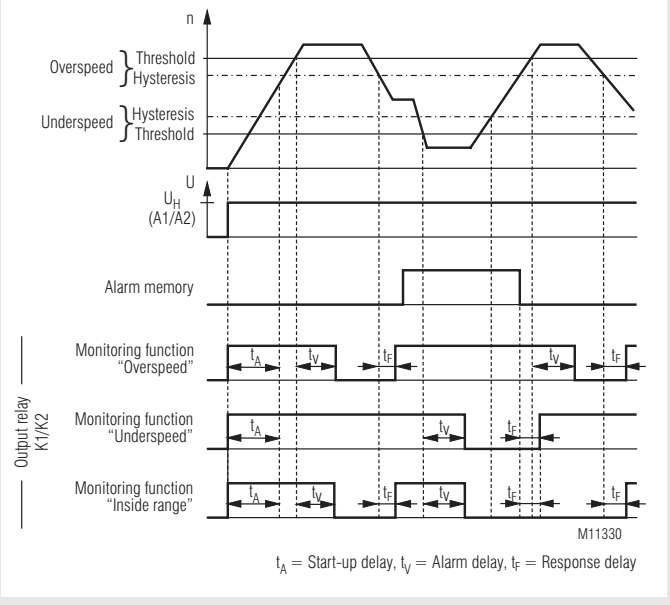
SAFEMASTER S
Speed monitor
UH 6932

0273535

Product Description

The speed monitor UH 6932 provides safe monitoring of motors and rotating equipment. It is used in machines and plants where machine movements or moving parts can be a danger to men and machine. Using the front side display the parameters can be easily and comfortably adapted to the individual application or changed when necessary.

Function Diagram



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

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
- Possible languages: english, german, french

Features

- **According to**
  - **Performance Level (PL) e und category 4 to EN ISO 13849-1: 2008**
  - **SIL-Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61511**
- Overspeed, underspeed or window monitoring
- Integrated user friendly frontside display
  - Comfortable, menu guided configuration
  - For set point and actual value of Hz
- Fast reaction time by measuring duration of cycle of input frequency
- For PNP- or NPN-sensors
- Adjustable hysteresis
- Adjustable reset delay function from 0 ... 100 s
- Adjustable start up time delay from 0 ... 100 s
- Adjustable alarm delay from 0.1 ... 100 s
- Manual or auto-reset
- 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 (2 V to 10 V) corresponding to the current speed;
  - the possibility of overriding the speed by a supervisory function (muting);
  - adjustable switchover time from 0 ... 100 s

Approvals and Markings

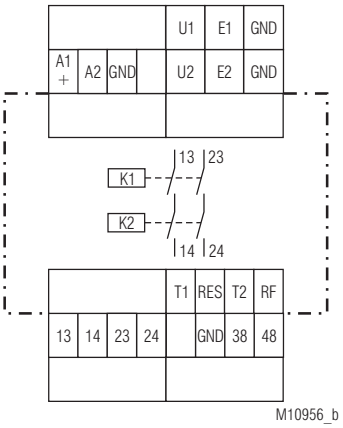
CE
TÜVRheinland CERTIFIED
Functional Safety Type Approved
www.tuv.com ID 0600000000

Application

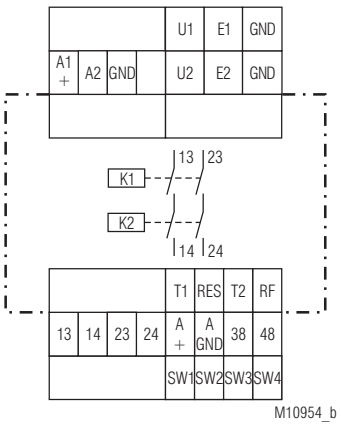
This device is designed for machinery and installations where hazards to people and property may be caused by the movement of machines or parts.

With correct connection it is possible to realise with the UH 6932 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor) and SSR (Safe Speed Range) 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.

Circuit Diagrams



UH 6932



UH 6932/_ _1

Connection Terminals

Terminal designation	Signal designation
A1+	DC24V
A2	0V
U1, U2	(+) supply for proximity sensors
E1, E2	measuring inputs for proximity sensors
GND	Reference potential for Semiconductor monitoring output and control outsputs, as well as (-) supply for proximity sensors
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

Functions

The auxiliary voltage is connected to terminals A1 to A2. The equipment can be configured via the display and the setting keys on the front plate. The detection of the speed is effected via two NPN- or PNP-proximity switches, which are connected up at the Inputs: E1 and E2. The electric power supply for the proximity switch is provided from the speed monitor of 24V DC at the Terminals: U1 and U2. The associated leads of the speed inputs are to be separated leads with separated shielding and spacial separation. The input speed are compared internally to the thresholds already set on the equipment. As the internally measures the time periods, the fastest possible speed detection monitoring is possible. Should the over-speed 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 speed 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) and return to its pre-set permitted supervisory state.
As regards the under-speed 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 speed 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). In the „internal window function mode“, the output relay will switch to the alarm

Functions

setting when the speed exceed the pre-set permitted range of the response parameter. Once the speed 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).
In the „external window function mode“, the monitoring function acts inversely to the „internal window function“. Should the manual reset function be activated, then the output relay continues to remain in the alarm setting when the speed 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 (t_A) is set, then the set start-up delay time 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 will also expire after a reset of the manual reset mode. During this time period, a speed evaluation is disabled and the output relays remain 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.

