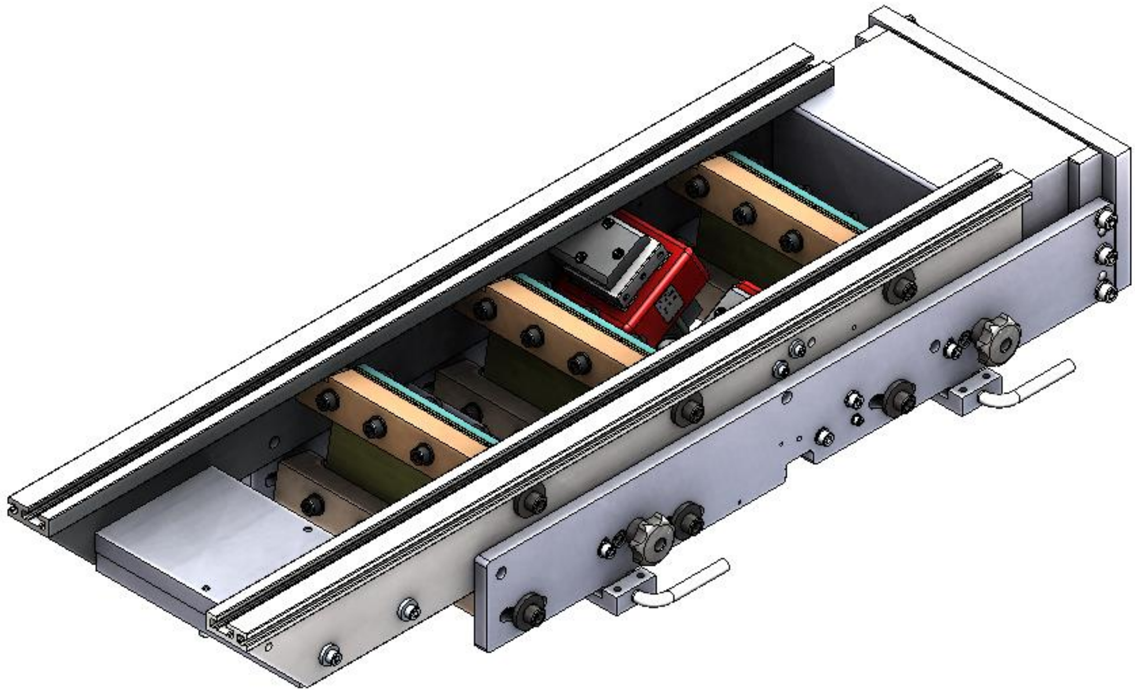


Operating Instructions
for
Linear feeder

SLF 1000 - 1000
SLF 1000 - 1500

SLF 1020 - 1000
SLF 1020 - 1250
SLF 1020 - 1500

SLF 1040 - 1000
SLF 1040 - 1250
SLF 1040 - 1500

Table of Contents

Declaration of Incorporation

according to Machinery Directive 2006/42/EC

We hereby declare that our product is intended to be incorporated into or assembled with other machinery to constitute one machine in terms of the Directive indicated above (or parts thereof) and that it must not be put into operation until the relevant machinery into which it is to beincorporated has been declared to be in conformity with the EC Machinery Directive.

Applied harmonised standards: DIN EN 60204 T1, DIN EN ISO 12100-2011-03, DIN EN 619, DIN EN 620

Remarks: This product has been manufactured in accordance with the Low-Voltage Directive 2014/35/EU.

