Vibration- and Acceleration sensor / monitor
CANopen interface + analogue output and switches
Model NVA115 / S3 or NVA120 / S3 with SIL2 status

- Contactless, wear-free sensor system in MEMS technology
- Number of measurement axes: 2
- Frequency range: 0.1 ... 60 Hz (opt. 0.05 Hz)
- Measuring range: ± 2 g
- Interfaces: 
  - CANopen safety SIL2
  - 2 switching contacts SIL2
  - 2 analogue outputs
- Special features:
  - Type of filter selectable
  - 'Safety Shut off' SSO due to heavy strokes
  - 'FFT' - fourier frequency detection
  - "Switch off phasing" adjustable
  - Various signal settings (RMS etc.)
- Parameterisable via CANopen

Design

The sensor system is intended as a component for use e.g. in wind power plants to measure and evaluate vibrations in the mast head. Registration of dynamic accelerations by means of MEMS sensors (Micro-Electro-Mechanical System) with subsequent digitisation by a controller.

The device consists of an acceleration sensor, a controller unit and three types of output interface. The main feature is two safety switching contacts (potential-free), which can be used e.g. in the safety chain to undertake safety shut-off in the event of excessively high acceleration values.

Data output is carried out via the CANopen interface.

The standard or the safety profile can be selected.

There are additionally two analogue outputs 4 ... 20 mA, which can be optionally assigned to two of the three measurement axes.

Thanks to its high resistance to vibration and shock, the sensor is suitable for use in areas with rough environmental conditions.

Electrical connection is carried out using two or three connectors.

Function

MEMS sensors are integrated circuits which are manufactured in silicon bulk micromechanics technology. They have a long service life and are very robust.

After determining the steady component and scaling, the measured values supplied by the acceleration sensor are made available to the six filter units. The steady component arises as a result of installation which is not precisely horizontal, with the result that part of the earth’s gravitational field would also be measured. The offset which occurs in the measured vibration value curve (zero point shift) due to the steady component is determined by means of calculation (distribution of the positive and negative measured values around the zero point) and is subtracted. The pure alternating component is output within a matter of 20 seconds. This calculation takes place continually. This function can be shut off in the factory.

The filter units can be individually programmed in the filter characteristics for frequency selection in the factory (low pass or band pass). They can be assigned to axes x, y or z (in the case of x and y also to the resulting ones). Certain types of filter (kind, order, frequency limits) can be defined by the customer and can then be selected via CANopen.

The signals which are then available can be used for:
  - activation of the safety switching outputs, time delay on demand (g limit values and assignment)
  - output on CANopen / CANopen safety
  - output on analogue outputs (amplification factor and assignment)
  - selection of momentary or RMS output or peak or integral output

The majority of parameters can be set using the CANopen interface.
Vibration sensor / monitor NVA115 / S3 or NVA120 / S3

General information

The vibration sensor measures on two axes in a frequency spectrum from 0.1 to 60 Hz (Option: 0.05 to 60 Hz). This spectrum can be subdivided into a maximum of 6 frequency ranges. The frequency ranges are set in the factory. All acceleration values acting within the relevant frequency window are registered and are output firstly as an analogue value (4 ... 20 mA, max. two outputs possible) and secondly as a digital value via CANopen or CANopen safety. The acceleration values which are presented are additionally compared with limit values (maximum values). If these limit values are exceeded, relevant switching contacts switch (a maximum of two is possible). In normal operating status, the contacts are closed. There is a warning stage and an alarm stage. The limit values for these stages can be set in the factory or by the customer. After 30 seconds, the warning status is reset to normal operating status if the measured acceleration level is not exceeding the warning limit any more. The alarm status can only be deleted through a reset.

The measuring axis is x, y or z or the vector sum √(x²+y²) built from x and y.

The acceleration value (instantaneous value) can be used directly or a mean value of the acceleration which occurs (RMS) may be used as the output value and the further processing value for the relay circuit. The time over which averaging is carried out can be set.

Filter characteristics

Digital pre-filtering is initially carried out in the MEMS sensor to extensively suppress higher-frequency interference vibrations (>= 100 Hz), as they reveal comparatively high amplitudes due to the higher frequencies (1st-order FIR filter).

The individual frequency bands are then realised in the downstream controller via digital 8th to 11th-order Chebichev filters (11th order in the lower frequency range, 8th order in the upper frequency range). Other types of filter can be prepared by TWK on customers demand (e.g. Butterworth of 2nd order). These filters can be activated by CANopen object 322x/08.

