SAFEMASTER S
Frequency Monitor
UH 6937

0273539

Product Description

The frequency monitor UH 6937 serves the reliable frequency monitoring of alternating currents and the safe monitoring of the phase sequence resp. rotary direction of motors with 3-phase alternating currents. It is used to monitor the output frequency of inverters or the rotor frequency of slipring motors. An other application area is the monitoring of motors in crane plants. Using the front side display the parameters can be easily and comfortably adapted to the individual application or changed when necessary. With the UH 6937 it is also possible to only monitor the frequency applied or only the rotary direction.

Approvals and Markings

CE | c UL us LISTED Canada / USA | UKCA

Your Advantage

- For safety applications up to PL e / Cat. 4 and SIL 3
- Simple and time saving setup without PC
- Comfortable, menu guided configuration via frontside display
- Reducing interruption time in production by extensive diagnostic functions
- Easy to integrate in existing drive applications
- For inverters up to 1200 Hz
- Possible languages: English, german, french

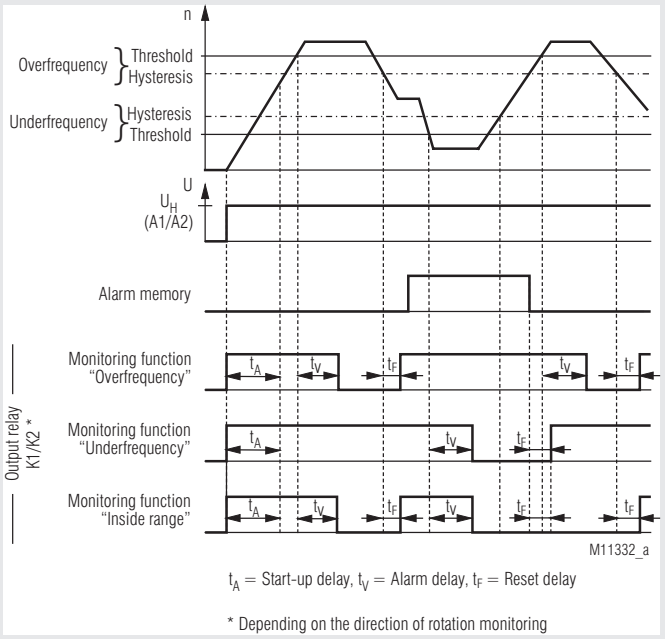
Features

- **Corresponds**
  For frequency monitoring:
  - **PL e and category 4 according to EN ISO 13849-1**
  - **SIL 3 according to EN 61508**

  For monitoring the phase sequence or direction of rotation:
  - **PL d and category 2 according to EN ISO 13849-1**
  - **SIL 2 according to EN 61508**
- **Can be used in safety applications of frequency monitoring as follows:**
  - **Up to maximum SIL 3 according to EN IEC 62061**
  - **Up to SIL 3 according to EN 61511**

  Can be used in safety applications of phase sequence or direction of rotation monitoring as follows:
  - **Up to maximum SIL 2 according to EN IEC 62061**
  - **Up to SIL 2 according to EN 61511**
- Over-, underfrequency or window monitoring of single or 3-phase in AC systems
- Monitoring the direction of rotation with 3-phase AC voltage
- Integrated user friendly frontside display
  - Comfortable, menu guided configuration
  - For set point and actual value display of frequency and direction of rotation
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring inputs for AC-voltages of 8 ... 280 V for single-phase monitoring as well as 16 ... 690 V for single- and 3-phase monitoring
- Suitable for inverters
  - Variant /0_ _ : Maximum input frequency 700 Hz
  - Variant /1_ _ : Maximum input frequency 1200 Hz
- Adjustable hysteresis
- Adjustable reset delay function from 0 ... 100 s for frequency monitoring
- Adjustable start up time delay from 0 ... 100 s for frequency motoring or tolerance when switching on from 0 ... 60000 periods for monitoring the direction of rotation
- Adjustable alarm delay from 0 ... 100 s for frequency motoring or tolerance when switching on from 5 ... 60000 periods for monitoring the direction of rotation
- Manual or auto-reset
- Galvanic separation between measuring input, auxiliary voltage and output contacts
- 2-channel function
- Forcibly guided output contacts
- LED-indicators and 2 semiconductor monitoring output
- Width 45 mm
- With pluggable terminal blocks for easy exchange of devices
- Variant /_ _1:
  - It is possible to set a variety of response parameters by means of a 4 bit selection facility from an overriding control unit;
  - Analog output (2V to 10V) corresponding to the current speed;
  - Possibility to override frequency and direction of rotation monitoring (muting);
  - Adjustable switchover time from 0 ... 100 s for frequency motoring or tolerance when switching on from 0...60000 periods for monitoring the direction of rotation

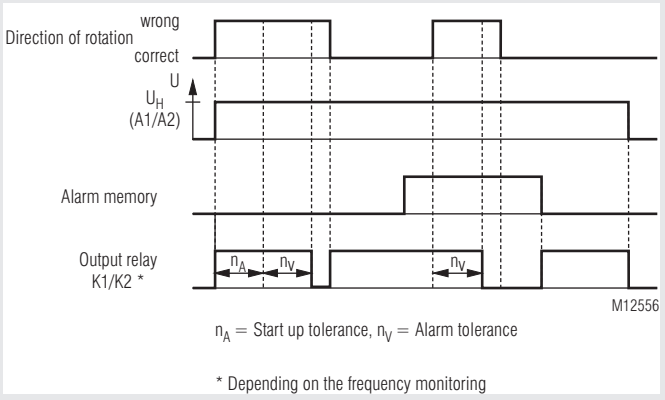
Function Diagram Frequency Monitoring



t_A = Start-up delay, t_V = Alarm delay, t_F = Reset delay

* Depending on the direction of rotation monitoring

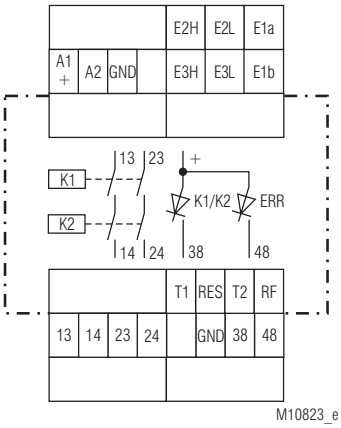
Function Diagram Rotation Monitoring



n_A = Start up tolerance, n_V = Alarm tolerance

* Depending on the frequency monitoring

Circuit Diagrams



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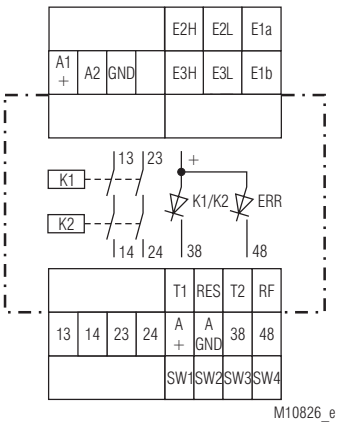


