envest

If you can't measure, you can't manage.

AQUA CNT

100S - 100F

100SL - 100FP

User Manual

Ver 1.2.1

INTRODUCTION

This document contains the user instructions for the AQUA CNT Compact Type Pump Control and Water Monitoring Device (will be referred as AQUA in the rest of the document). Please read this document carefully before the installation and the use of the device. The Compact Type Pump Control and Water Monitoring Devices are used in water wells, water supply stations, drinking water reservoirs and district metered areas (DMAs) to control the system and to collect data.

AQUA CNT is available with four different models such as 100S, 100F, 100SL and 100FP and each model comes with a specific package content.

HARDWARE SPECIFICATIONS

• Low Power Microcontroller
• Built-in flowmeter with minimum 1% sensitivity and with a measurement range of DN50-DN700 (Included only in 100F models).
• User interface with 64x128 Graphic LCD Screen and a membrane keypad.
• Built-in GSM/GPRS Modem (+5dBi antenna included).
• Battery Management Unit. Built-in DC UPS and charging regulator.
• 14,8V 12,800mA Li-Po Battery.
• 8MB ROM.
• 3 16-Bit Analog Inputs and 1 12-Bit Analog Output.
• 4 Digital Inputs amd 2 Digital (Relay) Outputs.
• Built-in assignable I/O table.
• MODBUS/TCP master/slave communication (supports up to 5 connections).
• IP Filtering and APN Support.
• The ability to update the Real Time Clock over GSM.
• IP 65 Protection.

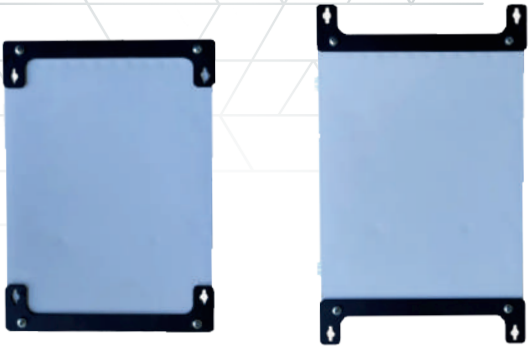
	AQUA 100S	AQUA 100F	AQUA 100FP	AQUA 100SL
AQUA CNT	✔	✔	✔	✔
Internal Flowmeter	–	✔	✔	–
Pressure Transmitter	–	–	✔	–
Water Level Transmitter	–	–	–	✔
Antenna	✔	✔	✔	✔
Ultrasonic Pad/Gel	–	✔	✔	–
Mounting Set	✔	✔	✔	✔
Clamps	–	✔	✔	–

Content Table

MOUNTING

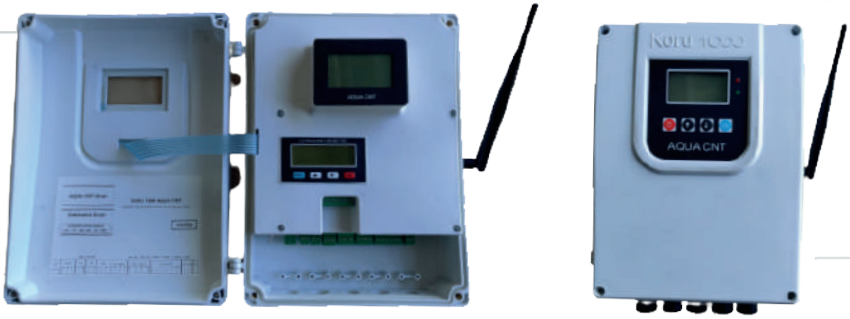
The installation of AQUA is pretty simple. By following the steps given in this chapter you can install your AQUA quite easily. As the first step, you should reverse the mounting pieces that are screwed behind AQUA as shown below.

By doing that AQUA will be enabled to be mounted on a wall-like surface. After reversing the mounting pieces, the cable glands should be installed to the threaded holes given below the case.



AQUA Back Profile

Lastly, to establish the communication, the MODEM antenna should be mounted as shown below.



AQUA Front Profile

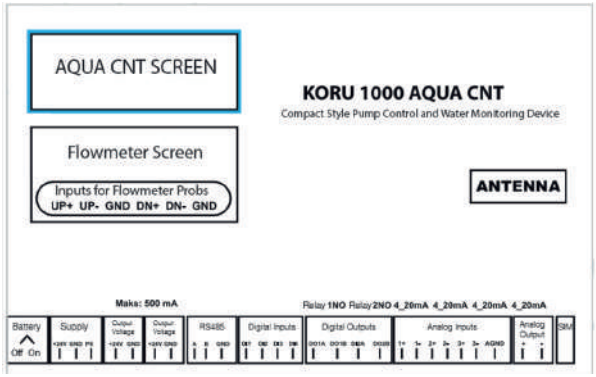
* It is advised to use an isolation transformer for the energy inputs of the device. The grounding for AQUA must be connected. The power cables for motors and/or drivers and the cables for signals and sensors must be passed through different cable routes. The cable that is used for the communication with the energy analyzer must be twisted and shielded.

INSTALLATION AND USE

In this chapter, the necessary information about the installation of AQUA are given.

Cable connection Scheme

In Figure 2.1, information regarding the terminals which are required to install and use AQUA are given.



AQUA Terminal Connections

Keypad and LED Indicators

There is a keypad on AQUA to be able to make the necessary adjustments and operate the device along with a green and a red LED indicator to give information about the state of the device. The keypad and the LED indicators are shown in Figure 2.2.

AQUA Keypad and LED Indicators

There are 4 buttons on the keypad, namely; C, UP, DOWN and OK. The functions of these buttons are explained below:

• The Button C has the functions to go back, return to the upper menu and to cancel.

• When entering a value, pressing the button C works as saving the value to the specific area.

• UP and DOWN buttons are used to navigate through menus. They are also used to change the value of the specific input when a value wants to be changed in a menu.

• OK button is used for saving and acknowledging operations. The OK button has some other special functions such as;

• In AQUA operating screen, when the buttons OK, UP and DOWN are pressed together, the device switches between automatic mode and manual mode.

• In AQUA operating screen, when the system is in manuel mode, the OK button functions as start and stop commands. These commands are operated with a delay of 30 seconds when OK button is pressed rapidly.

• In AQUA Alarms and Warnings screen, the OK button functions as erasing all the alarms.

The meanings of the LED indicators on the device are given below;

• The blink of the GREEN LED every one second indicates that the GPRS connection or the SCADA connection is established.

• The blink of the RED LED every one second indicates that the device has an alarm.

The LCD screen enters "sleep mode" when 60 seconds passes since the last time a button was pressed. In the sleep mode, the statement "Koru1000, Please press a key" is shown on the screen.

* Check the LED Screen Connector if there the screen light is ON yet no information is visible on the screen, or when the screen is not operating yet the membrane light is on.

DEVICE MENUS

The menus of the device can be reached through the help of the LCD screen and the keypad. These menus are further subcategorized into 8 sub-menus (Figure 2.3) and they are;

- Operating Screen
- System Settings
- Motor Operating Settings
- Motor Safety Settings
- Alarms and Warnings
- Modbus RTU Settings
- About
- Device Test

The Main Menus of AQUA

1. OPERATING SCREEN

The operating screen consists of 2 pages. When the screen is entered for the first time, the user sees page 1 of the operating screen. By the help of UP and DOWN keys, the user can navigate through the first and second pages. In figures 2.4 and 2.5, the first and the second page of the operating screen are shown respectfully.

The information that the Page 1 of the Operating Screen consists are; In the first line, hour, date and the reception levels are given. The reception level can vary between 0 and 31.

Reception	Explanation
0-16	Level 1 Reception
16-22	Level 2 Reception
22-26	Level 3 Reception
27-31	Level 4 Reception

• In the second line, the working status of the MODEM and the Device are given.

The status of the modem can be detected via the help of the LED that is on the MODEM module and the information that is given in here (Table 2.1).

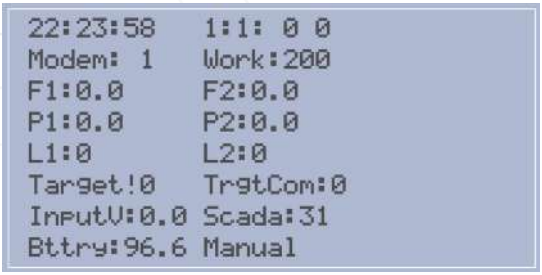


Figure 1.1 AQUA Operating Screen #1

Modem Status (Operating Screen)	Modem LED Status	Explanation
0	LED is off	Either the power regulator or the power on transistor of the modem is not functioning.
0	Blinking	The MODEM is powered and yet there is a problem regarding the communication. If the state is stuck at 0, the modem resets itself in every 150 seconds.
1	-	Device is Reading the SIM It is not possible to get to the next stage if there is a PIN Code required to activate the SIM . If there is no PIN and yet the status is still stuck at this point, it means that either the SIM is not working or there is a problem with the SIM Slot.
2	-	Trying to connect to the GSM network. If it is sturck at this stage and cannot proceed to the next, it means the reception is very low or the antenna is not connected.
15	-	GSM connection established. At this point, the device awaits for MODBUS TCP queries at the port 502 (the APN Network settings must be made for this to happen. The default APN setting is "mgbs")
102	-	The device is trying to connect to the target IP.

Table 1.1 Modem Operating Status Information

• By the help of the operation status, the user can have the knowledge of the state of operationg of AQUA. The information given here are explained in Table 2.2

• In the 3rd row, the flow rates of the Flowmeter 1 and Flowmeter 2 are shown (if the flowmeters are connected and defined).

