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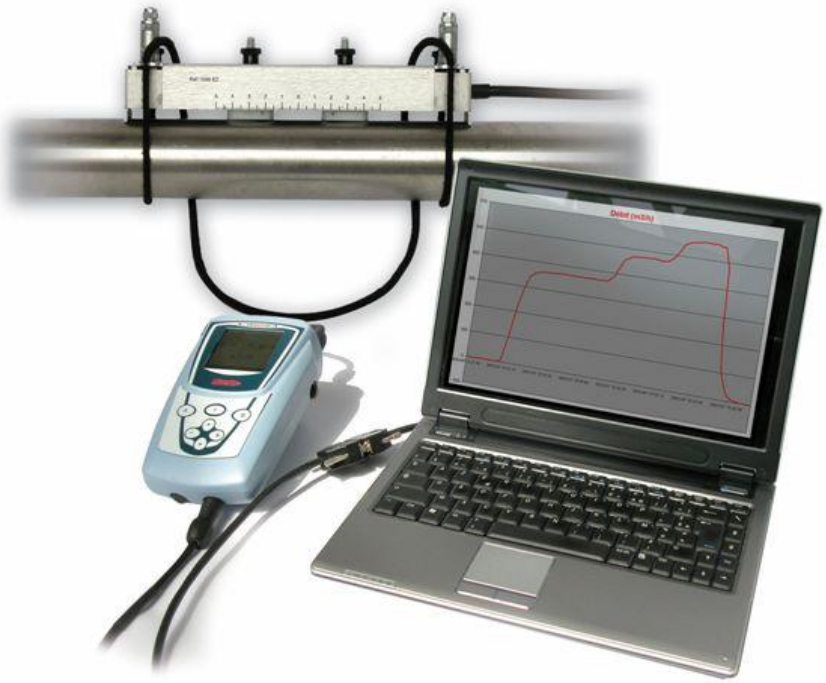

UF 801-P / UF 801-PB

NEW GENERATION ULTRASONIC PORTABLE FLOWMETERS

NT 228B GB2

Rev.8: Nov 2012

1 - INTRODUCTION

Thank you for choosing Ultraflux as your technical partner. We have offered since the 70's a full range of portable and fixed flow meters.
We have over30 years' experience and expertise using Ultrasonic techniques including following developments:

- The famous and innovative DigiSonic P/E family of portable flow meters with integral loggers and built-in signal analysis function.

- The UF322 family of fixed flow meters, with adapted versions for liquids (L), Gas (G), Multi Chord (MC, L&G), Open channels (CO) and large Rivers (RV).

- The MiniSonic family with the portable meter (Mini-P), the dual pipe meter (PB), fixed meter CO_Mini-600 / 2000 with also Ex d versions (COD), dual chord versions (CO_Mini-600-2 / 2000-2), dual pipes versions CO_Mini 600-B/2000-B and velocity versions Mini-Speed 1 & 2.

- The new UF 8xx family is our latest state of art, offering with improved characteristics

  UF 801-P portable unit is the first new meter of this family.

All our flow-meters work on the principle of ultrasonic transit time and can be associated with clamp-on or wetted probes depending on the application.

Regarding this manual, it has been specifically written for the personal operating the UF 801-P. It contains very important information about the instrument to guide you through the different steps of handling, precaution and installation, commissioning and possible troubleshooting.

***Other documents and tools are available on paper or in electronic format**:*

- *A training manual concerning ultrasonic measurement, reference **NT 122***
- *A short form manual with direct instructions to end user.*
- *The specific PC software **LS 801W _version** *** with connection cable*

Most of these manuals and PC tools exist and can operate in different language, with a minimum of English and French, which you can select among the proposed choices.

Make sure you have read and understood these manuals before using UF 801P

Windows & Excel that we use are trademarks of Microsoft Corporation.

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In the interest of continuous improvement of its products, Ultraflux reserves the right to change them or some of their characteristics without notice.

This document is written with the end user in mind. It tries to explain all the instrument and measurement methods to a non specialist and specialist alike, to obtain the best results.

Meanwhile, Ultraflux will not accept any liability for errors, including language, or missing information which may be in the documentation.

But, suggested updates and improvements by users are gratefully received on e-mail via our website.

Note that the document reference NT 228 has two added signs:

- ***A letter that concerns the contents revision (here B)***
- ***A number after the language (GB = English), that concerns a text or grammatical revisions (here 2).***

UF 801-P COMPLIANCE:

1-Safety Precautions:

When using this UF 801-P with probes or accessories, please respect site safety regulations. Access to pipe work very often requires removal of protection or lagging. Pipes can be hot or may possibly contain corrosive or toxic liquids or gases: ensure always you use PPE (Personal Protective Equipment) i.e. helmet, gloves, glasses…

Particular attention is required when a flow test is in an ATEX Ex classified area: please respect site instructions and ask for a possible permit. Probes, connection and instrument handling… may cause a spark, providing a source of ignition for flammable or explosive mixtures.

Always keep the instrument in good condition.

Charging the UF 801-P batteries requires significant current charging, involving a mains power connection. Even with the best built-in safety components to prevent from over voltage or other external reason, over charging may cause over-heating…. Avoid leaving the device connected to the charger longer than necessary, without checking or securing these conditions.

2-Conformity to EC Norms: *All equipments are CE certified*.

UF 801-P is typically announced as IP67 and moreover was successfully tested IP68 under 2 m of water during 8 hours. Anyway, it is better to prevent it from immersion or to provide heavy duty protection if the immersion risk is great or the humidity is high.

ATEX certification can be delivered for the relevant probes and standards, when required. All equipment will be labeled accordingly. In the absence of the relevant marks and attached certificates, never consider the instrument as certified!

Main Applicable Standards:

- *Concerning high voltage human safety risks :*
  UF 801-P: N/A – Only low voltage (< 60 V).
  Charger: 100-240 V AC : conform to UL & CE Directive 73/23/CE, Rev. 2006/95/CE…
- *Concerning EMC : Directive 91/157/CE*
- *Concerning tightness (IP) : EN 60529*
- *Concerning ATEX : Directive 94 / 4 / CE and Directive 99/92/CE (*)*
- *Recycling & Environment Protection: ISO 14001 / DEEE > 13/06/2005 in France*

(*) UF 801-P could be only concerned by Ex mb IIC T6 transducers with attached cables.
Please refer to official documents / conformity certificates

3- Other Certifications:

All equipment has a flow test before delivery, in comparison with a standard.
On request (but not free of charge), the instrument can be delivered with a calibration certificate. Contact our sales people to know more about these conditions.

4-Warranty: *Please refer to the sales contract for term and conditions.*

This Warranty supposes that this instrument is used for the purpose of its design and has been operated according the instructions given in this manual. Any maintenance operation or component replacement must be done by an Ultraflux authorized agent.

2 - TABLE OF CONTENTS

3 - APPLICATIONS

Contents

3.1 Overview

UF 801-P is a high performance ultrasonic portable flow meter for closed pipes and conduits.
UF 801-PB is the dual pipe or channels version that offers double menus and multiplexed resources. We will consider mainly UF 801-P except some points as mentioned in §9.

They both use ultrasonic signals between two aligned probes arranged on one or two paths, to integrate a flow section.

> *See measurement principle on 2.2 or better NT122.*

UF 801-P performs a very accurate time of flight measurement on these ultrasonic pulsed signals and, after calculation from entered data. I displays the following results:

- The flow velocity
- The volume flow
- The totalized flow
- The sound velocity
- And much more information that you will discover.

For this, the **correct probes** must be selected with respect to pipe diameter, pipe or fluid conditions, pipe wall temperature and so one.

> *Please contact Sales for further information.*

As the **UF 801-P is a portable unit**, it is usually powered from its internal battery. It is delivered with an external charger that requires an external supply to be connected to Mains from 100 to 240 V AC / 50 or 60 Hz, by using the suitable cable and connectors.

UF 801-P with its accessories is presented in a robust carrying case. See picture.

With an optional probe (**SE 1701**), UF 801-P is able to measure pipe walls thickness.

UF 801-P can operate in different languages. This selection is done in the Configuration Menu.
You can refer to our short form guide NT 227. This NT 228 manual is the reference manual.

It is possible to customize your UF 801-P by choosing your input / output modules. Basically, UF 801-P is equipped with one 4-20 mA output, 2 Relays and one RS232 port.

As the **UF 801-P** is a self operating unit, it has an integrated data-logger able to record up to 135 000 measured flow values with the time and date, or, with 14 simultaneous values, up to 36 000) records.

Each record can be the average or min/max peak value during the recording period. Thus, it is possible to do less often records without loosing information.

3.2 Measurement Principle

As written above, please print out from our CD the NT122 didactic handbook. Inside is very useful information on this measurement principle, ultrasonic waves transmission, hydraulic conditions, flow profile and Reynolds Number

The first condition to measure flow is that the fluid can transmit ultrasound at chosen F: it must not be too viscous or include too much particles o gas bubbles that create a barrier or disperse the energy.

Contrary to the electromagnetic principle, there is no influence of fluid conductivity.

So, with two probes with following installation:

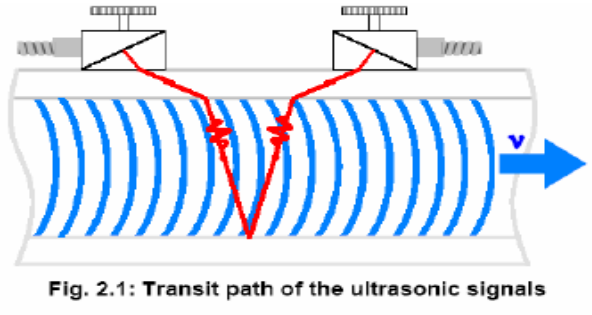
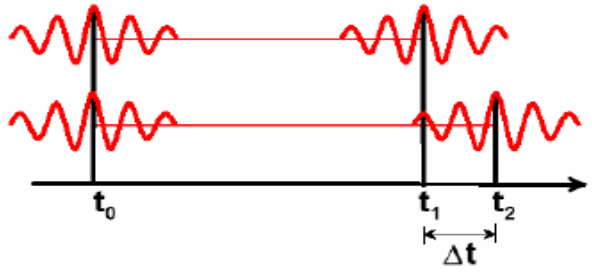
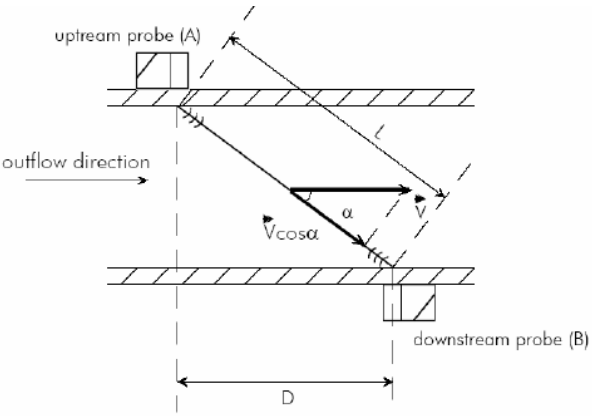


Fig. 2.1: Transit path of the ultrasonic signals





The two probes are used alternately as an emitter and receiver: the difference between the sound and the flowing fluid velocities creates a small time difference between upstream and downstream sound transmissions.

UF 801-P, with its sophisticated dual 32 bits processors and DSP PC Board, permits a signal digital shape analyse and offers a very high resolution and accurate transit time and Delta t measurements, the key of high level and reliable results.

Delta t = t_{BA} - t_{AB} (nanosecond)

$V_{US} = (L^2/2*D)*(\Delta t/t_{AB}*t_{BA})$ (m/s)

And, with Kh = V_{US} / V_s (S = section)

Q (Flow) = S * V_{us} / Kh (m^3/h ...)

Volume = Q * Time (m^3 ...)

Always keep in your mind that the flow integration and flow results depend on the flow section and the flow profile. Choose the best probe arrangement and location to minimize other influences. Fully developed and stabilized hydraulic conditions are preferred measurement locations.

Always keep in your mind that the physical measurement is based on the time and Delta t result. Lower Delta t requires more attention to probe choice, installation and zero setting …

So, a flow of 2 m/s in a 1 m I.D. pipe would give a Delta t around 1500 nanosecond when 0.5 m/s in a 10 mm ID pipe would show 5 ns, which could be sufficient but is a low range value.

3.3 Typical Applications

The main purpose of the UF_801 P and P-B is a competitive flow measurement that can be installed quickly and easily. With **clamp-on** transducers, there is no need for a spool piece or pressure tapping, but keeping the same final accuracy as any flow meter. Compared to previous or existing devices and compared to our main competitors, this new device increases the performance limits.

The concept is a smart use of hardware and firmware resources, easy to adapt to end user flow problems and to offer complete diagnostics on actual flow conditions, including liquid quality or density information…

The UF 801-P/PB gives the actual flow value and its direction. Normally used as a portable device, it can also be use for temporary replacement of any flow-meter for flow indication, regulation and also volume counter.

Ultraflux offers a wide range of probes with different sizes and frequencies to be selected depending on the application and pipe diameter from 10 mm I.D. to more than 5 metres.
A large advantage on ultrasonic signals is obtained by choosing our microstructure technology probes. From the smallest to the largest:
SE 1714/2~4 MHz ; SE 1586/2 MHz ; SE 1515/1 MHz or SE 1599/0.5 MHz.

The clamp on solution is available on all metallic or plastic pipes. Most asbestos pipes are also accepted. The only limitations could come from too high corrosion or too thick internal pipe deposits. Lower is the probe frequency, higher is the limit.

When the pipe wall material (concrete …) or condition (corrosion …) is not suitable for clamp on transducers, we can propose insertion transducers with possible installation by hot tapping.

Most liquids are acceptable: Water first, any quality, from ultra-pure and non conductive to sewage and charged quality. That includes also hot water.

Clamp-on sensors are very convenient for petrochemical products, acids or any liquid presenting some contact or vapour danger.

With some restrictions concerning the pipe material and diameter, and also the pressure, UF 801-P permits clamp-on flow results on gas pipe-lines: natural gas, compressed air….

When the instrument must have an official use, it is recommended to obtain an official certificate by comparing it to a reference standard on a flow rig.

Basically, we practice only a dry calibration. Its reliability is sufficient for a standard use. Moreover, it offers a very high repeatability when redoing the same probe installation.

Example of installation:

Here is a dual pipe installation.
SE_1586 probes are in V reflex mode.
Application is ultra pure water.
Purpose is to calculate from flow and return the real production / consumption.

3.4 Probes, Supports and Accessories (see also § 5)

The UF 801-P / PB accepts all standard or special transducers from Ultraflux catalogue with frequency from 200 KHz up to 4 MHz. Most of them, for portable use, are clamp-on with fast connection, but UF 801 can accept insertion or wetted models as well.

Please, refer to the probe data sheet for specific technical characteristics.

UF 801-P menu lists the standard available probes:

- **Clamp-on probes are referenced SE**. Each reference is attached to an internal table with the probe frequency, the beam angle and the dead time in the wedge.

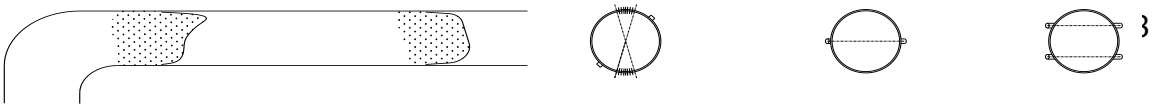
- **Insertion probes or wetted probes are referenced SM**. The attached table considers only the crystal frequency and the dead time in probe face. If probe has a built-in angle, only **L & D** installation distances describe the exact installation.

- It is also possible to enter **special probe SA or SB** (clamp-on or wetted).

The selected pipe section to install the probes should allow for the best the straight lengths, mainly upstream from the probes, but also downstream, in order to benefit from a predictable and stable hydraulic profile.

We usually consider 10 pipe diameters upstream, and 3 downstream, as acceptable conditions. Larger distances are preferred, if possible. Consider these distances with respect to the upstream disturbance: a divergent is typically worse than a convergent flow!

To avoid deposits or accumulation of gas, planes close to vertical (+/- 15°) must be avoided. So, install the sensors in a horizontal plane (unless the conduit is vertical!).



If you are using intrusive/wetted probes, adjust the insertion and then the alignment or orientation of the probes for the same pair (up to have parallel faces). L is the exact distance between probes face to face and D is the projection part of L that is concerned with the flow: (L – 2 * lo) * Cos (angle)

With external probes, the flexibility does not exempt the user to ignore the above rules.

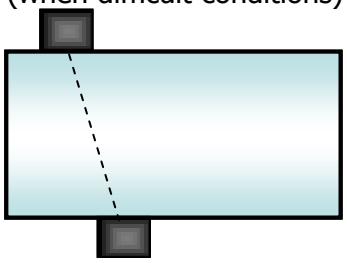
The choice of a Direct (\), Reflex (V), the more common, or N / W installation mode will depend on your decision regarding the pipe dimensions and internal / external conditions, and also the flowing fluid to be measured.

From the entered data and selected probe characteristics, the UF 801-P calculates the distance D.S required between these probes.

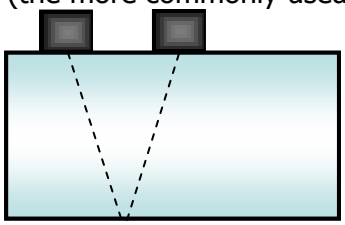
Particular attention should be paid to cleaning the pipe at the probe location and to ensure the coupling surface is clean and smooth.

The 4 installation modes are:

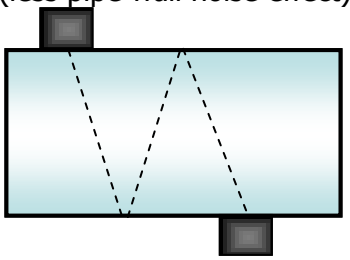
Direct mode
(when difficult conditions)



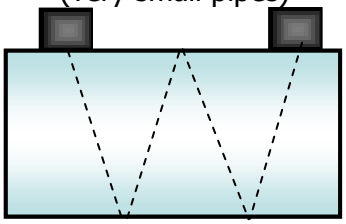
Reflex mode
(the more commonly used)



N mode
(less pipe wall noise effect)



W mode
(very small pipes)



4 - HANDLING THE FLOWMETER

Contents

4.1 Présentation / Scope of Delivery

On delivery, please make sure that all items of the following list are in the package (we consider below our standard scope of delivery):

1 Transport case with internal arrangement for usual items
1 The UF_801-P or P-B pocket converter with inserted (charged) NiMH batteries.
1 protection bag for UF_801
1 Power adapter and battery charger with EC mains cable
1 Cable with "Y" termination for connection to probes (L=5m)
1 Cable for connection to PC or other outputs
1 Pair of straps for general purpose probe attachment to pipes
1 Coupling gel bottle
1 Short form user guide
1 CD Rom including PC Software and Technical manuals / probes data sheets

Depending on your choice / P.O., different probes and supports in relation to your expected use are included in the transportation case or packed separately.

Example of delivery: presentation of UF 801-P in its case with 3 sets of probes: SE1586 / SE1707 / SE1599. Under the cover on the right hand there is space for cables, belts and charger

If you ever detect something that seems abnormal, please contact our sales or after sales services.

General precautions / Cleaning:

UF 801-P/PB is a very reliable instrument. It has been designed for general and special service work as requested. Always respect the usual handling precautions and special instructions given in this manual.

Some macro components (LCD display) or flat cable connections could be susceptible to vibration. Protect the device from heavy shocks and poor transportation conditions. For instance, if you travel by air, keep UF 801-P/PB in its bag and place all items in the over head locker rather in baggage compartment.

Never leave the UF 801-P/PB in the sun. The black of LCD display can cause overheating and damage the liquid crystals; this is the same with too cold conditions.

On dirty sites, please keep the UF 801-P/PB inside its protection bag.

We can deliver UF 801-P with a transparent protection tape on the LCD display PU glass, to prevent it from scratches. Contact Ultraflux for such a protection and for replacements.

If the UF 801-P/PB is dirty after some use (finger prints, muddy water projection…), clean the instrument with a soft cloth. Do not use detergents. Alcohol solution is acceptable.

Remove traces of acoustic gel from the probes with a paper tissue before storage.

Be careful with the powerful magnets of concerned supports (SE/SU 1707…). Never remove them from their housing.

For long term storage conditions, please keep all items in the packing case.

Meanwhile, if this storage is very long (many months), please note that the batteries will become discharged (current for the clock…). We recommend doing a complete charging cycle every 2 months and leave the device in a charged condition (see here after).

