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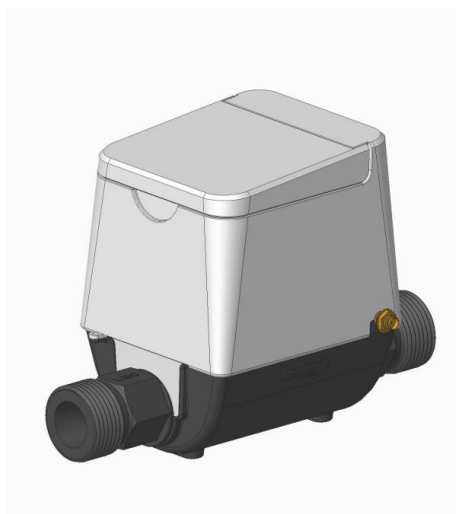# User Manual

**UM20
SICONIA WATER
Smart METERs**

With LTE LPWAN radio

**Optical Port (optional) &
BLE interface (optional)**

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Safety Guidelines:
ALWAYS READ THE INSTALL MANUAL GUIDE BEFORE SET UP OR USE OF THIS PRODUCT. IT IS YOUR RESPONSIBILITY TO FAMILIARIZE YOURSELF WITH THE PRODUCT INSTALL MANUAL GUIDES AND WARNINGS, AND TO USE THE PRODUCT PROPERLY.

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1. GLOSSARY

AWWA	**American Water Works Association**
UL	**Underwriter Laboratories INC**
EN	**European Standards**
IEC	**International Electrotechnical Commission**
LCD	**Liquid-crystal display**
LED	**Light-emitting diode**
PAN	**Personal Area Network**
RAM	**Random Access Memory**
LP	**Long Press (for the button to use the LCD)**
SP	**Short Press (for the button to use the LCD)**
DP	**Doouble press (for the button to use the LCD)**
SW	**SoftWare**
FW	**FirmWare**
WAN	**Wide Area Network**
FCC	**Federal Communications Commission**
ISED	**Innovation, Science and Economic Development Canada**
PDA	**Personal Digital Assistant**

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2. PREAMBLE

2.1. General overview

The product is a water meter intended to be installed to count volume of water passing through. It offers measurements of different flow parameters, a CAT-M1 ™ radio with an optional external antenna connector, an optional BLE interface, an optional optical infrared interface and a push button.
The measurement data can be displayed on the front panel LCD or are also remotely available via optical, BLE or the radio.
The meter pipe can be installed for metrology in whatever direction.The meter will not measure flow when an empty pipe condition is experienced. An empty pipe is defined as a condition when the flow sensors are not fully submerged.
The unit of measure and resolution are factory programmed. Options include gallons, cubic feet and cubic meters.

FCC
Federal Communications Commission (FCC) Statements

WARNING TO USERS IN THE UNITED STATES

Federal Communication Commission Interference Statement 47 CFR Section 15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device UM20-CM4-13 complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NO UNAUTHORIZED MODIFICATIONS

47 CFR Section 15.21

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CAUTION: This equipment may not be modified, altered, or changed in any way without signed written permission from Sagemcom USA. Unauthorized modification may void the equipment authorization from the FCC and will void the Sagemcom USA warranty.

This device complies with FCC RF radiation exposure limits set forth for general population (uncontrolled exposure). This device must be installed to provide a separation distance of at least 31 cm (1 ft) from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

FCC Responsible Party:

Sagemcom USA
14651 N. Dallas Parkway Suite 900
Dallas, TX 75254
Phone: 972-674-4100

FCC Radiation Exposure Statement
This device produces radio frequency energy in the 3GPP band 4 (1710 to 1755 MHz), band 13 (777 to 787 MHz) and 2.4GHz spectrum. The antenna must be positioned to keep a minimum distance of 31 cm (1 ft) from the radiating element to any nearby person.

Innovation, Science and Economic Development Canada "ISED"

WARNING TO USERS IN THE CANADA

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada.
To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This device complies with Industry Canada RF radiation exposure limits set forth for general population (uncontrolled exposure). This device must be installed to provide a separation distance of at least 31cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of +3 dBi. Antennas not included in this list or having a gain greater than +3 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ω.
List of acceptable antenna(s):
- 1GH-06SA-A

2.2. UL certification

 This product is certified by UL. Representative samples of this product have been evaluated by UL and meet applicable standards.

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- o Purpose of control: Water Flow Operating Control
- o Method of mounting CONTROL: independently mounted control
- o Type 1 Action
- o Pollution Degree 2
- o Rated Impulse Voltage: 330 Vac
- o Maximum fluid temperature (TL): 0T50°C
- o Maximum working pressure: 12 bars
- o The Battery is not intended to be replaced by the USER,
- o The instructions for CONTROLS incorporating a battery that contains materials which are hazardous to the environment shall give details on how to remove the battery and shall state that:
- o At end of life of the product the battery must be removed from the product for recycling according to the applicable rules
- o When opening the product, the battery must be disposed safely.