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) Expiry of the delay time periods t_A or t_U
	yellow-flashing	(K1/K2 does not light up) Expiry of the delay time periods t_F
	yellow-flashing	(K1/K2 light up) Expiry of the delay time periods t_V
DISPLAY:		Status indication Alarms / diagnostics Parameterization

Reset the manual reset, automatic reset function
In the manual reset function mode, a reset input is provided for acknowledging error messages (over-speed and under-speed). Should a 'T1' status engage the input for longer than 1 second, then a reset will be conducted in the equipment. A renewed reset is however possible if the reset signal at the reset input is briefly interrupted. In the automatic reset mode, the input will be ignored because the above mentioned error message will be automatically reset.

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 speed 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 speed 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 speed threshold can be calculated as follows:

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

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

Notes

Only at variant /_ _ 1

Digital selection via the software Inputs: SW1 to SW4
Four various speed 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. Should a speed mode be altered whilst operating, then the switchover time period (t_U) will commence, provided the output relays are switched on through the switchover, and the start-up delay time period has expired. During this time period, no speed evaluation will be conducted and the output relays remain energized (closed). Should during the switchover time period the speed modus again be altered, then the switchover time will not again be initiated. After the expiry of the switchover time period, the monitoring function will be continued at the currently set speed mode). The switchover time period, for example can affect the overriding of an alarm message during the start-up stage- or the braking stage -of a generator or electric 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 !

Any continuously repeated switching over of the speed modus (always immediately after the expiry of the switchover time period) can lead to the situation, that the equipment starts to function similarly as in the 'Muting Mode' (i.e. the speed monitoring function is overridden and the output relays remain permanently on).

Muting function
The speed monitoring function 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 speed moduses: 1 to 3, as described above. Should a selection be made of the speed mode 4 (muting) via the 'SW' software inputs, then no further speed monitoringwill 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) and the alarm-delay function (t_V) will all be reset.

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 (2000 Hz).
In the monitoring function "overfrequency" the minimum value of the analogue output is equal to 0 Hz.
If the muting function is selected, the maximum value of the analogue output is equal to the maximum setting value of the device (2000 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.

Frequency Measuring Input E1 and E2

Supply voltage:	DC 24 V (provided by the device)
Input current:	max. 30 mA
Output:	as option PNP or NPN
HIGH-level:	DC 10 V ... DC 26.4 V
LOW-level:	< DC 2 V
Min. pulse duration e. g. on and off time:	75 µs
Input frequency:	< 3 kHz
Response value:	adjustable from 1 Hz ... 2 kHz
Measuring accuracy:	< ± 2 %
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 response delay
Response delay t_v:	adjustable from 0.1 ... 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
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:	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:	> 3 s

Output

Contacts:	2 NO contacts	
Contact type:	Relay forcibly guide	
Thermischer Strom I_{th}:	8 A (see current limit curve)	
Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
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 60 947-5-1
Short circuit strength max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles	
Semiconductor monitoring output:	50 mA, plus switching	

General Data

Nominal operating mode:	continuous operation	
Temperature range		
operation:	- 20 ... + 60°C	
storage:	- 20 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Cross section:	1 x 0,25 ... 2,5 mm^2 solid or stranded ferruled (isolated) or 2 x 0,25 ... 1,0 mm^2 solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	7 mm	
Wire fixing:	captive slotted screw	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 320 g	

Dimensions

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

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	132.9	a (year)
DC_{avg}:	99.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	99.0	%
SFF	99.6	%
PFH_D:	4.13E-10	h^{-1}
PFD:	3.47E-05	
T_1:	20	a (year)

*) HFT = Hardware-Failure Tolerance

The values stated above are valid for the standard type. Safety data for other variants are available on request.

The safety relevant data of the complete system has to be determined by the manufacturer of the system.

Standard Type

UH 6932.02PS DC 24 V
Article number:

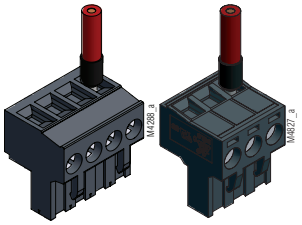
- Output: 2 NO contacts
- Auxiliary voltage U_H: DC 24 V
- Width: 45 mm

