



### Your Advantages

- Universal usage
- Easy handling

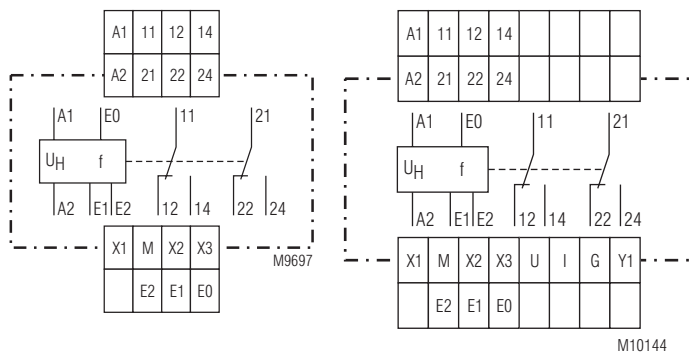
### Features

- According to IEC/EN 60255-1
- Detection of over- **or** underfrequency of alternating voltage (adjustable function) (detection of over- **and** underfrequency see datasheet MK 9837N/5\_0)
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring input for AC-voltages of 15 ... 280 V as well as 30 ... 550 V
- As option with measuring input for inverters
- 4 ranges adjustable response value 1,5 ... 200 Hz or 5 ... 600 Hz
- Adjustable hysteresis
- Adjustable start up time delay 0 ... 50 s at function underfrequency
- Adjustable monitoring time for missing input signal at function overfrequency
- Response delay programmable via terminals 0 ... 100 s
- Alarm storing or auto-reset programmable via terminals
- Galvanic separation between measuring input, auxiliary voltage and output contacts
- MH 9837 available with wide input range for auxiliary supply (AC/DC 24 ... 60 V or AC/DC 110 ... 230 V)
- 2 changeover contacts, closed circuit operation
- Open circuit operation on request
- LED indication for auxiliary voltage, measuring voltage and alarm status
- MH 9837.12/008: With galvanic separated analogue output (current/voltage) and 11 step LED chain for the actual frequency
- Device available with 2 response values and separately controlled outputrelays for under- and overfrequency see MK 9837N/500
- 2 possible compact designs:  
MK 9837N: Width 22,5 mm  
MH 9837: Width 45 mm

### Product Description

The frequency relays MK 9837N and MH 9837 are used for frequency monitoring of AC voltages. They are used for monitoring the output frequency of frequency converters (/050) or for monitoring the rotor frequency of slip ring motors. Further areas of application are the monitoring of drives in crane systems, as well as the frequency monitoring of the supply voltage in rail vehicles.

