Creating a new machine configuration

Before creating a new configuration, an appropriate location and tools must be prepared.
Creating a new configuration is associated with installing sensors on the machine.
It is recommended to perform the configuration in a garage or hall, on a hardened and leveled surface.
If it is not possible to perform the configuration indoors, it is recommended to choose a flat, hardened outdoor area with reduced lighting conditions (e.g. heavy cloud cover, after sunset), so that during measurements the light lines generated by the cross-line laser projecting onto the excavator boom can be observed.
Assistance from a second person will most likely be required to perform the measurements.
Installing the system on the machine requires permanently attaching 4 or 5 mounting brackets to the bucket, boom segments, and the slewing structure.

WARNING!

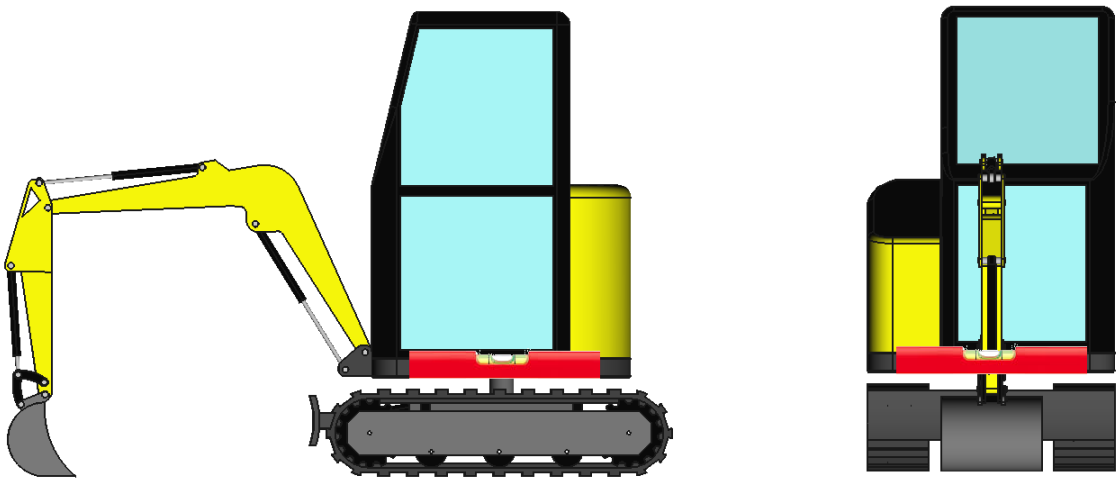
Mounting the sensor on the bucket, depending on its size and design, may require constructing appropriate protection (e.g. welding protective covers or a protective housing) to protect the sensor from damage during operation!

When building such protection, care must be taken not to fully enclose the sensor in metal, as this would prevent wireless communication with the rest of the system.

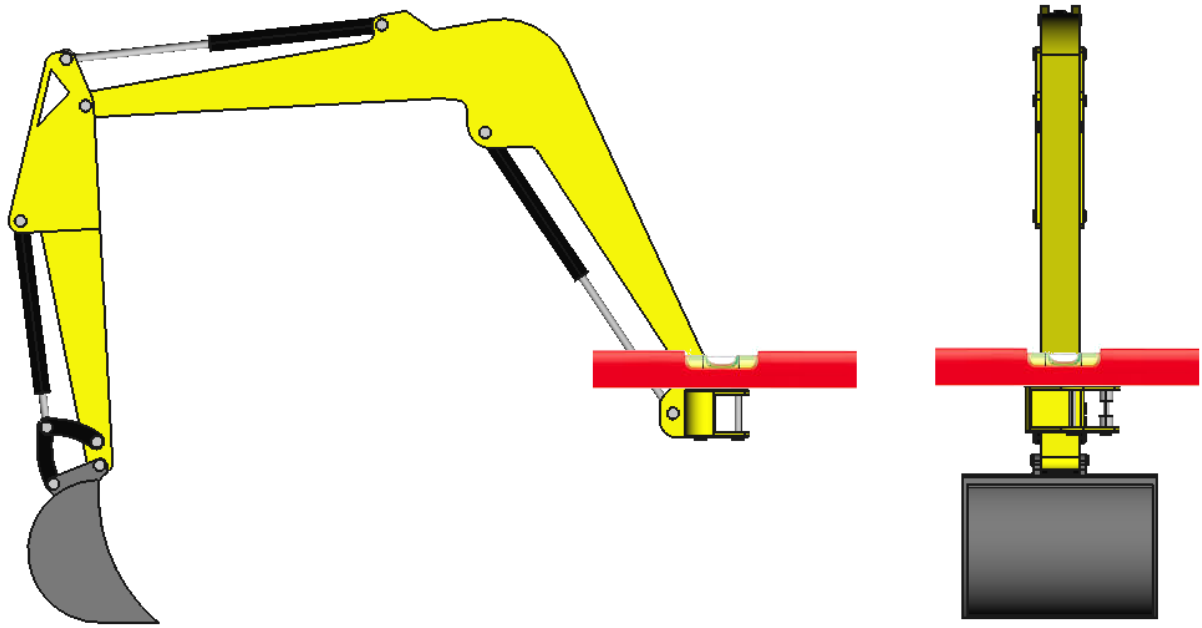
Required tools:

- A set of BlueDig BLE IMU Sensor units (charge the batteries before starting the configuration)
- A set of mounting brackets for BlueDig BLE IMU Sensor units
- A self-leveling cross-line laser (charge the battery before starting the configuration)
- Tape measure
- Spirit level
- Cleaning cloths and degreasing agent (e.g. isopropyl alcohol, IPA)
- Permanent marker

Place the machine on a level surface.
Using a spirit level, verify that the machine is set horizontally (this refers to leveling the rotating upper structure of the machine, not the undercarriage), so that the axis of rotation is vertical.
In the case of a rotating excavator, this means leveling the upper rotating structure



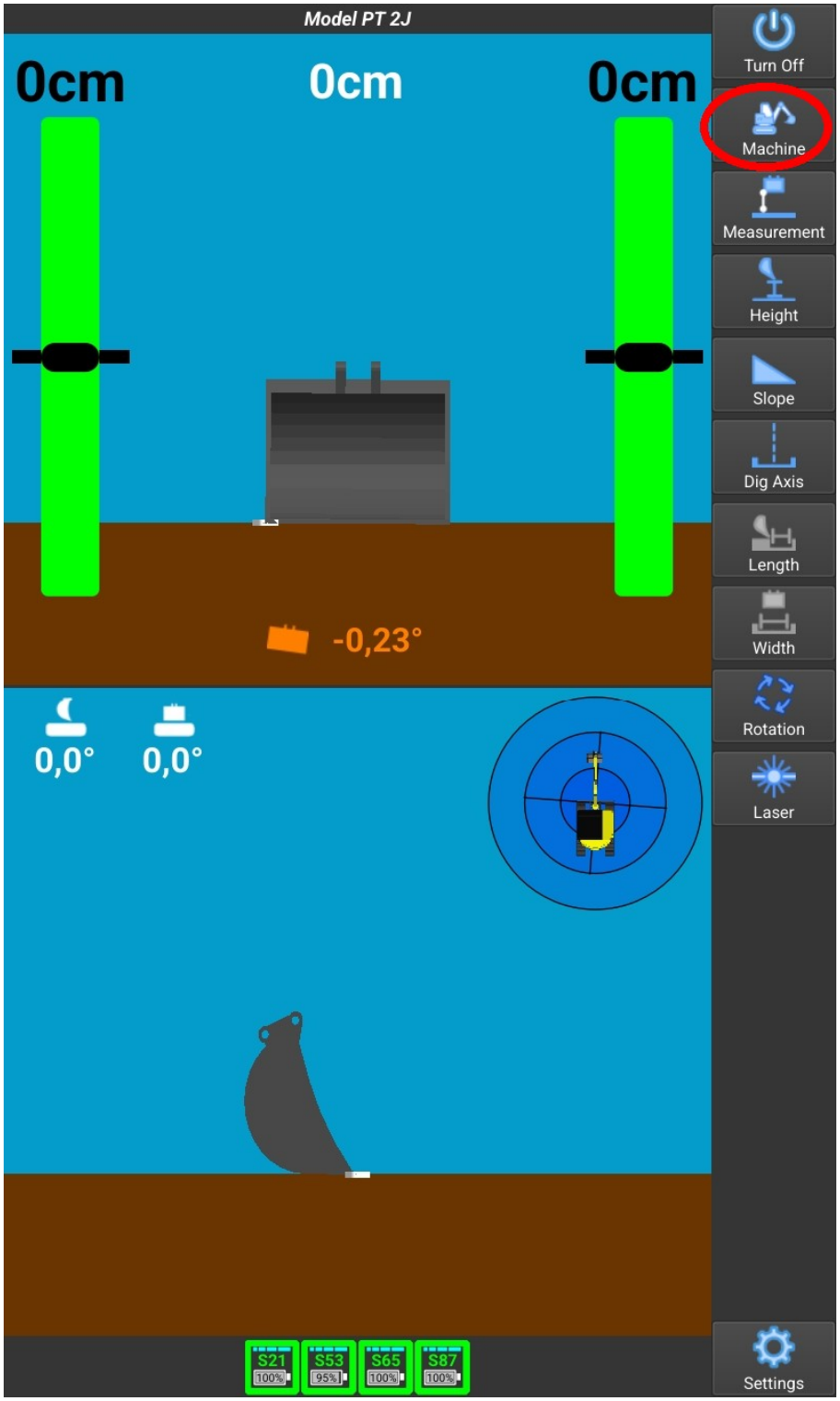
In the case of a non-slewing excavator (with only the arm pivoting), this refers to leveling the rotating part of the arm



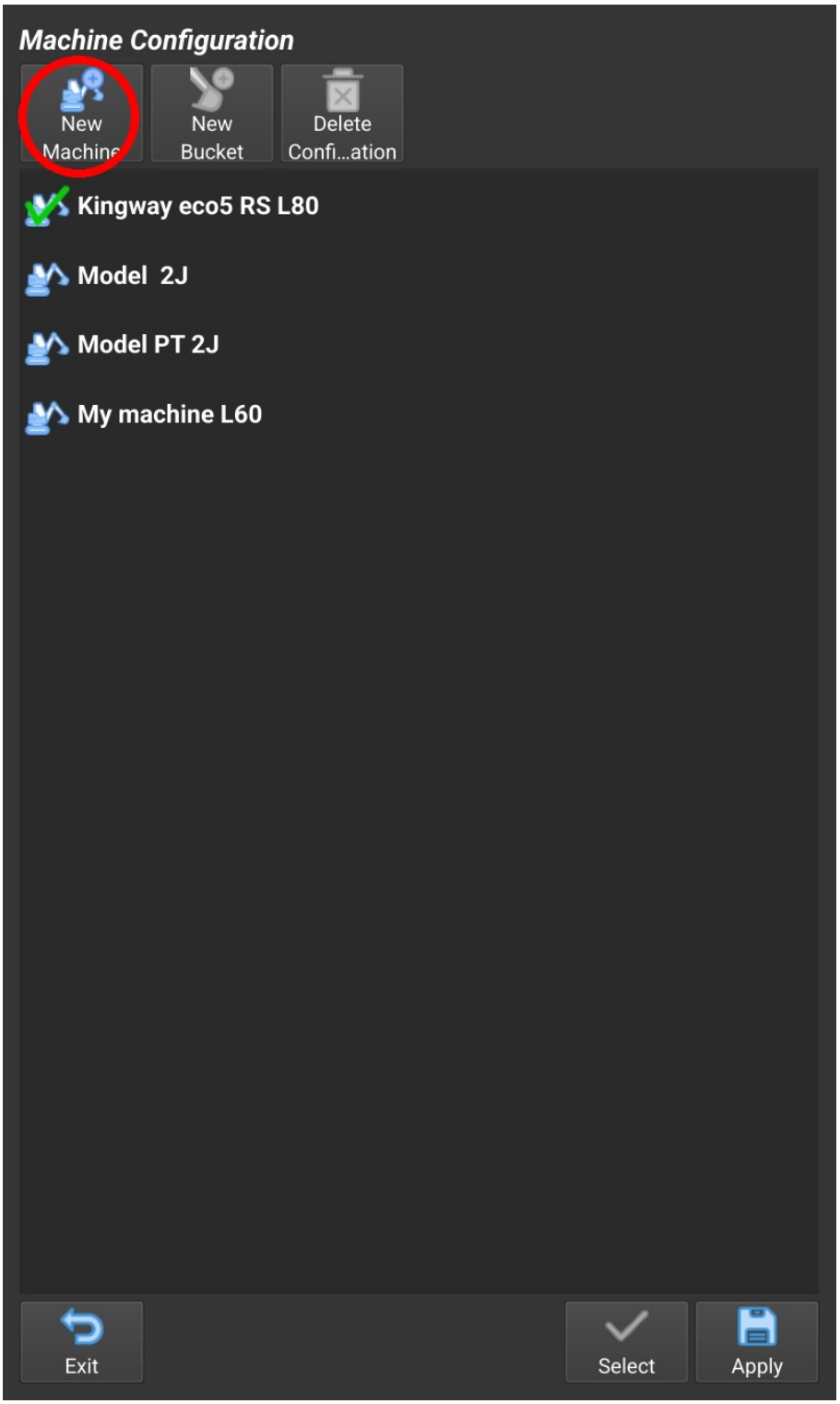
If, after positioning the machine, the rotating part is not level, the machine must be leveled using the outriggers/supports, or, if the machine is not equipped with them, this can be done for example by placing wooden blocks under the tracks or wheels.

WARNING! Great care must be taken when leveling the machine and during subsequent distance measurements, because the accuracy achieved during configuration creation has a direct impact on the accuracy of the system's operation.

To create a new configuration, launch the BlueDig application and press the **Machine** button in the drop-down menu.

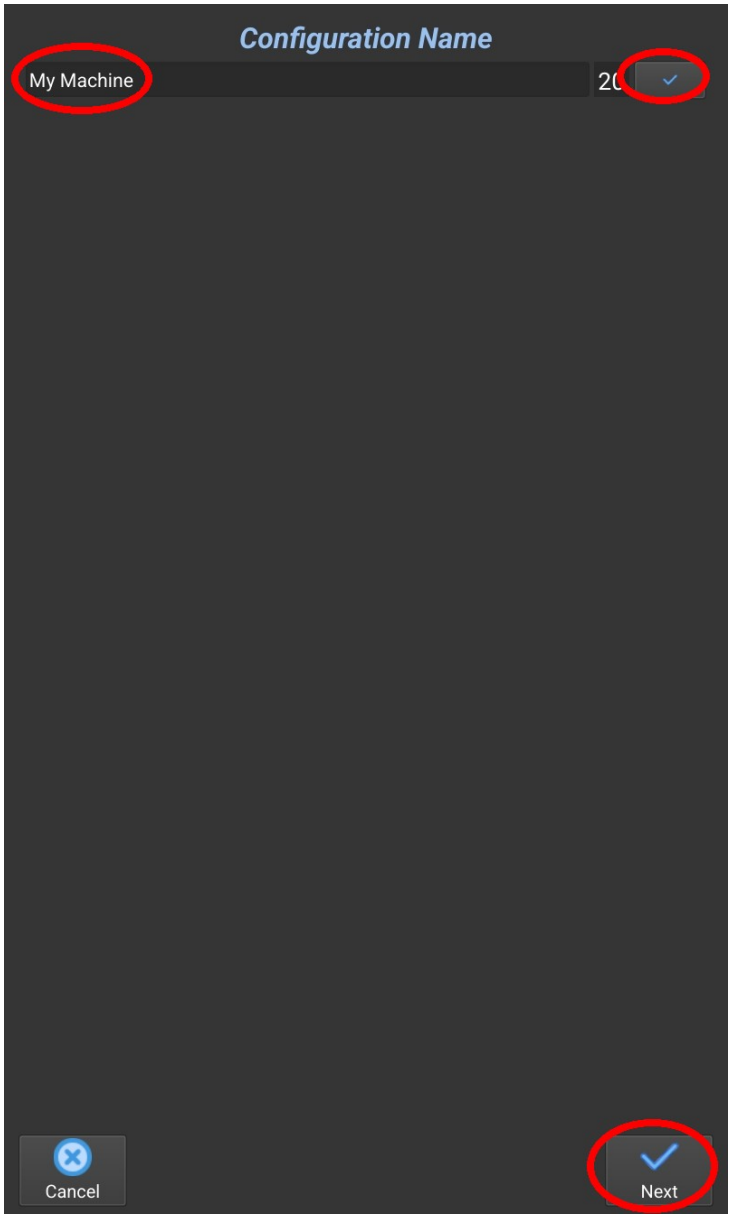


In the Machine Configuration menu, press the **New Machine** button.

