



# Locator V

## USER INSTRUCTIONS

**03-09-2010**

**Document Ref: Version – 2.0**

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## 1 Revision History

Version	Date	Modifications	Approved by PTL
V1.0	09/06/10	Original	J DUFFY
V2.0	13/09/10	Corporate Identity Update	V CHAPRONT

## 2 Information

**IMPORTANT:**

It is essential correct installation instructions are followed. Pulsonic Technologies will not be liable for any incorrect installations.

Serial Number: \_\_\_\_\_

Date of Purchase: \_\_\_\_\_

Factory Set Security Code: \_\_\_\_\_

**Configuration:**

Supply 230

115V

24V

**Communications:**

RS232

RS422/485

4-20mA

5 Relays

**Temperature Compensation:**

Automatic

Manual

**Transducer Driver:**

Internal

External

### 3 General Specification

The Locator V is the latest addition to the family of the Ultrasonic Level Measurement and Control Systems available from Pulsonic Technologies. The Locator V is a low cost single channel ultrasonic level / volume monitor which uses the latest state-of-the-art technology.

High in functionality, the Locator V offers non-contact level measurement of liquids and solids. Standard features include the measurement of level, volume, target distance and Tonnes if SG known. Also available as an open channel flow monitor.

By eliminating the need for complex setting up programs, the Locator V can be configured by using the two line integral programming and status LCD display, simply by scrolling through the menu and selecting the appropriate answers.

Calibration, relay settings and communication are all programmable, with in-built software traps to prevent user programming the unit incorrectly.

In the run state the display simultaneously display level, volume, distance and temperature.

**Applications:** *Multiple Pump Control, Filling and Discharge Control, Overflow & Dry Running Pump Protection, Level / Volume Indication and Object Proximity Detection*

**Features:** *Simple user friendly programming, Two line programming and status display, 4 programmable and 1 lost echo relay, Relay status LED's, Analogue isolated 4-20mA output and RS232 or RS422 output*

***Big in functionality but small in price the Locator V is ideal for Low budget applications which require a flexible solution!***

## 4 Specifications

### 4.1 Operating Performance

Range	Up to 30 metres depending on transducer
Resolution	1mm
Accuracy	+/-0.25% of measured range

### 4.2 Outputs

Analogue	Galvanically Isolated 4-20mA into 500 ohms (max)
Digital	RS232 or RS422 output (optional)
Relay	4 programmable relay outputs SPCO contact rated at 5A 230VAC non-inductive 1 lost echo relay

### 4.3 Programmable Features

Calibration Menu	Security code entry into programming mode Four programmable relays for pump control level and volume Volume conversion for up to 8 tank shapes Other tank shapes, factory programmed Level, Volume, Distance – weight conversion in tonnes Damping filter Firing delay
Communications Menu	Independent 4-20mA, RS232 or RS422
Keyboard Simulation	User test mode to verify running status

### 4.4 Options Available

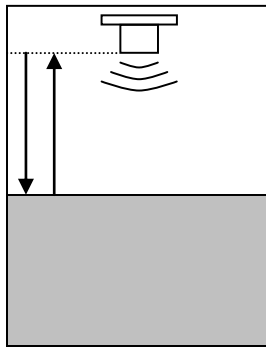
Panel enclosure
Data logging (open channel flow only)

## 5 Introduction

The Pulsonic Technologies Locator V instrumentation unit is for use in conjunction with the Pulsonic range of ultrasonic sensor heads. It provides distance, level, volume and tonnes measurements for a range of tank shaped and dimensions.

The universal instrumentation unit will operate one head form the Pulsonic range. The choice of ultrasonic head you have been supplied with is dependent on the far-field operational range you require.

Model	Range	
	Solids	Liquid
PenMet 014	0.5 – 9m	0.5 – 15m
PenMet 014L	0.5 – 13m	0.5 – 20m
PenMet 016	0.3 – 4m	0.3 – 10m
PenMet 018	0.25 x 4m	0.25 x 6m
PenMet 034	0.6 x 18	0.6 x 30m



Time  
of  
Flight

Each head measures the time of flight of an ultrasonic pulse to travel from the sensor to the reflecting surface and back to the transducer. This information is transmitted to the instrumentation unit where it is converted into distance, level or volume information.

$$\text{Distance (d)} = \frac{\text{Time of Flight} * \text{Ultrasonic Velocity}}{2}$$

The instrumentation unit contains a versatile fully programmable computer which enables a number of processing functions to be carried out. These functions must be configured on first power up of the system. This is known as 'Calibration'.



**Programming the unit is simple as the unit is fully menu driven and prompts the user for his preferred choice.**

You will notice that the instrumentation unit is divided into two sections, Figure 1.

On the left hand side of the fascia you will find the **programming keys** and LCD display. On the right hand side you will find the **Alarm Set LEDs**.

## 6 Operations and Programming

When installing the Locator V, first fit the ultrasonic Head to the tank as per the instructions in Section 8 and wire it to the instrumentation unit as described in Appendix B of this manual.

When power is first applied to the Locator V, it will show the following messages on the LCD display quickly in succession:

Retrieving data  
from EEPROM

This means the Locator is retrieving the system; set-up data from the non-volatile memory

Pennine  
Metronics Ltd

PenMet  
LOCATOR V x

Displays the software version number

Addr=0 Baud=96  
32K CFG=2000

System information concerning the unit's RS485 address and Baud Rate

Level xx.xxm  
Tank Temp xxC

At this point the Locator will start to fire the Ultrasonic Head and display the level and temperature of the tank using the factory programmed default tank dimensions

This is called 'Run Mode' and is the mode the Locator uses to display the tank contents.

To program the Locator, the user is presented with several menus each of which contain numerous options that can be toggled on/off or a numeric value entered

The menus are all presented on the display as a series of statements which 'cycle round' each time the 'UP' or 'DOWN' push-button is pressed. To select a particular option, the user has to press the 'SET' button when the relevant menu option is displayed.

For all numeric values, the menu statement displays the currently programmed value and allows the user to increase or decrease this value by pressing and holding 'UP' or 'DOWN'. Pressing 'SET' will enter the new value into the system and overwrite the old value. If the old value is on the display and the user presses 'SET', it has the effect of leaving the number unchanged. The push-buttons automatically repeat if held pressed. The user will see the numbers displayed change slowly at first the increase in speed every few seconds as long as a push-button remains held down. The Locator also emits a short 'bleep' as an acknowledgement of a key press or when the auto repeat function is in use.

## 6.1 Run Mode

The Locator will normally remain in 'Run Mode' displaying the contents of the tank. All the relay outputs are active during this mode.

Depending on the options programmed, pressing the 'UP' or 'DOWN' buttons will scroll the display through the following:

Level xx.xxm Tank Temp xxC	Displays the level and temperature in the tank. The level is displayed in metres (m) and the temperature in degrees
Level xx.xxm Tank Temp xxC	Displays the tank level as a percentage of full i.e. 100% = full 0% = empty
Level xx.xxm Tank Temp xxC	Displays the distance from the Ultrasonic Head to the top of the tank contents.
Level xx.xxm Tank Temp xxC	Displays the volume of the tank contents in metres cubed (m <sup>3</sup> ).
Level xx.xxm Tank Temp xxC	Displays the tank volume as a percentage of full i.e. 100% = full 0% = empty.
Level xx.xxm Tank Temp xxC	Displays the weight of the tank contents in metric tonnes (T).
Level xx.xxm Tank Temp xxC	All the information regarding the shape and size of the tank, the head offset and the specific gravity of the contents are programmed into the Locator in other menus. If the Ultrasonic Head should fail to receive echoes from the tank contents, the 'Lost Echo' error message is displayed. If the echo is lost for longer than 20 seconds, the Lost Echo Relay will then be de-energised. The relay coil is re-energised when the echo returns.
Level xx.xxm Tank Temp xxC	To bring the Locator out of 'Run Mode', press the 'SET' button. The unit will then ask for the Security Code number to be entered. The factory pre-set code number is indicated on the front cover of this manual but this can be changed by the authorised user at any time. Use the 'UP' or 'DOWN' buttons to change the displayed number then press 'SET' to enter the code. If no code is entered within 12 seconds, the Locator returns to run mode.
Level xx.xxm Tank Temp xxC	If an incorrect Security Code is entered, this error message is displayed and the unit returns to 'Run Mode'.

## 6.2 Main Menu

When the correct security code has been entered, the Locator stops firing the head, turns off all the relays and displays the main menu. This is where the system set-up and calibration parameters can be entered.