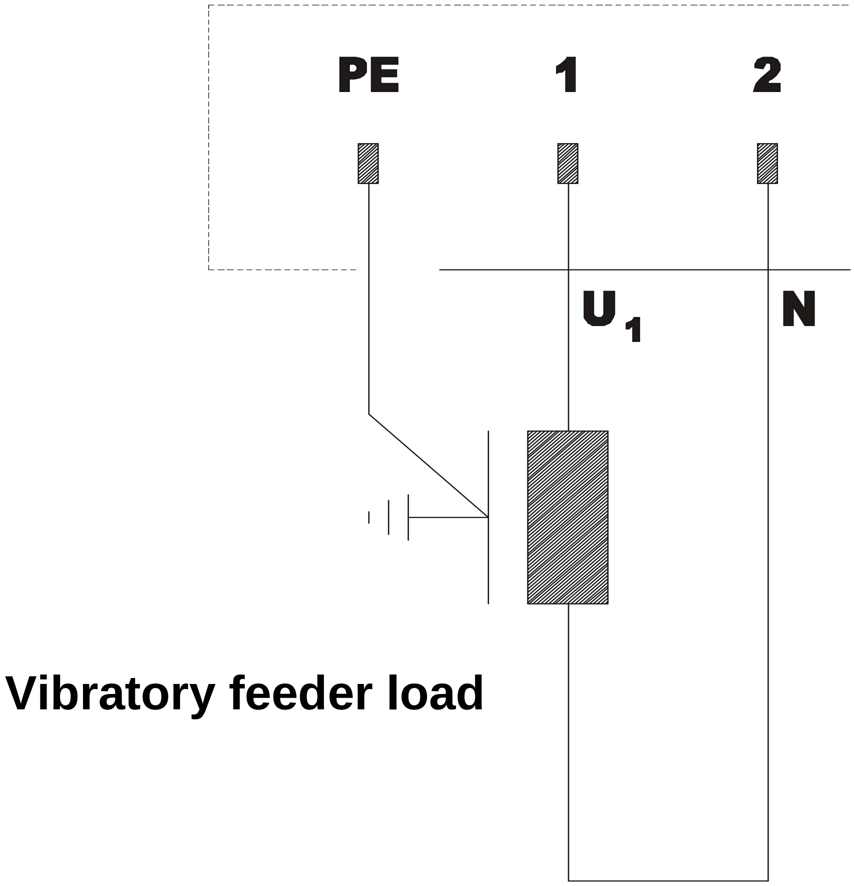
We assume that our product will be incorporated into a stationary machine.

Rhein-Nadel-Automation

Managing Director
Jack Grevenstein

1. Technical data

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. Special voltages (please refer to separate data sheet).



All linear feeders of types SLF 10XX have a vibration frequency of 50 Hz and are '-1' devices.

Linear feeder type	SLF 1000 - 1000	SLF 1000 - 1500
Dimensions L x W x H (mm)	1,100 x 244 x 178	1,600 x 244 x 178
Weight (kg)	62	80
Degree of protection	IP 54	IP 54
Connecting cable length (m)	2	2
Power input[1)] (VA)	2 x 251	4 x 251
Current [1)] (A)	2.51	5.02
Nominal magnet voltage [1)] / frequency (V / Hz)	200 / 50	200 / 50
Number of magnets	2	4
Magnet type/ Article code	YZAW 080 / 35000763	YZAW 080 / 35000763
Magnet colour	red	red
Air gap (mm)	2	2
Vibration frequency in Hz [1)]	50	50
Number of spring packs	2	3 (+1 optional)
Standard spring configuration per spring pack	4 x 3.5 mm	4 x 3.5 mm
Spring dimensions (mm) Length x width (borehole gauge)	128(108) x 160(2x60)	128(108) x 160(2x60)
Spring thickness (mm)	3.5	3.5
Property classes of spring fastening bolts	8.8	8.8
Tightening torque of spring fastening bolts (spring pack)	60 Nm	60 Nm
Tightening torque of lateral spring fastening bolts	80 Nm	80 Nm
Max. weight of vibrating units (linear rail)	approx. 35 kg	approx. 55 kg
Maximum rail length (mm)	1,400	2000
Max. useful weight, depending on bulk product	approx. 30 kg	approx. 45 kg

