Robotics, Integration, and Automation

REMOTE MONITORING & BLUETOOTH

Name	Class/Period	Date

1. Overview

In this lab activity, you will connect your SmartCart 4.0 to the remote monitoring software and observe sensor values both remotely and locally.

2. Performance Objectives

After completing this lab activity, you will be able to:

- Set your IO-Link master's IoT port IP address.
- Connect the SmartCart to remote monitoring software.
- Generate a monitoring dashboard for the SmartCart's IO-Link devices.
- Monitor sensor data from IO-Link devices using your smartphone or tablet.

3. Required Materials

You need the following materials to complete the lab activity:

- SmartCart 4.0
- Computer
- Ethernet cables
- IO-Link Bluetooth adapter
- Smartphone or tablet

4. Required Software

Ethernet Device Configuration (Hilscher) and **IFM Moneo** are required for this lab activity. Ensure that the software is installed on your workstation and has a valid license. If you are having problems installing or licensing the software, contact your instructor or IT manager.

5. Inventory and Safety

Before beginning the lab activity, review this checklist and mark off each item as you complete it.

- ☐ All hardware components are available for this lab activity.

- ☐ Hands, hair, and clothing are securely away from the work area.

- ☐ The work area is clean and devoid of food or drink.

- ☐ Review the SmartCart safety guidelines.

- ☐ Read through the entirety of this lab activity to familiarize yourself with the requirements.

6. Background

6.1. Remote Monitoring

A sensor-to-cloud system increases the capacity of traditional networks for scalability, storage, and communication. A cloud software service (SAAS) can manage sensor information from multiple sensors, including collecting sensor data, processing it, and storing the history.

Moneo RTM is a state-of-the-art remote monitoring system. The software enables you to set up your own custom dashboards, giving you the option of having plant status at a glance and the opportunity to acquire important process information from any computer with authorized access. Monitored smart sensor values are uploaded to the cloud, allowing any licensed Moneo users to observe what is happening to their factories from just about anywhere.

A key feature of Moneo is the **navigator**. The navigator is a hierarchically-organized tree where specific areas of a factory can be monitored in isolation.
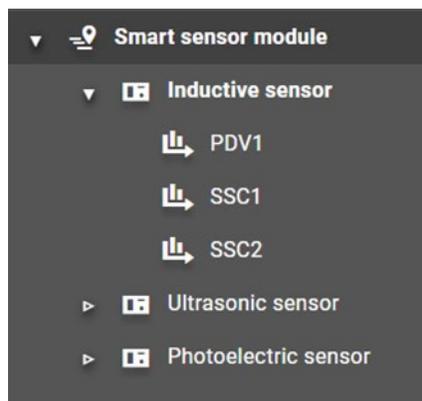
Elements of the navigator are called **nodes**. Device nodes contain **info points**. An info point is a process value or piece of data that is being monitored, such as the distance reading of an ultrasonic sensor. Moneo cannot poll acyclic data from sensors, so info points are only for cyclic data.

6.2. Bluetooth Monitoring

A cloud monitoring system is typically employed at a desktop computer at a factory's supervisory station or control room. The plant manager would have a large dashboard displaying all of the factory areas and their connected nodes.

This type of setup, however, would be cumbersome should the plant manager or one of their technicians need to know the status of specific sensors as they survey the actual production floor. A much more convenient setup in this case is that of **Bluetooth monitoring**, which is something that you will get the chance to do today. Bluetooth is a short-range wireless communication standard for devices, especially mobile devices. Using an IO-Link Bluetooth adapter, technicians and plant managers can wander their production areas and observe sensor values from the convenience of a smartphone or tablet.

7. Lab Activity

In this lab activity, you will observe sensor data from IO-Link devices using the IFM Moneo and Moneo Blue applications.

7.1. Adding the IO-Link Master's IoT Port to the SmartCart LAN

In this task, you will configure the IP address of the 8-port IO-Link master's IoT port so that it can be added to the SmartCart network and send sensor data to the cloud.

Perform these steps:

1. Ensure that your workstation is connected to the SmartCart switch.

2. Ensure that the 8-port IO-link master is connected to the switch at both the IoT port and at one of the EtherNet/IP ports.

ⓘ **Note:** *Ideally, the IoT port should be connected to another computer so that it can be on a different network (and simulate an IT network instead of a factory [OT] network). These instructions are for a single workstation on the SmartCart LAN.*

3. Power on the I/O box.

4. Use the Windows Command Prompt and the ipconfig command to confirm that the workstation that is connected to the master has an IP address of **192.168.0.1**.

5. Open the Ethernet Device Configuration tool.
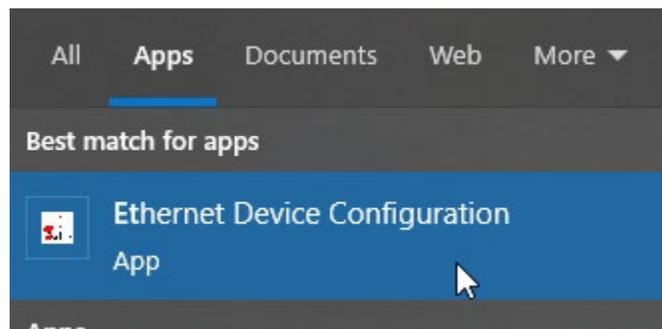
6. The application window opens. Click **Search Devices**.
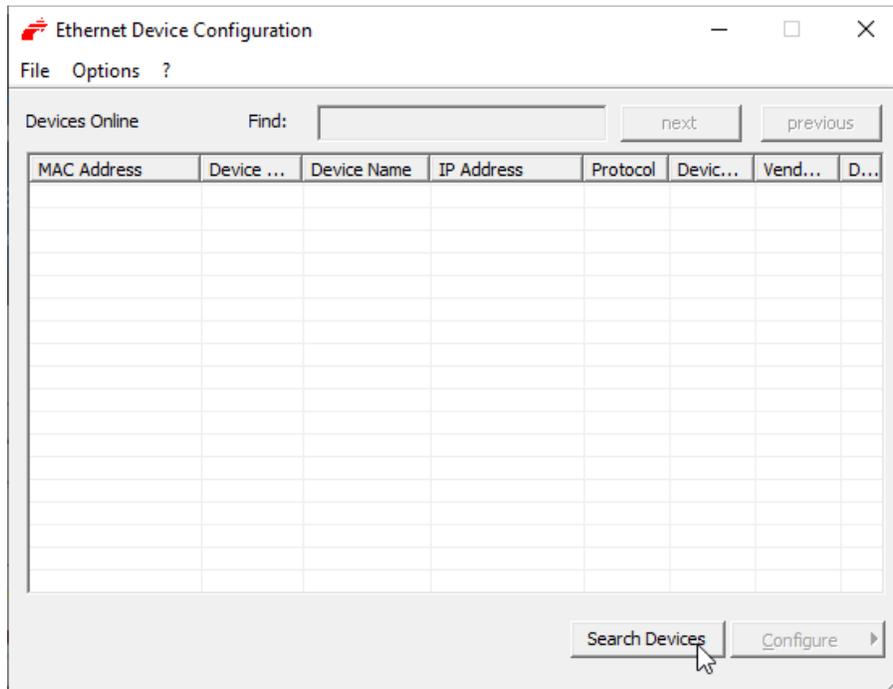

