

VARIMETER

Sensorless Standstill Monitor UG 9146



Your Advantages

- Fast reaction time
- Easy to retrofit
- No external sensors necessary

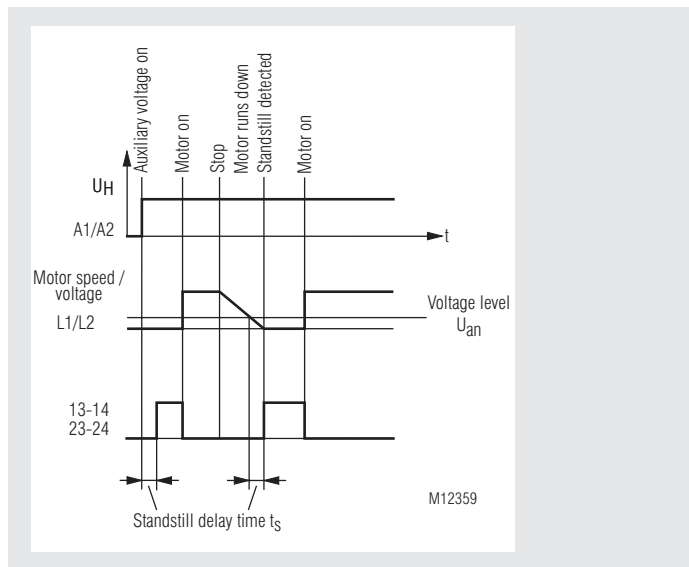
Features

- According to DIN/EN 60255-1
- Standstill detection on 3- and single-phase motors
- Independent of direction
- Broken wire detection
- Forcibly guided safety contacts:
 - 2 NO contacts for AC 250 V
 - 1 NC contact for DC 24 V
- Adjustable voltage setting
- Adjustable standstill time delay
- LED indicators for standstill, event of line breakage and operation voltage
- Suitable for operation with inverters
- Removable terminal strips:
 - UG 9146 PS: plug in screw terminals
 - UG 9146 PC: plug in cage clamp terminals
- Width: 22.5 mm

Product Description

The sensorless standstill monitor UG 9146 is used for sensorless monitoring of electric motors for standstill. It measures the induced voltage of the coasting motor at 2 terminals of the stator winding. If the induced voltage approaches 0, this means motor standstill for the device and the output relay switches on.

Function Diagram



Approvals and Markings



Applications

Standstill detection for 3-phase and 1-phase electric motors, e.g. for speed-dependent switching in production processes, for activating holding brakes or for signalling to higher-level control systems.

Function

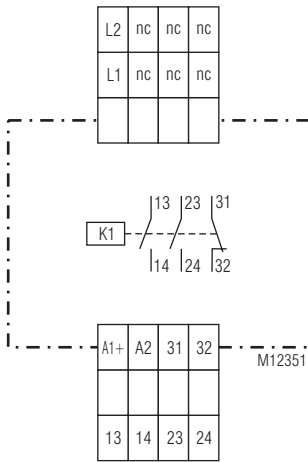
The sensorless standstill monitor UG 9146 is suitable to monitor the standstill of all electric motors that generate a remanence voltage while coasting to stop.

It is connected to the motor terminals and measures the induced back emf voltage. If the back emf voltage drops to 0 this indicates standstill and the output relay is energized.

To adopt the unit to all different types of motors and applications the voltage threshold indicating standstill on UG 6946 is adjustable. Also the time delay between detection and energisation of the relay is adjustable (standstill time t_s).

In addition the unit detects broken wire on the measuring inputs L1 / L2. If broken wire is detected the output relay goes into deactivated state (as with running motor). This state is stored and can be reset by bridging terminals X3-X2.

Circuit Diagrams



UG 9146.22

Connection Terminals

| Terminal designation | Signal description |
|----------------------|---|
| L1-L2 | Connection to monitored motor |
| 31-32 | Forcibly guided indicator output |
| 13-14, 23-24 | Forcibly guided NO contacts for release circuit |
| A1-A2 | Auxiliary voltage (U_H) |

Indicators

| | |
|-------------------------|--|
| Green-red LED „UH“: | Green on, when operation red on, with internal error |
| Yellow-green LED „OUT“: | Yellow on, at $EMK > U_{an}$ flashes green at time progression of t_s permanent on, when output contacts are enable |
| Red LED „ERR“: | Flashes at error |

Function

The UG 9146 can be used for standstill detection on all 3-phase, single phase and DC motors, that generate a voltage caused by remanence when freewheeling. As the voltage level U_{an} for standstill monitoring and the time delay t_s , after detection of standstill until the safety relays are switched on, are adjustable, the function can be adopted to different motors and applications.

