GASCLAM 2

SOFTWARE MANUAL

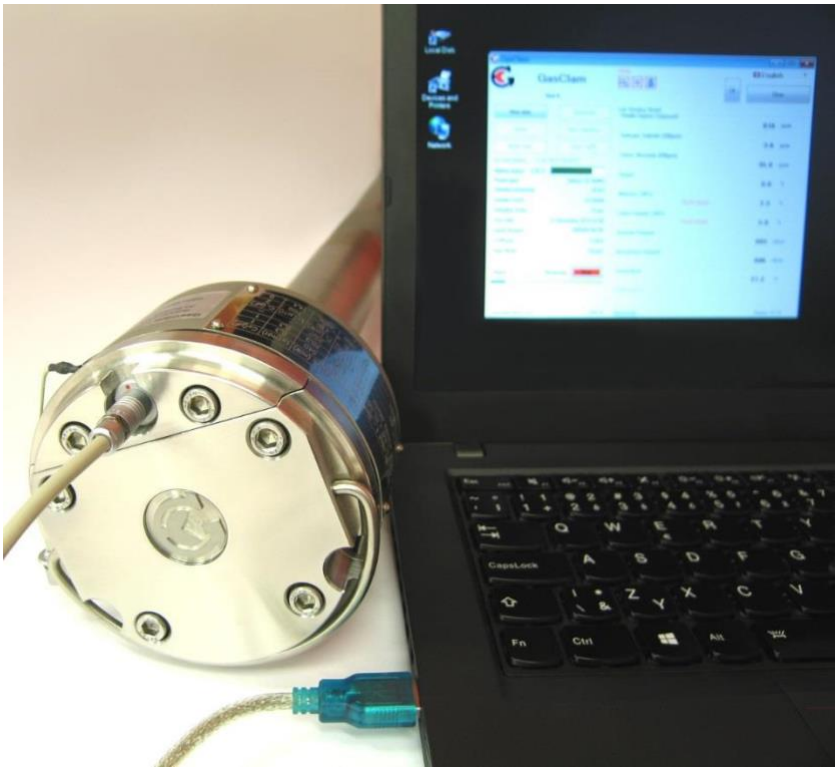


Table of Contents

In this manual a Warning identifies conditions and actions that pose a hazard to the User or the Unit.

WARNING: Before using the GasClam you must read this and the user manual paying particular attention to the sections covering optimisation of GasClam performance and the effects of water.

WARNING: Do not connect or disconnect any cables in hazardous areas and do not use non-approved equipment in hazardous areas such as laptops, notebooks and mobile phones.

WARNING: For reasons of intrinsic safety, batteries MUST NOT be changed within hazardous areas. Always ensure you are in a safe area before carrying out any type of work on your GasClam.

WARNING: To maintain the Unit's certification and intrinsic safety use ONLY GasClam approved batteries.

1. Introduction

⚠ WARNING: All connections between a PC and a GasClam and all software settings must be performed outside the hazardous areas.

1.1. Version Compatibility

This manual is for GasClam 2 software version **6.1.11** onwards.
SW version 6.1.11 can be used with GasClam 2 using firmware **8.03** onwards.

1.2. System Requirements

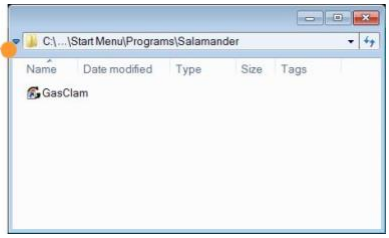
This GasClam 2 software will run on the following operating systems:

Windows 7
Windows 10

The software needs 46 MB of free space on the hard disk for the installation.

The GasClam 2 software installation package (the latest version can be provided by your service centre) also includes dotNet Framework (downloadable also from the Microsoft website).

1.3. Software Installation



Download GasClam 2 software from www.ionscience.com
Run the "setup.exe" file from the folder.
The guide will then go through the installation step by step.
The default location for the GasClam 2 software is:
C:\Program Files\Salamander\GasClam 2
The software can be installed for all users or just the current user.
The GasClam 2 shortcut is in the startup menu.

1.4. Function

The GasClam 2 software is used to:

- Configure the GasClam 2 for logging
- Download the logged data
- Perform primary analysis of logged data
- Export data for more detailed analysis in other programs such as Excel.

The software is also used to perform a periodic "Bump Test".

The main settings for logging are the logging interval, variable interval logging programme, the number of samples, the outlet gas venting method and whether a borehole water level sensor is fitted.

To help make data analysis easier the software can also set each GasClam 2 a "friendly" name so that if more than one GasClam 2 is being used on a monitoring site it is easier to identify the Unit.

2. Connecting GasClam 2 to a PC

⚠ WARNING: Do not connect or disconnect any cables in hazardous areas and do not use non-approved equipment in hazardous areas such as laptops, notebooks and mobile phones.

2.1.1. Connecting to a GasClam 2

Whilst the GasClam 2 is outside the hazardous area it can be programmed using a computer with the GasClam 2 software. Use the Serial Communication Cable (supplied) and an RS232-USB converter (not supplied) (The RS232 convert may need to install drivers the first time it is connected to the computer).

1) The GasClam 2 must have a charged battery inserted. (See User Manual to change batteries correctly)

2) Remove the cap from the GasClam 2 Com Port and carefully connect the Serial Communication Cable ensuring that the two red dots are aligned, then push for a firm click.

3) Connect the Serial Communication Cable to the RS232 converter and connect to the USB port of the computer.

4) Start the GasClam 2 software using the shortcut icon.

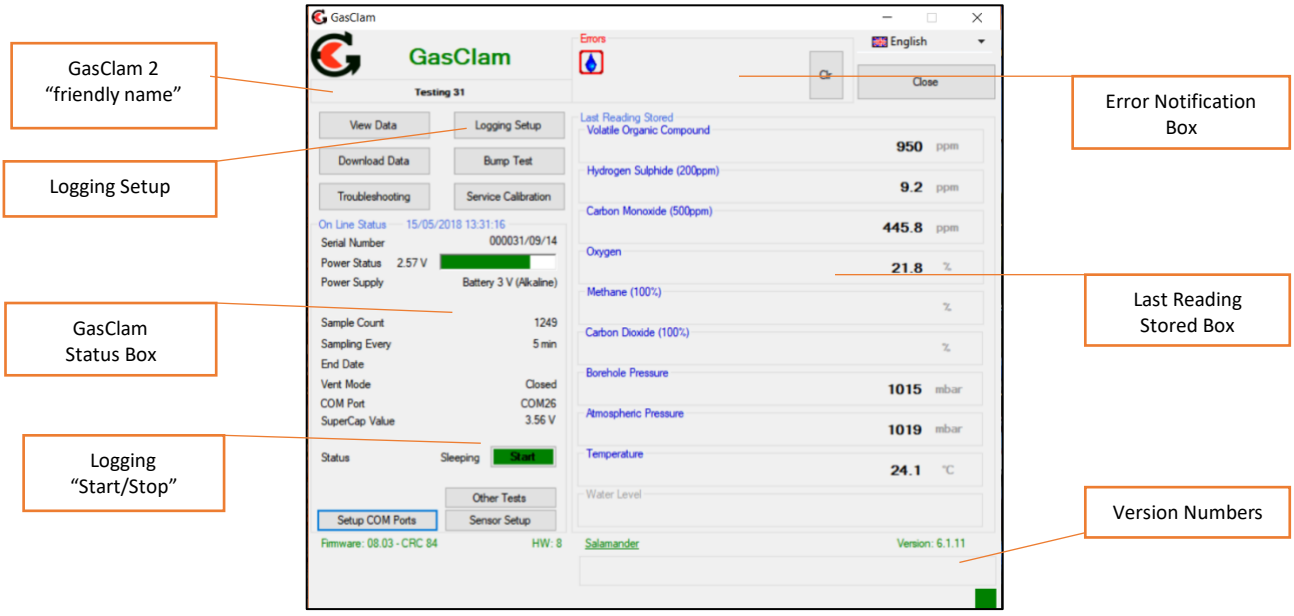
5) The software will start in the “Home” window.

2.1.2. Disconnecting from a GasClam 2

When finished close the software, disconnect the Com Cable and replace the Com Port Cap on the GasClam 2.

3. Home Window

The GasClam 2 Home window displays the current status of the GasClam 2 and shows the recorded values from the last sample taken. Buttons are provided to access further features including Logging Setup.



3.1. Version Numbers

All the version numbers are displayed in the last line in the "Home" window, before starting check that all the numbers are correct.

Firmware Version

The FW version should show "**08.03 – CRC84"**.

If the firmware version is lower, then the GasClam 2 needs to have the latest firmware installed

Hardware Version

The GasClam 2 HW version should show "**HW:8**"
If the HW number is lower this software is not fully compatible with the GasClam 2 and an earlier version of the SW should be used

Software Version

The SW version, which should correspond with this manual

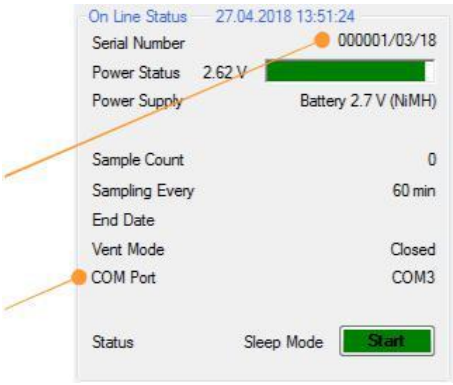
For new manuals and software updates contact Ion Science or your local dealer / service centre. For Firmware updates contact your local service centre.

