

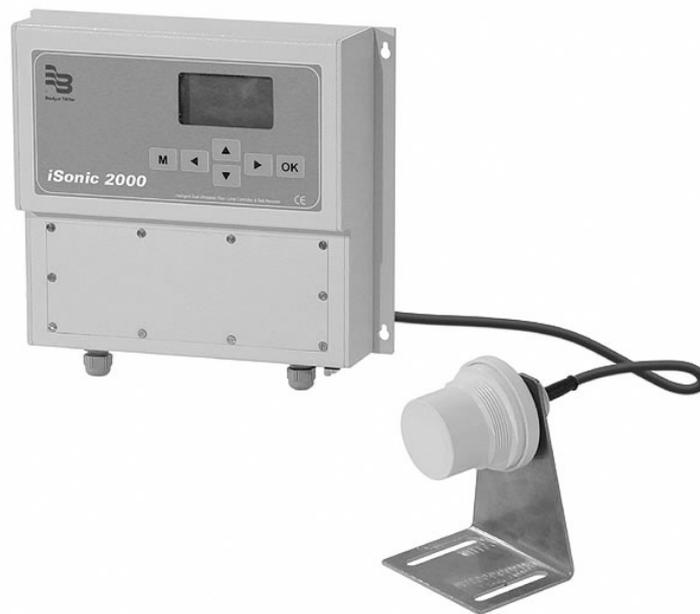


®

Badger Meter Europa GmbH

iSonic 2000

Intelligent ultrasonic meter and controller



PC Menu system

July 2002 (Applicable to iSonic Firmware revision 1.6)

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1. Introduction

The user-interface for the iSonic consists of a graphic LCD and a 6-key keyboard. With this interface, the user can configure the entire set-up of the instrument and select different information screens whilst the unit is in measurement mode.

After a power-up, the iSonic will always start the measuring process, this is called RUN mode. When a user presses the “M” key on the keyboard, the unit will enter a configuration mode, this is called MENU mode.

The interface for the user has been made to consistently work as follows:

- The ‘**M**’ button either, when in RUN mode, calls up the menu, or, when in MENU mode, takes the user a menu level up.
- The ‘**OK**’ button either starts the editing of a value or confirms a value. When editing a value, the ‘**M**’ key acts as a abort key, the value remains unchanged.
- When editing a value, the Up and Down arrows (▲▼) either select options for that value (eg. ON/OFF), or for numeric values selects the next digit value.
- When in menu selection mode the Up and Down arrows (▲▼) select the next menu entry.
- When editing a value, the Left and Right arrows (◀▶) either select options for that value (for instance: ON/OFF), or for numeric values select the digit next to the one currently selected.
- When in MENU mode, the Left and Right arrows (◀▶) select the next menu entry.

The entire menu system is shown in the attached, “Appendix 2 – Total Menu System” Please note that the RUN mode is not always entered after a power-up; if unit has detected a faulty configuration, the MENU mode is automatically entered, requiring a user to configure the unit again.

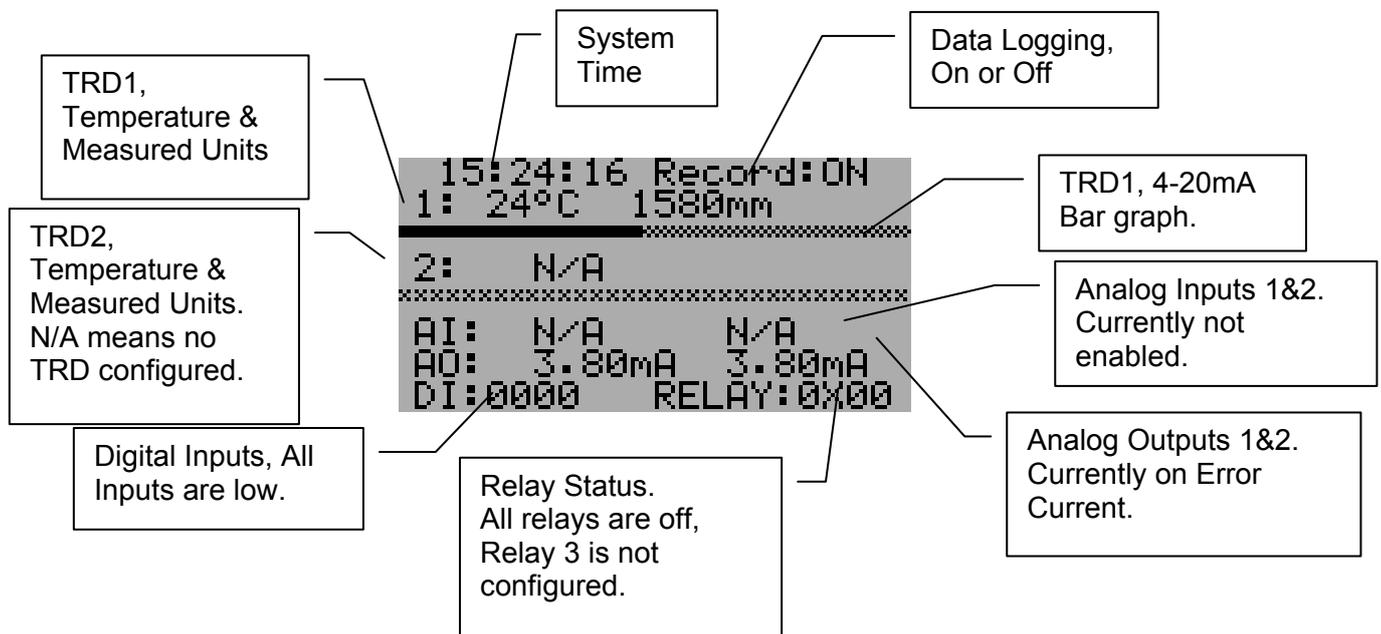
Not all configuration data is available through this interface, certain settings such as modem configuration, telephone numbers and the likes are only accessible through the PC configuration program. The LCD/Keyboard interface is mainly provided for quick field configuration changes and it is recommended to use the PC interface for initial configuration of a unit. The reasons for this is two fold:

1. The PC configuration program is easier to work with and gives a more comprehensive overview of a configuration.
2. The PC configuration program performs numerous checks and does not allow invalid configurations. This is contrary to the menu system where a user is able to enter an invalid configuration. The iSonic does perform certain checks on the configuration but not all situations are tested.