The 'UP' and 'DOWN' buttons move the Locator through the following menu option:

Main Menu Run Mode?	Returns the Locator to 'Run Mode'
Main Menu Setup Head	Programmes the ultrasonic head, tank and relay parameters
Main Menu Setup 4-20mA	Programmes the 4-20mA output signal
Level xx.xxm Tank Temp xxC	Programmes the temperature, new password, the RS485/RS232 data communications address and allows the keyboard simulation mode to be selected
Level xx.xxm Tank Temp xxC	Displays the settings programmed for the ultrasonic head, 4-20mA, tank and relays

Each of the above menus should be programmed as appropriate when first installing the Locator V.

### 6.2.1 Set-Up head

Selecting 'Set-up head' brings the Locator to the 'Calibrate Menu'. This is where the tank details and relay settings can be entered.

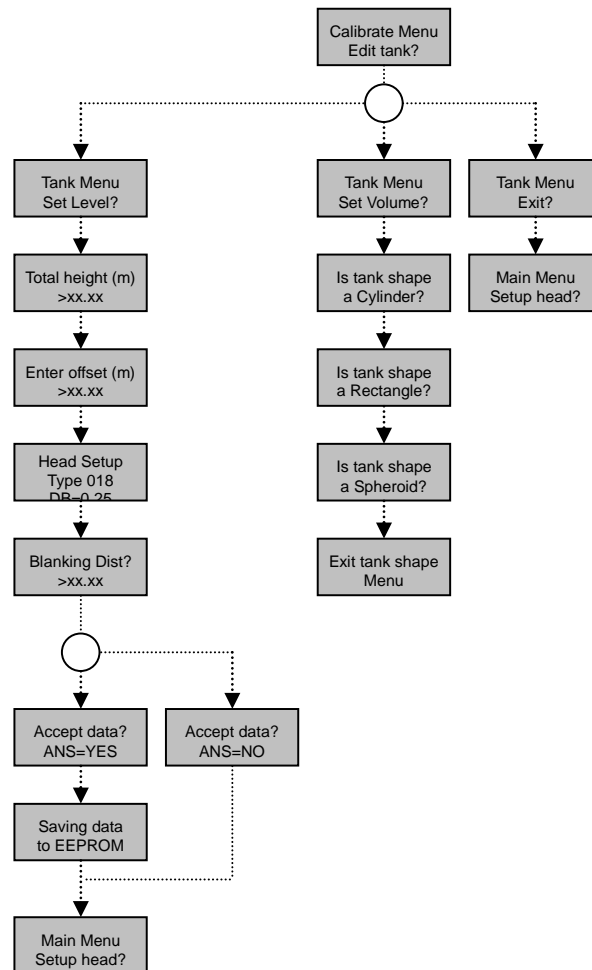
The LCD shows the following options in conjunction with the 'UP', 'DOWN' and 'SET' keys.

Level xx.xxm Tank Temp xxC	Programmes the shape and size of the tank
Level xx.xxm Tank Temp xxC	Programmes each relay
Level xx.xxm Tank Temp xxC	Return to 'Main Menu'

## 6.2.2 Edit Tank

The 'Edit Tank' menu is where the tank shape and size is entered into the Locator. See Appendix A for the definition of tank shapes as recognized by the instrumentation unit.

The 'Calibrate Menu' displays the following menu structure:

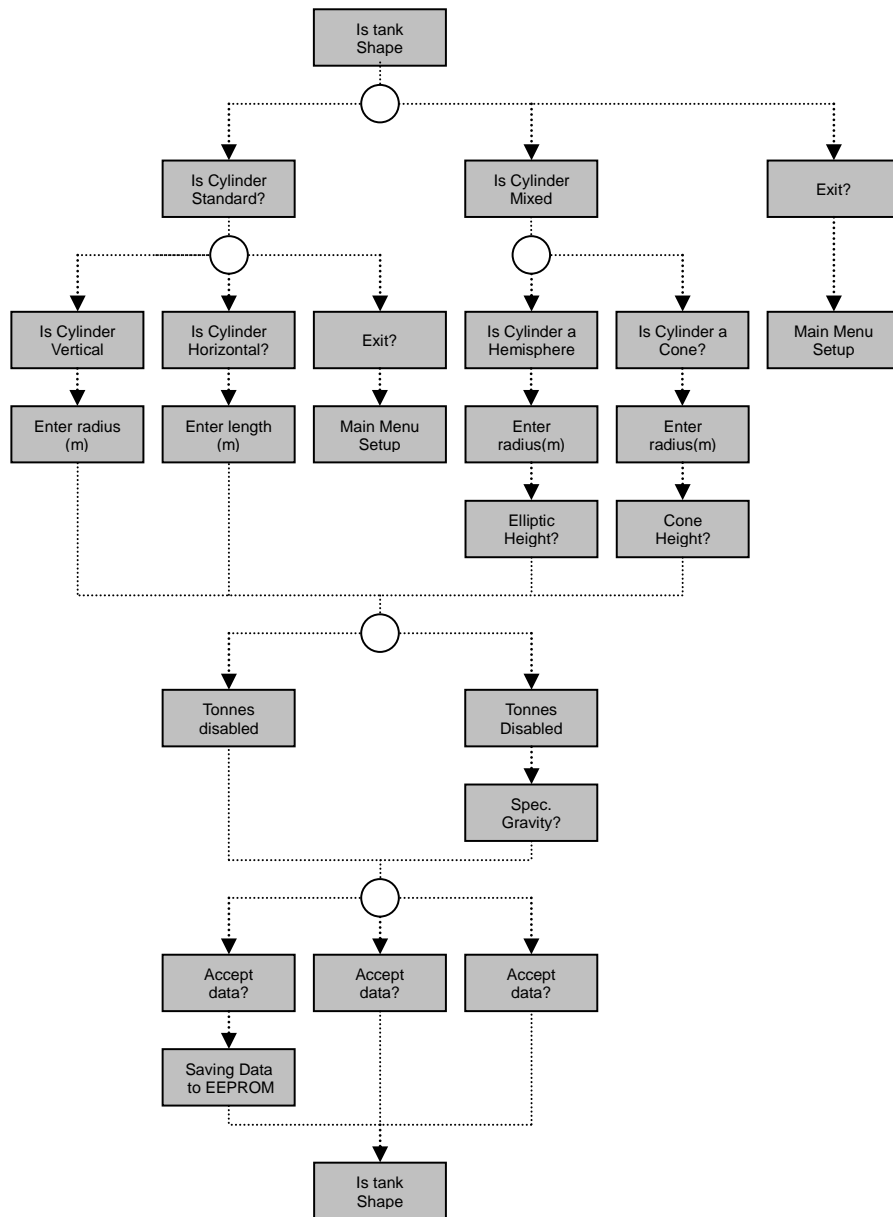


If the Locator is only required to display the level of the tank then the only parameters that need to be programmed are the tank height, head offset, head type and blanking distance. See the 'Offset Pipe' and 'Blanking Distance' sections of this manual for further details concerning these parameters. The instrument displays '>' when the user is required to enter a numeric value.

However, if the Locator is required to display the tank volume, then further parameters have to be programmed in addition to those stated above regarding the shape of the tank and its dimensions. The tank level must be programmed before the instrument will allow volume settings to be entered. Reprogramming the level will disable any relays already set to switch on volume settings. The volume of the tank needs to be reprogrammed before volume switching relays can be used. The Locator recognises several variations of 3 basic tank shapes i.e. Cylinders, Rectangles or Spheres (see Appendix A). The menu structure for programming each of these 3 tank shapes is explained separately.

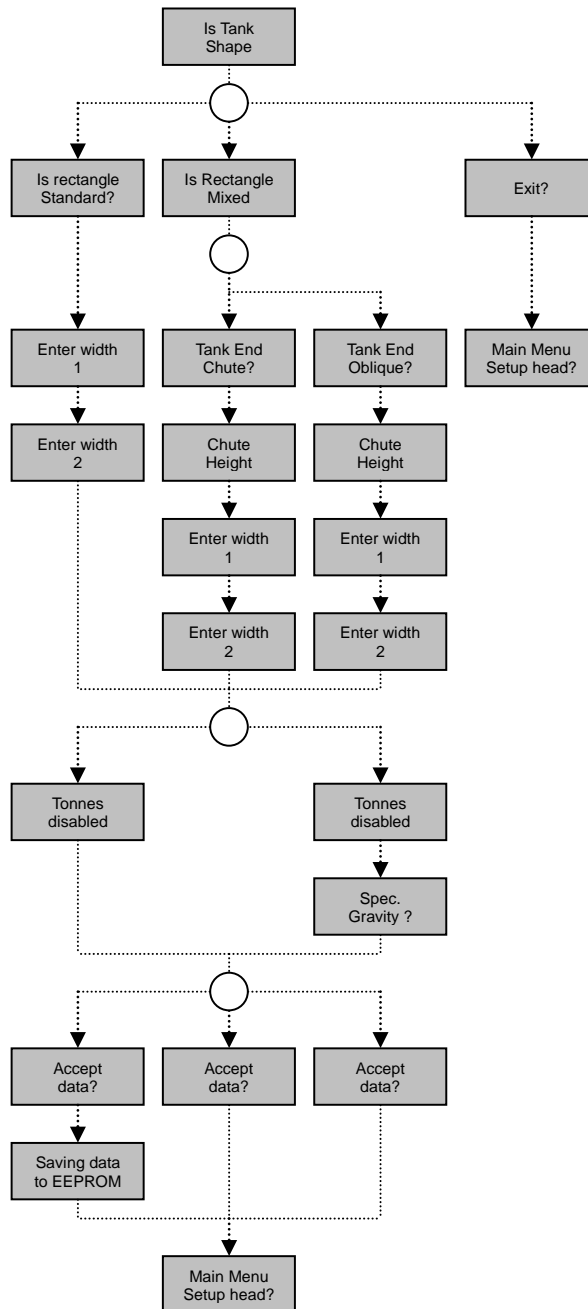
### 6.2.2.1 Cylinder Tank

If the tank to be programmed is cylindrical in shape, the following menu structure is displayed on the LCD display:



