USER MANUAL

Guardian2

Guardian2 & Casella 24/7 Data Management System

HB4085-05

August 2020

Contents

Important notices

Manual handling

Take care when carrying or installing the Guardian2 particularly if working at height or holding the Guardian2 itself above head height during installation.

> **Note:** If in doubt, check with your local health & safety representative who will advise you on whether two people are required.

Power

The Guardian2 is delivered ready wired for 110V operation but may also be operated from 240V. A competent electrician should fit the correct plug. Live mains runs through the product so all necessary precautions should be taken.

> **Note:** If you have ordered Solar or Battery power options, please refer to page 50 of this manual for additional information.

Email notifications

In order to get the best response from the **Casella24/7 Data Management System** you (or your IT support staff) should add the following email address to your email system's whitelist (or safelist): no-reply@casella247.com

> **Note:** Failure to do so may result in important email notifications from the **Casella24/7 Data Management System** being delayed or even blocked entirely.

Weekly checks

Due to the nature of construction sites, it is advisable to check the installation on a weekly basis i.e. for physical damage to the Guardian2's housing and cables and that air inlets/outlets are not blocked. At the same time, it is recommended that noise versions are calibrated using an acoustic calibrator at which time the microphone and its enclosure can also be inspected. Dust versions should be checked to ensure that the air sampling inlet is not damaged or blocked. For further information refer to Service and Maintenance.

Relocation of the Guardian2 Unit

If you would like to move your Guardian2 system outside of the country that Casella configured its use for, then please notify this prior to the unit being moved. Any notification should be raised via Casella Technical Support Helpdesk using the below link:
https://helpdesk.casellasolutions.com/

This allows us to re-configure the SIM with the Telecoms provider, so that it is set up for use in the new destination country prior to installation. Please note that re-configuration of the SIM can only take place with a live cellular network connection and therefore this must take place before the Guardian is moved to another country. On completion of the re-configuration, we will confirm the unit is ready to move. This process needs to be completed again once the unit is ready to return to the original destination. Again, this must be completed before the unit is despatched / returned.

Caution – laser product

The particulate sensor is a Class3B laser and the sensor should not be opened to avoid exposure to the beam. The sensor uses a diode laser (max 25mW) which is Class 1 as a user does not have access to the source. The user must not open or access the laser source.

Introduction

Thank you for purchasing the Guardian2 and Casella 24/7 Data Management System.

Casella prides itself on providing precision instrumentation since 1799, supplying eminent figures including Darwin and Livingstone. A lot has changed in our 200-year history but what does remain is our commitment to reliable, trustworthy and credible solutions.

For more information or to find out more about Casella and our products, please visit our website at: http://www.casellasolutions.com.

The Guardian2 hardware and Casella247 Data Management Software are intended to be intuitive and easy to use but we recommend that you familiarise yourself by reading this user manual.

If you have any queries, concerns or problems with the products or service we've supplied, please don't hesitate to contact us either by email at: info@casellasolutions.com or by phone to Technical Support on 01234 847799.

Guardian2 system with particulate, noise and wind sensors

System Description

The system consists of Guardian2 hardware which is installed at a sensitive façade(s) and **Casella 24/7 Data Management System**, which is hosted on an off-site server where data is accessed by a secure login and password.

Once power is connected, the instrumentation will power up and the custom designed mHUB datalogger, central to the Guardian2's operation, will establish communication with the server and begin to transfer data. This assumes that a mobile signal is available but the mHUB uses an on-board electronic SIM which means it will search for the best available connectivity.

There are several versions of Guardian2 hardware which may be configured at the time of ordering to measure single or combinations of so-called agents; namely noise, dust and ground vibration with optional wind speed & direction. The latter could be important in dealing with complaints about dust since information about the prevailing wind conditions could prove that your site was not the cause of the fugitive dust. There is also an optional Volatile Organic Compound (VOC) sensor which can be fitted, this is ideal for monitoring at the boundary of land remediation sites where VOCs may be emitted.

Email and SMS alerts can be set up should any of the agents exceed set limits, allowing immediate actions to be taken to head off potential complaints, plus regular reports can be generated for compliance purposes.

Your organisation will have been given Administration rights in order to make local changes e.g. to set limits and generate reports and to enable other Users to be set up.

Taking Delivery

The Guardian2 system has been assembled and tested prior to dispatch in accordance with your order. On receipt, please check the Guardian2 hardware itself and the other contents of the packaging against the part number in the table and the bill of materials. If you believe anything is missing or has been damaged in transit please notify Casella at once.

Model Numbers

Depending on which Guardian2 system was ordered, the sensors will have been delivered as per the table below.

Guardian2 - Part Numbers

Part Number	Particulate (PM10 & PM2.5)	Noise	Vibration	Windspeed & Direction
208049D			●	●
208052D		●	●	
208054D		●		●
208057D		●		
208061D			●	
208063D		●	●	●
208170D	●	●	●	●
208171D	●	●		●
208172D	●		●	●
208173D	●			●
208174D	●	●	●	
208175D	●	●		
208176D	●			
208177D	●		●	

For VOC Sensor Assembly simply add /VOC to the end of the part number above

All Guardian2 systems as standard are delivered with a 5M 110-240VAC lead. This lead may be fitted with a regional AC plug or industrial connector. This will attach to the unit using the twist & lock plug, forming a watertight secure connection.

If the Guardian2 is to be powered using the solar or remote power supply units then the power input will be via the three-pin Buccaneer connector supplied with the remote power supply units. (Further details in Connecting Power)

Accessories

208041C	Replacement windshield enclosure system.
208104D	Windshield enclosure system extension kit (includes 5m extension cable and mounting brackets.
208083C	Spare 5m windshield extension cable
208022C	Replacement windshield foam
CEL-120/1	Class 1 acoustic calibrator
N104007	Vibration sensor extension cable (30m).
208147A	VOC Interface Calibration Kit (calibration gas is not supplied)
SE52	Replacement VOC sensor
G301002	Replacement VOC electrode stack
G301001	Replacement VOC sensor lamp
G301000	VOC sensor lamp cleaning kit
208163A	Replacement Particulate Inlet

External Sensors

The sensors attached to the outside of the Guardian2 will depend on the model ordered. See the diagram below for their description. These external parts will have been packaged separately to the main Guardian2 enclosure, and instruction on attaching them is included in the following manual.
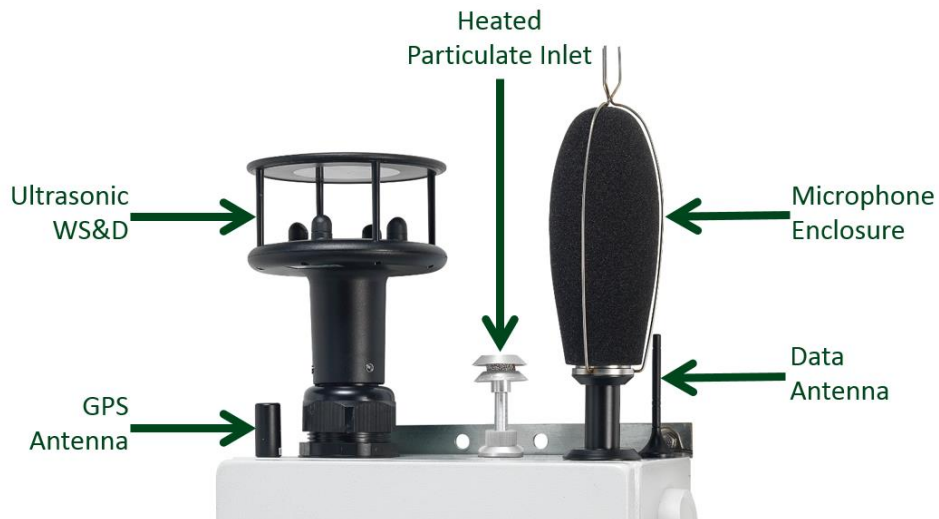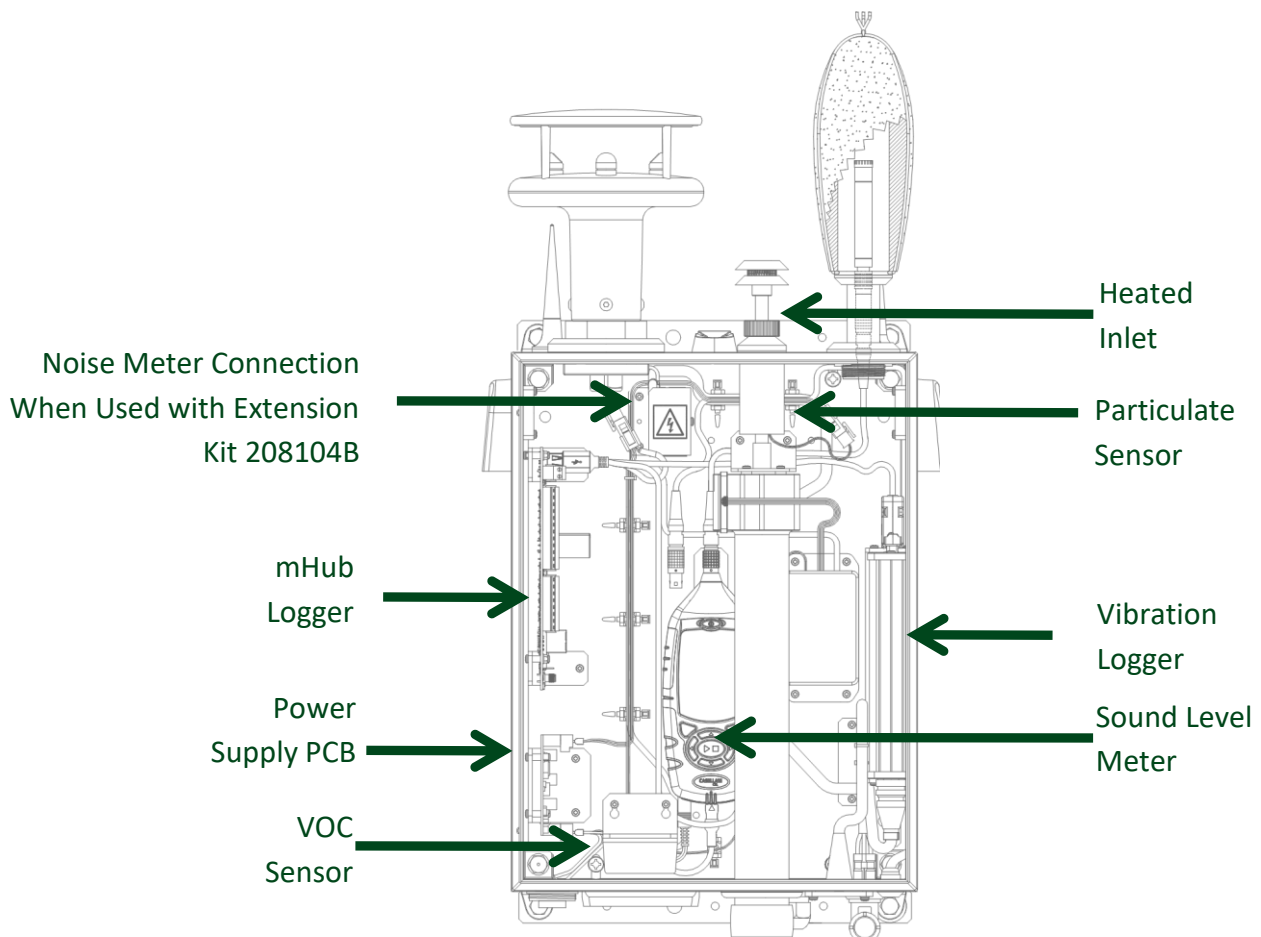

Notes: The GPS antenna supplied may be different to the one pictured above. The vibration sensor is not shown in the picture above as it is situated outside of the main Guardian2 enclosure.

Internal Configuration

The diagram below illustrates the internal configuration of the Guardian2 unit when all sensors are fitted.

> **Notes:** A rain cover is provided on the left of the enclosure which is not shown in the below diagram. Lift the rain cover as necessary.

Noise Meter Connection When Used with Extension Kit 208104B

Heated Inlet

Particulate Sensor

mHub Logger

Vibration Logger

Power Supply PCB

Sound Level Meter

VOC Sensor

Connections to the Guardian2

The diagram below refers to a Guardian2 with all sensors installed. Some connectors will be replaced with blanking plugs where sensors are not installed. Guardian2 comes with simple power connections. If the unit is to be powered with mains supply only then a 5M lead (PN:208717B) with a regional AC plug will be provided. In case of solar or battery powered options, the 12VDC socket will be used with a lead (PN: 208712B) connecting to remote power supply enclosures (See further details in Solar and Battery Power Options)
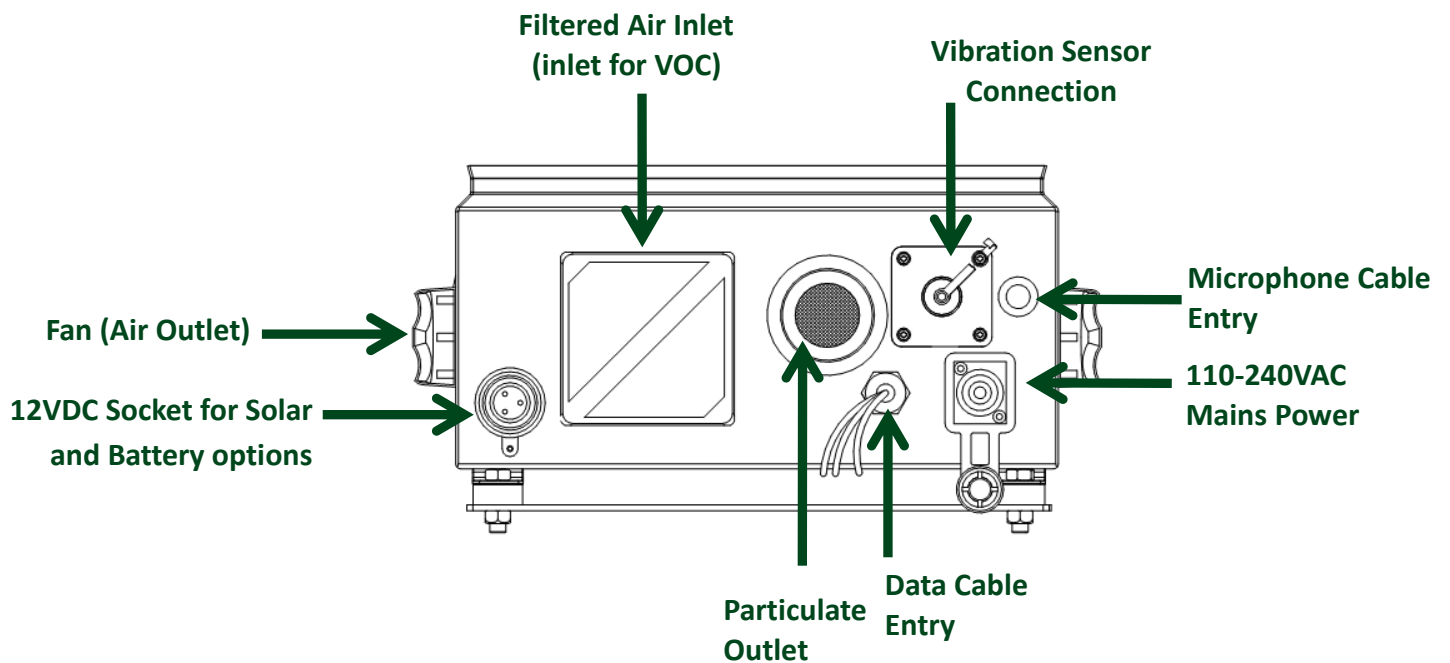
Underside View of Guardian2

> **Note:** The data cable entry will already have the cables to the data antennas fitted.

Noise Versions

- 63X Sound level meter (installed in Guardian2)
- Measurement Microphone and preamplifier
- Outdoor Microphone protection system and support bracket (part 208104B - optional)
- Microphone Extension Cable (part 208083C - optional)
- CEL-120/1 Acoustic (Microphone) Calibrator (Optional)

Particulate Versions (PM10, PM2.5 and PM1.0)

Particulate sensor will come installed in the Guardian2 for the applicable models.

> **Caution:** The particulate sensor is a Class3B laser and the sensor should not be opened to avoid exposure to the beam.

Vibration Versions

Geophone & 25m cable will be supplied. This will need connecting to the Guardian2 enclosure and siting the sensor in a suitable location. An additional two extension cables (N104007) can be fitted to the standard cable to give a total cable length of 85m.

VOC (Volatile Organic Compound)

The optional VOC sensor assembly will be fitted if ordered (part number: 208143B). If necessary, purchase a calibration kit (part number 208147A) and calibration gasses i.e. Zero Air and Calibration (Span); 100ppm Isobutylene is recommended.

Parts Common to all Systems

- Data communication antenna (2-off), already fitted.
- GPS antenna, already fitted.
- U-bolts for 50mm scaffold fixing (2-off).
- Case key.
- User Manual (this document, HB4085 – downloadable from website).
- Power cable (5M 110-240VAC lead (PN: 208717B).

> **Note:** If the wind speed & direction option has been specified, the sensor will be supplied fitted to the Guardian2 but will require aligning to North.

Installation of the Guardian2 hardware

Fixing

There are two mounting options: -

The first option is to fix the Guardian2 to a solid structure e.g. brickwork by using 4 off M8 x 50mm expanding rawl bolts or suitable alternative fixings depending on the material.
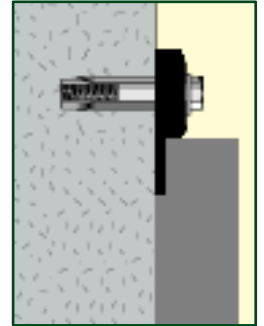
Use the brackets on each rear corner of the Guardian2 casing (with the cross braces removed) as shown.


The second option is to fit the Guardian2 to a standard 50mm scaffold-style pole using the "U" bolts and cross braces provided. With the latter in place, the Guardian2 may be fitted to a scaffold-style pole using the holes centrally located on the top and bottom cross braces as shown.

