PORTAFLOW SE

ULTRASONIC FLOWMETER MANUAL

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WARNING - Users should ensure or note that:

a) The PORTAFLOW SE is not certified for use in Hazardous areas.
b) The local site safety regulations are complied with.
c) Work is carried out in accordance with The Health & Safety at Work Act 1974.
d) Please charge the battery set fully before using the instrument. Follow the procedure detailed on page 34-35, section "Battery"

INTRODUCTION

The PORTAFLOW™ SE is a portable flow meter designed by Micronics for use on liquid flows in full pipes, which utilises Ultrasonic transit-time “Clamp-On” transducer technology.

Easy to operate, the Portaflow SE features are as follows:

- Large easy to read Graphics Display with backlighting.
- Simple FAST TRACK set up procedure.
- Simple to follow keypad
- IP55 electronics enclosure
- Guide rail assembly with chains.
- 100K memory logger
- RS232 output
- 4-20mA or 0-20mA output
- 10hr Battery (rechargeable)
- Self checking diagnostics
- Continuous signal monitoring

The instrument displays volumetric flow rate in m^3/hr, m^3/min, m^3/sec, g/min, US g/min, US g/hr, l/min, l/sec and linear velocity in metres and feet per second. When in flow mode the total volume both positive and negative is displayed, up to a maximum of 12 digits.

The Portaflow SE is supplied as a complete kit that includes, Electronics, Transducers, Charger, RS232 cable, 4-20mA cable, mounting hardware with Coupling Grease and an Instruction manual. ***(See Figure 1)***

The following simple guide will enable the user to quickly set up the flowmeter to measure flow. Additional data on the facilities available and many useful hints are contained in the latter sections of this manual.

Figure 1:

Fast Track Set up Procedure

1. Switch on and press ENTER.
2. **Check battery level** - If the battery symbol on the display is full, the unit is charged, press **ENTER**.
3. Select **Quick Start** - Press **ENTER**.

Dimension Units? – Scroll to select units required. Press ENTER.
Pipe OD – Enter data, press **ENTER**.
Pipe Wall Thickness – Enter data, press **ENTER**
Pipe Lining Thickness – Enter data, press **ENTER**. Zero if no lining on application
Select Wall Material – Select using scroll keys, press **ENTER**.
Select Lining Material – This will only be displayed if a lining thickness has been entered. Select using scroll keys. Press **ENTER**.
Select Fluid Type – Select using scroll keys. Press **ENTER**.

4.The instrument selects the mode of operation using the data entered and will display the following.

yy:mm:dd hh:mm:ss

Attach sensor set
in XXXXXX mode
Approx. max. flow:
XXX m/s
ENTER to continue
SCROLL changes mode

5. Fluid Temp? Enter Fluid Temp.in the units required (°C) or (°F)

Retract the sensor blocks back into the guide rail by turning the locking nuts clockwise.
Apply couplant to both sensor blocks as shown in **(Figure *2*)**, attach to the pipe using the appropriate mounting hardware in either Reflex or Diagonal Mode.

Figure 2

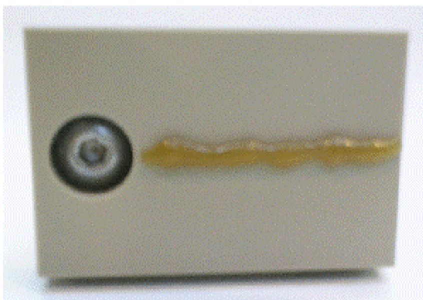


Figure 3: - Reflex Mode Operation

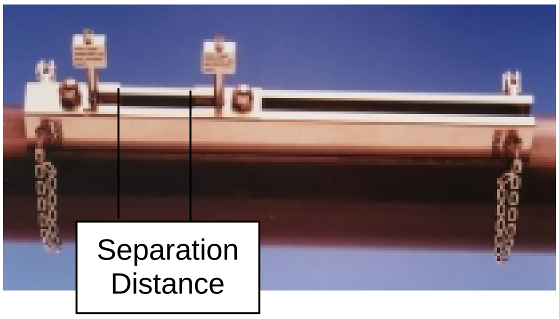
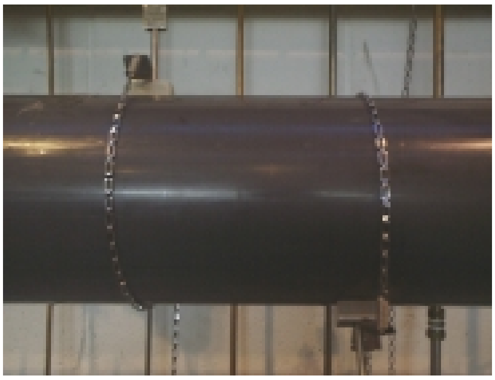


Figure 4: Diagonal Mode Operation



For Diagonal beam mounting follow the sensor mounting instructions on pages 34 and 35 of this manual.

6. Connect the red and blue sensor cables to the electronics and the guide rail assembly. The red cable indicates +ve flow if upstream.

7. For Reflex Mode attach the guide rail (Figure 3) to the pipe as shown above. Turn the locking nut anti-clockwise on the fixed transducer, screwing it down on to the pipe so that it is finger tight and making good even contact to the pipe surface.

8. Set the separation distance ***(See figure 3)*** by sliding the floating transducer along the scale until the front edge of the block is at the recommended distance displayed by the electronics. Now turn the locking nut on the floating transducer anti-clockwise, until it makes finger tight contact with the pipe surface. To mount the transducers in Diagonal Mode follow **Figure 4** and the instruction on Page 34/35 of this manual.

9. Now Press ENTER to read flow. Pressing the appropriate key on the keypad can change flow units. An additional key press will change the timescale of the reading - hr/min/sec.

PARTS AND ACCESSORIES

Connectors

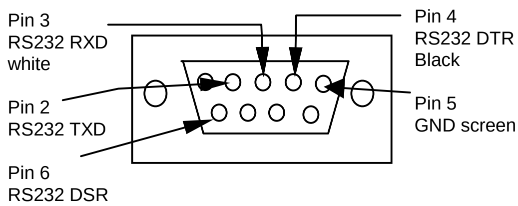
There are five sockets on the electronic housing. Two for the transducer assemblies (Down Blue/Up Red), one for the 4-20mA output, one for the PSU/charger and one for the RS232.Each socket is appropriately marked.

4 - 20mA Cable Connections

4 - 20mA - Red positive, Black negative. The output can be adjusted to either 4- 20mA, 0-20mA or 0-16mA.

RS232 Cable Connections

Figure 5*:*
9 way 'D' plug viewed from reverse



Charger (Use only the charger supplied.)
The charger is supplied with universal plug-in adaptors. When the instrument is charging, but switched off, the display reads 'CHARGING**'.** It also displays a battery and plug symbol. CHARGING is displayed under the word 'Battery' when in flow mode, and a 'plug' symbol is displayed in place of the battery symbol.

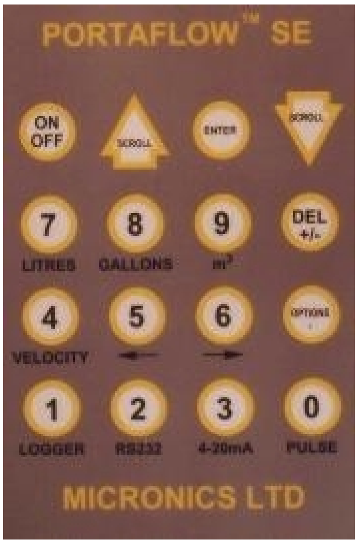
Figure 6: Battery Charger

Battery

A Battery management circuit controls the battery recharge. The circuit helps to prevent the batteries from being damaged through overheating. The circuit automatically cuts off the high-level charge current after 4hrs after which it will provide only a trickle charge, which is not enough to fully charge the battery. Disconnect the charger plug from the instrument, connect again allowing a further 4 hrs at full charge. The battery should now be fully charged and will continue to be trickle charged with the mains still attached and while the instrument is in operating mode. In operating mode a fully charged battery can maintain functionality for up to 10hrs depending upon the demand. The backlight will use a lot of current and whilst it is continuously enabled the operating life will drop to 4hrs from a fully charged battery. When in flow measurement mode the battery charge level is continually displayed as a percentage of full charge. When this indication reads approximately 40%, a warning message will appear on the screen. This indicates that there is only 30 minutes of use left in the battery. The battery can be charged when the instrument is switched to the ON or OFF state.

Keypad

Programming is via a key tactile membrane keypad.



When measuring flow it is possible, by selecting keys 4, 7, 8, and 9, to change from one unit to another without the need to re-program. Additional key presses will adjust the time scale of the measurements.

Example:

- Press 4 for m/s, press 4 again for f/s
- Press 7 for l/s, press 7 again for l/min
- Press 8 for g/min, press 8 again for USG/min
- Press 9 for m^3/hr, press 9 again for m^3/min, press 9 again for m^3/sec

There are some facilities that require the cursor to be moved from right to left. This can be done using keys 5 (left) and 6 (right).

The 4-20mA, RS232 and logger keys can only be activated in the flow mode (see page 17 – Keypad options). The RS232 and data logger are also on the main menu.

Transducers

The Portaflow SE is supplied with one (matched) pair of transducers and a single guiderail to measure flow. The instrument selects the mode of operation (Reflex or Diagonal) dependent on the pipe size and flow velocity. The instrument can be used over a range from 50mm to 1000mm. In Reflex Mode the transducers are positioned in the guide rail to assist correct alignment along the pipe axis, **(Figure 3)**. In Diagonal mode **(Figure 4)** the transducers are removed from the rail and attached to the pipe using the gull wings and chains See Figure 4. The pipe is then measured and marked up and the transducer blocks are clipped to the pipe wall using a suitable amount of grease applied to the face of the transducer.

Separation Distance

The instrument calculates the separation distance when all parameters have been entered via the keypad. Also the instrument calculates the maximum flow velocity allowed with the standard sensors and indicates whether Reflex or Diagonal mode should be used.

```
                 00-02-89    10:42:00

          set sensor
          separation to

             31.1
```

Ultrasonic Couplant

Ultrasonic couplant must be used on the transducer face to interface with the pipe wall.

Fluid Types

Portaflow SE is capable of measuring clean liquids or oils that have less than 3% by volume of particulate content and air bubbles. During the set up procedure the user is prompted to select from a list of liquids, which include water and oils.

Applications include - river water, seawater, potable water, demin water, treated water, effluent, water/glycol mixes, hydraulic oil, diesel oil and most chemicals.

PROGRAMING-MAIN MENU

Switch 0n...

```
Micronics Ltd.

Serial No: 0000    v 1.13
Press Enter to start
```

Main Menu

Press SCROLL up or down to move cursor to required option and press ENTER to select. Before moving to the flow and data logging facilities, please ensure that date and time details are correct (see page 15, Main Menu-Set-up Portaflow)

```
yy-mm-dd   hh:mm:ss

MAIN MENU
Quick start
View/Edit Site Data
Sensor set
Data Logger
Set up RS232
Set up Instrument
Read flow
```

Main Menu - Quick Start

Selecting quick start offers the user the easiest and quickest option to achieve a flow measurement. If the instrument has already been used, it stores the last application data entered. This allows the user to read flow on the same application without spending time entering new data. Go to 'Read Flow' in the main menu.

If **QUICK START** is selected, proceed with the following routine. Use the scroll keys to select, then press ENTER.

```
yy-mm-dd   hh:mm:ss
QUICK START

Dimension units?
mm
Inches
```

The instrument now asks for the **Pipe outside diameter?** After entering the outside diameter press ENTER.

```
yy-mm-dd  hh:mm:ss

QUICK START

Dimension units          mm
Pipe O.D.?               58.0
```

Pipe wall thickness now appears on the display. After entering the pipe wall thickness, press ENTER.

```
yy-mm-dd  hh:mm:ss

QUICK START

Dimension units          MILLIMETRES
Pipe O.D.?                      58.0
Wall thick?                      4.0
```

Pipe lining thickness now appears on the display. If the pipe you are measuring has a lining, enter the **Pipe lining thickness**. If nothing is entered the instrument automatically assumes there is no lining. Press ENTER to move on, or after entering the data.

```
yy-mm-dd  hh:mm:ss

QUICK START

Dimension units            MILLIMETRES
Pipe outside diameter?            58.0
Wall thick?                        4.0
Lining?                            0.0
```

The instrument now displays **Select pipe wall material**. Using the scroll keys it is possible to scroll up or down the options available. Select the required material and press ENTER.

```
yy-mm-dd  hh:mm:ss

QUICK START

Select pipe wall material:
Mild Steel
S' less Steel 316
S' less Steel 303

Plastic
Cast Iron
Ductile Iron
Copper
Brass
```

Concrete
Glass
Other (m/s)

The following will only be displayed at this stage if a lining thickness has been entered. Use the scroll keys to select the required material, then press ENTER. If **Other** is selected, enter the Sound speed of the lining in metres/sec. **(Contact Micronics if this is not known.)**

yy-mm-dd hh:mm:ss

QUICK START

Select pipe lining material:
Steel
Rubber
Glass
Epoxy
Concrete
Other (m/s)

Select fluid type now appears on the display. Use the scroll keys to select the fluid type and press ENTER.
If the liquid is not listed select **Other** and enter a liquid sound speed in metres/second. This may be found in the back of the manual under **Liquid Sound Speeds.**

yy-mm-dd hh:mm:ss

QUICK START

Select fluid type:
Water
Glycol/water 50/50
Lubricating oil
Diesel oil
Freon
Other (m/sec)

Attach Sensors

The instrument will now provide the user with details of the mode of operation. It will also give the approximate maximum velocity that can be achieved with the sensors provided.
Use the keypad to check the other maximum volumetric flow.
Connect the RED and BLUE sensor cables, between the guide rail and the electronics.

yy-mm-dd hh:mm:ss

Attach sensors in
REFLEX mode
Approx. max. flow:

ENTER to continue
SCROLL changes mode

yy-mm-dd hh:mm:ss

Fluid temp?
(oC)

yy-mm-dd hh:mm:ss

Set sensor
Separation to
13.0

ENTER to continue

READ FLOW now appears on the display.

