



User Manual 0v5

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Important Safety Information

Before using the product, please read carefully the following safety warnings and make sure that you strictly follow them. Failing to observe any of these instructions **could risk serious injury and/or property damage**. It will also void your warranty.



Always ensure that chargers are free from any damage. In particular, any damage to charger cables/wires or their insulation could cause a **SERIOUS SAFETY HAZARD even if the charger is not connected to the mains power.**

If you notice any such damage, you **MUST immediately disconnect the charger from the equipment as well as the mains power and stop using the charger.**



Please do not attempt to repair the damaged battery charger/power adaptor or rewire/repair the cables. Damaged battery chargers/power adaptors should either be discarded or returned to EMT.



Only battery chargers/power adaptors provided by EMT can be used with the equipment. Use of any other manufacturer's battery charger/power adaptor could be unsafe and cause permanent damage to the instrument.



Make sure that the pressure of the gas that is connected to the equipment does not exceed the maximum value indicated near the **GAS SAMPLE port on the equipment fascia. This could be 10 or 12 bar depending on the model.**

Introduction

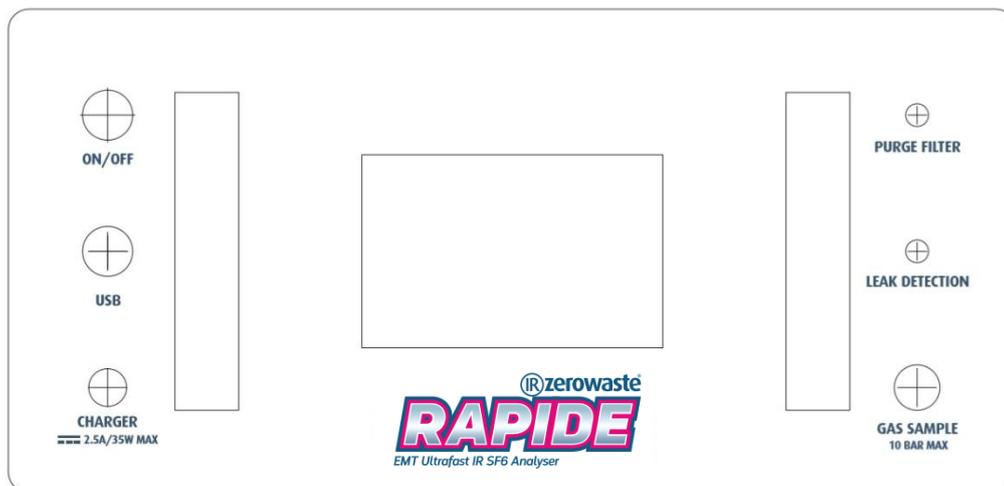
Thank you for choosing EMT IR Zerowaste Rapide SF6 impurity gas analyser. The Zerowaste Rapide builds on the success of the Zerowaste incorporated with a fast response time. It has the following features:

- Complete measurement cycle in as short a time as 1 minute
- Can measure up to 10 gases per cycle
- Uses advanced infrared absorption technology to measure SF6, H2O, HF and CF4 in addition to SO2, CO, H2S with electrochemical cells bringing laboratory-standard measurement to the field.
- Internal compressor for pumping gas back.
- Fully battery operated even during gas pump back.
- Automatic sampling with up to 3 sequential measurements.
- Automatic pump back for sampled gas (user selectable).
- Automatic start of measurement upon detection of gas connection (user selectable)
- Innovative modular design that allows for the measurement of the largest number of gases offered in the market.
- Optional built-in SF6 leak detection module.
- Full colour, touch screen display with user friendly interface.
- Data logging.
- User-Selectable methods to display compliance with different standards.

This has been made possible by utilising some of the best experience and knowledge in gas sensing, spectroscopy and product design together with an extensive knowledge of the SF6 impurity market.

Basic Components

Main Unit



The main unit houses the sensors, a pump back compressor, a battery, the pneumatic and control system assembly as well as the touch screen display. The unit is powered by three processors: a system, a sensor and a user interface processor.

The unit is available in three model variants - ZW3, ZW6 and ZW8 depending on the selection of gases ordered. Additional and/or special gases such as CO₂ and R12 can also be ordered - please contact EMT.

The top fascia houses the touch screen display, the ON/OFF switch as well as the following connectors:

1. **PURGE FILTER:** This connector is used to connect the purge filter tube which must be permanently connected to the purge filter connector on the unit at all times.
2. **LEAK DETECTION:** This connection is used to connect the leak detection probe. The leak detection probe is an optional accessory that can be ordered with the unit.
3. **GAS SAMPLE:** This connection is used to for connecting and pumping back the gas to be measured. Gas pressure in the range of 0.2 to 10 Bar can be sampled.
An option for 12 bar gas pressure is available.
Please contact EMT for further details
4. **CHARGER:** This connection is used to connect the battery charger. Please note that only the charger supplied with the unit should be used for re-charging the internal battery.
5. **USB:** A USB Memory Stick can be connected to the analyser via a the short adaptor cable supplied. This allows the logged data to be transferred directly to a USB stick in form of a CSV file.

Purge Filter Tube

The purge filter tube contains special filter material that provides clean dry air that is used during the purge phase of the measurement cycle. The filter tube is mounted on the fascia and held in position using spring clips.



Purge Filter Refill Sachets and Filling Funnel

The sealed sachets contain fresh filter material. These sachets are to be used to refill the purge filter tube which must be done at least once a week or when the instrument displays a “Filter Replacement Due” warning message.



Battery Charger

A universal battery charger is provided with UK, US and European interchangeable mains/power plugs.

The charger also accepts a standard “figure of 8 mains cable” as shown below (not provided) if preferred.



The battery charger is used to re-charge the internal battery. The pumping back of analysed gas to the circuit breaker or to a waste vessel is done by an internal compressor pump connected to the battery. The battery must be charged to a certain level to allow the pump back operation. Therefore, where possible the unit should be used with the battery charger connected to AC mains power so that the battery is continuously charged.

Optional Accessories

Leak Detection Probe

The flexible probe is provided with all units ordered with the leak detection option. The probe plugs into the LEAK DETECTION Port of the instrument through a coiled tube that is extendable to 1 meter.



Power On

The ON/OFF button powers on the unit. The screen will switch on and start to display a sequence of instrument diagnostic and initialisation messages.



As part of the diagnostic routine the instrument checks the flow of air entering via the external filter. Should a restriction be detected inside the instrument a warning screen will be displayed. If this occurs please check that the inlet of the purge filter and the vent on the front of the instrument case are clear. After removing any obstructions press the 'OK' button appearing at the bottom of the restricted flow message screen.

The initialisation stage also checks the date when the filter material contained within the filter tube was last replaced. The filter material should be changed every ten days and a warning message (shown below) will appear if the filter replacement is overdue. Replacement of the filter tube material should be confirmed by pressing the OK button.



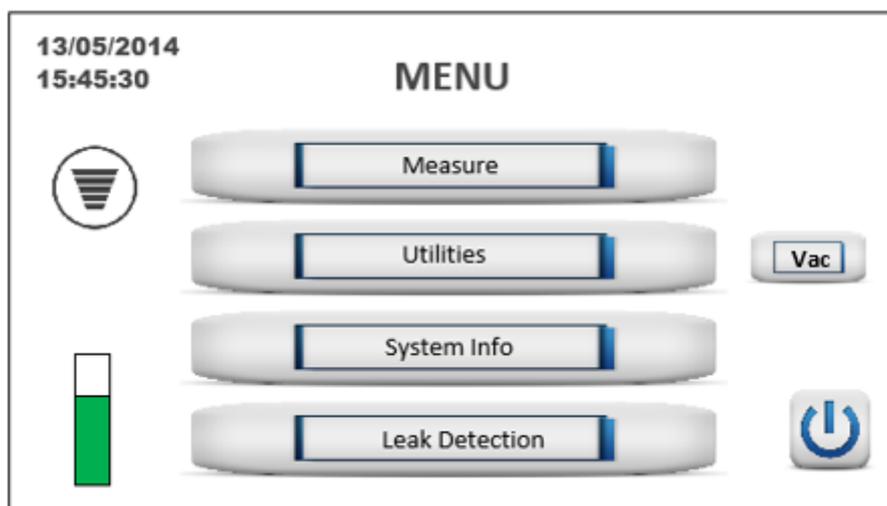
Regular filter replacement will produce reliable and repeatable measurements.

Once the instrument has run its diagnostic checks the instrument will then enter a 1 minute stabilisation period to ensure best measurement performance.

Once the stabilisation period has been completed the Main Menu screen will be displayed.

Main Menu

The main menu screen presents three choices: Measure, Utilities and System Info. “Leak Detection” is an option which will be displayed on instruments with this accessory. “Vac” is used to vacuum the gas from the sample hose before connection to the switchgear to prevent contamination of the sample.



The current date/time and battery status are also displayed. The button  in the lower right hand corner of the screen is the power On/Off button.

Filter Icon

 This shows the condition of the molecular sieve filter material. The black bars progressively turn white as the filter material expires. Replace the filter material when the black bars have all turned white.