Connecting the outdoor microphone enclosure

Noise versions of the Guardian2 require an Outdoor Microphone Enclosure to protect the sensitive microphone element from wind and rainfall. It requires a connection between the microphone and preamplifier located inside the Outdoor Microphone Enclosure to the sound level meter itself housed within the Guardian2 enclosure. If the Outdoor Microphone Enclosure has been delivered mounted on top of the Guardian2, an internal cable (part 208077B) will already have been connected.

If it is being remotely mounted, it requires a mounting extension kit (part 208104B) and microphone extension cable (part 208083C, included in 208104B). This can be mounted to a pole as shown below.
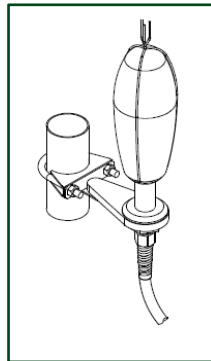
Outdoor Microphone Enclosure with mounting extension kit

When using the microphone extension kit, the microphone and preamplifier must be connected to the input connector located on the underside of the casing on the right-hand side as previously shown, using the extension cable which is part of the extension kit. There is a small red dot on the connector and also on the mating panel mounted socket on the Guardian2 and these should be lined up and simply pushed together. To remove, pull back on the outer knurled part of the connector to release the locking mechanism.

Microphone

Gland to hold microphone
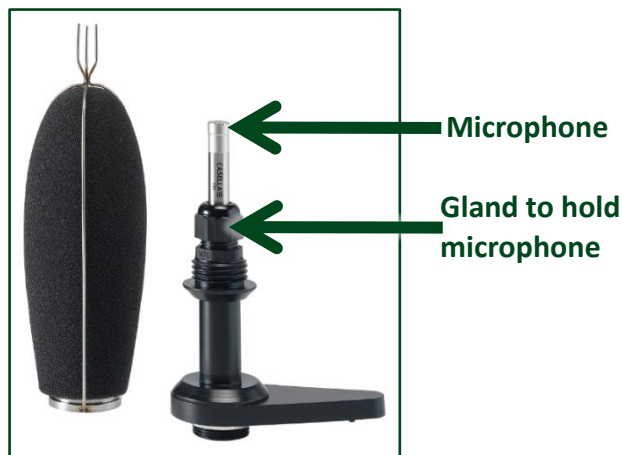
Ensure the tip of the microphone is about 60mm from the top of the gland. This will ensure it is half way up the windshield and create the best protection for the microphone. Once positioned tighten the gland to hold the microphone in place.

Connecting the vibration sensor (geophone)

The geophone sensor (pictured below) will come complete with a cable of 25m. Site the sensor where it will not be damaged and with the arrow pointing at the potential source of vibration. An M5 hole is provided through the sensor to allow it to be securely mounted. The sensor should be fixed directly to a surface (e.g. concrete) using the mounting bolts provided. A spirit level shows if the sensor is vertical. Incorrect mounting will mean the frequency and amplitude of the measurements are affected. Connect the sensor cable to the underside of the Guardian2.
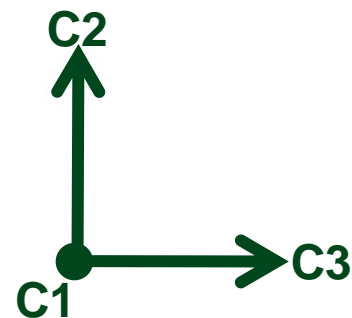
The arrow on the sensor block points along the longitudinal axis which is described as Channel 2 (C2 on casellaview247). Likewise, the vertical axis is C1 and the transverse axis is C3.

Particulate Inlet

The dust inlet will have a screw on cover, remove the cover and attach the inlet as shown in the picture below if it is not already fitted to the Guardian2.
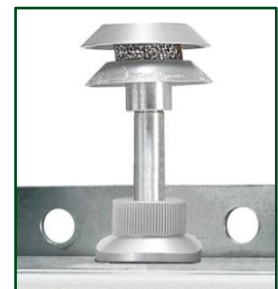

Setting the Wind Speed and Direction

If fitted, the wind speed & direction sensor must be aligned to North. There is a small red mark on the underside of the wind speed & direction sensor and an embossed arrow, see picture below. Use a compass in order to locate North and rotate the assembly such that the red dot/arrow is facing North. Once set, tighten the large locking nut at the base of the sensor by hand to fix it into position and then recheck the alignment.
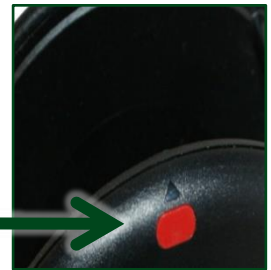
Once the sensor is aligned and screwed securely to the Guardian2 enclosure, the electrical connection must be attached to the logger.

Align Arrow to North →
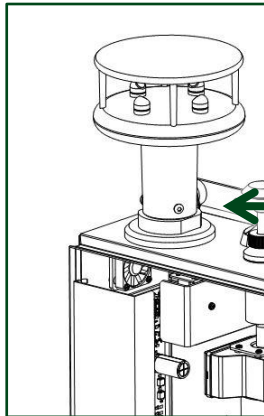
Tighten Locking Nut

> **Note:** The sensor has a grommet to seal against water ingress. When aligning the sensor only rotate rather than lift to prevent the grommet becoming unseated.

Data Communication & GPS

There are three black wires extending from the Guardian2 which connect to two mobile communication antennas plus one GPS antenna. The data antennas have magnetic bases and should be mounted as high as possible to achieve the best reception for data transfer. The aerials should not be placed near the wind sensor. The GPS antenna can be located on top of the Guardian2, as can the data antennas if there is no wind sensor. The GPS antenna should have clear line of sight to a good cross section of clear sky.

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Connecting Power

The Guardian2 comes supplied with a 5M 110-240VAC lead. This lead may be fitted with a regional AC plug or industrial connector (see list of plugs below). This will attach to the unit using the twist & lock plug, forming a watertight secure connection. Below diagram shows the Mains power system in more detail.
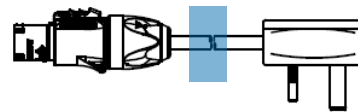
110-240 VAC Socket with Lead PN: 208717B

12VDC Socket for remote power options
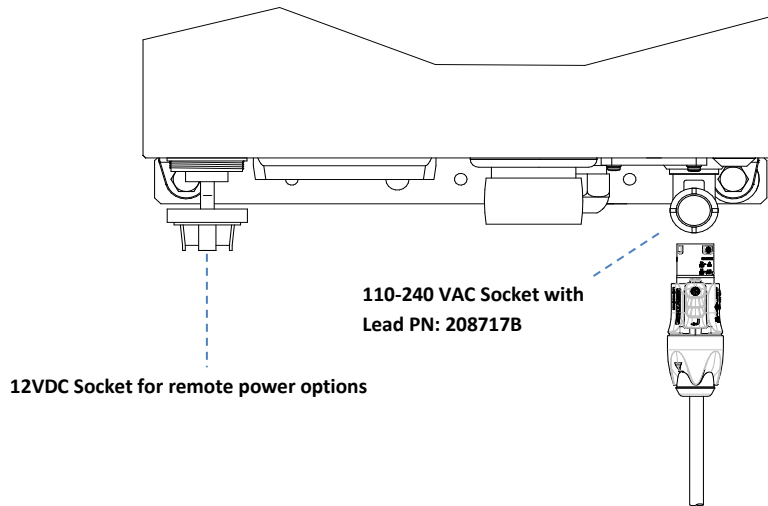
The above lead 208717B can be fitted with a regional plug to suit country specific sockets. This arrangement is only for Mains powered Guardian2 systems.
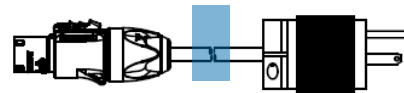
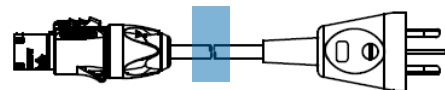**208710B** (110VAC to 2P+E 16A Plug (5M)) Yellow
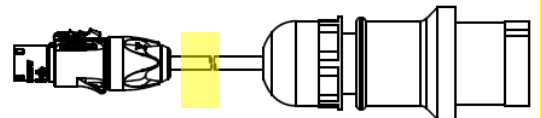
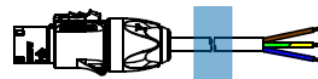**208711B** (240VAC to 13A UK Plug (5M)) Blue

208715B (USA NEMA 5-15P (5M)) Blue

208716B (Australia/NZ (19-1226) (5M)) Blue

208717B (Non-Regional Specific (5M)) Blue

If the Guardian2 is to be powered using the solar or remote power supply units then the power input will be via the three-pin Buccaneer connector (PN: 208712B) supplied with the remote power supply units. This connector is fitted to the 12VDC socket located under the right-hand-side of the Guardian2 as shown below.

12VDC Socket for
remote power options

3 Pin Buccaneer Connector PN
208712B
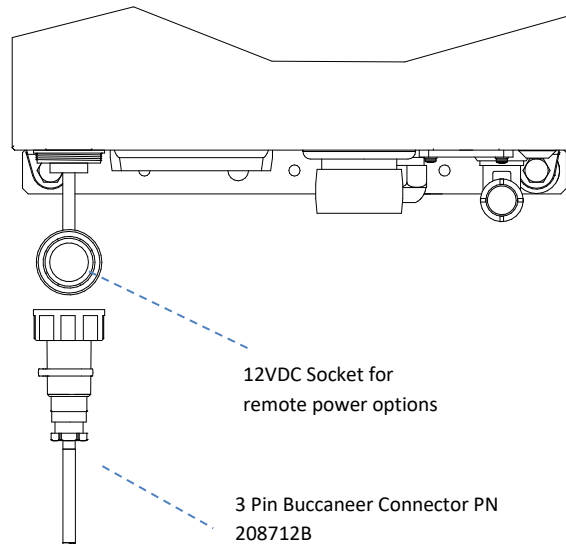
For more details on remote power options like Solar, Battery and Battery Backup options refer to Solar and Battery Power options.

Switching-on and Commissioning

Open the Guardian2 using the case key provided and swing the rain cover located on the left-hand side up to view the mHUB datalogger (itself located on the upper left-hand side of the enclosure). The rain cover is there to protect electronics and power if the enclosure is opened when it is raining. With power applied, after a few moments the Guardian2 will automatically switch on. You will see a series of flashing LEDs on the mHUB logger and the instrument(s) within the Guardian2 will also switch on.

Lift rain cover from bottom to access the mHub
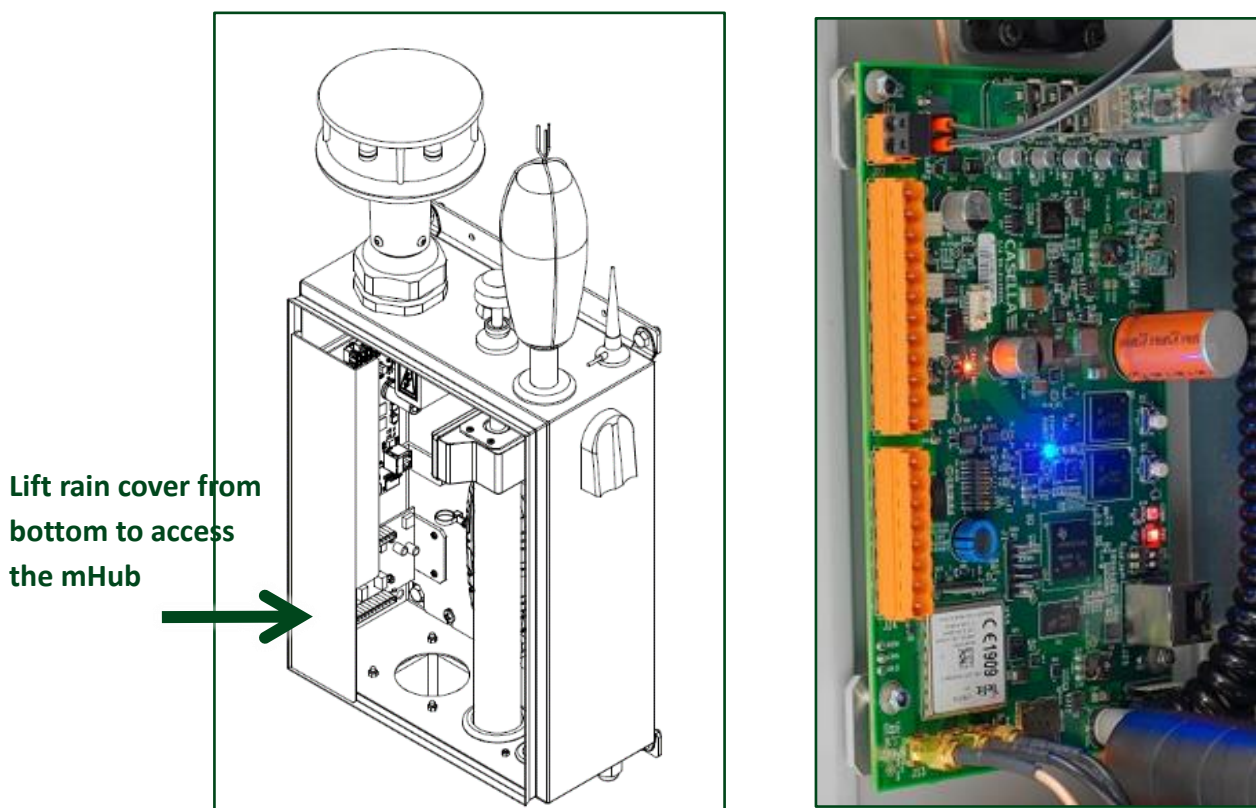
General view of the Guardian2 (rain cover in place) and close up of the mHUB Datalogger

Layout of mHUB
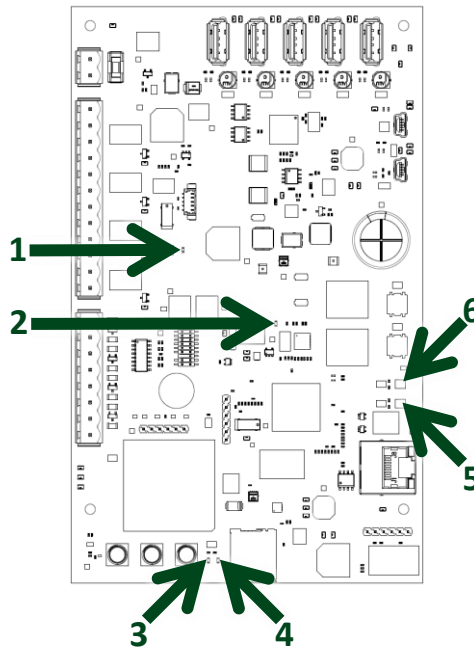
Layout of mHUB datalogger

Referring to the mHUB layout diagram above, the start-up sequence is:-

1. **Red** LED flashes to indicate that the on-board backup power supply is charging (see note below). After a while it will flash rapidly then permanently turn on, this may take up to 4 minutes.
2. The **blue** LED will then illuminate to indicate that the mHUB is being powered.
3. The **green** LED will then illuminate to indicate that the on-board modem is powered.
4. The **amber** LED will flash to indicate that it is connected successfully to a mobile network. If there is no network connection this light will be off. If it can find a network but is unable to register, the LED will be a solid amber.
5. The **red** LED will permanently turn on, shows there is an active cellular connection.
6. Under normal operation this LED will have a flashing **amber** element on a **green** background which shows the Linux operating system is working correctly and the time is being synchronised to the server.

Note: that the on-board backup power supply is only sufficient to perform an orderly shutdown to preserve data in the event of an external power outage. The Guardian2 will not continue to capture data without external power.

The Guardian2 is now running and data will be sent to the Casella24/7 Data Management System website.

Calibrating for Noise

Open the Guardian2 using the case key provided. Identify the noise meter within the Guardian2 and press the keys in the order shown below to stop the measurement. The screen will go red at the top and bottom edges to denote the measurement has stopped.

Step 1

Step 2

Grip here and screw anti-clockwise to remove windshield frame

Remove the outdoor wind/rain microphone protection enclosure (foam and frame assembly) by unscrewing (as above), exposing the microphone. Connect the acoustic calibrator (CEL-120) to the top of the microphone pushing down gently to make a seal, picture below.

Note: Do not twist or screw on or off the calibrator on the microphone capsule.

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The sound level meter will recognise that a calibration tone is present once the calibrator is switched on. Follow the instructions on the screen (pictured below) of the sound level meter to perform a calibration. Once complete remove the calibrator, press the large button (▶ ■) in the middle of the keypad, the display screen will go green at the top and bottom edges indicating that a measurement run is in progress. Reattach the microphone enclosure.
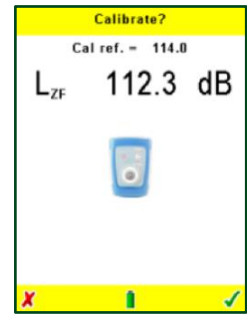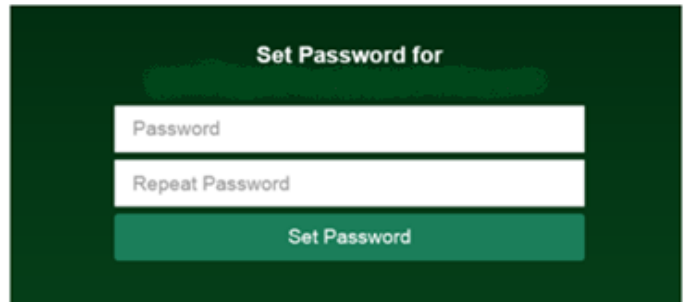
Note: It is recommended that calibration is performed regularly as part of a program of periodic checks to ensure the Guardian2 is working correctly.

Accessing Data – Casella247.com

Log-in and Password

In order to gain access to the **Casella 247 Data Management System (Casella247)** users are initially added either by Casella or their own Organisation Administrator. Once added, the new user will automatically receive an invitation email with a link to the website allowing them to specify their preferred password. There is also a 'Forgotten Password?' link on this screen, with which passwords can be reset.

Available User Accounts

Casella247 supports two levels of user account; Organisation Administrator and Standard User.

Organisation Administrator (Admin)

Users with this level of account access are able to add and remove users, allocate and deallocate Guardian2 systems, configure Guardian2 systems and create reports and alert notifications.

