SUPREME SENSORING

Acceleration sensor (MEMS)
Model NVW
Interface: LoRaWAN®

Document no.:
NVW 16631 BE
13.09.2023

- **Contact-less, wear-free sensor system in MEMS technology**
- **Number of measuring axes: 3**
- **Frequency range: 0.05 ... 50 Hz**
- **Measuring range: ± 2 g**
- **Various signal settings: RMS, kurtosis, mean/actual frequency**
- **Status and signal transmission via LoRaWAN interface**
- **USB interface for parameter update and data readout**
- **Flexible mounting with magnetic feet**

LoRaWAN®

KEY INFORMATION OVERVIEW

DESIGN & FUNCTION

The sensor system is intended for use e.g. in wind turbines to measure and evaluate tower vibrations. The accelerations of the tower head are detected by MEMS sensors (Micro Electro-Mechanical System) with subsequent digitisation by a controller.

The device consists of an acceleration sensor, a controller unit, a flash memory for data storage and a LoRaWAN® interface for wireless transmission of status information over several kilometres.

Thanks to its high resistance to vibration and shock - more than the defined measuring range - the sensor is suitable for use in areas with rough environmental conditions.

Electrical connection is carried via a M12 connectors for data and power supply and a N-type connector for the antenna.

Four status LEDs assist during installation and diagnosis of the NVW.

MEMS sensorsareintegrated circuits which are manufactured in silicon bulk micro-mechanics technology. They have a long service life and are very robust.

The MEMS output values are processed by digital filters. The filter characteristics and parameters are programmed for each customer individually in the factory (low pass, high pass or band pass). They can be assigned to a single axes or to a combination of axes (e.g. RMS of x and y).

FEATURES INTERFACE

The resulting output signal can be:

- saved on internal flash memory
- readout via USB interface (USB as well for update purposes)
- output via LoRaWAN® interface
  - LoRaWAN® Version 1.0.3
  - Protocol LoRaWAN®, Class A
  - Frequency EU 863-870
  - Transmitted power 15 dbm max.

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GENERAL INFORMATION

The acceleration sensor measures in a frequency spectrum from 0.05 to 50 Hz. These two main axes are located parallel to the mounting surface of the NVW. The input spectrum can be processed with a maximum of 6 digital filters. The filter settings are set in the factory.

The measuring axis can be a single axis or the vector sum of several axes, e.g. $\sqrt{(x^2+y^2)}$.

The output of the main frequency filters (momentary values) can be used directly or they can be used to calculate statistical values (average, RMS, kurtosis, etc.). The time over which averaging is carried out can be set (e.g. 60 s). Further more, a PEAK value or an integration value can be calculated. The peak value can be decremented to certain times and with a certain decrease rate.

Finally, the signals can be analysed to estimate the mean frequency of the input signal within a certain band.

This sensor is designed for horizontal installation. Tilt angles up to 5° are allowed. When the tilt angle exceeds 5° an error is indicated by a red LED and no data is transmitted. On customer request, other orientation can be allowed and the coordinate system can be adjusted automatically to other orientations.

Output data is saved internally on a flash memory and can be read via a USB interface. A limited amount of data (up to approximately 12 bytes per minute) can send via a LoRaWAN® interface. This data can either be one of the output values or status bits, which can be set when a limit value is exceeded.

TECHNICAL DATA

ELECTRICAL DATA

Sensor system	MEMS acceleration sensor
Number of frequency bands	maximum of 6 (setting ex works)
Measuring range	± 2 g for each axis
Sampling frequency	MEMS: 100 Hz Filter stage: 5 Hz to 10 Hz, depending on the frequency range Higher frequencies on request
Resolution	4096 digits / g (9.81 m/s^2 = 1 g)
Accuracy	5 % typ.
Operating voltage range	+ 3.5 to 3.7 VDC
Power consumption	< 0.1 W average
Current consumption	approx. 25 mA average, 100 mA peak
Maximum inclination vs. horizon	5° (at angles >5° an error message will be indicated via LED)
Sign of output data	see drawing concerning axes and sign of acceleration direction
Electrical connection	2 x connector M12 and 1 x N-type connector (Power supply, USB, antenna) Cable outputs on request

LORAWAN®

DevEUI address	88:A9:A7:BF:FF:XX:XX:XX The actual DevEUI and JoinEUI can be found on the nameplate
AppKey	See connection diagram included with device
Frequency	EU 863-870, others on request
Transmitted power	14 dbm max., 22 dbm on request
Protocol	LoRaWAN®, Class A
Activation method	Over-The-Air Activation (OTAA)
LoRaWAN® Version	1.0.3
Transmission cycle time	Every 1 minute min. (configurable ex works)

ENVIRONMENTAL DATA

Operating temperature range	- 40 °C to + 70 °C
Resistance to shock	200 m/s^2 / 5 ms, according to DIN EN 60068-2-27
Resistance to vibration	100 m/s^2 at 10 Hz ... 2000 Hz according to DIN EN 60068-2-6
Protection type (DIN 40 050)	IP 65
EMC	EN 61000-6-4 interference emission EN 61000-6-2 interference immunity
Housing material	Aluminium (see drawing)
Weight	0.4 kg

