................................................... 20
2.2.4 Safety Barriers at the Mounting System ....................................................... 20
2.2.5 servo Controller SE Power and Technical Data ............................................. 21

3.0.0 Installation manual .......................................................................................... 23
3.1.0 Manufacturer’s Address: .............................................................................. 23
3.1.1 General Description ..................................................................................... 24
3.1.2 Safety Notes ............................................................................................... 24
3.1.3 Scope of Delivery for the Linear Transport Modules .................................... 25
3.1.4 Warranty .................................................................................................... 26
3.1.5 Areas of Use ............................................................................................... 26
3.1.6 Description and Setup .................................................................................. 27
3.1.7 Setup ......................................................................................................... 28
3.1.8 Technical Data LTM-V-100-xxxx / LTM-V-180-xxxx .................................. 29
3.1.9 Workpiece Carrier Loads ............................................................................ 30
3.2.0 Commissioning of the Linear Transport Modules .......................................... 31
3.2.1 Reference Run ............................................................................................ 32
3.2.2 Programming ............................................................................................... 32
3.2.3 Hot Surface on the Motor .......................................................................... 33
3.2.4 Danger Zone at Deflection ........................................................................... 33
4.0.0 Maintenance Instructions........................................................................................................34
4.1.0 Maintenance and Care of the Linear Transport Modules ..................................................34
4.1.1 Further Maintenance ................................................................................................................34
4.1.2. Spare Parts, Toothed Belt ......................................................................................................35
4.1.3. Spare Parts, Lateral Guides ...................................................................................................35
4.1.4. Elongation of the Toothed Belt when Tensioning .................................................................35
4.1.5 Replacing the Workpiece Carrier: ..........................................................................................36
4.1.6 LTM accuracy: ........................................................................................................................37
4.1.7 Replacing the toothed belt: ........................................................................................................38
4.1.8 Replacing the lateral guide: ........................................................................................................38
4.1.9 Toothed Belt Tension: ..............................................................................................................39
4.2.0 Troubleshooting .........................................................................................................................40
5.0.0 Removal and Repair of the Linear Transport Modules .........................................................42
6.0.0 Linear Transport Module Setup on the Mounting Platform ..................................................43
7.0.0 Disposal....................................................................................................................................44
1.0.0 Declaration of Incorporation (Original document)

1.10 Machinery Directive: 2006/42/EC

Standard: EN ISO 12100:2010 (German version)

The manufacturer:

Afag Automation AG, Fiechtenstrasse 32, CH-4950 Huttwil, Switzerland

hereby declares that the incomplete machine:

Product name: Linear transport module.
Types: LTM-V-100 and LTM-V-180
Order: No…………………………….

Applicable EC Directives: EC Machinery Directive: 2006/42/EC

Directive: Applied and satisfied fundamental requirements:
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; 1.4; 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

The person or company installing this partly completed machinery or combining it with other machinery must carry out a risk assessment for the resulting machinery that satisfies the requirements of the EC Directive: 2006/42/EC.

Applied harmonised standards: EN ISO 12100:2010

- Safety of machinery - General principles for design - Risk assessment and risk reduction.
- In response to a duly substantiated request, these special technical documents will be submitted to the competent national authorities as printed documents or in electronic form (pdf).

Authorised representative:
Responsibility for the compilation of the technically relevant documents lies with:
Niklaus Röthlisberger, Product Manager, Afag Automation AG, CH-4950 Huttwil

Place/date: Huttwil, 03.09.2019

Siegfried Egli
Managing Director
Afag Automation AG

Niklaus Röthlisberger
Product Manager
Afag Automation AG
2.0.0 Module Information

2.1.0 Transport and Storage (Packing and Unpacking)

⚠️ CAUTION

Take care when packing and unpacking the linear transport modules! Handling the linear transport module carelessly may injure persons. The linear transport modules must be transported with suitable lifting gear.

By crane
Procedure when lifting and lowering

Pass the lifting straps through the recesses provided in the side cheeks, connect them to the hoist and then lift them.

The linear transport module must not be transported by persons. It must be transported with suitable lifting gear (crane, stacker). The linear transport module must be stored dry and dust-free.
**CAUTION**

Caution! Back injury when packing and unpacking the linear transport module. The linear transport module must not be carried by persons.

---

**NOTE**

Depending on type of the linear transport module, the weight may be between 50 and 400 kg. We recommend strapping the linear transport module with belts to the transport frame and lifting it with a lifting device. The same shall apply to installation of the linear transport module in a mounting system.