Basic function of UG 9146

The auxiliary voltage is connected to the terminals A1-A2; the LED „UH“ lights up green. On undervoltage or missing auxiliary supply the outputs are disabled.

A motor connected to the terminals L1-L2 of the UG 9146 generates a voltage when running down (motor is switched off). The voltage is proportional to the speed and caused by residual magnetism (remanence).

If this voltage drops below the adjusted response value U_{an} , the UG 9146 detects this as standstill and switches on the output contacts 13-14 and 23-24 after the adjusted "standstill time" t_s .

At the same time the LED „OUT“ lights green. During time delay t_s this LED flashes.

If the voltage measured at terminals L1-L2 of the UG 9146 exceeds the value of U_{an} plus hysteresis (the connected motor is energized or starts up due to mechanical action), the output contacts are switched off immediately (contacts 13-14 and 23-24 open).
the "Out" LED lights up yellow (= U_{an} exceeded).

Broken wire / offset

The connection wires between UG 9146 and motor are continuously monitored for broken wire and on a DC-voltage offset higher than U_{an} . In the case of a broken wire or offset failure the output relays are switched off immediately and the LED „OUT“ lights yellow. In addition a failure signal comes up with delay (on broken wire after 2 s on offset failure after 8 s): the LED „ERR“ flashes.

Failure storing / reset

In the case of the externally caused error "wire break / offset", the user can select whether this error status remains stored or is automatically reset after the error has been eliminated: If the 10 step potentiometer t_s is set to position 1-5, the error remains stored.
If the t_s potentiometer is set to position 6-10, the error will be reset after elimination.

Connection of UG 9146

The UG 9146 has to be connected according to connection examples or in a similar way. The connection of DC- motors is made as with single phase AC-motors.

L1 - L2

The measuring wires L1-L2 have to be connected directly to the windings of the monitored motor (not via transformers) in order to provide a correct broken wire detection for the connection wires and motor windings.

The motor windings must not be disconnected from the measuring wires by motor contactors, because broken wire detection is activated and standstill monitoring is disabled.

Interference to the measuring wires should be avoided as no standstill may be detected by the UG 9146. If possible the measuring wires should be run separately from the motor wires or screened wires should be used. In this case the screen can be connected at the motor side.

A1 - A2

Connection of the auxiliary supply, recommended fuse : 2 A.

13-14, 23-24, 31-32

Forcibly guided output contacts, connection according to the connection examples or similar.

Recommended fuse: 5 A fast acting, to avoid welding of the contacts in the case of external wiring or component failures. See also technical data.

Operation Notes

Motors with switched windings

(e.g. star delta starters, reversing circuits, multi speed motors)

With these applications please make sure, that the measuring inputs must be linked via the motor windings. An open connection will result in broken wire indication and disable the output contacts.

Operation with DC motors

However, since the remanence voltage here is generally a DC signal, the UG 9146 constantly reports an offset or wire break error to LED "ERR" during operation and rund-down.

If this is taken into account and the error storage is deactivated, the device can be used for proper release of the output contacts at motor standstill.

Operation with electronic motor controller

(inverters, DC-brakes)

The operation of UG 9146 to detect standstill on motors with electronic motor control is possible, if the output voltage of the motor controller drops under the adjusted response value on standstill. (No position control on inverters, no DC voltage on brakes after standstill).

If the inverter produces a DC offset or a DC brake is active, an offset or broken wire failure is indicated on LED „ERR“. This error resets automatically if the error storage is deactivated.

When there are inverters in the installation it is recommended to use screened measuring wires to the motor. The screen can be connected to the motor.

Attention

If the motor current is run down by inverters or softstop modules in a slow way the motor may be de-magnetised. It is necessary to check if the remaining remanence voltage is sufficient to guarantee a correct and safe standstill monitoring. At high frequencies an increasing damping of the measuring inputs has to be taken into account (see technical data measuring input „response value dependant on frequency“).

