Inclination sensor on MEMS technology
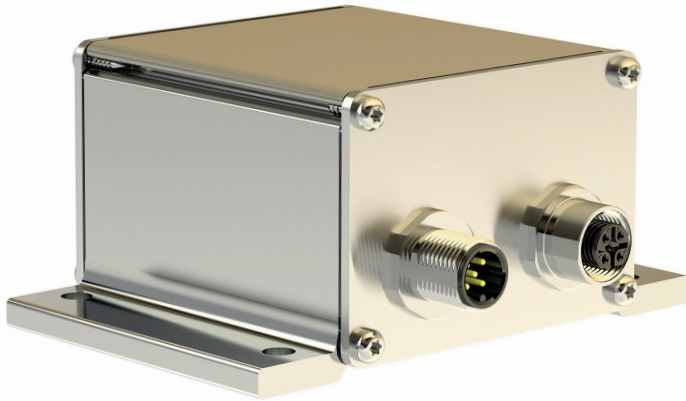## Interfaces: CANopen and Analogue
Models NBN and NBA

- **Number of measuring axes: 1 or 2**

- **Selectable Measuring range: ± 5° to ± 90° and 360° ***

- **Programmable**

- **High vibration and shock resistance**

- **Options:**
  - **SIL2 certificate:
    see datasheet NBN 12054/NBN14705**
  - **Output of acceleration **
    (Special version NVA65...Bxx)**
  - **Correction of tilt output signal due to implemented gyroscope sensor
    (only at NBN - version 'G')**
  - **Output of a velocity signal °/s
    (only at NBN - version 'D')**

Contents

Design and function

Registration of inclination in the gravitation field using MEMS sensors (Micro-Electro-Mechanical-System) with subsequent digitisation and linearisation via a controller. Data output is carried out via the CANopen interface or as an analogue signal.

The inclination sensor has a stable aluminium housing (optionally stainless steel). Slots are available for mechanical alignment (up to approx. ± 7.5°). In the case of CANopen, one connector or one male/female connector combination can be selected optionally for connection purposes. Casting measures in the housing lead to the achievement of protection class IP 69K, e.g. for use under water.

MEMS sensors are integrated circuits manufactured using silicon bulk micromechanical technology. These micromechanical structures are used to form dual capacities. If these structures are deflected in the case of acceleration, e.g. gravitational acceleration **(g)**, this results in capacity changes, which are registered and further processed using measuring technology. Due to the differential capacity dependency described here, the output voltage follows the function $U \propto g * \sin \alpha$. In this case, the angle **α** is the inclination angle of the sensor measured against the **g** vector. These sensors measure precisely, have a long service life and are very robust. The measuring axes operate independently of each other.

The optional available gyroscope sensor is based on MEMS technology as well.

  * : On request at NBN with CANopen interface. See special datasheet NBN15268.
** : The special version NVA...Bxx, based on model **NBN** provides accelerations in 3 axes - not converted into an inclination. Frequency range 0 to 60 Hz, 3 axes. xx means special versions.

Sensor with gyroscope correction, version 'G' (NBN with CANopen interface only)

TWK has developed a new generation of inclinometers. They measure more precisely and faster than the standard inclinometers with averaging filter, and are insensitive to interfering acceleration and lateral inclination excursion.

Due to the addition of a MEMS yaw rate sensor (gyroscope), it is possible to transmit a stable measurement value to the control system even during shock and vibration disturbances. The reaction time and measurement accuracy are also increased in comparison with conventional notification procedures (see diagram).

These sensors are highly suitable for applications with dynamic requirements in which precise inclination angles nevertheless have to be registered and transferred to a control system.

This improved performance is enabled by extending the original acceleration sensor with a yaw rate sensor, also known as a gyroscope, and skilfully combining the measurement signals to form a corrected output signal that precisely indicates the measured angle.

Both sensor types are based on MEMS technology.

The measured variables of the original acceleration sensor and the gyroscope are merged and processed by adding a Kalman filter. This filter technology enables the measurement value that is to be output to be calculated, corrected and predicted for a short time. This is necessary because the acceleration sensor is unable to supply a usable measured inclination value when subject to dynamic interfering acceleration; instead, the yaw rate sensor calculates and predicts a measurement value with the aid of the Kalman filter.

Unlike the acceleration sensor, the yaw rate sensor does not react to linear interfering acceleration but only to changes in the inclination angle.

All possible, realistic application simulations and measurements at TWK show that the sensor fusion system operates precisely and safely. This sensor system not only guarantees safe, hazard-avoiding operation in mobile machines, even when using motors and hydraulic pumps or during other operations that generate strong vibrations.

As soon as there is no further interfering acceleration resulting from shock and vibrations, regular acceleration sensor inclination data are again output without gyroscope correction. See order designation: version 'G'.
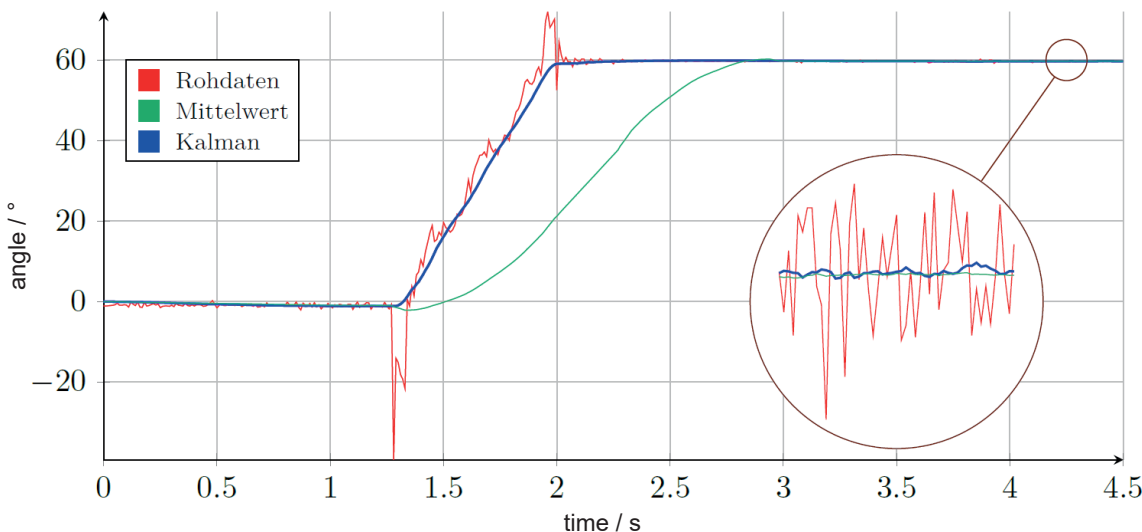
360° sensor, optional: output of the angular velocity: version 'D' (NBN with CANopen interface only)