Batt CHRG Sig 48%
(ERROR MESSAGES APPEAR HERE)

100.0

l/m
+ l 1564
- l 0

When reading volumetric flow the instrument will display a positive and negative total. Selecting OPTIONS from the keypad can reset these totals. (See page 19).

The instrument will continually display the battery and signal levels. Signal levels should be above 40%.

If there is an error with the site data entered or the application, the instrument will display an Error or warning message (See page 21), which will appear above the flow reading. If there is more than one message it will scroll between them all.

To stop reading flow press ENTER **ONCE**. The display will read the following.

yy-mm-dd hh:mm:ss

This will stop all
logging and outputs

Press ENTER to EXIT
SCROLL to return

to READ FLOW

Pressing ENTER a second time will stop all logging and outputs and return the instrument to **MAIN MENU or** Press the scroll key to return the instrument to **READ FLOW**.

Main Menu - View/Edit Site Data

The **VIEW/EDIT SITE DATA** mode can be accessed from the main menu and allows the user
to enter application details for up to 20 different sites. This facility is useful if a number of sites are being monitored on a regular basis. Application data can be programmed into each site before getting to site.

When scrolling up/down the menu press ENTER to select at each prompt.

yy-mm-dd hh:mm:ss

VIEW/EDIT SITE DATA	
List sites	
Site number	0
Name	QUICK START
Units	MILLIMETRES
Pipe O.D.	58.0
Wall thick	4.0
Lining	0.0
Wall	MILD STEEL
Lining	---------
Fluid	WATER
Read flow	
Exit	

Note:

- Site Zero is always the **QUICK START** data and cannot be changed.
- Changing the data in any site is automatically saved when leaving this menu. Data will have to be re-entered to over ride the old data.

List Sites

Selecting **LIST SITES** allows the user to view the names of up to 20 sites, numbers 1-5 appear first. Pressing ENTER will display sites from 6-10. Pressing again will display sites 11-15, and again to display 15-20.

yy-mm-dd hh:mm:ss

1 site not named
2 site not named
3 site not named
4 site not named
5 site not named
Press ENTER to continue

Site Number

Site number allows the user to enter the number of the site data that you wish to be displayed. If the site has not been used then no data would be stored. You can now enter new application data.

Site Name

Site name allows the user to edit or enter a site name. Use the scroll keys to move the cursor to the letter/figure required and press ENTER. Press 0 to return the instrument to **VIEW/EDIT SITE DATA**. The new site name will appear on the display.

yy-mm-dd hh:mm:ss

SCROLL & ENTER select
for space, 0 to end

abcdefghijklmnopqr
stuvwxyz01234567890
>…….................<

Dimension Units

Dimension units allow the user to switch between millimetres and inches. This converts all the application data in a particular site.

Pipe wall/lining thickness and **Pipe wall/lining material** can now be changed as required. Lining material is ignored if a lining thickness has not been entered. A selection of pipe wall/lining materials will be displayed when these options are selected.

Fluid type

Fluid type allows the user to scroll through a selection of fluid types. Select **OTHER** in the **menu if a liquid is not mentioned.**

Select fluid type. When **Other (m/s)** is selected the user must enter the liquid sound speed in m/s. This can be supplied by Micronics or found in the back of the manual under **Liquid Sound Speeds**.

Read Flow

Selecting **Read flow** informs the user of the mode of operation and the approximate maximum flow rate. Press the appropriate key can change the units required.

yy-mm-dd hh:mm:ss

Attach sensor set
in REFLEX mode
Approx. max. flow:
7.22 m/s
ENTER to continue
SCROLL changes mode

Pressing ENTER asks the user to enter a temperature in °C.

	yy-mm-dd hh:mm:ss
Fluid temp? (°C)	20.0

Now press scroll (up) to display the separation distance before displaying flow.

Main Menu - Select Sensor mode

When the application information is programmed into the instrument it selects and defaults to the most suitable mode of operation i.e. REFLEX or DIAGONAL.

	yy-mm-dd hh:mm:ss
SENSOR SET	
Mode	REFLEX
Read flow	
Exit and default	

This option is available for two main reasons. Firstly, lets assume that the instrument has selected “mount sensors in DIAGONAL MODE It may not be possible to do this so in these circumstances, provided that the velocity is low

enough it is possible to force the sensors into REFLEX mode (See page 4). Changing the sensor mode from Diagonal to Reflex would allow the user to measure the flow.

The display may also read, sensor mode invalid for this pipe size.

> yy-mm-dd hh:mm:ss
>
> Cannot READ FLOW
> Because pipe
> to large/small for sensor
>
> ENTER to continue

Sensor Mode

Selecting **Sensor mode** allows the user to choose the appropriate method for clamping the sensors to the pipe. The default would have been displayed on the previous screen and **Sensor**

mode can be selected to give the user a choice between Reflex and Diagonal.

Read Flow

Moving the cursor to **Read flow** and pressing ENTER informs the user of the mode of operation and the maximum flow capable.
If the actual flow is higher than the one specified on the instrument, the other mode of operation can be selected. Selecting EXIT will take you back to **MAIN MENU**.

Main Menu - Data Logger (See also **KEYPAD OPTIONS** - data logger)

Access the Data-logger when in the flow mode via the keypad or from the main menu. Selecting the logger via the keypad when in flow mode allows the user to set up the logger. e.g. start time, interval time etc. and view the stored data. Selecting the logger from the main menu only allows the user to view the data that has already been stored. If no data has been stored in the memory the instrument will display the following.

> yy-mm-dd hh:mm:ss
>
> No data in memory
> ENTER to continue

Data is stored in 240blocks, each block having 240 data points. Every time the logger is started a new block of memory is used. If one application took up all the memory it would use all 224 blocks. Use scroll to move the cursor to the required option then press ENTER to select.

	yy-mm-dd hh:mm:ss
DATA LOGGER	
Units	l/s
List blocks	
Next to view	7
View as text	
View as graph	
Y axis max.	7.3
Download	
Clear log	
Memory free	50000
Exit	

Units

Selecting units only informs the user of the flow units that the logger is measuring.

List block names/ Next block to view

The blocks of data will now appear in groups of 5. Press the SCROLL key to find the block of data required. When the block number is found, press enter to return to the DATA LOGGER menu. Scroll down to **Next block to view** and enter the number selected from the **List block names** option. When viewing data, the instrument will go

directly to the block of data selected, either when viewing as text or graph.

yy-mm-dd hh:mm:ss

1. block not used
2. block not used
3. block not used
4. block not used
5. block not used

SCROLL or ENTER exits

View Log as Text

Text can be viewed in blocks, each having 240 data points. The display will list the text that has been logged from 0-240. It is possible to scroll up and down the list using the scroll keys or by using key **5** and **6.** The data will move in blocks of 60. Every point is equivalent to the time the user logged data into the instrument. i.e. if the instrument has been programmed to read every 10 minutes each data point will be equivalent to the reading at that time.

The message **Error occurred** appears on the display when there is a signal loss or unstable flow conditions while logging. The instrument cannot record what the error is under these conditions.

yy-mm-dd hh:mm:ss

Block: 1 Point 23

(log name)
yy-mm-dd hh:mm:ss
l/m 276.0

When no data is stored the following is displayed.

yy-mm-dd hh:mm:ss

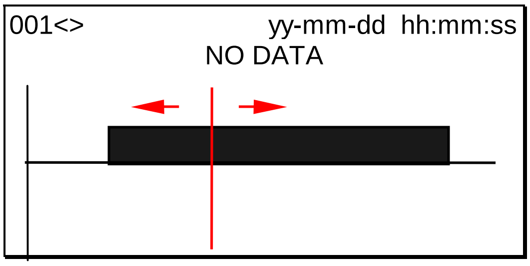
Block: 1 Point 23

NO DATA FOUND

View Log as Graph

The logged data can also be viewed as a graph in blocks or a section of data points. It is possible to view the flow rate and time at any point on the graph by moving the cursor along to that particular point in time. Pressing the scroll keys up or down will move the cursor to the point required on the graph. The flow rate and time that appears in the bottom left hand corner of the display, relates directly to the position of the cursor.

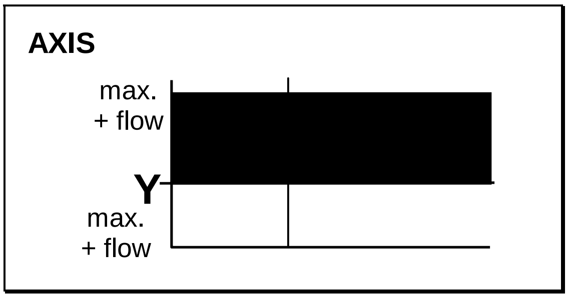
The user can scroll along each block of 240 data points (in two 120 blocks) in either direction by using the scroll keys. Pressing keys **5** and **6** the user can page backwards or forwards in blocks of 120 data points. The left and right arrow indicate the range you are viewing. For example: the left pointing arrows (<) indicates you are viewing data points from 1 up to 120. The right pointing arrow indicates you are viewing data points between 121 and 240.



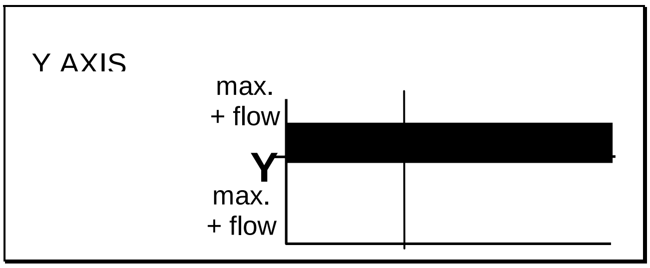
Graph Y Axis Maximum

The Y axis defaults to the maximum flow achievable and can be adjusted to increase the resolution of the graph.

This example shows the flow is constantly at maximum flow rate.



The following example shows the flow rate with the Y axis double the maximum flow rate measured.



Download log

If the data is being downloaded to Windows 95/98/NT or Windows 3.1the electronics have to be set up before the user selects the range of data to download. Go to the logger menu, move cursor to **Download log** and press ENTER. Scroll down to **First block to Download**, press ENTER then select the block you wish to start.

The same procedure should be followed to select the **Last block to download.** When both of these are selected scroll back up to **Download range to RS232** and press ENTER.

Example:

It may be that data has been recorded in blocks 1 to 7 and only information in blocks 1 to 3 are required. Selecting 1 as the **first block to download** and 3 as the **last block to download**, scrolling back up to **download range to RS232** and pressing ENTER, will download the data required. If a block number entered is out of

range, an error message **Block number out of range** will appear.

```
                                yy-mm-dd hh:mm:ss
DOWNLOAD
 Download range
 Start block                                1
 End block                                  3
 Exit
```

Press ENTER the instrument will display.

```
                              yy-mm-dd  hh:mm:ss

           Currently Downloading
     Block    /                  1P    1t

     Printer status: UNKNOWN/READY

           Press ENTER to cancel
```

Printer status: UNKNOWN means when setting up the RS232, **Handshaking > None** was selected.
Printer status: Ready means the unit is ready to send data.
Printer status: Busy means the unit is off line or the buffer is full to the printer.
The Portaflow SE will continue to download the data until complete. Press SCROLL to exit or return to the **MAIN MENU.** Press ENTER to stop downloading.

Clear Log

WARNING! This clears logged data in **ALL** block numbers.
Selecting clear log and pressing ENTER, the display will read the following.

```
                                yy-mm-dd  hh:mm:ss


          Press ENTER to clear the log
           or press SCROLL to return
```

Press ENTER will display the following.

```
                                yy-mm-dd  hh:mm:ss

              log memory cleared

              ENTER to continue
```

If **Clear log** is selected while the data logger is recording the following message will appear.

```
                                yy-mm-dd  hh:mm:ss

              You cannot change
                during logging

            Press ENTER to continue
```

Memory Free

Gives the number of free data points for a maximum of 50,000 (240 x 240).

Exit

Pressing EXIT will return the instrument back to the **MAIN MENU** and onto the next item **Set up RS232.**

Main Menu - Set up RS232

The RS232 must be configured to work with exactly the same parameters as the printer or

computer that you are connected to. All parameters on this menu are stored when the instrument is switched off.

Selecting **HANDSHAKING** (also known as flow control or protocol) shows the following display.

Select using the scroll keys then press ENTER to confirm.

```
                                yy-mm-dd  hh:mm:ss
HANDSHAKING
 None
 Dtr/Dsr
 Xon/Xoff
```

Data bits, **Stop bits**, **Parity** and **New line**, scroll down these options in the **SET UP RS232** and press ENTER to bring up selection. Scroll down the options and press ENTER to select.

