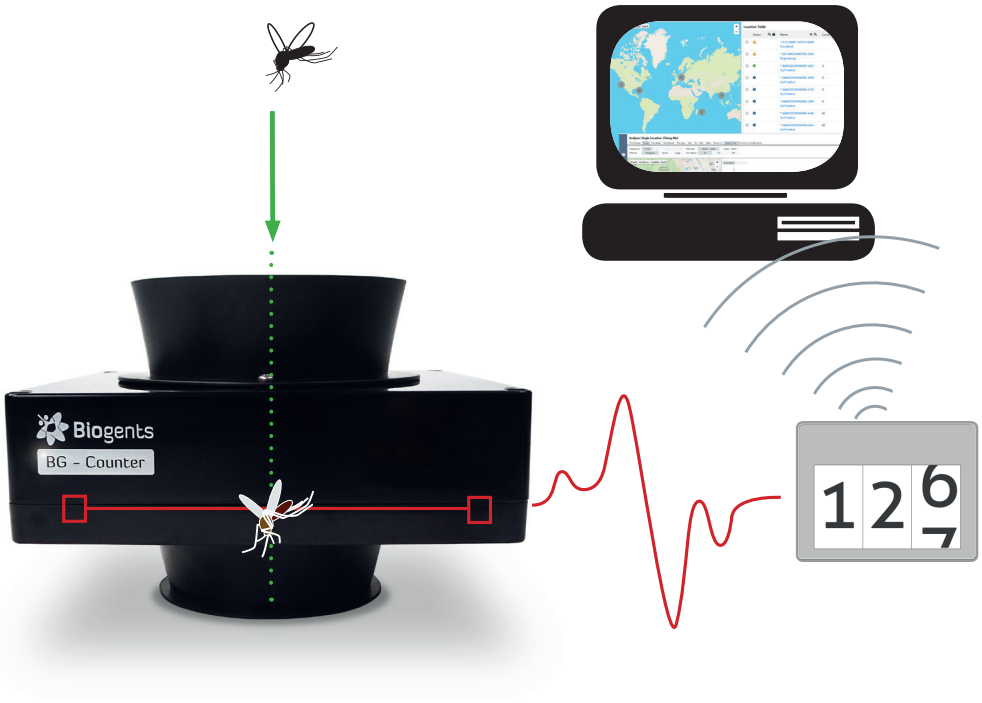
Biogents



BG - Counter 2

EN Instruction Manual

Updates for the manual are available online » https://eu.biogents.com

Status: October 2023

BG-Counter 2™

Table of Contents

BG-Counter 2 Description and Set-Up

The BG-Counter 2 is an electronic device that counts mosquitoes as they fly through and wirelessly transmits the data to a cloud server. Differentiation of mosquitoes from smaller or larger insects, and from other objects such as dust or rain particles, is based on size and wing beat. Mosquitoes, small Diptera such as chironomid midges and fungus gnats, and other insects with a similar size cannot be reliably differentiated. Therefore, to improve classification accuracy, the BG-Counter 2 utilizes carbon dioxide (CO_2) to attract mainly blood sucking insects. When using CO_2 as an attractant the accuracy of correctly counted mosquitoes is in the range of 80-90 %. Accuracy may vary from location to location and should be verified from time to time (see p. 12).
We recommend to use the BG-Counter 2 in combination with a BG-Trap Station and a BG-Pro trap. The trap removes the insects after they are counted, avoiding multiple counts of the same insect. To ensure accurate counts, collected mosquitoes must not escape from the trap.
Equipped with basic sensors, the BG-Counter 2 also samples local environmental data such as temperature, humidity and light. The system is supported by the BG-Counter App, a web application for storage of mosquito counts as well as geospatial and environmental data. Via the BG-Counter App you can remotely switch the trap and the BG-Counter 2 on and off. It also allows you to set up varying time schedules to run the trap and control the application times of CO_2. The app includes an analyzer tool that allows you to vizualize graphs, maps and tables of your monitoring data. You can analyze daily, weekly, or monthly trends of single or multiple traps.

BG-Counter 2

The BG-Counter 2 is the next generation version of the BG-Counter. It offers the following improvements over the previous model:

1. Internal antenna
2. Not affected by eventual sunset of 3G network
3. Improved protection against corrosion and environmental influences
4. Better insect classification accuracy through improved algorithms
5. 4G Cellular Communication Module, works on the LTE cellular network
6. The BG-Counter 2 comes with a BG-Pro trap (counter version with 12 V fan).

Safety Instructions and Warnings

WARNING

To avoid injury, read the following safety information and the operating instructions before using the BG-Counter 2. Failure to follow these safety instructions could result in fire, electric shock, or other injury or damage to the BG-Counter 2 or other property.

Important safety instructions

Read and follow these instructions to use the BG-Counter 2 safely.

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Install in accordance with instructions.
- Clean only with a dry cloth.
- Protect the power lead from being walked on or pinched, particularly at the plugs and at the point where it exits from the BG-Counter 2.
- Unplug the BG-Counter 2 during lightning storms or when unused for long periods of time.
- Do not use the BG-Counter 2 near or immersed in water.
- Only use attachments/accessories specified by Biogents.
- Refer all servicing to qualified service personnel. Servicing is required when the BG-Counter 2 has been damaged in any way, such as when the housing, power lead or plug is damaged, does not operate normally or has been dropped.

Handling

Your BG-Counter 2 may be damaged by improper storage or handling. Be careful not to drop the BG-Counter 2 when transporting it.

Operation

The device contains a cellular modem emitting radio-frequency electromagnetic radiation. Keep a distance of at least 20 cm when the device is in operation. The device also contains LED emitters of invisible infrared radiation. Do not operate the device with the housing opened or removed.

Repairing

Do not make repairs yourself. If the BG-Counter 2 is damaged or malfunctions, contact your Sales and Service Representative. Repairs by service providers other than Biogents or a Biogents Authorized Service Provider may not involve the use of Biogents genuine parts and may affect the safety and functionality of the device. Any changes to the device may affect warranty.

Power

The BG-Counter 2 has no on/off switch. To disconnect the BG-Counter 2 from power, unplug the power lead. Make sure the power lead is always easily accessible. When connecting or disconnecting the BG-Counter 2, always hold the plug by its sides. Don't pull on the cable. Keep fingers away from the metal part of any plugs or solar wires.

WARNING: To reduce the risk of fire or electric shock, do not expose the BG-Counter to liquids, excessive heat or naked flame.

How to Set-Up the BG-Counter 2

The BG-Counter 2 needs mobile reception

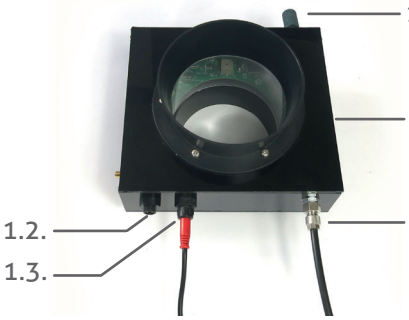
The BG-Counter 2 needs mobile reception to transmit data to the web server. Therefore, place the BG-Counter 2 with the trap only in areas with mobile reception. You can check the local reception with your mobile phone.

The BG-Counter 2 will automatically select a mobile provider available at the location.
Contact Biogents Technical Support for a list of mobile providers supported in your country.

Product Components

1. **BG-Counter 2**

   1.1. Body with internal antenna
   1.2. Connector for 12 V power
   1.3. Fan connector (red) with attached fan adapter cable
   1.4. CO_2 input port with attached CO_2 tube
   1.5. CO_2 release port
   1.6. Adjustable pressure regulator
   1.7. Battery adapter cable
   1.8. Outdoor power supply
   1.9. BG-Pro Counter version: 1x funnel net, 2x catch bag, 1x inner cylinder with upper part and lower part with **12 V fan**, 1x trap body, 1x carrying bag, 1x tripod that enables the trap to stand on the ground.



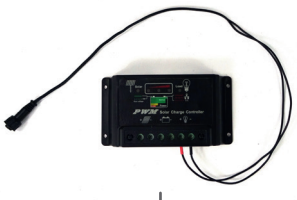
Optional

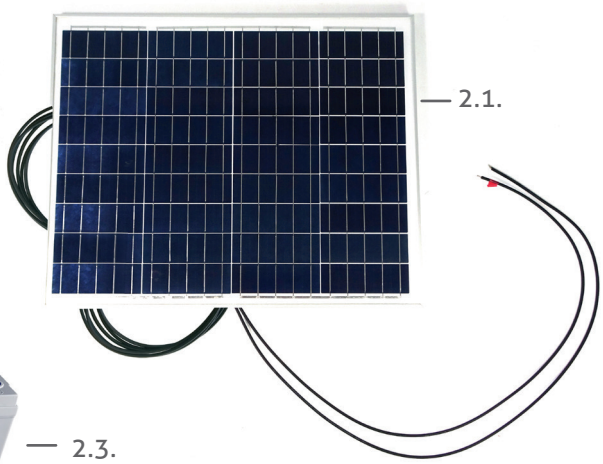
2. **Solar system**

   2.1. Solar panel with connectors
   2.2. Charge controller with connectors } order no. 10755-1
   2.3. Battery with battery cables (order no. 10766)

3. **BG-Trap Station (recommended)**

   3.1. Metal stand with bottom ring, lid, 2 beams, screws, and nuts





WARNING

The BG-Counter 2 runs on 12 V. Never connect the BG-Counter 2 to a voltage above 14.4 V.

When using the BG-Counter 2, always confirm that the rated voltage on the fan label is 12 V (Biogents SKU 10042). Do not connect a 6 V fan!

Set-Up with the BG-Trap Station (recommended)

1. Assemble BG-Pro parts
   Follow the assembly instructions for the BG-Pro. See manual at » www.biogents.com.
   In case you already have a BG-Pro trap:
   - Do not add a UV light.
   - Do not add a funnel.
   - Always run the BG-Counter 2 with the **12V BG-Counter fan** included in the contents of the BG-Counter 2.
   - If you do not use a BG-Trap Station, attach the tripod to place the trap on the ground.

2. Add a BG-Lure or BG-Mozzibait
   We recomend to add a BG-Lure or BG-Mozzibait into the body of the BG-Pro [F1]. When using the attractant in addition to CO_2, it acts as an synergist and can multiplies your mosquito catch rates and increase the accuracy of the BG-Counter 2. Make sure to remove the packaging from the lure before placing it inside the trap.

F1

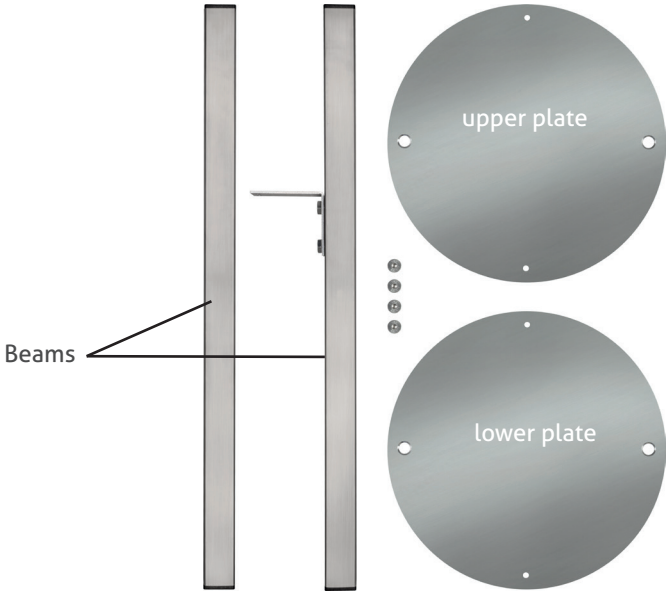
3. Assemble the BG-Trap Station
   Assemble the stand by fixing the beams on the lower plate with the enclosed socket screws. Place the upper plate on the other ends of the beams and also fix them with socket screws [F2].


F2

4. **Set up the BG-Pro in the stand**
Insert an enclosed screw through one of the holes on the central upper bracket of the BG-Pro [F3]. Continue to insert the screw through one of the holes of the trap holder of the BG-Trap station [F4] and fix it with a nut. Repeat this process with another screw and the second hole. The BG-Pro should now be firmly attached to the BG-Trap station [F5].

F3

F4



F5

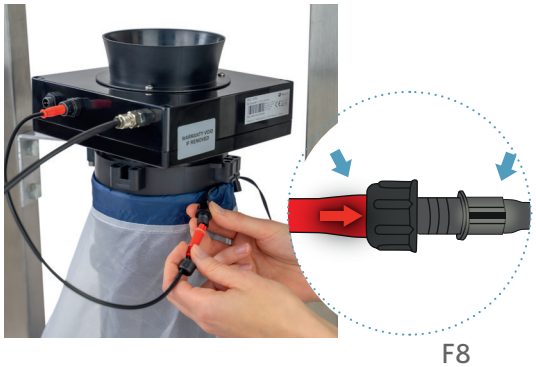
5. **For routine operation of the BG-Counter 2, we recommend to not install a catch bag.**
A catch bag and funnel net can be installed when the trap and BG-Counter 2 are run only overnight or for a few hours, with the aim to manually inspect the catch bag:
Attach a funnel net and a catch bag to the bottom part of the BG-Counter 2 [F6]. The funnel net is important to avoid double counts of insects crawling out.
For more information about this topic see chapter "Determination of Counting Accuracy".

F6, optional

F7

6. **Place the BG-Counter 2 into the opening** on top of the trap [F7] and turn it clockwise until it fits tight.

7. **Connect the fan to the BG-Counter 2**
Connect the red fan adapter cable with the fan cable of the trap. Please pay attention to always connect with the arrow in line with the black marking line [F8].



F8

Connect CO_2

The CO_2 bottle is not included, and must be provided by the user.

The fittings of the regulators are either US CGA-320 or Europe W21.8x1/14 RH standards. **Please check with your local CO_2 gas suppliers to determine which Biogents pressure regulator is required to connect to the available CO_2 cylinders. If your supplier is not offering one of the above-mentioned fittings for the CO_2 cylinder, contact Biogents!**

It is important to buy the CO_2 gas from a reliable supplier. The use of beverage and food grade gas (99.9% pure CO_2) is strongly recommended. It is also important that the CO_2 gas is filled in clean bottles or cylinders. Corrosion inside the bottles or other impurities can destroy the CO_2 pressure regulator.

Install the CO_2 pressure regulator on the bottle and make sure it is tight by using a wrench or pliers [F9].

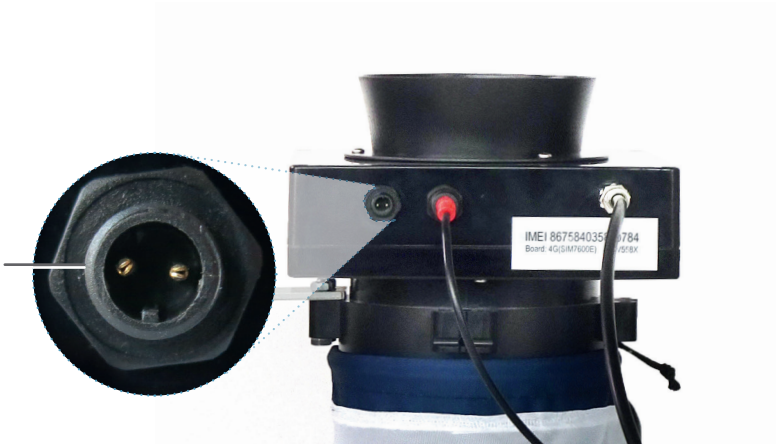
1. Connect the free end of the CO_2 tubing to the regulator [F10]: unscrew the nut on the outlet, thread the end of the CO_2 tube through the nut, insert the end of the CO_2 tube firmly onto the outlet and re-screw the nut back onto the outlet.
2. Now open completely the main valve on the top of the CO_2 bottle to start the release of CO_2.
3. Adjust the pressure to the mark "C" on the dial of the pressure regulator (2.6 bar).

