Installing

Tecnotion Ironcore Linear Motors

TECNOTION

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Document nr. 4022.363.4190.2
Version 3.1
Issue Date: May 11

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Intro

I Introduction

Generally a linear motor system is a part of a specific machine. Tecnotion's linear motors can be combined with numerous application devices. This installation manual is intended for those technicians who construct a machine that includes a linear motor system

When installing a linear motor system one should be familiar with some important safety remarks. In the first chapter these remarks are made. Please, read them carefully.

Besides mounting the coil unit and the magnet plates, the installation includes the electrical wiring and the connections between the motor, the servo-controller and the linear encoder.

Before starting up, some required settings will be discussed. Finally your linear motor can take off for it's first ride.

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Chapter

Ch 1. Before you start

Please read the following instructions very carefully. They are important for a safe and warranted installation and operation of the Linear Motor.

1.1. Important notice

Before installing and using the Linear Motor, read this instruction manual carefully. The manufacturer declines all responsibility in case of accident or damage due to negligence or lack of observance of the instructions described in this manual. The manufacturer also declines all responsibility in case of accident or damage in conditions that differ from those indicated in the manual; Tecnotion also declines all responsibility for damage caused by improper use of the Linear Motor.

Handle the components of the Linear Motor with care, packed as well as unpacked. Especially the magnet plates are sensitive to mechanical shocks. Never drop a magnet plate or release it in an uncontrolled way.
Do not expose the magnets to temperatures higher than 70° C. The magnets may be demagnetized at higher temperatures.

Unpack the Linear Motor and check its integrity. If there is any irregularity, contact the dealer or manufacturer, signalling the nature of the defects.
Make a note of the serial number. This facilitates the correspondence with the supplier.

1.2. Safety warnings

The Linear Motor is used as a part of a machine. The user has to take care that the machine as a whole fulfils all CE requirements.

The magnet plates show large attraction forces on all soft magnetic objects such as iron. These forces cannot be controlled by hand. They may cause serious jamming danger.

Do not bring any soft magnetic objects (iron) nearer than 10cm of the magnetic side of the magnet plates.

Be sure that the magnetic plates are fixed into your machine before removing the magnetic field neutralizing protection plates.

Put the magnetic field neutralizing protection plates on the magnetic plates again before dismounting them.

Magnetic sensitive objects like banking cards, pacemakers or other magnetic information carriers may be damaged if they are brought within 1m of the magnet plates.

If at any time and in any situation there is any doubt about the safety of the Linear Motor, do not use it and contact your supplier.

The Linear Motor is powered by a servo amplifier. In case of a power disruption or fatal error this may automatically result in a free run out of the motor. Make mechanical precautions to prevent damage on the motor or your machine in the case of such an event.

Before installing the motor, make sure that the supply mains are grounded and operate in conformity with the regulations in force.

Make sure that there is an effective protective earth. Make sure that there is no voltage at the line wire terminals before connecting.

An earth connection does not work on non-conducting mounting surfaces like granite. In these cases the protective earth must be established by an earthing wire

Before carrying out checks or doing any maintenance, clear the system by disconnecting the voltage. Be sure that there is no possibility of accidental connections.

Be aware of electrical danger when the cooling liquid comes in contact with the supply means.

1.3. EC declaration

Tecnotion B.V. declares that all linear motors mentioned in this Installation manual are manufactured in accordance with European directive 2006/95/EC and in conformity with the following standards:

Standard #	Name of Standard
EN 60034-1: 2004	Rotating Electrical Machines, Part 1: Rating and performance
EN 60204-1: 2006	Safety of machinery – Electrical equipment of machines, Part 1: General requirements

Chapter

Ch 2. Components

Figure 1: A complete iron core linear motor system

An iron core linear motor of Tecnotion is not a system on itself. It contains several components, such as a coil unit and magnet plates. The components should be build within a total machine concept or a working unit. The size and the shape of the mounting frame, the design of the slide, the type of rails and bearings or the kind of dampers depend of the required application. For instance the mounting frame and the slide should be designed in such a way that a correct air gap between coil unit and magnet track will be obtained.

Tecnotion provides standard and special components which are suitable for numerous linear motor applications. These components can easily be applied in your system.

Before starting the installation, check the presence of the right number and type of the delivered components. In case of doubt, please contact Tecnotion immediately.

2.1. Basic components

The basic Linear Motor components supplied by Tecnotion are:

- The ***coil unit*** (the N- and S-versions differ in voltage and current requirements)

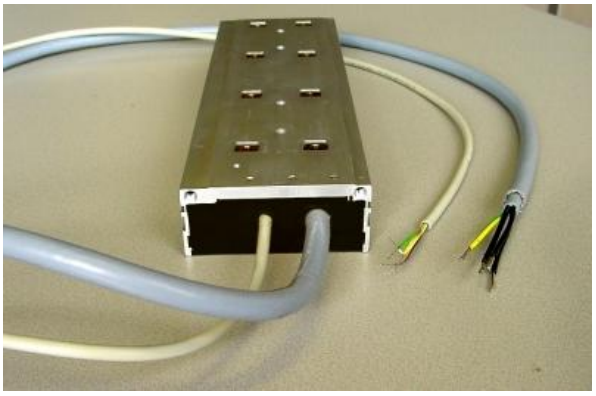


Figure 2: Coil unit

- The ***magnet plates*** (in different lengths)

Figure 3: Magnet plate

- Magnetic field neutralizing ***protection plates*** for mounting and dismounting purposes.

Figure 4: Magnet plate covered with protection plate

2.1.1. Bolts and dowel pins

Figure 5: Bolts and dowel pins

The following bolts and dowel pins are not provide by Tecnotion and required for positioning and connecting the coil unit to the slide as well as connecting the magnet plates to the mounting frame:

Features	TM	TL	TB	TG
Bolts for magnet plates (stainless) (low head)	M5x10, DIN7984	M5x10, DIN7984	M5x16, DIN912	M5x25, DIN912
Bolts for coil unit (steel), length depends on thickness slide	M4 DIN912	M5 DIN912	M5 DIN912	M5 DIN912
Dowel pins (stainless)	5h8 M3			

2.1.2. Tools

Necessary for the installation is:

- Allen key set
- Protective gloves (for handling the cover plate)

2.2. Additional Features

2.2.1. Controller and measurement unit

Required is:

- An appropriate servo controller/amplifier
- A ruler and a linear encoder or an analogue Hall module
- Power supply, cabling and connectors

For more information please contact Tecnotion.

