MAG**B**2 User Guide

BATTERY POWERED

SN 20200673

▶▶ D m3/h 12:45:55

29.30
1114.881

Total+ !00000008 m3

TRANSMITTER

MAG**B**2

MODBUS

WARNING! SWITCH OFF THE POWER TO THE FLOWMETER BEFORE REMOVING ANY MODULES. FAILURE TO DO SO CAN RESULT IN DAMAGE TO THE FLOWMETER.

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List of Contents

1. Introduction

1.1. Operating Principle

The measurement is based on the principle of Faraday's law on electromagnetic induction in which an electric voltage is induced in an electrically conductive body that moves in a magnetic field. Liquid flows through a tube in the direction of the magnetic field. Liquid with a certain minimum electrical conductivity induces a voltage which is detected by two electrodes located in a 90 degree angle from the magnetic field and the flow direction.
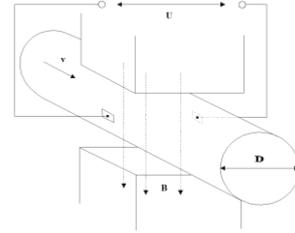
Minimum liquid conductivity	>20 μs / cm for demineralised cold water.
	>5 μs / cm for other liquid.
Liquid velocity	min. 0.1 m / sec, max. 10 m / sec.

1.2. Applications

Water / waste water	Chemical industry	Food industry	Power engineering	Agriculture	Effluent Industry

1.3. Safety Instructions

 Please read this manual carefully before using the product.

 Keep this manual for future reference. Arkon Flow Systems, s.r.o will not be liable for any damage caused by improper use of the product or its accessories.

 The MAGB2 flow converter - flow-meter must not be mounted in explosive hazardous areas.

1.4. Unpacking the flowmeter

❶ While unpacking the flowmeter, conduct a visual check of the flowmeter upon receipt to make sure the product has not been damaged during transport.

❷ Check the completeness of the package. In case of any problem, contact the Arkon sales department without delay.
- o Flowmeter
- o Cables
- o Pendrive + Manual
- o Mounting kit + Key

2. Installation

2.1. Remote or Compact?

Any MAGB2 flowmeter can be delivered in two versions; Compact or Remote. The compact version has the transmitter unit connected directly to the sensor body. This version does not require any further mounting or installation of the transmitter.

The remote version has a separated transmitter. It is connected to the sensor via a cable. The cable entry into the sensor is protected by a junction box, which is potted to IP68. The cable entry on the transmitter side is through a M20x1,5 gland.

The cable type used for the connection between sensor and transmitter for remote versions:
UNITRONIC® Li2YCY (PiMF), 2x2x0.34
The MAGB2 can be used with a maximum 6 mts of cable between sensor and transmitter in remote version.

2.2. Sensor installation

Sensor dimensions can be found on Chapter 18.
Proper sensor installation is extremely important in order for your flowmeter to work correctly. Below, you will find the minimum sensor installation requirements that need to be respected at all time.

Sensor installation requirements:
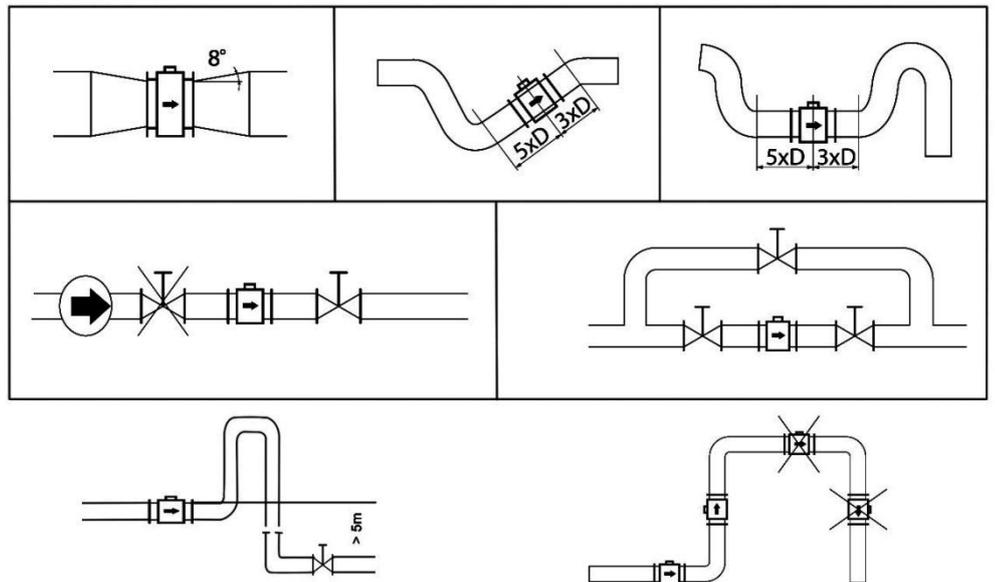
NOTE: 5×D | 3×D requirement is NOT necessary for versions with Reduced-bore sensor body. U0D0 installation condition is applied instead.

All MAGB2 sensors are supplied with a built in earthing electrodes that are sufficient for all applications with metal pipes and tanks. However on applications where all pipes and tanks are manufactured from plastic, it is recommended that earthing rings are also installed to ensure the maximum resistence of the sensor to earth is <1 ohm.

| Conductive (metal) pipe | Non-conductive (plastic, lined) pipe |

Sensor grounding with earthing rings:

Sensor grounding with earthing rings

Plastic

Metal
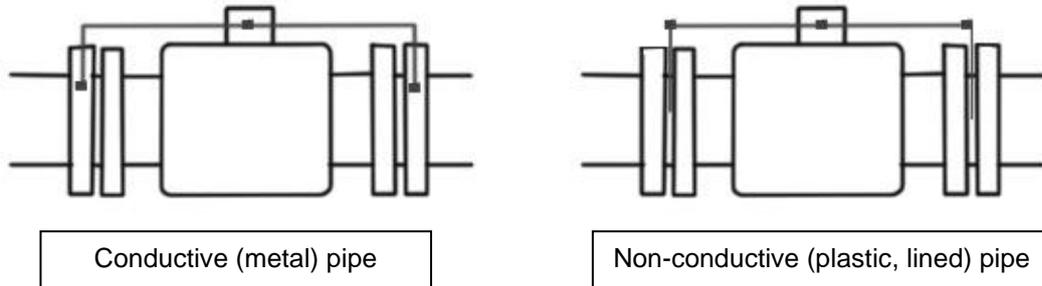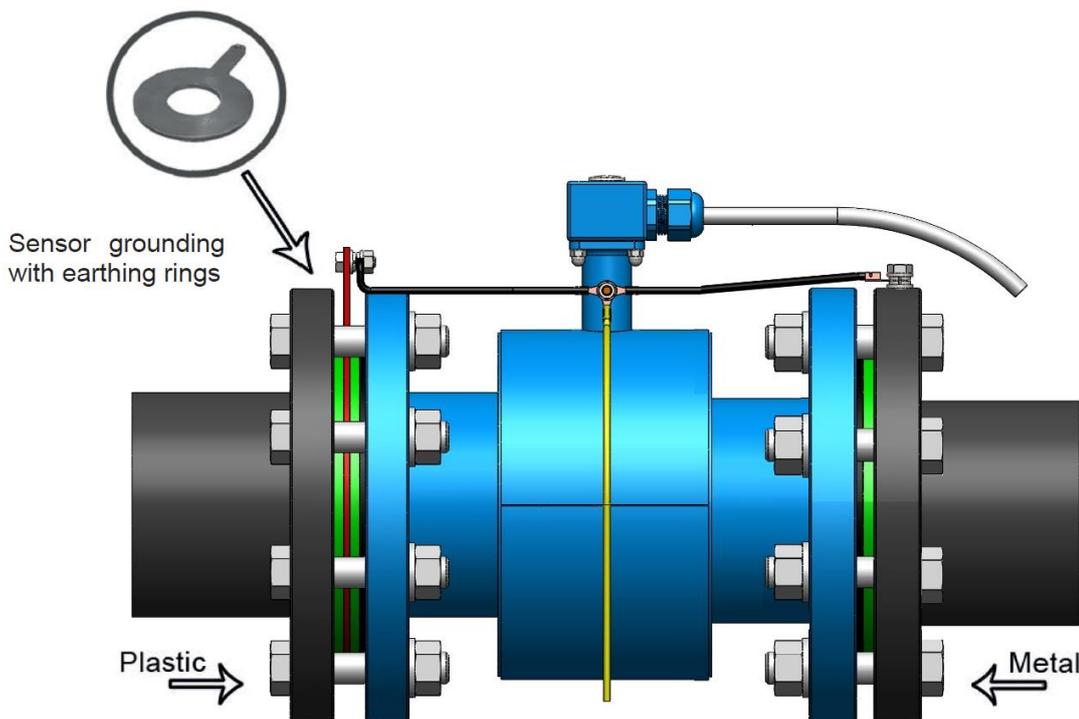
> To ensure correct meter operation make sure the earthing rings and sealings around are centered.

2.3. Dry liner

Flowmeters with a Hard Rubber liner can show incorrect readings during the first 2-3 days after installation. This is due to the fact that the time needed for transport and the time before installation is long enough for the liner to dry out and thus it changes shape/size. This change, in effect, affects reading accuracy. Simply be keeping the meter wet, this problem solve itself within 2-3 days and no other action is required at all.

2.4. Installation of the transmitter

In case of a compact flowmeter version, the transmitter will need no further installation, and should be ready for use.

In case of a remote version, the following 4 steps are necessary.

❶ Mount the transmitter to a wall, panel, or DIN-rail.

Wall mounting:

DIN-rail mounting:

Panel mounting:

The electronics have to be protected against direct sunlight and high temperatures!

The transmitter housing should be exposed to minimal mechanical strain only (max. 1kg)!

MAX 1 KG
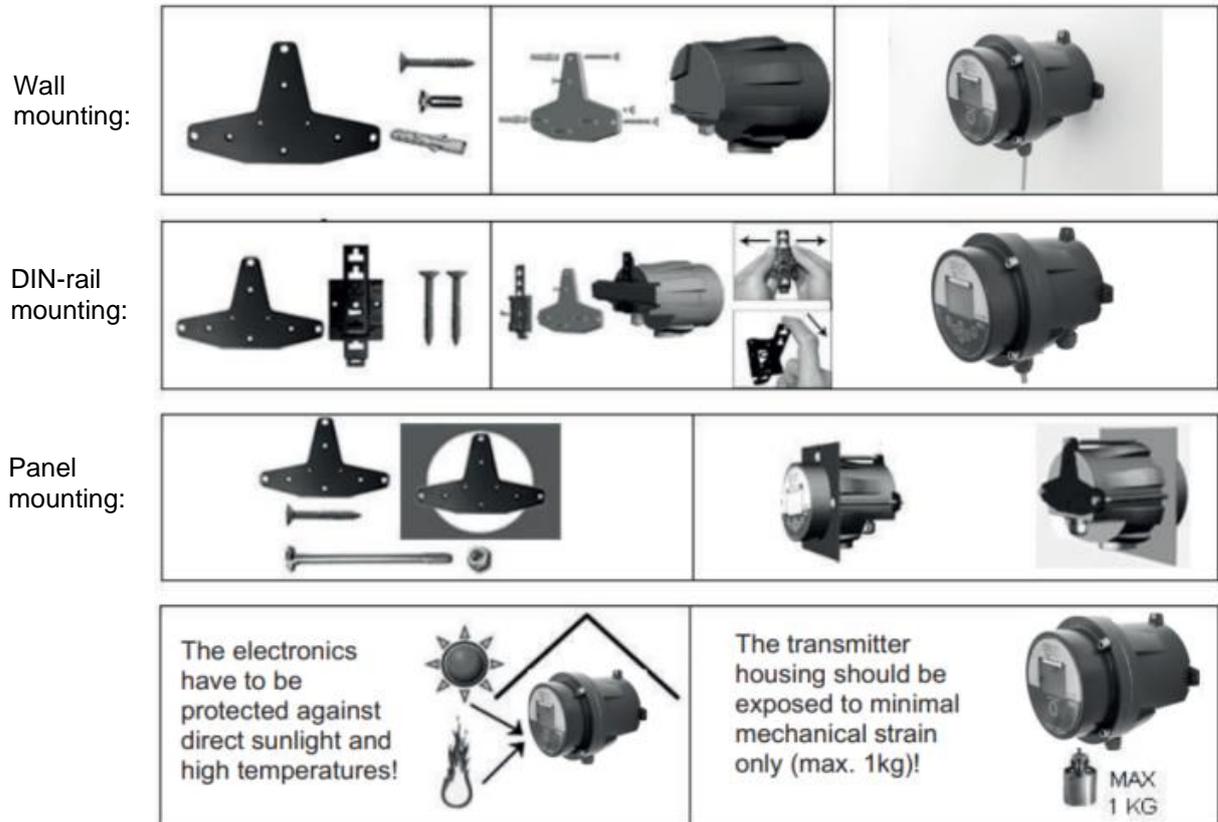
❷ Connect the transmitter to the signal cable from the sensor.
To do this undo four M6x22 screws using allen key nr.5 that is part of the delivery.

❸After the meter is opened, pull the signal cable through the cable gland on the bottom of the transmitter housing (see page 7). Connect the connector at the end of the signal cable from the sensor to the transmitter circuit board.

	Electrical installation should only be performed by a qualified person. Standard safety regulations for hazardous electrical installations have to be respected. The O-ring sealing shall be exchanged every 6 months of operation.

❹ Set up the transmitter for use.
You are now ready to start using your flowmeter or to customize its settings as per your requirements. For example;
- Set-up the measurement unit of flow-rate displayed, e.g. m3/hr.
- Set up of the unit for the volume displayed. For all volume counters this same unit will be used.

2.5. Cables connections

The following diagram shows the connections of the cables between sensor and transmitter.

2.5.1. Compact version
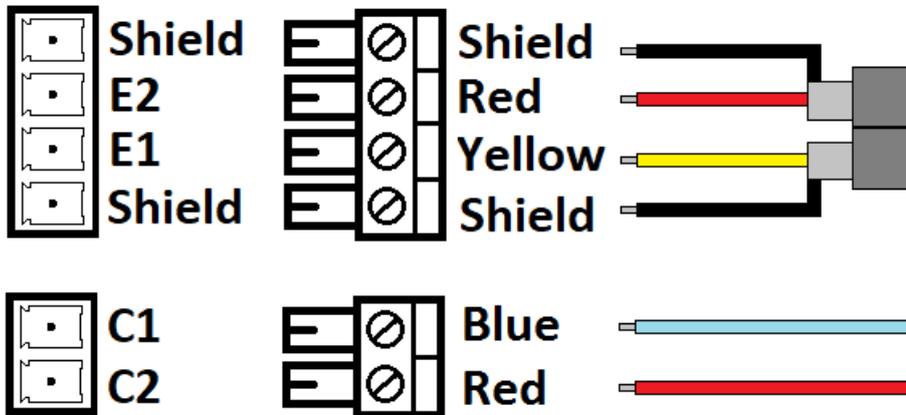
Note: keep the unshielded part of electrode cable as short as possible.