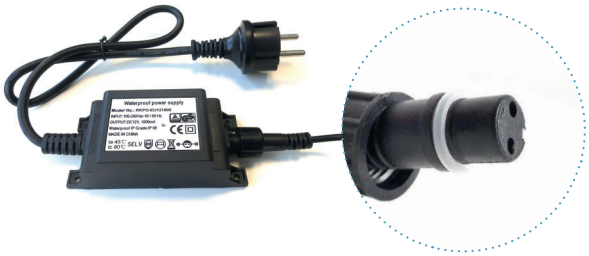
F9

F10

Connecting the BG-Counter 2 to Power: 3 Options

There are 3 options to connect the BG-Counter 2 to power via the 12 V power connection





Option 1: Power cord with transformer

This is recommended if AC power is available at the counter location.
Use only the provided AC adapter, and confirm local outlet style before ordering:

- US: Nema 1-15
- Europe: CEE 7

Only connect to outdoor AC outlets with a weather-proof cover complying with local electrical codes.

Option 2: 12 V battery (provided by user)

This is recommended if the counter is operated for a few days in a location where AC power is unavailable, before being serviced or moved. The minimum number of hours of operation possible with a full battery can be calculated as follows:
Operation hours = Battery capacity (Ah) x 2.
For example, with a battery capacity of 60 Ah (Ampere hours), the counter and fan can be operated for at least 60 x 2 = 120 hours = 5 full days.

Use only "deep cycle" lead-acid batteries. Normal car batteries are not designed for continuous charge/discharge cycling, and thus would have significantly reduced lifetime.

- Connect battery using battery cable

Option 3: Solar panel with solar battery

This is recommended when the system needs to be operated autonomously for extended periods of time.
While the trap/Counter are usually placed in a shady location, the solar panel should be placed in a sunny spot nearby; the charge controller and battery should be placed near the counter.

WARNING

When setting up solar system connections, it is mandatory to follow these instructions!

1. **Never connect the BG-Counter 2 to the charge controller unless a fully charged 12 V battery is connected first.**
2. **Never disconnect the battery without first disconnecting the BG-Counter 2.**
3. **Do not alter the wires provided with the solar sytem**

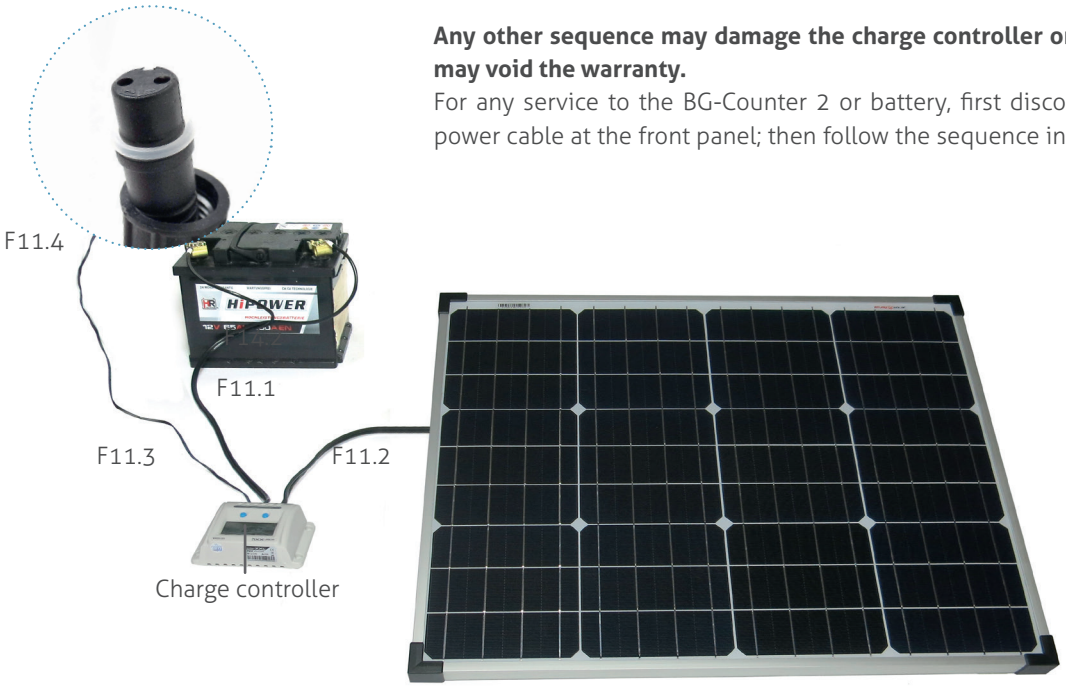
Before making any connections to the charge controller:

1. Confirm the BG-Counter 2 is disconnected (nothing plugged into the black power connector on the left side of the counter front panel).
2. Review the instruction leaflet for the charge controller (model may vary).
3. Confirm the battery is a **fully charged 12 V lead-acid deep cycle battery**; the voltage across the terminals should read no less than 12 V and no higher than 13.8 V.
4. **The battery must not be a lithium battery of any kind** to avoid a fire hazard and system damage.

In case of any questions or concerns at this stage, contact your distributor or Biogents.

Then, make the charge controller connections in this order:

1. Connect battery clamps to the battery and the other ends to the charge controller [F11.1]. Pay attention to connect minus-pole to minus-pole (black) and plus-pole to plus-pole (red).
   This is necessary to power up the controller, enable its control and protection functions to avoid damage.
2. Connect the solar panel [F11.2], making sure the polarity is correct.
   Now check the voltage and/or indicator LEDs on the controller front panel and confirm function according to the instruction leaflet. Specifically, any voltage reading should indicate a 12 V system.
3. Connect the BG-Counter 2 power cable to the solar controller [F11.3] but don't yet plug the other end into the BG-Counter 2; re-check the solar controller indications.
4. Plug the BG-Counter 2 power cable [F11.4] into the leftmost connector on the front panel.



Any other sequence may damage the charge controller or the BG-Counter 2 and may void the warranty.
For any service to the BG-Counter 2 or battery, first disconnect the BG-Counter 2 power cable at the front panel; then follow the sequence in reverse order.

Operating the BG-Counter 2

Registration

See page 13 for first-time user registration.

Starting Sequence of the BG-Counter 2

1. **Automatic start-up**
The BG-Counter 2 has no on/off switch or other buttons. It automatically starts when connected to 12 V power.

2. **Battery check**
After the counter is connected to power, there will be from 1 to 4 beeps, depending on battery voltage.

- 4 beeps mean the battery is sufficiently charged
- 1-3 beeps indicate that the battery is low and needs charging. The counting function, fan, and CO_2 will be off until the voltage increases to >11.8 V
- If there is no beep at all, see chapter Troubleshooting / Trap does not start up

3. **Cellular connection check**
Following the battery check, the device proceeds to check the strength of the cellular connection. This usually takes less than 30 seconds, but may take several minutes, for example, if the counter has been moved to a new location with a different cellular provider.
At the end of the check, the counter indicates signal strength as follows:
- 1-5 long beeps: corresponding to 1-5 bars of signal
- 2 short beeps: no signal, no cellular connection possible

If no cellular connection is available, the counter can still be operated. Data will be stored internally, and transmitted the next time a connection is available.

4. **Fan and CO_2 flow check**
After powering up, the fan and CO_2 valve are switched on until the next round 15-minute interval (for example, if powered up at 16:03 until 16:15). This provides time for the operator to confirm that the BG-Pro 12 V fan is working, and the CO_2 flow is on.
Confirm fan operation visually by looking into the trap funnel, or by holding a piece of tissue paper above the funnel.

By default, the CO_2 flow is adjusted to 50 g/h. The CO_2 dosing valve is located inside the counter housing. It briefly turns on and off every 4 seconds.

Check for the presence of CO_2 flow as follows:
- Make sure that the CO_2 tank valve open
- You should listen a click sound from the valve
- You should listen a hissing sound from the CO_2 release port

5. **Counter check**
You can verify the functioning of the counter by throwing a small object (for example a small piece of paper) into the trap funnel. A short beep indicates that the counter has registered the object.

First Cloud Connection

The first connection to the cloud takes place at the first full 15 minutes after the counter was started (for example at 16:15, if you started the counter at 16:07).
When connecting to the cloud, results are uploaded, and the schedule defined on the website is downloaded and activated.

Depending on the schedule, fan, CO_2 and/or counting function may be turned off at this time.
If this is a new counter, the first connection also auto-registers the counter on the website.

Reset

The BG-Counter 2 is reset every time the power is disconnected and re-connected, and the start-up sequence commences as described above.

Maintenance

Daily

Check the dashboard of the BG-Counter 2 web app for warnings or error messages. If a fan or voltage problem is indicated, or there are no new transmissions, take corrective actions immediately.

Every 2 weeks

Inspect and clean the counter and trap, as necessary:

- Remove everything that deters mosquitoes from entering the trap such as spider webs, leaves, and dirt.
- Empty the catch bag.
- Wipe the counter housing and the inside of the funnel to remove dust or other contaminants.

Depending on local conditions, more frequent service may be required.

CO_2

- Replace or fill CO_2 tank as necessary.
- Access the web app and update the CO_2 trap settings at each replacement (blue "Fill CO_2" button).

BG-Lure or BG-Mozzibait

- Replace the BG-Lure every 5 months.
- Replace the BG-Mozzibait every 2 months

Determination of Counting Accuracy

Catch bag

For routine operation, it is **not** recommended to use a catch bag as it might fill up too quickly and result in counting errors. For routine operation with the BG-Counter 2, the BG-Pro is used without a catch bag. Mosquitoes are sucked through the ventilator and end up dead at the bottom of the trap.

A catch bag can be installed when the BG-Counter 2 runs only for a few hours in order to check if the number of counted mosquitoes by the BG-Counter 2 corresponds with the actual number of collected mosquitoes. In this way the accuracy of the BG-Counter 2 can be determined.

Protect the trap from predators

When comparing manual catch bag counts to electronic counts, note that mosquitoes can "disappear" from the catch bag:
Mosquitoes and other insects may be "stolen" by ants, spiders, or geckos. Therefore, make sure for all calibration experiments that ants or other predators have no access to the catch bag. You can protect the trap by placing a water surface around it, or by adding glue or PTFE to all trap parts that might be accessible for predators.

Check CO_2 settings

The accuracy of the BG-Counter 2 strongly depends on the presence of CO_2. Make sure that CO_2 is turned on during the whole time range that you select for determination of the Counter's accuracy. We recommend a flow-rate of 50 g/h.

Compare

If you make sure that mosquitoes do not leave the catch bag after they have been sucked in, the accuracy of the BG-Counter 2 for correctly counted mosquitoes is expected to range between 80% and 90%.
Make sure to compare the catch bag results with the electronic results reported for the **same time interval**!
This means, that you should install and take out the catch bag as close as possible to a round 15 min intervall. Make a note of the exact time range in which your catch bag was attached to the BG-Counter 2 (e.g. the time range of your manual counts. After downloading the raw data of the BG-Counter 2 (p. 30), make sure to only consider the number of mosquitoes that were counted in the same time range!

Description of the BG-Counter App

The BG-Counter App is a multifunctional tool that allows you to manage your BG-Counter/s. You can for example remotely switch traps in the field on and off and set up varying time schedules for the traps and application times of CO_2. There are dashboard notification icons, when one of your traps has an issue, such as for example connection problems, ventilator fail, or low CO_2 level. Furthermore, you have access to all collected mosquito count data, and local environmental data (temperature, humidity, ambient light). The web app includes an analyzer tool that you can use for exploratory analysis of the catch count data of single or multiple traps. You can for example compare the mean catch rates of different neighborhoods, or simply visualize the mosquito catches of a single trap on different time ranges and for different temporal aggregations (e.g., 15 min, 1 day, 1 week or 1 month).
The address of the BG-Counter web app is:
» https://bg-counter.biogents.com/app

System Requirements

The BG-Counter App is optimized for usage on a screen with a diameter of at least 13 inches. We therefore recommend using a laptop or desktop computer.

Windows PC with Windows 10
Browser: Google Chrome, Firefox, or Edge. Internet Explorer is not supported.

Macintosh with macOS X 12 or later
Browser: Google Chrome, Firefox, or Safari.

Registration: New Customer

Go to » https://bg-counter.biogents.com/registration/

The "New Customer Registration" page has the fields specified below that you should fill in. The fields marked with an asterisk are mandatory to fill, while the others are optional.

- Personal Information*
- Mailing Address
- Technical Contact
- Billing Contact

After clicking the "Confirm" button, a new account is created. You will receive a confirmation e-mail (please have also a look for the e-mail in your spam folder). Follow the e-mail verification link. After verifying your e-mail and setting a password, you can access your account at:
» https://bg-counter.biogents.com/app

Registration: New Trap

Go to "**Traps**" and click on the blue "**New Trap**" button in the top right corner of the screen. Enter one or multiple IMEIs (comma separated) in the field. Click the blue "Assign" button to register your BG-Counter(s). You find the IMEI on a sticker at the side of the BG-Counter 2, on a sticker on the registration flyer in the BG-Counter 2 box, and at the side of the BG-Counter 2 box.

BG-Counter App: Quick Start

- go to "**Dashboard**", then click on a location name, then on the "View/Edit" button to set the trap name, schedule, mosquito catch threshold, custom groups, etc.
- go to "**Traps**" to check the subscription status of your devices, to assign a manually created location to an IMEI, to register traps, to change the geolocation mode of your traps.
- go to "**Users**", then click on the "New User" button to invite other users
- click on "**Analyzer**" to analyze your data (charts, tables, and maps)
- go to "**Profile**" to set a new password for your account

Basic Concepts

Trap

On the website and in these instructions, the word "trap" refers to a complete system including a trap (BG-Pro or BG-Sentinel) and a BG-Counter 2. Each trap is uniquely identified by the IMEI of the BG-Counter 2.

Location

Each trap is assigned to a location – the place where the trap is installed to count and collect mosquitoes.

IMEI

IMEI stands for International Mobile Equipment Identity. Think of it as your BG-Counter's fingerprint — it's a 15-digit number unique to each device.

Info Icons

You find info icons at several places of the web app. Hover over the icon with the mouse and a window with more information will pop up.

Geo-tags

Each Location automatically gets the geo-tags "Country", "State", and "City" assigned.
There are two additional geo-tags that you can define yourself: "Custom Group 1" and "Custom Group 2". If you have multiple traps in the same city, you could, for example, use "Custom Group 1" to specify the neighborhood, and "Custom Group 2" to characterize the biotope, such as for example: suburban, urban, forest, lake, swamp, park, or similar. It is not mandatory to assign your locations to custom groups. The geo-tags allow you to make group-based analyses of your catch count data.

Tables

Sorting function

All tables include a sorting function for every column: click on the arrow that appears, when you hover with the mouse over the name of each column. When you click on the arrow for the first time, it will show upwards and sort the table in an ascending order. When you click on the same arrow again, it will point downwards and sort the table in a descending order. This function is helpful if you have many traps and want to easily identify for example those traps, that have error notifications, or traps that had an unusually high or low catch rate in the previous night.

Search function

All columns that have a magnifying glass icon include a search function: click on the magnifying glass and type in some info that makes it easier for you to find the desired trap/s. For example, in the dashboard, you can specify in the "Catch Count" column, that you only want to see the traps that collected between 150 and 200 mosquitoes since last noon.

Data storage based on Location

Trap counts, environmental data, and other parameters like CO_2 schedule are stored by location. Traps can be assigned to locations manually, or automatically using transmitted GPS coordinates.

When Geolocation is set to "Auto" (= default setting), the location will be automatically determined via geofencing:

- When a trap is within the geofence radius (100 m) of an existing location, it will automatically assign itself to that location
- Otherwise, a new location will be created automatically with a default name that includes the IMEI.

When Geolocation is set to "Fixed", the trap data will be assigned to a selected location independent of transmitted GPS coordinates.
You can edit a location at any time in the Trap Info table of the "Settings: Single Locations" page (see p. 20 for details).

Examples: What does data storage based on location mean for you

These examples are also explained in the video linked on page 39.

Example 1: You have several traps, but you use them only during a part of the year.
At the start of the new season, when you put the traps back to the field at already existing locations, set geolocation to auto and the traps will automatically assign themselves to their locations. You don't need to make sure that a BG-Counter 2 unit with a certain IMEI is placed again at the same location, to have a continuation of historical data.

Example 2: You have more locations than traps and rotate the traps between them.
The collected data will be automatically stored for the location the trap is currently at. Instead of having all the data stored for one IMEI, it is stored for as many locations as the trap was used at.