2. Run screens

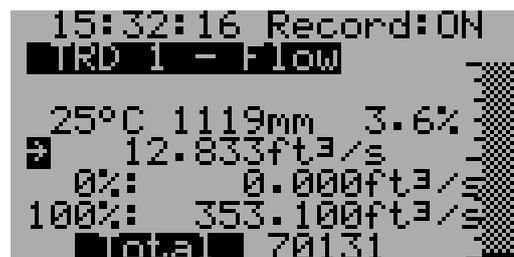
The first screen that is brought up by the unit combines most of the measurements that are being taken. It typically looks as follows:



Other RUN screens can be selected by using the Up/Down and Left/Right keys. Available screens are:

Either TRD 1 or TRD2 screen:

All relevant information for the selected transducer, measured level, calculated units and a min - max bar graph:



In the above screen, head is indicated in mm, also the process value is expressed in a percentage value. The application is a flow measurement, indicated in cubic feet per second. The minimum & maximum flow points (0% and 100%) are also indicated. The bottom of the screen shows the totaliser value for this channel.



Relay and Analogue Inputs screen:

```

15:25:02 Record:ON
AI0:      N/A
AI1:      N/A
RELAY
1 0 60.0 40.0 44.9%
2 0 70.0 30.0 44.9%
3 X      N/A
4 0 30.00m 30.00m

```

This screen shows the analogue inputs in mA and in percentage value. It also shows the complete status of each relay, whether it is ON (1) or OFF (0), the ON switch point and the OFF switch point, and what the current process value is. On the above screen, Relay 4 is configured as a periodic timer and the ON and OFF time is shown in minutes.

Bigger sized readout screen:

Calculated measurement information only.

```

15:34:07 Record:ON
1: cfs
 12.776
2: N/A

```

This screen can be selected by pressing a “Right” or “Left” button.

3. Main menu

Any editing of the instrument’s settings can only be performed when the correct password is entered. To enter the MENU mode from the Run mode, press the ‘M’ button on the instrument. The following password screen will appear:

```

Version: 03.8
Serial: 000001
Password: 0000

```

At time of shipping, the password is set for “0000”. When the password screen is shown, the unit also displays the version number of the software and its serial number.

If an incorrect password is entered at this stage the software will simply return to Run mode. Also, if nothing is entered for 15 seconds, the unit will automatically return to Run mode.



Once the password is correctly entered, the main menu navigation screen will appear:

```
MAIN MENU
>Run
Configure
Calibrate
Reset Output
Tune
Language: English
Change Password
```

During menu navigating, a '>' character on the left hand side of the screen will indicate at which menu entry the user is busy. Pressing the Up & Down arrow keys moves the selection indicator. To select a menu entry, press the 'OK' button.

At an editable entry, when pressing the 'OK' button, the indicator will change to a '*' character, showing that this entry is now being edited.

The main menu entries perform the following functions:

- **Run;** will start the measurement process again.
- **Configure;** allows the user to configure the settings of the instrument (password protected)
- **Calibrate;** allows the user to calibrate the measurements of the instrument (password protected).
- **Reset Output;** allows the user to reset all the outputs.
- **Tune;** is intended for measuring the echo manually, it is typically intended for use during an installation or during trouble shooting.
- **Language;** allows the user to select a preferred interface language.
- **Change Password;** here the user can configure a unique password setting.

4. Configuration menu

The configuration menu is displayed as follows:

```
CONFIGURATION
>I/O channels
Units
Set Date/Time
Error delay: 001min
Log/Power/Comms
Factory default
```

Where:

- **I/O channels;** allows the user to enter the configuration for all the I/O signals.
- **Units;** allows the user to configure the measurement units for the unit. Under this sub-menu one can set the temperature, level, flow and volume units. Also, it is possible to configure the date & time format.



The iSonic supports:

- Temperature: C°, F°
- Level: mm, m, inch, ft
- Volume: m³, l, acft (Acre Feet), gal(USA), gal(UK), bbl (Barrel)
- Flow: m³/s, m³/d, l/s, cfs, Mgd(USA), gpm(USA), Mgd(UK), gpm(UK)

One special note on gallons; regardless of whether the user has selected US or UK gallons, the iSonic will display “gal” in its measurements, whilst using the correct conversion factor in its calculations.

- **Set Date/Time;** configures the instrument’s internal clock. The screen shows the actual time and allows the user to change the settings.
- **Error delay;** this factor determines how long the “last known good value” is held.
- **Log/Power/Comms;** enters a sub-menu where the user can set Logging parameters, Low Power operation and communication parameters.
- **Factory Default;** selecting this option resets all the parameters back to a factory default setting.

When “drilling” one level down from I/O channels, the user is presented with the following screen:

```

INPUT/OUTPUT
>Transducer: 1
  Analogue In: 1
  Relay: 1
  Digital In: 1
  Analogue Out: 1

```

From this point onward, any I/O channel of the unit can be configured, using the appropriate type selection and index.

5. I/O channels: Transducer menu

The configuration for a transducer is reached through the selection, “Configuration → I/O channels → Transducer”. Once the “Transducer” entry is reached, the screen will show “* Transducer 1”, at that stage the user can select transducer 1 or 2 by pressing the Up Down arrows and then confirming by pressing “OK”.