2.5.2. Remote version
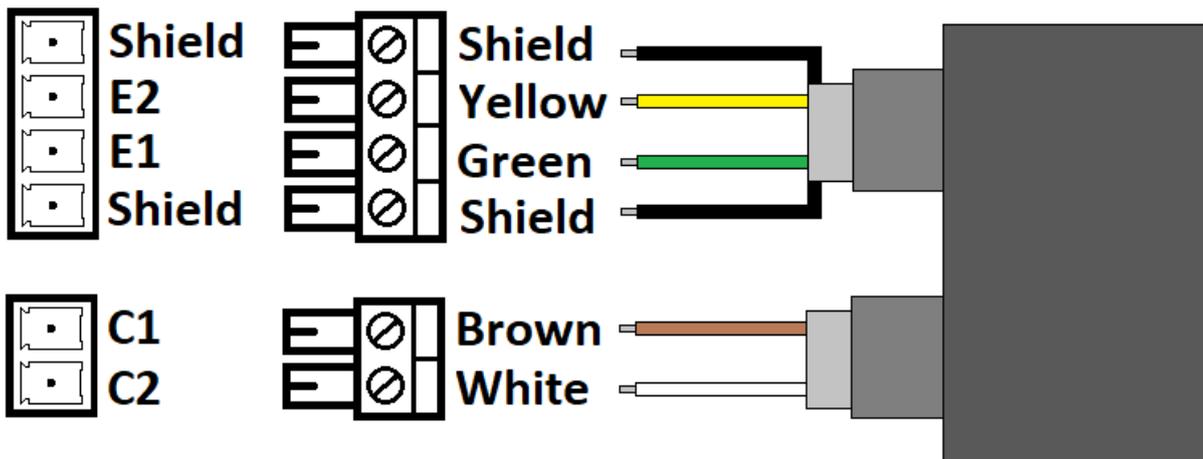
Recommended cable Li2YCY 2 x 2 x 0.34 PiMF.
Note: keep the unshielded part of electrode cable as short as possible.

2.6. Connections overview
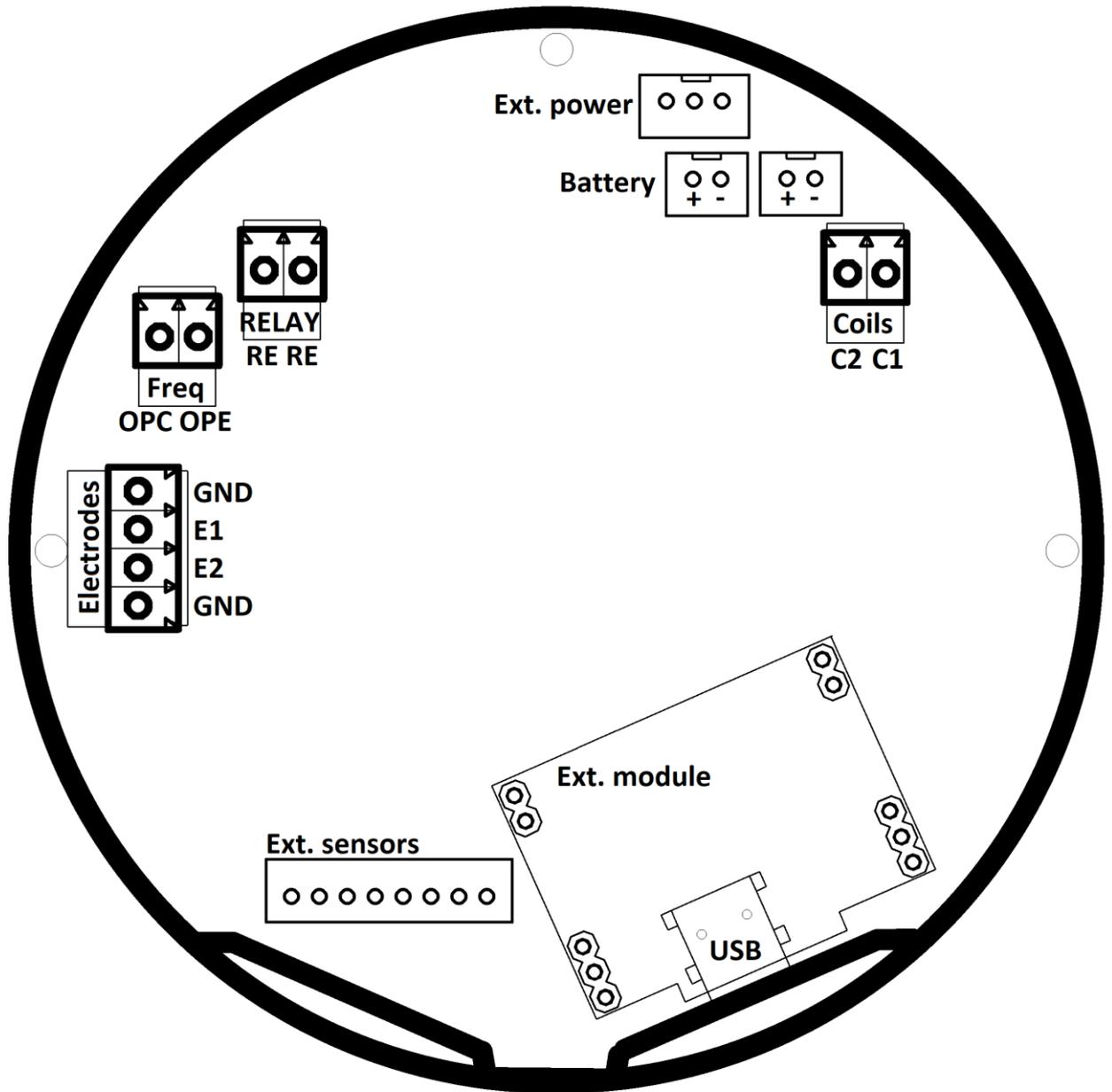
3. MAGB2 Transmitter Unit

The MAGB2 Transmitter unit is the main part of the flowmeter. It consists of the MAGB2 motherboard, a graphical display, touch-buttons and transmitter housing. Through the display and with help of the buttons, you can navigate the meter menu. The following symbols are used in this manual and on the flowmeter display.

3.1. Main screen
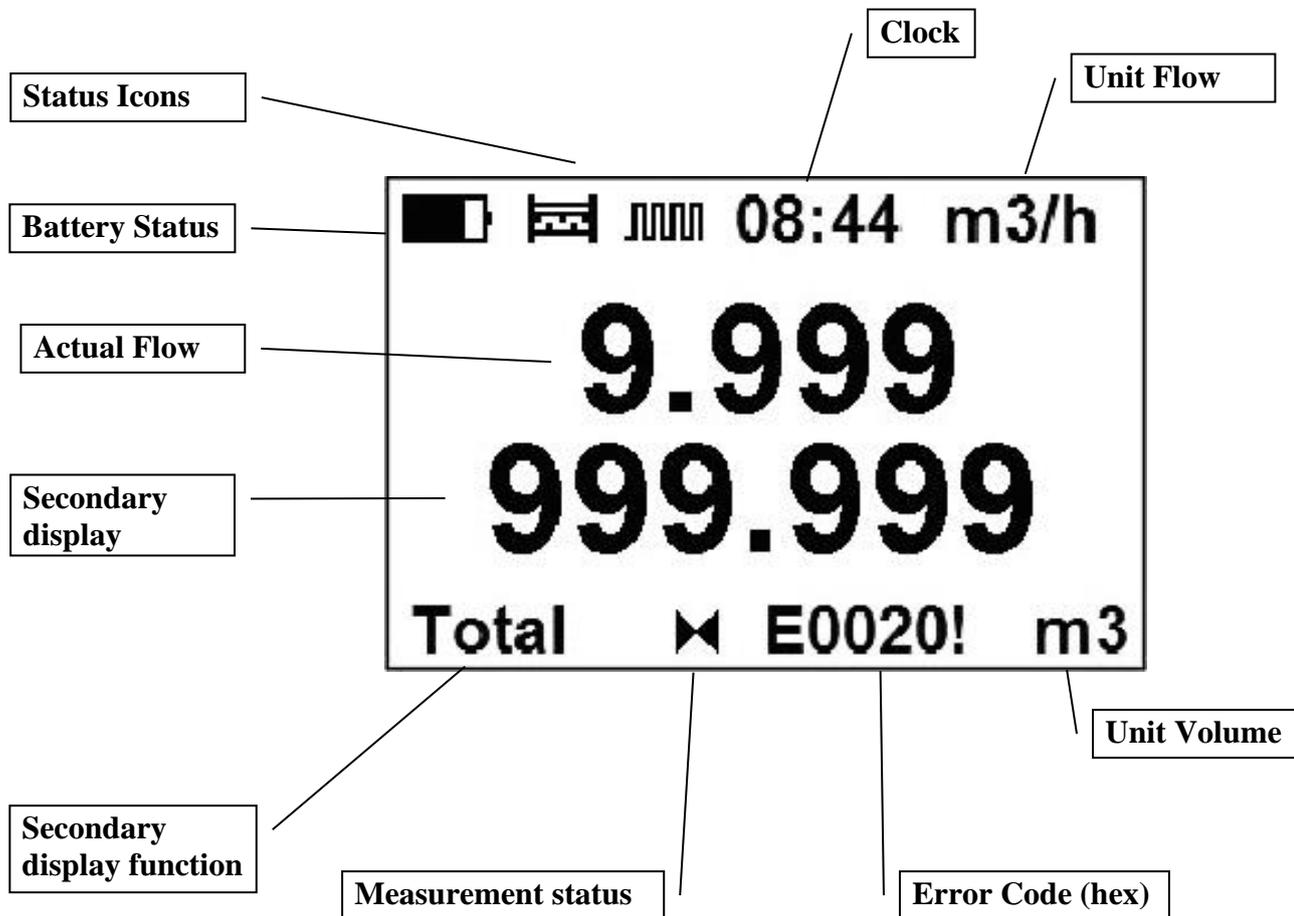
Possible secondary display functions:

Total Volume
This is the total volume counter; the sum of all historical flows for a particular flowmeter. The user is not able to zero this counter without use of the service password. Direction of flow is ignored for this counter (negative flow is calculated the same way as positive flow).

Total + Volume
This counter is only credited when the measured medium is flowing in the chosen positive direction. In case the flow is 0, or if it is flowing in the opposite (negative) direction, the number on the counter remains the same.

Total - Volume
This counter works the same way as the positive volume counter, yet in the opposite direction. In case the flow is 0, or flowing in the designated positive direction, the number on this counter will remain the same.

Auxiliary + Volume
This is a 2nd total + volume counter. It works the same as the Total + Volume counter, yet with the only difference being that it can be reset to 0 at any time, with User Settings password.
You can cycle through these 4 indication screens by pressing the up/down buttons on the transmitter.

Date
Show actual date set in the meter.

Frequency output (FOUT)
Show actual frequency on the output.

External temperature reading (XTemp)
Show actual temperature using external temperature sensor.

External pressure reading (XPress)
Show actual pressure using external prsesure sensor.

Velocity
Shows calculated velocity from actual flow and set DN

Symbol	Battery capacity
	100 % - 80 %
	80 % - 60 %
	60 % - 40 %
	40 % - 20 %
	< 20%

If the battery capacity display is between 20% - 40%, we recommend that the existing batteries are replaced with new batteries.

Symbol	Function
☑	Enter
☒	Escape
←	Back
↻	Down
↺	Up
↻	Left
⟳	Right
D	Flow simulation mode
↓↑	Selection menu
⊩◀	**Measurement Stop**: If the display indicates this symbol, the totalizers are not incremental.
▶▶	**Measurement Running**: Flow meter run, totalizers are incremental
⎍⎍	**Fast Excitation function:** This icon indicates a maximum frequency of excitation (6.25 Hz). This option is available if you turn on this function in user menu and push the button for more than 5 second. The following 5 minutes will be at Fast Excitation and will then revert back to the previous setting. **This setting is battery consumable!**
⟂	**RS485 module connected**
▊ı	**GPRS module connected**
≋	**Excitation failed**
⚊	**4-20mA module connected**

4. Battery

4.1. Battery Specification

	Electrical Specifications of 5 pack batteries
Nominal voltage	3,6V
Capacity	75000 mAh
Estimated battery life	Up to 10 years (dependent on flowmeter settings and ambient conditions)
Temp. Range	-20 – 70°C
Dimensions:	width = 99 mm - depth = 54 mm - height = 60 mm
Weight	430 g

NOTE: The specifications mentioned above are related only to "Arkon battery packs". We can only guarantee them when using original Arkon batteries. A new battery packs can be ordered from Arkon.

4.2. Battery life
The battery operation time depends on ambient temperature, conditions, flowmeter functions.

Excitation frequency [Hz]	6.25	3.125	1.5625	1/5	1/15	1/30	1/60
Average battery operation time [months] of 5 batteries pack	6	12	22	96	120	150	150

Settings negatively affecting battery life:
- USB communication
- RS485 communication
- Display and/or backlight still on
- Frequency or relay set to Volume pulse
- GPRS communication
- 4-20mA output
- External measurements inputs
- Fast excitation mode

4.3. Changing the battery
If the battery indicator indicates low battery capacity, remove the battery by the following steps:
- Un-plug the old battery pack, remove it, reinstall new battery pack.
- Activate in SERVICE menu Battery capacity with 75000mAh and Battery exchange date with real date of the battery exchange.
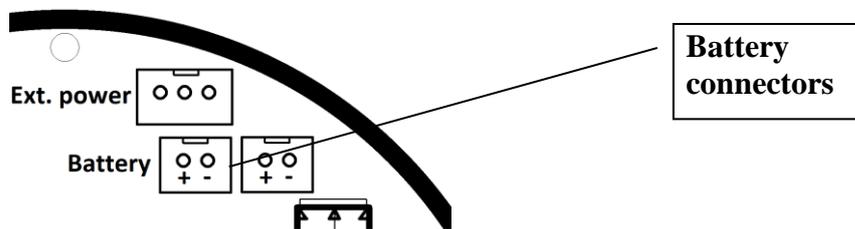
4.4. External power
The unit is prepared to be powered from external power source.

