

Operating Instructions for the Frequency Control Units for Vibrator Drives

ESR 25
ESR 28

BA

Rhein-Nadel Automation GmbH

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Technical Data

Function description

The control units of the ESR2X family are devices for power control of RNA vibration and linear feeders. The device generates a mains independent output voltage with variable frequency. The microprocessor continually senses the vibration amplitude and the resonance frequency from the behaviour of the vibration solenoids. This means that no additional sensor is required for actual value determination (a patent application has been made for this method). The controller holds the vibration amplitude constant at the selected value regardless of the actual loading. The frequency of the operating current is controlled by a phase locked loop (PLL) so that the feeder always operates under optimum conditions, i.e. close to resonance.

The control system self-adapts to the actual feeder by means of an automatic calibrating procedure. This calibration must be carried out when a particular feeder is connected for the first time. This makes it possible to eliminate the cumbersome procedure of mechanical tuning (more or less springs in the drive). Up to eight individual programs can be stored allowing fast change over times for different components or bowl tops.

With these control units, vibration feeders can be operated on supply mains grid systems with various mains frequencies without requiring new adjustment of the feeders.

The device is self-protecting. Neither the solenoids of the feeder nor other components can be overloaded. The operating parameters are monitored continuously. In the case of large deviations, the monitoring function issues corresponding alarm messages before serious consequences could arise. This will detect a broken spring or loose nut before damage is incurred.

The solenoids of the vibration feeders are driven sinusoidal with width-modulated pulses, giving steady running behaviour of the feeder.

The control unit is equipped with a sensor input for connecting customary fill level sensors with PNP/NPN output or a signal contact. The sensor connection is a 5 pin DIN connector. The sensor signal starts or stops the connected feeder with time delays that can be programmed separately for each signal transition.

The soft start and soft stop times are separately programmable.

Which control unit for which RNA-feeder?

The load current of the feeder, which is to be driven, determines the correct choice of control unit. The load current is affected by four factors:

- **Operating frequency**

- **Size of the air gap**
- **Load voltage**
- **Weight of the superstructure (bowl top / linear rail)**

The following table shows typical guidance values as averages of measurements, made in our production factory.

Table 1 Which frequency control unit for which RNA vibration feeder?

Vibration feeder Type designator of RNA drive	Measured current [A]	Max. permitted load current [A]	Guidance value for current limit* in [A]	Recommended control unit Type
SRC - N 160 - 2	0.4	0.6	0.5	ESR 25 / 0,6
SRC - N 200 - 2	0.5	1.2	1.0	ESR 25 / 1,8
SRB 250 - 2	0.6	1.2	1.0	
SRC - N 250 - 2	1.5	2.6	2.0	ESR 25 / 5,5
SRB 400 - 2	1.5	2.8	2.0	
SRC - N 400 - 1	3.2	3.8	4.0	
SRC - N 400 - 2	3.4	4.3	4.0	
SRHL 400 - 1	3.9	5.7	4.5	ERS 28
SRHL 400 - 2	4.1	5.3	4.5	
SRC - N 630 - 1	3.9	5	5.0	
SRC - N800 - 1	5.3	8.5	5.5	

Table 2 Which frequency control unit for which RNA linear feeder?

Linear feeder Type designator of the RNA drive	Measured current [A]	max permitted load current [A]	Guidance value for current limit* in [A]	Recommended control unit Type
GL 01	0,3	0,6	0,5	ESR 25 / 0,6
SLL 400	0,4	0,6	0,5	
GL 1	0,3	1,1	0,9	ESR 25 / 1,8
SLL 800	0,6	1,4	1,2	
SLK - N 6	0,7	1,4	1,2	
SLF 1000	1,5	2,6	2,0	ESR 25 / 5,5

- The **Current limit** is entered in the calibration menu when calibrating the control units for a new feeder, see Section 3.4.1. The values tabulated here are for general guidance only. The current limit can be set higher for heavy bowl tops or linear rails.

Under no circumstances is it permissible to set the current limit higher than the specified maximum tolerated load current for the particular feeder.

The basic unit for the variants ESR 25 / 0.6 and ESR 25 / 1.8 is the standard control unit ESR 25. Conversion to a lower current region requires modification of the hardware of the control unit and changes of the factory settings; therefore conversions should always be made in the RNA factory.

If you have any questions relating to the ESR control please contact the electrical engineering department of the company Rhein-Nadel Automation in Aachen. Mr. Heinrichs is your contact.

Tel 0241 / 5109 - 207 Fax 0241 / 5109 - 219. Email RNA@RNA.DE

In the UK contact RNA AUTOMATION LTD. Birmingham. Mr. John Stanton is your contact.

Tel 0121 749 2566 Fax 0121 749 6217 Email RNA@RNA-UK.COM

EC conformity

The control unit complies with the following regulations:

EC EMC Directive 89/336/EEC;

EC Low voltage equipment directive (73/23/EEC).

Applied harmonised standards:

EN 60335-1

EC EMC Directive EN 50081-2

EC EMC Directive EN 50082-2

Conformity is ensured only when our installation instructions are observed as set forth in Section 3.

Technical data

Table 3 Technical data

	ESR 25	ESR 28
Input voltage ¹⁾	230 V + 6%-10% 50/60 Hz	230 V + 6%-10% 50/60 Hz
Mains fuse	5 x 20mm, 4 A slow, I ² t ³ 72	5 x 20mm, 4 A slow, I ² t ³ 72
Output voltage	0-210 V	0-210 V
Output frequency	25-150 Hz	25-150 Hz
Output current ²⁾	5.53 A	8.5 A
Setpoint specification	Key-programmable	Key-programmable
Input ³⁾	12-24 V DC or contact	12-24 V DC or contact
Soft start time	0.05 to 10 seconds	0.05 to 10 seconds
Soft stop time	0.005 to 10 seconds	0.005 to 10 seconds
Sensor signal	XS2/Pin 4, HIGH>16 V, LOW < 8	XS2/Pin 4, HIGH>16 V, LOW < 8
Sensor power supply	XS2/Pin 2 = +24 VDC, Pin 5 = 0	XS2/Pin 2 = +24 VDC, Pin 5 = 0 Volt
Sensor current	maximum 50 mA	maximum 50 mA
Sensor signal delay	0,000 to 10 seconds	0.000 to 10 seconds
Status output ³⁾	24V, 50mA	24V, 50mA
Tolerated temperature	0-40°C	0-40°C
Dimensions (WxHxD)	172 x 220 x 169 mm	172 x 220 x 169 mm
Interference	according to EMC directive	according to EMC directive
Type of protection	IP 54	IP 54
Multicalibration programs	Maximum of 8	Maximum of 8

Key

1) Convertible to 115 V +6-10%, 50/60 Hz

2) Self-limiting (internally selectable for 1.38A, 0.59A, 0,14A)

3) Optional when ESC 06 board is fitted

Safety Instructions

It is always necessary to read and understand the safety instructions. This ensures preservation of valuable material and avoids impairment of health.

Steps must be taken to ensure that all persons working with this control unit are familiar with the safety regulations and observe them.