3.2. GasClam 2 Status

The main information about a GasClam 2 when it is connected is shown in the Status Box.

3.2.1. On Line Status

The title of the status box in blue displays that a GasClam 2 is online (connected) and the date and time of the GasClam 2's internal clock.



3.2.2. Serial Number

The serial number displayed must correspond to the serial number on the GasClam 2 data plate, otherwise contact your service centre.

3.2.3. COM port

Displays which com port is being used by the software on your computer. This is useful if there is a conflict with the com ports.

3.3. Power Supply

WARNING: For reasons of intrinsic safety, batteries MUST NOT be changed within hazardous areas. Always ensure you are in a safe area before carrying out any type of work on your GasClam.

WARNING: To maintain the Unit's certification and intrinsic safety use ONLY GasClam approved batteries.

The GasClam 2 can use 4 approved power sources:

2x 1.5 V Alkaline-Manganese Duracell - MN1300 (Alk-Mn)
2.6 V Nickle Metal Hydride rechargeable battery pack (NiMH)
7.2 V Lithium non-rechargeable primary battery pack (Li)
12 V External dc power supply (Ext)

The GasClam 2 automatically selects the power supply type based on the voltage of the source.

Important: all sources **must** be of the nominal voltage when inserted otherwise an incorrect source can be selected, it is highly recommended that when replacing batteries only new or fully charged batteries are inserted.

The power source is automatically selected after a hard reset (the GasClam 2 is without power for more than 10s) and is set in the GasClam 2 memory until the next hard reset.

NOTE: The Alkaline and Metal Hydride batteries have similar nominal voltages. The GasClam 2 automatically selects the Mi-MH battery, however when Alkaline batteries are inserted change the power supply manually (see Logging Setup section).

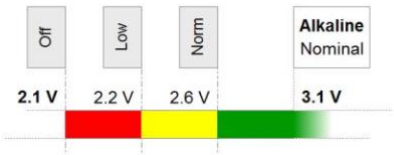
After new batteries have been inserted or an external power supply connected, check that the correct power supply has been selected in the "Power Supply" line and that the "Power Status" is showing the correct voltage and colour.

The "Power Status" voltage and bar are a live reading of the battery voltage and will change during the sampling sequence as the load on the battery changes. The bar also changes colour according to capacity of the battery or external power supply providing a rough guide to the actual state of the supply.

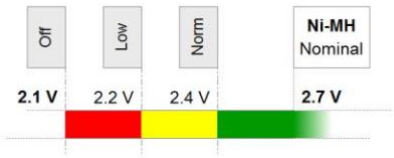
Green:	Capacity is fine for a long sampling period.
Yellow:	Batteries need to be replaced very soon.
Red:	Replace batteries immediately.

If the voltage falls below a set value, indicating that the capacity is no longer sufficient to continue sampling the GasClam 2 will automatically interrupt logging and switch to Sleep Mode. A battery error will be logged. All logging and error data is stored in non-volatile memory and will not be lost.

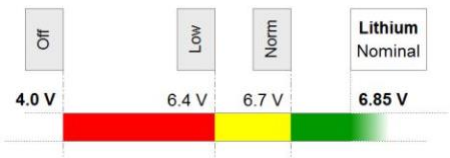
1) Alkaline-Manganese Duracell - MN1300 (**Alk-Mn**)
Nominal voltage 3.1 V
Minimum auto-select voltage > 2.6
V Stop logging sleep voltage ≤ 2.1



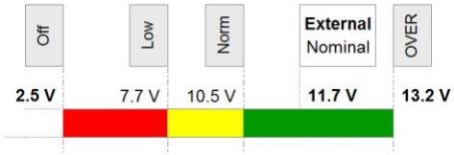
2) Nickle Metal Hydride rechargeable battery pack (**NiMH**)
Nominal voltage 2.7 V
Minimum auto-select voltage > 2.4 V Stop logging sleep voltage ≤ 2.1



3) Lithium non-rechargeable primary battery pack (**Li**)
Nominal voltage 6.85 V
Minimum auto-select voltage > 6.7
V Stop logging sleep voltage ≤ 4.0



4) 12 V External dc power supply
(Ext) Nominal voltage 11.7 V
Minimum auto-select voltage > 10.5 V Stop logging sleep voltage ≤ 2.5
Maximum voltage < 13.1 V



3.3.2. Battery Life and Sample Count

The battery life and the number of samples taken will depend on the operating temperature, humidity and the logging interval of the chosen battery type. All batteries will have a reduced life at low temperatures.

Power Supply	Voltage (V)	Capacity (Ah)	Operating range (°C)	Maximum Number of Samples for Logging Interval (1)			Nominal Battery Life in days for interval (2)	
				5 min	15 min	1 hour	15 min	1 hour
Alkaline Duracell 2x	3.0	13.5	0 – 50	197	**963**	**963**	8	32
NiMH Rechargeable	2.6	9.5	0 – 40	**680**	**666**	**666**	5	23
Li Long Life Primary	7.2	19.0	0 – 50	x	**2937**	**2937**	24	98

(1) The “Maximum Number of Samples” depends on actual operating temperature, the number of gas sensors and the state of the filters. Values in the table are for 20 °C with the maximum number of sensors and clean filters.

(2) The “Nominal Battery Life” is a conservative calculation of the number of days a battery should last under “nominal” conditions (fully charged battery at start, operating temperature 20 °C, clean filters and all sensors). Values in the table are 80% of the average calculated value. Other factors such as relative humidity can also affect the battery life.

3.3.3. Alkaline Batteries

Alkaline batteries are useful for initial checks and can be used for immediate deployment in the field when the rechargeable battery is not charged. However, for normal field work it is recommended to use either the NiMH rechargeable or Li long-life battery packs.

The Duracell batteries can be stored in the instrument case as a reserve because they have a long “shelf life” but do not use them after the date shown on the battery. Also they are not suitable for short logging intervals (less than 15 minutes).

Important: when a GasClam 2 is to be stored for more than 2 months it MUST be fitted with the Duracell batteries to maintain the electronics.

3.3.4. NiMH Rechargeable

The NiMH rechargeable battery packs should be fully charged using the charger provided (*see instructions*) and used for logging as soon as possible. Rechargeable batteries do not have a long “shelf life” as they will self-discharge over time.

This also means that battery life is not proportional with an increase in logging interval, e.g. if the logging interval is increased from 1 hour to 12 hours the nominal battery life will not increase 12 times to 276 days (9 months). The NiMH batteries self-discharge at a rate of 15% - 20% per month.

To obtain the maximum working life from the NiMH battery packs it is recommended that they are always first fully discharged and then charged using the charger provided and also the NiMH battery packs should be charged at least once every 6 months even if they are not being used.

3.3.5. Lithium Long-Life

The Long-life battery pack will last up to 3 months at an hourly logging interval. Only the Li battery pack has a restriction on the minimum logging interval which must not be less than 15 minutes.

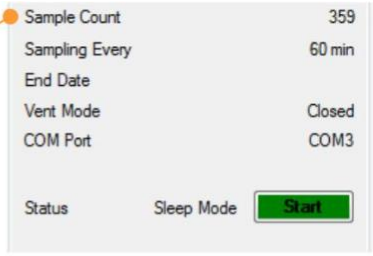
The Li battery pack has a built-in fuse to maintain intrinsic safety and if the GasClam 2 is switched on/off rapidly using the Push-button cable in rare cases this can cause the fuse to blow. If the GasClam 2 does not react with a Li battery pack first check the battery using a voltmeter.

Important: Adhere to the conditions of use and safety instructions enclosed with the Li battery packs.

3.4. Logging Information

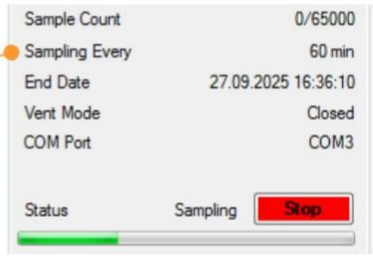
3.4.1. Sample Count

When the GasClam 2 is in Sleep Mode the value shown is the total number of samples that are stored in memory, e.g. 359. After erasing logging data it will be zero (see Logging Setup section). When the GasClam 2 is in Logging Mode and Sampling the value shown is the number of completed samples for the current logging run. After Sampling is complete the number increases by one.



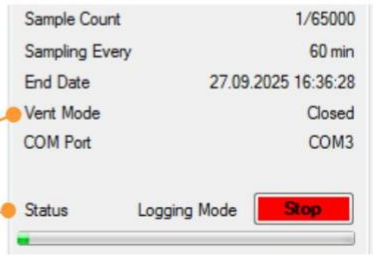
3.4.2. Sampling every

Shows the set Logging Interval (see Logging Setup section).



