

General

- ▶ 3-axis tower oscillation monitor in compact design
- ▶ Redundant system with two independent CPUs and two oscillation monitors arranged at 45° to each other
- ▶ Two integrated safety relays with mechanically interlocked contacts as per EN 50205 class. A switch on reaching the adjustable limits
- ▶ Maintenance and wear-free operation due to MEMS acceleration sensors
- ▶ Measuring system is not subject to ageing, is insensitive to temperature fluctuations, dirt or condensation
- ▶ Trigger criterion either evaluation of the geometric sum of the limits or axis-related evaluation
- ▶ Unambiguous hole pattern in the base plate identifies the mounting position
- ▶ Full function in case of condensation: dew-point resistant!

Features

- ▶ Measuring direction X, Y and Z
- ▶ Resolution 0.01 m/s²
- ▶ Extended temperature range -40 °C to +85 °C
- ▶ Interfaces:
 - CANopen
 - Factory-adjusted safety relay outputs
- ▶ Protection class IP 67
- ▶ Maximum installation altitude 4000 m
- ▶ Performance Level **PLd** as per DIN EN ISO 13849

Advantages

- ▶ Appropriate for safety application with PLd requirement as per DIN EN ISO 13849

Field of application

- ▶ Wind power

Description

Construction and design

The tower oscillation monitor GEL 3011 is designed for monitoring oscillations and vibration on machines and installations. As a safety component it is integrated into a safety circuit for a SIL installation and features Performance Level **PLd** as per EN ISO 13849.

MEMS acceleration sensors, safety relays and CANopen interface are integrated into a compact aluminium housing. The state of the oscillation monitor can be checked on-site using diagnostics LEDs.

The tower oscillation monitor contains two mechanically interlocked switched outputs that can be integrated into an existing safety circuit.

The GEL 3011 is suitable for standard and heavy-duty applications, it also withstands aggressive media and impresses with a long, maintenance-free service life. It can be used in the extended temperature range from -40 °C to +85 °C and up to an installation altitude of 4000 m.

Interfaces

The tower oscillation monitor is available with a CANopen interface.

The switched outputs are formed by two floating safety relays with one normally closed contact and one normally open contact; the contacts are mechanically interlocked. Mechanical interlocking designed as per EN 50205 Class A. In the de-energised state and in case of an error, the relays are open. The switching points (trigger limits) and the trigger delay are adjustable.

Function

The tower oscillation monitor GEL 3011 measures the acceleration in the X, Y and Z direction using so-called MEMS (Micro-Electro-Mechanical System) acceleration sensors. If the measured values exceed the factory-set limits in the X/Y direction (horizontal plane), the sensor switches the switched output (safety-related section). The trigger delay can be set in the factory, as standard the delay is 50 ms. The current acceleration values for all axes are also output via a fieldbus interface.

The acceleration values are pre-filtered using up to two digital signal filters using factory-set parameters to remove undesirable frequency components. If the acceleration exceeds the limit, the safety circuit is opened. Normal operation remains inhibited for an adjustable time, even if the acceleration drops below the limit again. The time set in factory as standard is 30 s.

Safety-related section

The architecture of the system is based on parallel redundancy with continuous monitoring.

The safety-related section is type approved. All function parameters are set in the device in the factory in accordance with customer requirements; it is not possible for the customer to change the settings.

Requirements on the customer system

The higher level control, regulation and safety system must meet a number of requirements so that the specified function can be ensured. These are:

1. Regular self-test
At least once in an interval of 12 months, the higher level (safety) control system must trigger the device self-test via the fieldbus or by interrupting the supply of power for at least 10 seconds. In this way it is also possible to detect relay faults that would not be apparent in normal operation.
2. Re-start protection
If previously defined limits are exceeded or a fault is detected, the safety circuit is opened by the device. Provided the limits are not exceeded again during the inhibit time (customer-specific) or the fault state has been left, the safety circuit is automatically closed again by the device.
3. Operating parameters
Depending on the type of installation, various operating parameters have been set in the factory: limits, filters, trigger characteristic, mounting position, mounting orientation. As the manufacturer is not familiar with the physical model, the control parameters or the safety concept for the related type of installation, it is the responsibility of the customer to determine the operating parameters such that safe operation of the installation and reliable shutdown in undesirable operating states is ensured.
4. Monitoring the safety circuit
The higher level safety control system must be able to detect an opened safety circuit within 500 ms and to place the installation in a safe operating state in this case.

