DEPRAG

Operating Instruction Booklet

Linear Conveyor

Type KLF 3,5,7,15,25

Customer:
Serial-No.:
Type:

011938 EN

Dear Customer:

This tool is the result of more than 70 years of experience in the design and manufacturing of pneumatic tools for the industrial market.
We kindly ask, that you read these operating instructions carefully, so that you will be able to use this tool safely and for many years to come. If you need additional information, please contact your DEPRAG Representative, one of our international support offices or us direct at DEPRAG. We will be happy to answer any questions. Please visit our web site: www.deprag.com

Contents:

1 Safety information

1.1 Basic safety information

Familiarity with these basic safety rules and regulations constitutes the fundamental prerequisite for safe handling and trouble-free operation of DEPRAG KLF linear conveyors.
These operating instructions contain the most significant regulations for safe KLF operation. These operating instructions - and in particular the safety regulations - must be observed by anyone working on and with the KLF.
The applicable on-site accident prevention rules and regulations must also be observed.
These operating instructions must always be kept handy where the KLF is operated.
Further to these operating instructions, generally applicable as well as local accident prevention regulations and environment protection standards must also be kept handy and be observed.

1.2 Obligations to be met by the operator

The operator is obliged to authorise only those persons to work with the KLF linear conveyor who are familiar with the basic work safety and accident prevention standards and who have been trained in KLF operation. Furthermore, these persons must confirm with their signature that they have read and understood the chapter on safety and the warnings contained in these operating instructions. Steps are to be taken at regular intervals to monitor and document that all personnel are performing their work in a safety-conscious manner.

1.3 Operating personnel training

Only trained and instructed personnel is permitted to work on the KLF.
The scope of responsibilities of personnel entrusted with KLF assembly, commissioning, adjustment, maintenance and repair must be clearly defined.
Personnel still to be trained must work on the KLF only under the supervision of an experienced operator.

1.4 Dangers in handling the unit

The KLF linear conveyors are state-of-the-art equipment designed in compliance with the EU Machinery Directive and accepted safety regulations. Nevertheless, however, risks may arise from using this equipment

that may endanger life and limb of user or third parties and cause interference with the KLF or other material assets.
The KLF must be used only as intended and in perfectly safe condition.
Any malfunctions that may have an adverse effect on the safety of any persons, the KLF or other material assets must be eliminated without delay.

1.5 Appropriate use

The KLF is intended exclusively for the incoming and outgoing transport of components and can also be used for component sorting. Due to its open connector design, the KLF must not be used in areas where readily flammable or explosive media are present.
For maximum permissible dimensions and weights of add-on components, observe details in chapter 3, table 1, *Technical data,* and chapter 4, *Installation instructions*.
Any other use, or use beyond the above specifications, shall be deemed as inappropriate. United Components GmbH shall not accept any liability for any damage incurred through non-observance of this clause.
Appropriate use also includes observation of all Notes in these operating instructions.

1.6 Safety measures for normal operation

The KLF must be operated only if it is in perfectly safe condition. This must be checked at least once per shift.
Check the correct air gap setting in particular after adjustment activities. For further details refer chapter 5.3, *Setting the air gap.*

1.7 Hazards caused by electrical power

Any work on the power supply must be performed by a qualified electrician. The KLF electrical equipment must be checked regularly. Any loose connections and cables scorched or otherwise damaged must be replaced immediately.
The KLF nameplate specifies the mains supply.

W A R N I N G : The linear conveyor must be operated only at the mains supply specified on the nameplate.

1.8 Specific danger points

The KLF, and in particular the built-in electromagnet, must not be operated in liquids. The linear conveyor must be installed and the drive supply cable be laid in such a way that no liquid can collect at the cable sealin point at the magnet. Start the KLF only once this has been ensured. The electrical supply must be interrupted immediately if liquid is suspected to have penetrated the magnet. Due to their open connector design, DEPRAG linear conveyor must not be used in hazardous areas.

1.9 Structural modifications

The KLF must not be modified, extended or altered without the manufacturer's approval. Exceptions to this rule are the tracks described in chapter 4.2, feed rails, and chapter 4.3, *Flexible add-on solutions*, and the accessories listed in chapter 8, *Accessories.*
Any other alterations are subject to the written approval of DEPRAG Schulz GmbH & Co.
Any unacceptable components must be replaced immediately. Use only original spares for this purpose. There is no guarantee that third-party parts have been designed and manufactured in accordance with the applicable stress-bearing and safety standards. Failure to observe this clause cancels the warranty on the linear feeder.

1.10 Specific danger points

The KLF, especial the built-in electromagnet, is NOT for use in liquids. The linear conveyor must be assembled so, that the cables and the magnet never get contact with liquid. Don’t use is, if this is not guaranteed. Is there a suspicion of liquid in the magnet, turn off the electrical supply immediately. Using the linear conveyor in explosive areas is prohibited because of the open plug design.

2 Application

The linear conveyor type KLF are used to transport work pieces away from upstream or towards downstream machines. Furthermore they are used under special premises for sorting components.
The KLF`s may be integrated into several screw feeding machines and also in complex automated assembly units.

Linear conveyors are designed to transport work pieces and must not be used for any other purposes (vibrator, vibrating mixer etc.) Due to their open connector design, KLF`s must not be used in hazardous areas.

