GF Piping Systems

Instruction manual

PORTAFLOW 330 - Portable Ultrasonic Flowmeter

Original instruction manual

Observe instruction manual

The instruction manual is part of the product and an important element within the safety concept.

- Read and observe instruction manual.
- Always have instruction manual available at the product.
- Pass on instruction manual to all subsequent users of the product.

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1 Intended use

The flowmeter is designed to work with clamp-on transducers to enable the flow of a liquid within a closed pipe to be measured accurately without needing to insert any mechanical parts through the pipe wall or protrude into the flow system. Using ultrasonic transit time techniques, the Portaflow 330 is controlled by a micro-processor system which contains a wide range of data that enables it to be used with pipes with an outside diameter ranging from 13mm up to 5000mm and constructed of almost any material. The instrument will also operate over a wide range of fluid temperatures.

The flowmeter can be used to measure clean liquids or oils that have less than 3% by volume of particulate content. Cloudy liquids such as river water and effluent can be measured along with cleaner liquids such as demineralised water.

Typical applications

- River water
- Seawater
- Potable water
- Demineralised water
- Treated water

2 About this document

This document contains all necessary information for the installation, operation and service of the product.

2.1 Warnings

In this instruction manual, warnings are used, which shall warn you of death, injuries or material damage. Always read and observe these warnings!

⚠ WARNING

Risk of fatal or serious injury!

There is a risk of fatal or serious physical injury if warnings are ignored!

NOTICE

Risk of damage to property!

Failure to comply leads to a risk of damage to property (loss of time, loss of data, machine fault etc.)!

Further labels

Symbol	Meaning
1.	Call for action in a certain order: Here, you have to do something.
▶	Call for action: Here, you have to do something
•	Listing

2.2 Other related documents

- Georg Fischer planning fundamentals

These documents are available via the agency of GF Piping Systems or at www.gfps.com.

2.3 Abbreviations

Abbreviation	Description
ABS	Acrylonitrile-butadiene-styrene
DA	Double acting function
EMC	Electromagnetic Compatibility
FC	Fail safe to close function
FO	Fail safe to open function
LCD	Liquid crystal display
LED	Light-emitting diode
MOSFET	Metal oxide semiconductor field effect transistor
PB-INSTAFLEX	Polybutene plastic piping system
PE-ELGEF	Polyethylene plastic piping system
PP-PROGEF	Polypropylene plastic piping system
PVDF-SGEF	PVDF (polyvinylidene fluoride) plastic piping system
SPNO MOSFET	Single-pole normally open metal oxide semiconductor field effect transistor
VC-U-PVC	Polyvinyl chloride

3 Safety and responsibility

- ▶ Only use the product for the intended purpose, see Intended Use.
- ▶ Do not use any damaged or faulty product. Sort out any damaged product immediately.
- ▶ Make sure that the piping system has been installed professionally and that it is inspected regularly.
- ▶ Have the product and accessories installed only by persons who have the required training, knowledge or experience.
- ▶ Regularly train personnel on all questions regarding the locally regulations applying to occupational safety and environmental protection, especially for pressurised pipelines.

4 Transport and storage

- Protect the product against external forces during transport (impacts, knocks, vibrations etc.).
- Transport and / or store the product unopened in its original packaging.
- Protect the product from dust, dirt, moisture as well as heat and ultraviolet radiation.
- Ensure that the product is not damaged either by mechanical or thermal influences.
- Before assembling, check the product for damage during transport.

5 Design and function

5.1 Design

Legend

Pos.	Name	Pos.	Name
1	Test Block	7	Guide Rails (x2)
2	Transducer Cables (x2)	8	Transducers (Sensors Ax2, Bx2)
3	4-20mA / Pulse Output Cable	9	Ruled Separation Bars (x2)
4	Ultrasonic Couplant & Applicator	10	Portaflow 330 Instrument
5	Attachment Chains (x2)	11	USB Memory key
6	Power Supply (Batt.Charger)		

The Portaflow equipment is supplied in a rugged IP67 carrying case fitted with a foam insert to give added protection for transportation.

Standard equipment

- Portaflow 330 instrument with backlit graphic display.
- Power supply - with UK, US, European adaptors. 110/240VAC.
- 4-20mA/Pulse Output cable.
- USB memory key.
- 2 lengths of attachment chain each at 3.3 metres long.
- Test block.
- Transducer cables (x2) 2 metres long.
- Transducer set 'A' (Transducers x2).
- Transducer set 'B' (Transducers x2).
- Set of guide rails for use with 'A' or 'B' transducers.
- Ruled separation bar (2-piece).
- Ultrasonic couplant.
- Manual.

Optional equipment

Reflex mode

- Transducer set 'D' – used for monitoring pipes of 1500mm to 5000mm diameter, over a temperature range -20°C to +80°C. Kit is supplied in a separate case and includes the sensors together with ratchet straps and guide rails for attaching to the pipe.
- Magnetic guide rail kit, for use on mild steel and cast iron pipes.

5.2 Portaflow 330 Instrument

The Portaflow 330 is a microprocessor controlled instrument operated through a menu system using an inbuilt LCD display and keypad. It can be used to display the instantaneous fluid flow rate or velocity, together with totalised values, or act as a data logger. When operating in the data logger mode, the logged data can be stored in the instrument's non-volatile memory for downloading to a USB key at a later time. Up to 200k logging events can be stored internally.

The instrument can also provide a variable current or variable 'pulse' (volumetric or frequency) output that is proportional to the detected flow rate. This output can be calibrated to suit a particular flow range and used with a range of external interface devices such as those found in BMS or site monitoring systems.

5.2.1 Connectors

Legend

Pos.	Name	Pos.	Name
1	Battery Charger	5	LCD Display
2	4-20mA / Pulse Output	6	Keypad
3	USB Socket	7	Reset pin-hole
4	Transducer Cables		

Transducer connections

The transducers are connected to two colour-coded miniature coaxial sockets located on the top of the instrument. Using the red/blue connector cables provided, the upstream transducer should always be connected to the RED socket and the downstream transducer to the BLUE one for a positive flow reading. It is safe to connect or disconnect the cable while the instrument is switched on.

USB Socket

A standard USB socket is provided to enable logged data stored in the Portaflow 330 to be transferred to a USB memory key.

4-20mA and Pulse output connection

The 4-20mA / 'pulse' output cable should be connected to the green 7-pin connector on the top of the flowmeter, as shown in Figure 1.4. A single cable that can be adapted for use for either of these output functions is included in the Portaflow 330 kit. The 'tails' on the free end of the cable must be terminated to suit the intended application.

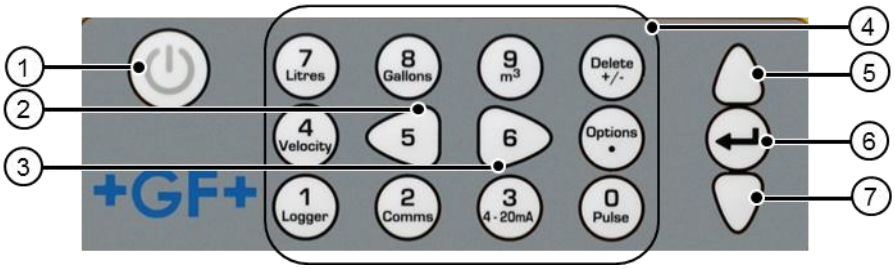
- Red – 4-20mA positive
- Black – 4-20mA negative
- White – Pulse output
- Green – Pulse return
- Thick Black – Cable screen
- Battery charger connection

The supplied battery charger is connected to the instrument by means of the grey 2-pin connector on the bottom of the unit.

NOTICE

The above connectors have different key-ways to prevent incorrect cable connection.

5.2.2 Keypad



Legend

Pos.	Name	Pos.	Name
1	ON/OFF	5	Scroll up
2	Scroll left	6	Enter (select)
3	Scroll right	7	Scroll down
4	Numerical keypad with dual function keys		

ON/OFF Key

The ON/OFF key is shown on the top left of the keypad. When turned ON an initialisation screen is displayed on the LCD showing the instrument's serial number and software revision. Once this appears, the instrument can be started by pressing the ENTER key once – the initialization screen is then replaced by a MAIN MENU which provides access to the remaining functions.

Menus and the menu selection keys

The Portaflow 330 menus are arranged hierarchally with the MAIN MENU being at the top level. Menu navigation is achieved by three keys on the right hand side of the keypad which are used to scroll UP and DOWN a menu list and SELECT a menu item. When scrolling through a menu an arrow-shaped cursor moves up and down the left hand side of the screen to indicate the active menu choice which can then be selected by pressing the ENTER (SELECT) key.

Some menus have more options than can be shown on the screen at the same time, in which case the 'overflowed' choices can be brought into view by continuing to scroll DOWN past the bottom visible item. Menus generally 'loop around' if you scroll beyond the first or last items.

If you select Exit it usually results in taking you back one level in the menu hierarchy, but in some cases it may go directly to the 'Flow Reading' screen.

Some screens require you to move the cursor left and right along the display as well as up and down. This is achieved using keys 5 (scroll LEFT) and 6 (scroll RIGHT).

Dual function numerical keypad

The block of keys shown in the centre of the keypad in Figure 1.5 are dual function keys. They can be used to enter straight-forward numerical data, select the displayed flow units or provide quick access to frequently required control menus.

5.2.3 Power supply and battery charging

Operating power is provided by an internal battery that can be charged from the utility supply using the supplied external charger. When you first receive the unit you must put the battery on charge for a minimum of 6.5hrs before use. A fully charged battery will power the instrument for up to 20hrs depending on the output utilisation and backlight usage.

The backlight can be selected to be either permanently OFF, illuminated for 10 seconds, 30 seconds or 1 minute every time a key is pressed, or permanently ON – as configured in the Setup Instrument menu. If the backlight is active continuously it will reduce the available battery operating time to 8hrs. Similarly, if the 4-20mA output is used constantly at 20mA, the battery life would reduce by 50%. It is therefore beneficial to turn off the backlight and 4-20mA output facilities when they are not required.

When the instrument is operating in the 'Flow Reading' mode the percentage battery charge level is displayed symbolically on the LCD screen. A warning message is triggered if the charge falls to approximately 30%, at which point there is up to four hours of battery operation remaining, depending on usage. The battery can be charged both while the instrument is in use or when switched off. The instrument's internal data is stored in non-volatile memory and will not be lost even if the battery discharges completely.

NOTICE

The battery is not a user-changeable item. The instrument must be returned to your distributor if the battery needs replacing.

Only use the supplied charger, or special adaptor lead. Failure to comply with this will invalidate your warranty.

5.3 Transducers

Two sets of ultrasonic transducers are provided as standard. When setting up the instrument it will indicate the appropriate transducer set to use for a particular application, depending on data entered by the user. Default pipe ranges are programmed into the instrument and most of the time there will be no need to use an alternative transducer set to the one suggested by the instrument. However, if circumstances dictate that a different set must be used it is possible to manually programme the instrument to accept the alternative set.

Transducer set 'A'

Supplied as standard for use on pipes 13mm to 115mm outside diameter.

Transducer set 'B'

Supplied as standard for use on pipes 50mm to 2000mm outside diameter.

Transducer set 'D'

Type 'D' transducers are optional equipment that can be used by the Portaflow 330 on pipes from 1500mm to

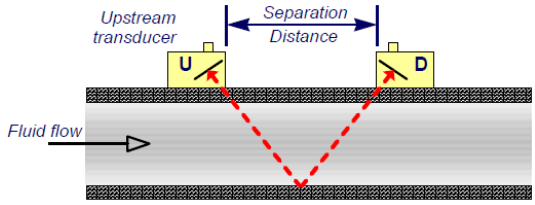
5000mm. They are supplied complete with ratchet straps for 'diagonal mode' attachment.

5.4 Principles of Operation

When ultrasound is transmitted through a liquid the speed at which the sound travels through the liquid is accelerated slightly if it is transmitted in the same direction as the liquid flow and decelerated slightly if transmitted against it. The difference in time taken by the sound to travel the same distance but in opposite directions is therefore directly proportional to the flow velocity of the liquid.

The Portaflow 330 system employs two ultrasonic transducers attached to the pipe carrying the liquid and compares the time taken to transmit an ultrasound signal in each direction. If the sound characteristics of the fluid are known, the Portaflow microprocessor can use the results of the transit time calculations to compute the fluid flow velocity. Once the flow velocity is known the volumetric flow can be easily calculated for a given pipe diameter.

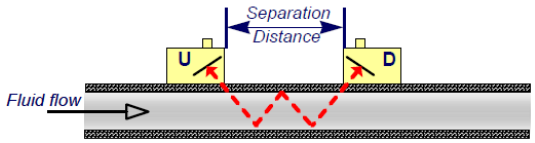
The Portaflow system can be set up to operate in one of four modes determined mainly by the pipe diameter and the type of transducer set in use. The diagram below illustrates the importance of applying the correct separation distance between the transducers to obtain the strongest signal.



Reflex mode

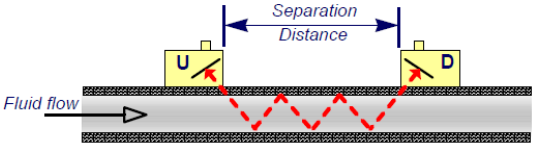
This is the mode most commonly used. The two transducers (U & D) are attached to the pipe in line with each other and the signals passing between them are eflected by the opposite pipe wall.

The separation distance is calculated by the instrument in response to entered data concerning the pipe and fluid characteristics.



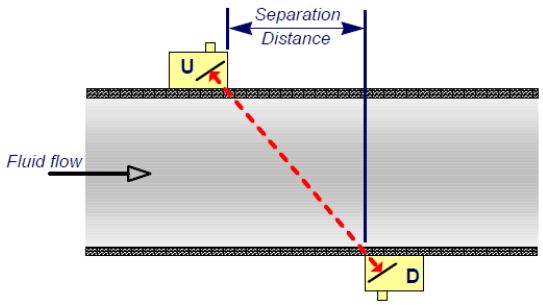
Reflex mode (double bounce)

In this mode the separation distance is calculated to give a double bounce. This is most likely to occur if the pipe diameter is so small that the calculated reflex mode separation distance would be impractical for the transducers in use.



Reflex mode (triple bounce)

This illustration goes one step further to show a triple bounce situation. This would normally apply when working with very small pipes relative to the transducer range in use.



