

Rapidox 6100-Portable Instruction Manual D61-070-5



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Declaration of Conformity

Manufacturer:	Cambridge Sensotec Ltd Unit 29 Stephenson Road St Ives CAMBS PE27 3WJ, ENGLAND	
Product Names:	Rapidox SF6 Portable Analyser	
Model Numbers:	R6100-PORTABLE	
Conform to the following specifications:	EMC: EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use
	LVD: EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control and laboratory use
Declaration:	I declare that the above product conforms to the applicable requirements of the LVD Directive 2006/95/EC, RoHS2 Directive 2011/65/EU and the EMC Directive 2004/108/EC and is CE marked accordingly.	
Signature:		
Name:	Dr Mark Swetnam	
Title:	Managing Director	
Company:	Cambridge Sensotec Limited	
Date:	12 th March 2022	

WEEE Regulations 2006



Cambridge Sensotec takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant in line with our corporate and social responsibilities. In the UK, Cambridge Sensotec has joined a registered compliance scheme "WeeeCare" (WeeeCare registration number WEE/MP3538PZ/SCH).

UK users only: If you have purchased any electronic or electrical product from Cambridge Sensotec since 2007 and would like to dispose of it correctly under the WEEE scheme, please contact us and we will be happy to either arrange the collection of the waste or have it returned to our offices for recycling. All our in-house manufactured products are scheme compliant and carry the WEEE label indicating that it is NOT allowed to be disposed of in a landfill site.

Warnings and Cautions



A warning icon indicates a threat to personal safety.



A caution icon indicates the possibility of damage to data or equipment.

	<ul style="list-style-type: none"> • Electrical Shock Hazard • Do NOT open • There are no user-serviceable parts in this unit • Do not attempt to repair the analyser yourself • Refer all servicing to qualified Cambridge Sensotec personnel
	<ul style="list-style-type: none"> • The unit must not be exposed to extreme temperatures below -5°C (23°F) or above 50°C (122°F) • Normal operating temperature is 5°C (41°F) to 35°C (95°F) • Avoid direct sunlight • Do not use liquid cleaners, aerosols or solvents to clean the case • Use a damp cloth for cleaning with the power cable disconnected • Do not use this equipment near water • Avoid touching the Display as this may cause permanent damage • Make sure the rear ventilation slots and the fan on the rear panel are free of obstruction
	<ul style="list-style-type: none"> • This unit is NOT designed for use in life support situations or any use that is not specified by the manufacturer • No responsibility can be held for injury or loss of life caused by inappropriate use of this equipment • Always use a tube connected to the gas outlet which is vented to atmosphere when working with gases that may be toxic or injurious
	<ul style="list-style-type: none"> • This unit is not suitable for enriched oxygen samples ($O_2 > 30\%$) unless it is certified as "oxygen clean"
	<ul style="list-style-type: none"> • HF & SO₂ are toxic and can be fatal if inhaled • HF & SO₂ cause severe skin burns • HF causes severe damage to the eyes • H₂S & CO are toxic and can be fatal if inhaled • Read the MSDS sheets carefully before working with these toxic gases
	<ul style="list-style-type: none"> • HF and SO₂ are extremely corrosive to the respiratory tract • Read the MSDS sheets carefully before working with these corrosive gases
	<ul style="list-style-type: none"> • H₂S and CO are extremely flammable in high concentrations • Long term exposure to CO causes organ damage • SO₂, HF and H₂S are harmful irritants to the eyes, skin and respiratory tract even in small doses • Very toxic to aquatic life

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1 Introduction

The Rapidox SF6 6100 Portable is a battery-powered SF6 multigas analyser capable of measuring multiple gases simultaneously in a rugged and portable case. Depending on the configuration the analyser can measure up to eight parameters including sulphur hexafluoride (SF₆), water (H₂O), sulfur dioxide (SO₂), carbon tetrafluoromethane (CF₄), hydrogen fluoride (HF), air, carbon monoxide (CO) and hydrogen sulphide (H₂S). In addition the SF₆ compartment gas pressure is displayed on-screen as well as some other selectable parameters. The ranges are shown in Table 1 below:

Calibrated Range / Sensor Type	SF ₆	O ₂	Air	N ₂	CF ₄	H ₂ O	SO ₂	CO	H ₂ S	HF	H ₂ S / CO
0 - 100%	IR		BAL	BAL							
0 - 80%					IR						
0 - 30%		EC									
0 - 5,000ppm								EC			
0 - 2,000ppm							EC	EC	EC		
0 - 1,000ppm								EC	EC		EC (CO)
0 - 500ppm							EC	EC	EC		EC (CO)
0 - 200ppm									EC		EC (H ₂ S)
0 - 150ppm							EC				
0 - 100ppm							EC				EC (H ₂ S)
0 - 50ppm											EC (H ₂ S)
0 - 20ppm										EC	
0 - 10ppm										EC	
-60°C to +20°C						CAP					
Standard Range											
Extended Range (on Request)											

Table 1: Sensor Matrix for R6100-PORTABLE. IR = Infra Red, BAL = Balance Gas, CAP =Capacitance Sensor, EC = Electro-Chemical.

The analyser has a built-in PC and all functions are accessed via a 7" touch screen panel. The unit has a sample pump to draw in gas when operating at very low pressure. The analyser will run in continuous or sampling modes where sample gas is drawn into the analyser via a special FEP lined sample hose and special tongue and groove self sealing couplings compatible with famous brands. The gases pass through the various sensors and data is processed and displayed on the screen. The analyser is fitted with a printer, alarms, data-logging functions and USB output. The portability of the analyser is achieved by means of a lithium battery pack which can be charged on any worldwide mains power. The unit will run for up to eight hours on the battery before recharging is required. The unit will also run directly on mains power while the battery is recharging. Note that for customers who purchase this analyser without an SF₆ sensor fitted, it is important to read the notes in Appendix 1: Analysers Without an SF₆ Sensor Fitted at the end of this manual.

2 Analyser Overview



Figure 1: Layout of the SF₆ 6100 Portable Analyser

- 1) Main display and touch screen menu system
- 2) Thermal printer
- 3) Sample gas inlet (via closed coupled fitting)
- 4) Sample gas outlet
- 5) a) sample flow adjuster b) flow indicator on the display
- 6) Power on/off switch
- 7) LED battery charging light
- 8) USB memory stick port
- 9) Fuse holder
- 10) Mains inlet
- 11) Rapidri dew point sensor storage system
- 12) Vehicle charger socket
- 13) Earth connection point
- 14) Cooling Fan
- 15) Ventilation hole

3 Getting Started

The fuse will be removed for transportation safety reasons. This completely isolates the lithium battery. The fuse is shown in Figure 1-9 labelled with the value listed in Table 2 at the end of this manual. The fuse must be inserted into the holder and tightened into position before first use. Remove the fuse temporarily if you are transporting the analyser by air. If you require the analyser to be earthed during operation, please connect your earth cable to the earth fixing point Figure 1-13.

Open the Peli-case fully and switch on the Rapidox using the switch Figure 1-7. The analyser screen will boot up and the display will show the operation screen as seen in Figure 1-1..

3.1 Rapidri System

This analyser is fitted with a “Rapidri” system that draws moisture out of the dew point sensor when not in use. A can of molecular sieve material is located inside to achieve this. This allows the moisture sensor to work much more quickly and improves the life and conditioning of the moisture sensor. The moisture sensor fitted to the Rapidox is a special high-speed type that will take less than ten minutes to go down to -60°Cdp from wet. To make the Rapidri system function correctly please turn the lever (Figure 1-11) to “STORAGE” and remove the sample hose from the gas inlet (Figure 1-3) when the unit is not in use (Figure 2). When starting the analyser, turn the lever to “RUN” to begin measurements. No gas will pass through the analyser when the lever is in the storage position. Please note that the molecular sieve eventually becomes exhausted and should be replaced during a scheduled service.

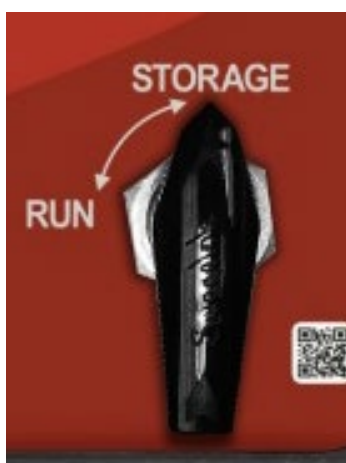


Figure 2: Make sure this lever is in the correct position to operate the Rapidox & and is returned to “Storage” position when the unit is not in use.

3.2 Battery Charging

When on mains power and the battery is charging, the LED (Figure 1-7) will show a red colour. This will eventually turn orange and finally when the unit is fully charged, green. There is an on-screen battery life meter which shows the remaining battery life and indicates if the unit is charging or not. It takes between five and seven hours to fully charge a flat battery depending on operational circumstances.

To charge the battery, simply attach the IEC mains lead to the mains socket on the side of the analyser (Figure 1-10). Note that you must leave the lid open when on charge and the cooling fan will operate to vent the battery compartment. Alternatively, the Rapidox can be charged using the vehicle charging kit accessory using the labelled socket (Figure 1-12). This is available to purchase as an option from Cambridge Sensotec.

3.3 Making Gas Connections

Note that the inlet gas pressure is the pressure of the SF₆ inside the gas compartment or gas bottle and is displayed in bar (0-10bar range). The maximum inlet pressure of the Rapidox is 10bar gauge.

Attach the closed-coupled sample hose (supplied) to the gas inlet port (Figure 1-3). The other end of this hose is normally connected to a special tongue and groove self sealing couplings compatible with well-known brands, which is attached in turn to the SF₆ gas compartment. Connect the gas outlet (Figure 1-4) to your gas recovery bag or recycling system using 6mmOD/4mmID FEP or polyurethane tubing. Note that the back pressure from the recovery system must not exceed 100mbar or the sensors will report a fault. Cambridge Sensotec supplies a range of gas bags and recovery systems for SF₆ recycling.



Pull the knurled collar down with your finger tips before trying to attach the male hose fitting. Line up the hose fitting before attempting to connect



Push male coupling into the female firmly whilst holding the collar down. Release the collar only when fully engaged

Figure 3: Correct procedure for attaching the sampling hose to the analyser.

