IO-Link Labs

LAB ACTIVITY M3: CALCULATED VALUES

Name	Class/Period	Date

1. Overview

In this lab activity, you will create a calculated value and add the info point of the calculated value to your dashboard for monitoring.

2. Performance Objectives

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

- Physically connect an IO-Link master to a computer using a connecting wire (M12-Ethernet).
- Enable communication between the computer and IO-Link master.
- Write information to the IO-Link master.

3. Background

3.1. Calculated Values

Calculated values are manipulations of device data that can be added as nodes to the navigator and monitored on a dashboard as info points. They also allow you to implement logic -such as AND, OR, and NOR operators into your monitoring scheme in order to obtain the data insights that you need.

4. Required Materials

You need these materials to complete the lab activity:

- IO-Link laboratory package level 1 and level 2 materials
- Computer
- Small wrench

5. Required Software

The following software is required for this lab activity. See the Resource List document for links to the software.

- LR Device software
- Ethernet Configuration Tool (Hilscher)
- Moneo monitoring software

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6. 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.
- ☐ All required software is installed in your computer.

7. Lab Activity

7.1. Hardware Setup

In this task, you will physically connect the IO-Link master to a power supply and to your PC. You will also connect slave devices to the master.

Perform these steps:

1. Connect the M12 end of the M12-Ethernet cable to the **IoT port** of the master. Connect the Ethernet end of the cable to your computer or Ethernet switch.
2. Using the power cable, connect the master's **Power IN** port to your power supply (a wall socket, for example).
3. Connect the following slave devices to ports 1 to 4 of the master.
   - Inductive sensor (Port 1)
   - Ultrasonic sensor (Port 2)
   - Photelectric sensor (Port 3)
   - Stack light (Port 4)

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7.2. Initial Setup

Previously, you configured the IO-Link master and its connected slave devices for communication with the Moneo software. You also generated a navigator with nodes and sensor info points, as well as a dashboard to monitor this info points.

If you were required to delete the navigator and dashboard, recreate these items now. Refer to the previous lab activity for detailed instruction.

If your navigator and dashboard are still intact, continue to the next task.

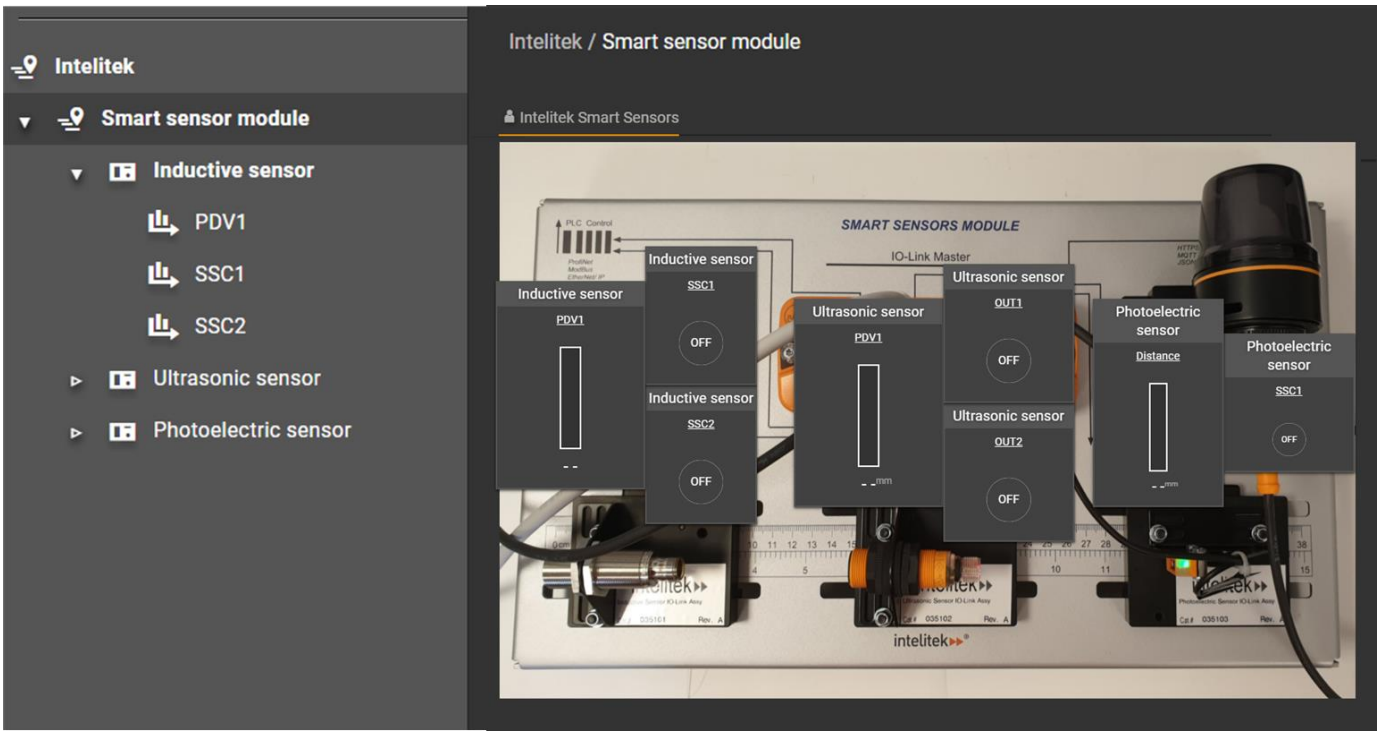


Figure 1. Navigator and Dashboard from Lab Activity M1.

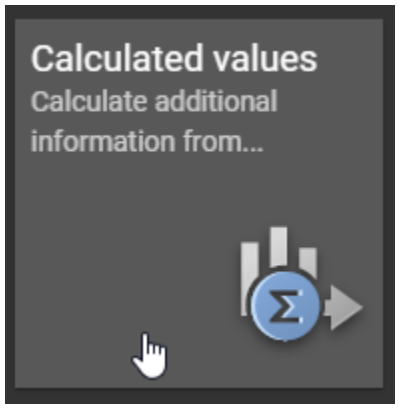
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7.3. Creating Calculated Values

In this task, you will create a calculated value that allows you to monitor the accumulated time that both the ultrasonic and photoelectric sensors detect an object in their range.

Perform these steps:

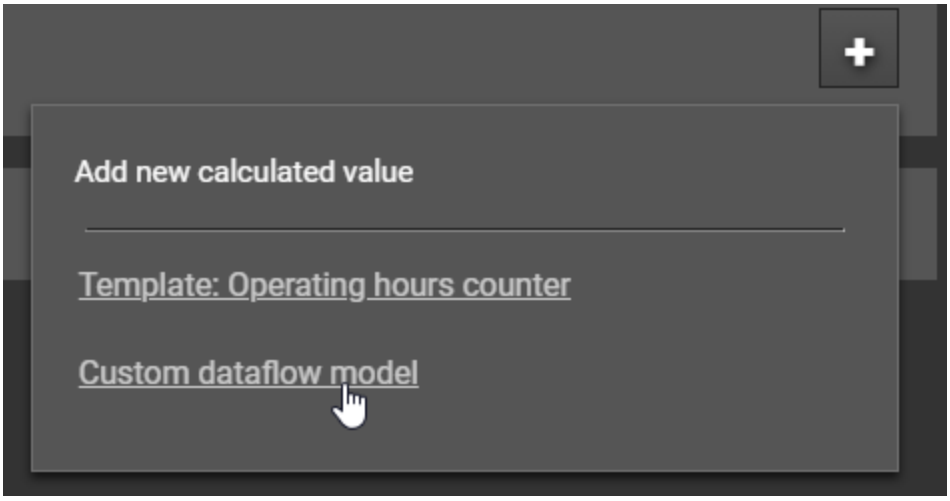
1. From the home page, click calculated values.