The connected IO-Link master devices are displayed. Shown below are the two connections to the same master 8-port. A device row showing the protocol **DCP** (IP Address 0.0.0.0) is the address of the master's IoT port.
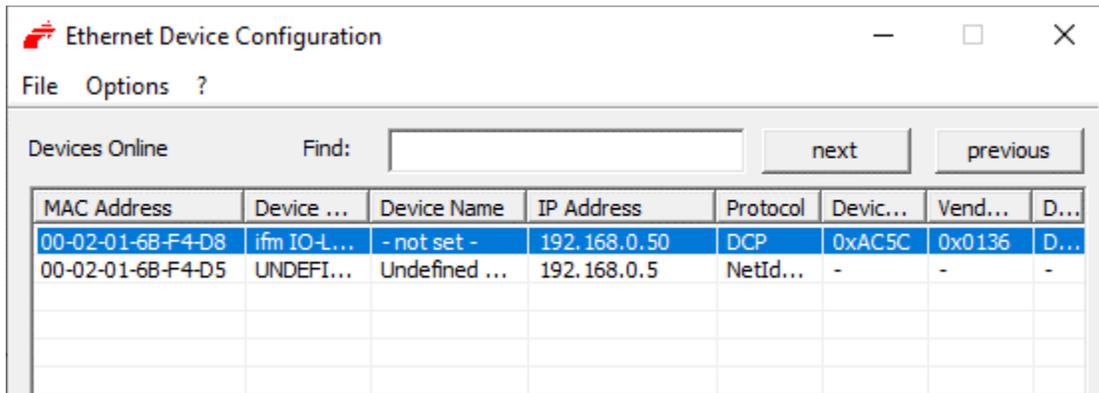
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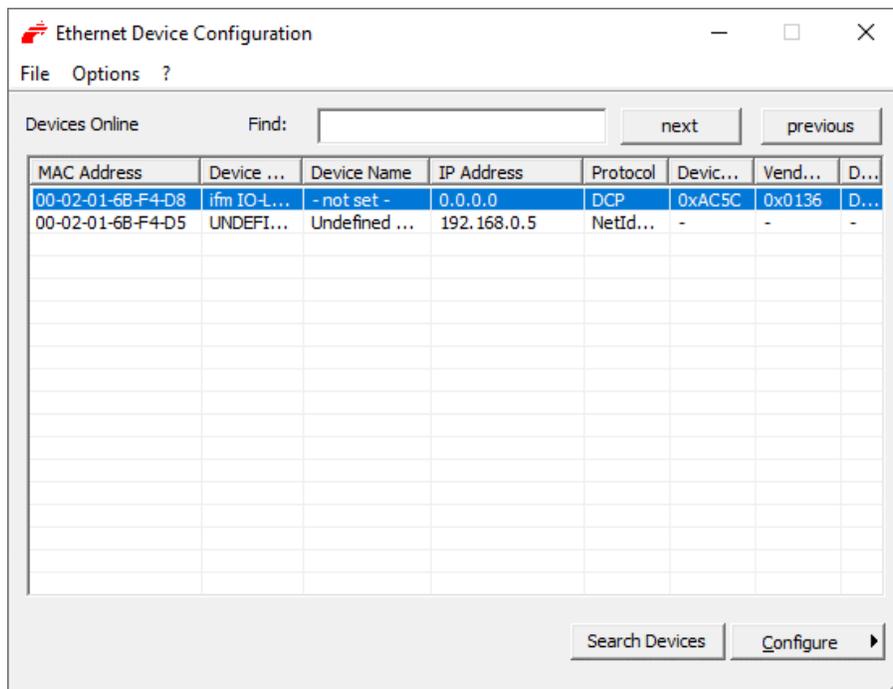
7. Right-click the relevant row and then select **Set IP Address**.
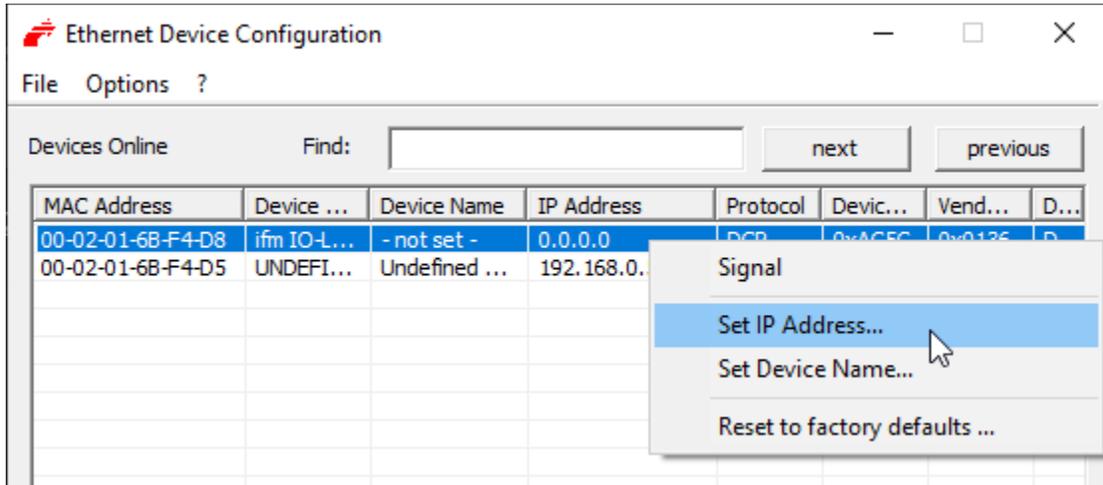
8. Set the port's IP address to a *unique* static IP address on the SmartCart LAN. Set the Subnet mask to **255.255.255.0**. Click **OK** when you are finished.
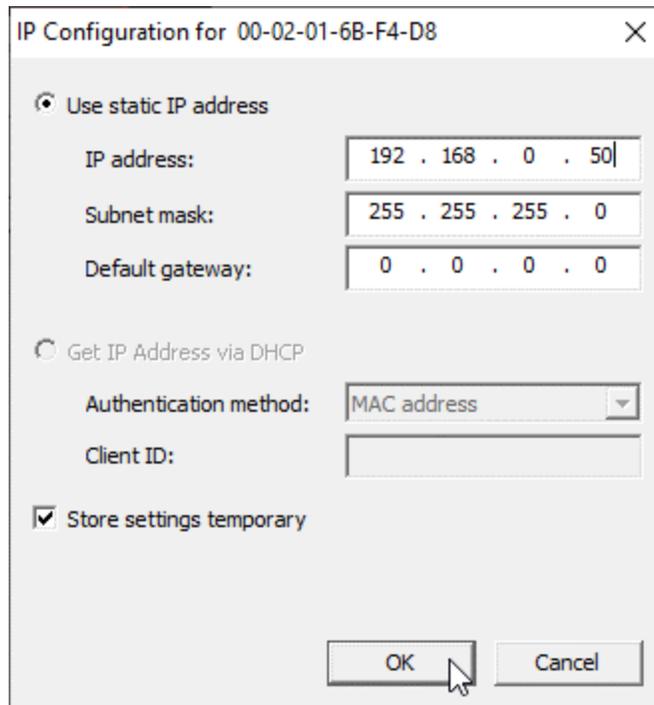
The IP address of the IoT port is changed.

9. Using the Windows Command Prompt, ping the IoT port's IP address to confirm connectivity.

10. Close the Ethernet Device Configuration window.

7.2. IFM Moneo and Sensor Value Monitoring

In this task, you will set up the Moneo software and connect the 8-port IO-Link master.

Perform these steps:

1. From the desktop or Windows start menu, launch the **IFM Moneo** application.

2. Log in to your account.
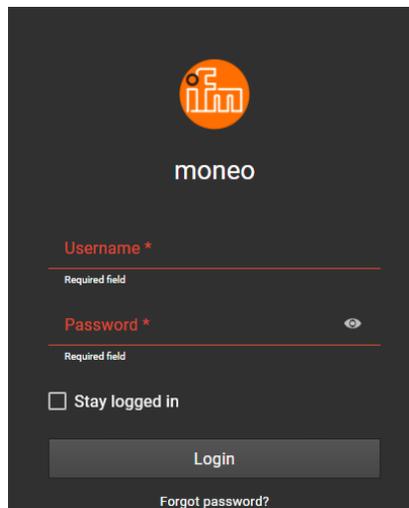
ⓘ *Note: In order to complete the exercises in this series of lab activities, you must have administrator privileges for the Moneo application.*

The Moneo home screen is displayed.
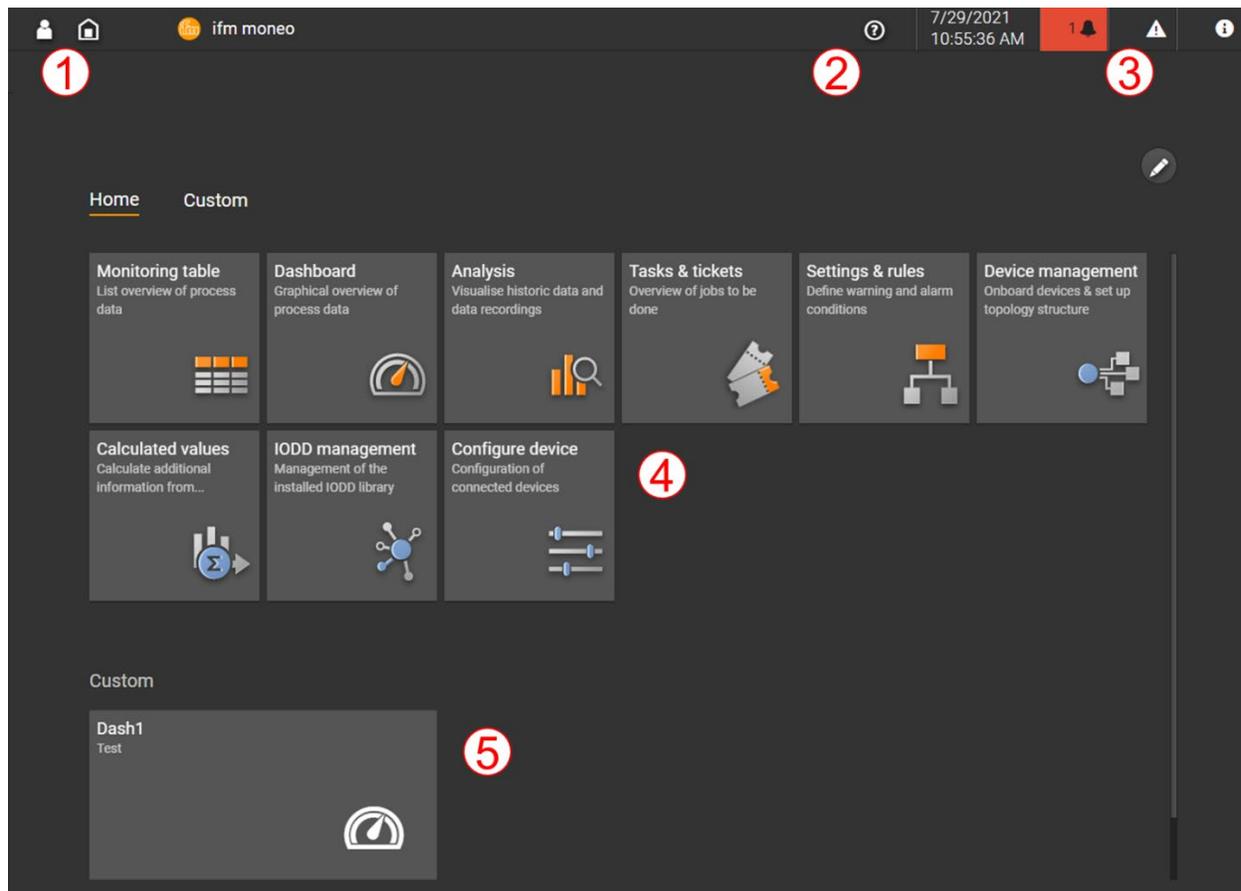
Label	Area	Description
1	Profile and home buttons	Click the profile button to access profile options. Click the home button to return to the home screen.
2	Help	Click this button to access Moneo documentation and video tutorials.
3	Notifications and alerts	Access notifications and alerts from this area.
4	Features	This area contains the Moneo monitoring features
5	Custom area	Custom dashboards are added to this area.

3. Click the **Configure device** button.

4. In the top-right corner of the Configure device screen, click **Network scan** to scan for devices on the network.
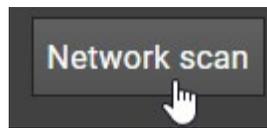
5. In the Network scan popup window, select **Whole network** and then click **SCAN**.
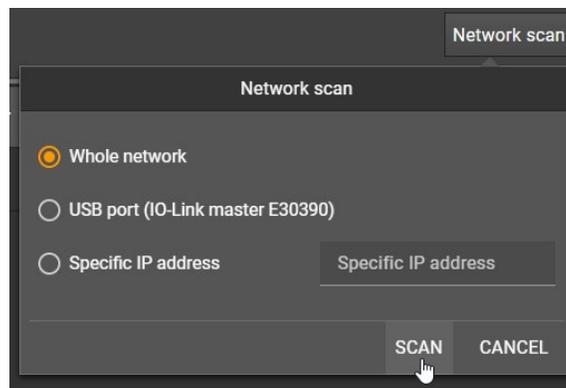
6. The table displays the IO-Link master.

Product name	Custom name	Location	Vendor	Family
▷ AL1322	AL1322	192.168.0.50	ifm electronic gmbh	IO-Link Master

7. Select the arrow next to the device's product name.
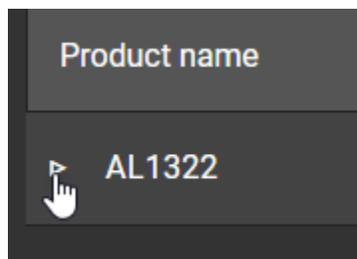
The devices that are connected to the master's IO-Link ports are displayed.