3.4 Main Screen

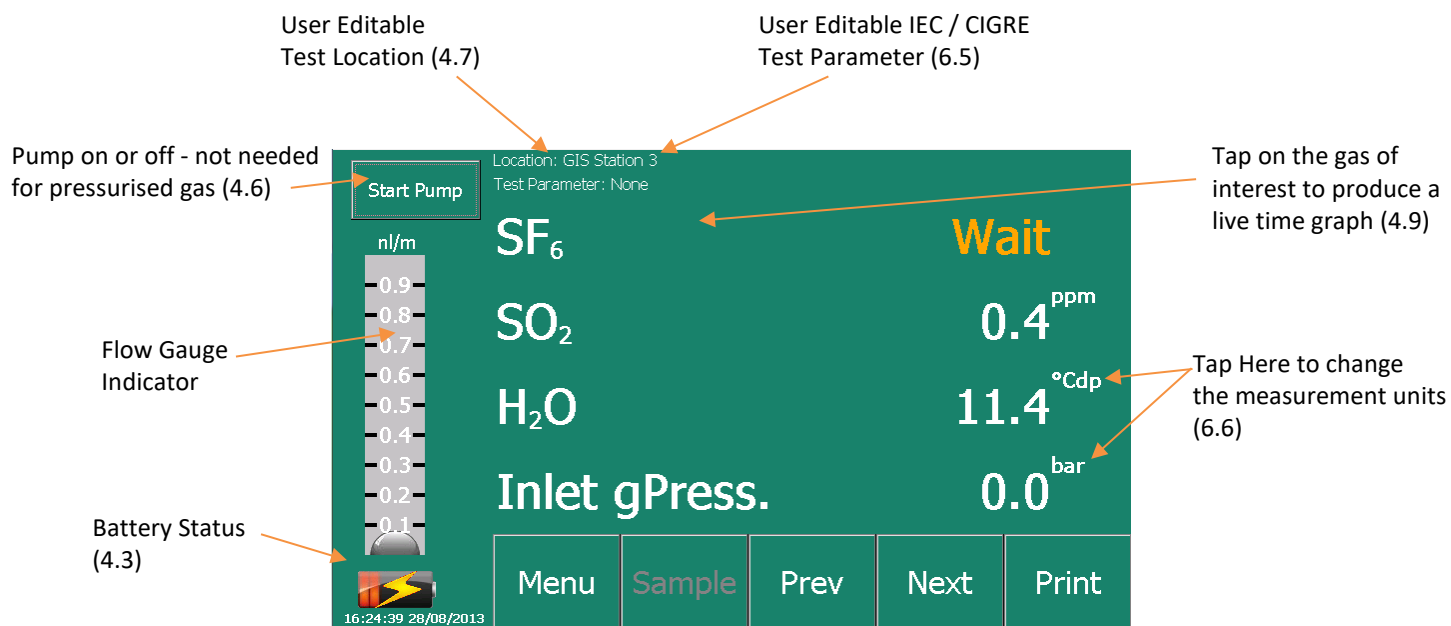


Figure 4: Main screen just after boot up. The infra-red SF₆ sensor is still warming up which takes approximately 60 seconds. Actual screen will vary depending on sensor configuration

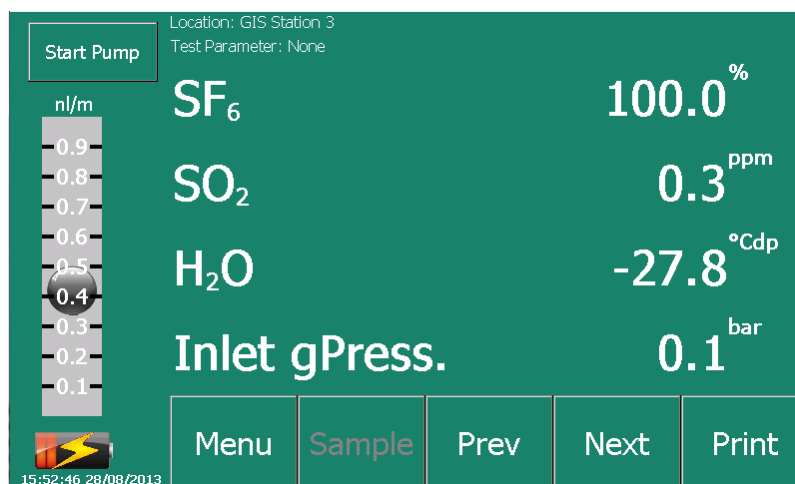


Figure 5: Main operation screen showing sensor readings and flow gauge working. Actual screen will vary depending on sensor configuration.

Press "Menu" to enter the analyser menu screen and "Print" to produce a print-out of the data as seen on the display. Press "Prev" and "Next" to scroll the sensor readings up and down. The display will then show Inlet gas pressure and Flow Rate:

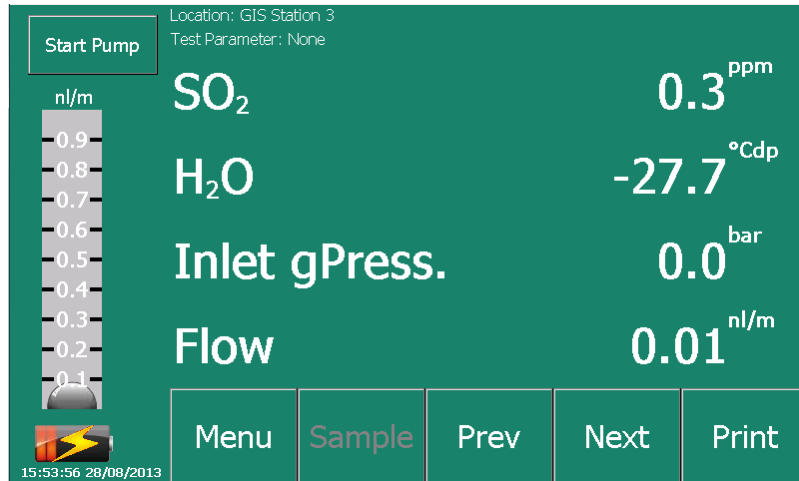


Figure 6: Using the Prev and Next buttons displays other measurements. Actual screen will vary depending on sensor configuration

3.5 Using the Sample Pump

If you are working with SF₆ at low pressure <0.5bar you may need to operate the sample, pump to get the gas flowing through the analyser. If the gas is sufficiently pressurised, then it is not necessary to run the pump and it can be left switched off. To sample using the pump press the button labelled “Start Pump” and adjust the required flow using the flow adjuster (Figure 1-5a). The flow rate will displayed using the on-screen gauge (Figure 1-5b). It is recommended that the flow is adjusted to read 0.5litres per minute so that the ball will be in the centre of the gauge. The gas analysis readings are displayed on the main panel.

3.6 Dewpoint Sensor Cleaning

Note that when the unit is operating in continuous mode the dewpoint sensor will clean itself automatically every thirty minutes after switching the analyser on. This ensure that the dewpoint sensor stays accurate in SF₆. The clean cycle takes approximately three minutes to complete and during this time readings and alarms are suspended. When a clean cycle is running, the display will say “WAIT” (see Figure 7 below). In Timed mode the clean cycle is commanded at the start of every test so the cleaning does not interrupt the measurements.

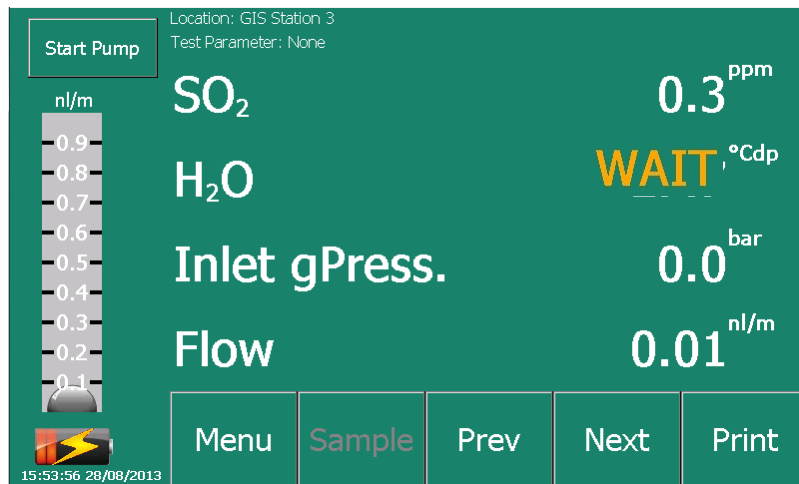


Figure 7: Every thirty minutes (in continuous mode only) the dewpoint sensor will clean itself which takes three minutes. During this time the reading will display the word “WAIT”

3.7 Timed Tests

If the analyser has been set to “Timed” mode then the “Sample” button will be enabled. In “Continuous” mode it is greyed out as shown above. See section 4.4 for information about this mode. If you want to see a live chart of any of the channels press over the live reading display of the gas / measurement of interest and the display will change.

3.8 Live Graph Display

The main panel shows a live display graph of the reading from the sensor. Use the “Back” button to return to the main display screen and the “Prev” or “Next” button to change the sensor you are viewing.

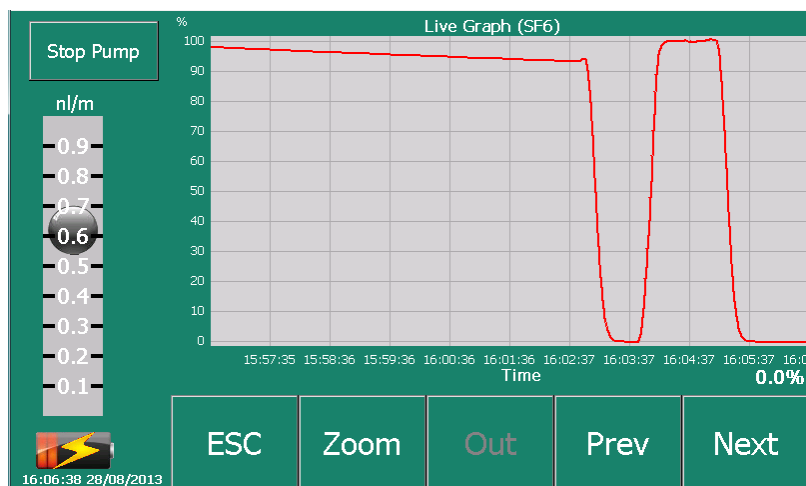


Figure 8: Pressing on any measurement part of the screen will display a live graph of that particular measurement

Rapidox SF₆ Analysers Gas Chart Colours

255 0 0	SF ₆	255 255 0	SO ₂
70 255 68	CF ₄	176 68 255	CO
255 107 36	N ₂	0 200 200	H ₂ S
255 0 255	AIR	183 132 0	HF
0 0 255	H ₂ O	0 100 0	Pressure
		0 0 0	Flow

Figure 9: Sensor order and graph colours used for on-screen graph display

4 Rapidox Menu System

Pressing “Menu” enters the main Rapidox Menu system as seen below. Press “Back” to return to the main analyser screen. If padlocks are displayed then these options are password protected. See 4.8 for more information.

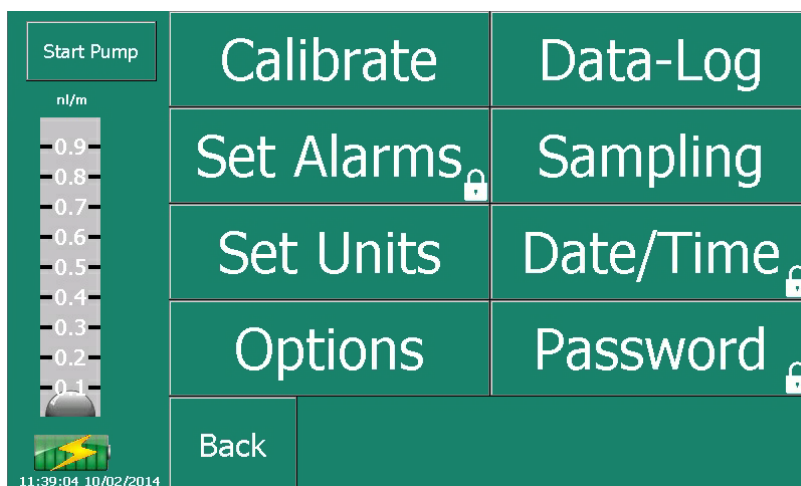


Figure 10: Rapidox Main Menu Screen

4.1 Calibrate

Use this screen to calibrate the gas sensors should they require updating. Note that it is not possible to calibrate the H₂O sensor because it has a special factory calibration over many measurement points. Should the H₂O sensor need re-calibrating please contact Cambridge Sensotec for advice. The HF sensor is also excluded from calibration by the user owing to the complexity of working with this gas.

