Smart Devices for Industry 4.0

RFID TRACKING

Name	Class/Period	Date

1. Overview

In this lab activity, you will physically connect an RFID read/write head to the IO-Link master and explore its capabilities.

2. Performance Objectives

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

- Physically connect an RFID read/write head 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 RFID read/write head.
- Write data to RFID tags.
- Read RFID tag data.
- Toggle activation of the RFID read/write head's antenna.

3. Background

3.1. The RFID Read/Write Head

RFID is short for **radio-frequency identification**. This technology is used for asset tracking in many different industries. An RFID system includes tags, a reader, and an antenna. The reader and antenna for your RFID system are included in the same device: The **RFID read/write head**.



The RFID read/write head reading an RFID tag.

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The RFID read/write head is used for reading data from and writing data to ID tags.

The ID tags in this lab activity are passive ID tags and therefore do not contain their own energy source. The energy required by the tag to transmit a wireless signal is supplied by the read/write head. The energy is transferred to the ID tag via inductive coupling.

3.2. Characteristics of your RFID Read/Write Head and RFID Tags

Your RFID read/write head can read the information stored in this lab activity's RFID tags, as well as write information to them. To read from or write to a tag, a tag must be within 90 mm of the read/write head.

Each tag contains the following information:

- A unique ID. This is the exclusive identification number of the tag and it can never be changed.
- A counter value between 0 and 255.
- 29 bytes of data that can be modified.

3.3. The RFID Read/Write Head Dashboard

Here are several things to look for when observing the RFID head's dashboard:

- Which mode is being displayed. The device has 5 modes: READ_UID, AUTO_READ_DATA, AUTO_WRITE_DATA, READ DATA, and WRITE_DATA.
- Whether or not the antenna is deactivated. If the antenna is deactivated, tags cannot be read or written to.
- Whether or not a tag is present. Only tags that are present (in range of the device) can be read or written to.
- If a read or write operation has been acknowledged (Cmd Start Acknowledge).
- If a read or write operation has been completed (Cmd End).
- The nature of the information read from the tag itself.

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)
- RFID read/write head ("the device")
- RFID tags. The tags should be pasted onto various objects. The objects from the previous lab activities (blue prism, plexiglass block, etc.) can be used for this purpose.
- 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)

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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 on your computer.

7. Lab Activity

7.1. Connections

In this task, you will physically connect the RFID head 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 sensor. 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 RFID read/write is indicated in the image below. Based on the image, the sensor is connected to Port 3.

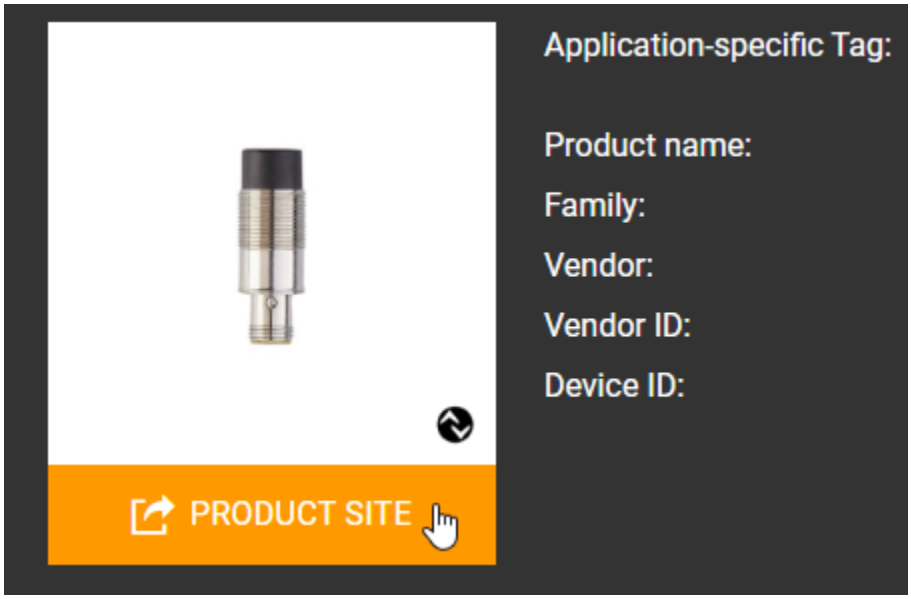
Device type	Product name	Custom name	Location	State
moneo	Windows	moneo		Connected
ifm Device (IoT ...	AL1300	Station 1 master	192.168.1.21:80	Connected
IO-Link device	IG6615	Inductive Sensor Station 1	Port 1	Connected
IO-Link device	UGT212	Ultrasonic Sensor Station 1	Port 2	Connected
IO-Link device	DTI421	DTI421	Port 3	Connected
IO-Link device	DV2131	Signal Lamp Station 1	Port 4	Connected

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5. Click the device to view its settings.