Standard User (User)

Users with this level of account access are limited to which Guardian2s they have access to and then only have read access to the data generated by these systems.

These users are able to create and edit reports for any of the systems they have access to but are unable to change the way any of the Guardian2s operate or set alerts.

First Time Log-in

After you receive the invitation email from **Casella247** click on the link provided and you will be redirected to the **Casella247** website where you will be asked to specify a new account password.

Please remember that the data contained within **Casella247** is extremely important to your organisation and so you should make every effort to ensure the password you set is secure enough to resist any attempts by third parties to gain access to the system. Seek advice from your IT support if necessary.

Enter a suitably secure password into the upper box and repeat it in the lower box, finally click the **Set Password** button. You should then be automatically re-directed to your **Casella247** homepage.

If this doesn't happen, manually type the web address (www.casella247.com) into your browser's address bar and log in using your email address and previously specified password.

Note: After being inactive for ten minutes users will be logged out automatically.

Log-in to Casella247

After your account has been created on the **Casella247** website and your password set, subsequent log-ins should be made directly to the main address (www.casella247.com). Either type this in manually or add as a bookmark to your browser:

If you forget the password for your account, go to the main address (www.casella247.com) enter your email address used to create the account if necessary, then click on the **Forgot Password** link (located under the **Login** button).

When prompted, confirm that you wish to reset or cancel. Check your email inbox and when the reset password email arrives click the link and enter a new password (as you did the first time). If no email is received in a timely manner, check with your IT support.
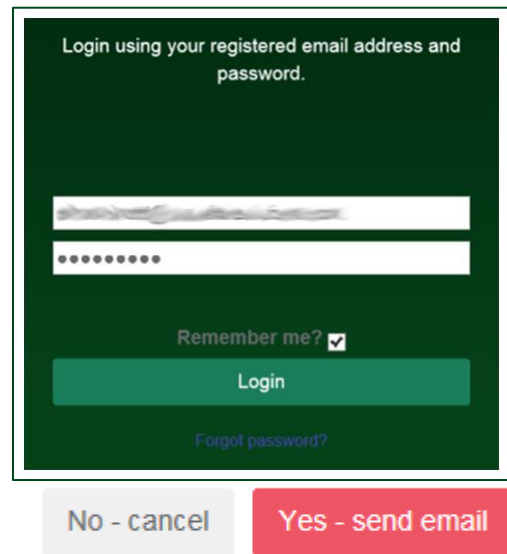
Users of Multiple Organisations

It is possible for users to be granted access to more than one organisation on the **Casella247** system, such as third-party consultants or government officials for compliance purposes.

When this is the case an additional dialog is presented to the user after they have entered their username and password:
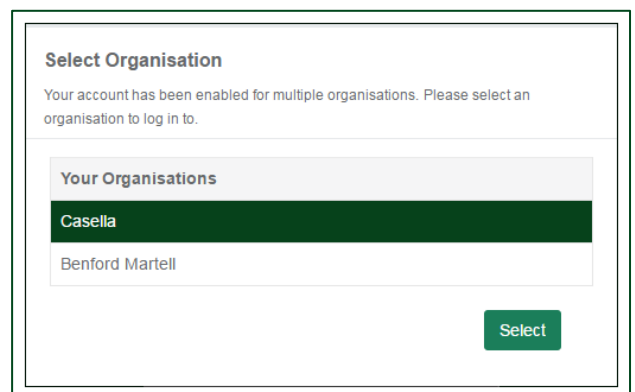
The user should highlight the organisation of interest and click the **Select** button.

Logging out (or Switching Organisations)

To log out from **Casella247** click on your username as displayed in the top left of the page and select the **Logout** option from the displayed menu:
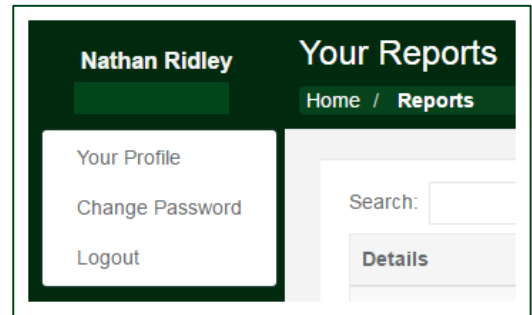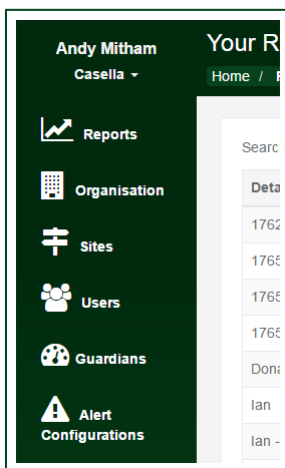
If you've been set up as a user for more than one organisation then the menu will also include the **Switch Organisation** option. This enables the user to switch between organisations without the need to manually log out and back in again:
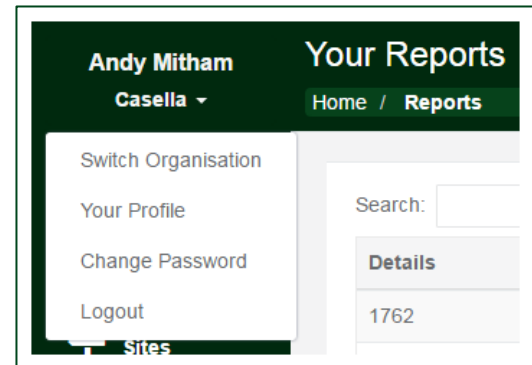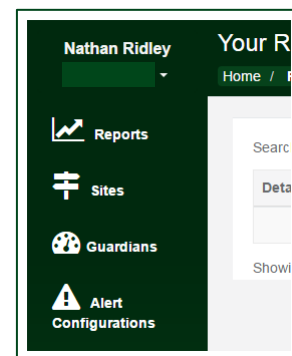
Site Navigation

The main areas of the site are accessed via the options available in the **Navigation Bar**:

Admin View

Standard User View

Reports

Any user can set up automated reports for Guardian2 data they have access to. In addition, any existing report can be generated manually in order to access historical data from any specified time/date.

Users are free to create new reports, edit existing reports and delete reports no longer required.

Any reports created are linked to that user and will not interfere with reports created by other users of the system.

Automated reports can be sent to more than one recipient if required.

> **Note:** Reports are the means of accessing data from Guardian2 units, reports must be set up in order to view data.

Organisation (Admin only)

From here new users can be added to the system or existing users granted access to your organisation's Guardian2 data.

New users will automatically receive an invitation email once their account has been created and will have to specify their own password before they can log in.

Existing users of the system can be added to your organisation, but you must already know the email address they are using to log into the system (this is a standard security/privacy measure for the **Casella247** site).

Sites

In order to more easily track Guardian2 assets deployed in the field, the **Casella247** system operates on a principle of **Sites** and **Locations**.

An organisation can contain one or more sites which in turn can contain one or more locations and each location contains a single Guardian2 unit.

By highlighting an available site in the displayed list all (active) Guardian2 stations associated with that site will appear as individual pins on the displayed map. Green pins are active, red pins mean the site is not communicating.

Admin users are able to change the structure of available sites and locations or add new ones and delete obsolete ones as required.

'Standard' users can only view the current structure and map data for (active) Guardian2s.
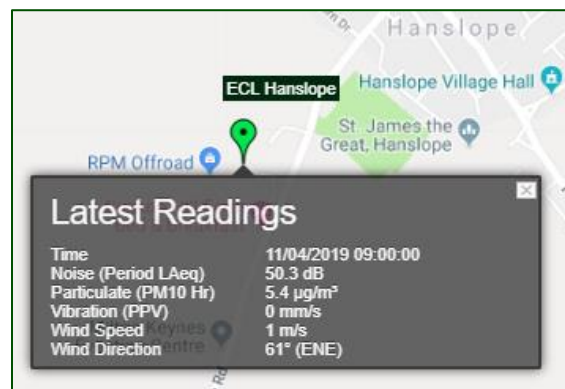
> **Note:** Map pins are coloured to indicate if the Guardian2 is active. A green pin indicates an active site, where as a red pin will indicate the Guardian2 is not transmitting data to its specified transmission (push) interval.

Add New Users (Admin only)

From here new users can be added to the system or existing users granted access to your organisation's Guardian2 data.

New users will automatically receive an invitation email once their account has been created and will have to specify their own password before they can log in.

Existing users of the system can be added to your organisation, but you must already know the email address they are using to log into the system (this is a standard security/privacy measure for the **Casella247** site).

Guardians

This page will list all the Guardian2 units that the user has been permitted access to (Admins will see all Guardian2s for the organisation).

Standard users will be able to display when any particular Guardian2 was last active on the system and any alerts associated with it.

Admin users will be able to modify the operation of any Guardian2, including what parameters are recorded in the unit and how often.

> **Note:** Individual users will need adding to each individual Guardian2 unit. If they are not added users will not receive automatic reports associated with the Guardian2.

Alert Configuration

For standard users this page lists all alerts currently configured on the Guardian2 units the user has access to. This includes how the alerts have been configured, who is notified and a history of alert notifications.

In addition, Admin users will be able to edit the alert configurations if required.

Setting up your Organisation (Admin only)

Your Organisation together with one or more Admin Users will already have been added to the **Casella247** system before any Guardian2 units were dispatched.

Each **Admin** user will have received an invitation email from the **Casella247** system and should aim to set their password as soon as possible after that.

As part of the Guardian2 manufacturing process new Guardian2s are automatically added to the organisation when they are commissioned prior to dispatch.

It is left up to the **Admin** to decide what structure (using **Sites** and **Locations**) is required and which (if any) new users need to be added to the system.
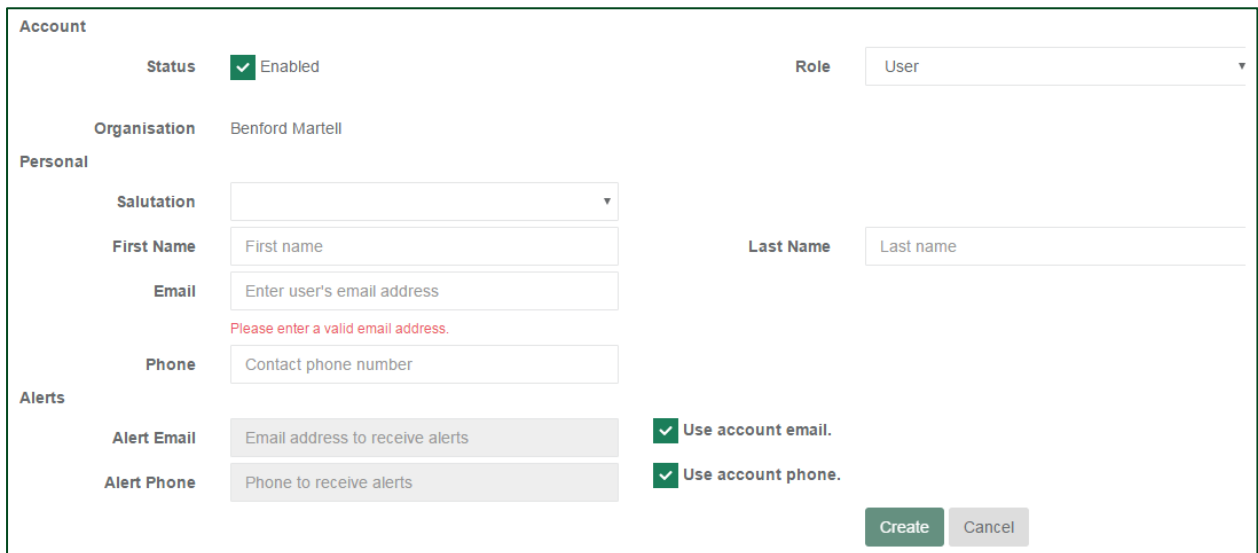
Once this ground work has been completed the **Admin** can then decide on what data is to be recorded and who should receive automated reports and alert notifications.

Users

Any organisation **Admin** is able to modify user accounts on the **Casella247** system for the given organisation.

Add New User

From the **Navigation Bar** select the **Users** option and click the [＋New User] button, the following screen will then appear:
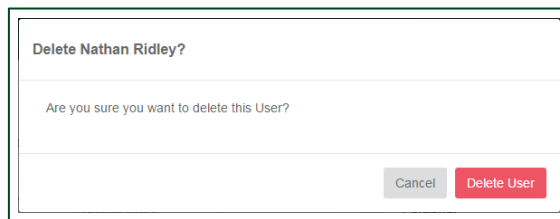

Fill in all the fields and for any new **Admins** change the **Role** field from **User** to **Organisation Admin**.

By default, alert emails and text messages are sent to the main account email and phone number. If these notifications need to be sent to different destinations then un-tick the **Use account email** and **Use account phone** options and fill in the corresponding **Alert Email** and **Alert Phone** fields with the required values.

Once all details have been entered click on the `Create` button. The Casella247 system will create the user account using the details supplied and automatically send an invitation email to the new user (using the email address specified).

Delete User

From the **Navigation Bar** select the **Users** option and highlight the user (to be deleted) from the list displayed. Click the 🗑 button (shown in the user's detail panel) and when prompted, confirm the operation by clicking on the `Delete User` button:

> **Delete Nathan Ridley?**
>
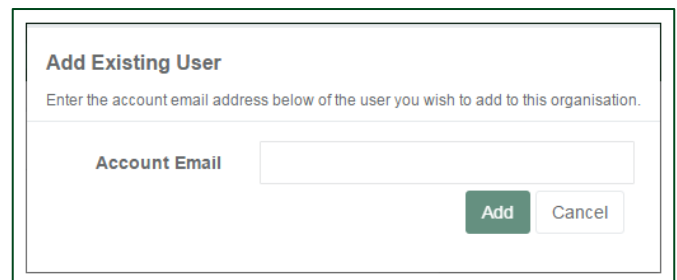> Are you sure you want to delete this User?
>
> Cancel   Delete User

Edit User

From the **Navigation Bar** select the **Users** option and highlight the user (to be edited) from the list displayed. Click the ✎ button (shown in the user's detail panel) to open the record in edit mode. Once all changes have been made save them by clicking on the `Update` button.

Add Existing User

From the **Navigation Bar** select the **Organisation** option then click the `Add Existing User` button:

Enter the email address of the existing user to be added to this organisation and click the `Add` button.

> **Add Existing User**
>
> Enter the account email address below of the user you wish to add to this organisation.
>
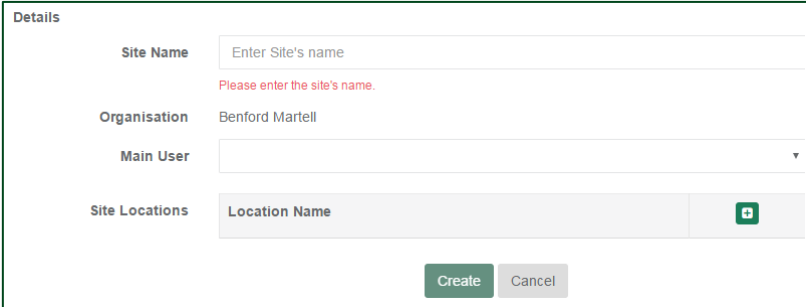> **Account Email**
>
> Add   Cancel

Sites

Any organisation **Admin** is able to modify the structure defined on the **Casella247** system for the given organisation.

To correctly identify any Guardian2 unit on the Casella247 system and in reports and alerts there should exist (a basic structure of) one site with one Location and one Guardian2.

As more Guardian2 units are added to the Casella247 system, this (basic) structure can be extended with new sites and locations to properly describe Guardian2 ownership and deployment.

Add New Site

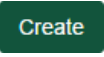From the **Navigation Bar** select the **Sites** option and click the ➕ New Site button:

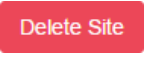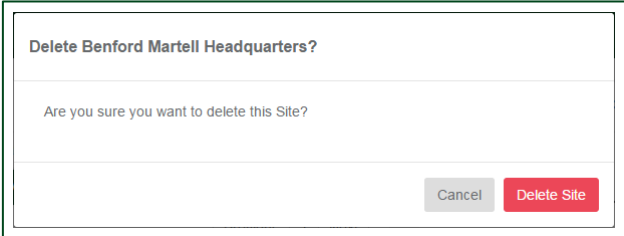| Details		
Site Name	Enter Site's name	
	Please enter the site's name.	
Organisation	Benford Martell	
Main User		▾
Site Locations	Location Name	➕

Create   Cancel

Enter a suitably descriptive Site Name and select a user from the Main User list. One or more Locations can be added to the Site at this point however this will be covered later on. For now, click the **Create** button to add this new site to your organisation.

Delete Site

From the **Navigation Bar** select the **Sites** option and highlight the site (to be deleted) from the list displayed. Click the 🗑 button (shown in the site's detail panel) and when prompted, confirm the operation by clicking on the **Delete Site** button:

Delete Benford Martell Headquarters?

Are you sure you want to delete this Site?

Cancel   Delete Site

Edit Site

From the **Navigation Bar** select the **Sites** option and highlight the site (to be edited) from the list displayed. Click the ✏️ button (shown in the site's detail panel) to open the record in edit mode.

Once all changes have been made save them by clicking on the **Update** button.

Locations

As referred to earlier **Locations** are managed from within individual **Sites**.

From the **Navigation Bar** select the **Sites** option and highlight the site (for which Locations are to be modified) from the list displayed. Click the ✏️ button (shown in the site's detail panel) to open the record:

Site Name	Engineering	
Organisation	Casella - Engineering	▼
Main User	Ian McCarthy	▼
Timezone	Europe/London	

Site Locations	Location Name	**+**
	MHUB-3969404	🗑
	Cubic Sensor	🗑

Update **Close**

Add New Location

From within the Site details page click on the **Add Location** ➕ button. This adds a new location line to the available **Site Locations** list:

Site Name	Engineering	
Organisation	Casella - Engineering	▼
Main User	Ian McCarthy	▼
Timezone	Europe/London	

Site Locations	Location Name	**+**
	MHUB-3969404	🗑
		☑↺

Update **Close**

Type in a suitably descriptive name and click the ☑ button to accept the new location.

This can be repeated for each new location to be added to the current site.

