Title: **Gocator Dual Sensor Setup Guide**

Purpose
This application note demonstrates how to setup and utilize the Gocator's built in support for dual sensor operation.

Equipment Used

Two Gocator sensors of the same model, *running the same firmware version*.
Master 200 (for Gocator 2000 family only)
Master 400 (for Gocator 2300 family)

Sensor Features Used

Dual Sensor Operation (a.k.a. Buddy Mode)
Alignment and Travel Calibration
Measurement Tools

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1 Introduction

This application note demonstrates how to setup and utilize the Gocator's built-in support for dual sensor operation. The document is divided into two main parts. The first part mimics the User's Manual for all the basic setup steps, whereas the second part describes in detail how to calibrate the system into a common coordinate frame and briefly explains how measurement tools can be used on the combined data. The aim of this document is to provide you with all the required setup steps to get a dual sensor system operating..

2 Dual Sensor Setup Steps

In a dual sensor system, two Gocator sensors work together to measure an object, typically in order to cover a wider Field of View or to measure thickness. The sensor system can deliver combined 3D-data in a common coordinate frame, provided by the Gocator's built-in alignment calibration support. The controlling sensor is referred to as the Main sensor, and the helper is referred to as the Buddy sensor. Gocator's software recognizes three installation orientations – None, Opposite and Wide. Opposite is when the sensors are facing each other, typically to measure the thickness of material. Wide is when the sensors are mounted side by side to scan a wide target. These orientations are illustrated in Figure 3 below.

2.1 Connecting the Components

For the Gocator 2000 family sensors, the Master 200 (or a Master 400) *must* be used to connect two sensors in a Dual Sensor system. Gocator 20x0 I/O cordsets are used to connect sensors to the Master 200. The Master 200 provides a single point of connection for system I/O and power. The Master 200 can be used to ensure that the scan timing is precisely synchronized across sensors. Sensors and client computers typically communicate via an Ethernet switch (minimum 100 Mbit/s).

- **Note!** The Main sensor *must* be connected to Port 1 on the Master 200. Otherwise, the time synchronization between the two sensors will not work correctly.

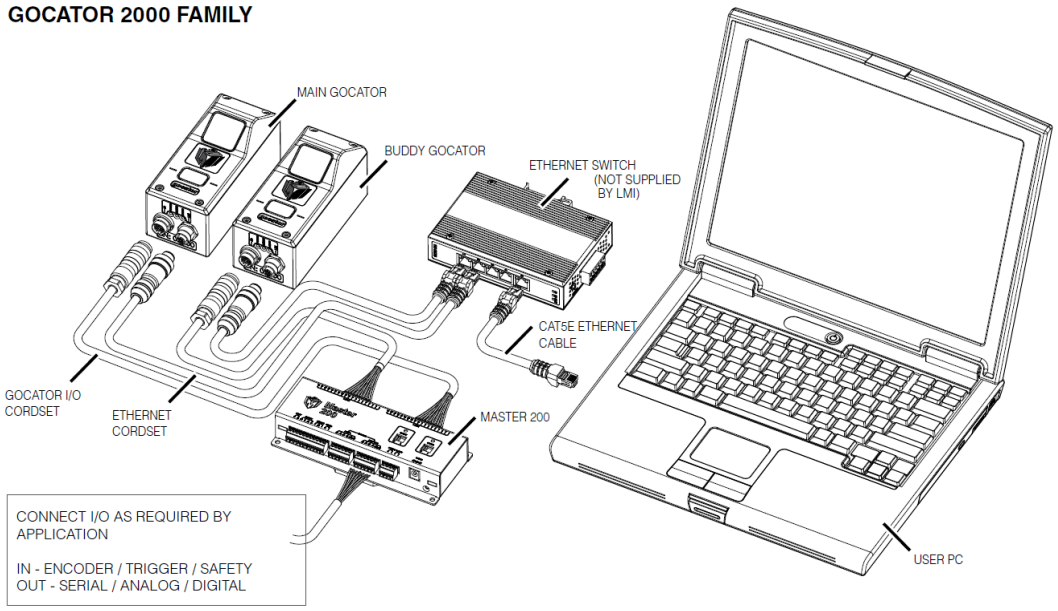


Figure 1: Gocator 2000 Family Connection.

For the Gocator 2300 family sensors, a Master 400 *must* be used to connect two sensors in a dual sensor system. Gocator 23x0 Master cordsets are used to connect sensors to the Master.