---

**NOTE**

Please note! A safety information sheet is included with each linear transport module. This information sheet must be read by every person involved with the linear transport module.
2.1.1 Overview of the Linear Transport Module

- Workpiece carrier
- Motor
- Planetary gearing
- Attachment flange
- Middle module
- Drive module
- Cover, clamping device
- Deflection module
- Maintenance opening
- Detail B
  - Recess for fastening and lifting straps
2.1.2 Overview for motor and gear attachment

Note: The drive package is designed depending on application by Afag!
2.1.3 Attachment Provisions for the Linear Transport Module

The mounting area for the linear transport module is at the bottom by default.

**LTM-V-100 / LTM-V-180**

**Side frames**

**Section through the LTM**

**Screws M10**

**View from below**

**Main attachment area:**

The main attachment options in the linear transport modules are the pre-produced \( \varnothing \) 10.5 mm holes at the bottom of the side frames!
2.1.4 Tightening Torques for Screws
Screws meeting at least the following specification must be used for installation:

| Standard: | VDI 2230 |
| Strength: | Class 8.8 |
| Surface:  | Blue galvanised, oiled or greased |

<table>
<thead>
<tr>
<th>Thread</th>
<th>Tightening torques</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3</td>
<td>1.1 … 1.4 Nm</td>
</tr>
<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>

2.1.5 Safety Notes
No modifications may be made to the linear transport module that are not described in this installation manual or have been approved in writing by Afag Automation AG. Afag Automation AG will assume no liability for any unauthorised modifications or for improper erection, installation, operation, maintenance or repair.

This is an incomplete machine

Purpose of the linear transport module in a system
The linear transport module series LTM-100-120 / LTM-180-120 provides impact-free linear transport of firmly installed workpiece carriers in non-explosive ambient and usage conditions as defined for these linear transport modules. The installation position is horizontal.

NOTE
This installation manual must be read carefully before any work on or with the linear transport module. The linear transport module may only be used for its intended purpose.
2.1.6 Installation of the Linear Transport Module in a System

The linear transport module may be integrated into the customer’s assembly facility.

**NOTE**

When installing the linear transport module into a customer’s system, the base must be stable enough. A safety barrier with service doors must be installed by the customer.

**CAUTION**

Beware of parts lying around on the workpiece carriers of the linear transport module. When parts enter the inside of the linear transport module, this may cause malfunction or failure of the system. A suitable cleaning station must be provided by the customer!
2.1.7 Procedure at Gear Change and Motor Attachment

⚠️ CAUTION

The linear transport module must be disconnected from the mains for this purpose.
→ The linear transport module then must be re-referenced!

Disassembly
1. Check that the linear transport module has been powered down!
2. Remove the connection cable from the linear transport module
3. Take away adapters, gears and motor as a package:
   3.1. Release 4x screws (1) at the clamping set.
   3.2. Turn 2 screws into the push-off threads until the clamping set comes loose.
   3.3. Turn the screws into the clamping thread again.
4. Remove 4x screws (2).
5. Remove gear adapter (3) with gear and motor

Mounting
6. Only for size 3, first push the adapter sleeve (4), and then the clamping set onto the gear shaft to the stop.
7. Push the gear shaft with the clamping set forward into the hollow shaft on the opposite side.
8. Attach the gear adapter with the 4 screws – do not tighten the screws yet! – only until the adapter is firmly supported on the attachment surface.

<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>

9. Tighten clamping set:
   - Tighten clamping screws crosswise with 1/3 TA (see Figure 1) then
   - Tighten clamping screws crosswise with 2/3 TA (see Figure 1) then
   - Tighten clamping screws crosswise with TA 17 Nm (see Figure 1) then
   - Tighten clamping screws clockwise with TA 17 (see Figure 1)
10. Tighten the gear adapter with the 4 screws.
11. Connect the motor, encoder and reference sensor plug.
12. Re-reference the LTM
Figure 1: Tighten clamping set

Specified tightening torque of the clamping screws TA 17 Nm
2.1.8 Attachment of External Drives

It is possible to attach any other than the drive concept offered by Afag to the LTM. The following prerequisites must be met for this:

- The diameter of the gear output shaft must be 32 mm. This results from the size of the matching attachment set.
- A matching adapter for the attachment surface (see illustration below) must be constructed.