5. Frequency output

As an analogue output MAGB2 has one frequency output (FOUT) configurable to be flow dependent. The output is galvanically isolated open drain with following connection. The use is mainly for calibration purposes, can be used as flowrate indicator for PLC units.

Connection:
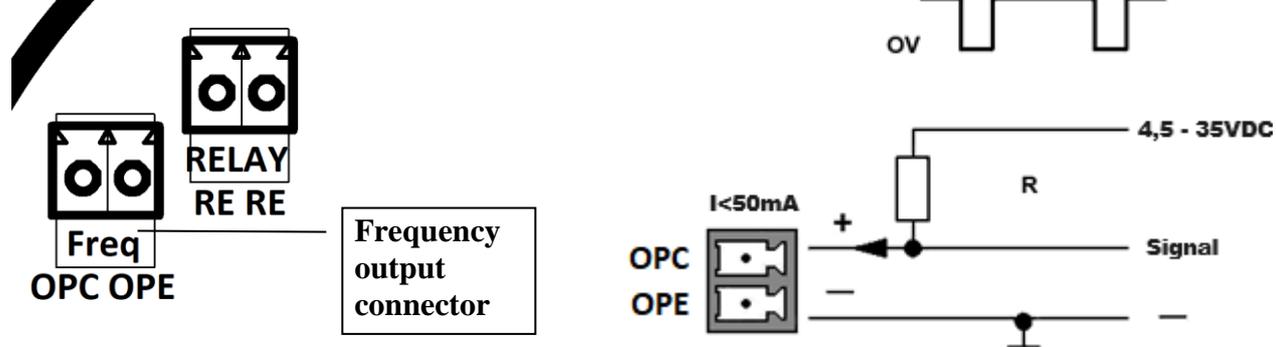
Recommended resistance R=1 k Ω

The output can be set to:
0) OFF (default)

1) FREQUENCY OUT – the output generate frequency based on actual flow. User sets the flow at 1000Hz signal. Then the frequency is proportional to the flow. The battery current consumption is higher if you choose this option. This output setting is used for calibration of the flowmeter, in cases where you want to transfer primarily the information about actual flow. The output is working only when the display of the flowmeter is on – when the meter is NOT in the sleep mode in between the excitations.

2) PULSE VOLUME –the output generates pulses based on volume that has passed the sensor (the pulse width can be set). The battery current consumption is higher if you choose this option. Minimal resolution is 1ml. This output is used for external volume counters and external dataloggers. Pulses are outputted in groups in the end of each excitation to save battery time. Works also in sleep mode when the display is off.
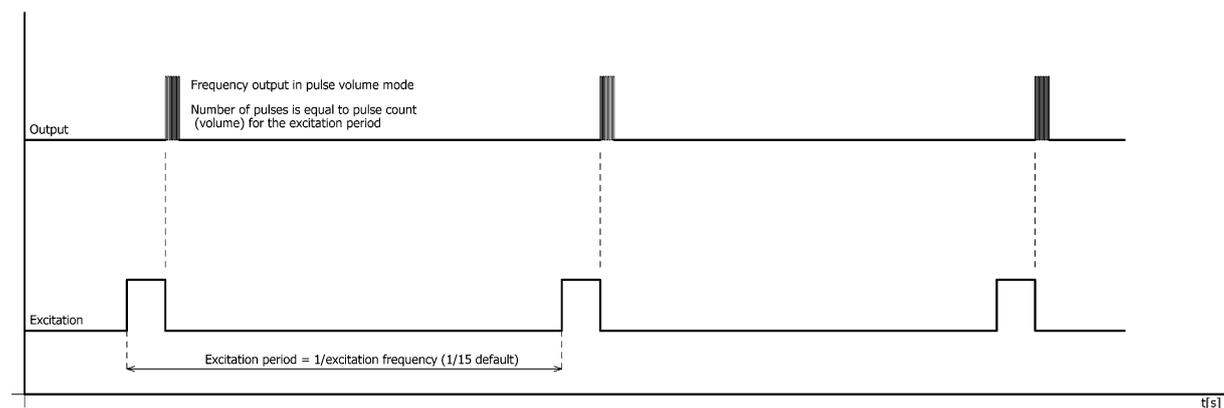
Example:
excitation is 1/15Hz, frequency output in pulse volume mode, set for 1litre per pulse.
Flowrate is approx. 10m3/hr (2,778l/s).
Flowmeter will output each 15 seconds set of 41 pulses – equal to 41 litres of liquid passed the meter.

3) CONTINUOUS VOL PULSE –the output generates pulses based on volume that has passed the sensor (the pulse width can be set). The battery current consumption is higher if you choose this option. Minimal resolution is 1ml. This output is used for external volume counters and external dataloggers. It can be also used for external flow displays. Works also in sleep mode when the display is off.

If in any case the FW cannot compute pulses or pulses are too fast it sets the FOUT overload error.

6. Relay output

As a second analogue output MAGB2 has one latching relay output configurable to an error detection or flow dependent. This output is used for status or volumetric information. The output is galvanically isolated dry contact.
Connection:

RELAY output connector
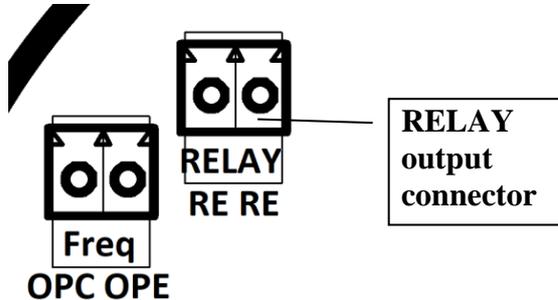
The output can be set to:
1)   **OFF** (default)
2)   **FLOW +** output ON, for any positive flow
3)   **FLOW –** output ON, for any negative flow
4)   **ERROR** output ON, for any error identified by the device
5)   **AIR DETECT** output ON, during air detection (empty pipe)
6)   **FIXED** output ON, fixed status signal
7)   **ON IN** output ON, if the actual flow is within the given range with hysteresis (can be set under Comparator Flow - Flow 1, Flow 2, Hysteresis 1 and Hysteresis
8)   **ON OUT** output ON, if the actual flow is outside the given range with hysteresis (can be set under Comparator Flow - Flow 1, Flow 2, Hysteresis 1 and Hysteresis 2)
9)   **ON > Flow1** output ON, if the actual flow is the bigger than the value set as Flow 1 and hysteresis (can be set under Comparator Flow – Flow 1, Hysteresis 1)
10)   **ON < Flow1** output ON, if the actual flow is smaller than the value set as Flow 1 and hysteresis (can be set under Comparator Flow – Flow 1, Hysteresis 1)
11)   **VOLUME PULSE** the output generates a pulse when the preset volume has passed the sensor (the pulse width can be set). The battery current consumption is higher if you choose this option. Minimal resolution is 1m3. Same as frequency output works with grouped pulses after each excitation.

	Option 11 is battery consumable!
On In:	
On Out:	

On > F$_1$:	ON ⟵
	OFF ⟶
	F$_1$ / F$_1$ + H$_1$
On < F$_1$:	ON ⟶
	OFF ⟵
	F$_1$ / F$_1$ + H$_1$
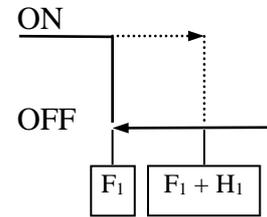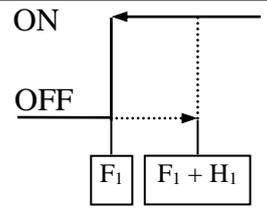
7. USB communication

The easy way to set and read the flowmeter is via USB interface. After connecting the standard mini USB cable to the computer, drivers will be automatically installed and the flowmeter appears in the computer as a virtual COM port. Therefore is possible to use Arkon communication software or use your own SCADA software. The communication protocol is Modbus RTU over serial port. Note USB connection is also used by datalogger download.
Maximum data size is 64B (about 14 MODBUS addresses at once)

⚠	**USB connection is battery consumable!**

BASIC CIRCUIT CONNECTIONS:	
VIRTUAL COM PORT (VCP) DRIVERS: **Drivers are installed automatically on MS Windows® 10 and 11. Lower version of MS Windows are not compatible.**	

8. External measurements

Two different sensors can be connected to MAGB2 flowmeter – low power temperature and/or low power pressure sensor. The needed tool is flat head screwdriver 2mm.

8.1. External temperature sensor

A special low power smart temperature sensor is used.

Specification:

Range	-20 - 130°C
Ambient temperature	-20 - 130°C
Power supply	3,3VDC
Output type	Impulse
Accuracy	+-0,5°C
Process connection	M20x1,5 male
Ingress protection	IP67
Cable legth	1 meter
Excitation frequency	1,5; 1/5; 1/15; 1/30
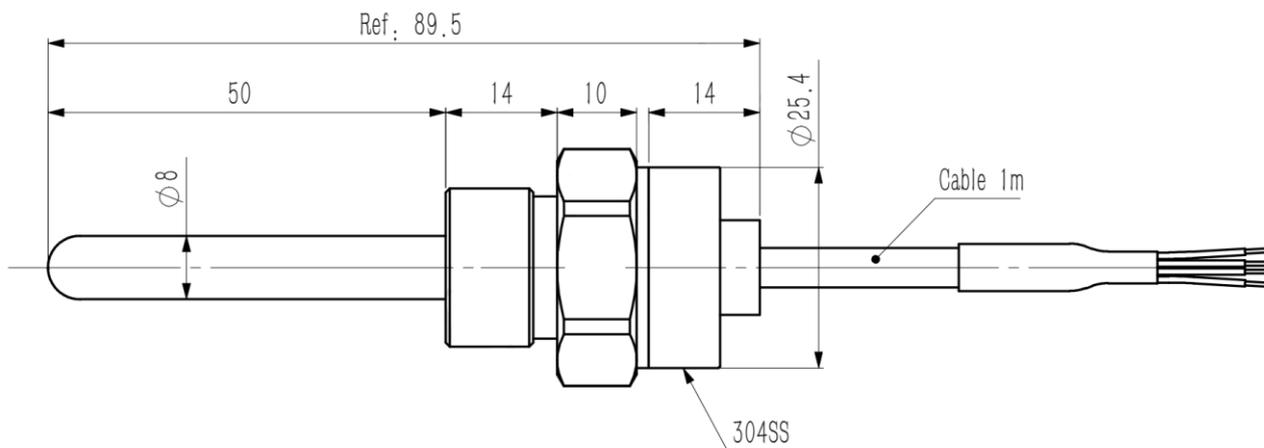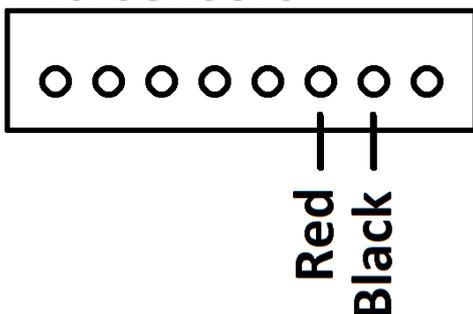
MAGB2 connection:

Mechanical connection:
The preload is 20Nm.
The installation torque is 34 Nm.
The maximum installation torque shall not exceed 70 Nm.
Sealing: O ring D17x2.5, NBR70°

8.2. External pressure sensor

A special low power smart pressure sensor is used.

Specification:

Range	0-20 Bar (0-2MPa)
Ambient temperature	-40 - 125°C
Power supply	3,3VDC
Output type	Digital
Accuracy	+-0,5% FS
Process connection	M20x1,5 male
Ingress protection	IP67
Excitation frequency	1,5; 1/5; 1/15; 1/30
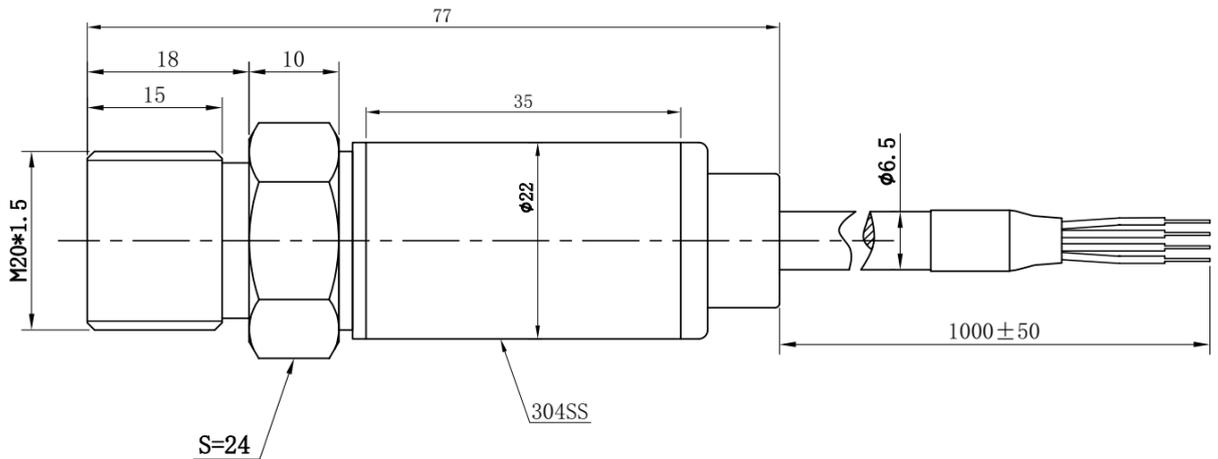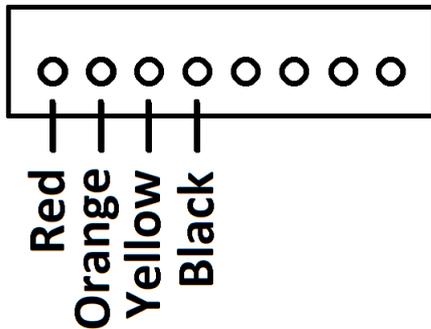
MAGB2 connection:

Mechanical connection:
The preload is 20Nm.
The installation torque is 34 Nm.
The maximum installation torque shall not exceed 70 Nm.
Sealing: O ring D17x2.5, NBR70°

9. External modules
9.1. RS485 Module

Module Name:	Symbol:	Ordering Code:
MAGB2 RS485 Module	RS485	******485I ******485N

APPLICATIONS:		
Industrial Automation, Industrial Process Control, Peripheral – PC and Terminal.		
Electrical Specifications		
VCC to Ground	3.3-5 VDC	
RS485I	Isolated version (standard)	Module needs external voltage for its operation. 3,3-5VDC applied on VCC and GND terminals. External power consumption 1-3mA.
Isolation	3750Vrms	
RS485N	Non-isolated version (on request)	Module is galvanically connected with MAGB2, does not require external power.
Baud rate	Max. 19200 baud/s	
Maximum cable length	30m	

BASIC CIRCUIT CONNECTIONS:	

RS485 module connection:
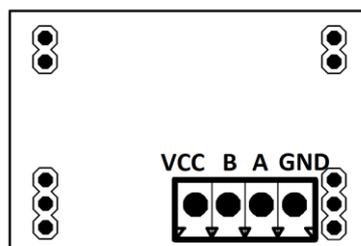
RS485I – isolated version of the RS485 module – multinode network
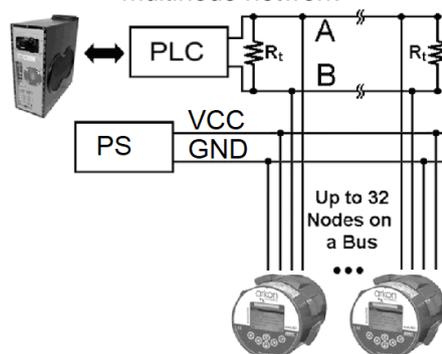
RS485N – non-isolated version of the RS485 module – multinode network
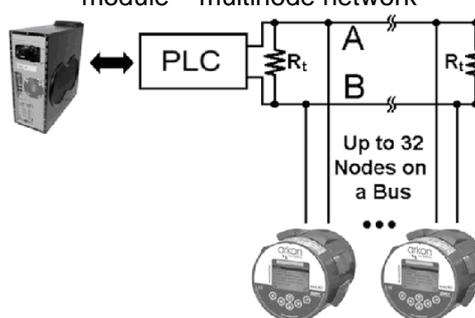
Terminator R$_t$ with resistance 100Ω should be connected to the end of line RS-485.
Note: RS485 module (both isolated and non-isolated version) usage increases battery consumption.