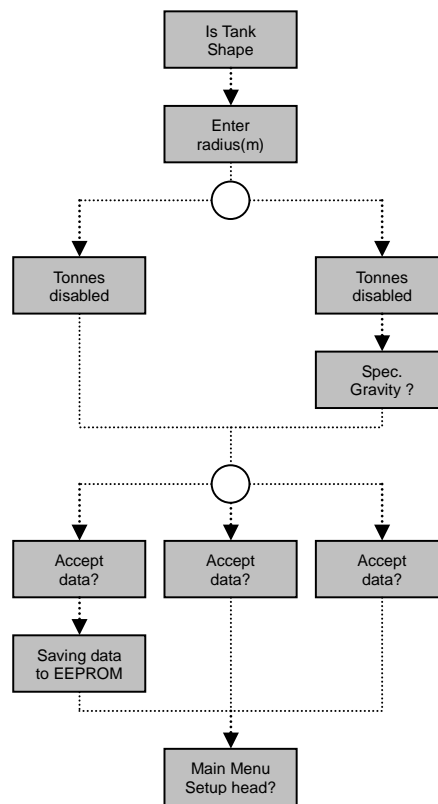
### 6.2.2.2 Rectangle Tank

If the tank to be programmed is rectangular in shape the following menu structure is displayed:



### 6.2.2.3 Sphere Tank

If the tank to be programmed is spherical in shape, the following menu structure is displayed:



### 6.2.3 Editing Relays

The relays can be programmed via the 'Edit Relay' option of the main menu. There are 4 full programmable relay outputs of both Normally Op (NO) and Normally Closed (NC) configuration (refer to Appendix B). There is also a fixed lost echo relay with Normally Open (NO) contacts.

The relays on the Locator can be programmed to switch on the following choices:

- Level

Duty Assist: Switches on alternate relays at a chosen level. Helps to reduce pump wear.

The relays can be:

- Numbers 1 and 2;
- Numbers 1,2 and 3;
- Numbers 1,2,3 and 4.
- High or Low: Relays can be switched on as high or low level alarms.
- Volume: Relays can be set as Level settings but for volume control;
- Rate of Rise: Switches relay on when the level rises beyond a rate set by the user;
- Rate of Fall: Switches relay on when the level falls beyond a rate set by the user;
- Temperature: Switches relay on when the tank temperature exceeds a value set by the user;
- Disable Relay: Removes all switching actions from a selected relay.

Once you have selected 'Edit Relay' you may cycle through these choices until you select one of them. You will then be asked to enter the appropriate values.

**Note:**

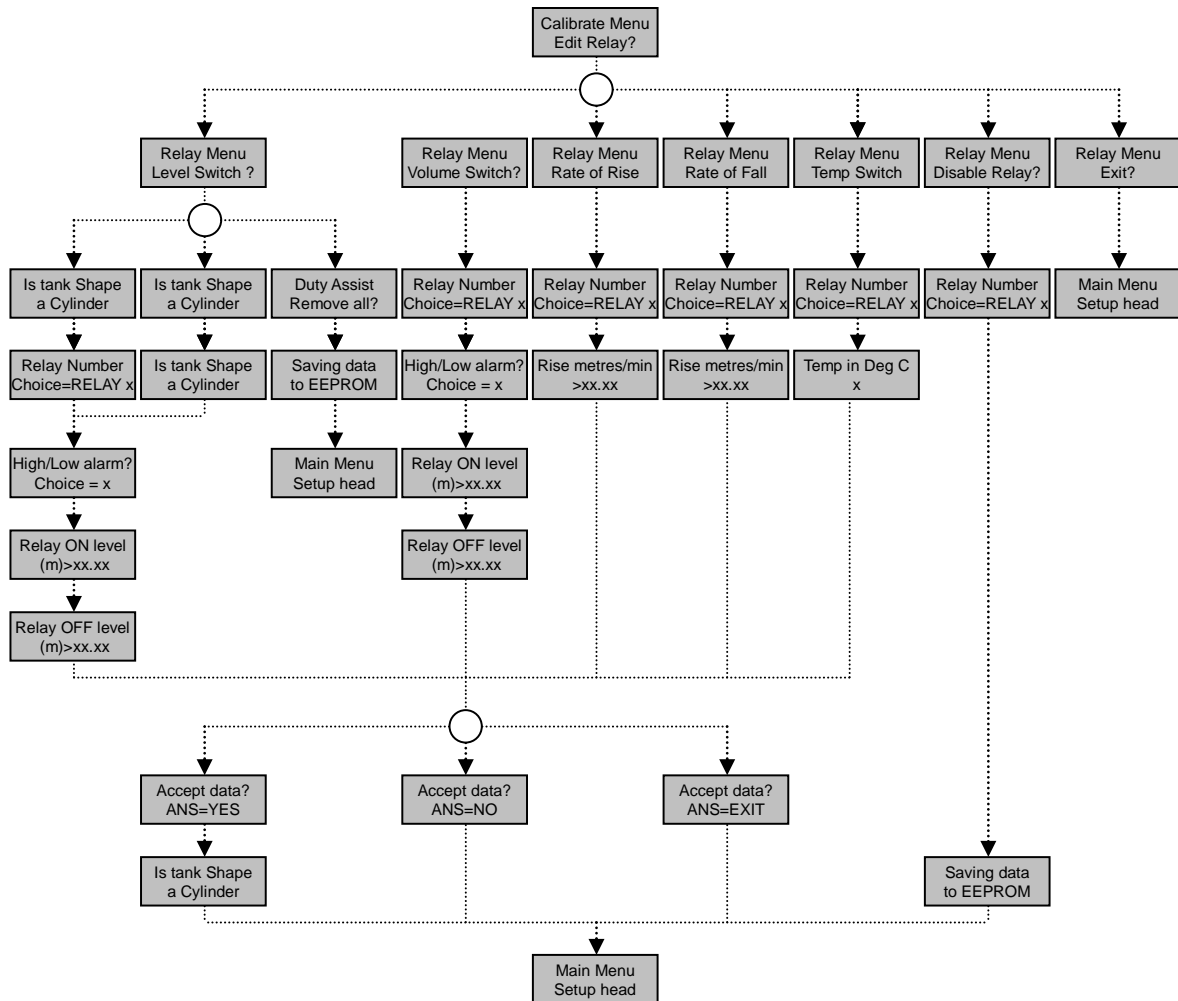
When the relays have been set in volume mode, the relays will be disabled when the tank level parameters are changed from the initial set-up. In order to enable the relays in the volume mode, the Volume set-up must be entered again. The previous values will be stored, therefore there is no need to set-up the values again unless changing.

**Note:**

There is a delay of approximately 10 seconds after starting 'Run Mode' before any relays will switch. This is to allow the measured level to stabilise before relay actions are performed on its value.

### 6.2.3.1 Edit Relay

The 'Edit Relay' menu is where the programmable relay information is entered into the Locator.