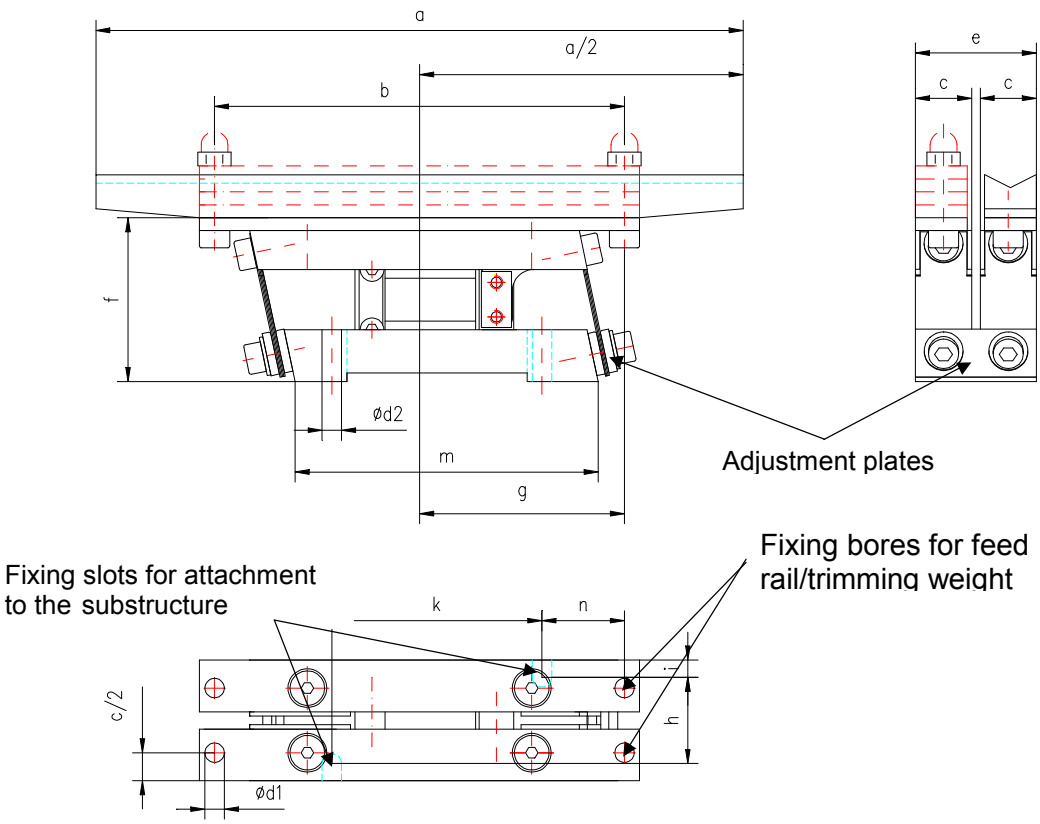
Note: Failure to observe these operating instructions while operating an KLF cancels the warranty.

The various linear conveyor types differ in size and range of application (s. chapter 3: *Equipment description and* chapter 4.3,Table 3: *Recommended values for maximum work piece widths*).

3 Equipment description

The KLF consists off 2 push-pull sections arranged next to each other. These are connected via bifurcated leaf springs to a common base plate where the opposing vibration forces are virtually cancelled out. Optionally, each of the vibrating sections can operate as useful or counter mass. Another option is to operate as useful mass. (see chapter 4.3 *Flexible add-on solutions)*
A magnet-system (armature- magnet core) is built in horizontally between the two vibrating sections.
The advantages of KLF`s are based on the adjustable balancing of useful and counter masses that largely eliminates the free vibration forces directly within the unit.