	WARNING: electrostatic sensitive device.
	Any connection or disconnection of any module has to be done with the battery being unplugged. Using RS485 module affects battery life.

9.2. 3G/GPRS/GSM Module

Module Name:	Symbol:	Ordering Code:
MAGB2 3G/GPRS/GSM Module	**GPRS**	******GPRS**

APPLICATIONS:	
Wireless monitoring of the flowmeter via SMS messages and/or GPRS/LTE data transfer	
Electrical Specifications	
VCC to Ground	3.3 VDC
Power Supply Current	RMS 400mA, MAX 1500mA External Li-Ion battery 4400mAh 3,6VDC
Operating systems	GSM:850MHz/900 MHz/1800 MHz/1900 MHz LTE-TDD:B38/B40/B41 LTE-FDD:B1/B3/B5/B7/B8/B20/B28
SIM Card	3.0 / 1.8 V
Temperature range	-20 – 70 °C

BASIC CIRCUIT CONNECTIONS:	Using the 3G/GPRS/GSM Module

For more information about installation and specification see document: MAGB2 GPRS-GSM User Guide.

The meter is sending flow and totalizer information in selected time interval to maximum 3 phone numbers in form of SMS message and/or GPRS TCP packet to selected IP address and port.

The settings of the SMS and data transfers are done using special Module menu in the meter. The module is capable of sending informations into Arkon.Track.
Note: GPRS module usage increases battery consumption.

⚠	WARNING: electrostatic sensitive device.
❗	Any connection or disconnection of any module has to be done with the network power to the meter switched off.

9.3. 4-20mA Module

Module Name:	Symbol:	Ordering Code:
MAGB2 4-20mA	Current Loop	******4-20mA

APPLICATIONS:		
Industrial Automation, Industrial Process Control		
Electrical Specifications		
Mode	Passive	
VCC	8-30VDC	
Max. load	30-1000Ohms	* depends on power supply
Temperature range	-20 – 70 °C	
Isolation	2500Vrms	

BASIC CIRCUIT CONNECTIONS:	Using the 4-20mA Module

VCC	R_L
8V	30 Ω
12V	200 Ω
24V	800 Ω
30V	1000 Ω

IOUT   V+
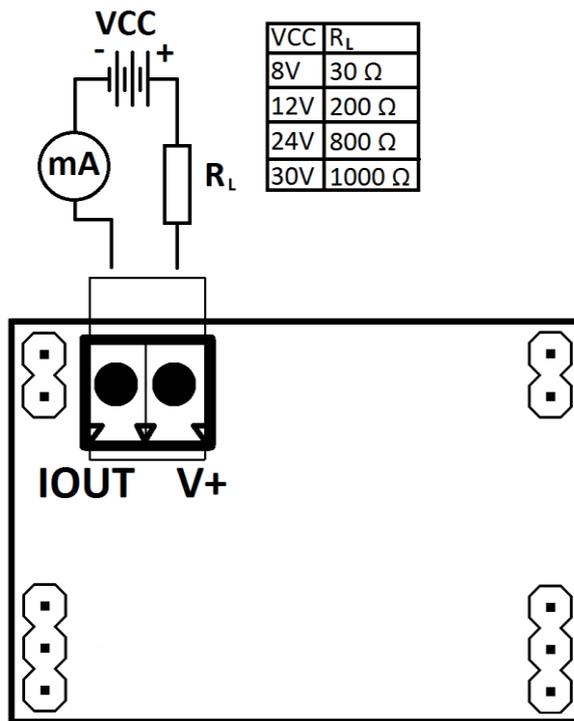
Note: 4-20mA module usage increases battery consumption.
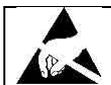
WARNING: electrostatic sensitive device.

9.4. NB-IOT Module

Module Name:	Symbol:	Ordering Code:
MAGB2 NB-IOT	NB-IoT	******NB**

APPLICATIONS:	
Wireless monitoring of the flowmeter, data collection	
Electrical Specifications	
Power Supply Current	MAX 500mA External Li-Ion battery 4400mAh 3,6VDC
Operating systems	B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/**B20**/B25/B26/B28/B66
SIM Card	1.8 V
Temperature range	- 20 – 70 °C

BASIC CIRCUIT CONNECTIONS:	Using the NB-IOT Module

For more information about installation and specification see document: MAGB2 NB-IOT installation manual.

The meter is sending flow and totalizer information in selected time interval to NB-IOT network via TCP packet to selected IP address and port.
Note: NB-IOT module usage increases battery consumption.

 WARNING: electrostatic sensitive device.

9.5. LoRa Module

Module Name:	Symbol:	Ordering Code:
MAGB2 LoRa	**LoRaWAN**®	******LoRa

APPLICATIONS:	
Wireless monitoring of the flowmeter, data collection	
Electrical Specifications	
Power Supply	External Li-Ion battery 4400mAh 3,6VDC MAX 200mA
Operating systems	868 MHz
Output power	Up to +19dBm
Range	Up to 15km (line of sight)
Authentication method	OTAA
Temperature range	-20 – 70 °C

BASIC CIRCUIT CONNECTIONS:	Using the LoRa Module

For more information about installation and specification see document: MAGB2 LoRa installation manual.

The module is sending data automatically every preset interval into LoRa network. An identification tag with all need information (Device EUI, APP EUI and APPKey) is sent with the module. Module settings are possible only via MODBUS RTU.
Note: LoRa module usage increases battery consumption.

⚠	WARNING: electrostatic sensitive device.

10. Menu

The menu structure is the same for MODBUS registers, software and internal flowmeter menu.
All functions are described in MODBUS section under each menu item. Menu overview is below:

Main menu:

Real time measurements (MODBUS only)
Info
Display
User settings
External measurements
Module settings
Service settings
Factory settings
Authorize

11. MODBUS

This manual describes the MAGB2 Modbus-RTU communication protocol.

11.1. General Modbus RTU

Definitions and Abbreviations

CRC	Cyclic Redundancy Check, Used for error-checking in Modbus RTU. See appendix
Modbus master	A Modbus device, which is able to access data in one or more connected Modbus slaves
Modbus slave	A Modbus device, which is able to respond to requests from a single Modbus master
Modbus address	Throughout this document the following notation is used to address Modbus RTU registers:
	1234 – Holding register 1234 (addressed in messages by 1233)
USB	Refers to the USB Specification usb.org
RTU	Remote Terminal Unit – Standard Modbus transmission mode

References

Reference 1	Modbus over Serial Line Specification & Implementation guide v. 1.0 modbus.org 12/02/02
Reference 2	Modbus Application Protocol Specification v. 1.1 modbus.org 12/06/02

Technical data

ARKON Flowmeter Modbus RTU specification	
Device type	Slave
Baud rates	4800, 9600, 19200, 38400 bits/sec.
Number of stations Recommended:	max. 31 per segment without repeaters
Device address range	1-247
Protocol	Modbus RTU (Other Modbus protocols like ASCII, Plus or TCP/IP are not supported)
Electrical interface	USB
Supported function code	3 read holding registers
	16 write multiple registers
Broadcast	No
Maximum cable length	USB Specification limits, RS485 up to 500mts

The communication module complies with the Modbus serial line protocol [Reference 1].

Among other things, this implies a master-slave protocol at level 2 of the OSI model. One node, (the master), issues explicit commands to one of the „slave"-nodes and processes responses. Slave nodes will not transmit data without a request from the master node, and do not communicate with other slaves. Modbus is a mono master system, which means that only one master can be connected at any single point in time. Two modes of communication are possible, Unicast and Broadcast. Unicast mode is where the master sends a request to one slave device, and waits a specified time for a response. In Broadcast mode the master sends out a request to address „0", which means that the information is for all slave devices on the network. In Broadcast mode there is no response from the slave devices.
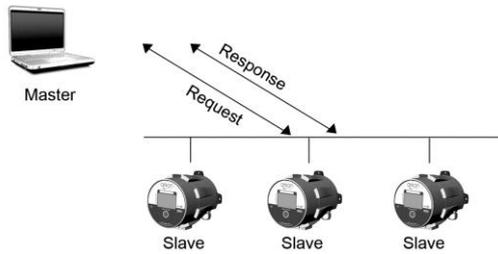
Unicast mode
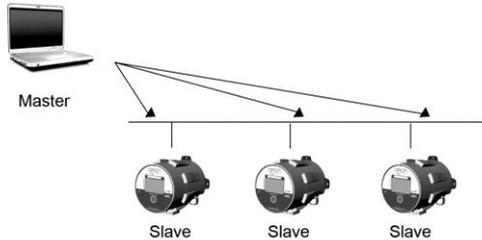
Broadcast mode

The Modbus frame is shown below, and is valid for both requests and responses.

Slave Address	Function code	Data	Crc
1 Byte	1 Byte	0-252 Bytes	2 Bytes

Further details of the Modbus protocol can be found in Reference 1 and 2.

11.2. Commissioning

Before communicating with the master, Baud rate, node ID and update rate must be selected.

Item	Value		Comments
Slave address	1-247		Device address [Factory setting: 1]
Baud rate*	9600, 14400, 19200, 38400, 57600, 115200		Communication speed [Factory setting: 9600]
Parity/framing*	Even, 1 stopbit		Communication parameters [Factory setting: None, 1 stopbit]
	Odd, 1 stopbit		
	None, 2 stopbit		
	None, 1 stopbit		

*Not important for USB connection

Modbus addressing module
The module allows R/W access to the following standard Modbus data register blocks:
• Holding registers
I.e. the module will not support the other standard data register blocks:
• Coils
• „Discrete input"
• „Input registers"

Modbus function codes
This device supports following function codes: 3, 16 and 17.
Function code 3 and 16 are used for accessing registers. Function code 17 (report slave ID) will return a structure of identification information of the device. Below the different function code exceptions are described.

Function code 3 (Read holding registers)	**Function code 16** (Write multiple registers)
General exceptions:	General exceptions:
• Requesting less than 1 or more than 125 registers => Exception 3 (Illegal data value)	• Exceeding max. Message size => Exception 2 (Illegal data address)
• Requesting more than max. Message size => Exception 2 (Illegal data address)	• Writing data above/crossing limitation of max. Register address (0xFFFF) => Exception 2(Illegal

• Requesting data above/crossing limitation of max. Register address (0xFFFF) => Exception 2 (Illegal data address) • If the end address is only part of a mapped holding register item (e.g. one half of a longint value) => Exception 2 (Illegal data address) Application exceptions: • Application errors => Exception 2 (Illegal data address) Holes/register alignment: • The read command always returns data if no exception is given. Bad start/end alignment will result in only parts of the data item being read. • Holes in the holding register map return Exception 2 (Illegal data address)	data address) Application exceptions: • Application errors => Exception 2 (Illegal data address) • Application errors include writing to ReadOnly holding registers Holes / register alignment: • If start-address is not the start of a mapped holding register => Exception 2 (Illegal data address) • Writing to holes is not allowed => Exception 2 (Illegal data address) • If the end address is only part of a mapped holding register item (e.g. one half of a longint value), the action depends on the datatype. • If the end address is only part of a mapped holding register item (e.g. one half of a longint value) => Exception 2 (Illegal data address)

11.3. Modbus holding registers

In the following the holding registers for the MAGB2 Modbus RTU module are described.

Modbus Start Register	Section
2	Password
100	Real-time measurement integer
150	Real-time measurement float
1000	Info
1500	Display
2000	User settings
2500	External measurements
3000	Service settings
4000	Factory settings
5000	Module settings
6000	Authorize

When writing to the Holding registers, data validity is not checked. Writing incorrect values can result in unexpected behaviour of the device. In any further explanations, the following data types are used:

• **Longint** – Number consisting of 32 bits, formed by 2 Modbus registers. It is necessary to write both Low and High Word of this item, the register number always has to be an even number. Not meeting these requirements will cause an Exception 2 error (Illegal data address). In case information about the number of decimals is available, then the final number is given by the following formula: $Y = X * 10^{\wedge}(-DEC)$, where Y is the final number, X the read number, and DEC the number of decimals.

• **Bool** – this item can be read, but its value has no meaning. Writing value 1 to this item will cause an unspecified operation to be performed (resetting the flow totalizers, etc.) It is necessary to write both Low and High Word of this item, the register number always has to be an even number. Not meeting these requirements will cause an Exception 2 error (Illegal data address).

• **Float** – IEEE 754-1985 single precistion (Approximately 7 decimal digits), number consisting of 32 bits, formed by 2 Modbus registers. It is necessary to write both Low and High Word of this item, the register number always has to be an even number. Not meeting these requirements will cause an Exception 2 error (Illegal data address). Full range $\pm1.18\times10^{-38}$ to $\pm3.4\times10^{38}$.

Data type memory map		
Modbus register	Data Type	Low/High Word
2	Longint	L
3		H
4	Bool	L
5		H
6	Float	L
7		H

It is always needed to read 4 bytes (2 words).

11.4. Password

To enter the "User settings and Factory settings" sections, it is necessary to enter a password.

