MAGE1

User Guide

arkon
flow systems

Arkon Flow Systems

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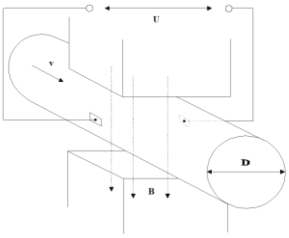
List of Contents

1. Introduction

1.1. Operating Principle

The measurement is based on the principle of Faraday‘s law of electromagnetic induction where a 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
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 MAGE1 flowmeter must not be mounted in explosive hazardous areas.

1.4. Unpacking the flowmeter

❶ When 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.

- Flowmeter
- Flash drive
- Manual

2. Installation

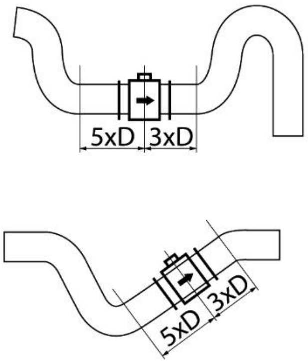
2.1. Sensor Installation

Proper installation is extremely important in order for your flowmeter to work correctly. There are minimum sensor installation requirements that need to be respected at all Times. Please note that Arkon cannot warranty any installation which does not comply with these requirements.

Horizontal standard mounting

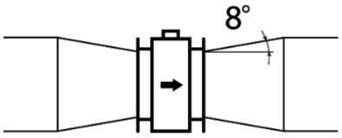
The sensor tube must always remain full. The best way to achieve this is to locate the sensor in a low section pipe, see the following picture.

It is mandatory 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.



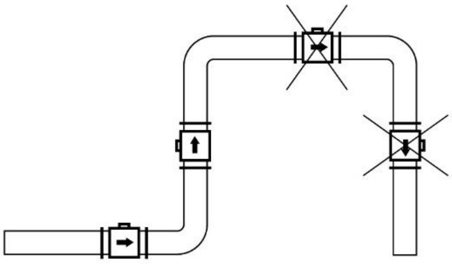
Pipe reducers

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 8º.



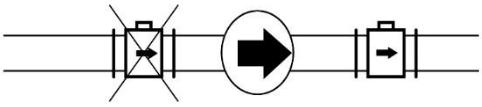
Vertical mounting

When the sensor is mounted on a vertical section of pipe, the flow direction must be upwards. In the case of a downward flow direction, air bubbles can collect in the sensor and the measurement could be unstable and inaccurate.



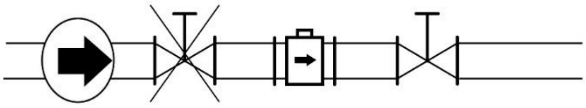
Pumps

Never install the sensor on the suction side of a pump or on a section of pipe where a vacuum is possible.



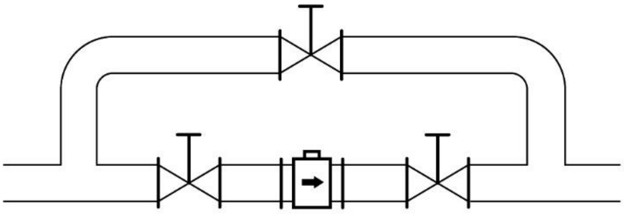
Valves

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

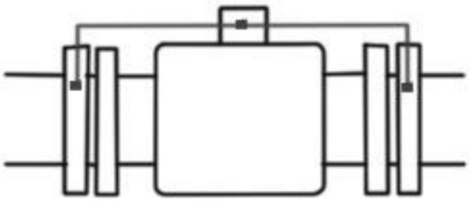


The sensor head has to be properly tightened
During the sensor installation please check the head and the four screws for proper tight.

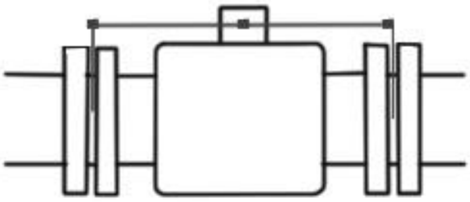
Removal during maintenance
If the application requires removal of the sensor for periodic maintenance, it is recommended to install a bypass section as the drawing below.



All MAGE1 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 resistance of the sensor to earth is <1 ohm.



Conductive (metal) pipe



Non-conductive (plastic, lined) pipe

2.2. Dry liner

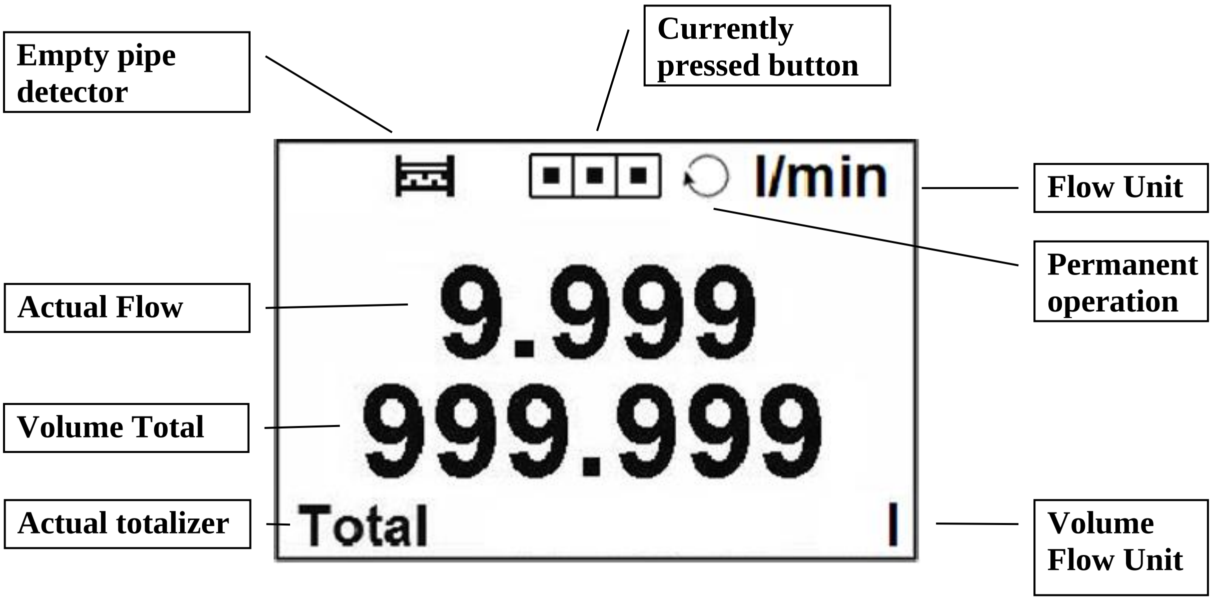
Flowmeters with a Hard Rubber liner can show incorrect readings during the first 2-3 days after installation. This is due to the fact that the time needed for transport and the time before installation is long enough for the liner to dry out and thus it changes shape/size. This change, in effect, affects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

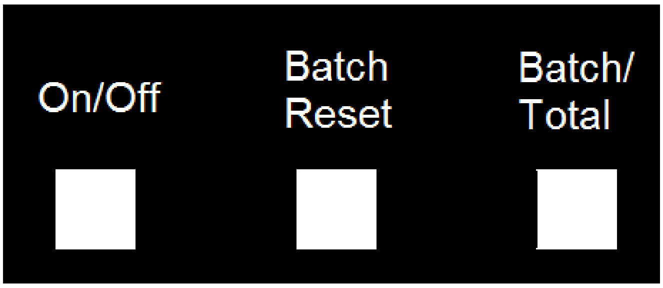
3. MAGE1 Unit

The MAGE1 flowmeter consists of the motherboard, a graphical display, touch-buttons and sensor housing. Through the display and with help of the controls, you can see and change flow and totalizers.

The following symbols are used in this manual and on the flowmeter display.

3.1. Main screen





Note: these are not pushing buttons, to activate hold your finger over the white rectangle for 2 to 4 seconds.

On/Off
Turns the meter on, switching the meter off.

Batch Reset
Clears the Batch volume.

Batch/Total
Switches between totalizers.

Combination On/Off and Batch/Total together
Changes the unit of a system (l/s and USG/min, resp. litres and gallons, etc.)

Total Volume
This is the total volume counter. Negative flow is not counted.*

Batch Volume
This counter works the same way as Total Volume. Both counters are independently clearable.*

*If value of any Volume counter higher than 4 000 000 m3, than value of Volume show only in m3 unit. If value of any Volume counter higher than 999 999 999 m3, then this Volume will be reset to 0

3.2. Errors and Warnings

That is a list of the possible errors for MAGE1:

Empty Pipe
If the Empty pipe appears on the screen there is no medium in the pipes.

Excitation
Coils interrupted or disconnected.

AD-converter
AD converter fault.

Note: The error disappears when the cause of it is fixed. You can see the measurement when you touch any of the controls.