Setup and Setting

Preparation

- Motor on standstill
- Terminals L1-L2 connected to the motor windings
- Deactivate error storage for DC motors or DC braking
- Adjust U_{an} to minimum
- Adjust t_s to minimum (0.2 s)

Connect correct auxiliary voltage to terminals A1-A2

⇒ After 1 sec the LEDs „UH“ and „OUT“ light up green and the contacts are switched on.

If standstill is not detected (LED „OUT“ lights yellow), possibly interference is coupled on the measuring circuit. Adjust U_{an} higher or screen the measuring wires.

Start of motor

⇒ LED „OUT“ changes colour to yellow. The output relays switch off. On DC motors the LED „ERR“ starts to flash after 2 s.

Stop of motor – run down DC braking off

The speed at which standstill is detected (yellow LED „OUT“ changes to green/green flashing) can be adjusted on Potentiometer „U_{an}“. When the run down is slow or irregular the time delay must possibly be increased to avoid switching on and off of the output relays. Possibly this effect can also be avoided by slightly increasing U_{an} . During time delay t_s the LED „OUT“ flashes green.

If standstill detection shall only take place at very low speed of the motor, U_{an} is set normally to minimum. By increasing the delay time t_s a possible pulsing of the output relays can be avoided. A longer time delay until the output relays are enabled also ensures that, depending on the stopping behavior of the motor, the output relays are not switched until the motor has come to an absolute standstill (especially on motors that generate only a small remanence voltage).

If the run down time of the motor is short t_s can be set to a minimum (0.2 s). This is suitable in production systems to shorten machine cycles.

Technical Data

Input (L1 - L2)

Measuring-/Motor voltage: Max. AC 690 V
Input resistance: 500 kΩ
Response value U_{an} : 20 mV ... 400 mV, adjustable or 0.2 ... 4 V, adjustable

Response value dependent on frequency

| | | | | | | | | |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-------|----|
| Input frequency (Hz): | 50 | 100 | 200 | 400 | 600 | 1k | 1,5 k | 2k |
| Multiplication factor for U_{an} : | 1.0 | 1.1 | 1.2 | 1.5 | 2.0 | 2.8 | 5 | 8 |

Hysteresis (for detection of running motor): 100 %
Release delay for detection of running motor: < 100 ms
Standstill time delay t_s : 0.2 ... 6 s adjustable

Auxiliary circuit (A1-A2)

Auxiliary voltage U_H : DC 24 V
Recommended fusing: 2 A
Voltage range: 0.9 ... 1.2 U_N
Nominal consumption: Approx. 1,2 W
Max. residual ripple (DC): 10 %
Start up delay when connecting U_H at standstill: 0.4 ... 0.8 s + adjustable t_s

Output

Contacts: 2 NO contacts, 1 NC contact

Contact type: relay, positive guide
Nominal output voltage
NO contact: AC 250 V
NC contact: DC 24 V
Thermal current I_{th}
NO contact: 8 A
NC contact: 2 A
(see quadratic total current limit curve)

Switching capacity

to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60947-5-1
to DC 13
NO contact: 2 A / DC 24 V IEC/EN 60947-5-1
NC contact: 2 A / DC 24 V IEC/EN 60947-5-1
to DC 13
NO contact: 4 A / 24 V at 0.1 Hz IEC/EN 60947-5-1

Short circuit strength

max. fuse rating: 10 A gG / gL IEC/EN 60947-5-1
Max. operating frequency: 1200 / h

Electrical life:

5 A, AC 230 V $\cos \varphi = 1$: $\geq 2 \times 10^5$ switching cycles

Mechanical life:

$\geq 20 \times 10^6$ switching cycles

Technical Data

General Data

Nominal operating mode: Continuous operation

Temperature range

Operation: - 25 ... + 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: - 40 ... + 85°C

Altitude,

Clearance and creepage distance

Rated impulse voltage /

pollution degree: IEC 60 664-1
≤ 2000 m > 2000 m up to ≤ 4000 m

13, 14, 23, 24 against all others: 6 kV / 2 4 kV / 2

31, 32, A1, A2 to

L1, L2, L3: 6 kV / 2 4 kV / 2

L1, L2, L3 each others: 6 kV / 2 4 kV / 2

13, 14 zu 23, 24: 4 kV / 2 2,5 kV / 2

EMC: DIN EN 60255-26

Interference suppression: 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.