The 'Calibrate Menu' displays the following structure:

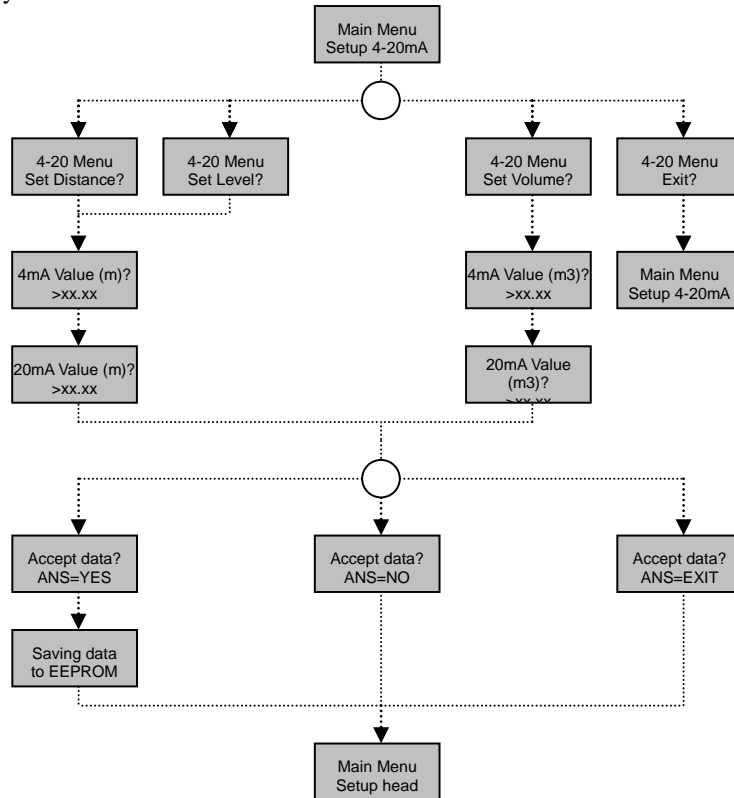
The user tries to programme a relay that is already set to duty assisted level alarm, the a message is displayed saying 'Cannot use Relay-Assigned to Duty'. The user is then returned back to the Main Menu.

To remove the duty assist, go into the Duty Assist menu and select 'Remove All'. These removes the duty assist and disabled all relevant relays.

### 6.2.4 Set-up 4-20mA

In this menu, the span of the 4-20mA output signal can be programmed. The signal can be proportional to either the distance, level or volume of the measured tank.

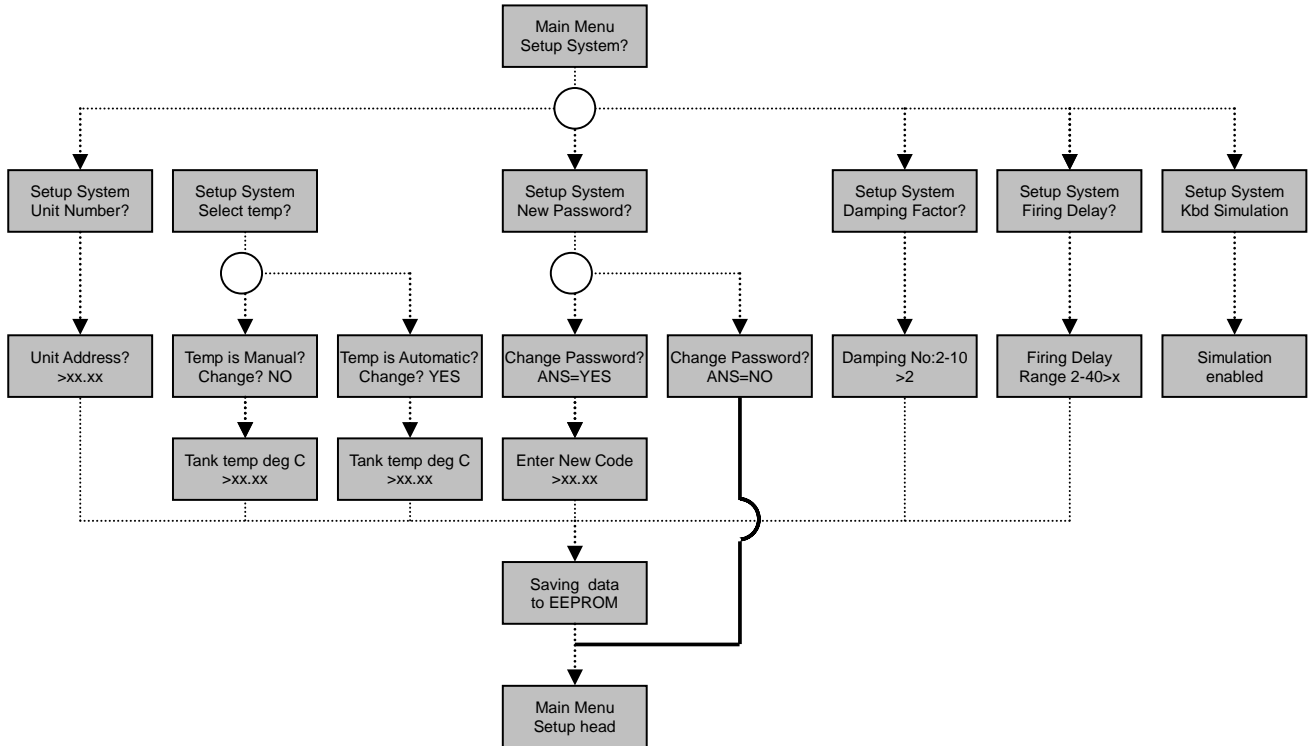
The displayed menu structure is as follows:



## 6.2.5 Set-up System

In this menu, the settings of the unit address (RS422485 only), temperature compensation, operator security code and damping and firing delay can be changed. The level simulation can also be selected.

The menu structure is displayed below:



Note:

The velocity of sound changes by 0.18% per °C change in temperatures. If a temperature sensor is not used for automatic compensation you should regularly manually update the temperature.

Damping Factor:

The damping factor should be increased with increased turbulence of the liquid surface to give a smoother output, representative of the average level.

Firing Delay:

This is the time delay between each firing of the ultrasonic transducer pulse. The minimum is 2 which will fire the head quickly and the maximum is 40 which will fire the head approximately once every 2.5 seconds. The factory default firing delay is 6.

The firing delay would usually only be increased if multiple echo's cause the transducer to read incorrectly when the level was near the top on an enclosed tank or close to the transducer face when full.

Filter Coefficient:

Adjust the filter coefficient to reduce fluctuations caused by an undulating surface. Decrease the filter coefficient for greater smoothing/damping effect. Increase the filter coefficient to reduce the smoothing effect.

### 6.2.6 Display Set-up

In this menu, the settings of the unit can be confirmed. Press any key to scroll through the display:

PenMet LOCATOR Vx	Relay 1 Mode is Low Volume
Head Type = x Deadband = x	On Val = x m Off Val = x m
Offset = x Blanking = x	Relay 2 Mode is
Damping = x FiringDelay = x	On Val = x m Off Val = x m
Measure Mode = Volume	Relay 3 Mode is
Tank Shape = VERT CYL+CONE	On Val = x m Off Val = x m
Height = x Radius = x	Relay 4 Mode is
Maxvol = x S.G. = x	On Val = x m Off Val = x m
Temp Mode = AUTO Temp = x deg C	4-20mA mode is Level
Temp = x deg C Snd Vel = x m/s	4mA Val = 2m 20mA Val = 8m

## 6.2.7 Keyboard Simulation

This mode can be used in conjunction with 'Display Set-up' and can be used as a final check of the programming and operation of the unit allowing a simulated tank level to be entered and observing the relay actions, volume calculations and 4-20mA output.

If this option is selected the message 'Simulation Enabled' is displayed.

After a few seconds, the display returns to the menu as normal.

When the user next selects 'Run Mode', the Locator functions normally but does not fire the ultrasonic transducer. The screen display will show:

Level 0.00m  
Tank temp x deg C

If the user press 'SET' the locator will display:

New Level (m)?  
>xx.xx

By pressing the 'UP' or 'DOWN' keys, the displayed can be adjusted within the range of the programmed tank height. Press 'SET' to accept the simulated level. The new level will be displayed. By pressing 'UP' or 'DOWN' keys, the user can then scroll through all the calculated measurements of Level, Level as percentage, Distance, Volume, Volume as percentage and Tonnes for the given level.

The 4-20mA output will also set itself to the appropriate value depending on the mode and range of the 4-20mA set-up (section7.2.4).

Any relays programmed for level or volume will also switch if the entered level is of an appropriate value.

If any relays are programmed for 'Rate of Rise' or 'Rate of Fall', they will switch on immediately for a few seconds, then switch off again because simulating a level this way causes a step change in the value from one level to the next. This is seen by the instrument as a rapid rise or fall in the tank level causing these relays to switch appropriately.

Press 'SET' again to enter a new simulated level.

There are 2 ways to exit the simulation mode:

1. Press 'UP' and 'DOWN' keys together. This returns the unit to proper 'Run Mode' i.e. firing the transducer
2. Wait 3 minutes without pressing any keys while the simulated level is displayed. The unit then returns to proper 'Run Mode' automatically.

