CleanFLEX(CAM)

User Manual
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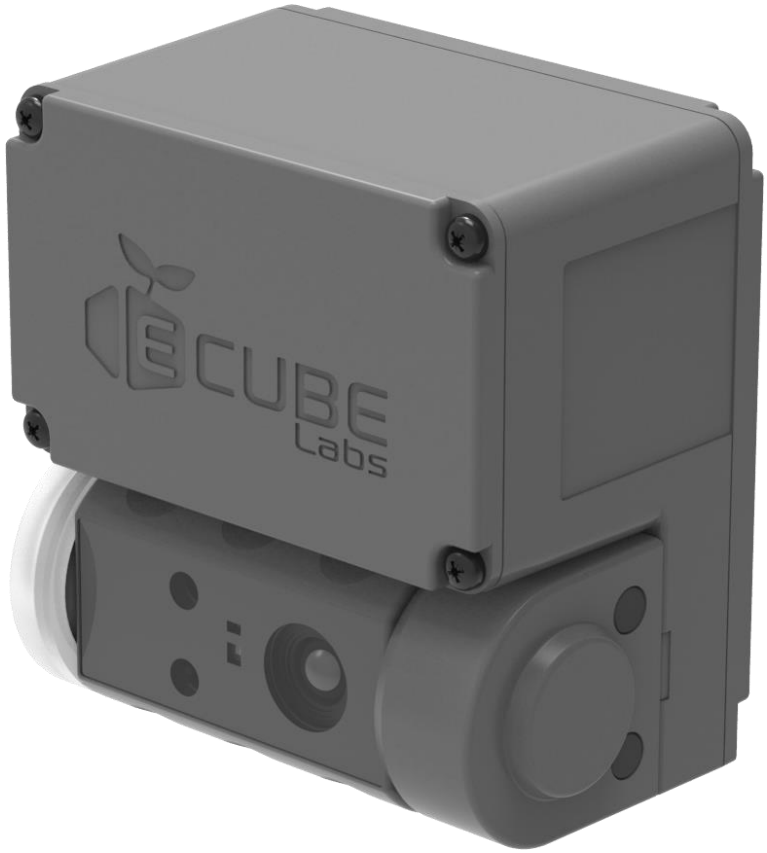

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1. Introduction to CleanFLEX

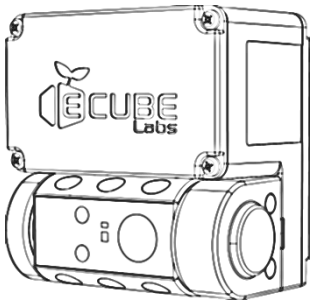
CleanFLEX(CAM) is a smart fill-level sensor that can be easily installed on any type of container. It uses robust ToF VCSEL (Time of Flight, Vertical Cavity Surface Emitting Laser) technology, allowing it to monitor any type of non-transparent solid substance. In addition, CleanFlex can take pictures of the inside of the trash bin using the built-in camera, and the photographed photos are transmitted to Clean City Networks wirelessly along with the collected bin fill-level and trash bin status information. Obtaining real-time fill-level data of bins empowers the user to make data-driven decisions.

1.1 CleanFLEX contents

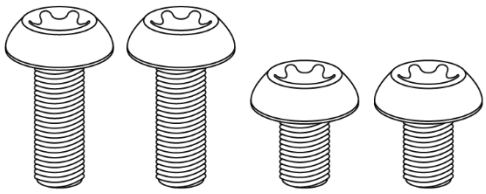
When you receive CleanFLEX, ensure you have all items mentioned in this section.

1.1.1 Included in CleanFLEX box

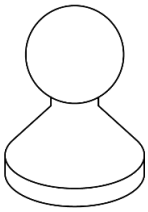
Each CleanFLEX box is shipped with the following:



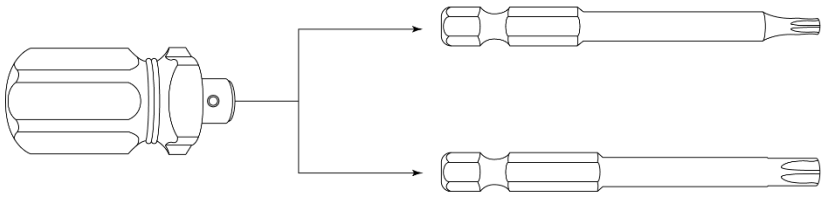
CleanFLEX(CAM) (1 EA)



M6 x 12mm (2 EA), M6 x 8mm (2 EA)



Magnet (1 EA)



Torx driver (1 EA), Torx bit M3 (1 EA), Torx bit M6 (1 EA)

1.1.2 Optional

In certain cases, optional items (e.g. brackets) are required for installing CleanFLEX inside a waste container. These items are customized to fit your waste containers and must be ordered separately. Before ordering these items, you must provide information about height, width, volume, and material of your waste container. Based on the information provided, Ecube Labs will calculate the exact height for installing CleanFLEX and will provide the appropriate bracket and kit.