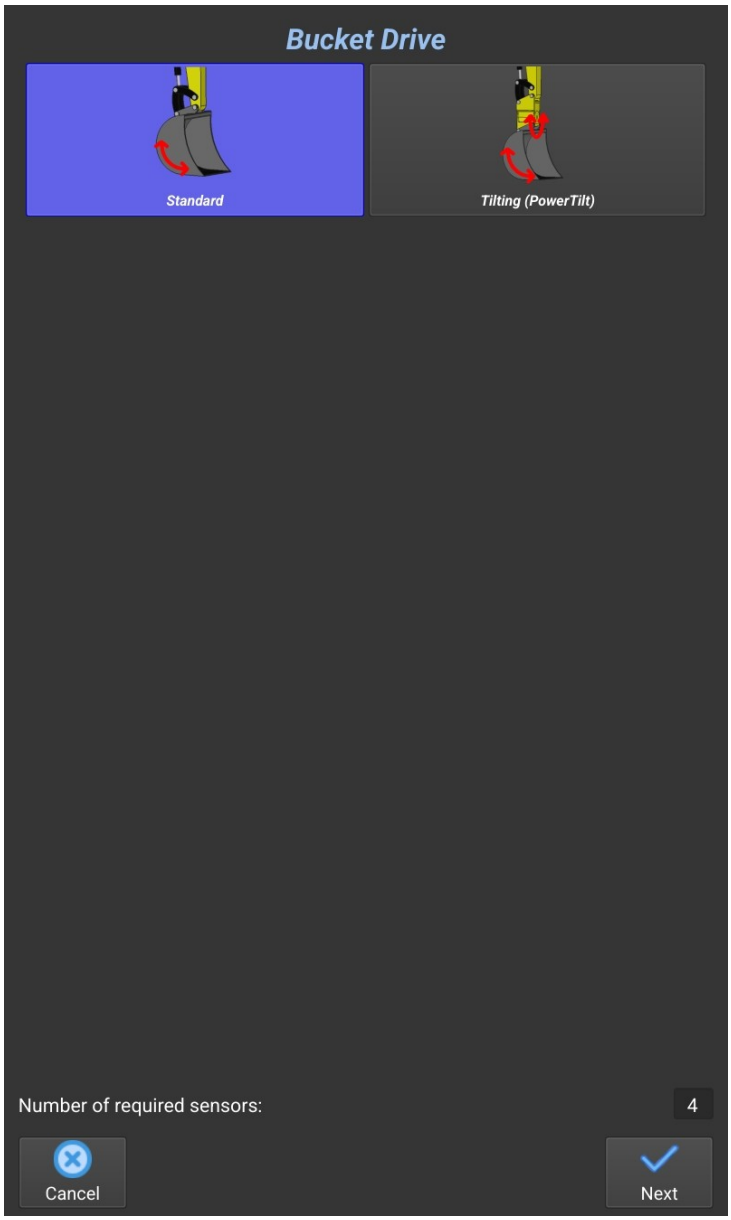


The New Machine Configurator will start.
The configurator guides you through the entire configuration process, presenting step by step all actions that need to be performed.
Read carefully and accurately follow all instructions displayed on the screen in the subsequent configuration steps.
Make sure that all actions have been completed correctly before proceeding to the next stage, because due to dependencies created in subsequent steps, the Configurator does not allow returning to a previous step.
This manual presents an example configuration process for a machine with a slewing upper structure, a single-articulated boom, and a standard bucket. When selecting different settings, the wizard will display the appropriate screens and steps for the given configuration.

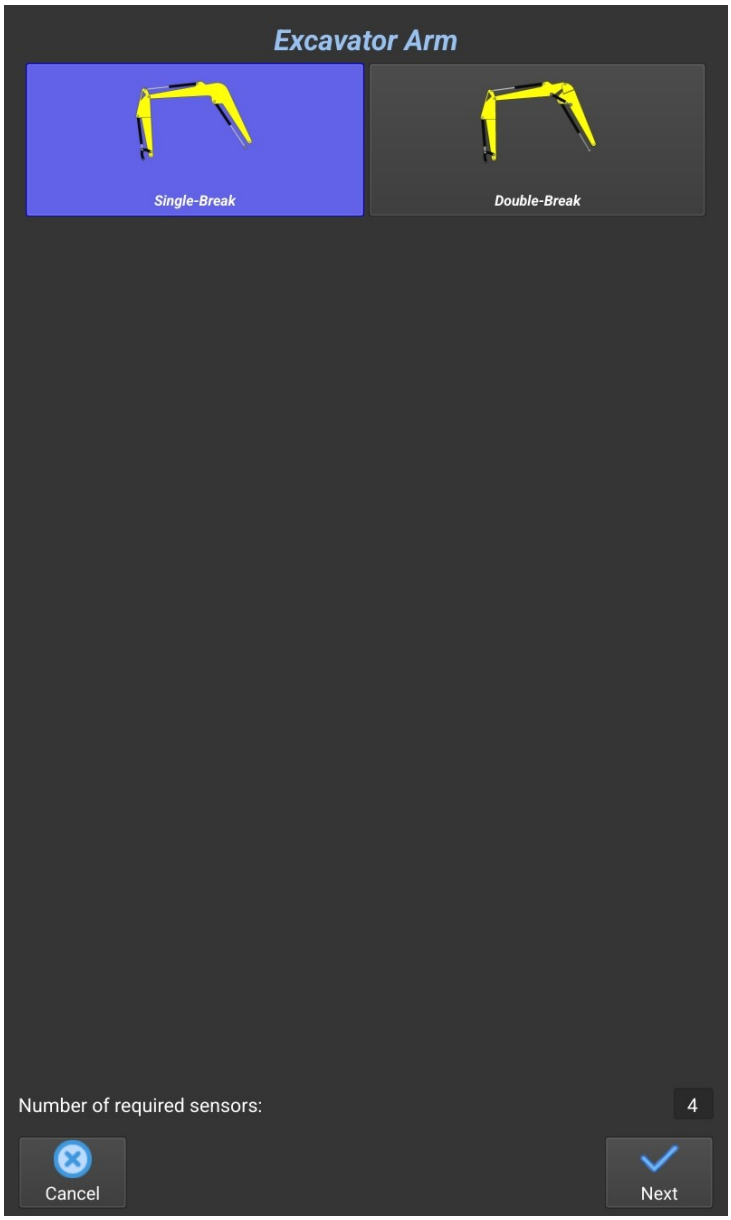
In the first step, enter your configuration name – preferably one that makes it possible to identify which specific machine it is and which bucket this configuration applies to.
Confirm the name using the button next to the name field.
Use the **Next** button to proceed to the next step.



In the next step, select the bucket drive type. The available options are a standard bucket and a tilting bucket.
For the purposes of this manual, the standard bucket has been selected.
Use the **Next** button to proceed to the next step.



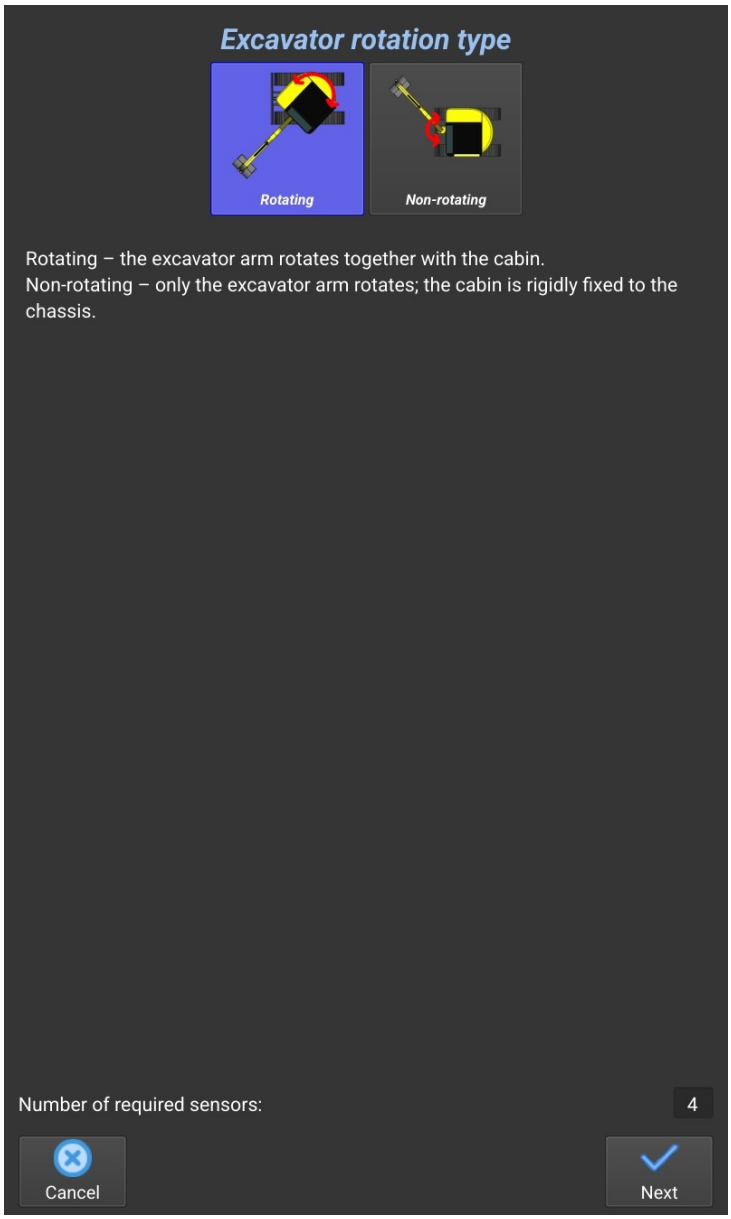
In the next step, select whether the excavator boom is articulated once (two-piece) or twice (three-piece).
For the purposes of this manual, a single-articulated boom has been selected.
Use the **Next** button to proceed to the next step.



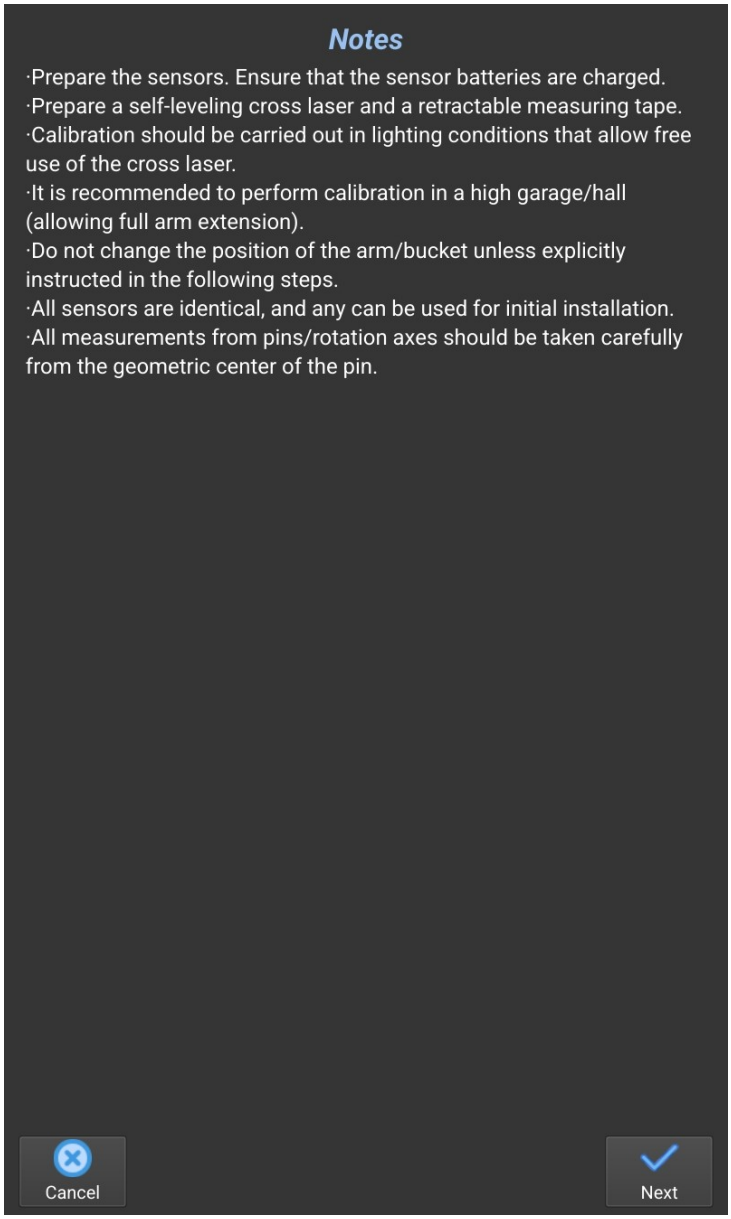
In the next step, select whether the machine is a slewing or non-slewing excavator.
A non-slewing excavator is one in which the boom rotates only on the dipper, for example the digging arm on backhoe loaders.
A slewing excavator, in addition to rotating the entire upper structure, may also have an additional rotating boom, but the system assumes that rotation will be performed around only one axis.

In the case of a slewing excavator with a rotating boom, when using the system you should work without additional boom rotation. In this situation, if there is also boom rotation at the dipper, set the dipper to the position in which work with the system will be performed (if there are no special requirements, straight ahead is recommended) and mark the dipper rotation position at which calibration was performed, for example using a permanent marker. This is to ensure that when working with the BlueDig measurement system, the boom rotation is set exactly as it was during configuration.

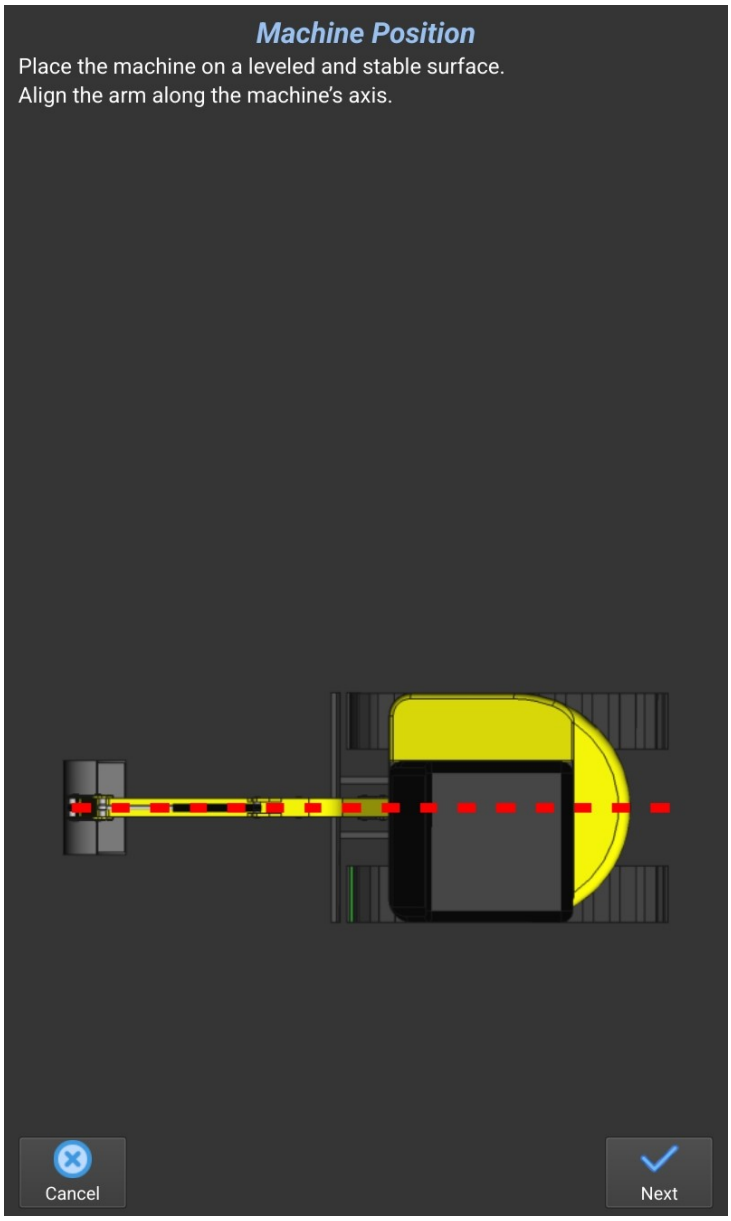
For the purposes of this manual, a slewing excavator has been selected.
Use the **Next** button to proceed to the next step.



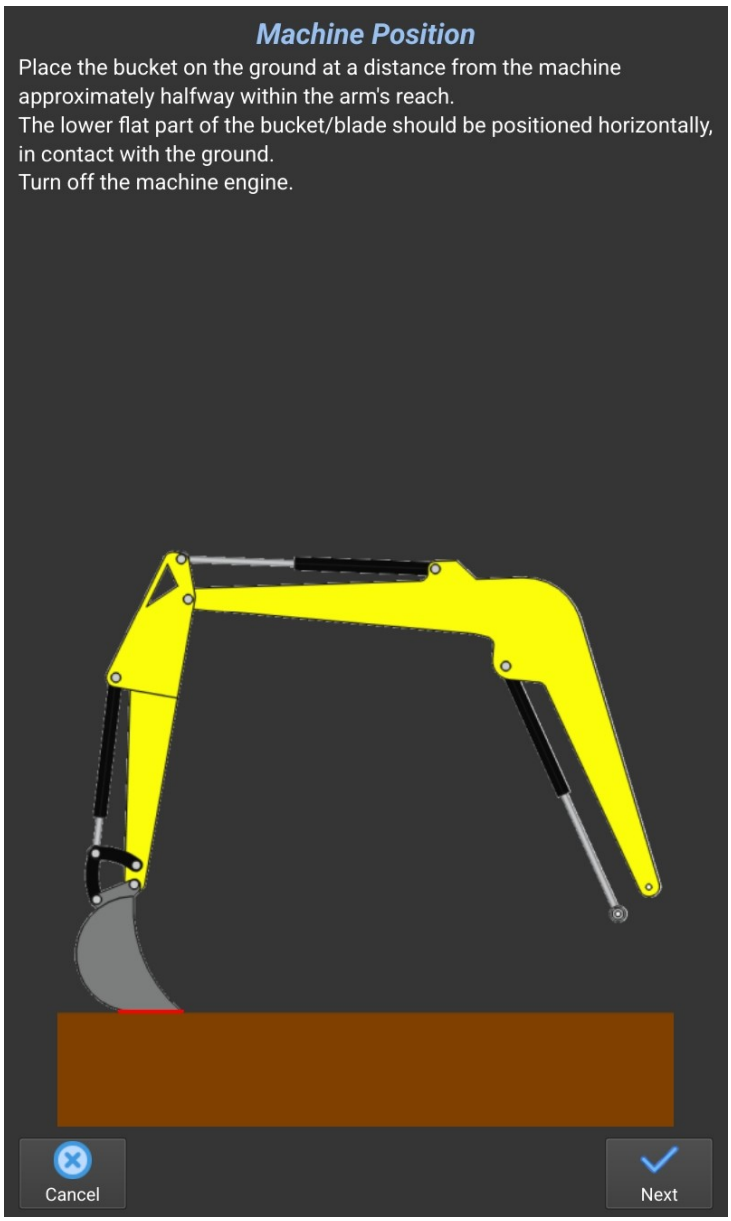
Next, a text instruction describing the further steps will be displayed.
After carefully reading and following it, press the **Next** button to proceed to the next step.