Only external gears that are suitable for operation of the linear transport module and that meet the requirements must be used!
2.1.9 Installation of the LTM in a Mounting System

**CAUTION**

Take care when installing the linear transport modules! Handling the linear transport module carelessly may injure persons. The linear transport modules must be installed in the mounting system with suitable lifting gear.

By crane

**CAUTION**

Installation of the linear transport modules in a system is only permitted with the control switched off and secured. The linear transport modules must only be installed by qualified technical personnel. Connect and disconnect cables only when the control system is switched off.

2.2.0 Information for the Installation of the LTM in a Mounting System

**NOTE**

When installing the linear transport module into a customer’s mounting system, the base must be stable enough. The customer’s applications must be designed for the technical options of the linear transport module.

**CAUTION**

For operation of the linear transport module, the facility must have a protection device to avoid endangering persons in operation.
2.2.1 Motor Control

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

**NOTE**

When using the Afag servo controller SE-Power, read the corresponding documents; the same applies to use of external controllers.

Pin assignment Afag motor connection:

(View, motor side)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>2</td>
<td>W</td>
</tr>
<tr>
<td>3</td>
<td>GND motor</td>
</tr>
<tr>
<td>6</td>
<td>Brake +</td>
</tr>
<tr>
<td>4</td>
<td>Brake -</td>
</tr>
</tbody>
</table>

Pin assignment Afag encoder connection:

(View, motor side)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1</td>
</tr>
<tr>
<td>2</td>
<td>S3</td>
</tr>
<tr>
<td>3</td>
<td>S4</td>
</tr>
<tr>
<td>4</td>
<td>S2</td>
</tr>
<tr>
<td>5</td>
<td>R1</td>
</tr>
<tr>
<td>6</td>
<td>R2</td>
</tr>
<tr>
<td>7</td>
<td>Thermal switch</td>
</tr>
<tr>
<td>8</td>
<td>Thermal switch</td>
</tr>
</tbody>
</table>

Pin assignment reference:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5 ... 24 V DC</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>Signal, PNP</td>
</tr>
</tbody>
</table>
NOTE

We recommend using the Afag standard cables that are listed in the accessories.

Motor plugs can be turned!
- Release screws at the plug.
- Turn the plug
- Tighten the screws again

NOTE

The peak torque of the motor may be slightly (10%) above the max. permitted shaft torque due to loss in the mechanical system. If the above values cannot be complied with when the customer uses an external motor, coordination with the manufacturer (Afag AG) is required!
2.2.2 Wrong Operation of the System

**NOTE**

It is possible that setup work within the system will cause the linear transport module to start up due to wrong operation and injure persons working on the system.

**CAUTION**

The system constructor (integrator of the linear transport module) is responsible for ensuring persons do not perform any wrong operation when setting up the linear transport module in an open system, thus causing the linear transport module to start up uncontrolledly.

2.2.3 Noise Emissions

**NOTE**

The linear transport module itself produces <70 dB(A) in full load operation; depending on the attachments, environment and reinforcement resonance, this value may be higher and impose increased noise on the plant operator.

**CAUTION**

The plant constructor is responsible for the approved noise references to be complied with or must require operating staff to wear hearing protection.

2.2.4 Safety Barriers at the Mounting System

**NOTE**

When installing a linear transport module in a mounting system, the system must be complemented with a safety barrier, since high acceleration and deceleration values may occur in full operation. Thus, persons may be injured by parts flying away.
2.2.5 servo Controller SE Power and Technical Data