2. In the top-right corner of the screen, click the **+** button.

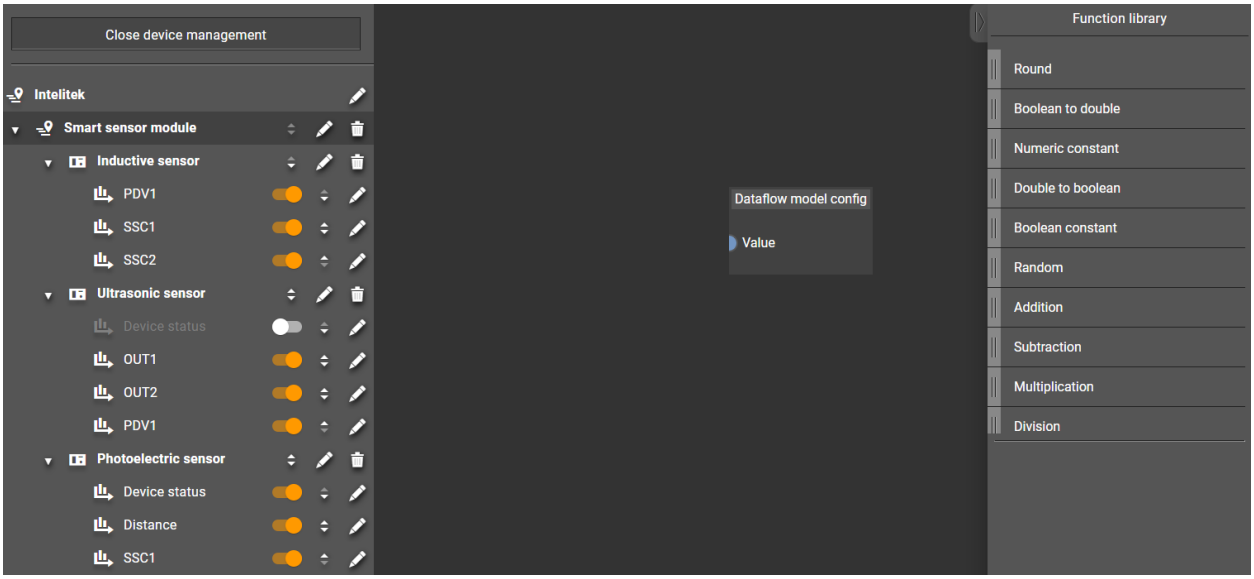


3. In the popup window, select **Custom dataflow model**.

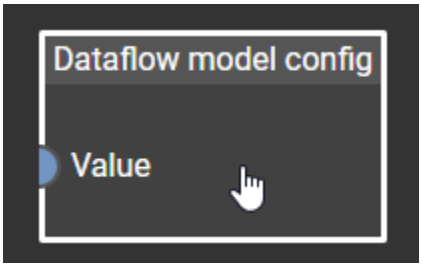


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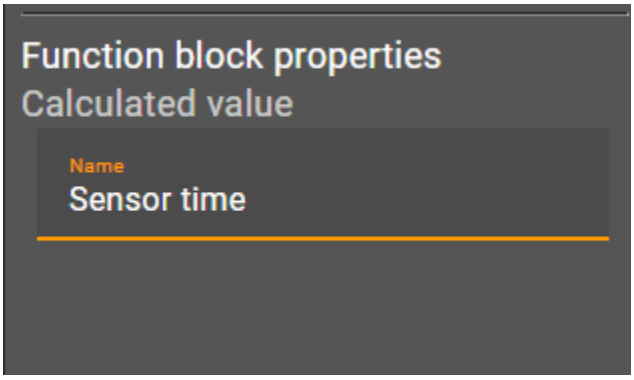
The Custom dataflow model area has a workspace in the middle that allows you to build your calculated value. Info points can be dragged from the navigator and added to the workspace. On the right side of the screen, the Function library contains function blocks that can be dragged into the workspace. These functions allow you to manipulate the data that is output from the info points.



4. The function block that is currently in the middle of the workspace will ultimately become the calculated value that will go into your navigator and dashboard. Click this block to highlight it.

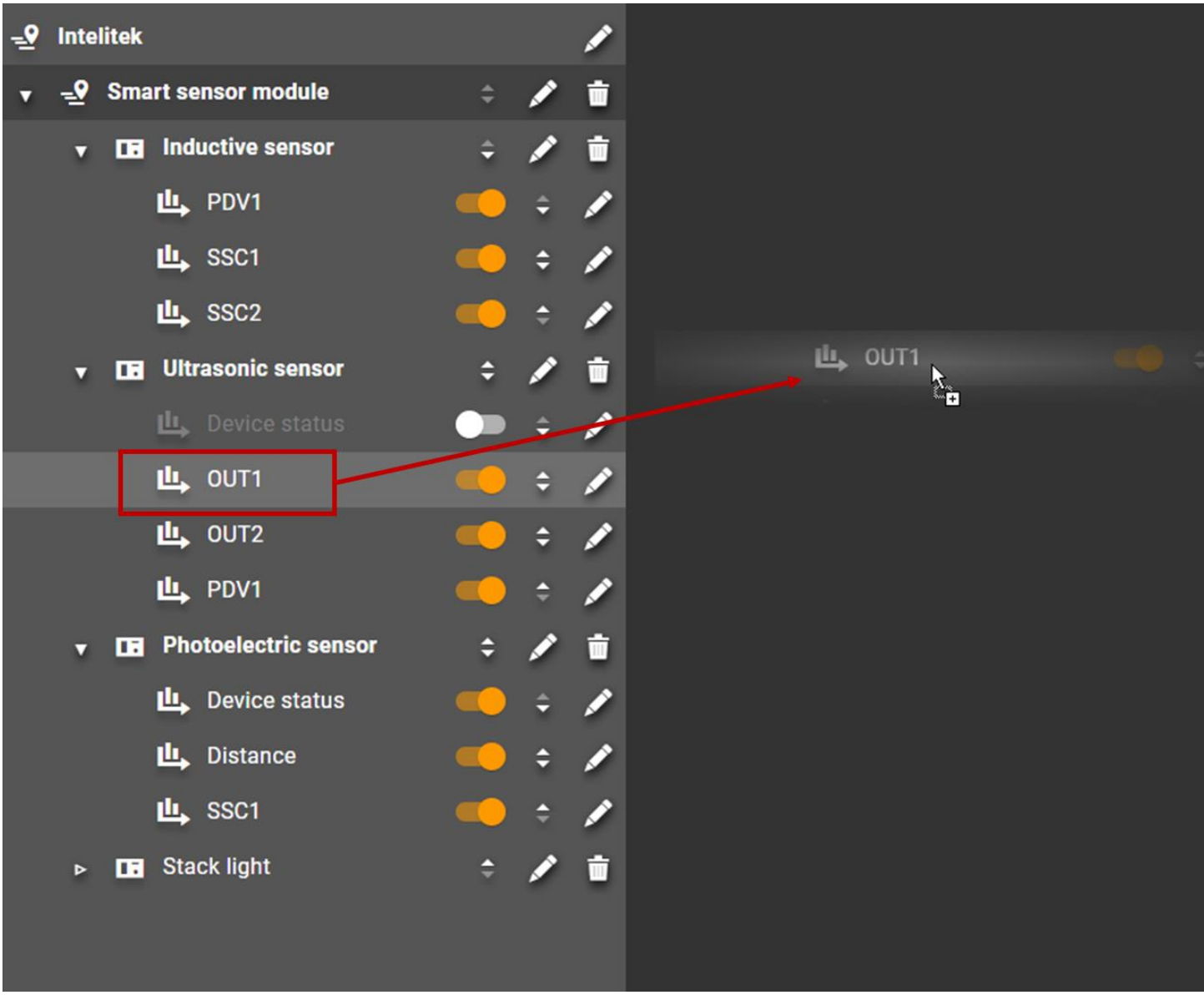


5. In the bottom of the Function library, in the Name field, enter **Sensor time**. This changes the name of the function block.

