Technical presentation

Arkon Flow Systems, s.r.o.
Nováčkova 11, 614 00 Brno, Czech Republic
Tel: +420 543 214 822 Tel/Fax: +420 543 215 249
E-mail: **arkon@arkon.co.uk / support@arkon.co.uk**
www.arkon.co.uk

LIST OF CONTENTS

1. Flowmeter selection

1.1. Material selection

To select the proper flowmeter for your application you should know:

- **Expected flow range** – affects DN selection
- **Size of pipes and pipe connections**
- **Expected maximum pressure** – affects flange selection
- **Expected maximum temperature** – affects liner selection
- **Measured medium** – affects liner and electrodes selection

Electrode	Liner	Connection	Pressure
Hastelloy	Hard rubber	DIN	PN10
Titanium	Soft rubber	ANSI	PN16
Tantalum	PTFE	JIS	PN25
Platinum	E-CTFE	Wafer	PN40
	NR	Hygienic	150PSI
		Tri-Clamp	300PSI

Expected maximum temperature – affects liner selection :
- 0 °C – 70 °C Hard rubber or Soft rubber
- 0 °C – 130 °C PTFE or E-CTFE plus remote connection

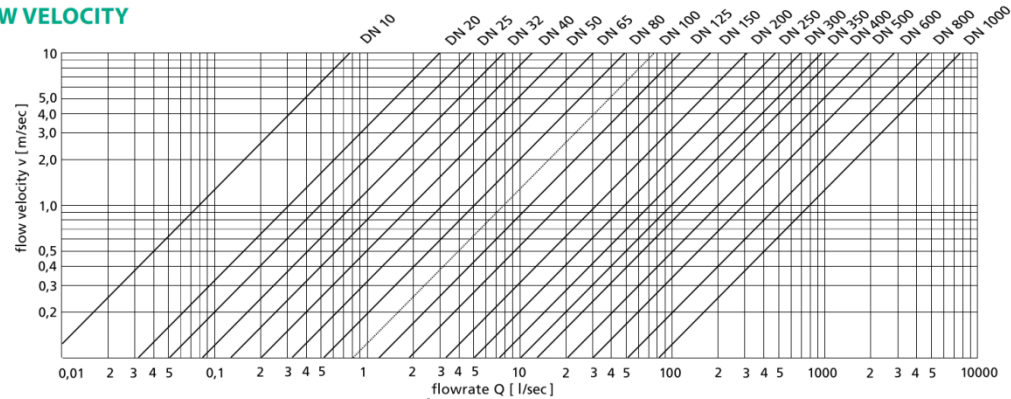Measured medium – affects liner and electrode selection :

		Flowtube liner			Electrode Material			
Process	Maximum	PTFE	ETFE	Hard	Hastelloy	Tantalum	Platinum	Titanium
Liquid	concentr.	Teflon		Rubber	C-276		-10% Iridium	
Acetaldehyde	100%	A1	A2	N	A4	B5	A5	A1
Acetamide	100%	A1	A1	N				
Acetic Acid	50%	A1	A1	N	A3	A1	A	A1

See material resistivity table for detailed information

1.1. Material selection

FLOW VELOCITY

DN 10 · DN 20 · DN 25 · DN 32 · DN 40 · DN 50 · DN 65 · DN 80 · DN 100 · DN 125 · DN 150 · DN 200 · DN 250 · DN 300 · DN 350 · DN 400 · DN 500 · DN 600 · DN 800 · DN 1000

flow velocity v [m/sec]

10 · 5,0 · 4,0 · 3,0 · 2,0 · 1,0 · 0,5 · 0,4 · 0,3 · 0,2

flowrate Q [l/sec]

0,01 · 2 · 3 · 4 · 5 · 0,1 · 2 · 3 · 4 · 5 · 1 · 2 · 3 · 4 · 5 · 10 · 2 · 3 · 4 · 5 · 100 · 2 · 3 · 4 · 5 · 1000 · 2 · 3 · 4 · 5 · 10000

DN	FLOW RATES [l/s]					FLOW RATES [m³/h]				
	Q 5%	QN	QN 50%	QN 100%	Q MAX	QN 5%	QN	QN 50%	QN 100%	Q MAX
10	0.04	0.2	0.39	0.79	0.8	0.14	0.8	1.41	2.83	3.20
15	0.09	0.5	0.88	1.77	2	0.32	2	3.18	6.36	8.00
20	0.16	0.9	1.57	3.14	3.6	0.57	3.2	5.65	11.31	12.8
25	0.25	1.4	2.45	4.91	5.6	0.88	5	8.84	17.67	20.00
32	0.4	2.2	4.02	8.04	8.8	1.5	8	14.5	29	32.0
40	0.6	4	6.3	12.6	16	2.3	13	22.6	45.2	52.0
50	1	6	9.8	19.6	24	3.5	20	35.3	70.7	80.0
65	1.7	9	16.6	33.2	36	6	35	59.7	119.5	140.0
80	2.5	14	25.1	50.3	56	9	50	90.5	181	200.0
100	3.9	20	39.3	78.5	80	14	80	141	283	320
125	6	30	61	123	120	22	150	221	442	600
150	9	50	88	177	200	32	200	318	636	800
200	16	100	157	314	400	57	300	565	1131	1200
250	25	150	245	491	600	88	500	884	1767	2000
300	35	200	353	707	800	127	800	1272	2545	3200
350	48	300	481	962	1200	173	1000	1732	3464	4000
400	63	400	628	1257	1600	226	1300	2262	4524	5200
450	80	444	795	1590	1778	288	1598,4	2862	5724	6400,8
500	98	600	982	1963	2400	353	2000	3534	7069	8000
600	141	800	1414	2827	3200	509	3000	5089	10179	12000
700	192	1000	1924	3848	4000	693	4000	6927	13854	16000
800	251	1200	2513	5027	4800	905	5000	9048	18096	20000
900	318	1500	3181	6362	6000	1145	6000	11451	22902	24000
1000	393	2000	3927	7854	8000	1414	8000	14137	28274	32000

To achieve the best performance choose DN by QN :

(10% of QN) < Q < QN

DN	Q_N [m³/hr]	DN	Q_N [m³/hr]
10	0,8	200	300
15	2,0	250	500
20	3,2	300	800
25	5,0	350	1000
32	8,0	400	1300
40	13,0	500	2000
50	20,0	600	3000
65	36,0	700	4000
80	50,0	800	5000
100	80	900	6000
125	150	1000	8000
150	200		

2. Installation rules for electromagnetic flowmeter

2.1. Installation into pipes

The sensor tube must always remain full of liquid.
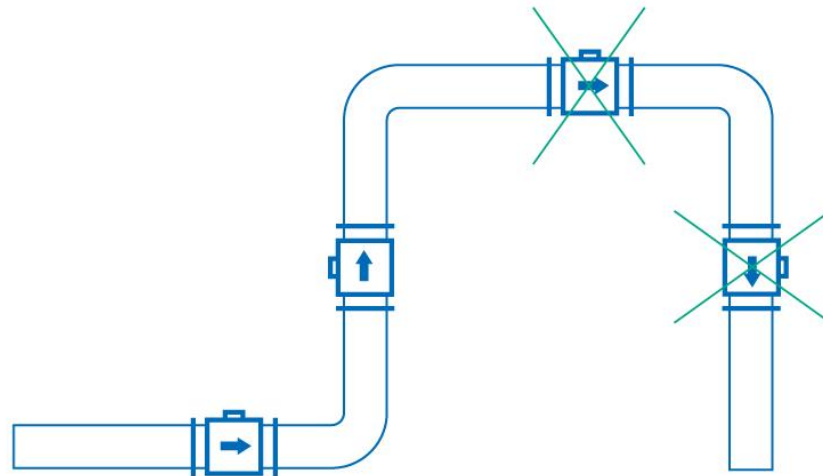
Horizontal (standard) mounting

The sensor tube must always remain full of liquid. The best way to achieve this is to locate the sensor in a low section of pipe, see the following picture.

It is recommended to install the sensor in a section of straight pipe with at least 5 times the pipe diameter before sensor and 3 times after sensor.

This is a general recommendation due to the occurrence of water eddies, which can directly affect the measurement deviation.
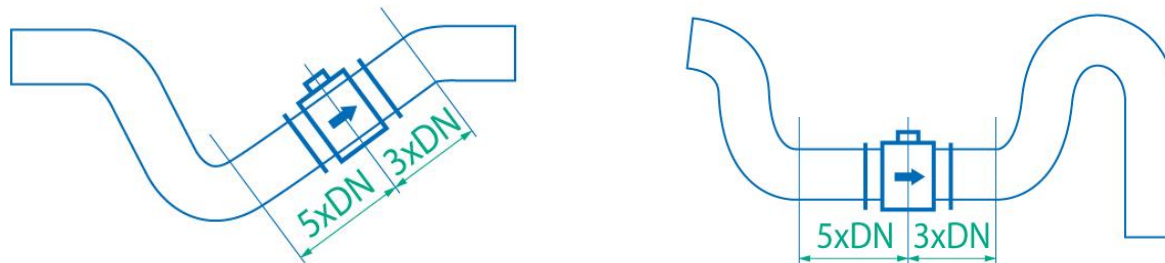
Vertical mounting

When the sensor is mounted on a vertical section of pipe, the flow direction must be upwards.

Downward direction is not an acceptable installation; air bubbles can collect in the sensor and the measurement could be unstable and inaccurate.
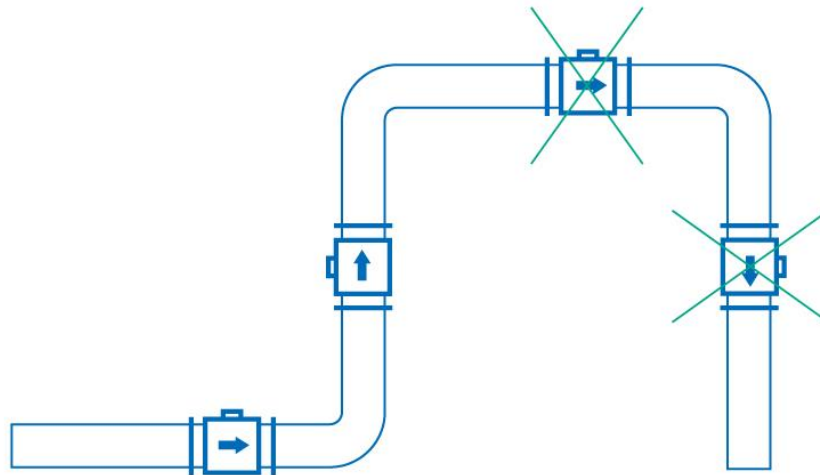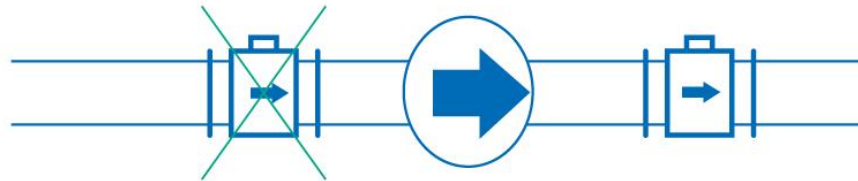
Pipe reducers

If the pipe diameter is not the same as the diameter of sensor, then pipe reducers can be used

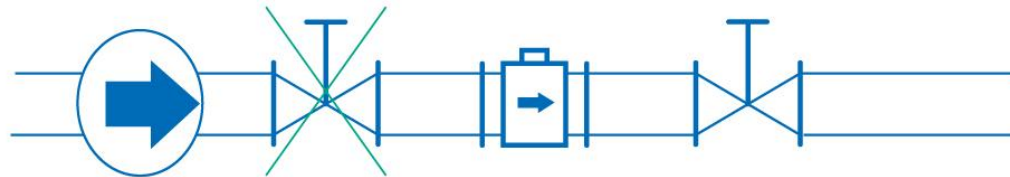So as not to lose accuracy of the measurement, the slope of reducers should not exceed 8°
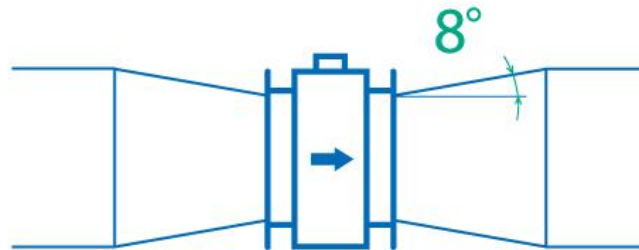
Pumps

Do not install the sensor on the suction side of a pump or on a section of pipe where a vacuum is possible.
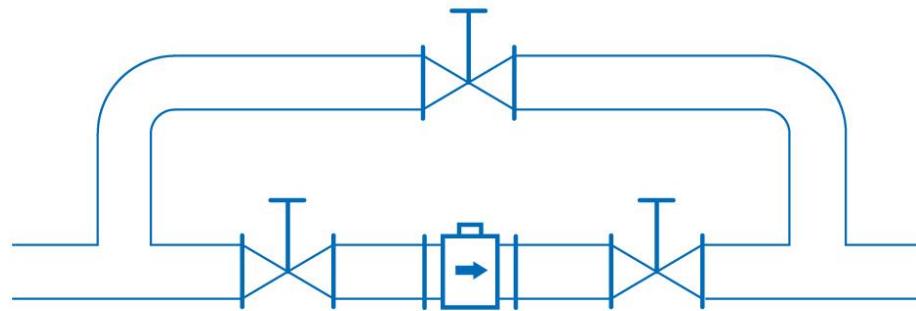Depends always on all piping system.

Valves

Suitable location of a shutoff valve is downstream of a sensor.

Depends always on all piping system.

Removal during maintenance

If the application requires removal of the sensor for periodic maintenance, it is recommended to install a bypass section as the following drawing.