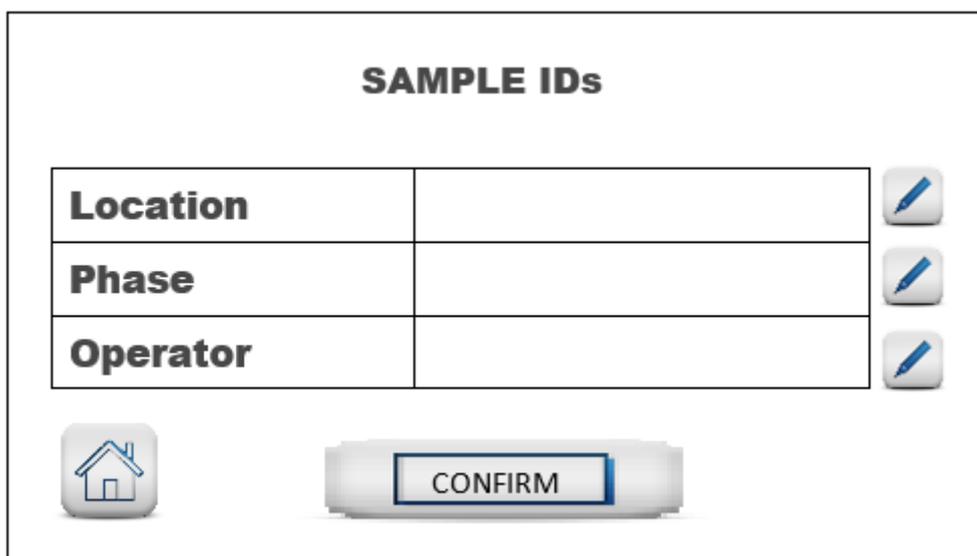
Connecting to a Circuit Breaker or Gas Cylinder

The sample line from the circuit breaker can be connected to the Zerowaste Rapide instrument at any time. EMT is able to provide a universal fittings kit that allows for any circuit breaker to be connected to the standard armoured two metre hose that is provided with the Zerowaste Rapide unit. The two metre hose has a DN7 male connector which connects to the Gas Sample port located on the Fascia of the instrument. Other lengths of sample hose are available upon request.

Taking a Measurement

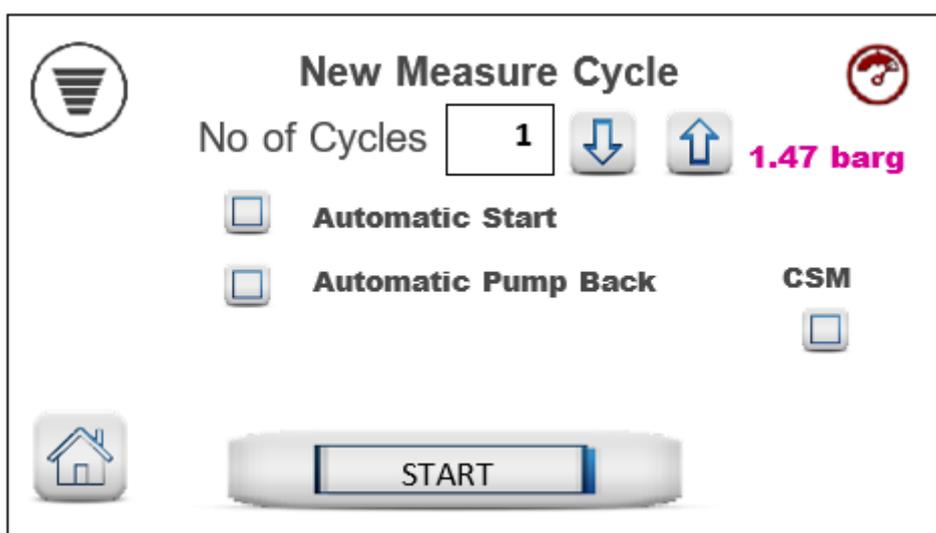
The measurement is started by pressing the Measure button.

The “SAMPLE IDs” screen will be displayed that allows information relating to the gas measurement to be recorded. The purge pump will switch on to prepare the sensors for measurement.



A measurement can be recorded with reference to the Location, the Phase being measured and the name of the Operator. The time and date as well as the gas pressure are automatically recorded. When the “SAMPLE ID” screen is displayed, the screen will show the last Sample ID information that was previously entered. Press the  next to the Location, Phase or Operator boxes to change the Sample ID information using the Keypad displayed. Once the Sample ID information has been entered then press the “Confirm button”.

The “NEW MEASUREMENT CYCLE” screen will then be displayed.



The internal gas storage has capacity for up to 3 measurement cycles of SF6 gas. Automatic Start and Automatic Pump Back are also configurable.

Pressure Reading

The pressure of the gas connected to the gas sampling port on the Zerowaste Rapide unit either from the circuit breaker or from a stand-alone test cylinder is displayed on the above screen. The units of pressure are user selectable and include Gauge Pressure units such as

barg (bar gauge), kPag (kPa gauge), psig (psi gauge) or Absolute Pressure units such as bara (bar absolute), kPaa (kPa absolute), psia (psi absolute).

Please note that, when the instrument is not connected to either a sampling point or test gas cylinder the pressure displayed is the internal pressure of the system caused by the small residual amount of gas within an internal manifold below the fascia where the gas sampling port is situated (approximately 3 cc of gas is contained within tubing connected to the internal manifold).

Number of Cycles

The Zerowaste Rapide allows up to three gas readings before the internal gas storage has to be emptied (see Pump Back). These measurements can be performed sequentially, individually or in any required sequence. Please note that when measuring gases in a background of N₂ or gases other than SF₆ (e.g. SO₂ in N₂ for verification purposes) only one cycle can be stored in the internal gas storage.

To select the number of measurement cycles press the up and down arrows.

Automatic Start

Ticking the “Automatic Start” check box will start the measurement session automatically once the gas is connected.

Please note that this feature is only enabled if the gas pressure is below 0.2 bar before the “NEW MEASUREMENT CYCLE” screen is displayed.

Automatic Pump Back

Ticking the “Automatic Pump Back” check box will instruct the instrument to pump back the gas into the sampling point at the end of the measurement session.

Once the “NEW MEASUREMENT CYCLE” has been configured the instrument is then ready to start the measurement session. Connect the circuit breaker or test gas cylinder to the GAS SAMPLE port if not already connected.

If the Automatic Start is enabled, the first measurement cycle will start automatically; otherwise press the “START” button.

No further actions are required until the measurement session has been completed.

The following sections describe the various stages which run automatically during a measurement cycle.

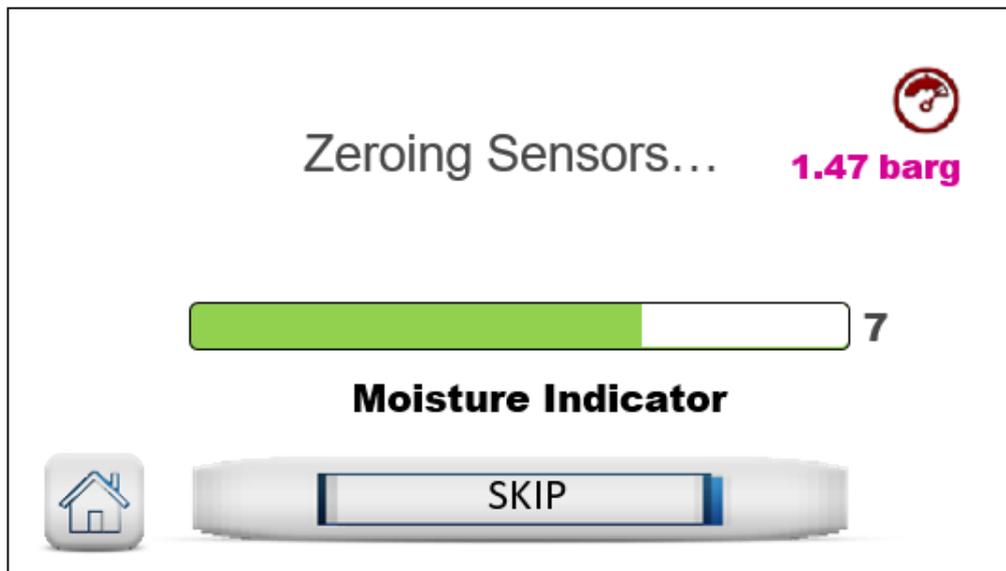
CSM, Continuous Sampling Mode

In Continuous Sampling Mode the analyser can be connected to a gas source (e.g. circuit breaker) and set to take periodically adjustable readings 10 to 600 minutes apart. It then pumps the sample back. The cycle of measurement and pump back continues indefinitely

until interrupted by the user. This feature is used for monitoring a circuit breaker over say a 24 hour period.

The Measurement Cycle

The ZeroWaste Rapide dew point/moisture measurement cycle comprises three stages: Instrument Purge, Analysing Gas Sample and Measurement. The instrument will automatically proceed from one stage to the other until a reading is obtained. A screen message will indicate the current stage of the measurement.



To ensure accurate results, the orientation of the unit should not be altered during the measurement cycle.

During each stage, the top left corner will indicate the current measurement cycle together with the total number of cycles selected for the measurement session in progress.

The estimated time before the current measurement cycle is completed is displayed in the bottom right hand corner of the display.

The measurement cycle can be cancelled at any time by pressing the Home button. This will return the display to the "MAIN MENU" screen.