Diagonal mode

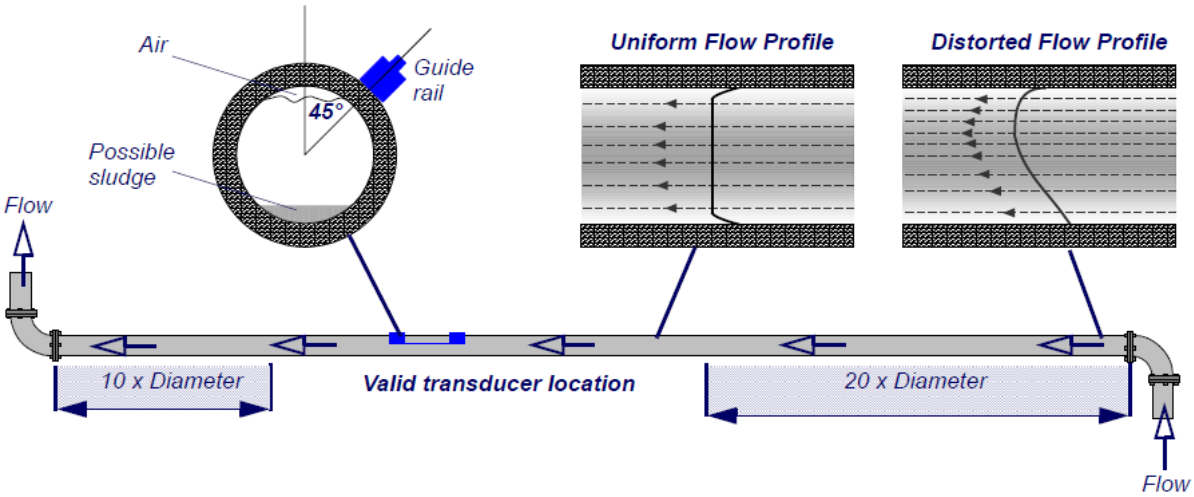
This mode might be selected by the instrument where relatively large pipes are concerned. In this mode the transducers are located on opposite sides of the pipe but the separation distance is still critical in order for the signals to be received correctly. This mode might be used with the standard 'A' & 'B' transducer sets but for really large pipe installation the optional transducer set 'D' might be recommended.

6 Installation

6.1 Transducer Positioning

In many applications an even flow velocity profile over a full 360° is unattainable due, for example, to the presence of air turbulence at the top of the flow and possibly sludge in the bottom of the pipe. Experience has shown that the most consistently accurate results are achieved when the transducer guide rails are mounted at 45° with respect to the top of the pipe.

The Portaflow equipment expects a uniform flow profile as a distorted flow will produce unpredictable measurement errors. Flow profile distortions can result from upstream disturbances such as bends, tees, valves, pumps and other similar obstructions. 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. Montage



To obtain the most accurate results the condition of both the liquid and the pipe wall must be suitable to allow the ultrasound transmission along its predetermined path. It is important also that the liquid flows uniformly within the length of pipe being monitored and that the flow profile is not distorted by any upstream or downstream obstructions. This is best achieved by ensuring there is a straight length of pipe upstream of the transducers of at least 20 times the pipe diameter and 10 times the pipe diameter on the downstream side. Flow measurements can be made on shorter lengths of straight pipe, down to 10 diameters upstream and 5 diameters downstream, but when the transducers are positioned this close to any obstruction the resulting errors can be unpredictable.

NOTICE

Do not expect to obtain accurate results if the transducers are positioned close to any obstructions that distort the uniformity of the flow profile.

6.2 Transducer Attachment (Type 'A' & 'B')

NOTICE

The use of chains to fix the guide rail to the pipe can be eliminated on steel pipes by using the optional magnetic guide rails. In all other respects the setting up of the sensors is the same as for standard guide rails.

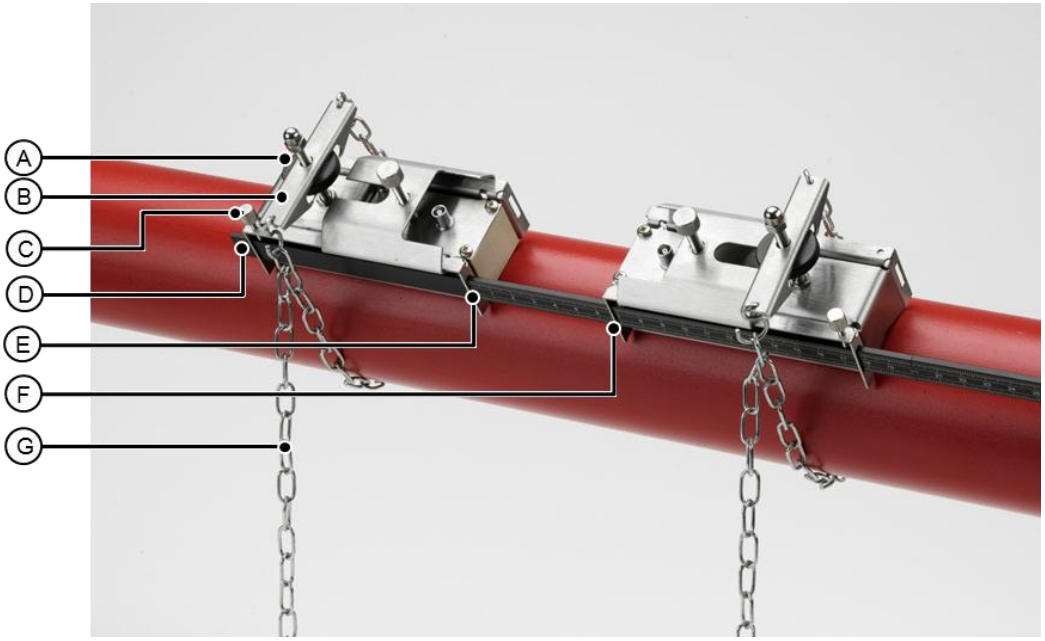
Type 'A' & 'B' transducers are fitted to adjustable guide rails which are secured to the pipe using wrap-around chains and mechanically connected together by a steel separation bar. The separation bar also acts as a ruler to allow the distance between the transducers to be accurately set to the value determined by the Portaflow instrument.

When fitting the guide rails it is easiest to assemble them onto the separation bar and adjust to the required separation distance before attaching them to the pipe.

6.2.1 Preparation

1. Before you attach the transducers you should first ensure that the proposed location satisfies the distance requirements shown in Figure 2.1 otherwise the resulting accuracy of the flow readings may be affected.
2. Prepare the pipe by degreasing it and removing any loose material or flaking paint in order to obtain the best possible surface. A smooth contact between pipe surface and the face of the transducers is an important factor in achieving a good ultrasound signal strength and therefore maximum accuracy.

6.2.2 Attaching the guide rails



Legend

Pos.	Name	Pos.	Name
A	Tensioning thumb-wheel	E	Ruler scale (0)
B	Tension bar	F	Set Separation distance
C	Separation bar securing screw	G	Securing chain
D	Separation bar		

1. Slide the separation bar (D) into the front of the left hand guide rail, align the front edge of the guide rail with '0' on the ruler scale (E) and secure it in place by tightening the thumbscrew (C).
2. Slide the other end of the separation bar into the front of the right hand guide rail, align the front edge of the guide rail to the required separation distance (obtained from the Portaflow instrument) on the ruler (F), then secure it in place by tightening the thumbscrew.

NOTICE

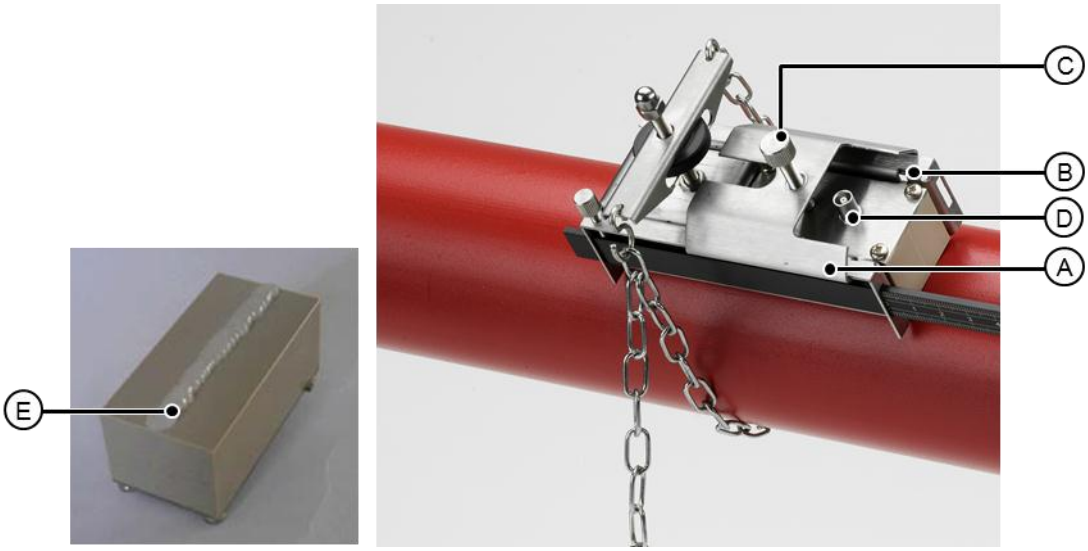
If magnetic guide rails are used on steel pipes then only the location at 45° on the pipe apply on the next two sections.

3. On each guide rail, attach one end of a securing chain to a hook on the tensioning bar (B), wrap the chain around the pipe (G) and then attach it to the hook on the other end of the tensioning bar whilst keeping the chain as tight as possible.
4. Rotate the complete guide rail assembly so that it is approximately 45° with respect to the top of the pipe. Then tighten the chain by turning the tensioning thumb-wheel (A) on each guide block until the assembly is securely attached to the pipe.

NOTICE

If you are unable to get sufficient tension on the chain to hold the assembly in place, fully slacken the tensioning thumb-wheel and shorten the effective length of the chain wrapped around the pipe by connecting the tensioning bar to the next link in the chain, then re-tension.

6.2.3 Attaching the guide rails



Legend

Pos.	Name	Pos.	Name
A	Transducer cover plate.	D	Transducer cable connection
B	Transducer locating slot/lug.	E	Ultrasonic couplant application
C	Transducer cover plate securing screw.		

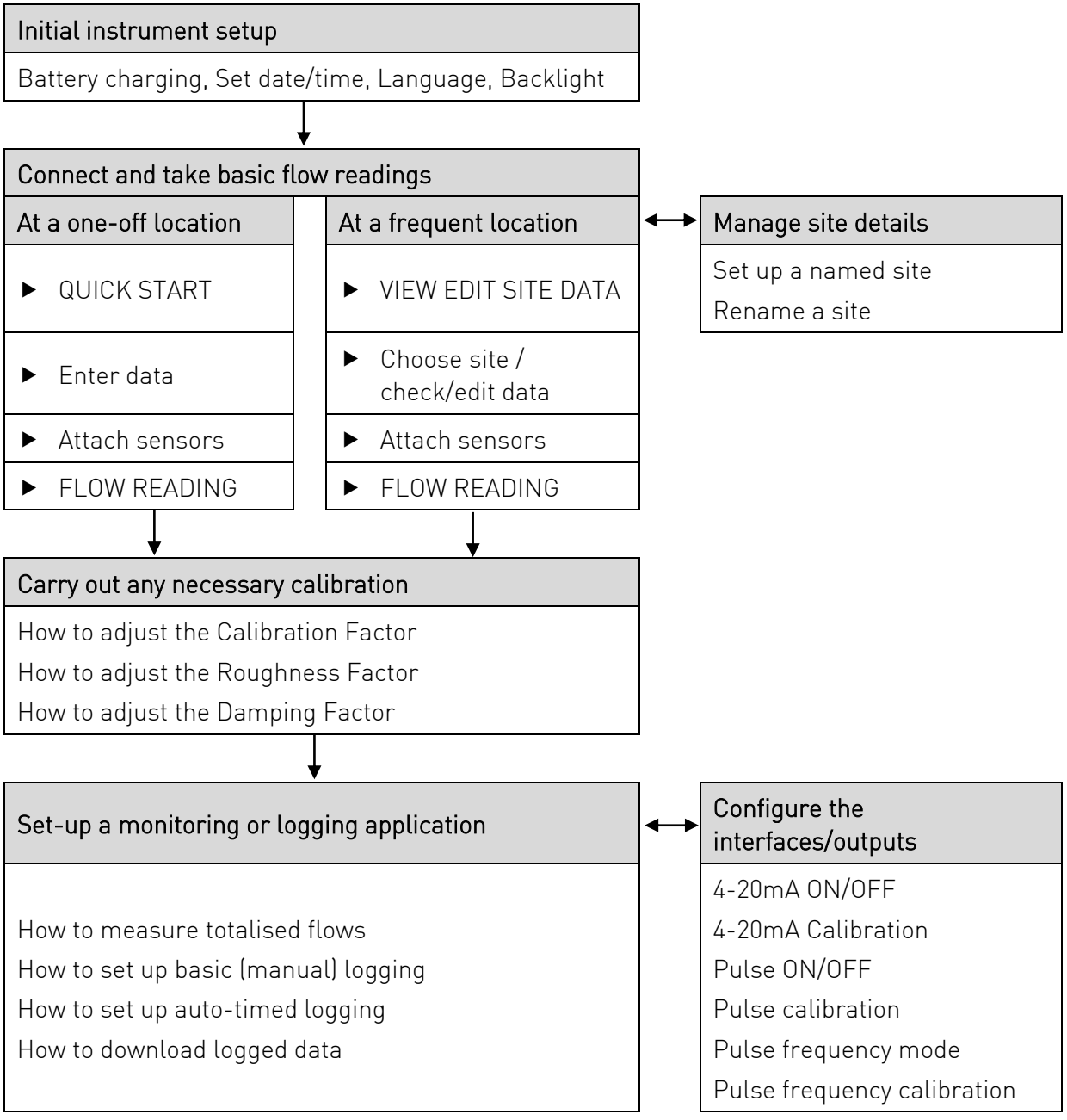
1. Slide the transducer cover plate (A) fully towards the outside of the guide assembly to allow sufficient access to fit the transducer.
2. Clean the face of the transducer, removing all traces of dirt and grease.
3. Apply a 3mm bead of ultrasonic couplant along the centre length of the transducer (E).
4. Fit the transducer into the guide block – ensuring the lugs on the sides of the transducer are correctly located into the slots on the sides of the guide block (B).
5. Slide the transducer cover plate (A) over the top of the transducer and tighten the thumbscrew (C) finger tight to secure the transducer in place. When securing the cover plate take care to leave sufficient room around the transducer connector (D) to connect the cable.
6. Repeat the above steps for the second transducer.
7. Connect the transducers to the Portaflow instrument using the coaxial cables provided. The RED cable must be connected to the upstream transducer and the BLUE cable to the downstream transducer. If you observe a negative flow, swap the red and blue cables at the sensor end.