GOCATOR 2300 FAMILY

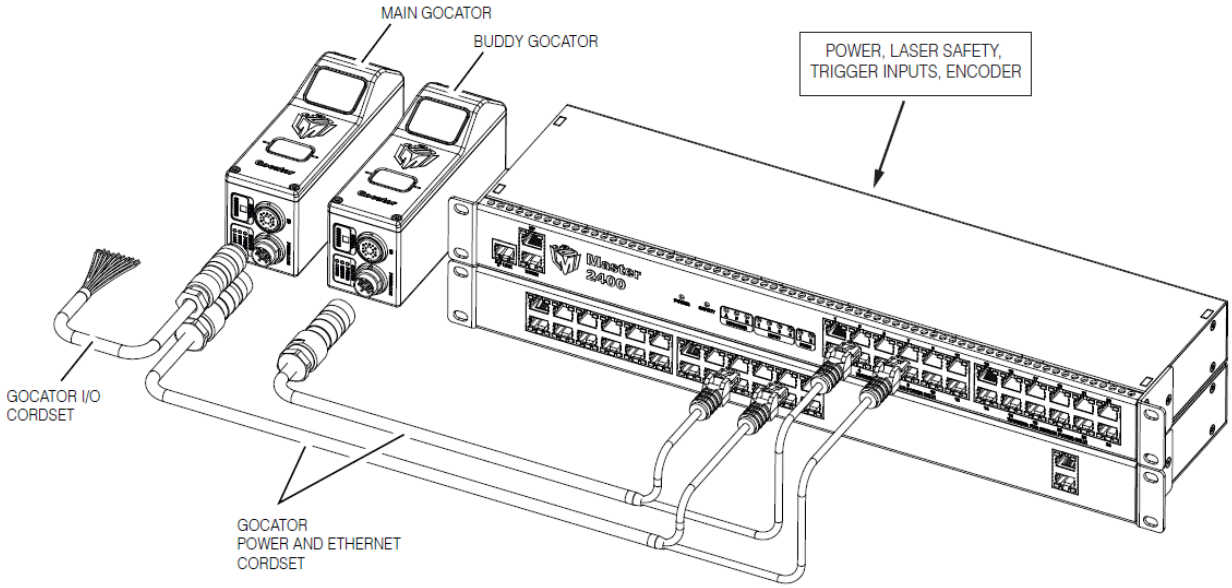
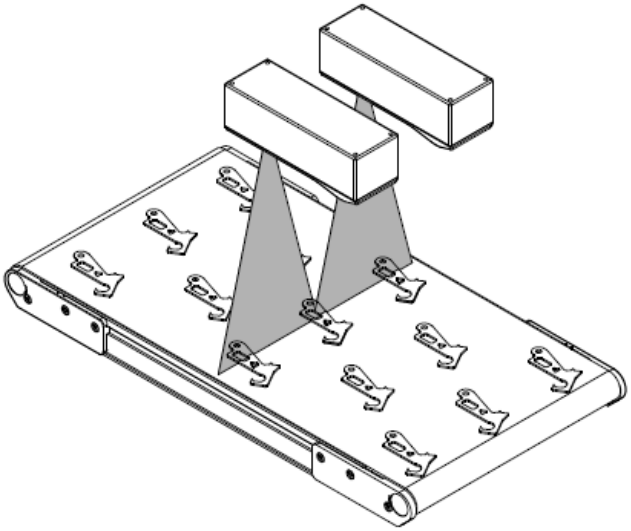


Figure 2: Gocator 2300 Family Connection (Master 2400 Pictured).

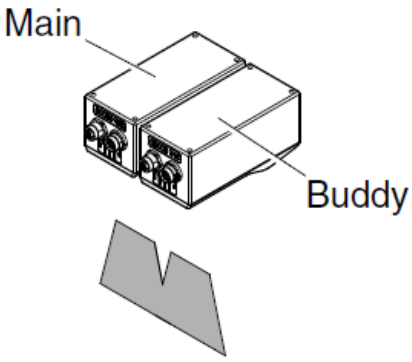
2.2 System Orientations

The examples below illustrate the possible mounting orientations for dual sensor systems. Note especially the mounting relationship between the Main and the Buddy.

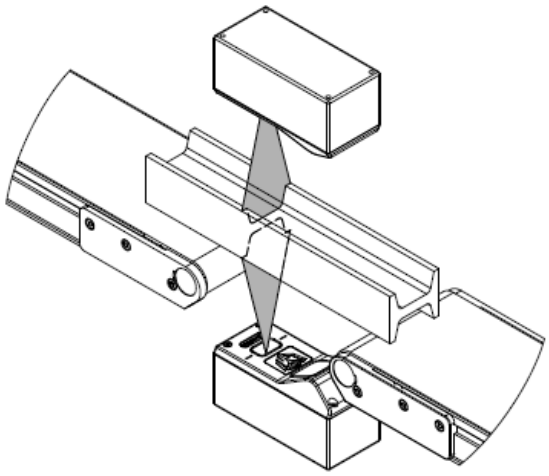
Dual Sensor System Orientations:



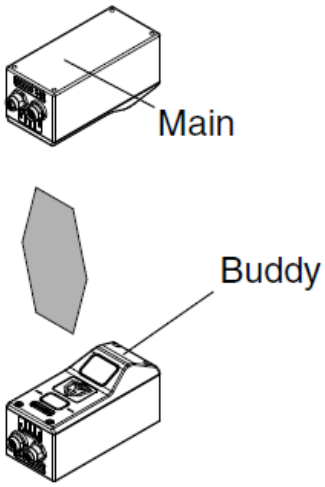
Side-by-side for wide-area measurement (Wide)



Main must be on the left side (when looking into the connector) of the Buddy (Wide)



Above/below for two-sided measurement (Opposite)



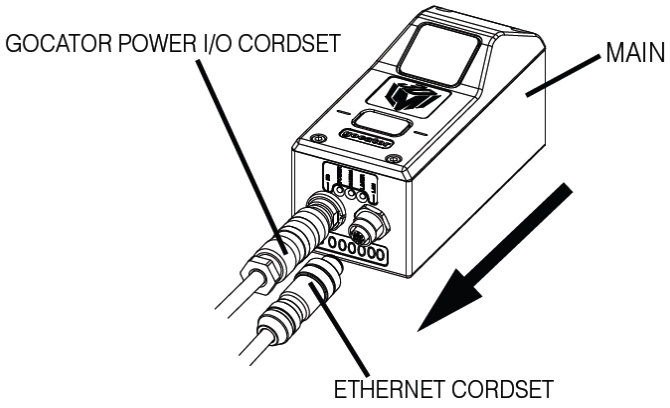
Main must be on the top with Buddy on the bottom (Opposite)

Figure 3: Wide and Opposite Orientation for Dual Sensor Operation.

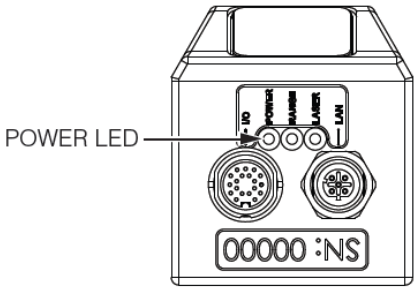
2.3 Running a Dual Sensor System

All Gocator sensors are configured to 192.168.1.10 as the default IP address. For a dual sensor system, the Main and Buddy sensors *must run the same firmware version* and *must be assigned unique addresses* before they can be used on the same network. Prior to proceeding with these instructions, connect the Main and Buddy sensors one at a time (to avoid an address conflict) and use the steps below.

1. **Turn off the sensors and unplug the Ethernet network connection of the Main sensor.** All sensors are shipped with a default IP address of 192.168.1.10. Ethernet networks require a unique IP address for each device. Skip step 1 to 3 if the Buddy sensor's IP address is already setup with a unique address.

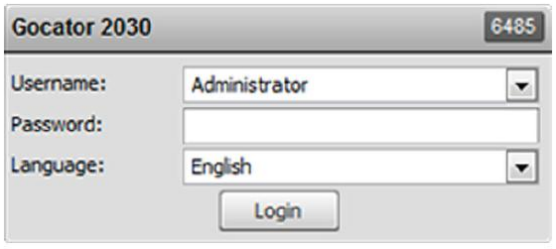


2. **Power up the Buddy sensor.** The power LED (blue) of the Buddy sensor should turn on immediately.



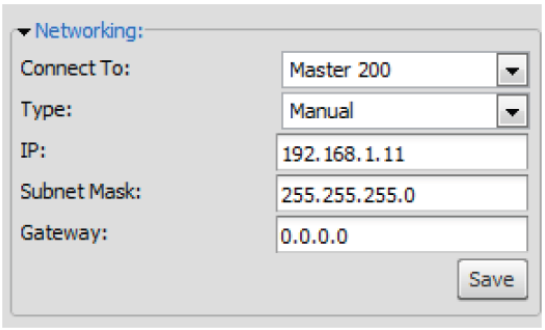
3. **Enter the sensor's IP address (192.168.1.10) in a web browser.** This will log into the Buddy sensor.

4. **Login as Administrator with no password**.

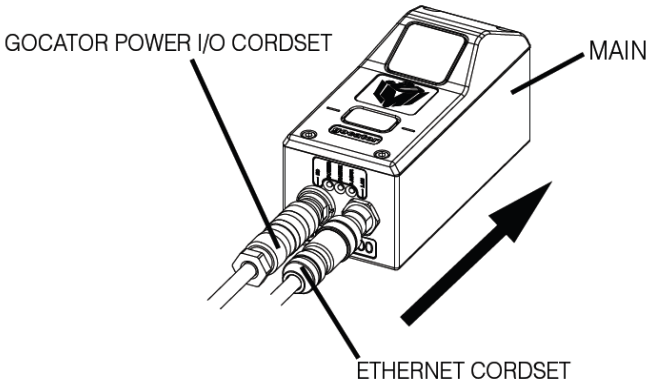


5. **Select the Connection Page**.