Linear feeder type	SLF 1020 - 1000	SLF 1020 - 1250	SLF 1020 - 1500
Dimensions L x W x H (mm)	1,100 x 420 x 190	1,350 x 420 x 190	1,600 x 420 x 190
Weight	170 kg	175 kg	180 kg
Degree of protection	IP 54	IP 54	IP 54
Connecting cable length (m)	1	1	1
Power input [1)] (VA)	2 x 570	2 x 570	2 x 570
Current [1)] (A)	5.7	5.7	5.7
Nominal magnet voltage [1)] / frequency (V / Hz)	200 / 50	200 / 50	200 / 50
Number of magnets	2	2	2
Magnet type/ Article code	YZUW 090 / 35000745	YZUW 090 / 35000745	YZUW 090 / 35000745
Magnet colour	red	red	red
Air gap (mm)	1.5	1.5	1.5
Vibration frequency in Hz [1)]	50	50	50
Number of spring packs	3	3	3
Standard spring configuration per spring pack	3 x 3.5 mm	4 x 3.5 mm	5 x 3.5 mm
Spring dimensions (mm) Length x width (borehole gauge)	222 (3x60) x 130 (108)	222 (3x60) x 130 (108)	222 (3x60) x 130 (108)
Spring thickness (mm)	3.5	3.5	3.5
Property classes of spring fastening bolts	8.8	8.8	8.8
Tightening torque of spring fastening bolts (spring pack)	60 Nm	60 Nm	60 Nm
Tightening torque of lateral spring fastening bolts	80 Nm	80 Nm	80 Nm
Max. weight of vibrating units (linear rail)	approx. 80 kg	approx. 85 kg	approx. 95 kg
Maximum rail length (mm)	2,000	2,250	2,500
Max. useful weight, depending on bulk product	approx. 80 kg	approx. 80 kg	approx. 90 kg

Linear feeder type	SLF 1040 - 1000	SLF 1040 - 1250	SLF 1040 - 1500
Dimensions L x W x H (mm)	1,100 x 525 x 190	1,350 x 525 x 190	1,600 x 525 x 190
Weight	230 kg	235 kg	240 kg
Degree of protection	IP 54	IP 54	IP 54
Connecting cable length (m)	1	1	1
Power input [1)] (VA)	570	570	570
Current [1)] (A)	5.7	5.7	5.7
Nominal magnet voltage [1)] / frequency (V / Hz)	200 / 50	200 / 50	200 / 50
Number of magnets	2	2	2
Magnet type/ Article code	YZUW 090 / 35000745	YZUW 090 / 35000745	YZUW 090 / 35000745
Magnet colour	red	red	red
Air gap (mm)	1.5	1.5	1.5
Vibration frequency in Hz [1)]	50	50	50
Number of spring packs	3	3	4 (+1 optional)
Standard spring configuration per spring pack	5 x 3.5	5 x 3.5	5 x 3.5
Spring dimensions (mm) Length x width (borehole gauge)	322 (4x60) x 130 (108)	322 (4x60) x 130 (108)	322 (4x60) x 130 (108)
Spring thickness (mm)	3.5	3.5	3.5
Property classes of spring fastening bolts	8.8	8.8	8.8
Tightening torque of spring fastening bolts (spring pack)	60 Nm	60 Nm	60 Nm
Tightening torque of lateral spring fastening bolts	80 Nm	80 Nm	80 Nm
Max. weight of vibrating units (linear rail)	approx. 100 kg	approx. 110 kg	approx. 120 kg
Maximum rail length (mm)	2,000	2,250	2,500
Max. useful weight, depending on bulk product	approx. 100 kg	approx. 100 kg	approx. 115 kg

[1)]For special connections (voltage / frequency) see rating plate on the magnet / drive

2. Safety directives

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 at 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 hand indicates useful tips for operation of the 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 products.
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 feeders have been manufactured in accordance with the following directives:

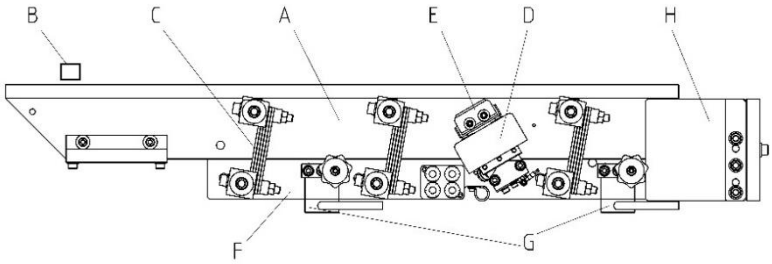
- EC Low-Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC

We assume that our product will be incorporated into a stationary machine. The requirements of the EMC Directive must be satisfied by the user.

