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NT 228B GB2

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UF 801-P / UF 801-PB

**NEW GENERATION ULTRASONIC
PORTABLE FLOWMETERS**

1 - INTRODUCTION

Thank you for choosing Ultraflux as your technical partner. We have offered since the 1970's a full range of portable and fixed flow meters.

We have over 30 years' experience and expertise using Ultrasonic techniques including following developments:

- The 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 and ATEX 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, precautions 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, manuals and PC tools, exist, in different languages, with a minimum of English and French, which are freely selectable.

Make sure you have read and understood this manual before using the UF 801P

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Ultraflux, UF 801-P / PB and attached probes or accessories are registered trademarks of Ultraflux S.A.

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 content 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 permit where required. Probes, connection and instrument handling... could cause sparks, 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 equipment is CE certified.

UF 801-P is typically specified as IP67 and has been successfully tested IP68 under 2 m of water for 8 hours. However, 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, do not consider the instrument so 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 : conforms 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 would only be considered as associated to Ex mb IIC T6 with relevant transducers and attached cables. The Converter would have to be in the safe area.*

Please refer to official documents / conformity certificates


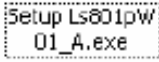
3- Other Certifications:

All equipment is flow tested before delivery, and compared to a standard.
On request (but not free of charge), the instrument can be delivered with a calibration certificate. Contact sales for further details.

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

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

2 - TABLE OF CONTENTS

1 - INTRODUCTION	2	7.1 Introduction	35
2 - TABLE OF CONTENTS	6	7.2 Additional Parameters of « normal » mode:	35
3 - APPLICATIONS	8	7.3 Zero / Auto Zero Settings:	36
3.1 Overview	9	7.4 Additional Parameters in Advanced mode:	37
3.2 Measurement Principle	10	7.5 Response time / flow display filtering	38
3.3 Typical Applications	11	7.6 Factory Settings (Advanced mode only)	39
3.4 Probes, Supports and Accessories (see also § 5)	12		
4 - HANDLING THE FLOWMETER	14	8 - DUAL PIPE VERSION (UF 801-PB)	40
4.1 Presentation / Scope of Delivery	15	8.1 Introduction to UF 801-PB	41
General precautions / Cleaning:	16	8.2 Complementary displays :	41
4.2 External Connections	17	9 - ECHO DISPLAY MENU	43
4.3 Connection to a PC or another terminal	18	9.1 When and How Use this menu ?	44
4.4 Using the Keypad:	19	9.2 Examples of echoes and criteria	45
4.5 The Menus Review	20	10 - PC Software	46
4.6 The Configuration Menu:	21		
4.7 The PC Software : General	22		
5 - PROBES INSTALLATION	23		47
5.1 Probe selection criteria:	24	10.1 Installation & Connections	47
5.2 Selection of the Measurement section	24	10.2 Menu « dialogue »	48
5.3 Probe Coupling :	25	10.3 Editing, Archiving and/or printing a file	52
5.4 First measurements:	26	11 - DATA-LOGGER	54
6 - SIMPLE MODE	27	11.1 Setting the Data-Logger	55
6.1 Mode « Simple »	28	11.2 Reading the Data-Logger	57
6.2 Measurement Menu:	29	11.3 Editing the data logger (by Excel)	58
6.3 Pipe/Fluid settings for the application	32	12 - TOTALIZERS	59
6.4 Probes choice:	32	12.1 Description	60
6.5 Distance between Probes (clamp-on)	33	13 - INPUTS / OUTPUTS	61
6.6 Other Settings:	33	13.1 Introduction	62
7 - NORMAL & ADVANCED MODES	34	13.2 Analogue Output	63

13.3	Relay outputs / pulsed output:	63	18.2	Typical installation on a heater	80
	Other uses of output relays	64	18.3	Wiring	81
13.4	Frequency Output	65	18.4	Physical data settings:	82
13.5	PT 100 / PT 1000 RTD Inputs	65	18.5	PT100 or PT1000 RTD settings	82
13.6	External connections / Wiring Diagram:	66	18.6	Measurements reading	83
14 -	TIMER / SEQUENCER	67	18.7	Recording and reading with the data logger	84
14.1	Settings :	68	18.8	Typical physical data	86
15 -	SETTING FILE SAVING AND RECALL IN UF801-P	70	19 -	BATTERY & CHARGER	87
15.1	Saving and recalling of a calibration file:	71	19.1-	Battery & Charger	88
16 -	PIPE WALL THICKNESS MEASUREMENT	72	19.2	Battery pack life (exchange: see 20.4)	88
16.1	Pipe wall thickness measurement :	73	20 -	TROUBLESHOOTING & FAQ	89
16.2	Installation procedure :	73	20.1	General Recommendations:	90
16.3	Sound velocity measurement in a material:	76	20.2	Typical Troubles or Situations	90
17 -	CUSTOMIZED FUNCTIONS	77	20.3	Other investigations	93
17.1	Introduction	78	20.4	After Sales Services (SAV)	93
17.2	Special Functions	78	21 -	APPENDIX	94
17.3	Currently available functions :	78	21.1	Pipes typical dimensions:	95
18 -	CALORIC HEAT FLOW/ ENERGY MEASUREMENT	79	21.2	Roughness Coefficient for pipes:	95
18.1	Introduction	80	21.3	Sound Velocity in Fluids :	96
			21.4	Applications on Water :	96
			21.5	Applications on Petroleum Products :	97
			21.6	Applications with Gas	98

3 - APPLICATIONS

Contents

- 3.1 Overview
- 3.2 Measurement Principle
- 3.3 Typical applications
- 3.4 Probes, Supports and Accessories

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 channel version that offers double menus and multiplexed resources. We will consider mainly UF 801-P except some points as mentioned in §9.

Both versions 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. It displays the following results:

- The flow velocity
- The volume flow
- The totalized flow
- The sound velocity
- Process / fluid data and user information.

The **correct probes** must be selected with respect to pipe diameter, pipe or fluid conditions, pipe wall temperature etc.

> 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 wall thickness.

UF 801-P can operate in different languages. This selection is made in the Configuration Menu.

A short form guide NT 227 is available. This NT 228 manual is the reference manual.

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

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.

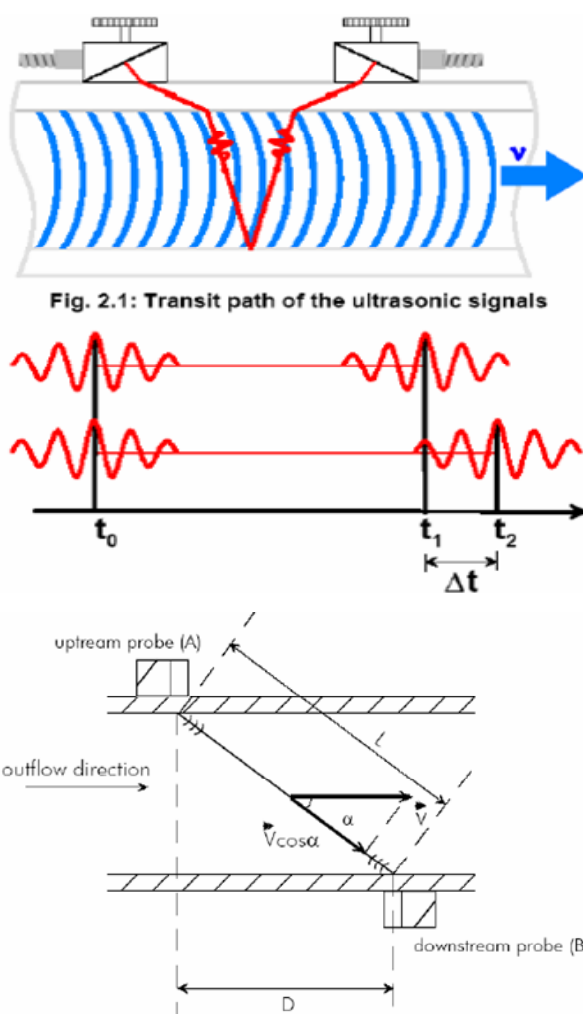
Each record can be the average or min/max peak value during the recording period. This can reduce the number of records without losing information.

3.2 Measurement Principle

As stated above, please refer to our NT122 didactic handbook on the included cd. It contains useful information on the measurement principle, ultrasonic wave transmission, hydraulic conditions, flow profile and Reynolds Number

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

Contrary to the electromagnetic principle, conductivity has no influence. So, with two probes with following installation:



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

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

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

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

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

$$Q \text{ (Flow)} = S \cdot V_{US} / Kh \text{ (m}^3/\text{h ...)}$$

$$\text{Volume} = Q \cdot \text{Time} \text{ (m}^3 \text{ ...)}$$

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

Always keep in 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, whilst retaining the same final accuracy as any respectable flow meter. Compared to previous or existing devices or to our competitors, this new device sets a new performance standard.

The concept is a smart use of hardware and firmware resources, to easily 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 used for temporary replacement of any flow-meter for flow indication, regulation and as a volume totaliser.

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. Limitations may come from very high corrosion or thick internal pipe deposits. Generally the lower the probe frequency, the higher 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, any quality, from ultra-pure and non conductive to sewage applications. This includes hot water circuits.

Clamp-on sensors are very convenient for petrochemical products, acids or any liquid presenting some corrosion or vaporisation risks.

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. It offers a very high repeatability when repeating 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 production / consumption figures.*



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.

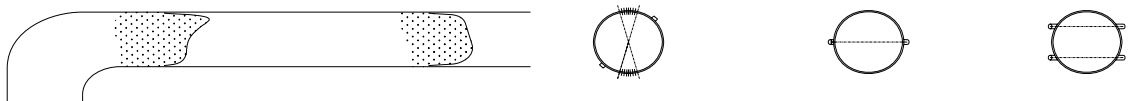
UF 801-P menu lists the standard available probes:

- **Clamp-on probes are referenced SE.** Each reference is attached to an internal table with the probe frequency, the beam angle and dead time.
- **Insertion probes or wetted probes are referenced SM.** The attached table considers only the crystal frequency and the dead time in probe face. If the 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 straight lengths, mainly upstream from the probes, but also downstream, in order to benefit from a predictable and stable hydraulic profile.

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

Avoid deposits or accumulation of gas. Sensor installation near the crown or base (+/- 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 depth and then the alignment or orientation of the probes for the same pair (to have parallel faces). L is the exact distance between probe faces' and D is the projection part of L that is concerned with the flow: $(L - 2 * l_o) * \cos(\text{angle})$

Once these adjustments are finished, it is necessary to measure with accuracy the face to face distance L between transducers and its projection D on the flow axis. Note these "As Built" values and enter in UF 801-P menu.

! The final flow accuracy depends on the data provided.

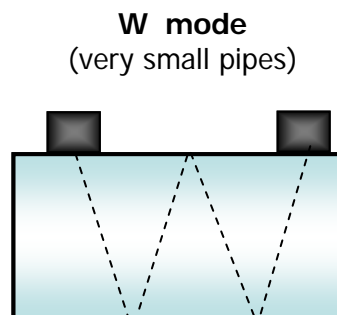
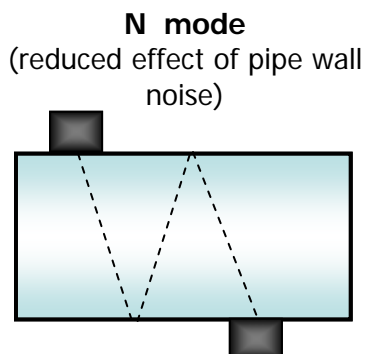
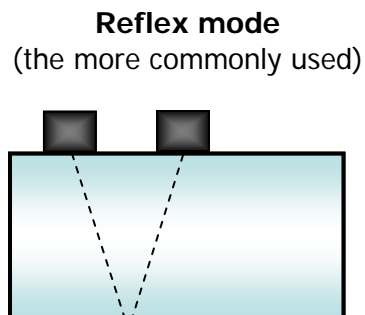
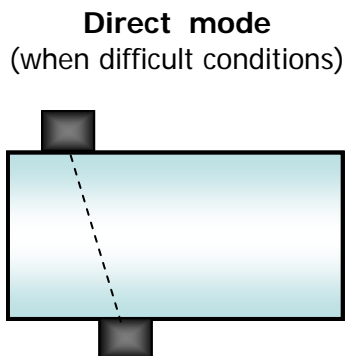
With external probes, the flexibility does not exempt the user to ignore the above rules.

The choice of a Direct (\), Reflex (V), 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:



4 - HANDLING THE FLOWMETER

Contents

- 4.1 Presentation / Scope of Delivery
- 4.2 External Connections
- 4.3 PC Connection
- 4.4 Using the Keypad
- 4.5 Menus Review
- 4.6 The Configuration Menu
- 4.7 The PC Software : General

4.1 Presentation / Scope of Delivery

On delivery, please make sure the following items are enclosed (standard scope of delivery):

- 1 Transport case
- 1 The UF_801-P or P-B converter with 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 / data sheets

Depending on your selection / P.O., different probes and supports related to 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



General precautions / Cleaning:

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

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

Do not expose the UF 801-P/PB to sunshine, the LCD display can over heat and damage the liquid crystals; do not expose to freezing conditions.

