Uf 811 CO

(open channel)

User Manual

Ultraflux

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TABLE OF CONTENTS

Note: A detailed table of contents is provided at the end of the manual.

Important: If you are unfamiliar with the transit time difference measuring technique, we recommend you start by reading our training manual "Ultrasonic transit time flowmeter".

CHAPTER 1: OVERVIEW

1.1 Converter overview

1.2 Dimensions and weight

- Height: 231 mm
- Width: 221 mm
- Depth: 59 mm
- Weight: 2 Kg

1.3 Working environment

- Temperature: from -20 to +70°C
- Screen reading: from -20°C to +60°C
- Hygrometry: 80 % maximum
- Ventilation: no special precautions necessary

1.4 Protection against dust and immersion

IP 67: Total protection against dust; protection against immersion for 30 minutes under 1m of water. This protection is only valid if the installation has been carried out or audited by Ultraflux.

This protection is only ensured when the connectors are connected or capped (where the connector is not in use).

1.5 Power supply

- Range: 10–32 VDC (SELV networks)
- Insulation: Safety class 3
- Peak power consumption: < 12 W
- Average typical consumption: < 6 W
- Protection via resettable fuse (PTC)
- Protection against polarity reversal
- Overvoltage protection in accordance with standard EN 61000-4-5

Notes:

- As the device is supplied from a protected extra low voltage network, an earth connection is not mandatory. Nevertheless, it is strongly recommended to install an earth connection in order to protect the installation, particularly when used outside with a long length of cable connected to the device. The earth can be connected to the power socket or via one screw.
- It is recommended to install a disconnectable bipolar circuit breaker interrupter with visible cut-off of 2 A upstream of the flow meter power supply. It is also recommended to install lightning arresters on each of the inputs/outputs of the flow meter.

Important:

- The connectors must only be connected or disconnected with the power off and the equipment isolated.
- If the flow meter unit is opened by anyone other than an Ultraflux technician, the warranty will be rendered null and void.
- Ultraflux accepts no responsibility for incidents which may occur following a failure to respect these instructions.

1.6 Communication

The Uf 811 has a serial link which can be wired using **RS232** or **RS485** mode. It also has a USB interface.

For this communication interface, the standard protocol chosen is the Slave JBUS (MODBUS). This enables the device to be connected to an instrumentation and control system or to a computer. Ultraflux provides PC software compatible with Windows XP or later which is used to configure the device, unload the logger and display the various values measured.

Please refer to the appendices for the JBUS configuration.

Note:

- If necessary, the 120 Ohm termination resistance for the RS485 may be added in the connector between the Y and Z pins.

- The USB interface allows a computer to be connected for configuration. This may be accessed by removing the IP protective cap.

1.7 Inputs/Outputs

The Uf 811 provides the following options:

- Integration of up to 4 single modules (or 2 double modules) of inputs/outputs.
- Connection of the inputs/outputs to the equipment directly via connectors, without the need for any intervention inside the flow meter.

The modules are factory-installed by Ultraflux.

The Uf 811 allows six types of inputs/outputs to be used:

- Single module 1 active 4-20 mA insulated analogue output: current from 0 to 24 mA,
- Single module 2 passive 4-20 mA insulated analogue inputs: current from 0 to 24 mA,
- Single module 2 passive 0-10 V insulated analogue inputs: voltage from 0 to 15 V,
- Single module 2 on/off outputs (50 V - 10 mA) which can be used as frequency outputs,
- Single module 2 on/off inputs (5 V),
- Double module 2 PT100/PT1000 temperature inputs; 2- 3- or 4-wire.

Notes:

- Please refer to the descriptive sheet for each module for more details.
- The sensors on the 4-20 mA loop may by powered from an external power supply.

1.8 Ultrasound chords

The Uf 811 can manage 2 ultrasound chords. Each connector corresponds to one ultrasonic chord, in other words two probes. As standard, it is therefore necessary to use the Y-cable provided with the flow meter in order to separate the two probe cables.

1.9 Navigation keys

- Changing from one type of screen to another is done by using the "Fn" (for Function) key. This "Fn" key in particular is used to enter "configuration" mode. The ◀ and ▶ keys allow the user to browse through the menus for this mode.
- A long press on the Fn key, or allowing approximately 1 minute to pass without using the keypad, returns you to "measurement" mode.
- Within a menu, the ◀ and ▶ keys are used to change page. These keys may also have a contextual function which in this case will be shown at the bottom of the screen page, such as that of selecting the measurement mode screen which is displayed by default.
- After powering on the Uf 811, the screen displays the page which has been selected as priority. To choose this "default" screen, select and validate it by pressing the "B" key in measurement mode.
- To scroll through the measurement screens, use the ▲ and ▼ keys.
- To access the other menus, press the "Fn" key, then successively press the ◀ key, or browse using the ◀ and ▶ keys.

- To enter a menu, press ▲ or ▼.
- To change page, press "A" or "B".
- To change a row, select it using ▲ or ▼ and change the value using ◄ or ►.
- If no key is pressed for approximately one minute, the Uf 811 automatically returns to "measurement" mode and to the display chosen as priority using "B".
- For a given parameter, the value to be applied is defined using the ► (increase) and ◄ (decrease) keys. An extended press on one of these two keys accelerates the increase or the decrease.

1.10 Operating lamps

Two LEDs are present on the front panel:

• **Blue measurement LED**: indicates whether or not the flow meter is measuring.	A flashing LED indicates normal operation. An LED which is fixed on or off indicates abnormal or interrupted operation.
• **Red, orange or green Communication LED:** indicates the status of the external communication of the flow meter (serial link or USB).	Flashing green light for each dialog on the serial link. Long red flashing light on each dialog error on the serial link. Fixed orange light when the flow calculation is in degraded mode or when a related function is faulty. Fixed red light when the flow calculation is faulty.

1.11 Screen

- LCD: graphic (14 rows x 20 characters).
- Backlighting: permanent or timed.
- Screen reading: from -20°C to +60°C.

1.12 Functions

- **Recording options**: The flow meter is used to record the measurement data (logger function). Up to 30 variables can be recorded (for example: average flow, minimum flow, maximum flow, water level). A total of 530,000 readings can be recorded. The frequency and sequencing of the recordings can be adjusted.
- **Echo display**: It is possible to display the measurement echo for each chord, which allows you in particular to check the quality of the measurement and directly view the effect of certain corrective actions (positioning and alignment of the probes, adjustment of the settings, cleaning of the probes, etc.).
- **Four flow volume totalizers** which can count the positive flows, negative flows or total flows, regardless of their sign,
- **Filtering of the measurement** using a first-order filter allowing the non-significant flow fluctuations to be smoothed,
- **Storage of the measurement** in memory in the event of a momentary loss of the echo (due, for example, to the passing of air bubbles) or other faults (adjustable storage interval),
- **Setting the measurement to zero** if the flow is below a programmable value,
- **Readjustment of the zero** if it is possible to completely stop the flow.

1.13 Performance of the flow meter

- Uncertainty over measured speed: up to ±0.5 %.
- Repeatability: up to 0.1 %.
- Linearity: up to 0.1 %.
- Typical uncertainty on the flow rate calculation: from 0.5 to 5 % depending on the application and the number of chords.

Important: The accuracy of the measurement also depends on the accuracy with which the geometry of the measuring point is measured, the dimensions of the probe pairs, the distance between the probes and the length the wave has to travel between two probes. An inaccuracy on one of these values may compromise the accuracy of the measurement.

1.14 Cleaning the flow meter

The box may be cleaned with water, diluted alcohol or detergent using a sponge or a soft cloth. Do not use abrasive materials or solvents.

1.15 Recycling the flow meter

In the context of decree no. 2005-829 dated 20 July 2005 relating to the collection, treatment and disposal of electrical and electronic equipment in France, Ultraflux delegates the responsibility for financial and also logistical recovery to the user, who will manage their own waste.

1.16 CE marking

The Uf 811 complies with CE certifications:

EN 55016-2-1	Measurement of conducted emissions Criterion A
EN 55016-2-3	Measurement of radiated emissions from 30 MHz – 6 GHz
EN 61000-4-6	Immunity to induced conducted disturbances Criterion B
EN 61000-4-2	Immunity to electrostatic discharges Criterion B
EN 61000-4-3	Immunity to radiated electromagnetic fields Criterion A
EN 61000-4-4	Immunity to rapid transients in bursts Criterion B
EN 61000-4-5	Immunity to shock waves Criterion B
EN 62311	Human exposure to electromagnetic fields

CHAPTER 2: SAFETY INSTRUCTIONS

2.1 Using the flow meter

The flow meter, equipped with ultrasonic measuring probes, is used to measure the flow of a liquid in an open channel.

It is important to correctly configure the flow meter for its measurement results to be correct. You are recommended to call on qualified staff from Ultraflux to ensure this is the case. This is strongly advised if your equipment is used to regulate a process, intervene in a monitoring system, or in the case of other applications for which an incorrect flow measurement would lead to risks.

In normal operation, the flow meter must not heat up to a level liable to cause burns. It is not necessary to take any particular precautions to allow it to cool. Should the temperature of the unit rise abnormally, it is recommended to power off the flow meter and call Ultraflux for expert advice. In the event of a fire inside the flow meter, power it off without opening or touching it, then call the competent services in order to secure the premises.

The flow meter must not be used beyond the possibilities and specifications given in this manual. The flow meter must be stored in a dry place, with the packaging provided by Ultraflux in order to protect the parts liable to be damaged by a shock. It is recommended to wear PPEs (Personal Protective Equipment) adapted for the handling and installation of the flow meter (safety boots, protective gloves).

The flow meter must only be modified or disassembled by Ultraflux personnel. Ultraflux accepts no responsibility should this rule not be respected. No consumables are used for the operation of the flow meter.

The connectors must only be connected or disconnected with the power off and the equipment isolated.

Ultraflux accepts no responsibility for incidents which may occur following a failure to respect these instructions.

2.2 Symbols used on the flow meter

User manual must be read before use

Disconnect the flow meter and power it off before opening the unit or connecting or disconnecting inputs and outputs.

2.3 Contact address

For any requests for information, please contact us at:

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CHAPTER 3: INSTALLATION AND WIRING

The units do not pose any particular danger to users. It is however recommended to wear personal protective equipment during assembly, including: gloves, safety boots, impact goggles. This equipment will allow you to avoid any risk when installing the flow meter.
It is recommended to follow the assembly method described below in order to avoid any risk of injury.
Assembly must be carried out or inspected by Ultraflux to ensure the unit is leakproof and will operate correctly.

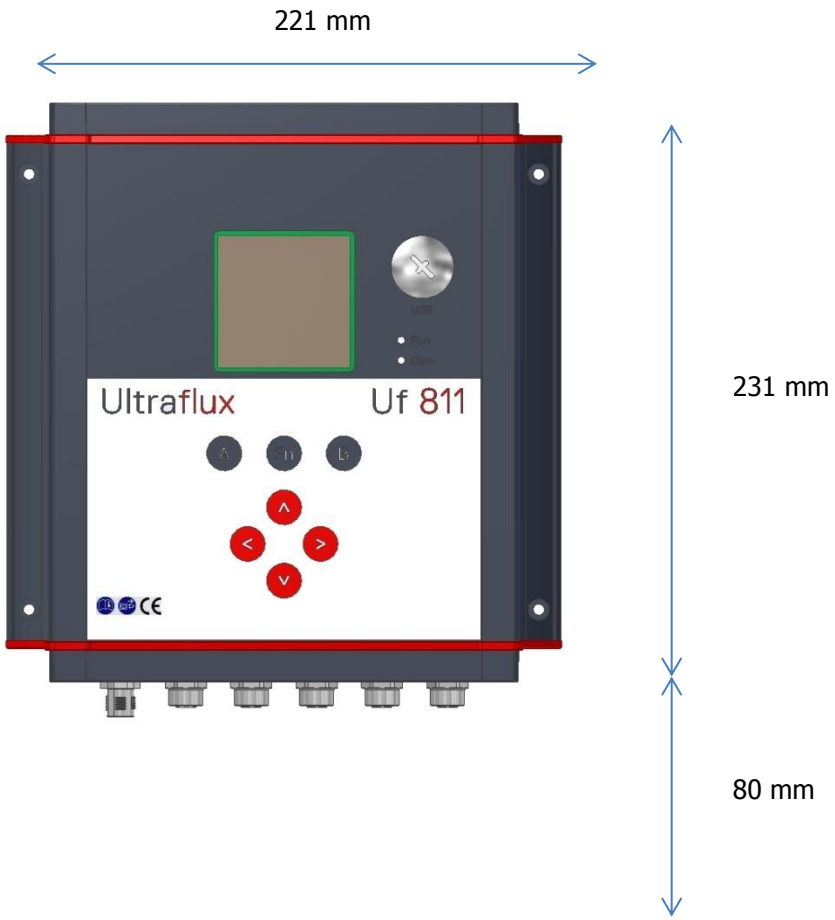
Important: Avoid installing the Uf 811 close to a frequency converter. If this cannot be avoided, interference filters must be installed. It is highly recommended to contact us if this situation arises.

It is also recommended to separate the paths of the probe cables and the power cables.

3.1 Wall attachment

Make attachment holes on a wall which is sufficiently solid. Firmly screw the flow meter to the wall so that it does not fall (take care with cavity walls).

A clearance of 80 mm must be left around the unit to allow the connectors to be connected.



3.2 Wiring instructions

Wiring must be carried out by a person with electrical accreditation. The flow meter must be powered off before installing or uninstalling. The isolation devices must be locked and tagged. The wiring must respect the diagrams provided for the power supply and for the inputs/outputs.

It is sometimes necessary to protect the inputs/outputs, the power supply and the ultrasonic chords. You are strongly recommended to contact Ultraflux to obtain a diagnosis on this point. Ultraflux accepts no responsibility in the event of the incorrect use of the flow meter, and in such cases, the Ultraflux guarantee would not be valid.

3.3 Connector wiring

Preliminary comments:

- If using an armoured cable, be careful with the "cutting edge" of the armour after cutting it to strip the wire. This edge may be very sharp. It is recommended to cover the cut edge of the armour with insulating tape to prevent any accidents.

- The armour must remain outside the plugs. The shielding must pass through the connector in order to prevent interfering signals from damaging the quality of the measurement. Remember to allow sufficient lengths to be able to access the locations of the probes and the inputs/outputs.

- The length recommendation in the assembly diagrams must be complied with in order to ensure good contact between wire and pin and provide leaktightness.

- The recommended wire cross-sections must be complied with in order to be compatible with the connectors.

- The recommended tightening torques must be complied with in order to ensure leaktightness and the good mechanical strength of the flow meter.

Note: All connectors are supplied with the flow meter.

Tools required:

- 18 mm open-ended wrenches
- Combination pliers
- Cutting pliers
- Stripping pliers
- Cutter
- 10-m tape
- Torque wrench
- 4 mm flat screwdriver

3.3.1 Communication connector

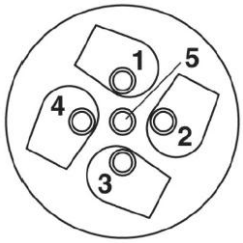
Depending on whether the RS232 or RS485 interface has been selected, connect the RX TX or A, B pins to ground.

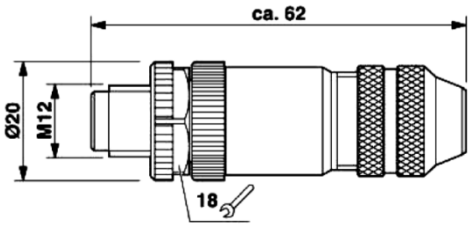
Notes:

- The serial link is electrically insulated.
- If the UF 811 is the last device on the RS485 network, a termination resistance of 120 Ohm must be added to the connector between pins A and B.
- Only one of the two interfaces may be in operation at any one time.

The connector used is a **male 5-pin M12 type** connector with inverted B coding.

View of the base





The pins have the following functions:

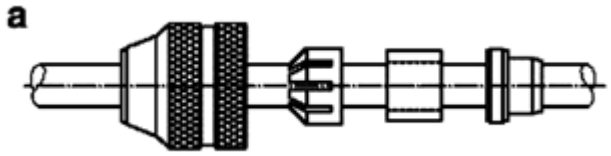
Pin	Functions
1	RS 485 : A / RTx (-)
2	RS 485 : B / RTx (+)
3	RS 232 : Tx (Output Uf 811)
4	RS 232 : Rx (Input Uf 811)
5	GND ISO

Note: the pin number is engraved directly on the connector.

Recommended length to strip, tightening torque and cross-section of cable:

Cross-section of conductor	0.25 mm² … 0.75 mm²
Cross-section of AWG conductor	24 … 18
External diameter of cable	6 mm … 8 mm
Tightening torque Wrench M12	0.4 Nm
Tightening torque Screw terminals	0.2 Nm
Tightening torque Set screw	0.8 Nm … 1 Nm

Plug fitting:

<table>
<tr>
<td> 
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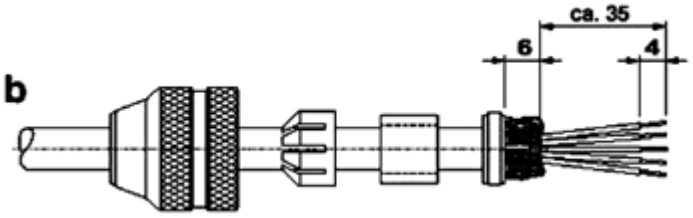
<td> 
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Strip the cable by 35 mm.
Strip the conductors by 4 mm.
Splay the armour and place it around the protector ring.
Cut off the excess braiding.
Feed the wires through the box.
Fit the armour, the packing and the ring clip.
Turn the set screw to fasten the cable in place.
Screw down the conductor wires.
Fit the connector.
Firmly tighten the set screw.</td>
</tr>
</table>

3.3.2 Input/output connectors

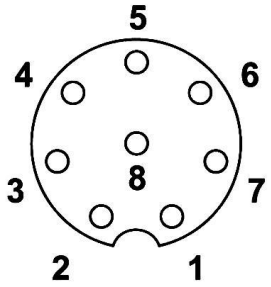
The Uf 811 can contain up to 4 single I/O modules or 2 double I/O modules.
2 connectors (I/O 1 & I/O 2) are provided for connection. Their wiring depends on the type and location of the modules determined when the order is placed.

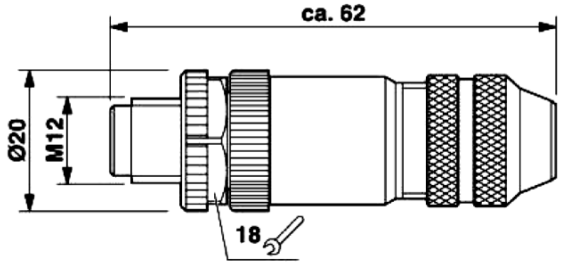
The location of the modules and their types are shown on the test report supplied with the device when it is delivered.

Locations 1 & 2 are connected to connector I/O 1.
Locations 3 & 4 are connected to connector I/O 2.

The connectors used are **female 8-pin type M12 connectors** with A coding.

View of the base





For the **I/O 1 connector**, the pins have the following functions:	
Pin	**Function**
1 I/O 1	Location 2 pin 1
2 I/O 1	Location 2 pin 2
3 I/O 1	Location 2 pin 3
4 I/O 1	Location 2 pin 4
5 I/O 1	Location 1 pin 1
6 I/O 1	Location 1 pin 2
7 I/O 1	Location 1 pin 3
8 I/O 1	Location 1 pin 4

For the **I/O 2 connector**, the pins have the following functions:	
Pin	**Function**
1 I/O 2	Location 4 pin 1
2 I/O 2	Location 4 pin 2
3 I/O 2	Location 4 pin 3
4 I/O 2	Location 4 pin 4
5 I/O 2	Location 3 pin 1
6 I/O 2	Location 3 pin 2
7 I/O 2	Location 3 pin 3
8 I/O 2	Location 3 pin 4

1) Wiring of the relay modules

The pins have the following functions:

Pin	Function
1	relay A
2	relay A
3	relay B
4	relay B

2) Wiring of the current output modules

The pins have the following functions:

Pin	Function
1	current (+)
2	current (-)
3	-
4	-

3) Wiring of the current input modules

The pins have the following functions:

Pin	Function
1	current A wire 1
2	current A wire 2
3	current B wire 1
4	current B wire 2

4) Wiring of the voltage input modules

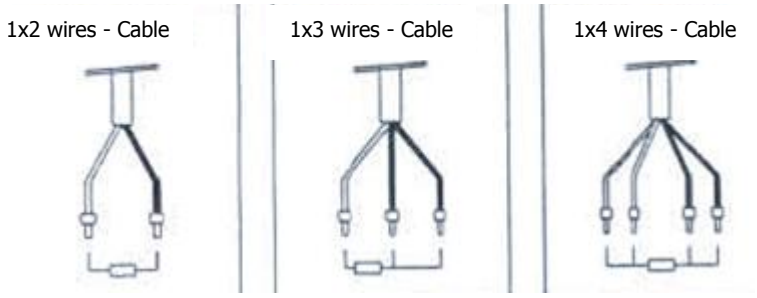
The pins have the following functions:

Pin	Function
1	voltage A(+)
2	voltage A(-)
3	voltage B(+)
4	voltage B(-)

5) Wiring of the temperature modules

Comment: This is a double location module

The sensors Pt 100 and Pt 1000 can be wired in different ways:



The most complete wiring is that using a 4-wire sensor:

Pin	Function
1	red wire 1
2	white wire 1
3	red wire 2
4	white wire 2

Warning: To ensure good measurement quality, it is recommended to use shielded platinum probes. 360° shielding connection is provided by the Binder connector.

Important: For 2- or 3-wire cables, just use "bridging" to make up for the missing wires. In the 3-wire version, a white wire is missing: simply bridge the two white wire terminals 1 and 2, and place the white cable on the "white wire" pin.

6) Example of a module configuration

- Single voltage input module in location 1.
- Single current input module in location 2.
- Double calorimetric module in locations 3 & 4.

For the I/O 1 connector, the pins have the following functions:

Pin	Function
1 I/O 1	current (+)
2 I/O 1	current (-)
3 I/O 1	-
4 I/O 1	-
5 I/O 1	voltage A(+)
6 I/O 1	voltage A(-)
7 I/O 1	voltage B(+)
8 I/O 1	voltage B(-)

For the I/O 2 connector, the pins have the following functions:

Pin	Function
1 I/O 2	red wire 1 probe 2
2 I/O 2	white wire 1 probe 2
3 I/O 2	red wire 2 probe 2
4 I/O 2	white wire 2 probe 2
5 I/O 2	red wire 1 probe 1
6 I/O 2	white wire 1 probe 1
7 I/O 2	red wire 2 probe 1
8 I/O 2	white wire 2 probe 1

7) Plug fitting instructions

Recommended length to strip, tightening torque and cross-section of cable:

Cross-section of conductor	0.25 mm² … 0.75 mm²
Cross-section of AWG conductor	24 … 18
External diameter of cable	6 mm … 8 mm
Tightening torque Wrench M12	0.4 Nm
Tightening torque Screw terminals	0.2 Nm
Tightening torque Set screw	0.8 Nm … 1 Nm

Plug fitting:

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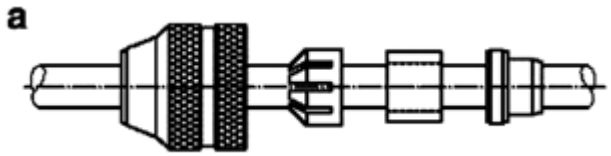
<td> 
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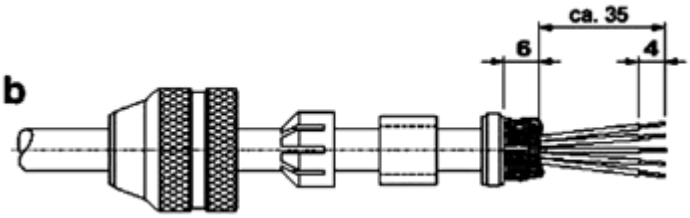
<td> 
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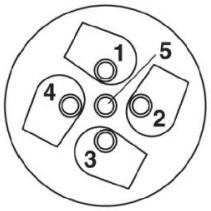
Strip the cable by 35 mm.
Strip the conductors by 4 mm.
Splay the armour and place it around the protector ring.
Cut off the excess braiding.
Feed the wires through the box.
Fit the armour, the packing and the ring clip.
Turn the set screw to fasten the cable in place.
Screw down the conductor wires.
Fit the connector.
Firmly tighten the set screw.</td>
</tr>
</table>

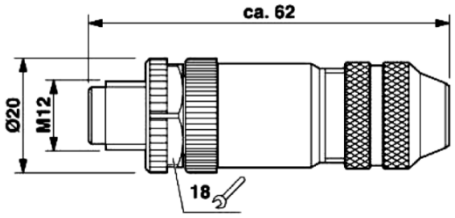
3.3.3 Probe and chord connector

Each connector (chord connector 1 & chord connector 2) relates to one ultrasound chord, namely two probes. As standard, it is therefore necessary to use the Y-cable provided with the flow meter in order to separate the two probe cables. The flow meter may be configured with only one probe per connector, but the number of possible chords is then divided by two. You are recommended to contact Ultraflux in order to define the best configuration for your application.

The connector used is a **male 4-pin M12 type** connector with A-standard coding.

View of the base





NB: pin 5 on base plate 5 is not used.

The **pins** have the following functions:

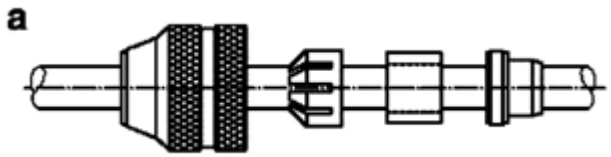
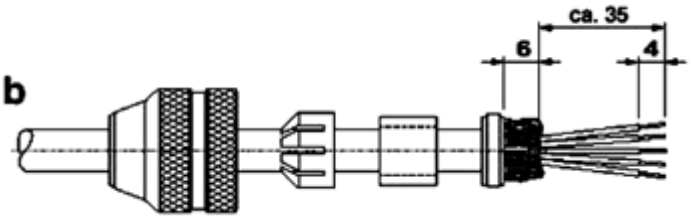
Pin	Function
1	upstream probe wire A
2	upstream probe wire B
3	downstream probe wire A
4	downstream probe wire B

Note: each pin number is engraved directly on the connector.

Recommended length to strip, tightening torque and cross-section of cable:

Cross-section of conductor	0.25 mm² … 0.75 mm²
Cross-section of AWG conductor	24 … 18
External diameter of cable	6 mm … 8 mm
Tightening torque Wrench M12	0.4 Nm
Tightening torque Screw terminals	0.2 Nm
Tightening torque Set screw	0.8 Nm … 1 Nm

Plug fitting:

	a Thread on the parts.
	b Strip the cable by 35 mm. Strip the conductors by 4 mm. Splay the armour and place it around the protector ring. Cut off the excess braiding. Feed the wires through the box. Fit the armour, the packing and the ring clip. Turn the set screw to fasten the cable in place. Screw down the conductor wires. Fit the connector. Firmly tighten the set screw.

3.3.4 Power supply connector

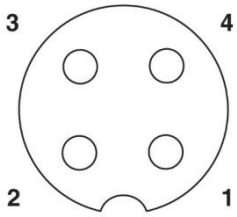
Warning: Before wiring the power supply, check that no current is circulating on the power supply cables. The installation must be locked and tagged so that it cannot be inadvertently powered on, for example by someone other than the user.

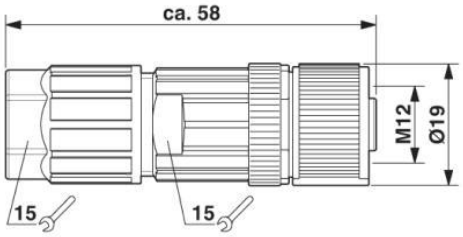
Important: Ensure the flow meter is powered off before removing the power supply connector. The flow meter may suffer irreversible damage should the power supply connector be removed whilst the flow meter is powered on.

1. Install the protective grounding braid on the dedicated screw.
2. Install the V+, 0V and ground wires on the connector.

The connector used is a **female 4-pin M12 type connector** with Speedcon A-standard coding.

View of the base





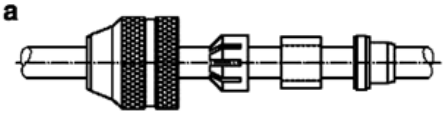
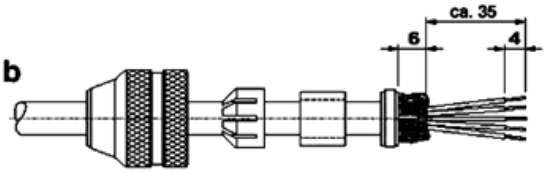
The **pins** have the following functions:

Pin	Function
1	VIN + 10-32 VDC
2	VIN – 0V
3	GROUND
4	not connected

Recommended length to strip, tightening torque and cross-section of cable:

Cross-section of conductor	0.25 mm² … 0.75 mm²
Cross-section of AWG conductor	24 … 18
External diameter of cable	6 mm … 8 mm
Tightening torque Wrench M12	0.4 Nm
Tightening torque Screw terminals	0.2 Nm
Tightening torque Set screw	0.8 Nm … 1 Nm

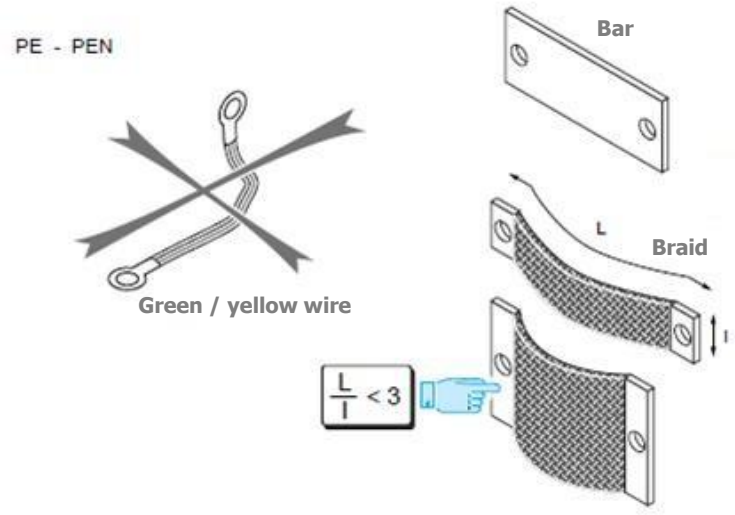
Plug fitting:

a 	b 
Thread on the parts.	Strip the cable by 35 mm. Strip the conductors by 4 mm. Splay the armour and place it around the protector ring. Cut off the excess braiding. Feed the wires through the box. Fit the armour, the packing and the ring clip. Turn the set screw to fasten the cable in place. Screw down the conductor wires. Fit the connector. Firmly tighten the set screw.

3.4 Ground connection

For the ground connection, it is recommended to use a copper braid. When choosing the braid, it is important to respect the following rule:

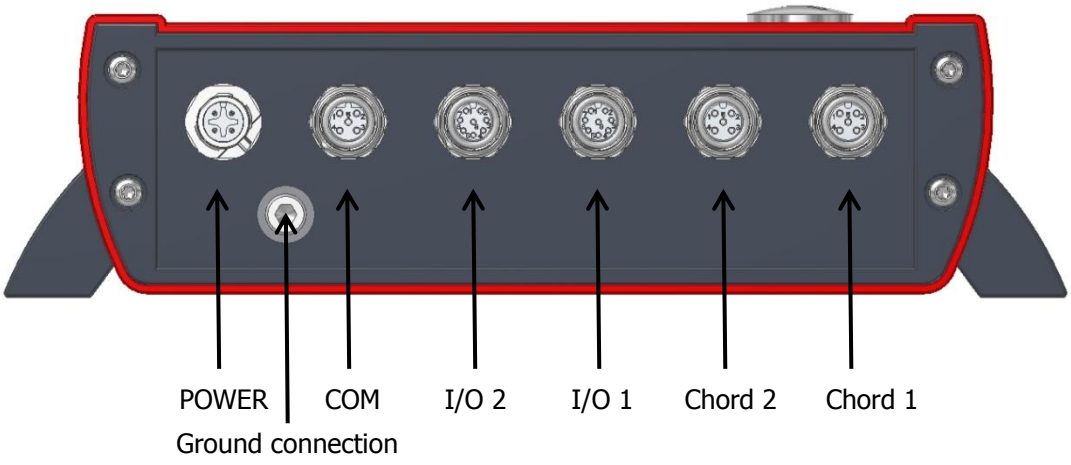
Length / Width < 3



3.5 Connection

Once the unit is fixed and the cables installed in the connectors, the probe connectors, input/output connectors, communication connector and finally (last of all) the power supply connector must be screwed into their allocated positions.

The connectors of the Uf 811 box are installed as shown on the figure below:



Important: All connectors must be connected with the equipment powered off, isolated and locked and tagged, by authorized staff. The power supply connector must be the last to be connected.

Screw the connector to the cable using the torque intended for the connector.

Note: If a connection is not used, cap it off at the Uf 811 in order to maintain IP67 leaktightness

CHAPTER 4: IMPLEMENTING A MEASURING POINT

There are 5 main steps to commissioning a measuring point and these must be followed very carefully. We would also like to remind you that Ultraflux can help with commissioning of your flow meters (for further information on this service, please contact us).

4.1 Choosing the measurement location

We highly recommend that you follow the instructions given in our document "Flow measurement by transit time difference".

As a reminder, the main precautions to be taken are as follows:

- Choose a measurement location providing straight lengths upstream and downstream of around 10 times the width of the channel or the river.
- Also choose a location where there is little aeration of the water. You should therefore avoid locations immediately downstream of:
    - a waterfall or a weir,
    - a screw-type pump,
    - a highly aerated grit chamber/oil separator,
    - an aerobic decantation installation,
    - a permanent tunnel aeration device.

4.2 Installing the probes

Given the many attachments and supports that are possible for wet probes (for open channels and rivers), we will not go into each of them in detail, but rather list the general principles and prerequisites for smooth operation of the installation.

1. When positioning the probe supports:
    - Respect the "axis diameter" when installing the supports. This value is provided by Ultraflux and is calculated based on the range of velocities expected at the measuring point.
    - Position the probe supports on each bank so that the ultrasonic chord(s) is (are) parallel to the water level (each probe the same distance from the water level).

2. When fixing the probe support:
    - Make sure that the position of the probe can still be adjusted (directional probes only).
    - Make sure that the attachments points are secure.

3. When aligning the probes:
    - Align the probes as far as possible using a laser sight or a rifle scope (depending on the distance and the meteorological conditions),
    - Once the work has been completed, make sure that the probe alignment mechanism is locked in place.

Comment: Probe alignment can be checked when the electronics have been put in place. You can then simply view the relative gain on each chord in your flow meter.

4.3 Measurements to be taken on site

4.3.1 Topography of the site

For future configuration of your Uf 811, the following points should be measured:

- Geometry of banks upstream, downstream and level with the measuring point,
- Pile (or probe support) position and the position of the ultrasonic probes,
- Floor profile (bathymetry),
- Water level on the water level gauge (day, date and time of operation).

4.3.2 Determining the different levels in relation to the stream

For future configuration of your Uf 811, the following measurements need to be taken on site in relation to the water level:

- The level probe(s),
- The velocity measurement chords (ultrasonic probes).

4.4 Analysing and processing data measured on site

In preparation for configuring your meter, produce the site plan and the plan of the different heights using the data collected.

Follow the 5 steps below to produce your 2 plans.

1. Trace the position:
    - Of the probe supports
    - Of the water level gauge
    - Of the banks

2. Work out the main axis of flow

3. Project the position of the probes onto this axis

4. On the plan, measure:
    - The distance between probes "L"
    - The axis diameter

5. Produce the plan of the different heights:
    - Of the water level gauge
    - Of the velocity measurement chords (ultrasonic probes)
    - Of the level sensors

4.5 Transferring the data collected to the converter

All of the data collected previously (points 4.3 and 4.4) must be transferred to the converter. There are two ways you can do this:

- Using the PC software for your Uf 811 (see Chapter 7),
- Directly in your UF 811's interface (see Chapter 5).

CHAPTER 5: USING AND CONFIGURING THE Uf 811

5.1 Using the Uf 811

The UF 811 has a screen and a keypad which can be used to configure and view the measurements as they are taken. LEDs indicate the status of the measurement and of the flow meter communication.

5.1.1 Operating mode

Uf 811 flow meters have 3 different modes (3 screen types):

- Measurement Mode (flow rate, velocity, gain, quality index, etc.) grouping together the measurement screens,
- Configuration Mode (description of the section, logger, etc.) grouping together the configuration screens,
- Echo Display Mode (landscape, zoom) grouping together the echo display screens.

5.1.2 Keypad

- The **Fn** (Function) key can be used to move from one screen type to another. This **Fn** key is used in particular to enter *configuration* mode. The ◀ and ▶ keys are used to browse through the menus of this mode.
- Pressing and holding the **Fn** key, or allowing approximately 1 minute to pass without using the keypad, takes you back to *measurement* mode.
- Within a menu, the ◀ and ▶ keys are used to change page. These keys may also have a contextual function. If this is the case, a reminder of this function will be provided at the bottom of the screen page, like the choice of screen in measurement mode, which is displayed by default.
- After powering on the Uf 811, the screen displays the page that has been selected as priority. To choose this "default" screen, select and validate it by pressing "**B**" in *measurement* mode.
- To scroll through the measurement screens, use the ▲ and ▼ keys.
- To access the other menus, press the **Fn** key, then successively press the ◀ key, or browse using the ◀ and ▶ keys.
- To enter a menu, press ▲ or ▼. To change page, press **A** or **B**. To edit a line, select it using ▲ or ▼ and change the value using ◀ or ▶.
- If no key is pressed for approximately one minute, the Uf 811 automatically returns to measurement mode and to the display chosen as priority using B.
- For a given parameter, the value to be applied is defined using the ▶ (up) and ◀ (down) keys. Pressing and holding one of these two keys accelerates the increase or decrease.

5.2 Main configuration elements

5.2.1 Geometric and physical definition of the measuring point

1) Composition of a measuring point

A measuring point consists of:

- an open channel measurement section (channel or river),
- a description of the hydraulic profiles,
- a fluid,
- one or more ultrasonic chords,
- up to four level sensors (which may or may not be provided by Ultraflux).

2) Reference systems used

Two reference systems are used:

- The customer reference system: the one used in measurement mode to display the water level. "Level" is used to refer to all elevations measured in this reference system,
- The section description reference system: the one used to describe the form of the channel or the river. "Height" is used to refer to all elevations given in this reference system.

Example: The water is at 150 mm on a water level gauge. The flow meter will display the level of the water surface in the customer reference system.

However, to describe the section, you may wish to take the bottom of the channel as a reference, with the water level to be displayed in relation to the customer reference system. The joint use of the two reference systems then involves reference planes.

3) Definition of the reference planes

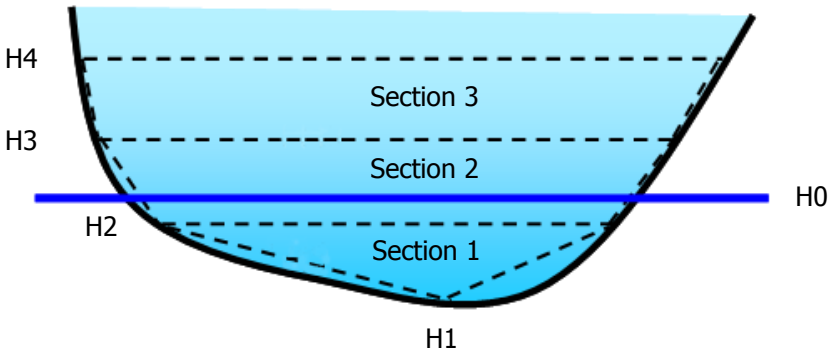
Each channel is defined by a set of trapeziums. Each trapezium is defined by:

- height at top/height at bottom,
- width at top left and right/width at bottom left and right.

To define the section of the channel, two reference planes are used, one for the heights (H0) and one for the width (W0). The form of the channel or the river is broken down into sections. Each section represents a part of the trapeziums. The heights and widths of the trapeziums are measured in relation to two reference planes.

Example:

For the following sections:

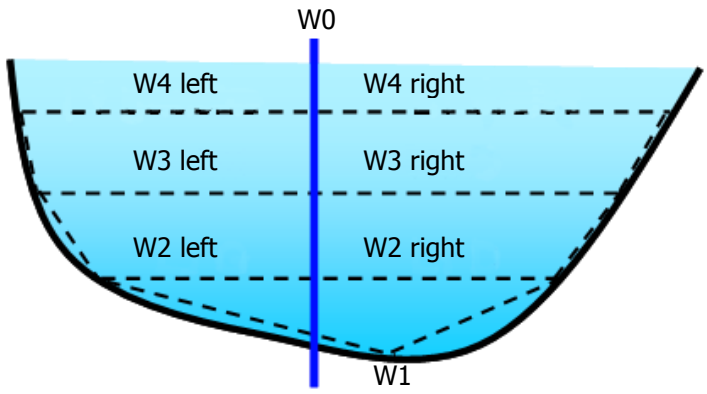


The section heights are defined as follows:

- H1= - 0.5 m
- H2= - 0.2 m
- H3= 1.2 m
- H4, H5 …. H20 (if defined) = to be determined

The elevations may be negative, null or positive depending on the H0 chosen.

The widths meanwhile are defined with regard to a vertical plane W0:



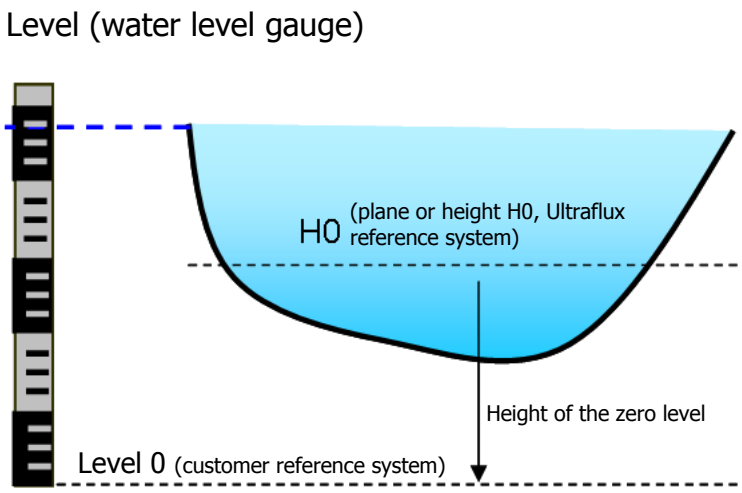
As for the heights, the widths may be negative, null or positive with regard to this plane.

Comments:

- The highest point must be greater than the maximum foreseeable water level. If the water exceeds this height, the entire area located above this last point is not taken into account.
- For rather complex sections (e.g. semi-circular outfall sewer with cunette), it is important to surround the discontinuities with two elevations close together.
- It is not compulsory to define 20 pairs of points. The widths of the unused points may be set to 0.

4) Correspondence between customer reference system and section description reference system

To connect these two reference systems, the elevation must be defined between the zero of the level and the plane H0.



Three scenarios can be envisaged:

- If the zero level of the water level gauge is **below** the plane H0, the height of the zero level has a **negative** value (see figure above),
- If the plane H0 and the bottom of the water level gauge correspond to the river bed, the height of the zero level is 0,
- If the plane H0 is defined as being the surface of the water at a reference height of 26m NGF (General Levelling of France), the height of level zero (therefore 0 NGF) has a value of -26m since, in the section description, the plane is located at a height of -26m NGF.

Note: The open channel pipe is defined by its section, its hydraulic profile and the position of the ultrasonic chords.

The number of chords must be determined based on

- the required accuracy
- the amplitude in the variation of the level (since the probes must be submerged in order to operate)

For all of these technical points, consult Ultraflux if necessary.

5.2.2 Number of channels

Note: for multi-channel flow meters only, it is possible to define the number of channels to be managed by the flow meter. The geometric and physical description of the measuring point must then be produced for each channel.

In the case of several channels, the channels are named in alphabetical order (A, B, etc.). Qa, Qb, etc. are the flows calculated for each channel. Qt is the total flow.

5.3 Configuring the UF 811

The configuration mode for the flow meter is divided into three levels:

- **Simple:** simplified configuration for basic use of the flow meter.
- **Normal:** configuration allowing more detailed use.
- **Advanced:** mode allowing complete adjustment of the flow meter settings. This mode is reserved for users with detailed knowledge of the transit time difference flow measuring technique and with some idea of hydraulic concepts.

The level can be changed by going to the menu Configuration / Settings / Simple, Normal or Advanced.

This menu is also used to activate functions such as

- the logger,
- the inputs/outputs,
- the totalizers.

To activate these options, position the cursor on the line corresponding to the required option and use the < and > keys.

5.3.1 Flow meter menu

Depending on the type of flow meter and the configuration mode selected (simple, normal or advanced), the flow meter menu may change. Below is a non-exhaustive list of the sections for the flow meter:

- CONFIGURATION: configuration of the operating modes, the registration name, the JBUS/MODBUS characteristics, configuration management, etc.
- PIPE/FLUID SETTINGS: settings for the type of fluid, the pipe, the chords, the geometry of the chords of the measuring point, etc.
- DESCRIPTION OF SECTION: settings for the section of the channel or the river.
- LEVEL SETTINGS: settings for the level measurement(s).
- HYDRAULIC PROFILE: settings for the hydraulic profile curve that the flow meter must use.
- HEIGHT/VELOCITY SETTINGS: settings for the height/velocity law in the event that the probes are all out of the water.
- TOTALIZER SETTINGS: settings for the totalizers.
- INPUT/OUTPUT SETTINGS: settings for the inputs and outputs.
- LOGGER SETTINGS: settings for the logger.
- LINEARIZATION SETTINGS: settings for linearization.
- FUNCTIONS SETTINGS: settings for the inputs for the function engine. This menu is only available upon request for specific applications.
- ADVANCED SETTINGS: settings for the simulation mode, the special probes, the specific codes for ultrasonic treatment, etc.
- ECHO DISPLAY: display of the echo signals of the ultrasonic probes.
- FIRMWARE UPDATE: update the firmware.

5.4 SIMPLE configuration mode

Below you will find the description of the menus, screen by screen, to guide you through the configuration of your flow meter.

5.4.1 "Configuration" menu

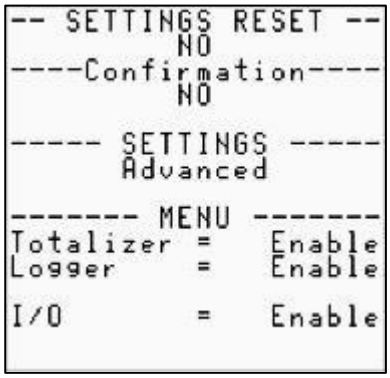
1) "Option Files" window

This window is used for loading and saving your configurations. The current configuration of the flow meter can be saved directly in the flow meter, or on a PC. Up to 11 configurations can be saved, numbered from 1 to 11.

To save the current configuration on the flow meter, select the configuration number under which you wish to save it. The saving of the configuration is then validated when you move to another menu page or after pressing and holding the **Fn** key.

To recall a configuration, enter the configuration number and validate this choice by moving to another menu page.

Make sure you remember to save the current configuration so that you do not lose it.



2) Reset

This command is used to reset the flow meter (restoration of factory settings).

3) Confirmation (of reset)

The flow meter is reset via a field requiring confirmation (protection against handling errors).

4) Settings

This command is used to change the flow meter's configuration level (Simple, Normal or Advanced).

5) Menu

Used to activate or deactivate:

- the logger,
- the inputs/outputs,
- the totalizers.

6) Access code

The flow meter is initially delivered without an access code (access code is 0), allowing you to freely modify all the settings. The introduction of a valid code is used to prohibit the modification of the settings by anyone who does not have the code. The settings can then be viewed freely, but cannot be modified.
The code comes into operation when the flow meter returns to measurement mode. The code must be entered in order to exit this mode. If the code is incorrect, the flow meter is locked for a few seconds. The time for which the flow meter is locked increases each time that an incorrect code is entered by the user.

Notes:

- The flow meter can be locked manually. Select the "Locked" field and set it to "YES".
- The code can be modified using the keypad (it is then defined using the **<** and **>** keys) or the serial link.

Important: For writing operations via the serial link or USB, the code must be "written" before any "writing" frame. The flow meter is automatically locked after 10 seconds without any "writing". Each incorrect attempt at entering the code increases the time before the next attempt can be made.

7) Language

The possible display languages are: French, English, Spanish, German, Italian, Portuguese and Russian.

8) Station name

Each flow meter can be assigned a label with up to 8 characters (registration number). The position of the current character is chosen using the ▼ and ▲ keys. To scroll through the characters, use the **<** and **>** keys.

9) Back light

The possible options are:

- ON: the back light is on for one minute after pressing any key, then remains dimly lit,
- TIMED: the back light is on for one minute after pressing any key, then goes off,
- OFF: No back light.

10) Connection

- Configuring the serial link
  Enter the JBUS/MODBUS number of the flow meter (number assigned to the flow meter and to which it will respond in a JBUS/MODBUS query).

- Transmission speed (bitrate)
  Enter the transmission speed that you wish to apply.

11) Time delay before return to "Measurement" mode

The flow meter automatically returns to the Measurement screens after approximately one minute. The modified settings will then be taken into account. This avoids the risk of forgetting to exit "Configuration" mode and needing to do further operations to return to "Measurement" mode.

5.4.2 "Pipe/fluid settings" menu

In "simple configuration" mode, access to the settings is restricted to the following sections:

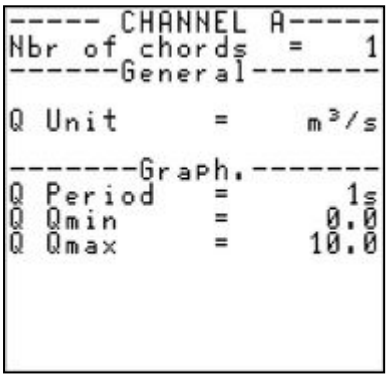
1) Number of chords

Enter the number of chords used for your application.

2) Flow unit (unit Q)

Enter the flow unit to be displayed.

3) Flow graph



The flow graph is a screen in Measurement mode. It displays the changes in a specific magnitude in the form of a curve (see the possible dimensions below).

Enter the minimum and maximum limits of the dimension associated with the flow graph. These limits mark the boundaries of the vertical display of the flow graph.

The flow graph Period setting is used to define the time interval between two successive points. The possible values are: 1 s, 5 s, 10 s, 30 s, 1 min, 2 mins, 5 mins, 10 mins, 15 mins, 30 mins, 1 hr, 2 hrs, 6 hrs, 12 hrs and 24 hrs.

Example: If the period of the flow graph is 1 min, each point of the curve represents the average value of the dimension associated with the flow graph over 1 min and the whole screen shows the evolution of the flow over the last 144 minutes.

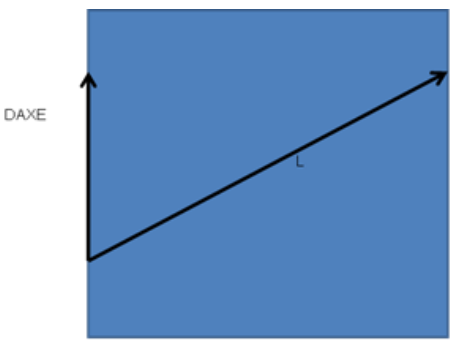
4) Type of fluid

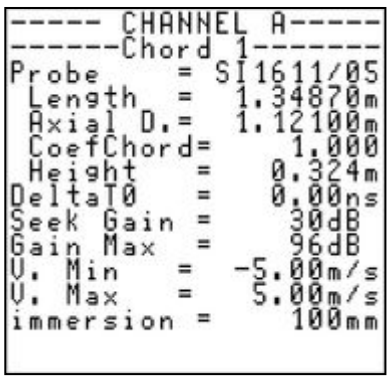
In simple configuration mode, the fluid must be water at ambient temperature (cannot be modified).

5) Chord settings

The settings to be entered for the definition of a chord are as follows:

- the reference of the probes used,
- the length (in metres) between the faces of the two probes,
- the projected length (axis diameter) with regard to the axis of the channel or the river,
- the height compared to H0.

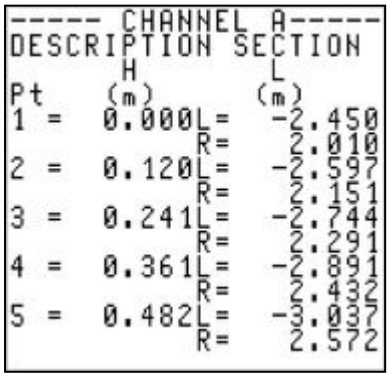




5.4.3 "Section Description" menu

This menu is used to describe the section of the channel or the river.

1) Section description

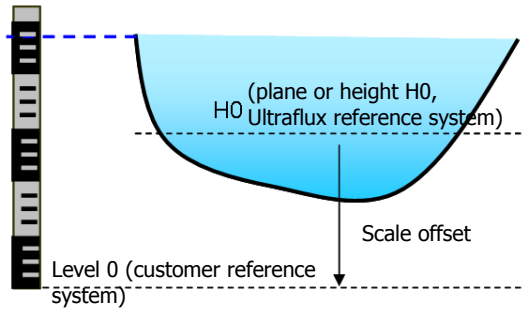


For each chord, enter the elevation of the plane of the chord with regard to the plane H0 and the two widths with regard to the plane W0 (H0 and W0 defined in part 5.2.1, point 3). This section can be defined in 20 points.

It is possible to define a distance to the right and to the left of the plane W0.

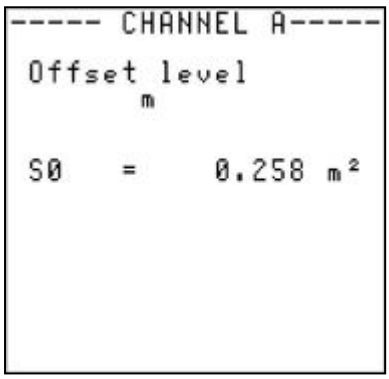
2) Gauge offset

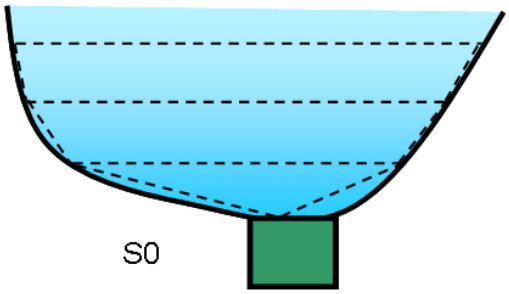
Level (water level gauge)



The gauge offset is the numerical value used to switch from the section description reference system ("height reference system") to the customer reference system ("level reference system").

3) Surface S0





When the bottom of the channel or the river is difficult to describe in terms of section (for example if there is sand silting, pebbles, etc.), it can be estimated using parameter S0 which defines a surface of the section in which the velocity is constant.

If this parameter is positive, the calculation of the flow adds this section to the hydraulic section (erosion of the channel) and considers a constant fluid velocity equal to the lowest hydraulic section velocity.

If the value of S0 is negative, the value of S0 is deducted from the section and it is considered that so long as the wetted section is smaller than S0, the flow is null (silting). The aim is to simulate silting of the channel.

5.4.4 "Level settings" menu

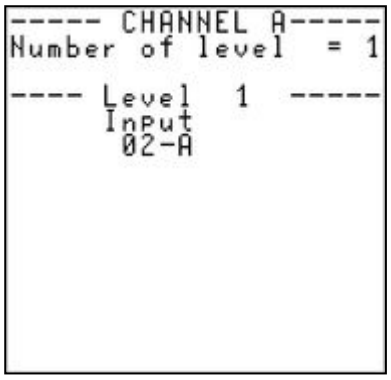
This menu is dedicated to configuring the level measurement.

The level measurement is essential for measuring the flow. In fact, ultrasonic probes are used to measure the average flow velocity of the fluid in the channel and the level is used to find out the surface wetted by the fluid in the section of the channel.

1) Number of level measurements

The UF 811 can be used to manage up to four level measurements.

The menu below is used to select, for each level, the input channel which corresponds to the level measurement (for example, a 4-20 mA input):



The measurement used to calculate the flow rate (priority measurement) is level 1. If this is faulty, the flow meter automatically switches to level 2.

Note: To measure a level, a simple solution involves using a current input. The flow meter will work out the level of water in which the sensor is submerged from the current measured. Simply configure the range of the sensor and the base of its scale. For further information on the configuration of inputs/outputs, see the chapter dedicated to this subject.

Comment: For a level sensor taking a downward measurement (for example, a measurement by ultrasound in the air), the range of the measurement entered in the flow meter must be negative.

5.4.5 "Hydraulic Profile" menu

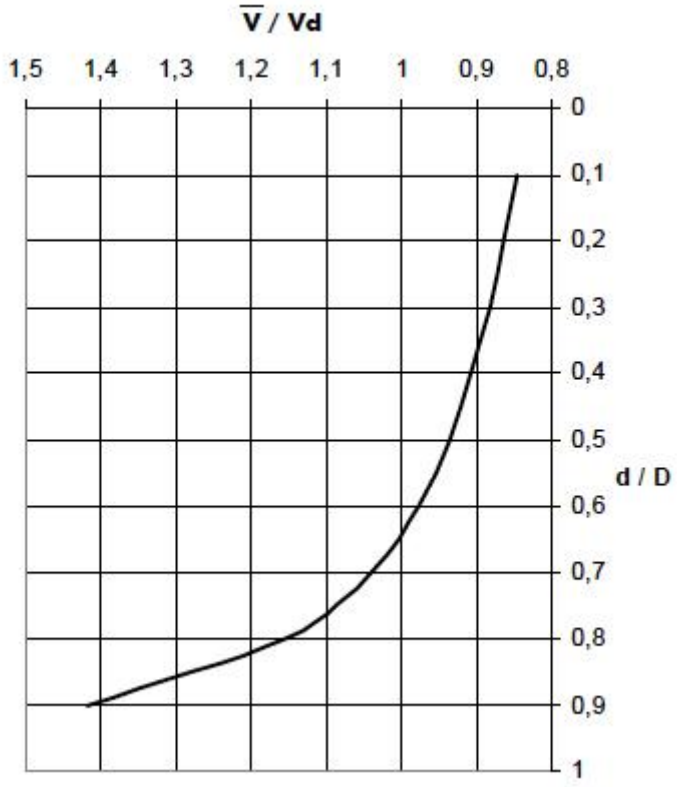
1) Description of the hydraulic profile

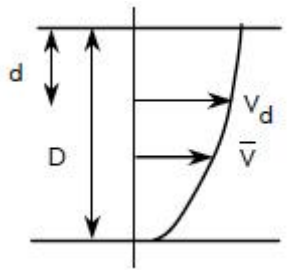
The vertical hydraulic profile is described using 20 sections.

Each section is defined by its lower and upper elevations and by its hydraulic coefficient (see this concept in our document "Flow measurement by transit time difference").

The value of this coefficient may be fixed section by section (absolute mode) or may be calculated for each section based on the distance from the section to the surface.

The graph below shows the rest of the coefficients specified by standard ISO 6416 (indicates the existing relation between the average velocity V in the entire wetted section and the velocity measured by a chord submerged at d / D.):





Comments:

- The deepest section is marked by the bottom of the channel or the river and by elevation no. 1,
- The sections describing the hydraulic profile are fully independent of the sections describing the measurement section.

2) Choosing the definition mode of the hydraulic profile

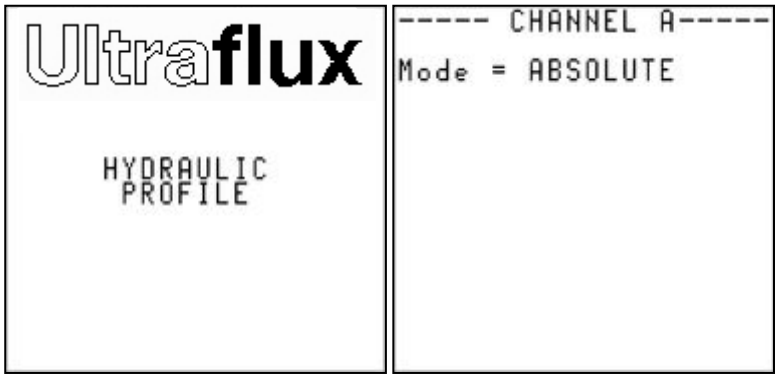
The hydraulic profile may be defined according to two modes:

- **Absolute mode**, in which the elevations marking the sections are specified in metres starting from the bottom of the channel or the river up until the maximum foreseeable height (point 1 = lowest elevation; point 20 = maximum foreseeable height) and in which the hydraulic coefficient of each section is fixed. This mode is particularly suited for narrow channels with an irregular section.

  Important: In absolute mode, all elevations are specified with regard to the reference plane H0.

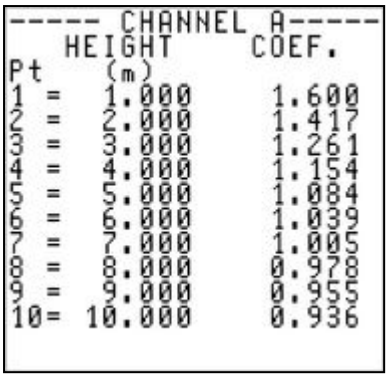
- **Relative mode**, in which the elevations marking the sections are specified as an immersion percentage (for example, point 1 = 95% immersion; point 20 = 0% immersion = surface), the hydraulic coefficient being calculated based on the depth of the section. This mode is more particularly suited to wide channels with a fairly regular section.

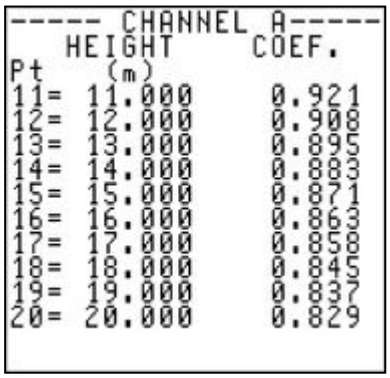
Select the required mode, absolute or relative.

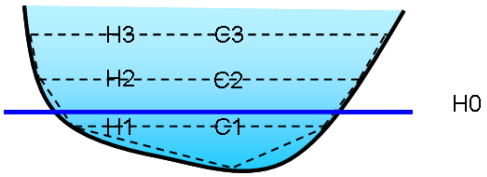


3) Absolute mode

Starting with the lowest elevation (Pt1), specify for each section the upper elevation of the section and the corresponding hydraulic coefficient.





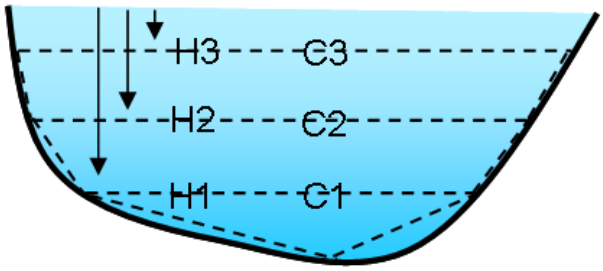


Comments:

- The elevation of point no. 20 must be greater than the maximum foreseeable level,
- For a given section, the velocity must be roughly constant.

4) Relative mode

Starting from the bottom, specify for each section the immersion percentage of the upper elevation and the corresponding hydraulic coefficient, the elevation of the last section being 0 (surface of the channel or the river).



----- CHANNEL A-----			----- CHANNEL A-----		
Pt	IMMERS. %	COEF.	Pt	IMMERS. %	COEF.
1 =	95	1.600	11=	45	0.921
2 =	90	1.417	12=	40	0.908
3 =	85	1.261	13=	35	0.895
4 =	80	1.154	14=	30	0.883
5 =	75	1.084	15=	25	0.871
6 =	70	1.039	16=	20	0.863
7 =	65	1.005	17=	15	0.858
8 =	60	0.978	18=	10	0.845
9 =	55	0.955	19=	5	0.837
10=	50	0.936	20=	0	0.829

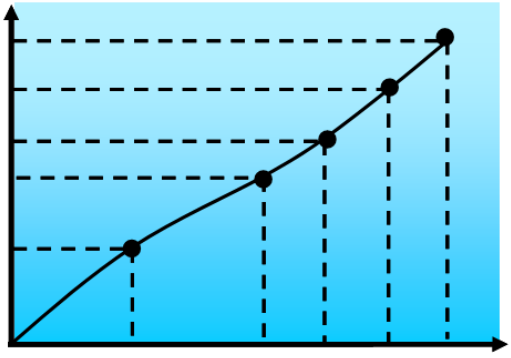
Comment: By default, the breakdown of the hydraulic profile (into basic sections) proposed by the flow meter copies the one recommended by the ISO 6416 standard concerning the ultrasonic flow measurement in an open channel.

5.4.6 "Height/velocity settings" menu

1) Velocity profile in low water situation

When the level is below the lowest chord, the flow cannot be measured using ultrasound. It can however be estimated using a linear interpolation curve with 4 points, or by self-learning (automatic regression).

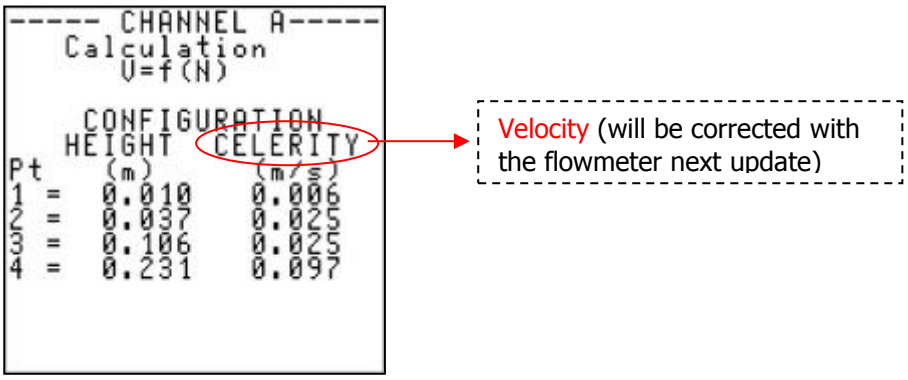
Velocity



Height

The settings to be indicated depend on the technique chosen:

- height/velocity curve:

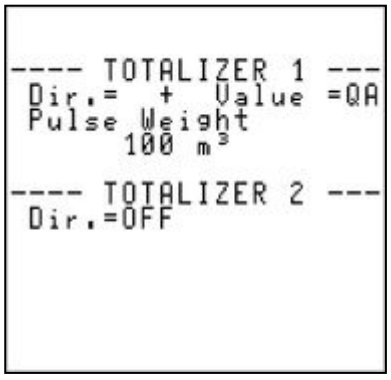


- automatic regression:

It is possible to trigger a "learning" mode for this height/velocity law, which is done by automatic regression. The flow meter will then estimate what the height/velocity curve could be, taking into account the measuring points.

A coefficient can then be defined which will be used until the flow meter takes new measurements.

5.4.7 "Totalizer settings" menu (if activated)



1) Activation and direction of metering

For each of the totalizers, the possible modes are:

- **OFF:** totalizer not activated,
- **+** : totalization of the positive flows, in other words going from the upstream probes to the downstream probes (see the wiring of the probes),
- **–** : totalization of the negative flows, in other words going from the downstream probes to the upstream probes,
- ±: totalization of all flows, whatever the direction.

Note: In addition to flow rate totalization, other magnitudes from the function engine can be totalized if this is activated. Contact Ultraflux for further details.

2) Pulse unit and weight

Each activated totalizer emits an incrementation pulse (which can be returned on a relay output, see part 5.4.4, point 5) each time that the Pulse weight x Unit volume flows in the metering direction of the totalizer.

The possible units are (non-exhaustive list): 1 ml, 1 l, 1 m³, 1,000 m³, 1 Gal, 1 Bbl, etc.

3) Resetting a totalizer (if authorised)

When it leaves the factory, totalizer reset is blocked. This feature enables the totalizer to be used as a tamper-proof meter and can therefore be used for internal billing (mutually agreed by both parties).

Upon request and before dispatch, totalizer reset can be authorised.

On site, only an Ultraflux representative will be able to reset the totalizers.

To reset a totalizer (if authorised):

1. Switch to measurement mode (press and hold the **Fn** key) on the page of the totalizer concerned,
2. Press the **A** key until the totalizer that you wish to reset is displayed on the right,
3. Press the **B** key to reset the totalizer. A negative image of the pop-up menu is then displayed.

5.4.8 "Input/Output settings" menu (if activated)

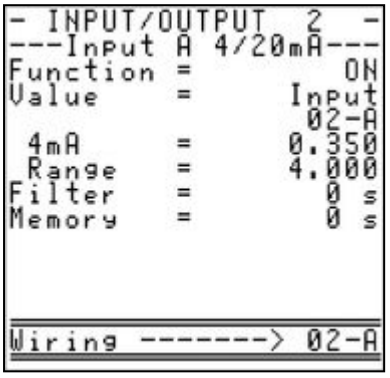
The input/output modules are:

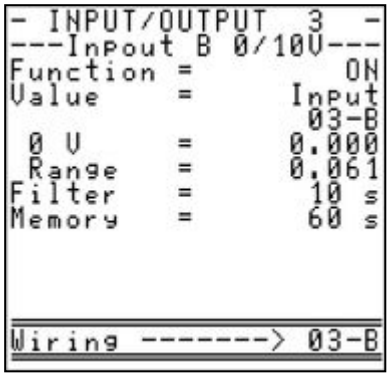
- As input:
  - Current,
  - Voltage,
  - Temperature (PT100/PT1000),
  - Contact.

- As output:
  - Current/Voltage,
  - Relay.

The menu only appears if inputs or outputs are installed on the flow meter. To install additional inputs/outputs, please contact Ultraflux to find out the specifications of all available inputs/outputs.

1) Current input and voltage input module





The possible options are:

- OFF: deactivated,
- ON: activated,
- Simulation.

For ON and Simulation, the following must be defined:

- the value corresponding to 4 mA (for a current input),
- the value corresponding to 0 V (for a voltage input),
- the sensor range,
- the value to be simulated (in simulation mode),
- the value of the filter and the memory (in ON mode).

2) Temperature input module

The possible options are:

- OFF: deactivated,
- PT100-PT1000 mode 2-, 3- or 4-wire (for further details, contact Ultraflux).

  Define:

  - the type of sensor, Pt 100 or Pt 1000,
  - the type of assembly, 2-wire, 3-wire or 4-wire,
  - the value of the filter and the memory,
  - any offset.

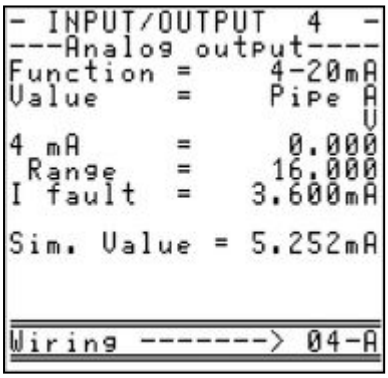
- Simulation
  Enter the temperature value to be simulated.

3) Contact input module

The possible options are:

- OFF: deactivated,
- Status: whether the contact is open or closed,
- Pulse: the number of open-close cycles of the contact.

4) Current/voltage output module



The possible options are:

- OFF: deactivated,
- Voltage output:
  - 0-5 V,
  - absolute value |0 - 5 V|.
- Current output:
  - 0-20 mA, 4-20 mA, 0-24 mA,
  - absolute value |0-20 mA|, |4-20 mA|, |0-24 mA|.

For the voltage output and current output choices, the following must be defined:

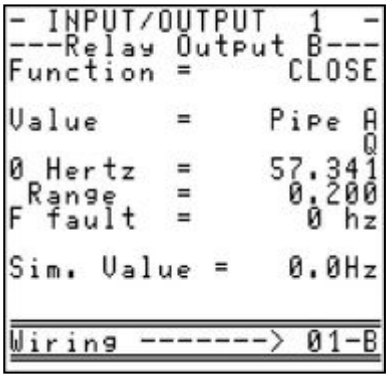
- the parameter that the output represents. Select the dimension that you wish to associate with the analogue output using the chapter headers (function) and the chapter items (value)
- the base of the scale:
  - value corresponding to 0 mA or 4 mA (for a current output),
  - value corresponding to 0 V (for a voltage output).
- the range,
- the value in the event of a fault in mA (for a current output) or in volts (for a voltage output).

Comment: This module can be used as a current or voltage generator.

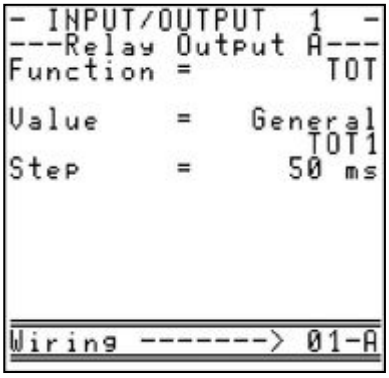
5) Relay output module

Each relay output may be configured according to one of the following operating modes:

- *Open:* The relay remains constantly off.
- *Closed:* The relay is on if the UF 811 is powered on, and off if it is not powered on. This choice therefore allows the relay to be used to detect the presence of the power supply (positive safety).



- *Totalizer:* The relay generates a pulse with an adjustable width on each incrementation of the selected totalizer.



The pulse width must then be defined, determining the time for which the relay remains closed (the relay, initially off, is then on for half of the period, then off again for at least the same duration).

The value of the relay period must be less than the pulse weight divided by the flow rate.

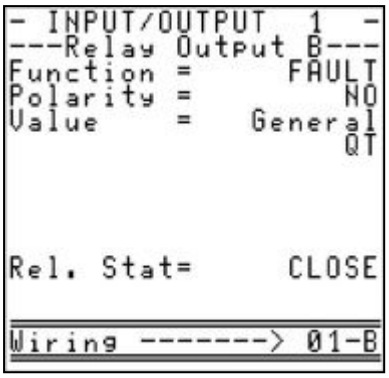
Example:

Flow rate = 1,000 l/s / Pulse weight = 100 l

We will therefore have 1 pulse every 100/1,000 = 100 ms

The value of the period must not therefore be greater than 100 ms, at the risk of not counting all of the pulses emitted by the totalizer.

- *Fault:* Depending on the polarity chosen (NO: normally open, NC: normally closed), the relay state changes when the associated fault occurs.



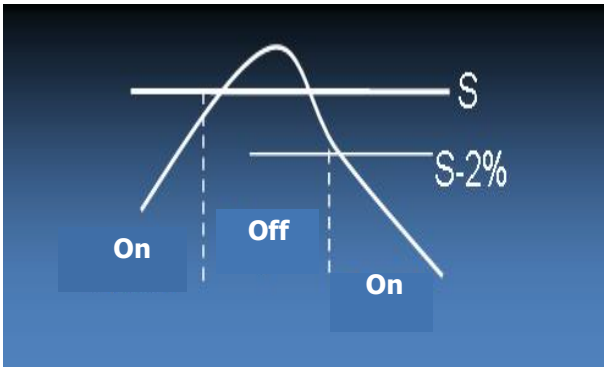
In the example, the variable selected is "general Q". This means that the relay closes when the flow meter is not measuring a flow and remains open otherwise.

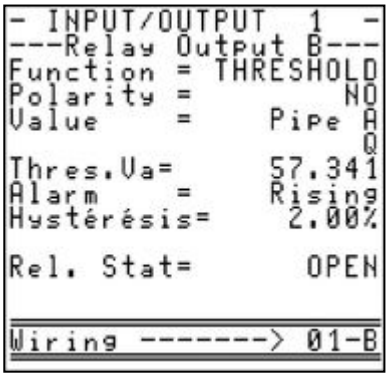
- *Direction:* Depending on the polarity chosen (NO: normally open, NC: normally closed), the relay state changes when the sign (+ or -) of the associated dimension changes.

- *Threshold:* Depending on the polarity chosen (NO: normally open, NC: normally closed) and the direction in which the threshold is crossed, the relay takes one state if the value is greater than the indicated threshold. The relay switches to the opposite state if the value concerned is lower than the threshold.

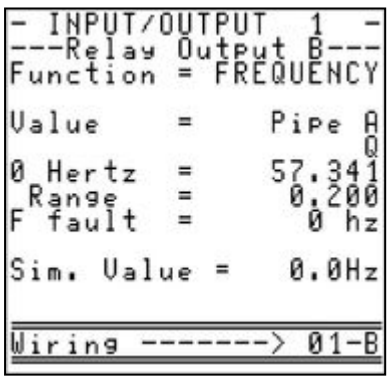
  Comment: In order to restrict the relay backlash when the dimension concerned fluctuates around the threshold, hysteresis must be defined.

  The diagram below illustrates this principle with hysteresis at 2% and the threshold crossed in the ascending direction:





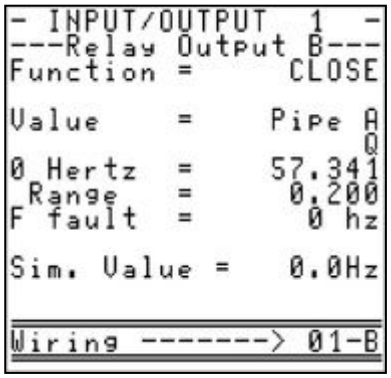
- *Frequency:* The frequency at which the relay is opened and closed depends on a value to be defined. Example: high flow, high frequency, low flow, low frequency.



The following must be defined:

- the parameter that the output represents.
  Select the dimension that you wish to associate with the analogue output using the chapter headers (function) and the chapter items (value).
- the value corresponding to 0 Hz.
- the value corresponding to 1 kHz.
- the value in the event of a fault.

The relays can be tested individually: select the open or closed mode on the relay status line.



5.4.9 "Logger settings" menu (if activated)

Important: The modification in the number of variables must be preceded by the logger being reset.

1) Resetting the logger

"YES" needs to be entered in the "LOGGER reset" field to reset the logger.

2) Confirming logger reset

The logger is deleted via a field requiring confirmation (protection against handling errors).

3) Number of logger parameters

Up to 30 variables can be recorded in the logger. The number of variables can be adjusted. Its maximum autonomy is for 530,000 time-stamped readings.

4) Logger mode

The logger can record in 2 modes: "rolling" (first files deleted when the logger is full) or "Stop when full" (the logger stops recording when it is full).

5) Logger increments

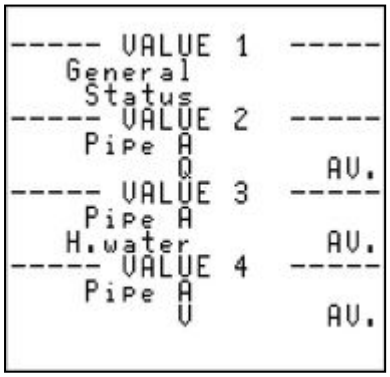
The recording period of the logger can be set from 1 s to 24 hrs: 1 s, 5 s, 10 s, 30 s, 1 min, 2 mins, 5 mins, 10 mins, 15 mins, 30 mins, 1 hr, 2 hrs, 6 hrs, 12 hrs and 24 hrs.

6) Logger autonomy

This field cannot be edited and indicates the logger's remaining autonomy.

7) Logger variables

For each of the variables of the logger, one of the following functions can be selected:

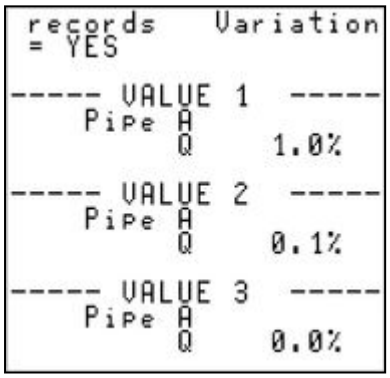


- *AVG:* average value over the recording period,
- *MIN:* minimum value over the recording period,
- *MAX:* maximum value over the recording period.

8) Logger on variation

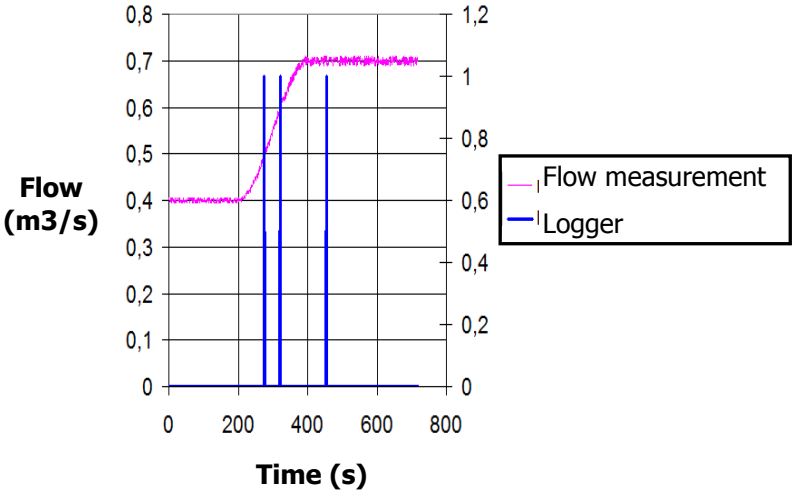
The variation mode of the logger is used to reduce the recording period for the data in the logger.

To do this, define the maximum variation percentage with regard to the previous recording. If the variation measured is greater than this maximum, the recording is instantly triggered (no more than once per second).



Comment: A percentage equal to 0% disables the associated value.

The following figure shows the reduction in the period of the logger when the flow experiences a variation:



The vertical lines (blue) correspond to the triggering of records of the logger. If the variation of the flow is greater than the configured threshold, the logger forces a recording.

5.4.10 "Echo Display" menu

Please note: The "Echo Display" mode blocks the measurement function. The measurement values are no longer calculated, the logger no longer records data.

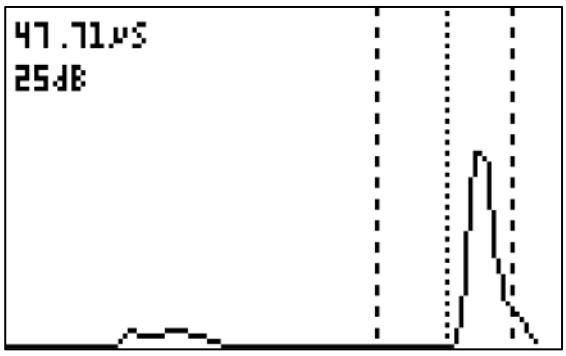
This mode is used to view the acoustic signal of each chord, which is of use during the commissioning or maintenance phase, or for example:

- to check the connection of the probes and their good working order,
- to check that the probes are placed at the correct distance,
- to find the origin of a measurement incident (clogging of the probes, obstruction of the structure between the probes, unforeseen pollution, rupture of a probe cable, etc.).

Comment: Various characteristic signals are analysed in Appendix 1.

"Echo Analysis" mode includes two screens per chord:

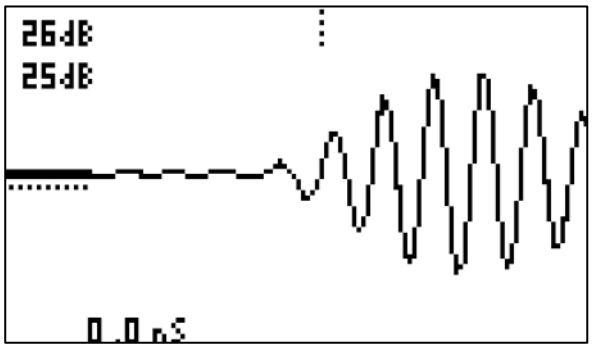
- The first displays the acoustic signal between the emission (for short travel times) and the echo analysis zone. This screen is called the "landscape" display:



  - The two dashed vertical lines give the zone in which the echo is expected. An echo received outside of this zone is not taken into account.
  - The dotted vertical line gives the measuring point on the echo.
  - The number of the chord is indicated below the graph.
  - In the top left hand corner of the screen, the gain applied to the echo and the sound path duration are shown.

  Comment: If no acoustic signal reaches the expected zone (for example if one of the probes is not connected, or if one of the probe cables is damaged), the screen displays a "!" sign in place of the acoustic signal.

- The second screen shows a zoom on the echo chosen for the measurement. This screen is called the "zoom display":



  - The horizontal bar continues to indicate the noise level.
  - The dotted vertical bar marks the place where the travel time is measured. Absence of this bar means that no measurement is taken (for example if there is too much disturbance).
  - The dashed horizontal bar indicates the measurement threshold. The measurement is taken the first time the alternation that crosses this threshold reaches 0.
  - The ultrasound path duration delta is indicated in the bottom left hand corner (not taking into account the $\triangle T0$).

5.5 NORMAL configuration mode

Comment: This section will be restricted to an explanation of the additional functions of "normal configuration" compared to "simple configuration". The entire common base already explained in the "simple configuration" section is not repeated in this section.

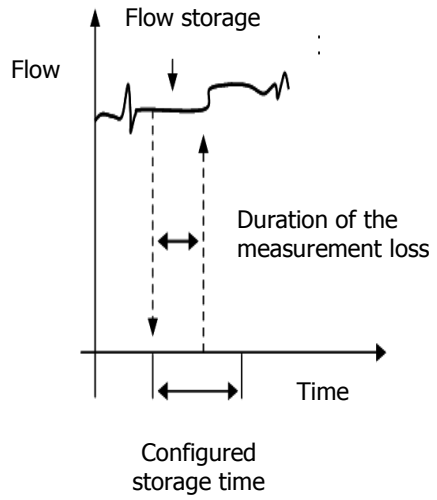
5.5.1 "Pipe/fluid settings" menu

1) Memory

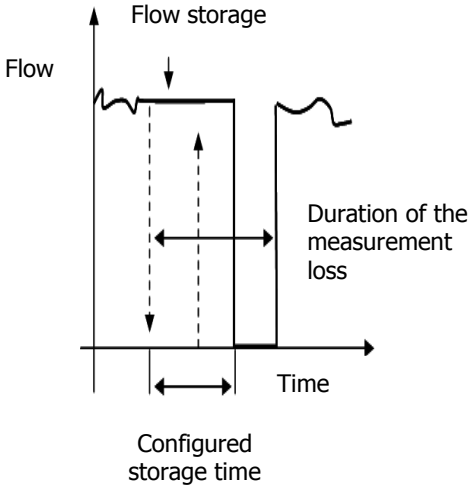
The memory is the time, given in seconds, for which the measurement is stored in memory when a measurement is lost (echo loss).

This storage is used in particular to avoid inopportune actions from the instrumentation and control part of the installation.

Two situations may arise:



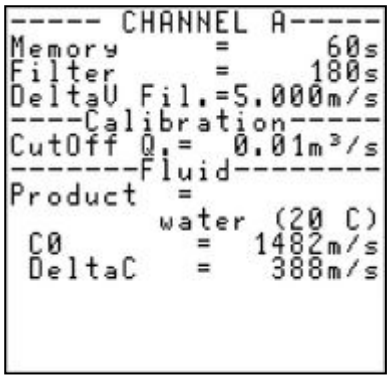
Situation 1: Measurement loss duration less than the storage time. In this case, the flow meter keeps the last measurement until a new measurement is valid.



Situation 2: Measurement loss duration greater than the storage time. The flow meter extends the last measurement until the time that has passed is longer than the storage time. The flow measurement is then given as faulty if there is still no new valid flow measurement.

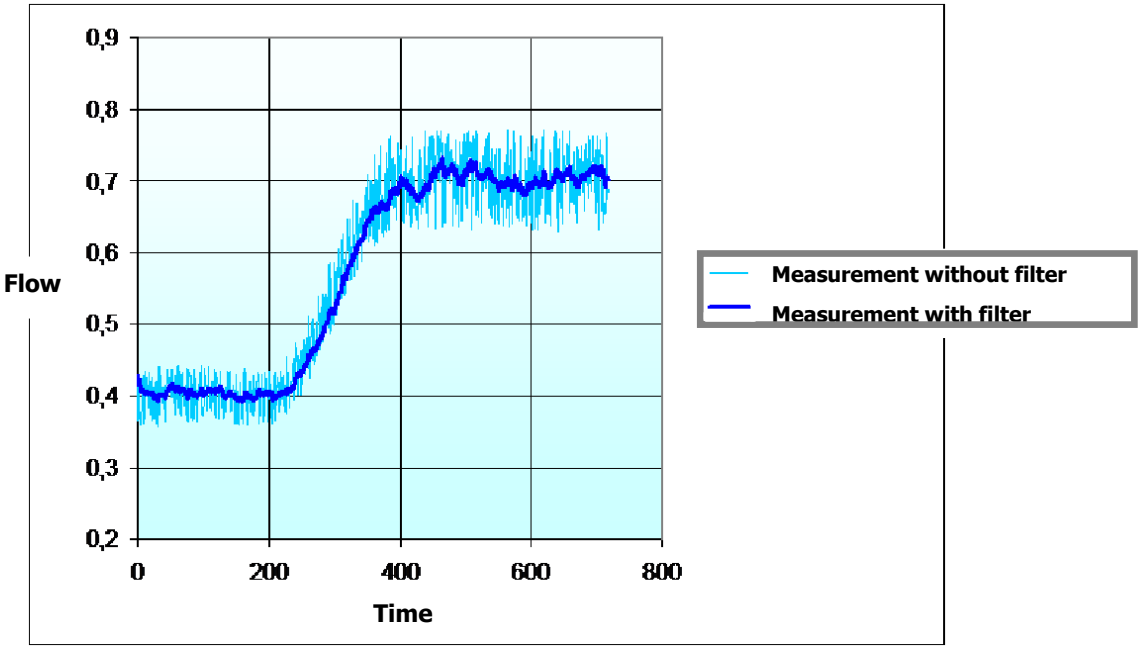
2) Filter

The flow measurement can be filtered so as to make the measurement results more legible.



This feature must be used when the flow is extremely chaotic and an average for the flow needs to be produced in order to view its evolution.

The diagram below illustrates the effect of the filtering in the event of a very versatile and turbulent measurement:



The filter time constant, given in seconds, defines the "force" of the filtering: following a flow rate step (quick opening of the isolation dam), the value measured reaches the final value at 1% after the time constant.

To adjust this time constant, a simple rule involves taking as the time constant a value equal to two or three times the foreseeable duration of any interference: for example, if you wish to avoid seeing flow variations quicker than every 20 seconds, give the time constant a value of 40 or 60 s.

However, you must ensure that the time constant is not too large, since this would risk masking significant events.

3) Deletion rate (CutOff Q)

The deletion rate is the flow rate value below which the flow meter displays 0. This gives us a clear indication of a flow rate considered to be zero.

