Spider & Spider 2

Basic User Manual for PermaNetPlus for PC installation

Version 1.1

Spider

Spider 2

Note: Spider & Spider 2 have a different body shape but for the purposes of this guide are operationally identical.

Warning: This manual contains important safety and operating information. Please read, understand and follow the instructions in the manual.

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WEEE and the Battery Directive

Waste Electrical and Electronic Equipment.
HWM-Water Ltd is a registered producer of Electrical and Electronic Equipment in the United Kingdom (registration number WEE/AE0049TZ). Our products fall under category 9 (Monitoring and Control Instruments) of The Waste Electrical and Electronic Equipment (WEEE) Regulations. We take all environmental issues seriously and fully comply with the requirements for collection, recycling and reporting of waste products.

HWM-Water Ltd is responsible for WEEE from customers in the United Kingdom provided that:
The equipment was produced by HWM-Water Ltd (Palmer Environmental / Radcom Technologies / Radiotech / ASL Holdings Ltd) and supplied on or after 13th August 2005
The equipment was supplied before 13th August 2005 that has been directly replaced HWM-Water Ltd products manufactured since 13th August 2005.
HWM-Water products supplied after 13th August 2005 can be identified by the following symbol:

Under HWM-Water Ltd's Terms and Conditions of Sale, customers are responsible for the cost of returning WEEE to HWM-Water Ltd and we are responsible for the costs of recycling and reporting on that waste.
Instructions for returning WEEE:
Ensure that the WEEE meets one of the two conditions above.
The waste will need to be returned in accordance with the regulations for transporting data loggers with lithium batteries.

a. Pack loggers in strong, rigid outer packaging to protect them from damage.
b. Attach a Lithium Warning Label to the package.
c. The package must be accompanied by a document (e.g. consignment note) that indicates:
    i. The package contains lithium metal cells;
    ii. The package must be handled with care and that a flammability hazard exists if the package is damaged;
    iii. Special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
    iiii. A telephone number for additional information.
    d. Refer to the ADR regulations on shipping dangerous goods by road.

Return the WEEE to HWM-Water Ltd using a licensed waste carrier.
In accordance with the regulations, customers outside the United Kingdom are responsible for WEEE.

The Battery Directive

As a distributor of batteries HWM-Water Ltd will accept old batteries back from customers for disposal, free of charge, in accordance with the Battery Directive.
PLEASE NOTE: All lithium batteries MUST be packaged and returned in accordance with the relevant regulations for transporting lithium batteries.

A licensed waste carrier must be used for transporting all waste.
For more information on WEEE compliance or the Battery Directive please e-mail CService@hwm-water.com or phone +44 (0)1633 489 479

Introduction

Thank you for choosing an HWM data logger(s), we trust it will provide you with many years of service.
The individual configuration of your logger(s) may differ slightly from the detailed descriptions that follow, but any additional setup information that you need, should be available from our website.

Unpacking

As you unpack your new logger, please confirm that you have the following parts required to install the equipment. If there are any omissions, please contact our sales team to rectify or supply the missing parts.

- Spider / Spider 2 data logger & Leak Noise Sensor
- Software Installation Tool (IDT) from www.hwm-water.com or CD-ROM
- External GPRS Antenna
- USB Cable (optional)

Please dispose of your waste packaging responsibly.

Before proceeding to site for physical installation, please take the time to configure your logger in an office environment. Most settings can be configured before visiting site and this will save time at the point of install.

You will need to have:-

- A valid HWM-water.com account with username & password.
- A valid HWM DataGate™ account with username & password. See DataGate™ setup later in this manual.
- A valid Almos account with username & password.
- A PC with Windows 7/8/10 installed (IDT also supports Windows XP & Vista) 32bit and 64bit systems are supported.
    - Minimum Requirements are:-
        - 1GHz processor
        - 512Mb RAM
        - 2GB Disk Space
- A USB cable for connection to the logger.
- A description and reference number for the installation site.
- The SIM card installed into the logger and a good GPRS signal on site for the chosen network (Roaming SIMs are also available). This is already done for you if you ordered a data package with the logger. See the Appendix 1 if you have your own data pack & SIM. About PermaNet+

The Spider and PermaNet+ software is a powerful leak detection system that allows the user to deploy a fleet of data loggers around a water network that are permanently installed to listen for leaking pipes.
The logger's highly sensitive Leak Noise Sensor switches on at night at a time specified by the user and takes samples of the noise it hears on the pipes. This is presented as 2 figures, Level and Spread. The level figure represents the sound level that occurs most often during the sample period and the spread is how much the sound varies during this time. So a large, consistent Level and small Spread is typical of a leak whereas a small level and large spread is typical of a background noise.
It then sends this data once a day to the PermaNet+ and HWMOnline systems.
If the logger believes that there may be a leak, then it takes another set of samples after a definable period and compares this to the first.
If leaking water noises are suspected, the logger will automatically make a short recording (Typically 10 seconds) and send this to the PermaNet+ software by GPRS telemetry (described later) to allow the user to decide for themselves if the recording sounds like a water leak.

Please note that sound recordings can use a lot of data and drain the battery if too many are made so in order to preserve battery life and reduce data costs the recording system can only make 7 recordings a month. If you have a specific requirement for more than this limit, then please contact HWM customer service for assistance.

In addition to the sound recording features, the PermaNet+ system will also perform noise analysis and present the data as Histograms that help to visualise the noise into patterns that can be identified as leaks. Please see Appendix 2 for more details on interpreting the data.

The logger can also be ordered to make recordings remotely, so if you decide that you need additional recordings or Aqualogs you can send a message to the logger to make an additional recording or Aqualog at a time you choose the next day.

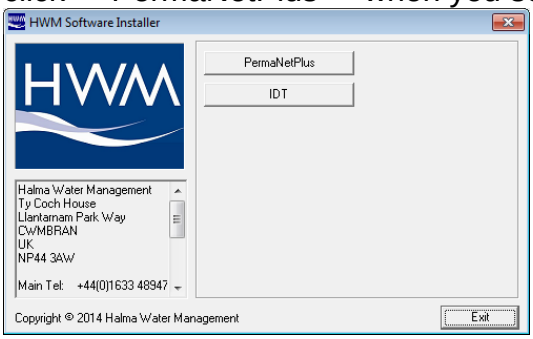
PermaNet+ Leak Localisation and Correlation is a secondary validation tool that can perform a correlation of the sound recordings to establish if there is genuinely a leak in the area. Whilst it cannot precisely pinpoint the leak, it will give a good indication of the area, allowing you to decide the next steps to take. (See later in this guide)

Installing the software

1. Insert the CD-ROM supplied into your CD drive.
   (If your PC does not have a CD drive, then either copy the files from the CD-ROM onto a memory stick, or download and run the installation file from the HWM website at http://www.hwmglobal.com)

2. Ensure you have system administration rights for your computer; ask your IT department if you are unsure.

3. If it did not run automatically, locate and run the “Installer” program and click <<PermaNetPlus>> when you see the screen below



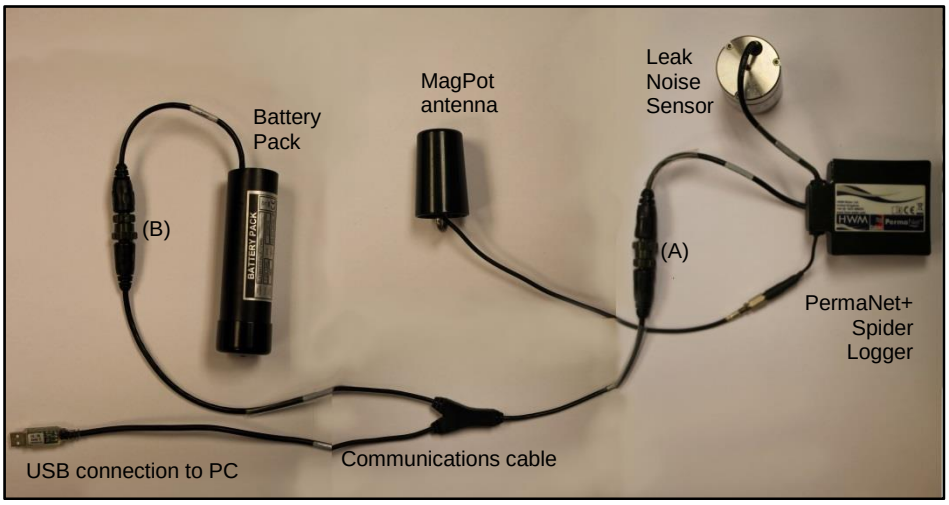
4. Follow the on screen installation instructions to complete the install of the PermaNet+ software.

5. When the installer menu re-appears, click the <<IDT>> button and follow the on screen instructions to install the Installation and Diagnostic Tool which is required for configuring loggers. If you do not need to configure loggers, then this step can be skipped.

   Should the automatic installation fail, please check with your system administrator that you have sufficient rights to install software or try installing the drivers manually.
   You may be required to update Microsoft .Net; the install file is included with the IDT setup files for your convenience.

Installation and site hardware Diagnostics Tool (IDT)

Once you have installed the IDT, connect the PermaNet+ Spider to the communications cable (A), the battery to the communications cable (B) and then the USB communications cable to your PC – Note there will be a short delay before the PC recognises the connection of the logger. This is normal, if your PC has sound enabled you will hear the “ping pong” sound as the logger connects.



The first time you connect your PermaNet+ Spider to a new USB port, Windows will configure the driver, wait until this process is completed before proceeding.

The following pages detail how to configure the logger; once these steps are completed you will need to connect the battery directly to the logger. To do this, remove the communications cable and connect the battery pack directly to the logger as shown below.

If you make the disconnection / reconnection within 30 seconds, then normally the real time clock in the logger will be preserved. However, if the time is lost, the logger will automatically make a data call and reset its clock via a time server.

Reading the logger

1. Run the “IDT” program.

2. The main window will appear of which the main items are:-

Toolbar

Software version no. (V1.01.00 or greater)

User Mode

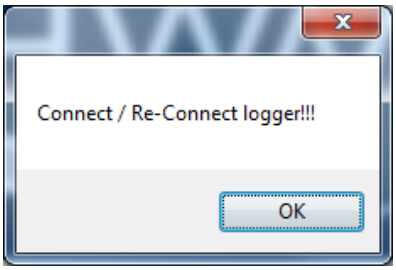
Configuration mode selection tabs

Main setup window

Function buttons

3. Now click the <<Read Logger>> button to load the current logger settings into the setup window.

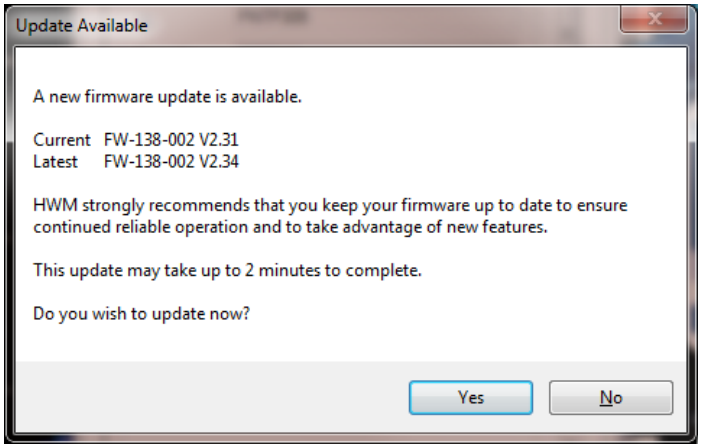
Important: As the logger is not powered from the PC directly, to preserve battery, the logger will automatically disconnect from the PC and shutdown if there has been no activity for **10mins**. If you try to communicate with the logger after this time, a message “Connect/Re-connect logger!” will appear. Simply unplug the USB plug from your computer, wait for 2 seconds and then reconnect. This will wake up the logger again.