2.2.Overheating

Where ambient temperatures above 30 °C are possible such as in a hot climate the electromagnetic unit should be protected against direct sunlight to avoid overheating. If necessary a sunshade has to be mounted over the electronic unit or a remote version with a separate electronic unit should be used.
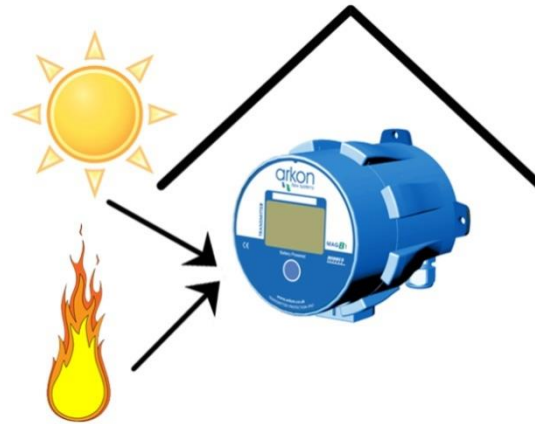
2.3.Vibration

Where strong vibrations are possible, both the input and output pipes must be mechanically fixed or a remote version with a separate electronic unit should be used.

2.4.Earthing

All metal sensors have to be properly earthed using the grounding screw on the flowmeter neck.

If you are connecting to metal pipe work, it is not necessary to earth with earthing rings (picture on the left).

If you are connecting to non-condutive (HDPE, plastic) or lined pipes, it is absolutely necessary to earth the flowmeter properly. You will need to earth through earthing rings. (picture on the right).

Steel Pipe

Plastic Pipe
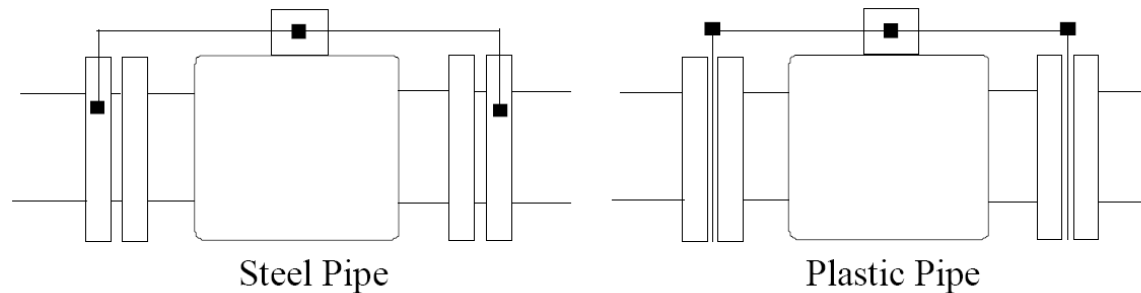
3. Compact and remote mounting

Mounting System for MAGX2 and MAGB2

All MAGX2 and MAGB2 electromagnetic flowmeters have different mounting options.

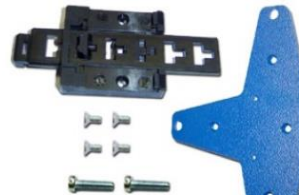| Wall	DIN Rail	Pannel

Compact version installation

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

Remote version installation

The cable entry into the sensor is protected by a junction box, which can (should) be potted to IP68. Standard poting is using silicon gel, extra solution can be using two component dielectric gel compound.

4. Modular

MAGX2

The MAGX2 structure

Transmitter IP68 - reads sensor flow
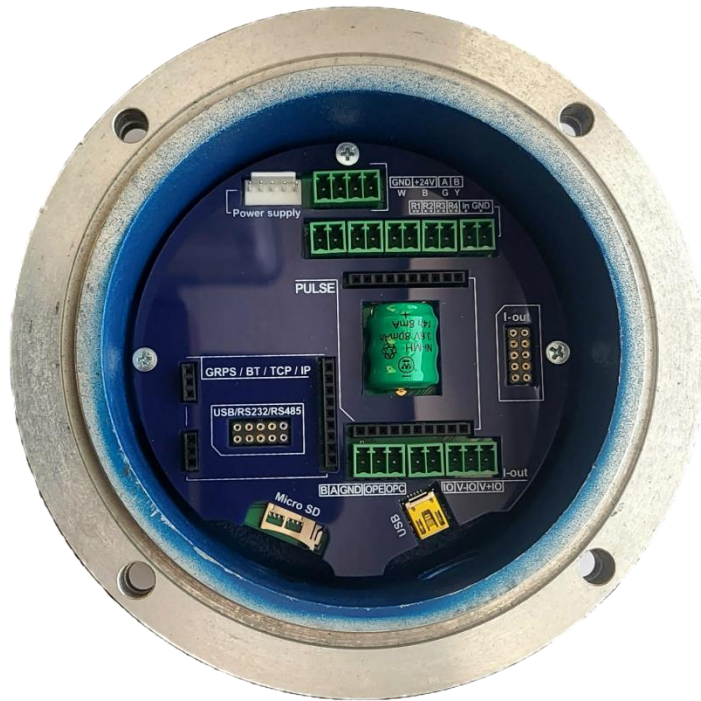
Sensor communication module – measures flow

Power supply:
12-36 VDC
90-250 VAC 50/60Hz

Sensor

The MAGX2 Basic Transmitter Unit

The core element of any MAGX2 flowmeter.

Consists of the MAGX2 mother board, touch button controls, graphic display, transmitter housing.

Available in IP68 version; compact and remote. For remote versions, one of the three possible remote mounting kits is required.
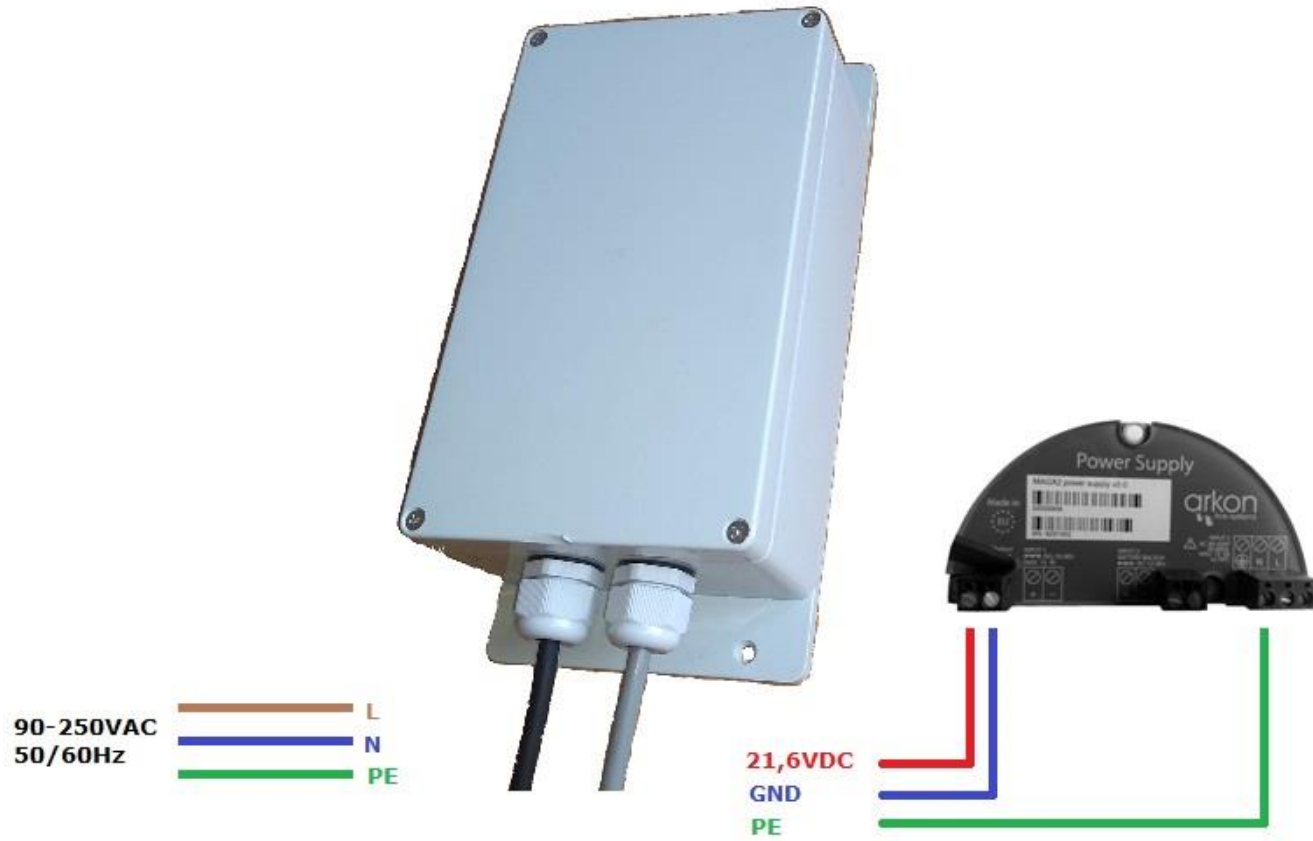
Powering MAGX2

- Connection of a flowmeter is to be done through a switch or circuit breaker because of safety purposes and also because the device does not have a network power switch.

- For any electrical work it is necessary to disconnect the device from network power, and this is done best through a switch.

- The customer is assumed to supply its own network power supply cable. The cable needs to be round crosscut 5-10mm in diameter.

- The power suply feed voltage possibility:
  - 90 – 250 VAC, 50 – 60 Hz
  - 12 – 36 VDC
  - 12 – 36 VDC input for non-charging battery backup

- Maximum power consumption is 10W (10VA), real is usually half that number

MAGX2 Battery backup

- Charging time 7 hours

MAGX2 Battery backup

90-250VAC
50/60Hz

L
N
PE

Power Supply

21,6VDC
GND
PE

www.arkon.co.uk

5.1. Modules

|	
Analogue outputs	4-20mA Current loop Pulse output Pulse 230 output
Digital outputs (1 out of 9)	RS232 comm. (1.8 m. cable) USB Comm. (1.8 m. cable) Bluetooth (class1- 200m) RS485 Comm. (1 Km) TCP/IP (No limits) GPRS/3G (No limits) Wi-Fi (200m) LoRaWAN MBUS
External sensor input	External pressure External temperature
Data-logger	Standard micro SD card
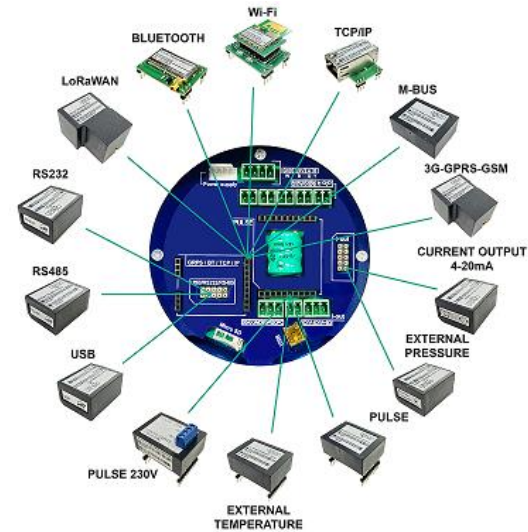
4.2. Modules installation

Always check if the module does not have a bent or broken pin, before placing it in the correct module slot of the MAGX2 motherboard.
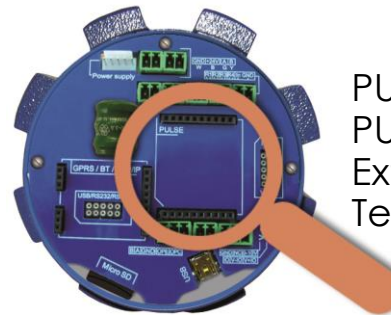
Choose the correct slot

Always make sure you place the module in the correct slot of the motherboard! The name that is written on the module itself has to match the name written next to the slot.
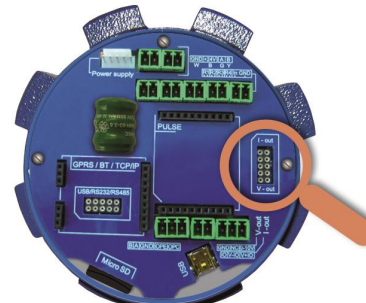
GPRS
BLUETOOTH
TCP/IP
Wi-Fi
LoRaWAN
MBUS
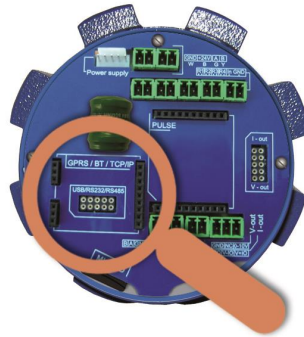
PULSE
PULSE 230
External
Temp

RS232
RS485
USB

4mA - 20mA
External
Press

Placing in the correct position

Check whether you are placing the module in the correct position. It does matter how you turn the module to fit the slot! The white line around the actual slot on the motherboard indicates the correct position of installation. The bevelled corner should be your point of orientation (note the picture below).

Examples of **_incorrect_** installations:

The RS232 Module is placed in a different slot

The RS232 Module is placed in the correct slot, but with the bevelled corner in the wrong direction.

4.3.Checking modules

It is possible to check analog module functionality using fixed function. This function will set the module with a stable output.

Module	Fixed function
Current	10 mA
Pulse - frequency	100 Hz
Pulse – each relay	Contact ON

You can set a fixed function by firmware or software and then measure with a multimeter to check if module working or not.

Flow simulation: It is also possible to simulate flow and check the setting of the modules for successful operation. In service settings – Flow simulation – ON and Simulated flow 0-100% of Flow Qn.