Picture 1: *Dimensions KLF3-5*



Picture 2: *dimension sheet KLF7-25*

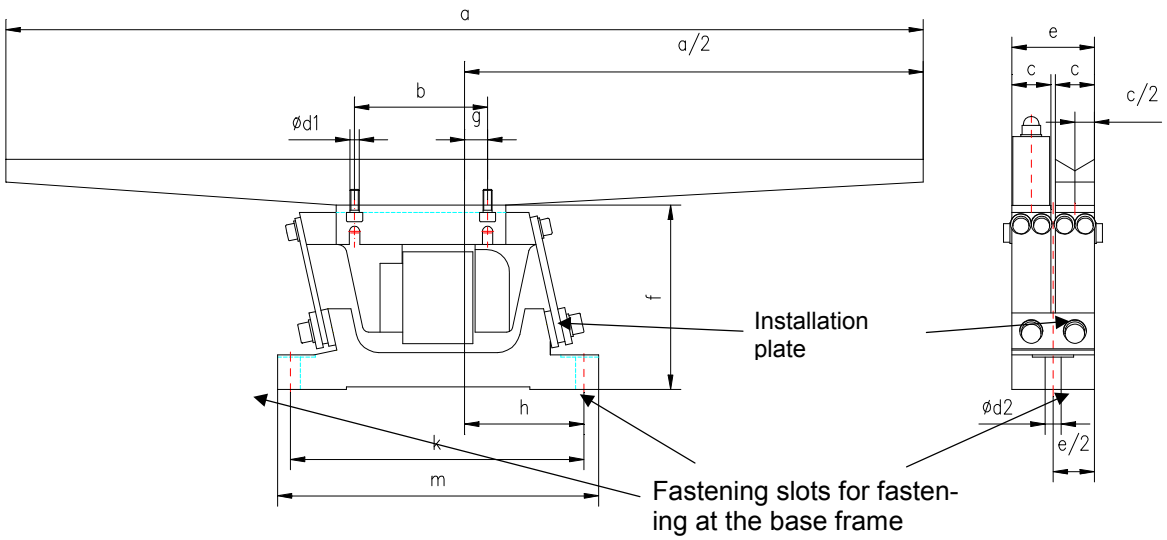


Table 1: *Technical Dates*

		KLF3	KLF5	KLF7	KLF15	KLF25
Main dimensions [mm]	a	100-170	150-250	200-400	300-600	500-800
	b	95	122	58	85	150
	c	13	17	17	24	29
	ød1	4,5	4,5	4,5	5,5	6,6
	ød2	4,5	4,5	7	9	10
	e	28	36	36	50	60
	f	38	49	79,7	111,7	139,7
	g	47,5	56	10	30	45
	h	20	28	52	88	133
	i	4	4	-	-	-
	k	48,7	75	128	177	283
	m	70,2	90	140	200	300
	n	19,1	17,3	-	-	-
max. weight – feed rail [kg]		0,15	0,3	0,65	1,5	3,0
weight - basic unit [kg]		0,4	0,7	1	2	7
vibration frequency [Hz]		2 times - Net frequency				
power supply [V/Hz]		230/50 or 110/60				
max. power consumption [VA]		4,7	10	15	25	60
Protection class		IP 54				
Controller (not included)		optional IRG 1-2-4				

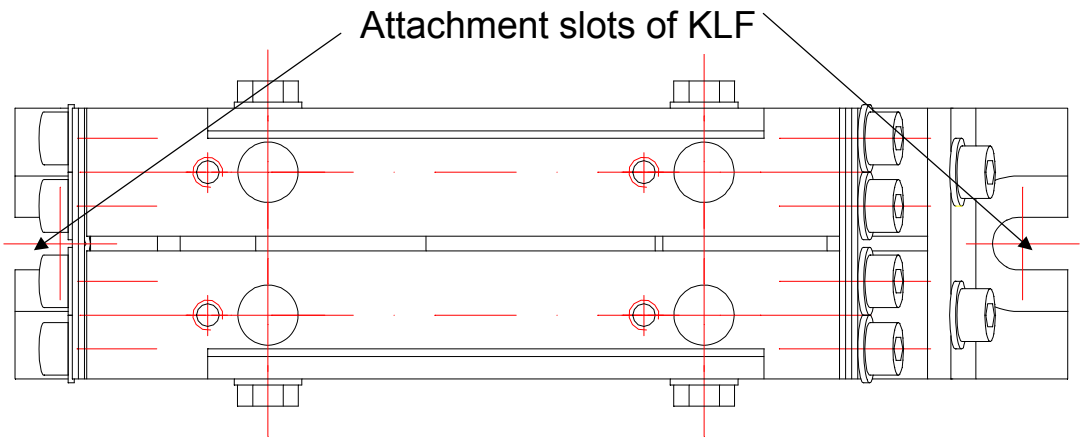
Depending on application field and spatial conditions you can select between different switch sizes (see *Table 1*). Main criteria are primarily the uses or counter-mass and the mounting room being available.
The linear conveyor is available with 230V/50Hz and 110V/60Hz – magnets.
For the KLF are different control units at the disposal. (s. CHAPTER 7 *Controllers*).

4 Installation instructions

4.1 Installation the unit

With the help of the slots in the base plate, the KLF is firmly screwed to the floor (refer Pic. 3). This allows for exact definition and adjustability of the junction points at the linear track intake and outlet. In the horizontal plane the floor should be non-yielding (plate or block construction) to absorb any residual forces in this plane. Any overhanging profiled structures must be reinforced with a plate to which the linear feeder will be attached. Best suited for this purpose is a steel plate at least 20mm thick and more than 120mm wide.
Impacting decisively on floor vibration, vertical vibration forces can be virtually eliminated through careful mass balancing (refer chapter 5.1, *Balancing the masses*).
Suitable substructures must be provided for height adjustment.
Suitable DEPRAG Schulz GmbH & Co standard parts are available for complete station extensions in combination with DEPRAG feed bowls.

Picture 3: *Attachment slots in the base plate*



4.2 Design of feed rails

The feed rail must be unyielding so that the transport pulses generated by the unit are fully transferred to the work pieces and no superimposed natural vibration can adversely affect the transport process. This requirement has priority over mass reduction measures. The preferred material for feed rails is tool steel (e. g., 1.2842, 90MnCrV8). Feed rail de-

sign should adhere to the useful masses specified in chapter 3, table 1, and/or chapter 5.1, table 4.
The following feed rail cross sectional dimension ratio is recommended:

$$\frac{Height}{Width} = \frac{2}{1}$$

The recommended dimensions are listed in table 2. The dimensions are for one vibrating section and can be applied to each of the two vibrating sections.