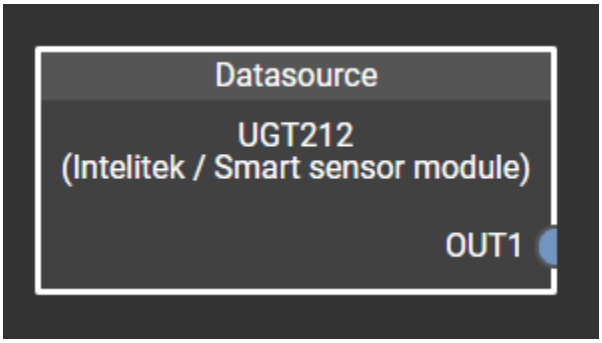


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6. Drag the Ultrasonic sensor's **OUT1** info point from the navigator to the workspace.



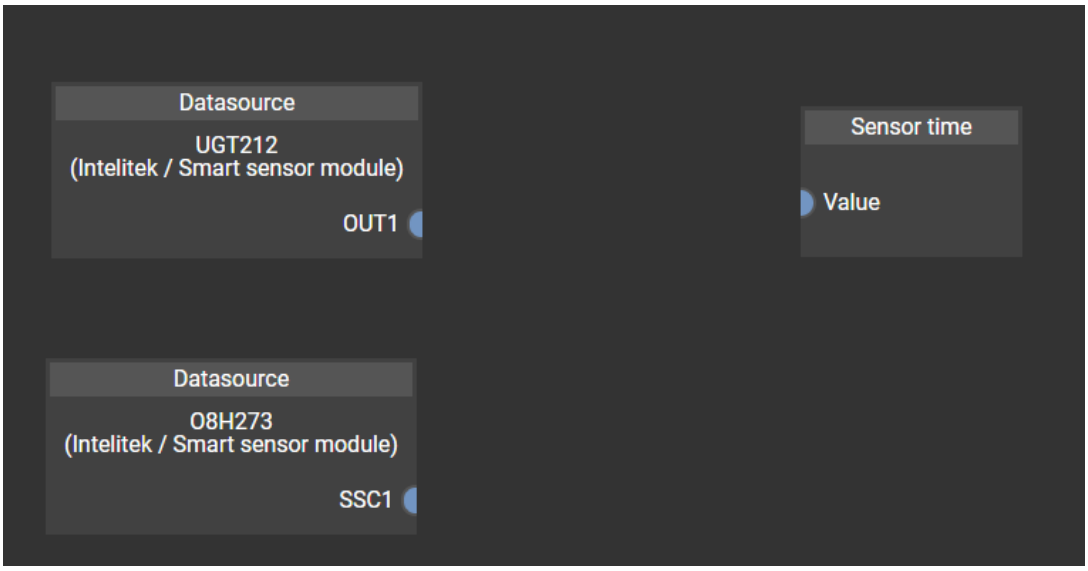
The info point turns into a draggable block.



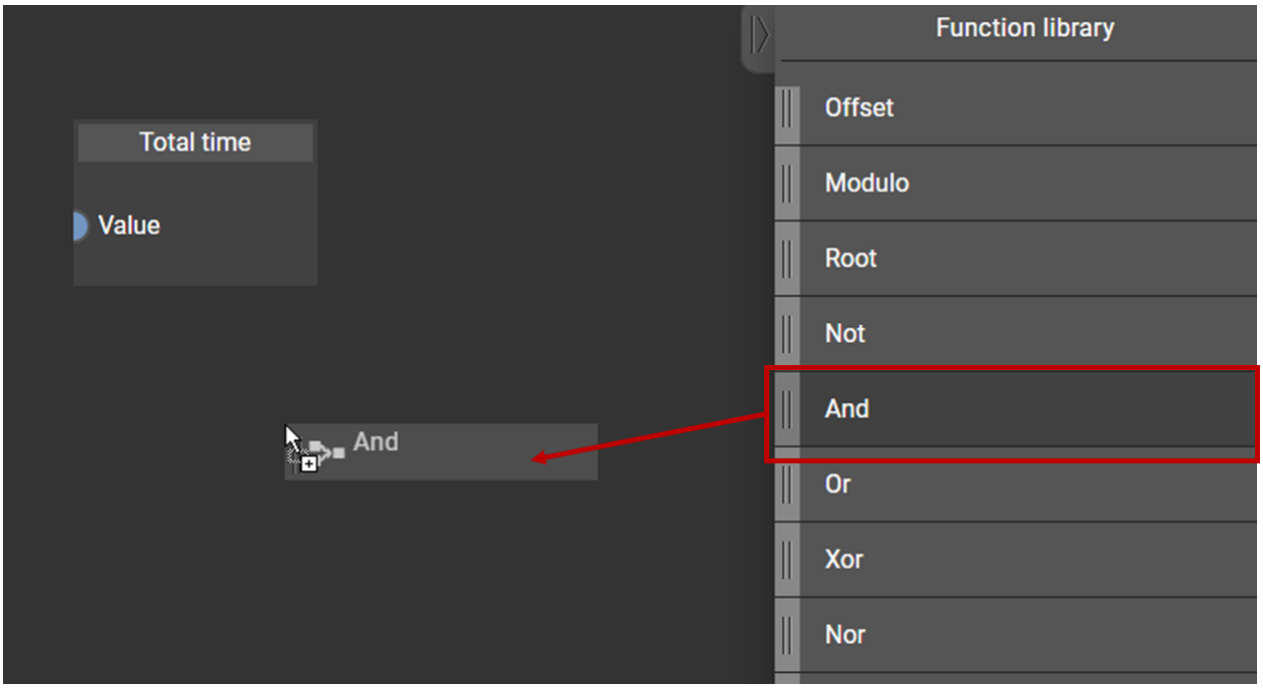
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ⓘ ***Note:*** *All blocks can be renamed by performing the procedure in steps 4 and 5. Blocks (and connecting elements) can be deleted by selecting them and then pressing the* ***Delete*** *key on your keyboard.*

7. Drag the Photoelectric sensor's SSC1 info point onto the workspace.



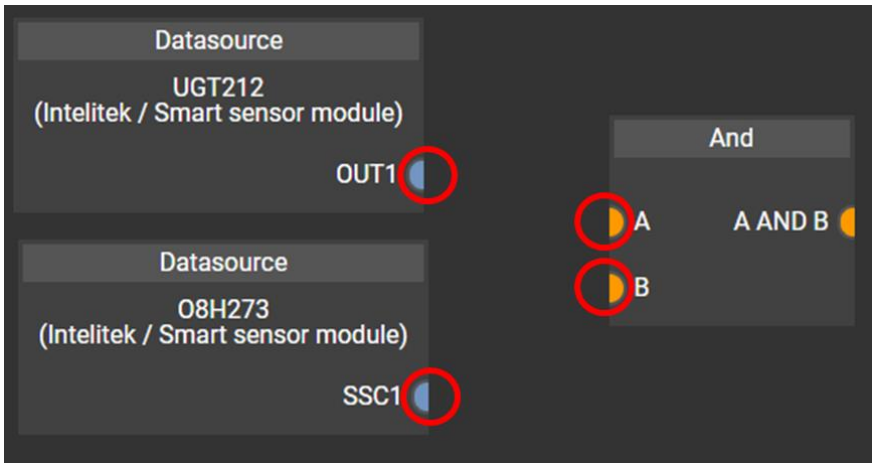
8. Scroll down the Function library and drag the **And** function block into the workplace.



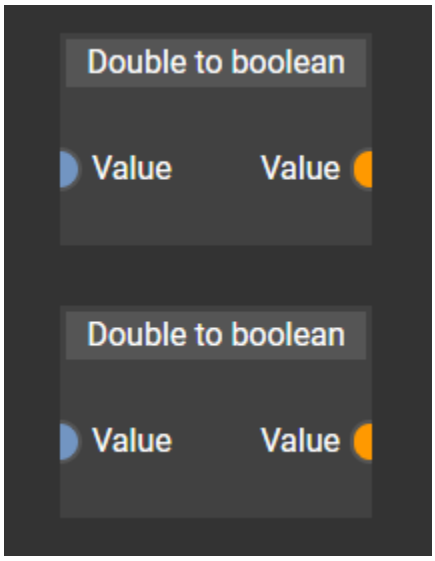
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Each function block has blue or orange connection nodes. The connection node color of the **Datasource block** is different from connection nodes of the **And block**. Each color represents a different type of data with blue being *double type* and orange representing *Boolean* data. Orange and blue connection nodes cannot connect with each other.