An additional version of the NBN inclinometer (version with CANopen interface only) is the version with a 360° measuring range. In this case, the NBN can be rotated completely around its own axis in a previously defined axis, and corresponding angle values are output. The output of a signed angular velocity signal (yaw rate) is also possible in this version with the aid of the integrated gyroscopic sensor.

See special datasheet NBN15268 and handbook NBN15269 for this version D.

General technical data

Electrical data

- Sensor system: MEMS acceleration sensor
- No. measuring axes: 1 or 2
- Measuring range: ± 5° to ± 90° and 360° (360° on request at NBN66 with CANopen interface)
- Absolute Accuracy and temperature drift   See below "Deliverable accuracies"
- Repeatability: ± 0.05°
- Zero error: ± 0.5°
- Noise: ± 0.05°
- Signal path: Parameterisable
- EMC standards: Interference immunity: EN 61000-6-2
                                                    Interference emission: EN 61000-6-4

Environmental data

- Temperature range: -40 ... +85 °C
- Storage temp. range: -20 ... +60 °C (due to packaging)
- Resilience
  - □ To shock: 500 m/s²; 11 ms
                                                    DIN EN 60068-2-27
  - □ To vibration: 100 m/s²; 10 ... 2000 Hz
                                                    DIN EN 60068-2-6
- Protection grade: IP 67, IP 69K (optional)
- Weight: Approx. 0.3 kg (aluminium)
                                                    Approx. 0.65 kg (stainless steel)

Accuracies   *without gyroscope and without cross tilt compensation*

- Device with 1 or 2 axes, when measuring angle ± 20° at maximum:
  Accuracy: ± 0.25° (cross tilt ± 5°), otherwise ± 0.5°
  Drift: ± 0.3°; range [-10 °C to +60 °C]
                                                    ± 0.5°; range [-40 °C to +85 °C]

- Device with 1 axis, when measuring angle ± 90°:
  Accuracy: ± 0.5° (cross tilt ± 3°)
                                                    ± 0.25° within 20° (cross tilt ± 3°)
  Drift: ± 0.3°; range [-10 °C to +60 °C] for ± 60°
                                                    ± 0.4°; range [-40 °C to +65 °C] for ± 90°
                                                    ± 0.5°; range [-40 °C to +85 °C] for ± 60°
                                                    ± 0.6°; range [-40 °C to +85 °C] for ± 90°

- Reaction time: 1 s (for 100 % of final value)

Accuracies (not available yet)   *without gyroscope and with cross tilt correction*

- Absolute accuracy: ± 0.25°
- Drift   TBD
- Repeatibility: ± 0.05°
- Noise: ± 0.05°
- Zero deviation: ± 0.5°
- Reaction time: < 1 s (for 100 % of final value)

Accuracies (not available yet)   *with gyroscope (in preparation) and cross tilt corr.*

- Absolute accuracy: ± 0.25°
- Drift   TBD
- Repeatibility: ± 0.05°
- Noise: ± 0.05°
- Zero deviation: ± 0.5°
- Reaction time: < 0.1 s (for 100 % of final value)

Important informations

At inclinometer versions without cross tilt correction the measured axis is no longer detected in case of an inclination in a second axis (cross-axis inclination) is greater than 30°. Meaning the sensor will go in an over flow stage (+180°). This feature is required since measuring accuracy decreases with increasing cross-axis inclination.

Behaviour of the due to averaging:

Dynamic, arithmetic averaging of the measured values is implemented in the inclinometer. This involves linear averaging over 1000 values, whereby a new value is recorded every millisecond. This results in a low-pass effect. In the event of an abrupt change in the measuring angle, the end value is reached after approx. 1 second. In the event of a linear change in the measuring angle, the relevant output signal follows after a delay of approx. 0.6 seconds. Other, e.g. shorter, values may be set depending on application conditions. However, the output signal then tends to have a higher noise factor.

CANopen data

Function

A CAN controller at the output enables integration into the CANopen network. The protocol is designed according to "CAN-open Application Layer and Communication Profile, CiA Draft Standard 301, version 4.1" as well as according to "Device Profile for Inclinometers, CiA Draft Standard Proposal 410, version 1.2" and "CANopen Layer Setting Services and Protocol (LSS), CiA DSP 305, version 1.1.1". The sensor is also available with a redundant system and CANopen safety profile (see datasheet NXN 12054).

- Operating voltage: 11 to 36 VDC
- Resolution: 0.01°
- Power consumption: < 1 W
- Signal path: Ascending values with CCW (parameterisable)
- Measuring range: ± 5° to ± 90°
- Output code: Binary
- Transmission rate: 1 MBaud
- CAN interface: According to ISO/DIS 11898
- Address/baud rate setting: Via SDO/LSS
- Terminating resistor: To be implemented separately
- Max. transmission length: 200 m. No galvanic separation between supply voltage and bus lines (also see CiA DS301).

The design guideline "CiA Draft Recommendation 303 CANopen additional specification Part 1: Cabling and connector pin assignment" must be observed on installation.