UH 6937/_ _1

Connection Terminals

Terminal designation	Signal designation
A1+	DC24V
A2	0V
E1a, E1b, E2L, E2H, E3L, E3H	Frequency measuring inputs
GND	Reference potential for semiconductor monitoring output and control outputs
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
38, 48	Semiconductor-monitoring output
T1, T2	Control output
RES, RF, SW1, SW2, SW3, SW4	Control input
A +, A GND	Analogue output

Applications

Safe frequency and speed monitoring of AC voltages
- Safe monitoring of the outputfrequency of inverters
- Safe monitoring of the rotorfrequency of slipring motors
- Safe control / monitoring of motorts in crane applications
- Safe monitoring of the direction of rotation with 3-phase AC voltages

With correct connection it is possible to realise with the UH 6937 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor), SSR (Safe Speed Range) as well as SDI (safe direction of motion) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Functions

The auxiliary voltage is connected to terminals A1-A2. he equipment can be configured via the display and the setting keys on the front plate. Terminals E1a, E1b, E2L, E2H, E3L and E3H form the measuring input.
For low voltages the measuring voltage is connected to E1a-E2L and E1b-E3L and for higher voltages to E1a-E2H and E1b-E3H (see section technical data).
When monitoring single phase AC voltage, it is recommended to connect the terminals E1a-E2L or E1a-E2H directly to the inverter, the terminals E1b-E3L or E1b-E3H directly to the motor connection terminals. Seperate wires in separate cables with space to each other have to be used for each of the frequency inputs. When monitoring 3-pase AC voltages it is recommended to wire these terminals directly to the motor connection terminals.
The input frequency and direction of rotation is compared to the setting value. As the device measures the cycle duration the fastest frequency measurement is possible.
Should the over-frequency function be set, then the output relay will switch to the alarm mode, when the set response parameter is over-exceeded longer than the parametered alarm-delay function (t_V). Should the frequency fall again below the response parameter, minus the set hysteresis, the output relay will be activated after the expiry of the reset-delay time period (t_F) (depending on the evaluation of the direction of rotation) and return to its pre-set permitted supervisory state.
As regards the under-frequency function, the output relay will switch to the alarm mode, when the set response parameter is under-exceeded longer than the parametered alarm-delay function (t_V) time period. As soon as the frequency return to the range governed by the response parameter, plus the set hysteresis, then the output relay will again return to the pre-set permitted state after the expiry of the reset-delay time period (t_F) (depending on the evaluation of the direction of rotation).
In the „internal window function mode“, the output relay will switch to the alarm setting when the frequency exceed the pre-set permitted range of the response parameter. Once the frequency again return within the range of both the upper- and lower response parameters, minus and/or plus the pre-set hysteresis values (upper response parameter minus- and/or the lower response parameter plus -the relative hysteresis values), then the output relay will again switch back to the pre-set permitted range after the expiry of the reset-delay time period (t_F) (depending on the evaluation of the direction of rotation).
In the „external window function mode“, the monitoring function acts inversely to the „internal window function“.
If the detection of the rotary direction is activated, the output relays switch to alarm position when the rotary direction detected deviates from the set rotary direction (Direction of rotation=wrong). If the rotary direction changes after that (Direction of rotation=correct), the output relays switch back to the good position (depending on the frequency evaluation). The rotary direction is only monitored from the adjustable minimum frequency onwards. Below this set minimum frequency, the rotary direction is considered as correct.
If the frequency monitoring and the monitoring of the rotary direction are activated, then the output relays only switch or remain in the good position if the good state is fulfilled for both monitoring functions.
If the frequency monitoring and the monitoring of the rotary direction are deactivated, the output relays are in alarm position.
Should the manual reset function be activated, then the output relay continues to remain in good range or the direction of rotation in the good state in the alarm setting when the frequency return to the pre-set permitted range. A resetting of the saved parameter is possible when the reset input is activated or the auxiliary voltage is shutdown. When a start-up delay time period (t_A) is set, then the set start-up delay time period will initially expire as soon as the auxiliary voltage of the equipment is switched-on and the ‘RF’ feedback circuit is closed. The start-up delay time period will also expire after a reset of the manual reset mode. During this time period, a frequency evaluation is disabled and the output relays remain (depending on the evaluation of the direction of rotation) at the pre-set permitted setting. The start-up delay function can, for example override an alarm message during the start-up stage of a generator or electric motor. Should, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.
If a start-up tolerance (nA) is set, first the counter for the start-up tolerance runs once the auxiliary voltage of the device has been switched on and the feedback circuit RF has been closed. Likewise, the start-up tolerance runs upon a reset in the operating mode alarm memory. During this time, there is no evaluation of the rotary motion, and the output relays remain in good position (depending on the frequency evaluation). By means of the start-up tolerance it is possible to suppress an alarm message during the start-up phase. If the feedback circuit is not closed upon a reset (in operating mode alarm memory), the device changes to a safe error state.

