

SMART

ULTRASONIC

BATTERY

**SMART
ULTRASONIC BATTERY
WATER METER**

WATER

METER

SECTION 01

Product Overview

SMART
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BATTERY
WATER
METER

Smart Ultrasonic Battery Water Meter

Smart Ultrasonic Battery Water Meter



AQUA-W is a low-power, real-time measurement water meter completed with precise and reliable domestic technology. It is an intelligent multi-purpose meter with additional functions such as remote communication and pressure and temperature measurement.

It is an ultrasonic water meter that calculates the flow rate by precisely measuring minute changes in ultrasonic propagation time for fluid flow. It does not cause pressure loss due to pipe diameter reduction and mechanical drive. This is an innovative new product that supports remote meter reading including small block/flow monitoring.

AQUA-W

System introduction



Ultra-precise digital measurement method

- **AQUA-W** is a water meter for large water use of a completely digital ultrasonic measurement method without a mechanical drive, and it has a **high measurement accuracy of 250 times**.
- Accurate flow rate measurement is possible for low flow rates of 2 cm/sec or less by applying digital signal processing technology, and an artificial **intelligence algorithm** is implemented to self-diagnose obesity ducts, reflux, bubble generation, and sensor abnormalities.
- By processing all measurement results digitally, measurement results can be converted into a database without loss, so that not only **remote meter reading** but also **pipe network monitoring** can be performed at the same time.



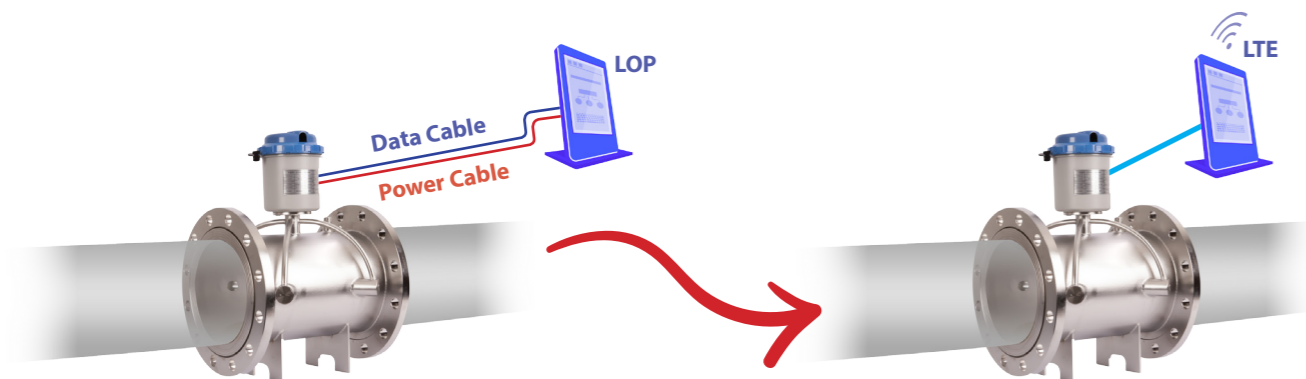
Wireless Data Transmission

- **MiniCAT-C1**, the secondary indicator used with the **AQUA-W**, can display the measurement result of the water meter digitally, so you can check the measurement status of the **AQUA-W** from the **outside of the manhole**.
- It collects/stores information such as flow rate, pressure, and device status, and transmits the collected data at **least every minute** in the LTE-CAT.M1 method. Security is enhanced by **providing an encryption function** during data transmission.



Low construction/Maintenance cost

- Because both **AQUA-W** and **MiniCAT-C1** are powered by the built-in battery, no external power construction is required during installation, and using a power saving algorithm, it can be used for up to **8 years without battery replacement**.
- In the case of black products, **the period of use can be extended through re-inspection and battery replacement**, so reinstallation costs can be reduced.
- Since **Mini-CATC1** enables remote data transmission even in closed places such as manholes or common pits, it is possible to configure a **remote meter reading** and **small block flow monitoring system** for large numbers at a low cost without construction required for power and LOP installation.



AQUA-W

technology introduction

Overview

- Battery-independent power water meter (50~350mm) : A product that implements the ultrasonic propagation time difference method with digital signal processing and picosecond precision time measurement technology. Pressure can be measured simultaneously in real time.
- Built-in high-performance ICT wireless communication function enables operation in poor communication environments such as underground manholes.
- It is manufactured as a flange replacement type that is easy to install by minimizing the size, so it is applied to all domestic and foreign environments with different flange specifications.
- By applying a super-power circuit, it can be operated without external power for 8 years using only battery power.

Specifications

- It operates at a level exceeding the required life span only by battery power (required lifespan of 6 years, operating life of more than 8 years).

Core Technology

- A product that implements complete low-power signal processing, a smart measurement technology, and power management according to temperature and flow rate changes, an intelligent diagnostic technology.

Technical Features

- Conveniently applicable to water supply pipes of different standards by replacing flanges. By adopting a remote meter reader capable of wireless communication in an underground manhole environment, installation costs are minimized. Usable (cost reduction)

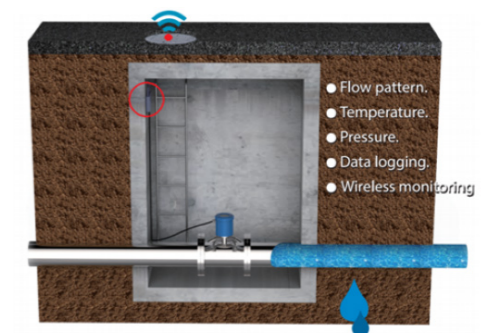
Characteristic

- Multi-function & multi-function ultrasonic flow sensor: Multi-item measuring meter (sensor) of pipe network combined with water meter + ICT + wireless pressure → Multi-item measuring products and sensors such as temperature, pressure, logger, wireless communication, and flood information.
- Intelligent ultrasonic flow sensor: After diagnosing the meter status, fluid condition, and performance condition of the flow meter beyond international standards, transmit it remotely.

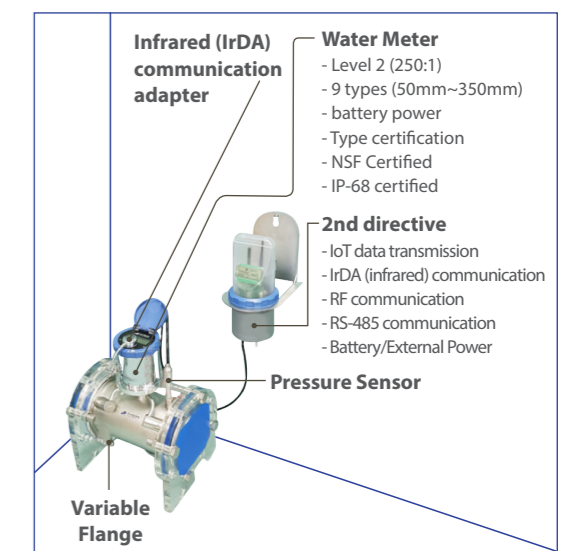
Target Technology (Photo)



[Fig.1] Ultrasonic water meter(50~350 mm, 10 types)



[Fig.2] Measurement and utilization in the underground manhole.



[Fig.3] Ultrasonic Water Meter Configuration and Features

AQUA-W System and Product Composition

AQUA-W

- Battery Powered Ultrasonic Water Meter.
- 250 magnification level 2.

