ADDRA

ADR series Water meter with integrated water valve

Technical description

Contains

Revision History

Version	Description	Date
1.0	Original document	30.05.2025
1.1	Editorial corrections	11.06.2025
1.2	Sections 1, 11 updated	18.07.2025
2.0	Section 1 updated	15.05.2026
2.1	Section 2 (Table 1); 3;5;9;15 updated	27.05.2026
2.2		19.06.2026

1. Purpose

ADRx-V series smart water meter with integrated water valve (hereinafter ADRV or meter) is based on ultrasonic principle and intended for cold water consumption metering and control.

The water meter is intended for 24-hours indoor or outdoor operation. It withstands ambient air temperature from -25°C to + 55°C and water temperature from 0.1°C to +50°C.

Note, that freezing of water in a meter pipe is strictly forbidden.

When installing the ADRV, note that the meter must be protected against the damage risks due to extreme water or ambient air temperatures.

2. Technical data

Main technical characteristics are summarized for different nominal diameters in the tables 1 below:

Table 1. Technical characteristics for ADRx-V meters

Characteristic	Value			
Model	ADR15		ADR20	
Nominal diameter	DN15		DN20	
Thread	G3/4”		G1”	
Connection type	BSP			
Permanent flow rate, Q3 (m^3/h)	1.6	2.5	2.5	4
Dynamic range Q3/Q1	R250 R400 R800	R250 R400 R800	R250 R400 R800	R250 R400 R800
Installation sensitivity class	U0/D0			
Sensitivity threshold (l/h)	1			
Temperature class	T30/T50 (0.1 – 50 °C)			
Storage/transportation temperature	From -25 to 70 °C			
Operating temperature	From -25 to 55 °C			
Metrological class	Class 2			
Maximum operation pressure	1.6 MPa			
Pressure loss	Δp40			
Protection class	IP68			
Environmental class	E2, M1, O			
Installation	Horizontally/vertically/at angle			
Power supply	Internal power supply: - C type batteries (one or optionally two) - Backup battery 1\2 AA - SPC (Super Pulse Capacitor) External power supply: - Two type AA batteries installed in the battery compartment			

Interfaces	BLE, NFC for local access

Characteristic	Value
WAN Communication	MultiRAT (LoRaWAN, Wireless M-Bus, NB-IoT) Different frequency ranges: EU863-870, US902-928, AU915-928, AS923
Non-volatile memory	Data storage not less than 10 years
Approvals	WRAS