<table>
<thead>
<tr>
<th>Type</th>
<th>SE-Power 1kVA</th>
<th>SE-Power 3kVA</th>
<th>SE-Power 6kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order number</td>
<td>50036337</td>
<td>50162993</td>
<td>50183996</td>
</tr>
<tr>
<td>Net weight</td>
<td>2.1 kg</td>
<td>2.7 kg</td>
<td>3.7 kg</td>
</tr>
<tr>
<td>Dimensions W x H x D</td>
<td>54x200x200 mm</td>
<td>69x250x240 mm</td>
<td>69x250x240 mm</td>
</tr>
<tr>
<td>Nominal output current</td>
<td>5 A</td>
<td>5 A</td>
<td>10 A</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>48 - 230 VAC</td>
<td>3 x 400 VAC</td>
<td>3 x 400 VAC</td>
</tr>
<tr>
<td>Voltage supply, alternative</td>
<td>60 - 380 VDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control voltage</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Protection type</td>
<td>IP 20</td>
<td>IP 20</td>
<td>IP 20</td>
</tr>
<tr>
<td>Intermediate circuit voltage</td>
<td>320 VDC</td>
<td>560 VDC</td>
<td>560 VDC</td>
</tr>
<tr>
<td>Output power</td>
<td>1 kVA</td>
<td>3 kVA</td>
<td>5 kVA</td>
</tr>
<tr>
<td>Programming interface</td>
<td>USB/RS 232</td>
<td>USB/RS 232</td>
<td>USB/RS 232</td>
</tr>
<tr>
<td>Standard interfaces for higher-level control</td>
<td>CANopen DSP 402</td>
<td>CANopen DSP 402</td>
<td>CANopen DSP 402</td>
</tr>
<tr>
<td>Number of position data records via Onboard I/Os</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Number of position data records with option I/O interface</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Analog</td>
<td>+/- 10 V</td>
<td>+/- 10 V</td>
<td>+/- 10 V</td>
</tr>
</tbody>
</table>

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

3.1.0 Manufacturer's Address:

Afag Automation AG
Fiechtenstrasse 32
CH-4950 Huttwil

Sales Handling:
Phone 0041 (0)62 959 87 02
www.afag.com

This installation manual is valid for:

<table>
<thead>
<tr>
<th>Product names:</th>
<th>LTM Linear Transport Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types:</td>
<td>LTM-V-100</td>
</tr>
<tr>
<td></td>
<td>LTM-V-180</td>
</tr>
</tbody>
</table>

This is an incomplete machine

The incomplete machine must only be put into operation when it has been found that the machine into which the incomplete machine is to be installed corresponds to the provisions of the machinery directive 2006/42/EC.

The authorised person for the compilation of the technically relevant documents is:
Niklaus Röthlisberger, PM & Marketing Services, Afag Automation AG, CH-4950 Huttwil
3.1.1 General Description

**This is an incomplete machine**

The linear transport module series LTM-V-100 / LTM-V-180 provides impact-free linear transport of firmly installed workpiece carriers in *non-explosive* ambient and usage conditions as defined for these linear transport modules.

**The installation position of the linear transport modules is horizontal.**

3.1.2 Safety Notes

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
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<tbody>
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No modifications may be made to the linear transport modules that are not described in this installation manual or have been approved in writing by Afag Automation AG. Afag Automation AG will assume no liability for any unauthorised modifications or for improper erection, installation, operation, maintenance or repair.

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>When installing a linear transport module in a mounting system, the system must be complemented with an enclosure, since high acceleration and deceleration values may occur in full operation. Thus, persons may be injured by parts flying away.</td>
</tr>
</tbody>
</table>
3.1.3 Scope of Delivery for the Linear Transport Modules

The scope of delivery consists of the linear transport module with or without drive system and an installation manual.

Accessories of the linear transport modules

The accessories of the linear transport modules can be found online at: www.afag.com

These are:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multi-stage planetary gear</td>
</tr>
<tr>
<td>2</td>
<td>Servo motor</td>
</tr>
</tbody>
</table>
3.1.4 Warranty

The term of the warranty on Afag handling components and systems is:

- 24 months following commissioning, but a maximum of 27 months following delivery.
- Wear parts are not covered by the warranty. *

The warranty covers the replacement or repair of defective Afag parts. No further claims will be accepted.

The warranty will be voided in event of the following:

- Use for other than the intended purpose
- Failure to observe the notes on installation, commissioning, operation and maintenance in the operating manual
- Improper installation, commissioning, operation and maintenance
- Independent repairs and constructional changes without prior instruction by Afag Automation AG
- Removal of the serial number on the product
- Inadequate monitoring of wear parts

*A customer has the right to a defect-free product. This is also applicable for accessories and wear parts, if they are defective. However, wear does not fall within the scope of the warranty.

3.1.5 Areas of Use

The linear transport modules of series LTM-V-100 and LTM-V-180 have been designed specifically for quick workpiece carrier transport or continuous operation. Use under conditions with increased dirt occurrence should be avoided, since no further protection measures or covers are available.