When selecting “Configuration → I/O channels → Transducer 1”, the user is presented with the following screen:

```

TRANSDUCER (1)
>Active: ON
  Freq: 052.000kHz
  Type: Level
  Filter: 64
  Deadband: 00100mm
  Rate: Medium
  Process setup

```



Using this menu, the user can edit all the parameters for Transducer 1:

- Whether it is active (On / Off)
- The transducer's active frequency, settable in kHz
- Which type of measurement is being performed, this can be Level, Volume, Flow, Function or Sound. The "Function" entry indicates that a combination of 2 transducers is used where both their values are added, subtracted, averaged or used to calculate a differential flow. The "Sound" type can only be used on TRD2. Making this selection indicates that a special "Speed of Sound" transducer is connected on TRD2.
- The filtering to be applied on the measurement, this can be; None, 16, 32, 64 and 128. This value describes the number of samples that are taken to reach the measured value, "None" means that the directly measured value is used.
- Deadband tells the instrument from which distance to start measuring.
- Rate allows the configuration of the firing rate of the instrument. This can be fast, medium and slow. When a slow varying measurement is sought, select 128 averaging together with a "slow" repeat rate.
- Process setup takes the user into the configuration for the actual process; this is where the measurement process can be described in detail.

6. I/O channels: Process setup menu

The process setup menu is reached through the Transducer Menu. The sequence "Configuration → I/O channels → Transducer 1 → Process Menu", produces the following display:

```

PROCESS (1)
>Level setup
Volume setup
Flow setup
Alarm setup
Function: Average
Gain setup
Custom table

```

The next screens from here on out are:

```

Level setup
LEVEL (1)
> 0%: 03000mm
100%: 00000mm

```

The two limits for the level measurement are set here. The bar graphs, which are available in several RUN screens, are also configured with these limits. The units used in 0% and 100% are as selected in the "Units" set-up. If values are entered in 'mm' and at a later stage 'inches' are chosen the instrument will automatically perform the correct conversion.



Volume setup

```

VOLUME (1)
>0% :0000.000m³
100% :0010.000m³
Tank: Vert Cyl
Bottom: 01000mm
Diameter:01000mm
X Dim: 01000mm
Scale: 01.000m³/mm

```

Again, the 0% and 100% points can be programmed here, but in addition, the tank can be described as:

- Vertical Cylinder (“Vert Cyl”)
- Vertical Cylinder with a Bottom Cone (“V-Cyl +Cone”). The “X Dim:” value is used to describe the height of the cone.
- Horizontal Cylinder (“Hor Cyl”). This would typically be a vessel lying on its side, the “X Dim:” value is used to indicate the horizontal length.
- Sphere (“Sphere”) for a round tank.
- Scaled (“Scaled”), where the vessel is calibrated in volume per head. Use the “Scale:” value to calibrate the reading.
- Other (“Other”), selects the custom table values.

After having made the proper tank type selection, the distance to Bottom, the Diameter, and other parameters can be filled.

```

FlowSetUp )
>0% :0000.000ft³/s
100% :0353.100ft³/s
Weir: V-Notch
Weir size: 00700mm
Zero level:02700mm
V-notch: 22.5°
Units/tic: 1

```

In addition to the 0% and 100% points, the user can select the following Weir & Flume types:

- V-Notch weirs
- Rectangular weirs with end contractions (“Contr. Rect.”)
- Rectangular weirs without end contractions (“Suppr. Rect.”)
- Trapezoidal weirs (“Cipolletti”)
- Parshall flumes (“Parshall”)
- Leopold-Lagco flumes (“Leopold-Lagco”)
- Other, select this option to describe a non-standard weir or flume in the “Custom Table” which can be found under the “Process Setup” screen. This is a 15 segment user entered discharge table (flow vs. head)

The “Weir size”, “Zero level” and “V-notch” parameters are used to describe the weir or flume in further detail.

The “Units/tic” parameter is used in applications where an external totalising instrument is connected to one of the iSonic’s digital outputs. In the above example, the tick rate is 1 tick for every 1 cubic meter.



Alarm setup

```

ALARMS (1)
>Active: NO
Alarm above: 095%
Alarm below: 005%
Hysteresis: 002%

```

If an alarm is required for the relevant transducer ('1' in this screen), this is where to configure that alarm. Typically, the Alarm indicates an out-of-process value hence the "Alarm above" and "Alarm below" values. The setting is in percentages of the entire measurement range. The "Hysteresis" value avoids a jittery boundary effect, in this example the alarm will trip at 95% but will only reset once the process value reaches 93%. Similarly on the bottom value, the alarm trips at 5% but will only reset at 7%.

The "Function" entry of the "Process Menu" can be a complex application to setup, please refer to the "Special Function Setup" appendix of this document for a more detailed description of the do's and don'ts of this setting.

This entry is only used if "Function" was chosen under "Transducer Menu → Type". Once this is done, iSonic is configured to make use of both transducers and perform one of the following functions:

- **Add**, the values of both measurements are added together.
- **Subtract**, the values of both measurements are subtracted as follows: "Measurement Value = Transducer1 – Transducer2".
- **Average**, the values of both measurements are averaged.
- **Differential Flow ("Diff Flow")**. This is an application where 2 transducers are used to measure differential flow. Please refer to Appendix 1 for a more detailed description.

Gain Setup

```

GAIN (1)
>  ->1m: None
    1m->3m: Low
    3m->6m: Medium
    6m->  : High

```

This screen allows the adjustment of gain over the total range of the returned echo signal. For each distance range a selection of gain can be made; None, Low, Medium or High. This is used when measuring difficult applications or tank environments where the default gain settings have to be adjusted in order to get proper signals.

The last entry of the "Process Menu" is marked "Custom table". This is used in certain instances of Volume & Flow applications. It is typically used in non-standard installations where the user describes a few known points and the system must interpolate between these points. Note that the custom table must be filled with consecutive values, starting from smallest head to biggest head. Please note that each transducer has its own table and not all table entries have to be filled.

The first entry where the 'Head' value is zero, terminates the table.



7. I/O channels: Analog inputs

Selecting the A/D inputs under “I/O Channels” presents the user with the following screen:

```

ANALOG INPUT (1)
>Active: OFF
Type: 4-20mA
Alarm setup

```

The Analogue inputs can be:

- Logged only
- Used as an alarm input
- Used as a control for a relays
- Used as a control for the Analogue Outputs

The user can activate the input by selecting “Active: ON”. The type entry describes the nature of the external input, this can be either: a 4–20mA or a 0-5V signal.

The “Alarm setup” is identical to the one that can be found under the transducer configuration screens. Please refer to that description for more details.