6.3 Installing the Data Logging Software

The supplied USB memory key contains a copy of the Portagraph program (together with user manual) which is used to display and save the logged data using a Microsoft based PC. The manual should be copied to a PC and the Portagraph software installed before the system is used to log data. A file on the USB key contains the instructions for installing the application.

Contact your local GF partner if the computer to be used is Apple based.

7 Operating Procedures



7.1 Setting-up the Instrument

7.1.1 Using the instrument for the first time

Before you use your Portaflow 330 for the first time you should first charge the battery, then select the display language and set-up the internal clock, as described below.

Charging the battery

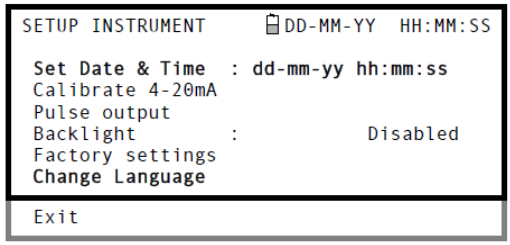
1. Connect the external battery charger to the charger socket at the bottom of the instrument then switch on the utility supply.
2. The instrument should indicate CHARGING and an animated battery symbol indicates that the battery is taking on charge.
3. Leave the instrument on charge for 6.5 hours before using it for the first time.

Selecting a language

The first time you switch on the instrument you may be asked to select a user language.

1. Switch on the instrument by pressing the N/OFF button.
2. If necessary, select the required language using the UP/DOWN scroll keys then press the ENTER key.
3. The selected language will be the default when the instrument is next used. To change the language again select the Change Language option in the SETUP INSTRUMENT screen (see below)
4. The initialisation screen will be displayed, giving details of the instrument's serial number and software revision details.
5. Press the ENTER key to start the instrument.
6. This is the MAIN MENU and is the starting
7. point for all the operations described in his chapter.

Setting the Date & Time



1. Select Setup Instrument from the MAIN MENU. The screen shown here should be displayed.
2. Select Set Date & Time and click ENTER.
3. A flashing cursor should appear under the first date number. Enter the date sequence in dd-mm-yy order then press the ENTER key.

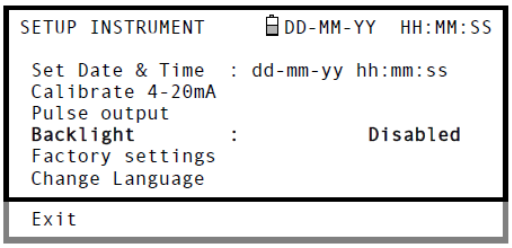
	4. Repeat this action to set the time. 5. Select Exit then press the ENTER key to return to the MAIN MENU.

NOTICE

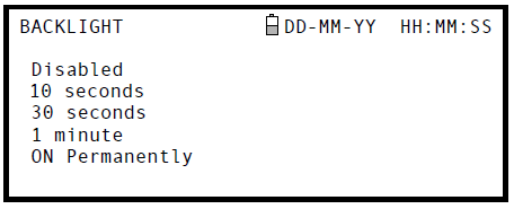
If you make a mistake when entering the data press the Delete key to move the cursor back to the number you wish to change, then continue. If you enter an invalid number an 'ERR:Invalid Date or Time!' error message is displayed on the second line of the screen. If this occurs repeat the set date/time procedure.

7.1.2 Enabling/disabling the backlight

The backlight can be selected to be either Disabled, illuminated for 10 seconds, 30 seconds or 1 minute every time a key is pressed, or ON permanently. If the backlight is not required it is recommended that you disable it to prolong the battery discharge time.



1. Select Setup Instrument from the MAIN MENU.
2. Select Backlight from the SETUP INSTRUMENT screen then press the ENTER key.



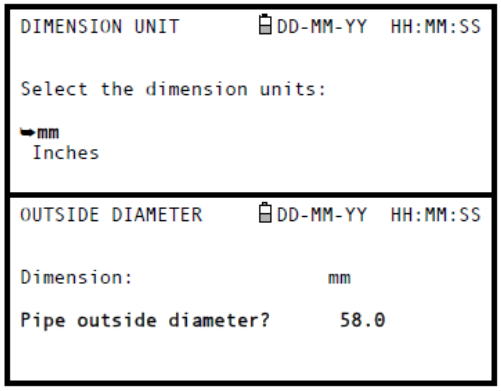
3. Select the required backlight operation.
4. Press the ENTER key to return to the SETUP INSTRUMENT screen.
5. Select Exit then press the ENTER key to return to the MAIN MENU

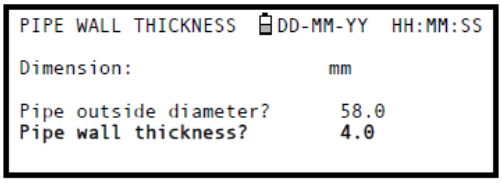
7.2 Using the Quick Start Menu

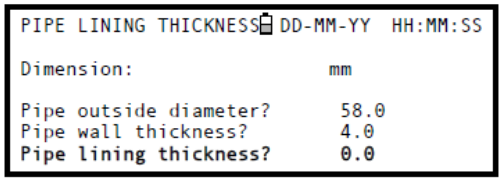
the quickest way to set up the Portaflow system and access the FLOW READING screen. If the point at which you intend to take the measurement is likely to require regular monitoring it is best to set it up as a 'Site' within the Portaflow 330, which then stores the site parameters Before you can use the Portaflow system you need to obtain the following details (this information will be required when setting up the Quick Start menu):

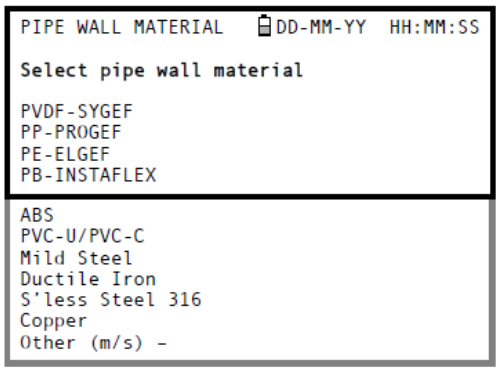
- The pipe outside diameter.
- The pipe wall thickness and material.
- The pipe lining thickness and material.
- The type of fluid.
- The fluid temperature.

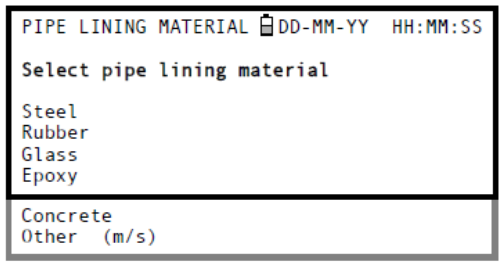
Entering the site data





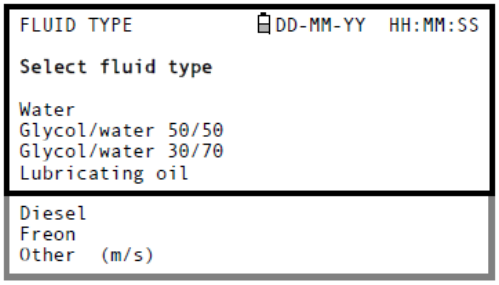


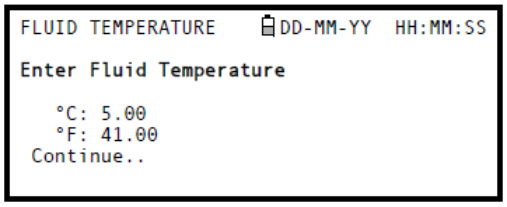


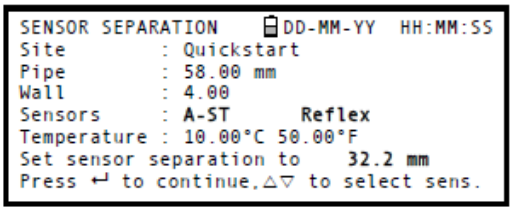


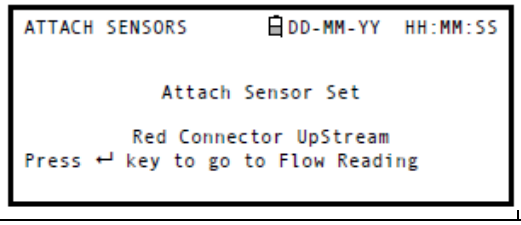
1. Select Quick Start from the MAIN MENU and press the ENTER key. You will then be presented with a series of screens in which to enter the data mentioned above.
2. Select the dimension units (millimetres or inches) used to measure the pipe, then press the ENTER key.
3. Enter the pipe outside diameter dimension, then press the ENTER key.
4. Enter the pipe wall thickness dimension, then press the ENTER key.
5. If the pipe has a lining, enter the lining thickness. If nothing is entered the instrument automatically assumes there is no lining.
6. Press the ENTER key to continue
7. Select the pipe wall material from the list provided, then press the ENTER key.

   If the material is not listed select Other and enter the propagation rate of the pipe wall material in metres/sec. Contact your local GF partner if this is not known.
8. If a lining thickness value was entered earlier, this screen is displayed to request that you enter the lining material type. If no lining thickness was entered this screen will be bypassed.
9. Select the lining material from the list provided then press the ENTER key. If the material is not listed select Other and enter the propagation rate of the lining material in metres/sec. Contact your local GF partner if this is not known.
10. Select the fluid type from the list provided and press the ENTER key. If the liquid is not listed select Other and enter a propagation rate in metres/second.









11. If you need to alter the fluid temperature from that shown select either °C or °F with the cursor and press the ENTER key.
12. Enter the new temperature value and ress the ENTER key.
13. The new temperature should now be indicated in both °C and °F.
14. Select Continue. then press the ENTER key.
15. The SENSOR SEPARATION screen now displays a summary of the entered parameters and informs you of the type of sensor to be used, the mode of operation and the distance to set up between the sensors. In this example it recommends type A-ST (A standard) sensors operating in the 'Reflex' mode spaced at 32.2mm apart.
16. Take a note of the displayed parameters, then press the ENTER key.
17. The ATTACH SENSORS screen displays, giving instructions to attach the sensors.

NOTICE

The SENSOR SELECTION menu can be entered by use of the Up/Down scroll keys. This allows the type and mode of the sensors being used to be selected. This menu will be entered automatically if the entered pipe OD and/or temperature are not valid for the currently selected sensors.

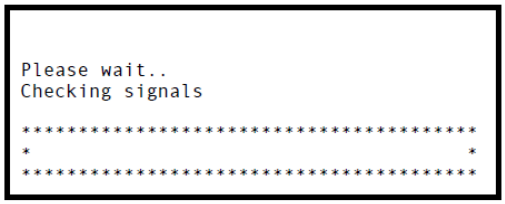
NOTICE

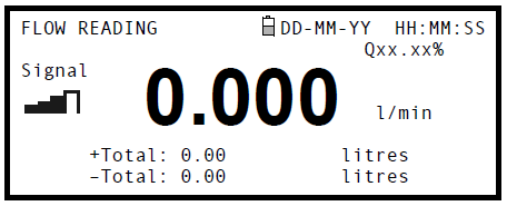
Do not press the ENTER key until the transducers are fitted and connected to the instrument.

Attaching and connecting the transducers

18. Fit the designated sensors to the pipe using the appropriate guide rails. Take great care to set the separation distance as accurately as possible.
19. Connect the red and blue coaxial cables between the sensors and the test instrument, ensuring that the red connector on the instrument is connected to the 'upstream' sensor.

Taking a flow reading





20. Once the transducers have been fitted and connected, press the ENTER key on the ATTACH SENSORS screen.
21. This will take you to the FLOW READING screen via a signal-checking screen (shown here).
22. Check that the indicated signal strength on the left of the screen is at least 2 bars (ideally 3 or 4). If less than 2 bars are shown it indicates there could be a problem with the transducer spacing, alignment or connections; or it could be due to an application problem.
23. Qxx.xx% indicates the signal quality and should have a value of 60% or greater.

Flow monitoring

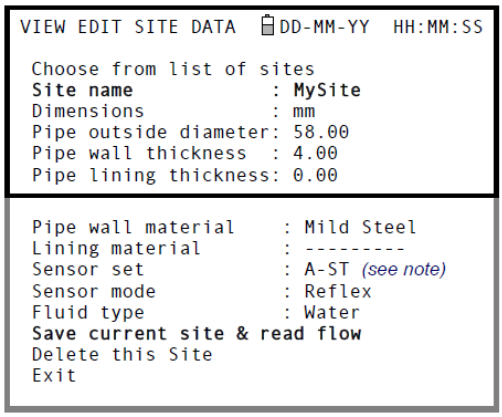
The FLOW READING screen is the one most used during normal monitoring operation. It shows the instantaneous fluid flow together with totalised values (when enabled). In this mode you can select the flow rate measurement units by pressing keys 7 (litres), 8 (Gallons, Barrels) or 9 (m^3), or change the display to show velocity by pressing key 4.

If the flow reading exceeds a value of +/-9999 in the current units then a *10 multiplier will be displayed above the units and the value displayed will be a tenth of the actual value. Similarly a * 100 and *1000 may be displayed on very large flow rates.

There are limitations on the use of these larger flow values with regards to logging of data and setting the current and pulse outputs. If the flow reading is less than 32000 m^3/hour then the value can be logged and downloaded via a USB memory key.

7.3 Using the System at a Regularly Monitored Location

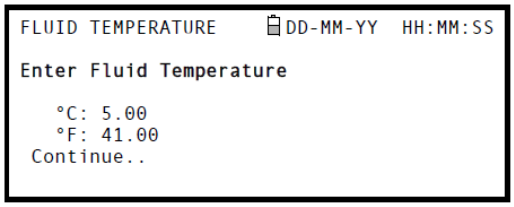
Setting up the Portaflow system using the Quick Start method is easy and the recommended method to use in a 'one-off' situation. But if you have a site location that you want to monitor on a frequent basis it is better to set up a named 'Site' for that location so that you can recall it when needed and so avoid the need to re-enter the site details every time you want to install the equipment there.