6. **Modify the IP address to 192.168.1.11 in the Network settings and click the Save button.** When you click the Save button, you will be prompted to confirm your selection.

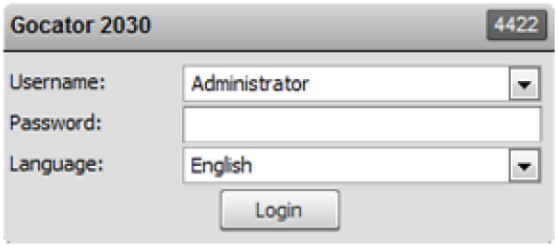


7. **Turn off the sensors, re-connect the Main sensor's Ethernet connection and power-cycle the sensors.** After changing the network configuration, the sensors must be reset or power-cycled before the change will take effect.



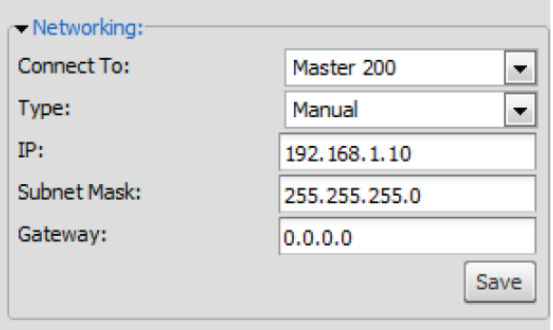
8. **Enter the sensor's IP address (192.168.1.10) in a web browser.** This will log into the Main sensor.

9. **Login as Administrator with no password**. The interface display language can be changed using the language option. After selecting the language, the browser will refresh and the web interface will display in the selected language.

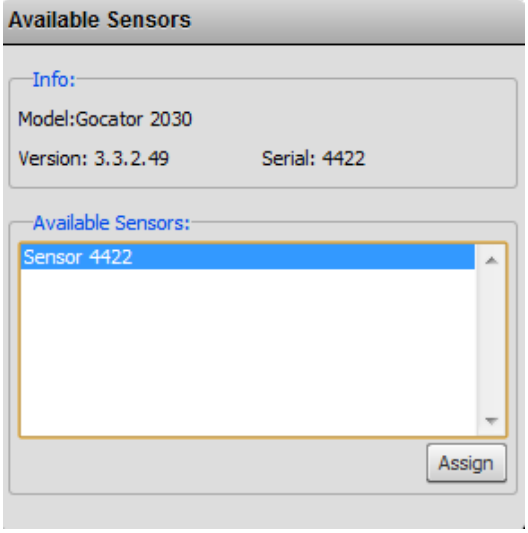


10. **Select the Connection Page.**

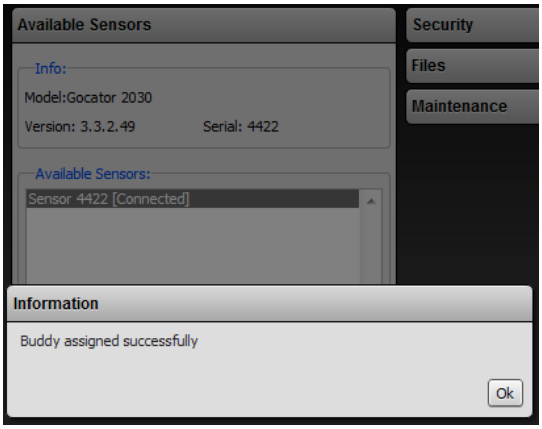
11. **Specify the Connect To setting.** The Connect To setting specifies whether the sensor system is standalone, connected to a Master. For Dual Sensor operation, select Master 200 (Gocator 2000 family) or Master 400 (Gocator 2300 family).



12. **Go to Connection Page > Available Sensors panel.** The serial number of the Buddy sensor is listed in the Available Sensors panel.

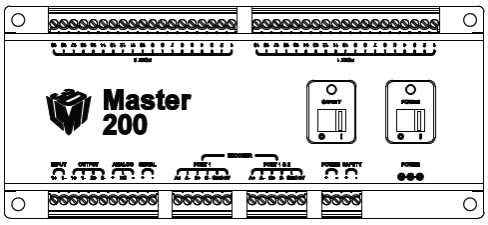


13. **Select the Buddy sensor. Click the Assign button.** The Buddy sensor will be assigned to the Main sensor and its status will be updated in the System panel. *Note that the firmware version on the Main and the Buddy must be the same for Buddy assignment to be successful*.

