

Inclination sensor on MEMS technology

Model NBA51 with analogue output



- MEMS technology
- Analogue output signal
 - 4 ... 20 mA
 - 0 ... 10 VDC
 - 0 ... 5 VDC
 - 0.5 ... 4.5 VDC
- High protection grade IP67 and wide temperature range from -40 °C ... +85 °C
- Stable accuracy over whole temperature range
- Resolution 0.01°
- Single axis up to 360° or ±180° (Redundant output possible)
- Double axis up to ±60°

Design and function

NBA51 is available with one or two measurement axes. The inclinometer working principle is based on a micro machined silicon capacitive transducer (developed with MEMS technology).

NBA51 is suited for applications (cranes, aerial platforms, drilling machines and excavators) in harsh environments especially for mobile machines.

NBA51 has very compact dimensions, has high shock/vibration resistance and a high reliability and long service life for outdoor and indoor applications.

NBA51 can be preset via pin for easy adjustment of the output signal. A redundant signal output at single axis version is available (with reverse signal behaviour CW/CCW). In addition more than one device can be mounted easily one upon the other to achieve another redundancy (see drawings).

Inclination sensor NBA51

Technical data

Electrical data

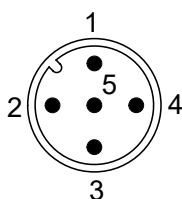
■ Power supply:	9 ... 30 VDC (for outputs 0.5 ... 4.5 VDC and 0 ... 5 VDC) 12 ... 30 VDC (for outputs 0 ... 10 VDC and 4 ... 20 mA)
■ Reverse polarity protection:	Yes
■ Measuring range:	$\pm 1^\circ$ to $\pm 60^\circ$ for horizontal version 0° to 360° for vertical version or $\pm 180^\circ$
■ Accuracy (+25 °C):	$< \pm 0,3^\circ$
■ Resolution:	0.01°
■ Temperature coefficient:	0,01 °/K
■ Initialing time:	<0,3 s after power on

Environmental data

■ Temperature range:	-40 °C ... +85 °C [-40 °F ... +185 °F]
■ Shock resistance:	30 g, 11 ms - acc. to EN 60068-2-27
■ Vibration resistance:	10 ... 500 Hz - acc. to EN 60068-2-6
■ Electromagnetic compatibility:	acc. to EN 61326-1, EN 61326-3-1
■ CE compliant:	acc. to EMC guideline 2014/30/EU RoHS guideline 2011/65/EU
■ Material housing:	PA6 + GF30%
■ Protection grade:	IP67
■ Weight:	approx. 100 g [3.53 oz]

Electrical connection

Connector M12 x 5 pins, A-coded



Single axis (axis type S, T)

Pin	Function
1	+Vs
2	Vo/Io output 2 (CCW) *
3	GND
4	Vo/Io output 1 (CW)
5	zero input **

Double axis (axis type D)

Pin	Function
1	+Vs
2	Vo/Io output - Y axis
3	GND
4	Vo/Io output - X axis
5	zero input **

* only for redundant versions (R1 at axis type S, T) in other cases should not be connected

** connect to GND for two seconds to set an offset (low active)

Inclination sensor NBA51

Order code format

NBA	51	—	P	xxx	S	R0	S	B	01	
									01	Electrical and mechanical variants: Standard
										Output signal: B 4 ... 20 mA C 0 ... 10 VDC D 0 ... 5 VDC E 0.5 ... 4.5 VDC
										Electrical connection: S Male device connector M12 K Cable 30 cm with male connector M12
										Redundancy*: R0 No redundancy (possible at all axis types) R1 With redundant system (poss. only at axis type S, T → signal out on pin 2)
										Axis type (Number of axes and signal output): S Single axis, signal output: 0 ... xxx° (select 001 ≤ xxx ≤ 360) T Single axis, signal output: ± xxx° (select 001 ≤ xxx ≤ 180) D Double axis, signal output: ± xxx° (select 001 ≤ xxx ≤ 060)
				xxx						Measuring range: Put in at output: 0 ... xxx°: full scale value (e.g. 090 for 0 ... 90°) → axis type S ± xxx°: "half" scale value (e.g. 050 for -50° ... +50°) → axis type T, D
										Housing material: P Polyamide 6 with 30 % glass fiber
										Design form: 51 51 mm
										Model: NBA with analogue interface