CANopen features

- NMT master: No
- NMT slave: Yes
- Maximum boot-up: No
- Minimum boot-up: Yes
- COB ID distribution: Default, SDO
- Node ID distribution: Via Index 2000 or LSS
- No. of PDOs: 2 Tx
- PDO modes: Sync, async, cyclic, acyclic
- Variable PDO mapping: No
- Emergency message: Yes
- Heartbeat: Yes
- No. of SDOs: 1 Rx / 1 Tx
- Device profile: CiA DSP 410 Version 1.2
- Baudrate, factory setting: 20 kBaud
- Node ID, factory setting: 1

A detailed description of the profile you will find in the NBN 12527 specification.

* At digital output version NBN the resolution is set to maximum. Reducing the measuring range means only that at smaller angels the overflow will be reached and output to signalize the applications controller that the maximum angel is exceeded. See characteristic curve on page 6.

CANopen data

Data format CANopen

Data Byte 0								Data Byte 1							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB															MSB
angle (or acceleration) x-axis															

Data Byte 2								Data Byte 3							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB															MSB
angle (or acceleration) y-axis															

Data Byte 4								Data Byte 5							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB															MSB
angle (or acceleration) z-axis															

Model NBN: Inclination values.

Model NVA...Bxx (based on NBN): Acceleration values

Design of PDO when a velocity signal is available - version 'D' - see datasheet 15268.
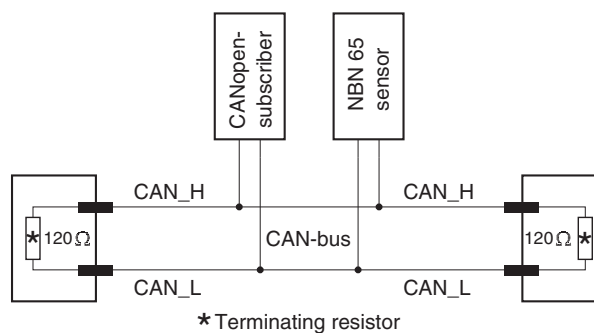
Principle circuit diagram NBN (without gyroscope)
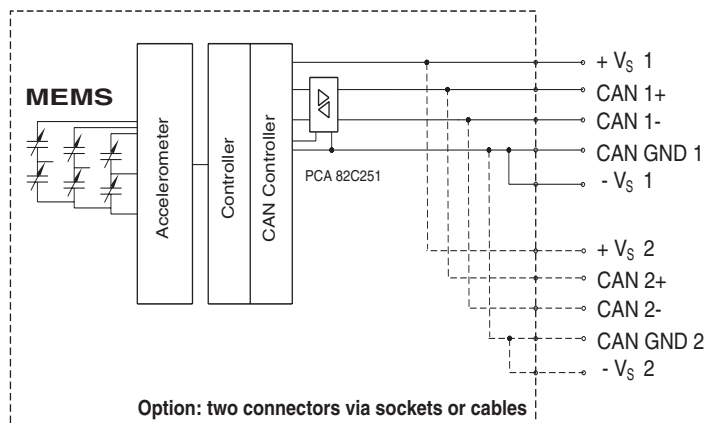
Output level according to ISO / DIS 11898
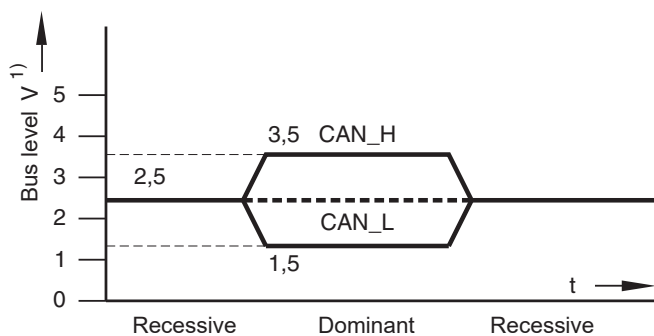
[1] With common mode voltage = 0V

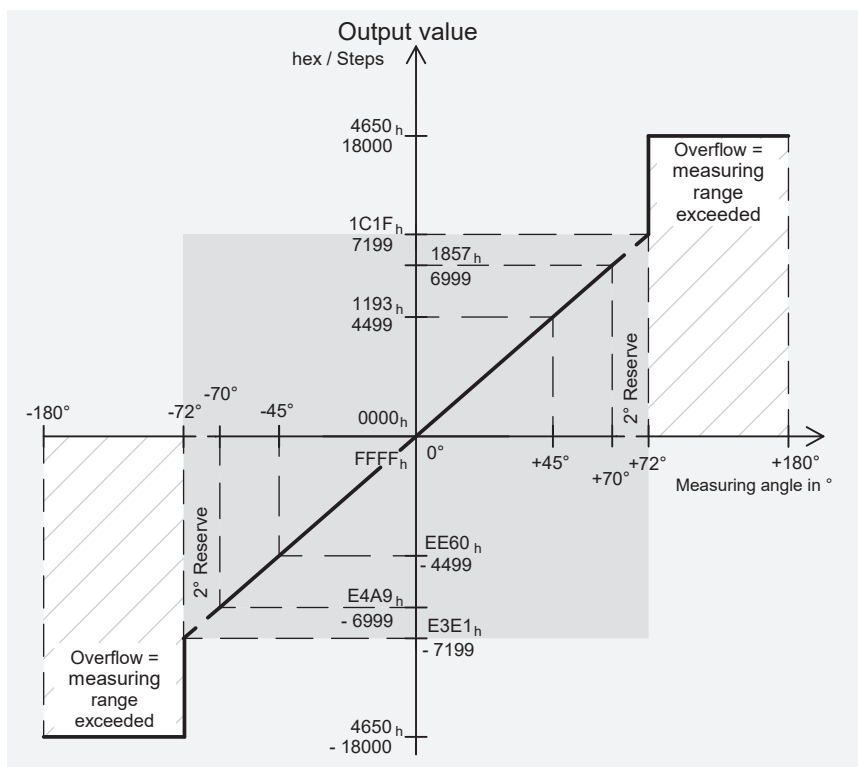### Bus activation according to ISO / DIS 11898

* Terminating resistor

CANopen data

Characteristic curve

- Example: ± 70° ≙ 2 x 7000 increments with resolution 0.01°.
- Data format: Signed 16-bit.

