

Operating Instructions
for
Linear Feeders

SLK 05
SLK 1
SLK - N 6
SLK - N 6G
SLK 12

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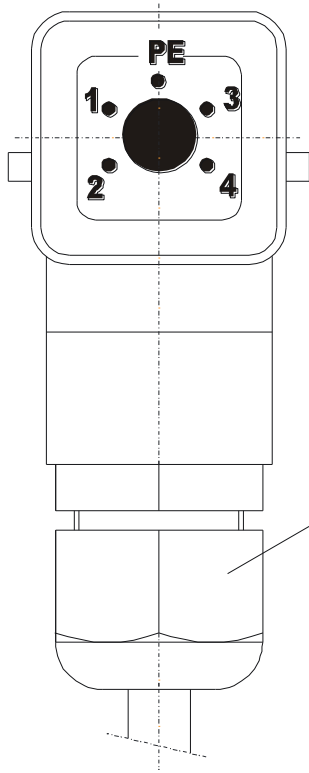
**Notice**

All linear feeders listed in this table shall be operated only in conjunction with an RNA control unit and with a mains voltage of 230 V / 50 Hz. For special voltages and frequencies please refer to the separate data sheet.

1. Technical data

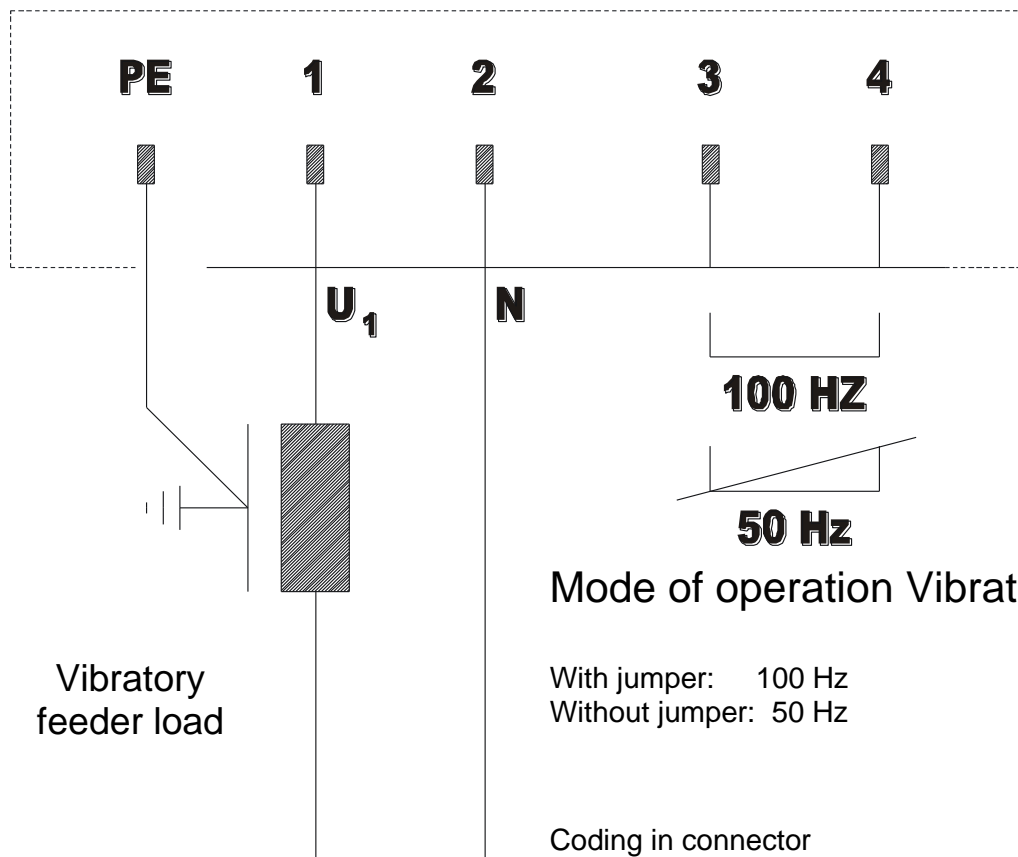
Linear Feeder Type		SLK 05	SLK 1	SLK-N 6	SLK-N 6 G	SLK 12
Dimensions L x W x H	in mm	210 x 50 x 86	305 x 123 x 104	410 x 162 x 143	600 x 196 x 143	515 x 203 x 164
Weight	in kg	2.8	7.8	22.3	34.2	33
Degree of protection		IP 54	IP 54	IP 54	IP 54	IP 54
Length of connecting cable	in m	1.5	1.5	1.5	1.5	1.5
Power input (1)	in VA	16	44	250	250	484
Current input (1)	in A	0.07	0.2	1.25	1.25	2.2
Nominal magnet voltage (1) / frequency	in V / Hz	200 / 50	200 / 50	200 / 50	200 / 50	200 / 50
Number of magnets		1	1	1	1	1
Magnet type		WS 3 / 25	ME 1/100/120	YZAW 080	YZAW 080	ME 12/50/60
Magnet colour		black	brown	red	red	brown
Air gap	in mm	0.8	1.0	2.5	2.5	3.5
Vibrating frequency	in Hz ⁻¹	100	100	50	50	50
Number of spring packs		2	2	2	2	2
Standard spring set No. of springs per pack		1 x 1.0 1 x 1.0	1 x 3.0; 1 x 2.5 2 x 2.5	2 x 3.5 1 x 3.5; 1 x 2.0	2 x 3.5 1 x 3.5; 1 x 2.0	1 x 3.0; 1 x 3.5 1 x 3.0; 2 x 3.5
Spring dimensions Length (borehole gauge) x width	in mm	55(46) x 42	73(59) x 85	108(90) x 120	108(90) x 120	128(107) x 160
Spring thickness	in mm	0.5; 0.8; 1.0	2.5; 3.0	2.0; 3.5	2.0; 3.5	3.0; 3.5
Spring material		V2A	Plastic	Plastic	Plastic	Plastic
Property classes of spring fastening bolts		8.8	8.8	8.8	8.8	8.8
Tightening torque of spring fastening bolts	in Nm	8	15	30	30	60
Max. weight of vibrating units (linear rail), depending on mass moment of inertia and desired feeder speed	in kg	1.0	1.3 - 3.4	5 - 8.5	5 - 8.5	12 - 18
Maximum rail length	in mm	350	400	800	800	1,000
Max. useful weight of the linear feeder	in kg	1.0	1.3 - 3.4	5 - 8.5	5 - 8.5	12 - 18

