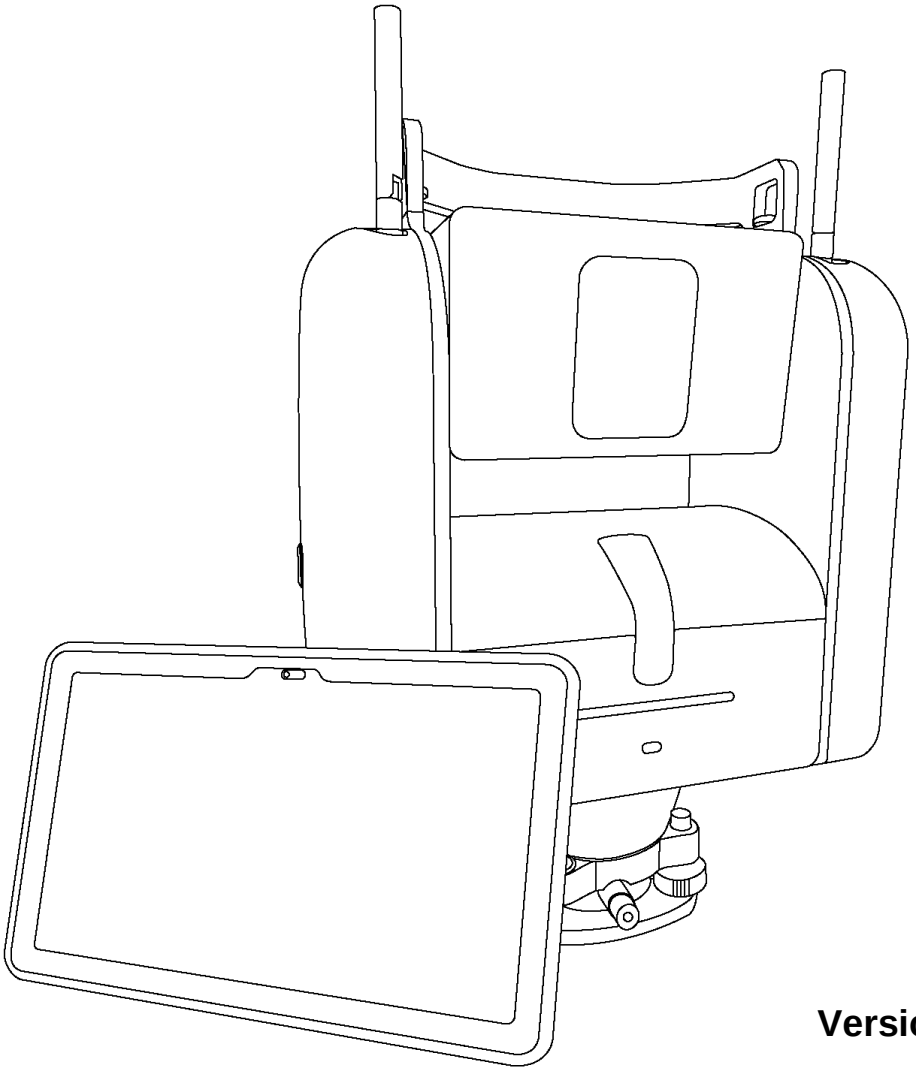
MECHASYS

XR Projector

User Manual



Version September 2024

IMPORTANT INFORMATION

Laser Safety

Before using the instrument, ensure a thorough understanding of this user manual and all safety requirements for both the instrument and the job site.

Caution - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure to diode or laser radiation. As with any bright light source, such as sunlight, electric welding arcs or arc lamps, common sense applies. DO NOT look into the laser port when the laser is on. For more information on the safe use of lasers, refer to IEC 60825-1.

The XR Projector is a LASER PRODUCT CLASS 3R

The instrument contains visible laser sources:

- Laser diode for electronic distance measurement and laser pointer function operating at 655nm (visible light, with 0.16 x 0.6 mrad beam divergence and <1 mW output power, coaxial emission. This mode operates in LASER CLASS 2.

- The laser diode for the projection and displacement functions operates at 520 nm (visible light, with a beam divergence of 1.67 urad and an output power of <5 mW, coaxial emission. This mode operates in LASER CLASS 3R.

Questions

For any inquiries regarding laser safety, please contact us at:

support@mechasys.ca

SUMMARY

1

INTRODUCTION

In this chapter:

- Welcome
- Relative information
- Technical assistance
- Your comments

Welcome

Welcome to the User's Manual for the XR Projector by Mechasys. This manual provides detailed instructions on the setup and operation of the instrument in real-world applications. Even for those experienced with surveying tools, it is recommended by Mechasys to thoroughly review this manual to fully understand the unique features of this product.

Relative information

For more information about this product, please visit our website: www.mechasys.ca.

Technical assistance

In the event of an issue where the necessary information cannot be located within the product documentation, it is advised to contact your local branch. Alternatively, consider the following options:

- Request technical support on Mechasys website https://app.mechasys.ca/login
- Send an email to support@mechasys.ca

Your comments

Your feedback on this user manual helps us improve with each revision.

Email your comments to support@mechasys.ca

2

MAINTENANCE OF THE INSTRUMENT

In this chapter:

- Control of the box
- Instrument case and accessories
- Maintenance
- Site-to-site transportation of the instrument

Control of the box

Check the shipping container. If it arrives in poor condition, immediately file a claim with the carrier and notify the Mechasys sales office. Retain the shipping container for inspection by the carrier.

Instrument case & accessories

The instrument case is equipped with an IP67 certification, based on the international standard IEC 60529. This certification assesses the level of protection of electronic and electrical products against environmental elements such as dust and water.

Upon opening the instrument box, the instrument itself will be found. It is essential to verify that the instrument is properly positioned within the box to ensure optimal protection during transport.

The instrument is accompanied by its accessories, whether included in the instrument box or provided separately. These accessories comprise all essential components required for effective use of the instrument, along with additional space to accommodate personal work equipment.

See below a complete list of the accessories provided:

Item No.	Description	Quantity
1	XR Projector	1x
2	Professional Tribrach	1x
3	Carbon Fiber Tripod	1x
4	Ruggedized Remote Controller	1x
5	PSU 80~264VAC 50/60 Hz	1x
6	Power Cord to Instrument	1x
7	Power Cord to Outlet	1x
8	XR Hard Case	1x
9	XR Hard Case Backpack Conversion	1x
10	Mechasys Rugged 5m/16ft Measuring Tape	1x
11	Maintenance tools	1x

**Additional accessories may be purchased in extra*

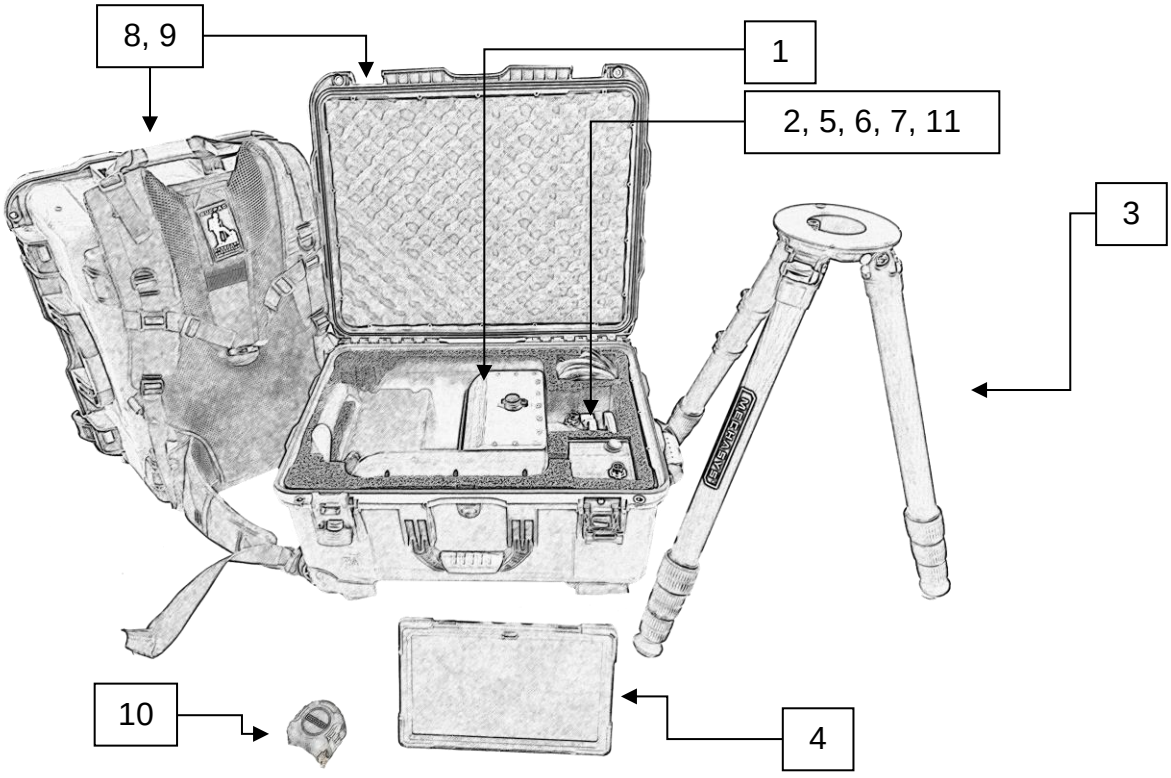


Figure 1 – Instrument case with accessories

Choice of tripods

Carbon Fiber tripod

The carbon fiber tripod provides notable ergonomic advantages. However, it is not recommended for applications requiring sub-1mm accuracy due to potential torsional rigidity requirements that may impact performance. Despite this, the carbon fiber tripod represents an excellent balance between accuracy, ergonomics, and portability.

Fiberglass Tripod

The fiberglass tripod is a survey-grade tripod that complies with ISO standard 12858-2-H, guaranteeing maximum accuracy levels. However, its robust construction may impact transportability.

Maintenance

Warning – It is forbidden to remove the instrument cover. The instrument is designed to withstand normal electromagnetic interference, but it contains circuits that are sensitive to static electricity. If an unauthorized person opens the instrument cover, the operation of the instrument is not guaranteed and the warranty is no longer valid.

The instrument is designed and tested to withstand field conditions, but like any precision instrument, it needs maintenance. Take the following steps to get the best results from the instrument:

- Avoid shocks or careless treatment of the instrument.
- Keep the laser projection's glass opening clean. Use only equipment specified by Mechasys, see page 16 for more details.
- Keep the instrument protected and in an upright position, preferably in the instrument case.
- Do not carry the instrument by the projection apparatus, use the handle.
- When extreme accuracy is required, ensure the instrument is within the operating temperature range specified by Mechasys. Wide temperature variations may affect accuracy.

Note – *No part of the Instrument can be serviced by the end-user*

Mechasys advises returning the instrument to an authorized Mechasys service agency for maintenance and calibration at least once annually to ensure the specified accuracies are maintained. When shipping the instrument to the service center, it is important to clearly mark the sender's and receiver's names on the instrument box. If repairs are necessary, a note should be attached to the instrument box, detailing any defects or issues and indicating the need for service.

Cleaning

Attention – Never use strong detergents such as benzine or thinner on the instrument or the instrument case.

Be careful when cleaning the instrument, especially when removing sand or dust from the front glass. Never use a dirty or thick cloth or heavy paper. Only materials recommended by Mechasys may be used to clean the lens of the instrument.

Dust removal
Start by using air to gently blow away loose dust and particles. This contact-free method is safe and helps avoid scratching the surface.

Fingerprints and Smudges
If there are fingerprints or smudges, use a lens tissue or a cotton swab. Lightly moisten the tissue or swab with a few drops of reagent-grade isopropyl alcohol (99.99%). Place the tissue over the optic's surface, and gently drag it across. Avoid soaking the tissue excessively to prevent streaking.

Cleaning Motion
For stubborn smudges, use small circular motions starting from the center and working outward. This technique helps reduce streaks on the optical surface. Only use a lint free cotton swab or a soft tissue to wipe the surface. Never insert pressure perpendicular to the surface of the glass.

Moisture removal
If the instrument has been used in wet conditions, bring the instrument indoors and remove it from its case. Let the instrument dry itself. If there is condensation on the lenses, let the moisture evaporate on its own. Keep the carrying case open for at least 24 hours after all moisture has fully evaporated.

Avoid Certain Chemicals
Never use acetone on plastic optics or those in plastic housings, as it may cause damage. Instead, use de-ionized water or alcohol for such components.

Site-to-Site transportation of the instrument

Always transport the instrument in the XR Hard Case and in the original shipping container.

Risks related to vibrations

When transporting the instrument, it is essential to consider the potential vibrations to which the instrument may be exposed. These vibrations may occur in various scenarios, such as during air transport, ground transport by automobile, or when the system is moved on wheels over a rough surface.

To minimize the need for frequent calibration, it is advisable to be mindful of these vibrations. Severe vibrations may damage the instrument's components and compromise its accuracy, leading to more frequent calibration requirements. Therefore, taking precautions to reduce vibration during transport is strongly recommended.

Handling of the instrument in its XR Hard Case

When handling the instrument on a job site, two situations may arise: transporting the instrument while still being in its carrying case, and transporting the instrument while in use and needing to be moved from one station to another.

Figure 2 – Transporting the instrument using the wheels

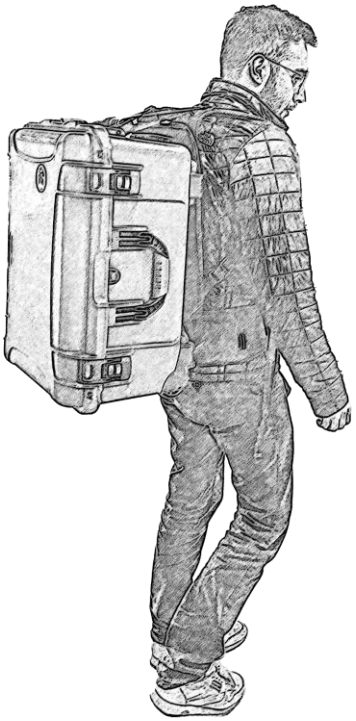


Figure 3 – Transporting the instrument using the backpack converter

3

FIRST STEPS

In this chapter:

- Power management
- Description of the instrument
- Information on lasers

Power management

The instrument provides various power access options. In static environments, a standard power outlet may be utilized. Alternatively, a battery pack may be employed for greater flexibility, or the custom battery design may be leveraged for optimized performance, ensuring seamless operation regardless of specific power requirements.

Using an Extension Cord

The base package of the instrument includes an outlet connection tailored to the specifications of your country. To initiate operations, simply plug the connector into the outlet and activate the power supply. This straightforward process enables immediate use of the projector with minimal effort.