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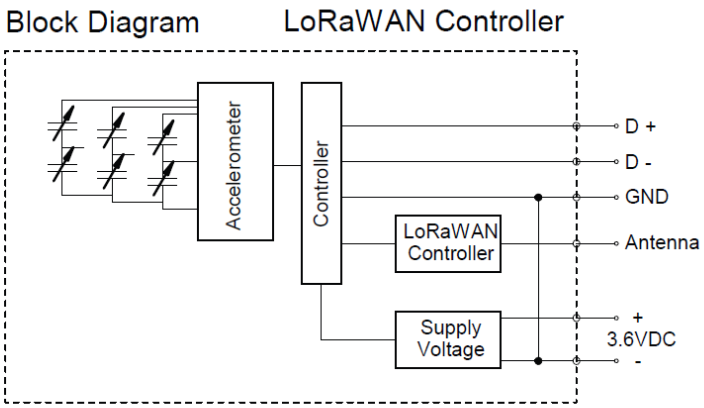
TECHNICAL DATA

PRINCIPAL CIRCUIT DIAGRAM

LoRaWAN Interface

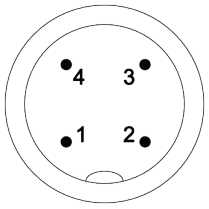


ELECTRICAL CONNECTION - PIN CONFIGURATION AND NUMBERING

Supply . . . . . M12 connector, A-coded, 4-pole, pins or cable output via cable glands
Antenna . . . . . N-type connector
USB . . . . . M12 connector, A-coded, 4-pole, socket or cable output via cable glands

M12 CONNECTOR S1, A-CODED, PINS/MALE

PIN. . . . . Function
1 . . . . . + UB (+ 3.6 VDC)
2 . . . . . –
3 . . . . . - UB (0 VDC)
4 . . . . . –

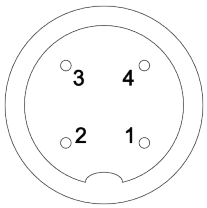


COLOUR-CODING FOR OPTIONAL CABLE OUTPUT (POWER CONNECTION)

Colour. . . . . Function
White . . . . . + UB (+ 3.6 VDC)
Brown . . . . . - UB (0 VDC)

M12 CONNECTOR S3, A-CODED, SOCKETS / FEMALE

PIN. . . . . Function
1 . . . . . GND
2 . . . . . D-
3 . . . . . D+
4 . . . . . Vbus



COLOUR-CODING FOR OPTIONAL CABLE OUTPUT (DATA / USB)

Colour. . . . . Function
Black . . . . . GND
White . . . . . D-
Green . . . . . D+
Red . . . . . Vbus

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ORDER CODE FORMAT

NVW	90 -	A	T	4 -	2	E	9	U	W	01	STANDARD VERSION

NVW	Vibration sensor with wireless interface		
90	Design form	90	Design form 90 mm
A	Housing material	A	Aluminium 3.3206 / 3.3316 (see drawing)
T	Mechanical connection	T M	Through holes Magnetic feet
4	Number of mechanical connections	4	
2	Measuring range	2	± 2 g
E	LoRaWAN® region	E U I C	Europe USA India China** **China and other world regions on request
9	Flash memory	9	2^9 MBit = 512 MBit
U	Output connectors	U	Standard: 2 x M12 connectors (power, USB), 1 x N-type connector (antenna)
W	Output interface	W	with wireless interface
01	Electrical and mechanical variants*	01	Standard according to this data sheet

* The basic versions according to this data sheet carry the number 01. Deviations are identified with a variant number and are documented in the factory. For example, certain filter settings will be assigned with a variant number (e.g. 0.05 Hz to 5 Hz).

ACCESSORIES - SELECTION (to be ordered separately)

ANTENNA

NVW-ANT-900-01 . . . . . Antenna for 868/915 Mhz with N-type connector

BATTERY

NVW-BAT-3.6-17-01 . . . . . Battery, 3.6V, 17Ah, in plastic housing with cable and M12 connector

COMPLETE SET

NVW-SET-xx . . . . . Complete set including

- NVW90
- NVW-ANT-900-01
- NVW-BAT-3.6-17-01
- Robust storage case for storage and transportation

STRAIGHT MATING CONNECTOR

STK4GS60 . . . . . for the supply voltage (Zinc die-cast nickel-plated), see data sheet STK14572
STK4GS104 . . . . . for the supply voltage (stainless steel 1.4404), see data sheet STK14571
STK4GP41 . . . . . for serial communication, plastic housing

ANGLED MATING CONNECTOR

STK4WS117 . . . . . for the supply voltage, see data sheet STK16392

CONNECTING CABLE - POWER SUPPLY

KABEL-5-191 . . . . . With moulded M12 connector, A-coded, straight, 2. side open, length 5m, see data sheet KBL13411

CONNECTING CABLE - DATA

KABEL-2-240 . . . . . With M12 connector, A-coded, straight, 2. side USB-A, length 2m

DOCUMENTATION

DOCUMENTATION

The following documents can be found in the Internet under www.twk.de in the documentation area, model NVW.