Pin assignment



M20 gland

grey-2 100 Hz vibration frequency
 black-1 50 Hz vibration frequency
 Metal EMC gland for frequency-controlled systems



With jumper: The jumper must be inserted between connections 3 + 4.

2. Safety Information

We have taken great care in design and manufacture of our linear feeder in order to ensure smooth and safe operation. You, too, can make an important contribution towards safety at work. We therefore ask you to read the brief operating instructions completely prior to commissioning the system. Observe the safety directives at all times!

Make sure that all persons working with or on the equipment also read the following safety directives carefully and follow them!

These Operating Instructions only apply to the equipment types indicated on the cover page.



Notice

This symbol indicates useful tips for operation of your linear feeder.



Attention

This warning triangle indicates safety notices. Non-observance of such warnings may cause serious injury or even death.

Machine hazards

- Hazards arise mainly from the electrical components of the linear feeder. If the linear feeder comes into contact with moisture or liquids there is risk of electric shock.
- Make sure that protective earthing of the power supply system is in perfect condition!

Intended use

The intended use of the linear feeder is the driving of feed rails. They serve for linear transfer as well as correctly oriented and metered supply of bulk parts.

Intended use also includes observance of the operating instructions and compliance with the maintenance rules.

For the technical data of your linear feeder please refer to 'Technical Data' in Section 1. Make sure that the rating data of the linear feeder, control system and power supply are compatible.



Notice

Operate the linear feeder in perfect condition only.

Never operate the linear feeder in areas subject to explosion hazards or in wet areas.