Instrument Purge

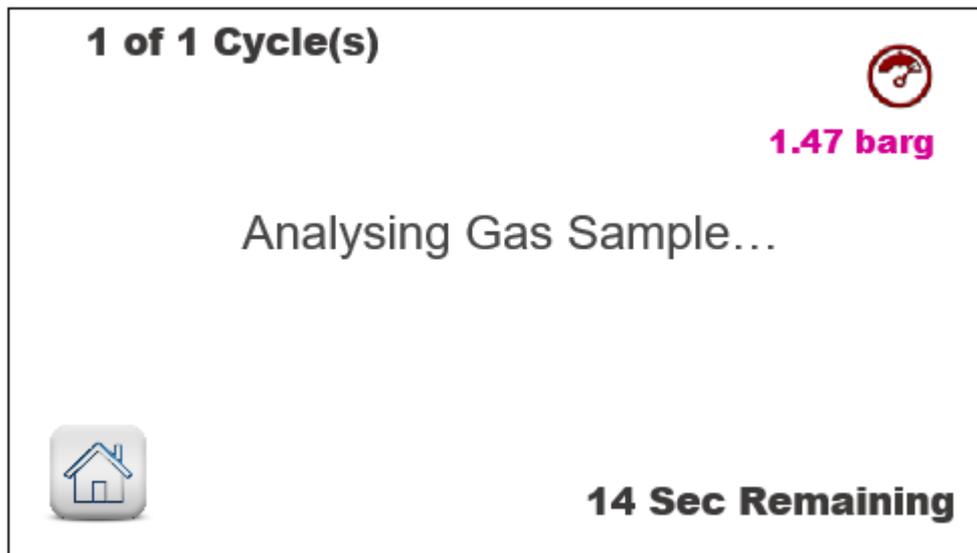
The first stage of the measurement cycle is the Instrument Purge, where the sensors are purged with clean dry air. This starts as soon as the user touches the "Measure" icon. During this stage purge air is vented out through the relief valve on the front of the case.

During the purging instrument stage the instrument checks for any restrictions in the flow of air through the filter tube into the sensors and out through the front vent on the front of the case. If the instrument detects a flow restriction then a "Restricted Flow!" message will be displayed. If the restricted flow message is displayed then the inlet of the filter tube and the relief valve on the front of the case should be checked for any obstruction. The flexible tube connecting the filter tube to the instrument should also be checked to make sure that it is not kinked. Once any obstructions have been cleared the OK button should be pressed.

When the “START” icon is touched the analyser goes into “Zeroing Sensors” screen. The moisture reading of the dried purge air is monitored, when it is stable the analyser automatically zeroes the sensors and moves on to analysing the gas sample. This step can be skipped, it will not affect the SF6 reading but the internal entrained moisture will not have been fully purged from the analyser so the H2O reading may be high.

The input gas pressure is indicated in the top right hand corner of the screen.

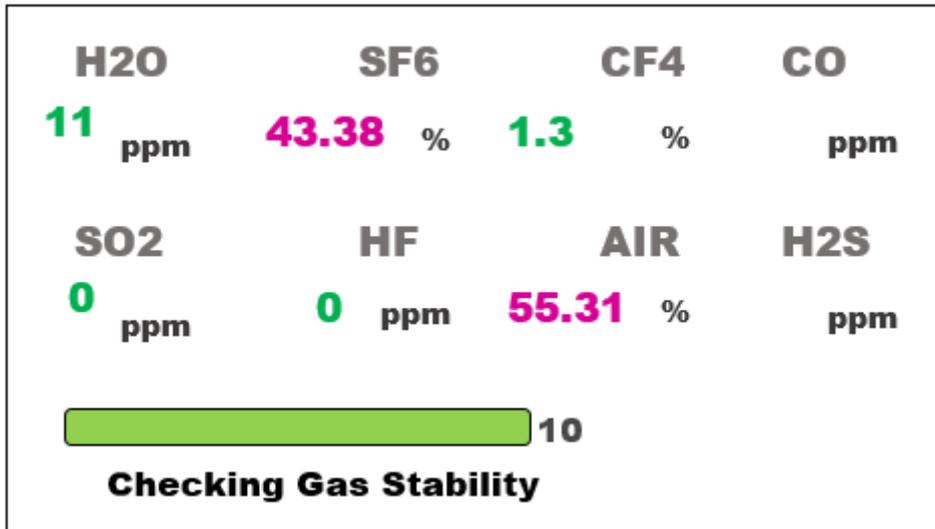
Analysing Gas Sample Stage



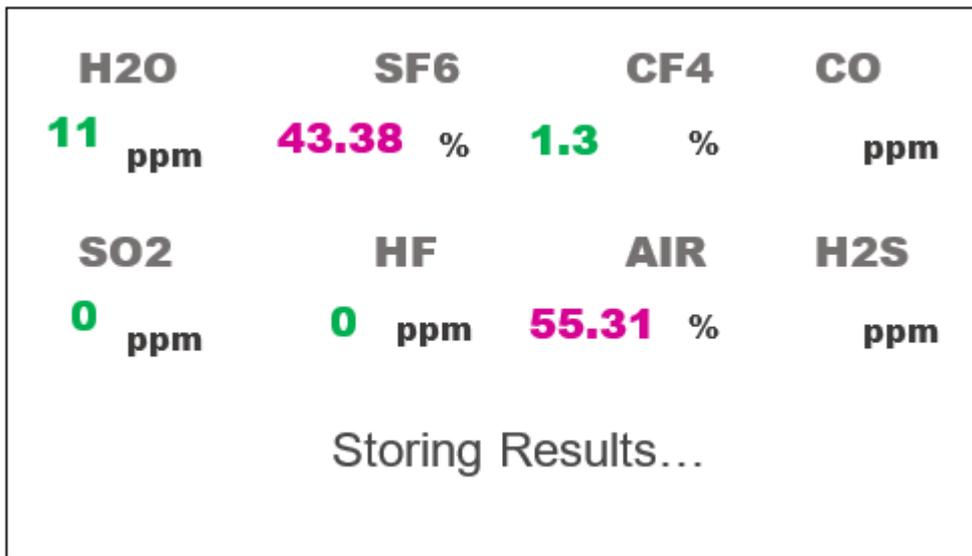
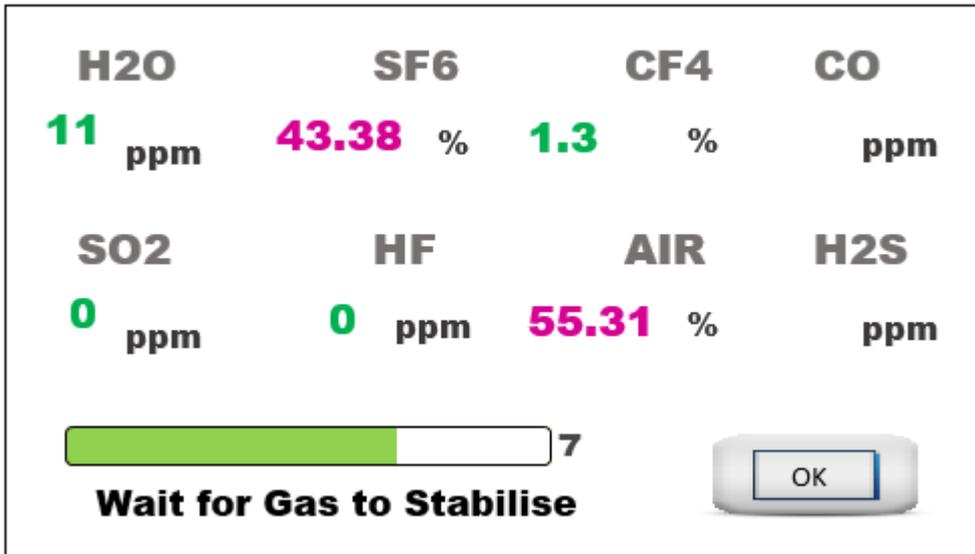
stage The gas sampling and analysis lasts for 1 minute. The time remaining for the analysis is shown in the lower right hand corner of the screen. The vacuum pump and purge pump work in parallel to draw the sample through the sensors to the internal storage. During this period the gas is analysed and the output of the sensors monitored.

Measurement

After the Analysing Gas Sample stage the analyser moves to the Measurement screen. The measurement process starts with the checking gas stability screen:



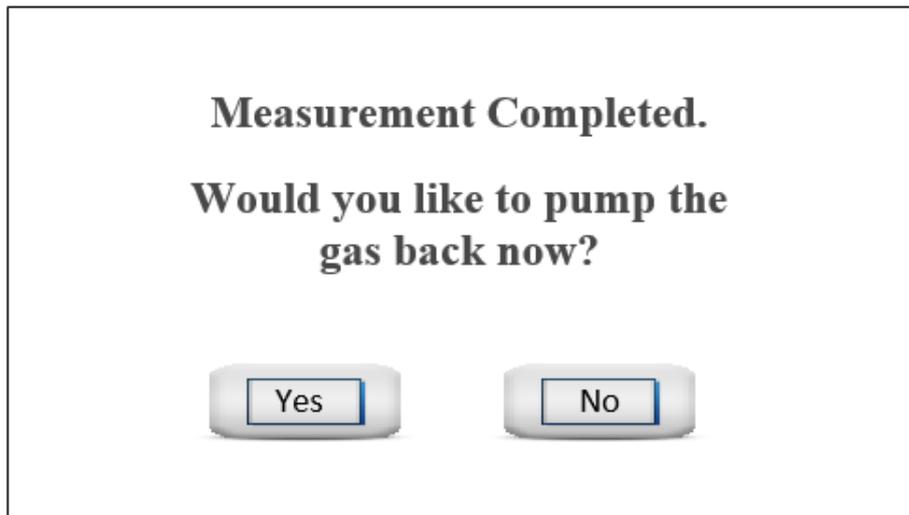
This moves on to the “Wait for Gas to Stabilise” screen which remains displayed until the gas has stabilised or the “OK” button is pressed after which the measurement data is stored. Readings that are within the limits specified in the selected method are displayed in green, while those outside the limits are displayed in red.



