

SCHNEEBERGER
LINEAR TECHNOLOGY



MINI SCALE

Mounting instruction

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1 Information on Installation Instructions

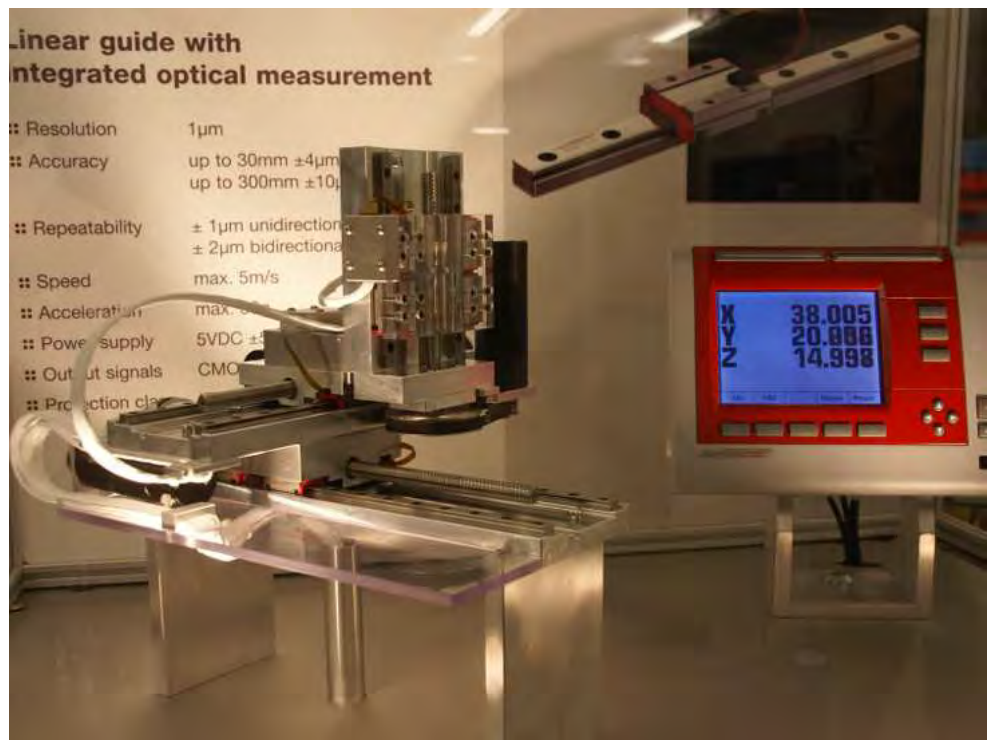
1.1 Function and Validity

The MINISCALE instructions describe how to install the profile rail guide systems with integrated positioning measurement system.

MINISCALE is based on MINIRAIL. Accordingly, the installation instructions of this guide are almost identical.

1.2 Further Literature

Product catalogues MINISCALE and MINIRAIL.



2 For your Safety

2.1 Authorised persons

MINISCALE may only be installed by trained specialists who have read and understood these instructions.

2.2 Correct use

MINISCALE is used for precision linear movements.

MINISCALE must only be used under the permitted environmental conditions (see also Section 10.1).

2.3 General safety and protection measures

Storage

Store the MINISCALE in its original packing until it is installed, and protect it against moisture and damage (see also section 10.1).

Installation

During installation, all components must be at the same room temperature. Dirt or lubricants can disturb the optical measuring system of MINISCALE. Consequently, lubrication should be well aimed and the top surface of the rails kept clean (see sections 9.1 and 10.3).

Caution!

Invisible laser radiation.

Before power is applied, the carriage of MINISCALE must be fitted onto the rail.

Repairs

Use only SCHNEEBERGER original parts for repair work.

Miscellaneous

Before working on the electrical system interrupt the power supply.

Please observe instructions about handling of ESD-sensitive components (En 100015-1).

County-specific regulations, standards and directives on accident prevention must be observed. SCHNEEBERGER accepts no liability for damage resulting from unauthorized modifications to the MINISCALE.

2.4 Environmentally responsible behavior

Do not allow lubricants to escape into the environment and dispose of them in an environmentally responsible way.