Table 2: *feed rail dimensions*

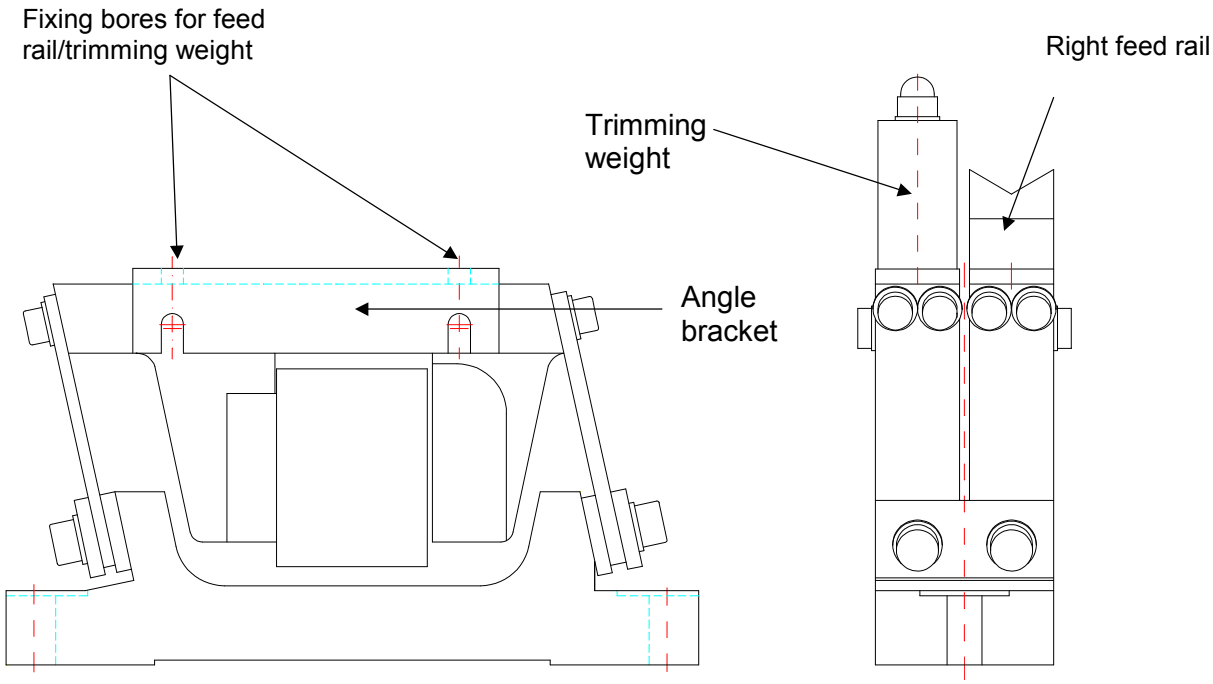
	KLF3	KLF5	KLF7	KLF15	KLF25
Length	170 mm	250 mm	400 mm	600 mm	800 mm
Width	13 mm	17 mm	17 mm	24 mm	29 mm

4.3 Flexible add-on solutions

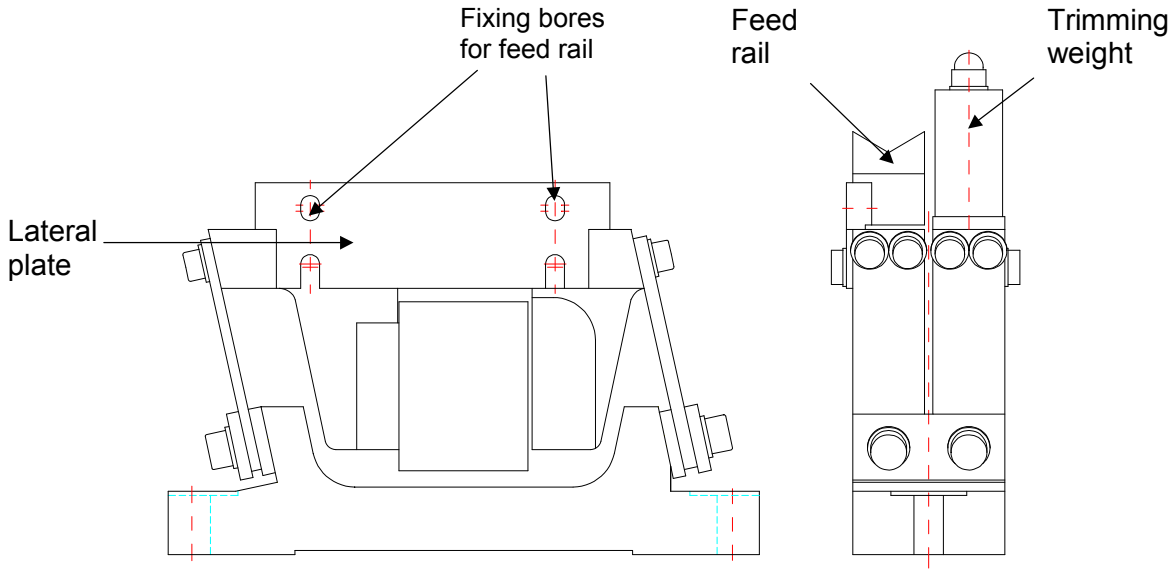
4.3.1 Attaching one Feed rail

The linear track is attached to either vibrating section with the help of an angle bracket or a lateral plate (refer Pic. 4 and 5). In the case of the KLF3 and KLF5, the linear track is attached directly to the vibrating section (refer chapter 3, Pic. 1). In any case, make sure to observe the correct attachment position as per chapter 3, Pic. 1 and 2. Any deviations may adversely affect floor vibration.

