

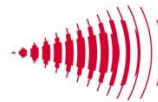
User Manual

Minisonic SPEED 1

(Minisonic_SPEED-1)

Minisonic SPEED 2

(Minisonic_SPEED-2)



Ultraflux

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Ultraflux NT 223C GB1

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PREAMBLE

Thank you for choosing Ultraflux to make your flow measurement.

We offer a full range of portable or fixed flowmeters backed by 30 years' expertise and experience using Ultrasonic techniques:

- ® UF 801-P family, high features portable flow meters, with integral loggers and signal analysis functions.

- ® UF 8xx families of fixed flowmeters, applications include
 - L - Liquids,
 - G - Gas,
 - MC: Multi-chord applications, Liquid and Gas flow measurement,
 - CO / RV: Open Channel and River Flow Measurement.

- ® The MiniSonic family with:
 - P – Portable Metering with also a two pipes or dual path version P-B 600/2000, single-channel fixed flowmeters,
 - 600-2 and 2000-2, for dual-chord flow metering,
 - 600-B and 2000-B, for dual-pipe flow measurement configurations,
 - Speed 1 & 2 are devices for open channel flow velocity measurements.

This manual is specifically concerned with MiniSonic Speed 1 & 2 for flow velocity measurements and has been drafted to guide you in the stages of installation and commissioning.

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

- > A training manual concerning ultrasound measurement, reference NT 122

- > A guide about the use of our software in the Windows environment Ref NT 204

- > The PC software specific to your application Ref LS 600W _version *** with an interconnection cord to the PC.

- > The JBUS communication protocol with its address table NT 207

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

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1 – TYPICAL APPLICATIONS

1-1- Introduction

As its name let suppose, the MiniSonic Speed is designed to operate flow velocity measurements. As all MiniSonic family, it is based on ultrasonic waves transit time difference in fluids when they are flowing.

In full pipes under pressure, our MiniSonic 600 & 2000 are designed to calculate the actual flow and passed volume. They take in consideration the pipe section and the hydraulic conditions.

MiniSonic Speed although being very similar, is oriented to flow velocity measurement and especially over speed survey in forced ducts.

With a free surface flow, channel or duct can be closed or open as well, the flow calculation is more complex and requires more information on flow velocity, wetted surface from water level and hydraulic profile changes.

Ultraflux proposes a global solution with our UF_322-CO / RV product range. Our didactic handbook NT 122 explains the general principles. Specific documents complete the information. These UF_322 can drive up to 5 chords on a same channel or river.

But, when a simpler solution is sufficient or when only the velocity information is requested, Ultraflux can propose the MiniSonic Speed which takes in charge only the flow velocity on one or two chords, the flow being calculated somewhere else (in a local PLC for instance).

1-2- Why a velocity measurement?

Some state of art constructions as Venturi, weir with V-notch or contraction discharge, Parshall or other flume can force a reliable relation between the fluid level level and its flow. The main conditions are a rigorous construction with a correct straight length, a correct slope angle and not any influence from downstream. Otherwise, a same level can correspond to many flows even no flow or a reverse flow.

In such cases, only the velocity measurement can bring a solution.

To do these velocity measurements, there are different principles, each having its own advantage / disadvantage : insertion or in wall electromagnetic probe, surface Radar, ultrasonic Doppler ... most of them being narrow area sensors which require to introduce hydraulic hypothesis to estimate the actual flow. They are OK and mainly used on small ducts.

The main advantages of an ultrasonic measurement are:

- An ultrasonic chord permits to average the velocity measurement on a larger distance, which is usually the channel or duct width.
- This measurement can easily be done at different levels by multiplexing chords.
- It can be also a complement to an above sensor, one being used fro dry conditions and the ultrasonic chord doing the survey in flood conditions.

A very important complementary measurement is the level. An external sensor must be installed as a complement to MiniSonic-Speed. The flow calculation, when requested, is done in an external computer or PLC that is not a standard Ultraflux delivery.

1-3 – Measurement principle

The principle of measurement is explained on in our training manual NT 122.

To summarize, note that it bears on the velocity difference (and therefore the ultrasound wave transit times) in a moving medium, depending on whether the movement is with or against the current.

To achieve this, it is necessary to establish dialogue between two sensors using an L-shaped route whose projection D on the control axis is sufficient, and to measure alternatively the route times $T_{1>2}$ and $T_{2>1}$.

The time measurement, combined with knowledge of the geometry parameters (L / D, pipe diameter & thickness if clamp on probes) allows the flow velocity to be calculated :

$$V = L^2 / 2D * (1/T_{2>1} - 1/T_{1>2})$$

MiniSonic-Speed has a very high time resolution (0.01 nano second) which permits a very high accuracy if elsewhere geometrical data are very well known, hydraulic conditions are correct (straight length > 10 width upstream, > 3 downstream) with no water fall and if probe choice and installation are correct (good signal and good zero).

So, the preliminary choice on “At what level must be installed each chord and how many chords must be installed“ are very important:

- A chord that is not or not sufficiently immersed will not give any measurement.
- What represent the measured velocity compared to the average one?
- A chord installed too low will be too influenced by the bottom friction.
- What is the typical hydraulic profile to extrapolate between two chords?
- What are the two coefficients to be applied to V_1 & V_2 to calculate average V?

In practice, in a rectangular shape channel, a chord placed at 25 / 30 % of water level from bottom gives a good image of the average velocity.

Except when Ultraflux participate to the installation design, these above choices are of installation responsibility. .

Ultraflux propose to bring you his experience for the best choice of probes, design and frequency as well, depending on your application.

Standard proposed probes have frequency from 0.25 to 1 MHz. Some are designed to be sealed in wall thickness, with a without a support for extraction. Some others have a design to be installed on wall and some have a support with permit their orientation.

Sound velocity in fluids - Case of water:

Water has a very reliable “speed of sound < > temperature” relationship which will be put to good use whenever possible for dimensional checking: a simple temperature measurement is a means of predicting the speed of sound to be compared with the result obtained by MiniSonic on the basis of the measured times and the dimensions as set up: A deviation may require these values to be reexamined, like L for intrusive probes or the diameter and thickness of the pipe for external probes.