1.2 Features

CleanFLEX provides the following features:

- Mountable to any type of bin or container(Brackets can be provided If necessary)
- Provides wireless transmission of bin fill-level and bin status data to CleanCityNetworks.
- Provides accurate sensing with ToF technology(Non-transparent solid materials).
- Taking pictures using the camera sensor
- Allows you to configure sensors remotely.
- Provides location information through GPS module.

For details on how to use the above features, please refer to the “Clean City Networks User Manual”.

1.3 Caution Notice

To protect the battery of CleanFLEX, please pay attention to these.

- When replacing batteries, do not reverse the polarity.
- Do not pierce the battery with sharp objects.
- Damaged batteries may cause fire.
- Do not damage the battery with sharp objects, etc.

2. Installing CleanFLEX

CleanFLEX can be installed inside of waste containers or under its lid. If the installation is for a waste container with a lid, CleanFLEX should be mounted under the lid. If the installation is for a waste container without a lid, CleanFLEX should be mounted on the inside of the waste container.

CleanFLEX must be installed, connected, commissioned, operated, and maintained by qualified personnel only.

2.1 Installation prerequisites

The accuracy of CleanFLEX data is affected by the location and environment of installation. It is recommended that CleanFLEX be installed with the direction of the sensor's light beam being perpendicular to the bottom base of the waste container (or bin). If necessary, please adjust the angle of the ToF sensor.

If the direction of the light beam is not perpendicular to the base of the waste bin, the distance traveled by the reflected light may not be the same with the bin profile and may result in inaccurate measurements.

In order to receive accurate fill-level data, the user must enter the sensor and bin height into CleanCityNetworks. Refer to Section 4 (Bin Profile) for more information.

Any protruding objects (i.e., vinyl bin liner) between the light beam and the bottom base of the waste bin may affect fill-levels.

CleanFLEX's cameras have a wide angle of view, but they may need to be adjusted as they may be obscured by the internal structure of the trash bin.

CleanFLEX's installation height range is up to 2m from the floor.

2.2 Installing CleanFLEX

Fill-level accuracy depends on how well it is mounted and configured. Depending on the container type, it may be necessary to seek advice on appropriate installation location and method of installation.

Ensure you have the following items before beginning the installation:

- Stencil pen, marker
- M6 drill bit
- Power drill
- Torx driver
- M6 torx bolts (2 EA)
- CleanFLEX

Take the following steps to install CleanFLEX under the lid or inside the bin.

1. To determine the mounting location of CleanFLEX, find a spot with a clear line of sight to the center of the bin's bottom base. Use a stencil pen to mark the spots where you will drill holes.
2. Using a power drill with an M6 drill bit and drill holes on the marked spots.
3. Position CleanFLEX on the installation surface and tighten with screws from the other side.
4. Make sure the sensor is pointed at the center of the bottom base of the bin. Change the angle of CleanFLEX's adjustable sensor head if necessary.
5. Make sure CleanFLEX is securely installed.

If the installation surface is too thick, use long M6 torx bolts to secure CleanFLEX.


1
2
3
4
5
6

3. Activating CleanFLEX

After installing CleanFLEX, activate the device and check its operation. If you contact Ecube Labs or your point of purchase, you will be provided with more accurate activation confirmation.

3.1 Checking CleanFLEX ON or OFF status

Perform the following to check the ON or OFF status of CleanFLEX.

1. Refer to the diagram and place the magnet on the following location. The magnet is recognized only on this location.

2. Remove the magnet in 5 seconds to check the status of the unit.
   A. If the red LED light flashes 4 to 5 times in 5 seconds: the unit is in sleep mode.
   B. If the green LED light flashes 4 to 5 times in 5 seconds: the unit is ON mode.

3.2 Turning CleanFLEX ON

Once CleanFLEX is installed, turn CleanFLEX ON to ensure it is working. Before turning CleanFLEX ON, perform the tasks described in the following prerequisite section.