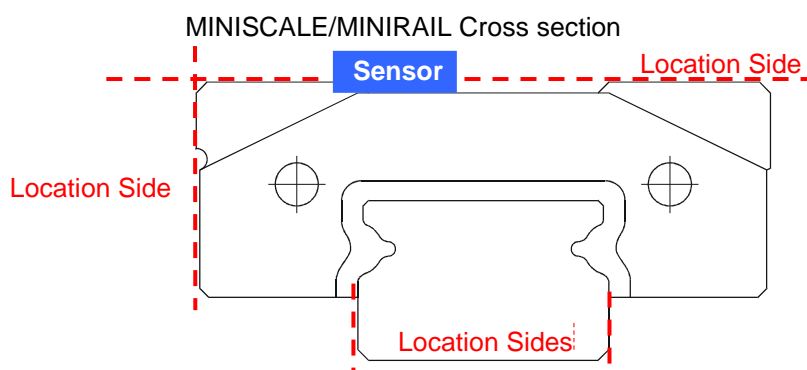
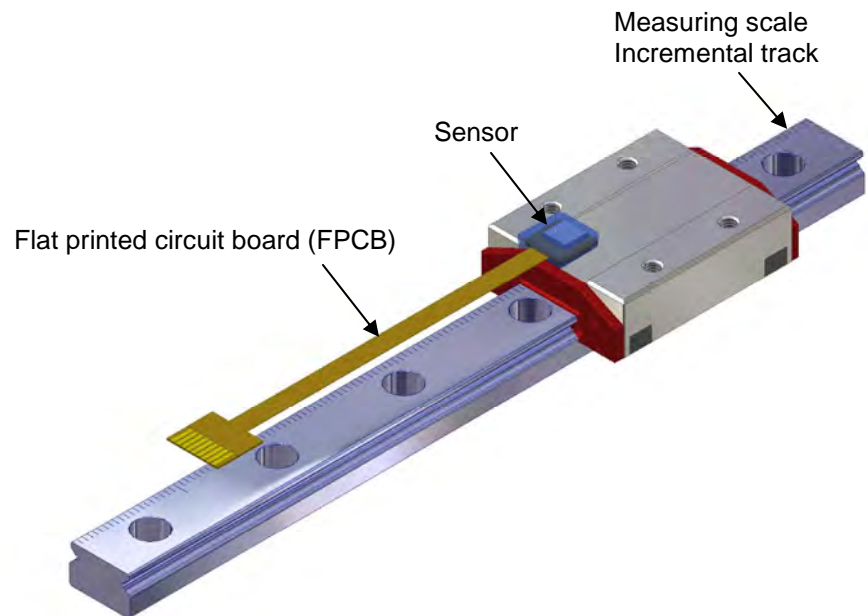
Dispose of components according to regional/national laws and guidelines

3 Description

3.1 Components

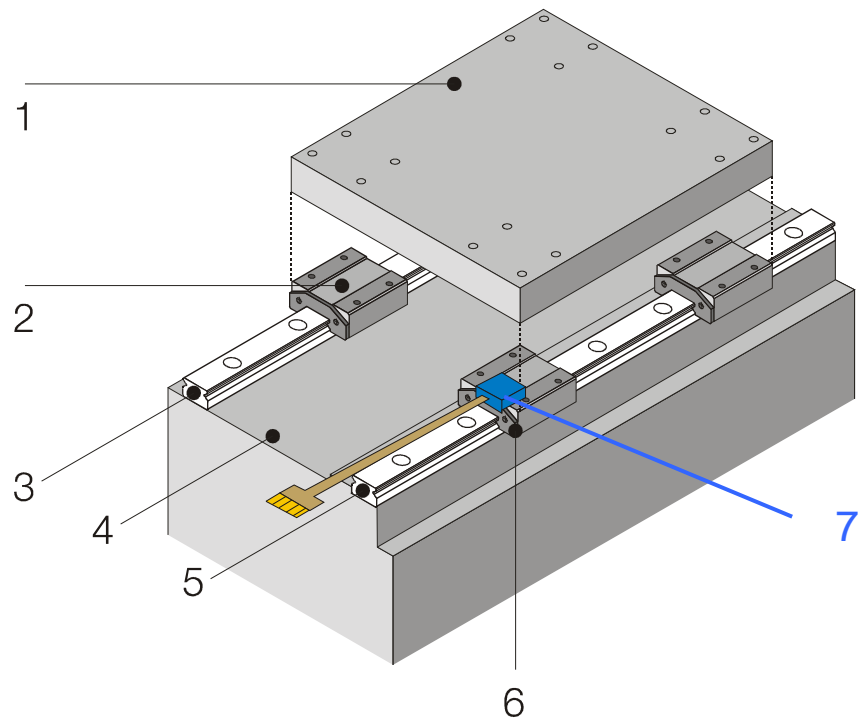
As mentioned before, MINISCALE is based on MINIRAIL. Compared to MINIRAIL, MINISCALE has an integrated measuring system consisting of the following main components:

- The guidance rail is engraved with an **incremental measurement scale**.
- The carriage bears a **sensor** with a flexible printed circuit board. The **interpolated electronics** are integrated within the sensor.



With most of the MINISCALE carriages (Excepting MNS 15 and MNS 42) the sensor lies over the location side of the carriage. The mounting plate must, therefore, have the appropriate clearance.

MINIRAIL/MINISCALE
System



- 1 Mounting Plate
- 2 Carriage
- 3 Rail 2
- 4 Machine bed
- 5 Rail 1 (Reference rail which is laid onto the location side of the machine bed)
- 6 Front Plate
- 7 **MINISCALE Sensor**

3.2 Operating principle

The integrated positioning measurement system consist of a measurement scale (optical grating) with an interval of 40 μm engraved into the surface of the hardened steel rail and a sensor which reads the output from the grating. These signals are interpolated and converted into digital TTL signals which are then processed by a drive control or an indicator with digital TTL input e.g. an NC control. The incremental grating also carries an engraved reference mark which likewise generates a digital TTL signal.