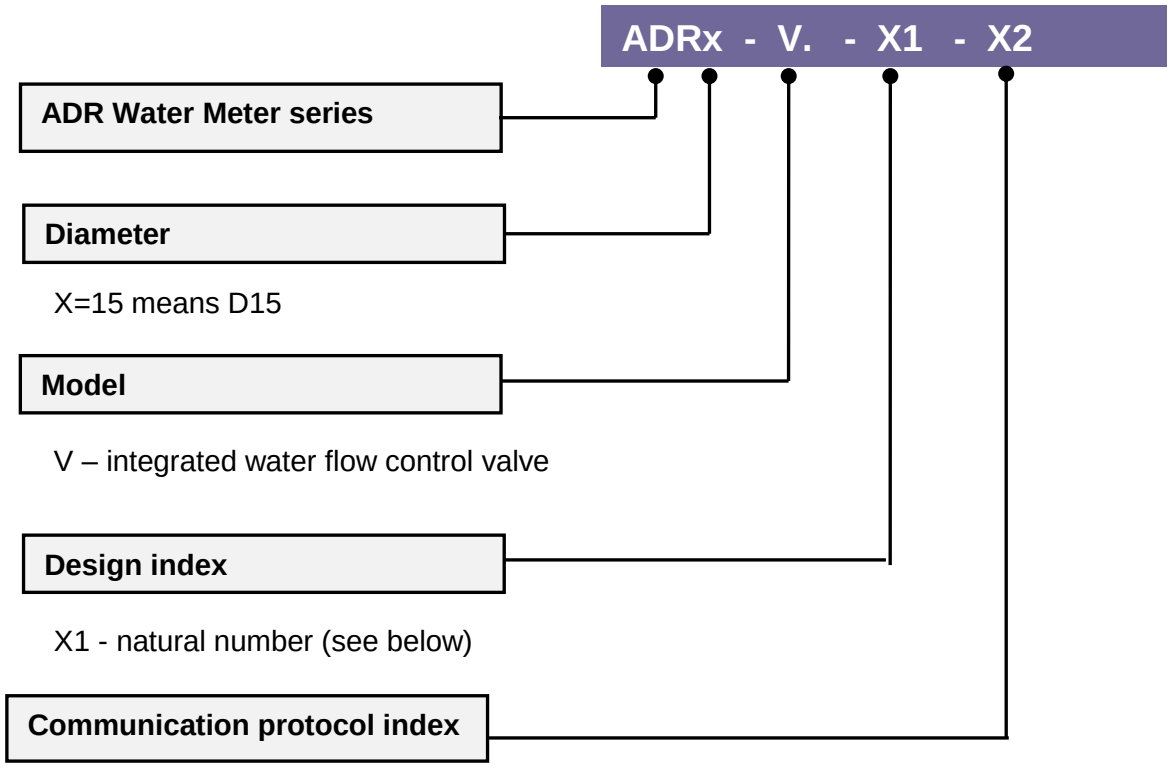
3. Standards

EN 14154-1:2005+A2:2011	Water meters - Part 1: General requirements
EN 14154-2:2005+A2:2011	Water meters - Part 2: Installation and conditions of use
EN 14154-3:2005+A2:2011	Water meters - Part 3: Test methods and equipment
EN 14154-4:2014	Water meters - P art 4: Additional functionalities
ISO 4064-1:2017 (OIML R 49)	Water meters for cold potable water and hot water - Part 1: Metrological and technical requirements
ISO 4064-2:2017 (OIML R 49)	Water meters for cold potable water and hot water - Part 2: Test methods
ISO 4064-3:2017 (OIML R 49)	Water meters for cold potable water and hot water - Part 3: Test report format
ISO 4064-4:2017 (OIML R 49)	Water meters for cold potable water and hot water - Part 4: Non-metrological requirements not covered in ISO 4064-1
ISO 4064-5:2017 (OIML R 49)	Water meters for cold potable water and hot water - Part 5: Installation requirements
MID Directive 2014/32/EC	Measuring Instruments Directive of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of measuring instruments
LoRaWAN® L2 1.0.4 Specification	The LoRaWAN® 276 network protocol optimized for battery277 powered end-devices.
LoRaWAN® Regional Parameters RP002-1.0.4	LoRaWAN Regional Parameters for different regulatory regions worldwide
NIST-AES	Advanced Encryption Standard (AES). National Institute of Standards and Technology 2001, updated 2023
EN 13757-3:2013-08	Communication systems for and remote reading of meters – Part 3: Dedicated application layer
EN 13757-4:2019	Communication systems for meters - Part 4: Wireless M-Bus communication
EN 13757-7:2018	Communication systems for meters - Part 7: Transport and security services

IEC 62056	Electricity metering data exchange – DLMS/COSEM suite
Welmec 7.2 rev.2025	Software Guide. Guide for examining software in measuring instruments subject to legal control

4. Meter designation

ADRx-V defines the family of portable water meters with different functionality, integrated with water valve. ADRV is developed by ADD GRUP based on up-to-date ADDRA technology. The following system is used to indicate the types of ADRVs within the family:



Thus, the designation ADR15-V is used to identify a series of ADRVs with DN15.

Identifier “Model” determines the ADRV body length L_B as follows:

DN	min_L_B (mm)
DN15	110
DN20	130

Identifier “Communication protocol” is the natural number identified meter RF communication protocol. Communication protocol is defined by legally non-relevant part of the meter firmware. In ADR serial meters the following communication technologies can be supported:

- LoRa;
- NB-IoT;
- Wireless M-bus;
- BLE;
- NFC.

Several assembling variants are implemented:

- ADRV with LoRa communication module
- ADRV with NB-IoT communication module

ADRV with NB-IoT/LoRa communication module. Simultaneous operation of LoRa and NB-IoT is not allowed. These modules work independently according to the set scenario.

5. Measurement

5.1. Measurement principle

The ADRV features a flow sensor based on proven ultrasonic measurement. The flow sensor is used to measure the average flow rate and estimate the difference of measured transit time between the sound signals along with and against the direction of the flow.

The flow meter as a part of ADRV is equipped with 2 U-Sonic transducers used to send sound signals with/against the flow (see Figure 1).

The meter calculates the consumed water volume based on signals from flow sensor. Measured and calculated data are stored in the ADRV memory and can be presented on the meter display.