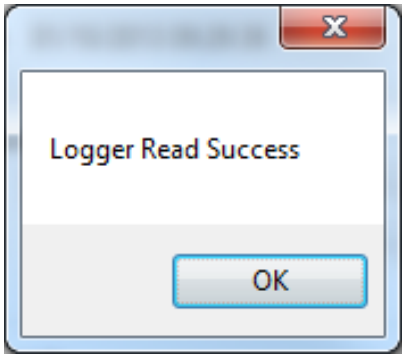
4. The IDT will now download the current settings from the logger.

   At this point the IDT will check to see if there is a more up-to-date version of the logger firmware available on your PC, if so, you will see the message “Update Available”. Click <<Yes>> to update the logger, the process will take approximately 2 minutes, however the logger will be restarted so you may wish to transfer any logged data first, in which case click <<No>>.

The IDT checks the firmware version each time you read it.



5. Once all the settings have been loaded you will see this message, Click <<OK>> to start configuring your logger.



Configuring the logger

1. You will now see the main setup menu (expanded for illustration purposes) The menu is structured in sections for easy setup:

i) Logger Details including ID, SIM card phone number and recording indicator: Recording, Waiting to record or Stopped

ii) Logger start time, data capture interval and Leak Noise Sensor read time

Selections for AqualLog and Acoustic logging (see page 12)

iv) Cellular data service provider settings

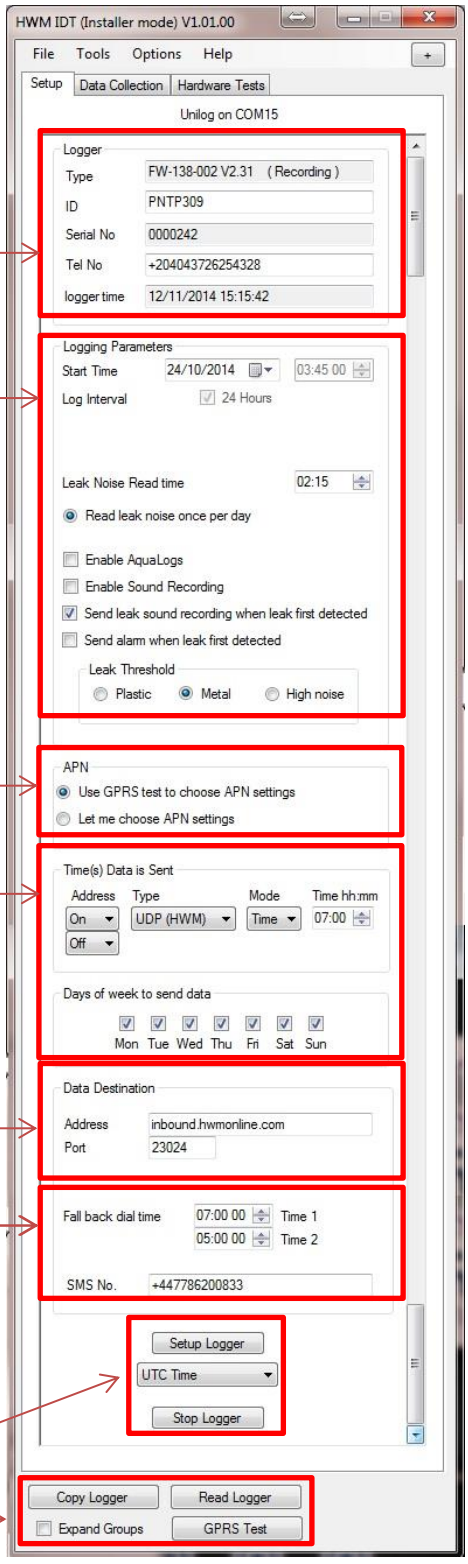
v) Data call settings

Data Destination details, the server address for the UDP data

vi) Backup call in timing details in case of main call failure or external battery exhaustion and SMS message destination number

Final Setup button and logger time zone selection

Main function buttons

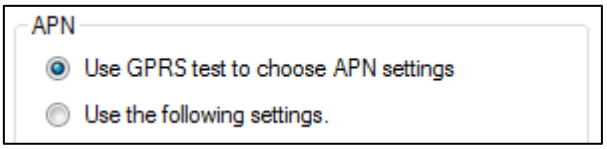


Note that the IDT is regularly updated so may not match the picture above

2. Now you can enter the configuration you require for each section
    i. **Logger** – enter the site ID that you wish for the logger, e.g. Postal/ZIP code up to 7 alpha-numeric characters and the telephone number associated with the SIM card. If you ordered a SIM with the logger, this will have been programmed already for you, otherwise enter the number from your service provider in international format (e.g. +44…)

    ii. **Logging Parameters** – Accept the default start date or enter your own. Default start date is in the past so the logger will begin recording immediately. You can delay this start date by selecting one from the calendar. Enter the time you wish to make a leak determination by reading the Leak Noise Sensor.

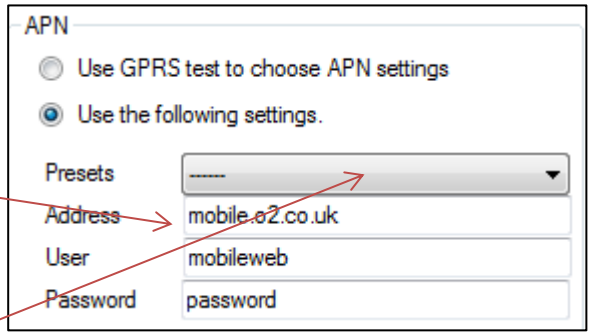
    iii. **APN** – If you have ordered a data pack from HWM you can leave this setting alone (as below) as your logger will have been preconfigured by HWM.



If you have ordered your data service & SIM card, then you will need to separately configure your service. HWM recommends that you allow the GPRS test utility to search for these settings automatically, however if you wish to enter them manually, click the button beside “Use the following settings”

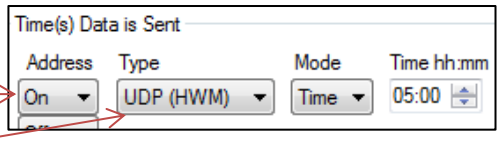
You can now enter your data service provider’s details into the appropriate boxes.

Alternatively select your network from the drop down list of presets

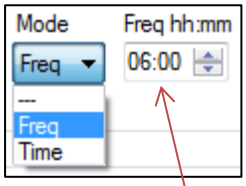


    iv. **Time(s) Data sent** – Here you specify the Call Out requirement for the logger. There are 2 modes available, SMS and UDP. SMS is a one way unacknowledged data transfer service using the common text messaging service. UDP is a true 2 way confirmed data transfer process via the internet over a GPRS connection. Both have advantages, however HWM recommends UDP wherever possible as this offers the most secure method of data transfer.

Switch on the Call out by selecting “1” in the Address selector, then choose UDP or SMS from the Type selector.

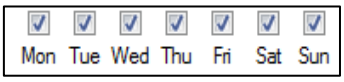


Now choose your Call out mode, this can be either “Freq” for a call made at a regular frequency throughout the day (e.g. every 6hrs) or “Time” to specify up to 8 individual times during the day.

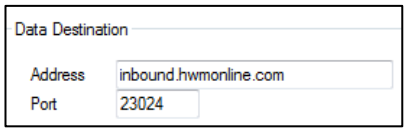


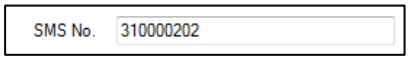
For the PermaNet+ system it is recommended to set 2 “Time” based calls at the earliest 1.5hours & 2hours after the Leak Noise Read time to allow for the data processing time.

You can also choose the days of the week that you wish the logger to send its data, this way you can save battery on days you don’t need data.



v. **Call Addresses** – These will usually have been entered at the factory and should not be adjusted, however if you have your own data server, then you can enter either the telephone number for your receiving modem, or the UDP address & port no for where the logger is to send its data.

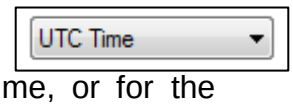




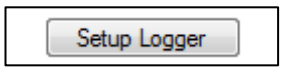
The fall back times specified here instruct the logger what to do in the event of the primary Call Out requirement not being met. This can be for 2 reasons:-

a. If a connected external battery goes flat, the logger will default from the normal call out requirement to a 2 times per day routine. The times of these calls are specified by both Fall back 1 & 2.
b. If a GPRS data call cannot be completed due to non-availability of a GPRS service, then the logger will try to send an SMS message at the Fall back 1 time.

3. Final steps – By default the logger is set to UTC (Coordinated Universal Time, equivalent to GMT), however you can choose either an offset from this time, or for the logger to use your PC time.



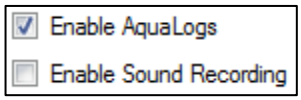
4. When you are happy with all the settings click the <<Setup Logger>> button to program the logger.

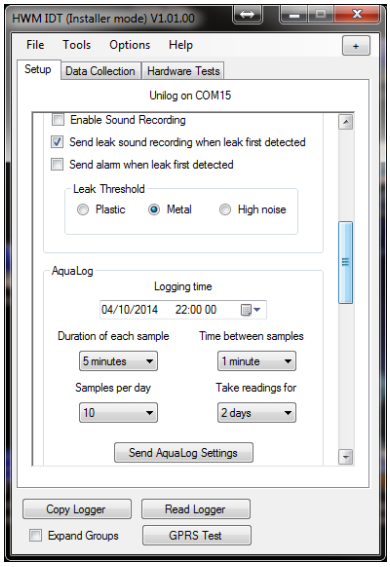


5. If you wish to copy all these settings to another logger, simply connect the next logger and click the <<Copy Logger>> button.

AquaLogs & Sound Recording

The PermaNet+ system allows you to capture Histograms of leak noise and Sound recordings. The set up of these is similar.
Tick the appropriate box to show the logging details panel:-





Choose the start time for the logging mode, the duration of how long the measurement log should be.
If you wish to make more than 1 log per day, specify the gap between log events and the number of logs per day.
Finally choose how many days you wish recordings to be taken.

If you wish to send Aqualog or Sound recording settings only, then click the “Send” button, otherwise click the “Setup Logger” button to send all the settings to the logger.

The Histograms and Sound recordings are then forwarded by the logger to DataGate and can be later downloaded to your PC using the PermaNet+ software (see page 26).

Data Communications Confirmation – GPRS Test

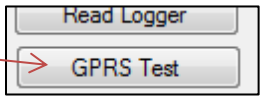
It is important to confirm that your logger is communicating with the data server before you leave site (or to be confident, your office), so you should undertake a GPRS test before you leave the logger in the field.

1. Connect the antenna to the FME socket on the logger.

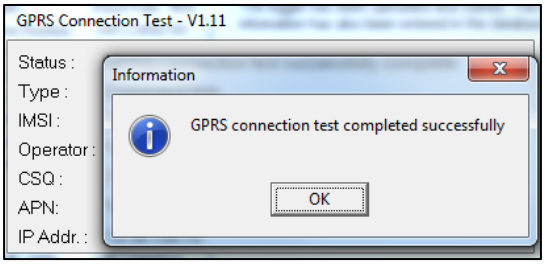
   Note: If this is the final aerial connection, ensure that the connector is tightened with spanner or pliers to prevent water ingress to the antenna plug as this will reduce performance. Additional protection with self-amalgamating tape is recommended. Do not over tighten.