STATUS	EXPLANATION	
0	No working scenario selected System is in Auto Mode	Motor is not working
10	Reservoir Filling Modeis selected Connected to the target reservoir	Motor is not working
11	Reservoir Filling Modeis selected Connected to the target reservoir	Motor is working
100	Reservoir Filling Modeis selected Not connected to the target reservoir – imitate the past emergency scenario activated	Motor is not working
101	Reservoir Filling Modeis selected Not connected to the target reservoir – imitate the past emergency scenario activated	Motor is working
120	Reservoir Filling Modeis selected Not connected to the target reservoir – imitate the past emergency scenario is not activated	Motor is not working
121	Reservoir Filling Modeis selected Not connected to the target reservoir – imitate the past emergency scenario is not activated	Motor is working
20	Pressure Modeis selected	Motor is not working
21	Pressure Modeis selected	Motor is working
200	Manual Mode	Motor is not working
201	Manual Mode	Motor is working
30	Pressure PI Mode is selected	Motor is not working
31	Pressure PI Mode is selected	Motor is working

Table 1.2 The State of Operation of AQUA

• In the 4th row, the pressure values of Pressure Sensor 1 and 2 are shown (if the pressure sensors are connected and defined).

• In the 5th row, the water level values of Water Level Transmitter 1 and 2 are shown (if the water level transmitters are connected and defined).

• In the 6th row, the water level of the target station and the time passed since the last establishment of the last connection to the target station device is shown. If the communication is successfully established with the target device, the data is shown as Target: (Value) cm. Otherwise it is shown as Target!:(Value) cm.

• In the 7th row the supply voltage and the time passed since the last connection between AQUA and the SCADA is established are given.

• In the 8th row, the battery charge percentage, the charging status of the battery and the information whether AQUA is in Auto or Manuel mode are given.

• In the 9th row, Battery: means the device is operated in normal mode while Battery!: means the device is operated in low-power mode.

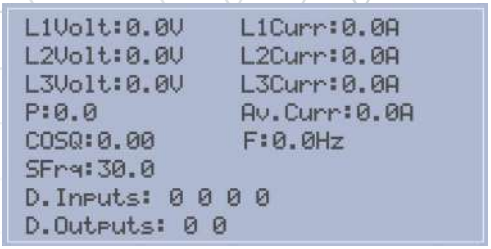


Figure 1.2 AQUA Operating Screen #2

The information given in the second screen of the Operating Screen are given as follows:

In 1st row, the Voltage (Volts) and Current (Amps) values of L1 are given.

In 2nd row, the Voltage (Volts) and Current (Amps) values of L2 are given.

In 3rd row, the Voltage (Volts) and Current (Amps) values of L3 are given.

In 4th row, the Active Power (kiloWatts) and the Average Current (Amps) values are given.

In 5th row, the cosΦ and the Network Frequency (Hz) are given (If the value of cosΦ is not in between 0 and 1, the connections of the current transformer must be checked and the neccesity of reversing the terminal connections must be analyzed).

In the 6th row, the Output Reference Frequency of the Inverter is given

In the 7th and 8th rows, the physical states of the digital inputs and digital outputs are given respectively.

2. SYSTEM SETTINGS

The system settings is where the necessary settings of AQUA are set. The parameters can be reached through up and down keys.

The Allowed IP and IP filtering

In AQUA, two different IP filters can be defined. These filters are defined in the screens with the header "ALLOWED IP" from 1-1 to 2-4.

Every IP has 4 octets and each octet can be set in a specified screen. The octets can be set such as entering the first octet of the IP at the screen ALLOWED IP 1-1 and the second octet at the screen ALLOWED IP 1-2 and so on.

The same procedure applies when setting the second IP filter.

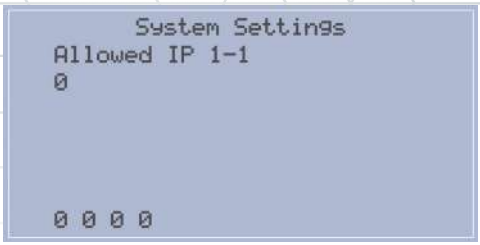


Figure 2.1 IP Filtering Screen for IP1-Octet1

Target IP

If AQUA is going to communicate with the target device directly and read the water level automatically from the target device, the IP of the target device is set from the screens with the header "TARGET IP". In Figure 2.7, the Target IP Octet 1 setting screen is given.

Figure 2.2 Target IP Octet 1 Setting Screen

Target Modbus Register Address

The Modbus Address of the register that is going to be read from the Target Device is set in this screen (Figure 2.8). If the target value is a floating point value, the value 10000 should be added to the Modbus address of the register.

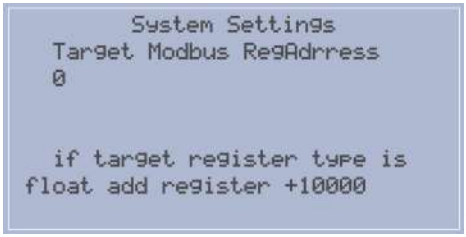


Figure 2.3 Target Modbus Register Address Setting

Target Modbus ID

The Modbus Network Address of the target device is set in this screen (Figure 2.9). If the device to be communicated with is an AQUA, the network ID must be set as 3.

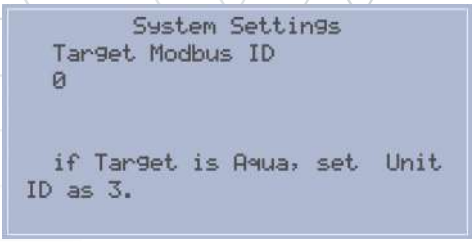


Figure 2.4 Target Modbus ID Setting

Target Query Port

In this screen the TCP query port is defined. After completing this setting, the settings that are required to communicate with target is completed (Figure 2.10). If the target device is an AQUA, the port must be set as 502.

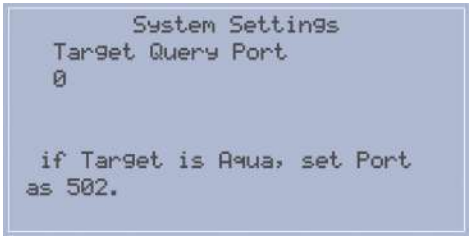


Figure 2.5 Target Query Port Setting

Flowmeter 1 Range Set (m^3/s)

In this setting, if the flowmeter is connected to an analog input, the maximum range value of the Flowmeter 1 is set as an integer in m^3/s.

Flowmeter 2 Range Set (m^3/s)

In this setting, if the flow meter is connected to an analog input, the maximum range value of the flowmeter 2 is set as an integer in m^3/h. In Figure 2.11, the setting for the range value of Flowmeter 1 is given. The range of flowmeter 2 is adjusted in the same manner in the following screen.

Figure 2.6 The Setting for The Range Value of Flowmeter 1

Pressure Sensor 1 Range Set (bar)

In this setting, the maximum range value of the Pressure Sensor 1 is set as an integer in bars.

Pressure Sensor 2 Range Set (bar)

In this setting, the maximum range value of the Pressure Sensor 2 is set as an integer in bars.

In Figure 2.12, the setting for the range value of Pressure Sensor 1 is given. The range of the Pressure Sensor 2 is adjusted in the same manner in the following screen.

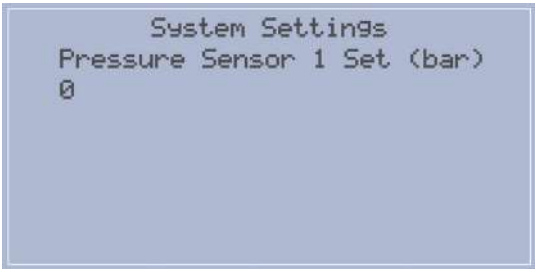


Figure 2.7 The setting for the range value of the Pressure Sensor 1

Water Level Transmitter 1 Range Set (cm)

In this setting, the maximum range value of the Water Level Transmitter 1 is set as an integer in centimeters.

✻ What is Static Ground Water Level?

This is the distance between the ground level and the water level *when the pump is not running*. It is found by subtracting the water level above the sensor from the sensor mounting level.

What is Dynamic Ground Water Level?

This is the distance between the ground level and the water level *when the pump is running*. It is found by subtracting the water level above the sensor from the sensor mounting level.

Water Level Transmitter 2 Range Set (cm)

In this setting, the maximum range value of the Water Level Transmitter 2 is set as an integer in centimeters.

In Figure 2.13, the setting for the range value of Water Level Transmitter 1 is given. The range of the Water Level Transmitter 2 is adjusted in the same manner in the following screen.

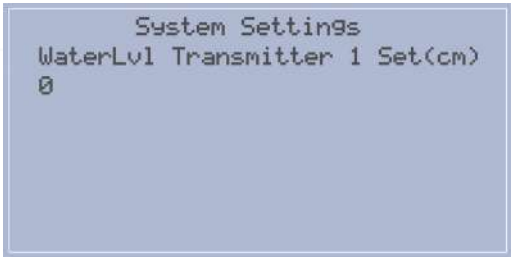


Figure 2.8 The Setting for the Range Value of the Water Level Transmitter 1

Flowmeter 1 Input Selection

The physical input of the Flowmeter 1 is set in this screen (Figure 2.14). The options are given in Table 2.3 and these options apply to Flowmeter 2 as well.

Flowmeter 1 Input Selection

The physical input of the Flowmeter 2 is set in this screen.