Note:

If it is required to test any relays set to switch on temperature, this has to be done as follows:

1. Programme the required relays accordingly
2. Go into 'Set-up System' menu
3. Select Temperature Compensation to 'Manual'
4. Enter the tank temperature greater than or equal to the programmed relay temperatures
5. Select 'Keyboard Simulation' active on the 'Set-up System' menu
6. Enter 'Run Mode'

After the initial delay of approximately 10 seconds, the appropriate relays will energise because the tank temperature equals or exceeds the relays pre-set temperature.

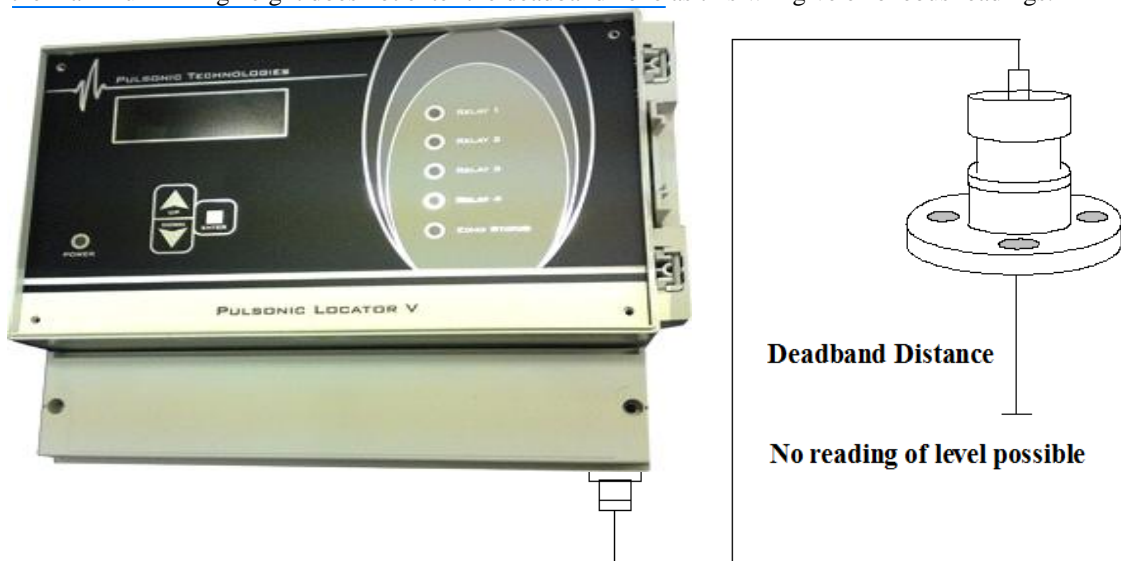
## 7 Mounting Instructions

On closed tank applications with the transducer flange mounted, it is recommended that the mounting flange on the tank is located on a stub pipe of appropriate diameter and height above the tank to overcome the deadband on the transducer as follows

014	Transducers – Deadband = 0.5m
014L	Transducers – Deadband = 0.5m
016	Transducers – Deadband = 0.3m
018	Transducers – Deadband = 0.05m
034	Transducers – Deadband = 0.6m

This arrangement allows the transducer's operating range to cover the full tank height. The mounting details for the transducers are shown in section 4.

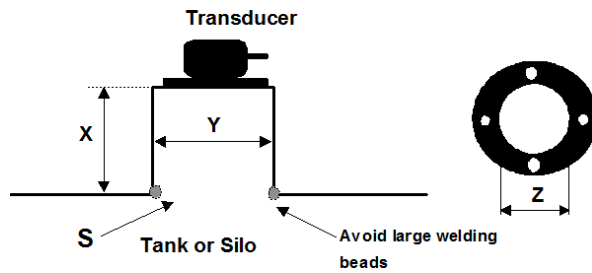
For applications where the transducer is bracket mounted and hangs inside the tank it is important that the maximum filling height does not enter the deadband zone as this will give erroneous readings.



### Note

You will have been provided with the correct/requested length of transducer cable for your application. Should you wish to extend this cable length it should only be done by adding to the existing length through an IP68 gland. Any attempt to rewire the transducer through accessing the top enclosure invalidates the guarantee. Always use the nylon mounting bolts provided.

## 7.1 Offset Pipe



If you require to measure level to the top of the tank you must place the transducer on a stand-off pip of length (x) equal to the deadband distance of the transducer

For optimum performance ensure the diameter of the stand-off pipe (Y) is twice the diameter of the active transducer face (Z). Should this not be possible you may receive a false echo from point (S), where the pipe enters the tank.

To avoid this you should program the unit's blanking distance to ignore any echoes within the distance  $X + 10\%$  from the transducer face. See 'Blanking Distance' below.

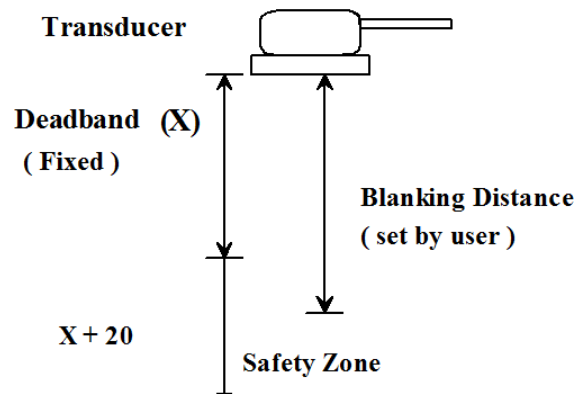
Avoid large welding beads as they may give rise of false echoes.

## 7.2 Blanking Distance, Deadband and Safety Procedure

There may be instances where obstructions in the tank give rise to false echoes. If such obstructions are above the maximum level to be measured then they may be gated out by instructing the computer to ignore any return echo in the flight path up to such an obstruction. This is performed in the calibration mode by programming in a blanking distance. The blanking distance programmed should be the distance from the transducer plus a nominal 10% to overcome variations due to temperature.

Blanking distance programming is also useful to implement in situations where the diameter of the offset pipe is narrower than recommended. This gives rise to a false echo at the interface between the end of the pipe and the tank due to a pressure differential.

All ultrasonic transducers have a blind area called the "deadband". Within this area the sensor cannot detect the true echo. This should be borne in mind when setting up the unit since if you allow your liquid or solid to fill into this area the instrumentation unit will not return lost echo but give an erroneous reading which relates to a multiple echo, which in the time base is perceived to be outside the deadband region. As a result your tank will continue to fill and may reach an overflow condition.



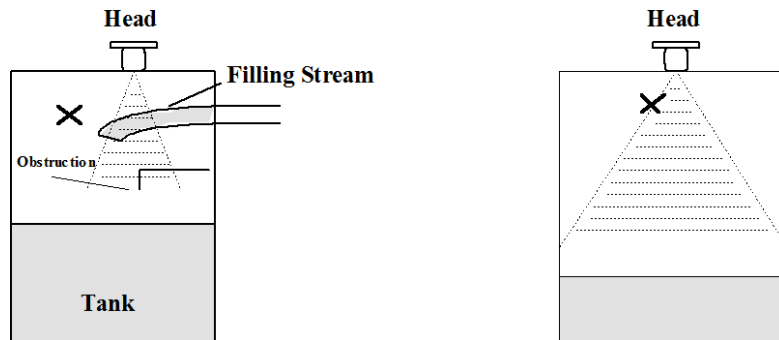
In order to prevent this occurrence you should always assign one of the relays to a high alarm condition which can terminate the fill sequence. The level of this high alarm must be below the dead band zone which is given in metres in the set-up head menu for each head type. It is recommended that you make this alarm setting equal to the distance of the deadband plus 20%. For example an 018 head with a deadband of 0.25 metres should have a high level alarm set at a distance of 0.3 metres from the surface of the transducer head.

If you have programmed the unit with a blanking distance to overcome obstructions or false echoes from a offset pipe stub the unit treats the blanking distance as an extended deadband and as a result the same condition occurs. In this event you should again assign a relay in the same manner to prevent filling into the blanking zone.

A safety margin of 0.2 metre above the blanking zone should be sufficient for most applications.

### 7.3 Correct Location

The transducers should be placed such that the ultrasonic beam does not reflect from interfering structures during its flight path.



The table below gives the beam spread for the ultrasonic wave as it travels from the transducer for a angle of 6 degrees.

Ensure that at the maximum distance to be measured, the beam does not collide with the wall of the tank.

Tank Height l (metres)	Beam Half Width w (metres)
1	0.11
2	0.21
3	0.32
4	0.42
5	0.53
6	0.63
7	0.74
8	0.84
9	0.95
10	1.05

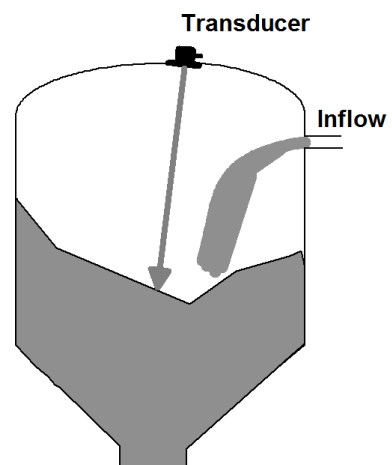
### 7.4 Solids

Ensure that the filling curtain does not interfere with the ultrasonic beam.