Printer test confirms the settings that will be displayed or printed and that there is a connection from the computer and the Portaflow.
Exit from RS232 and return to **MAIN MENU**

```
                                yy-mm-dd  hh:mm:ss
```

SET UP RS232

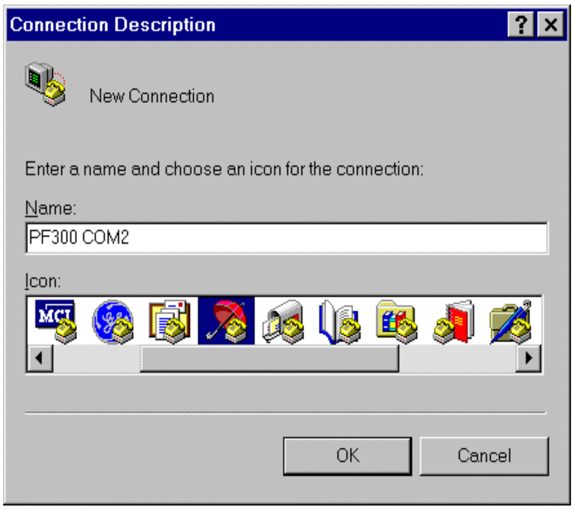
Handshaking	none
Baud rate	19200
Data bits	8
Stop bits	1
Parity	NONE
New line	CR
Printer test	
Exit	

Download Data To Windows 95/98/NT

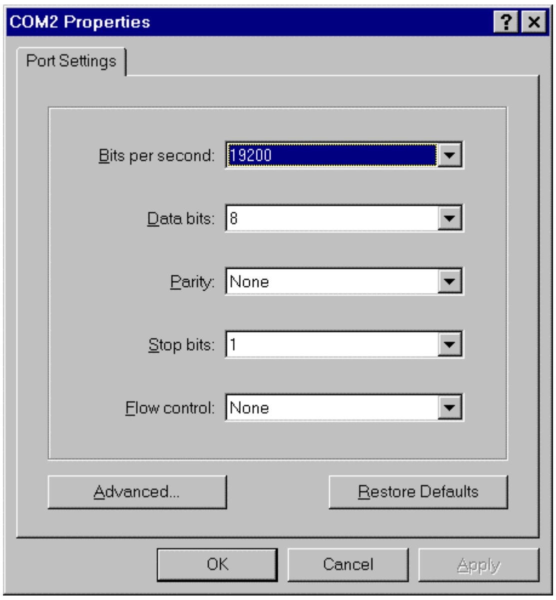
Micronics suggest when downloading to a computer that **Handshaking > None** is selected. When setting up the RS232 for maximum data transfer speed check there is data to download by selecting view text in the **DATA LOGGER** menu.

Connect the RS232 cable between the Portaflow and COM1 or COM2 on your computer. When in Windows 95/98/NT select, **Start >Programs >Accessories > communications >Hyper Terminal,** then select a suitable icon. See following picture.

The heading **Connection Description** will appear. Enter the name of your choice. Select an icon and press OK when complete.



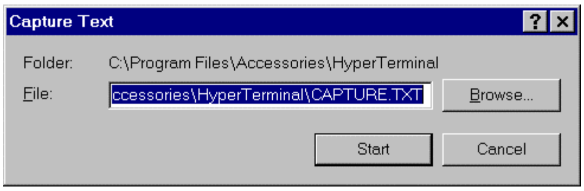
The heading **Phone Number** will appear. Select **Connect using:** then **Direct to Com 2.** When this has been selected the heading **Com 2 Properties** will appear, select OK.



Downloading data to a spreadsheet in WINDOWS 95

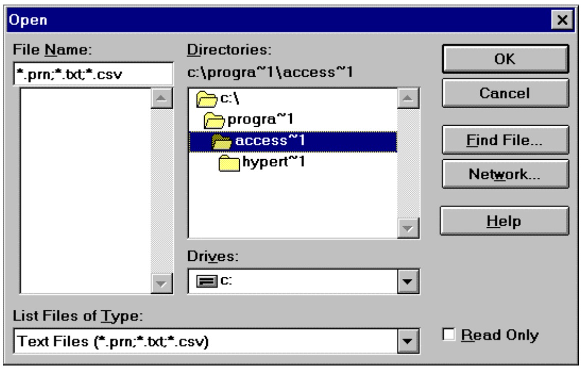
Before download data onto a spreadsheet and **Download range to RS232** is selected on the Portaflow SE, the data has to be stored to a file. Data cannot be entered onto a spreadsheet after **Download to RS232** has been selected.

Select **Transfer** then **Capture Text** from the **Hyper Terminal** Window. The following will be displayed.

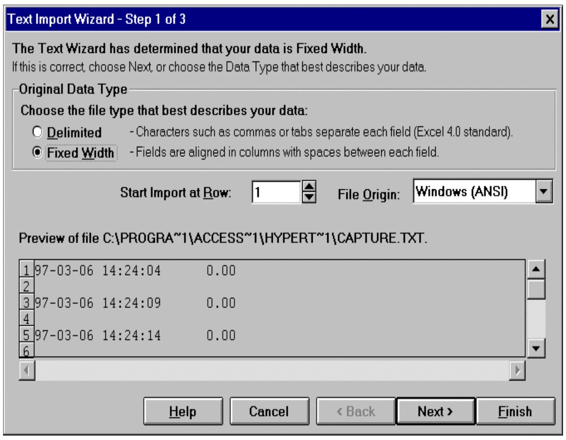


The data can be saved in any file or directory as a TEXT file. CAPTURE.TXT is a default name that can be changed. Make sure a new file name is given every time you download, otherwise data is just added to the file of the same name. Press start. When entering a file name make sure **.TXT** is entered directly after the name given. Once the data is in the file you can leave the Hyper Terminal without having to save the data.

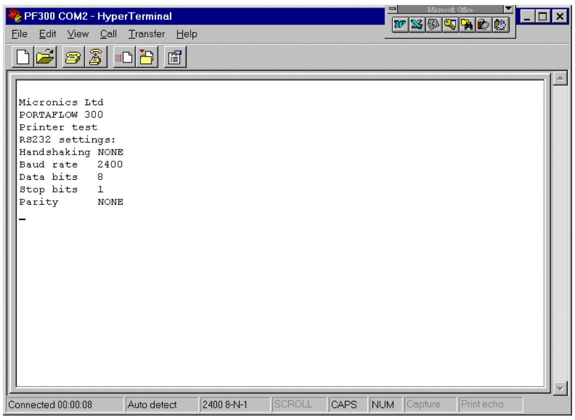
Now go to Excel and find the file name and enter it on a spreadsheet. The following will be displayed.



The following will be displayed, allowing the data to be set in a format for Excel.



Complete the following 3 Steps in Text import wizard, then select **Printer test** on the Portaflow SE. The following will be displayed.



On the Portaflow SE now select **Main menu**, ENTER **> Data logger** ENTER **> Download log** ENTER.

Select a range to download as described on page 12 and press ENTER to download the data.

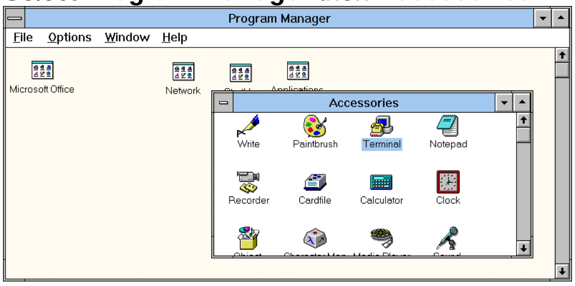
Download Data To Windows 3.1

Before downloading data onto a spreadsheet and **Download range to RS232** is selected on the Portaflow SE, the data has to be stored to a file.

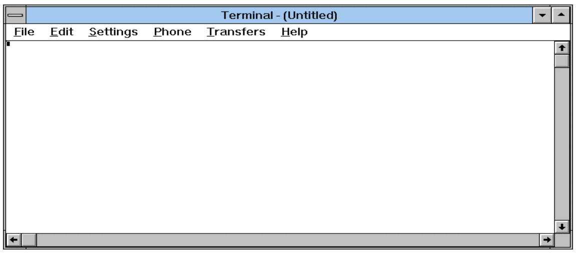
Data cannot be entered onto a spreadsheet unless it has been stored to a file.

Micronics suggest when downloading to a P.C. **Handshaking > None** is selected (See page 12- **Set Up RS232**) when setting up the RS232.

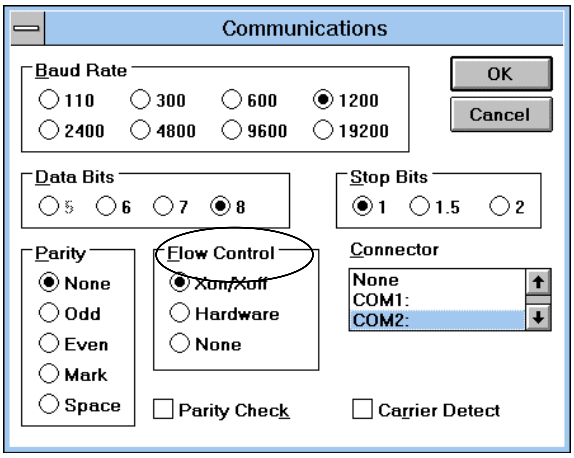
Select **Program Manager** then **Accessories.**



Now select **Settings** and Communications from the **Terminal Window**.



The following will be displayed.

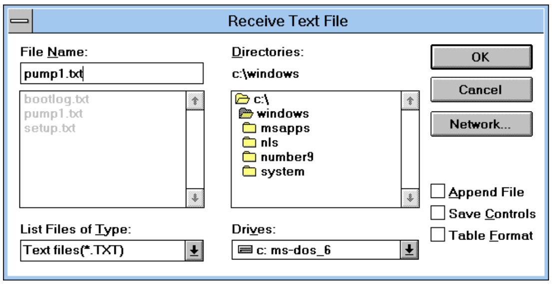


Note: Flow Control is also known as Handshaking or Protocol.

Check now that the above settings are the same as the settings on the Portaflow SE. This can be done from **Read flow** mode using the **RS232** key or from the **MAIN MENU** and **Set up RS232.** If they are not set up correctly an error message will occur in Windows.

Downloading data to a spreadsheet in Windows 3.1

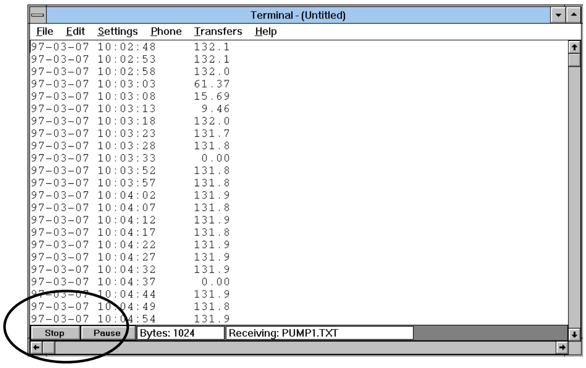
Select **Transfer** from the Terminal Window then **Receive text file.**



Select a name making sure **.txt** is entered immediately after it and select OK. Make a note of the file name for when you go into the spreadsheet.

Select a range to download on the Portaflow SE as described on page 11 and press ENTER to download the data.

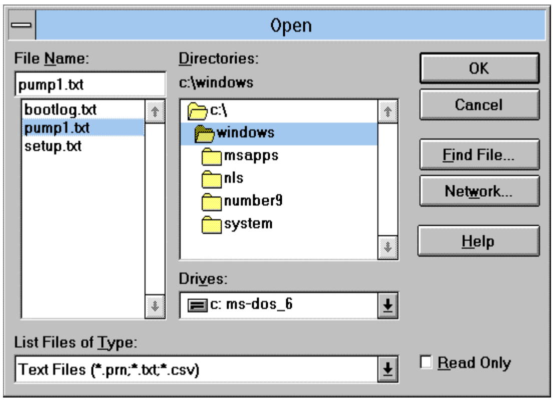
Press **Download Range to RS232** on the Portaflow SE will now display the following in the Terminal window. Press STOP when complete and escape.

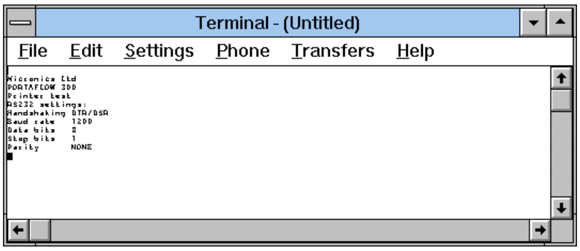


At this point you can go into the spreadsheet to find the file under a text format.

Example from Excel

By selecting OK at this point it is possible to follow the instructions in the Excel handbook.





Main Menu - Set Up Instrument

Set Date & Time

When the cursor bar is on **Set date and time** press ENTER, the display will show.

	yy-mm-dd hh:mm:ss
TIME 96-01-01 09:30:31	
Calibrate 4-20mA	
Backlight	Disabled
App. options	
Sensor params	
Factory settings	
Exit menu	

A cursor will be positioned on the month and start flashing. Using the scroll keys you can select the month and by taking the month forward or back past month 12 every time, increases or decreases the year. When the month and year have been selected press ENTER and follow the same procedure for the day. The same procedure is used in setting the time. When adjustment is made press ENTER and the instrument returns to the SET UP INSTRUMENT menu.

Calibrate 4-20mA (Note: A meter is required to measure the output.)

The 4-20mA Output is calibrated before it leaves the factory and also allows the user to adjust the calibration to match a specific display. The DAC value is a number between 0 and 40,000 and is a number internal to the Portaflow that will change when calibrating the 4-20mA.

The first stage is to adjust the output current to 4mA. When connected to any device that accepts 4-20mA, it may require adjustment to exactly 4mA or 20mA and this is possible by using the scroll keys or keys 5 and 6. The scroll keys move the DAC value in larger steps of 25 and keys 5 & 6 move the value one at a time.

The DAC value should be approximately 8000 for 4mA and 40000 for 20mA. By watching the actual current value displayed on the meter, it is possible to scroll up and down or use keys **5** and **6** to calibrate the 4-20mA to the exact value.

When the 4mA is adjusted press ENTER. If the 4-20mA is **not** connected then the instrument will still display the DAC number but display **Error** instead of **OK**.

yy-mm-dd hh:mm:ss
Adjust to 4mA Use UP/DOWN to set, 5/6 to trim DAC value: 8590 mA **OK/ERROR** Press ENTER when done

Now adjust the 20mA, press ENTER when complete and the display will return to the **SETUP PORTAFLOW** menu.

yy-mm-dd hh:mm:ss
Adjust to 20mA Use UP/DOWN to set, 5/6 to trim DAC value: 39900 mA **OK/ERROR** Press ENTER when done

If the load is not connected or too high ERROR will be displayed next to mA, as shown below.