When exceeding the selected range (eg ± 70 °), plus about 2° the CANopen output values is set to 4650hex (= 18,000 steps = 180 °) in order to signal the controller that the inclinometer is tilted out of the selected scale.

Special version NVA65...Bxx, based on model NBN65, provides 4096 digits/g resolution as a signed 16 Bit output value for positive and negative accelerations due to forward and backward acceleration direction.

The version NBN....360 is defined with an unsigned 16 Bits signal output: ... 0, 1, 2, ..., 8C9E, 8C9F, 0, 1, ... , with 8C9F = 35999.

When a velocity signal is provided (yaw rate) it is defined as a signed 16 Bits signal.

Programming parameters

Parameter	Function
Resolution	0,1° / 0.01°
Zeroing / preset value	Adjustment within ± 5°
Signal path	CW / CCW
Scaling	On / Off

Documentation, EDS file, etc.

- The following documents plus the EDS file, a bitmap and example programmes can be found in the Internet under www.twk.de in the support / documentation section, model NBN (letter "N")
  - □ Data sheet No. NBX 11918
  - □ Specification No. NBN 12527
- The following are available on request:
  - □ EDS file
  - □ Bit map image file
  - □ Electrical connection assignment, if required
- 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)

Order code format NBN

| NBN | 66 - A | x / y / z | | | C3 | - x- | S | 2 | N | 01 | → **Standard version** |

						Electrical and mechanical variants *
					01	Standard
					50	Connection via plug M12, 5 pins instead 8 pins
					Output interface:	
				N	CANopen	
				Electrical connections:		
			1	Single connection		
			2	Double connection		
		Electrical connections:				
		S	Device connector M12			
		K	Cable 1 m (not at versions 'G' and 'D')		other length possible	
	Installation position:					
	1	TOP 1, 2, 3, 4, 5, 6 (See pages 16/17)				
	Profiles [1]:					
	C3	CANopen according to CiA, DS 301 Version 4.1, DS 410 Version 1.2				
G	G = with gyroscope for suppressing disturbance vibrations (only fill in if requested)					
D	D = with gyroscope for measuring of angular speed (only fill in if requested) [2]					

Measuring range [3]:

	$\pm z°$	z-axis
$\pm y°$		y-axis
$\pm x°$		x-axis

Please assign the measuring angles which you require to the "x, y, z" axes
Two axes at maximum selectable (Selectable from ± 5° to ± 90° in 5° steps and 360°)
For the undesired axis please choose '0' (Explanation on page 16/17)

Housing material:

A   Aluminium
S   Stainless steel 1.4305 (only on request and not at design form 66)
V   Stainless steel 1.4404 (not at design form 66)

Design form:

66   Extruded sheath version in aluminium → Standard
65   Milled version in aluminium or stainless steel

See drawings at the end of this document

Model [4]:

NBN   with **CANopen interface**

---

*   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. NBN: variant 50 is firmly assigned: electrical connection via M12, 5-pin (instead of 8-pin).

1)   CANopen profile C3: measuring system with CANopen profile according to CiA, DS 301 version 4.1, DS 410 version 1.2.
    CANopen safety profile S3: partly redundant measuring system with or without SIL2 certificate: see separate datasheet NBN12054.

2)   This version is particularly interesting in combination with the 360° version in order to also output the rotational speed in addition to the 360° position (see datasheet NBN15268).
    The versions D and G are only available with device connector M12 (not with cable).

3)   The measuring ranges for the various measurement axes can be selected in 5° steps, whereby it must be noted that only 2 axes can be used at any one time. Accuracy differences may possibly arise in terms of the compatibility of the measuring ranges or the measuring angles. If in doubt, please talk to one of our employees. For 360° version see separat datasheet NBN15268.

4)   The special version NVA...Bxx, based on model NBN, provides acceleration output - not converted in an inclination value. Frequency range: 0 to 60 Hz in 3 axes. xx means special versions. This datasheet and CANopen specifications NBN12527 are valid. In all othes cases of series NVA the regular documentation NVA12634 (Datasheet) and NVA12657 (CANopen specifications) are valid.

SUPREME SENSING

TWK

± 90°
0(4) ... 20 mA
0 ... 10 VDC
± 10 VDC
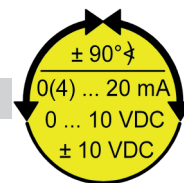
Function

The contactless MEMS sensor system is extended using a 12-bit D/A converter so that the measuring variable is available as an analogue signal from 0 (4) to 20 mA, 0 to 10 VDC or ± 10 VDC.

The customer can adjust the signal path (CW or CCW) and the measuring range from ± 5° to ± 90° in 5° steps (i.e. 2,5° on each side. Example: from ± 5° is the next step ± 7,5°). The preset "centre of measuring range" value can be set (see explanations on pages 9 and 10).

Electrical connection is carried out via one male connector M12, 8 pins, A-coded or cables.

On ordering, the measuring ranges must be selected according to the application (from ± 5° to ± 90° in 5° steps (2,5° on each side), e.g. ± 5°, ± 7.5°, ± 10° etc.). If the sensor is inclined past this measuring range, an overflow is output.
Due to the 12-bit D/A converter, the resolution of the output signal is dependent on the selected measuring range.
Examples: At ± 90°, it is 0.05°. At ± 20°, it is 0.01°, etc. (better than 0.01° is not possible).