Data sheet NVW16631
Manual NVW16705
Installation instructions AN16169
Serial communication program . . . . . Logplot

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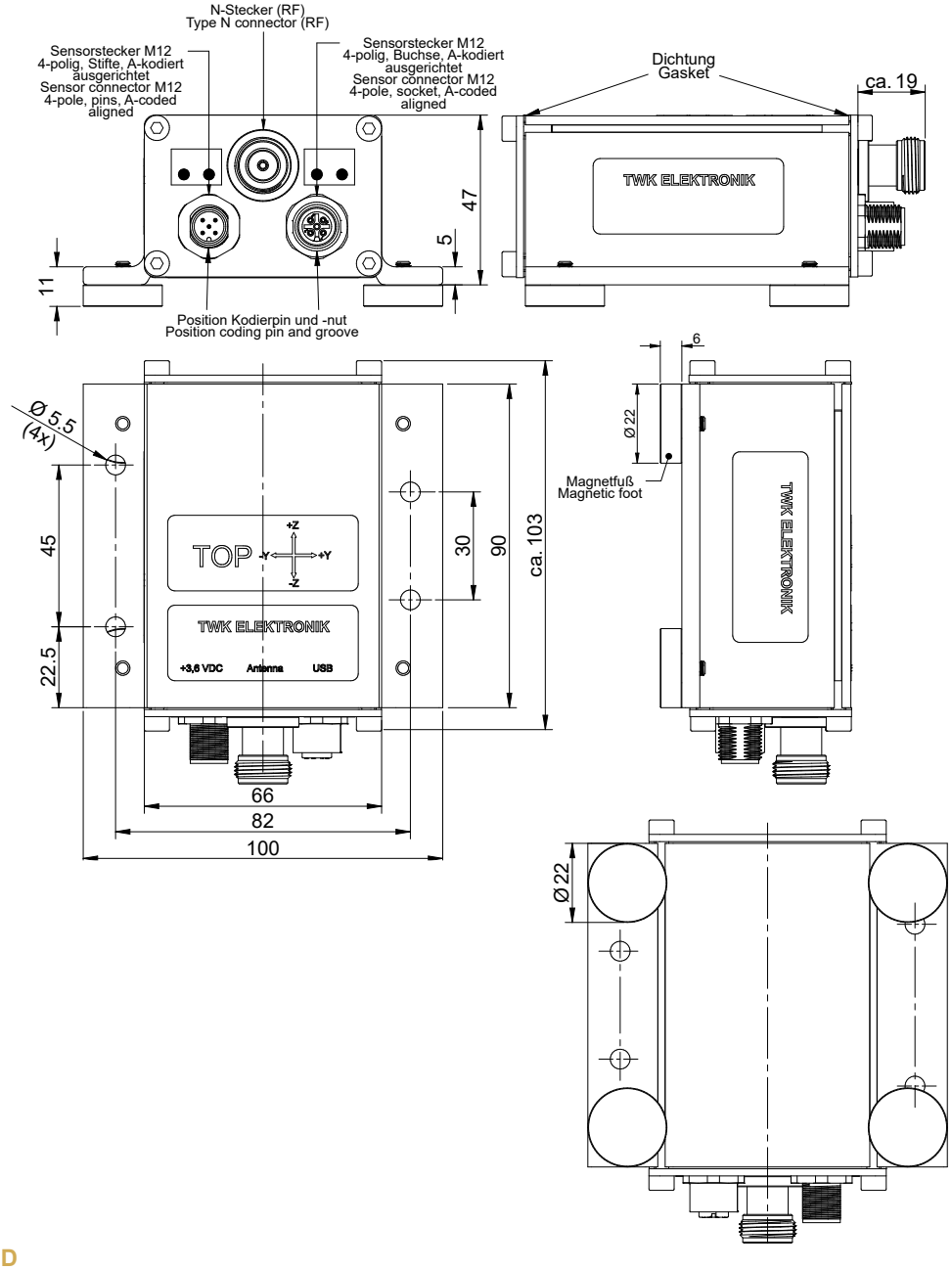
INSTALLATION DRAWINGS

MODEL NVW90 - X T4 - X X X UW01

Dimensions in mm

When NVW is accelerated in direction of the arrow the mentioned sign at the related axis is put out (signed 16 Bit: ...., FFFD, FFFE, FFFF, 0, 1, 2, ...).

Mounting orientation: horizontal



MATERIALS USED

Aluminium housing	Aluminium 3.3206
Aluminium front plates	Aluminium 3.3316
Connectors	Brass, nickel plated or diecast zinc, nickel plated
Sealing rings	Silicone / NBR