Smart Devices for Industry 4.0

WORKING WITH THE SIGNAL LAMP

Name	Class/Period	Date

1. Overview

In this lab activity, you will physically connect a smart signal lamp to the IO-Link master and explore its capabilities.

2. Performance Objectives

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

- Physically connect a signal lamp to the IO-Link master using the M12-to-M12 IO-Link connection cable.
- Enable communication between the computer, the IO-Link master, and the signal lamp.
- Generate different signal lamp output signals.

3. Background

3.1. Signal Lamp

What is a Signal Lamp?

Unlike the devices you learned about in the previous three lab activities, the signal lamp is not a sensor. Rather, it is an *output device* (and a smart one, at that), referred to in the language of Moneo Configure as an **actuator**. Also known as stack lights, signal towers, or warning lights, signal lamps are used in various industries and processes to indicate the status of a particular machine or station on a production or process line. These devices usually have several different colors of lamps and often include a sound module (buzzer or siren).

For example, if a part arrives at a QC station and is deemed to be defective, a signal lamp may sound its buzzer or flash a red lamp (or both simultaneously) to let a human worker know that the part must be removed from production.

Characteristics of your signal lamp

The following are characteristics of your IO-Link signal lamp:

- The signal lamp connects to the IO-Link master via an M12-to-M12 IO-Link connection cable, just like the IO-Link sensors.
- The Moneo Configure software enables control of the signal lamp's output signals. Some output signals can be controlled even when the system is operating ("online"). The settings for these particular output signals are modified in the **Dashboard**.
- The device has one LED segment and a buzzer.

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- The LED segment can be set with the following properties: color, frequency, and brightness. This is explained in detail in the next section.
- The buzzer has several types of alerts (known as “Buzzer Styles”) which can be set to varying intensities. This is explained in detail below.

The RGB Operating Mode

In this mode, LED and buzzer settings can be modified while the unit is operating. The options include:

- LED: Appearance and color (includes off)
- Buzzer: On/off & style (includes silent [“No sound”])

The OnOff Operating Mode

In this mode, buzzer settings can be changed while the unit is operating. There are 3 LED “buttons” whose settings on the setting screen and can only be turned on or off; the buzzer style can also be set.

Dashboard Status

The Dashboard screen shows various statuses. Some are not relevant for this activity. Others may not be relevant for your signal lamp. For example, only signal lamps with a feedback button can have an ON status in the Feedback Button status area.

4. Required Materials

You need these materials to complete the lab activity:

- IO-Link master (“the master”)
- Computer connected to the Internet.
- Ethernet switch (optional)
- IO-Link signal lamp
- IO-Link master power cable
- IO-Link master Ethernet cable
- M12-to-M12 IO-Link connection cable

5. Required Software

The following software is required for this lab activity:

- Moneo Configure software
- Ethernet Configuration Tool (Hilscher)

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.

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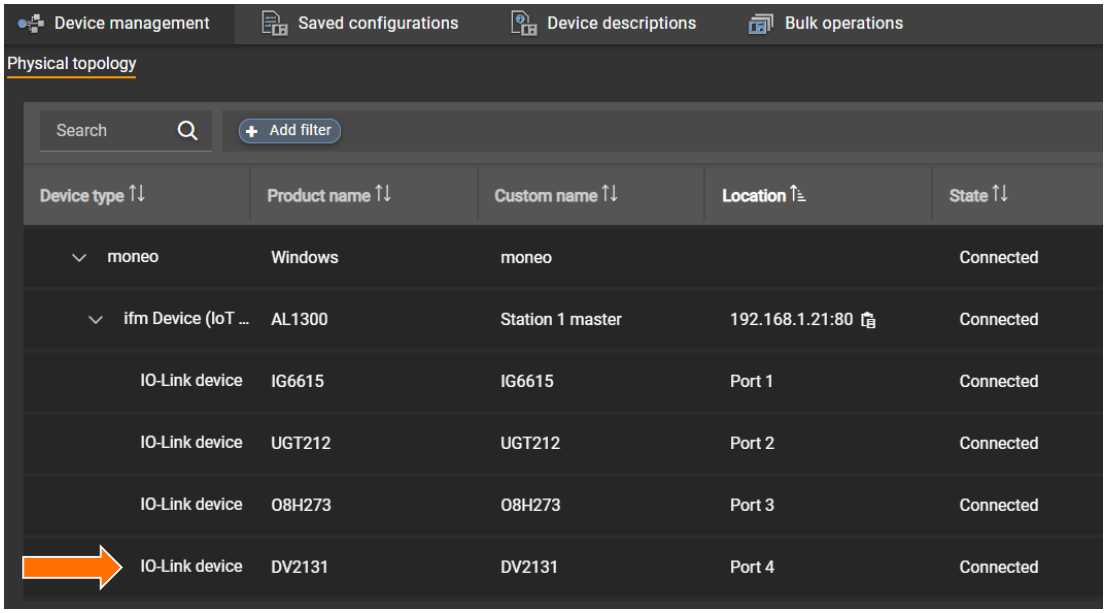
7. Lab Activity