The following simple equation gives a good estimation of C between 0 and 100°C:

$$C = 1557 - 0,0245.(74 - t)^2$$

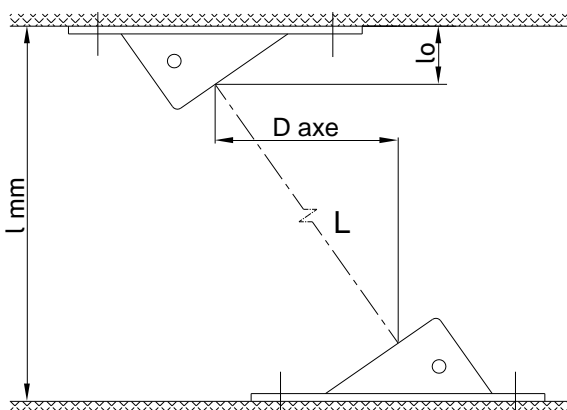
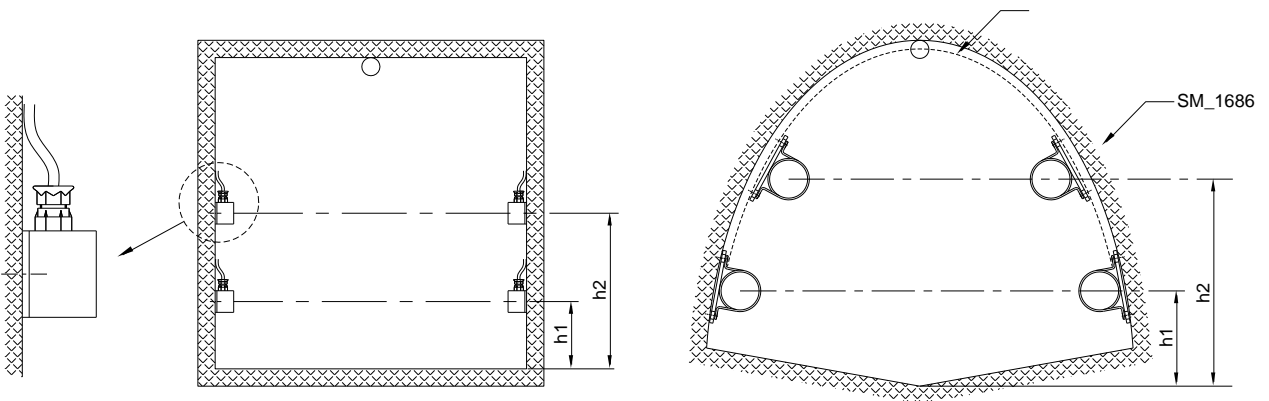
The following table defines the customary values more accurately.

t (°C)	C (m/s)	t (°C)	C (m/s)
0	1403	30	1506.4
5	1426.5	35	1520.1
10	1447.6	40	1529.2
15	1466.3	45	1536.7
20	1482.7	50	1542.9
25	1497		

The water load has little influence: this table applies to crude or used water.

The presence of salts solutions increases the value of C by approximately 1 m/s per g / liter (seawater ...)

1-4 – Typical installation: (here are probes with on-wall installation – possibility to seal probes in-wall with cement)



- Probe model and reference must be done prior to any installation.
- Respect limitations & installation rules.
- Once installation finished, check and note probes correct alignment and measure with accuracy H, L and D distances.

2 - COMPOSITION OF A MEASUREMENT POINT

- The two probes per chord or channel, normally wetted probes (SM).
- The integrated or optional supports (SU * 2)
- Integral or optional supports (SU)
- Probe / converter link cables. These cables are very often included with IP 68 probes.
- MiniSonic converter with its standard accessories (Software, PC cable ...)
- If required, external modules as A.C. transformer or DC Supply, Zener barriers...

CERTIFICATIONS

All equipment is CE certified.

ATEX certification for the relevant probes and standards when this quality is required, accepted and documented. All equipment will be labeled accordingly.

IP Rated as shown on each item.

The IP 67 rating of a MiniSonic is only complied with if assembly is according to the manual and installations rules.

APPLICABLE STANDARDS

- Concerning high voltage human safety risks: N/A – Only low voltage (< 60 V) .
- Concerning EMC : EN 61000, EN 55022 et EN 50204
- Concerning tightness (IP) : EN 60529
- Concerning ATEX : Directive 94 / 4 / CE
 - + EN 60079-0: General rules.
 - + EN 60079-1 : Ex d enclosures.
 - + EN 60079-7 : Ex e protection for connections.
 - + EN 60079-18 : Ex mb x – protection by encapsulation.
 - + EN 60079-11 : Ex ia - Intrinsic safety
 - + EN 60079-25 to guide you for your I.S. systems
- Beware to take in account the energised lightings (from thunderstorms for instance) and to place adapted modules when this risk can exist.

MINISONIC LIMITATIONS

MiniSonic Speed 1 accepts one chord / 2 probes only.

MiniSonic Speed 2 accepts two chords, to be installed on the same channel or two nearby channels.

The maximum length (L) between the two probes (SM) of a same chord is 50.000 metres

The maximum axial distances (D) is also 50.000 metres.

But, with clamp-on probes SE, the maximum pipe diameter is 9.999 metres.

The flow velocity measurement range is not really limited. It is displayed in m/s unit only.

3 – ERGONOMICS AND DIMENSIONS OF MINI SPEED 1 & 2 CONVERTERS

3-1 : Industrial version for wall mounting Mini-Speed 1 (IP 67):

The two glands on the left-hand side are for the supply (top) and the outlets.

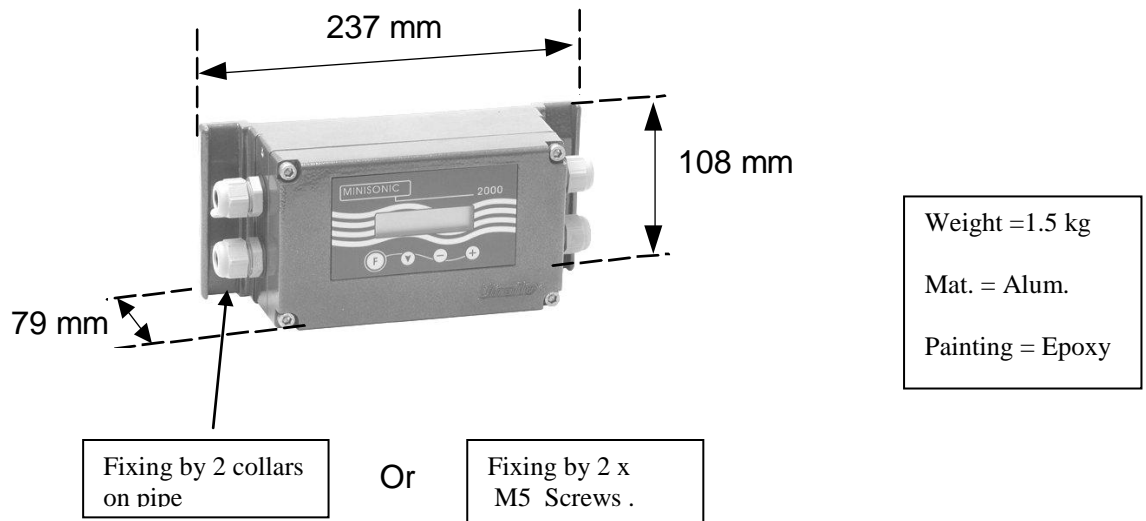
The two glands on the right are for probe cables.

