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INSTRUCTION MANUAL

Frequency-control-unit for round- and linearvibrators with fill-level-control unit

Typ FN 05

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Safety directions for the user

This description contains the required information for the use as prescribed of the described products. They are intended for qualified technical personnel.

Qualified persons are persons who on account of their training, experience and received instructions as well as their knowledge of relevant standards, regulations, rules for the prevention of accidents and operating conditions have been authorized by the responsible person in charge of the safety of the installation to execute the required work and who are able while doing so to detect and prevent all possible hazards (Definition of skilled labour, according to ICE 364).

Hazard indication

The following directions are for the safety of the service personnel as well as for the safety of the described products and the related devices and machinery.

Warning !

Hazardous voltage
Disregard may cause death, serious injury or heavy damages to the equipment.

- Isolate supply voltage before mounting- and dismounting work as well as in case of fuse replacement or modifications of the structure.

- Observe the specific safety regulations for the prevention of accidents and safety in force for the particular case.

- Check before commissioning if the nominal voltage of the device corresponds to the local mains supply.

- Emergency-Stop installations must be effective in all modes of operation. Unlocking the Emergency Stop installation must not cause an uncontrolled re-start of the device.

Use as prescribed

The devices described herein are electrical equipment for the application in industrial installations. The equipment is designed for the application in control and automation techniques.

Installation and commissioning

Installation
For installing the device three bore holes are provided on the backside. The assembly direction is optional. As the operation of the device generates heat an installation on or near other sources of heat should be avoided. The device must be mounted on a metal plate in the air flow in order to prevent overheating.

Commissioning
Before commissioning the local conditions of operation must be examined.

- Intensity of the mains supply
- Rated performance of the feeding device.

Adjustment directions
The following adjustments should only be effected by means of an adequate laboratory device (frequency adjustable from outside)and the results should then be transferred into this device.

Procedure
By means of the FN 05 first the mechanical resonance frequency is determined. For this purpose load the feed bowl or rail with only one test specimen. Then pass slowly through the drive frequency with the FN 05. At a mechanic resonance the test part has its highest speed. (ATTENTION: Two or more resonance points are possible). The main resonance point is the one with the highest speed of the part. As at this stage the system is very soft (conveying speed depending on absorbing) the output frequency of the FN05 must be increased by approx. 1,5 Hz compared to the mechanical resonance frequency (forced oscillation, see diagram 1). Thus the conveying system becomes mechanically stable and the conveying speed constant even in the case of weight modifications. The final adjustment of the requested conveying speed is then set by the set-point potentiometer (vibration intensity) and by the selection of the output current pulse form. Sine-wave current is often more adequate for circular feeders whereas triangle-wave current is preferred for linear vibration feeders.

Result
Not only a multiplication of the degree of efficiency (see diagram 2) by current back-feed results from this new concept but also a high stability of the conveying speed and a considerable simplification of the mechanical set-up work. The output frequency of the FN 05 is absolutely stable.

General information

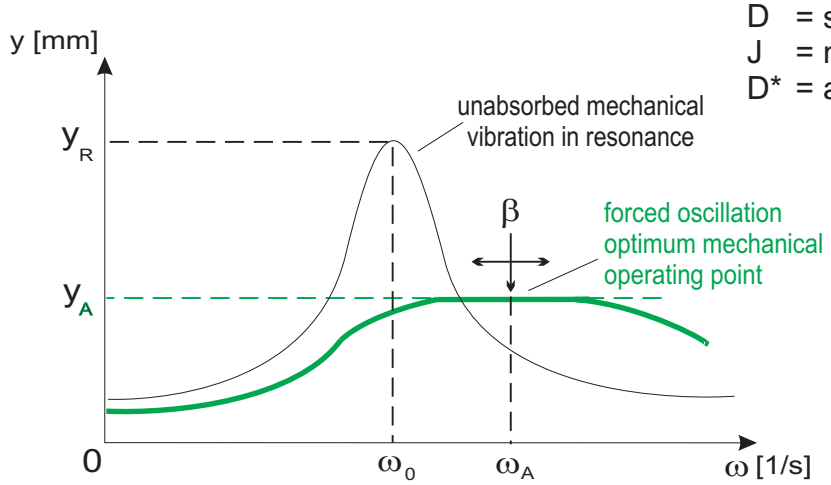
Adjustment of the operating point at vibration systems

