# Ultrasonics Water Meter

User Manual 1.1
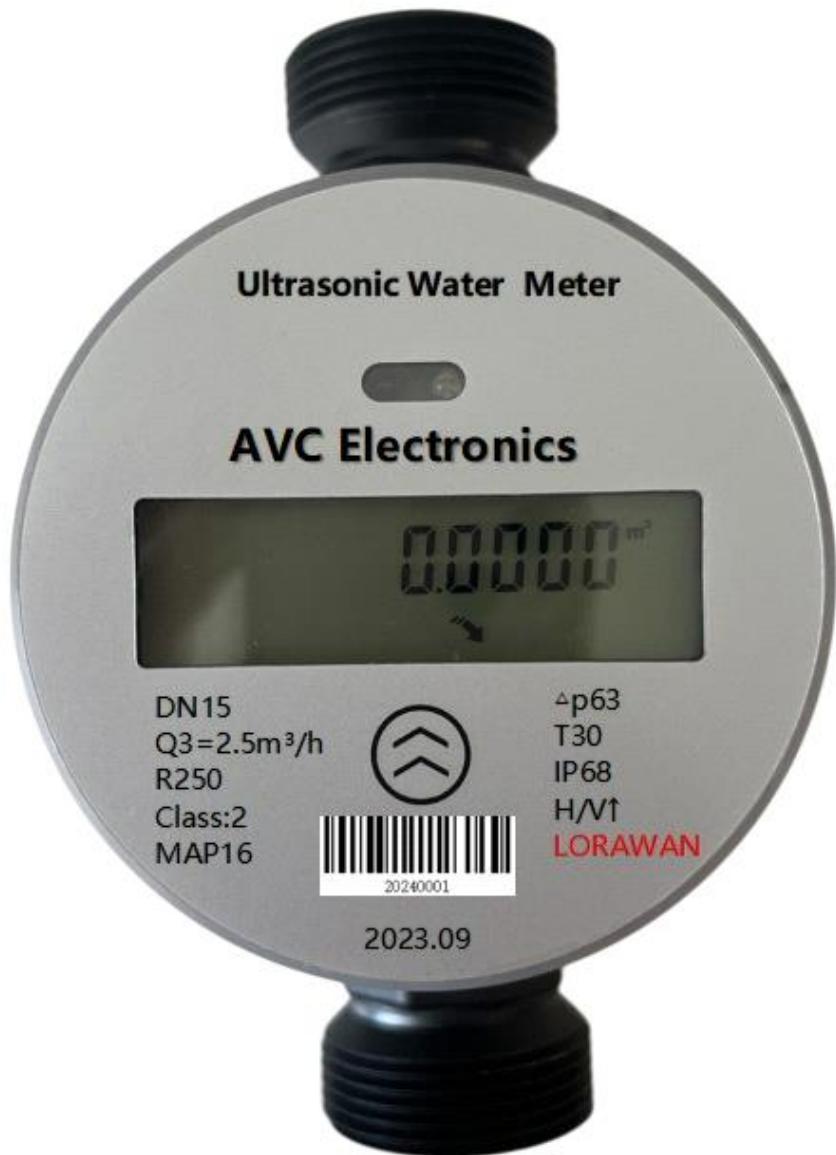
Ultrasonics Water Meter

D15-NBIoT/ D15-LoRaWAN Series

User Manual

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⚠ Attention!

⚠ Use with Caution!

- **Overview**

  All contact details can be found at the end of this manual.

  This manual provides essential information for the **AVC Electronics Ultrasonic Water Meter** used in water flow measurement applications. It includes information on product performance, installation, operation, maintenance, troubleshooting, and technical support.

  The meters are designed using Time-of-Flight ultrasonic sensing technology, offering high accuracy across a wide dynamic range. They are compatible with AMR/AMI remote metering systems.

- **Receipt/ unpack of the product**

  Upon receiving the package, inspect the box for visible damage before unboxing. Ensure the product was not damaged during shipping. If any abnormality is found, immediately notify the shipping carrier, distributor, or AVC Electronics technical support.