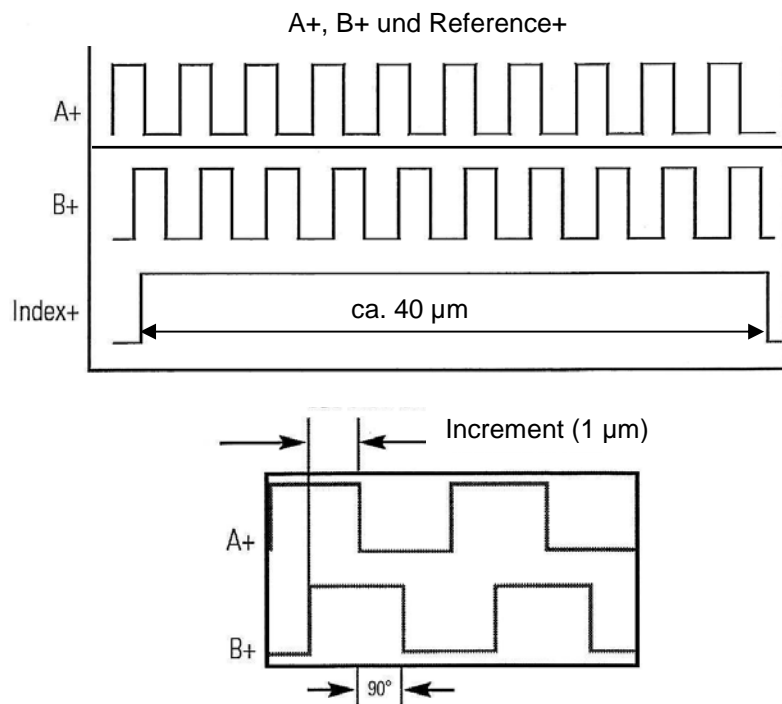
4 Signals

4.1 Output signals

Output signals for the drive control:

- Incremental signals A+/A- and B+/B- are RS-422 (RS-232) compatible square waves.
- The reference signal defines one particular fringe on the measuring scale. The signal is TTL compatible and approximately 40 μm wide. Please note that this signal is not synchronized with the flanks of the A or B signals.

The output signals are square wave incremental signals and a reference signal. These output signals are transposed to the drive control which calculates the current position and the number of measuring steps corresponding to the displacement of the scan head. By means of the 90° Phase shift of the incremental signal it is possible to deduce changes of direction and course of travel.



5 Transport and Storage

Always pay attention to the following when transporting and storing

MINISCALE:

- Transport in the original packaging
- Protect against impacts and moisture

6 Preparations for Assembly of the Rails and Carriage

6.1 Required tools and aids

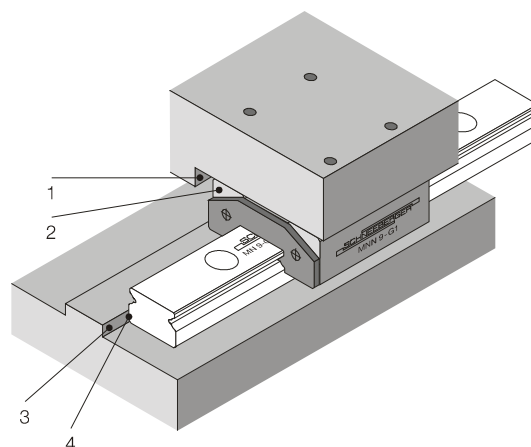
- Oilstone
- Lubricant
- Torque wrench
- Fastening screws for the rails and carriages

6.2 Checking the scope of delivery

The carriages and rails are packed together in the same delivery. An additional protection rail for the carriage is provided.

6.3 Preparing the location sides

1. Check the locating sides of the machine bed and mounting plate for dimensional and position accuracy. If these do not meet the requirements, have the locating sides reworked.



- 1 Locating side, mounting plate
- 2 Locating side, carriage; Note: if necessary with exception of the sensor
- 3 Locating side, machine bed
- 4 Locating side, rail

Note: Both rail sides can be used as locating sides.

2. Remove burrs and unevenness with an oilstone
Clean the locating and support sides of the rails and carriages using benzine solvent or mineral spirits. Do not use nitro!

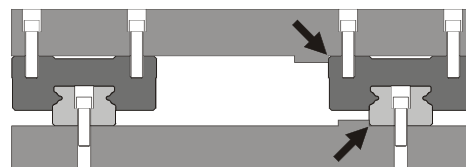
Lightly oil the locating sides on the rails and carriages.

6.4 Determining installation variants

Depending on the requirements for the accuracy and the rigidity of the rails, different installation variants are recommended. These may differ because of customer-specific locating sides and, therefore, of the lateral guide.

3 typical installation variants are described here in more detail:

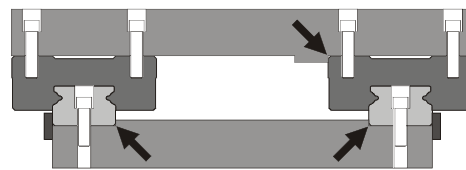
Variant 1



Reference rail

- On the side of the reference rail locating sides between machine bed and rails, mounting plate and carriage
- Mounting plate screwed onto the carriage from above

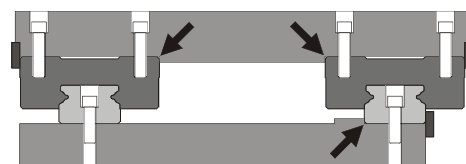
Variant 2



Reference Rail

- On both rail sides locating sides between the machine bed and rail
- On the reference rail side locating sides between the mounting plate and carriage
- Mounting plate screwed onto the carriage from above

Variant 3



Reference Rail

- On the side of the reference rail locating side between machine bed and rail
- On both rail sides locating sides between the mounting plate and carriage
- Mounting plate screwed onto the carriage from above

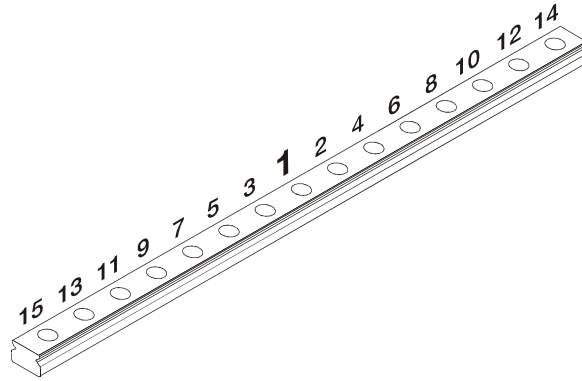
The rail which is placed on a locating side of the machine bed is designated the reference rail (rail 1).

7 Installing the Rails

7.1 Important information on installation

Rails

- The rails, machine bed, mounting plate and fastening screws must have the same room temperature at the start of installation.
- Always clamp the rails with their locating side against the locating side of the machine bed.
Both rail sides can be used as locating side.
- Always tighten the fastening screws with a torque wrench.
See section 10.2 for the tightening torques.
- Tighten the fastening screws alternately from the rail center and the rail train center.



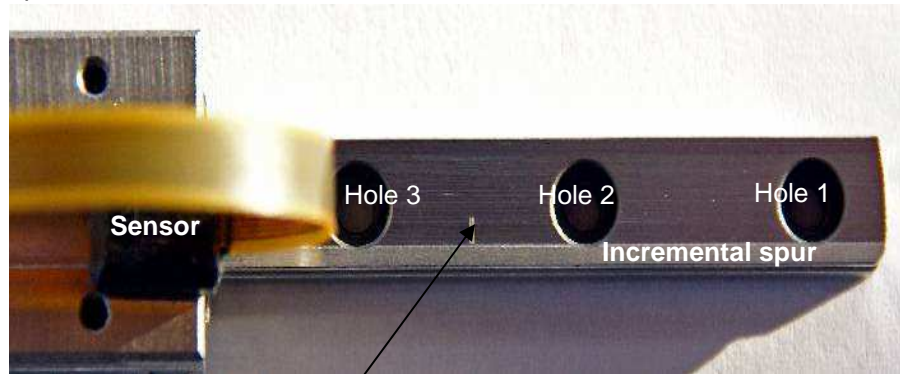
Carriage

- If possible, always leave the carriages on the protective rails or on the rail itself. To run a MINISCALE carriage on and off, use a protecting rail, see section 9.2.
- Always clamp the locating sides of the carriages against the locating sides of the mounting plate. The locating side of the carriage is the side opposite to the one bearing the SCHNEEBERGER emblem.

7.2 Positioning of rails and carriage

The sensor must be located over the measurement scale (incremental track).

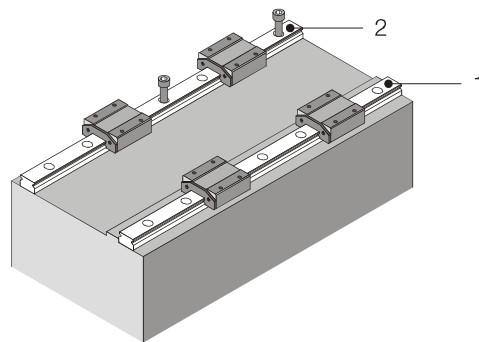
The reference mark lies next to the incremental track. Unless otherwise agreed upon, it is located between the second and third screw holes.



Reference mark

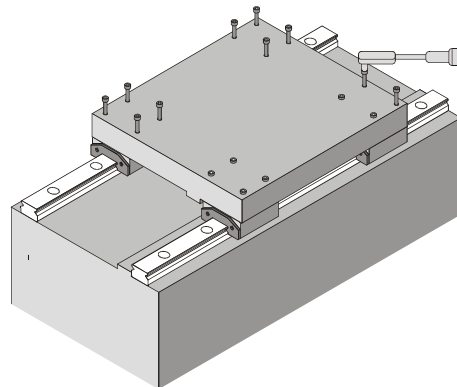
7.3 Installation Variant 1

1. Clamp the reference rail against the locating side of the machine bed and screw it securely into place, see section 7.1.