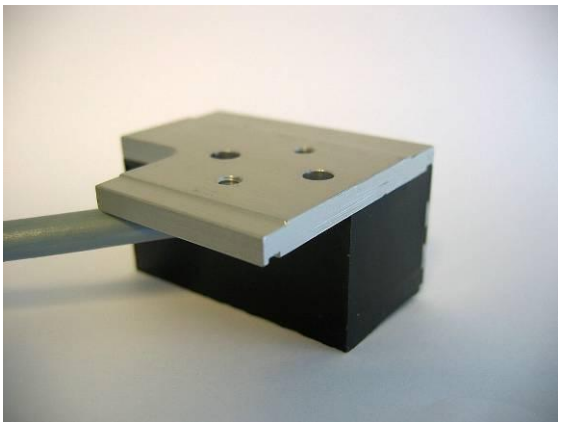


Figure 6: Hall module

2.2.2. Optional stainless steel cover plate

In addition to the linear motor system other special features can be supplied by Tecnotion. These don't pertain to the standard delivery by Tecnotion.

- Stainless steel ***cover plate*** to avoid contamination; one plate for the whole axis length.

For a proper installation of your linear motor system you also need

- fixing components, like bolts and pins;
- additional devices, like a servo controller and a linear encoder;
- the right mounting tools.

These features are no part of Tecnotion's standard delivery as well.

Chapter

Ch 3. Installation

Figure 7: Installing a linear motor system

3.1. Installation order

The installation order of this instruction manual must be followed. A different order may cause dangerous situations and damage due to uncontrolled magnetic attraction forces.

Before installing the linear motor components, the installation of the mounting frame should be completed. The rails should be properly positioned and mounted on the frame, as well as the ruler. The slide should be provided with bearings, dampers, linear probe and required cabling in such a way that a smooth, save and well positioned transport of the slide over the stroke is established. The operation of bearings and dampers should be tested as well as the guidance of the moving cables.

Tip: In case of the installation of an optional water cooling unit, please refer to chapter 4.

Now the correct installation order in headlines is:

1. Mount the connections for water cooling on coil unit (when used).
2. Mount coil unit to the slide.
3. Move slide to the end of the stroke. Secure slide against unwanted movements.
4. Mount magnet plates on the exposed part of the track. Make sure the magnet plates are covered with the protection plates. Keep magnet plates at least 10 cm away from coil unit.
5. Remove protection plates from the mounted magnet plates.
6. Move slide above the newly mounted magnet plates. Secure slide against unwanted movements.

7. Mount the remaining magnet plates.
8. – *Additional* –
   Mount the stainless steel cover plate and make an earth connection with the cover plate.
9. Check earth connection of the cover plate
10. Connect wiring and hoses for water cooling to coil unit.

These steps will be discussed in detail in the next paragraphs.

3.2. Mounting of the Coil Unit

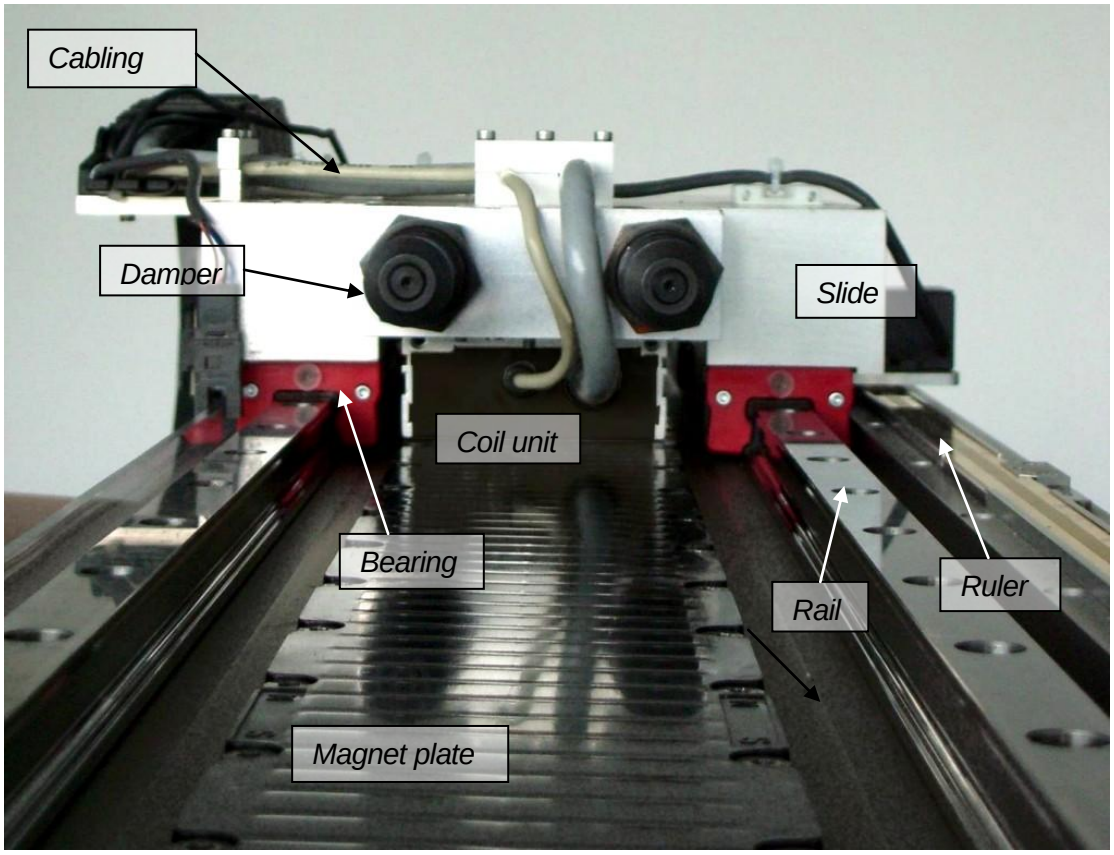


Figure 8: Detail of a linear motor axis, slide with coil unit

3.2.1. Mounting instructions

Before mounting, notice the following remarks. The flatness of the mounting surface for the coil unit must be better than 0.1 mm. The coil unit has to be mounted parallel to the magnet plate. The parallelism has to be better than 0.20 mm. For this purpose the side of the coil unit or the round holes in the mounting surface can be used. Dowel pins can be applied for the round holes. Sideward positioning of the coil unit to the magnet plates is not very critical. A tolerance of up to ±0.5 mm is acceptable.

Please note the following remarks and specifications.

Tip: use dowel pins with M3 internal thread to facilitate dismantlement afterwards.

Tip: Apply crosswise tightening of the bolts in order to obtain an equal distribution of fixing force.

Applying too long bolts for the coil unit may inconspicuously cause damage and dangerous situations.
Please, check
(1) bolt length before mounting and
(2) bolt height after mounting.