Example 3: A BG-Counter 2 is defective and replaced. The new BG-Counter 2 is placed at the same location.
The data of the two BG-Counter 2 units (e.g., 2 IMEIs) will be stored for the same location and you will have continuation of your historical data for that location.

Example 4: You need to place two traps within 100 m.
This is also possible, but we recommend creating the locations manually in this case: Click on the "New Location" button above the Location Table of the dashboard. Use Satellite View to determine the exact position on the map and use the right mouse button to set the Location pin on the map. In the "Trap Management" table (main menu: "Traps"), set Geolocation to Fixed and select the location for each trap from the drop-down list of the "Current Location" column.

Main Menu - Overview

Dashboard

- Overview of all locations: Location Table -> identify locations with a high catch count or counters with issues (such as fan fail, low CO_2, etc.)
- Access to the Location Summary Page: Catch Count graph, trap status parameters, Location Info table, and Catch Statistics
- Access to the Settings page (for one or multiple traps)

Analyzer

- Overview table: Choose which location/s or group/s you want to analyze
- Analyze your catch data for different time ranges and temporal aggregations (15 min, 1 Day, 1 Week, 1 Month) in graphs, tables, and maps.
- Data download (raw data).

Traps

- Trap Management table: A list of your traps with information on subscription status, IMEI, Location, Geolocation, diagnostic information, etc.
- Register new BG-Counters

Users

Invite users and give them a role ("Administrator", "Operator" or "Observer").

Profile

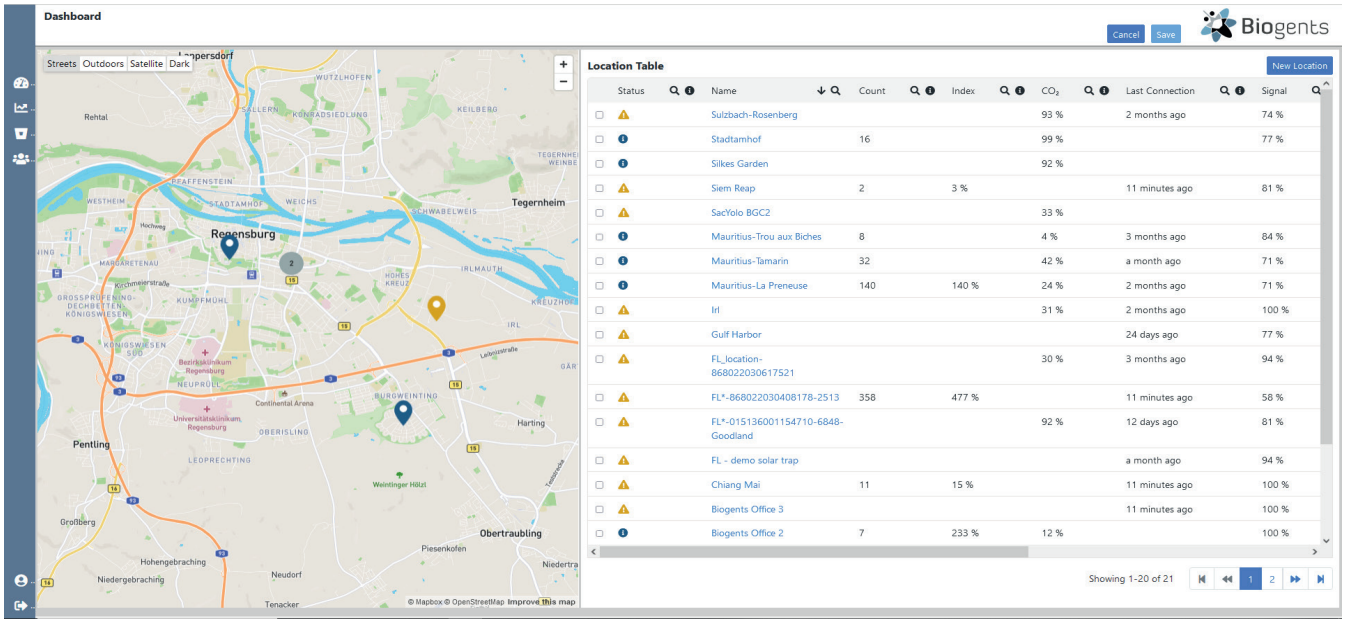
Set a new password

Logout

Logout, or change your login in case you have multiple accounts (for example, you are Admin of a set of traps, but for another e-mail address of yours and another set of locations, you were invited as an observer).

Dashboard

When you access the dashboard (figure below), you get an overview of all your locations in the form of a map and a table. Every pin on the map refers to a trap location, and the color of the pin refers to a notification warning level.



Location Table

The Location Table gives an overview of your locations and helps you to plan your operations, as it includes relevant information such as the catch count since last noon, warning icons, info about signal strength, voltage range and similar. You can sort the Location table by every column by clicking on the arrow that appears, when you hover with the mouse over the name of each column. This function is helpful if you have many traps and want to easily identify for example those traps, that have warning notifications, or traps that had an unusually high or low catch rate in the previous night.

The table includes the following columns:

- **Status:** Color-coded icons. When you hover over a yellow, blue, or red warning icon, the type of warning is displayed.
  - » **Green**: everything is functioning
  - » **Blue**: Info such as "No trap currently assigned", "Trap assigned but no transmission received"
  - » **Yellow**: Warning such as "No connection in the last 8 – 24 h", "CO_2 supply at < 25%"
  - » **Red**: Error message such as "Refill CO_2 (very low or empty)", "Subscription expired, transmission disabled", "Trap fan failure detected!"

You find more detailed information on the dashboard warnings in the section "Troubleshooting" (p. 34).

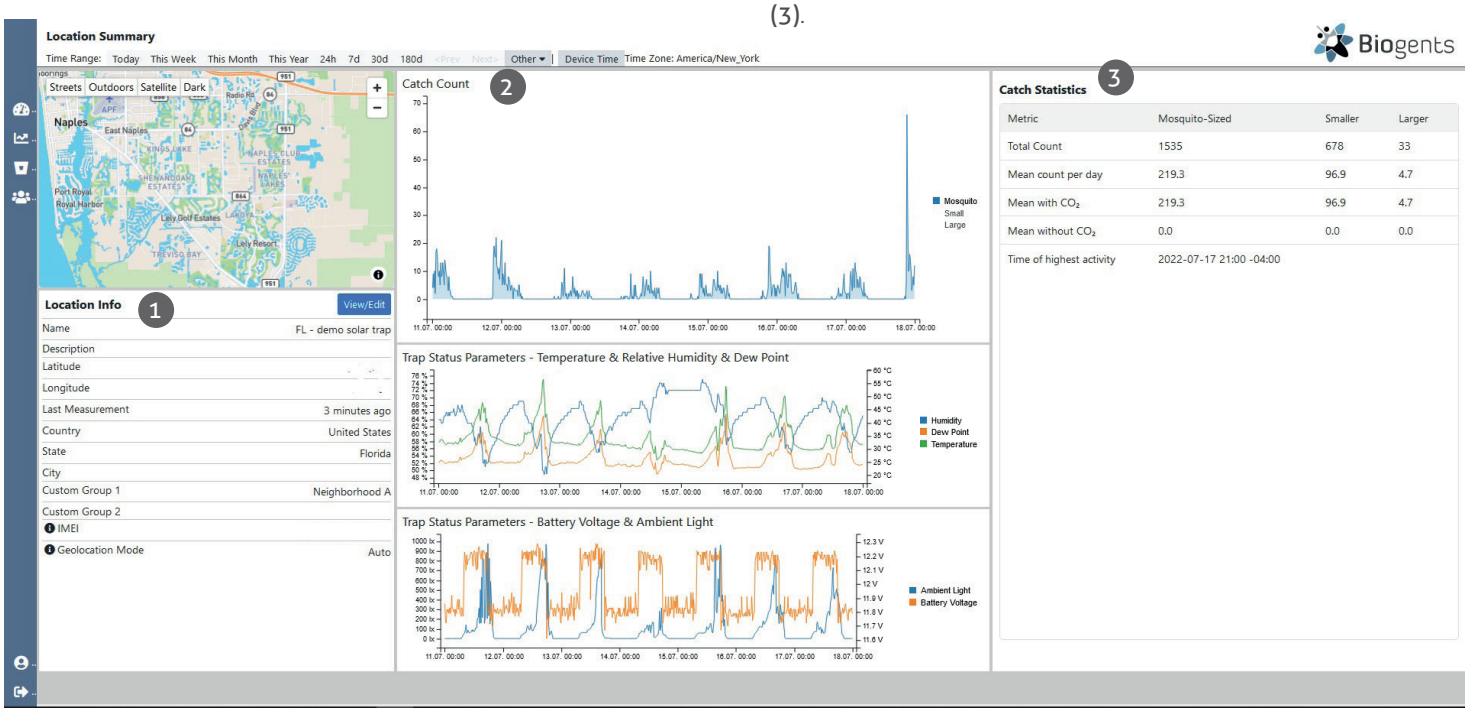
- **Name:** Location name. Automatically or manually assigned. Click on the name of a specific location to access the Location Summary page.
- **Count**: Number of mosquitoes counted since last noon.
- **Index:** Number of counted mosquitoes in relation to set **Mosquito Catch Index Threshold.** The field remains empty if you did not specify a threshold. The Mosquito Catch Index Threshold is an integer number (> 0) that you can specify for each trap. You can set a threshold on the settings page that you reach by clicking the blue "View/Edit" button next to the Location Info table (see p. 18).
- **CO_2**: Estimated CO_2 level of the cylinder. To get a good estimate, make sure to always inform on the settings page when you refill CO_2. Also make sure to select the correct cylinder size and the desired flow rate.
- **Last Connection**: The last time when data was transmitted.
- **Signal**: Strength of the transmission signal.
- **Voltage Range**: Min and max supply voltage in the past 24 h. Fully charged battery: >12.8 V. Battery draining or inadequate solar charging: < 11.5 V. The counter will be turned off when the voltage drops to less than 11.2V to protect the electronics. Once turned off, the counter remains turned off until the voltage builds up again to 11.8 V.
- **Fan Status**: Either "On", or "Fail". Fail: currently turned on but no current detected (fan is either defective or not powered).
- **Fan Current**: Current that is drawn by the trap ventilator. Normal range: BG-Pro: 250 mA +/- 20 %. BG-Sentinel: 400 mA +/- 20 %. < 50 mA: fan is either turned off, not connected, or defective. Reading suddenly exceeding normal range: fan blocked by twig or similar.

Location Summary Page

There are two ways to access the Location Summary page of a specific location. Choose a location in the table and click on the blue text in the "Name" column. Alternatively, click on a Location on the map. A window with the location name appears. Click on the blue location name.

The objective of the Location Summary page is to give you a comprehensive overview of all location attributes and key trap parameters to make sure your trap is functioning as planned. When errors occur, this page can help you to pinpoint, when and why certain problems came up.

The Location Summary page (figure below) includes the **Location Info table (1)** with details about the location, a **graphical overview of your catch counts (2) and different trap status parameters** (temperature, relative humidity, dew point, battery voltage, ambient light), and the **Catch Statistics table (3)**.



Location Info table

This table (1) provides an overview of relevant information for the location. You can change some of these parameters on the settings page that you reach by clicking the blue "View/Edit" button next to "Location Info":

- **Name:** Every trap has an automatically assigned location name that includes the IMEI and geographical information. Click on the field to change this name in a way that makes it easy for you to identify the trap e.g., the location.
- **Description:** If you want, add a description to your trap such as for example "close to a forest", "airport", "university campus" or whatever best describes the location.
- **Latitude and Longitude**: can be adjusted, by either typing in correct coordinates in the two fields (after clicking the the blue "View/Edit" button) or by moving the location pin in the map to the exact location.
- **Last Measurement**: The last time the trap successfully connected and sent data.
- **Country:** The country of the location (geo-tag, automatically assigned by geolocation).
- **State**: The state of the location (geo-tag, automatically assigned by geolocation).
- **City**: The city of the location (geo-tag, automatically assigned by geolocation).
- **Custom Group 1**: Geo-tag. Shows a name if the trap was assigned to a custom group (for example: neighborhood, name of a region, biotope, etc.). This field is not editable. To assign this trap to a custom group, click on the blue „View/Edit" button to access the settings page. Note that you can conduct group-based analyses when you assign your traps to custom groups.
- **Custom Group 2**: See above. This is a second Custom Group that you can define.
- **IMEI**: Serial number (IMEI) of the trap that is currently assigned to this location; if empty, you can assign a trap in the Trap menu. This field is not editable.
- **Geolocation Mode:** Auto: trap has been assigned by Geolocation; Fixed: trap has been assigned manually. This field is not editable. You can change the geolocation mode in the Traps menu.

Graphs

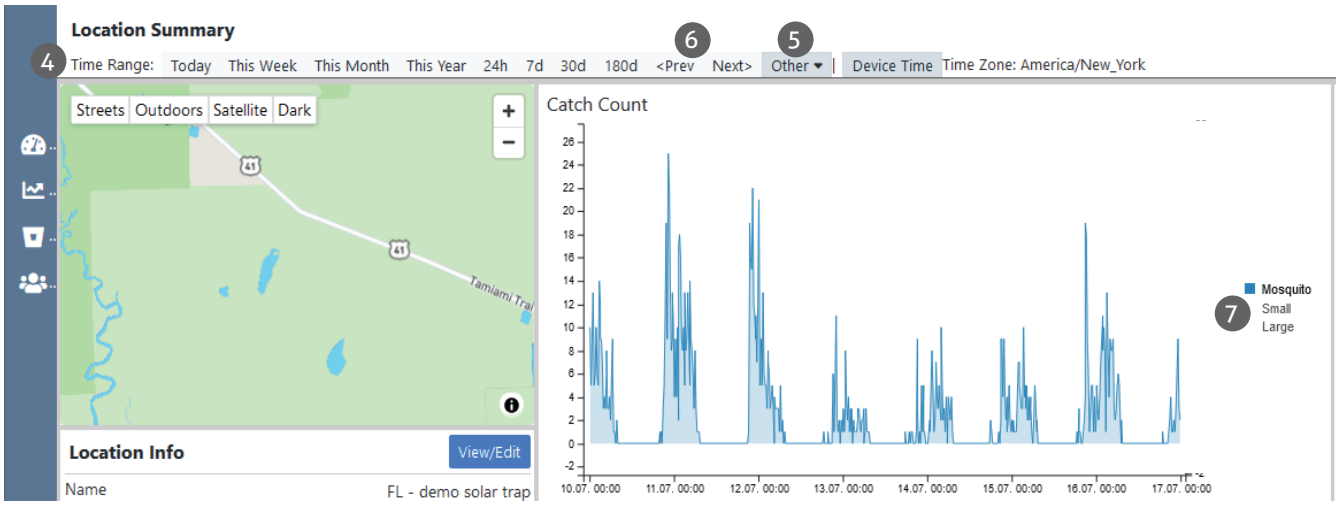
There are three line charts on the Location Summary page:

- "Catch Count" (2)
- "Trap Status Parameters - Temperature, Relative Humidity & Dew Point"
- "Trap Status Parameters - Battery Voltage & Ambient Light"

In the upper left menu, you can change the **time range (4)** of the x-axes of all three graphs. By clicking on "**other**" (5), you can specify a customized time range. When you select one of the time range options "**Today**", "**This Week**", "**This Month**", or "**This Year**", you can use the **<Prev** and the **Next>** buttons (6) to navigate from one day, week, month, or year to the previous or next day, week, month, or year.

The temporal resolution of the three line charts depends on the selected time range:

Time range	Data resolution	Catch Count Graph	Trap Status Parameters
1 day	15 min	Raw data	Raw data
1 week	1 hour	Sum	Mean
1 month	4 hours	Sum	Mean
> 1 month	1 day	Sum	Mean



The "**Catch Count**" graph shows mosquito counts by default, but you can **click on "Large" and/or "Small" in the graph's legend (7)**, to add the count data of large and/or small objects. By clicking on a category that is currently shown in the graph, you can remove it. The same applies for the two other graphs.