Modbus register	Modbus address	Data type	No. Of decimal	Min Value	Max Value	Description	Read/Write
2	1	Longint	0	0	9999	Password (User)	R*/W
4	3	Longint	0	0	999999	Password (Service)	R*/W
6	5	Longint	0	0	99999999	Password (Factory)	R*/W
8	7	Longint	0	0	9999	Authorize**	R*/W
10	9	Longint	0	0	9999	Password (External measurements)	R*/W
12	11	Longint	0	0	999999	Password (Module)	R*/W

*) For safety purposes, it is not possible to read this item directly. In case a 0 is read from this register, it means that no valid password was entered, and the given section is not accessible. In case a 1 is read, a valid password was entered and hence the given section can be accessed freely. To close the section, you write any possible invalid password to the password entry.

**) In case of lost user password it is possible to restore it using serial number of the flowmeter. Send the serial number of the meter together with the authorize request to support channel of the company.

11.5. Real-time measurement – Integer

Modbus register	Modbus address	Data type	No. Of decimal	Min Value	Max Value	Description	Read/ Write
100	99	Longint	3	-10^7	10^7	FLOW	R
102	101	Longint	0	0	2^32	TOTAL DIG	R
104	103	Longint	6	0	2^32	TOTAL DEC	R
106	105	Longint	0	0	2^32	AUX+ DIG	R
108	107	Longint	6	0	2^32	AUX+ DEC	R
110	109	Longint	0	0	2^32	TOTAL+ DIG	R
112	111	Longint	6	0	2^32	TOTAL+ DEC	R
114	113	Longint	0	0	2^32	TOTAL- DIG	R
116	115	Longint	6	0	2^32	TOTAL- DEC	R
118	117	Bool	0	0	1	Reserved	R
120	119	Longint	0	0	2^16	ERROR CODE	R
122	121	Longint	0	0	2^32	Ext. Temperature	R
124	123	Longint	0	0	2^32	Ext. Pressure	R

FLOW
Unit: m3/h – it is not possible to change it.
Real value = Actual value / 1000.

TOTAL (TOTAL +, TOTAL -, AUX +) DEC and DIG
Unit: m^3 – it is not possible to change it.
The final number is given by the sum of the whole and the decimal. Example: Resulting Total measurement = (TOTAL DIG) + (TOTAL DEC*10^-3).

ERROR CODE
Convert read value to binary number. Number one means error. For more information see chapter 20.

Ext. Temperature
If external measurements module temperature is used then real temperature value = Actual value divided by 10.

Ext. Pressure
If external measurements module pressure is used then real pressure value = Actual value divided by 1000.

11.6. Real-time measurement – Float

Modbus register	Modbus address	Data type	Description	Read/Write
150	149	Float	FLOW	R
152	151	Float	TOTAL	R
154	153	Float	AUX+	R
156	155	Float	TOTAL+	R
158	157	Float	TOTAL-	R
160	159	Float	ERROR CODE	R
162	161	Float	Ext. Temperature	R
164	163	Float	Ext. Pressure	R
166	165	Float	ADC RAW data	R
168	167	Float	EP RAW data	R

FLOW
Unit: m3/h – it is not possible to change it.

TOTAL (TOTAL +, TOTAL -, AUX +)
Unit: m^3 – it is not possible to change it.

ERROR CODE
Convert read value to binary number. Number one means error. For more information see chapter 20.

Ext. Temperature
If external measurements module temperature is used.

Ext. Pressure
If external measurements module pressure is used.

ADC and EP RAW data
Used for troubleshooting purposes.

11.7. Info

Modbus register	Modbus address	Data type	No. Of decimal	Min Value	Max Value	Description	Read/ Write
1000	999	Longint	0	0	0x29991231	Date	R
1002	1001	Longint	0	0	0x00235959	Time	R
1004	1003	Longint	0	0	999 999	Unit No.	R
1006	1005	Longint	0	0	2^32	Error code	R
1008	1007	Longint	0	0	1 000	Diameter	R
1010	1009	Longint	3	0	36 000 000	Flow Qn	R
1012	1011	Longint	2	0	9 999	FirmWare No.	R
1014	1013	Longint	0	0	2^32	Excitation counter	R
1016	1015	Longint	0	0	65535	FW Checksum	R
1018	1017	Longint	0	0	0x29991231	Battery Insert Date	R
1020	1019	Longint	0	0	2^32	Battery Remainig Capacity	R
1022	1021	Longint	0	0	100	Battery Status	R
1024	1023	Longint	0	0	2^32	Error (min)	R
1026	1025	Longint	0	0	2^32	OK (min)	R
1028	1027	Longint	0	0	2^32	RC_version	R

Date - date is stored in BCD format YYYYMMDD   (ie 25.03.2010 = 0x20100325)

Time - time is stored in BCD format HHMMSS   (ie 08:33:15 = 0x00083315)

Unit no. – exclusive number for this Flowmeter. If there are any problems, please refer to this number.

Error code – Convert read value to binary number. Number one means error. For more information see chapter 20.

Diameter – this item shows the nominal sensor diameter that is currently configured for the given flowmeter.

Flow Qn – nominal flow of the meter, set around 3m/s.

Firmware No. – this shows the current firmware version.

Excitation Counter – the number of excitations after battery exchange.

FW Checksum - validation of not allowed changes in FW (metrological purposes).

Battery Insert Date – date of the last battery exchange. in BCD format YYYYMMDD (ie 25.03.2020 = 0x20200325)

Battery Remaining Capacity – remaining battery capacity in mAh.

Battery Status - this number shows remaining capacity of battery in %.

Error (min) – the number of minutes the device was not measuring because of errors.

OK (min) - the number of minutes that the device measured correctly.

RC version – release version of current FW.

11.8. Display

Modbus register	Modbus address	Data type	No. of decimal	Min. Value	Max. Value	Default	Description	Read/ Write
1500	1499	Longint	-	0	4	2	Unit Flow (+/-), 0=UKG/min, 1=USG/min, 2=m3/h, 3=l/min, 4=l/s	R/W
1502	1501	Longint	-	0	3	2	Unit Volume, 0=UKG, 1=USG, 2=m3, 3=l	R/W
1504	1503	Longint	-	0	1	0	Unit Temperature 0 = °C, 1 = °F	R/W
1506	1505	Longint	-	0	1	0	Unit Pressure 0 = bar, 1 = psi	R/W
1508	1507	Longint	-	0	5	0	Language*, 0 = ENG 1 = SPA	R/W
1510	1509	Longint	-	0	100	25	Contrast [%]	R/W
1512	1511	Longint	-	0	30	0	Backlight	R/W
1514	1513	Longint	-	0	2147480	30	Display Enable Time [s]	R/W

*so far only ENG and SPA implemented, other languages will come in future updates

Unit Flow – actual flow unit (default m^3/h)

Unit Volume – totalizer unit (default m^3)

Unit Temperature – applies for external temperature sensor (default °C)

Unit Pressure – applies external pressure sensor (default bar)

Language – Language of transmitter menu. (so far English only)

Contrast – Set display's contrast

Backlight – sets the time in seconds when the backlight is on. 0 means backlight off.

Display Enable Time – number of seconds when the display is working after touching the button. This function is for battery conservation. Value must be multiple of 5s. (If you write bad value, non multiple, this value is automatically converted). If the value is "0", function is off and display is all the time **ON**.

11.9. User settings

To enter this section, it is necessary to enter the User Password (default is 1111).
Please note each FW version might have different user settings registers.

Modbus register	Modbus address	Data type	No. of decimal	Min Value	Max Value	Default	Description	Read/ Write
2000	1999	Longint	0	0	10	7	Datalogger Interval, 0=OFF, 1=1min, 2=5min, 3=10min, 4=15min, 5=30min, 6=60min, 7=2hod, 8=6hod, 9=12hod. 10=24hod	R/W
2002	2001	N/A	N/A	N/A	N/A	N/A	reserved	N/A
2004	2003	Bool	0	0	1	0	Delete Aux + Volume	R/W
2006	2005	Longint	0	1	30	3	Samples per Avg.	R/W
2008	2007	Longint	0	0	3	0	Frequency Output - Setting - Signal, 0=OFF, 1=Frequency Output 2=Pulse volume 3=Continuous Volume Pulse	R/W
2010	2009	Longint	3	0	36 000 000	1000	Frequency Output – Q1kHz	R/W
2012	2011	Longint	3	0	36 000 000	10000	Volume per Pulse [m3]	R/W
2014	2013	Longint	1	0	36 000 000	50	Pulse Width [ms]	R/W
2016	2015	Longint	3	0	36 000 000	1000	Relay - Comparator Flow 1 [m3/hr]	R/W
2018	2017	Longint	3	0	36 000 000	1000	Relay - Comparator Flow 2 [m3/hr]	R/W
2020	2019	Longint	3	0	36 000 000	100	Relay - Comparator Hysteresis 1 [m3/hr]	R/W
2022	2021	Longint	3	0	36 000 000	100	Relay - Comparator Hysteresis 2 [m3/hr]	R/W
2024	2023	Longint	0	-999999	999999	0	Relay - Volume per pulse [m3]	R/W
2026	2025	Longint	0	1	999	5	Relay - Pulse Width [ms]	R/W
2028	2027	Longint	0	0	10	0	Relay - Setting - Signal, 0=OFF, 1=Flow+, 2=Flow-, 3=Error, 4=Air detect, 5=Fixed, 6=On In, 7=On Out, 8=On > F1,	R/W

							9=On < F1, 10=Volume Pulse	
2030	2029	Bool	0	0	1	0	Load Default Settings	R/W
2032	2031	Longint	0	0	9999	1111	Password Setup	R/W
2034	2033	Longint	0	1	247	1	Modbus Slave Address	R/W
2036	2035	Longint	0	0	5	2	Modbus BaudRate, 0=4800, 1=9600, 2=19200, 3=38400 4=57600 5=115200	
2038	2037	Longint	0	0	3	3	Modbus Parity, 0=Even, 1 stopbit, 1=Odd, 1 stopbit, 2=None, 2 stopbits, 3=None, 1 stopbit	R/W
2040	2039	Bool	0	0	1	0	Totalizer cycling 0= OFF, 1= ON	R/W
2042	2041	Longint	0	0	5	0	Module select 0=OFF, 1=RS485, 2=GPRS, 3=IOUT, 4=LoRa, 5=MBUS*	R/W
2044	2043	Bool	0	0	1	0	Leak detection 0= OFF, 1= ON	R/W
2046	2045	Longint	3	0	36 000 000	100	Leak detection threshold	R/W
2048	2047	Longint	0	0	23	18	Leak detection period start	R/W
2050	2049	Longint	0	0	23	6	Leak detection period stop	R/W
2052	2051	Bool	0	0	1	0	Leak dectection - clear flag 0= No action 1= Clear	R/W

*Not implemented yet

Datalogger Interval – this function selects how often data is written to the datalogger.

Delete Aux + Volume – write value different to zero for erasing the auxiliary flow totalizer.

Samples per Avg. – the number of samples that the flowmeter will use for calculation of its displayed average flow value. Default 3.

Frequency Output Setting - Signal – see chapter Frequency output

Frequency Output – Q1kHz – see chapter Frequency output

Relay – Comparator Flow 1 - see chapter Pulse Output.

Relay – Comparator Flow 2 - see chapter Pulse Output.

Relay – Comparator Hysteresis 1 - see chapter Pulse Output.

Relay – Comparator Hysteresis 2 - see chapter Pulse Output.

Relay – Volume per Pulse - see chapter Pulse Output.

Relay – Pulse Width - see chapter Pulse Output.

Relay – Pulse Output – setting signal - see Pulse Output.

Load default settings – Load default factory setting or users changing setting on function Save setting.

Password Setup – Set password (user).

Modbus Slave Address – Modbus device address. Default 1.

Modbus Baudrate – setup communication speed. Default 19200.

Modbus Parity – setup communication parameters. Default none, 1 stopbit.

Totalizer Cycling – If set, each 3 seconds the secondary display Main screen changes its value**.**

Module select – selects the used external module

Leak detection - if set to ON, checks flowrate between start and stop hour periiod for value higher than Leak detection threshold. If finds higher flow value, the Leak detection error flag is set. Error is permanent until cleared manually in Leak detection – clear flag.

11.10. External Measurements

To enter this section, it is necessary to enter the External Measurements Password.

Modbus register	Modbus address	Data type	No. Of decimal	Min Value	Max Value	Description	Read/ Write
2500	2499	Longint	0	0	1	External temperature measurement state, 0 = ON, 1 = OFF	R/W
2502	2501	Longint				External temperature offset	R/W
2504	2503	Longint	0	0	1	External temperature error enable 0 = ON, 1 = OFF	R/W
2506	2505	Longint				External temperature upper range for error	R/W
2508	2507	Bool				External temperature lower range for error	R/W
2510	2509	Longint	0	0	1	External pressure measurement state, 0 = ON, 1 = OFF	R/W
2512	2511	Longint				External pressure offset	R/W
2514	2513	Longint				External pressure R Span	R/W
2516	2515	Longint				External pressure R zero	R/W
2518	2517	Longint				External pressure A zero	R/W
2520	2519	Longint				External pressure A span	R/W
2522	2521	Longint				External pressure error enable	R/W
2524	2523	Longint				External pressure upper range for error	R/W
2526	2525	Longint				External pressure lower range for error	R/W

External temperature measurement state – Switches on/off the external temperature module.

External temperature offset – user offset calibration for temperature measurement

External temperature error enable – enables temperature error in the error code

External temperature upper and lower range – used for factory calibration of the temperature sensor

External pressure measurement state – Switches on/off the external pressure module.

External pressure offset – user offset calibration for pressure measurement

External pressure R and A span and zero – used for sensor calibration

External pressure error enable – enables pressure error in the error code

External pressure upper and lower range – used for factory calibration of the pressure sensor

11.11. Service settings

To enter this section, it is necessary to enter the Service Password.
Please note each FW version might have different service settings registers.