Operate the linear feeder only in the configuration of drive unit, control unit and vibratory system agreed with the manufacturer.

The linear feeder must never be subjected to any loads other than the parts for which this special type has been rated and dimensioned.



Attention

It is strictly forbidden to disable any guards or safety devices!

Equipment user's duties

- Observe the directives given in the operating instructions for any kind of work (operation, maintenance, repairs, etc.).
- Refrain from any working practice that affects the safety at the linear feeder.
- Make sure that only authorised personnel work at the linear feeder.
- Give immediate notice to the management of any changes that have occurred on the linear feeder affecting safety.



Attention

The linear feeder must be installed, put into operation and maintained by professional personnel only. Observe the legally binding provisions for the qualifications of qualified electrical workers and instructed workers as defined by standards IEC 364 and DIN VDE 0105, part 1.



Caution: Electromagnetic field

Magnetic fields may affect a cardiac pacemaker. Therefore, persons wearing a cardiac pacemaker are recommended to keep a distance of at least 25 cm.

Noise emission

The noise level at the place of use depends on the complete line into which the hopper will be incorporated and on the material to be conveyed. For this reason, sound pressure levels in accordance with the 'Machinery' directive can only be determined at the place of installation. If the noise level at the place of use exceeds the permissible, sound-insulating hoods can be installed which we can offer on request.

2.1. Applicable directives and standards

The linear feeder has been manufactured in accordance with the following directives:

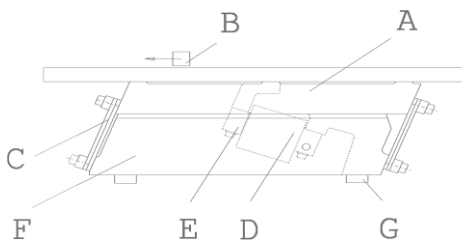
- 2006/42/EC Machinery Directive
- 2014/35/EU Low Voltage Directive
- 2014/30/EU Electromagnetic Compatibility Directive

We assume that our product will be incorporated into a stationary machine.

The applicable standards are specified in the Declaration of Incorporation (according to Annex II B of the Machinery Directive).

3. Design and functional description of linear feeder

Intended use of linear feeders is the feeding of parts. The driving force is provided by an electromagnetic coil. The figure below is a schematic representation of a linear feeder:



- A Feed rail and vibrating mass
- B Parts handled
- C Spring pack
- D Drive magnet
- E Armature
- F Exciter mass
- G Shock absorber

The linear feeder belongs to the family of vibratory feeders, but produces a straight-line motion. Electromagnetic oscillations are converted into mechanical vibrations that are used for conveying a material B. When current is applied to magnet D which is rigidly connected to counter mass F, the magnet exerts a force which attracts and releases armature E in synchronism with the mains frequency. Within each period of the 50 Hz A.C. mains supply, the magnet will achieve its maximum power of attraction twice as this force builds up independently of the current flow direction. Accordingly, the vibration frequency is 100 Hz in this case. If one half-wave is removed, the vibration frequency is 50 Hz. The vibration frequency of your linear feeder is indicated in the 'Technical data' table in Section 1.

A linear feeder is a resonant system (spring-mass system). As a result, its factory set-up will rarely meet your on-site requirements. Section 5 describes in detail how you can adapt the feeder to your specific requirements.

The linear feeder is controlled by a low-loss electronic control unit (type ESG 2000 or ESG 1000). The linear feeder control unit is supplied loose (not installed). The controller has a 5-pin connector on its front panel for connection to the linear feeder.

For assignment of the socket pins refer to the technical data in Section 1.



Notice

For comprehensive information on the full range of control devices please refer to the 'Control Units' operating instructions.

All control units have two essential operating elements:

- The **power switch** is used to energize and de-energize the linear feeder.
- A **rotary knob** (or buttons) can be used to set the feed rate of the system.

Frequency controller: Tuning of the linear feeders can also be done by means of frequency controllers. For detailed description of the tuning procedure refer to the frequency controller operating instructions.

4. Shipment and installation

4.1. Shipping and handling



Notice

Take care that the linear feeder cannot collide with other objects during handling operations.