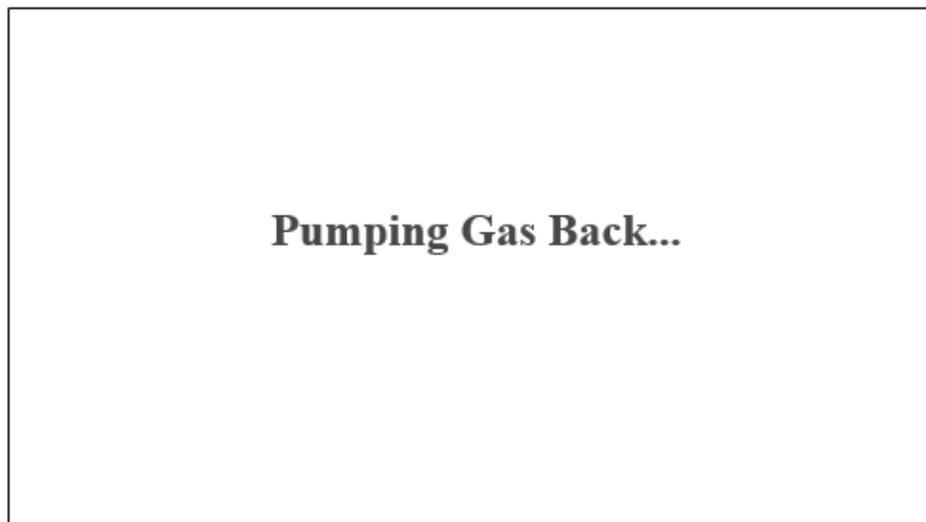
The analyser will then display the pump back screen.

Pumping the Gas Back

When the measurement cycles have been completed the gas collected inside the internal storage can be pumped back. Please note that the battery should have sufficient charge for the compressor to operate and pump the gas back to the breaker or to a waste vessel.



If the "Automatic Pump Back" was selected on the "NEW MEASUREMENT CYCLE" screen prior to commencing the measurement then the gas will be pumped back automatically. If the Automatic Pump back was not initially selected then the message below will be displayed allowing the gas to be pumped back on selection of the YES button.



After the gas is pumped back, the "LOGGED DATA" screen showing the measurement results is displayed. Please refer to the "View Data" section for more information about the LOGGED DATA screen.

Utilities

The Utilities screen provides access to four menus: Setup, Logged Data, Methods and Empty Gas. A detailed description of these menus can be found the "Utilities" section.

System Info

The system info screen shows the serial number of the unit, the software versions for the three processors that power the instrument and the amount of used storage in the logged data memory. The next service due date is also displayed.

System Info	
Unit Serial No:	140908HA04
System Software:	1v6 18/07/2014
Sensor Software:	5v3 8/3/2017
UI Software:	UI170228RP01
Used Memory:	187 of 1000 Records
Service Due Date:	14-Mar-16
Model:	Zerowaste IR8R

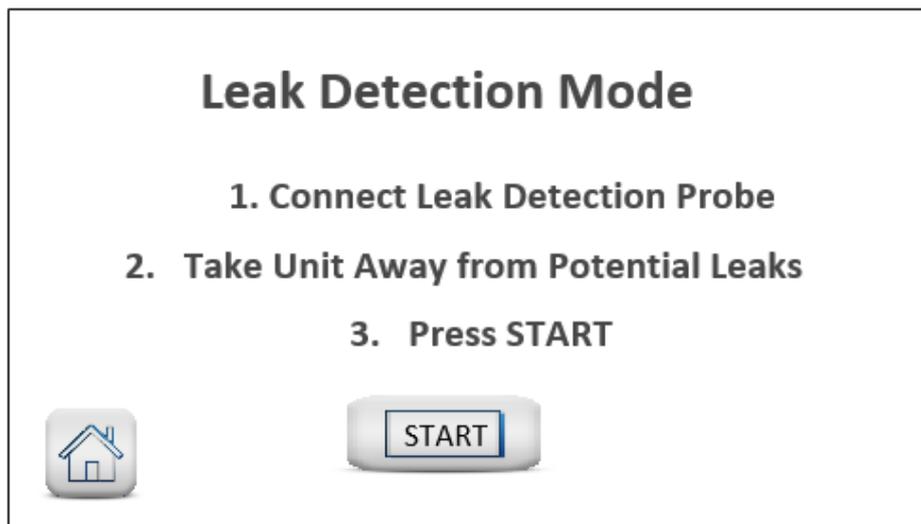


Leak Detection (Optional)

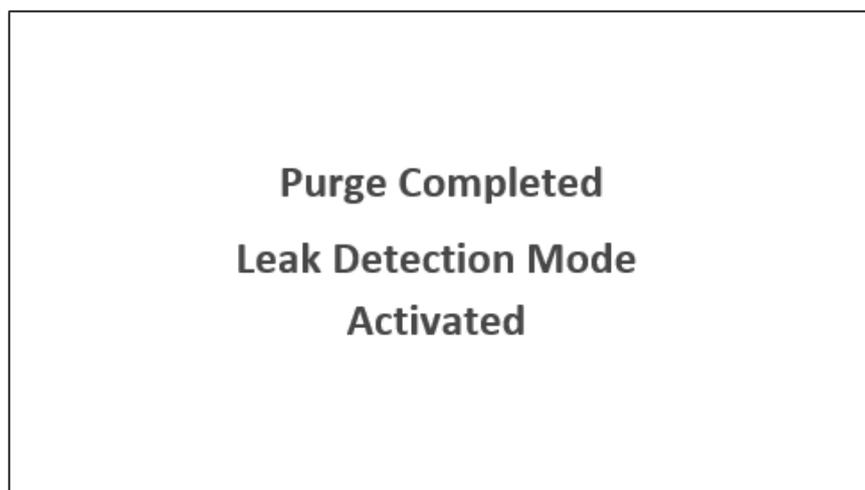
The leak detection option allows SF6 leaks to be located on switchgear apparatus. A leak detection probe accessory is provided with the instrument if this option has been purchased.

Activating Leak Detection Mode

To switch to Leak Detection mode press the “Leak Detection” button on the “Main Menu” screen. Follow the instructions on the “Leak Detection Mode” screen by connecting the leak detection probe to the *LEAK DETECTION* port. The *LEAK DETECTION* port is located on the instrument panel between the *GAS SAMPLE* and the *PURGE FILTER* inlet ports.

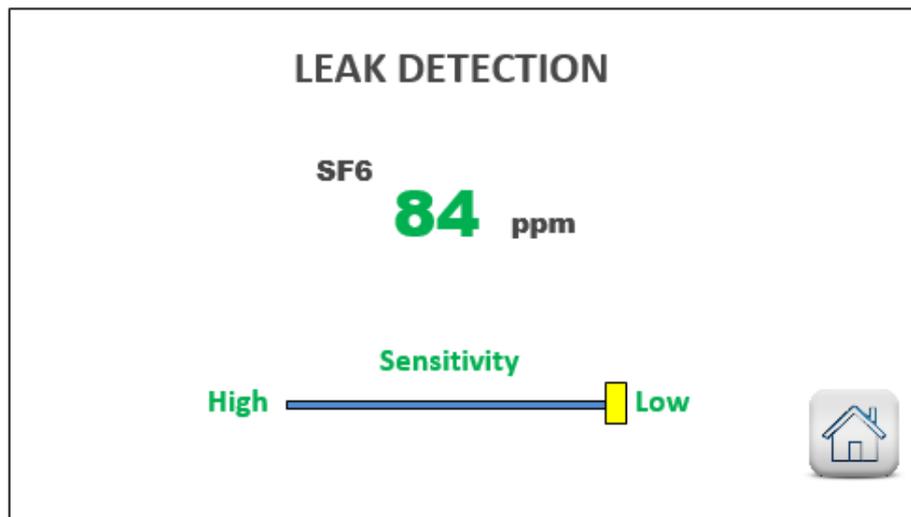


Leaks can be detected even in the presence of a back ground of SF6 gas. The back ground level of SF6 is first established by pointing the leak detection probe away from potential leaks and pressing the “START” button. This operation purges the leak detection sensor and establishes the ambient baseline reading. Once the baseline has been recorded a confirmation screen as shown below will appear on the display indicating that the Leak Detection Mode is activated.