Electrical data

- Operating voltage: 20 to 30 VDC (output: A,B,C)
- Power consumption: < 1 W
- Current: approx. 40 mA
- Resolution: 0.05° with ± 90° measuring range (12-bit D/A converter)
                                            (higher resolutions with smaller measuring ranges)
- Measuring range: ± 5° to ± 90° (parameterisable)
- D/A converter: 12-bit
- Signal path: Adjustable (CW or CCW)
- Preset value: Centre of measuring range, optionally other values

Electrical output data

- **Current output A:**   0 to 20 mA
  Current output B: 4 to 20 mA
  Accuracy: ± 50 µA
  Load resistance (burden):   0 ... 500 Ω

- **Voltage output C:**   0 to 10 VDC
  Accuracy: At 0 V + 100 mV
  At 10 V   ± 25 mV
  Output current: Max. 5 mA (short-circuit-proof) Corresp. to load resistance ≥ 2 kΩ

Characteristic curve (measuring range ± 90°)

Current output B:
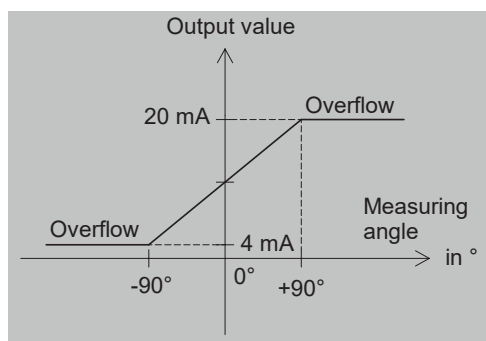
Technical data, analogue

Setting option via multifunctional pins MFP

The **signal path**, **preset value** and **measuring range** parameters and the **default values** can be set by the user according to the conditions in the operating location. Three multifunctional inputs are provided for this purpose. The input circuit for the MFPs is E1(see page 10).

The basic factory setting in accordance with the order number (i.e. signal path, original zero point and measuring range) can be restored on activation of the default values.

The signal path determines the inclination direction in which the output signal increases positively (see page 16/17).

The measuring range can be incremented by activating the corresponding MFP(s) in 5° steps (2,5° on each side) up to a maximum of ± 90° (e.g. ± 10° to ± 12.5°), with reference to the measuring axes selected on ordering. On further activation, the measuring range jumps back to the minimum value of ± 5°, etc.

The preset value is set to the centre of the measuring range. Other values can be implemented in the factory.

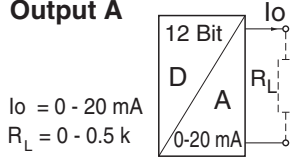| Table for multifunctional inputs (MFP). The functions for the 2nd axis are omitted in the 1-axis sensor				
Function	MFP 0	MFP 1	MFP 2	Logical 1 ≙ 11...+UB, logical 0 ≙ < 5 V or open
Signal path (CW / CCW), 1st axis (e.g. x)	1	0	0	Set pin MFP 0 to logical 1 for the duration of 4 s.
Set preset value, 1st axis	0	1	0	Set pin MFP 1 to logical 1 for the duration of 4 s.
Increment measuring range by 5° in each case, 1st axis	0	0	1	Set pin MFP 2 to logical 1 for the duration of 4 s.
Signal path (CW / CCW), 2nd axis (e.g. y)	1	1	0	Simultaneously set pins MFP 0 and MFP 1 to logical 1 for the duration of 4 s.
Set preset value, 2nd axis	1	0	1	Simultaneously set pins MFP 0 and MFP 2 to logical 1 for the duration of 4 s.
Increment measuring range by 5° in each case, 2nd axis	0	1	1	Simultaneously set pins MFP 1 and MFP 2 to logical 1 for the duration of 4 s.
Set default values for all axes	1	1	1	Simultaneously set pins MFP 0, MFP 1 and MFP 2 to logical 1 for the duration of 4 s.
Normal operation	0	0	0	MFP 0, MFP 1 and MFP 2 to logical 0 or open

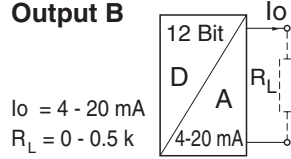### Principle circuit diagram NBA65
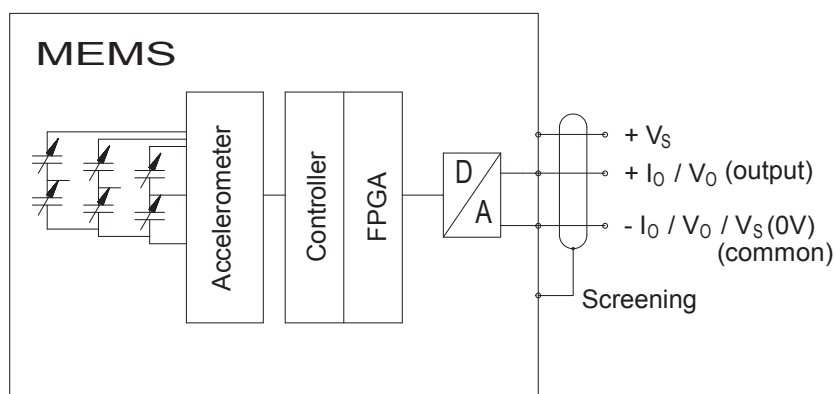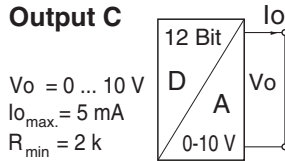
Technical data, analogue

Output circuits

Output A

Io

12 Bit

D / A

R_L

0-20 mA

$Io = 0 - 20$ mA
$R_L = 0 - 0.5$ k

Output B

Io

12 Bit

D / A

R_L

4-20 mA

$Io = 4 - 20$ mA
$R_L = 0 - 0.5$ k

Output C

Io

12 Bit

D / A

Vo

0-10 V

$Vo = 0 ... 10$ V
$Io_{max.} = 5$ mA
$R_{min} = 2$ k

Input circuit E1 for multifunctional pins (MFP)

Input E1   active "high"