7.1. Connections

In this task, you will physically connect the signal lamp to the master using an M12-to-M12 connection cable. You will also connect the master to the Moneo application. Perform these steps:

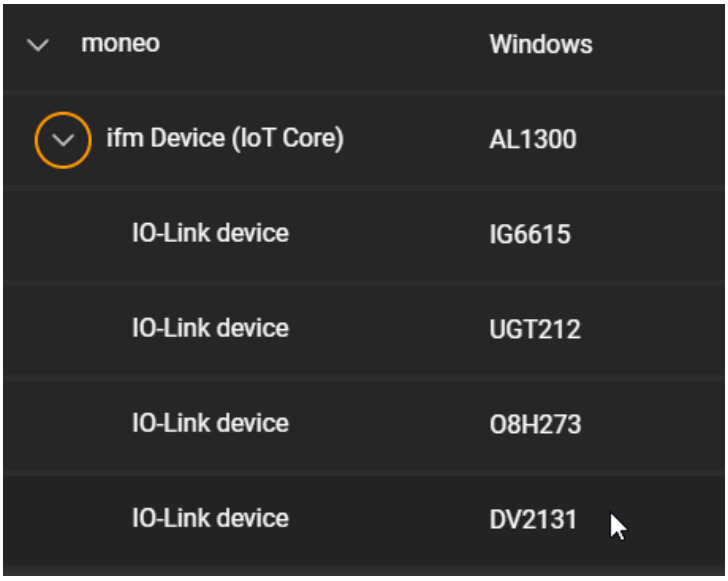
1. Connect the power cable to the master's 24 power input port. Connect the other end to a power source.
2. Connect the M12 end of the M12-Ethernet cable to the IoT port of the master. Connect the Ethernet end of the cable to your computer or Ethernet switch. Observe the LEDs to ensure that a connection has been made.
3. Connect one end of the IO-Link connection cable to the lamp. Ensure that the slit on the connection cable aligns with the protrusion. Manually tighten the screw on the power cable to secure the connection. Connect the other end of the IO-Link cable to one of the master's free IO-Link input ports.
4. Enable communication between the master and your computer using the Moneo Configure application and, if necessary, the Ethernet Configuration Tool.

Once connected, the master's parameters are displayed in Moneo Configure. The signal lamp is indicated in the image below. Based on the image, the lamp is connected to Port 4.



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5. Click the device to view its settings.



6. If you have an internet connection, take some time to review the device on the product site.

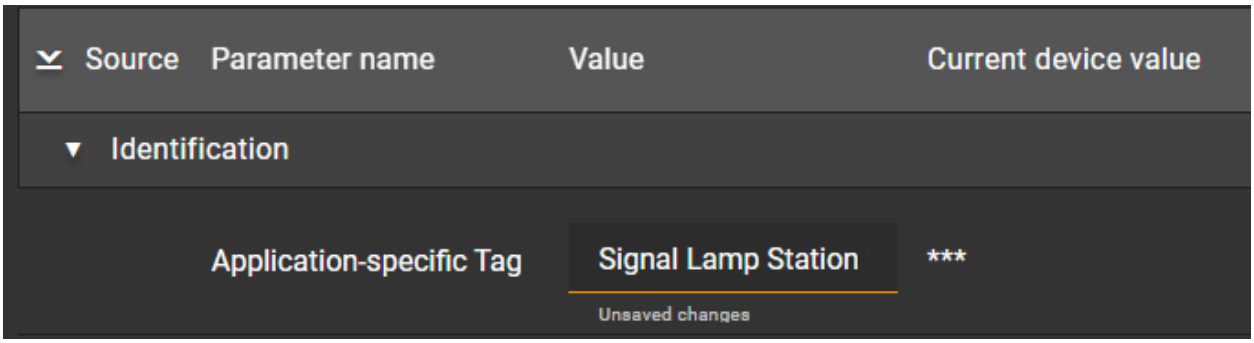


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7.2. Writing to the IO-Link Master