Functions

With correct connection it is possible to realise with the UH 6937 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor), SSR (Safe Speed Range) as well as SDI (safe direction of motion) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Indicators

LED ON:	Green	On, when supply connected
	Green-flashing	Parameterization mode
	Red-flashing	Parameterization error
LED K1/K2:	Green	Relay K1 and K2 energized
	Yellow	Muting (Relay K1 and K2 energized)
LED ERR:	Red	Internal failure
	Red-flashing	External failure
LED t:	Green-flashing	(K1/K2; light up) Delay times runoff t_A or t_U or tolerance procedure n_A or n_U
	Yellow-flashing	(K1/K2 does not light up) Delay time runoff t_F
	Yellow-flashing	(K1/K2 light up) Delay time runoff t_V or tolerance procedure n_V
DISPLAY:		Status indication Alarms / diagnostics Parameterization

Frequency measuring input
The measuring input is divided up in to voltage ranges (AC 8 ... 280 V on E1a-E2L und E1b-E3L and AC 16...690 V on E1a-E2H and E1b-E3H). If the measuring voltage is always higher then AC 16 V, the higher range should be used. A special dimensioned measuring input with low pass characteristic avoids the measuring of the pulse frequency. In addition the input sensitivity is adapted to the voltage-/frequency-characteristic of inverters.
Plesae make sure that the frequency measuring inputs are connected to the same single or 3-phase voltage system and that a 3-phase supply is required for monitoring the direction of rotation.

Manual reset, automatic reset
In manual reset mode, the reset input is used to restart the unit after over and under frequency, or after a direction of rotation error. If T1 is connected to RES for more more then 1 second, a reset is made. A new reset is only possible if this signal is briefly interrupted. In auto reset mode this input is not required, as the reset is automatically operated.

Semiconductor outputs
The Semiconductor Output: 38 will indicate the status of the Relays: K1 / K2. When the relays are energized, then the Semiconductor Output: 38 is switched on. The Semiconductor Output: 48 will report errors within the equipment. Should an error actually exist, then the Semiconductor Output: 48 will be switched on.
The semiconductor outputs are not safety related. They can be used for monitoring purposes.

Setting the frequency thresholds
For the monitoring functions: „internal window monitoring function“ and in the „external window monitoring function“, a minimum difference between the lower- and the upper -threshold of 5% is to be anticipated at the upper frequency threshold, in addition to the already set hysteresis parameter. This is internally verified during the setting of the speed threshold and an error message will be displayed in case of any erroneous setting and/or the setting will not be permitted by the display. The maximum settable lower frequency threshold can be calculated as follows:

Monitoring function: „Internal window monitoring“:
Maximum lower threshold =
upper frequency threshold - (5% + 2 x hysteresis) x upper frequency threshold
Example:
Upper frequency threshold 100 Hz, hysteresis 2 %
Maximum lower frequency threshold =
100 Hz - (0.05 + 2 x 0.02) x 100 Hz = 91 Hz

Monitoring function: „External window monitoring:
Maximum frequency threshold =
upper frequency threshold - 5 % x upper frequency threshold
Example:
Upper frequency threshold 100 Hz, any required hysteresis
maximum lower frequency threshold =
100 Hz – 0.05 x 100 Hz = 95 Hz

Feedbak circuit
The feedback contacts of external contactors are monitored on terminal RF. The terminal RF gets the test signal from T2 via normally open contacts of the contactors which are connected to terminals 14 and 24. The normally closed contact have to be closed to start the device. If no contact extension or reinforcement is used, the terminals RF and T2 have to br bridged.

Start up time delay t_A
The start-up delay time period expires when switching-on the auxiliary voltage of the equipment, once the ‘RF’ feedback circuit is closed. In addition, the start-up delay time period will also expire after a reset in the manual reset mode. During this time period, no frequency evaluation is conducted. The LED ‘t’ will flash and the output contacts: 13 to 14 and 23 to 24 will remain closed during this time period (depending on the evaluation of the direction of rotation). As a result of the start-up delay time period, an alarm message can, for example be overridden during the start-up time period of a generator or electric motor. Should however, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.

Alarm delay t_v
The alarm-delay time period will expire when the equipment has recognised, that the frequency exceed the permitted range. Only after the expiry of the alarm-delay time period, will the output contacts :13 to 14 and 23 to 24 be switched off. When the frequency again enter the permitted range during the alarm-delay time period, then the alarm-delay function is terminated. The LED ‘t’ will flash during the time period.

Reset delay time t_F
The reset-delay time period represents the time during after which the output contacts: 13 to 14 and 23 to 24 are switched on (when the frequency is within a permitted range) (depending on the evaluation of the direction of rotation). Should the frequency again enter the alarm state during the runoff of the reset-delay time period (when the speed exceed the required range), the reset-delay time period will be terminated. The LED ‘t’ will flash during the same time period.
The start-up delay time period will override the reset-delay time period, i.e. when the output contacts are on by the start-up delay mode, then the reset-delay time period will be overridden (output contacts: 13 to 14 and 23 to 24 are closed). Even after an expiry of the start-up delay time period, the reset-delay time period will not be initiated.

Start-up tolerance n_A
The start-up tolerance runs after the auxiliary voltage of the device has been switched on and the feedback circuit RF has been closed. In addition, the start-up tolerance runs upon a reset in the operating mode alarm memory. During this time, there is no evaluation of the rotary motion,
the LED “t” is blinking, and the output contacts 13-14 and 23-24 remain closed (depending on the frequency evaluation). By means of the start-up tolerance it is possible to suppress an alarm message during the start-up phase. If the feedback circuit is not closed upon a reset (in operating mode alarm memory), the device moves to a safe error state.

Alarm tolerance n_V
The alarm tolerance runs after the device has detected that the rotary motion deviates from the predefined settings. Only after the alarm tolerance has expired, the output contacts 13-14 and 23-24 are switched off. If the frequency returns to the good state while the alarm tolerance is running, the run of the alarm tolerance is stopped. During the expiration the LED “t” is blinking.

Minimum frequency
The direction of rotation is only monitored above the set minimum frequency. If the frequency at one of the two frequency measuring inputs is below this set minimum frequency, the direction of rotation is regarded as correct.

Discrepancy time
Within the discrepancy time, different frequencies at both measuring inputs are tolerated. If the discrepancy between the frequencies at the measuring inputs lasts longer than the set discrepancy time, the device moves to a safe error state.