Data conversion function blocks allow you to overcome this issue.

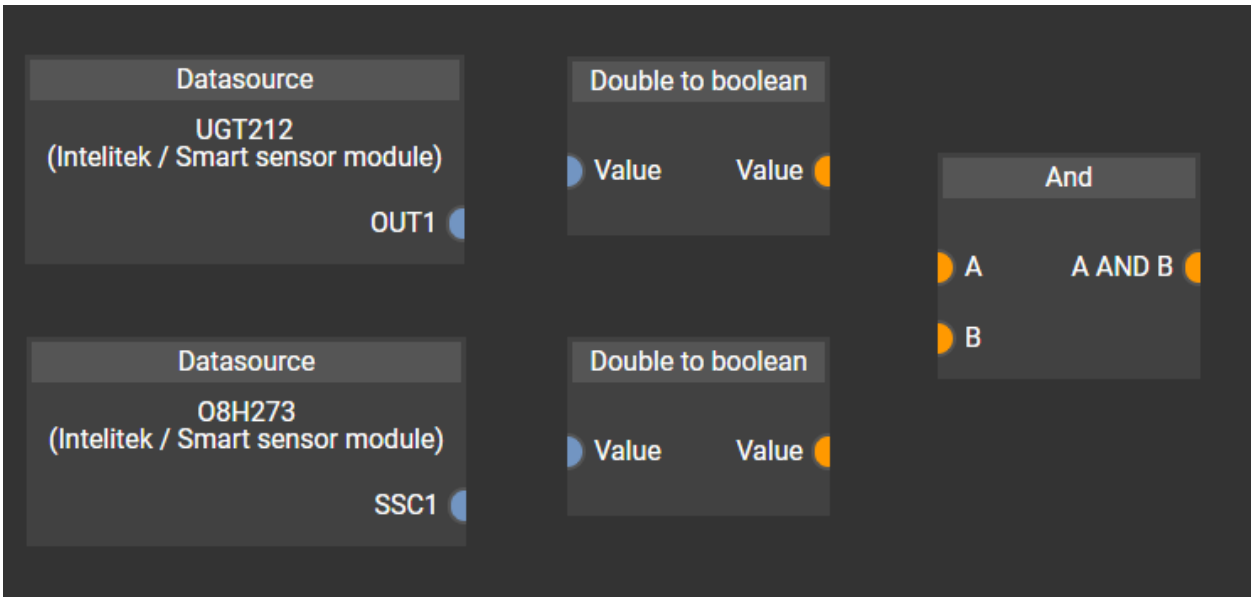


9. From the Function library, drag two **Double to Boolean** function blocks into the workspace. Note that these blocks have both types of connection nodes.

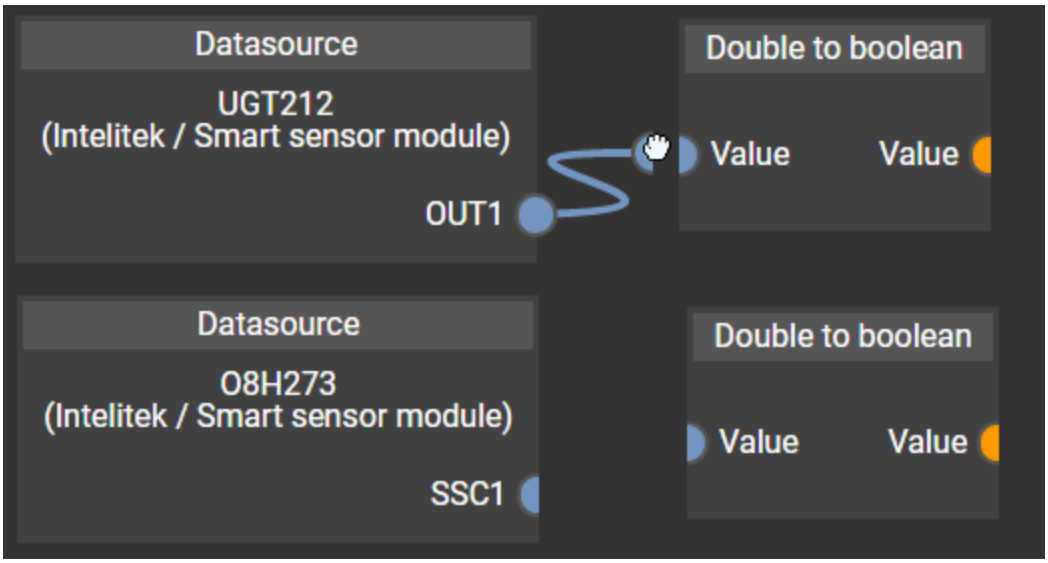


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10. **Arrange** the blocks as shown.

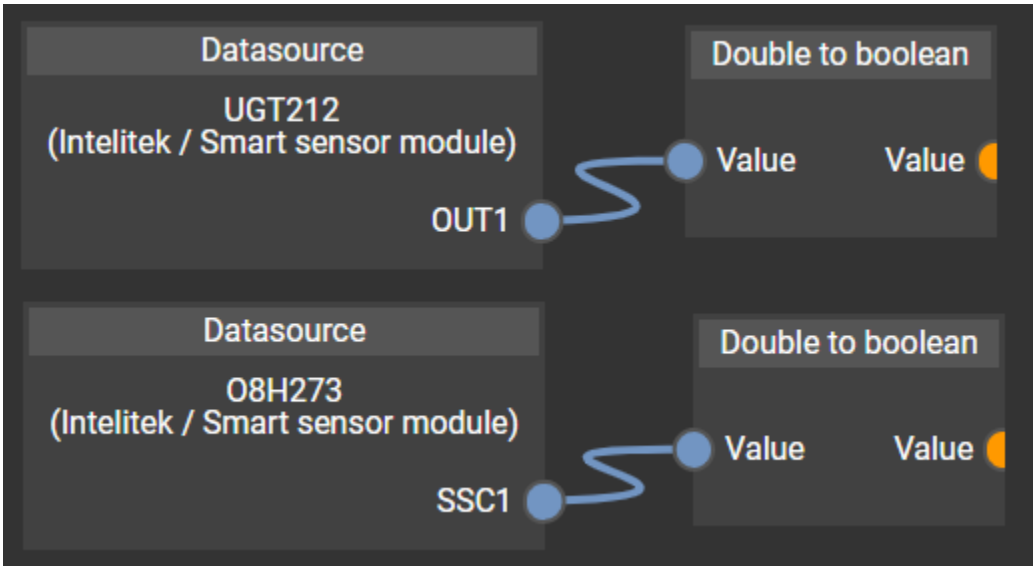


11. Connect the blocks by clicking the **OUT 1 Datasource** block's and dragging the connector to the Value port of the **Double to Boolean** block.