Electrical drive frequency ω_A

$\omega_A = \omega_0 + \Delta\ 1{,}5\ Hz$

Result: y_A **= constant**

y = elongation (execursion)
y^R = elongation at mech. resonance
y_A = elongation at ω_A
ω = angular frequency
ω_A = electrical drive-frequency
ω_0 = mech. resonance frequency
β = absorption
m_0 = mass (weight)
D = spring constant (spring)
J = mass moment of inertia
D* = angular recommended dimension



$$y = f(\omega)$$

$$y_A = f(\omega_A)$$

spiral feeder $\omega_0 \approx \sqrt{\frac{D^*}{J}}$

linear feeder $\omega_0 \approx \sqrt{\frac{D}{m_0}}$

$$\beta \approx k \cdot m_0$$

General information

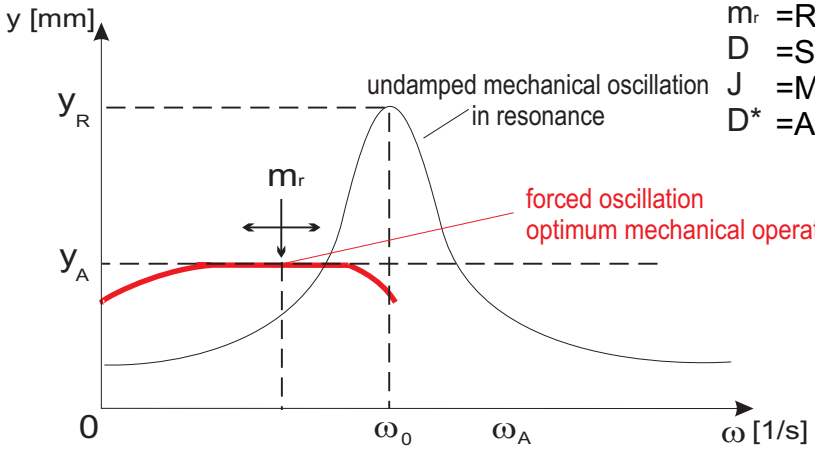
Adjustment of operating point on oscillating systems **with high changes in weight**

electrical. operating frequenz ω_A

$\omega_A = \omega_0 - \Delta\ 3{,}0$ Hz

Result: y_A **= constant**

y =Excursion
y_R =Excursion with mechanical resonance
y_A =Excursion with ω_A
ω =Angular frequency
ω_A =Operating frequency, electrical
ω_0 =Mechanical resonance frequency
d =Attenuation
m_r =Resulting mass (weight)
D =Spring constant (spring)
J =Mass moment of inertia
D* =Angular guide value $\frac{M_d}{\varphi}$



Constant feeding velocity with high changes in weight up to emptying
Pay attention to the slightly higher power input at this operating point

$$y = f(\omega)$$

$$y_A = f(\omega_A)$$

spiral feeder $\omega_0 \approx \sqrt{\frac{D^*}{J}}$

linear feeder $\omega_0 \approx \sqrt{\frac{D}{m_r}}$

$$d \approx k \cdot m_r$$

General information

Half-wave operation

Characteristic of the vibration feeding system

$$f_0 = \frac{1}{2\pi}\sqrt{\frac{D_{ges}}{m_r} - \left(\frac{d}{2m}\right)^2}$$

d =Damping constant
D_{ges} =Total spring constant
m_r =Resulting mass of the oscillator and resulting mass moment of inertia

Attention!
Pay attention to the following items in half-wave operation!

Optimum operating point of the oscillator $f_A = f_0 \pm \Delta\ 3{,}0Hz$
As f_A can be selected with absolute stability by the Universal Resomat in the range of 4,0 – 99,9 Hz, the oscillator characteristic fo can be executed as a variable, standardized, mechanical value.