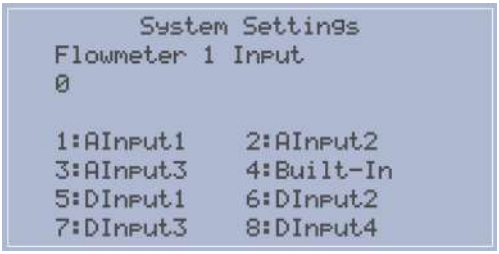


Figure 2.9 The Options for The Physical Connections of Flowmeter 1

Input	Definition	Input	Definition
0	No Input	5	Digital Input 1
1	Analog Input 1	6	Digital Input 2
2	Analog Input 2	7	Digital Input 3
3	Analog Input 3	8	Digital Input 4
4	Built-In		

Table 2.3 Flowmeter Input Options

Pressure Sensor 1 Input Selection

The physical input of the Pressure Sensor 1 is set in this screen (Figure 2.15). The options are given in Table 2.4 and these options apply to Pressure Sensor 2, Water Level Transmitter 1 and Water Level Transmitter 2 as well.

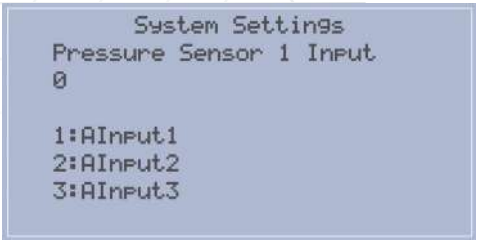


Figure 2.10 The Options for the Physical Connections of Pressure Sensor 1

Input	Definition
0	No Input
1	Analog Input 1
2	Analog Input 2
3	Analog Input 3

Table 2.4 Pressure Sensor and Water Level Transmitter Input Options

Pressure Sensor 2 Input Selection

The physical input of the Pressure Sensor 2 is set in this screen (Table 2.4).

Water Level Transmitter 1 Input Selection

The physical input of the Water Level Transmitter 1 is set in this screen (Table 2.4).

Water Level Transmitter 2 Input Selection

The physical input of the Water Level Transmitter 2 is set in this screen (Table 2.4).

Circuit Breaker Input Selection

The physical input of the circuit breaker is set in this screen (Table 2.5).

Motor Started Information Input Selection

The physical input of the “Motor is Running” Information is set in this screen (Table 2.5).

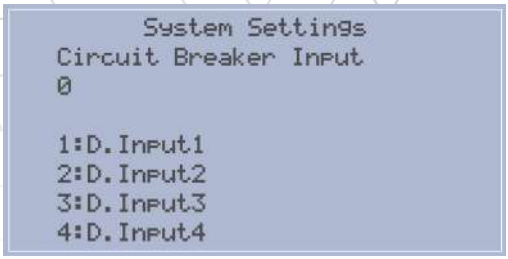


Figure 2.11 The Setting for the Circuit Breaker Input

Input	Definition
1	Digital Input 1
2	Digital Input 2
3	Digital Input 3
4	Digital Input 4

Table 2.5 The Input Options For The Circuit Breaker

Water Level Relay Input

The physical input of the water level relay is set in this screen. The options are the same as of the circuit breaker input options (Table 2.5).

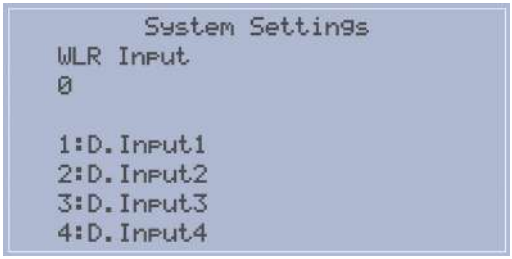


Figure 2.12 The Setting for the Water Level Relay Input

Flowmeter Pulse Factor

If the flowmeter is connected to a digital input, the number of pulses required for the 1m³ of water to pass through is defined in this setting.

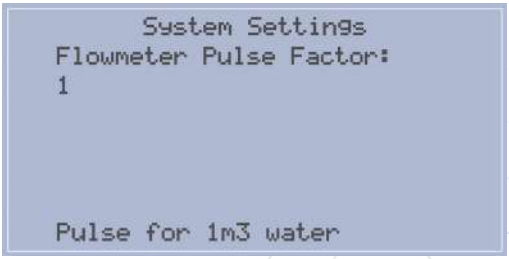


Figure 2.13 The Flowmeter Pulse Factor

Motor Start Output

The physical output to supply the start contact for the motor is set in this setting (Figure 2.19). The options are given in Table 2.6.

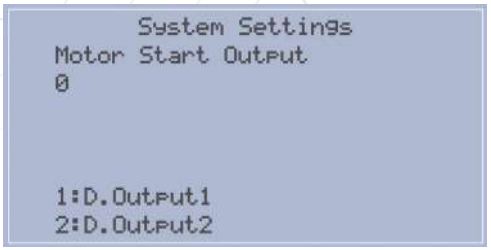


Figure 2.14 The Setting for the Motor Start Output

0	No Output
1	Digital Output 1
2	Digital Output 2

Table 2.6 The Output options for the motor start contact

Logging Interval (min)

When the communication with the device is interrupted or disconnected, the device logs the values of the sensor values and status bits with a given interval. That interval is set in this screen between 1 and 1000.

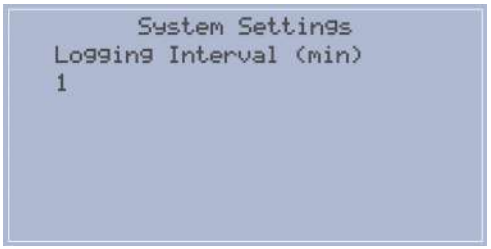


Figure 2.15 The Setting for Logging Interval

APN Network

AQUA supports APN Networks and here in this screen the APN network can be defined(Figure 2.16).

Figure 2.16 Setting for Defining an APN

Motor Reference Output

In case of the use of an inverter, the reference frequency value is entered in this screen. The value is entered by multiplying the reference frequency by 10 (Figure 2.22). For example, for the reference frequency of 45,5Hz, the value 455 must be entered.

* The minimum value of the reference output is (when the motor is running) set to be 30 Hz.

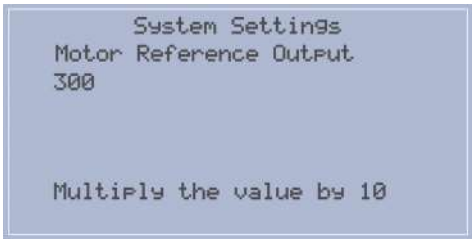


Figure 2.17 The Setting for Motor Reference Frequency

Motor Max Reference

In case of the use of an inverter, the maximum reference frequency value is set in this screen (Figure 2.23). The default maximum reference value is 50 Hz.

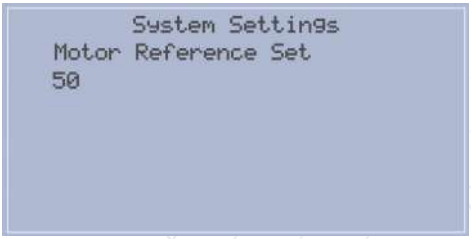


Figure 2.18 The Setting for Motor Reference Frequency

Low Power Mode

Here the low-power mode can be activated (Figure 2.24). If this mode is activated, in the stations where AQUA is supplied by a solar panel, the device stops the communications to operate on Low Power Mode when the battery voltage gets less than %40.

This attribute is only valid for versions 1.2 or higher

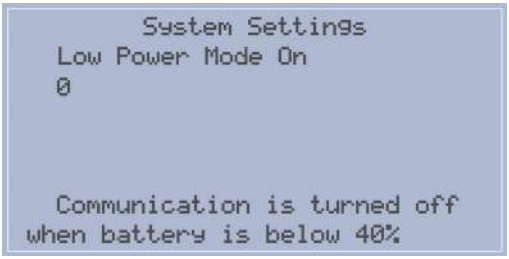


Figure 2.19 The Setting to Activate Low-Power Mode

Flowmeter Selection

In case of the use of serial communications to read data from flowmeters, the type of flowmeters can be selected in this screen (Figure 2.25).

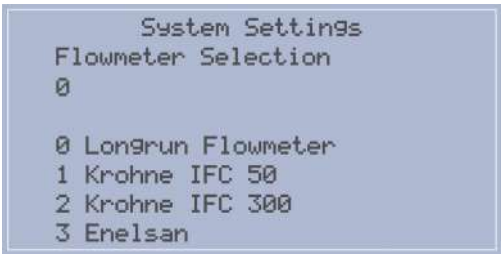


Figure 2.20 Setting for Flowmeter Selection

0	Longrun
1	Krohne IFC50
2	Krohne IFC300
3	ENELSAN

Table 2.7 Flowmeter options

In case of a need for adding more devices that could be read through RS485, please contact the manifacturer to make a request. After the evaluation process, the R&D team will add the requested devices among the devices read by AQUA through RS485.

Activating the Energy Analyzer

The activation of the communication with the energy analyzer is done in this screen (Figure 2.26).

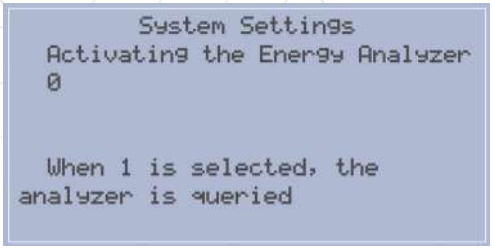


Figure 2.21 Setting for Activating the Communication With an Energy Analyzer

Energy Analyzer Selection

AQUA can communicate with three different previously defined energy analyzers. The defined analyzer models and the values to select those models are;
for Klemsan KLEA220P, enter 0;
for Entes MPRS332S, enter 1;
and for Schneider PM2100, enter 2.