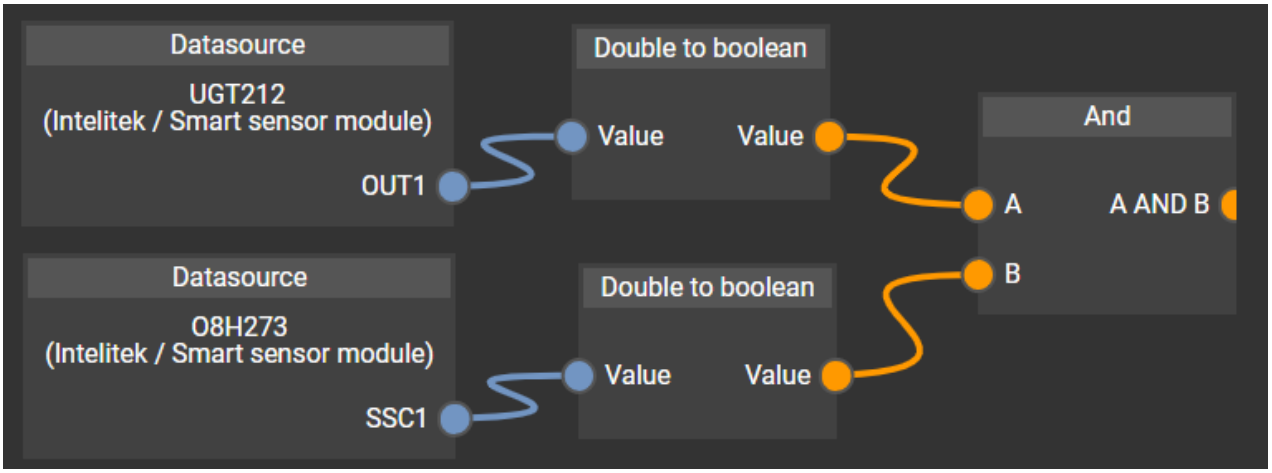


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12. Do the same for the **SSC1 Datasource** block as shown.



13. Connect the **Double to Boolean** block's orange **Value** connection nodes from the **Double to boolean** blocks to the **And** block's **A** and **B** connection nodes as shown.

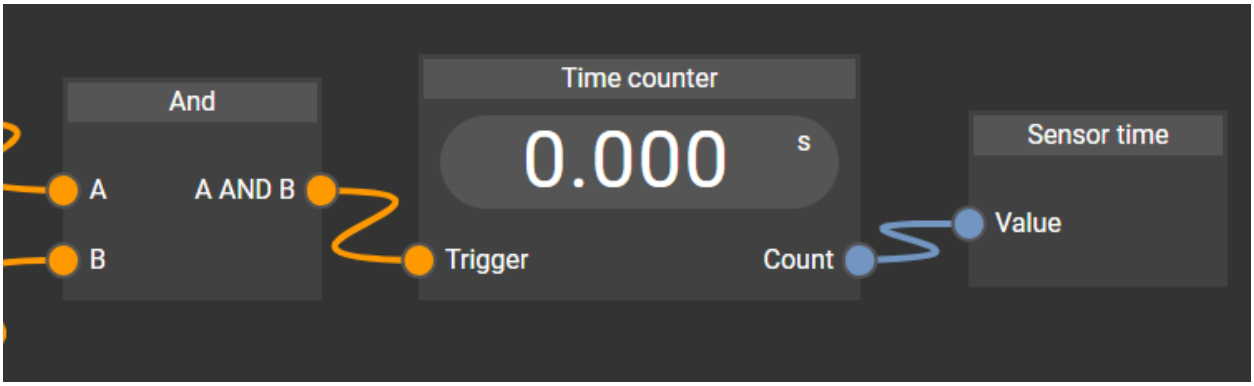


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14. Add the **Time counter** function block to the workspace and place it between the And block and Sensor time block as shown.

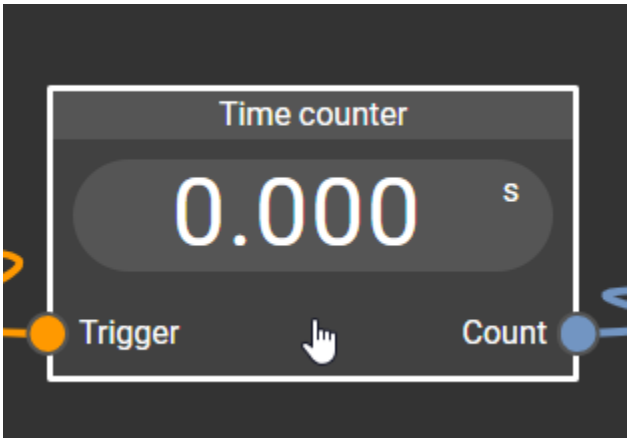


15. Connect the **And** block's A AND B connection node to the **Time counter** block's Trigger connection node. Connect the **Count** connection node to the **Sensor time** block's **Value** connection node.

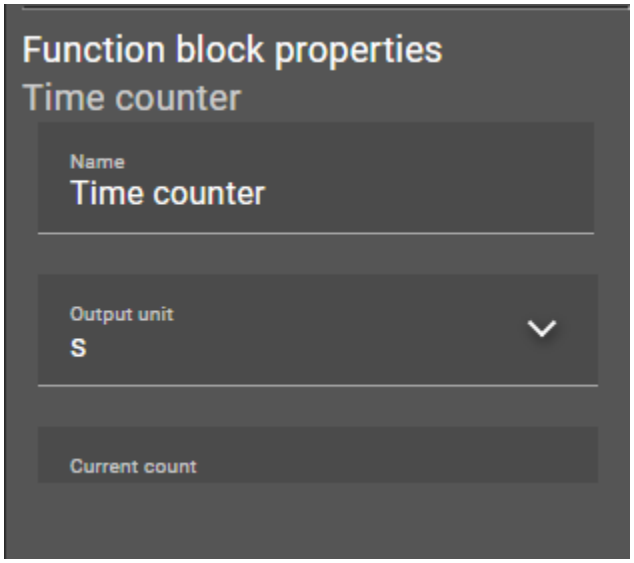


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16. Click the Time counter to highlight it.



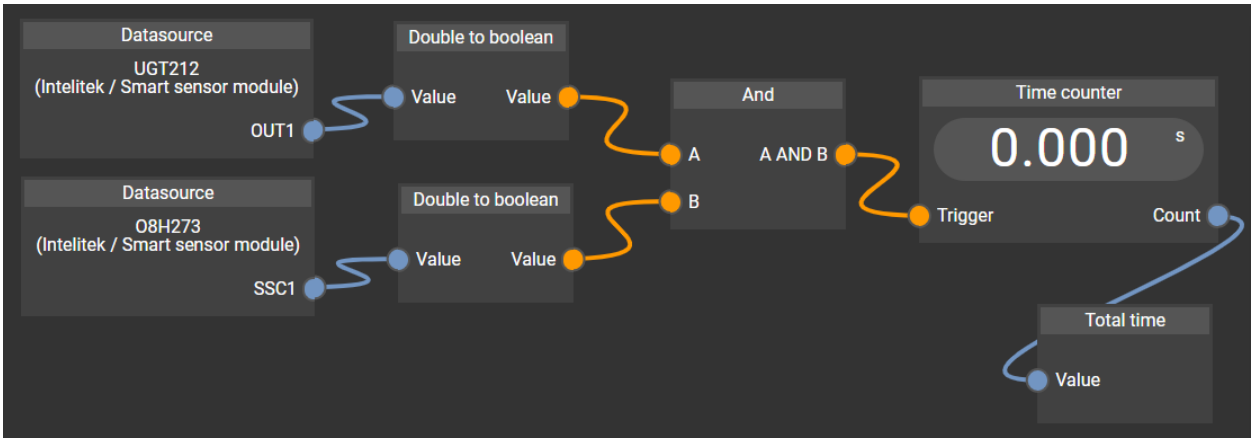
17. At the bottom of the Function Library, change the Time counter block's **Output unit** to S (seconds). To do so, click the Output unit field and select **S** from the dropdown menu.