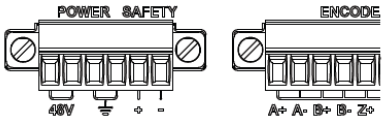


14. **Ensure that the Laser Safety Switch is enabled on the Master 200, or the Laser Safety input is high if using a Master 400.**

    Also verify that the Main sensor is connected to Port 1 on the Master 200 (for Gocator 2000 family sensors).



Master 200 (for Gocator 2000)

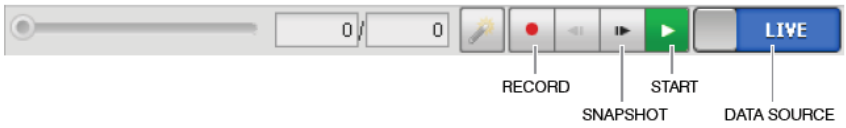


Master 400/800/1200/2400 (for Gocator 2300)

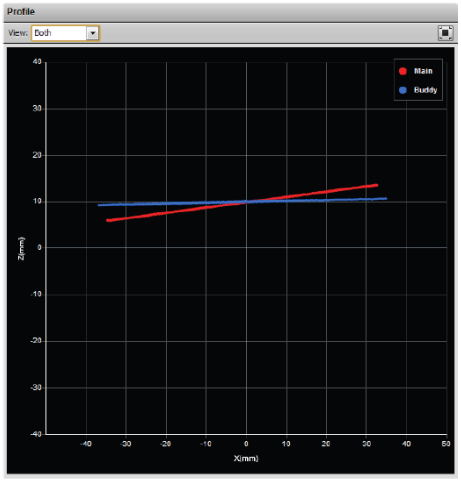
15. **Select the Setup Page.**

16. **Ensure that the Data Source selector is showing LIVE.**

17. **Press the Start button to start the sensors.** The Start button is used to run sensors continuously, while the Snapshot button is used to trigger a single profile.



18. **Move a target into the laser plane.** If a target object is within the sensor's measurement range, the Data Viewer will display the shape of the target and the sensor's Range Indicator LED will illuminate. In the Data Viewer's drop-down box select Both to view data from both sensors at the same time.



3 Calibration and Measurement Example

In order to use the dual sensor setup to actually measure targets in a single combined Field of View, the sensors have to be made aware of each other's mounting location. In the Gocator this is done through the built-in Alignment or Travel Calibration, which supports calibration of the dual sensor system into world coordinates.

The example presented here is for the Wide Orientation scenario, i.e. when the sensors are mounted side by side to cover a wider Field of View. For wide multi-sensor systems, calibration bars are required to perform the system calibration according to the specification in Figure 4. The bar should not be made of a reflective or shiny material, but a brushed or matt metallic surface may still work. As a rule-of-thumb the diameter of the reference holes should be at least 10 times the sensor's X resolution.

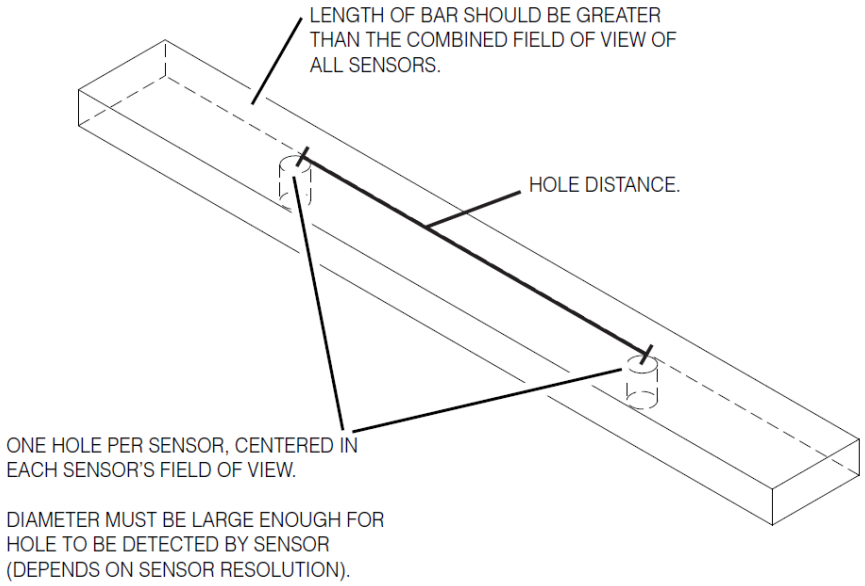


Figure 4: Calibration Bar Specification.

Figure 5 shows two Gocator 2030 sensors mounted side by side in the Wide Orientation, with a calibration bar in their Field of View. In this case the sensors are close together and their individual FOV's are physically overlapping, which is suitable in applications where high resolution is required to scan a target that is larger than the FOV of a single sensor.