To open the MiniSonic *(cabling or other), undo the four corner screws and remove the cover by disconnecting the flat interconnection cable from the display on the display side.

It is possible to leave this cable connected while temporarily attaching the face by 2 screws.

The unit is designed for wall mounting or mounting on a pipe or an electrical cabinet on a DIN rail. The arrangement of the outputs will allow the superimposed assembly of several units.

Use flexible cables that are in conformity and secure the stuffing boxes used (IP 67).



F = Function

▼ = Choice (menu or parameter)

+/- = Modification

*N.B.: MiniSonic * must be supplied at low voltage, whether DC or AC.*

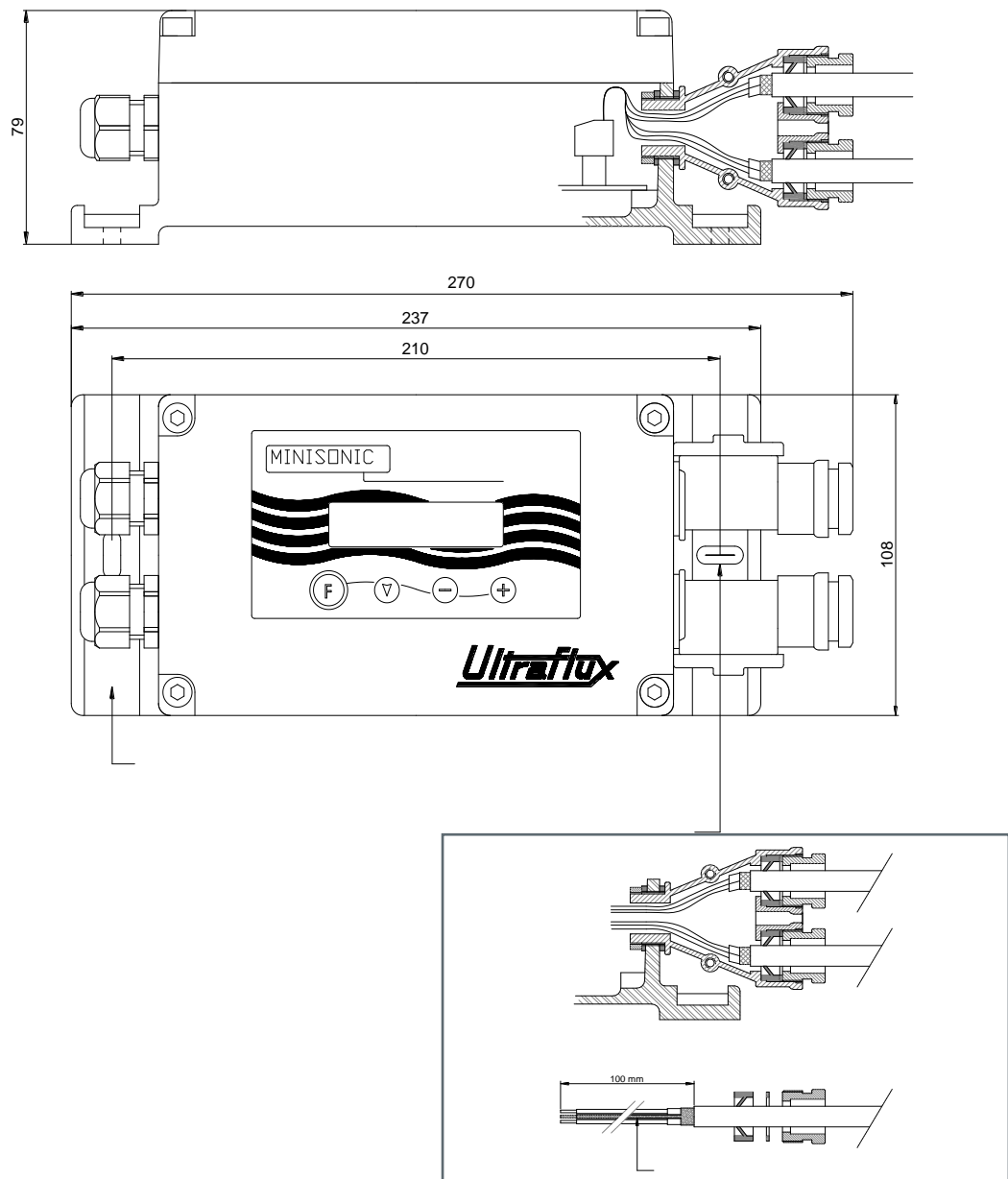
When a conversion module is used from the 230 V AC or 110 V AC mains (transformer, 24 V DC power supply), the latter must include DBT protections and be situated near the MiniSonic. The same applies if it has to be incorporated (as GP 01).

Meanwhile, the MiniSonic enclosure must be electrically earthed, both for human safety and to drive any noise collected by cables shields.

This connection can be done from the outside by using the threaded hole near the upper left gland or from the inside by using the terminals at each P.C. Board corner.

3-2 : Industrial version Mini-Speed-2 – (IP 65)

It differs from Speed 1 version by some firmware presetting and mainly by internal and external wiring resources as shown on following drawings (Y glands) .