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3. METER CHARACTERISTICS

3.1. Meters overview

An overview of the UM20 meter in its standard configuration is presented in the next figure.
Protection cover, LCD display, button, optical port and pipe screw sealing are always visible.
The BLE antenna is accessible on the front side on the LCD display.

WAN Radio Antenna	Water Outlet
Water flow direction	External RF connector
PAN BLE Antenna	Infrared interface
Flash led for metrology	LCD display
Package and Threading Screw seal ring	Button
	Water inlet
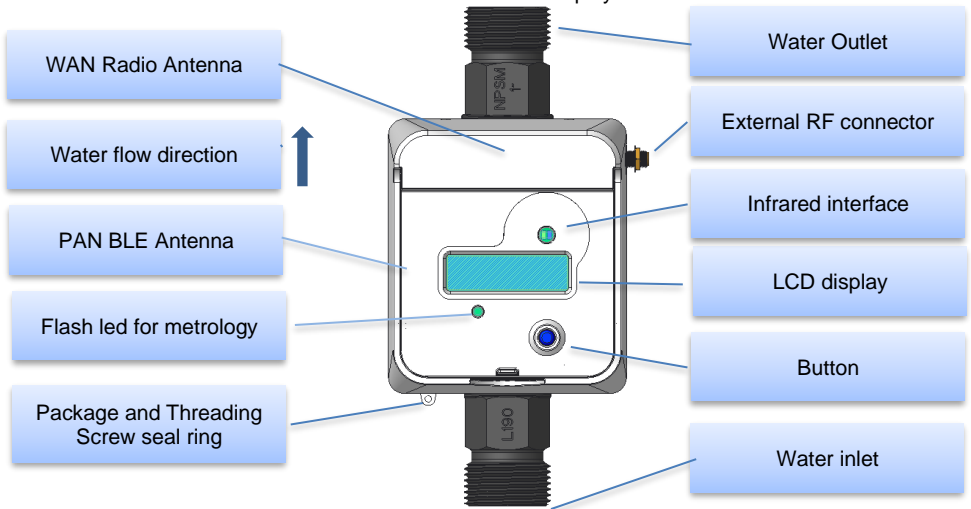
Figure 1 –UM20 water meter – Top view

On the back side, the external antenna connector is visible.

Protection lid	
Package and Threading Screw seal ring	Water output
	External RF connector
	Flow direction arrow
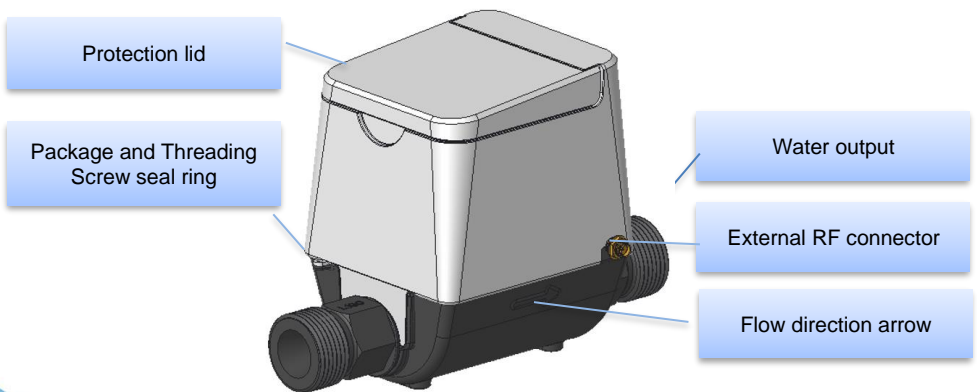
Figure 2 –US20 meter – side view

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3.2. Technical characteristics

Meter Size	5/8 in. x 3/4 in. (15 mm)	1 in. (25 mm)
Pipe lenght	190 mm	273 mm
Operating Range	0.1…25 gpm (0.4…95 lpm)	0.4…55 gpm (1.5…208 lpm)
Minimumm test flow	0.1 gpm (0.4 lpm)	0.4 gpm (208 lpm)
Extended ++	0.03 gpm (0.12 lpm)	0.13 gpm (0.5 lpm)
Extended Low-Flow Rate	0.05 gpm (0.2 lpm)	0.25 gpm (95 lpm)
Maximum test flow	25 gpm (95 lpm)	55 gpm (208 lpm)
Pressure Loss	TBD	TBD
Starting Flow	0.01 gpm (0.04 lpm)	0.07gpm (0.27 lpm)
Reverse Flow – Maximum Rate	TBD	TBD
Operating Performance	33 to 158°F (1 to 70°C)	
Storage Temperature[2]	-13 to 158°F (-25 to 70°C)	
Measured-Fluid Temperature Range	33 to 122°F (1 to 50°C)	
Operating humidity	0 to 99%	
Maximum Operating Pressure of Meter Housing	175 psi (12 bar)	
Flow measurement indexes	Front flow, backflow,	
Alarms	- Dry pipe, overflow, - Air bubbles - Backflow - Water & Air temperature temperature - Leaks - Tampering - Battery level	
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.29 in.(7.25 mm) high	
Register Display	- Water Consumption (up to nine digits) - Rate of flow - Alarms - Metrological menu - History menu - Serial number menu	
Totalization Display Resolution	- gal : 0.XX - ft3: 0.XX	