Connecting to PC –RS485

RS485 module is required. Terminator may be needed.
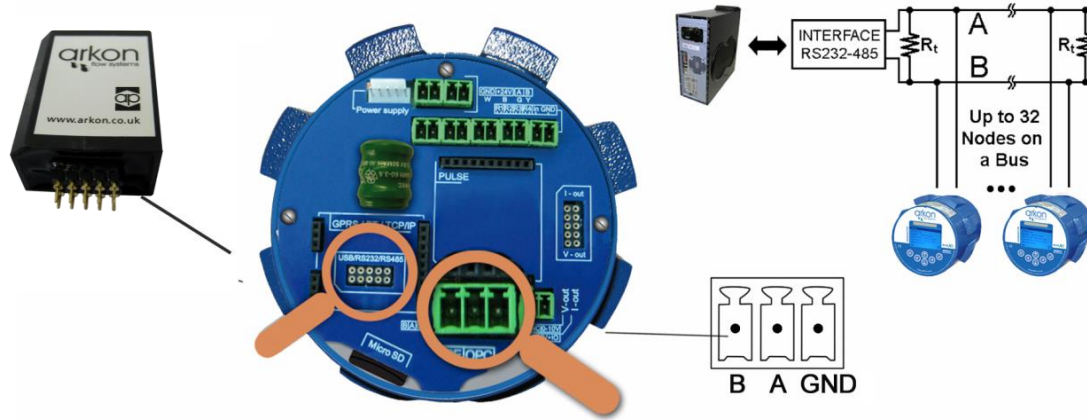
Connecting to PC –RS232

RS232 module and special cable are required.

Connecting to PC –USB

USB module and USB-A to mini USB cable are required.

For connection to a PC, you will need to install device drivers, which are on the MAGX2 product CD, or can be downloaded from the Internet. www.arkon.co.uk/support

Connecting to PC –TCP/IP

TCP/IP module is required.

For connection to a PC, you will need to install device drivers, which are on the MAGX2 product CD, or can be downloaded from the Internet. Settings are documented in MAGX2 TCP/IP installation manual (www.arkon.co.uk/support)
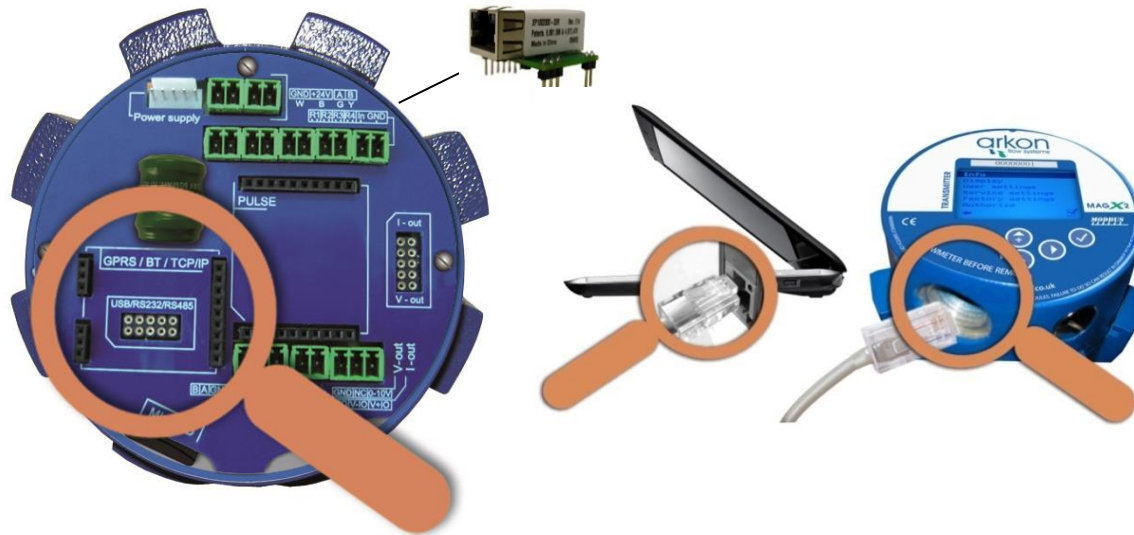
Connecting to PC – Bluetooth

Bluetooth module and antenna are required.

For connection to a PC, you will need to install Bluetooth device and its drivers and configure the device according to MAGX2 Bluetooth installation manual. (www.arkon.co.uk/support)

Connecting to PC – GPRS

GPRS module and antenna are required.

Module is sending measured data to preset IP address and port and/or SMS messages in selected interval. For data collection there is a IOT solution called Arkon.Track.
See MAGX2 GPRS installation manual. (www.arkon.co.uk/support)

Connecting to PC or PLC - Wi-Fi

Wi-Fi module is required.

Everywhere where there is needed an easy communication between flowmeters and PC or PLC without cable. For detailed information about connection please see Wi-Fi module instalation procedure (P31).

www.arkon.co.uk

LoRaWAN

LoRa module and antenna are required.

Module is sending measured data via LoRaWAN network in preset interval.
Module is authorized in the network using OTAA method. The maximum distance is 15km (line of sight).
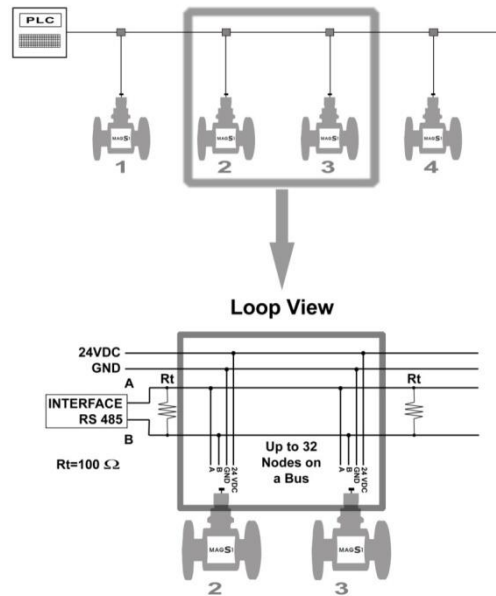See MAGX2 RF module installation manual. (www.arkon.co.uk/support)

MBUS

Module is mostly used in HVAC systems to colect data from the flowmeter, it is not used for meter settings. Meter is not powered from the MBUS line, it needs its own power.

See MAGX2 MBUS module installation manual. (www.arkon.co.uk/support)

4-20mA Current loop

The 4-20mA output may be used for error detection and flow-dependent output. It is possible to use it with four-wire powered systems as active or passive loop.
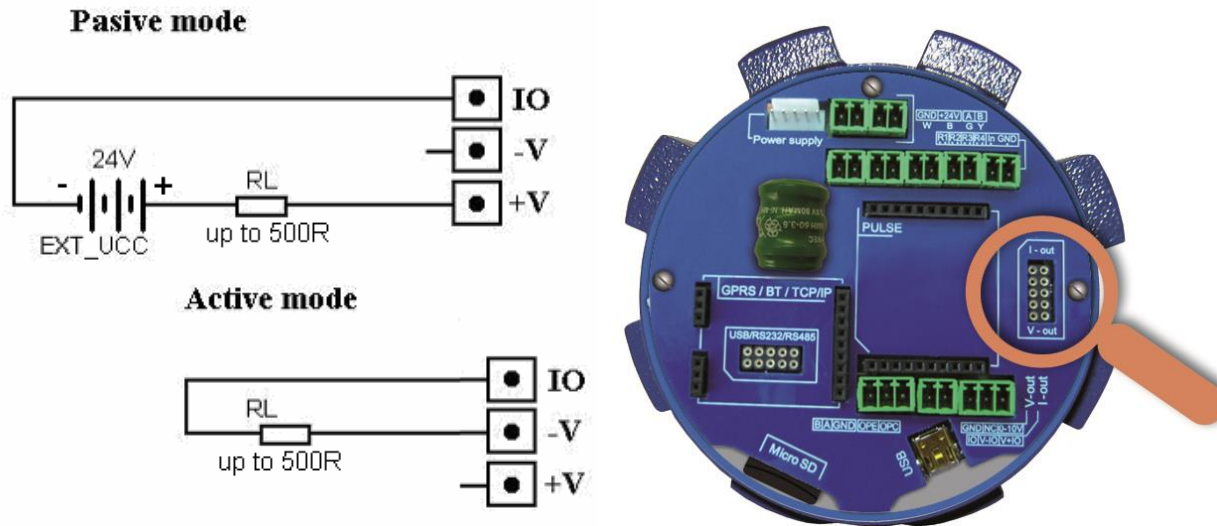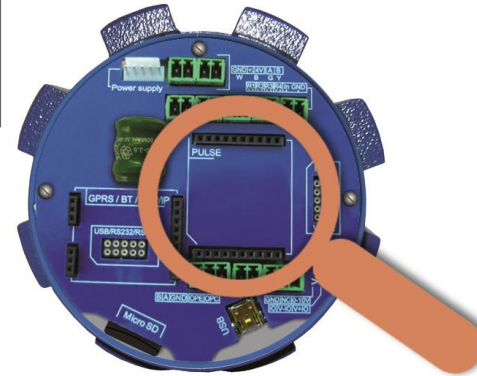
Pulse output

The Pulse output may be used for error detection, pulses per liters and dosing purposes.

Errors
comparators

Errors
Batching, pulses per litre

Max. switched power

130 VAC, 50VDC
0,5 A

RE1	RE1	RE2	RE2	RE3	RE3	RE4	RE4	IN	GND

+5 - 14 V DC
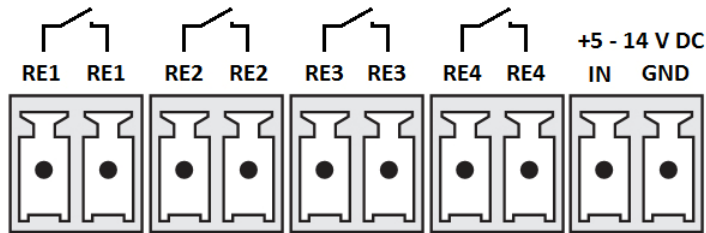
V DC	R
5 V	1k8
12 V	3k3
24 V	6k8

External power supply
External resistor R

OP-E   OP-C

+5 - 24V DC

GND   R
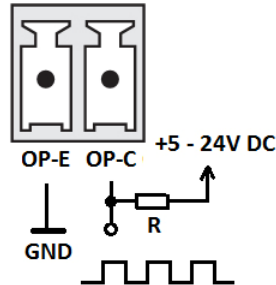
Pulse 230 output

The Pulse output may be used for error detection, pulses per liters and dosing purposes.

External power supply	V DC	5 V	12 V	24 V
External resistor R	R	1k8	3k3	6k8
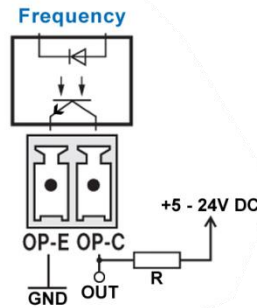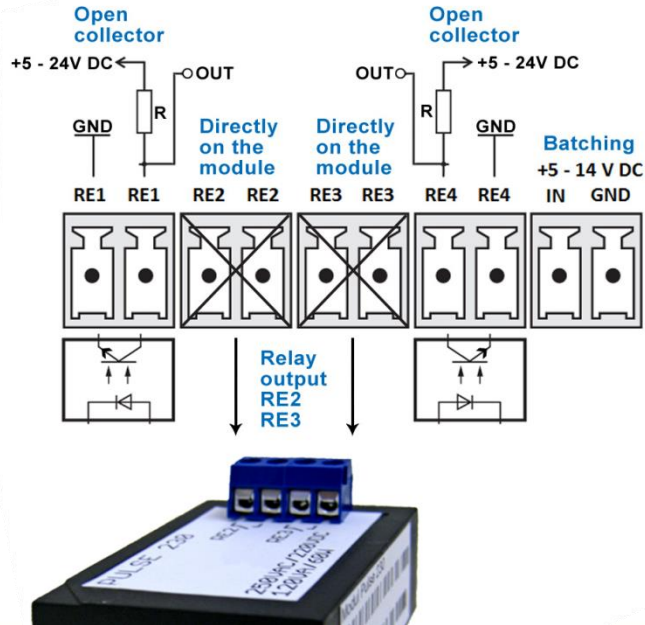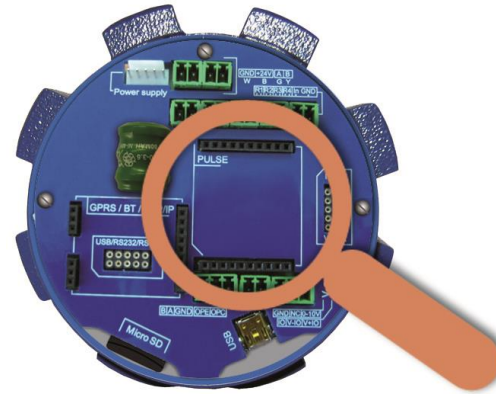
5. MAGS1

MAGS1

Features

- Stand-alone (non-transmitter) version of flowmeter

- RS485 on Modbus RTU protocol connection (31 devices on one line – save wiring cost)

- 24VDC power supply

- Empty pipe detection, automatic electrode cleaning

- Available in wide range of sizes and pressure grades

Connections and Settings

The connection to pipe work is the same as every flowmeter-see above

You can imagine MAGS1 as a MAGX2 in remote version, just instead of MAGX2 transmitter you connect your PLC system.