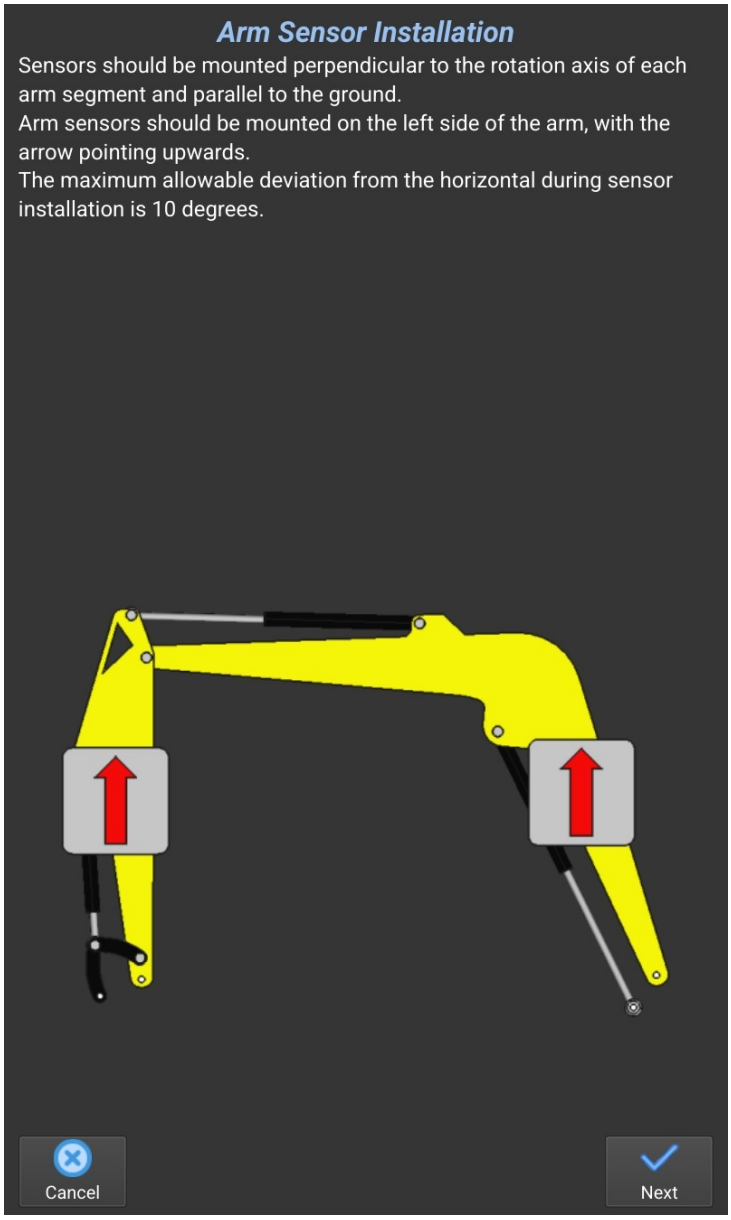
The next screen presents instructions on how to position the machine for configuration.
As mentioned earlier, in the case of a slewing excavator with an additional rotating boom, it is acceptable to create the configuration with the boom rotated, but the boom rotation position must be marked during configuration.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.



The next screen also presents instructions on how to position the machine for configuration. After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

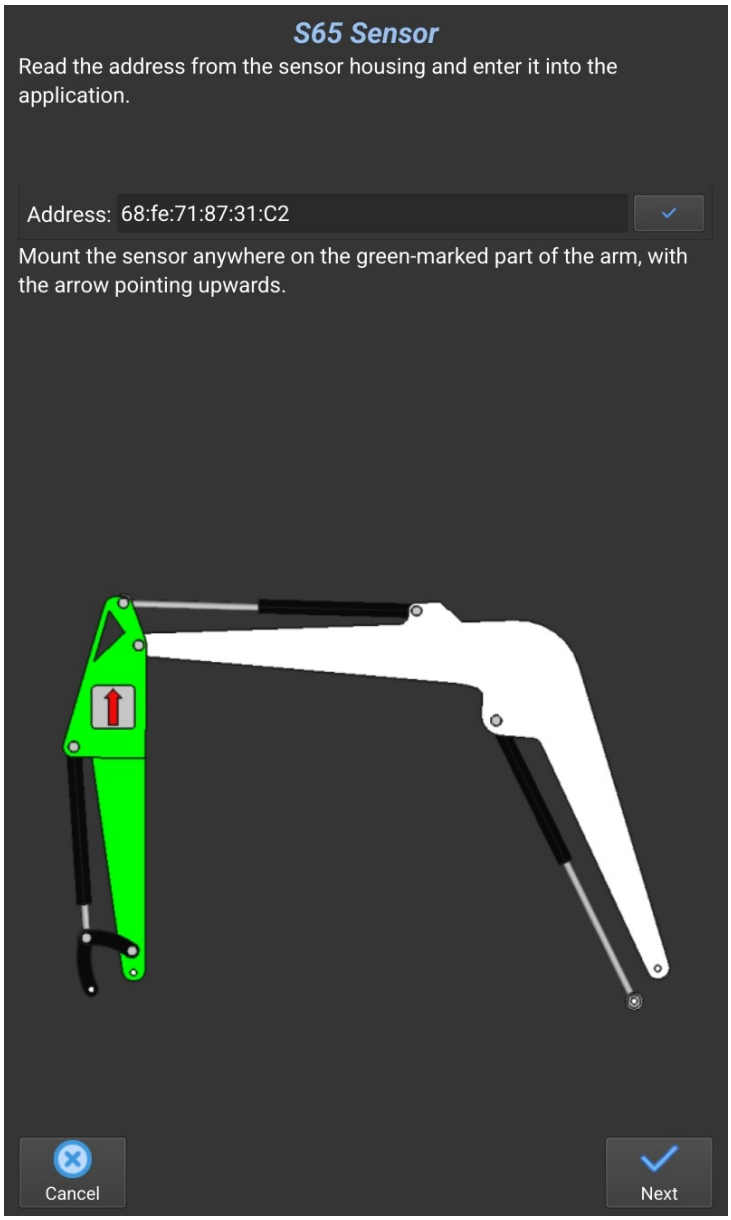


The next screen presents instructions and notes regarding sensor installation.
After carefully reading and following them, press the **Next** button to proceed to the next step.



The mounting brackets have a very strong adhesive layer that does not allow the bracket to be easily removed if it is mounted incorrectly; therefore, great care must be taken during installation.
The maximum permissible deviation from level when mounting a sensor bracket is 20 degrees.
Before attaching each sensor bracket, thoroughly clean, degrease, and dry the surface to which it will be bonded – for example using IPA.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

In the next step, the Configurator will ask you to install the S65 sensor.



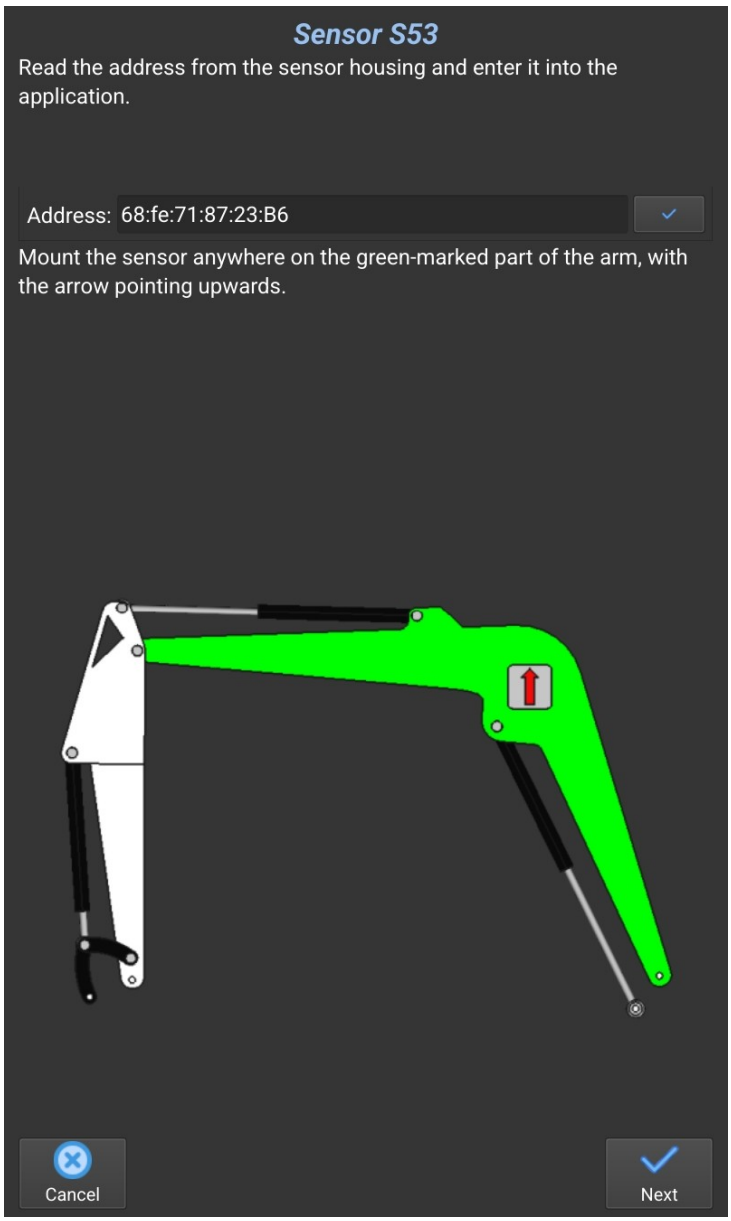
There is freedom in mounting the sensors during configuration, because all sensors are identical. Therefore, during their first installation, they must be labeled, which will be described later in this manual.
When the Configurator asks for the sensor MAC address, read it from the label located on the sensor housing and enter it into the application.
The MAC address consists of digits 0–9 and letters A–F.
Letter case does not matter, so it can be entered in either lowercase or uppercase.
If the character 0 appears in the address, there is no ambiguity between the digit zero and the letter “o”, because the letter “o” does not occur in MAC addresses.
The MAC address must be entered correctly and verified before proceeding, because if the address is entered incorrectly, the sensor will not connect and the configuration cannot be completed.

After mounting the sensor, mark the sensor number to which it has been assigned.
The appropriate table is located on the label on the front of the sensor.
Using a permanent, non-erasable marker, mark a dot in the appropriate field so that after removing the sensors they can be easily reinstalled in the correct mounting brackets.
For example, for sensor S65:

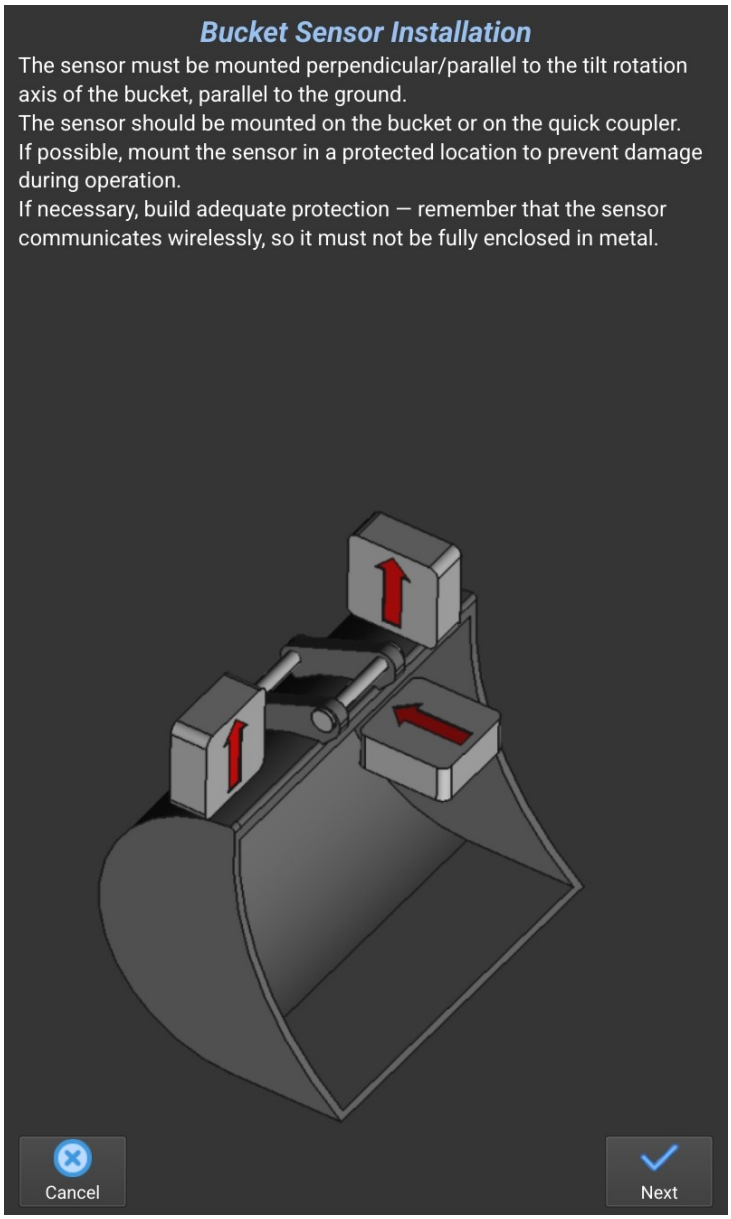
Additionally, it is recommended to write the same sensor name on the mounting bracket assigned to it, to avoid confusion at the beginning about where each sensor number should be installed.

The same procedure should be followed for each sensor installed in the subsequent steps.
Sensors are numbered sequentially along the boom, from the highest number to the lowest, with the highest number assigned to the bucket sensor. Therefore, even if the marking wears off, there will be no problem identifying the correct sensor mounting location.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

In the next step, the Configurator will ask you to install the S53 sensor.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

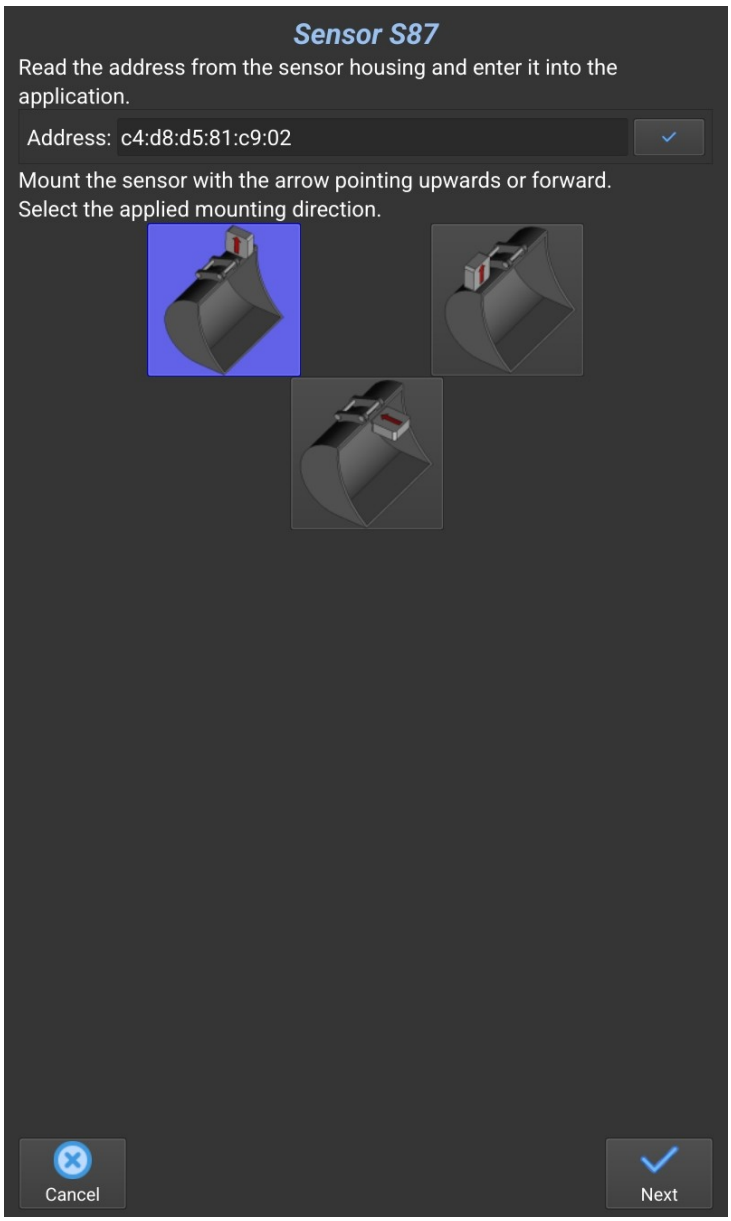


In the next step, the Configurator will display instructions for mounting the bucket sensor.