Delete Location

From within the Site details page click on the **Delete Location** 🗑 button located to the right of the location to be deleted and when prompted, confirm the operation by clicking on the [Delete Location] button:

Any (all) deletions are made permanent by clicking on the **Update** button.

Edit Location

From within the Site details page, click on any of the items shown in the **Location Name** list and edit the displayed name as required. Once all changes have been made save them by clicking on the **Update** button.

Guardians

In this section we deal only with those details of the Guardian2 that effect how it fits into the structure of the organisation and not how data is collected or alerts generated.

From the **Navigation Bar** select the **Guardians** option and **Casella247** will display a list of available Guardian2 systems:

Name	Serial Number	Organisation	Site	Location	Active Alarms
MHUB-3969404	1762	Benford Martell	Benford Martell Headquarters	Loading Bay	None

Search: ⟳ Refresh

Showing 1 to 1 of 1 entries   Previous 1 Next

To edit the details for a Guardian2 highlight it in the displayed list and select the **Edit Details** 🖉 option:

Serial Number	1762		Users	Actions
Name	MHUB-3969404		Mr. Ian McCarthy - nruser1	🗑
Organisation	Casella - Engineering ▾			+
Location	Engineering - MHUB-3969404 ✕ ▾			
Communications Timeout	30minutes 180minutes			
	30 68 105 143 180			Update Close

Serial Number

The serial number is fixed during production and is used by **Casella247** to uniquely identify each Guardian2 registered on the system.

Name

This field allows users to identify Guardian2s using a naming scheme.

Location

This is where the user integrates the Guardian2 into the organisation's structure. From the list of available locations (actually Site/Location pairs) select the one that identifies where the Guardian2 is to be collecting data for.

Communications Timeout

Although Guardian2 units operate autonomously in the field and regularly transmit data (or alerts) to **Casella247**, there may be instances when network coverage is interrupted.

By setting a suitable value in this field **Casella247** can notify the user when these regular communications have stopped.

The timeout specified should be set to a value greater than the corresponding **Push Interval** (interval at which the Guardian2 regularly transfers logged data to Casella247), but low enough to ensure a rapid response to network outages.

Users

Only those users specifically listed here will be able to gain access to data collected by the Guardian2 using Casella247.

Once all changes have been made, click on the Update button to save them.

Configuring the Guardian2

In this section we explain how to configure the operational parameters of a Guardian2 including how data is collected and alerts generated.

Whenever a Guardian2 is commissioned in the field (or rebooted) part of the start-up sequence is to synchronise its internal configuration with that held by **Casella247**.

In doing this **Casella247** is made aware of the Agents currently connected to the Guardian2 (used during the edit procedure) and the Guardian2 is updated with the latest configuration held by **Casella247**.

From the **Navigation Bar** select the **Guardian** option and **Casella247** will display a list of available Guardian2 systems:

To edit the details for a Guardian2 highlight it in the displayed list and select the **Edit Configuration** option available from the details panel:

The Guardian2 configuration is sub-divided into two sections **Data Collection** and **Alert Configuration**. As implied by the names **Data Collection** determines what (and how often) data is logged and **Alert Configuration** specifies what constitutes an alert condition and who should be notified in the event of an alert.

Because all the options available from within the Guardian2 Configuration effect the operation of the corresponding Guardian2 in the field; all necessary changes should be made before the **Update** button is clicked.

Once clicked **Casella247** will attempt to download the modified configuration to the **Guardian2** in order to update it:

To update and reboot the **Guardian2** click the **Update and Reboot Guardian** button.

> **Note**: If for any reason the **Casella247** is unable to update the Guardian2 at this time, the configuration will be placed in a queue and next time communication is established with the Guardian2, the update will occur automatically.

Data Collection

The first fields **Push Interval** and **Data Retention** are always available; however which **Agents** get displayed beneath is determined by those attached to the **Guardian2** when last commissioned:
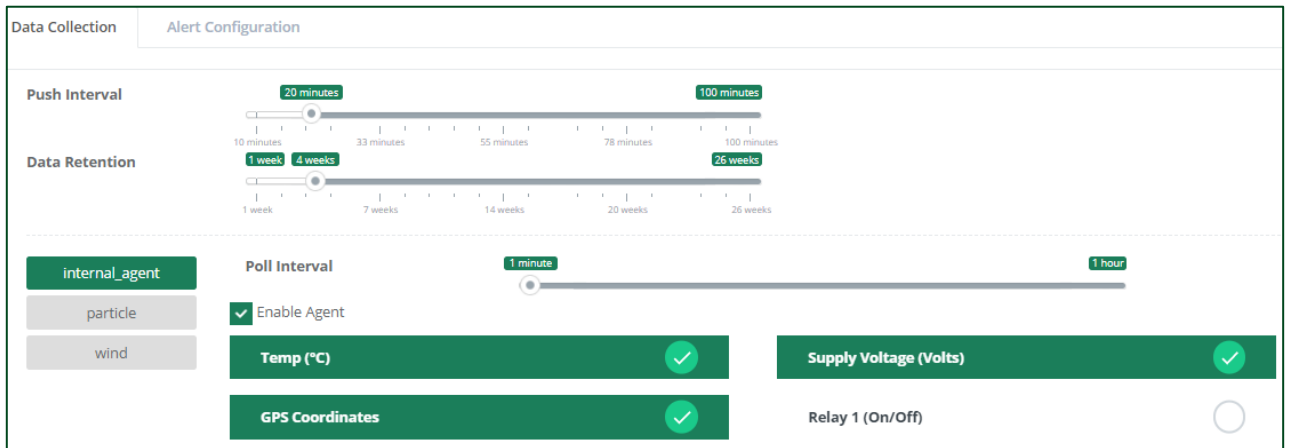
Push Interval

Data is logged from each attached Agent at their own specified (**Poll**) rate. This data is collected internally by the Guardian2 and then at each (**Push**) interval all data collected up to that point is compressed and uploaded to **Casella247**.

In instances where network outages may prevent the immediate transfer of accumulated data, the Guardian2 retains the information internally and when next able to do so upload it automatically without any loss of information.

> **Note:** It should be noted that very short **Push Intervals** may increase data charges, as smaller data payloads do not compress to the same extent as any larger ones generated over longer **Push Intervals**.

Data Retention

This setting determines for how long un-uploaded data will be retained by the Guardian2. As any Guardian2 has a finite storage capacity older data must be sacrificed in order to continue to log new data, in the event of a prolonged network outage.

Agent configuration

The Data Collection page will also contain a tab for each Agent currently active on the Guardian2. Each tab allows the user to pick and choose (with some restrictions) which parameters are logged and how often. Not all agents include options for **Poll Interval** or **Store Interval**. These differences will be detailed in the relevant sections.

Agent Enabled/Disabled

All agents include an **Agent Enabled/Disabled** option which allows for all parameters to be logged (or not) without having to manually update each individual parameter:

Channels

To include a particular parameter in the collected dataset for an agent, put a ✓ (in the **Enabled?** column) to the right of the parameter name:

Poll Interval

If included for the particular agent, the **Poll Interval** determines the rate at which parameter values will be logged. At the specified **Poll Interval** the Guardian2 will request a new set of parameter values from the agent and log these ready for uploading to **Casella247** at the next **Push Interval**.

Store Interval

If included for the particular agent, the **Store Interval** works in conjunction with the Poll Interval to allow calculated values to be generated from the agent data.

As with the other agents the **Guardian2** will request new sets of parameter values at the rate specified by the **Poll Rate**; however these values will be held back until the **Store Interval** occurs. At this point the Guardian2 will perform any necessary calculations on the data to generate the final values to be logged.
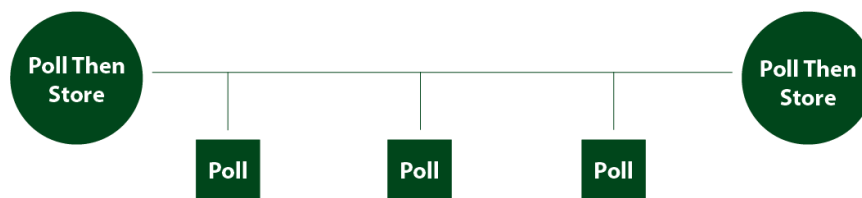
So, in the example above, the data from the 3 'Polls' in the middle, will be included in the final 'Poll' and 'Store'.

Alerts

By default, **Casella247** monitors communication with each Guardian2 and maintains a (non-removable) Communications Timeout Alert. This can be used to notify the user should the Guardian2 fail to communicate new data within a specified time period. To activate this alert, add the users to the alert that need to receive the alerts and specify a schedule for the alerts to be sent. Other (optional) alerts can be added to the Guardian2 configuration, to allow the system to notify the user when measured parameters exceed specified limits, i.e. dust concentrations or noise levels. These (optional) alerts can operate in isolation or logically linked to generate a single alert from a compound set of conditions. The alert editor can be accessed from the **Navigation Bar** from either the **Guardian2s** option (via the Guardian2 detail panel) or the **Alert Configurations** option instead:
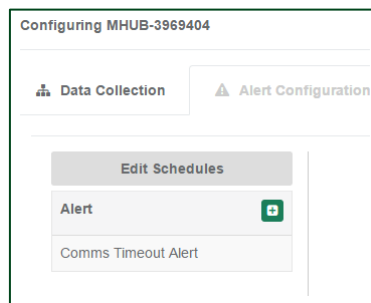
Another feature of the system is the implementation of Alert Schedules. These schedules allow different users to be notified of alerts depending upon the time of day or day of the week specified.

Note: Alert schedules are available to all Guardian2s registered with the current organisation and can only be modified by an **Admin** user.

Alert schedules

From the Alert Configuration page select the option:
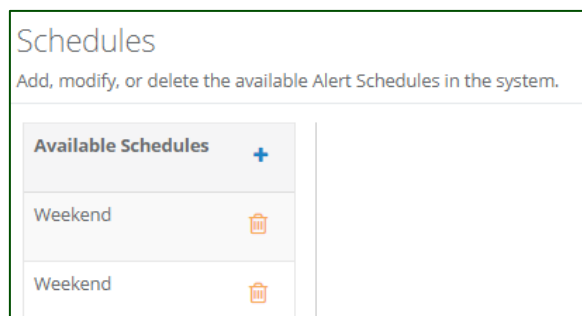
Add New Schedule
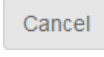
Click the ⊕ button (to the right of **Available Schedules**) and **Casella247** will add a new schedule to the list and open it in the schedule editor:
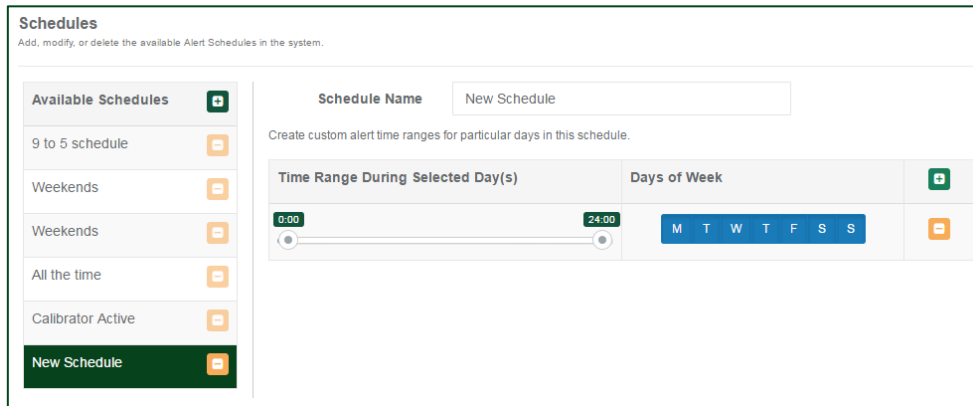
Delete Schedule

Highlight the schedule to be deleted and click the corresponding ⊟ button.

Once all deletions have been made, click the **Save All** button to make these changes permanent. Alternatively click the **Cancel** button to discard these changes.

Edit Alert Schedule

Highlighting any schedule in the displayed list will populate the schedule editor (right panel) with the corresponding schedule settings.

By default, a new schedule will contain a single **Time Range…Days of Week** entry. Additional entries can be added to the list by clicking the ⊕ button (to the right of **Days of Week**).

Schedule Name

To avoid confusion, give the schedule a name which best describes the overall function of the schedule.
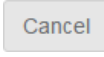
Time Range during Selected Day(s)

Use the two sliders ⊙ to select the start and end times to be used in this schedule. This time period will be applied to each day selected using the Days of Week field.

Days of Week

Highlight only those days that are to be included in this schedule.

Once all changes have been made, click the **Save All** button to make these changes permanent. Alternatively click the **Cancel** button to discard these changes.

Example

To create a schedule that accepts alerts between 09:00 and 17:00 (Monday through Thursday), 09:00 to 16:00 (on Friday) but not at the weekend:

> **Note:** An alert schedule must be set prior to configuring an alert. If an alert is not set the alert configuration cannot be saved.

Alert Configuration

Add New Alert

Click the ⊞ button next to Alert to add a new alert to the available list and open it in the Alert Editor:

Delete Alert

Highlight the alert in the displayed list and click the associated 🗑 button. When the confirmation dialog appears click the **Remove Alert Configuration** button to delete the specified alert:

Edit Alert Configuration

Once all changes have been made to the alert configuration click the **Update** button to transfer the modified configuration to the associated (deployed) Guardian2 in the field.

Description

Give the alert a descriptive name as this will be included in any notifications sent to the user by **Casella247** and will allow quick identification of the alert source.

Trigger Conditions

These conditions determine which measured parameter (or channel) is to be tested and against what limits the parameter value is to be compared:

Trigger Conditions	Agent	Channel	Condition	Threshold 1	Threshold 2	Logical Action	+
	internal_ag..▾	Supply Voltage ▾	Supply Voltage < 10 ▾	10			🗑

By clicking the ⊞ button (to the right of the Logical Action heading) an additional set of Trigger Conditions can be added to the alert.

This allows for compound conditions to be applied to a single alert notification.

For example: Trigger an alert notification when dust levels have exceeded a set level and prevailing wind conditions are blowing the resultant contaminate in an unfavourable direction.

Each Alert can have a maximum of three sets of Trigger Conditions defined.

Agent

Select the agent which hosts the channel the test is to be applied to. Only those agents currently connected to the Guardian2 unit will be available from the drop-down list.

Channel

Once the Agent has been selected this control will be populated with a list of channels available from the agent. Select the channel required from the drop-down list.

Condition

Select the test condition to be applied to the selected channel. **Casella247** can test for several conditions:

Below a limit	Threshold 1 is used as the condition limit value.
Above a limit	Threshold 1 is used as the condition limit value.
Inside a range	Threshold 1 is used as the lower and Threshold 2 as the upper condition limit value.

Outside Range	Specific condition for the Wind agent/Angle channel and specifically for detecting the sector encompassing north.

Threshold 1

Where the trigger condition has a single comparison limit value, Threshold 1 is used as the comparison value.

Threshold 2

Where the trigger condition has two comparison limit values, Threshold 1 is used as the first and Threshold2 as the second comparison value.

Logical Action

This is only available when the Alert contains more than one Trigger Condition and dictates how the result of the current condition is applied to the result of the next Trigger Condition:

And	Result of both Trigger Conditions must be true in order for the complete (compound) condition to be true.
Or	Result of either Trigger Condition being true will cause the complete (compound) condition to be true. The compound condition is also true if both (component) Trigger Conditions are true.

Guardian2 Action

Any Alert can be used to activate one of the internal relay outputs available from the Guardian2 PCB. By default relays are de-energised and become energised when the alert condition becomes true. Relays automatically become de-energised when the alert condition is no longer true. The relays available have both normally open and normally closed sets of contacts.

Send Notifications To

Click the button to the right of **Notification to be Sent** in order to add a recipient to the list of current recipients.

> **Note:** If no recipients are listed then **Casella247** will be unable to send out notifications in the event of an alert occurring.

Multiple users can be selected as recipients of alert notifications, add one line for each recipient required:

User	**Casella247** user to be notified when alert occurs.
Schedule	Alert schedule to use when alert occurs. For more information refer to **Alert Schedules**.
SMS	If ticked a copy of the alert notification will be sent to the user's mobile number specified in the user's account profile.

Email   If ticked a copy of the alert notification will be sent to the user's email address specified in the user's account profile.

> **Important Note: For SMS alerts ensure phone number in the USERS profile included the country code e.g. for the UK +44 should be entered before the actual number removing any preceding zeroes. If the phone number is not entered correctly then the system will not be able to send any text message to your device.**

Rate Limiting

Rather than bombarding users with multiple alert notifications when an alert condition exists, **Casella247** can be configured to limit the number and frequency of alert notifications sent.

Max # of alerts   Specifies the maximum number of alert notifications **Casella247** will send (to any user) within the interval specified by the **Every** field.

Every   Determines the interval of time multiple alert notifications are to be limited within.

Re-trigger Time   Specifies the minimum interval between successive alert notifications within each interval specified by the **Every** field.

> Note: For example (using the settings shown):
>
> **Max # of alerts:** 5
>
> **Every:** 1 hour
>
> **Re-trigger Time:** 5 minutes
>
> Each user specified as a recipient will receive 5 SMS (and/or email) messages, within each hour the alert condition exists and each subsequent notification will be sent 5 minutes after any preceding one. If the initial alert condition occurs at **15:10** then the users will receive notifications at:
>
> **15:10**
>
> **15:15**
>
> **15:20**
>
> **15:25**
>
> **15:30**
>
> Then nothing else until **16:10** where upon Rate Limiting restarts.

Reports

The default landing page after a user log-in is the **Reports** page. This page lists all the reports currently defined in **Casella247** that the user has access to:

Scheduled reports

By default, all reports are deemed to be Scheduled Reports and **Casella247** will automatically run these reports at their pre-determined time (and interval) sending the generated report to the specified recipients.

Highlighting a report in the list will cause **Casella247** to display the current configuration for that report in a separate panel:

Add Report

Click the ![New Report] button located at the top of the displayed list. A new report will be added to the displayed list and opened in the Report Editor:

Delete Report

Highlight a report in the displayed list and click the ⊟ button displayed at the top-right of the report detail panel.

Edit Report

Highlight a report in the displayed list and click the 📝 button. The selected report will be opened in the Report Editor.

Once changes are complete click the **Save** button to make these changes permanent.