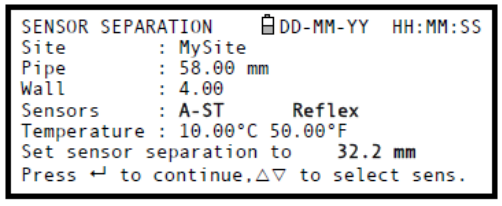
1. Once Select View Edit Site Data from the MAIN MENU.
2. Select Choose from list of sites.
3. Select one of the sites listed and press the ENTER key.
4. The Site name will show the selected site and the site parameters will be listed on the screen.
5. Scroll down through the menu list and enter/change the data that might have changed since the last time the site was accessed.
6. When you are satisfied that the parameters are correct select Save current site & read flow.

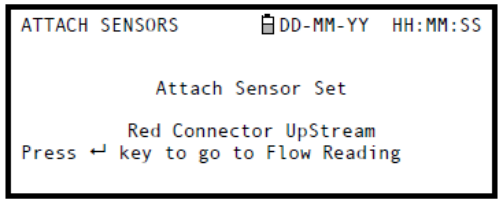
NOTICE

If you select a different Sensor set (e.g. A-ST) when entering new site data you could receive an "invalid" error message if the previous Sensor set was operating at a temperature above 135ºC. If this occurs, ignore the warning as it will disappear when you enter a temperature in the correct range for new sensors.



7. If you need to alter the fluid temperature from that shown select either °C or °F with the cursor and press the ENTER key.
8. Enter the new temperature value and press the ENTER key.
9. The new temperature should now be indicated in both °C and °F.
10. Select Continue.. and then press the ENTER key.





11. The SENSOR SEPARATION screen now displays a summary of the entered parameters and informs you of the type of sensor to be used, the mode of operation and the distance to set up between the sensors. In this example it recommends type A-ST (A standard) sensors operating in the 'Reflex' mode spaced at 32.2mm apart.
12. Take a note of the displayed parameters, then press the ENTER key.
13. The ATTACH SENSORS screen displays, giving instructions to attach the sensors.

NOTICE

The SENSOR SELECTION menu can be entered by use of the Up/Down scroll keys. This allows the type and mode of the sensors being used to be selected. This menu will be entered automatically if the entered pipe OD and/or temperature are not valid for the currently selected sensors.

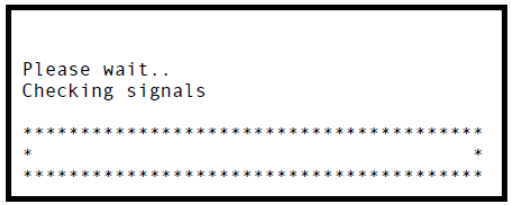
NOTICE

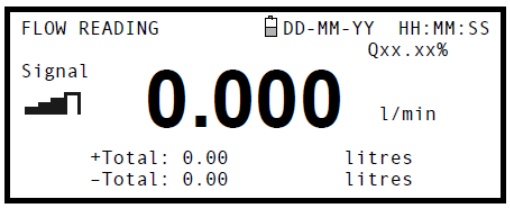
Do not press the ENTER key until the transducers are fitted and connected to the instrument.

Attaching and connecting the transducers

14. 14. Fit the designated sensors to the pipe using the appropriate guide rails. Take great care to set the separation distance as accurately as possible.
15. Connect the red and blue coaxial cables between the sensors and the test instrument, ensuring that the red connector on the instrument is connected to the 'upstream' sensor.

Taking a flow reading





16. Once the transducers have been fitted and connected, press the ENTER key on the ATTACH SENSORS screen.
17. This will take you to the FLOW READING screen via a signal-checking screen (shown here).
18. Check that the indicated signal strength on the left of the screen is at least 2 bars (ideally 3 or 4). If less than 2 bars are shown it indicates there could be a problem with the transducer spacing, alignment or connections; or it could be due to an application problem.

Flow monitoring

The FLOW READING screen is the one most used during normal monitoring operation. It shows the instantaneous fluid flow together with totalised values (when enabled). In this mode you can select the flow rate measurement units by pressing keys 7 (litres), 8 (Gallons, Barrels) or 9 (m^3), or change the display to show velocity by pressing key 4.

7.4 Managing Named Sites

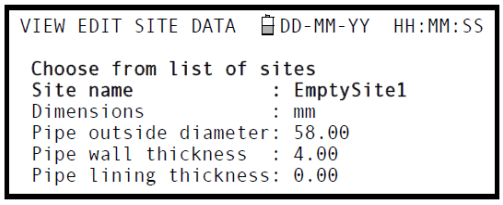
If you want to monitor a particular site location frequently you can set up a named 'Site' to store the installation details, such as pipe dimensions and material, required to set-up the Portaflow 330 system. These can then be recalled later when revisiting that particular location. The instrument can store up to 20 sites, the first site is reserved for QUICK START

and cannot be renamed; subsequent sites are initially named EmptySite1 through to EmptySite19.

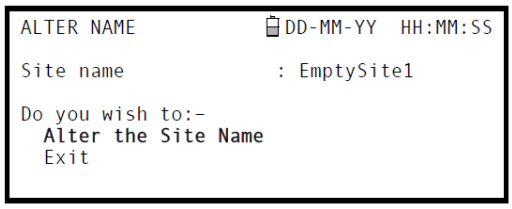
7.4.1 Setting up a new site

NOTICE

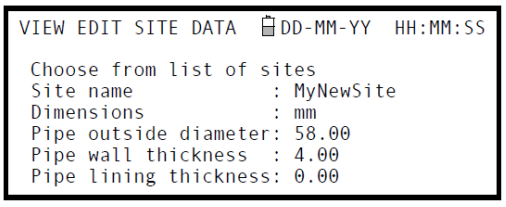
Once you have set up a named site you are advised to log some data to the site in order to avoid the possibility of the site name being overwritten when the QuickStart data is saved.

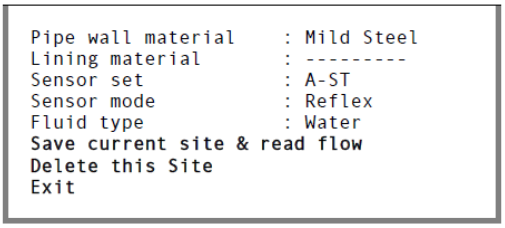


1. Select View Edit Site Data from the MAIN MENU.
2. Select Choose from list of sites.
3. Select one of the EmptySites from the presented list (e.g. EmptySite 1 as shown).
4. Select Site name and press the ENTER key.



5. This opens the ALTER NAME screen.
6. Select Alter the Site Name and you will be presented with a screen which allows you to enter a new name in much the same way as when composing a mobile text message.
7. On completion press the ENTER key then select Exit. This will take you back to the VIEW EDIT SITE DATA screen.





8. Scroll down through the menu list and enter/ change the pipe parameters and other data pertaining to the site. Note that this menu allows you to choose a Sensor Set, unlike the QUICK START menu which recommended the sensor set to use. If you enter an inappropriate sensor set in this menu you will be presented with an error message later when you go to the SENSOR SEPARATION screen.
9. When all the data is correct you can either:
   a) Select Save current site & read flow to continue fitting the transducers and opening the FLOW READING screen.
   b) Select Delete this site to delete the site name and values and restore it to the original EmptySite name.
   c) Select Exit to return to the MAIN MENU.

7.4.2 Changing a site name

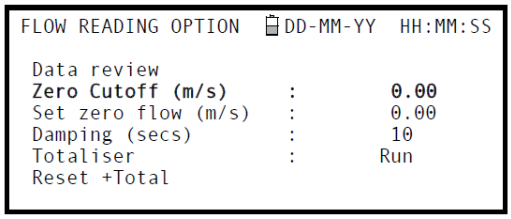
To change a site name use the same method described above for generating a new site: but in this case access a current site name to change rather than an EmptySite. If you change a site name while the site is logging the logging will stop.

7.5 Instrument Calibration

The Portaflow is fully calibrated before it leaves the factory; however the following adjustments are provided to allow you to further 'fine tune' your instrument to suit local conditions and application where necessary. Apart from the zero flow offset adjustment, these are normally carried out only where the instrument is to be used in a permanent or semi-permanent location.

7.5.1 Adjusting the zero cut-off

This adjustment allows you to set a minimum flow rate (m/s) below which the instrument will indicate '0'. The default setting is 0.1 m/s but you may adjust this value if required.



1. With the instrument operating in FLOW READING mode, press the Options key to access the FLOW READING OPTIONS menu shown.
2. Select Zero Cutoff (m/s) and press the ENTER key.
3. Enter the value for the Zero Cutoff (e.g. 0.06 m/s) then press the ENTER key.
4. Scroll down to select Exit and press the ENTER key to return to the FLOW READING screen.

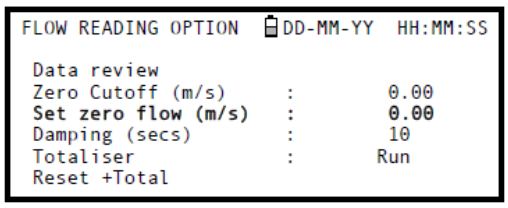
7.5.2 Adjusting the set zero flow offset

The Portaflow instrument operates by comparing the time taken to send an ultrasonic signal between two transducers in either direction. A Set zero flow offset adjustment is provided to compensate for any inherent differences between the two sensors, noise pick-up, internal pipe conditions etc. It can be used to 'zero' the flow indication under no-flow conditions.

NOTICE

If you have adjusted the Zero Cutoff point to anywhere above '0' you must reset it to '0' before you can observe and adjust the Set zero flow offset, as its value is very small. Once the Set zero flow offset has been calibrated you can then reapply the Zero Cutoff if required.

1. Stop the liquid flow.
2. With the instrument in FLOW READING mode press the Velocity function key and observe the reading (m/s). Any reading other than 0.000 indicates an offset error and in practice this will typically be in the range ±0.005m/s (possibly higher on smaller diameter pipes). If a greater figure is shown it is worth calibrating the offset to obtain a more accurate result. Continue as follows:



3. Press the Options key to access the FLOW READING OPTION screen shown.
4. Select Set zero flow (m/s) and press the ENTER key.
5. Press the ENTER key on the subsequent screen to accept the change, which will return you to the screen shown.
6. Scroll down to select Exit and press the ENTER key to return to the FLOW READING screen.ENTER key to return to the FLOW READING screen.

NOTICE

In order to cancel any applied offset you must either read flow via Quick Start or switch the Portaflow instrument OFF & ON. Any value that you trim-out using the offset adjustment will be added/subtracted from the flow reading across the whole range.

7.5.3 Adjusting the calibration factor

⚠CAUTION

USE THIS FACILITY WITH CARE & ONLY WHERE NECESSARY

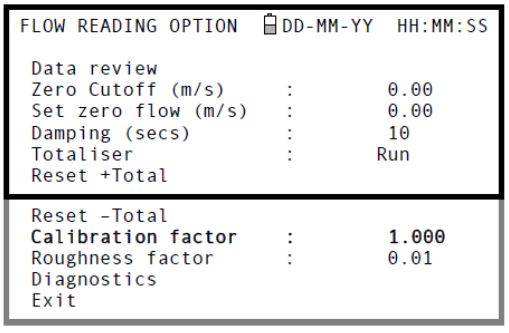
The Portaflow instrument is fully calibrated before leaving the factory and under normal circumstances does not require further calibration when used on site.

This facility can be used to correct the flow indication where unavoidable errors occur due to the lack of a straight pipe or where the sensors are forced to be fitted close to the pipe-end, valve, junction etc.

Any adjustment must be made using a reference flowmeter fitted in the system.

With the system running:

1. Stop (Stall) the Portaflow's totaliser facility and zero it.
2. Run the Portaflow's totaliser to measure the total flow over a 30-60 minute period, and note the total flow indicated by the reference flow meter over the same period.
3. Calculate the % error between the Portaflow and reference meters. If the error is greater than ±1% calibrate the Portaflow as detailed below.



4. Press the Options key to access the FLOW READING OPTION screen shown.
5. Scroll down and select Calibration factor.
6. Change the calibration factor according to the error calculated in step 3. For example, if the Portaflow was reading 1% high then increase the Calibration factor value by 0.010. Conversely, if the reading is 1% low then

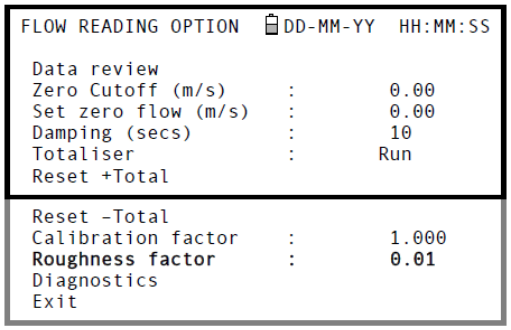
	decrease the calibration factor to 0.990. 7. Press the ENTER key to apply the change. 8. Select Roughness factor or Exit as required.

7.5.4 Adjusting the roughness factor

The roughness factor compensates for the condition of the internal pipe wall, as a rough surface will cause turbulence and affects the flow profile of the liquid. In most situations it is not possible to inspect the pipe internally and the true condition is not known. In these circumstances experience has shown that the following values can be used:

Pipe Material	Roughness Factor
Non ferrous metal Glass Plastics Light metal	0.01
Drawn steel pipes: • Fine planed, polished surface • Plane surface • Rough planed surface	0.01
Welded steel pipes, new: • Long usage, cleaned • Lightly and evenly rusted • Heavily encrusted	0.1
Cast iron pipes: • Bitumen lining • New, without lining • Rusted / Encrusted	1.0

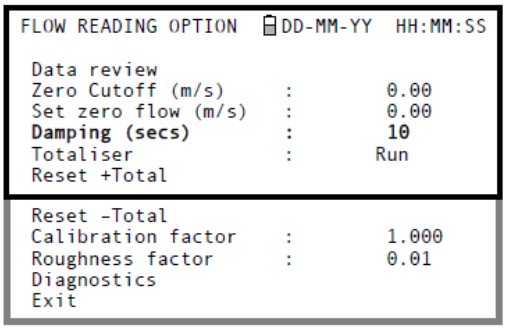
With the system running in FLOW READING mode:

	1. Press the Options key to access the FLOW READING OPTION screen shown. 2. Scroll down and select Roughness factor. 2. Change the roughness factor according to the pipe material and condition as described above. 3. Press the ENTER key to apply the change.