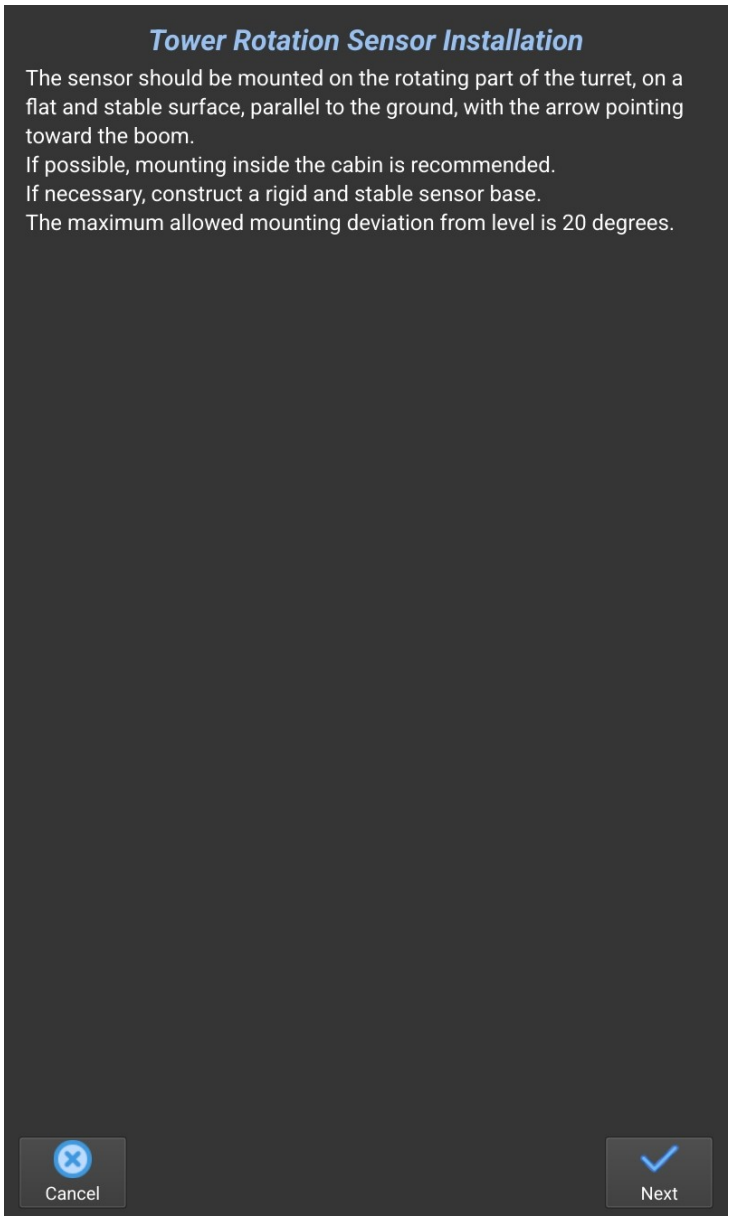


The bucket sensor is the most exposed to damage due to its location. It should be mounted in such a place on the bucket or quick coupler that it cannot be damaged during operation.
If necessary, metal protective covers should be constructed for the sensor, making sure not to fully enclose it, as this would prevent wireless communication between the sensor and the rest of the system.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

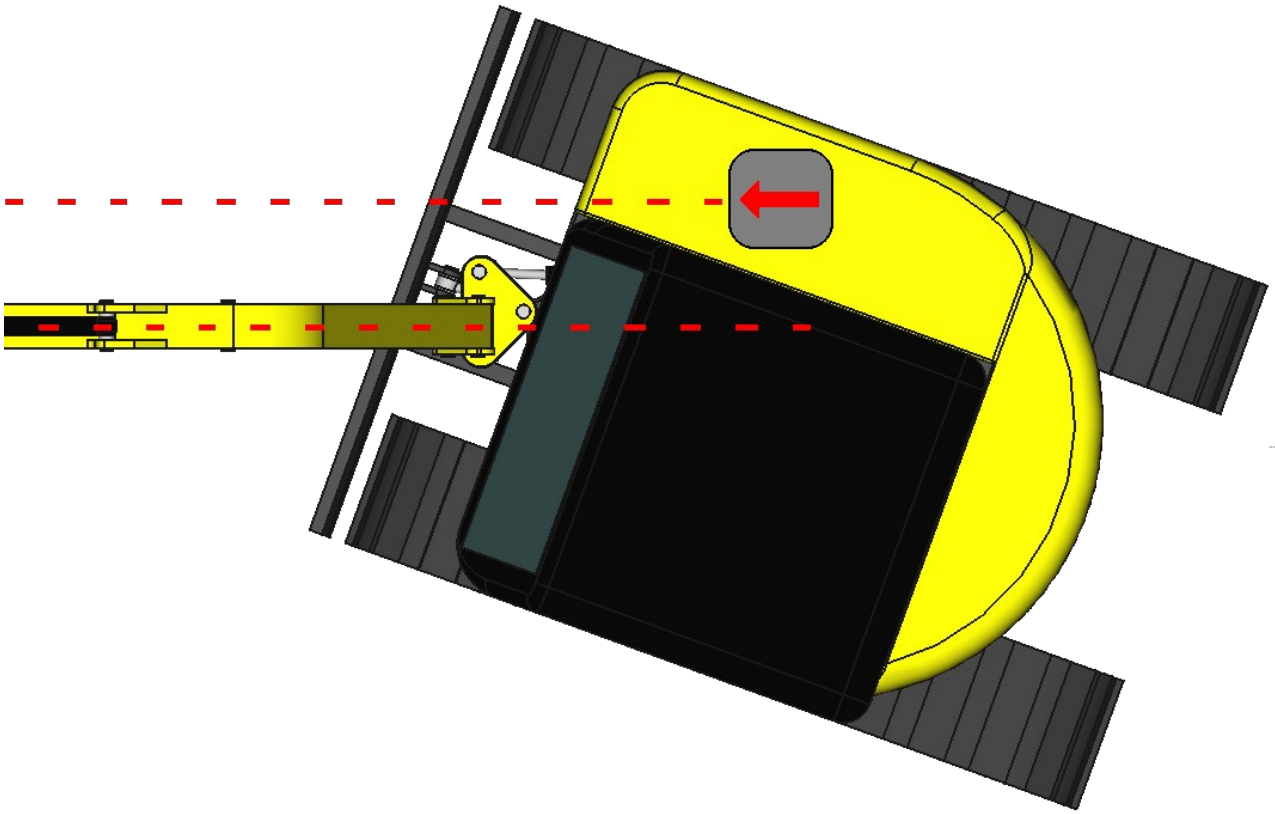
In the next step, the configurator will ask you to enter the sensor address, mount the sensor, and select the chosen sensor mounting orientation.
After completing these actions, press the **Next** button to proceed to the next step.



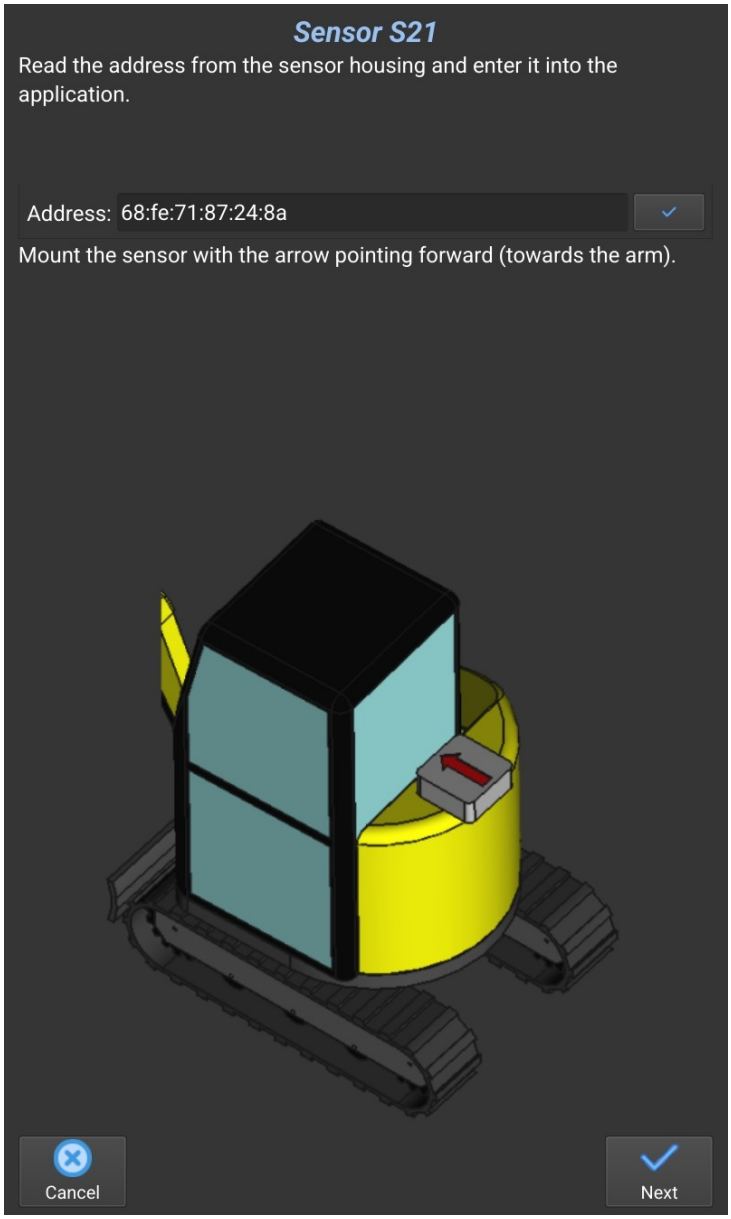
In the next step, the Wizard will display instructions regarding the installation of the rotation sensor on the slewing structure.
After carefully reading and following the instructions, press the **Next** button to proceed to the next step.



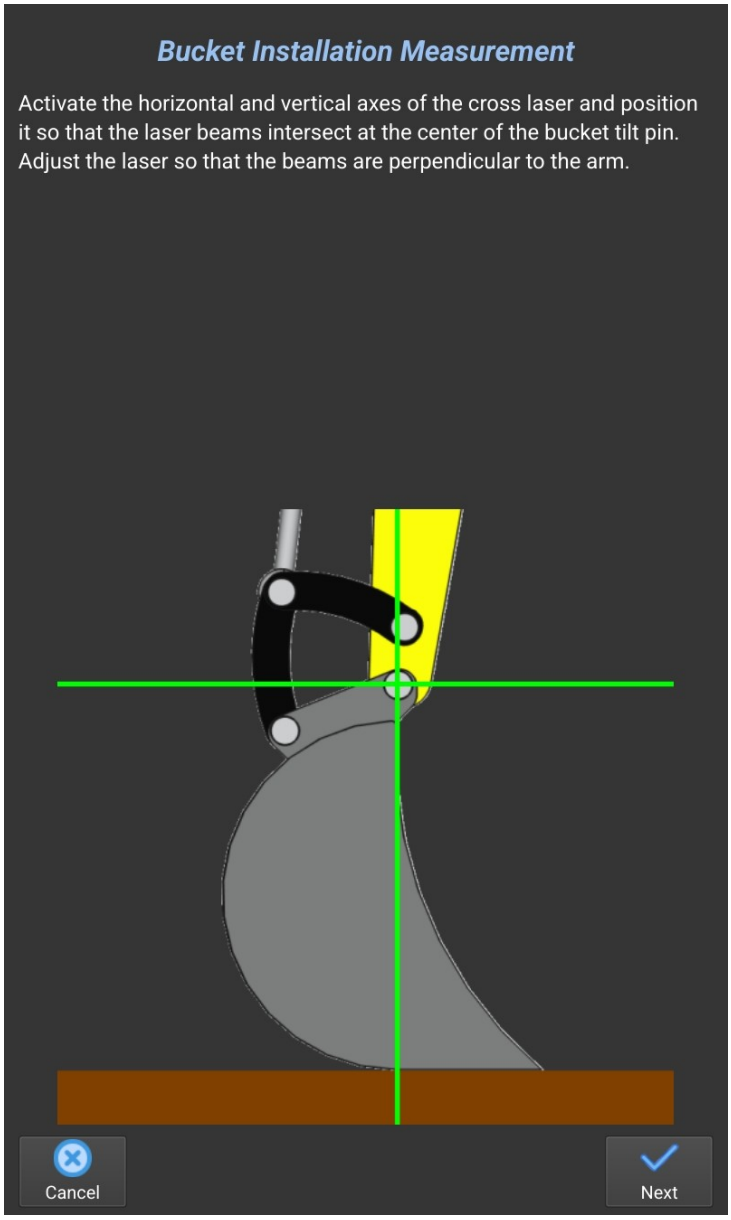
And here is another note. If the machine configuration is created with the boom rotated, remember that the axis of the sensor mounting direction arrow should be parallel to the boom axis, not to the cab axis.



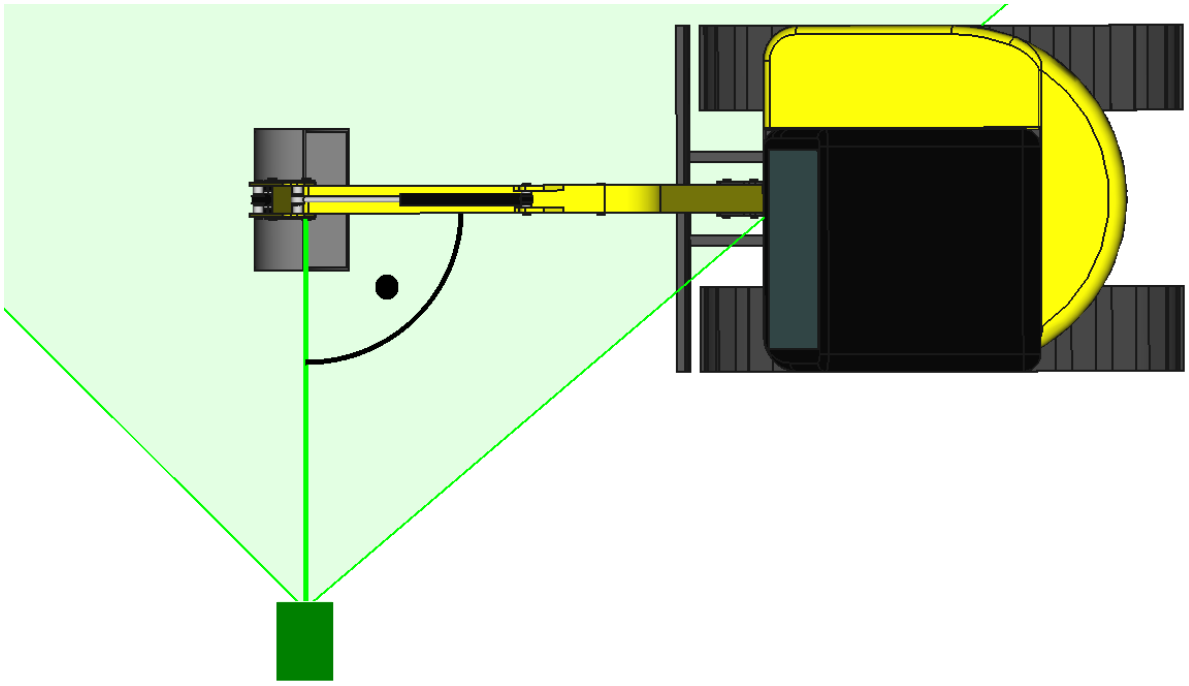
In the next step, mount the sensor and enter its address.
Press the **Next** button to proceed to the next step.



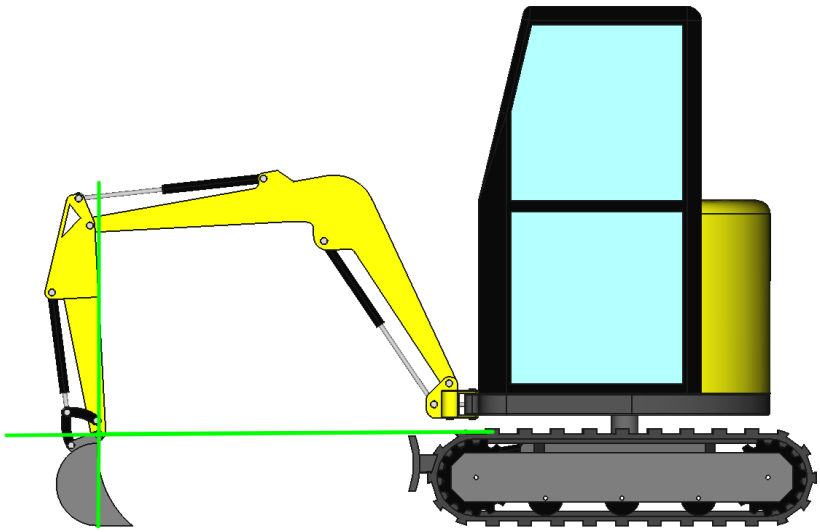
In the next step, the Wizard will inform you to set up the cross-line laser to facilitate the upcoming measurements.



The laser should be positioned so that the vertical beam falls perpendicular to the side plane of the boom.