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[2] Without water in the spool piece. Temperature above 40°C (104°F) could impact the battery lifetime

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	- m3 : 0.XXX
Battery	Product contains a non-replaceable battery of 3.6-volt lithium thionyl chloride; battery is fully encapsulated in a sleeve and is not replaceable; 20-years battery life of metrology
IP (IEC 60529)	IP68
Active communications CAT-M™ per day included	Configurable: eg: 4 frames per day + 1 supervision frame per week
For WAN radio CAT-m™ or PAN BLE	This equipment generates radio frequency signals on 3GPP Band 4 and 13 or 2.4GHz ISM for the BLE radio.
Certification	AWWA, FCC, ISED, UL, VERIZON

3.3. Functionalities

Functionalities	
Metering	
One direction flow meter with numerical display	The direction of water flow is noted on the pipe with an arrow, and also with a symbol displayed on the LCD that blinking during water flow.
Visual indicators and display	
LCD	9 digits local display used for: - Metrological results display - Customer application information - Radio / Battery / Alarm status (icons)
LED	1 LED on the front panel for water volume information only active in the metrology validation mode
Button	1 button for LCD scrolling
Communication link	
Remote access radio interface	CAT-M or BLE
Memory registers / Logging capability	
Capacity	- Minute consumption history: Up to 30 days - Daily consumption history: up to 1 years - Monthly consumption history: up to 3 years - Yearly consumption history: up to 20 years - Events: up to 900 entries NB: Historization is circular (FIFO mode)
Anti-tampering	
Package	Mechanically sealed and seal

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4. PHYSICAL DESIGN

4.1. Meter dimensions

The meter has the dimensions described in the next pictures. All values are in millimeters.
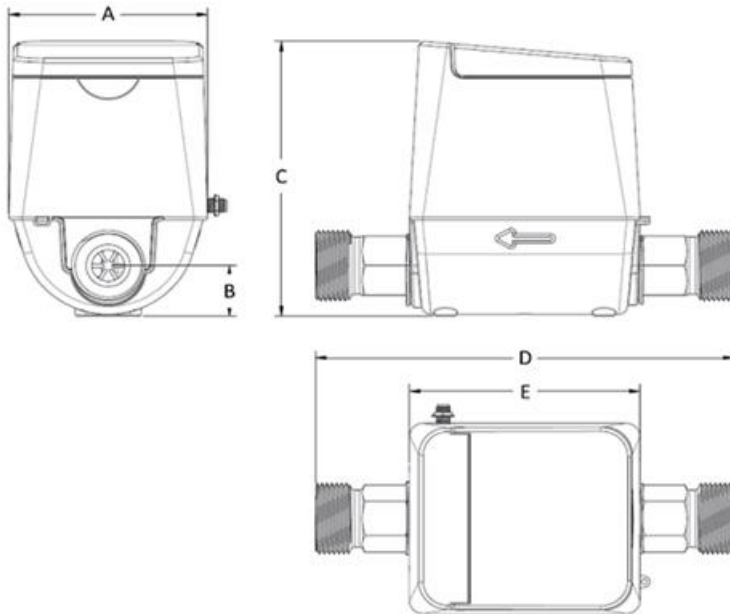
Figure 3 – Dimensions.

	Notes	UM PL190	UM PL273
Box Width (A)	Except RF connector	90.2 mm	90.2 mm
Height (B)	Height below pipe axis	24 mm	22 mm
Height (C)	Total height	130.3 mm	130.3 mm
Pipe Length (D)		190 mm	273 mm
Box Length (E)		104.6 mm	104.6 mm
Thread		NPSM 1"	NPSM 1 1/4"
Weight		1007 g	1069 g

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4.2. Sealing

4.2.1. Casing inner seals

The integrity and the inviolability of the meter are ensured by the internal clipping seals and a lead seal (see position in the Figure 1)
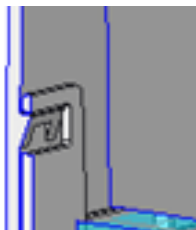

Figure 4 – Example of internal casing seal

The sealing is done by the factory as shown on the above picture. Any tampering suppose destruction of the the sealing clip and surrounding of the packaging.

4.2.2. Screw cover seal

The integrity and the inviolability of the attachment of the meter can be ensured by one sealable threading screw. See position in the Figure 1.