2. Run the IDT and read your logger as in steps 1 to 3 above.

3. Now click the <<GPRS Test>> function button.



4. The GPRS Test program will now automatically execute a communications check with the data server, DataGate™ and deposit a test message that can be checked later on.

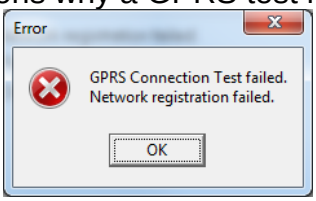


The test will take a few minutes and will confirm that the communication is successful.

5. You can now disconnect the programming cable and connect the battery pack directly to the Spider ready to deploy.

Troubleshooting a GPRS test failure.

There are a number of reasons why a GPRS test may fail,



the following points should be checked before calling HWM support for assistance:-

Possible Problem	Solution
Network Busy due to excessive traffic. Commonly occurs around schools.	Retry the test after a few minutes.
GPRS signal not available at your location. Not all Cell masts carry GPRS traffic	The logger will call into the data warehouse once per day using an SMS message; relocate the logger if more frequent communications is required.
Network signal not strong enough. You need a CSQ (reported by the GPRS test) of at least 8 for reliable communications.	Relocate the antenna if possible or try alternative antenna configurations. Ensure antennas are vertically orientated where possible. See aerial placement notes section.
APN settings incorrect.	The GPRS tester knows about a large number of cellular networks and will try as many settings as possible and correct any error automatically. If there is still a failure, then you need to check with your network operator that you have the correct settings for your SIM.

If you continue to experience problems with communication, you may need to check the network coverage in your location.

To perform a signal (CSQ) check, refer to page 22.

Aerial installation considerations

The method of installation at site should be carefully selected.

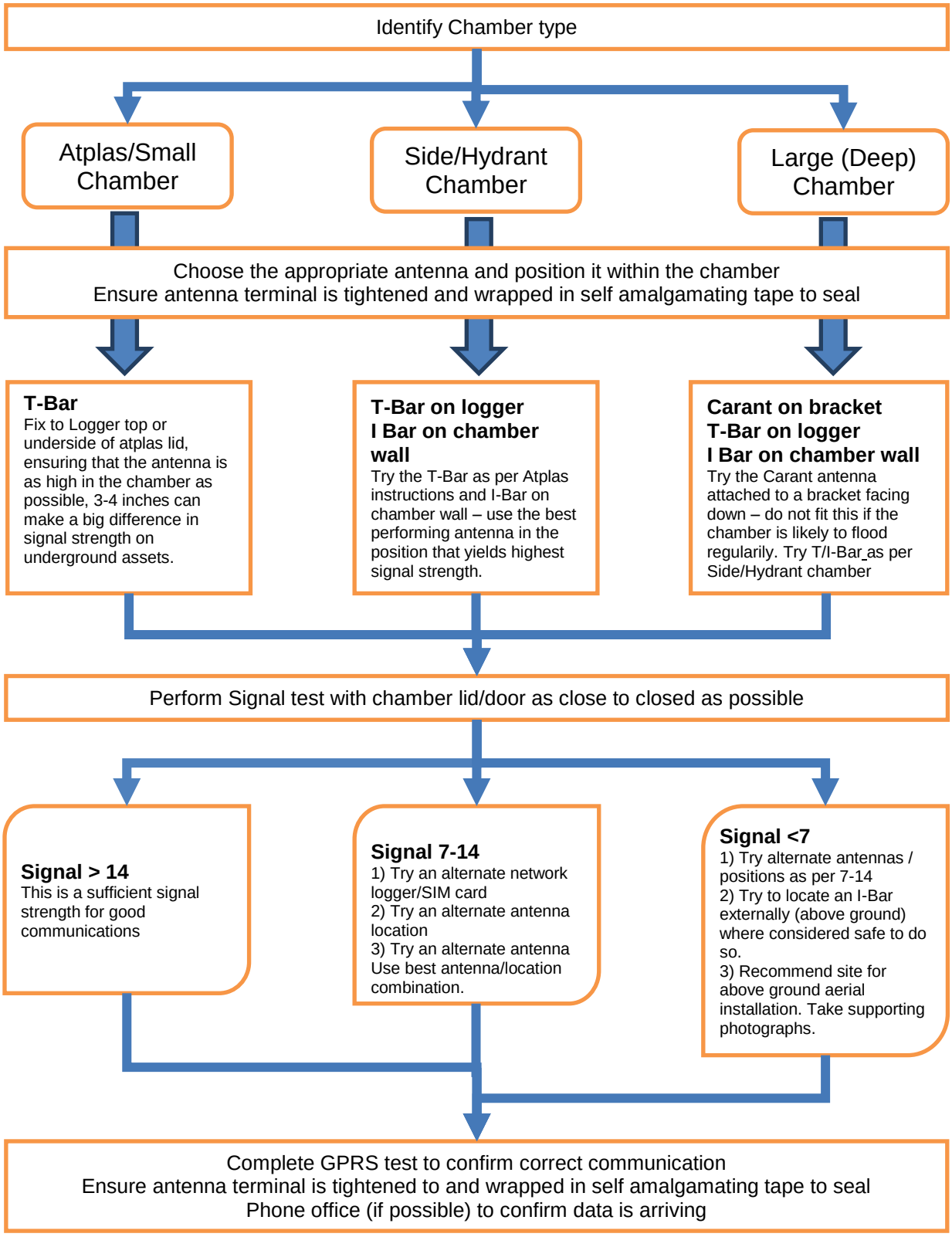
Signal strength within the cellular network can vary dramatically even within the same cell; proximity to the transceiver, type of antenna, position and angular orientation of the antenna, all have a significant effect on the ability of a device to reliably communicate with the cellular network. To ensure reliable GSM/GPRS data communications it is essential that the most suitable antenna is selected and it is mounted in the most appropriate location.

Installing a device without considering the type of antenna and its installation constraints can lead to disrupted and unreliable data communications and accelerated battery consumption. The following gives practical advice on how to minimise potential problems.

General Considerations

- Always perform multiple signal strength tests moving the antenna to different positions (please see below for description of signal strength test results).
- When performing Signal Strength Tests ensure that the chamber lid/cabinet door is in as close to normally closed position as possible to ensure an accurate result.
- Deploy the antenna as close to the surface as practically possible, especially when installing in a large chamber.
- If the device is installed in an underground chamber consider, where possible, locating the antenna in a secure position outside the chamber.
- Ensure that the antenna connector is in good condition and correctly tightened (finger-tight is not sufficient for the type of connectors used). Adequate tightening of the connector reduces the risk of water ingress and thereby signal attenuation as a result of changes in impedance.
- Never attempt to modify the dielectric seal of the antenna connector, it is designed to keep moisture away from conducting parts which lead to corrosion and attenuation.
- Consider using secondary environmental protection for the antenna connector such as self-amalgamating tape.
- If a logger is installed in a chamber that is likely to flood (e.g. an Atlantic Plastics chamber), position the logger upside-down in the chamber to avoid unnecessarily submerging the antenna connector.
- Use the shortest possible antenna lead.
- Where long transmission leads are required, consider using a low-loss alternative to corrugated copper cables, e.g. Times Microwave white braided coaxial cable.
- The signal emitted from any antenna submerged under water will be significantly attenuated; place the antenna in a location where it will not become submerged.
- Always ensure that the latest firmware is installed in the device.

Installation Process Decision Tree

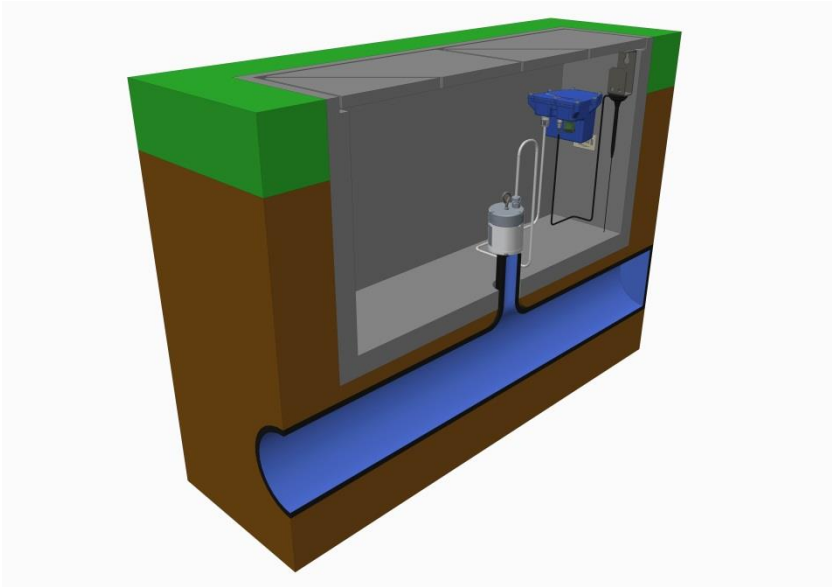


Cellular Network Signal Strength (as measured by CSQ Test)

0-7	Insufficient, the device may be able to register with network but will not be able to send or receive data reliably.
7-14	Marginal, depending upon the ambient conditions data transmission may be possible, important to select the correct antenna and install it in the most suitable location.
14-21	Adequate, Data transmission should be reliable.
21+	Ideal, Strong signal strength data transmission will be reliable.

Antenna Options

Carant – For most installations the Carant antenna will give the best performance.

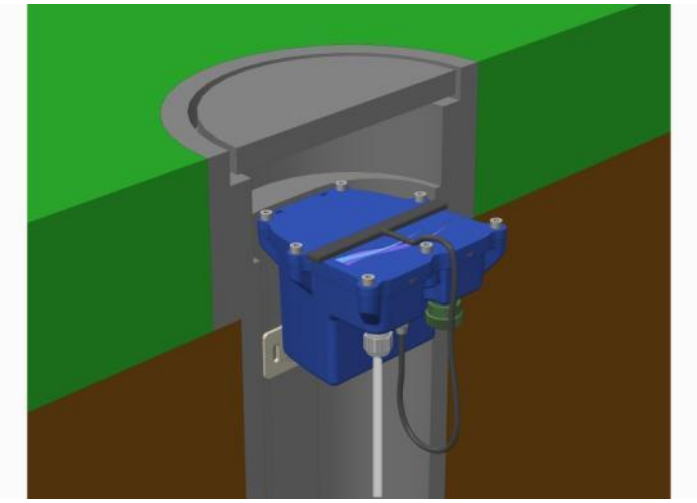


Carant Installations Considerations

For optimum performance the antenna requires a metal grounding plane, consider installing a metal bracket made of a ferrous material to attach the magnetic base of the antenna.

- Install the antenna near to as close to the surface in large underground chambers, ensuring that the lid will not interfere with the antenna when being opened/closed.
- This antenna is vertically polarised, it should always be installed in the vertical orientation.
- Never bend the radiating element of the antenna
- The Carant can also be attached to an installation bracket mounted to an existing marker post

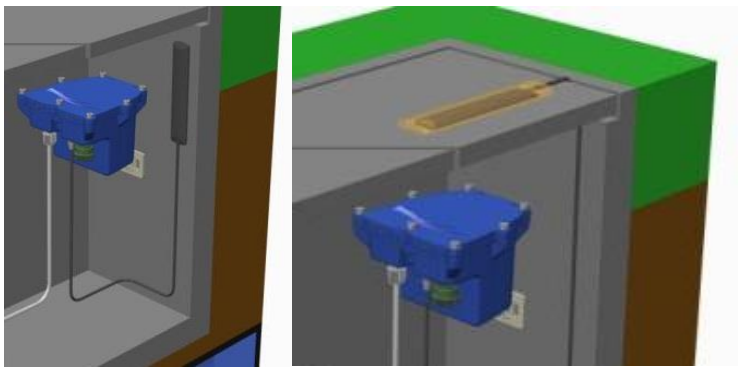
T-Bar – This antenna is ideal for installing on top of the device especially in locations with restricted space.