The Leak Detection Screen will then appear indicating the SF6 level. The SF6 leak detection units can be configured for either ppm or gm/year from the Units Setup screen (MAIN MENU-> UTILITIES-->SETUP—>UNITS SETUP)

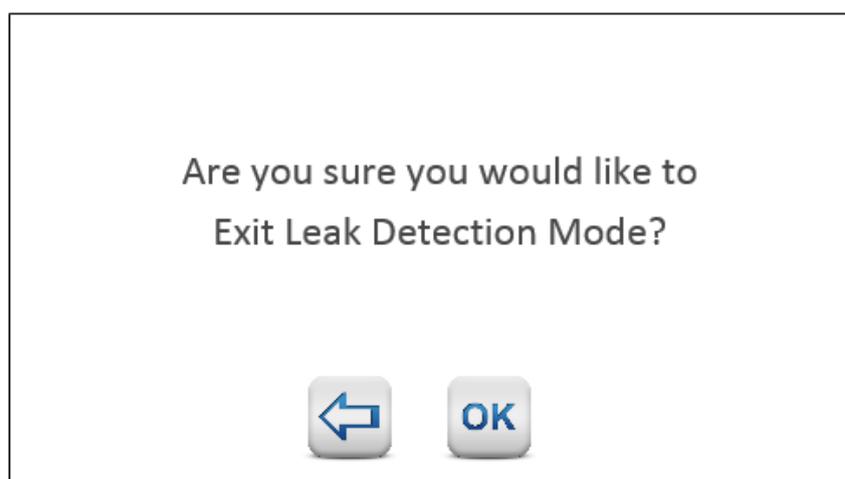
The detection of an SF6 leak is indicated by a measurement reading on the screen together with an audible alarm. The frequency of the audible alarm increases with the level of the leak detected.



The sensitivity slide bar can be used to adjust the sensitivity of the audible alarm to the level of the detected leak. When the bar is set to “High”, the alarm frequency will increase faster with respect to the level of the detected leak making it more suitable for detecting very small leaks. In the “Low” position, the frequency will increase slower which is more suitable for the detection of larger leaks. Note that the sensitivity bar only changes the frequency of the audible alarm and does not alter the measured reading.

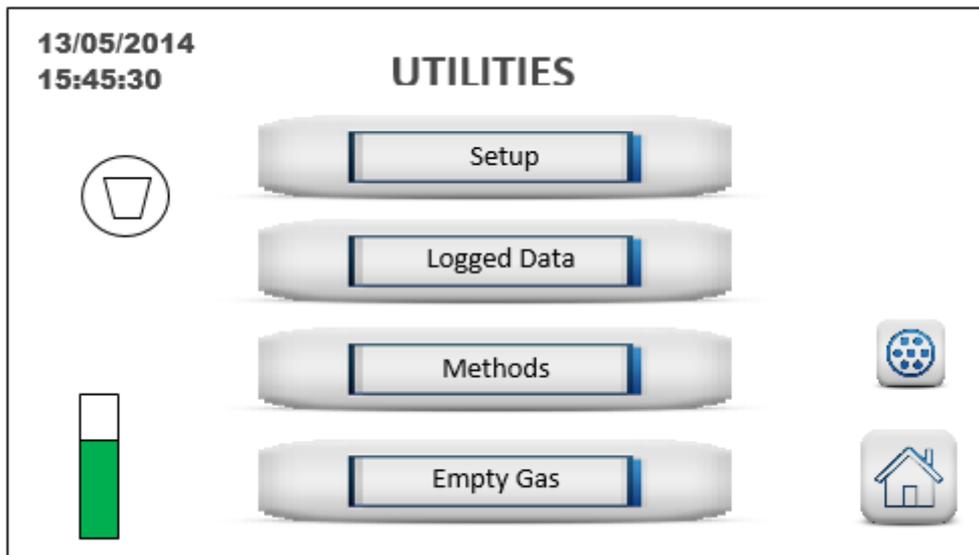
Leaving Leak Detection Mode

To exit Leak Detection Mode, press the  button then Press “OK” to confirm or  to return to leak detection mode.



Utilities

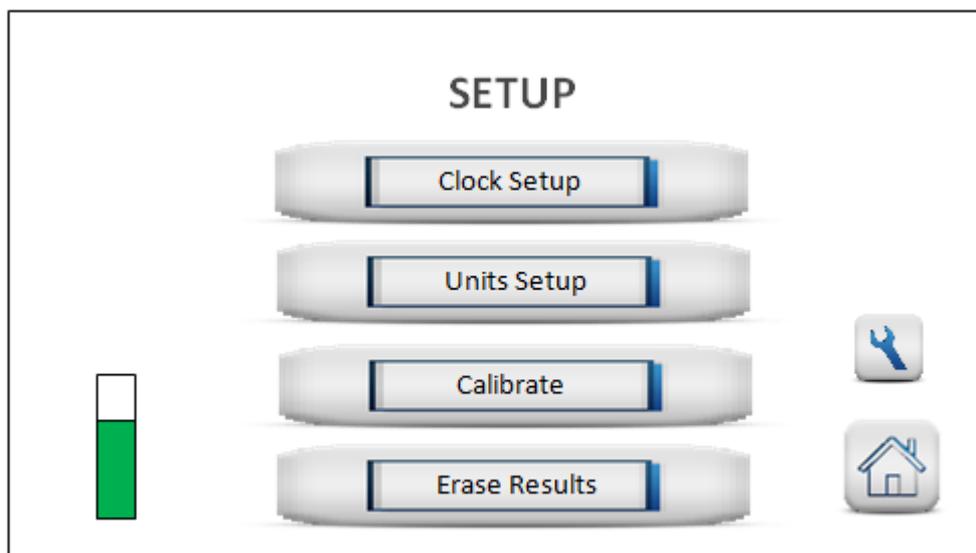
The Utilities screen provides access to four menus: Setup, Logged Data, Methods and Empty Gas. The filter change  button should be used when refilling the purge filter.



Setup

The "Setup Menu" provides administrator level functions to setup the Clock, measurement Units as well as to provide a User Calibration function. The Setup menu also allows the operator to erase the results.

The setup Menu is protected using an Administrator password to prevent unauthorised changes to certain protected functions. If you have administrator rights for the instrument, please contact EMT to obtain the Administrator password.



The “Setup Menu” displays five options:

Clock Setup

The Clock Setup screen allows the time and date to be configured to the local time. Results stored (logged) in the instrument memory are stored with a time and date stamp. Therefore, maintaining the correct date and time is important to ensure that logged data is properly traceable.

Both European or US date format can be selected using the check boxes on the left of the screen.

The date and time can be set using the arrow keys and confirming the entry by pressing the OK button.

Units Setup

The Units Setup screen allows the selection of measurement units for Gas Pressure, H₂O concentration and, when SF₆ Leak detection Option is available, SF₆ Leak concentration.

- Gas pressure units can be selected as follows:
 - Gauge Pressure: barg (bar gauge), kPag (kPa gauge), psig (psi gauge)
 - Absolute Pressure: bara (bar absolute), kPaa (kPa absolute), psia (psi absolute)
- H₂O units can be set to either ppm v, ppm w or °C.
- Leak Detection units can be set to either ppm or gm/year.

Select the units by ticking the appropriate box

Please note that the unit of measurement for a particular gas as well as the pressure unit of measurement are stored on the header of the logged results. Therefore, when changing the unit of measurement of H₂O or the gas pressure, the previously stored data needs to be erased in order for the new header to show the new units of measurements.

The steps required to reconfigure the H₂O channel and Pressure header units are as follows:

- Read and save any previously stored results using the PC, USB Memory Stick (for units with that option) or manually.
- Change the measurement units as required using the “Units Setup” screen.
- Erase the previously stored results (Menu → Utilities → Setup → Erase Results)

A header with the new measurement units will automatically be stored and any newly acquired results will be stored under that new header.

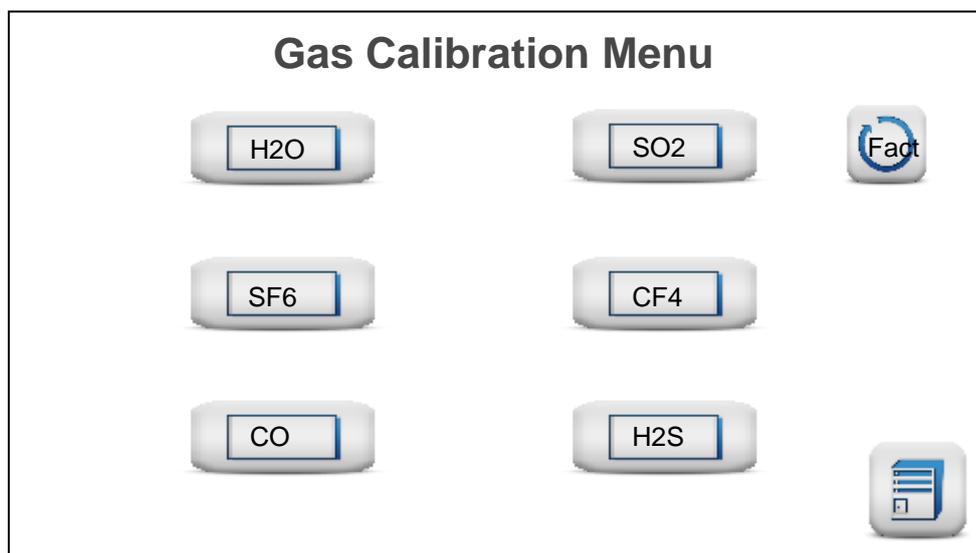
Calibration

The “Calibration Menu” allows you to calibrate gas sensors that are available in your instruments. Calibration gas is required in order to calibrate a gas sensor. Table 1 provides an indication of the concentration of calibration gas that is required in order to calibrate each sensor. Calibration gas between the minimum and maximum concentrations given in the table below can be used for the calibration. To obtain the best performance choose a calibration gas with a concentration close to the normal operating level of interest or close to the allowable concentration limit of your circuit breaking system.