The applicable standards are specified in the Declaration of Conformity.

3. Design and functional description of linear feeder

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



A Feed rail and vibrating mass
B Parts handled
C Spring pack
D Driving magnet
E Armature
F Counter mass
G Suspension system
H Counterweight

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 this type of linear feeder is 50 Hz (see technical data in section 1).

A linear feeder is a vibration 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 with or without frequency control. The linear feeder control unit is supplied loose (not installed). The control unit 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.
- The **buttons** or the **rotary knob** can be used to set the feed rate of the system.

The tuning procedures with the different control unit models are described in section 5.

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. Shipment

☞ **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.

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.

Shipping braces
The linear feeder is fitted with shipping braces to prevent it from vibrating freely during shipment. They are marked black/yellow and must be removed for operation. Be sure to re-mount them prior to any subsequent shipment/handling.

4.2. Installation

The linear feeder should be mounted on a stable substructure at the point of use. This substructure must be dimensioned such as to ensure that it does NOT vibrate during operation.

5. Commissioning / tuning

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.

Attention

It is imperative that the vibrating drive be connected to the equipotential bonding system of the overall equipment before commissioning. The adaptation points are marked with earth symbols.
See also: DIN EU 60204 / VDE 0100-540

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.

Verify that

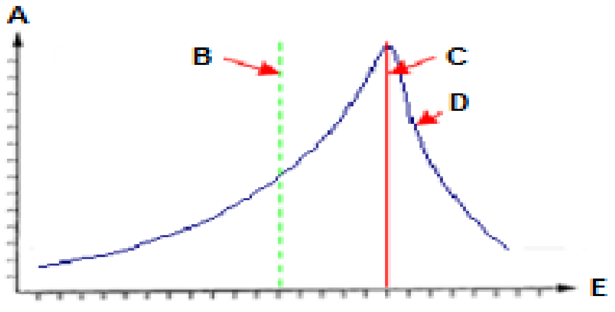
- the linear feeder is arranged freely without contact to any solid body.
- the linear rail is properly aligned and firmly bolted in place.
- the linear feeder connecting cable is plugged into the control unit.
- The available electricity supply (frequency, voltage, power) must correspond to the connection 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.

The following graph shows the resonance curve of a linear feeder. This information is fundamental for understanding the workings of a vibration system which is essentially made up of the vibrating masses, of a **spring constant**, and of the resulting **resonance frequency**. In operation, the **driving frequency of the current** causes the system to vibrate. These vibrations propel the parts to be conveyed at the feed rate (A). In the case of a linear feeder, there are four possibilities to tune the vibration system:

1. Changing the masses of the vibratory unit and the counter mass. This changes the resonance frequency (B)
2. Changing the spring constant by adding or removing springs This changes the resonance frequency (B)
3. The driving frequency can be changed via the frequency controller (point on the curve)
4. Adjustment of spring angle to obtain uniform feeder speed.



A Feed rate
B Desired feeder speed
C Resonance frequency of the system
D Resonance curve
E Spring force (number of springs) increasing

Notice

The resonance frequency of the linear feeder must not coincide with the mains frequency (driving frequency). In most cases, it should be lower than this driving frequency.

When changing springs, take into account that leaves of different thicknesses have different spring forces. As the spring force increases to the square of spring thickness, please note the following examples:

- 2.5 mm spring thickness = 6.25 spring force
- 3.0 mm spring thickness = 9.0 spring force
- 3.5 mm spring thickness = 12.25 spring force

One 3.5-mm thick leaf spring produces approximately the same spring force as two 2.5 mm thick leaf springs. It is always recommended, therefore, to perform the final adjustment / fine-tuning with thin leaf springs.