Display
In normal operating mode, all settings can be checked at any time by pressing the UP or DOWN keys.
Additionally, the frequency is displayed. However, this frequency does not correspond to the device’s accuracy and is only designed for diagnostic purposes.
In the case of wiring errors and system failures corresponding diagnostic messages are displayed on the display.

Parameterization using the display
See attached form page 49.

Change tracking
To detect non permitted changes of the settings, the menue item change tracking is available. This setting allows to activate a counter once, which is then incremented with each confirmed change of the settings. After activation of this function the user cannot reset the counter or disable this function again.

Only at variant /_ _ 1

Digital selection via the software Inputs: SW1 to SW4
Four various frequency modes with different response parameters, can be configured via the software Inputs: SW1 to SW4 (see Table). The electric power supply for the inputs should be between 10V DC and 26.4V DC to GND. A switchover configuration can also be undertaken during the operating mode. If the frequency mode is changed during operation, the switching time (t_U) for the frequency evaluation and the switching tolerance (n_U) for the rotary motion evaluation runs under the condition that the output relays are switched through and the start-up suppression (t_A) has expired. During the switching time resp. switching tolerance there is no evaluation of frequency resp. rotary motion, and the output relays remain energized. If the frequency mode is changed again during the switching time resp. the switching tolerance, the switching time resp. switching tolerance is not restarted. Upon expiry of the switching time resp. switching tolerance, the monitoring is continued with the currently set frequency mode. By means of the switching time resp. switching tolerance it is possible to suppress an alarm message during the start-up or braking phase of a generator or motor.

SW1	SW2	SW3	SW4	Mode
0	0	1	1	Frequency mode 1
0	1	1	0	Frequency mode 2
1	0	0	1	Frequency mode 3
1	1	0	0	Frequency mode 4

Caution !

Permanent switching of the frequency modes (immediately upon expiry of the switching time resp. switching tolerance) may result in the device acting like with the muting function, i.e. the frequency monitoring resp. rotary motion monitoring is bridged and the output relays are permanently switched through.

Muting function
The frequency monitoring function or direction of rotation monitoring can be overridden on the display and by an appropriate activation of the software Digital Inputs: SW1 to SW4. For this purpose, the muting function should be activated when parametering on the display. Once this function is activated, then it will continue to be possible to continue to switch over between the frequency moduses: 1 to 3, as described above. Should a selection be made of the frequency mode 4 (muting) via the 'SW' software inputs, then no further frequency monitoring or direction of rotation monitoring will be conducted. The output relays remain permanently on and the start-up delay function (t_A), the switchover time period function (t_U), the reset-delay function (t_F), the alarm-delay function (t_V), Start-up tolerance (n_A), Switch-over tolerance (n_U), and Alarm tolerance (n_V) will all be reset.

Device and function description

Analogue output A+ and A GND
The analogue output 2-10 V shows the actual measured frequency. The maximum value of the analogue output (10 V) is equal to the adjusted upper frequency threshold. The minimum value of the analogue output (2 V) is equal to the adjusted lower frequency threshold. The scaling is frequency linear.
In the monitoring function „underfrequency" the maximum value of the analogue output is equal to the highest possible setting value of the device (Variant UH 6937/0_ _ = 600 Hz and UH 6937/1_ _ = 1000 Hz).
In the monitoring function „overfrequency" the minimum value of the analogue output is equal to 0 Hz.
If the muting function or the frequency monitoring and the direction of rotation monitoring are deactivated is selected, the maximum value of the analogue output is equal to the maximum setting value of the device (Variant UH 6937/0__ = 600 Hz and UH 6937/1_ _ = 1000 Hz) and the minimum value is equal to 0 Hz.
In the case of a failure the analogue output goes to 0V.
The analogue output is not safety related. It can be used for diagnosis.

Switchover time period t_U
The switchover time period expires when the frequency mode is altered during operations at the digital inputs: SW1 to SW4, the output contacts are closed, no start-up delay function is running and the Switchover Time Period: 'tU' has not already been initiated and/or is running. During this time period, no frequency monitoring is conducted and the output contacts remain on (depending on the evaluation of the direction of rotation).

Switch-over tolerance n_U
The switch-over tolerance runs out if the frequency modes are changed using the digital inputs SW1-SW4 during operation, the output contacts are closed, no start-up tolerance is running and nU has not already been started or is running out. During this time, no evaluation of the direction of rotation takes place and the output contacts are switched through (depending on the frequency evaluation).

The parameterization menü has follow structure: Illustration shows the factory setting [4]
Changing parateters see formular on page 49.

1.	Parameterization			
1.1	Lim. dir. of rot.			
	Frequency mode 1			
	Monitoring function 1	Overfrequency	x	
		Underfrequency	-	
		Inside range	-	
		Outside range	-	
		f-monitoring off	-	
	f-limits 1			
	Upper limit 1	400.0	Hz	2)
	Lower limit 1	200.0	Hz	3)
	Direction of rotation 1	Clockwise rotation	-	
		Anticlockwise rot.	-	
		Direct. of rotat. off	x	
	Frequency mode 2			
	Monitoring function 2	Overfrequency	x	
		Underfrequency	-	
		Inside range	-	
		Outside range	-	
		f-monitoring off	-	
	f-limits 2			
	Upper limit 2	400.0	Hz	2)
	Lower limit 2	200.0	Hz	3)
	Direction of rotation 2	Clockwise rotation	-	
		Anticlockwise rot.	-	
		Direct. of rotat. off	x	
	Frequency mode 3			
	Monitoring function 3	Overfrequency	x	
		Underfrequency	-	
		Inside range	-	
		Outside range	-	
		f-monitoring off	-	1)
	f-limits 3			
	Upper limit 3	400.0	Hz	2)
	Lower limit 3	200.0	Hz	3)
	Direction of rotation 3	Clockwise rotation	-	
		Anticlockwise rot.	-	
		Direct. of rotat. off	x	
	Frequency mode 4			
	Monitoring function 4	Overfrequency	x	
		Underfrequency	-	
		Inside range	-	
		Outside range	-	
		f-monitoring off	-	
	f-limits 4			
	Upper limit 4	400.0	Hz	2)
	Lower limit 4	200.0	Hz	3)
	Direction of rotation 4	Clockwise rotation	-	
		Anticlockwise rot.	-	
		Direct. of rotat. off	x	
	Esc		OK	
1.2	Hysteresis			
	5	%		
	Esc		OK	
1.3	Time Delay			
	Start-up delay			
	0.0	s		
	Reset delay			
	0.0	s		
	Alarm delay			
	0.1	s		
	Changeover bridging			1)
	0.0	s		
	Esc		OK	