The device described in this manual is a control unit for operating **RNA vibration and linear feeders**. The limit values specified in the technical data must be observed.

Attention!



This warning triangle designates safety instructions.
Failure to heed this warning can lead to severe injuries or death!



Work on electrical equipment of the machine/plant may be carried out only by a trained electrician or by untrained persons under the leadership and supervision of a trained electrician in accordance with the regulations for electrical engineering!
All safety and danger warning signs on the machine/plant must be observed!
The electrical equipment of a machine/plant must be inspected and checked regularly.
Defects such as loose connections or damaged cables must be remedied immediately!

Before opening the unit, disconnect the mains plug and wait for at least 5 minutes!

The dangerous voltage in the intermediate circuit decays slowly after disconnection from the mains supply voltage! Failure to pay attention to this entails danger to life!



Before commencing operation, make sure that the safety grounding line (power earth, PE) is intact and installed at the connecting point. Only test instruments approved for this purpose may be used for checking the safety-grounding conductor.

Commissioning Instructions



The connecting cable between the control unit and the vibration feeder must be shielded, and the shield must be connected to the safety grounding line at both ends. The maximum permitted cable length is 2 metres.

Before connecting-up to the mains input voltage and switching on the control unit, it is essential to check the following points:



- * Are all plug connections secure?
- * Is PROPER INTENDED USAGE ensured?
- * Does the mains voltage specification on the control unit agree with the local mains voltage?

Operation of the control unit may commence only when all the above questions can be answered unambiguously with YES.

The following devices are installed on the control unit for operator control and for making connections:

- * Mains power switch.
- * Operator control and display section
- * Mains input cable with grounded plug
- * Plug connector for connecting the feeder device
- * Sensor connector for fill level / blockage monitoring
- * Blind plug PG9 for additional wiring

To avoid damage to the feeder at commissioning time of the control unit, the following basic settings have been programmed in the factory:

- * Vibration amplitude 10%
- * Output frequency 100 Hz
- * Soft start approx. 0.3 seconds
- * Sensor input disabled

The feeder will vibrate very slowly after switch on.

Operator control

Keyboard

The keyboard consists of the display window and the four keys: ON/OFF, Enter, Arrow "Up" and Arrow "Down". See Fig. 1.

Key ON/OFF

The ON/OFF key is used chiefly to auto calibration (see Section 3.4.1) the ON/OFF key is used as an escape key, it switches off the current for the feeder and aborts the calibration process.



switch the current for the feeder on and off. In connection with

Arrow keys "Up" / "Down"



The arrow keys have several functions:

- In **Normal**

operation they can be pressed to access the individual menu options in both directions.



- In the menu option **CHANGE PASSWORD** the code number is entered with the arrow keys.
- In the **Activated menu option** they are used to select the desired value or operating state.

Enter key



The enter key is pressed to activate the individual menu options and to acknowledge the set parameters. The set value is saved by pressing the enter key. In this way the ESR retains its setting values even when it has been switched off. After completing a setting the enter key should always be pressed to save programmed values.

To make a setting, for example the speed, first of all select the corresponding menu option with the arrow keys then press the enter key to activate this menu option. The speed setting is marked with ><, e.g. >57%<. This marking indicates that the value can now be changed with the arrow keys, e.g. to >68%<. When the desired change has been made, press the enter key to acknowledge it. This saves the new value to memory. The arrows will now disappear leaving the value 68%.

Certain error messages must always be acknowledged with the enter key. These messages concern serious errors such as "Short circuit protection active" and others. Other error messages disappear automatically when the error condition no longer exists.

Menu structure ESR 2x

The menu structure consists of 4 separate menus:

- Main menu
- Control menu
- Calibration menu
- Factory settings

Passwords are used to access the menus.

Each menu is designed as a scrolling list from which the individual options (list items) can be selected with the arrow keys. To change the value of the parameter associated with a menu option, press the "Enter" key to mark the currently selected parameter with ><. The parameter value can then be changed with the arrow keys. Press "Enter" to confirm the new choice of value and return to the scrolling list of menu options. At the same time the new setting is saved into the non-volatile memory.

A password must be known to obtain access to the individual submenus. When in a submenu, the password can be changed, except for the menu "Factory settings" which has a fixed password.

To reset all changed values (except for the factory settings), switch-off the mains voltage, press in and hold in the two arrows keys "Up" and "Down" then switch the mains voltage on again.

The standard password for the control menu is: 1000

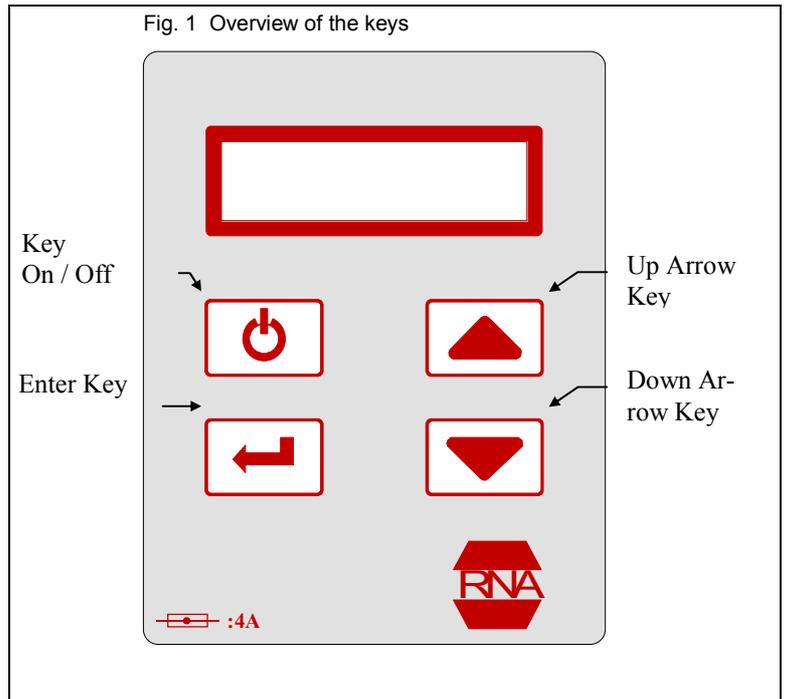
The standard password for the calibration menu is: 2000

Both these values can be changed within their respective menus, and both are restored to their standard values on making a reset as described above.

The menu "Factory settings" contains device specific data that may be changed only by instructed personnel.