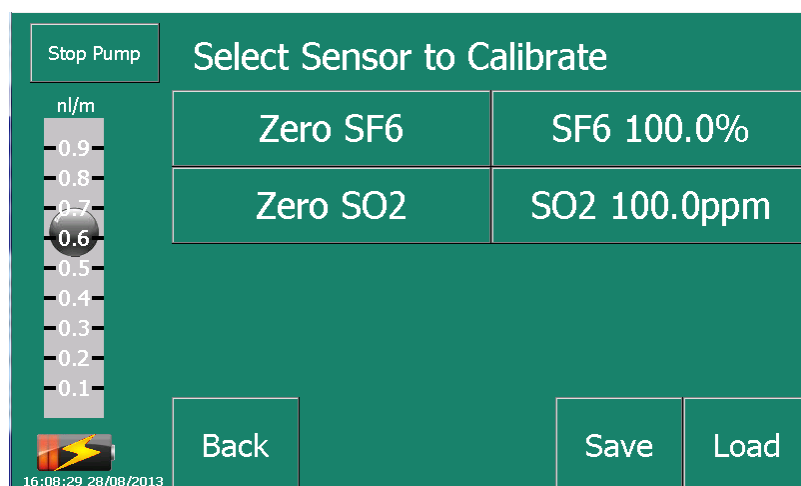


Figure 11: Main calibration screen. Actual screen will vary depending on sensor configuration

Press on the option you have chosen to either zero or span calibrate the sensor of choice.

To zero the sensors first make sure that you have fresh air or nitrogen flowing through the analyser.

To calibrate the span of the sensor you will need a gas bottle of known concentration gas (normally 100% SF₆ and 100ppm SO₂). The current calibration values are displayed on the calibrate screen as seen above but these can be changed if they do not match the value of your gas bottle.

You can load a previous calibration by pressing “Load” and you can save the calibration you have just performed by pressing “Save”. All calibrations including the initial factory one are stored on the hard drive of the analyser.

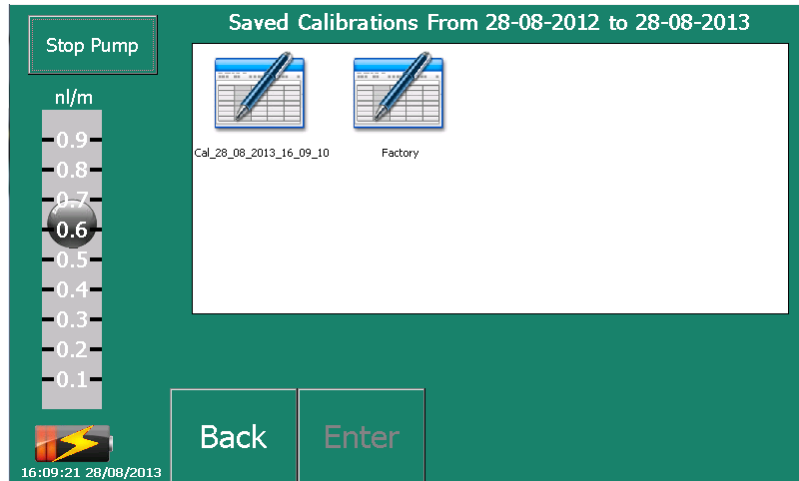


Figure 12: Historical calibrations can be re-loaded and new ones saved using the “Load” and “Save” buttons.

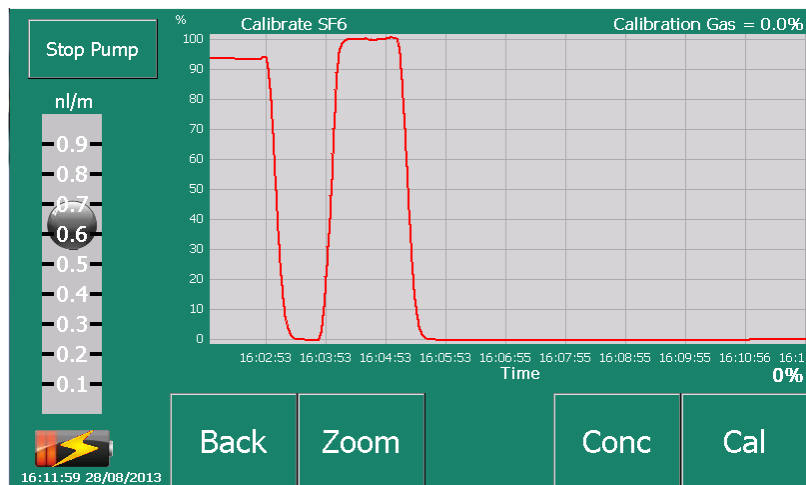


Figure 13: Calibration of the zero point for the SF₆ sensor

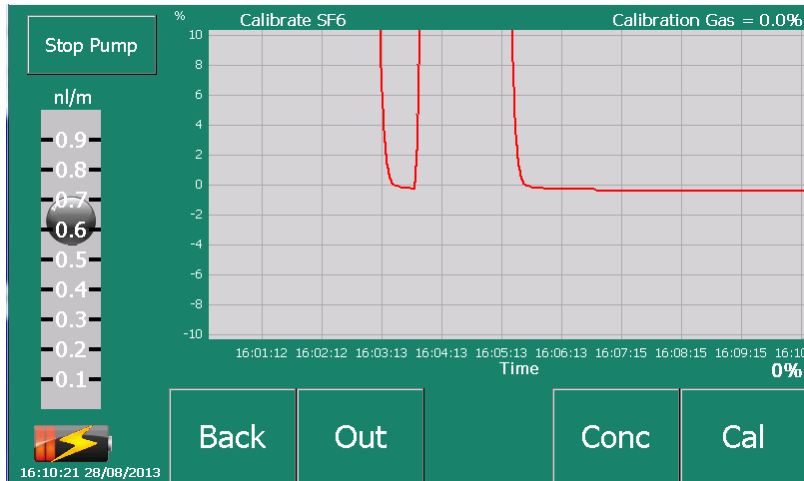


Figure 14: Use the “Zoom” button to magnify the graph when calibrating & “Out” to return to full

The current calibration gas concentration is shown in the top right hand corner of the main screen. To change this value press “Conc” and enter a new value using the number pad. This will be remembered for next time.

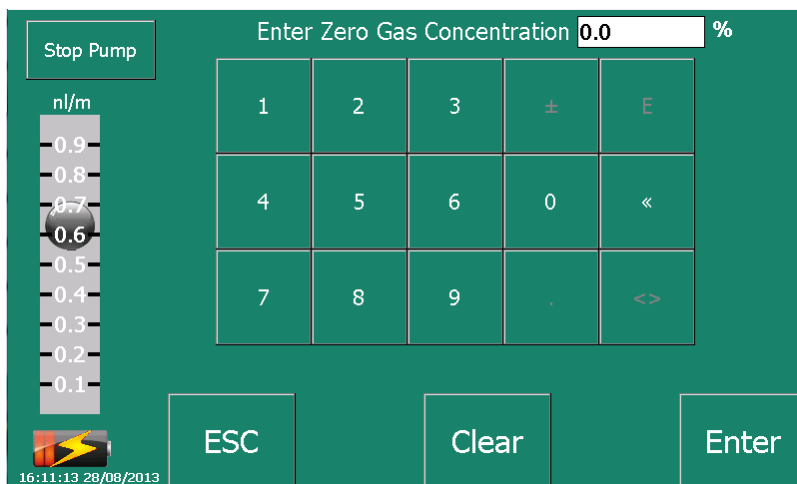


Figure 15: The zero and span calibration gas concentrations can be modified by the user

Once you are happy that the reading is stable press “Cal” to save the new calibration. Use the “Out” button to redraw the graph full scale. Use the “Back” button to return to the main calibration screen. Repeat the process for any other sensors that you want to calibrate. Note that if you calibrate with the wrong gas or try to calibrate ‘back to front’ the analyser will give you a warning to check before proceeding.

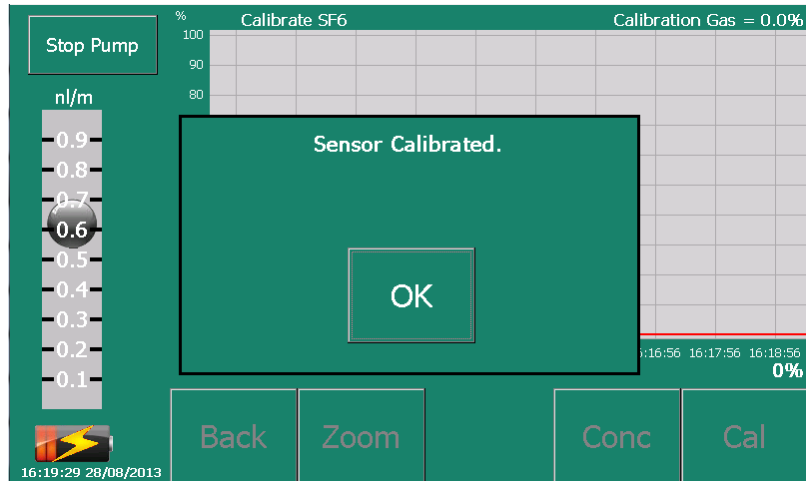


Figure 16: To complete the calibration press “Cal”. Note that the analyser will warn you if the expected value is out of range.

4.2 Data-Logging

The Rapidox data-logs all parameters constantly whilst the machine is operating. The data is stored indefinitely until the hard drive is full and then data will be overwritten oldest first. There is sufficient space on the hard drive for a minimum of twelve months of continuous data storage based on how the unit is used. You can use this option to review and re-graph historical data.

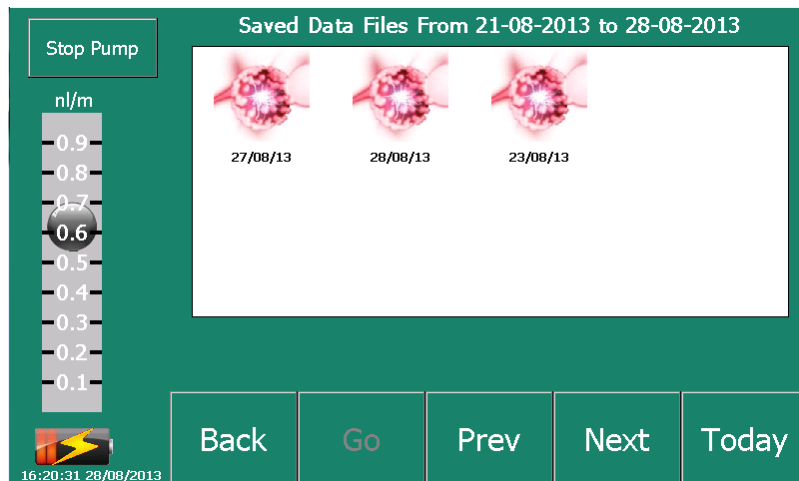


Figure 17: Use this screen to select data-files stored in date blocks and view them in graph form.

Use the “Prev” and “Next” buttons to search through the history of data files. Each session is recorded as a separate file on the hard drive. To return to the current set press “Today”. To view the data as a graph press on the file icon of interest and press “Go”.

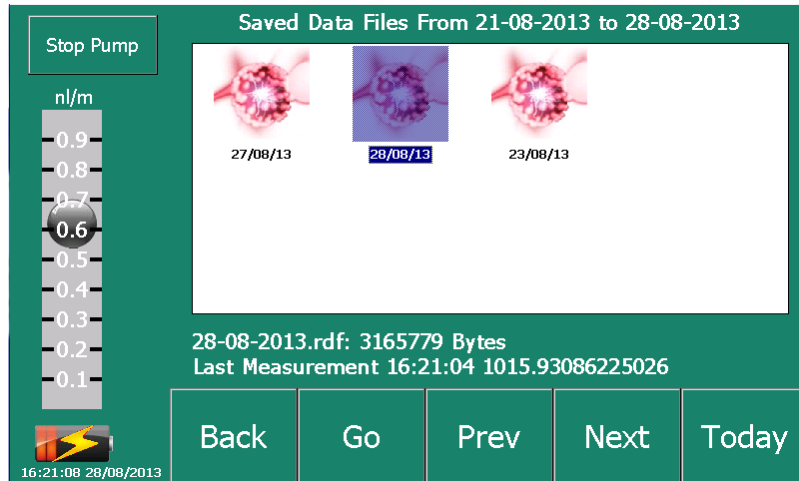


Figure 18: Select the file of interest using the keys and press “Go” to view.