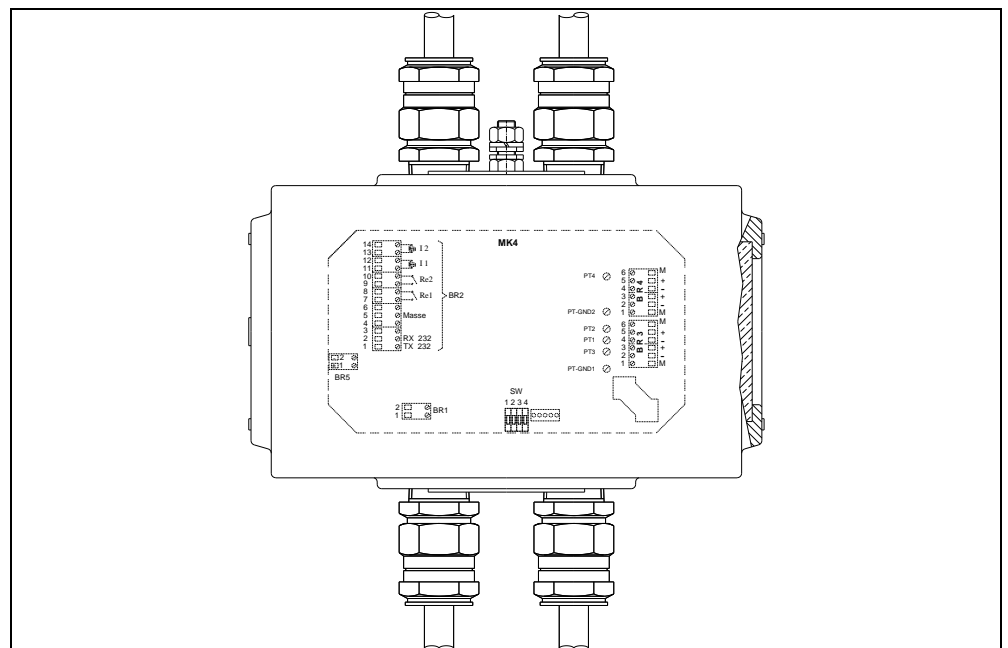
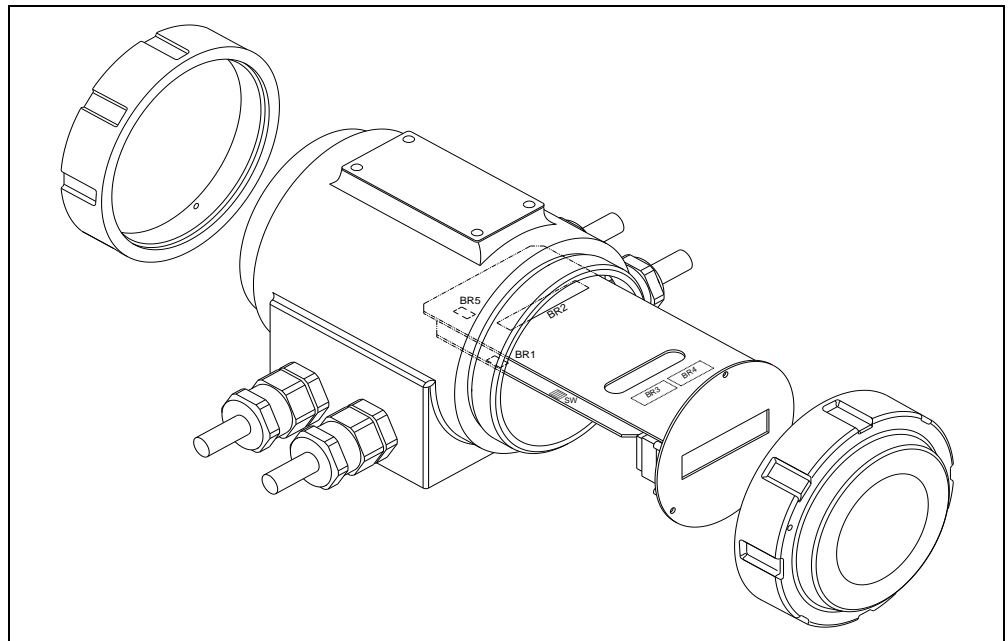


Cables shields are normally separated from cable wires inside the « Y » gland and continue as so up to terminals on the main P.C. board..

N.B.: In order to help wiring operations, please remove the. « Y » glands to have them in hands.

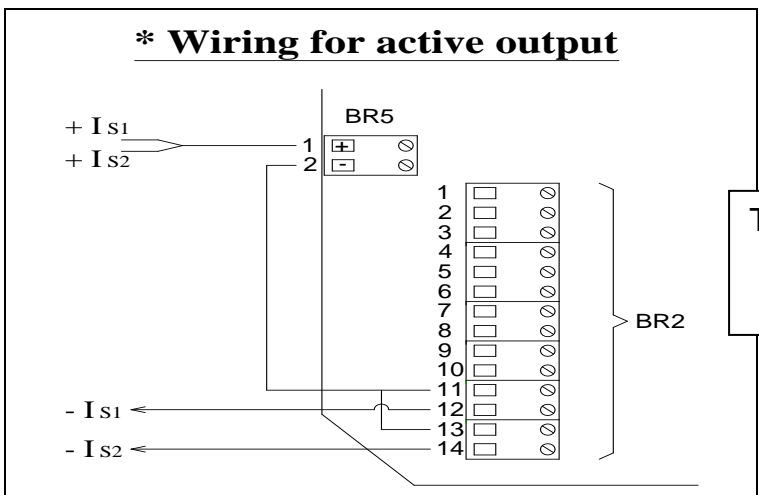
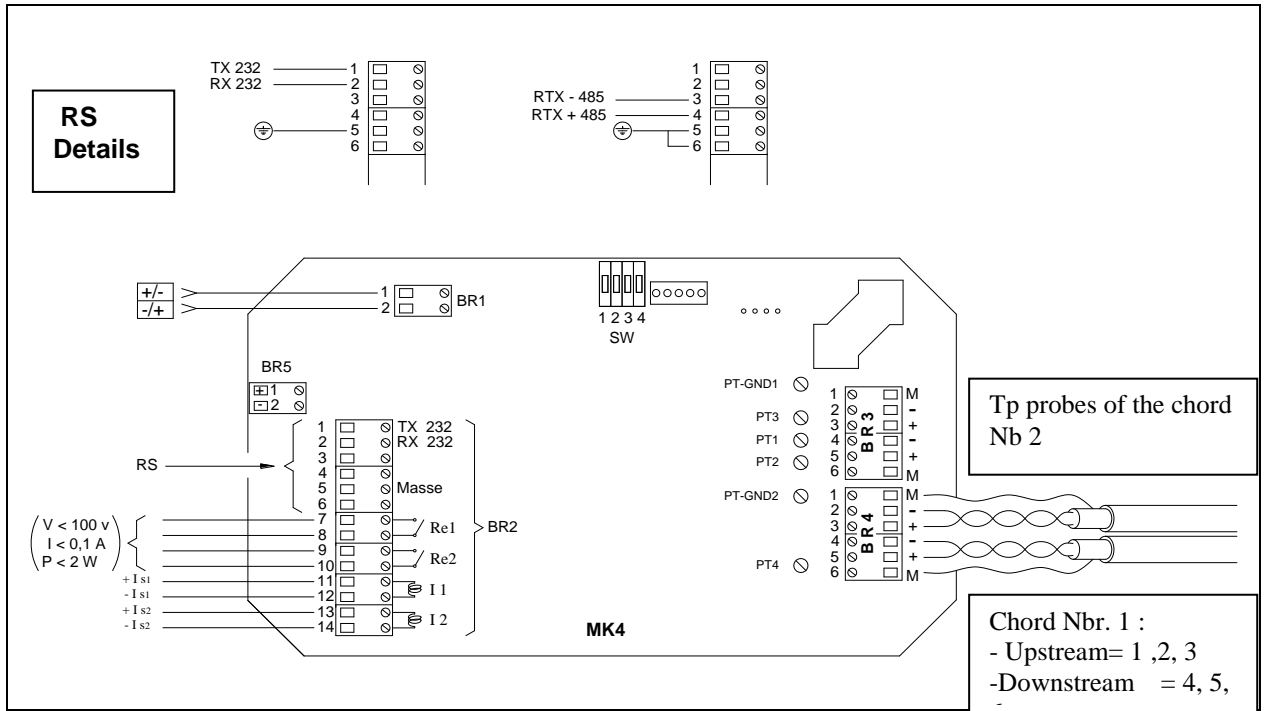
3-3: COD CE ATEX Version (Ex d IIC T6) – IP 67: (See also NT 219-B)

- The keypad keys have the same functions as for the industrial version.
- The two stuffing boxes on the porthole side are reserved for cables to the probes.
- To carry out the internal cabling of the probe cables on the MiniSonic card, it is necessary to pull the support rack forwards: remove the three front panel screws.
- To comply better with EMC rules, stop and ensure the electrical connection of the cable braids in the stuffing box housings.
- Once all the connections have been terminated and before closing up the unit, connect the MiniSonic card to housing of the unit using the yellow / green wire at the rear.
- The unit must be grounded with respect to the external screw. Screw in and tighten the covers (IP 67), then secure the removal-prevention screws before powering-up.