Calibration gases purchased for use with the Zerowaste instrument MUST be balanced using nitrogen gas. The use of a cylinder containing a mixed gas concentration is not recommended as this could result in incorrect readings.

No	Gas	Minimum	Maximum
1	H2O	90ppm	10000ppm
2	SO2	5ppm	150ppm
3	SF6	60%	100%
4	CF4	1%	60%
5	CO	50ppm	1000ppm
6	H2S	5ppm	100ppm

Table 1



The gas icons (H2O, SO2 etc.) will vary depending on the gas measurements ordered with the analyser.

To calibrate a gas channel, first select the channel that requires the calibration and enter the concentration of the calibration gas. The concentration value entered will be checked against the limits shown in Table 1 above and if the concentration is within the limits set by the values shown in the table the calibration cycle will begin.

Connect the calibration gas to the “GAS SAMPLE” port and press “OK”. The calibration cycle will then start.

The calibration cycle proceeds through similar stages to those observed during a measurement cycle. The instrument screen will indicate the progress of the calibration as different calibration stages are reached. A time period of above 5 minutes is required to complete the full calibration cycle. However this is preceded by a Line Purge period to purge the hose from old gas and, in the case of H₂O calibration, an automatic moisture purge.

If the instrument suspects that the connected gas is not of the correct concentration, an error message will be displayed. If the message appears then the concentration entered should be re-checked against the certified concentration of the cylinder and re-entered if required.

The “Fact” button resets the analyser calibration to the original factory calibration. All user calibrations will be lost.

Please note that due to highly reactive nature of HF, user calibration is not offered for this gas. A very carefully designed procedure and specially selected and treated components are used in the factory to ensure accurate calibration of HF. As these are unlikely to be available to users, user calibration can introduce large errors to the instrument readings and is therefore not made available. However, due to the excellent long term stability of IR absorption technology, this calibration will only need to be checked/repeated once a year during the recommended annual calibration of the instrument. If you feel that you are getting low HF readings, please read the FAQ at the end of this manual.



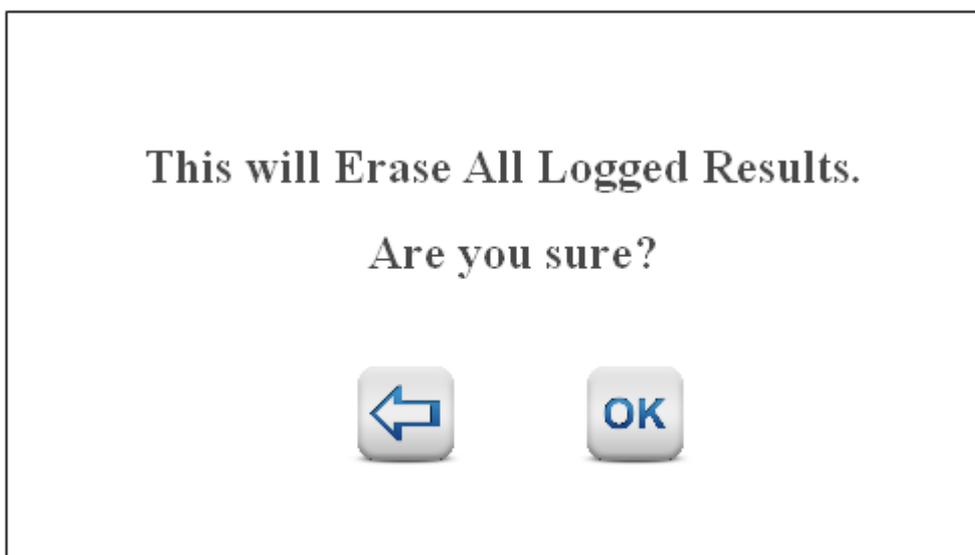
The maximum gas pressure that can be applied to the GAS SAMPLE port is 10 or 12 bar depending on the model. Please ensure that the output pressure of the pressure regulator that is used on the calibration gas cylinder does not exceed that level.



Please note that an internal solenoid valve will stop the gas flowing during different stages of the calibration cycle. Therefore ensure that the type of regulator used with the cylinder can withstand a blockage on its output without releasing gas in an unsafe manner.

Erase Results

The last button in the “Setup Menu” is the “Erase Results” button. All the stored results can be erased by pressing this button. A confirmation screen will appear to ensure that data is not erased accidentally. Press “OK” if you would like to erase the results, or the back arrow to go back to the “Setup” Menu.



Service Menu

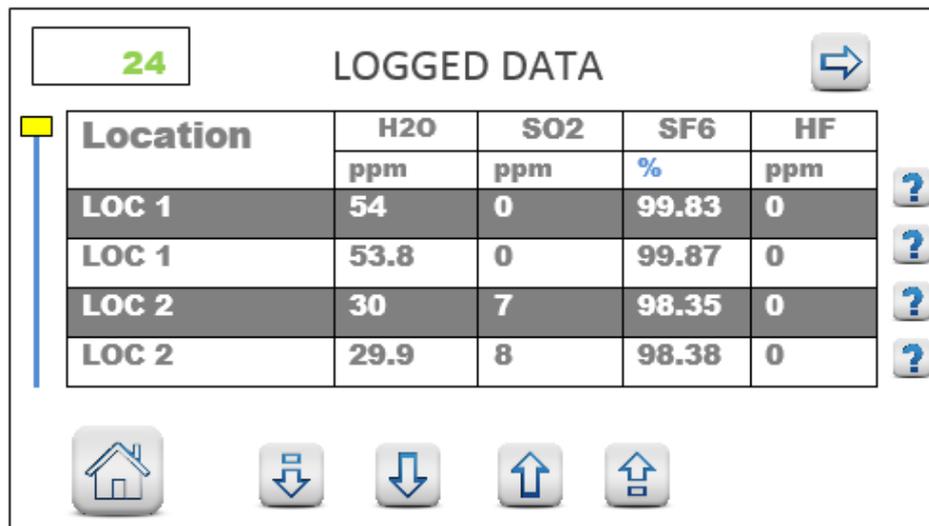
Press the “spanner” icon to open the Service Menu. The Service Menu allows the purge/sample pump, sample valves, leak detection pump (if fitted) and compressor to be operated manually. This is only normally done when testing the analyser in the factory so it is not recommended that the user accesses this menu.

The “H2O Stability Threshold” slider icon at the bottom of the screen has been set for optimum measurement performance. We recommend that the user does not adjust this without consulting EMT first.

Logged Data

Standard units

For standard units, pressing the “LOGGED DATA” button on the “UTILITIES” screen will display the Logged Data screen.



Location	H2O	SO2	SF6	HF	?
	ppm	ppm	%	ppm	
LOC 1	54	0	99.83	0	?
LOC 1	53.8	0	99.87	0	?
LOC 2	30	7	98.35	0	?
LOC 2	29.9	8	98.38	0	?

The Logged Data screen allows all the readings stored in the memory of the unit to be displayed. When the screen is first loaded it shows the most recent readings with the last stored reading shown at the top. The number of records stored is displayed in the top left corner of the screen. There are a number of ways to scroll through the data.

The  and  buttons allow for scrolling through the data by one reading at a time.

The  and  buttons allow you to scroll to the top (most recent data) and bottom (earlier data) in the logged data record.

A slider on the left side of the screen also allows for scrolling through the data. The slider position indicates the relative position of the displayed data with respect to the full record.

The H2O readings can be displayed in units of ppmv, ppmw and °C. Pressing the “H2O” label header allows the units displayed on the logged data screen to be changed.

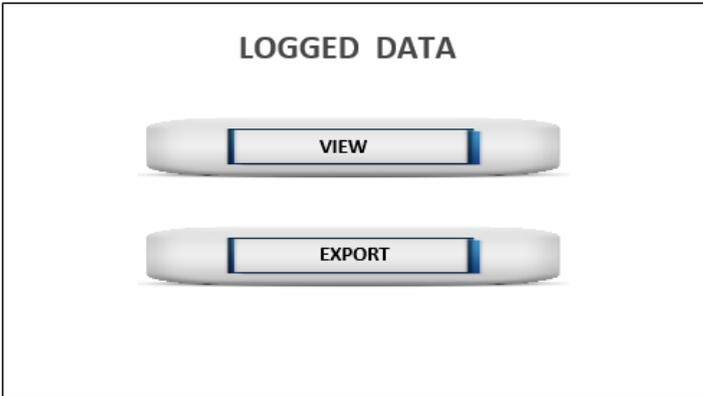
The displayed data shows the gas readings, the gas pressure and the location. To view additional information associated with the recorded data such as the date and time as well as the phase and operator strings, press  the button next to the required record. This shows the following screen:

Reading Record				
Gas	Reading	Unit	Sample IDs	
H2O	75	ppm	20/05/16 14:07:23	
SO2	0	ppm	Location	Sf6test20
SF6	99.83	%	Phase	
HF	0	ppm	Operator	bh
CF4	0	%	Method	IEC60480-1
AIR	0.16	%		
CO		ppm	GasP	3.98 barg
H2S		ppm		

USB Memory Stick Interface

Logged data can be exported onto a USB Memory Stick from the analyser as a CSV file. The memory stick should be plugged into the short USB adapter cable supplied with the instrument. This adaptor cable should then be connected to the USB connector located on the instrument panel.