Self-test

After switching on, a self-test is run automatically on the acceleration sensors and relays. Readiness is signalled via the DIAG LEDs and to the installation control system via the bus interface.

Continuous monitoring ensures the function of both acceleration sensors is tested in operation. In this way a defective sensor is reliably detected; the device then signals the failure of the sensor via the fieldbus and opens the safety circuit. The self-test can be also triggered by the installation control system in accordance with the fieldbus protocol. During this process the acceleration sensors are subjected to a function test and each relay switched once, as a result the safety circuit is opened. The safety function is then re-started afterwards.

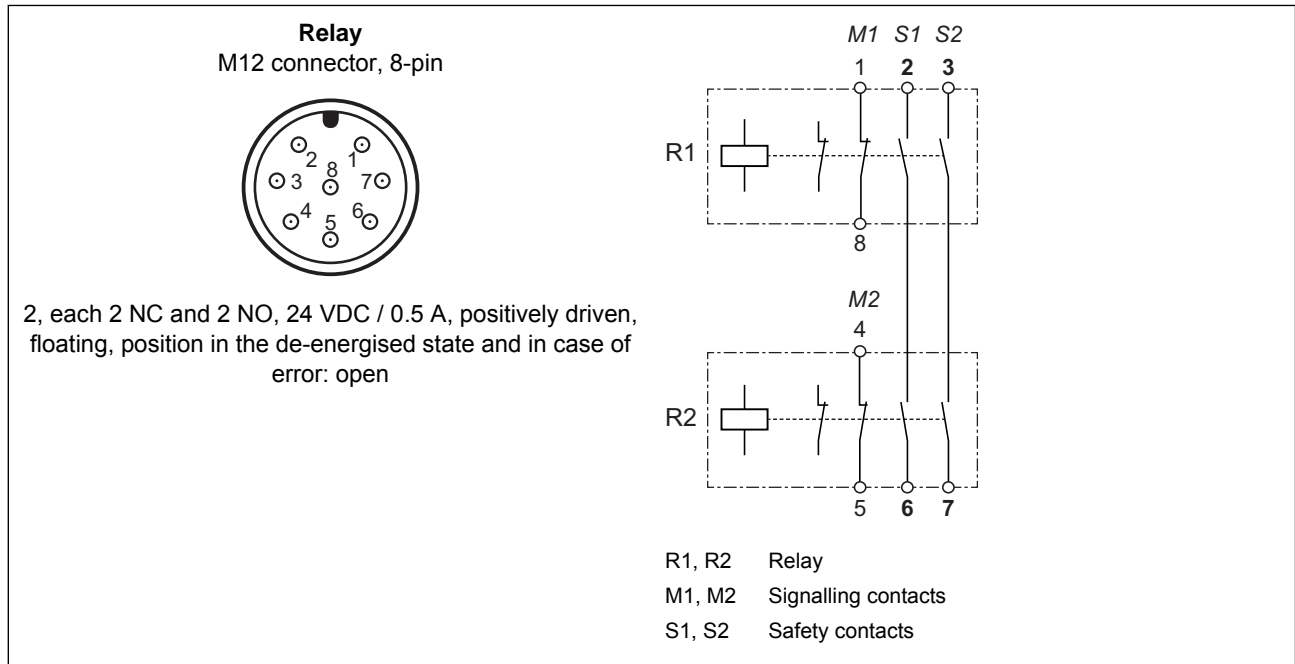
To ensure the safety circuit is not interrupted, two tower oscillation monitors must be connected in parallel; these sensors are then not allowed to be subjected to a self-test **simultaneously**. This is the only function from the non-safety-related section of the tower oscillation monitor (fieldbus communication) that affects the safety-related section.