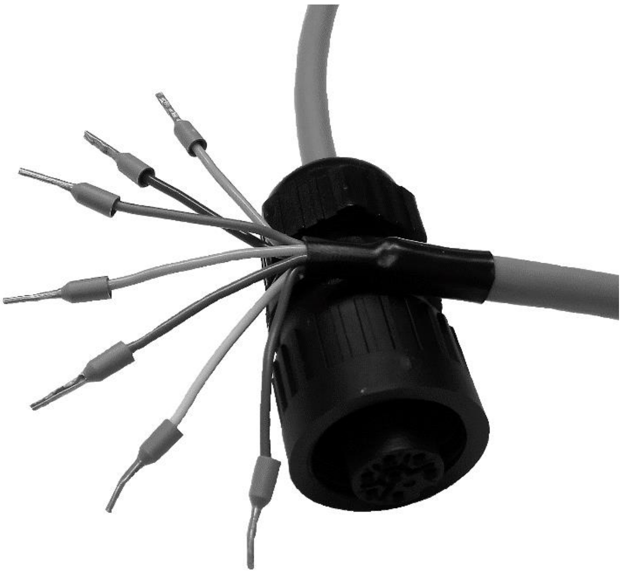
Overloaded
That error occurs when the measured flow is bigger than 1.2 * Flow Qn. Depending on the size:

Generally that error will occur when the AD converter is overloaded. It can be because on the electrodes are very big voltage or because the flow is really that high.

4. Power Supply

- The voltage power supply range is 9 – 35VDC.
- Maximum power consumption is 1,3W.
- 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.

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

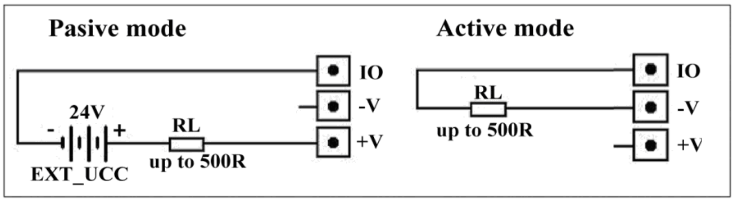


5. Outputs

5.1. 4-20 mA output

Each MAGE1 is equipped with embedded 4-20mA current loop output signal proportional to actual flow.

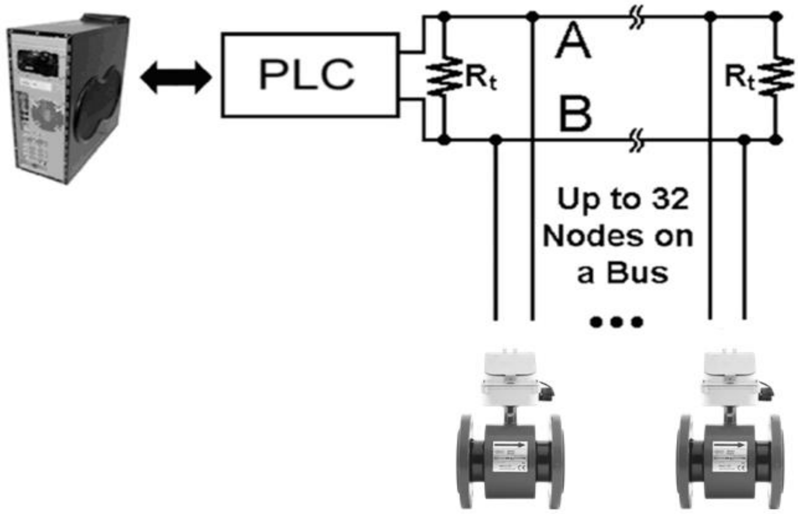
Electrical Specifications: **12-bit DAC** **Maximum Resolution** 3.9 µA.	
Output mode	Active or Passive



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

5.2. RS485 output

Protocol	MODBUS RTU – for detailed information see MAGE1 MODBUS guide
SW	Standart Arkon SW
Baud rate	9600 baud/s

BASIC CIRCUIT CONNECTIONS:

Multi-Node Network with End Termination using RS485
Terminator R_t with resistance 100Ω should be connect to the end of line RS-485.

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

6. Internal backup

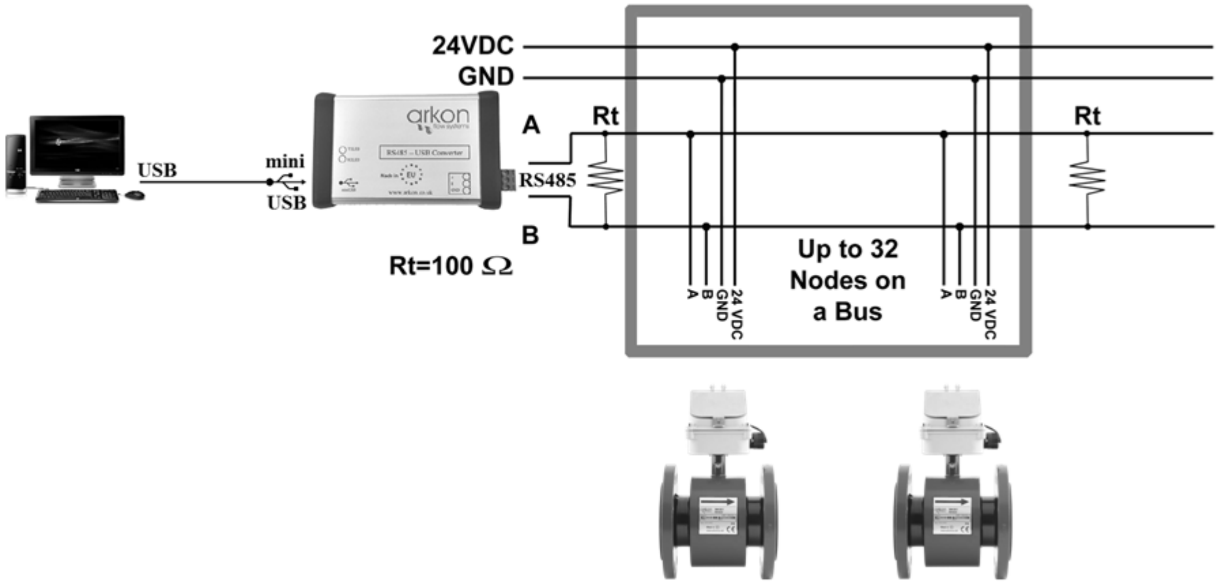
6.1. Automatic data saving

Once an hour some data is saved to the internal EEPROM. These are:

- Total
- Batch

When power is removed, the last Total and last Batch will be saved in the EEPROM until the unit is switched on again. Up to one hour of totalizers can be lost due to power off.

7. MAGE1 connection to PC



Picture above shows practical connection MAGE1 to PC through USB using RS485 – USB Converter.

8. Datalogger

Data from datalogger save into external Flash memory. Capacity for write entries is 131072 (one entry has 8B)

All items in Datalogger are creating from 8 Bytes:

Date	**Time**	**Total+**
2B	2B	4B

For more information see section 9.16 - Datalogger.

9. Modbus

9.1. 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)
RTU	Remote Terminal Unit - Standard Modbus transmission mode