  If the box is intact, open it to find the ordered water meter unit (based on your order specification – e.g., DN15 with NB-IoT communication).

Figure 1. AVC Electronics

Please verify the product's integrity immediately. If any issues are identified, contact your distributor or AVC support as soon as possible. If confirmed defective, a replacement will be arranged through official sales channels. This user manual is provided inside the box or available electronically prior to delivery.

Knowing the products

Product description
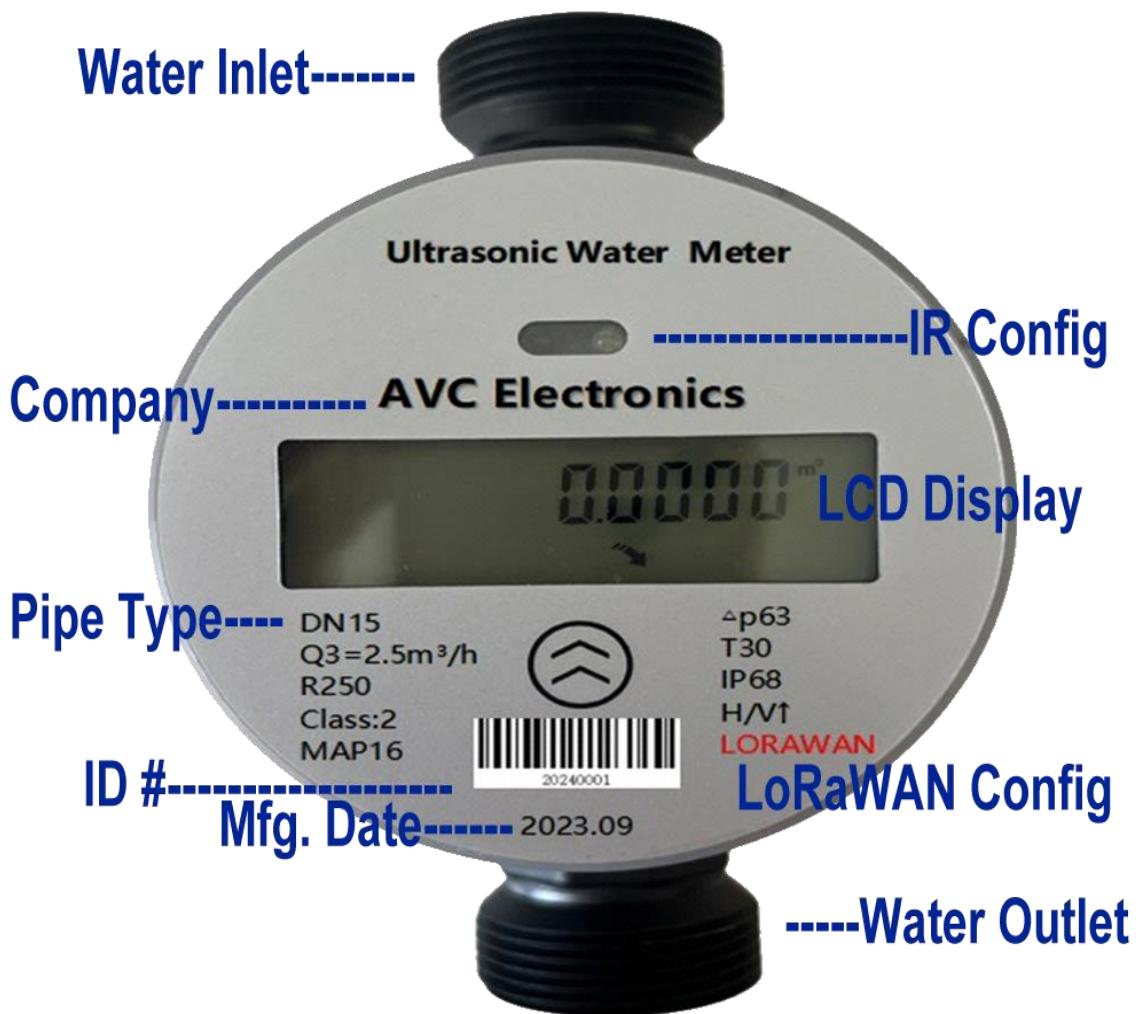
Figure 2. Product description