I_i

V_i
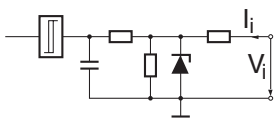
Log 0 < 5 V or not connected
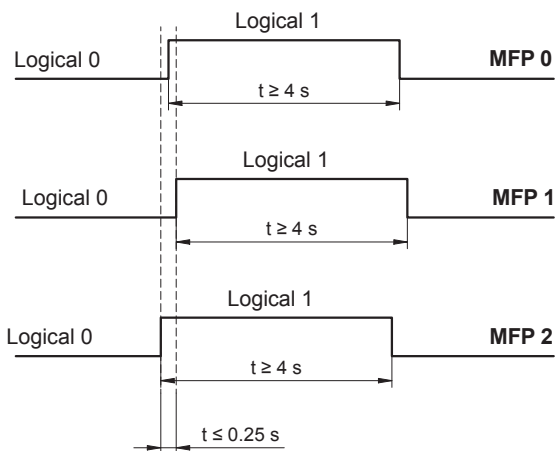Log 1 = 11 ... Vs
E1 specification

Timing charts for the MFP settings

1. Set MFP 0 or MFP 1 or MFP 2 once

Logical 0 | Logical 1 | Logical 0

$t \geq 4$ s
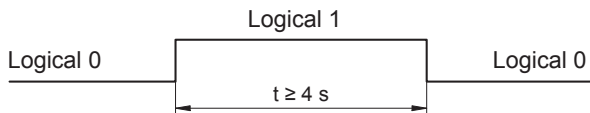
2. Set two or all three MFPs simultaneously

Time difference between MFP 0 and MFP 1 (and MFP 2) ≤ 0.25 s.

Logical 1
Logical 0   MFP 0
$t \geq 4$ s

Logical 1
Logical 0   MFP 1
$t \geq 4$ s

Logical 1
Logical 0   MFP 2
$t \geq 4$ s

$t \leq 0.25$ s

Order code format NBA 65

NBA	65	- A	x / y / z	W	S	1	- x - B	01	→ **Standard version**

Electrical and mechanical variants *
01   Standard

Output signals:
A   0 - 20 mA
B   4 - 20 mA
C   0 - 10 V

Installation position:
2   TOP 1, 2, 3, 4, 5, 6 (See pages 16/17)

Version:
1   1 measuring system

Electrical connections ***:
S   Device connector M12
K   Cable 1 m

Signal path:
W   CW
C   CCW   For all measuring ranges. (See explanation on page 16)

Measuring ranges **:
± z°   z-axis
± y°   y-axis   Please assign the measuring angles which you require to the "x, y, z" axes
± x°   x-axis   Two axes at maximum selectable (Selectable from ± 5° to ± 90° in 5° steps)
                     For the undesired axis please choose '0' (Explanation on page 16/17)

Housing material:
A   Aluminium AlMgSi1
S   Stainless steel 1.4305 (only on request)
V   Stainless steel 1.4404 (recommended)

Design form:
65   65 mm

Modell:
NBA   with **analogue interface**

---

*   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.
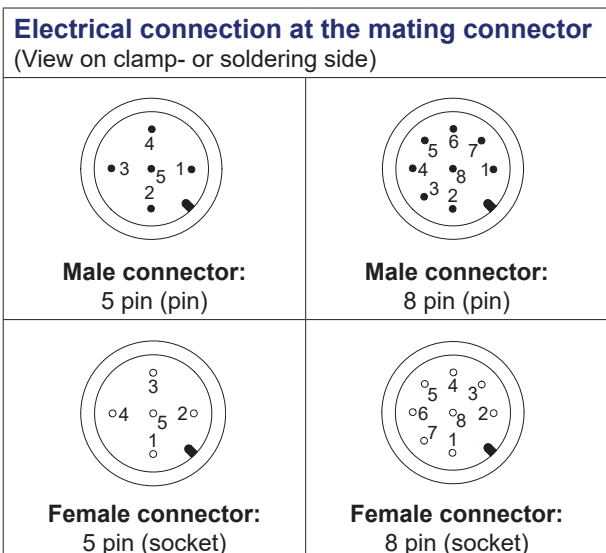
** The measuring ranges for the various measurement axes can be selected in 5° steps (2,5° on each side), whereby it must be noted that only 2 axes can be used at any one time. Accuracy differences may possibly arise in terms of the compatibility of the measuring ranges or the measuring angles. If in doubt, please talk to one of our employees.

Electrical connections

NBA: - 1 x connector M12 (male), 8-pole, A-coded or
- 1 x cable

NBN: - 1 x connector M12 (male), 8-pole, A-coded or
- 2 x connectors M12 (male + female), 8-pole, A-coded or
- 2 x connectors M12 (male + female), 5-pole, A-coded (Variant 50 in CANopen sensor NBN65 order code format) or
- 1 or 2 cables

Electrical connection at the mating connector (View on clamp- or soldering side)	
Male connector: 5 pin (pin)	**Male connector:** 8 pin (pin)
Female connector: 5 pin (socket)	**Female connector:** 8 pin (socket)

The pin assignment can be found in the connection assignment which is enclosed with each device.
Two connections recommended in order to loop the CANopen bus and the voltage supply through.