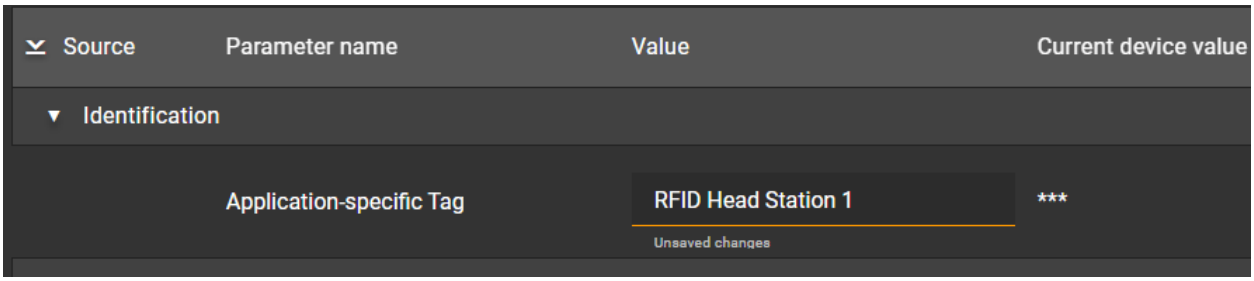
6. If you have an internet connection, take some time to review the device on the product site.



7.2. Writing to the IO-Link Master

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

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



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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.

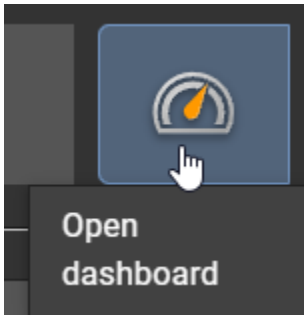
3. Show the new application tag to your instructor.

7.3. Reading Unique IDs

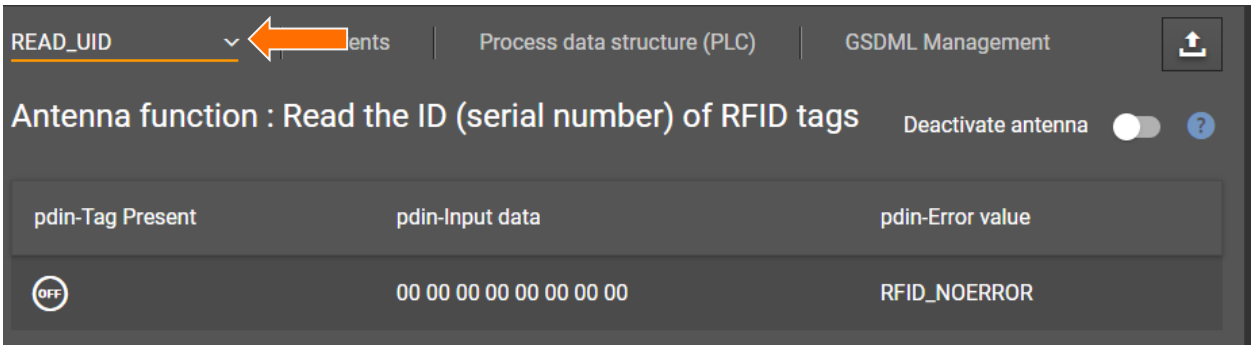
In this task, you will read the unique IDs of the RFID tags. The device mode for reading unique IDs is a different mode than the one used to read modifiable tag data.

Perform these steps:

1. Open the **Dashboard**.



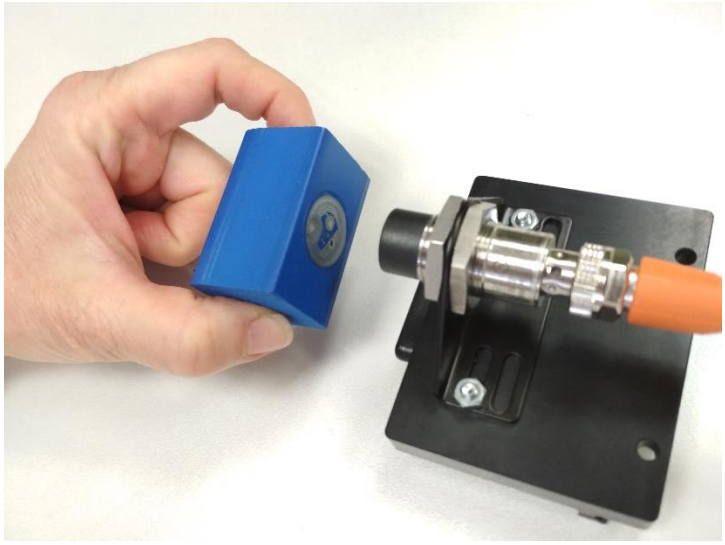
2. In the Process data output pane on the right side of the Dashboard, in the command value dropdown menu, ensure that **READ_UID** is selected. (UID is short for Unique ID.)