For example, you can display only the temperature, humidity, or dew point, instead of all three at the same time. Use the scrolling wheel of your mouse to zoom in and out at specific positions in the graphs.

Catch Statistics table

The Catch Statistics table shows you the statistics of the chosen Time Range: Total Count of mosquitoes, small and large objects, the mean count per day (if time range > 1 day), mean count with and without CO_2, and the time of highest mosquito activity.

Catch Statistics

Metric	Mosquito-Sized	Smaller	Larger
Total Count	8	69	0
Mean count per day	8.0	69.0	0.0
Mean with CO_2	2.0	12.0	0.0
Mean without CO_2	6.0	57.0	0.0
Time of highest activity	2022-09-19 07:00 +07:00		

Settings Page

The settings page can be accessed for a single trap, or for multiple traps that you select via checkboxes in the Location Table.

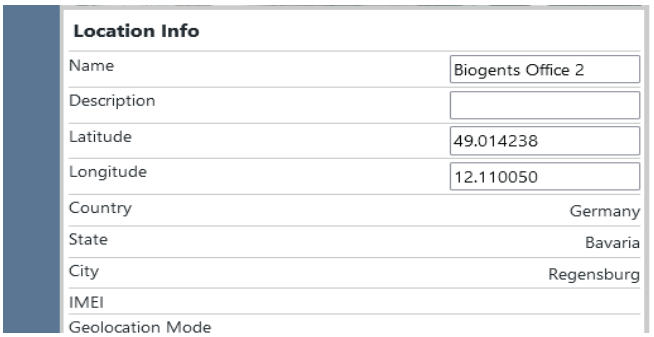
Go to the Dashboard and click on the check boxes at the left side of the Location Table to select the location/s that you want to change settings. A blue "**View/Edit**" button will appear in the top right corner of the screen. The number in brackets behind "**View/Edit**" indicates the number of traps that you selected. Click this button to access the settings page. When accessing the Settings page for multiple locations, all setting changes will be applied to all selected traps at the same time. Be sure to carefully select the traps when you want to apply the same settings to multiple traps.

For a single trap you can alternatively access the settings page through the blue "**View/Edit**" button next to the Location Info table of the Location Summary page.

Settings: Single Location

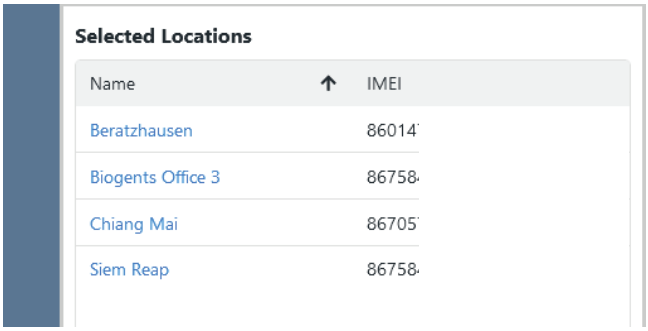
The settings page for a single location is divided in two parts. At the left, you find the "Location Info" table, as explained above for the "Location Summary" page. You can edit some of the fields:

- **Name**: choose a name for the Location. This name will appear in the Location overview table and in the analyzer overview table.
- **Description**: You can add an additional description to this location. The description is only visible at the Location summary page.
- **Latitude and Longitude**: Here you can manually fine-adjust the trap position. You can also use the mouse to move the position pin on the map. Fine adjustment of the position is also possible when geolocation mode is set to automatic.



Settings: Selected Locations

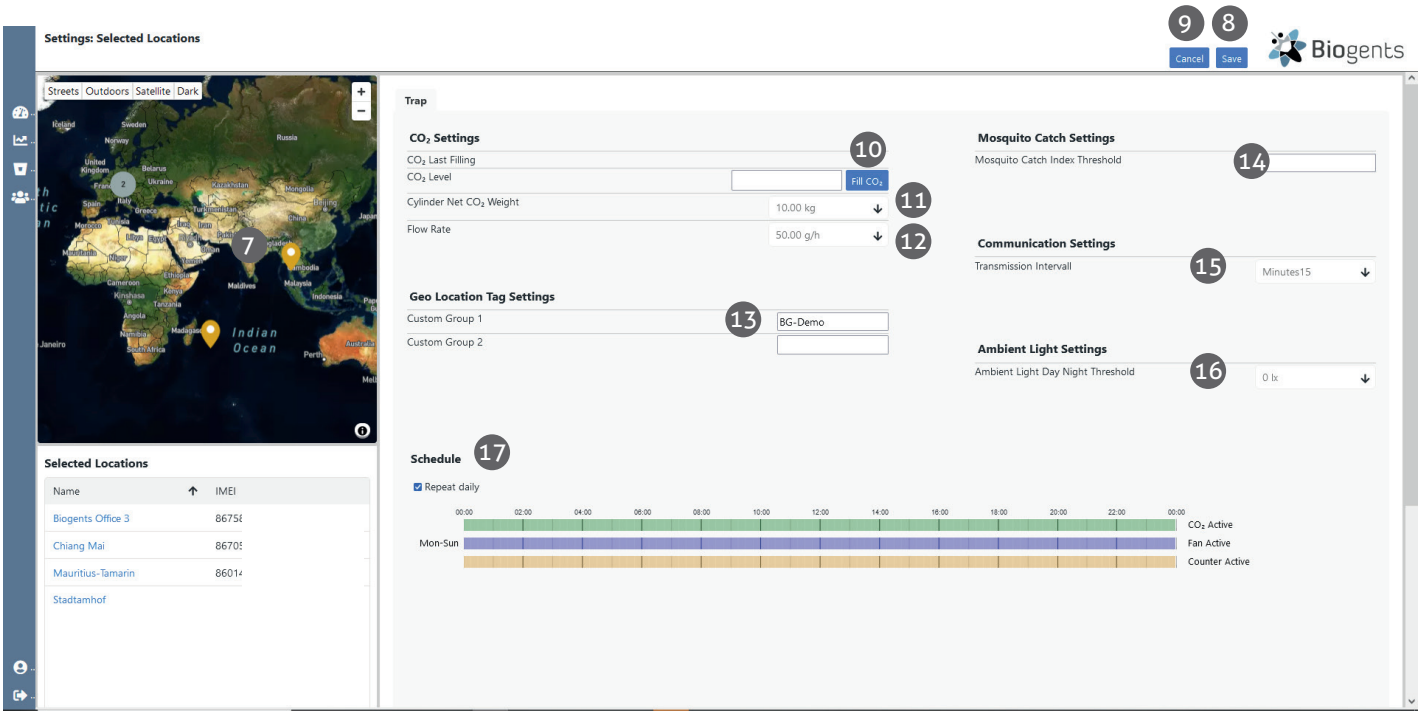
The settings page for selected locations looks a bit different: Instead of the location info table, there is a list (Selected Locations) of the traps that you have previously selected by using the checkboxes of the dashboard location table.
All settings that you change on the Settings: Selected Locations page will apply to all of the locations that you have selected.
Changing settings for multiple traps at the same time can be very convenient if you have many traps. For example: If you want to assign 20 of your traps to the same custom group, and another 30 traps to another, you can accomplish the assignment of 50 traps in only 2 steps.



Settings: Single Location & Selected Locations

The following settings can be edited for single and multiple locations: CO_2 Settings, Geo Location Tag Settings, Schedule, Mosquito Catch Settings, Communication Settings, and Ambient Light Settings.

Click on "**Save**" (8) to save your changes. Click on "**Cancel**" (9) if you want to come back to the previously saved settings.



CO_2 Settings

The field "**CO_2**" in the Location Table of the dashboard provides an estimate for the current fill status of the CO_2 cylinder. For the estimate to be correct, it is necessary to have a fixed schedule, and you should make sure to always indicate when the cylinder was last filled: When you replace the CO_2 cylinder, click on the blue "**Fill CO_2**" button (10). This will also set the field "**CO_2 Last Filling**". Please note that after clicking the "**Fill CO_2**" button, the dashboard "CO_2 level warning" might still be visible for up to one hour.
Select the amount of CO_2 in your cylinder in the drop-down menu "**Cylinder Net CO_2 Weight**" (11).
Adjust the desired flow rate in the drop-down menu "**Flow Rate**" (12). The default setting is **50 g/h** as this **is the optimum to attract mosquitoes** while at the same time repelling other insects.
A high level of CO_2 also gives the best counting accuracy: CO_2 increases the trap's specificity for blood-sucking insects, and it increases the overall catch rate of mosquitoes.
You can also select 10 g/h and 20 g/h; this will reduce the CO_2 flow but extends the time of CO_2 release of the tank filling. When selecting 10 or 20 g/h, the CO_2 flow is reduced by a shortened valve cycle time. Therefore, nothing needs to be changed on the pressure regulator of the CO_2 tank.

Geo Location Tag Settings

You can assign two custom geo-tags by writing it in the fields next to „Custom Group 1" and „Custom Group 2" (13). All locations with the same Custom Group geo-tag will be joined to a group. This is relevant for the Analyzer that allows you to analyze your traps based on groups. For example, you could give custom group names based on the location in a specific region (neighborhood name, strategic area, or similar), or by habitat (swamp, urban, suburban, forest). In the Analyzer, when selecting for example: Custom Group 1 = "Neighborhood A", all locations that were assigned to "Neighborhood A" will be analyzed together (comparison of group members in a map, linechart, and table).

Mosquito Catch Settings

Set a threshold for a daily mosquito count (integer > 0). For example, if you consider up to 85 mosquitoes per day as tolerable for a certain location, insert "85" in the field next to "Mosquito Catch Index Threshold" (14). The analyzer makes use of the Mosquito Catch Index Threshold in the tables: For example, when you analyze a time range longer than 1 day, the table includes a column "N days above threshold". The threshold map in the Analyzer section shows, which traps were above threshold. You can define different thresholds for each of your locations.

Communication Settings

This setting (15) determines how often the counter will try to connect to the website and transmit counts and other data. The default setting is 15 min. Other choices are every 1, 2, 4, and 8 hours. Independent of this setting, count data are always stored with 15-minute resolution.
The 15-minute setting is useful for diagnostics when the counter is first set up. However, during each transmission, mosquito counting stops for 15-120 seconds, depending on the cellular signal strength. This can result in a small under-counting error. To minimize this, a data connection period of 1 hour or longer is recommended for routine operation. A new setting is transmitted at the next data connection. This means that if previously the interval was set to 4 hours, and you now chose an interval of 1 hour, it may take up to 4 hours until the new setting is transmitted.

Ambient Light Settings

The BG-Counter 2 has a built-in ambient light sensor. We use this information to distinguish between day and night, so that the activity of day- and night-active mosquitoes can be visualized separately in the Analyzer.

In most cases, **0 lux** (default setting) is the appropriate setting for the night. When a trap is placed at a location with a high level of nocturnal light pollution, 1 or even 2 lux might be necessary as a threshold. If you think your trap location is relatively enlighted during the night, access the Dashboard-Location Summary page and take a closer look at the Battery Voltage & Ambient Light graph. Check how many lux are registered during the night hours (check not only one, but several nights). If most of the time, your device registers 1 or 2 lux during nighttime, adjust the ambient light setting accordingly (16).

Schedule

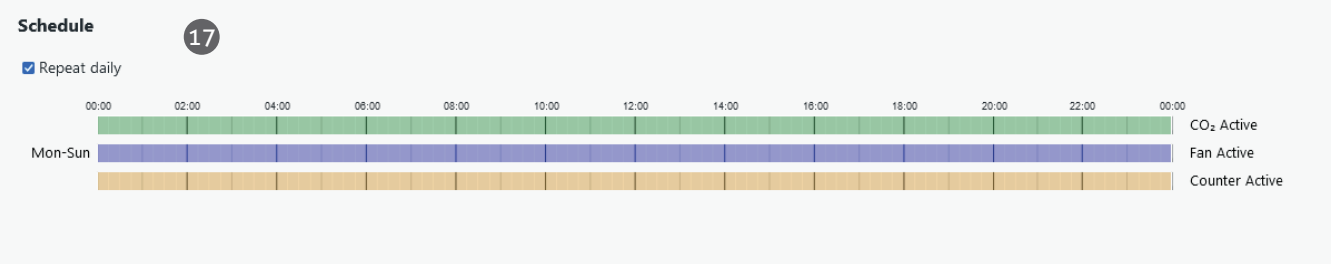
The trap schedule (17) is used to control the operation of the trap: Here you can set a timer for the CO_2 release and the operation of the fan and the counter. For each 15-minute interval during a day, the on/off status can be selected: Click on the green, blue, or orange line at the time that you want CO_2 addition/Fan activity/Counter activity to start and pull it until the point that you want it to stop. To delete a time window, click on the green, blue or orange stripe to make it disappear.

- CO_2: green = on, grey = off.
- Fan: blue = on, grey = off.
- Counter: orange = on, grey =off.

A new schedule is downloaded to the trap, and becomes effective at the time of the next data connection.

When starting a BG-Counter 2 at a new location, we recommend turning CO_2 on for 24 hours to get an idea for mosquito activity times. If you are only interested in the catch rates of mosquitoes during a specific time window, you can add CO_2 only during this time.
Please **keep in mind that the catch counts from the time without CO_2 addition are less accurate and we recommend turning off counting whenever CO_2 is disabled.** Also, whenever you disable the fan, make sure to also disable the counting function (otherwise you may count mosquitoes escaping the trap.

If you want to monitor the activity of mosquitoes only on certain weekdays, or when you want to have differing CO_2 schedules for different days of the week, uncheck the box next to "**Repeat daily**" and set up differing schedules for each day.



Save / Cancel

After making changes in your settings, be sure to click on the blue "**Save**" button in the upper right corner of the screen. If you don't want to save your changes, and want to come back to the previous settings, click on the blue "**Cancel**" button.

Analyzer

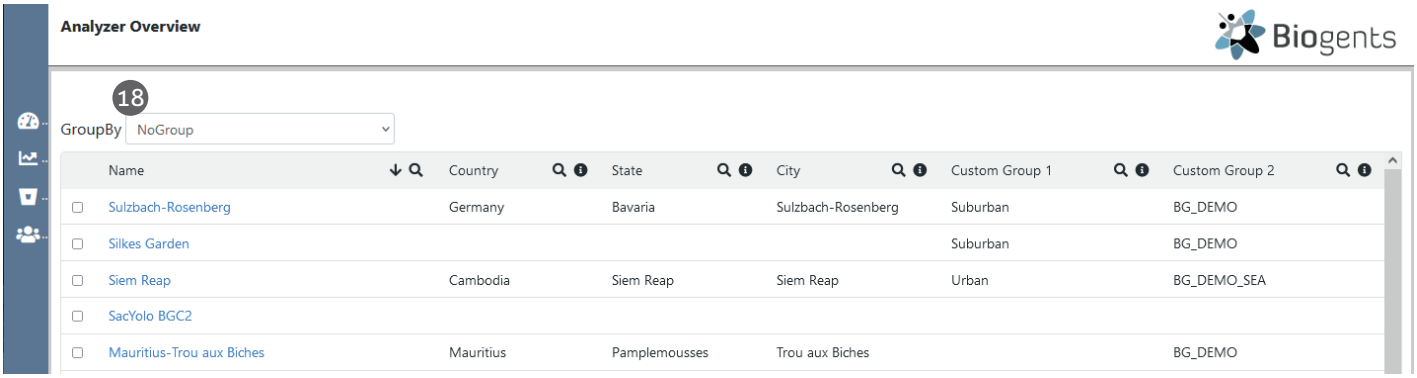
The Analyzer allows you to analyze your mosquito catch data in a more comprehensive way, than in the Dashboard:

- You can analyze single traps or compare selected traps with each other.
- Charts, tables and density maps help you to identify locations with high mosquito infestation.
- The "threshold map" shows, which of your traps collected on average more mosquitoes per day, than their specified threshold.

If you have many traps so that you have different geo-tags ("State", "City", "Custom Group 1", "Custom Group 2"). You can either select one group or compare multiple groups with each other. For example: If you have the two categories "Neighborhood A" and "Neighborhood B" for the geo-tag Custom Group 1, you can compare the mean counts (Mosquitoes, small or large objects) of the two groups with each other, and compare all locations that belong to these groups with each other.