ⓘ *Note: Your SmartCart may not have an Inductive Sensor.*

Product name	Custom name	Location
▼ AL1322	AL1322	192.168.0.50
IG6615	Inductive Sensor - Conveyor	Port 1
–	–	Port 2
–	–	Port 3
DTI421	RFID Head - Gravity Feeder	Port 4
DV2131	Signal Lamp	Port 5

8. Select one of the proximity sensors.

UGT212	Ultrasonic Sensor	Port

The device page contains most of the information and options available in LR Device…
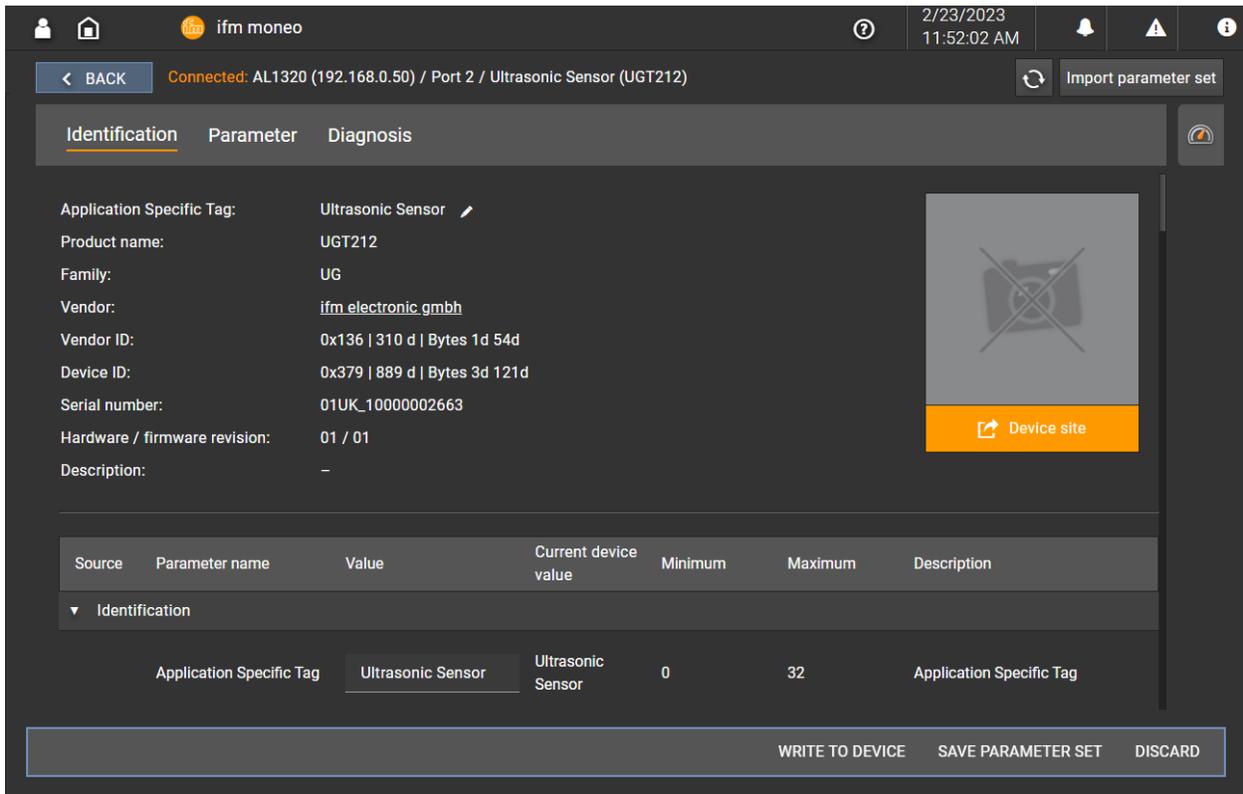
…including a dashboard (cockpit), which can be accessed via the button on the top-right.
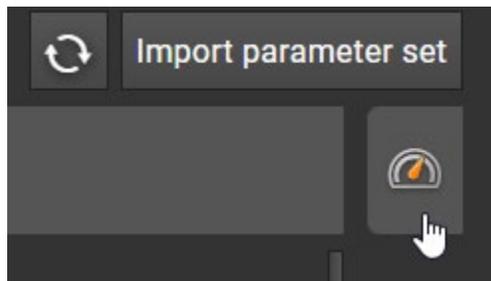
9. The dashboard displays the current sensor values and charts the data on a graph. Test the proximity sensors by moving a block in and out of its range. Observe the changes in values and the trace on the graph.
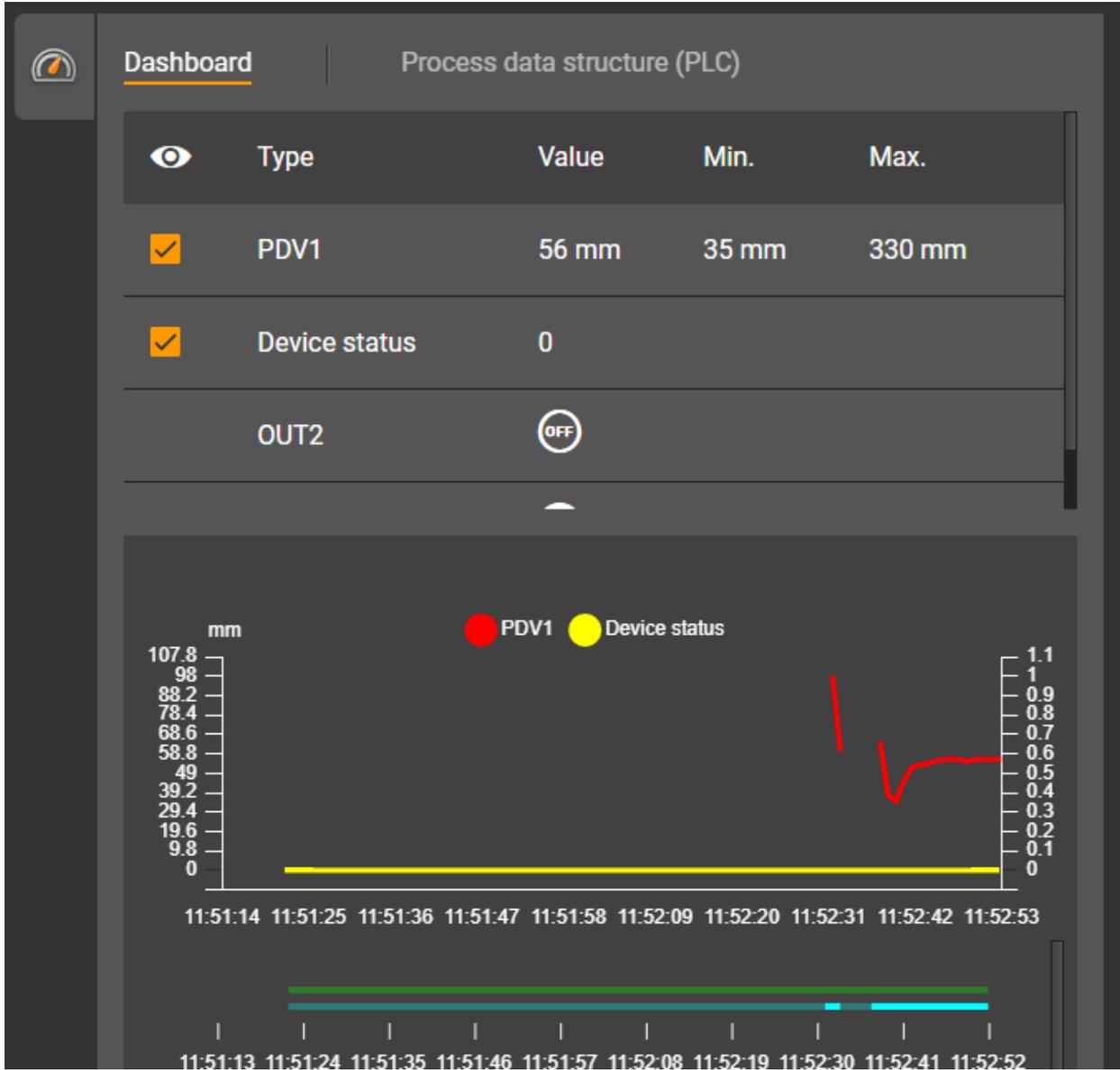
10. Click the home button to return to the home screen.
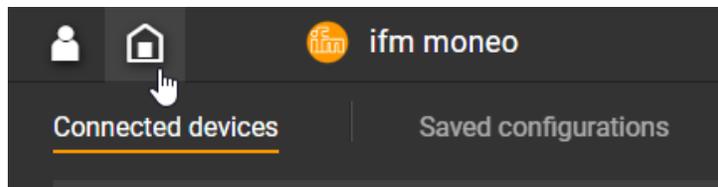
7.3. Building a Navigator and Dashboard

In this task, you will build a hierarchical production structure, also known as a **navigator**. The navigator organizes the components of production and allows you to more easily find the production component that you want to monitor. You will also create a dashboard with widgets that display the process data of the SmartCart IO-Link sensors.

Perform these steps:

1. From the home screen, click **Device management**.

2. The Device management screen is shown below. The left side of the Device management screen contains your navigator (which is currently empty), while the right side of the screen has location elements and devices that can be added to the navigator. Elements added to the navigator are collectively known as **nodes**.
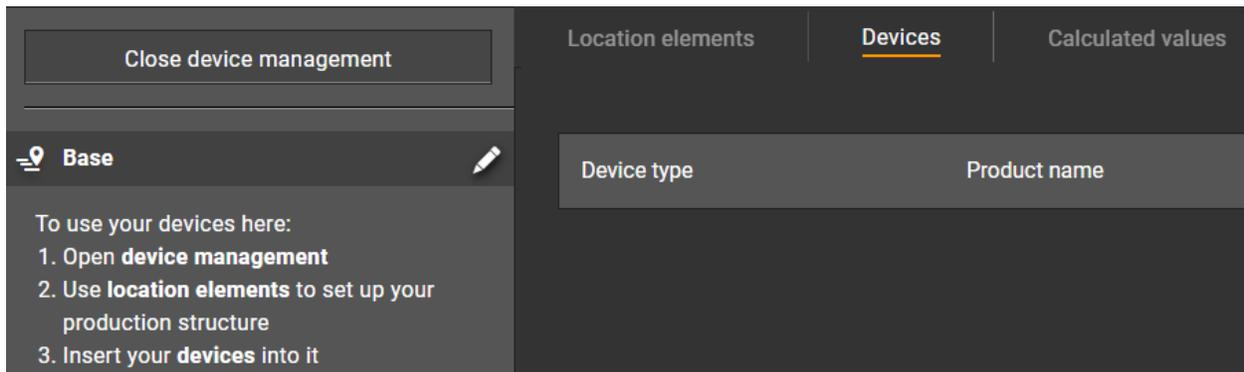
3. In the navigator, click the pencil icon next to **Base**.