4 – MINISONIC-SPEED-1 & 2 WIRING DIAGRAM : (Low Voltage Supply)
If our GP 01 90 to 230 V AC module is installed, see also our NT218

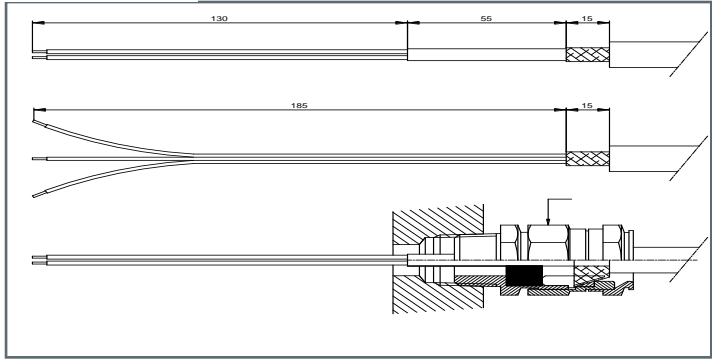
- Internal cables must be kept as short as possible. Cables are to enter through the stuffing box facing the terminals.
- For the Ex d unit, imagine the card turned over with access from underneath.
- Plug-in connectors assist with cabling and maintenance. Choose flexible cables with a limited cross-section (1.5 mm²) to facilitate these operations.



To have (-) of 4-20 mA common, please invert connections to terminals 1 & 2 on BR5 .

185 mm

Version Ex d : cables to probes



5 – CONVERTER ASSEMBLY

5-1 : Mechanical assembly

Prefer conditions allowing easy access and legibility.

Avoid mounting on supports exposed to vibration.

Avoid extreme climatic conditions and direct exposure to sunlight.

Attachment is by two M5 screws for industrial boxes or on a 2" stake for a EEx d box.

5-2 : Electrical Connections: Refer to the diagram on the previous page.

Power supply: Connector BR 1 – Use a flexible cable having a section of 0.5 to 1.5 mm²

- Recommended source is DC , 10 to 30 Volts (60 V in option) : 12 / 24 (48)
- Any polarity will do. The required power is less than 2 Watt.
- The source may also be alternating (9 to 18 Volts – 50/60 Hz) via a transformer.

RS 232 or 485 digital outputs: BR 2 , terminals 1 to 6.

- The PC-DB9 cable uses RS 232 with Tx at 2, Rx at 3 and 0 Volt at 5 .
- For a permanent link (logic controller, modem):
 - . For RS 485: connect RTx – to terminal 3 and RTx + to terminal 4
 - . For RS 232: connect Tx to terminal 1 , Rx to terminal 2 and common to terminal 5
 - . The RS 232 output is activated by default. To activate RS 485 instead of RS 232 , connect terminals 5 & 6

On/Off outputs - Relay (Static) : BR 2 , terminals 7 to 10 – flexible multipair cable.

- Comply with the limits $V < 100\text{ V}$ – $I < 0,1\text{ A}$ and allow for $R_{ON} = 10\text{ Ohm}$.
- Each relay Re 1 (terminals 7 & 8) or Re 2 (terminal 9 & 10) will transmit the chosen status information from the “General Parameters” menu.

Analog outputs 4 – 20 mA: BR 2, terminals 11 to 14 – Flexible multipair cable.

- These outputs are independent and **galvanically isolated** from each other, but also from other MiniSonic circuits and by default are **passive**. They must be connected to a receiver providing the power supply (30 V max.) to allow a load of more than 1 kOhm .
- Output No. 1 (terminals 11 & 12) and output No. 2 (13 & 14) will transmit magnitude and range variation information as chosen from the “General Parameters” menu: flow rate, but also speed of sound and gain.
- Using the power supply voltage appearing on terminal block BR 5 (see diagram) permits to have analog outputs **active**, but with the drawback of losing some of the galvanic insulation.

! With a 12 V DC or AC supply, R “loop” is limited to 150 or 200 Ohms.

Attention! If this R loop is too high for the supply, the current fall down to 4 mA

Connection of two probes: BR 4 (BR 3 is reserved for the dual-channel versions)

- Use preferably the twin-ax cable (ET1217) specified by Ultraflux.
- For armored cable, stop the foil wrap before or inside the gland.
- For a positive flow rate, connect the upstream probe across terminals 2 and 3 with a shield at 1, and the downstream probe across terminals 4 and 5 with a shield at 6.
- If coaxial cable, connect the cores to 3 and 5 and the shields to 2 and 4. For a triaxial cable, the external shields will be connected to 1 and 6.
- For the COD / Ex d version, the external shields will preferably be stopped and connected in the Ex d glands, and the conductors will be approximately 15 cm long as far as the terminal blocks.

6 - PROBES INSTALLATION – General Procedures.

The MiniSonic Speed 1 & 2 accept all standard or special transducers of Ultraflux catalogue with frequency from 250 KHz up to 2 MHz: clamp-on, insertion or wetted...

- > Unless specified and instructed otherwise in the order, refer to the probe data sheet of the model used .
- > The installation of the probes in a conduit should allow for the best the straight lengths, particularly upstream, but also downstream, in order to benefit from a predictable and stabilized hydraulic profile. Provide upstream a minimum of 15 times the pipe diameter.



- > Similarly, to avoid the nuisance of deposits, it is recommended to place probes closed to channel bottom.
- > In any case, never install probes downstream waterfall. Air bubbles excess will affect ultrasonic transmission with the risk of no measurement.

- > **For intrusive or wetted probes**, adjust the insertion then the alignment or orientation of the probes for the same pair (> parallel faces)

We recommend installation tools to guaranty alignment or a LASER to check it.

Important! : *Once these adjustments finished, it is necessary to measure with accuracy the distance L between transducers face to face and its projection D on flow axis and note these values on an “as built” data sheet for further entering in instrument menu.*

! The final accuracy depends on.



- > **For external probes**, the freedom offered should not prompt the user to ignore the above rules.

However, the choice of direct (\backslash), reflex (\vee) or even (N or W) installation mode will depend on the decision regarding the conduit (state) and the fluids to be measured.

Therefore, we advise initially a provisional installation known as a validation installation (coupled with gel or grease) and final assembly (supports, solid coupling) once the conditions have been validated.