4) Product

Drop-down list for choosing the type of product transported in the channel.

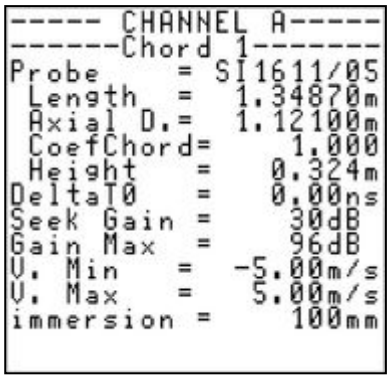
5) Delta T0

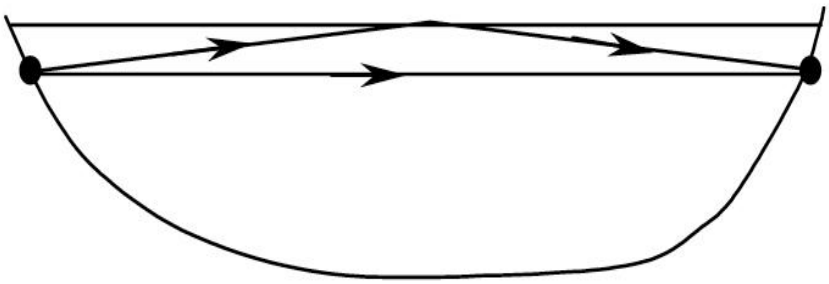
The deltaT0 field is used to correct installation errors. For example, it is possible to compensate for a bias due to an incorrect position of the probes by adding to deltaT0 the value required in order to rectify it.

6) Vmin and Vmax

In certain situations, the velocity of the fluid measured by the flow meter may be disrupted. Limits can then be set for the velocity of the fluid using a minimum velocity and a maximum velocity.

7) Probe immersion depth





For it to be possible for the velocity measured by a chord to be included in the flow calculation, the chord must be sufficiently submerged so as not to suffer disturbances created by the trough of the wavelets or for there to be no interference between the direct path of the ultrasonic wave and the path of the wave reflected by the surface.

If the signal generated by the reflected wave follows the signal generated by the direct wave too closely, the wanted signal may be appreciably altered by the secondary signal. The minimum immersion depth of the probes below which the measured velocity is considered invalid must therefore be indicated. This minimum immersion depends on the frequency used and the length of the acoustic path.

Comment: The immersion depth of the probes is counted from the central plane of a chord.

5.6 ADVANCED configuration

Comment: This section will be restricted to an explanation of the additional functions of advanced configuration compared to the two modes defined above (simple and normal). The entire common base already explained above in this document is not repeated in this section.

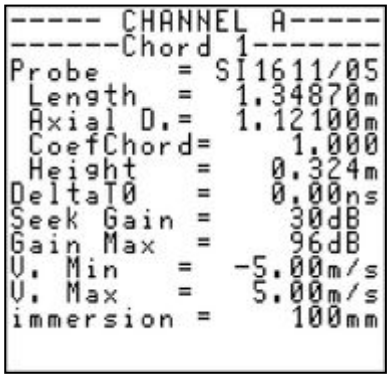
5.6.1 "Pipe/fluid settings" menu

1) Delta V filtering

When a filter has been activated, it is possible to request that the flow meter disables the filter if the measurement evolves very quickly. This provides a filter which is sufficient to comfortably see the evolution of the measurement and to retain reactivity while not filtering large variations in velocity.

2) Weighting coefficients of the chords

A weighting coefficient is a corrective factor and is applied when calculating the velocity. For example, if you wish to reduce the velocity of a chord by 10%, a coefficient of 0.9 must be entered.



3) Required gain and Maximum gain

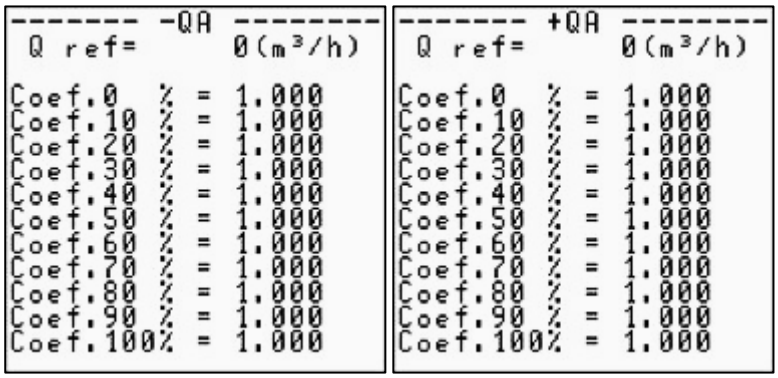
The gain is the parameter which determines the amplification of the ultrasonic signal required for the flow meter to take a measurement. If the flow meter needs to increase the gain, this means that the ultrasonic signal received is very weak. The poorer the quality of the signal, the greater the gain and the more difficult it is to measure the flow.

Using the maximum gain parameter, you can limit the gain so that the unwanted acoustic noise does not disrupt the operation of the flow meter.

Important: It is highly recommended to contact Ultraflux before modifying these settings.

5.6.2 "Linearization settings" menu

One last action possible on the flow is the linearization of the result. Depending on the flow, the flow is corrected by X% based on a pre-defined table:



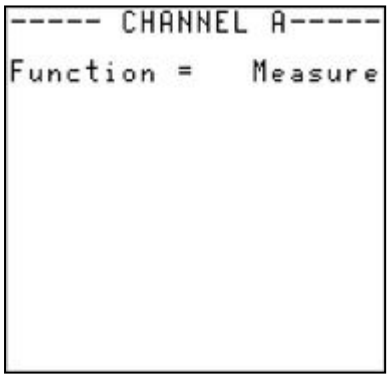
The parameter Q ref defines the maximum flow used for the linearization. The points of the table are then defined as a percentage of this maximum.

The rectifier coefficient must be defined by the user:
- A coefficient of 1 does not change anything in the result.
- A coefficient of 0.8 reduces the value of the flow by 20% at this point, etc.

There are two tables, one for positive flows and one for negative flows.

5.6.3 "Advanced configuration" menu

1) Simulation mode



The flow meter can be used:

- in Measurement mode (normal operation of the flow meter),
- in Velocity simulation mode.

Enter the value of the flow velocity required and the sine wave (as a percentage) applied around this value.

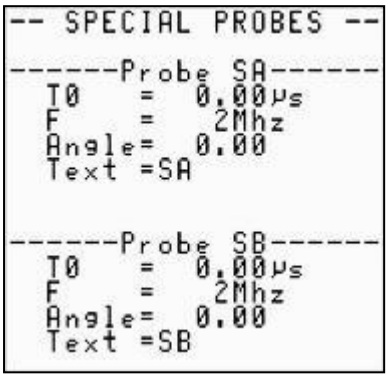
Comment: A modulation of 0% keeps the flow velocity constant. A modulation of 100% fluctuates the simulated velocity between 0 and 2 times the indicated value.

To simulate the level, go to the input/output settings and change the simulation value in the input corresponding to the level measurement (see chapter dedicated to inputs/outputs).

2) Special probes

It may be necessary in certain cases to define a probe which is not referenced in the list of Ultraflux probes. Before using this option, it is highly recommended to contact Ultraflux.

To use probes other than Ultraflux probes, use the "special probes" function.



T0 represents the dead time of the probe.

F represents the frequency of the probe.

Angle corresponds to the angle of the ultrasonic probe. For an open channel probe, the angle is always 0.

Text is used to identify the special probe in the list of references of accessible probes.

3) US & TRT processing

These settings allow the Ultraflux teams to adapt the operation of the flow meter to a specific case. You must consult us before modifying these settings.

5.6.4 "Firmware update" menu

This option is used to update the flow meter without needing to uninstall it. Consult us prior to using this option.

5.7 "Measurement" mode

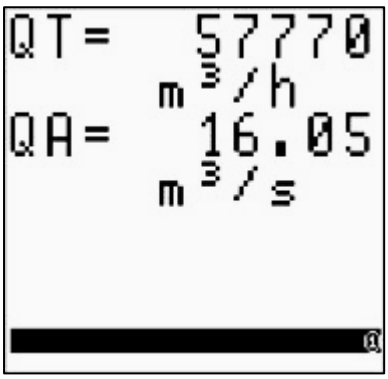
The flow meter has measurement pages (different values are displayed, page after page) and a flow graph.

5.7.1 Available pages

The Measurement screens give a large amount of information: the pages scroll down and are accessible using the ▲ and ▼ keys.

The same information is displayed for each of the chords of the application:

1) Flow rate

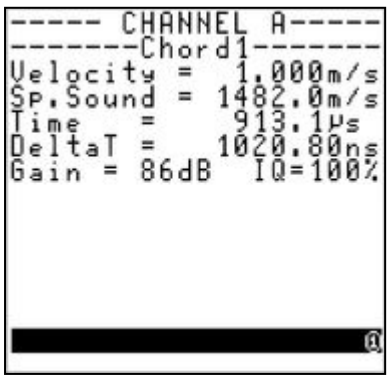


This page displays the flow measured with the unit.

2) Channel measurement

This page displays the data relating to the flow: rate, average velocity in the channel, water level.

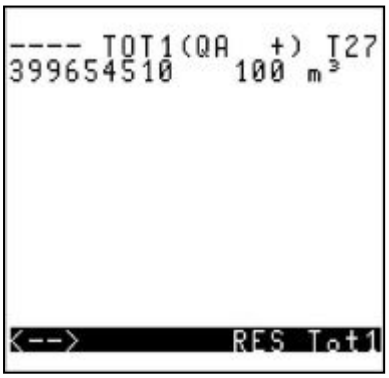
3) Specific information relating to the chords



These pages (depending on the number of chords) provide information on the specific measurements for a chord:

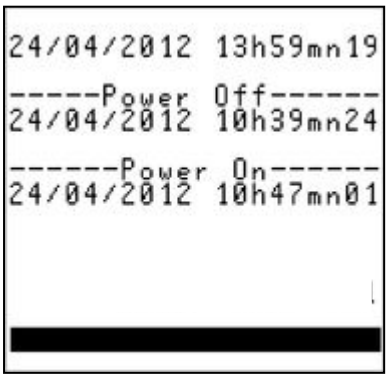
- average time (average of the time for the upstream-downstream journey and the time for the downstream-upstream journey),
- delta T (time difference between the upstream-downstream journey time and the downstream-upstream journey time),
- measurement gain (the higher the gain, the more difficult it is to obtain a measurement),
- QI quality index (100% indicates a very good measurement, 0% indicates that the measurement is not possible).

4) Totalizers



This screen indicates the metering status of the totalizers and allows them to be reset (if authorised).

5) Date and time

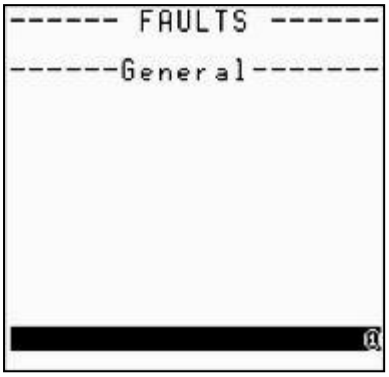


This screen indicates the date and time of the flow meter and the information concerning the last powering on.

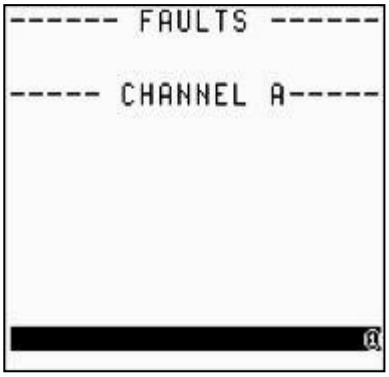
6) Logger info

This page indicates the status of the logger and the last recording made.

7) Events



These pages are used to find out whether there is a problem on the flow meter and to localise it in order to resolve it.



8) Probe type

These pages (depending on the number of chords) provide the reference of the associated probes for each chord.

9) Flow graph

The flow graph is a screen for displaying changes in a particular magnitude on a curve.

5.7.2 Verification of measurement quality and consistency

The information on the different "Measurement" mode pages is used to check the consistency of your measurement.

The gain and QI (quality index) values also tell you about the quality of your measurement.

CHAPTER 7: PC SOFTWARE

7.1 Introduction

The PC software is used to configure the flow meter using a PC, rather than accessing the parameters using the flow meter's keypad.

It is used in particular:

- to define all settings for the application,
- to monitor, in real time, the measurement parameters (flow, average velocity, speed of sound and gain for each chord, etc.),
- to save the measurement or settings data in a file for later consultation,
- to download, using the serial link or USB, the flow meter operation settings, the measurement data, the logger,
- to print the displayed data,
- to transfer the measurement and logger data to a spreadsheet program.

The minimum requirements are a PC with Windows version XP or later.

7.1.1 Installing and running the software

To install the software:

1. Run the Setup.exe installation program on the CD-ROM,
2. Select the language to use for the installation and for displaying the screens,
3. Using the Browse button, specify the software installation path (by default C: \ Program Files \ Ultraflux \ [PC software corresponding to your flow meter].x, with x designating the version no.).

Comment: For an identical reinstallation of the program (for example in the event of damage to the execution file) or to uninstall it, select the program from the list of installed programs (Start / Settings / Control panel / Add/Remove programs) and click the Add/Remove button.
A window asks you which action you wish to carry out: Change (function not available for the software, since it only contains a single component), Repair or Remove.

The program is run by double-clicking the icon associated with the  software and placed on the desktop, or by selecting the program via Start \ Programs \ Ultraflux \ software corresponding to your flow meter.

The choices proposed by the three main menus are:

- "File" menu – to:
  - Open a measurement file, settings or logger (via the "*Open*" command),
  - Create a settings file (via the "*New*" command),
  - Close the program (via the "*Exit*" command).

- "Dialogue" menu – to:
  - Open the measurement window,
  - Open the settings window,
  - Modify the access code,
  - Download the logger data from the flow meter to the PC,
  - Display the echo,
  - Save all flow meter settings.

- "Options" menu – to:
  - Configure the PC software,
  - Load the configuration file,
  - Save the configuration file.

- "About" menu – to:
  - Get information about the PC software version.

7.1.2 Connecting the flow meter to the PC

To connect the UF 811 to the PC, you must connect the lead provided (serial link or USB cable). The exchanges are made in the JBus/ModBus protocol, the PC being master and the UF 811, identified by its number, being the slave.

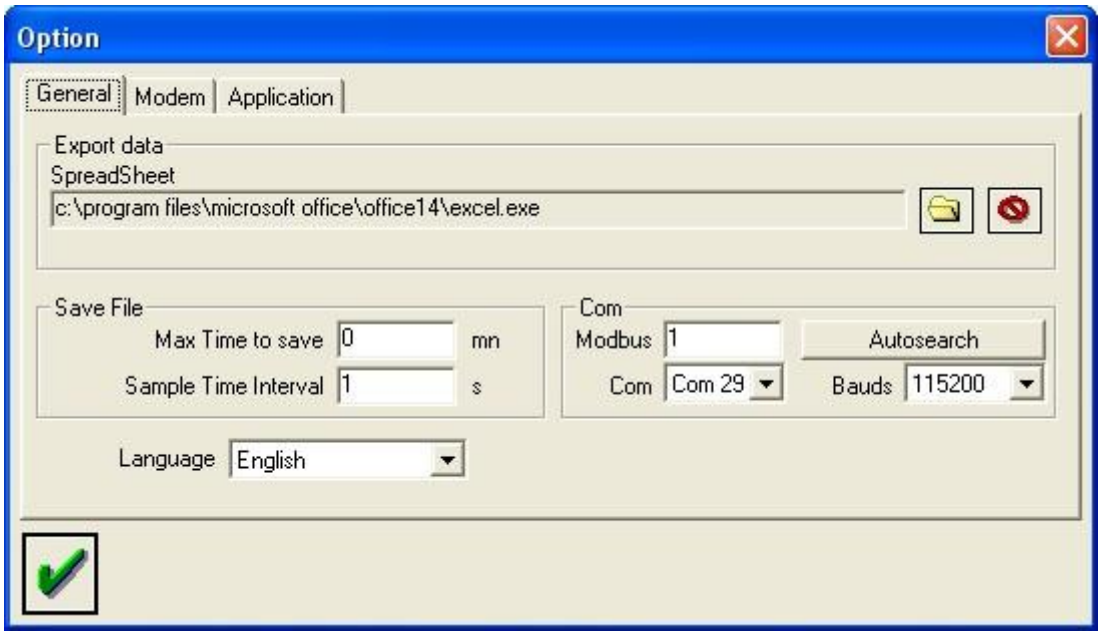
7.1.3 Home page

When run, the software displays the following window:

This window contains four main menus:
- "File",
- "Dialogue",
- "Options",
- "About".

First open the Options menu to define the settings relating to your application.

7.1.4 Options window



The window opened by the Options menu is used in particular to select the display language and to define the path of the software used to work with the data (Excel by default, if this is installed on your computer).

It also includes a "**Autosearch**" button used to automatically detect the presence of an Ultraflux flow meter.

Comment: To use the serial link, the transmission speed can be set from 300 to 115,200 bauds, the fastest speed being preferable, especially for data-logger downloads.

7.1.5 Icons

Icons are displayed at the bottom of each window under the "Dialogue" menu.

This disk icon runs the save procedure. The software then asks you for the name of the folder in which to save. You can then read, print or handle these records in Excel (or other data processing software) using the command File / Open / [save name].

Comment: When measuring, once the saving has started ("Save" button), the data is saved at the pace established by the period entered in the Options menu of the software, for the time established. When Time = 0, it is stopped manually.

This icon is used to print all data displayed on the screen.

This icon launches the data transfer procedure from the PC to the flow meter.

7.1.6 File menu

The File menu allows you to open a saved file ("Open" command), or prepare a settings file offline ("New" command). Once the file has been saved, you can export it to a UF 811.

7.1.7 Measurement window

The measurement window is opened using the Dialogue/Measurement command.

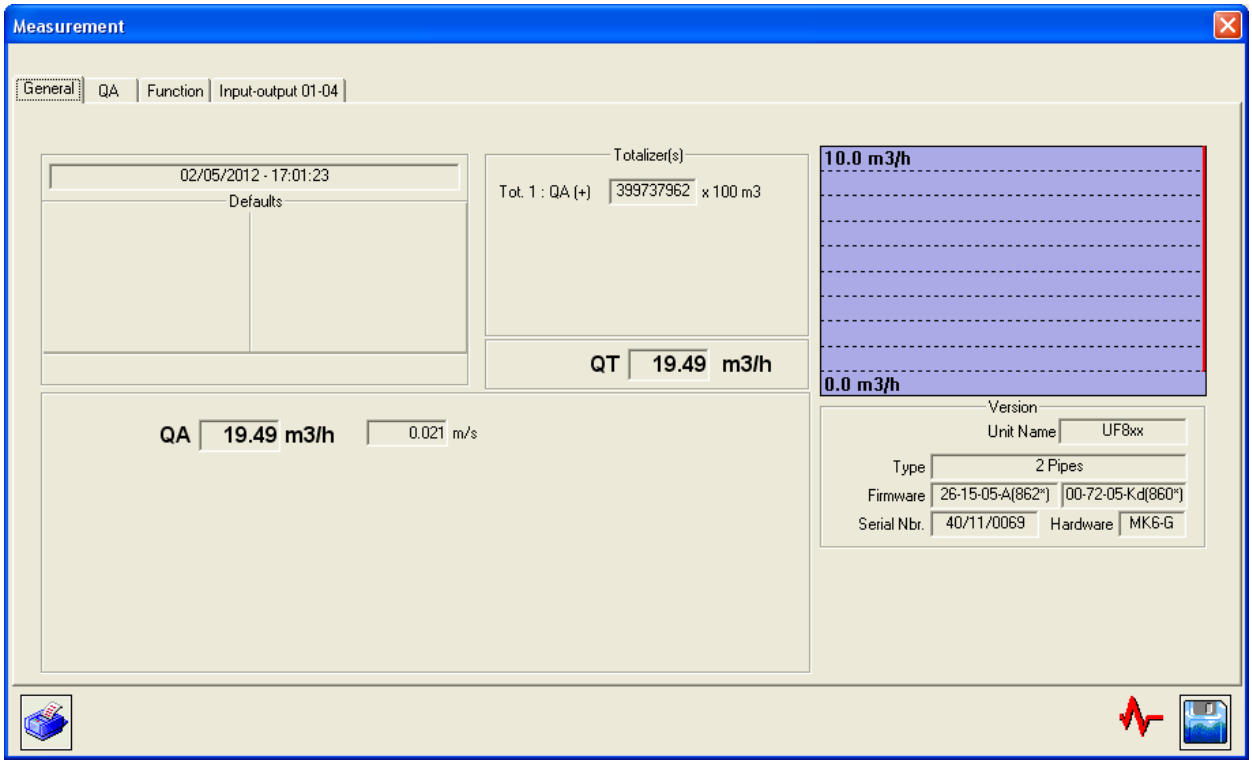
1) List of available tabs

The measurement window has the following tabs:

- "General" tab: contains general information about the measurement.
- "QA" (flow rate) tab: contains general information about the measurement channel.
- "Inputs/outputs" tab: contains general information about the inputs-outputs.
- "Function" tab (optional): contains settings information for the function engine if this is used (tab only appears if at least 1 engine output is configured).