MiniCAT-C1

- Battery Powered Remote Meter Reading/Data Acquisition Device.
- Water meter measurement result display.
- LTE wireless data transmission.
- Flow/pressure/diagnostic result storage.
- Device can be controlled via dedicated Bluetooth App.

Infrared communication (IrDA) cable

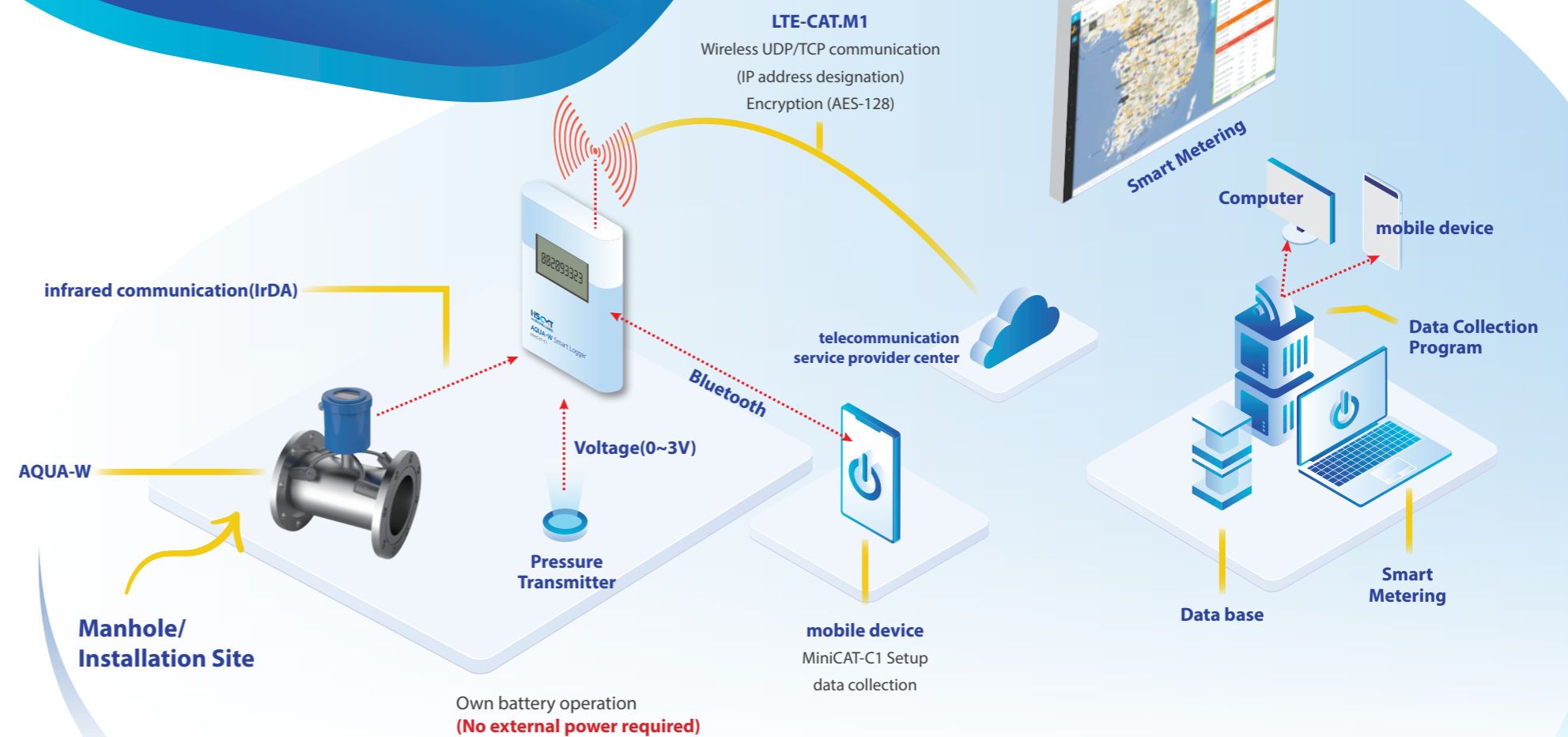
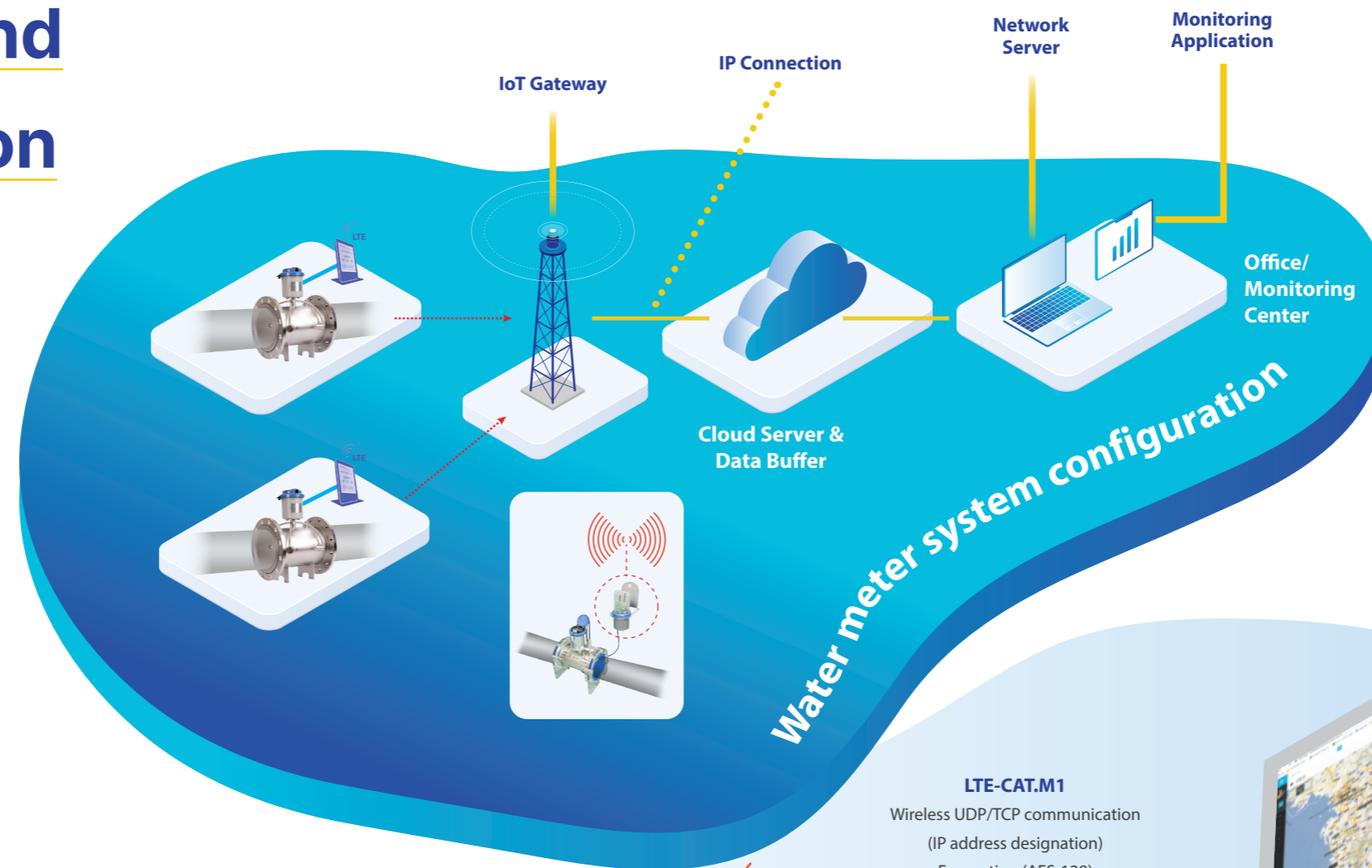
- Infrared flow measurement and diagnostic data transfer to MiniCAT-C1.