Since the MiniSonic calculates for you the distance $D.S$ required between the probes, the setting up operations will, in theory, take place once the converter parameters have been set.

Particular attention will be paid to cleaning the conduit at the probe location.

7 - COMMISSIONING AND PARAMETERING OF MINISONIC SPEED 1 & 2

1. Once the cabling has been carried out and verified, power up the system:

> The MiniSonic must display its home screens:

- Hardware version = MiniSonic Speed 1 or 2
- Firmware version = 18.10-01 (e.g. – make a note of the first figure)
- Serial number = see if it is identical to the company nameplate
- Technical information: parameterized probes

Then it automatically switches to the measurement function and displays set value (V1, V2, V, C...).

> Check the consistency of these messages with respect to your application. If your instrument is set ready to be used, you can start readings and records.

> However, it is recommended you to check and, if necessary, to optimize the adjustments, taking into consideration the exact dimensions and, if possible, zero flow conditions (see the “Self-zero Adjustment” menu).

2. Parameter settings using the PC software: *Use same version than Firmware*

- Refer to the manual supplied with the software (CD-Rom).
- The fields of the main values to be entered are listed below under Heading **8**.
- The software offers extended configuration possibilities.
- At the end of the manual, a printout of a typical file is given.

3. Parameter settings using the keyboard

Successive pressing on the **F** key, or **F** then **+** or **-** gives access from the “Measurements Display” menu to the titles of the different menus :

- Access (Authorization) to Adjustments
- Pipe or Channel parameters
- Velocity / Fluid parameters
- Probe parameters
- General parameters including Outputs
- Zero adjustment
- Tests
- Optionally: “Current outputs setting” and Factory Adjustments”.

To enter the Menu, use the **▽** key in the same way as to move to the next field to be filled in .

To modify (text or values), use **-** or **+**

Exit by the **F** key that does return to the “Measurement Display” menu

If there is no action on the keypad for 1 mn, the MiniSonic automatically returns to “Measurement Display” menu.

When inside a menu, the browser only scrolls forwards. When necessary, do a complete scroll.

8 – DETAILED REVIEW OF MENUS – MiniSonic Versions Speed 1 & 2

Here below we list the different menus with values and data as displayed by the LCD and what it is allowed to modify to do the setting. At the end of the chapter, we list some other functions or menu, which require the use of our LS_600W software on a PC.

8 -1 : “ Measurement Display ” menu:

Every time you return to this menu, MiniSonic displays Chosen probes and , if S.E., distance D.S.to fix between these probes :

**Probe = SM 05/ SExxxx
+ D.S. = xxxx mm**

Then the Flow Velocity (Speed) result or any other chosen data ; with possible messages .

**V = xx.xxx m/s
Seek Echo , Fault**

*If one chord , SM or SE , $V = V / Kh$
If 2 chords and SM, $V = Cv1 * V1 + Cv2 * V2$
If 2 chords and SE, $V = (V1 + V2) / 2 * Kh$*



Gains 1 & 2 (mode and value)
et I.Q.1 & 2 signal quality indicators:
*If I.Q. is less than 33 %, the last
measurement cycle is rejected.*

**Gain 1 & 2 = xx dB
I.Q. 1 & 2 = 100 %**



Velocity of fluid and sound velocity :
*V is the copy of above value.
S. Sound comes from chord 1 or is
the averaged result from chord 1 & 2.*

**V = x.xxx m/s
S. Sound = xxxx.x m/s**



Velocity per chord (V1 & 2 / S.Sound1 & 2)

**V 1 & 2 = x.xxx m/s
S.Sound 1 & 2 = xxxx.x m/s**

*N.B.: Sound velocity is calculated from transit time measurements and each path length.
By comparing this value to expected one at fluid (water) actual temperature , you have a
good information to control your L1 & L2 data.*



Physical measurements of time of flight
and Delta T difference , chords 1 & 2 :

**T1 = xxx.x μs
DT1 = ns**



Date and Time display
> *Change only by PC and Software.*

**16 / 05 / 2005
15 : 46 : 22**



Hydraulic information on calculated
KH and Reynolds Number:

**Kh = 1. 055
Rey = 3,1E5**

N.B.: only with clamp on probes SE

*This Kh corrects the raw flow velocity measurement at chordal level to estimate
the average velocity on the whole pipe or channel.*



Return to menu header.

8-2: « Calibration Allowed » Menu :

> Access = press **F** once from the Measurement Display menu

> If the display is :
Enter this code (1 to 65535)

**Calibration Allowed : 0
Code ?**

> If the display does not request "Code?", there is none (code = 0)

> Press **▽** : possibility to enter a code
> Enter this code :

Access Code = xxxx

! This code will become active after de-energizing.

Remember to make a note of it. It will be required for any further intervention.

> In case of loss, contact Ultraflux giving the following informations : the serial number of your MiniSonic MK4*/xx/xx/xxxx as it appears just after switching On and the date or dates on which you want action to take place. An operation will be requested allowing a "joker" code to be calculated.

> A second press on **▽** will provide access to the existing Languages choice field.

8-3 : « Pipe Setting » Menu :

! This menu appears only if you have first selected clamp on (SE) probes.

With wetted probes (SM) selection, geometrical dimensions are entered in probe menu.

To enter pipe characteristics and dimensions (only one pipe),

Press twice on **F** or **F** once, then **+** and Enter by **▽**
(operations common to all the menus)..

▽ External Diameter (mm)
or pipe circumference

**Ext D = xxxx.x
Ext C = xxxx.x**

▽ Pipe material, to be chosen
from programmed list :

**Pipe =
Steel ... PVC ... Other**

If other: characterization of this material by its sound velocity CM

This selection will resolve permit to solve applications on new or special materials as well on composite pipes having several materials (ext. & int. liner)










▽ Total pipe thickness:

**Thickness = xx.x
mm**

▽ If Other (only one material) :

CM = xxxx m/s

8-4: « Q Settings » menu (Flow / Velocity / Fluid)

Velocity unit – not programmable: (l/h ...tot ... m3/s);		V unit = m / s
 Reference “ V max “ : <i>V max is used as the range reference for graphics on PC screen and for cut-off %</i>		V max (unit) +/xxxxx.x
 Product (+ / -) : > If WATER: C = 1300 to 1600 m/s > If OTHER:		Product = WATER / OTHER
 Fluid Characteristic in terms of sound velocity range:	}	Co = xxxx m/s
		Delta C = xxx m/s
Hydraulic corrections : <i>They concern only full pipes equipped of clamp-on probes</i>		
 Hydraulic corrections (+ / -) <i>Prefer mode AUTO.</i>		K Hydro = AUTO / MANUAL
 Entry of Coefficient KH or data to do its calculation : > If MANUAL: entry of coefficient depending on profile : Laminar = 1.333 or Turbulent = 1.03 to 1.08		K Hydro = 1.xxx
 > If AUTO: entry of parameters : Fluid viscosity:		Viscosity (cst) x.x
 Pipe roughness: As well as the critical Turbulent / laminar flow transition:		<u>Roughness (m m)</u> <u>xx.xx</u>
 Critical Reynolds Number (ReyC)		ReyC = 2800
 Transition range (LBR): <i>(Recommended values)</i>		LBR = 3