Then you configure MAGS1 as a new device in your SCADA system or define registers for PLC unit.
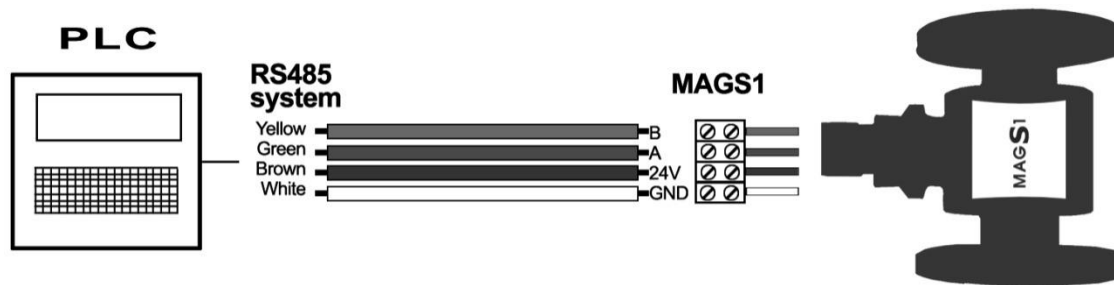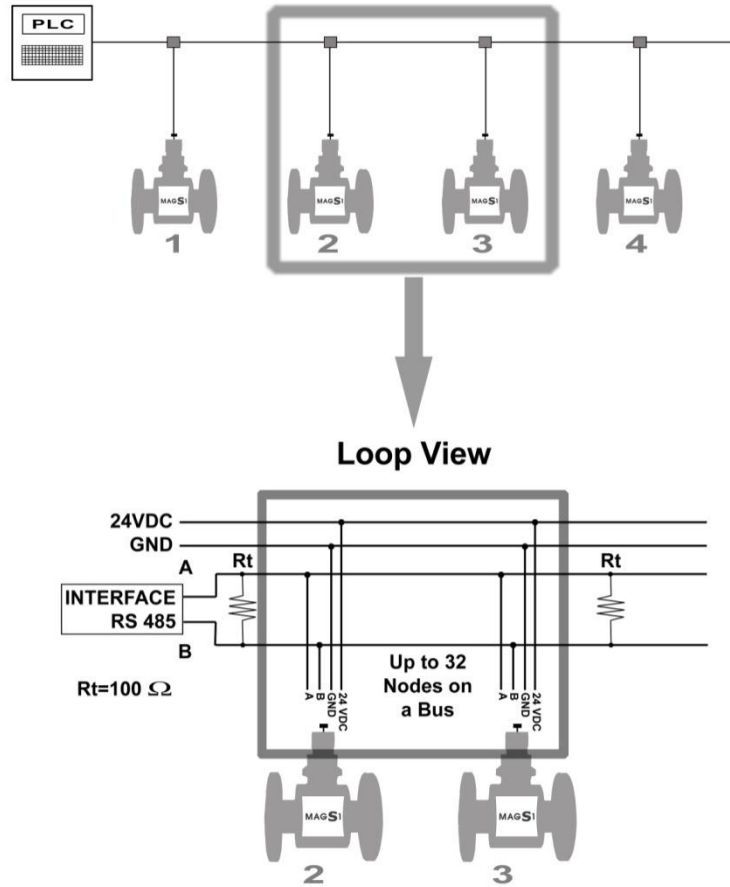
Multipoint Connection

Loop View

7. Battery Powered MAG**B**2

Features

- Battery powered electromagnetic water meter

- Battery life up to 10 years (5x3.6 V battery pack)

- Battery conservation when the pipe is empty

- Modbus RTU communication protocol

- Built-in USB communication

- 4 totalizers – total +, total -, total, aux

- Adjustable filter constant 1 – 30 excitations

- Built-in relay output (Pulse/Litre, Alarm), Frequency output

- Flow simulator to check the binary output

- Graphical display 128*64dots and keypad for simple operation and instant access to information about totalizers

- Easy access to data on-site Standard USB interface for configuration and data collection using MAGB2 software

- 3G/GPRS/GMS communication module

- WRAS APPROVED MATERIAL for all standard sizes

Theory of operation

The flow meter takes a sample every X seconds. This sample time is selectable from 0,16 to 60 seconds. Default setting for sample time is 15 seconds.

To get the flow rate the flow meter does the average of the last Y samples. The number of samples used for the average is selectable from 1 to 30 samples. Default setting for number of samples used to get the flow rate is 4 samples.

Connections overview
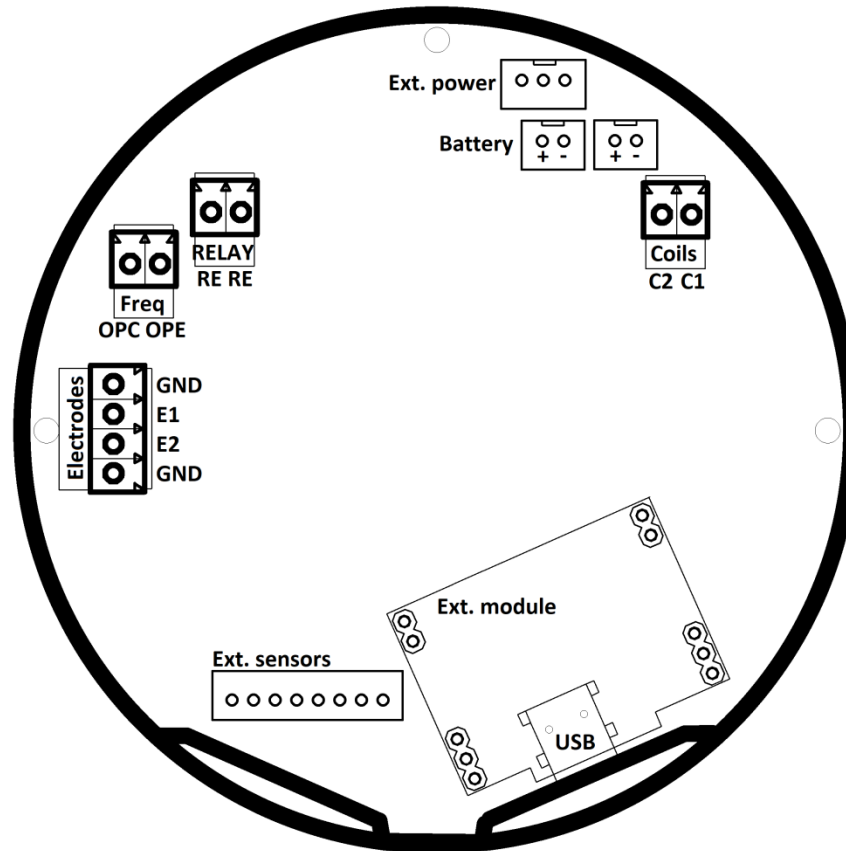
Remote cable connection

Recommended cable Li2YCY 2 x 2 x 0.34 PiMF.

Compact version:

Shield	Shield	
E2	Red	
E1	Yellow	
Shield	Shield	

C1	Blue	
C2	Red	

Remote version:

Shield	Shield	
E2	Yellow	
E1	Green	
Shield	Shield	

C1	Brown	
C2	White	
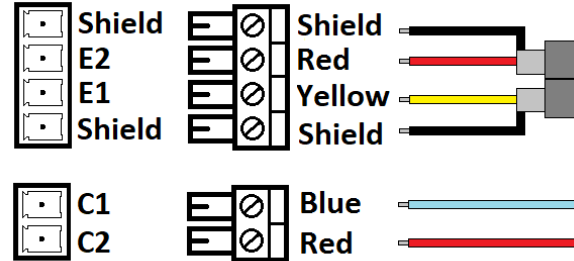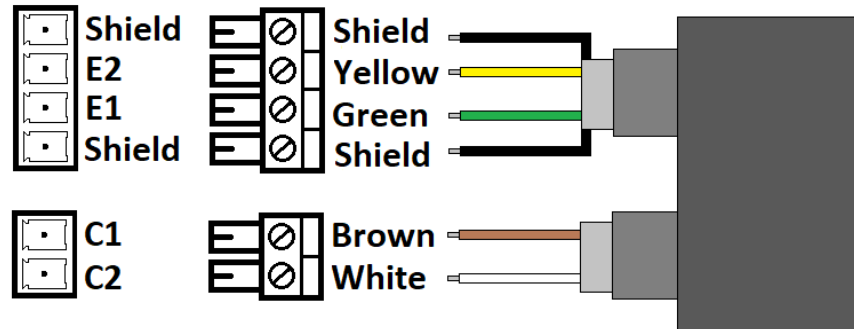
MAGB2 Connecting to PC – USB

MAGB2 is a composite USB device, it features USB mass storage for datalogger and Modbus RTU over virtual serial line. In special mode USB is used to update FW of the unit.

USB-A to mini USB cable is required.

Fully supported operating systems are Windows 10 and newer, for connection to a PC, you will need to install Arkon Flow Systems Floweters2 SW, which is on the MAGB2 product pen drive or can be downloaded from the support webpage of the company.

Maximal MODBUS packet data is 64B (14 addresses)

Using USB is battery consumable.

PULSE vs FREQ output for MAGB2

As an analogue outputs MAGB2 has inbuilt frequency output configurable to be flow dependent and one relay output configurable to an error detection or flow dependent. Both outputs are galvanically isolated.

Frequency output is open collector with opto barier

Relay output is latching relay – dry contact
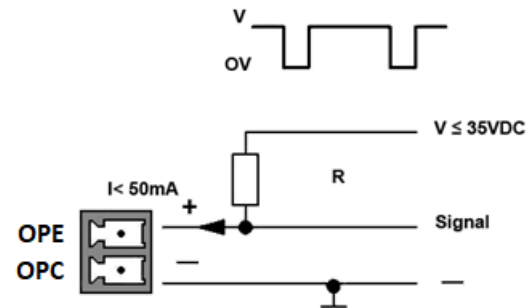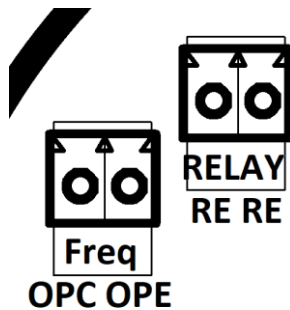
Recommended resistance R=1 k Ω

External Input Options

Both external sensors are very low power sensors, needs to be supplied by Arkon Flow Systems.

External temperature sensor   External pressure sensor
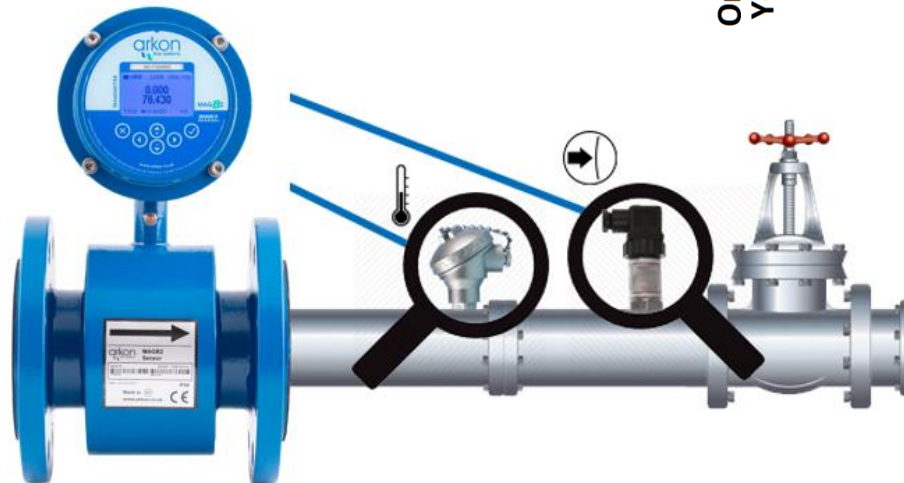
External modules – RS485

- Two possible versions
- - galvanically isolated (needs external power)
- not isolated – powered from MAGB2

- slot is shared with other modules – 4-20mA, GPRS
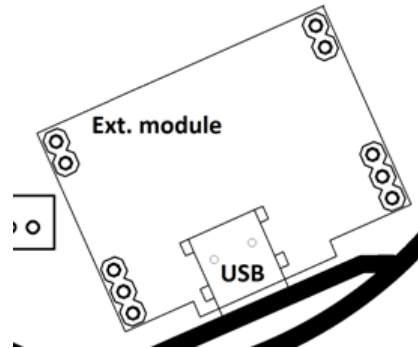
Terminator R_t with resistance 100W should be connect to the end of line RS-485.

External modules – GPRS

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.

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

Can be used with Arkon.Track platform.

All settings are done using meter keyboard.
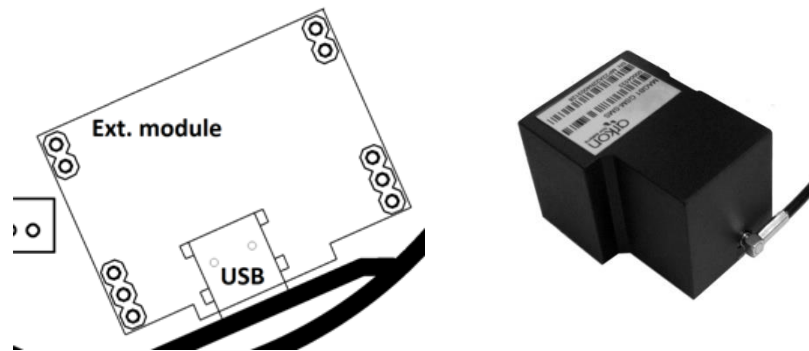
Terminator R_t with resistance 100W should be connect to the end of line RS-485.

External modules – 4-20mA

Standard passive 4-20mA loop – needs power from the loop master.

Maximal load 1000Ω

Power 8-30VDC

Galvanically isolated.

Ext. module

USB
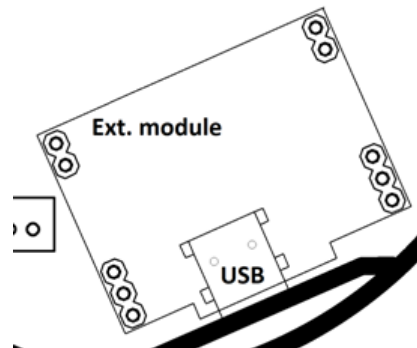
Terminator R_t with resistance 100W should be connect to the end of line RS-485.

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 from 5minutes to 24hours.