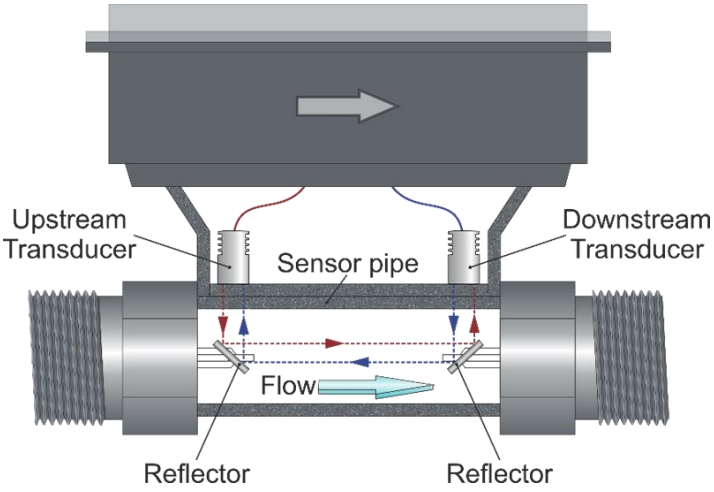


Fig.1. Measurement principle

The ADRV calculates water flow currently according to a fixed measuring cycle. The measurement data is captured each hour, for other measuring cycles (day, month, year) the volume is calculated. All data are saved in the non-volatile memory.

The ADRV is resistant to air passage. The meter measures potable water parameters with particulates and air impurities within the accuracy class, according to the standard for the potable water and installation rules.

5.2. Registers

The following values are registered:

Table 3. ADRV values

Values	Description
Volume	Current reading of accumulated water volume Format in normal mode (to be agreed with a customer) ######.### m^3 Format in test mode: ###.###### m^3
Reverse volume	Current reading of accumulated water volume in reverse direction Format in normal mode (to be agreed with a customer) ######.### m^3 Format in test mode: ###.###### m^3
Values	**Description**
Clock	Actual date and time
Flow rate	Current velocity of water flow in both directions
Water temperature	Actual value of water temperature
Ambient temperature	Actual value of ambient temperature

The ADRV stores the historical data in three profiles. The parameter sets differ for different archives and can be negotiated as well as storage capacity. See an example below:

Monthly	36 months
Daily	14 months
Hourly	60 days

The ADRV registers and records alarms as:

- info codes which represents ADRV flags of certain alarm situations;
- alarm events in the event log with the relevant time stamp;
- special symbols on the meter display.

Event log stores up to 120 events.

Information on alarms can be transmitted via WAN channel to a Control Center or can be obtained locally via BLE.

6. Meter States

The ADRV can be in one of the states described in Table 4.

Table 4. ADRV states

State	Description
Off	There is no power.
Active	Powered. The ADRV measures and displays the current parameter on the LCD. Can exchange data via BLE and WAN modem.

7. Alarms

The ADRV records alarm situations as follows in Table 5.

Table 5. ADRV alarms

Alarm	Description
DRY	The water meter is not filled with water. In this case, there is no measurement of consumption.
REVERSE	Water flows in wrong direction. Reverse water flow more than Q1 detected.
LEAK	Water flows continuously for more than configurable period (e.g. 24 hours).
BURST	The water flow is constantly high for more than configurable period (e.g. 30 minutes).
TAMPER	Indicates that the ADRV has been opened or magnetic field is detected (in case the tamper sensors are available).
LOWBAT	Indicates low battery.

In case an alarm is registered the ADRV can send alarm notification to the Control Center. The list of alarms to be sent is configurable.

8. Design

The ADRV is made from durable components:

- Ultrasonic measuring pipe and valve housing – Brass
- ADRV Housing – Polycarbonate (PC).

Overall dimensions of the ADRV are presented in Figure 2:

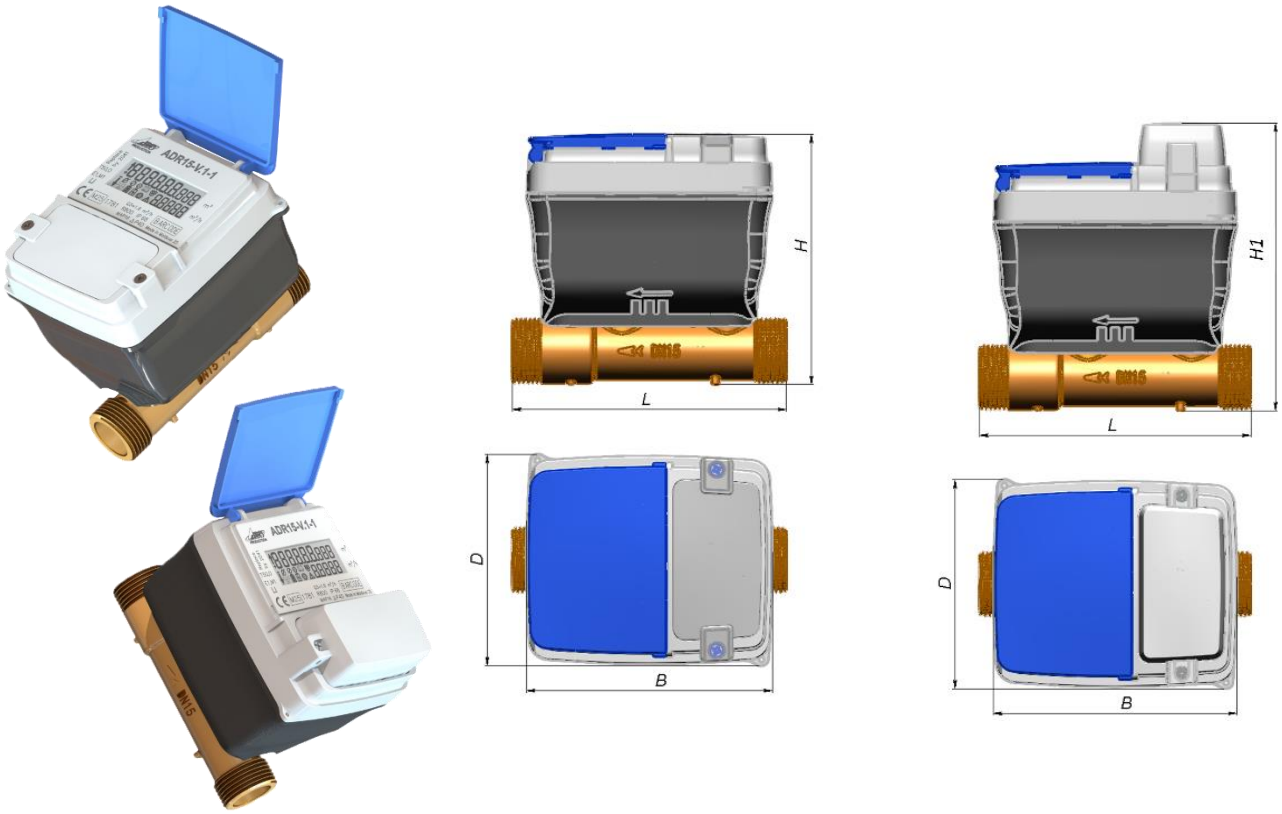


Fig.2. ADRV general view with/without the external power source and overall dimensions

A sealing point (pos.1 in Fig.2) on the ADRV case is provided to install metrological/manufacturer's seal. In addition, the ADRV can be optionally sealed according to local requirements (pos.2 in Fig.2).

Table 6. ADRV dimensions for different pipe diameters

Dimensions	ADR15-V	ADR20-V
Measuring pipe length, brass (L)	110	130
dimensions (HxDxB) without external powe source	105x85x99	
dimensions (H1xDxB) with external power source	121x85x99	

9. Marking

Marking is set on the ADRV case according to ISO 4064-1.

Symbols and text are engraved on the nameplate by a laser to be in contrast with the background are easily visible to the user.

Since there is not enough space for the markings on the meter case, the symbol is placed on the meter nameplate, accompanying by appropriate information in the technical documentation. Relevant parameters and information are marked with this symbol in Technical description and Installation manual to proper use of the meter.

See as an example summary information in the table below.

Throughout the whole document this additional information is also marked with

Storage temperature (IEC 60721-3-1)	-25 °C to +70 °C
Accuracy class	2
Q3/Q1	800
IP rating (IEC/EN 60529)	IP68
Pressure loss	Δp 40
Meter base standards	OIML R49
sensitivity class	U0/D0
Environmental classification	E2, M1, O

The ADRV basic parameters are placed on the face surface as illustrated below:

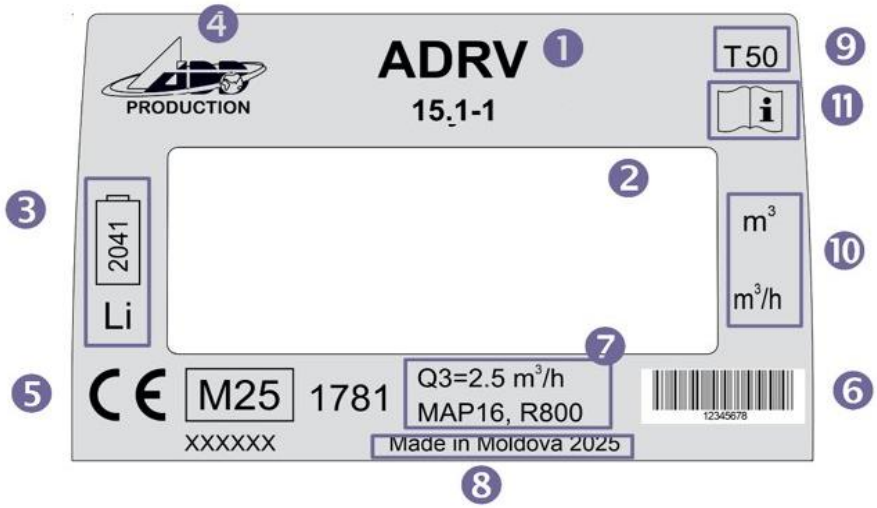


Fig.3. ADRV nameplate structure for ADR15V.1-1

Table 7. ADRV nameplate elements

1	Meter model
2	Display to view consumption data and states
3	Battery expiry date
4	Meter manufacturer
5	CE mark accompanied with the last two digits of the year of manufacture (YY after M sign) and identification number of the notified body XXXX
6	Barcode with serial number
7	Technical parameters
8	Place of manufacturing and the last two digits of the year
9	Temperature class
10	Measurement units
11	Special IEC 60417 symbol used on metering equipment (according to ISO 7000). Identifies that the operating instructions should be considered when operating the device.