9.2. 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

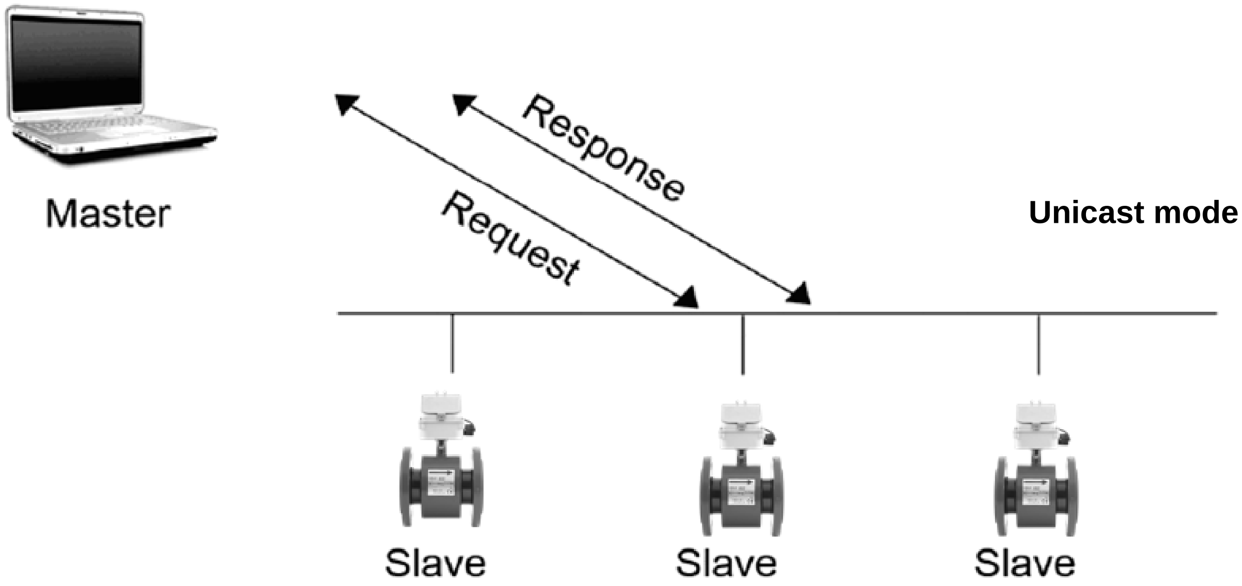
9.3. Technical data

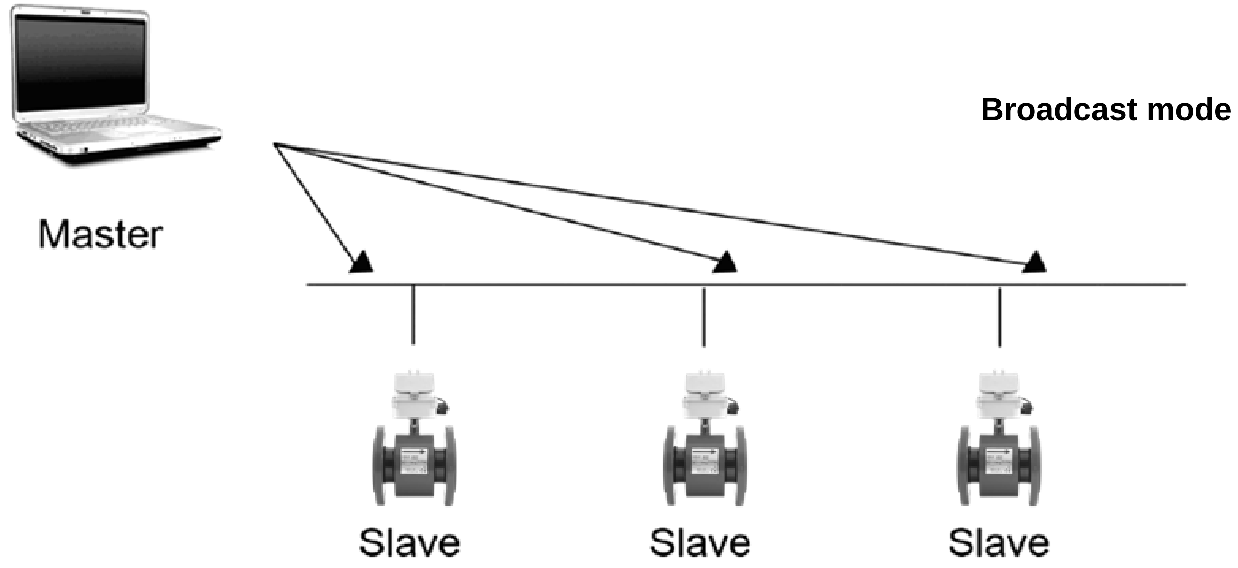
ARKON Flowmeter Modbus RTU specification	
Device type	Slave
Baud rates	9600, 14400, 19200, 38400, 57600, 115200 bits/sec.
Number of stations Recommended:	max. 31 per segment without repeaters
Device address range	1-247
Protocol	Modbus RTU (Other Modbus protocols like ASCII, Plus or TCP/IP are not supported)
Electrical interface	RS485
Supported function code	3 read holding registers
	16 write multiple registers
	17 report slave ID
Broadcast	No
Maximum cable length	RS485 Specification limits
Standard Modbus over serial line v1.0)	
Certified	No

9.4. General Modbus RTU

The 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.





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.

9.5. 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	

9.6. 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“

9.7. 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)
General exceptions:
- Requesting less than 1 or more than 125 registers => Exception 3 (Illegal data value)
- Requesting more than max. message size => Exception 2 (Illegal data address)
- 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)

Function code 16 (Write multiple registers)
General exceptions:
- Exceeding max. message size => Exception 2 (Illegal data address)
- Writing data above/crossing limitation of max. register address (0xFFFF) => Exception 2(Illegal 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)

Function code 17 (Report Slave ID)
- There are no exceptions for this function

9.8. Modbus holding registers

In the following the holding registers for the MAGE1 Modbus RTU module are described.

Modbus Start Register	Section
2	Password
100	Real-time measurement
200	Datalogger memory management
1000	Info
1500	Display
2000	User settings
4000	Factory settings
10000	Datalogger items

Holding registers memory map

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^(-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).

Data type memory map

Modbus register	Data Type	Low/High Word
2	Longint	L
3		H
4	Bool	L
5		H

9.9. Password

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

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Description	Read/ Write
2	1	4	Longint	0	0	9 999	Password (User)	R*/W
4	3	4	Longint	0	0	9 999	Reserved	R*/W
6	5	4	Longint	0	0	9 999	Password (Factory)	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.

9.10. Real-time measurement

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Description	Read/ Write
100	99	4	Longint	3	0	2^32	FLOW	R
102	101	4	Bool	0	0	1	SIGN	R
104	103	4	Longint	N/A	0	2^32	TOTAL	R
106	105	4	Longint	N/A	0	2^32	Batch	R
108	107	4	Longint	0	0	2^16	ERROR CODE	R

Flow

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

Sign

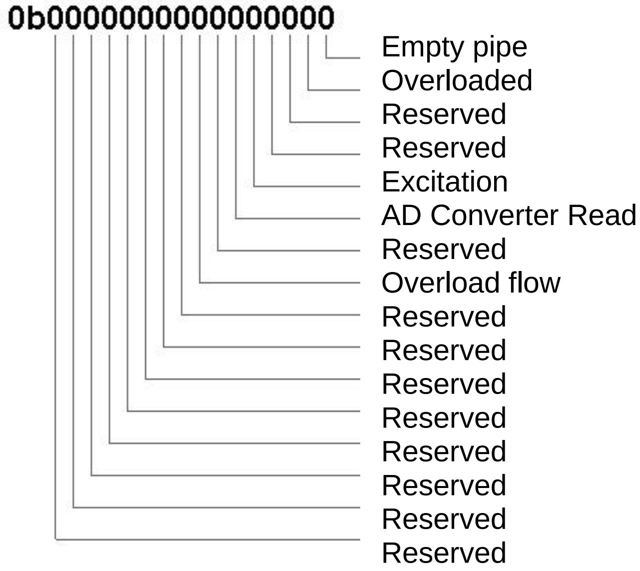
Sign of the read flow.
0 – positive flow
1 – negative flow

Total , Batch

Unit: m^3 – it is not possible to change it.
Real value = Actual value / 1000.

Error code

Convert read value to binary number. Number one means error. For more information see chapter **Chyba! Nenalezen zdroj odkazů.**.



9.11. Datalogger memory management

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min. Value	Max. Value	Default	Description	Read/ Write
200	199	4	Longint	-	0	2^32	1048576	DATALOGGER MEMORY SIZE	R
202	201	4	Longint	-	0	DATALOGGER MEMORY SIZE	0	DATALOGGER BASE ADDRESS	R/W

Datalogger memory size - memory size in bytes, according to Flash memory size capacity is 1048576 bytes

Datalogger base address - actual base address in memory, value in range of 0 to Datalogger memory size

9.12. Info

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Description	Read/ Write
1000	999	4	Longint	0	-	-	Time	R
1002	1001	4	Longint	0	-	-	Date	R
1004	1003	4	Longint	0	-	-	Unit No.	R
1006	1005	4	Longint	0	-	-	Error (min)	R
1008	1007	4	Longint	0	-	-	OK (min)	R
1010	1009	4	Longint	0	-	-	Diameter	R
1012	1011	4	Longint	2	-	-	FirmWare No.	R
1014	1013	4	Longint	3	-	-	Flow Qn	R
1016	1015	4	Longint	0	-	-	Excitation counter	R

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

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

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

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

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

Firmware No. – this shows the current firmware version

Flow Qn – Nominal flow. Real value = Actual value / 1000

Excitation Counter – the number of excitations

9.13. Display

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min. Value	Max. Value	Default	Description	Read/ Write
1500	1499	4	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	4	Longint	-	0	3	2	Unit Volume, 0=UKG, 1=USG, 2=m3, 3=l	R/W
1504	1503	4	Longint	0	0	100	50	Contrast [%]	R/W

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

Unit Volume – totalizer unit (default m^3)

Contrast – Set display’s contrast

9.14. User settings

To enter this section, it is necessary to enter the User Password “1111”.

