uRAD By Anteral

Anteral
Innovative Antennas,
Passives & Radar Technologies.

uRAD TOUCH WALL

Innovative System for Making Walls Tactile

OPERATING INSTRUCTIONS

Version 1.4

Product

uRAD Touch Wall

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1. ABOUT THIS DOCUMENT

1.1. General Information

Read these operating instructions carefully to familiarize yourself with the product and its functions before starting any work.

The operating instructions are an integral part of the product. Keep the instructions accessible to personnel at all times. If the product is handed over to a third party, these operating instructions must be provided along with it.

These operating instructions do not provide information about the handling and safe operation of the machine or system in which the product is integrated. This information can be found in the operating instructions of the machine or system.

1.2. Explanations of Symbols



Radiation Hazard: Indicates an imminent hazardous situation related to laser emission that may cause severe injuries if not avoided.



Caution: Indicates a potentially hazardous situation that may result in moderate or minor injuries if not avoided.



Important: Indicates relevant information and recommendations that should be considered during the use and handling of the device.

2. SAFETY INFORMATION

2.1. Intended Use

uRAD Touch Wall is a non-contact distance measurement system based on laser emission within a 2D optical scanning plane. Its primary use is the precise measurement of the distance from the device to a part of the body, such as fingers or hands, or certain objects held by the user. The ultimate goal is to simulate tactility over the area covered by the scanning plane.

The device is designed for both indoor and outdoor use. The product has been developed for use in various environments, including industrial settings (EN 61000-6-4).



Read this user manual thoroughly and operate the device only in accordance with its intended use. Anteral is not responsible for any misuse.

2.2. Improper Use

Any use other than the “intended use” is not permitted and is considered “misuse.”

Do not use the device in any application or component used in life-support devices, to operate nuclear facilities, or in other mission-critical applications or components where human life or property may be at risk.

Do not use the device in areas with explosion hazards or in corrosive environments.

2.3. Limitation of Liability

Anteral assumes no liability for damages caused by:

- Failure to comply with the product documentation.
- Misuse.
- Unauthorized repairs.
- Technical modifications.
- Use of unauthorized accesories.
- Inadequate installation.

2.4. Qualified Personnel

Any work, operation, or installation of the device must be carried out by qualified and authorized personnel.

Qualified personnel must have sufficient training and experience with the equipment to handle it properly and avoid any hazardous situations. They must also have adequate technical knowledge of the regulations and standards of each region to ensure the safe use of the equipment.

2.5. Basic Safety Notes

Carefully read all the safety and handling information provided below, as well as the operating instructions, before using the device to avoid injury or damage.

Keep this guide handy for future reference.

- **Optical radiation**



Class 1 laser product. The accessible radiation poses no hazard if viewed directly for up to 100 seconds. It may present a hazard to the eyes and skin in the event of improper use.

Do not open the housing. Opening the housing may increase the level of risk.

Applicable national laser safety regulations must be observed.

- **Mounting and electrical installation**



Risk of injury due to hot surfaces. Always switch off the device before operating it manually to allow it to cool down. Ensure there is sufficient space around the device to allow for heat dissipation.



Electrical voltage can cause serious injury or even death.

Only qualified electricians should carry out work on the electrical system.

The power supply must be switched off when making electrical connections.

Only connect a power source that complies with the technical specifications.

Follow the recommendations and requirements of the applicable regulations in your region.

3. PRODUCT DESCRIPTION

3.1. General Information

The uRAD Touch Wall system contains the following components:

- **Main device**: consists of a LiDAR system, an enclosure, and a metal mounting and adjustment system suitable for wall, ceiling, and floor installations.

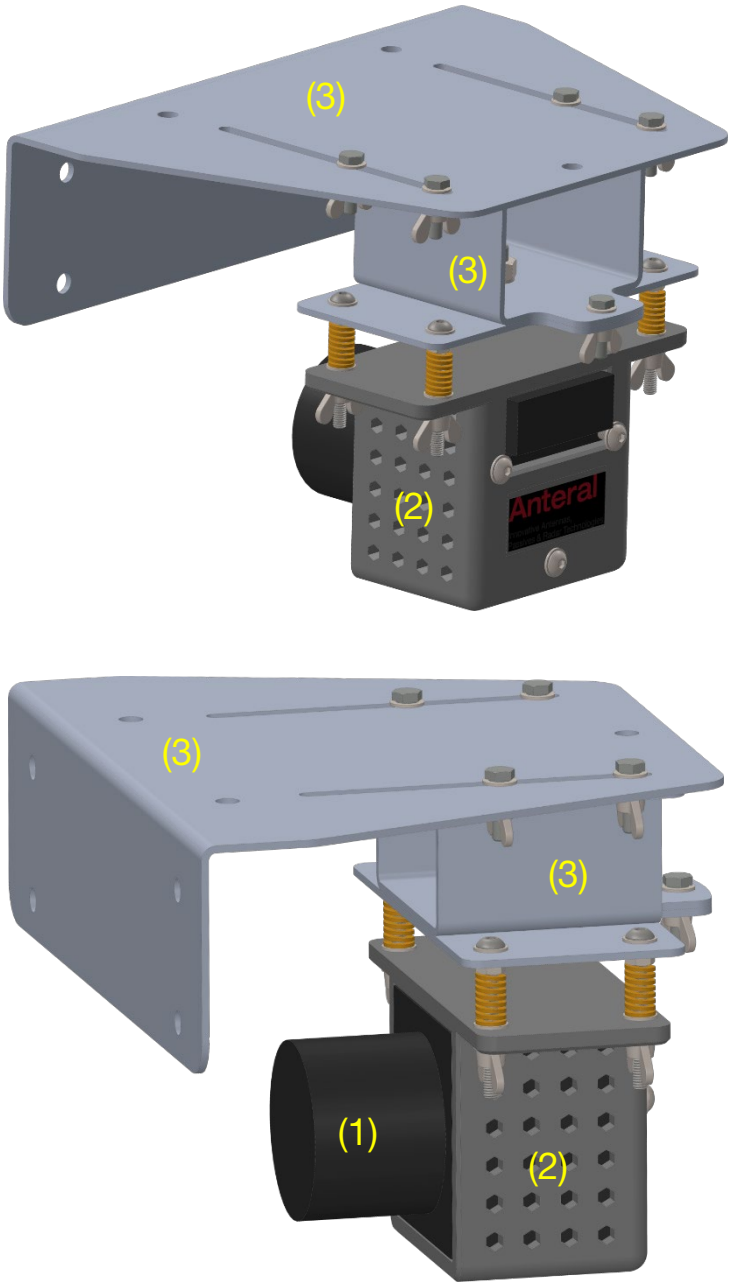


Figure 1. 3D model representing the system.

(1) LiDAR System.

(2) Plastic enclosure.

(3) Mounting and adjustment system.

- **Power cable**: The power cable must be connected to a source that provides the required supply voltage (9V DC to 30V DC). It is 5 meters long. One end features a 5-pin female M12 industrial connector, necessary to connect it to the LiDAR system. The other end has open wires so the user can attach the desired connector based on the power source to be used. **The brown wire corresponds to the positive voltage, and the blue wire to the negative voltage.**



Figure 2. Power cable

- **Ethernet network cable**: The Ethernet cable is a 5-meter, 4-wire cable suitable for data transmission between the LiDAR system and the computer. One end features a 4-pin male M12 industrial connector required for connection to the LiDAR system. The other end has a standard male RJ45 connector.



Figure 3. Ethernet network cable

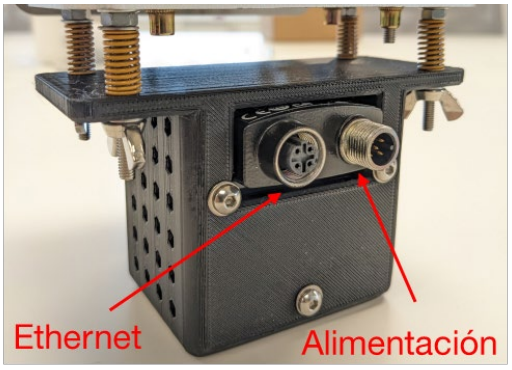


Figure 4. Connectors

3.2. Principle of Operation

uRAD Touch Wall is a system that enables any wall to become touch-sensitive. It works by creating a laser curtain parallel to the wall so that when a finger, hand, or object touches this laser curtain, the information is sent to a computer and translated into a gesture, similar to how a touchscreen operates.

The curtain is generated using a Class 1 LiDAR or laser system. It has a maximum coverage angle of 276°, an angular resolution of 0.25°, and a maximum range of up to 25 meters, depending on lighting conditions. The refresh rate is 25 Hz. The device can be installed either at the top or bottom of the wall.

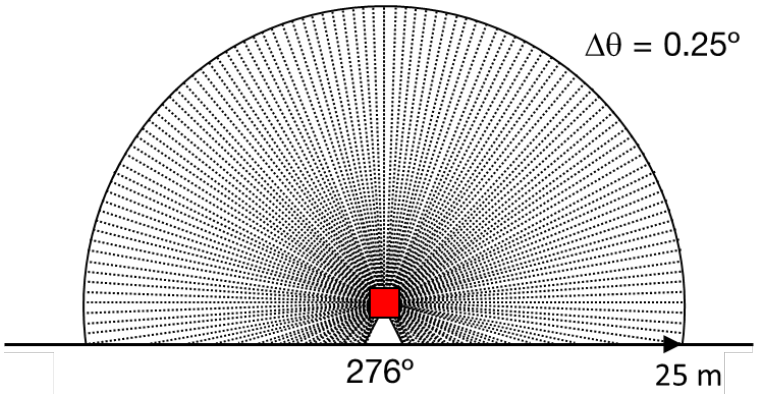


Figure 1. Representation of the laser curtain



Be especially careful to ensure that the laser curtain **does not shine directly into the eyes**, as it may cause permanent damage. The curtain is not harmful to any other part of the body.

The detection software translates all the points reflected by the laser curtain into gesture points or pointers. It is capable of detecting up to 20 different pointers. You will see how intuitively you can perform the most common touchscreen actions such as **clicking**, **dragging** objects, **zooming** in or out, **resizing** objects, **scrolling**, and more.

Gesture information is sent formatted according to the **TUIO** protocol, a standard and widely used protocol for applications involving gesture-based devices (https://www.tuio.org/).

Additionally, it is possible to define non-touch zones, as many as needed, of any desired size, where no pointer will be created. This can be very useful, for example, to prevent interaction in areas obstructed by objects like a door handle, a power outlet, etc.

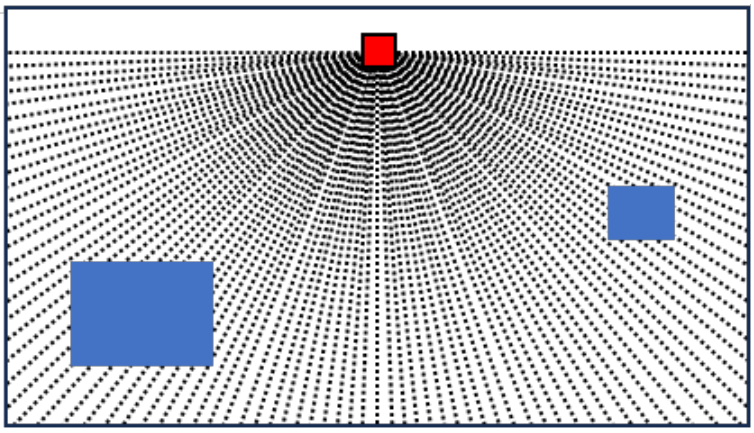


Figure 2. Configuration of two non-touch zones

4. SOFTWARE DESCRIPTION

The system software can be divided into two main components: the web interface for real-time data visualization and LiDAR configuration, and the software for receiving, processing, and sending TUIO data. Each of these provides different functions, which are described below.