Bolts for coil unit	**TM**	**TL**	**TB**	**TG**
Bolts (steel)	M4	M5	M5	M5
Depth bolt in thread hole	Min: 4 mm Max: 5 mm	Min 4 mm Max: 5 mm	Min: 4.5 mm Max: 6 mm	Min: 5 mm Max: 7 mm
Tightening torque	2.0 – 3.0 Nm	3.0 – 5.0 Nm		

In case of applying water cooling: be aware that the connections for the water cooling unit can lay up to 1 mm above the mounting surface. Create enough space or use an intermediate plate of at least 1 mm thickness. Also see chapter 4: Additional installations.

3.3. Mounting the magnet plates

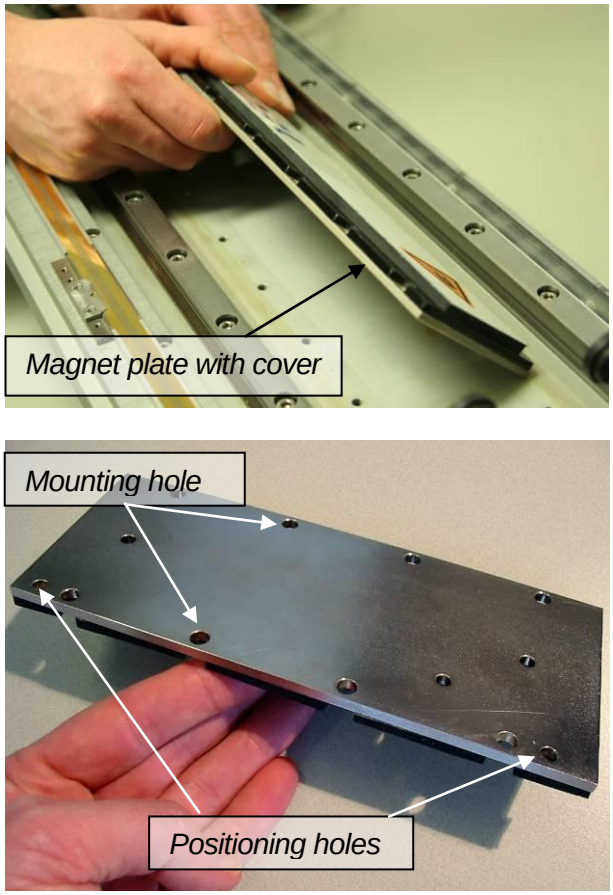


Figure 9: Magnet plate, details

3.3.1. Warning

Especially the magnet plates must be handled with care. They are sensitive to mechanical shocks. Never drop a magnet plate or release it in an uncontrolled way!

The magnetic side of the plates is the structured side. The magnet plates do show large attraction forces on all soft magnetic objects such as iron. These forces cannot be controlled by hand. They could cause serious jamming danger. Therefore, consider the following warnings.

Only handle the magnet plates if covered with the magnetic field neutralizing protection plates.

Be sure that the magnet plates are fixed into your machine before removing the magnetic field neutralizing protection plates.

Put the magnetic field neutralizing protection plates on the magnet plates again before dismounting them.

Do not bring any soft magnetic objects (iron) nearer than 10 cm of the magnetic side of the magnet plates.

Magnetic sensitive objects like banking cards or other magnetic information carriers may be damaged if they are brought within 10cm of the magnet plates.

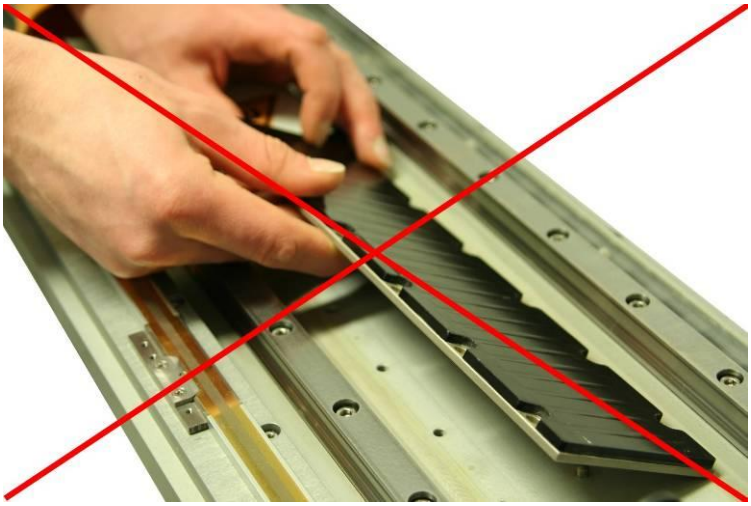


Figure 10: Please don’t handle an uncovered magnet plate!

3.3.2. Mounting the magnet plates

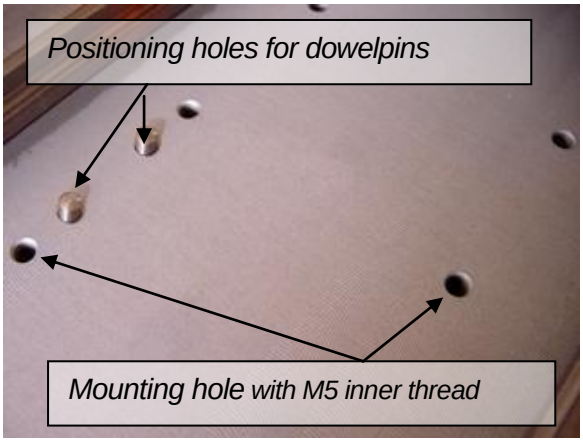


Figure 11: Mounting frame, detail

1. Move the slide to one end of the stroke. The first magnet plate will be mounted against the other end of the stroke. Secure the slide against unwanted movements. Make sure the mounting surface is free of dust and small particles.

2. Apply dowel pins for the positioning holes in the mounting frame (see Figure 11: Mounting frame, detail). Choose the holes according to the position of the accurate ø5 positioning holes in the magnet plate (see Figure 9: Magnet plate, details)

Tip: Use pins with M3 internal thread to facilitate dismantlement afterwards.

The total height of the dowel pin above the mounting surface should be maximum 3 mm.

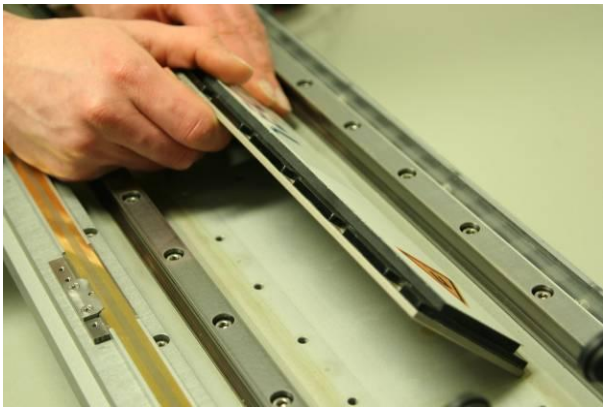


Figure 12: Orientating the magnet plates

3. Take care that magnet plate is well orientated. Finally all magnet plates should be orientated in an equal direction. For example, all magnet plates could be placed in such a way that the dowel pin holes are directed in the right upper corner (see Figure 11)

Figure 13: Mounting the Magnet plates

4. Fix the magnet plate to the mounting frame. Depth of thread should be at least 6.5 mm. Tightening torque: 2.5 to 3.5 Nm for stainless steel. All holes must be used!