4.3. Meter connection to water pipes

The water meter is screwed on the water source and distribution pipes using the threading (see the Figure 1)
Installation of seal over the water source screw is described in above section.

4.4. Name plate

The laser marking is only applied on the top cover of the meter.
It is precise, durable, legible and permanent. It is applied without mechanical constraints and without contact.

The name-plate of every meter contains all information required by FCC and additional information. It can be seen below:

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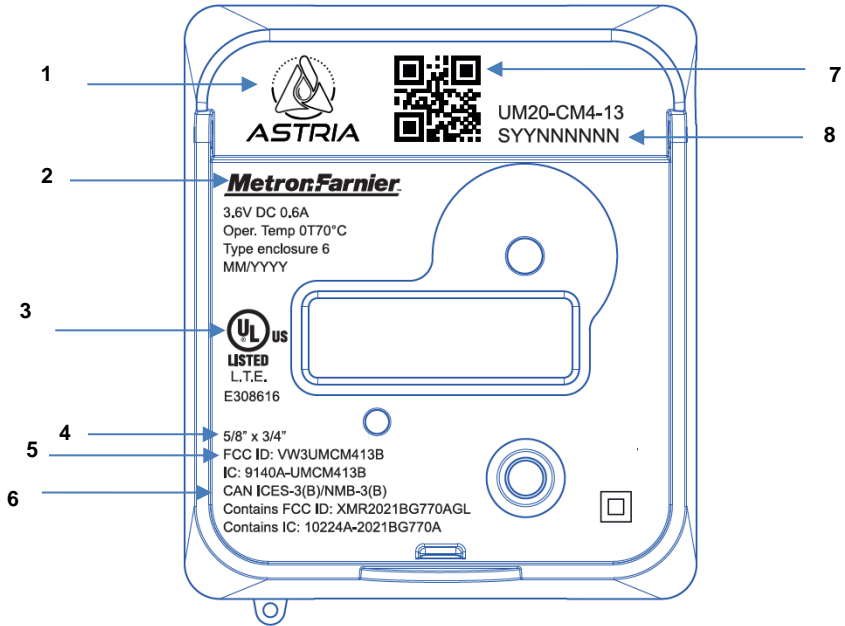
Figure 5 – Meter's nameplate

Table 1: Legend of the nameplate

Number in above figure	Description
1	Commercial name and logo
2	The brand name
3	UL symbol marking
4	Water Meter size
5	FCC ID marking
6	ISED Marking information
7	QR Code
8	Customer serial number

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5. FUNCTIONALITIES

The product supports all the following functionalities.

5.1. Metering Functions

The main function of the product is the metering of water volume flowing through it. It measures and computes all of the values described in this chapter.

All the meters are calibrated and checked in metrology accuracy according to the AWWA. This calibration and these metrology checks are performed once during the manufacturing process. Thus, there is no need to re-calibrate the meters during their certified lifetime.

5.1.1.Measurements

Measurements are done using ultrasonic wave and measuring the time for sound to progress in both flow direction. Those times are processed into the metrologic part to obtain the instantaneous flow. This flow is integrated over time to obtain the volume flown by the meter.

Assuming the notations: c for sound speed in water, v is the flow speed in the spool piece, L is the ultrasonic active measurement path length, Tu and Td are the propagation time for downstream and upstream.

$$Tu = \frac{L}{(c-v)} \ and \ Td = \frac{L}{(c+v)} les \ informati$$

The propagation time difference is then:

$$dTOF = Tup - Tdw = \frac{2 \times L \times v}{c^2 - v^2} \cong \frac{2 \times L \times v}{c^2} \leftrightarrow v = \frac{c^2 \times dTOF}{2 \times L}$$

The sound speed in water is dependant of the water temperature, so we calculate it out of the sum of propagation times.

$$sTOF = Tup + Tdw = \frac{2 \times L \times c}{c^2 - v^2} \cong \frac{2 \times L}{c} \leftrightarrow c = \frac{2 \times L}{sTOF}$$

And thus

$$v = \frac{2 \times L \times dTOF}{sTOF^2}$$

Once the flow speed is known, the volume noted V is calculated by integration over time based in the path section S:

$$V = \int v \times S \times \delta t$$

5.1.2.Temperature

The temperature in °C is obtained from the ultrasonic sound speed, using a reversed approximation of the known Bilaniuk and Wong (1993,1996) convertion of Del Grosso and Mader's 1972 data.

$$c = 1.40238677 \, x \, 103 + 5.03798765 \, T - 5.80980033 \, x \, 10 - 2 \, T^2 + 3.34296650 \, x \, 10 - 4 \, T^3 - 1.47936902 \, x \, 10 - 6 \, T^4 + 3.14893508 \, x \, 10 - 9 \, T^5$$

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5.2. Historical consumption data

5.2.1. Daily record

ID	Name
1	Index
2	Backflow index
3	Period of max flow
4	Period of min flow
5	Maximum temperature
6	Minimum temperature
7	Average temperature
8	Max flow of day
9	Date/Hour

The water meter ensure the possibility to store up to 365 entries (1 year).