For the weight of the linear feeder please refer to the table titled 'Technical Data' in Section 1.

4.1.1. Shipment ex works

The linear feeders are delivered ex works in a box or crate.

4.1.2. On-site moving

The weight of the linear feeder depends on its dimensions and motor rating. Please refer to the shipping documents for the weight of your specific equipment.



Attention

Check all guards when unpacking. Replace any damaged parts before commissioning!



Attention

For lifting the feeders, be sure to use only sufficiently dimensioned vehicles, ropes, chains and sling gear.



Attention

Handling operations to be carried out only by employees who are capable of performing such work due to their own knowledge and experience in this field.



Warning

Warning against suspended loads

4.2. Installation

The linear feeder should be mounted on a stable substructure (available as an accessory) at the point of use. This substructure must be dimensioned to ensure that no vibrations from the linear feeder can be transmitted.

Fix the linear feeder to the shock absorbers (part G in overview drawing of Section 3) from below. Following table gives an overview of the drilling data for the drive units used:

Linear Feeder Type	Length in mm	Width in mm	Shock absorber thread
SLK 05	180	35	M 4
SLK 1	200	70	M 4
SLK-N 6	270	100	M 6
SLK-N 6 G	270	100	M 6
SLK 12	345	140	M 6

Table: Drilling data

Make sure that the linear feeder cannot touch other devices during operation.

For further details on the control unit (drilling template, etc.), please refer to the separate operating instructions manual of the control unit.



Attention

The linear feeder is intended to complete / to be incorporated into a complete system. Do not operate the machine before safe completion/incorporation by the user.

5. Commissioning



Attention

Make sure that the machine frame (rack, substructure, etc.) is connected to the protective earth conductor (PE). Protective earthing has to be provided by user as necessary.

Make sure that:

- the linear feeder is arranged freely without contact to any solid body
- the linear rail is properly aligned and firmly bolted in place
- the linear feeder connecting cable is plugged into the control unit.



Attention

Electrical connection of the linear feeder must be made by trained professional electricians only! When making any change to the electrical connection make absolutely sure that the 'Control Units' operating instructions are duly observed.

- The available electricity supply (frequency, voltage, power) must correspond to the connection data of the control system (see rating plate on the control unit).

Plug the cable of the control unit into a power socket and operate the power switch to energize the control unit.



Notice

For linear feeders that are supplied as a completely set-up system the optimum feed rate has been factory-set. It is marked with a red arrow on the dial of the rotary knob. In this case set the rotary knob to this mark.

Optimum tuning is achieved when the desired feed rate is obtained with a control unit setting of 80 %. In case of larger deviations (> +/- 15%) you should re-tune the system.

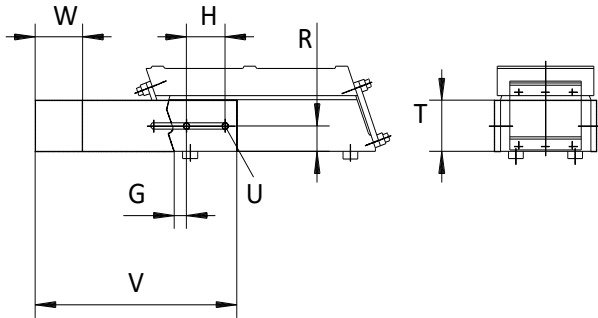
Adjusting the feeding behaviour



Notice

As a first step, make a rough adjustment of the feeder speed (by tuning the natural frequency). Then tune the feeding behaviour of the system. As the last step, fine-tune the feeder speed (natural frequency).

For linear feeders without counterweight the feeding speed at the exit end is always higher than that at the entry end. This can be seen from the fact that the vertical amplitude of the feed rail is larger at the exit end. This difference in speed can be compensated by mounting a counterweight. This counterweight increases the counter mass of the linear feeder and can be mounted in accordance with following sketch:



Type	SLK 1	SLK - N 6	SLK 12
G	10	20	10
H	45	65	2 x 50
R	24	40	40
T	40	80	80
U	M 8	M 10	M 10
V	200	340	390
W	40	80	80

The size of the counterweight must be determined through trials. Linear feeders of types **SLK 05** and **SLK - N 6 G** come with a factory-mounted counterweight.