Mechanical dimensions

Flow channel	L (mm)	W (mm)	H (mm)	G Threaded connector
DN15	165	93	90	G3/4B
DN20	195	93	90	G1B
DN25	225	93	90	G1-1/4B

Technical specifications

All specifications listed in the table below apply under calibration conditions at 20°C and 101.325 kPa absolute pressure using clean water. The device is factory-calibrated in horizontal installation mode.

Spec	Value			Unit
DN	DN15	DN20	DN25	L/min
Class		2.0		%
Q3	2.5	4	6.3	m^3/h
Q3/Q1		400/250		
Q1	6.25/10	10/16	15.8/25.2	L/min
Q2	10/16	16/25.6	25.2/40.4	m^3/h
Q4	3.125	5	7.9	m^3/h
Flowpipe		U10 D5		
Pressure		MAP16		
Pressure Loss		40		
Temperature		T30/T50		
Protection Level		IP68		
Communication		Optional: NB-IoT, LoRaWAN		

⚠ Attention!

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Installation

Do not attempt to open, disassemble, or modify any part of the product, as this may cause malfunction or permanent damage.

For best performance, the ultrasonic water meter should be installed in a low-vibration pipeline system. Avoid installation near strong mechanical vibrations or electromagnetic fields.

Horizontal installation is recommended. If vertical installation is unavoidable, ensure the pipe is completely filled with water, especially at the measurement section.

The meter performs best under vibration-free conditions. Excessive vibration may generate turbulent flow and acoustic noise, leading to inaccurate measurements.

Before installation, carefully check the pipeline and fittings:

- Ensure the pipeline is clean, free from particles, rust, oil, or any foreign substances.

- Connectors must be intact, undamaged, and free of leakage.

- After installation, pipes should not be twisted or bent sharply. If bends are required, they must be smooth and gradual.

Always install the device in accordance with the flow direction arrow printed on the meter body.

⚠ Note: The ultrasonic water meter is not suitable for corrosive liquids or high-viscosity fluids. For questions regarding fluid compatibility, please contact AVC Electronics Technical Support.

A / B / C: Suggested

D / E: Not suggested
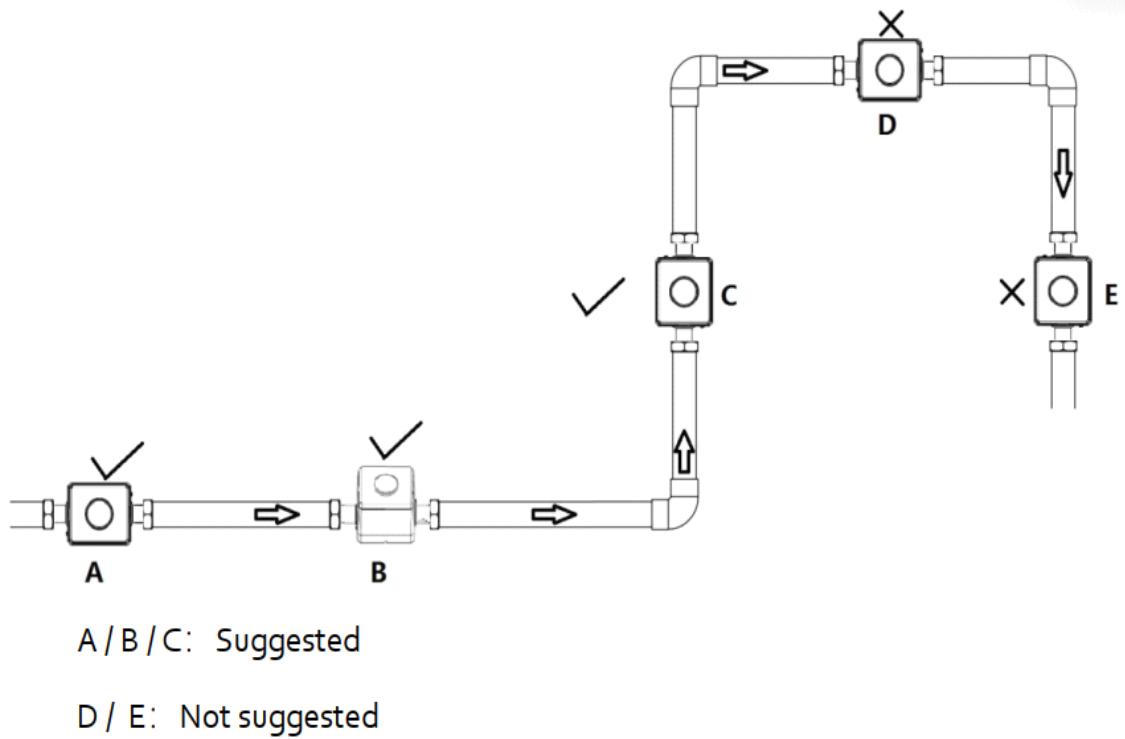
- **Basic operation**