- **In this operating mode the mechanical frequency changes to half the value**
- The output current shows as pulsating direct current (d.c.)
- All other values are maintained.

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Technical data

Type	FN 05
Supply voltage	230 V or 115V , + 10% / -15% 50 / 60Hz
Operating frequency	10,0 - 99,9 Hz digitally adjustable in 0,1Hz steps (quartz stable)
Output current (oscillating force)	sine-wave or delta-wave a.c. (short circuit proof)
Maximum continuous current	6 A
Soft start	approx 3sec. connectable/disconnectable
Opto-coupler input block / release	24 VDC 10mA (invertable)
Contact input block / release	contact, contact charge 12V , 10mA (can be inverted)
24 V output	24V max. 200mA
Nominal value input	10K poti or 0 - 10V (Ri approx. 10K)
Protection type	IP 54
Temperature range	0 - 40° C
Dimensions	aluminium housing 200 x 100 x 80 mm drilling pattern 187 x 87 mm

Description of the device

Connection of the vibration feeding device
The control unit is provided with a flush-type socket-outlet. The proper mating connector is to be installed at the connection cable of the vibration feeding device.

Control input lock / release
The control input is designed for a potential-free contact (connection according to connection diagram page 10). Inside the device the input can be set to "lock" or "release" by switch no.2. If the selector switch is set to "lock" and the contact is closed, the output of the control unit disconnects. If the selector switch is set to "release" the output connects when closing the contact.
If the control input is not used then the selector switch must be set to "lock".

Internal adjustment possibilities

ATTENTION! Before opening the device and when working inside unplug mains connector!!!

Selector switch 1.3 "sine-wave/rectangle-wave current"
Thus the output pulse form can be selected. Sine-wave is often more advantageous at circular devices and rectangular is preferred at linear vibration feeding devices.

Selector switch 2.3 "lock / release"
Pre-selection of the control input function.
If the control input is not used the selector switch must be set to "lock".

Selector switch 3.3 "Soft start"
The soft start becomes effective in the starting moment and it is meant to accelerate the feeding performance in due time, so that e.g. oriented material does not change ist position in the starting moment. The duration of the soft start is 3 sec. If no soft start is requested it must be switched off by actuating selector switch 3.

Frequency switch
By the frequency switches (10-1-0,1) the frequency can be adjusted in the range of 10,0 Hz and 99,9 Hz in steps of 0,1 Hz.