Degree of protection

Housing: IP 40 IEC/EN 60529

Terminals: IP 20 IEC/EN 60529

Enclosure: Thermoplastic with VO behaviour according to UL subject 94

DIN EN 60255-21-1

Vibration resistance: Frequency / Amplitude: 10 ... 60 Hz, 0.075 mm constant

Acceleration: 60 ... 150 Hz, 1 g constant

Climate resistance: 25 / 060 / 04 IEC/EN 60068-1

Terminal designation: EN 50005

Plug in with screw terminals

max. cross section

for connection: 1 x 0.25 ... 2.5 mm² solid or stranded ferruled (isolated) or 2 x 0.25 ... 1.0 mm² solid or stranded ferruled (isolated)

Insulation of wires

or sleeve length: 7 mm

Plug in with cage

clamp terminals

max. cross section

for connection: 1 x 0.25 ... 2.5 mm² solid or stranded ferruled (isolated) 2 x 0.25 ... 1.5 mm² stranded twin ferruled (isolated)

Insulation of wires

or sleeve length: 10 mm

Wire fixing: captive slotted screw or cage clamp terminals

0.8 Nm

Wire fixing: Captive slotted screw or cage clamp terminals

Mounting: DIN-rail IEC/EN 60715

Weight: Approx. 170 g

Dimensions

Width x height x depth:

UG 9146 PS: 22.5 x 110 x 120.3 mm

UG 9146 PC: 22.5 x 120 x 120.3 mm

UL-Data

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

Auxiliary voltage U_H: Device must be supplied with a Class 2 or a voltage / current limited power supply.

Measuring-/Motor voltage: Max. AC 600 V

Switching capacity

Device free-standing:

Ambient temperature 60 °C: Pilot duty B300, Q300

5A 250Vac G.P.

5A 24 Vdc

Ambient temperature 50 °C: Pilot duty B300, Q300

8A 250Vac G.P.

8A 24 Vdc

Device mounted without distances heated by devices with same load:

Ambient temperature 50 °C: Pilot duty C300, Q300

1A 250Vac G.P.

1A 24 Vdc

Ambient temperature 25 °C: Pilot duty B300, Q300

8A 250Vac G.P.

8A 24 Vdc

Device mounted with 10 mm distance heated by devices with same load

Ambient temperature 60 °C: Pilot duty C300, Q300

2A 250Vac G.P.

2A 24 Vdc

Ambient temperature 40 °C: Pilot duty B300, Q300

8A 250Vac G.P.

8A 24 Vdc

Wire connection: 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.

Standard Type

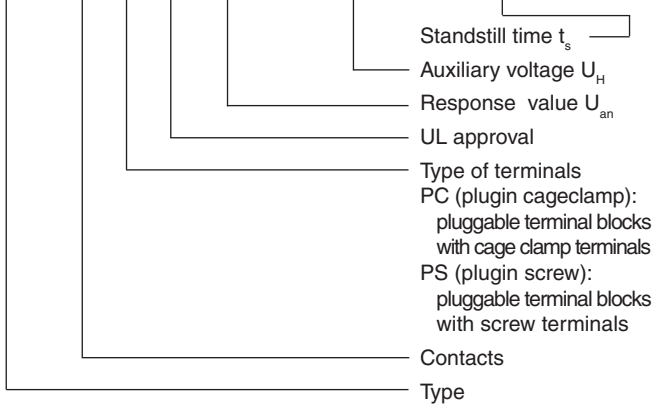
UG 9146.22PS/61 20 ... 400 mV UH DC 24 V 0,2 ... 6 s