4.1. Web Interface

Once the device is powered on, it can be accessed via the web. Access to the web interface is done through the IP address configured on the LiDAR, which is **192.168.0.1** by default, although the user can modify it according to their needs, as shown later.

Within the web interface, there are various options for configuring the LiDAR itself; however, it is not necessary to modify each one of them.

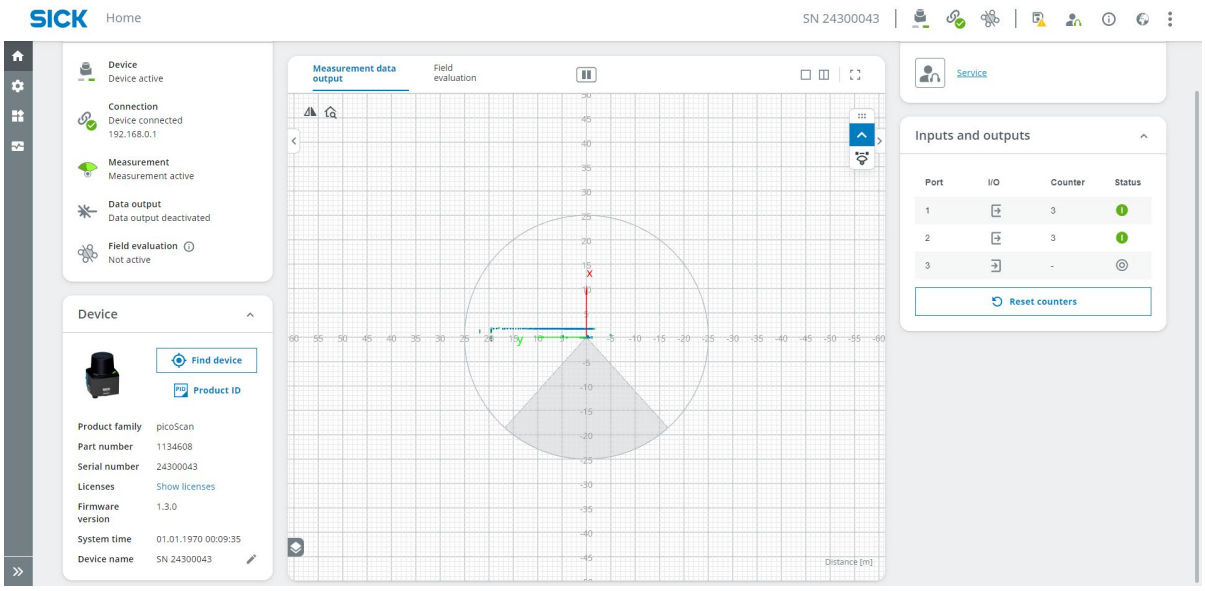


Figure 3. Main screen.

- **Top menu**

The top menu displays the operational status of the LiDAR. The first three icons indicate whether the device is active and connected .

The fourth icon is used to permanently save the configuration. In other words, even if the LiDAR is turned off and then powered on again, the configuration will remain unchanged if it has been saved.

Important: Once the entire system has been configured according to the needs of the scenario, **save the configuration to avoid losing the changes made** when the system is restarted or disconnected from the power supply.

The fifth icon is used to log in and make changes to the configuration. By default, you must log in as '**Service**' with the password '**Anteral**'.



Figure 4. Top menu.

- **Configuration menu**

You can access the configuration from the side menu.

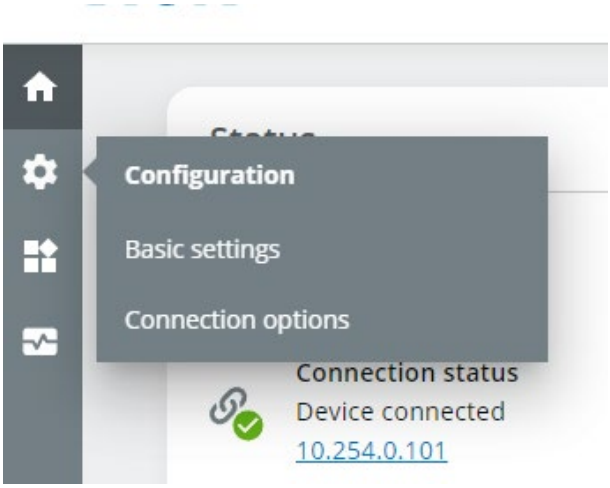


Figure 5. Configuration menu.

Within the configuration menu, two options are displayed: basic configuration and connection options.

– ***Basic settings***

Within the basic configuration, the first dropdown window refers to the scan frequency and sensitivity. It should be set to **25Hz & 0.25º**, and sensitivity to **Optimized for low remission**. The **Autostart measurements** option must also be **enabled** for automatic startup, along with the LED option to visually indicate whether the device is operating or not. In the **Measurement** section, enable only the first option, which corresponds to the IMU data window and serves only as a reference.

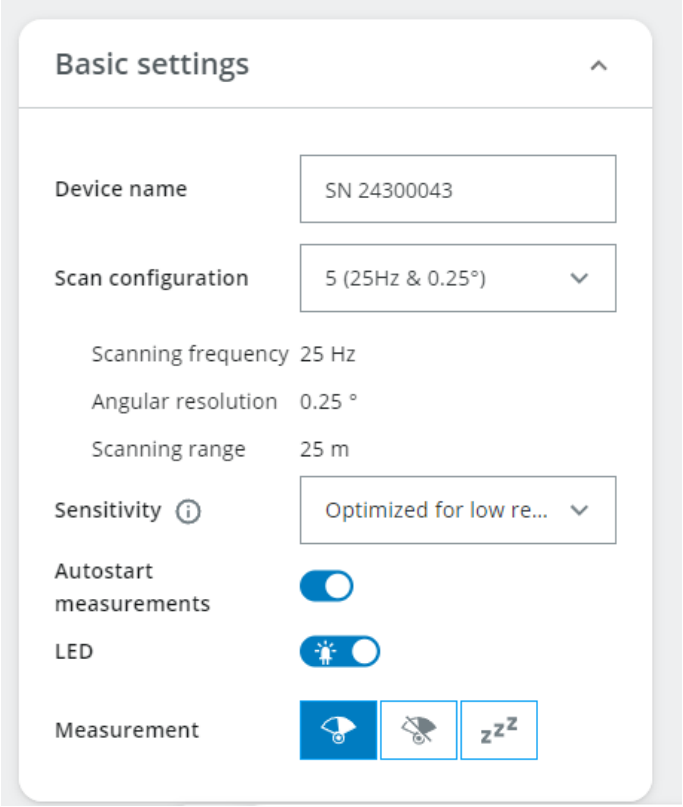


Figure 6. Basic configuration.

The following window corresponds to the different available filters. By default, all filters should be **disabled**. If you want to eliminate small reflections that may appear, you can enable the **Fog Filter** and **Particle Filter**, although for this use case, it will not make a significant difference. It is important to **set** the **Echo Filter** to **All echoes** and not to activate the Moving Average Filter.

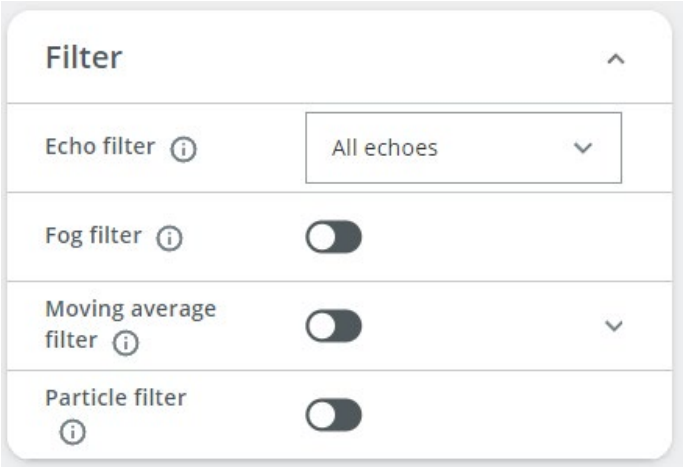


Figure 7. Filter menu.

– ***Connection options***

This is the screen where you can modify the IP address and the type of address assignment for the web service.

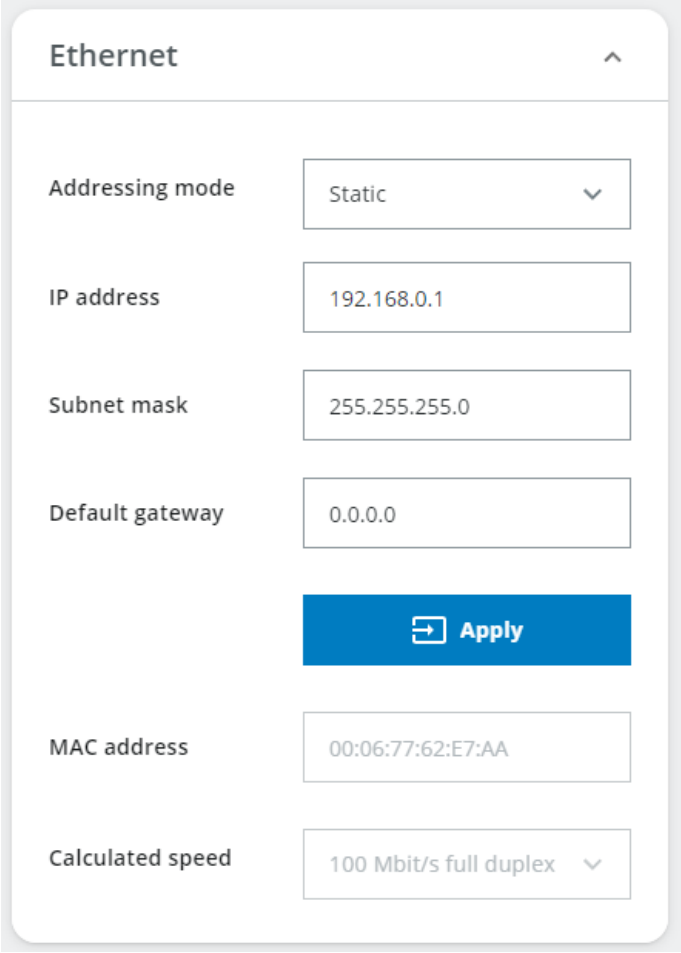


Figure 8. Ethernet menu.

- **Application menu**

In the side menu, within the application menu, two options are displayed: data output and inputs and outputs.

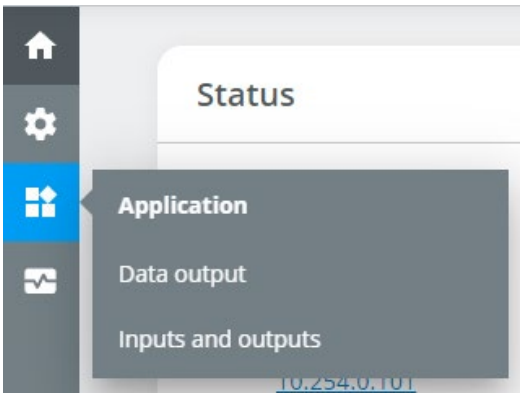


Figure 9. Application menu.

– *Data output*

In the first window, Measurement Data Output, you can modify the data output from the LiDAR. The format must remain set to **Compact**, but the IP address and port can be changed.