The following screen will be displayed when the “LOGGED DATA” button on the “UTILITIES” screen is selected.

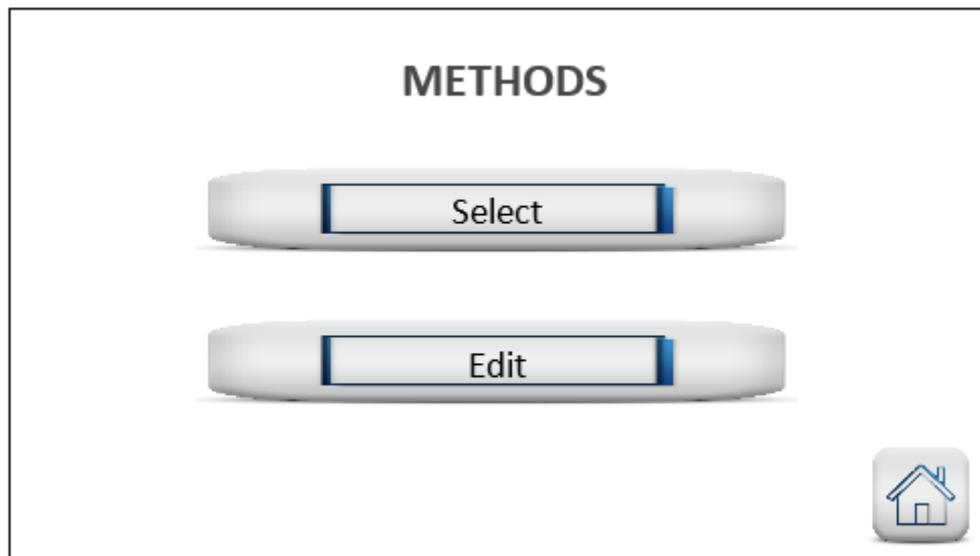


To transfer data to the USB memory stick press the “Export” button and enter a file name for the data to be stored using the alphanumeric keypad. The filename can contain alphanumeric characters but should not contain special characters such as +, /, ;, <, =, >, [\] | or any spaces. The file name length should not exceed 8 characters.

Pressing the “View” button allows the data to be viewed on the screen as described above.

Methods

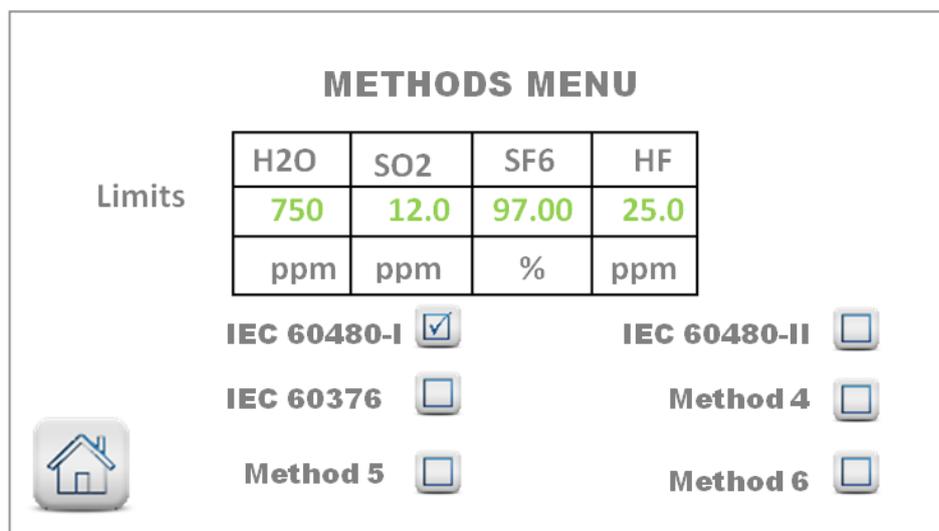
Methods refer to international IEC standards that define the maximum allowable concentration limits of decomposition products for gas used in a circuit breaker. To display the Methods menu go to the UTILITIES screen and select the “Methods” option. The “METHODS” menu screen allows for a method to be either selected or edited.



Selecting a Method

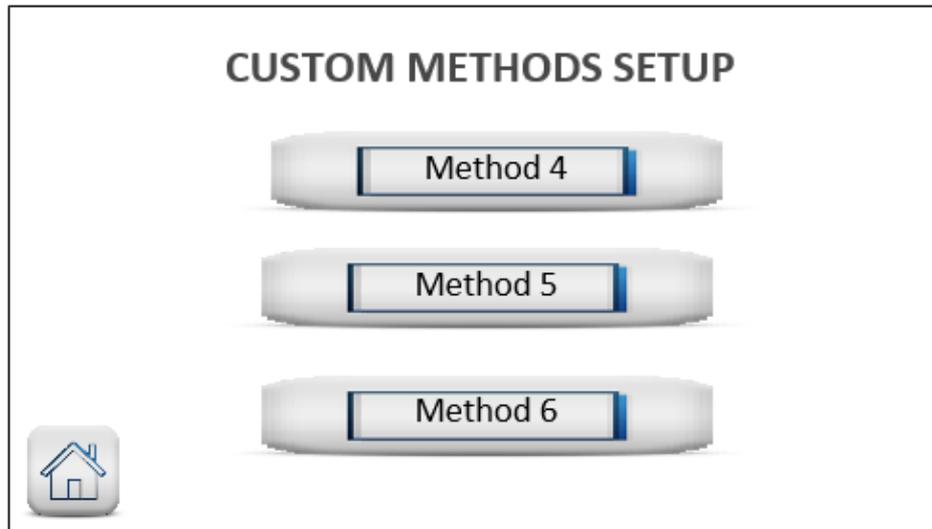
A method can be selected by pressing the “Select Method” button. The “METHODS MENU” screen will then appear showing six method options. Three of these options are pre-designated for IEC standards (IEC 60480-I, IEC 60480-II and IEC 60376) and three further methods (4, 5 and 6) are available for customer specific configuration.

Clicking on the tick box next to the method selected will display the minimum allowable concentrations gas levels associated with the method selected.

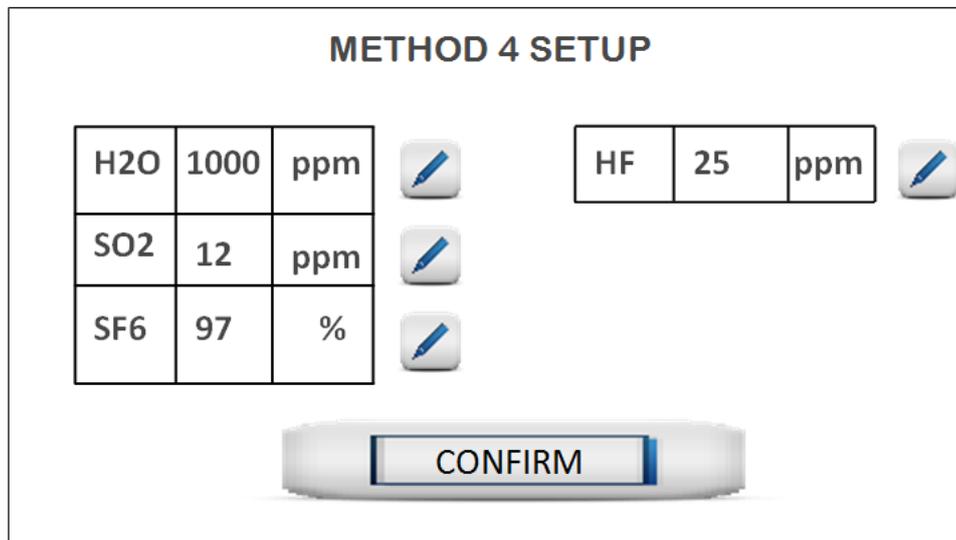


Customising a Method

To customise one of the three user-specific methods go to the “METHODS” screen and press the “Edit Method” button. The “CUSTOM METHODS SETUP” screen will be displayed allowing methods 4, 5 or 6 to be selected.



When one of the three methods is selected the “METHOD SETUP” screen will appear.



The “METHODS SETUP” screen displays the current thresholds for the different decomposition gas products. To change any of the values click to the right of the value then enter a new value using the numeric keypad. Confirm the number entered as correct by pressing the OK button. After all the gas threshold values are set press the Confirm button to save the new settings.

Empty Gas

The internal gas storage can be emptied by pressing the “Empty Gas” button on the “UTILITIES” menu screen. Pressing the button will empty the gas from internal storage back into the sampling point or into an external storage tank.

Refilling the Purge Filter

The Purge filter tube located on the face plate of the instrument is an extremely important part of the instrument. Material inside the purge filter tube allows air entering the instrument during purge cycles to be dried before entering the sensor system.

Use of the purge filter material is shown by the Filter icon:



Filter material new.