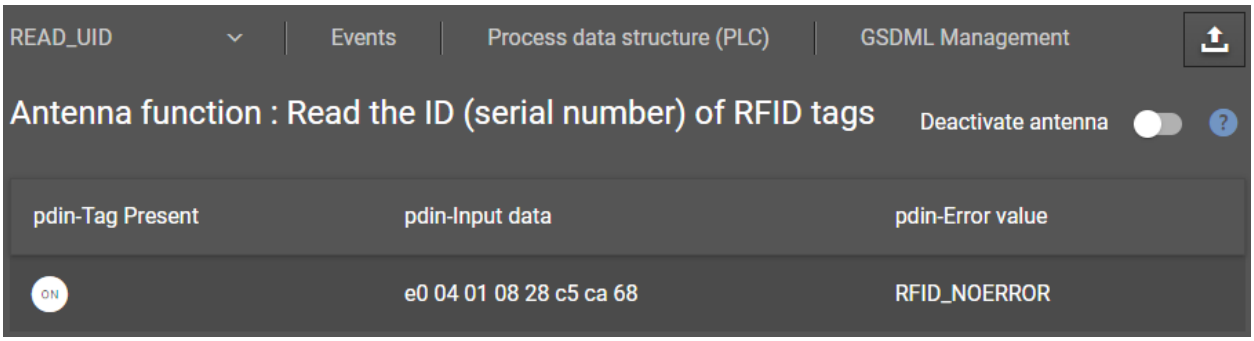
3. If you changed the settings, click **WRITE ALL TO DEVICE**.

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4. Move an RFID tag (i.e. an object with a tag stuck to it) into the range of the device.



When a tag is moved into range, the **Tag Present** indicator turns ON and the unique ID of the tag is displayed in the **Input data** area.



5. Take note of the pdin-Input data value.
6. Remove the tag and place a different tag into the device's range. Compare the input data value with that of the previous tag.
7. Perform the previous step with the rest of the tags. Note that all tags have unique IDs. Also take note of which bytes differ between the various unique IDs.

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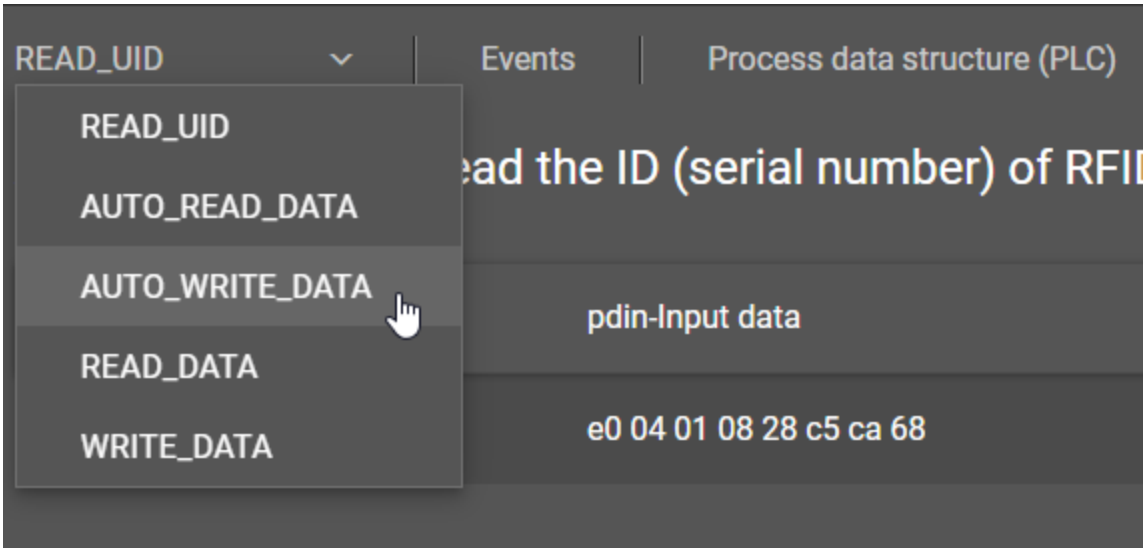
7.4. Writing Data to Tags

In this task, you will write data to several RFID tags using AUTO_WRITE_DATA mode. In the next task, you will read the data of the tags that you wrote to using AUTO_READ_DATA mode.