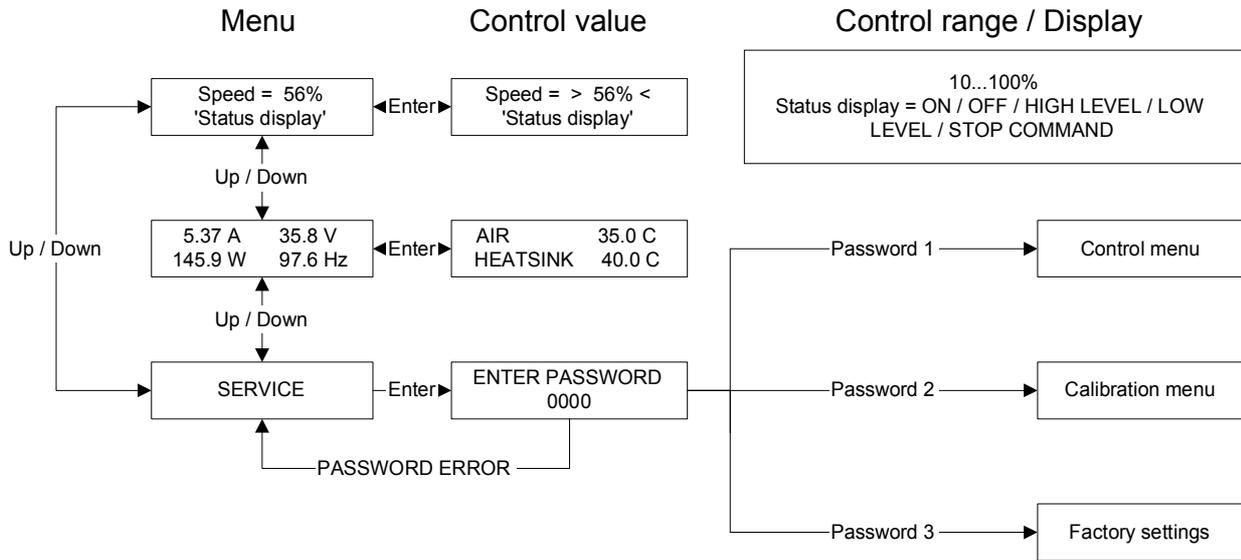
Therefore the password for this menu is not stated here.

Fig. 1 Overview of the keys



Main menu

Fig. 1 Main menu



Menu option: "Speed"

The speed can be set to values in the range of 10% to 100% when this menu option is activated, i.e. when the currently valid value is marked with angular brackets: >100%<. The speed setting determines the vibration amplitude in a completely linear manner.

Menu option: "Measuring values"

The measured values for current / voltage / power and frequency as well as the actual temperature in the casing and on the heat sink are shown in the display.

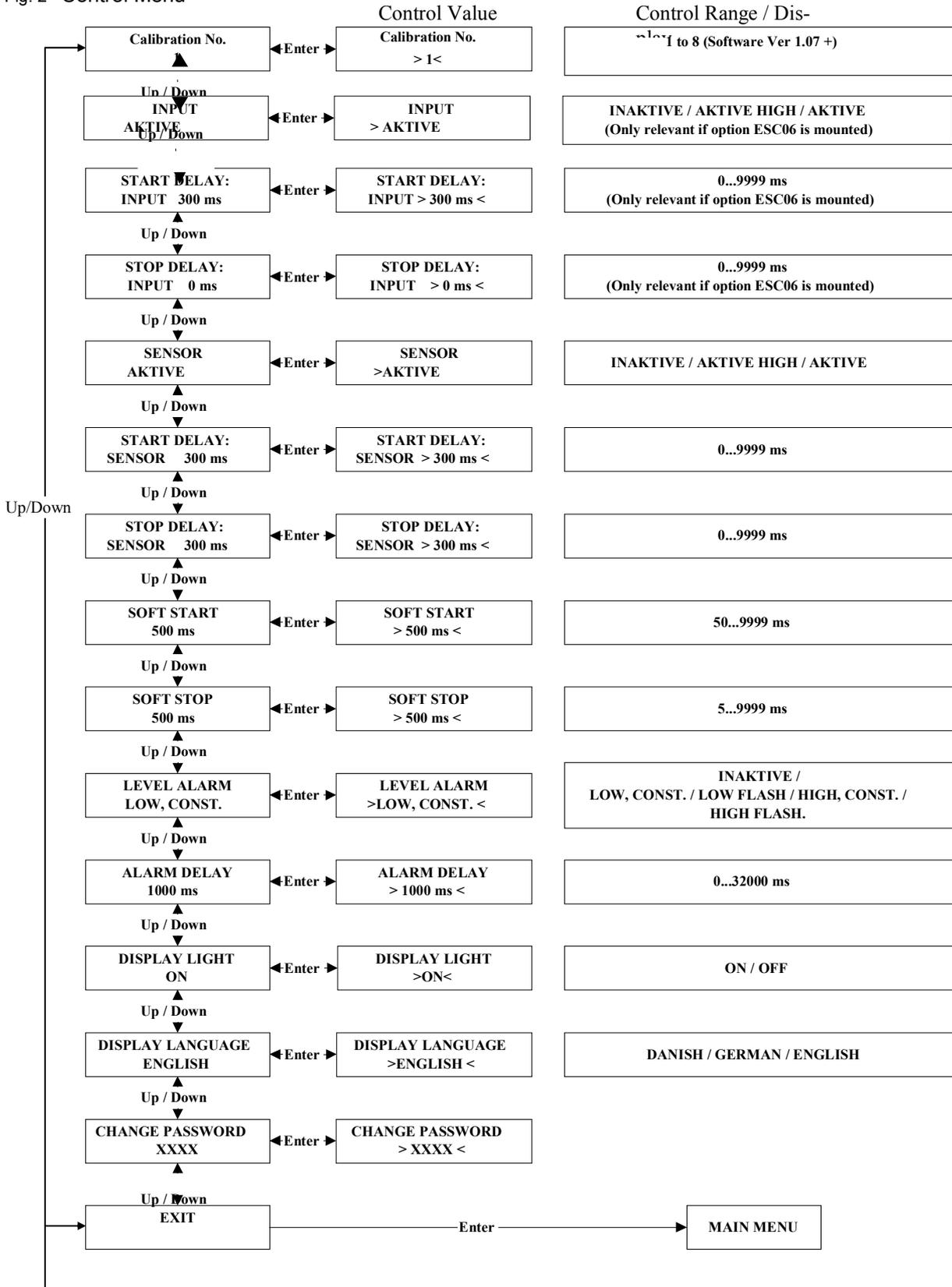
Menu option: "Service"

This menu option provides access to the other menus.

On activation with the enter key, each individual digit of the desired password can be changed. The activated digit is marked by the flashing cursor.

Control Menu

Fig. 2 Control Menu



3.1.4.1 Menu option: "Calibration No." (Relevant for software version 1.07 and greater)

The stored parameters for up to eight programs are selected with this menu. Press the "Enter" key to activate the menu then press the "Up" or "Down" keys to select the required program number. The data must be programmed using the "Calibration Menu". Do not select a program number that does not contain valid data.

3.1.4.2 Menu option: "Input" (Relevant only when the optional PC board is fitted)

The feeder can be switched on and off with an external source 24 V signal, e.g. from a PLC system, via the "Input" connection.

This menu option provides the choices to make the input "Inactive", "Active +24 Volts" or "Active 0 Volts".

"Inactive": The input signal is ignored and the input always has status = "switched-on".

"Active + 24 Volts": A signal level of +24 Volts at this input stops the feeder. A signal of 0 V starts it again.

"Active 0 Volt": A signal level of 0 V at this input stops the feeder. +24 Volts starts it again.