3.4.3. End Date

Displays the date and time when Logging should finish, based on the remaining logging memory – note this is an approximate value, the logging memory is not only used to store sampling data but also errors and other information and the volume can vary.



3.4.4. Vent Mode

Shows the state of Venting Mode (see Logging Setup section).

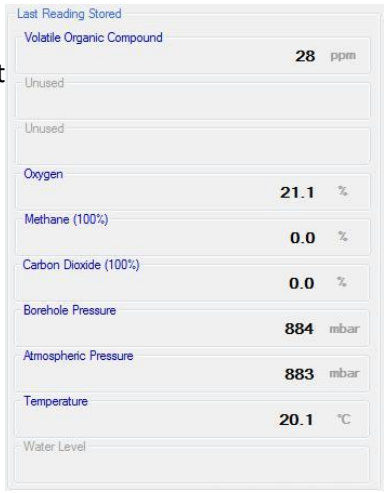
3.4.5. Logging Status

Displays the current status and progress:

Sleep Mode the GasClam 2 is not logging, data can be downloaded and setup.
Logging Mode – the GasClam 2 is logging but between samples.
Sampling – the GasClam 2 is logging and currently taking a sample or recoding the results.
Erase Memory – the GasClam 2 is logging data is being deleted.
Undefined – if this appears it is an error, immediately contact a service centre.

3.5. Last Reading Stored

When logging is started the GasClam 2 takes its first sample and the “Last Readings” will change to “sampling” and are updated throughout sampling. When sampling has finished the last readings taken are displayed until the next sampling cycle starts.



The displayed ranges of individual gas sensors depend on the sensor configuration of the given GasClam 2. When a sensor is fitted in the GasClam 2 it will be shown in blue with its range and its sampling result will be displayed. When a sensor is not fitted it will be shown in grey and its units and value will not be shown.

The pressure and temperature sensors are built-in to the GasClam 2 and are always available. Atmospheric pressure is not shown if the venting mode is set to “Vent Plug Inserted” (see Logging Setup section).

The water level sensor is optional (see Logging Setup section).

3.6. Error Notification

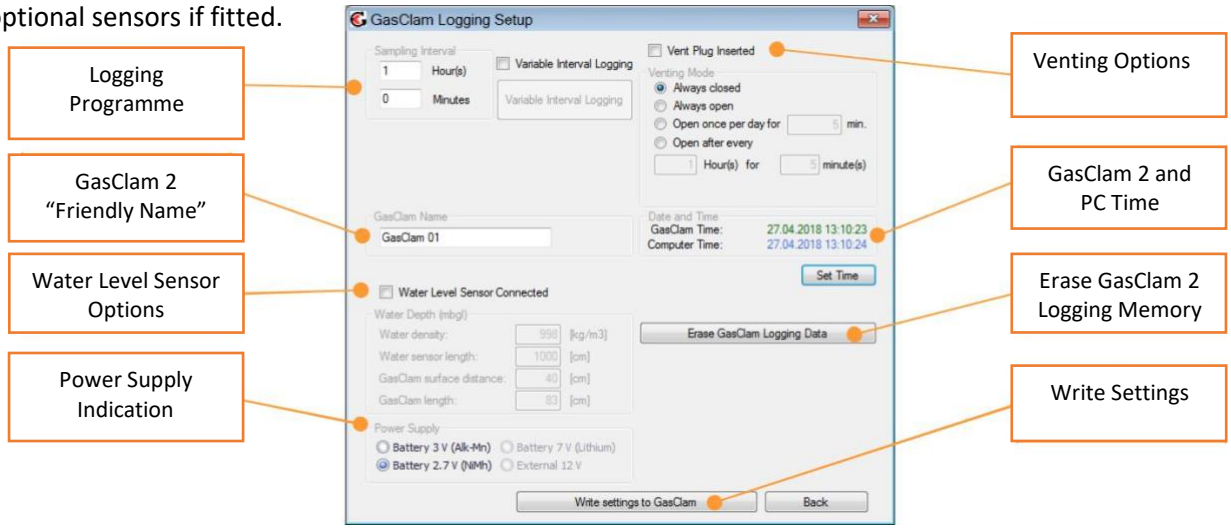
During normal operation the GasClam 2 should not have any errors and the Error Notification Box will be empty.

In the event that a sensor has a problem an error icon will appear in the box and the “Clr” button will appear, also a “Check Sensor” message will appear next to the sensor in the “Last Reading Stored” box. By moving the mouse over the error icon a tooltip will describe the error. Click “Clr” to clear the notification box, this will not delete the errors.

Other errors can occur such as Low Battery or a blocked filter due to a very dusty environment, for a full list of errors and solutions see the Errors and Troubleshooting section.

4. Logging Setup Window

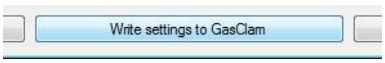
The GasClam 2 logging settings are set in the “Logging Setup” window which is accessed by clicking the “Logging Setup” button in the “Home” window. This window is used to setup the logging requirements for a given job and the optional sensors if fitted.



4.1. GasClam 2 Date and Time

The GasClam 2 time and date is shown in green and the PC time and date is shown in blue. To update the GasClam 2 time click the “Set Time” button. Note. The GasClam 2 time is likely to differ from the PC time if it was set on a different computer than is currently being used.

4.2. Save Setting Changes

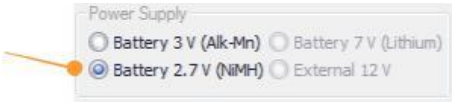


After making any changes in the “Logging Setup” window it is important to click the “Write settings to GasClam 2” button to save all changes.

If the write is successful a message “Settings written successfully” will appear. Click OK to continue.

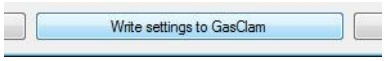
Without clicking the “Write settings to GasClam 2” all the changes that have been made will be disregarded.

4.3. Manual Battery Selection

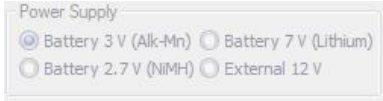


The Alk-Mn Duracell and NiMH rechargeable batteries have similar nominal voltages, if either are fitted the GasClam 2 automatically selects the NiMH battery.

However, when Alk-Mn batteries are fitted the power supply should be changed manually, Alk-Mn batteries have different performance characteristics.

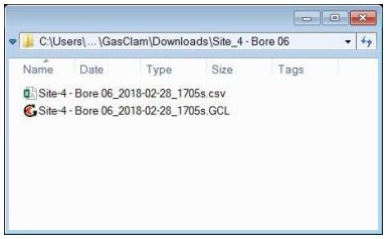


After saving the power supply cannot be change until after a hard reset (the GasClam 2 is without power for more than 10s).



4.4. GasClam 2 Name

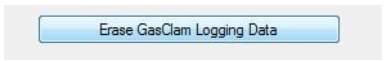
Each GasClam 2 can be assigned a “friendly” name. This is useful if more than one GasClam 2 is being used on a site or more sites are being monitored. For example, the named could represent the site and borehole number.



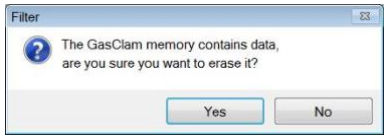
Only alphabetic characters, numbers and “-“ or “_” can be used.

The “friendly” name is also used in the filename for the data downloaded from each GasClam 2 helping to identify from which location the data was obtained.

4.5. Erasing Logging Data

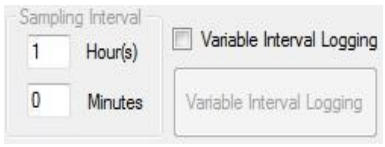


To erase all the logging data from the GasClam 2 click the “Erase GasClam 2 Logging Data” button, you will be prompted to confirm the action.



Important: This process erases stored data permanently. Make sure you have downloaded the data from the GasClam 2 onto your computer (see Download section).

4.6. Logging Settings



The logging interval is set either using the Sample Interval box or the Variable Interval Logging popup window.

4.6.1. Sampling Interval

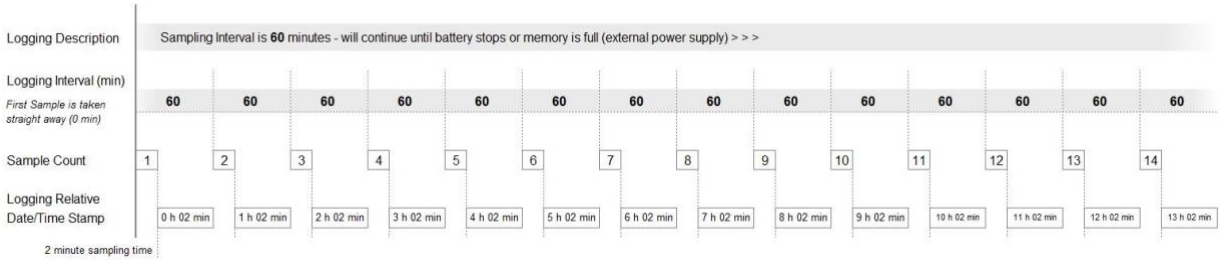
The sampling interval defines the time between samples in hours and minutes. The maximum interval is 24 hours (a sample is taken once per day), the default setting is once every hour and the shortest logging interval is 3 minutes, however for Alk-Mn it is not recommend and Li battery packs must not be set with an interval less than 15 minutes.