Analyzer Overview Table

When you access the Analyzer section, you see the "Analyzer Overview" table (see figure below). In this table, you choose which location(s) or group(s) you want to analyze.
Over the table, there is a drop-down menu "**GroupBy**" (18). In the default selection "**No Group**", all of your locations are listed. The table shows, which geo-tags are assigned to each of your locations.
When you select **GroupBy = City**, you get a list of all cities, where you have traps.
By selecting **GroupBy = Custom Group 1**, you get a list of your Custom Group 1, and so on.



Select what to analyze

Single Location

If you want to analyze a single location, the drop-down menu should be set to "No Group" (default setting). Click on the name of the location that you want to analyze to access the Single Location Analyzer.

Multiple Locations

If you want to compare two or more locations, the drop-down menu should be set to "No Group". Check the boxes next to the location names of the traps that you want to compare. Click on the blue button "**Analyze (N)**" that appears on the top-right corner of the screen. "**N**" refers to the number of locations that you selected.

Single Group

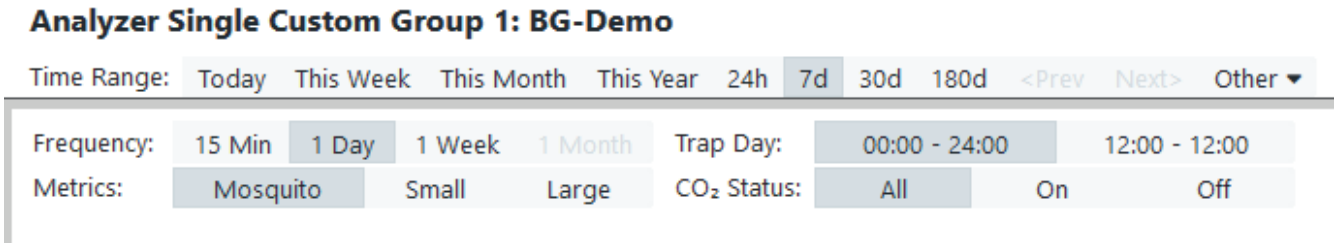
Choose in the drop-down menu, which kind of group you want to analyze (Country, State, City, Custom Group 1, Custom Group 2). Click on the name of the group that you want to analyze to access the Single Group Analyzer.

Multiple Groups

Choose in the drop-down menu, to which category the groups that you want to compare belong to (Country, State, City, Custom Group 1, Custom Group 2). Check the boxes next to the names of the groups that you want to compare. Click on the blue button "**Analyze (N)**" that appears on the top-right corner of the screen. "**N**" refers to the number of selected groups.

Analyzer Settings

Once you have selected what you want to analyze (Single Location, Multiple Locations, Single Group or Multiple Groups), there are several global options available for your analyses. This means, that the displayed map, graph, and table change, depending on what you choose in the analyzer settings. For example: when you select "Time Range = This Week", the line chart, the map, and the table will display the data for the present week.



Time Range

Choose the time range that you want to analyze. Default setting = Today. Further shortcut choices are "This Week", "This Month", "This Year", "24 h", "7 d", "30 d", "180 d". Click on "**Other**" to specify a custom day, week, month, year, or custom time range (day x – day x) in a pop-up window with drop-down menus. To make the pop-up window disappear, click again on "Other". When you chose one of the options "Today", "This Week", "This Month", or "This Year", you can use the **<Prev** and the **Next>** buttons to navigate from one day, week, month, or year to the previous or next day, week, month, or year.

Frequency

The frequency specifies, if and to what extend data points are aggregated. For example: the default frequency for "Time Range = 7 d" is "15 Min". This means that mosquito counts are displayed on the same resolution, as they are being collected (96 datapoints per day, 1 data point every 15 minutes). When you select frequency = "1 Day", the data is aggregated on a daily basis. This means that you will see 1 datapoint per day (sum of mosquitoes counted per day). The same logic applies for longer time ranges and the frequencies "1 Week" and "1 Month". Note that if your selected time range is longer than 1 month, the frequency "15 Min" cannot be selected.

Trap Day

This setting specifies how to define a day: either from midnight to midnight (the conventional definition of a day), or from midday to midday. The latter might be of interest, if you're mainly interested in night-active mosquitoes and want to cross-reference your counter catches with other traps that you had running during the night. This setting can only be changed for Time range = Today.

Metrics

Choose what you want to analyze: "Mosquito" (=default), "Small" or "Large" objects. Note that in the single location analyzer, you can select up to three metrics at the same time. This is not possible when you analyze multiple locations or single and multiple groups. In that case, you can select one metric at a time.

CO_2 Status

Choose between "All", "On" and "Off". When you choose "On", only data points that were collected while CO_2 was "On" in your CO_2 schedule settings, are considered. Note that you must make sure, that your trap is supplied with CO_2. The trap has no sensor that determines if CO_2 was released when it was supposed to do so according to your schedule.

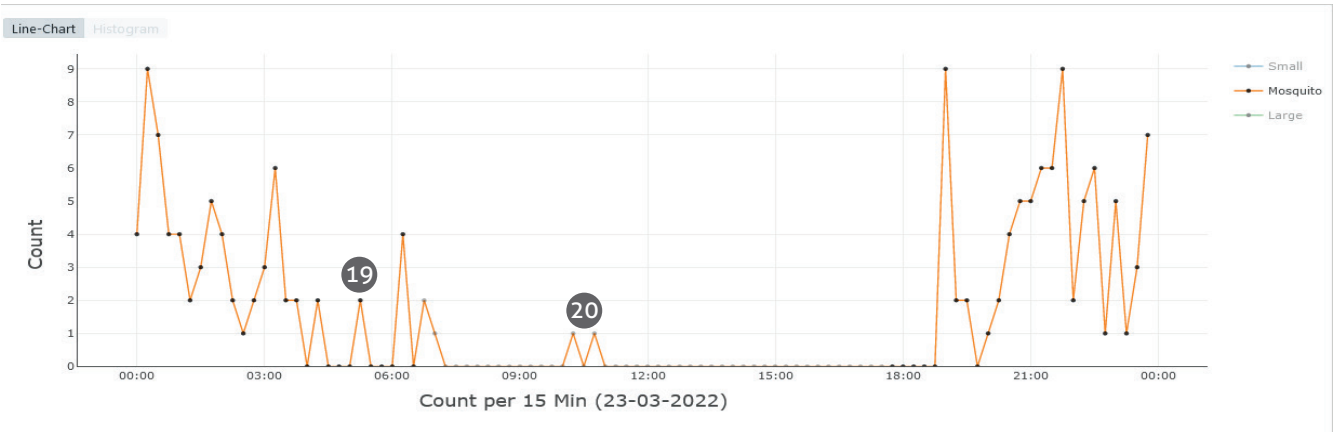
Analyzer Charts and Tables

Depending on what you choose to analyze, there are slightly different charts and tables available. In all charts, when hovering with the mouse over a single data point, additional information such as the time stamp and catch count appear in a pop-up window.
Under each chart, there is a table with complementary information.

The table always refers to the selected **time range**, and the displayed mean values change, according to the selected **frequency**.
When analyzing a single location, the table below the graph always includes all three metrics.
When analyzing multiple locations or groups, the table will only display one metric at a time, and there will be one line for each location.

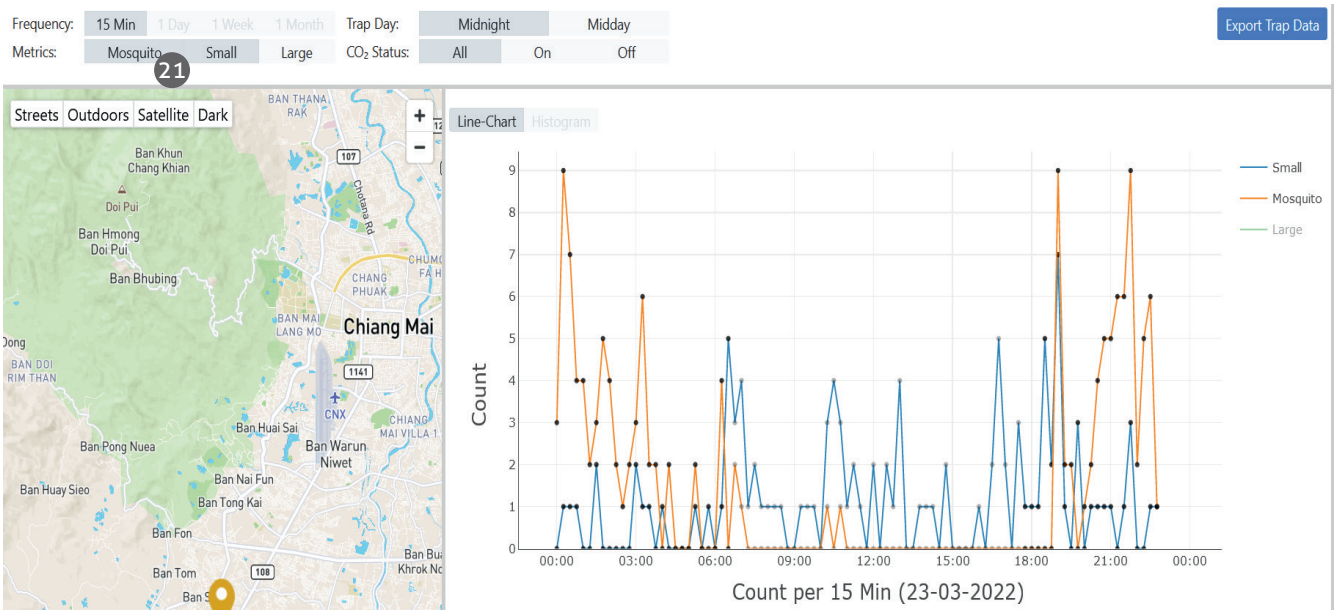
Single Location Analyzer

The default chart that appears once you access the Analyzer for a single location is a line chart of the current day, with a temporal resolution of 15 min. Hover over a data point and info about this data point will be displayed in a pop-up window. Black data points (19) refer to a 15 minutes time window, at which CO_2 was set "ON" in the CO_2 schedule, and grey points (20) refer to 15 min time windows, at which CO_2 was "Off", according to schedule.



When analyzing a single location, you can select multiple metrics (mosquitoes, small objects, large objects) to be displayed in the line chart at the same time. Select the metric/s that you want to be displayed in the global settings (21).

When analyzing a single location, the table below the graph always includes all three metrics. The column "Total Count" (22) is the sum of Mosquitoes (small objects, large objects) collected. The following three columns (23) refer to the mean count per 15 minutes (or 1 day, 1 week, 1 month - depending on which frequency you select in the Analyzer settings) – for all data, and day-and nighttime separately. "N days above threshold" (24) indicates if / and on how many days the location was above the threshold (you can specify a mosquito catch index threshold in the settings). As it is not possible to define a threshold for small and large objects, the value in that column will always be a dash (not available). The last column indicates the day (or time) of highest activity.



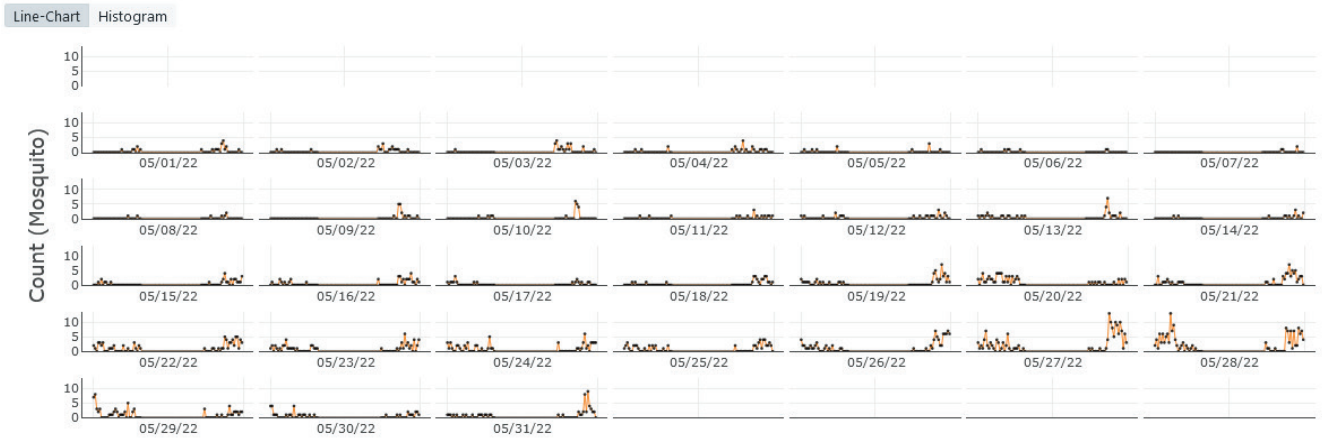
23 Mean count per 15 Min

22 24

Metric	Total Count	All Data	Day	Night	N days above threshold	Time of highest activity
Small	111	1.16	1.38	0.94	-	03/23/2022 13:00
Mosquito	154	1.6	0.1	3.1	1	03/22/2022 18:15
Large	1	0.01	0	0.02	-	03/23/2022 15:00
N datapoints	96	96	48	48		

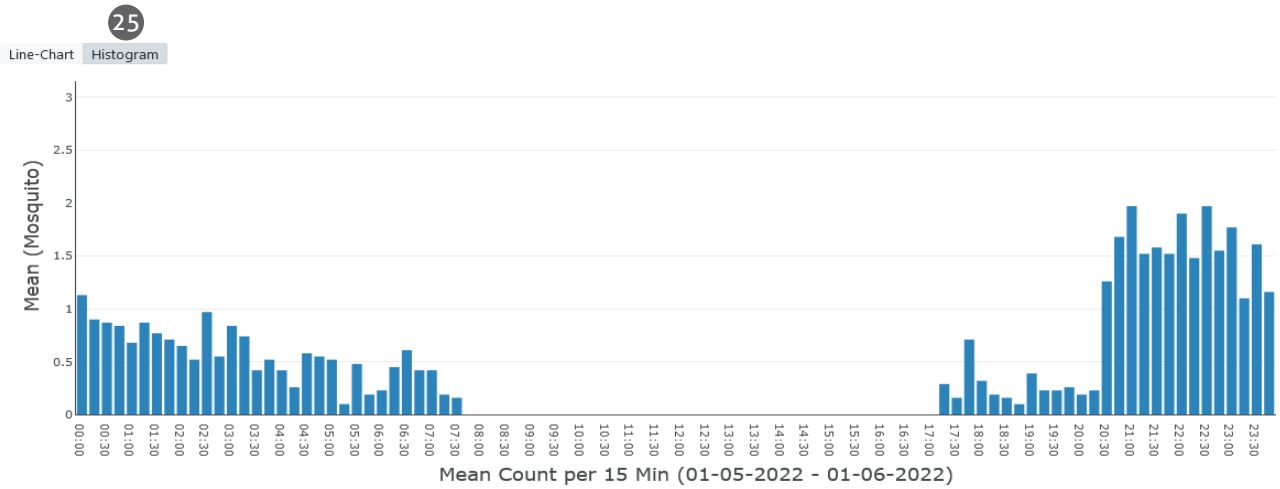
Calendar view

When you select a time range of a month (or roughly a month, such as 30 d), and a Frequency of 15 min you get a calendar view multi panel plot of the data: every day is a little chart and each day's position is like in a calendar (from left to right: Sunday, Monday, ..., Saturday). The example below shows the custom time range Month = 2022-05.