Typical areas of use include, among others:

- Integration into a mounting system where high cycle rates are required
- As a stand-alone machine for high output
- Use in the food industry is possible. Please coordinate with Afag

**NOTE**

Other use cases, specifically transport of persons and animals, are not permitted. In chemistry and in the Ex area, use of the LTM is not permitted without additional measures. Please coordinate with our technical department in such cases.
3.1.6 Description and Setup

The linear transport modules are designed for quickly cycling, linear movements, i.e. workpiece carriers that move linearly in pre-defined step lengths are placed on a highly precise toothed belt.

The drive unit with gear adapter (8), gear (9) and motor (10) is firmly installed and thus not part of the moving mass of the system.

The linear transport modules consist of a drive module (1), one or up to five middle modules (2) (depending on design), a deflection module (3), workpiece carriers (4), and drive packages (5).

The modules (1,2,3) have highly precise plastic guides that guide the workpiece carriers along the side. The plastic guides are inserted into the side frames of the modules (1,2,3). Inside the modules (1,2,3), there is the high-precision toothed belt (6). The drive and deflection modules are attached to the toothed belt deflection pulleys (7). The workpiece carriers are firmly screwed to the toothed belts. The clamping device (12) is located on the deflection module (3).

Planetary gears are attached. The play-free connection between the output shaft and deflection pulley is ensured by a clamping set. The reference switch is an inductive sensor (11) and recognises the zero position of the workpiece carrier at the reference run.
3.1.7 Setup

The reference sensor is installed on the linear transport module at delivery.

The sensor queries the window in the toothed belt pulley. This is the respective zero position of the WC. For the delivery test, the reference sensor is installed on site (see figure).
3.1.8 Technical Data LTM-V-100-xxxx / LTM-V-180-xxxx

LTM-V

The LTM is a quickly cycling linear transport module that permits high machine outputs depending on the design of the Pick and Place stations.
The LTM-V offers highest accuracy, high speed, uniform movement, high resilience, flexible step length and module widths, and different standard lengths.
The time for workpiece carrier transport is reduced to a minimum. This means more process time is available for the actual application. The empty workpiece carriers run space-savingly back on the bottom of the linear transport module. The LTM can be equipped with 6 – 31 workpiece carriers depending on the working length; the graduation is 5 workpiece carriers per middle module.

<table>
<thead>
<tr>
<th>Speed</th>
<th>up to 180 cycles/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat accuracy</td>
<td>+/- 0.1 mm</td>
</tr>
<tr>
<td>Infeed lengths</td>
<td>10, 20, 30, 40, 60, 80, 90, 120, 180, 240 mm or continuous operation</td>
</tr>
<tr>
<td>Infeed time</td>
<td>0.1-0.5 seconds, depending on infeed length and WC payload</td>
</tr>
<tr>
<td>Drilling pattern for WC attachment</td>
<td>individually according to customer requirement</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 WC without middle module</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Additional WC/middle module</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>WC length</td>
<td>120 mm</td>
<td>120 mm</td>
</tr>
<tr>
<td>WC width A</td>
<td>100 mm</td>
<td>180 mm</td>
</tr>
<tr>
<td>WC height</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>Max usable WC area</td>
<td>80 x 118 mm</td>
<td>160 x 118 mm</td>
</tr>
<tr>
<td>Max WC cavity height</td>
<td>80 mm</td>
<td>80 mm</td>
</tr>
<tr>
<td>Max payload WC</td>
<td>3 kg</td>
<td>3 kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length graduation</th>
<th>Number of middle modules</th>
<th>L1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic configuration (drive module + deflection module)</td>
<td>0</td>
<td>720 mm</td>
</tr>
<tr>
<td>Basic configuration + 1 middle module</td>
<td>1</td>
<td>1320 mm</td>
</tr>
<tr>
<td>Basic configuration + 2 middle modules</td>
<td>2</td>
<td>1920 mm</td>
</tr>
<tr>
<td>Basic configuration + 3 middle modules</td>
<td>3</td>
<td>2520 mm</td>
</tr>
<tr>
<td>Basic configuration + 4 middle modules</td>
<td>4</td>
<td>3120 mm</td>
</tr>
<tr>
<td>Basic configuration + 5 middle modules</td>
<td>5</td>
<td>3720 mm</td>
</tr>
</tbody>
</table>
3.1.9 Workpiece Carrier Loads

<table>
<thead>
<tr>
<th>Typ</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. Kräfte Fx</td>
<td>100 N</td>
<td>100 N</td>
</tr>
<tr>
<td>Max. Kräfte Fy</td>
<td>500 N</td>
<td>500 N</td>
</tr>
<tr>
<td>Max. Kräfte Fz</td>
<td>5000 N</td>
<td>5000 N</td>
</tr>
</tbody>
</table>

*Note: The diagram shows the forces Fx, Fy, Fz, Mx, My, Mz acting on the workpiece carrier.*
3.2.0 Commissioning of the Linear Transport Modules

**WARNING**

Commissioning of the linear transport modules with attachments and superstructures should take place in setup or step operation. Wrong programming may trigger uncontrolled movement of the linear transport modules. Quick or unintended movements of the modules may cause injury or property damage. Ensure that no persons or loose tools are present in the working area of the linear transport modules.