To keep clean, please keep the UF 801-P/PB inside the protective pouch.

The UF 801-P can be delivered with a transparent protection tape on the LCD display PU glass, to prevent scratches. Contact Ultraflux for protection and replacements.

Clean instrument with a soft cloth. Do not use detergents. Alcohol solution is acceptable.

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

Take care with the enclosed magnets (Supports SE/SU 1707...). Do not remove from the housing.

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

If storing for long periods (several months), please note that the batteries will discharge (current drain from the clock...). We recommend a complete recharge 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)

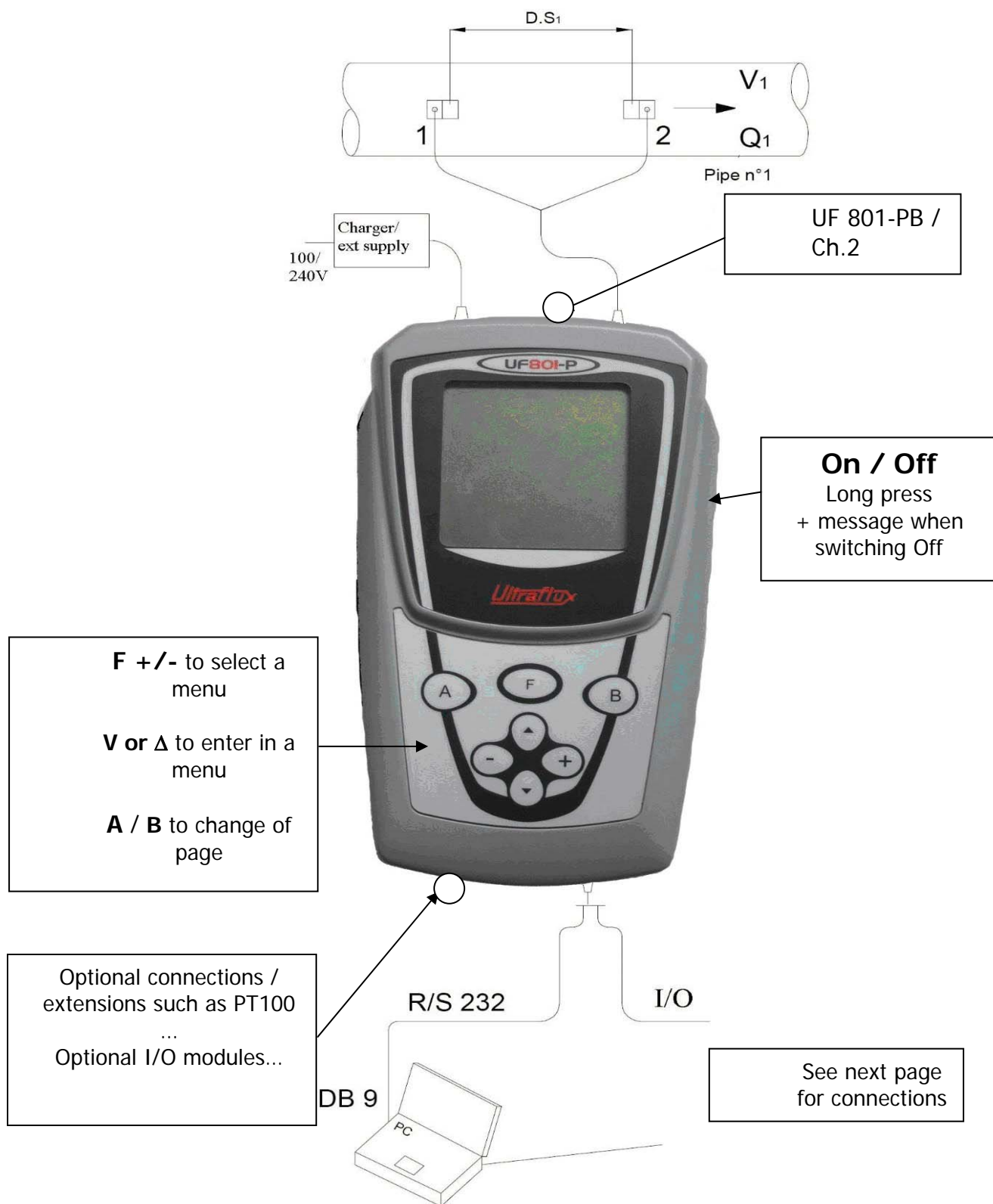
Look through the different menus, without changing the settings at this stage.

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

Inside some menus, pressing A & B can have a dedicated function that is shown at the bottom of the relevant display screen, (i.e. "default screen" selection in measurement menu).

4.2 External Connections

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

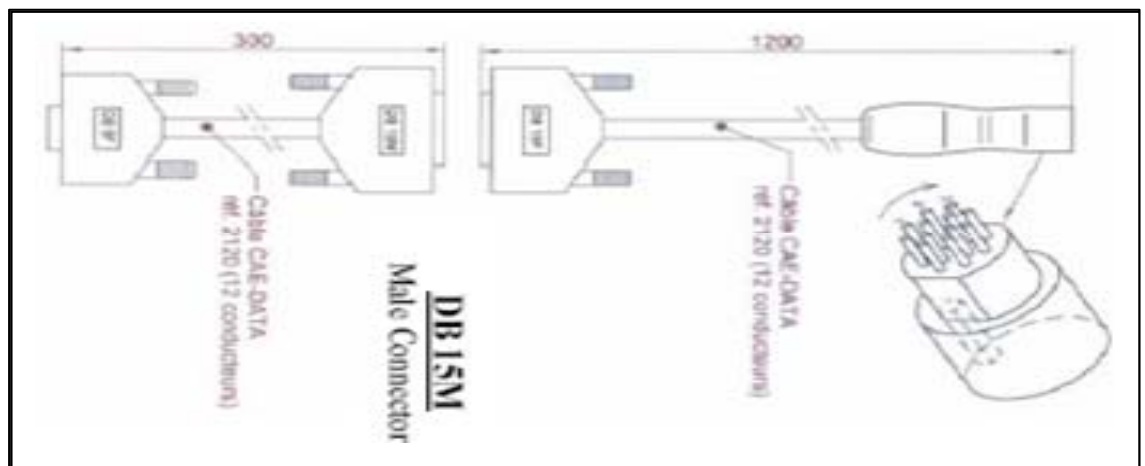
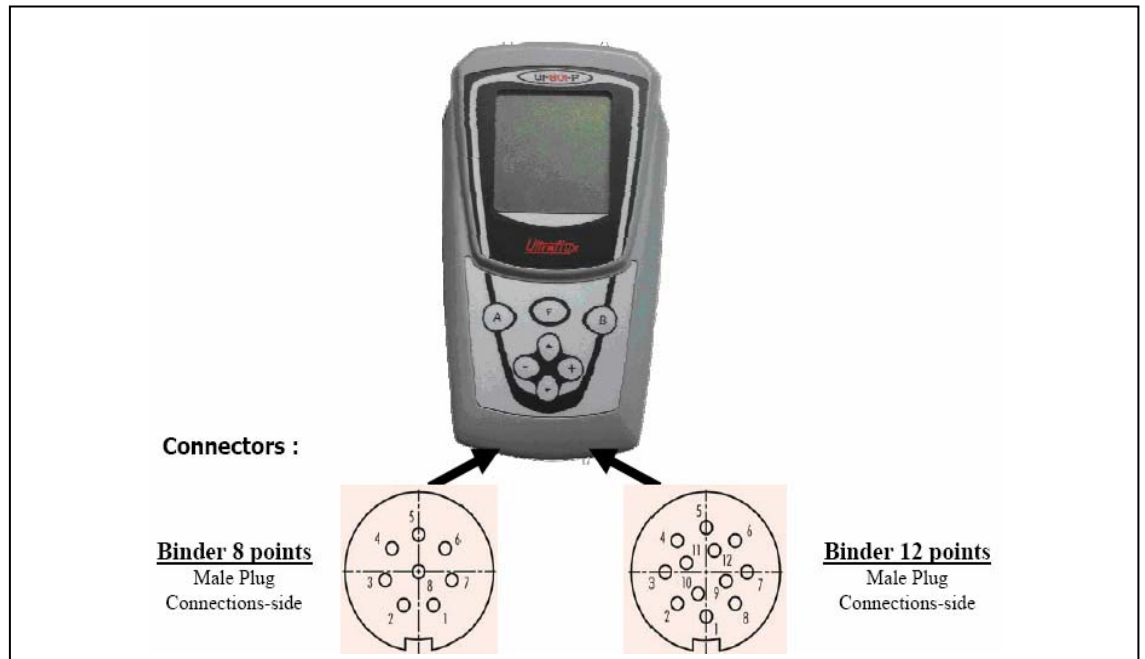


4.3 Connection to a PC or another terminal

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

Connection to a PC is required for data logger download. The delivered cable is ready for use directly on a RS 232 port or on a USB-232 port converter.

Other connections can be wired on the DB 15 to transmit or to acquire analogue 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**, the UF 801-P displays its configuration (serial Nr, Hardware / Firmware revision), its main settings (with probe reference) and starts 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 to go to the next screen,

or alternately 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) , the display returns automatically to the measurement display screen that was selected with **B** (see * above).

4.5 The Menus Review

Pressing  once gives access to the Configuration menu.

Pressing  twice gives access to Pipe / Fluid Settings Menu

Pressing  three or more times, or  then  or 

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

We list here below these different menus:

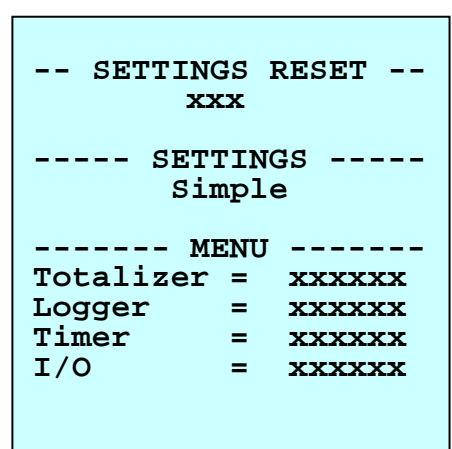
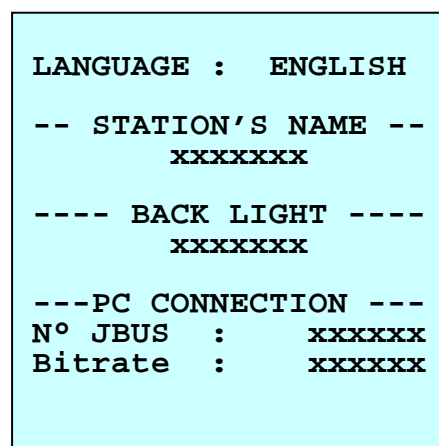
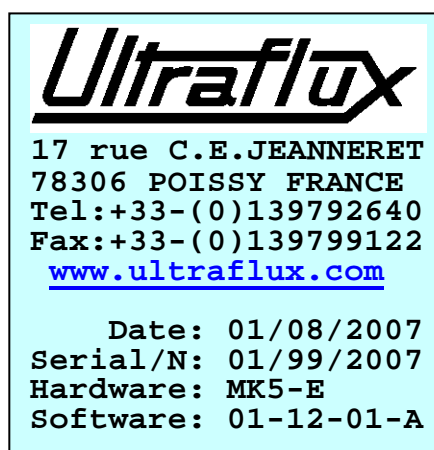
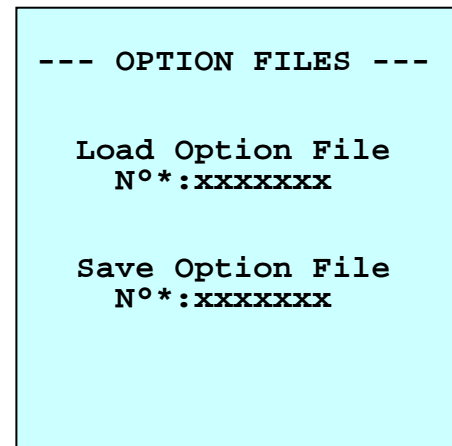
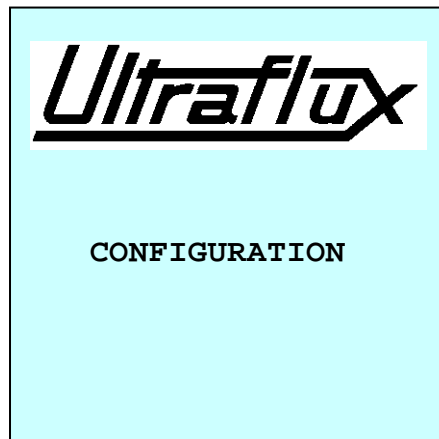
<u>Menu</u>	<u>Description / Function</u>
Configuration	This menu selects general choices, such as the language or settings level, and activate or disable I/O or logging resources.
Pipe / Fluid Settings	Sets the pipe geometry & fluid characteristics and the probes.
Totalizers	Volume count settings: units...
Inputs / Outputs	Sets the 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	Pipe wall thickness.
Linearization	Used for optimised calibration accuracy
Factory settings	Setting of some advanced modes ...