CALIBRATE 4-20mA	yy-mm-dd hh:mm:ss
Adjust the output current to 20mA Use UP/DOWN to set, 5/6 to trim DAC value: 39900 mA ERROR Press ENTER when done	

Backlight

Use the scroll key to select backlight and press ENTER. This allows the user to enable or disable the backlight. Enable, means the backlight will stay on for 15secs with every key press. It will stay on permanently with the mains plugged in. Use the scroll key to select and press ENTER.

Backlight	yy-mm-dd hh:mm:ss
Enabled Disabled	

Application Options

Use the scroll key to select Application Options and press ENTER. It is a facility that could enhance signals levels on difficult applications, primarily very small or very large pipes.

Sensor Parameters

This facility is password protected. It stores sensor information used by Micronics and is not available for the user.

yy-mm-dd hh:mm:ss
WARNING! Sensor should only be edited following instruction from the factory Enter password

Factory Settings

This option is password protected and a facility for Micronics engineers to calibrate each instrument at the factory. Pressing ENTER in this mode takes the user back to the **SETUP INSTRUMENT MENU**.

Exit

Means EXIT and will take you back to the Main Menu.

Main Menu - Read Flow

When choosing the **Read flow** option from the **MAIN MENU** the instrument reverts directly back to the data that was last entered. Therefore the instrument will have to be reprogrammed if it is to be used on a new application.

yy-mm-dd hh:mm:ss
Attach sensor set in REFLEX mode Approx. max. flow: 7.20 m/s ENTER to continue SCROLL changes mode

Press ENTER. The user can now enter a temperature value between -20°C and +125°C, press ENTER for the separation distance.

The display will now read the following.

yy-mm-dd hh:mm:ss

FLUID TEMPERATURE (°C) 20.0

Enter a temperature and press ENTER. The display will now show the following.

yy-mm-dd hh:mm:ss

Set sensor
Separation to
XXX

ENTER to continue

Set the transducers to the required separation distance. Pressing ENTER will take the instrument into flow mode.

Batt CHRG Sig 48%
(ERROR MESSAGES APPEAR HERE)

100.0

l/m
+ l 1564
- l 0

KEYPAD OPTIONS

The output options can only be adjusted/operated in flow mode.

Logger Key

The data logger can only be set up from flow mode and is accessed via the keypad. Once the logger is recording only some parameters can be changed.

By pressing the logger key the display will read the following.

	yy-mm-dd	hh:mm:ss
DATA LOGGER		
Log name	--	
Log to	MEMORY	
Interval	5 seconds	
START/STOP NOW		
Start	97-01-22	00:00:00
Stop	97-01-25	00:00:00
Memory free	50000	

List names	
Next to view	
View as text	
View log as graph	
Units	l/m
Y axis max.	3450
Clear log	
Exit	

Log Name
This allows the user to give the data that is going to be logged, a name. The name will be displayed at the start of each block of memory until the instrument has stopped logging.

yy-mm-dd hh:mm:ss

SCROLL & ENTER select
• for space, 0 to end

abcdefghijklmnopqr
stuvwxyz0123456789
>……...............<

Log Data To
Selecting this option gives the user the choice of logging to the memory, RS232 or both. Select the option required by using the scroll keys and press

ENTER (See also Downloading to Windows pages 12 and 14).

Logging Interval
This option displays a range of times that allow the user to decide how often the readings need to be logged. The times range from 5 seconds to 1 hour. Use the scroll keys to select then press ENTER.

Start/Stop Now
This starts and stops the logger immediately. When Start now is displayed press ENTER to start, the display will change to Stop now. When Stop now is displayed press ENTER, the display will change to Start now. This function defaults the logger to 1 hour of logging. If a longer period of logging is required then the **Start/Stop time** will have to be set up.

Start/Stop Time
This allows the user to program a time for the logger to start and stop logging in advance of going on site. Press ENTER to select and program as per the instructions for setting time and date on page 15 - Setup Portaflow.

Note:- Memory free, List block names, Next block to view, View log as text, View log as graph, Units, Graph Y axis max, Clear log and Exit are the same as described on page 10 - Main Menu - Data Logger

4 - 20mA Output KEY

The 4-20mA Output can be scaled to the maximum flow rate. It is also possible to enter a negative figure for the minimum output and would enable a reverse flow to be monitored. The 4mA would then be the maximum reverse flow (e.g. –100 lpm) and the 20mA would be maximum positive flow (e.g. 100 lpm).

mA Out
This displays what the current output is giving at any particular time.

	yy-mm-dd hh:mm:ss
4-20MA	
Units	l/m
Flow at max.	xxx
Flow at min.	xxx
mA for error	22.0
Exit	

Output
This option allows the user to select between three different outputs or switching the output off. The display will read as follows.

Scroll down the options to select required output, and press ENTER. The display will then revert

back to the **4-20mA** menu and **Flow at max. output.**

	yy-mm-dd hh:mm:ss
OUTPUT	
OFF	
4 - 20mA	
0 - 20mA	
0 - 16mA	

The Units
The flow units can be changed at this stage by selecting them from the keypad. When selected, scroll down to move onto the next option.

Flow at Max. Output
This sets the output at the top end of the scale so that the maximum flow gives 20mA (or 16mA).

The instrument automatically defaults to the maximum flow rate. The user can press ENTER and set the output to a level required. When selected press ENTER to continue.

If the flow was to go over the maximum range set, the instrument will go to a maximum of 24.4 mA and stay there until either the flow reduces or the output is re-scaled. The instrument will also display a warning message- **mA out over range-**if the output is greater than 20mA or 16mA.

Flow at Min. Output
This sets the output at the bottom end of the scale so that the minimum flow gives 4mA or 0mA.

The instrument automatically defaults to zero, but the user is able to enter any figure they wish including a minus figure for reverse flow conditions.

Output mA For Error
This gives an error output to inform the user of loss of signal. The figure set to between zero and 24mA, but defaults to 22mA.

Exit

RS232 Output Key
This is set up in exactly the same way as when the RS232 is set up from the **MAIN MENU** (See page 15).

Delete Key
If anything is entered in error, press the DELETE key and re-enter the information required.

Options Key
This can only be used in flow mode. Scroll down the options then press ENTER to select.

	yy-mm-dd hh:mm:ss
OPTIONS	
Cutoff (m/s)	0.05
Set zero	
Total	RUN
Reset + total	
Reset - total	
Damping (sec)	5
Cal. Factor	1.000
Corr. Factor	1.000
Diagnostics	
Exit	

Zero Cut Off (m/s)
The instrument has an automatic ZERO CUTOFF that is calculated to 0.05 m/s. The maximum flow is calculated when the instrument is programmed and is displayed when sensor set and mode of operation are displayed (See page 9 - Read Flow - Attach sensors). Measuring flows below this range is possible, but Micronics cannot guarantee the performance of the results obtained.

This also allows the user to not record any unwanted flow. For example it may be that the user may not want to measure flows below 50 LPM in a 50mm pipe that is equivalent to 0.42 m/sec, in which case 0.42 m/sec would be entered into the instrument and nothing would be recorded below that level. The maximum **cut off** 1 m/sec.

Set Zero Flow
On some applications and in some conditions it may be that although there is no flow the instrument may show a small offset due to picking up noise. The offset can be cancelled out and will increase the accuracy of the instrument. By

selecting this option and pressing ENTER the display will show the following.

yy-mm-dd hh:mm:ss
Stop the flow COMPLETELY and press ENTER or SCROLL to cancel

Pressing ENTER before the flow has stopped will result in an error message asking if you **are sure the flow has stopped**. This occurs when the flow is still above 0.25m/sec.

When this option has already been selected, press ENTER to cancel the previous instruction, then it is possible to re-set the Zero balance. This

option is not available when error messages E1 and E2 (See page 21) are being displayed.

Total
This option allows the user to disable the positive and negative total. When you select either of these options the total will start or stop functioning. It does not zero the total, this is a separate function described below.

Reset + Total/- Total
The Portaflow SE has forward and reverse total that can be reset when this option is selected. Use the scroll keys to select then press ENTER to reset. The Total is stored when unit is switched off or battery goes flat, therefore may need to be reset before each use.

Damping (sec)
This option is used when the flow readings are unstable due to turbulence caused by obstructions, bends etc. Damping or averaging can be used to make the readings more stable. It can be set to up-date the display, anything between 3 and 100 seconds.

Calibration Factor
This facility should not need to be used in general use. One reason could be that a guide rail was being used that had not been calibrated with the instrument and had been supplied as a spare. This could cause the instrument to be out of calibration.

If for any reason the instrument goes out of calibration and the readings may be higher or lower than normal then this facility enables the user to correct the reading. If for example the reading is 4% higher than normal then entering 0.96 will reduce the reading by 4%. If the reading were 4% lower than normal then entering 1.04 would increase the reading by 4%.

When the instrument is supplied it will always default to 1.00 and when this is changed it will stay in the memory to whatever it has been changed to, until such time as it needs to be changed again.

Correction Factor
This is a facility that can be used when errors occur due to lack of straight pipe or the sensors have been placed too close to a bend, this could give an incorrect reading to what is expected. The user can set this as a % in the same way as the calibration factor, but it will not be stored in the memory.

Diagnostics

Calculated µs
This is a value the instrument predicts will be the time in µsecs that it should take for the transmitted signal to go across a particular pipe size. This

value is ascertained from the data entered by the user. i.e. Pipe size, material, sensor set etc.

Up µs, Dn µs
This is the actual transit time measured by the instrument and will be slightly (5-10µs depending on the pipe size and signal condition) less than the calculated value above.

Measurement µs
A point in the signal transmitted, where the flow measurement is taken from. It is used to see if the signal is being taken from the burst at the correct time to get the strongest signal. It is normally used on smaller pipes when the instrument is being used in double or triple bounce as signals can sometimes interfere with each other. This value is normally a few µs below the **Up µs, Dn µs** value.

Phase up/dn µs
Only valid if **Calculated µs** and **Up µs, Dn µs** are correct. If the reading is zero then there is no signal, which could mean the pipe is empty, or the liquid is contaminated with particles or air.

Phase offset
This value will be between 0 and 15. The exact value is not important and will vary between applications. It should however, be stable when the flow condition is good and velocity is within the range of the transducers being used. As the flow rate increases towards and beyond the maximum, this figure will continuously change. In flow mode the instrument will read unstable or high flow.

Flow (m/s)
This displays flow velocity in m/sec to 3 decimal places.

Signal
This is the averaged value of **Signal up/dn** and is a value between 800 and 2400 as this calculates the signal strength as a percentage (800=0%, 2400=100%).

Signal up/dn
This value is internal to the electronics and must be greater than 800. There is an option in the SET UP INSTRUMENT menu to allow this value to be taken down to 400 in extreme circumstances. This is useful on some applications when the signal levels are poor.

Sensor separation
The distance required between the transducers on the pipe.

STATUS/ERROR/WARNING MESSAGES

There are three types of message that will appear and they are Status, Error and Warning. These messages appear under the time and date on the display when in flow mode.

Status Messages

S1: INITIALISING
Appears when first entering flow mode to show instrument is starting up.

S2: LOGGING TO MEMORY
This informs the user that the instrument is logging to the internal memory.

S3: LOGGING TO RS232
This informs the user that the instrument is logging to an external device i.e. a printer.

Error Messages

E1: UNSTABLE OR HIGH FLOW
This error message occurs when either the sensors have been positioned too near to an obstruction or bend causing turbulence, or the instrument is being used outside its normal flow range.

When the instrument is programmed the user is informed of the maximum flow rate that is possible to measure and if this is exceeded then the high flow message occurs.

It may be possible to get round these problems by moving the sensors to a straighter length of pipe or in the case of high flows another set of transducers may be used.

E2: NO FLOW SIGNAL
This message appears when the two transducers cannot send or receive signals, which could happen for various reasons. Firstly check that all cables are connected, transducers are on the pipe correctly with grease on the face.

These reasons could be when trying to measure a partially empty pipe, aerated liquid or when the particulate content of that liquid is too high. It could also happen if couplant has not been applied to the transducers or the condition of the pipe being measured is poor.

Warning Messages

W1: CHECK SITE DATA
This message occurs when the application information has been entered incorrectly and the wrong sensors have been attached to the wrong pipe size causing the timing to be in error. The site data needs to be checked and the instrument reprogrammed.

W2: SIGNAL TIMING POOR
Unstable signal timing or differing up/down stream times indicate that the liquid is aerated or pipe surface is of poor quality.

W3: RS232 NOT READY
This occurs when the equipment that is not connected to the Portaflow SE via the RS232 or off line. Check that the connections and that ancillary equipment is switched on.
W4: LOG MEMORY FULL
This occurs when all memory blocks in the 112K built data logger have been used up. (To clear the memory see page 12).

W5: FLOW SIGNALS POOR
This warning appears when there is a signal lower than 25%. This could be due to the application, a poor quality pipe, amongst others.

W6: mA OUT OVERANGE
The mA output is over-range when the flow is higher than the maximum mA range. Once the 4-20mA has been set up and the flow goes above the range set then this message will appear. It is possible to re-scale the 4-20mA to be able to cope with the higher flow.

W7: BATTERY LOW
The battery low warning occurs when battery indication is on 20%. This leaves the instrument with approximately 30 minutes usage before it needs recharging.

W8: mA LOAD TO HIGH
The 4-20mA Output is designed to work with a load up to 750Ω. When the load is too high or not connected, the above warning message will be displayed.

Other Messages

The messages below appear mainly when data has been incorrectly entered or the Portaflow SE is trying to be used on an application that it is not capable of working on.

Pipe OD out of range
The outside diameter of the pipe has been entered and is out of range of the instrument.

Wall thickness out of range
The wall thickness that has been entered is out of range of the instrument.