4. Give the node a name, such as your personal name or institution's name, and then click **OK**.
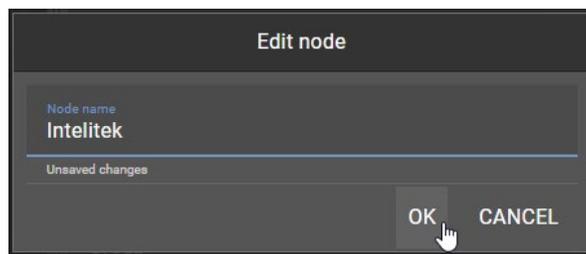
5. In the top menu, click **Location elements**.
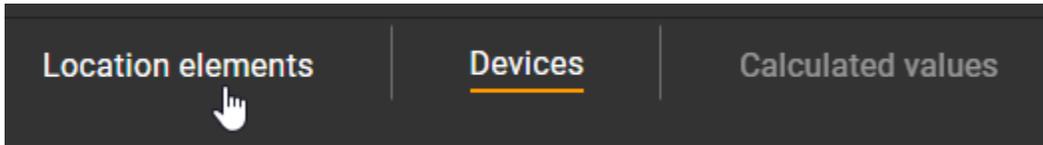
**6.** Drag any location element to the base node of the navigator.
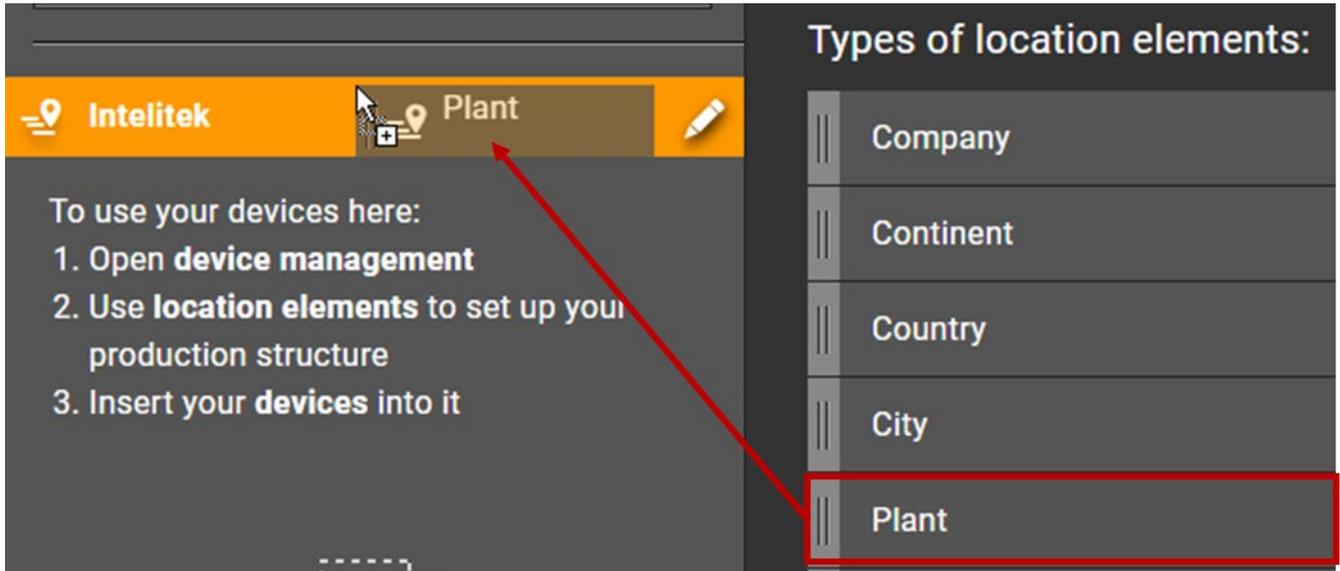
**7.** Give the location element a name and then click **OK**.
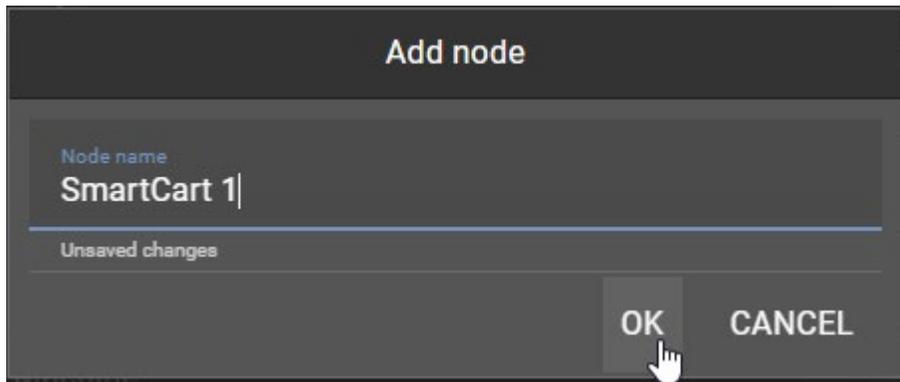
ⓘ *Note: Only location elements and devices with a grey* ▯ *can be dragged.*

ⓘ *Note: The types of location elements have no meaning. The layout on the right side of the screen is simply a suggested hierarchy for setting up the navigator. Location elements can be renamed and dragged up and down within the hierarchy.*

8. In the top menu, click **Devices** to display the connected IO-Link masters.
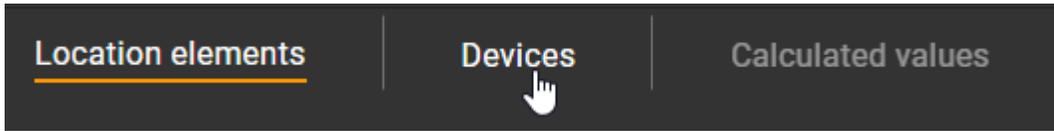
9. Drag a proximity sensor to the node you created.
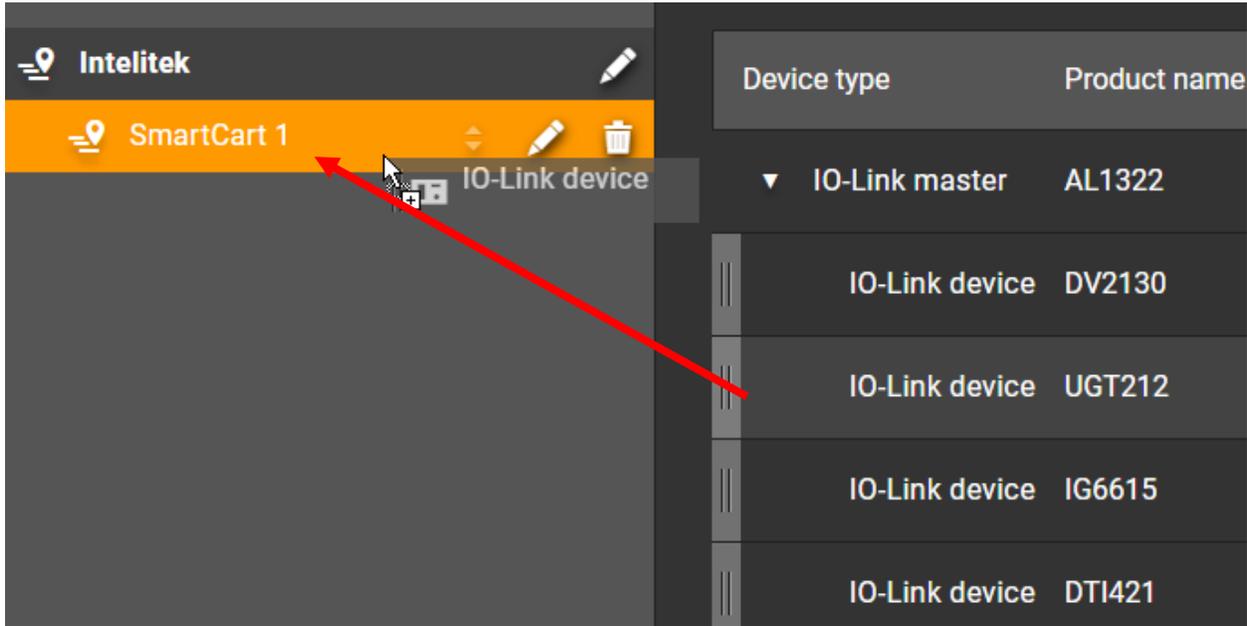
The device is displayed in the navigator. It has several info points that can be monitored.
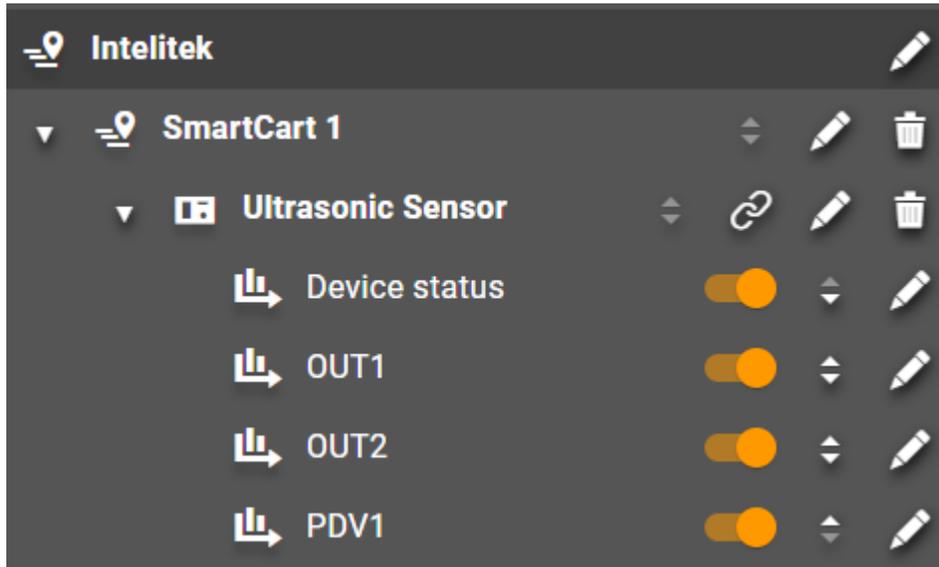
ⓘ **Note:** *The bottom-left corner of the Device management screen displays the number of licenses remaining for info points. Additional licenses can be purchased from IFM. Info points that are turned off do not use licenses.*
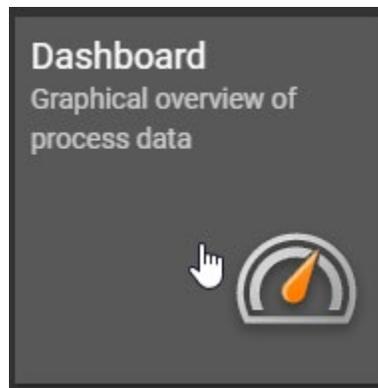