A list of separate files representing sessions for the selected day are now displayed. Use the “Up” and “Down” buttons to scroll the list and select the session of interest. If you are using the “Timed” function (see 4.4) then each individual sample is logged as a separate session. In “Continuous” mode (see 4.4) the session will record all data from the time the machine is switched on until it is switched off again.

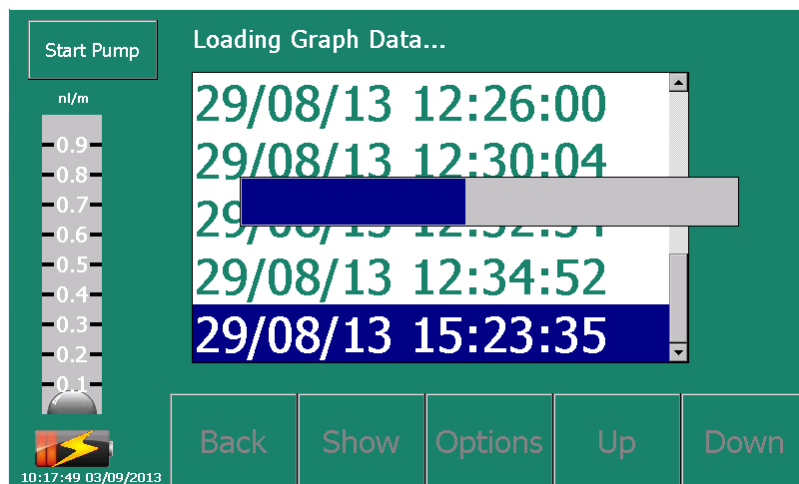


Figure 19: The Data is loaded from the hard disc drive and displayed on the screen

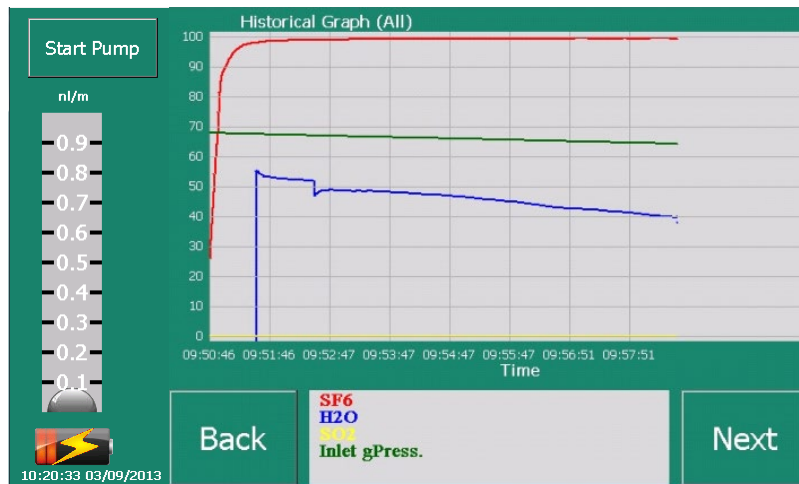


Figure 20: Historical data-log graph with colour coded key

Pressing “Back” and “Next” will redraw the graph with a single gas or parameter to aid with clarity. Using the “Options” button seen on Figure 19 the user can set a default choice for what sensors are displayed on the historical graph:

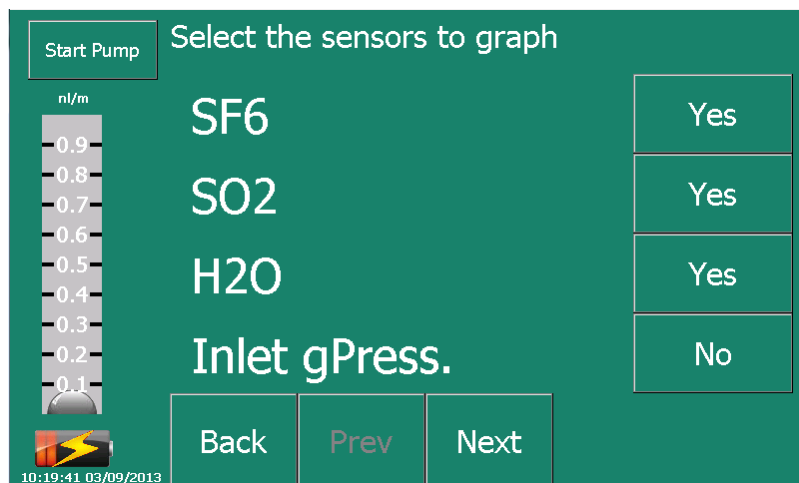


Figure 21: The user can customise the historical graphs using the “Options” button and selecting which sensors to display and which to hide.

4.3 Set Alarms

Warning alarms can be set from here. Both visual and audible alarms (internal buzzer) can be programmed for each gas sensor channel, and other measurement parameters such as flow, pressure and temperature.

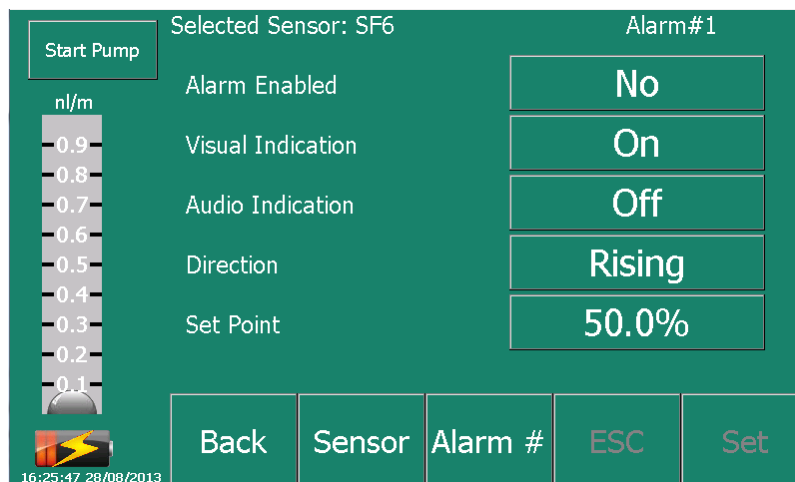


Figure 22: Alarm set up page

After selecting the gas or measurement of choice you can enable or disable the alarm function, visual indication (main screen text will change colour to red on a white background) and audible buzzer. Select “Falling” or “Rising” to determine the direction of the alarm trigger. Select the set point for the alarm to trigger by pressing the value indicated alongside “Set Point”.

For example if you require an alarm to trigger if the SF₆ content falls below 92%, then choose “Falling” for the direction and 92.0% as the “Set Point” value. Repeat for any other sensors you wish to have alarms associated with (including pressure and flow).

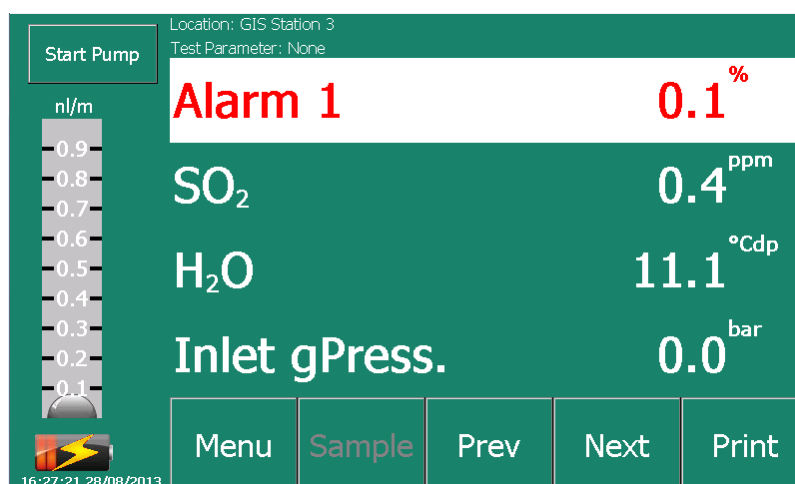


Figure 23: Screen showing visible alarms enabled. The word Alarm (1, 2 or 1&2) is displayed alternating with the gas name and the text is highlighted red on a white background.

Note that if you are using the analyser in “Timed” mode (see 4.4) then the alarms still work in exactly the same way but will only display after the countdown is complete. The audible alarm will go off if selected to do so. Once the “Sample” button is pressed and a new count down commences, the audible buzzer will silence itself. The alarm events are all logged by the analyser and can be reviewed historically.

4.4 Sampling Mode

You can choose the method of gas analysis as “Continuous” or “Timed”. These are described below. You can choose if the pump is switched on or off during the test, and select if you would like an automatic print out of the results at the end. There is an option to identify the sample with a name (e.g. “GIS Station 3”) that is displayed on the main screen. This name is also recorded on the data log file and on the print out.

4.4.1 Continuous Mode

In “Continuous” mode the data displayed on the main screen is always a live analysis and changing constantly. This is the default mode of operation.

Please note that in “Continuous” mode the dewpoint sensor will enter a self-clean cycle every thirty minutes which lasts for approximately three minutes. During cleaning the display with say “WAIT” and no readings are displayed. Once cleaning is finished the sensor will return to normal operation.

4.4.2 Timed Mode

In “Timed” mode the user selects a fixed time period to sample gas. The analyser then samples for this period of time and then displays the result on the screen as fixed until the next sample is required.

Note that the minimum sample time in this mode is four minutes to allow the dewpoint sensor enough time to complete its cleaning cycle and record a meaningful result.

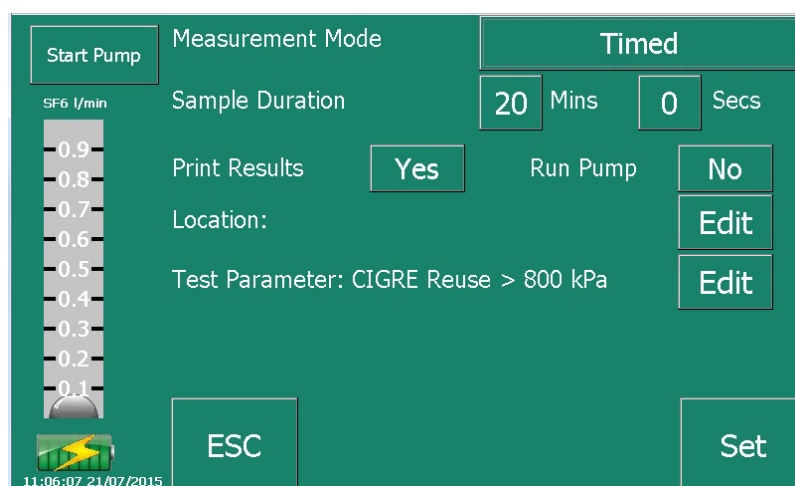


Figure 24: Use this option to change the sampling method from “Continuous” to “Timed” and set the sampling duration and other options.

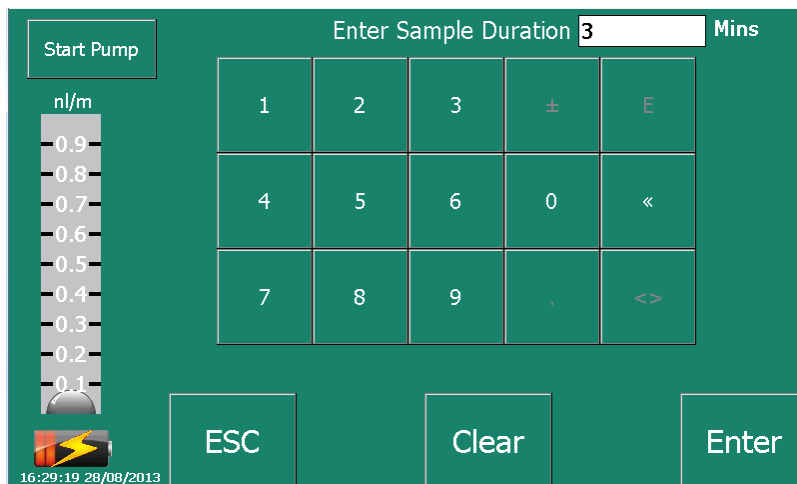


Figure 25: The sample duration can be modified in minutes and seconds using the keypad.