Using a Battery Pack

The system is also compatible with standard battery packs available on the market. To use this option, simply connect the system to the outlet of the battery pack. When powered by an approved portable battery pack, the instrument is designed to operate continuously for a full working day, approximately 8 hours. However, to ensure optimal performance, it is essential that the following specifications are met:

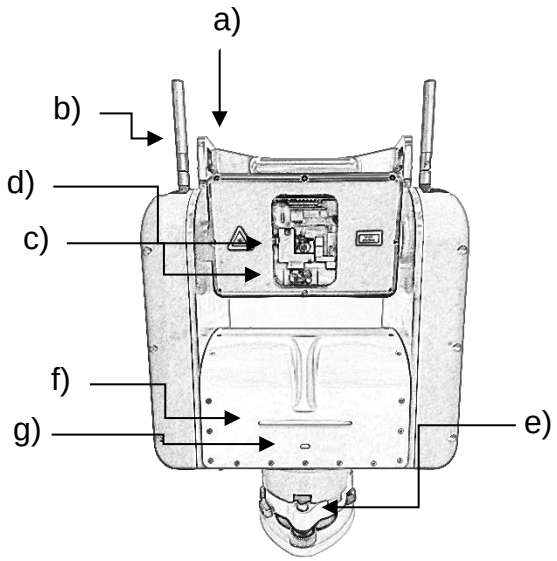
Specification	Units
Battery capacity	>512Wh
Power output	>500W
Charging time	< 2h
Input and output ports	100 to 240VAC - 50Hz to 60Hz
Discharge temperature	-10 to 40°C
Weight	< 7 kg
Volume	< [28 x 26 x 20 cm]
Battery management system (BMS)	BMS to manage : - overvoltage - overcurrent - overload - temperature overheating - cell balancing - short circuit

Here are some examples of approved portable battery packs that may be used to power the instrument:

Ecoflow River 2 MAX	KINGBOSS
	
Capacity: 512 Wh Power: 1000 W Charging time: ~1h Input port: Type E, 220VAC@50Hz Output port: Type C, 220VAC@50Hz Discharge temperature: -10 to 45°C Weight: 6kg Volume : 26.92 x 25.91 x 19.56 cm BMS : included	Capacity: 568 Wh Power : 600 W Charging time: ~2h Input port: Type B, 110VAC@60Hz Output port: Type A, 110VAC@60Hz Discharge temperature: -10 to 40°C Weight: 5.4 kg Volume: 27.5 x 21.5 x 17 cm BMS : included

Description of the instrument

This chapter outlines the instrument's controls. It is recommended by Mechasys to take the time to become familiar with the names and locations of these components. Please refer to the following figures for detailed illustrations.



a) Carry Handle

b) Antennas

c) EDM Sensor

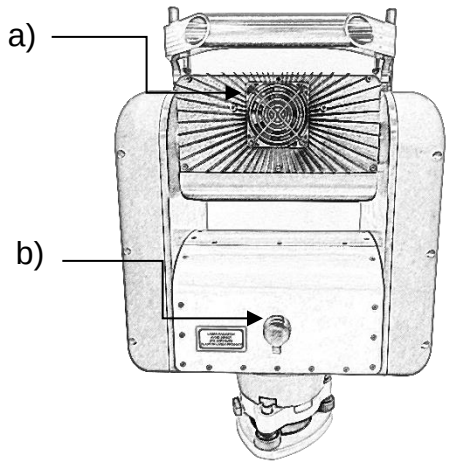
d) Laser Projector

e) Circular Level

f) LED Indicator

g) Proximity Sensor

Figure 4 – Instrument front panel



a) Heatsink

b) USB Connector

Figure 5 – Instrument back panel

Information on lasers

For more information, see Laser Safety on page 3

Laser aperture and labeling

The instrument, as shown in Figure 6 & 7, has been tested and complies with the applicable regulations for a Class 3R product, according to IEC 60825-1 and ANSI Z136.1 standards.

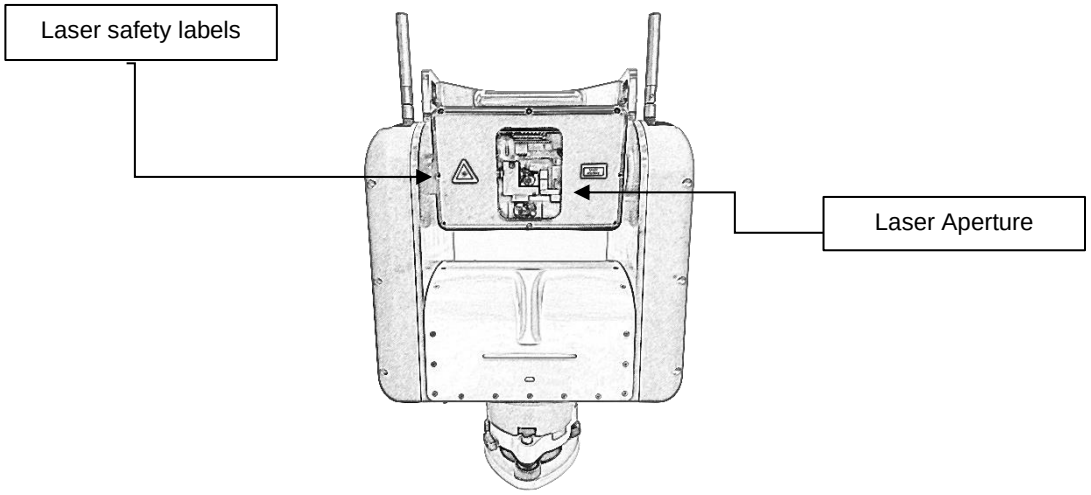


Figure 6 – Laser localization

The laser warning label is located on the front & back of the instrument.

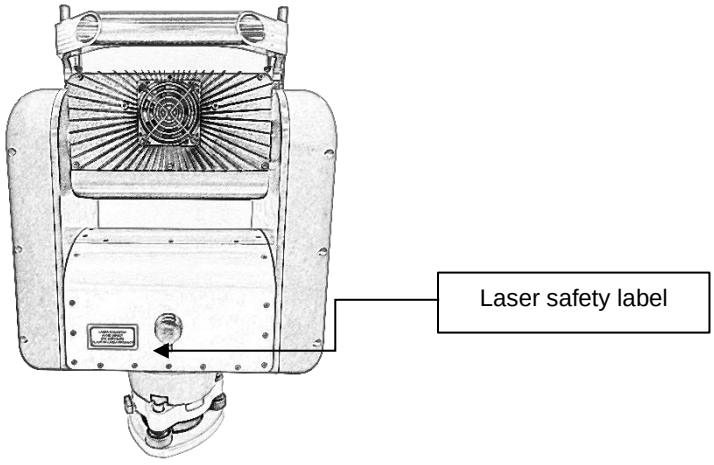


Figure 7 –Location of the warning label

4

SETUP OF THE INSTRUMENT

In this chapter:

- Setting up the instrument
- Powering on the instrument
- Logging in with Layout Field™
- Connecting the controller to the instrument

Setting up the instrument

A stable installation of the instrument will ensure accuracy of measurement and projection functionality.

Height of the instrument

If the laser projector is intended solely for ground projection, it is generally recommended to station the instrument at a height of approximately 1.75 meters (65 inches).

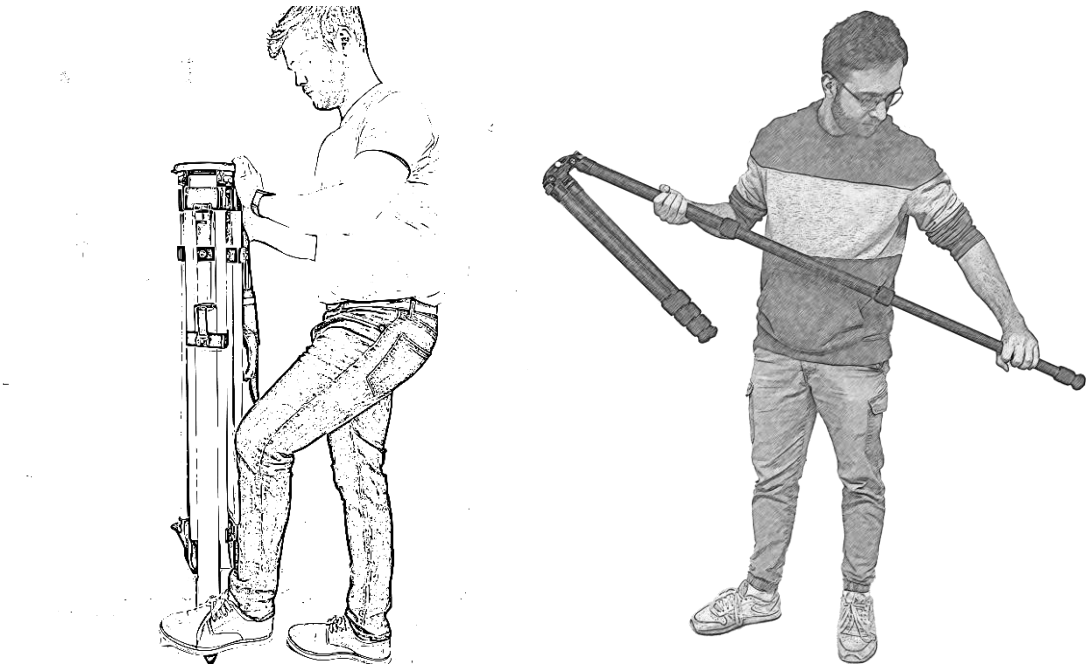


Figure 8 – Recommended Tripod Height

For ceiling projections, it is recommended to maintain a distance of 1.75 meters (65 inches) between the optical axis of the instrument and the ceiling surface. This ensures that the instrument maintains consistent accuracy during projection operations.

Figure 9 – Optical Axis of the instrument

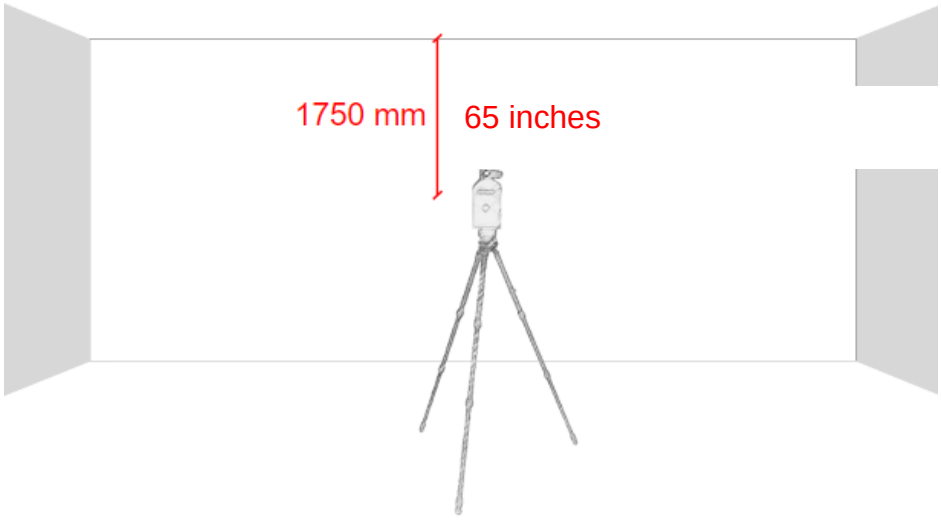


Figure 10 –Height from the ceiling

When projecting onto both the floor and the ceiling, the tripod height should be adjusted based on the ceiling's height. It is recommended to station the instrument halfway between the floor and the ceiling by setting the tripod height accordingly. This will ensure uniform projection quality on both surfaces.

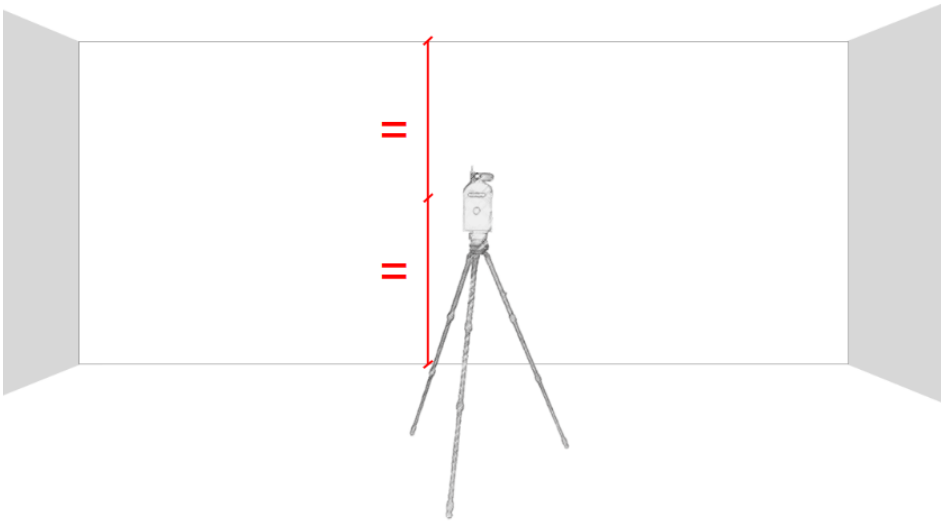


Figure 11 – Height for floor and ceiling projection

Deployment of the system on wheel (extra accessory)

To facilitate moving the instrument between different stations, Mechasys has implemented a wheel system. To use this system, simply deploy the wheels and ensure that the tripod is correctly inserted into the dedicated notches. Once the instrument is positioned on the wheel system, secure it by fastening the safety strap to ensure stability.

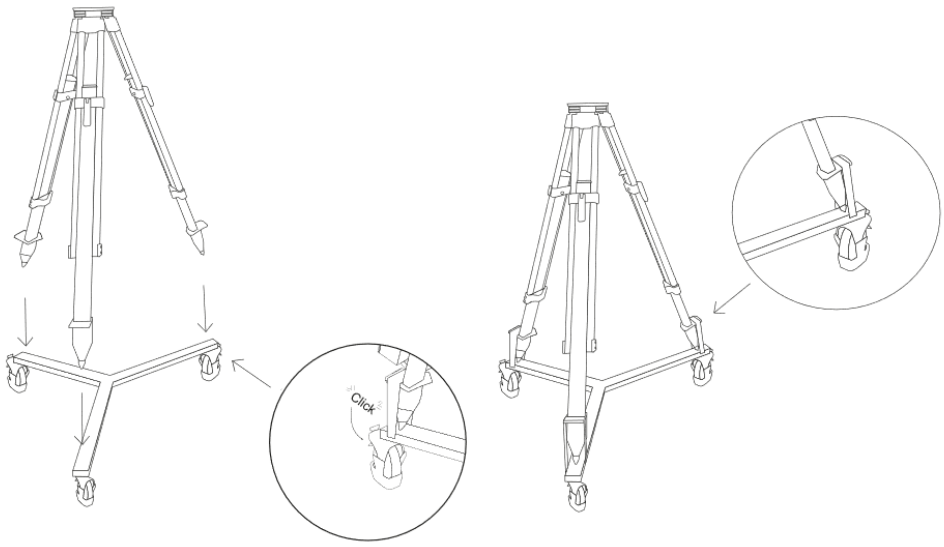


Figure 12 - Placement of the tripod on the wheel system

Installation of the instrument on the tripod

To ensure the stability of the instrument, Mechasys recommends holding it with both hands: one hand on the upper handle and the other on the lower part. By adopting this position, stability is enhanced, reducing the risk of the instrument falling.

Note - It is strongly discouraged to hold the instrument by the bezel as this may cause damage.

Figure 13 – How to carry the instrument

Connecting the instrument to the power supply

After securely mounting the power supply and instrument onto the tripod, proceed by connecting the power cord from the power supply unit (PSU) directly to the instrument.