Power Source	Sampling Interval Range
3V Alkaline-Manganese Duracell 2x - MN1300 (**Alk-Mn**)	15 minutes to 24 hours
2.6V Nickle Metal Hydride rechargeable battery pack (**NiMH**)	3 minutes to 24 hours
7.2V Lithium non-rechargeable battery pack (**Li**)	**15** minutes to 24 hours
12V External dc power supply (**Ext**)	3 minutes to 24 hours

Once logging has been started it will continue at the set interval until the battery stops, the GasClam 2 memory is full (external power supply) or logging is stopped manually.

The first sample is taken immediately after logging is started and takes 2 minutes, the date stamp that is recorded is the time when the sample was completed, so all date stamps in the downloaded data are shifted by 2 minutes from the actual start time.

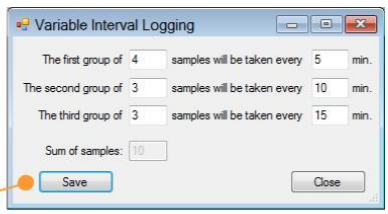
Example of Sampling Interval timeline



4.6.2. Variable Interval Logging

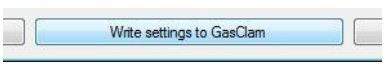
Variable Interval Logging is useful when for example a faster sampling rate is required in the beginning to see more detail on the site and later a longer term view is required.

To use Variable Interval Logging tick the box and click the “Variable Interval Logging” button to open the popup window.



Four different logging intervals can be set each with a different sample count. The first three are sets using the “Variable Interval Logging” popup window and the fourth set is based on the Sample Interval.

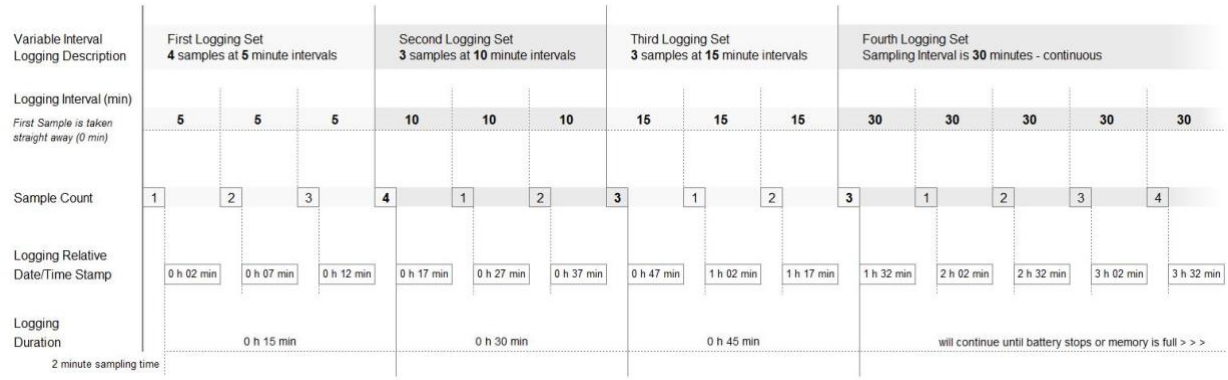
After entering the required details click the “Save” button.



To save all changes the “Write settings to GasClam 2” button must also be clicked, otherwise any changes made will not be saved.

Example of Variable Interval timeline

Example of Variable Interval timeline



4.7. Venting Options

The GasClam 2 has several options to vent the borehole gases to the atmosphere.

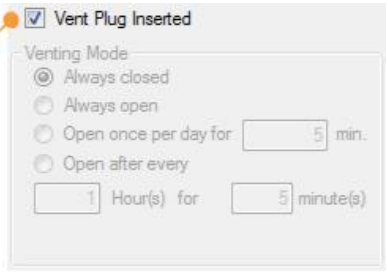
If a vent plug is inserted instead of a vent barb then tick the box.

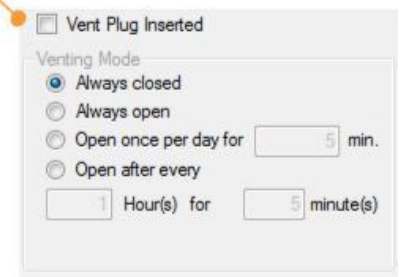
If a vent plug is not inserted, then select one of 4 options:

Always Closed – The vent valve is always closed. Always Open – The vent valve is always open.

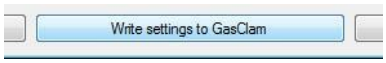
Open once per day – The vent valve opens once a day for a set period of time. The vent valve opens immediately after the first sample and shuts after the allocated time.

Open after every – The vent valve opens after the set interval and stays open for the set interval.





Important: If the GasClam 2 is to be deployed in a wet area and there is a risk of flooding the GasClam 2, the Vent Plug should be fitted (see User Manual) and the "Vent Plug Inserted" box ticked. When this is selected atmospheric pressure is not recorded.



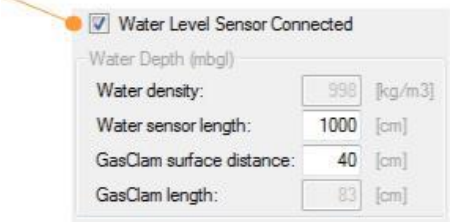
To save any changes do not forget to click the "Write settings to GasClam 2" button, otherwise any changes made will not be saved.

4.8. Water Level Sensor

The GasClam 2 can also measure the depth of the water table in the borehole using an optional Water Level Senor *(see User Manual).*

When a Water Level Sensor is not connected the "Water Level Sensor Connected" box must not be ticked.

When a Water Level Sensor is connected the “Water Level Sensor Connected” box should be ticked.



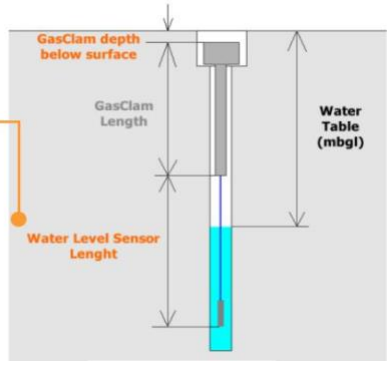
The GasClam 2 records the water level in “meters below ground level” (mbgl).

In order to calculate this depth 2 parameters need to be entered:

Depth of the GasClam 2 below ground level.

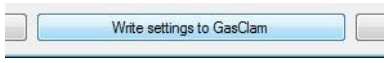
Water Level Sensor length.

(See User Manual for details)



Pure water has a density of 1000 kg/m3 at 4°C. Borehole pressure affects the water level reading but this is automatically corrected.

To save any changes do not forget to click the “Write settings to GasClam 2” button, otherwise any changes made will not be saved.



5. Logging

5.1. Pre-start check

Once the GasClam 2 has been setup for logging using the “Logging Setup” window return to the “Main” window to check the settings.

GasClam 2 “friendly” Name

GasClam 2 Time and Date

Power Supply Voltage

(is the battery fully charged)

Power Supply Type

Sample Count

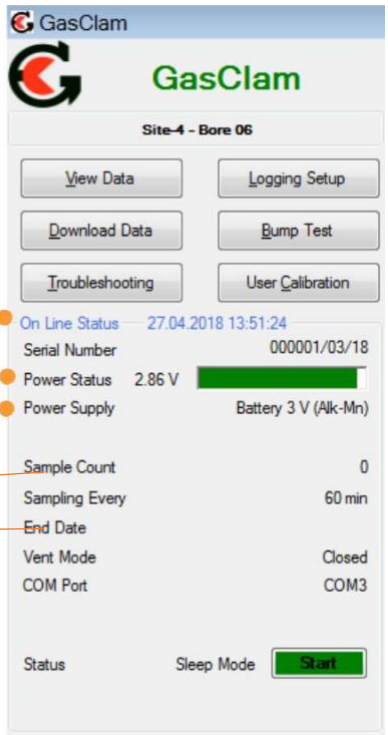
Is logging memory empty if required?

Logging Interval (Sampling Every)

Vent Mode

“Closed” either “Vent Plug Inserted” or set to “Always Closed” “Open” set to “Always Open

“Changing” set to “Once a day for…” or “Every…”



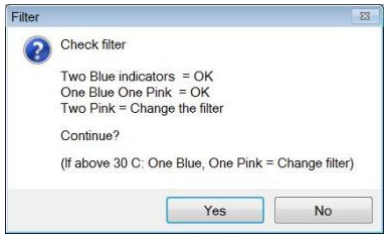
If all the settings are correct, logging can be started using either the Start Button Cable (*see User Manual*) or the software start/stop button in the “Home” window.