  ### Check the Product Specifications

  Before using the water meter, verify the specifications in this manual or on the product label:

  - The operating pressure rating of the meter must not be lower than the system pressure.

  - The operating flow range must remain within the specified limits.

  - The measured liquid must be clean water, without suspended solids, corrosive agents, or high viscosity.

  ⚠ Note: Exceeding the rated pressure may cause permanent damage to the device.

Check the Pipeline System
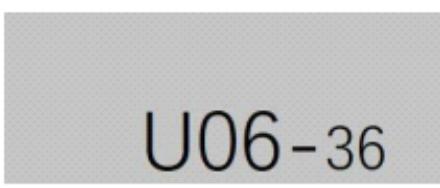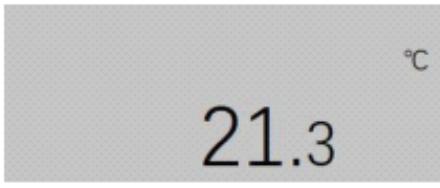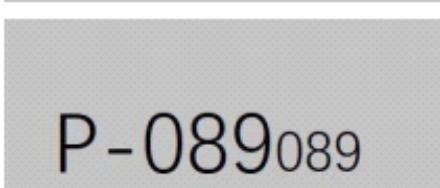
For accurate measurement and safe operation:

- Ensure the pipe is clean and free of particles, rust, grease, or foreign materials.

- An upstream filter is recommended to prevent contamination.

- Check all connections to ensure no leakage, twisting, or sharp bends.

- Always confirm the installation direction matches the flow arrow on the meter body.

Check for Leakage

Before commissioning, check the system for leakage. Pressurized air or nitrogen may be used for testing. Any detected leakage must be resolved before normal operation begins.

LCD Display

99999.999 m³

Totalized flow rate (m³)

9.999 m³/h

Instant flow rate (m³/h)

U06-36

Version

21.3 ℃

Temperature(℃)

00000001

Serial number

P-089089

Reverse flow & forward flow signal strength

No water in the pipeline

Flow direction

Leakage

Wireless communication

Battery low power:

Error
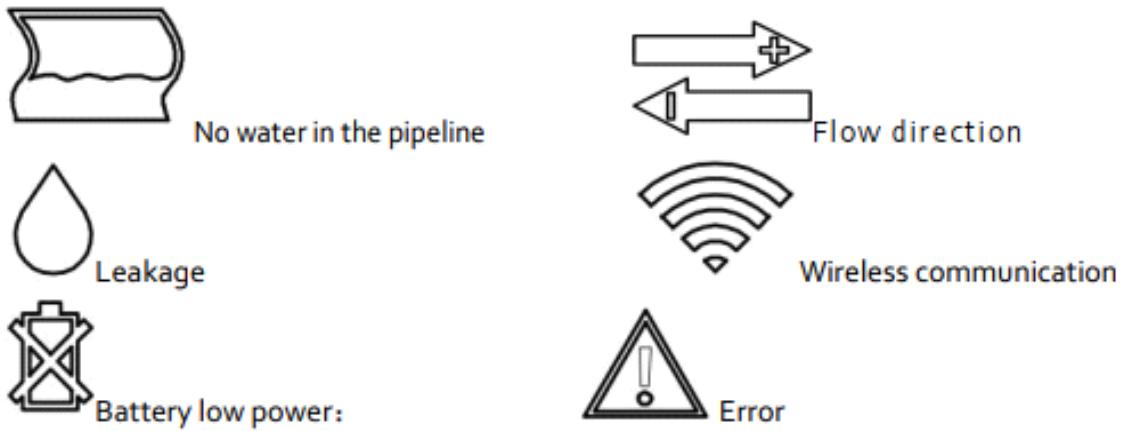
- **NB-IoT Communication**

  - **NB-IoT Communication – Downlink Control Protocol**

The water meter supports NB-IoT communication. Downlink control is performed using AT commands.

AT+SUPLDPA:01440,00010,60,01440,00000\r\n

Original Data Feedback:

AT+SUPLDPA:OK\r\n<Command>

Upload interval: 1440 minutes

Upload delay (minutes): 10 minutes

Upload delay (seconds): 60 seconds

Active meter reading cycle: 1440 minutes

 "reserve": "1", "cmdData": "AT+SUPLDPA:01440,00010,60,01440,00000\r\n"

AT+SUPLDPA:01440,00010,60,01440,00000\r\n

- **Agreement Content**

Specific Analysis of Upload Protocol:

FE FE FE 68 10 78 56 34 12 00 00 00 81 91 92 1F 01 00 30 06 15 03 18 28 03 DD 05

03 F8 1F 00 2B 18 06 00 2B 09 03 00 35 00 50 01 00 25 00 08 00 00 68 01

00 00 00 00 03 2B 18 06 00 00 00 2B 09 03 00 00 00 15 03 18 2B 18 05 00

00 2B 09 02 00 05 00 00 00 00 14 03 18 2B 18 04 00 00 2B 09 01 00 00 00

13 03 18 A0 05 E0 01 3C A0 05 64 00 62 00 62 00 01 15 00 92 29 04 00 50 25

18 11 86 89 30 50 82 45 40 81 64 08 00 00 28 03 DD 05 01 00 FF FF 2E EB 8C 16

> **68** is the frame start symbol 68H
>
> **10** is the instrument type T
>
> **78 56 34 12 00 00 00** is the address A0–A6, BCD code, with the lower order first. Parsed as: 00000012345678
>
> **81** is the control code C
>
> **91** is the data length field L

92 1F 01 00 30 06 15 03 18 28 03 DD 05 03 F8 1F 00 2B 18 06 00

00 2B 09 03 00 35 00 50 01 00 25 00 08 00 00 68 01 00

00 00 00 03 2B 18 06 00 00 00 2B 09 03 00 00 00 15 03 18

2B 18 05 00 00 2B 09 02 00 05 00 00 00 00 14 03 18 2B 18 04 00

00 2B 09 01 00 00 00 13 03 18 A0 05 E0 01 3C A0 05 64

00 62 00 62 00 01 15 00 92 29 04 00 50 25 18 11 86 89

30 50 82 45 40 81 64 08 00 00 28 03 DD 05 01 00 FF FF 2E EB A

Total of 145 characters

> **92** is the data identifier **DIO**
>
> **1F** is the data identifier **DII**
>
> **01** is the serial number **SER** (00: key triggered; 01–250: serial number)
>
> **00 30 06 15 03 18** is the time → **March 15th, 2018 at 6:30:0s**
>
> **28 03** is Protocol No. **808**
>
> **DD 05** is the status word number **1501**
>
> **03 F8 1F 00** is the identification code

Data Area Definition

- 2B 18 06 00 00 represents a positive cumulative flow of 0.618 m³

- 2B is the flow unit code representing 0.001 m³

Flow unit codes:

- **2A** → 0.0001 m³
- **2B** → 0.001 m³
- **2C** → 0.01 m³
- **2D** → 0.1 m³
- **2E** → 1 m³
- **2B 09 03 00 00** is the reverse cumulative traffic of 0.309 m³
- **2B** is again the flow unit code representing 0.001 m³

Additional flow unit codes:

- **29** → 0.00001 m³
- **2A** → 0.0001 m³
- **2B** → 0.001 m³
- **2C** → 0.01 m³
- **2D** → 0.1 m³

- **35 00 50 01 00** is the instantaneous flow rate, BCD code, with the lower digit first. → **1.5000 m³/h**, where **35** represents the instantaneous flow unit code **m³/h**.

- **05 25 00 00** is the water temperature → **25.05°C**

- **08 00** is the working time → **8 hours**

- **68 01** is the power supply voltage, unit: 0.01 V

  - Example: 0x0168 → 3.60 V

- **00 00** is the status word

- **00 00** is the status word 2

- **00** is the working mode

  - 00 → No valve

  - 01 → Remote control mode

  - 02 → Prepaid mode

- **03** is the number of daily historical data records (here: **3 records**)

- **2B 18 06 00 00** represents the previous day's frozen **positive flow** of **0.618 m³**

- **2B** represents the flow unit code of **0.001 m³**

Flow unit codes:
- 29 → 0.00001 m³
- 2A → 0.0001 m³
- 2B → 0.001 m³
- 2C → 0.01 m³
- 2D → 0.1 m³
- 2E → 1 m³
- **2B 09 03 00 00** represents the **previous day's frozen reverse flow** of **0.309 m³**
- **2B** represents the flow unit code of **0.001 m³**

Flow unit codes:
- 29 → 0.00001 m³
- 2A → 0.0001 m³
- 2B → 0.001 m³
- 2C → 0.01 m³
- 2D → 0.1 m³
- 2E → 1 m³

- **00 00** is the status word
- **00 00** is the status word 2

- **15 03 18** was frozen on the previous day with a **timestamp of March 15th, 2018**
- **2B 18 05 00 00** represents the **positive flow rate** of **0.518 m³** frozen in the first 2 days
- **2B** is the flow unit code of **0.001 m³**

Flow unit codes:
- 29 → 0.00001 m³
- 2A → 0.0001 m³
- 2B → 0.001 m³

- 2C → 0.01 m³

- 2D → 0.1 m³

- 2E → 1 m³

- **2B 09 02 00 00** represents the **previous 2 days' frozen reverse flow** of **0.209 m³**

- **2B** represents the flow unit code of **0.001 m³**

Flow unit codes:

- 29 → 0.00001 m³

- 2A → 0.0001 m³

- 2B → 0.001 m³

- 2C → 0.01 m³

- 2D → 0.1 m³

- 2E → 1 m³

- **00 00** is the status word

- **00 00** is the status word 2

- **14 03 18** was frozen on the previous day with a **timestamp of March 14th, 2018**

- **2B 18 04 00 00** represents the **positive flow rate** of **0.418 m³** frozen in the first 3 days

- **2B** represents the flow unit code of **0.001 m³**

Flow unit codes:

- 29 → 0.00001 m³

- 2A → 0.0001 m³

- 2B → 0.001 m³

- 2C → 0.01 m³

- 2D → 0.1 m³

- 2E → 1 m³

- **2B 09 01 00 00** is the **reverse cumulative flow** of **0.109 m³** in the first 3 days

  - **2B** represents the flow unit code of **0.001 m³**

Flow unit codes:

- 29 → 0.00001 m³

- 2A → 0.0001 m³

- 2B → 0.001 m³

- 2C → 0.01 m³

- 2D → 0.1 m³

- 2E → 1 m³

- **00 00** is the status word

- **00 00** is the status word 2

- **13 03 18** was frozen on the previous day with a **timestamp of March 13th, 2018**

- **A0 05** is the reporting interval unit in minutes → **1440 minutes (1 day)**

Content	Data format	Unit	Byte count	Description	Note
Reporting interval	HEX	Minute	2	Reporting interval	**Example:** Original data: A0 05 Analysis method: HEX