10. Add the air pressure sensor and the speed monitor to the navigator.

11. Click **Close device management** or the home button to return to the home screen.
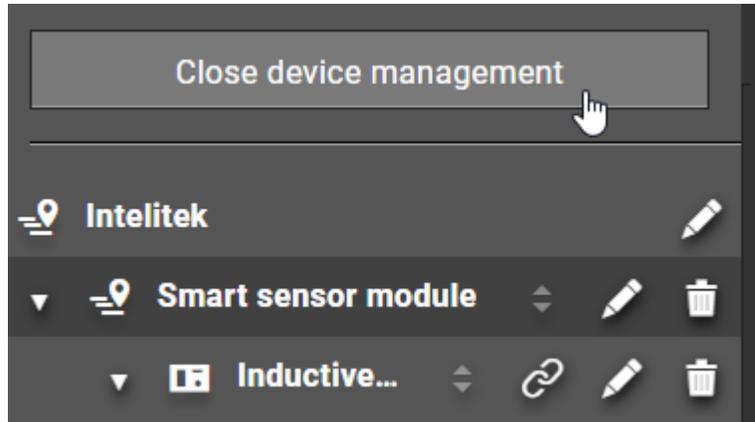

12. Click the **Dashboard** button.

ⓘ **Note:** *The screens that are accessed via the tabs at the top of the screen can also be accessed via the home screen.*

ⓘ **Note:** *The dashboard is created for the selected node only. Dashboards can be created for different nodes, and nodes can contain multiple dashboards.*
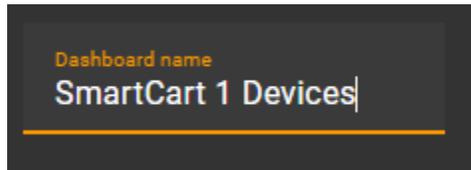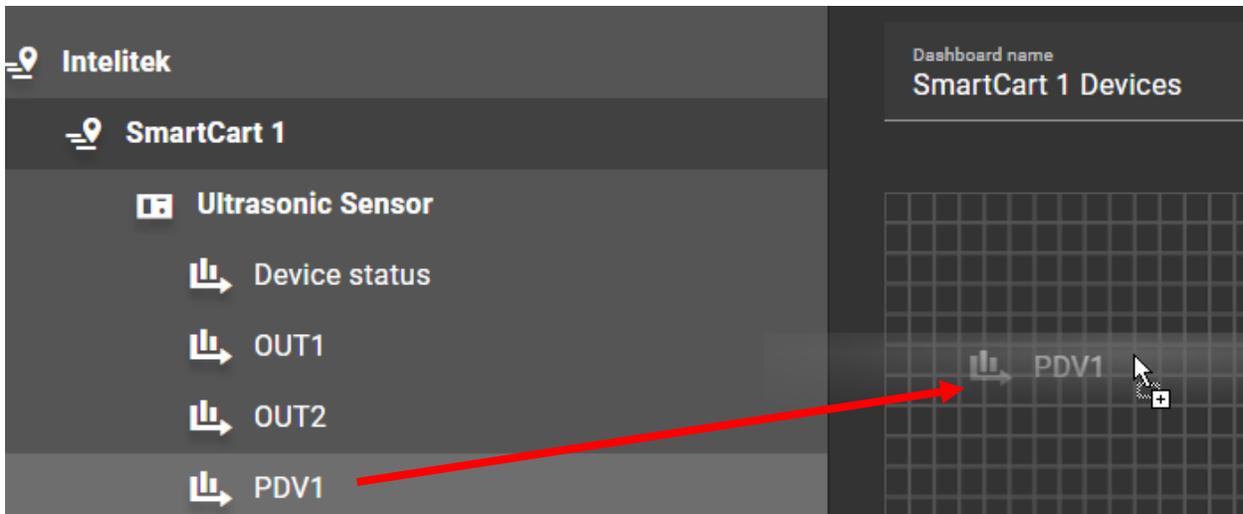
13. In the navigator, select the second level node.
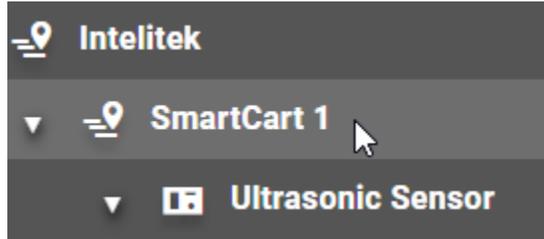
**14.** In the top-right corner, click the **+** button.
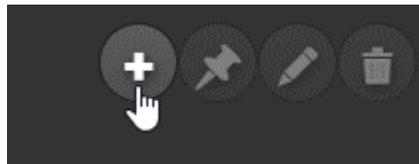
**15.** A new dashboard is displayed. Give the dashboard a name.

16. Drag the proximity sensor's **PDV1** node onto the grid.

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17. A PDV1 widget is displayed in the dashboard. The widget can be modified in size, location, and appearance. Adjust the widget's size by dragging the bottom-right corner.
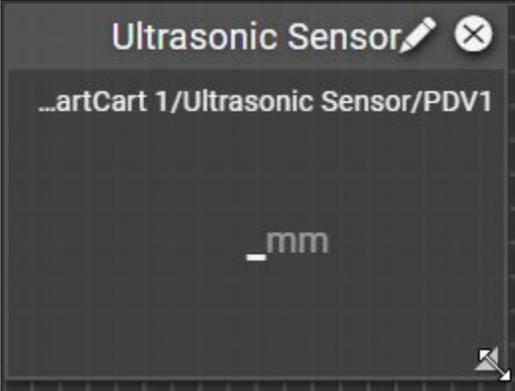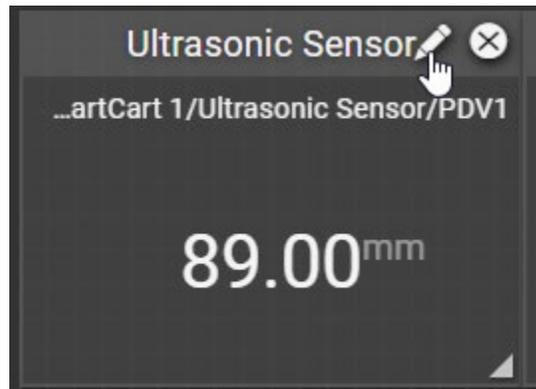

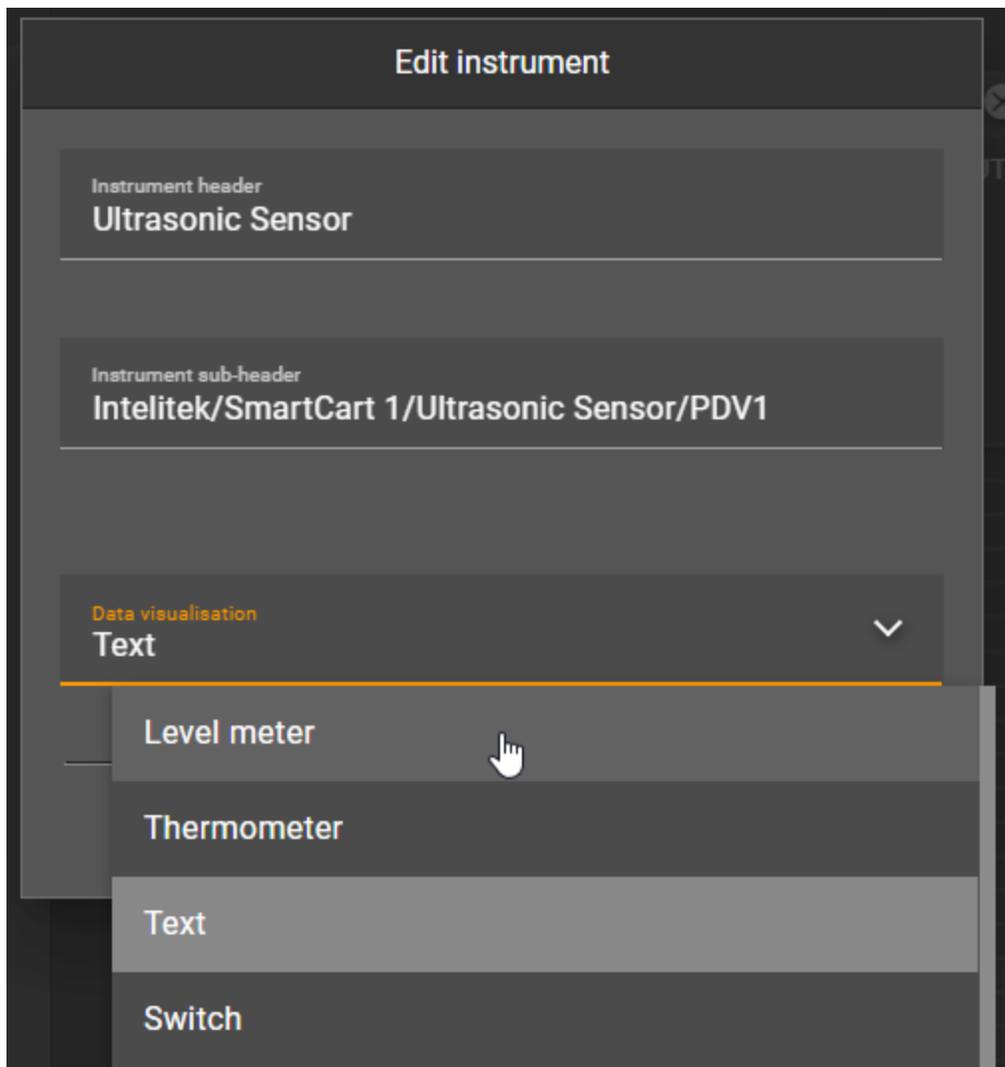**18.** Add the **OUT1** data point from the navigator to the dashboard.
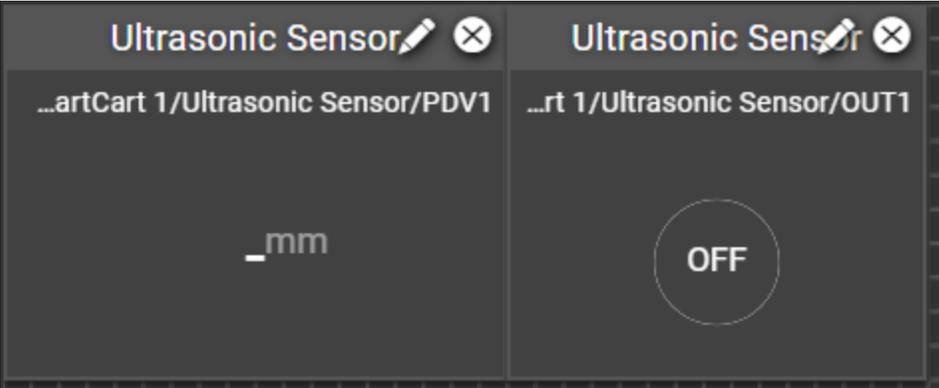
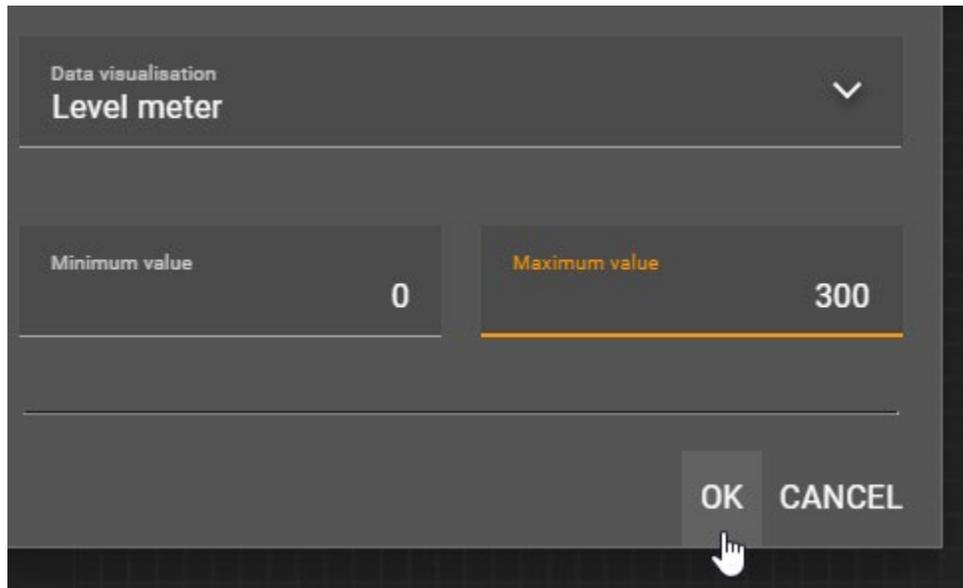**19.** Place an object in range of the sensor and observe the change in values.
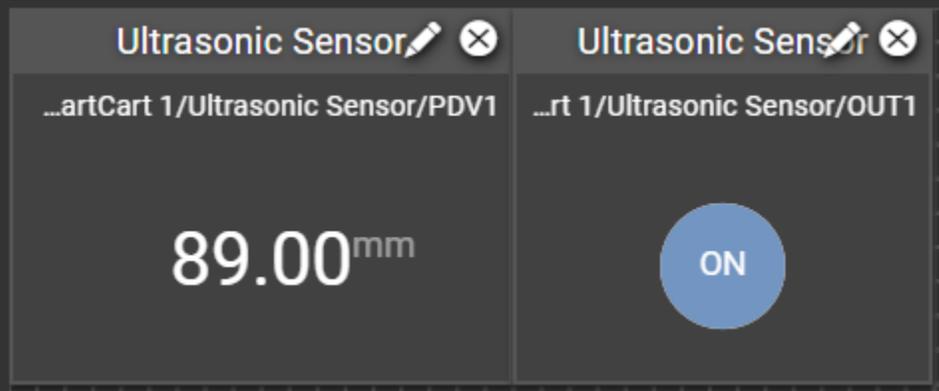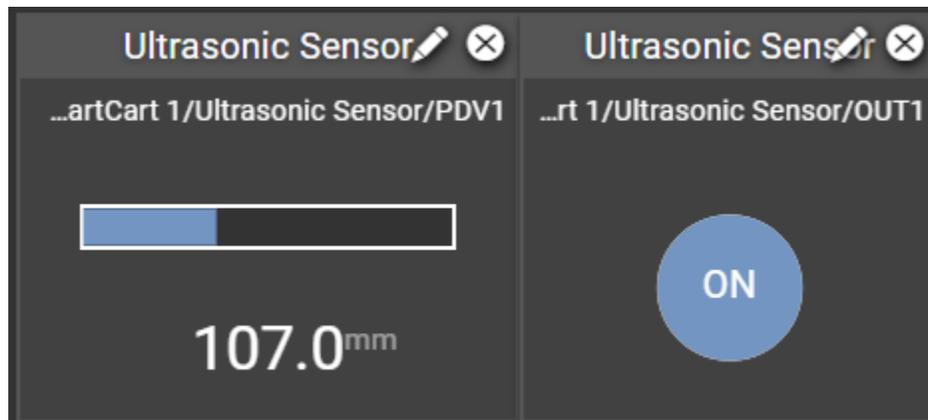
20. Click the PDV1 widget's pencil icon.