Examples:

Axis type S:	NBA51-P090SR0SB01 → 0 ... 90°	→ signal z-axis
	NBA51-P360SR1SC01 → 0 ... 360°	→ signal z-axis plus signal z-axis (reverse)
Axis type T:	NBA51-P060TR0SD01 → -60° ... +60°	→ signal z-axis
Axis type D:	NBA51-P045DR0SB01 → -45° ... +45°	→ signal x-axis and y-axis

See drawings on page 4 and 6 for axis definitions and signal outputs.

* The redundant axis will be output on pin 2 in connector M12. The redundant signal has reverse signal form (=CCW).

Inclination sensor NBA51

Installation position double axis (D)



Double axis NBA51 inclination sensor (axis type D)

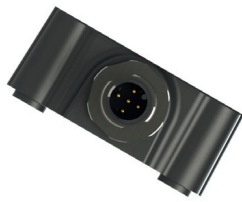
The 2-dimensional inclination sensor must be mounted with the base plate in horizontal position, i.e. parallel to the horizontal line.

The sensor can be inclined both towards the X and Y axis at the same time.

For each axis a separate measured value is provided.



+X



-X



+Y



-Y

Installation position single axis (S, T)



Z = 0°

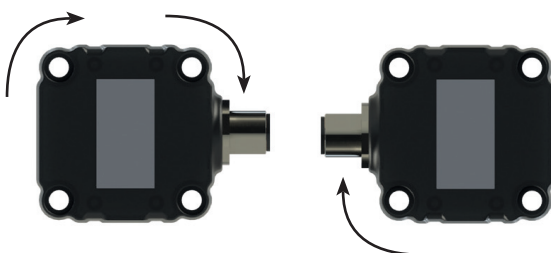
Single axis NBA51 inclination sensor (axis type S, T)

The 1-dimensional inclination sensor must be installed with its Z-axis in line with the force of gravity, as illustrated below.

The 1-dimensional sensor default position is 0° as shown in the following illustration (connector down).

The examples show the maximum angles which are possible at axis types S and T. For less angles (e.g. at S: 090 = 0 ... 90°) the same principle of signal output is valid.

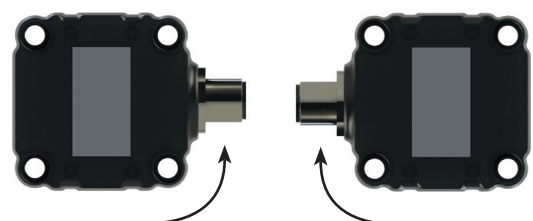
Axis type S (0...360°)



Z = 270°

Z = 90°

Axis type T (± 180°)