The ADRV design allows efficient fraud and tamper detection. To protect the ADRV from tampering a case opening sensor and a magnetic field sensor are provided. The sensors are operating even when the ADRV is in sleep mode.

10. Sealing and secure features.

The meter body is closed by a non-separable cover to ensure the meter complete protection.

The meter cannot be accessed without visible damage of the enclosure such as breakage and cracks.

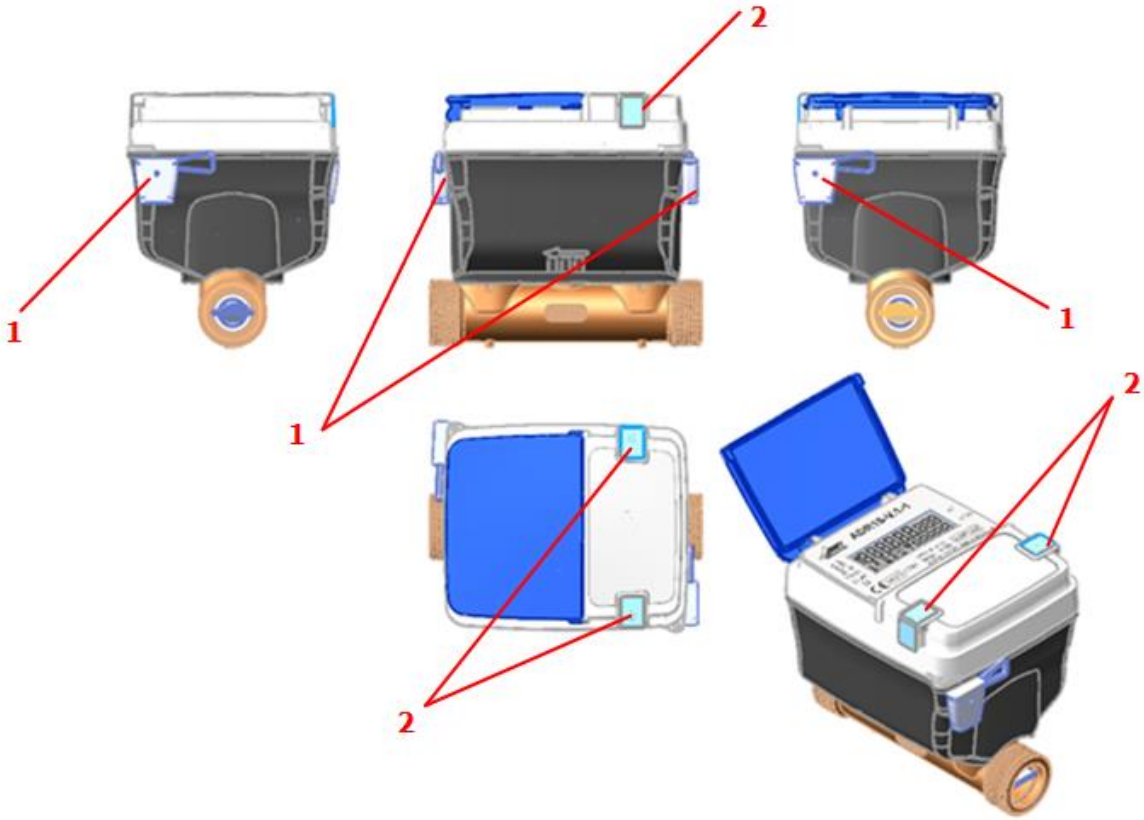


Fig.4. ADRV general view and sealing options (The meter without the external power source is taken as an example).

There are several sealing options that allows the meter additional protection according to the local regulations:

- Two optional security seals (pos. 1 in Fig.4). The meter design provides holes to thread the security seal wires.
- Two optional security self-destructive stickers (pos. 2 in Fig.4) to protect power source.

In Fig.4 see as an example of sealing positions: 3 with no seal and 1 with already installed security seal.