### Circuit Diagrams



MK 9837N

MH 9837/008

### Approvals and Markings



\*) Only MK 9837N

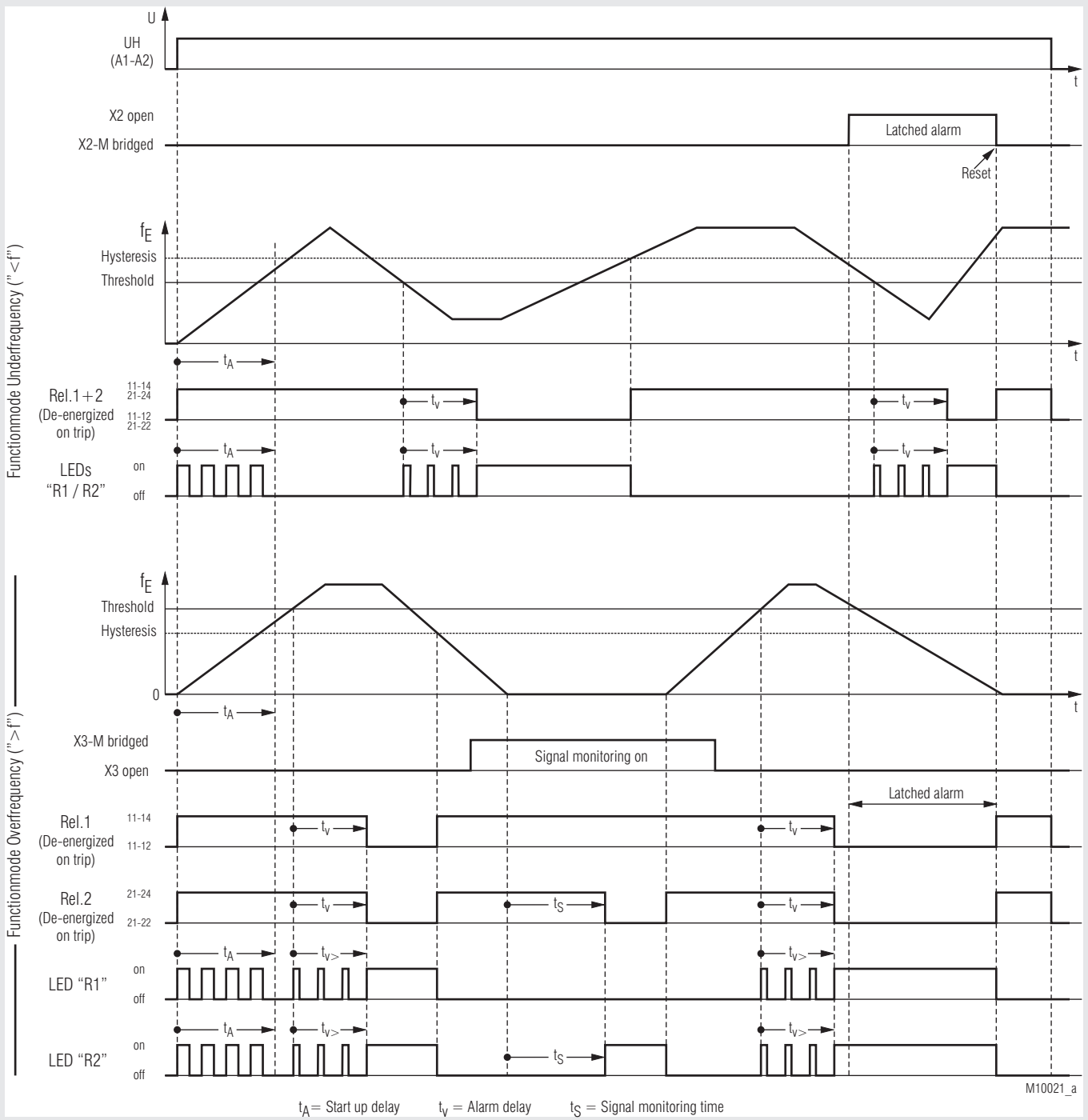
### Connection Terminals

Terminal designation	Signal description
A1+, A1	+ / L
A2	- / N
E0, E1, E2	Frequency input
X1, X2, X3	Programming terminals
M	Reference for programming terminals
U	Analogue output voltage
I	Analogue output current
G	Reference for analogue output
Y1	Range selection for analogue output
11, 12, 14, 21, 22, 24	"monitoring output frequency failure (2 changeover contacts)"

### Applications

- Monitoring of frequency in AC systems
- Monitoring of rotor frequency on slip ring motors
- Control and monitoring of motors in sewage water treatment plants
- Monitoring of output voltage on inverters (variant /050)
- Monitoring of supply voltage frequency on railway rolling stock

# Function Diagram



## Functions

The auxiliary supply is connected to terminals A1-A2.

Terminals E0-E1-E2 form the measuring input. For low voltages the measuring voltage is connected to E1-E0 and for higher voltages to E2-E0 (see section technical data).

The input frequency is compared to the setting value (response value = fine tunig x range).

As the device measures the cycle duration the fastest frequency measurement is possible (reaction time = cycle time + 10 ms).

In overfrequency mode (switch on front in pos. ">f") the output relay switches to alarm state if the input frequency rises above the response value for a longer time then selected on the terminals. If the measuring frequency drops again under the hysteresis value, the output relay switches back to good state without delay.

In underfrequency mode (switch on front in pos. "<f") the output relay switches to alarm state, if the input frequency drops below the response value for a longer time then selected on the terminals. If the measuring frequency rises again above the hysteresis value, the output relay switches back to good state without delay.

If manual reset is chosen, the output relay stays in tripped position, even if the frequency is back to normal. The reset is made by bridging terminals X2-M or by disconnecting the auxiliary supply.