Modbus register	Modbus address	Data type	No. Of decimal	Min Value	Max Value	Default	Description	Read/Write
3000	2999	Longint	0	0	9999999	120000	Noise filter threshold	R/W
3002	3001	Bool	0	0	1	0	Start noise filter	R/W
3004	3003	Bool	0	0	1	0	Delete Error	R/W
3006	3005	Bool	0	0	1	0	Delete Total -	R/W
3008	3007	Bool	0	0	1	0	Delete Total +	R/W
3010	3009	Bool	0	0	1	0	Delete Total	R/W
3012	3011	Bool	0	0	1	0	Flow Simulation, 0=OFF, 1=ON	R/W
3014	3013	Longint	3	0	36 000 000	3600	Simulated Flow	R/W
3016	3015	Bool	-	0	1	0	Service Mode, 0=OFF, 1=ON	R/W
3018	3017	Bool	0	0	1	0	Measurement, 0=Stop, 1=Running	R/W
3020	3019	Longint	0	-99999999	99999999	4500000	Air Constant	R/W
3022	3021	Bool	0	0	1	0	Invert Flow, 0=No-invert, 1=Invert	R/W
3024	3023	Longint	0	0	5	3	Low Flow Cutoff, 0=OFF, 1=0.5%, 2=1%, 3=2%, 4=5%, 5=10%	R/W
3026	3025	Longint	3	0	36 000 000	-	Flow Qn	R/W
3028	3027	Longint	0	0	0x29991231	-	Date Settings	R/W
3030	3029	Longint	0	0	0x00235959	-	Time Settings	R/W
3032	3031	Longint	0	0	0x29991231	-	Battery insert date	R/W
3034	3033	Longint	0	0	999999	-	Battery capacity left	R/W
3036	3035	Bool	0	0	1	0	Delete Error (min)	R/W
3038	3037	Bool	0	0	1	0	Delete Ok (min)	R/W
3040	3039	Longint	3	-36 000 000	36 000 000	0	Flow MAX limit	R/W
3042	3041	Longint	3	-36 000 000	36 000 000	0	Flow MIN limit	R/W
3044	3043	Bool	0	0	1	0	Delete User Datalogger 0= No action 1=Delete	R/W

3046-3106	3045-3105	Longint	-	-	-	-	Buttons Related Settings	R/W
3108	3107	Longint	-	0	6	4	Fast Excitation Frequency, 0=1/30 Hz, 1=1/15 Hz, 2=1/5 Hz, 3=1.5625 Hz, 4=3.125 Hz, 5=6.25 Hz	R/W
3110	3109	Longint	-	0	6	4	Slow Excitation Frequency, 0=1/30 Hz, 1=1/15 Hz, 2=1/5 Hz, 3=1.5625 Hz, 4=3.125 Hz, 5=6.25 Hz	R/W
3112	3111	Longint	-	0	4	4	Menu Level 0=Only Info and Display menu 1=No Factory, Service and Module settings 2=No Factory and Service settings 3=no Factory settings 4=Full Menu	R/W
3114	3113	Bool	0	0	1	1	Air Detector, 0=OFF, 1=ON	R/W

Noise filter threshold – determines which value from AD converter is restarting the averaging filter

Start noise filter – manual restart of the filter

Delete Error – major errors needs to be deleted by service settings

Delete Total – Volume – write value different to zero for erasing the Total – flow totalizer.

Delete Total + Volume – write value different to zero for erasing the Total + flow totalizer.

Delete Total Volume – write value different to zero for erasing the Total flow totalizer.

Flow Simulation – switch off/on the simulation flow function. Default OFF.

Simulated Flow – write simulated flow.

Service Mode – write value different to zero for turn ON the service mode. Default OFF.

Measurement – 0 = Stop – the unit shows actual flow, but the totalizers are stopped.
1 = Running – totalizers are active. Default Stop.

Air Constant – constant value to determine the Empty pipe detection limit. Default 188.

Invert Flow – this function serves to change the direction of the flow. Default OFF.

Low Flow Cutoff – this function serves to set the minimum flow the flowmeter will react on. Default 2%.

Flow Qn – setup to the excepted flow Qn. It is set automatically when you write diameter.

Date Settings - date write in BCD format YYYYMMDD   (ie 25.03.2010 = (hex)0x20100325)

Time Settings - time write in BCD format HHMMSS   (ie 08:33:15 = (hex)0x00083315)

Battery insert date – each time main battery is replaced it is necessary to set correct date of replacement

Battery capacity left – each time main battery is replaced it is necessary to set correct battery capacity

Delete OK (min) – write value different to zero for erasing the OK min counter.

Delete Error (min) – write value different to zero for erasing the Error min counter.

Flow MIN - MAX limit - limits the flow value for the flowmeter - whenever the measured flow is outside of set boundaries, replaces the flow value by limit value. If set both to 0 this function is switched off.

Delete User Datalogger - Deletes the content of the user datalogger, doesnt affect internal device dataloggers.

Buttons Related Settings – sets upper and lower thresholds of capacitive buttons

Fast and Slow excitation frequency – there is a special mode for rarely used meters where the meter is using Slow excitation frequency while the flow value is 0m3/hr. When meter reads non-zero flow it automatically switches the fast excitation frequency. Then when the flow becomes back zero meter switches back to Slow excitation frequency. Function is on only when Fast exciation frequency is higher than slow excitation frequency.

Menu Level – Allows user to select which menu settings are visible for meter menu operation and RS485 functionality. Please note – does not affect USB MODBUS functionality.

Air Detector – this option allows selecting empty pipe check. Default ON. If the Air detector is active and the pipe is empty, the unit automatically turns down the excitation to prolong battery life.

11.12. Factory Settings

To enter this section, it is necessary to enter the Factory Password.

Modbus register	Modbus address	Data type	No. of decimal	Min Value	Max Value	Default	Description	Read/Write
4000	3999	Longint	0	0	1 000	-	Diameter	R/W
4002	4001	Longint	0	0	999999	-	Unit No.	R/W
4004	4003	Bool	-	0	1	1	Excitation, 0=OFF, 1=ON	R/W
4006	4005	Longint	-	0	3	2	Excitation Current, 0=50mA 1=35mA 2=20mA 3=19mA	R/W
4008	4007	Longint	-	0	6	2	Excitation Frequency, 0=1/30 Hz, 1=1/15 Hz, 2=1/5 Hz, 3=1.5625 Hz, 4=3.125 Hz, 5=6.25 Hz	R/W
4010	4009	Longint	0	0	99999	30	Measure Zero Constant [s]	R/W
4012	4011	Longint	3	0	36 000 000	-	Calibration Positive Point 1	R/W
4014	4013	Longint	0	-8388608	8388607	-	Calibration Positive Data 1	R/W
4016	4015	Longint	3	0	36 000 000	-	Calibration Positive Point 2	R/W
4018	4017	Longint	0	-8388608	8388607	-	Calibration Positive Data 2	R/W
4020	4019	Longint	3	0	36 000 000	-	Calibration Negative Point 1	R/W
4022	4021	Longint	0	-8388608	8388607	-	Calibration Negative Data 1	R/W
4024	4023	Longint	3	0	36 000 000	-	Calibration Negative Point 2	R/W
4026	4025	Longint	0	-8388608	8388607	-	Calibration Negative Data 2	R/W
4028	4027	Longint	3	0	99999999	-	Positive Flow Correction	R/W
4030	4029	Longint	2	-99999	99999	-	Positive Error Low Corr.	R/W
4032	4031	Longint	2	-99999	99999	-	Positive Error High Corr.	R/W
4034	4033	Bool	-	0	1	0	Do Positive Correction	R/W
4036	4035	Longint	3	-99999999	0		Negative Flow Correction	R/W

4038	4037	Longint	2	-99999	99999		Negative Error Low Corr.	R/W
4040	4039	Longint	2	-99999	99999		Negative Error High Corr.	R/W
4042	4041	Bool	-	0	1	0	Do Negative Correction	R/W
4044	4043	Bool	-	0	1	0	Service Mode, 0=OFF, 1=ON	R/W
4046	4045	Bool	-	0	1	0	Update FW 0=Update, 1=No action	R/W
4048	4047	Bool	-	0	1	0	Excitation Polarity	R/W

Diameter – diameter of the sensor.

Unit No. – the serial number of unit.

Excitation – write zero for turn OFF the excitation. Default ON.

Excitation Current – excitation current is set during calibration – not to be changed

Excitation Frequency – choose the excitation frequency. The battery life depends on excitation frequency.

Measure Zero Constant – by setting time the meter starts to measure zero constant. Note real flow in the tube needs to be 0.

Calibration Positive Point 1
Calibration Positive Data 1
Calibration Positive Point 2
Calibration Positive Data 2
Calibration Pegative Point 1
Calibration Pegative Data 1
Calibration Pegative Point 2
Calibration Pegative Data 2
Positive Flow Correction
Positive Error Low Corr.
Positive Error High Corr.
Do Positive Correction
Negative Flow Correction
Negative Error Low Corr.
Negative Error High Corr.
Do Negative Correction
Excitation Polarity
   -   Calibration related constants

Service Mode – write value different to zero for turn ON the service mode. Default OFF.

Update FW – To update the FW – meter is set to DFU mode to receive new FW. Display of the meter goes off and the meter is waiting for FW update. To stop update take out battery and put it back on.

Under Factory password there is consumption menu (addr. 7000-7050).

11.13. Module settings

To enter this section, it is necessary to enter the Module Password. Please note each FW version might have different module settings registers.

Modbus register	Modbus address	Data type	No. of decimal	Min Value	Max Value	Description	Read/ Write
5000	4999	Longint	0	0	99999	Interval	R/W
5002	5001	Longint	0	0	24	Start Hour	R/W
5004	5003	Longint	-	0	3	Automatic Sending, 0=OFF, 1=TCP only, 2=SMS, 3=TCP and SMS	R/W
5006	5005	*	-	-	-	Server IP	
5008	5007	Longint	0	0	99999	Server Port	R/W
5010	5009	*	-	-	-	SIM APN	
5012	5011	*	-	-	-	SMS Phone 1	
5014	5013	*	-	-	-	SMS Phone 2	
5016	5015	*	-	-	-	SMS Phone 3	
5018	5017	Longint	0	0		Device ID	R/W
5020	5019	Bool	0	0	1	SMS Format, 0=Default, 1=NMX	R/W
5022	5021	*	-	-	-	NMX RFC	
5024	5023	Longint	5	-99999999	99999999	Latitude	R/W
5026	5025	Longint	5	-99999999	99999999	Longitude	R/W
5028	5027	Longint	0	0	999	UV	R/W
5030	5029	Bool	-	0	1	Send GPRS Message	R/W
5032	5031	Bool	-	0	1	Send SMS	R/W
5034	5033	Longint	0	0	999999	Module Password Setup	R/W
5036	5035	Longint	0	1	66	NB-IOT Band, default 20	R/W
5038-5040	5037-5039	-	-	-	-	LoRa Device EUI	R/W
5042-5044	5041-5043	-	-	-	-	LoRa APP EUI	R/W
5046-5052	5045-5051	-	-	-	-	LoRa Device Key	R/W
5054-5056	5053-5055	-	-	-	-	LoRa module Settings	R/W
5058	5057	Bool	-	0	1	Send LoRa Message	R/W
5060	5059	Longint	-	1	96	Batch Log Count	R/W

*subject to development of the string mode of MODBUS. So far to be set via keyboard.

Interval – sets interval between messages.

Start Hour – sets at which hour the interval starts.

Automatic Sending – if set to on the meter sends messages automatically to server/phone based on interval and start hour.

Server IP – sets server IP address where the data goes.

Server Port – sets server TCP port where the data goes.

SIM APN – sets the APN of the SIM card – check with SIM card provider.

SMS Phone 1, SMS Phone 2, SMS Phone 3 – sets up to 3 phone numbers to send the messages to.

Device ID – Used for Arkon.Track.

SMS Format – format of the SMS message – specific to some countries

NMX RFC, UV – country specific

Latitude, Longitude – place of meter installation

Send GPRS Message – sends one TCP message to server – used for testing purposes.

Send SMS – sends one message to the phone – used for testing purposes.

Module Password Setup – Set password (module).

NB-IOT Band – Settings for NB-IOT module. For more information please see MAGB2 NB-IOT installation guide.

LoRa Device EUI, LoRa APP EUI, LoRa Device Key, LoRa module Settings – LoRa related settings, for more information please see MAGB2 LoRa installation guide.

Send LoRa Message – sends one LoRa message to server – used for testing purposes.

Batch Log Count – Used with GPRS module while sending data over TCP packet. Flowmeter can collect more data and send them all in the selected interval. Batch log count specifies how much data is sent inbetween intervals. Example. Interval is set to 720 (12 hrs), Batch log count is set to 12. Flowmeter will save data each one hour and send them all together each 12 hours to the server.

For more information please see each MAGB2 modules manuals.

11.14. Authorize

To enter this section, it is necessary to enter the Authorize Password. The password will be calculated upon sending the serial number of the meter to the technical support.

Modbus register	Modbus address	Data type	No. of decimal	Min Value	Max Value	Description	Read/Write
6000	5999	Longint	0	0	9999	User Password Setup	R/W
6002	6001	Longint	0	0	999999	Module Password Setup	R/W

User Password Setup – Set password (user).

Module Password Setup – Set password (module).

12. Datalogger

Datalogger functionality is based on coping the data from device once is connected via USB cable. A removable drive is installed once the meter is connected to the PC (works only with Windows 10 and higher) and a log file (userLog.csv) can be found on the drive.
It is recommended to copy the data to hard drive on the PC before working with the file.
Datalogger interval is selectable via user settings menu, can be se to:

- Off (default)
- 5 minutes
- 10 minutes
- 15 minutes
- 30 minutes
- 1 hour
- 2 hours
- 6 hours
- 12 hours
- 24 hours

Note: Datalogger usage increases battery consumption.

Datalogger content:
DATE OF READ: 2022-09-05 09:30 [YYYY-MM-DD HH:MM]
SERIAL NUMBER: 72208679
FLOW QN: 40.000 [m3/h]
SENSOR DN: 50 [mm]
FW VERSION: 22.27 RC: 2
FW_CHECKSUM: 0x424D5109 [hex]

YYYY-MM-DD,HH:MM,FLOW[l/s],TOTAL+[m3],TOTAL-
[m3],AUX+[m3],ERROR[hex],BATTERY[mAh],TEMP[degC],PRESS[MPa],
2022-09-05,09:35, 0.00000,   0.1179,   -0.5747,   0.1179,00002,74911, 0.0, 0.000

13. Internal backup

13.1. Automatic saving data

After each parameter change – that one is saved to EEPROM. Every minute the date, time and dataloggers are saved to internal EEPROM.

In case of battery disconnection the totalizers are lost to last saved minute. This means up to one minute of totalizers will be lost. To prevent that user needs to physically stop the flow, wait for meter time cross whole minute and then it is safe to disconnect the battery.

If you don't change the battery before it is completely inactive (discharged) then only the last bit of data recovered before the battery was inactive, will be kept in the memory.

14. MAGB2 SW

14.1. System requirements

There are minimum hardware and software requirements of your computer that must be satisfied to ensure that the software functions properly. These are:
MS Windows Wndows 10 operating system
Flowmeters software program
USBmini cable

14.2. Installation/Uninstall Flowmeters software

Can be downloaded from http://www.arkon.co.uk/support or obtained on delivered pen drive. Run the "Setup.exe" in the "Flowmeters" folder.