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Default	Description	Read/ Write
2000	1999	4	Bool	-	0	1	0	Measurement, 0=Stop, 1=Running	R/W
2002	2001	4	Bool	-	0	1	1	Air Detector, 0=OFF, 1=ON	R/W
2004	2003	4	Longint	3	0	999	188	Air Constant	R/W
2006	2005	4	Longint	0	1	30	3	Samples per Avg.	R/W
2008	2007	4	Longint	-	0	5	3	Low Flow Cutoff, 0=OFF, 1=0.5%, 2=1%, 3=2%, 4=5%, 5=10%	R/W
2010	2009	4	Bool	-,0	0	1	0	Invert Flow, 0=No-invert, 1=Invert	R/W
2012	2011	4	Longint	0	0	0x29991231	-	Date Settings	R/W
2014	2013	4	Longint	0	0	0x00235959	-	Time Settings	R/W
2016	2015	4	Longint	0	1	247	1	Modbus Slave Address	R/W
2018	2017	4	Longint	-	0	5	0	Modbus BaudRate, 0=9600, 1=14400, 2=19200, 3=38400, 4=57600, 5=115200	R/W
2020	2019	4	Longint	-	0	3	0	Modbus Parity, 0=Even, 1 stopbit, 1=Odd, 1 stopbit, 2=None, 2 stopbits, 3=None, 1 stopbit	R/W
2022	2021	4	Longint	-	-	-	0	Reserved	-
2024	2023	4	----	-	-	-	0	Always ON 0= OFF, 1= ON	R/W
2026	2025	4	----	3	0	36000	0	Flow Min	R/W
2028	2027	4	----	---	----	---	-	Flow Max	R/W
2030	2029	4	----	0	4	20	4	Current Min	R/W
2032	2031	4	----	---	----	---	20	Current Max	R/W
2034	2033	4	Longint	0	0	13	0	Datalogger Interval 0= OFF 1= 15 s 2= 30 s 3= 1 min 4= 2 min 5= 5 min 6= 10 min	R/W

								7= 15 min 8= 30 min 9= 1 hr 10= 2 hrs 11= 6 hrs 12= 12 hrs 13= 24 hrs	
2036	2035	4	Longint	0	0	1	0	Datalogger Delete 0= OFF, 1= ON	R/W

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

Air Detector – this option allows selecting empty pipe check. Default ON.

Air Constant – constant value to determine the Empty pipe detection limit. Default 188
Real value = Actual value / 1000

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

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

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

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)

Modbus Slave Address – Modbus device address. Default 1

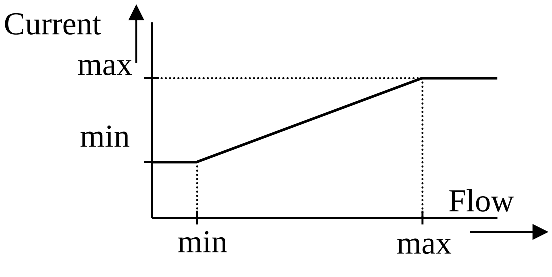
Modbus Baudrate – setup communication speed. Default 9600

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

Always on – set to 0 always

Current Min – Max – Setup of the current output range, corresponds to the actual flow-rate within given range

Flow Min – Max – Setup of measurement flow-range
Real value = Actual value / 1000 (only positive values)



9.15. Factory Settings

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

Modbus register	Modbus address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Default	Description	Read/ Write
4000	3999	4	Bool	0	0	1	0	Delete Volume	R/W
4002	4001	4	Bool	0	0	1	0	Delete Batch	R/W
4004	4003	4	Bool	0	0	1	0	Delete OK (min)	R/W
4006	4005	4	Bool	0	0	1	0	Delete Error (min)	R/W
4008	4007	4	Bool	0	0	1	0	Flow Simulation, 0=OFF, 1=ON	R/W
4010	4009	4	Longint	3	0	36 000 000	3600	Simulated Flow	R/W
4012	4011	4	Longint	0	0	1 000	-	Diameter	R/W
4014	4013	4	Longint	0	0	999999	-	Unit No.	R/W
4016	4015	4	Longint	3	0	36 000 000	-	Flow Qn	R/W
4018	4017	4	Longint	3	0	36 000 000	-	Calibration Point 1	R/W
4020	4019	4	Longint	3	0	36 000 000	-	Calibration Point 2	R/W
4022	4021	4	Longint	3	0	36 000 000	-	Calibration Point 3	R/W
4024	4023	4	Longint	0	-8388608	8388607	-	Calibration Data 1	R/W
4026	4025	4	Longint	0	-8388608	8388607	-	Calibration Data 2	R/W
4028	4027	4	Longint	0	-8388608	8388607	-	Calibration Data 3	R/W
4030	4029	4	Bool	-	0	1	0	Zero Flow Set	R/W
4032	4031	4	Bool	-	0	1	0	Zero Flow Erase	R/W
4034	4033	4	Longint	7	0	1000000	0	Zero Flow Constant	R/W
4036	4035	4	Longint	-	0	6	4	Excitation frequency, 0=1/60 Hz, 1=1/30 Hz, 2=1/15 Hz, 3=1/5 Hz, 4=1.5625 Hz, 5=3.125 Hz, 6=6.25 Hz	R/W
4038	4037	4	Bool	-	0	1	1	Excitation, 0=OFF, 1=ON	R/W
4040	4039	4	Bool	-	0	1	0	Reserved	R/W
4042	4041	4	Bool	-	0	1	0	Reset system	R/W

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

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

Simulated Flow – write simulated flow. Real value = Actual value / 1000

Diameter – diameter of the sensor.

Unit No. – the serial number of unit

Flow Qn – setup to the excepted flow Qn. It is set automatically when you write diameter.
Real value = Actual value / 1000

Calibration Point 1 – calibration flow 1

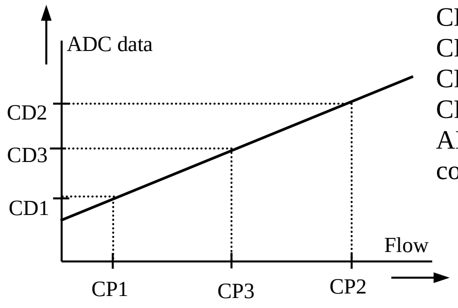
Calibration Point 2 – calibration flow 2

Calibration Point 3 – calibration flow 3

Calibration Data 1 – calibration data 1

Calibration Data 2 – calibration data 2

Calibration Data 3 – calibration data 3



CD1 = Calibration data 1
CD2 = Calibration data 2
CD3 = Calibration data 3
CP1 = Calibration point 1
CP2 = Calibration point 2
CP3 = Calibration point 3
ADC data = data from AD converter

Note: CP1 < CP3 < CP2 and CD1 < CD3 < CD2.
The calibration point 3 and the calibration data 3 could be set to zero. CP1 < CP2 and CD1 < CD3.

Zero Flow Set – after activation this function, next 125 samples are compute to average value for zero flow constant

Zero Flow Erase – erase zero flow constant to 0

Zero Flow Constant – Set manually value for zero flow constant

Excitation Frequency – choose the excitation frequency.

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

Reset – Reset all system. After application it must be restarted by connecting SW with flowmeter

9.16. Datalogger

Data from datalogger are saved into Flash memory. Size is 1048576 B, capacity for write entries is 131072 (one entry has 8 B).

Please refer to chapter 9.11 to determine datalogger memory size and actual base address (Modbus registres 200, 202).

Datalogger base address defines base address in record memory in range < 0;1048575>. Reg_datalogger_start (10000) defines first register of datalloger. Example in table shows how to read blocks of 4 records from modbus registers. After each step the change of Datalogger_base_address determines Datalogger_item available at defined MODBUS_Register:

Datalogger item = ((MODBUS_Register - Reg_datalogger_start) + Datalogger_BASE_address)

Datalogger item	MODBUS register	MODBUS address	Data logger BASE address	No. of bytes	Data type	No. of decimal	Min Value	Max Value	Description	Read/ Write
1.	10000	9999	0	4	Int	0	0	65535	Date+Time	R
	10002	10001	0	4	Longint	0	0	4294967295	Total	R
2.	10004	10003	0	4	Int	0	0	65535	Date+Time	R
	10006	10005	0	4	Longint	0	0	4294967295	Total	R
3.	10008	1007	0	4	Int	0	0	65535	Date+Time	R
	10010	10009	0	4	Longint	0	0	4294967295	Total	R
4.	10012	10011	0	4	Int	0	0	65535	Date+Time	R
	10014	10013	0	4	Longint	0	0	4294967295	Total	R
5.	10000	9999	32	4	Int	0	0	65535	Date+Time	R
	10002	9999	32	4	Longint	0	0	4294967295	Total	R
6.	10004	10001	32	4	Int	0	0	65535	Date+Time	R
	10006	10003	32	4	Longint	0	0	4294967295	Total	R
7.	10008	10005	32	4	Int	0	0	65535	Date+Time	R
	10010	1007	32	4	Longint	0	0	4294967295	Total	R
8.	10012	10009	32	4	Int	0	0	65535	Date+Time	R
	10014	10011	32	4	Longint	0	0	4294967295	Total	R
	…	…		…	…	…	…	…	…	…
	…	…		…	…	…	…	…	…	…
131069.	10000	9999	1048575	4	Int	0	0	65535	Date+Time	R
	10002	10001	1048575	4	Longint	0	0	4294967295	Total	R
131070.	10000	9999	1048575	4	Int	0	0	65535	Date+Time	R
	10002	10001	1048575	4	Longint	0	0	4294967295	Total	R
131071.	10000	9999	1048575	4	Int	0	0	65535	Date+Time	R
	10002	10001	1048575	4	Longint	0	0	4294967295	Total	R
131072.	10004	10003	1048575	4	Int	0	0	65535	Date+Time	R
	10006	10005	1048575	4	Longint	0	0	4294967295	Total	R

All items in Datalogger are created from 8 bytes:

Date	**Time**	**Total+**
2B	2B	4B

- Date +Time (4 B) – Number in Hex form show date in format:
  bit[0..5] - seconds
  bit[6..11] - minutes
  bit[12..16] - hours
  bit[17..21] - day
  bit[22..25] - month
  bit[26..31] - year (since 2015)
- Total - number is without decimal point. To calculate real value Actual value must be divided by 1000 (4bytes, byte 0 = LSB)
  Example: Actual value 26530 » 26530/1000 = 26,530 m^3.