The message "Stop command" appears under the menu option "Speed xxx%" in the main menu when the enable input is activated as "Stop".

3.1.4.3 Menu options: "Start delay: input" and "Stop delay: input" (Relevant only when the optional PC board is fitted)

The time delay between receiving a start/stop signal at the "Enable input" and start/stop of the feeder can be set here individually in the range 0...9999 ms.

3.1.4.4 Menu option: "Sensor"

The feeder can be switched on and off with a 24 V signal at the "Sensor" input. For example, this signal can be derived from a photocell that monitors whether an output track is full.

This menu option provides the choices to make the input "Inactive", "Active +24 Volts" or "Active 0 Volts".

"Inactive": The input signal is ignored and the input always has status = "switched-on".

"Active + 24 Volts": A signal level of +24 Volts at this input stops the feeder. A signal of 0 V starts it again.

"Active 0 Volt": A signal level of 0 V at this input stops the feeder. +24 Volts starts it again.

The message "High level" appears under the menu option "Speed xxx%" in the main menu when the enable input is activated as "Stop".

3.1.4.5 Menu options: "Start delay: Sensor" and "Stop delay: Sensor"

The time delay between receiving a start/stop signal at the "Sensor" input, and the feeder starting or stopping can be individually set here in the range 0...0000 ms.

3.1.4.6 Menu options: "Soft start" and "Soft stop"

Soft start produces a timed ramp-up of vibration amplitude after the power supply is switched on, or external enable or level sensor enable. If this time is set too short, the vibrator solenoids will impact. Heavy devices tend to overshoot due to their own dynamic response if vibration build-up is too rapid.

Stopping the feeder device normally should not be delayed, but a delay may be necessary in some cases to avoid incorrect orientation of the components on the feeder, if stopped too abruptly. The time setting determines how long the build-up of vibration from 0% to 100% or decay from 100% to 0% will take. For example, if the "Soft start time" is set to 1000 ms, the feeder will take 1 second to build-up the vibration amplitude from 0% to 100%.

3.1.4.7 Menu option: "Level alarm"

The conditions which will produce an alarm signal at the alarm output can be set here (available only when the control unit is equipped with the options board), and whether the alarm shall be a continuous signal or an intermittent signal (flashing). The available possibilities are:

"Inactive", "Low, Cont.", "Low, flash", "High, Cont.", "High, flash".

If the sensor alarm is set such that alarm will be issued for "Low level", the status message "Low level" will also appear under the menu item "Speed xxx%" in the main menu.

3.1.4.8 Menu option: "Alarm delay"

Here the time delay can be set which will elapse between receiving a signal at the sensor input which will produce an alarm, until the alarm is activated at the alarm output. Under normal conditions of level monitoring the signal at the level sensor input continually changes between +24 V and 0 V, but an alarm signal is desired only if components have been missing or there have been too many for a considerable time.

3.1.4.9 Menu option: "Display light"

The display illumination back light can be switched on and off here.

3.1.4.10 Menu option: "Display language"

A selection of one of the available languages can be made here, e.g. German, Danish and English.

3.1.4.11 Menu option: "Change password"

A new password can be entered here for access to the control menu. The standard password is 1000.

If the active password has been forgotten, making a "Memory Reset" can reset it.

Refer to section 3.1.2.

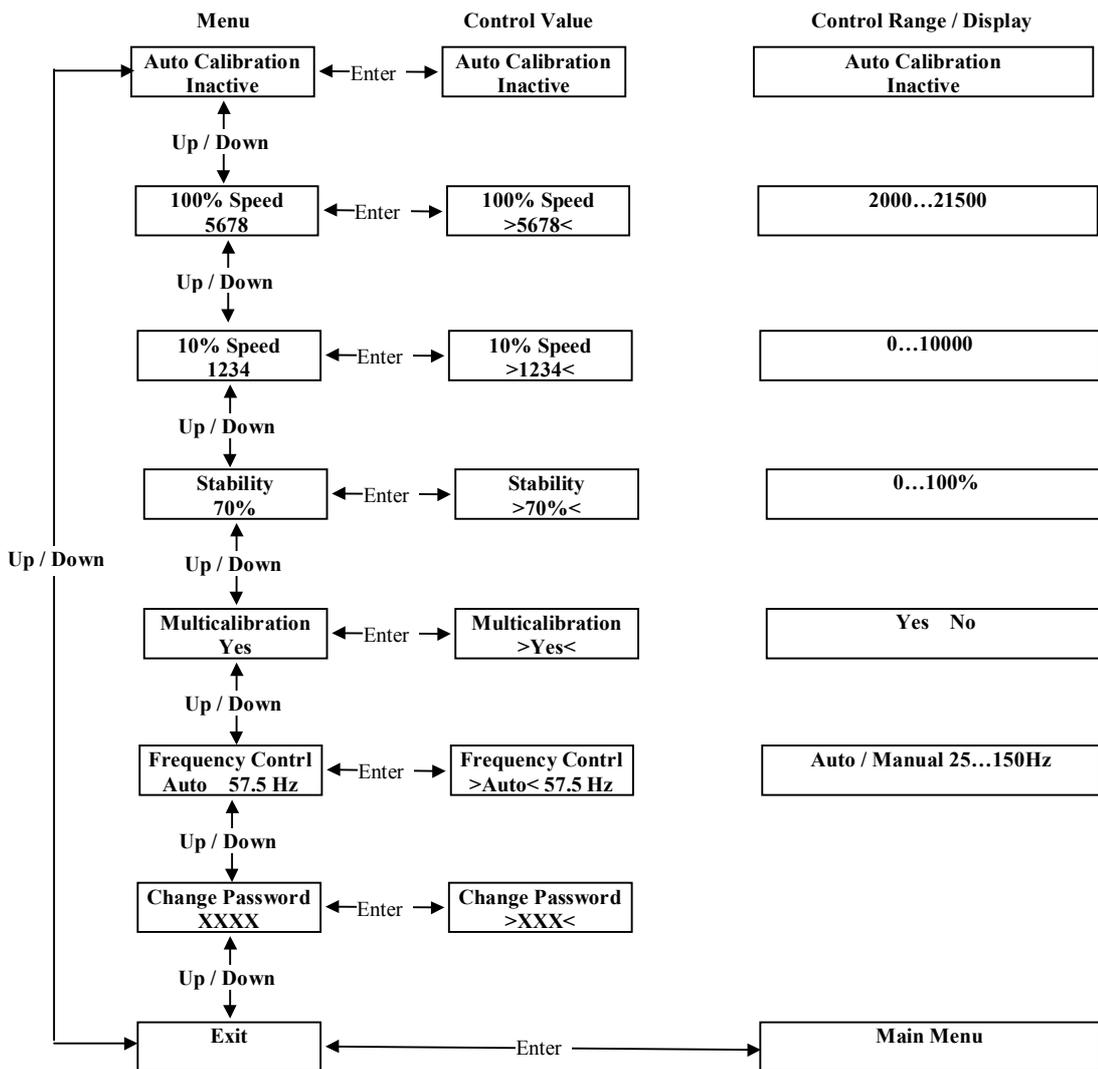
Warning. This will delete all calibration data for all stored programs.