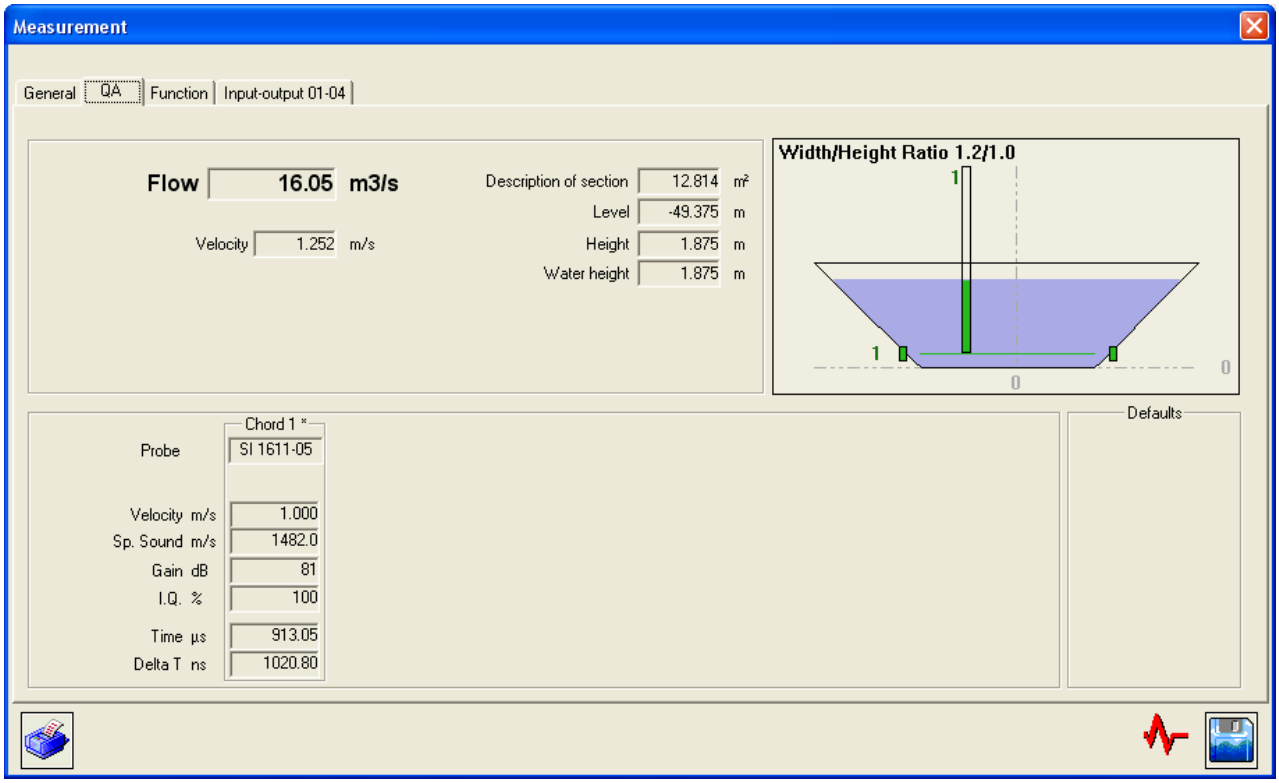
2) "General" tab

This tab displays the main measurement information: graph of the measurement, point value for the flow and the flow velocity, totalizers.



3) "QA" tab (flow rate)

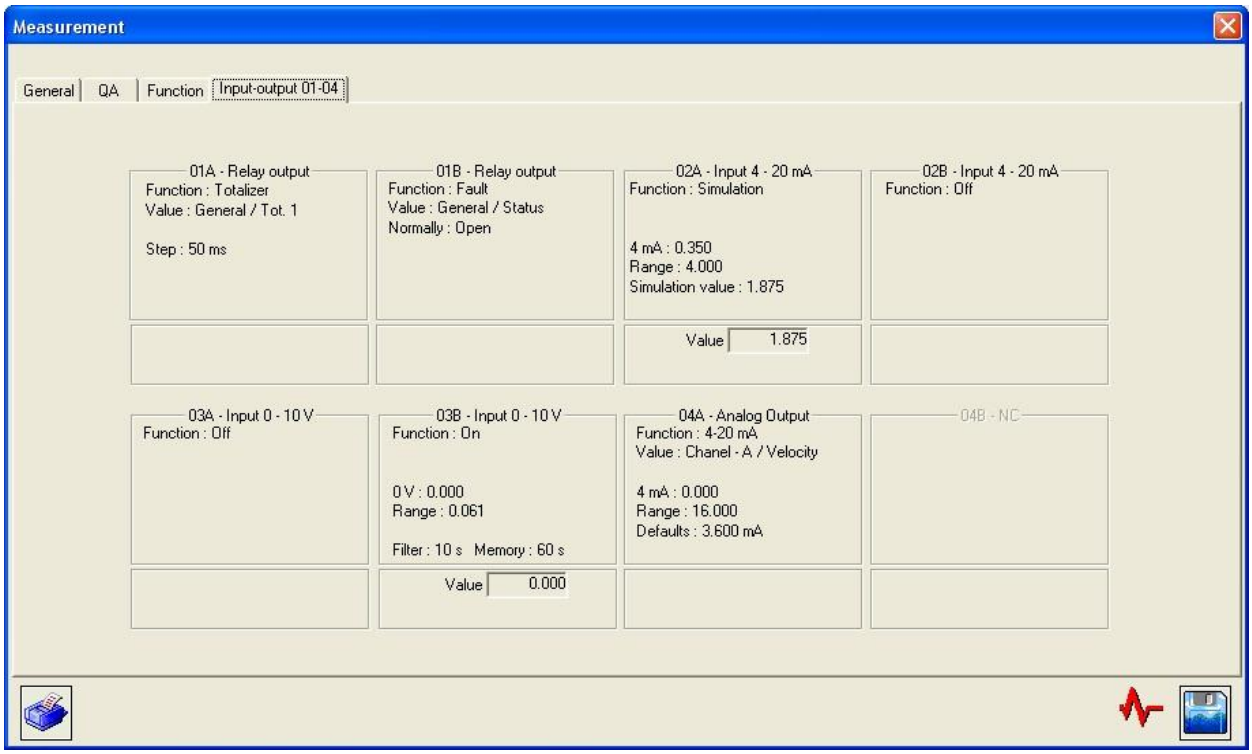
This tab displays the main information about the measurement channel: value of flow, flow velocity, section and height of water. It also provides information concerning the measurement chords.



Comment: There are as many tabs as there are channels configured.

4) "Input-output" tab

This tab displays the information concerning the inputs/outputs of the flow meter.



7.1.8 Settings window

1) List of available tabs

This window, opened using the Dialogue/Settings command, contains the following tabs:

- In the "General" drop-down menu
  - "General" tab: selection of the flow meter display language (and name of the flow meter defined during the installation).
  - "Logger" tab: description of the operation of the logger.
  - "Totalizer" tab: definition of the operation of the totalizers.
  - "Function" tab: definition of the engine input constants accessible to the user (when a function is located in the engine).
  - "Advanced" tab: definition of the Advanced operating mode.
  - "Inputs/outputs" tab: definition of the input/output settings (including the 4-20 mA inputs for the Level inputs).

- In the "Channel" drop-down menu
    - "Channel" tab: time constants, flow graph settings, display options, etc.
    - "Chord" tab: definition of the probes, positions of the chords, etc.
    - "Advanced chord" tab: definition of specific codes used to fine-tune the behaviour of the flow meter (contact Ultraflux before modifying these settings).
    - "Section" tab: definition of the geometry of the measurement section.
    - "Hydraulic profile" tab: settings of the measurement section hydraulic profile.
    - "Level" tab: number of level measurements and assignment of the inputs.
    - "Height/velocity" tab: definition of the operation of the flow meter in low water mode.
    - "Linearisation" tab: flow rate linearisation coefficient.

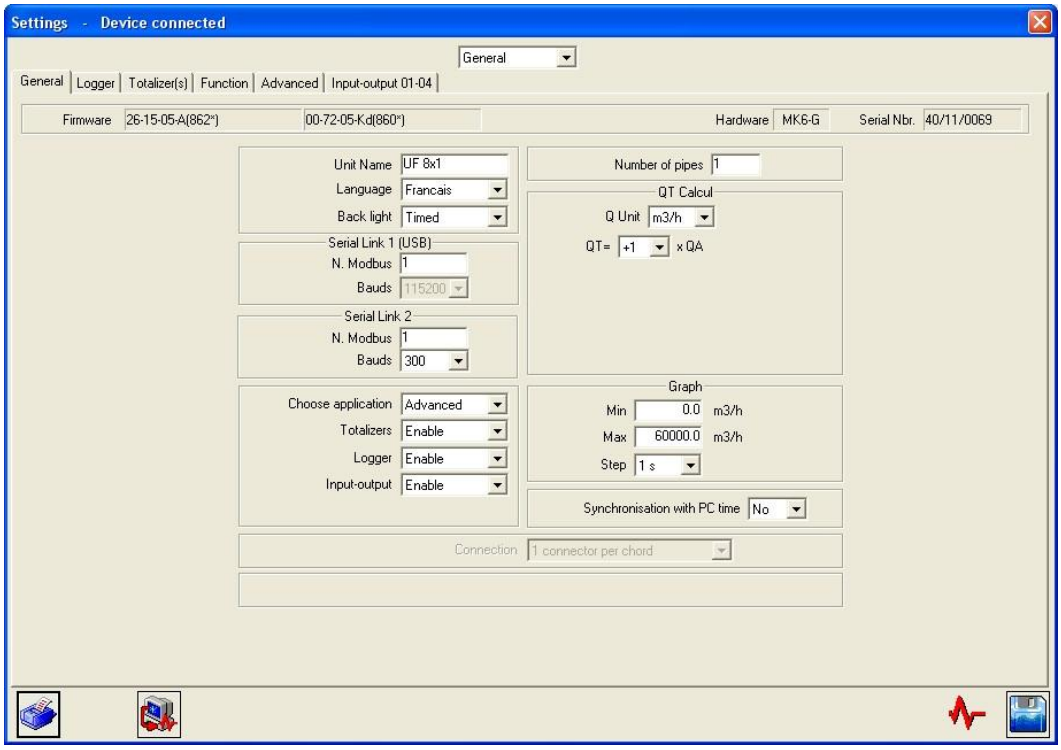
Once configuration is complete, upload the configuration to the flow meter by clicking this button.

Comment: On opening the settings window, the configuration loaded in the PC is the current configuration of the flow meter.

2) "General" tab (in the "General" drop-down menu)

The settings window is used to configure the flow meter from the PC. As with the keypad, you can choose the level of complexity using the command: General/Application Selection/Level = Simple, Normal or Advanced.

The screenshot below shows an example of settings in Advanced mode. All parameters displayed below are described previously in this document (see Chapter 5).

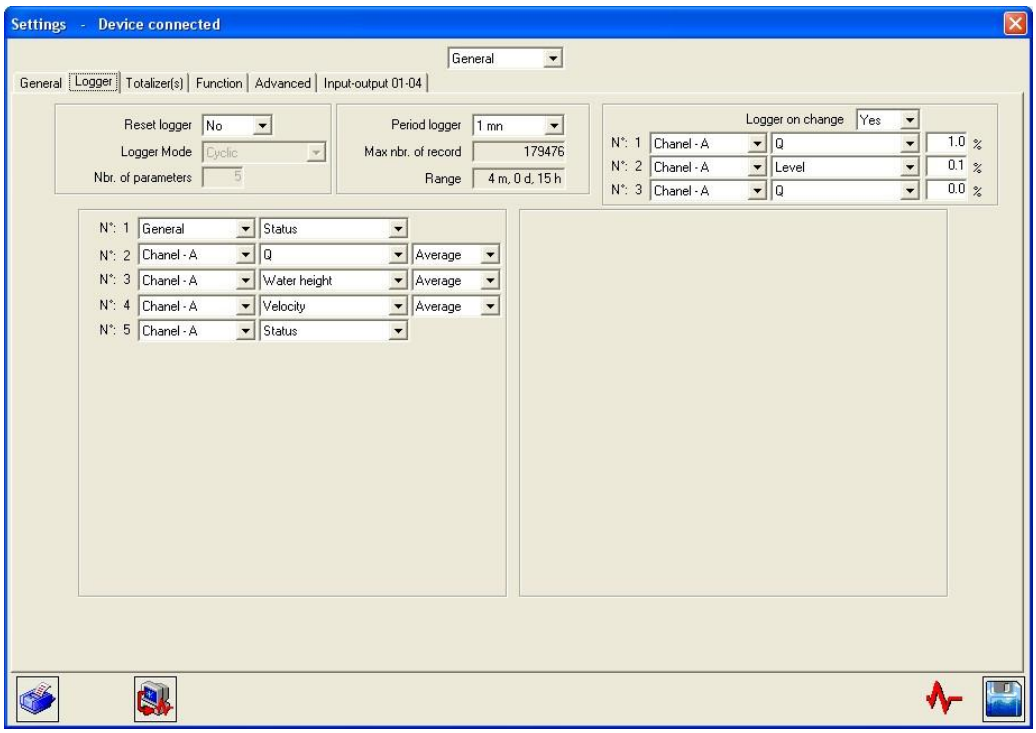


The software allows the date and time of the UF 811 to be synchronised with the date and time of the host PC: select the option "Synchronise with PC time" before saving the settings on the flow meter.

It is important to correctly set the date and time in order to time stamp the records (country, summer/winter time).

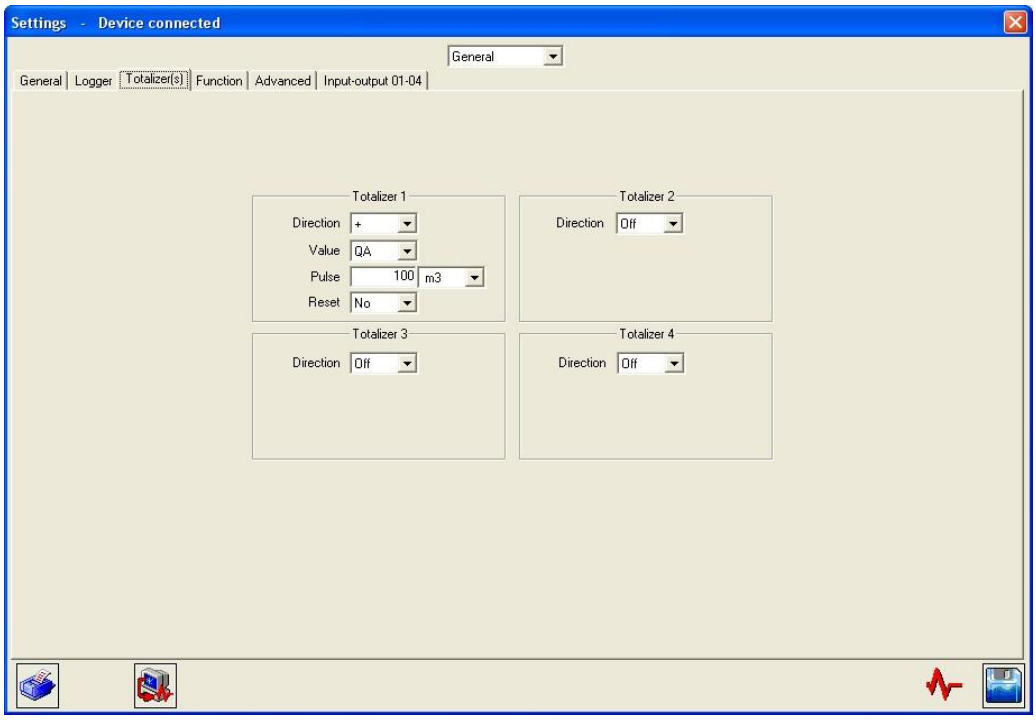
3) "Logger" tab (in the "General" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.9).



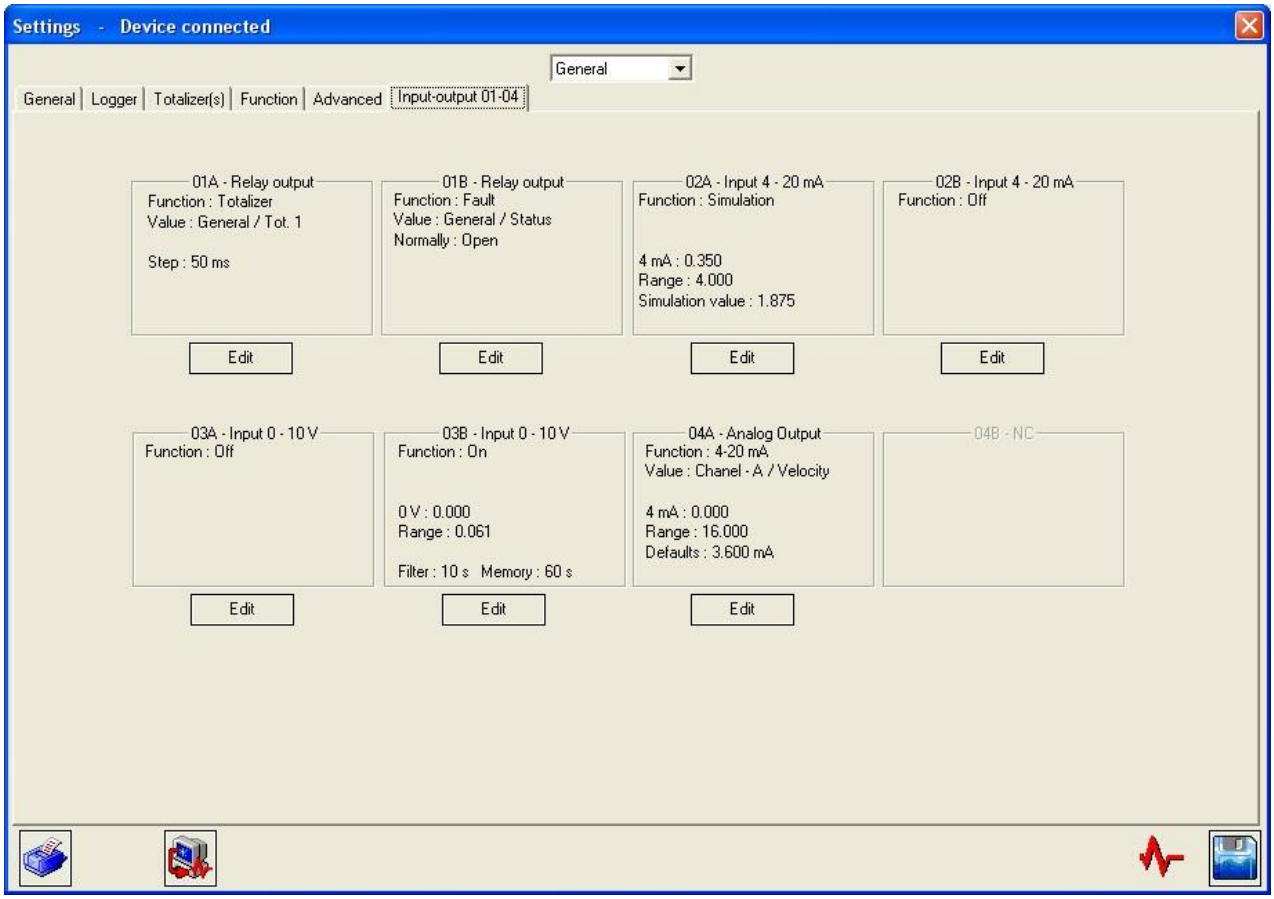
4) "Totalizers" tab (in the "General" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.7).



5) "Inputs/Outputs" tab (in the "General" drop-down menu)

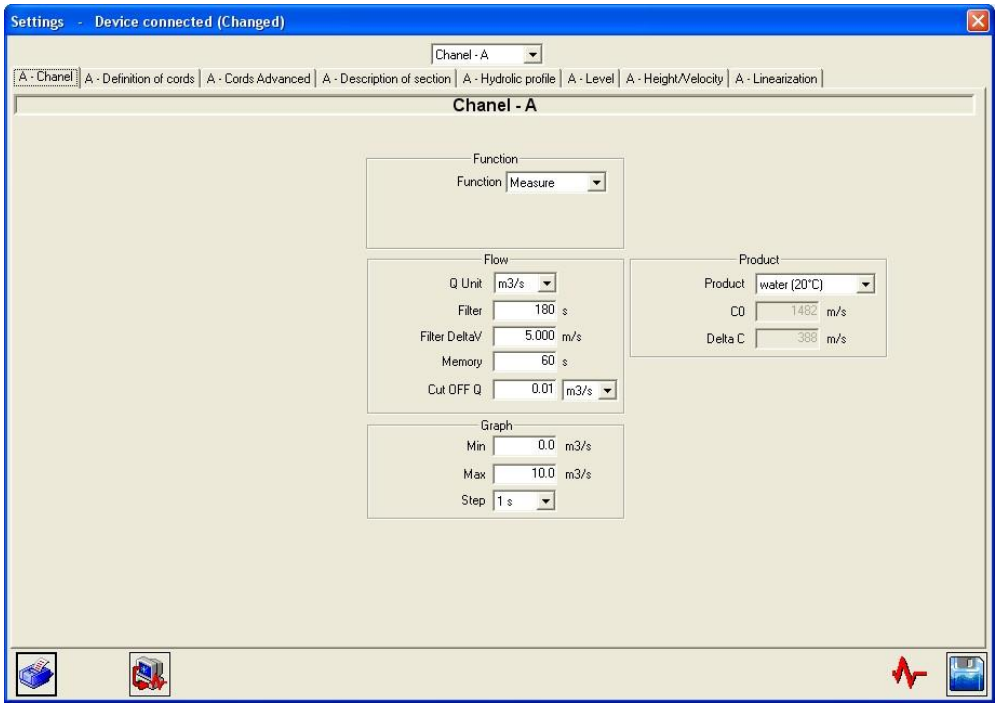
The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.8).



You can choose whether or not to activate the Totalizer, Logger and Input/Output functions resources.

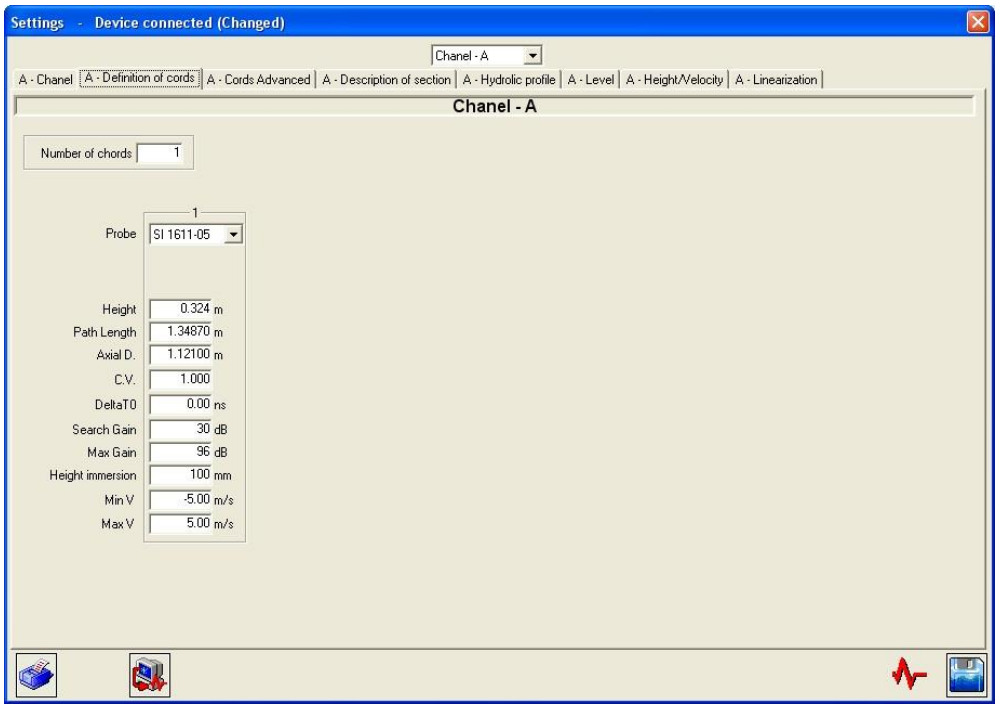
6) "Channel" tab (in the "Channel" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.2).



7) "Chord" tab (in the "Channel" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.2).