In alarm state the yellow LEDs „R1“ / „R2“ are continuously on, during time delay they flash with short pulse.

In de-energized on trip mode the output relay is energized in good state (contacts 11-14 etc. closed).

In energized on trip mode the output relay is energized in alarm state (contacts 11-14 etc. closed).

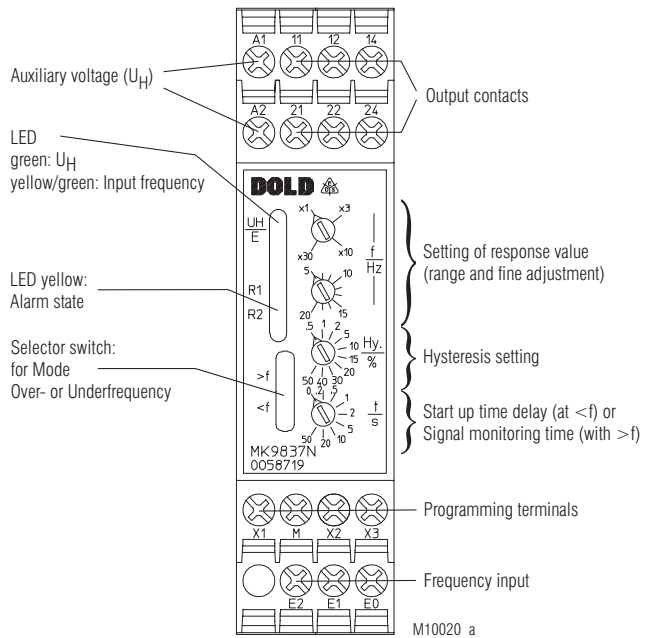
If start up delay is selected a timer is started after connection of auxiliary supply that disables the measuring circuit for the adjusted time. This start up delay avoids an alarm e.g. when starting a generator or motor.

When measuring overfrequency, monitoring of the signal on E0-E1-E2 can be selected. If the signal is missing longer then the selected monitoring time, relay 2 (contacts 21-22-24) and LED "R2" indicate alarm.

## Indicators

- Upper LED „UH/E“:
- Green, when only auxiliary voltage connected to A1 - A2
  - Yellow/green, when measuring frequency is detected on E0-E1-E2
- Lower LED „R1“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active
- Lower LED „R2“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active
  - Additional flashes at signal monitoring alarm LEDs "R1" and "R2" flash together during start up delay

## Setting



## Notes

### Frequency measuring input

The standard measuring input is divided up in to voltage ranges (E1-E0 AC 15... 280 V and E2-E0 AC 30 ... 550 V). If the measuring voltage is always higher then AC 30 V, the higher range should be used. To measure the output frequency on inverters the variant /\_5\_ has to 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 (see diagram in technical data).

Visual indication of measuring voltage: If the voltage on the measuring input is to low for correct function on inputs E0-E1-E2 the upper 2-colour LED "UH/E" shows green continuous light. If underfrequency is selected the unit indicates underfrequency alarm, if overfrequency is selected together with measuring signal monitoring the unit indicates measuring signal alarm. If the voltage on the measuring input is high enough the LED "UH/E" flashes yellow/green.

### Start up delay / monitoring of measuring signal.

The start up time delay ( $t_A$ ) can be adjusted with the lowest potentiometer on the front side of the unit and is activated when connecting the auxiliary supply.

In underfrequency mode ("<f") the start up delay can be extended/restarted at any time with a control contact between terminals X3-M. As long as X3-M is bridged the start up delay is continuously on and the frequency is not measured. When the link on X3-M is opened the start up delay time restarts.

In overfrequency mode (">f") with a bridge on X3-M, the lowest potentiometer sets the measuring signal monitoring time ( $t_S$ ) (The adjusted time values  $t_A/t_S$  are identically).

When signal monitoring in mode ">f" is selected by bridging X3-M the measuring input is monitored as follows: If during the adjusted monitoring time interval no measuring signal is detected, measuring signal alarm is indicated. As soon as the measuring signal returns the alarm status is reset (auto reset selected) and the monitoring interval  $t_S$  starts again.