11. Sensors

The meter is equipped with several sensors:

Measurement sensors	
Water temperature sensor (optional)	Intended to measure water temperatures in pipelines - PT1000 resistance thermometer compliant with IEC 60751 - Class «B» - Operating temperature range : from -25 up to +70℃* - Two-wire connection
Pressure sensor (optional)	To measure water pressure in pipelines - pressure from 0 to 1.6MPa - output I2C - Operating temperature range: from -25 up to +70℃* - VCC 3.3V - accuracy 1%
Anti-tampering means	
Case opening sensor	- Push button switch type - Operates from any power source
Magnetic field detection sensor	- Hall-effect sensor
Accelerometer unit	Intended to control ADR position in space Operates from any power source

Freezing of water in a meter pipe is strictly forbidden

In case of tamper attempt, the relevant alarm is registered in the Event log and is indicated on the meter display. Information on alarms can be transmitted via WAN channel to a Control Center or can be obtained locally via BLE.

12. Meter installation position

During the meter installation, pay attention to the flow direction, which is indicated by an arrow on the meter side (see Fig. 2).

The meter can be mounted on a pipe horizontally, vertically, or at any angle (including the display down position), unless the flow direction arrow is downward.

It is recommended to mount the meter in such a way that the display can be read easily.

13. Intelligent power supply

13.1. Intelligent power source operation

Water meter is equipped with Intelligent Power supply source, that allows optimizing the meter operation and increase its working time.

The meter operates on internal or external power source.

Internal power source	- C type battery pack to ensure the meter complete functionality. - Backup battery 1/2 AA to ensure measurement mode (see section 12) - SPC (Super Pulse Capacitor), Helper Both internal batteries and SPC are constructional combined into a single assembly with a common connector.
External power source	Two parallel connected batteries (type AA) which are installed in the battery compartment

Both battery packs (internal or external power source) operate along with the internal SPC which provides all the necessary power supply for the meter operation and ensures protection against voltage fluctuations and high frequency noise. The batteries are intended for the SPC charging only.

The battery is considered as discharged when the voltage is less than 2.9 V.

Battery switching is implemented as follows:

- In presence of serviceable external battery (2xAA), the meter is powered from an external source. Along with this, C battery is automatically disconnected. Only periodic status checks are allowed.
- When the external battery pack is discharged or removed, two variants are possible:
  - ✔ if the C battery is in working condition, the meter automatically switches to power from this battery. The meter remains in normal mode.
  - ✔ If the C battery is discharged, the meter switches to the "measurement" mode from 1/2 AA battery.
- When operating in normal mode, the 1/2AA battery does not contribute to powering process of the meter. Only periodic status checks are allowed.

13.2. Power source specifications

Power source technical specifications are as follows:

- Input voltage U_{inp} =3.6 ±0.1V.
- Output voltage U_{out} =3.3±0.1V with maximum long-term current up to 350 mA, Ipeak=500 mA

Product Life is determined by the battery set and communication conditions.

With the average consumption of 0.02344 mA the life time from the battery C will be more than 16 years.

Backup battery 1/2AA should provide a service life of 16 years, including half a year in the measurement mode. The average current consumption in the measurement mode is 0.0132 mA.

14. Flow control valve

Flow control valve is an integrated part of the ADRV. The meter allows managing the water supply to a consumer by opening/closing the valve:

- Shutting off water supply in case of unpaid bills or leaks/bursts.
- Stopping the water flow for the specified period (configurable).
- Modulating the flow, for reduction of water consumption. The valve may take the following positions: 0% (fully closed), 25% (partially open), 50% (partially open), 75% (partially open) and 100% (fully open). Intermediate positions (25%, 50%, 75%) are available as configurable options and can be adjusted upon customer request.
- Managing water supply remotely from the Control Center.

The valve service life is more than 1000 times.

The valve maintains its last known position in case of battery discharge or disconnection — the ball remains in the current position without power supply. Valve control is only possible when the battery is active. The valve may be in one of the following states:

- Off - if the valve is not active;
- On - when activated, the valve displays its state on the LCD (and symbols, see table 8). Upon completion of the valve state changeover, the LED is either switched off immediately (in case the valve is closed) or lights for a few seconds and then switched off (if the valve is open).

15. Indication

The meter features easily readable 9-digits LCD to visualize measurement data, states, info codes etc.

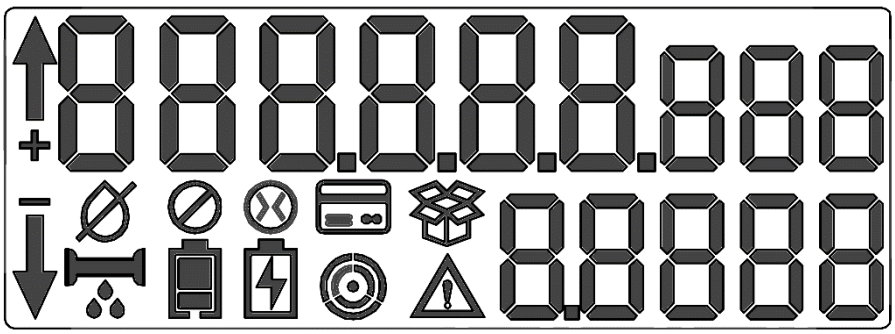


Figure 5. LCD display segments.