Solids often lie in a non-uniform manner. For the most reliable reading angle, the transducer such it is at right angles to the most regular slope of the material.

Direct the transducer such that it measures over the maximum range required which is often the outflow of the silo.

The maximum measurement range is affected by the angle of repose of the solid, the granular size and the presence of dust clouds. This should be taken into account when choosing the transducer.



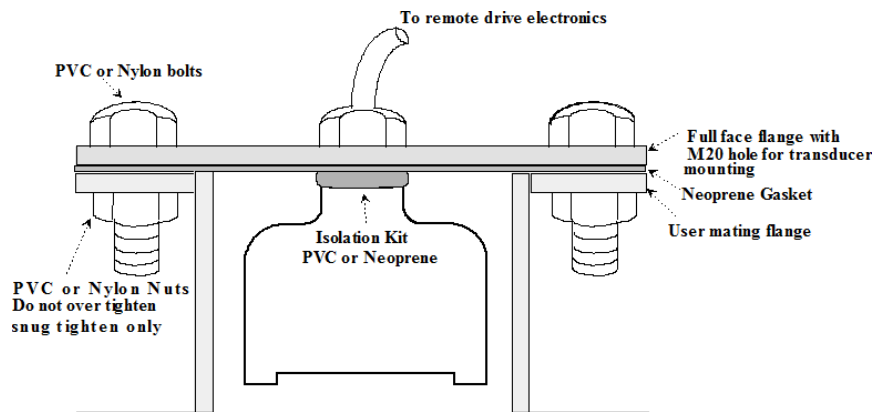
## 8 Transducer Mounting

### 8.1 Flange Mounted

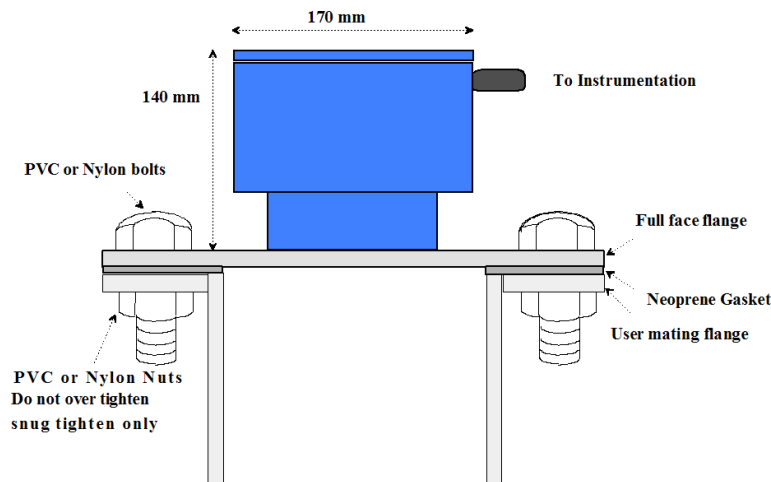
Always insert the gasket provided between the transducer and its mating flange. When aggressive chemicals are present you should use an appropriate gasket such as PVDF or PTFE.

Use the nylon bolts provided to secure the transducer. Do not over-tighten the bolts as this can lead to the transducer “RINGING” (see Fault Finding)

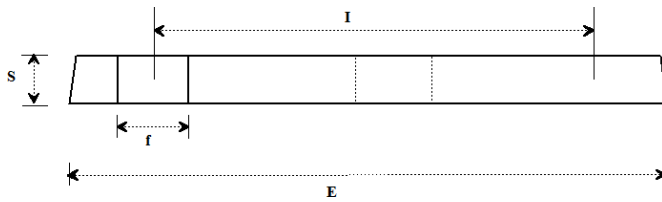
#### 8.1.1 Transducer 018/014 with M20 Thread Mount onto Integral Flange



#### 8.1.2 Smart Ultrasonic Transducer 018/014 Mounting



### 8.1.3 Flange Dimensions



Drilled To BS4504 NP Dimensions in mm

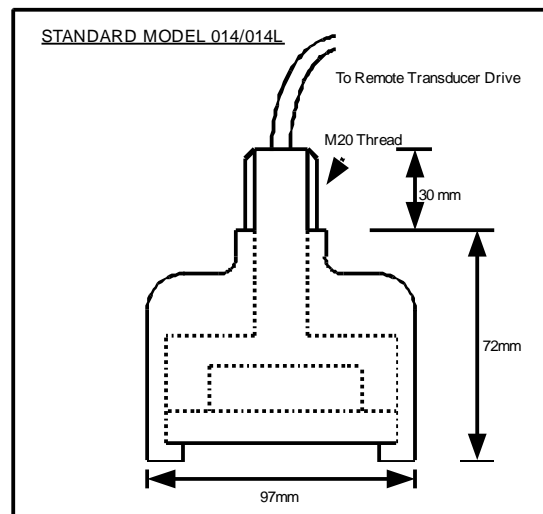
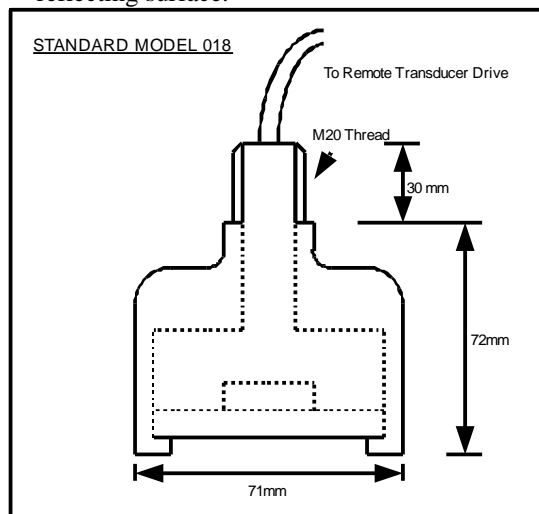
D	Code	E	S	I	f	Holes	Bolts	gru	
63	FCL 0630	165	18	125	18	4	M116x80	370	018 transducer
90	FCL 0900	200	20	160	18	8	M116x90	630	014/014L transducer
355						12	M30x150		034 transducer

### 8.2 Three Head Transducer 034

The 034 multiple heads are mounted on a nominal 38cm flange. The user should drill mounting holes in appropriate locations and mount the unit paying regard to the instructions above.

### 8.3 Screw Mounted

Always use the nut provided and insert the damping washers. Do not over-tighten the nut as ringing may occur. Use a spirit level or a plumb line to ensure the transducer is aligned “normal” to the reflecting surface.

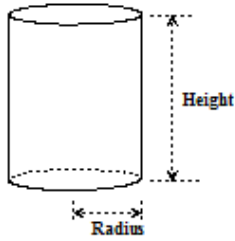


### 8.4 Installation Kit

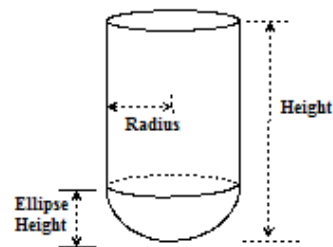
Each transducer will have been provided with an Installation kit for mounting, which consists of 4 PVC/nylon screws and a gasket. It is essential that the installation kit is used with the Isolation Adapter if provided

# 1 Appendix A: Tank Dimensions and Head Offset Convention

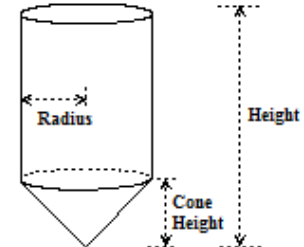
**CYLINDER / Standard**



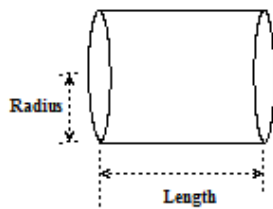
**CYLINDER / Hemisphere Mix**



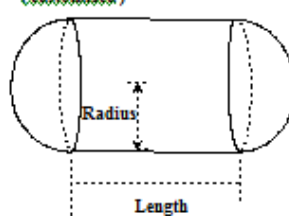
**CYLINDER / Cone Mix**



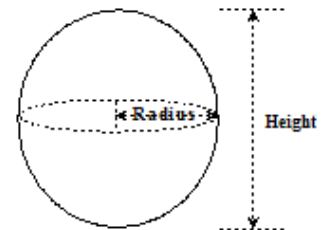
**CYLINDER / Horizontal**



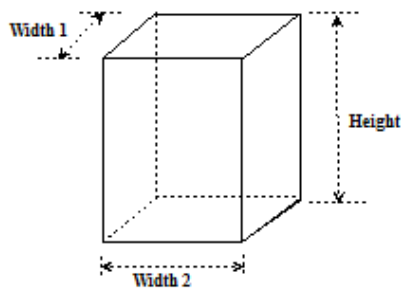
**CYLINDER / Horizontal Hemisphere Mix (customised)**