Datalogger content:
DATE OF READ: 2020-01-05 17:07 [YYYY-MM-DD HH:MM]
SERIAL NUMBER: 71200622
FLOW QN: 40000 [m³/h]
SENSOR DN: 0 [mm]
FW VERSION: 2218
FW_CHECKSUM: 0x283FD871 [hex]
YYYY-MM-DD,HH:MM,TOTAL[m³/h],TOTAL+[m³/h],TOTAL-[m³/h],AUX+[m³/h],ERROR[h],BATTERY[mAh],TEMP[°C],PRESS[Bar]
2020-01-05,16:12, 2.3842,12.3977, 0.0000,12.3349,0003,100.000,0.0,0.000
2020-01-05,16:12, 2.3842,12.3977, 0.0000,12.3349,0003,100.000,0.0,0.000

8. Economic

Features

- Accuracy: ±0,5% (0,5 to 10 m/s) of actual value

- Communication: RS485 – Modbus RTU

- Current output - preset for full range at 20mA/Flow max

- Sizes: from 25 – 250 mm (1''- 10'')

- Connection: DIN, ANSI, other on request

- Power Supply: 9-35 VDC

- Internal datalogger (131 072 records, several intervals possible)

- Settings possible only via RS485 line

- Velocity Range: 0,1 to 10 m/s

- Flange material: Steel 1.0036 or higher

- WRAS APPROVED MATERIAL for sizes up to DN600

MAGE1 vs AgrimagP2 vs MAGB2

- MAGE1 features MAGB2 flow sensor and AgrimagP2 electronics

- Sensor specifications of MAGE1 is according to MAGB2 sensor. For more information see MAGB2 sensor.

- Electronics specification of MAGE1 is accoding to AgrimagP2. For more information see section AgrimagP2

9. Agri**mag**

Agri**mag**P

Agri**mag**P2

Agrimag

Features

- Agrimag is a user friendly low cost flowmeter

- Powered by 6x AA batteries - battery life of 1-3 years

- Accuracy of 1%

- Connections offered: Manifold clamping flanges compatible with fitting kits for DIN, BSP, NPT and other common connections

- Available in DIN 25, 50, 80 mm (1", 2" and 3") sizes

- Glass filled polypropylene body

AgrimagP

Features

- AgrimagP is a user friendly low cost flowmeter with output

- Accuracy of 1%

- Powered by external power supply in range of 9-35VDC

- Frequency output preset for full range at 0 - 1000Hz/Flow max

- Connections offered: Manifold clamping flanges compatible with fitting kits for DIN, BSP, NPT and other common connections

- Available in DIN 25, 50, 80 mm (1", 2" and 3") sizes

- Glass filled polypropylene body

AgrimagP2

Features

- AgrimagP2 is a user friendly low cost flowmeter with output

- Accuracy of 1%

- Powered by external power supply in range of 9-35VDC

- Current output - preset for full range at 20mA/Flow max

- Communication via RS485 Modbus RTU

- Connections offered: Manifold clamping flanges compatible with fitting kits for DIN, BSP, NPT
- and other common connections

- Available in DIN 25, 50, 80 mm (1", 2" and 3") sizes

- Glass filled polypropylene body

Agrimag   AgrimagP

AgrimagP2

Features

🔹 Almost no maintenance is needed

🔹 Turns off after some time with no flow

🔹 Reports any error by text on the screen

SPECIFICATIONS

Measurable media	Conductive fluids
Min. Media electrical conductivity	≥20μS/cm
Flow range	0,1 to 10 m/s
Displayed values	Flow range (m3/h, l/s, l/m, US gal/min, UK gal/min), Volume (m3, l, US Gal, UK Gal) Total, Batch volume
Accuracy	±1% of reading from 100% to 10% of full scale ±3% of reading from 10% of full scale to cut-off
Full scale	1": 0.5 – 4.8 l/s 2": 1.9 – 18.9 l/s 3": 5.0 – 49.0 l/s
Power supply Agrimag	6 AA alkaline batteries, expected lifetime 1 year
Power supply AgrimagP, AgrimagP2	9-35VDC Power supply available in special connector
Flow direction	Bi-directional measurement

SPECIFICATIONS

Ambient temperature	- 12 to 54ºC (10 to 130ºF)
Display	LCD 128 x 64 px graphical, sleep mode
Control	3 touch buttons
Low flow cut-off	2% of full scale
Electronics protection	Nema 4X standard
Other features	Test of excitation coils
	Earthing through 3rd and 4th electrodes
	Empty pipe detection - battery conservation
Excitation frequency	1/1,67s
Samples per Average	4 excitations
Coils resistance	100Ω
Agrimag P – Frequency output	Open collector proportional to flow 0-1000Hz for 0-Qmax. Max Switching voltage 24 VDC, max. current 50mA

Agri**mag**
Battery exchange

1. Unscrew 4x IMBUS 4 screws.

2. Carefully open the display part of the flowmeter.

3. Open battery holder and remove batteries.

4. Install new six pieces AA batteries 1,2-1,6V.

5. Close battery holder.

6. Close display part of the flowmeter, mind the cables.

7. Tight the 4x IMBUS 4 screws.
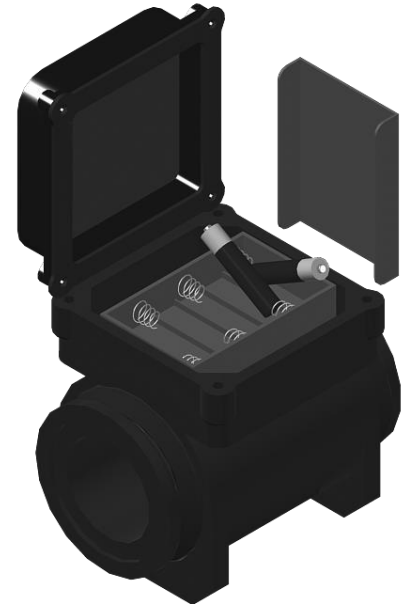
AgrimagP

- The voltage power supply range is 9 - 35VDC.
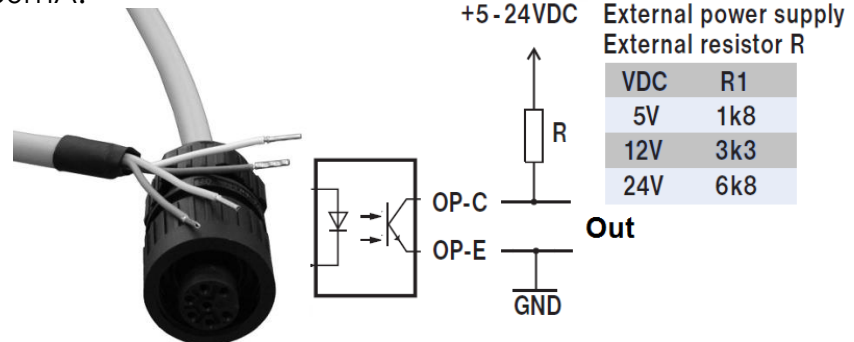
- Maximum current consumption 20mA.

- Connection to the unit is done via CA6 connector - a part of the delivery - standard 1m.

- Maximum cable length is 20mts.

- The power supply input is protected against reverse polarity and voltage spikes.

- Each AgrimagP is equipped with 0-1000Hz frequency output proportional to actual flow.

- Standard open collector circuit.

- Max switching voltage 24VDC, max. current 50mA.

- A1":211,765 pulses/lt
  A2":52,941 pulses/lt
  A3":20,455 pulses/lt

- Colour coding:
  Brown … +U
  White … GND
  Green … OPE

+5 - 24VDC External power supply
External resistor R

VDC	R1
5V	1k8
12V	3k3
24V	6k8

OP-C

OP-E

Out

GND

AgrimagP2

- The voltage power supply range is 9 – 35VDC (20mA max) available in special connector

- Internal datalogger (131 072 records, several intervals possible)

- Connection to the unit is done via CA6 connector - a part of the delivery - standard 1m.

- Maximum cable length is 20mts.

- The power supply input is protected against reverse polarity and voltage pike.

- Each AgrimagP2 is equipped with 4-20mA current loop output proportional to actual flow.

- RS485 for communication (SW included)

- Colour coding:
  Brown … +U
  White …. GND
  Green … A (RS485)
  Yellow …. B (RS485)
  Gray …. I/O (4-20mA)
  Blue …. –V (4-20mA)
  Pink …. +V (4-20mA)

Pasive mode

24V

EXT_UCC   RL
           up to 500R

IO
-V
+V

Active mode

RL
up to 500R

IO
-V
+V
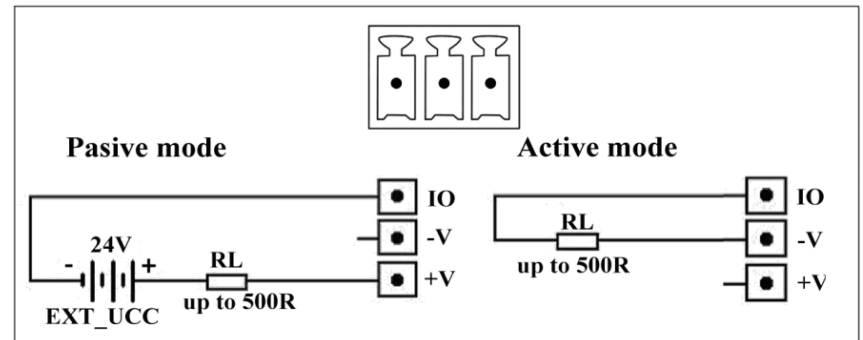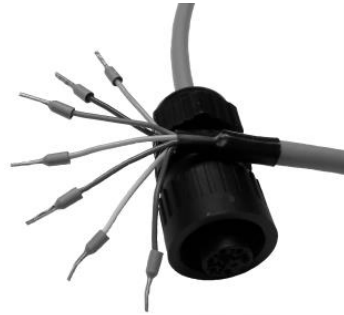
Keyboard Settings

On/Off

Turns the meter on, switching the meter off.

Batch Reset

Clears the Batch volume.

Batch/Total

Switches between totalizers

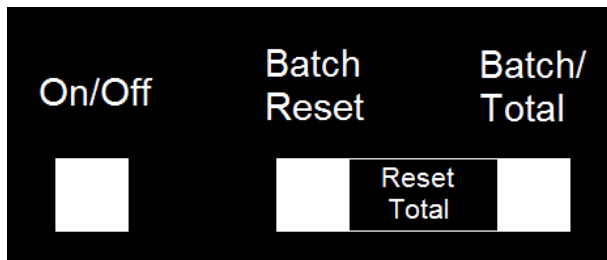**Combination Batch Reset and Batch/Total together**

Clears the Total volume.

Combination On/Off and Batch/Total together

Changes the unit of a system (l/s and USG/min, resp. litres and gallons, etc.)

Combination On/Off and Batch Reset together

Changes permanent operation and Battery saving mode.

Fittings

AGRIMAG SIZE		
25 mm		
PIPE CONNECTION	PART NUMBER	DESCRIPTION
Male BSP	M100BSP	1" Manifold x 1" Male BSP
Female NPT	M100050FPT	1" Manifold x 1/2" Female NPT
	M100075FPT	1" Manifold x 1" Female NPT
	M100FPT	1" Manifold x 1.1/4" Female NPT
Male NPT	M100075MPT	1" Manifold x 3/4" Male NPT
	M100MPT	1" Manifold x 1" Male NPT
	M100125MPT	1" Manifold x 1.1/4" Male NPT
Male NPT 316SS	M100MPTSS	1" Manifold x 1" Male NPT SS
Flanged Couplings	M100CPG	1" Manifold x 1" Manifold
Male QDC	M100A	1" Manifold x 1" Male QDC
Hose Barb	M100075BRB	1" Manifold x 3/4" Hose Barb
	M100BRB	1" Manifold x 1" Hose Barb
	M100125BRB	1" Manifold x 1.1/4" Hose Barb
Socket weld 316 SS	M100SWFSS	1" Manifold x 1" Socket weld fitting

Fittings

| 50 mm		
PIPE CONNECTION	PART NUMBER	DESCRIPTION
Male BSP	M220BSP	2" Manifold x 2" Male BSP
Female NPT	M220FPT	2" Manifold x 2" Female NPT
Male NPT	M220MPT	2" Manifold x 2" Male NPT
Male NPT 316SS	M220150MPTSS	2" Manifold x 1.1/2" Male NPT SS
	M220MPTSS	2" Manifold x 2" Male NPT SS
Flanged Couplings	M220CPG	2" Manifold x 2" Manifold
	M220CPG6	2" Manifold x 2" Manifold x 6" long
Female QDC	M220D	2" Manifold x 2" Female coupler QDC
Male QDC	M220A	2" Manifold x 2" Male QDC
Hose Barb	M220125BRB	2" Manifold x 1.1/4" Hose Barb
	M220150BRB	2" Manifold x 1.1/2" Hose Barb
	M220BRB	2" Manifold x 2" Hose Barb
Socket weld 316 SS	M220SWFSS	2" Manifold x 2" Socket weld fitting
	M220375SWFSS	2" Manifold x 2" Socket weld Fitting 3.3/4"

Fittings

80 mm		
PIPE CONNECTION	PART NUMBER	DESCRIPTION
Male BSP	M220BSP	2" Manifold x 2" Male BSP
Female NPT	M300BSP	3" Manifold x 3" Male BSP
	M300FPT	3" Manifold x 3" Female NPT
Male NPT	M300MPT	3" Manifold x 3" Male NPT
Male NPT 316SS	M300220MPTSS	3" Manifold x 2" Male NPT SS
Flanged Couplings	M300MPTSS	3" Manifold x 3" Male NPT SS
	M300CPG	3" Manifold x 3" Manifold x 4" long
Female QDC	M300CPG7	3" Manifold x 3" Manifold x 7" long
Hose Barb	M300A	3" Manifold x 3" Male QDC
	M300220BRB	3" Manifold x 2" Hose Barb
	M300BRB	3" Manifold x 3" Hose Barb
Socket weld 316 SS	M300SWFSS	3" Manifold x 3" Socket weld fitting
	M300375SWFSS	3" Manifold x 3" Socket weld Fitting 3.3/4"