5.2. Software Start/Stop

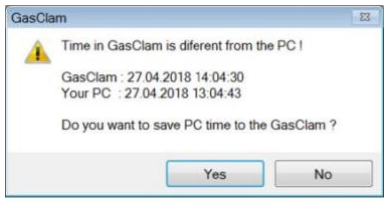
When the GasClam 2 is in “Sleep Mode”, start logging by clicking the green “Start” button.

A few questions will be asked before logging actual starts:

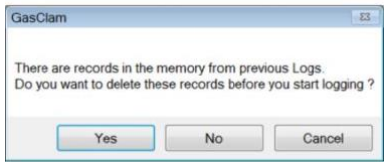
- Moisture filter state (see User Manual), “Yes” if the filter is OK will continue.
  “No” will abort the logging start.



- If the GasClam 2 date and time is not the same as the PC date and time you will be prompted if this is ok.
  “Yes” will update the GasClam 2 time and continue.
  “No” will not update the time but also continue.



- If the GasClam 2 already contains some logging data you will be asked if you want to erase it before continuing.
  “Yes” will erase the data and start logging.
  “No” will not erase the data but will also start logging.
  “Cancel” will abort the logging start.



The GasClam 2 will then immediately start the first sample, this takes approximately 2 minutes. Progress is shown in the green bar.

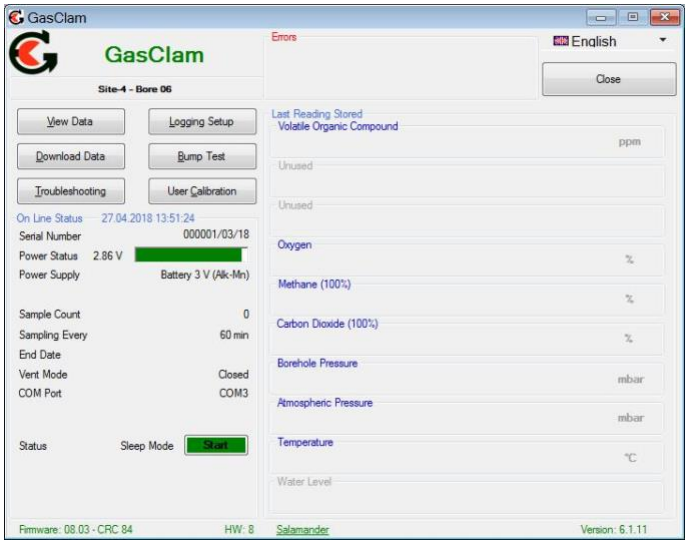
Logging can be stopped at any time by clicking the red “Stop” button. You will then be prompted to confirm the action.

5.3. Logging Cycle

Sleep Mode

When the GasClam 2 is in “Sleep Mode” all the buttons are available and the start/stop button is green ready to start logging when clicked.

The “Sample Count” shows the total number of records in the memory. Once logging has started the sample count will show how many samples have been completed.



Sampling

When sampling starts the status text changes to “Sampling”.

During sampling all the readings on the right-hand side progressively change from “Sampling” to a value, starting with the pressures then the temperature and then the sensors.

This takes approximately 2 minutes.

Note: The voltage of the battery will slightly decrease when the GasClam 2 is sampling due to a higher load on the batteries.

Logging Mode

When sampling is complete the status text changes to “Logging Mode” and the “Sample Count” increases by one.

All the previous readings are visible in the “Last Reading Stored” box.

If any errors occur they will appear in the Error Notification Box.

After the logging interval “Sampling” will start again.

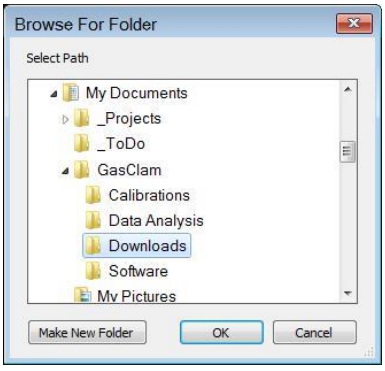
Important: Before deploying the GasClam 2 in a borehole it is highly recommended to perform at least one sample to check that the readings are correct.

6. Download Data

6.1. Download Folder Path

To download logging data from the GasClam 2 first stop logging by either using the Start Button Cable (see User Manual) or the software start/stop button in the “Home” window.

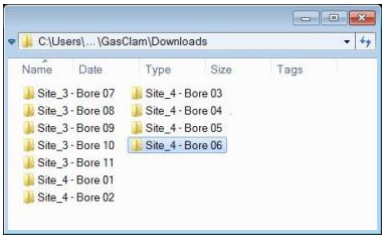
Click the “Download Data” button. A popup window will ask you for the path to your download folder, either select an existing folder or “Make New Folder” in the selected location e.g.:



My Documents\GasClam 2\Downloads

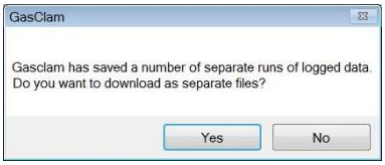
The software will remember your last chosen path but will ask you each time. Click “OK” to continue.

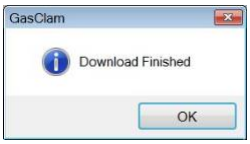
This folder will be the root folder for GasClam 2 downloads each data download will be downloaded into a sub-folder using the GasClam 2 “friendly” name e.g.:



My Documents\GasClam 2\Downloads\Site_4 - Bore 06

If there have been several start/stop logging cycles (runs) they can be saved as one single file or separate files. The file name of single run data files will end with “s” and the file name of multi-run combined data files will end with “c”. The software will prompt you if you would like to download as separate files or one combined file.

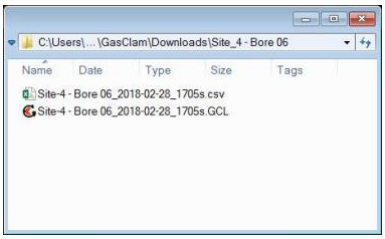




Important: wait for the “Download Finished” prompt.

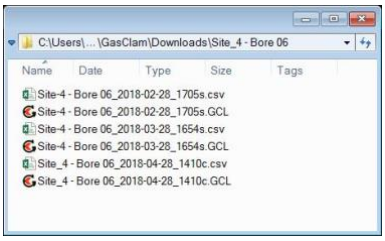
6.2. Data File Format

The file name will be the GasClam 2 Name and the date and time logging was started with either “s” or “c” at the end of the name in the format:



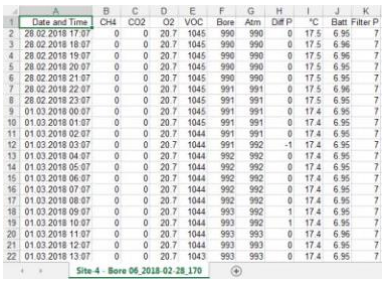
GasClam 2Name_yyyy-mm-dd_hhmm

If the GasClam 2 “friendly” Name is not changed all downloads from that GasClam 2 will be added to the same folder, so that all the data over time from one borehole is in the same folder.



Two files are downloaded with each download:

- “.csv” files contains all the recorded parameters in a format that can be opened by a spreadsheet such as excel. Clicking on the file will open it in the spreadsheet.
- ***Note:*** *The time in the download name is the logging start time 2018-02-28_**1705** but the first data row is 28.02.2018 **17:07** which is the first sample completed time (2 minute sampling).*
- “**.GCL**” files contain all the recorded parameters in a format that can be opened by the GasClam 2 software data viewer. Double click on the file will open it in the GasClam 2 software (*see View Data section*).

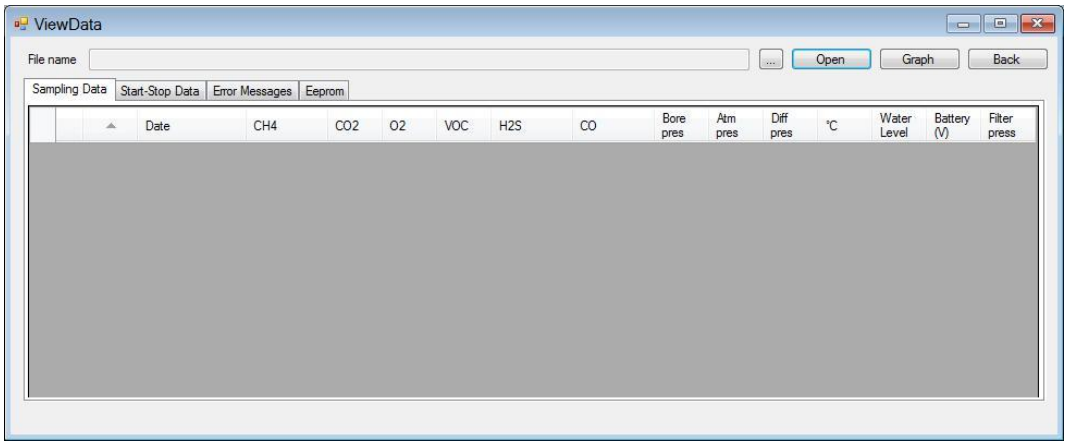


7. View Data

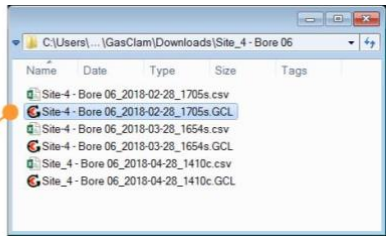
The “View Data” window is accessed from the Home window by clicking the “View Data” button. Data can be viewed either if a GasClam 2 is connected or without connecting a GasClam 2.