5.2.2. Monthly record

ID	Name
1	Index
2	Backflow index
3	Day of max flow
4	Day of min flow
5	Maximum temperature
6	Minimum temperature
7	Average temperature
8	Max flow of month
9	Date/Hour

The water meter ensure the possibility to store up to 36 entries (3 years).

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5.2.3.Quarter record

ID	Name
1	Index
2	Backflow index
3	Temperature
4	Date/Hour

The water meter ensures the possibility to store up to 288 entries (> 3 days).

5.2.4.Minutes record[3]

ID	Name
1	Index
2	Date/Time
3	Delta index (0 to 59)

The water meter ensures the possibility to store up too 720 entries (30 days)

5.3. Metrological certified consumption for radiotransport

The meter is able to produce a water consumption data which can be authenticated using a per-device key. It is possible to retrieve these certified consumption data on-demand over WAN and PAN.

5.4. Real Time Clock

A real time clock (RTC) is integrated to the meter which permits to provide all times concerning calendar management and timestamp. The RTC is adjusted at the factory, and could be updated via the network by the Network System (CS).

5.5. Metering volume indicator

The meter has one light-emitting diode (LED) blinking 50 times per liter of water (programmable). See section 6.4.3

5.6. Button

The meter is equipped with 1 push button on the front panel.

It is used to navigate through the different screen and menus.
For this, different push duration are used:

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[3] Every record stores the last 60 minutes consumption indexes. To reduce memory footprint, this indexes are saved as a delta consumption.

- Short delay between push and release (< 1.2seconds)
- Long delay between push and release (> 1.2 s)
- Quick double push and release on button (0.7s)

Details of the LCD menu and information are available below in this document.

5.7. Communication ports

All communication ports are protected and requires a proper identification to work.

In case of uninstalling the product from the water pipes and prior to send it by air transportation, unsure that you have desactivated all the radio.

5.7.1. Bluetooth Low Energy PAN radio (if product is so equipped)

The meter can include a local Personal Area Netwrok made by a Bluetooth Low Energy port.
The BLE implementation is Bluetooth ® 5.2 certified working in the 2400 – 2483MHz ISM frequency band and uses a integrated antenna transmitting less than +10 dBm EIRP for short distance communication only.
This local BLE can be used through a Mobile Phone application to read and write informations into the applicative part of the device. The BLE range is more than 3 meters and depends of the installation place and the mobile equipment.
To enable the BLE broadcast, prepare the Mobile App, and push the button of the meter. Within few seconds, the APP should locate the meter and enable communication. Take care to activate the local BLE feature before hand if not already done. The access is protected by individual credential.

Note that WAN communication is disabled during the BLE activity. WAN communication is resumed only once BLE is disabled.
For security reason, the minimal distance to respect between the meter and the human body is 31 cm (1 feet).

5.7.2. Infrared communication port

An optical port compatible with IrPHY SIR 115.2kb/s could be available. This port can be used to read and write information into the applicative part of the meter. The access is protected by individual credential and must be activated.
To reduce power consumption, the infrared is disabled most of the time. A button press must be performed to activate infrared for a 10 sec window. If a communication exchange is detected, the meter extends the activation timeout accordingly

5.7.3. Remote CAT-M™ WAN radio

The Wide Area Network radio communication port is based on a LTE 4G Cat-M1 into the band 4 &13.

Band	Uplink Low Freq (MHz)	Uplink High Freq. (MHz)	Downlink Low Freq. (MHz)	Downlink high Freq. (MHz)	Bandwidh (MHz)
4	1710	1755	2110	2155	45
13	777	787	746	756	10

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The WAN radio is configured to be in Power Save Mode [4] most of the time and initiates a uplink communication only few times a day to save the battery energy.

5.7.4.Internal WAN antenna

The meter is equipped with an integrated antenna. This antenna is enabled by default when leaving factory.

For security reason, the minimal distance to respect between the meter and the human body is 31 cm (1 feet).

5.7.5.External WAN antenna

In case of poor signal reception with the internal antenna due to the meter location for example, it is possible to connect an external antenna and then switch the internal RF signal to the side RF connector. This switching can be done through the Infrared or the BLE interface.
Only use a passive antenna with RF gain below 3 dBi. Never use an amplified antenna, nor a directional antenna.
Respect the installation instruction of the external antenna, and keep 31 cm (1 feet) away once connected to the product.
In order to radiate properly, and for current consumption sake, the external antenna must be installed 31 cm (1 feet) away from any metallic items.
When the product is configure for external antenna usage, never leave the SMA connector not connected and/or RF mismatched to the external antenna. This could leave to product damages.
The length of the external antenna must not be more than 3 meter (around 10 ft)

5.8. Error register

This register stores error which may impact metrological information.The bit assignment is defined in the following table.