In fig.5 the display test is presented when all LCD segments are active. Test mode is set using Client's application via BLE or NFC, by selecting the special test screen from the configured list of screens.

Each measurement value is accompanied by its measurement unit.

The number of decimals is configurable. The volume resolution is 0.000001 m^3.

Measured values and states are cyclically displayed on the meter local LCD. The list of parameters to be displayed is configured and includes legally relevant data (consumed water volume).

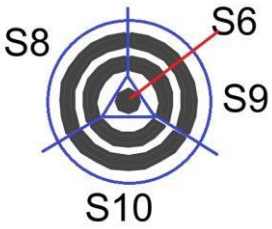
Almost all the displayed data (both screens and state symbols) are controlled by legally relevant firmware. Display icons are described in Table 8.

Table 8. Display icons

Icon	Description
	It is displayed in case of **TAMPER** event (attempts to open cover, magnetic field detection etc.).
	Displayed when an external battery is connected and powering the meter. If the external source is depleted, the meter automatically switches to the internal primary battery and this icon turns off.
	Displayed when the meter operates on the internal primary battery (external source absent or depleted).
	**Steady** — internal primary battery depleted; meter operates on the internal backup battery. **Blinking** — Critical: all batteries are absent or depleted.
	Communication indicator - displays the **status** and **level** of the WAN channel signal
	Appears when **DRY** alarm (the meter is not filled with water).
	It is displayed at the **LEAK** alarm
	It is displayed at the **BURST** alarm (possible breakthrough pipe).
	It is displayed when the **threshold** is reached in prepay-mode (small credit, you need to replenish the account).
	Transportation mode
	It is displayed when the water supply valve is **closed**. (For example, due to non-payment).
	It is displayed when the water supply is limited.
	Displayed in case **REVERSE** water flow is detected.

	It is displayed when detecting the flow rate of water above the **sensitivity threshold** of the ADRV. The icon blinks in proportion to the flow rate (at least 4 distinct blink frequencies).

Table 9. Communication status icon

Icon	Description	
	Each communication channel is presented by the part of communication status symbol as follows: S8 – LoRaWAN S9 – NB-IoT S10 – BLE and/or NFC S6 – WM-Bus These symbols behave depending on communication channel status.	
	Symbol lights	The channel is properly configured and is already operating (or will be active at the appropriate time)
	Symbol doesn't light	The channel is not configured or an error is occurred
	Symbol blinks	Connection to the network occurs or data exchanged is in progress
S10	Symbol is absent	An error of BLE or NFC interface occurred or both interfaces are disabled
 S6	Lits	Interface is active
	Not lit	Interface is disabled

16. Communications

The water meter can be accessed locally (via BLE or NFC) or remotely via WAN channels LoRaWAN, NB-IoT,WM-BUS.

Operating hours of WAN channel is configurable. The list of readout data is coordinated with the Client. See actual parameters below.

16.1 Bluetooth Low Energy (optional)

Bluetooth Low Energy (BLE) is used to communicate locally with flow control valve and meter software application and to update the meter firmware.

Standard	BLE specification v5.3
Frequency range	2.4 GHz
Data exchange rate	1 Mbps
Signal level	Maximum 5 dBm
Battery	To increase the battery lifespan, BLE operation by a schedule is used. In this case BLE is available at specified time intervals In case of battery C discharge and main supply off, BLE module is disabled or transmits to ultralow consumption mode

16.2 LoRaWAN

LoRaWAN provides communication at long distances with very low battery usage and ensures data collection, remote monitoring and control.

Standard	LoRaWAN specification v1.1
Frequency range	EU863-870, US902-928, AU915-928, AS923
Data exchange	Bidirectional: • Data from the meter • Control commands to the meter (for example, open/close the valve)
Data transmission interval	Configurable 12 hours recommended
Restrictions	To increase the battery lifespan, LoRaWAN operation by a schedule is used. In this case LoRaWAN is available at specified time intervals

16.3 WM-Bus

Wireless M-Bus being a robust, power efficient, long range wireless communication solution, operates in the license-free ISM bands and is used for remote communication between the meter and HES.