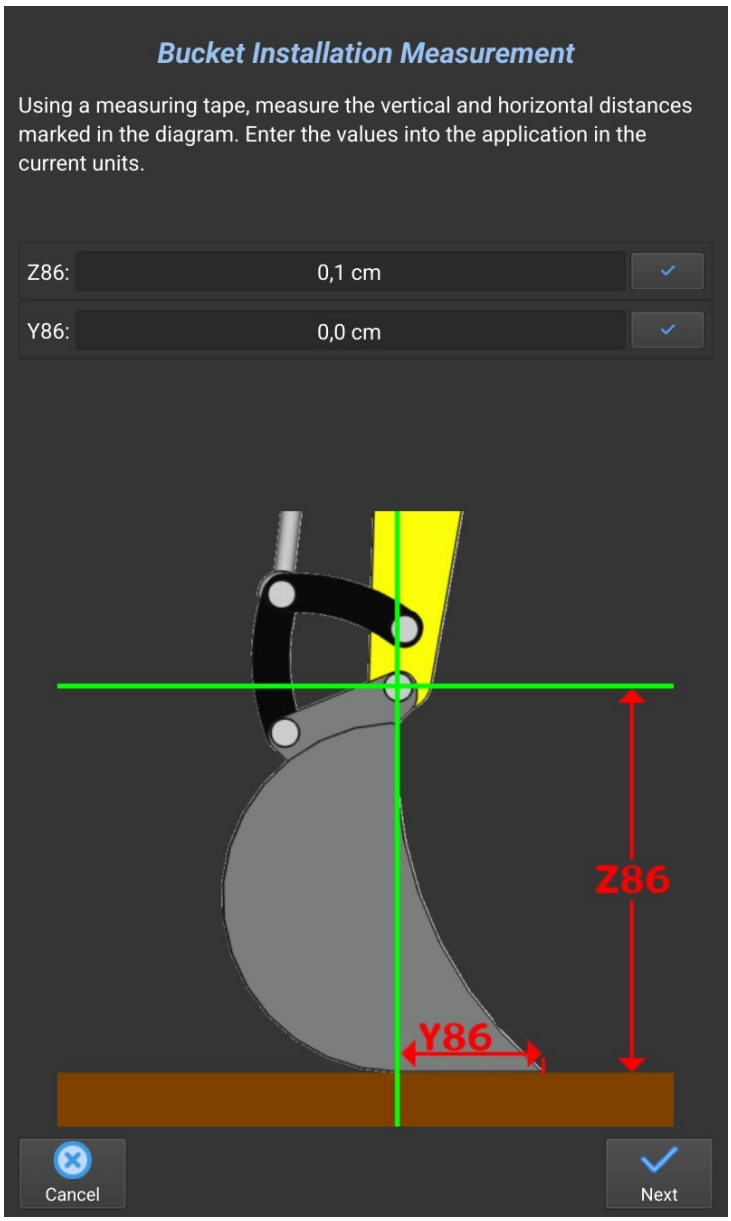


Position the laser at such a distance from the excavator that the horizontal beam reaches at least the dipper, and the vertical beam reaches at least the upper part of the boom.

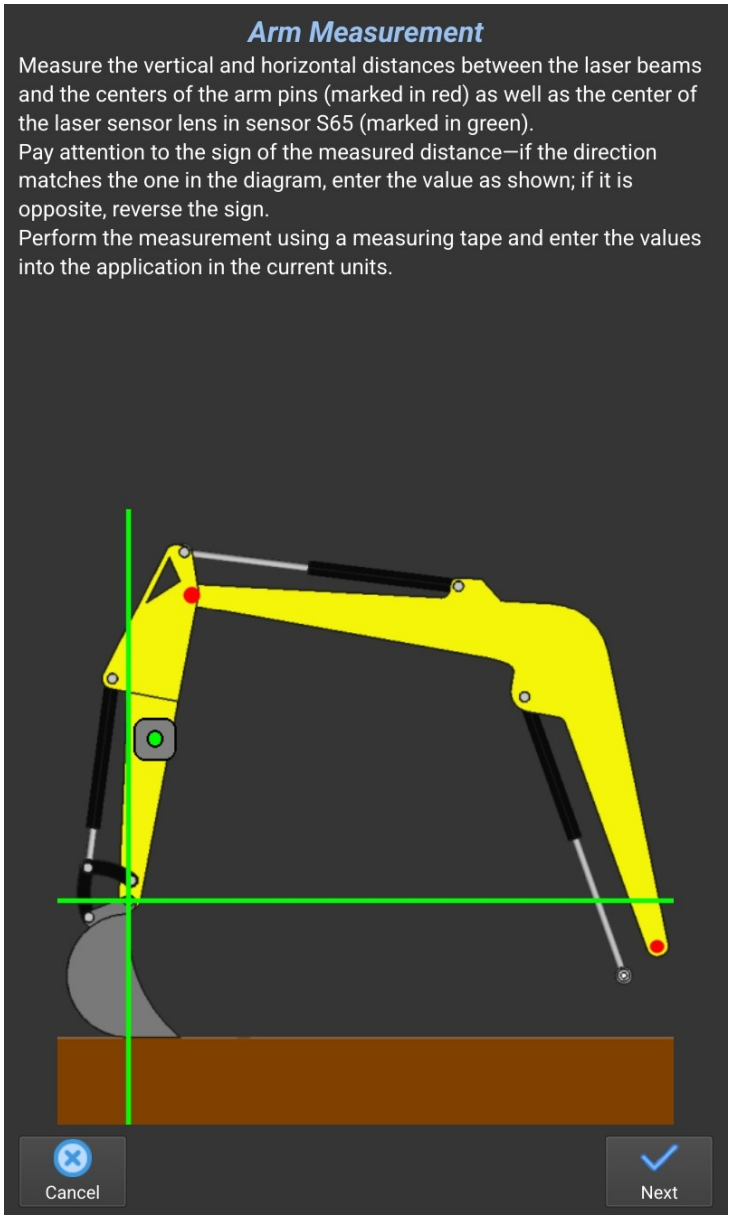


After carefully reading and following the instructions, press the **Next** button to proceed to the next step.

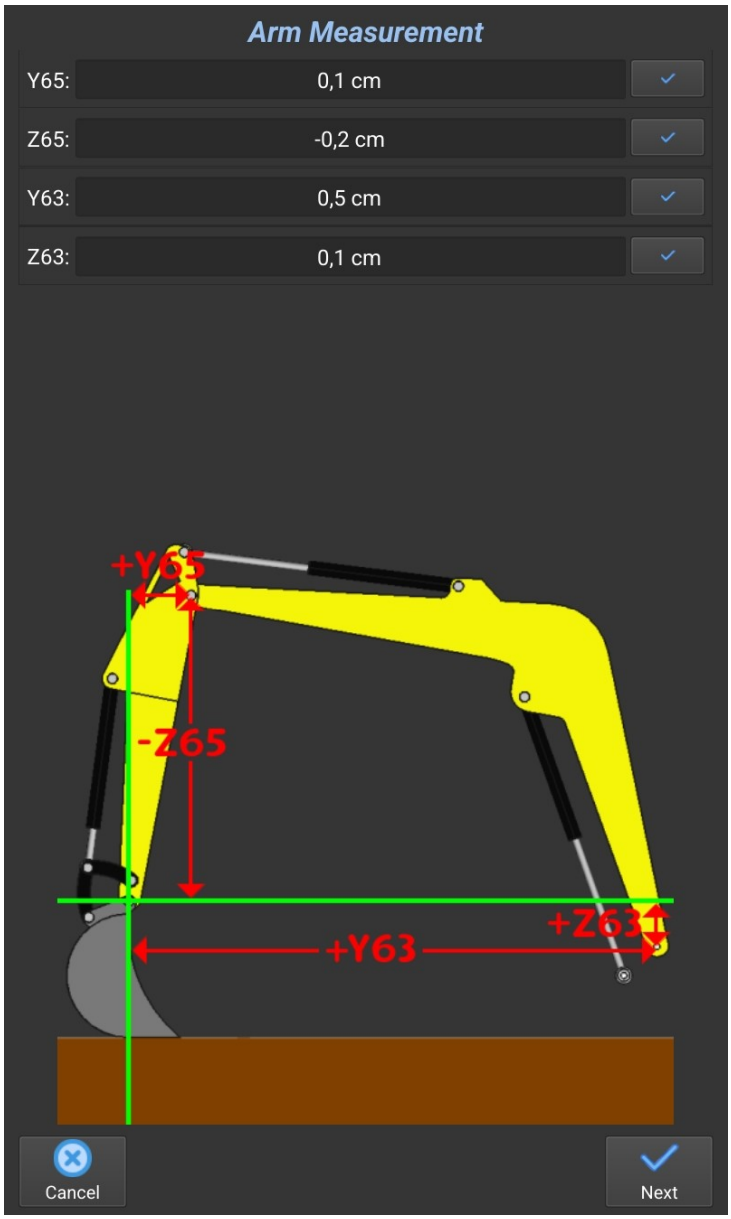
In the next step, measure and enter the distances marked in the diagram.
After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.



In the next step, instructions regarding the subsequent measurements are displayed. After carefully reading them, press the **Next** button to proceed to the next step.

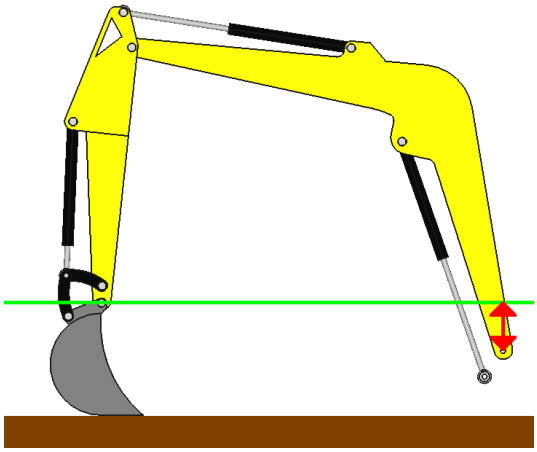


In the next step, measure and enter the distances marked in the diagram.

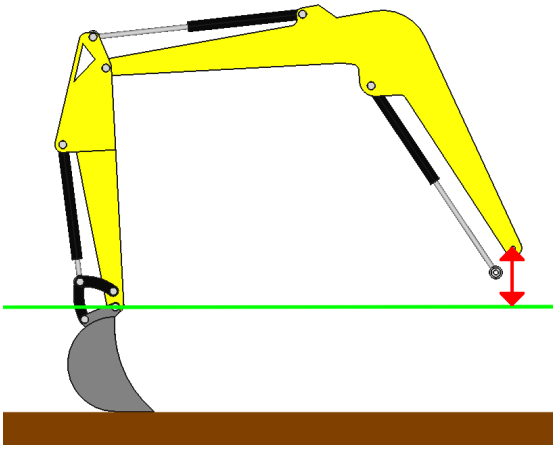


As shown in the illustration, the names of individual dimensions are marked together with a plus or minus sign. When taking measurements and entering them into the application, the sign must also be taken into account.
If the arrangement of the measurement points is the same as in the diagram, enter the measured distance with the same sign as shown. If the arrangement is opposite, enter the distance with the opposite sign.

As an example, the Z63 distance will be explained.
If the measurement point (pin at the dipper) is located as shown in the diagram displayed in the application, i.e. below the laser line, the measurement value should be entered with the sign shown in the application diagram, which is positive.



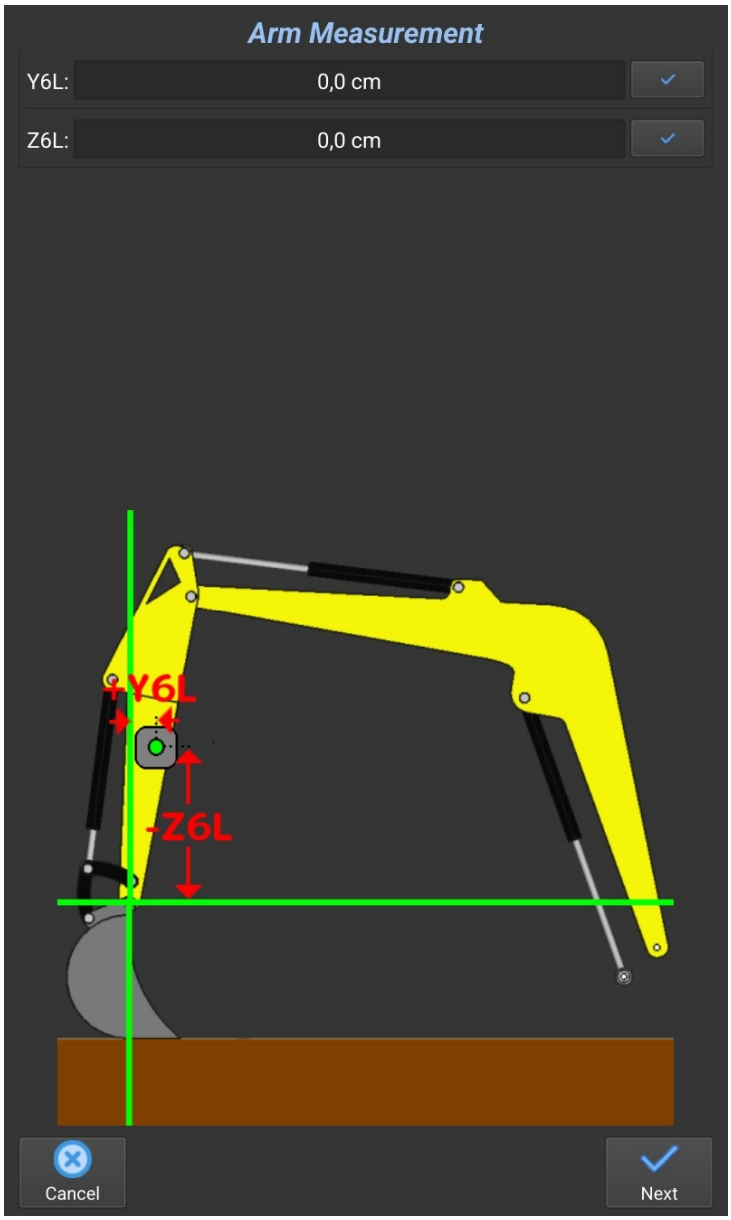
If, however, the measurement point (pin at the dipper) is located above the laser line (i.e. opposite to the diagram shown in the application), the measurement value should be entered with the opposite sign to that shown in the application diagram, i.e. negative.



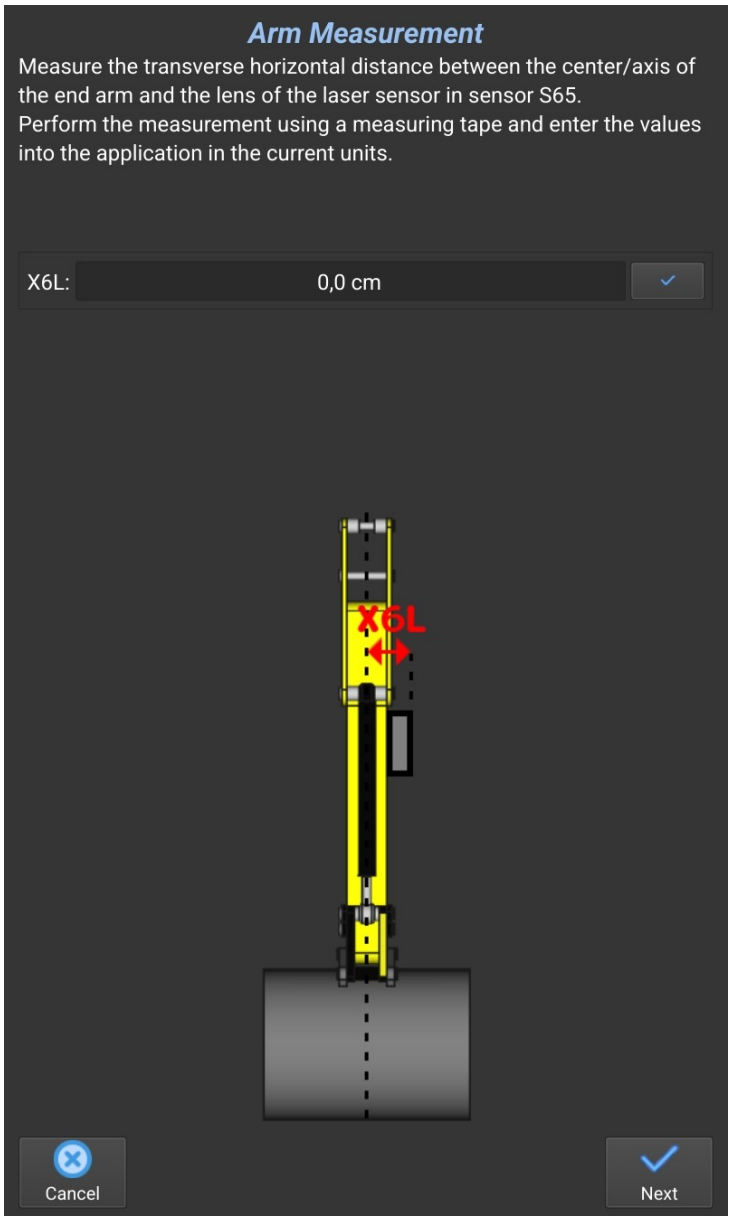
This is how each such measurement marked with a plus or minus sign in the application diagram should be interpreted.

After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.