Digital pressure transmitter

- Hydraulic pressure measurement up to 20 bar.

Smart Metering (control program)

- Database management.
- Remote meter reading and pipe network monitoring function.



SECTION 02

Principle and composition

SMART
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Smart Ultrasonic Battery Water Meter

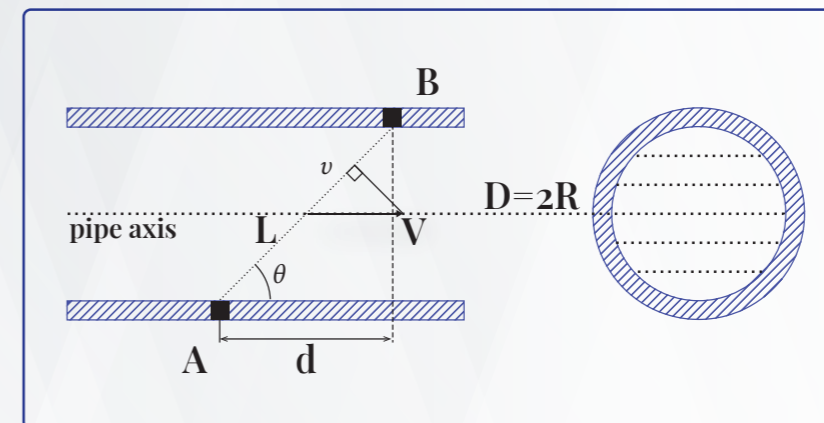
AQUA-W

Measuring Principles

The ultrasonic multi-path flow measurement AQUA-W is connected to paired ultrasonic transducers which are arranged at specific heights in the channel and the pipe.

The flow velocity on the chords at each of height is determined by a transit time measuring method in which the ultrasonic wave is transited more rapid in the forward direction than in the reverse direction to the fluid flow.

When the ultrasonic wave is traveled crossing in a diagonal direction to the fluid flow, it is accelerated upon being traveled in a forward direction to the fluid flow and on the contrary decelerated upon being traveled in a reverse direction thereto due to the flow velocity component of fluid.



$$t_1 = \int_0^{t_1} dt = \int_0^L \frac{ds}{c + v(s) \cos \theta}, \quad t_2 = \int_0^{t_2} dt = \int_0^L \frac{ds}{c - v(s) \cos \theta}$$

$$t_1 = \frac{1}{c} \int_0^L \left\{ 1 - \frac{v(s)}{c} \cos \theta \right\} ds, \quad t_2 = \frac{1}{c} \int_0^L \left\{ 1 + \frac{v(s)}{c} \cos \theta \right\} ds$$

$$t_1 = \frac{L}{c} - \frac{1}{c^2} \int_0^L v(s) \cos \theta ds, \quad t_2 = \frac{L}{c} + \frac{1}{c^2} \int_0^L v(s) \cos \theta ds$$

$$\int_0^L v(s) \cos \theta ds = 2L^2 \frac{t_2 - t_1}{(t_1 + t_2)^2}$$

$$\text{Finally, } Q = \int_0^L v(s) \sin \theta ds$$

Product Composition

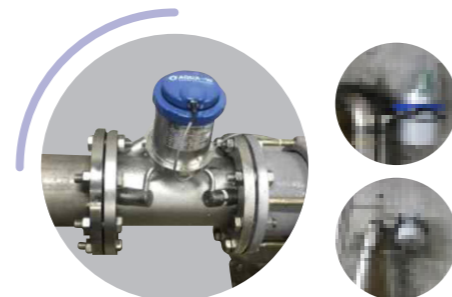
Ultrasonic water meter structure



Product Structure



Field application result w/IoT remote meter reading

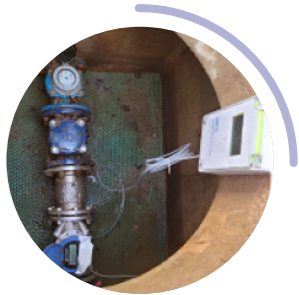


Simultaneous measurement of volume, temperature, and pressure (w/IOT)

