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Subject to technical change.
All dimensions in mm (inches).

We assume no liability for typing errors.
Different variations to those specified are possible.
Please contact our technical consultants.

Safety notes / Technical support

Notes

- Installation, maintenance and commissioning must be carried out only by qualified technical personnel.
- The product must be used only in the manner outlined in this instruction manual.

Special attention must be paid to warnings and notes as follows:

	WARNING Relates to a caution symbol on the product and means, that a failure to observe the necessary precautions can result in death, serious injury and/ or considerable material damage.
	WARNING Relates to a caution symbol on the product: Risk of electric shock
	WARNING Relates to a caution symbol on the product and means, that a failure to observe the necessary precautions can result in death, serious injury and/ or considerable material damage. This symbol is used, when there is no corresponding caution symbol on the product.
CAUTION	A failure to observe the necessary precautions can result in considerable material damage.

Safety symbols

In manual and on product	Description
	CAUTION: refer to related documents (manual) for details.
	Earth (ground) Terminal
	Protective Conductor Terminal

Technical support

Please contact your local supplier (see www.uwtgroup.com for address). Otherwise you can contact:

UWT GmbH
Westendstr. 5
87488 Betzigau
Germany

Tel. 0049 (0)831 57123-0
Fax. 0049 (0)831 76879
info@uwtgroup.com
www.uwtgroup.com

Introduction

The Nivobob® NB 4000 is an electromechanic level measuring instrument for continuous measuring of level or volumes in silos, hoppers or tanks.

Applications

- Powder, granulate, small or coarse bulk goods

Available for industries such as
- Food
- Grain
- Cement
- Plastics
- others

Features

Process

- Suitable for most types of bulk goods
- Independent of bulk material properties, such as:
  - Dielectricity and conductivity of the bulk good
  - Dusty atmosphere in the silo
  - Changing humidity inside the product
  - Products that tend to stick
- No mechanical load on the silo roof, the sensor weight just touches the surface of the material
- Accurate measurement

Service

- Simple installation and commissioning
- Measurement principle easy to understand
- Rope, tape with increased service life
- Low maintenance

Approvals

- Approval for use in Hazardous Locations

Mechanic

- Measurement range up to 30 m (100 ft)
- 1½" process connection possible
- Aiming flange to be mounted directly on a flat silo roof
- Internal tape cleaner for difficult materials
- Robust cast housing, ingress protection IP66

Electronics

- Micro processor controlled measurement
- Diagnostics possibilities
- Output 4-20 mA
- Two programmable Relais (can be used as Counting/ Reset pulse output or as Failure/ Upper stop position)
- Measurement start with external signal or integrated timer

Function

The Nivobob® NB 4000 is mounted on the top of the silo. A sensor weight is driven down into the silo. It is mounted at the end of a rope or tape which is wound on a motor driven roller. Upon contact with bulk material, the motor changes the winding direction and the sensor weight is driven back to the upper stop position.

During downwards movement of the sensor weight the distance is electronically measured by the rotations of the internal rope/ tape roller. The microcontroller converts the measured distance into an output signal, which is a volumetric signal based on the silo geometry. The output signal is updated, when the sensor weight touches the bulk material.

Diagnostics

Comprehensive diagnostics possibilities are present:

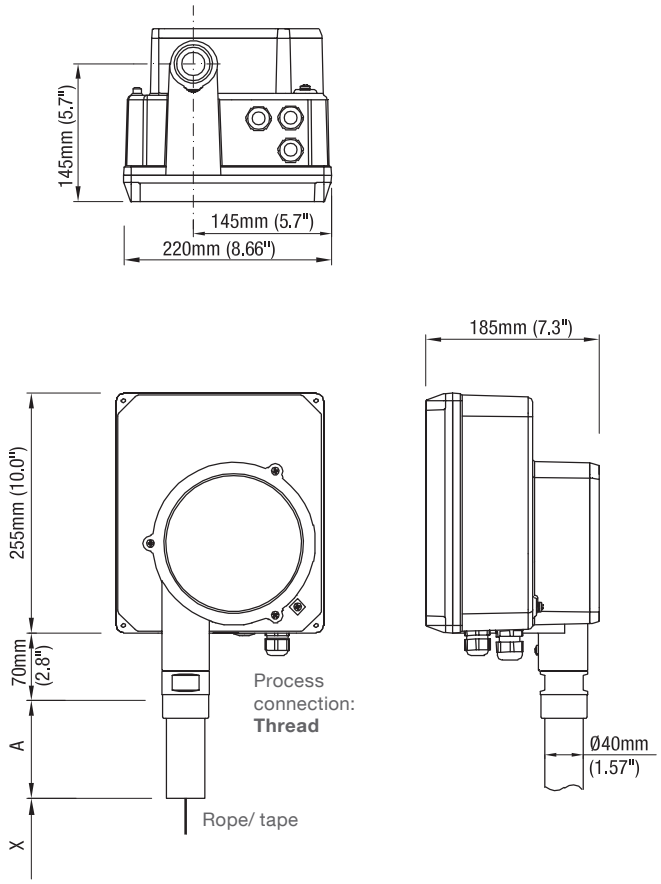
- Measurement control is done by comparing the moved distance between up and downward movement and checking for discrepancy. In case of discrepancy, the sensor weight is pulled to the upper stop position to ensure, that the sensor weight is not inside the silo.

- Service interval after a certain amount of measurements and run time.

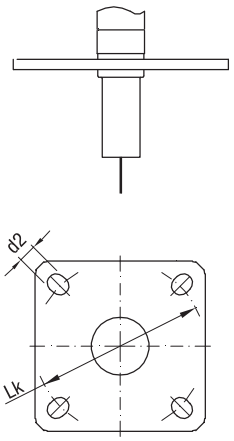
- Internal control of motor and motor driver electronic.

Diagnostics is in accordance with NAMUR recommendation NE107.

Dimensions and materials

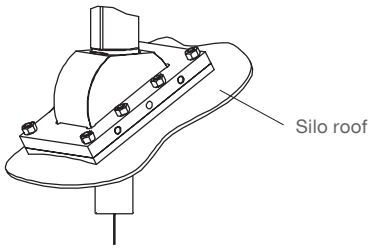


Process connection: **Flange**



Process connection: **Aiming flange**

To be screwed directly to the silo roof
0° - 50° adjustable
Including screws, nuts and sealing



Flange plate outside dimensions:
Width x Heigth: 120 mm x 180 mm (4.7" x 7.1")

Dimensions

X = Length to bottom of sensor weight (in upper stop position, see next page)	
A = Length of socket pipe 100 mm (3.9") Optional 200 mm (7.9")/ 500 mm (19.7")/ 1,000 mm (39.4")	
Flanges	
fitting to: DN100 PN16/ 4" 150lbs	Lk = ø180 - 190.5 mm (ø7.1 - 7.5") slot d2 = ø19 mm (ø0.75")
fitting to: 2"/ 3" 150lbs	Lk = ø120.7 - 152.4 mm (ø4.75 - 6.0") slot d2 = ø19 mm (ø0.75")
Rope	ø1.0 mm (ø0.04")
Tape	12 x 0.2 mm (0.47 x 0.008")

Materials

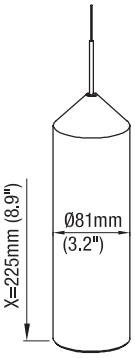
Housing outside	Aluminium, outside powder coated
Thread/ flange	Aluminium
Aiming flange	Aluminium/ 1.4301 (304)
Rope	1.4301 (304)
Tape	1.4310 (301)

Dimensions and materials

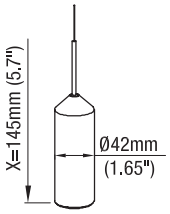
Sensor weights

Rope version

PVC

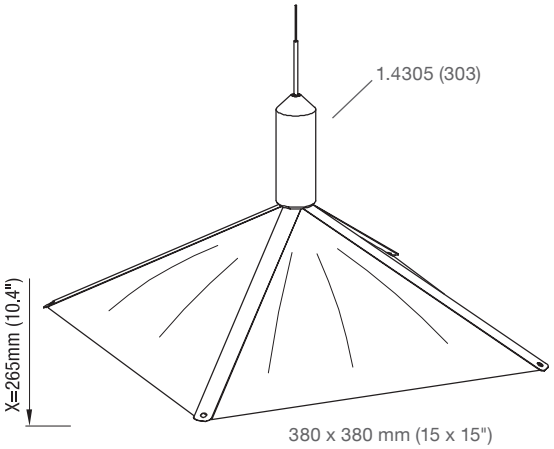


Stainless steel



Material:
1.4305 (304)