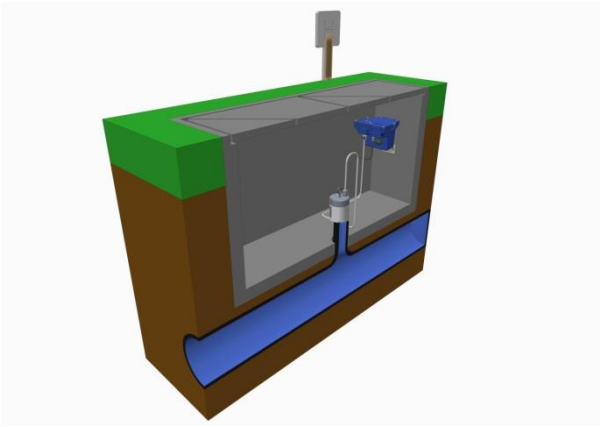


T-Bar Installations Considerations

- Adhere the antenna to external structures using marine quality adhesive (such as the brand ‘Goop’).
- Keep the antenna cable as short as possible, 0.5m.
- Avoid attaching the T-Bar to a metallic surface as this can adversely affect signal strength and performance, however it may be better than underground

I-Bar – The physical construction of this antenna makes it ideal for attaching to structures external to subsurface chambers.





I-Bar Installations Considerations

- Antenna can be attached to the side wall of a small chamber or to the top side of the chamber lid.
- With the use of a longer cable version (or an extension cable where absolutely necessary) and a sealing compound, this antenna can also be fitted in the ground, on marker posts, in cracks or brickwork near to the chamber.
- If the antenna is to be placed outside the chamber care must be taken to physically protect both the antenna and cable from damage. This can be done by burying the cable or installing a suitable conduit.
- Avoid attaching the I-Bar to a metallic surface as this adversely affects signal performance

Button – The button antenna is designed for mounting into chamber lids.

Button Installations Considerations

- Antenna needs to have the chamber lid drilled out as the top surface of the antenna needs to be 0.5mm below the surface of the lid to prevent damage.
- Use a 31mm core drill to make a suitable countersink in the lid to fit the antenna.

These are available from specialist tool suppliers.

- Once fitted, cover the top of the antenna with a resin epoxy such as Marine “Goop”

Installation pictures:

Installing your Spider with Leak Noise Sensor at site

Having performed all the steps in the previous sections, you should now be confident that your logger is configured for your purposes and is communicating correctly in a controlled environment. The next step is to physically install you logger on site.
Every site installation is unique with various types of connections, positioning or environmental conditions possible, the following recommendations will assist in a reliable installation.

- Warnings
  - The Leak Noise Sensor unit uses a high strength magnet and should not be carried by anyone with a heart pacemaker.
  - Keep the magnet away from any magnetically sensitive devices, PC, watches, etc.
  - The Leak Noise Sensor can be seen from the bottom of the unit. Users must not attempt to unscrew this sensor as this may break internal components resulting in irreparable internal damage, sensor replacement is then the only option.

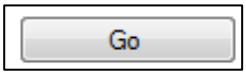
- Keep the equipment neatly arranged in chambers so that cables are not crushed.
- Do not allow logger or battery to rest on the connectors as crush damage to cables can result.
- Use wall mounting brackets were possible to keep the logger in clear space.
- Position loggers away from sources of electrical interference such and motors or pumps.
- Carefully Locate the Leak Noise Sensor onto the pipe or tap to avoid shocking the sensor. Always grasp the main body of the sensor when placing or retrieving it from the pipe fitting. Do not pull the sensor by its cable as this can cause damage.
- Always ensure that the contact point is free from dirt so that the magnet makes a good contact.
- Average operating temperature of the Leak Noise Sensor should be below 50°C, therefore if fitting to a hot water pipe, ensure a suitable insulation is used.

Taking a reading from the logger and hardware tests

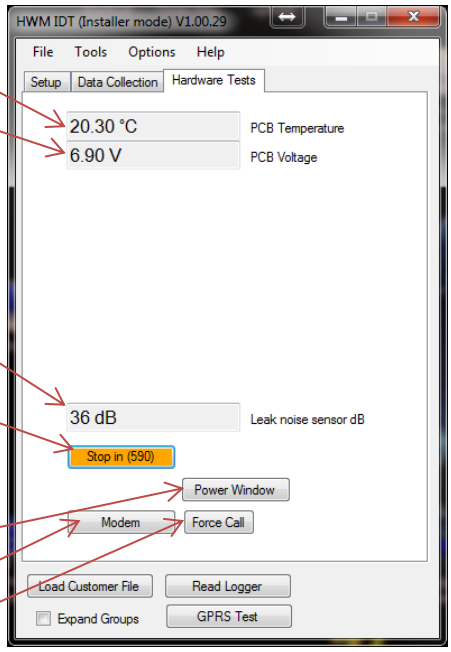
You are now ready to confirm that the logger is measuring real data from the sensors by taking an Instantaneous Value.

1. From the IDT menu bar, click the <<Hardware Test>> tab.

2. Click the <<Go>> button to start to check the operation of your installed system.



3. The IDT will now display its measurements for a period of 10 minutes to allow you to diagnose any issues with cabling.



Ambient temperature
Battery voltage

Sound Level sent to Spider from Leak Noise Sensor

Time until test stops & Manual Stop button

Open 10m power window button
Modem Diagnostics
Force a data call now

When you are ready to stop the test just click the <<Stop>> button.

Note: If you see '------', for Leak Noise sensor dB, beyond the first few seconds, then check your connection to the Leak Noise Sensor.

4. A "Power Window" allows you to keep the logger's modem turned on for a period of 10 minutes. This allows you to close the chamber lid and send a text message to it to confirm that communications is still OK. See final site checks on page 24.

5. Pressing <<Force Call>> forces the logger to send its data in immediately. Useful for when you wish to shift a logger to a new site.

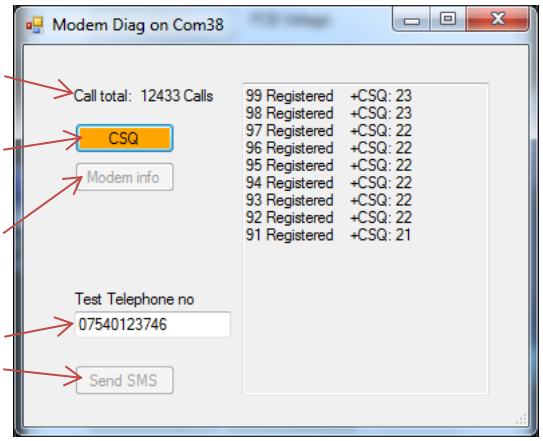
6. The <<Modem>> button allows some more advanced diagnostics to be performed on the modem.

Indicates total number of calls made

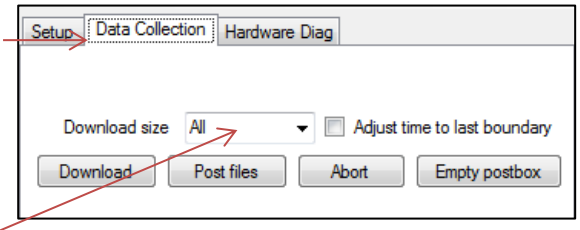
Provides the current signal strength

Provides the IMSI & IMEI numbers for the modem

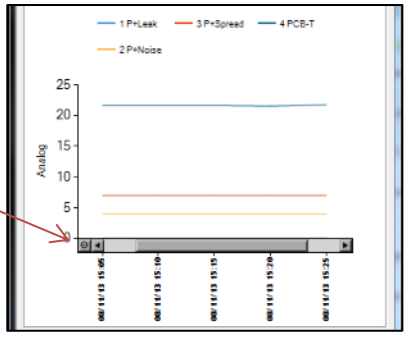
Enter a mobile phone number here & click <<Send SMS>> to instruct the logger to send you an SMS test message.



7. If you click the <<Data Collection>> tab you will now see a set of tools for downloading data from your logger for later uploading to the data server. It can also be of assistance for diagnosing problems.



   a. From the Download size selection, choose how much data you wish to retrieve, from everything the logger has stored to any un-sent data since the last time the logger called in.
   b. Click <<Download>> and choose “Archive” when prompted and the data will commence downloading. If you wish to stop the process, click <<Abort>> and the download will cease.
   c. A small chart will now be displayed showing the data downloaded. By using your mouse to draw boxes in the graph area you can zoom into areas of interest. Click the small circles at the end of the drag bars to zoom out. By hovering your mouse over the points on the graph, you will see the exact value recorded.



   d. If your logger is in a location where GPRS communication is not possible, you can now upload the data when you are next connected to the internet. Simply click <<Post files>> and all the data you have downloaded to your PC will be uploaded in one go. If you are downloading more than one logger in a route, all data is stored and transmitted together. If you decide that you do not wish to post the data you have downloaded, click the <<Empty postbox>> button to remove the downloaded data from your PC.

      Note: Choose the other data types depending on what recordings you wish to retrieve / view.

Final site commissioning checks

Having made all the configuration checks, checked all the wiring is good, verified the instantaneous values are what you need and confirmed communications with a GPRS test, there is one last check that you can make with your mobile phone to confirm everything is working as it should.

1. In the Hardware tests tab, click the <<Power Window>> button to power up the logger for 10 minutes.

2. Close the chamber or cabinet such that everything is in its final positions.

3. Now using a standard mobile phone, send a text message to the SMS number of the logger (see page 9 for the number) including the international dialling code if needed.
   The text message should read **TTTT#**

4. After a few seconds/minutes (depending on the network operator) the logger will send a message back to you with details of its current status.
   Example response from a logger:
   TTTT138-002 V01.70CSQ:1010.9VyouridRT hh:mm ss dd-mm-yy …

5. To decipher the message returned, please refer to the table below:

Message	**Description**
TTTT	Original command text without #
138-002	Logger type number
V01.00	Firmware version in Logger.
CSQ: nn	Signal strength nn (nn = 6 to 30)
10.9V	Operating voltage
yourid	Your Logger ID
RT hh:mm ss dd-mm-yy	Real Time Clock setting
ST hh:mm ss dd-mm-yy	First Time the logger was started
LR hh:mm ss dd-mm-yy	Last Time the logger was re-started
Ch1 (A) 0000.0	Channel 1 – Leak status
Ch2 (A) 0002.2	Channel 2 – Noise value
Ch3 (A) 0002.2	Channel 3 – Spread value
Ch4 (A) 0014.2	Channel 4 – Temperature (optional)

6. If the CSQ: value in the message is OK then the installation is complete. The logger will automatically go back to sleep after 10 minutes.

7. There can be delays in the SMS network, so the response to your message may not be immediate. If you have had no response in 10 minutes, re-open the chamber and using the modem diagnostic send yourself a test SMS. If this gets through then improve the location of the antenna and try again.

Note: Some Roaming SIM cards do not accept incoming text messages. Check with your service provider if you are unsure.

Installation checklist

Before you leave site, review the following items to be sure that the installation is going to be a good one.