Recommendations to a new user: (See also the short form user guide)

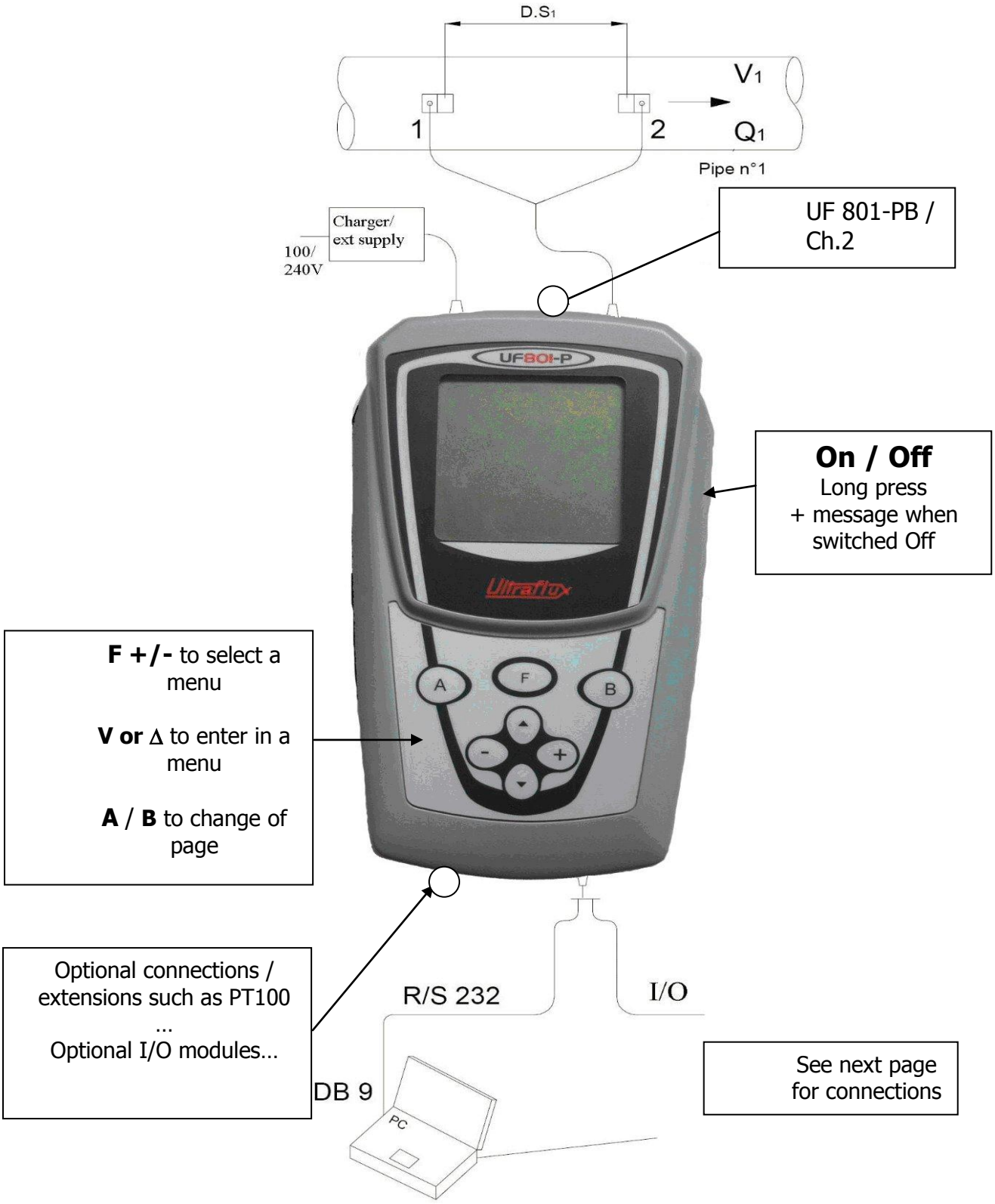
Look through the different menus, without changing the settings at this stage.

Note that some functions have a different action following a short or a long pressing action. As an example, a short press on F pages forward to the next menu and returns to measurement menu after a long press.

Inside some menus, pressing A & B can have a dedicated function that is shown at concerned display screen bottom (as for instance "by default screen" selection in measurement menu).

4.2 External Connections

The UF 801-P is tested and delivered ready for use, with its batteries charged.

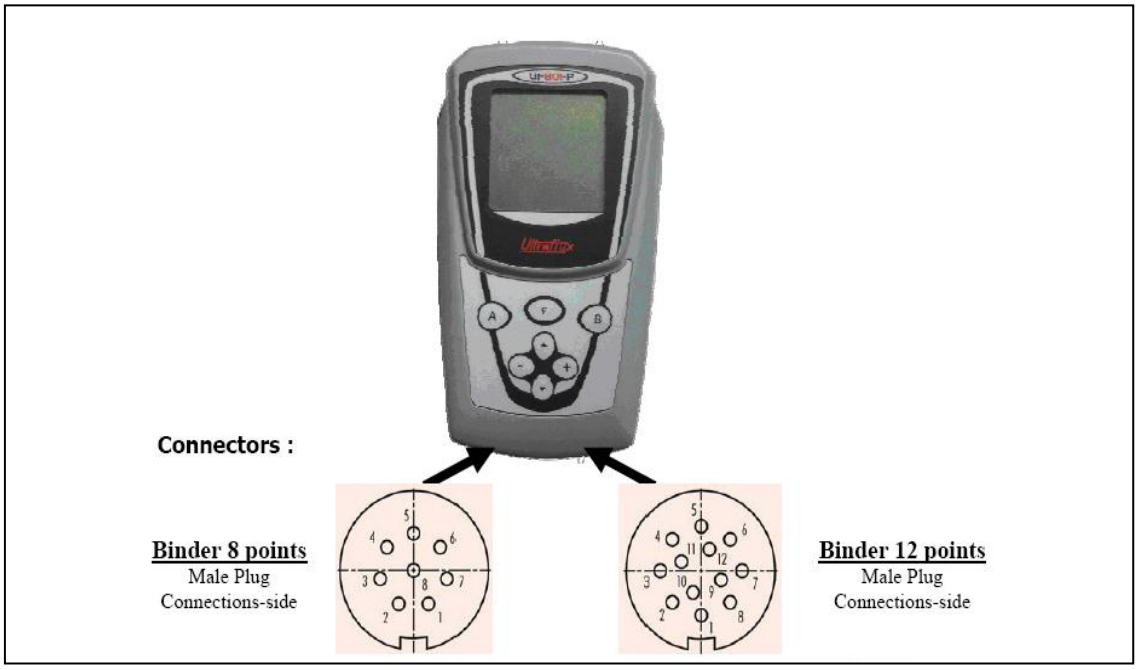


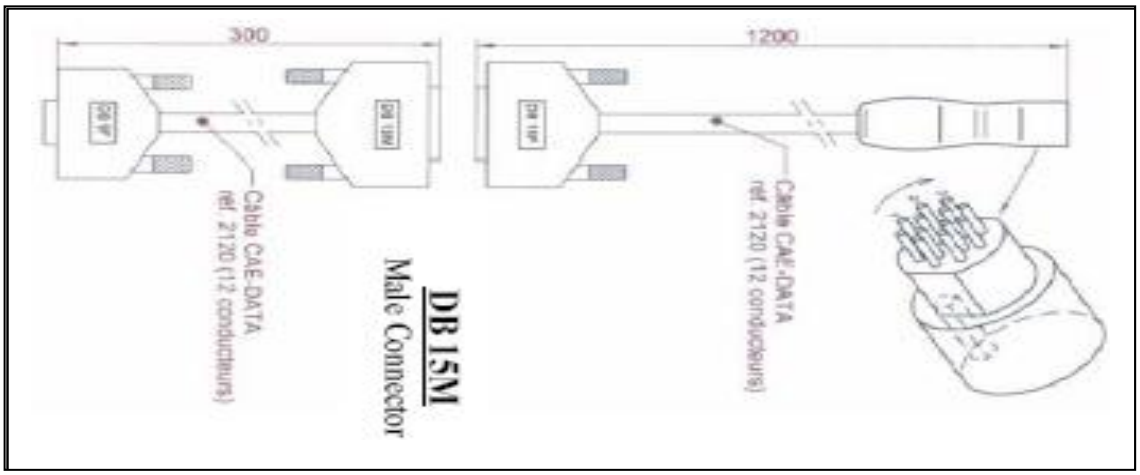
4.3 Connection to a PC or another terminal

See § 13 for more information and wiring instructions + pin-out.

Connection to a PC is requested for data logger download. Our delivered cable is ready for use directly on a RS 232 port or on an USB port through a converter.

Other connections can be wired on the DB 15 to transmit or to acquire analog data or On/Off status.





Respect the 600 Ohm maximum impedance on the 4-20 mA output.
Respect relays limits: 0.1 A / 100 V / 3 VA
With PT 100 / 1000, prefer 3 or 4 wires connection.

4.4 Using the Keypad:

> See also the short form User's Guide NT 227

After switching **ON** (Long Press on the right side button), the UF 801-P displays its configuration (serial Nr, Hardware/Firmware revision), its actual main settings (with probe reference) and starts automatically in the Measurement mode menu: Q / Graph / Flow information (*).

If the unit is already set up for the expected use, there is no need of extra-programming: only read the results in the screen that you can select by pressing **V or Δ (**up/down), after probe installation and connection.

(*) To select a measurement screen "by default", display it

and then press 

Menus header access: Press 

, and repeat it to go the next screen,

or travel with 

or 

A short press accesses to the different menu headers.
A long press returns back to measurement menu.

To enter a menu, press 

or 

To change a page, press 

or 

To change a line, select it with 

or 

To modify value or text, use 

or 

If no button is pressed for a long time (1 to 10 mn following the version) , the display returns automatically to the measurement display screen that was selected with B (see * above).

4.5 The Menus Review

Pressing F **one time gives access to the <u>Configuration menu</u>.**

Pressing F **twice gives access to <u>Pipe / Fluid Settings Menu</u>**

Pressing F **three or more times, or** F **then** + **or** -

Gives access to the **next other menus** or **optional functions** as enabled in Configuration Menu:

We list here below these different menus:

<u>Menu</u>	<u>Description</u> / <u>Function</u>
Configuration	This menu permits to fix general choices, as the interface language or the level of settings and also to activate or disable I/O or logging resources.
Pipe / Fluid Settings	Permits to set the pipe geometry & fluid characteristics and the probes.
Totalizers	Volume counting settings: units…
Inputs / Outputs	Setting of the available outputs: analogue, relays, frequency, input switch, PT100 …
Data Logger	Memory space for automatic records : choice of data, recording period …
Timer / Sequencer	Delayed auto start, with synchronised records…
Echo Display	To control ultrasonic signals quality
Thickness measurement	To know pipe wall thickness.
Linearization	To used when a calibration to optimise accuracy
Factory settings	Setting of some advanced modes …

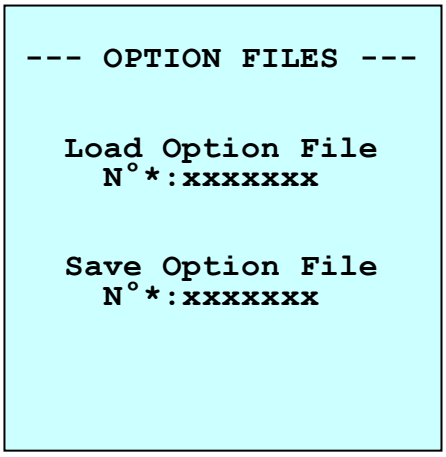
Remark : some menus could not appear and are displayed only if they have been first asked through the configuration menu, or are tight to a reserved mode.

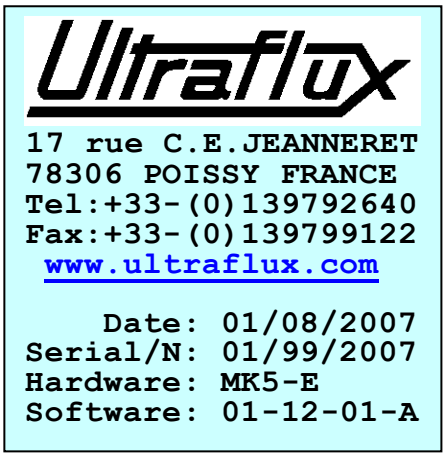
4.6 The Configuration Menu:

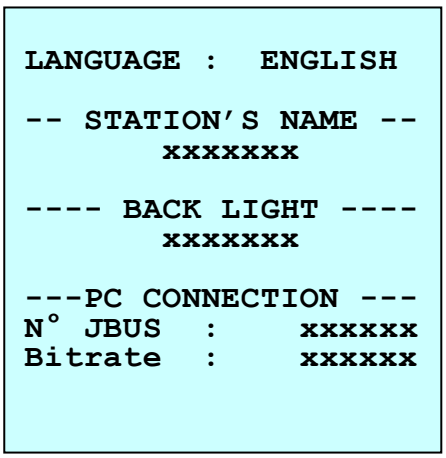
As explained above, from this menu you can decide at any time to have an efficient but basic instrument, very simple to use or a very powerful flow-meter with plenty of available resources.

This menu shows also the manufacturer information about your instrument version.

We list below with only a few comments these possibilities:





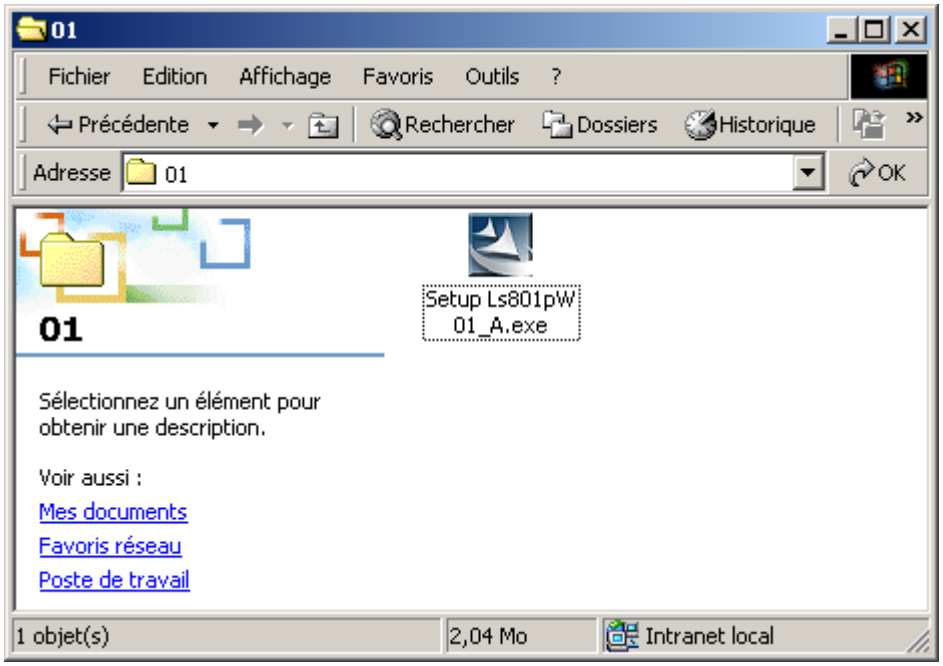


4.7 The PC Software : General

Operating details are given in § 10: Installation and User Instructions.

Other user information concerning the Data-Logger Down-Load are in § 11.

This PC Software is included in the CD Rom, delivered with the UF 801-P
Use your PC browser to select it, up to display a Set-Up file as follows:



This software works on **all Microsoft Versions** since Windows 98, included: 2000 or Millenium, NT, XP pack 1 or 2, Vista.

The installation proposes you create an **Ultraflux folder in Program Files** and makes an attached sub-data file to store your results or settings.
It asks also for the **language** that you would prefer to use.

The installation proposes also the **connection to your already installed Microsoft Excel** version. It is up to you to accept this connection. It will be very useful later for data-logger treatment.

Note that some languages such as French consider the coma as a **decimal separator** and some others as in English use the decimal point. We normally adapt this with the language, but some persons could prefer to use coma separator. Consider the right adaptation for Excel right interpretation.

Our software includes a **Macro-Function for automatic edition by Excel**.

Important! To allow its execution, it is necessary since Excel 2000 or 2003 versions to set the acceptation level in Excel menu: **Tools / Macro / Safety / Medium.**

5 - PROBES INSTALLATION

Contents

5.1 Selection criteria of a clamp-on probe:

High frequency probes are small compared to lower frequency ones and are suitable for small pipes with thin pipe wall. They offer a higher Delta T accuracy measurement, insuring a good theoretical zero and better flow accuracy. But, at higher frequency, pipe or liquid conditions may have more influence on signal quality: a high signal damping or a high distortion could bring some limitations and force you to try lower frequency probes.

- For very small pipes with I.D. from 8 to 15 mm (lower limit depends on pipe quality), we recommend SE 1714 / F = 2 ~ 4 MHz

- Recommended choice for pipes 15 to 80 mm is SE 1586-E2 / F=2 MHz

Lower frequency transducers are less sensitive to above conditions and are also more suitable for larger pipes: the Delta T is more important and thus it weights less on the zero and flow results.

For medium and not corroded pipes with ND 60 up to 1000 mm, the good compromise is using F=1 MHz probes.

- We recommend our SE_1515 (SE_1707) or our SE_1662/S

- For larger pipes ND 0.8 m up to 10 m or difficult conditions, our recommended choice is SE_1599-I / F=0.5 MHz.

Most of these probes are delivered with a support including a ruler and fittings for fast attachment to the pipe. Rulers with integral magnets such as SE_1707, SE_1519 are very convenient on carbon steel pipes. SE 1714 or SE 1586 include an elastic for fast attach.

5.2 Selection of the Measurement section

See 1.4 and our NT122 for general purpose recommendations.

Most of the following rules are common sense:

- Easy access and the possibility to have the UF 801-P at a convenient height allow easier diagnostics.
- Check that you have a sufficient space to install probes (including support?).
- If there are existing straight lengths, use them.
- If you detect upstream aeration or cavitations (such as from a pump), place probes further upstream or downstream.
- Check that the pipe is full.
- Avoid measurement locations near pipe defects or deformations.
- Avoid welded joints. Never place a probe on weld seams.
- If the installation must work for several days, pay attention to the diagnostics.

In case of turbulent to laminar flow transition risk (very rare with water), we give some complementary recommendations in Expert menu.

5.3 Probes Coupling :

Clean the pipe at location for the probes: take into account the probe distance and consider also the distance for the probe support or ruler.

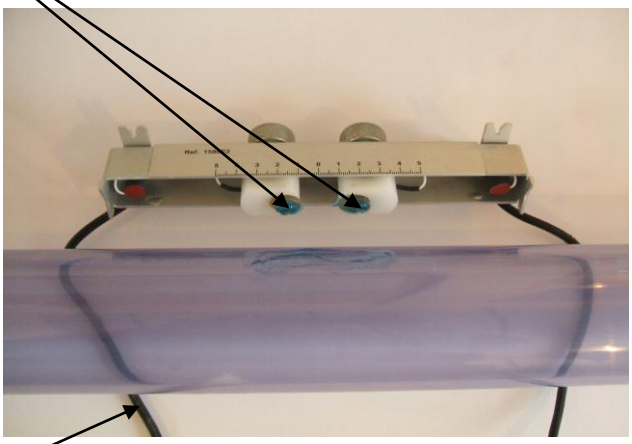
This cleaning can be done simply with a paper tissue or an old cloth piece. If the pipe is very dusty, use a metallic brush.

No need to remove good paintwork.

If paintwork is flaking off, remove it with a brush or a scrapper: the air gap under the paint will stop ultrasonic transmission.

Use the right gel for actual conditions. Blue Gel is for ambient temperature and temporary measurements. In wet or rainy conditions, it could be better to use grease (electro-mechanical).

Spread some gel over the measurement points and apply gel on each probe face.



Attach probes to the pipe with straps or better use the probe support.

Ensure the gel interface between each probe and the pipe is continuous.

Avoid slipping the probe: this may break the coupling film.

5.4 First measurements :

(See § 6 / measurements in simple mode for more information)

First operation is to connect the **UF 801-Pto its probes**. Use the delivered cable with a Y termination. If too short (large pipe, too long imposed distance), we propose prolongations, to be always used per pair (symmetry).

To obtain a positive flow display, connect cable N°1 to upstream probe and cable N°2 to downstream one**.**

As soon probes are connected and UF 801-P device correctly parameterized, the flow reading should be available.

To check that conditions are OK, or if no result, we duly recommend using the **echo display menu** to have a look on ultrasonic signals. See § 9.

If the « no results situation » persists, we list here below some investigation ways:

- Bad coupling?
- Air under probe face?
- Coupling has degraded?
- Old and not adhesive paint on pipe?
- Is the fluid homogeneous?
- Is the fluid too viscous?
- Is there a risk of air?
- Pipe is too corroded or includes internal deposits?
- Bad choice for the probes?

More information is given in trouble shooting chapter.

6 - SIMPLE MODE

Contents

6.1 Mode « Simple »

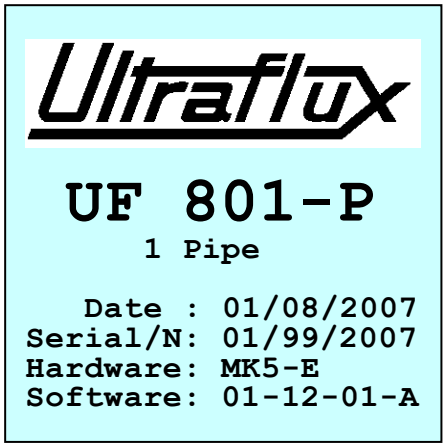
This menu is dedicated to flow measurements on water, at ambient temperature, with a minimum of settings.