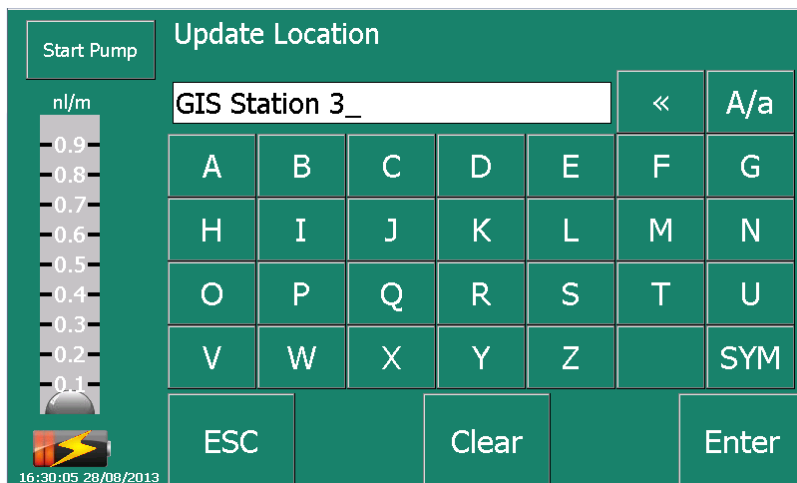


Figure 26: The Location name can be edited here using the alphabet keypad. Names are displayed on the main screen and are printed and saved with the data.

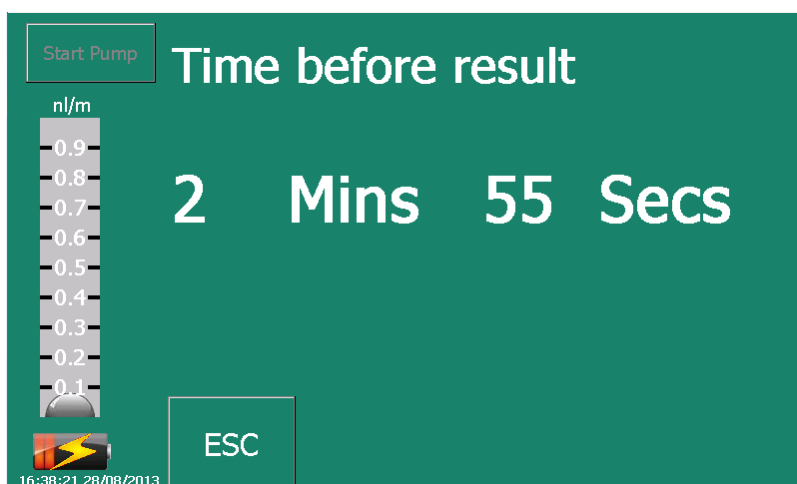


Figure 27: During a timed test the main screen displays a timer while the sample is being taken. The results are displayed after the clock reaches zero. Press "Esc" to abort the sample mid-run.

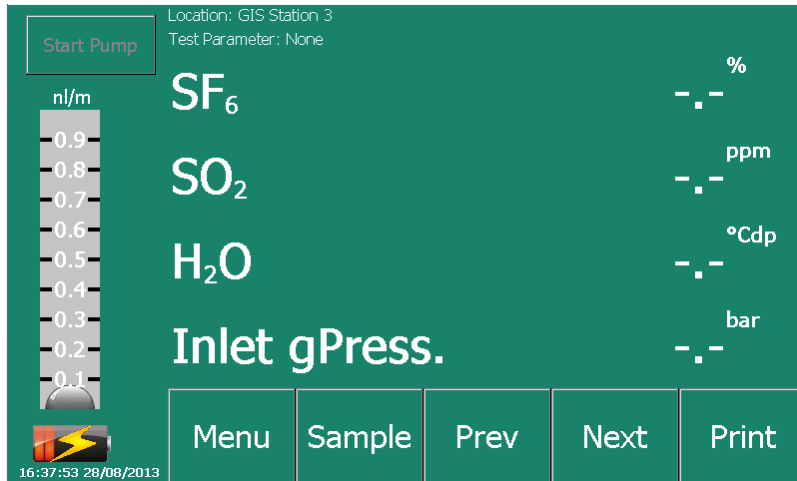


Figure 28: If during sampling the user wants to escape, pressing the “Esc” button will stop the sample and the screen will show -.- to indicate that the sample was incomplete.

4.5 Working with Pre-Loaded Test Parameters

The Rapidox has several commonly used SF₆ test parameters pre-loaded for quick and easy selection. The list includes CIGRE and IEC international test standards as well as the option to create and name your own custom test. To set up this function press “Menu” and then “Sampling”. The pre-loaded tests are accessed by pressing the “Edit” button alongside the label “Test Parameter”:

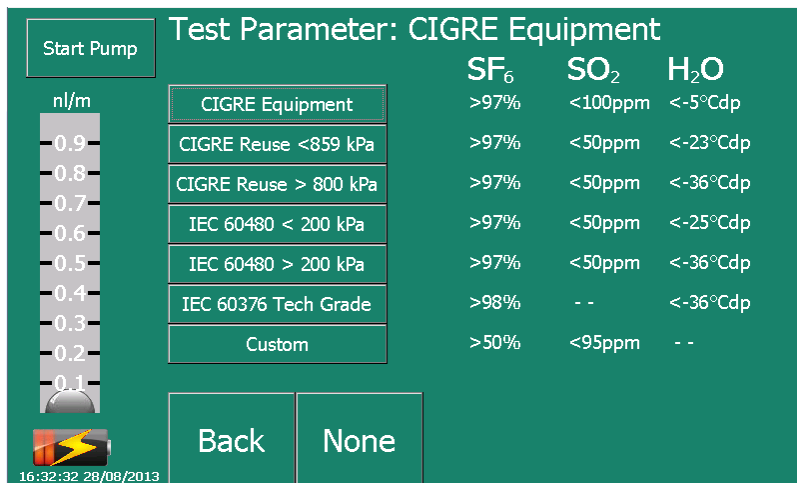


Figure 29: Pre-loaded test parameter screen. Press the “None” button to remove any tests that have been selected.

On this screen the user can remove any tests by pressing “None”. This will clear all previous selections. To select the relevant test simply press on the labelled button of choice and the pass/fail alarm settings will be loaded as displayed. Or if the user wants to create a new bespoke test click on the button labelled “Custom” to access the editing screen.

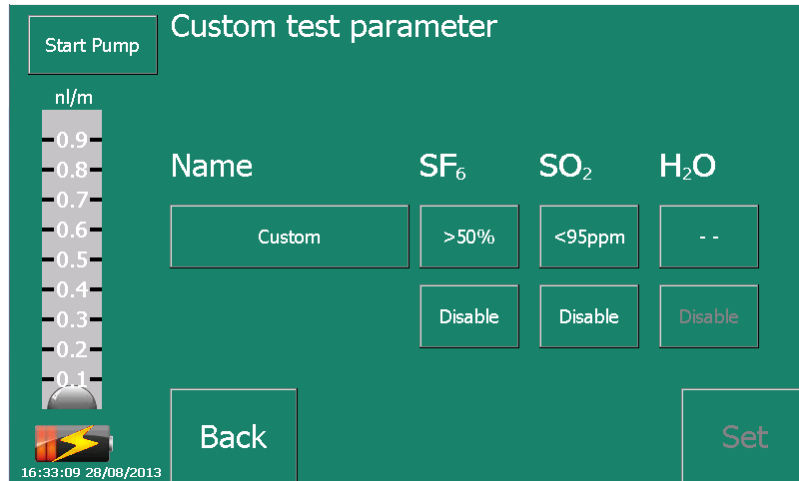


Figure 30: Custom test parameter edit screen

By clicking on the button below “Name” the user can re-name the test e.g. “Taiwan GIS recycle”. Next the three gas parameters can be edited in turn. For each gas a pass/fail set point can be entered as > and <. Or alternatively the test can be disabled for the gas in question. Once the custom test parameters are set up press “Set” to store them. Pressing “Back” returns you to Sampling screen where you will see that the test name has changed to your custom name. This new test can be selected and used in exactly the same way as the standard tests until it is edited and modified again.

With the test of choice selected the user can return to the main screen and begin sampling gas. If the readings are outside the test parameter the screen will display “FAIL” in red alongside the gas symbol. Or if the sample is within the test parameter the word “PASS” in green will be displayed. This information is logged and printed as a permanent record.

As an example the user wants to run a three minute gas sample from a high pressure GIS and test to IEC 60480 standard. To set up the test the user selects “Menu” and “Sampling”. First toggle the sample mode button to “Timed”. Next edit the sample time to say 3 minutes. Next choose if the pump needs to be on (not necessary if the SF₆ is at pressure), and if the test should produce a print out at the end (recommended). Finally press “edit” to change the test parameter and then select the button “IEC 60480 > 200kPa”. Press “set” to save this option and back to return to the main screen. Once programmed all the user needs to do is start passing the SF₆ gas sample through the analyser and press the “Sample” button. The Rapidox will run the test for three minutes and then display the results with PASS or FAIL on the screen. The printer will produce a print-out of the test result automatically (if enabled).

Note that if you are working with SF₆ and CF₄ gas mixtures that the combined total of the two gases will be used to determine the pass or fail criteria.

4.6 Set Units

Use this menu to change the units displayed by the analyser for the different measurement parameters and the number of decimal places for the readings. Use the “Back” button to return to the main menu.

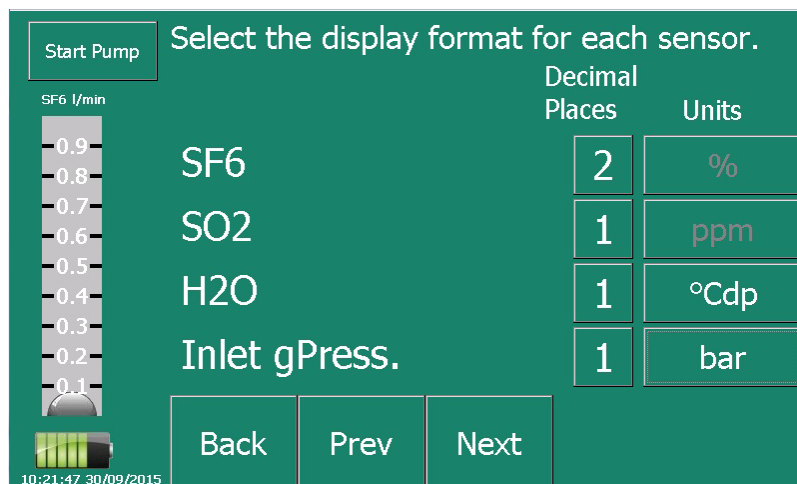


Figure 31: Setting the display units for the different sensors. Note on this analyser only the Energy units may be changed.

Where the option is available you can choose between 0,1 or 2 decimal places to display on-screen. Note that some options grey out when configuration is not allowed. For example in ppm(v) format for H₂O it is not possible to set the number of decimals as it varies over a wide range of numbers and is fixed by the software. In this case the option becomes greyed out. Once selected the choice will be saved as the default until changed again.

4.7 Date & Time

There are various options for setting the analyser date and time and how it is displayed. This information appears in the bottom LH corner of the display and is used for data-logging and record keeping.