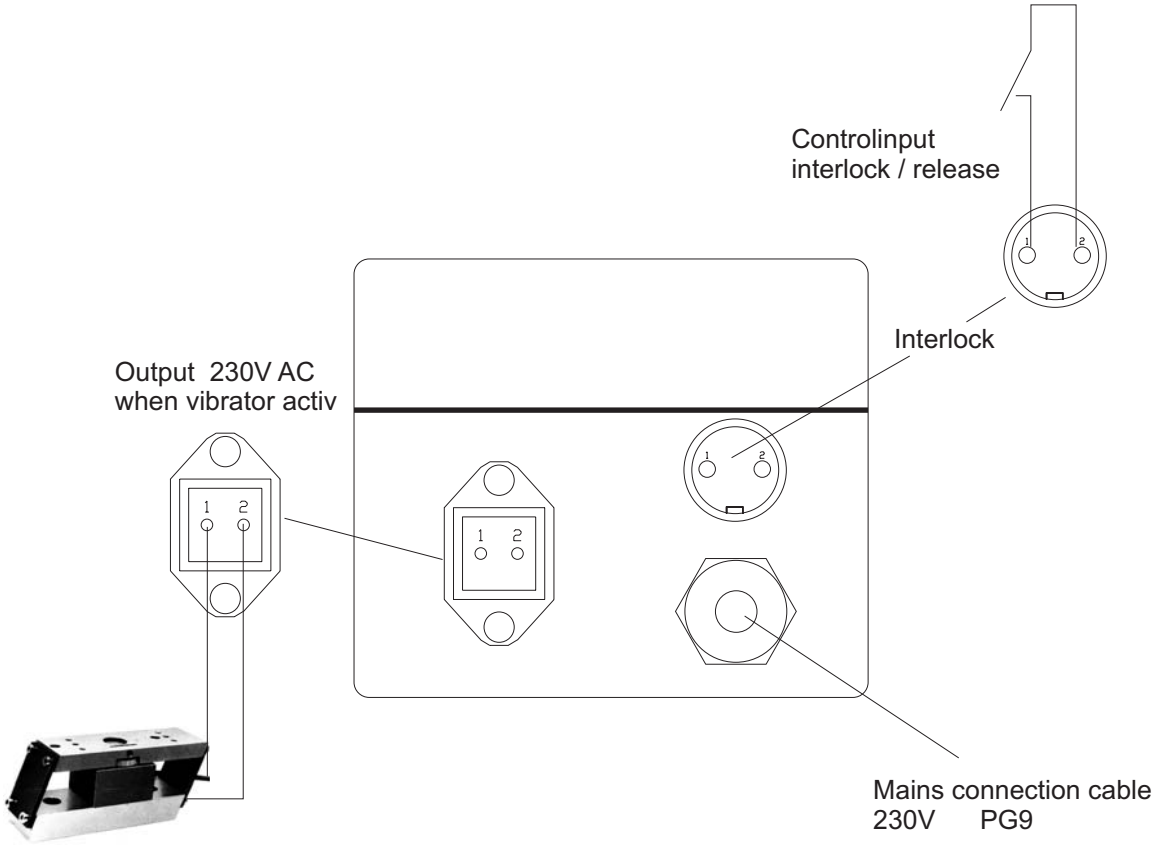
Selector switch 1.2 Set-point value input
There are two ways for the set-point value input. By means of a potentiometer which is installed as a standard in the device and is wired according to the connection diagram, or by
0 - 10 V DC. For this the plug-in jumpers must be plugged according to the connection diagram in each individual case.

Selector switch 2.2 "half-wave"
Thus the output pulse form can be selected between half-wave and full-wave.

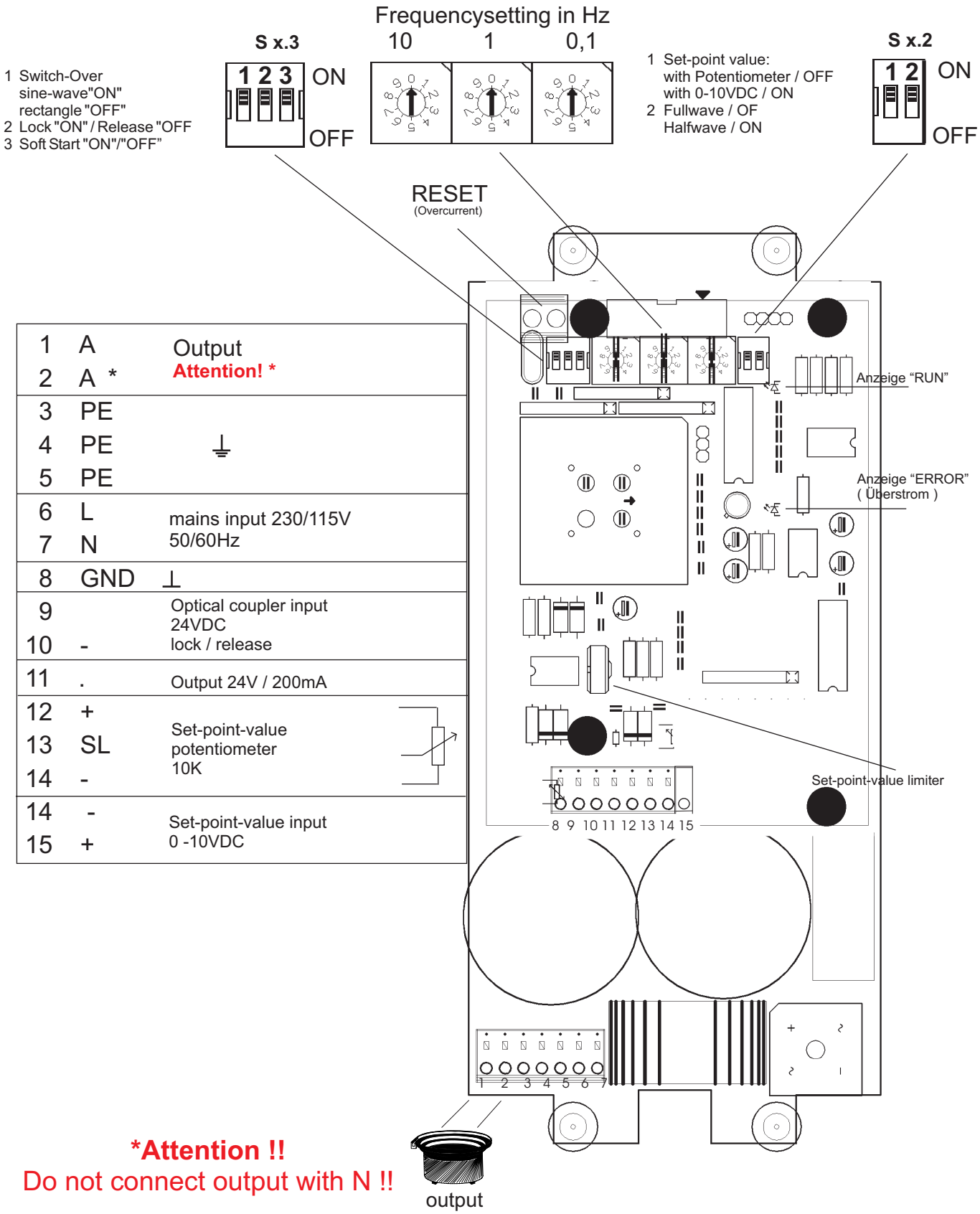
Set-point value limiter
By means of a potentiometer which is for limiting the set-point value.