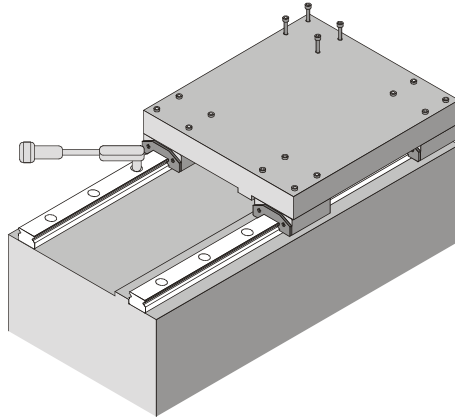


- 1 Reference rail
- 2 Opposite rail

2. Align the opposite rail parallel and provisionally secure it.
3. Place the mounting plate on the carriages and gently tighten the fastening screws.
4. Clamp the mounting plate against the locating sides of the carriages on the secured reference rail and screw securely into place.



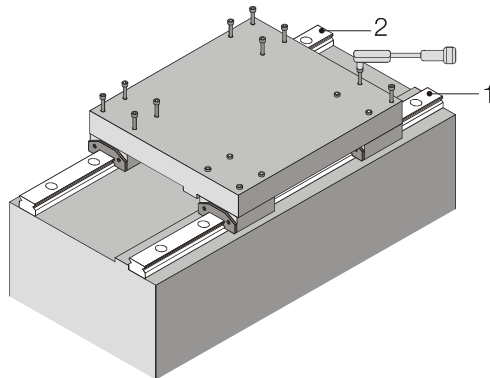
5. Securely screw a carriage on the not yet fastened rail on the mounting plate.
6. Slide the mounting plate with the carriage backwards and forwards and tighten the fastening screws of the unsecured rail securely next to the carriage, see section 7.1.



7. Securely screw on the mounting plate.

7.4 Installation Variant 2

1. Clamp both rails against the locating sides and securely screw them into place, see section 7.1.
2. If necessary, fit clamping screws, clamping bars or conical bars.
3. Place the mounting plate on the carriage and tighten all fastening screws
4. Clamp the mounting plate against the locating sides of the carriage on the reference rail and securely screw it to these two carriages.

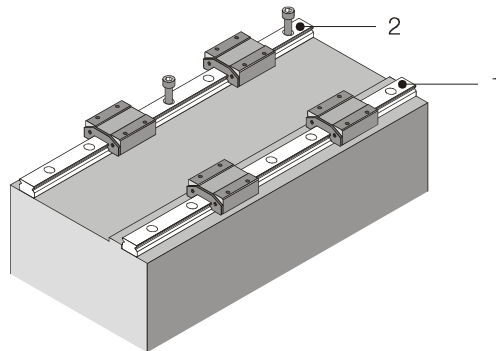


- 1 Reference rail
- 2 Opposite rail

5. Slide the mounting plate with carriage once over the entire rail length.
6. Securely screw the mounting plate into place.

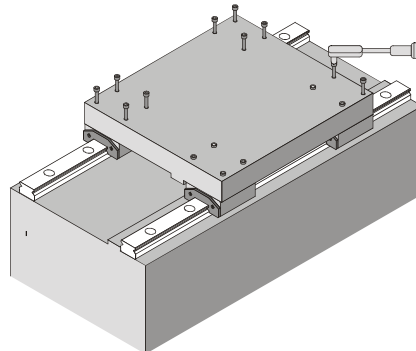
7.5 Installation Variant 3

1. Clamp the reference rail against the locating side and screw it securely into place, see section 7.1.

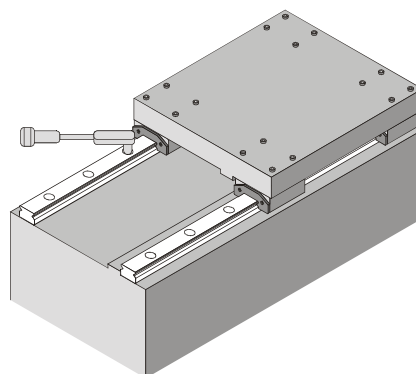


1 Reference rail
2 Opposite rail

2. Align the opposite rail parallel and provisionally secure it.
3. Place the mounting plate onto the carriages and gently tighten all fastening screws.
4. Clamp the mounting plate on each rail side against the locating sides of the carriages and securely screw into place.



5. If necessary, fit clamping screws clamping bars or conical bars.
6. Slide the mounting plate with the carriages backwards and forwards and tighten the fastening screws of the unscrewed rail securely next to the carriage, see section 7.1.



8 Connection

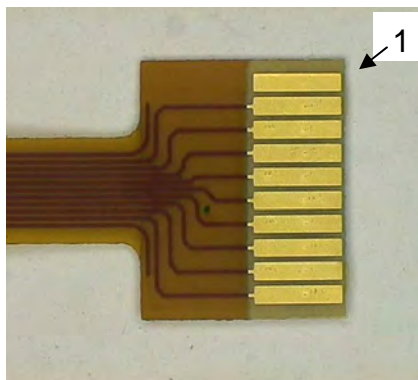
CAUTION!

The electronics can be damaged by short circuits.

Before connecting or disconnecting of cables, interrupt the power supply and ensure that it cannot be switched on.