21. The **Edit instrument** window is displayed. Open the **Data visualization** dropdown menu and select **Level meter**.

**22.** Change the range to **0 – 300** (mm) and then click **OK**.

**23.** Move an object in and out of range of the proximity sensor and observe the sensor values.

24. Drag the **PDV1** node (may be called *Revolution*) of the speed monitor and the **Pressure** node of the air pressure sensor (may be called *PDV1*) onto the grid. Adjust the widgets and change the data visualization parameters so that the sensor values are clearly visible on the dashboard.

25. Power on the robot controller and the air compressor. Wait for the robot to boot up.

26. Ensure that the programming pendant mode key is in Teach mode. Using the pendant, navigate to the **General Purpose Output** screen and turn **OUT#0003** on. The conveyor turns on.

27. Note the value of the speed monitor's PDV1 widget. Adjust the speed of the conveyor motor using the dial and observe the changes in value.

28. Note the values of the Pressure widget. Turn OUT#0001 and OUT#0002 on. The end effectors of the multi-gripper change states. Observe the changes in the Pressure value, if any.

29. Turn all outputs robot off.

30. Add the rest of the devices to the navigator. Drag at least 5 more data points to the grid and modify their widgets.

31. This step is optional. Perform it if time remains:

    a. Using a Smartphone or digital camera, take a photo of your SmartCart. Transfer the image file to the workstation.

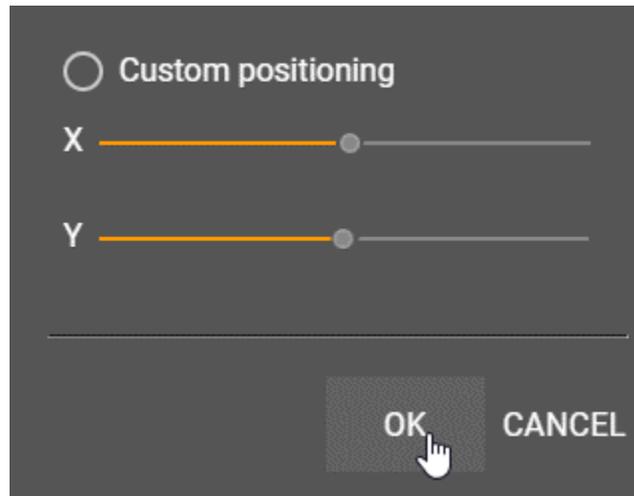   b. In the top-right corner of the screen, click the Add background image button.
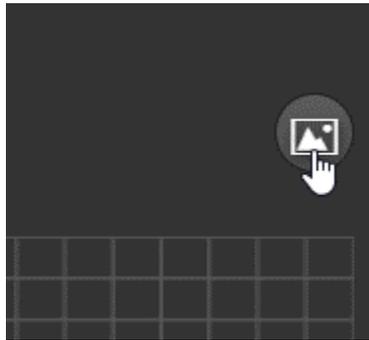
    c. Click **Select file**. Browse to the SmartCart image file that you captured and select it.
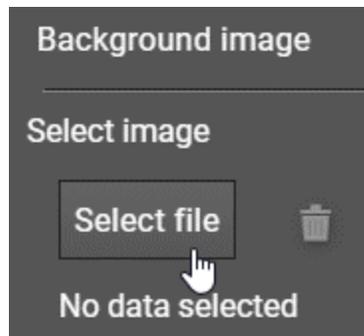
    d. The image is added to the background. If necessary, adjust the width, height, and any other image parameters.
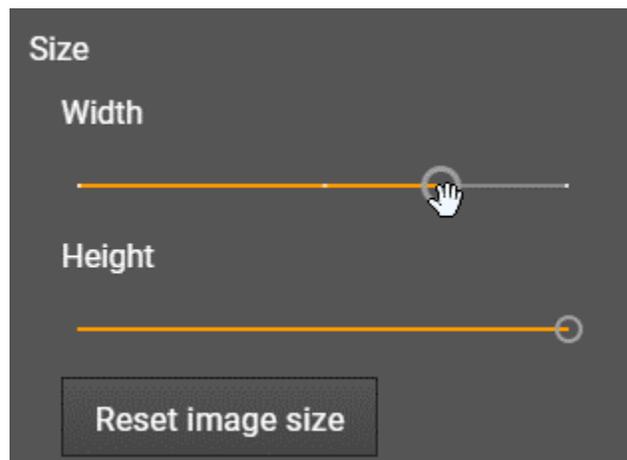
e. Scroll down to the bottom of the image settings and click **OK**.

f. The image of the SmartCart is now in the background. Reposition and adjust the sizes of the widgets so that they are in the general area of each device in the image.
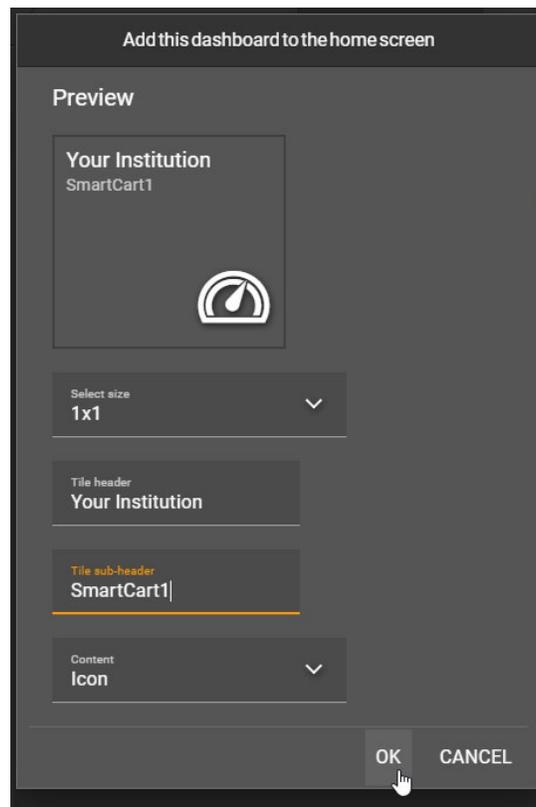
32. At the bottom-right corner of the screen, click **FINISH**.

33. The dashboard is saved. Click the pin button to add the dashboard to the home screen.

34. Complete the two Title fields and then click **OK**.

35. Return to the home page. Ensure that the dashboard is displayed at the bottom.

36. Test your dashboard by moving items into and out of range of the proximity sensors, changing the speed of the conveyor, and changing the states of the multi-gripper's end effectors.

37. Show your completed dashboard to at least one classmate and your instructor. When you are done, turn off all robot outputs.