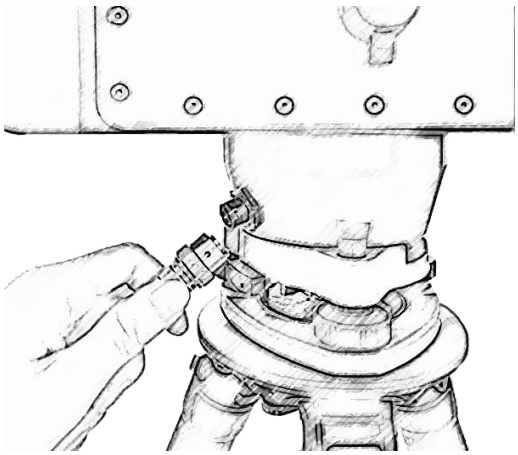


Figure 14 – Connect instrument to PSU

Powering on the instrument

Upon completing all necessary steps, the instrument can be activated by flipping the switch located at the top of the power supply. A red LED indicator illuminates on the power button, signaling the initial activation. Next, press the power button on the instrument. The red LED on the button will begin flashing, indicating that the instrument is booting up. Once the instrument is fully operational and ready for use, the LED on the button will turn green, confirming that it is ready for operation.

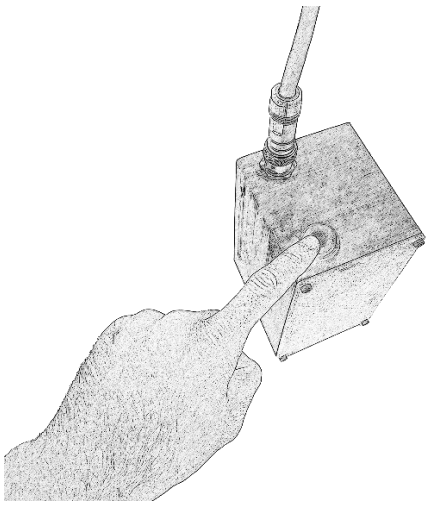


Figure 15 - Instrument switch

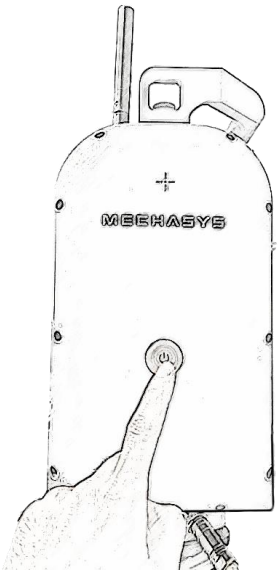


Figure 16 - Starting up the instrument

LED indicators

The instrument features two LED indicators strategically positioned to provide user guidance and real-time status updates. One is located at the front, while the other is incorporated into the power button on the right side of the instrument.

Front LED indicator

- White on: Instrument is prepared for operations;
- White blinking: Awaiting connection to the remote controller;
- Graduated flashing white: Instrument is booting up;
- White loading bar: Engaged in an autonomous action;
- Dead rainbow: A critical issue has happened during bootup of the instrument;
- Red light: An obstacle within 1.3 meters (50 inches) of the instrument has been detected.

Power Button LED

- Green: Instrument is powered on;
- Red: Instrument has an active current but is not powered on;
- Red Blinking: Instrument is booting up or shutting down.

Logging in with Layout Field™

Once the instrument is turned on and ready to be used, the actions will now be transferred to the controller.

Online Mode

Before proceeding, ensure a stable internet connection via Wi-Fi. Next, launch the Layout Field™ app and enter your account credentials, which are the same as those used for Layout Cloud™. Tap the "log in" button to continue, providing access to the array of projects assigned to your account.

If the internet connection is lost while operating on the controller, the Layout Field™ application will automatically switch to offline mode. In this mode, it is still possible to work with existing drawings and projects, but access to new updates, drawings, or projects will be unavailable until the internet connection is restored. Therefore, it is important to regularly check the internet connection while in the field to avoid any interruptions in service.

Offline Mode

If an internet connection is unavailable, logging in to the account is still possible in offline mode. However, it is important to note that a prior connection to the internet with login information is required for the controller to store credentials. Once this is completed, the username and password can be entered, followed by clicking "Log In." In offline mode, only the projects and CAD files previously uploaded to the controller will be accessible. New CAD files cannot be downloaded in offline mode, making it crucial to ensure all

necessary information is available before proceeding to a job site without an internet connection.

Download CAD files to your controller

With an active Wi-Fi connection, enter one of your projects and click on the "download" icon to upload your CAD drawing to the controller. Once the "eye" icon appears on your CAD, it indicates that the drawing has been successfully downloaded and is available for use in offline mode. Refer to the figure below for more details.

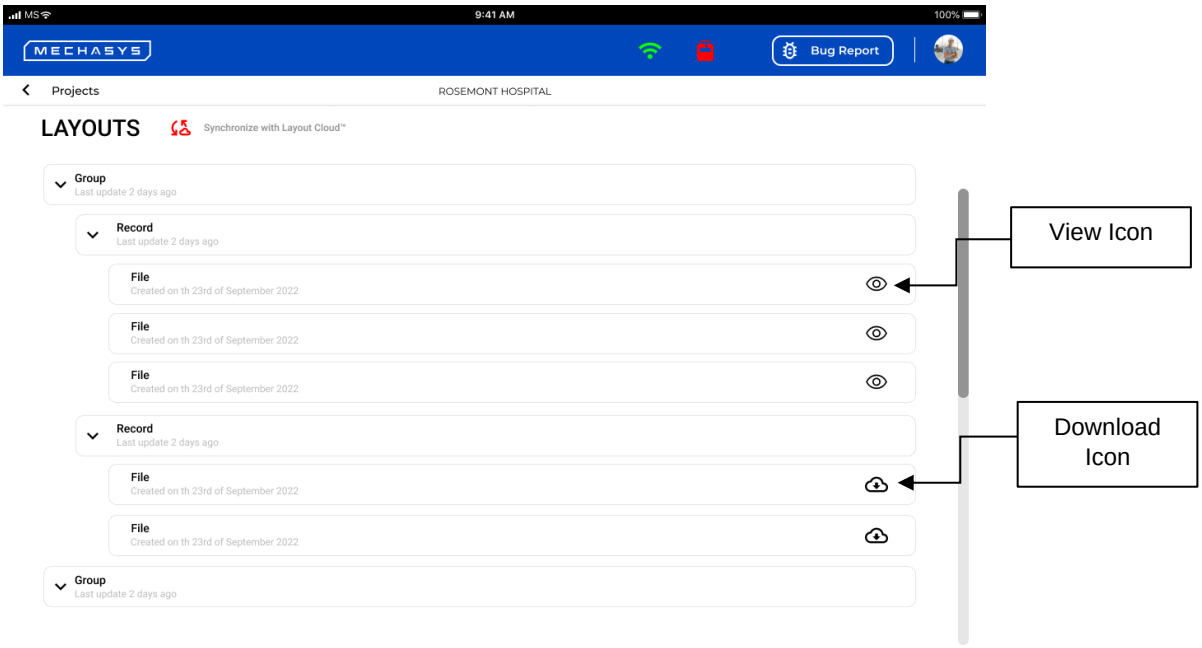


Figure 17 – Layout List View

Connecting the controller to the instrument

To connect to the instrument, access the controller's Wi-Fi settings and select the instrument's Wi-Fi network. To do this, swipe down from the top corner of the controller's screen and long press the Wi-Fi icon to open the settings. Once in the Wi-Fi settings, locate and select the serial number of your XR Projector.

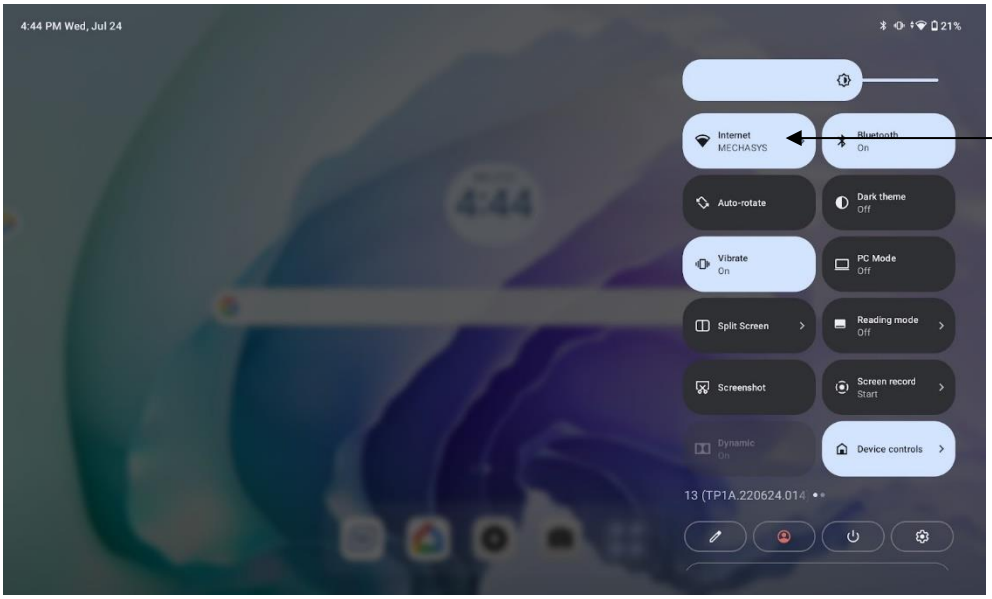


Figure 18 - WIFI selection

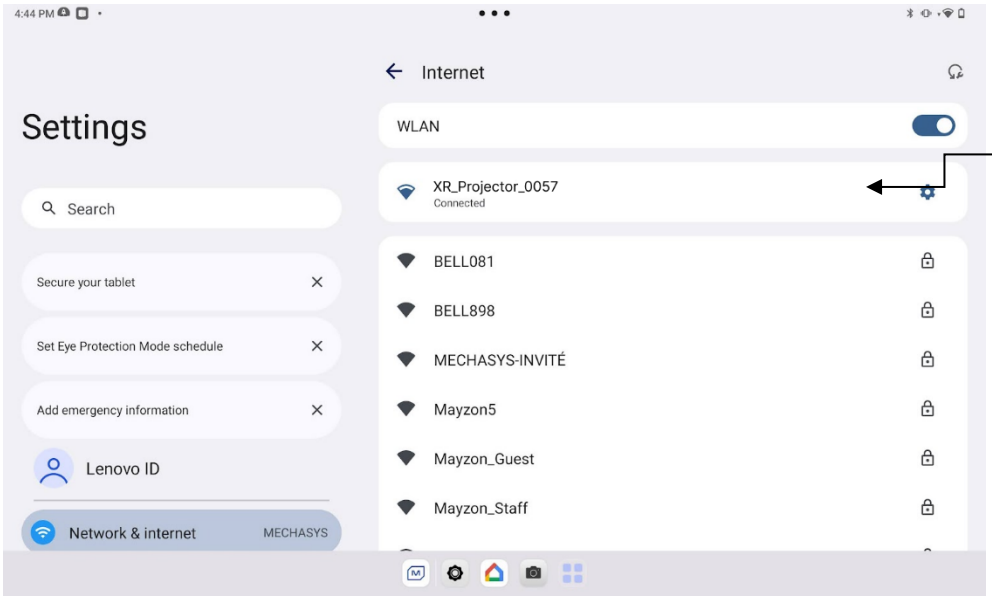


Figure 19 - WIFI settings

After connecting to the instrument's Wi-Fi, tap the connection icon in the Layout Field™ application to secure the connection. The icon will turn green once the connection is successfully established.

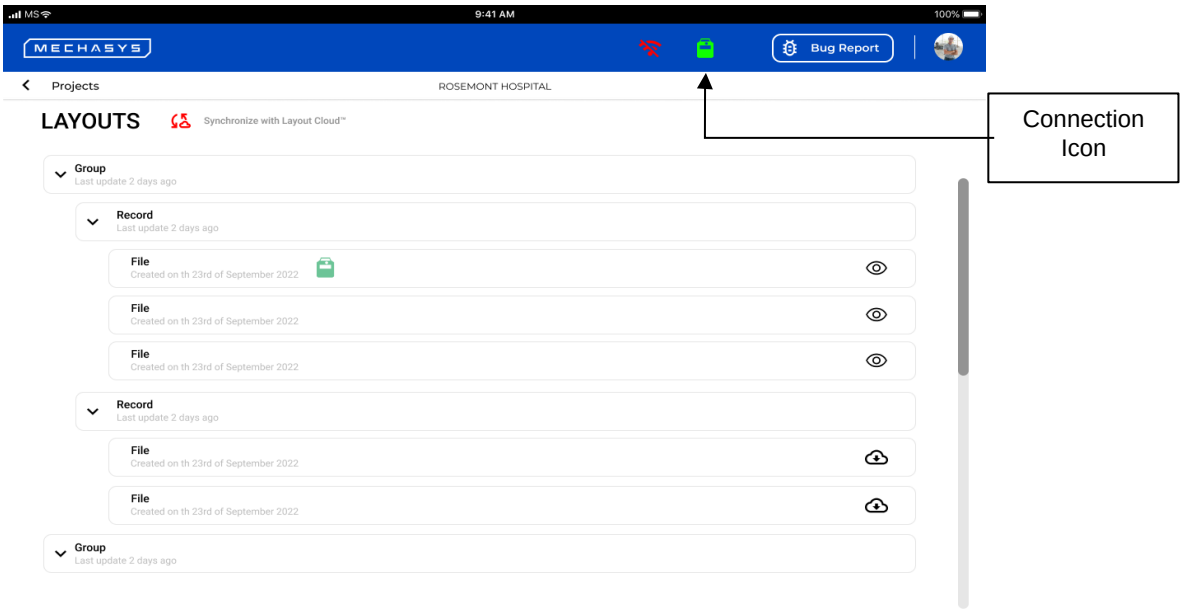


Figure 20 – Connection icon

5

OVERVIEW OF THE GRAPHICAL INTERFACE

In this chapter:

- List of projects
- List of drawings
- Main viewer
- Projection viewer

List of projects

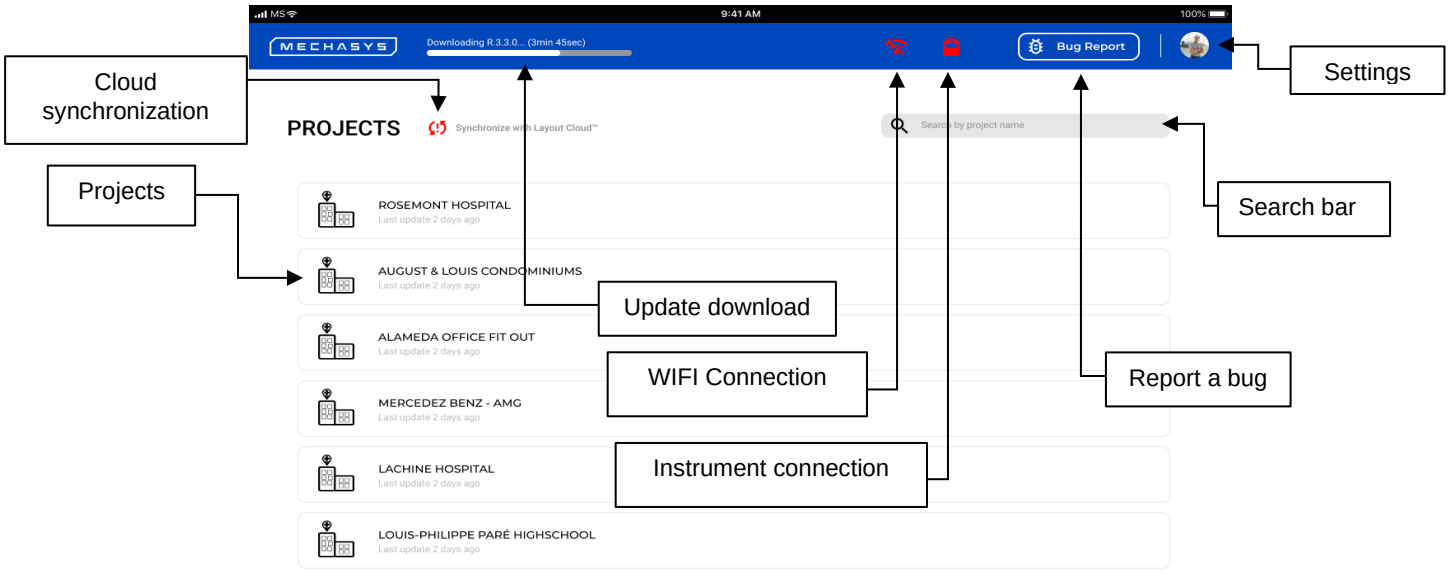


Figure 21 – List of projects

List of drawings

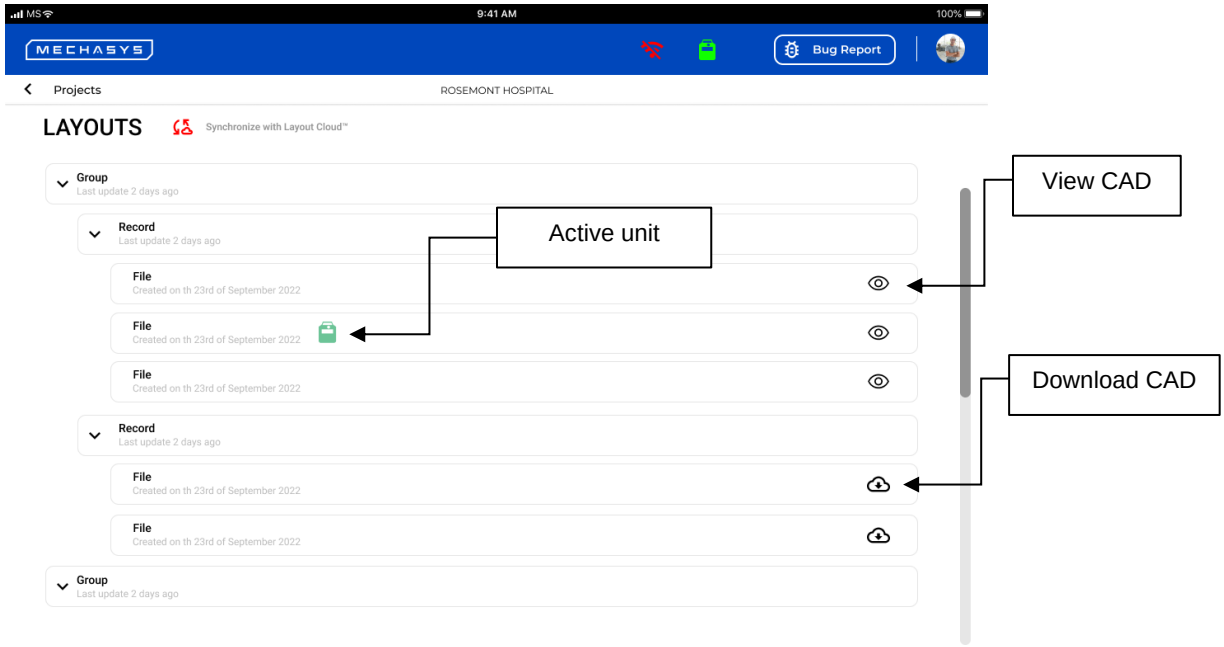


Figure 22 – List of drawings

Main viewer

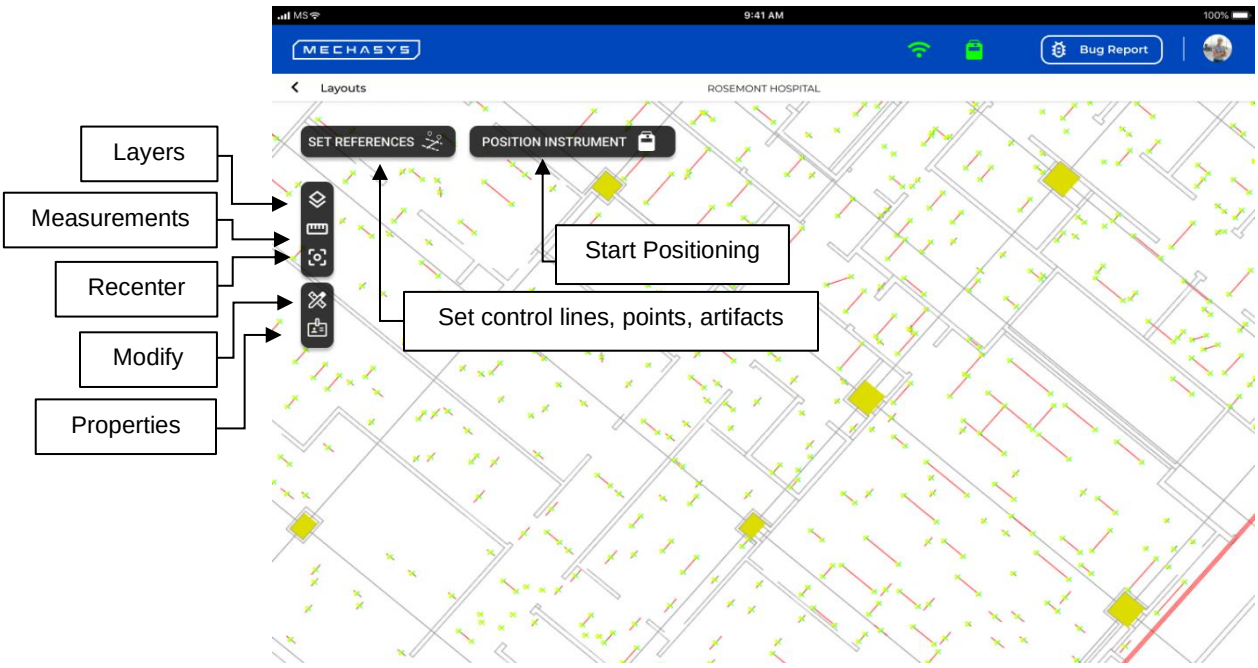


Figure 23 – Main viewer

Projection viewer

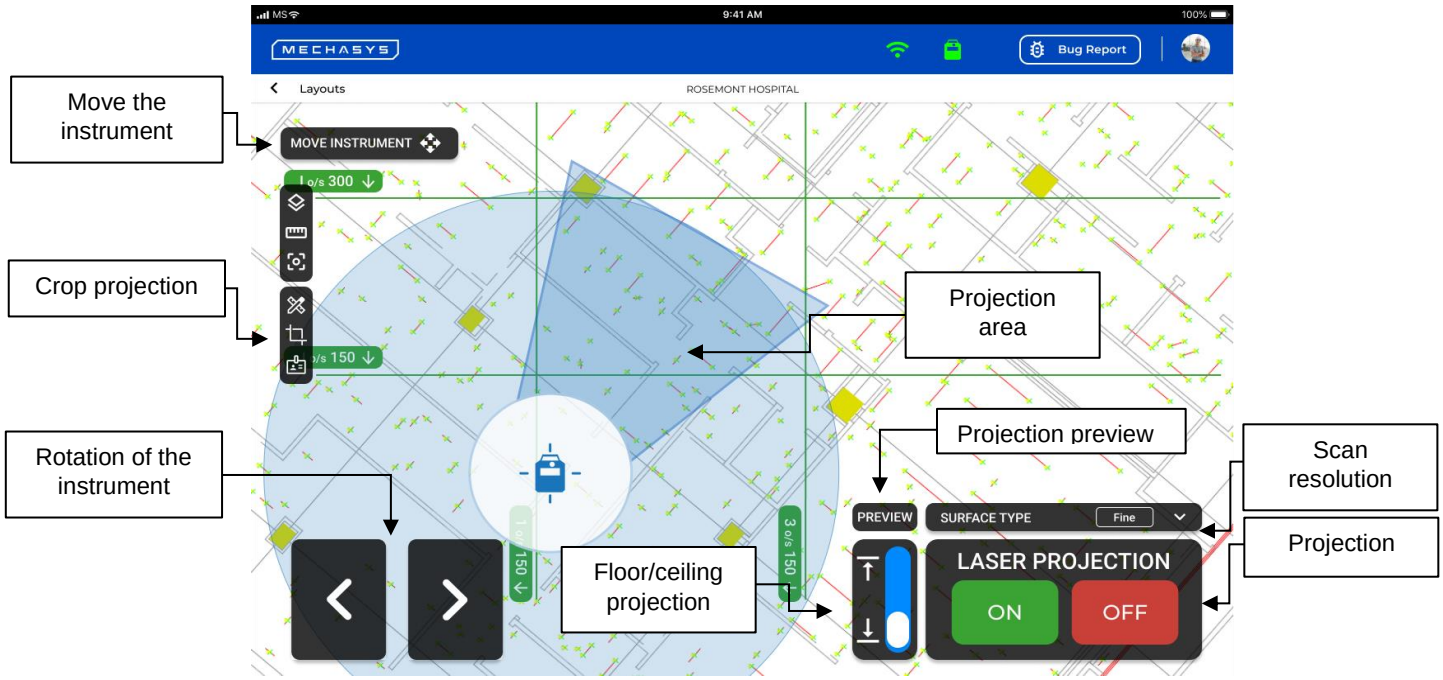


Figure 24 – Projection viewer

6

POSITIONING THE INSTRUMENT

In this chapter:

- Set the field references
- Instrument digital level
- Instrument height
- Positioning process
- Types of measurements with EDM sensors
- Positioning recommendations

Set the field references

Control lines

Selection of control lines

Attention – Before preparing the control lines, it is imperative to physically mark these lines on the floor of the workspace. These references are essential for the instrument to determine its relative spatial position. Without these environmental markers, positioning the instrument on the job site will not be possible.

Note – When using the instrument, it is important to distinguish between axes lines and control lines.

Axes lines are determined by the project professionals and are present on the original drawing.

The control lines represent an offset of one of the axis lines to facilitate the work of the workers on the site.

To set up the control lines, the "Set References" button on the main viewer can be used.

Offset of an axis line
Once the "Set References" mode is activated, the axes lines will appear in orange on the viewer. These axes lines can then be selected to create an offset, thereby establishing a control line.

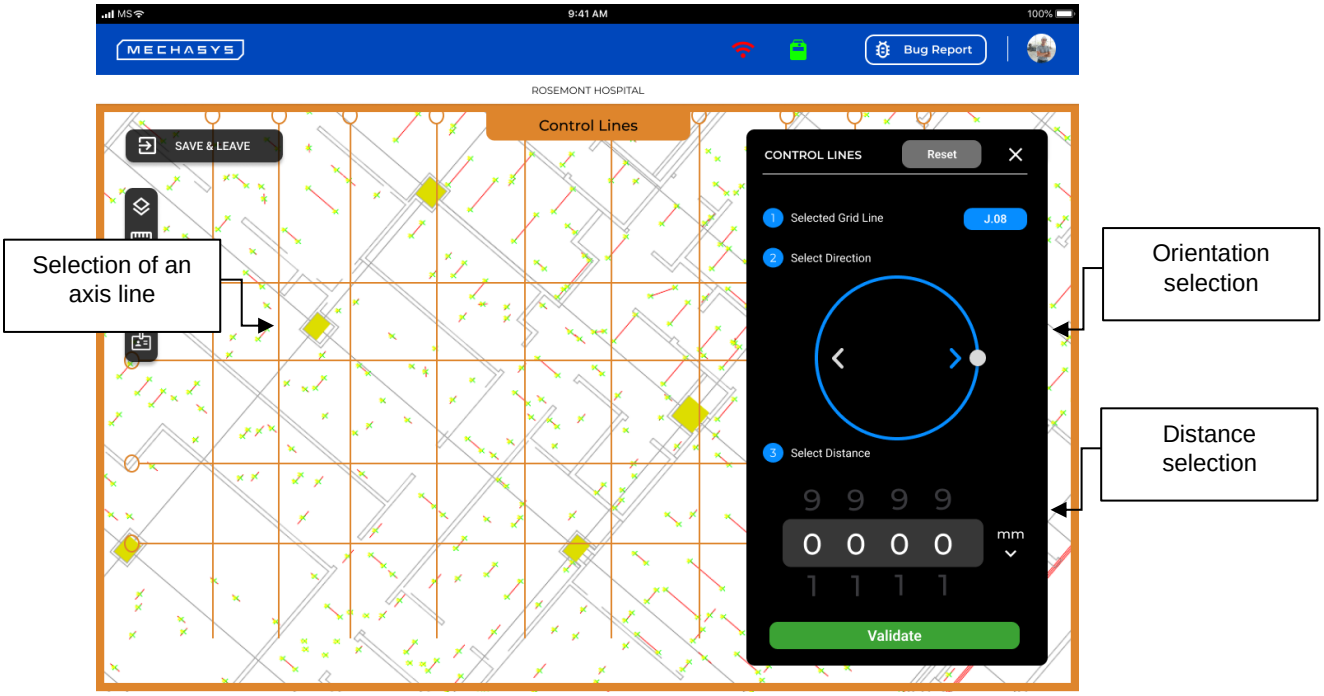


Figure 25 - Offset of a control line

Validation of a control line

After making the change, green control lines will automatically appear on the canvas. It is essential to set up a minimum of two perpendicular control lines before beginning to station the instrument.