To activate this mode, select it in the configuration menu. You keep the possibility to add other optional functions (I/O, data logger …).:

With Simple Option Menu, some settings, which are adjustable with Normal or Advanced option, are here forced at following values:

- Product = Water with Co=1472 m/s and Delta C=+/- 400 m/s
- K Hydro = Auto / Viscosity = 1.0 CSt / Pipe Roughness = 0.1 mm
- Flow Cut-Off = 0 / Auto Zero = No
- Memory = 10 s / Filter = 10 s
- Graph Period = 10 s

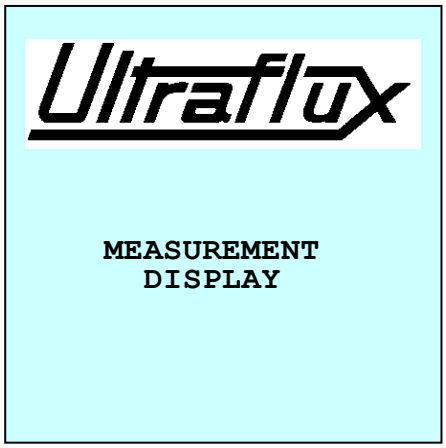
Supposing your instrument already in that mode, after switching ON, the UF 801-P displays menu title, the instrument configuration and serial numbers (see 3.3) and then the chord / probes configuration (see 6.4).

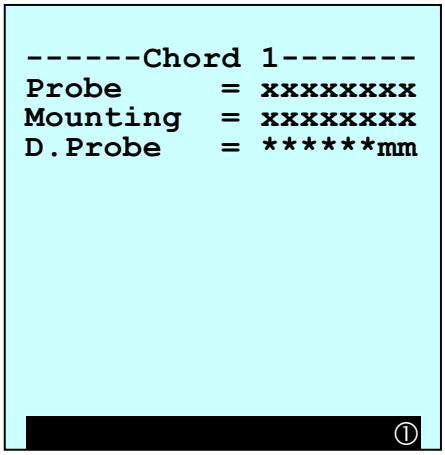


Otherwise, a long press on (F) switches the device to measurement menu.

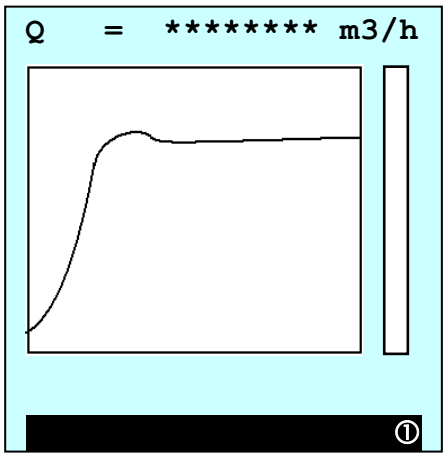
6.2 Measurement Menu:

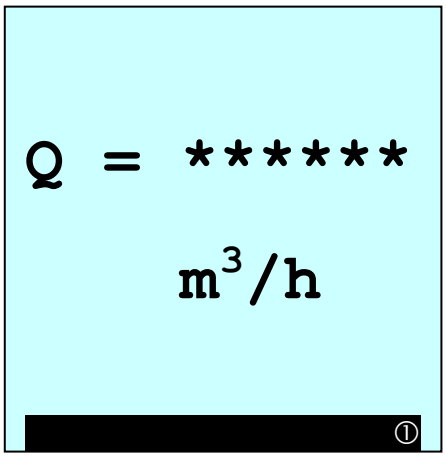
Supposing everything set as per 6.3 to 6.6 instructions, UF 801-P displays as a reminder the chosen probes and the required distance:



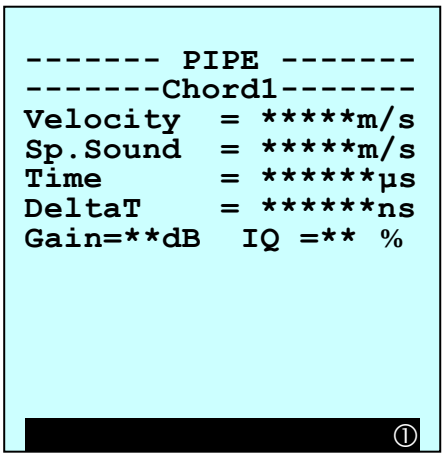


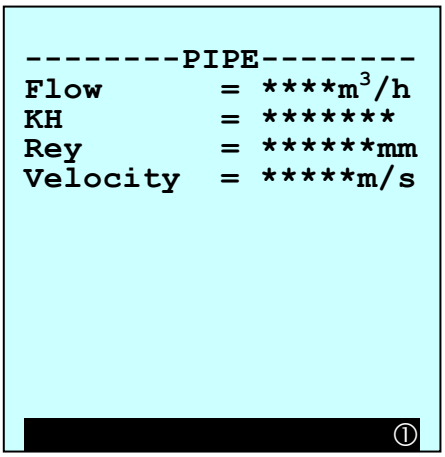
Next automatic display is the "By Default" screen that you have already selected with (B) or that you can select at any time among the following displays (see 3.1), large or small characters, numerical or graphical …





With more or less information on measurement conditions (ultrasonic, hydraulic, pope condition…), as shown on next screens:





The flow velocity informs you about actual conditions compared to the typical flow range of a flow meter (0.5 to 5 m/s).
A low velocity value signifies that actual conditions are more likely to have errors.

The Reynolds Number (see NT122) shows the flow turbulence coefficient.
If its value is less than 4000, you are informed that the laminar flow transition could be very near.

The KH shows the applied automatic correction coefficient for the typical flow profile.
It considers that the probe measurement section is chosen to have a fully developed flow profile (available straight lengths).
In different conditions, this coefficient can be manually set via the Normal or Advanced modes.

Speed of Sound value (Ultrasonic wave velocity) permits correlations with water temperature.

Transit time is the raw transit time measurement.

Actual Delta T (given in nanosecond) is very important to estimate the possible flow measurement error due to possible offset influence. The UF 801-P time measurement resolution is smaller than 0.05 ns. Probe time accuracy depends on their frequency. For instance, SE 1586 can offer better than 0.1 ns. But, if this Delta T is very small and if actual flow zero has not been checked, you must question yourself about the actual accuracy limits.

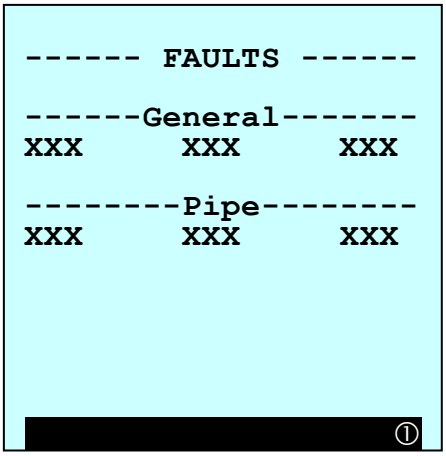
The amplification gain (in **dB**) shows the signal strength. Lower amplification means a stronger signal. This strength depends on probe choice and pipe conditions.

I.Q (%) shows the signal rejection ratio. IQ=100 % means that all measurements are accepted.

Faults Report Table:

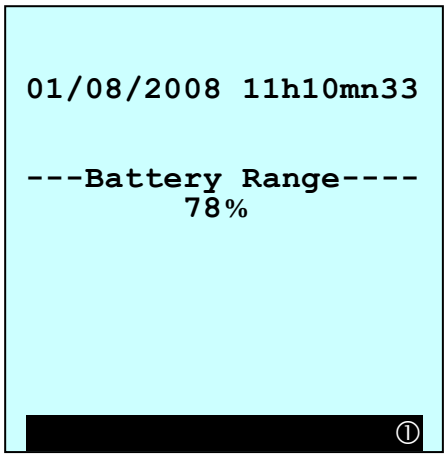
A "Flow fault" message does not mean that the device is faulty.

It indicates that actual conditions do not permit velocity and flow measurement on the tested pipe or the considered chord.



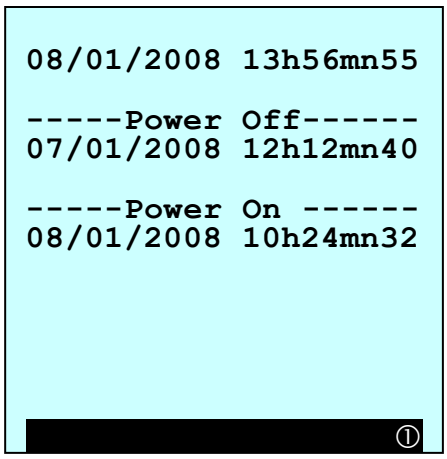
Other messages or warning: In measurement mode, when a value is replaced with - - - -, this means that there is no result.

At the bottom of the measurement screens, if display shows ΔΔΔΔ, this is fault warning: > Consult fault report.



This screen shows actual date and time.

And also the battery condition (see 19.1)



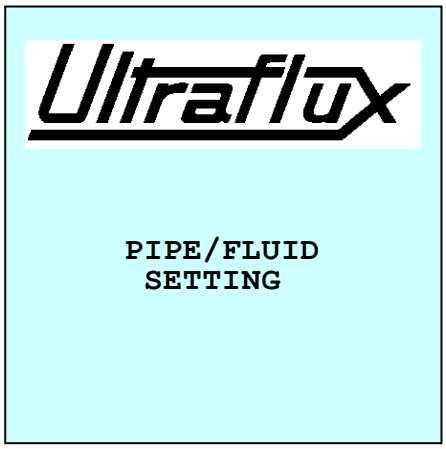
This screen shows also actual date and time

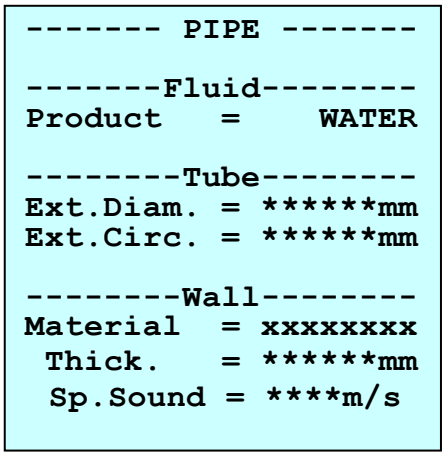
plus date and time of last switching Off/On.

Measurement menu can show other displayed screens depending on the activated functions in Configuration menu.

6.3 Pipe/Fluid settings for the application

Mode Simple considers water in usual ambient temperature range. Sound velocity, which drives the requested distance between probes, and also signal tracking window, is considered around **15°C**, with **Co=1472 m/s** with a whole **Delta C** range sufficiently wide at **400 m/s** (+/- 200 m/s).



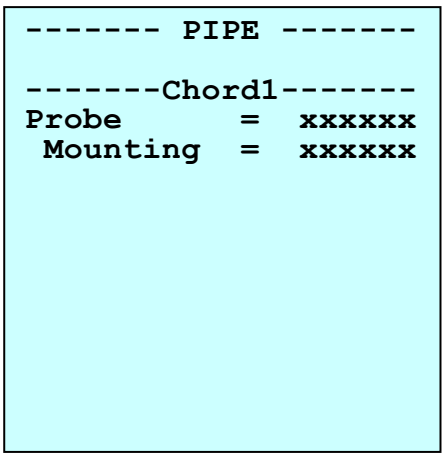


Please enter with accuracy the pipe dimensions as Ext. Diam or Ext. Circ.(= Π *O.D). UF 801-P displays both and calculates the pipe I.D.

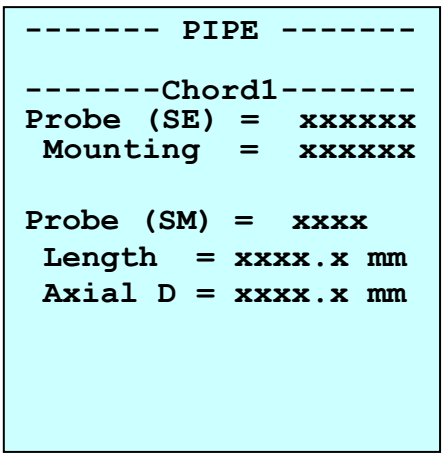
Use a tape measure or a vernier for Ext. Diam. and a thickness gage for pipe thickness unless drawings are available (or marks on pipe / site construction records).

6.4 Probes choice:

It is very important to **select the right probes & supports** for your application. > See §5.1. Depending on these probes and your application or pipe conditions, select the best compromise for the probe installation. > See § 3.4 and 5.2 **By default, start with the V Reflex mode**.



(Welter probes menu)

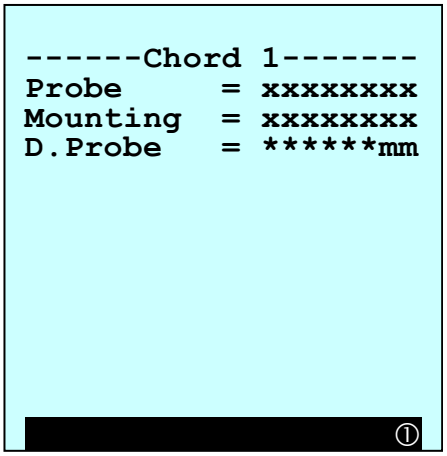


(Clamp-on probes menu)

6.5 Distance between Probes (clamp-on)

When the above basic settings are finished **long press on** F returns you to the Measurement menu.

UF 801-P temporarily displays the following screen. Note the required distance that must be measured between lateral marks on probe side.

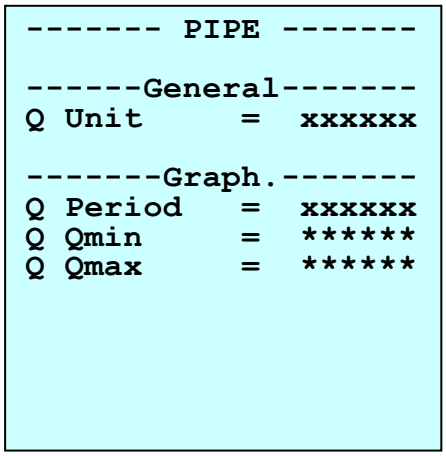


You can at any time select this screen with ▲ in measurement menu.

6.6 Other Settings:

You can select also the flow unit that corresponds to your requirements.

To display a flow curve that reflects your flow range, you can also fix the Graph response time (with period) and the min./max. range.



7 - NORMAL & ADVANCED MODES

Contents

7.1 Introduction

As for Simple mode, the Normal or Advanced modes are selected in the Configuration menu.

The Normal mode permits further programming on any fluid or any application: water, petroleum or chemical products, gases …

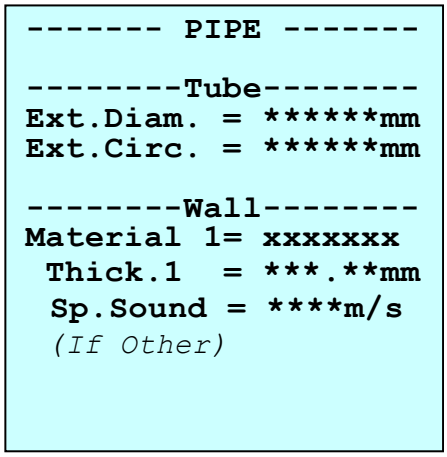
The Advanced mode is not reserved for advanced users. It allows more possibilities such as:

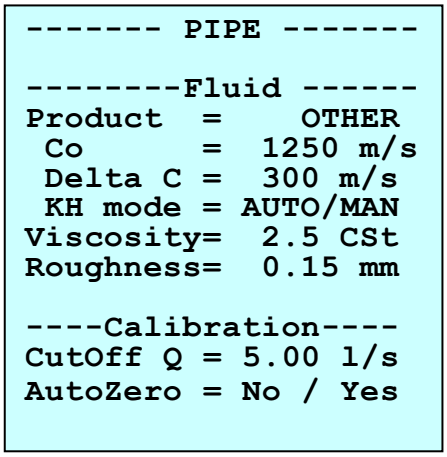
- Settings up on pipes with up to 3 layers (internal or external liners)
- Adaptation of Kh within the turbulent to laminar flow transition range
- Entering 2 slopes filtering on a Delta V threshold
- Setting the amplification in manual mode.
- Entering a linearization curve, for optimised accuracy.

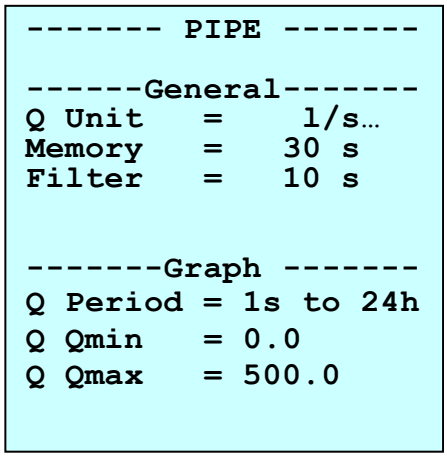
In addition, this menu includes a test menu, 2 special probe setting and possibility to apply specific ultrasonic signal treatment.

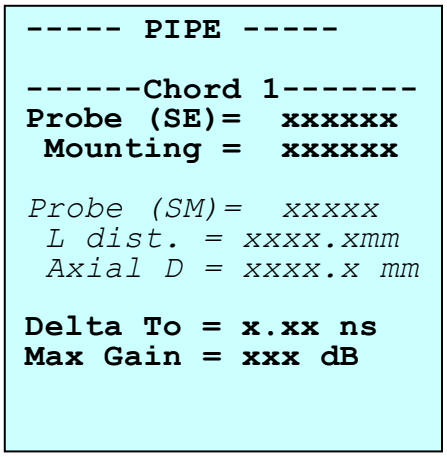
7.2 Additional Parameters of « normal » mode:

The settings for the pipe and the fluid are separated and ask for more data.









How to estimate actual Co for a product that is not in the attached list (see also § 21).
Since firmware version 4, UF 801-P has benefit of a more completed product list included in its menu.

If your product is not in the list, you can proceed as follows:

- Enter an approximate Co and a large Delta C range, expecting just an echo in the capture window.

- Read the returned Speed of Sound (Measurement menu), enter it instead of previous value, read and adjust the new distance between probes and check again.

- If new Speed of Sound display is very close to this entered Co, you have now a reliable estimation of this characteristic in your product.

7.3 Zero / Auto Zero Settings:

Simple mode does not permit zeroing the flow, only normal or advanced are offering. This possible zero offset has more or less weight, but can be very important for accuracy when there is a low delta T at flow range: small pipe ... This offset is almost due to the pipe itself, to the probes choice, even matched, and their installation.

To prevent from errors at flow range lower part, we duly recommend to perform a null flow control and to compensate it if too different from expected.

Attention ! Ensure yourself that the flow is perfectly null and will stay as so during time when you will perform the zero setting: valves must be and stay closed, pumps stopped and turbulences or oscillations down to zero.

Two methods:

- Manual method : read this **Delta To**, and enter it in probes menu at Delta To line (see previous page).
- Automatic method with **Auto-Zéro**: In the Fluid settings menu, at screen bottom (see next page), Auto Zero line, change No to Yes anr set averaging time from 30 Sec. to 5 Mn for less or more accuracy.
- After have returned to measurement mode (long press on **F**), UF 801-P must be able to measure (otherwise, nothing will happen).

If everything is OK, UF 801-P displays "Zero" at screen bottom.

As long this « Auto Zero" message is displayed, the UF 801-P is in progress and acquires this "Delta To" offset. When finished, it automatically places this value at" Delta_To" line.

Attention ! This value is tight to actual measurement point. As an approximate, it can be considered as attached to a same probes set, but, if the next application is very different, please reset it to zero in probes menu.

Q. Cut Off[t]. : Another possibility in normal and advanced modes : entering of a low threshold to force a Zero Flow display below the set value.

Attention! This does not mean that you have adjusted the zero. You just have forced it to zero as long it stays below the set value. Totalizers will not be ordered and current output flow copy will stay at range bottom (0 or 4 mA).

7.4 Additional Parameters in Advanced mode:

Exact Settings on a multilayer pipe :

```
------- PIPE -------
--------Tube--------
Ext.Diam. = ******mm
Ext.Circ. = ******mm

--------Wall--------
Material 1= xxxxxxx
 Thick.1  = ***.**mm
Material 2= xxxxxxx
 Thick.2  = ***.**mm
Material 3= xxxxxxx
 Thick.3  = ***.**mm
Sp. Sound = I Other
```

In the other modes, you can simply enter the whole thickness and a material Speed of Sound (CM) that averages the diverse materials from their %.

Here, this setting is much more accurate.

If there is only two materials, set NONE at material 3

Turbulent to Laminar transition range:

```
------- PIPE -------
--------Fluid ------
Product  =    OTHER
 Co      =  1250 m/s
 Delta C =  300 m/s
 KH mode = AUTO/MAN
Viscosity=  2.5 CSt
Roughness=  0.15 mm
Reyn.Crit=  2800
LBR      =  3.000

----Calibration----
CutOff Q = 5.00 l/s
AutoZero = No / Yes
```

In the other modes, the UF 801-P manages this transition. The typical entered values (Critical Reynolds=2800 / LBR=3) offer good results on viscous fluids as hydraulic oil on pipes in the range 3/8" ~ 2".