The data are written into Flash memory in clusters of 16 records. It takes 16 times datalogger interval to fill the cache memory before it is written into Flash thus last 16 records might not be seen in the flash memory.

10. Sotware

10.1. System requirements

There are minimum software requirements of your computer that must be satisfied to ensure that the software functions properly. These are:

MS Windows 98/ME/NT/2000/XP/Vista/Wndows 7 operating system.
Flowmeters software program
RS485 input to your computer

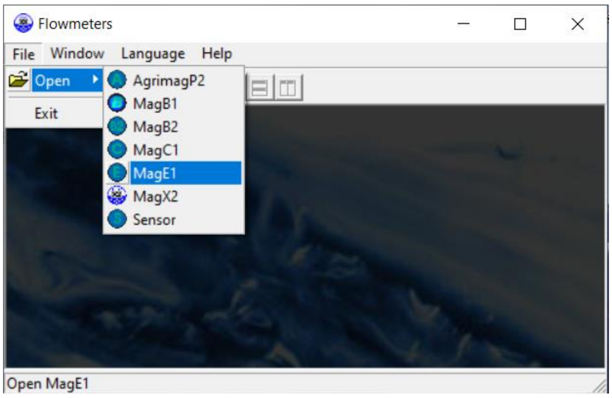
10.2. Installation/Uninstall software

If you received the Flowmeters SW on a flash drive, plug it into your computer and open the drive directory. Then run the “Setup.exe” in the "Flowmeters Software" folder.

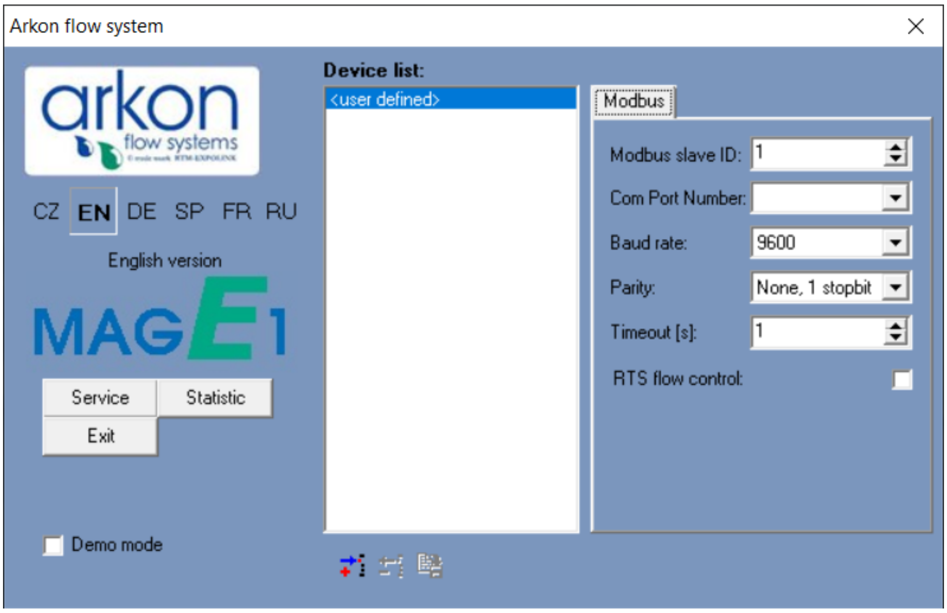
The installation package can be downloaded from Arkon website.

To uninstall Flowmeters SW in „Settings“ (Start menu), under „Add/remove programs“ you select Flowmeters 2 and then click the „uninstall“ button.

SW Flowmeters allows settings of all flowmeters manufactured by Arkon. To start with MAGE1 click on its icon or select MAGE1 from menu.



The MAGE1 window software program consists of two independent sections – Service and Statistics:



<user defined>

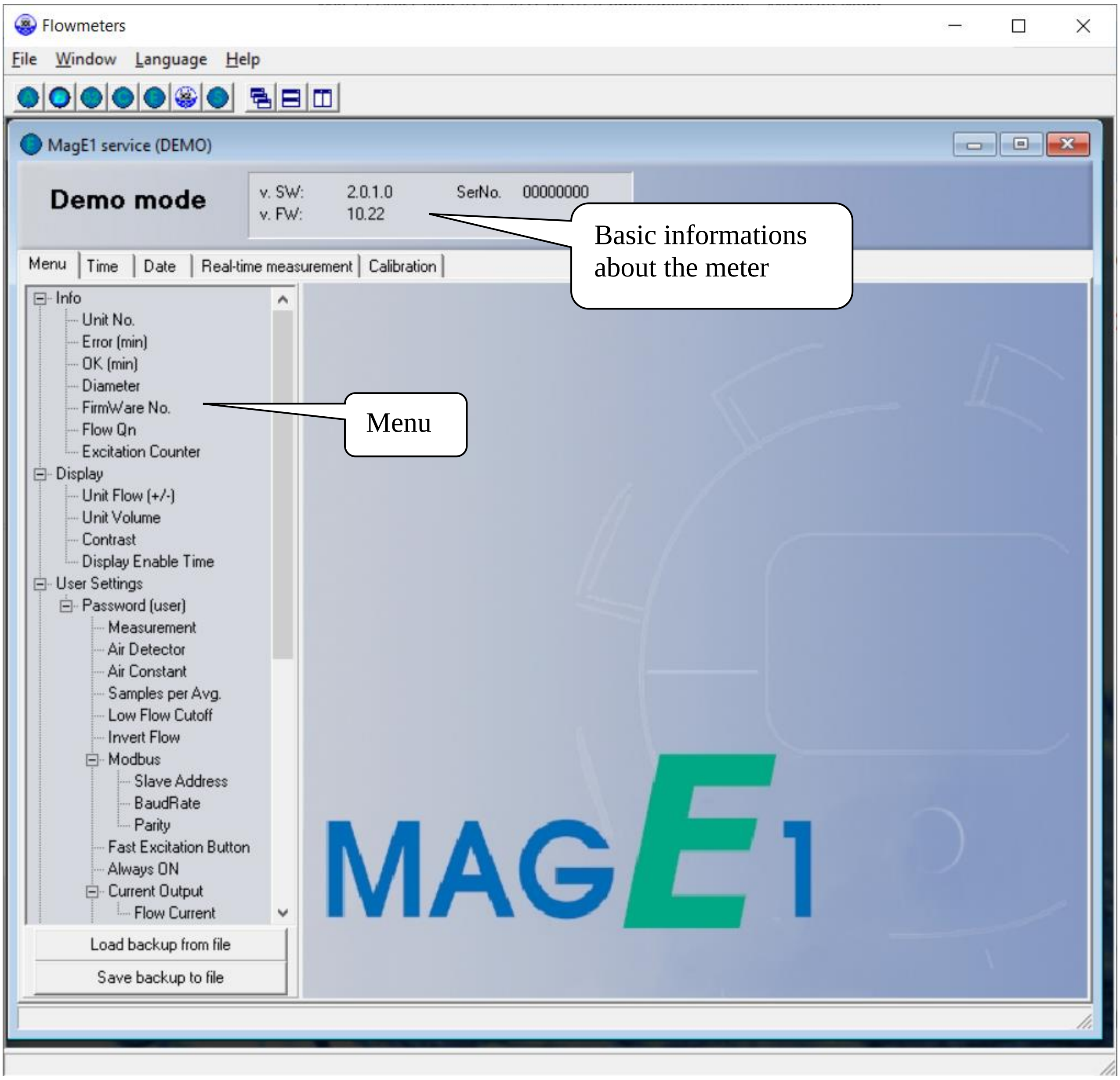
Modbus slave ID: 1
Com Port Number:
Baud rate: 9600
Parity: None, 1 stopbit
Timeout [s]: 1
RTS flow control: ☐

☐ Demo mode

• **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.

• **The STATISTIC data - reading section (“Statistic”)** – This section serves for reading/exporting statistical data for given time periods from the flowmeter. You can enter this section by clicking “Statistic" in the above window.
The communication parameters needs to be set same in the device and in the SW
You can add shortcuts to your devices in Device list section by clicking on + sign below window.