3.2.1 Prerequisites

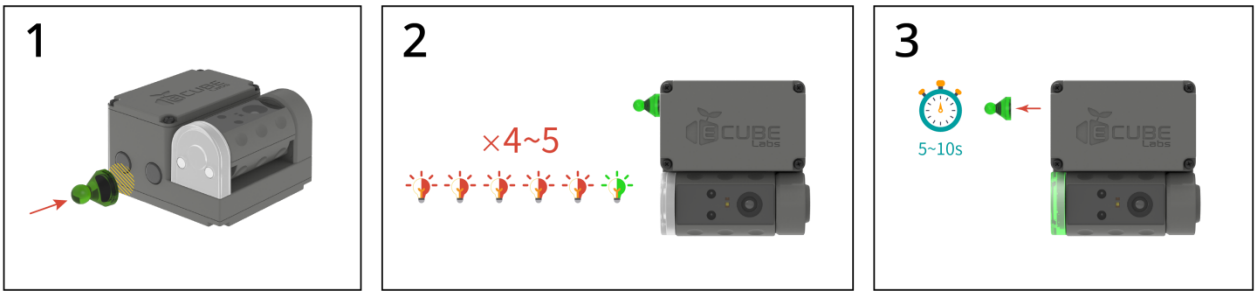
Before turning CleanFLEX ON, log in to the CCN web interface, select the respective CleanFLEX unit and click "**Request GPS Update**". This ensures accurate GPS location updates from CleanFLEX. Refer to the "*CleanCityNetworks Web User's Manual"* for instructions on requesting a GPS update.

For CleanFLEX installed underground, it is highly recommended to perform "Set Manual Location" as CleanFLEX installed underground does not obtain accurate GPS location coordinates.

Take the following steps to turn CleanFLEX on.

1. Place the magnet on the indent located on the side of CleanFLEX and hold it there for 5 to 10 seconds and then remove it.
2. The LED light will blink red and then eventually turn green. Please note that removing the magnet too soon (<5 seconds) or too late (>10 seconds) will fail to turn the unit on.

After the unit is on, it will try to reach the server. The green LED will blink 5 times rapidly to show that it successfully communicated with the server.


1
2
×4~5
3
5~10s

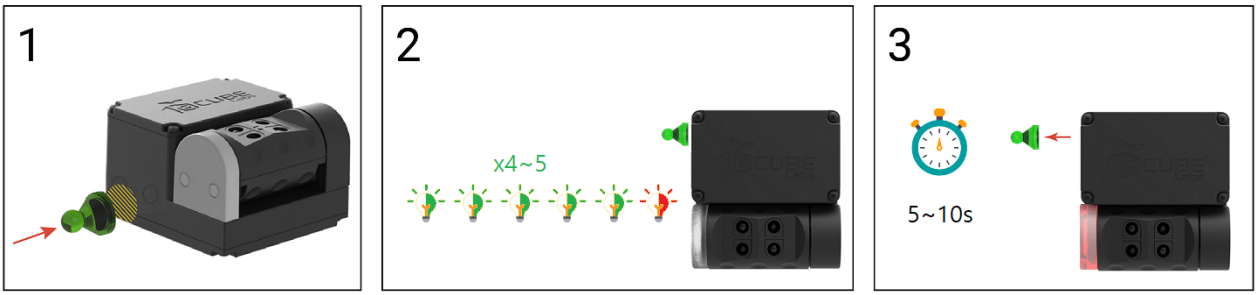
3.3 Turning CleanFLEX OFF

Take the following steps to turn CleanFLEX off.

1. Place the magnet on the indent located on the side of CleanFLEX and hold it there for 5 to 10 seconds and then remove it.
2. The LED light will blink green and then eventually turn red. Please note that removing the magnet too soon (<5 seconds) or too late (>10 seconds) will fail to turn the unit off.

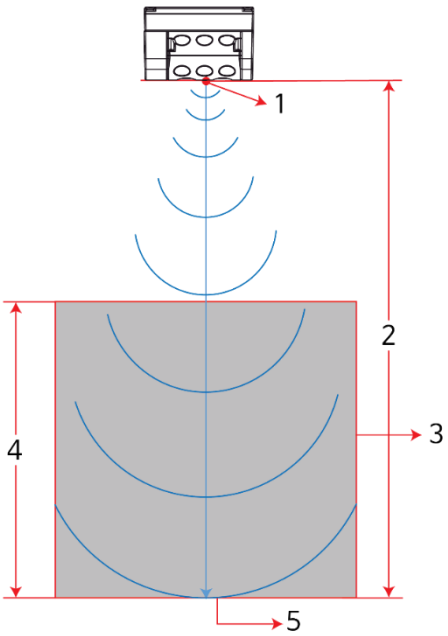
Before the unit turns off, it will try to reach the server. The red LED will blink 5 times rapidly to show that it successfully communicated with the server.

Avoid performing any procedures within ten minutes after turning CleanFLEX off. If the user fails to follow the appropriate steps to turn CleanFLEX off, CleanFLEX will return to its previous ON status.