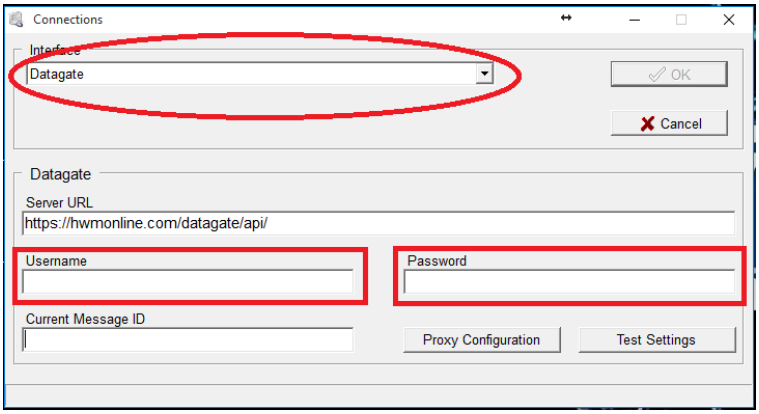
- ☐ Have you placed the Leak Noise Sensor unit correctly?
- ☐ Have you run an instantaneous value to confirm data quality?
- ☐ Have you run a GPRS test to confirm communications quality?
- ☐ Have you confirmed the GPRS message was received by DataGate™?
- ☐ Have you confirmed an SMS message with the chamber lid closed?
- ☐ Have you recorded all your site information, serial nos, photos, etc?
- ☐ Have you closed all open chambers and recorded any damage?
- ☐ Have you left all wiring tidy and safe – not tied to ladders?
- ☐ Have you removed all your installation tools?
- ☐ Have you recorded the GPS location of the logger?

You have now completed your site installation and confirmed that the logger is operating and transmitting its data to DataGate™ (or your local data server). The next sections deal with how to use DataGate™, Almos™ and the PermaNet+ PC software.

Using PermaNet+ for PC

Configuration for DataGate

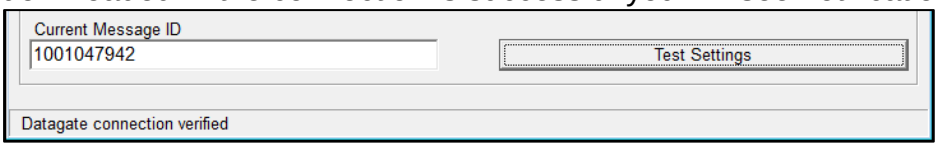
When you run PermaNetPlus for the first time you will be prompted to configure your connections:-



If it does not appear automatically, click the connections icon.

1. Choose DataGate as indicated above, then enter your Account Name and Password into the two boxes highlighted above.

2. Click <<Test Settings>> to confirm your connection to DataGate. At this point you may see a warning from your system regarding internet access. Authorise the connection request to allow data to be downloaded. If the connection is successful you will see notification:



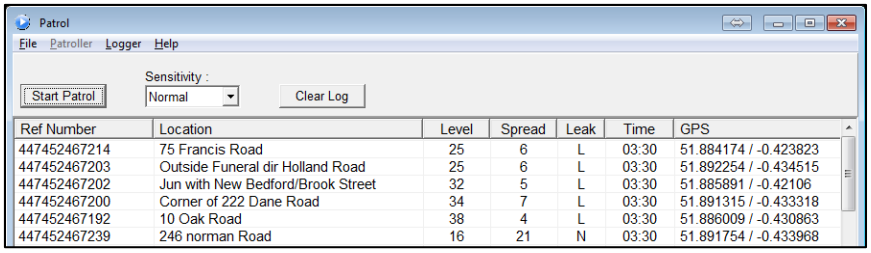
Note the Current Message ID is populated automatically. If you wish to retrieve messages from earlier, reduce the size of the Message ID. Each day is roughly 1 million therefore reduce the count by the number of days you wish to go back. Do not press Test Settings again.

3. Once the data link is set up, you need to download the data from DataGate.

4. From the main menu, click the 

button to start downloading data.

5. PermaNet+ will then download data from the loggers into the PC database.



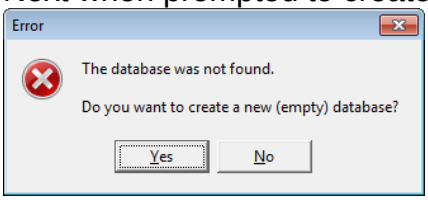
Ref Number	Location	Level	Spread	Leak	Time	GPS
447452467214	75 Francis Road	25	6	L	03:30	51.884174 / -0.423823
447452467203	Outside Funeral dir Holland Road	25	6	L	03:30	51.892254 / -0.434515
447452467202	Jun with New Bedford/Brook Street	32	5	L	03:30	51.885891 / -0.42106
447452467200	Corner of 222 Dane Road	34	7	L	03:30	51.891315 / -0.433318
447452467192	10 Oak Road	38	4	L	03:30	51.886009 / -0.430863
447452467239	246 norman Road	16	21	N	03:30	51.891754 / -0.433968

6. The patrol will stop automatically once all available data has been downloaded. Close the window when complete.

Creating your first DMA

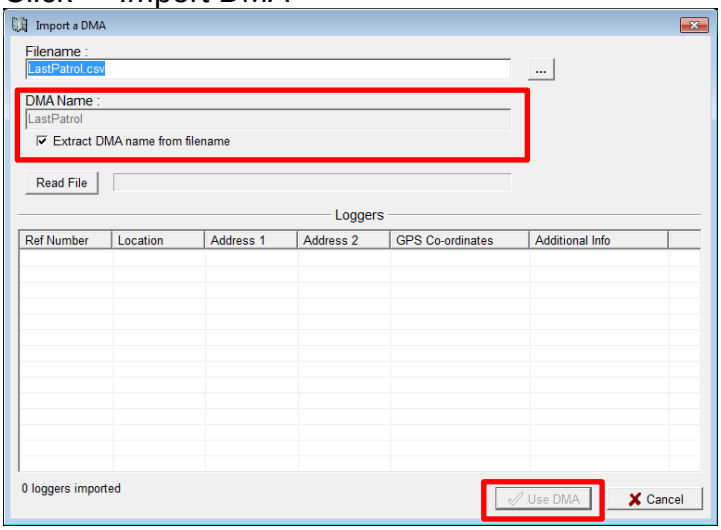
1. From the main menu click 

2. Next when prompted to create a new database



click <<Yes>> and then again when prompted to create a new DMA list, click <<Yes>>.

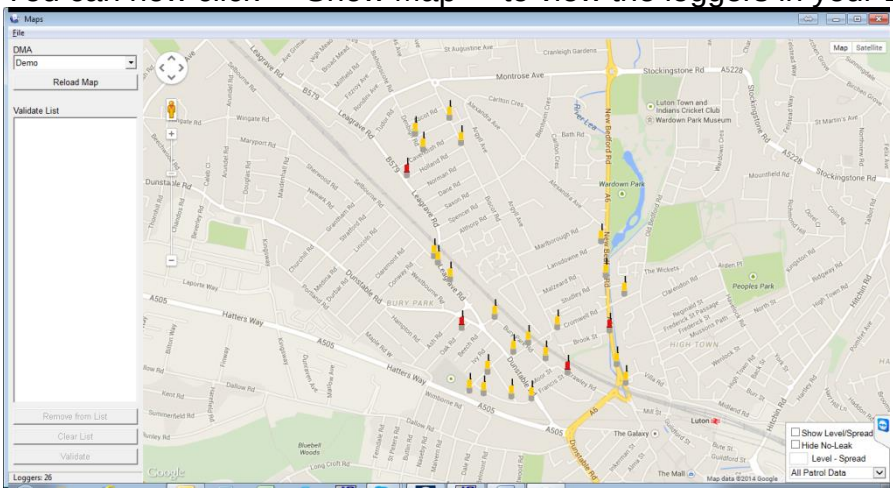
3. Click <<Import DMA>>



Clear the checkbox and enter a name for the DMA you wish to create.

4. Click the <<Read File>> button to import the list of loggers and click <<Use DMA>> to store the list.

5. You can now click <<Show Map>> to view the loggers in your DMA.



Additional settings

If you have upgraded from a previous edition of Palmer PC Patroller II, there are a few additional options that you may need to check/set.

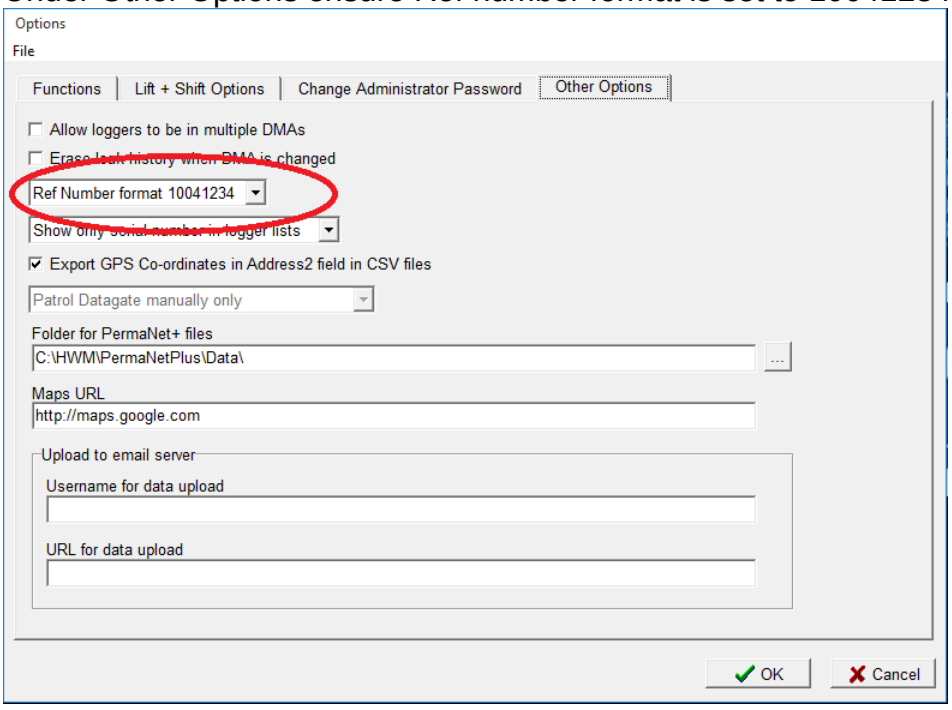
1. From the **Setup** menu choose **Options...**

2. When prompted, enter the password. This is **admin**, if you haven't changed it from the default.

3. In the Functions Tab, ensure the following options are ticked:

Patrol	Aqualog
DMA Management	Connections
Deploy	Backup/Restore
Data Analysis	Maps

4. Under Other Options ensure Ref number format is set to 10041234

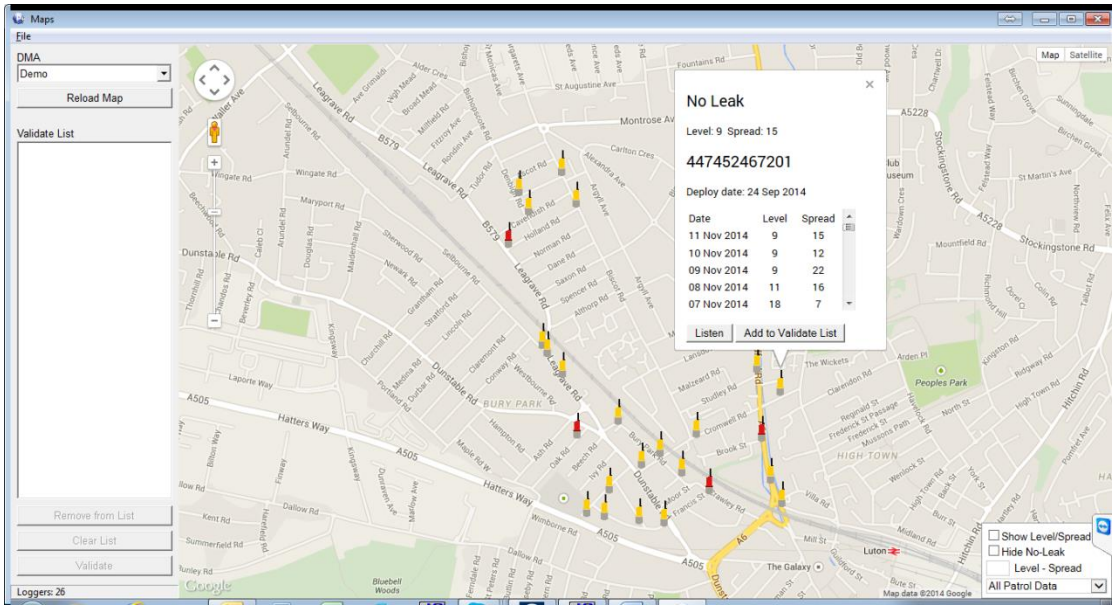


Note: this option will be set by default to 10041234 if the interface is set to Datagate, and the option will be greyed out.