Figure 2.22 Setting for Energy Analyzer Selection

3. MOTOR OPERATING SETTINGS

Operating Mode

If AQUA is used to control a motor, the scenario with which the motor is to be operated is set in this screen (Figure 3.1). The options are given in Table 3.1.

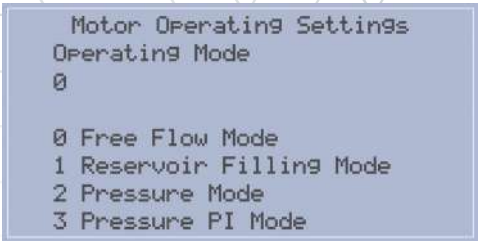


Figure 3.1 The Setting for Operating Mode

0	Free Flow Mode
1	Reservoir Filling Mode (RFM)
2	Pressure Mode (PM)
3	Pressure PI Mode (PIM)

Table 3.1 Options for Operating Mode

Target Minimum Water Level

In case of the selection of RM, the minimum water level of the reservoir (the level when the pump starts working) to be filled is set in this screen in centimeters (Figure 3.2).

Target Maximum Water Level

In case of the selection of RM, the maximum water level of the reservoir (the level when the pump stops working) to be filled is set in this screen in centimeters.

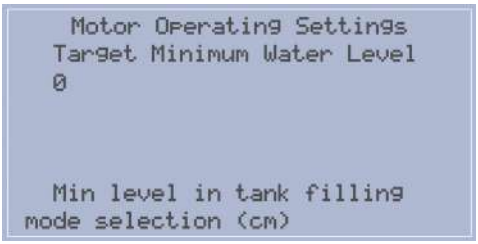


Figure 3.2 The Setting for the Minimum Water Level for RM

Pressure Mode Minimum Pressure

In case of the selection of PM, the minimum pressure level required for the pump to start working is set in this screen in bars (the entered value must be multiplied by a hundred) (Figure 3.2). For example, if the value to be set is 4,55 bars, the value should be entered as 455 bars.

Pressure Mode Maximum Pressure

In case of the selection of PM, the maximum pressure level required for the pump to stop working is set in this screen in bars (the entered value must be multiplied by a hundred). For example, If the value to be set is 6,55 bars, the value should be entered as 655 bars.

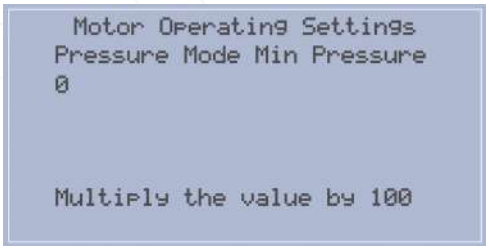


Figure 3.3 The Setting for PM Minimum Pressure

Pressure PI Mode Set Pressure

In case of the selection of PIM, the desired pressure value is set in this screen (the value must be multiplied by a hundred when entered) as shown in Figure 3.4.

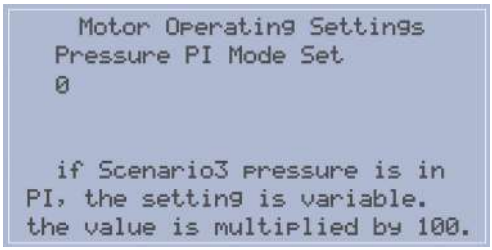


Figure 3.4 The Setting for PIM Set Pressure

Pressure PI Mode Cycle Time

In case of the selection of PIM, the cycle time is set in this screen in miliseconds (Figure 3.5).

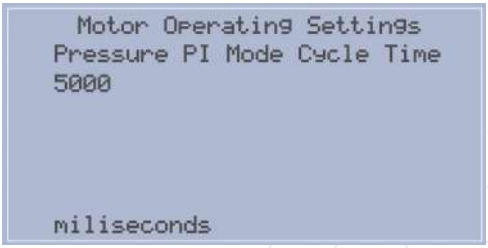


Figure 3.5 The Setting for PIM Mode Cycle Time

Emergency Scenario

The emergency scenario is activated in this screen (Figure 3.6).

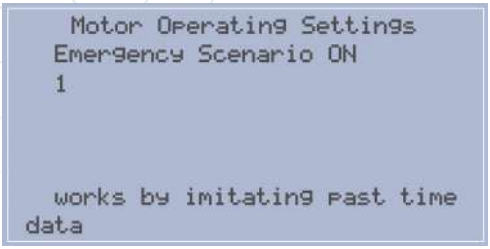


Figure 3.6 The Setting for Activating the Emergency Scenario

If the emergency mode is activated and the operating mode is set as 1 (RFM), in case of a failure in the communicate with the target device, AQUA follows the routine of the last day when the communication was established and operates the motor by imitating this routine. The period for sampling the start and stop states of the motor is 15 minutes.

Critical Situation Waiting Time

If the emergency mode is NOT activated and the operating mode is set as 1 (RFM), in case of a failure in communicating with the target device, AQUA makes sure that the motor starts and stops with given time periods. The time that needs to elapse before the motor starts working is set in this screen in minutes (Figure 3.7). The value must be between 10 and 300.

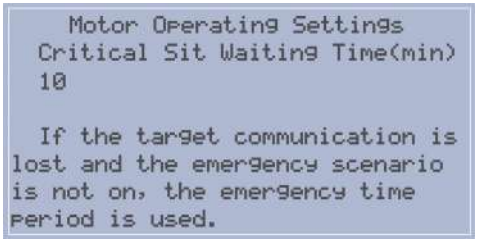


Figure 3.7 The Setting for the Critical Situation Waiting Time

Critical Situation Working Time

If the emergency mode is NOT activated and the operating mode is set as 1 (RFM), in case of a failure in communicating with the target device, AQUA makes sure that the motor starts and stops with given time periods. The time that needs to elapse before the motor stops working is set in this screen in minutes. The value must be between 10 and 300.

* The critical situation only works when there is a communication failure with the target and the emergency scenario is not activated (in RFM) and keeps on working until the communication is re-established.

SCADA Link Active

This setting must be activated when the operating mode is selected as 1 (RFM) and the water level of the target station is wanted to be linked to AQUA through a SCADA (Figure 3.8).

If this setting is not activated and the target IP settings are completed, AQUA tries to communicate with the target device directly.

When this setting is activated along with target IP settings, the water level is obtained through the SCADA Link. When the communication with the SCADA is distrupted (10 minute passes since the last successful communication), then AQUA tries to communicate with the target device directly until the SCADA communication is re-established.

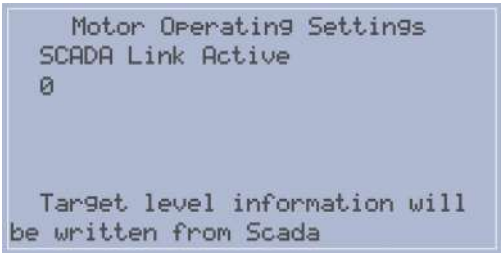


Figure 3.8 Setting for Activating the SCADA Link

Take Pressure Sensor 2 as Reference

If PM and PIM modes are to operate depending on the value read from the Pressure Sensor 2, this reference should be activated (Figure 3.9). In this case the reference pressure will be the value read from the pressure sensor 2 rather than the value read from the pressure sensor 1.

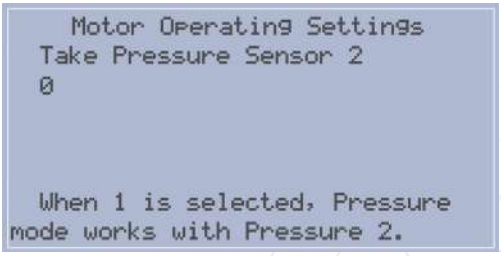


Figure 3.9 The Setting for Setting Pressure Sensor 2 as the Reference Pressure

Clear the Device Log

The Device Log can be cleared in this screen.

Anti-Icing Mode

This mode makes sure that, when the weather is cold enough to turn water into ice in the pipelines, pump works for 5 minutes in every 90 minutes to prevent icing (Figure 3.10).

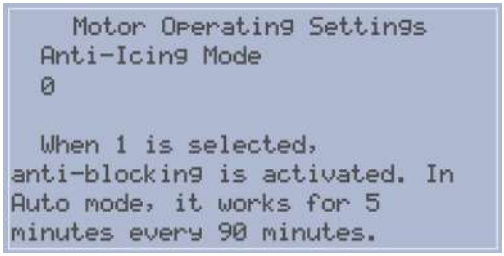


Figure 3.10 The Setting to Activate Anti-Icing Mode

4. MOTOR SAFETY SETTINGS

In order to prevent possible faults in the system and protect the motor, AQUA, with the help of the connected sensors and peripheral units, has a set of built in safety settings. When the values read from the analog inputs exceed the limits for a given time, the device will give an alarm about that specific value and stops the motor. The system gives an alarm about that specific value if the lower and upper limits for that specific alarm is given and also the limits are greater than zero.

Minimum Water Level Safety

If the Water Level Transmitter is defined in the device, when the water level of either the well or the reservoir the motor draws water from gets less than the value set in this screen, the motor stops. The value must be set in centimeters (Figure 4.1).

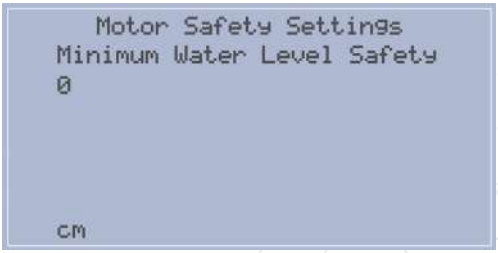


Figure 4.1 The Setting for Water Level Safety – Minimum Level

Maximum Water Level Safety

If the Water Level Transmitter is defined in the device, when the water level of either the well or the reservoir the motor draws water from gets higher than the value set in this screen, the motor stops. The value must be set in centimeters.