4. Bin profile

For accurate fill-level measurements, the user must create a bin profile for each unique bin CleanFLEX is mounted on. The dimensions mentioned in the diagram below are essential in creating the bin profile on CCN. If you fail to create an accurate bin profile using these dimensions, then CleanFLEX is set to a default bin profile which may lead to inaccurate measurement data. Refer to the "*CleanCityNetworks User's Manual"* for creating bin profiles for CleanFLEX.



Profile

1. Profile name
2. Sensor height
3. Bin volume
4. Bin height
5. Bin base (width & length)

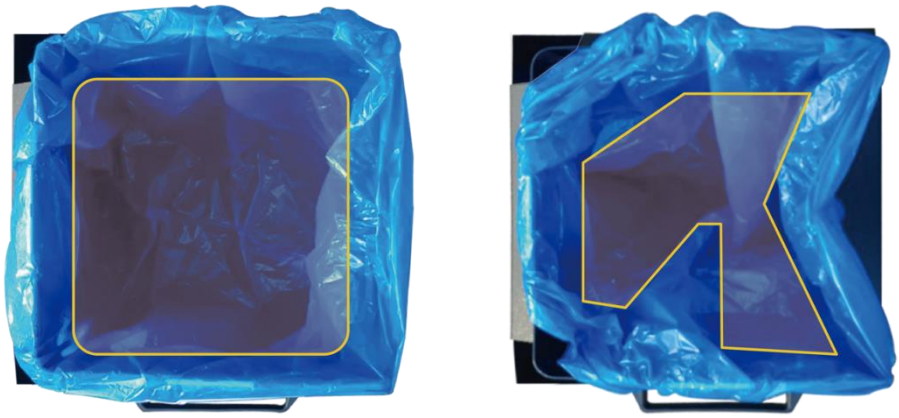
If the direction of the light beam emitted from the sensor is not perpendicular to the center of the bin's bottom base but emits at an angle (i.e., mounted off center or on the wall of a container), measure the distance from the sensor to the center of the bin's base (rather than the sensor height) for more accurate results. The Pythagorean Theorem ($a^2 + b^2 = c^2$) can be utilized to find this distance (c^2 or the hypotenuse) by measuring the sensor height (a^2) and the floor distance from the sensor to the center of the bin's base (b^2).

4.1 Placing liner bag inside the waste bin

If using bin liners, please ensure the following steps are followed. Failure to follow the instructions may result in inaccurate fill-level readings.

1. Fill the bin liner with air before inserting it into the bin.
2. Fold the top of the bag over the top edge of the bin while pushing the bin liner against the inside of the bin to keep the bag away from the center of the bin.
3. Fold the excess length of the bag over the outside of the bin.

The liner bag must be pushed completely to the sides of the bin. If the liner bag is protruding toward the center of the bin, it will lead to inaccurate measurement data. After the liner bag is placed in the bin, ensure the inside of the bin looks as illustrated below.



O X

5. Troubleshooting

If you experience network problems or operation issues after installing CleanFLEX, check the following.

5.1 Fill-level measurement issues

Visually inspect the installed CleanFLEX and:

- Check whether the sensor is surrounded by any foreign substances
- Check the status of liner bag
- Check for damages on the sensor

If foreign substances are found around the sensor, remove them. If the liner bag is not placed properly, refer to “4.1 Placing liner bag inside the waste bin” and place the bag correctly. Also check whether the sensor is physically damaged. In case of damage, contact Ecube Labs or point of purchase.

5.2 Taking pictures issues

Visually inspect the installed CleanFLEX and:

- Check whether the camera is surrounded by any foreign substances
- Check whether the sensor is damaged

If there is any foreign matter or condensation, please remove it. Also check whether the sensor is physically damaged. In case of damage, contact Ecube Labs or point of purchase.

5.3 Telecommunication and Battery issues

Occasionally the network provider may experience temporary outages and CCN will highlight a particular CleanFLEX unit with a red icon. Occasionally a unit’s battery status may temporarily drop to “Low” or “Critical” (even for a new unit) and you may experience network quality or connectivity issues. Often times, both of these issues resolve themselves on its own. If no improvement is found after several days or you suspect you have depleted your unit’s battery, please contact Ecube Labs or point of purchase.

6. Regulatory Notices

User notification

This device has been tested for compliance with the intended use in a commercial environment. If the device is used in a domestic environment, it may cause radio interference.

FCC Part 15.19

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.

FCC Part 15.21

Any changes or modifications (including the antennas) to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement

This equipment complies with FCC RF Radiation exposure limits set forth for an uncontrolled environment.

This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

FCC Part 15B Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.