In this next task, you will change the actuator's **application-specific tag**. Recall that the application-specific tag is a name given to the device to make it more identifiable in the field or factory floor where many of these devices may be present.

1. From In the **Application-specific Tag** field, add a word or phrase such as "Signal Lamp Station 1" that will make the sensor more easily identifiable. If such a tag already exists, make a small change to the text.



2. In the menu at the bottom-right, click **Write Changes to device**. The application tag is written to the master, and the *Unsaved changes* indicator is no longer present.

3. Show the new application tag to your instructor.

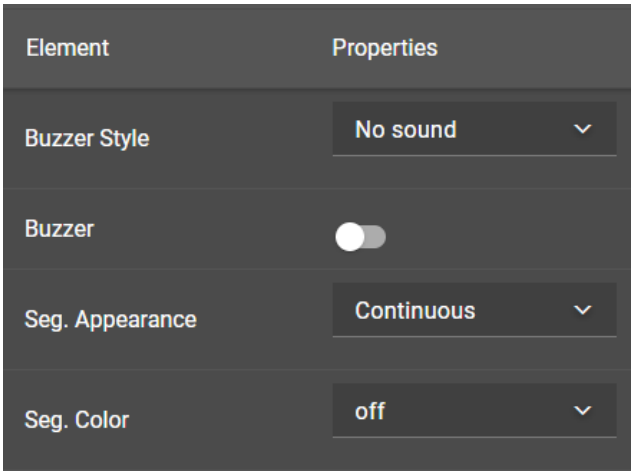
7.3. RGB Mode

In this task, you will experiment with the RGB mode signal lamp output settings.

In RGB mode, the following settings can only be modified when the signal lamp is offline ("offline settings"). These settings are modified in the Setup screen:

- LED (Segment) intensity
- Buzzer intensity

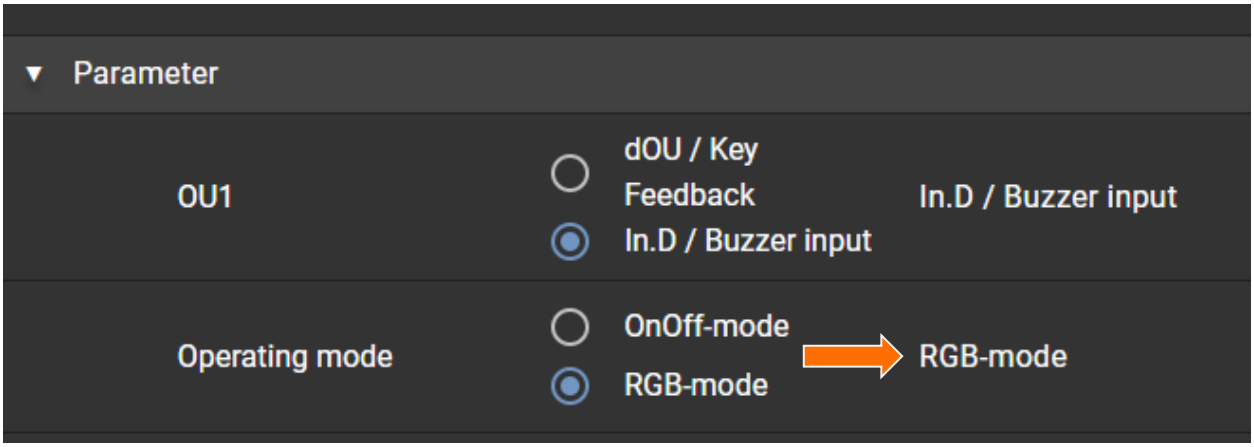
The settings shown in this image can be modified when the signal lamp is online ("online settings"). They are modified in the **Dashboard** screen.