Picture 4: *Feed rail mounted with angle bracket*



Picture 5: *Feed rail mounted with lateral plate*



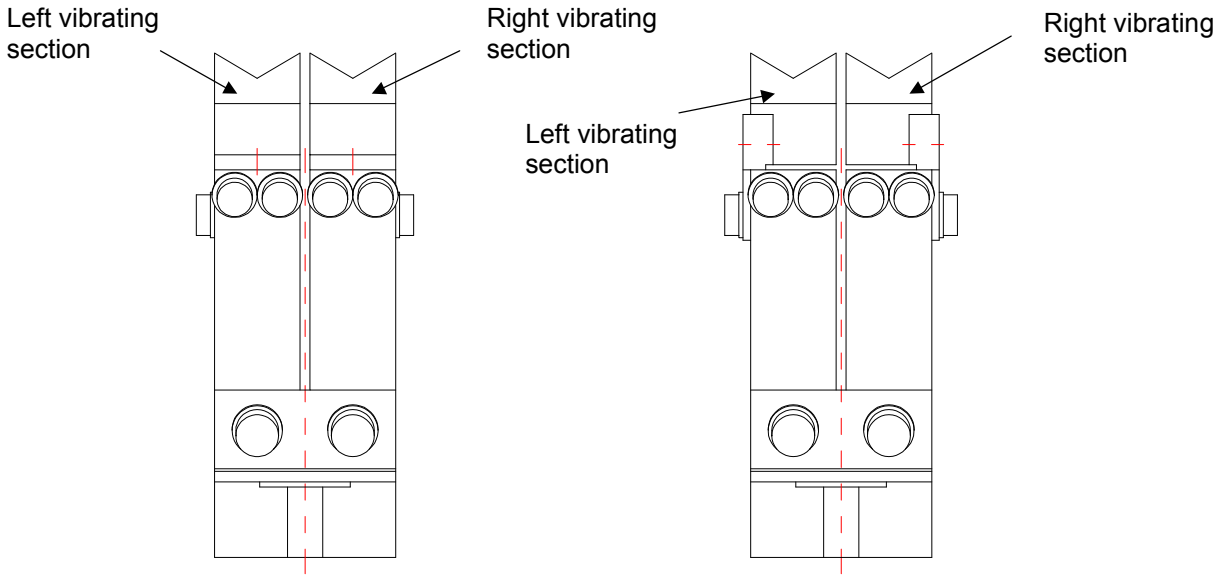
The vibrating sections are designed with recesses on the outer side to receive the angle brackets and trimming weights. The run out height of the feed rail can be precisely adjusted during initial installation by means of the slot-type bores in the lateral plates. Thus no rail readjustment is necessary when the feed rail is removed and reinstalled for cleaning purposes or change to a different product.
Selection of the feed rail location on the left or right is dependent on the installation and transfer requirements of the upstream and downstream equipment. The feed rail must always be mounted at the inner side of the lateral plate (refer Pic. 5).
The weight of the feed rail (refer chapter 3, table 1, or chapter 5.1, table 4) and its attachment (angle bracket and/or lateral plate) must be balanced by a counter mass (trimming weight) mounted to the second vibrating section. For a detailed description refer chapter 5.1, *Balancing the masses.*

Note: KLF 3, KLF 5 and KLF 25 require useful and counter masses to be identical at all times. KLF 7 and KLF 15 require a specific difference to be adhered to between useful and counter masses. Useful and counter masses should correspond to the values specified in chapter 5.1, table 4.

4.3.2 Attaching two Feed rails

Instead of the trimming weights (refer Pic. 4 and 5) it is also possible to attach a second linear track (refer Pic. 6). Linear tracks may be attached using angle brackets as well as lateral plates. Balance the masses as described in chapter 5.1, Balancing the masses.

Picture 6: *Linear conveyor with two Feed rails*



4.3.3 Attaching split Feed rails

For the purpose of feeding larger work pieces it is possible to provide a feed rail design split in longitudinal direction, attaching each half to the associated vibrating section. Mass balancing is subject to the rules described in chapter 5.1, *Balancing the masses.* In this case, the mass balance impacts on the transport speeds of both linear track sections and should be adhered to as exactly as possible.
Larger work pieces are transported smoothly as long as these conditions are observed.
Recommended values for max. work piece widths refer table 3 .

Picture 7: *Linear conveyor with split feed rail*

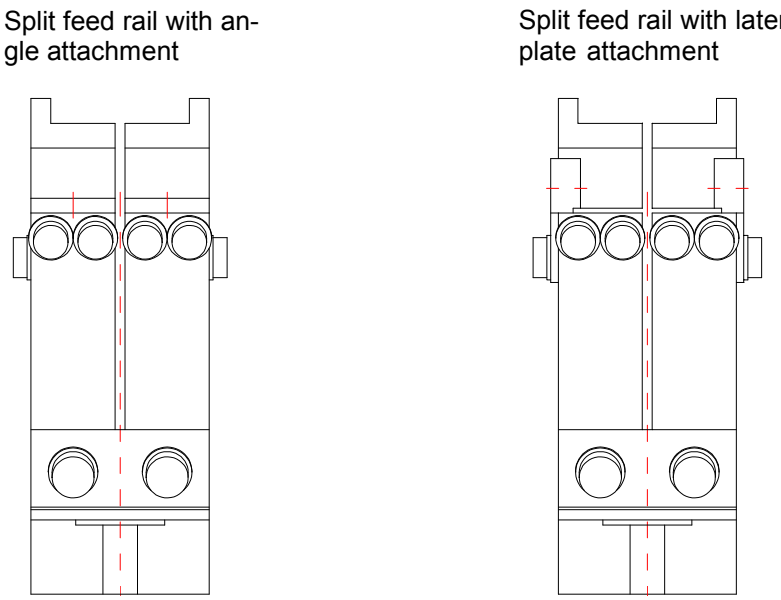


Table 3: *Recommended values for maximum work piece widths*

Type	Max. work piece width
KLF 3	Approx. 20 mm
KLF 5	Approx. 30 mm
KLF 7	Approx. 50 mm
KLF 15	Approx. 70 mm
KLF 25	Approx. 80 mm

5 Adjustment instructions

The first step in adjusting the linear conveyors is always to balance the masses (chapter 5.1) and then to adjust the natural frequency (chapter 5.2).