Table 2: Error Register

Bitfield	Fatal Error description
1	Bubbles error
2	Persistant hardware error
3	Internal clock problem
4	Metrological CRC problem
5	Metrological CRC problem
6	Configuration problem
7	Metrological RAM problem
8	Metrological Communication problem
[9 .. 31]	Reserved for future use

5.9. Flag register

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[4] Power Save mode feature is requested from modem to the network and it's up to the network to accept or change the parameters.

This register stores information which has been detected by metrological software but does not impact metrological measurement.

The bit assignment is defined in the following table

Table 3: Information Register

Bitfield	Fatal Error description
1	Bubbles detected
2	Hardware problem
3	No water detected
4	Negative flow detected
5	Low battery
6	Extremely low battery
7	No Application or Application not started
8	Application deactivated due to Xlow bat.
9	Reserved
10	Application incompatible with metrology FW
[11 .. 31]	Reserved for future use

5.10. Events

Besides error register and information register, other events are logged by the application. These events allows to keep track of major events happening in the meter. Each event is indentified by an ID, a timestamp in BCD format and optional parameters (up to 4 bytes). Multiple bytes paremeters are in big endian representation.

The following table summarizes supported events:

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Table 4: Summary of supported events

	ID	Event name	Level	Event description	Parameters
FLAG	10	FLAG_ACTIVITY	INFO	Activity detected or finished in the optical flag	[1 byte] 1: FLAG activity detected 0: FLAG activity finished
	11	FLAG_ERROR_CRC	WARN	Incorrect CRC on the last frame	NA
RADIO	20	Radio attachement: START	INFO	Join request sequence started	NA
	21	Radio attachement: SUCCESS	INFO	Join request accepted	[4 bytes] device address
	22	Radio send	DEBUG	Radio frame sent	[1 byte] FPort of the rx frame [1 byte] Size of payload [1 byte] Data rate
	23	Radio receive	DEBUG	Radio frame received	[1 byte] FPort of the rx frame [1 byte] Size of payload [1 byte] Data rate
	25	Radio attachment: FAILURE	INFO	Supervision frame sent	NA
CMD	40	CMD_ACCESS_LVL	INFO	User with particular access level started a session	[1 byte] New access level [3 bytes] User Identifier
METER	50	METER_STATE	INFO	Meter switched from state A to state B	[1 byte] State A [1 byte] State B
	51	METER_ALARM	CRIT	Meter alarms mask changed	[1 word] Alarms mask
	52	DEVICE_REBOOT	INFO	Device rebooted	NA
	53	DISPLAY_STATE	INFO	Display enabled or disabled	[1 byte] 1: Screen is enabled 0: Screen is disabled
	60	MONTHLY	INFO	Monthy event to keep track of time	NA
	61	PARAM_RESET	WARN	Internal parameters reset	NA

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5.11. Alarms

An alarm mechanism is implemented on application to detect any unwanted or suspicious behaviour during the meter lifetime. The bit assignment for alarms register is as follows:

Bitfield	Alarm name	Description
1	Low air temperature	Air temperature below threshold
2	High air temperature	Air temperature above threshold
3	Low water temperature	Water temperature below threshold
4	High water temperature	Water temperature above threshold
5	Fraud suspicion	Fraud is suspected when several attempts to access one of the input interfaces are detected.
6	Small water leakage	Small water leakage is sometimes present in the water system and causes unwanted water waste over time
7	Hard water leakage	Hard water leakage is present when one of the water equipments is draining water, if a pipe has serious damage or if a faucet is left open
8	Air bubbles	Bubbles are present in water which may lead to unreliable measurements
9	No water	Pipe is not filled with water
10	Hardware error	Meter hardware error
11	No consumption	Meter didn't measure any flow during a detection window
12	Water backflow	Backflow is an unwanted flow of water in the reverse direction. The reverse flow happens when the local water system presents a higher pressure than in its supply network or when the supply is interrupted or drained down.
13	Low battery	Low battery level
14	Critical battery	Extremely low battery level. The product must be replaced.
15	Metrological CRC error	Metrological firmware CRC is incorrect
16	Tampering	Meter is tampered, dismantled
17	Water overflow	Overflow is detected when water flow exceeds the maximum allowed flow
[18 .. 31]	Reserved for future use	

NB: all thresholds in the table above are configurable.

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6. DISPLAY FEATURES AND FUNCTIONS

The product use the LCD to show information concerning the status of the meter, of the communication and, not the least, all information concerning the End-Consumer consumptions.

6.1. User interface

The display remains ON all the time.