Important: always **enable** the **Start/Stop Data Output option.**

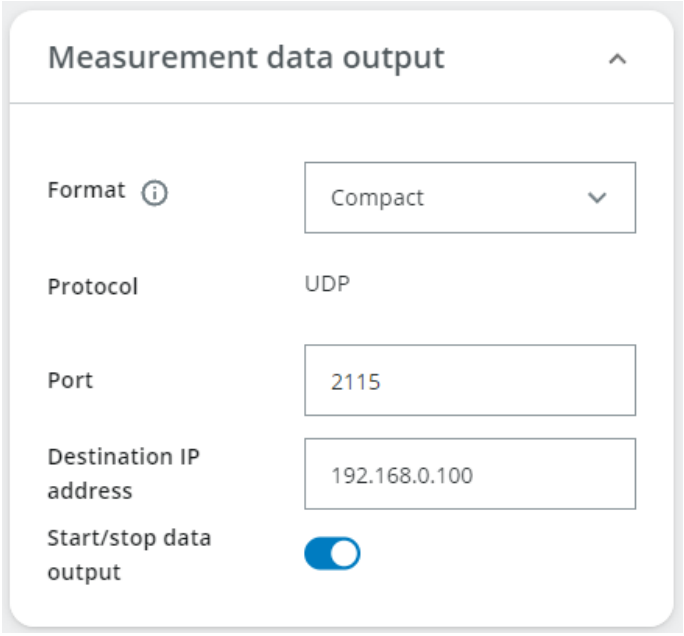


Figure 10. Measurement Data Output menu.

The following window refers to the IMU data, which must be disabled, as they are not required for the application.

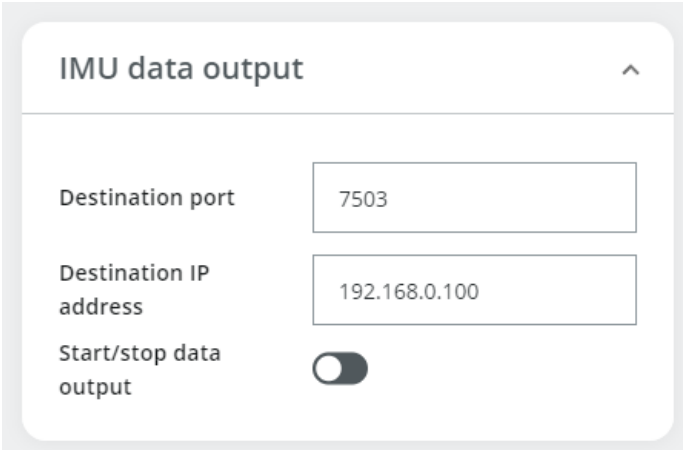


Figure 11. IMU Data Output menu.

Similarly, the data reduction options must be **disabled**.

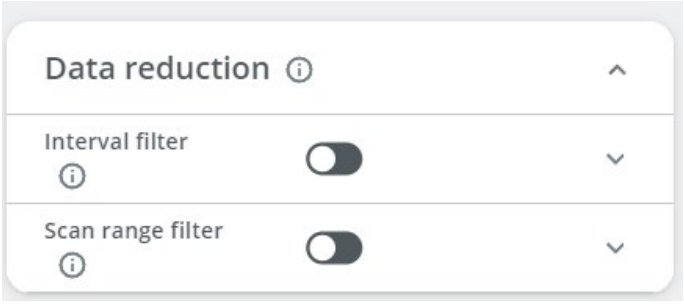


Figure 12. Data Reduction menu.

In the following window, you will find the configuration for the region of interest. This region defines the LiDAR's detection area. It can be adjusted along both the X and Y axes.

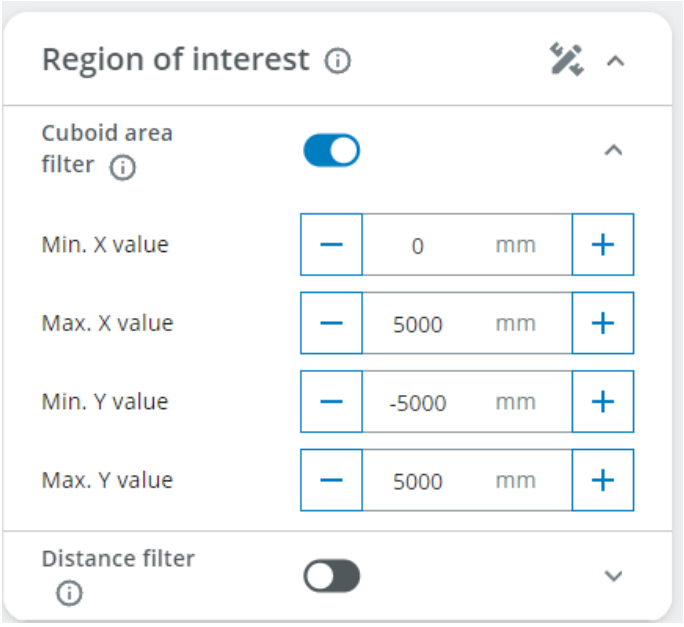


Figure 13. Region of Interest menu

The region of interest can be viewed in real time from the web application itself. In the following image, the region of interest is marked with a yellow rectangle. Important: the vertical axis is X, and the horizontal axis is Y.

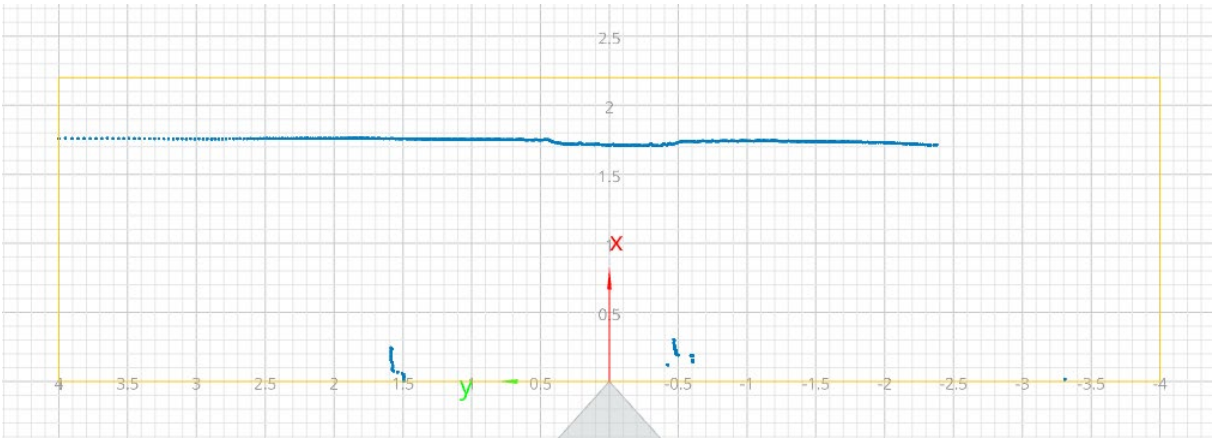


Figure 14. Real-time point visualization.

This visualizer is used during installation to adjust the tilt of the device. More details are provided in the chapter on the installation procedure.

– **Inputs and outputs.**

No configuration is needed in this section.

4.2. TUIO Program

Minimum Requirements

Operating system	Computer running 64-bit Windows 10/11
CPU	2 cores / 4 threads, >2 GHz; 4 cores, >2.5 GHz recommended
Architecture	Intel/AMD x64
RAM 8GB	8GB
Storage	2 GB
Network	100Mbps Ethernet

Installation

The program must be installed using the **Touch-Wall-App_Installer** installation file provided. The installer guides the user through the different stages of installation, notably the installation path, which by default installs the application in Program Files\Anteral\TouchWall.

The different installation screens are shown below.

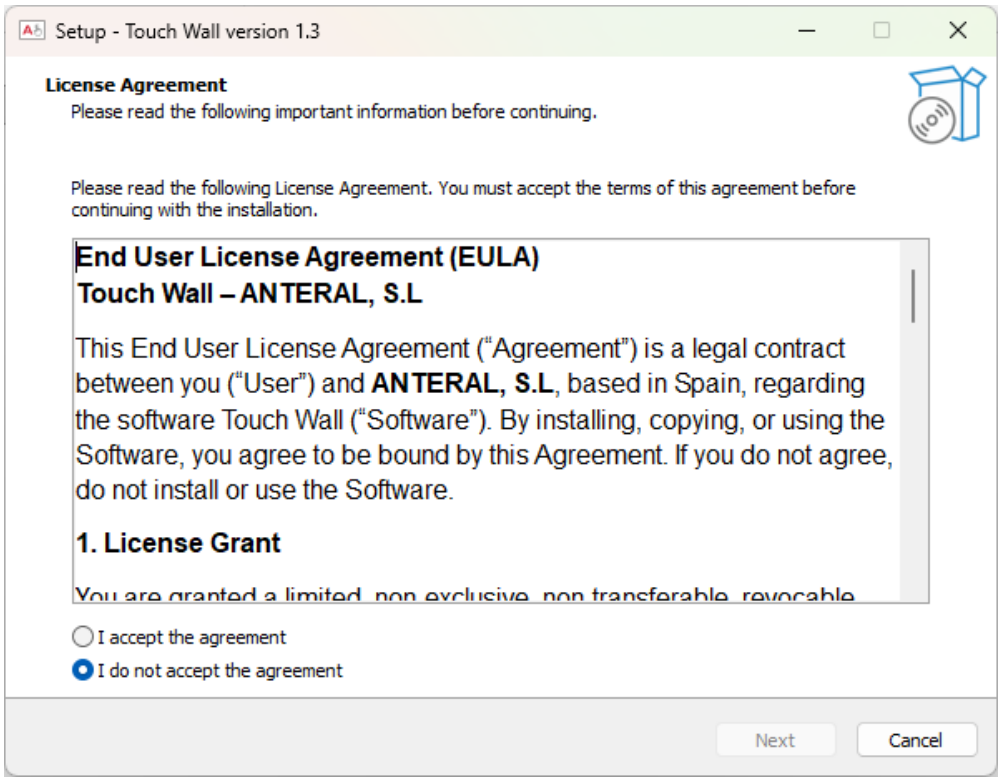


Figure 15. License agreement.

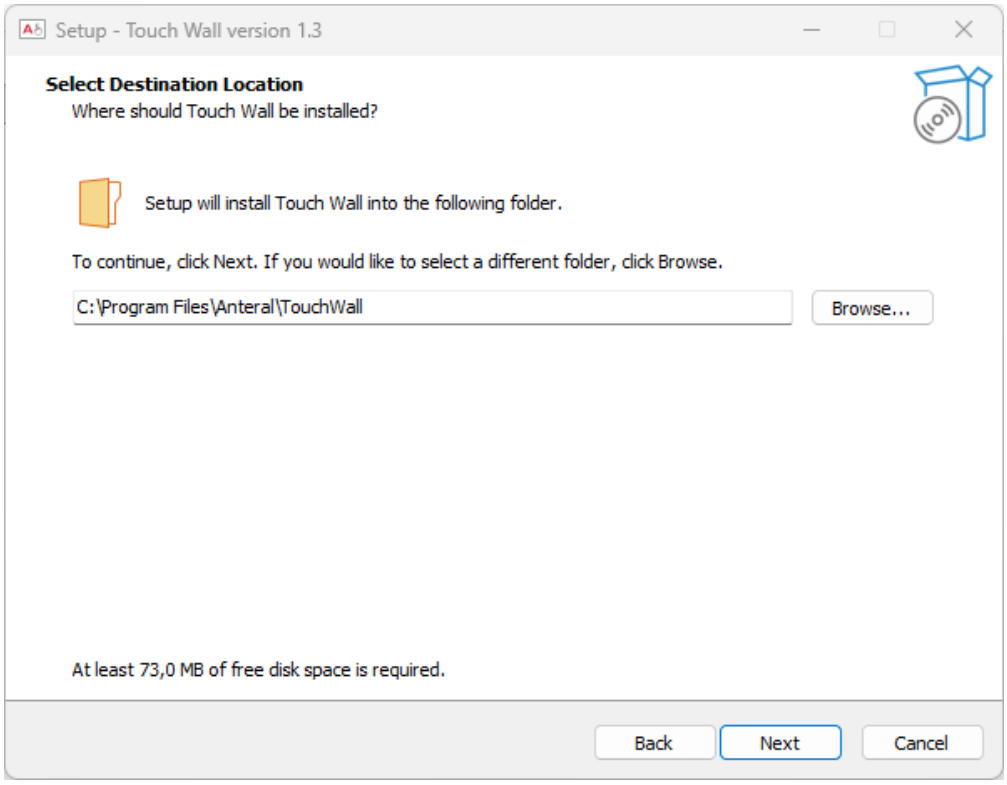


Figure 16. Destination folder selection.