Article number: 0069310

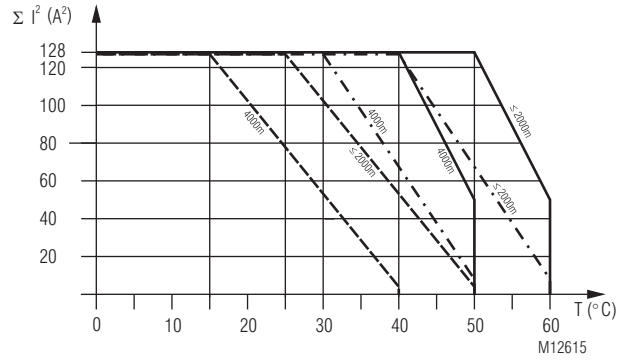
- Output: 2 NO contact, 1 NC contact
- Response value U_{an} : 20 ... 400 mV
- Auxiliary supply U_H : DC 24 V
- Standstill time delay t_s : 0,2 ... 6 s
- Width: 22,5 mm

Ordering Example

UG 9146 /61 20 ... 400 mV UH DC 24 V 0,2 ... 6 s



Characteristic



Device free-standing.
 Max. current at 60°C ($\leq 2000m$) or 50°C (4000m) over
 2 contact paths = $5A \hat{=} 2 \times 5^2 A^2 = 50A^2$

Device mounted with 10mm distance.
 Max. current at 60°C ($\leq 2000m$) or 50°C (4000m) over
 2 contact paths = $2A \hat{=} 2 \times 2^2 A^2 = 8A^2$

Device mounted without distances heated by
 devices with same load.
 Max. current at 50°C ($\leq 2000m$) or 40°C (4000m) over
 2 contact paths = $1A \hat{=} 2 \times 1^2 A^2 = 2A^2$

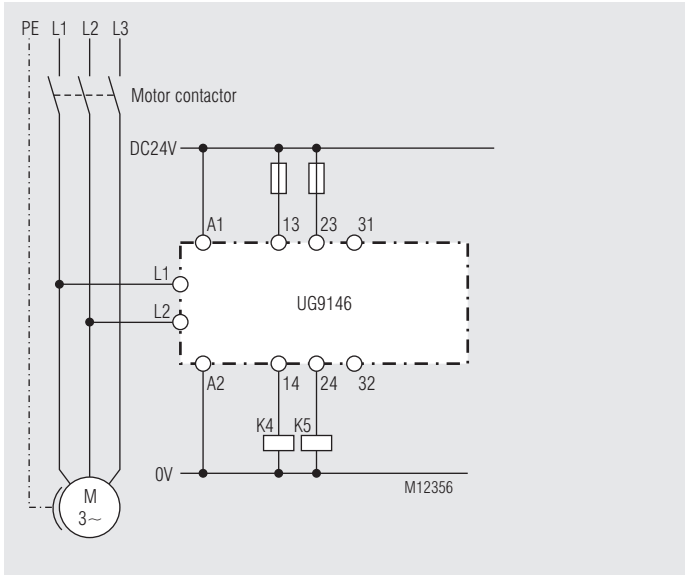
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - Current in contact paths

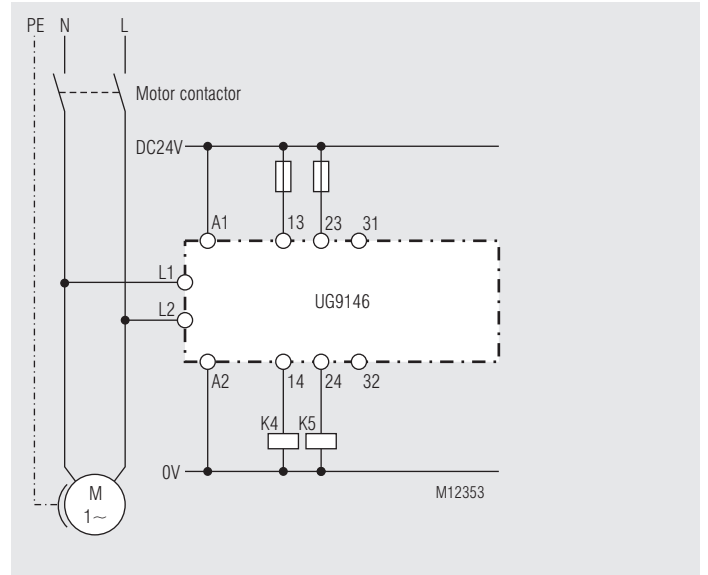
Quadratic total current limit curve

At an altitude ≥ 2000 m adjustment of the curve by $-0.5^\circ C / 100$ m
 (see example 4000 m)

Connection Examples



With 3-phase motor



With 1-phase motor