5. Remove the protection plate from the mounted magnet plate and move the slide to the other end of the stroke. Secure the slide

against unwanted movements (now this could be done by re-placing a protection plate, see Figure 14: Securing the slide with a protection plate). Once again, make sure the mounting surface is free of dust and small particles.

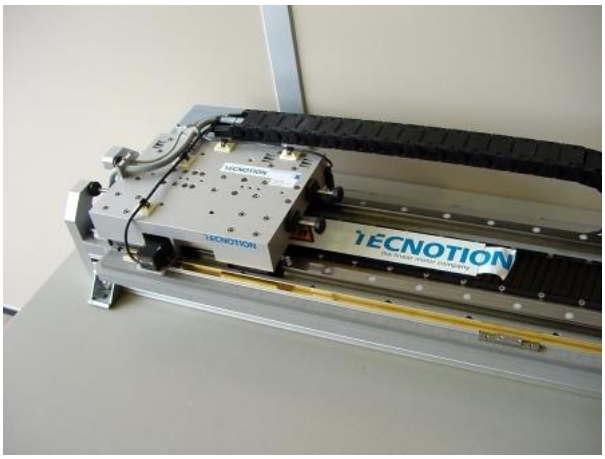


Figure 14: Securing the slide with a protection plate

6. Now the rest of the magnet plates can be mounted in a similar way. The right orientation of the plates can also be noticed when another plate is placed. The adjacent plates should attract each other. When they are repelling each other the plates are wrongly orientated.

Figure 15: Placing another magnet plate

7. Finally remove all protection plates and check whether the slide can move freely and smoothly over the magnet plates. When there is a strong force ripple at the edges of the magnet plates, please check the orientation of the plates.

Figure 16: Uncovering the magnet track

3.4. Electrical Connections

Before starting any activity on the wiring, make sure that the mains are disconnected.

Work carefully according the instructions belonging to the applied servo controller. Be sure your machine as a whole meets the requirements of all applicable electrical standards, such as the EN 60204 standard.

3.4.1. General remarks

The linear motor's electrical wiring is externally configured with two one meter cables: a power cable and a temperature cable. For wiring scheme see figure below. If desired you can shorten these cables and provide them with appropriate connectors. Note that these cables are not meant for use within cable chains. Therefore user defined cables should be used that meet the specifications concerning bending radius, length, replacebility, etcetera. In this case the motor's standard cables must be connected properly to the user defined cables. Both power cable and temperature cable are shielded with a plaited metal cable sheath for electromagnetic immunity.

Besides this manual you should follow carefully the installation instructions of your servo amplifier supplier. Make sure that the linear motor system as a whole meets all the applicable electrical directives.

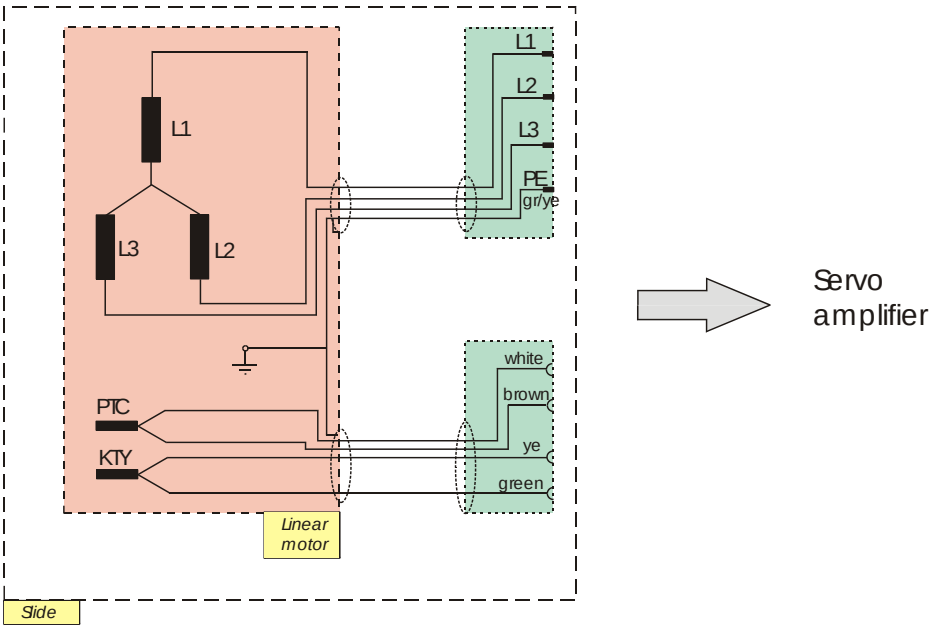


Figure 17: Wiring scheme iron core

3.4.2. Power lines

The three phases of the motor's power cable has to be connected to the servo amplifier in such a way that the positive three phase direction of the motor conforms the positive direction of the linear encoder. This polarization has to be tested, it cannot be seen at first sight.

Testing the polarization is very important, because a wrong polarization will result in an uncontrolled run out of the slide.

The power cable can be confectioned by the user to fit on the servo drive. For moving cables it is advised to make the moving parts replaceable. This can be done by making a connection of the coil unit cable to the moving cable on the slide.

Powerlines		**Color TL/TB/TG/TM**	**Connection to servo controller**
3-phases	L1	black '1'	3-phases
	L2	black '2'	
	L3	black '3'	
Protective Earth		green/yellow	Protective Earth
Shield		(Protective) Earth	

3.4.3. Protective earth

Be sure that the earth shield of the cable is well connected – also through the connecting devices – to the PE connector or the housing of the amplifier. Most TL linear motors are driven on the principle of pulse width modulation. This involves large electrical impulses and causes a significant risk of electromagnetical interference.

Internally the motor's PE wire is galvanic connected to the motor housing. This wire must be connected to the PE connector of the servo amplifier. Provide the motor system with PE lines to the amplifier that are as short as possible.

3.4.4. Temperature Sensor

The coil unit is equipped with two temperature sensors, one of the PTC-1k-type and one of the KTY83-122 type. The PTC resistor is the motor's standard device for checking the heat production in the coil unit.
The temperature cable consists of four wires. For wire color and function, see table below.

Sensor Lines (color)	Connection to servo controller
PTC (white)	PTC
PTC (brown)	PTC
KTY21 (green)	KTY83-122
KTY21 (yellow)	KTY83-122
Shield	Protective Earth

3.4.5. Temperature protection

The temperature sensors are normally used for overheating protection of the coil unit. The KTY-sensor can be used for monitoring temperature, PTC can be used a switch when maximal temperature is exceeded. For specifications and behavior see the next two paragraphs.