5. Click <<OK>> to store these settings

Map view

To view details about each site where a PermaNet+ logger is installed simply click on the site:



Sites coloured Yellow are not detecting a leak, Red sites are where a leak is suspected.

The PermaNet+ logger can automatically send a sound recording file to Datagate which is downloaded during the Patrol. When sound files are available, the two buttons appear.
To listen to the sound recording, click <<Listen>>.

Should you wish to schedule your own recordings, refer to the section on Aqualog / Sound Recordings.

To perform secondary confirmation validation click <<Add to Validate List>> and the click the <<Validate>> button to launch the Leak Localisation & Correlation tool. **Note:** Sound Recording must be enabled when programming the PermaNet+.

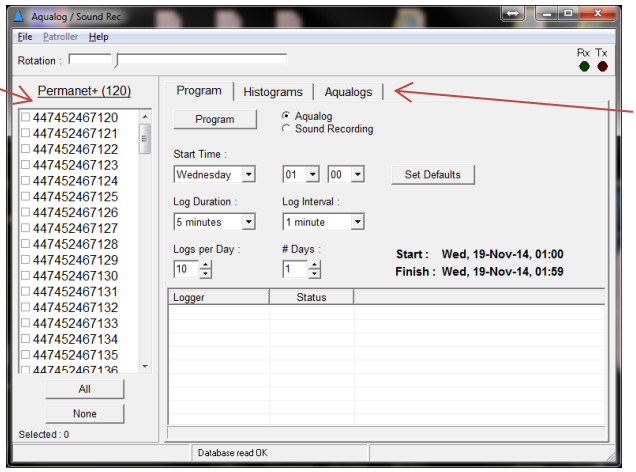
Examples of the sound of a quiet pipe and one with a leak can be found on our website at:-
http://www.hwm-water.com/products/palmer-environmental-products/leak-detection-localisation/leak-noise-logging/permanet-/

Sound recordings and Aqualogging

1. From the main menu click 

2. The Aqualog / Sound Recording menu below appears

Loggers



Mode tabs

Scheduling Recordings

3. The first mode (Program) allows you to set loggers to make either an **Aqualog** recording or a **Sound Recording**.
   Note that care should be taken to decide if a recording is really necessary as each data transfer will use up some logger battery.

4. Choose the loggers you wish to command by ticking the check boxes on the left of the reference number.

5. Setup the recording parameters as required.

6. Click the <<Program>> button to send the commands to the loggers you chose. The loggers will pick up the commands the next time they call in, so be sure you allow sufficient time for the call in before setting the recording. i.e. If in the next 24 hours the logger is due to call in at Midnight and 5am, then if you choose 10pm today, the logger will not make a recording.

Viewing Daily Histograms

7. Click the **Histograms** tab

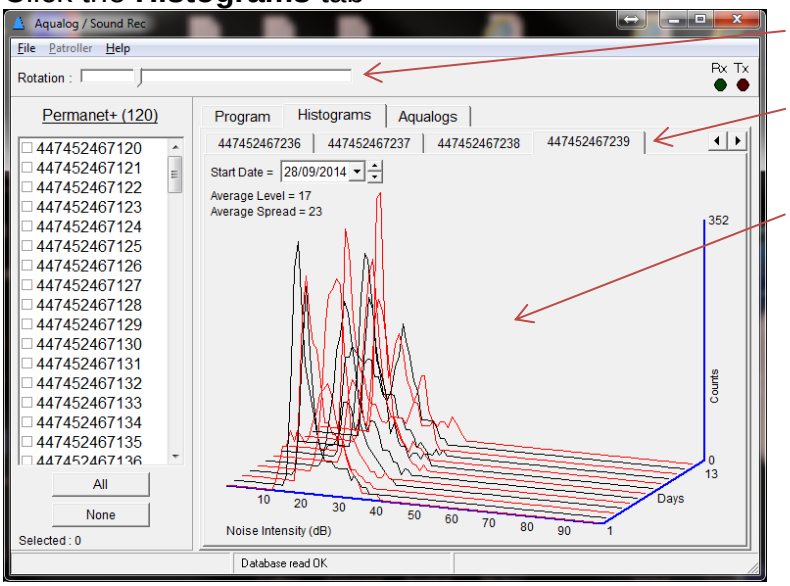


Chart rotation

Ref no of logger

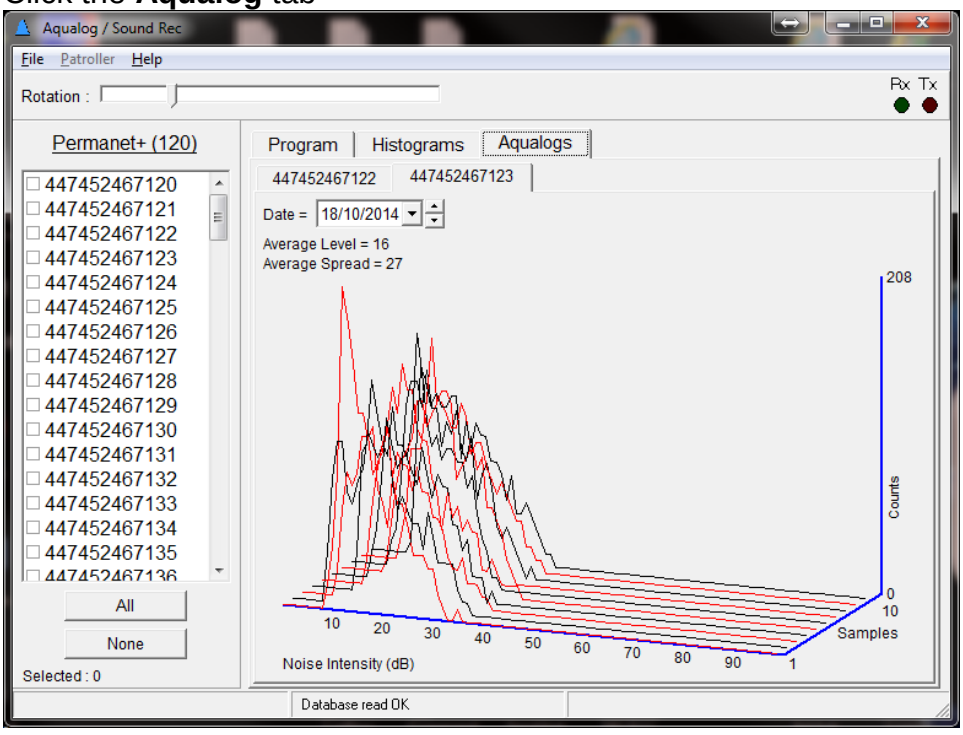
Chart

8. Choose the logger you wish to examine by clicking the appropriate tab. You can now quickly shift between loggers using the left & right cursor keys.

9. Use the **Rotation** tool to rotate the 3D chart to make it easier to view.

Viewing Aqualogs

10. Click the **Aqualog** tab

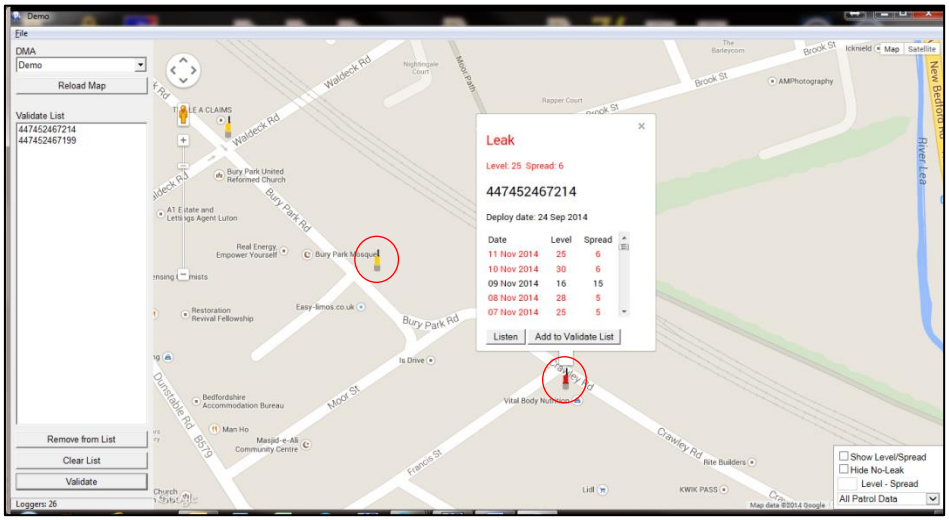


11. The more detailed, programmed Aqualogs can now be viewed in the same way as the histograms.

Leak Localisation and Correlation Tool

In addition to listening to the sounds recorded, you can use this tool to perform some rudimentary correlations to gain confidence that a leak is present.

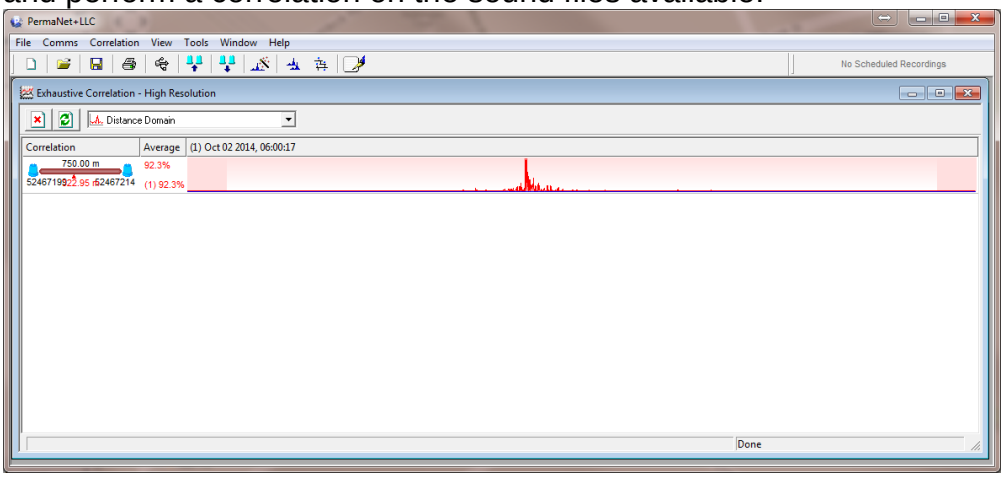
1. Choose 2 loggers to test between. In the example below we will check between the 2 sites ringed to identify if the Leak suspected can be confirmed.



2. For both loggers, click <<Add to Validate List>>

3. Next click the <<Validate>> button

4. The PermaNet+LLC (Leak, Localisation & Correlation) tool will launch and perform a correlation on the sound files available.