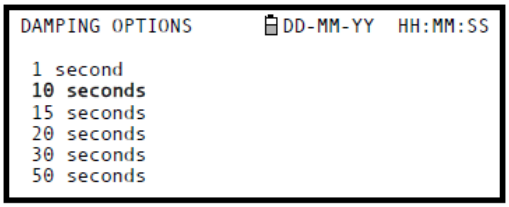
7.5.5 Adjusting the damping factor

By averaging-out the flow rate over several seconds, the Damping factor can be used to smooth out rapid changes in flow rate to prevent wild fluctuations in the displayed flow value. It has a range of 1, 10, 15, 20, 30, 50 seconds, with a default setting of 10.

With the system running in FLOW READING mode:



1. Press the Options key to access the FLOW READING OPTION screen shown.
2. Scroll down and select Damping (secs).
3. This will open the DAMPING OPTIONS screen.



4. Select the value of the Damping factor as required to remove any unwanted display fluctuations. Increasing the value applies a greater smoothing affect.
5. Press the ENTER key to apply the selection and return to the FLOW READING OPTIONS screen.

NOTICE

If the damping factor is set too high the value displayed may appear stable but it may exhibit large step changes when the value is updated.

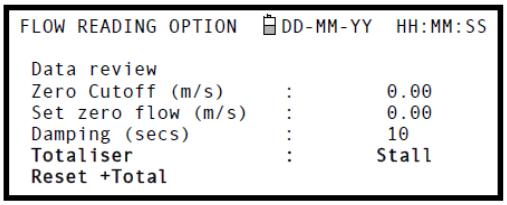
7.6 Performing Monitoring & Logging Functions

This procedure shows you how to set up a basic logging session under manual start/stop control.

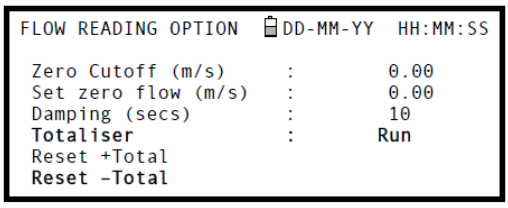
The flow rate and both +ve and -ve totals are logged by the instrument and downloaded to the USB memory key. The Totals can be selectively displayed in the View Log as Text screen.

7.6.1 How to measure totalised flows (manually)

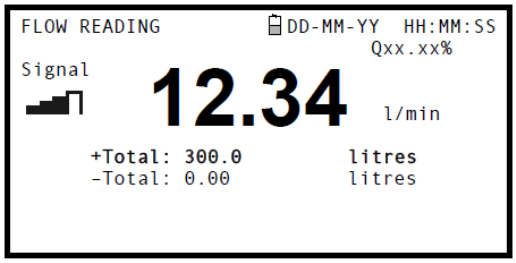
The basic measurement indicated on the FLOW READING screen is the instantaneous flow rate, which in some applications may vary over a period of time. Average flow rates are therefore often required in order to get a better understanding of an application's true performance. This is simply achieved by noting the total flow over a specific period (for example 30-60 minutes) and then calculating the average flow rate over that period of time.



1. Press the Options key to access the FLOW READING OPTION screen shown.
2. If the Totaliser is indicating Run, select it and change it to Stall. Press the ENTER key.
3. Select Reset +Total and press the ENTER key.
4. Press the ENTER key on the subsequent screen to accept the reset.
5. Press the ENTER key again to return to the FLOW READING OPTIONS menu.



6. Select Reset –Total and press the ENTER key.
7. Press the ENTER key on the subsequent screen to accept the reset.
8. Press the ENTER key again to return to the FLOW READING OPTIONS menu.
9. Note and record the current time.
10. Select Totaliser and change it to Run. Press the ENTER key. Note: the totalisers begin to count up as soon as Totaliser is put to Run.



11. Scroll down and select Exit to return to the FLOW READING screen which will now indicate the instantaneous flow together with the totalised flow.

Calculating the average flow

To calculate the average flow wait for the allotted monitoring period to expire then divide the indicated total flow by the time taken. This will give you the average flow in m/s, galls/hour or whatever units you select. Note that in a bi-directional flow situation you must calculate the difference between the indicated positive and negative flow totals before carrying out the average flow rate calculation.

How to stop the totaliser temporarily

If you want to stop the totaliser temporarily for operational reasons, set the Totaliser option to Stall in the FLOW READING OPTIONS screen as described above. This will stop the totaliser operation without affecting its current values.

7.6.2 How to set up the basic logging application to memory

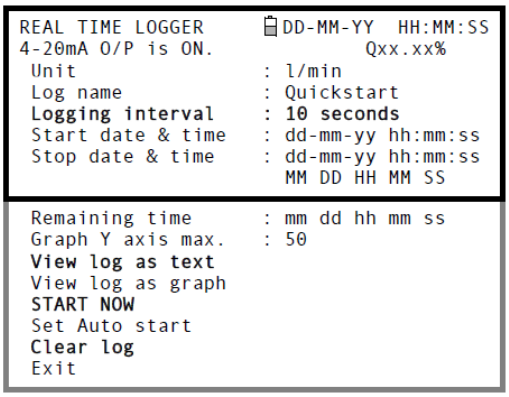
This procedure shows you how to set up a basic logging session under manual start/stop control. The logged data is saved to the instrument's memory and can be downloaded to a USB memory key at a later time.

Starting point

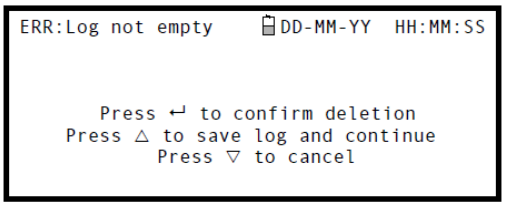
This procedure assumes that the Portaflow instrument has been correctly installed and is operating in the FLOW READING mode.

Setting up and starting the logging

1. With the Portaflow operating in FLOW READING mode, check that the indicated flow units are the same as those you want to appear on the logger output (e.g. l/min).



2. Press the Logger function key to access the REAL TIME LOGGER screen.
3. Select Logging interval and enter the required period (e.g. 10 seconds).
4. Select Clear log if you want to discard any existing logging data.
5. Select START NOW.



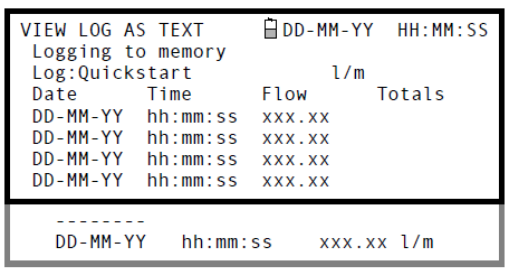
6. This screen appears only if a log already exists for the QuickStart site. It allows you to either delete or save the existing log, or cancel the START NOW request.

If you choose to save the existing log it will be saved to the highest number site that does not currently have an attached log (e.g. EmptySite19, EmptySite18.... etc). The name of the site to which the log is saved will be changed to CopyQS_xx (where xx is a numerical value which is incremented each time a log is saved). For example: if EmptySite19 is available when you elect to save the QuickStart log, the log is saved to EmptySite19 and the sitename is changed to CopyQS_1.

NOTICE

When setting up a named site it is advisable to run a brief logging session on the new site to establish a data log file, as this will prevent the site name being overwritten when saving the QuickStart log, as described above.

View log as text



7. The VIEW LOG AS TEXT screen displays the log events in date-stamped chronological order.

NOTICE

Press key 5 to go to the top line of logged data or key 6 to go to the bottom line.

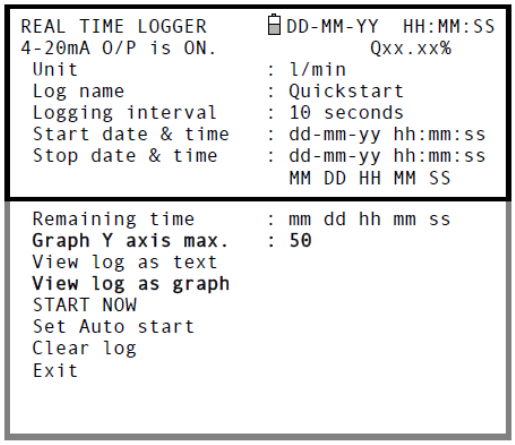
8. Press the ENTER key to return to the REAL TIME LOGGER screen. Then select Exit to return to the FLOW READING screen. Logging

	will continue to take place in the background.

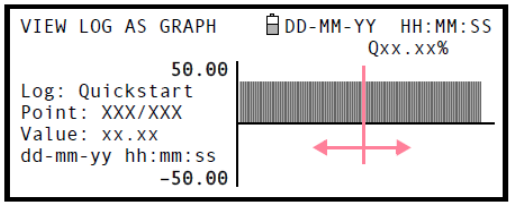
NOTICE

There can be only one set of logged data per site. If a new data log is started on a site it will clear the existing data.

View log as graphic



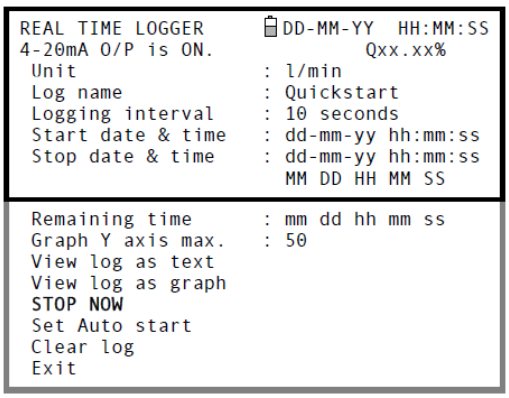
9. If you want to view the logging progress graphically rather than as text, press the Logger function key to get to the REAL TIME LOGGER screen.
10. Select Graph Y axis max and enter a value equal to the expected maximum flow.
11. Select View log as graph. This will open the VIEW LOG AS GRAPH screen shown below.
12. You can select the data at any point in time by scrolling along the time axis of the graph using the LEFT/RIGHT scroll keys (5 & 6). The data values for the selected point are then shown to the left of the graph. Keep the scroll key pressed for the cursor to move automatically.



13. If you want to change the value of the Y axis to improve the resolution of the graph press the UP/DOWN scroll keys. The maximum values will then increase/decrease as appropriate.
14. 14. To exit the VIEW LOG AS GRAPH screen and return to the REAL TIME LOGGER screen press the ENTER key.

Monitoring the logged events at a later time

15. If you wish to monitor the logging progress at any time while you are operating in FLOW READING mode, press the Logger function key as described above to switch to the REAL TIME LOGGER screen. You can then select View log as text or View log as graph, as required, without interfering with the logging operation.



16. From the FLOW READING screen, press the Logger function key to access the REAL TIME LOGGER screen.
17. Select STOP NOW to cease logging. Note that the START NOW and STOP NOW options toggle depending on which was last selected.
18. Select Exit to return to the FLOW READING screen.

NOTICE

The logged data will remain storednin the instrument's memory and can be accessed at any time as described above.

7.6.3 How to set up automatic (timed) logging mode

This procedure shows you how to set up an auto logging session under timed start/stop control. The logged data is saved to the instrument's memory and can be downloaded to a USB memory key at a later time.

Starting point

This procedure assumes that the Portaflow has been correctly installed and is operating in the FLOW READING mode. Also that the instrument's date and time are correctly set.

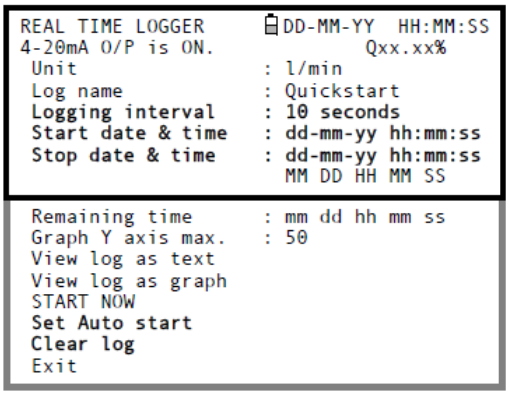
Setting up, starting and cancelling auto logging

NOTICE

When entering the Start and Stop times in this procedure, you must enter '00' in the seconds field rather than leave it blank, otherwise an error message is displayed.

If you enter a Start time that is later than the Stop time you will see an error message until the stop time has been set to be later. This does not however affect the operation of the equipment once the correct times have been set.

1. With the Portaflow operating in FLOW READING mode, check that the indicated flow units are the same as those you want to appear on the logger output (e.g. l/min).



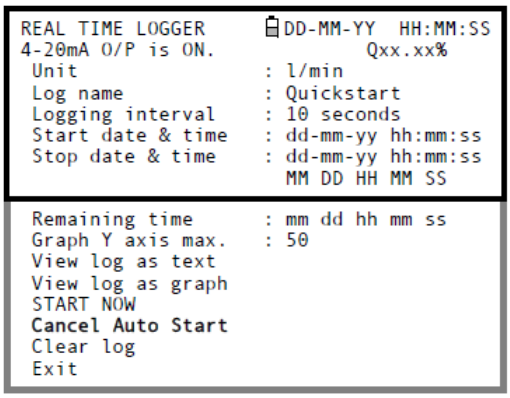
2. Press the Logger function key to access the REAL TIME LOGGER screen.
3. Select Logging interval and enter the required period.
4. Select Start date & time and enter the date and time you wish logging to commence. Note this must be in the future.

NOTICE

If the log is not empty then a warning screen will be displayed, and when a key is pressed the menu will be displayed with the cursor at the Clear Log

item. The log must be cleared before new times can be entered.

5. Select Stop date & time and enter the date and time you wish logging to cease. Note this must be later than the start time.



6. Select Set auto start. This enables the auto logging application.

NOTICE

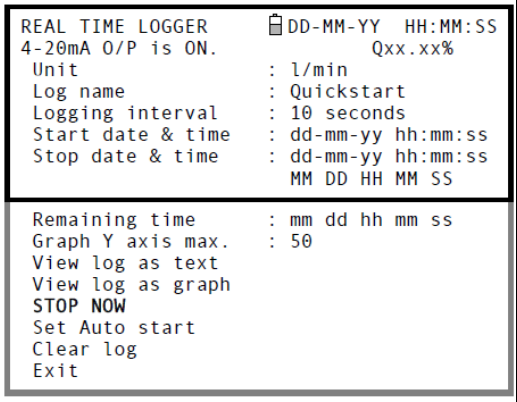
If Set Auto start is enabled with valid start and stop times then this entry will change to Cancel Auto start.