3.1.4.12 Menu option: "Exit"

This menu option must be chosen to return to the main menu. The control unit automatically returns to the main menu if no key has been pressed for 2 minutes.

Calibration menu

Fig. 3 Calibration menu



Menu option: "Auto calibration"

The menu option "Auto calibration" activates the automatic calibrating procedure. The ESR2x adapts itself to the connected feeder. To start the automatic calibration mode select "Active" and press the enter key to confirm. See Section 3.4.

Menu option: "100% speed"

The maximum speed with which the feeder will operate is set here. The feeder is switched on with the key "ON/OFF" and the desired maximum speed can then be set.

If the feeder impacts mechanically press the ON/OFF key immediately to switch off. Reduce the set value by approx. 5-10% then switch the feeder on again to check that it no longer impacts. If maximum voltage or current limit message is displayed, the maximum permissible loading value for the solenoids has been reached. In this case just let the feeder run, whereby the ESR2x will automatically reduce the current and voltage to acceptable values. Let the feeder run until the alarm no longer appears for at least 10 seconds.

Menu option: "10% speed"

The minimum speed with which the feeder shall operate can be set here. The components should move very slowly. Switch on the feeder with the "ON/OFF" key and leave it switched on throughout the procedure for adjusting this parameter. It is particularly important to make sure that the feeder is running stable on exit from this menu option with the enter key. This is because the automatic adjustments of alarm thresholds and operating conditions are saved to memory on exit from this menu option.

Alarms such as frequency errors can appear during this calibration. This is because the values for maximum and minimum frequency are changed during this calibration. A genuine fault is present only if the alarm persists for a considerable time, more than 1 minute.

Attention! The control unit can adjust the vibration amplitude and frequency only when motion of a certain magnitude is present. Therefore it is possible that a persistent error display, such as a frequency error, may appear when the vibration amplitude is very small. The set value must then be increased until an audible or visible vibration of the feeder is present. The value can then be reduced again, taking care that the vibration does not stop completely. After completing the adjustment, press the enter key to save the set values to memory.

Menu option: "Stability"

This menu option should be selected if the feeder shows strong overshoot on starting or if the speed setting produces fluctuating vibration amplitude. In such cases it is advisable to set the "Stability" parameter somewhat higher, e.g. to 70-80%.

Menu option: "Multicalibration"

This menu option should be selected if multi-programming is required. Up to eight different programs can be stored.

Menu option: "Frequency control"

The frequency control option can be used to control the frequency of the feeder manually. Automatic amplitude control is lost when manual frequency control is selected.

First select between automatic and manual frequency control. The frequency can then be adjusted manually with the arrow keys when manual frequency control has been activated.

Menu option: "Change password"

A new password can be entered here for access to the calibration menu. The standard password is 2000.

If the currently valid password has been forgotten, making a memory reset can reset it. **Warning. This also deletes all calibration data for all stored programs.**

Menu option: "Exit"

Activate this menu option to return to the main menu. The control unit automatically returns to the main menu if no key has been pressed during the last 2 minutes.

Alarm messages and other displays

Various alarm messages and other notifications can appear in the display under certain circumstances. The alarm messages have an order of priority. If more than one alarm is active, only the one with highest priority is displayed. The priority of some alarm messages is that they remain in the display until the operator acknowledges the alarm by pressing the enter key. Alarm messages with this priority level will also produce an alarm signal at the alarm output of the options board. This provides the possibility for indicating the alarm with an alarm lamp or other alarm device.

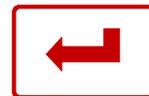


Table 4 Alarm messages

Priority	Alarm text	Acknowledge necessary	Alarm output
1	Short circuit protect. active	Yes	Continuously on
2	NV Memory error	Yes	Flashing
3	DAC offset error	Yes	Flashing
4	Offset error voltage meas.	Yes	Flashing
5	Offset error current meas.	Yes	Flashing
6	Offset error PWM modulation	Yes	Flashing
7	DC Servo circuit Not functional	Yes	Flashing
8	Resonance freq. Not found	Yes	Flashing
9	Resonance max: Not found	Yes	Flashing
10	Overmodulation protection	No	Flashing
11	Peak-current limit	No	Flashing
12	RMS-current limit	No	Continuously on
13	Load disconnected	Yes	Flashing
14	Temperature error	Yes	Flashing
15	High temperature	Yes	Continuously on
16	Frequency error	No	Flashing
17	Vibration restricted	No	Flashing
18	Max. voltage	No	Flashing

Explanation of the alarm messages

Short circuit protection active

Short circuit protection becomes active when the current exceeds twice the value of the maximum RMS current. In this case the ESR2x instantly switches off the output voltage to protect its output stage against overload. The alarm message remains on the display until it is acknowledged by pressing the enter key. This alarm appears if a genuine short circuit is present at the output of the ESR2x or if the connected feeder is much larger than the current limit setting permits.



Remedy:

1. Switch off the feeder and examine the cable for faults.
2. Make a new calibration ensuring that the current limit is set to the value specified in Table 3 or slightly lower.

NV memory error

This error is self-diagnostic and appears only when there is a fault in non-volatile (NV) memory. The ESR2x can continue operation but it will possibly not retain all calibration data after power supply (mains voltage) is switched off. In this case new calibration is necessary after power supply is switched off.

Remedy:

Call customer service.

DAC offset error

This error is self-diagnostic and comes only in connection with the calibration process when there are so serious faults present in the control loop that the automatic offset adjustment is unable to compensate them.

Remedy:

1. Make a new calibration.
2. Call customer service.

Offset error voltage measurement

This error is self-diagnostic and comes only in connection with the calibration process when there are so serious faults present in the measuring circuits that the automatic offset adjustment cannot compensate them.

Remedy:

1. Make a new calibration.
2. Call customer service.

Offset error current measurement

This error is self-diagnostic and comes only in connection with the calibration process when so serious faults are present in the measuring circuits that the automatic offset adjustment cannot compensate them.

Remedy:

1. Make a new calibration.
2. Call customer service.

Offset error PWM modulation

This error is self-diagnostic and comes only in connection with the calibration process when so serious faults are present in the modulation circuit that the automatic offset adjustment cannot compensate them.

Remedy:

1. Make a new calibration.
2. Call customer service.

DC servo circuit not functioning

This fault is self-diagnostic and comes only in connection with the calibration process when the DC servo circuit is unable to keep the DC current 0 A.

Remedy:

1. Make a new calibration, if necessary with a somewhat higher setting of the current limit. If this is unsuccessful, call customer service. Bear in mind that if the current limit is set to a value higher than the limit specified for the vibration solenoids, the latter may suffer damage.
2. If the feeder is very small in relation to the maximum current of the ESR2x (i.e. the current specified in Table 3 is less than $\frac{1}{4}$ of the maximum output current of the ESR2x, see Table 1), the ESR2x can be set internally to a more suitable current value. This increases the accuracy of all measuring circuits and reduces their measuring errors. Call customer service to get this conversion made.