In some cases where long peak current are demanded, the thermal response time of the coil unit is too long to ensure a proper overheating protection of the sensors. This can occur for example during an accidental run or by taking a new axis in control.

In this case a I^2t protection can be used to prevent the coil unit from overheating. In almost all controllers an I^2t-protention can be set in the software. We can ensure proper protection of the temperature sensors up to an Irms of 45% of the ultimate current(10°C/s) of the motor.

For more information contact Tecnotion's Application support team.

3.4.6. PTC specification

The PTC-1k type is a sensor which has a very sudden resistance rise near the critical temperature of the coils. It is almost a digital indicator: temperature below vs. over critical temperature. Therefore it is very useful for signalizing over temperature without requiring sensitive electronics. Disadvantage is that it is not possible to obtain a temperate signal.

At room temperature the PTC has an electrical resistance of about 65 Ohms. When the temperature raises to the critical temperature the resistance will increase rather uniformly up to 1000 Ohms. Above this temperature the resistance increases exponentially. Now, 1000 Ohms is the switching resistance. The amplifier should immediately stop the power supply when this resistance is exceeded. In this way overheating and motor damage can be prevented. No need to say that the PTC cable must be connected properly to the amplifier.

Temperature	**Resistance**
Up to 20°C below critical temperature	< 250 Ω
Up to 5°C below critical temperature	< 550 Ω
Nominal switching resistance	***1000 Ω***
Above critical temperature	> 1330 Ω

3.4.7. KTY specification (KTY21-6 or KTY83/122)

The KTY-sensor has a rather stable and slow temperature coefficient. It can supply a temperature reading in the whole range. Therefore it is useful to monitor the coil temperature during tests and to decide whether the thermal margins are enough to guarantee error-free running of the machine under certain conditions. Disadvantage is that the sensor requires sensitive and accurate electronics to obtain a reliable reading

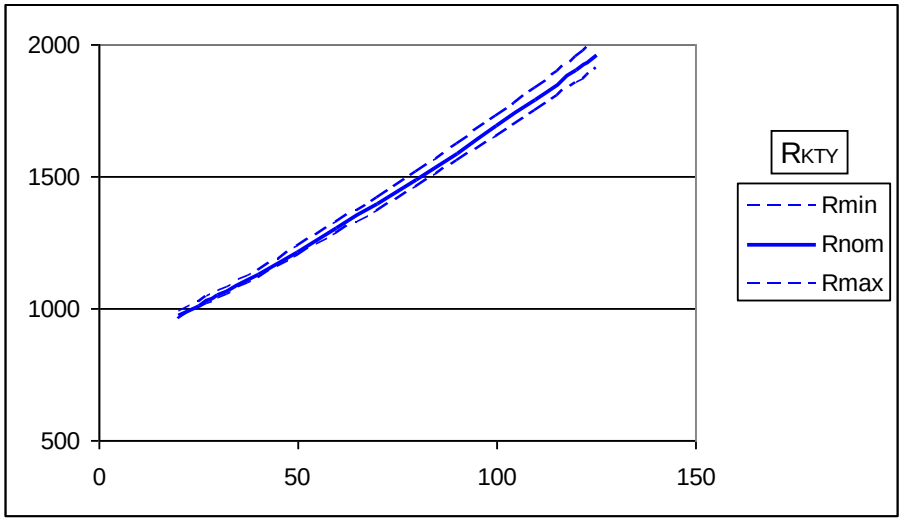


Figure 18: Temperature dependance of KTY21-6 and KTY83/122 sensor

T (ºC)	20	25	30	40	50	60	70	80	90	100	110	120	130
R_{NOM} (Ω)	972	1010	1049	1130	1214	1301	1392	1487	1585	1687	1792	1956	2012

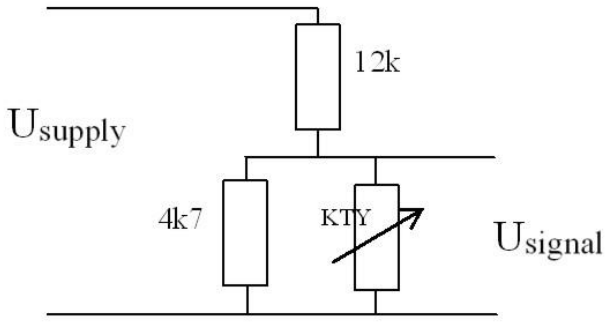


Figure 19: Scheme for obtaining a linear voltage signal from the KTY-sensor

3.4.8. Polarization test

Before testing, make sure that the electrical and mechanical protection of the linear motor system is well configured!

There is one regular way of testing the polarization. Most servo amplifiers can operate in an *in moment service* mode. By means of regulating an external resolver manually, it can be determined whether the motor's direction of running conforms the resolver's sense of rotation. If so, the motor is well connected. If not, two phases of the power cable – phase 1 and 3 – must be changed.

Internally all iron core linear motors are equally wired and connected, so one test satisfies to find out the polarization of a motor ruler combination. If more axes are constructed in a similar way the polarization will be equal.

For more information, please contact Tecnotion.

3.5. De-installation order

The de-installation order of this instruction manual must be followed. A different order may cause dangerous situations and damage due to uncontrolled magnetic attraction forces.

The correct de-installation order in headlines is:

1. Disconnect wiring and (when applied) hoses for water cooling of the coil unit.
2. Move slide to one side. Secure slide against unwanted movements.
3. Dismount the earth connection of the plate and the stainless steel cover plate.
4. Adhere the protection plate to each magnet plate that needs to be removed.
5. Remove one or more magnet plates. Keep magnet plates at least 10 cm away from coil unit.
6. Move slide to other end. Secure slide against unwanted movements.
7. Remove remaining magnet plates.
8. Remove coil unit from the slide.

Chapter

Ch 4. Additional installations

4.1. General remarks

In this chapter additional attention is paid to the installation of an optional water cooling unit. In Tecnotion's standard program of iron core linear motor the water cooling option has only been intended for the TL series.

If you intend to construct a linear motor system based on the TM or TB series and if water cooling is required, please contact Tecnotion.

Note that Tecnotion does not accept any responsibility for the effects of leakage.

4.2. Covering the magnet plate

Now the magnet plates are mounted, an additional finishing touch can be made. By covering the magnet track with the stainless steel cover.