To achieve a uniform feeding speed adjust the feed rail as follows:

- If the vertical amplitude of the feed rail is larger at the exit end than at the entry end, you must either mount a counterweight or move the installed counterweight all the way outward in the oblong hole. For type SLK 05 weight plates must be mounted in addition. If this is not sufficient, an additional counterweight must be mounted.
- If the vertical amplitude of a feed rail with mounted counterweight is smaller at the exit end than at the entry end, proceed in opposite manner.

Tuning the natural frequency

Linear feeders supplied without a rail are factory-tuned for average weights of the vibrating units. To ensure optimum feeding behaviour the linear feeder has to be fine-tuned for the actual local operating conditions. Tuning is done by adding or removing leaf springs and spacers. First check that the correct control unit is connected (see table 'Technical Data' with frequency, voltage and power ratings in Section 1).

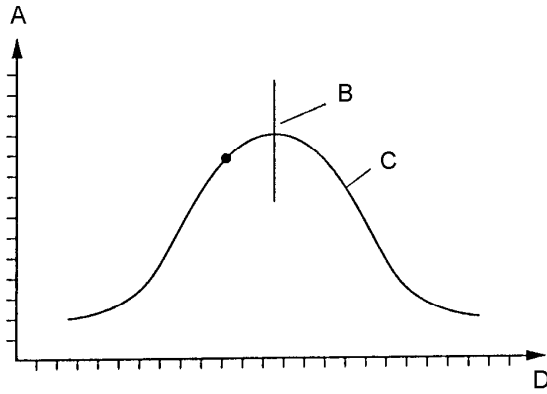
Now perform following steps:

- Firmly tighten all spring and rail fastening screws. For the tightening torques of the spring fastening screws please refer to the table titled 'Technical Data' in Section 1.
- Check that the magnet is compatible with the voltage and frequency ratings specified under Technical Data.
- Measure the air gap. Adjust the air gap to the correct setting if it doesn't match the values specified under Technical Data.
- Fill the feed rail with parts and set the feeding capacity to 90% via the rotary knob of the controller.
- Slowly loosen one of the bottom fastening screws on one spring pack (by about a quarter turn or half turn).

If no change in the feeding speed can be detected after loosening the first screw, slowly loosen another bottom fastening screw.

When you loosen the spring fastening screw you can observe a change in feeder speed.

The following graph shows the resonance curve of a linear feeder:



- A Feed rate
- B Resonance frequency of the system
- C Resonance curve (not true to scale)
- D Spring force (number of springs)



Notice

The resonance frequency of the linear feeder must not be equal to the mains frequency.

If the feeder speed decreases after you loosen the spring fastening screw, please proceed as described in **section 5.1**.

If, on the contrary, the feeder speed increases, proceed as described in **section 5.2**.



Notice

Tuning is facilitated by the use of an electronic frequency converter available from our range of accessories.

The vibratory feeder should be tuned so that the desired feeder speed is obtained with a controller setting of approx. 80%.

5.1. Feeder speed decreases?

Install additional springs (including spacers). Start by adding one spring to **one** spring pack. If the feeder speed continues to decrease after you loosen a fastening screw anew, install an additional spring with spacers in the second spring pack. When using springs of differing thicknesses, make sure that the thinnest spring rests against the contact surface.

5.2. Feeder speed increases?

Remove springs (including spacers). Start by removing one spring from **one** spring pack. If the feeder speed continues to increase after you have loosened another fastening screw, remove more springs one by one.

When mounting or removing additional springs, make sure that the engagement depth of the spring fastening screws corresponds to 1.5 - 2 times the screw diameter. For the tightening torque of spring fastening screws refer to section 1 'Technical data'.



Notice

If the rotary knob on the controller is set to 100% and the air gap correctly set, the magnet must not hit the armature upon power-on. If it does, proceed as described under section 5.2. (removal of springs)

Objective of the tuning procedure:

When the desired feeder speed is obtained at a controller setting of 80 %, the feeder speed must always decrease when the spring fastening screw is loosened.