Resonance frequency not found

This error is connected with the calibration process and appears when the ESR2x cannot find the resonance frequency of the feeder.

Remedy:

1. Check that the feeder can vibrate freely and that it contains no components. Then try making a new calibration.
2. Make a new calibration and ensure that the current limit is set to the value specified in Table 3 or possibly slightly higher. If the current limit is set higher than the specified value, bear in mind that the vibration solenoids may suffer damage.

Resonance maximum not found

This error is connected with the calibration process and appears when the ESR2x cannot make optimum adjustment of the frequency with respect to the feeder.

Remedy:

1. Check that the feeder can vibrate freely and contains no components then try making a new calibration.
2. Make a new calibration and increase the current limit setting slightly (e.g. by 2-5%). If the current limit is set higher than the value specified in Table 3, bear in mind that the vibration solenoids may suffer damage.

Overmodulation protection

This is not a fault but only a notification that the ESR2x is trying to generate a voltage higher than available on the 230 V mains input side. The ESR2x will automatically limit the output voltage to a safe value, and the message will then

disappear of its own accord. This limitation is reset to zero each time the control unit is switched-on with the ON/OFF key, wherefore a new message can appear and new limiting can start.

The message may appear if the ESR2x increases the voltage to much in order to achieve the set speed, for example when the feeder is heavily loaded or in the case of rapid start-up of the feeder.

Remedy:

None

Peak current limit

This is not a fault, but a message that the output current to the feeder is more than 75% greater than the current limit setting. The ESR2x automatically reduces the maximum output voltage to a safe value and then this message disappears again of its own accord. This limiting is reset to zero every time the control unit is switched-on with the ON/OFF key. The message can then appear again and a new automatic limitation can be made.

This message can be produced when the ESR2x greatly increases the voltage in order to achieve the set speed, for example when the feeder is heavily loaded or when it is started very rapidly.

Remedy:

None

RMS current limit

This is not a fault, but a message that the output current to the feeder is 1% greater than the set current limit. The ESR2x automatically limits the maximum output voltage to a safe value, and this message then disappears again. This limiting is reset to zero every time the control unit is switched-on with the ON/OFF key. This message can then appear again and a new limitation can start.

This message can be produced when the ESR2x greatly increases the voltage to achieve the set speed, e.g. when the feeder is heavily loaded or when it is started very rapidly.

Remedy:

None

Load disconnected

This message appears when it has been forgotten to connect a feeder, or in the case of a cable breakage, or if the connected feeder is very small in relation to the current limit setting.

Remedy:

1. Disconnect the connected feeder and examine the cable for faults therein.
2. Make a new calibration and thereby ensure that the current limit is set to the value specified in Table 3 or slightly lower.

Temperature error

The temperature on the heat sink is now greater than 80°C.

Remedy:

1. Switch-off the feeder with the ON/OFF key.
2. Make sure that airflow past the heat sink is unimpeded.
3. Remove dust and dirt deposits from the cooling fins.



High temperature

The temperature on the heat sink is now greater than 70°C.

Remedy:

1. Make sure that airflow past the heat sink is unimpeded.
2. Remove deposits of dust and dirt from the cooling fins.

Frequency error

The resonance frequency of the feeder has now reached an outer frequency limit. This can have several causes.

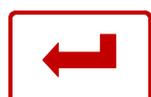
1. Poor calibration of the 10% speed. During calibration of the 10% speed the ESR2x finds the outer limits of the permissible frequency range. It is therefore important that the feeder is running stable and has been running stable for at least 10 seconds before exit from this menu option. The limits are saved to memory on exit from this menu option. The control unit can automatically control the vibration amplitude and the frequency only when movement of a certain magnitude is taking place. If the feeder is running so slowly during the 10% speed adjustment that the frequency becomes unstable, the frequency limits found may be incorrect.
2. Very high loading with heavy articles. The consequence is that the frequency has dropped by 20% due to the heavy loading. The alarm can therefore appear in the case of heavy loading of the feeder which increases the total weight of the feeder system by more than 20%.
3. A broken or loose spring.

Remedy:

2. None. The feeding speed will possibly be reduced to some extent if the loading further increases. Alarm messages will then also appear: Maximum voltage, RMS current limit, etc.
3. Recalibrate the 10% speed thereby making sure that the feeder is running stable before exit from this menu option.
4. Check the springs; replace and retention them as may be necessary.

Vibration restricted

This alarm appears when the ESR2x is unable to maintain the desired speed (vibration amplitude) without overloading the vibration solenoids.



1.

This alarm message appears when the feeder speed is less than half of the set speed but the feeder is receiving full current. This is not necessarily a fault; it could be caused by excessive loading of the feeder with heavy articles. Another possible reason why the feeder cannot vibrate freely is that a spring is broken or loose. The air gap of a solenoid might be clogged with dirt.

This alarm message can also appear when heavily loaded feeders are started very rapidly. It then takes some time until the feeder reaches the desired speed, although it is receiving full current.

Remedy:

1. Reduce the loading of the feeder.
2. Set the soft start time and possibly the stability to a higher parameter value. This has no adverse effect on the start-up because the loading is here limiting the starting speed.
3. Check that the feeder can vibrate freely.
4. Check the springs. Replace and retention them as may be necessary, and clean the air gap of the solenoids.

Maximum voltage

This is not a fault, but a notification that the ESR2x is now giving out the maximum voltage (approx. 230 V) of which it is capable.

The reason for this message may be that the ESR2x has greatly increased the voltage in order to achieve the set speed when the feeder is heavily loaded or in the case of very rapid start up of the feeder.

Remedy:

None. This message automatically disappears again when the loading is reduced.

Preparations required before applying power to the control

Vibration feeders and linear feeders must be operated properly in accordance with the instructions in order to prevent damage of their mechanical construction.

Therefore the electrical operating conditions must be adjusted to suit the vibrating system. The following table shows the variation ranges for the entire RNA range of devices, within which safe operation is possible.

A prerequisite condition for constant and stable running performance is uniform distribution of weight on the feeder bowl top (balance).

Balanced loading of the spring package is shown in detail in the operating instruction manual for the **vibration feeder**.