The alarm status is indicated on relay 2 (contacts 21-22-24) and LED "R2" and can be easily differentiated from under/over frequency alarm where both relays (contacts 11-12-14 and 21-22-24) and LEDs "R1" and "R2" are active.

The detection of missing measuring signal can increase the safety in critical applications on overfrequency. It detects if the measuring signal is connected to the input of the device and works correctly

## Notes

### Programming terminals (M-X1-X2-X3):

**Attention!** The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit, and must be operated potential free.

- M: Common connection (Ground) of the programming terminals  
X1: A response delay of 0...100 s after connection of auxiliary supply is achieved by connecting a X1 to M with a potentiometer or fixed resistor (see technical data). The delay can be stopped by bridging X1 to M at any time.  
If no start up delay is required the terminals X1-M must be linked.  
X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.  
X3: When X3-M is bridged in mode "underfrequency" the start up delay is continuously active or the time is restarted. In mode overfrequency the monitoring of the measuring signal is switched on by bridging X3-M.

### Adjustment aid for start up delay and alarm delay

During the elapse of start up delay and alarm delay the yellow LED „R1“ and „R2“ is flashing with a frequency of 2 Hz. To set a specific time value in seconds the number of flash pulses can be used to check the setting: Number of flash pulses divided by 2 = time delay in seconds.

### Variant MH 9837.12/008: 45 mm width

Identically to MK 9837N.12, but with 11 step LED chain indicator and galvanic separated analogue output to display the actual measured frequency.  
On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0-20 mA are available. By bridging terminals Y1 and G the output can be switched over to 2-10 V and 4-20 mA. The max. value of the analogue output is indicating 2 times of the max. value of the selected range this allows also to indicate overfrequency values. The scaling is linear to the input frequency (lowest analogue value is 0 Hz). The LED chain indicator shows on 10 LEDs the actual frequency ( $\leq 10\% \dots 100\%$  of the setting range). If the frequency exceeds the maximum value of the range the indicator is switched over to 2 x max value and the top LED (red) is on.

## Technical Data

### Frequency Measuring Input (E0-E1-E2)

#### Standard-frequency measuring

##### Voltage range

E0-E1: AC 15 ... 280 V,  
E0-E2: AC 30 ... 550 V

##### Input resistance

E0-E1: Approx. 300 k $\Omega$   
E0-E2: Approx. 850 k $\Omega$

### Frequency Measuring Input for Inverters (variant /\_5\_)

**Max. input voltage:** AC 550 V

**Min. measuring voltage:** See characteristic M9349

**Input resistance:** Approx. 900 k $\Omega$

### Common Data for Both Measuring Inputs

**Galvanic separation:** Frequency measuring input to auxiliary voltage and output contacts

#### Frequency ranges:

1.5 ... 6 Hz	5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz or
5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz	150 ... 600 Hz 4 ranges selectable

#### Response time

(response value): Continuously variable;  
1:4 in each response value

#### Tolerances of the adjusted tripping values at variation of auxiliary supply and temperature:

**Hysteresis:** Better than  $\pm 1\%$   
Continuously variable: 0.5 ... 50 % of adjustable response value

#### Reaction time of

##### frequency monitoring:

(Alarm delay set to 0)  
Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms  
Adjustable 0 ... 100 s with resistor/potentiometer across terminals X1-M:

R / k $\Omega$ :	0	15	22	33	47	68	100	150	220	470	$\infty$
t <sub>v</sub> / s:	0	0.3	0.7	1.3	2.3	5	9	15	25	50	100

#### Time between connection of auxiliary supply and ready to measure:

Approx. 0.4 s (with start up delay is 0)

#### Start up time delay /

##### Signal monitoring time:

20 ms ... 50 s continuously variable on logarithmic scale

### Auxiliary Circuit (A1-A2)

#### Auxiliary voltage U<sub>H</sub> (galvanic separation):

AC 115, 230, 400 V  
DC 12, 24, 48 V  
AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)

#### Voltage range

AC: 0.8 ... 1.1 U<sub>H</sub>  
DC: 0.9 ... 1.2 U<sub>H</sub>  
AC/DC: 0.75 ... 1.2 U<sub>H</sub>