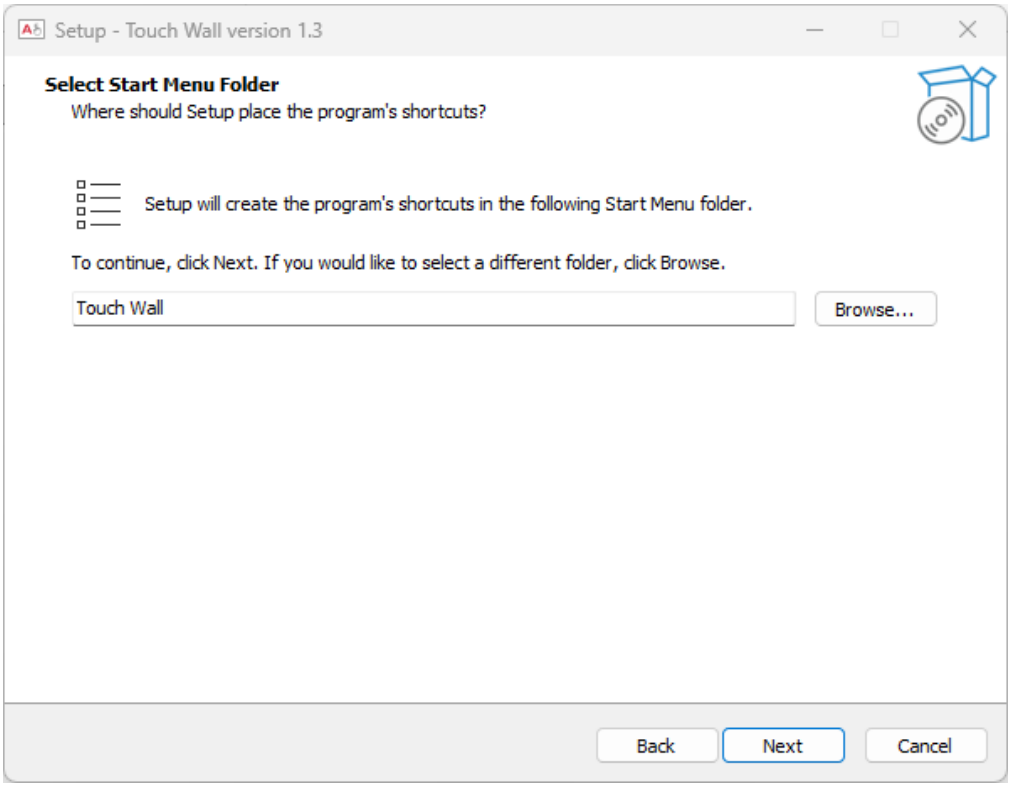


Figure 17. Shortcut selection.

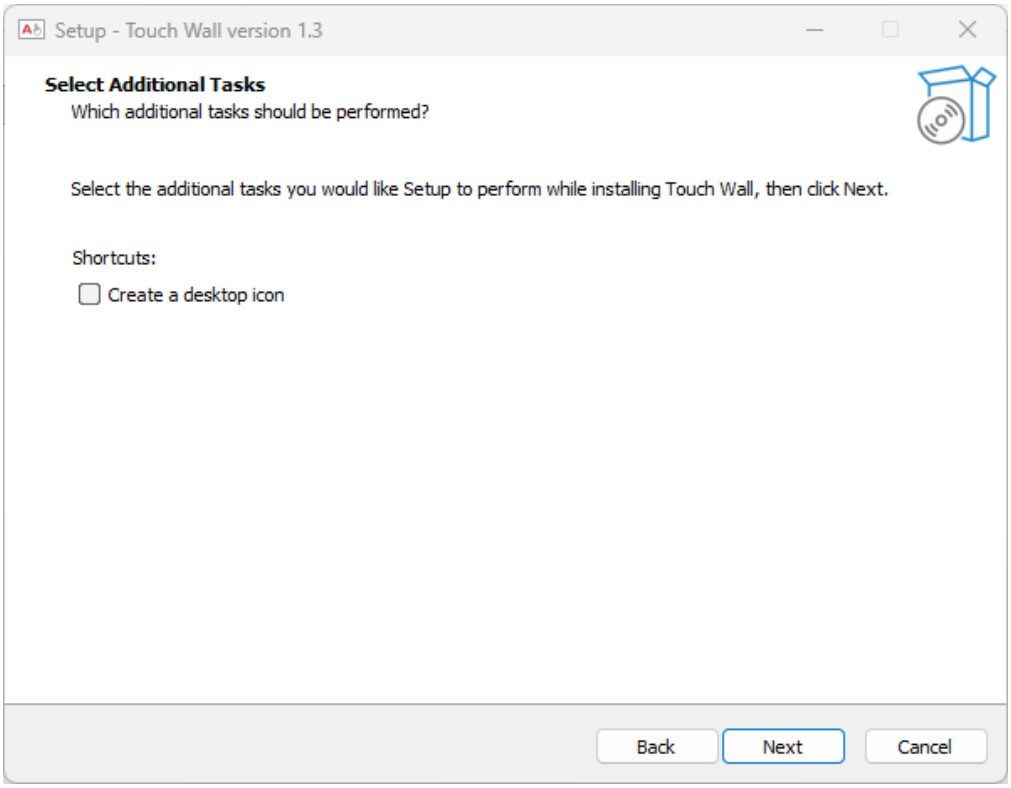


Figure 18. Direct access selection.

Activation

To use the software, a license key is required. This key is only needed once, the first time the program is started. Once validated, it is stored locally and does not need to be entered again. The process is very simple: when starting for the first time, a window opens asking for the key:

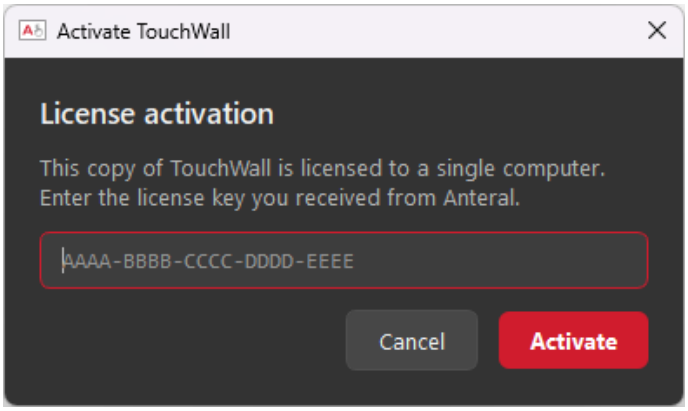


Figure 19. License introduction message.

Once validated, it is stored in encrypted form on the computer, allowing the license to be activated transparently in the future without user intervention. The main program is displayed as follows:

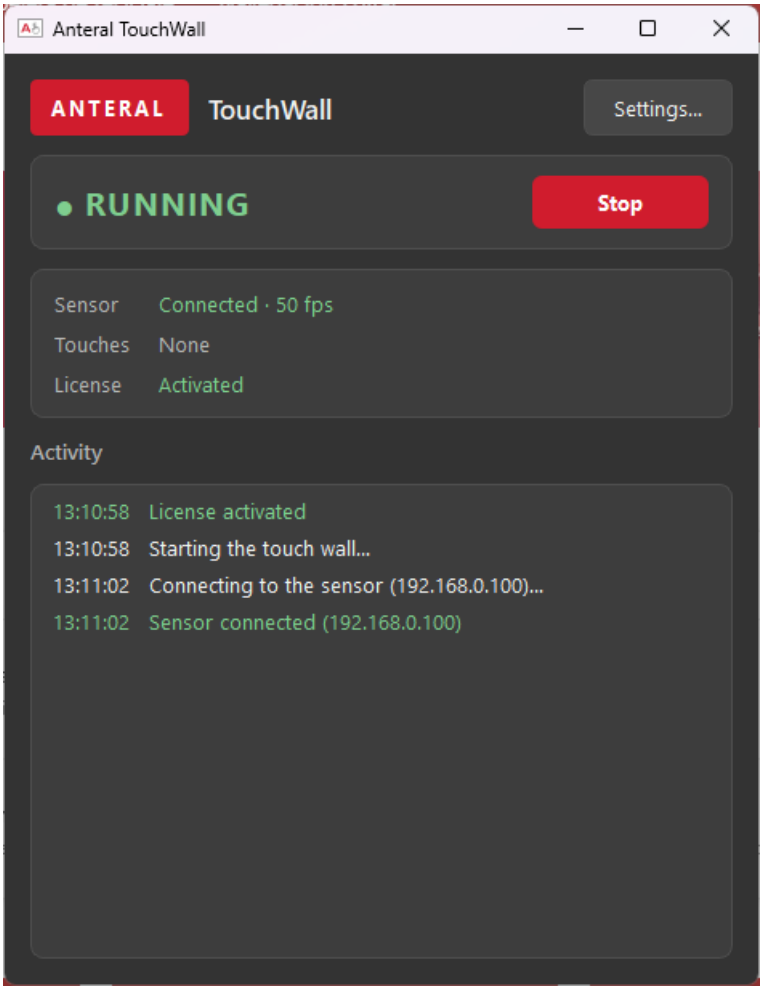


Figure 20. Initial activation message after the license has been activated for the first time.