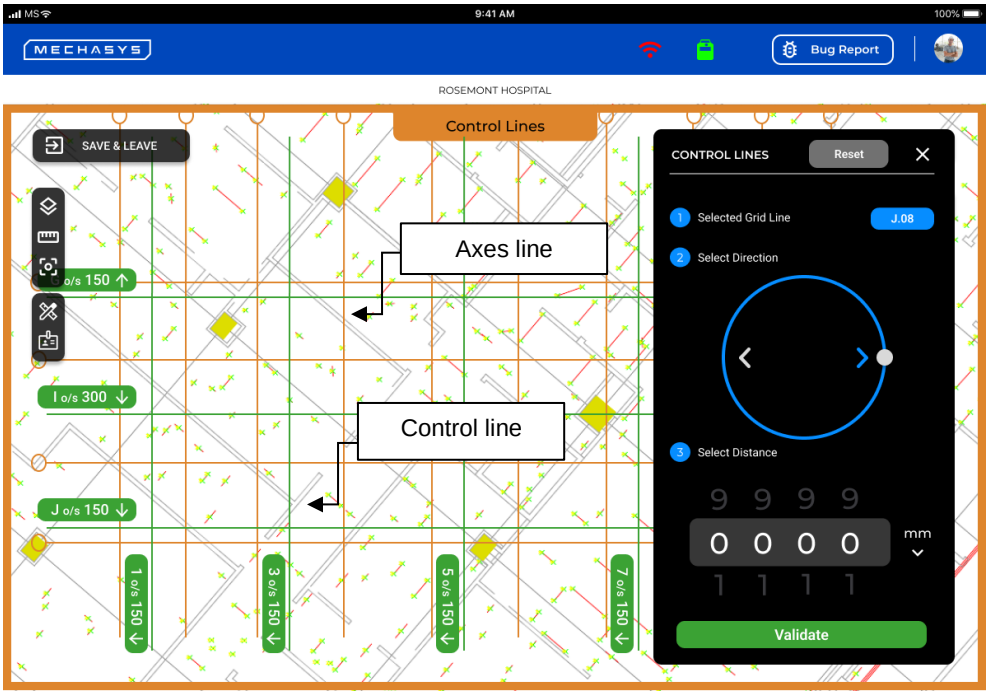


Figure 26 - Validation of a control line

Artifacts

The instrument's position can be determined by using existing elements in the construction environment, referred to as artifacts.

Note – An artifact represents an element that is both found on the CAD drawing and in the actual construction environment. It may be different elements such as concrete walls, concrete columns, party walls, finished walls and many others.

Artifact selection

To identify positional Artifacts in the controller's work area, first enter the "Set References" mode. Once this mode is activated, an "Artifact" button will appear on the left side of the screen. Click on this button to enter "Artifact" mode. In this mode, each CAD element can be selected and transformed into an Artifact.

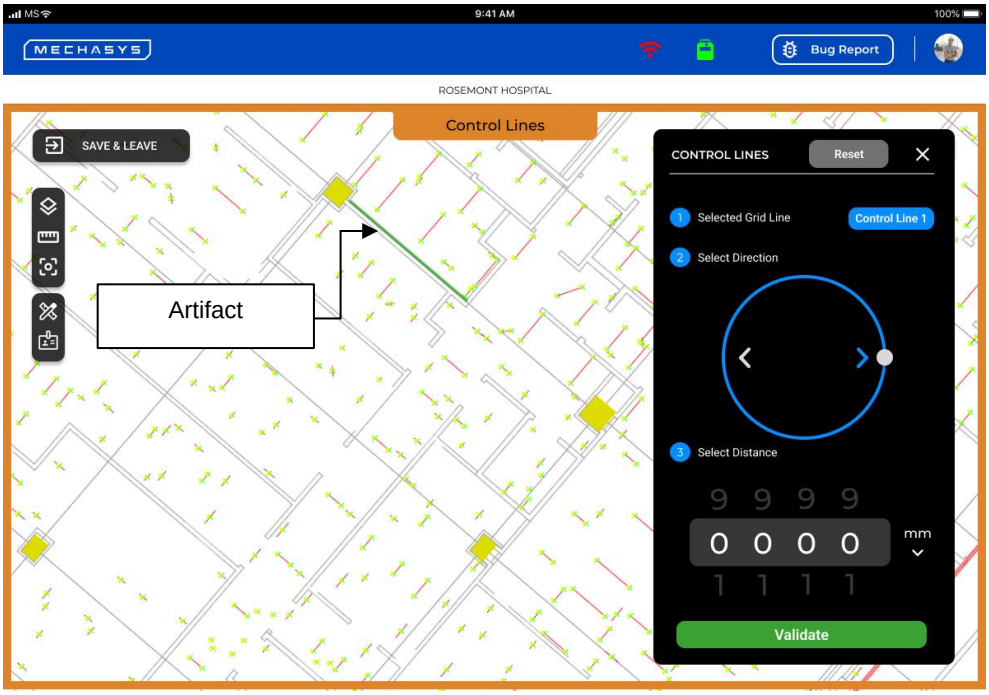


Figure 27 - Artifact selection

Artifact offset

Once the Artifact is selected, choose its orientation and specify the required offset, if any. If no offset is needed, an offset of "0" can be applied. After approving the parameters, the line will turn green, indicating that positioning can be performed. To position the instrument, at least two perpendicular Artifacts are required. It is also possible to use a combination of control lines and Artifacts for positioning, provided they are perpendicular.

Instrument digital level

The instrument is equipped with a high-precision tilt sensor, enhancing the system's overall accuracy while reducing the potential for human error by the operator. Leveling the instrument is a crucial step in the positioning process, streamlining subsequent field operations.

Recommended leveling procedure

To level the instrument, use the macro-metric screws of the tribrach to make precise adjustments. The user interface includes color-coded indicators to guide through the leveling process:

- Red: Indicates when the leveling is outside the scope of view.
- Yellow: Signals when the leveling is slightly off tolerance but still within the scope of view.
- Green: Confirms that the leveling is within acceptable tolerances.

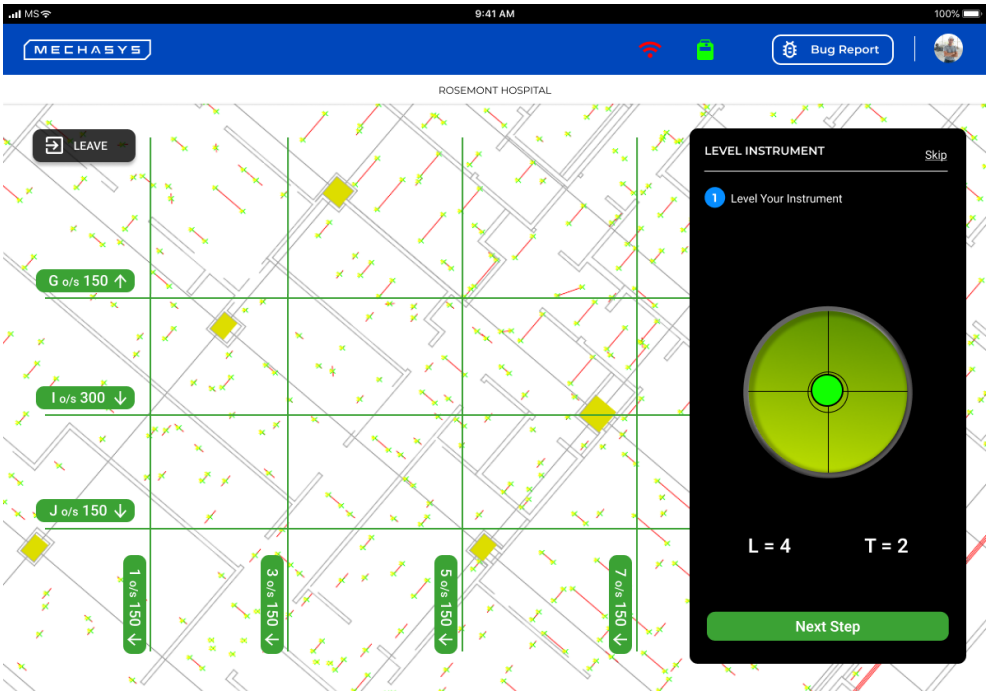


Figure 28 – Graphical interface of the digital level of the instrument

For a smoother process, it is recommended to position oneself directly in front of the instrument. This positioning helps to accurately simulate the leveling behavior, thereby simplifying the overall procedure.

Instrument Height

The instrument is equipped with a measurement mark on the side, aligned with the axis of the instrument's trunnions. To measure the height, a traditional measuring tape or a rangefinder may be used, referencing this mark for accuracy.

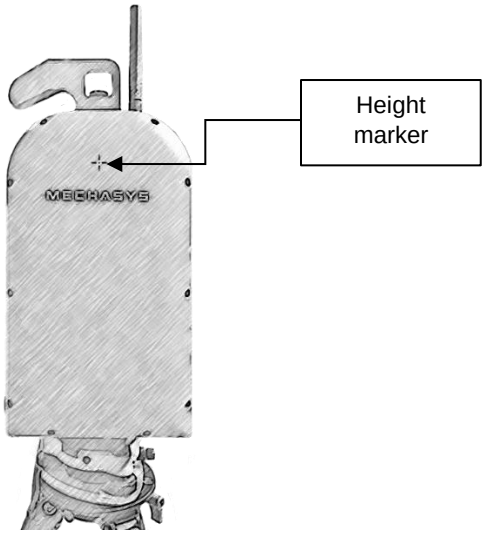


Figure 29 - Height marker

Figure 30 - Measurement method for height

After taking the measurement, input the value into the controller to proceed with the next steps.

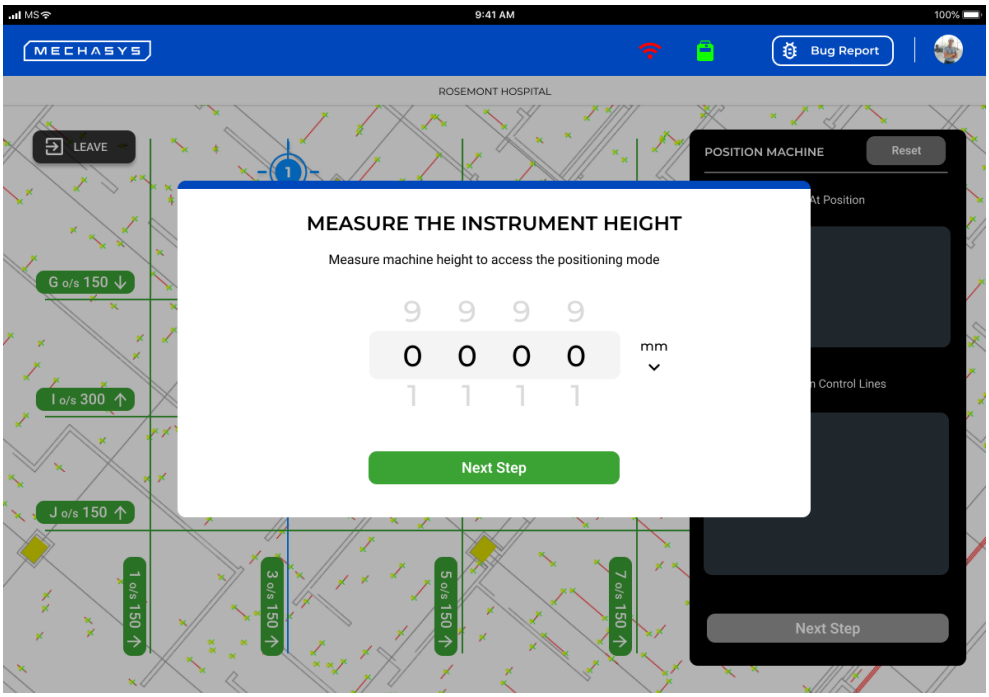


Figure 31 – Measure height

Positioning process

Pre-location of the instrument

The first step is to inform the software of the instrument's approximate location within the environment. To do this, press the token on the instrument and place it on the canvas at the corresponding position of the current station.

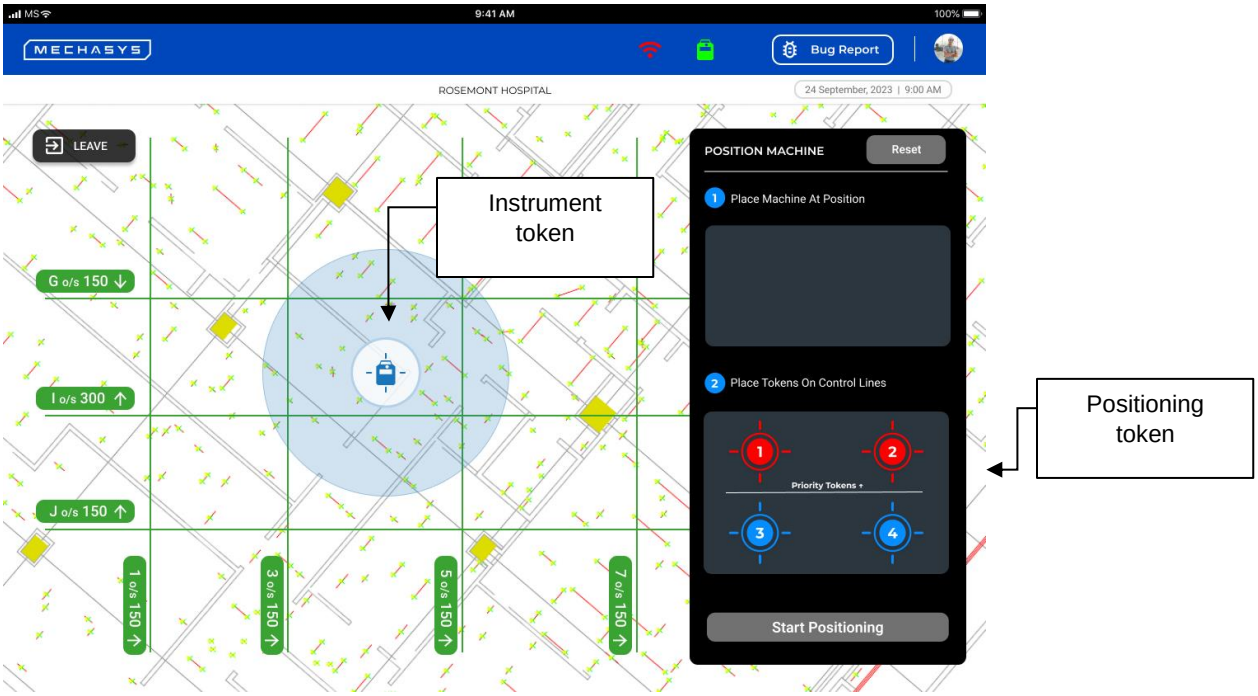


Figure 32 - Pre-positioning of the instrument

Place the positioning tokens

Once the instrument's pre-positioning is complete, proceed by placing the positioning tokens onto the designated control lines.

Important – The positioning tokens should be placed in the following order:

1. Token #1 and #2 on the priority control/artifact line;
2. Token #3 and #4 on the other control line/artifact, perpendicular to the first control/artifact line.

The four tokens should be positioned so that the instrument token is in the same quadrant as the three positioning tokens.