Z = -90°

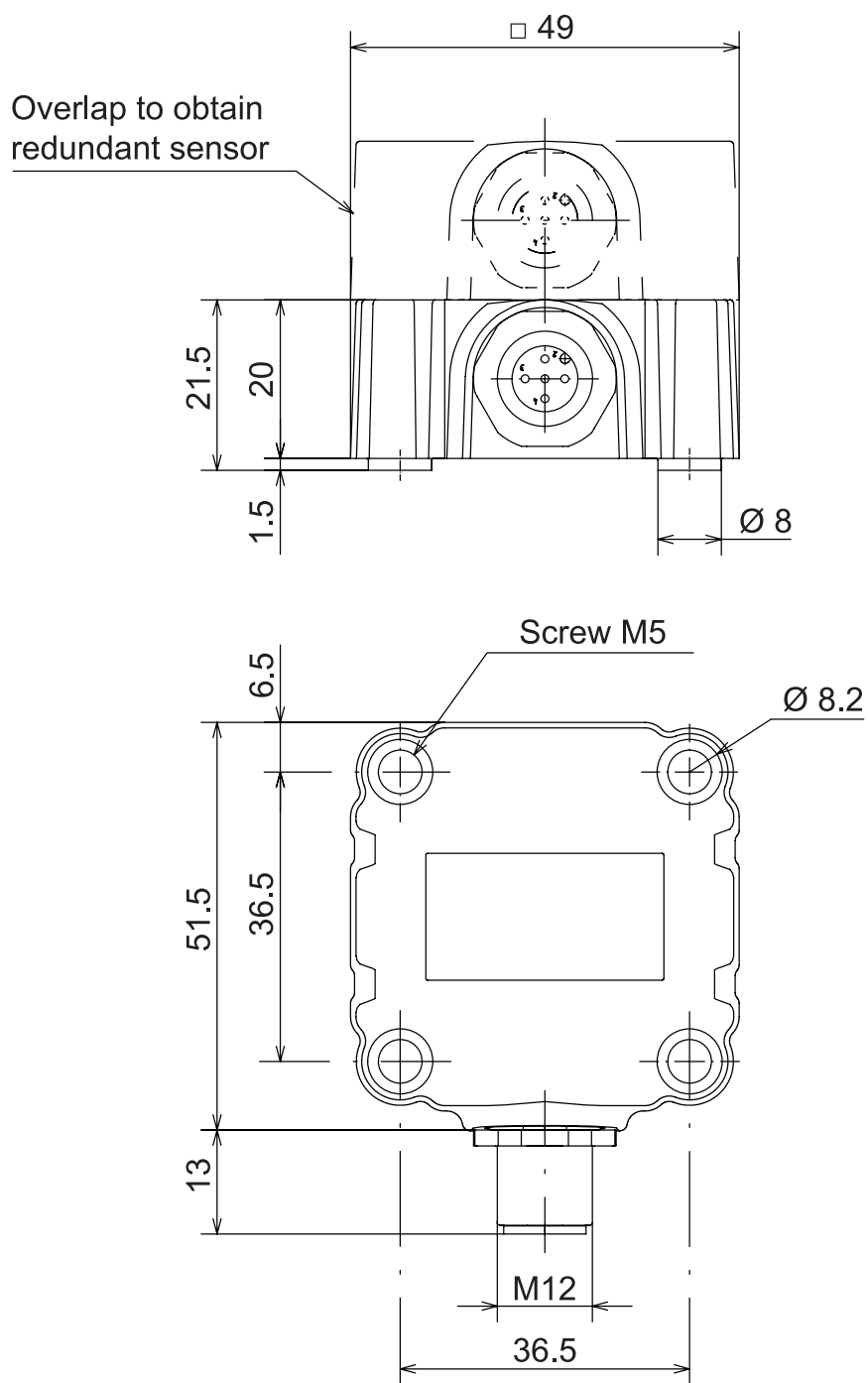
Z = +90°

Inclination sensor NBA51

Installation drawing

Dimensions in mm

Sensor NBA51 can be mounted easily one upon the other via $\varnothing 8$ mm centerings.



Inclination sensor NBA51

Analogue signal outputs

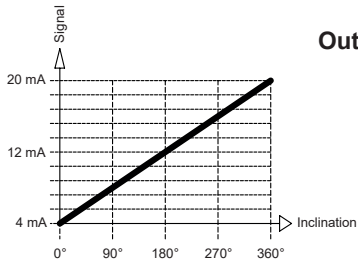
Single axis: Axis types S and T (Shown for maximum angle)

Double axis: Axis type D (Shown for maximum angle)