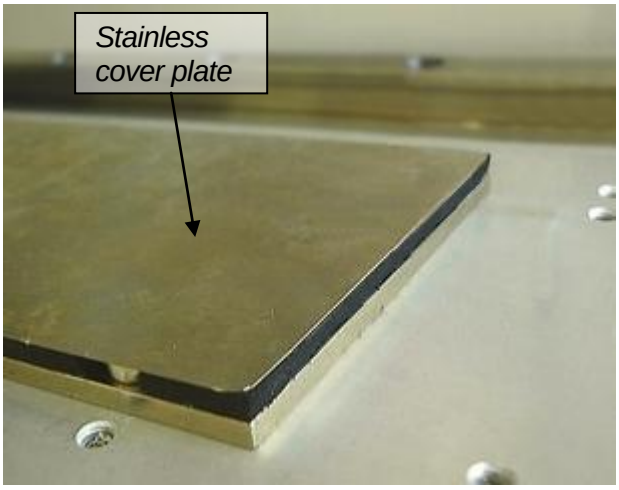


Figure 20: The end of the stroke, detail

1. The magnet plate cover must be placed according to the steps below.

Be careful! The stainless steel magnetplate cover could have sharp edges. Wear protecting gloves while handling the cover.

Because of the high magnetic forces the cover will adhere firmly to the magnet plates. Placing is easily performed by rolling off the flexible cover. Removing is best performed by rolling up.

For the next steps also see Figure 21: Placing the stainless magnet cover.

a. Move the slide to one end of the stroke to clear the major part of the magnet track.

b. Unroll the cover over the cleared magnet track.

c. Move the slide to the middle of the stroke.

d. Now lift up the ends of the cover so that only a small part of the cover (underneath the slide) sticks to the magnet plate. This could best be handled by two persons.

e. In this position the cover can be slipped over the magnet track. Now position the cover so that there is a small overlay at each end of the stroke.

f. Cut off the overlay and place the cover accurately. The stainless cover should precisely cover the protective strips.

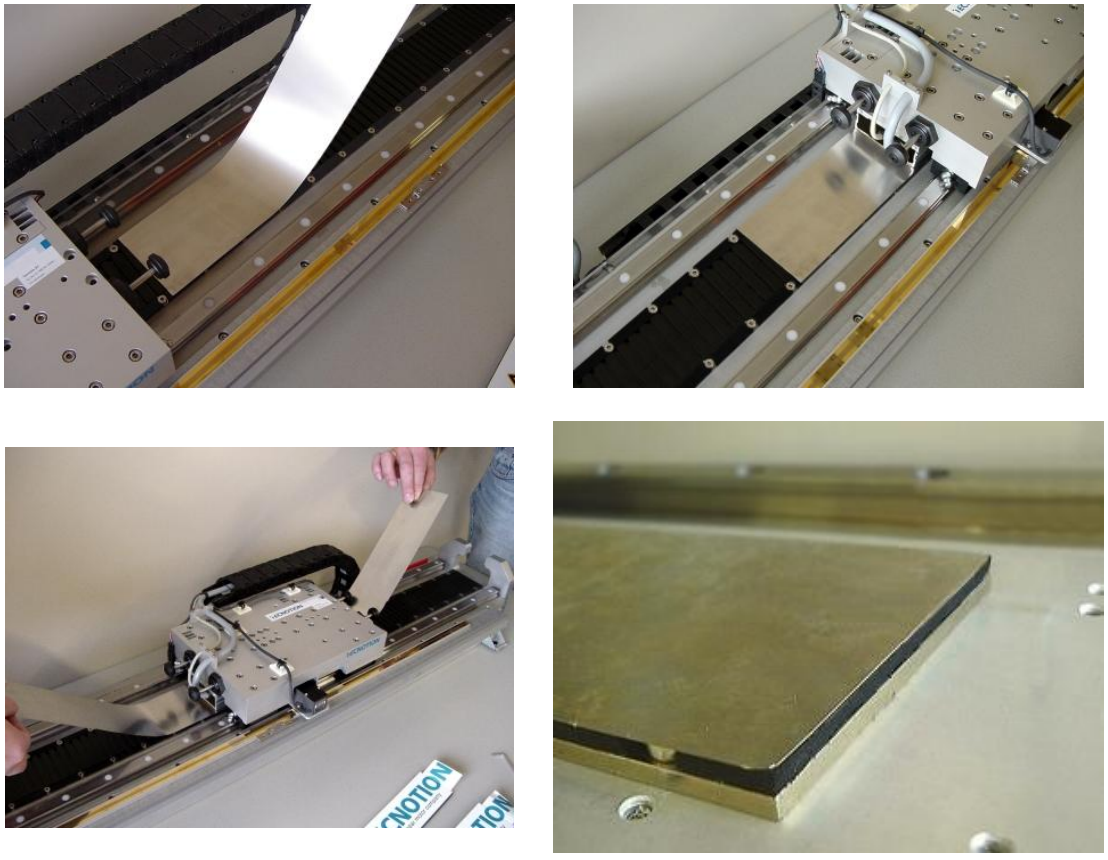


Figure 21: Placing the stainless magnet cover

Note that the magnets are fixed obliquely on the stroke.

2. Finally the earth connection of the stainless cover has to be checked in accordance with the machine's safety standards.

Before operation make sure that there is an effective protective earth.

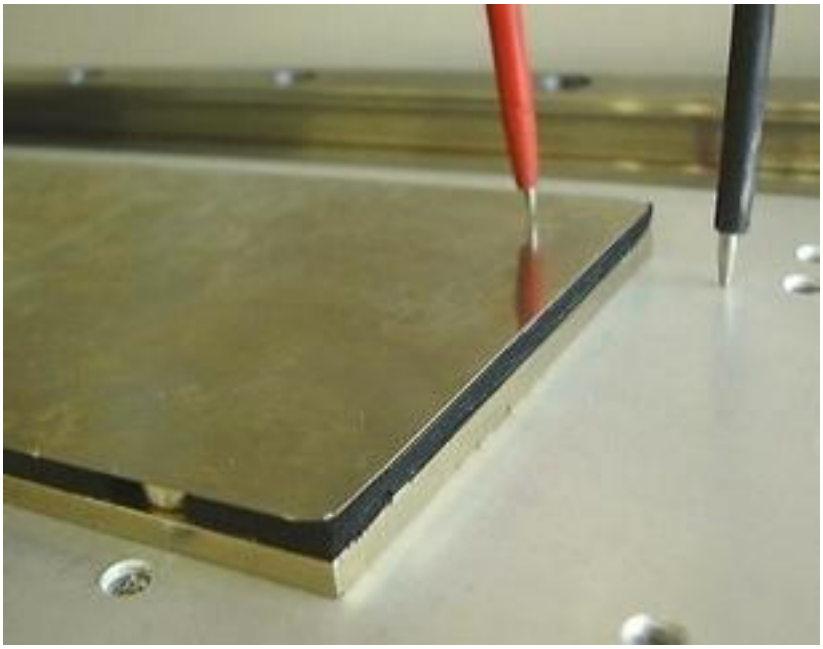


Figure 22: Protective earth test for stainless cover

4.3. Installation water cooling connection (TL & TBW)

4.3.1. Requirements

For connecting the water cooling unit to the coil unit you need at least:

- hoses
- hose connections (Nipple/Fitting)
- sealings/sealant

Below a diagram with technical data for TL and TBW-series.