> **Note:** Most fields in the report editor screen are mandatory. If all the relevant fields have not been filled in or the check ☑ boxes have not been 'ticked', you will be unable to save the report and the icon 🚫 will be displayed when selecting the save button.

Details

Basic details regarding report ownership and whether scheduled reports should be generated for it.

Report Description

Give the report a suitably descriptive name. This allows recipients of the report to quickly identify the source and content.

Report Status

Untick this option to temporarily stop **Casella247** from generating and sending reports based upon this template to users.

Report Owner

This user is granted (in addition to any Admin User) the ability to amend/delete this report.

Schedule

Determines when and how often reports will be generated by **Casella247** and sent to the specified recipients.

Start Date

Click on the **displayed date** to display the calendar (as opposed to the calendar icon). Select the date upon which the first Scheduled Report will be generated and sent based upon this template.

Recurrence

This specifies the interval between successive reports automatically generated and sent to the designated recipients. The available options are:

Every Day   A new report will be generated every day covering the previous 24 hours of recorded data.

Every Week   A new report will be generated every 7 days covering the previous 7 days of recorded data.

Every Two Weeks   A new report will be generated every 14 days covering the previous 14 days of recorded data.

Every Four Weeks   A new report will be generated every 28 days covering the previous 28 days of recorded data.

Time

From the drop-down list, select the hour the report is to begin from.

Next Report

This field automatically displays the date and time the next report (based upon this template) is due to be generated.

As Start Date and Time are modified this field automatically updates accordingly.

Send To

Specifies which users will receive a copy of the report generated by **Casella247**. Users must have been added to the specific Guardian2 to be able to see data on reports.
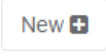
Users

One or more users can be specified as recipients for generated reports. Each user will receive a separate copy of the report by email.

Limit Lines

Limit lines can be added to line graphs on reports. This may be used to illustrate specific levels of interest for a site.

Graphs & Tables

Each report is constructed from one or more sections, either a chart or data table. To add a new section to the report, click the ⬚ New ➕ button in the **Action** column. Multiple graphs and tables can be shown on reports. For example, separate graphs can be displayed for noise and dust parameters.

Type

Three different types of report section are available:

Chart

Displays selected data as a line chart.

Data Table

Appends selected data to the report in the form of a CSV attachment.

Alert Table

Appends a list of previously generated alerts to the report in the form of a CSV attachment.

Location

From the available Guardian2s select one from which the report section will extract the necessary data.

Data Channels

From the available Agent/channel list select one or more parameters to be included in the report section.

> **Note:** For a detailed description of the data channels please refer to the Data Channels section.

Actions

Click the ☑ button to save changes made to the current report section or click the ⊟ button to discard any changes made.

> **Note:** Ensure the ☑ is checked after adding individual channels or you will be unable to save the report.

Report Preview (Manual Reports)

Any report currently available in the displayed list can be previewed by clicking the ⬈ button in the detail panel.

A prompt will then open to enter a start date/time for the report. The generated report starts at this point and includes the number of days specified in the report configuration.

> **Note:** Each report generated in this way will open in a new browser window. Remember to close the browser window once the report is no longer required.

Manual Reports

By unticking the Report Status (disabled) in the Report Editor, any report can be omitted from the automatic Report Schedule run by Casella247.

However, these reports can still be run manually at any time by clicking the Report Preview ⬈ button. An example noise report is pictured below.
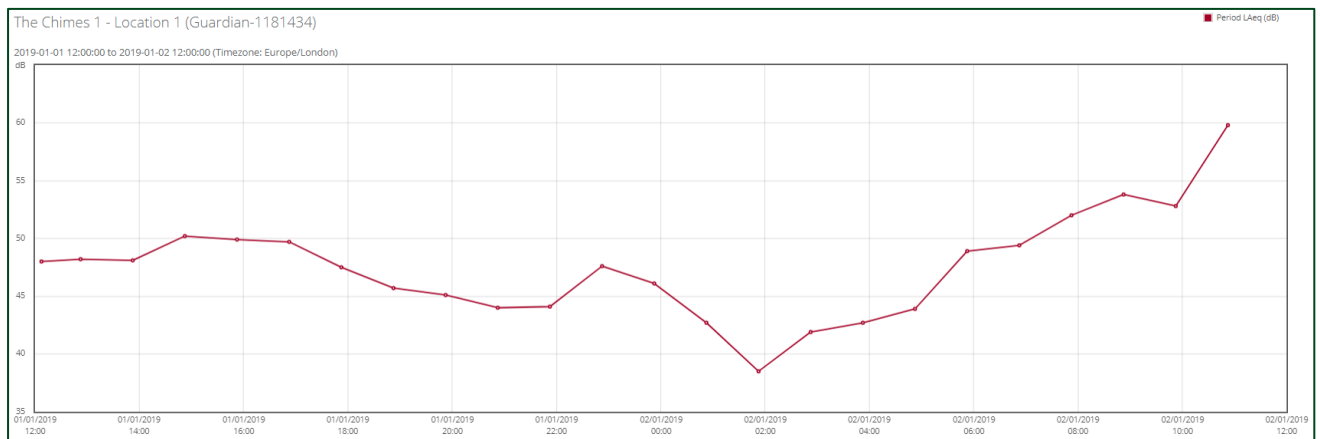
Regenerating past reports

It is possible to resend reports sent in the past. With the report selected, click the 'Report History' tab as shown below. A calendar will be displayed showing when the reports were sent. Click on the relevant report to resend it via email. Only the current user will receive the report in PDF format, not all of the users stipulated on the original report.

Data Channels

The Guardian2 stores multiple parameters, described as agents in the Guadian2 configuration. Many of these agents have an abbreviated description and this section is to provide a full description of those agents.

Internal agents

Internal agents are stored by the Guardian2 and can provide additional information as necessary.

Channel	Description
Temp ($^{\circ}$C)	Temperature (Celsius) recorded on the mHUB's sensor, located on the PCB
Supply Voltage	Voltage (V) of the power supply coming in to the Guardian2
GPS Coordinates	The GPS coordinates recorded by the GPS sensor
Relays	Four relays available, stores their output state (on/off as 1 or 0)
Inputs	Four inputs, stores their state (energised/not energised as 1 or 0). On is defined as having 5-12VDC applied to the input terminal

Noise Channels

Noise channels are split into two-time intervals.

PER – Period data which is hourly values of the specific parameter.

PRF – Profile data which is 15-minute values of the specific parameter.

Both the hourly period and the 15-minute profile are set locally within the CEL-633 instrument located in the Guardian2 and cannot be changed remotely via casella247.com.

Channel	Description
Period LAeq (dB)	Average 'A' weighted level over the period time
Period LAF$_{max}$ (dB)	Maximum 'A' weighted level over the period time with a Fast time response
Period LAS$_{max}$ (dB)	Maximum 'A' weighted level over the period time with a Slow time response
Period LZ$_{Peak}$ (dB)	Peak unweighted level over the period time
Period LAF$_{min}$ (dB)	Minimum 'A' weighted level over the period time with a Fast time response
Period LAS$_{min}$ (dB)	Minimum 'A' weighted level over the period time with a Slow time response

Period LAF$_{10}$ (dB)	Noise level that has been exceeded for 10% of the period time
Period LAF$_{50}$ (dB)	Noise level that has been exceeded for 50% of the period time
Period LAF$_{90}$ (dB)	Noise level that has been exceeded for 90% of the period time, often referred to as the background noise level for a period
Period LAF$_{95}$ (dB)	Noise level that has been exceeded for 95% of the period time
Period LAF$_{99}$ (dB)	Noise level that has been exceeded for 99% of the period time
Period 10 Hour LAeq (dB)	The average 'A' weighted level between 8am and 6pm local time. Often required for monitoring of construction activities
Profile LAeq (dB)	Average 'A' weighted level over the profile time
Profile LAF$_{max}$ (dB)	Maximum 'A' weighted level over the profile time with a Fast time response
Profile LAS$_{max}$ (dB)	Maximum 'A' weighted level over the profile time with a Slow time response
Profile LC$_{Peak}$ (dB)	Peak 'C' weighted level over the profile time
Profile LAF$_{10}$ (dB)	Noise level that has been exceeded for 10% of the profile time
Profile LAF$_{50}$ (dB)	Noise level that has been exceeded for 50% of the profile time
Profile LAF$_{90}$ (dB)	Noise level that has been exceeded for 90% of the period time
Profile LAF$_{95}$ (dB)	Noise level that has been exceeded for 95% of the profile time
Profile LAF$_{99}$ (dB)	Noise level that has been exceeded for 99% of the profile time

Particulate Channels

Particulate matter (PM) is split into three size categories (PM1.0, PM2.5 and PM10) and over several rolling average time intervals (1 minute, 5 minutes, 15 minutes and 1 hour).

Channel	Description
PM1.0	One-minute rolling average ($\mu g/m^3$)
PM1.0	Five-minute rolling average ($\mu g/m^3$)
PM1.0	Fifteen-minute rolling average ($\mu g/m^3$)
PM1.0	One-hour rolling average ($\mu g/m^3$)
PM2.5	One-minute rolling average ($\mu g/m^3$)
PM2.5	Five-minute rolling average ($\mu g/m^3$)
PM2.5	Fifteen-minute rolling average ($\mu g/m^3$)
PM2.5	One-hour rolling average ($\mu g/m^3$)

PM10	One-minute rolling average (µg/m^3)
PM10	Five-minute rolling average (µg/m^3)
PM10	Fifteen-minute rolling average (µg/m^3)
PM10	One-hour rolling average (µg/m^3)

Vibration Channels

The vibration sensor (Geophone) measures over three axis and combines the values to give an overall measurement (PPV).

Channel	Description
Peak Particle Velocity	Peak Particle Velocity (PPV) in mm/s
Vertical Axis Velocity	Channel 1 (vertical-axis) velocity in mm/s
Vertical Axis Frequency	Channel 1 (vertical-axis) frequency in Hz
Longitudinal Axis Velocity	Channel 2 (longitudinal-axis) velocity in mm/s – this axis is marked with an arrow on the sensor block
Longitudinal Axis Frequency	Channel 2 (longitudinal-axis) frequency in Hz
Transverse Axis Velocity	Channel 3 (transverse-axis) velocity in mm/s
Transverse Axis Frequency	Channel 3 (transverse-axis) frequency in Hz

Wind Channels

The ultrasonic wind speed and direction sensor has two channels.

Channel	Description
Wind Speed	The magnitude (speed) of wind in m/s
Wind Direction	The wind direction in degrees

VOC Channels

VOC (Volatile Organic Compound) is split into several rolling average time intervals (1 minute, 5 minutes, 15 minutes and 1 hour).

Channel	Description
VOC Status	Status of VOC Sensor
VOC 1min Average (ppm)	One-minute rolling average (ppm)
VOC 5min Average (ppm)	Five-minute rolling average (ppm)
VOC 15min Average (ppm)	Fifteen-minute rolling average (ppm)
VOC 1hour Average (ppm)	One-hour rolling average (ppm)

Using the FTP Functionality

The File Transfer Protocol (FTP) is a standard network protocol used for the transfer of computer files between a client and server on a computer network. Guardian2 and Casella247 support the FTP functionality. This allows the users to receive data on their own FTP site alongside Casella247. This feature typically helps organisations dealing with multiple monitoring systems. Accessing this functionality is simple via Casella247. Following steps should be followed to enable this feature.

1. Creation of an FTP Site
2. Addition of the FTP Site to Casella247
3. Configuration of the FTP Site on Casella247

Creating an FTP Site

Most organisations trying to access this feature already have a functional FTP site. However, if you are not sure about it then consult your internal IT Department. Creation of an FTP site is easy but requires adherence to your organisation's security protocols.

Adding an FTP Site to Casella247

Once you have details of your FTP site, navigate to **Organisations** and then select the organisation you wish to add an FTP site to. Click on the **FTP Sites** tab next to the **Users** tab. Clicking the **+** button will open up a dialog box where details of the FTP site can be entered.

In order for Casella247 to gain access and connect to your FTP site, you must enter the logon credentials for your FTP site.

Configuring the FTP Site

After addition of the FTP site to an Organisation, users can assign that FTP site to a particular Guardian2 unit. Navigate to **Guardians** and select the Guardian you would like to add for the FTP functionality. Click ⚙ to edit the configuration of the Guardian. Under Data Collection, FTP Data Transfer option will now be visible. Select your FTP site from the dropdown and click Test.

After you click the **Test** button, Guardian2 will try to establish connection with the FTP site using the logon credentials provided and explained in the previous step. Click on the 🔔 icon top right of the screen to find the status of the connection test. You are ready to go once you see the test passed notification.
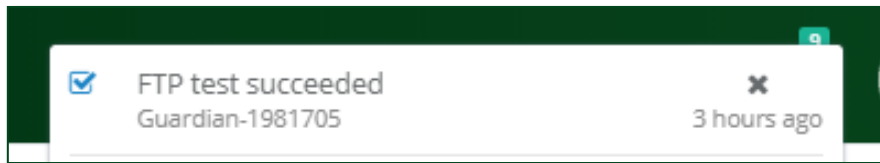
Note: Once the FTP option is enabled, Guardian2 pushes the data to both Casella247 and the user FTP site. This method doubles the amount of data traffic and hence users can incur additional data charges.

Solar and Battery Power Options

Introduction

As well as mains power there are options available for when mains is not available or is intermittent in nature. The Guardian2 can be powered by solar panels, which powers a battery. A second option is to power the Guardian2 from a battery alone, then swap the battery for a fully charged one as required. Finally, a battery is used as a back up to the mains supply. All of these options require a second enclosure to house the battery and power controllers, plus additional cabling and accessories.

Solar Power

This includes one or more 100w solar panel which charges a battery via a controller. This in turn is connected to the Guardian 2. Up to three solar panels can be connected together, each panel producing 100W of power. The number of panels required will vary depending on your geographical location. To select the number of panels required, pick the location below which best matches the latitude of the site for the Guardian2.

Regional Solar Energy Conditions	Recommended Solar Panel Rating	Example Locations
'High'	100W	New York City - USA, Atlanta - USA, Beijing - China, Shanghai - China, Hong Kong - China, Dubai - U.A.E , Johannesburg - S.Africa, Sydney - Australia, Perth - Australia, Singapore, Buenos Aires - Argentina, Sao Paulo - Brazil, Campinas - Brazil, Auckland - New Zealand,
'Medium'	200W	Chicago IL - USA, Pittsburgh - USA, Madrid - Spain, Sofia - Bulgaria, Melbourne - Australia, Vancouver Canada, Halifax - Canada, Toronto - Canada,
'Low'	300W	Seattle - USA, London - UK, Southampton - UK, Paris - France, Frankfurt - Germany, Berlin - Germany, Praha - Czech Republic, Copenhagen - Denmark, Brussels - Belgium,

For more detailed information for a specific location please contact info@casellasolutions.com.

Important suitability factors to consider at a site include:

- Is there a suitable, safe location to mount the system and solar panels? (Theft and unwanted access to potentially hazardous voltages)

- Can the systems solar panels face due south (in the Northern Hemisphere) or North (in the Southern Hemisphere)?
- Will the solar panels be exposed to **<u>direct</u>** sunlight, with no risk of partial shading or obstruction (from say trees, buildings, parked vehicles etc) at any point during daylight hours? Consider especially low-level obstructions which may block direct sunlight during challenging winter months when the sun is low in the sky.

Solar Systems are designed with sufficient battery storage capacity to maintain operation during normal periods of poor weather. It should however be recognised that for some locations in temperate latitudes, extended periods of extreme winter weather (i.e Snow cover, Fog, etc) will always present a challenge to a practical and cost-effective Solar design. During such extreme events, very occasional supplementary charging of the batteries using a mains charger may be necessary, and/or having a spare battery to swap out.

Parts

The solar panel system consists of three main parts:

- An enclosure to hold the battery and solar controller (PN: 208500D) – includes cable (PN:208712B) to Guardian2.
- A battery (Part B162 ordered separately from the above enclosure) which fits in the base of enclosure 208500D.
- The solar panel array (one to three panels), which include mounting brackets for scaffold poles and the power input cables to 208500D enclosure.

Part Number	Description
208500D	GUARDIAN2 REMOTE PSU (SOLAR) S/A Dimensions (60x50x26cm)
B162	12V Leisure Battery 130AH
208512D	GUARDIAN2 SOLAR PSU - SINGLE PANEL ARRAY Dimensions (54x120cm)
208511D	GUARDIAN2 SOLAR PSU - DUAL PANEL ARRAY
208510D	GUARDIAN2 SOLAR PSU - TRIPLE PANEL ARRAY
VB5	Double Scaffold Coupler (optional)

Note: Place the enclosure (208500D) in a suitable location close to the Guardian2. Mount the solar panels as per the guidance given in <u>Appendix1</u> wire the solar panels according to <u>Appendix2</u> and <u>Appendix3</u> angling the solar panels.