Remark : some menus may not appear and are displayed only if set in the configuration menu.

4.6 The Configuration Menu:

Select basic, simple or advanced measurement for more complex configuration.

The menu shows the manufacturer information and the instrument version.

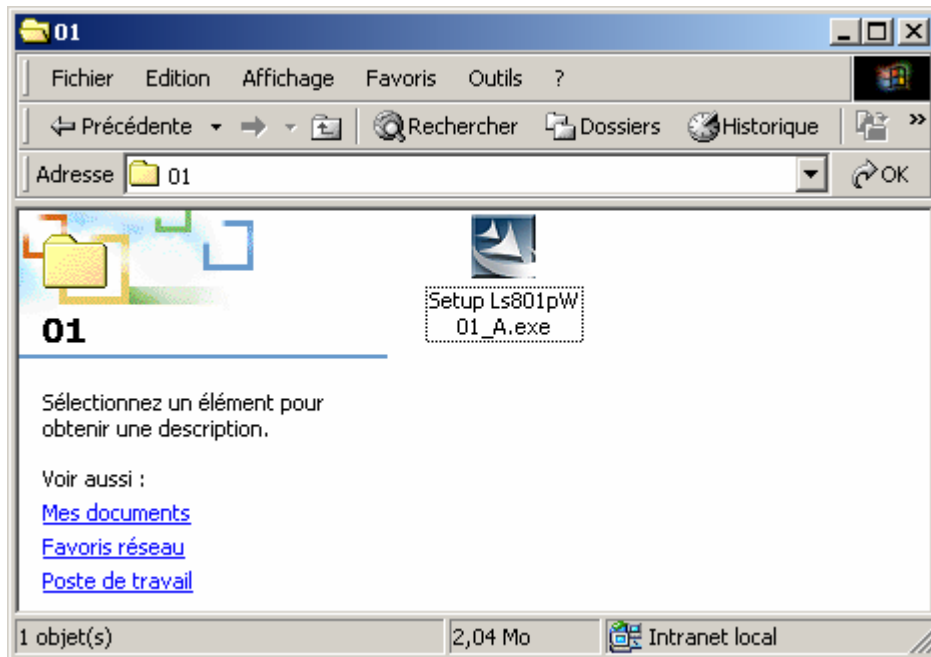


4.7 The PC Software : General

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

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

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



This software works on **all Microsoft Versions** from Windows 98, including: 2000 or Millennium, NT, XP pack 1 or 2, Vista.

The installation prompts the creation of an **Ultraflux folder in Program Files** and makes a sub-data file to store your results or settings.
It asks also for the preferred **language**.

The installation prompts **connection to your installed Microsoft Excel** version.
It is your choice to accept this connection. It is useful for exporting the data-logger.

N.B.: Some languages (i.e. French) consider the coma as a **decimal separator** and others (i.e. English) use the decimal point. Take care if changing the standard option and ensure the correct format for your Excel settings.

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

Important! To allow execution, it is required by Excel 2000 or 2003 or later versions to set the accept level in Excel menu: **Tools / Macro / Safety / Medium**.

5 - PROBES INSTALLATION

Contents

- 5.1 Probe selection criteria
- 5.2 Selection of the measurement section
- 5.3 Probes Coupling
- 5.4 First Measurements

5.1 Probe selection criteria:

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 influence signal quality: high signal damping or high distortion may have limitations and require 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 / $F = 2 \sim 4$ MHz
- Recommended sensors for pipes 15 to 80 mm are SE 1586-E2 / $F=2$ MHz

Lower frequency transducers are less sensitive to poor conditions and are more suitable for larger pipes: the Delta T is more important and it has a reduced effect on the zero and flow results.

For medium and non corroded pipes with DN 60 to 1000 mm, 1 MHz probes are recommended:

- SE_1515 (SE_1707) or our SE_1662/S

For larger pipes DN 0.8 m to 10 m or corroded pipes and loaded fluids, the recommended choice is:

- SE_1599-I / $F=0.5$ MHz.

Most 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 for carbon steel pipes. SE 1714 or SE 1586 includes an elastic bungee for fast attachment.

5.2 Selection of the Measurement section

See 1.4 and our NT122 for general purpose recommendations.

Most of the following rules apply:

- Easy access.
- Check for sufficient space to install probes (including support).
- Select for a straight length of pipe.
- If you detect upstream aeration or cavitation (i.e. pump cavitations), 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 probes on weld seams.
- If the installation must work for several days, check the diagnostics.

In case of turbulent to laminar flow transition risk (very rare with water), there are extra recommendations in Expert menu.

5.3 Probe Coupling :

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

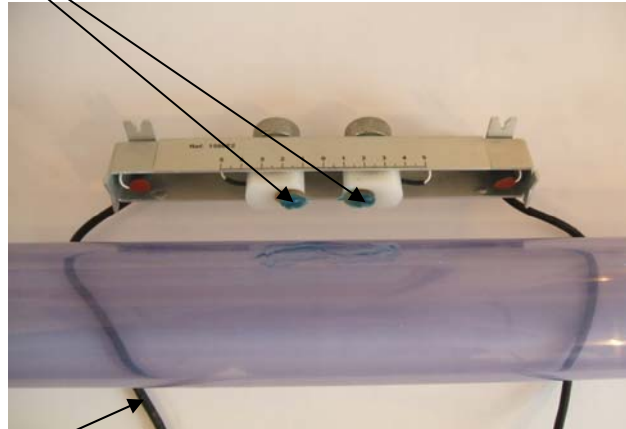
Simple preparation can be done with a paper tissue or old cloth piece. If the pipe is very dusty, use a metallic brush.

No need to remove good paintwork.

If paintwork is flaking off, remove 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, 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 the probe support.

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

Avoid slipping the probe along the pipe: this may break the coupling.

5.4 First measurements:

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

First operation is to connect the **UF 801-P to the probes**. Use the cable with a Y termination. If too short (large pipe, or for access to pipe work), use the extensions if supplied or ordered. It is recommended to use a pair for symmetry.

To obtain positive flow, connect cable N°1 to the upstream probe and cable N°2 to the downstream probe.

As soon probes are connected to the correctly programmed UF 801-P, the flow reading should be available.

To check that conditions are OK, or if there is no result, use the echo display menu to view the ultrasonic signals. See § 9.

If the « no measurement situation » persists, check the following:

- Bad coupling?
- Air under probe face?
- Coupling has degraded?
- Old flaking 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 of probes?

More information is given in trouble shooting chapter.

6 - SIMPLE MODE

Contents

- 6.1 Mode « Simple »
- 6.2 Measurement Menu
- 6.3 Pipe & Fluid settings.
- 6.4 Choice of probes
- 6.5 Distance between probes
- 6.6 Other settings

6.1 Mode « Simple »

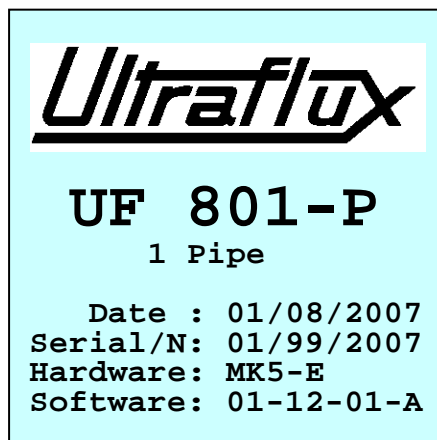
This menu is dedicated to flow measurements on water, at ambient temperature, with minimum settings.

This mode is selected in the configuration menu, plus additional possibility to add optional functions (I/O, data logger ...):

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

- Product = Water with $C_0=1472$ 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

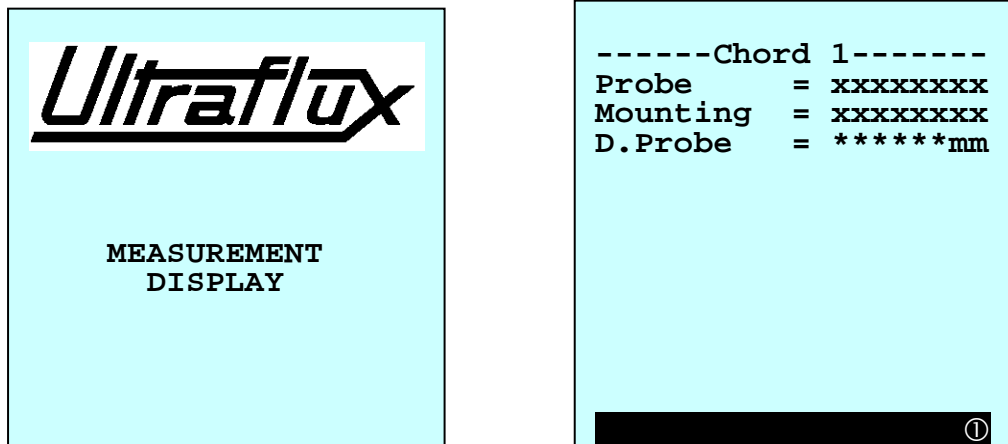
Assuming your instrument is already set in simple mode, after switching ON, the UF 801-P displays menu title, the instrument configuration and serial numbers (see 3.3), and the chord / probe configuration (see 6.4).



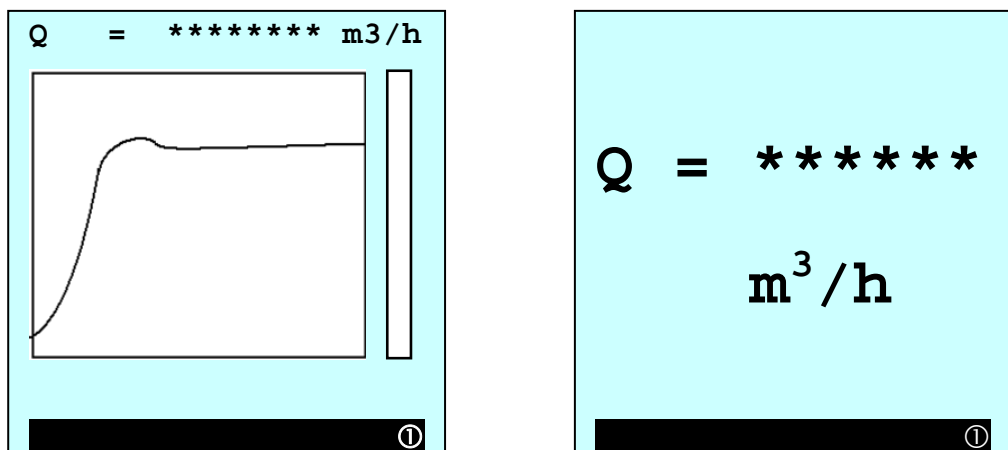
Alternately, a long press on  switches the device to measurement menu.

6.2 Measurement Menu:

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



The default display is the screen that you have already selected with **B** or the screen selected at any time among the following displays (see 3.1), large or small characters, numerical or graphical ...



More information on measurement conditions is available (ultrasonic, hydraulic, pipe condition...), and shown on following screens:

```

----- PIPE -----
-----Chord1-----
Velocity = *****m/s
Sp.Sound = *****m/s
Time     = *****µs
DeltaT   = *****ns
Gain=**dB IQ =** %
    
```

```

-----PIPE-----
Flow      = *****m3/h
KH        = *****
Rey       = *****mm
Velocity  = *****m/s
    
```

The flow velocity shows actual conditions compared to the typical flow range of a flow meter (0.5 to 5 m/s).

A low velocity value indicates that actual conditions are more likely to have errors.

The Reynolds Number (see NT122) shows the flow turbulence coefficient.

If the value is less than 4000, the laminar flow transition threshold is close.

The KH shows the applied automatic correction coefficient for the typical flow profile.

It assumes the probe measurement section selected has 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) facilitates correlations with water temperature.

Transit time is the raw transit time measurement.

Actual Delta T (given in nanosecond) is 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, the actual accuracy limits need to be checked.

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.

Fault 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.

----- FAULTS -----		
-----General-----		
xxx	xxx	xxx
-----Pipe-----		
xxx	xxx	xxx

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

At the bottom of the measurement screen, if display shows $\Delta\Delta\Delta\Delta$, this is fault warning: > Consult fault report.

01/08/2008 11h10mn33
---Battery Range---
78%

This screen shows actual date and time.