The user can access different screens on the display by using the front panel button. Different usages of the button are defined depending on the push & release duration:
- Short Press (SP) : the button is pressed and released during 1.2 seconds or less
- Long Press (LP) : the button is pressed and released in more than 1.2 seconds
- Quick double press (DP) on button (less than 0.7s)

6.2. Display layout

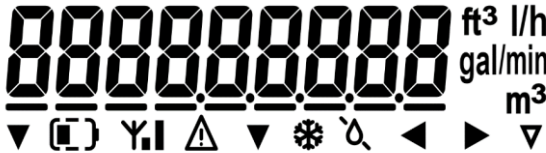The fully active LCD display of the product is depicted in Figure 6Figure 6.

Figure 6 – LCD display layout.

Table 5: LCD display symbols and meaning.

Icon	Description
∇	In order to identify all the metrological information, this symbol is visible. When this symbol is off, it depicts an informative data from application SW part.
⚠	In case of a error , the product displays this symbol
▶	This symbol defines the normal flow direction into the product. It is blinking during water flow.
◀	Whenever a reverse flow is detected, this symbol is active.
Y	The antenna symbol when blinking depicts the on-going locking on the network. Once fixed (non blinking), it indicates the normal function of the radio.
▮▮	The 2 level symbol defines the amongt of radio signal received by the product and thus indicates the link quality. With one bar, the radio signal is correct but low. With 2 bars, the radio link is perfect. When no bar, it means the link quality is too bad to be used.

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ft³ or **gal** or **m³**	Those symbols are the volume measurement unit.
gal/min or **l/h**	Those symbols are the flow measurement unit.
💧	This symbol indicates that there is air into the spool piece.
💧	This symbol indicates a leakage possibility. It means a slow steady flow during a long period.
(■)	When battery sign is OFF, it means that the battery is fully loaded. This symbol depicts a partially loaded battery.
( )	This symbol depicts a discharged battery. When blinking, it means that the meter is in low battery state and must be replaced immediately.
▼ ( ) ▲ ▼	Those 2 independent symbols at the bottom of the LCD indicate each an specific application menu.

6.3. Meter display state machine

The Meter display states machine is composed of 2 main modes:
The Display is all the time ON to have acces to the metrological menu

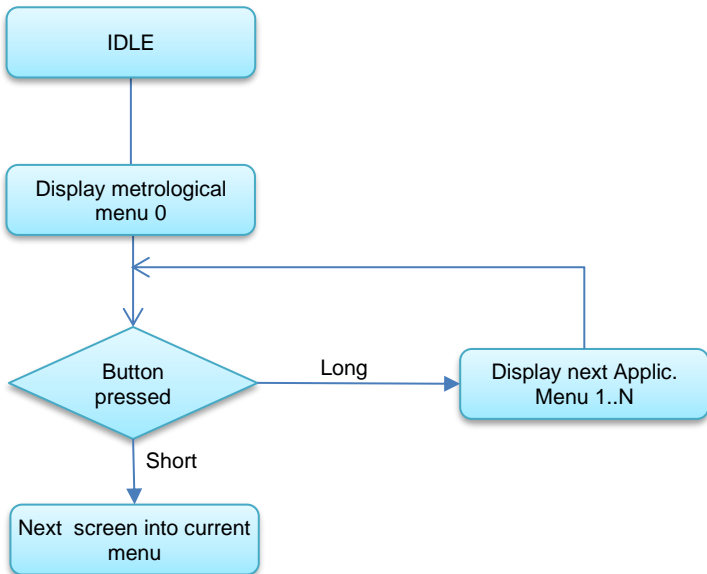The Meter display state machine is described in the Figure 7.

Figure 7 – Meter display state machine

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6.3.1.Metrological menu

The screens listed below are replaced on each short push on the button. Once at the last screen, it moves back to first screen.

If the user does a long push on the front button, the display state machine switches to the next menus. The triangle at the bottom of the display indicates which other menu is active , moving from left to right. In Metrological menu, no triangle are active.

On special certification screen (like **Test selection**), user must double press quickly on the button in order to enter in selection mode and the screen starts to blink. Then, with a simple press/release, the screen toggles between 'YES' or 'no'. Validation is done by a quick double press. The screen stops blinking and presents the value selected .

Table 6: Metrological menu screen

Menu 0 : metrological menu
Net Volume index
Volume index
Backflow index
Metrological Version and CRC
Serial Number
Error register
Flag register
Inst. Flow not filtered
Inst. Flow filtered
Inst. Backflow
Inst. Flow/Backflow "Net"
Temperature
Test selection
Local Date & Time

6.3.2.History menu

The history menu is a summary over time of the measurement.

Table 7: History menu screen

Menu 1 : Historical menu

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Qmax IN CURRENT month
Maximum / MINIMUM WATER Temperature since the fisrt day of the month
Index counter for current month
Index counter for previous month
Index counter for current year
Index counter for previous year

6.3.3. Installation menu

Table 8: Installation menu

Menu 2 : Installation menu
INSTALL (YES/NO)
BLUETOOTH

6.3.4. Serial number menu

The serial number menu is a summary of the product identification.