#### Frequency range

AC: 45 ... 440 Hz

#### Nominal consumption:

AC: Approx. 4 VA  
DC: Approx. 2 W

Technical Data		
<b>Output (11-12-14, 21-22-24)</b>		
<b>Contacts:</b>	2 changeover contacts	
<b>Thermal current I<sub>th</sub>:</b>	4 A	
<b>Switching capacity</b>		
According to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60947-5-1
According to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60947-5-1
<b>Electrical life</b>		
Acc. to AC 15 at 1 A, AC 230 V: 1.5 x 10 <sup>5</sup> switch. cycl. IEC/EN 60947-5-1		
<b>Short circuit strength</b>		
<b>Max. fuse rating:</b>	4 A gG / gL	IEC/EN 60947-5-1
<b>Mechanical life:</b>	≥ 30 x 10 <sup>6</sup> switching cycles	

#### Analogue Output with MH 9837.12/008

#### Galvanic separation AC 3750V

#### to auxiliary supply, measuring circuit and relay outputs

Terminal U(+) / G(-): 0 ... 10 V, max. 10 mA  
 Terminal I (+) / G(-): 0 ... 20 mA, max. burden 500 Ohm  
 change to 2 ... 10 V or 4 ... 20 mA by bridging terminal Y1 and G.  
 Scaling is linear with frequency (lowest value at f = 0, highest value at 2 x max setting value)

#### General Data

<b>Nominal operating mode:</b>	Continuous operation	
<b>Temperature range</b>		
Operation:	- 20 ... + 60°C (higher temperature with limitations on request)	
Storage:	- 25 ... + 60°C	
<b>Altitude:</b>	≤ 2000 m	
<b>Clearance and creepage distance</b>		
Rated impulse voltage / pollution degree:		
Output to measuring circuit:	4 kV / 2	IEC 60664-1
Output to auxiliary circuit:	4 kV / 2	IEC 60664-1
Output to output:	4 kV / 2	IEC 60664-1
Auxiliary circuit to measuring input:	4 kV / 2	IEC 60664-1
Programming terminals M-X1-X2-X3:	Without galv. separation to measuring circuit	
<b>EMV</b>		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61000-4-2
HF-irradiation		
80 MHz ... 6 GHz:	10 V/m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltage		
Between		
wires for power supply:	1 kV	IEC/EN 61000-4-5
Between wire and ground:	2 kV	IEC/EN 61000-4-5
HF-wire guided:	10 V	IEC/EN 61000-4-6
Interference suppression		
MK 9837N:	Limit value class B	EN 55011
MH 9837:	Limit value class A*)	EN 55011
*) The device is designed for use in an industrial environment (class A, EN 55011). Connecting the device to a low voltage supply grid (class B, EN 55011) may cause radio frequency interference. Take suitable measures to avoid this.		
<b>Degree of protection:</b>		
Housing:	IP 40	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
<b>Housing:</b>	Thermoplastic with V0 behaviour according to UL subject 94	
<b>Vibration resistance:</b>		
Amplitude 0,35 mm		
Frequency 10 ... 55 Hz IEC/EN 60068-2-6		
<b>Climate resistance:</b>	20 / 060 / 04	IEC/EN 60068-1

Technical Data	
<b>Terminal designation:</b>	EN 50005
<b>Wire connection:</b>	1 x 4 mm <sup>2</sup> solid or 2 x 1,5 mm <sup>2</sup> solid or 1 x 2,5 mm <sup>2</sup> stranded wire with sleeve DIN 46228-1/-2/-3/-4 or 2 x 1,5 mm <sup>2</sup> stranded wire with sleeve DIN 46228-1/-2/-3/ Plus-minus terminal screws M3,5 box terminals with wire protection
<b>Wire fixing:</b>	0.8 Nm
<b>Fixing torque:</b>	DIN rail IEC/EN 60715
<b>Mounting:</b>	
<b>Weight:</b>	
MK 9837N:	Approx. 210 g
MH 9837:	Approx. 350 g
<b>Dimensions</b>	
<b>Width x height x depth:</b>	
MK 9837N:	22,5 x 90 x 97 mm
MH 9837:	45 x 90 x 97 mm