And the battery condition (see 19.1)

08/01/2008 13h56mn55
-----Power Off-----
07/01/2008 12h12mn40
-----Power On -----
08/01/2008 10h24mn32

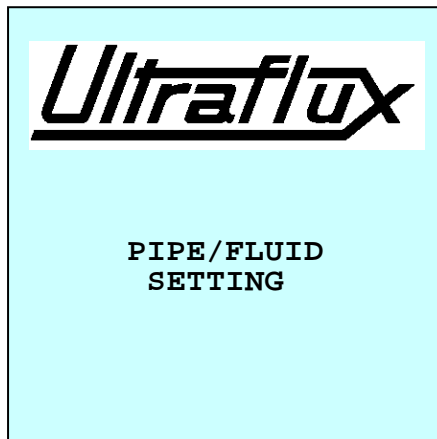
This screen shows also actual date and time

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 dictates the requested distance between probes, and the signal tracking window, is considered around **15°C**, with **Co=1472 m/s** with a wide **Delta C** range at **400 m/s** (+/- 200 m/s).



```

----- PIPE -----
-----Fluid-----
Product    =    WATER

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

-----Wall-----
Material   = xxxxxxxxx
Thick.     = *****mm
Sp.Sound   = ****m/s
  
```

Enter with accuracy the pipe external diameter 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 the 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.**

```

----- PIPE -----
-----Chord1-----
Probe      = xxxxxx
Mounting   = xxxxxx
  
```

(Insertion probe menu)


```

----- PIPE -----
-----Chord1-----
Probe (SE) = xxxxxx
Mounting   = xxxxxx

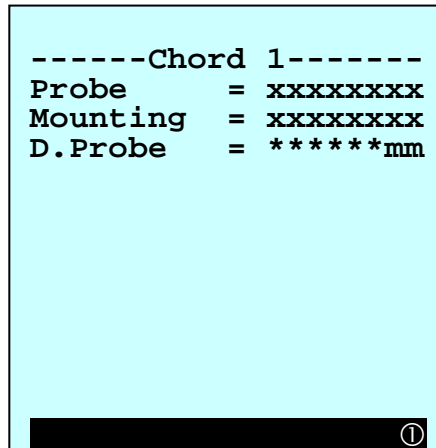
Probe (SM) = xxxx
Length     = xxxx.x mm
Axial D    = xxxx.x mm
  
```

(Clamp-on probe menu)

6.5 Distance between Probes (clamp-on)

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

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

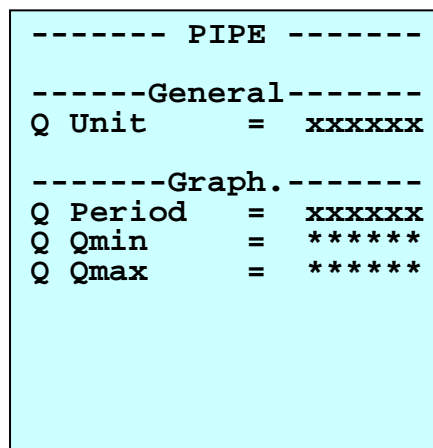


You can at any time select this screen with  in measurement menu.

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 (period value) and the min./max. range.



7 - NORMAL & ADVANCED MODES

Contents

- 7.1 Introduction
- 7.2 Additional Parameters in « normal » mode
- 7.3 Zero / Auto Zero Settings
- 7.4 Additional Parameters in « advanced » mode
- 7.5 Filtering / Response time
- 7.6 Factory settings

7.1 Introduction

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 further options such as:

- Settings 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 settings and the possibility of specific ultrasonic signal treatment.

7.2 Additional Parameters of « normal » mode:

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

```

----- PIPE -----

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

-----Wall-----
Material 1= xxxxxxxx
Thick.1   = **.*mm
Sp.Sound  = ****m/s
(If Other)
  
```

```

----- 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

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

```

----- PIPE -----

-----General-----
Q Unit    = 1/s...
Memory    = 30 s
Filter     = 10 s

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

```

----- PIPE -----

-----Chord 1-----
Probe (SE)= xxxxxx
Mounting  = xxxxxx

Probe (SM)= xxxxxx
L dist.   = xxxx.xmm
Axial D   = xxxx.x mm

Delta To   = x.xx ns
Max Gain   = xxx dB
  
```

How to estimate actual Co for a product that is not in the attached list (see also § 21).

Firmware version 4 onwards, UF 801-P has a product list included in menu.



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

- *Enter an approximate Co (Speed of Sound) and a large Delta C range in the fluid settings menu.*
- *Read the returned Speed of Sound (Measurement menu), re-enter this value in the setting menu, 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 the characteristic C for your product.*

7.3 Zero / Auto Zero Settings:

Simple mode does not permit zeroing the flow; this function is only available in the normal or advanced modes. The zero offset has a greater or less effect, and may be very important for accuracy when there is a low delta T (low flow) at the given flow range: for small pipe ... This offset is mostly due to the pipe itself, but also to a lesser effect the probe choice and installation.

To prevent errors at the flow range, we recommend performing a zero flow procedure and compensate it if there is a reading.

Attention! Ensure the flow is perfectly zero and will remain so during the zero setting: values must be and stay stable, valves closed, pumps stopped and turbulence or transient eddies must be down to zero.

Two methods:

- Manual method: read the **Delta To**, and enter it in the probe menu at Delta To line (see previous page).
- Automatic method with **Auto-Zero**: In the Fluid settings menu, at the bottom of the screen (see next page), Auto Zero line, change No to Yes and set averaging time from 30 Sec. to 5 Mn for the required accuracy.
- After returning to measurement mode (long press on **F**), UF 801-P must be able to measure the zero offset (or the zero procedure will not occur).

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

As long as « Auto Zero» is displayed, the UF 801-P zero adjustment is in progress and the "Delta To" offset is being set. When completed, the value is placed in the "Delta_To" line.

Attention! This value is unique to this actual measurement point. As an approximation, it can be considered as an offset for the same probe set, but, if the next application is very different, please reset it to zero in probes menu.

Q. Cut Off: In normal and advanced modes, entering a low threshold forces a Zero Flow display below the set value.

Attention! This is not a zero adjustment. The measurement is forced to zero as long it stays below the set value. Totalizers will not accumulate and current output flow stays at the bottom of the range (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= xxxxxxxx
Thick.1   = ***.**mm
Material 2= xxxxxxxx
Thick.2   = ***.**mm
Material 3= xxxxxxxx
Thick.3   = ***.**mm
Sp. Sound = I Other
    
```

In the other modes, you can enter the total thickness and a material Speed of Sound (CM) that is an average of the materials from their % thickness as a whole.

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 such 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 the critical Reynolds number and the transition range with LBR.

On crude oil, Critical. Reynolds=2500 / LBR=5 give good results.
On Air at 1 bar, Critical Reynolds =1500 / LBR=4 is recommended.

You are reminded that the transition is very weak and the data discussed is from statistical results. In theory you require more than 20 pipe diameters 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 than letting the unit manage the coefficient.

7.5 Response time / flow display filtering

The **filter** setting sets the averaging period. A high filter value gives very stable flow readings. But, if the actual flow changes suddenly (when a pump starts or stops), the UF 801-P flow display will have a delayed response.

The **Delta V Filter** parameter provides a filter override:

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

If the raw V changes suddenly, setting a threshold (Delta V Filter) in relation to the installation by-pass the filter applied on the flow reading, resulting in a short response time during the transition.

```

----- PIPE -----
-----General-----
Q Unit      = 1/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
    
```

Advanced settings or tests on amplification gain management

```

----- 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.

The max. range can be limited to avoid EMC or other noise 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.

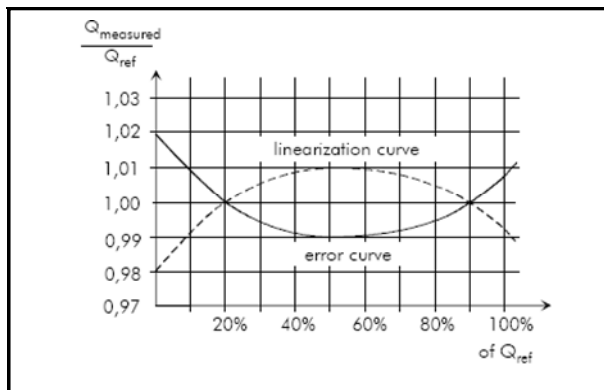
Angle concerns only clamp-on probes. We set here the typical refracted angle in carbon steel.

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 the value over Q max flow range. Above Q Ref., the compensation is inactive (coefficient = 1.00).

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

With Q Réf.=1000 m³/h, suppose an error of -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
- 8.2 Complementary screens

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 chord option can be designed for installation on separate pipes (UF 801-PB) or two chords on the same pipe (double set of clamp-on probes or two parallel intrusive probes).

```

----- TOTAL Q-----

-----General-----
Number of pipes= 2
QT Unit      = m3/h
QT = +/-QA+/-QB

-----Graph-----
QT Period    = 5 s
QT Q min     = xx.x
QT Q max     = xx.x
  
```

A 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 will be equal to QA.

After setting **Nr. of pipes =2** (Pipe/Fluid Menu), you will have complete and 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 copy sum or subtract flows.

8.2 Complementary displays :

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

```

----- PIPE A-----

-----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
  
```

```

----- PIPE B-----

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

-----Wall-----
Material 1= xxxxxxxx
Thick.1    = ***.**mm
Sp.Sound   = ****m/s
(If Other)
  
```

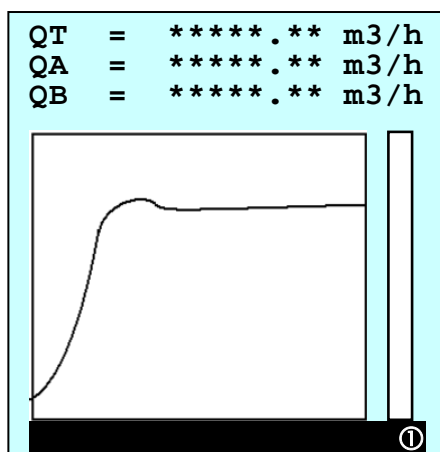
```

----- 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 screens are available:



```

QT=*****.**
      m3/h
QA=*****.**
      m3/h
QB=*****.**
      m3/h
  
```

Technical displays are identical to previous ones, but are titled 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 ?
- 9.2 Examples of echoes and criteria.

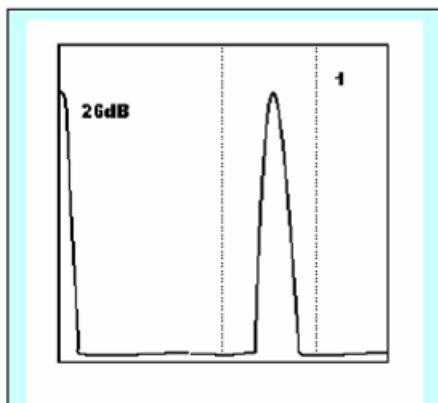
9.1 When and How Use this menu ?



This menu function allows you to check your ultrasonic measurement conditions and interrogates if they are good, acceptable, weak or poor.

The parameter **Q. max=** adjusts the Delta T display sensitivity depending your application. The display does not show the exact Delta T: It is limited to 1/4 of the ultrasonic signal period. From Q. max setting, you can force a Delta T display for any small or large actual Delta T.

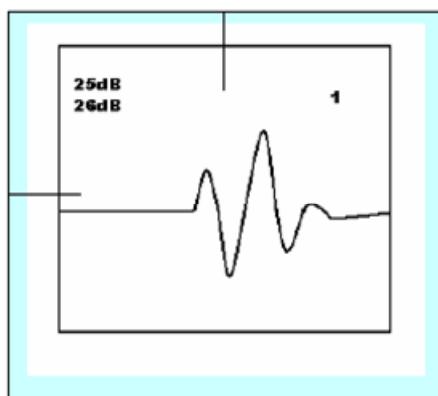
There are two graphic displays (4 if a dual chord / pipe version):



The first one shows, from left to right, all energised signals (ultrasonic, but also EMC noise) 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 start of the signal must be clean.



The second screen is an expanded view that results from the digital acquisition, our electronic lens for ultrasonic.

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 sharper when the distance between probes is shorter than the requested distance. A larger distance has the contrary effect.

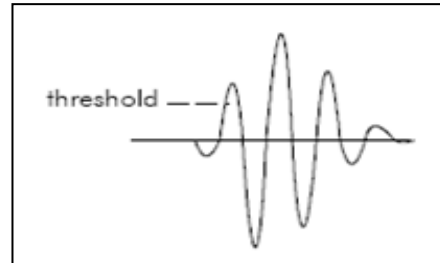
This is due to the total beam surface in comparison with multiple echoes in the pipe wall, and so the combination of received echoes.

Also, probe frequency, from its wavelength in the pipe material compared to pipe thickness, has influence on the echo shape. This could lead you to use higher frequency probes.

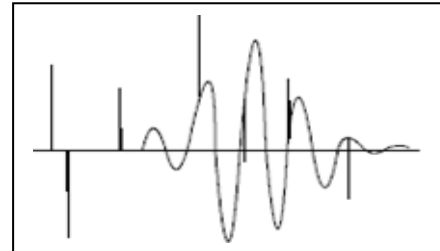
Finally, this probe frequency is affected more or less from the pipe roughness, corrosion or internal deposits.

Below are some typical pictures of echo displays:

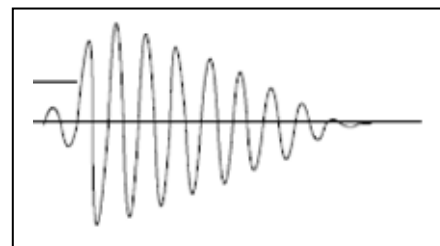
Good echo: low amplification gain (35 dB), low noise level, fast signal rising.



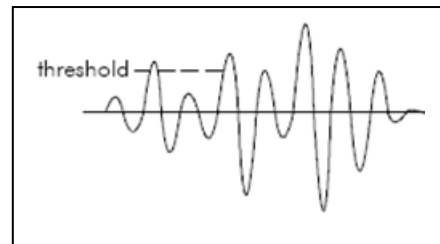
Difficult conditions: high gain (65 dB), noise, bad shape



Example shows the benefit of high frequency probes on a thin clean pipe wall.



This example shows a thick walled pipe on which lower frequency probes are used and also possibly some corrosion.



10 - PC Software

Contents

- 10.1 Installation & Connections.
- 10.2 Menu « Dialogue »
- 10.3 Archive & records management.



10.1 Installation & Connections

Double click on Set-Up*.exe icon to launch the installation.
By default, accept the 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

This display will 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

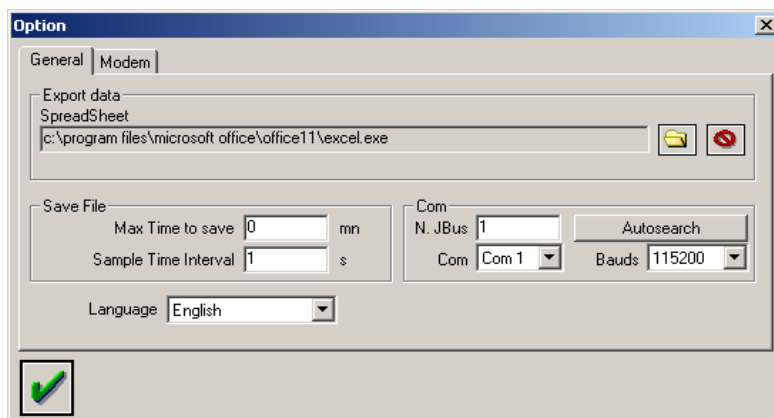


Configuration : Click on Option tab

Here you can change your communication data.

Select your software communication language.

View the Excel link.



You change the Com. Port Parameters manually as set on UF 801-P, or click on **Auto Search**. This searches the communication settings and the Com Port set by the PC for the USB converter: try with the UF 801-P at 115 000 and then at 9600 bauds if no result.

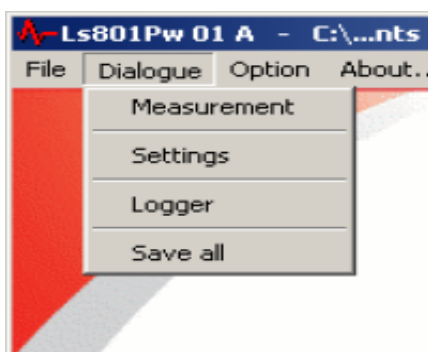
The recording period (max time) and sampling rate (time interval) are explained further in 10.2). They set the automatic measurement records by the PC.

A click on the green tab saves the actual configuration parameters.

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

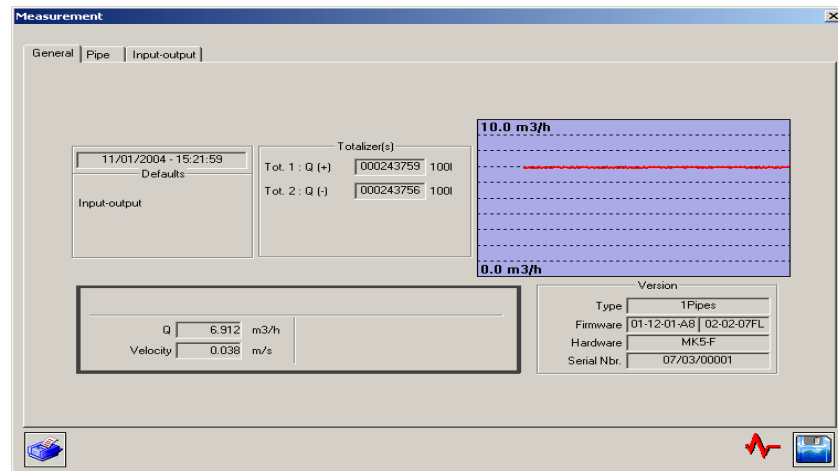
10.2 Menu « dialogue »

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

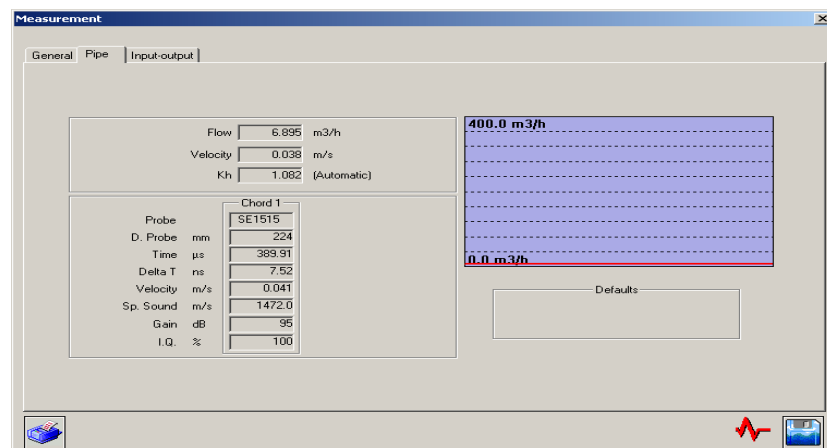


- The first choice is « **Measurement** ». It imports actual measurement results displayed by UF 801. They are grouped on three screens:

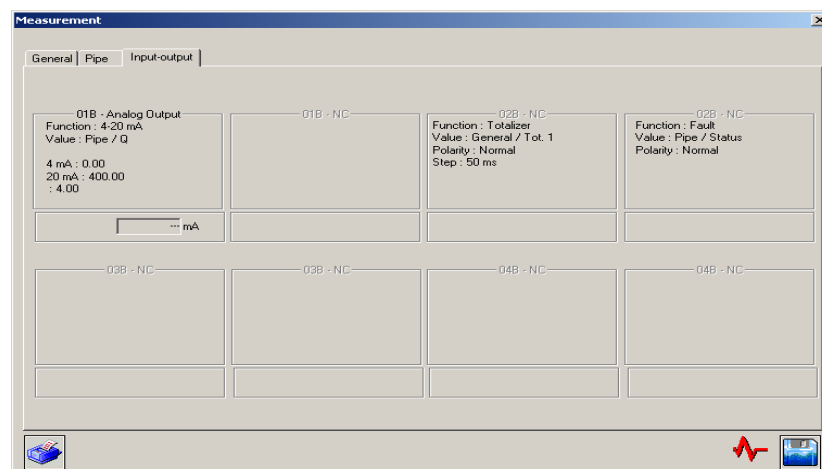
- General, which shows the actual flow and totalizers :



- Pipe per pipe technical display, with control data :



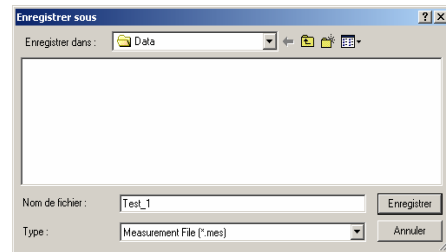
- Input(s) & output(s) :



- Following icons have the same function in above displays:



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

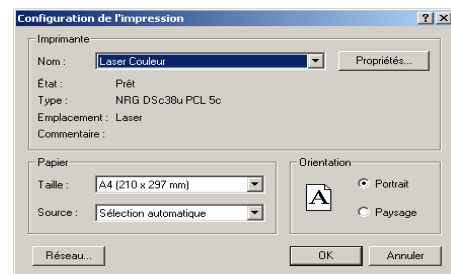


Once the routine is launched, the data is recorded as per the instructions in the option menu (sampling rate and recording period). Setting "Max. time" period = 0 means manual stop (the Stop icon replaces the Save icon).

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

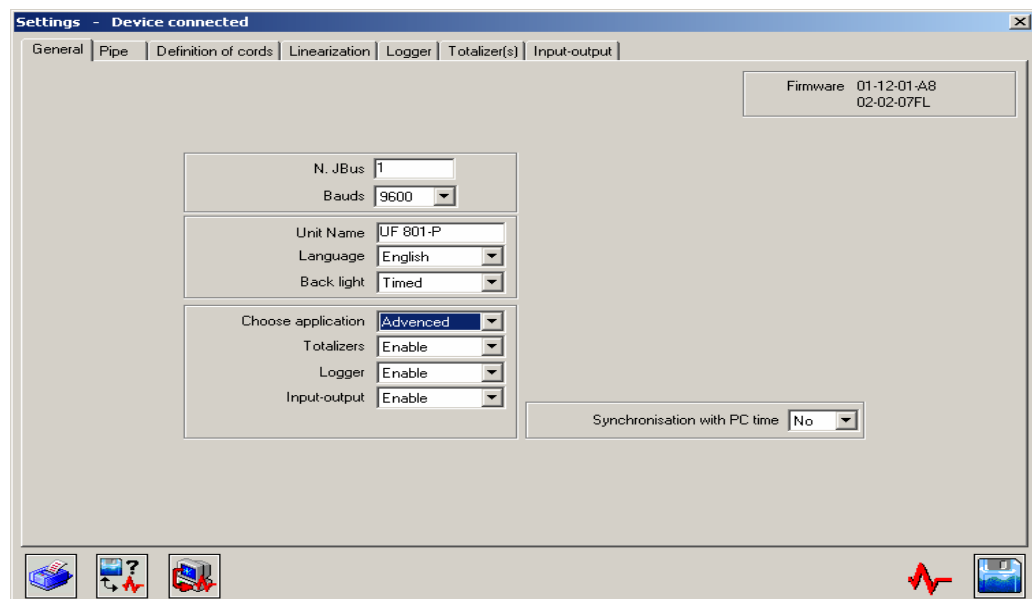


This tab opens the prints dialogue:

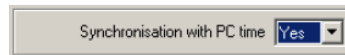


This icon is unused in this mode.

- The « **Settings** » option imports the settings from the UF 801. As with the keypad, you can select the level of the settings from the "General" Tab / Choose application / Level = Simple / Normal / Advanced or Expert



An important setting on the UF 801 is the time and date setting for the data logger and PC records. Updating summer / winter timesaving should be considered. PC connection is the only way to synchronise the date and time with Synchro = Yes and then Send:



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



Exports new settings to UF 801 and



saves them to a file.

Below is a typical menu in advanced / expert mode:

Settings - Device connected (Changed)

Tabs: General | Pipe | Definition of cords | Linearization | Logger | Totalizer(s) | Input-output

Flow

Q Unit: m³/h
 Filter: 10 s
 Filter DeltaV: 0.200 m/s
 Memory: 20 s
 Cut OFF Q: 0.00 l/h

Pipe

Ext. Diameter: 273.9 mm
 Material: St. Steel
 Thickness: 9.20 mm
 Material: No
 Material: No

Product

Product: Other
 C0: 1472 m/s
 Delta C: 400 m/s

Graph

Min: 0.0 m³/h
 Max: 400.0 m³/h
 Step: 5 s

Function

Function: Simulation
 Simulation Q: 7.50
 Jitter: 10 %

Kh

Kh Type: Automatic
 Viscosity: 1.0 cSt
 Roughness: 0.10 mm
 Critical Reynolds: 2800
 L.B.R.: 3.000

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

Settings - Device connected (Changed)

Tabs: General | Pipe | Definition of cords | Linearization | Logger | Totalizer(s) | Input-output

01A - Analog Output
 Function: 4-20 mA
 Value: Pipe / Q
 4 mA: 0.00
 20 mA: 400.00
 I. default (mA): 4.00
 Edit

01B - NC

02A - Relay output
 Function: Totalizer
 Value: General / Tot. 1
 Polarity: Normal
 Step: 50 ms
 Edit

02B - Relay output
 Function: Fault
 Value: Pipe / Status
 Polarity: Normal
 Edit

03A - NC

03B - NC

04A - NC

04B - NC

10.3 Editing, Archiving and/or printing a file

(For the UF 801 settings or the recorded measurements).

Measurements results recorded with PC:

These records include the flow results and measurement conditions. They complement the data-logger records. These files have [*.mes] extension.

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



to select a record,

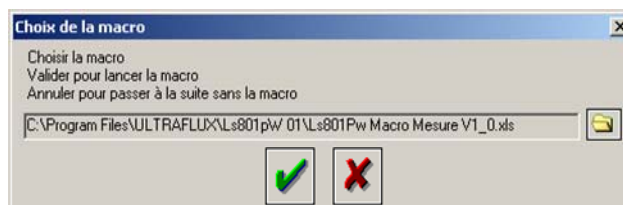


to print the actual page,



to export the file to Excel with the dedicated Macro.

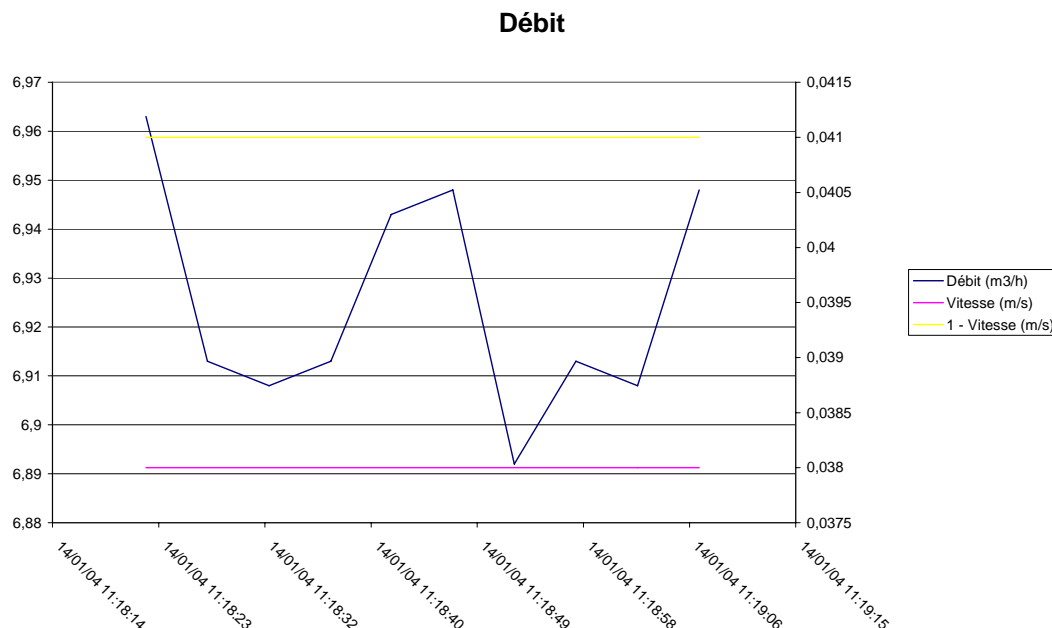
The Excel macro offers formatting and an automatic flow curve edition. It is necessary to validate the action with:



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

The results are arranged in Excel lines and columns, with automatic flow and velocity (UF 801-P) or two flow + summation (UF 801-PB) edited columns, which can be edited from the data.

Data can be edited or modified to take in account other recorded data such as C, amplification gain....



Settings menus files.

The UF 801-P has dedicated memory space to store two configurations. These can be recalled with "Load" : edit or reuse them, or save to PC.

PC archives can be used with reports or sharing typical settings.

The settings menu can also return the UF801 to the original factory settings.

If you have periodic tests or controls on a process, and need to control or replace another flow meter, 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 compares two settings files and shows the difference

11 - DATA-LOGGER

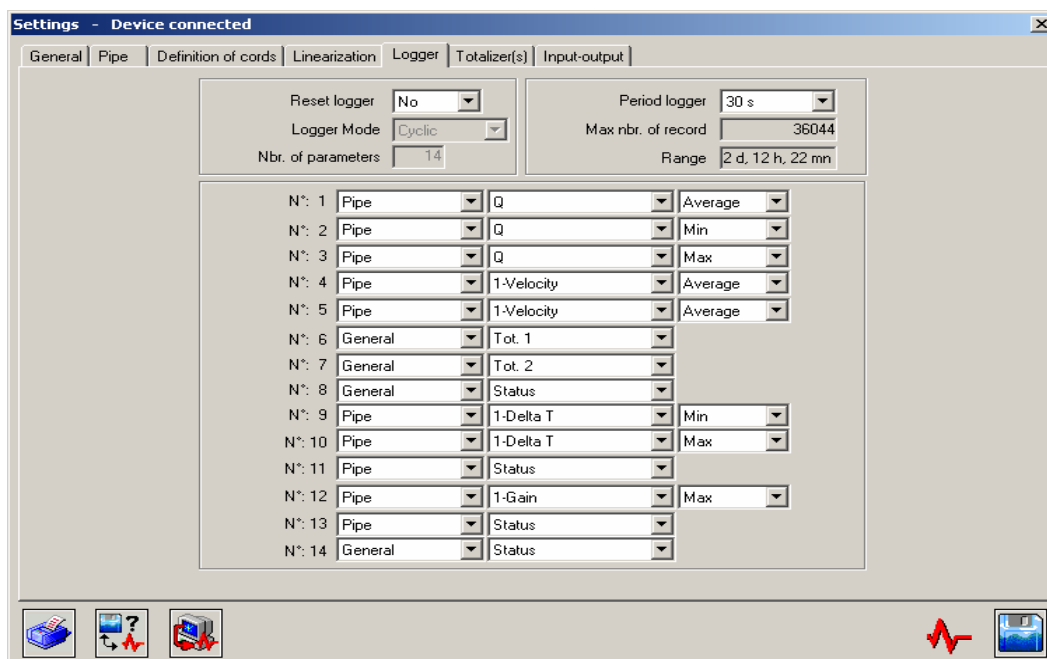
Contents

- 11.1 Setting the Data-Logger
- 11.2 Reading the data logger
- 11.3 Treatment by Excel


UF 801-P / P B has a large flash memory to store 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:

 <p>LOGGER SETTING</p>	<pre> --- LOGGER RESET --- xxx -Nbr of parameters- ***** ----Logger Mode----- xxxxxx ----Logger Step----- xxxxxx ----Logger Range----- xxxxxxxx </pre>	<pre> ----- VALUE 1----- Pipe1/Input/General Q AVerage ----- VALUE 2----- Pipe1/ C1 Max ----- VALUE 3----- General Tot 1 xxxxxx ----- VALUE 4 Input/Int. Fct. XXXX xxxxxx </pre>
---	--	--

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 suit your requirements, you need to **Reset the Data-Logger**. Before resetting the logger, ensure the logger is completely downloaded of all relevant data.

The Data-Logger can be set to **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, such as the totalisers or QT if it is a dual pipe PB version.

Returning to measurement menu by pressing F (or after up-loading settings from the PC) **starts the recording**. The Data-Logger will record immediately as long it is ON or unless it is full (if stop when full option is selected).

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

From the measurement menu, you can check the data-logger info such as Max number of records,

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