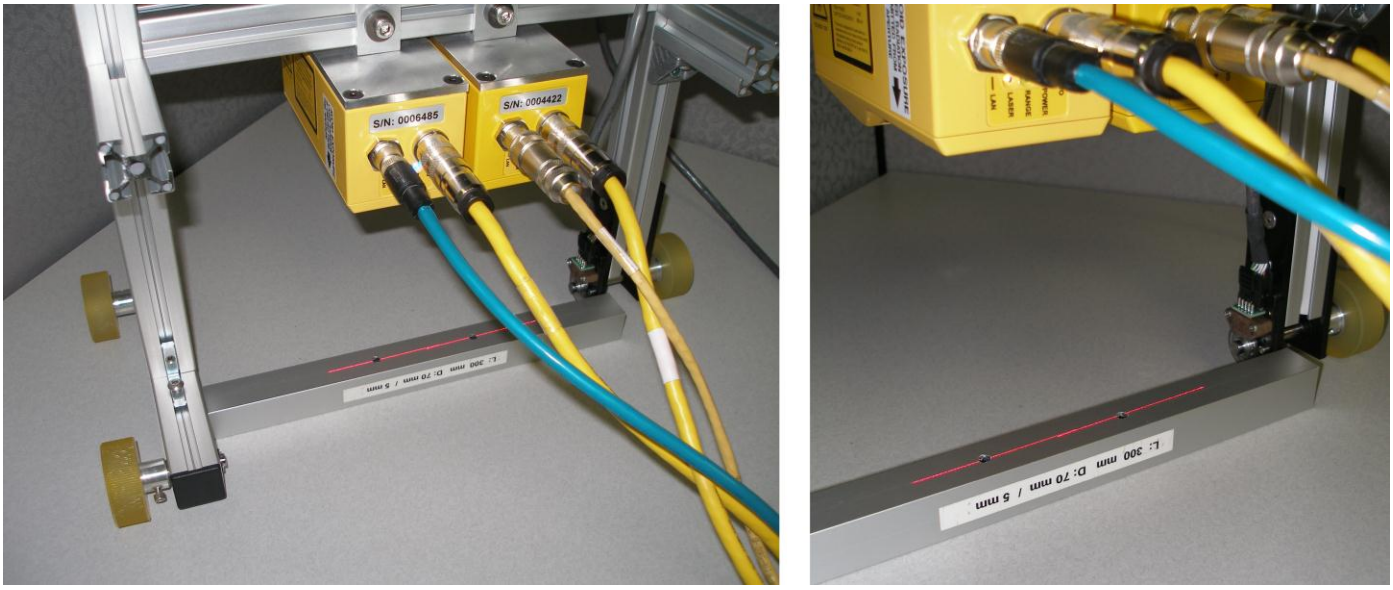


Figure 5: Dual Sensor setup with custom calibration bar.

Figure 6 shows what the uncalibrated profile data looks like in the Data Viewer. Note again that *Both* has to be selected in the viewer's drop-down selection box.

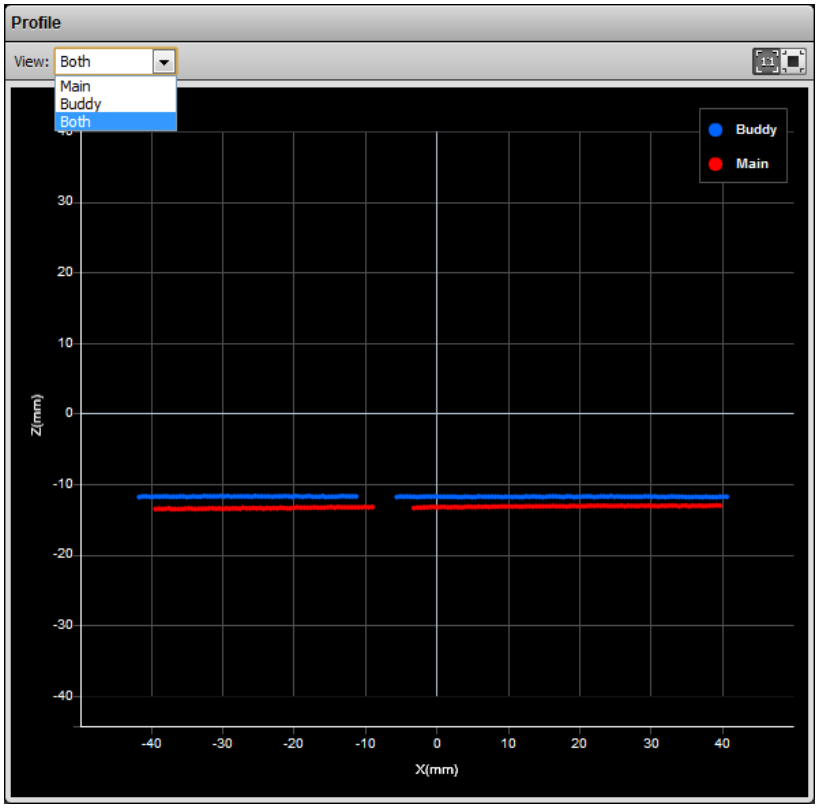


Figure 6: Uncalibrated profiles from both the Main and the Buddy.