1.	1.4	Tol. dir. of rot.		
		Start up tolerance		
		0	Period(s)	
		Alarm tolerance		
		10	Period(s)	
		Switchover tolerance		1)
		0	Period(s)	
		Esc		OK
	1.5	Alarm memory		
		Alarm memory	x	
		Automatic reset	-	
		Esc		OK
	1.6	Muting function		
		Activate	-	1)
		Deactivate	x	
		Esc		OK
	Esc			OK
	1.7	Ext. settings		
		Min. frequency for direction of rotation	5 Hz	
		Discrepancy time	30.0 s	
		Esc		OK
	Esc			OK
2.	Display settings			
	2.1	Languages		
		English	x	
		Deutsch	-	
		Français	-	
		Esc		OK
	2.2	Contrast		
		50	%	
		Esc		OK
	2.3	Backlight		
		OFF	-	
		10 s	x	
		1 min	-	
		5 min	-	
		Esc		OK
	2.4	Status indicator		
		Manual	x	
		10 s	-	
		1 min	-	
		5 min	-	
		Esc		OK
	Esc			OK
3.	Factory settings			
	Parameter			
	Displayeinstellungen			
	Parameter + Displayeinstellungen			
	Esc			OK
4.	Changes			
	4.1	Lock		
		Activate		
	4.2	Track		
		Activate		
	Esc			OK
Esc				OK

[1] Only available at variant /_ _1.
[2] Not available at monitoring function „underfrequency“.
[3] Not available at monitoring function „overfrequency“.
[4] Customers specific variants have other factory settings. They are available on request.

Technical Data

Frequency Measuring Input

Voltage range
E1a-E2L, E1b-E3L: AC 8 ... 280 V
E1a-E2H, E1b-E3H: AC 16 ... 690 V
(dependent to frequency see characteristic)
Input frequency:
Variante /0_ _: ≤ 700 Hz
Variante /1_ _: ≤ 1200 Hz
Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts
Response value
Variant /0_ _: Adjustable from 1 Hz ... 600 Hz
Variant /1_ _: Adjustable from 1 Hz ... 1000 Hz
Pulse frequency inverters
Variant /0_ _: ≥ 1 kHz
Variant /1_ _: ≥ 2 kHz
Measuring accuracy
< 700 Hz: < ± 0,5 %
700 Hz ... 1200 Hz: < ± 1 %
Stability of the setting threshold at variation of auxiliary voltage and temperature: < ± 1 %
Hysteresis: Adjustable from 2 ... 10 % of the set response value
Reaction time of frequency monitoring: Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms + adjusted alarm delay
Reaction time of direction rotation monitoring: Duration of 1 cycle (inverse value of the applied frequence) + 10 ms + adjusted alarm tolerance
Alarm delay t_V: Adjustable from 0 ... 100 s
Start up time delay t_A: Adjustable from 0 ... 100 s
Reset delay t_F: Adjustable from 0 ... 100 s
Switchover time period t_U: Adjustable from 0 ... 100 s
Alarm tolerance n_V: Adjustable from 5 ... 60000 periods
Start up tolerance n_A: Adjustable from 0 ... 60000 periods
Switchover tolerance n_U: Adjustable from 0 ... 60000 periods
Min. frequency direction of rotation: Adjustable from 1 ... 100 Hz
Discrepancy time t_D: Adjustable from 1 ... 250 s
Accuracy of the adjustable times: < ± 5 %
Time between connection of auxiliary supply and ready to mesure: Approx. 1.5 s (with start up delay is 0)

Auxiliary circuit (A1-A2)

Auxiliary voltage U_H (galvanic separation to measuring input): DC 24 V
The power supply shall meet the requirements of SELV / PELV.
Voltage range: 0.8 ... 1.1 U_H
Nominal consumption: Typ. 3.2 W
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR
Duty-cycle Reset button: > 1.2 s

Output

Contacts: 2 NO contacts
Contact type: Relay forcibly guide
Thermal current I_{th}: 8 A
(see current limit curve)
Switching capacity
to AC 15: 3 A / AC 230 V IEC/EN 60947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60947-5-1
to DC 13: 4 A / DC 24 V at 0.1 Hz
Electrical life
at 5 A, AC 230 V cos φ = 1: > 2.2 x 10^5 switch. cycl. IEC/EN 60947-5-1
Short circuit strength
max. fuse rating: 10 A gG / gL IEC/EN 60947-5-1
Mechanical life: 20 x 10^6 switching cycles
Semiconductor monitoring output: DC 24 V, 50 mA, plus switching
Analogue output: 2 ... 10 V, max. 10 mA

Technical Data

General Data

Nominal operating mode: Continuous operation
Operation: - 20 ... + 60 °C
(see quadratic total current limit curve)
At an altitude of > 2000 m the maximum permissible temperature reduces by 0.5 °C / 100 m
Storage: - 20 ... + 70 °C
Altitude,
Clearance and creepage distance
Rated impuls voltage / pollution degree: IEC 60664-1

	≤ 2000 m	> 2000 m to ≤ 4000 m
Measuring input against all others:	6 kV / 2	4 kV / 2
Output against all others:	4 kV / 2	2.5 kV / 2

EMC EN 61800-3, IEC/EN 61326-3-1
Interference suppression: Limit value class B EN 55011
Degree of protection:
Housing: IP 40 IEC/EN 60529
Terminals: IP 20 IEC/EN 60529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0,35 mm
frequency 10 ... 55 Hz IEC/EN 60068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60068-1
Terminal designation: EN 50005
Wire connection: DIN 46228-1/-2/-3/-4
Wire fixing: Captive slotted screw
Mounting: DIN-rail IEC/EN 60715
Weight: Approx. 320 g