Fittings

Clamps and gaskets						
	PART NUMBER	*Size 25mm*	*PART NUMBER*	*Size 50mm*	*PART NUMBER*	*Size 80mm*
Clamp	FC100	Pair	FC220	Pair	FC300	Pair
Gasket	M101G	Pair EPDM	M221G	Pair EPDM	M301G	Pair EPDM
	M100GV	Pair Viton	200GV	Pair Viton	M301GV	Pair Viton

Gasket
Clamp
Fitting
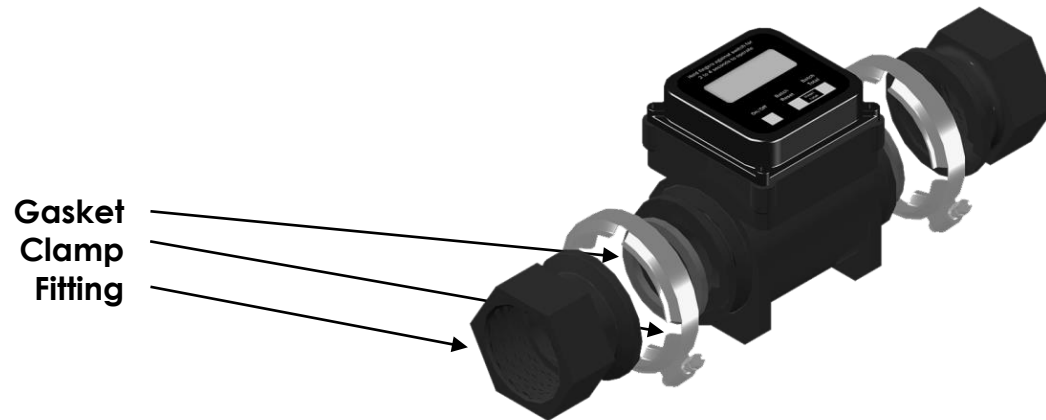
Example of Fitting Kit

All the fitting kits except the spare clamp pair and spare gasket pair includes:

2 fittings parts + 2 clamps + 2 gaskets.

10. Modbus

10.1. Modbus specification

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
Electrical interface	USB, RS232, RS485- 2 wire, TCP/IP, Bluetooth, GPRS, GSM-SMS
Supported function code	3 read holding registers
	16 write multiple registers
	17 report slave ID
Broadcast	No

Item	Value	Comments
Slave address	1-247	Device address
Baud rate	4800, 9600, 19200, 38400	Communication speed
Parity/framing	Even, 1 stopbit	Communication parameters
	Odd, 1 stopbit	
	None, 2 stopbit	
	None, 1 stopbit	
Response delay	0-255 msec.	The minimum time from when a slave receives a request and until it returns a response. This makes it possible to send data to slow masters without overwhelming its receiver.
Interframe spacing	3,5-25 chars	The minimum interframe space between two Modbus RTU messages in sequence is configurable.

10.2. MAGX2 (MAGB2) in SCADA software
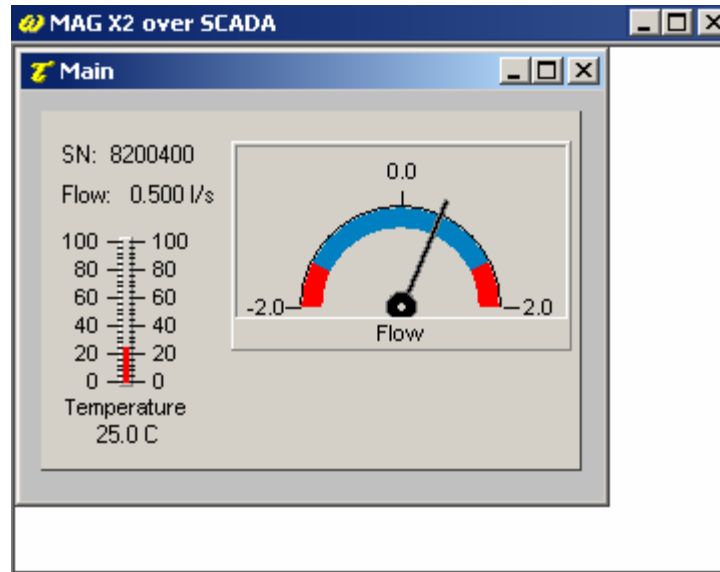
SCADA SIELCO SISTEMI – WINLOG LITE

Software vs Firmware vs Modbus

- General menu structure has been made and it is common for all – software, firmware and Modbus. It is divided into 6 main sections.

- **Info** show read only information about flowmeter.

- **Display** allows you to change readout units (m3/h, l/s…).

- **User Settings** consist setting for modules, air detector, Modbus, date/time and some other settings for user.

- **Service Settings** is for deleting volume counters.
- **Factory Settings** allows you calibration and some very important settings for measurement.

- **Authorize** is the last chance when you forget user password.

www.arkon.co.uk/support

For more information see:

MAGX2 software manual
MAGX2 Modbus protocol User Guide
MAGB2 User Guide

www.arkon.co.uk

11. Maintenance

Cleaning

The flowmeter does not require any special maintenance. Dependent on the media being measured it is recommended that approx. once a year, remove the sensor from the pipe and clean the liner. Method of cleaning consists of removing mechanical dirt and any non-conductive coating (like oil film) from the liner. A very dirty liner could cause inaccuracy of the measurement. Check mechanical state of the liner.
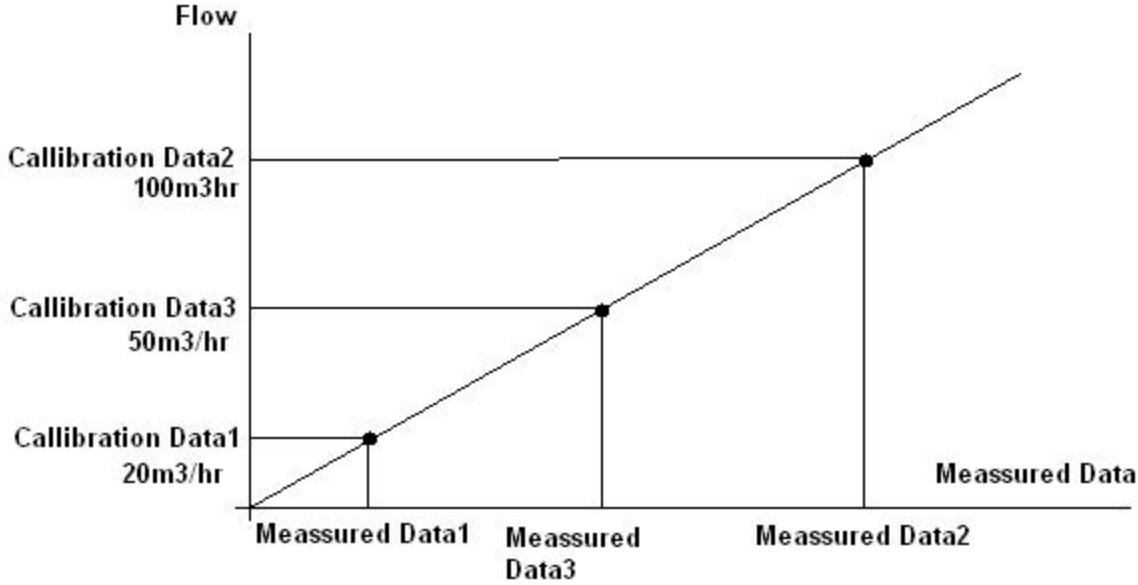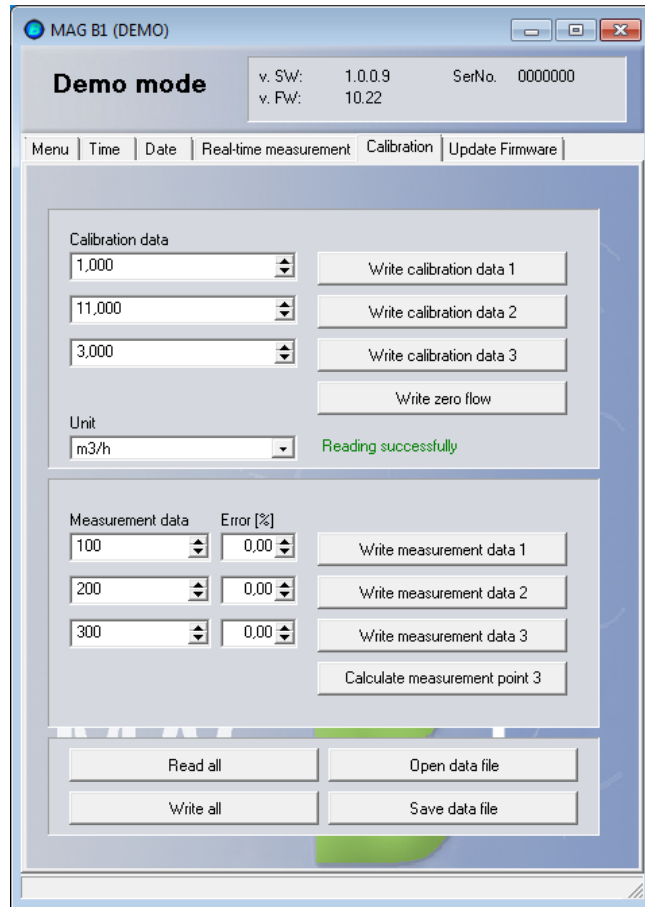
11. Calibration

Calibrations

- All MAGX2, MAGB2 and MAGS1 are calibrated at one of the Czech Republic calibration laboratory facilities. All those laboratories are traceable to the main Czech national standards that are maintained in the Czech Metrology Institute (CMI). CMI is the Czech national metrology body and is traceable to international standards such as TUV Germany and Delft Netherlands.

- All our flowmeters are wet calibrated, i.e. the flow rate is calibrated directly by comparison with a traceable flowmeter. If re-calibration is requested, the MAGX2, MAGB2 and MAGS1 should be recalibrated as a whole unit including the sensor. Accuracy of the flowmeter depends not only on the stability of the electronic unit, but also on the stability and mechanical changes of the liner. This is generally valid for all electromagnetic flowmeters.

- We offer a standard **3 point calibration**, on request we can offer up to a 10 point calibration at an extra cost.

- **MAGX2 and MAGB2 software** enables the entering of a measured misreading (error) during calibration directly in percentage. This simplifies the calibration making it much easier to complete.

Calibration can be done only with flowmeter connected to PC using MAGX2 and MAGB2

Write calibration data button use value next to it and takes measured data
(from AD conv.) from flowmeter.

Write measurement data doesn't take
any data from flowmeter but writes values "manually"

www.arkon.co.uk

Accredited Calibration rig, Brno, Czech Republic

Arkon internal calibration rig Brno, Czech Republic

12. Main rules, troubleshooting, procedures

Main rules

- Any connection or disconnection of any module has to be done with network power to the meter switched off.

- For any electrical work it is necessary to disconnect the device from network power.

- Use the manuals.

- Whole flowmeter tube should be flood all the time.

- Always open transmitter with transmitter special key.

- **Double-check the wiring and module connection before powering**

Troubleshooting

- **If the readings are unstable:**

- Check earthing. Resistance to the ground should be less than 1 Ohm.

- For remote installation check if there is some noise source near cable or flowmeter.

- Check if flowmeter is completely flooded.

- Execute self-cleaning procedure.

- Enlarge number of Samples per average in user menu.

- Make sure that flow is really stable.

- Few hours after installation readings can be unstable because liner needs to absorb some medium (i.e. water). Specially when flowmeter is dry for a long time.
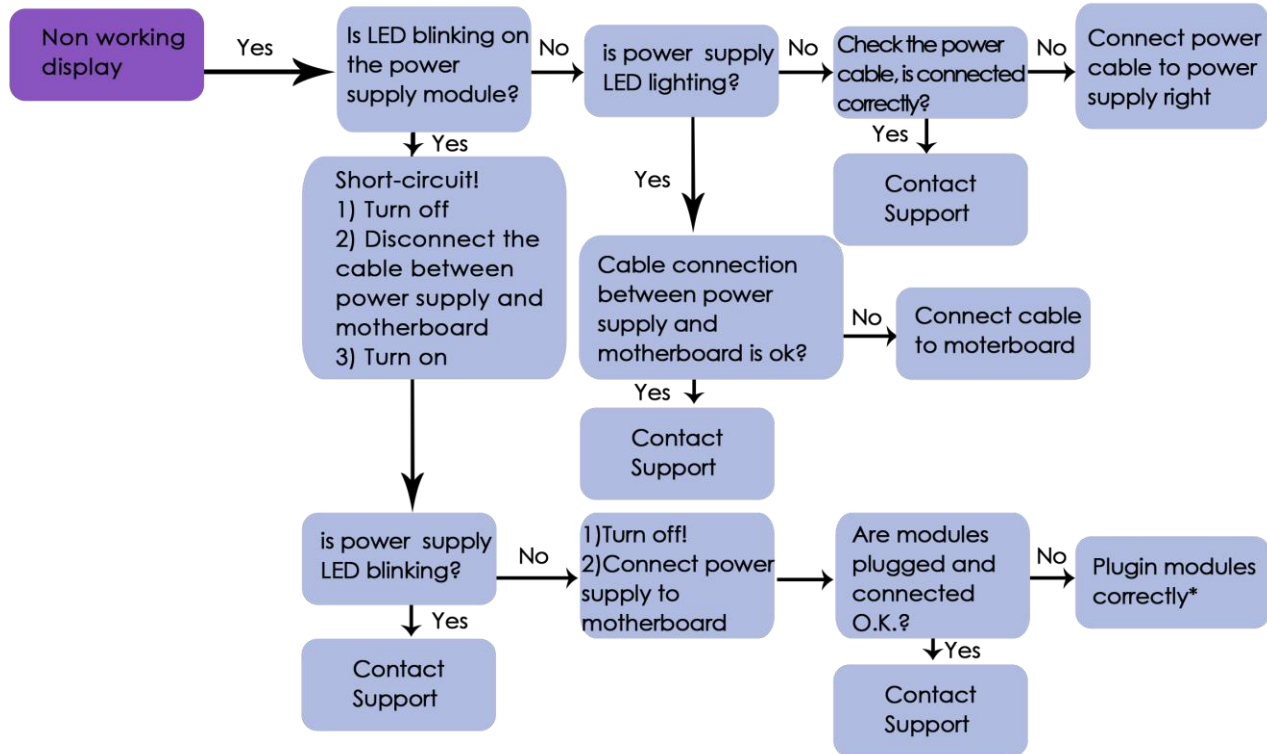
Troubleshooting