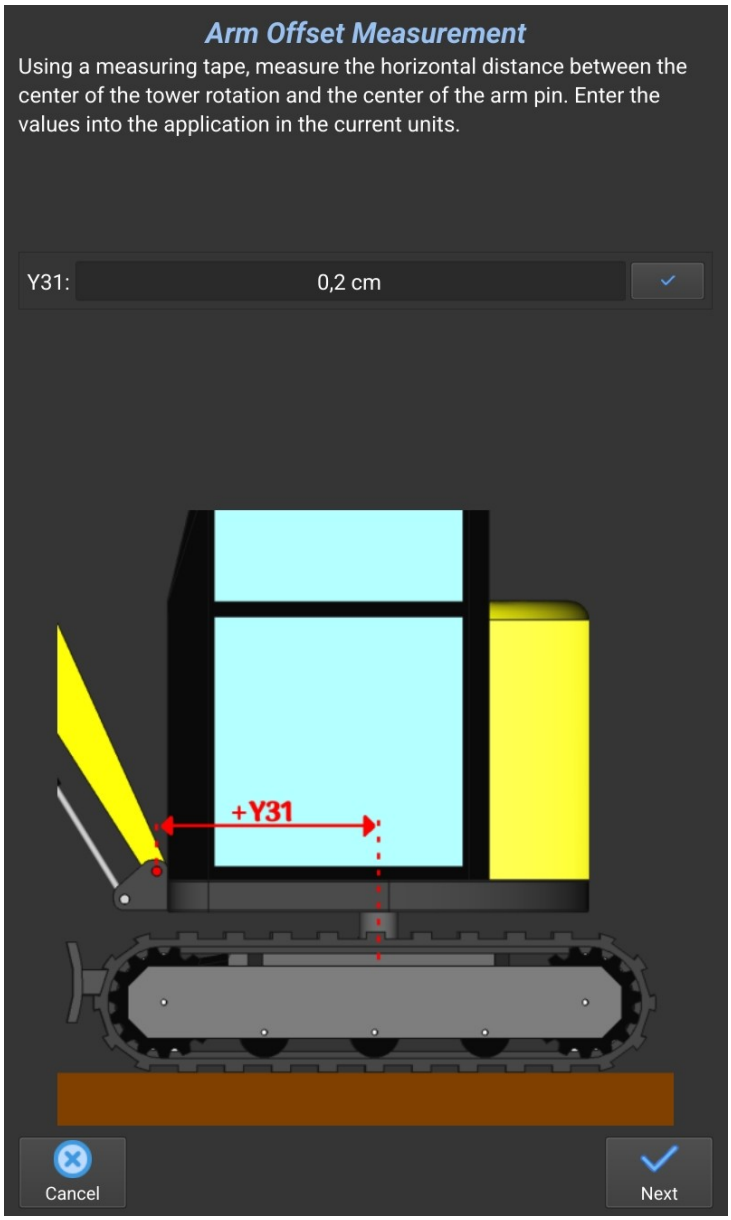
In the next step, measure and enter the distances from the laser line to the center of the laser detector sensor window on the S65 sensor. Pay attention to the +/- signs.
After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.



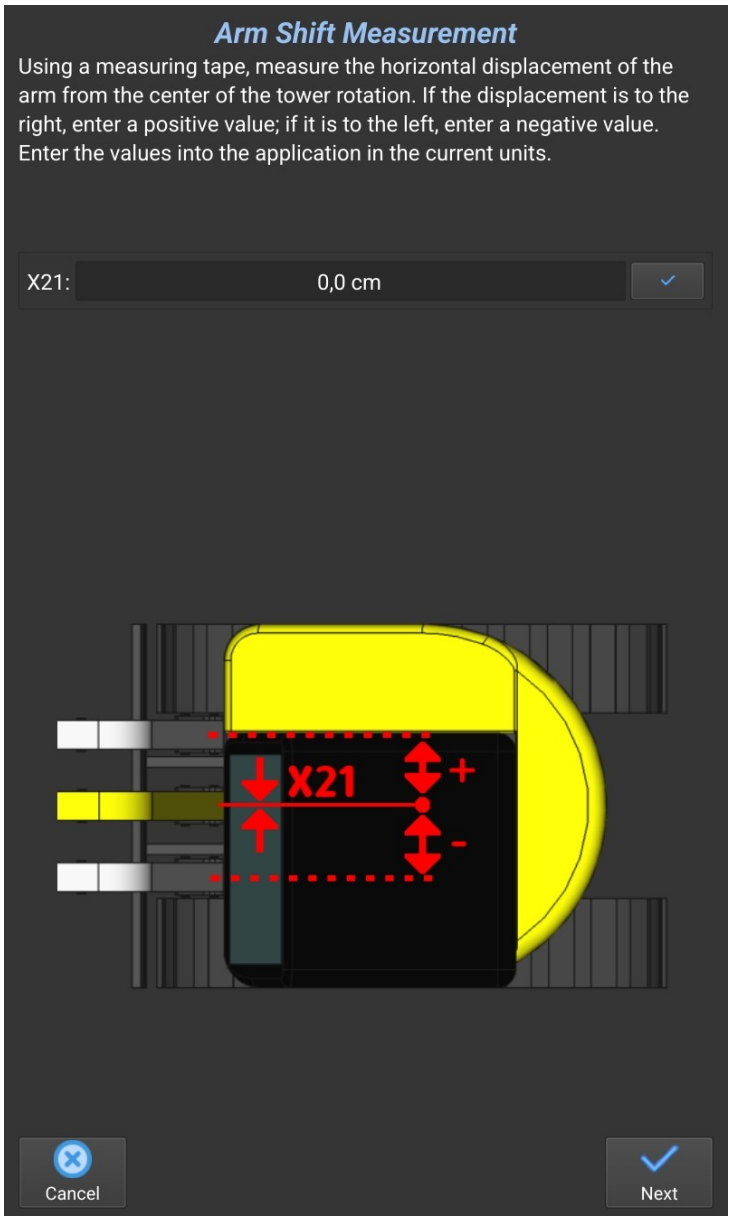
In the next step, measure and enter into the application the distance between the front of the sensor and the center/axis of the boom.
After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.



In the next step, measure and enter into the application the distance between the center of the boom lifting pin and the center of horizontal rotation. Pay attention to the +/- signs.
After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.

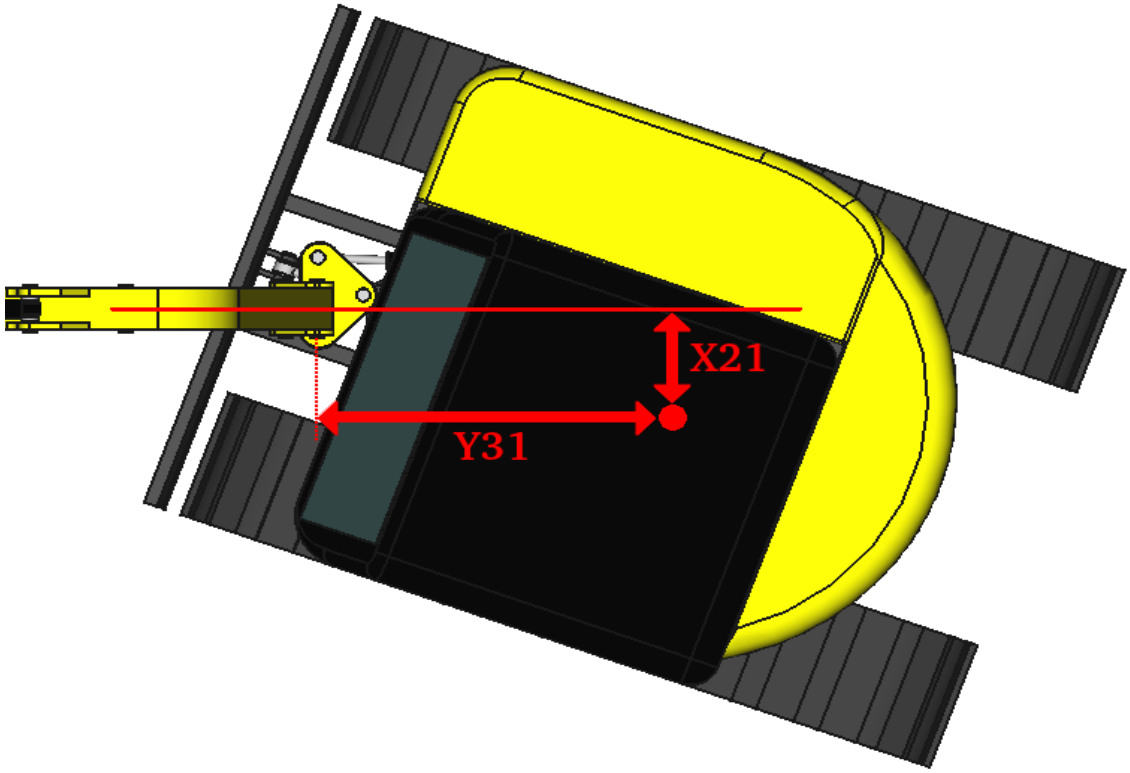


In the next step, measure and enter into the application the offset distance between the center of horizontal rotation and the longitudinal axis of the boom.
After completing the measurements and entering them into the application, press the **Next** button to proceed to the next step.

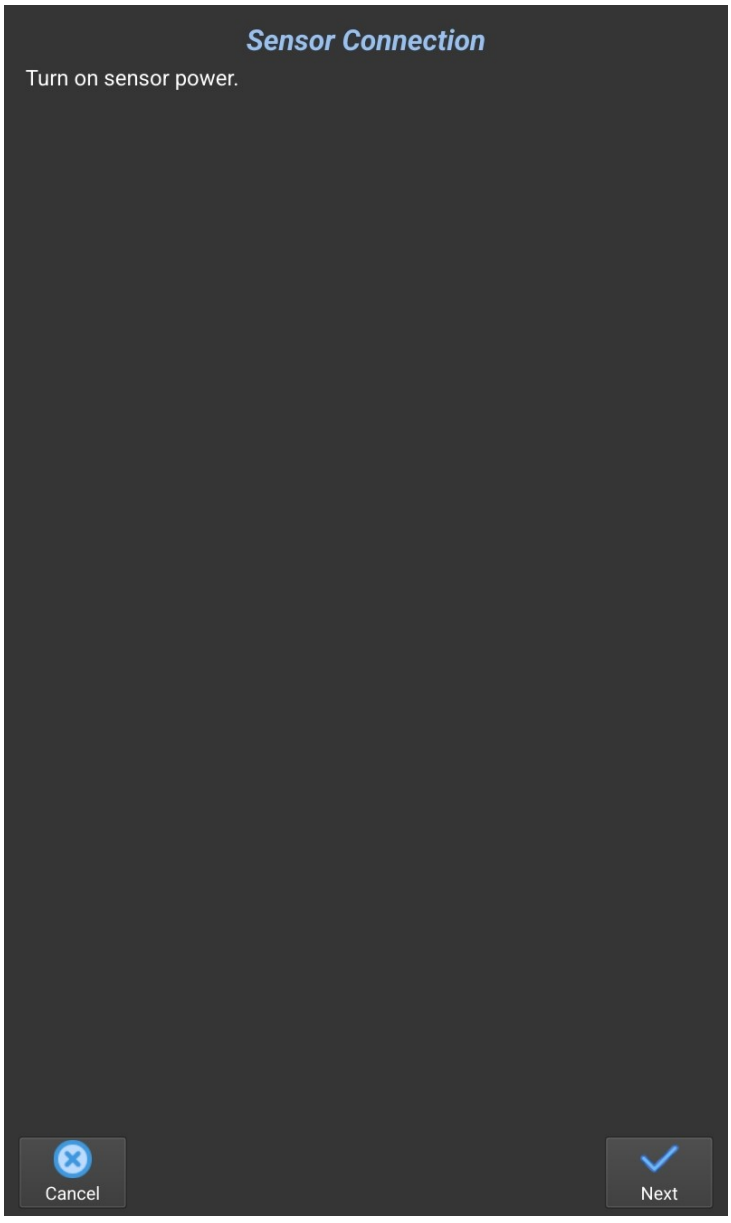


Explanation for measurements X21 and Y31.

If this is a slewing excavator with an additional rotating boom at the dipper and the calibration is performed with the dipper rotated, remember that the X21 and Y31 distances must be measured from the axis passing through the center of the boom, even if it is rotated.

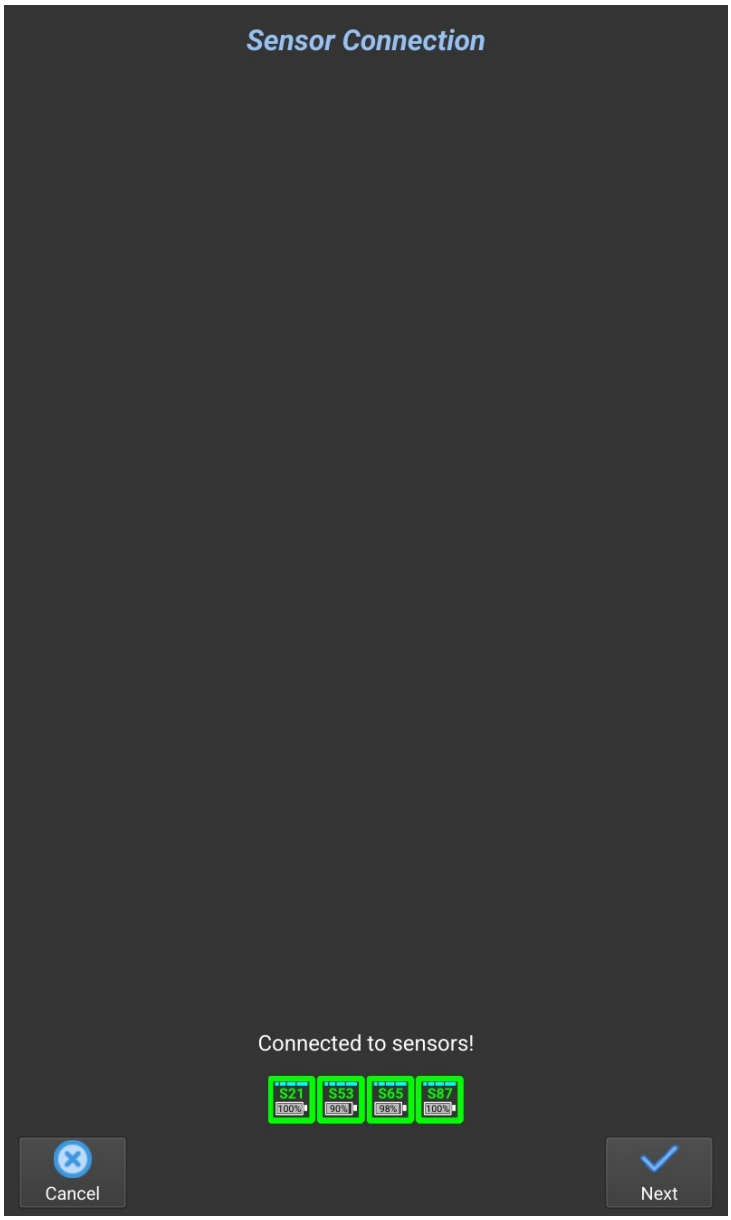


In the next step, turn on the sensors.
Each sensor is powered on by pressing and holding the power button on its housing for at least 1 second.
After turning on the sensors, press the **Next** button to proceed to the next step.
The sensors should be powered on efficiently, because if a connection is not established within 2 minutes of turning on a sensor, the sensor will automatically shut down.

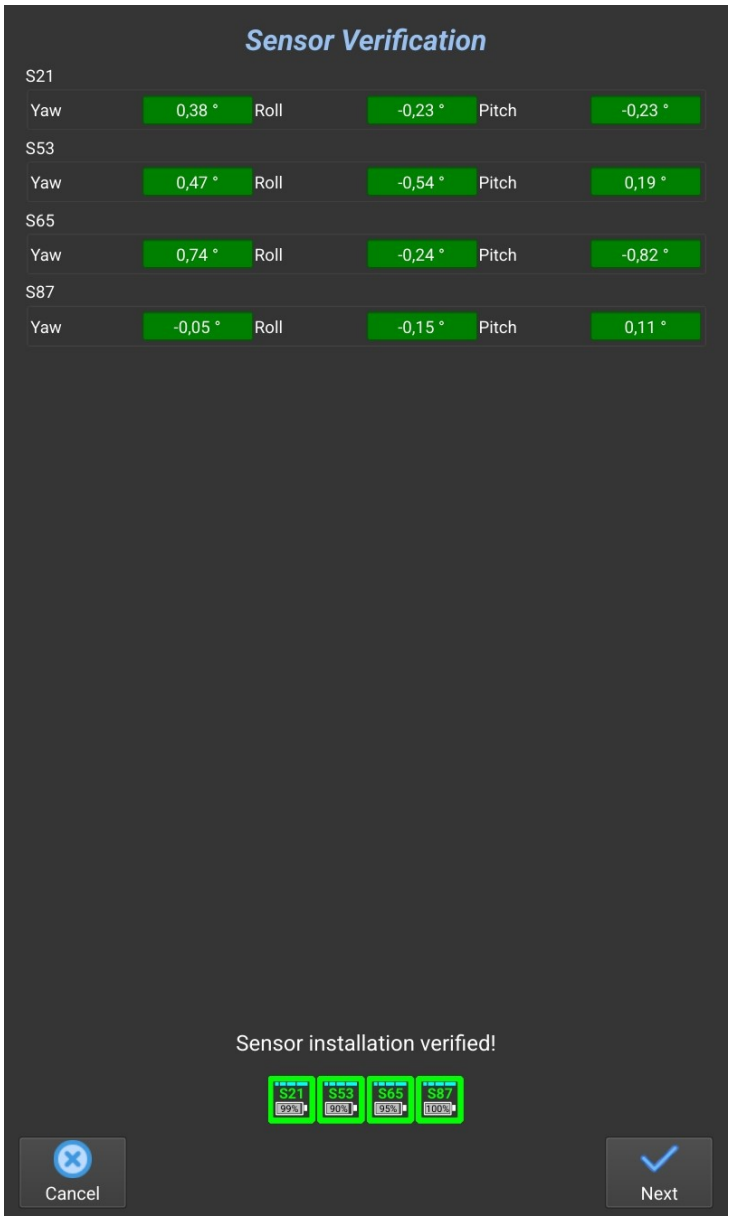


In the next step, the Wizard attempts to connect to the sensors.
If no connection is established for an extended period (more than 30 seconds), verify that the sensors are powered on. If the connection does not occur despite the sensors being on, it is highly likely that an error was made when entering the MAC addresses. In such a case, the configuration must be terminated and started again from the beginning.