Dimensions

Width x height x depth: 45 x 107 x 121 mm

Standard Type

UH 6937.02PS/61 DC 24 V
Article number: 0066820
- Output: 2 NO contacts
- Auxiliary voltage U_H: DC 24 V
- Max. response value: 600 Hz
- Type of terminals: Pluggable terminal blocks, with screw terminals
- Width: 45 mm

Ordering Example

UH 6937 .02 _ _ /_0_ /61 DC 24 V

- DC 24 V — Nominal voltage
- /61 — UL-approval
- /_0_ — 0 = Standard; 1 = With different frequency mode and analogue output
- _ _ — Max. response value: 0 = 600 Hz; 1 = 1000 Hz
- .02 — Type of terminals: PS (plug in screw): Pluggable terminal blocks, with screw terminals
- UH 6937 — Contacts; Type

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL60947, "general use applications"

Standards:
- ANSI/UL 60947-1, 5th Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-5-1, 3th Edition (Low-Voltage Switchgear and Controlgear Part5-1: Control circuit Devices an Switching Elements - Electro-mechanical Control Circuits Devices)
- CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition (Low-Voltage Switch-gear and Controlgear - Part1: General rules)
- CAN/CSA-C22.2 No. 60947-1-14, 1st Edition (Low-Voltage Switch-gear and Controlgear - Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)

Nominal voltage U_N:
DC 24 V: Device must be supplied with a Class 2 or a voltage / current limited power supply.

Altitude: ≤ 2000 m

Switching capacity:
Semiconductor monitoring outputs: 24Vdc, 50mA, pilot duty

Switching capacity
Relay output
device free-standing:
Ambient temperature 60°C: Pilot duty B300, R300
8A 250Vac G.P.
8A 24 Vdc

Device mounted without distances heated by devices with same load:
Ambient temperature 55°C: Pilot duty B300, R300
5A 250Vac G.P.
5A 24 Vdc

Ambient temperature 60°C: Pilot duty C300, R300
4A 250Vac G.P.
4A 24 Vdc

Voltage range
E1a-E2L, E1b-E3L: AC 8 ... 280 V
E1a-E2H, E1b-E3H: AC 16 ... 600 V

Wire connection
Ambient temperature
60°C, 4A bzw. 55°C, 5A: Min. 75°C aluminum or copper conductors

Ambient temperature
60°C, 8A: Min. 90°C aluminum or copper conductors

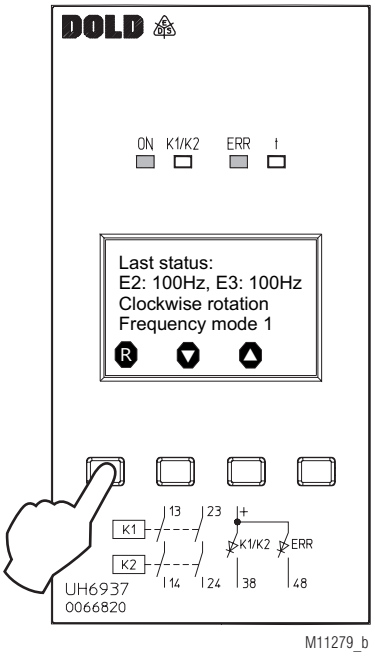
Technical data that is not stated in the UL-Data, can be found in the technical data section.

Troubleshooting

Failure	Potential cause
LED „ON" does not light up	- Power supply A1+/A2 not connected
LED „ON" flashes red	- Parameterization error (detailed description on display)
LED „ERR" flashes red	- External failure (detailed description on display)
LED „ERR" continuously on	- Device failure (if the failure still exists after restart, replace device)

Fault handling

When faults are detected on or in the device they are indicated on the display by an appropriate message. If a reset of the device is necessary due to the fault, at first the alarm and the associated diagnostic message have to be acknowledged. Then, the left key has to be pressed for approx. 3 sec. to initiate a reset of the device.



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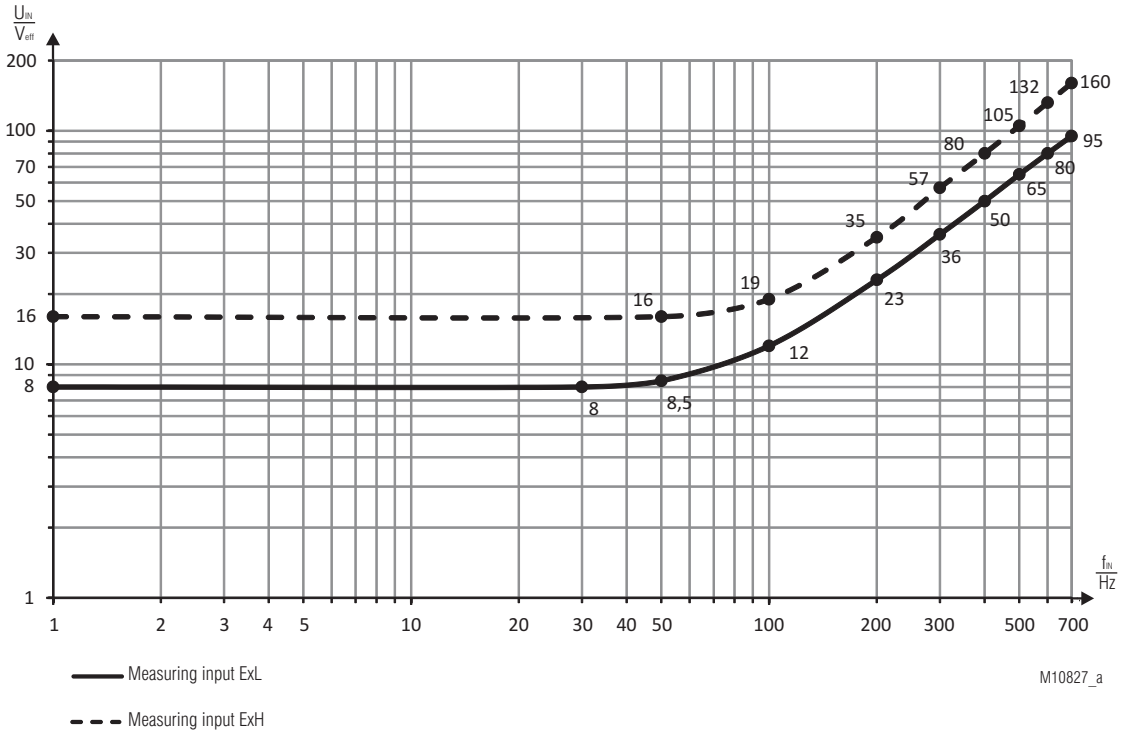
If a system failure is detected again after restart the device must be replaced and sent back to manufacturer.