Folding cover

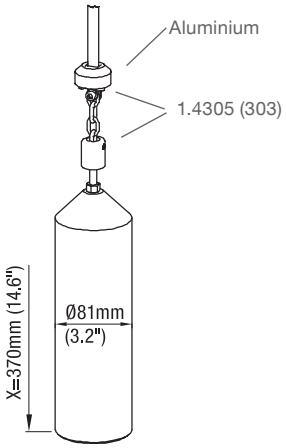


380 x 380 mm (15 x 15")
Material: 1.4310 (301)/ PA canvas
For material densitiy >20g/l (1.2 lb/ft³)
Fits through 1½" mounting hole

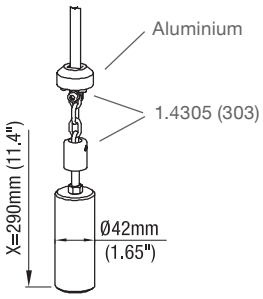
All sensor weights:
1.6 kg (3.5 lbs)

Tape version

PVC



Stainless steel



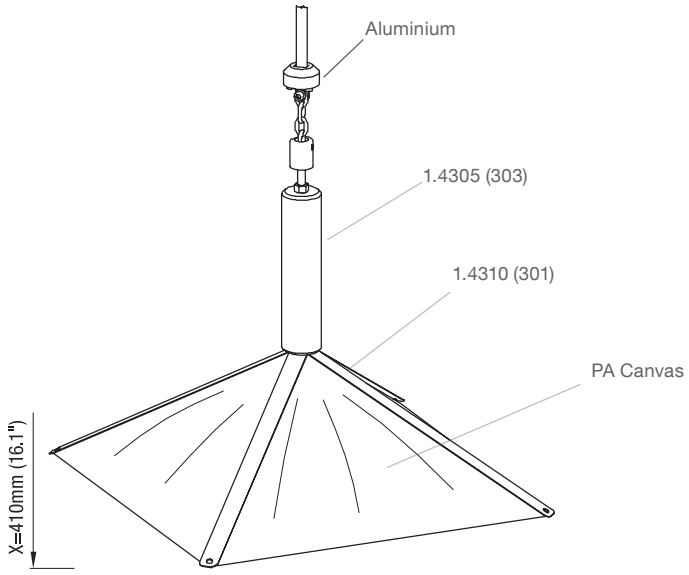
Material:
1.4305 (304)

Fixing elements between tape and sensor weight: aluminium/ 1.4305 (304)

All sensor weights:
1.6 kg (3.5 lbs)

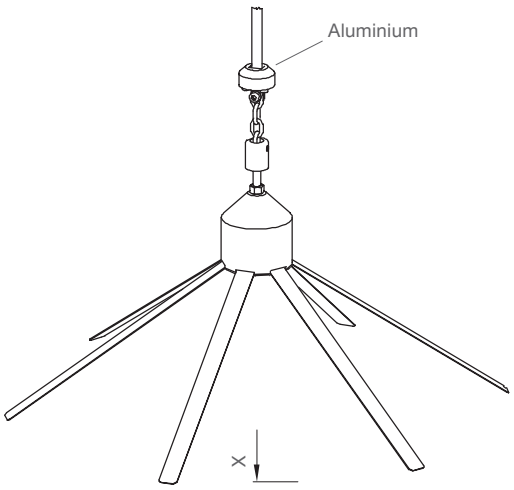
Dimensions and materials

Folding cover



380 x 380 mm (15 x 15")
Material: 1.4310 (301)/ 1.4305 (303)/
PA canvas
For material densitiy >20 g/l (1.2 lb/ft³)
Fits through 1½" mounting hole

Spider



ø600 mm (ø23.6")
X = 325 mm (12,8")
Material: 1.4301 (304)/ 1.4305 (303)
1.4310 (301)

Fixing elements between tape and sensor
weight: aluminium/ 1.4305 (304)

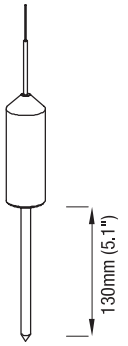
All sensor weights:
1.6 kg (3.5 lbs)

Options and Accessories

Options

Pin for sensor weight

Recommended for powder
The pin penetrates into the material and avoids slipping or tilting of the sensor weight on the steep bulk surface.

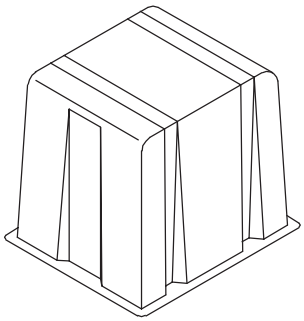


Weather protection cover

If the unit is used outdoors, the use of the weather protection cover is recommended. It protects the device from all atmospheric influences such as
- rain water
- condensation water
- excessively high temperatures
- excessively low temperatures in winter

Material: PE, weather and temperature stable

For use in Hazardous Locations only permitted for Zone 22 or Division 2

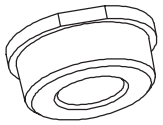


Accessories

Mounting kits

Material for mounting the unit on a flange
Sealings, screws and washers

Adapter NPT 1½" to NPT 3"
Aluminium
For mounting the unit on a 3" ferrule
Thread tapered ANSI B1.20.1



Technical data

Electrical data

Power supply

AC version 230 V or 115 V 50 - 60 Hz +10%/ -15% (incl. 10% of EN 61010)
DC version 20 .. 28 V (incl. 10% of EN 61010)

Installed load

AC version: 150 VA (including internal heater (80 W))

DC version:
One unit: 150 W (with or without internal heater) *
Further units which are connected to the same power supply:
25 W per unit (without internal heater, motor off) **
50 W per unit (without internal heater, motor running)
80 W per unit (with internal heater, supply voltage 20 V DC)
100 W per unit (with internal heater, supply voltage 24 V DC)
120 W per unit (with internal heater, supply voltage 28 V DC)

*Considers the max. motor traction which is needed in a failure condition. A failure condition is assumed for max. one unit at the same time.
** This value can be considered, if the controlling PLC starts the measurement for max. one unit at the same time.

Signal output: 4-20mA

Max. 500 Ohms (active, isolated) Linearity ±0.1 mA

Signal output: Relais

Optional: 1x Relais SPST and 1x Relais DPDT max. 250 V AC, 2 A, 500 VA non inductive

Communication: Modbus RTU

Physical layer: RS 485 and Ground, isolated
Mode: RTU, Type: Slave
Device number range: 1 - 247 (selectable in menu), Baudrate: 1,200 to 57,600 Baud, Data bits: 8, Stop Bits: 1
Parity: None
Multi-drop configuration possible. Factory setting of address is 31. Each unit which is connected to the network must be set to an individual address.
Supported commands
Reading: All diagnostics and parameters using command 03_{HEX}: Read Holding Register
Writing: All parameters using command 06_{HEX}: Write Single Register (not supported is command 10_{HEX}: Write Multiple Register).

Accuracy of measurement

Output	Measuring range	Accuracy Rope version	Accuracy Tape version
Counting pulse	< 10 m (33 ft)	2 pulses	1 pulse
	< 20 m (66 ft)	3 pulses	2 pulses
	< 30 m (100 ft)	5 pulses	3 pulses
4-20 mA/ Modbus RTU	< 30 m (100 ft)	1.5% of measured length	1% of measured length

Display

LCD

Indication light

Status by built in LED: Power On, Relay, Failure

Memory

Non-volatile (no backup battery required) > 10 years data retention

Connection terminals

0.14 .. 2.5 mm² (AWG 26 .. 14)
0.14 .. 1.5 mm² (AWG 26 .. 16) Modbus terminals

Cable entry

According to selection:
Screwed cable gland 1x M25 x 1.5 + 1x M20 x 1.5
Blind plug 1x M25 x 1.5 + 1x M20 x 1.5
or
Conduit ANSI B1.20.1 1x NPT ¾"+ 1x NPT ½"
Blind plug 1x NPT ¾"+ 1x NPT ½"

Clamping range (diameter) of the factory provided cable glands:
M20 x 1.5: 6 .. 12 mm (0.24 .. 0.47")
M25 x 1.5: 8 .. 17 mm (0.31 .. 0.67")

Technical data

Extension cables for Modbus	Use common recommended cables		
Isolation	Power supply to all other outputs/ inputs:	AC version 2,210 Vrms DC version: 1,000 VDC	
	Relay to relay: 2,210 Vrms		
Protection class	I		
Overvoltage category	II		
Pollution degree	2 (inside housing)		

Mechanical data

Ingress protection	IP66, Type 4		
Process connection	Threads:	R 1½" EN 10226 tapered, NPT 1½" ANSI B1.20.1 tapered (Adapter for NPT 3" available)	
	Flanges:	DN100 PN16 EN 1092-1 (unit fits to this flange) 2" or 3" or 4" 150lbs ANSI B16.5 (unit fits to this flange)	
	Aiming flange:	To be mounted directly on a flat silo roof	
Colour	Housing Lid	RAL 5010 (gentian blue) RAL 9006 (aluminium silver)	
Material	See detail specifications on page 4-6		
Measuring range	Max. 15 m (50 ft) or max. 30 m (100 ft)		
Measuring speed	Sensor weight speed in average: ca. 0.2 m/s (0.6 ft/sec)		
Sound level	max. 50 dBA		
Weight	With thread: ca. 9 kg (20 lbs) With flange: ca. 11 kg (24 lbs)		
Deviation of vertical mounting	max. 2°		

Operating conditions

Process overpressure	-0.2 .. +0.2 bar (-3.0 .. +3.0 psi)		
Process temperature	-40°C .. +80°C (-40 .. +176°F)		
Ambient temperature	-20°C .. +60°C (-4 .. +140°F)		
	-40°C .. +60°C (-40 .. +140°F)	CE, UKCA, FM General Purpose	with internal heater
	-40°C .. +60°C (-40 .. +140°F)	ATEX, UKEX, FM Class II	on request possible
Ventilation	Ventilation is not required		
Min. powder density	>300 g/l (18 lb/ft³) >40 g/l (1.4 lb/ft³) with spider >20 g/l (1.2 lb/ft³) with folding cover The data is a guideline and is valid for material which has settled after filling. During the filling the bulk density can change (e. g. for fluidised material).		