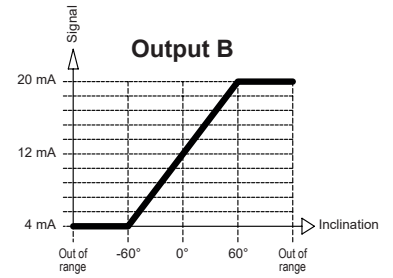
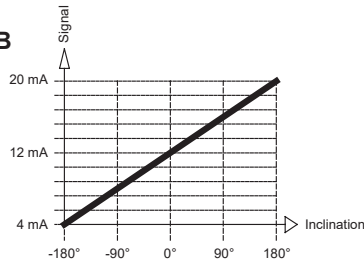
S (at 0...360°)

T (at ± 180°)

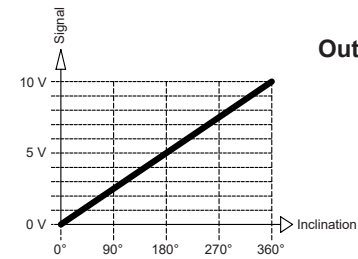
D (at ±60°)



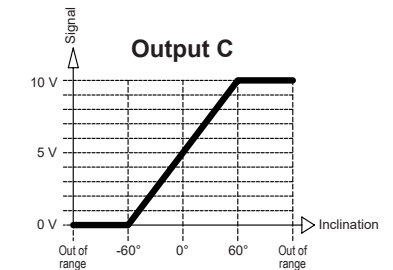
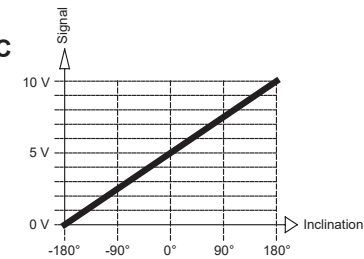
Output B



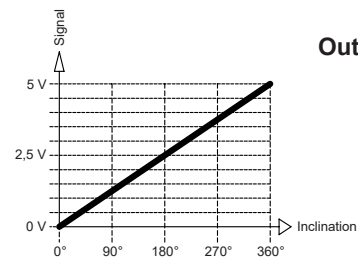
Output B



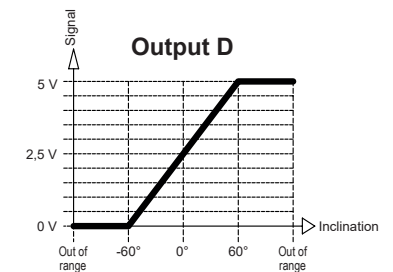
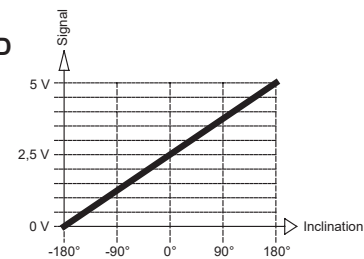
Output C



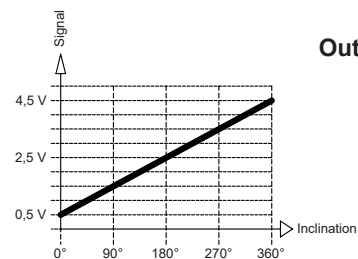
Output C



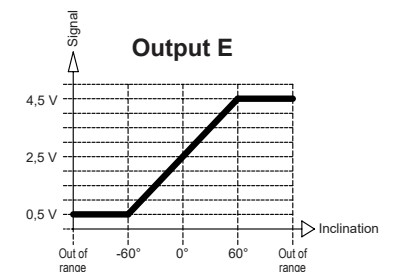
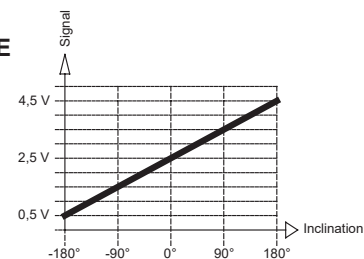
Output D



Output D



Output E



Output E