MAGX2
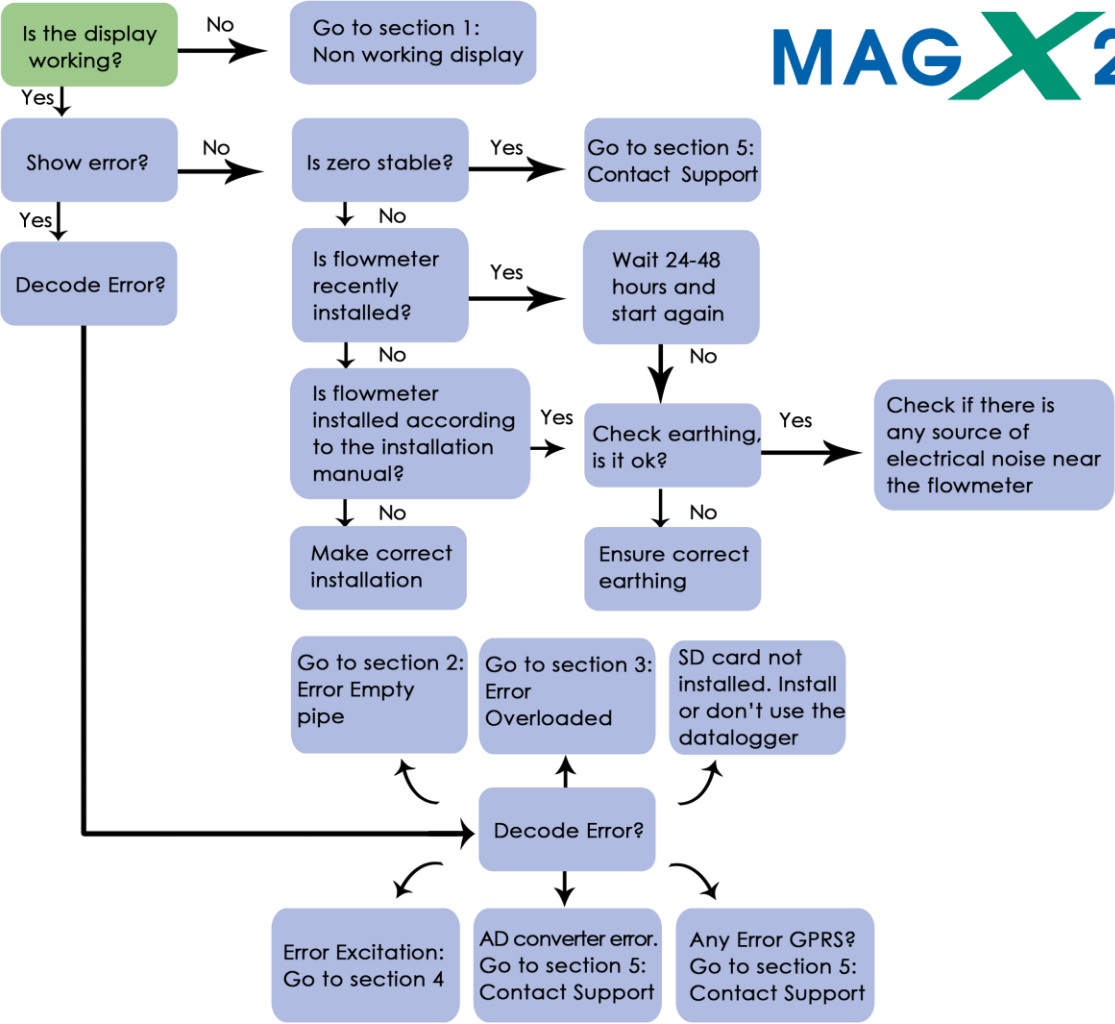
Error position	Error Description
0	Empty Pipe (Air Detect)
1	Overloaded
2	Excitation
3	Sensor not responding
4	SD open file
5	SD card not inserted
6	Write flash
7	ADC
8	GSM SMS Module Timeout
9	GSM SMS Module Low Signal
10	GSM SMS Module Sim card error
11	GSM SMS Module send SMS error
12	GSM SMS Module error
13	Very low or high temperature of the sensor
14	GPRS COMUNNICATION
15	GPRS CHECK
16	GPRS TIMEOUT
17	GPRS RESET
18	GPRS ECHO
19	GPRS SIM PIN
20	GPRS SIGNAL
21	GPRS CALL
22	GPRS IP
23	GPRS ONLINE
24	OVERLOAD 2
25-31	RESERVED (non-use)

Section 1: Non working display

MAG X 2

Non working display → Yes → Is LED blinking on the power supply module? → No → is power supply LED lighting? → No → Check the power cable, is connected correctly? → No → Connect power cable to power supply right

Is LED blinking on the power supply module? → Yes → Short-circuit!
1) Turn off
2) Disconnect the cable between power supply and motherboard
3) Turn on

Check the power cable, is connected correctly? → Yes → Contact Support

is power supply LED lighting? → Yes → Cable connection between power supply and motherboard is ok? → No → Connect cable to moterboard

Cable connection between power supply and motherboard is ok? → Yes → Contact Support

Short-circuit → is power supply LED blinking? → No → 1)Turn off!
2)Connect power supply to motherboard → Are modules plugged and connected O.K.? → No → Plugin modules correctly*

is power supply LED blinking? → Yes → Contact Support

Are modules plugged and connected O.K.? → Yes → Contact Support

*before switch off the flowmeter

www.arkon.co.uk

MAG X2

Section 2: Empty pipe

Error Empty Pipe → Is sensor installed exactly according to installation manual?

— No → Correct the installation

— Yes → Is pipe complete full with conductive liquid?

— No → EMPTY PIPE Is confirmed

— Yes → There are bubbles in the liquid?

— Yes → Eliminate the bubbles

— No → Contact Support

Section 3: Error overloaded

Check earthing of the sensor ok?

Yes → There is a source of noise near the flowmeter

No ↓ Correct the installation

Section 4: Error excitation

Check the Connection of the coils (C1, C2) ok?

No → Connect coils to the flowmeter

Yes ↓

Turn off the power supply module and measure resistance between C1 and C2

75-120 ohms → Contact Support

infinite → Contact Support

< 2 ohms → Check connection of the cables for shortcircuit, insulate it

Troubleshooting

MAG*B*2

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

*will be added in future updates

![MAG B2 logo]

Section 1: Non working display

```
┌─────────────────┐              ┌─────────────────┐          ┌─────────────────┐
│ Check the       │    Yes       │ Connect to pc   │   No     │ Go to section 5:│
│ battery         │ ───────────▶ │ and try to read │ ───────▶ │ Contact Support │
│ connection,     │              │ any data,       │          │                 │
│ is it ok?       │              │ is it ok?       │          └─────────────────┘
└─────────────────┘              └─────────────────┘                  ▲
     No │                             │ Yes                           │
        ▼                             ▼                               │
┌─────────────────┐              ┌─────────────────┐   No             │
│ Connect         │              │ Unplug battery  │ ─────────────────┘
│ Battery         │              │ for a while, and│
│                 │              │ plug it again,  │
└─────────────────┘              │ is it ok?       │
                                 └─────────────────┘
                                      │ Yes
                                      ▼
                                 ┌─────────────────┐
                                 │ OK, set the     │
                                 │ correct date    │
                                 │ and time        │
                                 └─────────────────┘
```
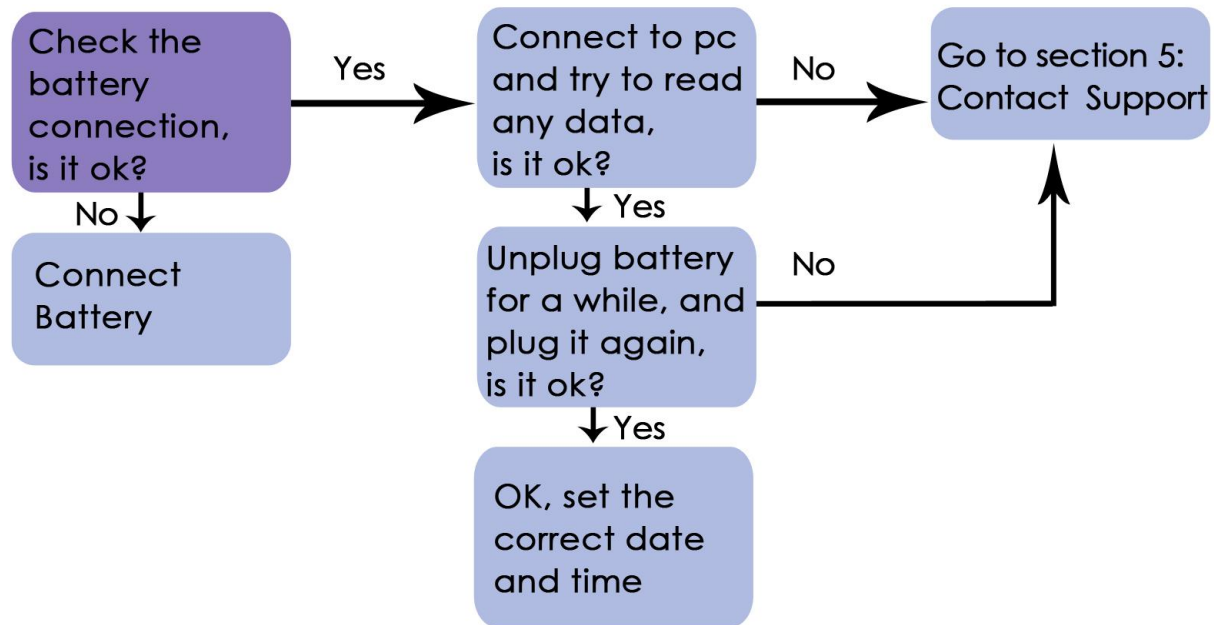
Section 2: Empty pipe

Section 3: Error overloaded

Check earthing of the sensor ok?