Minimum Current Safety

If the Energy Analyzer is defined in the device, when the current that the motor draws gets less than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in amps (Figure 4.2). For example, for 10,5 Amps, 105 must be entered.

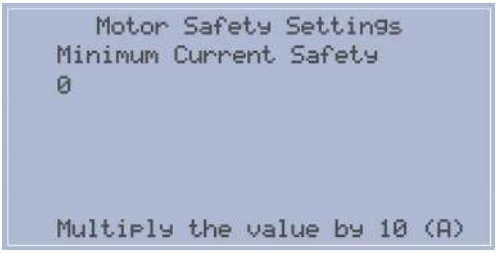


Figure 4.2 The Setting for Current Safety – Minimum Current

Maximum Current Safety

If the Energy Analyzer is defined in the device, when the current that the motor draws gets more than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in amps. For example, for 50,2 Amps, 502 must be entered.

Minimum Pressure Safety

If the Pressure Sensor 1 is defined in the device, when the pressure value gets less than the value set in this screen, the motor stops. The value must be multiplied by 100 and the unit is in bars (Figure 4.3). For example, for 3,48 Amps, 348 must be entered.

Figure 4.3 The Setting for Pressure Safety – Minimum Pressure

Maximum Pressure Safety

If the Pressure Sensor 1 is defined in the device, when the pressure value gets more than the value set in this screen, the motor stops. The value must be multiplied by 100 and the unit is in bars . For example, for 6,54 Amps, 654 must be entered.

Minimum Waterflow Safety

If the Flowmeter 1 is defined in the device, when the waterflow value gets less than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in m3/h (Figure 4.4). For example, for 10,5 cubic meters, 105 must be entered.

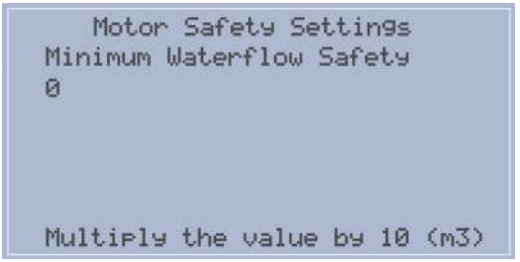


Figure 4.4 The Setting for Waterflow Safety – Minimum Flow

Maximum Waterflow Safety

If the Flowmeter 1 is defined in the device, when the waterflow value gets more than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in m3/h . For example, for 20,5 cubic meters, 205 must be entered.

Minimum Voltage Safety

If the Energy Analyzer is defined in the device, when the Voltage that the motor is supplied with gets less than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in volts (Figure 4.5). For example, for 280 Amps, 2800 must be entered.

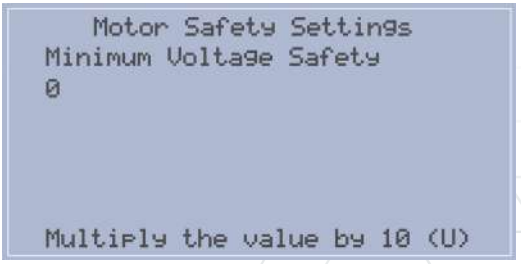


Figure 4.5 The Setting for Voltage Safety – Minimum Voltage

Maximum Voltage Safety

If the Energy Analyzer is defined in the device, when the Voltage that the motor is supplied with gets more than the value set in this screen, the motor stops. The value must be multiplied by 10 and the unit is in volts (Figure 4.5). For example, for 382 Amps, 3820 must be entered.

Water Level Safety Time

In this screen the time that needs to pass for the water level safety alarm to occur is set (Figure 4.6). When the value gets out of the limit specified by the lower and higher limits specified above, the device waits for the amount of time specified here and then forms an alarm.

Figure 4.6 The Setting for water level safety time

Current Safety Time

In this screen the time that needs to pass for the current safety alarm to occur is set. When the value gets out of the limit specified by the lower and higher limits specified above, the device waits for the amount of time specified here and then forms an alarm.

Pressure Safety Time

In this screen the time that needs to pass for the pressure safety alarm to occur is set. When the value gets out of the limit specified by the lower and higher limits specified above, the device waits for the amount of time speci fied here and then forms an alarm.

Waterflow Safety Time

In this screen the time that needs to pass for the waterflow safety alarm to occur is set. When the value gets out of the limit specified by the lower and higher limits specified above, the device waits for the amount of time specified here and then forms an alarm.

Voltage Safety Time

In this screen the time that needs to pass for the voltage safety alarm to occur is set. When the value gets out of the limit specified by the lower and higher limits specified above, the device waits for the amount of time speci fied here and then forms an alarm.

5. ALARMS AND WARNINGS

The alarms and warnings that form in the device are shown here. The alarms are reset by AQUA 3 times in a row with a 15 minutes of breaks and if an alarm still forms that alarm needs to be reset by the user manually (Figure 5.1). The defined alarms are given in Table 5.1

Figure 5.1 Alarms and Warnings

ALARM	DEFINITION
Current Alarm	Current out of limits
Pressure Alarm	Pressure out of limits
Waterflow Alarm	Waterflow out of limits
Motor Operation Alarm	The motor start information does not come within 30 seconds after the motor is started
Motor Circuit Breaker Alarm	The circuit breaker is not set or the driver is not ready
Water Level Alarm	Water Level out of limits
Analyzer Comm. Error	Analyzer Comm. Is not established when Current Limits are set
Flowmeter Comm. Error	Flowmeter Comm. Is not established when flowmeter limits are not set
Analyzer Comm. Warning	Analyzer Comm. Is not established when Current Limits are not set
Battery Temperature Low	Battery NTC is lower than 0C
Battery Temperature High	Battery NTC is higher than 45C
Memory Cannot be reached	Please contact the authorized service
ADC Channel 1 Cannot be reached	Please contact the authorized service
ADC Channel 2 Cannot be reached	Please contact the authorized service
ADC Channel 3 Cannot be reached	Please contact the authorized service
Driver Works in hand mode	Motor Start information comes without giving the start command
Low power mode active	The battery is low and the supply voltage is not present
Voltage alarm	Voltage out of limits
Supply Voltage	Low supply voltage
Battery closed	Battery switch Closed

Tablo 5.1 Defined Alarms

6. MODBUS RTU SETTINGS

In this section the serial communication parameters that need to be set when communicating with a flowmeter or an energy analyzer are indicated (Figure 6.1). The settings must be set as follows;

- The serial communication parameters: 9600/8/N
- Flowmeter Modbus ID: 1
- Energy Analyzer Modbus ID: 2

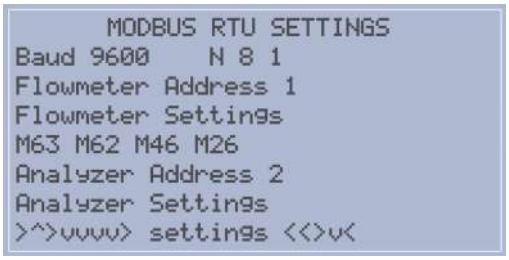


Figure 6.1 MODBUS RTU Settings

7. ABOUT AND DEVICE TEST

In the about screen the information about the manufacturer, the hardware and software versions of AQUA, Static IP, IMEI Number and Serial number of the device are given (Figure 7.1)

Figure 7.1 About Screen

In the test screen the physical terminals of the device are tested. For this, a specific instrument is needed and these tests are conducted by the manifacturer (Figure 7.2)

Figure 7.2 Device Test Screen

MODBUS TCP Communication Table

AQUA devices come with a built in 2G modem and Modbus TCP Communication support.AQUA can respond up to 5 querries.

If there is only 1 querry at the same time the querry intervals should be 1 second or longer. In devices that have both SCADA and device querries, the communication interval should be at least 15 seconds.

The device can respond to a querry with a 64 word long response. In querries, the port 502, the standard Modbus Port, is used.

The device can respond to FC3, FC6, FC16 and FC22 Modbus commands. The Modbus Address table is given below.

The registers after Control Word 2 (Control Word 2 included) are stored in flash memory.