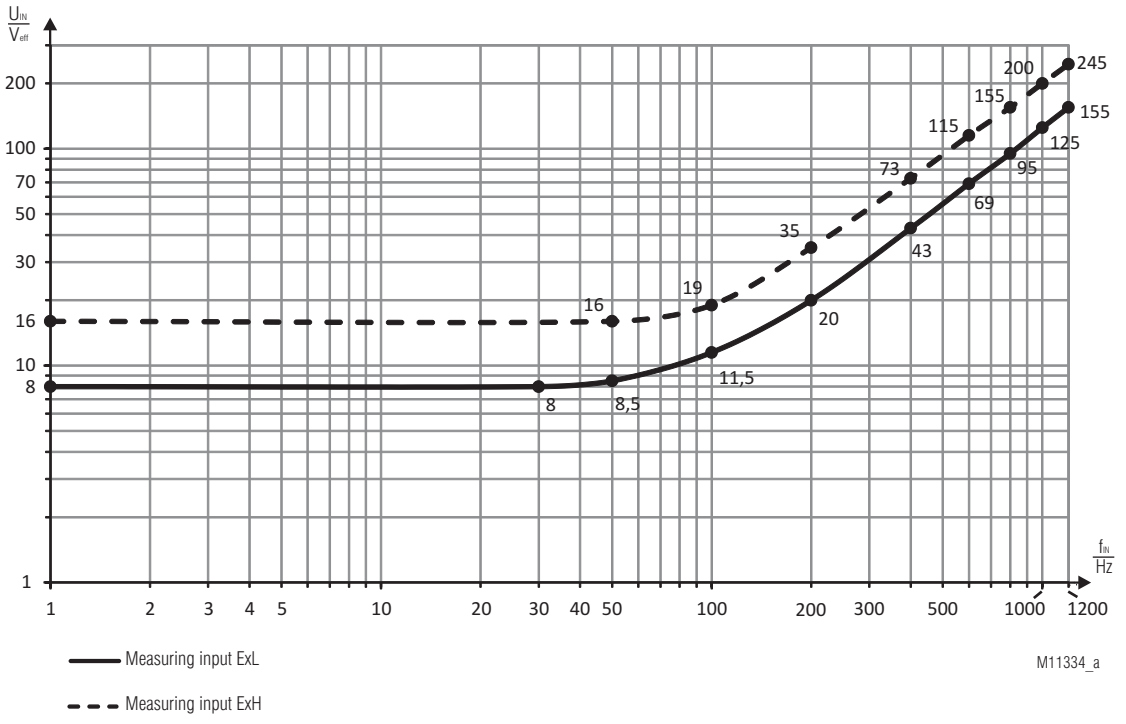
Maintenance and repairs

- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristic

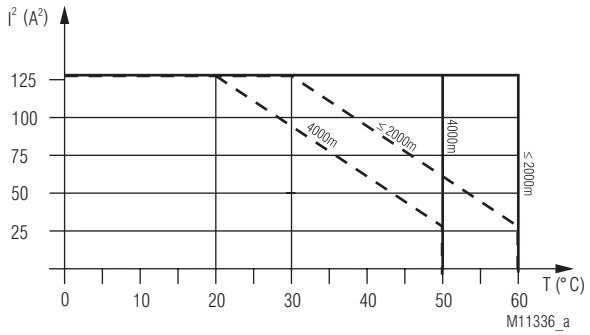


Min. voltage at measuring input for variant /0_ _



Min. voltage at measuring input for variant /1_ _

Characteristic



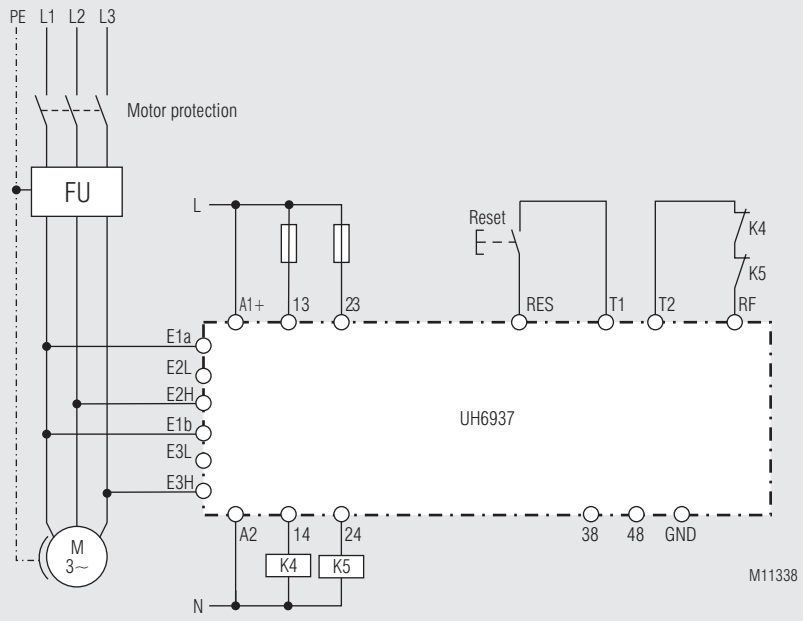
Device free-standing.
Max. current at 60°C (≤ 2000m) or 50°C (4000m) over 2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

Device mounted without distance heated by devices with same load.
Max. current at 60°C (≤ 2000m) or 50°C (4000m) over 2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