#### Width x height x depth:

MK 9837N: 22,5 x 90 x 97 mm  
 MH 9837: 45 x 90 x 97 mm

## Classification to DIN EN 50155

**Vibration and shock resistance:** Category 1, Class B IEC/EN 61373  
**Service temperature classes:** OT1 compliant  
 OT2, OT3 and OT4  
 with operational limitations  
**Protective coating of the PCB:** No

## CCC-Data

### Auxiliary voltage $U_N$ :

MK 9837N: AC 115, 230 V  
 DC 12, 24, 48 V

### Switching capacity

To AC 15  
 NO contact: 1,5 A / AC 230 V IEC/EN 60947-5-1



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

## Standard Types

MK 9837N.12 5 ... 600 Hz  $U_H$  AC 230 V  
 Article number: 0058719

- Switchable monitoring modus: over- or underfrequency
- Closed circuit operation
- Mode overfrequency with selectable signal monitoring
- 4 settable frequency ranges are possible:  
 5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz, 150 ... 600 Hz
- Settable hysteresis of 0,5 ... 50 %
- Start up time delay / signal monitoring time:  
 Settable to 0 ... 50 s
- Response delay: settable with external resistor to 0 ... 100 s
- Alarm storing or auto-reset selectable
- Frequency measuring input: AC 15 ... 280 V / AC 30 ... 550 V
- Auxiliary voltage  $U_H$ : AC 230 V
- Output: 2 changeover contacts
- Width: 22,5 mm

## Variants

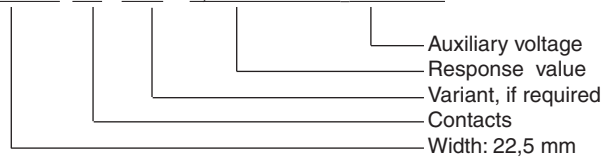
MK 9837N.12/050: As MK 9837N.12, but with measuring input for inverters

MH 9837.12: As MK 9837N.12, but for variants with wide auxiliary voltage range  
 Width: 45 mm

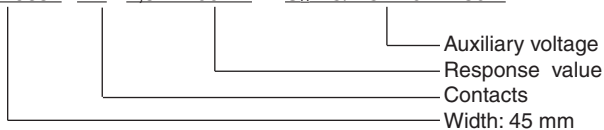
MH 9837.12/008: Similar to MK 9837N.12, but with galvanic separated analogue output (current/voltage) and 11 step LED chain.  
 Width: 45 mm

## Ordering example for variants

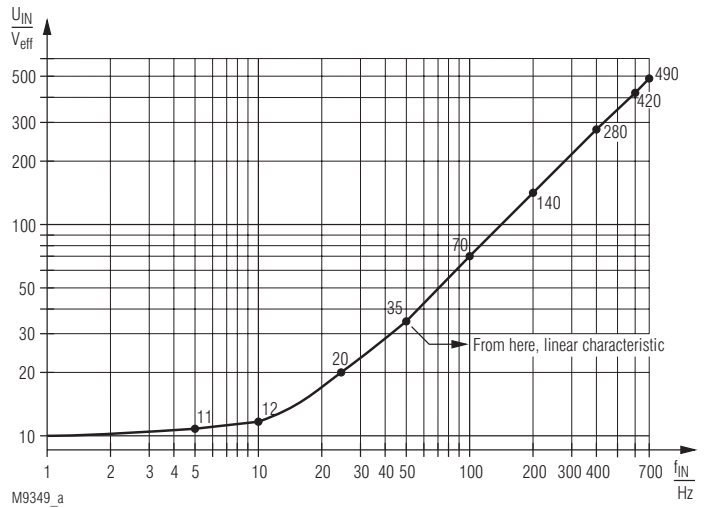
MK 9837N .12 /050 1,5 ... 200 Hz  $U_H$  AC 230 V



MH 9837 .12 1,5 ... 200 Hz  $U_H$  AC/DC 110 ... 230 V



## Characteristic



Typical sensitivity of the measuring input at variant MK 9837N.12/\_5\_

A large grid for calculations or notes, consisting of 20 columns and 40 rows. The grid lines are solid, while the internal vertical and horizontal lines are dashed, creating a pattern of small squares suitable for mathematical work.

A vertical list of horizontal lines for writing, consisting of 40 lines. These lines are intended for notes or observations related to the grid content.