Scenario Configuration

The general scenario and network configuration is performed using the program's Settings button, which opens the following window:

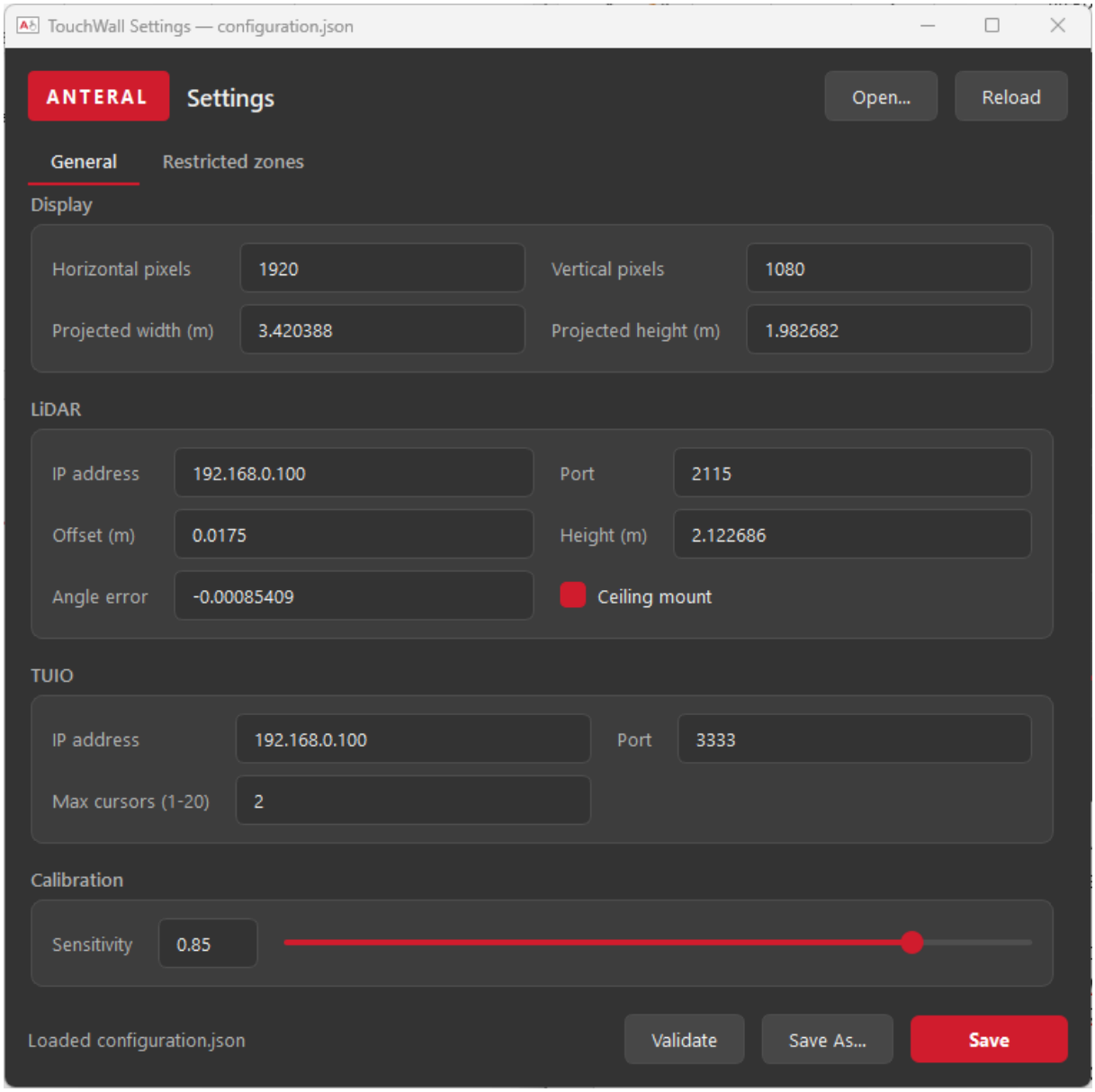


Figure 22. General settings screen.

The configuration parameters are saved in the json file as:

- *Horizontal pixels* : number of pixels of the projected area along the horizontal axis.
- *Vertical pixels* : number of pixels of the projected area along the vertical axis.
- *Proyected horizontal dimension* : horizontal dimension of the projected area.
- *Proyected vertical dimension*: vertical dimension of the projected area.
- *Lidar offset* : distance between the LiDAR and the center of the **projected area** on the horizontal axis. Positive values correct when the device (viewed from the front) is to the left of center, and negative values correct when it is to the right.
- *Lidar ip* : IP address of the LiDAR; it must match the one used by the system sending the data.
- *Lidar port* : data transmission port, default is 2115.

- *Angle error* : error in the LiDAR mounting angle. Positive values indicate an angular error to the right, and negative values to the left.
- *Lidar height* : height of the LiDAR relative to the bottom of the projected area.
- *Ceiling mount* : boolean option (0 or 1) indicating whether the device is mounted on the ceiling. A value of 0 is for floor mounting, and 1 for ceiling mounting.
- *Tuio ip* : IP address to which TUIO data should be sent—this should typically be the PC running the program.
- *Tuio port* : port for sending TUIO data, default is 3333 (standard for the TUIO protocol).
- *Max cursors*: the maximum number of TUIO cursors generated.
- *Sensitivity* : range from 0 to 1. The higher the value, the faster the response due to less smoothing. The lower the value, the slower the response as smoothing increases. Recommended starting value: 0.85.

The following figure shows the screen dedicated to defining restricted areas:

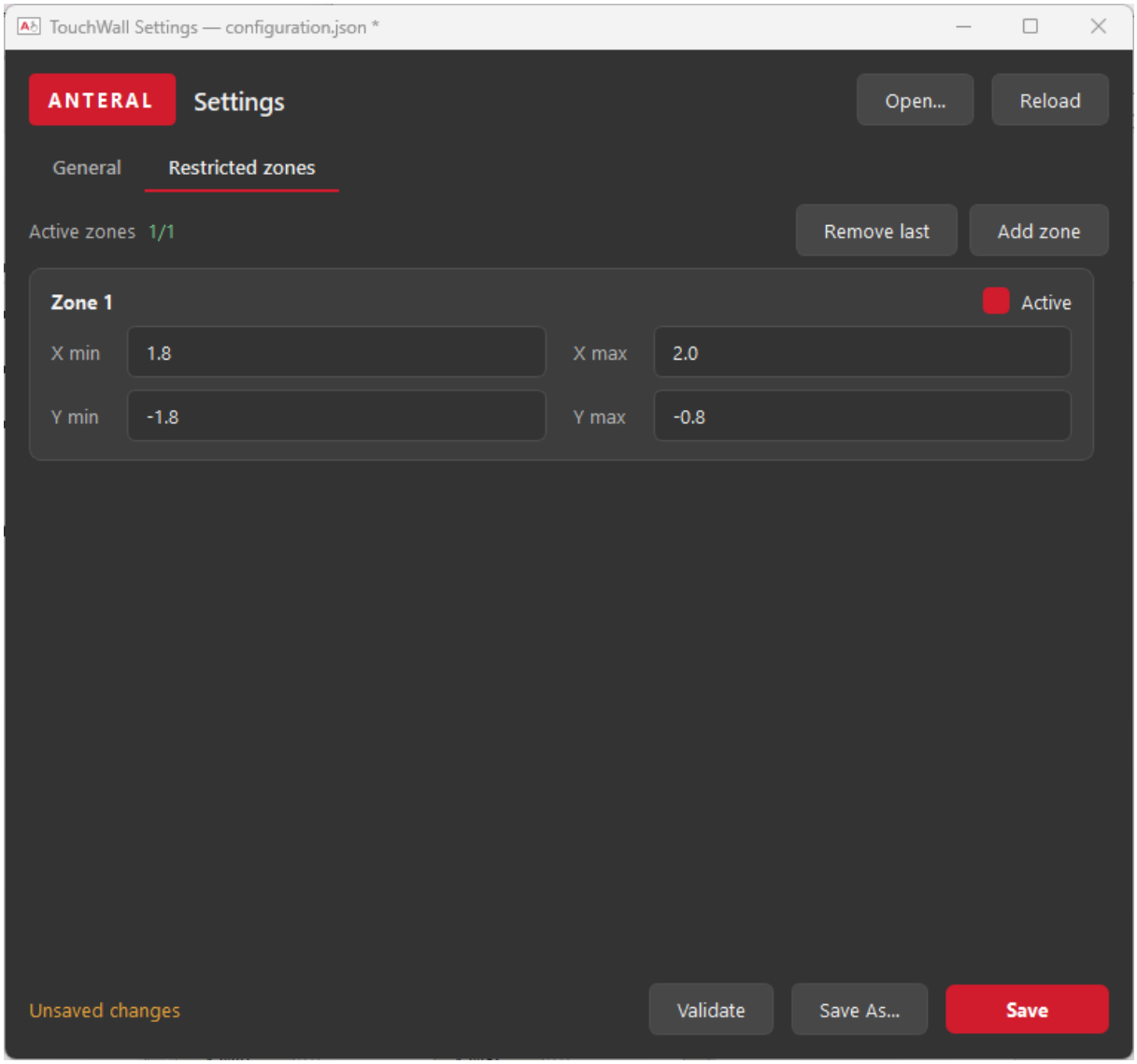


Figure 23. Restricted zones screen.

Within this screen, there are five different parameters for each restricted area:

- active: Boolean variable that defines whether that zone is active or not
- *x_min* : minimum x-axis coordinate of the first restricted region.
- *x_max* : maximum x-axis coordinate of the first restricted region.
- *y_min* : minimum y-axis coordinate of the first restricted region.
- *y_max* : maximum y-axis coordinate of the first restricted region.



All units for dimensions and coordinates are in **meters**. The **origin of the coordinate** system is located at the position of the LiDAR. In this case, the **X-axis** is the **vertical** axis and the **Y-axis** is the **horizontal axis** (see Figure 14 for reference). For the values of the restricted regions, use the values and coordinate system provided by the interface itself.

By default, the application loads the configuration file located in the program's default installation directory. However, it also allows other configuration files to be loaded if the program was installed in a different location.

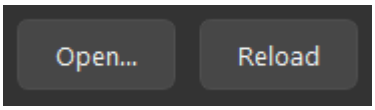


Figure 23. Top menu.

The top menu allows you to load or reload a configuration file.

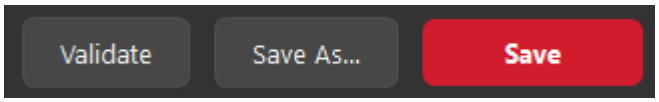


Figure 24. Bottom menu.

The bottom menu allows you to save and validate the file.

Below are two images that represent some of these variables within a typical scenario and how they relate to the configuration parameters.

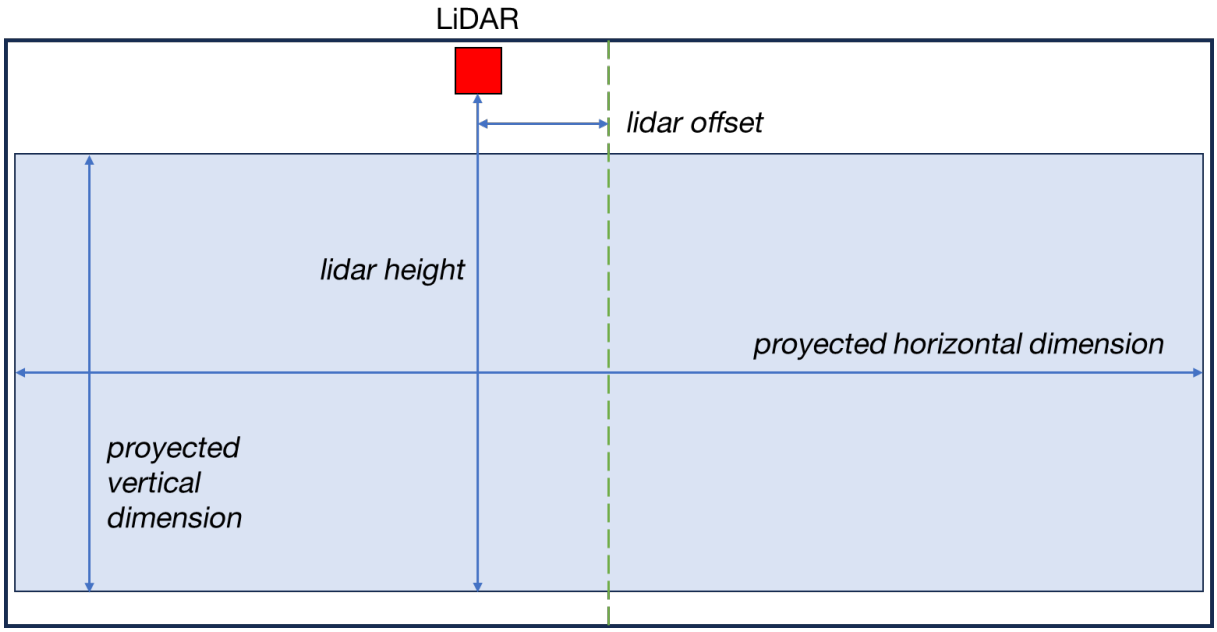


Figure 25. Illustration of variables for scenario configuration.