When data is loaded using the “…” and “Open” buttons it is shown numerically in 4 tabs and can be shown graphically by clicking the “Graph” button.

It is possible to order the data according to each individual parameter by clicking the column header. The selected column and order is indicated by an arrow in the column header, the first click arranges data in ascending order [▲] and another click arranges data in descending order [▼].

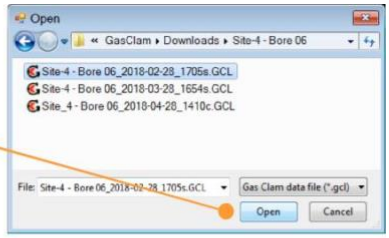


7.1. Selecting a Data File to View



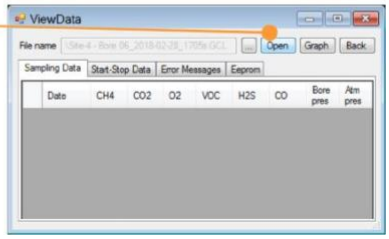
There are several ways to open downloaded ".GCL" logging data files for viewing:

Double click directly on the downloaded ".GCL" data file in the download folder which will open the "ViewData" window with the logging data.



Start the GasClam 2 software and click the "View Data" button in the home window. This will open the "ViewData" window. Click the "…" button and select the required folder and file to view the logging data.

Straight after downloading is complete click the "View Data" button. In the "ViewData" window "File Name" bar the current downloaded file will be visible. Click "Open" to view the logging data.



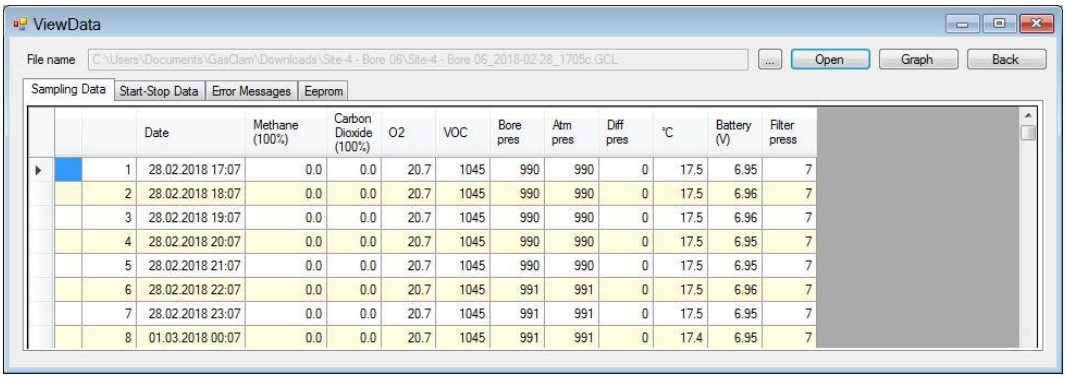
The "…" button is used to select the folder for the required data file.

The "Open" button will open the data file that is shown in the "File Name" bar, if a file is not selected and visible in the "File Name" bar then it can also be used to find a folder and data file.

7.2. View Logging Data

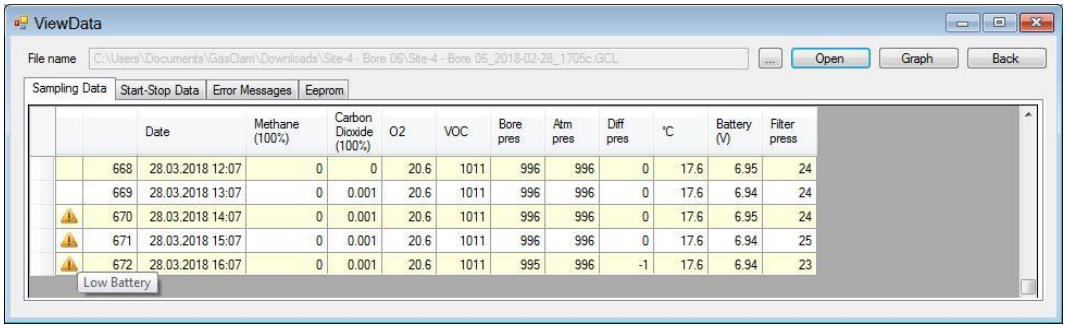
7.2.1. Sampling Data Tab

The data file that has been selected opens in the "Sampling Data" tab. This shows all the readings for each sample that was taken during the logging run (or runs if a combined data file was selected).



	Date	Methane (100%)	Carbon Dioxide (100%)	O2	VOC	Bore pres	Atm pres	Diff pres	°C	Battery (V)	Filter press
1	28.02.2018 17:07	0.0	0.0	20.7	1045	990	990	0	17.5	6.95	7
2	28.02.2018 18:07	0.0	0.0	20.7	1045	990	990	0	17.5	6.96	7
3	28.02.2018 19:07	0.0	0.0	20.7	1045	990	990	0	17.5	6.96	7
4	28.02.2018 20:07	0.0	0.0	20.7	1045	990	990	0	17.5	6.95	7
5	28.02.2018 21:07	0.0	0.0	20.7	1045	990	990	0	17.5	6.95	7
6	28.02.2018 22:07	0.0	0.0	20.7	1045	991	991	0	17.5	6.96	7
7	28.02.2018 23:07	0.0	0.0	20.7	1045	991	991	0	17.5	6.95	7
8	01.03.2018 00:07	0.0	0.0	20.7	1045	991	991	0	17.4	6.95	7

If an error occurred during sampling a yellow warning triangle will appear in the first column and moving the mouse over the error will show a tooltip with a description of the error or errors if there are more.



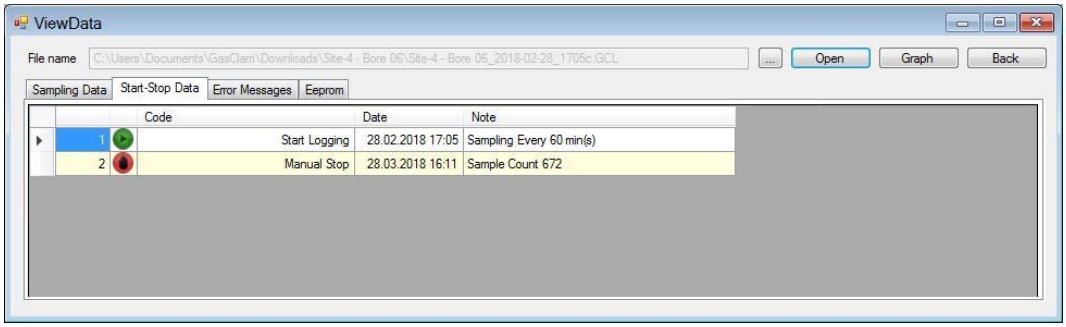
	Date	Methane (100%)	Carbon Dioxide (100%)	O2	VOC	Bore pres	Atm pres	Diff pres	°C	Battery (V)	Filter press
668	28.03.2018 12:07	0	0	20.6	1011	996	996	0	17.6	6.95	24
669	28.03.2018 13:07	0	0.001	20.6	1011	996	996	0	17.6	6.94	24
670	28.03.2018 14:07	0	0.001	20.6	1011	996	996	0	17.6	6.95	24
671	28.03.2018 15:07	0	0.001	20.6	1011	996	996	0	17.6	6.94	25
672	28.03.2018 16:07	0	0.001	20.6	1011	995	996	-1	17.6	6.94	23

The data is shown in columns with the following information and formats, if certain sensors or the water level sensor are not installed, the data is not logged and will not appear in the “Sampling Data”.