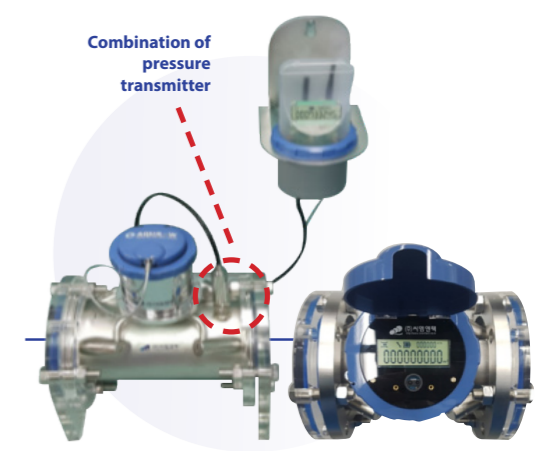


Characteristic

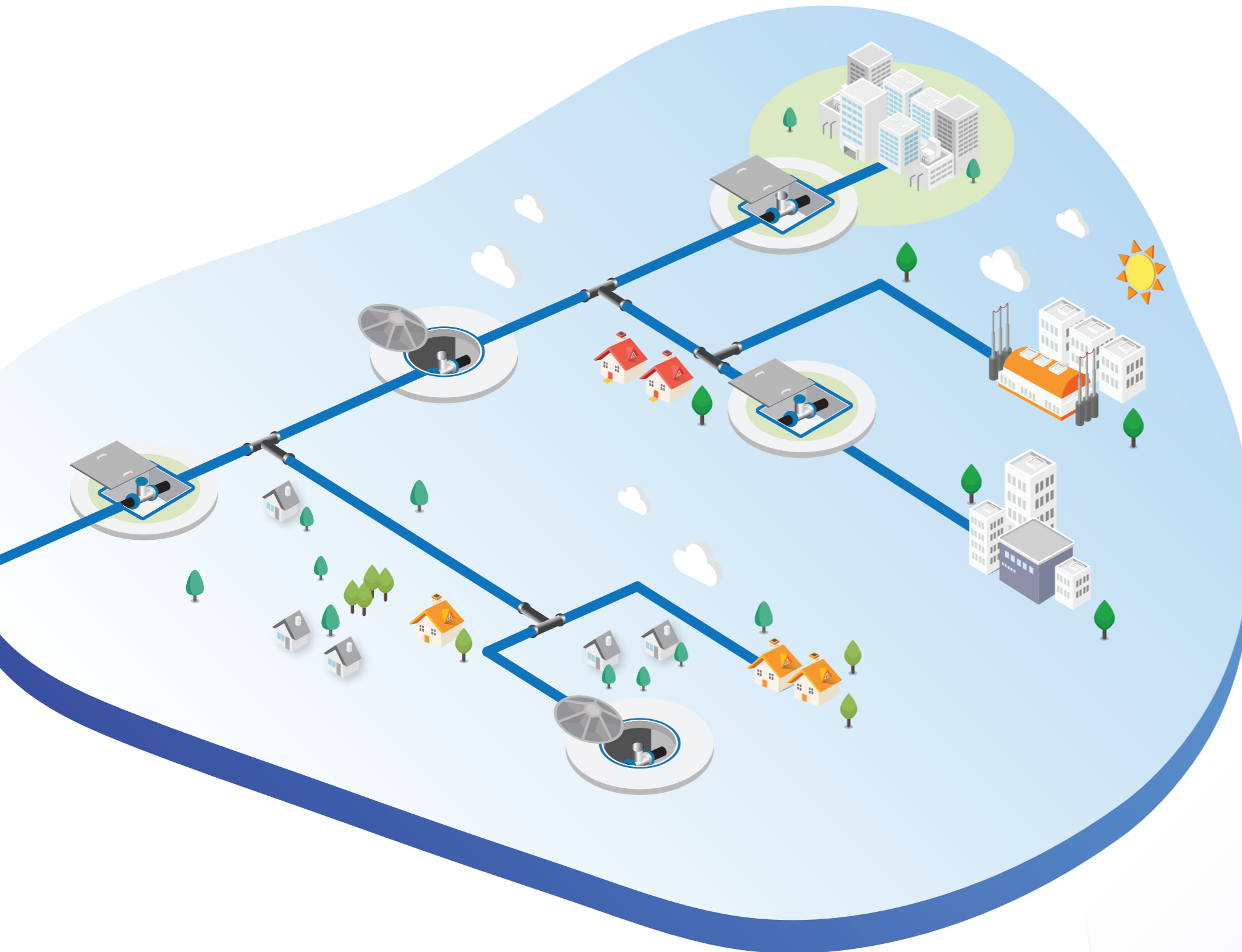
- Ultra-precise digital flow measurement method.
- Wireless data transmission capability via dedicated communication transmission device.
- Ultrasonic measurement method without mechanical drive.
- 250:1 flow ratio realization (Class 2)
- Design application considering the water supply network.
- It is possible to configure a small flow rate monitoring system at a low construction cost.
- 1:1 compatibility with mechanical calorimeter flow parts.



Main Specifications

<h3>Main Specifications</h3>	<ul style="list-style-type: none"> • Completed development of low-power products with a diameter of 50 to 350mm • Performance(@DN100mm) : Grade 2, R250, Qs(0.008), Q1(0.1) • Life expectancy prediction: 0.1 mW/s Lifespan 8 years or more(D-cellx7unit) • Material: STS-304 (pipe), PEEK (sensor) • Structure: 2 lines (diametric), measurement interval 2 Hz(performance check for each interval) • Performance evaluation of low-power pressure sensor installation completed (3.6 V, power consumption ~1.45μA, 0~2μA) • Improvement of correction method to improve performance • Low Power IoT Implementation (RF, LoRA and Nb IoT) 	 <p>Combination of pressure transmitter</p> <ul style="list-style-type: none"> • Ultrasonic propagation time difference method ($\Delta t \sim V$), [Flow velocity \times cross-sectional area]
<h3>Applied Technology</h3>	<ul style="list-style-type: none"> • Ministry of Environment Global Top Environmental Technology Development Project. (Eco Smart Waterworks System Development Project) • Development of multifunctional(flow, temperature, pressure) intelligent measurement system for pipe network analysis. • Registered 5 related patents. • 9 types of type approval, KC certification, NSF certification, registration of innovative technology development products by the Ministry of Environment. 	<h3>Core Technology</h3> <ul style="list-style-type: none"> • Low-power signal processing technology (firing cycle less than 1 second, lifespan: more than 8 years) • High-efficiency sensor manufacturing technology (for high frequency: secure more than 2 times) • Measurement pipe pressure loss within 0.05 bar. • Implementation of killer function by applying complex diagnosis such as smart leak diagnosis function.
<h3>Performance</h3>	<ul style="list-style-type: none"> • Domestic: Seongnam, K-water (Goesan, Seocheon), Jeju, Boryeong, etc. • Overseas: China, Uzbekistan - 1 each 	

Installation location and Function/Purpose



- **APPLICATIONS** :Drinking water, waterworks and industrial applications.
- **AVAILABLE SIZES** : DN50~DN350mm.
- **FLANGE STANDARD** : We changed flange with stop-ring, so if you can all of type standard
- **CONSTRUCTION** : Stainless steel 304 material(ASTM)
- **PRIMARY PROGRAMMABLE DISPLAY**
- **ELECTRICAL OUTPUT** : Pulse resolution(m^3 /pulse)and pulse duration

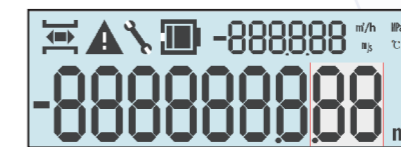
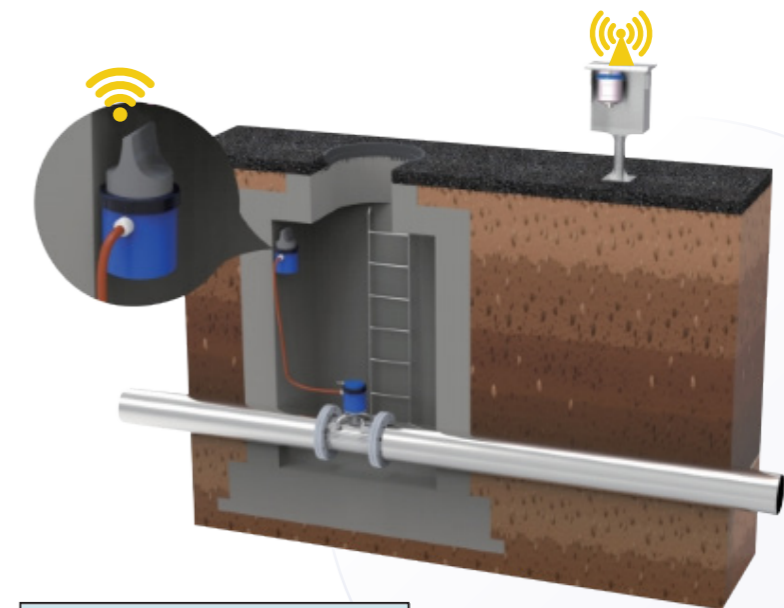
INSTALLATION REQUIRMENTS

The AQUA-W can be installed inlet and outlet any position. It's must be full and no entrained air bubbles(2%/Vol.) with water all the time. It's needs straight pipe run 5D(up-stream) and 2D(down-stream).