First, measure the distance from the LiDAR to the center of the projected area. Enter this value in the lidar_offset variable. Similarly, measure the distance from the LiDAR to the lower edge of the projected area and enter that value in the lidar_height variable. Run the application and create a pointer directly below the LiDAR. If you notice that the pointer still has an error along the horizontal and/or vertical axis, adjust the variables accordingly.

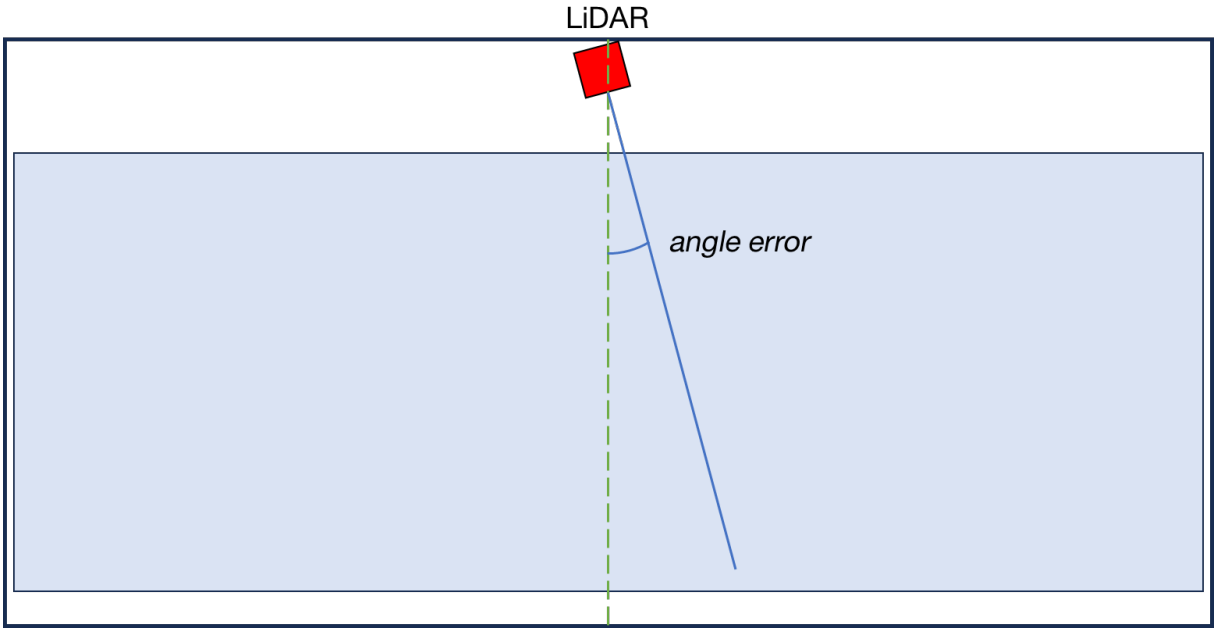


Figure 26. Illustration of the Angle Error variable.

It is possible that even if the variables lidar_offset and lidar_height are properly adjusted, the pointer may still show a slight deviation. This is because the system has not been positioned perfectly parallel to the ceiling or floor. You can correct this angular error using the configuration variable angle_error.

4.3. WINDOWS program for mouse event emulation

This second software is used to directly emulate mouse events in Windows as if a mouse peripheral were connected to the PC. This allows you to interact naturally with applications running in Windows.

To use this application, run the **TouchWall_windows.exe** file. If you need to run it as an administrator, right-click the file and select **Run as administrator**.

By default, the application listens for messages on **UDP port 3333**. Ensure that the port in the TouchWall application is configured to send TUIO data to this same port. If not, you can run the application from the command line to change the listening port. Here is an example command:

TouchWall_windows.exe --port 3334

The application recognizes the following gestures:

- **Tap (Left Click):** briefly touch the surface and lift your finger.
  - How to: tap and release quickly.
  - Movement limit: the finger must remain almost still.
  - Result: left mouse click at the tap position.

- **Double Tap (Double Click):** two quick taps at the same point.
  - How to: tap once, then tap again in the same location.
  - Timing: based on your personal operating system settings.
  - Location: the second tap must be very close to the first.
  - Result: left double-click (to open files, select words, etc.).

- **Press and Hold (Right Click):** touch the surface and keep your finger still.
  - How to: touch and hold without moving your finger.
  - Required time: hold for at least 600 ms.
  - Movement limit: the finger must remain almost still.
  - Result: right mouse click.

- **Drag (Click and Drag):** touch, hold briefly, and then move your finger.
  - How to: place your finger on the surface, wait a moment (~100 ms), and then slide it.
  - Result: mouse button is pressed at the starting point, the cursor follows your finger, and the mouse button is released when the finger is lifted.

- **Scroll:** place two fingers—separated by at least ~40cm—on the surface at the same time and slide them up or down together.
  - How to: two fingers moving in the same vertical direction.
  - Result: mouse wheel scroll at the midpoint between your fingers.
  - Scroll Up: both fingers slide upward.
  - Scroll Down: both fingers slide downward.

- **Pinch / Expand (Zoom):** place two fingers—separated by at least ~40cm—on the surface and bring them closer together or move them further apart.
  - How to: two fingers changing the distance between them.
  - Pinch (fingers closer): zoom out.
  - Expand (fingers further apart): zoom in.
  - Result: native Windows touch zoom event.

5. INSTALLATION

The mechanical system is composed of various components that allow the solution to be mounted on the wall, ceiling, or floor, as well as independent adjustment along all axes.

5.1. Mounting

Several mounting options are provided: wall mounting (4 holes) and floor or ceiling mounting (3 holes). Each option is based on **holes with a diameter of 6.4 mm**. The holes intended for direct wall mounting are shown in red, while the ones for floor or ceiling mounting are shown in blue.



It is important to leave enough space between the system and the ceiling/floor to allow for adjustment of the upper screws.

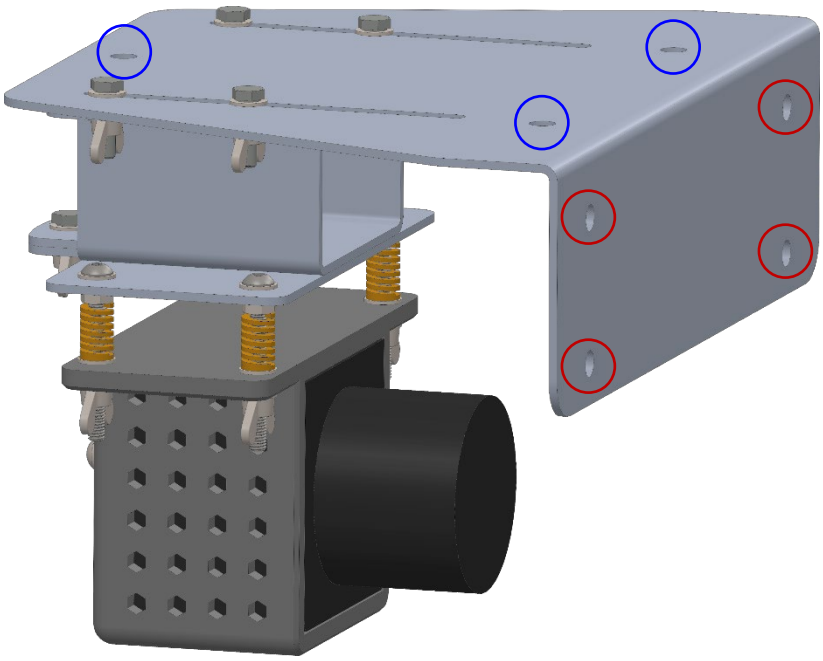


Figure 27. Mounting.

For floor or ceiling mounting, it is necessary to use three spacers to bridge the distance created by the heads of the upper adjustment screws. These spacers are not included with the product.

5.2. Distance to the Wall

The mechanical system includes a mechanism to adjust the distance perpendicular to the wall. It consists of two rails along which the screws marked in red can slide. These four screws, in turn, move the entire lower part of the mechanical structure as a single unit. To adjust this axis, it is necessary to loosen the screws from below using the knobs.



The recommended distance from the front of the LiDAR to the wall **is two to three centimeters**, although it may vary depending on the scenario.

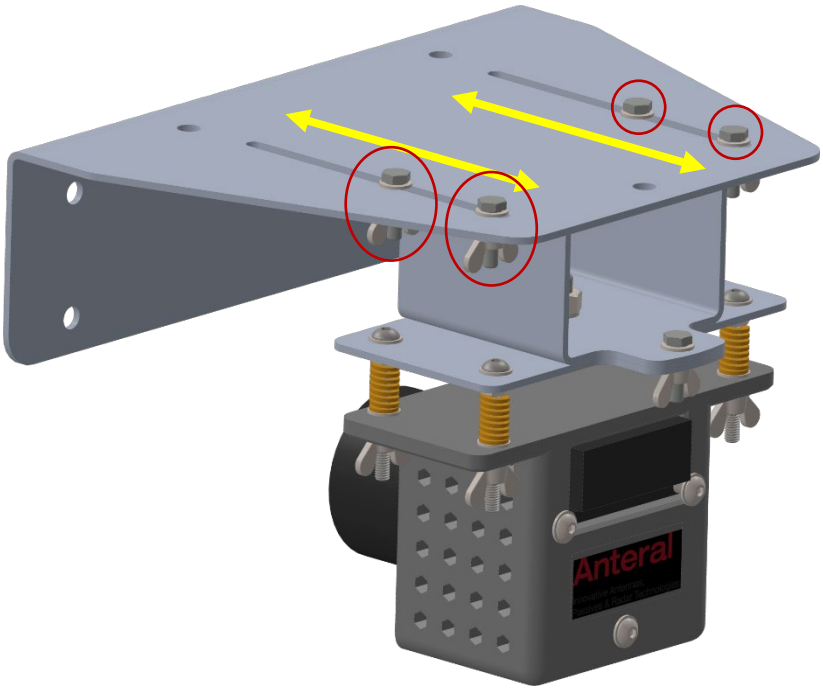


Figure 28. Distance adjustment.

5.3. Rotation

To rotate the system, first loosen the knob marked in red. The system rotates around a central axis indicated by the rotation screw, marked in blue. In general, it is not necessary to loosen the rotation screw, as it has just the right amount of play. If you find the rotation screw is too tight, you may loosen it slightly. Once the desired rotation angle is set, tighten the knob again. **Position the system as parallel to the wall as possible.**

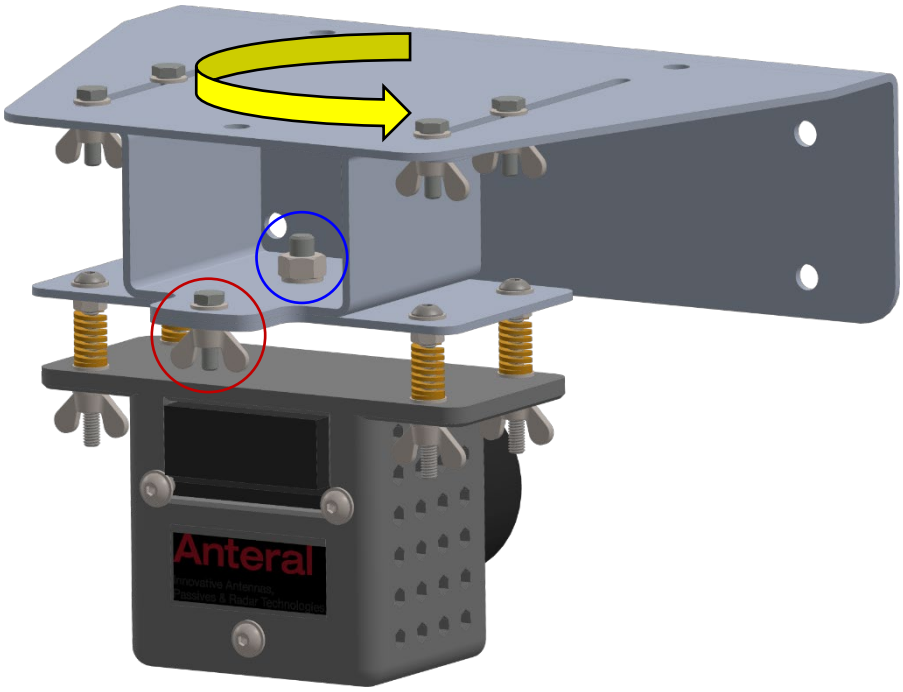


Figura 29. Ajuste de rotación.