Technical data

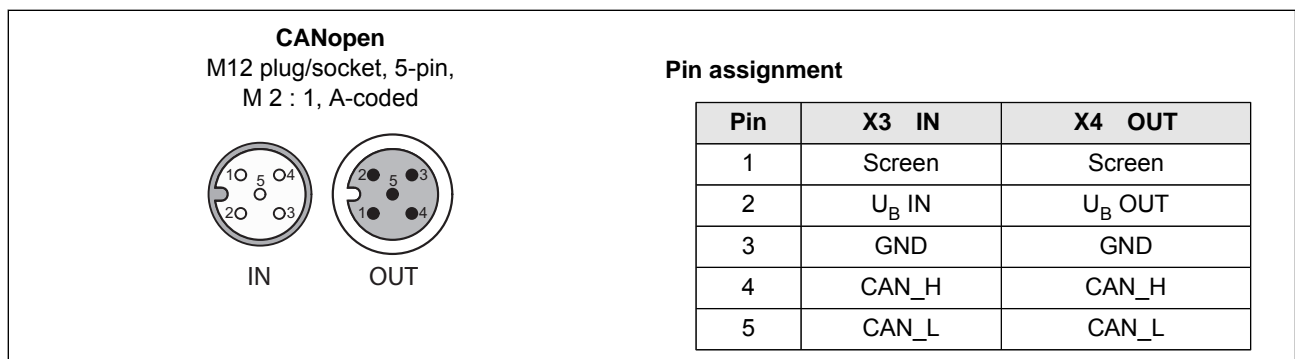
General	
Measuring axes	3 (X, Y, Z); X and Y monitored
Measuring range	$\pm 15 \text{ ms}^{-2}$ (approx. 1.5g)
Resolution	$\pm 0.01 \text{ ms}^{-2}$
Accuracy (X, Y)	$\pm 0.05 \text{ ms}^{-2}$ at 25 °C $\pm 0.25 \text{ ms}^{-2}$ at -40 °C to +85 °C
Temperature dependency	$\pm 0.004 \text{ ms}^{-2}\text{K}^{-1}$
Safety level	PLd according to EN ISO 13849
Electrical data	
Operating voltage	24 VDC $\pm 10 \%$
Power consumption	Approx. 2.4 W
Scanning rate	5 ms
Digital interfaces	CANopen
Switched output	
Relay	2, each 2 NC and 2 NO, 24 VDC / 0.5 A, positively driven, floating, position in the de-energised state and in case of error: open
Release criteria (alternatively)	Axis related (X, Y) or geometric sum (radius)
Trigger limits in X direction (+/-)	Customized preset
Trigger limits in Y direction (+/-)	Customized preset
Trigger limit radial	Customized preset
Trigger delay	Customized preset (default: 0.05 s)
Inhibit time after relay triggering	Customized preset (default: 30 s)
Filter	1. Customized preset (default: Butterworth 2nd order low-pass filter, $f_c = 10 \text{ Hz}$); 2. Optional additional filter with customized characteristics
Mechanical data	
Housing material	Aluminium
Weight	Approx. 625 g
Dimensions (W×D×H)	140 × 60 × 45 mm
Environmental conditions	
Assured operating temperature range	-40 °C to +85 °C
Storage temperature range	-40 °C to +85 °C
Max. installation altitude	4000 m
Protection class in accordance with DIN 60529	IP 67
Vibration resistance (EN 60068-2-6)	100 ms^{-2} (approx. 10g), 10 to 100 Hz
Shock resistance (EN 60068-2-27)	1000 ms^{-2} , 11 ms (transport only)
EMC	EN 61000-6-1 to 4
Insulation strength	$R_i > 1 \text{ M}\Omega$, at a test voltage of 500 VAC
Max. relative humidity of air	99 % (annual average < 75 %)
Condensation permitted	Yes