Yes → There is a source of noise near the flowmeter

No ↓ Correct the installation
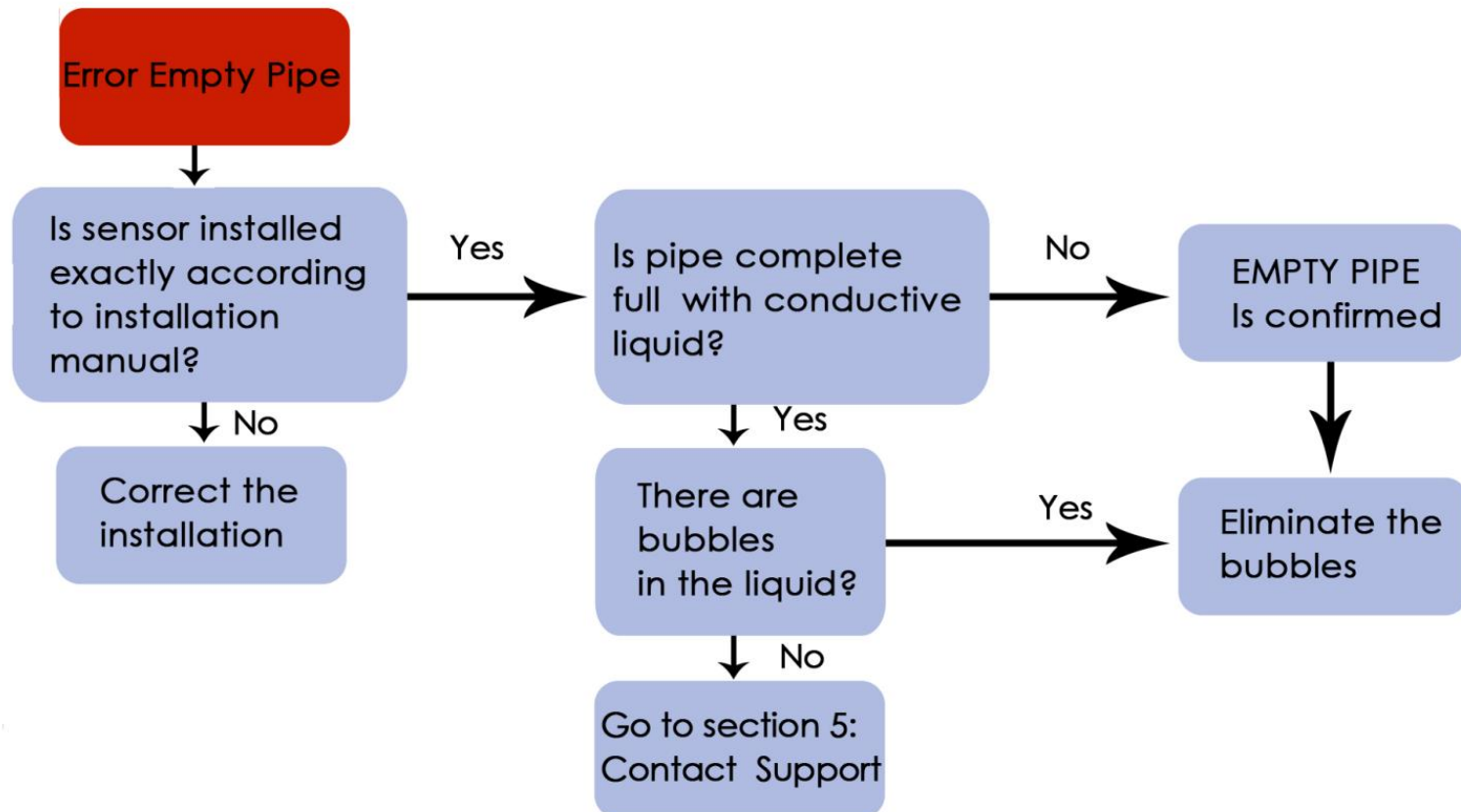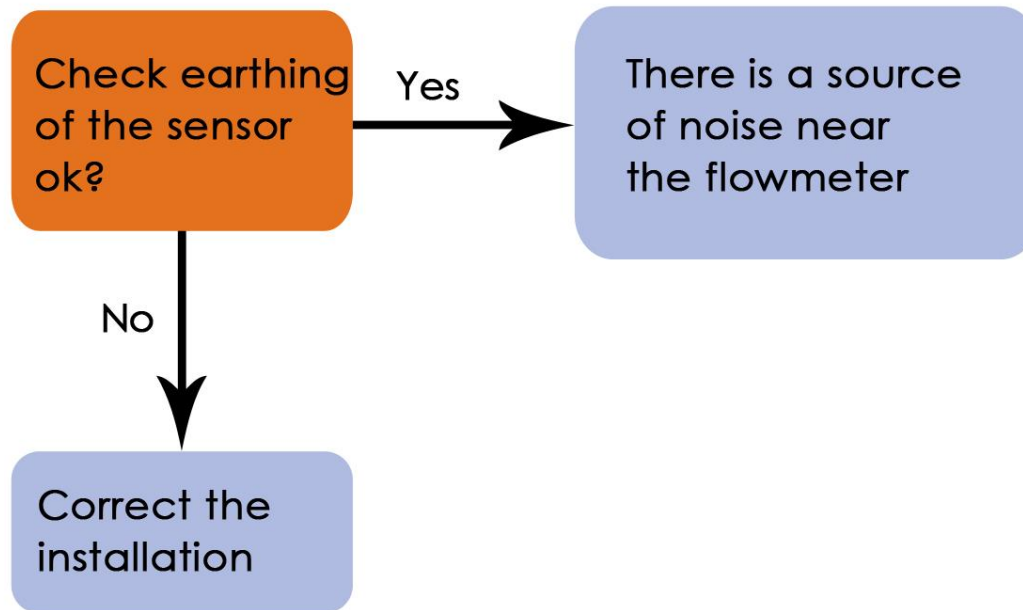
Section 4: Error excitation
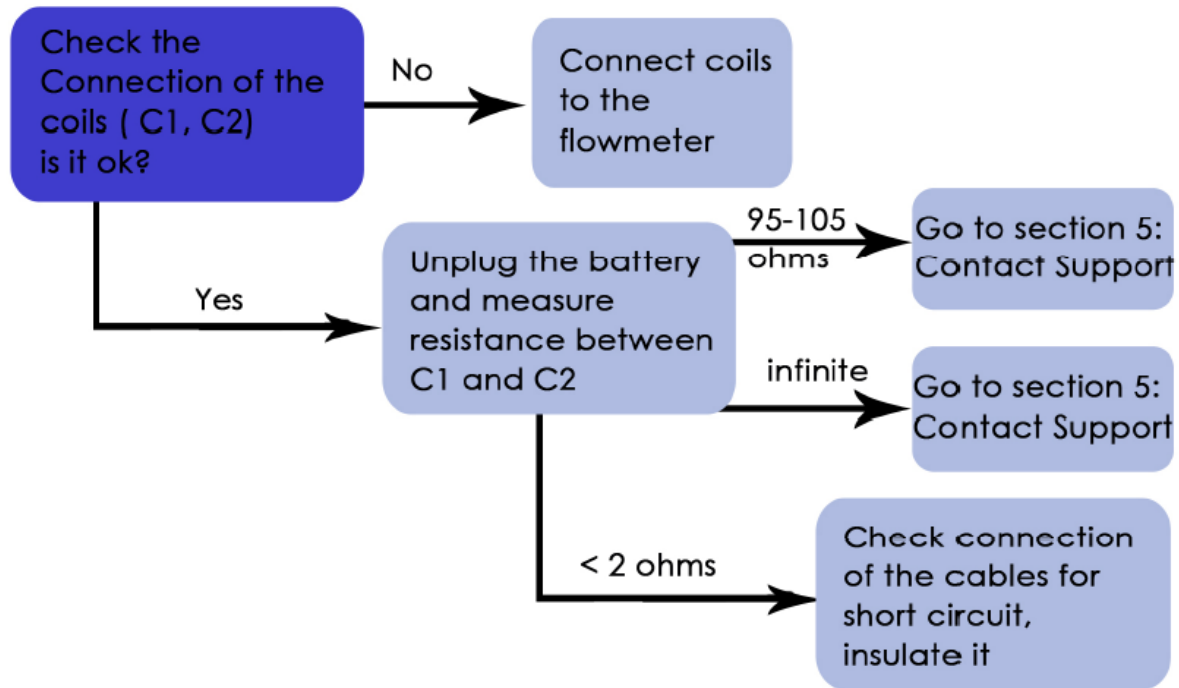
Test No:	Check resistance:	Expected Value:	Probable cause if different value:
1	(E1 x GND) (E2 x GND) (E1 x E2)	1 kΩ to 1 MΩ With a full sensor tube > 1 MΩ With an empty sensor tube	Lower value: Short-circuit on the electrode Higher value: If the value with a full sensor tube is higher, the electrode is not connected.
2	C1 x C2 (EXCITATION)	95 to 105 Ω	Lower value: Short-circuit on the excitation coils Higher value: Disconnected or interrupted excitation.
3	C1 x GND of electrodes C2 x GND of electrodes	> 10 MΩ	Lower value: Coils not insulated from the sensor body
4	GND from electrodes x earthing screw	< 2 Ω	GND from electrodes x earthing screw

All measurement must be done within the device disconnected from battery and sensor disconnected from motherboard!

Troubleshooting

Agrimag

1. Non working display

Agrimag

Is the display working? — Yes → Ok

No ↓

Touch the On/Off button for 2 to 4 seconds to operate, is the display working now? — Yes → Ok

No ↓

Check if the batteries are plugged in right way — Yes → Unplug one battery for 20 seconds and plug it again, is the display working now? — Yes → Check if the On/Off button is working — No → Contact Technical Support

No ↓ (from "Check if the batteries are plugged in right way")

Plug the new batteries in right way and start with check of this troubleshooting again

No ↓ (from "Unplug one battery...")

Check if the batteries are OK or replace the batteries, is the display working now? — Yes → Ok

Yes ↓ (from "Check if the On/Off button is working")

No ↓ (from "Check if the batteries are OK...")

Contact Technical Support

Agrimag

2. Non stable flow or Empty Pipe alam

Agrimag

Is flowmeter installed according to the installation manual → No → Make correct Installation

↓ Yes

Check if there is any source of electrical noise near the flowmeter or pipe → Yes → Turn off all sources of noise and check if the flow is stable now → Yes → Eliminate the electrical noise

↓ No (from "Check if there is any source...")

No (from "Turn off all sources of noise...")

Does the screen show LOW BATTERY status?

↓ No

Is the pipe totally full with measured liquid all the time? → No → Empty pipe is confirmed. Make better installation of the flowmeter

↓ Yes

Are there bubbles in the liquid? → Yes → Eliminate the air bubbles

↓ No

Has the liquid minimal conductivity ≥ 20µS/cm → No → Electromagnetic flowmeter is not applicable for this liquid

↓ Yes

Contact Technical Support

www.arkon.co.uk

Agri**mag**

3. Error Overload

Agrimag
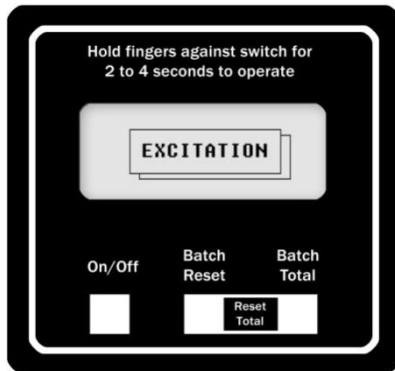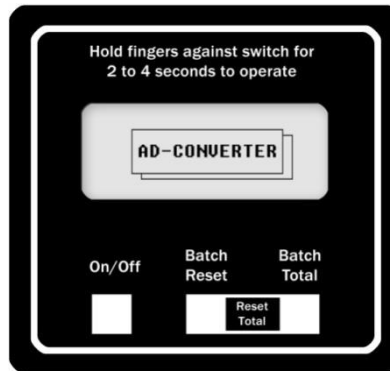
3. Error Overload

```
┌─────────────────────┐        ┌─────────────────────┐        ┌─────────────────────┐
│  Check if there is  │  Yes   │  Turn off all       │  No    │                     │
│  any source of      │  ───►  │  sources of noise   │  ───►  │  Eliminate the      │
│  electrical noise   │        │  and check if the   │        │  electrical noise   │
│  near the flowmeter │        │  error persists     │        │                     │
│  or pipe            │        │                     │        │                     │
└─────────────────────┘        └─────────────────────┘        └─────────────────────┘
         │ No                           │ Yes
         ▼                              ▼
┌───────────────────────────────────────────────┐  Yes   ┌─────────────────────┐
│  Check if the real flow is not bigger than     │  ───►  │  Eliminate the      │
│  maximum applicable flow                       │        │  high flow          │
└───────────────────────────────────────────────┘        └─────────────────────┘
                     │ No
                     ▼
            ┌─────────────────┐
            │  Contact        │
            │  Technical      │
            │  Support        │
            └─────────────────┘
```
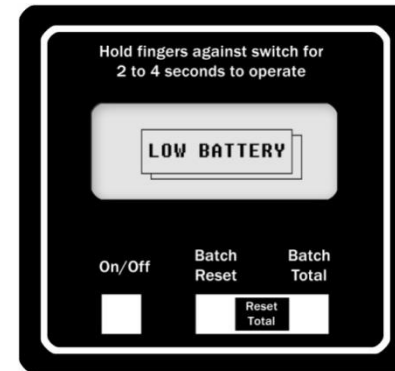
Procedures

P_20_Load calibration data MAGX2
P_21_Procedure Sensor Test MAGX2
P_23_Procedure Transmitter Exchange MAGX2
P_24_Procedure Service Menu Encoding MAGX2
P_25_Firmware Update MAGX2
P_26_Procedure Bluetooth Installation MAGX2
P_27_Procedure TCP-IP Installation MAGX2
P_28_Procedure GPRS Installation MAGX2
P_31_Procedure WiFi Installation MAGX2
P_50_Firmware Update MAGB2
P_51_Service menu encoding MAGB2
P_52_Load calibration data MAGB2
P_53_Compact to Remote MAGB2

www.arkon.co.uk/support

All procedures are available on the Arkon´s website.

Technical support materials

- MAGB2 User Guide

- MAGX2 Software User Guide

- MAGX2 Firmware User Guide

- MAGX2 Modbus Protocol User Guide

- MAGS1 User Guide

- Agrimag User Guide

- Technical Procedures

- First Installation Guide and Troubleshooting

- Procedures

www.arkon.co.uk/support

Technical support (MSN, email):
support@arkon.co.uk

www.arkon.co.uk

Certificates
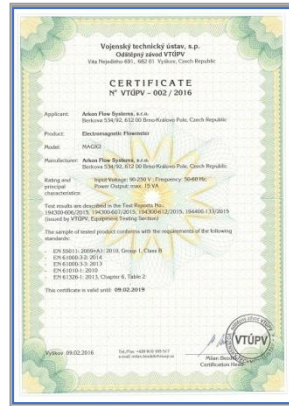
CE Certificate: MAGX2

CE Certificate: MAGS1
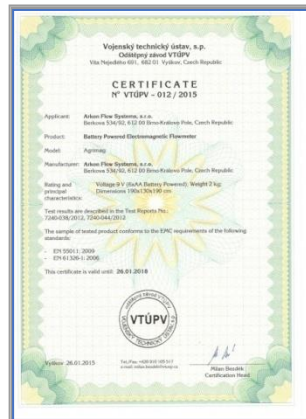
CE Certificate: Agrimag

WRAS Approval

Certificates

IP68 Certificate MAGX2

ISO Certificate

IP68 Certificate MAGB2

Type Examination
Certificate – Ukraine

Certificates

OIML MAGX2

OIML MAGB2

MID MAGX2

MID MAGB2

Technical support materials

- MAGB2 User Guide

- MAGX2 Software User Guide

- MAGX2 Firmware User Guide

- MAGX2 Modbus Protocol User Guide

- MAGS1 User Guide

- Agrimag User Guide

- Technical Procedures

- First Installation Guide and Troubleshooting

- Procedures

www.arkon.co.uk/support

Technical support (MSN, email):
support@arkon.co.uk

Arkon Flow Systems, s.r.o.
Nováčkova 11, 614 00 Brno
Czech Republic
Tel: +420 543 214 822
Fax: +420 543 215 249

Sales / General: arkon@arkon.co.uk
Logistics: office1@arkon.co.uk
Technical support: support@arkon.co.uk

Arkon Middle-East & Asian Regional Office
Villa 11, Al Hoora
Kingdom of Bahrain

E-mail: middle-east@arkon.co.uk

Arkon Flow Systems Asia PVT LTD
44/7 Malani Bulathsihala RD
Bellanwila
Boralesgamuwa 10290, Sri Lanka

E-mail: middle-east@arkon.co.uk

www.arkon.co.uk

Arkon Flow Systems, s.r.o.

www.arkon.co.uk