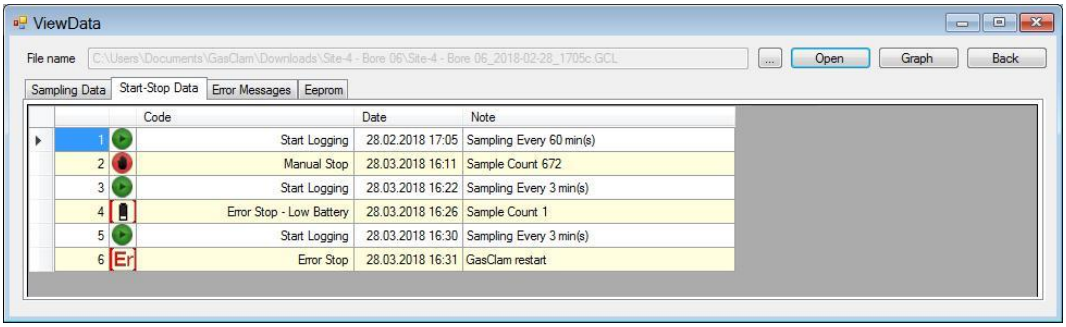
Information	Detail
Date	The date is shown in the format dd.mm.yyyy.hh:mm
CH4 (Methane)	The specific type of sensor and range is shown – values (%)
CO2 (Carbon Dioxide)	The specific type of sensor and range is shown – values (%)
O2 (Oxygen)	The specific type of sensor and range is shown – values (%)
VOC (Volatile Organic Compound)	The specific type of sensor and range is shown – values (ppm)
H2S (Hydrogen Sulphide)	The specific type of sensor and range is shown – values (ppm)
CO (Carbon Monoxide)	The specific type of sensor and range is shown – values (ppm)
Bore Pres	Borehole Pressure – values (mBar)
Atm Pres	Atmospheric Pressure – values (mBar)
Diff Pres	Differential pressure between Borehole ad Atmosphere – values (mBar) *If the value is negative it means the pressure in the borehole is lower than atmospheric and if the pressure is positive it is higher than atmopheric*
°C	GasClam2 internal temperature – values °C If there are no great fluctuations during the loggin interval then the value will equate to the actual Borehole temperature.
Water Level	The depth of the water table below ground level in metres – values (mbg)
Battery	The voltage of the internal battery or external power supply – values (V) *The voltage recorded is the voltage under maximum load during sampling.*
Filter Pres	The depth of the water table below ground level in metres – values (mbg)

7.2.2. Start-Stop Data Tab

The “Start-Stop Data” tab shows when logging was started with a note regarding the logging interval. The tab also shows when and how logging was stopped with a note regarding the total number of samples taken during that run. If a single run is shown and there were no errors then just two rows are shown.

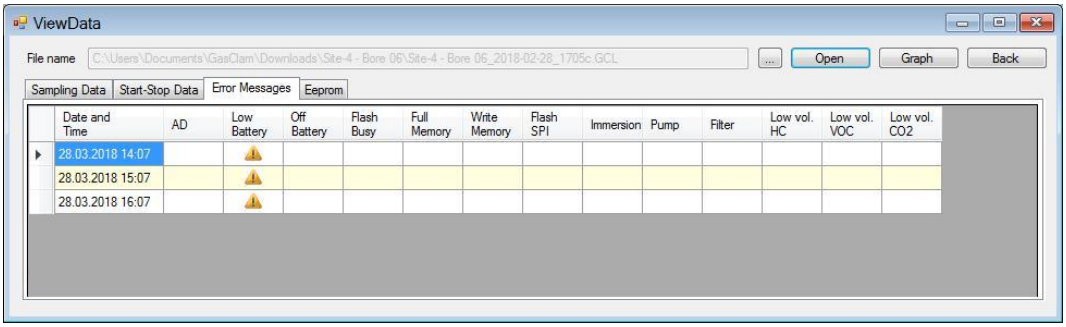


If the data is from a combined file more start and stop rows will be visible and also if any logging runs were halted by errors, such as “Low Battery”, then this information is also shown.



7.2.3. Error Message Tab

All errors can be view in one location in the “Error Messages” tab. This is useful information to evaluate actual battery life if there are “Low Battery” errors and to consider shorter intervals between site visits.

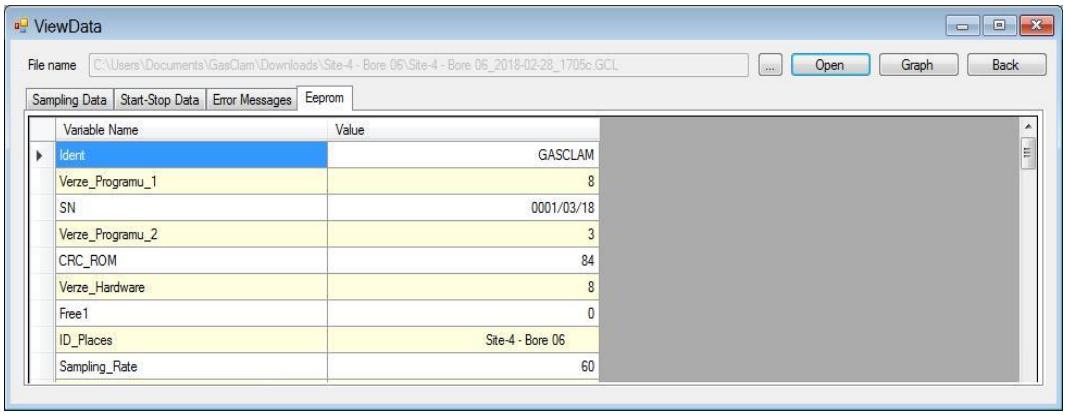


An important error is the “Immersion” error which indicates that the GasClam 2 has been flooded (see User Manual for service details).

The “Filter” and “Pump” errors indicate that the filter needs replacing. For a full list of errors and solutions see the Error section.

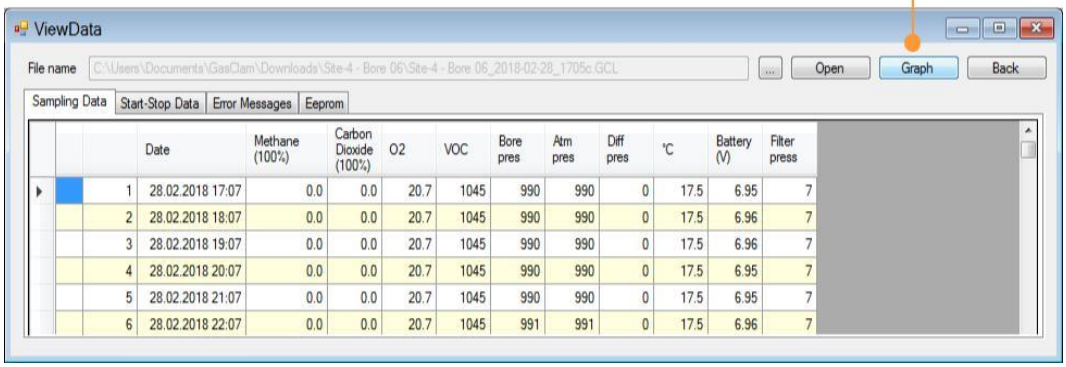
7.2.4. Eeprom Tab

The “Eeprom” tab shows information about the GasClam 2 firmware (e.g. version), internal settings (serial number) and user settings (Name, Sample Rate, etc.). This information is useful when trouble shooting.



7.3. View Logging Graph

The “Graph” window is accessed from the “ViewData” window by clicking the “Graph” button when a data file is loaded and is useful for a quick visualisation and analysis of the data.



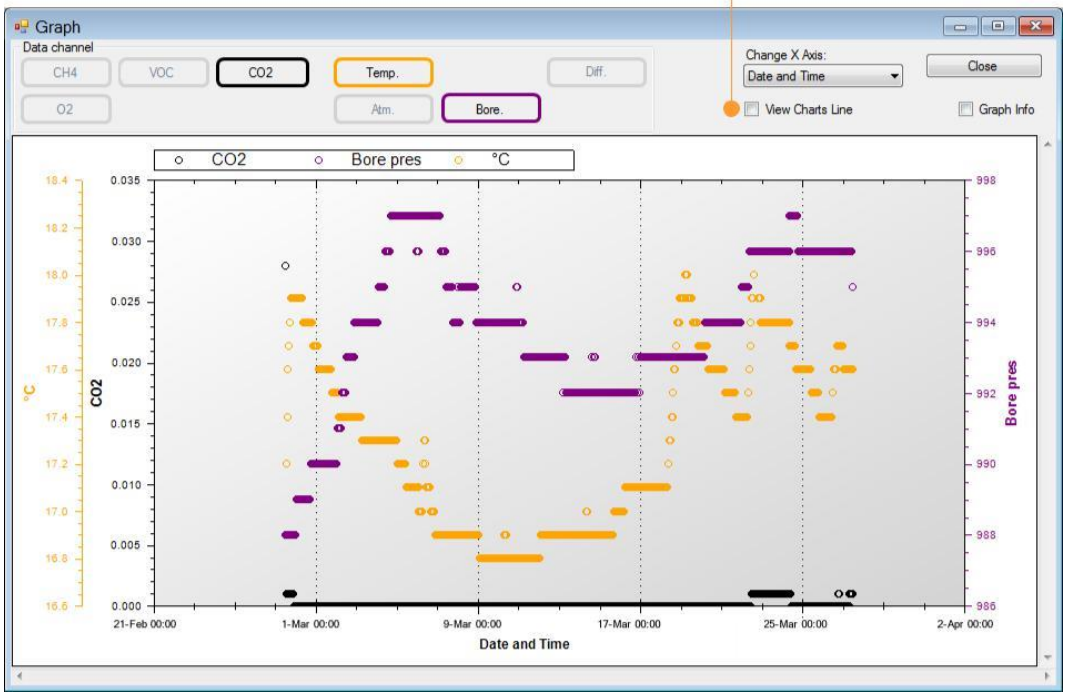
The “Graph” window opens in a separate popup window and offers several options.