8. I/O channels: Relay

Selecting “Relay” under “I/O Channels” presents the user with:

```

RELAY (1)
In use: NO
Channel: Trd 1
On perc.: 010.0%
Off perc.: 090.0%
Rotate: NO
Timer: Inactive
>Setup Timer

```

The user has full control over the behaviour of four of the five relays on the iSonic. The entries available are:

- “**In use:**”, this is where the relay can be enabled and disabled
- “**Channel:**”, this describes which measured value actually controls the selected relay. Options are:
 - **TRD 1** for transducer 1
 - **TRD 2** for transducer 2
 - **A/D 1** for Analogue Input 1
 - **A/D 2** for Analogue Input 2
 - **None** indicates that the relay is controlled only by a time value.
- “**On perc:**”, indicates the percentage at which the relay should switch ON
- “**Off perc:**”, indicates the percentage at which the relay should switch OFF. On and Off percentages can be programed in 0.1% units



- **“Rotate:”**, enters this particular relay into the rotation list. This feature is used for pump control where several pumps need to be operated in an even wear mode.
- **“Timer:”**, allows the user to select a number of options:
 - **“Inactive”**, the timer is not running
 - **“Daily”**, the relay is switched ON at a certain time of the day and switched OFF again at another time.
 - **“+Periodic”**, in addition to the previous rule the relay is also switched at certain intervals.
- **“Setup Timer”**, results in:

```

RELAY TIMER (1)
>On time: 00:00:00
Off time: 00:00:00
On for: 0030.00m
Off for: 0030.00m

```

These timer values are the parameters which are used for the behaviour as selected under “Timer:”. The periodic timer is programmable with a resolution of 0.01 minutes.

Notes:

- A relay can be controlled simultaneously by a measured value as well as a timer event. Note that the timer has higher priority.
- If one wishes Periodic behaviour but no Daily event, simply make the “On time: and “Off time:” values zero.
- If both daily timer and periodic timer have been enabled, the daily timer will have higher priority.
- More than one relay can be controlled by the same transducer or analogue input. For instance one relay can be controlled in the range of 30 to 50% and another in the range of 10 to 70%.

A few examples for relay set-ups follow:

- A tank is filled with water from a borehole, and is discharged into a household. The rule is that the borehole pump should only run when the tank is emptied below 50% and also that the tank should never fill above 95%. In this case, set the ON percentage to 50% and the OFF percentage to 95%. As soon as the tank empties below 50%, the relay (pump) will activate and will only de-activate when the measured level/volume is above 95%.
- A stream empties into a holding tank for further distribution into a network, the network is only allowed to take water when enough supply is available (Tank above 50%), when the tank reaches a critical level (10%) a valve shuts off the outflow. In this case, set the ON percentage to 50% and the OFF percentage to 10%. The valve will open once the measured level/volume is above 50% and will only close once the process reaches 10% or less.

Other combinations of the above are also possible. With the Normally Open and Normally Closed contacts being available, other logical combinations can be made.



9. I/O channels: Digital inputs

Selecting “Digital In” under “I/O Channels” presents the user with:

```
DIGITAL INPUT (1)
>Active: NO
Type: CONTROL
Scale: 0001.000
Window (s): 060
Relay: 1
Invert: YES
Alarm: NO
```

The “Type” tells the iSonic what the usage of this particular input is, it can be either a control input or a pulse output from, say, a water meter.

When configured as a control type, the input functions as a trip alarm. Digital Inputs can only be used to de-activate a condition. If a relay is activated by a measurement or timer it can be “tripped” (deactivated) by the digital input.

One application could be a safety switch, which measures near the top of a tank. Even if the transducer measurement fails, overfilling is avoided because of the digital input. The “Scale” and “Window” parameters are used in a situation where the digital input is configured as a counter. The scale selects the unit increment per pulse and window selects the length of the logging window. At the start of a window period the count value is zeroed automatically.

As an example:

The iSonic has been set up to perform cubic meter measurements. An external water meter generates a pulse for every 10 litres of water (0.01m³). The user wants a data log of cubic meters per minute.

In this case, configure the “Scale” as 0.01 and the “Window” as 60 seconds. The data-log will reflect a cubic meter reading every one minute.

10. I/O channels: Analog outputs

Selecting “Analog Out” under “I/O Channels” presents the user with:

```
ANALOG OUT (1)
>In use: YES
Channel: Trd 2
Type: Retransmit
4mA at: 035.0%
20mA at: 100.0%
Error mA: 03.80mA
Setup Control
```

Here the two analogue outputs of the unit can be programmed.

“Channel” selects which input process value controls the behaviour of this particular analogue output. The user can select the following channels; Transducer 1 & 2 and Analogue Inputs 1 & 2.

The “Type” option selects whether the unit should re-transmit the current as measured by either transducers or analogue inputs, or whether a “Control” type action should be performed.



The 4 and 20mA points can be programmed for any percentage of the process value of the relevant channel. The unit will linearly interpolate the output current between the two set points. If for example the percentages are set for 90% and 10% then for any PV value >90% the unit will maintain 4mA and for any PV value <10% the unit will maintain 20mA.

The "Error mA" setting allows for the programming of an error current to be output when the input values are improper or out of range.

When selecting "Setup Control", the following screen appears:

```
CONTROL (1)
>Action: Direct
Linked: NO
P: 100.0%
I: 0000
D: 0000
Deadband: 000.0%
```

Please note that this screen is only valid when the "Type" selection was "Control".

In this section the PID parameters can be set, using these settings a PID regulation process kicks in action where the channel's output current is set in response to changes in the process value. The instrument will attempt to control the process in such a way that the required setpoint is always correct. The controlling "Action" can be set to be "Direct" or "Reverse" indicating whether the response should be normal or inverse to the measured error. The PID values can all be individually set by the user to tune the process to the required response speed and stability. For more details on PID refer to a PID handbook or access the Internet, many useful tutorials are freely available.

The "Deadband" setting defines the area around the Setpoint where the output is kept constant. When regulating from outside the deadband the output is only made constant after the input has crossed the Setpoint. (Known as zero-crossing).