5.1 Balancing the masses

As a consequence of the push-pull principle, DEPRAG linear conveyor virtually balance the vibration forces in the basic unit. However, this balance of vibration forces is ensured only if useful and counter masses are adjusted to each other as precisely as possible. For the linear conveyor KLF 3, KLF 5 and KLF 25, this means that useful and counter masses must be identical. KLF 7 and KLF 15 require a specific mass difference to be adhered to between armature and magnet side. Table 4 below lists the armature side as the useful side so that there is a higher mass available for feed rail design. Where the available space requires the linear track to be attached only to the magnet side of the serial unit, rearrange the magnet system so that the armature is on the magnet side and vice versa. In that particular case readjust the air gap afterwards as per chapter 5.3, *Setting the air gap.* Table 6 resumes validity after these steps have been performed.

The useful mass (i. e., the feed rail mass, refer chapter 3, table 1, or chapter 5.1, chapter 4) is the total weight of all components attached to the feed rail side, including lateral plate or angle bracket. Accordingly, the counter mass is the total of all individual weights of the components on the counter side including lateral plate or angle bracket.

Mass balance is checked through simple weighing of useful and counter masses. Any additional weights required to reach the masses specified in table 4 must be attached in such a way that the distance between the mass centre points of useful and counter masses, viewed in a direction transverse to the transport direction, is as close as possible. In other words, if possible, the additional masses should not protrude laterally beyond the linear conveyor as this would lead to increased residual vibration in the floor.

The masses are precisely balanced when hardly any vibrations are noticeable in the floor and the transport speed of a component freely placed upon the feed rail or counter mass, is identical on both vibrating sides.

Table 4: *Recommended values for useful and counter masses with mass difference*

Type	Useful mass [kg] (Armature side)	Counter mass [kg] (Magnet side)	Difference [kg]
KLF 3	0.15	0.15	0.00±0.01
KLF 5	0.30	0.30	0.00±0.02
KLF 7	0.65	0.55	0.10±0.02
KLF 15	1.80	1.30	0.50±0.03
KLF 25	3.00	3.00	0.00±0.05

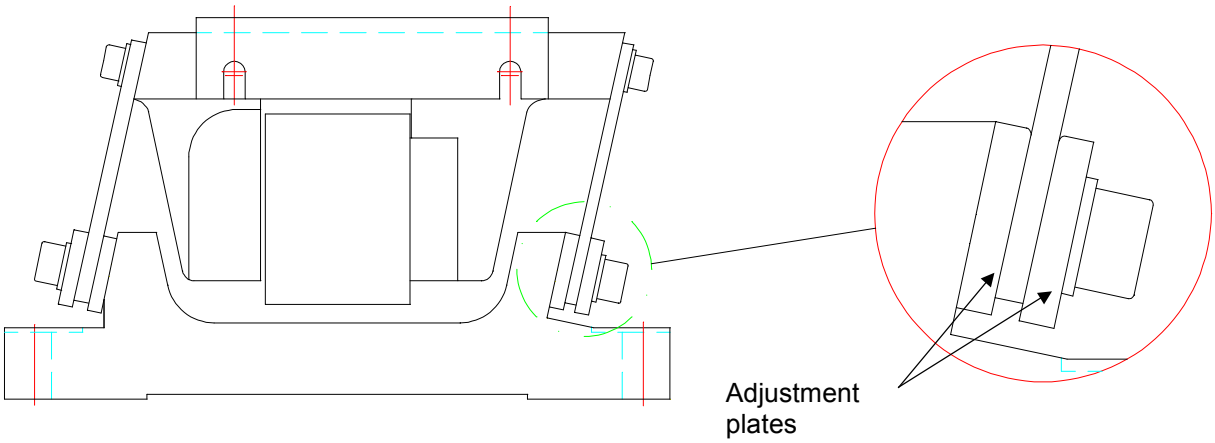
Note:
Useful and counter masses should correspond to the values specified in table 4.

Note:
1. Masses are fully balanced if hardly any vibrations are noticeable in the floor.
2. When masses are fully balanced, the transport speeds at useful and counter sides are identical.

5.2 Adjusting the natural frequency

The DEPRAG linear conveyor is a spring- mass vibration system that operates utilising the resonance behaviour.
Any changes in the mass require adjustment of the spring stiffness. For this purpose, sliding adjustment plates are provided on the spring assembly attachment at the base plate (refer Pic. 8). Sliding these adjustment plates sets the natural frequency.

Picture 8: *Spring assembly with adjustment plates*



The linear conveyor must always be adjusted **'subcritically'**, in other words, the natural frequency must be approximately 5 % above the exciter frequency. For a 100Hz feeder this translates to a natural frequency of around 104Hz, for a 120Hz feeder to one around 126Hz.

The adjustment procedure is as follows:

Place one test component on the feed rail and switch on the controller. Use the rotary button to reduce the transport speed of the linear conveyor until the component on the feed rail moves only slowly. Keeping the controller setting constant, slowly loosen the screws of the adjustment plates at one linear conveyor spring assembly (refer Pic. 8). Check the speed at which the test component is transported while the screws are being loosened. If the transport speed briefly increases initially and then decreases again as the screws are further loosened, the linear feeder is correctly adjusted and the natural frequency is slightly above the exciter frequency. The adjustment plates must be returned to the position they were in before the screws were loosened.
If the transport speed increases while the screws are loosened, and decreases only slightly or not at all when the screws are fully loosened, the linear conveyor is adjusted too tightly and its natural frequency is too

high. In this case, move the adjustment plates down or remove a leaf spring as required if the weight deviation is too great. Then repeat the test.
If the transport speed decreases immediately while the screws are being loosened, the linear conveyor adjustment is too soft. In this case, move the adjustment plates up or install an additional leaf spring as required. Then repeat the test.
Make sure when sliding the adjustment plates that they are always horizontal and always arranged exactly opposite each other.