5.4. Leveling

Leveling allows for fine adjustments to properly align the LiDAR with the environment and its mounting position. For this, it is equipped with four knobs that operate independently. By rotating them, the necessary movements can be made to level the LiDAR as accurately as possible, thereby reducing error.

The adjustment of the knobs allows control over the **lateral pitch** and the **front pitch** toward the wall. Once the desired positioning is achieved, there is no need to tighten or lock anything in place.

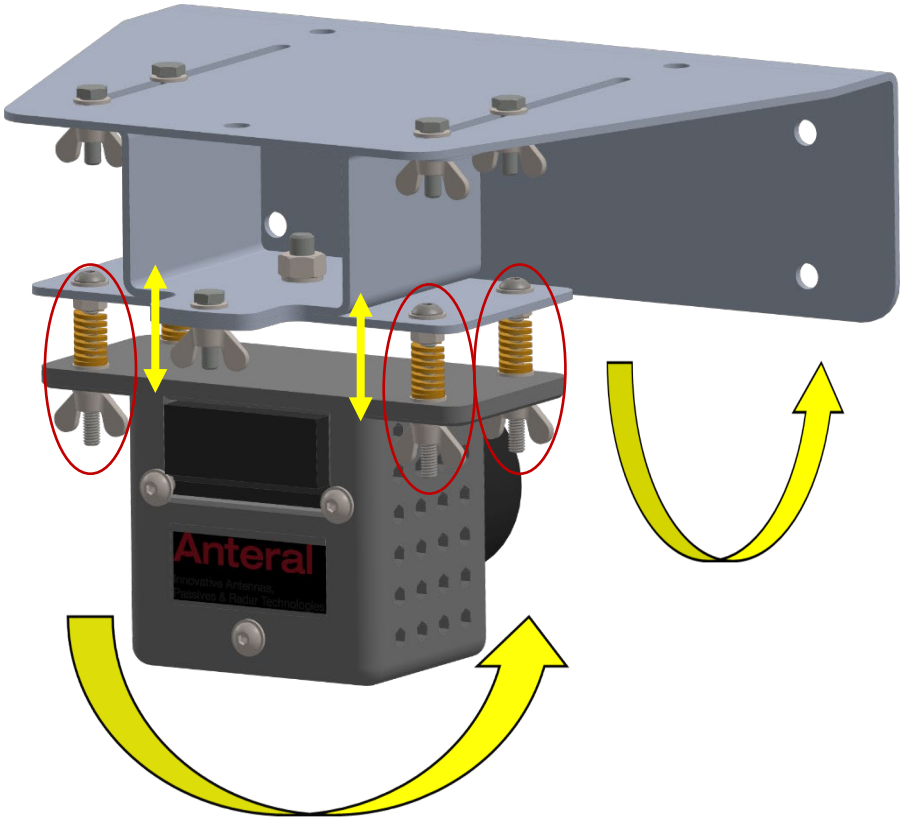


Figure 30. Tilt adjustment.

6. INSTALLATION PROCEDURE

Follow the steps below for correct installation and adjustment of the system.

1. Anchoring

First, decide on the mounting point for the system—wall, floor, or ceiling—and then proceed to anchor it using the provided holes.

2. Spacing

Leave a gap of two to three centimeters between the LiDAR and the wall. To do this, use the four upper screws. First, loosen the knobs and move the structure along the rails. Once it is properly positioned, tighten the screws to fix the distance from the wall.

3. Rotation

Adjust the rotation with the help of the **graphical interface**. To do so, first loosen the four screws related to the rotation system.

In the graphical interface, **define a viewing area larger than the dimensions of the projected zone**. The goal is to capture the side and top/bottom edges—that is, both the floor/ceiling and the walls.

View the side edges in the web interface. Rotate the LiDAR while observing the reflected points. When rotating, the beam may hit the front wall before reaching its edge. The goal is to adjust the rotation to avoid this and ensure that the beam reaches the edge of the front wall on both sides. Once properly adjusted, both side walls and their outlines should be visible at the sides of the displayed area.

4. Tilt

Adjust the tilt using the **graphical interface**. First, adjust the **front pitch** so that the system is as parallel to the wall as possible. Loosen or tighten the tilt knobs depending on the desired adjustment. The goal is to set the tilt so that the floor/ceiling just begins to appear in the visualization. With a steep tilt toward the wall, the reflection of the wall will appear at a shorter distance than the floor/ceiling. However, with a steep tilt away from the wall, the floor/ceiling will appear but at a greater distance than the actual one.

For example, if the distance between the system and the floor is 2.5 meters, and the system is tilted toward the wall, a line will appear at a distance shorter than 2.5 meters, corresponding to the wall reflection. On the other hand, if it is tilted too far away from the wall, the reflected floor will appear at a greater distance, but it will not be the floor directly beneath the system.

Once the front tilt is adjusted, proceed to adjust the **lateral pitch**. To do this, observe the side edges and adjust the knobs so that both edges and the floor/ceiling appear perfectly straight.



Once all adjustments have been made, don't forget **to define a slightly smaller display area in the graphical interface so that all points corresponding to the side walls and floor/ceiling disappear** and are not interpreted as hand detections.

7. CALIBRATION

Once installation is complete, a calibration tool is provided to make the device as accurate as possible. This tool automatically guides the user through adjusting the scenario dimensions shown in the configuration.

Before starting the calibration process, it is **recommended that you configure the scenario as accurately as possible and then launch the calibration tool**. This will ensure the best possible calibration.

Once the tool is launched, you should see the main menu, where several options appear:

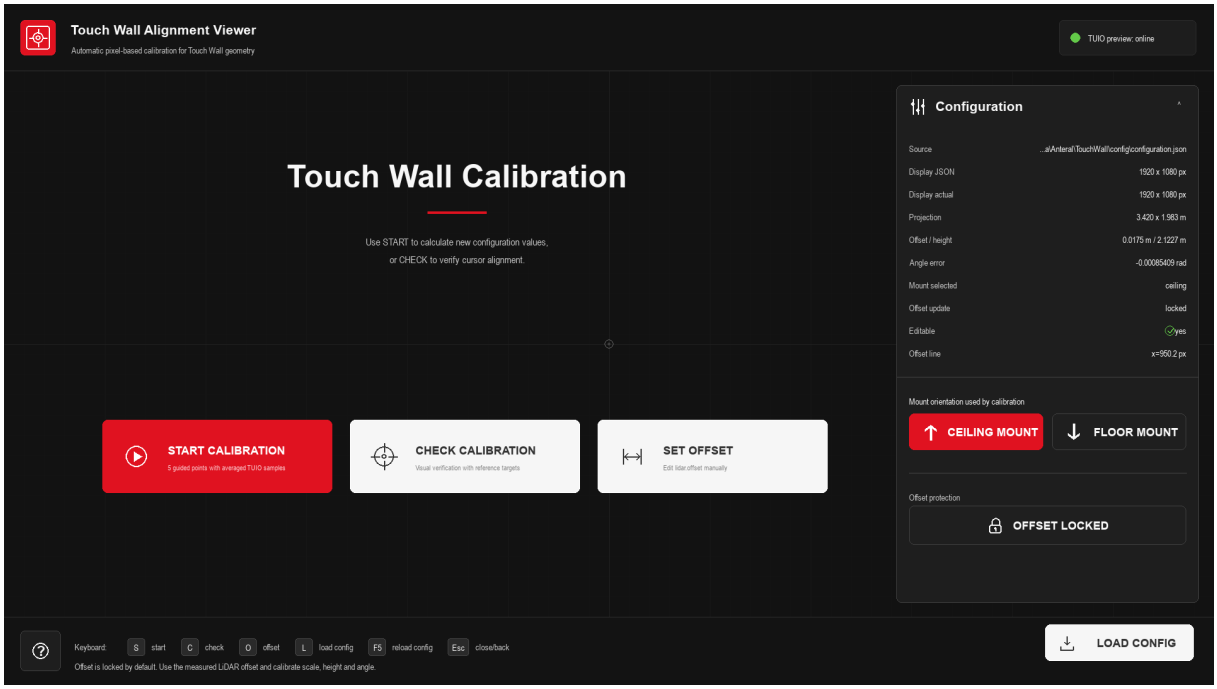


Figure 31. Calibration application main screen.

On the right-hand side of the application, you will see:

- The TUIO event connection status at the top.
- The scenario configuration values.
- The option to select floor or ceiling mounting.
- An option to lock or unlock the offset value. This determines whether the offset value is taken into account during calibration or kept fixed at the specified value. It is recommended that you keep it locked and set the offset manually with the help of the application. Unlocking it is only recommended when greater accuracy is required after performing several calibrations.

Three buttons are displayed in the center:

- *Start Calibration*: This operating mode guides you through the calibration process. Several circles will appear on the screen. Touch and hold each circle for a few seconds. The circle will then disappear, and another one will appear elsewhere on the screen. This process is repeated five times. When finished, the application will display the new values and compare them with the previous ones, allowing you to save the new configuration.

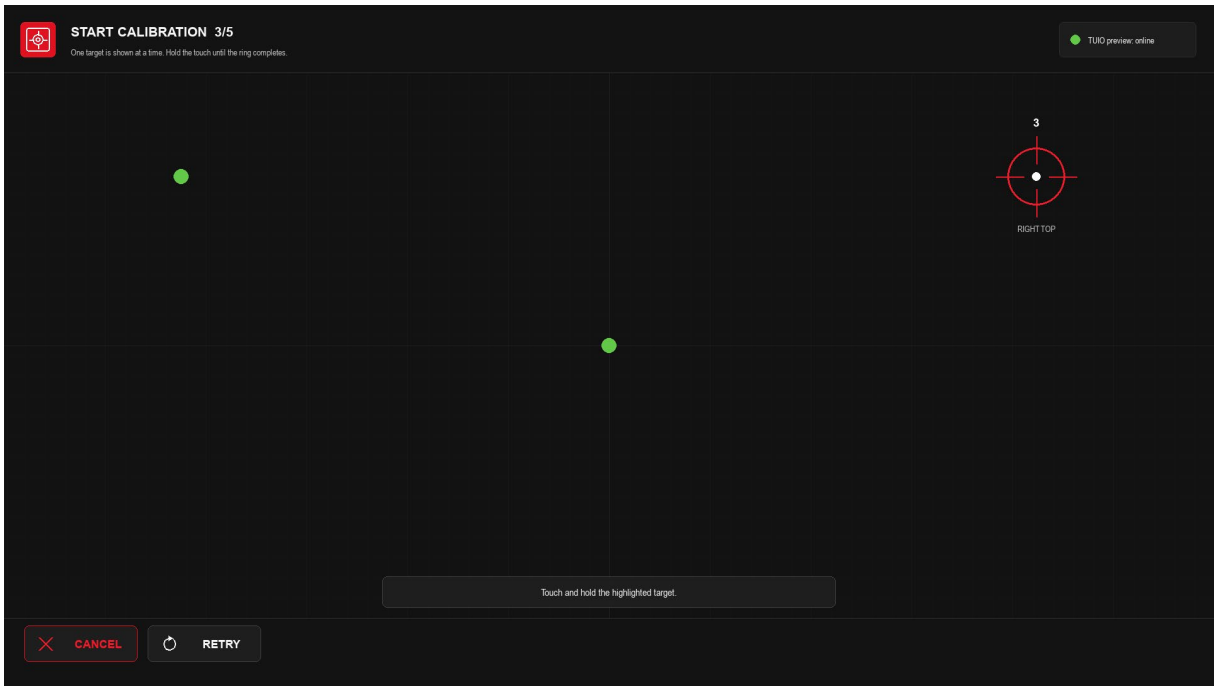


Figure 32. Calibration mode.