**Process:**

- Switch off the control and check that it is secured.
- Connect the encoder cable
- Connect the motor cable
- Connect the reference switch cable
- Switch on the control and check proper function of the reference sensor
- Perform a reference run
- Perform a test run
  - Start with slow movement,
  - then use operating conditions

**Electrical shock**

**CAUTION**

Unauthorised persons must not perform any work at the control and in the control cabinet.

**Persons may suffer electrical shock.**
3.2.1 Reference Run

For referencing the linear transfer module, the linear transfer module has a reference sensor.

The referencing run is to be set as follows:

Start in the search direction until the signal switches from the sensor; then switch the rotating direction and move off the sensor until the signal changes again.

From this position onwards, the actual position is set to "Zero" or occupied with an offset.

The reference offset can be put down either on the servo controller or the PLC. The servo controller Afag SE-Power also offers the option for the offset to be written into the controller by the PLC.

3.2.2 Programming

**WARNING**

Commissioning of the linear transport modules with attachments and superstructures should take place in setup or step operation. Wrong programming may trigger uncontrolled movement of the linear transport modules. Quick or unintended movements of the modules may cause injury or property damage. Ensure that no persons or loose tools are present in the working area of the linear transport modules.

Programming takes place differently depending on the control used. Observe the respective manuals of the control providers.

When using the servo controller Afag SE-Power, use the short installation instructions that are enclosed with the servo controller.

These short installation instructions can be found at [www.afag.com](http://www.afag.com)

**NOTE**

When the corner data is incorrectly entered at the PLC, the linear transport module may move with the wrong acceleration and deceleration values. Thus, persons may be injured by parts flying away. The linear transport module may perform unexpected movements when the path measuring system fails. This may injure persons.
3.2.3 Hot Surface on the Motor

**WARNING**

During permanent operation of the linear transport modules, the surface of the drive motor heats up (up to 100°)! Caution is required here, so that the system operator will not suffer burns. Cautionary measure: (Wear safety gloves)!

3.2.4 Danger Zone at Deflection

**WARNING**

Commissioning of the linear transport modules with attachments and superstructures should take place in setup or step operation. Wrong programming may trigger uncontrolled movement of the linear transport modules. Quick or unintended movements of the modules may cause severe injury to fingers. Ensure that no persons or loose tools are present in the working area of the linear transport modules.

Great danger of injury at deflection and drive modules
4.0.0 Maintenance Instructions

The shock absorbers and stop screws must undergo regular functionality checks, and be replaced if required. We recommend replacing the shock absorber after a maximum of 5 million load cycles. If shock absorbers are missing, defective or incorrectly set up, the functionality of the module will be compromised and may lead to its destruction!

4.1.0 Maintenance and Care of the Linear Transport Modules

⚠️ WARNING

Commissioning of the linear transport modules with attachments and superstructures should take place in setup or step operation. Wrong programming may trigger uncontrolled movement of the linear transport modules. Quick or unintended movements of the modules may cause injury or property damage. Ensure that no persons or loose tools are present in the working area of the linear transport modules.

<table>
<thead>
<tr>
<th>Maintenance interval</th>
<th>Maintenance work</th>
</tr>
</thead>
<tbody>
<tr>
<td>On demand</td>
<td>Cleaning the linear transport module with a dry, link-free cloth. The linear transport module must not be splashed and no aggressive cleaning agents must be used for cleaning.</td>
</tr>
</tbody>
</table>

4.1.1 Further Maintenance

Further maintenance is not necessary under the following ambient conditions:
- Clean workshop atmosphere
- No splashing water
- No abrasion or process dust or steam
4.1.2. Spare Parts, Toothed Belt

The toothed belt of the linear transport module consists of highly resistant polyurethane elastomer with steel-cord tension carriers. This toothed belt ensures high stiffness, very low elongation and freeness from play. Furthermore, this toothed belt material does not produce any abrasion and is maintenance-free. Retensioning is not necessary. After a brief run-in phase, consistent belt tension is ensured.