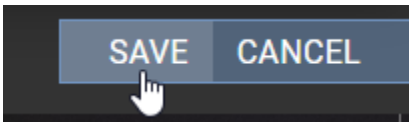
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ⓘ ***Note:*** *The Time counter block also has the option of setting the starting count value (Current count). You can also set the block to count backwards.*

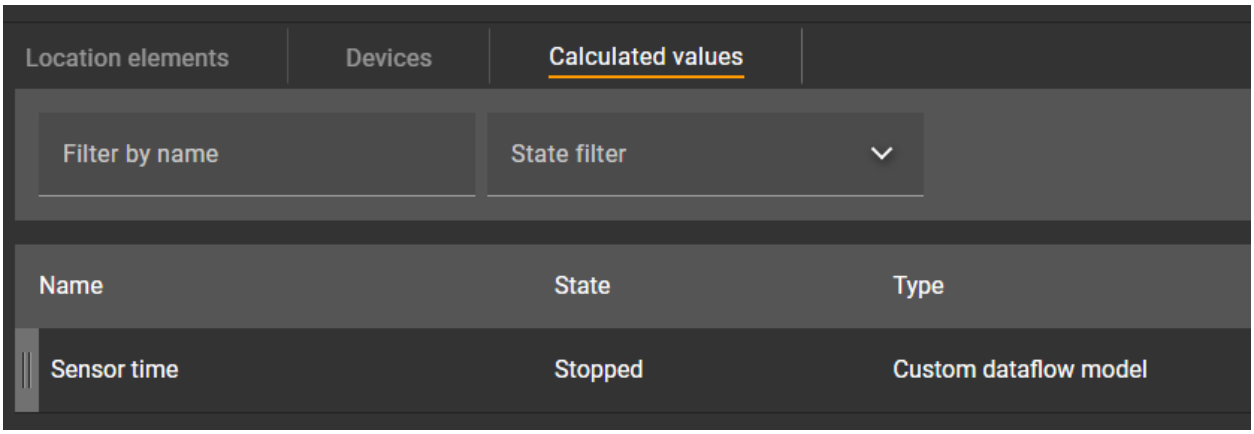
Your calculated value is now complete and should look similar to this image.



18. Click **SAVE**.



The calculated value is created and is displayed in the Calculated values tab.



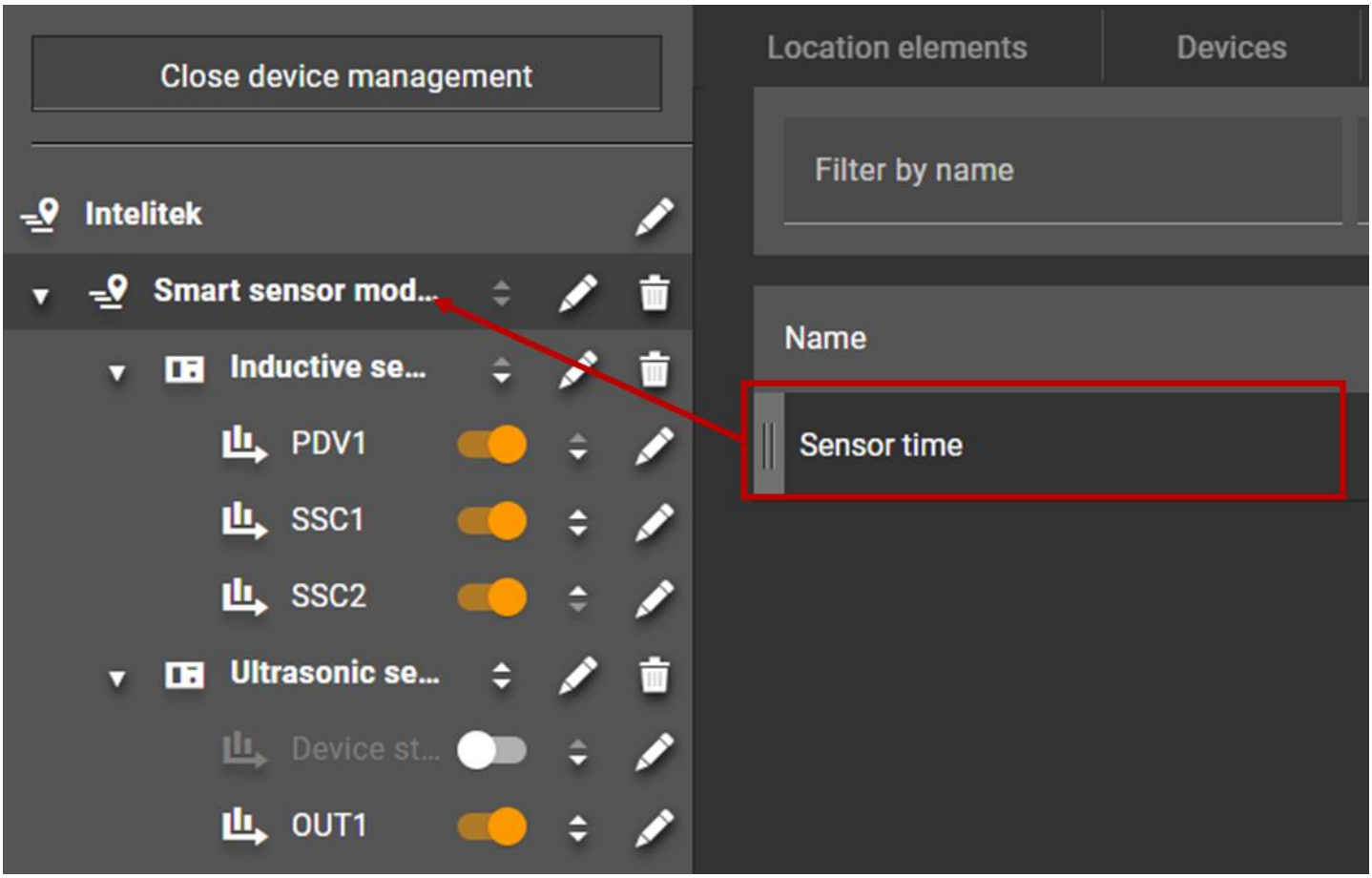
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7.4. Adding the Calculated Value to the Dashboard

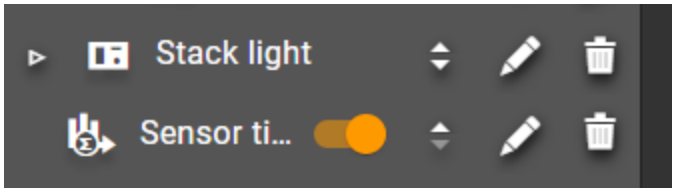
In this task, you will add the calculated value that you created to your dashboard.

Perform these steps:

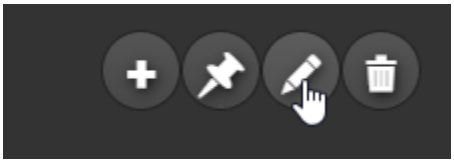
1. Drag the calculated value into the navigator. Drag it directly to the second level node.



The calculated value is added to the navigator. Its info point is turned on by default.