Notice

See to it that one third of the spring force is installed in the entry-end spring pack and two thirds of the spring force in the exit-end spring pack.

The spring force of a spring increases to the square of its thickness. For example, a 3.5 mm strong spring has a spring force similar to that of two springs of 2 mm thickness each combined with two springs of 1.5 mm thickness each, whereas a 4 mm strong spring corresponds to a combination of four springs of 2 mm thickness each.

6. Feed rail design rules

For feed rail projections in longitudinal direction of the vibratory unit observe a ratio of **1/3 on the entry end to 2/3 at the exit end**.

The design of the rails must provide maximum stability. Upright profiles of high section modulus are to be preferred (U profiles, square tubes etc.).

In particular, rails used for feeding thin parts, such as punched parts etc., should have the largest possible clearance between parts and cover. However, it must be ensured that the parts handled do not pile up or get jammed.

Take care to locate the rail as precisely on the centre of the vibratory unit as possible. Rails projecting on one side of the vibratory unit may have to be balanced using counterweights.

7. Maintenance

Linear feeders basically require no maintenance. They should be cleaned when soiled or after coming into contact with liquids.

- Before starting such work be sure to pull the mains plug.
- Clean the inside of the linear feeder, and in particular the air gap of the coil.
- After plugging in the mains plug the linear feeder is again ready for operation.

Attention



For installation, maintenance and repair work all poles of the power supply must be disconnected from the linear feeder in compliance with VDE provisions. Any work on electrical equipment of the linear feeder shall be carried out exclusively by a professional electrician, or by instructed persons (see chapter 2) working under the direction and supervision of a professional electrician, according to electrotechnical rules.

Attention



Be careful when working on linear feeders! The magnets can get hot during operation. Therefore let magnets cool down before working on them. If this is not possible, take suitable protective measures such as the use of gloves.

Attention



If any guards have been removed, be sure to fit them back in place!

8. Spare parts and customer service

For an overview of genuine spare parts available please refer to the separate spare parts list. In order to make sure that your order is processed swiftly and correctly please specify the device type (see rating plate), the quantity required, the spare part designation and the spare part number.


For a list of Service Center addresses refer to the back cover page of this manual.

9. What if... (Advice on troubleshooting)



Attention

Only professional electricians are allowed to open the control unit or connector. Pull the mains plug before opening!

Fault	Potential cause	Remedy
Linear feeder does not start on power up	<p>Power switch off</p> <p>Mains connector of control unit not plugged-in</p> <p>Connecting cabled between linear feeder and control unit not plugged-in</p> <p>Defective fuse in control unit</p>	<p>Close power switch</p> <p>Plug in the mains connector</p> <p>Plug 5-pin connector into control unit</p> <p>Replace fuse</p>
<p>Only slight feeder vibration</p> 	<p>Rotary knob on control unit set at 0 %</p> <p>Wrong vibration frequency</p> <p>Attention If you operate the linear feeders of type SLK 05 and SLK 1 without having inserted the jumper in the 5-pin connector, there is a risk of damage to the controller and magnet!</p>	<p>Set control unit to 80 %</p> <p>Check that coding in plug connector of the linear feeder is correct. (See rating plate and 'Technical Data' in Section 1.)</p>
The linear feeder no longer meets the required feed rate after prolonged operation.	<p>Fixing screws of linear rail have come loose.</p> <p>Screws of one or both spring packs have come loose.</p> <p>Coil-to-armature air gap has gone out of adjustment</p> <p>Broken springs</p>	<p>Re-tighten the screws.</p> <p>Tighten screws (for tightening torques see 'Technical Data' in Section 1).</p> <p>Readjust the coil-to-armature air gap (for air gap size see 'Technical Data' in Section 1).</p> <p>Replace broken springs</p>
Linear feeder makes loud noises.	Foreign matter in air gap	Stop linear feeder and remove foreign matter. Then check the coil-to-armature gap.



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