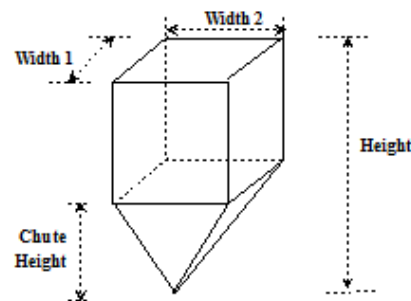
**SPHERE / Ellipsoid**



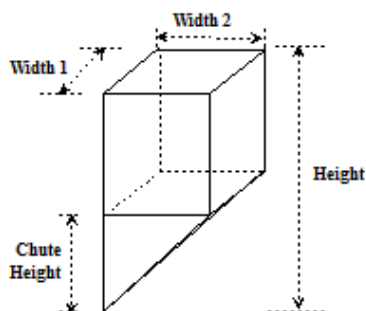
**RECTANGULAR / Standard**



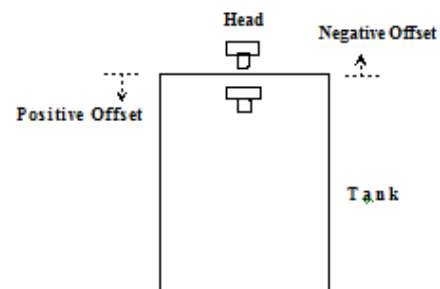
**RECTANGULAR / Chute Mix**



**RECTANGULAR / Oblique Mix**



**HEAD OFFSET CONVENTION**



## 2 Appendix B Terminal Connections

All connections to the unit are located in the lower section of the unit housing. Access to this area does not invalidate the guarantee.

All wiring must be to the latest IEE regulations.

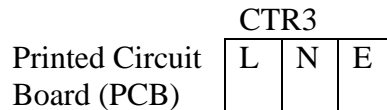
The unit supply voltage must be provided via a double pole spur.

### 2.1 Mains Connection

The units are factory set to operate from either 115V or 230V, 50Hz mains. This is indicated on the rating label adhered to the unit.

Fuse Rating: 20mm 250v, 250mA Anti-Surge.

The diagram below shows the connections for Live, Neutral and Earth:



### 2.2 Relay Connections

There are 4 programmable relays and 1 lost echo relay that are available to external circuitry. These relays have both normally open (NO) and normally (NC) contact so that they can be used in any configuration.

The ratings for the relays are as follows:

Max. Switched current: 5A

Max. Switched voltage: 30V DC / 250V AC

Electrical life at full load: min.  $8 \times 10^4$  operations

Mechanical life: min.  $10^7$

The connections for the relays are shown below

#### 2.2.1 Lost Echo Relay

Normal procedure for the lost echo relay would be to connect the NO and COM terminals since the relay is energised during normal operation of the transducers.

On a lost echo condition relay is de-energised.

The L.E. relay should be used as a fail-safe relay connected in series with the other 4 programmable relays. This ensures that all power to external equipment is removed when the Locator V is not in the 'Run Mode' or if there is a power failure to the unit. If the L.E. relay is not used, any equipment connected to the NC connections of the other relays will run if power is removed to the Locator V because these relays will de-energise, i.e. NC contact is made

### 2.3 Ultrasonic head connections from enclosure to remote transducer driver

The connections for the ultrasonic head is shown below. Normally the head uses four wires, red, green, yellow and blue as indicated in the table below.

The 'RTN' connections is the pulse from the instrumentation unit that instructs the head to send a packet of ultrasound.

The 'TR' connections are the pulses sent back from the head relating to echoes.

The 'THERMISTOR' connections relate to the thermistor sensor associated with the ultrasonic head and are only used if purchased as an optional extra.

Connection	Head Cable Colour		CTR10	CTR11
+VE	Red	Printed Circuit Board (PCB) Note: Ensure connection block from transducer is correctly wired		
0V	Green			
SCR	Screen			
RTN	Blue			
TR	Yellow			
Thermistor +	White OR Temperature Sensor			
Thermistor -	Black			

### 2.4 Ultrasonic Head Connections with Internal Transducer Driver

Connection	Head Cable Colour		CTR10	CTR11
+VE	No Connection	Printed Circuit Board (PCB)		
0V	No Connection			
SCR	Screen			
RTN	Red			
TR	Black			
Thermistor +	White (Temperature sensor)			
Thermistor -	Green (Temperature sensor)			

### 2.5 Communications

The RS232/422 is factory set to:

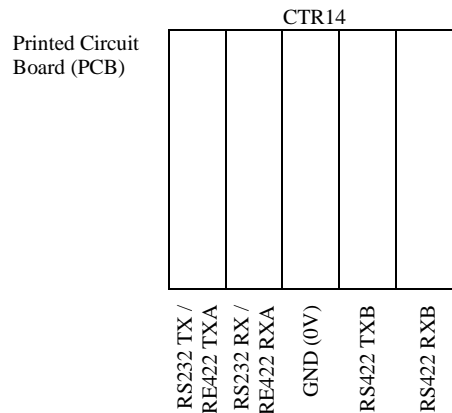
8 Data bits

1 Start bit

1 Stop bit

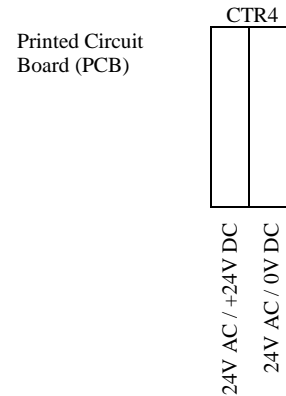
No Parity

The data rate is fixed at 9600 baud. The information is an ASCII string of character that is determined by a ZERO character before the information is repeated. The connections are as shown



## 2.6 Low Voltage Power Connections

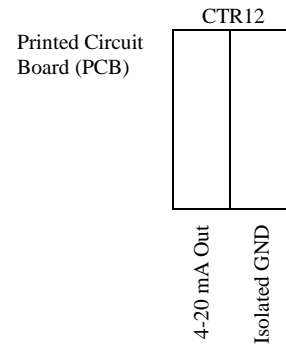
The unit can be powered from either 24 Volts AC or 24 Volts DC. The details of the low Voltage power connections are:



THIS MUST BE FACTORY SET

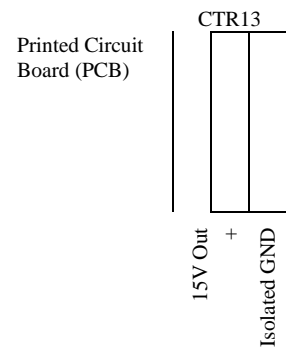
## 2.7 4-20mA Output

The unit can be provided with a 4-20mA output option. The terminal connections for this are shown below.



## 2.8 pH Input

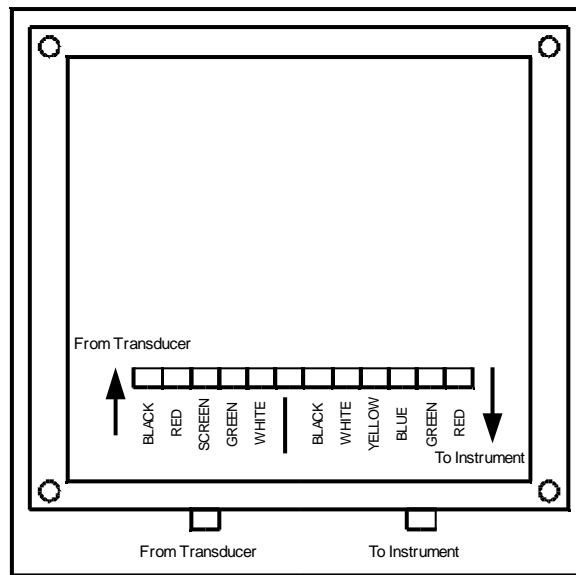
The pH input is used when the instrument has open channel flow monitor software



## 2.9 Installation With Remote Driver Electronics

Note: If you have specified the distance from the instrument to the transducer less than 50m, the instrument supplied may have an integral transducer driver board built in. Consult page 5 of this manual for details.