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Solar Power System Schematic

Guardian2

**208712B
power lead**

Input cables from solar
panels connecting
directly to the terminal
block

SOLAR PANEL(S)

**Remote Power Supply
Enclosure 208500D**
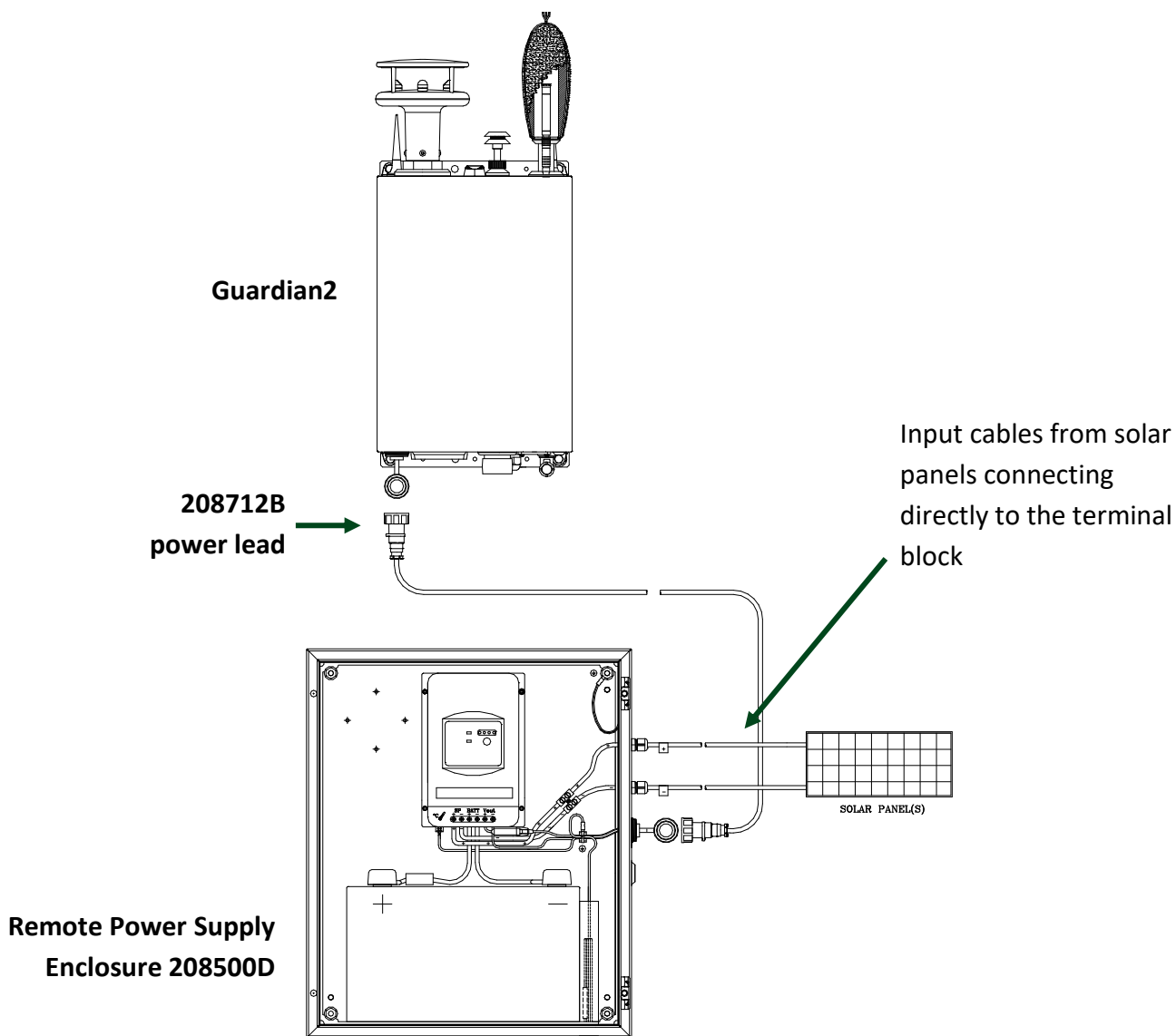
Note: The enclosure features a temperature sensor which disables charging above 65°C. This can be left loose within the enclosure.

Battery Power

With a good quality 130Ah battery the Guardian2 (all sensors) will run for more than 5 days before failure. It is therefore recommended that the battery be replaced every 4 days to avoid data loss. The following considerations are important when working with high capacity lead acid batteries:

- It should be remembered that lead acid batteries are heavy, they contain corrosive chemicals a present an electrical fire risk if short circuited. Care should be taken when lifting, handling and transporting.

- Always recharge your battery as soon as you can after discharge and keep it as fully charged as possible during periods of in-activity.

- Avoid completely discharging your battery (Below 9.7V), this will significantly reduce its cyclic lifespan and may cause permanent damage.

- A disciplined routine of charging and exchanging discharged batteries with fully charge ones will be required to maintain continuous Guardian2 operation.

Example battery lives are shown below for different Guardian2 configurations:

Configuration	Battery Life (130Ahr Battery)
Noise	9 days
Dust	6.5 days
Noise and Dust	6 days
Dust and Wind	6.5 days
Dust, Noise, Wind and Vibration	5 days

Note: As the battery voltage drops below 9.7V power will be cut to avoid damage to the battery. Ensure you use the 'Alerts' system in casella247.com to ensure you have advanced notice before the voltage gets as low as 9.7V.

The battery is housed an external enclosure (208503D). The recommended battery is 130Ahr 12V 'Leisure' type battery. These batteries are sealed lead acid 'leisure' type batteries designed to offer deeper discharge characteristics and robust operation over multiple charge cycles. For maximum battery life, batteries should not be fully discharged or stored in a discharged condition. Batteries may remain connected to the charger to hold them in a fully charged condition prior to exchange. The battery enclosure has a cut off system to prevent batteries from going into a deep discharge state.

Guardian2

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Parts

The battery power part system consists of the parts as described below. It is recommended that two batteries are use and while one is powering the enclosure, the other is being charged by a battery charger (part number CF43).

Part Number	Description
208503B	GUARDIAN2 REMOTE PSU (BATTERY SWAP-OUT) S/A
B162	12V Leisure Battery 130AH
CF43	Charger

Connecting the Battery

Each power enclosure comes with quick connector to enable easy connection of the lead acid battery. The connectors fit on standard 19mm pins on the top of the leisure lead acid batteries.

⚠ **CAUTION**

Lead acid batteries are heavy and manual handling precautions should be followed.

1. Lift the quick release connector (A).
2. Ensure the RED connector is attached to the positive side of the battery and the BLACK or BLUE connector is attached to the negative side.
3. Press down on the top of the quick release connector to lock it in place.

Quick release connector (A)

Place the remote enclosure (208503D) in a suitable location where it will not get knocked or damaged. Wire the enclosure to the Guardian 2 using the cable provided, see 'Connecting power to the Guardian2'. Fit and connect the Lead Acid battery as shown above

Battery Power System Schematic
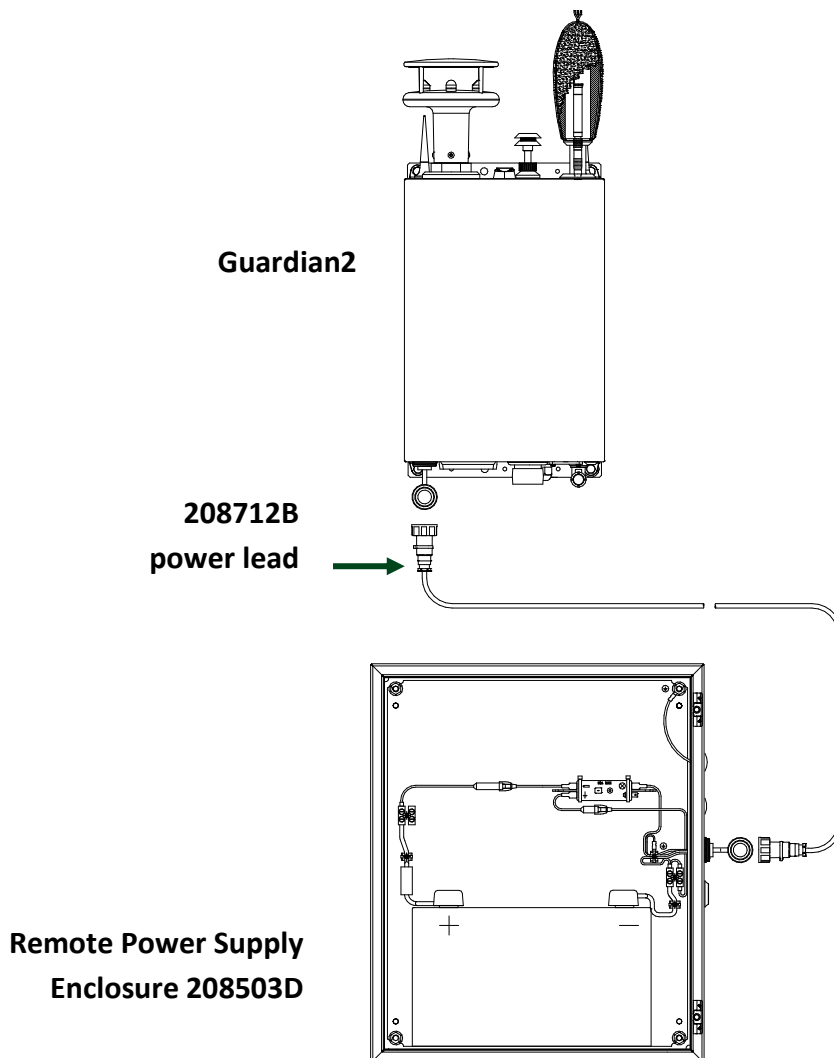
Guardian2

208712B
power lead

Remote Power Supply
Enclosure 208503D

Once power has been connected the Guardian2 will boot up, go to the section 'Switching on and commissioning'.

Note: As the battery voltage drops below 9.7V power will be cut to avoid damage to the battery. Ensure you use the 'Alerts' system in casella247.com to ensure you have advanced notice before the voltage gets as low as 9.7V.

Mains with Battery Backup

This option combines the normal mains power but uses a battery backup in case of power loss. This can be useful if there is an intermittent mains supply on site. The mains supply continually charges the battery which in turn powers the Guardian2.

Parts

The system consists of an enclosure (208504D) which houses the lead acid battery and control equipment to charge the battery. The Lead Acid battery is ordered separately.

Part Number	Description
208504D	GUARDIAN2 REMOTE PSU (AC PWR/BATT BACK-UP) S/A
B162	12V Leisure Battery 130AH

Assembly

Place the remote enclosure (208504D) in a suitable location where it will not get knocked or damaged. Wire the enclosure to the Guardian 2 using the cable provided, see 'Connecting power to the Guardian2'. Fit and connect the Lead Acid battery, see 'Connecting the battery'.

Once power has been connected the Guardian2 will boot up, go to the section 'Switching on and commissioning'.

Battery with Mains Power System Schematic
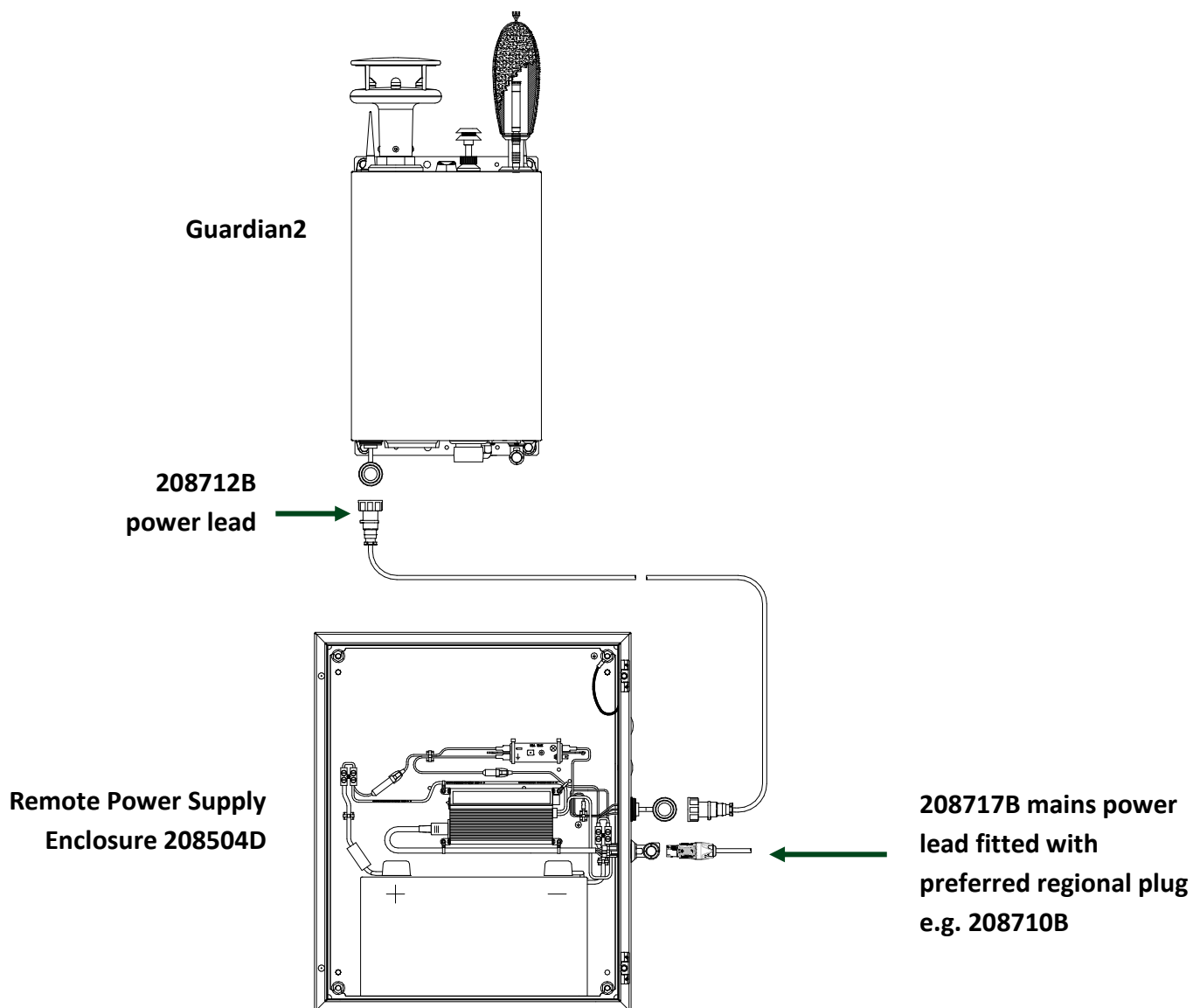
Guardian2

**208712B
power lead** ⟶

**Remote Power Supply
Enclosure 208504D**

**208717B mains power
lead fitted with
preferred regional plug
e.g. 208710B** ⟵

> **Note:** As the battery voltage drops below 9.7V power will be cut to avoid damage to the battery. Ensure you use the 'Alerts' system in casella247.com to ensure you have advanced notice before the voltage gets as low as 9.7V.

CE Declaration of conformity

$C\epsilon$

Casella declares that the products supplied are individually in compliance with the essential requirements and other relevant provisions of applicable EC directives. A copy of the EU Declaration of Conformity for Casella manufactured products may be obtained by clicking on the product compliance documentation link at www.casellasolutions.com. Other certificates from 3rd party manufacturers are available on request.

WEEE information

The use of the WEEE symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about recycling of this product, please contact your local waste disposal service or contact the agent where you purchased the product.

Servicing & Maintenance Information

For an annual calibration of applicable sensors of the Guardian2 please contact Casella on 01234 847799, our regional offices or your local distributor. You can find your most local contact by visiting the 'where to buy' section of www.casellasolutions.com.

General

Guardian2 units should be inspected on a regular basis, especially if any data appears anomalous.

Routine checks should be performed, such as:

- Ensuring there is no external damage to the cabinet.
- Power and antenna data cables are not damaged or pinched.
- Any significant build of dust should be cleaned with a cloth moistened with soft detergent
- External fans are not blocked.
- The inlet filter is not blocked on the base of the enclosure – remove and clean if necessary, by removing the bolts on the inside of the cabinet that retain the filter.
- If a particulate sensor is installed, inspect the inlet and outlet to remove any debris or blockage.
- Open the cabinet and ensure that all cables are connected and there is no water ingress.

Wind Speed and Direction

Cleaning

If there is any build-up of deposit on the unit, it should be gently cleaned with a cloth moistened with soft detergent. Solvents should not be used, and care should be taken to avoid scratching any surfaces. The unit must be allowed to defrost naturally after being exposed to snow or icy conditions, do NOT attempt to remove ice or snow with a tool. Do NOT remove black "rubber" transducer caps.

Servicing

There are no moving parts or user-serviceable parts requiring routine maintenance. Opening the unit or breaking the security seal will void the warranty and the calibration. In the event of failure, return the unit to your authorised distributor.

Vibration

Checking

There is no need for maintenance on the vibration sensor. Check should be made to ensure there is no damage to cables and that the sensor is securely fastened to the ground.

Noise

Checking

Ensure the windshield is not damaged. Windshields have a finite lifespan so if there are any signs of degradation, a replacement should be fitted, part number 208022C. Remove the windshield and ensure that there is no signs of moisture or damage to the microphone and preamp. The sound level meter should be routinely calibrated as per page 17 of this manual and it is worth performing additional checks if there have been any extreme weather events.

If dB levels being logged and are abnormally low (e.g. below 25dB) this could be an indication of a damaged microphone. Calibration should be undertaken as above and if the unit fails to calibrate, a replacement microphone should be sourced.

Particulate

Replacement

The particulate sensor has a finite lifespan of about two years but does not require any maintenance or calibration in that time. It will become evident that the unit has failed if zero values are continuously outputted from the particulate sensor. A replacement particulate sensor is available, part number 208044C. The sensor comes complete with the tube to attach to the outlet of the Guardian2.

To replace the sensor, refer to the diagram below. Ensure power is switched off to the Guardian2 before replacing the sensor.

1. Remove the two sensors mounting screws (B).
2. Slide the particulate sensor (C) down by about 10cm.
3. Gently slide off the heated inlet (A) from the particulate sensor (C).
4. Remove the signal connector (E).
5. Pull the particulate sensor up so that the tube leaves the base of the Guardian2.
6. The sensor can now be removed from the mounting plate by removing the screws (D).