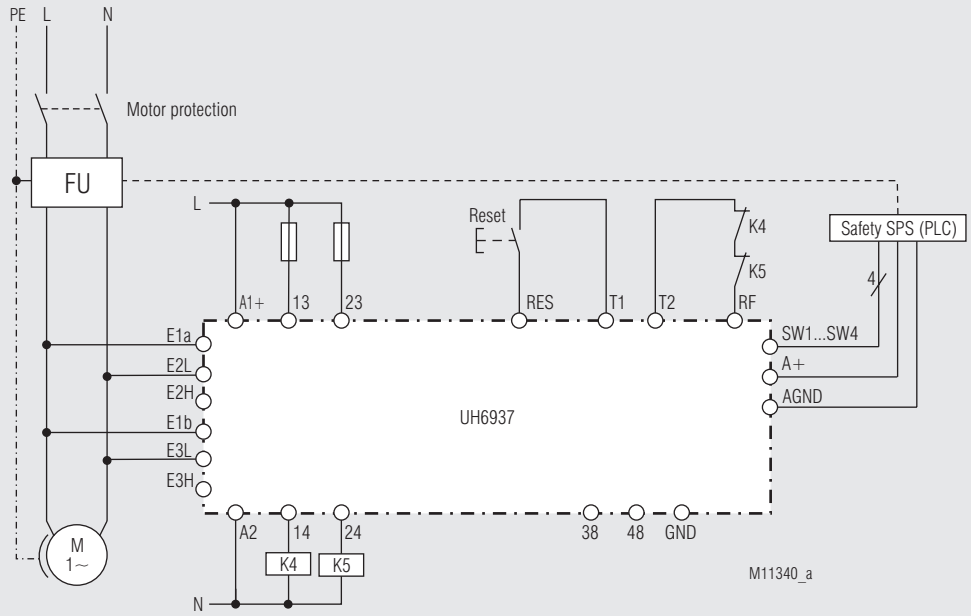
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - Current in contact paths

Quadratic total current limit curve
At an altitude > 2000 m adjustment of the curve by -0,5 °C / 100 m (see example 4000 m)



Inverter monitoring function, 3-phase;
Frequency monitoring: Suited up to SIL3, Performance Level e, Cat. 4
Direction of rotation monitoring: Suited up to SIL2, Performance Level d, Cat. 2



Inverter monitoring function, single-phase with variant UH6937/_ _1;
Frequency monitoring: Suited up to SIL3, Performance Level e, Cat. 4

Formular for documentation of the setting parameters

Device: UH 6937

Device No: . . . . . .

Configurated by: . . . . . .

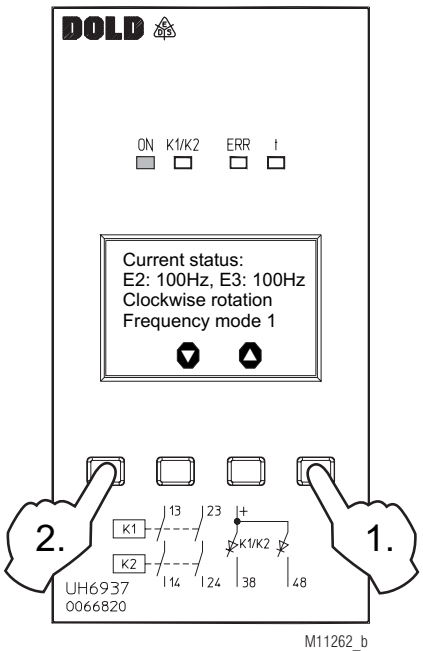
Date: . . . . . .

1.	Parameterization			
1.1	Lim. dir. of rot.			
	Frequency mode 1			
	Monitoring function 1	Overfrequency		
		Underfrequency		
		Inside range		
		Outside range		
		f-monitoring off		
	f-limits 1			
	Upper limit 1		Hz	2)
	Lower limit 1		Hz	3)
	Direction of rotation 1	Clockwise rotation		
		Anticlockwise rot.		
		Direct. of rotat. off		
	Frequency mode 2			
	Monitoring function 2	Overfrequency		
		Underfrequency		
		Inside range		
		Outside range		
		f-monitoring off		
	f-limits 2			
	Upper limit 2		Hz	2)
	Lower limit 2		Hz	3)
	Direction of rotation 2	Clockwise rotation		
		Anticlockwise rot.		
		Direct. of rotat. off		
	Frequency mode 3			
	Monitoring function 3	Overfrequency		
		Underfrequency		
		Inside range		
		Outside range		
		f-monitoring off		1)
	f-limits 3			
	Upper limit 3		Hz	2)
	Lower limit 3		Hz	3)
	Direction of rotation 3	Clockwise rotation		
		Anticlockwise rot.		
		Direct. of rotat. off		
	Frequency mode 4			
	Monitoring function 4	Overfrequency		
		Underfrequency		
		Inside range		
		Outside range		
		f-monitoring off		
	f-limits 4			
	Upper limit 4		Hz	2)
	Lower limit 4		Hz	3)
	Direction of rotation 4	Clockwise rotation		
		Anticlockwise rot.		
		Direct. of rotat. off		
	Esc		OK	
1.2	Hysteresis			
		%		
	Esc		OK	
1.3	Time Delay			
	Start-up delay			
		s		
	Reset delay			
		s		
	Alarm delay			
		s		
	Changeover bridging			1)
		s		
	Esc		OK	

1.	1.4	Tol. dir. of rot.		
		Start up tolerance		
			Period(s)	
		Alarm tolerance		
			Period(s)	
		Switchover tolerance		1)
			Period(s)	
		Esc	OK	
	1.5	Alarm memory		
		Alarm memory		
		Automatic reset		
		Esc	OK	
	1.6	Muting function		
		Activate		1)
		Deactivate		
		Esc	OK	
	Esc		OK	
	1.7	Ext. settings		
		Min. frequency for direction of rotation	Hz	
		Discrepancy time	s	
		Esc	OK	
	Esc		OK	

Parameterization Using the Display

To enter the device's parameterization mode the following key combination is provided:
Press and keep pressed the right key at first. Then, press the left key (see below). A display test follows and has to be acknowledged using the OK key (right key) when it was successful. Then, it is possible to change the parameterization. Before the device adopts changed parameters, they must be confirmed once more for safety reasons.



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1) Only available at variant /_ _1.
2) Not available at monitoring function „underfrequency".
3) Not available at monitoring function „overfrequency".

Please cut off and file it !