Accessories

- Mating connector (EMC) **STK5GP90** (M12, 5 pin male connector (pin), A-coded)
- Mating connector (EMC) **STK5GS56** (M12, 5 pin female connector (socket), A-coded)
- Mating connector (EMC) **STK8GP99** (M12, 8 pin male connector (pin), A-coded)
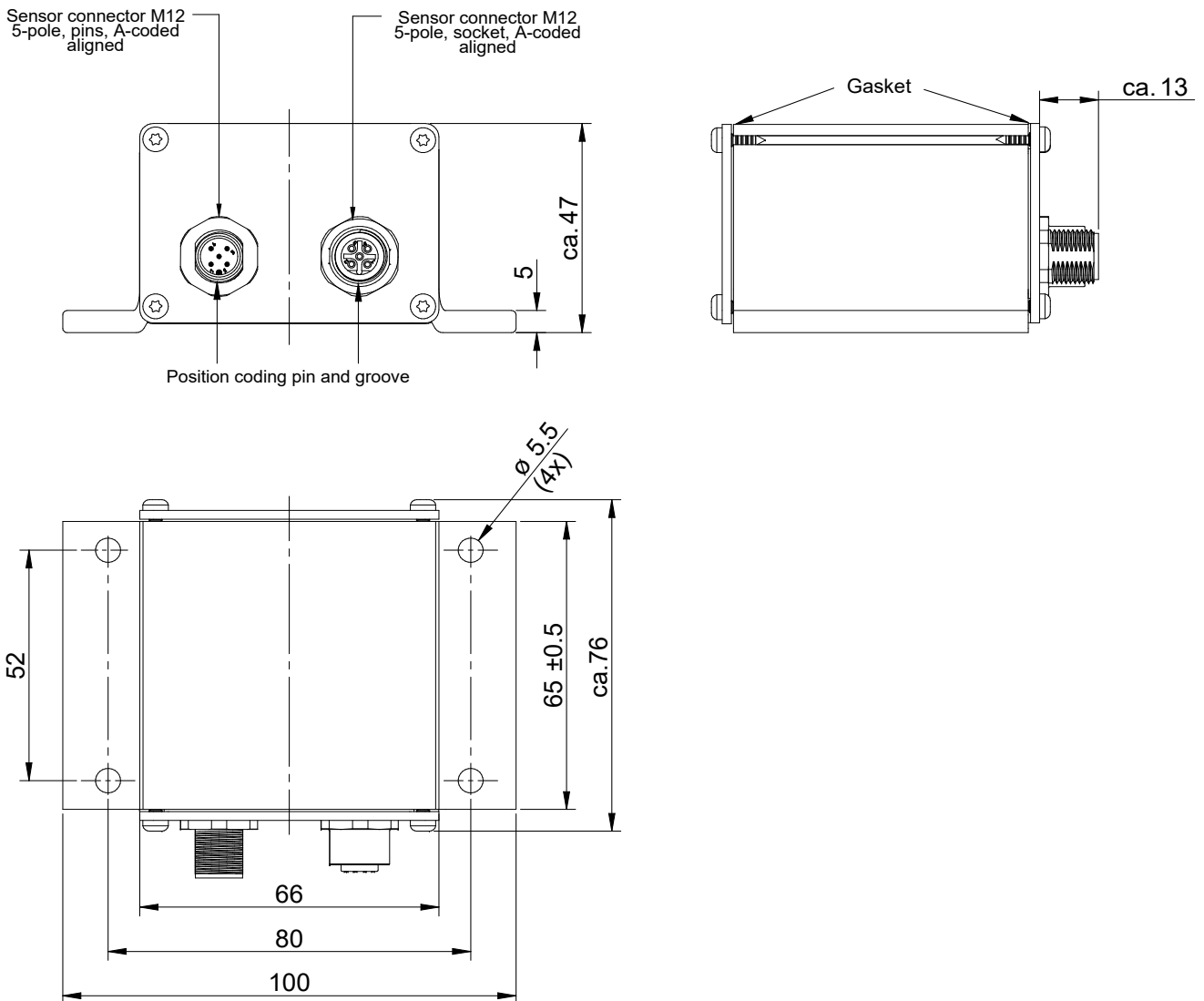- Mating connector (EMC) **STK8GS54** (M12, 8 pin female connector (socket), A-coded)

(Mating connectors have to be ordered separately)

Inclinometers NBN and NBA

Via round and slotted mounting holes for M5 bolts. The inclination sensor can be mechanically adjusted up to approx. ± 7.5° via the slots. Fasteners are not enclosed in the scope of delivery.

No dummy plug in case of two connectors.

Dimensions in mm

Materials used

Aluminium housing:	AlMgSi1
Stainless steel housing:	1.4305
or:	1.4404
Connector/cable gland:	Diecast zinc, nickel plated
or:	stainless steel
Sealing rings:	NBR

Version IP67 with 2 x cable

Dimensions in mm

EMC cable gland M16x1.5

Version IP69K with 1 x cable (Housing height is bigger than at IP67)

EMC cable gland M16x1.5 made of 1.4404

Nominal cable length

Housing made of 1.4404

Inclinometers NBN

Dimensions in mm

Sensor connector M12
5-pole, pins, A-coded
aligned

Sensor connector M12
5-pole, socket, A-coded
aligned

ca. 47

5

Position coding pin and groove

Gasket

ca. 13

ø 5.5
(4x)

52

65 ±0.5

ca. 76

66

80

100

Page 15: Materials used

Aluminium housing:	AlMgSi0.5 (EN AW 6060)
Aluminium front plates:	AlMg3
Connector:	Diecast zinc, nickel plated
Sealing rings:	Silicone

Page 14: Materials used

Aluminium housing:	AlMgSi1
Stainless steel housing:	1.4305
or (recommended):	1.4404
Connector/cable gland:	Diecast zinc, nickel plated
or:	stainless steel
Sealing rings:	NBR

Installation positions and measurement axis assignment

Installation position TOP 1... 6 of the 1- or 2-axis incli-nometer must be taken into consideration on assignment or selection of the **measurement axes**. The installation positions specified below define the measurement axes and measuring range centre for x, y and z.

Which of housing surfaces 1 to 6 is to point upwards must be specified in the order number for the NBN65 (see figure on the right). The installation position is clearly marked on each device ('TOP'). This surface/edge must point upwards.

Only 2 of 3 axes are selectable. The installation position determines these axes.

Signal path: with the CW setting, the prefixes in the figures below specify the direction of rotation in which the output values increase positively during inclination measurement. This is accordingly reversed with the setting CCW.