Technical data

Minimum time between measuring starts	measuring height 5 m (16 ft)-> 3 min measuring height 10 m (33 ft) -> 6 min measuring height 20 m (66 ft) -> 12 min measuring height 30 m (98 ft) -> 18 min
Rope/tape operating time	see page 28
Max. permitted tractive force	ca. 800 N
Relative humidity	0 - 100%, suitable for outdoor
Altitude	max. 2,000 m (6,562 ft)
Expected product lifetime	Following parameters have a negative influence on the expected product lifetime: High ambient- and process temperature, corrosive environment, high vibration, high flow rate of abrassive bulk material passing the sensor element, high amount of measurement cycles.

Transport and Storage

Transport	Observe the instructions as stated on the transport packaging, otherwise the products may get damaged. Transport temperature: -40 .. +80°C (-40 .. +176°F) Transport humidity: 20 ..85% Transport incoming inspections must be caried out to check for possible transport damage.
Storage	Products must be stored at a dry and clean place. They must be protected from influence of corrosive environment, vibration and exposure to direct sunlight. Storage temperature: -40 .. +80°C (-40 .. +176°F) Storage humidity: 20 .. 85%

Approvals

Hazardous Locations*	ATEX II 1/2D Ex ta/tb IIIC T! Da/Db UKEX II 1/2D Ex ta/tb IIIC T! Da/Db FM Class. II, III Div.1 Gr. E-G TR-CU Ex ta/tb IIIC T117°C…T150°C Da/Db X
Ordinary Locations *	CE EN 61010-1 UKCA General purpose FM TR-CU
EMC	EN 61326 - A1 (industrial standard)
RoHS conform	According to directive 2011/65/EU

* Depending on selected version in selection list

Mounting

General Safety Instructions

Process pressure	Improper installation may result in loss of process pressure.
Chemical resistance against the medium	Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.
Mounting location	The right mounting place is significant for a proper function. Observe mounting instructions.
Vibrations	Avoid mounting in applications with strong vibration. Use rubber mounts for absorption in case of light vibrations.

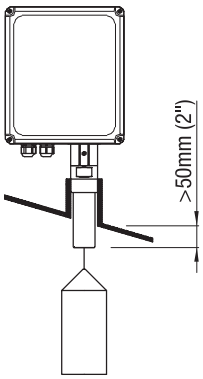
Additional Safety Instructions for Hazardous Locations

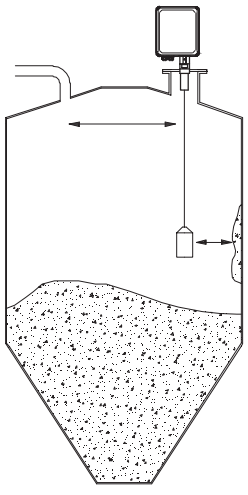
Installation regulations	For devices to be used in Hazardous Locations the respective valid installation regulations must be observed.
Sparks	The installation has to be done in a way, that mechanical friction or impact does not cause sparks between the aluminium enclosure and steel.

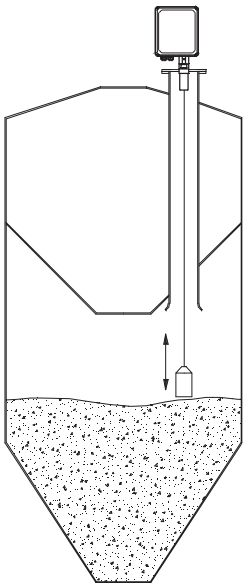
Mounting instructions

Mounting position

- The unit is mounted vertically on the silo. Max. deviation is 2°.
- There must be at least 200 mm (7.87“) space for the sensor weight to move down in case of a full silo. Observe the bottom of the sensor weight at "upper stop position" (dimensions see page 4). With overfilling the rope/tape may break.
- The socket pipe of the unit must protude at least 50 mm (2") into the silo. A version with longer socket pipe is available.
- Proper movement of the sensor weight must be guaranteed, even if the sensor weight oscillates. Observe enough distance to the silo wall, stanchions and built-in fittings.
- For measurements through a long pipe in a double chamber silo we recommend the use of NB 4200 (tape version).







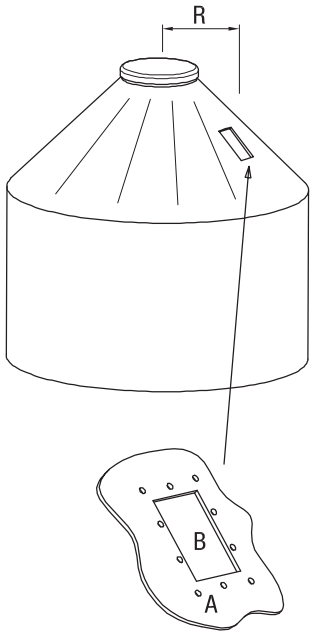
Measurement during filling of the silo	Filling of the silo while measuring might cover the sensor weight with bulk material. Measurements during filling are possible, if there is enough distance to the infeed, so that no material can fall on the sensor weight.
Sealing	• A rubber seal must be used to tighten the thread or flange. • Close both lids of the enclosure tightly.

Mounting with aiming flange

Mounting with aiming flange

The aiming flange allows to mount the unit directly on the roof of a silo without the need of a socket.

When working on a silo roof, take precautions according to the valid safety regulations to avoid, that persons can fall down.



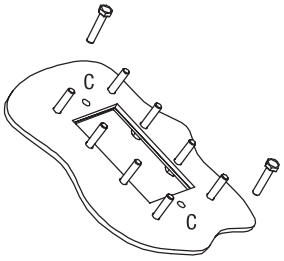
1. Find the right mounting position (see page before).
To ensure a proper sealing of the rubber on a shaped silo roof, the distance "R" from the center of the silo to the mounting position must be >500 mm (19.7").

2. Mark ten drilling holes "A" and the cutaway "B" with a marker on the silo roof. Use the attached template.

While doing the next steps 3. and 4., ensure that swarfs or any parts can not fall into the silo.

3. Drill ten holes "A" with a 9.5 mm driller.
Use a cut-off grinder to grind out the shape "B". Before doing this, drill a bigger hole in the middle of "B", where you can hold the cutted plate to avoid that it falls into the silo when it gets loose.

4. Insert the clamping plate from inside the silo and fix with two screws "C"

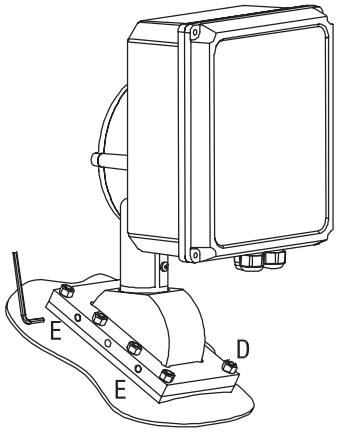


5. Apply the rubber sealing from outside over the shafts. Take care that the shaped side faces to the (shaped) silo roof and the knobs faces upwards..

If the sealing is fixed in the wrong direction, the sealing may not be water and dust tight.

6. Mount the NB 4000 unit.
Fix equally and crosswise all the eight nuts "D", first with a low torque, increase up to a torque of 2 Nm

7. Adjust the unit to a vertical position (deviation of max. 2°) by using a water level. Fix two screws "E" with a torque of 15 Nm.