Depending on the previous scenario configuration, you may need to perform the calibration process several times. If the calibration remains significantly misaligned after three attempts, review the scenario configuration.

– *Check calibration*: This mode allows you to check the system's accuracy. Five points will be displayed. You can point to the center of each one with your finger to see the error in pixels.

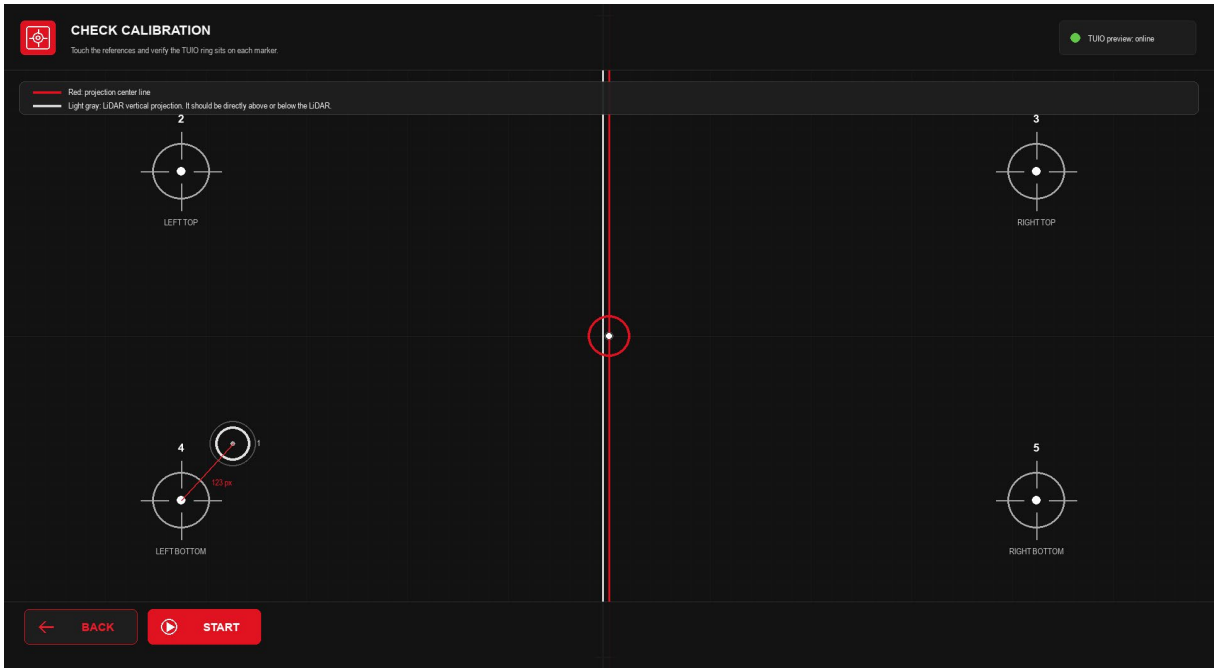


Figure 33. Check calibration mode.

The difference between the reference value—in this case, area number four—and the cursor position can be observed. In this example, guided calibration using the previous operating mode would be required.

The red and white lines displayed in the center represent the physical center of the projected area and the LiDAR position, respectively.

– *Set offset*. This final mode allows you to define the LiDAR offset relative to the center of the area more accurately. This is one of the main parameters, and an error of just a few centimeters can affect all other measurements.

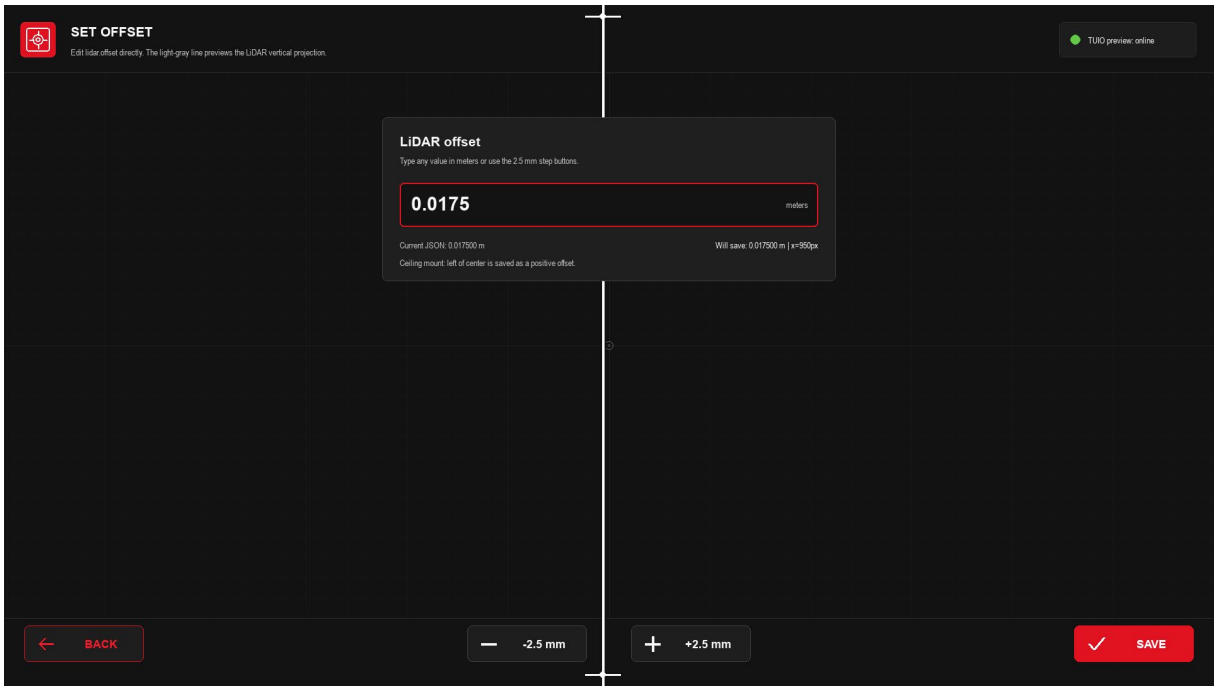


Figure 34. Offset mode.

In this operating mode, adjust the offset value so that the device is aligned with the white line shown on the screen. Center the line on the device as accurately as possible. This value is locked by default.

The calibration process should be performed as follows:

– Check the scenario values and select whether the device is mounted on the floor or ceiling.
– Set the offset value using Set Offset mode. Make sure the white line is positioned directly below or above the device.
– Perform a calibration using Start Calibration mode. Once complete, review the new values and accept them if they are reasonable.
– Use Check Calibration mode to verify the accuracy. If the generated cursors fall within the defined areas, the calibration has been successful. Otherwise, another calibration pass may be necessary, in which case repeat the previous step.

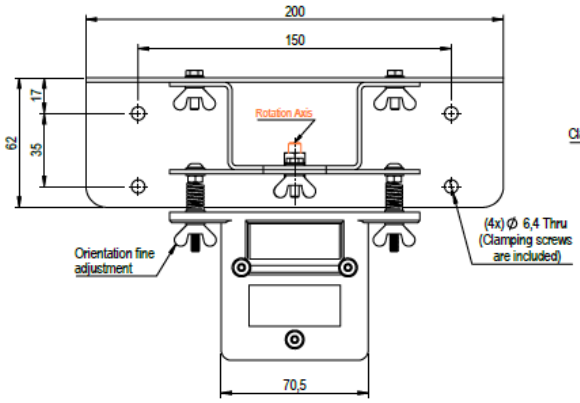
8. TECHNICAL SPECIFICATIONS

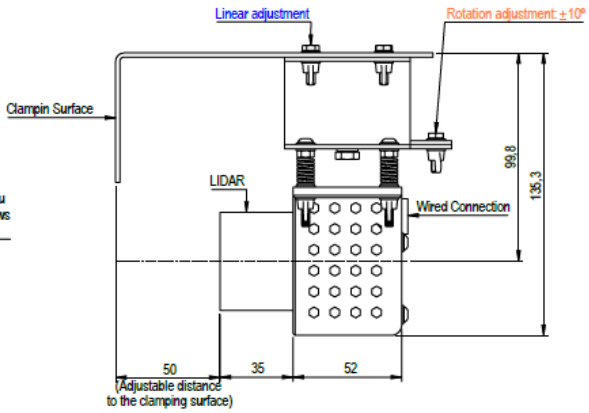
8.1. Specifications

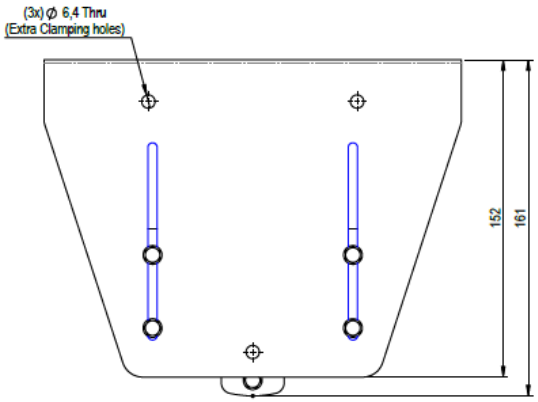
Application area	Indoor, outdoor
Emission	Infrared (905 nm)
Laser class	1 (IEC 60825-1:2014, EN60825-1:2014+A11:2021
Coverage angle	276°
Angular resolution	0.25°
Sampling frequency	two versions: 25 Hz, 50 Hz
Range	0.05 – 25 meters
Field flatness	±1°

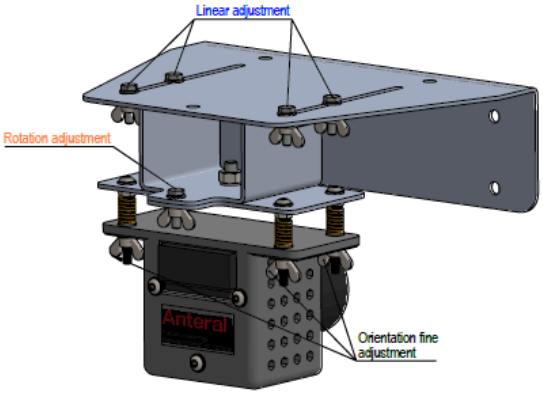
Power supply voltage	9V DC – 30V DC
Power consumption	Typical 4.5W, maximum 17W
Output current	≤ 200 mA
LiDAR housing	Aluminum with Suretec650 coating
LiDAR optics cover	Polycarbonate
LiDAR enclosure	PLA
Mounting system	Aluminum
Protection rating	IP65 (IEC 60529:1989+AMD1:1999+AMD2:2013) IP67 (IEC 60529:1989+AMD1:1999+AMD2:2013)
Protection class	III (IEC 61140:2016-11)
Electrical safety	IEC 61010-1:2010-06+AMD1:2016
Weight	550 grams
Dimensions	161 x 200 x 135 mm

8.2. Mechanical Diagram









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