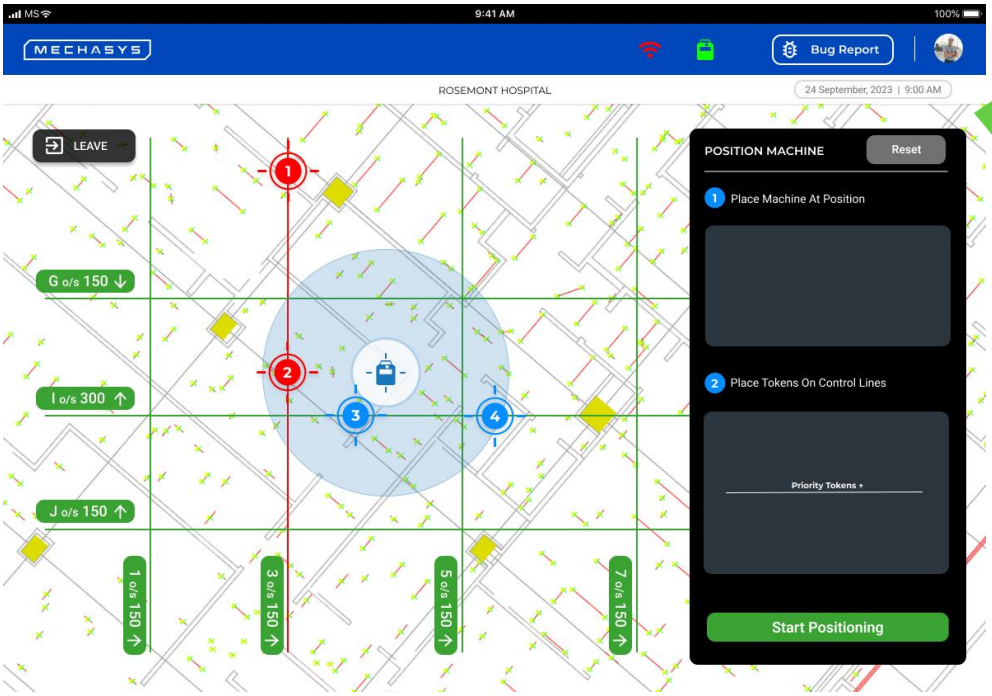


Figure 33 - Good positioning of the tokens on control lines

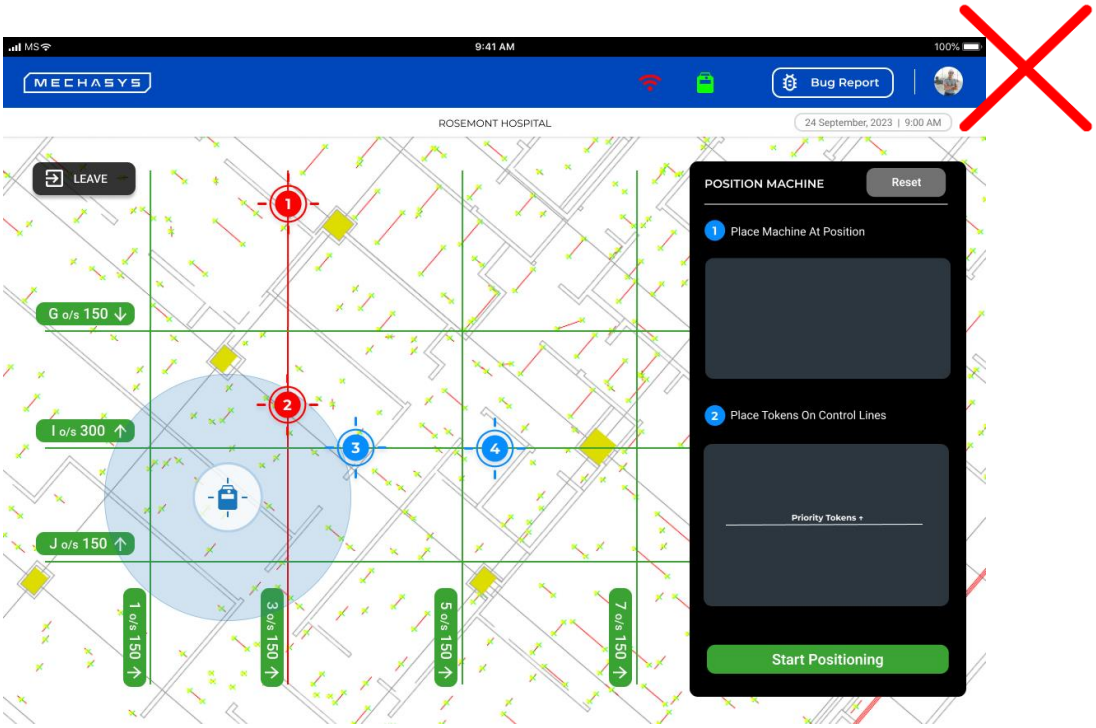


Figure 34 - Incorrect positioning of the tokens on control lines

Control lines or artifacts are not perpendicular on site

If the control lines or artifacts deviate from the specified tolerance of perpendicularity, an error notification will appear, alerting with a message similar to the following:

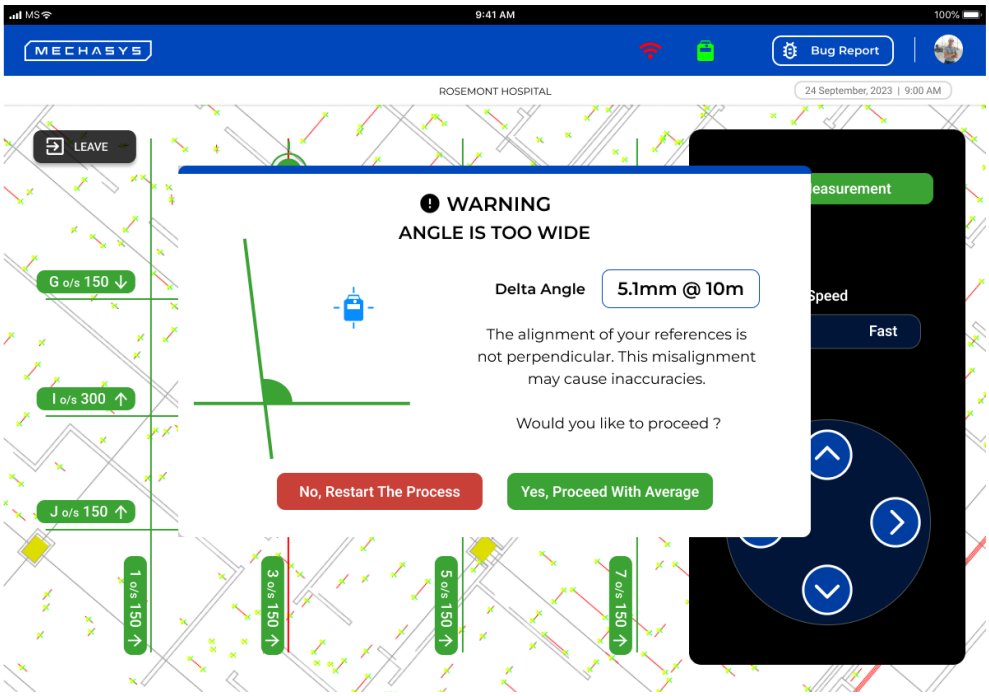


Figure 35 – Control Line or Artifact has obtuse angle

By default, the tolerance on the angle is set to 3mm at 10m (1/8” at 33’). If the deviation of the control line or artifact exceeds this threshold, a notification will appear. In this scenario, two options are available:

- Option 1: Click "Restart the Process" to rectify the perpendicularity of your control lines or artifact.
- Option 2: Click "Proceed with Average" to utilize the average location of tokens #3 and #4. Refer to the image below:

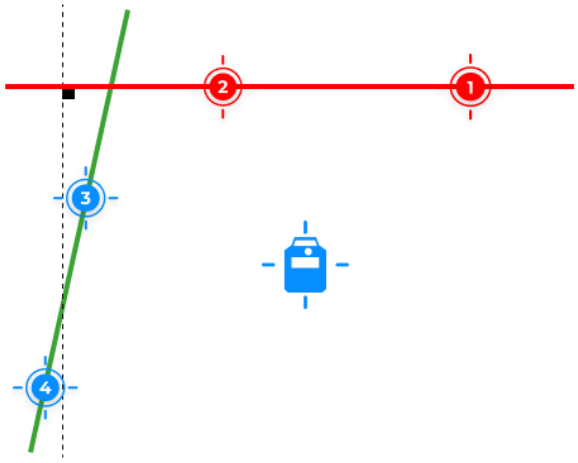


Figure 36 – Average calculation of out-of-tolerance control lines or artifact

Important – Your priority tokens should be placed where it matters

1. Token #1 and Token #2 function as priority tokens, consistently maintaining their true positions. If there are specific dimensions that must be adhered to, it is essential to use these references.

2. Conversely, tokens #3 and #4 are non-priority, which implies they may lead to inaccuracies. It's crucial to ensure your references are perpendicular to mitigate this risk.

Types of measurements with EDM sensors

There are multiple methods for measuring distances using the EDM sensor. Depending on the field environment, the following two options are recommended:

Laser pointer on floors

Using the EDM sensor directly on the floor for close-range positioning may be effective, but it is crucial to maintain perfect alignment with the control lines. It is recommended to use a laser pointer for distance measurements up to 10 meters (30 feet) on floors.

Important – To ensure the accuracy of the instrument, the laser point must be placed directly over the control/Artifact line marked on the ground.

If using an artifact with no offset, simply aim the laser at the vertical feature. It is recommended to point at the bottom of the feature to improve vertical alignment.

Figure 37 - Laser pointer positioning for control line

Laser pointer on walls

In a closed environment, such as within a concrete apartment condominium project, using artifacts for positioning the instrument and targeting directly onto walls may be advantageous. To do this, control the laser pointer to aim directly at the wall. It is recommended to aim at a point approximately 0.5 meters (about 1.5 feet) above the floor to achieve consistent and stable results.

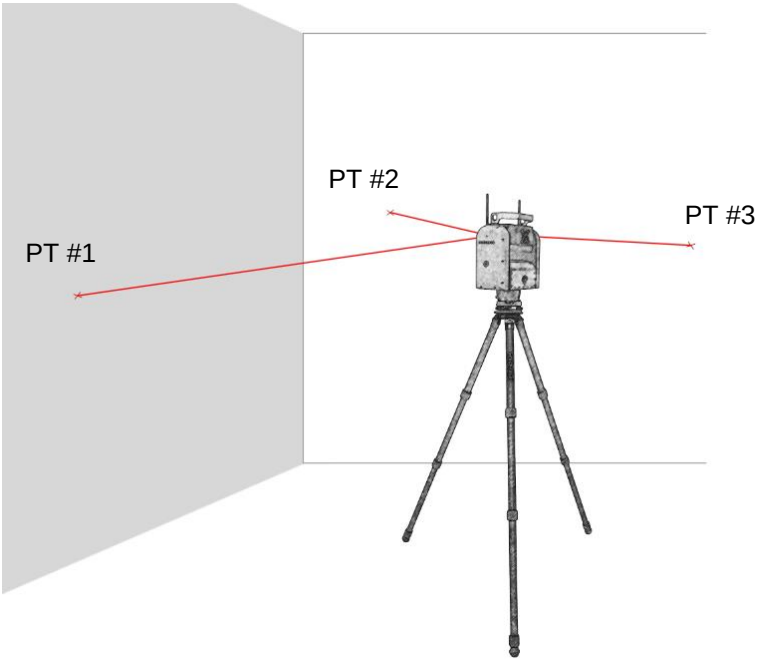


Figure 38 - Laser pointer positioning on walls

Positioning recommendations

Note – It is recommended that there be at least 2 meters of space between the positioning tokens in the real environment to ensure accuracy. The further apart the tokens are, the more accurate the positioning of the instrument will be.

It is also advisable to position the instrument using control/Artifact lines within 10 meters of the instrument to improve accuracy.

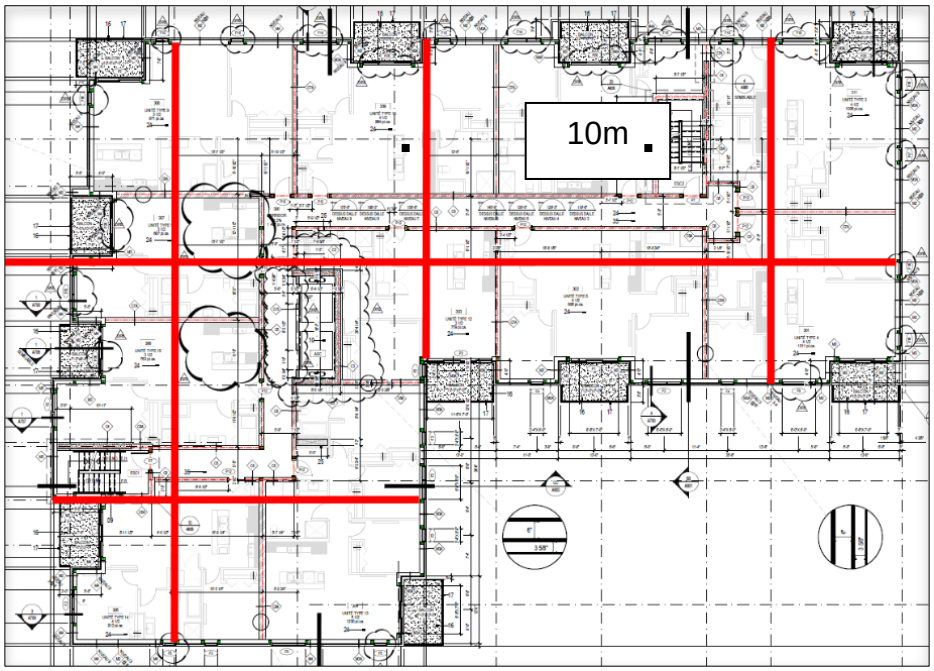


Figure 40 - Ideal positioning

Validation of the positional accuracy

To verify the accuracy of the positioning, it is recommended to project the control lines used for positioning the instrument and check if they align correctly with the control lines marked on the ground. To do this, use the "Layers" function and select only the control lines layer by activating the green toggle. This will enable the projection. Then, return to the main viewer and press the projection function, selecting the “multi-level” scan option. Finally, check to ensure that the projection matches the control lines marked on the ground.

Note – Validation of the positioning accuracy can only be done for reference elements previously marked on the floor. It is essential to have these marks to evaluate the accuracy of the positioning of the instrument.