The toothed belts are not subject to guarantee!

The toothed belts, the workpiece carrier incl. lock are deemed to be wear parts!

4.1.3. Spare Parts, Lateral Guides

The lateral guides of the linear transport module consist of highly resistant polyurethane elastomer (UHMW-PE). These lateral guides ensure high abrasion resilience.

The lateral guides are not subject to guarantee!

The lateral guides are deemed to be wear parts!

4.1.4. Elongation of the Toothed Belt when Tensioning

The toothed belt of the linear transport module is pre-tensioned. This pre-tension causes lengthening of the toothed belt. However, this elongation remains consistent.

The elongation factor is $= 1.00135$

Example: When one station is set up at workpiece carrier 1 and a second one at workpiece carrier 5, the stations are 480 mm apart by calculation (4x 120 mm). Due to the lengthening factor, the stations are actually farther apart by the factor $1.00135$, i.e. $480 \times 1.00135 = 480.648$ mm.

Spare Parts, Toothed Belt:

Inform Afag Automation AG of the LTM type for orders. The belts are then configured to this LTM type by Afag. Please observe the delivery periods!

Spare lateral guides:

Inform Afag Automation AG of the LTM type for orders. The lateral guides are then produced to this LTM type by Afag. Please observe the delivery periods!
4.1.5 Replacing the Workpiece Carrier:

**CAUTION**
Check that the control is off and secured!
Ensure when working on the linear transport module that the control is off and secured against reactivation.

**Process:**

1. **Check that the control is off and secured!**
2. Remove the lid at the maintenance opening (1) of the deflection module (2).
3. Remove the workpiece carrier (3) by loosening the screws (4) of the toothed belt lock (5).
4. Lift the lock (5) from the workpiece carrier (3). Attention! Do not lose the setting sleeves (6).
5. Now manually remove the workpiece carrier.
6. Manually cycle on the toothed belt (7) until the next WC can be removed again.
7. The workpiece carriers are installed in the reverse order.
4.1.6 LTM accuracy:

All LTMs are measured before delivery and a measurement log is created. The accuracy of each individual workpiece carrier (WC) can be seen in this measurement log. Due to the manufacturing process, the belts are subject to a certain level of inaccuracy. Without compensating the “inaccurate WCs”, we cannot increase the accuracy any further. The WCs are not inaccurate, but the belt pitching is. By using a correction lock, the WCs moves back to their correct positions, which improves the accuracy. We achieve a repeatability in running direction of +/- 0.1 mm. Each correction lock has a special identification and coloring.

When removing and installing the WC make sure, that the WC-locks are installed exactly in the same direction again. Please note the identification marking and the color of the correction lock.

**Correction lock with offset 0.05 mm**

![Correction lock with offset 0.05 mm diagram]

Identification: Offset center hole 0.05 mm

Color: Colourless anodized

**Correction lock with offset 0.08 mm**

![Correction lock with offset 0.08 mm diagram]

Identification: Offset center hole 0.08 mm

Color: Black anodized

**Correction lock with offset 0.11 mm**

![Correction lock with offset 0.11 mm diagram]

Identification: Offset center hole 0.11 mm

Color: Dark gold anodized
Example measurement protocol

The gradient shows the deviation of the actual towards the nominal position in the direction of the WC. The measurement is visually on the crosshairs on the WC.

It is recommended, when you align the stations, to reflect the WC which position themselves is near the 0-line. Example below.

4.1.7 Replacing the toothed belt:

⚠️ CAUTION

Replacing the toothed belt may only be performed by trained personnel from Afag Automation AG.

4.1.8 Replacing the lateral guide:

⚠️ CAUTION

Replacing the lateral guide may only be performed by trained personnel from Afag Automation AG.
4.1.9 Toothed Belt Tension:

**NOTE**

For the toothed belt tension, ensure that this process is performed precisely as described so that operation can be continued as before!

**Process:**

1. For toothed belt tensioning, all workpiece carriers at the toothed belt must be removed.

2. The toothed belt is pre-tensioned in the factory for the tensioning device.

3. The toothed belt can be tensioned with tensioning screw (A). Please ensure that the process is performed on both sides.