The new sensor can then be fitted by repeating the process above in reverse.
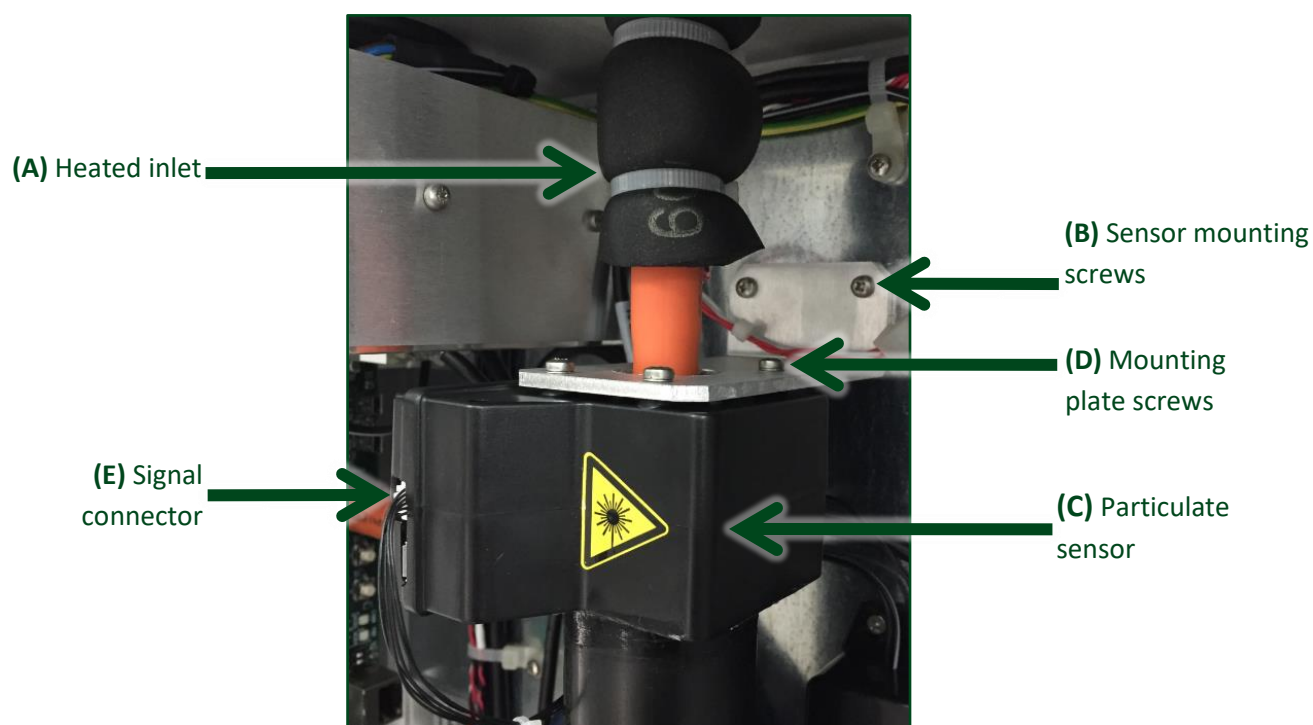
VOC

Calibration

In order to calibrate the VOC sensor a separate Calibration Kit is required (Part Number: 208147B) comprising a calibration cowl (Part Number: 208146B), a 2m length of tubing (Part Number: TU229) and a USB extension lead. Suitable calibration gases will also be required i.e. 'zero air' and a 'span gas' such as 100ppm Isobutylene (available from suppliers such as Ion Science or Speciality Gases).

You will also need to download the VOC Agent Calibration Utility to a suitable laptop from the clicking [here](#).
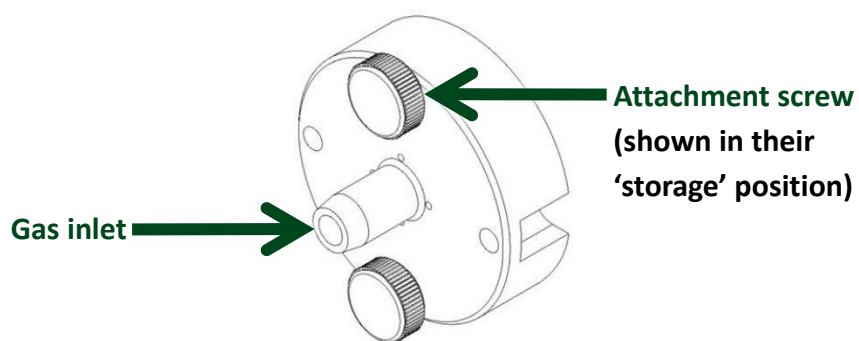
Calibration Cowl (208146B)

To calibrate the VOC sensor assembly, it first has to be removed from the Guardian2; refer to the diagrams below. **Ensure power is switched off to the Guardian2 before removing/replacing the sensor assembly.**

The VOC sensor interface assembly (part 208143B) is located 'face down' at the bottom of the Guardian2, above the filtered air inlet.
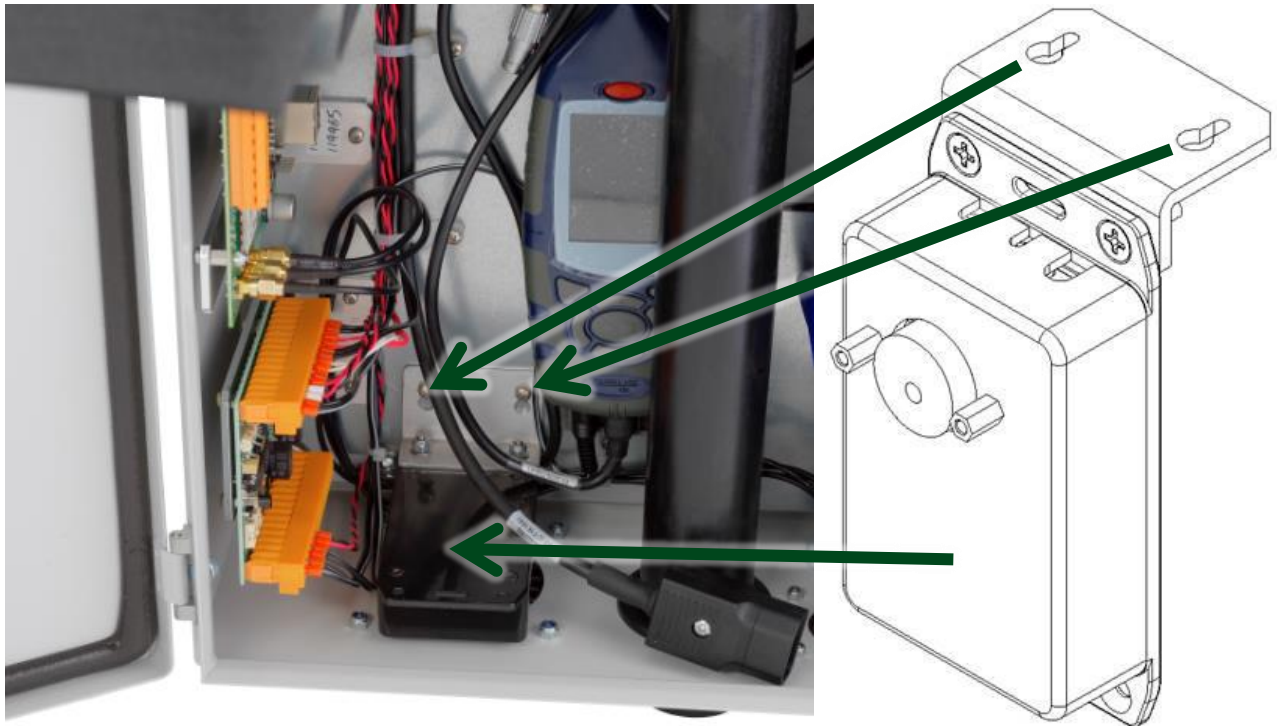
1. Loosen the two sensor assembly mounting screws shown above.
2. Slide the whole sensor assembly up (by about 1cm) then gently pull away from the back panel towards you.
3. Remove the USB connector from the mHUB logger and re-connect to a suitable laptop using the USB extension cable if necessary
4. Fit the calibration cowl (with tubing attached) over the now 'exposed' sensor element (you will see a blue coloured cap). Use the posts on the sensor assembly housing and slots in the cowl to locate it then secure it in place with the knurled thumbscrews (having first unscrewed them from their storage position).
5. Run the VOC Agent Calibration Utility and proceed as shown overleaf
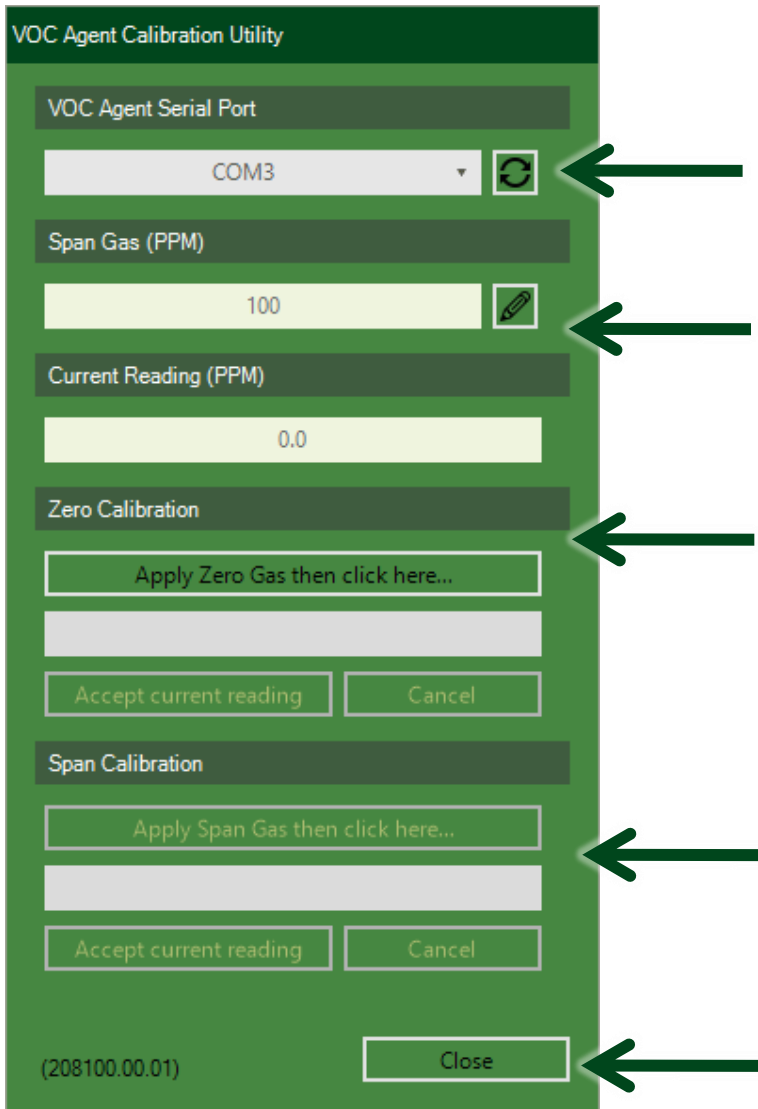
1. Press to locate the sensor assembly if not detected automatically. A green LED should now be flashing on the USB connector and the current calibration factors will be displayed in a separate window.

2. Check/enter the target value of the calibration gas e.g. 100 ppm for Isobutylene

3. Connect the free end of the tubing to the Zero Air gas bottle and proceed as prompted. A status bar will increment over about 45 seconds but you can accept the current (zero) reading at any time.

4. Now connect the Calibration (span) gas and proceed as prompted (similar to 3 above). The current reading should match the target value in 2 above.

5. Press here to close the utility
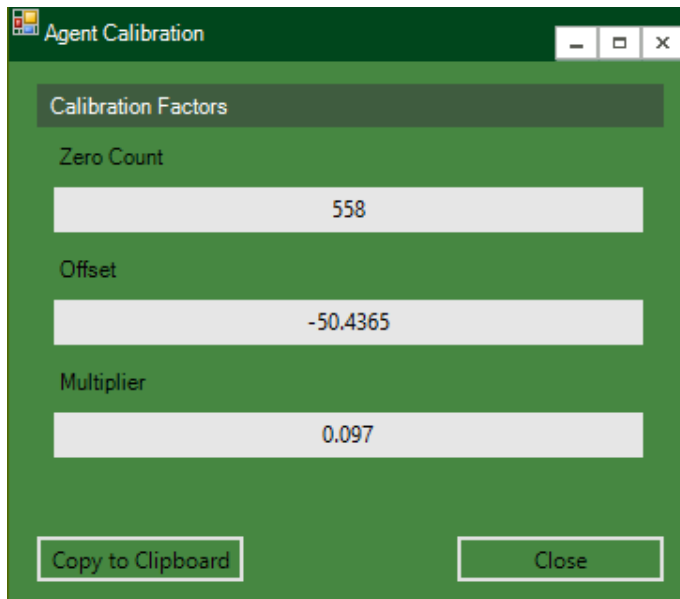
A new set of calibration factors will be shown (as above) and once calibrated, the sensor assembly can then be re-fitted by repeating the process above in reverse.

If the sensor does not calibrate repeat the process. You may need to clean the sensor lamp or consider replacing the VOC sensor (part SE52) if a satisfactory calibration cannot be achieved.

Replacing the VOC Sensor

Remove the sensor assembly as previously described. With the assembly face down on a clean surface, remove the four retaining screws and take off the cover. Gently pull the sensor off the circuit board and fit a replacement sensor (part SE52). It has 3 pins and will only fit one way. Replace the cover and screws and perform a calibration before refitting the sensor assembly.

Cleaning the Sensor Lamp

The VOC sensor lamp will need cleaning from time to time. How often depends on the environment being measuring. If VOCs and particulates are present in high concentration then check calibration frequently and if the VOC sensor has lost sensitivity or an error code is reported, change the electrode stack as explained below. Signs when the VOC sensor needs attention are:

• If the baseline climbs after you zero the sensor, then the electrode stack needs replacing.

• If the sensor becomes sensitive to humidity, then the electrode stack needs replacing.

• If the baseline shifts/is unstable when VOC sensor moves, then the electrode stack needs replacing.

• If sensitivity has dropped too much (note the change required when checking calibration), then the lamp needs cleaning.

Validity of lamp warranty is compromised if lamp cleaning maintenance is not followed and lamp has obvious fouling/contamination.

Removing electrode stack and lamp

> **Caution:** Always use the electrode stack removal tool. Any other tools (for example screwdrivers) may damage the VOC sensor body and will invalidate any warranty.

1) Gently remove the sensor as previously described.
2) Place the MiniPID 2, electrode stack side down, onto a clean surface.
3) Locate electrode stack removal tool into the side slots of the sensor and squeeze together until electrode stack and lamp are released.
4) Lift carefully the sensor body away from the electrode stack and lamp.
5) Occasionally the lamp may be temporarily lodged in the cell and will need to be freed carefully with tweezers.
6) Occasionally the small spring behind the lamp will come out when the lamp is removed from the sensor. Simply replace it in to the sensor housing.

Cleaning the VOC sensor lamp
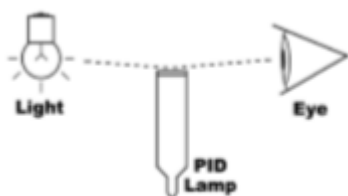
Inspection of the lamp may reveal a layer of contamination on the detection window that presents itself as a 'blue hue.'

To check for contamination, hold the lamp in front of a light source and look across the window surface

Only clean the lamp using the recommended lamp cleaning kit (part TBA) and to avoid contaminating the sensor and affecting accuracy, do not touch the lamp window with bare fingers.

> **Caution:** The lamp cleaning kit contains a vial of cleaning compound which conatians alumina (CAS Number 1344-28-1) as a very fine powder. Cleaning should be undertaken in a well-ventilated area. A full material safety data sheet (MSDS) is available on request. Key safety issues are identified below:

Hazard identification:
• May cause irritation of respiratory tract and eyes

Storage:
• Keep container closed to prevent water adsorption and contamination.

Handling:
• Do not breathe in the powder. Avoid contact with skin, eyes and clothing
• Wear suitable protective clothing
• Follow industrial hygiene practices: Wash face and hands thoroughly with soap and water after use and before eating, drinking, smoking or applying cosmetics.
• The powder carries a TVL(TWA) limit of 10 mg/m^3

Cleaning the Lamp

> **Caution:** Only use the lamp cleaning kit A-31063

1) Open the container of alumina polishing compound and with a clean cotton bud, collect a small amount of the powder.
2) Use this cotton bud to polish the PID lamp window. Use a circular action, applying light pressure to clean the lamp window. Do not touch the lamp window with fingers.
3) Continue polishing until an audible "squeaking" is made by the cotton bud moving over the window surface (usually within 15 seconds).
4) Remove the residual powder from the lamp window with a clean cotton bud. Care must be taken not to touch the tips of cotton buds that are to be used to clean the lamps as this may contaminate them with finger oil
5) Ensure the lamp is completely dry and any visible signs of contamination are removed before refitting.

Re-fitting the VOC sensor 2 electrode stack and lamp

Caution! Never refit a damaged lamp

1.   Place the lamp inside the O-ring seal in the electrode stack as illustrated. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the front electrode stack.   The lamp should be freely supported by the O-ring.

2.   Lay the electrode stack front face down on a clean, flat surface and then screw the lamp down into the O-ring until it firmly abuts against the front electrode face – this is most important

3. Then bring the sensor body carefully down over the lamp so as not to disturb its positioning within the electrode stack and then push the body firmly onto the face down electrode stack so that it clicks into place.

4. Refit the sensor into the VOC sensor assembly and re-calibrate as previously described

5. Refit the sensor assembly in the Guardian2 as previously described

Error codes

The **Casella247** software will 'notify' should any fault conditions occur with recommended actions as per the table

Error Code	Fault Condition	Recommended Action
1	Power removed	Check Guardian 2 power, that the VOC sensor interface's USB is connected (and green LED is flashing) and mHUB logger power is on (blue LED)
2	Oscillator loaded	Change electrode stack
3	Oscillator not working	Change electrode stack or replace VOC sensor (part SE52)
4	Lamp not illuminated	Clean or replace lamp and/or check the electrode stack is fitted correctly
5	Under range	No action, information only

Appendix 1 – Solar Panel Mounting

Assembly

Place the enclosure (208500D) in a suitable location close to the Guardian2, cables provided from the solar panels are 5m in length. Mount the solar panels as per the guidance given above using the mounting brackets provided (illustrated below) and angle the solar panels at the correct angle, see Appendix 3. Wire the solar panels as shown in Appendix 2.