					Low position in front, high position in back $0x05A0 \rightarrow 1440$ **Result:** 1440 minutes

- **E0 01** is the upload delay minute → **480 minutes (8 hours)**

Content	Data format	Unit	Byte count	Description	Note
Upload Delay Score	HEX	Minute	2	Upload Delay Score	**Example:** Original data: E0 01 Analysis method: HEX Low position in front, high position in back $0x01E0 \rightarrow 480$ **Result:** 480 minutes

3C is an upload delay of **60 seconds** (hexadecimal value).
If it is greater than or equal to 60 seconds, the NB module will split the data according to its own IMEI number and reporting interval.

Upload Delay in Seconds

- **3C** = Upload delay in seconds → **60 seconds**

Content	Data format	Unit	Byte count	Description	Note
Upload delay seconds	HEX	Second	1	Upload delay in seconds	**Example:** Original data: 3C Analysis method: HEX $0x3C \rightarrow 60$ **Result:** 60 seconds

Meter Reading Interval

- **A0 05** = Meter reading interval in minutes → **1440 minutes (1 day)**

Content	Data format	Unit	Byte count	Description	Note
Meter reading interval	HEX	Minute	2	Meter reading interval	**Example:** Original data: A0 05 Analysis method: HEX Low in front, high in back 0x05A0 → 1440 **Result:** 1440 minutes

Total Number of Uploads

- **64 00** = Total number of uploads → **100 times**

Content	Data format	Unit	Byte count	Description	Note
Total number of uploads	HEX	Times	2	Total uploads	**Example:** Original data: 64 00 Analysis method: HEX 0x0064 → 100 **Result:** 100 times

Number of Successful Uploads

- **5A 00** = Number of successful uploads → **90 times**

Content	Data format	Unit	Byte count	Description	Note
Number of successful uploads	HEX	Times	2	Successful upload count	**Example:** Original data: 5A 00 Analysis method: HEX Low in front, high in

				back 0x005A → 90 **Result:** 90 times

Total Number of Meter Readings

- **62 00** = Total number of meter readings (hexadecimal value) → **98 times**

Content	Data format	Unit	Byte count	Description	Note
Total number of meter readings	HEX	Times	2	Total meter readings	**Example:** Original data: 62 00 Analysis method: HEX 0x0062 → 98 **Result:** 98 times

Number of Successful Meter Readings

- **62 00** = Number of successful meter readings → **98 times**

Content	Data format	Unit	Byte count	Description	Note
Number of successful meter readings	HEX	Times	2	Successful meter readings count	**Example:** Original data: 62 00 Analysis method: HEX Low in front, high in back 0x0062 → 98 **Result:** 98 times

Validity of Data Before This Frame

- **01** = Validity of the data before this frame

  - **00** = Invalid

- **01** = Valid

Content	Data format	Unit	Byte count	Description	Note
Is the data before this frame valid	U8	—	1	Data validity before this frame	**Example:** Original data: 01 Result: 01 (Valid)

Signal Strength (RSSI)

- **15** = Signal strength (hexadecimal data) → **21**

Content	Data format	Unit	Byte count	Description	Note
Signal strength	U8	—	1	RSSI (signal strength)	**Example:** Original data: 15 HEX: 0x15 → 21 Result: 21

Type of Operation Room (NB Module Type)

- **00 00** = Type of operation room (hexadecimal data)

  - 00: Telecom NB

  - 01: Mobile NB

  - 02: Unicom NB

Content	Data format	Unit	Byte count	Description	Note

Type of operation room	U8	—	1	NB module type	00 = Telecom NB 01 = Mobile NB 02 = Unicom NB

ICCID of SIM Card

- **92 29 04 00 50 25 18 11 86 89** = ICCID (BCD code) of the SIM card

Content	Data format	Unit	Byte count	Description	Note
ICCID of SIM card	BCD Little Endian High position at the back	—	10	ICCID of SIM card	**Example:** Original data: 92 29 04 00 50 25 18 11 86 89 Analysis method: BCD code **Result:** 8986111825500042992