Usage

NB-IoT

Remote meter reading (1 HR, data 1 minute)



- 1 Instantaneous flow rate change pattern(maximum, minimum, hourly, night minimum flow)
- 2 Alarm, diagnosis (excessive metabolism, regurgitation, water temperature, water quality, etc.)
- 3 Pressure changes (pressure events, water gunshots, etc.)
- 4 Change in water quality (change in temperature, change in concentration)

1. Material: Stainless steel and hygienic (STS-304)
2. Adoption of variable LCD with high visibility (9 digits)
3. Output pulse: resolution (m^3 /pulse)

Caliber	50	65	80	100	125	150	200	250	300	350
Pulse 1(L)					1, 10, 100, 1000, 10000	Choose 1				
Pulse 2(L)					1, 10, 100, 1000, 10000	Choose 1				
Black mode					0.001, 0.01, 0.1, 1, 10, 100	Choose 1				

SECTION 03

Specifications and Features

SMART
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WATER
METER

Smart Ultrasonic Battery Water Meter

AQUA-W

Technical Specifications

- 01 Measurement method**
 - Ultrasonic 2 lines.
- 02 Measurement accuracy (Class 2 water meter)**
 - Q1 ~ Q2 = 5%, Q2 or higher = 2%, Q3/Q1 = 250x magnification.
- 03 Flow rate display**
 - Accumulated flow: $\pm 123,456.789$ or $\pm 1,234,567.89$ (m³)
 - Instantaneous flow rate: ± 123.456 or $\pm 1,234.56$ (m³/h)
- 04 Supply power**
 - Internal battery (more than 8 years lifespan)
- 05 Internal battery
(More than 8 years lifespan)**
- 06 Communication**
 - Infrared (IrDA) measurement data output.
 - Transmission of measurement data via dedicated secondary indicator.
- 07 Certifications**
 - Type approval (KTC, grade 2), NSF, IP-68 waterproof certification, sanitary safety certification (Korea Water and Sewerage Association)
 - Korea Institute of Standards and Science (KRISS) performance test certification.

Ultrasonic Battery Water Meter

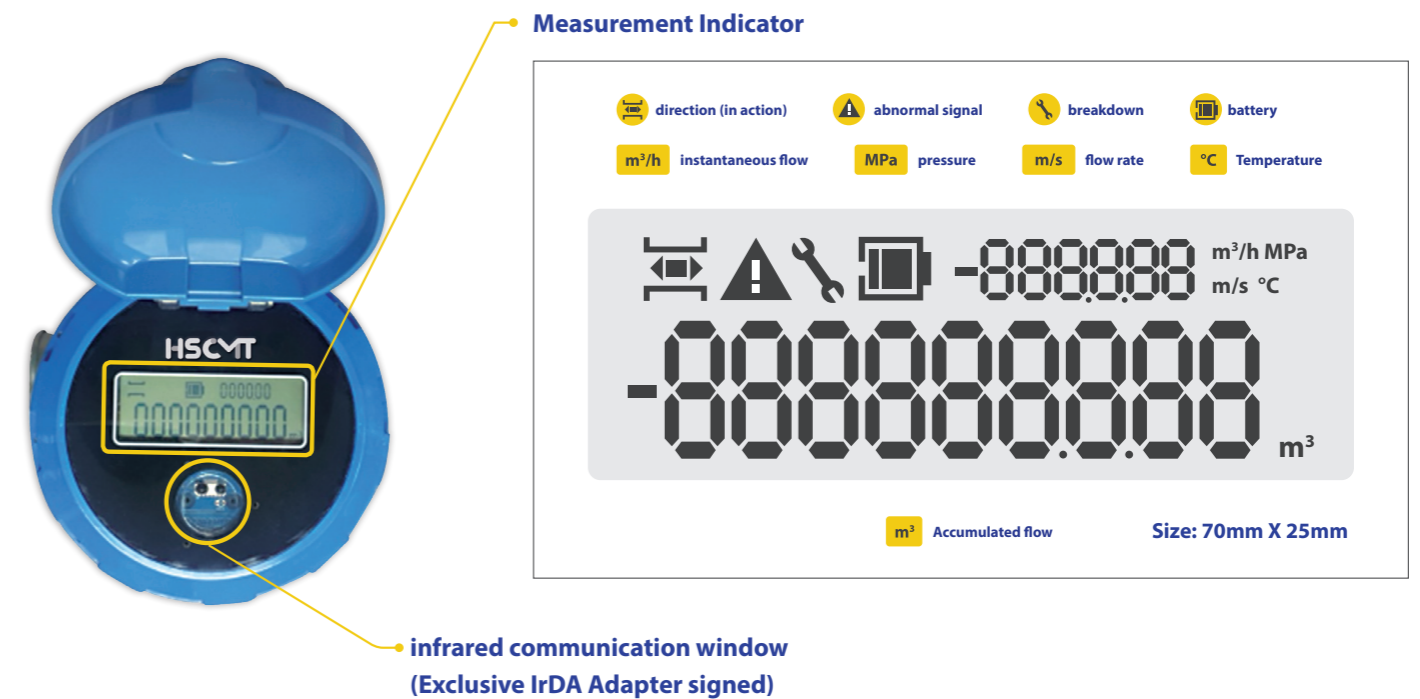
AQUA-W

Specifications

Common Specifications

Item	Details	Shame	Note
Model name	AQUA-W		HSCMT Ultrasonic Water (Flow) Meter
Ultrasonic measurement method	Channels	Wet 2Ch	Time difference measurement method, reflection type (150 A or less), direct method (200 A or more)
	Frequency	1 Mhz	
MCU	STM32L	32LMhz	-
Measurement accuracy	$Q1 \leq Q \leq Q2$	5%	Grade 2 water meter (Refer to the table on the back for the standard flow rate by diameter)
	$Q2 \leq Q$	2%	
Supply Power	Li-SO ₂ Cl ₂ Battery	1330 Ah	Lifespan 8 years or more (Energy saving mode applied)
Measurement period	Minimum measuring cycle	1.5 seconds	
Display	Exclusive black and white LCD	Accumulated amount display: 123456.89ton	-
		Accumulated amount display: 123456.89ton	-
		device status	Device error, full check, battery level, sensor failure
data communication	serial communication	IrDA (115,200 bps)	dedicated infrared module is used, measurement result transmission only
texture	Measurement unit (Controller)	ABS	-
	Measuring part(Tube)	STS-304	Obtained NSF Certification
waterproof rating	IP68	-	-
Flange standard		KS D 3578	Variable flange can be applied (optional)
size and weight	Measurement unit (Controller)	Measuring part(Tube)	
	Measuring part(Tube)		Reference flow rate by diameter

*IrDA Infrared Data Association



Standard flow rate by diameter

Nominal standard	Starting flow QS [m ³ /h] (Flow [m/sec])	Q1 [m ³ /h] (flow rate [m/sec])	Q2 [m ³ /h] (flow rate [m/sec])	Q3 [m ³ /h] (flow rate [m/sec])
50A	0.05 (0.006)	0.25 (0.031)	0.40 (0.049)	63.0 (7.78)
65A	0.20 (0.015)	0.40 (0.029)	0.64 (0.047)	100.0 (7.36)
80A	0.20 (0.011)	0.64 (0.034)	1.02 (0.055)	160.0 (8.06)
100A	0.6 (0.019)	1.00 (0.031)	1.60 (0.050)	250.0 (7.82)
150A	1.5 (0.022)	2.52 (0.037)	4.03 (0.059)	630.0 (9.25)
200A	1.5 (0.015)	2.52 (0.025)	4.03 (0.040)	630.0 (6.24)
250A	1.5 (0.012)	4.00 (0.031)	6.40 (0.049)	1000.0 (7.07)
300A	1.5 (0.007)	6.40 (0.028)	10.24 (0.046)	1600.0 (7.13)
350A	1.5 (0.005)	6.40 (0.023)	10.24 (0.037)	1600.0 (5.77)