Table 9 : Serial number menu screen

Menu 3 : Radio & com. menu (serial number menu)
serial number
dev_eui / MAC_ADDRESS
RADIO_address
version application
version installation

6.4. Metrological Certification mode.

6.4.1. General description

The activation of this mode is done by sending a specific command via the local interface (Infrared or BLE).

Its deactivation is done either by command or upon a timeout of 7 days.

When the Certification mode is enabled, the following actions are performed:
- Define the improved volume resolution on the display.

- Set the volume pulsing LED.

When exiting the certification mode, the changed parameters are reverted back to their default values.

6.4.2.Improved volume resolution on display

In the certification mode, the volume is displayed with more precision, so more digits after decimal point. This means:
- Decimal separator allows 6 digits after m^3 or equivalent in gallons or ft3, so displayed 0.000001 cubic meters or the equivalent active volume unit on the water Meter.
- The integer volume part is limited to the lowest 3 digits.

When exiting the certification mode, the resolution on display is reverted back to default including the sub-decimal digits surrounding bracket.

6.4.3.Pulse rate of the LED

The LED pulse rate is the typically 50 pulses per liters (see exact value into the table), so distinguishing 0.02 Liter. It is a trade of between pulse period (10ms minimum) and maximal flow to be measured.
With 10ms pulse period, you can have maximum 100 pulses per seconds, so 2 L/s or 7200 L/h for example.
It's possible to change this LED pulse rate to speed up low flow measurement, but this will limit the maximum flow than could be measured accurately using LED pulses to 100 pulses/sec max.

This LED pulse is only blinking in the certification mode.

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7. SOFTWARE APPLICATION

SAGEMCOM developed an Android application for local servicing of the meter. This application can be set up on a laptop or on the PDA and allows to:

- Read meter identity,
- Read historical consumption values,
- Alarms displaying,
- Events,
- FW upgrade change
- Change of parameters (Radio, ...)

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8. INSTALLATION

For more details about the installation, please consult the installation manual provided by SAGEMCOM.

8.1. Meter installation

The product can be installed whatever the pipe orientation, it is however necessary that the display must be accessible and visible at any time.

The Product must be installed with the product arrow in the same direction than the normal water flow into the pipe.

Due to the battery chemical, the garanteed product lifetime is not achieved when the product is with the pipe installed horizontally and the SMA connector downward

8.2. Safety instructions

All installations of product must be done according to safety regulations and rules. The instructions detailed in this guide must be carefully followed in order to prevent from any form of danger for the installation, for the installer or for the end user.

The following safety instructions must be observed at all time:

- The installation and commissioning must only be performed by a qualified and trained installer, authorized to work on domestic water installations. This Installer must carefully read and scrupulously follow this meter user manual.

- The installation must be conform to the applicable standards for drinking water installation.

- Local safety regulations must be observed.

- The installation altitude wrt to the sea level must be lower than 2000m.

- The product must be protected from shock and vibration.

- Any inappropriate behaviour not described in this document can lead to injuries or damage of the meter.

- No part inside this product is intended to be replaceable.

- If an installed product is removed from installation and intended to shipped through air transportation, the radio function must be disabled using BLE or other interface.

- According to AWWA, even if section 250.53(D) of the National Electric Code (NEC) requires that "continuity of the grounding path or bonding connection to interior piping shall not rely on water meters", all meters should be installed with permanently ground-strapped strapping.

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- The battery contains environmentally hazardous substances. The product must be recycled according to the manufacturer's instructions and in compliance with safety regulations.

8.3. Installation instructions

The installation instructions are the following:

- The product must not be exposed to mechanical stress during installation. The intake and outcome piping must be aligned and match the product pipe dimension.

- The meter can be installed on plastic or metallic pipe, after a general closing tap.

- During installation of the meter, the water supply must be cut and the remaining water flush out.

- Do not hold the product casing but the pipe during the installation screwing.

- Always used new gaskets for mounting the product onto the piping.

- The torque applied to screw of the product must be higher than 15 N.m and not overpass 30 N.m whatever the thread and pipe material.

- The water supply must be re-opened smoothly, enabling air bubble to be removed without mechanical impact..

- The provisioning onto the facility radio network can be done using the QR code information written on the product. Be aware that this provisioning over the network could required some time to be effective . The product cannot register on the network until this provisioning is over.

- Once water flows, the radio attachment process starts; and it indicates the radio link quality to the network. When the antenna icon stops blicking, it shows that the network attachment succeed

- If radio link after installation is too poor (no bar next to the antenna symbol) and if product is so-equipped, an external antenna must be installed in a higher place, more likely to receive radio signals and then connected to the product. It should be activated using the optical flag interface or BLE.

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