7. To cancel the automatic logging session before it commences, click the Cancel Auto Start.
8. Select Exit to return to the FLOW READING screen.

Monitoring the logged events

9. If you wish to view the logging progress at any time while you are operating in FLOW READING mode, press the Logger function key as described above to access the REAL TIME LOGGER screen. You can then select View log as text or View log as graph, as required, without interfering with the logging operation.

Manually stopping the auto logging session



10. The logging session will stop automatically at the programmed Stop date & time.
11. If you wish to manually stop logging earlier than programmed, press the Logger function key to access the REAL TIME LOGGER screen then select STOP NOW to cease logging.
12. Select Exit to return to the FLOW READING screen.

NOTICE

The logged data will remain stored in the instrument's memory and can be viewed at any time as described above.

7.6.4 How to download logged data to a USB memory key

NOTICE

The backlight will be disabled while the data is being downloaded to the USB memory key.

This procedure shows you how to download the logged data stored in the Portaflow 330 internal memory to a plug-in USB memory key. The USB key must be formatted with a FAT format file directory. The files on the memory key will be named LOGxxx, where xxx is a three digit number. The actual site name is preserved in the header of the data file and if a further log from the same site name is downloaded it will be appended to the existing data file. The created file can be imported into Portagraph to provide a graphical display of the data and then saved in Windows Excel format. The data, which is downloaded at approximately 10,000 samples per hour, always includes the positive and negative totaliser values.

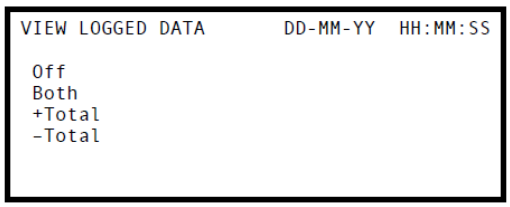
NOTICE

The USB key must be inserted before you select the download operation.

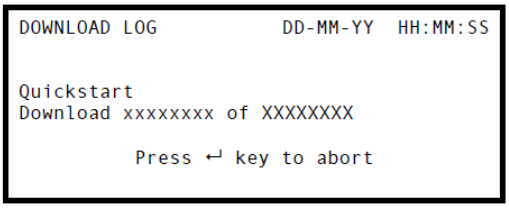
1. Access the MAIN MENU.

NOTICE

If this is done from the FLOW READING screen any logging currently taking place will be terminated.



2. Select Data Logger from the MAIN MENU.
3. Select Choose from list of sites and select the name of the site to download.
4. The totals are always logged. If you wish to display them when viewing a log, then use the options in Select Log Totals. The default is Off.
5. If you want to view the log prior to downloading it you can do so using the View log as text or View log as graph options.



6. When you are ready to begin downloading, insert the USB memory key.
7. Select Download log and press the ENTER key.
8. The selected logged data is now downloaded to the USB key and the display changes to show download activity with the sample count increasing towards the total number of samples.

NOTICE

As shown on the display the download can be aborted by pressing the ENTER key.

9. The display will return to the VIEW LOGGED DATA menu when the download is complete.
10. On the VIEW LOGGED DATA screen you can now Clear the log if required or Exit directly back to the MAIN MENU.

7.6.5 Transferring data to a PC

Once the data is on the USB memory key it may be plugged into a PC that has the Portagraph software installed on it.

To view a graph of the data:

1. Click on File in the top left corner of the Portagraph application screen.
2. From the presented menu options, select Import, then CSV.
3. Navigate to the drive location of the USB key and select the file to be viewed.

To save the USB key data to the PC

1. Follow the instructions in the Portagraph user manual.

NOTICE

Due to the indirect method of inserting the data into Portagraph, some functions, such as site details, will not have the relevant data present.

7.7 Configuring the Current / Pulse Output

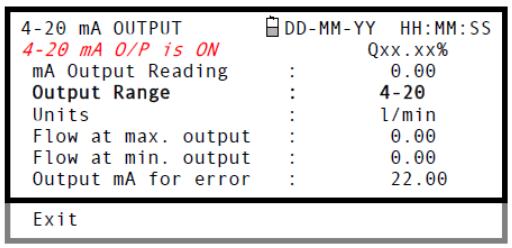
The Current/Pulse Output connector provides two output signals that are proportional to the measured fluid flow. The first is a current signal calibrated to a standard control range (e.g. 4-20mA), and the second is a pulse output. It is permissible to use both outputs simultaneously.

7.7.1 Current output

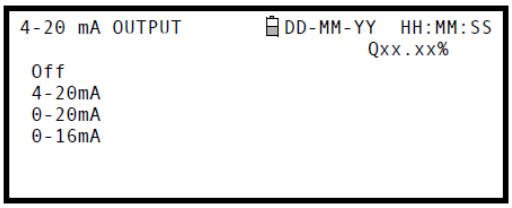
Using the instrument's menu system, the operator can use the following procedures to:

- Select the current output function Off/On
- Select the current output signal range (4-20mA, 0-20mA, 0-16mA)
- Calibrate the current output signal to a required flow range

Turning the 4-20mA output OFF/ON and selecting the current range



1. With the instrument operating in the FLOW READING mode, press the 4-20mA function key. This will access the 4-20mA OUTPUT screen.
2. The ON/OFF status of the 4-20mA output is shown on line 2 of the display.
3. To change the ON/OFF status select Output Range and press the ENTER key.



4. Select Off, to turn OFF the 4-20mA Output or select one of the output ranges to turn it ON.
5. Press the ENTER key to return to the 4- 20mA OUTPUT screen.

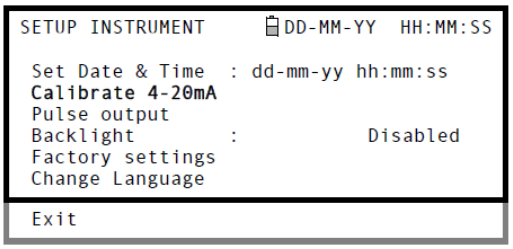
4-20mA signal calibration and ranging

NOTICE

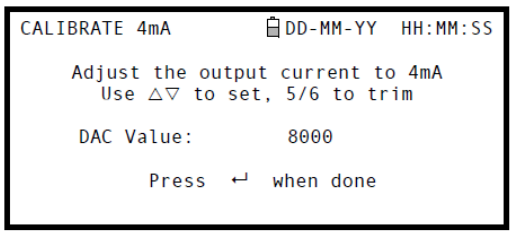
The 4-20mA output has been calibrated in the factory and should not require further adjustment. In the rare event that re-calibration is necessary, this procedure should be carried out only by a trained engineer.

This procedure describes how to calibrate the 4-20mA output and 'scale' it to operate over a defined flow-rate range.

Signal calibration



1. Select Setup Instrument from the MAIN MENU, to access the SETUP INSTRUMENT screen.
2. 2. Select Calibrate 4-20mA.



3. Connect a calibrated ammeter to the 4-20mA output and adjust the UP/DOWN Scroll keys (Coarse) and LEFT/RIGHT Scroll keys 5 & 6 (fine) until the output is exactly 4.0mA. The DAC should indicate approximately 8000.
4. Press the ENTER key when done.
5. With the meter still connected to the 4-20mA output adjust the Scroll keys to obtain an output of exactly 20mA. The DAC should indicate approximately 40000.

CALIBRATE 20mA DD-MM-YY HH:MM:SS Adjust the output current to 20mA Use △▽ to set, 5/6 to trim DAC Value: 40000 Press ↵ when done	6. Press the ENTER key when done.

4-20mA Signal scaling

NOTICE

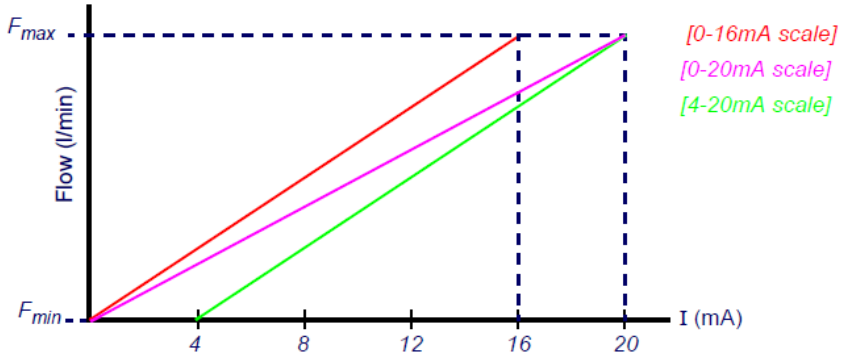
The 4-20mA can be set to represent a particular flow range. It is also possible to enter a negative figure for the minimum output and this would enable a reverse flow to be monitored

4-20 mA OUTPUT DD-MM-YY HH:MM:SS 4-20 mA O/P is ON Qxx.xx% mA Output Reading : 0.00 Output Range : 4-20 Units : l/min Flow at max. output : 0.00 Flow at min. output : 0.00 Output mA for error : 22.00 Exit	7. With the instrument operating in the FLOW READING mode, press the 4-20mA function key. This will access the 4-20mA OUTPUT screen. 8. Select Flow at max. output and enter a value of the flow rate that you want to associate with a 20mA output. 9. Select Flow at min. output and enter a value of the flow rate that you want to associate with a 4mA output. This could be '0'.

10. Select Output mA for error and enter a value (default is 22mA) that you want the 4-20mA output to produce in the event of an error (e.g. if the flow-rate is outside the set range).
11. Upon completion press the ENTER key to return to the FLOW READING screen.

Converting the measured current to flow rate

Assume the maximum flow rate is F_{max} (l/min) and the minimum flow rate Fmin is '0' (l/min), as shown.



To calculate the flow rate (l/min) for a measured current I(mA) then:

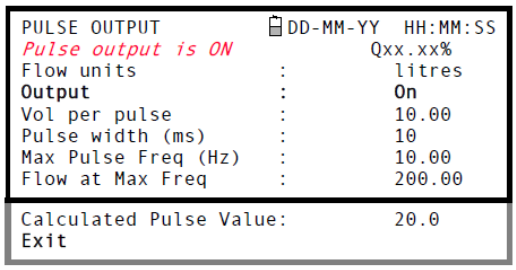
0-20mA	0-16mA	4-20mA
$\text{Flow rate} = \frac{I \times (F_{max} - F_{min})}{20} + F_{min}$	$\text{Flow rate} = \frac{I \times (F_{max} - F_{min})}{16} + F_{min}$	$\text{Flow rate} = \frac{(I - 4) \times (F_{max} - F_{min})}{(16)} + F_{min}$

7.7.2 Pulse output

The pulse output can be used in two modes, 'volumetric' and 'frequency'. When operating in the 'volumetric' mode a pulse is produced every time a pre-selected volume of liquid passes through the pipe; and when in the 'frequency' mode the output is a continuous pulse-train with a frequency proportional to the flow rate (l/s). Using the instrument's menu system, the operator can use the following procedures to:

- Select the pulse output function Off/On/Frequency
- Volumetric mode – select the output pulse width and volume per pulse
- Frequency mode – select the maximum pulse frequency and the corresponding maximum flow rate

Turning the pulse output OFF/ON (volumetric mode)



1. With the instrument operating in the FLOW READING mode, press the Pulse function key to access the PULSE OUTPUT screen.
2. A Pulse output is ON (or OFF) message appears in the second line of the display.
3. To change the pulse output operational status, select the Output menu option then select Off/On as required.
4. Select Exit and press the ENTER key to return to the FLOW READING screen.

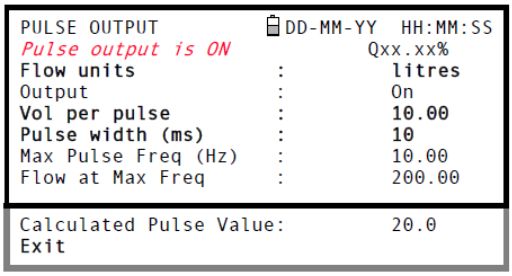
Generating a 'Test' pulse

If the PULSE OUTPUT menu screen is accessed from the SETUP INSTRUMENT menu you can generate a 'test' pulse by selecting Flow units and pressing the Option key.

NOTICE

This does not apply if the PULSE OUTPUT menu is accessed by pressing the Pulse key when operating in the FLOW READING mode.

Calibrating the pulse output signal range (volumetric mode)



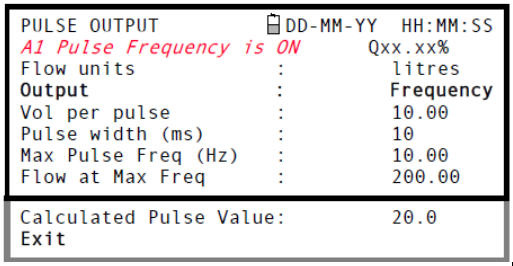
1. With the instrument operating in the FLOW READING mode, press the Pulse function key to access the PULSE OUTPUT screen.
2. To change the Flow units shown in this menu you must return to the FLOW READING screen and select the required units using keys 7,8 and 9.
3. Select Vol per pulse and enter the required value. In the example shown, a 10ms pulse is produced for every 10 litres of flow.

NOTICE

The pulse Output must be Off in order to change the Volume per pulse.

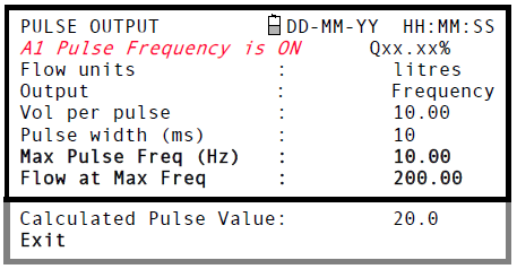
4. Select a Pulse width (in ms) to suit the particular application – e.g. electro-mechanical counter. Refer to the manufacturer's data sheet for the minimum pulse width.
5. Select Exit and press the ENTER key to return to the FLOW READING screen.

Selecting the pulse output frequency mode



1. With the instrument operating in the FLOW READING mode, press the Pulse function key to access the PULSE OUTPUT screen.
2. To change the pulse output to 'frequency' mode, select the Output menu option then select Frequency as required.
3. A1 Pulse Frequency is ON message appears in the second line of the display.
4. Select Exit and press the ENTER key to return to the FLOW READING screen.