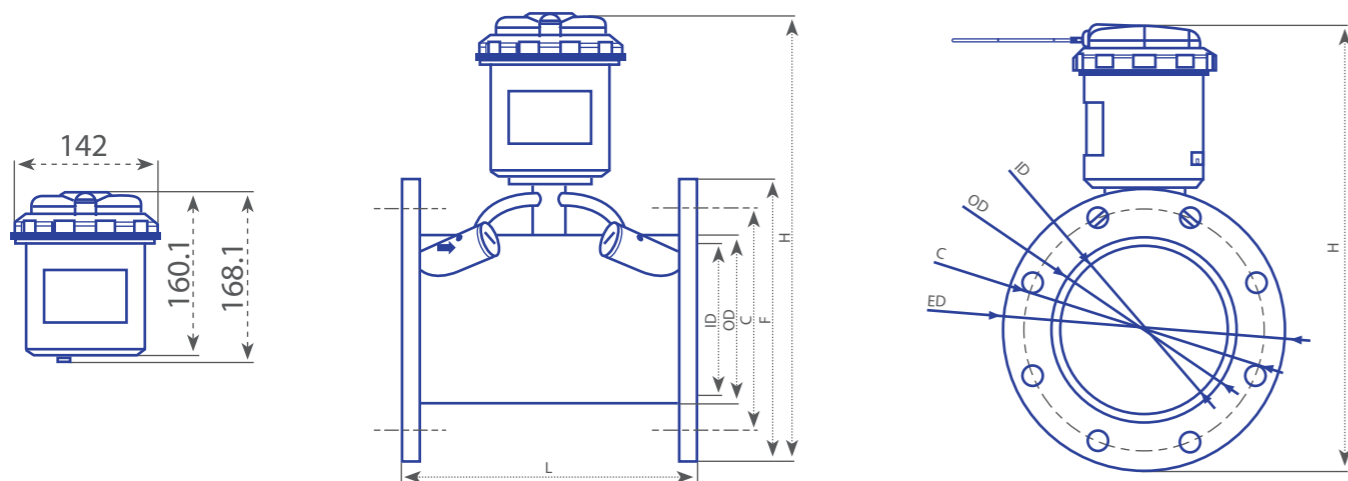
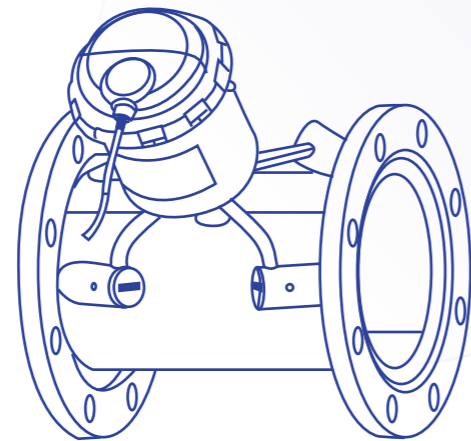
Certifications and Awards	Certification
Excellent product by the Ministry of Environment	Excellent product by the Ministry of Environment
Type Approval	KTC (Korea Institute of Machinery, Electrical and Electronic Equipment)
NSF Certification	National Sanitation Foundation, USA
Sanitary Safety Certification	Korea Water and Sewerage Association
IP-68 waterproof certification	Korea Test Institute of Industrial Technology
Performance Certification	Performance Certification

Ultrasonic Battery Water Meter

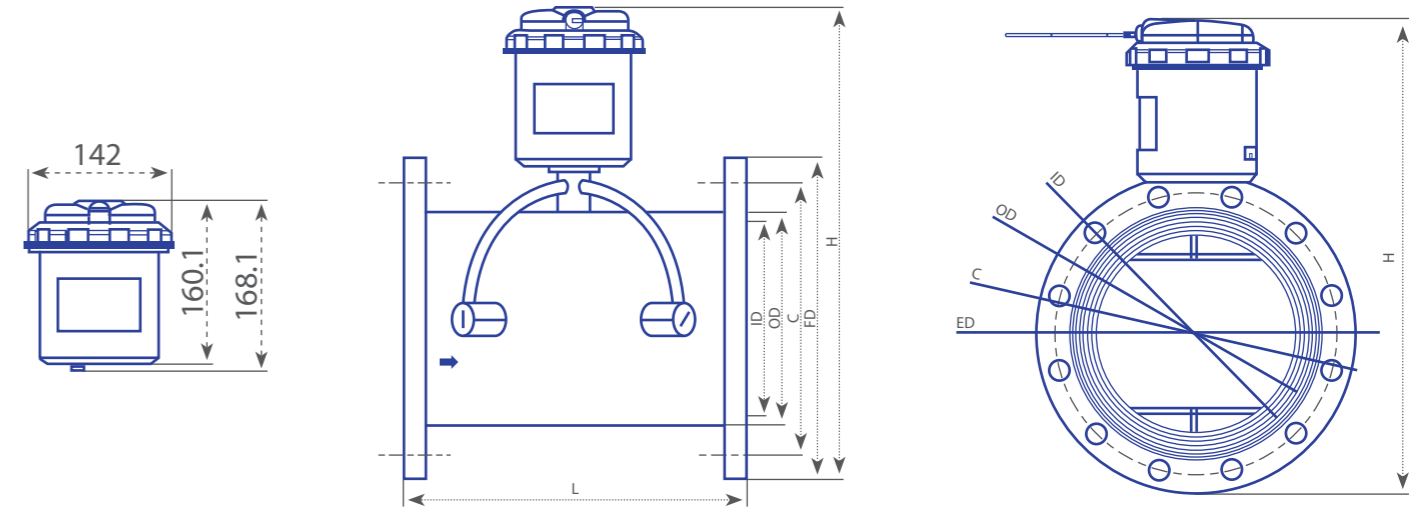
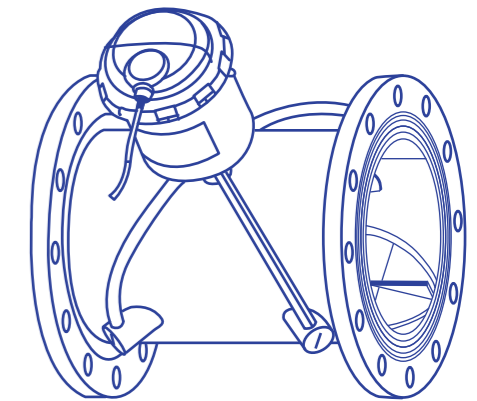
AQUA-W

Specifications

DC Water Meter
Backwashes
50A-150A



DC Water Meter
Conditions
200A-350A



Product specifications by diameter

View	L (interface distance)	H (height)	FD (Flange Diameter)	C (bolt fastening)	ID (inner diam- eter)	OD (outer diam- eter)	BOLT HOLE/N	Weight (kg)
50A	200	315	155	120	53.5	60.5	Ø19 X 4	12
65A	200	335	175	140	69.3	76.3	Ø19 X 4	15
80A	200	345	185	150	81.1	89.1	Ø19 X 8	19
100A	250	370	210	175	106.3	114.3	Ø19 X 8	21
125A	250	410	250	210	129.8	139.8	Ø23 X 8	25
150A	300	440	280	240	155.2	165.2	Ø23 X 8	29
200A	350	501	330	290	203.3	216.3	Ø23 X 12	36
250A	450	545	400	355	254.4	267.4	Ø25 X 12	50
300A	500	589	445	400	305.5	318.5	Ø25 X 16	60
350A	550	630	490	445	339.6	355.6	Ø25 X 16	80

Ultrasonic Battery Water Meter

AQUA-W

Product Highlight

Description

- HSCMT's flowmeters utilize the multi-path transit-time flow measurement technique which is designed for accurate flow measurement ($\pm 0.20 \sim 0.5\%$ of actual flowrate) in pipes. Depending on accuracy requirements, the flowmeters can be set up to operate 1-10 acoustic paths.