5. The Average indicates a confidence level for the correlation and clear the peak indicated on the graph confirms that a leak is detected with high confidence between the two loggers selected.

IMPORTANT: Whilst the PermaNet+ system is designed to assist the user with remote leak detection, local listening should always be performed before commencing site works.

Technical Specifications

Sensor Input Options	Serial	Leak Noise Sensor
Logger Features	Memory	Primary recording 2 million readings
	Alarms	Leak / No leak Signal received / Not received
	Logger ID	Up to 7 alphanumeric characters. Also readable factory set serial number in firmware.
	Clock	On board 24 hour real time clock with date facility
	Internal Cellular modem	GPRS to HWM DataGate or customer specific FTP server, multiple messages per day
		Quad band modem supplying 850/900/1800/1900MHz bands
	Dimensions	Logger without antenna = H 85mm x W 115mm x D 114mm Leak Noise Sensor = H 80mm x H 50mm
	Weight	Logger = 570g Leak Noise Sensor = 740g
	Operating Temp	-20 to +60°C (-5 to +140°F)
	Ingress protection	IP68 submersible
	Power	Lithium Thionyl-Chloride cell operational for up to 5 years under standard operating conditions*, complete with low battery alarm
** Typical battery life expectancy is based upon operational setup and achieving network registration regularly and with ease. If GPRS-enabled network registration is unachievable, the logger will convert to SMS-only operation after 24 hours and will attempt to re-establish GPRS communication when possible. A signal strength test should be performed during installation.*		

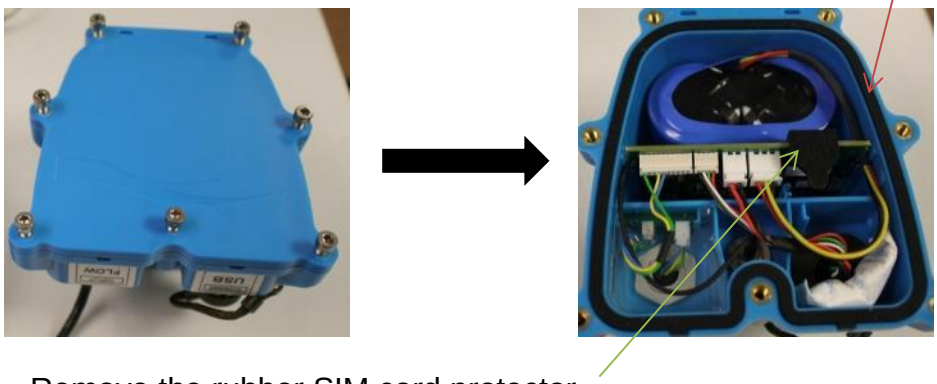
Order Codes	
FS/LBF/1/xxx	PermaNet+ Spider GPRS Data Logger with Leak Noise Sensor

Order Codes – Optional extras	
CABA9315	USB programming 'Y' cable
EXTBATTPACK/72V/D	D-Cell Battery pack
EXTBATTPACK/72V/C	C-Cell (small body) Battery pack
CABA4255	3m Tether Line for Leak Noise Sensor
CABA8110	Magpot antenna
AER8015	T-Bar antenna 0.5m
AER8020	I-Bar antenna 1.0m
AER8025	I-Bar antenna 3.0m
AER9010	Button antenna 0.5m
AER6000	High Gain antenna 2.5m
AER6001	High Gain antenna 5.0m
AER6003	High Gain antenna 8.0m
AER6002	High Gain antenna 10.0m
CABA8510	FME Aerial Extension 10.0m
CABA8510-1	FME Aerial Extension 8.0m
CABA8510-2	FME Aerial Extension 5.0m
CABA8510-3	FME Aerial Extension 2.0m

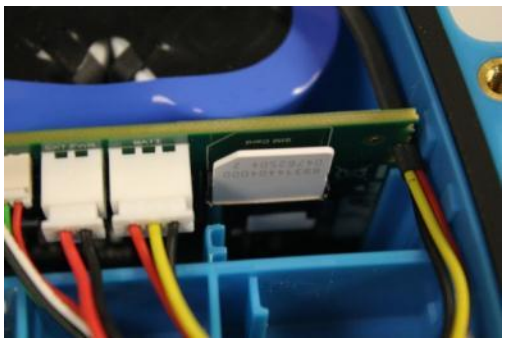
Appendix – Additional Information

1) Fitting your own SIM card

1. Remove the lid of the logger taking care not to damage the seal.



2. Remove the rubber SIM card protector



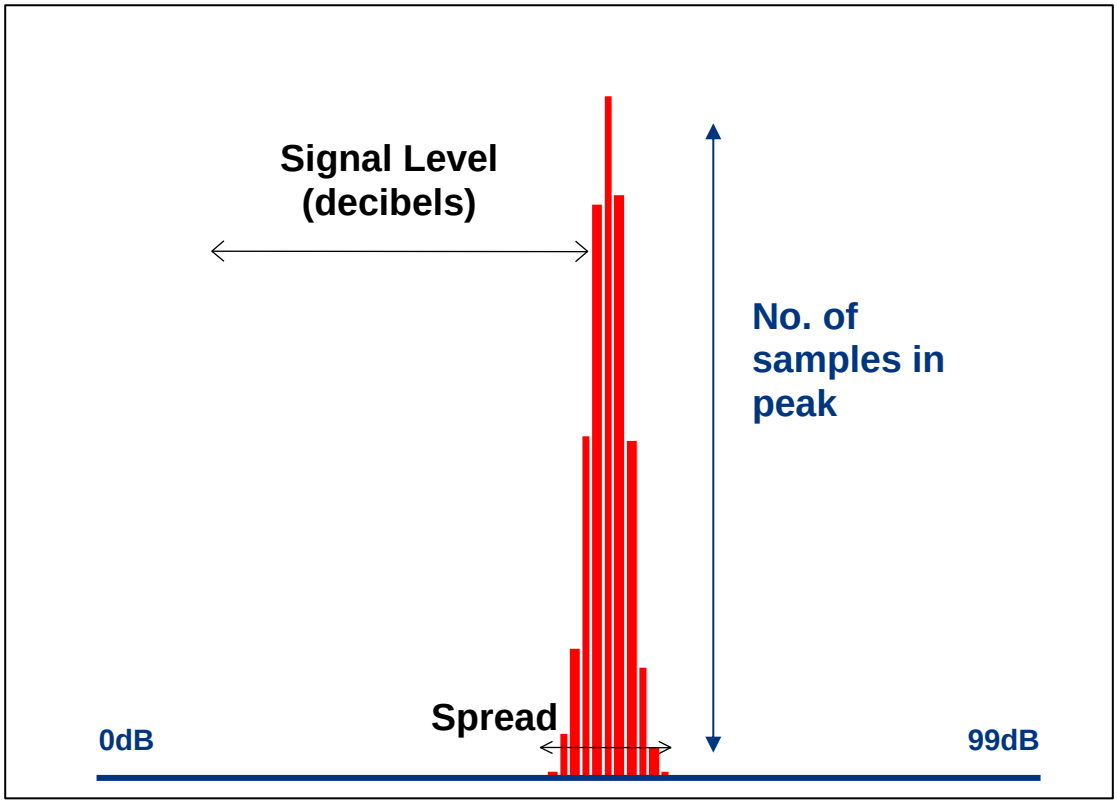
3. Insert your new SIM into the empty slot as shown above.
   Ensure the gold contacts face the board and the notch is to the left.

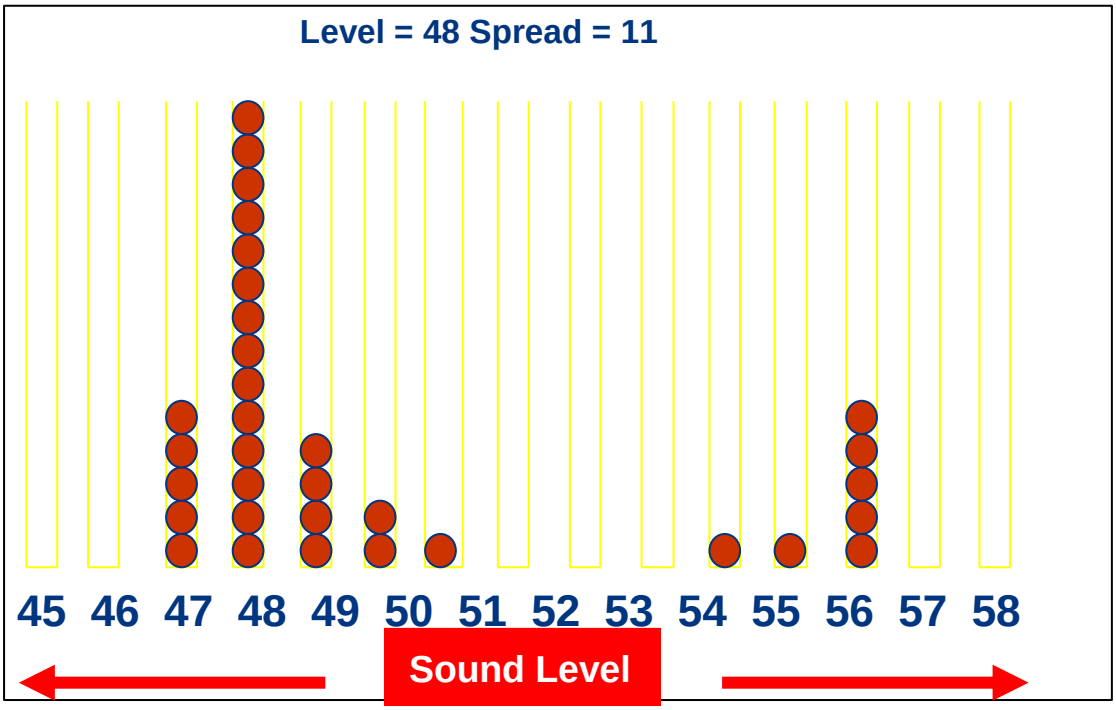
4. Replace the SIM protector and lid ensuring the screws are retightened to 1.2nm to ensure the logger remains water tight.

5. Proceed with programming the logger and ensure you enter the new SIM phone number into the software (step 2.i on page 10) including the '+' symbol and the international dialling code with no spaces. e.g. +4477xxxx.
   This is an important step as the logger sends an SMS message to itself once a month to synchronise its clock. If the wrong phone number is entered, this can result in an international SMS message being sent.