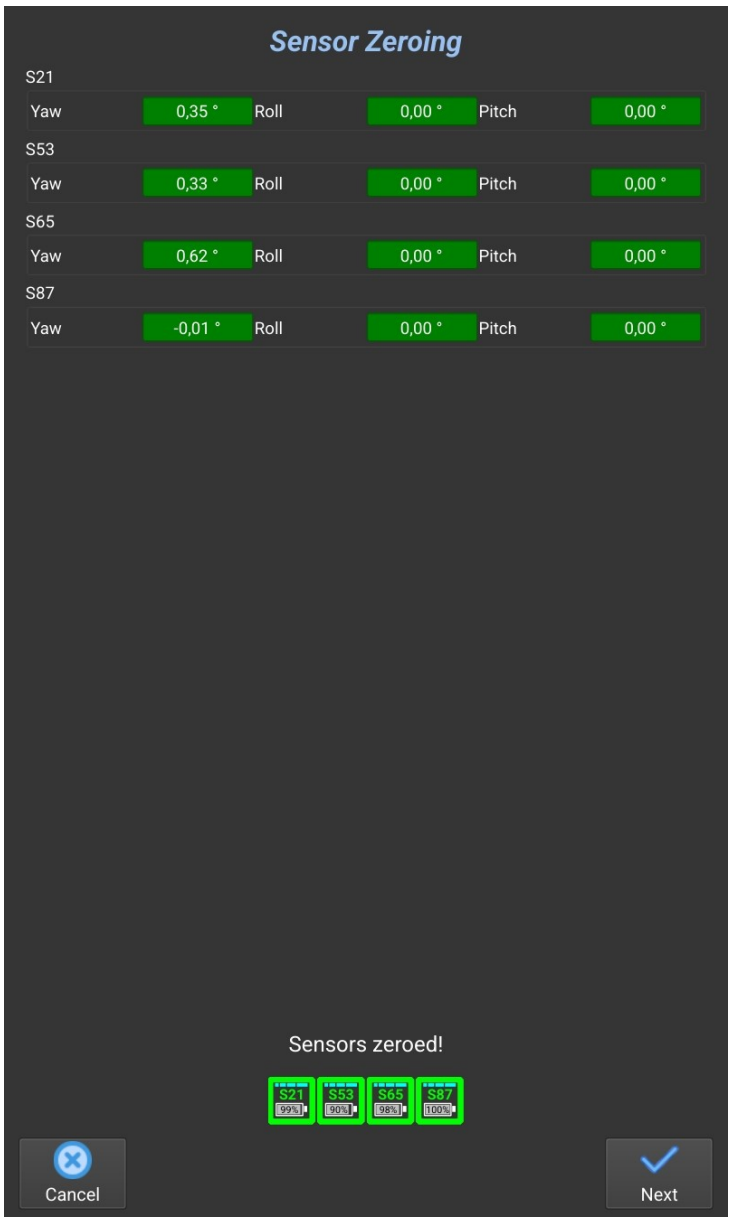
A successful connection is indicated by an appropriate message.
After a successful connection, press the **Next** button to proceed to the next step.



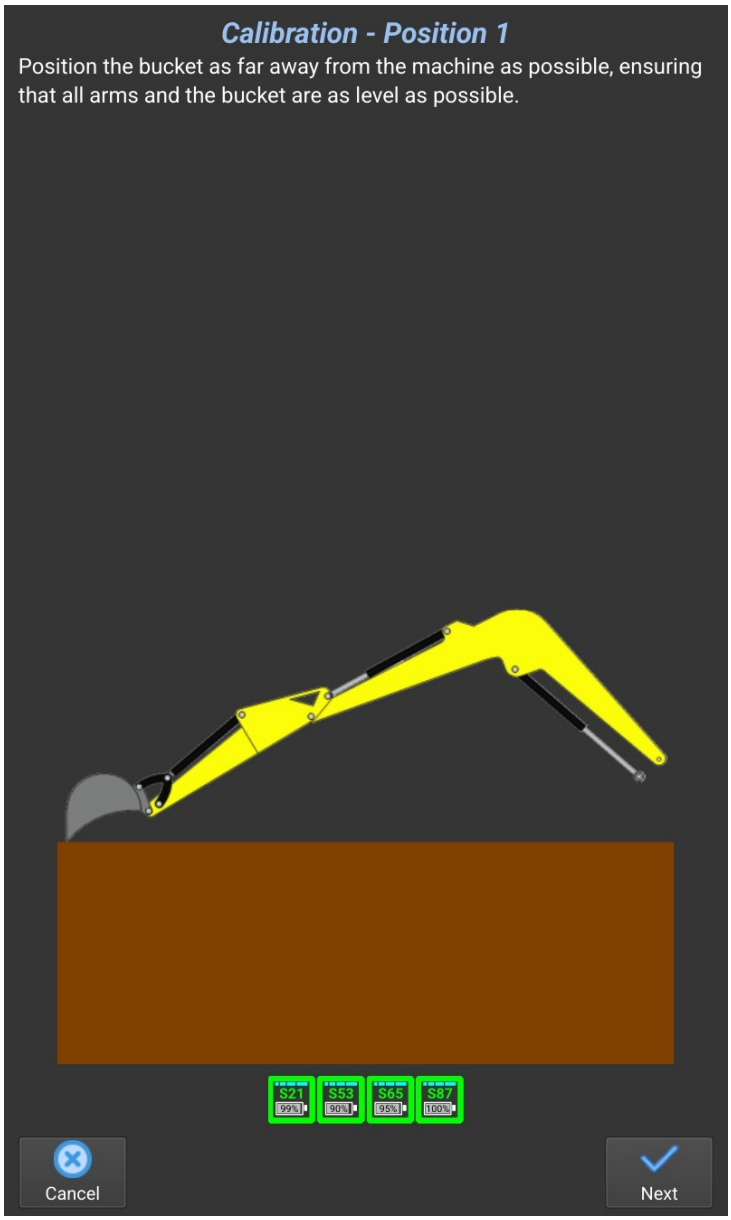
In the next step, the sensor installation is verified.
If any sensor indication lights up red, it means that the sensor has not been mounted correctly (arrow orientation) or its deviation from level exceeds 20 degrees. In such a case, the configuration must be terminated and restarted, with the sensors mounted correctly.
After successful verification, press the **Next** button to proceed to the next step.

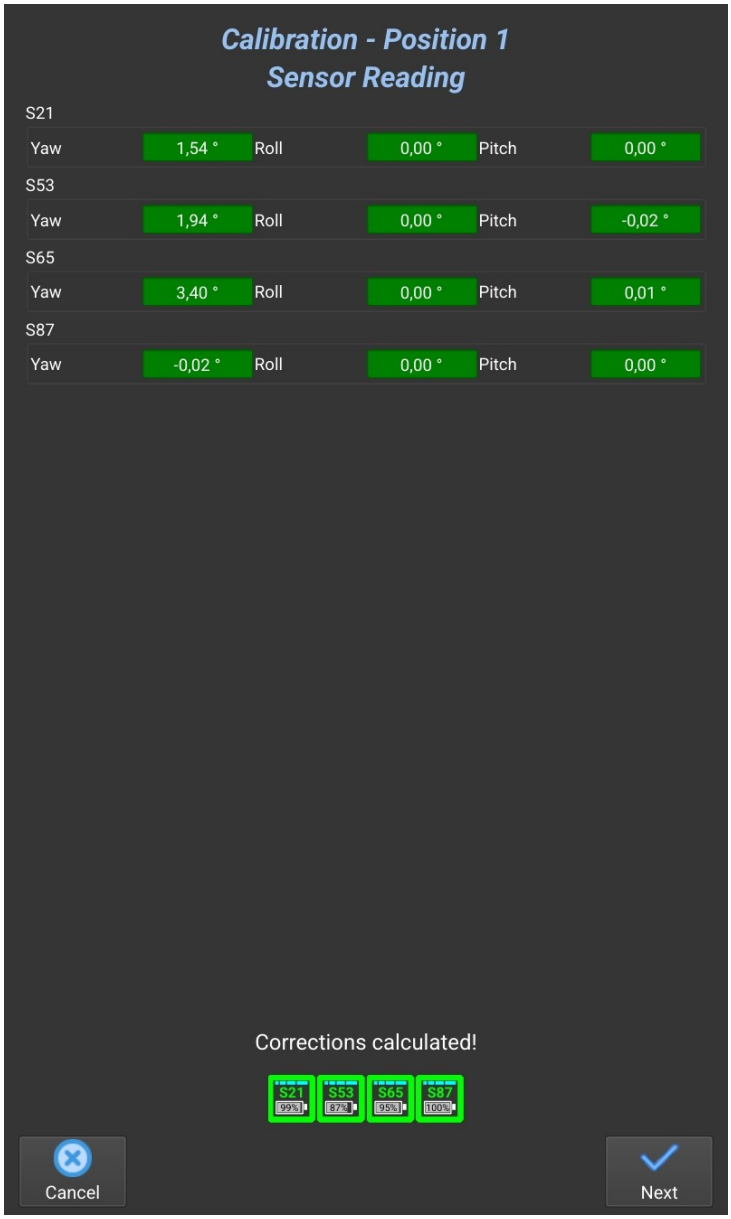


In the next step, the sensors are being zeroed.
Do not move anything during this time.
After successful zeroing, press the **Next** button to proceed to the next step.



In the subsequent steps, position the bucket according to the instructions provided by the Wizard.
It is recommended to switch off the machine engine after each positioning, before pressing the **Next** button, in order to minimize the influence of engine vibrations on the measurement.
Use the **Next** button to proceed through the subsequent steps and perform the actions displayed on the following screens.



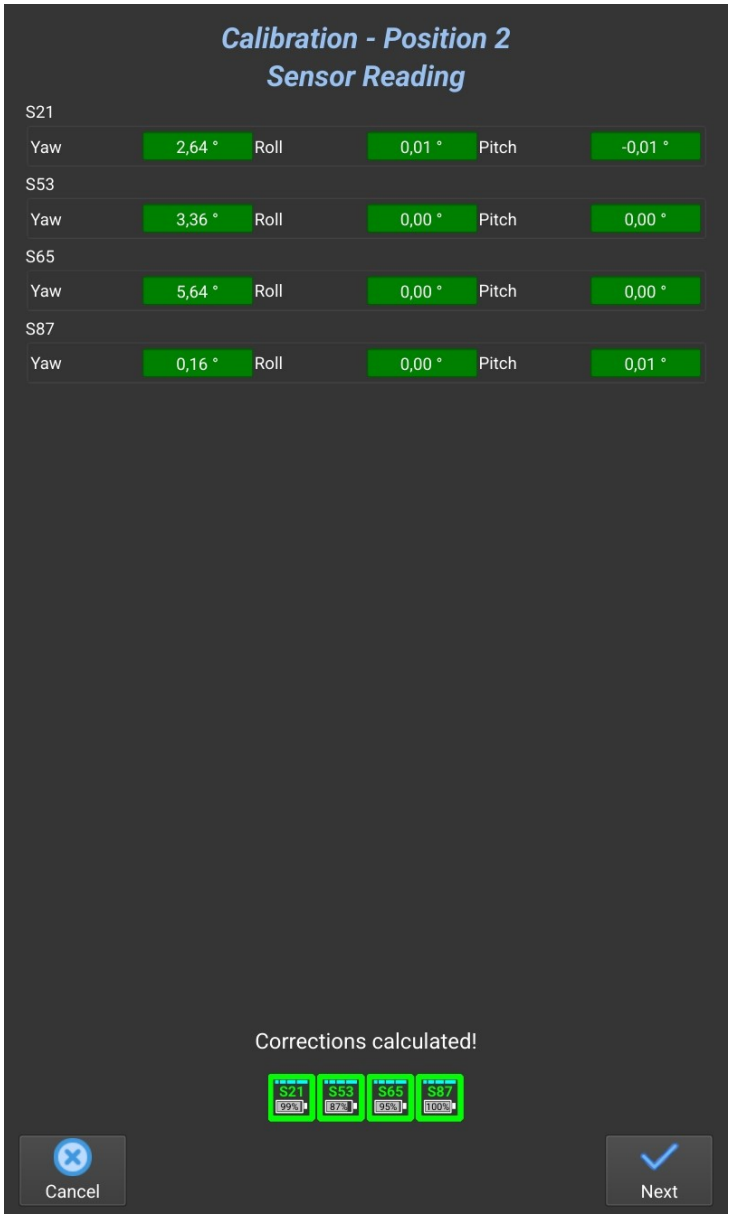

Calibration - Position 1
Sensor Reading
S21
Yaw 1,54 ° Roll 0,00 ° Pitch 0,00 °
S53
Yaw 1,94 ° Roll 0,00 ° Pitch -0,02 °
S65
Yaw 3,40 ° Roll 0,00 ° Pitch 0,01 °
S87
Yaw -0,02 ° Roll 0,00 ° Pitch 0,00 °
Corrections calculated!
S21 99%
S53 87%
S65 95%
S87 100%
Cancel
Next

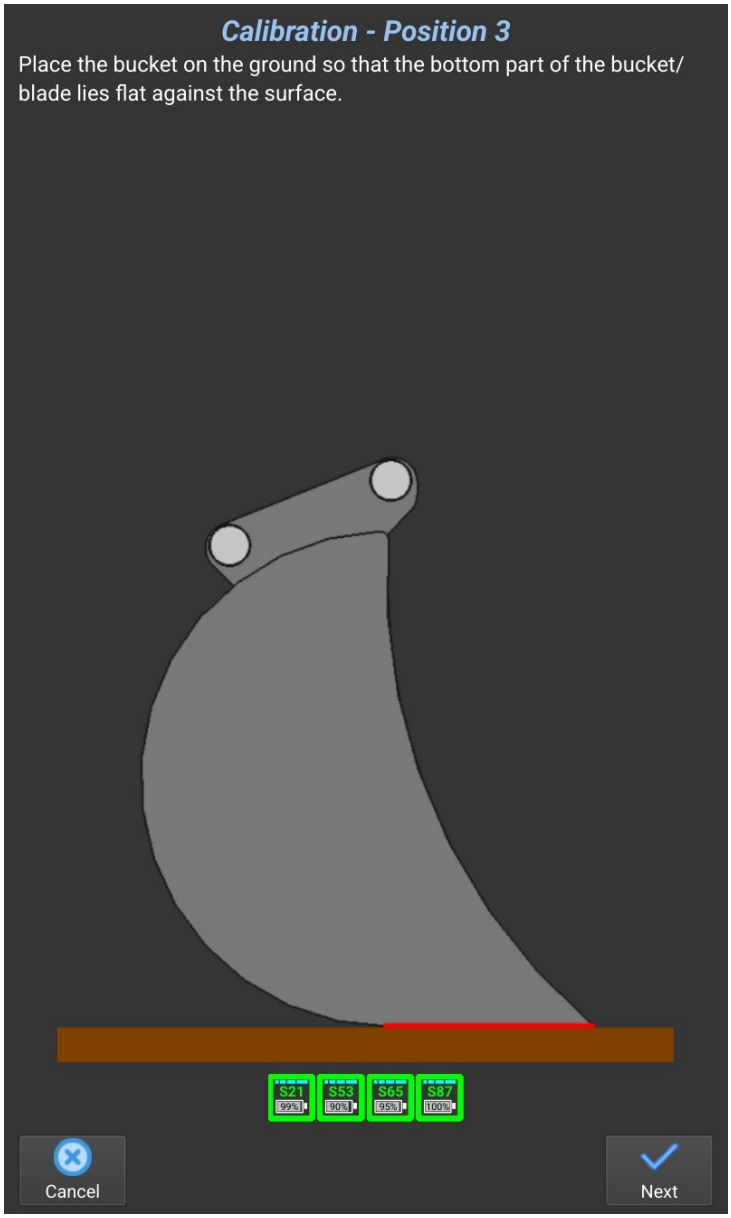
Calibration - Position 2

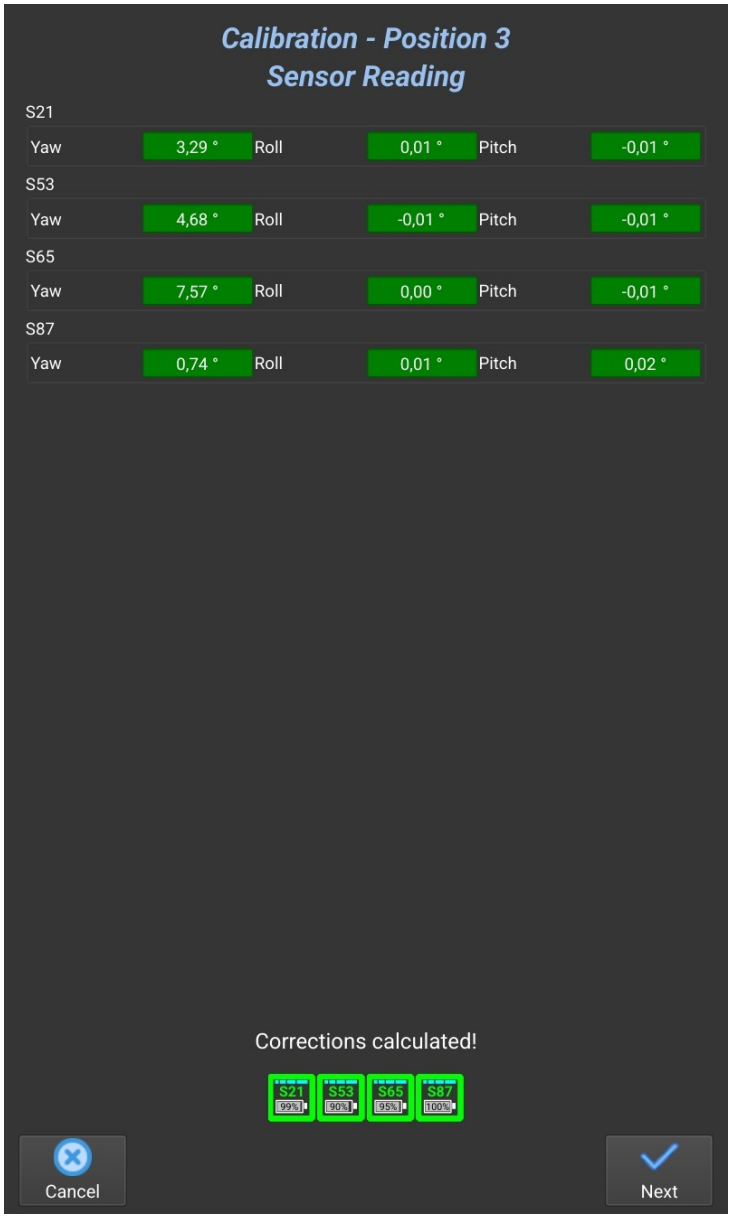
Raise the first arm to its maximum height, keeping the end arm and bucket approximately level.