Register Addr.	Register Name	Data Type	Factor	Definition
0	L1 Voltage	WORD	/10	
1	L1 Current	WORD	/10	
2	L2 Voltage	WORD	/10	
3	L2 Current	WORD	/10	
4	L3 Voltage	WORD	/10	
5	L3 Current	WORD	/10	
6	Average Current	WORD	/10	
7	CosΦ	WORD	/10	
8	Active Power	WORD	/10	
9	Frequency	WORD	/10	
10	Flowmeter Totalizer	FLOAT		
11				
12	Total Active Power	DWORD		
13				
14	Total Reactive Power	DWORD		
15		WORD		
16	Digital Inputs	WORD		
17	Flow-1	WORD	/10	
18	Flow-2	WORD	/10	
19	Pressure-1	WORD	/100	
20	Pressure-2	WORD	/100	
21	Water Level -1	WORD		
22	Water Level -2	WORD		
23	Battery Charge Level	WORD		
24	RTC (EPOCH TIME)	DWORD		Updated through GSM. In UNIX Time Stamp Format
25		WORD		
26	Warnings -1	WORD		Details Given Below
27	Warnings -2	WORD		Details Given Below
28	Alarms -1	WORD		Details Given Below
29	Alarms -2	WORD		Details Given Below
30	Status Word	WORD		Details Given Below
31	Supply Voltage	WORD	/10	Details Given Below
32	NTC Battery Temperature	WORD	/10	Real Temperature Value
33	Target Level			
34	Dynamic Water Level			

Register Addr.	Register Name	Data Type	Factor	Definition
35	Static Water Level			
36	NPSH			
37	Digital Outputs			
38	ControlWord-1			
39	ControlWord-2			
40	Driver Output Frequency	X10		
41	Water Level Sensor Mounting Level			
42	Pump Mounting Level			
43	Operating Mode			0- Free Mode 1- RFM, 2-PM, 3-PIM
44	Motor Start Output			
45	Water Level Safety Time			
46	Current Safety Time			
47	Voltage Safety Time			
48	Pressure Safety Time			
49	Waterflow Safety Time			
50	PI Timer			
51	Voltage Safety Min. Voltage			
52	Voltage Safety Max. Voltage			
53	Target IP 1-1			
54	Target IP 1-2			
55	Target IP 1-3			
56	Target IP 1-4			
57	Target Modbus Address			If the address is bigger than 10000 the value will be read as floating point value.
58	Target Modbus ID			If the target is AQUA, enter 3
59	Target Modbus Port			If the target is AQUA, enter 502
60	Target Min. Water Level			
61	Target Max. Water Level			
62	Min. Pressure		X100	
63	Max Pressure		X100	
64	Driver Max. Frequency			
65	Critical Situation Wait Time			
66	Critical Situation Work Time			
67	Pressure PI Set Value			
68	Water Level Safety Min. Level			

Register Addr.	Register Name	Data Type	Factor	Definition
69	Water Level Safety Max. Level			
70	Current Safety Min. Current			
71	Current Safety Max. Current			
72	Pressure Safety Min. Current			
73	Pressure Safety Max. Current			
74	Waterflow Safety Min. Current			
75	Waterflow Safety Max. Current			
76	Flowmeter 1 Range			
77	Flowmeter 2 Range			
78	Pressure Sensor 1 Range			
79	Pressure Sensor 2 Range			
80	Water Level Transmitter 1 Range			
81	Water Level Transmitter 2 Range			
82	Flowmeter 1 Input			
83	Flowmeter 2 Input			
84	Pressure Sensor Input 1			
85	Pressure Sensor 2 Input			
86	Water Level 1 Input			
87	Water Level 2 Input			
88	Circuit Breaker Input			
89	Motor Started Information Input			
90	Flowmeter Pulse Factor			
91	Flowmeter Type Selection			0- Longrun 1- Krohne ifc 50 2- Krohne ifc 300 3- Enelsan
92	Energy Analyzer Type Selection			
93	Water Level Relay Input			
94	Logging Interval (min)			

Bit	Warning Word 1	Warning Word 2
0	Analyzer Comm. Warning	Reserved
1	Flowmeter Comm. Warning	Reserved
2	Log Cycled once	Reserved
3	LCD Not Connected	Reserved
4	Can't Reach Flash Memory	Reserved
5	Can't Reach ADC Channel1	Reserved
6	Can't Reach ADC Channel2	Reserved
7	Can't Reach ADC Channel3	Reserved
8	Inverter Operates on Hand Mode	Reserved
9	Battery Switch Closed	Reserved
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

Bit	Alarm Word 1	Alarm Word 2
0	Motor Operation Alarm	Reserved
1	Motor Circuit Breaker Alarm	Reserved
2	Water Level Alarm	Reserved
3	Current Alarm	Reserved
4	Waterflow Alarm	Reserved
5	Pressure Alarm	Reserved
6	Analyzer Comm. Alarm	Reserved
7	Flowmeter Comm. Alarm	Reserved
8	Water Level Relay Alarm	Reserved
9	Supply Voltage Too High	Reserved
10	Voltage Alarm	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

Bit	Status Word 1	Status Word 2
0	Supply Voltage Present	Reserved
1	Battery is Charging	Reserved
2	Target Comm. Established	Reserved
3	Alarm Present	Reserved
4	System is on Auto	Reserved
5	Motor Working	Reserved
6	Battery Temperature Low	Reserved
7	Battery Temperature High	Reserved
8	Motor Works on Anti Icing Mode	Reserved
9	Reserved	Reserved
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

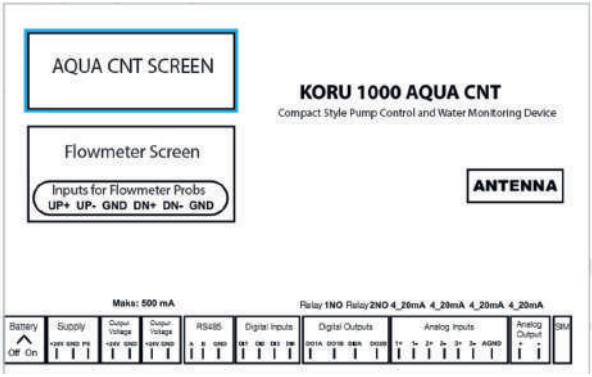
Bit	Control Word 1	Control Word 2 (Flash Memory)
0	Alarm Reset	Automatic
1	Start/Stop (Manual Mode)	The Target Level is Read From the SCADA
2	Flash Memory Clear Logs	Emergency Scenario Active
3	Link No Error	Low-Power Mode Active
4	Restart AQUA	Analyzer Selected
5	Cut off the Output Supply Voltage*	Pressure Sensor 2 taken as reference
6	Reserved	Anti-Icing Mode Active
7	Reserved	Reserved
8	Reserved	Reserved
9	Reserved	Reserved
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

* For hardware versions 1.2 and higher

* It is adviced that the querry interval be higher than 15 seconds. The timeout Period can be defined as 3 seconds. The maximum packet number in a querry should not be more than 64 words.

In the cases where there will be querries from multiple SCADA systems, the querry intervals should be higher than 30 seconds.

HARDWARE



Battery

The device has a built in battery charging unit. The battery switch must be opened (to the right) to activate the battery.

The battery temperature can still be read when the battery is connected properly even thoughthe battery switch is at OFF position or when the battery is depleted.

* Why do we see the battery is full and empty in short intervals?

This can be the result of cases such as the battery switch being on OFF mode, the battery being in the safety mode or the + cable of the battery supply contact is loose from its connector.

* When the battery voltage is depleted the battery enters the safety mode and does not provide energy. If the supply voltage of the battery is high enough when the device is supplied by an external power supply or a solar panel, the battery automatically ceases being in the safety mode.

If the Battery Temperature is between 0-45 centigrade degrees, the requirements for the battery to be charged are the supply voltage being higher than 21VDC and the current being higher than 1 amps.

Is the temperature sensor necessary for the battery? For the battery to be charged the necessary temperature conditions must be met. Low temperature alarm is formed in the devices where the battery temperature sensor is not present.

Supply

AQUA needs a supply voltage of 24VDC and 2.5 Amps. It can be supplied by either an external power suply or a solar panel. It is necessary that the supply of the battery be more than 21V in order for the built in battery to be fully charged.

Voltage Outputs

AQUA can provide outputs with a capacity of 24VDC and 500mA. The glass cartridge fuse inside the device must be control when the output voltage is not present.

RS485

AQUA uses this port to communicate with flowmeters that supports RS485 communication and energy analyzers.

Digital Inputs

AQUA has 4 24VDC digital inputs (with optocoupler isolation).

Digital Outputs

AQUA has 2 relay (NO) outputs.

Analog Inputs

AQUA has 3 16-bit 4-20mA analog inputs and the inputs have 24VDC and current protection.

Analog Output

AQUA has 1 12-bit 4-20 analog Reference output.

Appendix 1. Pressure Sensor

In this section the information about the pressure sensor included in AQUA 100FP models is given. This sensor is suitable for using in pump controlling applications.

The pressure sensor can be connected to either one of the analog inputs shown in Figure 2.1 and the settings are done as mentioned above (see: System Settings).


```
      System Settings
Pressure Sensor 1 Set (bar)
0
```

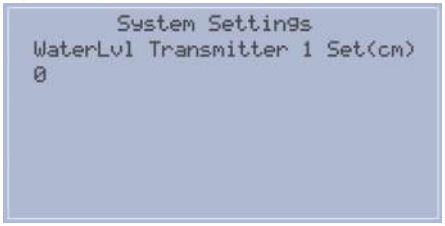
```
      System Settings
Pressure Sensor 1 Input
0

1:AInput1
2:AInput2
3:AInput3
```

Pressure Range (Bar)	-1	1	2	5	10	20	50	100	200	400	600
Overload (Bar)	-3	3	7	12	35	50	120	250	400	600	1200

Technical Properties	
Working Principle	
Measuring Principle	Piezoresistive Measuring Cell
Inputs	
Measured Parameters	The relative and absolute pressure
Measurement Range	Max. 600 bars
Outputs	
Current Output	4~20 mA
Load	(U~10V) / 0,02 A
Sensitivity	
Measurement error (Linearity, hysteresis and repeating included)	Less than the 0,07% of the range
Stability	± 0,1 Range / year
Zero point	± 0,2 mV/V
Temperature Effects	
Span	0°-70°C'de -0,010% TS/K 70°-85°C'de -0,012 % TS/K 85°-135°C'de -0,014 % TS/K
Zero	± 0,02 % TS/K
Operating Conditions	
Operating Temperature	-40°~135°C
Ambient Temperature	-25°~85°C
Storing Temperature	-50°~100°C
Protection Class	IP67
Supply	
Supply Voltage	8...42 VDC
Materials	
Sensor	Stainless 316L, Ceramic
Process connector	Stainless Steel 316, Hastelloy C and other materials
O-ring	Viton
Outer Case	Stainless Steel 316
Terminal Case	Stainless Steel 316
Process Connection	
Male	1/2" gear / 1/4" gear
Dimensions and Weight	
Weight	About 1 kg
Dimensions	Φ 27x80mm
Packaging	200mm x 200mm x 300mm

Appendix 2. Water Level Transmitter

In this section the information about the water level transmitter included in AQUA 100SL models is given. This sensor is suitable for using in water reservoirs.