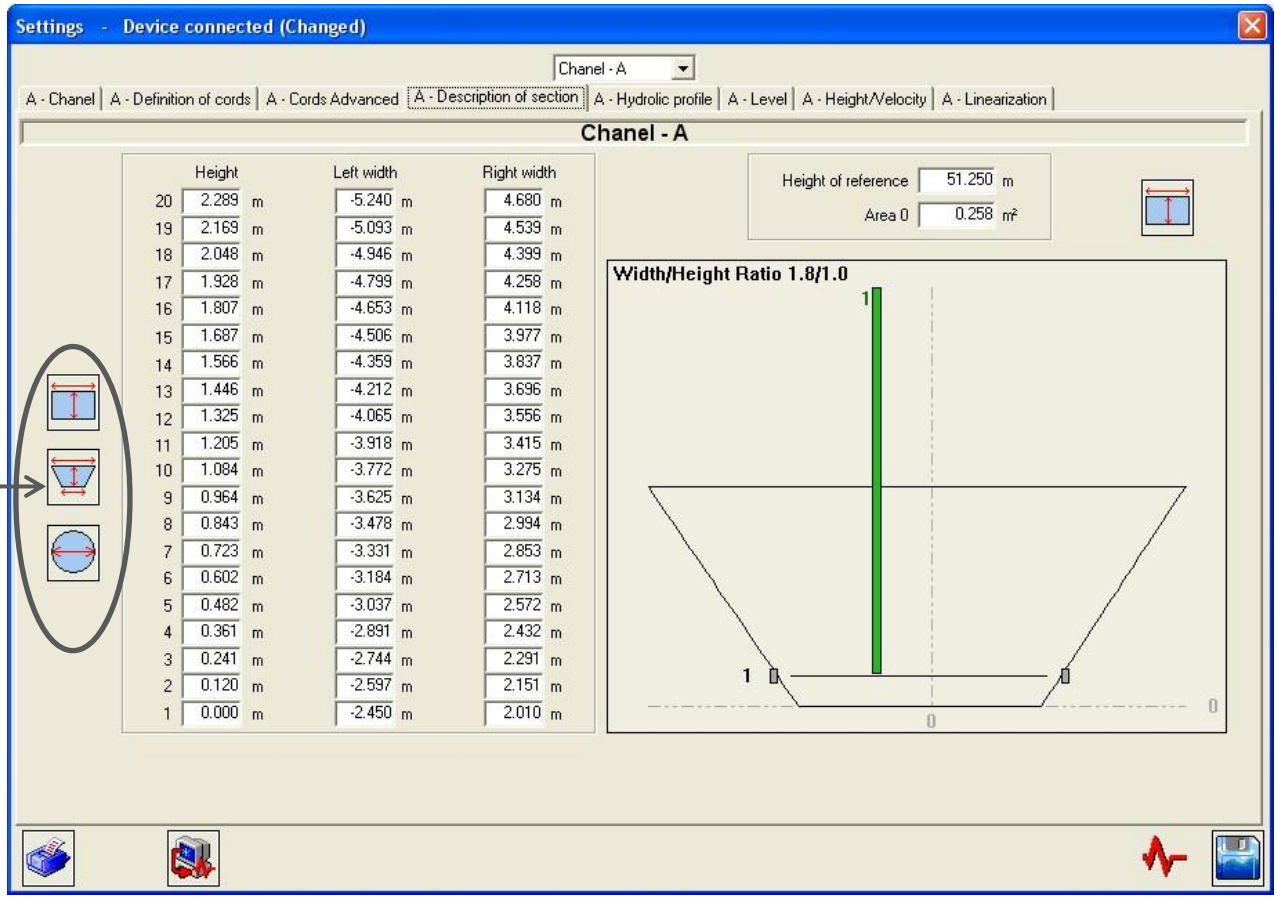
Note: It is possible to enter in the flow rate calculation a chord external to the converter (for example, a Doppler velocity measurement).
The settings to be defined for this chord are the same as those for the internal chords, but the following must also be defined:

- the internal chord associated with the external chord: when the internal chord is faulty, it is the external chord which takes over.
- the input module which will serve as a velocity measurement: a 4-20 mA module may serve to recover a Doppler velocity.

The main advantage of this virtual chord lies in being able to measure the flow using several measurement methods.

8) "Section" tab (in the "Channel" drop-down menu)

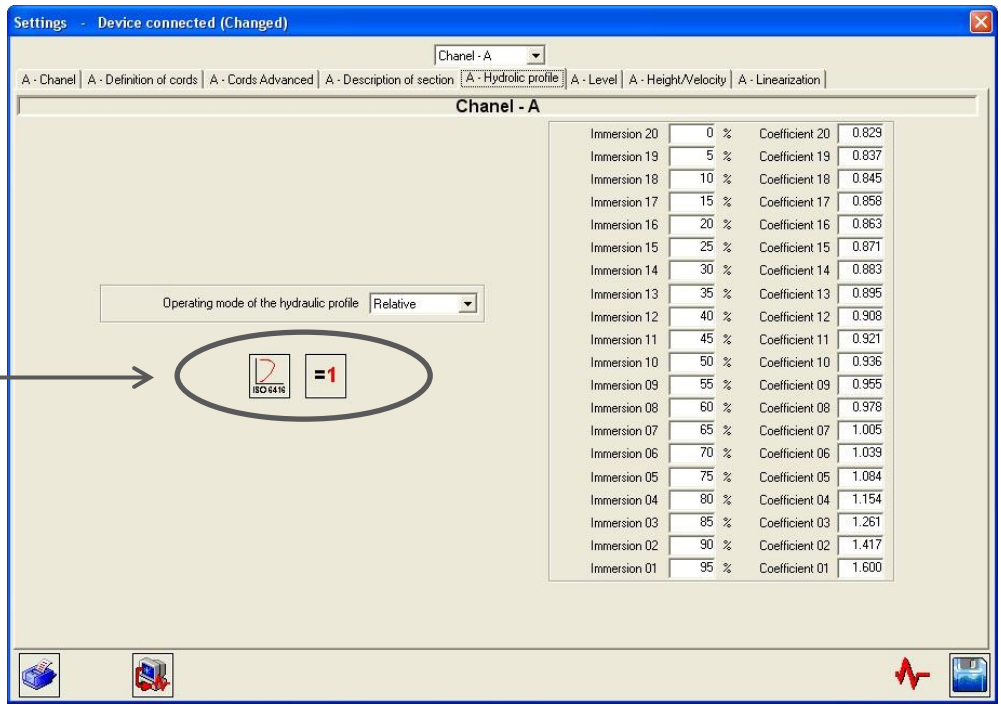
The screenshot below shows an example of settings in Advanced mode. All of the parameters displayed below are described previously in this document (see part 5.4.3).



These three buttons are used to define the sections of predefined shapes (rectangle/trapezium/circle) via a "wizard".

9) "Hydraulic Profile" tab (in the "Channel" drop-down menu)

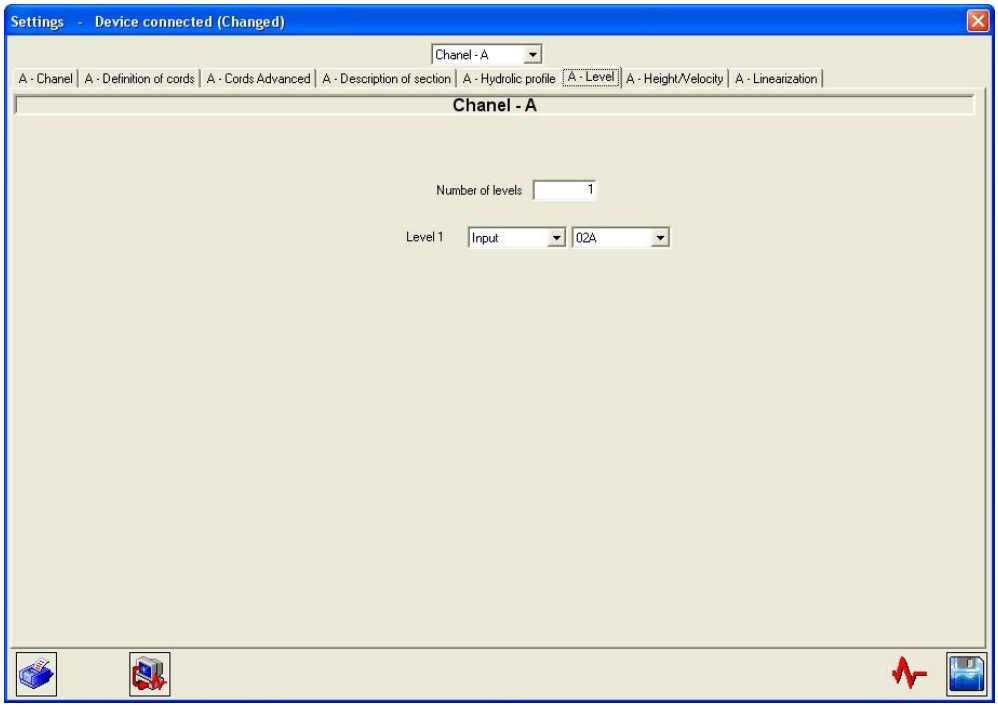
The screenshot below shows an example of Advanced settings. All of the parameters displayed below are described previously in this document (see part 5.4.5).



These buttons are used to force the hydraulic profiles (with standard ISO 6416 or with all coefficients equal to 1).

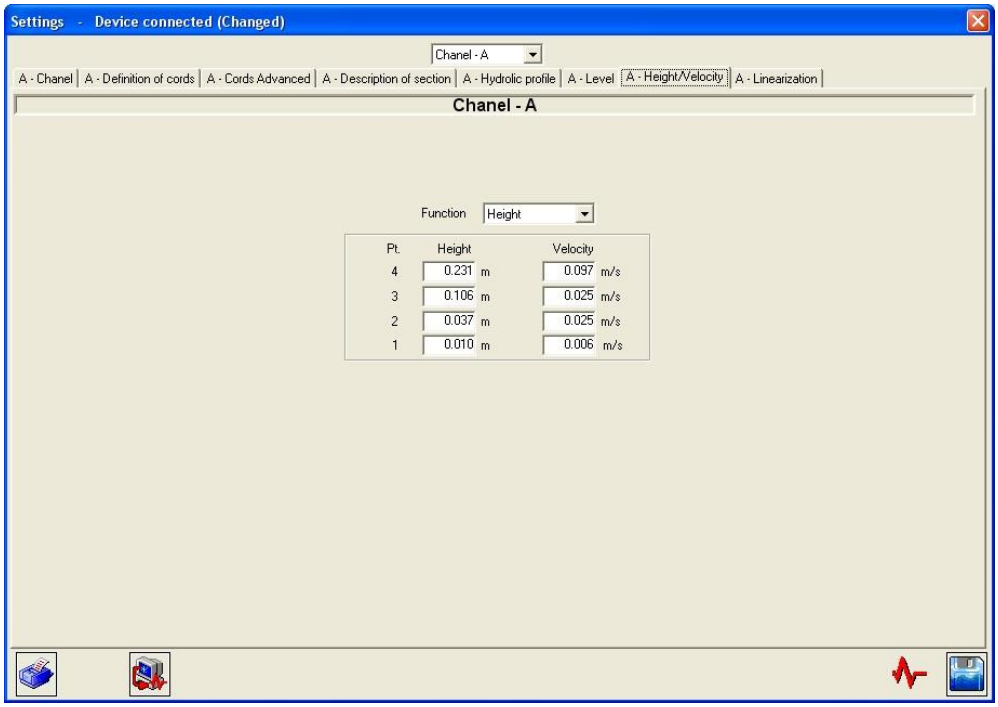
10) "Level" tab (in the "Channel" drop-down menu)

The screenshot below shows an example of Advanced settings. All of the parameters displayed below are described previously in this document (see part 5.4.4).



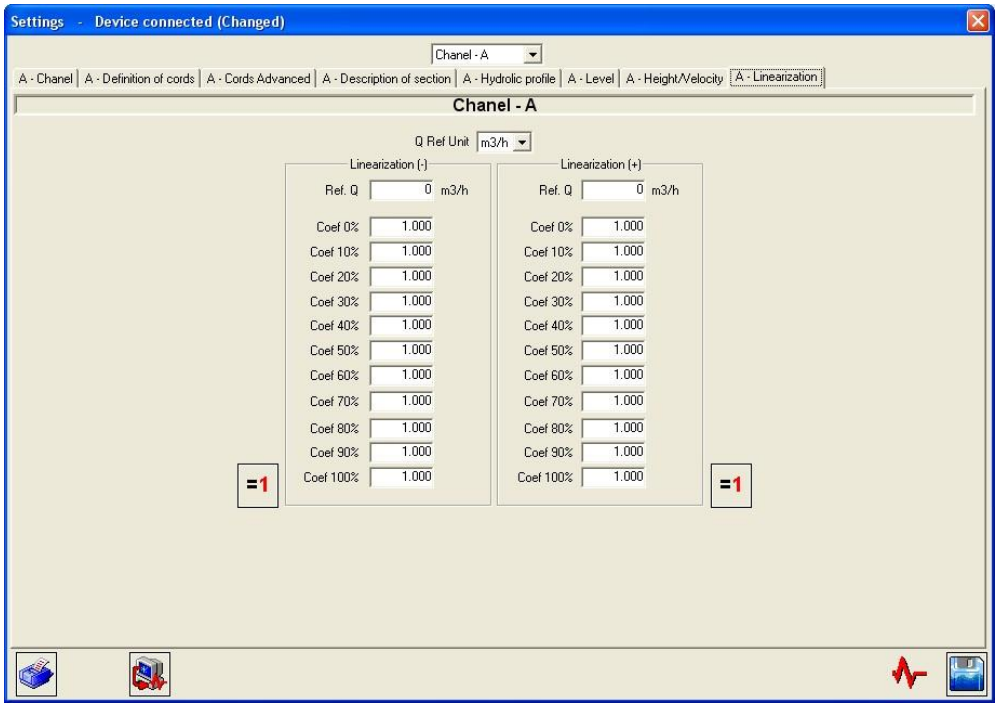
11) "Height/Velocity" tab (in the "Channel" drop-down menu)

The screenshot below shows an example of Advanced settings. All of the parameters displayed below are described previously in this document (see part 5.4.6).



12) "Linearisation" tab (in the "Channel" drop-down menu)

The screenshot below shows an example of Advanced settings. All of the parameters displayed below are described previously in this document (see part 5.6.2).



7.2 Archiving, processing and printing of saved files

You can save the settings for the flow meter and the associated measurement results.

These are complete records of the measurements and conditions observed, which are a useful addition to those of the data logger. The files are named with an extension [*.mes].

These records on the screen are presented in the same way as the Measurement dialog (see section 5.8), with a few additional icons at the bottom of the screen.

Use the following buttons to browse or select the records:

Use the following button to print the records:

If you have saved a sequence (Configuration/General/Save file/Period and Time) command), you will be able to process this data with the software used for data handling (Excel by default, if this is installed on your computer). A macro for Excel is provided.

Data processing is called by clicking the following button:

In the windows opened, confirm the name of the file to be processed, and accept the macro. You should first specify the security level of this macro.

The results from the measurement pages are automatically arranged in the columns and rows of Excel, and the flow and velocity curves are produced. You can then freely modify this data.

7.3 Settings files

The Uf 811 has 11 spaces in its free memory for the storage of configurations (see part 5.4.1): you can therefore recall or save your selections.

Important: only the first 5 locations are accessible from the PC software, the other 6 may only be accessed via the converter.

Appendix I: Characteristic echo signals

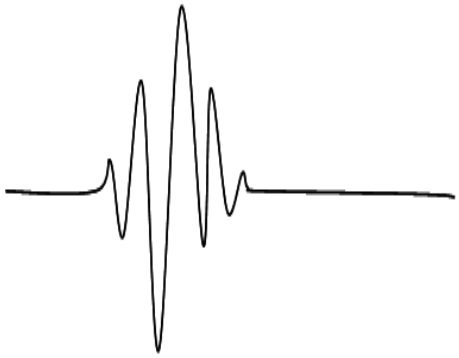
The most common echo signals

The display of the echo signal is not essential, but does facilitate the implementation of the measuring point. It also allows the origin of a problem to be detected.

The positioning and orientation of the probes are correct when the amplitude of the echo is at its maximum and the echo is rising rapidly, without too much distortion (deformations).

The following figures show the most commonly observed echo signals:

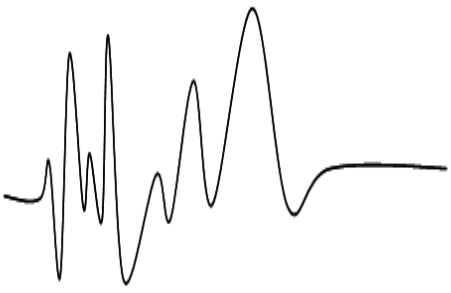
- Ideal signal: quick rise well above the detection threshold.



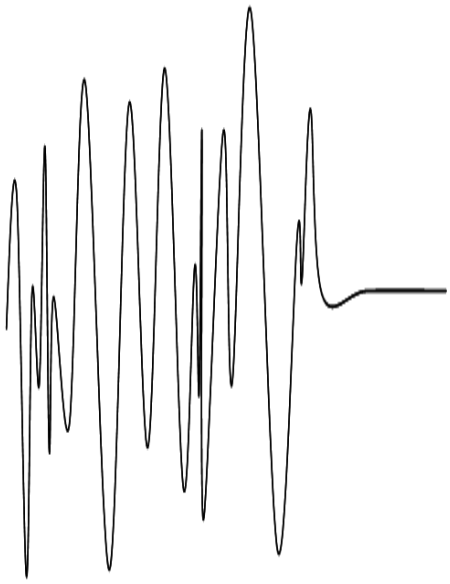
Comment: The signals observed are often longer than the one shown above. This is completely normal, the important criterion being the velocity of the signal rise above the threshold.

- Slowly rising signal:

- Signal distorted by an incorrect positioning of the probes:



- Presence of noise (acoustic interference)



Comment: For the last three cases, a weak signal (gain greater than 50 dB) may mean that the probes require realignment or maintenance (pollution on the surface of the probe).

- Presence of electromagnetic interference

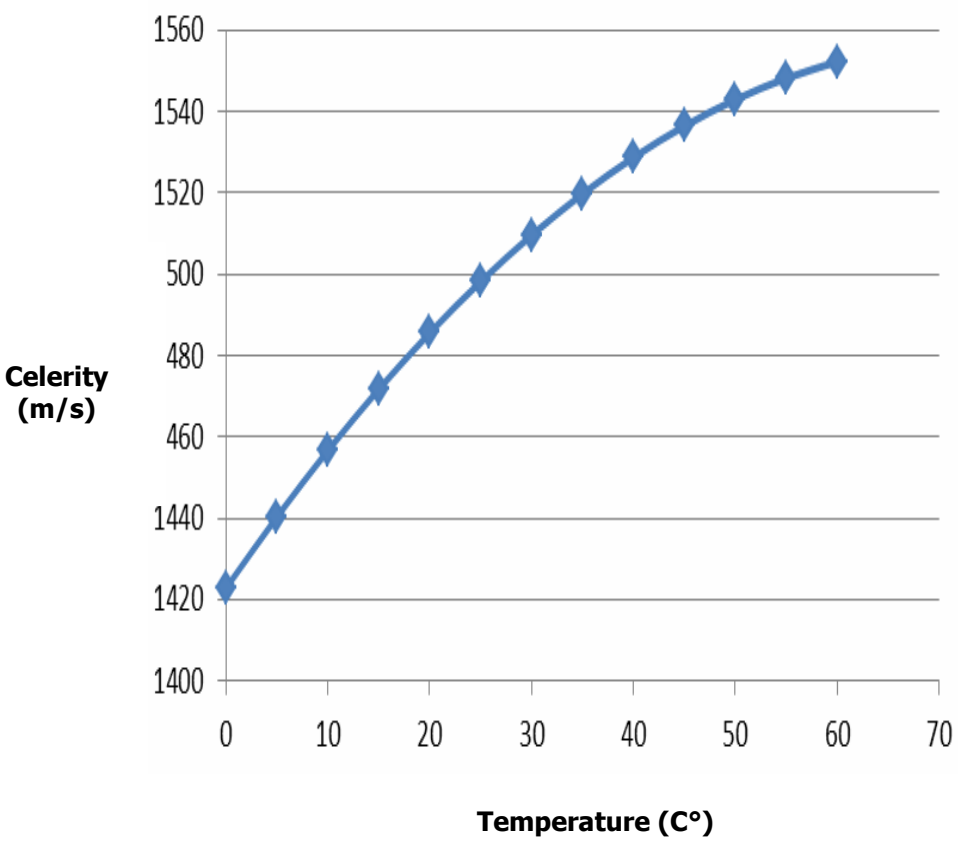
Comment: in this case, move the cables (in particular the probe cables) away from the power cables. Check the ground connections and the shielding.

Appendix II: Speed of sound in water

Sound propagation velocity in water

t (°C)	C (m/s)	t (°C)	C (m/s)
0	1422.8.	30	1506.4.
5	1426.5.	35	1520.1.
10	1447.6.	40	1529.2.
15	1466.3.	45	1536.7.
20	1482.7.	50	1542.9.
25	1497	—	—

Approximate value: C = 1557 – 0.0245.(74 – t)2



Appendix III Troubleshooting

III.1 Diagnostic indications

III.2 Description of fault bits

III.3 Fault grid

III.1 Diagnostic indications

Certain factors may lead to a degradation of the measurement. The following diagnostic indications will help you to resolve any problems which may occur.

- **The message "Velocity faults" is permanently displayed**

  Possible causes:

  - Probes different to those indicated in the settings. Incorrect programming of the Daxe and L settings.
  - Incorrect connection of the probes. A probe may have been disconnected.
  - Presence of a solid body between the probes.
  - Chords out of the water.
  - Probes incorrectly positioned with regard to each other.
  - Probes excessively clogged.
  - Fluid too absorbent, too much slurry, excessively aerated. Contact us and we will work with you to find the best solution.
  - Probes defective or Uf 811 malfunctioning. Contact us if your checks result in this conclusion.

- **The message "Flow faults" appears intermittently**

  The intermittent message "Flow faults" may be due to a weak echo, resulting in a high gain.

  The possible causes are, to a lesser extent, identical to those of the "Velocity faults" message (see above), and in particular:

  - Probes misaligned,
  - Probes clogged,
  - Fluid absorbent, or slurry, or aerated.

  Comment: A simple way of masking intermittent measurement faults and increasing the memory storage time (see section 5.5.1).

- **The measurement differs from the predicted flow**

  Actions to take

  - Check that the probes are far enough away from hydraulic disturbances.
  - Check the precise dimensions of the section of the pipe or the channel at the location of the measurement and the position of the probes.
  - Have faith in your Uf 811.