```

--- INFO. LOGGER ---
-Max Nbr of records-
*****
-Nb written records-
*****
----Last record----
01/08/2007 11h09mn00
  
```



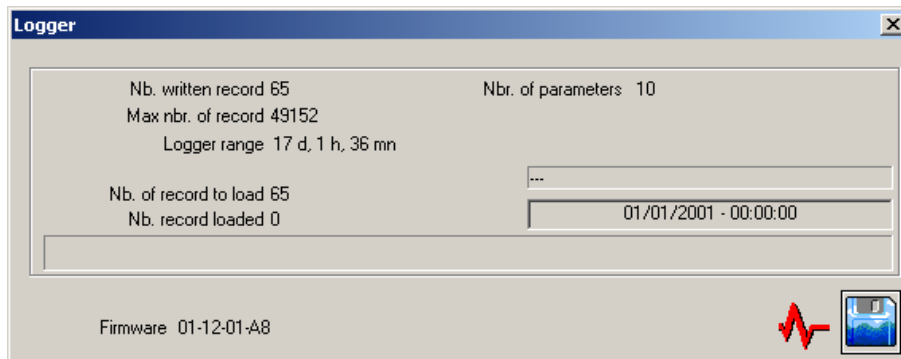
It can be useful to temporary stop the records, during the probe installation or during adjustments for instance. This prevents non valid records being edited.

You have two options:

- Change the recording period > 24 h
- Temporarily disable the data-logger

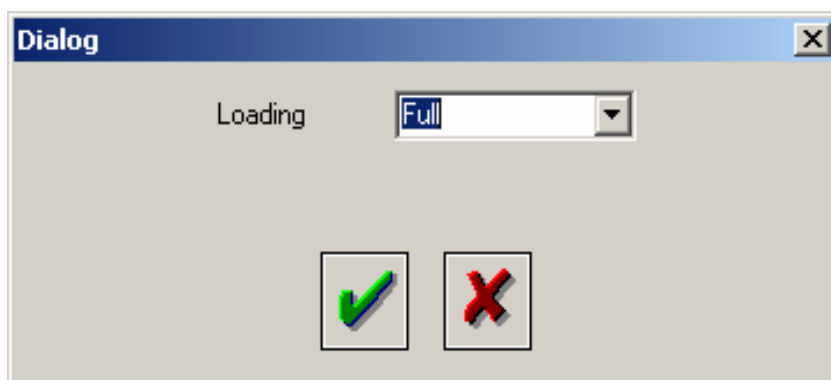
11.2 Reading the Data-Logger

Select Dialogue / Logger to open the following window :

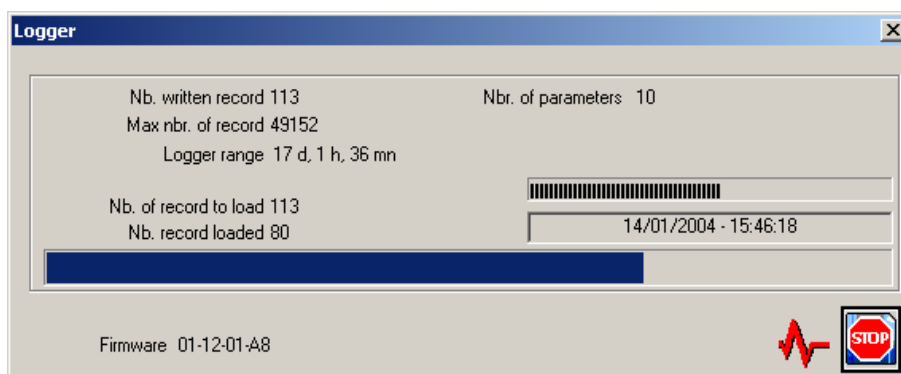


Click on the Diskette icon, a window opens with two options to confirm with the green tick :

- 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:



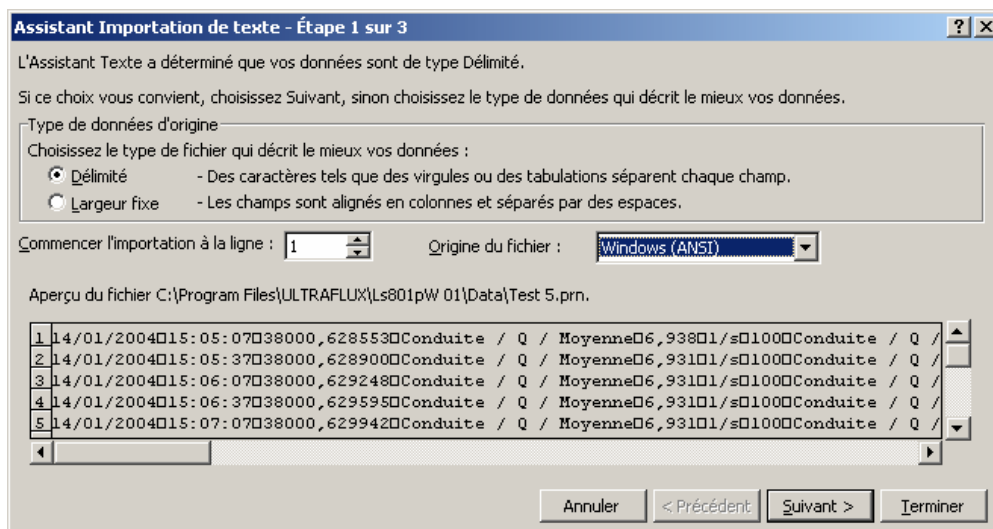
Clicking on Stop closes the file at downloaded Number / Time. This file is stored "by default" in the data folder with an extension [*.log]. It is Excel compatible and stored in [*.prn] format_(ASCII + Tab separators).

11.3 Editing the data logger (by Excel)

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

The recommended method is manual imports 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 opens the import 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.

Automatic Edit:

Just after importing the data-logger, the software asks (if Excel is available) 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 a UF 801-PB version (dual-pipe), we will edit the three curves Q_A , Q_B and Q_T .

You can rename the final file as an *.xls file, for direct opening by Excel.

Attention ! If your recorded file has more lines than Excel can accept (32000), it results in an error. You can save the data-logger in two files by using Stop or downloading between two dates, or later split the file into two or more files.

12 - TOTALIZERS

Contents

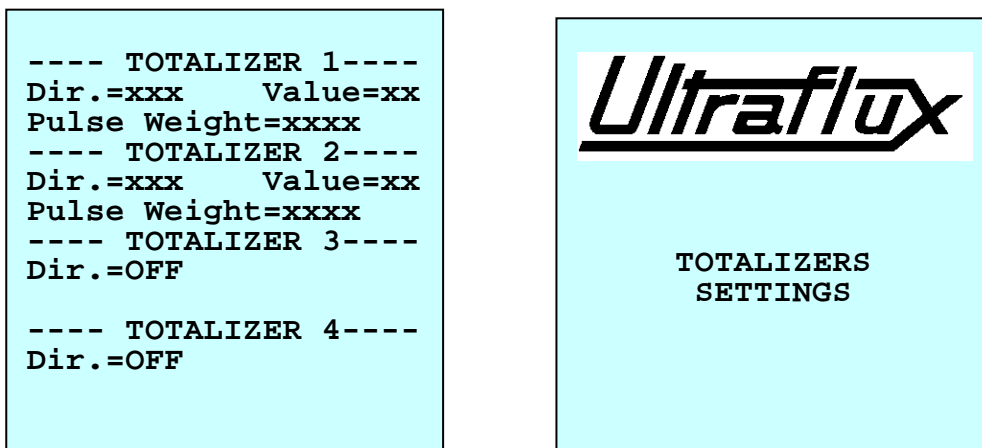
12.1 Description

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 applications: checking 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 you have a **UF 801-P B** dual chord version, you can select which pipe drives the each 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 m³. Totalized volumes (Nr + set weight) readings are displayed in the measurement menu.

Resetting a totalizer (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 bottom right of the line. Accept by pressing **B**

With the PC software, it can be performed from Settings / Totalizers / / Reset = No / Yes.

13 - INPUTS / OUTPUTS

Contents

- 13.1 Introduction
- 13.2 Analogue Output(s)
- 13.3 Relay Outputs (as pulsed volume ...)
- 13.4 Frequency Output
- 13.5 PT100 / RTD Inputs
- 13.6 External Connections / Wiring diagram

13.1 Introduction

The UF 810-P / P B has the option to output data & measured values.
The corresponding output modules must be installed and must be activated.

These resources are obtained by internal modules that are 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)

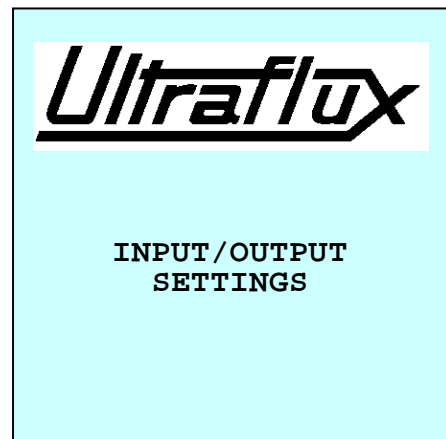
UF 801 is delivered as standard with two modules: 1 current output and 2 relays.
Optionally, it can receive two other modules

The settings can be changed through the keypad or PC software.
Below are some typical LCD displays:

```
- INPUT / OUTPUT 1 -
---Analogue Output---
Function = [4-20mA]
Value    = Pipe
          Q
  4 mA    =    0.00
 20 mA    =   400.00
I Fault   =    4.00mA

Sim.Value =   12.5mA

Wiring -----> 01-A
```



```
- INPUT/OUTPUT 2 -
---Relay Output A---
Function = TOT
Value    = St.General
          TOT 1
Step.    =    50 ms

Rel. Stat.=    OPEN

Wiring -----> 02-A
```

Header shows module N° and the 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 with or without [**±**]. 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 option line, you can force and simulate a current. It is useful to test wiring and connected instrumentation.

This analog output is **active**. It is powered by UF 801-P. It is galvanically insulated.

The loop resistance must be less than 600 Ohms. If overloaded, it switches automatically **Off**, for circuitry safety reasons.

To use it, you must connect to the DB 15 male connector (or a dedicated Binder connector) 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 the reverse).

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.

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

The final information is the wiring for the relay circuit (**02-A** shown).

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, such 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
```

Output the sign with respect 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 on 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 program a relay with a higher frequency than the totalizer increment, 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 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 connector (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 the wiring.

Specific cables exist for the 8 pts Binder, for dedicated PT 100 or 1000.

14 - TIMER / SEQUENCER

Contents

14.1 Settings

14.1 Settings :

This function is rarely used when you operate alone, so is normally disabled.

It sets the UF 801 OFF (rest time) and ON time period or for a set period. To help the records during the ON periods, the data-logger is automatically synchronized to have at minimum of one record per cycle.

This function has multiple purposes or applications:

- Install everything now, but the required period is for a later event (night survey for instance) : UF 801-P offers a delayed auto-start.
- Flow investigations are for a flow survey at a specific time (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 infinite 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, during the installation or other setting procedures.
- **Differed**, with a delayed start, and then a measurement / one shot recording period.
- **ON** offers a delayed start and then the ON/OFF period and total duration of ON state (i.e. for one week).
- **∞ or infinite** mode, this is very similar to the previous mode, but without time limitation except the data-logger capacity (*Set to "Stop when Full" to keep the oldest records*).

The different active menus are:

```

----- TIMER -----
              ON

-----Recording-----
Log. Step=      ****
Duration = **h**m**s
----Powering On-----
Start      = **h**m
Period     = **h**m
---Total Duration---
              **d**h**mn

11:10
  
```

```

----- TIMER -----
          Differed

-----Recording-----
Log. Step=      ****
Duration = **h**m**s
----Powering On-----
          25 Jan.  05h30min

11:10
  
```

```

----- TIMER -----
      ⌚
    ! Data-Logger !
-----Recording-----
Log. Step=      ****
Duration = **h**m**s
----Powering On-----
Start      = **h**m
Period     = **h**m
---Total Duration---
99999 d *99 h 99 mn
=====
                        11:10
=====

```

Very important

When your selected mode is set, you must valid it by a long press on F to return 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 switch ON at the 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:

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 provide the possibility to cancel or modify all settings that you will need to validate as before.

15 - SETTING FILE SAVING AND RECALL IN UF801-P

Contents

- 15.1 Saving and recalling of a Calibration file.

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 t operations are performed from Configuration menu.

<pre> LANGUAGE : ENGLISH -- STATION'S NAME -- xxxxxxxx ---- BACK LIGHT ---- xxxxxxxx ---PC CONNECTION --- N° JBUS : xxxxxx Bits Rate: xxxxxx </pre>	<pre> --- OPTION FILES --- Load Option File N°*:xxxxxxx Save Option File N°*:xxxxxxx </pre>
--	---

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 pressing the down arrow (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 overwrites those settings previously in Config. 0.
- If you want **to cancel a record**, just overwrite it with a new one.

Records can be saved 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 factory settings. They correspond to our tests, and UF 801-P is normally delivered with this data in the configuration settings.

To re-install this factory setting file, select **"Settings Reset" / "Yes"** in configuration menu.

16 - PIPE WALL THICKNESS MEASUREMENT

Contents

- 16.1 Pipe wall thickness measurement
- 16.2 Installation procedure
- 16.3 Sound velocity measurement in a material

16.1 Pipe wall thickness measurement :

The measurement principle of an ultrasonic thickness gage is very common. We have developed one dedicated to the UF 801. The probe includes an emitting and receiving cell in the sensor body, angles towards each other with a 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 test material and the transit time measurement, we can measure with accuracy ($< \pm 0.1$ mm) the thickness of this layer.

The pipe wall thickness is very important for accurate flow measurement.

The **SE_1701** probe or an equivalent is required to use this function.

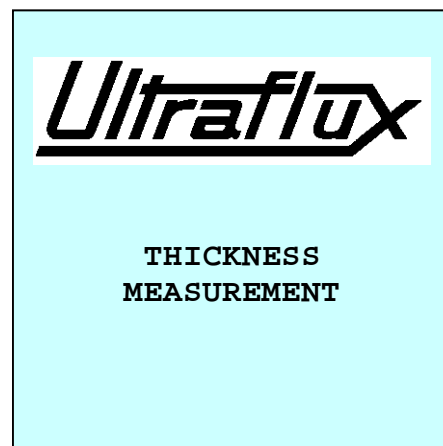
It is delivered as an option. Menu is available as standard.



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 display shows the wall thickness.

Thickness Measurement menu of UF 801-P is available via the F key:



Select the function "Thickness"

Select the correct material in the list (*Otherwise refer to Celerity mode explained below*).

Select AUTO Mode.

```

----- MODE-----
      Thickness/
      (Speed of sound)

-----WALL-----
Material = St Steel

--Display / Graph--
Mode = AUTO / MANUAL
      (If Manual)
Résolution (mm)
Th.Min / Th.Max
    
```

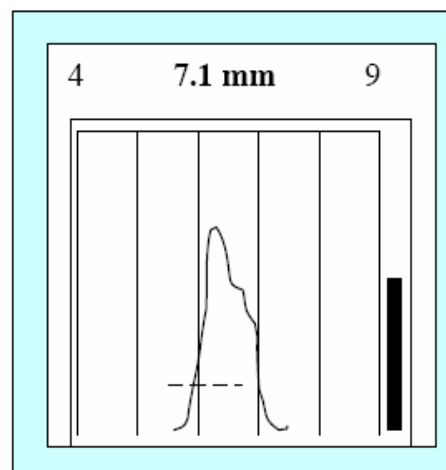
The Thickness measurement result should be displayed :

Thickness

7.1 mm

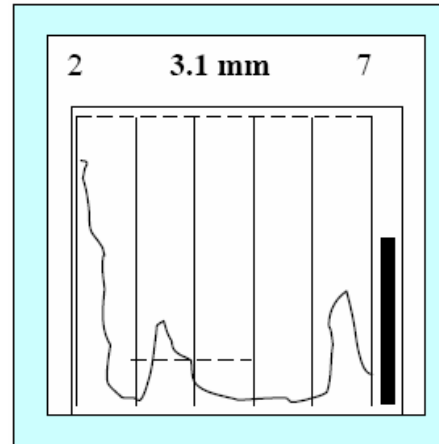
We recommend using the second measurement display screen, which shows in addition the echo signal quality.

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



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.



With the graph, you can have complementary information on the echo and other conditions attached to the wall thickness: corrosion, 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 twice the correct wall thickness value. Graphical mode allows you to check the numeric value and, if it's wrong, to estimate it from the graphical vertical graduations.



Thickness probe orientation: from the probe face, there is a separation wall between emitter and receiver. It is recommended to orientate the probe to have the separation perpendicular to the pipe axis.

Keep the probe perpendicular to the pipe wall.

16.3 Sound velocity measurement in a material:

We must consider the longitudinal wave. If this C value for the Material is unknown or there is not a sufficient accuracy, the method is to test on a known thickness sample piece with the same material as the pipe.

Select mode Speed of sound".

Enter the sample thickness.

```

----- MODE-----
      Speed of sound
      (Thickness)

----Test Material---
      Thickness= xx.x mm
    
```

Go to the next display :

The corresponding sound velocity must be displayed >

Press B to send this result to thickness mode.

```

      Speed Sound

      xxxx m/s

      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 show the thickness of an internal liner or internal deposits layer.

17 - CUSTOMIZED FUNCTIONS

Contents

- 17.1 Introduction
- 17.2 Special Functions
- 17.3 Currently available Functions

17.1 Introduction

We name « Function motor » a special or specific function that is or can be optionally implemented in the UF 801-P firmware. Such a function uses selected internal or externally acquired results to deliver a calculated result that is of 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 this purpose, the UF 801-P currently uses its acquisition modules.

17.2 Special Functions

The 'UF 801-P architecture allows us Ultraflux to easily adapt special functions on request.

This is subject to conditions and specifications, and development fees after agreement by both parties.

17.3 Currently available functions :

One of the first functions developed and available is the heat or caloric flow application.

Explained in the next chapter § 18.

18 - CALORIC HEAT FLOW/ ENERGY MEASUREMENT

Contents

- 18.1 Introduction
- 18.2 Typical Installation on a heater/thermal exchanger
- 18.3 Wiring
- 18.4 Physical data settings
- 18.5 PT100/PT1000 settings
- 18.6 Measurements readings
- 18.7 Records and readings with the Data-Logger
- 18.8 Other Physical data

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). Calculation that can be done manually later from the records of actual flow and temperatures is 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 chiller circuits.

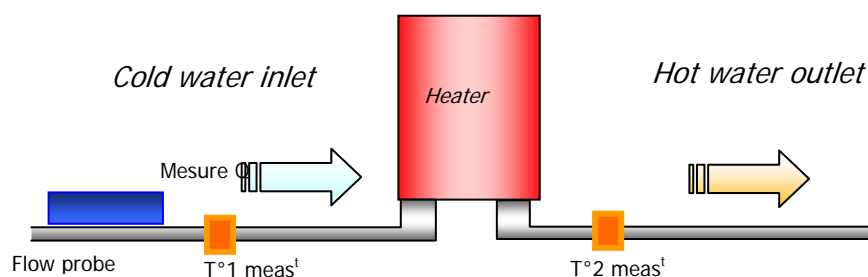
To keep the flexibility of non-invasive measurement, as with ultrasonic clamp-on probes, we suggest clamp-on thermal sensors, PT100 / PT1000/Din quality. Insure the best coupling to the pipe with a heat conductive paste. If invasive probes are available, they will offer a better accuracy and are recommended as a preferred option.

We recommend our new modules for PT 100/PT1000, with the 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.

18.2 Typical installation on a heater



Equipped with this function in the UF801 and two T probes, the UF 801-P measures and displays the two temperatures (inlet and outlet), their difference and computes 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, control of the efficiency of a heater or a heat pump, or a thermal exchanger is achieved by comparing results to energy consumption.

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

Where Q = Volume flow rate(m³/s)
 m = Density (kg/m³)
 C_p = Fluid characteristic (K Joule/kg.°C)
 ΔT° = [T₁ – T₂] , temperatures (°C)

Energy : $E = \Sigma P * dt$

18.3 Wiring

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

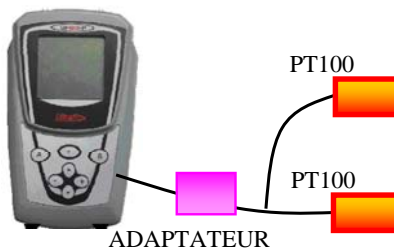
A ready for use Cable with a connected PT 100/1000.

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



A Binder Cable with a dedicated connection box with terminals.

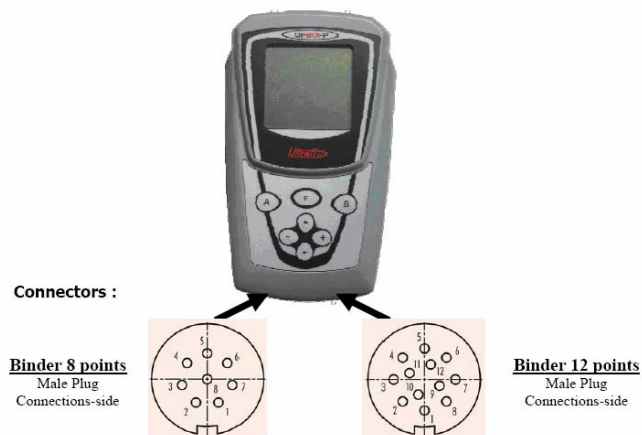
Here, any type of PT 100 or PT 1000 can be connected



Attention ! We cannot mix PT100 and PT1000 on a same application.

The terminals for connection are shown as for the I/O modules.

If it is a two pipe application (UF 801-PB) with this heat flow function, it is necessary to use two Binders _ 8 and 12 Pts for the T probes.



18.4 Physical data settings:

Through the keypad or PC software enter the fluid characteristics for the caloric calculation : its density at T and its caloric/mass:

Through keypad :

Input the 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".

Constante 1	
Calorimetrie	Densité 1000.000 kg/m3
Constante 2	
Calorimetrie	Chaleur massique 4196.000 J/kg.K

18.5 PT100 or PT1000 RTD settings

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

Any PT100 or PT1000 can bring its own deviation, depending on its class and exact accuracy. The same issue affects the wirings for 2, 3 or 4 wires connection.

The proposed adjustment balances the offset for a pair of probes. Install the two probes in the same T°C conditions and note the displayed T difference. Enter it.

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