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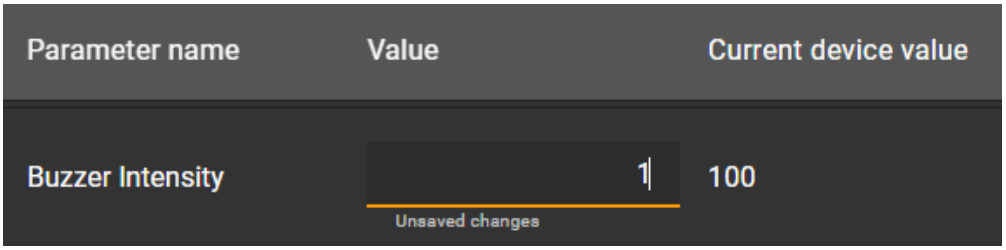
Perform these steps:

1. In the Parameter area, in the **Operating mode** settings, ensure that **RGB-mode** is selected.

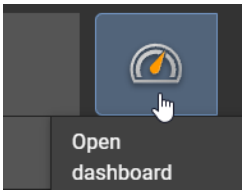


Warning: *The default buzzer intensity of 100 is extremely loud and can cause hearing damage if the buzzer is operated at close range. Do not skip the next two steps!*

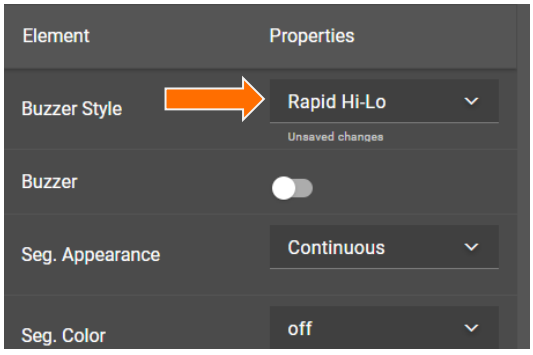
2. In the RGB mode area, change the Buzzer Intensity to **1**. Write the changes to the device.



3. Open the **Dashboard**.



4. In the pane on the right side of the Dashboard screen, in the Buzzer Style dropdown menu, select **Rapid Hi-Lo**.

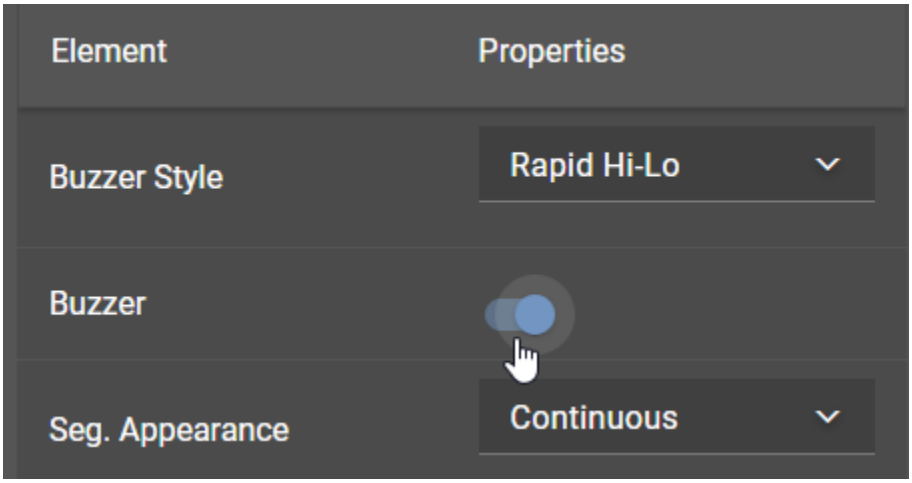


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5. In the bottom-right menu, click **WRITE ALL TO DEVICE**.

   The buzzer has not sounded yet because the Buzzer output is still off.

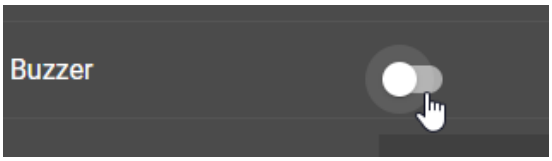
6. Click the **Buzzer** switch to toggle the buzzer output on.