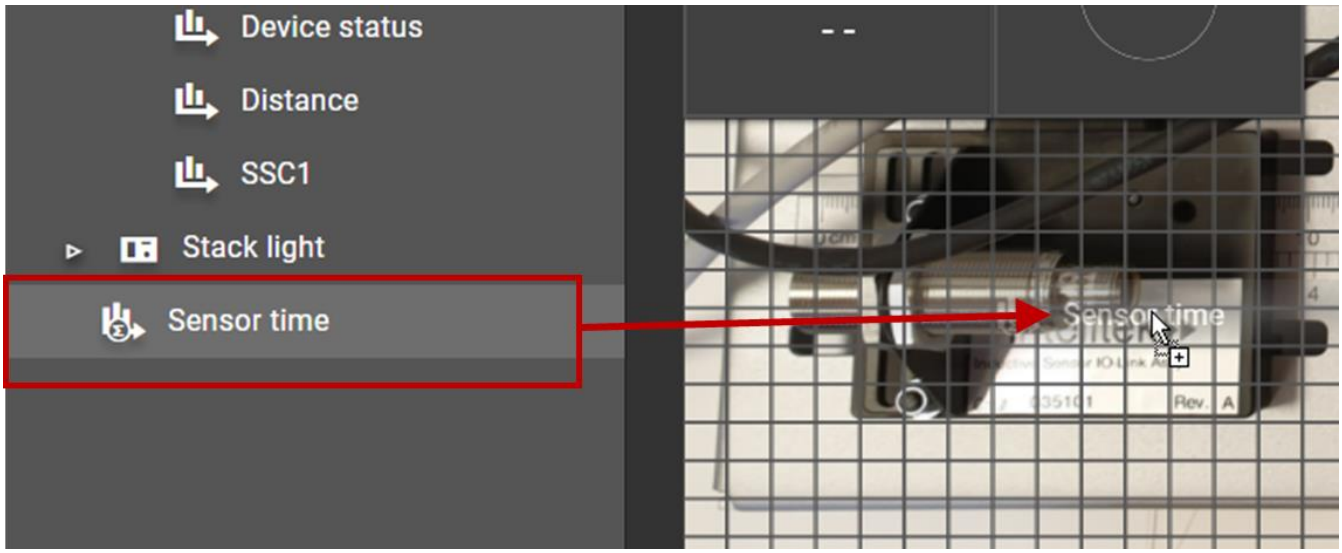


2. Return to the dashboard.
3. Click the edit button.

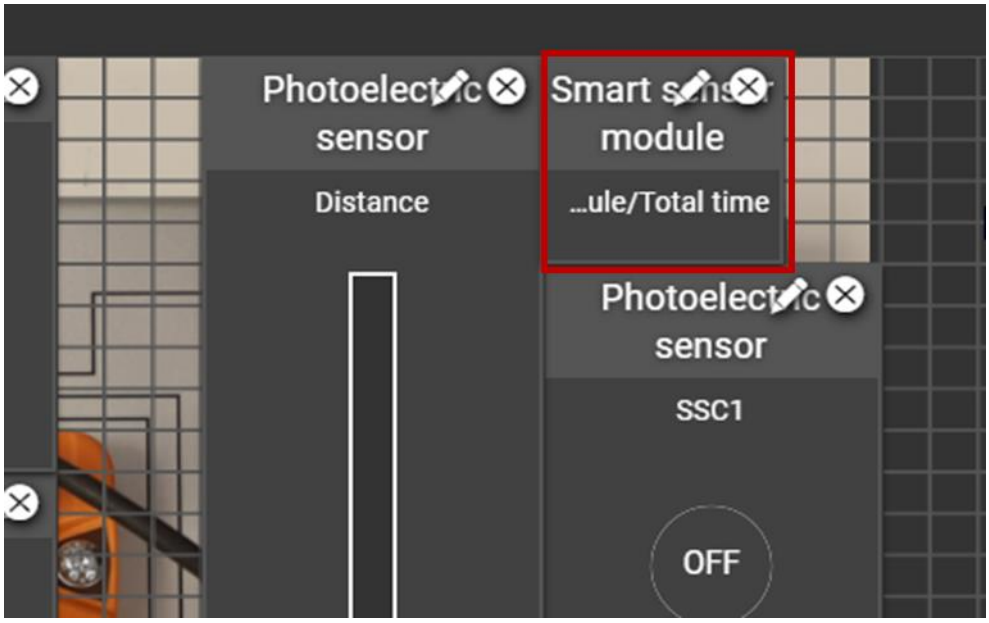


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4. Drag the calculated value into the grid.

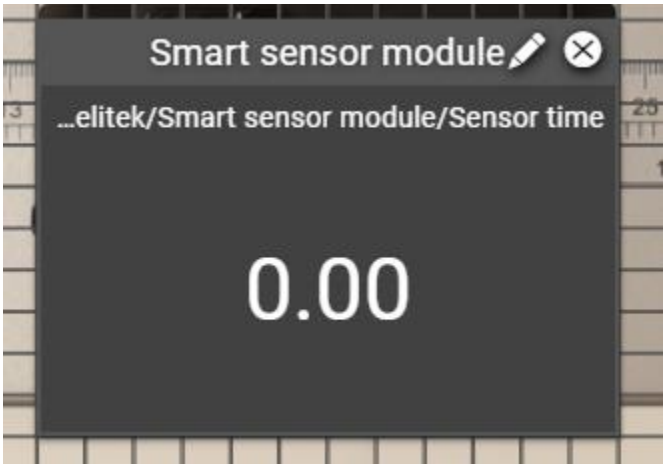


A new widget for the calculated value appears in the top-right corner of the grid.

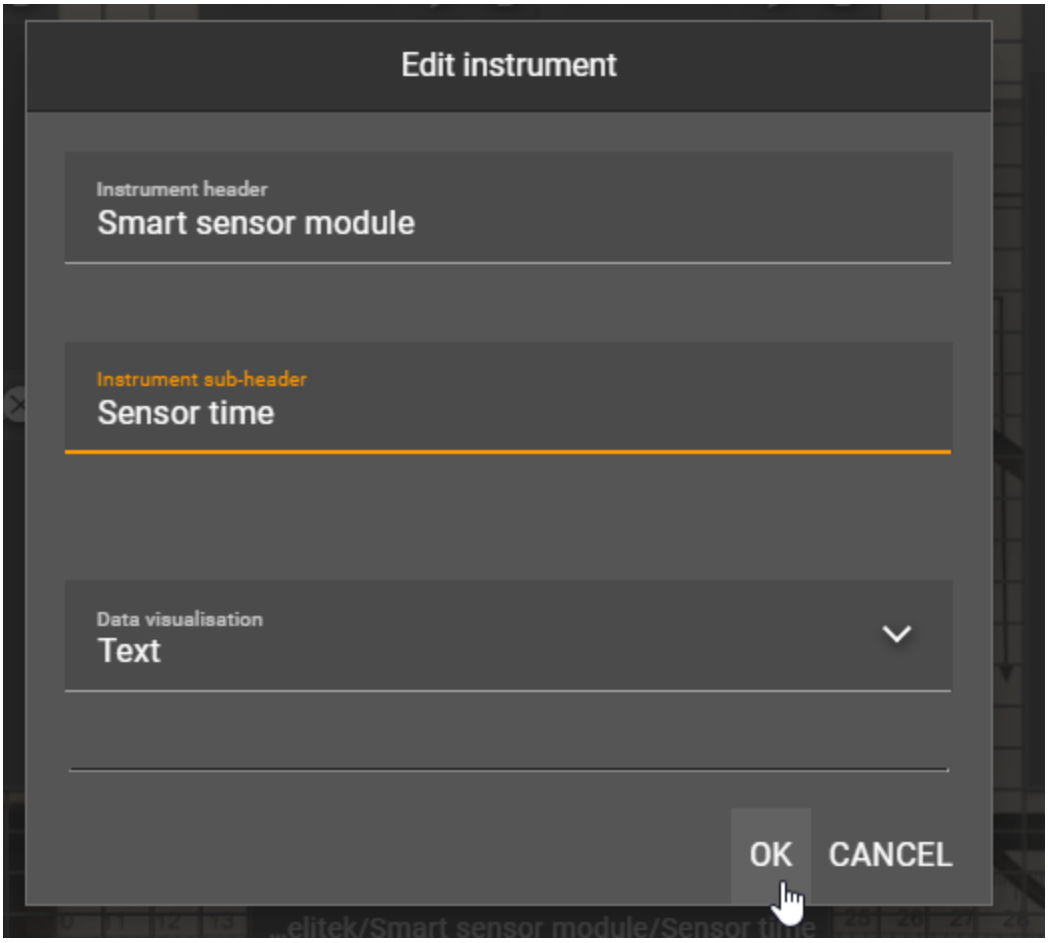


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5. Drag the widget into an open area of the grid and expand it.