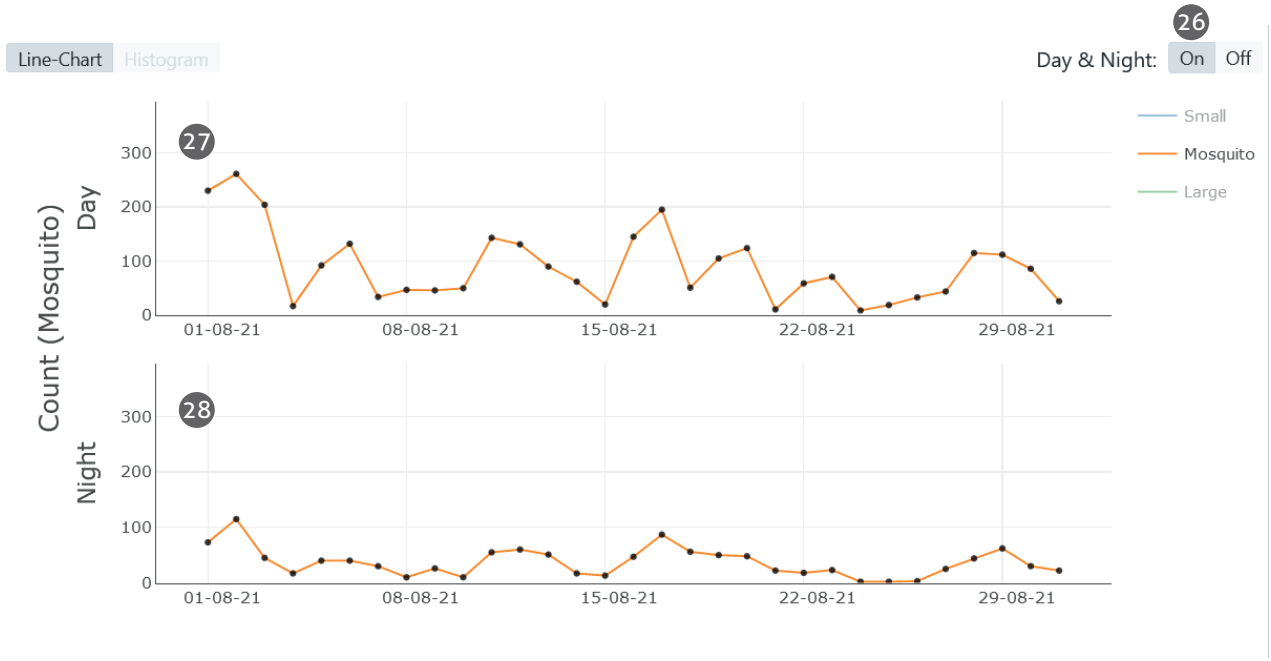
Histogram

When your time range includes more than one day, and your selected frequency is 15 min, you can click on "**Histogram**" (25). You get a bar chart with an average count of mosquitoes at each 15 min time window. For example, when you analyze data of a 30-day time range and the trap was turned on all that time, you get for each 15 min time window the average number of mosquitoes collected at that time window (sum of mosquitoes collected in 30 days divided by 30). In this way you can get a better idea of average activity peaks at your location. This can be helpful if you want to determine the best time for adulticide treatments, for example. The chart below shows what happens, when switching from "Line-Chart" to "Histogram" in the chart above:



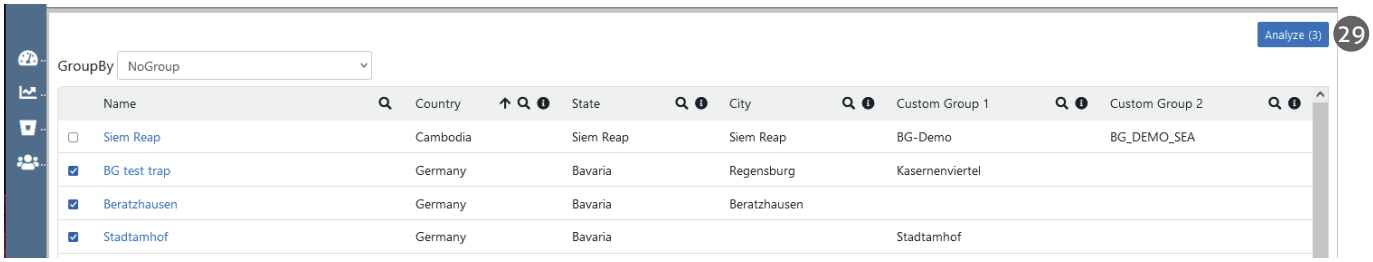
Separated View of Day & Night Catches

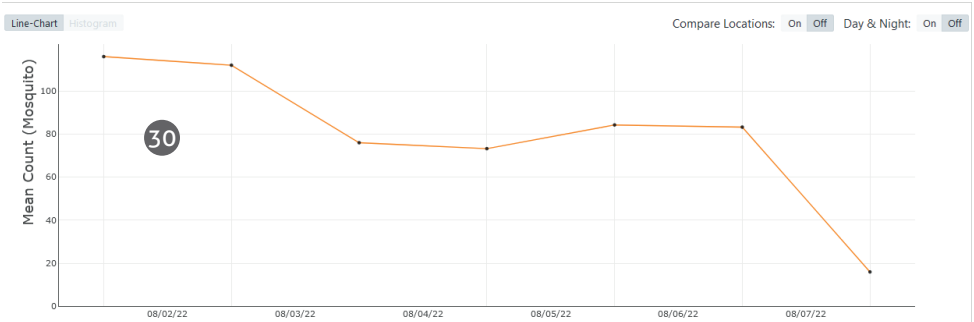
When your selected frequency is "1 Day", "1 Week", or "1 Month", you can switch to **Day & Night = On** (26). In this case, two graphs are displayed – one for the catches during the day (27), and one for the catches during the night (28).



Multiple Locations Analyzer

To analyze multiple locations, go to the Analyzer Overview table, and check the boxes next to the location names of the traps that you want to compare. Click on the blue button "**Analyze (N)**" (29) that appears on the top right corner of the screen. "**N**" refers to the number of locations that you selected. The default chart (30) shows the mean number of mosquitoes at each time point (sum of mosquitoes from all locations at the time point / number of locations that sent data for the time point).
The table under the line chart includes a line for each of the selected locations (31).



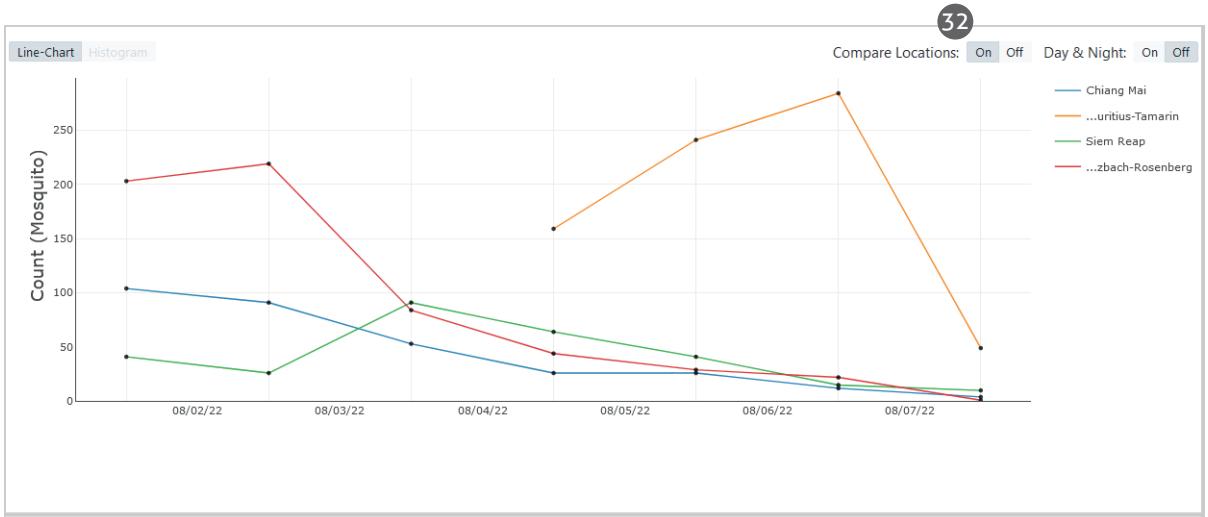


31

		Mean count per 1 Day				
Location	Total Count	All Data	Day	Night	N days above threshold	Day of highest activity
Chiang Mai	316	45.14	7.43	37.71	2	08/02/2022
Mauritius-Tamarin	733	183.25	40.25	143	-	08/07/2022
Siem Reap	288	41.14	23.86	17.29	1	08/04/2022
Sulzbach-Rosenberg	602	86	61.43	24.57	6	08/03/2022
All (N = 4)	**1939**	**88.88**	**33.24**	**55.64**	**9**	
N datapoints	**2688**	**2688**	**1444**	**956**		

Direct Comparison of selected Locations

When analyzing a group or multiple locations, the switch "Compare Locations" appears in the top right corner of the chart. When you switch "Compare Locations" to "On" (32), you get a chart with two or more lines (depending on the number of locations that you selected), each showing the mosquito count at each time point.



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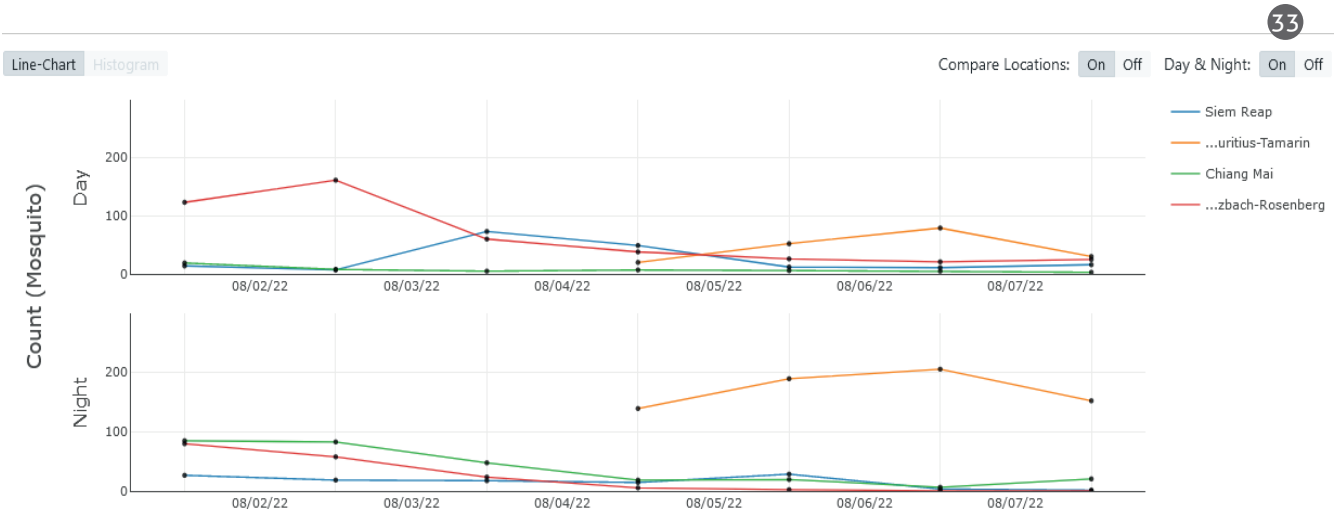
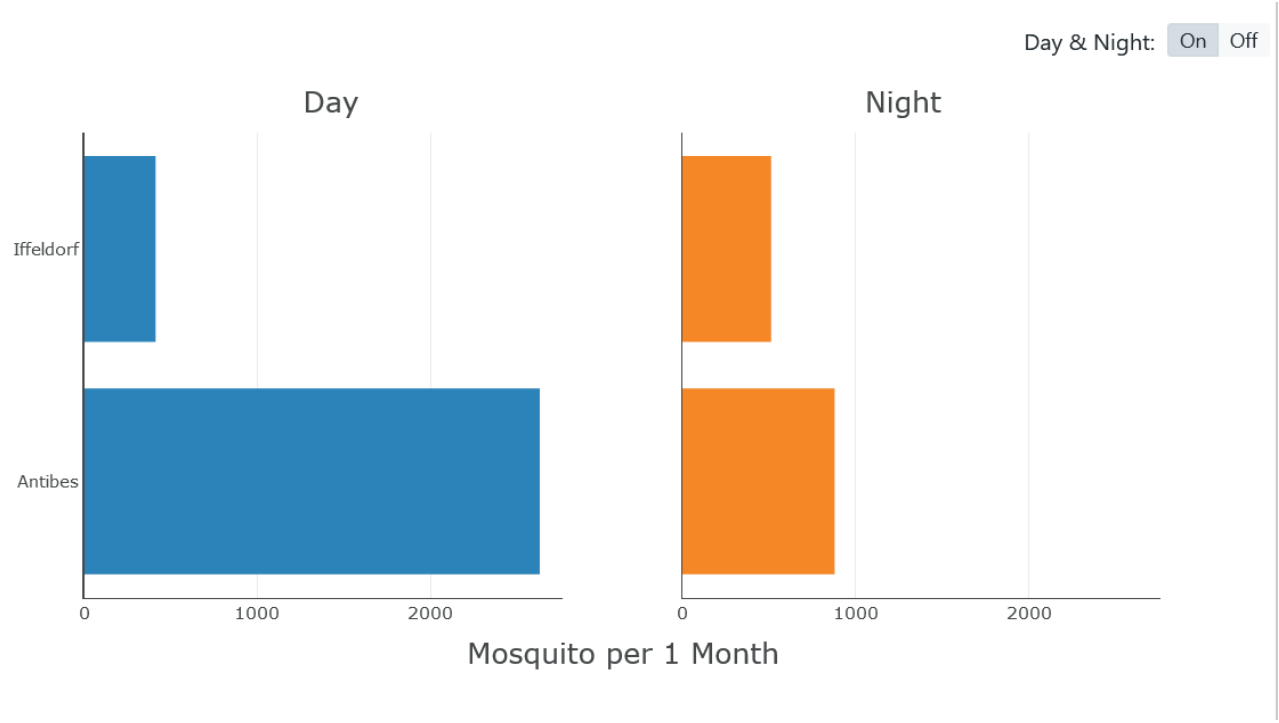
All (N = 4)	**1939**	**88.88**	**33.24**	**55.64**	**9**	
N datapoints	**2688**	**2688**	**1444**	**956**		

The option **Day & Night = On** (33) is also available when analyzing multiple locations. In this case you will get two charts: one for the catches during daytime, and one for the catches during the night:



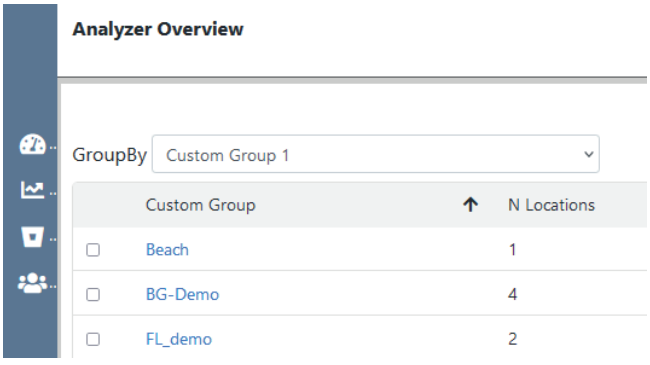
Horizontal Bar Chart

For multiple locations (or groups), you can also select the same value for **Time Range** and **Frequency** in the Analyzer settings (for example: **Time Range = This Month & Frequency = 1 Month**). The result is a horizontal bar chart with the sum of mosquitoes (or small or large objects) collected in the selected time range, for each location.
The Day & Night option is also available for the horizontal bar chart.