7. Write the changes to the device. The buzzer sounds.

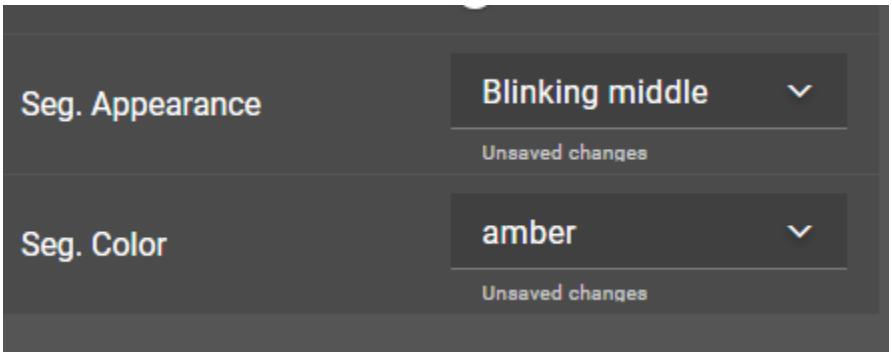
ⓘ ***Note:*** *A warning message may appear before the buzzer sounds. Accept the warning (click OK) to sound the buzzer.*

8. Toggle the **Buzzer** switch off.



9. Write the changes to the device. The buzzer turns off.

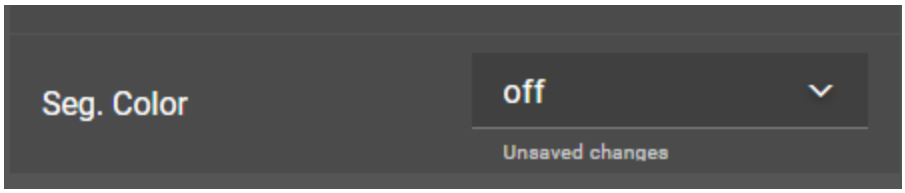
10. In the **Seg. Appearance** dropdown menu, select **Blinking middle**. In the **Seg**. **Color** dropdown menu, select **amber**.



11. Write all the changes to the device. The lamp blinks with an amber color at medium speed.

12. Change **Seg. Color** to **off** and write the changes to the device to turn off the lamp.

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13. Take some time to experiment with the rest of the buzzer styles, LED appearances, and colors. Remember to write the changes to the device.

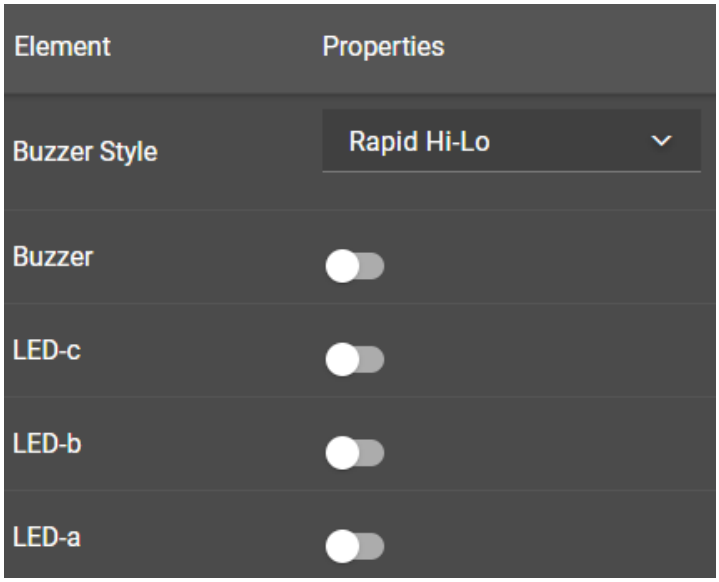
7.4. OnOff mode

In this task, you will experiment with the OnOff mode signal lamp output settings.