Lining thickness out of range
The pipe lining thickness has been incorrectly entered.

Site range is 0 - 20
There are only 20 storage sites available with 0 being the QUICK START site.

- CANNOT READ FLOW BECAUSE…
  ….Pipe dimensions are invalid
- CANNOT READ FLOW BECAUSE
  …materials are invalid
- CANNOT READ FLOW BECAUSE
  …Pipe is too large for sensor set
- CANNOT READ FLOW BECAUSE
  …Pipe is too small for sensor set
- CANNOT READ FLOW BECAUSE
  …Sensor mode is invalid for this pipe size

Temperature range is -20°C to +125°C
The temperature range of the transducers is -20°C to +125°C.

Logging has started
This will only appear if the instrument has been supplied with a logger.

Enter a lining thickness first
This message appears when in VIEW/EDIT SITE DATA the user has tried to enter a pipe lining material before entering a thickness.

APPLICATION INFORMATION

The PORTAFLOW SE is a Transit Time ultrasonic flow meter. It has been designed to work with Clamp-On transducers, thus enabling flowing liquid within a closed pipe to be measured accurately without the need for any mechanical parts to be inserted either through the pipe wall or protrude into the flow system.
The meter is controlled by a micro-processor containing a wide range of data which enables the instrument to measure flow in any pipe diameter from 13mm bore up to 5000mm and made from any material, over a wide range of operating temperatures.
The system operates as follows:

Figure 8 : Reflex mode

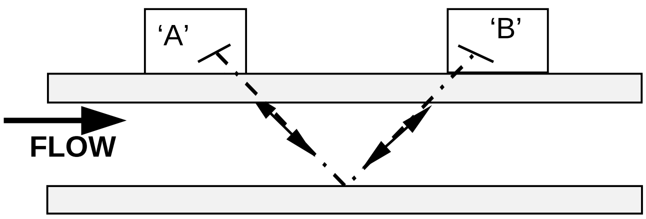
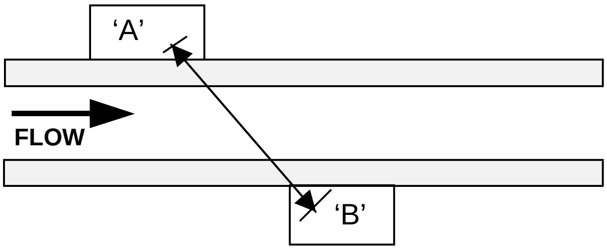


Figure 9: Diagonal mode



When ultrasound is transmitted from Transducer 'A' to Transducer 'B' (REFLEX MODE) or Transducer 'A' to 'B' (DIAGONAL MODE) the speed at which the sound travels through the liquid is accelerated slightly by the velocity of the liquid. If sound is transmitted in the opposite direction from 'B' to 'A', it is decelerated because it is travelling against the flow of the liquid. The differences in time taken to travel the same distance but in opposite directions are directly proportional to the flow velocity of the liquid.

Having measured the flow velocity and knowing carried out by the microprocessor.

To measure flow, it is first necessary to obtain detailed information about each application, which is then programmed into the processor via the Key Pad. This information must be accurate otherwise flow measurement errors will occur.

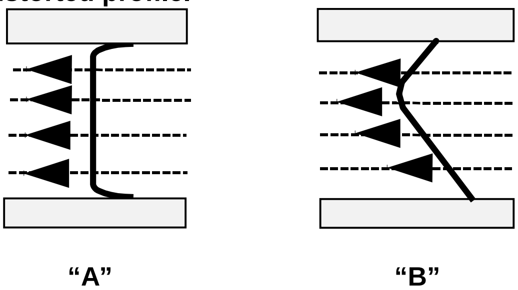
Further, having calculated the precise position at which the transducers must be clamped onto the pipe wall, it is equally important to align and separate the transducers accurately with respect to one another, as failing to do so will again cause errors in measurement.

Finally to ensure accurate flow measurement it is imperative that the liquid is flowing uniformly within the pipe and that the flow profile has not been distorted by any upstream or downstream obstructions.

To obtain the best results from the Portaflow SE it is absolutely necessary that the following rules are adhered to and that the condition of the liquid and the pipe wall are suitable to allow transmission of the sound along its predetermined path.

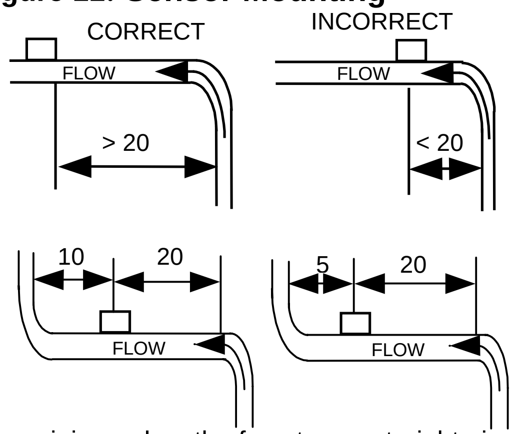
TRANSDUCER POSITIONING
As the transducers for the Portaflow SE are clamped to the outside surface of the pipe, the meter has no way of determining exactly what is happening to the liquid. The assumption therefore has to be made that the liquid is flowing uniformly along the pipe either under fully turbulent conditions or under laminar flow conditions. Further it is assumed that the flow velocity profile is uniform for 360° around the pipe axis.

Figure 10: A uniform profile as compared to a distorted profile.



The difference between (a) and (b) is that the Mean Velocity of the flow across the pipe is different and because the Portaflow SE expects a uniform flow as in (a), the distorted flow as in (b) can give measurement errors which cannot be predicted or compensated for.
Flow profile distortions result from upstream disturbances such as bends, tees, valves, pumps and other the pipe cross-sectional area, the volumetric flow can be easily calculated. To ensure a uniform profile the transducers must be mounted far enough away from any cause of distortion such that it no longer has an effect.

Figure 11: Sensor Mounting



The minimum length of upstream straight pipe is 20 Diameters and 10 Diameters downstream that ensures accurate results will be achieved.
Flow measurements can be made on shorter lengths of straight pipe down to 10 Diameters Up-stream and 5 Diameters downstream, but when the transducers are sighted this close to any obstruction errors can be considerable.

It is not possible to predict the amount of error as this depends entirely upon the type of obstruction and the configuration of the pipework.

The message therefore is clear: Do not expect to obtain accurate results if the transducers are positioned closer than allowed to any obstruction that distorts the uniformity of the flow profile.

MOUNTING THE TRANSDUCERS

It will be impossible to achieve the accuracy of measurement specified for the Portaflow SE if the transducers are not clamped to the pipe correctly and if the data - I.D. O.D., Pipe Material - are not accurate.

Apart from the correct positioning and alignment of the transducers, of equal importance is the condition of the pipe surface in the area under each of the transducers.

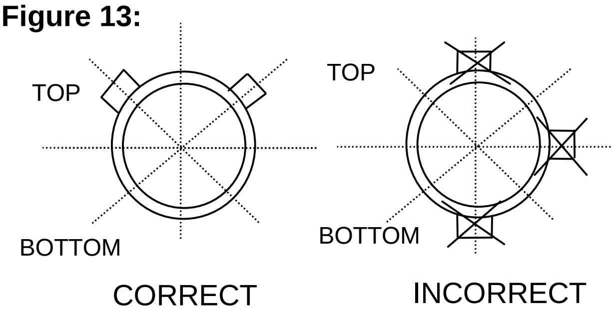
An uneven surface that prevents the transducers from sitting flat on the surface of the pipe can cause Signal Level and Zero Offset problems.
The following procedure is offered as a guide to good practice with respect to positioning and mounting the transducers.

1) Select the site following the rules explained on page 23 - Transducer Positioning.

2) Inspect the surface of the pipe to ensure it is free from rust or is not uneven for any reason. Transducers can be mounted directly on painted surfaces as long as the surface is smooth and that the underlying metal surface is free from rust bubbles. On bitumen or rubber coated pipes the coating must be removed from the area under the transducers as it is preferable that the transducers are mounted directly on to the base metal.

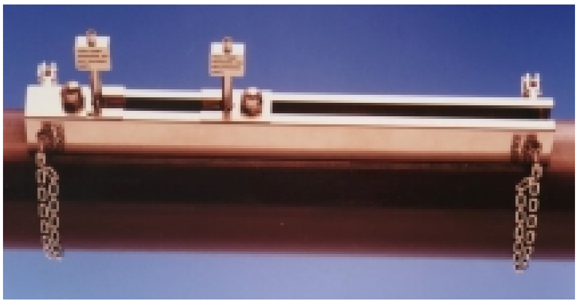
3) Transducers can be mounted on both Vertical and Horizontal Pipe Runs.

Figure 13:



4) Apply Interface couplant to the face of the transducers. The amount of couplant used is extremely important particularly on pipes of less than 89mm bore.

Figure 12:



On Stainless Steel Pipes the amount of couplant applied should never exceed the amount indicated in the Example: above. For large Plastic and Steel Pipes the amount of couplant applied is less critical, however do not use more than is absolutely necessary.

5) Strap the guide rail assembly to the pipe so that it is perfectly parallel to the pipe axis.
6) When screwing the transducers on to the pipe surface use only enough force to ensure that the Transducer is flat against the pipe surface and then lock in position.
7) Clamping the transducers in exactly the correct position is extremely important. The Separation Distance is calculated by the Portaflow SE electronics and the transducers must be positioned and clamped exactly at the distance specified.
8) Always use the couplant provided.

LIQUID CONDITIONS

Transit time ultrasonic meters perform best on liquids that are totally free from entrained air and solids. With sufficient air in the system the ultrasound beam can be attenuated totally and therefore prevent the instrument from working.

Often it is possible to tell whether there is air in the system or not. If a flow signal cannot be obtained a simple test to determine whether the flow is aerated involves stopping the flow for a period of 10 - 15 minutes. During this time the air bubbles will rise to the top of the pipe and the flow signal should return.
If the flow signal does return switch on the flow and if sufficient entrained air is locked in the system it will very quickly disperse and kill the signal.

To correct the Portaflow SE for operation in the laminar region calculate the Reynolds No and set the **correction factor** as described on Page 20.

PROPAGATION VELOCITY

To make a flow measurement using the Portaflow SE on any liquid, it is necessary to know the propagation velocity in metres/second. There is a short list of fluids that appear on the display when programming (See page 7), showing water and various other liquids. However if the liquid you are measuring is not on the list, by selecting **Other** it is possible to enter the propagation rate in m/sec, if known.

REYNOLDS NUMBER

The Portaflow SE has been calibrated to operate on Turbulent flow with Reynolds Number of approximately 100,000. If the Reynolds No. is below 4000-5000 the instrument calibration is no longer valid.

If the Portaflow SE is to be used on laminar flow application it will be necessary to calculate the Reynolds No. for each application. To calculate the Reynolds No. it is necessary to know the Kinematic viscosity in Centistokes; the flow velocity and the pipe inside diameter.

To calculate R_e use the following formula: -

$$R_e = \frac{dv}{\upsilon^1}(7730) \text{ or } R_e = \frac{d^1\, v^1}{\upsilon^1}(1000)$$

Where

d = inside pipe diameter in inches
d^1 = inside pipe diameter in millimetres
v = velocity in feet/second
v^1 = velocity in metres/second
υ^1 = Kinematic viscosity in centistokes

MAXIMUM FLOW

The maximum flow is dependent on the velocity and pipe size.

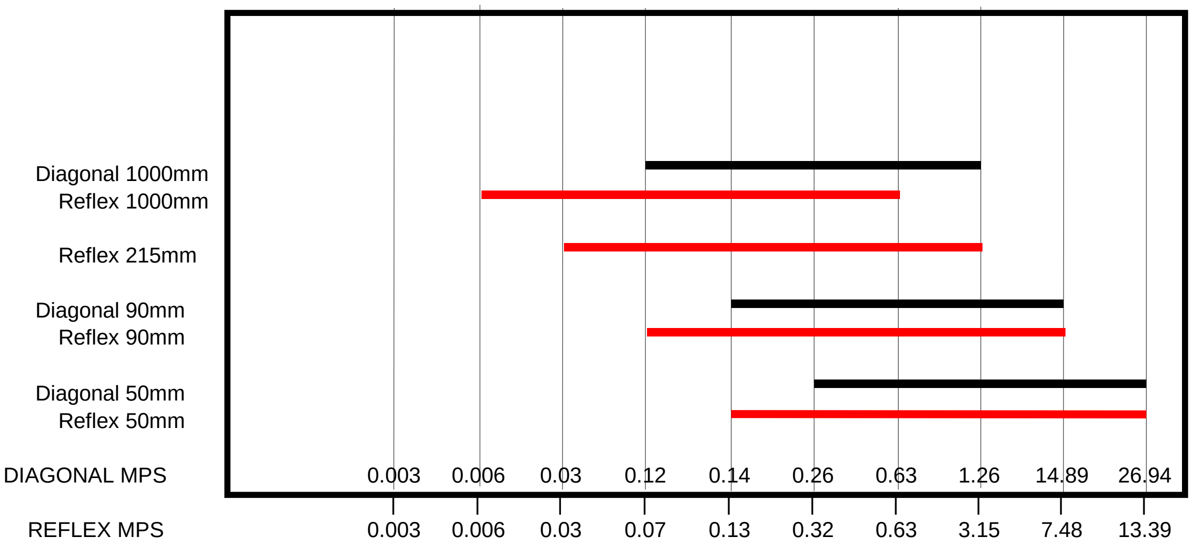
APPLICATION TEMPERATURE

On any application whose operating temperature is either above or below ambient temperature so ensure that the transducers reach and are maintained at the application temperature before undertaking a measurement.

When applying the transducers to low temperature applications do not allow the pipe surface to ice up between the transducer and the pipe wall. The ice will force the block away from the pipe wall and consequently you will lose the signal.