	TL	TBW
Thread holes	4 times M5 (on both sides of coilunit)	2 times 1/8" NPT (both on one side)
Recommended Nipple/Fitting	M5 nipple	Push-Pull Fitting, -Festo QS-1/8-8*
Sealings	M5 plastic sealings and Loctite 638/648 glue	Teflon tape
Tightening torque	0.2 - 0.3 Nm	4.0 Nm

*Other 1/8" Push and Pull Fitting can also be Applied, but the use of smaller hose sizes and use of a inner hole of the fitting/nipple can reduce the flow.

Figure 23: TBW-water-cooling with two fittings

Figure 24: TL-water-cooling with four connection points

For the dimensions of the coil unit and the position of the standard water-cooling connections please contact Tecnotion

The use of other connnections may cause higher pressure drops than indicated due to smaller throughput.

4.3.2. Fitting Water-cooling Connections

Follow the direction below to ensure a proper leak free water-cooling connection.

	TL
1	Degrease connection and thread hole. Before continuing make sure the degreasing agent has vaporized completely.
2	Place plastic sealing ring on connection.
3	Put one drop of Loctite 638/648 glue on thread and distribute glue around.
4	Mount connection and turn until the sealing ring is deformed visibly. (This only requires about 0.2 - 0.3 Nm torque. Do not turn too hard!)
5	Remove surplus of glue.
6	Let glue harden for 4 hours before applying loads.
7	Let glue harden for 12 hours before applying pressure.
8	Hoses must fit with the connections chosen.

	TBW
1	Degrease connection and thread hole. Before continuing make sure the degreasing agent has vaporized completely.
2	Use Teflon tape on the thread of fitting, if the thread doesn't have a standard sealant
3	Mount connection and fix the fitting with 4.0 Nm torque
4	Hoses must fit with the connections chosen.

The water cool nipples of the TL can extend further then the coil units mounting surface. This has to be taken care of when designing a mechanical slide.

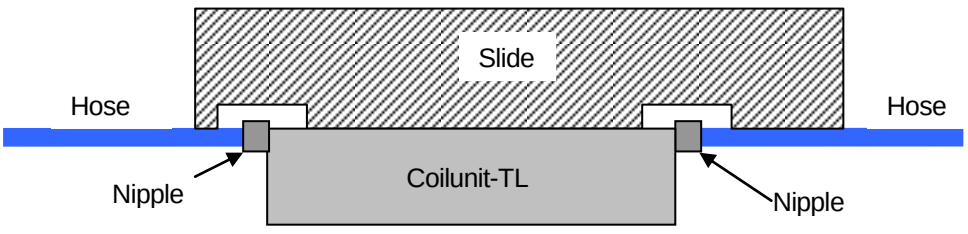


Figure 25: Beware of extending nipples

4.3.3. Connection of hoses

When fitting the hoses, the connections have to be free of greases and oil.

The two cooling channels of the TL-motor can be connected in series. Both cooling channels can also be used in parallel configuration. This connection reduces the pressure drop, but only if cavitation is less ø6mm-ø8mm, when using Y-joints.

	TL-serie	**TBW18**
Hose diameter	ø4 (inner diameter)	Ø8mm (outer diameter)
Minimum flow diameter Fitting	ø2.5mm	Ø5mm
Hose Examples:	Festo PU-4* Rauclair PVC E 4x1* flexible	Festo PUN-H-8x1,25*

*Other Hoses can also be Applied, but the outer diameter should Ø8mm to fit properly on a 1/8" Push and Pull Fitting.

	TL6	**TL12**	**TL15**	**TL18**	**TL24**	**TBW18**	**TBW30**	**TBW45**
Minimum Flow (l/min)*	0.7	1.4	1.8	2.2	2.9	3.1	5.2	7.8
Pressure drop (bar)*	1	2	2	2	3	1	1.5	2.5

*Values are indication and are dependent on used connections and hose-system.

4.4. Installing the Analogue Hall Sensor for T- Series

The Analogue Hall Position sensor is meant to be used with Tecnotion Iron core linear motors as position sensor. In this function, the sensor can replace a separate optical or magnetic scale, depending on the demanded resolution.

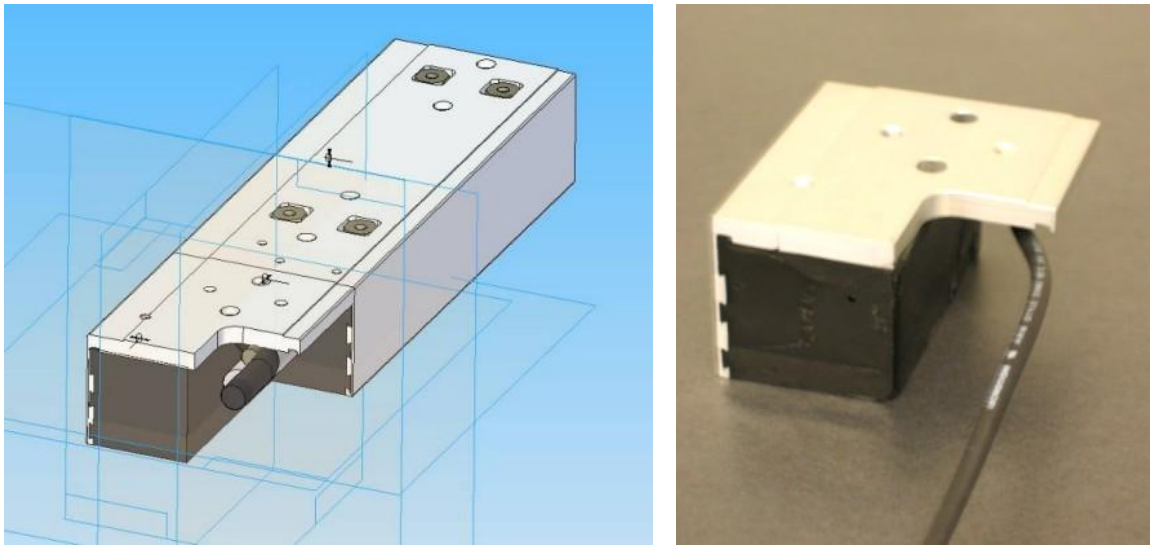


Figure 26: The analogue Hall sensor

4.4.1. Introduction

Our Analogue Hall sensor is a cheap replacement for expensive optical and magnetic scales when accuracy level aren't much demanding. One obtains a complete feedback system for the price of a reading head. Because it uses the magnetic scale as magnet track.