- This meter uses multi-path ultrasonic waves to measure the mean value of velocities of the fluid lines on the cross section area of the fluid and calculates the flow volume without any coefficients by applying a double integral formula to the velocity and the area distribution. (Patented) This method minimizes measurement errors due to the complicated velocity profile with installed conditions. (near elbows, valves, pumps and etc.)

Measurement Principle

Features

High accuracy measurement technology.

With large measurement range (max/min flow).

With large measurement range (max/min flow).

On-site calibration test. (Dry Calibration Method)

High accuracy with the short straight pipe and slow flow velocity.

Measurement based on the measured value (MV), not the full scale deflection (FS), nullifies the effect of flow range.

Installation without stopping flow (Hot-tapping) and In-line transducer replacement.

Diagnosis : Empty, Power ON/OFF, Factor, Reset and Error Code.

Technical Specifications

Maximum Working Pressure	~1.6 Mpa
Liquid Temperature	0.1 – 50°C
Accuracy Class	Class2 (OIML R-49)
Configuration	Compact - The display is built in to the unit
Power Source	D size Li-battery - 8 years life time
Environmental Protection	IP 68, Ambient operation temp. -25°C ~ 55°C
Display Units (SI)	Multi line 9 digit LC display (Programmable - m ³ , Flow rates and volume)
Outputs (optional)	IrDA, Programmable dual open collector pulse output

Ultrasonic Battery Water Meter

MiniCAT-C1 Specifications

Secondary indicator (MiniCAT-C1)

Item	Details	Shame	Note
Model name	MiniCAT-C1		HSCMT AQUA-W Smart Logger
Wireless communication	LTE-CAT.M1	LGT (800MHz)	Global SIM applicable
MCU	STM321	32MHz	-
	RAM	128KB	-
Memory	FRAM (non-volatile)	128KB Expandable to 2MB (optional)	128KB (11 days per minute of data) Expandable to 2MB (360 days per minute of data)
	IrDA*	115,200 bps	water meter (meter) connection , powered by MiniCAT-C1
Communication port	Analog Input	0~3V	pressure transmitter (voltage output) connection
	Bluetooth	115,200 bps	Dedicated app connection for control/data storage
	Supply Power	Li-SO2CI2 Battery	38.0Ah Lifespan of more than 6 years (when wireless data transmission interval is set for 6 hours) External power supply (5V/2A) can be connected.
Display	Exclusive black and white LCD	Accumulated amount display: 1234567.89ton	
		Instantaneous flow rate display: 123.456t/h	
		Pressure display: 123.456bar	
		Equipment status: Equipment error, full charge, battery level	
Network	IP Configuration	Static	-
	Network protocol	UDP, TCP/IP selection	LTE-CAT.M1 wireless data communication
	Serial communication	RS-232C, RS-485 (optional) 115,200bps	Modbus support available (optional)
Bluetooth	Bluetooth 4.2	Dedicated App Connection	
Encryption	AES-128		
Data communication	Measurement data collection interval	1 minute / 10 minutes / 30 minutes / 1 hour	Accumulation, flow, pressure data collection/storage
	Wireless data transmission interval	1 minute / 10 minutes / 30 minutes / 1 hour / 6 hours	LTE-CAT.M1 communication (data transmission to designated server)
	Bluetooth	Used when connecting a dedicated Android App	Device setting, logging data collection
Antenna	LTE-CAT.M1 dedicated internal antenna		
support program	Dedicated Android App	Supports Android Ver 11.0 or higher	Device setting/monitoring, logging data download
Waterproof rating	IP67		
size and weight		125mmX175mmX75mm, 650g (with internal battery)	

*IrDA Infrared Data Association.

The above specifications are subject to change for performance improvement.

Data transmission cycle

Data wireless transmission cycle	Number of data transmitted at one time (data interval)	note
1 min	1 piece (1 minute)	External power required
10 minutes	1 piece (10 minutes)	External power recommended
30 minutes	1 piece (30 minutes)	External power recommended
1 hours	6 pieces (10 minutes)	External power recommended
6 hours	6 pieces (1 hour)	External power recommended



Dedicated Android App for Controlling MiniCAT-C1

Installation location information input, data collection communication related settings, measurement status check

- Connect with MiniCAT-C1 via Bluetooth
- Download saved 1-minute measurement data in MiniCAT-C1
- Android 6.0 or higher



Ultrasonic Battery Water Meter

AQUA-W

Field Installation

Actual installation example



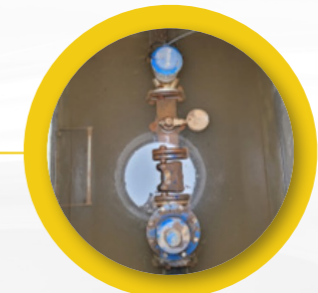
Attaching the MiniCAT-C1



Jeju Bollard installation



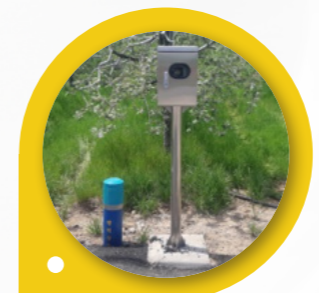
Buan, Jeollabuk-do
Direct installation in the hall



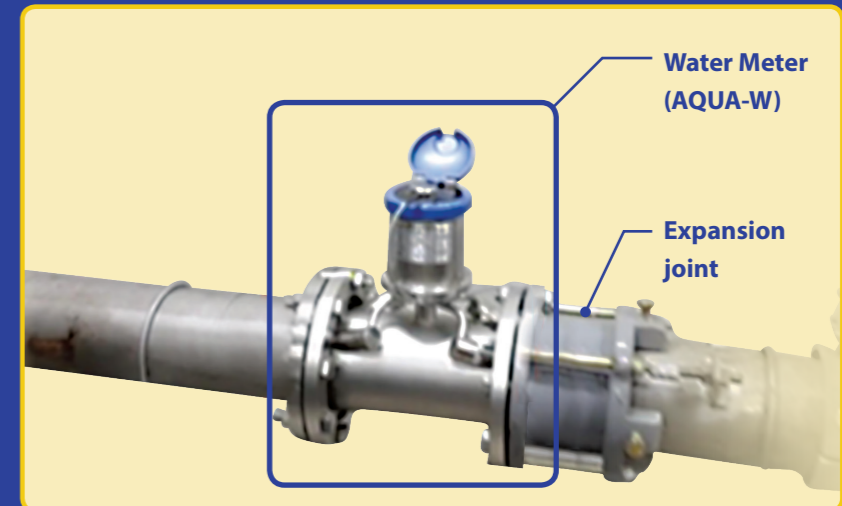
Geochang, Gyeongbuk
LOP installation + external power input



Yesan, Chungcheongnam-do
Mini LOP installation



Actual installation status



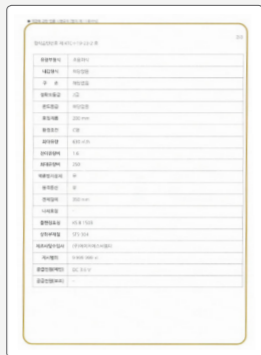
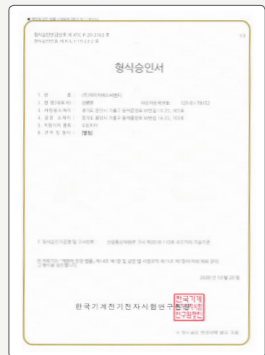
Certificates and Patents

A LEADER
IN THE ENVIRONMENTAL FIELD.
HSCMT.