The pressure sensor can be connected to either one of the analog inputs shown in Figure 2.1 and the settings are done as mentioned above (see: System Settings)

Technical Properties	
Diaphram	Stainless 316L, Ceramic
Used in	Liquids
Liquid Temperature	0-70 °C
Range	Min 0-300mm Max 0-150000mm
Linearity	± 0,2% of the range
Sensitivity	± 0,3% of the range
Connection	Polipropen
Protection Class	IP68
Supply	10-36 V DC
Output	4-20 mA
Body	Stainless steel

Appendix 3. Built-in Flowmeter

In this section the information about how to set up and use the built-in flowmeter that comes with AQUA 100F and 100FP models is given. The flowmeter module cannot be used seperately.

Menu Window No	Function
M00	Display flow rate and NET totalizer If the net totalizer is turned off, the net totalizer value shown on the screen is the value prior to its turn off Select all totalizer unit in menu M31
M01	Display flow rate, velocity
M02	Display date time and POS(positive) totalizer
M03	Display flow rate and NEG(negative) totalizer If the negative totalizer is turned off, the negative totalizer value shown on the screen is the value prior to its turn off
M04	Display date and time, flow rate. The date and time setting method is found in MENU60
M05	Display energy rate(instantaneous Caloric)and total energy (Caloric)
M06	Display temperatures, inlet T1, outlet T2
M07	Display analog inputs, AI3/AI4, current value and its corresponding temperature or pressure or liquid level value
M08	Display all the detailed error codes. Display working condition and system error codes. 'R' stands for normal, others refer to Chapter 8 for details.
M09	Display today's total NET flow
M10	Window for entering the outer perimeter of the pipe.If pipe outer diameter is known, skip this menu and go to Menu 11to enter the outer diameter
M11	Window for entering the outer diameter of the pipe. Valid range:0 to 18000mm. Note: you just need to enter either the outer diameter in M11 or the peripheral in M10
M12	Window for entering pipe wall thickness. You may skip the menu and enter inner diameter in M13 instead.
M13	Window for entering the inner diameter of the pipe. If pipe outer diameter and wall thickness are enter correctly, the inner diameter will be calculated automatically, thus no need to change anything in the window
M14	Window for selecting pipe material Standard pipe materials (no need to enter material sound speed) include: (0) carbon steel (1) stainless steel (2) cast iron (3) ductile iron (4) copper (5) PVC (6) aluminum ,(7) asbestos (8) fiberglass (9) other(need to enter material sound speed in M15)
M15	Window for entering the pipe material speed, only for non-standard pipe materials
M16	Window for selecting the liner material, select none for pipes without any liner. Standard liner materials(no need to enter the liner sound speed) include: (1) Tar Epoxy (2) Rubber (3) Mortar (4) Polypropylene (5) Polystryol (6)Polystyrene (7) Polyester (8) Polyethylene (9) Ebonite (10) Teflon (11) Other (need to enter liner sound speed in M17)
M17	Window for entering the non-standard liner material speed.
M18	Window for entering the liner thickness, if there is a liner
M19	Window for entering the ABS thickness of the inside wall of the pipe
M20	Window for selecting fluid type For standard liquids(no need to enter fluid sound speed) include: (0) Water (1) Sea Water (2) Kerosene (3) Gasoline (4) Fuel oil (5) Crude Oil (6) Propane at -45C (7) Butane at 0C

	(8)Other liquids(need to enter sound speed in M21 and viscosity in M22) (9) Diesel Oil (10)Caster Oil (11)Peanut Oil (12) #90 Gasoline (13) #93 Gasoline (14) Alcohol (15) Hot water at 125C
M21	Window for entering the sound speed of non- standard liquid, used only when option item 8 'Other' is selected in M20
M22	Window for entering the viscosity of the non-standard liquids, used only when option item 8 'Other' is selected in M20
M23	Window for selecting transducer type, There are 22 types as following 0. Standard M (The middle size) 1. Insertion Type C 2. Standard S 3. User Type 4. Standard B 5. Insertion Type B(45) 6. Standrad L (The large size transducers) 7. JH-Polysonics 8. Standard-HS (small size transducer for Handheld flow meter) 9. Standard-HM (middle size transducer for Handheld flow meter) 10. Standard-M1 (middle size transducer #1) 11. Standard-S1 (small size transducer #1) 12. Standard-L1 (large size transducer #1) 13. PI-Type 14. FS410 (middle size transducer for FUJI flow meter) 15. FS510 (large size transducer for FUJI flow meter) 16. Clamp-on TM-1 (Middle size transducer) 17. Insertion TC-1 18. Calmp-on TS-1 (Small size transducer) 19. Reserved 20. Clamp-on TL-1 (Large size transducer) 21. Insertion TLC-2 If the user-type-transducer is selected, you need enter additional 4 user-type-wedge parameters that describe the user transducers. If the PI-type transducer is selected, you need enter additional 4 PI-type transducer parameters that describe the PI-type transducers
M24	Window for selecting the transducer mounting methods Four methods can be selected: (0) V-method (1) Z-method (2) N-method (3) W-method
M25	Display the transducer mounting spacing or distance
M26	(1) A switch for the parameters in flash memory will be loaded when power is turned on. The default option is that the parameters will be loaded. If this switch is not turned on, the system will try to use the parameters in the system RAM, if **LRF-2000M** **Ultrasonic Flow Module/RTU** **- 15 -** these parameters are ok, otherwise the system will load the parameters in flash memory (2) Function to store the current parameters into the flash memory, so that these parameters will be solidified and will be loaded as the default parameters every time when power is turned on.
M27	Entry to store to or restore from the internal Flash memory, as many as 9 different pipe parameter configurations To save or load the current setup parameter, use the going up or going down keys

	to change the address number, press 'ENT' key, and use going down or going up keys to select to save to or load from the memory.
M28	Entry to determine whether or not to hold (or to keep) the last good value when poor signal condition occurs. YES is the default setup.
M29	Entry to setup empty signal threshold. When the signal is less than this threshold, the pipe is regarded as empty pipe, and the flow meter will not totalize flow. This is based on the fact that, for most occasions, when pipe is empty, the transducer would still receive signal, just smaller than normal, As a result, The flow meter would show normal operation, which is not correct. Make sure that the entered value must be less than the normal signal strength. When much noisy signals are received, to make sure the flow meter will not incorrectly totalize flow, there is also a 'Q' threshold should be entered in M.5
M30	Window for selecting unit system. The conversion English to Metric or vice versa will not affect the unit for totalizers.
M31	Window for selecting flow rate unit system. Flow rate can be in 0. Cubic meter short for (m3) 1. Liter (l) 2. USA gallon (gal) 3. Imperial Gallon (igl) 4. Million USA gallon (mgl) 5. Cubic feet (cf) 6. USA liquid barrel (bal) 7. Oil barrel (ob) The flow unit in terms of time can be per day, per hour, per minute or per second. So there are 32 different flow rate units in total for selection.
M32	Window for selecting the totalizers unit. Available units are the same as those in M31
M33	Window for setting the totalizer multiplying factor The multiplying factor ranges from 0.001 to 10000. Factory default is 1
M34	Turn on or turn off the NET totalizer
M35	Turn on or turn off the POS (positive) totalizer
M36	Turn on or turn off the NEG(negative) totalizer
M37	(1) Totalizer reset (2) Restore the factory default settings parameters. Press the dot key followed by the backspace key. Attention, It is recommended to make note on the parameters before doing the restoration
M38	Manual totalizer used for easier calibration. Press a key to start and press a key to stop the manual totalizer.
M39	Interface Language selection. The selection could also be changed automatically by the system, if English LCD display is used as the display device.
M40	Flow rate damper for a stable value. The damping parameter ranges form 0 to 999 seconds. 0 means there is no damping. Factory default is 10 seconds
M41	Low flow rate (or zero flow rate) cut-off to avoid invalid accumulation.
M42	Zero calibration/Zero point setup. Make sure the liquid in the pipe is not running while doing the setup.
M43	Clear the zero point value, and restore the solidified zero point value.
M44	Set up a flow bias. Generally this value should be 0.
M45	Flow rate scale factor. The default value is '1'. Keep this value as '1', when no calibration has been made.