7.3.1. Data Chanel Selection

To select a data channel click the parameter from the “Data Channel” box. Various combinations of parameters can be viewed on the graph. Only the logged parameters are available to view. The parameter button is an on/off toggle button.

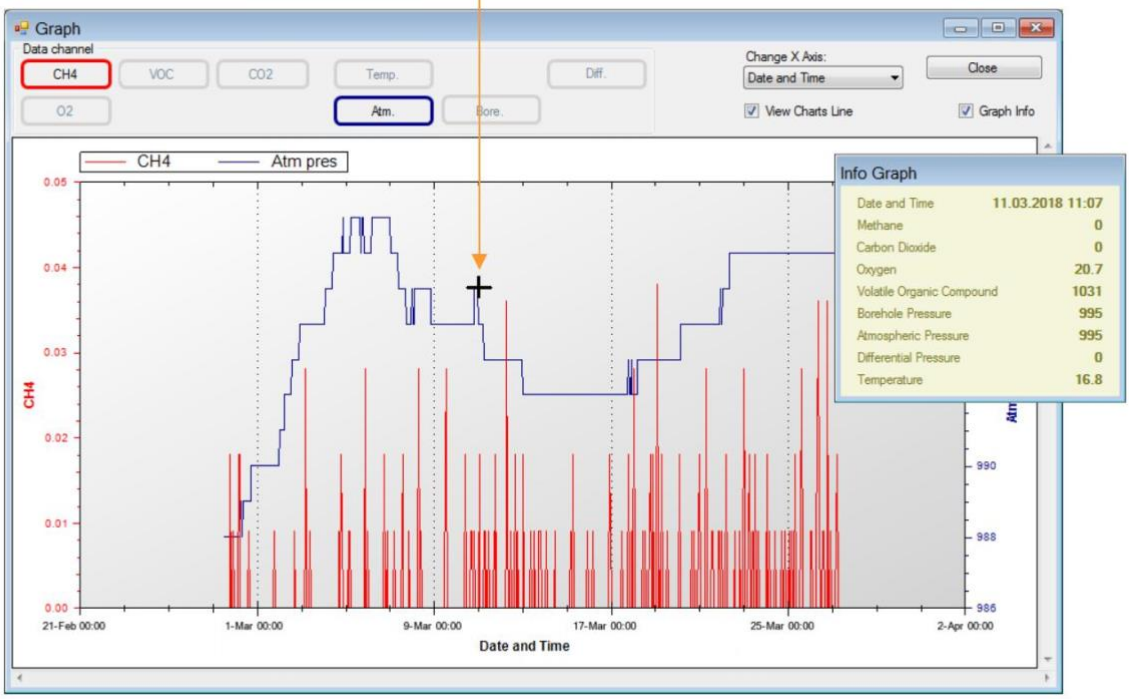
7.3.2. Chart Lines or Data Point

The graph can be viewed either with lines joining the data points or just the data points without lines. Use the “View Chart Lines” tickbox as a toggle.

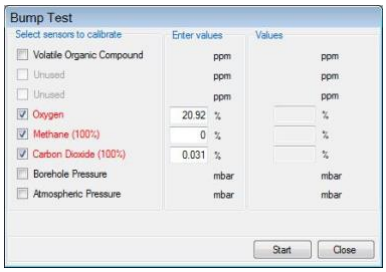


7.3.3. Data Point Information

By ticking the “Graph Info” a cross cursor and a popup window with the data of a specific point will appear with the actual data for that point.



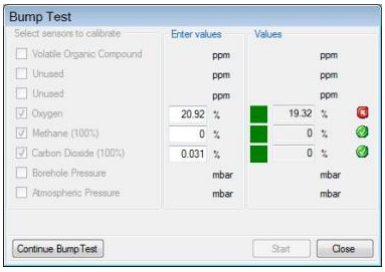
8. Bump Test and User Calibration



It is advisable to always perform a bump test before starting a logging cycle. The bump test will check if the values measured on the sensors is within the tolerance and conforms to with the actual gas mix being tested. To start a Bump Test click the “Bump Test” button on the Home window and a popup window will appear.

Select the sensors you wish to test by ticking the appropriate boxes. The concentration values that appear are for air (different values can be entered if a calibrated gas supply is available). Then click the “Start” button to continue.

You will be prompted to save an xml file. If “No” is clicked the Bump Test will continue, if “Yes” the Bump Test will continue and after completion save an xml file with all the details to the “Calibrations” folder selected in “User Calibration” (see User Calibration).

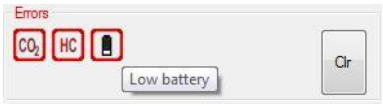


The bump test will take approximately two minutes, this is indicated by brown flashing boxes next to the selected sensors.
When complete the measured concentrations are displayed in the “Values” column. If the result has passed a green tick will appear if

the value is outside the tolerance range a red cross will appear. The values are informative and nothing is saved in the GasClam 2 memory. If a result fails try a second bump test then a user calibration or contact your service centre for advice.

9. Errors and Troubleshooting

9.1. Error Notification



In the event that fails or has a problem an error icon will appear in the “Error Notification” box in the Home window, also a “Check Sensor” message will appear next to the sensor in the “Last Reading Stored” box. By moving the mouse over the error icon a tooltip will describe the error.

Other than sensor errors such as Low Battery will also be shown in the “Error Notification” box in the Home window.

All errors are logged in the GasClam 2 data file and can be view in the “Error Messages” tab in the “ViewData” window.

9.2. Error Description and Solution

A list of the errors shown, their description and solution are shown in the table below:

Symbol	Error	Reason	Solution
	Low Battery	Battery voltage is LOW for 10 s.	GasClam will run but batteries need to be changed immediately.
	Flat Battery	Battery voltage is below OFF for 60 s.	GasClam will not sample, batteries must be changed.
	Filter Error (1)	The Moisture Filter is clogged.	Change the Moisture Filter, if this does not work then refer to service centre.
	Immersion	Water in the borehole has risen to the base of the GasClam.	When water level drops the GasClam will start sampling again after 1 hour. If submerged for longer than 7 days the user will have to inspect for water ingress. If OK sampling can continue if any suspicion that water has reached the inlet barb refer to service centre.
	Pump Error (2)	Pump is not working correctly.	Check if battery level is above LOW. If problem persists refer to service centre.
	Low Voltage	Low voltage on the CO2 sensor.	Check if battery level is above LOW. If problem persists refer to service centre.
	Low Voltage	Low voltage on the CH4 sensor.	Check if battery level is above LOW. . If problem persists refer to service centre.
	Low Voltage	Low voltage on the VOC sensor.	Check if battery level is above LOW. . If problem persists refer to service centre.

	AD Overflow	The AD convertor is not working.	Perform a hard reset (removing and replace the batteries). If problem persists refer to service centre.
	Flash Busy	The memory has timed out.	Perform a hard reset (removing and replace the batteries). If problem persists refer to service centre.
	Full Memory	The logging data memory is full.	Download data from the GasClam and erase logging memory data.
	SPI Flash	The flash memory has not worked correctly.	Perform a hard reset (removing and replace the batteries). If problem persists refer to service centre.
	Write Error	Error writing to the flash memory.	Perform a hard reset (removing and replace the batteries). If problem persists refer to service centre.

9.2.1. Filter Pressure

Every time a sample is taken the borehole pressure is measured, whilst the pump is running the filter pressure is compared to the borehole pressure. The maximum difference is recorded under the parameter “Filter pres”. The filter pressure is normally 15 – 30 mBar.

(1) If this value exceeds 50 mBar a filter error is flagged. The most likely cause of the problem is that the Moisture Filter is clogged. Check and if required replace the Moister Filter (see User Manual), if the problem persist refer to a service centre.

(2) If this value drops below 5 mBar a pump error is flagged. This will be due to a faulty pump or faulty power supply to the pump.

9.2.2. Freezing Problem

If the temperature around the GasClam 2 drops below 0°C in high humidity the valves may freeze. This will prevent the GasClam 2 from sampling correctly and could flag a “Filter” or “Pump” error. This will not damage the GasClam 2 and when temperatures rise above 0°C it will function correctly.

9.3. Troubleshooting

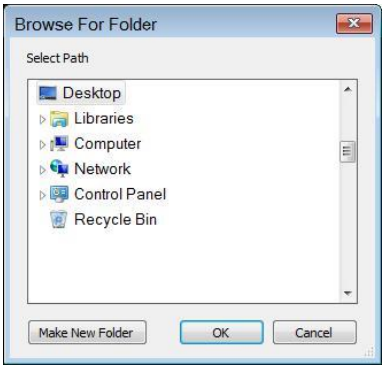
Troubleshooting File

If the GasClam 2 has a problem a Troubleshooting zip file can be sent to a service centre to aid fault finding.

Click on the “Troubleshooting” button in the “Home” window and confirm the prompt popup.

Select the path where to download the Troubleshooting folder and click “OK”. The default path is the desktop - this is recommended as the folder is easy to find, zip and then send by email to a service centre.

Important: wait for the “Download Finished” prompt.



The folder name will start with “TS” and be based on GasClam 2 serial number and time of the download e.g.:

Desktop\TS00001-03-18_2018-04-29_1130

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