The 6 filter units are of the same design; their characteristics can be set in the factory as desired by the customer. In the standard version, these filters (low-pass, band-pass and high-pass) are implemented as Chebichev filters. Chebichev filters are continuous frequency filters which are designed for the sharpest possible kinking of the frequency response at the limit frequency fg. To achieve this, amplification in the pass range or in the stop range is not monotone but possesses a waviness which has to be defined. The higher the permissible waviness, the sharper the drop within an order. A distinction is made between type I and type II Chebichev filters. In the pass range, type I Chebichev filters possess an oscillating frequency response curve. Type II Chebichev filters have this frequency response waviness in the stop range and are also referred to as inverse Chebichev filters in the specialist literature. The case here involves type II.

The maximum upper frequency limit of the vibrations to be measured is 60 Hz.

The steady component - generally caused by axis inclination on inclined installation - is calculated out by means of averaging which is performed prior to filtering. As a result of this, the lower limit frequency - irrespective of filter - is around 0.1 Hz (optionally 0.05 Hz). Steady component suppression can be shut off in the factory.

Figures 1 and 2 show examples of a possible frequency curve. The filter's output values are signed.

The output of each filter 1 - 6 is further processed for the analogue outputs (filters 1 + 2 only), for output via CANopen and for the limit value relays which respond to the exceeding of acceleration limit values.

The filters' relevant output signal can be set via the CANopen interface as follows:

- Output of the momentary value of the measured acceleration
- Output of a mean value over time for the measured acceleration (RMS averaging time adjustable via CAN)
- Output of a summarized value if the measured acceleration exceeds a customer defined limit

Switching outputs

The switching outputs react to the amount of the filter's output value (amount = folding up of the negative half-waves of the measured vibration curve).

The warning output is activated after exceeding the corresponding limit, i.e. the relay contact opens. The relevant relay drops off. It is reset when the limit is no longer reached for 30 s. Otherwise the time is extended.

The alarm output is activated after exceeding the corresponding limit, i.e. the relay contact opens. The relay drops off and remains constantly triggered. It can only be deleted by resetting the system.

The reference value is the amount of the currently measured vibration's momentary value. If a positive deviation event occurs 1 x, the corresponding relay is triggered. During normal operation, the relays are picked up. They drop off in the event of triggering or when the NVA is voltage-free.

Special features like an integral function, an FFT analysis and a self-test function are available (see NVA13660). Shut-off in a specific vibration phase which can be specified by the customer can also be set - important for the NVA115 or NVA120 as a mast vibration monitor.

Every NVA provides that the switching contacts switch immediately when the wind power plant is exposed to a heavy stroke or shock. The according limit value is parameterizable. This provides shock detection and a "Safety shut off" in cases of these heavy shock exposure: SSO.
Examples for filter output

![Filter Output Diagrams](image)

**Fig. 1:** Example band pass filter $f_{gu} = 0.8\text{Hz}$, $f_{go} = 2.5\text{Hz}$

**Fig. 2:** Example of a low pass filter $f_{go} = 23\text{Hz}$

**Diagram for analogue output $I_0(a)$** (Not SIL2 capable)

- Output: signed
  - $x$, momentary value
  - $y$, momentary value

- Output: absolute value
  - $x$ or $y$, RMS value
  - $x$ or $y$, Peak value
  - $S=\sqrt{x^2+y^2}$, RMS value
  - $S=\sqrt{x^2+y^2}$, momentary value

**Block Diagram**

**CAN-Bus**

Following version is shown:
CANopen + Analogue + Switches
Frequency detection by Fourier transformation FFT

In preparation is an NVA version which provides the output of the spectrum of measured frequencies via CANopen. This spectrum is gotten by Fourier transformation (FFT) of the momentary value of the acceleration measurement versus time.

This functionality can be used for blade or tower frequency detection.