Attention: Not all installation positions and measuring angles can be delivered. Please ask at first our technical departement.
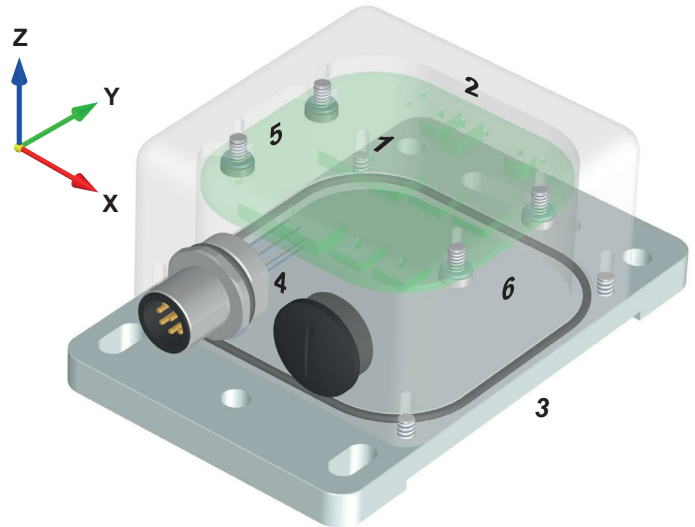
1: Upper side	2: Rear side	3: Lower side
4: Connector side	5: Left side	6: Right side

E.g. NBN 65 - A xx / yy / zz C3 - **1** - S 1 N 50: TOP1

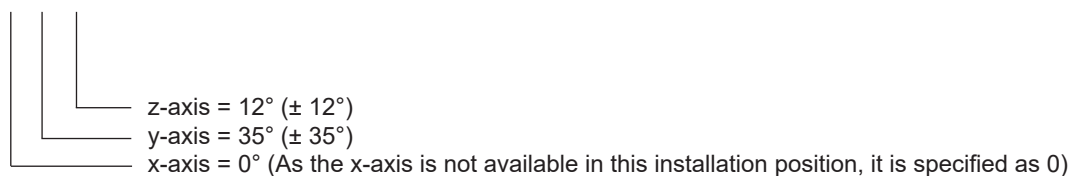In this example, circumstances necessitate the installation of the inclinometer in installation position "5".

The y-axis with a range of ± 35° to be measured and the z-axis with a range of ± 12° to be measured are required for measurement.
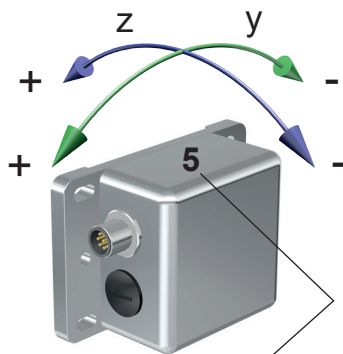
Installation position 5 (with reference to the upper side)

NBN65 - A 0/**35**/**12** C3 - **5** - S 1 N 01

NBA65 - A 0/**35**/**12** W S 1 - **5** - B01

z-axis = 12° (± 12°)
y-axis = 35° (± 35°)
x-axis = 0° (As the x-axis is not available in this installation position, it is specified as 0)

Further examples for installation positions

Further examples which refer to the assumed example measuring angles.

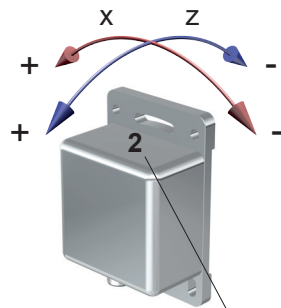x = ± 90°   y = ± 25°   z = ± 15°

It is to be noted that the installation position always represents the device surface which is viewed from above. In the various illustrations, this is indicated with the bold number and must be specified on ordering under all circumstances.
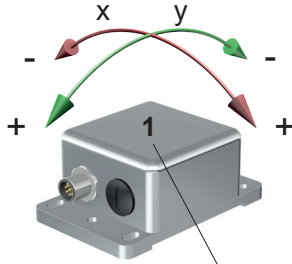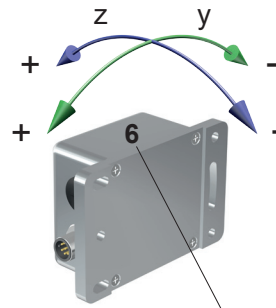

NBN65 - A **90**/**25**/0 C3 - **1** - S 1 N01
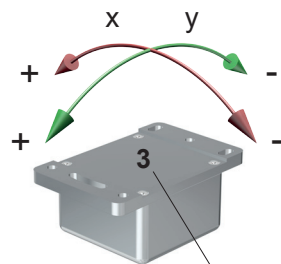NBA65 - A **90**/**25**/0 W S 1 - **1** - B01
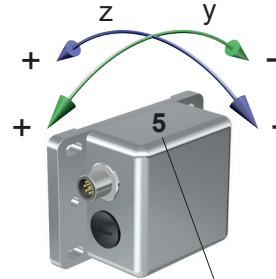
NBN65 - A 0/**25**/**15** C3 - **5** - S 1 N01
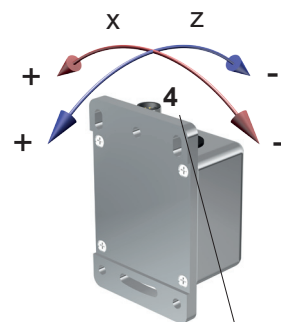NBA65 - A 0/**25**/**15** W S 1 - **5** - B01

NBN65 - A **90**/0/**15** C3 - **2** - S 1 N01
NBA65 - A **90**/0/**15** W S 1 - **2** - B01

NBN65 - A 0/**25**/**15** C3 - **6** - S 1 N01
NBA65 - A 0/**25**/**15** W S 1 - **6** - B01

NBN65 - A **90**/**25**/0 C3 - **3** - S 1 N01
NBA65 - A **90**/**25**/0 W S 1 - **3** - B01

NBN65 - A **90**/0/**15** C3 - **4** - S 1 N01
NBA65 - A **90**/0/**15** W S 1 - **4** - B01

Model NBN66 (Extruded sheath version): Direction of plugs like NBN65 for definition of TOP and axes.

Example: TOP1

NBN65   NBN66