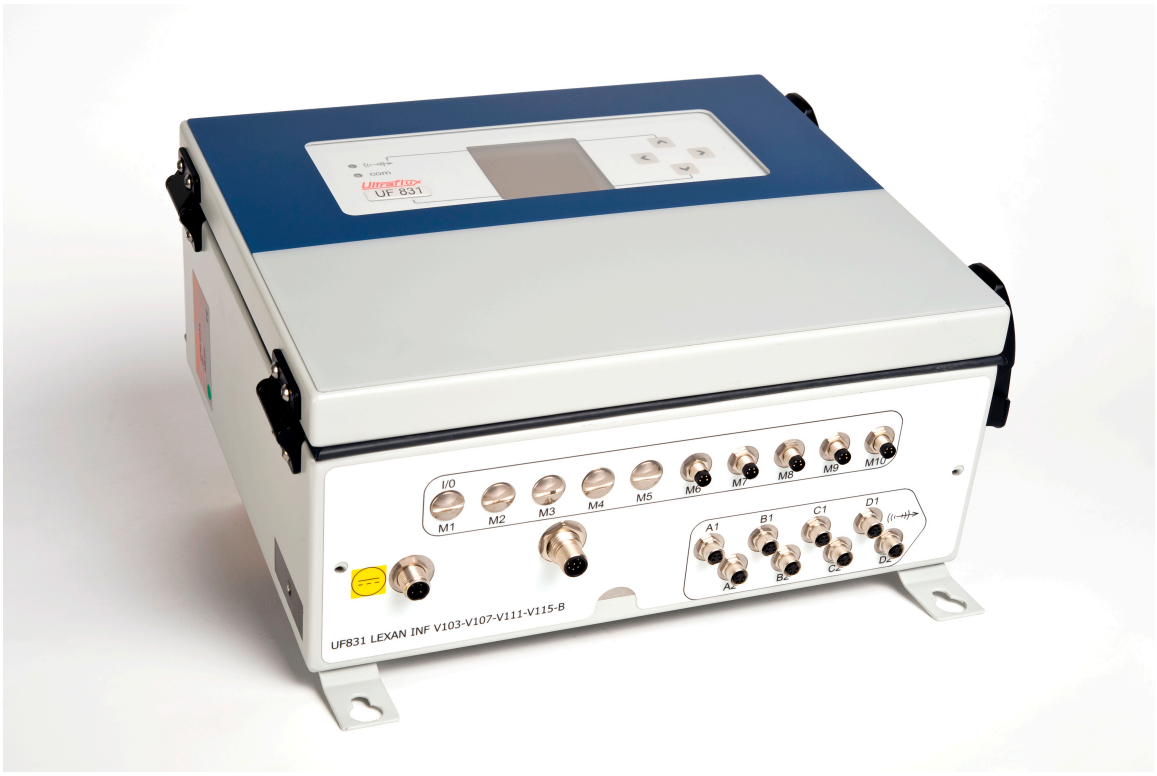
UF 831

(full pipe)

User manual



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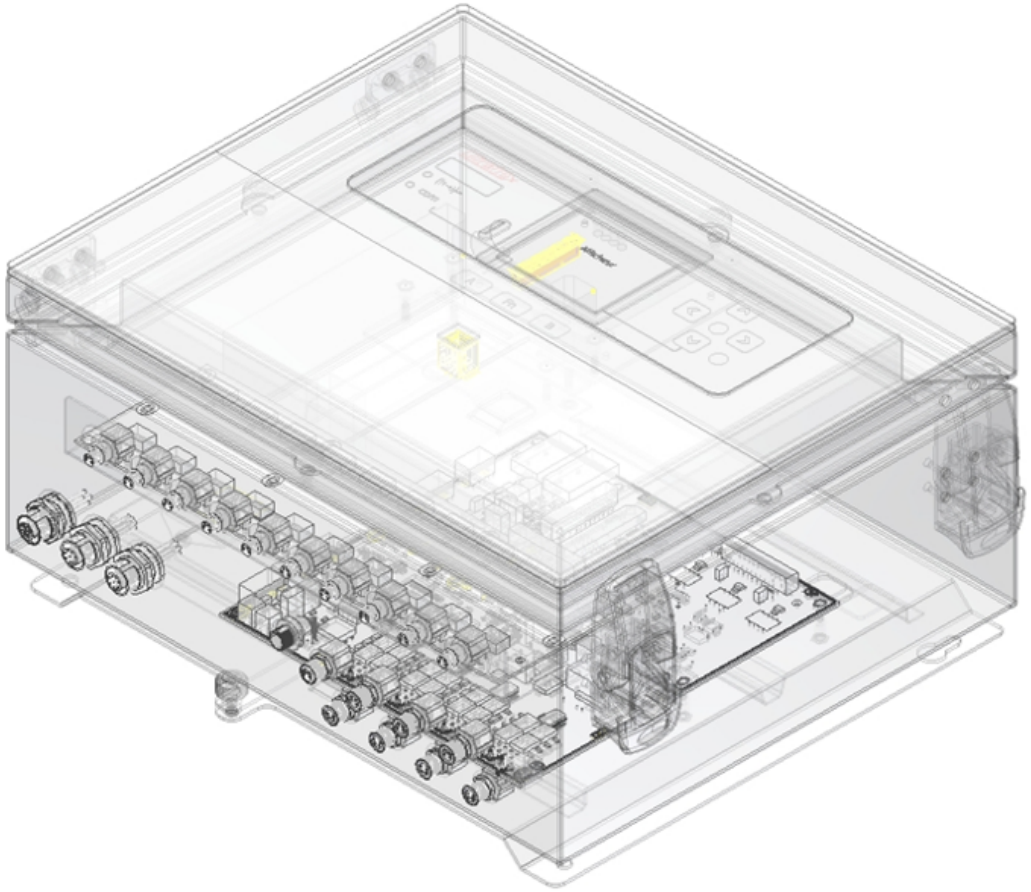
NT UF 831 CP GB (f) / June 2015



With a view to the constant improvement of its products, Ultraflux reserves the right to modify them without notice. Furthermore, Ultraflux shall not be held responsible for any error which may be present in its documentation despite the care taken in its production.

The UF 831 flow meter complies with the current regulations of the European Community and bears the CE compliance mark.

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

UF 831 flow meters are ultrasonic flow meters used to measure flows using the transit time difference method.

The measurement can be taken using an installation with up to 8 ultrasonic measurement chords. (One chord designates the acoustic path between two probes, each alternating between emitting and receiving. The use of several chords is above all required when the hydraulic conditions are poor and high accuracy is required).

1.1 Inputs/Outputs

In addition to the links with the probes, UF 831 converters offer the following possibilities:

- Integration of up to 10 single modules (or 5 double modules) of inputs/outputs.
- Connection of the inputs/outputs to the equipment, which is made directly on the base of the cabinet via connectors, without the need for any intervention inside the flow meter.

The modules are put in place by Ultraflux in the factory.

1.2 Communication with the flow meter

UF 831 has a serial link, which can be configured by RS232 or RS485 wiring. For this communication interface, the standard protocol chosen is the Slave JBUS (MODBUS). This is used to connect the flow meter to an instrumentation and control system or to a computer (Ultraflux provides PC software compatible with Windows XP or later, allowing you to configure the flow meter, unload the logger and display the values measured).

As an option, communication modules managing the following protocols may be installed on request:

- MODBUS TCP (Ethernet)
- MODBUS RTU

Important: This option must be requested on ordering, since it requires a specific cabinet.

A USB interface on the front panel allows a computer to be connected for the configuration. This is only accessible with the door open.

1.3 Recording possibilities

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.

1.4 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.).

1.5 Other functions available

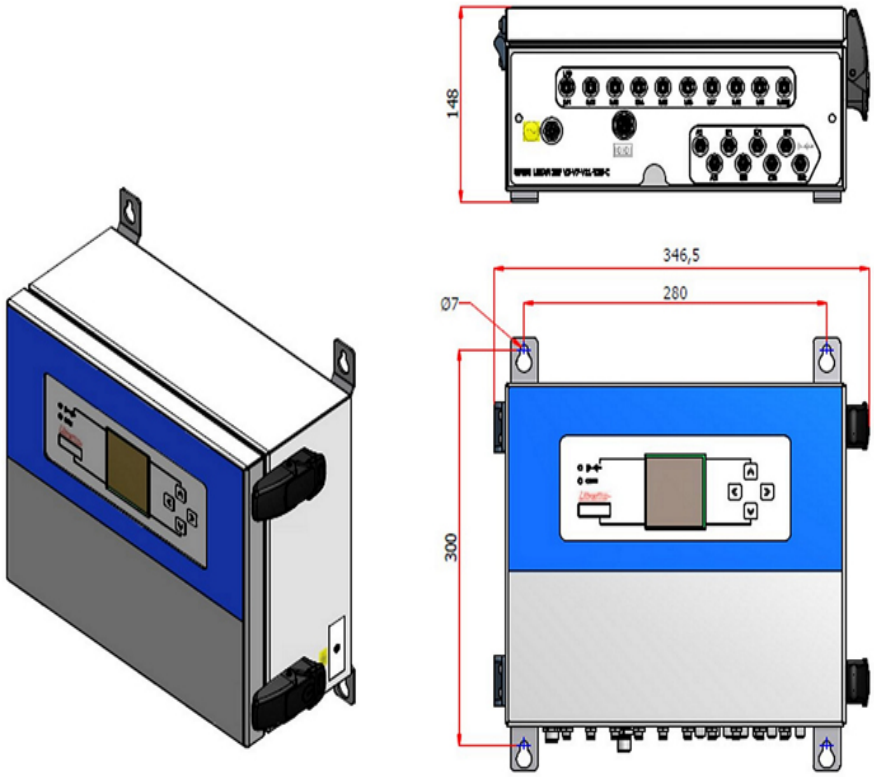
- Four flow volume totalizers which can count the positive flows, the negative flows or the total flows, regardless of their sign,
- Filtering of the measurement using a first-order filter allowing the non-significant flow fluctuations to be smoothed,
- Storage of the measurement in memory in the event 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.

1.6 Accuracy and availability

- 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.

1.7 Dimensions and weight



Weight: 7 kg (cabinet only)

1.8 Supply

- a UF 831 box
- the connectors
- the Y-cables for the probes

1.9 Protection against dust and immersion

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

This protection is only ensured when the connectors are connected or plugged (if not in use).

Important: If the flow meter is equipped with an optional communication module (Ethernet for example), the protection index becomes **IP20**.

1.10 Power supply

There are two power supply ranges for the flow meter:

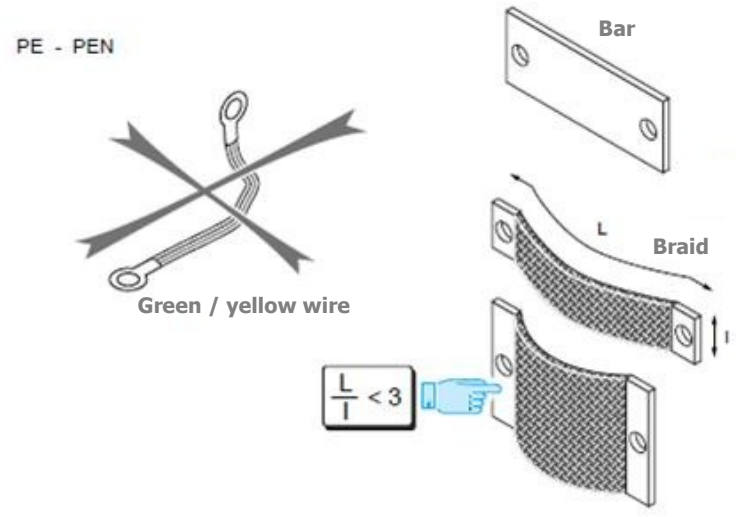
- 110 to 240 VAC (50 - 60 Hz)
- 9 to 36 VDC

The power of the flow meter is less than 40 W. A fuse-type internal protection protects the equipment. If this protection is triggered, the equipment must be returned to Ultraflux, otherwise the guarantee will no longer be valid.

The ground must be connected to both the power connector and to the ground connection contact, located alongside the connectors. 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



The cabinet power supply can be provided using an H05-RNF-3G0.75 type cable.

It is recommended to install a disconnectable bipolar circuit breaker interrupter with visible cut-off of 10 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, along with a galvanic isolator.

Important:

- The wiring and unwiring of the flow meter must be performed by a person with electrical accreditation. This accreditation must be obtained before dismounting the plate including the keypad and the display. It is essential for this plate to be closed with a tool after each intervention.
- Connection and disconnection from the outlets must be carried out with the power off and the equipment isolated.

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

Comments:

- Check the marking on the cabinet to ensure its supply voltage.
- The flow meter is intended for an overvoltage category II installation.

1.11 Environment for use of the cabinet

- Cabinet: –25°C to 50°C
- Hygrometry: 80% maximum
- Ventilation: no specific precautions.

Warning: This flow meter is a class A device. In a residential environment, it may cause radio-frequency interference. In this case, the user may be asked to take appropriate measures.

1.12 Cleaning the flow meter

Use a dry cloth to clean the screen and the keypad.

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.

1.13 Composition of a measuring point

Apart from the electronic converter (the cabinet), a measuring point includes the following elements:

- 1 to 8 pairs of probes
- 1 to 16 special cables for the probes (provided by Ultraflux)

CHAPTER 2: SAFETY INSTRUCTIONS

For safety reasons, this flow meter must be used by qualified persons aware of the possible dangers involved.

It is important for the user to be fully familiar with the indications covering the possibilities, the applications and the operation of this flow meter.

The protection provided by this flow meter may be compromised if it is not used in compliance with the instructions of this manual or if technical modifications are made to suit the user.

This flow meter complies with the safety standard IEC 61010-1 (cat II).

2.1 Symbols used on the flow meter

	Warning, risk of electric shock
	Warning, risk of DANGER (see note)
	Ground
	Protective ground
	User manual must be read before use
	Disconnection of flow meter when powered OFF

2.2 Assembly

The cabinets 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.

The assembly must be carried out or inspected by Ultraflux to have all the guarantees in terms of protection against dust and immersion, and correct operation.

2.3 Wiring

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

The protective cover must be fixed in place using a tool before powering on. The sectioning device must be locked and tagged before dismounting this cover. The cover can be identified by the marking series printed on its surface (symbol described later).

The flow meter must be powered off before dismounting the power connector. To do this, use the sectioning device provided for this purpose.

It is sometimes necessary to protect the inputs/outputs, the power supply and the ultrasonic chords. It is highly 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.

2.4 Using the flow meter

The flow meter, equipped with ultrasonic measuring probes, is used to measure the flow of a fluid (liquid) in a pipe.

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.

2.5 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.

2.6 Contact address

For any requests for information, please contact us at:

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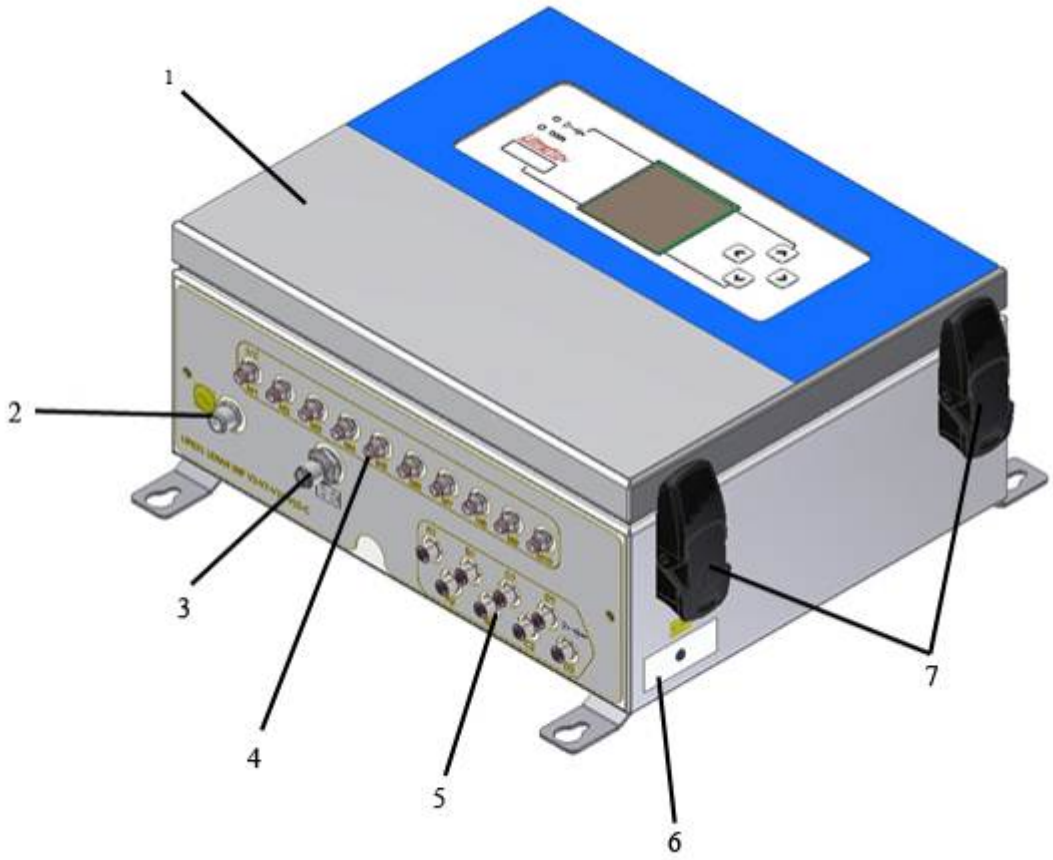
CHAPTER 3: INSTALLATION AND WIRING

3.1 Opening the cabinet

In order to configure the flow meter, the protective cover must be opened. It is opened by flipping and unlocking the latches located on the side of the cabinet.

On certain models, one of the latches may include a lock restricting access only to authorized persons.

These latches also ensure that the protection against dust and immersion is maintained. They must therefore remain closed in normal use.



1. Protective opening,
2. Power supply connector,
3. Communication connectors,
4. Input/output connectors,
5. Chord connectors,
6. Ground connection contact,
7. Latches (optional lock on one of the two).

The latches are adjusted in the factory. The guarantee of protection against dust and immersion is dependent upon this adjustment not being modified.

Likewise, this guarantee is no longer valid if the Lexan has deteriorated.

3.2 General procedures

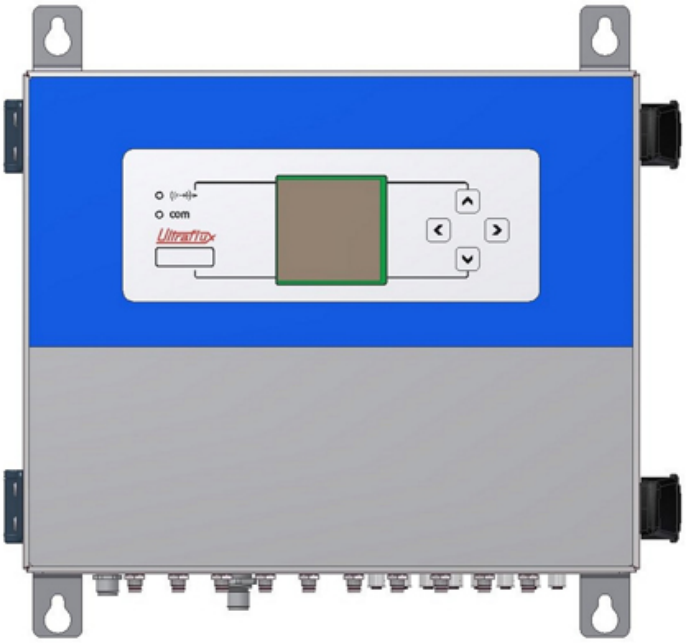
3.2.1 Wall attachment

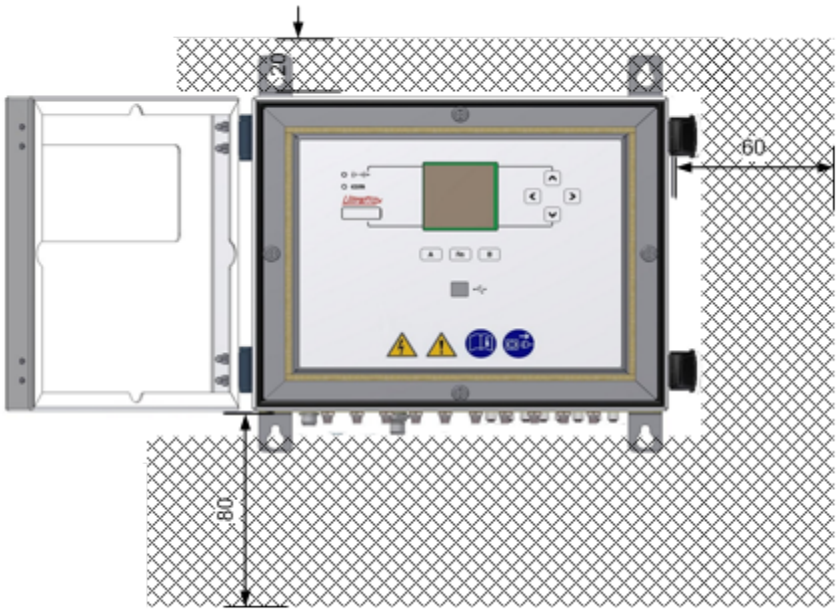
To install the flow meter on a wall:

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).

The area around the support must be clear in order to allow:

- the connection of the connectors,
- the movement of the latches.





3.2.2 Wiring of the connectors

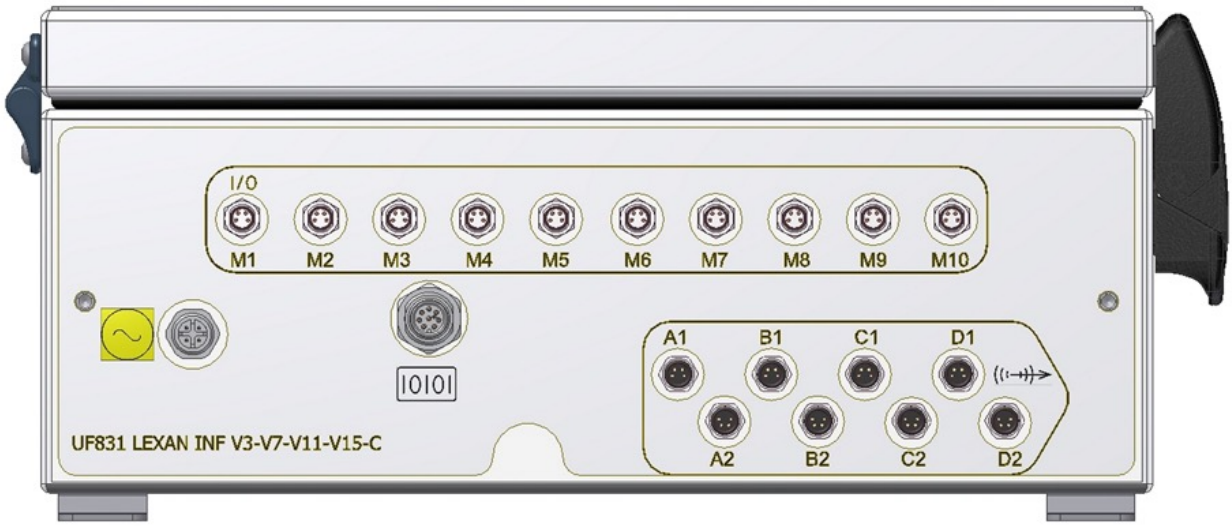
The cables must be stripped in such a way that the armor remains outside the connectors. The shielding must pass through the connector in order to prevent interfering signals from damaging the quality of the measurement. Remember to allow sufficient lengths to be able to access the locations of the probes and the inputs/outputs.

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

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

3.2.3 Connection

The connectors of the UF 831 box are installed as shown on the figure below:

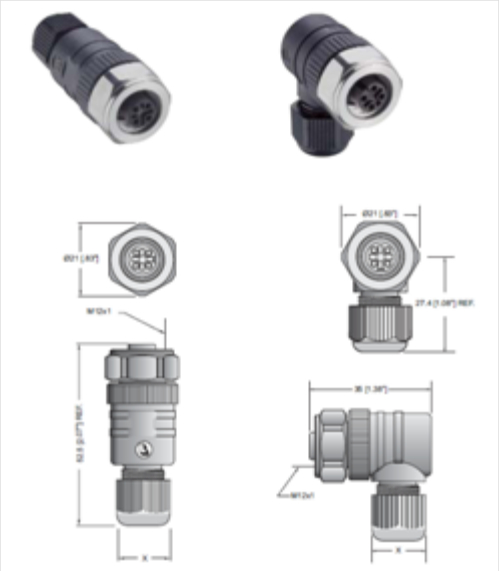


Comment: The addition of communication modules modifies the layout. Contact us for the details of the changes.

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.**

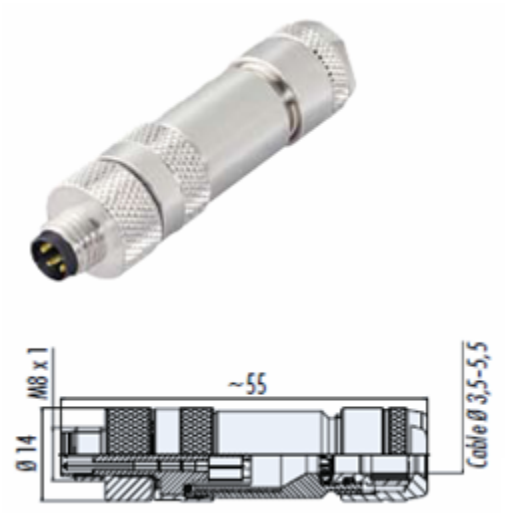
1) Power supply connector (wiring diagram in appendix 5)

Female 4-pin M12 plug



2) Probe connector (wiring diagram in appendix 5)

Male 4-pin M8 plug



Each connector corresponds to an 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. The flow meter can be configured to have only one probe per connector, but the number of chords possible is then halved. It is recommended to contact Ultraflux in order to define the most favorable configuration for your situation.

3) Communication connector (wiring diagram in appendix 5)

Female 8-pin M12 plug

4) Input/output connector (wiring diagram in appendix 5)

Female 4-pin M8 plug

3.2.4 Connectors

Preliminary comment: Before accessing the area reserved for the electronic connectors used to connect the flow meter to the inputs/outputs and to the probes, the wires must be stripped and the grounding strip assembled.

Once the cabinet is fixed and the cables installed on the connectors, the probe connectors and the input/output connectors must be installed in order to plug them in at their allocated positions.

1) Analog inputs/outputs

The UF 831 allows two types of inputs/outputs to be used:

- Current inputs/outputs (0-20mA, 4-20mA, 0-24mA) or voltage inputs/outputs (0-10V),
- Temperature measurement Pt 100 and Pt 1000 with 2, 3 or 4 wires.

The sensors must be powered externally. The wiring of the analog inputs/outputs is indicated in appendix 5: Wiring of the inputs - outputs.

2) On/Off inputs/outputs (relay)

Each relay of the UF 831 is a normally-open relay contact:

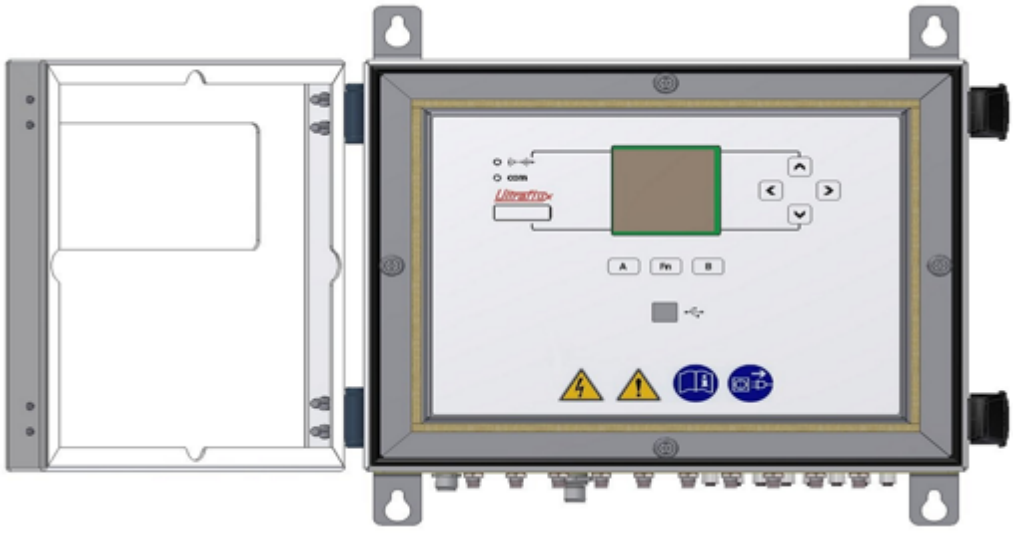
- Breaking capacity of each relay: U < 50 V, I < 10 mA,
- The maximum frequency of a relay in pulse mode depends on the length of the pulse.

3) Serial link

The serial link is connected using a connector, which can be configured by RS232 or RS485 wiring. The wiring diagrams are presented in appendix 5: Wiring of the communication port.

4) Connection to the PC

The connection to the PC is made using a USB connector on the front panel of the flow meter.



3.2.5 Installing the UF 831 close to a frequency converter

Important: Avoid installing the UF 831 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.

3.2.6 Power supply wiring

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.

Steps:

- Install the protective ground cable (green & yellow) on the terminal block indicated by the  symbol on the outside of the cabinet.

- Install the wired protective ground wire on the connector, and screw in. Then install the phase and the neutral on the connector provided.

Warning: To dismount the power supply connector, check that the flow meter is powered off correctly. The flow meter may suffer irreversible damage should the power supply connector be dismounted when the flow meter is powered on.

CHAPTER 4: IMPLEMENTING A MEASURING POINT

4.1 Composition of a measuring point

Apart from the electronic converter (the unit), a measuring point includes the following components:

- 1 to 2 pairs of probes
- 1 to 4 special cables for the probes (provided by Ultraflux)

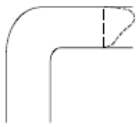
4.2 Choosing the measurement location

It is essential to follow the instructions given in our document "Mesure de débit par différence de temps de transit" (Flow measurement by transit time difference). As a reminder, the main precautions to be taken are as follows:

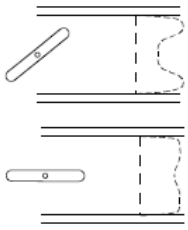
4.2.1 Straight lengths to be used

1) Monochord measurement

Using a monochord measurement implies that the speed profile at the measuring point is symmetrical relative to the axis of the pipe, and is fully developed and stable.
The following three conditions are not fulfilled in an area of disturbed flow, for example, at the outlet from an elbow or downstream from a regulating valve:



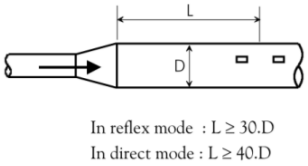
The speed profile is stable but not symmetric relative to the axis of the pipe.



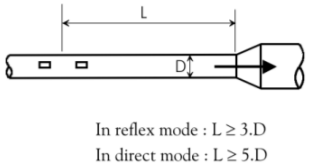
The symmetry of the speed profile varies relative to the pipe axis but is nether stable nor fully developed.

This is why probes need to be placed on a straight section of pipe sufficiently far upstream or downstream of a hydraulic disturbance (narrowing or widening of the pipe, elbow, pump, etc.).

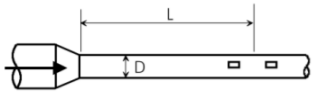
The following values show, for liquids, the minimum distances (L) to comply with before and after a disturbance depending on the internal diameter of the pipe (D) for the errors induced by these disturbances to be less than ± 1 %.



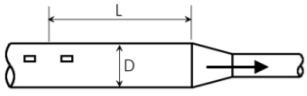
In reflex mode : L ≥ 30.D
In direct mode : L ≥ 40.D



In reflex mode : L ≥ 3.D
In direct mode : L ≥ 5.D

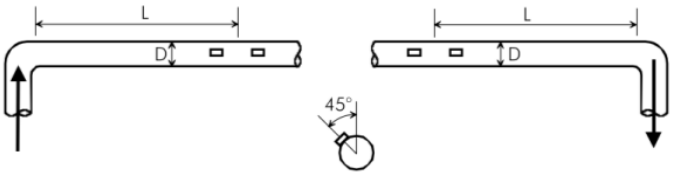


In reflex mode : L ≥ 10.D
In direct mode : L ≥ 15.D



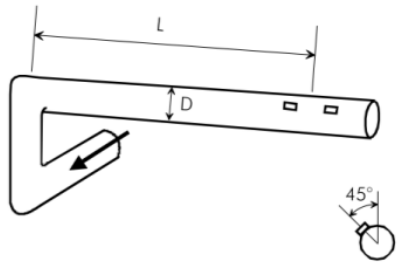
En mode reflex mode : L ≥ 3.D
En mode direct mode : L ≥ 5.D

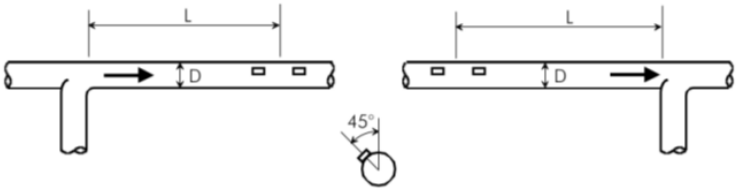
Comment:
The values shown must be multiplied by 2.5 for gases.



In reflex mode : L ≥ 15.D
In direct mode : L ≥ 20.D

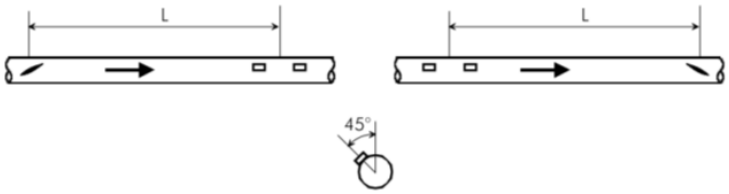
In reflex mode : L ≥ 3.D
In direct mode : L ≥ 5.D





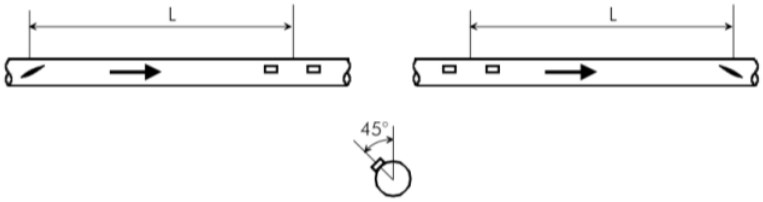
In reflex mode : L ≥ 15.D
In direct mode : L ≥ 20.D

In reflex mode : L ≥ 3.D
In direct mode : L ≥ 5.D



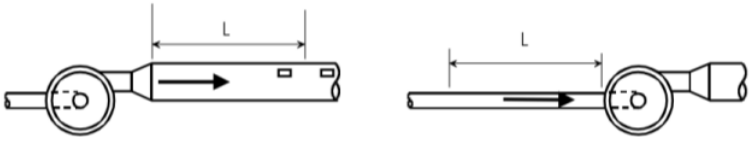
In reflex mode : L ≥ 15.D
In direct mode : L ≥ 20.D

In reflex mode : L ≥ 3.D
In direct mode : L ≥ 5.D



In reflex mode : L ≥ 15.D
In direct mode : L ≥ 20.D

In reflex mode : L ≥ 5.D
In direct mode : L ≥ 8.D



In reflex mode : L ≥ 30.D
In direct mode : L ≥ 40.D

In reflex mode : L ≥ 3.D
In direct mode : L ≥ 5.D

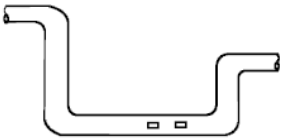
2) Multichord measurement

As multichord measurement copes better with irregularities in the speed profile, multichord measurements can be used on straight lengths much smaller than those required for a monochord measurement.

For example, we have been able to test a measurement made using 4 parallel chords placed at 1.6 D from a T followed by a butterfly valve. The error under these very unfavourable conditions was 2 %. Under the same conditions, a monochord measurement would have generated an error of the order of 10 %.

Recommended locations

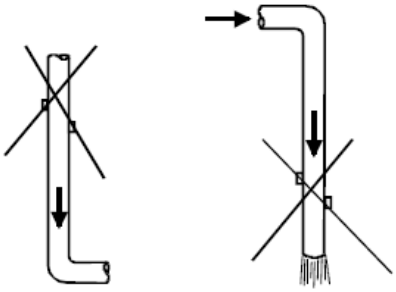
Vertical pipes with rising flow



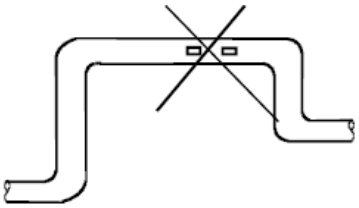
Low points of horizontal pipes

Siphon mounting for pipes with a slight slope

Locations not recommended



Vertical pipe with downflow, particularly in the case of free flow.

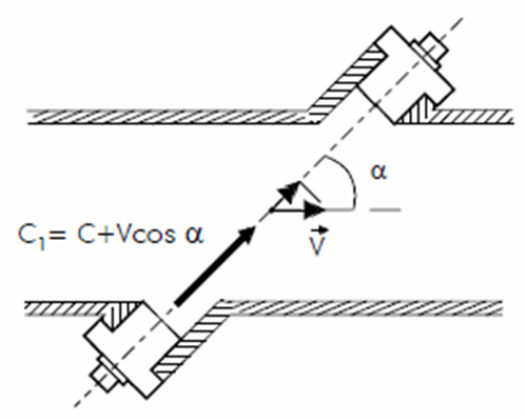


High points

4.3 Choosing the probe location

The installation depends on the type of probe.

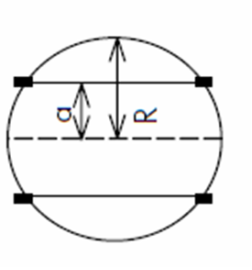
4.3.1 Intrusive probes



Two geometric modes may be applied:

- *Diametric mode:* The chord follows the diameter of the cross-section. An approach by Kh is then activated in order to model he speed profile and refine the measurement. The Kh coefficient takes account of the roughness of the wall and the viscosity of the fluid. You are strongly recommended to refer to the teaching manual available on request in order to understand the significance of these settings.

- *Parallel mode:* The chords are placed in parallel planes which "section" the fluid speed flow better.



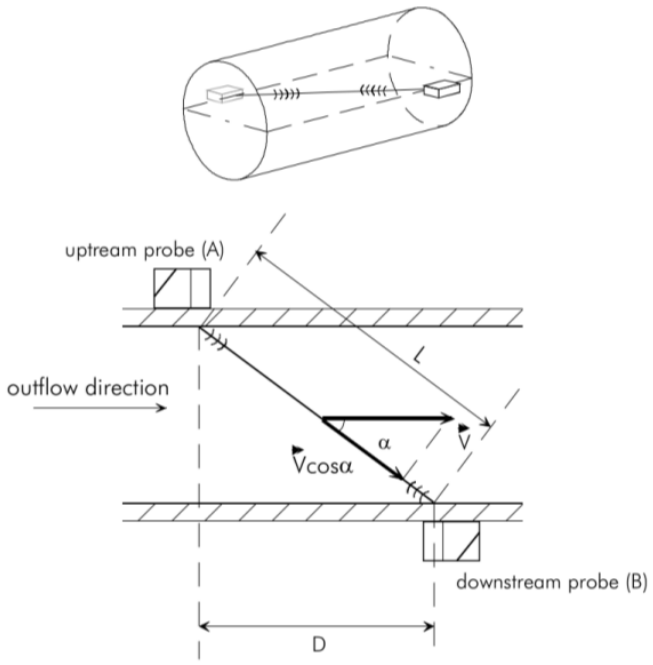
Note: The accuracy of the measurement is improved by increasing the number of chords.

Important: With a "simple" configuration, diametric mode must be used. Parallel mode is available from "normal" configuration level.

For each chord, enter the length (in meters) between the faces of the two probes. To help you, read our document "Ultrasonic transit time flowmeter".

Also enter the projected length (Daxe) of this measurement relative to the axis of the pipe.

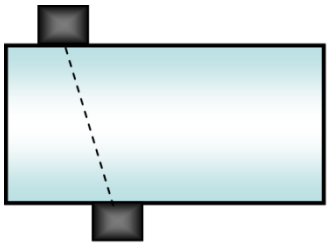
4.3.2 External probes (clamp-on)



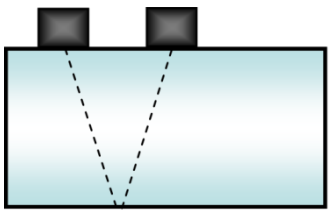
Probes and pipe viewed from above

External probes may be mounted in several configurations depending on the number of ultrasound wave reflections on the wall of the pipe:

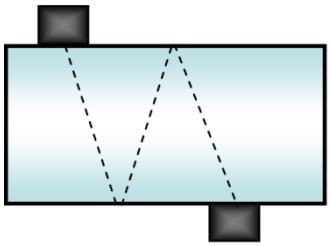
- Direct or / configuration:



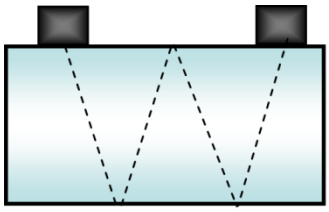
- Reflex or V configuration:



- N (or Z) configuration:



- W configuration:



Note: The longer the travel, the more accurate the measurement.

On the other hand, the ultrasound echo will be weaker the longer the distance and therefore difficult to measure. A compromise must therefore be found between accuracy and ease of finding the ultrasounds. This compromise depends on the application (fluid, quality of the wall, diameter, etc.).

4.4 Installing probes and connectors

The care taken to install the probes (sensors) and their alignment determines the accuracy of the flow measurement.

4.4.1. Permanent external (clamp-on) probes

1) Preparing the pipe

To install external probes (clamp-on), the areas of pipe where the sensors are to be installed must have been carefully cleaned beforehand. The pipe must be cleaned using absorbent paper or a piece of cloth. If the pipe is very dirty or corroded, use a metal brush or scraper. It is not necessary to remove good paintwork. It is even recommended to keep it to avoid corrosion. The same applies to most plastic coverings. On the other hand, if the paint is blistered or flaky (test by scratching with your nail or a pointed tool), it should be removed locally.

Then coat the locations where the probes are to be installed lightly with grease (do not use silicon grease).

2) Installing the elastomer strip

To start, cut a piece of strip to the size of the probe (+5 mm).

Then remove the plastic protective film.

Apply the strip where the probe is to be installed.

Lastly, lightly grease the external surface of the strip.

3) Installing the probe

Place the probe on the strip and fix it in place by firmly tightening the stainless steel collar supplied.

Preferably position the collar locking screw on the opposite side to the probe.

4.4.2. Temporary external (clamp-on) probes

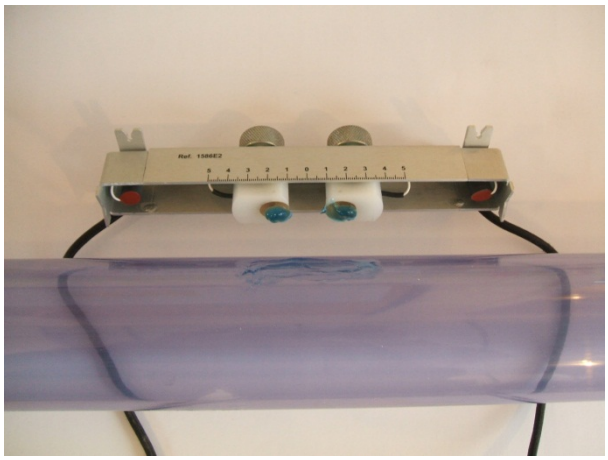
1) Preparing the pipe

To install external probes (clamp-on), the areas of pipe where the probes are to be installed must have been carefully cleaned beforehand. When doing this, take into consideration the distance between the probes and estimate the space required for probe/mounting assembly. The pipe must be cleaned using absorbent paper or a piece of cloth. If the pipe is very dirty or corroded, use a metal brush or scraper. It is not necessary to remove good paintwork. It is even recommended to keep it to avoid corrosion. The same applies to most plastic coverings. On the other hand, if the paint is blistered or flaky (test by scratching with your nail or a pointed tool), it should be removed locally.

2) Selecting and installing the coupling medium

A coupling medium must be selected which is suited to the humidity and temperature conditions of your application.
- "traditional" gel for temporary measurements at ambient temperature and without too much humidity,
- high temperature gel (<300°C),
- grease in the case of high humidity (quality depending on temperature).

After choosing a suitable coupling medium, spread it lightly around the locations chosen for installing the probes and copiously on the probes themselves.



3) Installing the probe

Attach the probes onto the pipe using straps or a dedicated support. Check the presence and continuity of the coupling medium (ensure no air layer forms between the pipe wall and the probe). To avoid this pitfall, refrain from sliding the probes too much (the coupling medium film could be altered/broken).

4.4.3. Inserted probes

Preliminary comment: before you do anything, you must check with Ultraflux whether your probes can be extracted under load or not. Whether an inserted probe may be extracted under load or not is determined by the probe used and the application conditions of your measuring point (pressure, fluid measured, etc.).

1) Flanged probes

1st step: Check the position of the bosses relative to the drawing provided by Ultraflux

2nd step: Check the state of the seal face which must be free of irregularities and dirt. Seal faces which are rusted, battered or generally in a bad state of repair must not be used.

3rd step: Insert the probe into the boss making sure the seal is present.

4th step: Insert the probe fixing screws and tighten them to the recommended tightening torques.

5th step: Connect the probes to the flow meter through the connecting head.

2) Screw probes

1st step: Check the position of the bosses relative to the drawing provided by Ultraflux

2nd step: Check the state of the seal face which must be free of irregularities and dirt. Seal faces which are rusted, battered or generally in a bad state of repair must not be used.

3rd step: Insert the probe into the boss making sure the seal is present.

4th step: Screw the probe down into the boss as far as it will go, then readjust so that the alignment marker of the probe is on the axis of its twin probe.

5th step: Carry out the previous steps from step no. 2 with the twin probe.

6th step: Connect the probes to the flow meter via the connection head or the push/pull connector (depending on the type of probe).

7th step: Readjust the alignment of the probes checking the gain displayed by the flow meter.

3) Probes with air lock

1st step: Check the position of the bosses relative to the drawing provided by Ultraflux

2nd step: Check the state of the seal face which must be free of irregularities and dirt. Seal faces which are rusted, battered or generally in a bad state of repair must not be used.

3rd step: Install the valve checking the presence of the seal. Screw the air lock onto the valve - at all times checking the presence of the seal.

4th step: Press the operating rod down as far as it will go then screw the guide into the air lock.

5th step: Orientate the packing gland in the axis of the twin probe.

6th step: Carry out the previous steps from step no. 2 with the twin probe.

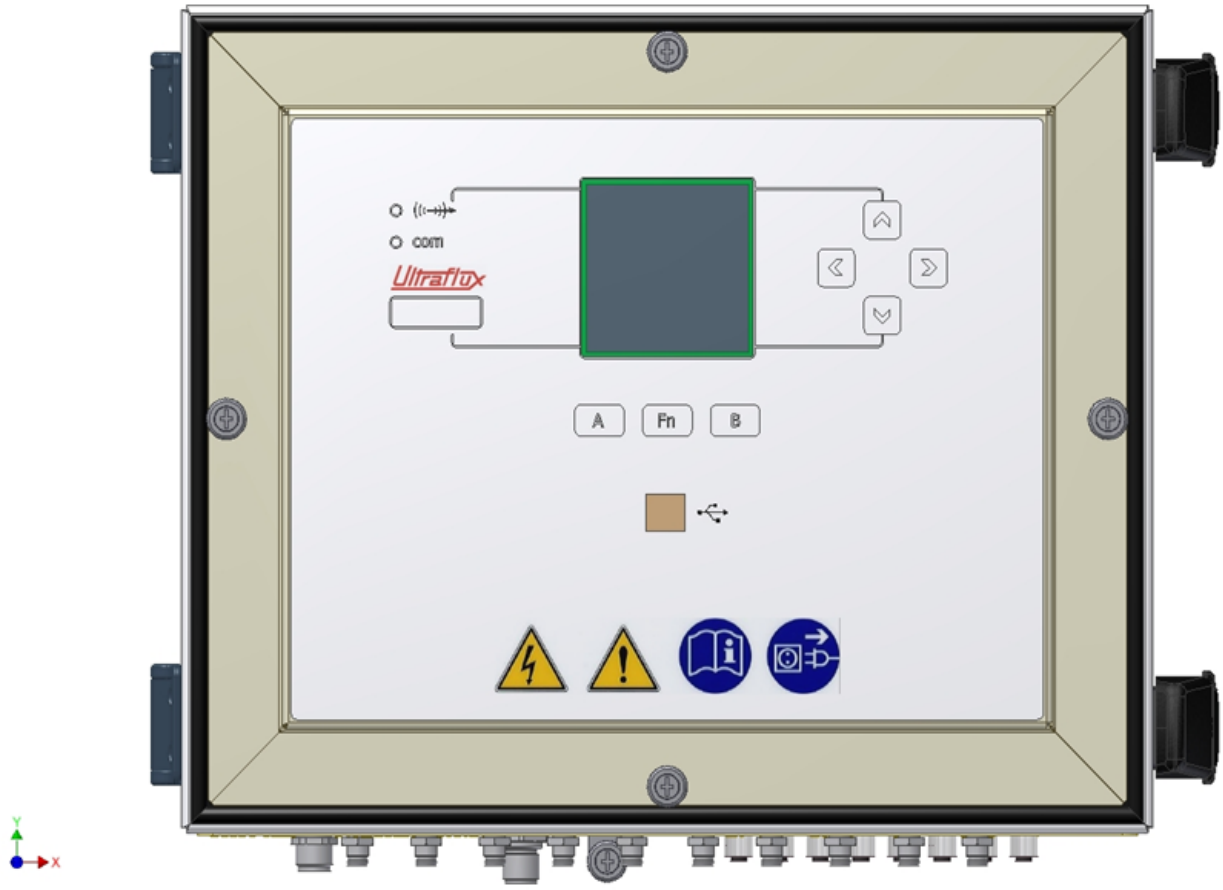
7th step: Connect the probes to the flow meter via the connecting head.

8th step: Readjust the alignment of the probes checking the gain displayed by the flow meter.

CHAPTER 5: USING AND CONFIGURING THE UF 831

5.1 Using the UF 831

The UF 831 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

The flow meters operate with 3 different types of displays:

- "Measurement" displays/mode (flow, quality…),
- "Settings" displays/mode (description of section, logger...),
- "Echo" displays/mode (landscape, zoom…).

5.1.2 Keypad

The **Fn** (for Function) key is used to switch between displays/modes. This **Fn** key is used in particular to enter the "settings" mode.

The **<** and **>** keys are used to browse through the menus of this mode.

A long press on the **Fn** key, or allowing approximately 1 minute to pass without using the keypad, returns you to the "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, in the same way as the choice of the screen in measurement mode which is displayed by default.

After powering on the 831, the screen displays the page which 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 modify a line, select it using ▼ or ▲ and modify the value using **<** or **>**.

If no key is pressed for approximately one minute, the UF 831 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.

Comment: An extended press on one of these two keys accelerates the increase or the decrease.

5.1.3 LEDs

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 on each dialog on the serial link.
    - Long red flashing on each dialog error on the serial link.
    - Orange LED fixed on when the flow calculation is in degraded mode or when a related function is faulty.
    - Red LED fixed on when the flow calculation is faulty.

5.2 Main configuration elements

5.2.1 Number of pipes

Note: for multi-pipes flow meters only, it is possible to define the number of pipes to be managed by the flow meter.

The geometric and physical description of the measuring point must then be produced for each pipe.

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

5.2.2 Description of the pipe

The pipe is described by its outside diameter (or equivalent sectional diameter) and the physical characteristics of the material(s) of which it is made.

- *In "simple" configuration:* you must define the outside diameter, the thickness of the material and the type of material. The fluid must be water.
- *In "normal" configuration:* you can choose the fluid from a list. This list depends on your flow meter type (gas or liquid).
- *In "advanced" configuration:* you can define a wall with up to 3 different materials/layers (see § 5.6.1).

Two different types of probe may be used:

- *External (clamp-on) probe:* the probe is "placed" on the outside of the pipe. The "clamp-on" probes may be positioned in direct (/), reflex (V) , N or W configurations.
- *Intrusive mode (wet probe):* a hole must be drilled in the pipe to install the probes, or the probes must be installed directly on a sleeve (welded or fixed by flange). Intrusive probes can be placed in parallel or diametric planes.

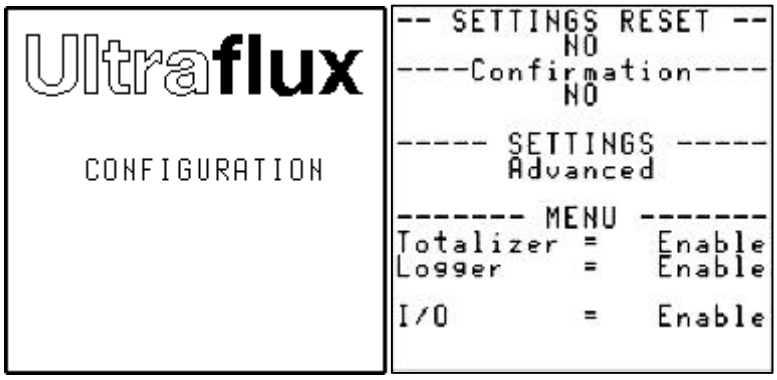
Note: The number of chords must be chosen depending on your application and the authorised limit for your flow meter type.

5.3 Configuring the UF 831

The configuration 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 the 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 selecting the menu option 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, place the cursor on the line corresponding to the required option and use the < and > keys.

5.3.1 Flow meter menu ("Settings" mode)

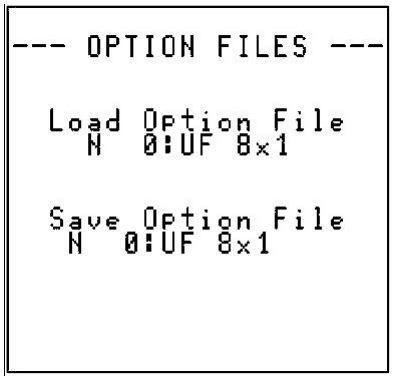
Depending on the type of flow meter and the configuration mode (simple, normal or advanced) selected, the flow meter menu may change. Below is a non-exhaustive list of the sections for the flow meter:

- CONFIGURATION: configuration of the operating modes, the registration name, the JBUS/MODBUS characteristics; configuration management, etc.
- PIPE/FLUID SETTINGS: setting of the type of fluid, the pipe, the chords, the geometry of the chords of the measuring point, etc.
- TOTALIZERS SETTINGS: configuration of totalizers.
- INPUT/OUTPUT SETTINGS: configuration of inputs and outputs.
- LOGGER SETTINGS: configuration of the logger.
- LINEARIZATION SETTINGS: configuration of linearization.
- FUNCTIONS SETTINGS: settings of the inputs for the function engine. This menu is only available on request for specific applications.
- ADVANCED SETTINGS: settings of 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 of the firmware

5.4 SIMPLE configuration

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



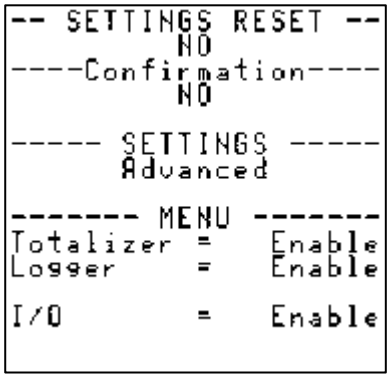
1) "Option files" Window

This window lets you load and save 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 confirmed when passing to another menu page or following an extended press of the **Fn** key. The name of the configuration is the same as the station name (see point 8).

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

Remember to save the current configuration in order not to lose it.



2) Reinitialisation: Settings reset

This command reinitialises the flow meter (to factory configuration).

3) Confirmation (of reinitialisation)

Reinitialisation of the flow meter requires the user to enter a field requiring confirmation (protection against handling errors).

4) Settings

This command allows the configuration level of the flow meter to be changed (Simple, Normal or Advanced).

5) Menu

Allow the user to enable or disable:

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

6) Access code (code access)

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 for 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's 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

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

- Bitrate
  Enter the bitrate that you wish to apply.

11) Timer before return to "Measurement" mode

The flow meter automatically returns to the Measurement screens after approximately one minute. The modified settings are then be taken into account. This avoids the risk of forgetting to exit "Configuration" mode and needing to intervene again on the flow meter 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:

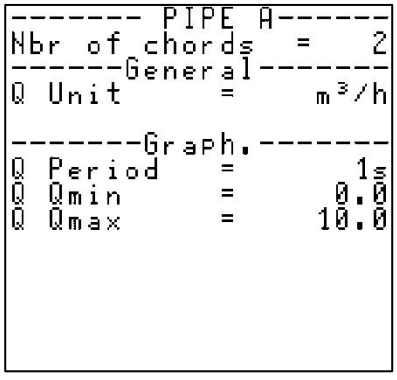
1) Number of chords

Enter the number of chords for your application

2) Flow rate unit (Q unit)

Enter the flow unit which will be displayed.

3) Flow graph



The flow graph is one of the Measurement screens. This shows the changes in a particular magnitude in the form of a curve (see the possible magnitudes below).

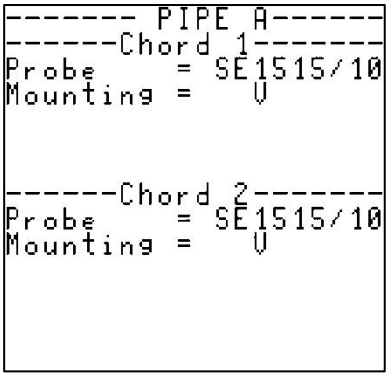
Enter the minimum and maximum limits of the dimension associated with the flow graph. These limits mark the boundaries of the vertical display of the flow graph.

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 magnitude associated with the flow graph over 1 min and the whole screen shows the evolution of the flow over the last 144 minutes.

4) Chord settings

For each chord, the two settings to be selected are the reference number of the probes used and the probe fitting type:



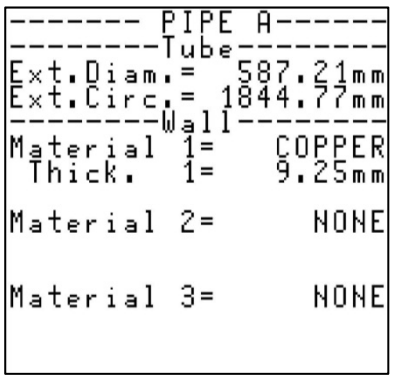
If the reference number of the probes you are using does not appear in the list, please contact Ultraflux.

5) Type of fluid

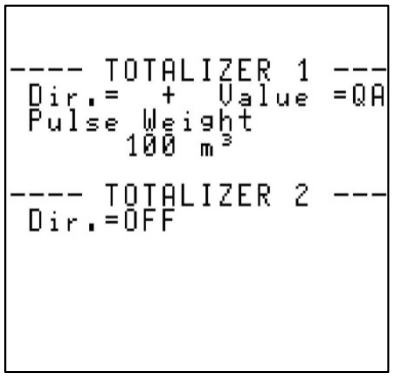
In "simple" configuration mode, the fluid must be water at ambient temperature (cannot be modified).

6) Definition of the pipe

The pipe diameter, thickness and material must be defined.



5.4.3 "Totalizer settings" menu (if enabled)



1) Activation and counting direction

For each of the totalizers, the possible modes are:

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

Note: In addition to flow totalling, other magnitudes from the function engine may be totalled if this is enabled. Contact Ultraflux for further details on this option.

2) Pulse unit and weight

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

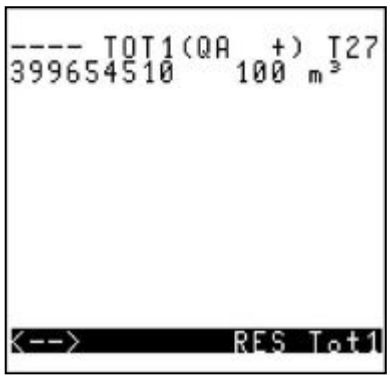
The possible units include (but are not limited to): 1ml, 1l, 1m3, 1000 m3, 1Gal, 1Bbl…

3) Resetting a totalizer (if authorised)

Resetting totalizers is inhibited when the flow meter leaves the factory.
On request and before shipping, it is possible to authorise the resetting of totalizers.
On site, only an Ultraflux operative will be able to reset the totalizers.

To reset a totalizer (if authorised):

1. Switch to measurement mode (long press on 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.



5.4.4 "Input/Output settings" menu (if enabled)

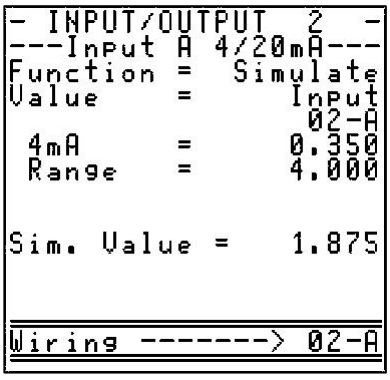
The input/output modules are:

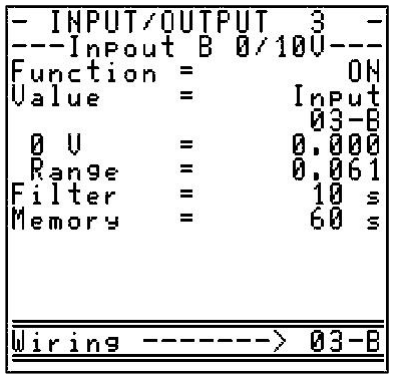
- On input:
  - Current,
  - Voltage,
  - Temperature (PT100/PT1000),
  - Contact.

- On 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: disabled,
- ON: enabled,
- 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: disabled,
- 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.

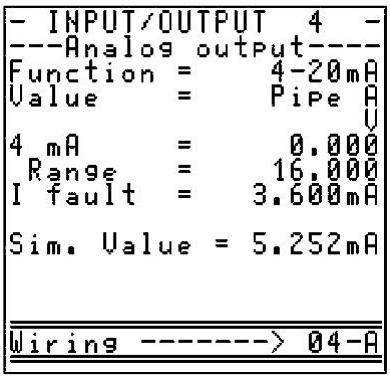
- Simulation: Enter the temperature value to be simulated.

3) Contact input module

The possible options are:

- OFF: disabled,
- Status: whether the contact is open or closed,
- Pulse: the number of opening - closing cycles of the contact.

4) Current/voltage output module



The possible options are:

- OFF: disabled,
- 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:

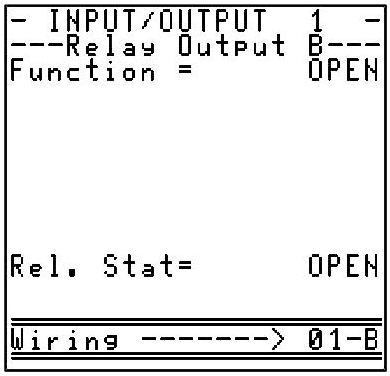
- the parameter that the output represents. Select the magnitude that you wish to associate with the analogue output using the chapter headers (function) and the chapter items (value).
- the bottom of the scale:
  - value corresponding to 0 mA or 4mA (for a current output),
  - value corresponding to 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.

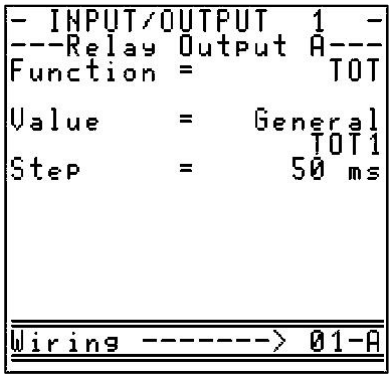
5) Relay output module

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 831 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 weight of the pulse divided by the flow rate.

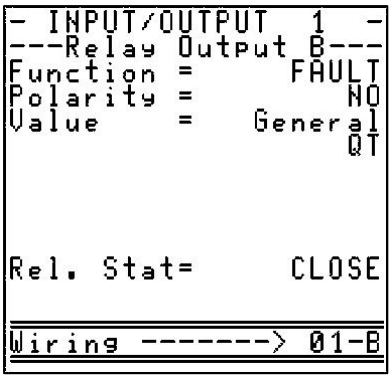
Example:

Flow rate = 1000 l/s / Pulse weight = 100 l.

We therefore have 1 pulse every 100/1000 = 100 ms.

The value of the period must therefore not exceed 100 ms otherwise not all pulses emitted by the totalizer will be counted.

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



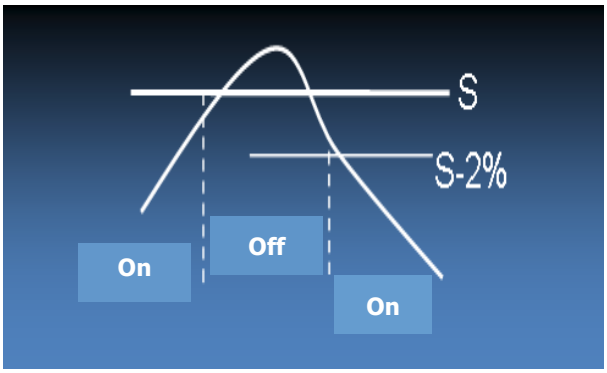
In the example, the variable selected is "general Q". This means that the relay closes when the flow meter is not measuring a flow and remains open otherwise.

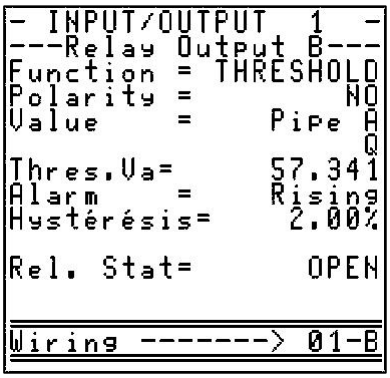
- *Direction:* Depending on the polarity chosen (NO: normally open, NC: normally closed), the relay changes state when the sign (+ or -) of the associated magnitude changes.

- *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.

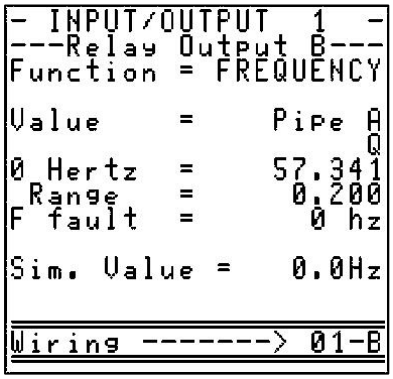
  Comment: In order to restrict the relay backlash when the dimension concerned fluctuates around the threshold, hysteresis must be defined.

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





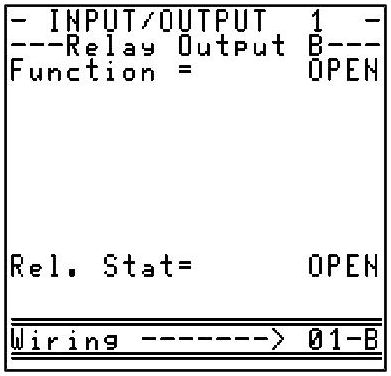
- *Frequency:* The frequency at which the relay is opened and closed depends on a value to be defined. Example: high flow, high frequency, low flow, low frequency.



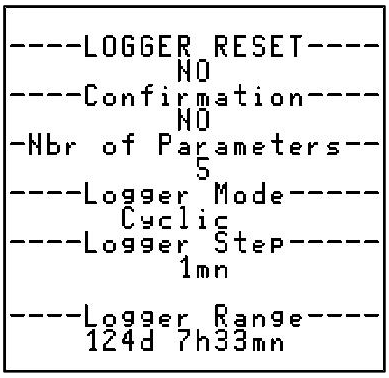
The following must be defined:

- the parameter that the output represents.
  Select the magnitude that you wish to associate with the output using the chapter headers (function) and the chapter items (value).
- the value relating to 0 hertz.
- the value relating to 1 Khertz.
- the value if a fault occurs.

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



5.4.5 "Logger settings" menu (if enabled)



Important: The logger must be reset before the number of variables is changed.

1) Resetting the logger

To reset the logger, enter "YES" in the "RESET LOGGER" field.

2) Confirmation of resetting the logger

Resetting the logger requires the user to enter a confirmation field (protection against handling errors).

3) Number of parameters for the logger

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 has 2 recording modes: "rotating" (initial files overwritten when the logger is full) or "Stop when full" (the logger stops operating when it is full).

5) Logger step

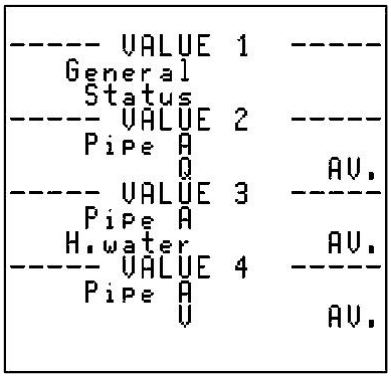
The recording period of the logger can be set from 1s to 24 hrs: 1 s, 5 s, 10 s, 30 s, 1 min, 2 mins, 5 mins, 10 mins, 15 mins, 30 mins, 1 hr, 2 hrs, 6 hrs, 12 hrs and 24 hrs.

6) Logger autonomy

This field, which cannot be changed, shows the remaining autonomy of the logger.

7) Logger variables

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

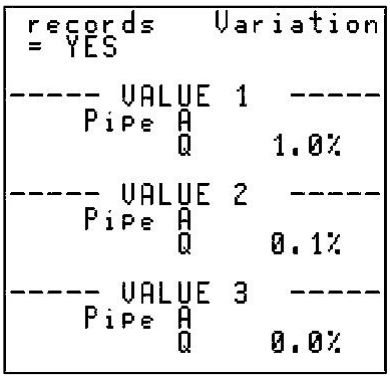


- *AVG: average value over the recording period,*
- *MIN:* minimum value over the recording period,
- *MAX:* maximum value over the recording period.

8) Records variation

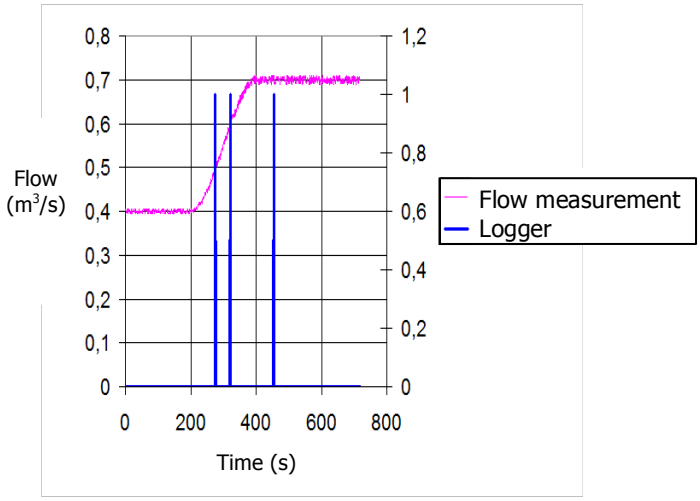
The variation mode of the logger is used to reduce the recording period for the data in the logger.

To do this, define the maximum variation percentage with regard to the previous recording. If the variation measured is greater than this maximum, 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) show when logger recording is triggered. If the variation of the flow is greater than the configured threshold, the logger forces a recording.

5.4.6 "Echo display" menu

Warning: Echo display mode blocks the measurement function (The measurement values are no longer calculated, the logger no longer records data).

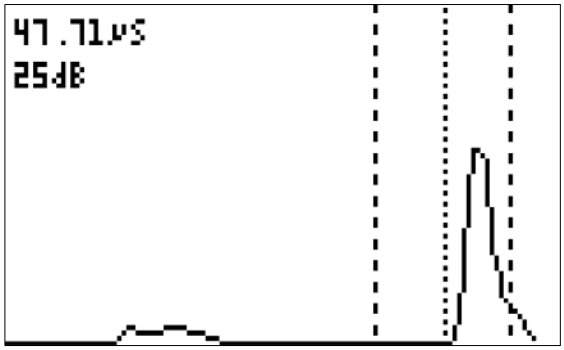
"Echo analysis" mode is used to view the acoustic signal of each chord, which is of use during the commissioning or maintenance phase, or for example:

- to check the connection of the probes and that they are working correctly,
- 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:

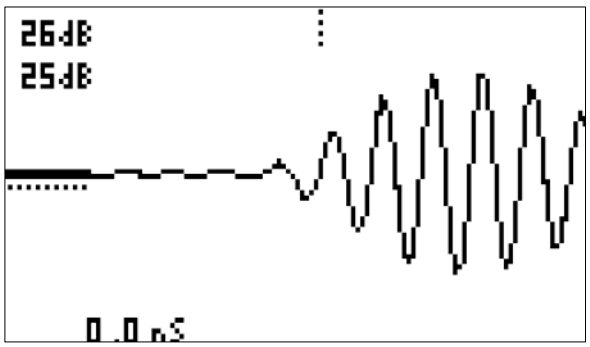
- The first displays the acoustic signal between the emission (for short travel times) and the echo analysis zone. This screen is called the "landscape" display:



- The two dashed vertical lines show the area where the echo is expected. An echo received outside of this area will not be taken into account.
- The dotted vertical line shows the measuring point on the echo.
- The chord number is shown underneath the graph.
- On the top left of the screen is shown the gain applied to the echo and the travel time of the wave.

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 continuous horizontal line shows the noise level.
- The vertical dotted bar marks the location where the travel time is measured. Its absence means that no measurement was carried out (for example if there were too many interfering signals).
- The horizontal dotted bar shows the measurement threshold. The measurement is carried out on the first movement to 0 of the cycle which crosses this threshold.
- On the bottom left is shown the travel time difference of the ultrasounds (does not include ΔT0).

5.5 NORMAL configuration

Comment: The following description will be restricted to the additional functions of normal configuration as compared with simple configuration. The common base already explained in the simple mode section is not repeated in this section.

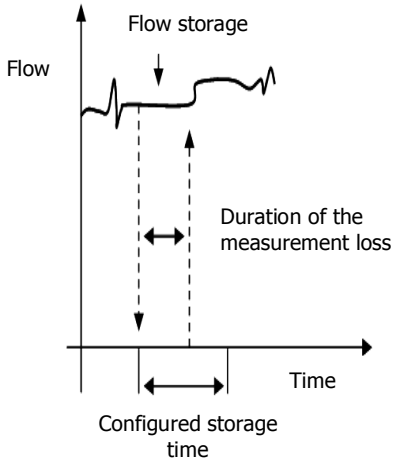
5.5.1 "Pipe/fluid settings" menu

1) Memory

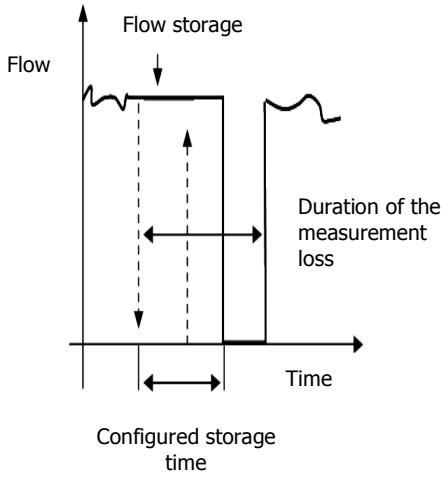
The memory time is the time, given in seconds, for which the measurement is stored in memory when a measurement is lost (echo loss).

This memory time is used in particular to avoid untimely actions from the instrumentation and control part of the installation.

Two situations may arise:



Case no. 1: Duration of the measurement loss less than the memory time. In this case, the flow meter holds the last measurement until a new valid measurement is obtained.



Case no. 2: Duration of the measurement loss greater than the memory time. The flow meter extends the last measurement until the elapsed time exceeds the memory time. Then the flow metering system faults itself if there are still no new valid flow rate measurements.

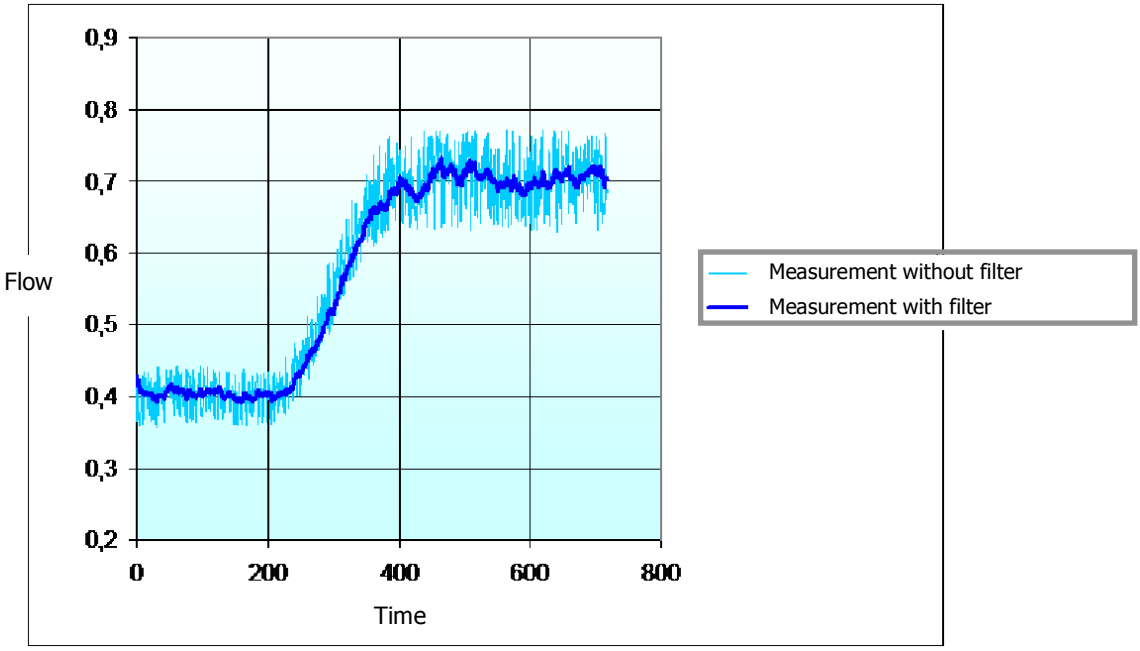
2) Filter

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

```
------- PIPE A------
Nbr of chords  =    2
------General-------
Q Unit         =    m³/h
Memory         =     10s
Filter         =     10s
DeltaV Fil.=5.000m/s
-------Graph.-------
Q Period       =      1s
Q Qmin         =     0.0
Q Qmax         =    10.0
```

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:

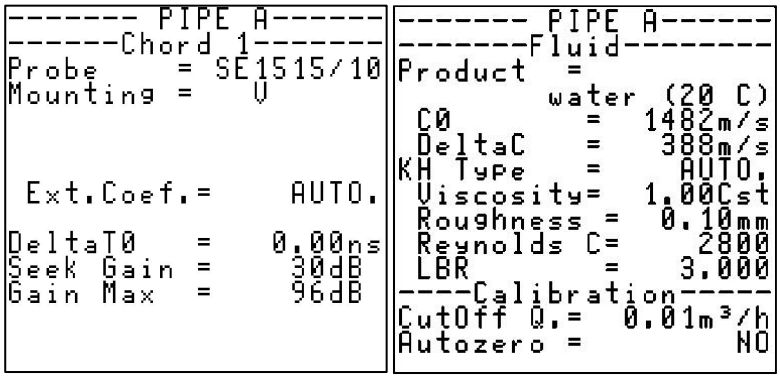


The filter time constant, given in seconds, defines the "force" of the filtering: following a flow rate step (quick opening of the isolation dam), the value measured reaches the final value at 1% after the time constant.

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) Delta T0 and Auto zero

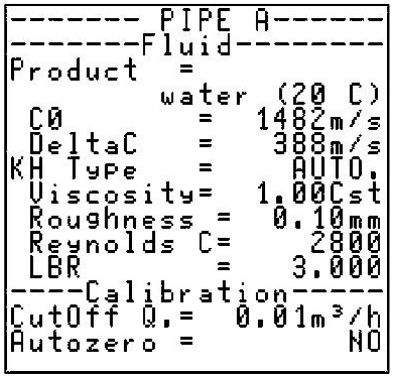


The DeltaT0 field is used to correct installation errors. For example, it is possible to compensate for a bias due to an incorrect position of the probes by adding to DeltaT0 the value required in order to rectify it.

It is also possible to launch an automatic determination mode for the Delta T0 by selecting a time (30 s, 1 min, etc.) in "Autozero". **Warning,** before doing this ensure that the pipe is definitely at rest.

4) C0 and Delta C

With a "normal" configuration, it is possible to select a fluid and its associated celerity from a non-exhaustive list. The celerity relating to the selected fluid is displayed automatically in the C0 field. If a fluid not shown in the list, you can select "Product = OTHER" and define a special C0 value (the C0 field becomes editable).



The Delta C is used to indicate to the flow meter the variation in the speed of the sound and therefore the "search" area for the ultrasound echo. To use this variable, it is preferable to use the standard settings and launch the echo display (see the "Echo display menu" section).

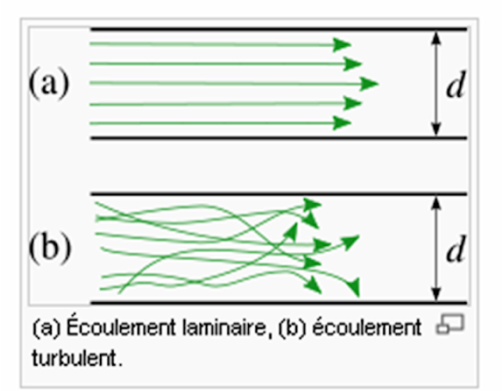
If the echo is outside the search window, you can:
- change the C0 to re-centre the window,
- change the Delta C to widen or shorten the search window.

If the echo is on the right, the value of C must be lowered.

Conversely, if the echo is on the left, the value of C must be increased.

5) KH

The hydraulic coefficient KH is used with external probes (clamp-on or diametric intrusive). It is used to determine the speed throughout the cross-section of the pipe from the average speed over a diameter. Its value therefore depends on the speed and the flow conditions (laminar or turbulent).

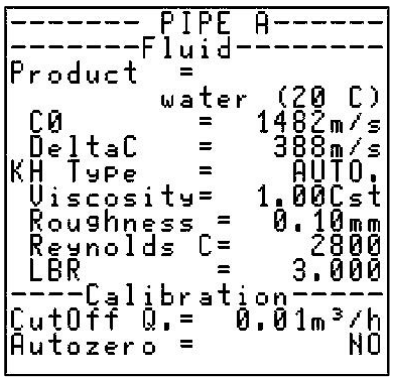


(a) Écoulement laminaire, (b) écoulement turbulent.

(a) Laminar: The fluid veins are parallel to the axis of the pipe. This results in a parabolic speed profile.

(b) Turbulent: The fluid veins are not parallel to the axis of the pipe. This results in a "rectangular" speed profile.

The KH can be calculated automatically ("Type KH = AUTO") or set manually.



In automatic mode, the viscosity of the fluid and the roughness of the inside of the pipe must be defined.

In manual mode, you can define the KH yourself (if you have a good understanding of the flow rate in your pipe).

6) Calibration (CutOff Q)

The calibration is the flow rate below which the flow meter will display 0. This gives you a clear indication of a flow rate considered to be null.

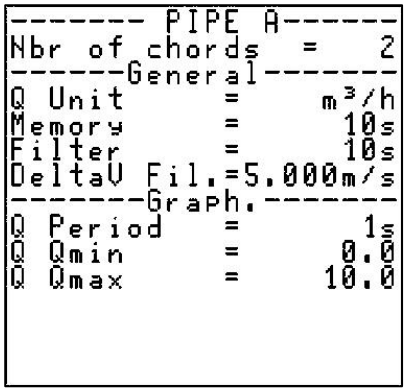
5.6 ADVANCED configuration

Comment: The following description will be restricted to the additional functions of advanced configuration as compared with the configurations defined previously (simple and normal). The common base already explained above in this document is not repeated in this section.

5.6.1 "Pipe/fluid settings" menu

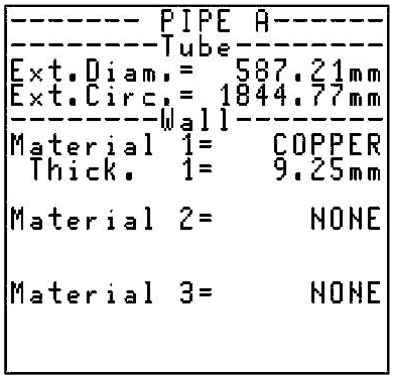
1) Delta V filtering

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



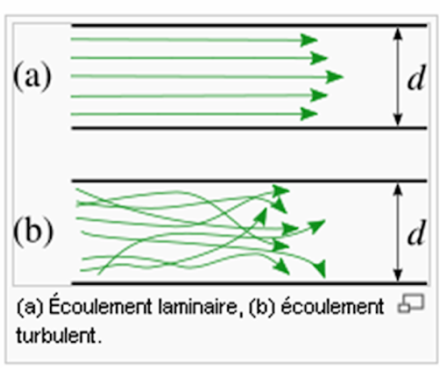
2) Material of the pipe wall

In Advanced mode, you can define the wall through 3 different materials/layers. On the image below, **#1** is the external material/layer, **#2** and **#3** follow in order towards the inside of the pipe. The materials/layers are deactivated if **NONE** is selected on the material line. To activate a material/layer, choose the material and adjust its thickness. All type of material/layers can be used as long as they can transmit ultrasounds. If you cannot find your material in the predefined list, select **OTHER** and enter in addition of the thickness your material's speed of sound.



3) Laminar/turbulent transition

We have previously mentioned in this document the flow type (laminar or turbulent) for the calculation of KH. In "Advanced" configuration mode, you can change part of the KH calculation mode by defining the laminar/turbulent transition point.



(a) Écoulement laminaire, (b) écoulement turbulent.

```
------- PIPE A------
-------Fluid--------
Product  =
        water (20 C)
 C0        =  1482m/s
 DeltaC    =   388m/s
KH Type    =    AUTO.
 Viscosity=  1.00Cst
 Roughness =  0.10mm
 Reynolds C=    2800
 LBR       =   3.000
----Calibration-----
CutOff Q.=  0.01m³/h
Autozero =        NO
```

The transition between the two types of flow varies according to the case and the measurement points. It is possible to change the configuration of this transition within the flow meter by changing the critical value of the Reynolds number (Reynolds number at which the flow transition occurs) and width LBR of the transition.

Comment: The higher the LBR, the more abrupt the transition.

4) Seek gain and Gain max

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.

```
------- PIPE A------
------Chord 1-------
Probe     = SE1515/10
Mounting  =    V


 Ext.Coef.=     AUTO.

DeltaT0    =    0.00ns
Seek Gain  =     30dB
Gain Max   =     96dB
```

Using the maximum gain setting, you can reject measurements if the gain exceeds the value entered in the flow meter.

Important: You are strongly advised to contact Ultraflux before modifying these settings.

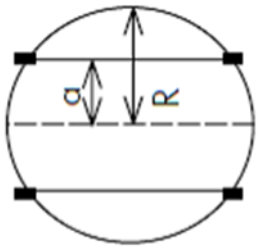
5) Weighting coefficients of the chords

The chord weighting coefficient is only useful for parallel intrusive probes. It is a correction factor for each chord applied to the speed before the overall calculation of the flow rate in the pipe from the weighted speeds of all the chords:

$$Q = \frac{\pi D^2}{4} * \sum Ci * Vi$$ where C_i are the weighting coefficients and V_i the measured ultrasound speeds.

These coefficients are fundamental for a measurement using parallel chords. They are predetermined according to the number of chords:

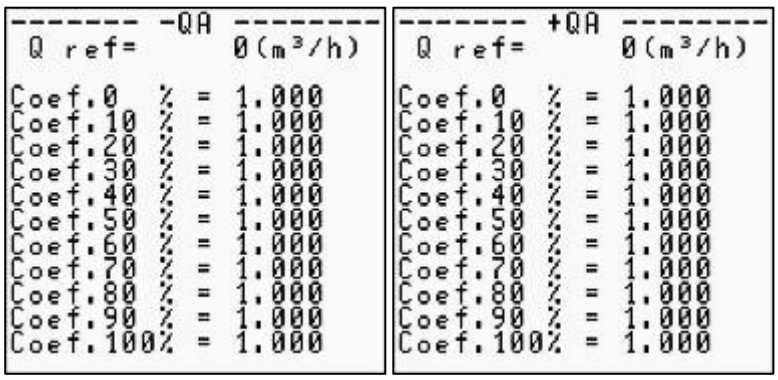
	a / R	Ci
2 chords	+ and – 0.5	0.5
4 chords	+ and – 0.3090	0.3618
	+ and – 0.8090	0.1382



Please feel free to contact Ultraflux to determine the value of the weighting coefficients.

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:



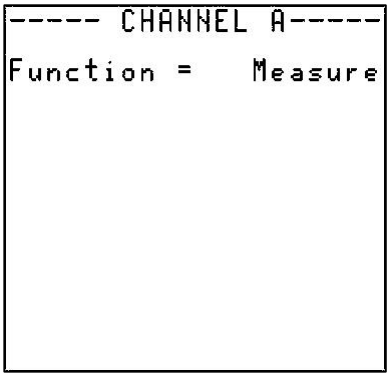
The parameter Q ref defines the maximum flow used for the linearization. The points of the table are then defined as a percentage of this maximum.

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 settings" menu

1) Simulation mode



The flow meter can be used:

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

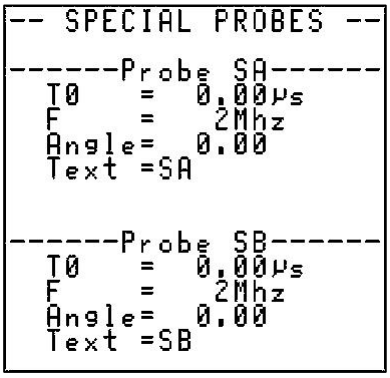
Enter the value of the flow required and the sine wave (as a percentage) applied around this value.

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

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, you are strongly recommended to contact Ultraflux.

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



T0 represents the dead time of the probe.

F represents the frequency of the probe.

Angle relates to the angle of the ultrasound 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 any modification of these settings.

5.6.4 "Firmware update" menu

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

5.7 "Measurement" mode

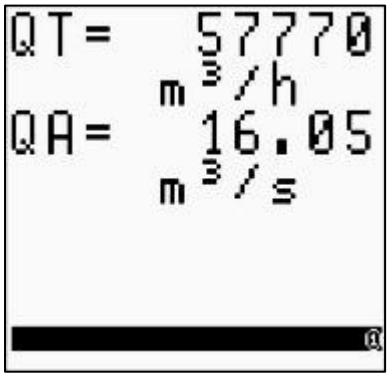
The flow meter has measurement pages (different values are displayed on successive pages) including a flow graph.

5.7.1 Pages available

The Measurement screens provide a large amount of information: to scroll through and access the pages, use the ▲ and ▼ keys.

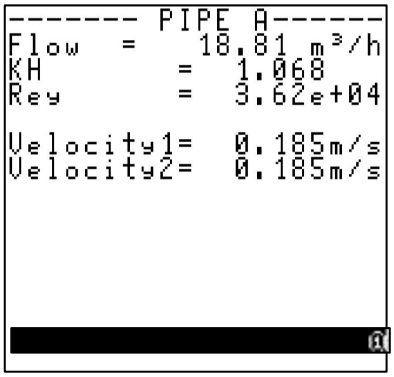
The same information is displayed for each of the chords of the application:

1) Flow



This page displays the flow measured with the unit.

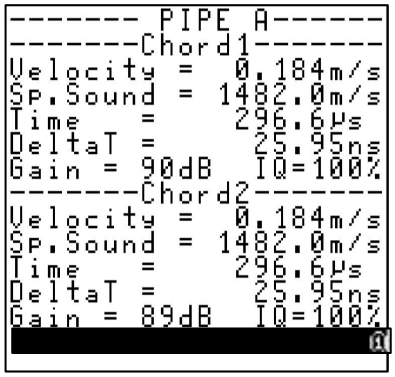
2) Pipe measurements



This page displays the data relating to the flow: flow rate, measured Reynolds number, calculated KH, average speed in the pipe, etc.

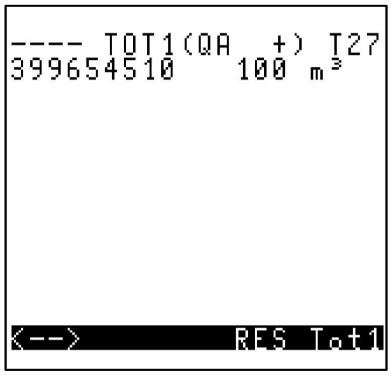
3) Specific information relating to the chords

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



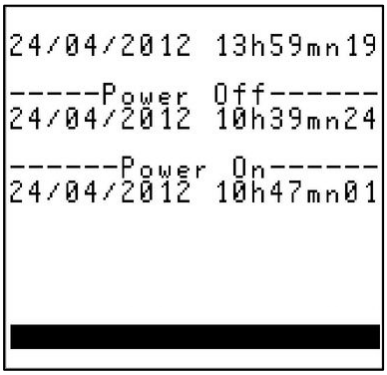
- average time (average of the time for the upstream-downstream journey and the time for the downstream-upstream journey),
- delta T (difference between the upstream-downstream journey time and the downstream-upstream journey time),
- measurement gain (the higher the gain, the more difficult it is to obtain a measurement),
- IQ 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

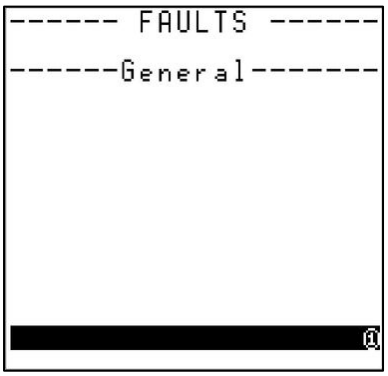


This screen shows the date and time of the flow meter and the information relating to when it was last powered on.

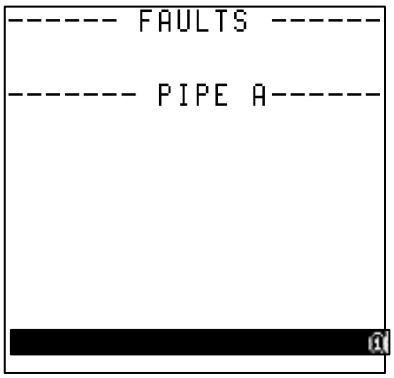
6) Info. logger

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

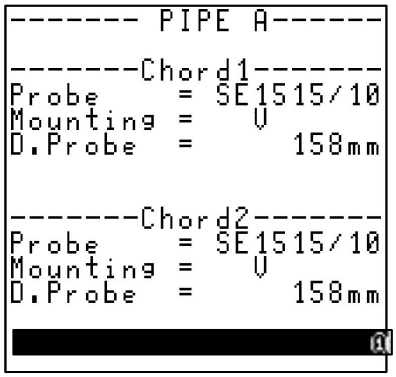
7) Events



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



8) Distance between probes



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

For external probes, this screen also shows:

- the installation type (direct/reflex),
- the required distance between the probes.

9) Flow graph

The flow graph is a screen which shows the changes in a particular magnitude in the form of a curve.

5.7.2 Verification of the quality and consistency of the measurement

The information from the various pages in the "measurement" mode allow you to check whether your measurements are consistent.

The gain and IQ (Quality Index) values also provide you with information on the quality of your measurement.

CHAPTER 6: FUNCTION ENGINE

6.1 Principle

Each UF 831 includes a miniature PLC. This PLC allows Ultraflux to easily install additional features for this flow meter.

On request, Ultraflux can quickly integrate a new feature for your UF 831.

6.2 Application examples

6.2.1 Water temperature calculation

The water temperature can be determined from its celerity (via a calculation).

You will find in the appendix the polynomial used to determine the temperature of the water based on the celerity measured by our flow meters.

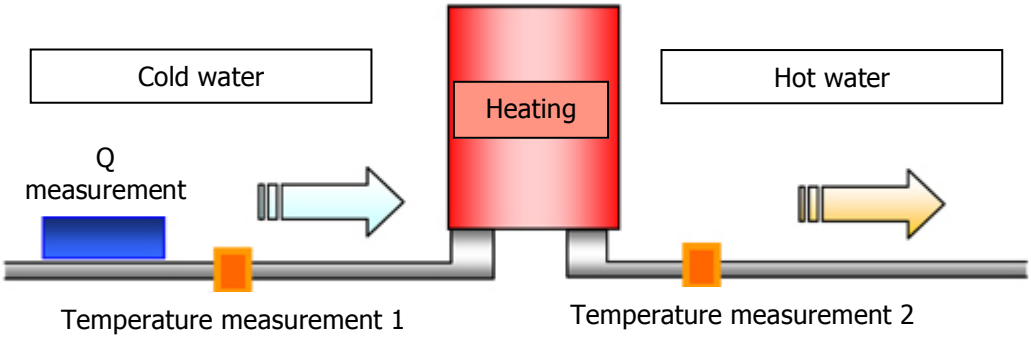
The function engine allows us to carry out this calculation internally in the flow meter.

6.2.2 Calorimetry

It is possible to measure the heat flow of an installation.

If a cold temperature measurement and hot temperature measurement is combined with the flow rate calculated by the flow meter, the heating power expended can be measured.

The diagram below shows a typical measuring point for this application:



UF 831

The following graph illustrates a measurement result typical of the application of calorimetry, the values displayed being:

- the temperature difference between the probes,
- the instantaneous heating capacity,
- the kWh totalizer.

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 keypad of the flow meter.

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 PC configuration required is a PC with a Windows version later than Windows XP.

7.1.1 Installing and running the software

To install the software:

1. Run the Setup.exe installation program included 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 / Configuration 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 options proposed by the 4 main menus are:

- "File" menu – to:
  - Open a measurement, configuration or logger file (using the *"open"* command),
  - Create a configuration file (using the *"new"* command),
  - Close the program (using the *"exit"* command).

- "Dialogue" menu (with the flow meter) – to:
  - Call up the measurement window,
  - Call up the settings window,
  - Change the access code,
  - Download logger data from the flow meter to the PC,
  - View the echo display,
  - Save all settings of the flow meter.

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

- "About" menu – to:
  - Obtain information on the version of the PC software.

7.1.2 Connecting the flow meter to the PC

To connect the UF 831 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 the master and the UF 831, identified by its number, being the slave.

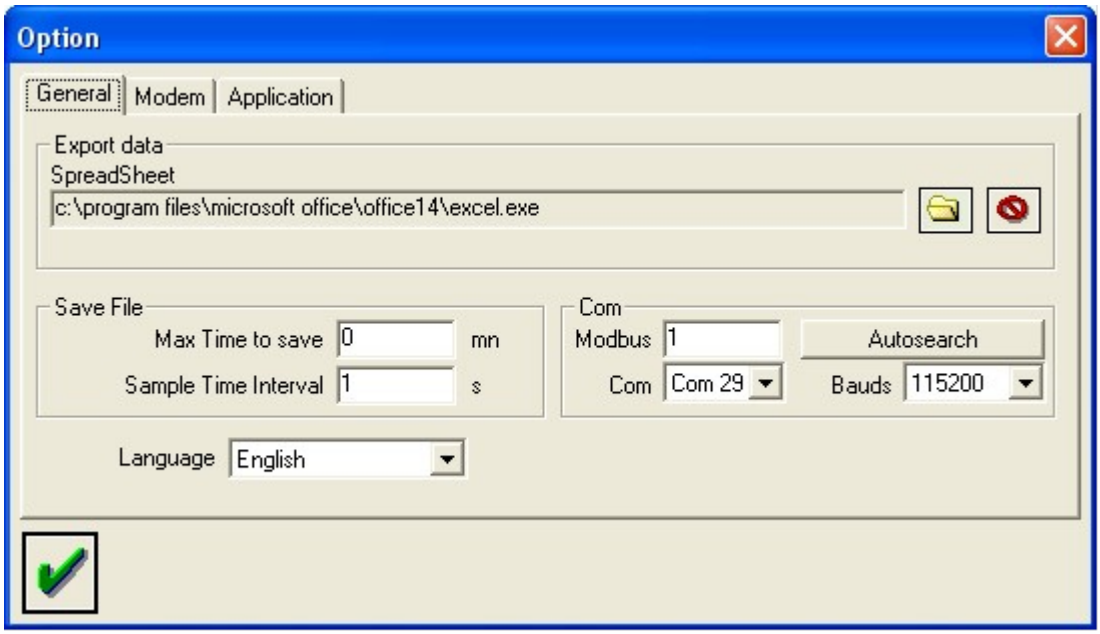
7.1.3 Home page

When run, the software displays the following window:

This window contains 4 main menus:
- "File",
- "Dialogue",
- "Configuration",
- "About".

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

7.1.4 Configuration window



The window opened by the Configuration 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 of the "Dialogue" Menu (with the flow meter).

This icon in the form of a disk 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 in Excel (or the data processing software) these records using the command File / Open / [save name].

Comment: When measuring, once the saving process has started ("Save" button), the data is saved at the pace established by the period entered in the configuration menu of the software, up to the set time. 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 is saved, you can export it to a UF 831.

7.1.7 Measurement window

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

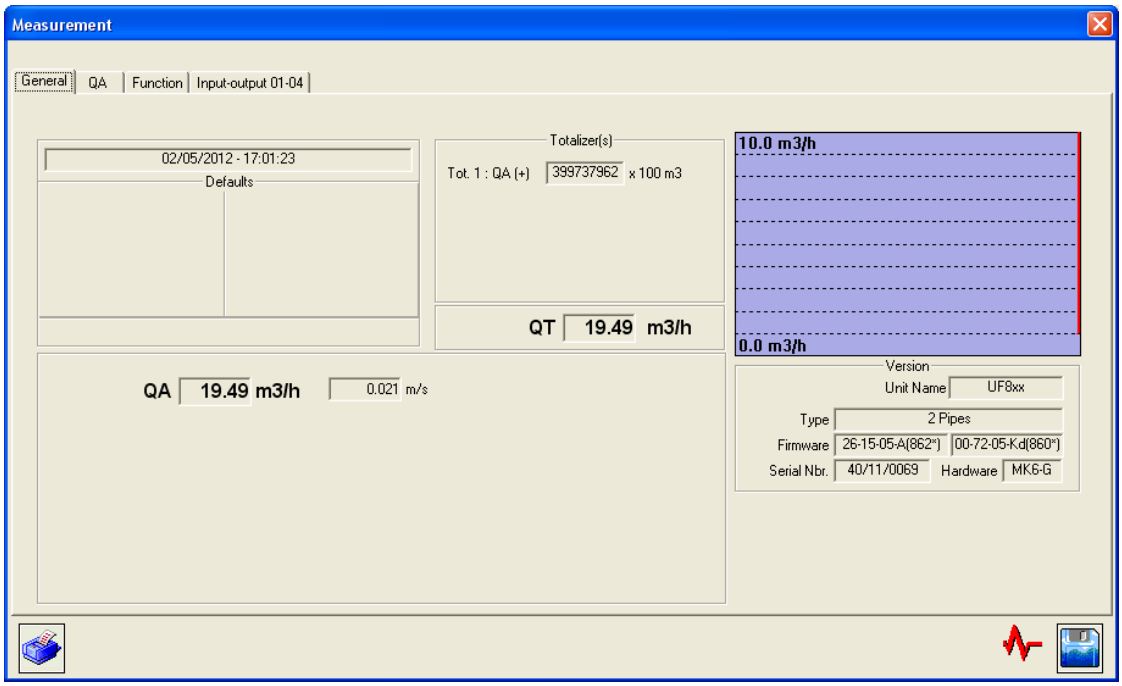
1) List of available tabs

The (measurement) window contains the following tabs:

- "General" tab: contains the general information on the measurement.
- "QA" (flow rate) tab: contains the general information concerning the measurement channel.
- "Input/output" tab: contains the general information on the inputs/outputs.
- "Function" tab (optional): contains configuration data for the function engine if this is used (this tab only appears if at least one output from the engine is configured).

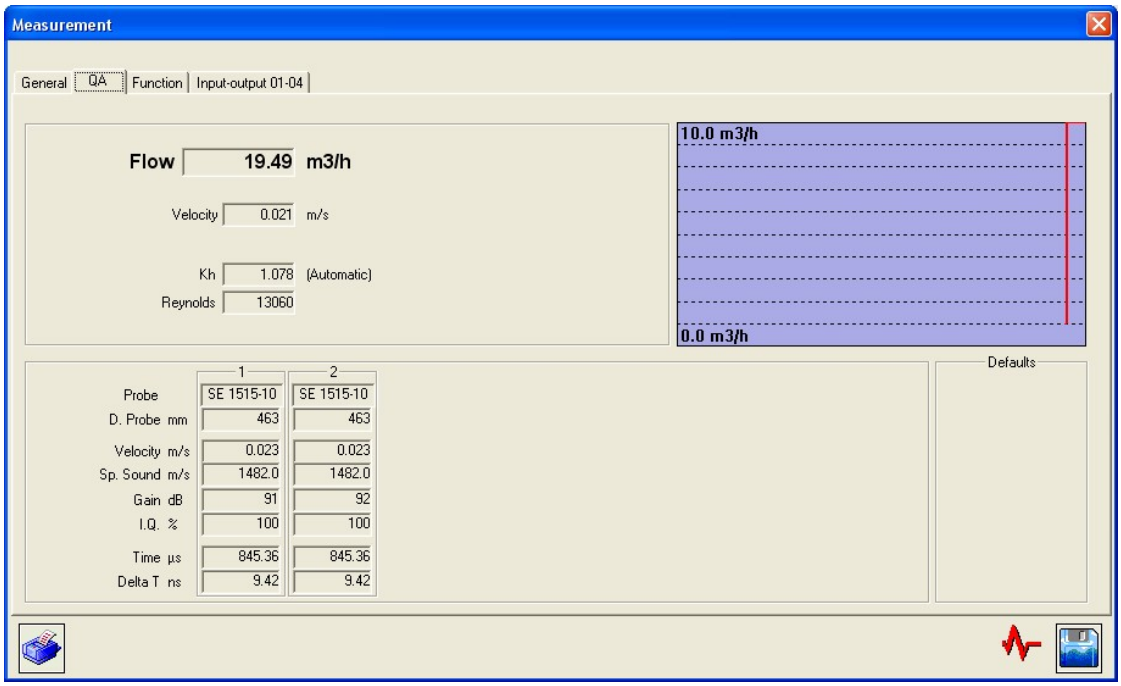
2) "General" tab

This tab displays the main information about the measurement: graphic display of the measurement, instant values of the flow rate and flow velocity, totalizers.



3) "QA" tab (flow rate)

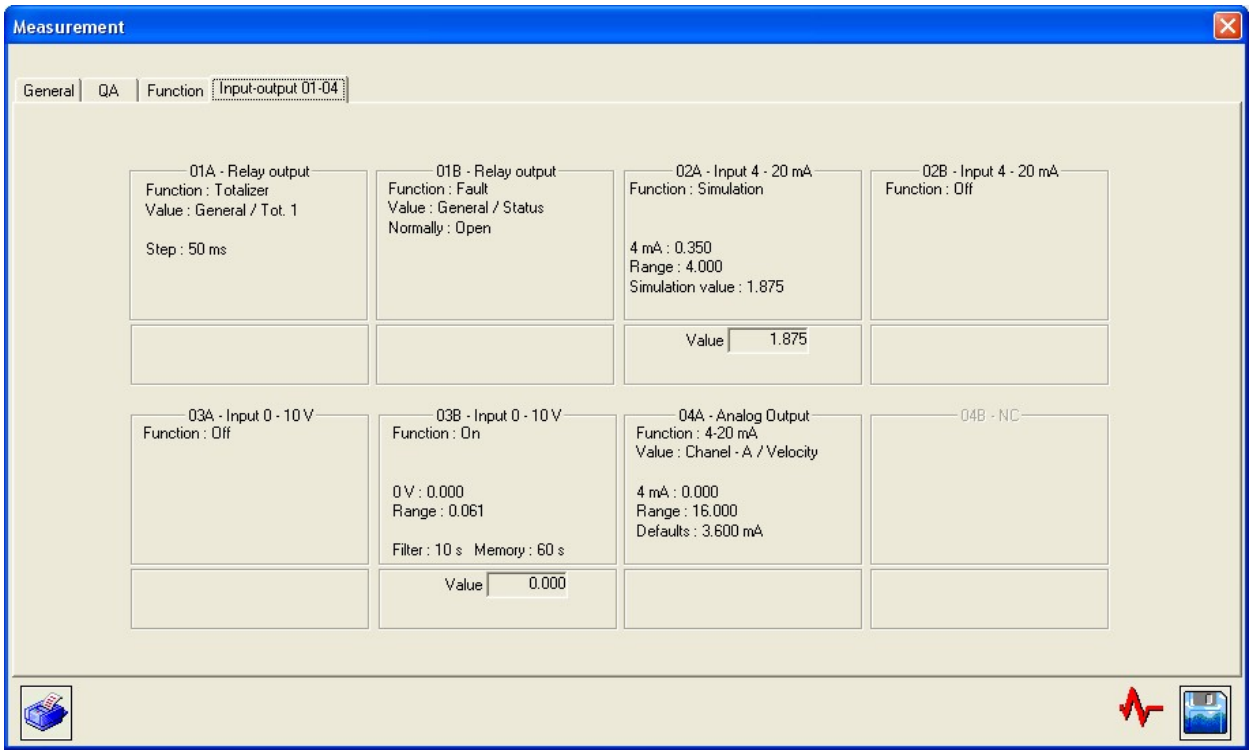
This tab displays the main information concerning the measurement channel: graphic display of the measurement, instant values of the flow rate and flow velocity and KH; information related to the measuring chords.



Comment: There are as many tabs as there are pipes 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 is a complete list showing all the tabs available in Advanced configuration mode. Simple or normal configuration reduces the number of tabs you can access.

The configuration 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 configuration of the inputs and outputs.

- In the "Pipe" drop-down menu
    - "Pipe" tab: flow unit, time constants, flow graph settings, display options, etc.
    - "Chord" tab: definition of the probes, positions of the chords, etc.
    - "Expert chord" tab: definition of specific codes used to fine-tune the behaviour of the flow meter (contact Ultraflux before modifying these settings).
    - "Linearisation" tab: flow rate linearisation coefficient.

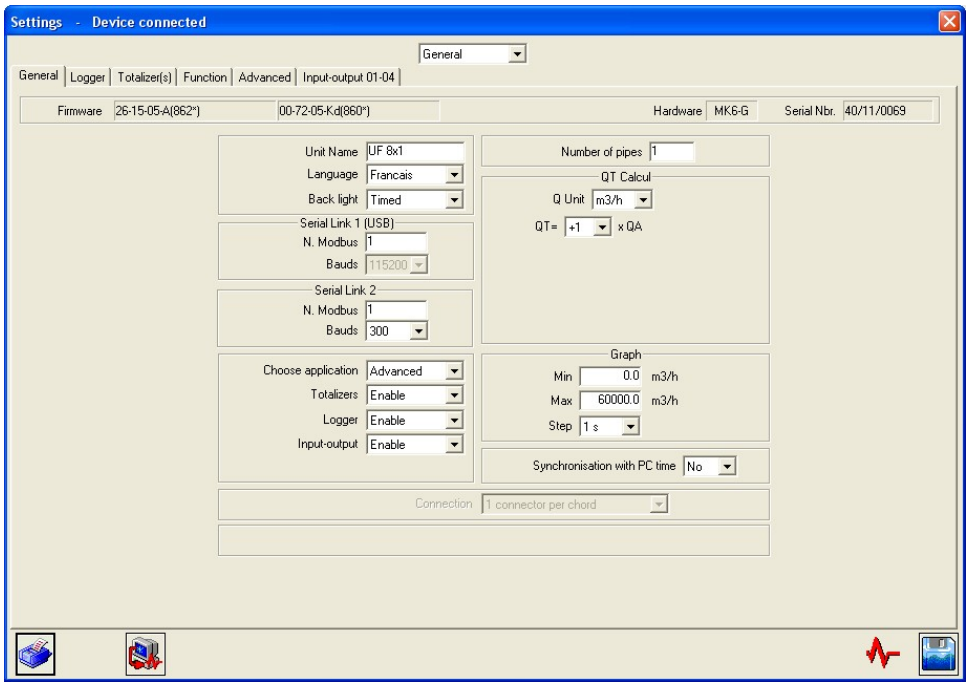
Once the settings are completed, upload the configuration to the flow meter by clicking this button.

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 an Advanced mode configuration. All settings displayed below have been described previously in this document.

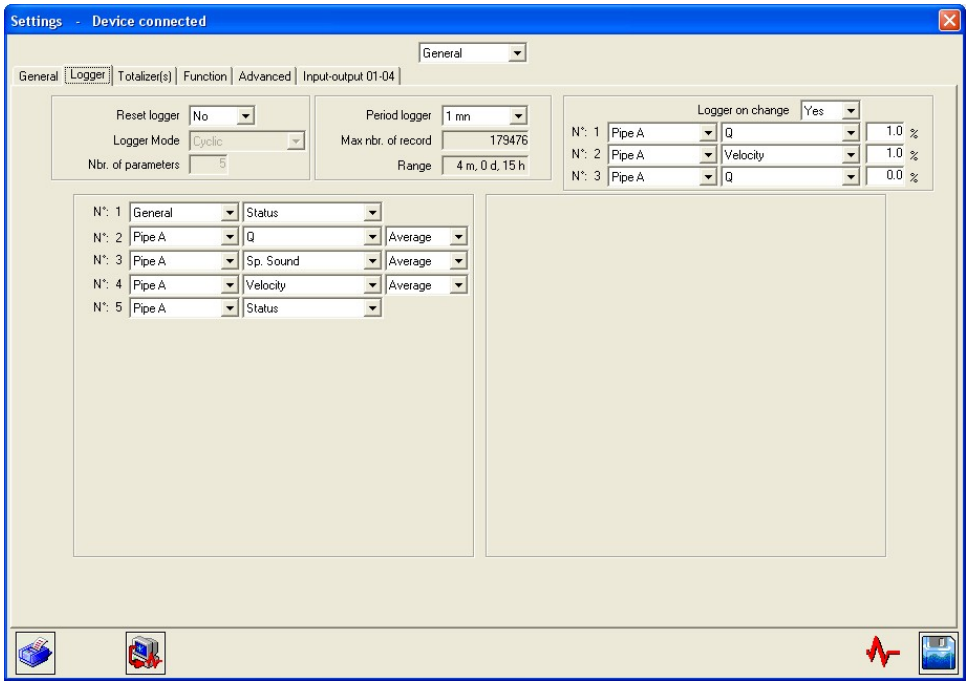


The software allows the date and time of the Uf 831 to be synchronized with those of the host PC: select the option "Synchronise with PC time" before saving the settings on the flow meter.

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

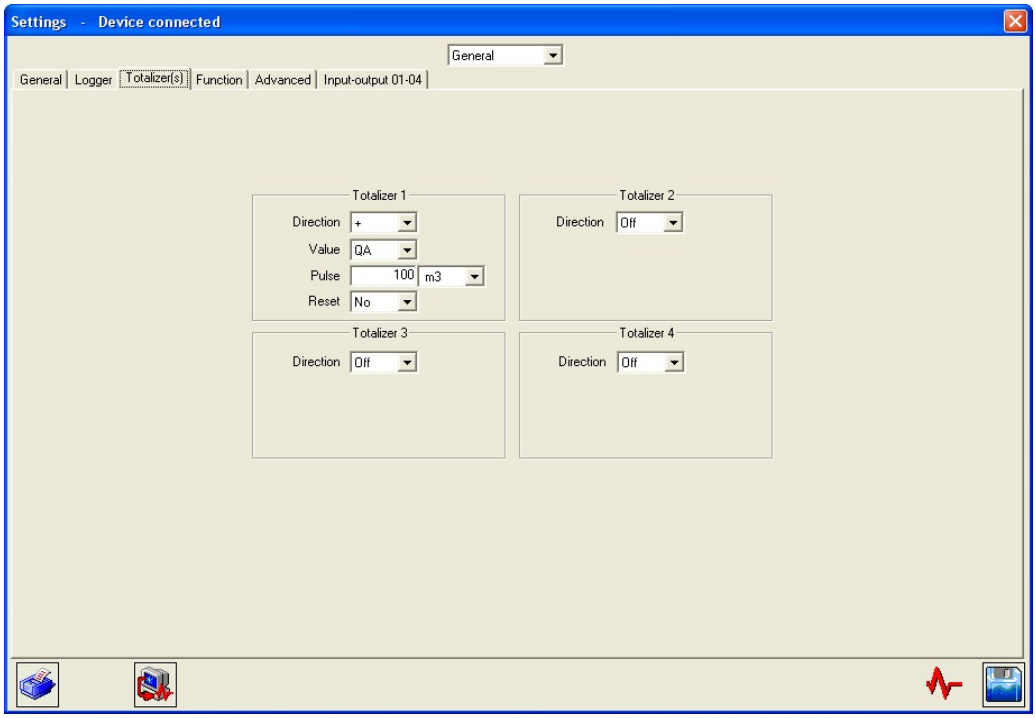
3) "Logger" tab (in the "General" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 5.4.5).



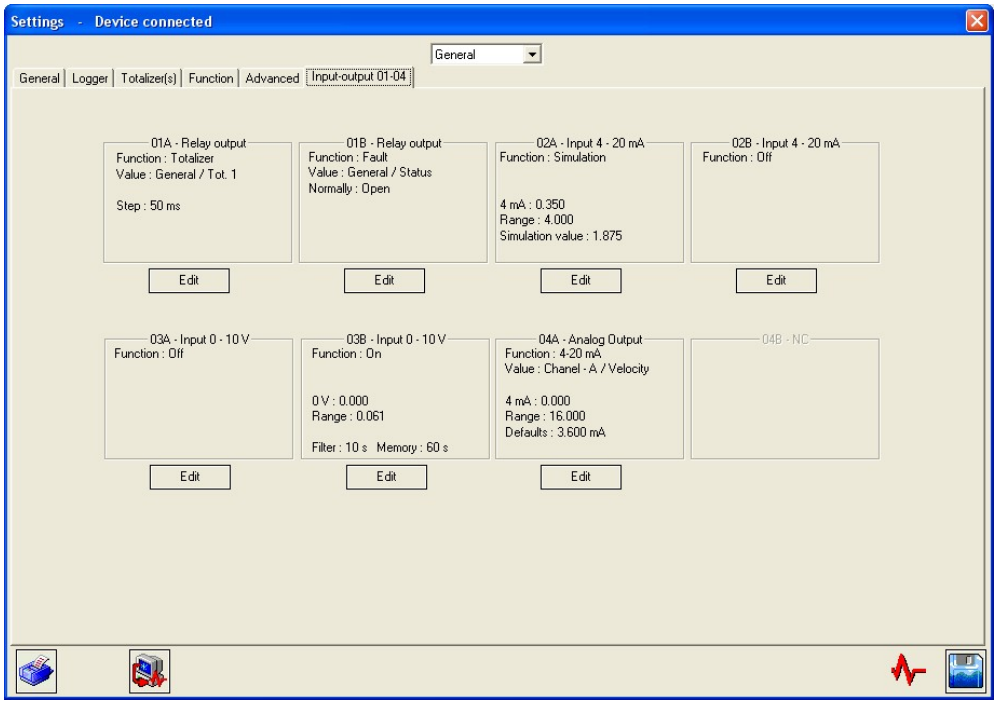
4) "Totalizers" tab (in the "General" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 5.4.3).



5) "Input/Output" tab (in the "General" drop-down menu)

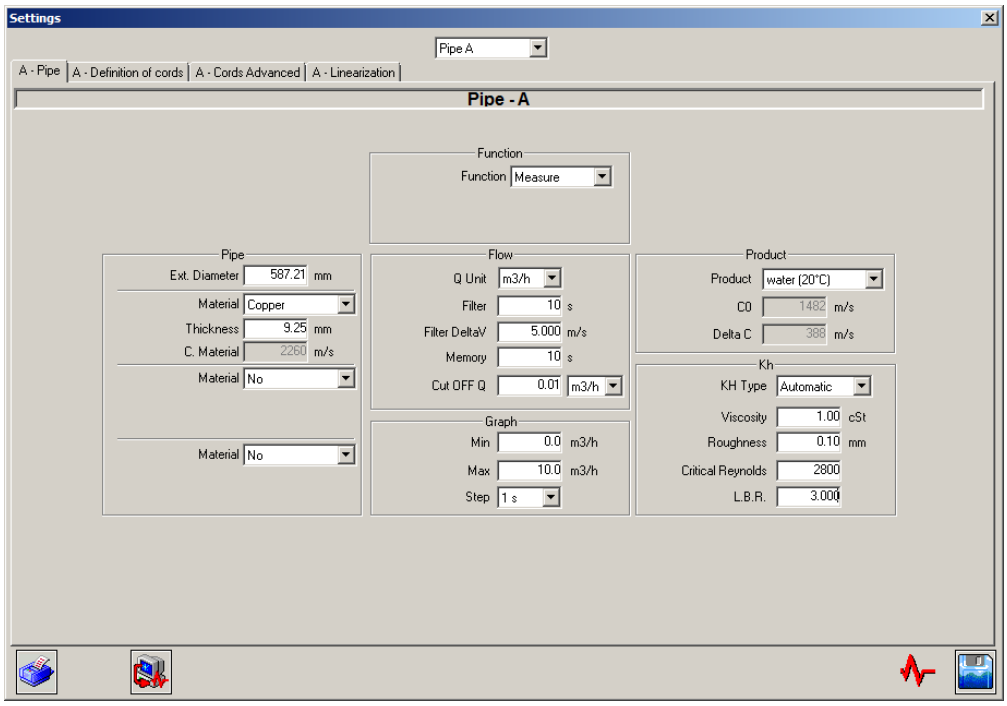
The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 5.4.4).



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

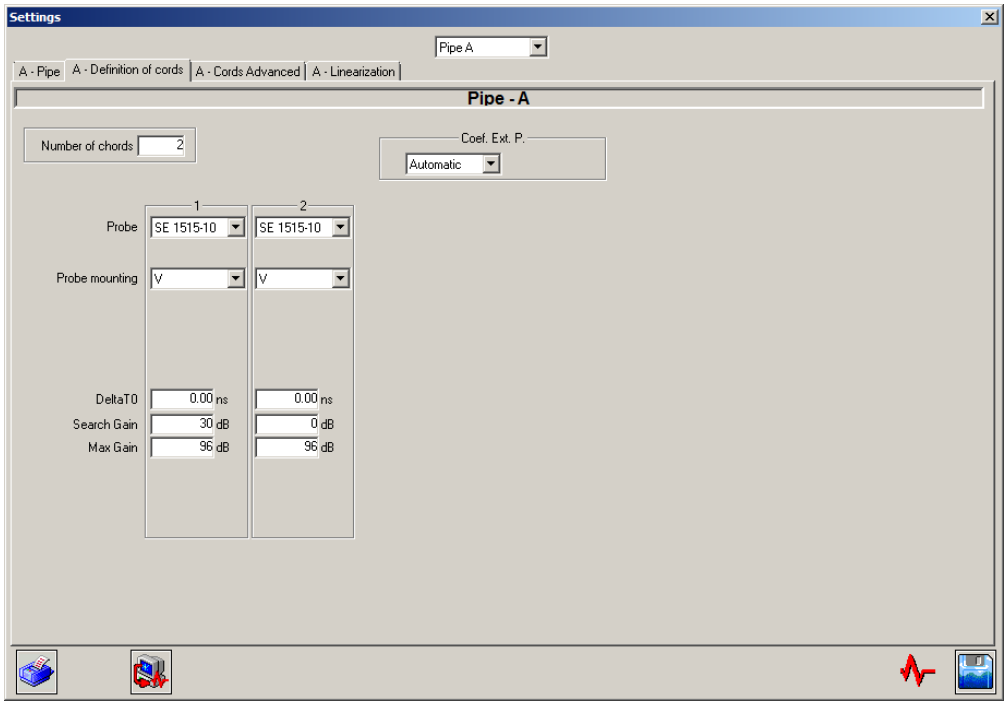
6) "Control" tab (in the "Pipe" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 5.4.2).



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

The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 5.4.2).



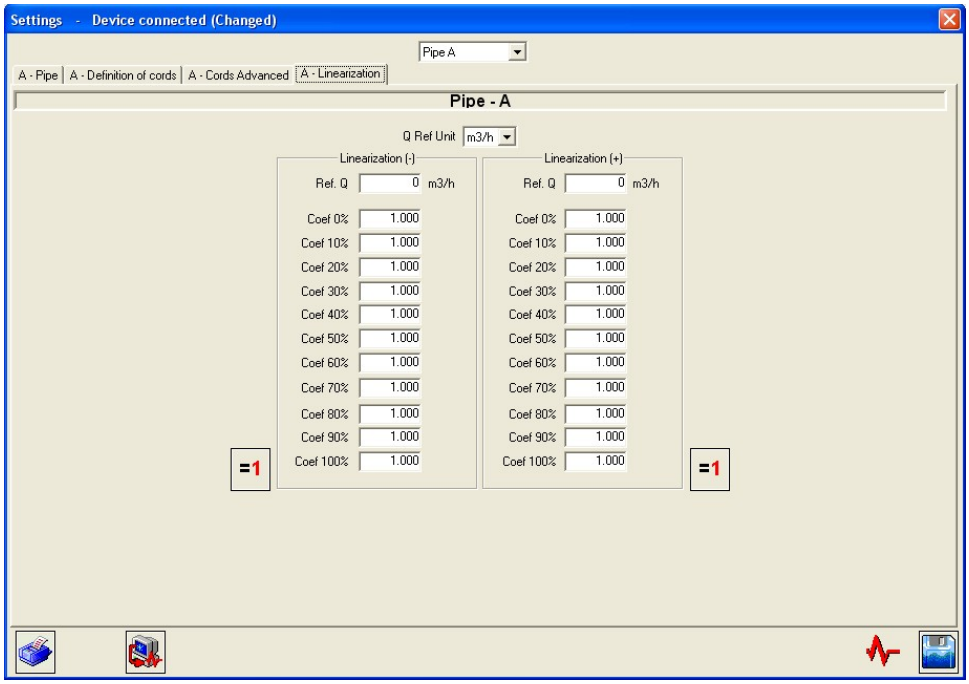
Note: It is possible to enter in the flow rate calculation a chord external to the converter (for example, a Doppler velocity measurement). The settings to be defined for this chord are the same as those for the internal chords, but the following must also be defined:

- the internal chord associated with the external chord: when the internal chord is faulty, the external chord takes over.
- the input module which will serve as a velocity measurement: a 4-20 mA module may be used 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) "Linearisation" tab (in the "Pipe" drop-down menu)

The screenshot below shows an example of settings in Advanced mode. All the settings displayed below have been described previously in this document (see section 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 831 has 11 spaces in its free memory for the storage of configurations (see page 34 – point 8): 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 1: Characteristic echo signals

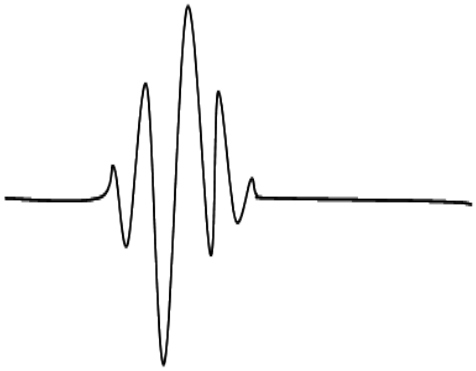
Characteristic echo signals

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:

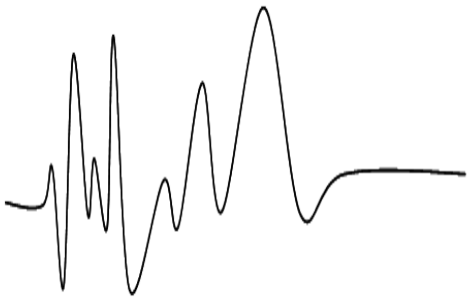
- Ideal signal: quick rise well above the detection threshold.



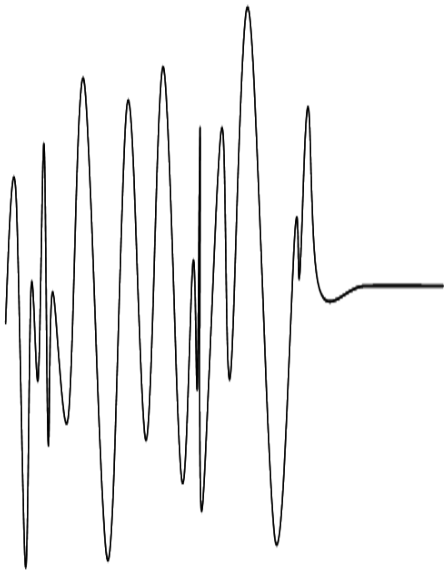
Comment: The signals observed are often longer than the one shown above. This is completely normal, the important criterion being the velocity of the signal rise above the threshold.

- 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

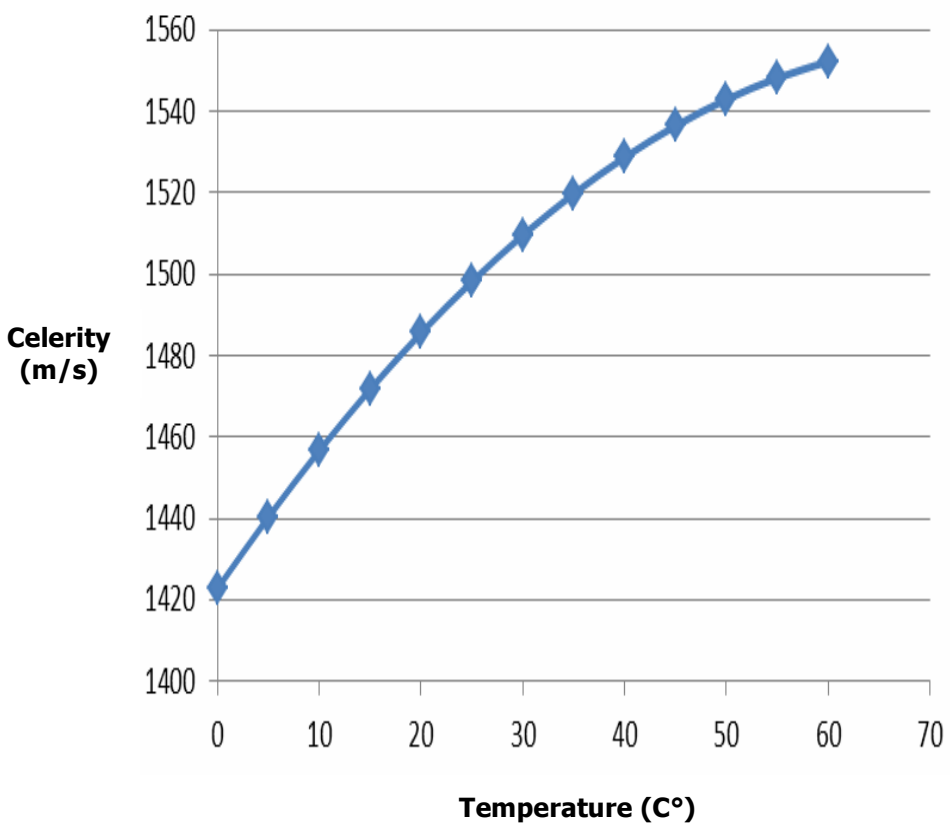
Comment: in this case, move the cables (in particular the probe cables) away from the power cables. Check the ground connections and the shielding.

Appendix 2: Speed of sound in water

Speed of sound 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 3: Troubleshooting

Diagnosis indications

Description of the fault bits

Fault grid

Diagnosis indications

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

- **The message "faults V" (velocity faults) is permanently displayed**

  Possible causes:

  - Probes different to those indicated in the settings. Incorrect programming of the Axial D. and W. 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. Consult us and we can work together to find the best solution.
  - Faulty probes or failure of the UF 831. Contact us if your verifications lead to this conclusion.
  - Problem on the level measurement.

- **The message "faults Q" (flow faults) appears intermittently**

  The intermittent message "faults Q" 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 permanent "faults V" (Velocity faults) message (see above), and in particular:

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

  Comment: A simple action to mask the intermittent measurement faults and increase the memory storage time (see page 50).

- **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 831.

- **The message "relay overflow" appears permanently or intermittently in the event 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).

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

Cause:

- Break in the loop.

- **The message "out of bands" appears permanently or intermittently when setting an analog input**

Cause:

- Current or voltage outside the range of use.

Description of the 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	The measurement is not possible, but not abnormal (1).

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

General fault

BIT No.	FUNCTION NAME	DESCRIPTION
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	logger	At least one reading in the logger is not coherent.
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 / channel 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 (a)	All levels are faulty.
18	Height velocity (a)	The height velocity law or the automatic regression is activated.
30	Fault	Fault on a velocity.
31	Not valid	Velocity not valid.

(a) Open channel only

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.

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, the measurement is impossible. Contact Ultraflux.
Function	There is a bug in the execution of the function engine. Check the function engine inputs. If the problem persists, contact Ultraflux.
Com .ER	There is a programming problem for 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; the measurement is possible but not the archiving by the logger. Contact Ultraflux.
logger	The data of the logger cannot be used or is false. 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 4: Link protocol of the UF 831

Serial link characteristics

Reading of N words (with N ≤ 125)

JBUS/MODBUS table

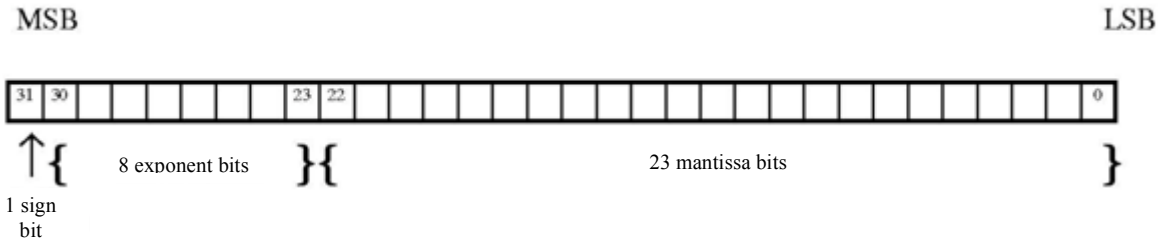
CRC16 calculation algorithm

Serial link characteristics

The following list presents the characteristics of the serial link to be used:

- Protocol used: JBUS/MODBUS,
- Transmission speed: from 300 to 115,200 bauds,
- Number of bits: 8,
- Parity: None,
- Number of stop bits: 1.

Comment: To ensure that an automaton can take measurement recordings, contact Ultraflux to obtain the measurement variables description table in the JBUS/MODBUS protocol.



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.

Reading of N words (with N ≤ 125)

The function code for reading N words is 3.

Request

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

Response

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

JBUS/MODBUS table

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

For the other pipes (C to H), there is simply an offset address of 200 hexadecimal or 512 decimal between each pipe.

		Pipe A		Pipe B	
PARAMETER NAME	Type	JBUS Hexa address	JBUS Dec address	JBUS Hexa 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		**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	FLOAT	**0231**	**561**	**0431**	**1073**

		Pipe A		Pipe B	
PARAMETER NAME	Type	**JBUS Hexa address**	**JBUS Dec address**	**JBUS Hexa address**	**JBUS Dec address**
Point (2)					
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**
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**

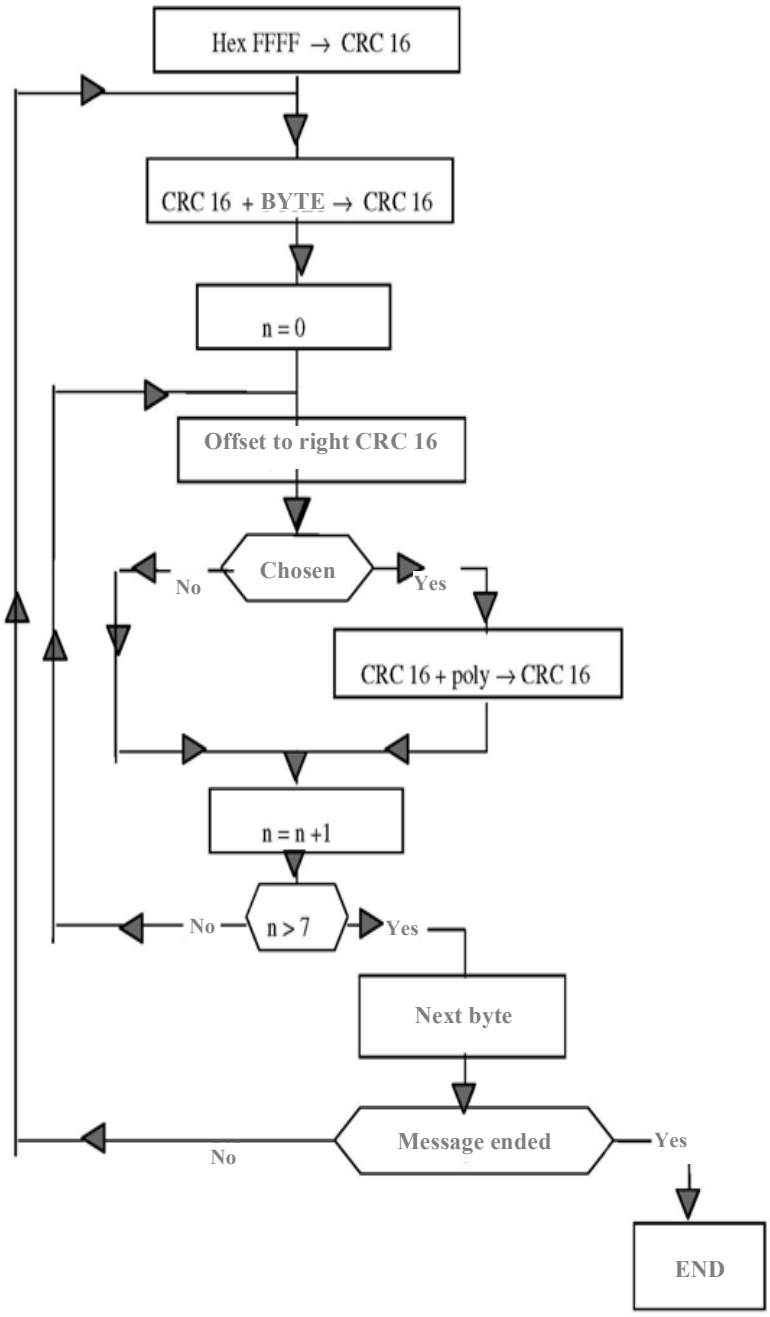
		Pipe A		Pipe B	
PARAMETER NAME	Type	**JBUS Hexa address**	**JBUS Dec address**	**JBUS Hexa address**	**JBUS Dec address**
Fault	ULONG	**0275**	**629**	**0475**	**1141**
Probe Reference	USHORT	**0277**	**631**	**0477**	**1143**
Distance Between Probes	USHORT	**0278**	**632**	**0478**	**1144**
		0279	**633**	**0479**	**1145**
chord 05		**0279**	**633**	**0479**	**1145**
Average V	FLOAT	**0279**	**633**	**0479**	**1145**
T	FLOAT	**027B**	**635**	**047B**	**1147**
DeltaT	FLOAT	**027D**	**637**	**047D**	**1149**
C	FLOAT	**027F**	**639**	**047F**	**1151**
Gain	FLOAT	**0281**	**641**	**0481**	**1153**
IQ	FLOAT	**0283**	**643**	**0483**	**1155**
Fault	ULONG	**0285**	**645**	**0485**	**1157**
Probe Reference	USHORT	**0287**	**647**	**0487**	**1159**
Distance Between Probes	USHORT	**0288**	**648**	**0488**	**1160**
		0289	**649**	**0489**	**1161**
chord 06		**0289**	**649**	**0489**	**1161**
Average V	FLOAT	**0289**	**649**	**0489**	**1161**
T	FLOAT	**028B**	**651**	**048B**	**1163**
DeltaT	FLOAT	**028D**	**653**	**048D**	**1165**
C	FLOAT	**028F**	**655**	**048F**	**1167**
Gain	FLOAT	**0291**	**657**	**0491**	**1169**
IQ	FLOAT	**0293**	**659**	**0493**	**1171**
Fault	ULONG	**0295**	**661**	**0495**	**1173**
Probe Reference	USHORT	**0297**	**663**	**0497**	**1175**
Distance Between Probes	USHORT	**0298**	**664**	**0498**	**1176**
		0299	**665**	**0499**	**1177**
chord 07		**0299**	**665**	**0499**	**1177**
Average V	FLOAT	**0299**	**665**	**0499**	**1177**
T	FLOAT	**029B**	**667**	**049B**	**1179**
DeltaT	FLOAT	**029D**	**669**	**049D**	**1181**
C	FLOAT	**029F**	**671**	**049F**	**1183**
Gain	FLOAT	**02A1**	**673**	**04A1**	**1185**
IQ	FLOAT	**02A3**	**675**	**04A3**	**1187**
Fault	ULONG	**02A5**	**677**	**04A5**	**1189**
Probe Reference	USHORT	**02A7**	**679**	**04A7**	**1191**
Distance Between Probes	USHORT	**02A8**	**680**	**04A8**	**1192**
		02A9	**681**	**04A9**	**1193**
chord 08		**02A9**	**681**	**04A9**	**1193**
Average V	FLOAT	**02A9**	**681**	**04A9**	**1193**
T	FLOAT	**02AB**	**683**	**04AB**	**1195**
DeltaT	FLOAT	**02AD**	**685**	**04AD**	**1197**
C	FLOAT	**02AF**	**687**	**04AF**	**1199**
Gain	FLOAT	**02B1**	**689**	**04B1**	**1201**
IQ	FLOAT	**02B3**	**691**	**04B3**	**1203**
Fault	ULONG	**02B5**	**693**	**04B5**	**1205**

		Pipe A		Pipe B	
PARAMETER NAME	Type	**JBUS Hexa address**	**JBUS Dec address**	**JBUS Hexa address**	**JBUS Dec address**
Probe Reference	USHORT	**02B7**	**695**	**04B7**	**1207**
Distance Between Probes	USHORT	**02B8**	**696**	**04B8**	**1208**
		02B9	**697**	**04B9**	**1209**
chord 09		**02B9**	**697**	**04B9**	**1209**
Average V	FLOAT	**02B9**	**697**	**04B9**	**1209**
T	FLOAT	**02BB**	**699**	**04BB**	**1211**
DeltaT	FLOAT	**02BD**	**701**	**04BD**	**1213**
C	FLOAT	**02BF**	**703**	**04BF**	**1215**
Gain	FLOAT	**02C1**	**705**	**04C1**	**1217**
IQ	FLOAT	**02C3**	**707**	**04C3**	**1219**
Fault	ULONG	**02C5**	**709**	**04C5**	**1221**
Probe Reference	USHORT	**02C7**	**711**	**04C7**	**1223**
Distance Between Probes	USHORT	**02C8**	**712**	**04C8**	**1224**
		02C9	**713**	**04C9**	**1225**
Inputs/Outputs		**02C9**	**713**	**04C9**	**1225**
IO 01		**02C9**	**713**	**04C9**	**1225**
Value	FLOAT	**02C9**	**713**	**04C9**	**1225**
Fault	ULONG	**02CB**	**715**	**04CB**	**1227**
		02CD	**717**	**04CD**	**1229**
IO 02		**02CD**	**717**	**04CD**	**1229**
Value	FLOAT	**02CD**	**717**	**04CD**	**1229**
Fault	ULONG	**02CF**	**719**	**04CF**	**1231**
		02D1	**721**	**04D1**	**1233**
IO 03		**02D1**	**721**	**04D1**	**1233**
Value	FLOAT	**02D1**	**721**	**04D1**	**1233**
Fault	ULONG	**02D3**	**723**	**04D3**	**1235**
		02D5	**725**	**04D5**	**1237**
IO 04		**02D5**	**725**	**04D5**	**1237**
Value	FLOAT	**02D5**	**725**	**04D5**	**1237**
Fault	ULONG	**02D7**	**727**	**04D7**	**1239**
		02D9	**729**	**04D9**	**1241**
IO 05		**02D9**	**729**	**04D9**	**1241**
Value	FLOAT	**02D9**	**729**	**04D9**	**1241**
Fault	ULONG	**02DB**	**731**	**04DB**	**1243**
		02DD	**733**	**04DD**	**1245**
IO 06		**02DD**	**733**	**04DD**	**1245**
Value	FLOAT	**02DD**	**733**	**04DD**	**1245**
Fault	ULONG	**02DF**	**735**	**04DF**	**1247**
		02E1	**737**	**04E1**	**1249**
IO 07		**02E1**	**737**	**04E1**	**1249**
Value	FLOAT	**02E1**	**737**	**04E1**	**1249**
Fault	ULONG	**02E3**	**739**	**04E3**	**1251**
		02E5	**741**	**04E5**	**1253**
IO 08		**02E5**	**741**	**04E5**	**1253**
Value	FLOAT	**02E5**	**741**	**04E5**	**1253**

		Pipe A		Pipe B	
PARAMETER NAME	Type	JBUS Hexa address	JBUS Dec address	JBUS Hexa address	JBUS Dec address
Fault	ULONG	**02E7**	**743**	**04E7**	**1255**
		02E9	**745**	**04E9**	**1257**
IO 09		**02E9**	**745**	**04E9**	**1257**
Value	FLOAT	**02E9**	**745**	**04E9**	**1257**
Fault	ULONG	**02EB**	**747**	**04EB**	**1259**
		02ED	**749**	**04ED**	**1261**
IO 10		**02ED**	**749**	**04ED**	**1261**
Value	FLOAT	**02ED**	**749**	**04ED**	**1261**
Fault	ULONG	**02EF**	**751**	**04EF**	**1263**
		02F1	**753**	**04F1**	**1265**
IO 11		**02F1**	**753**	**04F1**	**1265**
Value	FLOAT	**02F1**	**753**	**04F1**	**1265**
Fault	ULONG	**02F3**	**755**	**04F3**	**1267**
		02F5	**757**	**04F5**	**1269**
IO 12		**02F5**	**757**	**04F5**	**1269**
Value	FLOAT	**02F5**	**757**	**04F5**	**1269**
Fault	ULONG	**02F7**	**759**	**04F7**	**1271**
		02F9	**761**	**04F9**	**1273**
IO 13		**02F9**	**761**	**04F9**	**1273**
Value	FLOAT	**02F9**	**761**	**04F9**	**1273**
Fault	ULONG	**02FB**	**763**	**04FB**	**1275**
		02FD	**765**	**04FD**	**1277**
IO 14		**02FD**	**765**	**04FD**	**1277**
Value	FLOAT	**02FD**	**765**	**04FD**	**1277**
Fault	ULONG	**02FF**	**767**	**04FF**	**1279**
		0301	**769**	**0501**	**1281**
IO 15		**0301**	**769**	**0501**	**1281**
Value	FLOAT	**0301**	**769**	**0501**	**1281**
Fault	ULONG	**0303**	**771**	**0503**	**1283**
		0305	**773**	**0505**	**1285**
IO 16		**0305**	**773**	**0505**	**1285**
Value	FLOAT	**0305**	**773**	**0505**	**1285**
Fault	ULONG	**0307**	**775**	**0507**	**1287**
		0309	**777**	**0509**	**1289**
IO 17	0	**0309**	**777**	**0509**	**1289**
Value	FLOAT	**0309**	**777**	**0509**	**1289**
Fault	ULONG	**030B**	**779**	**050B**	**1291**
		030D	**781**	**050D**	**1293**
IO 18		**030D**	**781**	**050D**	**1293**
Value	FLOAT	**030D**	**781**	**050D**	**1293**
Fault	ULONG	**030F**	**783**	**050F**	**1295**
		0311	**785**	**0511**	**1297**
IO 19		**0311**	**785**	**0511**	**1297**
Value	FLOAT	**0311**	**785**	**0511**	**1297**
Fault	ULONG	**0313**	**787**	**0513**	**1299**

		Pipe A		Pipe B	
PARAMETER NAME	Type	JBUS Hexa address	JBUS Dec address	JBUS Hexa address	JBUS Dec address
		0315	**789**	**0515**	**1301**
IO 20		**0315**	**789**	**0515**	**1301**
Value	FLOAT	**0315**	**789**	**0515**	**1301**
Fault	ULONG	**0317**	**791**	**0517**	**1303**
		0319	**793**	**0519**	**1305**
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**

CRC16 calculation algorithm



⊕ = 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

Appendix 5: Wiring

Wiring of ultrasonic probes

Wiring of the inputs - outputs

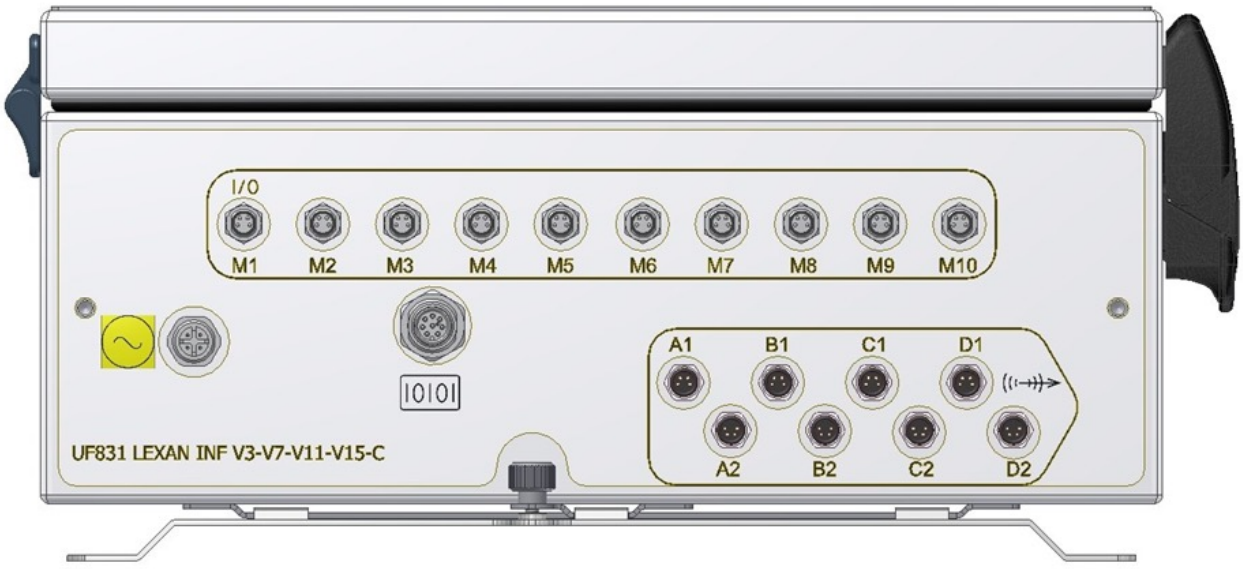
Wiring of the relay modules
Wiring of the current output modules
Wiring of the current input modules
Wiring of the voltage input modules
Wiring of the temperature modules

Wiring of the communication port

Wiring of the serial link in RS232 mode
Wiring of the serial link in RS485 mode

Supply wiring

Pin function for the 110-240 VAC supply
Pin function for the DC supply



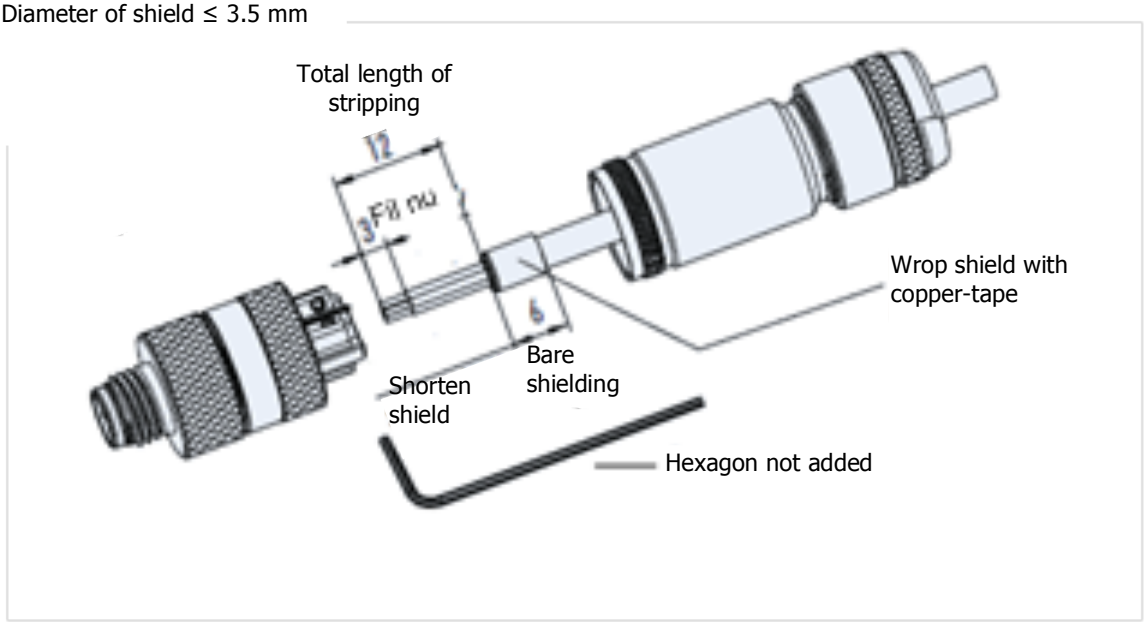
Wiring of ultrasonic probes

The ultrasonic probes must be wired as follows:

Base view 

Pins	Functions
1	probe upstream wire A
2	probe upstream wire B
3	probe downstream wire A
4	probe downstream wire B

Diameter of shield ≤ 3.5 mm



Wiring of the inputs - outputs

Base view

The wiring depends on the module assigned to the connector.

Wiring of the relay modules

The pins have the following functions:

Pins	Functions
1	relay A
2	relay A
3	relay B
4	relay B

Wiring of the current output modules

The pins have the following functions:

Pins	Functions
1	current (+)
2	current (-)
3	-
4	-

Wiring of the current input modules

The pins have the following functions:

Pins	Functions
1	current A wire 1
2	current A wire 2
3	current B wire 1
4	current B wire 2

Wiring of the voltage input modules

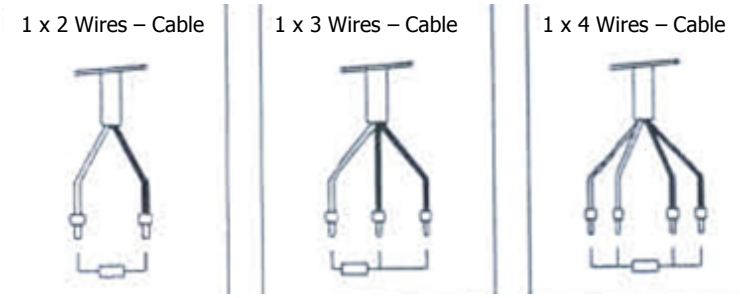
The pins have the following functions:

Pins	Functions
1	voltage A(+)
2	voltage A(-)
3	voltage B(+)
4	voltage B(-)

Wiring of the temperature modules

Comment: This 2-input module takes up the physical space of two modules.

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



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

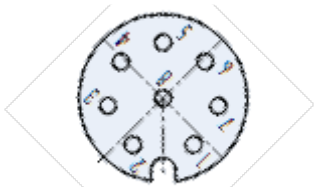
Pins	Functions
1	red wire 1
2	white wire 1
3	red wire 2
4	white wire 2

Warning: In order to provide a good measurement quality, it is recommended to use platinum armoured probes. The 360° shield connection is operated by the binder connector.

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

Wiring of the communication port

Base view



There are two possible ways to wire the serial link:

- RS232
- RS485

The choice of the mode is made through specific wiring. It is not possible to use the flow meter in a mode other than the one chosen by wiring.

The serial link connector is a 6-pin connector, the function of which depends on the type of wiring.

Wiring of the serial link in RS232 mode

The pins have the following functions:

Pins	Functions
1	Rx (UF 831)
7	Tx (UF 831)
8	SG
Jumper between 6 and 8	Forcing mode RS 232
2, 3, 4, 5	Not used

Wiring of the serial link in RS485 mode

The pins have the following functions:

Pins	Functions
4	Z
2	Y
8	SG
Jumper between 2 and 3	To activate the terminating resistance
1, 5, 6, 7	Not used

Supply wiring

The supply connector is a 4-pin connector. The function of the pins depends on the type of supply: 110-240 VAC supply or DC supply.

Base view

Pin function for the 110-240 VAC supply

The pins have the following functions:

Pins	Functions
1	phase
2	not connected
3	neutral
4	protective ground

Pin function for the DC supply

The pins have the following functions:

Pins	Functions
1	Vin +
2	not connected
3	Vin -
4	protective ground

Detailed table of contents