8-5: « Probe / Echo parameter settings » menu :

Number of chords:
MiniSonic Speed-2 only

**Number of Chords =
1 or 2**

Choice of probe:
*Same choice for the 2 chords
From this choice depends F (MHz)
And access to L & D (SM) or D.S (SE)*

**Probe = SM_F 0.5 MHz
(or SE ou SP. A/B)**

> if **SE** (External probes)
/ = single traverse
V = reflex mode
N , W = 3 or 4 paths

**Probe mounting = V
(or / , N , W)**

> If **SM** (wetted internal probes), see below parameters **L, D, Cv**

Management of amplification gains :
*ESC Mode recommended.
(Echo Shape Control)*

Gain 1 & 2 = ESC

Otherwise :

➤ If **MANUAL** (gain adjustment.) :

Gain 1 & 2 = xx dB

➤ If **AUTO** : adjust **Margin** to have
a gain bonus over echo loss gain Go

This amplification mode and a limited margin (10 ~12 dB) rather than ESC mode are showing often better results with charged water.

> If **SM choice**: position of probes depending
on geometrical measurements .

➤ as distance L between probes

➤ face to face , per chord

Length 1&2 = xxx.x mm

> as projected distance onto flow axis
(part of L concerned with the flow)


Ax. D 1 & 2 = xxx.x mm


Calculation weighting (MiniSpeed-2)


C.V. 1 & 2 = 0.500

These coefficients are applied to V1 & V2 to calculate average V. They depend on probes position and immersion.

8-6: « General Settings » menu


-  Setting of LCD backlighting


**Back Light
ON / OFF / TIMED**
-  Filter rate of measurements
(Number of 0.5 s cycles)


Filter = **
-  Memory time of last measure (IQ >30)
(Mode ESC: enter Mém. = > 20)


Mémory (s)= **

! Meanwhile menu exists, MiniSonic Speed don't activate the totalizers.

-  Setting of Totalizers 1 & 2
 > Depending on flow direction:

+ , - , +/-
-  > Depending on weight or unit:
(from 1 cl to 100 m3)


**Pulse weight =
1 m3**
-  Setting of Relays 1 & 2
 > By assignment:


**Closed/Open / Fault Q/ Dir.Q/
Threshold Q / Tot**
-  > If Threshold: enter value for V:

**Threshold R2 (unit)
Value**

Parameter settings of the two 4 – 20 mA current outputs:


! MiniSonic Speed don't calculate the flow. Don't use Q, Q1 or Q2

-  > By assignment

**SA 1/ SA2 Type
V1, V2 , V , C , GAIN**
-  > By Range (depending on unit)

{

**4mA SA 1 & SA 2
+ / - xxxx.x**

**20 mA SA 1 & SA 2
+ / - xxxx.x**
-  RS 232 ou 485 Communication
 Jbus slave No and Baud Rate:

**N. JBUS = 1
BAUD = 9600**

8-7: « Zero / Autozero Settings » menu



Status display:

**Delta To (ns)
= xx.xx (ns)**

Modification by +/- :

< No compensation (reset) :

RST Delta To

> Performs the zero under actual conditions (flow must be null)

Autozero

Exit by 

*! **Caution** = to carry out Self-zeroing, the flow velocity must be rigorously zero while the display indicates « * dTo * » .*

8-8 : « Output Current Settings» menu (normally reserved to Ultraflux)

It permits adjustment of coefficients to convert min / max range to 4 / 20mA

4 mA (1 & 2) = xxxx

*! **Caution:** use an a approved instrument to measure milliamperes .*

20mA (1 & 2) = xxxx

8-9 : « Factory Settings » menu (normally reserved to Ultraflux)

It permits to adjust a coefficient which optimises the compensation with clamp on probes (value 0.6 to1.4)

Correction S.E. = 1.0

Another parameter named “Delta T Band” permits to set a compromise between filtering and response time for some special applications : please contact Ultraflux .

Factory settings menu includes another facility but only through PC software: the entering of a linearization curve

8-10: « I / O Test » menu : simulation on outputs and relays .



Simulated current on SA 1 or SA 2
(Action by +/-)

**Current 1 & 2 = xx.xx
mA**



Simulation of status on Re 1 or Re 2
(Action by +/-)

**Relay 1 & 2 =
Open / Closed**

8-11: Additional adjustments possible using PC + Software only:

Ultraflux enters the «by default» values or states during testing before delivery. However, it may be necessary to modify some of them on site. If most of the operations can be performed from the keyboard, some call for the LS_600W (be sure to choose the right version). Using the software will also allow the backup of the modified menu.

Parameter Menu Dialogue:

In addition to the fields already described, this menu will allow two text fields in order to give MiniSonic an application or client name and an instrument reference, for instance:

> *Cf. General sub-men, line 1 & Line 2*

The MiniSonic internal clock time set is obtained by synchronizing it with that of the connected PC : > *Cf. General sub-menu, Synchronization with PC time = Yes*

The software allows to enter a Delta To to compensate for a zero default (flow velocity supposed to be zero) , when the Auto-zero function cannot be launched.

> *Probe sub-menu, Delta To*

The software will allow the input of a +/- Vmax defining the scale of the Measurement Dialogue menu graph. Using the scale of this Vmax, different from and independent of the 4-20 mA scales parameterized elsewhere, it is possible to enter an erase threshold (display forced to zero) for low velocity values : > *Cf. V eff. = % V max*

As long as they are accepted, and therefore as long as rights are justified and authorized by a confidential code, it is possible to work in a “ Factory Setting ” menu. Contact Ultraflux while justifying your request.

Factory Setting Menu Dialogue:

This menu will allow determining fields to be modified for the application and which we reserve for authorized people who have gone through in-depth training.

For information, we list some of the functions:

- Possible input of a *Linearization curve*, to compensate for an error curve characterized by metrological tests. This curve is symmetrical to the error curve and entered by 11 points defining 10 segments per 10% section through to a “reference” flow rate at the end of the scale. The input of V ref = 0 renders the curve inoperative.
- Definition of one or two *special probes*.
- Input by *Delta T Filtering* of a threshold to deactivate the filtering and obtain the best “response time / measurement stability” tradeoff. In this way, MiniSonic will be able to respond quickly when a pump starts or a valve opens or closes, and will then show filtered and stable reading when the flow rate / velocity is established.
- The limitation of the amplification gains (*Max. Gain*) permits to avoid some disturbances from noise under default conditions.
- Adjustment of *External Probe Correction* to optimize accuracy on very large pipes.
- *Simulation Menu* for testing.