- **The message "relay overflow" appears permanently or intermittently in the case of a relay output configured in totalizer mode**

  Cause:

  - Too many pulses output within the allocated time.

  Actions to take

  - Adapt the pulse weight and/or the width based on the flow of your application (see the "Totalizer" section 5.4.4 - point 5).

- **The message "open loop" appears permanently when setting a current output**

Cause:

- Break in the loop.

- **The message "outside limits" appears permanently or intermittently when setting an analogue input**

Cause:

- Current or voltage outside the range of use.

III.2 Description of fault bits

In general, a bit set to 1 means that there is a fault present and 0 means there is no fault. The numbering of the bits **starts at Zero**!

Two bits have the same meaning on each fault field:

BIT No.	FUNCTION NAME	DESCRIPTION
30	Fault	The measurement is faulty.
31	Not valid	Measurement is not possible, but the situation is not abnormal (1).

(1) For example, all probes are out of flow.

General fault

BIT No.	FUNCTION NAME	DESCRIPTION
4	Logger	At least one reading in the logger is not consistent.
18	Function engine	A problem has occurred on one of the outputs of the function engine. This fault is used to identify a calorimetry problem for example.
19	Ultrasound configuration	The ultrasonic board has a configuration problem.
20	Alarm C	A peripheral system has a fault.
21	Alarm B	Maintenance is required on the flow meter.
22	Alarm A	The flow meter has a general fault.
23	Access code	The maximum number of unlocking attempts has been reached. Please wait before trying again.
24	Configuration access	The configuration has been changed or the device is in echo display mode.
25	Power supply	The power supply has been cut off and restored.
26	Inputs/Outputs	Fault on an input/output module.
27	Internal clock	The clock time must be set correctly.
28	Qb	Fault on the Qb pipe.
29	Qa	Fault on the Qa pipe.
30	QT	Fault on the total flow.
31	QT not valid	Total flow invalid.

Pipe fault

BIT No.	FUNCTION NAME	DESCRIPTION
0	Velocity1	Chord 1 velocity faulty.
1	Velocity2	Chord 2 velocity faulty.
2	Velocity3	Chord 3 velocity faulty.
3	Velocity4	Chord 4 velocity faulty.
4	Velocity5	Chord 5 velocity faulty.
5	Velocity6	Chord 6 velocity faulty.
6	Velocity7	Chord 7 velocity faulty.
7	Velocity8	Chord 8 velocity faulty.
16	General velocity	All velocities are faulty.
17	General level	All levels are faulty.
18	Height velocity	The height velocity law or the automatic regression is activated.
30	Fault	Fault on a velocity.
31	Not valid	Velocity not valid.

Input/output modules fault

BIT No.	FUNCTION NAME	DESCRIPTION
0	On relay A output metering	Relay A cannot output the number of pulses required based on the programmed period.
1	Relay A output outside range	Relay A cannot output the required frequency based on the programmed range.
2	On relay B output metering	Relay B cannot output the number of pulses required based on the programmed period.
3	Relay B output outside range	Relay B cannot output the required frequency based on the programmed range.
4	Current A output loop open	Current loop open.
5	Current A output value outside range	The value of current A is outside the authorized range.
8	Value outside range input PT100/1000	The temperature measurement of PT100 A is outside the authorized range.
12	Current A input value outside range	The measurement of current A is outside the authorized range.
14	Current B input value outside range	The measurement of current B is outside the authorized range.
16	Voltage A input value outside range	The measurement of voltage A is outside the authorized range.
18	Voltage B input value outside range	The measurement of voltage B is outside the authorized range.

Chord fault

BIT No.	FUNCTION NAME	DESCRIPTION
22	Chord immersion	Chord submerged.
26	Overspeed/underspeed	Chord overspeed/underspeed.
29	Flow calculation	Chord taken into account in the flow calculation.
30	Fault	Fault on a chord.
31	Not valid	Chord not valid.

Function fault

BIT No.	FUNCTION NAME	DESCRIPTION
30	Fault	Function output fault.

III.3 Fault grid

There are three types of alarm:

- Alarm A: General fault,
- Alarm B: Maintenance requirement / Degraded mode,
- Alarm C: Alarm on peripheral system.

Using the PC software, you can find the detail of each of these alarms with the key word displayed in the fault window (see the chapter dedicated to the PC software).

The explanation of these key words is given below:

Alarm A:

KEY WORD	EXPLANATION
firmware	There is a recognition problem for the internal software of the flow meter. Contact Ultraflux.
EEprom	The non-volatile memory is faulty, measurement is impossible. Contact Ultraflux.
Function	The function engine has an execution bug. Check the inputs to the function engine. If the problem persists, contact Ultraflux.
Com .ER	There is a programming problem with the two DSP processors. Turn the flow meter off, and then back on. If the problem persists, contact Ultraflux.
Bad software	The internal software of the flow meter is not compatible with the type of flow meter programmed (Full Pipe, Open Channel, ISD, PSD, etc.). Contact Ultraflux.
Q	Fault on the flow.

Alarm B:

KEY WORD	EXPLANATION
velocity	Fault on one of the eight velocities.

Alarm C:

KEY WORD	EXPLANATION
Dataflash	The non-volatile memory is faulty; measurement is possible but not archiving by the logger. Contact Ultraflux.
logger	The logger data cannot be used or is corrupt. Contact Ultraflux.
h/w I/O	One of the inputs/outputs is no longer responding. Contact Ultraflux.
i/o	One of the inputs/outputs is incorrectly configured. Contact Ultraflux.
clock	The clock time must be set correctly.

Appendix IV: Link protocol of the Uf 811

IV.1 Serial link characteristics

IV.2 Reading of N words (with N ≤ 125)

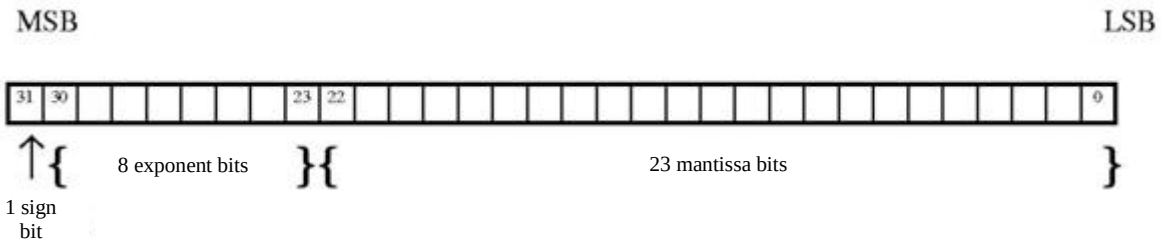
IV.3 Modbus/Jbus table

IV.4 CRC16 calculation algorithm

IV.1 Serial link characteristics

The characteristics of the serial link to be used are as follows:

- Protocol used: Modbus,
- Transmission speed: from 300 to 115200 bauds,
- Number of bits: 8,
- Parity: None,
- Number of stop bits: 1.



Where: $V = (-1)^S * \left(1 + \frac{M}{2^{23}}\right) * 2^{(E-127)}$

Example: float value = $40, $21, $00, $40

$S = 0$; $E =$, $80 = 128d$; $M = 210040 = 2162752d$

$$V = (-1)^0 * \left(1 + \frac{2162752}{2^{23}}\right) * 2^{(128-127)} = 2.5151640259$$

For FLOAT type information, it must be possible to read two consecutive words (or 4 bytes). The format complies with the IEEE standard.

For LONG type information, two consecutive words (or 4 bytes) must be read.

IV.2 Reading of N words (with N ≤ 125)

The function code for reading N words is 3.

Request

Data	Slave no.	3	address 1st word	number of words	CRC16
Size	1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Data	Slave no.	3	number of bytes read	value 1st word	.....	value last word	CRC16
Size	1 byte	1 byte	1 byte	2 bytes	.....	2 bytes	2 bytes

IV.3 Modbus / Jbus table

(1): full pipe only
(2): open channel only

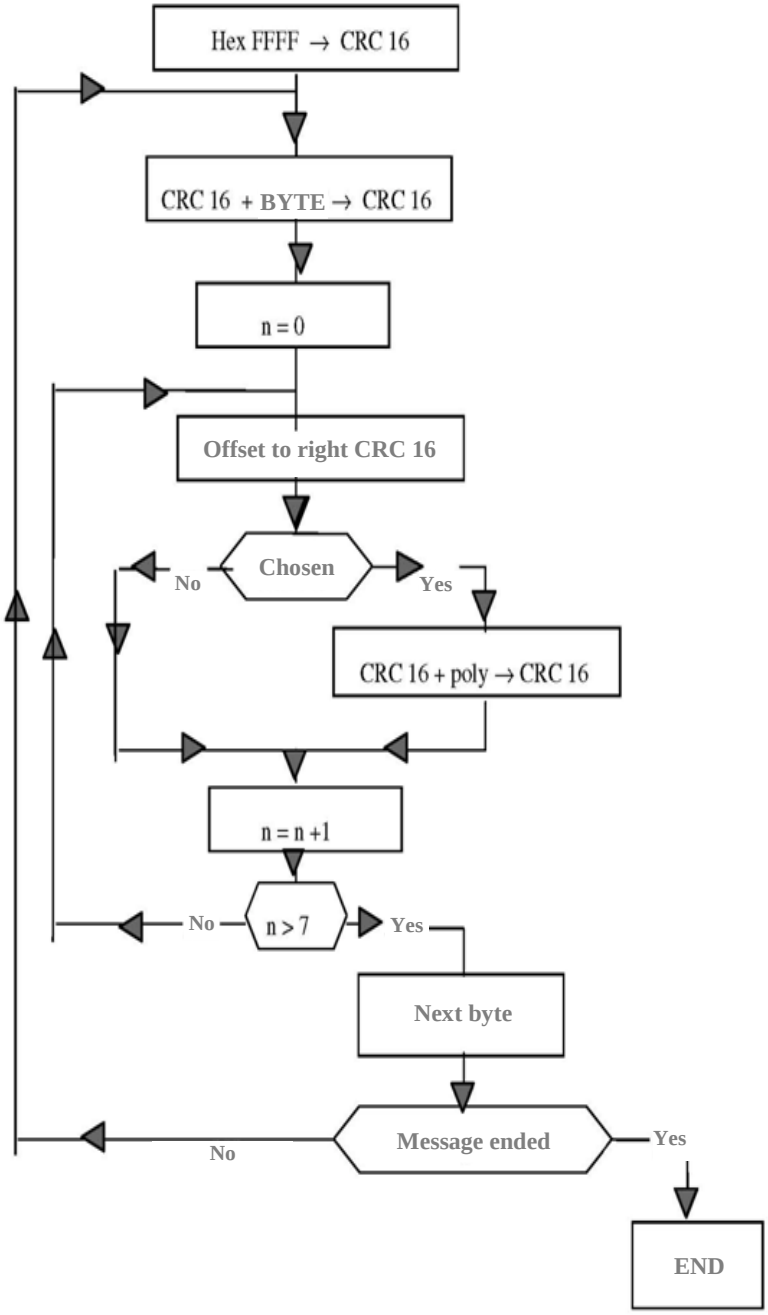
		Pipe/Channel A		Pipe/Channel B	
PARAMETER NAME	Type	JBUS Hex address	JBUS Dec address	JBUS Hex address	JBUS Dec address
Logger		**0200**	**512**	**0400**	**1024**
No. Variables Per Line	USHORT	**0200**	**512**	**0400**	**1024**
No. Completed Lines	ULONG	**0201**	**513**	**0401**	**1025**
Max. Line No.	ULONG	**0203**	**515**	**0403**	**1027**
Period (seconds)	ULONG	**0205**	**517**	**0405**	**1029**
		0207	**519**	**0407**	**1031**
Totalizers		**0207**	**519**	**0407**	**1031**
Totalizer1 value	ULONG	**0207**	**519**	**0407**	**1031**
Totalizer1 Weight	USHORT	**0209**	**521**	**0409**	**1033**
Totalizer1 Unit	USHORT	**020A**	**522**	**040A**	**1034**
Totalizer2 value	ULONG	**020B**	**523**	**040B**	**1035**
Totalizer2 Weight	USHORT	**020D**	**525**	**040D**	**1037**
Totalizer2 Unit	USHORT	**020E**	**526**	**040E**	**1038**
Totalizer3 value	ULONG	**020F**	**527**	**040F**	**1039**
Totalizer3 Weight	USHORT	**0211**	**529**	**0411**	**1041**
Totalizer3 Unit	USHORT	**0212**	**530**	**0412**	**1042**
Totalizer4 value	ULONG	**0213**	**531**	**0413**	**1043**
Totalizer4 Weight	USHORT	**0215**	**533**	**0415**	**1045**
Totalizer4 Unit	USHORT	**0216**	**534**	**0416**	**1046**
		0217	**535**	**0417**	**1047**
		0217	**535**	**0417**	**1047**
Year Clock	USHORT	**0217**	**535**	**0417**	**1047**
Clock Month	USHORT	**0218**	**536**	**0418**	**1048**
Clock Days	USHORT	**0219**	**537**	**0419**	**1049**
Clock Hour	USHORT	**021A**	**538**	**041A**	**1050**
Clock Minutes	USHORT	**021B**	**539**	**041B**	**1051**
Clock Seconds	USHORT	**021C**	**540**	**041C**	**1052**
QT Q	FLOAT	**021D**	**541**	**041D**	**1053**
QT unit	USHORT	**021F**	**543**	**041F**	**1055**
QT Fault	ULONG	**0220**	**544**	**0420**	**1056**
		0222	**546**	**0422**	**1058**
Pipe / Channel		**0222**	**546**	**0422**	**1058**
Q	FLOAT	**0222**	**546**	**0422**	**1058**
Flow unit index	USHORT	**0224**	**548**	**0424**	**1060**
Average V	FLOAT	**0225**	**549**	**0425**	**1061**
Average C	FLOAT	**0227**	**551**	**0427**	**1063**
KH (1)	FLOAT	**0229**	**553**	**0429**	**1065**
Reynolds (1)	FLOAT	**022B**	**555**	**042B**	**1067**
Surface	FLOAT	**022D**	**557**	**042D**	**1069**
Level (2)	FLOAT	**022F**	**559**	**042F**	**1071**
Height / Channel Description Point (2)	FLOAT	**0231**	**561**	**0431**	**1073**
Water Height (2)	FLOAT	**0233**	**563**	**0433**	**1075**
Water Height Max. Delta (2)	FLOAT	**0235**	**565**	**0435**	**1077**
Fault	ULONG	**0237**	**567**	**0437**	**1079**
		0239	**569**	**0439**	**1081**

		Pipe/Channel A		Pipe/Channel B	
PARAMETER NAME	Type	**JBUS Hex address**	**JBUS Dec address**	**JBUS Hex address**	**JBUS Dec address**
chord 01		**0239**	**569**	**0439**	**1081**
Average V	FLOAT	**0239**	**569**	**0439**	**1081**
T	FLOAT	**023B**	**571**	**043B**	**1083**
DeltaT	FLOAT	**023D**	**573**	**043D**	**1085**
C	FLOAT	**023F**	**575**	**043F**	**1087**
Gain	FLOAT	**0241**	**577**	**0441**	**1089**
IQ	FLOAT	**0243**	**579**	**0443**	**1091**
Fault	ULONG	**0245**	**581**	**0445**	**1093**
Probe Reference	USHORT	**0247**	**583**	**0447**	**1095**
Distance Between Probes	USHORT	**0248**	**584**	**0448**	**1096**
		0249	**585**	**0449**	**1097**
chord 02		**0249**	**585**	**0449**	**1097**
Average V	FLOAT	**0249**	**585**	**0449**	**1097**
T	FLOAT	**024B**	**587**	**044B**	**1099**
DeltaT	FLOAT	**024D**	**589**	**044D**	**1101**
C	FLOAT	**024F**	**591**	**044F**	**1103**
Gain	FLOAT	**0251**	**593**	**0451**	**1105**
IQ	FLOAT	**0253**	**595**	**0453**	**1107**
Fault	ULONG	**0255**	**597**	**0455**	**1109**
Probe Reference	USHORT	**0257**	**599**	**0457**	**1111**
Distance Between Probes	USHORT	**0258**	**600**	**0458**	**1112**
		0259	**601**	**0459**	**1113**
chord 03		**0259**	**601**	**0459**	**1113**
Average V	FLOAT	**0259**	**601**	**0459**	**1113**
T	FLOAT	**025B**	**603**	**045B**	**1115**
DeltaT	FLOAT	**025D**	**605**	**045D**	**1117**
C	FLOAT	**025F**	**607**	**045F**	**1119**
Gain	FLOAT	**0261**	**609**	**0461**	**1121**
IQ	FLOAT	**0263**	**611**	**0463**	**1123**
Fault	ULONG	**0265**	**613**	**0465**	**1125**
Probe Reference	USHORT	**0267**	**615**	**0467**	**1127**
Distance Between Probes	USHORT	**0268**	**616**	**0468**	**1128**
		0269	**617**	**0469**	**1129**
chord 04		**0269**	**617**	**0469**	**1129**
Average V	FLOAT	**0269**	**617**	**0469**	**1129**
T	FLOAT	**026B**	**619**	**046B**	**1131**
DeltaT	FLOAT	**026D**	**621**	**046D**	**1133**
C	FLOAT	**026F**	**623**	**046F**	**1135**
Gain	FLOAT	**0271**	**625**	**0471**	**1137**
IQ	FLOAT	**0273**	**627**	**0473**	**1139**
Fault	ULONG	**0275**	**629**	**0475**	**1141**
Probe Reference	USHORT	**0277**	**631**	**0477**	**1143**
Distance Between Probes	USHORT	**0278**	**632**	**0478**	**1144**
		0279	**633**	**0479**	**1145**

		Pipe/Channel A		Pipe/Channel B	
PARAMETER NAME	Type	JBUS Hex address	JBUS Dec address	JBUS Hex address	JBUS Dec address
Inputs/Outputs		**02C9**	**713**	**04C9**	**1225**
IO 01A		**02C9**	**713**	**04C9**	**1225**
Value	FLOAT	**02C9**	**713**	**04C9**	**1225**
Fault	ULONG	**02CB**	**715**	**04CB**	**1227**
		02CD	**717**	**04CD**	**1229**
IO 01B		**02CD**	**717**	**04CD**	**1229**
Value	FLOAT	**02CD**	**717**	**04CD**	**1229**
Fault	ULONG	**02CF**	**719**	**04CF**	**1231**
		02D1	**721**	**04D1**	**1233**
IO 02A		**02D1**	**721**	**04D1**	**1233**
Value	FLOAT	**02D1**	**721**	**04D1**	**1233**
Fault	ULONG	**02D3**	**723**	**04D3**	**1235**
		02D5	**725**	**04D5**	**1237**
IO 02B		**02D5**	**725**	**04D5**	**1237**
Value	FLOAT	**02D5**	**725**	**04D5**	**1237**
Fault	ULONG	**02D7**	**727**	**04D7**	**1239**
		02D9	**729**	**04D9**	**1241**
IO 03A		**02D9**	**729**	**04D9**	**1241**
Value	FLOAT	**02D9**	**729**	**04D9**	**1241**
Fault	ULONG	**02DB**	**731**	**04DB**	**1243**
		02DD	**733**	**04DD**	**1245**
IO 03B		**02DD**	**733**	**04DD**	**1245**
Value	FLOAT	**02DD**	**733**	**04DD**	**1245**
Fault	ULONG	**02DF**	**735**	**04DF**	**1247**
		02E1	**737**	**04E1**	**1249**
IO 04A		**02E1**	**737**	**04E1**	**1249**
Value	FLOAT	**02E1**	**737**	**04E1**	**1249**
Fault	ULONG	**02E3**	**739**	**04E3**	**1251**
		02E5	**741**	**04E5**	**1253**
IO 04B		**02E5**	**741**	**04E5**	**1253**
Value	FLOAT	**02E5**	**741**	**04E5**	**1253**
Fault	ULONG	**02E7**	**743**	**04E7**	**1255**
		02E9	**745**	**04E9**	**1257**

		Pipe/Channel A		Pipe/Channel B	
PARAMETER NAME	Type	JBUS Hex address	JBUS Dec address	JBUS Hex address	JBUS Dec address
Function output Start		**0319**	**793**	**0519**	**1305**
Function output 01		**0319**	**793**	**0519**	**1305**
Value	FLOAT	**0319**	**793**	**0519**	**1305**
Fault	ULONG	**031B**	**795**	**051B**	**1307**
		031D	**797**	**051D**	**1309**
Function output 02		**031D**	**797**	**051D**	**1309**
Value	FLOAT	**031D**	**797**	**051D**	**1309**
Fault	ULONG	**031F**	**799**	**051F**	**1311**
		0321	**801**	**0521**	**1313**
Function output 03		**0321**	**801**	**0521**	**1313**
Value	FLOAT	**0321**	**801**	**0521**	**1313**
Fault	ULONG	**0323**	**803**	**0523**	**1315**
		0325	**805**	**0525**	**1317**
Function output 04		**0325**	**805**	**0525**	**1317**
Value	FLOAT	**0325**	**805**	**0525**	**1317**
Fault	ULONG	**0327**	**807**	**0527**	**1319**
		0329	**809**	**0529**	**1321**
Function output 05		**0329**	**809**	**0529**	**1321**
Value	FLOAT	**0329**	**809**	**0529**	**1321**
Fault	ULONG	**032B**	**811**	**052B**	**1323**
		032D	**813**	**052D**	**1325**
Function output 06		**032D**	**813**	**052D**	**1325**
Value	FLOAT	**032D**	**813**	**052D**	**1325**
Fault	ULONG	**032F**	**815**	**052F**	**1327**
		0331	**817**	**0531**	**1329**
Function output 07		**0331**	**817**	**0531**	**1329**
Value	FLOAT	**0331**	**817**	**0531**	**1329**
Fault	ULONG	**0333**	**819**	**0533**	**1331**
		0335	**821**	**0535**	**1333**
Function output 08		**0335**	**821**	**0535**	**1333**
Value	FLOAT	**0335**	**821**	**0535**	**1333**
Fault	ULONG	**0337**	**823**	**0537**	**1335**
		0339	**825**	**0539**	**1337**
Function output 09		**0339**	**825**	**0539**	**1337**
Value	FLOAT	**0339**	**825**	**0539**	**1337**
Fault	ULONG	**033B**	**827**	**053B**	**1339**
		033D	**829**	**053D**	**1341**
Function output 10		**033D**	**829**	**053D**	**1341**
Value	FLOAT	**033D**	**829**	**053D**	**1341**
Fault	ULONG	**033F**	**831**	**053F**	**1343**

IV.4 CRC16 calculation algorithm



$\oplus$ = exclusive OR

n = number of bits

poly = calculation polynomial of CRC16 = 1010 0000 0000 0001 (generator polynomial = 2 X^2 X^{15} X^{16})

the first byte sent is the one with the least significant bits

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