Calibrating the pulse frequency range



1. With the instrument operating in the FLOW READING mode, press the Pulse function key to access the PULSE OUTPUT screen.
2. Select Max Pulse Freq (Hz) and enter the required value.
3. Select Flow at Max Freq and enter the required value (l/s).
4. Select Exit and press the ENTER key to return to the FLOW READING screen

The Calculated Pulse Value field is automatically calculated as:

$$Calculated\ Pulse\ Value = \frac{Flow\ at\ Max\ Freq}{Max\ Pulse\ Freq\ (Hz)}$$

This value is often required to be programmed into the device that is receiving the pulses to enable it to calculate the correct flow rate – for example, when connecting the pulse output to a Calec energy meter.

8 Maintenance and Repair

This instrument does not contain any user-serviceable parts. The following notes are provided as a guide to general equipment care

⚠ WARNING

Do not disassemble this unit unless advised by GF. Return the unit to an approved service agent or place of purchase for further advice.

1. Ensure the unit is switched off and disconnected from the mains, then wipe the exterior of the instrument with a clean, damp cloth or paper towel. The use of a solvent may damage the surface.
2. The instrument contains a rechargable battery, dispose safely and in accordance with the local regulations in force in the country of operation.
3. Ensure all cables and connectors are kept clean and free from grease or contaminants. Connectors may be cleaned with a general purpose cleaner if necessary.
4. Avoid the use of excessive grease/ultrasonic couplant on the sensors as this may impair the performance of the equipment. Excessive grease/couplant can be removed from the sensors and guide rails using an absorbent paper towel and a general purpose solvent cleaner.
5. We recommend that the ultrasonic couplant is replaced on the sensors every 6 months, especially on pipes where the application is too hot to touch. If the signal level drops below 30% this is also an indication that the sensors need re-greasing.
6. Regularly check all cables/parts for damage. Replacement parts are available from GF.
7. Ensure the person who services your instrument is qualified to do so. If in doubt, return the instrument to GF with a detailed report on the nature of any problem.
8. Ensure that suitable precautions are taken when using any materials to clean the instrument/sensors.
9. The instrument and sensors should be calibrated at least once every 12 months. Contact GF or your local GF partner for details.
10. When returning product to GF make sure it is clean and please notify GF if the instrument has been in contact with any hazardous substances.
11. If the instrument was supplied with dust or dirt caps make sure they are re-fitted when the instrument is not in use.

9 Troubleshooting

9.1 Overview

If you have a problem with your flow monitoring system it can be due to any of the following:

Faulty instrument

If you suspect the instrument is faulty you can check it out using a test block.

This will establish that the instrument is functional and receiving a healthy signal from the connected transducers.

Incorrect setup

A low, or zero, signal could be caused by incorrect set-up such as:

- Incorrect site data entered into the instrument.
- Incorrect or non-matching ultrasonic transducers selected for use.
- Incorrectly fitted transducers – lack of couplant applied, incorrect spacing, insecure attachment.
- Poor connections between the probes and the instrument.

Application problem

If you are certain that the instrument is healthy and suitably set-up for the current site; and the probes are properly assembled and fitted correctly, there could be an application problem concerned with the site.

Check such conditions such as:

Poor pipe outer surface quality

- Uneven surface preventing good surface contact with the transducer.
- Flaking paint (should be removed).
- Variable air gap in concrete-covered pipes affecting the ultrasonic signal quality.

Poor internal pipe construction

- Rough internal pipe walls affecting fluid flow (see roughness factor).
- Internal welds positioned in the transducer signal path affecting the signal quality.
- The 'drippings' in galvanised-dipped pipes or other irregularities interfering with the signal path.

Incorrect probe location

- Transducers located too close to bends or valves, disturbing the flow profile.
- Transducers located too close to insertion probes, disturbing the flow profile.
- For horizontal pipework transducers should not be positioned on the top of the pipe.

Poor fluid conditions within the pipe

- Fluid contains bubbles, high particle density or sludge.
- Air in the top of the pipe.

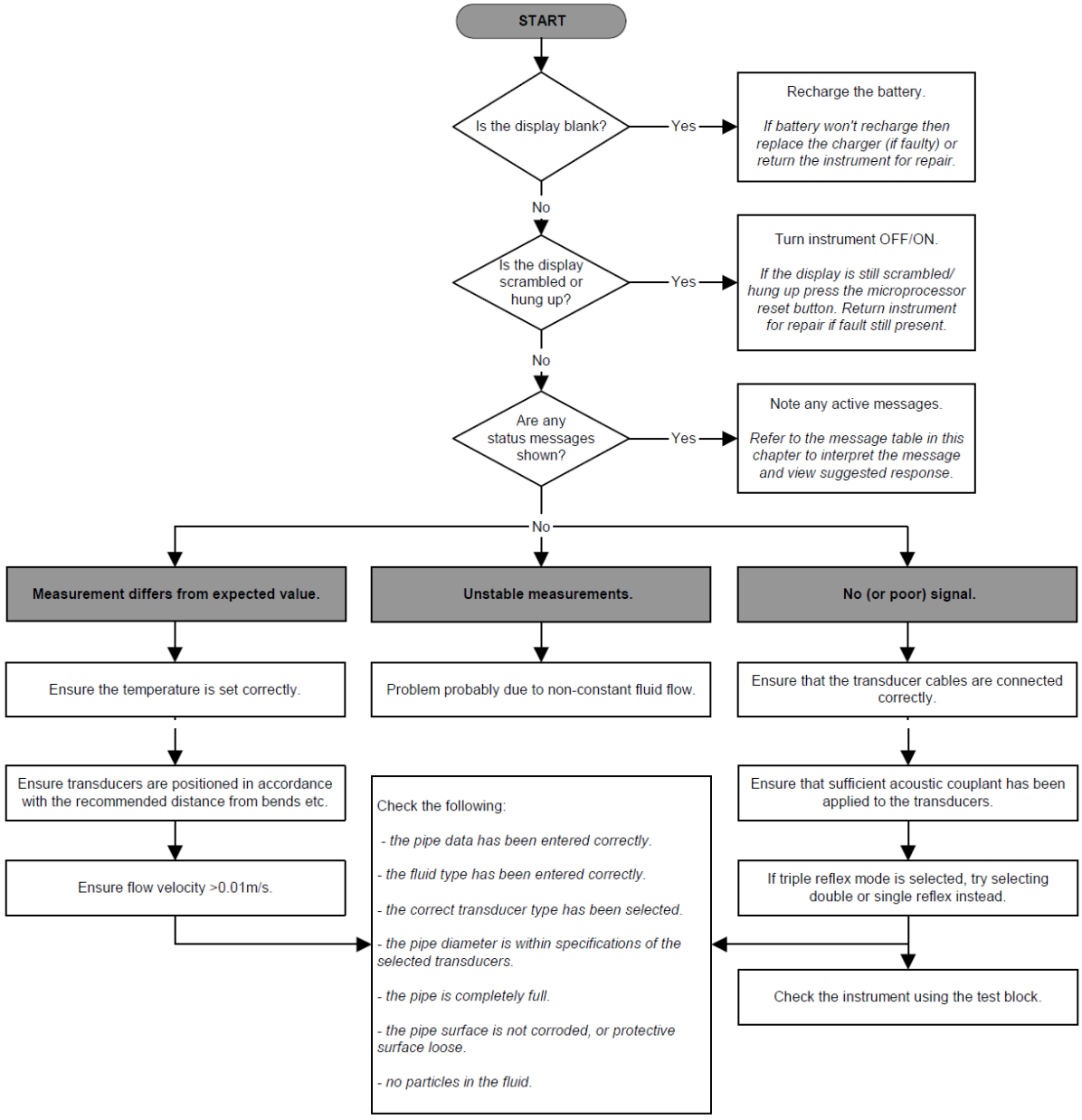
Low fluid flow within the pipe

- Pipe obstructions.
- Malfunctioning valve not opening fully (or closed inadvertently).

Liquid content problems

- Multiple liquid contents do not comply accurately to expected sound speed criteria.
- Very hot pipe almost turns water to steam and therefore exhibits the wrong speed characteristics –could be due to reduced pipe pressure.
- Flashover – liquid turns into a gas because of lower than required pressure.

9.2 General Troubleshooting Procedure



9.3 Warning & Status Messages

Flow rate errors	
No flow signal	Interpretation: This message appears when the transducers cannot send or receive signals to each other. Response: Firstly check that all cables are connected, transducers are on the pipe correctly with sufficient couplant on the face. This condition could also be due to a partially empty pipe, aerated liquid, particulate content too high or when the condition of the pipe being measured is poor.
Flow signal is poor	Interpretation: This warning appears when the signal is lower than 25%. Response: This could be due to an application problem, a poor quality pipe – see also the conditions for No flow signal (above). Check for sufficient couplant.
Zero cut-off error!	Interpretation: You have entered an out-of-range value in the Zero cutoff field in the Options menu. Response: Enter a valid number.
Totaliser beyond maximum!	Interpretation: The totaliser has overflowed its maximum count. The counter will roll-over and restart from zero but this message alerts you to the fact. Response: Reset the totalizer.

Pulse errors	
Pulse Rate > Max	Interpretation: The flow rate exceeds the capability of the pulse output – i.e. too many pulses per second are required than can be achieved. Response: Narrow the pulse width time or increase the volume per pulse
Pulse volume error!	Interpretation: You have entered an out-of-range value in the Pulse volume error field in the PULSE OUTPUT menu. Response: Enter a valid number.
Pulse width error	Interpretation: You have entered an out-of-range value in the Pulse width error field in the PULSE OUTPUT menu. Response: Enter a valid number.

4-20mA errors	
mA out > Max	Interpretation: The actual flow is higher than the maximum set on the mA range. Response: Re-scale the 4-20mA output to be able to cope with the higher flow.

4-20mA errors	
`Calibration 20mA Error!`	NOTE: *The 4-20mA output is calibrated before the instrument leaves the factory and should not require further adjustment.* Interpretation: You have adjusted the DAC outside its accepted range when calibrating the 20mA signal output. Response: Re-calibrate the 4-20mA output.
`Calibration 4mA Error!`	NOTE: *The 4-20mA output is calibrated before the instrument leaves the factory and should not require further adjustment.* Interpretation: You have adjusted the DAC outside its accepted range when calibrating the 4mA signal output. Response: Re-calibrate the 4-20mA output.

Data logging errors	
`Log not empty!`	Interpretation: When using QuickStart and manually starting a log, this message is displayed to warn you that a log already exists. The screen will offer the option to cancel the logging, or save the log to another site. Response: Attempt to save the existing log, then re-start logging. If logging still fails to start, and the error message remains, then either all the sites are in use or all the Logger memory is full. Check for any unwanted log files and delete them.
`Log memory full`	Interpretation: This occurs when all the data logger memory locations are filled. Response: Clear the logger memory
`USB key not found`	Interpretation: Attempt is made to download logged data without a working FAT format USB key being present in the USB socket. Response: Insert or replace the USB key and abort then restart the download

Battery errors	
`Battery Low`	Interpretation: The battery has discharged to below 30% remaining. This leaves the instrument with approximately 4 hours remaining, depending on power usage, before it needs recharging. Response: Recharge the internal battery at the earliest opportunity. Do not leave the instrument for a prolonged period with a fully discharged battery.
`Battery Exhausted`	Interpretation: The battery is approaching a fully

Battery errors	
	discharged state and the instrument is about to store the internal data and shut-down. Response: Recharge the battery.

Set-up errors	
Pipe OD out of range	Interpretation: You have entered an out-of-range value for the pipe outside diameter dimension – i.e. larger or smaller than the unit or sensor can be used on. Response: Enter a valid number.
Wall thickness out of range	Interpretation: You have entered an out-of-range value for the pipe wall thickness dimension – accepted range is 1mm - 75mm. Response: Enter a valid number.
Lining thickness out of range	Interpretation: You have entered an out-of-range value for the lining thickness dimension – acceptable range is 0mm - 25mm. Response: Enter a valid number.
Temperature range	Interpretation: You have entered an out-of-range value for the fluid Temperature. Accepted temperature range -20°C to +300°C. Response: Enter a valid number.
Invalid Date or Time	Interpretation: The entered Date or Time is invalid, or when setting up 'timed' data logging the Stop time is set earlier than the Start time. Response: Enter a valid Date and Time.
Sensors: INVALID	Interpretation: The selected temperature is higher than the maximum allowed for the sensor type. Response: Select alternative sensors or change the temperature.
Mode: Err Typ	Interpretation: The selected sensors are invalid and the mode cannot be verified. Response: Select a valid sensor type and choose a mode that gives a non-zero separation distance.

9.4 Test Block

A test block is included with the Portaflow 330 equipment to allow the transducers and inter-connecting cables to be functionally checked.

1. Switch ON the instrument.
2. Select Quick start and enter the parameters shown in the table below for the appropriate transducer type (A or B):

Parameter	A Sensors	B Sensors
Pipe outside diameter	30.0mm	50.0mm
Pipe wall thickness	14.0mm	22.0mm
Pipe lining thickness	0.00	
Pipe wall material	PVDF-SYGEF	
Fluid type	Water	
Mode	Diagonal	
Temp	20°C	

3. When the above data is entered, the SENSOR SEPARATION screen will be displayed.
4. Use the UP/DOWN scroll key to go to the SENSOR SELECTION menu. Select the appropriate sensor (the default will be "A") and press the ENTER key to return to the SENSOR SELECTION menu.
5. Select Sensor mode and position the cursor at Diagonal and press ENTER to return to the SENSOR SELECTION menu.
6. Select Exit and press the ENTER key to return to the SENSOR SEPARATION screen.
7. Check that the parameters displayed are correct.
8. Apply acoustic couplant to the sensors and attach them to the test block with the connectors positioned towards the centre of the test block as shown, and temporarily secure them in place using elastic bands or tape.
9. Connect the sensors to the Portaflow 330 instrument using the cables provided.
10. Press the ENTER key to go to the FLOW READING screen.
11. Select the Options key to go to the FLOW READING OPTION menu and set the Damping to at least 10 seconds.
12. Select Exit and press ENTER to return to the FLOW READING menu.
13. The flow reading value displayed is not important. The fact that a reading is obtained indicates that the instrument is functioning. This value may fluctuate but this is normal.
14. The signal strength indicator at the left of the display should show 3–4 bars.

9.5 Microprocessor Reset Facility

In the rare event that the Portaflow 330 instrument appears to totally hang-up, or displays total gibberish, you can reset its microprocessor by carefully inserting a straightened

paperclip into the pinhole located in the right-hand side of the instrument to operate the internal reset switch. Hold the paperclip perpendicular to the instrument while doing this.