See two simple examples for such a transformation in the following diagrams.
Programmable features

Parameters programmable via CANopen interface
- Measuring axis: x, y or z or √(x²+y²) separately for each filter (means output) 1 - 6
- Filter type which is prepared by TWK due to customers requirements for each output 1 - 6
- Signal type at filter output 1 - 6: momentary value, RMS mean value, peak value, integration value
- Averaging time for signal type 'RMS', degressive time for peak, integration time
- Amplification for analogue outputs 4 ... 20 mA (Analog outputs are assigned to filter 1 and 2)
- Acceleration limit values (limit) for relay warning function
- Acceleration limit values (limit) for relay alarm function
- Acceleration limit for calculation of integral
- Filter ↔ relay assignment
- Time constants for delayed and phase-optimised switching output response
- Further limit values for delayed switching output response and heavy shock detection
- "Safety shut off" limit values

Electrical data
- Sensor system: MEMS acceleration sensor
- Resolution: 4096 digits / g (9.81 m/s² = 1 g)
- Operating voltage range: +18 to +30 VDC
- Power consumption: ≤2 W (At V_S = 24 VDC: I_S = 80 mA, when both switching contacts ON)
- Overvoltage protection and galvanic separation power supply - CANopen - housing
- CAN interface: According to ISO/DIS 11898
- Address setting: Via LMT / LSS
- Terminating resistor: To be implemented separately
- Max. transmission length: 200 m with no galvanic separation (also see CiA, DS 301)
- Electrical connection: 2 x connector M12 - (Power supply / CANopen and switching outputs)
- Optional: cable
- CAN IC voltage rating: Maximum common mode voltage -7 to +12 V
- Maximum allowed voltage at pins ±36 V

Environmental data
- Operating temperature range: -40 °C to +70 °C
- Resistance to shock: 500 m/s² / 5 ms, according to DIN EN
- Resistance to vibration: 10 Hz ... 2000 Hz / 100 m/s², according to DIN EN 60068-2-6
- Protection type (DIN 40 050): IP 67 plug connection
  - IP 69K housing
- EMC:
  - EN 61000-6-4 interference emission
  - EN 61000-6-2 interference immunity
  - EN 61000-4-2 (ESD)
  - EN 61000-4-4 (burst)
  - EN 61000-6-3 (emission)
- Further standards:
  - IEC 60668-2-52 - Salt mist test (Type NVA115)
  - IEC 60668-2-30 - Damp heat, cyclic (Type NVA115)
  - IEC 60668-2-78 - Damp heat, steady state (Type NVA115)
  - IEC 60529 - Protection against water jets IPX6 (Type NVA115)
  - IEC 20653 - Protection against high pressure steam jets IPX9K (NVA115)
- Housing material: Aluminium AlSiMg1 (Stainless steel 1.4305 oder 1.4404 on request)
- Weight: 0.4 kg
Technical data

Signal acquisition

- Number of axes: 2
- Value output on analogue output: \( x \) and \( y \) as separate components or vector sum of \( x \) and \( y \) (resulting \( R \))
- Number of frequency bands: maximum of 6 (Setting ex works)
- Measuring range: \( \pm 2 \, g \) for each axis
- Sampling frequency: 120 to 800 Hz, depending on the frequency range of according filter
- Accuracy of the measured acceleration value: 5 %
- Maximum inclination vs. horizon: 15° (at angles >15° an error message will be transferred by CANopen)
- Lower limit frequency: 0.1 Hz (optionally 0.05 Hz)
- Upper limit frequency: 60 Hz

Signal output

- 1 CANopen interface with 4096 digits / g
- 2 analogue outputs 0 (4) ... 20 mA (12-bit resolution)
- 2 relays for warning and/or alarm function on exceeding limit values

System in general and Safety

- Data will be submitted subsequently

Limit value relay technical data - SIL2

- Maximum switching current: 1 A at 30 VDC / VAC, 0.5 A at 60 VDC / VAC
- Maximum switching voltage: 60 VDC / VAC
- Maximum contact resistance ON: 0.5 Ω
- Response time: 20 ms (ON and OFF)
- Voltage protection between relay- and electronic circuit: 1 kV

Relay control and monitoring

2 relays connected in series form 1 switching contact → safe shut-off even under unfavourable voltage and current conditions. Contact sticking is prevented through a short shut-off time lag in the millisecond range.
Safety parameters

Standard EN 13849-1:2008

Vibration sensor at 25°C

- Category: 2
- MTTFd (Years): 106
- CCF: fulfilled
- DC [%]: 94.8
- PL: d

Standard EN 61508:2010 and EN 62061

Vibration sensor at 25°C

- HFT: 0
- T1[s]: ~10,000
- SFF [%]: 96.8
- PFH [1/h]: 5.597 10^-8
- SIL: 2

CANopen technical data

CANopen communication profile

- CiA DS 301 version 4.2 (Application Layer)
- EN 50325-5 (Safety protocol)
- CiA DSP 401 version 3.1 (Profile for I/O devices – Part 1: Generic I/O modules)
- CANopen output code: signed 16-bit