Electrical installation

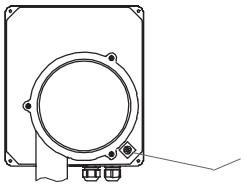
General Safety Instructions

Handling	In case of improper handling or handling malpractice, the electric safety of the device cannot be guaranteed.
Installation regulations	The local regulations must be observed.
Fuse	Use a fuse as stated in the connection diagrams.
RCCB protection	In case of a fault, the supply voltage must be automatically switched off by a RCCB protection switch to protect against indirect contact with dangerous voltages.
Power supply switch	A voltage disconnection switch must be provided near the device.
Wiring diagram	The electrical connections are made in accordance with the wiring diagram.
Supply voltage	Compare the supply voltage applied with the specifications given on the name plate before switching the device on.
Cable gland	The screwed cable gland and closing element must have following specifications: Ingress protection IP66, temperature range from -40°C to +70°C, certified depending on the country where the unit is installed, pull relief. Make sure that the screwed cable gland safely seals the cable and that it is tight (danger of water intrusion). Cable glands that are not used have to be sealed with a blanking element. The diameter of the field wiring cable has to match to the clamping range of the used cable gland.
Conduit system	In case of using a conduit system (with NPT thread) instead of a cable gland the regulations of the country, where the unit is installed, must be observed. The conduit must have a tapered thread either NPT ½“ or NPT ¾” in accordance with the unit and ANSI B 1.20.1. Not used inlets must be closed tight with a metal blanking element.
Field wiring cables	• The diameter has to match to the clamping range of the used cable gland. • The cross section has to match with the clamping range of the connection terminals and consider the max. current. • All field wirings must have insulation suitable for at least 250V AC. • The temperature rating must be at least 90°C (194°F). • If higher immunity interferences as specified in the stated EMC standards are present (see chapter approval), a shielded cable is required, otherwise an unshielded instrumentation cable is satisfactory.
Guiding the cables in the terminal box	Cut the field wiring cables to appropriate length to fit properly into the terminal box.
Relay protection	Provide protection for relay contacts to protect the device against inductive load surges.
Protection against static charging	The housing of the unit must be grounded to avoid static charging of the unit. This is particularly important for applications with pneumatic conveying and non-metallic containers.

Electrical installation

! Additional Safety Instructions for Hazardous Locations

External equipotential bonding terminal

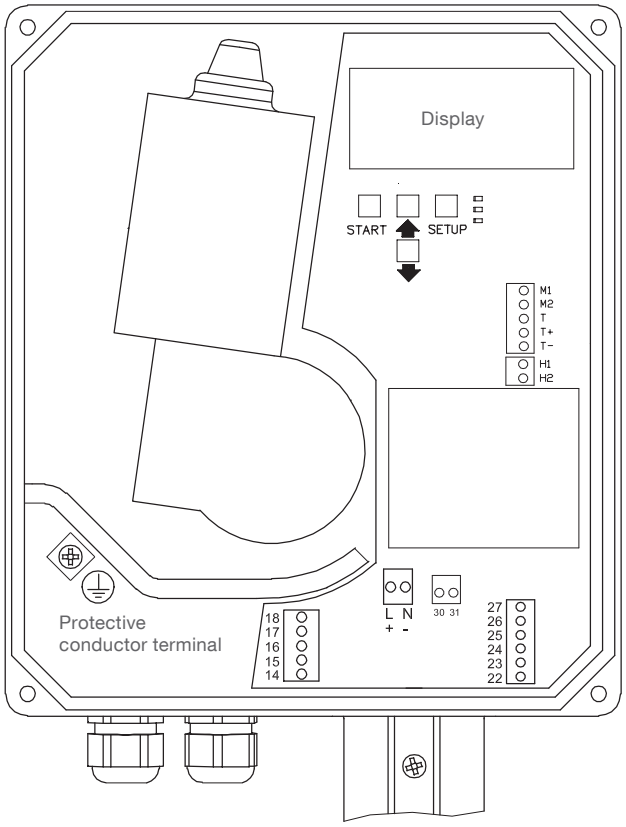


Field wiring	A strain relief must be provided for the field wiring cables, if the device is installed with the factory provided cable glands.
Cable glands for Hazardous Locations	The used entry devices and blanking elements must have an adequate type approval and a temperature range as defined in the technical data of the unit. In addition they shall be suitable for the conditions and correctly installed. Where available the provided original parts of the manufacturer must be used.
Conduit system for Hazardous Locations	In addition the regulations of the country must be observed. The used flameproof seals and blanking elements must have an adequate type approval and a temperature range as defined in the technical data of the unit. In addition they shall be suitable for the conditions and correctly installed. Where available the provided original parts of the manufacturer must be used.
Comissioning/ opening the lid	Comissioning only, when there are no dust deposits or swirls present.

Electrical installation

Version 4-20 mA

Terminal location



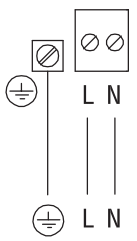
Internal terminals for motor and heater

Terminals for:
- Power supply
- Signal input:
  Start of measurement
  Measurement interruption
- Signal output:
  4-20 mA
  Relais

Note: Terminal 30 and 31 not used

Power supply

AC version

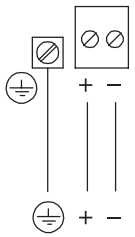


0.75 .. 2.5 mm² (AWG 18 .. 13)

AC or DC supply depending on ordered version

230 V or 115 V 50 - 60 Hz

DC version



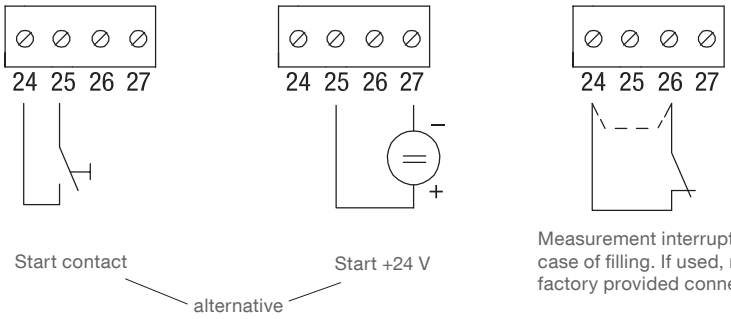
1.5 .. 2.5 mm² (AWG 15 .. 13)

20 .. 28 V DC

Signal input:

Start of measurement

Measurement interruption



0.14 .. 2.5 mm² (AWG 26 .. 14)

Start contact

alternative

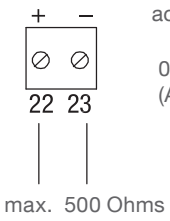
Start +24 V

Measurement interruption in case of filling. If used, remove factory provided connection.

Signal description:
See page 18

Electrical installation

Signal output:
4-20 mA



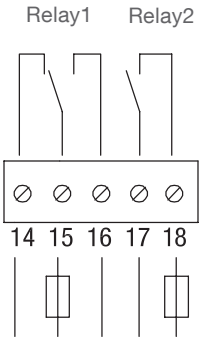
active, isolated *

0.14 .. 2.5 mm² (AWG 26 .. 14)

Signal description:
See page 18

* CAUTION:
If connecting to a PLC with isolated (floating) 4-20 mA input, the "-" line must be connected to ground of the PLC. See user manual of the PLC.

Signal output:
Relais
(optional)



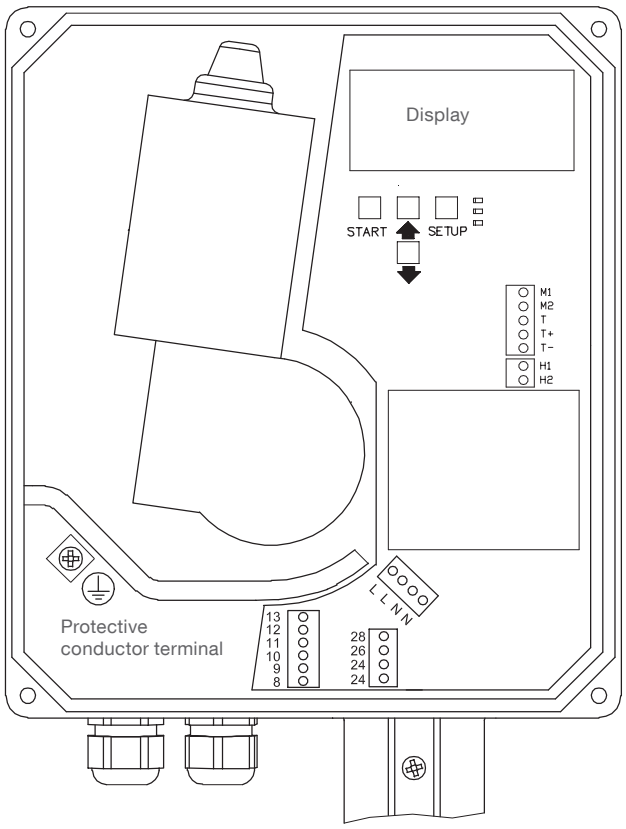
0.14 .. 2.5 mm² (AWG 26 .. 14)

Fuse: max. 2 A, 250 V, HBC, fast or slow
max. 250 V AC, 2 A, 500 VA, non inductive

Signal description:
See page 18

Version Modbus

Terminal location

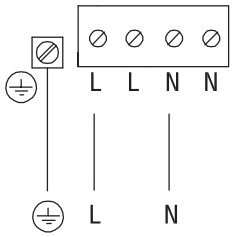


Internal terminals for motor and heater

Terminals for:
- Power supply
- Signal input:
  Measurement interruption
- Signal output:
  Modbus

Electrical installation

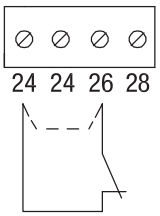
Power supply



0.75 .. 2.5 mm² (AWG 18 .. 13)

230V or 115V 50 - 60Hz

Signal input: Measurement interruption

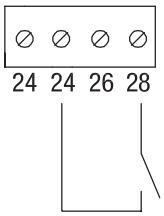


0.14 .. 2.5 mm² (AWG 26 .. 14)

Measurement interruption in case of filling. If used, remove factory provided connection.