Water meter certification requirements:

Water meter type approval

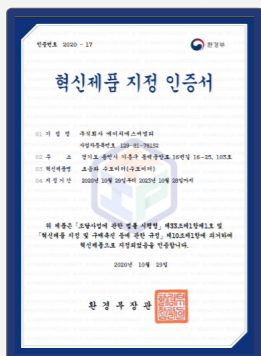
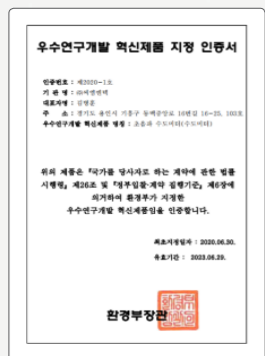
- Flow ratio 250:1
- Size 50A, 65A, 80A, 100A, 150A, 200A, 250A, 300A, 350A



Water Meter Certification: NSF



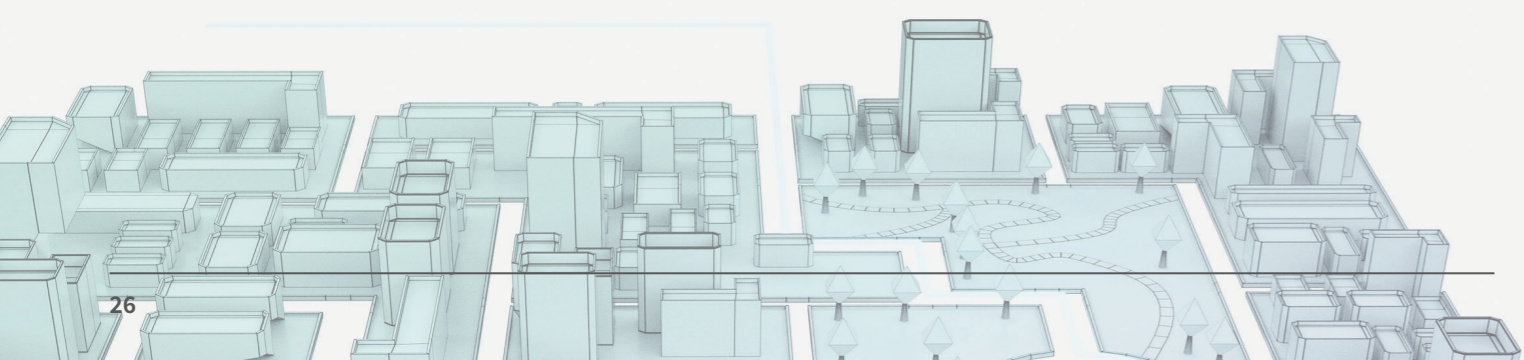
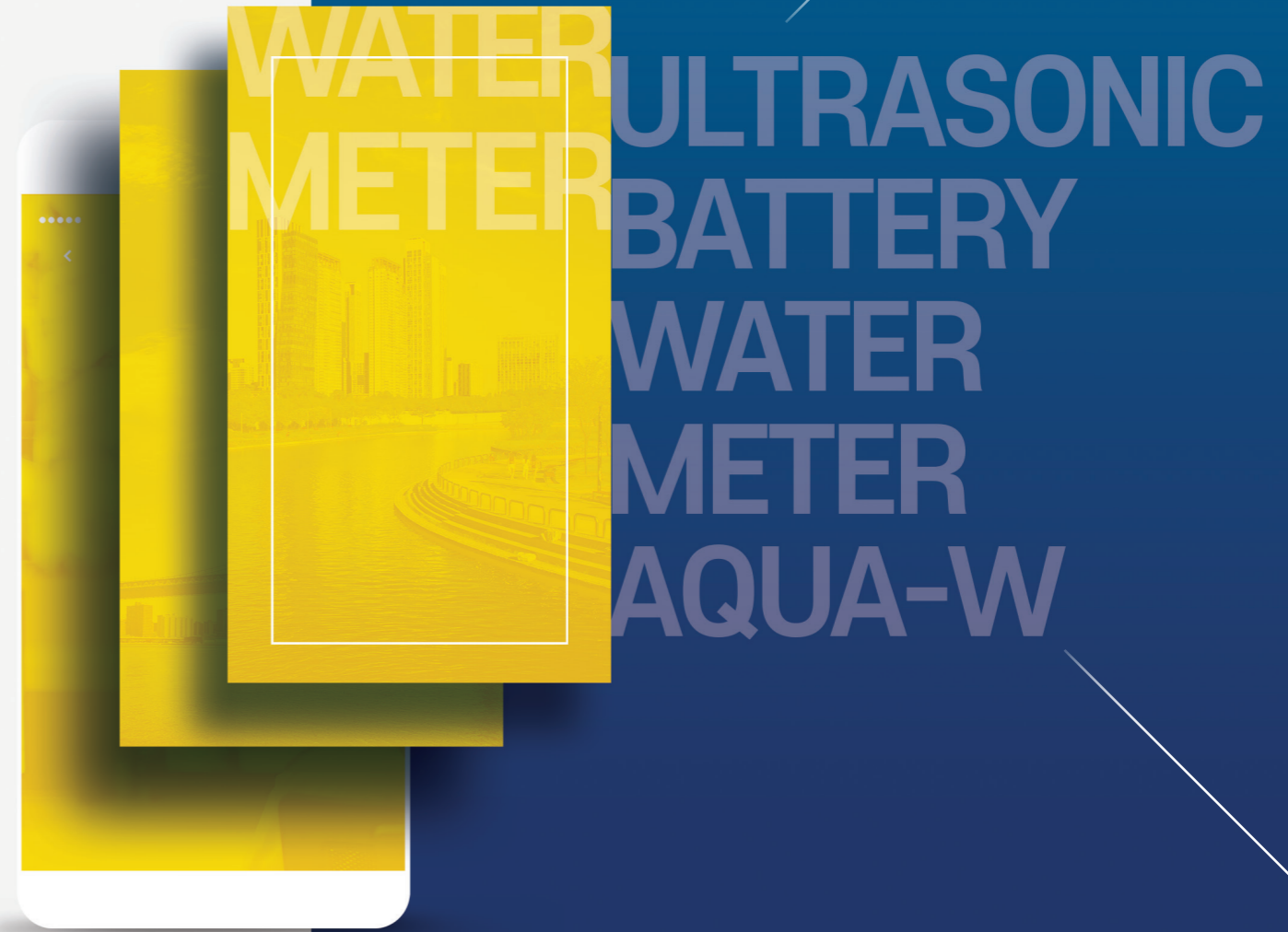
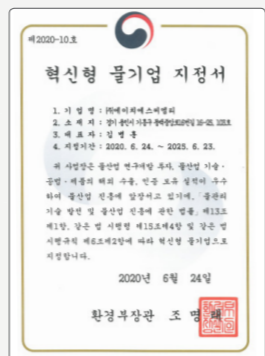
Innovative product designation certificate



KC conformity certification



Innovative water company designation



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