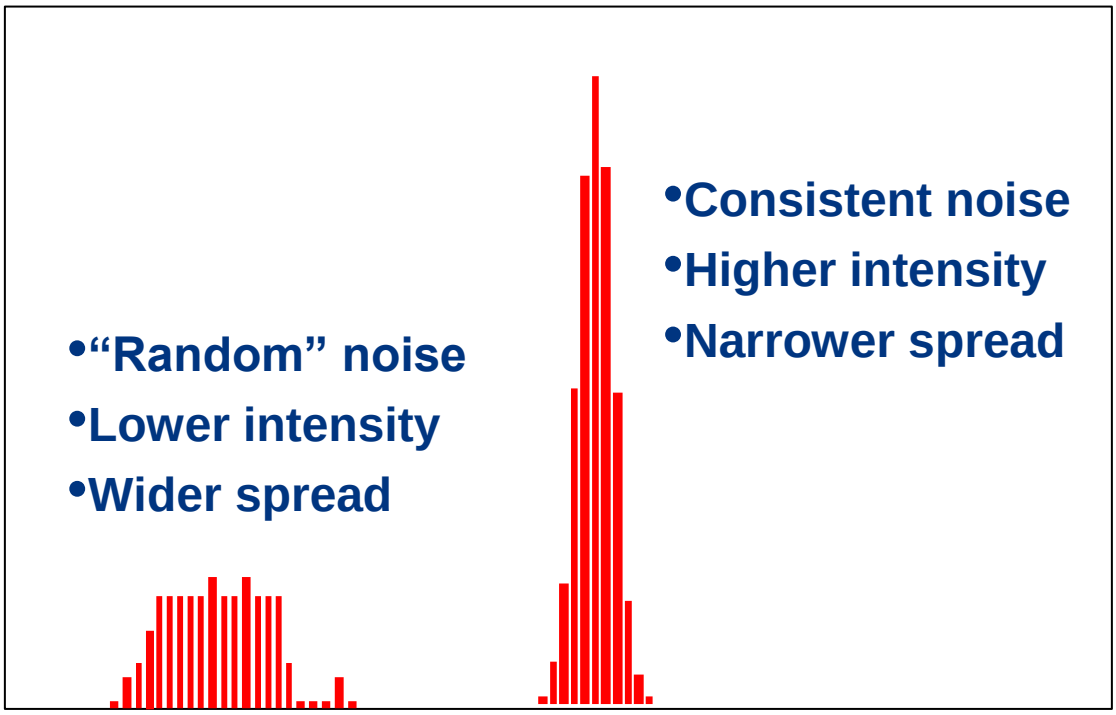
2) Interpretation of Leak Data

The raw sound level is measured on a scale between 0dB and 99dB.
The signal **Level** in decibels is the point on the scale where the clearly identifiable peak is.
The **Spread** is the number of samples that are included to make the biggest peak.





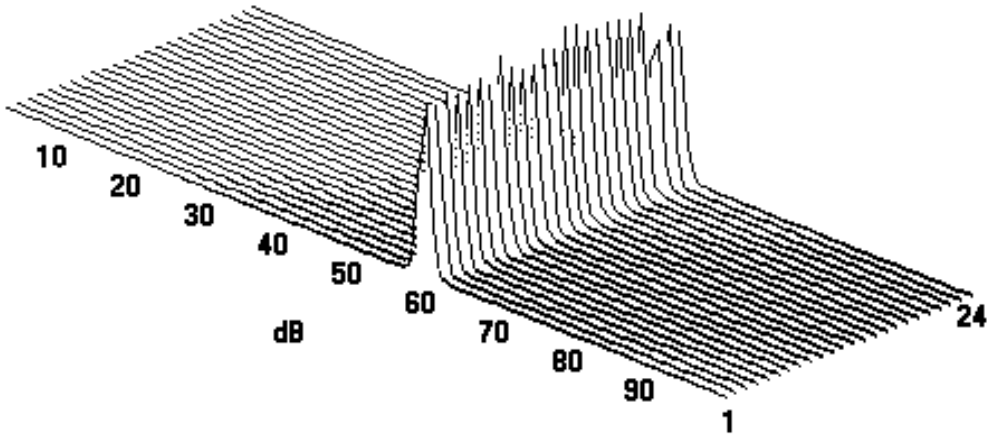
Each test will provide different results depending on the ambient noise conditions at any given deployment. A leak will be indicated by a consistent noise generated at a higher intensity than any random background noise, so the best indication of a leak is a high peak with a very narrow spread, see example on the right below. The noise on the left is a probably not a leak as it is low intensity and broad spread.



The following section discusses how to read Histograms.
Please note that an 'Aqualog' is the same as a 'Histogram' but is manually triggered and has customisable timings whereas the standard histogram is received from the logger once per day.

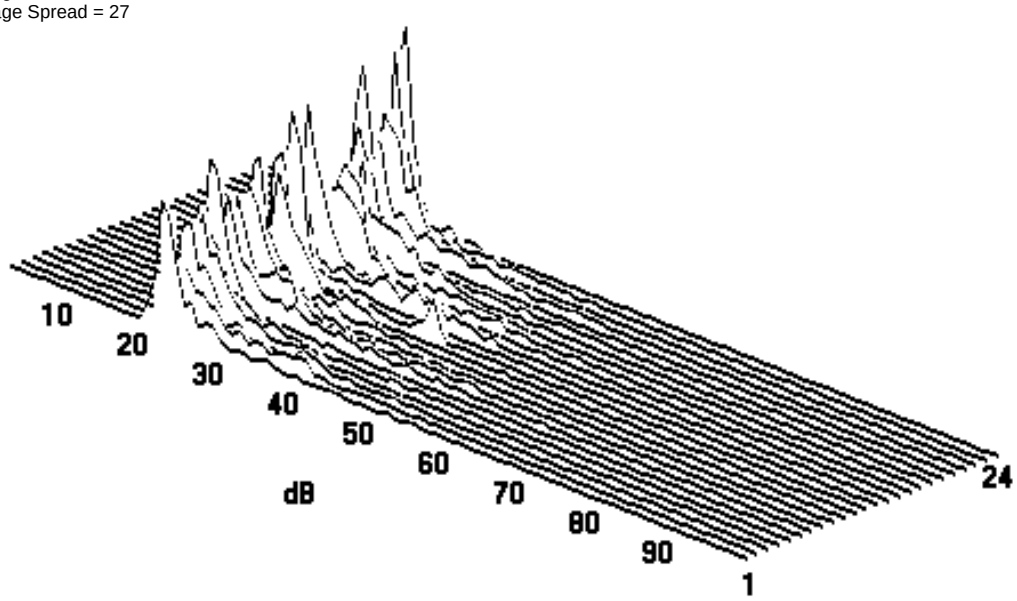
Daily Aqualog/Histogram Examples:
In the below example of a ‘good leak indication,’ measured over 24 days there is an average **Spread** of 5dB and **Level** of 58dB at the peak. This shows a high repeatability of the leak noise.

Average Level = 58
Average Spread = 5

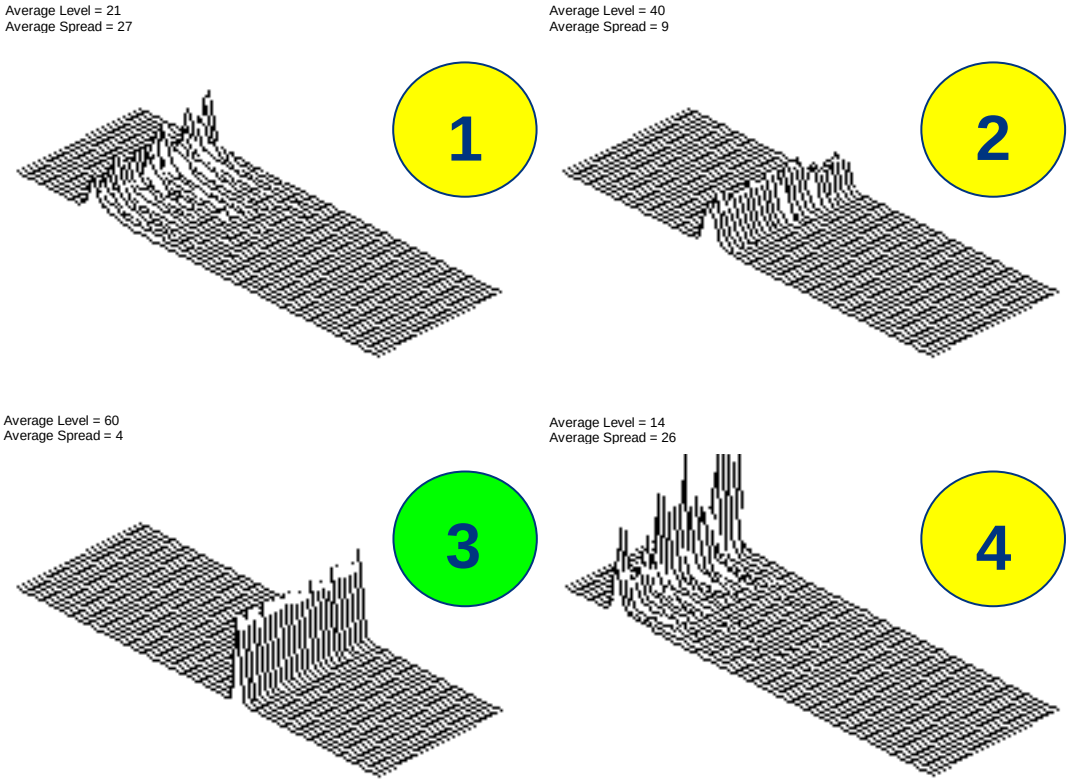


In the below example of a ‘poor leak indication’ again measured over 24 days, there is an average **Spread** of 27dB and **Level** of 21dB at the peak. This shows a poor repeatability of the leak noise.

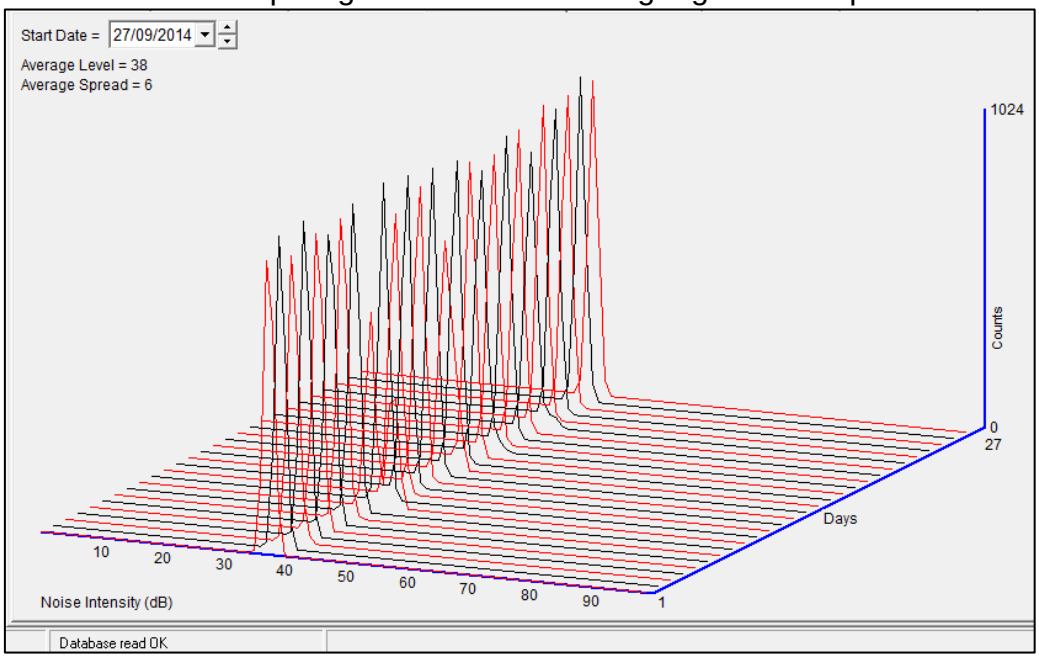
Average Level = 21
Average Spread = 27



In the below set of examples the strongest leak indication is No 3 – a narrow spread (5dB) and a strong level (60dB). The others do not offer good indications of leaks No 1 big spread / poorly defined peak, No 2 good spread but poor peak, No 4 big spread/ inconsistent peak.



In summary –
The best indication of a leak is with the highest consistent peak (noise) with the narrowest spread and the highest number of samples in it. See below a typical PermaNet+ Aqualog screen shot showing a good example of a leak.



SIMPLIFIED DECLARATION OF CONFORMITY

This simplified EU declaration of conformity referred to in article 10(9) shall be provided as follows:

Hereby, HWM Ltd declares that the radio equipment type transceiver is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at www.hwmglobal.com

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