Fix the brackets to the scaffold using the U-bolts (M8) and bolts (M5) to attach to the bracket

Attach angle adjustment bar

Fix the brackets to the solar panel using the bolts (M5) and washers provided
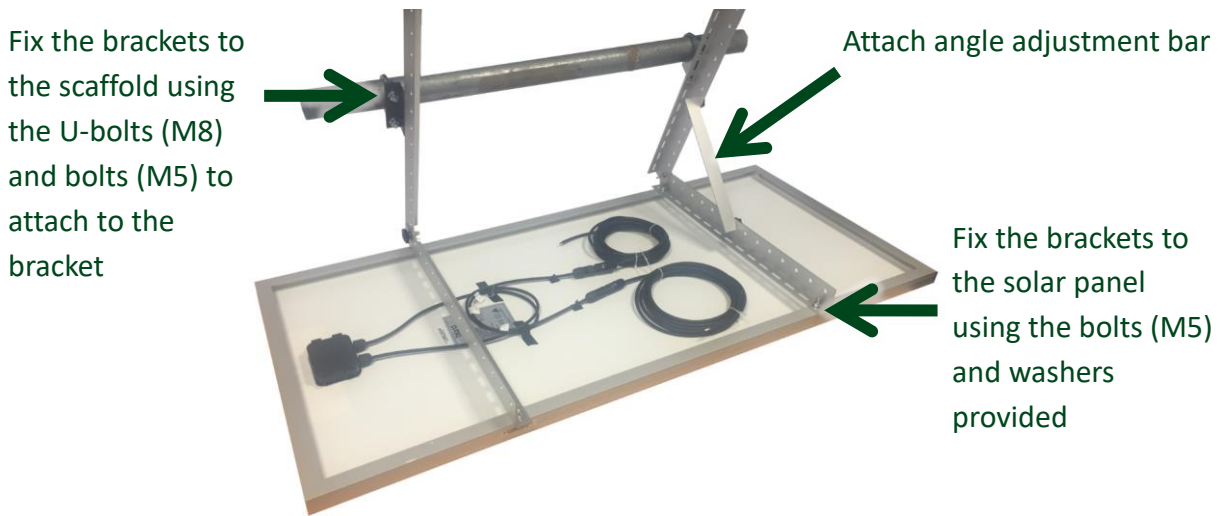
⚠️ **CAUTION**

Solar panels generate significant electrical voltage and so connections should be handled with caution.

An example of how to set up a single panel array is shown below mounted to scaffold poles (not supplied). Use cable ties to strap down loose cables as necessary. Detailed diagrams for assembling solar arrays and connecting the cables are shown in Appendix 2.

Once power has been connected the Guardian2 will boot up, so to the section 'Switching on and commissioning'.

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Connectors

Power box

For adjustment angle, see **Appendix 2**

Solar panel

Mounting bracket

VB5 coupler (optional)

Angle adjustment

Scaffold poles (not supplied)

Cable to 208500D enclosure (5m)
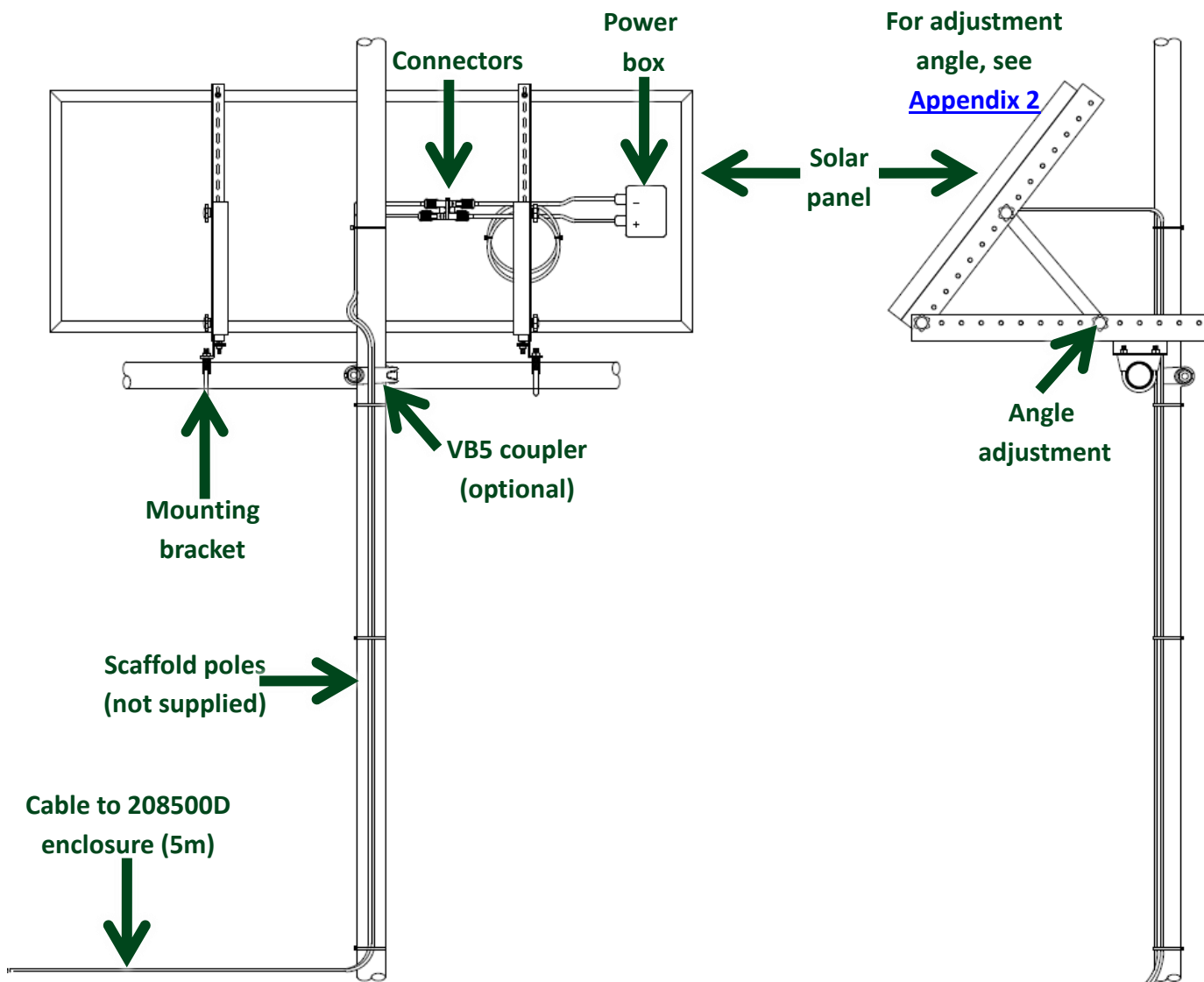
Note: Solar panel arrays include U bolt mounts for scaffold poles and the relevant cabling.

Appendix 2 – Solar Panel Wiring

From the solar panels, two wires need to be run to the Solar Remote PSU Enclosure 208500D, one positive and one negative. These cables can be routed through the glands in the side of the enclosure and connected to the solar controller within the enclosure, as illustrated below.

Negative (-) wire from solar panels

Positive (+) wire from solar panels
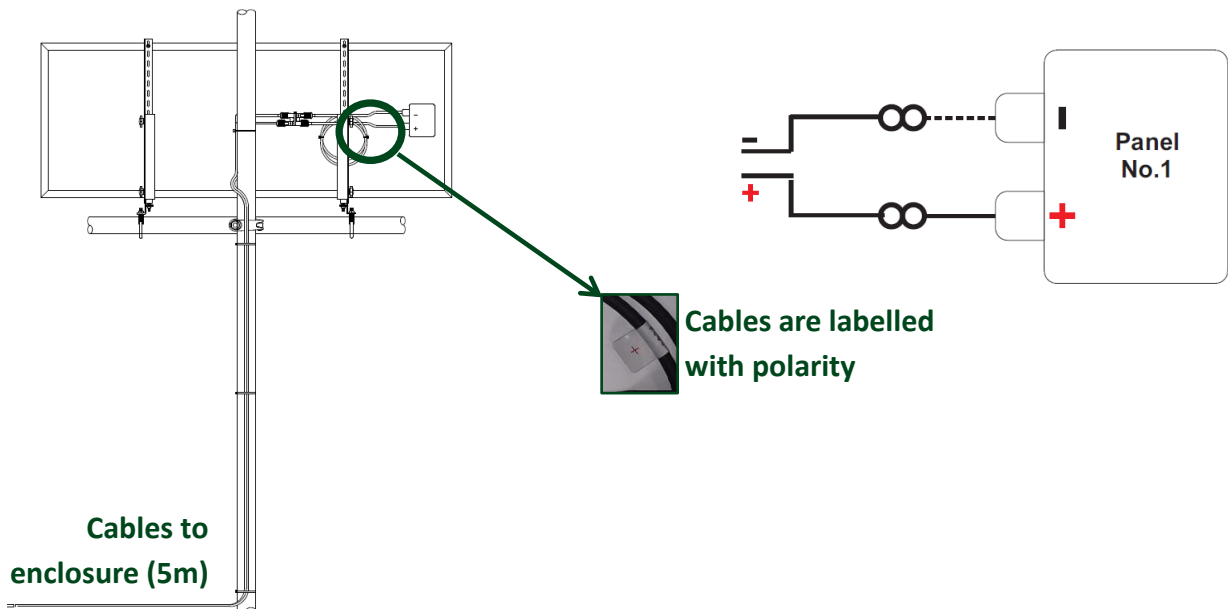
💡 Wiring and connections of solar panels to Guardian2 are also explained in this video

Single Panel Array

Cables are labelled with polarity

Cables to enclosure (5m)

Dual Panel Array

Ensure there is a 710m spacing between panel mounts to prevent shading of the solar panels. When connecting panel 1 and 2 to the connectors, ensure that wires are connected with the correct polarity as illustrated below.

710mm

Negative side

Positive side

Panel No.1

Panel No.2

Cables to enclosure (5m)

Cables are labelled with polarity

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Triple Panel Array

Ensure there is a 710m spacing between panel mounts to prevent shading of the solar panels. When connecting panel 1 and 2 to the connectors, ensure that wires are connected with the correct polarity as illustrated below.

710mm

710mm

Cables to enclosure (5m)

Negative side

Positive side

Panel No.1 (Top-Most)

Panel No.2 (Middle)

Panel No.3 (Bottom-Most)

Cables are labelled with polarity
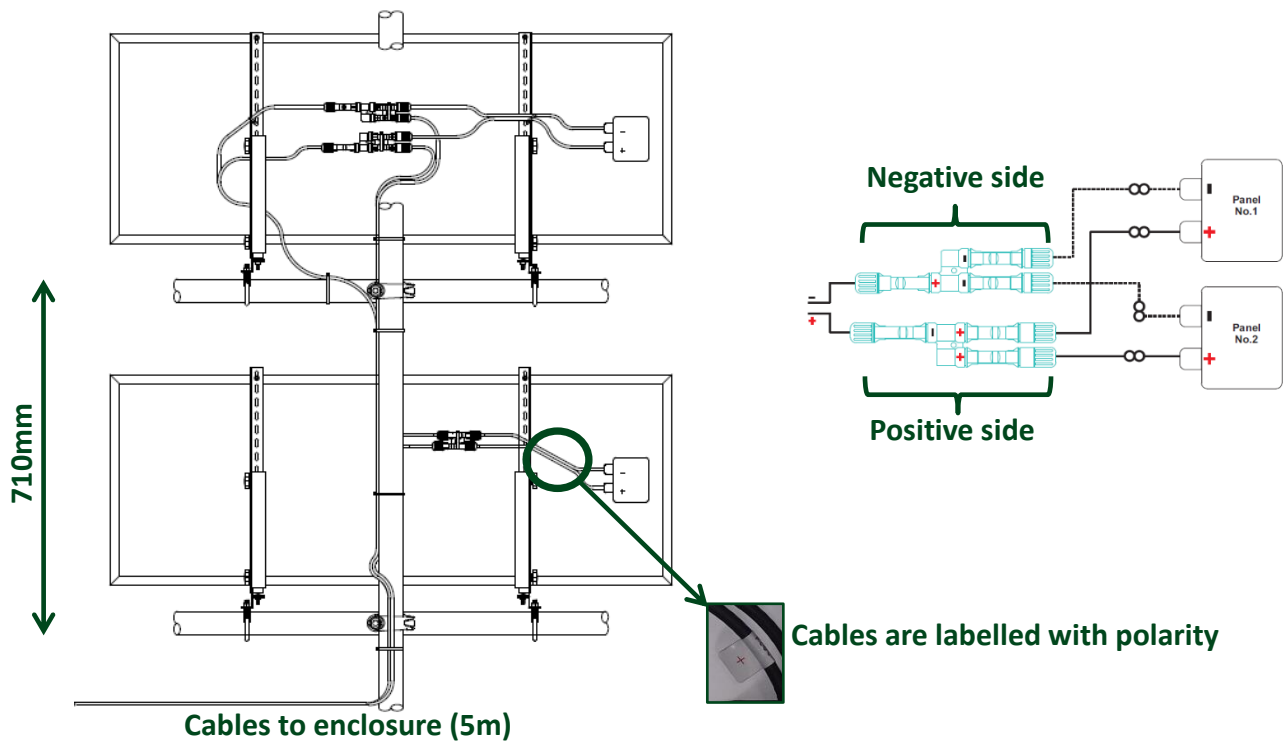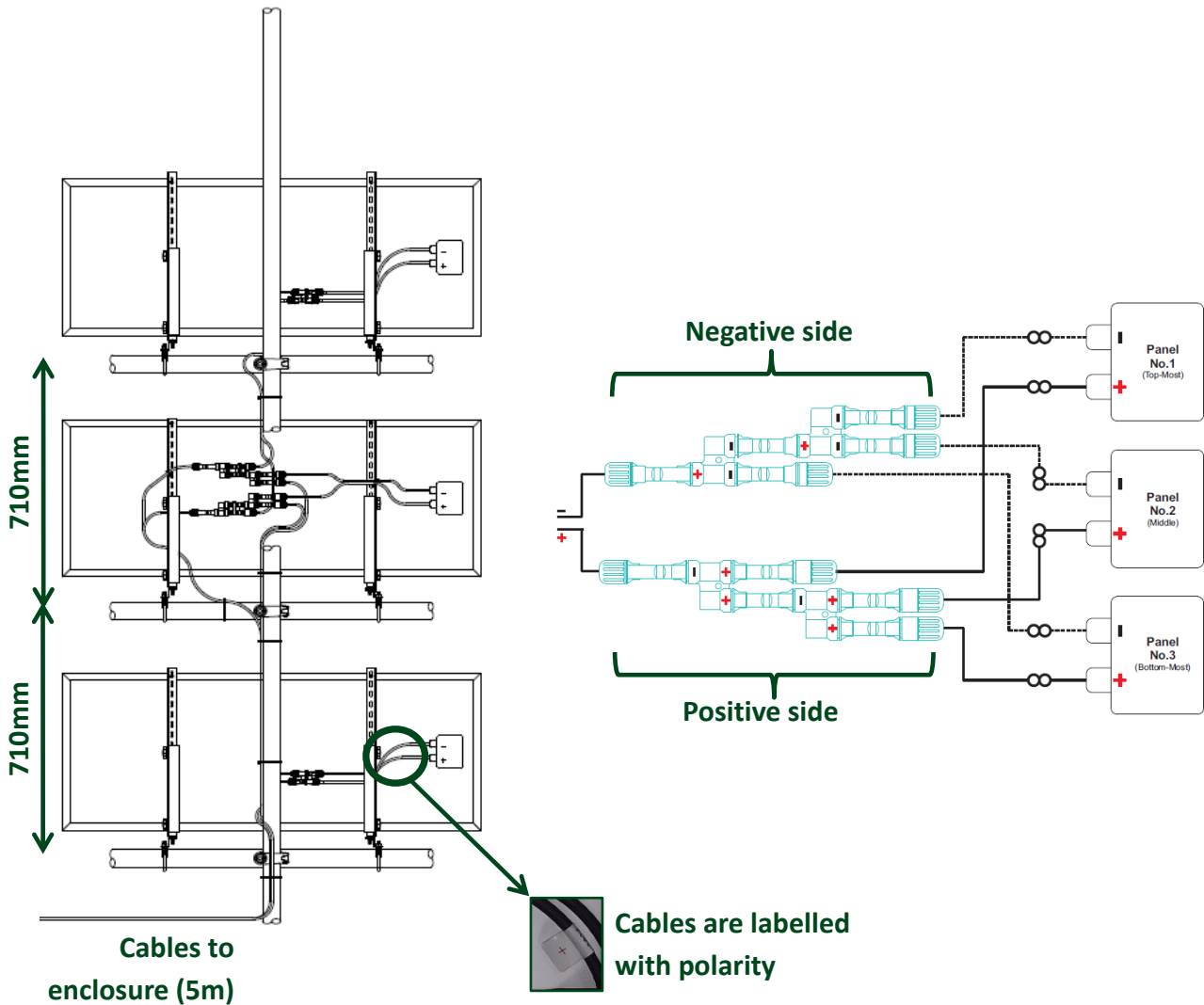
Appendix 3 – Solar Panel Angle

Angles to adjust the solar panel to by location are shown below, together with the panel direction for specific locations and countries. See the diagram below the table which illustrates the correct angle to adjust on the solar panel.

Location	Country	Panel Direction	Optimum Winter Angle	Optimum year-round angle
Buenos Aires	Argentina	North	40	55
Melbourne	Australia	North	37	52
Sydney	Australia	North	41	56
Perth	Australia	North	43	58
Brussels	Belgium	South	24	39
Sao Paulo	Brazil	North	51	66
Campinas	Brazil	North	52	67
Sofia	Bulgaria	South	32	47
Vancouver	Canada	South	26	41
Halifax	Canada	South	30	45
Toronto	Canada	South	31	46
Beijing	China	South	35	50
Shanghai	China	South	44	59
Hong Kong	China	South	53	68
Praha	Czech Republic	South	25	40
Copenhagen	Denmark	South	19	34
Paris	France	South	26	41
Frankfurt	Germany	South	25	40
Berlin	Germany	South	23	38
Dublin	Ireland	South	22	37
Groningen	Netherlands	South	22	37
Auckland	New Zealand	North	38	53
Johannesburg	South Africa	North	49	64
Madrid	Spain	South	35	50
Stockholm	Sweden	South	16	31
Dubai	U.A.E	South	50	65
London	UK	South	23	38
Manchester	UK	South	21	36
Southampton	UK	South	24	39
New York City	USA	South	34	49
Chicago IL	USA	South	33	48
Seattle	USA	South	27	42
Pittsburgh	USA	South	35	50
Atlanta	USA	South	41	56
Singapore	Singapore	South	89	89

A more extensive list of countries and locations is available by clicking here. Refer to the following diagram to adjust the solar panel to the correct angle. It is recommended to set the angle for the optimum year-round value. If power becomes intermittent in winter months then adjust the angle to the optimum winter angle.

Adjustment angle