Notice
Changing the counter mass or the vibrating mass (by adding or removing counterweights or add-on weights) will change the conveying speed or the natural frequency, respectively, of the linear feeder. If necessary, leaf springs must be added or removed.

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.
The feeder sizes come factory-equipped with a spring set designed for a feed rail weight that is approx. 25% lower than the maximum rail weight specified in the Technical Data (Section 1), and for a feeder speed of approx. 2 - 6 m/min.
If heavier or lighter feed rails are installed, or if much faster or slower feeder speeds are required, it will be necessary to change either the natural frequency of the vibrating system, or the driving frequency. If you are using a compact control unit without frequency control (using 50 Hz) it is mandatory to tune the system mechanically by adding or removing springs.
In conjunction with frequency controllers (such as ESR 2000) it is usually possible to dispense with mechanical tuning by adjusting the driving frequency on the control unit.
The fundamentals and procedures of mechanical tuning and of frequency-based tuning are described below.

5.1. Mechanical tuning procedure for use with compact control unit

If the feed rail assembly or the desired feed rate of a linear feeder deviate significantly from the values stated under Technical Data, or if no frequency control unit is provided, the vibration system is tuned mechanically.
As a first step it is important to determine the current tuning region of the vibration system: either the **natural frequency is less than 50 Hz** or **the natural frequency is higher than 50 Hz.** To do this, you must determine the feeder speed (using amplitude stickers) and then remove a counterweight while leaving all other settings/parameters unchanged. Now you must measure the feeder speed again. The result and the procedure to follow are shown in the table below:

Mechanical tuning of the feeder speed

Change after removal of a small counterweight	Location of natural frequency	Feeder speed to be faster	Feeder speed to be slower
Feeder speed slows down	**>** 50 / 100 Hz 'super-critical'	1. Refit the counterweight 2. **Remove** springs	1. Refit the counterweight 2. **Install** springs
Feeder speed increases	**<** 50 / 100 Hz 'sub-critical'	1. Refit the counterweight 2. **Install** springs	1. Refit the counterweight 2. **Remove** springs

Notice
'Super-critical' means that the *resonance frequency* of the vibrating system is *higher* than the frequency of the current driving the system.
'Sub-critical' means that the *resonance frequency* of the vibrating system is *lower* than the frequency of the current driving the system.

Notice
The feeder speeds that can be obtained by tuning the system in the 'super-critical' region are lower than the speeds possible in the sub-critical region. In addition, the speed differences between loaded and unloaded feeder are bigger in this case. 'Sub-critical' tuning should be favoured in most cases.

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).

5.2. Tuning procedure for use with frequency-controlled control unit

Tuning by adjusting the driving frequency is also based on the fundamental principle of the resonance curve described in Section 5.
Following procedure is recommended (for systems without vibration amplitude sensor) in most applications:

1. Shipping braces 'X' must be removed and all components of the rail assembly must be properly mounted.
2. Set the A value to approx. 60 % as a preliminary guideline. (Current limiter to P90% max.205V)
3. Set the frequency to 70 Hz and power up.
4. Slowly approach 50 Hz while you continue to monitor/observe the speed all the time.
5. If the magnets hit the armatures you must lower the A value. If very little vibration occurs, increase the A value and repeat the slow, progressive approach (see item 4).
6. Find the resonance frequency (biggest vibration amplitude) and note it down.