Here, you can adapt these settings to your fluid and your installation by adjusting this Reynolds Critic and the transition range with LBR.

As so, on crude oil, Crit. Reynolds=2500 / LBR=5 give better results.
On Air at 1 bar, Crit.Reynolds =1500 / LBR=4 seem more adapted.

We remind you that this transition is very weak. We can only speak about statistical results. In theory, it is necessary to have more than 20 pipe diameter straight length after a disturbance to recover a laminar flow.

Installing the probes just after the disturbance will force a turbulent flow: setting KH=Manual= ~1.10 could be more efficient that letting the unit manage the coefficient.

7.5 Response time / flow display filtering

Without any consequence on the flow results, **filter** setting permits adaptation of averaging period. A high filter value gives very stable flow readings. But, if the actual flow changes suddenly (when starts or stops of a pump for instance), the UF 801-P flow display will be in late and not realistic for some time.

The **Delta V Filter** parameter permits an efficient compromise:

UF 801-P does raw acquisitions of Delta T and calculates flow instantaneous velocity (V) before any filtering.

So, if this raw V result changes suddenly, setting a threshold (Delta V Filter) in relation to your installation will permit to by-pass the filter applied on the flow reading, to have a short response time during this transition.

```
------- PIPE -------

------General-------
Q Unit    =    l/s…
Memory    =   30 s
Filter    =   10 s
DeltaV Filt=0.5 m/s

-------Graph -------
Q Period = 1s to 24h
Q Qmin    = 0.0
Q Qmax    = 500.0
```

<u>Advanced settings or tests on amplification gain management</u>

```
------- PIPE -------

-------Chord1-------
Probe (SE) =  xxxxxx
 Mounting  =  xxxxxx
 Ext.Coeff =Auto/Man

Delta To   = x.xx ns

Gain Type  =Auto/Man
Gain Max   = xxx dB
or Gain    = xxx dB
```

The amplification gain can be set in Manual mode for a test.

Its max. range can be limited to avoid some EMC or other noises capture risks.

If allowed by Ultraflux, it is also possible to adapt DSP treatment modes (TRT_ER in factory settings)

7.6 Factory Settings (Advanced mode only)

The first possibility is to set special probes:

```
---SPECIAL PROBES---

------Probe SA------
  To      =  xx.x µs
  F       =  x MHz
  Angle   =  54°x
  Text    =  abcd

------Probe SA------
  To      =  xx.x µs
  F       =  xxx kHz
  Angle   =  0°x
  Text    =  efgh
```

To is the dead time through the probe face or wedge.

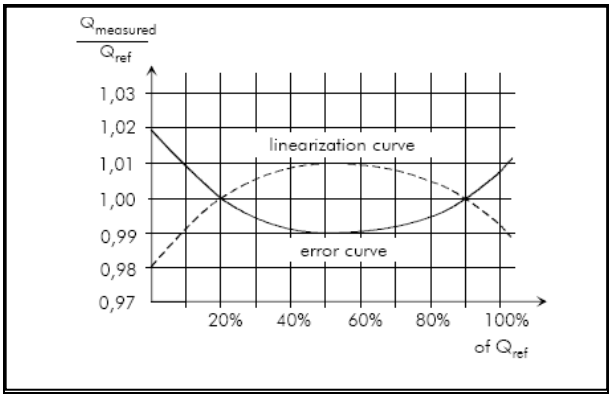
F is the probe crystal frequency.

Angle concerns only clamp-on probes. We set here the typical refracted angle in carbon steel.

The attached text can only be entered with the PC software. It will then appear in the probes list.

The second possibility is the entering of a linearization or error curve compensation.

The graph below shows an example and attached settings.
Note that one compensation curve can be entered for positive flows, another one for negative.




```
----- +Q or -Q ----
 Q Ref = 0 or x m³/h

Coef.   0% = 1.000
Coef.  10% = 1.005
Coef.  20% = 1.012
Coef.  30% = 1.008
Coef.  40% = 1.007
Coef.  50% = 1.005
Coef.  60% = 1.003
Coef.  70% = 1.001
Coef.  80% = 1.000
Coef.  90% = 0.999
Coef. 100% = 0.998
```

First operation is to enter a Q Ref. adapted to the application. It is recommended to enter its value a little bit over Q max flow range. Above Q Ref., the compensation is inactive (coefficient = 1.00).

Thus, with Q Ref. = 0, the linearization function is not active.

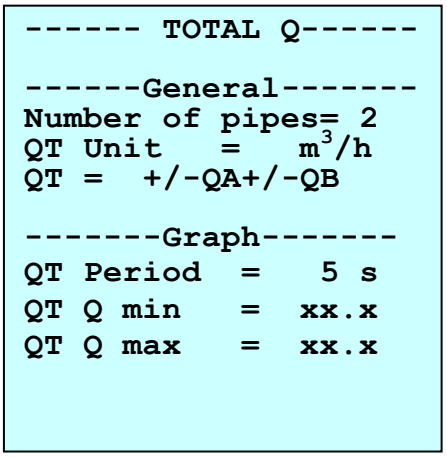
So, with Q Réf.=1000 m^3/h, supposing a whole error at -0.8% at 30% of the range, you must enter a compensation coefficient = 1.008 (+0.8%). UF 801-P interpolates between two successive points.

8 - DUAL PIPE VERSION (UF 801-PB)

Contents

8.1 Introduction to UF 801-PB

The UF 801 Hardware permits two ultrasonic chords by multiplexing internal resources of the emitting/receiving circuits. The two chords option can be designed for installation on a same pipe (UF 801-PB) or on two chords on a same pipe (double set of clamp-on probes or two parallel intrusive probes.



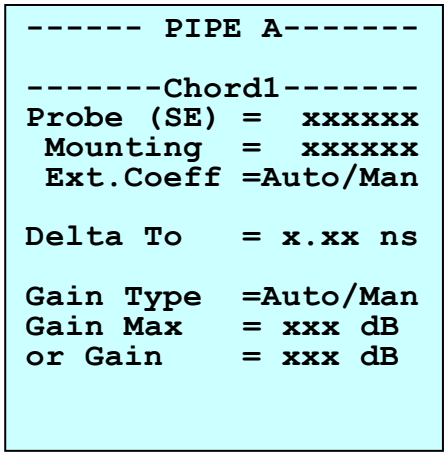
An UF 801-PB will also work on one pipe with Nr of pipes=1. It will be very similar to UF 801-P but QT display (as total flow) that remains and will be equal to QA.

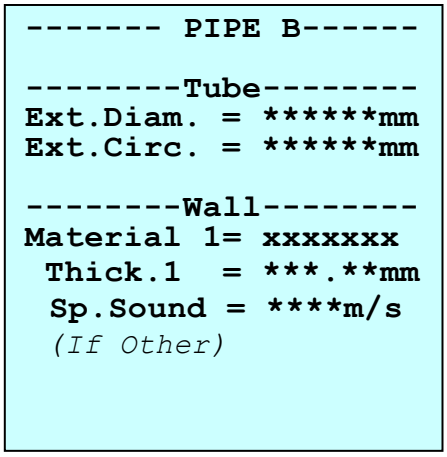
After setting **Nr. of pipes =2** (Pipe/Fluid Menu), you will have complete and totally independent resources to set your applications on two pipes.

The operation QT from QA and QB can be set with coefficients = +1 / -1 or Zero to do a copy, a sum or a difference.

8.2 Complementary displays :

They are very similar to the previous ones, but mention to A or B :



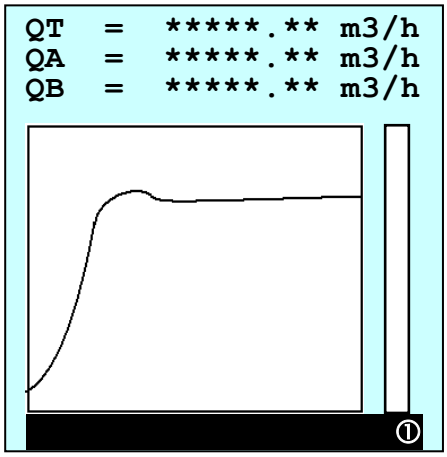


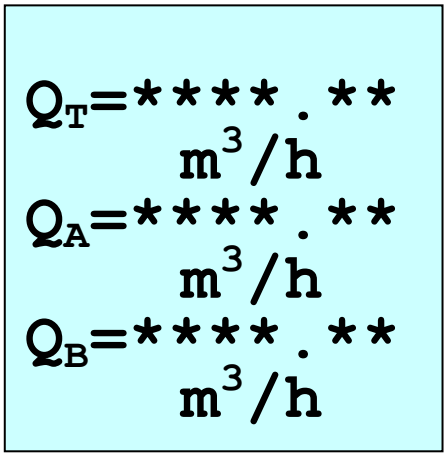
```
----- PIPE A------

--------Fluid ------
Product  =    OTHER
 Co      =  1250 m/s
 Delta C =  300 m/s
 KH mode = AUTO/MAN
Viscosity=  2.5 CSt
Roughness=  0.15 mm

----Calibration----
CutOff Q = 5.00 l/s
AutoZero = No / Yes
```

The main difference concerns the measurement menu : Two new screns are available:





Technical displays are identical to previous ones, but with mention QA or QB.

There are also two separated linearization functions.

In Factory Settings, there are separated menus to simulate values on Pipe A and B.

9 - ECHO DISPLAY MENU

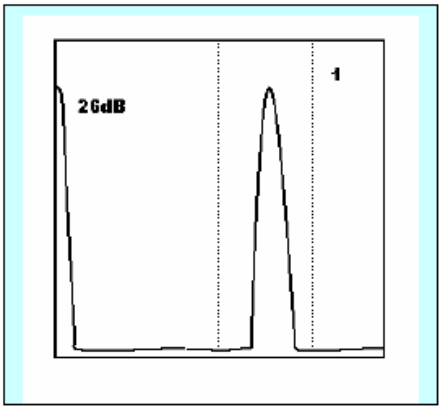
Contents

9.1 When and How Use this menu ?

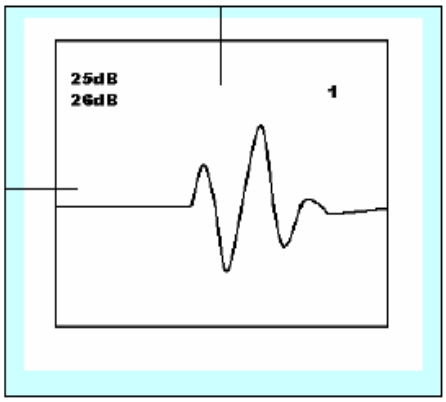
This menu function permits you to check your ultrasonic measurement conditions and know if they are good, acceptable, weak or impossible.

The parameter **Q. max=** permits to adjust the Delta T display sensitivity depending your application. The display does not show the exact Delta T: It is limited to ¼ of the ultrasonic signal period. From Q. max setting, you can force more or less a Delta T display for any small or large actual Delta T.

There are two graphic displays (4 if a dual chord / pipe version):



The first one shows, from the left to the right side, all energised signals (ultrasonic, but also noises) that UF 801-P is receiving and must filter and treat.
The two dotted vertical lines are showing the selection window that result from actual settings (Diam. Or L and also C)
Any signal out from this window will be ignored. The beginning must be clean.



The second screen is an expanded view inside above window that results from the digital acquisition in a tracking window, our electronic lens for ultrasonics.
This screen shows two dotted lines when all is OK.
- The vertical one shows triggered transit time measurement, usually at zero crossing.
- The horizontal one shows the automatic threshold result with the selected edge on the signal.

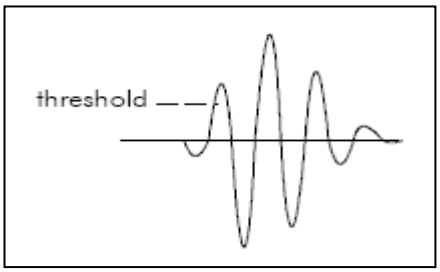
9.2 Examples of echoes and criteria

Experience shows that an echo shape is more propitious when distance between probes is a little bit shorter than the requested distance. A larger distance has the contrary effect.
This is due to the total beam surface in comparison with multiple echoes in pipe wall, and so the multiple combination of received echoes.

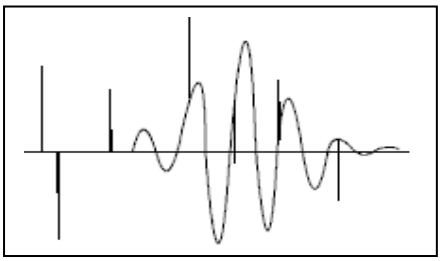
Also, probe frequency, from its wavelength in pipe material compared to pipe thickness, has influence on the echo shape. This could lead you to use higher frequency probes.
Finally, this probe frequency allows more or less from the pipe roughness, corrosion or internal deposits.

Below are some typical pictures of echoes display:

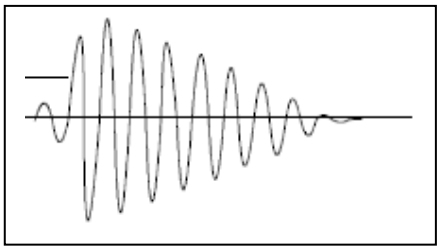
Here is a good echo: low amplification gain (35 dB), low noise level, fast signal rising.



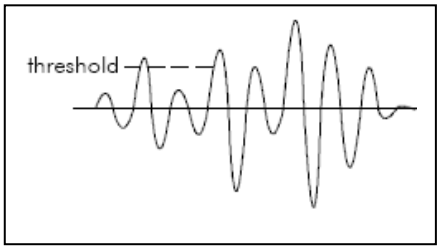
At contrary, here are very difficult conditions: high gain (65 dB), noise, bad shape



This example shows the benefit of high frequency probes on a thin and clean pipe wall.



This example shows a thick pipe on which we can use lower frequency probes and also accept some corrosion.



10 - PC Software

Contents

10.1 Installation & Connections

Double click on Set-Up*.exe icon to launch the installation.
By default, accept the proposed options (path / folder…) until complete.

The only option to install and accept the Macro and the link with Excel is to change the safety level for Macros (Tools / Safety / Medium / Valid).

To connect a UF 801-P to a PC, you need the dedicated cable delivered with the meter (See 4.3). Connect it as shown in 2.2.

If your PC does not have an RS232 serial port (DB9), you must use a converter. Ask to Ultraflux to provide a suitable model.

The exchange protocol is JBus / ModBus, with the PC as Master and UF801 as slave, which requires a slave Nr. (N° JBus), by default = 1.

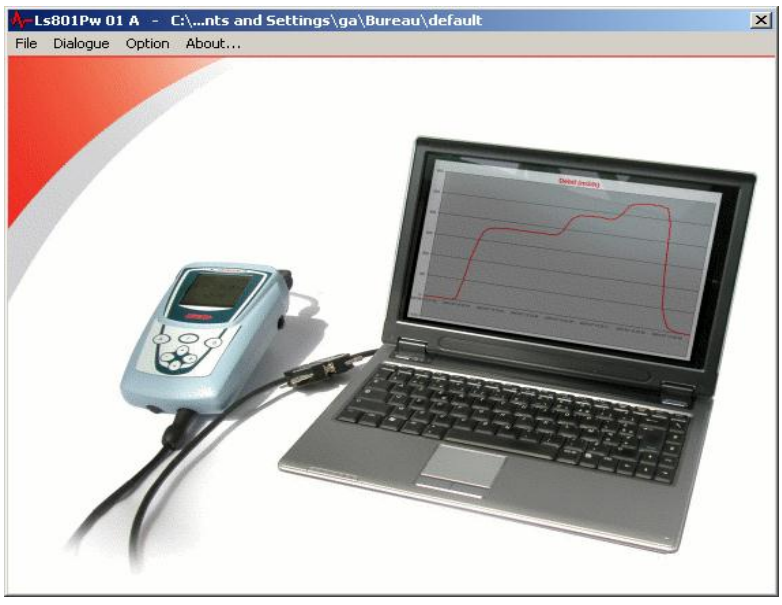
The Bytes or Baud Rate can be set from 300 up to 115200 Bd : Setting at **115200** makes faster data exchange. Some converters are limited to 9600 Bd.

To launch our Ls801PW software, double click on the *.exe by the icon that is installed on your PC Desktop:

You can also use your browser window, in the installed folder. Typical path is :
C / Program Files / Ultraflux / Ls801PW xx / Ls801PWxx.exe

Such a display must appear on your PC screen :

Other files appear in Ls801PW folder after the first connection such as the Excel Macro, a data folder to store saved files, saved Config. that has been accepted with the green tab

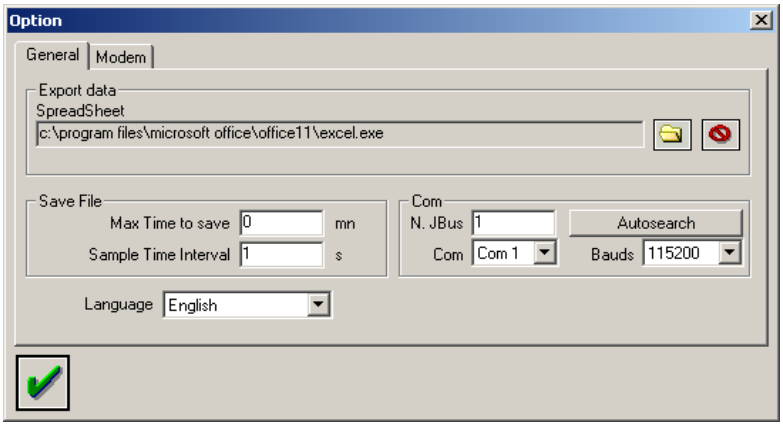


Configuration : Do a click on Option tab

Here you can adapt your communication data.

You can also select your communication language.

The found or forced Excel link is displayed



You can adapt the Com. Port Parameters manually as set on UF 801-P, but the easier method is to_click on **Auto Search**. This searches for the communication settings and the Com Port set by the PC for the USB converter: do a try with UF 801-P at 115 000 and then at 9600 bauds if no result.

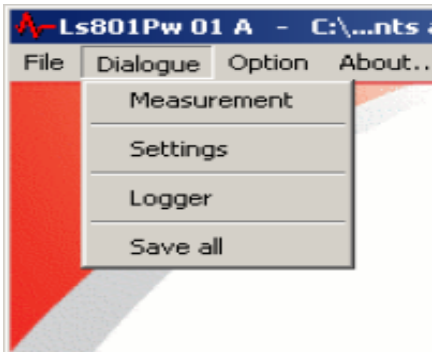
The recording period (max time) and sampling rate (time interval) are explained further in 10.2). They set the automatic measurement records by the PC.

A click on the green tab does the saving of actual configuration parameters.

The Tab "Files" permit opening an already saved file (File / Open) or to start a new Settings File for uploading at a later stage to an UF 801-P; this is possible from Dialogue Settings option. Please note that this menu only offers "Normal Mode Menu".