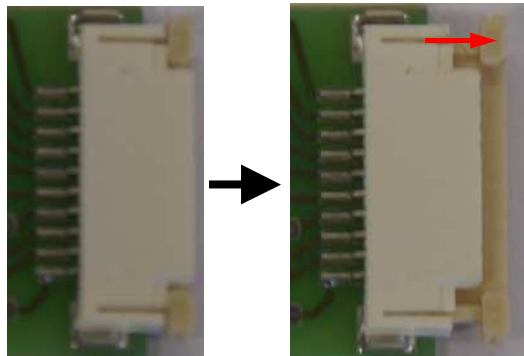
8.1 Connection of the Flexible Printed Circuit Board (FPCB)

The plug of the FPCB (see Figure below), is connected to a 10-pole zero force socket (ZIF plug).

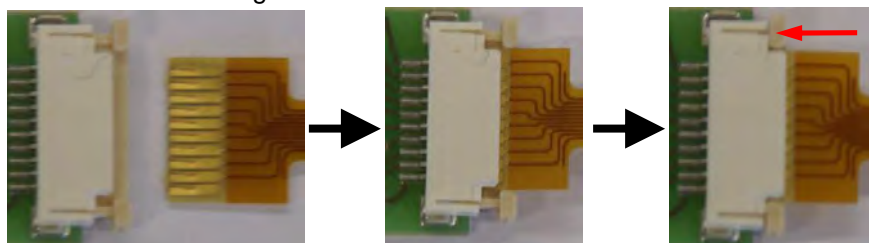


- 1: Empty
- 2: + 5 V DC
- 3: GND
- 4: Empty
- 5: Reference -
- 6: Reference +
- 7: A +
- 8: A -
- 9: B +
- 10: B -

1. ZIF plug open

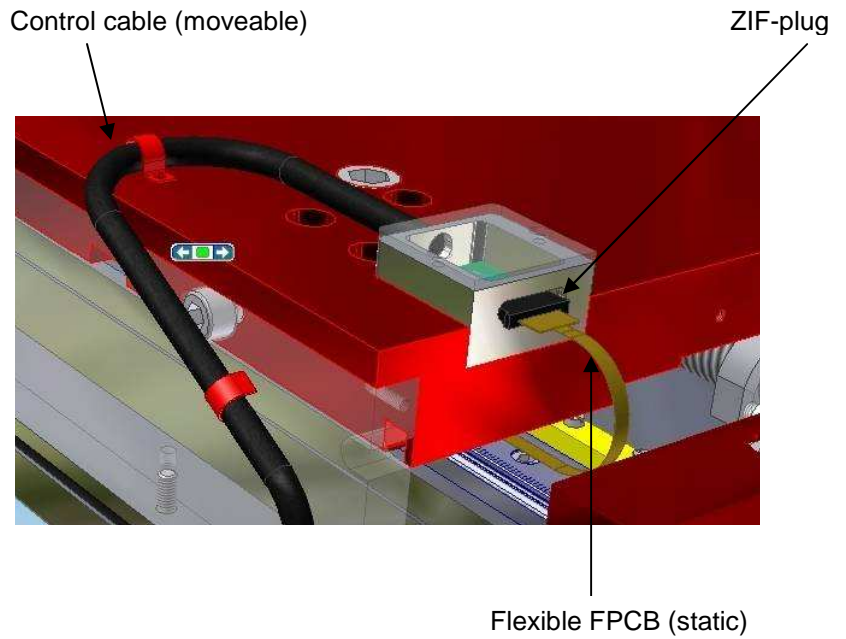


2. Insert FPCB into ZIF plug (pay attention to position of the contact surfaces!) and close ZIF Plug



CAUTION!

The FPCB forms a static connection, and therefore **must not be exposed to any movement**. For that reason movements of the electrical connection have to be compensated by the control cable.

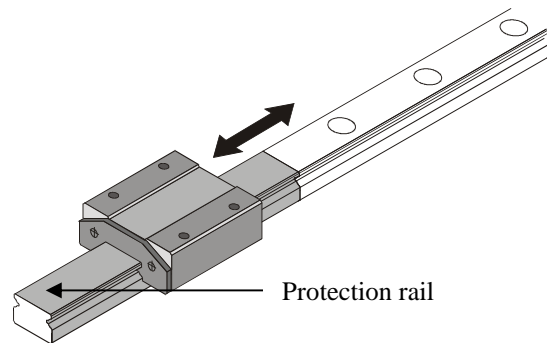


9 Maintenance

9.1 Cleaning

- Clean only with mineral spirits. Do not use nitro!
- Clean dirty rails with a soft, lint-free cloth or fabric cloth. Do not use compressed air!

9.2 Running the carriage on and off the rail



9.3 Exchanging the front plates

Front plates are attached with clips and can be easily exchanged.