In OnOff mode, the following settings can only be modified when the signal lamp is offline (“offline settings”). These settings are modified in the Setup screen:

- LED (Segment) intensity
- LED (Segment) color settings
- LED (Segment) appearance
- Buzzer intensity

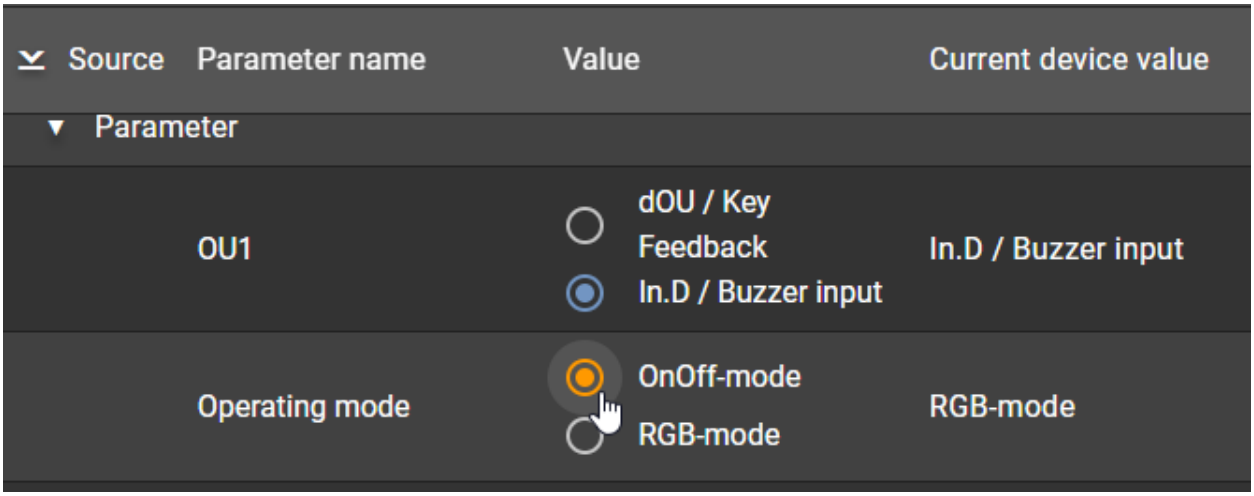
The settings shown in this image can be modified when the signal lamp is online (“online settings”). They are modified in the Dashboard screen.



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Perform these steps:

1. In the Device parameters' **Operating mode** row, select **OnOff-mode.**

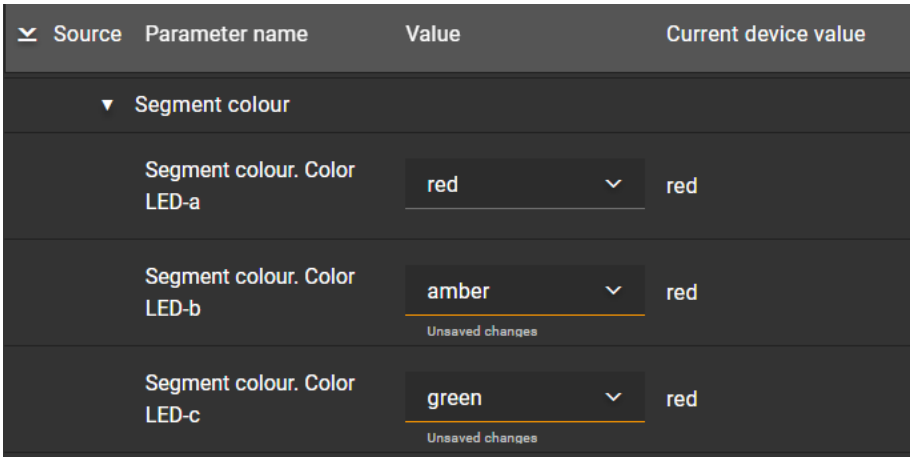


2. Write the changes to the device.

ⓘ ***Note:*** *The Dashboard changes to OnOff mode.*

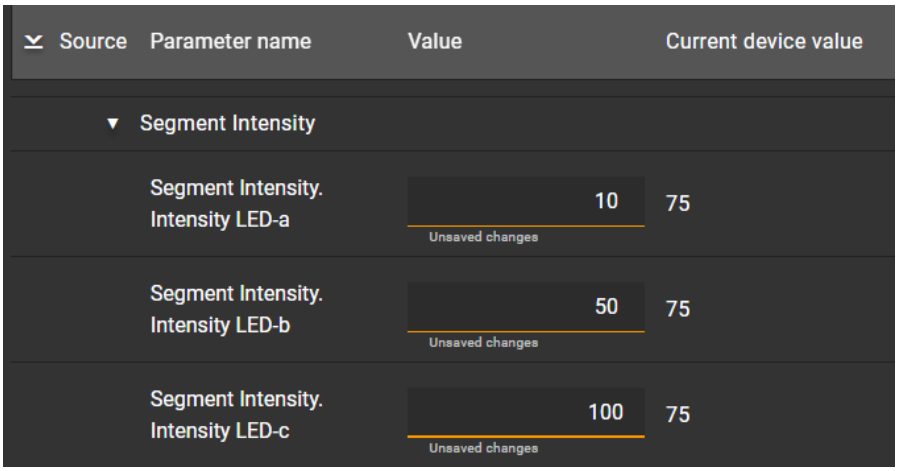
3. In the Segment color area, set:

   - LED-a to **red**
   - LED-b to **amber**
   - LED-c to **green**



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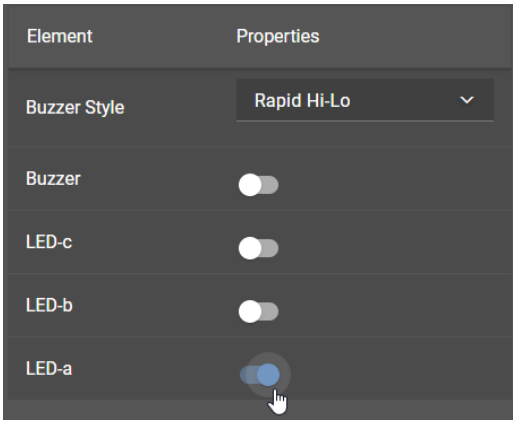
4. Set the LED intensities:
   - LED-a to **10**
   - LED-b to **50**
   - LED-c to **100**



ⓘ ***Note:*** *Unlike in RGB mode, segment appearance (e.g., continuous lighting, flashing, blinking, and the various blinking and flashing speeds) are modified in the Setup screen. The default setting is continuous lighting.*

5. Write the changes to the device.

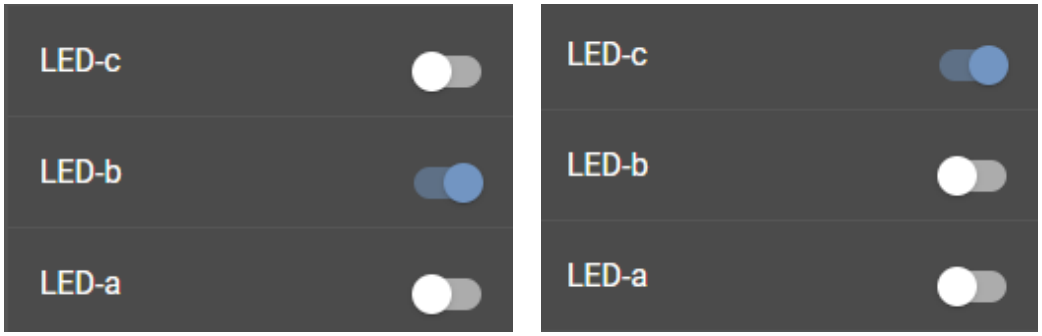
6. In the pane on the right side of the *Dashboard* screen, toggle **LED-a** on.



7. Write the change to the device. The lamp turns on with a red light.

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8. Try the other LED colors, writing the changes to the device after each color change.



9. Toggle both **LED-a** and **LED-b** on. Toggle **LED-c** off.

10. Write the changes to the device. Note that the lamp illuminates red only. This is because LED-a has a higher priority than LED-b. In production lines, multiple alerts can occur at a single time, and operators need to know which alert to deal with first.

11. Experiment with other combinations of multiple LED illumination. Which LEDs hold higher priority over the others?

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.

- ☐ Restore the device's factory settings. To do so navigate to **Parameter > Restore Factory Settings > Execute**.
- ☐ Close the Moneo Configure application and, if necessary, the Ethernet Device Configuration application.
- ☐ Disconnect and stow away the master, sensor, and connecting cables.

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