Signal description: See page 18

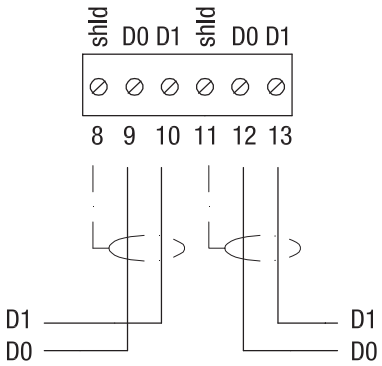
Signal input: Full detector



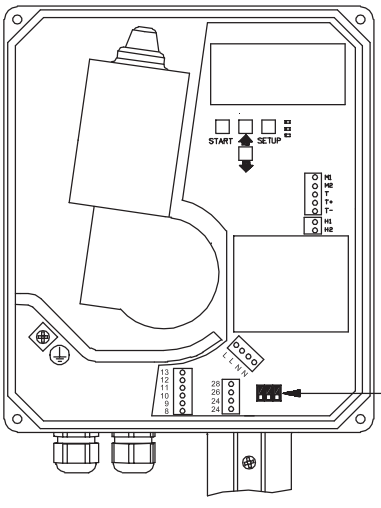
0.14 .. 2.5 mm² (AWG 26 .. 14)

Signal description: See page 18

Modbus network



Wiring according to Modbus standards



Setting Biasing and Termination Resistor

For use of NB 4000 units in a external Modbus network, it is possible to set Biasing and Termination Resistor on each unit as required.

Biasing	OFF*	OFF	ON	ON
Termination Resistor	OFF*	ON	OFF	ON

*factory provided

DIP Switch position:

Top view  Side view

Signal overview

Signal input/ output

Signal input:
Start of measurement
Measurement interruption

Start of measurement
• Floating contact (terminal 24, 25) or
• 24 V DC voltage (terminal 25, 27), current consumption approx. 25 mA, observe the polarity.

Duration of starting signal: 0.7 to 5 sec.
The contact must be closed or the 24 V signal must be present to start.

Measurement interruption
Used to avoid a measurement in case of filling and to interrupt a running measurement when filling starts.
When the terminal 24 und 26 are opened, the sensor weight returns to the upper stop position.
If required, remove factory provided wire between terminal 24 and 26 and connect to the filling coupling.
The contact must be closed to enable a measurement.

Signal input:
Full detector

Enables to implement a full detector signal in the Modbus.
When the signal is present (terminal 24 - 28 closed) the yellow LED next to the display in on.

Signal output:
4-20 mA

Programmable to indicate a level or a volume signal. The output is updated, when the sensor weight touches the surface of the bulk good. It stays until the next measurement is done.

Signal output:
Relais
(optional)

Relais can be setted as shown in the following table:

	Relay 1	Relay 2
Factory settings	Failure	Upper stop position
Programmable	Reset pulse	Counting pulse

Relais set to "Upper stop position/ Failure"

Relay 1: indicates a Failure (see also diagnostics "Failure" on page 29)
Relay 2: indicates "Upper stop position". The signal allows the user to determine whether the measurement has come to its end. In this case the sensor weight is in its upper stop position, relay contacts are closed.

	Relay 1	Relay 2
	Failure	Upper stop position
Present		
Not present		

Signal overview

Relais set to Counting/ Reset pulse:

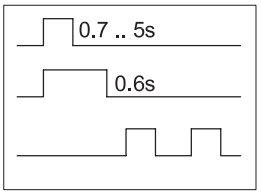
The counting pulse output is used to connect an external digital counter or a PLC with counting input.

Reset pulse (terminal 15 and 16, Relay 1):
After start of measurement, a reset pulse is given. It is used to reset the connected evaluation device (counter/ PLC, ...).

Counting pulse (terminal 17 and 18, Relay 2):
The counting pulse communicates the measured value to the connected evaluation device. During the downward movement of the sensor weight, this pulse is generated according to the following table:

Note: If the used digital counter or PLC requires a common ground for reset and counting pulse, the terminals 15 and 17 can be connected together.

Timing



Start

Reset pulse

Counting pulse
Pulse length 10 cm (1/3 ft)/
ON= 0.13 sec., OFF=0.13 .. 0.3 sec.

LED status

LED		Status
LEDs next to display	Green is on	Power On
	Red is on	Failure
	Red is blinking	Maintenance
	Yellow is on	Full detector is present (only Modbus version)
LEDs next to relais terminals	Yellow is on	Relay is energised

Diagnostics signals

Failure

Result is a non valid measurement.
Red LED is on. Relay indicates Failure (if selected).
The signal indicates critical situations. Evaluation can help to avoid losing the sensor weight inside the silo.

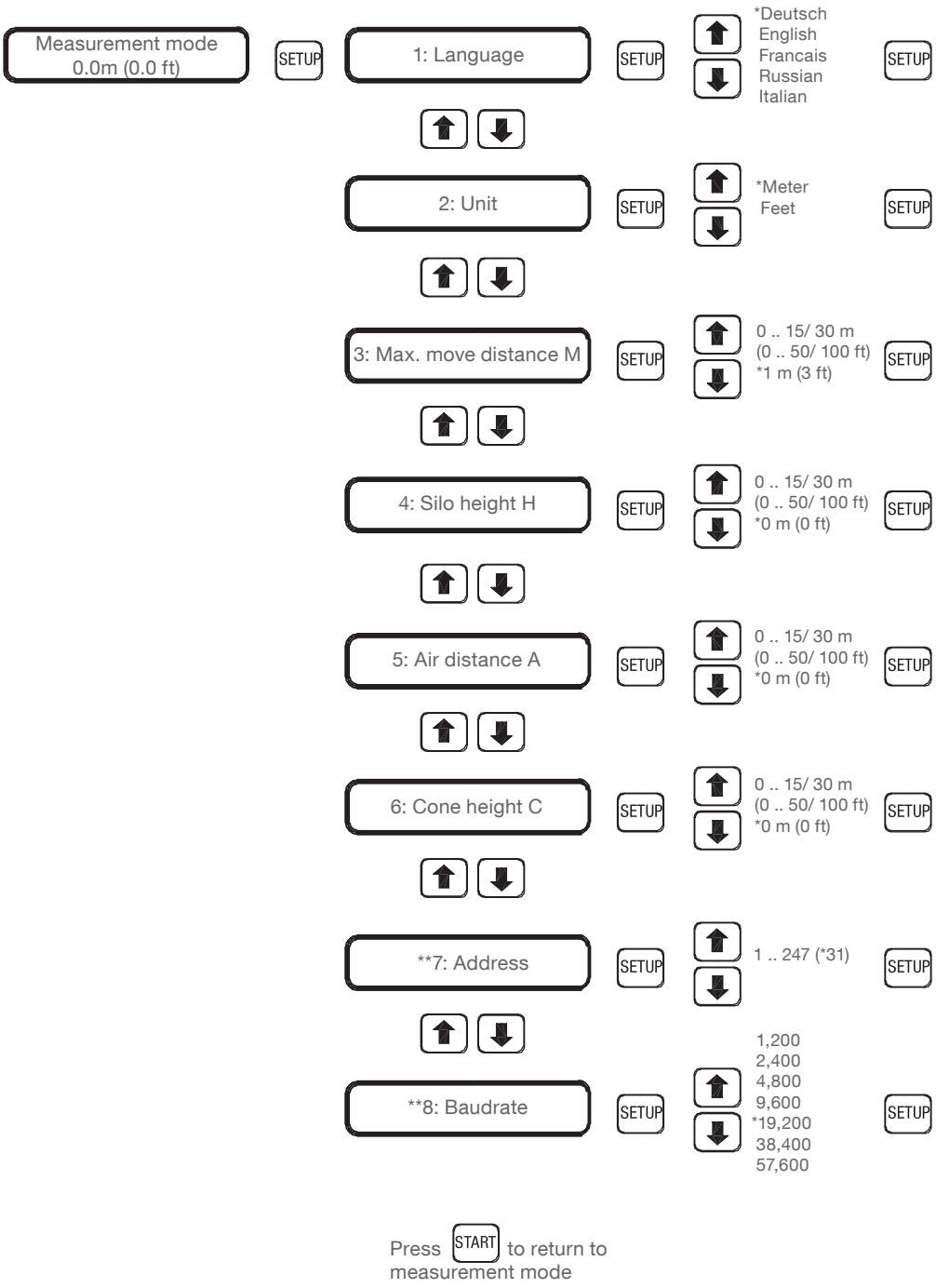
If Failure is indicated, the unit must be checked on site.