For instance, if the "Setpoint" is set for 30% and the "Deadband" is set for 1%, then the output will not change for process values between 31% - 29%. This deadband value can be made as small or as big as the process demands, it entirely depends on the required activity of the controlled device.

The above described control section allows each output channel to control an individual output based on an individual input. In addition to this mode it is also possible to link both outputs to a single measured process. This is done by setting the "Linked" option to "Yes". In this case the PID settings are taken from "DAC1".

This will result in both outputs being used to control a process, where the outputs mirror at the 4mA point. The entire regulation range can be graphically represented as follows:

Regulation Range:	
Output 1	20mA 100%
	4mA 50%
Output 2	4mA 0%
	20mA 0%



Meaning that Output 1 and Output 2 are mutually exclusive, if the PID response is in the 100% to 50% domain, then Output 1 is active and Output 2 is 4mA, if the response is in the 50% to 0% domain, then Output 1 is 4mA and Output2 is active.

As an example, if a flow has to be controlled by either taking away some water (Valve1) or by adding some water (Valve2) then this can be done by connecting each valve to an analogue output and by setting the "Interlocked" mode.

Assuming a start condition where both valves are closed (4mA), then the following will occur:

If the process value is set for 30% but is measured as 35% (flow rises) then in response the Output1 current will increase. The Output2 current will remain 4mA. In process terms this means that Valve1 opens and Valve2 remains closed. If the flow returns to 30% then the valve openings will remain as they are. For a decreasing flow, Valve1 / Output1 will initially close, if the flow continues to be too low, then Valve2 / Output 2 will start to open whilst Valve1 remains closed.

11. Logging, power and communications

The following screen is selected from "Configuration → Log/Power/Comms":

```
LOG/POWER/COMMS
>Data log: YES
Interval(min): 001m
Power save: NO
Clear EVENTS
Clear DATA log
Port2
Address: 01
```

Here the iSonic data-logging operation is either enabled or disabled.

The "Interval" determines at what rate logging should take place; this is configurable from 1 to 255 minutes per data log.

Please note that the event logging occurs asynchronously from this interval, entries into the event log are made whenever a relevant event occurs. The instrument has provision for 1000 event entries and 46080 data log entries. When the data log interval is set for 1 minute, enough space is available for 32 days worth of data. Setting the interval to a higher value, results in a longer duration data log. For instance when setting the interval to 5 minutes, there will be space for roughly 5 months worth of data.

"Power Save" selects low power operation, a unit can go into sleep mode and wake up every interval to perform measurements and put them into the data-log. The number of measurements taken is determined by the "Filter" setting under the transducer set-up.

To clear the "Events" log, select "Clear Events" (Password will be required)

To clear the "Data" log, select "Clear DATA log" (Password will be required)

The "Address" parameter is only used in RS485 networks or MODBUS communications; it can be configured from '01' to '99'. Setting the address to '01' means a MODBUS address of 49 (decimal), since this is code for an ASCII '1'.



Entering the “Port 2” menu, results in:

```
PORT 2
>Mode: MODBUS
Baud: 9600
```

The “Mode” parameter is used to configure the communications mode of iSonic’s second data port. The available selection options are:

- STALK, use the proprietary protocol
- TEXT, all measurements are dumped out of the port at 1 second intervals.
- MODBUS, use the MODBUS RTU protocol
- Tel-STALK, a MODEM is connected, once the unit is dialled and a connection exists, use the STALK protocol.
- Tel-Text. a MODEM is connected, once the unit is dialled and a connection exists, use the STALK protocol.
- MODBUS, communicate using the MODBUS RTU protocol.

Please note that the selected protocol does not automatically select the hardware interface type. The hardware jumpers inside the box will determine whether RS232 or RS485 is used.

As an example, if “Tel-STALK” is selected, then this will only work when RS232 is selected on the hardware. The reason for this is that most modems only talk RS232.

12. Calibration

This entry is directly accessible from the main menu, calibration should only be necessary in the factory but it is possible to re-calibrate a unit at a later stage.

Please note that:

- calibration changes affect measurement accuracy
- only attempt calibration when it is really necessary
- ensure the procedure is understood, BEFORE calibration is attempted.

The calibration screen is structured as follows:

```
Calibration
TRD █
>3.8mA: 00573
22mA: 03317
Thermistor: 840
AI █
Curr Ref: 14941
Volt Ref: 987
```



It is possible to calibrate:

- the 4mA to 20mA outputs, once for each current output
- the internal calibration for measurement of the external thermistors
- current input calibration of both analogue inputs
- voltage input calibration of both analogue inputs

At any stage, abort of the calibration process can be achieved by pressing the 'M' button. But please note that already calibrated values during this process are not discarded and will remain.

If a new value is entered (OK is pressed) during the calibration process, the instrument will display the following:

```

Calibration
TRD 0
Keep? M=No,OK=Yes
22mA: 03317
Thermistor: 840
AI 0
Curr Ref: 14941
Volt Ref: 987

```

Press 'M' to discard the new calibration and retain the old value, press 'OK' to accept the new calibration.

13. Tuning

This feature is accessible directly from the Main Menu, by selecting the "Tune" option. It allows the user/installer to look at echo patterns as seen by a particular transducer. Usage is typically for installation trouble shooting only.

The "Tune" screen appears as follows:

```

TUNE TRANSDUCERS
>Transducer: 0
Freq: 034.000kHz
Burst length: 005
Gain: None
Capture
Rate: 001

```

Where:

- "Transducer:", can be 1 or 2
- "Freq:", is the frequency for that particular transducer
- "Burst length:", is the number of cycles used to "fire" an echo signal at the selected frequency.
- "Gain:", enables a gain stage in the receiver. Available selections are "None", "Low", "Medium", "High".
- "Capture:", allows capture and inspection of an echo signal.
- "Rate:", sets the repeat rate of the transmit pulses, higher numbers indicate quicker repeat rate.



The initial settings for this process are as per current configuration and running conditions. Please note that key usage in this section is slightly different from normal, it is no longer necessary to press the 'OK' button to enter a value, simply use the Left & Right buttons (◀▶) to change values for a selection, the Up and Down buttons (▲▼) work normally.