Output level according to ISO/DIS 11898

Bus level (V): 0

- 2.5 CAN_H
- 1.5 CAN_L

1) bei Common-Mode-Spannung = 0V

Bus activation according to ISO / DIS 11898

* Terminating resistor (120 Ω)
Vibration sensor / monitor NVA115 / S3 or NVA120 / S3

Data format CANopen - SRDO

Data format CANopen Safety for Filters 3 to 6
Valid for SRDO - normal and bit-inverted

The momentary values of filters 1 and 2 can be output via the analogue outputs. With CANopen, they can be read out via relevant objects. In this case filters 3 to 6 via the SRDO (e.g. for cyclical output), as it has a maximum size of 8 bytes. See NVA 13660 specifications.

Analogue technical data (Not SIL2 capable)

Attention: The analogue output is not compliant according to SIL2 category and to safety functionality due to the fact it provides no safe data transmission.

Output circuits

Output A

Output B

Output data

- Current output A: 0 to 20 mA
  B: 4 to 20 mA
- Accuracy: ± 10 µA at room temperature, ± 50 µA over the entire temperature range
- Load resistance: 0 ... 500 Ω
## Order number

<table>
<thead>
<tr>
<th>NVA</th>
<th>115 - A 6 2 2 - 2 S3 S3 V1 N 01</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVA</td>
<td>Vibration sensor / monitor NVA115 / S3 or NVA120 / S3</td>
</tr>
</tbody>
</table>

### Electrical and / or mechanical variants *

| 01 Standard |

### Output interface:

| N CANopen / CANopen safety |

### Galvanic separation ≠ (see pages 11 and 12):

| V1 -V_S ≠ CAN_GND ≠ screen/housing → recommended |
| V2 -V_S = CAN_GND ≠ screen/housing |
| V3 -V_S = CAN_GND = screen/housing |

### Electrical connection (see below and on pages 11 and 12):

| S1 1 x device connector M12, 4/5-pin |
| S2 2 x device connector M12, 4/5-pin |
| S3 3 x device connector M12, 4/5-pin |

### Profile:

| S0 CANopen standard profile and SIL2 switching outputs |
| S3 CANopen Safety profile and SIL2 switching outputs |

### Measuring range:

| 2 2 g = approx. 20 m/s² - higher values on request |

### Number of analogue outputs 0 (4) ... 20 mA:

| 0, 1 or 2 |

### Number of switching outputs:

| 0, 1 or 2 - independent of each other and galvanically separated |

### Number of frequency filters:

| 1 to a maximum of 6 - set in the factory (frequency bands) |

### Housing material:

| A Aluminium AlMgSi1 (other materials, e.g. stainless steel, on request) |

### Design form:

| 115 Design form 115 mm |
| 120 Design form 120 mm |

### NVA Vibration sensor / monitor NVA with CANopen interface, switching and analogue outputs

#### Comments on connector designs:

Design without analogue outputs: 1 or 2 connectors can be selected for supply voltage + bus connection. The second is intended for BUS-OUT. A further connector contains the SIL2 switching contacts.

Design with analogue outputs: supply voltage + bus connection are located on connector 1 and the analogue outputs on connector 2 (socket). A third connector contains the SIL2 switching contacts. No BUS-OUT is provided in this case.

Special designs with 8-pin connectors and/or sockets with customer-specific assignments are possible on request.

#### Order Code format - mating connectors

* The basic versions according to the data sheet bear the number 01. Deviations are identified with a variant number and are documented in the factory. The special version in accordance with the table on page 9 is reflected in the variant number.

| M12, 5-pin, female, A-coded: | STK5GS56, angled: STK5WS58 |
| M12, 5-pin, male, A-coded: | STK5GP90, angled: STK5WP102 |
| M12, 4-pin, female, B-coded: | STK5GS67, angled: STK5WS87 (5 pole connector is suitable for 4 pole as well) |

| M12, 5-pin, A-coded: | STK5GS56, angled: STK5WS58 |
| M12, 5-pin, A-coded: | STK5GP90, angled: STK5WP102 |
| M12, 4-pin, B-coded: | STK5GS67, angled: STK5WS87 (5 pole connector is suitable for 4 pole as well) (EMC-resistant, metal version) |

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Further informations

Documentation, EDS file, etc.