Failure codes description see page 29.

Programming

Quickset menu

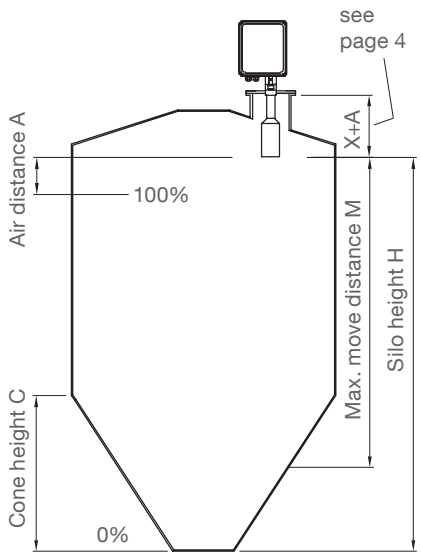
The Quickset menu is used for fast and easy start-up of the system.
If the unit is working in normal operation (measurement mode), the SETUP button brings up the Quickset menu.



* Factory-provided
** Present only with Modbus version

Programming

Max. move distance M	Ensures that the weight does not enter into the silo outlet.
(1) **Silo height H**	Definition of 0% level output. Note: If the maximum move distance M is smaller than the silo height H, the measured value will always be more than 0%.
(1) (2) **Air distance A**	Definition of 100% level output.
(1) **Cone height C**	Enables to set the current output as volume. C =0 Current output indicates material level C >0 Current output indicates material volume
Address	Selects the used communication address for Modbus.
Baudrate	Selects the used baudrate for Modbus.



(1) These values are not relevant, if the "Counting pulse output" is used.
(2) If needed the 100% level can be set higher than the level of the sensor weight. See advanced menue, item "Inverted air distance".

Programming buttons

SETUP	Continues with next adjustment item
START	Continues with measurement display after parameter adjustment Starts measurement Cancels a Failure message (when pressed 2 sec together with SETUP button)
↑	Increases the value to be adjusted
↓	Decreases the value to be adjusted

Runtime messages

During measurement mode, following runtime indications are given:

*	Upper stop position is reached
↓ ↑	Motor is moving the sensor weight downwards resp. upwards (fast mode)
←	Motor is moving in slow mode (shortly after motor start and before Upper stop position is reached)
Blocked 24 - 26 open	Measurement interruption is active (terminal 24 - 26 not connected, see page 15)

Note:
Pressing the ARROW DOWN button in measurement mode brings up more service information (not described in this manual)

Factory settings

To reset all programmed parameters to factory setting (default values), press the buttons ARROW UP, ARROW DOWN and SETUP together for approx. 10 seconds.

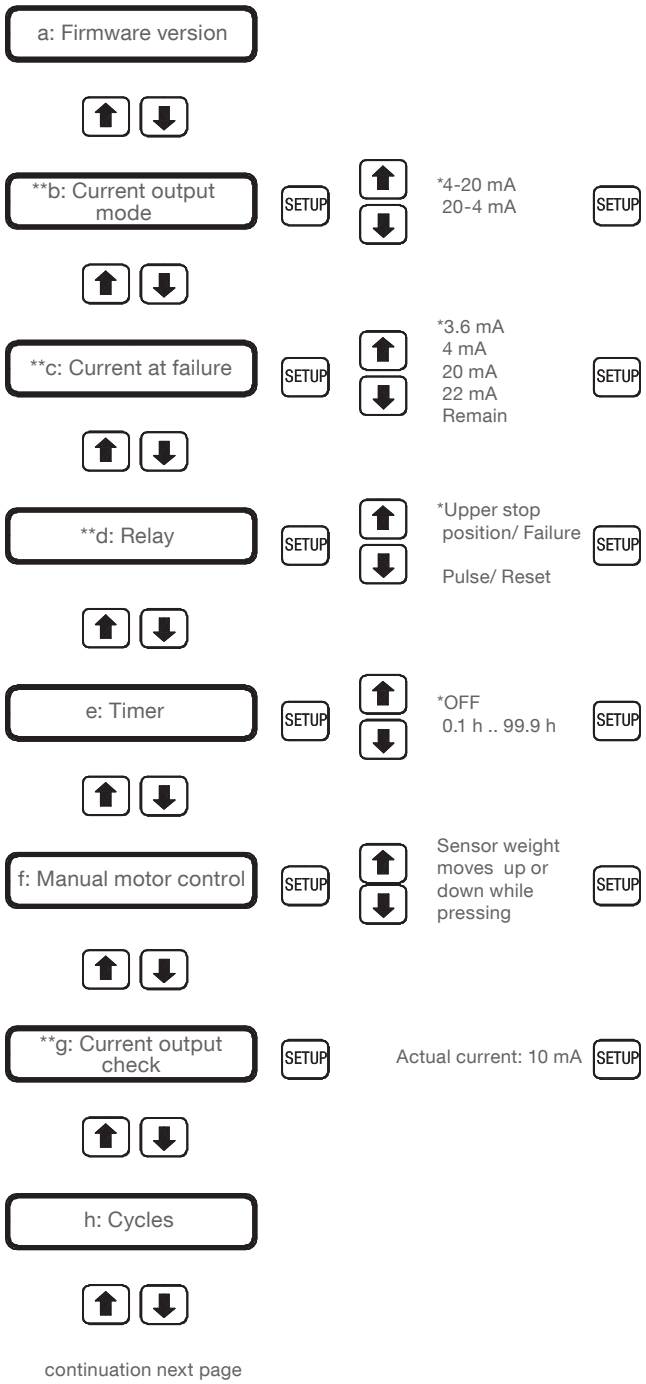
Programming

Advanced menu

(use only if necessary)

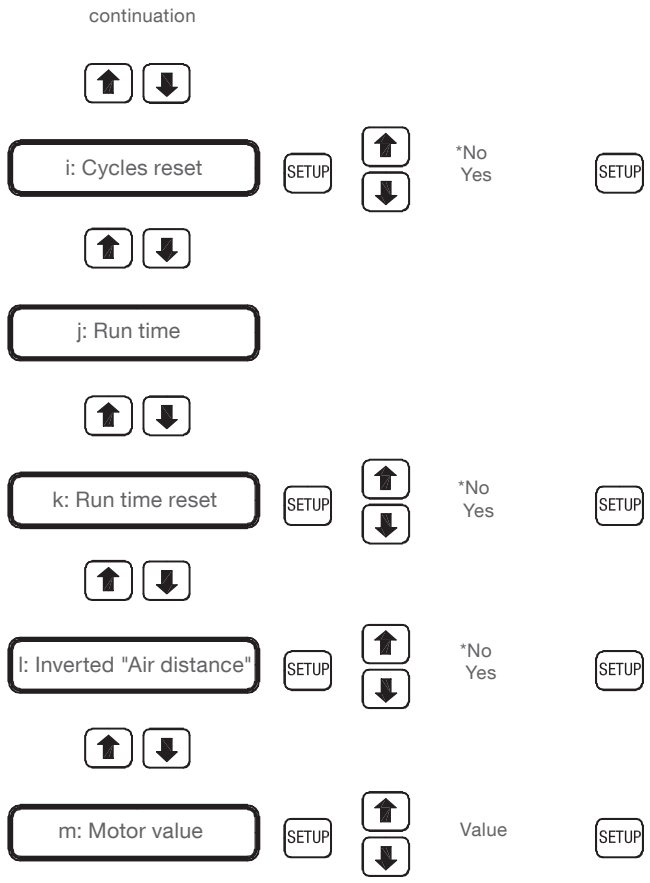
With the advanced menue it is possible to set the outputs and to display the actual state of the unit.

Entering the advanced menue:
If the unit is working in normal operation (measurement mode), press both "arrow" buttons together for approx. 2 seconds.



continuation next page

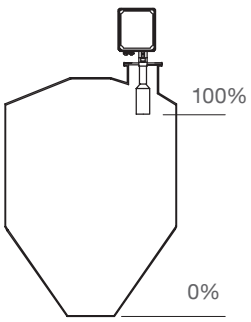
Programming



* Factory-provided
** Present only with 4-20 mA version

Firmware version States the firmware version of the unit.

Current output mode



Setting	Current output at level	
	0%	100%
4-20 mA	4 mA	20 mA
20-4 mA	20 mA	4 mA

Current at failure In case of failure the current output shows the adjusted value.