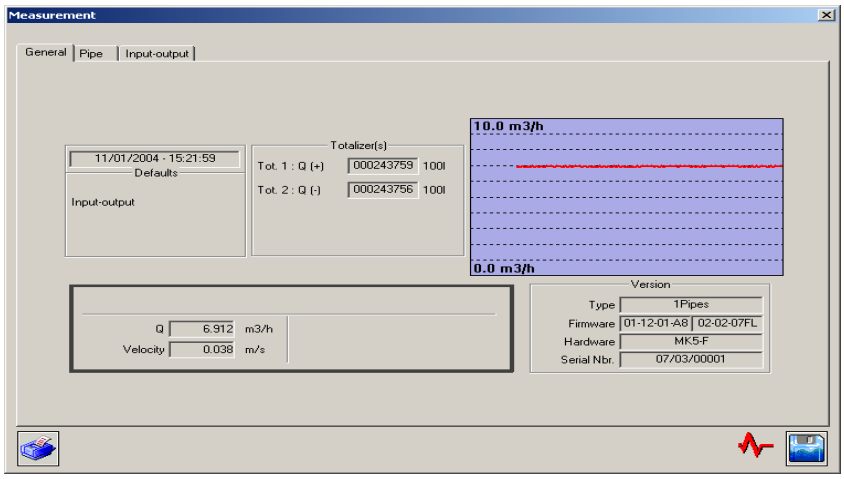
10.2 Menu « dialogue »

A click on **« dialogue »**allows you at minimum three options:

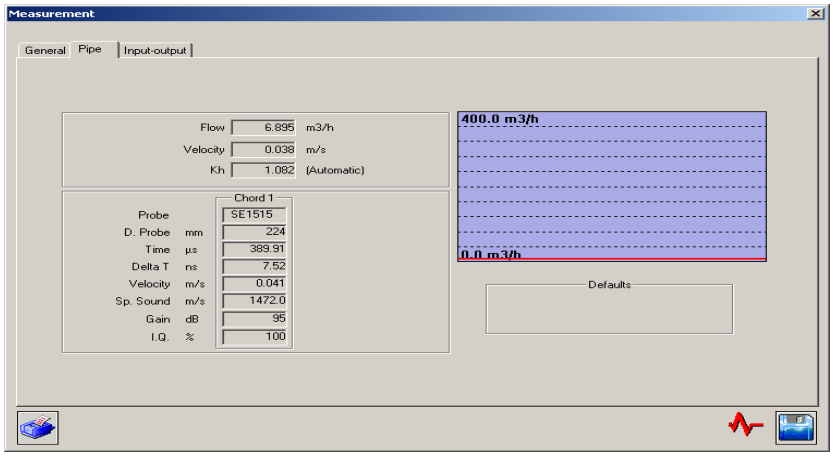


- The first choice is **« Measurement »**. It does importing actual measurement results that are displayed by UF 801. They are grouped on three screens:

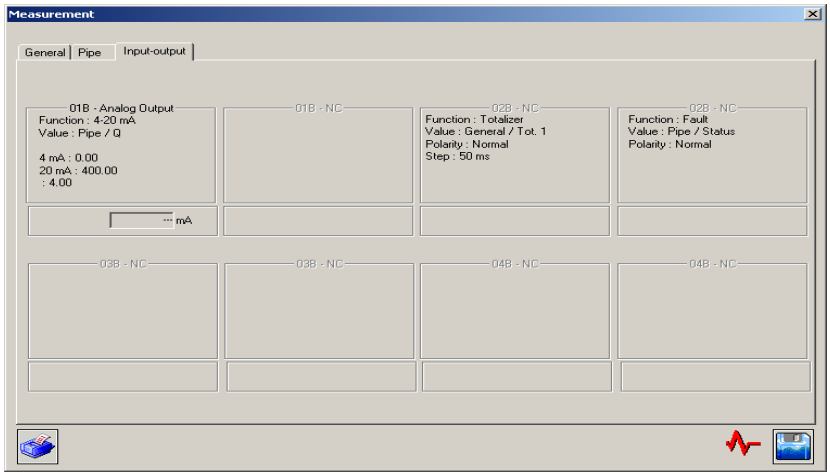
- Général, which shows the actual flow and totalizers :



- Pipe per pipe technical display, with control data :

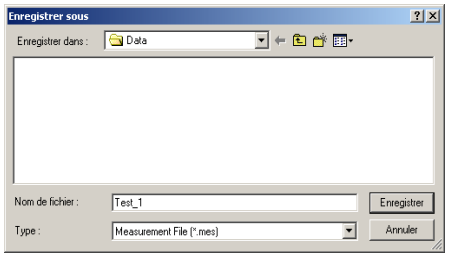


- Input(s) & output(s) :



- **Following icons have the same function in above displays:**

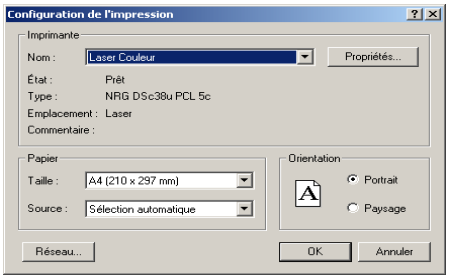
This icon launches actual measurements saving as a file into the data folder (or any other from user choice).
You are invited to give a name



Once the routine is launched, the data are recorded as per the instructions in option menu (sampling rate and recording period). Setting Max. time period = 0 means manual stop (the icon Stop replaces the icon Save).

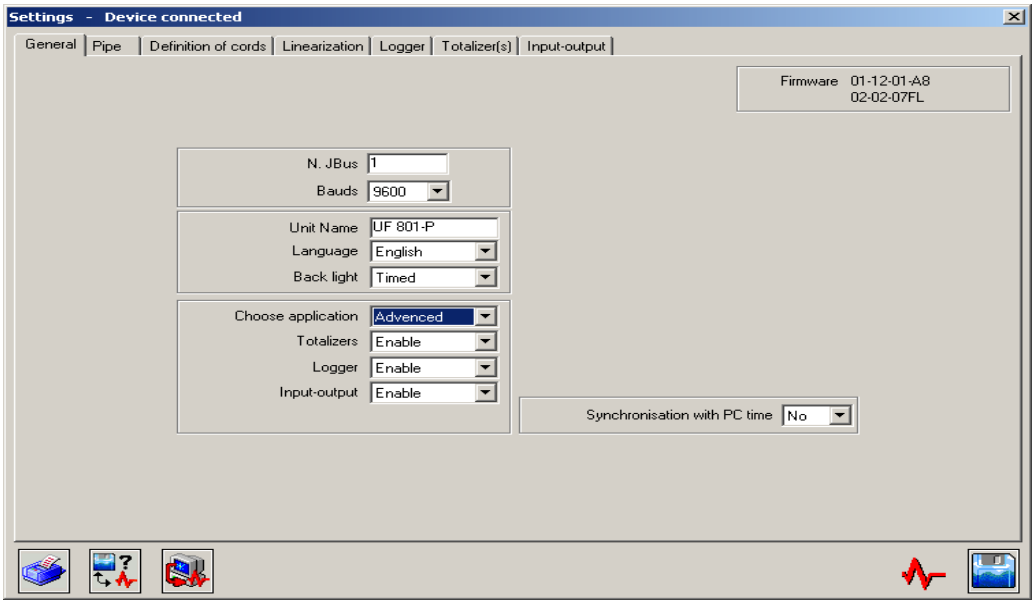
Then, you can read, print, manipulate these records with Excel, from the File / Open / Selection Menu.

A click on this tab prints after you have confirmed your printer.



This icon is unused in this mode.

- The option **« Settings »** does importing the actual settings from the UF 801. As it is with the keypad, you can select the degree of your settings from the Tab "General" / Choose application / Level = Simple / Normal / Advanced or Expert

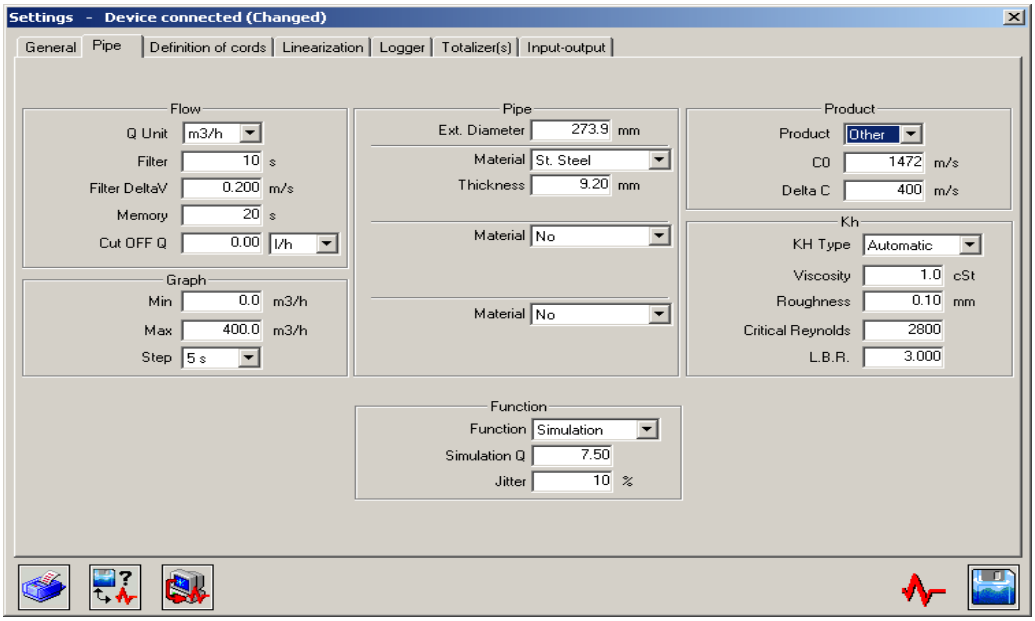


A very important setting is the UF 801 time and date setting for the data logger or PC records as well. Think updating it at summer / winter time changing. PC connection is the only way to do it, with Synchro = Yes and then Send:

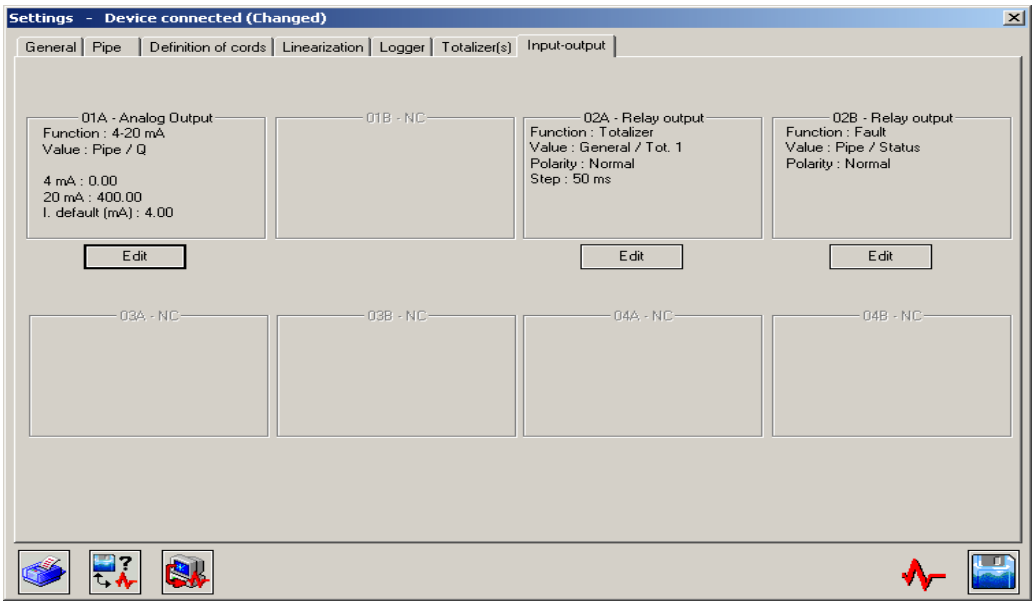
As with Keypad, you can activate or disable I/O, Tot. or data logger resources.

 does exporting these new settings to UF 801 and  permits to save them in a file (archive).

Here below is a typical menu in advanced / expert mode:



I/O modules ranges and assignment are set with this menu. A click on **Edit** opens a specific window for that. Accept the modifications with the green tab.



10.3 Treatment, Archiving and/or printing a file

This concerns the UF 801 settings or the recorded measurements as well.

Measurements results as recorded with PC:

These records include the flow results with the measurement conditions. They could be a very useful complement to records by data-logger. These files have [*.mes] extension.

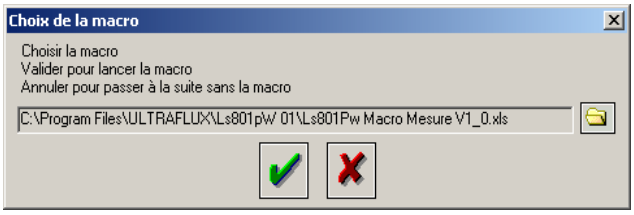
Their reading on PC screen has the same presentation than actual measurement results in menu « Dialogue / Measurements » with in addition the following icons:

 to select a record,

 to print the actual page,

 to send this file to Excel and do the automatic treatment with the dedicated Macro.

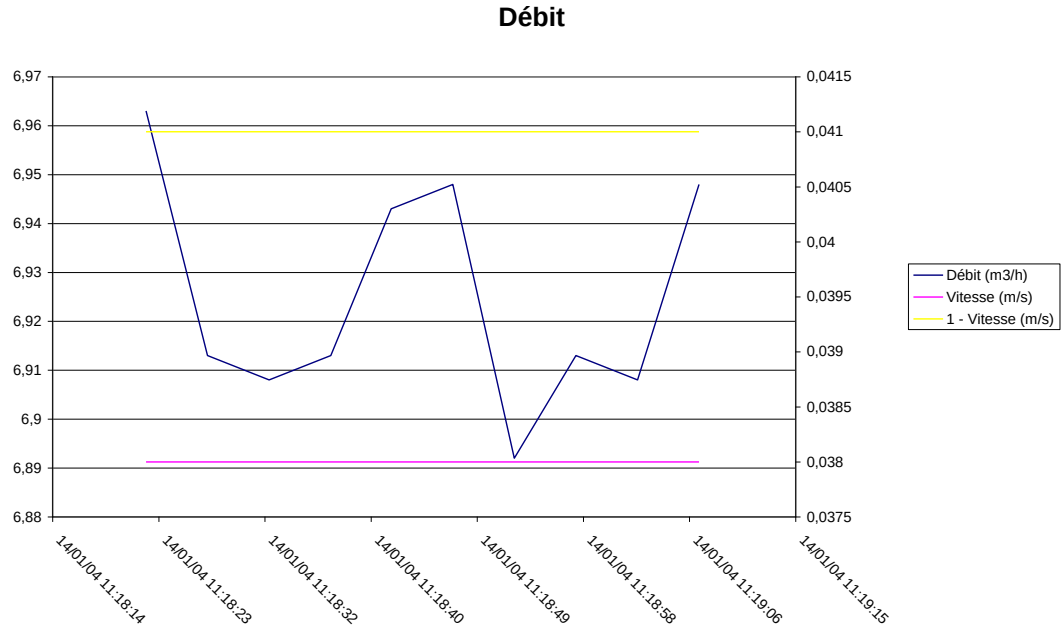
Excel macro offers you time saving for data treatments and does an automatic flow curve edition. Meanwhile, it is necessary to validate this action with:



After confirming the file, another message from Excel asks you to accept the macro where the safety level has been set (see previous comments).

The results are arranged in Excel lines and columns, and an automatic flow and velocity (UF 801-P) or two flow + compilation (UF 801-PB) are edited, which you can also edit yourself from the data.

Up to you to modify this automatic edition, data scale and range … or to take in account other recorded data as C, amplification gain….



Settings menus files.

The UF 801-P has some dedicated memory space to store two configurations. You can recall them with Load, edit or reuse them or, simply, save them on PC.

These archives on a PC present many advantages: they are very helpful for your reports or to share typical settings instructions.

Another use is when you are doing some tries and you want to return to the initial configuration.

If you have to do periodical tests or controls on a process, to control another flow mete or a pump, there is improved control and repeatability if the settings are saved in a PC file, and uploaded every time the test is required.

> Remember the exact probe position by marking the pipe where possible.

With the Option **Save All**, you have all records: Settings + Measurement + Factory and other hidden menus and echoes.

 This function permits to compare two settings files and give a difference

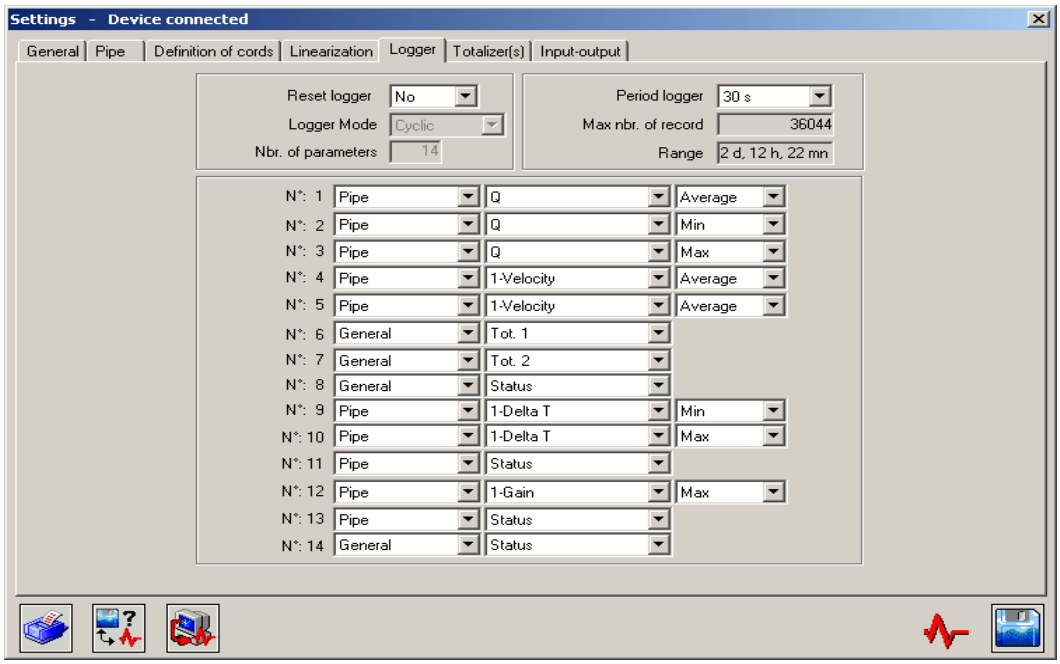
11 - DATA-LOGGER

Contents

UF 801-P / P B has a large flash memory to store running flow and data measurements. To use it you must enable the logger from the Keypad / Config. Menu or from PC Software, Settings / General.

11.1 Setting the Data-Logger

You can operate through the keypad. If you would prefer using the PC Software, select the Data-Logger tab in settings menu:



With the Keypad, you have successive programming screens, as follows:

Ultraflux **LOGGER SETTING**	**--- LOGGER RESET ---** **xxx** **-Nbr of parameters-** ********* **----Logger Mode-----** **xxxxxx** **----Logger Step-----** **xxxxxx** **----Logger Range----** **xxxxxxx**	**----- VALUE 1------** **Pipe1/**Input/General **Q AV**erage **----- VALUE 2------** **Pipe1/** **C1 Max** **----- VALUE 3------** **General** **Tot 1 xxxxx** **----- VALUE 4** **Input/Int. Fct.** **XXXX xxxxx**

Data-Logger can store up to 14 (*) simultaneous values + their time & date. Increasing the number of values reduces the total number of records and duration.

To change this number to your requirements, you need to **Reset the Data-Logger**. Before that, do not forgot to make previous data saving

The Data-Logger can be set as **Cyclic or Stop when full**.

Next set the **Logging Step or Period**. Shorter period reduces the logger range.

UF 801-P displays the available time (Nr of days / Time / Mn).

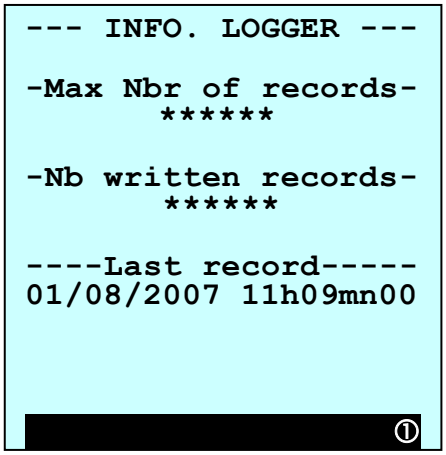
For most data applications, the UF 801-P requests you to save the average value during the recording period or the events min/max peak values.
Note that some values, Q (flow), Velocity (V), …, are attached to the pipe (pipe 1 or 2 if a PB version) and some are classified General values, as the totalizers or QT if it is a dual pipe PB version.

Return to measurement menu by F (or after up-loading setting from the PC) **starts the records**. Data-Logger will do recording immediately as long it is ON or unless it is full (if stop when full option).

If the timer / sequencer is used, the two periods are automatically synchronised.

At any time and from measurement menu, you can check some data-logger info as Max number of records,

Or number of done records and the time and date of the last record.