- The following documents can be found in the Internet under www.twk.de in the documentation area
  - NVA model (letter "N")
    - Data sheet No. NVA 13482
    - Specification No. NVA 13660
    - CRC checksum programme for parameterisation. Link: www.twk.de/files/CRC-Calculator20.zip
    - Certificate SIL2 when available

- The following are available on request:
  - EDS file
  - Bit map image file
  - Electrical connection assignment, if required
  - CRC checksum programme for parameterisation
  - Description of the filter and programming settings
    (individually for each pre-set device, therefore on request only)

- Supply source for the listed CANopen specifications:
  - CAN in Automation (CiA), Kontumazgarten 3, D-90429 Nuremberg
  - (Email: headquarters@can-cia.org, www.can-cia.org)

With this safety design, all changes to the adjustable parameters must be confirmed with a checksum. This checksum must be transmitted to the NVA after changing the parameters. The checksum can be determined using TWK software for a PC/notebook. All alterable parameters are entered in this programme, whereupon the checksum is calculated. Only when the correct checksum appropriate to the set parameters is transmitted to the NVA can the device be set to 'operational' operating status.

When changing parameterization data (limit values for switching contacts, assignments, etc.), the relevant data valid flags will be set to 0 automatically. The data valid flags must then be activated again. This procedure makes sure that no unintentional changes which affect the SIL2 switching contact functions are undertaken by the user.

(Also see: parameterisation recommendation for NVA115 / S3 or NVA120 / S3 in the NVA 13660 specifications)
Standard design plug connection and pin assignment for supply and CAN bus

Note: The recommended version is V1 with full galvanic separation. This offers maximum EMC resistance, maximum CANopen data transfer security and thus maximum operating safety.

Versions V2 and V3 are special versions which must be compatible with the structure (topology) of the CANopen bus system in the customer application (→ control system and other CANopen subscribers). Operating safety or data transfer security may otherwise be affected.

This is the contact assignment for the standard version. Other versions may have a different contact assignment. In this case, please observe connection assignment TY enclosed with each device.

Different M12 connector combinations or assignments are possible at the request of the customer.

For the following description and pictorials is valid:
Viewed looking at the PIN side of the connector installed in the NVA.

There is one connector for Bus-In and Bus-Out each for the NVA / S3 without analogue outputs.
If there is only Bus-In, the female connector Bus-Out is omitted.

Connector for operating voltage and CAN bus

Viewed looking at the contacts

![M12, Pins, A-coded](image1)

BUS-OUT connector for operating voltage and CAN bus

If available → 3-connector version
Viewed looking at the contacts

![M12, socket, A-coded](image2)

V1: CAN_GND and UB galvanically separated (ǂ). Screening/housing galvanically separated (ǂ)

This version is recommended and provides complete galvanic separation. Power supply and CAN_GND is galvanically separated. The housing and the screening of the cable is galvanically separated as well. The screening of the cable comes to the housing of the NOCN via the housing of the mating plug.

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAN GND</td>
</tr>
<tr>
<td>2</td>
<td>Operating voltage + V_S</td>
</tr>
<tr>
<td>3</td>
<td>Operating voltage - V_S</td>
</tr>
<tr>
<td>4</td>
<td>CAN_HIGH (+)</td>
</tr>
<tr>
<td>5</td>
<td>CAN_LOW (-)</td>
</tr>
</tbody>
</table>

V2: CAN_GND and UB not galvanically separated (=). Screening/housing galvanically separated (ǂ)

This version provides partly galvanic separation. Power supply and CAN_GND are not galvanically separated. The housing and the screening of the cable are galvanically separated from power supply and CAN_GND. The screening of the cable comes to the housing of the NOCN via the housing of the mating plug and/or Pin 1 of the connector. Please note the maximum voltage rating of the CAN interface IC.

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screen (Cable / housing)</td>
</tr>
<tr>
<td>2</td>
<td>Operating voltage + V_S</td>
</tr>
<tr>
<td>3</td>
<td>Operating voltage - V_S and CAN_GND</td>
</tr>
<tr>
<td>4</td>
<td>CAN_HIGH (+)</td>
</tr>
<tr>
<td>5</td>
<td>CAN_LOW (-)</td>
</tr>
</tbody>
</table>
Vibration sensor / monitor NVA115 / S3 or NVA120 / S3

V3: CAN_GND and U_B not galvanically separated (=). Screening/housing not galvanically separated (=)

This version provides no galvanic separation. Power supply and CAN_GND are not galvanically separated. The housing and the screening of the cable are not galvanically separated from power supply and CAN_GND. The screening of the cable comes to the housing of the NOCN via the housing of the mating plug and/or Pin 1 of the connector. Please note the maximum voltage rating of the CAN interface IC.