10 Appendix

10.1 Technical Data

Resolution		1 μm
Accuracy	up to 30 mm	+/- 4 μm (+/- 3 μm on request)
	up to 300 mm	+/- 10 μm
Repeated Accuracy	unidirectional	+/- 1 μm
	bidirectional	+/- 2 μm
Scale on Rail	grating pitch	40 μm
	max. length	300 mm
Rail	sizes	7, 9, 12, 15 and 14, 18, 24, 42
	quality	G1
	preload	V1
	length	600 mm
Speed		Max. 5 m/s
Acceleration		Max. 30 g
Sensor	lifetime	100 000 h MTTF (mean time to failure)
	shock	300 g
	vibration	30 g (20 Hz)
Power Supply		5 VDC +/- 5 % @20 mA
Output Signal		CMOS/TTL compatible, 60 Ohm
Interface		Flexible printed circuit board with 10-pole ZIF-connector (1 mm pattern). Total length 67 mm, allowed bending radius > 10 mm
RoHS Compatibility		From 2009 MINISCALE will accord with the directive 2002/95/EC.
EMV		accords with EN 61000-6 (EEC/89/336)
Protection Class		IP 60
Environmental Influences	temperature	in service: 0° - 70° C (32° - 158° F)
		storage: -20° - 100° C (-4° - 212° F)
	humidity	10 % - 90 % (not condensable)
	magnetism	no influence
vacuum		not possible

10.2 Tightening torques for rails and carriages

Tightening torques for fastening screws:

DIN 912 μ 0,125 (**12.9**)

and

DIN 912 μ 0,2 (**A2-70**)

strength class	max. tightening torques [Nm]		
	M2	M3	M4
12.9	0.6	2.1	5.0
A2-70	0.3	1.1	2.6

Note

- When the screws are lubricated with grease containing MoS₂ the friction coefficient μ can be reduced by as much as half. As the tightening torques required to reach the maximum permissible tightening force depend on the friction coefficient, they must be reduced accordingly. The values can be obtained from the screw manufacturer's information or from the specialist literature. If necessary, carry out tests to determine the actual friction coefficient.
- Refer to the screw manufacturer's information. This is always binding.

10.3 Lubrication

At delivery the carriages are greased (KLÜBER ISOFLEX NBU 15 long term greasing).

Lubrication before use is, therefore, not necessary.

The basic lubrication is sufficient for a re-lubrication interval of every 3000 km of travel, based on the following conditions:

- Load ratio C/P = 10
- Speed V = 1m/s
- Stroke = 150 mm

The required re-lubrication intervals depend on the way the instrument is used and the environmental conditions. Below table gives the amounts of lubricant to be used:

Quantity of grease per carriage (Type MNN, MNNL or MNNXL) in cm ³							
MNN 7	MNN 9	MNN 12	MNN 15	MNN 14	MNN 18	MNN 24	MNN 42
0.02	0.04	0.08	0.12	0.02	0.06	0.10	0.16
MNNL 7	MNNL 9	MNNL 12	MNNL 15	MNNL 14	MNNL 18	MNNL 24	MNNL 42
0.03	0.06	0.10	0.17	0.04	0.07	0.13	0.22
MNNXL 7	MNNXL 9	MNNXL 12	MNNXL 15				
0.04	0.07	0.13	0.22				

Aimed application of Lubricant!

The optical measurement system is sensitive to dirt. Ensure, therefore, that no lubricant contaminates the measurement scale or that lubricant covers the sensor on the carriage.

When re-lubricating via the grease-holes, care must be taken to ensure that no lubricant gets deposited between the measurement scale and the sensor. **For this reason the carriage should be moved during the application of lubricant.**

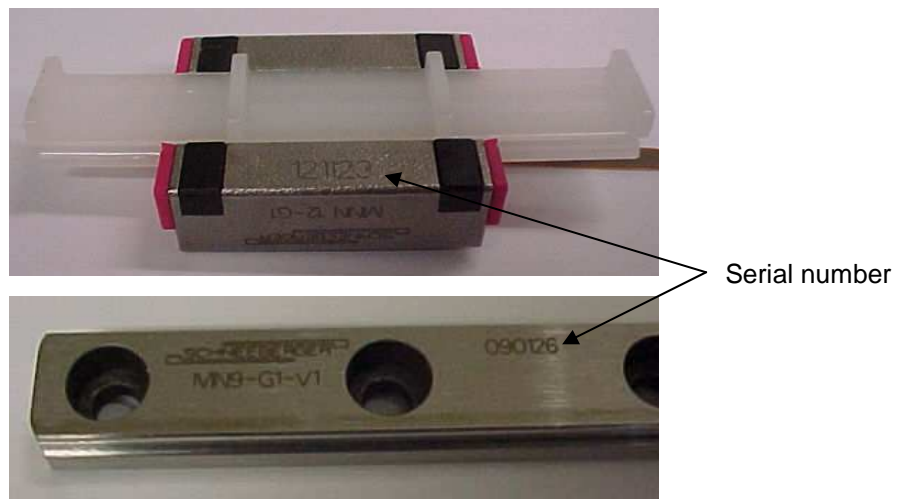
After greasing the carriage should be moved several times so as to distribute the lubricant. Use a cloth to remove excess grease.

Combined use of MINISCALE and MINIRAIL

Usually MINISCALE is ordered as a **System**. In this case, the carriages of MINISCALE as well as MINIRAIL are greased and delivered mounted on the rails.