10.3. Service section



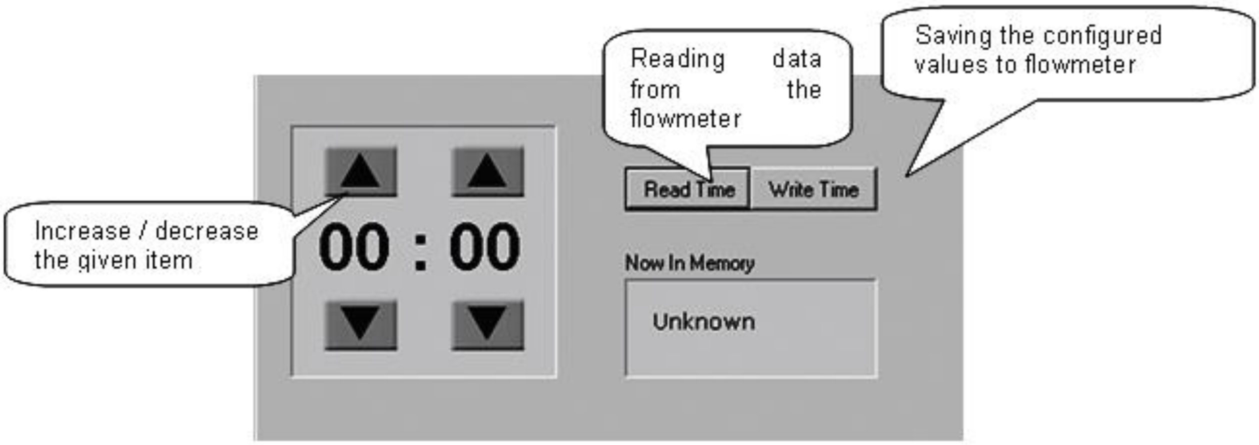
v. SW: 2.0.1.0
v. FW: 10.22
SerNo. 00000000

Basic informations about the meter

Menu

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 time.

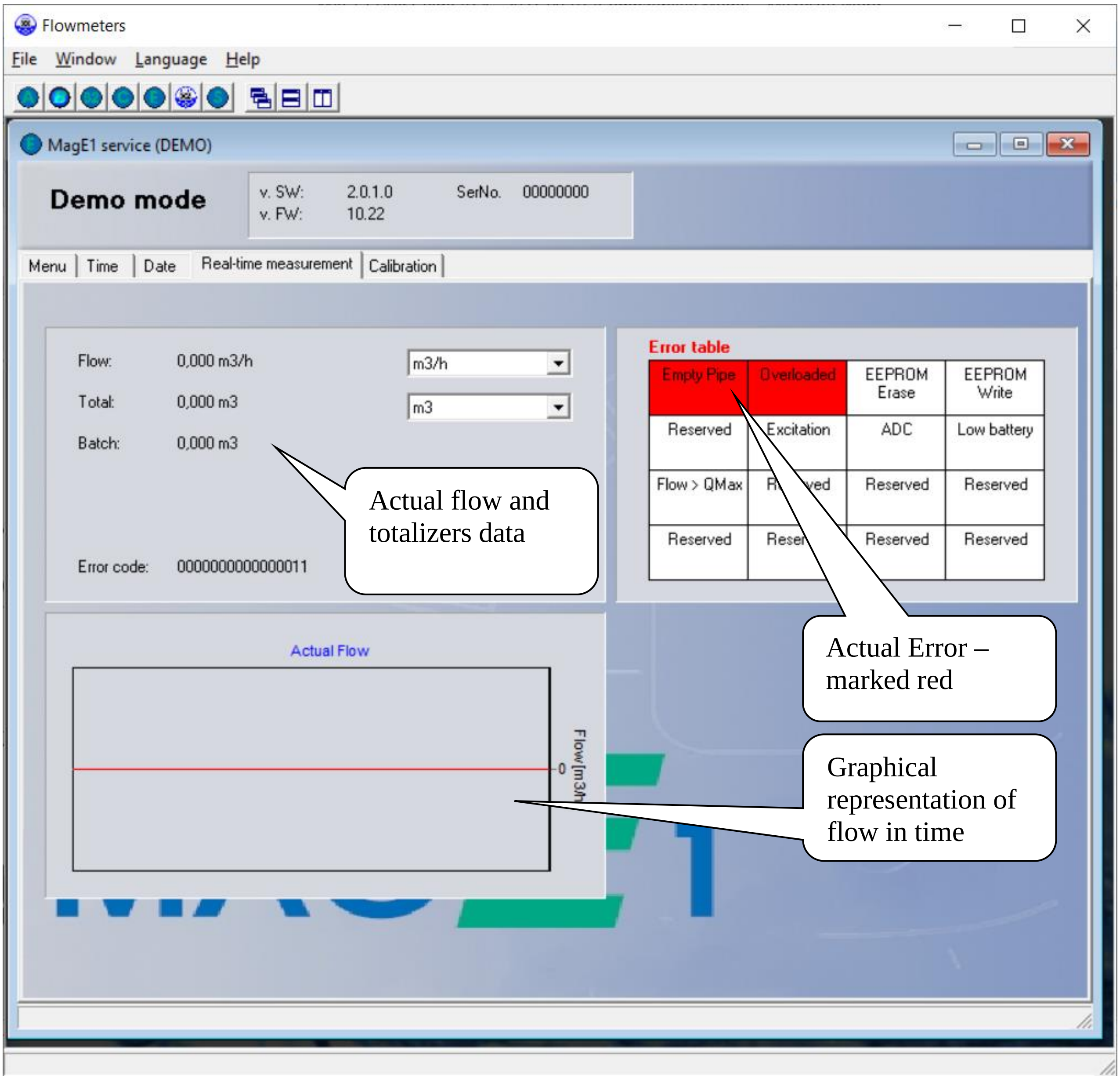


00 : 00

Now In Memory

Unknown

- *DATE* - The third tab from the left is "Date". Here, you can enter the correct 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.



Demo mode

v. SW: 2.0.1.0 SerNo. 00000000

v. FW: 10.22

Flow: 0,000 m3/h m3/h

Total: 0,000 m3 m3

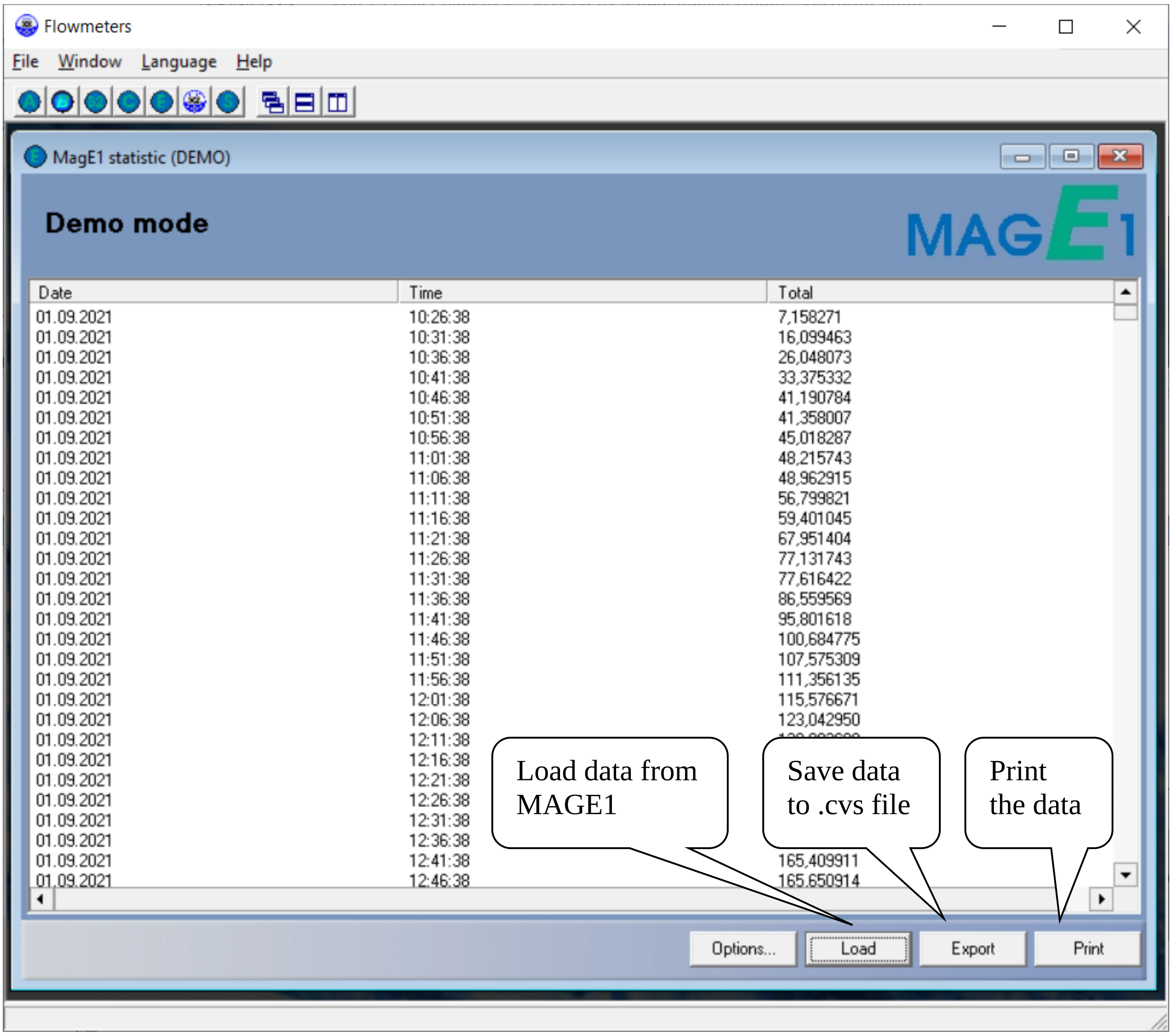
Batch: 0,000 m3

Error code: 0000000000000011

Error table

🟥 Empty Pipe	🟥 Overloaded	EEPROM Erase	EEPROM Write
Reserved	Excitation	ADC	Low battery
Flow > QMax	R ved	Reserved	Reserved
Reserved	Reser	Reserved	Reserved