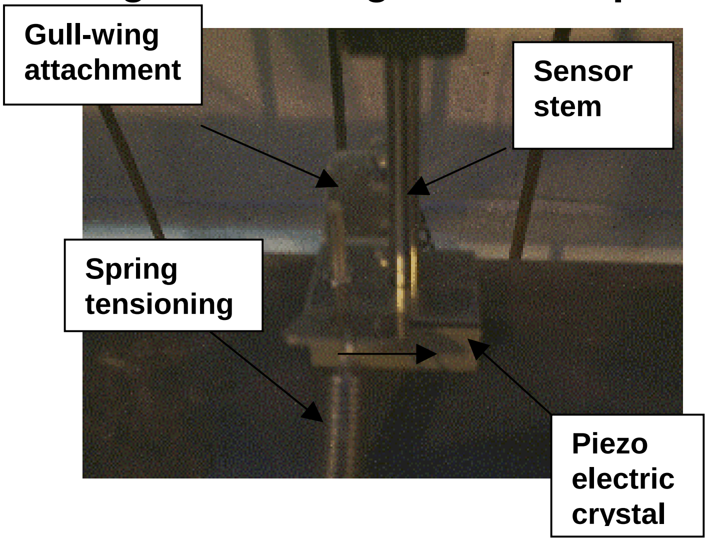
FLOW RANGE

Figure 14:


Diagonal 1000mm
Reflex 1000mm
Reflex 215mm
Diagonal 90mm
Reflex 90mm
Diagonal 50mm
Reflex 50mm
DIAGONAL MPS
0.003 0.006 0.03 0.12 0.14 0.26 0.63 1.26 14.89 26.94
REFLEX MPS
0.003 0.006 0.03 0.07 0.13 0.32 0.63 3.15 7.48 13.39

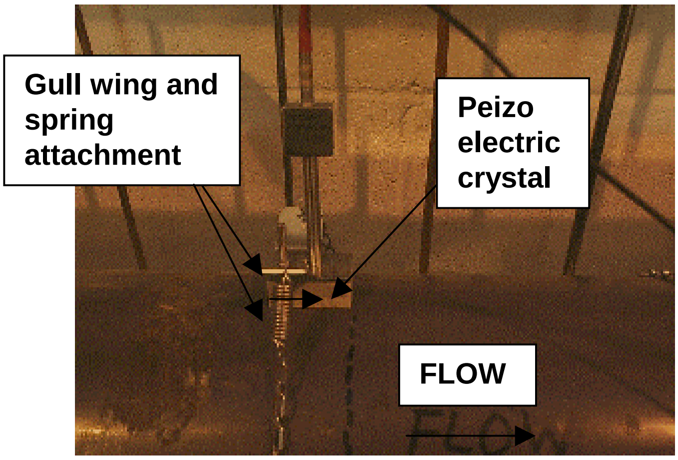
DIAGONAL MODE SETUP

Figure 11: Diagonal Mode parts supplied



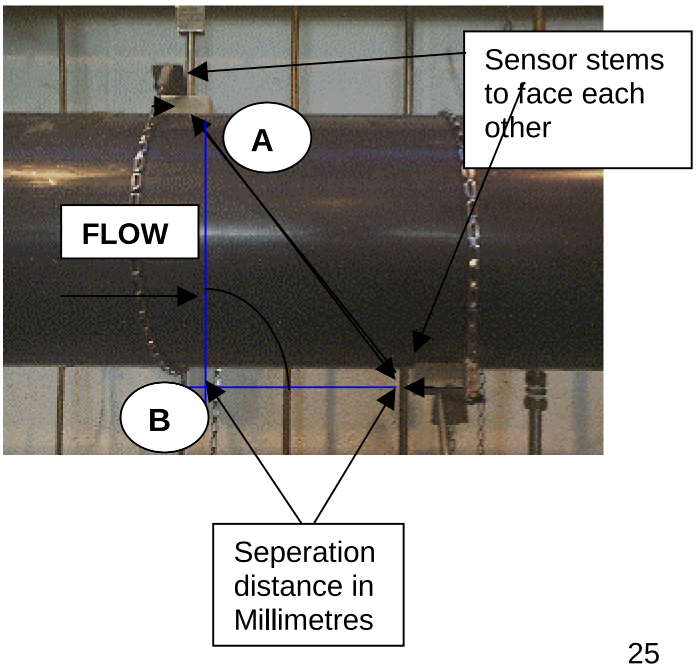
As part of your New Portaflow SE kit you will find 2 off stainless steel gull wings, spring and four lengths of chain.
Take the fixed sensor from the reflex guiderail. Apply grease to the bottom of the transducer (as shown on page3). Wrap the chain around the pipe as shown. Expand the spring and carefully position the sensor into the hole and slot on the Gull Wing. Plug the red connector into the socket on the sensor.
The sensor with the red cable must be positioned up stream. The stem of the sensor must point towards the downstream sensor.

Figure 12: Attaching the sensor to the pipe



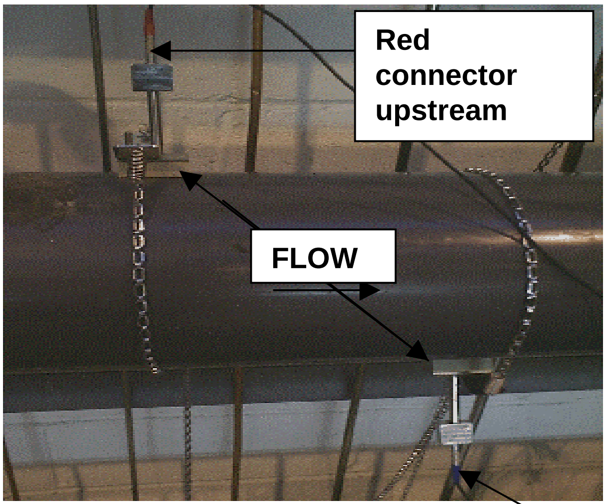
Program the Electronics with the application data and scroll to the calculated separation distance. Wrap the second chain and Gull wing around the pipe a short distance from the first sensor and chain.
Measure the circumference of the pipe and mark a position at the halfway point. (Outside Diameter of the pipe times 3.142 divided by 2). Apply grease to the second sensor and plug the blue connector into the top of the sensor. Follow (figure 13) next diagram to set up the sep distance.

Figure 13: Marking the Separation distance



Using a marker pen or a strip of ticket paper mark around the pipe from the front edge of the first sensor “A” till you reach the half way point of the pipe. From “B” measure the separation distance calculated by the electronics. Mount the second transducer as per the first with the stem facing the other transducer.
Press ENTER to view the flow. The signal strength should be greater than 50%. Should you have difficulty getting a signal remove the sensor from the Gull wing re-apply the grease and try to find a signal by moving it with your hand.

Figure 14: Positioning of the sensor cables



Position the Red sensor cable upstream and the Blue cable Downstream. The Electronics will display a positive flow reading with cables in this orientation. If the unit displays a negative reading the cables have been connected into the wrong sensors.

Liquid Sound Speeds at 25ºC

Substance	Form Index	Specific Gravity	Sound Speed	Δv/ºC -m/s/ºC
Acetic anhydride (22)	$(CH_3CO)_2O$	1.082 (20ºC)	1180	2.5
Acetic acid, anhydride (22)	$(CH_3CO)_2O$	1.082 (20ºC)	1180	2.5
Acetic acid, nitrile	C_2H_3N	0.783	1290	4.1
Acetic acid, ethyl ester (33)	$C_4H_8O_2$	0.901	1085	4.4
Acetic acid, methyl ester	$C_3H_6O_2$	0.934	1211	
Acetone	C_3H_6O	0.791	1174	4.5
Acetonitrile	C_2H_3N	0.783	1290	4.1
Acetonylacetone	$C_6H_{10}O_2$	0.729	1399	3.6
Acetylene dichloride	$C_2H_2C_{l2}$	1.26	1015	3.8
Acetylene tetrabromide (47)	$C_2H_2Br_4$	2.966	1027	
Acetylene tetrachloride (47)	$C_2H_2Cl_4$	1.595	1147	
Alcohol	C_2H_6O	0.789	1207	4.0
Alkazene-13	$C_{15}H_{24}$	0.86	1317	3.9
Alkazene-25	$C_{10}H_{12}Cl_2$	1.20	1307	3.4
2-Amino-ethanol	C_2H_7NO	1.018	1724	3.4
2-Aminotolidine (46)	C_7H_9N	0.999 (20ºC)	1618	
4-Aminotolidine (46)	C_7H_9N	0.966 (45ºC)	1480	
Ammonia (35)	NH_3	0.771	1729	6.68
Amorphous Polyolefin		0.98	962.6	
t-Amyl alcohol	$C_5H_{12}O$	0.81	1204	
Aminobenzene (41)	$C_6H_5NO_2$	1.022	1639	4.0
Aniline (41)	$C_6H_5NO_2$	1.022	1639	4.0
Argon (45)	Ar	1.400 (-188ºC)	853	
Azine	C_6H_5N	0.982	1415	4.1
Benzene (29,40,41)	C_6H_6	0.879	1306	4.65
Benzol (29,40,41)	C_6H_6	0.879	1306	4.65
Bromine (21)	Br_2	2.928	889	3.0
Bromo-benzene (46)	C_6H_5Br	1.522	1170	
1-Bromo-butane (46)	C_4H_9Br	1.276 (20ºC)	1019	
Bromo-ethane (46)	C_2H_5Br	1.460 (20ºC)	900	
Bromoform (46,47)	$CHBr_3$	2.89 (20ºC)	918	3.1
n-Butane (2)	C_4H_{10}	0.601 (0ºC)	1085	5.8
2-Butanol	$C_4H_{10}O$	0.81	1240	3.3
sec-Butylalcohol	$C_4H_{10}O$	0.81	1240	3.3
n-Butyl bromide (46)	C_4H_9Br	1.276 (20ºC)	1019	
n-Butyl chloride (22,46)	C_4H_9Cl	0.887	1140	4.57
tert Butyl chloride	C_4H_9Cl	0.84	984	4.2
Butyl oleate	$C_{22}H_{42}O_2$		1404	3.0
2,3 Butylene glycol	$C_4H_{10}O_2$	1.019	1484	1.51
Cadmium (7)	Cd		2237.7	
Carbinol (40,41)	CH_4O	0.791 (20ºC)	1076	2.92
Carbitol	$C_6H_{14}O_3$	0.988	1458	
Carbon dioxide (26)	CO_2	1.101 (-37ºC)	839	7.71
Carbon disulphide	CS_2	1.261 (22ºC)	1149	
Carbon tetrachloride(33,35,47)	CCl_4	1.595 (20ºC)	926	2.48
Carbon tetrafluoride (14)	CF_4	1.75 (-150ºC)	875.2	6.61
Cetane (23)	$C_{16}H_{34}$	0.773 (20ºC)	1338	3.71
Chloro-benzene	C_6H_5Cl	1.106	1273	3.6
1-Chloro-butane (22,46)	C_4H_9Cl	0.887	1140	4.57
Chloro-diFluoromethane (3) (Freon 22)	$CHClF_2$	1.491 (-69ºC)	893.9	4.79
Chloroform (47)	$CHCl_3$	1.489	979	3.4
1-Chloro-propane (47)	C_3H_7Cl	0.892	1058	
Chlorotrifluoromethane (5)	$CClF_3$		724	5.26
Cinnamaldehyde	C_9H_8O	1.112	1554	3.2