To uninstall Flowmeters SW in „Settings" (Start menu), under „Add/remove programs" you select Flowmeters and then click the „uninstall" button.

Start by selecting MAGB2 in the top menu of the Flowmeters SW. In case you want to use USB connection connect MAGB2 to USB before you start with MAGB2 SW.
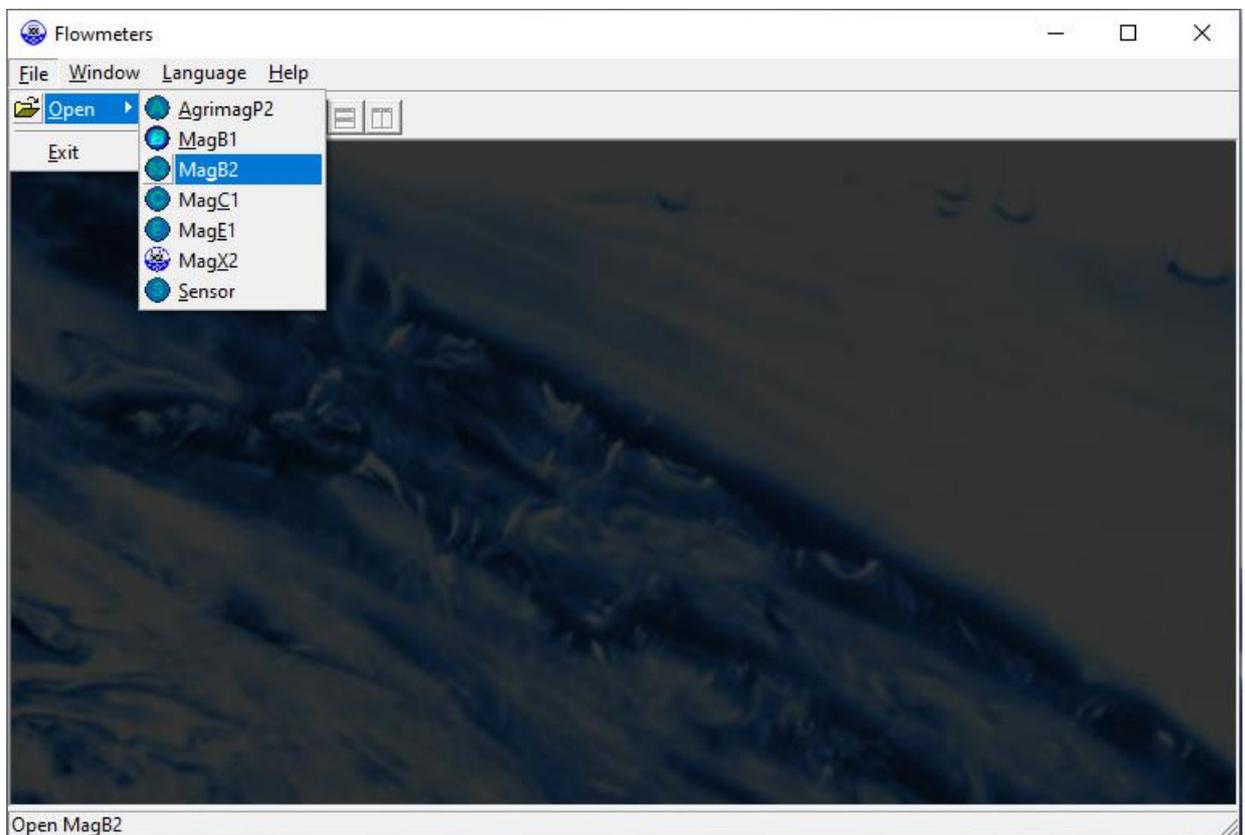
MAGB2 connection window appears. SW automatically searches for connected COM ports and gives you a list of available ports.
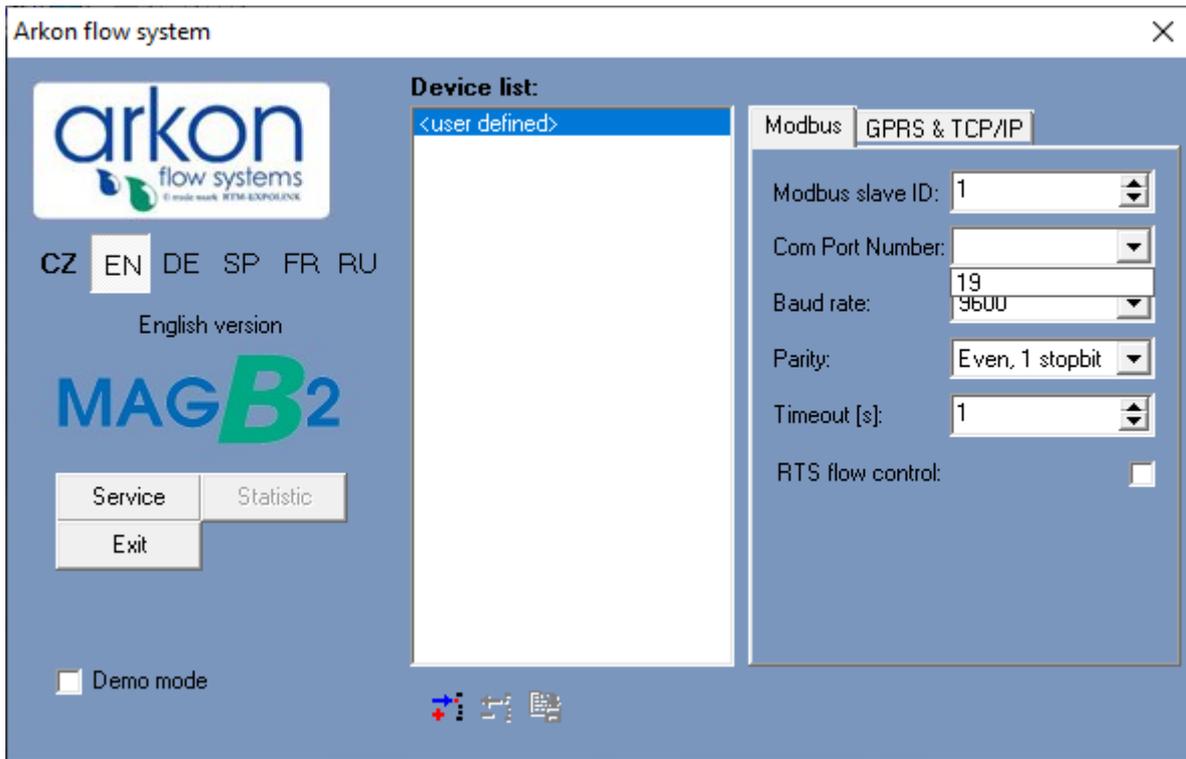
Here you can preset more MAGB2 devices (name them, usually important with more devices on one RS485 line)

Fill in the communication parameters and proceed to the SERVICE section ("Service") – This section serves for overall remote configuration of the flowmeter. You enter this section by clicking "Service" in the above window.

You can be connected simultaneously to several units in one instance of SW Flowmeters.

14.3. Service section
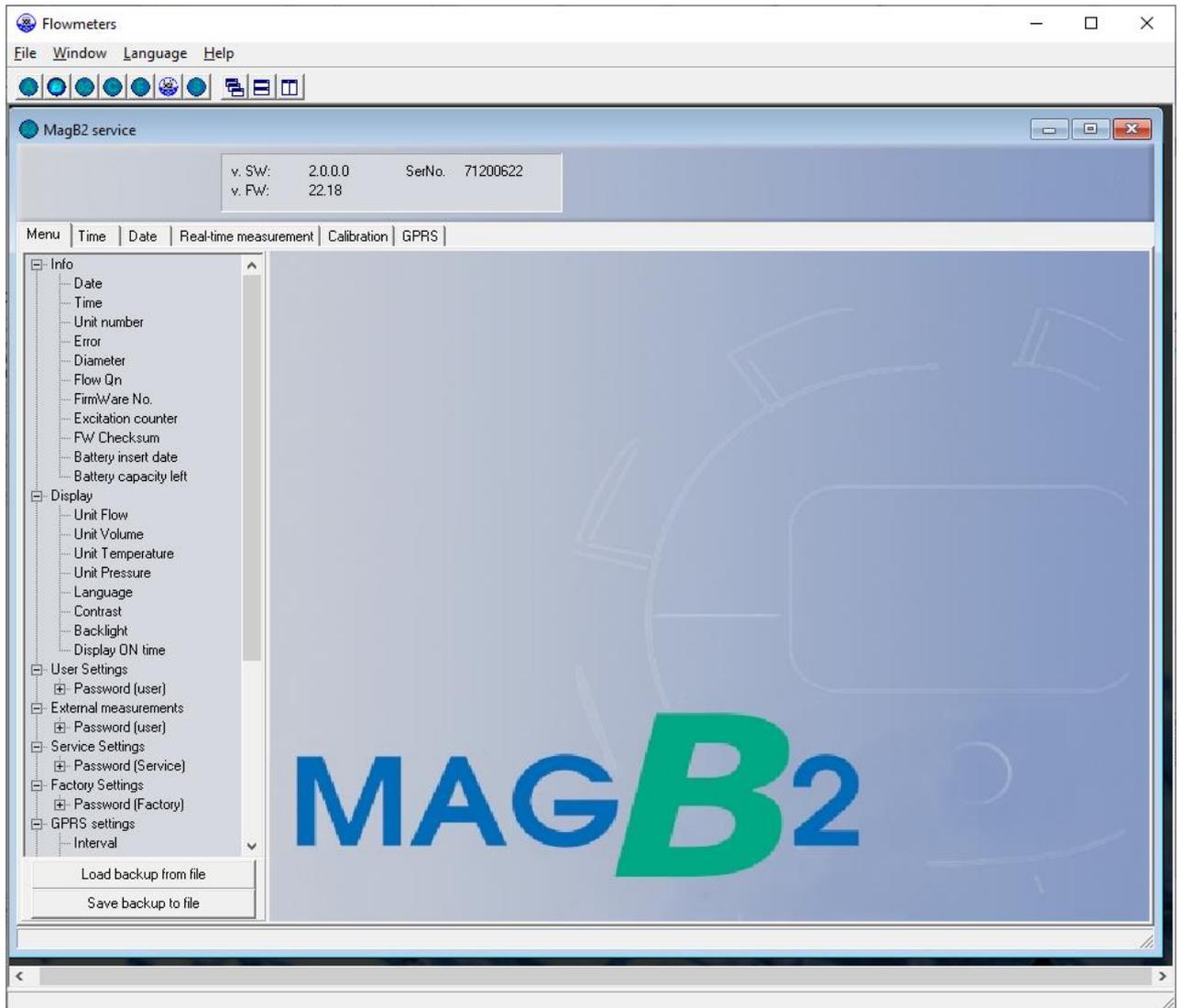
- At the top of the MAGB2 window you can see basic information about the connected flowmeter.

TABS

- *MENU* - The left-most tab is the "menu" tab, which will display the item selected in the menu-tree on the left hand side of the main window. Some items are only accessible after entering the correct password. When asked for a password, simply enter the correct password for the given section (User and Factory password) and click OK.
- *TIME* - The next tab is "Time". Here, you can enter the correct current time.

- *DATE* - The third tab from the left is "Date". Here, you can enter the correct current date. (Settings are the same as *TIME* - Tabs)
- *REAL – TIME MEASUREMENT* - The 4th tab is "Real-time measurement" and it serves to view actual current flow. The current flow is shown as the first item on top of this window, but it is also depicted in the form of a graph at the bottom. This graph shows current flow data for the last 100 seconds of measurement. On right side are actual errors in red color.

15. FW Update

It is possible to update flowmeter to a newer or older FW version. The FW update is possible via USB interface only.

In order to do so navigate in the menu into Factory settings-FW update = Yes. MAGB2 will reboot in FW update mode, then you can use new FW together with its uploading SW. Please contact support for more information.

There is a full procedure for FW update - P_40_MAGB2_Firmware Update.

16. OIML R49:2013

MAGB2 have been type tested and internationally proven and endorsed to the highest accuracy Class 2 for cold and hot potable water meters – OIML R49-1 (Organisation Internationale de Métrologie Légale). For full details, OIML R49 is available to download from www.oiml.org. Its requirements are in line with other international standards, such as EN14154 and ISO4064. MAGB2 flowmeter has been evaluated by type approval at the Czech Metrology Institute to OIML R49 and passed the very highest accuracy designations for sizes DN25 to DN250 (1 to 10 in. NB).
The OIML R49 certificate of conformity is available on our website (www.arkon.co.uk).