4. The belt tension has been set as described below. The setting size (C) is listed on the sticker (B), which is by the window of the tensioning device.
4.2.0 Troubleshooting

**CAUTION**

If the workpiece carrier of the linear transport module oscillates very strongly after activation of the control (vibrations at the drive), the linear transport module must be switched off at once, otherwise damage to the linear transport module is possible.

Fault when executing the reference run

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece carrier oscillates (very strong vibrations at the drive)</td>
<td>Regulation parameters badly set</td>
<td>Readjust parameters at control</td>
</tr>
<tr>
<td>The toothed belt moves more than one workpiece carrier length and then stands still with fault servo controller (&quot;End of search section&quot; or &quot;Time exceeded&quot;)</td>
<td>Reference sensor incorrectly connected</td>
<td>Check connection assignment and correct if necessary</td>
</tr>
<tr>
<td>Or the toothed belt runs endlessly without servo controller fault (monitoring on the servo controller is not active)</td>
<td>Interruption in the reference sensor connection</td>
<td>Check sensor cable</td>
</tr>
<tr>
<td>Reference sensor defective</td>
<td>Replace reference sensor according to repair instructions.</td>
<td></td>
</tr>
<tr>
<td>Workpiece carrier does not move</td>
<td>Drive incorrectly connected</td>
<td>Check connection assignment and correct if necessary</td>
</tr>
<tr>
<td></td>
<td>Perform function check according to chapter 3.2.0 Commissioning of the Linear Transport Modules.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interruption in the motor connection</td>
<td>Check motor cable</td>
</tr>
<tr>
<td></td>
<td>Drive defective</td>
<td>Have the drive replaced by Afag AG</td>
</tr>
</tbody>
</table>
## Fault in operation

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece carrier oscillates (very strong vibrations at the drive)</td>
<td>Regulation parameters badly set</td>
<td>Readjust parameters at the servo controller</td>
</tr>
<tr>
<td>Workpiece carrier stops after a short stroke</td>
<td>Drag error too large</td>
<td>Reduce values for acceleration and speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check that the toothed belt is not mechanically blocked</td>
</tr>
<tr>
<td></td>
<td>Interruption in the encoder connection</td>
<td>Check encoder cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check encoder for function. Function check according to chapter &quot;Commissioning&quot;.</td>
</tr>
<tr>
<td>Increased toothed belt sounds</td>
<td>Toothed belt tension not correct</td>
<td>Check toothed belt tension and tension toothed belts according to instructions if necessary</td>
</tr>
<tr>
<td></td>
<td>Normal operating sounds due to material pair polyurethane-aluminium</td>
<td>Treat toothed belt with lubricant or silicone spray</td>
</tr>
<tr>
<td></td>
<td>Toothed belt defective</td>
<td>Replace damaged toothed belt according to instructions or have it replaced by Afag</td>
</tr>
<tr>
<td></td>
<td>Noticeable play in the lateral guides</td>
<td>Have the guide replaced by Afag AG</td>
</tr>
<tr>
<td></td>
<td>Ball bearing of the drive shaft or deflection pulleys defective</td>
<td>Have the ball bearing replaced by Afag AG</td>
</tr>
<tr>
<td></td>
<td>Gear is defective</td>
<td>Replace gear</td>
</tr>
</tbody>
</table>
5.0.0 Removal and Repair of the Linear Transport Modules

⚠️ CAUTION

Removal of the linear transport modules from a system is only permitted with the control switched off and secured.
Disconnect the cables from the motor!

⚠️ CAUTION

Take care when removing and installing the linear transport modules!
Handling the linear transport module carelessly may injure persons.
The linear transport modules must be installed in the mounting system with suitable lifting gear.

By crane

NOTE

Defective parts are only to be replaced by Afag Automation AG!
Please note that Afag cannot assume liability for modules that have not been repaired by Afag Automation AG.
6.0.0 Linear Transport Module Setup on the Mounting Platform

The linear transport modules may also be set up on an Afag mounting platform.

Linear transport module
LTM

Mounting platform with:
- Table plate
- Basic elements

CAUTION
In this application, high speeds occur with large loads, so the required cautionary measures must be provided with an enclosure (protective device)!
The plant constructor is responsible for this!
Afag Automation AG does not assume any responsibility for this!
7.0.0 Disposal

NOTE

Linear transport modules no longer in use should not be disposed of as a complete unit, but should be dismantled into their individual parts and recycled according to the type of materials. Dispose of non-recyclable materials appropriately.