38. Exit the Moneo application.
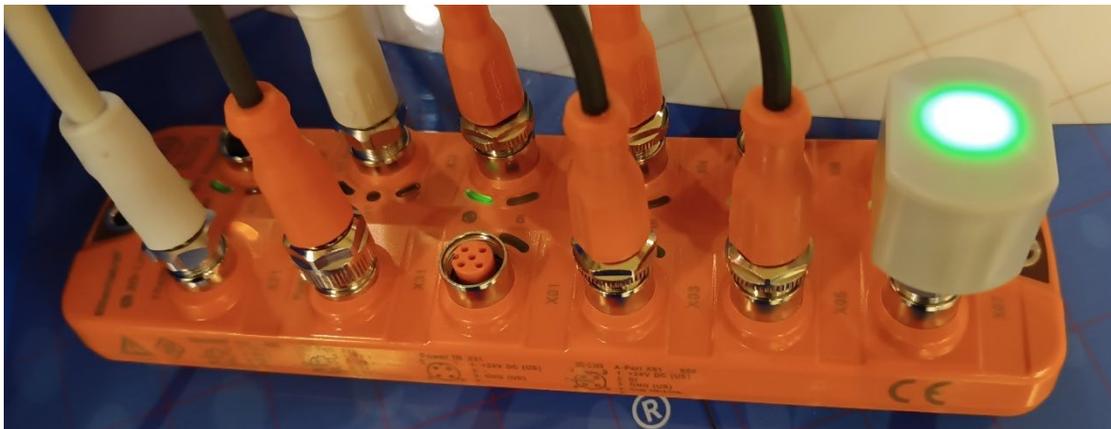
7.4. Moneo Blue

In this task, you will monitor IO-Link device process data values using the Moneo Blue application.

Perform these steps:

1. With your smartphone or tablet, go to the App Store or Google Play. Download and install the **Moneo Blue** app.

2. Ensure that the IO-Link Bluetooth adapter is connected to one of the IO-Link ports on the 8-port IO-Link master. The adapter's LED should be green to indicate that it is powered on but not connected to any external device.

3. Run Moneo Blue on your mobile device.

4. The start screen is displayed. Tap **Scan**.

ⓘ *Note: You will be prompted to turn on your device's Bluetooth and Location (GPS).*

ⓘ *Note: You may be prompted to accept a legal disclaimer and to download IODD files. The legal disclaimer must be accepted. The relevant IODD files can be downloaded later.*

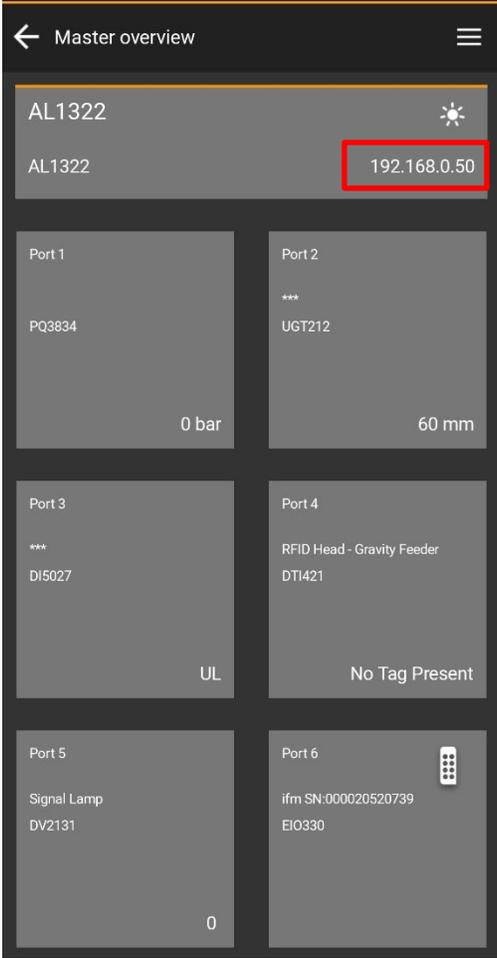**5.** The app scans for and finds the IO-Link master. Select the IO-Link master.
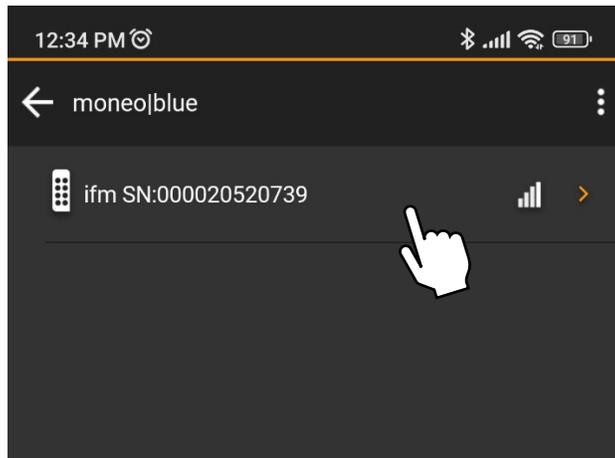
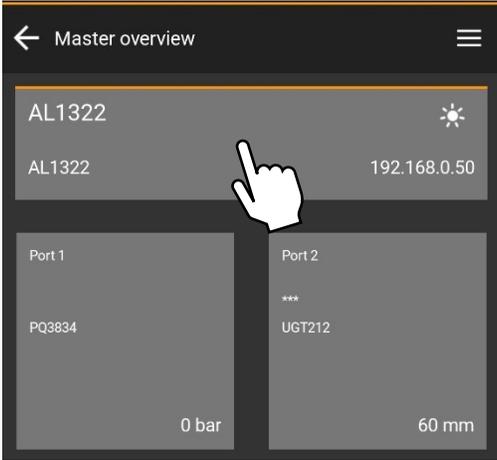The IO-Link master is now connected. The adapter's LED turns blue.

ⓘ **Note:** *The Bluetooth adapter can only connect to one external device at a time.*

The IO-Link master's overview page is displayed. Note the IP address, which is the IP address for the IoT port, not the Industrial Ethernet ports.
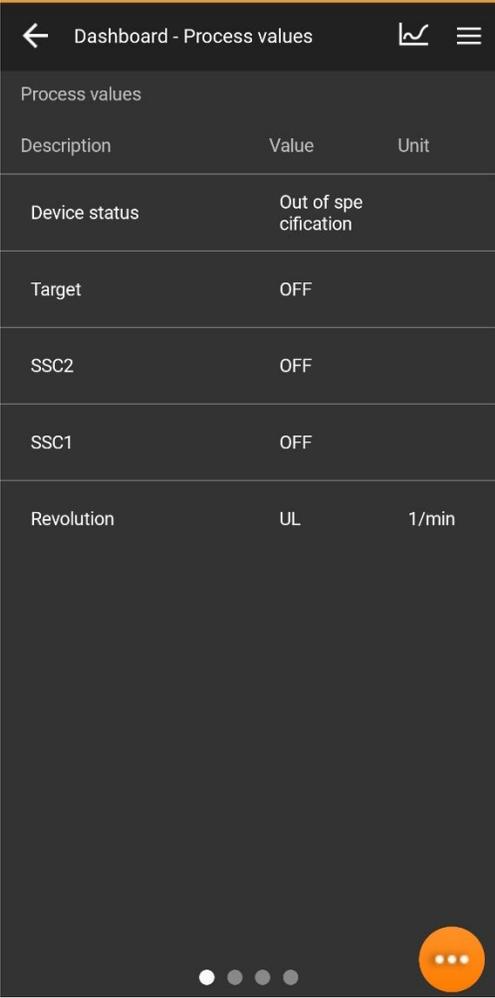

6. Select the IO-Link master.

7. The Master Config screen is displayed. Here, you can adjust the master's configuration settings much like in LR Device and save any changes by tapping the write to device button ( ). Tap the back arrow button to return to the Master overview screen.
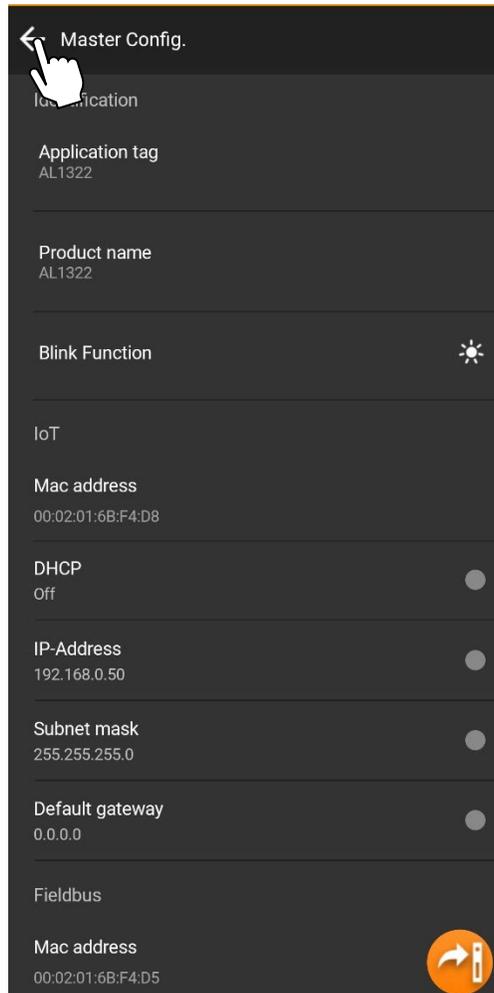
8. Select the speed monitor (DI5027).

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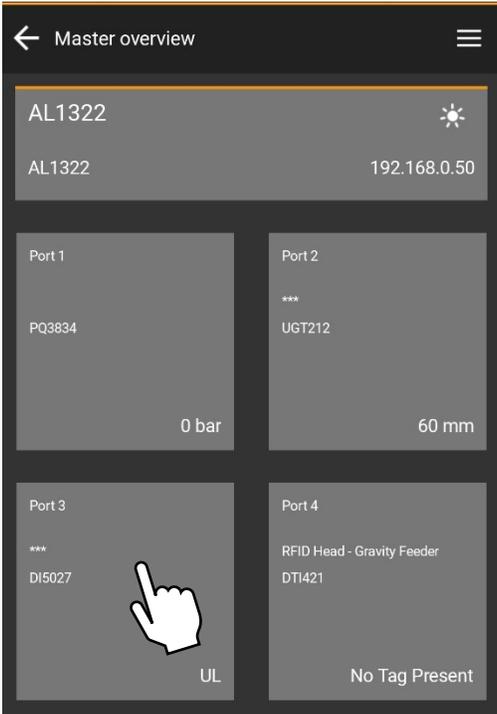
The app reads the parameters from the device and displays them on the device's Dashboard screen.