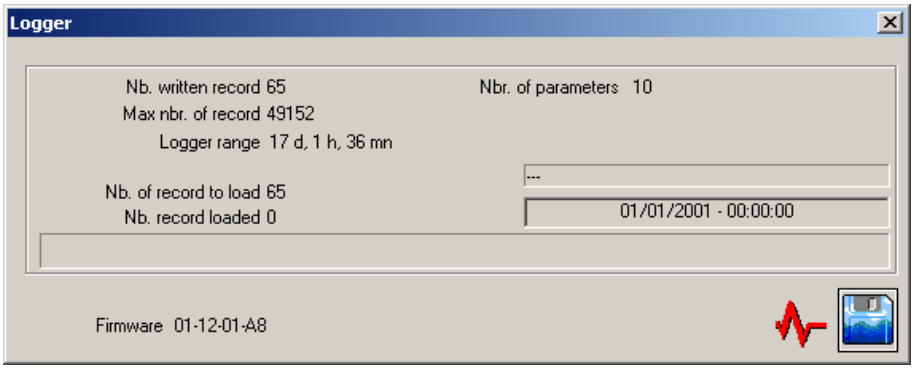


It can be useful to temporary stop the records, during the probe installation or during adjustments for instance. This prevents non valid records being edited.
You have two options:

- Change the recording period > 24 h
- Disable temporary the data-logger

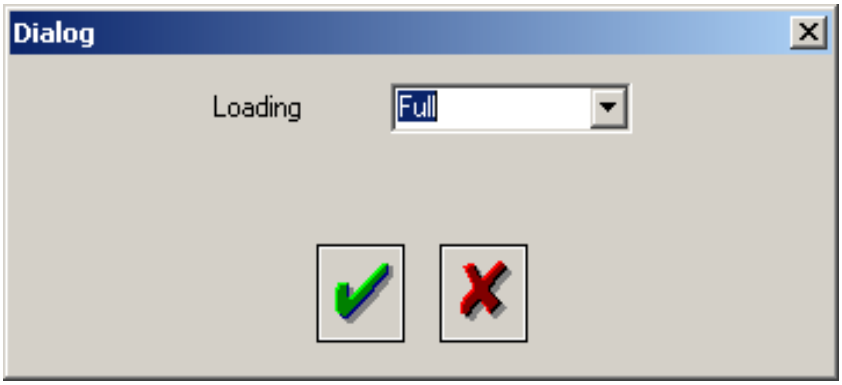
11.2 Reading the Data-Logger

Select Dialogue / Logger to open the following window :

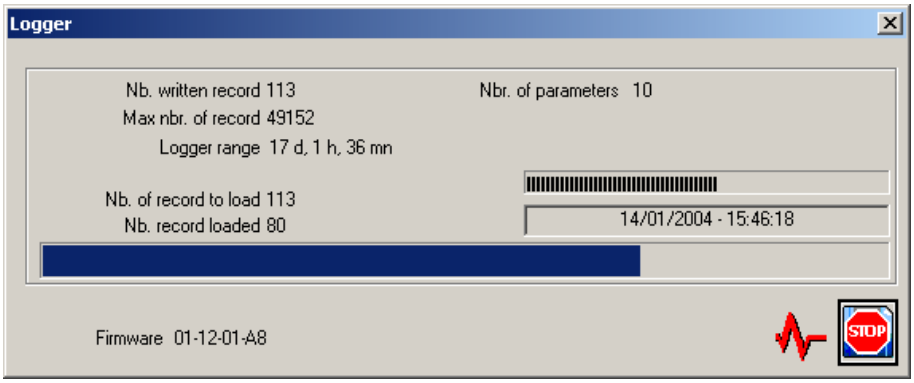


Click on the Diskette icon opens a window with two options to confirm with the green tab :

- Fully download the data logger
- Downloading between 2 dates.



You are requested to name the file to be saved. Then, downloading starts automatically. You can see it progress as follows:



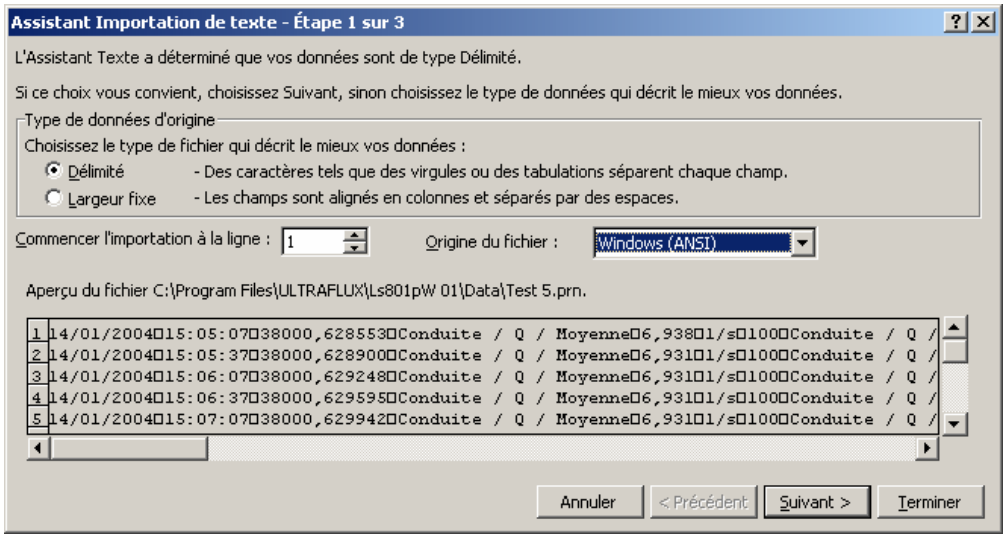
Clicking on Stop closes the file at reached Number / Time. This file is stored "by default" in the data folder with an extension [*.log]. It is Excel compatible by respecting a [*.prn] format (ASCII + Tab separators).

11.3 Editing the data logger (by Excel)

The Ultraflux Macro for Excel can do this edition through dialogue / File and the Excel icon, as it is with PC records.

The recommended method is manual edition with Excel import wizard:

Launch Excel and select the file to open (option All Files) with your browser. As the (*.log) file has a (*.prn) format, Excel asks for the wizard:



Accept Next / Next …, to Finish. **This opens Excel spreadsheet**.

It may be necessary to format column 3 that has a date + time information. Select it, then format / Cells / Date + Time format.

<u>Automatic Edit</u>:

Just after importing the data-logger, our software asks you (if Excel is available and tight) if you want to use our Macro for automatic edit.

If you accept, results will be arranged as above and the flow curve will be automatically edited.
If you have an UF 801-PB version (dual-pipe), we will edit the three curves Q_A, Q_B and Q_T.

When all is OK for you on Excel, you can rename the final file as an *.xls file, for further direct opening by Excel.

Attention ! If your recorded file has more lines than Excel can accept (32000), it could result a problem. You can save the data-logger into two files by using Stop or downloading from, or later split the file in two or more files.

12 - TOTALIZERS

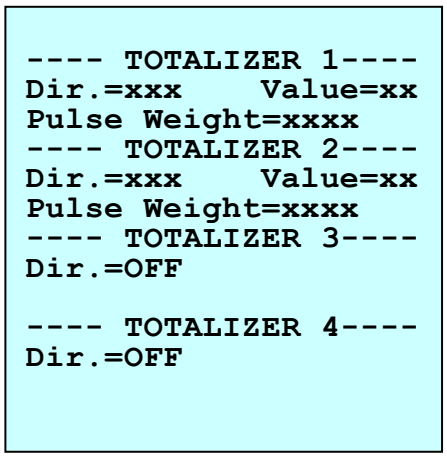
Contents

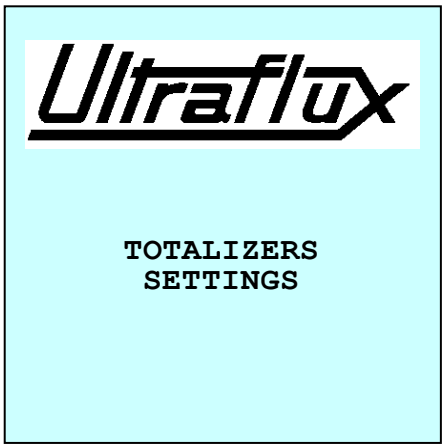
12.1 Description

As with the data-logger function, it is necessary to enable the totalizers in the instrument Configuration menu or through PC Software, Settings mode / General.

With the totalizers ON, the UF 801-P counts volume. The function is mainly used on dedicated units but can be useful with portable application: checkings of volumetric counters, flow calibrations by comparison to a standard gauge…

UF 801-P offers up to 4*9 digits totalizers, settable from software or from keypad:





Each totalizer can be set OFF to ON by attaching it to a flow direction (+ or -) or any (+/-). If your have a **UF 801-P B** dual chord version, you can select which pipe drives the concerned totalizer with flow value selection = QA / QB or QT (= sum or difference).

The pulse weight of each totalizer is set by units from 1 cl to 100 m^3. Totalized volumes (Nr + set weight) readings are displayed in the measurement menu.

Resetting of a tolalizer (or all) can be done from keypad / measurement menu, on the same page as the readings:

With A (**< --- >**) , select which totalizer you would like to reset: you can see your selection on the right of the bottom line. Accept by B pressing

With the PC software, do it from Settings / Totalizers / Reset = No/Yes) o

13 - INPUTS / OUTPUTS

Contents

13.1 Introduction

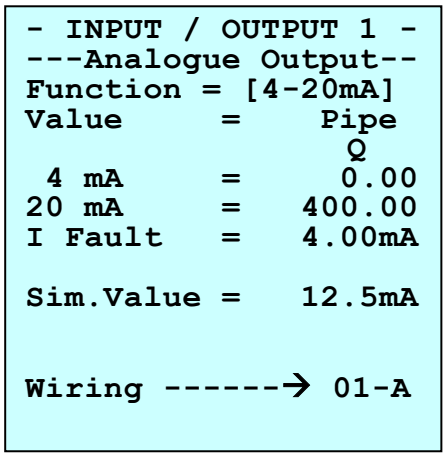
The UF 810-P / P B has the possibility to export data & measured values. For that the corresponding output modules must be installed and then be activated.

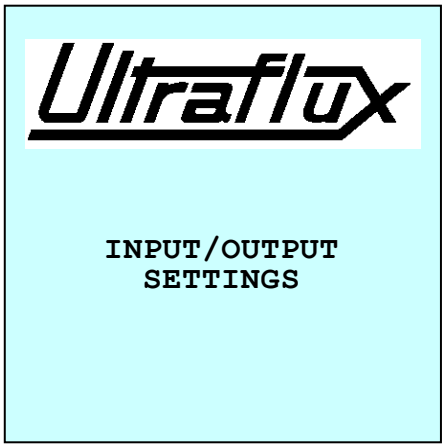
These resources are obtained by plugged internal modules that are automatically detected by the firmware. Up to 4 slots for modules are available:

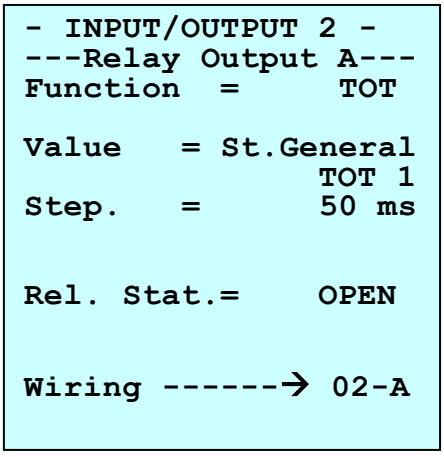
- A Current Output requires one internal module
- A Relay module includes 2 On/Off relays
- An analogue input module (current or voltage) offers two inputs.
- For PT100/PT1000 sensors, we install double module (2*T°C acquisitions)

UF 801 is delivered as standard with two modules: 1 current output and 2 relays. Optionally, it can receive two other modules

The settings can be done through keypad or PC software.
Here below, some typical LCD displays:







Header shows module N° and bottom the code for the wiring diagram.

Please refer to previous page for display examples.

13.2 Analogue Output

You can set the format: 0-20 / 0-24 / **4-20 mA** and take into account or not the sign of the concerned value by selecting this format without or with **[ ]**. So, a [4-20 mA] / Value = Pipe (A) = Q will output the measured flow without consideration of the flow direction.

You can set the flow range for 4 mA to 20 mA (end of range) with defined units.

The format 0-24 mA permits over-ranging.

At Simulation line option, you can force and simulate a current. It is useful to test wirings and connected receiver.

This analog output is **active.** It is powered by UF 801-P. It is galvanic insolated. The loop resistor must be less than 600 Ohms. If overloaded**,** it switches automatically **Off**, for circuitry safety reasons.

To use it, you must connect on the DB 15 male connector (or a dedicated one) as shown in attached **table 01-A**. It is necessary to solder two wires.

13.3 Relay outputs / pulsed output:

A typical use is to copy a totalizer increment by "Open/Close/Open" (or invert).
You must select Relay / Function = TOT.

Totalizers belong to the General data set. Select which one you want to copy (previous page shows TOT.1). Totalizers must be first activated in Config. menu.

Step is the duration of the event (time of the relay state changing). This duration fixes or limits the maximum frequency.

Next parameter sets the relay rest state (opened or closed). ON state resistor is around 10 Ohm. OFF state gives infinite resistance.

Last information is where to wire this relay circuit (Here **02-A**).

If this circuit is to be energized by the external circuit, check it respects the static relay characteristics in max. voltage, current or power : < 100 V/0.1 A/3 Watt.

Other uses of output relays

Each relay can be set separately to indicate other events, as ::

A Flow Fault Status :

```
- INPUT/OUTPUT 2 -
---Relay Output B---
Function = FAULT/DIR
Polarity = Norm/Open

Value    = Pipe (A/B)
             Q


Rel. Stat.=    OPEN


Wiring ------→ 02-B
```

Copy the sign attached to the flow direction + or

```
- INPUT/OUTPUT 2 -
---Relay Output B---

Function = Flow DIR
Polarity = Norm/Open

Value    = Pipe (A/B)
             Q


Rel. Stat.=    OPEN


Wiring ------→ 02-A
```

An alarm or an order on a low or high flow (or other measured value) threshold:

```
- INPUT/OUTPUT 2 -
---Relay Output B---
Function = THRESHOLD
Polarity = Norm/Open

Value    = Pipe (A/B)
             Q
Thresh.Val.=   xx.xx


Rel. Stat.=   Closed


Wiring ------→ 02-B
```

13.4 Frequency Output

It is possible to order a relay with a higher frequency than the totalizer copy, proportional to flow output from 0.5 Hz up to 1 kHz.

To obtain a pulsed voltage (logical 1/0) level, it is necessary to connect a DC source.

```
- INPUT/OUTPUT 2 -
---Relay Output A---
Function = FREQUENCY

Value    = Pipe(A/B)
             Q
0  Hertz =  xxx.xx
1 kHertz =  xxx.xx
Rel. Stat.=   Closed
F  Fault  =   0 Hz

Simul. F.=  xxx Hz

Wiring ------→ 02-B
```

This resource is mainly used for calibration by comparison to a standard.

13.5 PT 100 / PT 1000 RTD Inputs

These are normally confined to special functions. Those concerning PT 100 or 1000 and heat flow / energy measurement are explained in § 18 dedicated chapter.

Connection can be 2, 3 or 4 wires.

Typical acquisition accuracy with 4 wires is better than 0.1 °C.

13.6 External connections / Wiring Diagram:

From the Wiring code that you can read in above menus, connections on each Binder (12 or 8 Pts) and on DB 15 Male (recommended) are:

The here below table shows the standard wiring for each I/O label

ANALOGUE CURENT OUTPUT / VOLTAGE INPUT / CURENT INPUT

	CONNECTOR	PINS	OR	CONNECTOR	PINS
01-A	Binder 12 pts	4(+) / 5(-)	←→	DB 15M	7(+) / 14(-)
01-B	Binder 12 pts	6(+) / 7(-)	←→	DB 15M	8(+) / 15(-)
02-A	Binder 12 pts	8(+) / 9(-)	←→	DB 15M	10(+) / 11(-)
02-B	Binder 12 pts	10(+) / 11(-)	←→	DB 15M	12(+) / 13(-)
03-A	Binder 8 pts	1(+) / 2(-)		/	/
03-B	Binder 8 pts	3(+) / 4(-)		/	/
04-A	Binder 8 pts	5(+) / 6(-)		/	/
04-B	Binder 8 pts	7(+) / 8(-)		/	/

RELAYS OUTPUTS / LOGIC INPUT

	CONNECTEUR	PINS	OU	CONNECTEUR	PINS
01-A	Binder 12 pts	4 / 5	←→	DB 15M	7 / 14
01-B	Binder 12 pts	6 / 7	←→	DB 15M	8 / 15
02-A	Binder 12 pts	8 / 9	←→	DB 15M	10 / 11
02-B	Binder 12 pts	10 / 11	←→	DB 15M	12 / 13
03-A	Binder 8 pts	1 / 2		/	/
03-B	Binder 8 pts	3 / 4		/	/
04-A	Binder 8 pts	5 / 6		/	/
04-B	Binder 8 pts	7 / 8		/	/

UF 801-P is delivered with a cable having a 12 Pts Binder connector at one ending and a DB 15 Fem/Male at the other ending. Use a DB 15 M for these wirings.
Specific cables exist also. One with Binder 8 pts is dedicated to PT 100 or 1000.

14 - TIMER / SEQUENCER

Contents

14.1 Settings :

This function rarely used when you operate by yourself, thus disabled

It permits to put the UF 801 Off (rest time) and to wake up it periodically or during a set period. To help the records during these ON periods, the data-logger is automatically synchronized to have at minimum one record per cycle.

This function has multiple purposes or applications:

- You install everything now, but your interest is for a later event, during the following night for instance: UF 801-P offers a delayed auto-start.
- Your flow investigations are on flow survey at a time period (11:00 to 13:00) every day for a week: UF 801-P offers a delayed start with a periodic ON/OFF sequence.
- You want to save energy and thus keep the battery available for a much longer time: UF 801-P allows an infinitive sequential ON/OFF periods.

The Setting of the Timer/Sequencer is only available on the instrument, not through the PC.

The TIMER has four modes:

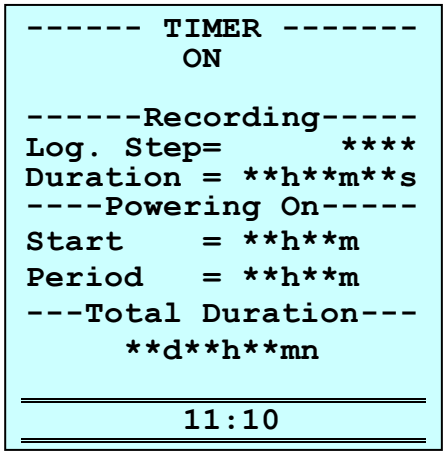
- **OFF** but enabled, for temporary reasons, as during the installation or other settings.

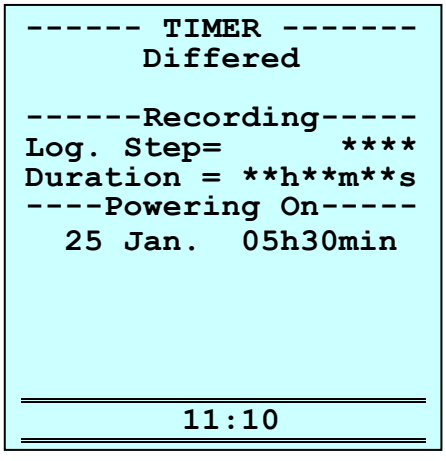
- **Differed**, thus with a delayed starting and then a measurement/one shot recording period.

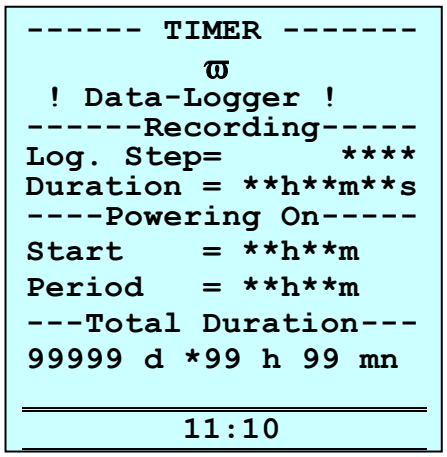
- **ON**, that offers a delayed starting and then the putting ON/OFF period with the Duration of ON state, during a whole duration (for instance one week).

- **ϖ or infinite** mode, this is very similar to the previous mode, but without time limitation except the data-logger capacity *(Set it as "Stop when Full" to keep the oldest records)*.

The different active menus are:







Very important

When your selected mode is set, you must valid it by a long press on F to returns to the Measurement menu.

Check everything is OK concerning your installation and measurement conditions.

Then, switch OFF the UF 801-P/PB.

The UF 801-P will self-switch ON at set time and then periodically (if requested) as per your settings.

Complementary information

If you have set the Differed mode, the Timer is automatically reset OFF after the operation.

If you have set the ON mode: the Timer is automatically reset after the set whole time is over.

The Infinite mode must be reset manually. You can do this when it is ON. Otherwise, proceed as below:

In any case, if the timer is started and the UF 801-P is waiting for its automatic start-up, pressing the ON button will restart the UF 801-P and give you the possibility to cancel or modify all settings that you will need to valid as before.

15 - SETTING FILES SAVING AND CALL IN UF801-P

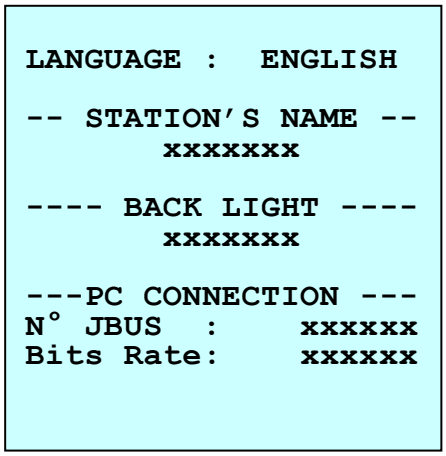
Contents

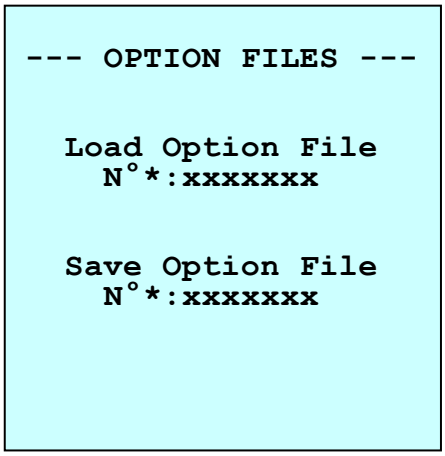
15.1 Saving and recalling of a calibration file:

The UF 801-P has memory space to store 1+2 calibrations / settings.