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screen (Cable / housing) - shorted to pin 3 -</td>
</tr>
<tr>
<td>2</td>
<td>Operating voltage + V_S</td>
</tr>
<tr>
<td>3</td>
<td>Operating voltage - V_S and CAN_GND - shorted to pin 1 -</td>
</tr>
<tr>
<td>4</td>
<td>CAN_HIGH (+)</td>
</tr>
<tr>
<td>5</td>
<td>CAN_LOW (-)</td>
</tr>
</tbody>
</table>

Standard design plug connection and pin assignment for supply and CAN bus

Standard design plug connection and pin assignment for analogue outputs (Not SIL2 capable)

Connector for analogue outputs
If available → 3-connector version. In this case the female Bus-Out connector is omitted.
Viewed looking at the contacts

<table>
<thead>
<tr>
<th>PIN</th>
<th>Connector M12, 4-pin, socket, A-coded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analogue output 1: 0 (4) ... 20 mA</td>
</tr>
<tr>
<td>2</td>
<td>Analogue output 2: 0 (4) ... 20 mA</td>
</tr>
<tr>
<td>3</td>
<td>Multifunctional pin: NVA-Reset (on request)</td>
</tr>
<tr>
<td>4</td>
<td>Reference potential for pins 1 to 3 (- V_S)</td>
</tr>
<tr>
<td>5</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

Standard design plug connection and pin assignment for SIL2 switching contacts

Connector for SIL2 switching contact
If available
Viewed looking at the contacts

<table>
<thead>
<tr>
<th>PIN</th>
<th>Connector M12, 4-pin, pins, B-coded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety contact 1 / (13)</td>
</tr>
<tr>
<td>2</td>
<td>Safety contact 1 / (14)</td>
</tr>
<tr>
<td>3</td>
<td>Safety contact 2 / (23)</td>
</tr>
<tr>
<td>4</td>
<td>Safety contact 2 / (24)</td>
</tr>
</tbody>
</table>

Each switching contact is galvanically separated.

(13) / (14): normally open contact of switching contact 1
(23) / (24): normally open contact of switching contact 2
## Plug connection and pin assignment

### PIN Connector M12, 5-pin, pins, A-coded

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operating voltage + $V_S$</td>
</tr>
<tr>
<td>2</td>
<td>Operating voltage - $V_S$</td>
</tr>
<tr>
<td>3</td>
<td>Do not connect</td>
</tr>
<tr>
<td>4</td>
<td>Do not connect</td>
</tr>
<tr>
<td>5</td>
<td>Do not connect</td>
</tr>
</tbody>
</table>

### PIN Connector M12, 5-pin, pins, A-coded

<table>
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<th>PIN</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Do not connect</td>
</tr>
<tr>
<td>2</td>
<td>Do not connect</td>
</tr>
<tr>
<td>3</td>
<td>CAN_LOW (-)</td>
</tr>
<tr>
<td>4</td>
<td>CAN_HIGH (+)</td>
</tr>
<tr>
<td>5</td>
<td>CAN_GND</td>
</tr>
</tbody>
</table>

### PIN Connector M12, 4-pin, pins, B-coded

<table>
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<tr>
<th>PIN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety contact 1 / (13)</td>
</tr>
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<td>2</td>
<td>Safety contact 1 / (14)</td>
</tr>
<tr>
<td>3</td>
<td>Safety contact 2 / (23)</td>
</tr>
<tr>
<td>4</td>
<td>Safety contact 2 / (24)</td>
</tr>
</tbody>
</table>
**Installation drawing**

**Type NVA115**

**Version with 3 connectors**

**Dimensions in mm**

![Dimensions Diagram]

**Materials used**

- Aluminium housing: AlMgSi1
- Stainless steel housing: On request
- Connector: Nickel-plated brass
- Sealing rings: NBR

All flange connectors are aligned for overmoulded mating connectors. Plug design is exemplary.
Installation drawing

Type NVA120

Version with 3 connectors

Materials used

- Aluminium housing: AlMgSi1
- Stainless steel housing: On request
- Connector: Nickel-plated brass
- Sealing rings: NBR

All flange connectors are aligned for overmoulded mating connectors. Plug design is exemplary.