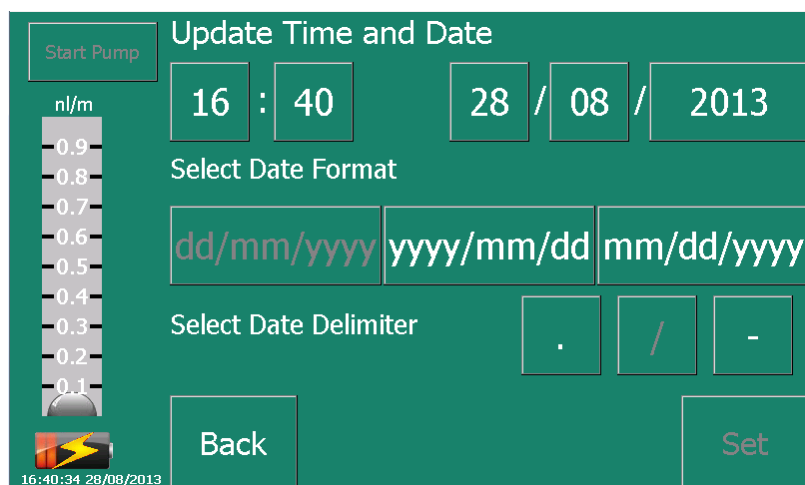


Figure 32: Use this screen to set the date and time and how it should be displayed on the main screen.

4.8 Passwords

Various levels of password protection can be set allowing access to selected menus and options. This gives the user full flexibility to set the analyser up in a way that restricts access only to sensitive screens and settings if desired. A four digit numerical administrator password is required to enter the password screen. The default admin password is 8888 but this can be changed later:

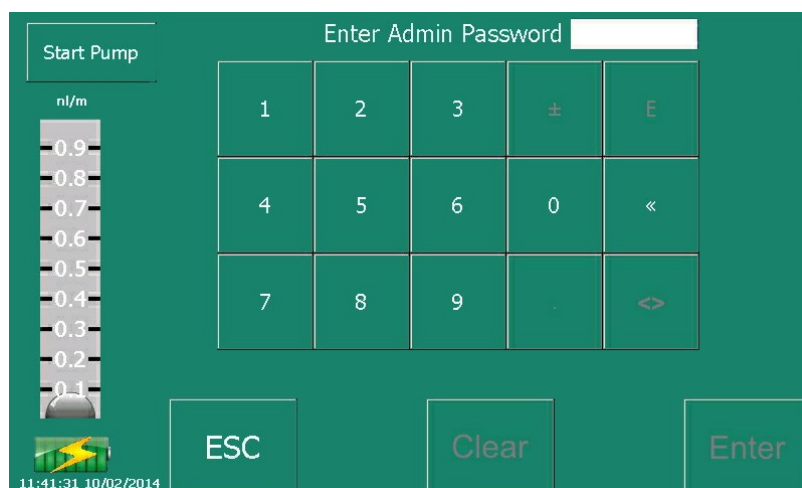


Figure 33: To enter the password menu the user must enter the Admin password. The factory default is 8888.

Once you have entered the password menu as the Administrator then you can set the restrictions and change the passwords as you so desire. There is an Admin password (used to enter only the password screens) and a user password (used to access menus and options on the analyser). The default factory user password is 2222.

Once a menu is set to “User” a padlock symbol will appear on the button and to continue the user password will need to be entered to gain access.

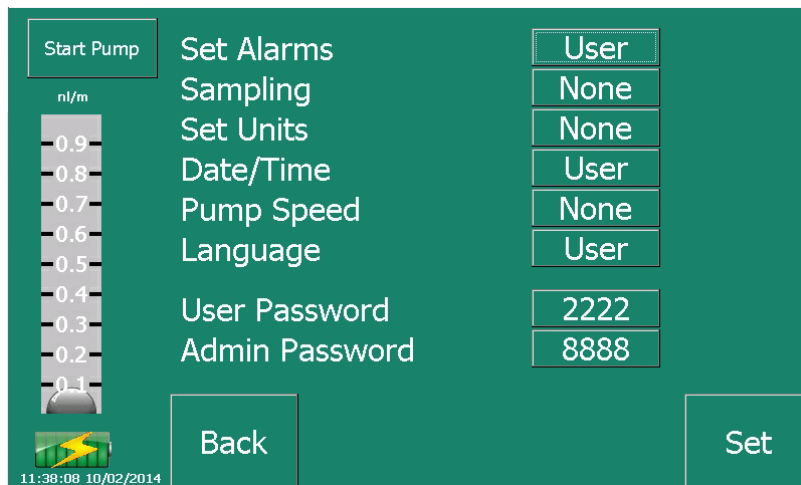


Figure 34: The password administration screen allows sensitive menus to be locked with a user password.

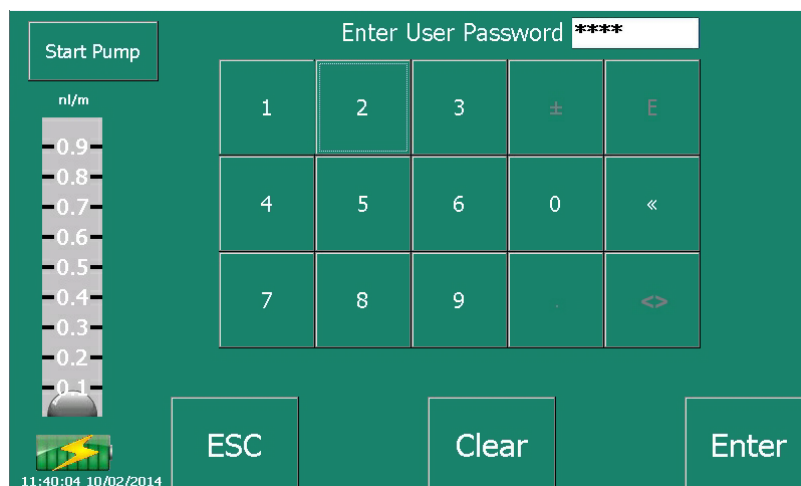


Figure 35: Once a password is enabled the user password will have to be entered to gain access to the menu button that is locked.

Press “Set” to store the new settings. Please contact Cambridge Sensotec for advice about how to recover a lost Administrator password.

5 Options Menu

The Options Menu displays various settings that the user may use to set the analyser up initially. Also included here are some diagnostics and other system tools. The “Data Transfer” button remains grey until you insert a memory stick into the socket (8) as shown in Figure 1. If padlocks are displayed then these options are password protected. See 4.8 for more information.

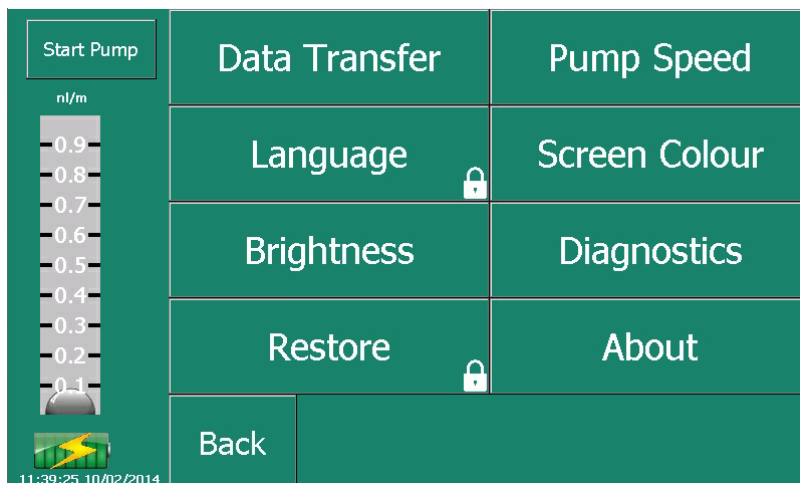


Figure 36: List of options Menu. The “Data Transfer” option remains grey until a suitable USB memory stick is attached.

5.1 Data Transfer

Use this function to transfer data onto a memory stick and view with Excel or similar programs. The memory stick should have sufficient space available to transfer the files selected. A warning is given if there is insufficient space.

Select a start data and end date of interest and the size of the files to be transferred will display:

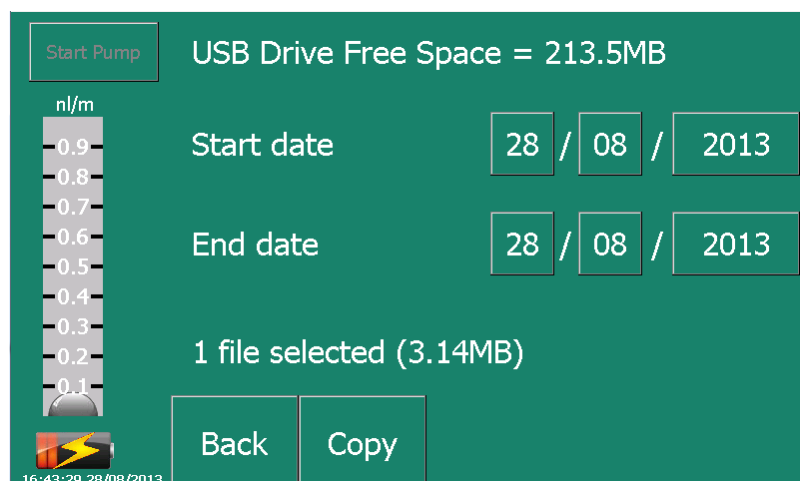


Figure 37: Use this screen to select the range of data to transfer onto your memory stick

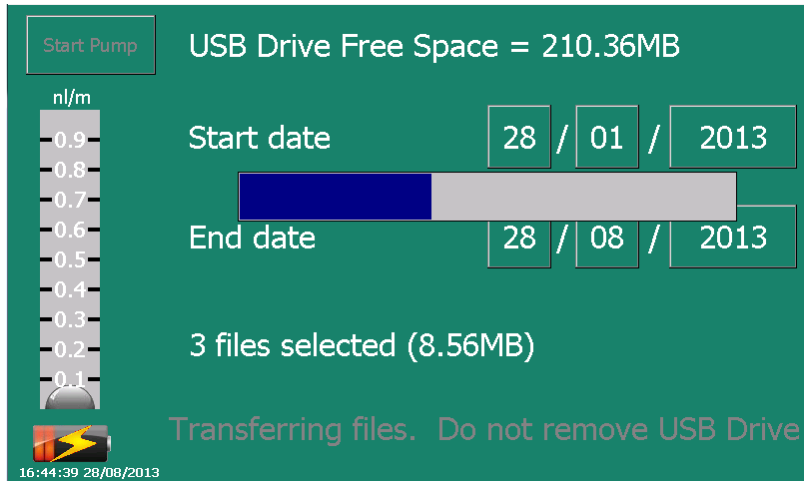


Figure 38: Press “Copy” to begin the transfer. Do not remove the memory stick until told to do so.

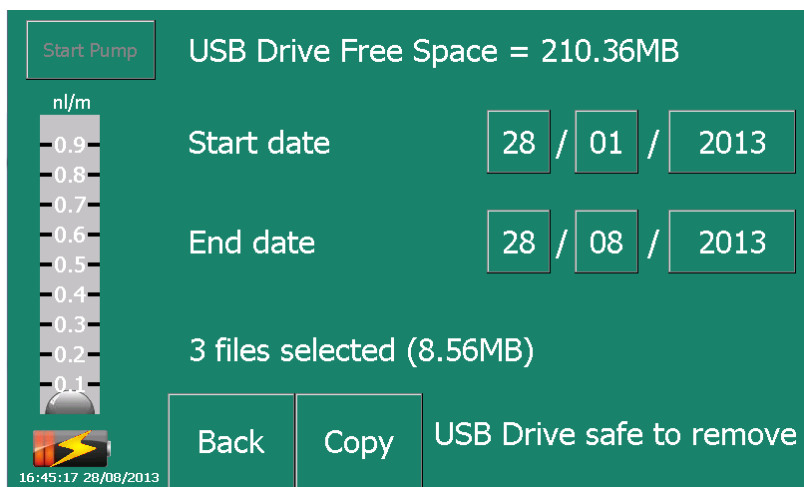


Figure 39: It is now safe to remove the USB memory stick.