The calibration of the Gocator is done via the Layout Panel. Figure 7 shows this panel with the correct settings entered corresponding to the setup pictured above in Figure 5.

- The correct Orientation *must* be selected prior to calibration for successful operation.
- If the Main and Buddy sensors are mounted such that the camera from one sensor can detect the laser from the other sensor, the *Overlap* feature can be used to eliminate laser interference. Overlap creates a time offset for laser exposures and ensures that interfering lasers are not strobed at the same time. *Note that the use of the overlap feature may reduce the maximum frame rate*.
- Select Bar:Custom as the Target and enter the dimensions of the calibration bar. The distance between the holes is from centre to centre.
- Select Alignment for a calibration where the bar remains static in the sensor's FOV during calibration. This type of calibration does not calibrate the encoder resolution and is the recommended method if the encoder resolution has already been established and has not changed.
- If an encoder is connected to the system it is possible to also calibrate the encoder resolution in a single operation by scanning the bar in the direction of travel. Select Travel calibration for this option. In this case the Width of the bar is used by the calibration routine to establish the encoder resolution. However, note that the encoder resolution can also be manually entered under the Trigger Panel.

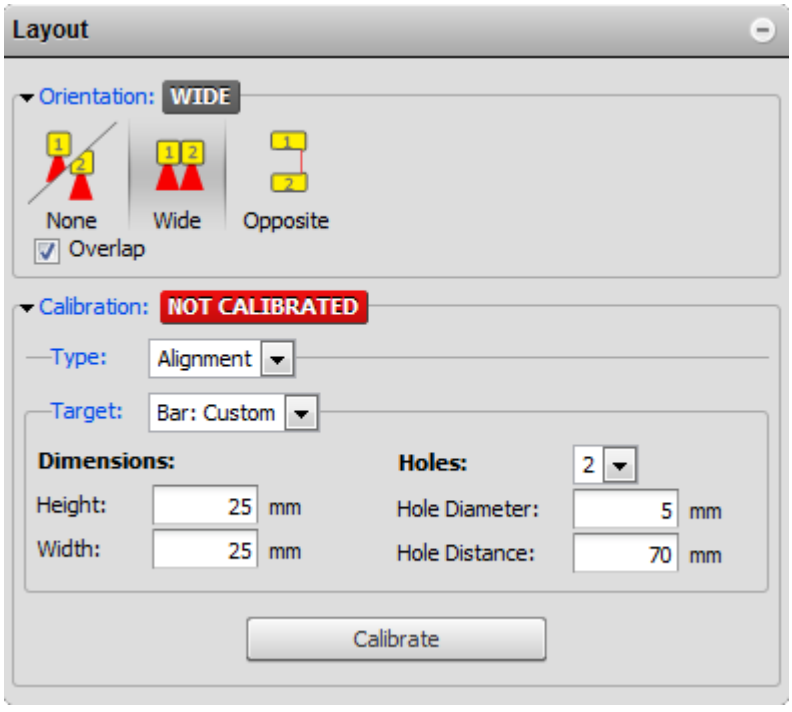


Figure 7: The Layout Panel with settings for the calibration.

After successful calibration the profile data from the two sensors should look like in Figure 8.

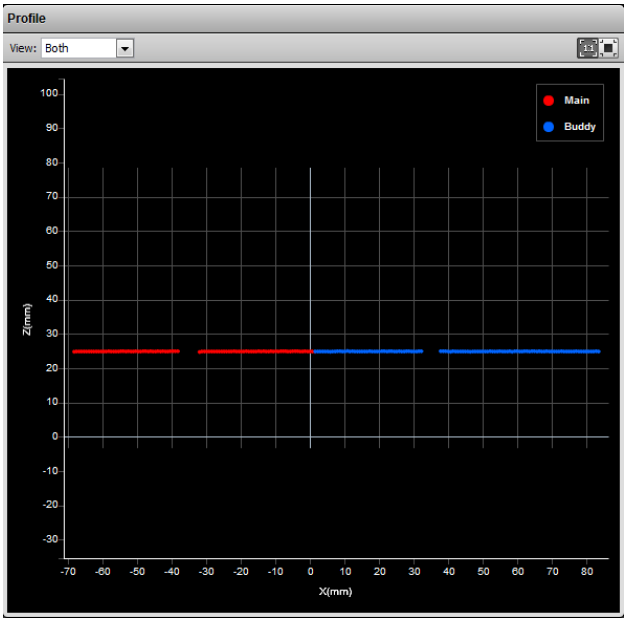


Figure 8: System calibrated profiles from both the Main and the Buddy.