Table 5 RNA vibration feeder operating parameters

Vibration feeder Type of drive	Max. load current [Amps]	Max. air gap on solenoid [mm]	Frequency range	Body colour of the solenoid
SRC - N 160 -2	0.6	0.5	90...120 Hz	black
SRC - N 200 - 2	1.2	0.5	90...120 Hz	black
SRB 250 - 2	1.2	0.5	90...120 Hz	black
SRC - N 250 - 2	2.6	1.2	90...120 Hz	black
SRB 400 - 2	2.8	1.2	90...120 Hz	black
SRC - N 400 - 1	3.8	2.8	45...60 Hz	red
SRC - N 400 - 2	4.3	1.2	90...120 Hz	black
SRHL 400 - 1	5.7	2.8	45...60 Hz	red
SRHL 400 - 2	5.3	1.5	90...120 Hz	black
SRC - N 630 - 1	5	2.8	45...60 Hz	red
SRC - N800 - 1	8.5	2-3	45...60 Hz	red

Table 6 RNA Linear feeder operating parameters

Linear feeder Type of drive	Max. load current [Amps]	Max. air gap on solenoid [mm]	Frequency range	Body colour of the solenoid
SLL 400	0.6	1	90...120 Hz	black
SLL 800	1.4	3	45...60 Hz	red
SLL 804 <1600	1.4	3	45...60 Hz	red
SLL 804 □1600	2.8	3	45...60 Hz	red
SLF 1000	2.6	2.5	45...60 Hz	red
GL 01	0.6	1.0	90...120 Hz	black
GL 1	1.1	1.2	90...120 Hz	black
SLK - N 6	1.4	2.5	45...60 Hz	red
SLK - N 6 G	1.4	2.5	45...60 Hz	red

To facilitate distinguishing of the vibration frequency, RNA equips the feeders with differently coloured connecting cables:

Table 7 Connecting cables

Cable colour	Mains frequency operation	Variable frequency operation
Black	50 / (60) Hz	45...60 Hz
Grey	100 / (120) Hz	90-120 Hz



Observe the maximum values for the load current and the solenoid gap, otherwise there is a danger of destruction of the vibration feeder and/or the control unit!

Commissioning

The operating parameters for a feeder delivered with control unit ESR2x have already been adjusted in the factory to suit the feeder. All settings have been archived in the RNA factory and can be called for.



After conversion, replacement of the control unit or mechanical modification of the feeder system there is a danger of damaging springs, vibrators, configuration elements or the transfer device when commissioning the feeder.

Setting the control unit for use with a vibratory feeder



If the vibration feeder impacts (very loud metallic hammering noise) during commissioning **Switch off the control unit immediately! (On / Off key).**

In the case of commissioning without taking these precautions specified above, there is a danger of destruction of the feeder system or parts thereof. Warranty becomes void in this case! Before the control unit can regulate amplitude and frequency, it must be calibrated for the actually connected feeder. This is necessary for initial commissioning after mechanical modification of the feeder (e.g. a change in the fitted springs) or after the feeder has been replaced completely. Use the calibration menu to make these calibrations, see Section 3.1.5. It is important to ensure throughout the calibration procedure that the feeder can vibrate freely and that it contains no articles, which could affect the vibration.

Table 8 Current limit setting guidance values for RNA vibration feeders

Vibration feeder Type of drive	measured current [A]	Max. load current [A]	Guidance value for the current limit* in [A]	Recommended control unit type
SRC - N 160 - 2	0.4	0.6	0.5	ESR 25 / 0,6
SRC - N 200 - 2	0.5	1.2	1.0	ESR 25 / 1,8
SRB 250 - 2	0.6	1.2	1.0	
SRC - N 250 - 2	1.5	2.6	2.0	ESR 25 / 5,5
SRB 400 - 2	1.5	2.8	2.0	
SRC - N 400 - 1	3.2	3.8	4.0	
SRC - N 400 - 2	3.4	4.3	4.0	
SRHL 400 - 1	3.9	5.7	4.5	ERS 28
SRHL 400 - 2	4.1	5.3	4.5	
SRC - N 630 - 1	3.9	5	5.0	
SRC - N800 - 1	5.3	8.5	5.5	

Table 9 Current limit setting guidance values for RNA linear feeders

Linear feeder Type of drive	measured current [A]	Max. load current [A]	Guidance value for the current limit* in [A]	Recommended control unit type
GL 01	0.3	0.6	0.5	ESR 25 / 0,6
SLL 400	0.4	0.6	0.5	
GL 1	0.3	1.1	0.9	ESR 25 / 1,8
SLL 800	0.6	1.4	1.2	
SLK - N 6	0.7	1.4	1.2	
SLF 1000	1.5	2.6	2.0	ESR 25 / 5,5

* When calibrating the control units for a new feeder, enter the current limit in the calibration menu (see Section 3.4.1). The values specified here are for guidance only. The current limit can also be set higher for heavy pots or linear feeders. However, it should never be set higher than the maximum permissible load current!

Description	Key	Display contents
<p>When the control unit is connected to the mains voltage in accordance with the safety instructions, the display first of all shows: ESR2X here stands for the device type and X.XX for the software version.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Vibrator Controller ESR 2X Ver. X.XX </div>
<p>The main menu appears after 5 seconds.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Speed 10% Switched Off </div>
<p>Pressing the "Up" arrow key accesses:</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Service </div>
<p>On pressing the enter key, the password for the calibration menu can be entered with the "Up" arrow key (standard password = 2000).</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Password 0000 </div>
<p>Then switch to the calibration menu. The display now shows:</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Auto calibration Inactive </div>
<p>Activate the menu option with the enter key. Pointed brackets enclosing the changeable parameter indicate this:</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Auto calibration > Inactive < </div>
<p>The parameter can now be changed with the arrow keys. In this case to</p>	<p>(possibly</p>  <p>)</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> Auto calibration > Activated < </div>
<p>Press the enter key to start the automatic calibration process. First of all the current magnitude (guidance value from Table 8 and Table 9) must be set here, with which the connected feeder is to be operated. This protects the feeder against current overload. The actual value must be set with the arrow keys:</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Current limit XXXX A </div>
<p>Then press "Enter" to start the calibration. The calibration process stops if a fault condition appears during calibration, or it can be stopped manually by pressing the ON/OFF key. The former calibration data are then restored and used.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Voltage Offset X.XXX V </div>
<p>First of all the offset adjustment is made for the voltage measuring circuit. This takes approx. 12 seconds to complete.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Current Offset X.XXX V </div>
<p>Then the offset adjustment is made for the current measuring circuit. This takes max. 20 seconds to complete.</p>		

Description	Key	Display contents
<p>A check is then made whether connection to the feeder exists. This takes max. 5 seconds to complete.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Last test X.XXX A XXX.X V </div>
<p>Next the offset adjustment is made for the DC servo circuit. This ensures that no DC current component flows in the feeder because it could cause unstable vibration and disturb the regulating circuits. The DC servo offset adjustment requires 2 to 50 seconds to complete.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> DC-Servo Offset X.XXX A </div>
<p>The impedance of the feeder is now measured (8 seconds). Then the ESR2X searches for the resonance frequency of the feeder. This typically requires 20 seconds to complete but may in some cases take up to 2 minutes. It is important to ensure that the feeder can vibrate freely during this part of the calibration procedure and that it is not touched.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Impedance Meas. </div>
<p>Magnetic saturation of the solenoids is now compensated. This typically takes 20-30 seconds to complete but may require up to 5 minutes.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Resonance Search XXX.X Hz </div>
<p>The ESR2X is then ready to operate the feeder close to resonance. However, first of all it must optimise its operating point so that maximum amplitude can be obtained with smallest possible current drain. This typically takes about 10 seconds to complete but may require up to 1 minute. It is important to ensure that the feeder can vibrate freely and is not touched during this part of the calibration procedure. After successful calibration, the data is saved to memory and used in future.</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Compensation for mag- netic saturation Calibration completed </div>
<p>The following message appears in the display after completion of the calibration:</p>		
<p>The following display appears on pressing the enter key:</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> Phase adjustment XXX.X ° </div>
<p>Here the maximum speed is set with which the feeder shall operate. Switch-on the feeder with the ON/OFF key and set the desired maximum speed with the arrow keys.</p>		
<p>Description</p>		<div style="border: 1px solid black; padding: 5px; text-align: center;"> 100% Speed >XXXX< </div>

Key

If the feeder impacts with a loud hammering metallic noise, switch-off immediately with the ON/OFF key and reduce the set value by about 5-10%. Then switch-on the feeder again to check that it no longer impacts.