Besides the price the advantages of the Analog Hall Position Sensor are:

- The sensor is not sensitive to dust and pollution.
- Mounting is straightforward on the same surface as the coil unit.

The sensor measures the magnetic field of the magnet track below and gives a standard, analogue feedback signal to the servo controller. The signals are 1V peak-peak Sine with a period of 24 mm.

For optimal results, the analogue signals have to be calibrated on offset and amplitude. This procedure can be performed by most standard servo controllers. When in doubt, please contact your supplier.

The system requires the mounting of the sensor head only. As notified before, the scale is formed by the magnet track.

The sensor head has to be mounted above the magnet track, in front of the coil unit (see Figure 27). Wiring can be joined with that of the coilunit.

Alignment is relatively uncritical. The sensor head mounting height corresponds to that of the TM and TL linear motors. For use with TB and TG linear motors, a filling of 1 or 3 mm respectively is needed between sensor and coil unit mounting surfaces (not available at Tecnotion's). Normal tolerance of linear motor mounting height is adequate for the sensor.

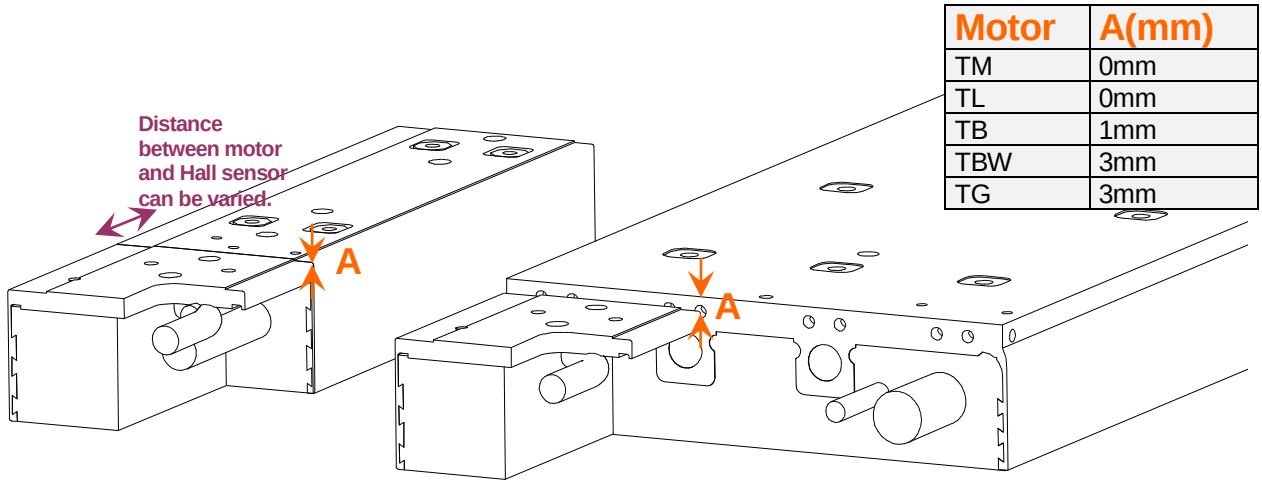
Rotation should be within 0.5 degree to movement axis. Side of sensor should be aligned with the coil unit (±1mm) to be sure that the sensor is not above a row of magnet joints. Position in length is irrelevant.

4.4.2. Installation

The mounting height in relation to the coil unit differs per type. In the drawing below the heights are indicated corresponding with there offset in the table.

The distance between coil unit and Hall sensor can be varied, depending on customers choice because the signal is relative to magnet track.

The Hall sensor can be aligned by two dowel pins (∅5 F8). It should be mounted with two bolts with M4-tread.



Motor	A(mm)
TM	0mm
TL	0mm
TB	1mm
TBW	3mm
TG	3mm

Figure 27: The Analogue Hall sensor, mounting position in front of the coil unit

Cable connection

Color	connection
Green	A+ (Cos)
Yellow	A- (Cos)
Blue	B+ (Sin)
Red	B- (Sin)
Brown	+5V
White	Gnd
Pink	+5V_sense
Grey	Gnd_sense
Shield	GND (Connected to Shield only)

Specifications	
Signal:	1Vpp SinCos 120R closing
Signal Period:	24mm
Repeatability:	±30µm
Resolution:	±10µm
Accuracy:	±100µm (±0.1mm) – with magnetplate mounting accuracy within ±20µm – using offset and amplitude compensation
Supply:	+5Vdc 100mA
Cable:	3m Lapp Unitronic-FD CP(TP), UL/CSA, ∅ 6.8mm, flexing: R=7.5D

4.4.3. Installing Digital Hall

All T-series motors can be used with a digital Hall sensor. For installation directions, Tecnotion offers you a manual on request.

Chapter

Ch 5. Operation

5.1. General

When you are convinced that your application's linear motor system is assembled in a proper way, both mechanically and electrically, you can do the next step. You can put your motor system into operation.

But before powering the system, please do have a final check:

1. ***Does the slide have a free run over the whole magnet track, without touching small mechanical parts like bolts or contamination?***
2. ***Are the mechanical end stops, end switches and the dampers well dimensioned and properly configured?***
3. ***Does your system have an emergency stop?***
4. ***Is the temperature cable properly connected?***
5. ***Does the motor ruler combination have the right polarization?***
6. ***Has the power cable been connected properly?***

5.2. Configuring

After the amplifier is powered up some input and output signals need to be examined.

1. Check the end switches by pushing the slide manually to the switch position. Simultaneously check whether the signal is detected by the amplifier.
2. Check the presence of the PTC signal.

The following motor items should be configured as parameter settings of the servo amplifier:

3. Maximum continuous current.
4. Maximum peak current.
5. Amount of self induction poles.
6. Maximum speed (rpm).
7. Presence/absence of an electromechanical motor brake.
8. Magnet interval (North-South distance) and/or pole pitch (North-North distance.
9. Switching resistance of PTC.

The following settings for the ruler system should be configured as parameters of the servo amplifier:

10. Type of interface of the ruler system.
11. Resolution or period of the linear encoder.

These are the I/O parameters to be configured:

12. Settings of the available digital inputs and outputs. For instance, pay attention to the type of end switches.
13. Settings of the available analog inputs and outputs.

Finally the controlling parameters must be configured.

14. Current control settings. These settings depend on both motor and amplifier.
15. Speed control settings.
16. Position control settings.

For configuring several types of servo amplifiers Tecnotion can offer parameter files. With these files motor specific settings can be configured. Nevertheless, application specific settings should be configured by yourself. Please contact Tecnotion for information.

5.3. Optimization of control settings

Now the current control is configured, the speed control can be adjusted. Supply the motor with several step signals (for example v=0 ... to ... 1m/s). Depending on the response the amplification factor and the integration time have to be adjusted according to the common rules of standard control technology. After this the position control can be adjusted in a similar way.