The data is in a csv format that can be opened directly into Excel:

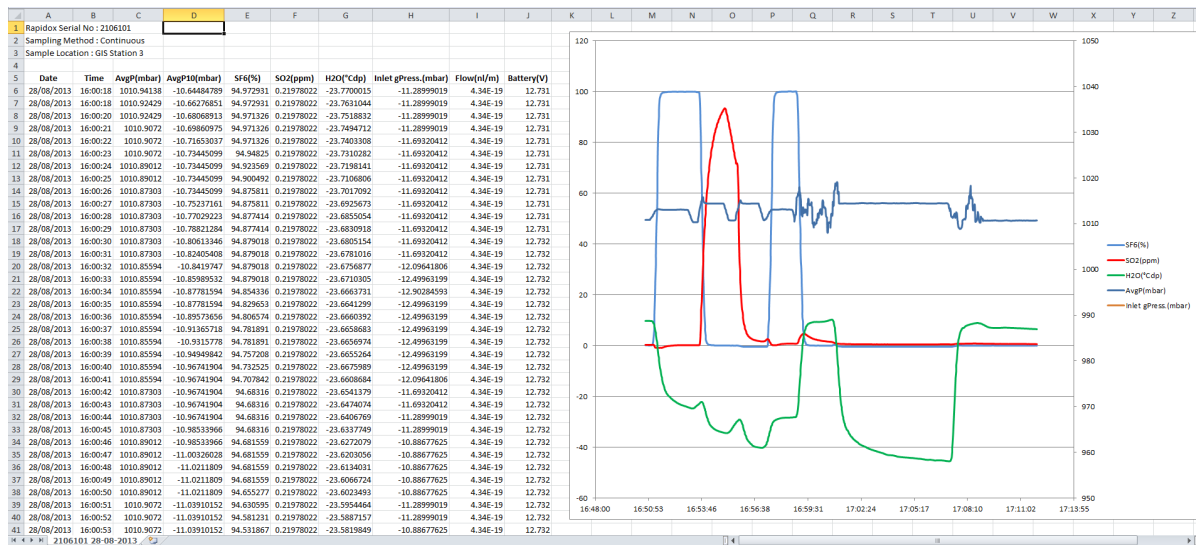


Figure 40: Data from the Rapidox is easily imported into an Excel spreadsheet.

5.2 Pump Speed

The speed of the sample pump in terms of a percentage can be entered here. Normally the pump runs at 100% but a slower speed may be set if smaller volumes of gas samples are required. Please note that if your sample gas is under pressure (this is quite normal if testing gas from a switchgear or bottle) then it is NOT necessary to use the pump. The pump is only required if the gas pressure is too low to flow through the analyser. This would normally be required if the SF₆ gas pressure was less than 0.5bar.

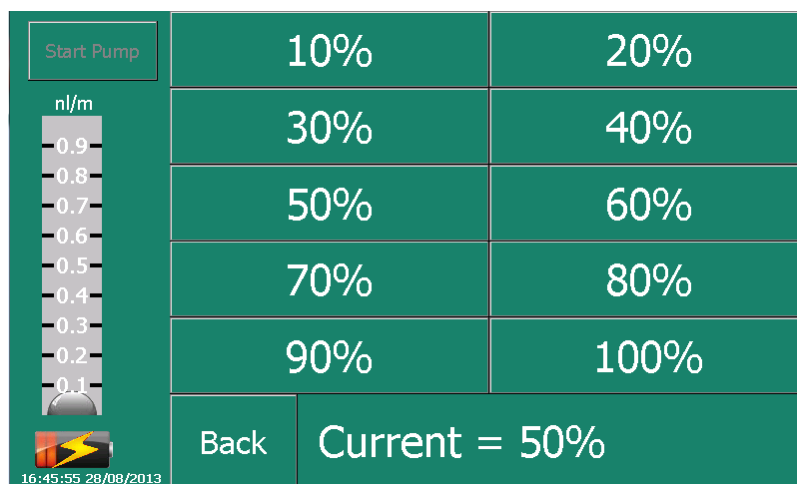


Figure 41: Use this option to set the sample pump speed.

5.3 Language

The default language is set to English but the user can change the screen language to other languages such as Spanish, French, German, Chinese (Mandarin), Turkish, Korean or Portuguese. Note that the analyser will request a system reboot if a different language is selected.

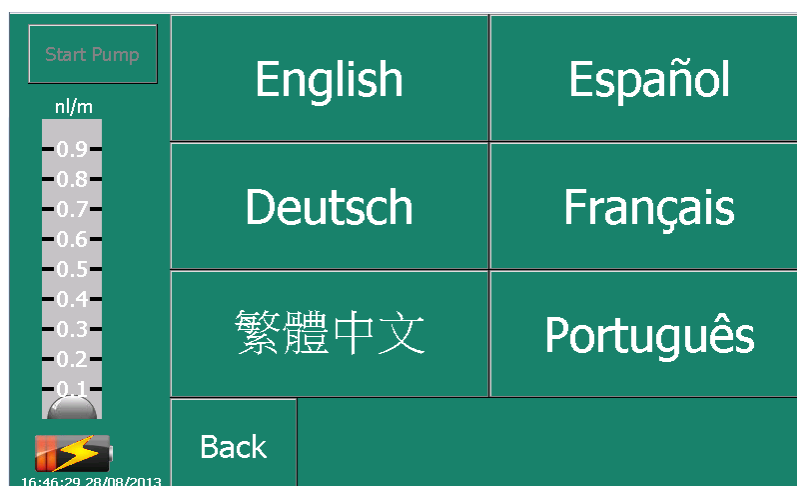


Figure 42: Use this option to change the language setting of the analyser. Not all languages are shown. Requires a system re-boot.



Figure 43: The analyser will ask you to confirm you really want to change the language before performing a re-boot.

5.4 Screen Colour

There are several choices of screen colour and two choices of text colour (black or white). Use the menu below to change the colours to your preference.

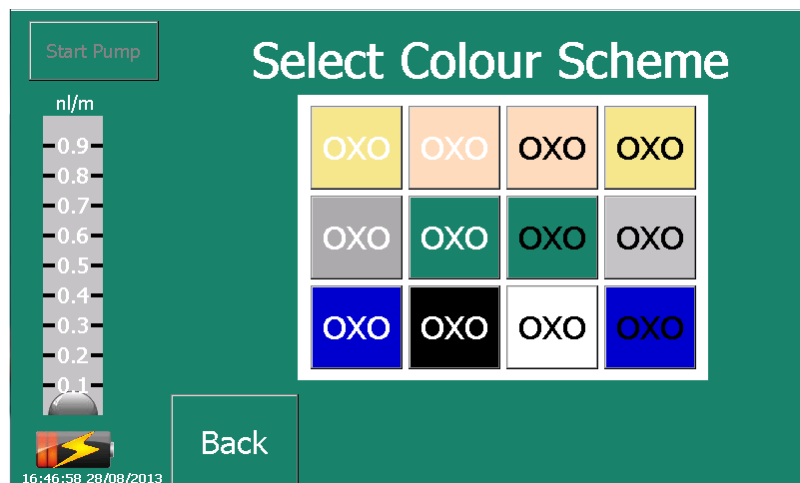


Figure 44: Use this option to change the colour scheme of the display

5.5 Screen Brightness

The brightness of the screen can be increased or decreased using this menu option. The screen brightness does have a significant impact on the battery life of the instrument.

There is also a screen saver option that can be enabled or disabled to help increase battery life. The screen will darken when the saver is active. The user can select a delay time in minutes before the screen saver switches on. The minimum time that can be set is one minute.

Use this screen to change the brightness level. The value will be stored until changed again.

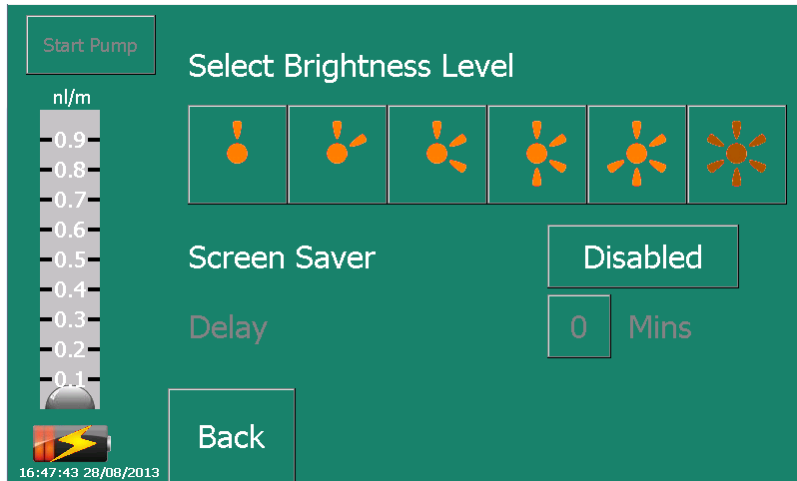


Figure 45: Use this option to adjust the screen brightness and screen saving feature.

5.6 Diagnostics

The diagnostics page provides information that is useful to Cambridge Sensotec when diagnosing problems with sensors or calibrations. The screen also displays readings from internal pressure sensors and the battery. Please note that the screen is provided for information purposes only.

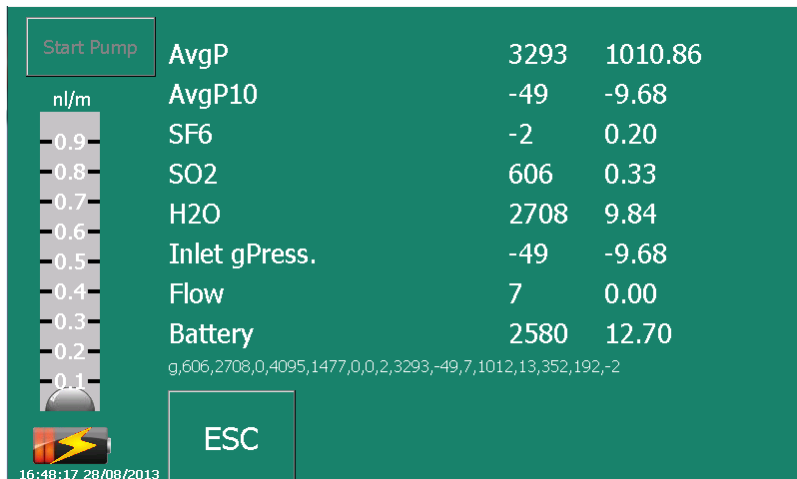


Figure 46: Diagnostics Page

5.7 Restore

This screen can be accessed and used to perform a factory restore of the analyser. In normal circumstances this would only be required if the user is experiencing difficulties with a calibration. Note that all data is lost during a factory restore and the sensors will require a fresh calibration afterwards as only a basic calibration is loaded. The analyser will ask you to confirm that you really do want to restore the machine and will reboot once this has been completed.