If the maximum voltage or current limit message is displayed, the maximum loading value for the solenoids has been reached. Let the feeder run, whereby the ESR2X will automatically reduce the current and voltage to safe values. Let the feeder run until no more alarm messages have appeared for at least 10 seconds.

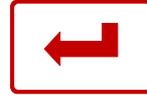
Press the enter key to switch to the menu option:

Here the minimum speed is set with which the feeder shall operate. Set typically such that the components just move at this speed setting.

It is important to ensure that the feeder is running stable on exit from this menu option with the enter key.

This is necessary because the automatic adjustments of alarm limits and operating conditions are saved to memory on exit from this menu option. During this calibration alarm displays such as frequency errors may appear because the values for maximum and minimum frequency are being changed too. A genuine fault is present only if the alarm persists for a considerable time.

Attention! The control unit can regulate the amplitude and frequency only when movement of a certain magnitude is taking place. Therefore it can happen that a persistent error message such as a frequency error appears when the vibration amplitude is very small. The set value must then be increased until the feeder is vibrating audibly or visibly. Thereafter the value can be reduced again, but thereby taking care that movement of the articles on the feeder remains visible.



10% Speed
>XXXX<

Description	Key	Display contents
After completing the adjustments, press the enter key to save the settings to memory. The display contents become:		10% Speed XXXX
Press the "Up" arrow key three times.		Return
Press the enter key to return to the main menu.		Speed 10% Switched Off
After successful commissioning, the sensor amplifier can be activated and the delay times as well as the soft start/stop times can be set.		Speed 10% Switched On
The vibration feeder can now be switched-on with the ON/OFF key. After calibration the drive is running at the set 10% speed.		Speed 10% Switched On
After pressing the enter key, the speed can be adjusted to the desired feed rate (e.g. 70%).		Speed >70%< Switched On
After making the adjustment, press the enter key to save the value to memory. The control unit is then in the main menu (see also Section 3.1.3).		Speed 70% Switched On

Input

The input for external signals permits switch-on and switch-off of the feeder system by simple means without power drive. Two inputs are available for this enable/disable function:

- * Enable via the level sensor connection;

the advantage is that no intervention is required on the control unit.

- * Enable via the electrically floating input on the internal terminal strip (option)

used mainly when the sensor input is already engaged for level monitoring.

The following holds for both applications: Enable signal can be given as closing of a contact or as a voltage level signal. The connect-up to the sensor connector is described in detail on the wiring diagrams. The input on the internal terminal strip is accessible through a PG9 screw fitting on the front of the casing.

As shown in Fig. 5, a voltage level signal can be applied or a contact can be closed for enable. Observing correct polarity, the contact can also be replaced by a switched transistor conduction path (e.g. an opto-coupler). An external voltage source is not required for this purpose. The control unit recognises a voltage between 10 and 24 V DC between the terminals 4 and 5 as enable signal.

For enable signal by closing a contact, the connecting line length must not exceed two metres!

Optional input board

A PC board is available as an optional accessory device for connecting external equipment devices or for coupling several ESR2X to a complete feeder system. This connectors PC board provides: An alarm output, the input for external enable and also two status signals of the ESR2X, namely "Ready for operation" and "Operating".

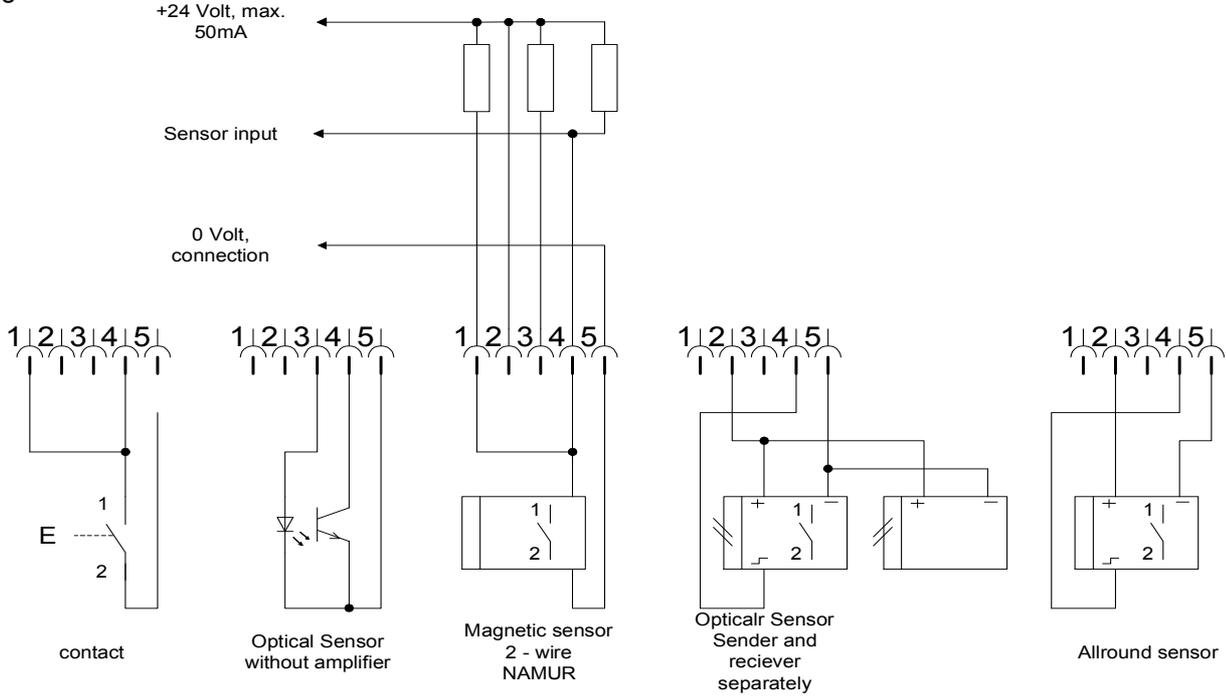
With these signals and the external enable signals, several ESR2X control units can be coupled for monitoring the level status of an extensive feeder system. The feeders can also be switched directly by a PLC system or similar facility via the external enable input. The alarm output can drive a lamp or other device requiring up to 7 W power. See the connections diagram in Fig. 6.

Sensor connection

The sensor input is disabled in the factory settings. This makes test runs and set-up possible without problems. To activate the input, program a switch-on delay in the control menu.

The sensor input at pin 4 of X02 has strong hysteresis in its response behaviour in order to ensure disturbance-free operation.

Fig. 4 Sensor connection



ESR 25 Dimensions

For more information on this or any other RNA product please contact

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