10.4. Statistic section



Date	Time	Total
01.09.2021	10:26:38	7,158271
01.09.2021	10:31:38	16,099463
01.09.2021	10:36:38	26,048073
01.09.2021	10:41:38	33,375332
01.09.2021	10:46:38	41,190784
01.09.2021	10:51:38	41,358007
01.09.2021	10:56:38	45,018287
01.09.2021	11:01:38	48,215743
01.09.2021	11:06:38	48,962915
01.09.2021	11:11:38	56,799821
01.09.2021	11:16:38	59,401045
01.09.2021	11:21:38	67,951404
01.09.2021	11:26:38	77,131743
01.09.2021	11:31:38	77,616422
01.09.2021	11:36:38	86,559569
01.09.2021	11:41:38	95,801618
01.09.2021	11:46:38	100,684775
01.09.2021	11:51:38	107,575309
01.09.2021	11:56:38	111,356135
01.09.2021	12:01:38	115,576671
01.09.2021	12:06:38	123,042950
01.09.2021	12:11:38	[illegible]
01.09.2021	12:16:38	[illegible]
01.09.2021	12:21:38	[illegible]
01.09.2021	12:26:38	[illegible]
01.09.2021	12:31:38	[illegible]
01.09.2021	12:36:38	[illegible]
01.09.2021	12:41:38	165,409911
01.09.2021	12:46:38	165,650914

***.CSV file**

This format file is standard output format for databases. Examples open in Microsoft Excel.

11. Cleaning

MAGE1 electromagnetic flowmeters do not have any moving parts so special maintenance is not required, however we strongly recommend:

1. Once a year check overall meter appearance - check for any obvious mechanical damage or water leakage.

2. Do yearly mechanical cleaning of the sensor to remove any sedimentation from liner or electrodes. That is enough to rub the inside the tube with a piece of emery cloth

12. Specifications

12.1. Technical specification

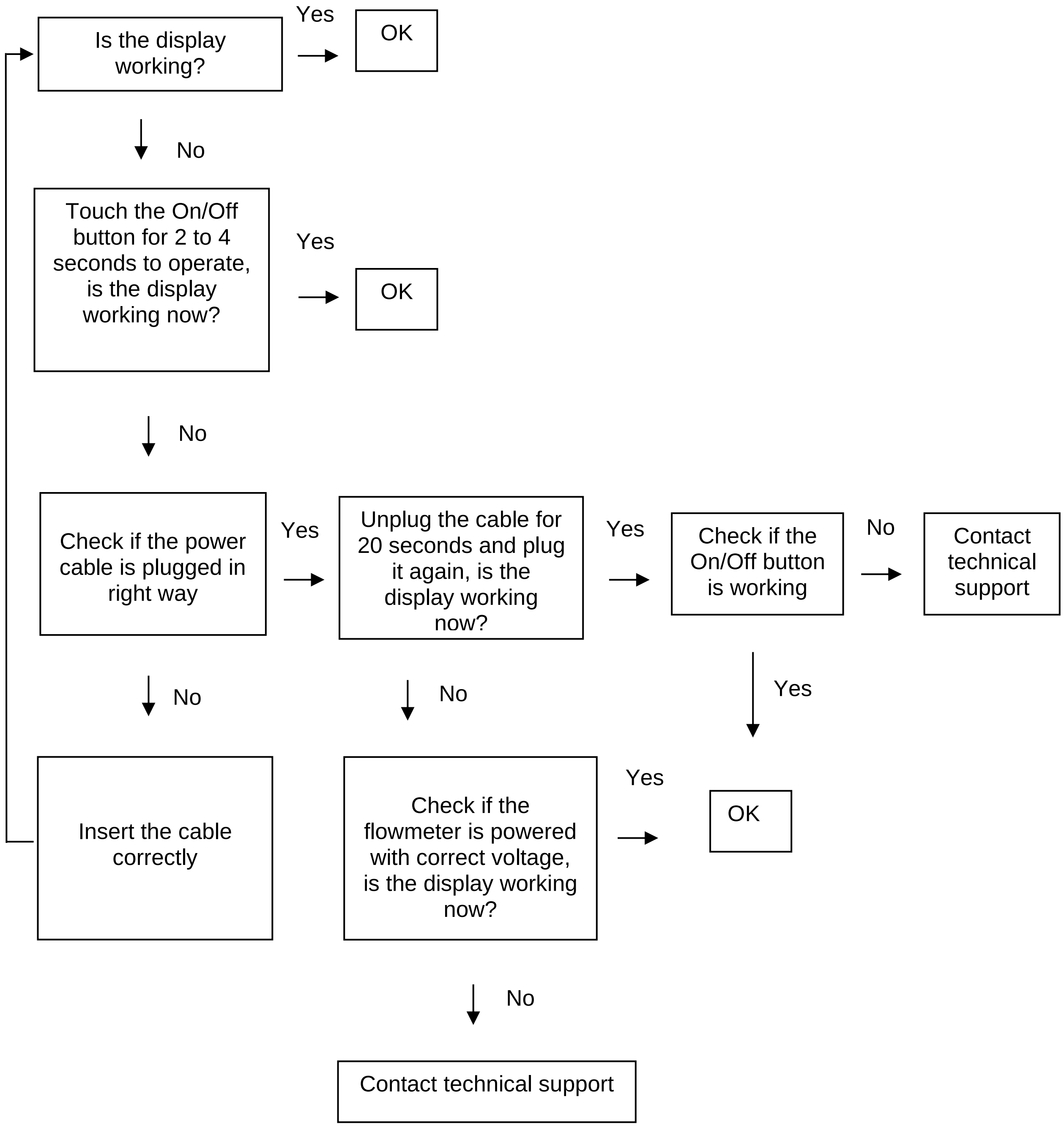
Measurable media	Conductive fluids
Min. media electrical conductivity	≥5µS/cm or ≥20µS/cm for demineralized water
Flow range	0,1 to 10 m/s
Displayed values	Flow range (m3/h, l/s, l/m, US Gal/min, UK Gal/min) Volume (m3, l, US Gal, UK Gal) Total Batch volume
Accuracy	±0,5% (0,5-10 m/s) of actual value
Power supply	9-35 VDC
Communication	Modbus RTU
Flow direction	Bi-directional measurement
Ambient temperature	-20 to 60°C
Display	LCD 128 x 64px graphical, sleep mode
Control	3 touch buttons
Housing material	Glass filled polyamide
Connector	CA 6 GS Connector
Electronics protection	IP67
Low flow cut-off	2% of full scale
Other features	Test of excitation coils Earthing through 3rd and 4th electrodes Empty pipe detection
4-20 mA output	Max. current 24 mA
Digital communication	RS485 communication bus +I/O
Data-logger	Flash memory 131072 records 15 seconds minimal record interval Saves date, time and total volume
Cable length	3 m as standard, other on request

12.2. Sensor specifications

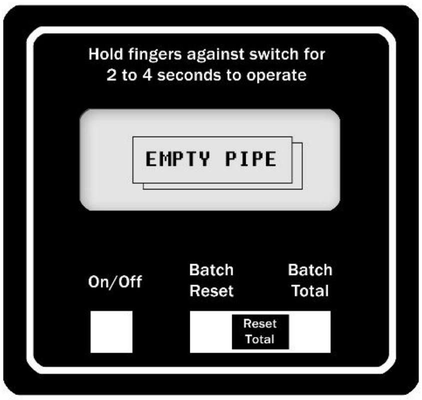
Connection types	DIN, ANSI, Other types on request
Flange	Steel 1.0036 or higher
Nominal size	25-250 mm, other sizes on request
Max. nominal pressure	PN40/300 psi
Ambient temperature	-20 to 60°C
Sensor	IP67
Liner	Hard Rubber, Hygienic Rubber, PTFE Other material on request
Electrodes	Hastelloy as standard, other materials on request
Measuring tube	Stainless steel 1.4301
Outer casing	Carbon steel (1.0036) as standard
External coating	Lacquered finish (anticorrosive)
Accessories options	Earthing rings for plastic and lined pipes
Coils resistance	100 Ω
Other features	Earthing through 3rd and 4th electrodes