```

- OUTPUT FUNCTION 1
CALORI C / DELTA T
= 11.00 °C

- OUTPUT FUNCTION 2
Cal ori c / Heat Power
= 50.0 KW

- OUTPUT FUNCTION 3
Cal ori c / ENERGY
= 12.0 KW/h
    
```

On the PC

Menu « Measurements » / Tab « Function » :

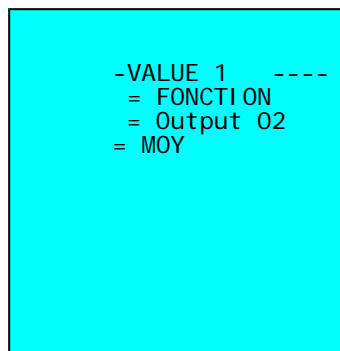
18.7 Recording and reading with the data logger

The results and readings are displayed through the data logger. It is necessary to set the data logger accordingly to record the required functions output:

- Directly on UF 801-P :

After entering the selection menu for recording (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).



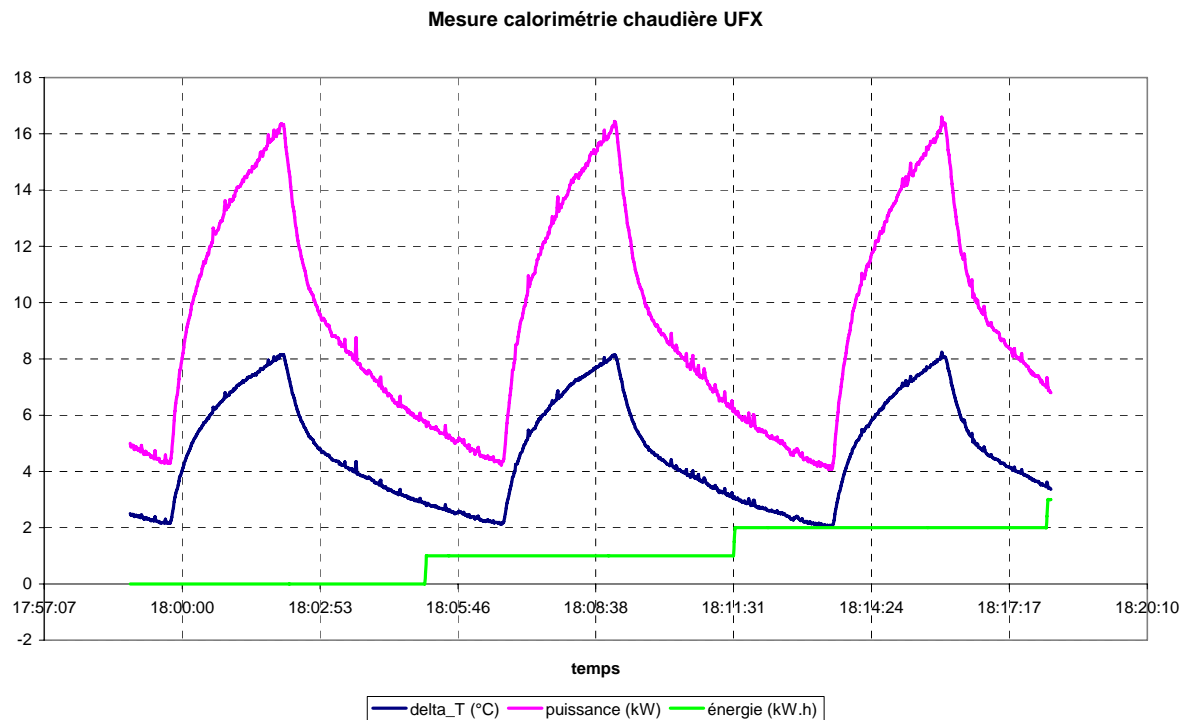
- With PC software :

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

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

Example of records after treatment with Excel

The graph below shows as example records on a heater for a house boiler. 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 boiler is 35 kW, but here the peak power is less than 20 kW, with an average power of 8 to 10 kW because gas is burnt only 30% of the time.

If you can know the gas or fuel consumption and its theoretical calorific power, it is very easy to calculate the global efficiency of the heater.

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

Calorific 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 calorific heat flow calculation.



Additive such as ethylene glycol in mixtures with water can change the above values.



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
- 19.2 Battery pack life

19.1- Battery & Charger

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

This battery is permanently supervised by a dedicated component & circuitry that looks for input/output currents. This component, after self calibration (see below) will show its **autonomy time as a % of the full capacity** at the dedicated line in the 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 lit) and plug-in the output to UF 801-P 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 ON.

In this 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 an abnormally high temperature at the back of the UF 810-P/PB, 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 perform this, a complete cycle after the UF 801-P has been automatically powered off by low battery voltage detection (sets the zero %) up to the maximum charge (sets the 100%).

This is recommended every two months.

19.2 Battery pack 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.

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

20 - TROUBLESHOOTING & FAQ

Contents

- 20.1 General Recommendation
- 20.2 Typical troubles or situations
 - 20.2.1 Case 1
 - 20.2.2 Case 2
 - 20.2.3 Case 3
 - 20.2.4 Case 4
- 20.3 Other investigations
- 20.4 After Sales Services (SAV)

20.1 General Recommendations:

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

Particular care must be taken with geometrical measurements, specific to each site. This is the responsibility of the end user, as is the 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 upgrading, 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 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 displays a Fault.
- Case 4 – There is no display (or fault display) or the buttons are inactive.

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

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 to 100%, is too low:

- This indicates several possible disturbances, 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 the offset manually.*

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 the programming.*

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 Reflex mode, less sensitive to hydraulic disturbance.*
- *Otherwise, choose $K_{Hydro} = Manual$ and adjust 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 C_o and ΔC_o 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 point "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 ...

- *Revise the setup. 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 possible to force a compromise with $Kh=Manual$ and value depending on probe 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 the bottom of the screen, 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.

Use the Echo display / Oscilloscope mode: it will provide 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 cavitation? Water fall causing aeration just upstream before the pump, such as the 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 the conditions? > Try Direct mode (I) 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 the local representative.*

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

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

The UF 801-P keypad is inactive:

- *Switch OFF/ON and leave 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 disconnection), 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 status depends on this.

When to exchange a battery pack?

UF 801-P includes a supervision module whose purpose is to prevent damage or depolarization. But, battery packs have 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

- 21.1 Typical pipe dimensions
- 21.2 Pipe Roughness coefficients for pipes
- 21.3 Sound Velocity in Fluids
- 21.4 Applications on Water
- 21.5 Applications on Petroleum Products
- 21.6 Measurements on Gas

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, such 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 such 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. A 4" pipe has 4.5"=114.3 mm OD, etc...

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 there are 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 a 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 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 NaCl 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:

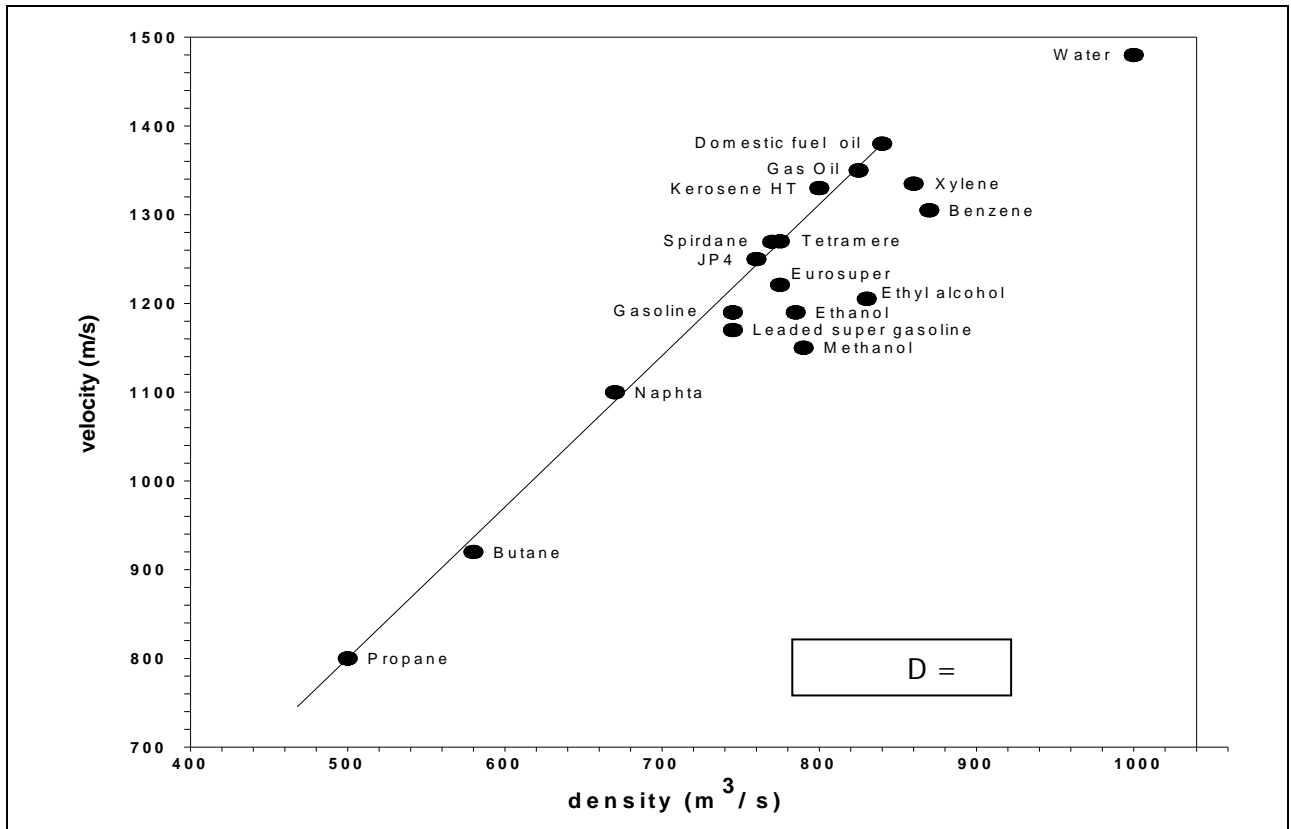
For instance: 30% > 1670 m/s and 50 % gives 1705 m/s.

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 test information, please contact us.

Self diagnosis can be performed, 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: $C = 341 \text{ m/s at } 20 \text{ °C / 1 bar.}$
*Approximate formula is $C = 20.1 * (T^{\circ K})^{1/2}$*
- Natural gas: C around 400 m/s at 15 °C / 1 bar