## 2.10 Wiring Connection for remote transducer driver



CONNECTION	ID	
To Instrument		
TH1	Instrument White	Temperature sensor
TH2	Instrument Black	Temperature sensor
TRIG	Instrument Yellow	
RTN	Instrument Blue	
GND	Instrument Green	
+15V	Instrument Red	
From Transducer		
X1	Transducer Red	
SCN	Transducer Screen	
X2	Transducer Black	
TH1	Transducer Green	Temperature sensor
TH2	Transducer White	Temperature sensor

## 2.11 Cable type and cable installation

**From Instrument to Remote Transducer Drive Electronics or From Instrument to 034 Heads:** Defence Standard, 61-12 Sub-miniature Cable Specification 16-2-6C. It is essential to use this cable type or cable with cores in the same orientation. Failure to do so will cause fluctuating readings due to cross coupling of transmit and receive signals.

**From Transducer to Remote Transducer Drive Electronics:** 4 Core Screened twisted Pair with Integral Drain Wire and individually screened. Impedance 54 ohms, capacitance core/core 115 pF.

**General Notes:** Where multiple sensors are connected to the instrumentation ensure that the cables are kept at least 3000mm apart to prevent magnetic coupling. Always ensure grounds and screens are connected.

## 3 Appendix C: Fault finding

### 3.1 Ringing

When in transmit mode, ultrasonic transducers convert electrical energy into mechanical energy causing the transducer to vibrate, like a loudspeaker. Most of this energy is converted into an ultrasonic acoustic wave but some is transmitted into the transducer housing. This is analogous to striking a bell whereby you hear a sound but also you can observe the bell mechanically "RINGING". If this is excessive it will take a long time to die away and can still be present when the return echo arrives back at the transducer. In such cases the transducer cannot recognise the returning echo and as a result the system cannot calculate range.

Ringing can be recognised by a higher than expected level indicated. To reduce ringing, always use gaskets and never over tighten bolts. Increasing the blanking distance beyond the ringing time will also lock out its effect.

### 3.2 No display showing

Check mains connection and fuse.  
Check mains' rating agrees with serial plate rating.  
Display shows higher than expected reading  
Ringing of transducer: check bolts have not been over-tightened and gasket is fitted.  
False echo from object in transmission path: reposition transducer or extend blanking distance.  
Velocity of sound not set correctly: reprogram to correct temperature setting or install temp sensor.

### 3.3 Display shows lost echo

Transducer incorrectly wired: check wiring diagrams against installation.  
Poor wiring connection: ensure all wires are securely connected.  
Poor earth: meter earth connection and rewire if necessary.  
Incorrect tank dimensions entered - Check height dimensions and temperature settings.  
Level has entered the blanking zone and / or the near field - reduce level until reading returns (see Section 3.2)  
Tank has curved bottom and is empty - this will cause the ultrasonic signal to bounce around the tank arriving back at the transducer outside its permissible time for the set height - ensure transducer is positioned as central as possible and tank always has liquid present below the transducer.  
Foam present - foam absorbs ultrasound - reposition transducer away from foam. Placing in a stand pipe will suffice provided foam does not penetrate the pipe.  
Particle absorption - temperature thermals - foam occasionally present; use stand pipe and / or increase transducer damping factor.

### 3.4 Display shows periodic lost echo

Large undulating surface associated with solids or very turbulent liquids causing unfavourable reflecting surface; reposition transducer above flattest surface or in the case of liquids use a stilling pipe.  
Transducer not mounted to the normal reflecting surface - using a spirit level realign transducer.

### 3.5 Temperature fluctuations

Damage to thermocouple - using a multimeter check the resistance of the thermocouple. It should read between 400 ohms and 100Kohms depending on the temperature being measured. (10K at 25deg.C)

### 3.6 Display fluctuates

Periodic lost echo - check all factors above.  
Rapid fluctuation in surface level due to filling / stirrers etc. - increase damping factor.  
Incorrect cable used.  
Cables running close together or close to interfering power or signal sources

### **3.7 Display Shows Zero**

If the echo from a reflecting surface takes a longer time to return than the height of the tank, the unit will return a zero level. This may occur where the tank has a conical bottom or a large undulation in a solid surface causes the echo to reflect at an angle. Where this occurs the echo will bounce against the walls of the tank before returning to the transducer which would normally indicate a level beyond the height of the tank.

Rather than return a negative level value the unit indicates the tank is empty.

Where this is undesirable, particularly with solids, reposition the transducer or align it such that the reflecting surface is normal to the transducer beam

## **4 GENERAL CONDITIONS OF SALE**

### **4.1 Application**

Unless otherwise specifically agreed in writing, these conditions shall be incorporated in every offer, quotation and contract for the sale of goods and services by Pulsonic Technologies Limited (the Company). Any conditions proposed by the customer are hereby excluded and receipt of the customer's order shall be deemed acceptance of these conditions.

### **4.2 Acceptance**

All quotations are given conformation by the Company upon receipt of the customer's order and no contracts shall be concluded until such conformation is given or the customer's order is otherwise accepted.

### **4.3 Pricing**

Prices quoted are those running at the time of the quotation and may be subject to revision without notice to allow for material or labour cost increases occurring before delivery (plus taxes). Prices unless otherwise quoted, are:

UK Sales - Carriage and insurance to the customer's premises will be arranged by the company and charged as an extra.

Overseas sales CIP.

Certain orders will be subject to advanced payment terms and/or progress payments at the vendor's discretion.

### **4.4 Terms of Payment**

UK Sales - Strictly net 30 days from invoice date. We reserve the right to charge interest at the rate of 2% for each month or part of month that payment is delayed. For orders above £10k, Pulsonic Technologies shall invoice 30% of the total value on acceptance of the order.

Overseas Sales - Orders not greater than £5,000 shall be paid by SWIFT bank transfer. Orders greater than £5,000 shall be paid by Irrevocable Letter of Credit established on a recognised London bank.

All bank charges to opener's account other than internal UK bank transfer charges which will be paid by Pulsonic Technologies Ltd.

### **4.5 Default**

In the event that payment is not made in compliance with Clause 4 above the customer shall be responsible for all costs reasonably incurred by the Company in collecting payment including the Company's legal fees on a full indemnity basis.

### **4.6 Title and Risk**

For overseas sales title and risk shall pass to the customer upon leaving the Company's premises. For UK sales title shall only pass to the customer on receipt of full payment.

### **4.7 Cancellation or Amendments**

The purchaser may not cancel or amend an order after it has been confirmed unless agreed in writing and on terms acceptable to the Company.

### **4.8 Trial or Loan of Goods**

Any goods delivered to the customer on loan or trial and evaluation shall remain the property of the Company. The Company reserves the right to charge the customer for any loss or damage incurred to the goods during the period of loan/trial.

#### **4.9 Guarantee**

Equipment found to be defective in material, design or workmanship within 12 months of commissioning or 12 months of delivery, whichever is shorter, will be replaced or repaired by the Company provided the goods have not been damaged by the customer or have not been improperly installed or operated, or the design altered, or for any other reason such a defect is not attributed to any act or omission on the part of the Company, and provided that prompt notice is given to the Company as soon as the defect or apparent defect is known to the customer, and the goods or defective part are returned to the Company at the customer's cost.

The foregoing states the Company's entire liability in contract and in negligence in respect of defects in material, design and workmanship and neither the Company nor any of its sub-contractors, employees or agents shall be liable in contract tort or otherwise for any injury, damage or loss of whatever kind attributed to such defects. The Company shall not be liable in the event of the manufacture delivery or commissioning of any goods sold hereunder being prevented or delayed by any act or circumstance beyond the Company's control including therein (but without prejudice to such generality) strikes or trade disputes (whether or not involving the Company) difficulty in obtaining raw materials or fuel interruptions

#### **4.10 Product Use and Application**

Unless otherwise stated all electrical ratings must be adhered to as representative of safe working conditions. Dimensions and physical dimensions are subject to normal mechanical tolerances. The product must be installed in accordance with the instructions given in each product instruction manual and the customer shall be responsible for ensuring the fitness of the product for the customer's application.

Where the product is purchased by the customer for supply to any other party, the original customer will be responsible for ensuring all conditions of sale are met.

#### **4.11 Cancellations Prior to Despatch.**

Any purported cancellation of orders will only be deemed effective if:

- Made in writing.
- Agreed by the Company.
- All Company expenses and loss of profit associated with the transaction are indemnified by the customer.

#### **4.12 Cancellations Following Despatch.**

Subject to Pulsonic Technologies consent having been obtained in writing, products must be returned in an unused condition within 14 days of the invoice date. If the product packaging is unopened a handling charge of 25% will apply. A higher charge will apply if the goods are returned after more than 14 days from the invoice date or in an opened but unused condition. Such charges will reflect the work that the company will be required to undertake to return the goods to stock.

Where goods have been found to have been used the full invoice amount will be charged.

#### **4.13 Copyrights**

Goods offered for sale by the company are subject to any copyright, patent, trade mark or other right of any person.

#### **4.14 English Law**

English Law shall apply to the sale of all goods and services hereunder with the jurisdiction of the English.