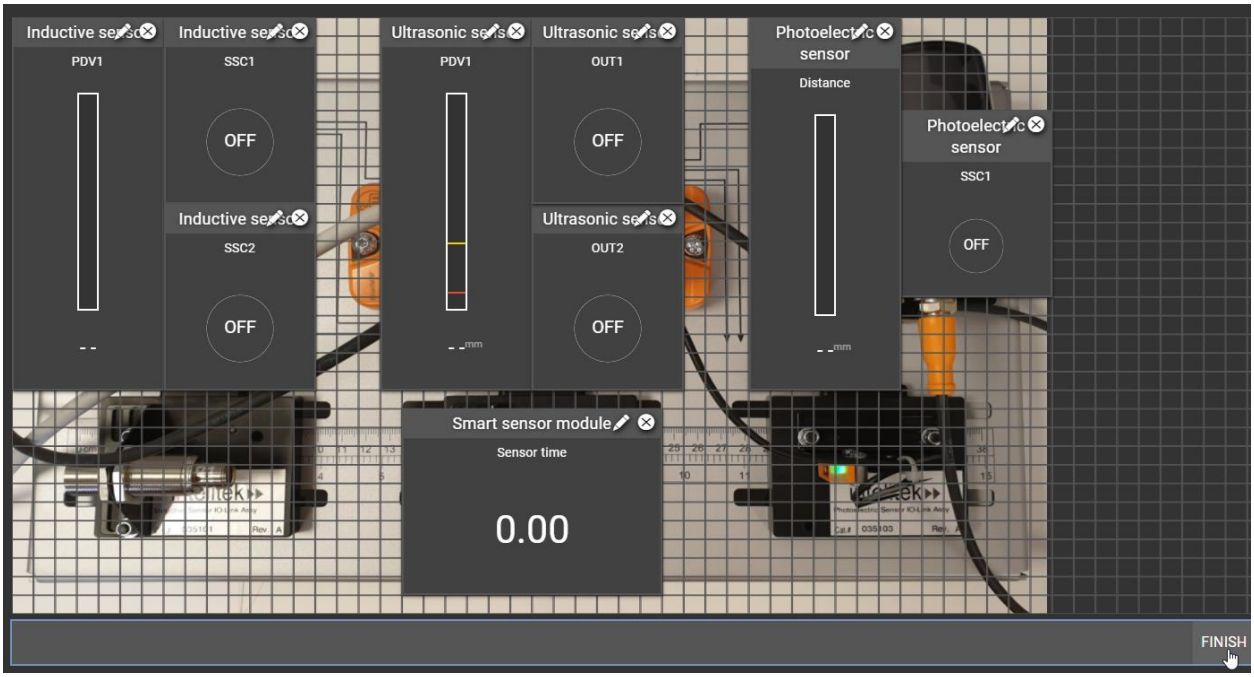


6. Click the widget's pencil icon to open the editing menu. Modify the **Instrument sub-header** to **Sensor time** and then click OK.



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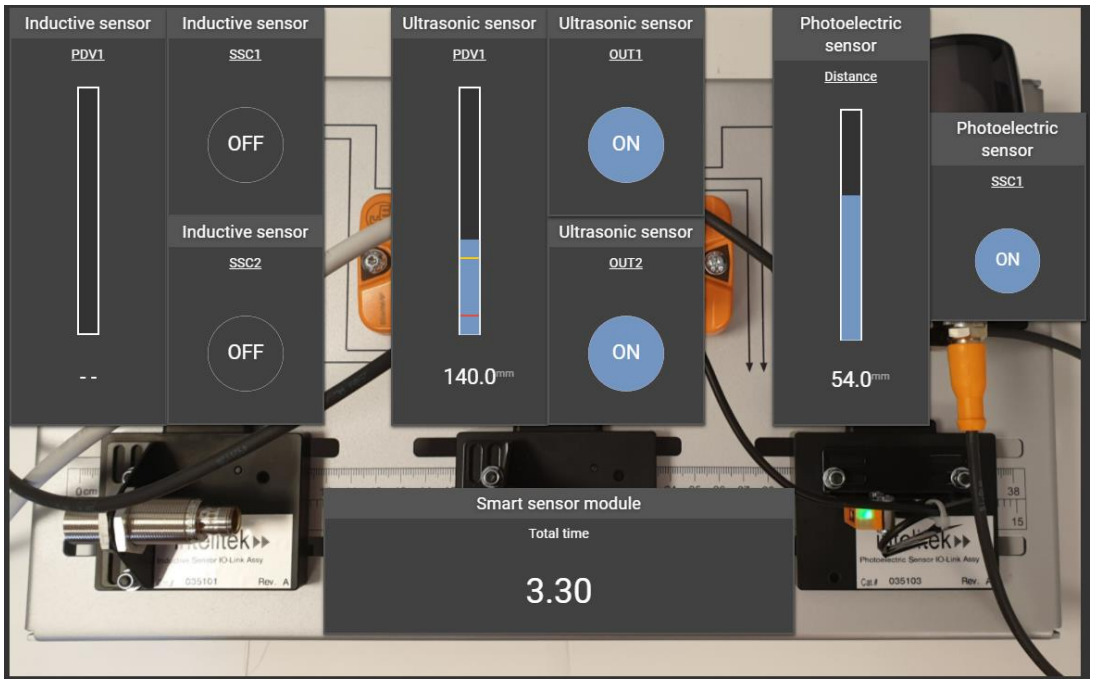
7. Click **Finish**.



8. Move objects into range of the sensors and monitor the dashboard while doing so. Try the following combinations:

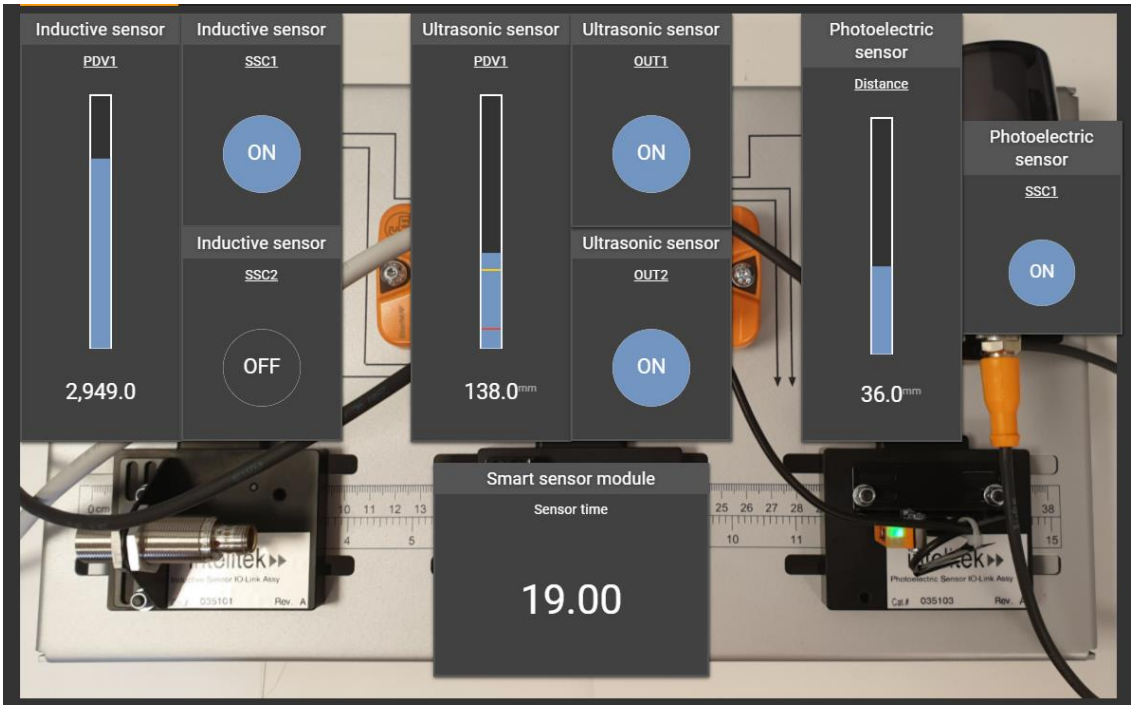
   - Place an object in range of the ultrasonic sensor only.
   - Place an object in range of the photelectric sensor only.
   - Place an object in range of both sensors.

   The timer only adds time when both sensors detect an object.



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9. Adjust the calculated value to include the inductive sensor as well. The timer should only increase when all three sensors detect an object. Note that the calculated value's info point needs to be turned off before the calculated value can be edited and must be turned back on to monitor its output in the dashboard.



10. Show the results of the new dashboard to your instructor.

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. Shutdown

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

- ☐ If other users will be performing this lab activity after you, **delete the navigator and all device information**.
- ☐ The IO-link master is disconnected and stowed away.
- ☐ The connecting cables are stowed away. A small wrench may be required to disconnect the cables from the master.

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