Cinnamic aldehyde	C_9H_8O	1.112	1554	3.2
Colamine	C_2H_7NO	1.018	1724	3.4
o-Cresol (46)	C_7H_8O	1.047 (20ºC)	1541	
m-Cresol (46)	C_7H_8O	1.034 (20ºC)	1500	
Cyanomethane	C_2H_3N	0.783	1290	4.1
Cyclohexane (15)	C_6H_{12}	0.779 (20ºC)	1248	5.41
Cyclohexanol	$C_6H_{12}O$	0.962	1454	3.6
Cyclohexanone	$C_6H_{10}O$	0.948	1423	4.0
Decane (46)	$C_{10}H_{22}$	0.730	1252	
1-Decene (27)	$C_{10}H_{20}$	0.746	1235	4.0
n-Decylene (27)	$C_{10}\ H_{20}$	0.746	1235	4.0
Diacetyl	$C_4H_6O_2$	0.99	1236	4.6
Diamylamine	$C_{10}H_{23}N$		1256	3.9
1,2 Dibromo-ethane (47)	$C_2H_4Br_2$	2.18	995	
trans-1,2-Dibromoethene(47)	$C_2H_2Br_2$	2.231	935	
Dibutyl phthalate	$C_8H_{22}O_4$		1408	
Dichloro-t-butyl alcohol	$C_4H_8Cl_2O$		1304	3.8
2,3 Dichlorodioxane	$C_2H_6Cl_2O_2$		1391	3.7
Dichlorodifluoromethane (3) (Freon 12)	CCl_2F_2	1.516 (-40ºC)	774.1	4.24
1,2 Dichloro ethane (47)	$C_2H_4Cl_2$	1.253	1193	
cis 1,2-Dichloro-Ethene(3,47)	$C_2H_2Cl_2$	1.284	1061	
trans 1,2-Dichloro-ethene(3,47)	$C_2H_2Cl_2$	1.257	1010	
Dichloro-fluoromethane (3) (Freon 21)	$CHCl_2F$	1.426 (0ºC)	891	3.97
1-2-Dichlorohexafluoro cyclobutane (47)	$C_4Cl_2F_6$	1.654	669	
1-3-Dichloro-isobutane	$C_4H_8Cl_2$	1.14	1220	3.4
Dichloro methane (3)	CH_2Cl_2	1.327	1070	3.94
1,1-Dichloro-1,2,2,2 tetra fluoroethane	$CClF_2\text{-}CClF_2$	1.455	665.3	3.73
Diethyl ether	$C_4H_{10}O$	0.713	985	4.87
Diethylene glycol, monoethyl ether	$C_6H_{14}O_3$	0.988	1458	
Diethylenimide oxide	C_4H_9NO	1.00	1442	3.8
1,2-bis(DiFluoramino) butane (43)	$C_4H_8(NF_2)_2$	1.216	1000	
1,2bis(DiFluoramino)- 2-methylpropane (43)	$C_4H_9(NF_2)_2$	1.213	900	
1,2bis(DiFluoramino) propane (43)	$C_3H_6(NF_2)_2$	1.265	960	
2,2bis(DiFluoramino) propane (43)	$C_3H_6(NF_2)_2$	1.254	890	
2,2-Dihydroxydiethyl ether	$C_4H_{10}O_3$	1.116	1586	2.4
Dihydroxyethane	$C_2H_6O_2$	1.113	1658	2.1
1,3-Dimethyl-benzene (46)	C_8H_{10}	0.868 (15ºC)	1343	
1,2-Dimethyl-benzene(29,46)	C_8H_{10}	0.897 (20ºC)	1331.5	4.1
1,4-Dimethyl-benzene (46)	C_8H_{10}		1334	
2,2-Dimethyl-butane (29,33)	C_6H_{14}	0.649 (20ºC)	1079	
Dimethyl ketone	C_3H_6O	0.791	1174	4.5
Dimethyl pentane (47)	C_7H_{16}	0.674	1063	
Dimethyl phthalate	$C_8H_{10}O_4$	1.2	1463	
Diiodo-methane	CH_2I_2	3.235	980	
Dioxane	$C_4H_8O_2$	1.033	1376	
Dodecane (23)	$C_{12}H_{26}$	0.749	1279	3.85
1,2-Ethanediol	$C_2H_6O_2$	1.113	1658	2.1
Ethanenitrile	C_2H_3N	0.783	1290	
Ethanoic anhydride (22)	$(CH_3CO)_2O$	1.082	1180	
Ethanol	C_2H_6O	0.789	1207	4.0
Ethanol amide	C_2H_7NO	1.018	1724	3.4
Ethoxyethane	$C_4H_{10}O$	0.713	985	4.87
Ethyl acetate (33)	$C_4H_8O_2$	0.901	1085	4.4
Ethyl alcohol	C_2H_6O	0.789	1207	4.0
Ethyl benzene (46)	C_8H_{10}	0.867(20ºC)	1338	
Ethyl bromide (46)	C_2H_5Br	1.461 (20ºC)	900	
Ethyliodide (46)	C_2H_5I	1.950 (20ºC)	876	
Ether	$C_4H_{10}O$	0.713	985	4.87
Ethyl ether	$C_4H_{10}O$	0.713	985	4.87
Ethylene bromide (47)	$C_2H_4Br_2$	2.18	995	
Ethylene chloride (47)	$C_2H_4Cl_2$	1.253	1193	
Ethylene glycol	$C_2H_6O_2$	1.113	1658	2.1
50% Glycol/ 50% H_2O			1578	
d-Fenochone	$C_{10}H_{16}O$	0.947	1320	
d-2-Fenechanone	$C_{10}H_{16}O$	0.947	1320	
Fluorine	F	0.545 (-143ºC)	403	11.31
Fluoro-benzene (46)	C_6H_5F	1.024 (20ºC)	1189	
Formaldehyde, methyl ester	$C_2H_4O_2$	0.974	1127	4.02
Formamide	CH_3NO	1.134 (20ºC)	1622	2.2
Formic acid, amide	CH_3NO	1.134 (20ºC)	1622	
Freon R12			774	
Furfural	$C_5H_4O_2$	1.157	1444	
Furfuryl alcohol	$C_5H_6O_2$	1.135	1450	3.4
Fural	$C_5H_4O_2$	1.157	1444	3.7
2-Furaldehyde	$C_5H_4O_2$	1.157	1444	3.7
2-Furancarboxaldehyde	$C_5H_4O_2$	1.157	1444	3.7
2-Furyl-Methanol	$C_5H_6O_2$	1.135	1450	3.4
Gallium	Ga	6.095	2870 (@30ºC)	
Glycerin	$C_3H_8O_3$	1.26	1904	2.2
Glycerol	$C_3H_8O_3$	1.26	1904	2.2
Glycol	$C_2H_6O_2$	1.113	1658	2.1
Helium (45)	He_4	0.125(-268.8ºC)	183	
Heptane (22,23)	C_7H_{16}	0.684 (20ºC)	1131	4.25
n-Heptane (29,33)	C_7H_{16}	0.684 (20ºC)	1180	4.0
Hexachloro-Cyclopentadiene(47)	C_5Cl_6	1.7180	1150	
Hexadecane (23)	$C_{16}H_{34}$	0.773 (20ºC)	1338	3.71
Hexalin	$C_6H_{12}O$	0.962	1454	3.6
Hexane (16,22,23)	C_6H_{14}	0.659	1112	2.71
n-Hexane (29,33)	C_6H_{14}	0.649 (20ºC)	1079	4.53
2,5-Hexanedione	$C_6H_{10}O_2$	0.729	1399	3.6
n-Hexanol	$C_6H_{14}O$	0.819	1300	3.8
Hexahydrobenzene (15)	C_6H_{12}	0.779	1248	5.41

Hexahydrophenol	$C_6H_{12}O$	0.962	1454	3.6
Hexamethylene (15)	C_6H_{12}	0.779	1248	5.41
Hydrogen (45)	H_2	0.071 (-256ºC)	1187	
2-Hydroxy-toluene (46)	C_7H_8O	1.047 (20ºC)	1541	
3-Hydroxy-tolune (46)	C_7H_8O	1.034 (20ºC)	1500	
Iodo-benzene (46)	C_6H_5I	1.823	1114	
Iodo-ethane (46)	C_2H_5I	1.950 (20ºC)	876	
Iodo-methane	CH_3I	2.28 (20ºC)	978	
Isobutyl acetate (22)	$C_6H_{12}O$		1180	4.85
Isobutanol	$C_4H_{10}O$	0.81 (20ºC)	1212	
Iso-Butane			1219.8	
Isopentane (36)	C_5H_{12}	0.62 (20ºC)	980	4.8
Isopropanol (46)	C_3H_8O	0.785 (20ºC)	1170	
Isopropyl alcohol (46)	C_3H_8O	0.785 (20ºC)	1170	
Kerosene		0.81	1324	3.6
Ketohexamethylene	$C_6H_{10}O$	0.948	1423	4.0
Lithium fluoride (42)	LiF		2485	1.29
Mercury (45)	Hg	13.594	1449	
Mesityloxide	$C_6H_{16}O$	0.85	1310	
Methane (25,28,38,39)	CH_4	0.162	405(-89.15ºC)	17.5
Methanol (40,41)	CH_4O	0.791 (20ºC)	1076	2.92
Methyl acetate	$C_3H_6O_2$	0.934	1211	
o-Methylaniline (46)	C_7H_9N	0.999 (20ºC)	1618	
4-Methylaniline (46)	C_7H_9N	0.966 (45ºC)	1480	
Methyl alcohol (40,44)	CH_4O	0.791 (20ºC)	1076	2.92
Methyl benzene (16,52)	C_7H_8	0.867	1328	4.27
2-Methyl-butane (36)	C_5H_{12}	0.62 (20ºC)	980	
Methyl carbinol	C_2H_6O	0.789	1207	4.0
Methyl-chloroform (47)	$C_2H_3Cl_3$	1.33	985	
Methyl-cyanide	C_2H_3N	0.783	1290	
3-Methyl cyclohexanol	$C_7H_{14}O$	0.92	1400	
Methylene chloride (3)	CH_2Cl_2	1.327	1070	3.94
Methylene iodide	CH_2I_2	3.235	980	
Methyl formate (22)	$C_2H_4O_2$	0.974 (20ºC)	1127	4.02
Methyl iodide	CH_3I	2.28 (20ºC)	978	
α-Methyl naphthalene	$C_{11}H_{10}$	1.090	1510	3.7
2-Methylphenol (46)	C_7H_8O	1.047 (20ºC)	1541	
3-Methylphenol (46)	C_7H_8O	1.034 (20ºC)	1500	
Milk, homogenized			1548	
Morpholine	C_4H_9NO	1.00	1442	3.8
Naphtha		0.76	1225	
Natural Gas (37)		0.316 (-103ºC)	753	
Neon (45)	Ne	1.207 (-246ºC)	595	
Nitrobenzene (46)	$C_6H_5NO_2$	1.204 (20ºC)	1415	
Nitrogen (45)	N_2	0.808 (-199ºC)	962	
Nitromethane (43)	CH_3NO_2	1.135	1300	4.0
Nonane (23)	C_9H_2O	0.718 (20ºC)	1207	4.04
1-Nonene (27)	C_9H_{18}	0.736 (20ºC)	1207	4.0
Octane (23)	C_8H_{18}	0.703	1172	4.14
n-Octane (29)	C_8H_{18}	0.704 (20ºC)	1212.5	3.50
1-Octene (27)	C_8H_{16}	0.723 (20ºC)	1175.5	4.10
Oil of Camphor Sassafrassy			1390	3.8
Oil, Car (SAE 20a.30)	1.74		870	
Oil, Castor	$C_{11}H_{10}O_{10}$	0.969	1477	3.6
Oil, Diesel		0.80	1250	
Oil, Fuel AA gravity		0.99	1485	3.7
Oil (Lubricating X200)			1530	5019.9
Oil (Olive)		0.912	1431	2.75
Oil (Peanut)		0.936	1458	
Oil (Sperm)		0.88	1440	
Oil, 6			1509	
2,2-Oxydiethanol	$C_4H_{10}O_3$	1.116	1586	2.4
Oxygen (45)	O_2	1.155 (-186ºC)	952	
Pentachloro-ethane (47)	C_2HCl_5	1.687	1082	
Pentalin (47)	C_2HCl_5	1.687	1082	
Pentane (36)	C_5H_{12}	0.626 (20ºC)	1020	
n-Pentane (47)	C_5H_{12}	0.557	1006	
Perchlorocyclopentadiene(47)	C_5Cl_6	1.718	1150	
Perchloro-ethylene (47)	C_2Cl_4	1.632	1036	
Perfluoro-1-Hepten (47)	C_7F_{14}	1.67	583	
Perfluoro-n-Hexane (47)	C_6F_{14}	1.672	508	
Phene (29,40,41)	C_6H_6	0.879	1306	4.65
β-Phenyl acrolein	C_9H_8O	1.112	1554	3.2
Phenylamine (41)	$C_6H_5NO_2$	1.022	1639	4.0
Phenyl bromide (46)	C_6H_5Br	1.522	1170	
Phenyl chloride	C_6H_5Cl	1.106	1273	3.6
Phenyl iodide (46)	C_6H_5I	1.823	1114	
Phenyl methane (16,52)	C_7H_8	0.867 (20ºC)	1328	4.27
3-Phenyl propenal	C_9H_8O	1.112	1554	3.2
Phthalardione	$C_8H_4O_3$		1125	
Phthalic acid, anhydride	$C_8H_4O_3$		1125	
Phthalic anhydride	$C_8H_4O_3$		1125	
Pimelic ketone	$C_6H_{10}O$	0.948	1423	4.0
Plexiglas, Lucite, Acrylic			2651	
Polyterpene Resin		0.77	1099.8	
Potassium bromide (42)	Kbr		1169	0.71
Potassium fluoride (42)	KF		1792	1.03
Potassium iodide (42)	KI		985	0.64
Potassium nitrate (48)	KNO_3	1.859 (352ºC)	1740.1	1.1
ropane (2,13)(-45 to -130ºC)	C_3H_8	0.585 (-45ºC)	1003	5.7
1,2,3-Propanetriol	$C_3H_8O_3$	1.26	1904	2.2
1-Propanol (46)	C_3H_8O	0.78 (20ºC)	1222	