Measurement tools can now be applied to the system calibrated data for dimensionally correct results across the combined Field of View, as shown in Figure 9. *Note that the Source has to be set to Both in order for the tool to operate on the combined data.*

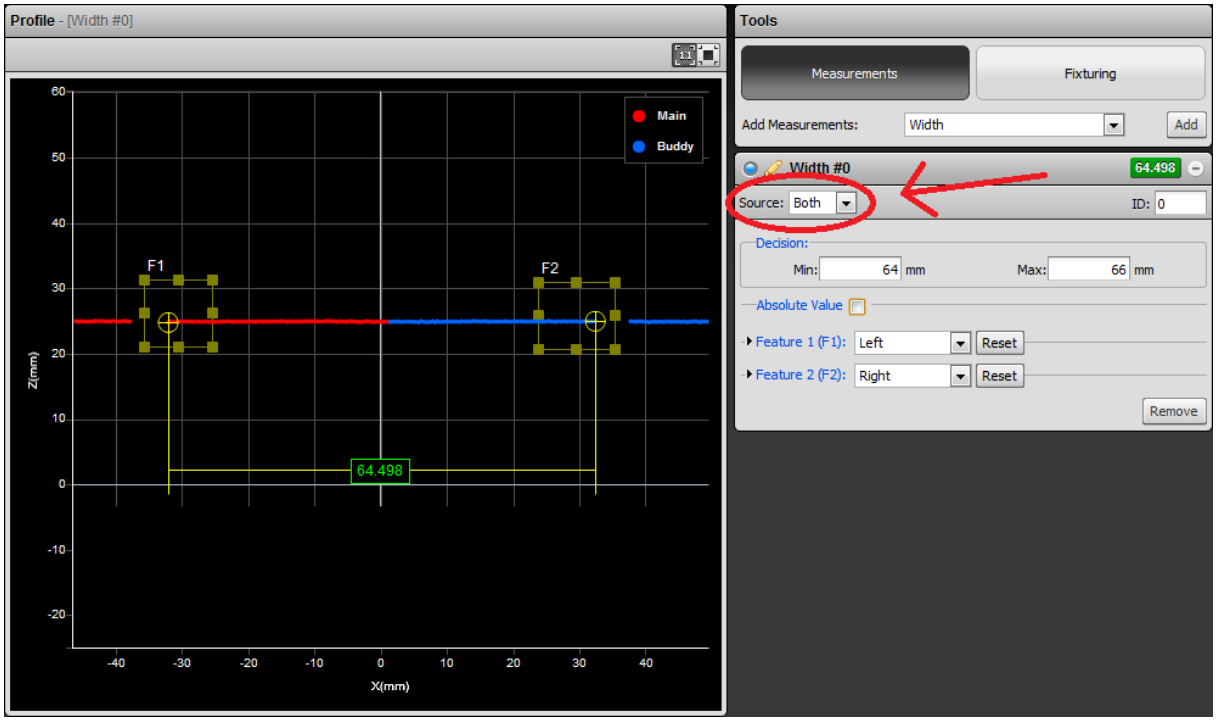


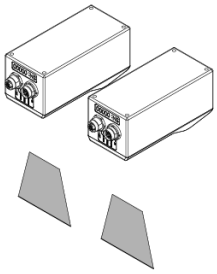
Figure 9: Example of Width measurement in combined Dual Sensor data.

3.1 Other Dual Sensor Mounting Orientations

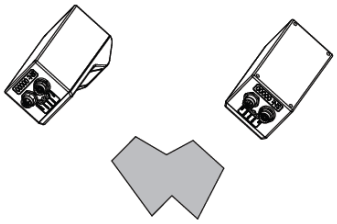
In addition to the example above, there are a number of other possible dual sensor orientations. Fundamentally they are configured and calibrated the same way as in the example, with the exception that sometimes only a single reference hole is needed for calibration.

- **Wide Orientation with overlapping FOV** – the example given in this document.

- **Wide Orientation with non-overlapping FOV** – used to measure width of a large web of material such as metal or rubber. The overlap feature should be disabled so that the two sensors capture data at the same moment in time. Calibration is performed with a bar with two holes, exactly the same way as described in the example above.



- **Angled Wide Orientation with overlapping FOV** – used to avoid occlusions on targets with complicated shape and sharp corners. The sensors are angled in towards each other, as pictured to the right. Calibration is performed with a bar with only a single hole.



- **Opposite Orientation** – used to measure true thickness of a target. The overlap feature should be disabled so that the two sensors capture data at the same moment in time. The two sensor's lasers should be aligned to form a single plane. Calibration is performed with a bar with only a single hole, as illustrated below.