Filter material expired.

The purge filter material should be refilled on at least once a week or more frequently if the instrument is heavily used (Sealed sachets of purge filter material must be supplied by EMT). Should the filter material exceed its maximum usage, a warning message will appear when the instrument is switched on. The “Filter Replacement is due” message (see page 8 of this manual) will be displayed. Follow the on screen instruction and replace the filter material. Press the OK button to confirm that the filter material has been replaced.

The filter material can be replaced at any time by selecting the filter icon  displayed on the “UTILITIES” screen. Replacement of the filter material is a straightforward task.

The purge filter tube should be first disconnected from the instrument panel. Empty and discard the filter material by unfastening and removing the fitting on the end of the filter tube.

Refill the tube using fresh filter material from a sealed filter refill sachet and the funnel provided. Tap the side of the funnel and the filter tube to ensure that the filter material is properly packed inside the filter tube.

Do not overfill the tube – make sure that there is enough thread visible inside the tube entrance to re-attach and screw home the fitting. The fitting is supplied with an O ring that provides a seal between the fitting and the tube.

Tighten the fitting to ensure that the tube is properly sealed. Failure to tighten the fitting correctly can produce inaccurate readings.



Re-attach the filter tube to the instrument panel. Re-connect the hose attached to the filter tube to the purge filter port on the instrument panel and ensure that there are no kinks in the hose.

On the "FILTER CHANGE" screen displayed on the instrument press the OK button to confirm that the filter material has been replaced. The instrument will then be updated and the new filter replacement date stored in the memory.

The instrument will then perform an automatic purge drawing air through the filter allowing the filter material to settle and removing any air pockets trapped in the tube during the refilling process.

Charging

In order to charge the instrument's internal lead crystal battery please plug the battery charger supplied with the instrument into the charger socket. A tri-colour LED indicator located on the battery charger shows the charging status.

Charging takes place in the following stages.

Indicator LED colour	Function
Orange	First stage constant current
Yellow	Second stage constant current
Green	Final termination charge

Charging before Storage

EMT recommends that the instrument should be fully charged before returning the unit to a storage location. Charging the unit before placing it in storage will lessen the likelihood of deep discharge occurring to the internal lead crystal battery. To charge the battery please see the section entitled "Charging" above. Note – that the unit can be left on charge when placed in storage to prevent deep discharge from occurring.



Always ensure that chargers are free from any damage. In particular, any damage to charger cables/wires or their insulation could cause a **SERIOUS SAFETY HAZARD even if the charger is not connected to the mains power.**

If you notice any such damage, you **MUST immediately disconnect the charger from the equipment as well as the mains power and stop using the charger.**



Please do not attempt to repair the damaged battery charger/power adaptor or rewire/repair the cables. Damaged battery chargers/power adaptors should either be discarded or returned to EMT.



Only battery chargers/power adaptors provided by EMT can be used with the equipment. Use of any other manufacturer's battery charger/power adaptor could be unsafe and cause permanent damage to the instrument and void any warranties.

Selection of Options

The Zerowaste can measure the largest number of gases available in the SF6 impurity world market today. This not only gives you the best picture possible of the condition of your switchgear, but also helps to provide you with the most accurate readings.

Virtually all gas sensors potentially suffer from some form of cross interference of one form or another. This is simply the effect when the presence of one gas affects the reading of another. Due to the high selectivity of IR absorption technology that is used in the Zerowaste, such cross interference effects are minimised, although not completely eliminated. However, as the Zerowaste is capable of measuring the widest range of gases present in the application, it uses compensation algorithms to further correct for any remaining cross interference. Putting it simply, the effect of any gas on the other gas channel readings is effectively removed during the factory calibration by applying correction algorithms.

However, if a gas is not measured, it would not be possible to correct for its effect on other gases. Therefore, to obtain the most accurate readings for all gases the maximum number of gas channel options should be selected when purchasing the instrument.

This is particularly true if the instrument is used to measure a gas mixture containing sulphur hexafluoride (SF6) or carbon tetra-fluoride (CF4). The CF4 option **MUST** be selected otherwise readings of SF6, H2O and HF could be out of specifications given at the end of this manual. This criterion also applies to carbon monoxide (CO). If the expected level of CO is above 100ppm then the CO option is recommended to ensure the measurement accuracy.

Frequently Asked Questions (FAQ's)

Q1 I am getting low or no reading on the HF channel.

Answer:

Hydrogen fluoride is a very reactive gas that can be easily absorbed by the components between the gas source and the instrument. For example, after fitting a new stainless steel regulator and stem to an HF cylinder, any gas that flows through these components will initially be completely absorbed by the metal work contained in the regulator and stem. A 100ppm HF gas may have to flow for almost an hour before enough of the HF passes through the regulator and stem to be measured! Even then a considerable amount of the flowing HF gas stream would continue to be absorbed during the test. Components used in the instrument have been selected and passivated using a number of techniques to ensure that HF introduced to the instrument is measured correctly. Therefore, when sampling gas directly from the switchgear the HF reading obtained will be accurate provided that PTFE tubes and stainless steel connectors are used.

Q2 I think that the instrument is showing inaccurate readings

Answer:

The Zerowaste has been designed and tested to give consistent and accurate readings. Inaccurate readings are caused by used or contaminated material within the purge filter tube. Please refill the filter with fresh filter material and repeat the measurement.

Inaccurate readings can also be produced if the purge filter tube is not correctly fitted. Please refer to "Refilling the Purge Filter" section above for guidance on the correct position of the purge filter tube.

Q3 Why do I sometimes see varying moisture readings when I take repeated samples?

Answer:

Changes in the moisture readings between sequential samples obtained from the same sampling point is usually a reflection of the changing moisture level of the gas as it flows through the external hose and fittings.

Moisture is embedded within the lining of the hose and fittings. This moisture will diffuse into the gas stream affecting its moisture content. During this process the moisture, embedded in the lining, asymptotically approaches that of the gas increasing the stability of moisture level in the gas.

The moisture level of the gas takes time to stabilise and this time depends on several factors including the difference between the moisture level of the gas and that in the hose lining, the

material of the hose lining, the flow rate of the gas and the length of the hose and its cross section.

The instrument is unique in that it allows up to 3 consecutive samples to be measured automatically which allows the best performance and the most accurate readings to be obtained. The high sample flowrate purges the hose of moisture before the measurement.

Q4 The sample line length is set to the provided 2 m length: what if it needs to be extended?

Answer:

The instrument software is configured for use with a two metre hose. However, EMT can provide longer hoses of either 6 metres or 12 metres in length for use with the instrument. If longer hoses are required then a software upgrade of the instrument has to be undertaken.

Q5 On reading of Dewpoint in DegC, at what pressure does the analyser carry-out the measurement?

Answer:

The instrument makes measurements at Standard Atmospheric Pressure (1 atm) which is the equivalent of 1.01325 bar a.

Q6 The sample line has a Rectus fitting at the instrument end; why not have the same fitting at the other end?

Answer:

The EMT supplied hose for use with the instrument has a ½ inch Swagelok female fitting. EMT supply a UNIVERSAL FITTINGS KIT that has been designed so that circuit breaker fittings, however they are configured, have to be attached to the ½" Swagelok fitting. EMT fittings are therefore used in a two stage connection at the circuit breaker. This prevents gas being lost to the atmosphere during a test on a live breaker. This is a very safe and important aspect of the EMT designed connection to the circuit breaker and is unique to EMT.

Technical Specifications

Gases Measured	Gas	Range	Repeatability	Technology
	SF6	60-100%	+/-0.5%FS ¹	NDIR
	Dew Point	-60 to -30oC	+/-20ppm v	NDIR
		-30 to +20°C	+/-0.5°C	
	HF	0-200ppm	+/-5% FS ¹	NDIR
	SO2	0-150ppm	+/-2% FS ¹	Electrochemical
	CF4	0-60%	+/-1% FS ¹	NDIR
	CO	0-1000ppm	+/-5%FS ¹	Electrochemical
	H2S	0-100ppm	+/-5%FS ¹	Electrochemical
¹ FS: Full Scale (of Measuring Range)				
SF6 Leak Detection	Detection Limit	3 gm/year		
	Technology	NDIR		
Screen	Type	TFT		
	Size	4.3" 16:9(wide aspect ratio)		
	Resolution	480x272 dots		
	Transmission Mode	TN/Transmissive/Normally White		
	Dot Pitch	0.198x0.198mm		
	Colours	24bit		
	Touchscreen	Integrated resistive touchpanel		
	Backlight	White LED PWM		
Luminance	350Cd/m2 (Typ.)			
Memory	Type	Flash EEPROM		
	Capacity	1000 readings		
Battery	Type	Lead Crystal		
	Capacity	10Ah		
	Operating Time	>8h		
	Charger input	100-240V- 50/60Hz		
PC Communications	Type	USB		
	Class	HID		
	Connector	Mini AB		
	0.5 to 10 bar	0.2		
Operating Environmental Conditions	Temperature Range	-20 to +50 °C		
	Humidity	0-95%RH non-Condensing		
	Ambient Pressure	800-1100 mbar		
Physical Specifications	Weight	16Kg		
	Maximum Dimensions	L500xW300xD470 mm		

Note: Due to EMT continuous programme of improvement, this specification is subject to change without prior notice.

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