2-Propanol (46)	C_3H_8O	0.785 (20ºC)	1170	
2-Propanone	C_3H_6O	0.791	1174	4.5
Propene (17,18,35)	C_3H_6	0.563 (-13ºC)	963	6.32
n-Propyl acetate (22)	$C_5H_{10}O_2$	1280 (2ºC)	4.63	
n-Propyl alcohol	C_3H_8O	0.78 (20ºC)	1222	
Propylchloride (47)	C_3H_7Cl	0.892	1058	
Propylene (17,18,35)	C_3H_6	0.563 (-13ºC)	963	6.32
Pyridine	C_6H_5N	0.982	1415	4.1
Refrigerant 11 (3,4)	CCl_3F	1.49	828.3	3.56
Refrigerant 12 (3)	CCl_2F_2	1.516 (-40ºC)	774.1	4.24
Refrigerant 14 (14)	CF_4	1.75 (-150ºC)	875.24	6.61
Refrigerant 21 (3)	$CHCl_2F$	1.426 (0ºC)	891	3.97
Refrigerant 22 (3)	$CHClF_2$	1.491 (-69ºC)	893.9	4.79
Refrigerant 113 (3)	$CCl_2F\text{-}CClF_2$	1.563	783.7	3.44
Refrigerant 114 (3)	$CClF_2\text{-}CClF_2$	1.455	665.3	3.73
Refrigerant 115 (3)	C_2ClF_5		656.4	4.42
Refrigerant C318 (3)	C_4F_8	1.62 (-20ºC)	574	3.88
Selenium (8)	Se		1072	0.68
Silicone (30 cp)		0.993	990	
Sodium fluoride (42)	NaF	0.877	2082	1.32
Sodium nitrate (48)	$NaNO_3$	1.884 (336ºC)	1763.3	0.74
Sodium nitrite (48)	$NaNO_2$	1.805 (292ºC)	1876.8	
Solvesso 3		0.877	1370	3.7
Spirit of wine	C_2H_6O	0.789	1207	4.0
Sulphur (7,8,10)	S		1177	-1.13
Sulphuric acid (1)	H_2SO_4	1.841	1257.6	1.43
Tellurium (7)	Te		991	0.73
1,1,2,2-Tetrabromo-ethane(47)	$C_2H_2Br_4$	2.966	1027	
1,1,2,2-Tetrachloro-ethane(67)	$C_2H_2Cl_4$	1.595	1147	
Tetrachloroethane (46)	$C_2H_2Cl_4$	1.553 (20ºC)	1170	
Tetrachloro-ethene (47)	C_2Cl_4	1.632	1036	
Tetrachloro-methane (33,47)	CCl_4	1.595 (20ºC)	926	
Tetradecane (46)	$C_{14}H_3O$	0.763 (20ºC)	1331	
Tetraethylene glycol	$C_8H_{18}O_5$	1.123	1586/5203.4	3.0
Tetrafluoro-methane (14) (Freon 14)	CF_4	1.75 (-150ºC)	875.24	6.61
Tetrahydro-1,4-isoxazine	C_4H_9NO		1442	3.8
Toluene (16,52)	C_7H_8	0.867 (20ºC)	1328	4.27
o-Toluidine (46)	C_7H_9N	0.999 (20ºC)	1618	
p-Toluidine (46)	C_7H_9N	0.966 (45ºC)	1480	
Toluol	C_7H_8	0.866	1308	4.2
Tribromo-methane (46,47)	$CHBr_3$	2.89 (20ºC)	918	
1,1,1-Trichloro-ethane (47)	$C_2H_3Cl_3$	1.33	985	
Trichloro-ethene (47)	C_2HCl_3	1.464	1028	
Trichloro-fluoromethane (3) (Freon 11)	CCl_3F	1.49	828.3	3.56
Trichloro-methane (47)	$CHCl_3$	1.489	979	3.4
1,1,2-Trichloro-1,2,2-Trifluoro-Ethane	$CCl_2F\text{-}CClF_2$	1.563	783.7	
Triethyl-amine (33)	$C_6H_{15}N$	0.726	1123	4.47
Triethylene glycol	$C_6H_{14}O_4$	1.123	1608	3.8
1,1,1-Trifluoro-2-Chloro-2-Bromo-Ethane	$C_2HClBrF_3$	1.869	693	
1,2,2-Trifluorotrichloro- ethane (Freon 113)	$CCl_2F\text{-}CClF_2$	1.563	783.7	3.44
d-1,3,3-Trimethylnor- camphor	$C_{10}H_{16}O$	0.947	1320	
Trinitrotoluene (43)	$C_7H_5(NO_2)_3$	1.64	1610	
Turpentine		0.88	1255	
Unisis 800		0.87	1346	
Water, distilled (49,50)	H_2O	0.996	1498	-2.4
Water, heavy	D^2O		1400	
Water, sea		1.025	1531	-2.4
Wood Alcohol (40,41)	CH_4O	0.791 (20ºC)	1076	2.92
Xenon (45)	Xe		630	
m-Xylene (46)	C_8H_{10}	0.868 (15ºC)	1343	
o-Xylene (29,46)	C_8H_{10}	0.897 (20ºC)	1331.5	4.1
p-Xylene (46)	C_8H_{10}		1334	
Xylene hexafluoride	$C_8H_4F_6$	1.37	879	
Zinc (7)	Zn		3298	

Solid Sound Speeds

1. Use Shear Wave for 'A' & 'B' Transducers
2. Use Long Wave for 'C' & 'D' Transducers

Material	Shear Wave m/s	Long Wave m/s
Steel 1% Carbon (hardened)	3150	5880
Carbon Steel	3230	5890
Mild Steel	3235	5890
Steel 1% Carbon	3220	
302 - Stainless Steel	3120	5660
303 - Stainless Steel	3120	5660
304 - Stainless Steel	3075	
316 - Stainless Steel	3175	5310
347 - Stainless Steel	3100	5740
410 - Stainless Steel	2990	5390
430 - Stainless Steel	3360	
Aluminium	3100	6320
Aluminium (rolled)	3040	
Copper	2260	4660
Copper (annealed)	2325	
Copper (rolled)	2270	
CuNi (70%Cu, 30%Ni)	2540	5030
CuNi (90%Cu, 10%Ni)	2060	4010
Brass (Naval)	2120	4430
Gold (hard-drawn)	1200	3240
Inconel	3020	5820
Iron (electrolytic)	3240	5900
Iron (Armco)	3240	5900
Ductile Iron	3000	4550
Cast Iron	2500	
Monel	2720	5350
Nickel	2960	5630
Tin (rolled)	1670	3320
Titanium	3125	6100
Tungsten (annealed)	2890	5180
Tungsten (drawn)	2640	
Tungsten (carbide)	3980	
Zinc (rolled)	2440	4170
Glass (Pyrex)	3280	5610
Glass (heavy silicate flint)	2380	
Glass (light borate crown)	2840	5260
Nylon	1150	2400
Nylon (6-6)	1070	
Polyethylene (HD)		2310
Polyethylene (LD)	540	1940
PVC, cPVC		2400
Acrylic	1430	2730
Asbestos Cement		2200
Tar Epoxy		2000
Rubber		1900

PORTAFLOW™ SE SPECIFICATION

ENCLOSURE:		
	Protection Class	IP55
	Material	ABS
	Weight	< 1.5 Kg
	Dimensions	235 x 125 x 42 mm
	Display	Graphics LCD display
	Keypad	16 Key Tactile Membrane
	Connections	IP65 Lemo Connectors
	Temperature Range	0°C to +50°C (operating) -10° to +60°C (storage)
SUPPLY VOLTAGE:		
Power supply/charger	Input	100-240 VAC ±10% @50/60 Hz
	Max. Power consumption	9 Watts
	Output	9VDC Regulated
BATTERY PACK:		
	5 AA Nickel Metal Hydride	10 hrs Operating Time
	Rechargeable	15 hrs Charge Time
		Low Battery Indication
OUTPUTS:		
Display	Volumetric Flow	m^3, , litres, gallons (Imperial and US)
	Flow Velocity	metres/sec, feet/sec
	Flow Rate	0.3…12 m/sec to 4 significant figures
	Total Flow	12 Digits (Forward and Reverse)
	Continuous Battery Level Indication	
	Continuous Signal Level Indication	
	ERROR messages	
Analogue	4 - 20mA into 750 Ω	User Definable Scaling
	Resolution	0.1% of full scale
Printer/Terminal	Serial RS232-C	inc. Handshaking
		User Definable Scaling
DATA LOGGER:		
	Memory Capacity	100K Bytes (50,000 readings)
Output	Via RS232 or displayed Graphically	
Logs	Block data storage with text and graphic display, transferred to Microsoft Windows or a Micronics user compatible software package (optional)	
TRANSDUCERS:	Frequency	Velocity Range Reflex (Diagonal Mode)
'B'	50 mm…1000mm pipe	0.3 m/sec… 6 m/sec (12 m/sec)
Standard	Temperature range	-20°C to +125°C

REPEATABILITY:

±0.5% with unchanged transducer position

ACCURACY:

± 1-3% of reading within velocity range or ± 0.1 m/sec under ideal flowing conditions on a 4” plastic pipe
Specification assumes turbulent flow profile with Reynolds numbers above 4000.

PIPE MATERIALS

Any sonic conducting medium such as Carbon Steel, Stainless Steel, Copper, UPVC, PVDF, Concrete, Galvanised Steel, Mild Steel, Glass, Brass. Including Lined Pipes – Epoxy, Rubber, Steel, Plastic.

Micronics reserve the right to alter any specification without notification.

CE MARKING

The Portaflow SE has been tested and found to conform to EN50081 - 1 Emission Standards and EN50082 - 1 Immunity Standards.

The tests were conducted by AQL - EMC Ltd, of 16 Cobham Road, Ferndown Industrial Estate, Wimborne, U.K. BH21 7PG.

The unit was tested with all cables as supplied of a maximum length of 3m. While the operation of the unit may not be affected by the use of longer cables, Micronics can make no statement about conformance to the above standards when these cables are in use.

The Portaflow SE is supplied with an external battery charging unit. This unit is manufactured by Friemann & Wolf, Geratebau GmbH. P.O. Box 1164 D-48342 Ostbevern, Germany who have CE marked the equipment. Micronics have purchased this equipment on the understanding that the manufacturers have tested the unit to the relevant standards prior to CE marking the product. Micronics have not tested the charger unit and cannot accept responsibility for any non conformance from the relevant standards.

WARRANTY

The material and workmanship of the PORTAFLOW SE is guaranteed by MICRONICS Ltd for one year from the date of purchase provided the equipment has been used for the purpose for which it has been designed, and operated in accordance with the operating manual supplied.

Misuse by the purchaser, or any other person, will immediately revoke any warranty given or implied. This includes failure of MICRONICS Ltd equipment has been damaged by machinery that has been used with PORTAFLOW SE, or any MICRONICS supplied component that has been replaced by a component that has not been so supplied.

Repair or replacement will be at MICRONICS LTD’s discretion and will be made without charge at MICRONICS LTD’s plant during the warranty period. MICRONICS Ltd reserves the right, without prior notice, discontinued from manufacture, re-design or modify any of its products. Your statutory rights are not affected by this warranty.

If any problems develop, customers are requested to take the following steps:

Notify MICRONICS Ltd or the Distributor/Agent from whom the flowmeter was purchased giving details of the problem. Be sure to include the Model & Serial Number of the instrument. Service data and/or shipping instructions will be forwarded to the relevant Distributor/Agent. If requested to return the flowmeter to MICRONICS, it should be sent prepaid to the authorised repair station, as indicated in the shipping instructions. The Warranty of the PORTAFLOW SE is strictly in accordance with that stated above, and cannot in any way be extended.

PORTAFLOW SE Battery Charge circuit Operation.

Charging Controller IC:

A Maxim IC MAX712 or MAX713 controls the Ni-Cd and Ni-Mh battery charger. It has two modes, fast charge and trickle charge; an output indicates the fast-charge status. In both modes it supplies, via a PNP power transistor, a constant current to the battery, by keeping a constant voltage across a current sensing resistor. In fast charge mode it is 250mV, in trickle charge mode 31mV, so the trickle charge current is 1/8 of the fast charge current.

By wiring up input pins on the IC, the number of cells is set to 5, the voltage sampling interval to 168 sec, and the fast-charge time limit to 264 minutes (the maximum). The battery temperature limits are not used.

The IC starts the fast-charge timer when a battery is connected or when power is applied. It terminates the fast charge and returns to trickle charge, either after the 264 min (~4.5 hrs) time limit, or when it senses that the battery voltage remains constant or begins to decrease, meaning that the battery is fully charged.

Charging Voltage:

The voltage available to charge the 6V battery is restricted by the 9V charger input and the two diodes in the input. The S2D silicon diodes had a fwd drop of 0.75V, limiting the available charge voltage to 7.5V, which caused the MAX712 to sense that the battery voltage had stopped rising, and therefore prematurely end the fast charge. With several days of trickle charging the battery could however still reach its full capacity.

In Dec.2000 the S2D diodes were replaced by SS14 Schottky diodes with a fwd drop of 0.35V, thus raising the available charge voltage to 8.3V. At the same time the current was increased.

Instrument differences:

The current sensing resistor consists of either 2 or 4 parallel 1.2Ω resistors, giving about 0.4A or 0.8A fast-charge current.

PF-300 and UFM610P:

Battery Capacity 3.5Ah, or 4.0Ah after Oct.2000

Current 0.4A before, 0.8A after Dec.2000

PF-SEand 216:

Battery Capacity 1.2Ah

Current 0.4A

Software:

The fast-charge status output is not used by the present software (ver.3.06); in a future software update a message will be added, indicating charging status.

Quicker full charge:

The fastest way to fully charge the battery is to charge for 4.5 hrs, then switch the power supply off and on again, thus re-starting the fast charge for another 4.5 hr period, followed by trickle charge.

Warning:

If the battery is getting warm, that would indicate that it is full, and the power supply should not be connected again - overcharging reduces the life of the battery.

Note:

After a recently fully charged battery is connected to the charger, it seems that it takes the MAX712 about 30 min to sense that the battery voltage stops changing, and go to trickle charge.

Examples:

Older PF-300:- A 15 hour charge consists of 4.5 hrs of fast charge (400mA), followed by 10.5 hrs of trickle charge (50mA): 4.5*0.4+10.5*0.05=2.325Ah=3.5Ah*0.66, which fills the battery to 66% of capacity (3.5Ah).

To fill the remaining 34% at 50mA takes 3.5*0.34/0.05=23.8hrs, +15hrs = 39hrs to 100%.

Assuming 20% losses:

(3.5Ah*20%)/50mA=0.7Ah/0.05A=14hrs of

trickle charge to cover losses, +39hrs=53hrs total.

In fact it needs ~9hrs * 0.4A = 3.6Ah to fill the battery from empty to 103% full capacity.

Assuming 20% losses:

(3.5Ah*20%-0.1)/50mA=0.6Ah/0.05A=12hrs of trickle charge to cover losses, +9hrs=21hrs total.

A third session of fast charge would fill the last 17% in 3.5Ah*17%/0.4A=1.5hrs, = 10.5hrs total.

Newer PF-300:-

4.5hrs fast: 0.8A*4.5h=3.6Ah = 90% of 4.0Ah

Slow: 10%= 0.4Ah/0.1A = 4h, total 8.5h to 100%

with 20% losses: 0.8Ah/0.1A = 8h

Total time fast and slow: 16.5hrs to 120%.

Fast only: 4.0Ah/0.8A=5hrs, +20%=6hrs,

that needs 2 sessions: 4.5hrs + 1.5hrs to 120%.

PF-SE & 216:- 1.2Ah/0.4A=3hrs to 100% capacity; with 20% losses 3h+20%=3.6hrs total.

This is well within the first 4.5hrs.

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