9.6 Diagnostics Display

This feature is designed for advanced users and is intended to provide information that will aid the user to diagnose problems – e.g. no signal strength. When operating in the FLOW READING mode you can access a diagnostics screen by pressing the Options function key and then selecting Diagnostics from the FLOW READING OPTIONS screen. This will display the operating values for the following parameters.

Calculated time (µ s)

This is a value the instrument predicts will be the time in µ secs that it should take for the acoustic wave to propagate across a particular pipe size. This value is ascertained from the data entered by the user. i.e. Pipe size, material, sensor set etc.

Actual time (µ s)

This is the value the instrument measures as the time taken for the acoustic wave to propagate across the pipe. It is used to see if the signal is being taken from the burst, at the correct time to get the strongest signal. This value is normally a few µ s below the calculated µ s value. If, however, this value is much greater than the calculated time then there is a problem with the set-up.

Flow (m/s)

This displays flow velocity in m/sec to 3 decimal places.

Signal strength

This is the averaged value of Signal and should be a value between 800 and 1600 – where 800 is approximately 50%, and 1600 is approximately 100%.

Gain

Gain values are typically in the range 600 to 850.

Switches

Typical Switches values are None and *10. On small pipes (and when using the test block) the value should be None. A Switch value of *100 indicates poor sensor set-up or poor connections.

UP/DN time difference

The difference in transit times between the upstream and downstream signals due to the fluid flow.

Fluid propagation rate

This is the sound speed of the fluid calculated using the data entered by the user.

Sensor separation

The same value as displayed in the setup screen.

10 Appendix A: Specification

General	
DSP Measurement Technique:	Transit time.
Timing Resolution:	50 pico-second, continuous signal level indication on display.
Flow Velocity Range:	Minimum Velocity 0.1m/s; Max Velocity 20m/s: Bi-directional.
Turn Down Ratio:	100:1
Accuracy:	±0.5% to ±2% of flow reading for flow rate ›0.2m/s and Pipe ID ›75mm. ±3% of flow reading for flow rate ›0.2m/s and Pipe ID in range 13mm - 75mm. ±6% of flow reading for flow rate ‹ 0.2m/s.
Repeatability:	±0.5% of measured value or ±0.02m/s whichever is the greater.
Reynolds Number Correction:	Flow velocity corrected for Reynolds number over entire velocity range.
Response Time:	‹ 500ms depending on pipe diameter.
Selectable Flow Units:	VELOCITY: m/sec, ft/sec. VOLUME: l/s, l/min, l/h, gal/min, gal/h, USgals/min, USgals/h, Barrel/h, Barrel/day, m^3/s, m^3/min, m^3/h.
Selectable Volume Units:	l, gal, USgals, Barrel, m^3.
Total Volume:	12 Digits - forward and reverse.

Applicable fluid types	
Fluid Condition:	Clean liquids or oils that have less than 3% by volume of particulate content. Applications include river water, sea water, potable water, demineralised water, glycol/water mix, hydraulic systems and diesel oil.

Applicable pipe types	
Pipe Materials:	Any sonic conducting medium such as PVDF-SYGEF, PP-PROGEF, PE-ELGEF, PB-INSTAFLEX, ABS, PVC-U/PVC-C, Mild Steel, Ductile Iron, S'less Steel 316, Copper
Pipe Dimension (outside diameter):	Min 13mm; Max 5000mm with D sensor set.
Pipe Wall Thickness:	1mm - 75mm.
Pipe Lining:	Applicable pipe linings include Rubber, Glass, Concrete, Epoxy, Steel.

Applicable pipe types	
Pipe Lining Thickness:	0mm – 25mm.
Pipe Wall Temperature Range:	Standard sensor operating temperature is -20°C to +135°C.

Transducer sets	
Standard:	Temperature Range -20°C to +135°C. 'A-ST' (standard) 13 mm...115 mm pipe O.D. (2MHz). 'B-ST' (standard) 50 mm...2000 mm pipe O.D. (1MHz). 'D'* 1500 mm...5000 mm pipe O.D. * Temperature Range -20°C to +80°C (0.5MHz).

Data logger	
Data Logged:	Site name, flow rate and totals. Logs data selected in setup, e.g l, gals, USgals, m^3.
No. data points:	200k.
Time Stamping:	All data points are time stamped.
No. Sites:	20 sites.
No. Data Points Per Site:	All free memory can be allocated to any site up to a max of 200,000 data points.
Programmable Logging Interval:	5 secs to 1hr.

Languages	
Standard Supported Languages:	English, French, German, Italian, Spanish, Portuguese, Russian, Norwegian, Dutch, Swedish.

Outputs	
USB Memory key:	FAT formatted
Analogue Output: Resolution: Alarm Currents: Isolation: Maximum Load:	4–20mA, 0–20mA, 0–16mA. 0.1% of full scale. Any between 0–26mA. 1500V Opto-isolated. 620 Ohms.
Pulse Output TTL: Max Current: (Volumetric mode) Pulse Repetition Rate: (Frequency mode) Max Pulse Frequency	Opto-isolated MOSFET relay. 150mA Up to 500 pulses/sec (depending on pulse width). 500ms for 1 pulse/sec. 5ms for 100 pulses/sec. 200Hz

Outputs	
Flow at Max Frequency	9999 l/s

Electrical	
Supply Voltage:	
Input Voltage Range:	9–24Vdc.
Power Consumption:	10.5W.
Battery	
Technology:	5-cell NiMH.
Capacity:	3.8AHr.
Operating time:	Typically 20 hours continuous with backlight and 4-20mA output OFF.
Recharge Time:	6.5 Hours.
Service Life:	›500 charge/discharge cycles.
Power Supply/Charger	
Manufacturer:	Mean Well type GE18I12-P1J
Input Voltage Range:	90–264Vac.
Input Frequency Range:	47–63Hz.
Output Voltage:	12Vdc.
Max. Output Current:	1.2A.
Approvals:	FCC, C-Tick, UL, CUL, TUV, CB & CE.

Mechanical	
Carrying case:	
Rating:	All components are contained in a hard-wearing IP67 rated carrying case with a protective moulded foam insert.
Enclosure:	
Material:	Flame retardant injection moulded ABS.
Dimensions:	264mm x 168mm x 50mm.
Weight (Including Battery):	1.1 kg.
Protection:	IP54.
Keypad:	
No. Keys:	16.
Display:	
Format:	240 x 64 pixel graphic display, high contrast black-

Mechanical	
	on-white, with backlight.
Viewing Angle:	Min 30°, typically 40°.

Environmental	
Operating Temperature:	–20°C to +50°C.
Storage Temperature:	–25°C to +65°C.
Operating Humidity:	90% RH MAX at +50°C.
Charging Temperature:	0°C to +40°C.

Approvals	
Safety:	BS EN 61010.
EMC:	BS EN 61326 - 1:2006, BS EN 61326-2-3:2006.
Battery Charger:	EN61204 - 3.

Shipping information	
Box Dimensions:	410mm x 205mm x 355mm.
Weight:	7.5 kg.
Volumetric Weight:	5. kg.

GF reserve the right to alter any specification without notification. PORTAFLOW 330 and PF330 are identical.

11 Disposal

- Before disposing of the different materials, separate them by recyclables, normal waste and special waste.
- Comply with local legal regulations and provisions when recycling or disposing of the product, the individual components and the packaging.
- Comply with national regulations, standards and directives.

	A product marked with this symbol must be taken to a separate collection point for electrical and electronic devices. If you have any questions regarding disposal of the product, please contact your national agent for GF Piping Systems.

If you have questions regarding the disposal of your product, please contact your national GF Piping Systems representative.

Notes

Notes

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ensure local customer support in over 100 countries

www.gfps.com

Argentina / Southern South America
Georg Fischer Central Plastics
Sudamérica S.R.L.
Buenos Aires, Argentina
Phone +54 11 4512 02 90
gfcentral.ps.ar@georgfische .com
www.gfps.com/ar

Australia
George Fischer Pty Ltd
Riverwood NSW 2210 Australia
Phone +61 (0) 2 9502 8000
australia.ps@georgfische .com
www.gfps.com/au

Austria
Georg Fischer
Rohrleitungssysteme GmbH
3130 Herzogenburg
Phone +43 (0) 2782 856 43-0
austria.ps@georgfische .com
www.gfps.com/at

Belgium / Luxembourg
Georg Fischer NV/SA
1070 Bruxelles/Brüssel
Phone +32 (0) 2 556 40 20
be.ps@georgfische .com
www.gfps.com/be

Brazil
Georg Fischer Sist. de Tub. Ltda.
04795-100 São Paulo
Phone +55 (0) 11 5525 1311
br.ps@georgfische .com
www.gfps.com/br

Canada
Georg Fischer Piping Systems Ltd
Mississauga, ON L5T 2B2
Phone +1 (905) 670 8005
Fax +1 (905) 670 8513
ca.ps@georgfische .com
www.gfps.com/ca

China
Georg Fischer Piping Systems Ltd
Shanghai 201319
Phone +86 21 3899 3899
china.ps@georgfische .com
www.gfps.com/cn

Denmark / Iceland
Georg Fischer A/S
2630 Taastrup
Phone +45 (0) 70 22 19 75
info.dk.ps@georgfische .com
www.gfps.com/dk

Finland
Georg Fischer AB
01510 VANTAA
Phone +358 (0) 9 586 58 25
Fax +358 (0) 9 586 58 29
info.fi.p @georgfische .com
www.gfps.com/fi

France
Georg Fischer SAS
95932 Roissy Charles de Gaulle Cedex
Phone +33 (0) 1 41 84 68 84
fr.ps@georgfische .com
www.gfps.com/fr

Germany
Georg Fischer GmbH
73095 Albershausen
Phone +49 (0) 7161 302-0
info.de.ps@georgfische .com
www.gfps.com/de

India
Georg Fischer Piping Systems Ltd
400 076 Mumbai
Phone +91 224007 2001
branchoffi @georgfische .com
www.gfps.com/in

Indonesia
George Fischer Pte Ltd –
Representative Offi
Phone +62 21 2900 8564
Fax +62 21 2900 8566
sgp.ps@georgfische .com
www.gfps.com/sg

Italy
Georg Fischer S.p.A.
20063 Cernusco S/N (MI)
Phone +39 02 921 861
it.ps@georgfische .com
www.gfps.com/it

Japan
Georg Fischer Ltd
556-0011 Osaka,
Phone +81 (0) 6 6635 2691
jp.ps@georgfische .com
www.gfps.com/jp

Korea
GF Piping Systems
Georg Fischer Korea Co., Ltd.
Unit 2501, U-Tower
120 HeungdeokJungang-ro (Yeongdeok-dong)
Giheung-gu, Yongin-si, Gyeonggi-do, Korea
Phone: +82 31 8017 1450
Fax : +82 31 217 1454
kor.ps@georgfische .com
www.gfps.com/kr

Malaysia
George Fischer (M) Sdn. Bhd.
40460 Shah Alam, Selangor Darul Ehsan
Phone +60 (0) 3 5122 5585
Fax +603 5122 5575
my.ps@georgfische .com
www.gfps.com/my

Mexico / Northern Latin America
Georg Fischer S.A. de C.V.
Apodaca, Nuevo Leon
CP66636 Mexico
Phone +52 (81) 1340 8586
Fax +52 (81) 1522 8906
mx.ps@georgfische .com
www.gfps.com/mx

Middle East
Georg Fischer
Piping Systems (Switzerland) Ltd
Dubai, United Arab Emirates
Phone +971 4 289 49 60
gcc.ps@georgfische .com
www.gfps.com/int

Netherlands
Georg Fischer N.V.
8161 PA Epe
Phone +31 (0) 578 678 222
nl.ps@georgfische .com
www.gfps.com/nl

Norway
Georg Fischer AS
1351 Rud
Phone +47 67 18 29 00
no.ps@georgfische .com
www.gfps.com/no

Philippines
George Fischer Pte Ltd
Representative Offi
Phone +632 571 2365
Fax +632 571 2368
sgp.ps@georgfische .com
www.gfps.com/sg

Poland
Georg Fischer Sp. z o.o.
05-090 Sekocin Nowy
Phone +48 (0) 22 31 31 0 50
poland.ps@georgfische .com
www.gfps.com/pl

Romania
Georg Fischer
Piping Systems (Switzerland) Ltd
020257 Bucharest - Sector 2
Phone +40 (0) 21 230 53 80
ro.ps@georgfische .com
www.gfps.com/int

Russia
Georg Fischer
Piping Systems (Switzerland) Ltd
Moscow 125047
Phone +7 495 258 60 80
ru.ps@georgfische .com
www.gfps.com/ru

Singapore
George Fischer Pte Ltd
11 Tampines Street 92, #04-01/07
528 872 Singapore
Phone +65 6747 0611
Fax +65 6747 0577
sgp.ps@georgfische .com
www.gfps.com/sg

Spain / Portugal
Georg Fischer S.A.
28046 Madrid
Phone +34 (0) 91 781 98 90
es.ps@georgfische .com
www.gfps.com/es

Sweden
Georg Fischer AB
117 43 Stockholm
Phone +46 (0) 8 506 775 00
info.se.ps@georgfische .com
www.gfps.com/se

Switzerland
Georg Fischer
Rohrleitungssysteme (Schweiz) AG
8201 Schaffhause
Phone +41 (0) 52 631 30 26
ch.ps@georgfische .com
www.gfps.com/ch

Taiwan
Georg Fischer Co., Ltd
San Chung Dist., New Taipei City
Phone +886 2 8512 2822
Fax +886 2 8512 2823
www.gfps.com/tw

United Kingdom / Ireland
George Fischer Sales Limited
Coventry, CV2 2ST
Phone +44 (0) 2476 535 535
uk.ps@georgfische .com
www.gfps.com/uk

USA / Caribbean
Georg Fischer LLC
9271 Jeronimo Road
92618 Irvine, CA
Phone +1 714 731 88 00
Fax +1 714 731 62 01
us.ps@georgfische .com
www.gfps.com/us

Vietnam
George Fischer Pte Ltd
Representative Offi
136E Tran Vu, Ba Dinh District, Hanoi
Phone +84 4 3715 3290
Fax +84 4 3715 3285
sgp.ps@georgfische .com
www.gfps.com/sg

International
Georg Fischer
Piping Systems (Switzerland) Ltd
8201 Schaffhausen/ witzerland
Phone +41 (0) 52 631 30 03
Fax +41 (0) 52 631 28 93
info.export@georgfische .com
www.gfps.com/int

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