Standard	EN13757-4:2019
Frequency range	868 MHz
Operation modes	Supported modes: C1, T1
Data exchange	Unidirectional synchronous transmission. Transmission interval: 20 sec, configurable Interval of consumption Data is 1 hour.
Restrictions	The meter battery lifespan essentially depends on use case (intensity) of the radio transmission via wireless M-Bus

16.4. NFC

The NFC is short-range wireless technology operating at 13.56 MHz to establish a wireless connection between a reader and a tag.
NFC tag is placed in the ADRV. When a reader device is brought close to the tag, it can read the information stored in the meter and perform a variety of tasks.
NFC is always active powering from the electromagnetic field generated by reader device.

from the main power source or from the battery, when necessary.

Standard	ISO/IEC 15693
Frequency range	13.56 MHz
Data exchange	Data from ADRV via a separate reader device compliant with ISO/IEC 15693 or a smartphone
Operation distance	The read head should be placed not more than 10 mm from ADRV upper case (in the vicinity of NFC antenna)
Data exchange rate	26 Kbps
Restrictions	In case of external power source connection, NFC interface can be disabled (due to increasing the operation distance)

16.5. NB-IoT

e-SIM card is used
Operates according to LTE Cat NB2 specifications.

NB-IoT unit operates in the following LTE bands (B3, B8, B20).
Flex antenna is placed on the sidewall of the meter.
In case of battery C discharge and main supply off, NB-IoT module is disabled or transmits to ultralow consumption mode.

17. Pressure loss

The pressure loss increases with flow rate as shown in Fig.6:

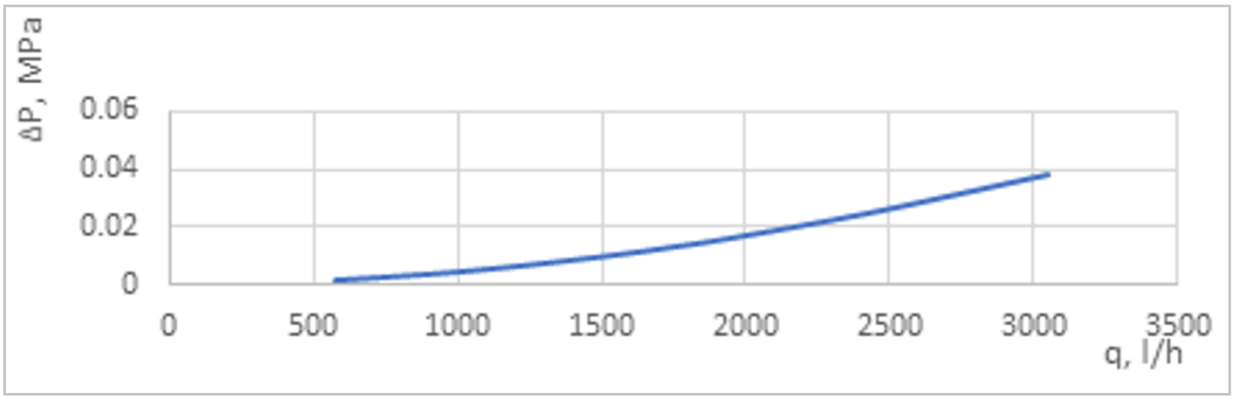


Fig.6 Pressure loss curve for DN15.

18. Firmware update

Non-relevant part of the meter firmware can be updated locally (via BLE or NFC). The image file is digitally signed by manufacturer to exclude modification.

Before the update is started the meter checks that the image is complete, corresponds to meter type and the digital signature is valid.

19. Security features

Encryption is used to provide confidentiality for data to be stored and transferred. ADRV supports the following security schemes:

LoRaWAN:

Based on LoRaWAN® L2 1.0.4 Specification, section 4.3.3 MAC frame payload encryption (FRMPayload)

The encryption scheme features the generic algorithm described in IEEE 802.15.4/2006 Annex B [IEEE802154] using AES encryption with a key length of 128 bits. AES encryption is defined in [NIST-AES].

WM-Bus:

Based on Open Metering System Specification Vol.2 Primary Communication, Section 9. Security.
Both supported security cases are described in Table 37 of this Specification: encryption enabled (Security profile A) and no encryption imposed (No security profile).

The security mode is defined in [EN 13757-7:2018], 9.4.4.

OMS Security profiles

Profile	Encryption	Authentication	Key
No Security profile	No encryption (Security Mode 0) data are transmitted plain	No MAC (MAC-Mode AT=0)	No key
Security profile A	AES128-CBC (Security Mode 5)	No MAC (MAC-Mode AT=0)	128 bit persistent symmetric key (with KeyID=0)

BLE / NFC / NB-IoT

Based on the DLMS/COSEM specifications.

Meters support the following security policies:

- Security is not imposed (default).
- All messages are authenticated.
- All messages are encrypted.
- All messages are both encrypted and authenticated.

AES-GCM-128 (Galois/Counter Mode of operation of AES-128 encryption algorithm) Security Suite ID: 0 is implemented for data encryption and authentication, and key transport methods.