10.4 Serial number of carriage and rails

Both carriage and rail are labelled with a serial number. On the rails it is located next to the SCHNEEBERGER logo. On the carriage it can be found on the lower side.



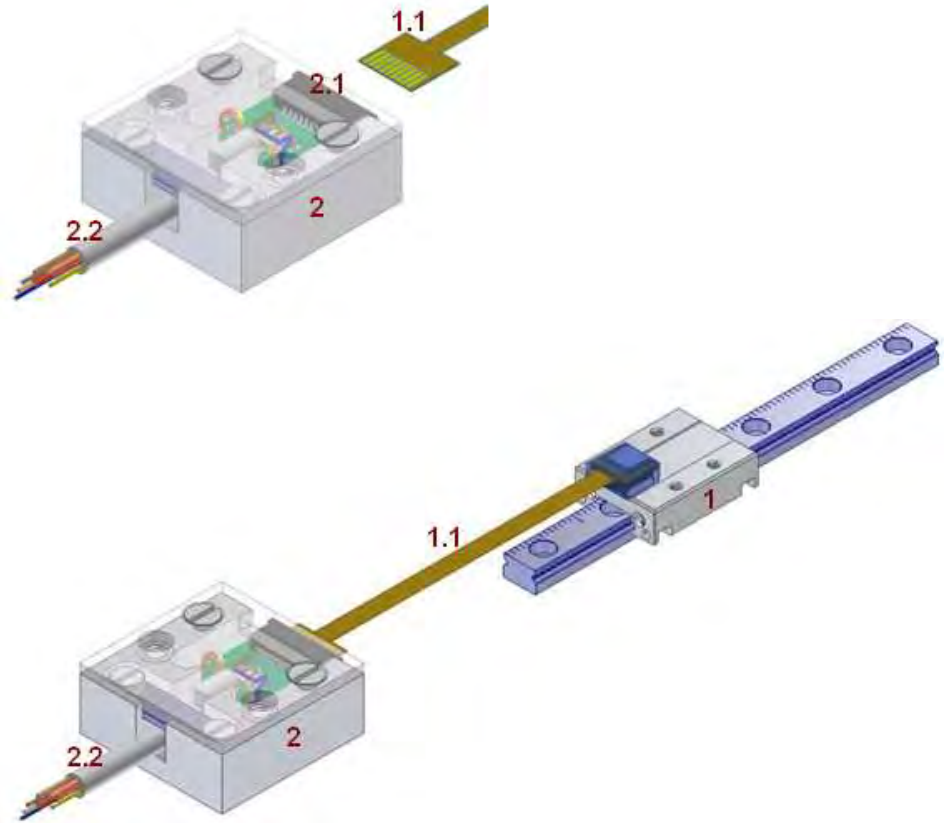
10.5 Trouble shooting

Problem	Possible cause	Procedure
No position indicated when carriage is moving	Carriage is the wrong way round on the rail (see section 7.2)	Turn carriage around
	No voltage on sensor	Check power supply
	Wrongly connected	Check connection (are the contact surfaces of the flexible printed circuit board on the correct side?)
	The flexible printed circuit board is damaged	Replace carriage with sensor
	The sensor is defective	Replace carriage with sensor
Position information do not correspond with traverse path	Rail is contaminated	Clean rail
	Sensor is covered by lubricant	Remove lubricant from the grease-holes and clean them carefully.

11 Options

11.1 Interface-Module

The interface-module serves to the connect the flexible printed circuit board to the control cable.



1 **MINISCALE**

1.1 **Flexible printed circuit board**

Length 67 mm

Smallest bendable radius 10 mm

Interface Module

2 **Housing**

Dimensions 30 x 30 x 13 mm, Aluminium anodised

The housing can lie on the lower or upper sides or fastened on the base depending upon the position of the flexible printed circuit board

2.1 **Plug**

Zif-10 (10-pole, 1 mm pattern)

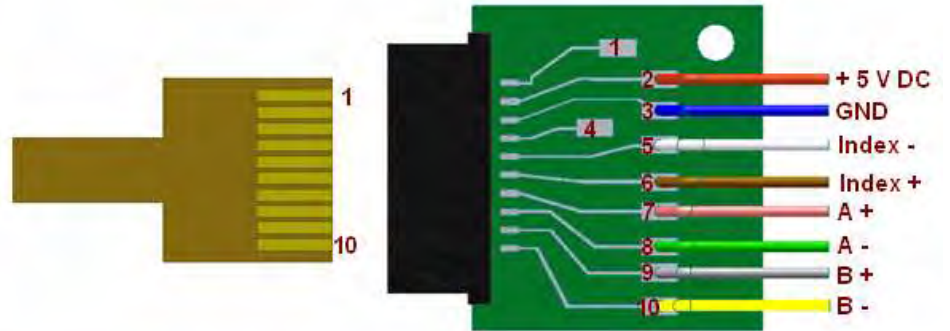
2.2 **Control cable (without plug)**

Insulated

Smallest bendable radius 62 mm

Diameter 6.2 mm, Length 2000 mm

Plug connections:



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