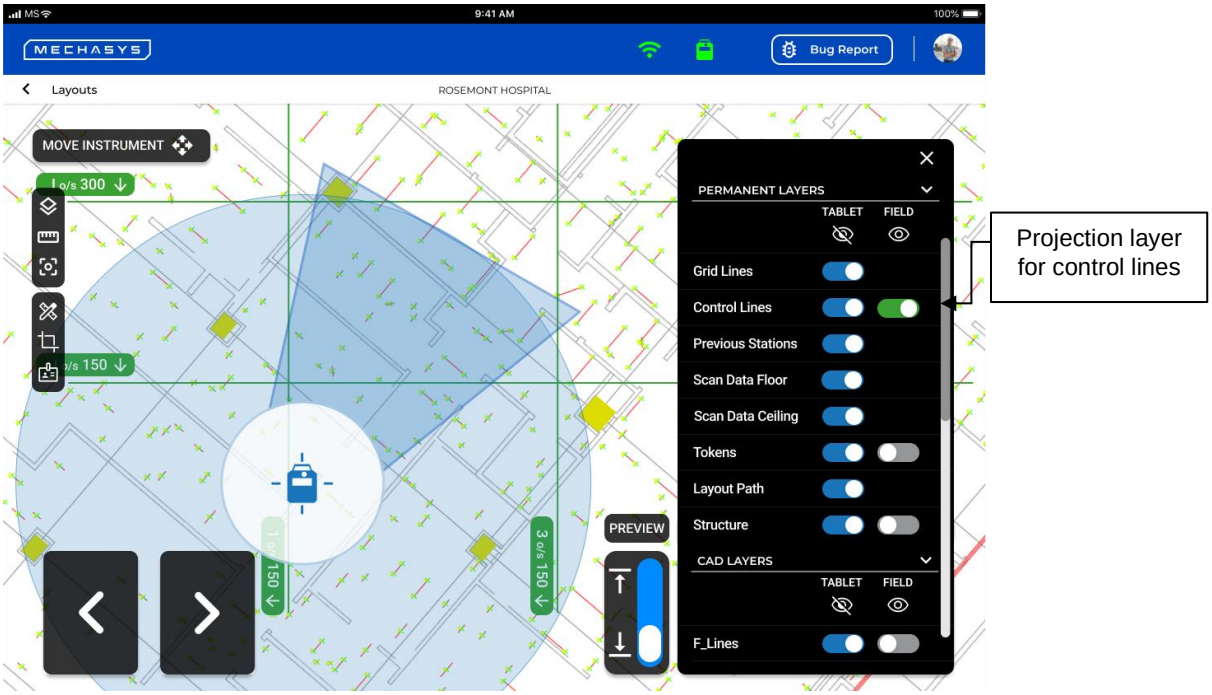


Figure 41 - Control lines layer

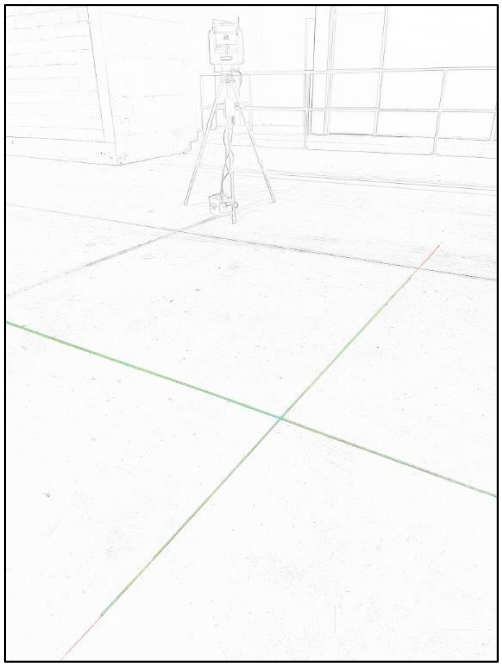


Figure 42 – Validation of positional accuracy

7

MOVING THE INSTRUMENT

In this chapter:

- Station to station movements
- Projection of the next station

Station to station movements

To ensure safe movement of the instrument, it is strongly recommended to use both hands. Place one hand on the top handle and the other on the base of the tripod for improved stability.

When moving the instrument from one station to another, it is advisable to use the recommended technique or the wheel system provided in the additional accessories.

Examples of these methods can be seen in the pictures below:

Figure 43 – Station to station transportation – Recommended technique

Figure 44 - Station to station transportation – Recommended technique with wheels

Projection of the next station

To plan the next station, the instrument may be used to guide the setup. From the projection viewer, press the "Move Instrument" button to open a new control panel. This panel allows the selection of the next setup location. After selecting the desired setup, press the "Reveal Next Station" button to receive guidance to the new station.

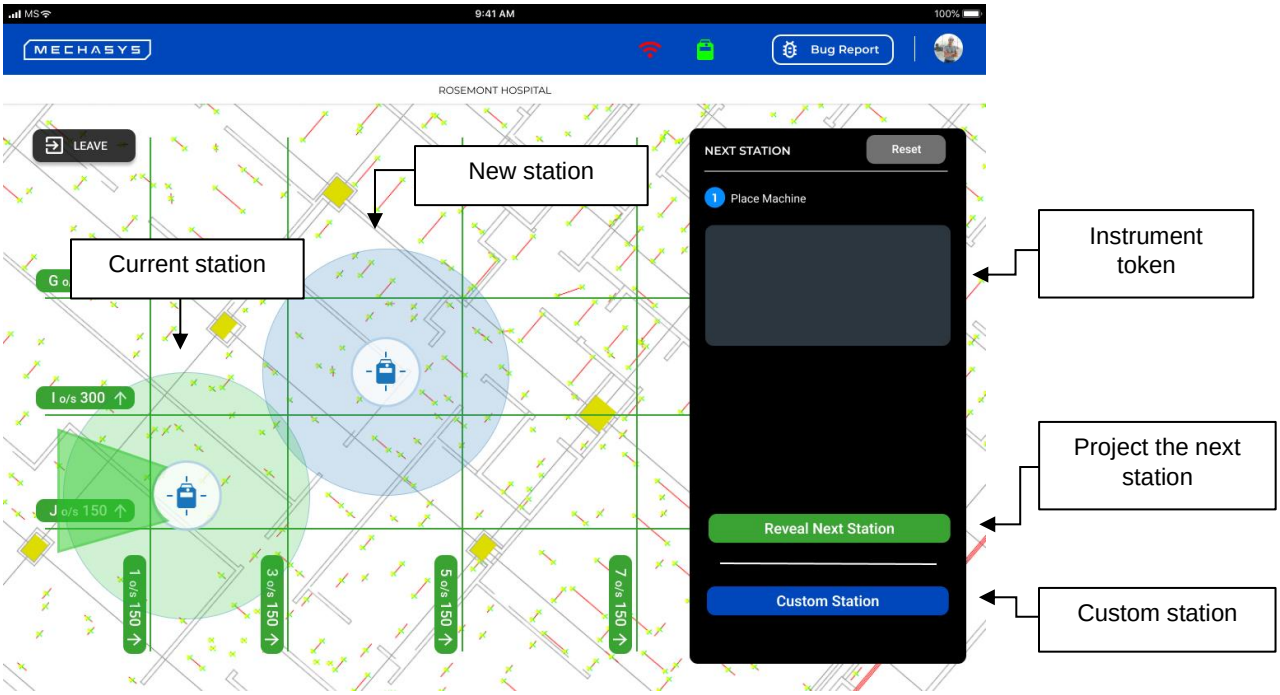


Figure 45 - Graphical interface of the next station

Once the next station is selected, the instrument will automatically position itself in the correct orientation and project an arrow and an "X" to indicate the exact position of the next station. Mark the projection with chalk, then press "Move Instrument" and move your instrument to the desired station.

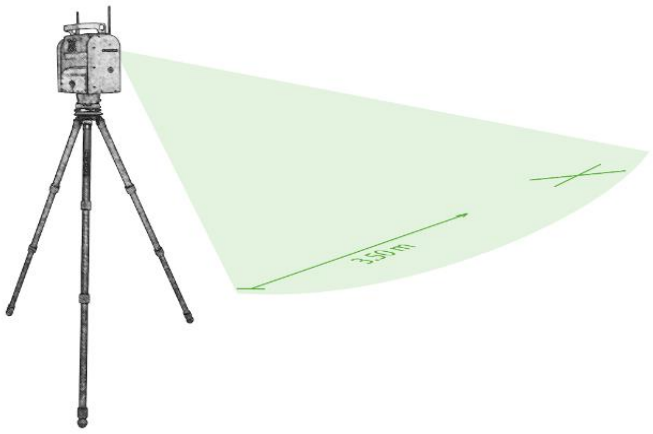


Figure 46 - Projection of the next station

8

MODIFY THE ELEMENTS IN THE DRAWING

In this chapter:

- Single selection
- Multiple selection

Adapting the drawings to meet the site requirements may be achieved by modifying the drawing elements. To guide users through this process and ensure that changes made on-site are carefully monitored, the following instructions are provided.

To begin, from either the main viewer or the projection viewer, press the "Modify Drawings" button located in the upper right corner of the graphical interface.

Single selection

There are various methods to select objects on a drawing. The primary method is single selection, where one item is selected at a time. When using this method, the letters A and B will appear at each end of the selected item, respectively.

To apply a translation, select both ends A and B. To rotate, extend, or modify a single end, simply select the desired end.

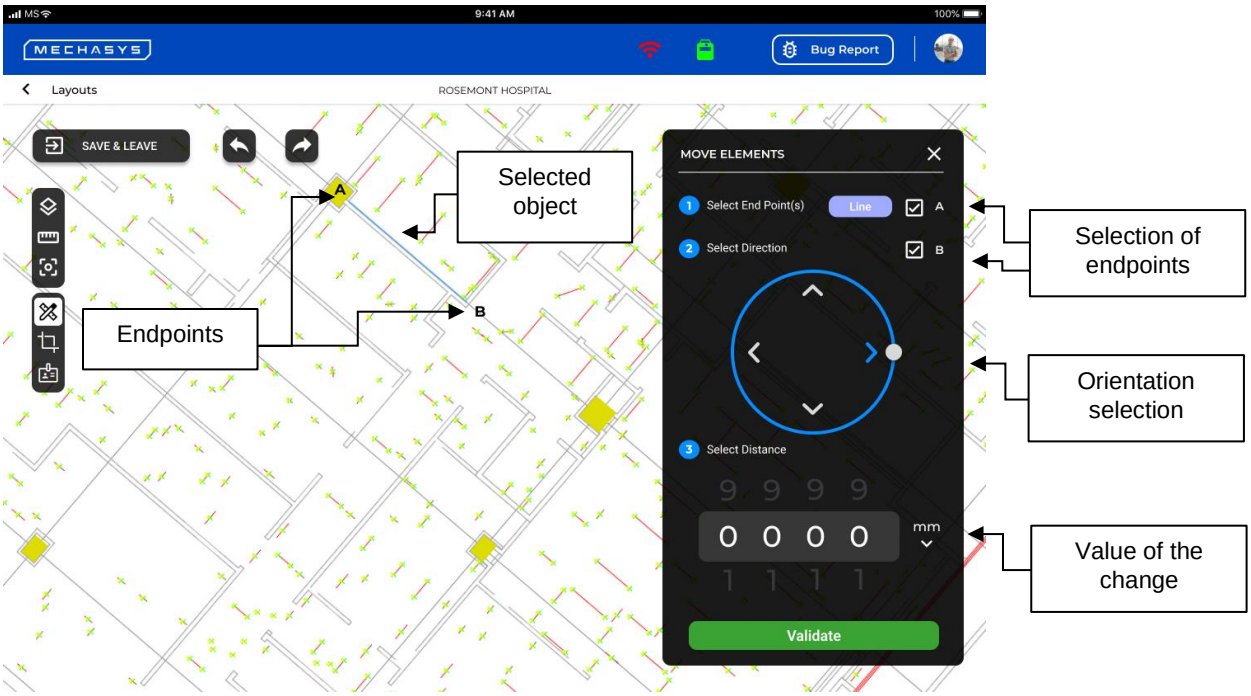


Figure 47 - Single selection for modification

Multiple selection

Multiple selection enables the simultaneous selection of several elements within the drawing. There are two methods to achieve this: window selection and box selection.

Window Selection

Window selection allows for the simultaneous selection of multiple elements by drawing a closed rectangular shape around them. All elements within this shape, as well as those touching the border of the selection area, will be selected.

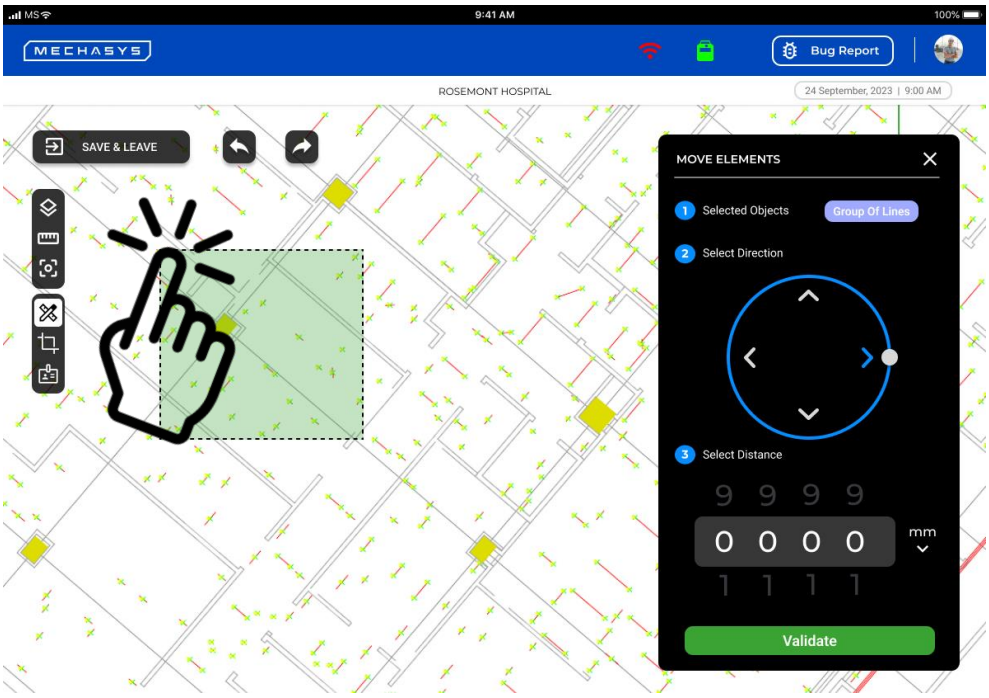


Figure 48 - Selection in window

Boxed selection

Boxed selection, in contrast, selects only those items that are entirely within the selection box. Items that are partially cut off by the selection box will not be included in the selection.

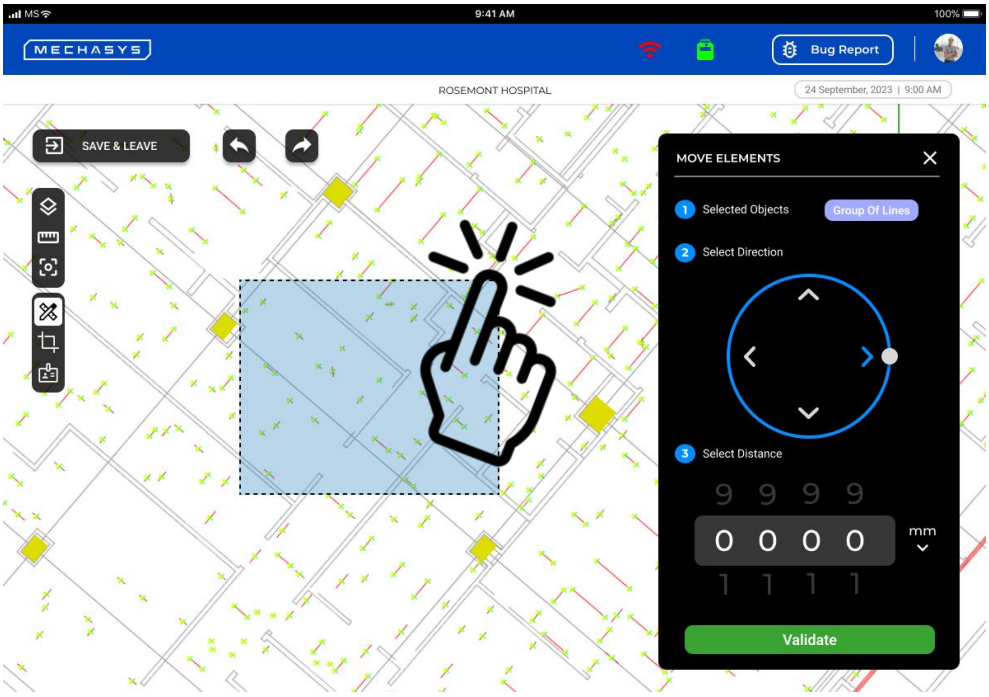


Figure 49 - Boxed selection

9

INSTRUMENT TECHNOLOGY

In this chapter:

- Distance measuring technology
- SmartScan technology
- Resistance to vibration
- Laser safety system
- Instrument 4G/LTE data network

Distance measuring technology

The instrument is equipped with an EDM using time-of-flight technology with phase shift. It is able to measure the distance on a reflective surface provided by Mechasys or on a natural surface.