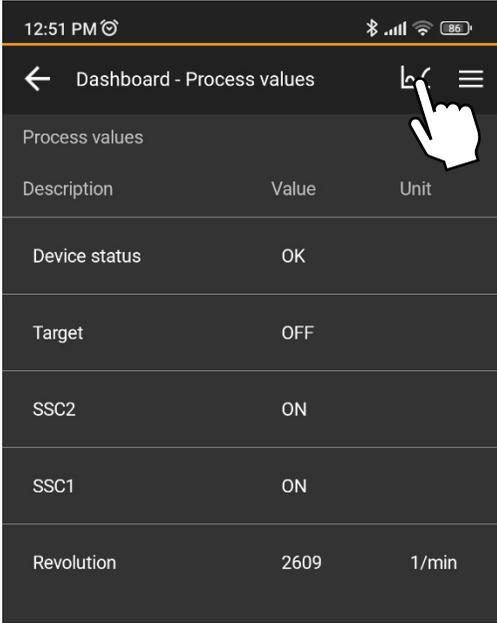**Robotics, Integration, and Automation│Remote Monitoring & Bluetooth**

9. Using the programming pendant, turn on the robot's **OUT#0003** bit to power on the conveyor. Use the conveyor speed dial to increase and decrease the speed. Note the changes in the sensor values.
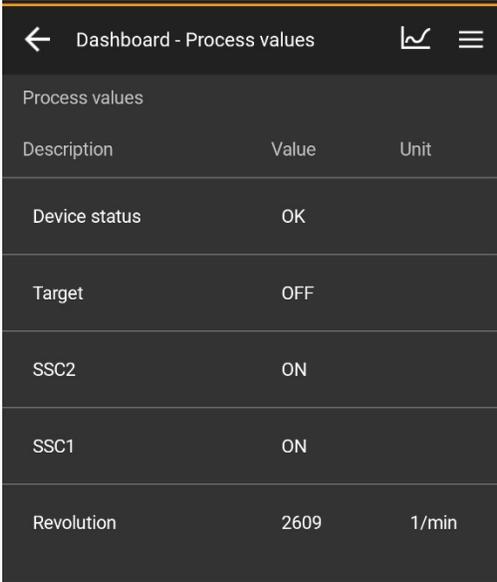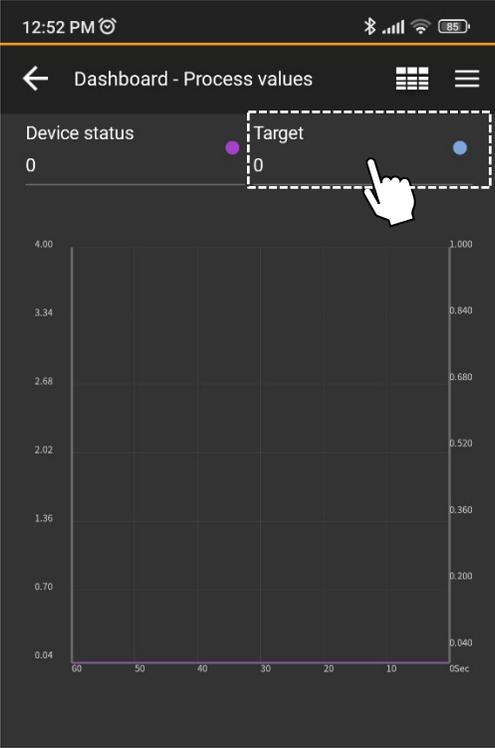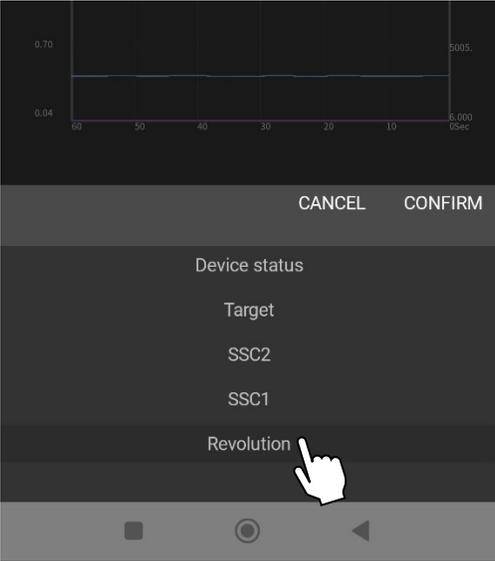

10. Tap the trace button.

11. The sensor's Process values page is displayed. The graph has room for two process variables: one is represented by a purple trace and one by a blue trace. Both shown in the image are 0. Click the process variable on the right (blue trace)
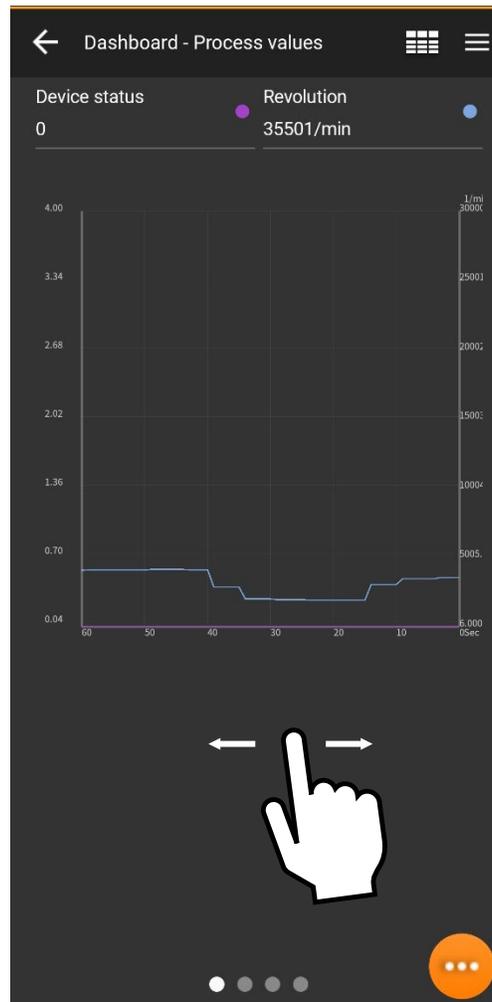

12. A menu is displayed at the bottom of the screen. Select **Revolution**.

13. The revolution speed value is displayed at the top and is traced in the graph. Adjust the conveyor speed and watch how the trace rises and falls.

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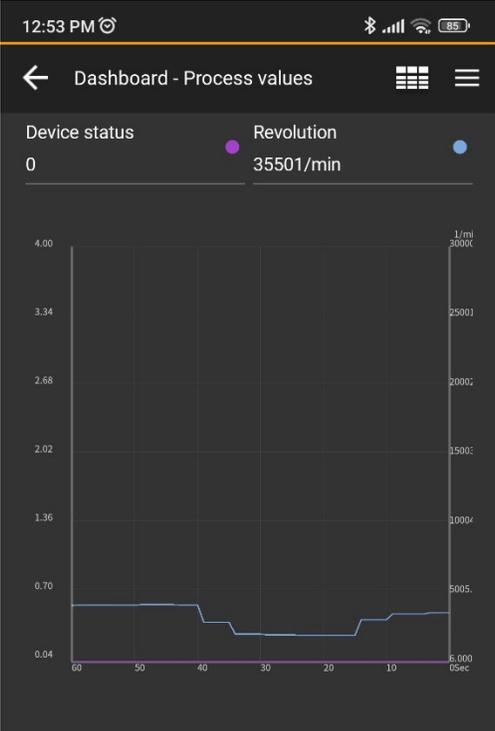
14. Swipe left and right to review the other features in the device's dashboard.
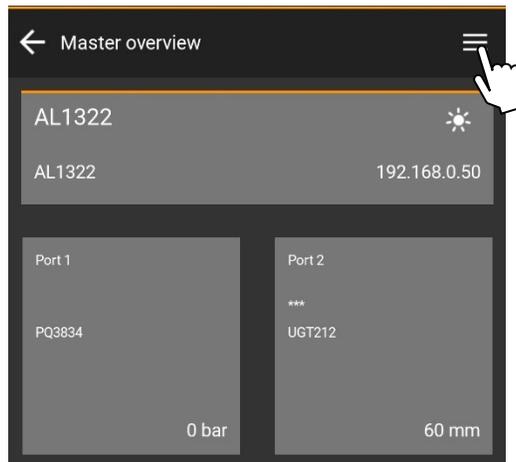

15. Using the programming pendant, turn off the conveyor.
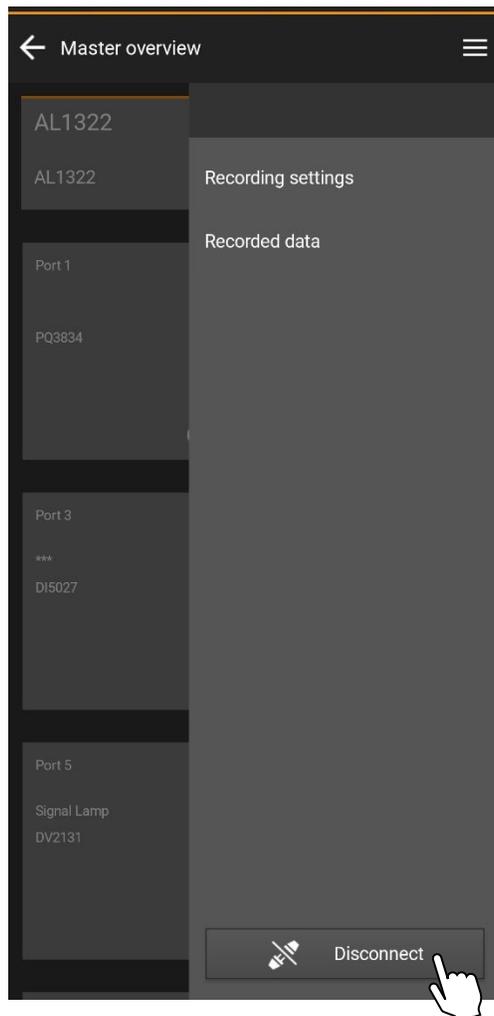
16. Tap the back arrow to return to the Master overview page.

17. Select some of the other devices and observe their sensor values.

18. Tap the three-line button at the top-right corner.

19. A side menu is displayed. Tap **Disconnect**.

20. Exit Moneo Blue.

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8. Authentic Skill Assessment

Have your instructor verify that your work meets the requirements in the performance objectives and sign below. Keep this lab activity sheet for future reference.

Instructor Signature	Date

9. Reset Steps

If someone else is going to be performing this lab activity after you, perform the reset procedures below. Consult with your instructor before performing these procedures.

- Using the Ethernet Device Configuration tool, return the IP address of the 8-port IO-Link master's IoT port to **0.0.0.0**.

- If you are sharing a Moneo account with someone else, delete all nodes in the navigator and disconnect from the IO-Link master.

10.   Shutdown

Unless instructed otherwise by your instructor, review and complete each of the items on the checklist below.

- ☐   Ensure the pendant mode key is in Teach mode.

- ☐   Return the pendant to its storage hook on the side of the SmartCart.

- ☐   Power down the robot.

- ☐   Turn off the air compressor.

- ☐   Power down the I/O box.