Adjustment plates up ⇒ Natural frequency increases
Adjustment plates down ⇒ Natural frequency decreases.

W A R N I N G : It is vital that the linear feeders be 'subcritically' adjusted (i.e. the natural frequency must be about 5% above the exciter frequency) as otherwise the magnet may overheat and burn out, and the transport speed may decrease as soon as components are placed upon the linear track.

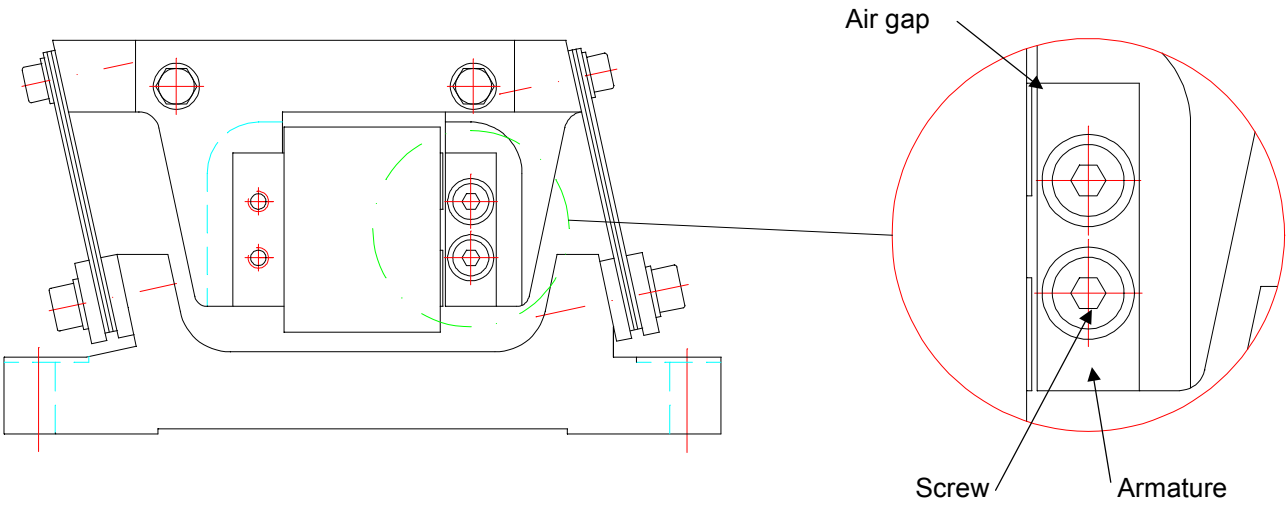
To avoid the vibrating sections from subsiding, make sure to loosen the adjustment plates of one spring assembly only at a time during frequency setting.

Note: The adjustment plates must be aligned horizontally. The top edges must always be arranged opposite each other.

5.3 Setting the air gap

During serial assembly, the air gap of the magnet system is set to the values specified in table 5. If it deviates from the values specified in table 5, after adjusting natural frequency, for example, the air gap must be readjusted. For this purpose loosen the lateral armature fixing screws and reset the air gap with the help of a spacer (refer Pic. 9).

Picture 9: *Armature attachment*



The values specified in table 5 apply only to the associated power supply. It is absolutely vital to ensure during adjustment that the faces of magnet core and armature are aligned exactly parallel to each another. To achieve the necessary precision, tighten the screws step by step and in turns.

table 5: *Setting values for the air gap between armature and magnet core*

Type	Power supply	Air gap value	Tolerance range
KLF3	230V/50Hz	0,5	± 0,05
	110V/60Hz	auf Anfrage	auf Anfrage
KLF5	230V/50Hz	0,8	± 0,05
	110V/60Hz	0,6	± 0,05
KLF7	230V/50Hz	0,8	± 0,05
	110V/60Hz	0,6	± 0,05
KLF15	230V/50Hz	1,0	± 0,05
	110V/60Hz	0,6	± 0,05
KLF25	230V/50Hz	0,8	± 0,05
	110V/60Hz	0,6	± 0,05

W A R N I N G : Setting an air gap larger than specified may cause the magnet to overheat and the coil to burn out. It is therefore vital that the specified air gaps be adhered to.

6 Maintenance

A type KLF linear feeder is basically maintenance-free. The leaf springs, however, may oxidise in certain conditions of use, thus affecting the vibration behaviour in the long run. In such cases the leaf springs may need to be removed and cleaned. Make sure to always dismantle one spring assembly only as the vibrating sections are otherwise displaced and trouble-free functioning is no longer guaranteed. Use the appropriate calibration gauge for initial linear feeder height adjustment (refer chapter 8, table 7: *Accessories*).

W A R N I N G : **The leaf springs must not be oiled or greased as this would make the springs sticky and in turn adversely affect the vibration response.**

7 Controllers

The KLF is connected to the 230V/50Hz AC system via an IRG controller and can be rated for other mains voltages and frequencies, e.g. 110V / 60Hz. They operate in full-wave mode at double mains frequency, i.e. at 50Hz AC, with a vibration frequency of 100 Hz.
Vibration displacement and thus the transport speeds are infinitely adjustable due to magnet current and thus magnetic force variability.
Soft-starting, all IRG types can be mounted in various different ways and offer extra controls for photoelectric barriers, initiator elements, or extern 24VDC signal.
For a detailed description of the controllers refer full-range catalogue from DEPRAG Schulz GmbH & Co.
Third-party controllers can also be used as long as they meet the technical requirements.