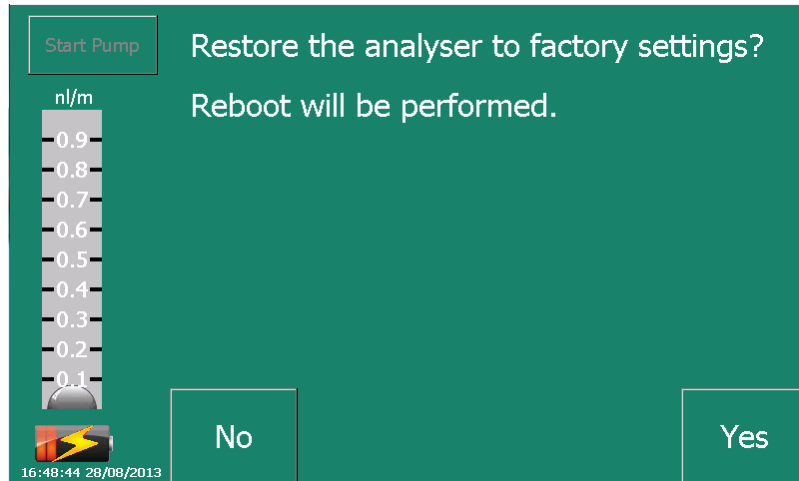


Figure 47: Use this option to perform a system restore.

5.8 About

This screen is for information purposes only and shows the configuration of the analyser including sensors and their ranges.

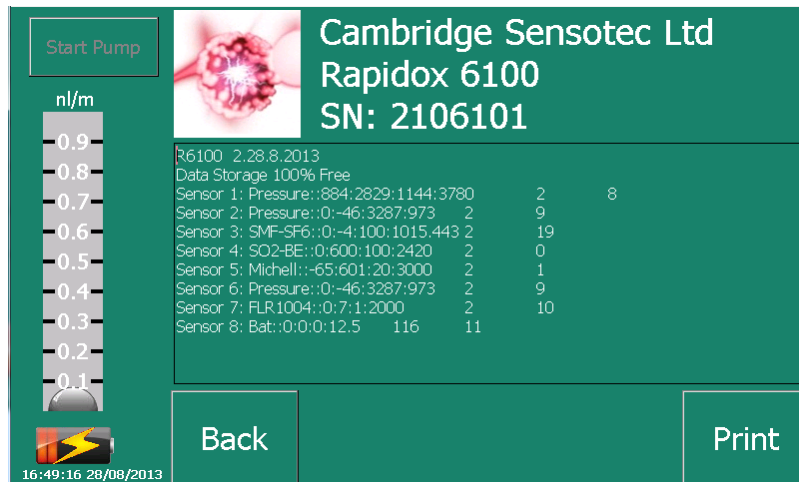


Figure 48: This screen shows important system information about the analyser and sensors connected.

6 Troubleshooting

- Q: When I switch on the unit the SF₆ sensor display says “Wait”.
- A: The infra-red SF₆ sensor needs a bit of extra time to warm up before it can give readings. The Rapidox waits for an internal signal coming from the sensor to say it is ready before displaying readings. This should take around sixty seconds to complete. If the “Wait” message does not clear please contact us for advice.
- Q: When I switch on the unit the H₂O sensor display says “Wait”.
- A: The Rapidox is fitted with a new H₂O sensor that self cleans every time the analyser is switched on. The self-cleaning guarantees that the dewpoint readings remain accurate. This cleaning takes approx. three minutes to complete and happens every thirty minutes of operation.
- Q: Every half an hour in Continuous Mode the H₂O sensor display says “Wait”.
- A: The dewpoint sensor runs a self-clean operation every thirty minutes so if you operate the equipment in continuous mode every thirty minutes you will see the message “Wait”. The cleaning takes three minutes and during this time the alarms and other functions are disabled.
- Q: I see other messages such as “O/Range” or “U/Range” instead of the gas reading.
- A: This message displays if the reading goes above 102% or below 0%. This is usually caused by a bad calibration or if the gas is being forced into the analyser under excessive pressure. Make sure that the back pressure on the gas outlet is not excessive (eg your gas recovery bag is full). Try recalibrating the sensor in question once more, making sure that a sensible flow and pressure are being used. If all else fails try restoring the analyser back to factory setting (see 5.7 for details). Contact Cambridge Sensotec if the message refuses to clear.
- Q: One or more of the sensor readings says “Fault”
- A: Please contact Cambridge Sensotec for further advice.
- Q: The Rapidox won't power up at all.
- A: If the battery is flat then please connect the mains IEC cable and leave the unit to charge for five to six hours. Note that you can use the analyser whilst it is charging. The red LED should change to orange (almost fully charged) to green (fully charged).
- Q: The Rapidox still won't power up at all.
- A: Please check that the fuse located on the side is fitted and is not blown. This fuse is a 3.15A / 3150mA 20mm anti surge fuse readily available from electronics suppliers. The rating of the fuse is given in Table 1 and clearly marked on the artwork of the analyser alongside the socket.
- Q: I get a “Sensor out of Range” warning when I try to calibrate.
- A: Check that the calibration gas value on the bottle matches the value you have programmed into the Rapidox. If they are different then the Rapidox will get a signal it is not expecting and try to warn you with this message. Check that you are not trying to calibrate the sensor ‘backwards’ by applying span gas when you are setting the zero point.
- Q: I messed up the calibration procedure and the analyser is not working properly.
- A: Return the box to the factory defaults using the instructions given in section 5.7 and try again.
- Q: The sample pump is making weird noises.
- A: This analyser is fitted with a state-of-the-art pump which is designed to last many years. It does not have a normal diaphragm so there are no wear parts. In some gases such as pure SF₆ the pitch of the pump can change tune because of the density of the gas changing. It is nothing to be concerned about.

Q: Do I need to always use the pump?

A: No if you are feeding gas to the analyser under pressure (e.g. from a gas bottle or gas compartment) then you can and indeed should switch the pump off. The gas will flow under pressure through the pump even when it is off. The pump should only be used if the gas pressure is below 0.5bar.

7 Warranty

The Rapidox analyser and the sensors have been carefully tested and inspected before shipment and are guaranteed to be free from defective materials and workmanship for a period of twelve months from date of purchase and delivery. However, if the analysis gas contains corrosive gases or large quantities of particulates, sensor life may be shortened. In the case of the latter, it is normally possible to insert a filter prior to the sensor head to remove the particulate material. Damage caused to the sensors by contamination, chemical attack or water ingress will not be covered by this warranty.

7.1 Conditions of Warranty:

- 1) This warranty is in addition to and does not affect any statutory rights of consumer purchasers. This warranty is valid worldwide on a "back to base basis".
- 2) This warranty covers breakdowns due to design or manufacturing faults; it does not apply to damage, however caused, wear and tear, neglect, unauthorised adjustment or repair, or any items of limited natural life.
- 3) In the event of failure, please take the following action:
 - a) Refer to the "Troubleshooting" section of your instruction manual to identify and possibly correct the problem.
 - b) If the fault cannot be resolved, please contact the Cambridge Sensotec service and repair centre at the address given on the cover of the manual.
- 4) The warranty period applicable shall be 12 months from the date of delivery provided that:
 - a) Notice in writing of the defects complained of shall be given to Cambridge Sensotec (The Seller) upon their appearance, and
 - b) such defects shall be found to have arisen from the Seller's faulty design, workmanship or materials, and
 - c) The defective goods shall be returned to the Seller's premises at the Purchaser's expense if so requested by the Seller.
 - d) Any repaired or replaced goods shall be redelivered by the Seller free of charge to the original point of delivery but otherwise in accordance with and subject to these Conditions of Sale.
 - e) Alternatively the Seller shall be entitled at its absolute discretion to refund the price of the defective goods in the event that such price shall already have been paid by the Purchaser to the Seller, or, if such price has not been so paid, to relieve the Purchaser of all obligation to pay the same by the issue of a credit note in favour of the Purchaser in the amount of such price.

8 Appendix 1: Analysers Without an SF₆ Sensor Fitted

If your analyser has been built without an SF₆ sensor fitted (ie as a dewpoint only type) then there needs to be some additional features added to help with the readings and calibration of the electrochemical sensors.

With an SF₆ sensor present, the electrochemical sensor (SO₂, H₂S or CO) reading is straightforward because the reading of SF₆ is used to make density corrections. This is important because the high density of SF₆ dramatically affects the electrochemical sensor response.

It is important that users who don't have an SF₆ sensor fitted can select whether they are running these sensors in SF₆ or N₂ (or air) background gas, so the following Menu "Set Units" is modified to allow this to happen. This replaces the screen shown in Figure 31 above.

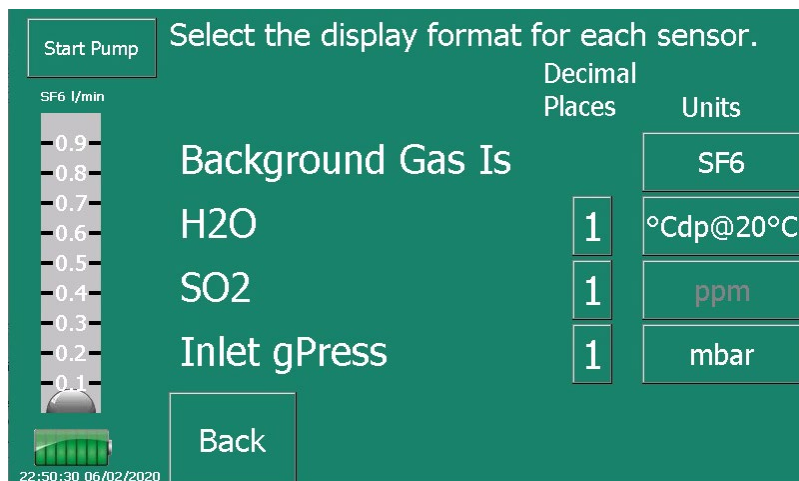


Figure 49: Modified "Display Units" Menu which allows the user to define the background gas as either SF₆ or N₂ (or air).

Note that selecting the wrong background gas will give approximately a 50% error in reading on the SO₂, H₂S and CO sensors so it is vital that this setting is made correctly.

9 Technical Specification

Property	Specification
Mains Voltage for charging	90-260Vac 50/60 Hz using an external 24V charger block (supplied)
Lithium Battery Operation	Up to 8 hours on a single charge 5-7 hours to fully charge from flat
Analyser dimension	470mm (w) X 360mm (d) X 180mm (h)
Weight	8.5 kg without accessories
Sample Time (timed Mode)	2 - 8 minutes user selectable. A minimum of six minutes is required for H ₂ O measurements.
Display	7" full colour PC touch screen
Warm up time	15 minutes at 20°C
Normal operating conditions	Temperature -10°C to 40°C Humidity 10 to 90% RH Pressure 800 to 1100 mbar absolute.
Minimum Gas Inlet Pressure	0.3 bar
Maximum Gas Inlet Pressure	10 bar
Data Output	Via USB memory stick or thermal printer
Sampling	Timed or Continuous modes
SF ₆ Sensor (infra red)	0-100% scale +/- 0.5% full scale accuracy
SO ₂ Sensor (electrochemical)	0-100ppm 0-150ppm or 0-500ppm scale +/- 2% full scale accuracy
H ₂ O Sensor (polymer)	-60 to +20°Cdp +/- 2°Cdp of reading accuracy Optional display corrected to 20°C available
CF ₄ Sensor (balance)	>20 <80% scale calculated as a balance gas
HF Sensor (electrochemical)	0-10ppm scale (0-20ppm and 0-30ppm ranges available on request) +/-2% full scale accuracy
Air (electrochemical O ₂ sensor) or N ₂ (balance)	0-100% scale +/-2% full scale accuracy
CO & H ₂ S Sensor (electrochemical)	0-1000ppm scale +/- 2% full scale accuracy
Sample Pump	Long life diaphragm pump with ten speed settings
Maximum Free Air Displacement	1.2 L.min ⁻¹
Calibration	Calibration by the user using zero and span gases. Not H ₂ O sensor*
Data Logging	Continuous on-board data-logging downloadable via USB
Fuse	T3.15A H250V 20mm anti-surge

Table 2: Technical specification

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