IMEI of the Module

- **30 50 82 45 40 81 64 08 00 00** = IMEI (BCD code) of the module

Content	Data format	Unit	Byte count	Description	Note
IMEI of the module	BCD Little Endian High position at the back	—	10	IMEI of the module	**Example:** Original data: 30 50 82 45 40 81 64 08 00 00 Analysis method: BCD code **Result:** 864814045825030

Protocol Version

- **28 03** = Protocol version **808** (used for removing status words from uploaded data blocks)

Content	Data format	Unit	Byte count	Description	Note
Protocol version	HEX Little Endian High position at the back	—	2	Protocol version	**Example:** Original data: 28 03 Analysis method: HEX 0x0328 → 808 **Result:** 808

Upload the Verification Code for Data Blocks

Content	Data format	Unit	Byte count	Description	Note
Upload the verification code for the data block	HEX (U16) Little Endian High position at the back	—	2	Upload the verification code of the data block, and accumulate it from the reporting interval to the first 2 bytes of the current byte	**Example:** Accumulated bytes: A0 05 E0 01 3C A0 05 64 00 5A 00 62 00 62 00 01 15 00 92 29 04 00 50 25 18 11 86 89 30 50 82 45 40 81 64 08 00 00 28 03 DD 05 01 00 FF FF **Result:** 0xEB

8C is the **verification code CS**

68 10 78 56 34 12 00 00 00 81 91 92 1F 01 00 30 06 15 03 18 28 03

DD 05 03 F8 1F 00 2B 18 06 00 00 2B 09 03 00 35 00 50 01 00 25 00

08 00 00 68 01 00 00 00 00 03 2B 18 06 00 00 00 2B 09 03 00 00 00

15 03 18 2B 18 05 00 00 2B 09 02 00 05 00 00 00 00 14 03 18 2B 18

04 00 00 2B 09 01 00 00 00 13 03 18 A0 05 E0 01 3C A0 05 64 00 62

00 62 00 01 15 00 92 29 04 00 50 25 18 11 86 89 30 50 82 45 40 81

64 08 00 00 28 03 DD 05 01 00 FF FF 2E EB

- Perform binary arithmetic accumulation, disregarding overflow values exceeding FFH.
- 16 is the ending symbol 16H.

- **Definition of Status Word**

Table 1. IOTST1501.2 Status ST First Byte Definition Table

Bit	Definition	Description
D7	Reverse measurement	0: Positive 1: Reverse direction
D6	Flow sensor malfunction or air traffic control	0: Normal 1: Fault
D5	Temperature Sensor Failure	0: Normal 1: Fault
D4	Water pipe leakage fault	0: Normal 1: Fault
D3	Water pipe burst fault	0: Normal 1: Fault
D2	Main power status	0: Normal 1: Undervoltage
D1	Reserve	Reserve
D0	Reserve	Reserve

Table 2 IOTST1501.2 Status ST Second Byte Definition Table

Bit	Definition	Description
D7	Verification status	0: Non-calibrated 1: Verification
D6	Reserve	0
D5	Reserve	0
D4	Reserve	0
D3	Reserve	0
D2	Reserve	0
D1	Reserve	0
D0	Reserve	0

Warranty and Liability

Service contact and information

AVC Electronics is committed to ensuring the quality of its products. For any questions or product support, please contact our customer service at the address below. We will respond to your request in a timely manner and work with you toward your complete satisfaction.

Customer service and all orders should be addressed to:

AVC Electronics Inc.

16600 Harbor Blvd. Suite F

Fountain Valley, CA 92708

Email: son@avcelectronic.com

For orders, please provide an accurate and full postal address.

AVC Electronics does not ship to P.O. Boxes or via a third party.

Please contact infomation@acv.com to obtain a Return Materials Authorization (RMA) before shipping products back for returns or factory services such as calibration. Please specify as clearly and detailed as possible in your email the product's status and your intention to return it. Be sure to include the RMA on the returned package or attach a letter with the RMA information.

For further information and updates, please visit www.acvelectronic.com.