Relay Selects, if Relais shall indicate "Upper stop position " and "Failure" or work as Counting/ Reset pulse output
Details see Signal Overview on page 18/ 19

Programming

Timer

Automatic start of measurement with timer function.

The timing interval between two measurements can be adjusted between 0.1 hour (6 minutes) and 99.9 hours. Position „off“ causes no automatic measurement start.

The timer will be reset after finishing a measurement or after connecting the terminals 24 and 26 (measurement interruption).

If the timer is set, a measurement will start immediately after power on.

For automatic measurement at a predetermined time of day, an external start unit connected to terminals 24/ 25/ 27 is necessary.

To avoid needless wear and tear, the unit should not be started more often than necessary.

Manual motor control

The motor moves the sensor weight upwards while the "ARROW UP" button is beeing pushed.
The motor moves the sensor weight downwards while the "ARROW DOWN" button is beeing pushed.

Note: If the sensor weight is in the upper stop position or touching the bulk material surface or after the max. move distance, the motor is automatically stopped.

CAUTION: Avoid the sensor weight reaching the outlet position of the silo.

Current output check

Enables to check, if the current output is working proper. The current output is forced to 10 mA. This can be evaluated by an external connected multimeter.

Cycles

Indicates how many measurement cycles have been performed up to now.

Cycles reset

Can be done after a rope/tape change, if the service interval message F16 was not yet present. It sets the internal counter to zero to have the full amount of measurement cycles until the next service interval message will appear.

Note: After a F16 message is reset with the "START" + "RESET" button, the rope/tape counter is automatically set to zero.

Run time

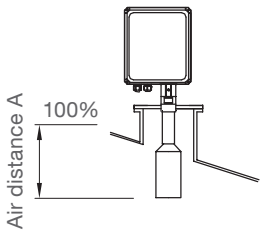
Indicates, how long the motor has been runnning up to now (in hours).

Run time reset

Can be done after a motor change, if the service interval message F17 was not yet present. It sets the internal counter to zero to have the full amount of motor run time until the next service interval message will appear.

Note: After a F17 message is reset with the "START" + "RESET" button, the motor counter is automatically set to zero.

Inverted "Air Distance"



Enables to set the 100% reference of the 4-20 mA output to a level which is over the level of the sensor weight.

To do this the value must be set to "Yes".
The "Air distance A", which is adjusted in the Quickset Menue (see page 20/ 21), is now over the level of the sensor weight.
The display in the Quickset menue indicates this with a minus as follows: Air distance: -1.5 m

Note: In this case the output will never reach 100%.

Motor value

Internal value only to be used in case of replacement of the motor (see instruction manual of motor replacement).

Programming

Modbus Register

The following registers describe the communication via Modbus.

CAUTION

Writing to the registers different from what is stated will cause a miss function of the unit

Register address	Register name	Register description	Register use	Default value
Setup				
40001	M_LANGUAGE	Language on the menu DEUTSCH 0 ENGLISH 1 FRANCAIS 2 RUSSIAN 3 ITALIAN 4	R/W	0
40002	M_UNIT	Unit used for distance visualisation METER 0 FEET 1	R/W	0
40003	M_MAX_MOVE_DIST	Max. move distance mm	R/W	1000
40004	M_SILO_HEIGHT	Silo height mm	R/W	0
40005	M_AIR_DIST	Air distance mm	R/W	0
40006	M_CONE_HEIGHT	Cone height mm	R/W	0
40022	M_TIMER	Timer interval (for automatic start of measurements) , in 1/100 hours (Off = 0) Notes: 1/100 hour = 36 sec. Minimum time: 0.10 hours (value =10)	R/W	0
Measurement				
40051	M_START	Start of a measurement Start 1	W	
40046	M_DISTANCE	Actual measured distance, in mm Note: After the unit has finished the measurement, the M_STATUS register states “Ready, measurement valid” (the Modbus master must read the M_STATUS register). Then the data on the register M_DISTANCE is valid.	R	
40055	M_VOLUME	Actual measured volume (considering the programmed cone height, air distance and silo height), in %. See note on register M_DISTANCE	R	
40052	M_INHIBIT	Block command (allows to block the unit, so that no measurement can be started) No block 0 Block 1 The unit will remain blocked as long as the register has the value “Block”. Note: Unit states the blocked status through the M_ STATUS register.	W	0
40045	M_STATUS	States the functional status of the unit Blocked 1 Ready, measurement not valid 2 Ready, measurement valid 6 Busy 8 Failure present 16 Temporary not ready 32 Explanation: Blocked: No measurement can be started. Ready: A new measurement can be started. Measurement valid: Indicates a valid measurement. Measurement not valid: Indicates a maintenance condition (details see M_MAINTENANCE)	R	
40057	M_FULL_DETECTOR	States the full detector input status Contact open (24 - 28) 0 Contact close (24 - 28) 1	R	

Programming

Diagnostics

		Total measured cycles up to now = “M_TOTAL_CYCLES” + 65536 * “M_TOTAL_CYCLES_H”		
40026	M_TOTAL_CYCLES	Total measured cycles up to now, in cycles	R	
40044	M_TOTAL_CYCLES_H	Total measured cycles up to now, in 65536 cycles	R	
		Measurement cycles left until failure message F16 will appear = “M_CYCLES_LEFT” + 65536 * “M_CYCLES_LEFT_H”		
40028	M_CYCLES_LEFT	Measurement cycles left until F16 will appear, in cycles	R	
40050	M_CYCLES_LEFT_H	Measurement cycles left until F16 will appear, in 65536 cycles	R	
		Total motor run time up to now = “M_TOTAL_RUN_TIME” hours + “M_TOTAL_RUN_TIME_S” seconds		
40029	M_TOTAL_RUN_TIME	Total motor run time up to now, in hours	R	
40048	M_TOTAL_RUN_ TIME_S	Total motor run time up to now, in seconds	R	
40031	M_RUN_TIME_LEFT	Motor run time left until F17 will appear, in hours	R	
40053	M_FAILURE	Failure status of the unit (stated on a bit basis) F10 – Motor or motor-driver-electronic defect b0 = 1 F11 – Sensor weight is buried b1 = 1 F12 – Rope/tape broken b2 = 1 F13 – Spring broken b3 = 1 F16 – Service interval rope/tape b5 = 1 F17 – Service interval motor b6 = 1	R	
40054	M_MAINTENANCE	Maintenance status of the unit (stated on a bit basis) M11 – Sensor weight blocked inupper position b1 = 1	R	

Communication

40035	M_ADDRESS	Device address 1 to 247	R/W	31
40036	M_BAUDRATE	Communication speed 1,200 baud 0 2,400 baud 1 4,800 baud 2 9,600 baud 3 19,200 baud 4 38,400 baud 5 57,600 baud 6	R/W	4

R/W: read/ write R: read only W: write only

Maintenance

General items

Opening the lid (cover)

Before opening the lid for maintenance reasons observe following items:
- Do not remove the lid while circuits are alive.
- No dust deposits or whirlings are present.
- No rain can enter into the housing

Frequent check of the unit

To ensure durable safety in hazardous locations and with electrical safety, following items must be checked frequently depending on the application:
- Mechanical damage or corrosion of any components (housing side and sensor side) and of the field wiring cables.
- Thight sealing of the process connection, cable glands and enclosure lid.
- Properly connected external PE cable (if present).

Cleaning

If cleaning is required by the application, following must be observed:

- Cleaning agent must comply with the materials of the unit (chemical resistance). Mainly the lid sealing, cable gland and the surface of the unit must be considered.

The cleaning process must be done in a way, that:
- The cleaning agent cannot enter into the unit through the lid sealing or cable gland.
- No mechanical damage of the lid sealing, cable gland or other parts can happen.

A possible accumulation of dust on the unit does not increase the maximum surface temperature and must therefore not be removed for purposes of maintaining the surface temperature in hazardous locations.

Production date

The production date can be traced by the serial number on the typeplate. Please contact the manufacturer or your local distrubutor.

Spare parts

All available spare parts are stated in the selection list

Maintenance

Rope/ Tape lifetime

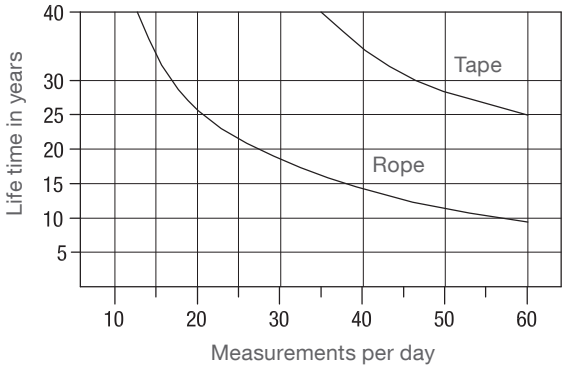
The expected life time (measurement cycles) for the rope/ tape is:
Rope version: approx. 200,000
Tape version: approx. 500,000

Note: These values refer to lifetime tests under the following conditions:
No excessive material influence. The sensor weight meets an inclined surface, so that an oscillating movement of the sensor weight during upwards movement is caused.

The failure message is displayed at 90% of the expected lifetime to provide some safety. For further information see message F16.

See figure on right hand for the operating time depending on the measurement cycles per day.

For applications with adverse conditions it is recommended to change the rope/tape more frequently.

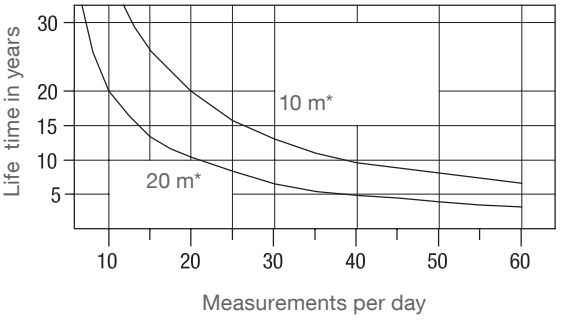


Motor lifetime

The expected life time (run time) for the motor is approx. 3,500 hours.

The failure message is displayed at 90% of the expected lifetime to consider some safety. For further informations see message F17.

See figure on right hand for the operating time depending on the measurement cycles per day.



*average measurement distance

Maintenance

Diagnostics Failure:

Result is an invalid measurement.
Red LED is on. Relay 1 indicates Failure (if selected).
The signal indicates critical situations. Evaluating the signal can help to avoid loosing the sensor weight inside the silo.
If Failure is indicated, the unit must be checked on site.

Failure code	Description	Indication	Performance of the device	Solution
F10	a) Rope/ tape too short or rope jammed in the rope roller. b) Motor or motor-driver-electronic defect.	Motor does not rotate when it is actuated.	If possible, the sensor weight will be moved up to the "Upper stop position".	a) Check rope/ tape. b) Check motor connection. Motor or electronic change.
F11	Sensor weight is buried or jammed.	Difference of distance between down and up movement too big.	Motor moves 4 seconds upwards, then waits 10 seconds. After that motor moves shortly downwards and then upwards again. If the sensor weight is still jammed, this cycle is repeated 5 times. After that the cycle goes on with a delaytime of one hour.	Release the sensor weight. Make sure, that the sensor weight can move freely.
F12	Rope/ tape broken.	Motor is running but the upper stop position is not reached.	Motor moves upwards. If after a certain time the upper stop position is not reached, the motor stops.	Repair of rope/ tape break. Check, if rope/ tape maintenance was properly done. Check possibility of buried sensor weight.
F13	Spring broken.	Motor moves downwards and upper stop position is sensed	Motor stop.	Check internal spring.
F15	Not enough current available from DC power supply (DC version only).	Supply voltage drops during function.	Sensor weight is moved to the upper stop position.	Enable enough supply current according to the technical data specification.
F16	Service interval: rope/ tape.	The amount of measurement cycles is 90% of the rope/ tape lifetime.	The measurement cannot be restarted.	Change rope- or tape roller (do not just cut the rope or tape*).
F17	Service interval: motor.	The actual run time is 90% of the motor lifetime.	The measurement cannot be restarted.	Change motor.

By pushing the START and SETUP button together for 2 seconds, the failure message shown on the display can be reset.

* Cutting of the rope or tape shall not be done. This leads to an inaccurate measurement result, because it changes the diameter of the rope- or tape roller and therefore leads to a different tape length related to the number of turns of the tape roller.

CAUTION
Resetting F16 or F17 without changing the rope/tape respective the motor will cause material damage by a broken rope/ tape.
Before removing the rope/ tape roller, remove the unit from the silo to avoid, that the sensor weight can fall into the silo.

Diagnostics - Maintenance:

Red LED is blinking.
The following message is indicated on the display, but will NOT lead to a failure state and is not indicated by the failure relais or the 4-20 mA output:

Code	Description	Performance of the device	Solution
M11	Sensor weight blocked in "upper stop position" or block distance of sensor weight to short	The unit tries to start 5 times. If the sensor weight is not released during this time, the message is shown. If after a new measurement start the sensor weight is released, the message will automatically disappear.	Release sensor weight. Ensure, that the min. moving distance (block distance) is >200 mm (7.87“)

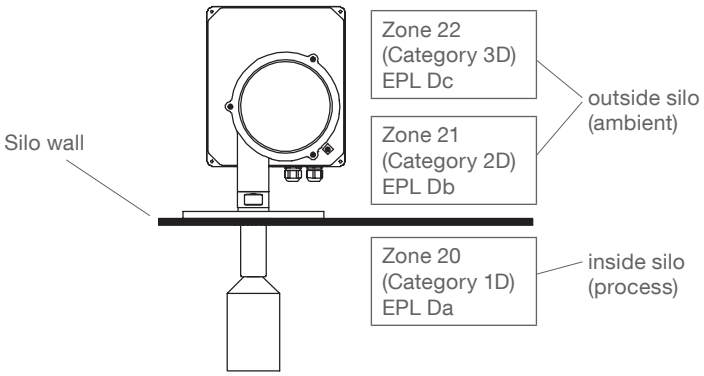
Notes for use in Hazardous Locations

Zone classification

Category	useable in zone	Equipement Protection Level (EPL)
1 D	20, 21, 22	Da
2 D	21, 22	Db
3 D *	22	Dc

* in case of conductive dust, additional requirements for installation are necessary.

Permitted zones (categories) for mounting in partition wall



General notes

Marking

Devices with Ex-approval are marked on the type plate.

Process pressure

Devices with Ex Approval are approved for atmospheric pressure.
A detailed explanation is given below for ATEX and applies analogously for other Ex approvals:
The scope of the ATEX directive is generally limited to atmospheric pressure, see ATEX directive 2014_34_EU Chapter 1 Art.2 (4).
Atmospheric pressure is defined as absolute pressure 0.8bar to 1.1bar, see ATEX guideline §50 and IEC 60079-0 chapter 1 Scope.
The technical background is that an explosive atmosphere which is compressed (overpressure) or released (underpressure) can exhibit different explosion behaviour than under atmospheric conditions.
The standards for the types of protection against explosion (IEC 60079 series), on which a type approval according to the ATEX directive is based, are designed for atmospheric conditions and do not automatically cover deviating pressure conditions.
Thus, an ATEX type approval issued in accordance with this directive only covers atmospheric pressure.
This applies to all manufacturers.
A deviating operating pressure can be assessed and approved by an expert for the respective application.
Regardless of this, the design of the level indicators is suitable for a vessel overpressure / underpressure in accordance with the specified technical data.

Process and ambient temperature

The permitted temperature range is marked on the type plate.

ATEX/ UKEX: Year of manufacturing

Marking on the name plate is done according to IEC 60062 as follows:

Year of manufacturing	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Marking code	K	L	M	N	P	R	S	T	U	V	W	X

Specific conditions of use

Electrostatic charge

The apparatus shall be installed in a way that danger caused by electrostatic charges is avoided.

Notes for use in Hazardous Locations / Disposal

Maximum Surface Temperature

The maximum surface temperature refer to the warmest area outside on the unit which can occur in failure case (according to Ex definition).

Max. Ambient temperature T_a	Max. Process temperature T_p	Max. Surface temperature (EPL Db)	Max. Surface temperature (EPL Da)	Temperature Code
60°C (140°F)	80°C (176°F)	117°C (243°F)	T_{200} 117°C (243°F)	T4A
50°C (122°F)	90°C (194°F)	117°C (243°F)	T_{200} 117°C (243°F)	T4A
40°C (104°F)	100°C (212°F)	117°C (243°F)	T_{200} 117°C (243°F)	T4A
	110°C (230°F)	117°C (243°F)	T_{200} 117°C (243°F)	T4A
	120°C (248°F)	120°C (248°F)	T_{200} 120°C (248°F)	T4A
	130°C (266°F)	130°C (266°F)	T_{200} 130°C (266°F)	T4
	135°C (275°F)	135°C (275°F)	T_{200} 135°C (275°F)	T4
	140°C (284°F)	140°C (284°F)	T_{200} 140°C (284°F)	T3C
	150°C (302°F)	150°C (302°F)	T_{200} 150°C (302°F)	T3C

Static discharge of the material surface

It must be ensured that no static discharge can occur when the grounded metal sensor weight or rope/ tape touches the surface of the bulk material. If this can not be ensured, the safe use of the unit is NOT guaranteed. The responsibility for this rests with the user. In case of inclarity an assessment from a notified body is necessary.

From the manufacturer side a version with a plastic sensor weight and additional plastic rope insulation part is available on request. This keeps a 500 mm (19.7") distance from the material surface to the grounded rope/ tape.

Disposal

The product consists of materials which can be recycled, details of the used materials see chapter "Technical data - mechanical data".
Recycling must be done by a specialised recycling company.