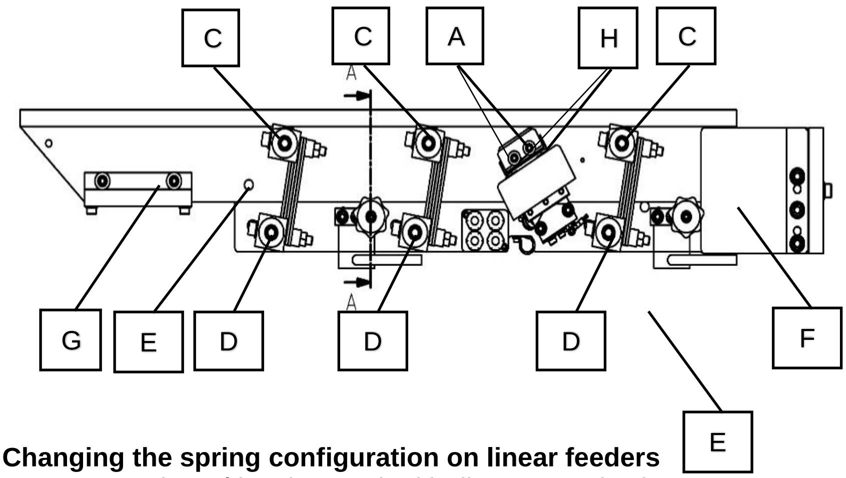
If the resonance frequency deviates by +6Hz/-3Hz from 50 Hz you must install or remove springs.

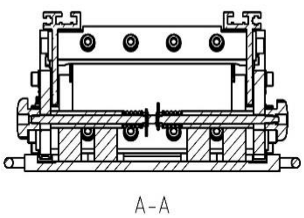
7. The driving frequency for operation is now set approx. 1-2 Hz above the determined resonance frequency.
8. Next, the required vibration amplitude (speed) is set via the A value.
   The A value setpoint should be between 70% and 80 %.

Notice

For the tuning procedure of a **vibrating system with amplitude sensor** refer to the operating instructions for the respective control unit.

5.3. Adjusting the synchronism and other procedures for optimizing the system





Changing the spring configuration on linear feeders

Insert a round steel bar (St 37 K) with diameter 12 h9 (approx. 400 mm long, one end angled) into the two adjusting holes 'E'.
Remove the M12 spring fastening screws 'C+D'. Now you can remove the spring pack to the bottom. To ensure centered position of the complete spring pack we recommend to use an assembly device (can be sourced from RNA). When replacing springs take care to observe the specified tightening torque (see technical data), also for the lateral spring fastening screws. After that, remove the round steel bars.

Adjusting the desired feeding behaviour / synchronism of the vibrating units

Observe the following principles when optimizing the vibrating system:

Feeding behaviour **at discharge end** too unstable or too fast:	- **Mount** additional counterweight plates at 'F' or 'G' or increase spring angle (e.g. from 0° to 3°).
Feeding behaviour **at entry end** too unstable or too fast:	- **Remove** additional counterweight plates at 'F' or 'G' or reduce spring angle.

Adjusting the spring angle
Fix the vibratory unit and counter mass (see description of spring replacement procedure), loosen all spring fastening screws 'C+D' and set the desired spring angle as described. As this linear feeder is a system that generates a flat throw angles, the spring angle should be set no higher than 5° approximately. After that, remove the round steel bars.

Adjusting the magnet air gap
The factory setting of the air gap between armature and coil is indicated in the 'Technical Data' in Section 1. Adjustment of this air gap can be performed from the outside without dismounting any components. Slightly loosen the two exterior armature fastening screws 'A' on the right and left-hand side. Insert a round bar (2.5 mm in diameter, 250 mm long) in each of the two holes in the vibratory unit's supporting member ('H'). Adjust the air gap (see section 1, 'Technical data') by pressing down the two armature fastening screws against the magnet body, then tightening them. Pull out the round metal bars.

☞ **Notice**
If the control unit 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. (remove springs or mount weight)

Objective of the tuning procedure:
When the desired feeding speed is obtained at a control unit setting of 80%, it must increase when a weighting plate is removed ('sub-critical').

☞ **Notice**
Make sure that the number of springs per spring pack will not deviate by more than 1 - 2 springs.

6. Maintenance

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

- First pull and tag out the mains plug to prevent accidental activation.
- Clean the inside of the linear feeder (dismount components as necessary), and in particular the air gap between coil and armature.
- After remounting the components and plugging in the mains plug the linear feeder is again ready for operation.