- The current configuration called "Config. 0"
- Two (or more) configuration spaces (1 & 2) that you are free to use.

All these operations are done from Configuration menu.





To keep a record of actual settings (now in config. 0):

- Give it a name at Station Name : Site **/** line Nr. (letter by letter)
- At Save Option File, select memory space Nr. 1 or 2.
- Validate the saved record by changing the line (V).

To recall these archived settings:

- Go to "Load Option File" line and select which one you want
- To load the file, press the down arrow (change of line)
- The corresponding data overwrite those previously in Config. 0, now lost
- If you want **to cancel a record**, just overwrite on it with a new one.

These records can be done with Simple / Normal or Expert modes. If you want to import a normal or an expert setting file, you need to configure your UF 801-P in the corresponding mode.

Settings Reset: UF 801-P has a permanent memory of the typical factory settings. They correspond to our tests, and UF 801-P is normally delivered with these data as actual settings. To re-install this factory settings file, select **"Settings Reset" and "Yes"** in configuration menu.

16 - PIPE WALL THICKNESS MEASUREMENT

Contents

16.1 Pipe wall thickness measurement :

The measurement principle of an ultrasonic thickness gage is very common. We have developed one dedicated to UF 801. A probe includes an emitting cell and a receiving cell in the same body and that look each other with some convergence angle to the pipe wall. When the probe is coupled to the test piece, the short emitted pulse is transmitted into this material and then reflected by the other side of the test piece or its first boundary layer and is returned to the receiving cell.

With the knowledge of the longitudinal sound velocity in the tested material and the transit time measurement, we can know with accuracy (< +/- 0.1 mm) the thickness of this layer.

This pipe wall thickness knowledge is very important for flow result accuracy.

You need this **SE_1701** probe or an equivalent to use this function.

It is delivered as an option. Menu is available in standard.

16.2 Installation procedure :

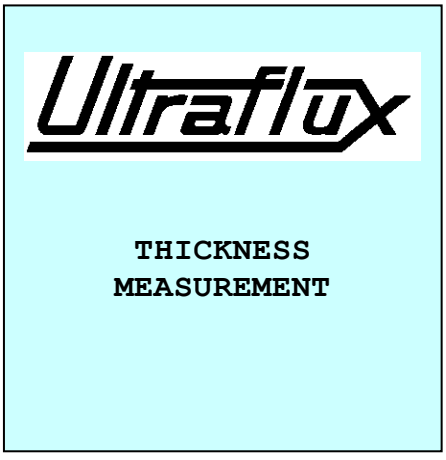
- Connect the probe SE1701 to the 'UF 801 P, at probe input channel A.

- Clean the pipe at measurement location.

- Spread some coupling gel at this location and on probe face.

- Take the probe and keep it pressed on the pipe until expected display

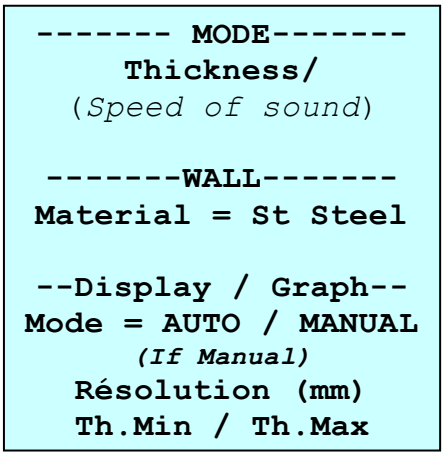
Select whenever you want during previous operations the Thickness Measurement menu of UF 801-P :



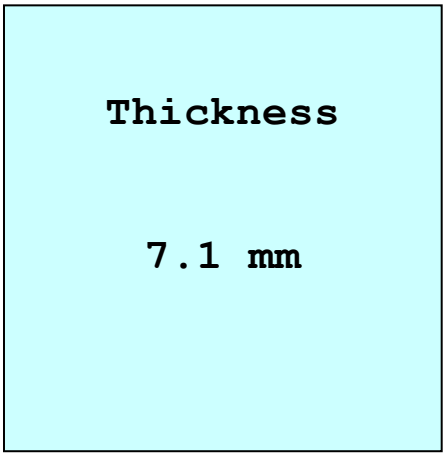
Select the function "Thickness"

Select the right material in the list (*Otherwise refer to Celerity mode explained further*).

Select AUTO Mode.

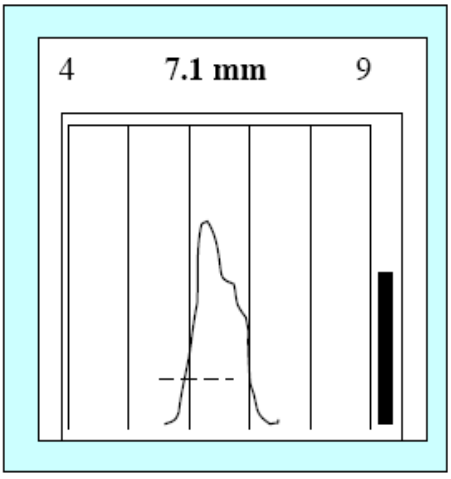


The Thickness measurement result should be displayed :



We recommend using the second measurement display screen, which shows in addition the echoes signals quality.

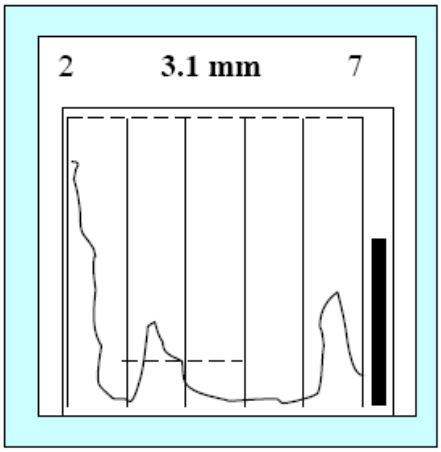
In Auto mode, the used echo is automatically centered in the display window, with min/max thickness values (5 mm width).



Nous conseillons d'utiliser l'écran avec graphique sur lequel vos pourrez voir les échos et la confirmation de l'endroit où se fait la mesure. La fenêtre d'affichage se centre automatiquement sur l écho sélectionné.

In Manual mode, you can set this window width by changing the resolution parameter.

The dotted horizontal line shows which echo is considered for the thickness measurement.
Is it the right one ?



With the graph, you can have complementary information on the echo and other conditions attached to the wall thickness: corrosion, including crystallization (as with grey cast iron):

- The **vertical bar** graph gives you information on echo strength.

With very thin pipe walls (less than 3 mm on steel) the danger is to measure the second echo and display two times the wall thickness correct value. Graphic mode allows you to check the numeric value and, if is wrong, to estimate it from the graphical vertical graduations.

Thickness probe orientation: from the probe face, you can see the separation wall between emitter and receiver. With more importance on the results with thin pipe walls, it is recommended to orientate the probe to have this separation perpendicular to the pipe axis.

Keep the probe perfectly perpendicular to the measured wall.

16.3 Sound velocity measurement in a material:

We must consider the longitudinal wave. If this C Material value is unknown or with a not sufficient accuracy, the method is to do a test on a known thickness wedge done with the same material than the pipe.

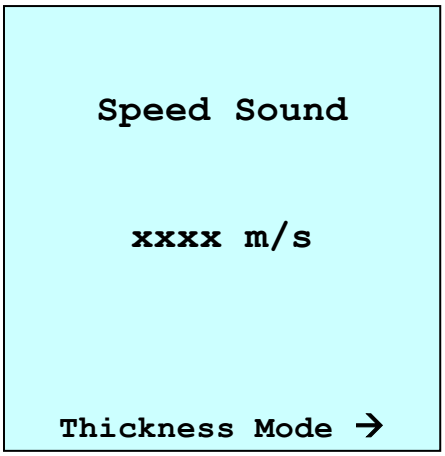
Select mode Speed of sound".

Enter the wedge thickness.

Go to the next display :

The corresponding sound velocity must be displayed >

Press B to send this result to thickness mode.



This result is entered in Material = Other / CM

You can note for the next similar control.

Now, the thickness control of the pipe should be more accurate.

This control can be very important for flow results accuracy.

Attention ! Ultrasonic thickness measurement method does not permit to know the thickness of an internal liner nor internal deposits layer.

17 - CUSTOMIZED FONCTIONS

Contents

17.1 Introduction

We name « Function motor » a special or specific function that is or can be optionally implemented in UF 801-P firmware. Such a function uses selected internal or externally acquired results to deliver a calculated result that is of the most interest for the application.

A typical application is to calculate P & T influence compensated and corrected flow and volume, as it is necessary with gases or petroleum liquids.

For that, UF 801-P uses currently its acquisition module possibilities.

17.2 Special Functions

The 'UF 801-P architecture allows us to adapt easily special functions on request. This is submitted to duly explained conditions and specifications, and also some development fees after both parties acceptance.

17.3 To day available functions :

One of the first functions that is now developed and available for sales is the heat or caloric flow application.

It is explained in the next chapter § 18.

18 - CALORIC HEAT FLOW/ ENERGY MEASUREMENT

Contents

18.1 Introduction

This function involves optional acquisition modules and function.

When equipped, the UF 801-P can measure the heat flow rate (K Watt) and the heat quantity (K Watt-h). Such a calculation that can be done manually later from records of actual flow and temperatures is here automatically done in the unit.

The applications allow for the performance testing such as heat exchangers, boilers, the power and energy sent to a building for central heating …and is applicable to cold exchangers as well

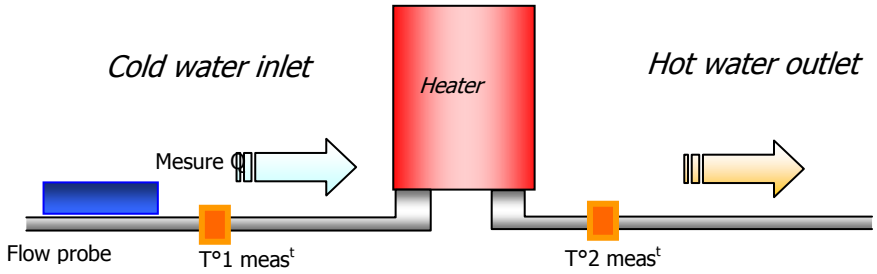
To keep the flexibility of a non-invasive measurement, as it is with ultrasonic clamp-on probes, we propose to install clamp-on thermal sensors, as PT100 / PT1000/Din quality. Insure the best coupling to the pipe with a heat conductive paste. If invasive probes exist, they should offer a better accuracy, thus we recommend using them.

We recommend our new modules for PT 100/PT1000, with possibility of 2, 3 or 4 wires connection to optimize cable length compensation. They offer a typical accuracy of +/- 0.1°C.

The temperatures can also be acquired through analogue input modules.

Comment on heat flow accuracy: Supposing a delta T°C of 20 °C between the inlet and outlet of the circuit, an error of +/- 0.5 °C on each T acquisition can make 5 % error on the heat flow energy. Thus, it can be important to do better.

18.2 Typical installation on a heater



Equipped with this function and two T probes, the UF 801-P measures and displays the two temperatures (inlet and outlet), their difference and compute the energy flow from the raw flow rate and the characteristics of the fluid.

Actual Energy flow (delivered or exchanged) is displayed in kW and Energy is totalised in kWh.

So, it is easy to control the efficiency of an heater or an heat pump, or a thermal exchanger by comparing results to energy consumption.

Caloric Power : $P = Q * m * C_p * \Delta T$

Où Q = Volume flow rate(m3/s)
m = Density (kg/m3)
C_p = Fluid characteristic (K Joule/kg.°C)
$\Delta T° = [T_1 - T_2]$, temperatures (°C)

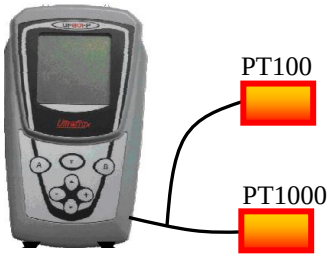
Energy : $E = \Sigma P*dt$

18.3 Wirings

To connect PT 100 or Pt 1000 to UF 801-P, two wirings are possible:

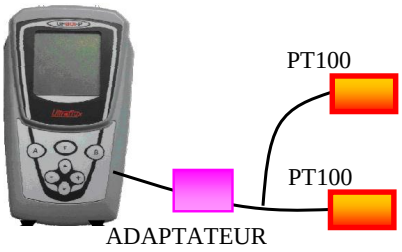
A ready for use Cable with already connected PT 100/1000.

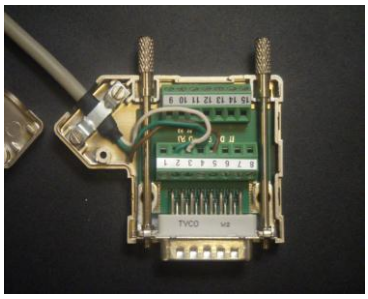
The 8 Pts Binder plug uses the second entry on UF 801-P



A Binder Cable with at its other ending a dedicated connection box with terminals.

Here, any type of PT 100 or PT 1000 can be connected

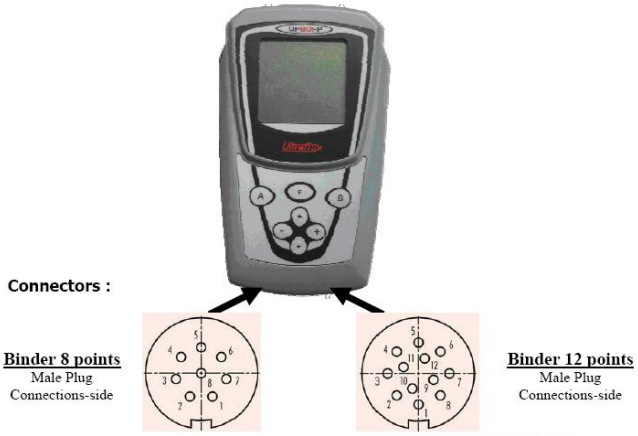




Attention ! We cannot mix PT100 and PT1000on a same application.

The terminals for connections are shown as it is for the other I/O modules.

If it is a two pipe application (UF 801-PB) with this heat flow function, it is necessary to use the two Binders _ and 12 Pts for the T probes.



18.4 Physical data settings:

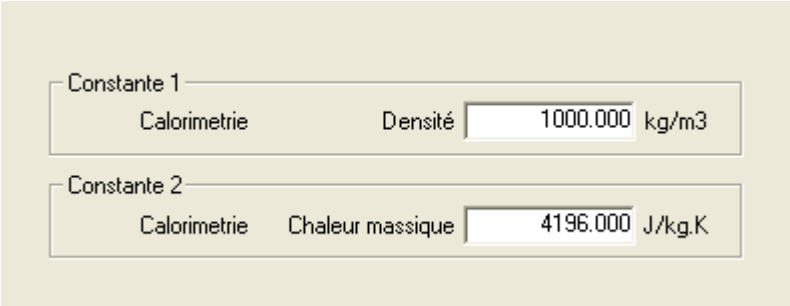
Through the keypad or PC software as well, it is important to enter the fluid characteristics that concern the caloric calculation : its density at T and its caloric/massic:

Through keypad :

Set these data in menu « Function Settings», in respect of the shown units.

With PC software :

In « Settings », when this heat flow option is installed, it appears a new Tab named "Function".



18.5 PT100 or PT1000 RTD settings

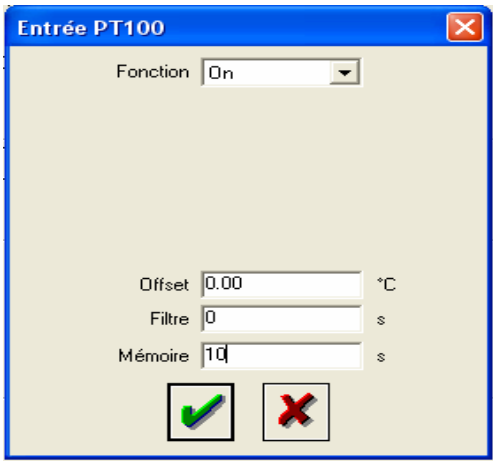
The temperature acquisition modules are factory calibrated or controlled on very accurate resistor used as standards to simulate min / max T range.

Meanwhile, any PT100 or PT1000 can bring its own deviation, depending on its class and exact accuracy. It is the same concerning the wirings flowing 2, 3 or 4 wires connection.

The proposed adjustment is to balance the offset difference for a pair of probes. Install these two probes in the same T°C conditions and note this displayed T difference.

This offset can be compensated through the PC software. It is available as long you use the same pair of RTD probes.

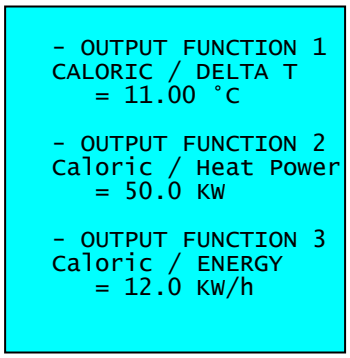
This menu is in Settings / Input or Outputs tab / PT 100 (1000) / Offset:



18.6 Measurements reading

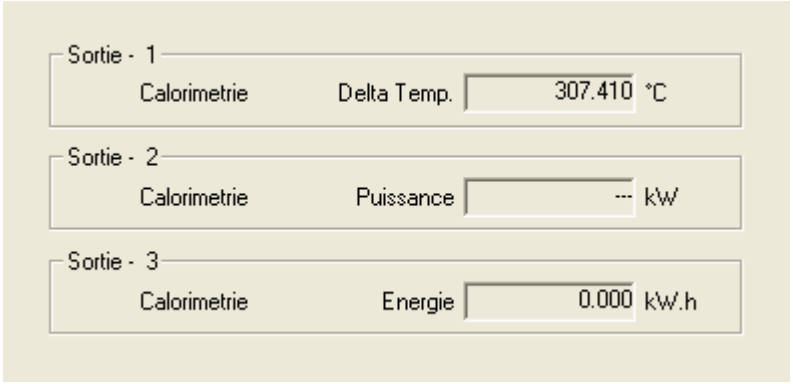
On the UF 801-P :

Measurement menu / dedicated display



On the PC

Menu « Measurements » / Tab « Function » :



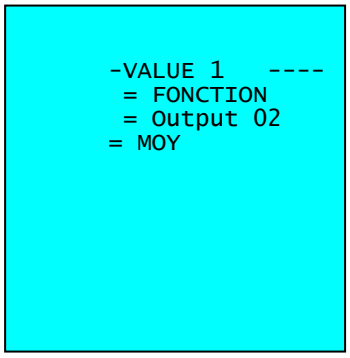
18.7 Recording and reading with the data logger

The results records and then their reading are allowed through the data logger. It is necessary to set first the data logger accordingly to record the above shown functions outputs that you want to record.

Directly on UF 801-P :

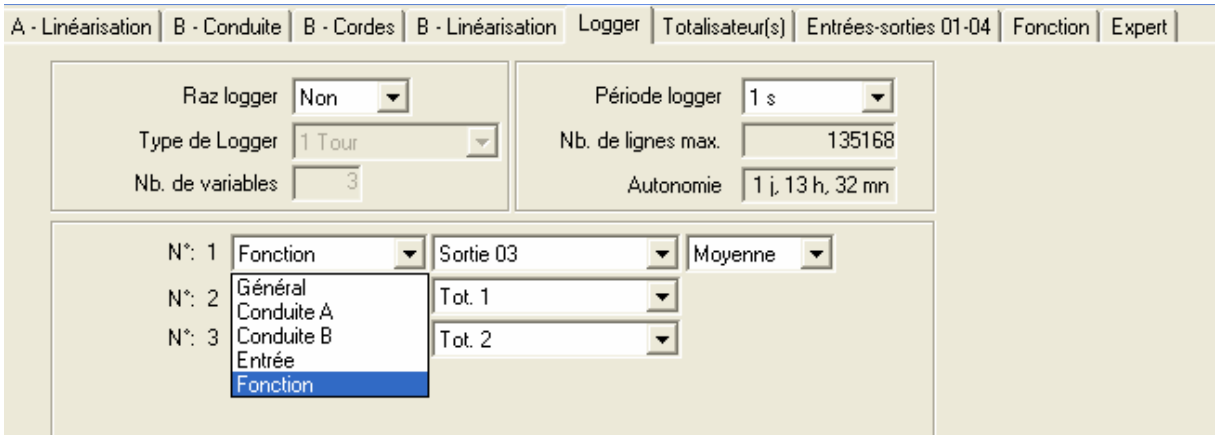
After have entered the selection menu for records (data logger), select « function » and then the output values that you need to record.

Value N° 1 is for the Delta T °C / Value 2 is for the Power and value N° 3 is for the Energy (equivalent of a totalizer for the power).