To capture a signal, select "Capture" and press "OK", at this stage a picture appears on the screen, looking somewhat as follows:



This indicates an echo pattern as seen by the instrument. From left to right, the first "column" indicates the transmit pulse and the second "column" indicates the return echo. The distance displayed in the top right corner of the display indicates the distance for the end of the screen. The user can calculate from this displayed distance where the echo signals are positioned.

Whilst this picture is on the screen, it is possible to "zoom-in" the data by pressing the right-hand arrow key, the left-hand arrow key performs a "zoom-out" function. In total, 5 different levels of viewing are possible. The following picture shows the same signal after it has been zoomed two levels up.



The echo information is clearer in this picture.

When pressing "OK", the "Tune" screen re-appears and the user can start changing parameters. The editing of parameters is done by pressing left and right buttons whenever the item is selected. When a parameter has been changed, by simply pressing "OK" the user can inspect the effect of the change. The display that appears each time will remain at the last selected zoom level.

As stated before, primary use is trouble shooting in the environment. Things the user / installer can check for:

1. Does the mounting of the transducer do an adequate job of isolating vibrations / ringing
2. Is there an obstruction in the echo path
3. Is the transducer seeing a proper echo from the level.



Number 1 can be checked by looking at the ring down slope of the transmission pulse. When zooming to the highest magnification, the ring down slope of the transducer should look somewhat like the following picture:



The downward slope is smooth showing that the installation was properly done. The assumption here is that the level is at least 600mm/2 ft away. Closer targets will show up in the ring-down, and the issue of whether the mounting was done properly, will be confused.

When the mounting of the transducer is not isolated properly from the environment (for instance a steel tank), this will show up in extra “waves” during or in the end of the ring-down phase of the transducer.

An example of a faulty or “ringing” mounting would look somewhat as follows:



Obstructions in the path should also be checked; if no extra echoes appear between the transmit signal and the return echo, this shows that the echo path is clear from obstructions. Obstructions could be pipes, ladders, stirrers and the like. An example of a “non-clean” echo path would be as follows:



The small echo that shows in the above picture between the transmission and the proper return echo might at some stage start to confuse the instrument and cause false readings.

Lastly, check that the return echo has a proper size, a small echo, or no echo at all might indicate an skewed mounting; check that the target is perpendicular to the transducer. The echoes as shown in the previous examples are of correct height; considerably smaller echoes could indicate installation troubles.



14. Language selection

The language selection is made from the main menu by selecting the “Language” entry. Standard available languages are English, French and Spanish. Other languages will require a re-load of the firmware of the instrument.

15. Change password

The password for the unit can be modified by the user. Typically, the password is used to avoid tampering with the set-up of the instrument. When a custom password is used, please take care to store it in a safe place. Your agent has the means to reset a forgotten password but this will require a site-visit.

16. Special function setup

As the iSonic is able to operate two transducers concurrently, combined operations have been allowed for in the configuration of the instrument. Even though the measurements are combined, individual transducers can still be used for control purposes. For example where a total level is calculated from two transducers, transducer 2 can still be used to control a relay.

Please note again that little checking is performed in the menu structure, whether the user enters data correctly. If wrong selections are made, the measurement results will not be correct. In the PC configuration program, this process is better guided and checked and the user is simply not allowed to make the wrong entries.

The basic functionalities are easy to understand, take the distance measurements from both transducers, process them according to their set-up's and only then apply a combined action such as:

- **Add**, take processed value of TRD1, add processed value of TRD2, then display and log that as the measurement for TRD1.
- **Subtract**, take processed value of TRD1, subtract processed value of TRD2, then display and log that as the measurement for TRD1.
- **Average**, take processed value of TRD1, add processed value of TRD2, divide that value by 2, then display and log that as the measurement for TRD1.

In all the above cases, the readout for TRD2 still shows what that process is measuring. A few examples of set-ups would be:

- Both transducers perform Level Measurement; the average is shown in TRD1's readout.
- Both transducers perform Volume Measurement; one transducer is measuring a vertical tank and the other is measuring a sphere, the total volume is shown in TRD1's readout.
- Both transducers perform Flow Measurement; one transducer is measuring a Parshall Flume and the other is measuring according to a custom table, the difference (subtract) in flow is shown in TRD1's readout.



To make the above-described situations working correctly, please perform the following actions:

- Select “Function” for Transducer 1’s measurement type.
 (“Configuration -> I/O channels -> Transducer 1->Type”)
- Select the required operation under Transducer 1’s function. This can be Add, Subtract or Average.
 (“Configuration -> I/O channels -> Transducer 1->Process setup->Function”)
- Select the type of measurement, Level, Volume or Flow for both transducers, under Transducer 2’s type.
 (“Configuration -> I/O channels -> Transducer 2->Type”)
- Configure both transducers individually in their process setup to get the measurements correct.
 (“Configuration -> I/O channels -> Transducer x->Process setup-> ...”)

A differential flow measurement is also allowed for in the instrument, this has been implemented to allow measurement on flumes or weirs using a dual transducer set-up. In all cases Transducer 1 must be the transducer that sees the most “Head”. This usually means that Transducer 1 is the upstream unit and Transducer 2 is the downstream unit.

This operation only works for:

- Parshall Flumes with submerged flow
- Custom Table

On Parshall flumes, flow compensation is performed when there is submerged flow (Flume overloaded). This compensation only functions under the following conditions:

- Where the throat size is between 1 and 8 foot and a submergence ratio greater than 0.7.
- Where the throat size is bigger than 8 foot and the submergence ratio is greater than 0.8.

The correction factor that is applied is an approximation of various published tables and graphs, and may not be accurate in all situations. From a technical point of view, it would in any case be better to use a correctly sized Parshall flume, rather than rely on submerged flow correction factors. To enable this operation from the menu system, select “Diff Flow” at the “Function” menu entry.