Cancel

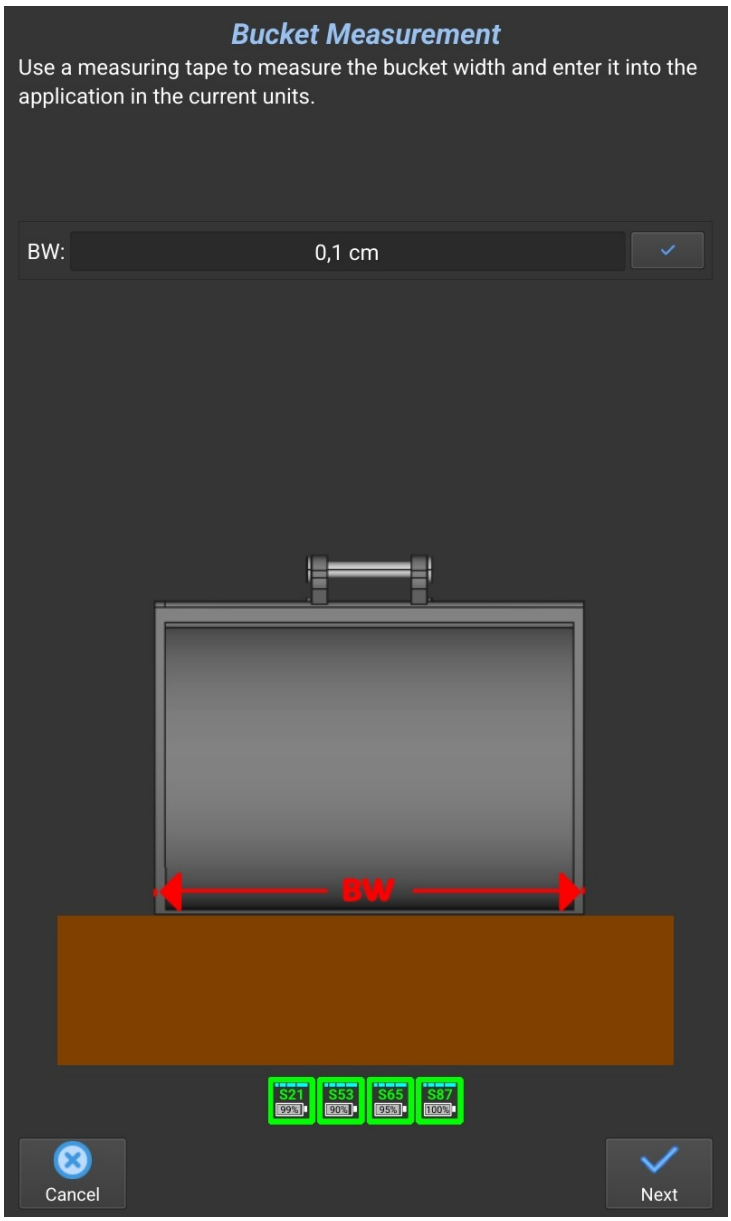
Next


Calibration - Position 2
Sensor Reading
S21
Yaw
2,64 °
Roll
0,01 °
Pitch
-0,01 °
S53
Yaw
3,36 °
Roll
0,00 °
Pitch
0,00 °
S65
Yaw
5,64 °
Roll
0,00 °
Pitch
0,00 °
S87
Yaw
0,16 °
Roll
0,00 °
Pitch
0,01 °
Corrections calculated!
S21
99%
S53
87%
S65
95%
S87
100%
Cancel
Next

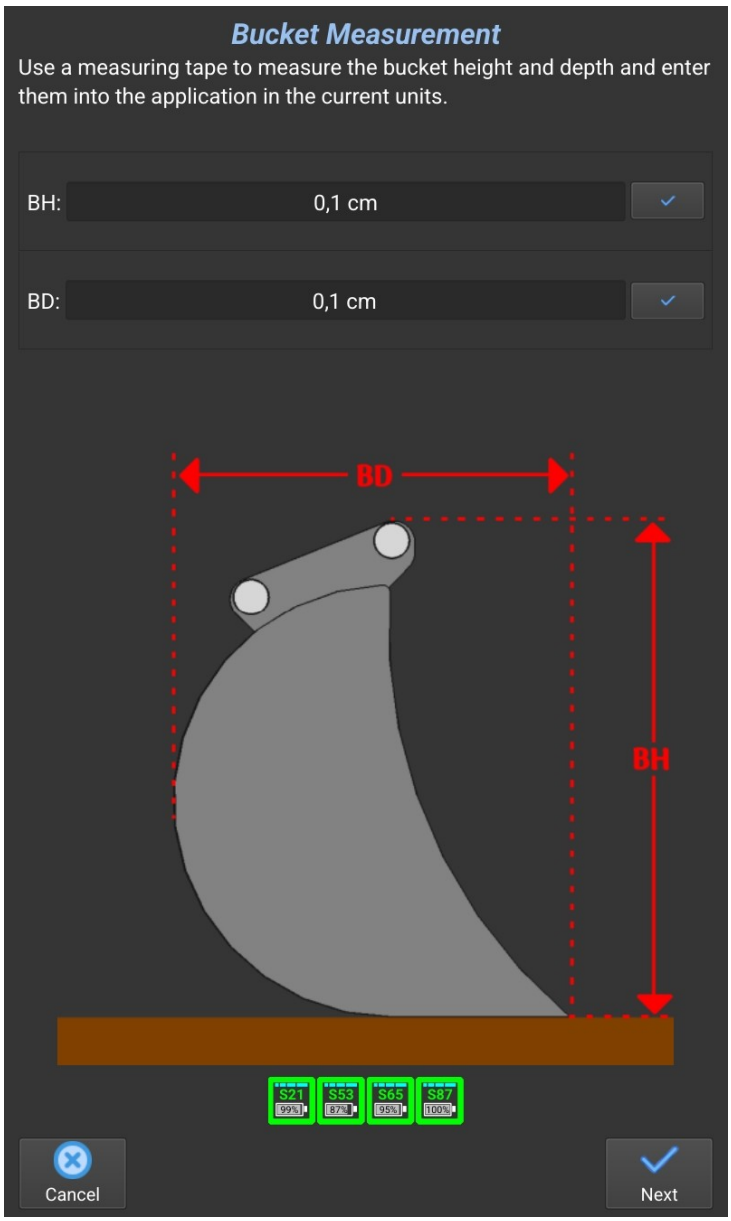

Calibration - Position 3
Place the bucket on the ground so that the bottom part of the bucket/ blade lies flat against the surface.
S21
99%
S53
90%
S65
95%
S87
100%
Cancel
Next


Calibration - Position 3
Sensor Reading
S21
Yaw
3,29 °
Roll
0,01 °
Pitch
-0,01 °
S53
Yaw
4,68 °
Roll
-0,01 °
Pitch
-0,01 °
S65
Yaw
7,57 °
Roll
0,00 °
Pitch
-0,01 °
S87
Yaw
0,74 °
Roll
0,01 °
Pitch
0,02 °
Corrections calculated!
S21
99%
S53
90%
S65
95%
S87
100%
Cancel
Next

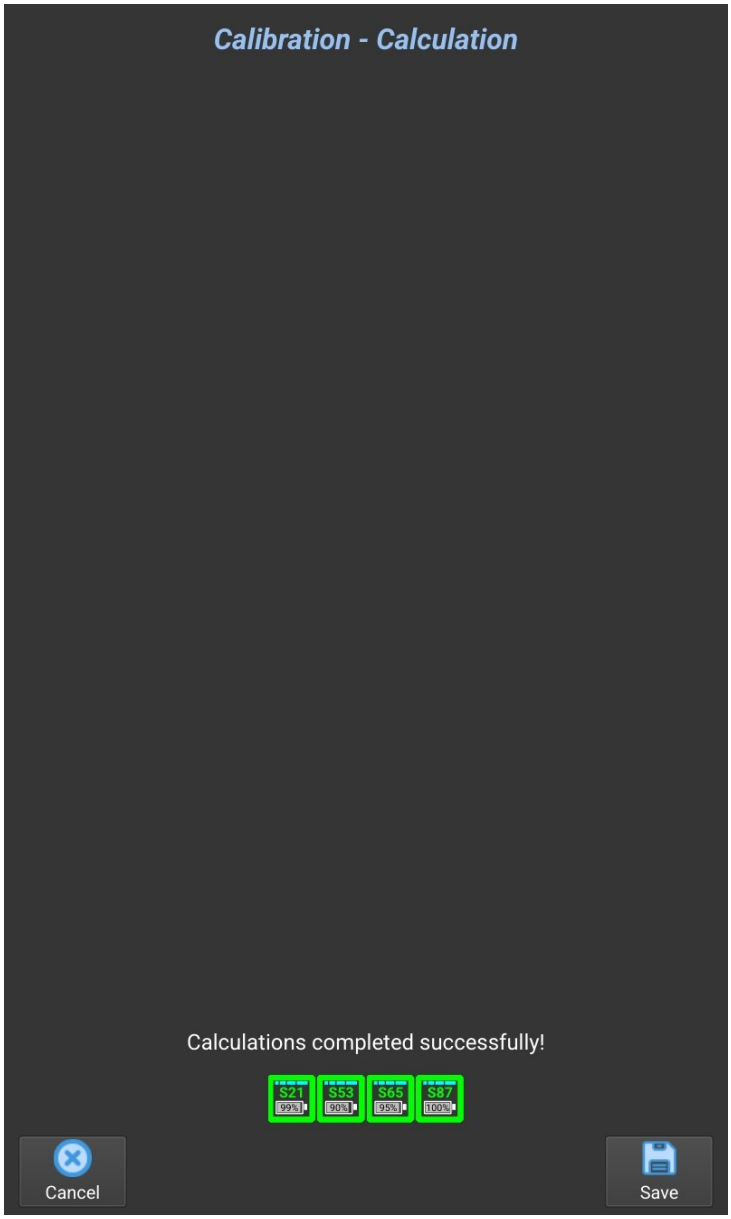
In the next step, enter the bucket width – specifically the width of the bucket cutting edge.
After taking the measurement and entering it into the application, press the **Next** button to proceed to the next step.



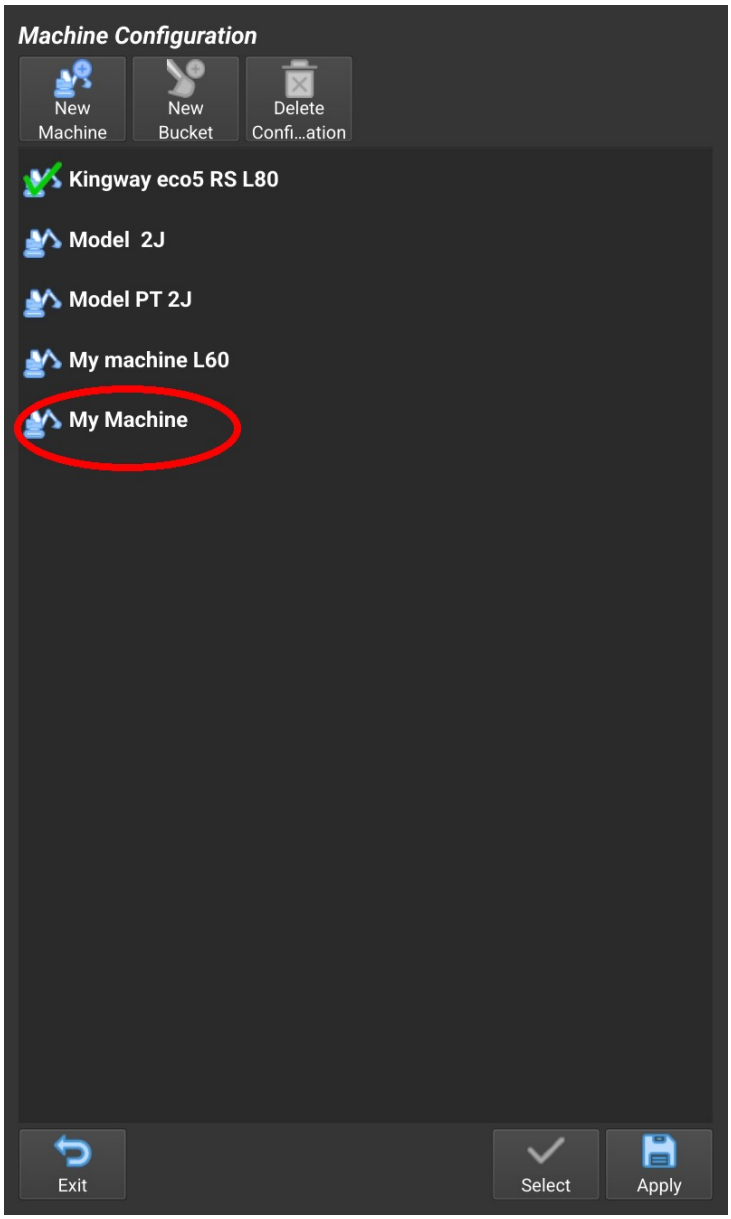
In the next step, enter the bucket height and depth.
After taking the measurements and entering them into the application, press the **Next** button to proceed to the next step.



After completing the configuration, a final screen will appear.
Use the **Save** button to create the configuration and proceed to the list.

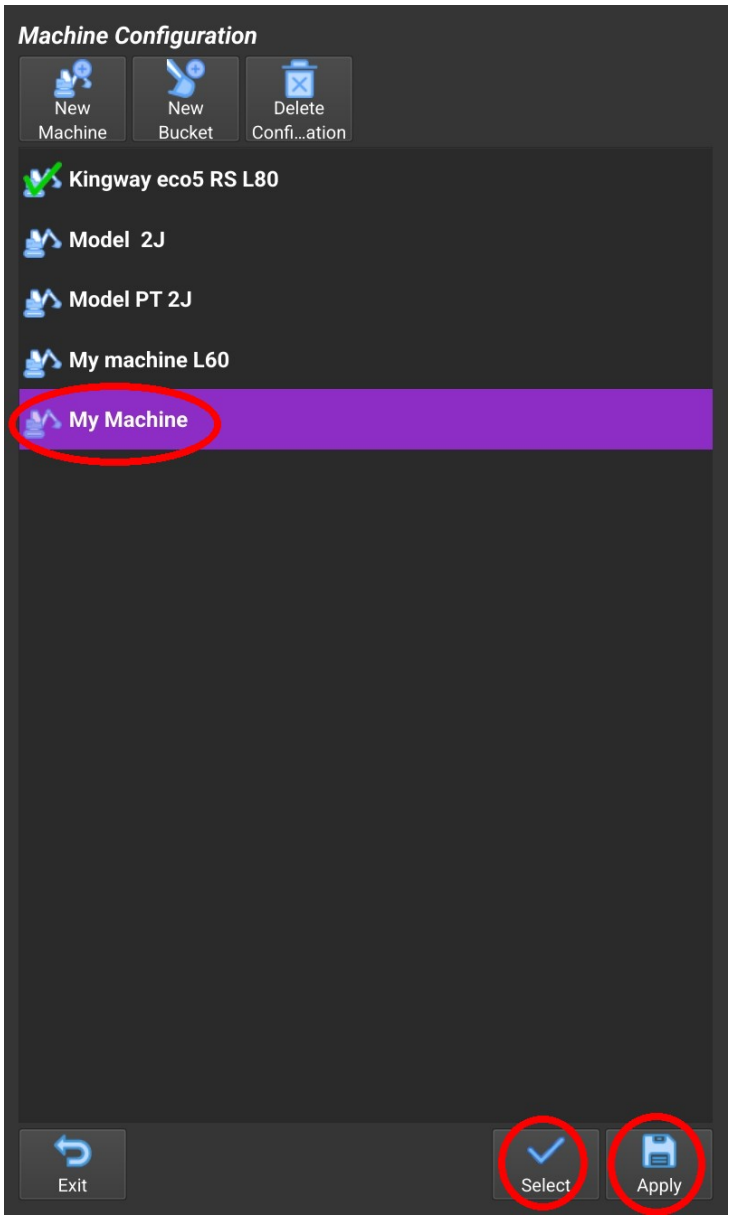


After completing the configuration, the newly created configuration will appear in the list.



Very important!
After creating the configuration, press the Apply button to permanently save the configuration in the device memory.
Clicking Exit without pressing Apply will result in the loss of the created configuration.

To select a configuration for use, highlight it in the list and click the **Select** button, then **Apply**.



The machine configuration selected for use has a green check mark next to its name in the list.