Pin layout, technical data – interfaces

Pin layout



Pin layout – interfaces

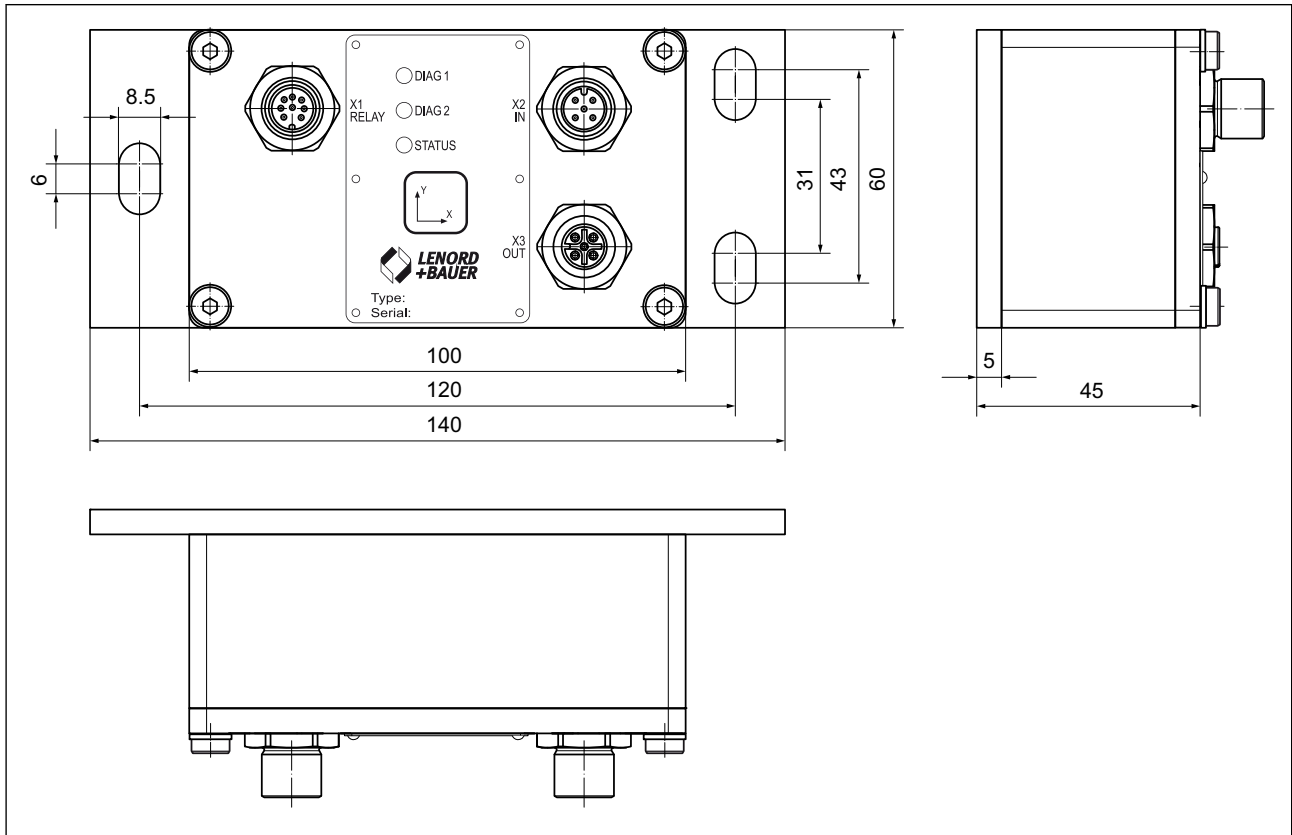


Technical data — interfaces

Interface	CANopen
Device profile	CANopen DS 401
Connection	A-coded M12 connectors and diagnostics LEDs
Parameters	Limits in X, Y and Z direction, trigger delay, relay inhibit time, cut-off frequency (low-pass filter)
Sensor ID	LSS in accordance with DS 302
Operating temperature	-40 ... +85 °C

Dimensional drawing

Dimensional drawing GEL 3011



Type code

		Interface	
	CO	CANopen	
		Measuring axes	
	3	3-axes (X, Y, Z)	
		Measuring range	
	A	$\pm 15 \text{ ms}^{-2}$ (approx. 1.5g)	
		Switched output	
	1	Relay 2x, positively driven	
		Type of mounting	
	G	Floor mounting	
		Housing material	
	A	Anodised aluminium	
		Device pre-setting	
	00	Default setting	
GEL 3011	--	--	--

Accessories

Description	Item number
CANopen connection cable 10 m, 5-pin plug / flying lead with ferrules	BK 2100
CANopen connection cable 2 m, 5-pin plug / flying lead with ferrules	BK 2101
CANopen connection cable 10 m, 5-pin socket / flying lead with ferrules	BK 2102
CANopen connection cable 2 m, 5-pin socket / flying lead with ferrules	BK 2103
CANopen connecting cable 10 m, 5-pin socket/plug	BK 2104
CANopen connecting cable 2 m, 5-pin socket/plug	BK 2105
CANopen, mating connector 5-pin socket, A-coded	FS 3020
CANopen, mating connector 5-pin plug, A-coded	FS 3021
CANopen terminating resistor M12	FS 3040
Relay output mating connector, M12, 8-pin socket, A-coded	FS 1352
Relay output connection cable 10 m, 8-pin socket M12 A-coded / flying lead	FS 1095



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