Over-current-limiter
If the over-current-limiter has turned off the device, it is possible with the RESET-Button to turn on the device again.

Plugging and connect



Connection diagram



1	A	Output
2	A *	**Attention! ***
3	PE	
4	PE	⏚
5	PE	
6	L	mains input 230/115V
7	N	50/60Hz
8	GND	⊥
9		Optical coupler input
10	-	24VDC lock / release
11	.	Output 24V / 200mA
12	+	Set-point-value
13	SL	potentiometer
14	-	10K
14	-	Set-point-value input
15	+	0 -10VDC

***Attention !!**

Do not connect output with N !!

Fault clearance

The device does not function:

- Check if mains supply is connected.
- Check fuses in device or replace, if required.
- Adjust control input "lock / release" correctly.
- If this input is not used, the selector switch must be set to "lock"

Vibration feeding device does not perform:

- Check if the correct output frequency is adjusted (adjustment directions page 3)

Feeding device vibrates depending on load:

- Check if the correct output frequency is adjusted (adjustment directions page 3)

Magnet heats up:

- Magnet has wrong nominal voltage, check!
- Because of wrong nominal voltage or too big an air gap the current consumption is too high, check!

EG - Konformitätserklärung

EFR01S12.CDR

Für das folgend bezeichnete Erzeugnis

Regler Kombination FN 05
mit Rund-. und Linearförderer
der Firma Fimotec-Fischer Montagetechnik Friedhofstraße 13
D-78588 Denkingen

wird hiermit bestätigt, daß es den wesentlichen Schutzanforderungen entspricht, die in der Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit (89/336/EWG) festgelegt sind.
Diese Erklärung gilt für alle Exemplare, die nach den anhängenden Fertigungszeichnungen - die Bestandteil dieser Erklärung sind - hergestellt werden.
Zur Beurteilung des Erzeugnisses hinsichtlich elektromagnetischer Verträglichkeit wurden folgende Normen herangezogen:

EN 55014	IEC 801-2
EN 50082-2	IEC 801-3
VDE 113 - EN 60204	IEC 801-4

Diese Erklärung wird verantwortlich für den Hersteller/Importeur

Bühner & Schaible GmbH
Ameisenstraße 12
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abgegeben durch

Herrn Kurt Bühner
Geschäftsführer

Berglen, den 17.06.96

Unterschrift: