

Cordonel[®] Static Flow Meter

Installation and Operating
Instructions

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1. General information

Please read these instructions carefully and fully before you start installing the meter. Follow all the safety and warning instructions to avoid personal injury and damage to the meter and the overall installation. Before installing the meter, make sure the delivery is complete and free from damage.

Intended use

Cordonel meters may only be used for the applications specified in the data sheet and in these operating instructions. Correct and safe use of the products requires proper transportation, storage, installation, commissioning and operation. The permissible ambient conditions must be observed at all times. The notes given in these instructions must be followed fully.

Exclusion of liability

The contents of these operating instructions have been checked thoroughly for compliance with the hardware and software described. Nevertheless, minor deviations cannot be ruled out due to continuous improvements, meaning Sensus shall assume no liability whatsoever for full compliance. The information in these instructions is checked regularly and any corrections are included in the next edition.

2. Product description

Cordonel is a static bulk water meter for industrial and commercial applications. The meter uses ultrasonic technology based on the transit time method. The meter is equipped with three ultrasonic paths, which are arranged in pairs and alternately send and receive ultrasonic signals with and against the direction of flow of the water. The time the signal takes to go from the transmitter to the receiver is measured. The flow velocity is calculated using the differing transit time of the signal with and against the flow. The flow volume is calculated by multiplying the flow velocity by the constant cross-section of the measuring tube.

3. Uses

- For measuring potable water up to 50 °C
- For measuring clean process water up to 50 °C
- For measuring water in field irrigation systems
- For controlling industrial processes using the pulse output

4. Scope of delivery

1 water meter, 2 flange gaskets, 1 operating instructions

5. Technical data

Nominal widths	DN 40 ... 300
Pressure stage	PN10; PN16
Connections	Flanges according to EN1092-2
Medium	Water; chemically neutral
Metrological approval	DE-19-MI001-PTB008
Potable water approvals	KTW, DVGW, WRAS, ACS, KIWA
Medium temperature range	0.1 ... 70 °C for industrial applications 0.1 ... 50 °C for commercial applications
Ambient temperature during storage and transportation	Normal conditions: -10 °C ... 40 °C for one week: -40 °C ... 60 °C
Ambient temperature during use	-10 °C ... 70 °C (medium must never freeze)
Accuracy class	Class 2
Protection class	IP 68 acc. to DIN EN 60529:2014
Mechanical environmental conditions	Class M2
Electromagnetic environmental conditions	Class E2
Pulse output (optional)	External module; galvanically isolated
Battery	2x type D lithium battery
Display	LCD; 2 rows with symbols Display line 1: 9 digits Display line 2: 4 digits
Radio frequency	433 MHz or 868 MHz
Transmitting power	433 MHz: 10 mW 868 MHz: 25 mW

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6. Metrological data

	Nominal width	DN	40	50	65	80	100
Q_5	Max. peak flow rate	m ³ /h	78	90	125	200	310
Q_4	Max. flow rate according to MID	m ³ /h	50	50	78.75	125	200
Q_3	Permanent load according to MID	m ³ /h	40	40	63	100	160
Q_2	Cut off according to MID	m ³ /h	0.06	0.06	0.1	0.16	0.25
Q_1	Minimum flow rate according to MID	m ³ /h	0.04	0.04	0.06	0.1	0.16
Q_3/Q_1	Max. ratio		1000	1000	1000	1000	1000
	Starting flow	m ³ /h	0.012	0.012	0.02	0.033	0.054
Δp	Pressure loss at Q_3	bar		0.15			

7. Marking

Nominal width	DN 50	Cordonel	Name
Nominal flow, ratio	Q_3 40 R1000	433 MHz	Radio frequency
Max. temperature	T 50	(E) 10412002065	Radio address
Nominal pressure	MAP 1,6 MPa	2039 Lithium	Battery life
Low profile class	U0D0 IP 68		Disposal symbol
Conformity mark	CE M19 0102		Data matrix code
Approval number	DE-19-MI001-PTB008	Sensus GmbH Meinekestr.10 30880 Laatzen	Manufacturer's address
Serial number	S-No. 8 SEN20 1977 5668		
Country of origin	Made in Germany 2019		

8. Installation

8.1. Hazard warnings

The meter must be installed without mechanical stress in the pipe. A mechanically stressed installation may lead to the destruction of the meter housing. This would cause water to escape.

The pipe pressure must not be higher than the pressure specified on the rating plate. Excessive pressure can lead to leakages or destruction of the meter housing. This would cause water to escape.

8.2. General information

The Cordonel meter may only be installed by a qualified and instructed specialist. The generally accepted rules of technology and the applicable safety regulations must be observed at all times (in particular, the notes contained in standard ISO 4064-5:2014).

The meters are disinfected after the production process. Handling during installation must be carried out in accordance with applicable hygiene rules. We refer in particular to VDI/DVGW Guideline 6023 Section 6.7 and 6.8 and DVGW Worksheet W557 Section 5. Before installing the meter, it must be disinfected again. We recommend removing the meter from the transport packaging at the actual measuring point shortly before installation.

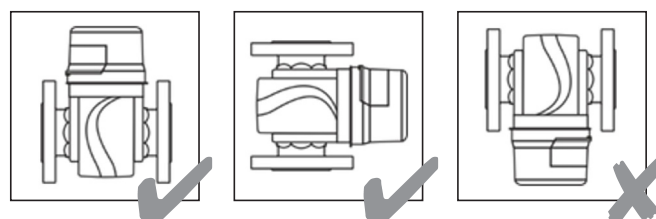
Install the meter in such a way that no forces greater than 100 kg can act on any of the plastic parts.

8.3. Required tools

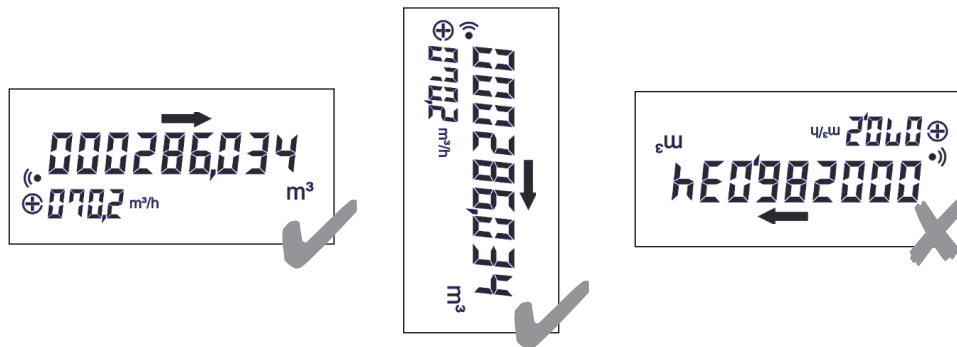
Two wrenches or hexagon socket wrenches, both corresponding to the nominal size of the bolts used. In some cases, suitable lifting gear. The variable parameters are programmed by radio using the Sensus SIRT radio interface and the Diavaso config app from Sensus.

8.4. Installation positions

The meter can be installed in horizontal and vertical pipes. It should be installed in such a way that the LCD is easy to read.



Do not install the meter with the display facing downwards or with the display upside down.



8.5. Installation notes

- According to ISO 4064:2014, the Cordonel meter does not require an inlet and outlet section (UOD0).
- The Cordonel meter does not require an inlet section, not even behind 90° pipe bends.
- The installation point should be the same length as the meter plus twice the thickness of the flange gaskets used.
- For outdoor installations Sensus recommends the meter display installed in a shaded location. Direct exposure to sunlight of the meter head can increase the inner temperature of the meter, thus drastically reducing the battery life time.
- Before installation in horizontal lines, align the display in such a way that the numbers can be read easily in the intended main reading position. (Avoid overhead positions)
- According to Directive 2014/32/EU (MID), the meters are classified in mechanical environment class M2 (considerable to strong vibrations and shocks).
- The pipe cross-section must not be reduced or extended abruptly directly upstream or downstream of the meter. All cross-sectional changes should be made concentrically at an angle of <math><8^\circ</math>.
- All flow regulation components (e.g. valves) must be mounted downstream of the meter in the direction of flow.
- Flange gaskets must not protrude into the pipe.
- Flush the pipe thoroughly before installing the meter.
- After installation, fill the pipe slowly to prevent damage to the meter caused by water hammers.
- Select the installation point making sure that air bubbles cannot form in the meter and the pipe is always filled completely. Do not install the meter at the highest point of the pipe. It may be necessary to provide suitable de-airing in the direction of flow upstream of the meter.
- Use suitable measures to protect the meter against water hammers in the pipe.
- Do not carry out welding work on the pipe with the meter installed to avoid overheating.

8.6. Commissioning

After correct installation and filling, the meter automatically determines its main direction of flow. During the detection period, the two arrows above the volume display will flash. The main direction of flow is defined as the direction of flow in which 2 m³ of water first flows after installation. The main direction of flow is fixed when only one arrow is permanently visible in the display.

Note that the volumes that flow through the Cordonel while in testing mode are not added together to determine the main direction of flow.

8.7. Operating notes

- During normal operation, the pipe pressure downstream of the meter must not fall below 0.5 bar in order to avoid cavitation at higher flow rates. For flow rates greater than Q₄, the pressure downstream of the meter must be greater than 1 bar.
- The pipe should always be filled completely with water during operation.
- The manufacturer's specification of the Q₃ must not be exceeded for a longer period of time.
- The maximum media temperature should not exceed 50 °C during operation or 70 °C at standstill.
- Avoid permanent ambient temperatures above 60 °C to enjoy full battery capacity.

9. Reading

9.1. Display description

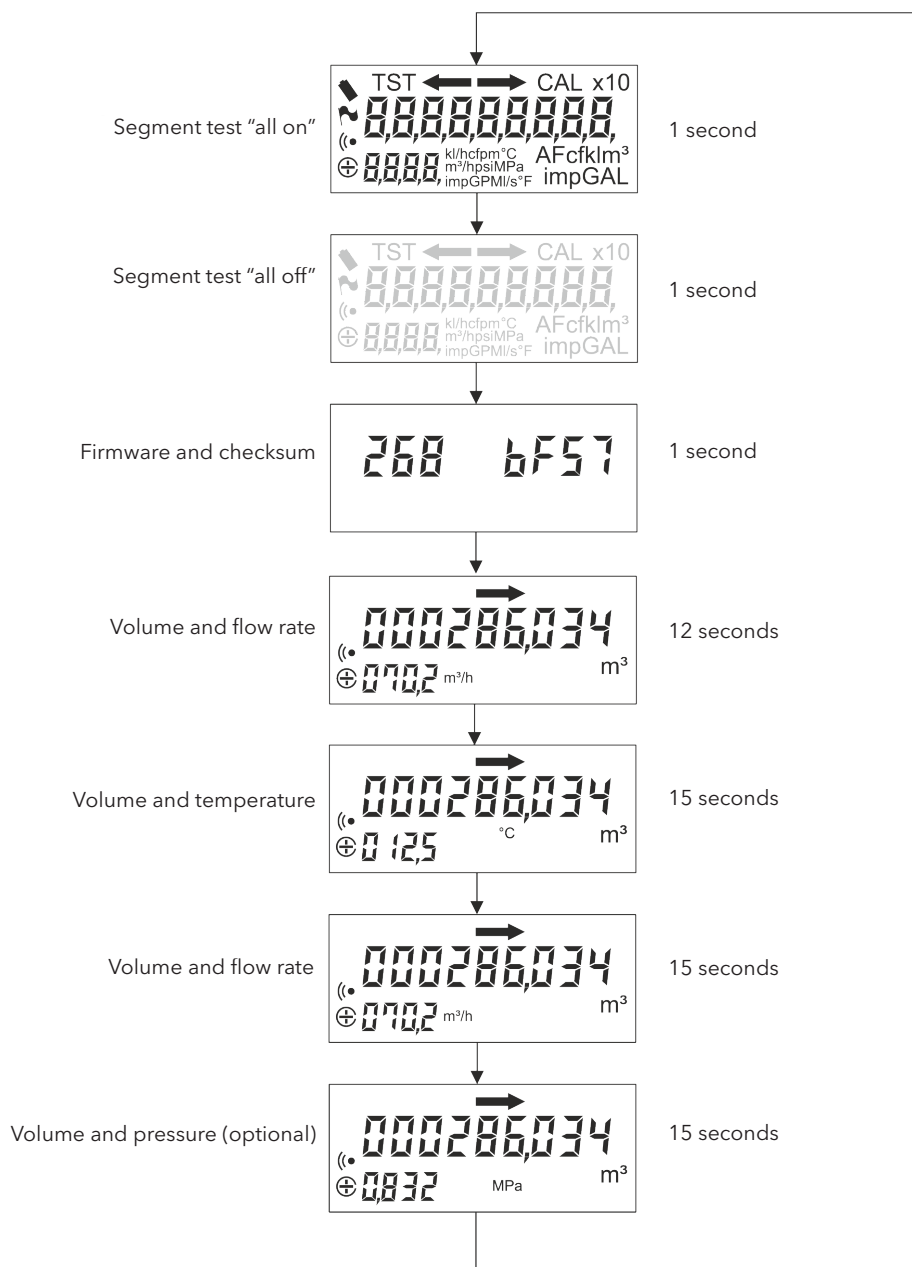
The Cordonel meter has an LC display with two lines. Numbers and symbols are displayed.

	<ol style="list-style-type: none"> 1 Volume value 2 Volume unit 3 Flow rate, pressure or temperature value 4 Flow rate, pressure or temperature unit 5 Current direction of flow 6 Radio activated (flashing) 7 Alarm flag 8 Low battery level, less than 12 months remaining 9 Meter in testing mode 10 Main direction of flow 11,12 Not used
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9.2. Display sequence

The display shows the display values as part of a one-minute sequence.



9.3. Alarms

Alarms are displayed by the alarm flag (ALr). If the flag is present, alarm codes are displayed for two seconds each once per minute in display line 1.



Fig. 4 Display example with alarm flag and alarm code

Alarm Code	Description	Comment
ALr 001	Low battery alarm	Appears when the remaining battery life is approx. six months.
ALr 004	Empty pipe alarm	Appears when the measuring pipe is empty or only partially filled.

Alarm Code	Description	Comment
ALr 006	Negative flow alarm	Appears if the flow is against the main direction of flow during a pre-programmed period.
ALr 007	Leakage alarm	Appears if the flow rate has not fallen below the programmed threshold value during the programmed period.
ALr 008	Pipe burst alarm	Appears if the flow rate has exceeded the programmed threshold value during the programmed period.
ALr 009	Low pressure alarm	Appears if the pressure has fallen below the programmed threshold value during the programmed period.
ALr 010	High pressure alarm	Appears if the pressure has exceeded the programmed threshold value during the programmed period.
ALr 011	Low temperature alarm	Appears if the temperature has fallen below the programmed threshold value during the programmed period.
ALr 012	High temperature alarm	Appears if the temperature has exceeded the programmed threshold value during the programmed period.

Alarms remain in the display until either the programmed display duration is over or a reset command is issued by radio.

9.4. Testing mode

The Cordonel can be set to testing mode for testing purposes in a calibration laboratory. The testing mode switches the display to a 1000 times higher resolution in order to achieve an optimal testing time. The testing mode can be switched on and off by radio command. The testing mode is terminated automatically after 72 hours at the latest. The time of the automatic termination of the testing mode can be set using the Diavaso config app.

In normal operation after switching into test mode the volume index is resetted to zero. Switching to testing mode has no effect on the previously accumulated meter reading. The volume metered in testing mode is added to the cumulative meter reading. After exiting testing mode, the sum of the previously accumulated volume and the volume accumulated during testing mode is displayed.

Attention! If the main flow direction is not yet determined, after leaving the test mode, the volume index is resetted to zero.

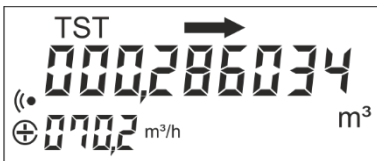


Fig. 5 Display in testing mode

10. Data logger

The Cordonel has two integrated data loggers, which can be parameterised and read out by radio. The first logger records data periodically, while the second logger records data for a defined key date. The following data can be saved:

1	Alarm status	13	Absolute positive volume
2	Volume (net)	14	Minimum pressure
3	Absolute reverse volume	15	Minimum pressure period
4	Maximum flow rate *	16	Maximum pressure
5	Maximum flow rate period	17	Maximum pressure period
6	Peak flow rate **	18	Minimum temperature
7	Peak flow rate period	19	Minimum temperature period
8	Average flow rate	20	Maximum temperature
9	Pipe burst alarm	21	Maximum temperature period
10	Pipe burst alarm period	22	Last measured pressure
11	Minimum flow rate	23	Last measured temperature
12	Minimum flow rate period	24	Extended alarm status (temp. and pressure)

*) The maximum flow rate is an averaged value depending on the logger period:

Logger period	Average period
1 minute	1 minute
2 minutes	1 minute

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Logger period	Average period
3 minutes	1 minute
5 minutes	1 minute
6 minutes	1 minute
10 minutes	2 minutes
15 minutes	3 minutes
30 minutes	3 minutes
60 minutes (1 hour)	5 minutes
120 minutes (2 hours)	10 minutes
180 minutes (3 hours)	15 minutes
300 minutes (5 hours)	30 minutes
360 minutes (6 hours)	30 minutes
720 minutes (12 hours)	30 minutes
1440 minutes (1 day)	60 minutes

**) The peak flow rate is a value averaged over 2 seconds.

The recording intervals of the first data logger are programmable between 1 minute and 1440 minutes (1 day). The data loggers can be programmed and read out via SensusRF radio.

11. Radio

11.1. General

The Cordonel is equipped with a radio interface in the license-free 433 MHz or 868 MHz band. To use the radio data, the user must have appropriate receivers of the same frequency, e.g. Sensus SIRT. The radio is switched off upon delivery. It can be switched on either by radio command or automatically by watering the pipe. The radio data are secured by a 128 bit key.

11.2. SensusRF

SensusRF is a licence-free radio system with a combination of uni-directional and bi-directional radio. The meter sends a short data telegram (BUP) every 15 seconds. After every fourth BUP, the meter listens for a short period (LAT) as to whether further information is requested. If a radio command (PAM) is received during this period, the meter sends the corresponding information (SEMI). The meter can also be configured via the PAM.

BUP content

Radio address
Meter reading
Alarm messages
Signal strength (via the receiver)
Time stamp (via the receiver)

SEMI content

Type of meter	BUP interval
Current flow rate	LAT interval
Min. and max. flow rate with time	wM-Bus status
Reverse volume	wM-Bus transmission interval
Start and end of leakage	Data logger programming values
Start and end of negative flow	Alarm activation
Start and end of pipe burst	Leakage detection parameters
Last measured pressure	Pipe burst detection parameters
Last measured temperature	Remaining battery life
	Time since low battery was detected

11.3. wM-Bus (OMS)

The Cordonel transmits a wM-Bus data protocol according to EN13757-4:2018.

The Cordonel supports T-mode and C-mode. Standard setting is T-mode and a transmission interval of 15 minutes. The settings are changeable with the Diavaso Config app in the range of 15 to 240 minutes.

Content wM-Bus

Radio address
Meter reading
Flow rate
Temperature
Pressure
Alarm messages

11.4. Radio data security

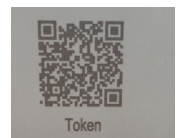
Data transmitted by Cordonel through radio are encrypted to prevent unauthorized access. To decrypt the radio data of a particular Cordonel, the appropriate radio key (KEY) is required.

To access the radio key, the meter is equipped with a QR code. The QR code contains an internet address and a so-called token (=process number with server connection). The token is not the actual radio key, but is used to provide the radio key exclusively to authorized authenticated person. The QR code can be scanned with any suitable device, e.g. a smartphone, using a QR app. After successful authentication the appropriate key will be provided from the website. The radio key is only available to the authenticated user and is blocked against further access by third parties.

If the token cannot be accessed or the meter has already been registered, a new code transmission can only be achieved through a formal request to the Sensus Service Team (recoverkey@xylem.com).

It is strongly recommended to store radio keys carefully and securely to ensure the protection of data and to enable a secure radio reading.

Note: Radio key and QR code are unique for each meter!



Example of a key and token

Caution! The radio key must be assigned to the radio address of the meter and stored in a secure place. The loss of the radio key or incorrect assignment leads to the loss of readability.

12. Last meter reading

Cordonel is equipped with an NFC interface, which stores and can transmit the last meter reading before failure in the case of a meter without display and radio communication.

NFC means Near Field Communication and is a function integrated in modern mobile phones and supported by Android operating systems. The NFC aerial of the Cordonel is arranged in a loop around the display.

For correct readout, the readout device with the NFC sensor (usually on the back of mobile phones) must be placed on the display of the Cordonel and the app started. Sensus recommends the app NFC ST 25.

Readable values are:

- Meter number
- Last saved meter reading
- Volume unit
- Time that data was last saved

13. Factory settings

Values	Unit	DN 40	DN 50	DN 65	DN 80	DN 100
Leakage duration	Days	14				
Leakage threshold value	m ³ /h	0.25	0.375	0.625	0.875	1.25
Pipe burst duration	Min.	5				
Pipe burst threshold value	m ³ /h	25	37.5	62.5	87.5	125
Leakage alarm		Off				
Pipe burst alarm		Off				
Battery alarm		On				
Negative flow alarm		On				
Storage period of alarms	Days	29				
Data logger period	Min.	60				
Data logger forward volume		Off				
Data logger time minimum flow rate		Off				
Data logger minimum flow rate		On				
Data logger time pipe burst		Off				
Data logger pipe burst		Off				
Data logger instantaneous flow rate ¹		Off				

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Values	Unit	DN 40	DN 50	DN 65	DN 80	DN 100
Data logger time peak flow rate ²				Off		
Data logger peak flow rate ²				Off		
Data logger time maximum flow rate ³				Off		
Data logger maximum flow rate ³				Off		
Data logger minimum pressure				Off		
Data logger time minimum pressure				Off		
Data logger maximum pressure				Off		
Data logger time maximum pressure				Off		
Data logger minimum temperature				Off		
Data logger time minimum temperature				Off		
Data logger maximum temperature				Off		
Data logger time maximum temperature				Off		
Data logger current pressure				Off		
Data logger current temperature				Off		
Data logger extended alarms				Off		
Data logger reverse volume				Off		
Data logger net volume				On		
Data logger alarm status				On		
Readout on ... day of month	Day:			1		
Key date value of forward volume				Off		
Key date value time minimum flow rate				Off		
Key date value minimum flow rate				Off		
Key date value time pipe burst				Off		
Key date value pipe burst				Off		
Key date value instantaneous flow rate 1				Off		
Key date value time peak flow rate 2				Off		
Key date value peak flow rate 2				Off		
Key date value time maximum flow rate 3				Off		
Key date value maximum flow rate 3				Off		
Key date value minimum pressure				Off		
Key date value time minimum pressure				Off		
Key date value maximum pressure				Off		
Key date value time maximum pressure				Off		
Key date value minimum temperature				Off		
Key date value time maximum temperature				Off		
Key date value maximum temperature				Off		
Key date value time maximum temperature				Off		
Key date value current pressure				Off		
Key date value current temperature				Off		
Key date value extended alarms				Off		
Key date value reverse volume				Off		
Key date value net volume				On		
Key date value alarm status				On		
Wake up interval	Sec.			3		
UTC time shift	Hours			0		
Pulse				On		
Pulse mode				A4 balanced pulse		

Values	Unit	DN 40	DN 50	DN 65	DN 80	DN 100
Pulse value	Litres	100				
Pulse length	ms	500				

- 1) The instantaneous flow rate is the mean value of the logger period
- 2) The peak flow rate is the mean value over 2 seconds
- 3) For maximum flow rate, see section 10

14. Temperature measurement

The Cordonel measures the water temperature. The measurement is performed directly by the ultrasonic signal. The measured temperature is shown on the display in line 2 and can be transmitted by radio via the SEMI data protocol of SensusRF.

15. Optional pulse output

The Cordonel is equipped with a slot for a pulse adapter.

If the Cordonel is delivered without a pulse module, the slot is fitted with a dummy to protect it against contamination.

The dummy must be removed before installing the pulse module. When doing so, make sure dirt does not enter the slot. If the slot is dirty, it must be cleaned carefully by rinsing and wiping it with a soft cloth. Avoid scratching the surface.

If the pulse module has been installed, the cable must be routed directly from the Cordonel meter towards the bottom of the meter.

Never wind the cable around the head of the meter.

16. Time stamp

The Cordonel has a real time clock (RTC) from which time and calendar are derived. By default, the time is set to UTC.

Most reading systems display the meter results in local time because they take into account the offset to UTC. It is therefore generally not necessary to change the time in the Cordonel.

17. Maintenance and cleaning

Under normal operating conditions, the meter is maintenance free. The meters can be cleaned however, if necessary. Do not use chemicals, high-pressure cleaners or sharp-edged tools when cleaning (please observe section 8.2).

18. Transportation

- The meters should be transported dry, as frost-free as possible and under hygienically harmless conditions.
- If possible, the meters should always be transported in the individual packaging supplied in order to avoid damage and soiling.
- Transportation temperature:
 - Standard conditions: -10 °C ... 40 °C
 - for one week: -40 °C ... 60 °C

19. Storage

- The meters should be stored in a dry, dust-free place and under hygienically harmless conditions.
- If possible, the meters should always be stored in the individual packaging supplied in order to avoid damage and contamination.
- Storage temperature:
 - Standard conditions: -10 °C ... 40 °C
 - For one week: -40 °C ... 60 °C

20. Disposal

The Cordonel meter contains lithium batteries and must therefore not be disposed of with household waste.

21. Declaration of conformity



Date: 23.11.2022

EU Declaration of Conformity no. CE/ Cordonel/0619

Herewith we,

Sensus GmbH Hannover
Meineckestraße 10
30880 Laatzen

declare under our sole responsibility for the meter type

Cordonel DN 50, 65, 80, 100 und 125

conformity with the legal regulation of the Directive 2014/32/EU of the European Parliament and the Council dated 26th of February 2014, including

Annex I, Essential requirements
Annex III, MI-001, water meters

and the Directive 2014/53/EU (RED) of the European Parliament and the Council dated 16th of April 2014.

applied harmonized normative documents

- OIML-R 49-1, Edition 2013
- OIML-R 49-2, Edition 2013
- OIML-R-49-3, Edition 2013
- DIN EN ISO 4064-1, Edition 2014
- DIN EN ISO 4064-2, Edition 2014
- DIN EN ISO 4064-4, Edition 2014
- DIN EN ISO 4064-5, Edition 2014
- DIN EN 14154-4, Edition 2014
- WELMEC Software guide 7.2:2018
- EN 301 489-1 V2.2.0
- EN 301 489-3 V2.1.1
- EN 300 220-1 V3.1.1
- EN 300 220-2 V3.1.1
- EN 62368-1:2014 + AC:2015 + A11:2017
- EN 62479:2010
- Additional applied rules
- EN 14268, Edition 2005
- DIN EN 60529/VDE 0470 part 1:2014

The conformity assessment procedure was accomplished under the surveillance of the notified body at PTB Id.-No. 0102.

The design examination certificate DE-19-MI001-PTB008 was issued.

The Managing Director on behalf of the manufacturer makes this declaration.

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