This measurement technology is very accurate and allows fast and reliable distance measurements on both reflective foils and natural surfaces. The use of this technology is common in distance measurement applications and is highly valued for its accuracy and ease of use.

Averaging to reduce measurement errors

This instrument has an automatic averaging function, which automatically reduces measurement errors. During the measurement process, the instrument requires about two seconds to obtain the accurate distance.

Laser beam divergence

As the range of an EDM instrument increases, the beam of EDMs tend to diverge. However, it is important to note that this divergence does not result in a degradation of measurement accuracy, but rather an increase in the area scanned by the beam.

Projection frame rate and speed

The mirror galvanometer system has a maximum projection capacity based on the number of frames per second (FPS). This is because a laser spot is reflected off the mirror, which oscillates very quickly to form a geometric shape. The more complex or larger the geometric shape, the longer the galvanometer system will take to complete one frame of the projection. In general, a projection at 24 FPS will not create any flicker visible to the naked eye. However, if the projection drops below 20 FPS, some flickering may be visible. It is important to note that this flicker will not affect the accuracy of the mirror galvanometer system in any way.

Smartscan technology

The Smartscan technology was developed to meet the demands of job sites that can be difficult and highly variable. Several aspects of our scanner allow the user to accelerate productivity and reduce the risk of errors on the job site.

Supported surface types

Smartscan technology allows the system accuracy to be tailored for several imperfect surface types. They can be classified in several ways, including roughness, flatness and slope.

With regard to roughness, the figure below classifies the different surfaces according to the job site environment.

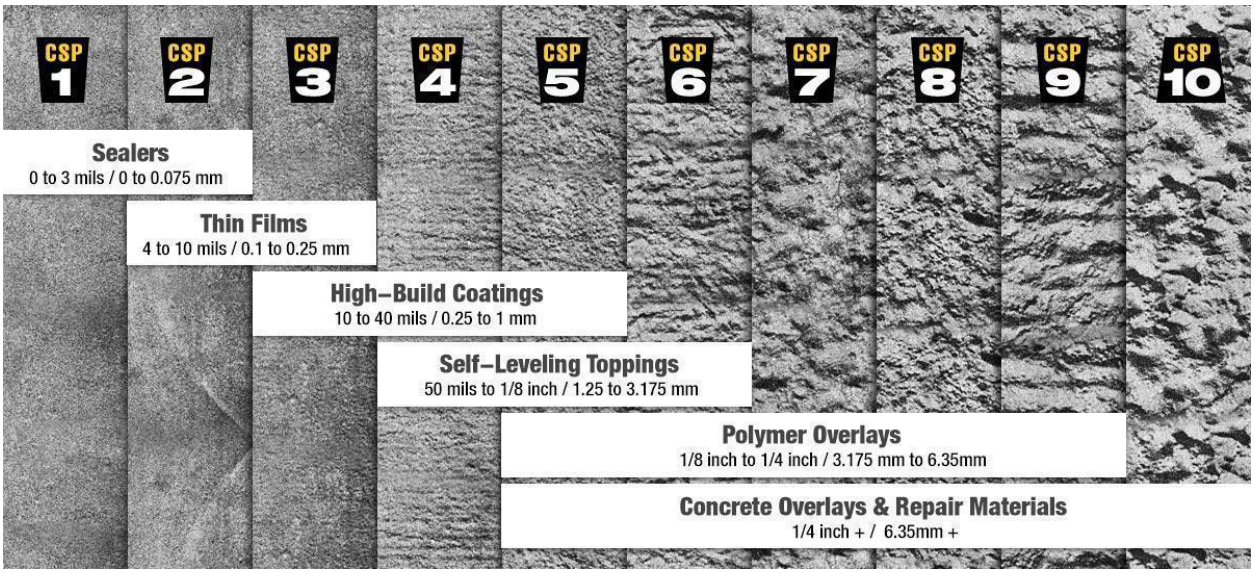


Figure 50 - Categorization of supported surfaces (source : graco.com)

Resolution of scans

The choice of scan resolution allows the projection to be adapted to any type of environment. The Layout Field™ application consists of three scan capabilities to guide the user through different job site environments.

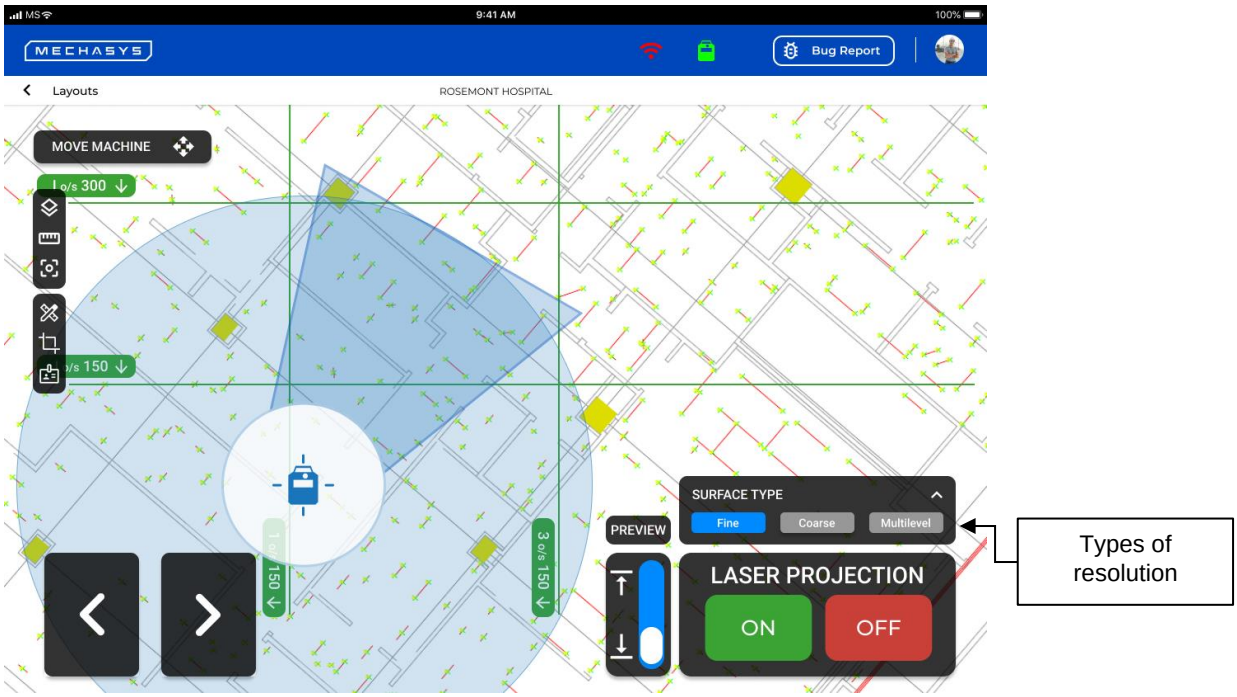


Figure 51 - Resolution of scans

Based on these three types of resolutions, the table below explains the differences between the three possible types of scanning, as well as the situations on a job site for which the instrument can compensate for irregularities.

Slab Type →	Fine	Coarse	Multi-Level
Concrete Surface Profile	CSP1 to CSP4	CSP4 to CSP8	CSP1 to CSP8
Scan Point Grouping	142mm ($5\ ^{19}/_{32}$")	N/A	N/A
Max Scan Deflexion	30mm ($1\ ^{3}/_{16}$")	10mm ($^{25}/_{64}$")	10mm ($^{25}/_{64}$")
Max Slope	5%	10%	10%
Max Elevation Step	0	0	300mm ($11\ ^{13}/_{16}$")

Obstacle detection

Smartscan technology is also able to detect obstacles in the projection area and apply an effect to projected lines that may be affected in terms of accuracy. If an element of the projection is projected onto an obstacle, the line in question will appear dashed, indicating the presence of an obstacle. The dashed lines will not be accurate, allowing the user to know whether or not they can rely on these lines.

Resistance to vibrations

The instrument is also equipped with sensors to detect vibrations during active projection, ensuring consistent accuracy throughout the process. If vibrations are generated when positioning the instrument, it is recommended to wait to ensure that the rangefinder pointer is stable before taking a measurement.

Laser safety system

Laser safety systems have been put in place to comply with IEC 60825-1 standards. The security system comprises three main components:

- Proximity sensor
  - The proximity sensor empowers the instrument to swiftly detect any moving obstacles within a "hazard zone" ranging from 0.02m to 1.3m, promptly shutting down the projection system within a remarkable 1/60th of a second response time.
- Dynamic laser power control
  - Our dynamic control over laser power enables the system to adjust its projection brightness according to environmental conditions and projection density, consistently optimizing visibility while prioritizing safety.

- Continuous monitoring of laser system
  - The instrument is outfitted with internal sensors that monitor laser performance, addressing potential hardware defects.

Instrument 4G/LTE data network

The instrument is equipped with a 4G/LTE GSM Module that autonomously transmits data to Layout Cloud Servers. This functionality allows users and project managers to compile and access this information, enhancing the decision-making process while working remotely from the office. Below are the details regarding the respective plans and limits for the GSM module.

Type of data transmitted

Product update notifications
The GSM module is integrated with the Layout Cloud platform, providing access to any available firmware or remote controller updates. As a result, when updates are available, the GSM module utilizes internet connectivity to promptly notify of the latest release. The update is downloadable using a standard Wi-Fi connection.

Bug reports
Bug reports are automatically transmitted to Mechasys' database via the GSM module. This process ensures that the support team is informed and prepared to assist with any challenges encountered on-site.

Instrument data
Instrument data, including utilization rates, internal and external temperatures, stations, and other metrics, is recorded and transmitted to the Layout Cloud platform. This system provides comprehensive fleet management tools, enabling monitoring and optimization of operations.

Field analytics
All field analytics captured by the instrument on-site are integrated into the Layout Cloud Pro version. These analytics include a wide array of critical data, such as 3D point clouds, surface flatness reports, modification reports, as-built drawings, and more.

Usage Zone Mapping

Below is the URL for the updated Usage Zone Mapping based on every country where our SIM card can be operated. Please note that information may be subject to change.

https://support.telnyx.com/en/articles/7966416-telnyx-iot-sim-data-usage-zone-mapping

Instruments deployed in Zone 4 and beyond may incur additional fees or experience service interruptions. For detailed information regarding Zone 4 and higher, it is recommended to contact the assigned sales representative for further clarification and assistance.

10

TROUBLESHOOTING

In this chapter:

- Robot control
- Projection & laser safety
- Positioning & accuracy
- Communication & motor control
- Knowledge center

Robot Control

The Robot Control page is a tool available to the user, providing total control over the instrument on-site. This page allows for manual adjustment of projector values, monitoring of performance data, and the ability to initiate specific actions if necessary. An example is shown below:

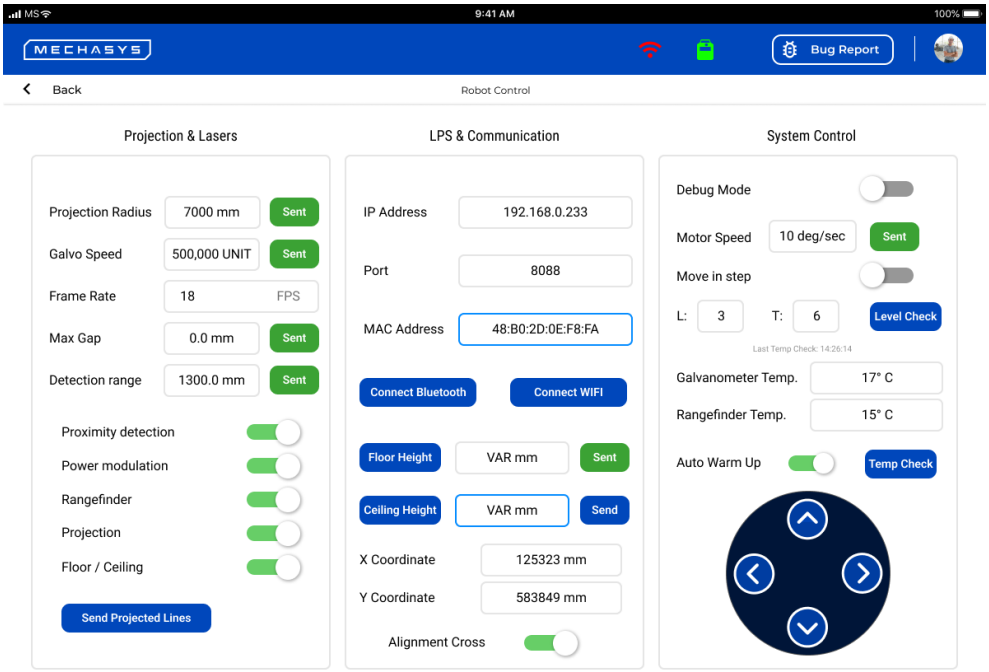


Figure 52 – Robot control page

Projection & laser safety

Activate/deactivate the proximity detection

The proximity sensor can be activated or deactivated by the user at any moment. However, please note that after every bootup, the instrument will, by default, re-activate the proximity sensor.

Activate/deactivate the power modulation

Power modulation can also be activated or deactivated by the user at any time. However, it is important to note that after each bootup, the instrument will, by default, re-activate the power modulation.

Complex ceiling projections

For ceiling projection involving complex surfaces, such as joists or other steel structures, it is possible to adjust the ceiling height of the instrument to adapt to field conditions. The instrument automatically measures the ceiling height directly above it. To manually adjust

(or "cheat") this height, measure the difference from the instrument's base reference to a new Z=0 value using a tape measure. Subtract this value from the automatically set ceiling height on the Robot Control's page. After saving the modification, the adjusted ceiling height will be applied. Same concept can also apply to a floor projection.

Communication & motor control

Ideal motor speed

The ideal motor speed for the instrument is 14 degrees per second, which allows the motor to move swiftly without generating any backlash. During positioning, it is also possible to adjust the speed to medium or slow for finer adjustments.

Communication protocol

The instrument uses Wi-Fi communication to connect with its controller. The Wi-Fi communication protocol relies on an IP address, port, and MAC address. If any issues arise with the communication of the instrument, it is advisable to double-check the communication credentials, including the IP address, port, and MAC address.

- IP Address: 192.168.12.1
- Port: 8080
- MAC Address: Unique for each instrument

Warm up sequence

The warm-up sequence enables the instrument to heat itself during cold temperatures, which helps increase accuracy under challenging conditions. If any issues are experienced with the warm-up sequence, it is advised to disable it using the toggle on the Robot Control page.

Knowledge center

For more information, it is recommended to continue reading online on the Knowledge Center page. Follow the provided URL or scan the QR code to access the page.

https://app.mechasys.ca/api/1.1/wf/re-quickstarter-guide

XR Projector

User Manual

Learn more at www.mechasys.ca