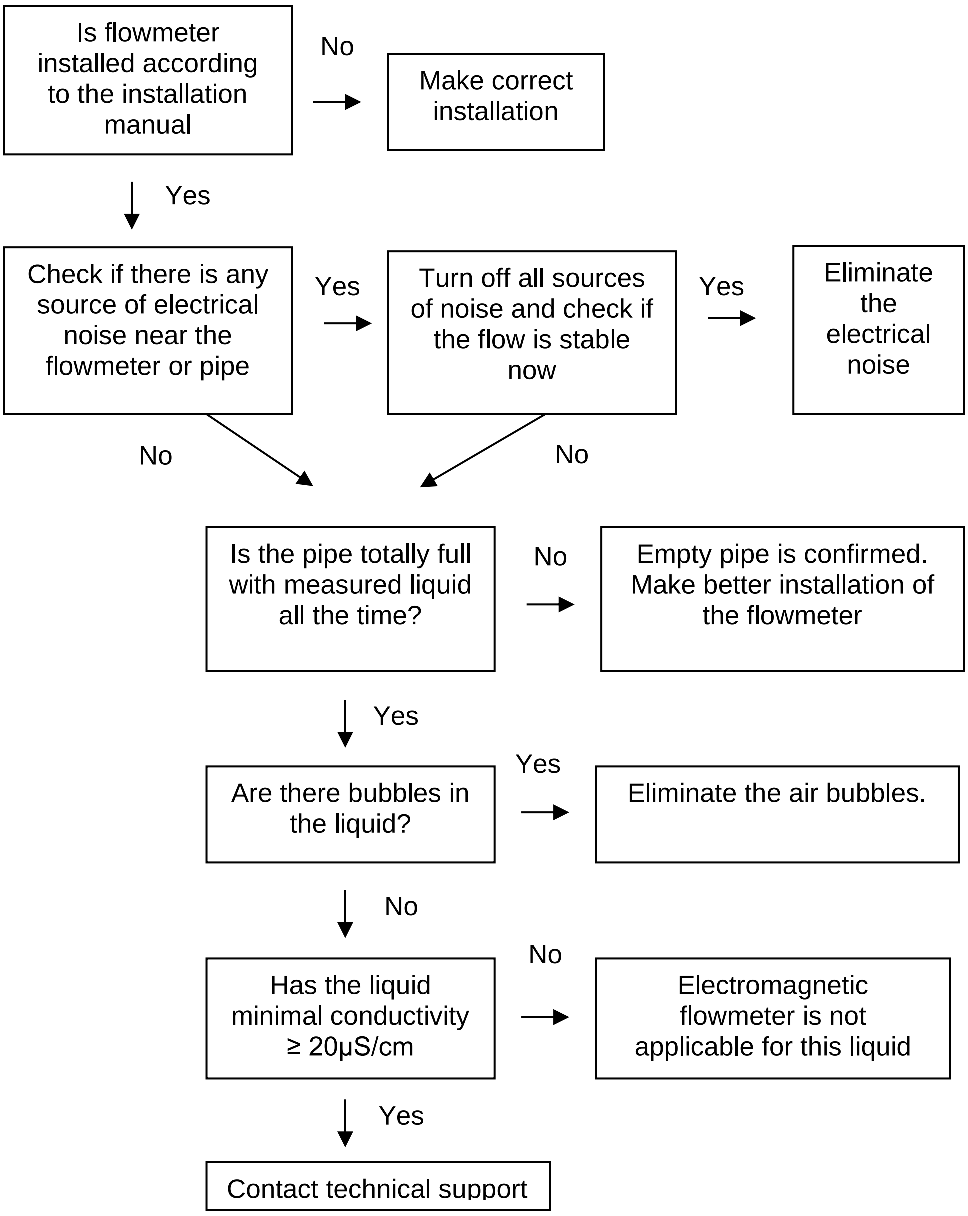
13. Troubleshooting

13.1. Trouble: non working display

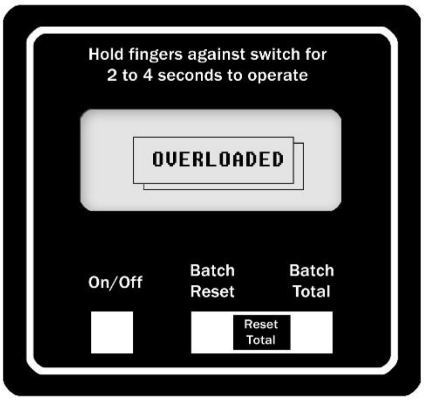


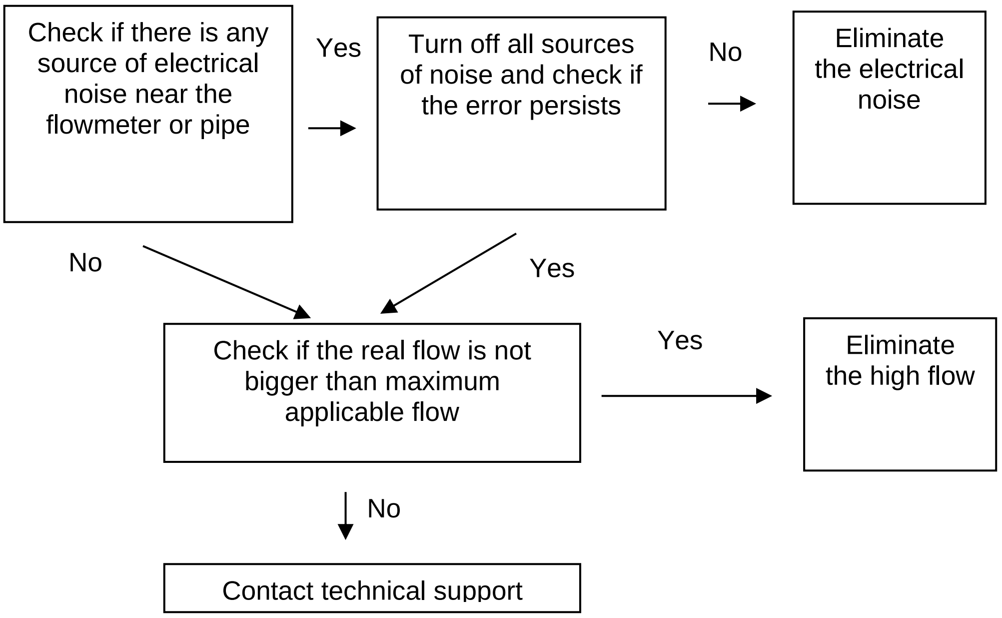
13.2. Trouble: Non stable flow or Empty pipe alarm



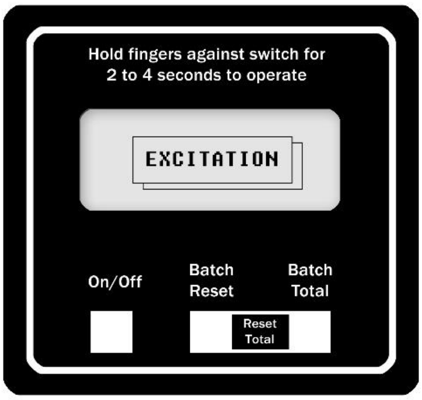


13.3. Trouble: Error overloaded



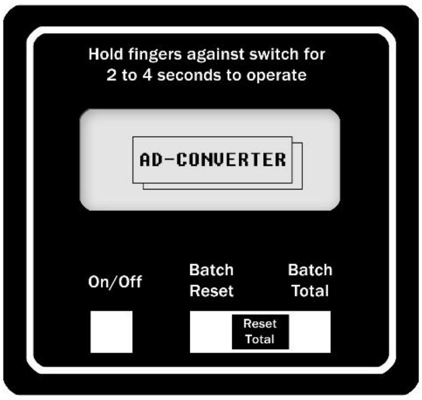


13.4. Trouble: Error excitation



Contact technical support

13.5. Trouble: AD – converter error



Contact technical support

14. How to order your MAGE1

In case you are interested in purchasing a MAGE1 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.

Model	**Ordering code**						**Description**
MAGE1	**1**	**2**	**3**	**4**	**5**	**6**	
							Version
	C						Compact
	R						Remote
							Connection
		D					DIN
		A					ANSI
							Size
			25-250				25-250 mm
			1 - 10				1" - 10"
							Liner
				HR			Hard Rubber
				PT			PTFE
				SR			Soft rubber
				NR			Hygienic rubber
							Pressure
					150		150psi
					300		300psi
					10		PN10
					16		PN16
					25		PN25
					40		PN40
							Electrodes
						HA	Hastelloy C
						TA	Tantalum
						TI	Titanium
						PL	Platinum

Example

MAGE1	C	D	100	HR	16	HA

Standard cable length is 3 m. Extra cable on request.

15. Appendix

15.1. Country of Origin

The MAGE1 Electromagnetic flowmeter is made in Czech Republic.

15.2. CE requirements

MAGE1 flowmeter are manufactured conforming to CE requirements.

15.3. 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.

15.4. Contact

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

Sales office: arkon@arkon.co.uk

Office hours:
8:30 – 18:00 (GMT+1)

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