Table 6: *Controllers for KLF linear conveyors*

Type	Power supply
IRG1-N	230V/50Hz
	110V/60Hz
IRG2-N	230V/50Hz
	110V/60Hz
IRG4	230V/50Hz
	110V/60Hz

8 Accessories

Table 7: *Accessories for KLF linear conveyors*

Type	Designation	Comments	Order reference no.
KLF3	Trimming weight	Weight: 30g	KTG3
KLF5	Trimming weight	Weight: 65g	KTG5
KLF7	Trimming weight	Weight: 100g	KTG7-100g
	Trimming weight	Weight: 50g	KTG7-50g
	Angle bracket	Weight: 47g	KBW7
	Lateral plate	Weight: 70g	KSP7
KLF15	Trimming weight	Weight: 200g	KTG15-200g
	Trimming weight	Weight: 100g	KTG15-100g
	Trimming weight	For double track	KTG15-D
	Angle bracket	Weight: 133g	KBW15
	Lateral plate	Weight: 190g	KSP15
KLF25	Angle bracket	Weight: 350g	KBW25
	Lateral plate	Weight: 550g	KSP25

9 Checklist – Troubleshooting at the linear conveyor

Problem Identification:

1	Conveyor doesn't run, no vibration noticeable
2	Conveyor runes to slow or there is no movement visible
3	The feeding characteristic is instable, the feeding speed is variable
4	The conveyors do transfer vibrations

A Electrical power, Controllers

Problem No.:	Reason	Elimination
1, 2, 3	Electrical power is to low or instable, i.E. just 180 V	Check the main voltage, or New-adjustment of the linear conveyor with the existing main voltage.
1	Connection to main supply broke down	Check the connection drive-controller and controller-main supply
1	Controller is OFF <0>	Turn controller ON <1> or at use with jam control, check the jam control sensor
1	Controller is faulty	Electrical check of device, or install an exchange- or re-placement device
2, 3	Outgoing frequency of con-troller is installed wrong	Take care the right fre-quency at the controller is installed 25 Hz position = half wave power exciting frequency = 50 Hz 50 Hz position = full wave power exciting frequency = 100 Hz

NOTE:

If you are using other controllers, check the linear conveyor is working with the right frequency.

B Feed bowl KLF and KWF

Problem No.:	Reason	Elimination
2, 3, 4	The feed bowl or the feed rail is not strong enough connected with the drive. At feed bowls you hear a bright sound.	Tighten the adjusting screws and check the thread.
2, 3, 4	The magnet screws or the leaf spring are not tighten strong enough,	check all connections where its something screwed together
1, 2, 3	The magnet is damaged, the magnet coil is blow	Electrical check of magnets, install a new magnet
1, 2	The air-gap between magnet and anchor is to small (nail on) or to big	Reinstall the air-gap like in the instruction booklet
1, 2	Foreign part is between magnet and anchor in the air-gap	Remove the foreign part
2, 3, 4	Spring fracture changed the frequency	Loosen screws of spring packages, check the springs, remove damaged parts **Attention**! Reason is mostly the vibration amplitude (check air-gap)
2, 3, 4	The feed rail at the linear conveyor has not enough stiffness or exceeds the limit for weight and rail length	Pay attention at rail design.

NOTE !

At use of Feed bowls of other manufacturers resp. feed rails should absolutely read the respective Operator's manuals with the technical data being noticed.

10 Spare parts

Failure of individual components is not likely to occur during appropriate use as the KLF design does not include any wear-and-tear parts. Please order any individual components yet requiring exchange from DEPRAG Schulz GmbH & Co. The serial number of the unit is important for fast and correct handling of the spare parts delivery.

11 Warranty

The warranty period is twelve months irrespective of the number of shifts.
Any objections must be reported in writing without delay and at the latest 8 days from receipt of goods. Any hidden defects not revealed within this period must be reported within 7 days from the time at which the customer discovered or, upon careful inspection of the goods delivered, could have discovered, the defect. Where the complaints are justified, the supplier will, at his discretion, either replace or repair the goods unless the damage was incurred due to the customer's improper handling of the goods. The warranty period for replacement item and repair is 3 months. At the least it will extend until expiry of the original warranty period for the equipment supplied. The period of liability for defects in the equipment supplied is extended by the time operation is interrupted as a consequence of the repair work. The customer shall send the goods to the supplier at his own expense. Warranty claims can be filed only within 6 months from the time the customer received the goods. The customer's right to file any claims for defects expires in all cases 3 months from the time a prompt complaint was made, and at the earliest upon expiry of the warranty period.
Further claims, if permissible, are excluded. The supplier's legal and contractual liability is limited to bad intent and gross negligence.
The supplier's liability for essential third-party products is limited to assigning the liability claims which he is entitled to file with the supplier of the third-party product.
The supplier is not obliged to provide any information or other technical documentation beyond the scope of these operating instructions, even if this may have occurred in exceptional cases in the past.
The illustrations, dimensions and weights in these operating instructions are not binding. Printing errors, mistakes and state-of-the-art modifications reserved.

12 Picture Contens:

13 Table - Contens:

14 Customer specific informations

15 Service stations and authorized partners

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