7. 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.

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

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

If the rail feeding speed or height amplitude is not uniform but rather higher at the exit than at the entry, this indicates that the spring angle is incorrectly set relative to the centre-of-gravity angle (see Section 5.1.3.). In this case proceed as follows:

- Increase the spring angle on all spring packs.
- Displace counterweight ‘F’ against part travel direction.
- Fit additional weighting plates to the counterweight.
- Install additional weight 'G' in the vibratory unit's supporting member.

If the rail feeding speed or height amplitude is not uniform but rather higher at the entry than at the exit, this indicates that the spring angle is incorrectly set relative to the center-of-gravity angle (see Section 5.1.3.). In this case proceed as follows:

- Decrease the spring angle on all spring packs.
- Displace counterweight ‘F’ in part travel direction.
- Remove additional weighting plates from the counterweight.
- Remove additional weight 'G' from the vibratory unit's supporting member.

If the rail speed is uniform but the running behaviour is instable and the product jumps too much between rail contact surface and top cover, this indicates that the centre-of-gravity angle and the set spring angle of the overall system and thus the height amplitude is too large. In this case proceed as follows:

- Change the centre-of-gravity angle (more 'flat') by shifting the counterweight 'F' against the feeding direction, attaching additional weighting plates to the counterweight, installing the additional weight into the vibratory unit supporting member and making the feed rail lighter, if necessary.
- Adjust the spring angle to match the new centre-of-gravity angle.

If despite uniform height amplitude the running behaviour is unstable, especially with product having a large contact area or oil-contaminated parts, this indicates that the centre-of-gravity angle and the set spring angle of the entire system is too small. The height amplitude is too small. This prevents the throwing motion and in case of oily product the adhesive force is higher than the throwing force, i.e. the product cannot take off. In this case proceed as follows:

- Change the centre-of-gravity angle (more 'steep') by shifting the counterweight 'F' in feeding direction, removing weighting plates from the counterweight and removing the additional weight from the vibratory unit supporting member.
- Adjust the spring angle to match the new centre-of-gravity angle.

If it is impossible to set-up the feed rail properly by following the above procedures and if lateral oscillation occurs or 'dead spots' are found in certain areas, then the stiffness of the rail is insufficient. The abutment joints move relative to one another or non-symmetric rail sections lead to non-uniform running behaviour. In this case proceed as follows:

- Fit additional reinforcing ribs and screw abutment joints together. Counter-balance non-symmetric sections by weights or replace by material lighter in weight.

Fault	Potential cause	Remedy
Linear feeder does not start on power up	Power switch off Mains connector of control unit not plugged-in Connecting cabled between linear feeder and control unit not plugged-in Defective fuse in control unit	Close power switch Plug in the mains connector Plug 5-pin connector into control unit Replace fuse
Linear feeder vibrates only slightly 	Rotary knob on control unit set at 0 % Shipping locks or braces not removed Wrong vibration frequency	Set control unit to 80 % Remove shipping locks or braces. Check that coding in plug connector of the linear feeder is correct (see rating plate and 'Technical Data' (Section 1))
The linear feeder no longer meets the required feed rate after prolonged operation.	Fixing screws of linear rail have come loose. Screws of one or more spring packs have come loose. Misadjusted coil-to-armature gap Vibratory unit displaced towards the counter mass	Re-tighten the screws Tighten screws (for tightening torques see 'Technical Data' in Section 1). Readjust the air gap (for gap size see 'Technical Data' in Section 1). Re-adjust the vibratory unit (see Section 5).
Linear feeder makes loud noises	Foreign matter in air gap	Stop linear feeder and remove foreign matter. Then check the coil-to-armature gap.
Linear feeder cannot be tuned to a permanently constant feeding speed.	The spring constant of the vibrating system has changed. The linear feeder operates close to the resonance point.	Re-tune the linear feeder. Remove springs. See Section 5: Tuning

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