9 - RECOMMENDATIONS

Each application has its priorities. Accordingly, the MiniSonic is particularly flexible and can be adapted to extreme situations, meaning that many applications are possible.

Ultraflux fills in each value or text field before the final tests and delivery.

Nevertheless, it is advisable to verify them by running through the various menus, comparing them with files given at the time of order, or with your instructions or particular choices.

More particularly, geometrical descriptions specific to the site and the choice of scale are the responsibility of the end user.

During a run-through of the various menus, it is advisable to fill in the "Probes / Echoes" menu first, followed by those related to the Pipe or Channel dimensions and then the Flow Rate / Fluid (Q) to obtain a measurement to be transmitted according to the instructions entered into the "General" menu

FINAL CHECKS AND TESTS

Once installation, connections and parameters have been set up, several possible situations may arise:

Case 1 – The measurement displayed and transmitted meets your expectations.

Case 2 – The measurement operates but may lack accuracy or is unstable.

Case 3 – The measurement is not reliable or the MiniSonic is displaying a Fault.

> **Case 1:** Although everything appears to be OK (Flow Velocity = OK , ...),

> *Check the other values:*

- The echo or gain level compared to typical values.
 - For external probes, a gain exceeding 50/60 dB reveals certain difficulties such as the wrong choice of probes, incomplete installation or coupling, rusted pipe , absorbent fluid ...
 - For intrusive or sealed / wetted probes, the gain level is usually lower (10 ~30 dB)
The ESC mode can decide a high gain due to an higher margin. Take in account it in your diagnosis.
- The quality index Q.I. is normally close to 100 % .
By default, it indicates several perturbations = electrical interference, passage of bubbles, highly charged fluid ...
In this case, in-depth investigation is advisable.
- The displayed speed of sound should be close to that expected, an index of good control of the geometry or application . We can use this information to adjust L 1 & 2.
- If the flow rate can be interrupted, check the Zero
If necessary, carry out adjustment using the Auto-Zero menu.
By PC and software, it is possible to set the measurement to Zero at very low flow (cut-off = % of Q max) .It is better to don't use this function for portable applications

> **Case 2:** In addition to the points mentioned above, the possible causes are:

- Poor control of the installed dimensions, changing product, ...:
Reanalyze and correct if possible.
- An installation constructed with poor hydraulic conditions:
If possible, change the location of the probes.
Otherwise, it is possible to choose $K_{Hydro} = Manual$ and adjust this coefficient to display the expected flow velocity value: Increasing K_h does velocity value decrease.
With insertion/wetted probes, it is also possible to play on Axial D.
- An unstable fluid causing the ESC mode to restart too often:
Try the AUTO mode with a reduced margin (~ 12 dB or less).
- To permit a greater precision or a wider flow range, the MiniSonic allows the input of a "Linearization" correction law.
> *Plot the error curve and use the software LS 600W to enter the complementary law (Factory Adjustments Menu) .*

With free surface flow application, please check that probes are sufficiently immersed.

> *If not, please correct their position or wait for better conditions*

- The Delta t offered by the measurement conditions (Diameter, Flow velocity rate, Assembly, Choice of probes) is too low to claim any measurement accuracy.
Is it possible to revise these choices?
- The measurement conditions reveal poor control of transitions from turbulent to laminar configurations:
Adapt declared Critical Reynolds and range (LBR) values or play with $K_h=manual$.

> **Case 3:** The MiniSonic does not operate:

- There is no display or measurement transmission (4 – 20 mA) .
Is the MiniSonic powered up? Check with a Voltmeter.
Has it failed? If yes, the only solution is to call in our after-sales service.
- If the MiniSonic displays INIT constantly, attempt a power cutoff, then re-energize
Would the MiniSonic supplied by a too low voltage or power source?
If the fault persists, contact Ultraflux (Problem with the microprocessor).
- If the MiniSonic displays "Fault", this message does not mean that the MiniSonic has failed, but that the ultrasound signals have not reached the expected level or are outside the window [Co +/- Delta C]. There are several possibilities:
Pipe empty?
Problem of site? Two-phase fluid or too highly charged or too viscous?
Old pipe and / or with walls not transmitting ultrasonic signals?
Unsuitable installation mode = try Direct mode (\) or other sensors .
Incorrect sensor installation (orientation, coupling

10 - INVESTIGATIONS

If there is a difficulty or a problem, logical analysis can be assisted by the implementation of expert apparatus:

- Either an oscilloscope: the MiniSonic has internally on its P.C. Board test points

PT 0 = 0 Volt – Ground

PT 1 = Selection windows. Echo must be inside.

PT 2 = Synchro –Positive edge 0 to 5 Volt

PT 1 = Selection windows. Echo must be inside.

PT 3 = Emission < > Reception transit time.

PT 4 = Echo – Alternating signal , peak to peak max = 4 Volt / 0.65 V negative threshold.

→ *Please refer to didactic handbook to have typical signals information.*

- In case of doubt on signal quality or level, assuming that probes installation must have been performed rigorously, using tools when available, we recommend to control probes alignment with a LASER beam or equivalent tool by placing it alternatively on each probe face. Usual requested accuracy is +/- 2 °.

SPARE PARTS

Ultraflux offers possibilities of purchasing spare cards or, as long as acceptance is granted, the standard replacement of equipment in the event of failure.

Contact the Ultraflux commercial services or the regional dealer.

11 – APPENDIX 1: Print of a typical setting file with wetted probes / 2 chords

Settings - C:\...Ls600W 18\Fichier Type Speed 2.eta (03/05/2005

General

N. JBus = 1 Filter = 10 Cycle 1st screen = Velocity
 Memory = 60 Cycle Back light = Timed
 Line 1 = ULTRAFUX
 Line 2 = CHANNEL_1
 Firmware = 18-10-

Probe

Number of chords = 2
Probe = SM-F0,5
Stop meas. on = Zero Crossing
US Impulse = 1

Chord 1

Polarity = Normal
Type of Gain = E.S.C.
Margin = 12 dB
Path Length = 4500.0 mm
Axial D. = 2200.0 mm
C.V. = 1,000
Delta T0 1 = 0.00 ns

Chord 2

Polarity = Normal
Type of Gain = E.S.C.
Margin = 12 dB
Path Length = 2850.0 mm
Axial D. = 1900.0 mm
C.V. = 1,000
Delta T0 2 = 0.00 ns

Pipe - Product

Product = Water

Velocity

Max V = 4.0
Cut OFF V = 1 %

Relay 1

Type = Direction V
Direction = Normal

Relay 2

Type = Threshold V
Threshold = 0.5 m/s
Direction = Normal

Analog Output 1

Type = V1
4 mA = 0.0
20 mA = 2.0

Analog Output 2

Type = V2
4 mA = 0.0
20 mA = 3.0