For the Parshall Flume set-up to work correctly, please perform the following actions:

- Select “Function” for Transducer 1’s measurement type.
 (“Configuration → I/O channels → Transducer 1 → Type”)
- Select “differential flow” operation under Transducer 1’s function.
 (“Configuration → I/O channels → Transducer 1 → Process setup → Function → Diff Flow”)
- Select the correct Weir type.
 (“Configuration → I/O channels → Transducer 1 → Process setup → Weir → Parshall Flume”)
- Program the flow limits for Transducer 1.
 (“Configuration → I/O channels → Transducer 1 → Process setup → Flow”)
- Program the level limits for Transducer 2.
 (“Configuration → I/O channels → Transducer 2 → Process setup → Level”)



When selecting custom table for Differential Flow operation, the following section applies:

The principle behind this set-up is to measure the levels of both transducers, subtract them (measured level = level TRD1 – level TRD2), and then process the level according to a customised look-up table.

To make this set-up work correctly, all configurations as described under the Parshall Flume actions are the same except for the following two sections:

- Enter the translation table values.
(“Configuration → I/O channels → Transducer 1 → Custom table”)
- Select “Custom” weir:
(“Configuration → I/O channels → Transducer 1 → Process setup → Weir → Custom”)

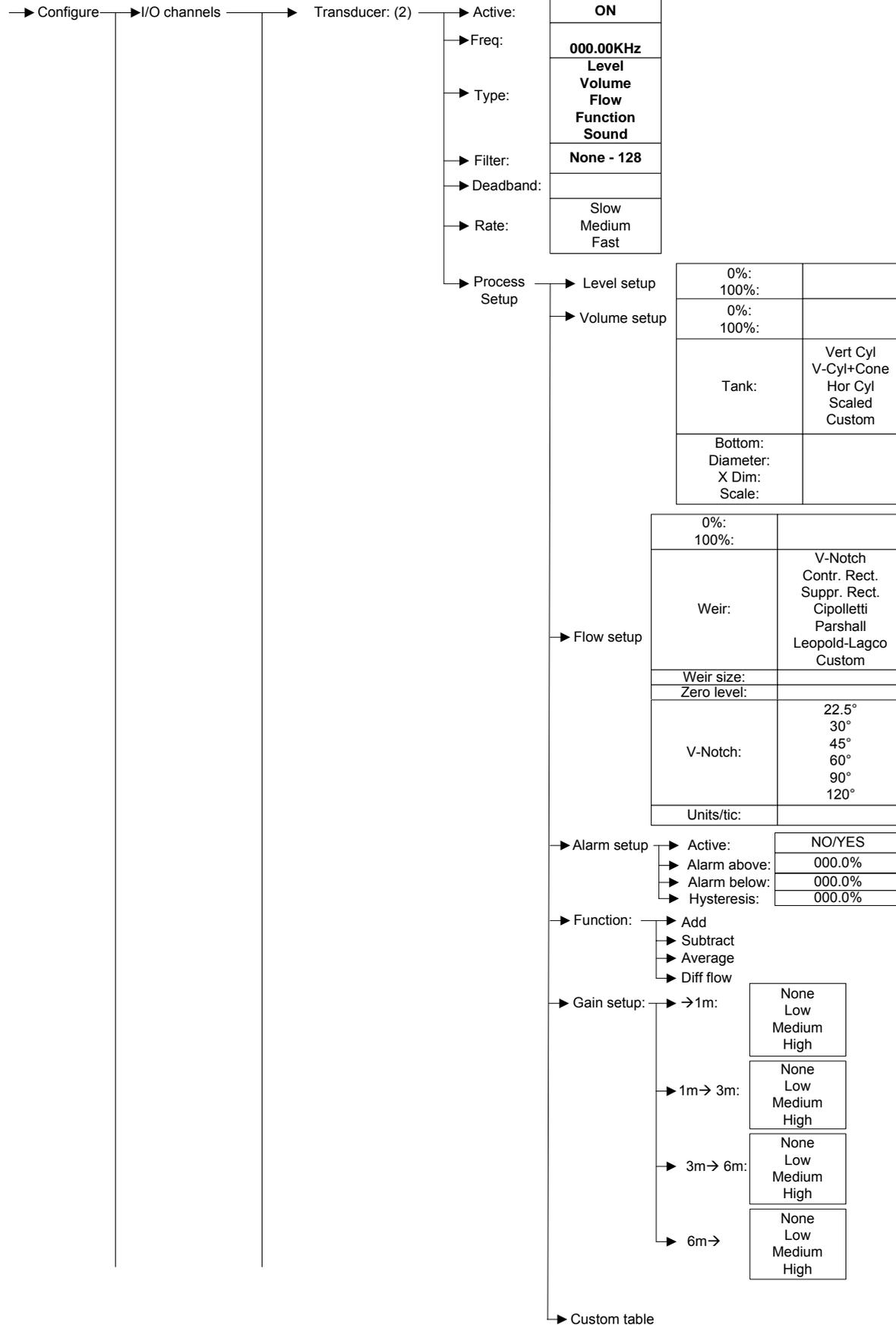
Please note:

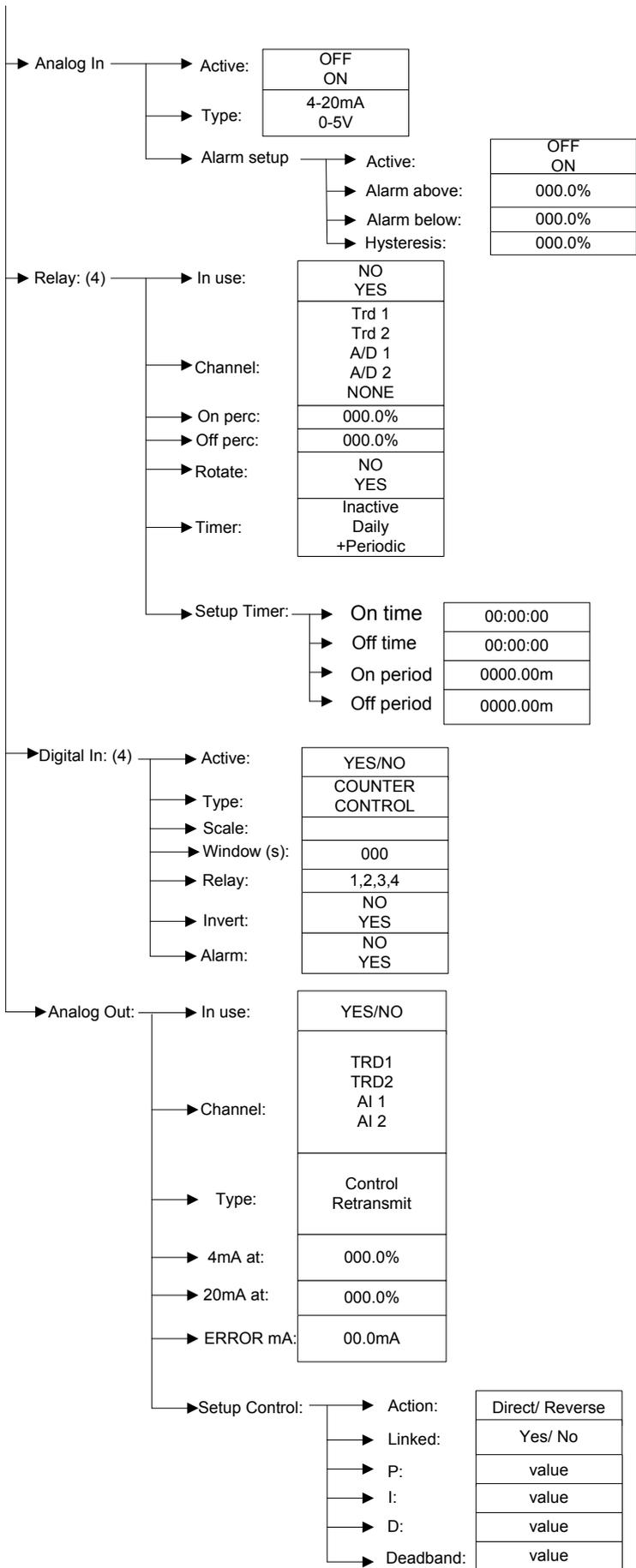
- Only the values in the table for Transducer 1 will be used
- Values should be entered from least head to most head, not all entries have to be used, and please zero the not used entries.

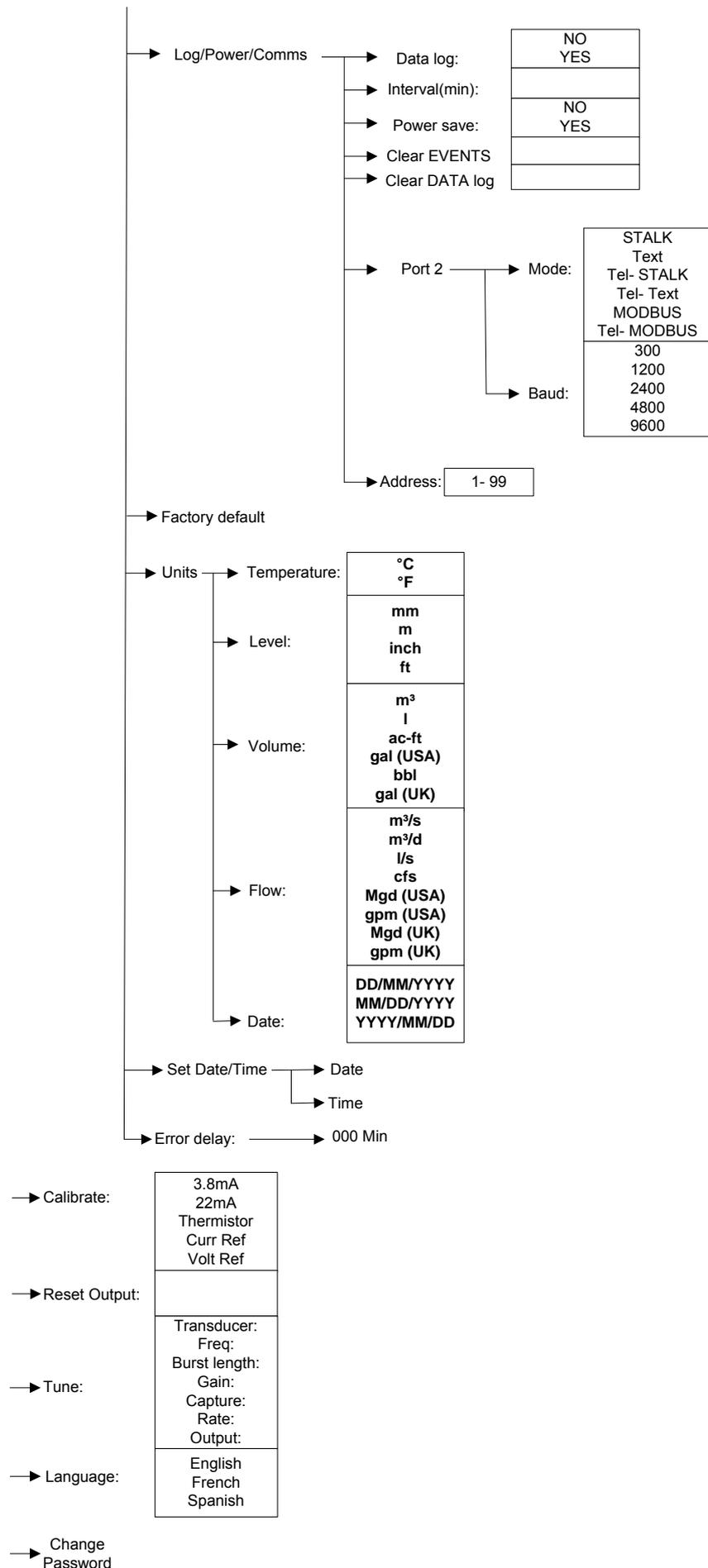


17. Total menu system

→ Run







Hotline

Tel. **+49-7025-9208-0 or -79**
Fax **+49-7025-9208-15**



Badger Meter Europa GmbH
Subsidiary of Badger Meter, Inc.

Nürtinger Strasse 76
72639 Neuffen (Germany)
E-mail: badger@badgermeter.de
www.badgermeter.de