Single Group Analyzer

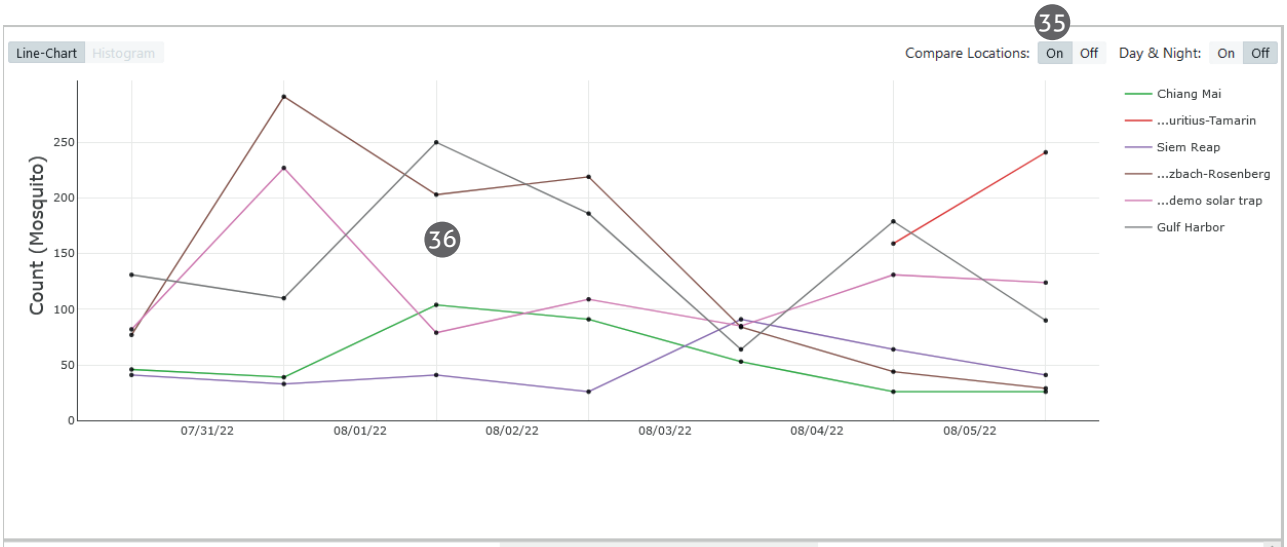
The Single Group Analyzer is like a shortcut of selecting multiple locations: For example, instead of manually selecting all 10 locations that belong to a certain group, you can simply select that group:
Go to the "GroupBy" drop-down menu of the Analyzer Overview table and select the grouping factor. Then choose the group that you want to analyze, by clicking on its name. For example, **Custom Group 1 = BG-Demo**.
The four locations that were manually assigned to Custom Group 1 = "BG-Demo" will then be analyzed.
By default, you'll see a chart with the mean catch count of all locations that belong to the selected group. Like for multiple locations, you can switch "Compare Locations" to "On", to see a line for each of the locations



Multiple Group Analyzer

The Multiple Group Analyzer is also like a shortcut of selecting multiple locations: For example, instead of manually selecting all locations that belong to two groups (with the same grouping factor), you can simply select these two groups.
For example, if you want to analyze the two groups "**BG-Demo**" and "**FL_demo**" of the grouping factor **Custom Group 1**, go to the Analyzer overview table and choose "**Custom Group 1**" in the GroupBy drop-down menu. Then use the checkboxes to select "**BG-Demo**" and "**FL_demo**" and click on the blue "**Analyze (2)**" button in the top right corner of the screen. The number in brackets refers to the number of groups that you selected.

By default, you will see a chart with two lines: one line for the mean mosquito catch-count of all group members of "BG-Demo", and another line for the mean catch count of all members of "FL_demo". In the table below the chart, there is a line for all locations that are members of the two groups. The column "Group" (34) specifies to which Group each location belongs to.
Like for multiple locations, you can switch „Compare Locations" to "On" (35), to see a line for each of the locations that belong to the two groups (36).



Mean count per trap per 1 Day

34

Location	Group	Total Count	All Data	Day	Night	N trapdays above threshold	Day of highest activity
Chiang Mai	BG-Demo	385	55	8.14	46.86	2	08/02/2022
Mauritius-Tamarin	BG-Demo	400	200	36	164	-	08/06/2022
Siem Reap	BG-Demo	337	48.14	27.43	20.71	1	08/04/2022
Sulzbach-Rosenberg	BG-Demo	947	135.29	89.43	45.86	7	08/01/2022
FL - demo solar trap	FL_demo	837	119.57	1.43	118.14	6	08/01/2022
Gulf Harbor	FL_demo	1010	144.29	134.29	10	-	08/02/2022

Data Download

Data can be downloaded in their raw format. This means you will get for every location the data on a frequency resolution of 15 min. When you choose the group analyzer, the raw data for each location that is member of the group will be downloaded and there will be no data aggregation on group level. If you selected for example 3 single locations, or a group with 3 locations as group members, the downloaded excel file will contain 3 sheets: one sheet for each location.

Follow these steps to download your data:

1. Go to the Analyzer overview table and select the location/s or group/s that you want to download
2. Choose the desired time range
3. Push the blue "**Export Trap Data**" button in the top right corner of the Analyzer window

Your data will be downloaded in .xlsx format. The data for each location is stored on a separate sheet of the same excel file.

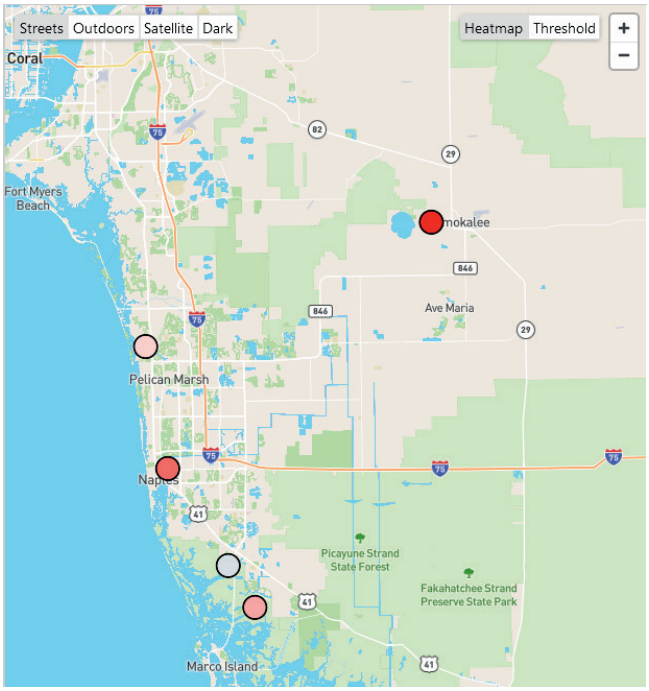
Important!
The download may take a while, when you select a long time range and/or many locations at the same time. Avoid to click the "Export Trap Data" button repeatedly for the same download request.

Mosquito Maps

When analyzing multiple locations, a group, or multiple groups, the mosquito **heatmap** and the **threshold map** complement your analysis by showing you the locations with high (or low) catch counts, or the locations with a catch count above threshold.

Heatmap

The heatmap is a map that shows the relative density of mosquitoes at each location. The map works for all time ranges and shows the **mean number of mosquitoes per day** for each location.
When selecting multiple locations, a group, or multiple groups in the Analyzer overview table, you'll automatically see this heatmap additionally to the line chart and the table.

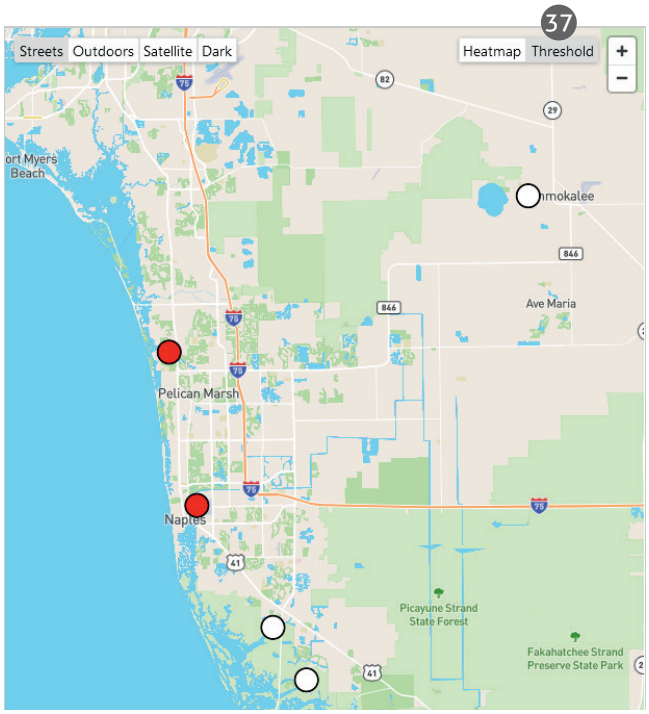


The heatmap is available for mosquitoes, small objects, and large objects.

- **Red circles** (in different shades of red): Mosquitoes were collected at the location. The darker red the circle, the more mosquitoes were counted.
- **White circles** refer to zero mosquitoes.
- **Grey circles** appear, when there is no data available for a certain locations during the selected time range. This happens for example, when the BG-Counter was turned off, or moved to another location.

Threshold map

To access the threshold map, you have to click on **"Threshold"** (37) in the top right corner of the heatmap.
The threshold map shows, which of your locations are **above threshold**. This map also works for all time ranges.
When the selected time range is longer than 1 day, a location is considered as "above threshold", when the mean catch per day is above the defined mosquito catch index threshold.



The threshold map is only available for mosquitoes.

- **Red circles** refer to a location **above threshold.**
- **White circles** indicate a location **below threshold**.
- **Grey circles** indicate that there is **no data availble**. That can happen when there is no threshold defined for this location, when the BG-Counter was turned off during the selected time range, or when there is currently no BG-Counter on this position.

To set a threshold for your locations go to the settings page that you can reach through the dashboard.

Traps

The traps page is where you go to when you want to register a BG-Counter. It also includes a list of your traps with a variety of information. The objective is to give you a comprehensive overview of details for each BG-Counter (as defined by IMEI). As each counter can be assigned to more than one Location, the "Trap Management" table can include less items, than the the "Location Table" from the dashboard.

Trap Management table

The Trap Management table includes the following columns:

- **IMEI**: International Mobile Equipment Identity (Serial Number). This is the number that you must type in, when registering a new BG-Counter. You find this 15-digits number on the sticker at the side of each BG-Counter.
- **Subscription**: Status as of current day: "**InUse**", "**ExpiresSoon**" (expiration of subscription within 60 days), or "**Expired**". Please contact your Biogents representative or distributor if the status is on "Expiring Soon" or "Expired", and you wish to continue your subscription.
- **Device**: Status of your device.
  - » "**Active**": The device is activated, has a location based on geofencing, or was assigned to a fixed location.
  - » "**Standby**": Initial status after adding a new trap to the account.
  - » "**Inactive**": Subscription is expired.
- **Geolocation**: Select between "**Auto**" and "**Fixed**" in the drop-down menu.
  - » "**Auto**": Default setting. GPS geofencing is used to either find an existing location, or to create a new location. This is only possible if the counter is outdoors and has an unobstructed view of the sky.
  - » "**Fixed**": Use this setting to assign the trap to an existing location. This is required when a reliable GPS fix cannot be obtained or if the GPS fix has errors or drift. When you have two locations with less than 100 m between each other, it is also necessary to use the "Fixed" setting. Geofencing only determines two locations as different, if they are at least 100 m apart from each other.
- **Current Location**: Select one of your existing locations, when Geolocation is set on "fixed". In this way, you can for example assign the IMEI of a replacement trap to the Location of a defective trap.
- **Last Connection**: The time at which the trap last connected with the server successfully.
- **Transmitted Coordinates**: Last reported coordinates as measured by the built-in GPS device, unless otherwise indicated.
- **Expiration**: Subscription expiration date.
- **ICCID**: SIM Card serial number.
- **Transmissions**: Number of 15-min reports in the database. A small number means the counter has not been used much.

New Trap

To add one or multiple new traps, click on the blue "**New Trap**" Button. Enter one or multiple IMEIs in the field. If you enter multiple traps, separate the IMEIs with a comma. Click the blue "**Assign**" button to register your BG-Counters.

Automatic geolocation

After registering a new BG-Counter, you might want to turn it in on in your office to make sure that it works properly.

Please note the "time-fence" rule for geofencing: If the time span between turning off the BG-Counter in your office, and turning it on in the field is **less than 2 h**, a new location won't be automatically created (field data would be assigend to the office location). If you have to activate the field location after < 2 hours, make sure to manually create the location: Go to "Dashboard"-> Location table-> "New Location" and set the Location manually with the help of the map. Then go to "Traps", set the geofence mode to "Fixed" (Geolocation column), and assign the newly created location to this trap (Current Location column).

Users

This section is only available for Administrators and Operators. You can invite new users by clicking on the blue "**New User**" button. Enter the e-mail address, choose the desired role (Administrator, Operator or Observer) in the drop-down menu and click the blue "Save" button in the top right corner of the screen. If a newly invited user does not appear in the user list, click the refresh button of your browser. **Assign locations to users:** open the drop-down menu of the "Assigned Locations" column and select the locations that you want to assign to the user (check boxes).

Administration Roles and their Rights

Administrator

- Registers BG-Counters
- Can change trap settings in the dashboard
- Invites Administrators, Operators and Observers (and can delete them)
- Assigns users to selected BG-Counters (if applicable)

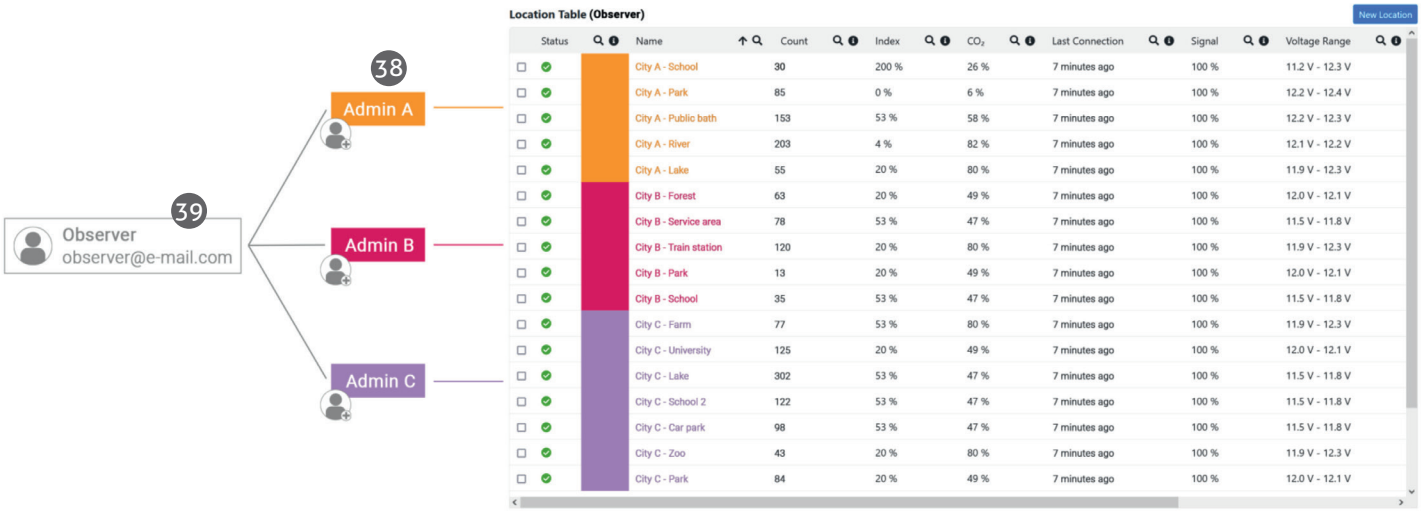
Operator

- Can change trap settings in the dashboard
- Visualization and control of BG-Counters that he/she was given access to by an Administrator

Observer

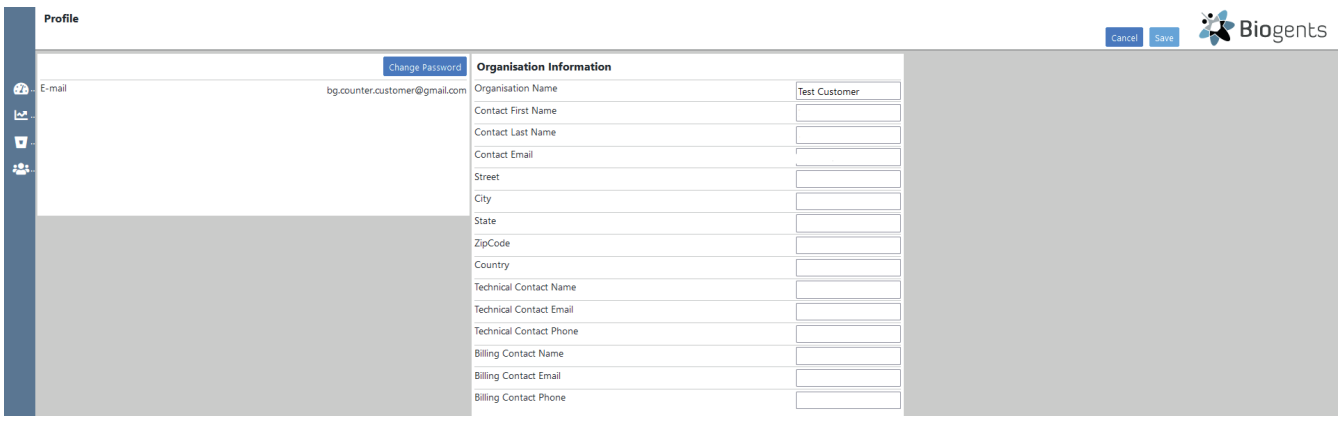
- Restricted access to the app. The Observer cannot
  - » change settings
  - » add traps, register traps
  - » create locations
  - » invite users
- Visualization of BG-Counters that he/she was given access to.