Ordering Example

UH 6932 .02 _ _ / 0 _ _ DC 24 V

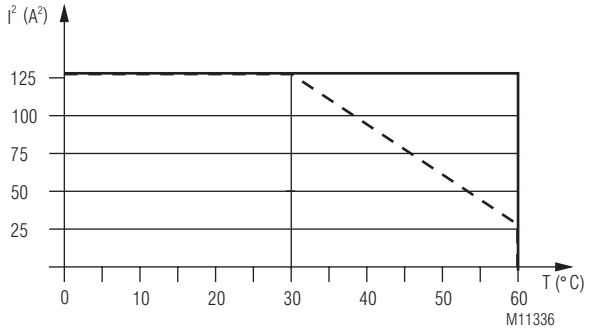
- DC 24 V — Nominal voltage
- 0 = Standard; 1 = with different frequency mode and analogue output
- 0 = npn-input; 1 = pnp-input
- Type of terminals PS (plug-in screw): pluggable terminal blocks, with screw terminals
- .02 — Contacts
- UH 6932 — Type

Options with Pluggable Terminal Blocks



Screw terminal
(PS / plug in screw)

Characteristic



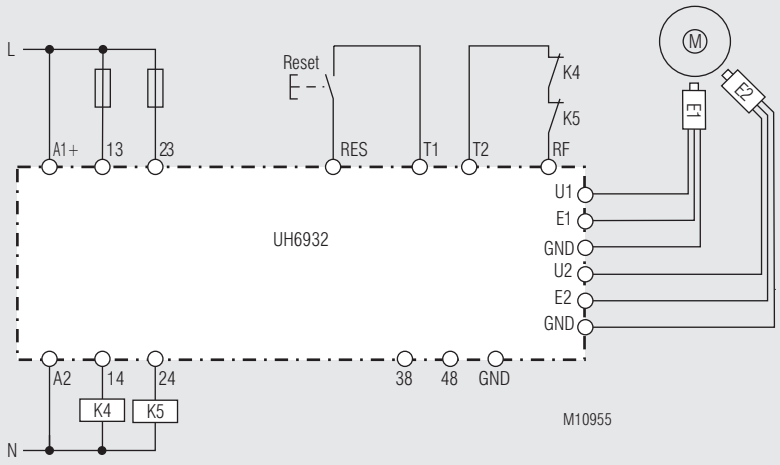
device free-standing
max. current at 60°C over
2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

device mounted without distance heated by
devices with same load,
max. current at 60°C over
2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

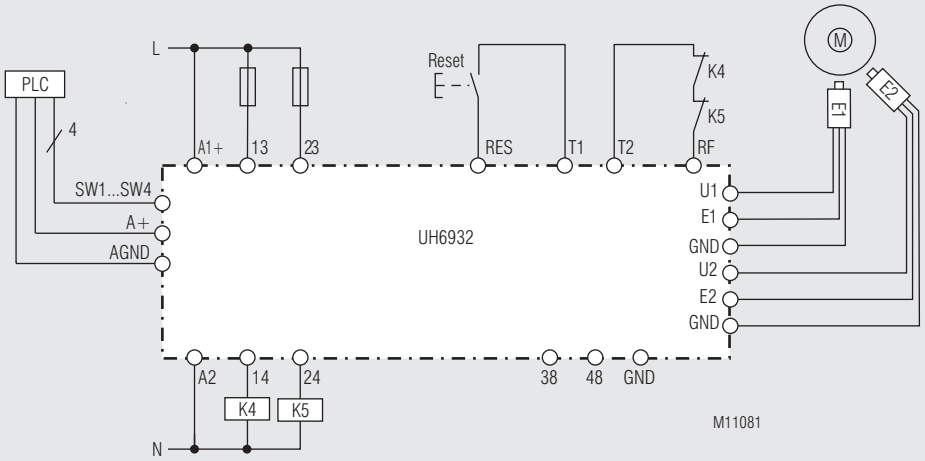
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - current in contact paths

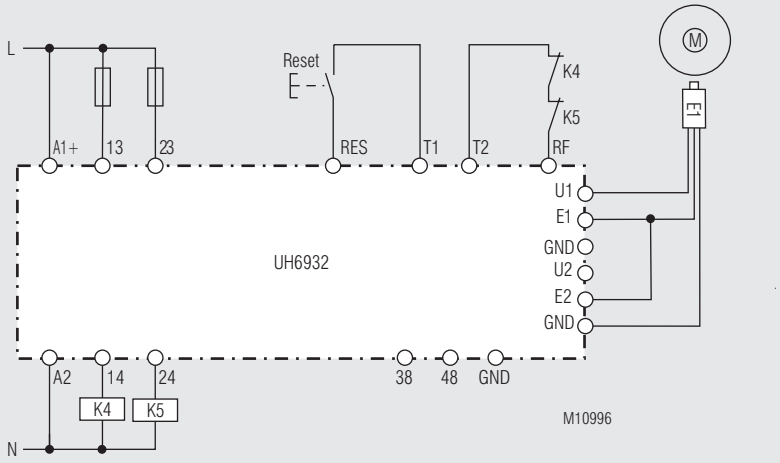
Quadratic total current limit curve



Standard connection,
Suited up to SIL3, Performance Level e, Cat. 4



Standard connection with UH6932/_ _1,
Suited up to SIL3, Performance Level e, Cat. 4



Connection with a proximity sensor,
Suited up to SIL 2, Performance Level c, Cat. 2
(to achieve Cat. 2 the safety function has to be tested on a regulare base)