With PC software :

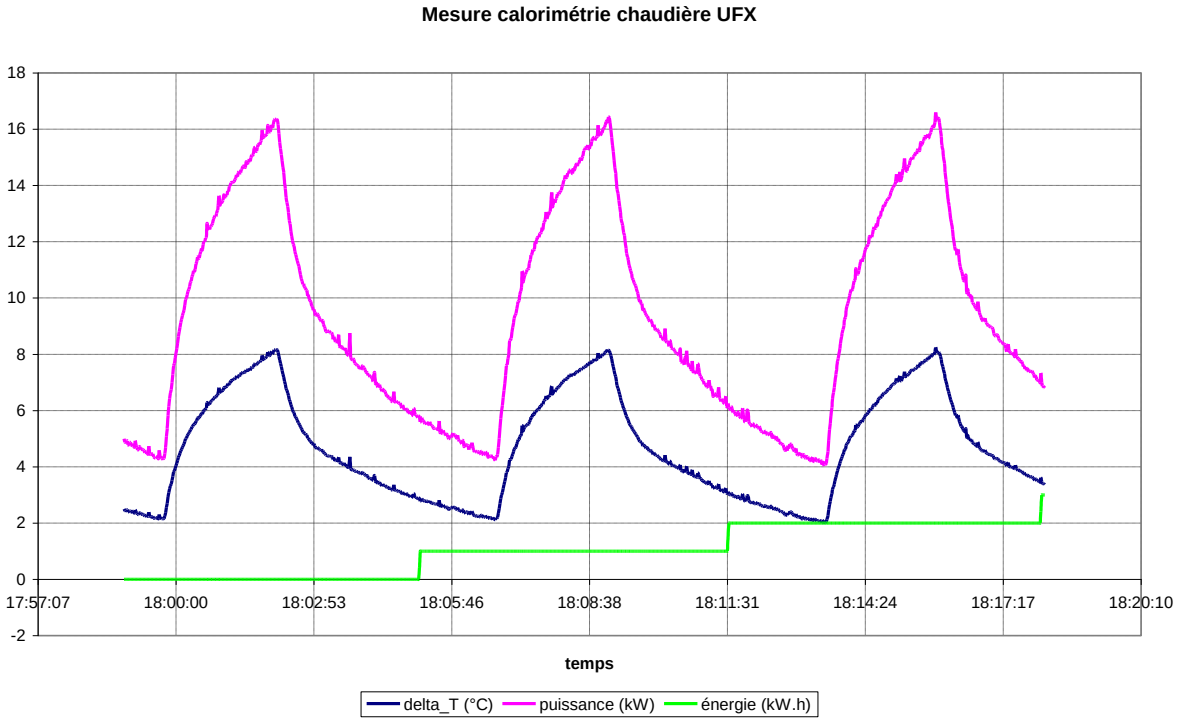
«Settings » menu / Tab « Logger ». Select Function and output N°



You must remember the used units, because they cannot be changed and data logger will only store results numbers without showing their unit.

Example of records after treatment with Excel

The graph below shows as example records on a heater for house warming.
You can see the cycles with heating periods (T °C and Power increasing) and hot water energy flow delivered to the installation:



The theoretical power of the heater is 35 kW, but here the peak power is less than 20 kW, with an average power of 8 to 10 kW because gas burning is done during only 30% of the time.

Supposing that you can know the gas or fuel consumption an its theoretical caloric power, it is very easy to calculate the global efficiency of the heater.

As so, with a heat pump installation, having a water / water or air / water exchanger, measure at the same time the electricity consumption.

18.8 Typical physical data

Caloric specific heat characteristics for water: (/ P = 1 bar or above if T>100 °C)

T °C	P bar	d Kg/m^3	Cp (J*kg^{-1}*k^{-1})
0	1	999.8	4218
10	1	999.7	4192
20 (*)	**1**	**998.2**	**4182**
30	1	995.7	4179
40	1	992.3	4178
50	1	988.0	4181
60	1	983.2	4184
70	1	977.7	4190
80	1	971.6	4196
90	1	965.2	4205
100	1.01	958.1	4216
110	1.5	950.4	4230
120	2.0	942.9	4245
130	2.75	934.3	4265
140	3.6	925.8	4285
150	4.5	916.5	4312
160	6.2	907.3	4339
170	8.0	897.0	4373
180	10.0	886.9	4408
190	12.5	875.7	4452
200	15.5	864.7	4497

(*) This yellow line shows the by default values as used by UF 801-P for caloric heat flow calculation.

Additive as ethylene glycol in mixture with water can slightly change above values..

Avec If the energy / heat flow carrier is oil, it is necessary to compensate with the ratio of the two products Water / Oil.

19 - BATTERY & CHARGER

Contents

19.1- Battery & Charger

UF 801-P/PB has an internal NiMH battery pack. This pack includes some protection against short circuits, an over charging or over temperature.

This battery is permanently supervised by a dedicated component & circuitry that looks for all input/output currents. This component, after self calibration (see below) will show its **autonomy time as a % of the full capacity** at a dedicated line in measurement menu. It also drives the fast/slow charging sequence.

To prevent damage due to a too low battery voltage, these supervising circuits have an automatic power-off, if this voltage becomes lower than an internally set threshold.

User battery life: Completely charged new batteries should offer a continuous use of 12~14 hours. It is possible to increase this service time by using the ON / OFF sequencer (See §16).

Charger use / Charging time: Connect the charger at Mains 100 to 240 V AC 50/60 Hz (Green LED must be lighted) and plug-in the output to UF 801-P dedicated connector. The typical charging time is 2.5 hours.

When battery is charged, the charge supervisor switches from high to low current, to maintain the charge but also to supply an UF 801-P that is kept ON.
In that case, the charger can be considered as an external supply. No problem to use this supply module during a long period, but monitor the unit periodically.

Attention! If you detect a too high temperature at UF 810-P/PB back or any abnormal situation, please unplug the charger supply and advise Ultraflux after sales service.

How to re-initialize the battery supervisor? To have a correct display of the battery level, it is necessary to calibrate this range in relation with the actual battery condition. To do this, do a complete cycle after the UF 801-P has been automatically powered off by low battery voltage detection (that set the zero %) up to the maximum charge (that sets the 100%).
We recommend doing this every two months.

19.2 Battery pack whole life (exchange: see 20.4)

Any battery pack has a limited life depending on the complete number of charge/discharge cycles, and also the care you have had for their use.
NiMH technology offers typically 500 complete cycles following IEC standard.

So, during your UF 801-P life, it will be normal to exchange the battery pack.

20 - TROUBLESHOOTING & FAQ

Contents

20.1 General Recommendations:

It is important to separate site problems (the most frequent) from setting problems or device problems.

A particular care must be taken with geometrical measurements, specific to each site. This is the responsibility of the end user, as it is for probe selection.

It is always possible to come back to the original settings of your UF 801-P when it was delivered, with the function "Re-init" + Yes.

Please, keep us in touch and stay informed about the firmware and software up-grading, which can be easily done through the serial link with adapted tools.

20.2 Typical Troubles or Situations

Once the installation, connections and parameters have been set up, there may be several possible situations:

- Case 1 – The measurement displayed and transmitted meets your expectations.
- Case 2 – The measurement operates but is inaccurate or is unstable.
- Case 3 – The measurement is not reliable or the UF 801-P is displaying a Fault.
- Case 4 – The UF 801-P has no display or the buttons are inactive or shows a fault.

Case 1 : Although everything appears to be OK (Flow Rate = OK), check the other displayed values as:

The echo shape and amplification gain level, compared to typical values:

- With external probes, a gain exceeding 60 dB indicates difficulty, such as wrong probes, incomplete installation or coupling, corroded pipe, absorbent fluid …
- For intrusive probes, the gain level is usually low (excepted for gas))

➢ *Use the Echo Display menu facilities*

The quality index I.Q., which is normally = 100 % or close value, is too low:

- This indicates several possible disturbances, as electrical interference, passage of bubbles, or high % of suspended solids…

➢ *In-depth investigation is advisable on the process to improve conditions.*

The displayed speed of sound should be close to that expected, indicating good control of the geometry on this application. Otherwise:

- *Check again pipe diam., pipe wall thickness, distance between probes.*

If the flow can be interrupted, check the Zero.

- *You can use the Auto-Zero menu or enter manually the offset.*

Case 2 : In addition to the points mentioned above, you could have some questions as those that follow:

There is a poor installation or poor data control, with wrong settings concerning dimensions or fluid properties.

- *Reanalyse and correct.*

There are bad hydraulic conditions (too short straight length from disturbance…):

- *If possible, change the location of the probes.*
- *If installation was in Direct mode, try with a Reflex mode, less sensitive to hydraulic disturbance.*
- *Otherwise, choose K_Hydro = Manual and adjust this correction coefficient to compensate this particular flow profile and have a reliable flow rate reading (Flow = f (1/Kh).*
- *With insertion probes, it is also possible to adjust the Axial Distance.*

The range of sound velocity (Delta C) is set too short for the fluid range:

- *Set your Co and Delta Co accordingly.*
- *On a very large pipe, Direct mode may be preferred to a Reflex mode*

To permit a greater precision or a wider flow range, the UF 801-P allows a 10 points "Linearization". This function is normally unused with portable units.

- *If needed, plot the error curve and enter the corrective data points.*

The Delta t is too low, in the measurement conditions, to claim any measurement accuracy: pipe I.D. not adapted, probes …

- *Is it possible to revise these choices? Install probes on a smaller pipe? Use W mode?*

The measurement conditions are showing a risk of turbulent to laminar flow transitions:

- *Adapt if necessary the declared Critical Reynolds and its range (LBR)*

- *It is also possible to force a compromise with Kh=Manual and value depending on probes position: placing them just after a disturbance should force a turbulent flow and a Kh around 1.08 ~1.10.*

Case 3 : The UF 801-P is ON but does not display the flow:

If the UF 801-P displays **" !!!! "** at screen bottom, this message means that there is no valid ultrasonic signal or that the signals exist but the UF 801-P is not configured or set to treat them.

Never forget the Echo display / Oscilloscope mode: it will give you the key for 95 % of encountered problems.

- *A common reason is because the echo is out of the receiver window because of programming wrong pipe diameter, probes mode (/, V,N or W)…*
- *Is the pipe full or partially full (not purged), or empty?*
- *Excess bubbles? Pump cavitations? Water fall just upstream before the pump such as inlet to a wet well…*
- *Check connection to the probes and cables.*
- *Is the pipe wall transmitting ultrasonic signals? (Concrete pipe / corroded pipe …)*
- *Is the installation mode suitable for conditions? > Try Direct mode (\) or other sensors.*
- *Are the probes correctly installed? > orientation, coupling …) .*

Case 4 : The UF 801 has no display or some of its functions are inactive.

If there is no display and no backlight:

- *Is the UF 801-P powered up?*
- *Is the battery charged?*
- *Switch ON/OFF after connecting the charger module as an external supply.*

- *If nothing changes, there may be a hardware problem: contact Ultraflux or his representative.*

The UF 801-P is **OK on the charger** but **still faulty on the battery** (after charging):

- *This may indicate a problem on the charge, from supervisor circuit or on the battery itself (short battery life).*
- *Same, refer to Ultraflux for service or control.*

The UF 801-P keypad is inactive:

- *Switch OFF/ON and let the unit ON to discharge the battery and give a full recharge.*
- *If this problem persists, please contact Ultraflux.*

Attention! After a very low battery state (or after have disconnected it), thus below a low-low voltage threshold, it is necessary to reinitialize the internal clock. This operation requires the Software and a PC connection.

- *The data-logger and the timer need reinitializing.*

If any installed module is not giving the expected function, please check that it has not been damaged.

- *Please refer to the corresponding § and menu and activate the simulation mode.*

20.3 Other investigations

If there is a difficulty or a problem, an in-depth analysis can be done with our assistance by phone.

Please, do not hesitate to contact us for site support.

20.4 After Sales Services (SAV)

Attention! Only Ultraflux qualified technicians are allowed to open a UF 801-P / PB (adding a module, maintenance purpose).

The IP 67 or 68 keeping depends also from.

When to exchange a battery pack?

UF 801-P includes a supervision module which purpose is to prevent from damage or depolarization. But, any battery pack has a limited life depending on the complete charging/discharging cycles and also the care that you have had for their use.
For easy reconditioning, the UF 801-P battery pack is easily removable, but, this operation must be done also by an Ultraflux qualified agent or you loose our Guaranty and some instrument characteristics.

We decline any responsibility in case of unauthorized opening.

21 - APPENDIX

Contents

In this appendix, we provide information on some physical data that you may need. Many other references are in our didactic handbook or can be obtained from general data bases, i.e. the Internet.

21.1 Pipes typical dimensions:

The safest investigation is to use pipe manufacture specifications. Then, a short check on site will confirm the data.

When pipes, as Stainless Steel pipes, PCV pipes, copper pipes, **have printed marks** showing their dimensions, read and apply them in the UF 810-P settings.

Note that some pipes use metric units concerning their ID. It is usually the rule with cast pipes as cast iron (with or without cement liner). So, "Pont-à-Mousson" (French manufacturer) considers 400 mm I.D. for a 400 mm pipe. From the circumference and O.D., you will have the whole pipe wall thickness.
It is similar with most of concrete pipes, asbestos pipes, GRP pipes …

ANSI / API pipes consider O.D. dimensions and are labeled in inches. The thickness and also the I.D. depend on the pipe pressure schedule. So:

- For pipes with diameter 14" and above, the O.D. is obtained by multiplying this Nominal pipe size by 2.54. A 20" has its O.D. = 508 mm.

- With 10 and 12", consider 10.75 or 12.75. With 6" and 8", consider 6" 5/8 and 8" 5/8. A4" has its 4.5"=114.3 mm OD and so one.

21.2 Roughness Coefficient for pipes:

This has some influence on the flow calculation, especially on small pipes. The problem is that this characteristic is rarely known. We must usually estimate it. > Please refer to NT 122 manual for typical values.

As a quick guide, we can recommend as typical values:

- Drawn pipes / non ferrous metal, glass, plastics: 0.002 to 0.02 mm if some deposits.
- Drawn steel & Stainless Steel pipes: 0.02 to 0.06 mm, up to 0.10 if rough or with deposits.
- Welded Steel pipes : New = 0.05 to 0.1 / Long usage but cleaned = 0.15 to 0.50 / Very old or encrusted or corroded = up to 4.0 mm
- Cast Iron with lining (bitumen, cement, epoxy) = 0.1 to 0.2 / without lining = 0.2 to 1.0 / encrusted or corroded = up to 3.0 mm.

21.3 Sound Velocity in Fluids :

The speed of sound in a fluid is physical characteristic of this fluid which may be linked to other characteristics, such as density (d), pressure (P), temperature (T) or the % of two or several miscible products, or with another magnitude having good analogy, like compressibility.

For most miscible products like refined petroleum products or petrochemical bases, experience shows a reliable and accurate relationship between the speed of sound and the density of the product for constant P and T or the concentration of the mixture.

But, some other products show deviations of sound velocity depending mainly on fluid compressibility.

Water has special and unique characteristics, but presents a very reliable relation between this sound velocity and the temperature that allows a number of tests to be run on the installation (see below).

Gases have lower speed of sound than liquids.

Refrigerating fluids are in the wide middle range, with high P & T coefficients.

21.4 Applications on Water :

Water has a very reliable "speed of sound < > temperature" relationship which will be put to good use whenever possible for dimensional checking: from T, you can predict this speed and compare it with the result obtained by UF 801-P on the basis of the measured transit time and the set-up dimensions. A deviation may require these values to be reexamined, like L for intrusive probes or the pipe diameter and its thickness for external probes.

The following simple equation gives a good estimation of C between 10 and 100°C: $C_{m/s} = 1557 - 0.0245 * (74 - T_{°C})^2$

The following table defines the customary values more accurately.

t (°C)	C (m/s)	t (°C)	C (m/s)
0	1 403	30	1 506.4
5	1 426.5	35	1 520.1
10	1 447.6	40	1 529.2
15	1 466.3	45	1 536.7
20	1 482.7	50	1 542.9
25	1 497		

The water solid content has little influence: this table can be applied to raw or waste water.
When compared with other fluids, the water temperature coefficient for C is positive up to 74°C. Beyond that, the water becomes a conventional product again.

The water pressure coefficient is relatively low, at around 0.15 m/s per bar.
The presence of salts as Na Cl in solution increases the value of C by approximately 1 m/s per g/l.

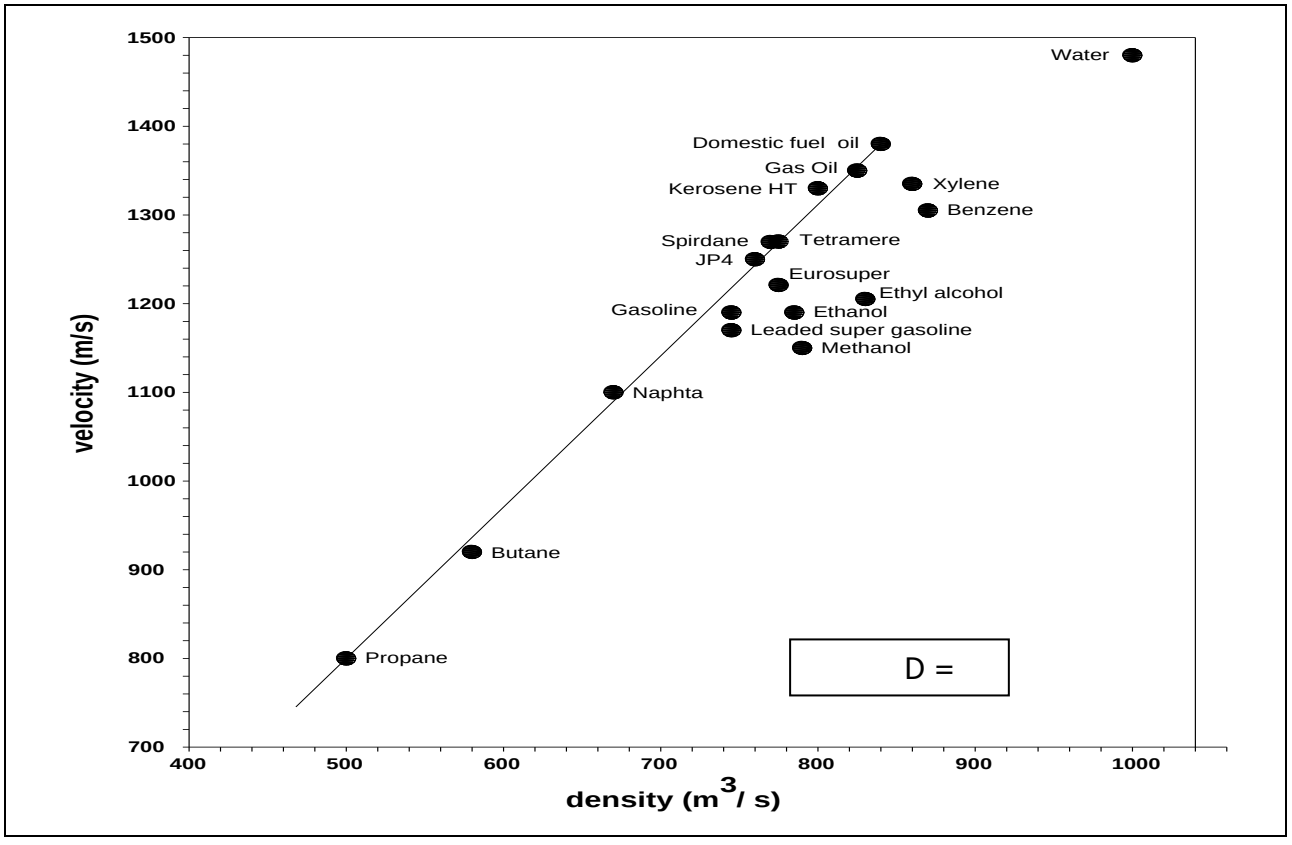
The addition of glycol ethylene increases also the speed of sound within the proportions:
For instance: 30% > 1670 m/s and 50 % gives 1705 m/s.

Overheated water involves curve or graph networks taking into consideration P & T. Consult us.

We give complementary information after on the Cp to take in account energy measurements.

21.5 Applications on Petroleum Products :

These data are given at 1 bar / 15 °C, except for Butane and Propane (5 bars)



This speed of sound varies also with the pressure and temperature, in a larger proportion compared to water. For instance:

- Influence of pressure = + 1 m/s per bar for liquid butane and + 0.4 m/s per bar for diesel oil.

- Influence of temperature = - 6 m/s per °C for butane and – 4 m/s per °C for diesel oil.

Chemical or Other Products :

The list of products has no limitation. From version 4, UF 801-P offer a more completed list of typical products encountered in the industry.

If you need some prior to test information, please ask us.

You can also do some tests by yourself, with the method explained in § 7.2

21.6 Applications with Gas

Gases are characterized by lower speed of sound, much lower than for liquids.

Temperature coefficients are positive (0.2% per degree approximately), and pressure has low influence. Consult us for more details.

Here are two usual gases examples:

- Air: C = 341 m/s at 20 °C / 1 bar.
  Approximate formula is $C = 20.1 * (T_{°K})^{1/2}$

- Natural gas: C around 400 m/s at 15 °C / 1 bar