M46	Networks address identification number. Any integer can be entered except 13(0DH, carriage return), 10 (0AH, line feeding), 42 (2AH), 38, 65535. Every set of the instrument in a network environment should have a unique IDN. Please refer to the chapter for communication.
M47	System locker to avoid modification of the system parameters. If password is forgotten, you could send a command 'LOCK0' to the serial input to unlock. Or you can write 0 to REGISTER49-50 under MODBUS protocol.
M48	Entry to linearity correcting data inputs. By using of this function, the non-linearity of flow meter will be corrected. Correcting data shall be obtained by careful calibration.
M49	Displays the input contents for the serial port. By checking the displays, you can know if the communication is ok.
M50	Switches for the built-in data logger. There are as many as 22 different items can be chosen. To turn this function, select 'YES' the system will ask for selecting the items. There are 22 items available. Turn on all those items you want to output
M51	Window to setup the time of scheduled output function (data logger, or Thermo-printer). This includes start time, time interval and how many times of output. When a number great than 8000 entered for the times of output, It means the output will be keeping always. The minimum time interval is 1 second and the maximum is 24 hours.
M52	Data logging direction control. (1) If 'Send to RS485' is selected, all the data produced by the data logger will be transmitted out through the RS-232/RS485 interface (2) If 'To the internal serial BUS is selected, the data will be transmitted to the internal serial bus which allows a thermal printer, or a 4-20mA analog output module, to be connected to it.
M53	Display analog inputs, AI5, current value and its corresponding temperature or pressure or liquid level value.
M54	Pulse width setup for the OCT (OCT1) output. Minimum is 6 mS, maximum is 1000 mS
M55	Select analog output (4-20mA current loop, or CL) mode. Available options: (0) 4-20mA output mode (setup the output range from 4-20mA) (1) 0-20mA output mode (setup the output range from 4-20mA, This mode can only be used with Version-15 flow meter) (2) Serial port controls 0-20mA (3) 4-20mA corresponding fluid sound speed (4) 20-4-20mA mode (5) 0-4-20mA mode (can only be used with Version-15 flow meter) (6)20-0-20mA mode(can only be used with Version-15 flow meter) (7) 4-20mA corresponding flow velocity (8)4-20mA corresponding heat flow rate
M56	4mA or 0mA output value, Set the value which corresponds to 4mA or 0mA output current (4mA or 0mA is determined by the setting in M55)
M57	20mA output value, Set the value which corresponds to 20mA output current
M58	Current loop verification Check if the current loop is calibrated correctly.
M59	Display the present output current of current loop circuit.
M60	Setup system date and time. Press ENT for modification. Use the dot key to skip the digits that need no modification.

M61	Display Version information and Electronic Serial Number (ESN) that is unique for each flow meter. The users may employ the ESN for instrumentation management
M62	RS-232/RS485 setup. All the devices connected with flow meter should have matched serial configuration. The following parameters can be configured: Baud rate (300 to 19200 bps), parity, data bits (always is 8), stop bits
M63	Select communication protocol. Factory default is 'MODBUS ASCII. this is a mode for MODBUS-ASCII, Meter-BUS, Fuji Extended Protocol If you are going using MODBUS-RTU you have to select 'MODBUS_RTU'.
M64	AI3 value range. Used to enter temperature/pressure values that are corresponding to 4mA and 20mA input current. The display values have no unit, so that they can present any physical parameter.
M65	AI4 value range. Used to enter temperature/pressure values that are corresponding to 4mA and 20mA input current.
M66	AI5 value range. Used to enter temperature/pressure values that are corresponding to 4mA and 20mA input current.
M68	Window to setup the minimum flow rate value which corresponds to the lower frequency limit of the frequency output.
M69	Windows to setup the maximum flow Rate value that corresponds to the upper frequency limit of the frequency output.
M70	LCD display backlight control. The entered value indicates how many seconds the backlight will be on with every key pressing. If the enter value is great than 50000 seconds, It means that the backlight will always keeping on.
M71	LCD contrast control. The LCD will become darker or brighter when a value is entered.
M90	Display signal strengths S (one for upstream and one for downstream), and signal quality Q value. Signal strength is presented by 00.0 to 99.9, the bigger the value, the bigger the signal strength will be, and more reliable readings will be made. Q value is presented by 00 to 99, the bigger the better. It should at least be great than 50 for normal operations.
M92	Displays the estimated fluid sound velocity. If this value has an obvious difference with the actual fluid sound speed, pipe parameters entered and the transducer installation should be checked again.

INSTALLATION STEPS

1- Enter MENU 11 window to input the digits for the pipe outer diameter, and then press ENT key.

2- Enter MENU 12 window to nput the digits for the pipe outer diameter and then press ENT key.

3- Enter MENU 14 window to select the intended pipe material.

4- Enter MENU 16 window to select the liner material.

5- Enter MENU 18 window to add the liner thickness.

6- Enter MENU 20 window to select the proper liquid.

7- Enter MENU 23 window to select the proper transducer type.

8- Enter MENU 24 window to select the proper transducer mounting method.

9- Enter MENU 25 window to check up the installation space.

10- Enter MENU 90 window to check up signal strength and quality.

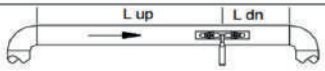
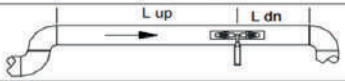
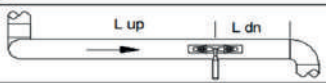
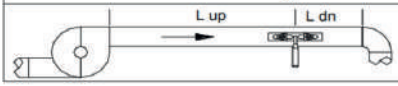
11- Enter MENU 20 window to check up the working status, “R” means work well.

12- Enter MENU 20 window to check up the measuring data.

13- After setting parameter, remember to store parameter in MENU 26, to avoid parameter lose after turn off.

TRANSDUCER MOUNTING ALLOCATIONS

The first step in the installation process is the selection of an optimum location in order to obtain a more accurate measurement. For this to be completed effectively, a basic knowledge about the piping and its plumbing system would be advisable. An optimum location would be defined as a straight pipe length full of liquid that is to be measured. The piping can be in vertical or horizontal position. The following table shows:

Piping Configuration and Transducer Position	Upstream Dimension L up *Diameter	Downstream Dimension L dn *Diameter
	10D	5D
	10D	5D
	10D	5D
	12D	5D
	20D	5D
	20D	5D
	30D	5D

EXAMPLES OF OPTIMUM LOCATIONS

1- Install the transducers on a longer length of the straight pipe.

2- Make sure that the temperature on the location does not exceed the range for the transducers. Generally speaking, the closer to the room temperature,the better.

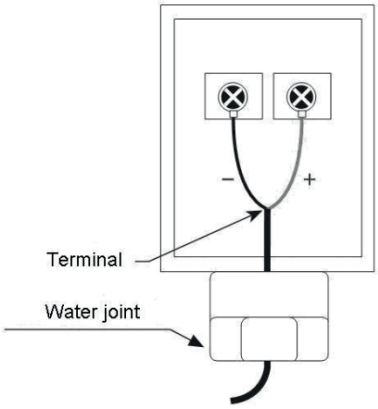
3- Take the pipe fouling into consideration. Select a straight length of a relatively newer pipe.

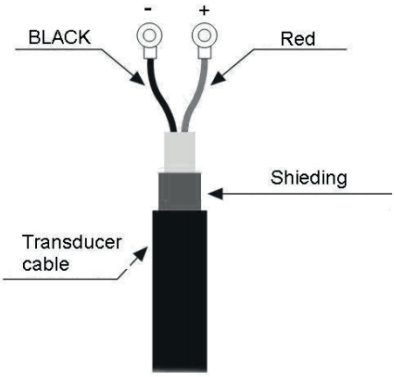
4- Some pipes have a kind of plastic liner, and between the outer pipe and the liner there may be a certain thickness difference that will prevent the ultrasonic waves from direct traveling. Such conditions will make the measurement very difficult. Whenever possible, try to avoid this kind of pipes.

5- Clean any dust and rust. For a better result, polishing the pipe with a sander is strongly recommended.

6- Apply adequate coupler to the spot where the transducers are to be installed and leave no gap between the pipe surface and the transducers.

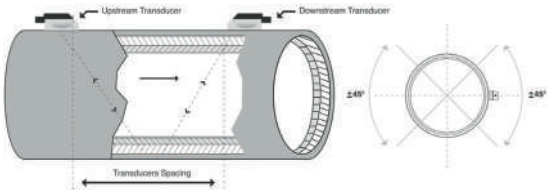
7- To avoid gas bubbles inside the upper part of the pipe, the transducers should be installed horizontally by the side of the pipe.





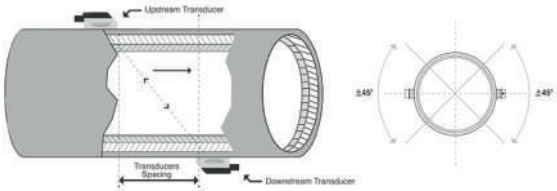
V-method Installation

V-method installation is the most widely mode for daily measurement with pipe inner diameters ranging from 15 mm to 200 mm. It is also called reflective mode.



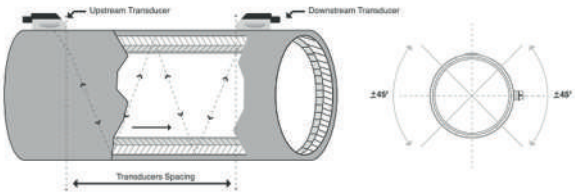
Z-method Installation

Z-method is commonly used when the pipe diameter is above 200mm.



W-method Installation

W-method is usually used on pipes with a diameter from 32mm to 50mm.



Error code	Correspondent Message displayed on M08	Causes	Counter-measures
R	System Normal	No error	
I	Detect No Signal	• No signal detected • Transducers installed properly. • Too much fouling. • Pipe liners are too thick • Transducer cords are not properly connected	• Relocate measuring location • Clean the spot • Check the cords
J	Hardware Error	Hardware problem	Contact the factory
H	PoorSig Detected	• Poor signal detected. • Transducers installed improperly. • Too much fouling. • Pipe liners are too thick • Problem with transducers cords	• Relocate measuring place • Clean the spot • Check the coupler
F	System RAM Error Date time Error CPU or IRQ Error • Rom parite error	• Temporary problems with RAM, RTC • Permanent problems with hardware	• Power on again • Contact factory
G	Adjusting Gain	Instrument is in the progress of adjusting the gain for the signal, and the number indicates the progressive steps	
K	Empty pipe	No liquid inside pipe Setup error on M29	Relocate where the pipe is full of Liquid. Enter 0 on M29

envest

If you can't measure, you can't manage.

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