Climatic class: **B**
Electromagnetic class: **E2**
Orientation limitation: **H↑**(Max. R250) **V↑**(Max. R100)
Pressure class: **MAP16**
Temperature class: **T50**
Pressure loss: **ΔP 16**
Installation condition: **U0D0**
Accuracy class: **2 (±5% Q1-Q2, ±2% Q2-Q4)**
Flow direction: **positive and negative**
Q3/Q1 ratio is described in following table:

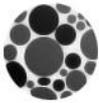| DN	Flowrates and Q3/Q1 ratio									
25	Q_1 [m³/h]:	0.064	0.080	0.100	0.128	0.160	0.200	0.254	0.320	0.400
	Q_2 [m³/h]:	0.102	0.128	0.160	0.205	0.256	0.320	0.406	0.512	0.640
	Q_3 [m³/h]:	16	16	16	16	16	16	16	16	16
	Q_4 [m³/h]:	20	20	20	20	20	20	20	20	20
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
32	Q_1 [m³/h]:	0.100	0.125	0.156	0.200	0.250	0.313	0.400	0.500	0.625
	Q_2 [m³/h]:	0.160	0.200	0.250	0.320	0.400	0.500	0.635	0.800	1.000
	Q_3 [m³/h]:	25	25	25	25	25	25	25	25	25
	Q_4 [m³/h]:	31.25	31.25	31.25	31.25	31.25	31.25	31.25	31.25	31.25
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
40	Q_1 [m³/h]:	0.160	0.200	0.250	0.320	0.400	0.500	0.635	0.800	1.000
	Q_2 [m³/h]:	0.256	0.320	0.400	0.512	0.640	0.800	1.016	1.280	1.600
	Q_3 [m³/h]:	40	40	40	40	40	40	40	40	40
	Q_4 [m³/h]:	50	50	50	50	50	50	50	50	50
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
50	Q_1 [m³/h]:	0.252	0.315	0.394	0.504	0.630	0.788	1.000	1.260	1.575
	Q_2 [m³/h]:	0.403	0.504	0.630	0.806	1.008	1.260	1.600	2.016	2.520
	Q_3 [m³/h]:	63	63	63	63	63	63	63	63	63
	Q_4 [m³/h]:	79	79	79	79	79	79	79	79	79
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
65	Q_1 [m³/h]:	0.400	0.500	0.625	0.800	1.000	1.250	1.587	2.000	2.500
	Q_2 [m³/h]:	0.640	0.800	1.000	1.280	1.600	2.000	2.587	3.200	4.000
	Q_3 [m³/h]:	100	100	100	100	100	100	100	100	100
	Q_4 [m³/h]:	125	125	125	125	125	125	125	125	125
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
80	Q_1 [m³/h]:	0.640	0.800	1.000	1.280	1.600	2.000	2.540	3.200	4.000
	Q_2 [m³/h]:	1.024	1.280	1.600	2.048	2.560	3.200	4.064	5.120	6.400
	Q_3 [m³/h]:	160	160	160	160	160	160	160	160	160
	Q_4 [m³/h]:	200	200	200	200	200	200	200	200	200
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
100	Q_1 [m³/h]:	1.000	1.250	1.563	2.000	2.500	3.125	3.970	5.000	6.250
	Q_2 [m³/h]:	1.600	2.000	2.500	3.200	4.000	5.000	6.350	8.000	10.000
	Q_3 [m³/h]:	250	250	250	250	250	250	250	250	250
	Q_4 [m³/h]:	313	313	313	313	313	313	313	313	313
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
125	Q_1 [m³/h]:	1.60	2.00	2.50	3.20	4.00	5.00	6.35	8.00	10.00
	Q_2 [m³/h]:	2.56	3.20	4.00	5.12	6.40	8.00	10.16	12.80	16.00
	Q_3 [m³/h]:	400	400	400	400	400	400	400	400	400
	Q_4 [m³/h]:	500	500	500	500	500	500	500	500	500
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
150	Q_1 [m³/h]:	2.52	3.15	3.94	5.04	6.30	7.88	10.00	12.60	15.75
	Q_2 [m³/h]:	4.03	5.04	6.30	8.06	10.08	12.60	16.00	20.16	25.20
	Q_3 [m³/h]:	630	630	630	630	630	630	630	630	630
	Q_4 [m³/h]:	788	788	788	788	788	788	788	788	788
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
200	Q_1 [m³/h]:	2.52	3.15	3.94	5.04	6.30	7.88	10.00	12.60	15.75
	Q_2 [m³/h]:	4.03	5.04	6.30	8.06	10.08	12.60	16.00	20.16	25.20
	Q_3 [m³/h]:	630	630	630	630	630	630	630	630	630
	Q_4 [m³/h]:	788	788	788	788	788	788	788	788	788
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40
250	Q_1 [m³/h]:	4.00	5.00	6.25	8.00	10.00	12.50	15.87	20.00	25.00
	Q_2 [m³/h]:	6.40	8.00	10.00	12.80	16.00	20.00	25.40	32.00	40.00
	Q_3 [m³/h]:	1000	1000	1000	1000	1000	1000	1000	1000	1000
	Q_4 [m³/h]:	1250	1250	1250	1250	1250	1250	1250	1250	1250
	Q_3/Q_1:	250	200	160	125	100	80	63	50	40

OIML Certificate No.: R49/2013-A-CZ1-2023.02

17. Liner and electrode selection

Liner and electrode material selection are an important issue when choosing your flowmeter. The tables below serve to give you an idea of general material compatibility. If you are not sure about suitability of liner/electrode material for a particular medium, please contact the Arkon sales department for further assistance, and the site where the flowmeter is to be used for what materials are acceptable for the process media. Arkon can only recommend materials, we cannot guarantee them.
Please note that Arkon offer also WRAS approved material for all standard sizes. For more info contact our sales department.

Liner Selection:

Hard Rubber	Drinking water and wastewater		0 - 70°C
Soft Rubber	Water with abrasive particles		0 - 70°C
PTFE	Chemicals and food industries		0 - 130°C
Hygienic Rubber	Drinking water, WRAS approved		cold water

Electrode selection:

Hastelloy	General purpose, sewage, water, seawater, chemicals	
Titanium	Aggressive chemicals	
Platinum	Aggressive chemicals	

18. Flowmeter Dimensions

Compact version
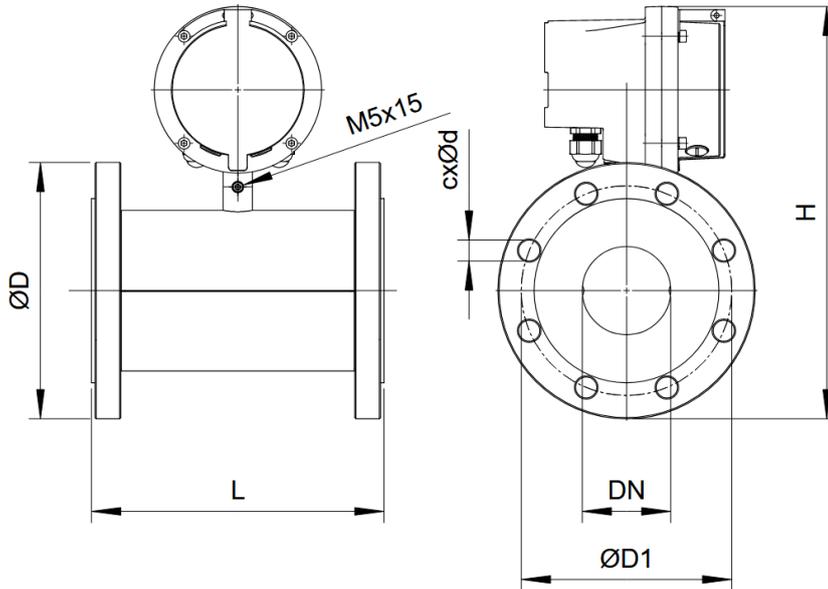
Remote version

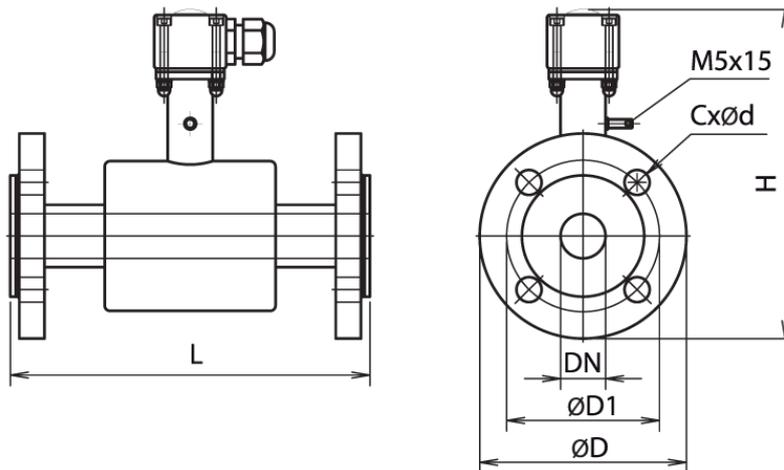| DN	ØD	ØD1	CxØd	H_compact	H_remote	L
10	90	60	4x14	257	160	200
15	95	65	4x14	262	165	200
20	105	75	4x14	269	172	200
25	115	85	4x14	275	178	200
32	140	100	4x18	293	196	200
40	150	110	4x18	302	205	200
50	165	125	4x18	316	220	200
65	185	145	8x18	336	239	200
80	200	160	8x18	354	257	200
100	220	180	8x18	374	277	250
125	250	210	8x18	407	310	250
150	285	240	8x22	444	347	300
200	340	295	12x22	501	404	350
250	405	355	12x26	571	474	400
300	460	410	12x26	615	518	500
350	520	470	16x26	683	586	500

DN	ØD	ØD1	CxØd	H_compact	H_remote	L
1/2"	88.9	60.5	4x15,7	258	161	200
3/4"	98.6	69.9	4x15,7	266	169	200
1"	108	79.2	4x15,7	271	174	200
1.1/4"	117.3	88.9	4x15,7	282	185	200
1.1/2"	127	98.6	4x15,7	290	193	200
2"	152.4	120.7	4x19,1	309	212	200
2.1/2"	177.8	139.7	4x19,1	332	235	200
3"	190.5	152.4	4x19,1	349	252	200
4"	228.6	190.5	8x19,1	378	281	250
5"	254	215.9	8x22,4	409	312	250
6"	279.4	241.3	8x22,4	441	344	300
8"	342.9	298.5	8x22,4	502	405	350
10"	406.4	362	12x25,4	571	474	400
12"	482.6	431.8	12x25,4	626	529	500
14"	533.4	476.3	12x28,4	690	593	500

Tolerance of built-in length and height for DIN and ANSI type sensors:
DN 10 – DN 150 → L ± 5 mm
DN 200 – DN 1000 → L ± 10 mm

Standard pressure:
DN 10 – DN 50 → PN 40 / 150 lbs.
>DN 50 → PN 16 / 150 lbs.

19. How to order your MAGB2

In case you are interested in purchasing a MAGB2 flowmeter, you can either contact the Arkon Sales Department and request a quote to serve as a basis for ordering, or you can use the Arkon price-list as an easy order form. Due to the design of the MAGB2, no single ordering code exists. Only the MAGB2 sensor has its own ordering code:

Model	Ordering code							Description
MAGB2	1	2	3	4	5	6	7	Standard calibration
MAGB2 OIML	1	2	3	4	5	6	7	OIML R49 Version (DN25–DN250)
MAGB2 MID	1	2	3	4	5	6	7	MID Version – MI-001, Class 2 (DN25–DN250)

Code							Description	
							Version	
Z							**Reduced-bore body (up to DN150 only)**	
C							Compact	
W							Remote: WALL mounting kit (incl. 6m cable)	
P							Remote: PANEL mounting kit (incl. 6m cable)	
R							Remote: DIN-Rail mounting kit (incl. 6m cable)	
							Connection type	
	D						DIN	
	A						ANSI	
							Size	
		20 / 3/4	150 / 6				20 mm / ¾"	150 mm / 6"
		25 / 1	200 / 8				25 mm / 1"	200 mm / 8"
		32 / 1.1/4	250 / 10				32 mm / 1.1/4"	250 mm / 10"
		40 / 1.1/2	300 / 12				40 mm / 1.1/2"	300 mm / 12"
		50 / 2	350 / 14				50 mm / 2 "	350 mm / 14"
		65 / 2.1/2	400 / 16				65 mm / 2.1/2"	400 mm / 16"
		80 / 3	450 / 18				80 mm / 3"	450 mm / 18"
		100/ 4	500 / 20				100 mm / 4"	500 mm / 20"
		125 / 5	600 / 24				125 mm / 5"	600 mm / 24"
							Liner material	
			HR				Hard Rubber	
			SR				Soft Rubber	
			PT				PTFE	
			NR				Hygienic rubber	
							Pressure	
				150			150 psi	
				300			300 psi	
				10			PN10	
				16			PN16	
				25			PN25	
				40			PN40	
							Electrodes material	
					HA		Hastelloy C	
					TA		Tantalum	
					TI		Titanium	
					PL		Platinum	
							Module	
						GPRS	3G/GPRS/GSM module	
						4-20	4-20 mA module	
						485I 485N	RS485 module	
						NB	NB-IOT module	
						LoRa	LoRa module	

Example

MAGB2	C	D	100	HR	16	HA

20. MAGB2 Error Code Table

0b0000000000000000
Position 0
Position 1
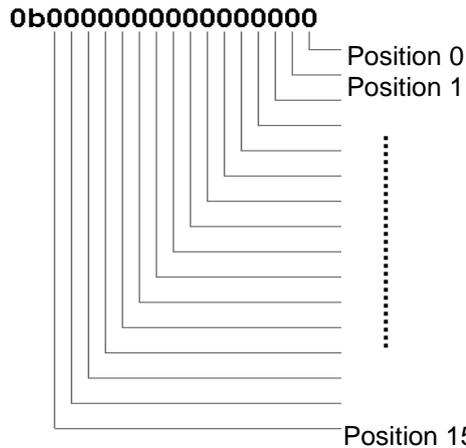
Position 15

MAGB2can detect and show a number of errors in one error code value.

Error position	Error Description
0	Empty Pipe (Air Detect)
1	Excitation
2	Low battery
3	GPRS
4	FOUT overload
5	Relay overload
6	Relay comparator
7	Temperature sensor fault*
8	AD converter error*
9	Pressure alarm*
10	FW Checksum fail
11	External temperature alarm
12	External pressure alarm
13	Memory log error
14	Leak detected

*will be added in future updates

> **Errors on the display are indicated in hex format. This number must be converted to binary format! You can use a calculator with hex converting function.**

Once the error code has been converted to binary format, each position is related to a different error (see the table above). Number 1 indicates error and number 0 indicates no error.

Example:

Error shown on display:	Error position:	Readed errors:
	76543210	
0043HEX =	01000011 BIN	Relay comparator / Excitation/ Empty pipe

21. Firmware version compatibility

It is possible to check the version of each MAGB2 in info menu > Firmware No.
MAGB2 offers the option of updating the firmware version using USB connection.

FW	MB	Comments	RS485	GPRS	Datalogger
22.14	V3.3	Initial version	no	no	Not readable
22.15	V3.4		no	yes	Not readable
22.16	V3.4	Final menu structure	no	yes	Not readable
22.17	V3.4	Datalogger, RS485	yes	yes	As a pen drive
22.18–22.20	V3.5	Various stability changes	yes	yes	As a pen drive
22.21– 22.22	V3.5, V3.6	Battery calculation changes, service menu changes	yes	yes	As a pen drive
22.23–22.27	V3.5, V3.6, V3.7	NB-IOT, LoRa	yes	yes	As a pen drive
22.28	V3.6, V3.7	MID	yes	yes	As a pen drive

22. Appendix

22.1. CE and Conformity

The MAGB2 Electromagnetic flowmeter is manufactured conform CE requirements.

$$C\epsilon$$

22.2. Warranty

The warranty conditions are covered by Arkon Flow Systems, s.r.o. Terms & Conditions of Sale and by Arkon Flow Systems, s.r.o Return Regulations and Warranty Conditions. The Arkon Flow Systems, s.r.o Terms & Conditions of Sale and the Arkon Flow Systems, s.r.o Return Regulations and Warranty Conditions are an integral part of the Resellers contract and of any Order Confirmation. Please see your Resellers contract or www.arkon.co.uk; Support section. The Warranty sheet is part of the Packing note of any new goods sent. For the claim or return procedure, please consult our web site www.arkon.co.uk or call the Arkon Flow Systems, s.r.o. sales office.

22.3. Contact

Technical support: support@arkon.co.uk
Skype: support.arkon

Sales office: arkon@arkon.co.uk

Office hours:
8:00 – 16:30 (GMT+1)

Direct technical support:
8:00 – 17:00 (GMT+1)