An Observer can be invited by Admins of different sets of traps (38). This means, that if the observer got invitations of Admin A, Admin B and Admin C, who oversee different sets of traps, the Observer will be able to see the traps of these Admins with one login, if all invitations are based on the same e-mail (39).



Profile

- **Change your password**: Click on the blue "**Change Password**" button, then select "**Password**" in the menu of the Keycloak page. Set a new password in the field "**New Password**" and type again the same new password in the field "**Confirmation**".
- **Update Information of your Organisation**: Complete or adapt the Organisation Information table by fulfilling the respective fields.
- **Save**: Click on the blue "**Save**" button to save the changes you made.



Dashboard Warnings

When you access the dashboard, you see the status of all Locations in your account in the first column of the Location Table. You can use the arrow that appears when you hover with the mouse over the area next to the column title "Status", to sort your locations by dashboard warning category. In this way, your locations with errors and warnings will appear on top of the list.

Error messages

Error messages are indicated by a red circular warning sign:

"No connection in >24 h"
Possible causes:
- The trap has lost power or has been shut off.
- The battery has been depleted, or the solar panel is not charging.
- The cellular signal is too weak or non-existent.
- The cellular network refuses connection or is overloaded.
- The electronics have failed.

Corrective actions:
- Check the power source (e.g. battery charge or solar panel orientation).
- Check cellular coverage and signal strength at trap location.
- Perform a reset (disconnect power, wait 30 s, reconnect power).
- Contact distributor or Biogents technical support.

"Fan failure detected"
- The fan current is very low or zero.

Corrective action:
- Check the fan for proper connection and operation.

"Refill CO_2 (very low or empty)":
- CO_2 supply < 10 %

Corrective action:
- Replace the CO_2 cylinder of your trap, then click on the "Fill CO_2" button on the settings page.

"Subscription has expired, transmission disabled"
Corrective action:
- Contact your distributor or Biogents about renewing your subscription.

Warnings

Warnings are indicated by a yellow triangle:

"Subscription expires in < 30 days!"
Corrective action:
- If you desire to continue to use the BG-Counter, make sure to renew your subscription.

"No connection in the last 8 – 24 h"
- This serves as an early warning indicating connectivity issues.
- If this message appears frequently but the cellular signal is strong and there are no power issues, it is an indication of 2G/3G network congestion.
- Many cellular service providers are shutting down their 2G and/or 3G networks, so installing a BG-Counter 2 with 4G/LTE connectivity may result in more frequent and regular updates.

"CO_2 supply at < 25 %"
Corrective action:
- Make sure to replace the CO_2 cylinder in time so that the trap does not run out of CO_2.

"High fan current (fan blocked or wrong fan)"
- The wrong fan is installed in a BG-Pro (5 V fan instead of 12 V fan).
- The fan may be blocked by an object or animal (such as a lizard trying to steal the captured mosquitoes).

Corrective actions:
- Check the label on the BG-Pro fan.
- Remove any object blocking the fan.

"Low battery (trap may turn off)"
When the voltage is lower than about 11.8 V, the battery is completely discharged, and the BG-Counter may turn off to protect the electronics.
Once turned off, the counter remains off until the voltage builds up again to a safe level.
Corrective actions (one or more of the following):
- Make sure solar panels are in full sun.
- Check connections on charge controller (see instructions included with the controller).
- Check charge controller for proper function (see instructions included with the controller).
- Charge the battery.
- Use a battery with higher capacity.

WARNING

When servicing the battery of the solar system, it is mandatory to follow these steps:

1. **First disconnect the BG-Counter by unplugging the black power connector on the left side on the counter front panel (where the electric and CO2 connections are).**
2. **Then disconnect the solar panel wires from the charge controller before disconnecting the battery.**
3. **Any other sequence may damage the charge controller or the BG-Counter and may void the warranty.**

Info

„Info" items are indicated by a blue circle:

"No trap currently assigned"
There is no BG-Counter at this Location in the moment.

"Trap assigned but no transmission received"
There is a trap assigned to the location, but no transmission has been received.

"Weak cellular signal"
Weak or no cellular reception at the present location. To check the quality of the cellular signal at your location/s, go to **Dashboard** -> **Location table** and scroll the horizontal bar until you see the column "**Signal**".
Corrective actions:
- Move trap to a location which has stronger reception.
- If you continue to use the trap at the same location, data will be saved and uploaded the next time there is reception.

"Subscription expires in < 60 days!"
Corrective action:
- If you desire to continue to use the BG-Counter, make sure to renew your subscription.

"Catch index > 100 %"
The number of collected mosquitoes exceeded the specified threshold.

"Two or more locations with geofencing radius, automatic geolocation not possible!"
In this case, the gelocation mode will be automatically set to „fixed". You can then assign a trap to the location.

Further issues

Trap does not start up

Symptoms:
- No beeps after connecting power
- Fan not working
- CO_2 valve not clicking
- A blue glow may be visible when looking into the counter funnel.

Cause: No power or wrong polarity.
Solution: Check voltage, continuity, and polarity on the power connection.

Only one or two beeps upon start-up

Symptoms: Counter, fan and CO_2 valve are off. No data transmission.
Cause: Battery is too low.
Solution: Recharge battery or replace with full battery.

SOS beep during start-up

Symptom: 3 short, 3 long, 3 short beeps
Cause: SD card failure.
Solution: Contact customer support.

Cellular signal & Transmission

Checking cellular connectivity

If the counter is in a location with weak cellular signal, the cellular data connection to the server may be unreliable. The signal strength at the deployment site can be checked as follows:
Go to **Dashboard -> Location table** and scroll the horizontal bar until you see the column "**Signal**".
Alternatively, disconnect and re-connect the counter to power, then pay attention to beeps:

1.) **Immediately**: One to four beeps indicate battery voltage:
- 4 beeps: fully charged
- 3 beeps: partially charged
- 2 beeps or 1 beep: discharged, counter and trap will not run

2.) **After 10-90 seconds**, check for 1-5 long beeps that indicate cellular signal strength (like the bars on a cell phone):
- 3-5 beeps: strong signal
- 2 beeps: marginal signal
- 1 beep: weak signal
- 2 short beeps: no connection

Cellular signal too low

Symptom:
Two short beeps about 1-2 minutes after connecting the trap to power.
Cause: Weak or no cellular reception at the present location.
Solutions:
- Move trap to a location which has stronger reception.
- Continue using the trap: data will be saved and uploaded upon the next time there is reception.

Irregular transmission times

Symptom:
Trap doesn't transmit data when scheduled.
Cause:
Weak cellular connection or cellular network is busy.
Solution:
See "Cellular signal is too low".

Cellular transmission stops

Symptom:
Counter stops transmitting despite good cellular signal strength.

1. **Cause:**
Extremely low battery. To protect the counter from damage, the electronics, fan and CO_2 are automatically shut down. To view the battery voltage range during the last 24 h, go to **Dashboard -> Location table** and scroll the horizontal bar until you see the column "Voltage Range".
Note: A 12 V battery is considered 0 % charged when the voltage is below 11.8 V, and fully charged, when voltage is above 12.8 V.
Solution: Replace or charge battery.

2. **Cause**:
Counter needs reset.

Solution:
- Disconnect power
- Wait 30 seconds
- Reconnect power
- Insert hand into the funnel to block the sensor
- Wait 4 beeps that indicate power (4 beeps if battery is fully charged)
- After 15-90 seconds, verify cellular signal strength beeps (1-5 long beeps, corresponding to 1-5 signal bars); if there **are only two short beeps, there is no cellular connectivity**
- Right after the cellular signal indication, there will be 5 additional short beeps followed by a long beep.
- Power-cycle the counter once more
- After 30 minutes, go to the website and verify if new transmissions have been recorded.

Solar battery voltage gradually drops

Symptom:
In the **Dashboard -> Location** table, scroll the horizontal bar until you see the column "Voltage Range": The solar battery does not maintain its voltage. Eventually, counting and transmission of data stops.
Cause:
There is insufficient sunlight to keep the solar battery charged.

Solutions:
- Modify your trap schedule to only measure during peak hours of mosquito activity
- Move the solar panel to a sunnier position
- In rare cases, a larger solar panel may be needed. Contact Biogents or your distributor.

Counting errors

Fan failure

Symptoms:
- Mosquito counts may appear low
- Small counts may appear high
- Catch bag (if used) may be empty
- In the **Dashboard -> Location** table, scroll to the columns "Fan Status" and "Fan Current". The Status is on "Fail" and the current is near 0, even when the fan is supposed to be on.
- Error message in the Dashboard: "Fan failure detected"

Cause: Fan has failed.
Solution: Check fan wiring; if necessary replace fan.

Overcounting

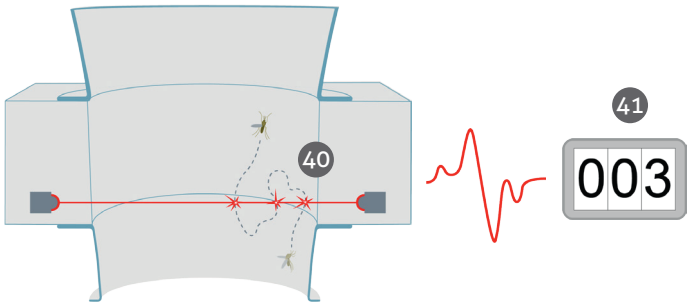
Symptom: Fewer mosquitos in catch bag than counts on website.

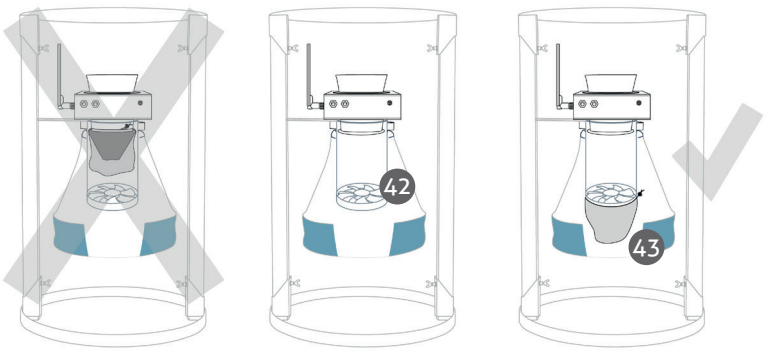
1. **Cause:**
Mosquitos might be able to escape if the catch bag is full or due to a reduced air flow. When leaving the trap, the mosquitoes sometimes cross the infrared barrier several times (40) and are therefore also counted several times (41).
Solution:
A) Remove the funnel net and catch bag (42).
B) In case you need to analyze the mosquitoes, install a catch bag below the fan (43).

2. **Cause:**
Mosquitoes were "stolen" by other insects (e.g. ants)
Solution:
Place the trap ant-protected, e.g. in a water bath or grease the basement with petroleum jelly.

Undercounting

Symptom:
More mosquitos in catch bag than counts on website.
Cause: Some mosquitoes were misclassified as large.
Solution: An accuracy of 80% or higher is normal. If there are no other large objects in the catch bag, use the sum of mosquito and large object counts.





CO_2 issues

CO_2 failure

Symptoms:
- Low mosquito counts
- No CO_2 flow even when CO_2 is activated
- CO_2 tank empties rapidly
- Valve not clicking or no hissing sound even though CO_2 is turned on

Causes:
- CO_2 tank empty
- CO_2 regulator (a) not adjusted correctly, (b) failure
- Leak in CO_2 lines
- Contaminants in CO_2 stream damaging internal regulator or valve parts
- Valve or electronic failure

Solution:
- Check CO_2 tank and regulator pressure (see „Checking CO_2 system)
- Leak-check the CO_2 system (see „Checking CO_2 system)
- Confirm proper grade of CO_2 is being used (99.9% pure; at least technical grade)

Make sure to maintain cleanliness of the CO_2 system by careful handling of the CO_2 exhaust port air stone and prompt replacement if broken off, and properly covering open ports when CO_2 tank or counter are removed.

Checking the CO_2 system

Checking the CO_2 flow
- Confirm that the tank valve is open and the regulator is set to 1.5 bar.
- Confirm that the CO_2 dosing valve inside counter is clicking and a hiss can be heard from the CO_2 exhaust port (blue, black or gold air stone).
- Note that at the time of test, CO_2 may be turned on in the schedule on the website

If there is no clicking or hissing: the valve may be contaminated or there is a electrical problem

Checking for leaks
- Disconnect the power cable at the BG-Counter front panel.
- Close the valve of the CO_2 tank.
- Observe the CO_2 regulator gauge for at least 3 minutes.
  -> The pressure indication should be stable at 1.5 bar

A drop of the pressure may indicate

1.) **a leak in the CO_2 tubing. In this case leak-check the pressure regulator and the tubing with soapy water. A leak location will be indicated by the presenece of air bubbles)**

2) **an internal leaking of the dosing valve. In this case the valve needs cleaning or replacement. Please contact technical support.**

Technical Data for BG-Counter 2

Weight (Body): 730 g
Dimension (Body): 23 x 23 x 14 cm
BG-Counter 2 including ventilator: 12 V DC, 7 Watt
Switching power supply: AC Input 100 – 230V,
Frequency 60Hz/50Hz,
DC Output 12V 1A

European Union Compliance Statement

Biogents hereby declares that this device is in compliance with Directive 2014/53/EU. A copy of the EU Declaration of Conformity, including frequency bands and maximum radio-frequency power, is available at:
» https://eu.biogents.com/ce-declaration-of-conformity-and-frequency-band-bg-counter/

ROHS ✓ CE

If equipped with SIM7600E-H:	
Frequency	Maximum Power
GSM 900 MHz	Class 4, Class E2
GSM 1800 MHz	Class 4, Class E2
UMTS 2100 MHz Band I	Class 3
UMTS 900 MHz Band VIII	Class 3
E-UTRA LTE Bands 1, 3, 7, 8, 20, 38, 40	Class 3

If equipped with SIM7600SA-H:	
Frequency	Maximum Power
E-GSM 900 MHz	Class 4, Class E2
DCS 1800 MHz	Class 1, Class E2
UMTS 2100 MHz Band I	Class 3
UMTS 900 MHz Band VIII	Class 3
E-UTRA LTE Bands 1, 3, 7, 8, 28, 40	Class 3

If equipped with SIM7600G-H:	
Frequency	Maximum Power
GSM850, EGSM900	Class 4, Class E2
DCS1800, PCS1900	Class 4, Class E1
UMTS B1, B2, B4, B6, B8	Class 3
LTE Fdd B1-5 , B7-8, B12-13, B18-20, B25-26, B28, B66, TDD B34, B38-41	Class 3

European Union Disposal Information

The symbol above means that according to local laws and regulations, your product and/or its battery shall be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. The separate collection and recycling of your product and/or its battery at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

FCC Compliance Statement (if equipped with SIM7600A-H)

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Exposure to Radio Frequency Energy

The radiated output power of this device meets the limits of FCC/IC radio frequency exposure limits. This device should be operated with a minimum separation distance of 20 cm (8 inches) between the equipment and a person's body.

Contact Information

Biogents AG, Weissenburgstr. 22, 95055 Regensburg, Germany.

Links

» www.youtube.com/watch?v=BVgKV_2PXD0
This Video explains the BG-Counter App in four chapters:

- Data storage based on location
- Structure of the app
- The Dashboard
- The Analyzer

» https://eu.biogents.com/bg-counter
Webpage with resources about the BG-Counter, including the newest version of the manual, customer stories, publications and many more.

Contact

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SCIENCE FOR MOSQUITO CONTROL

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