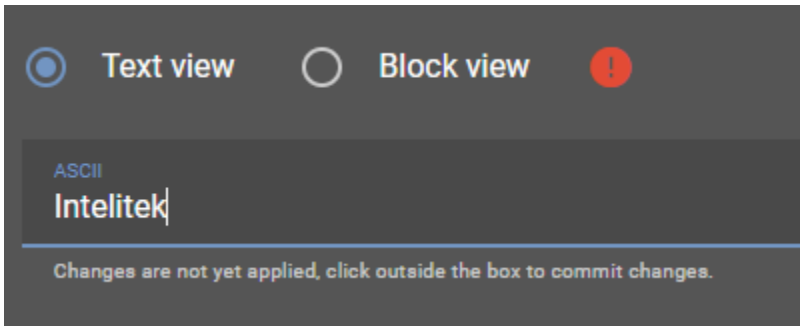
In AUTO_WRITE_DATA mode, the RFID head automatically writes stored data to every tag that enters its field.

Perform these steps:

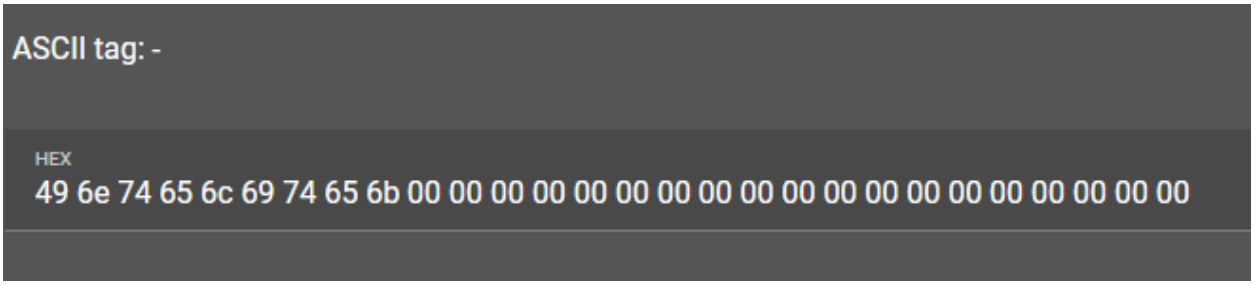
1. In the Dashboard, set the mode to **AUTO_WRITE_DATA**.



2. In the ASCII field, write your name.

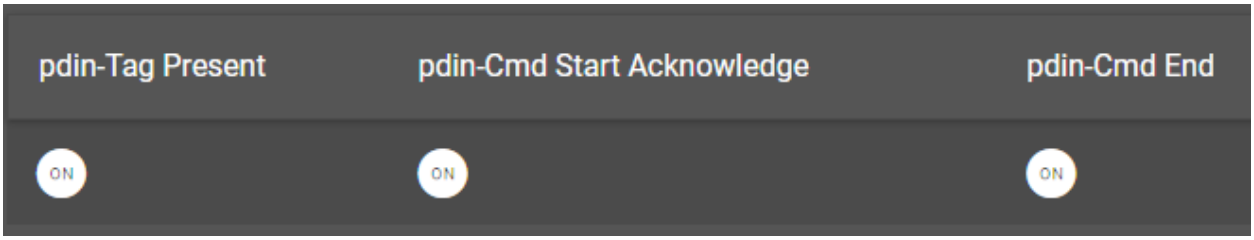


3. Click outside the ASCII field to apply the changes. Note that the value of the ASCII tag changes. These values are the raw bytes of data that will be transferred to RFID tags moved in range of the RFID head.



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4. Move a tag into range of the device. Ensure that the **Cmd End** indicator changes to ON to indicate that the data has been written to the tag.



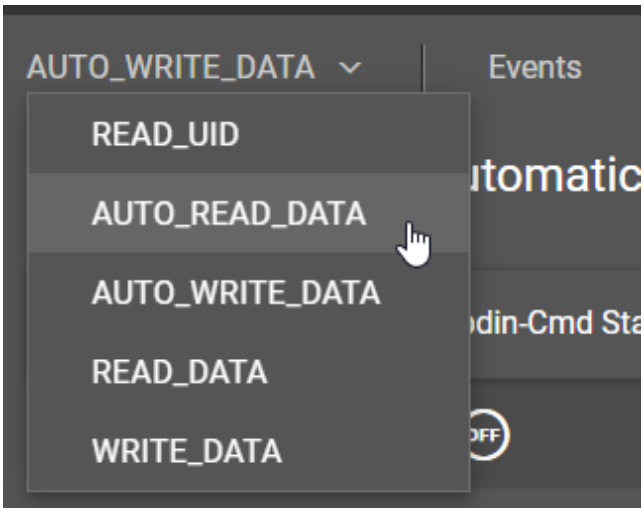
5. Remove the tag from the device's range.
6. Repeat the steps 2 through 55 for a different tag. Ensure that the data written to this tag is different from the data written to the first tag (i.e., write something else in the ASCII field before writing to the tag).
7. Remove all tags from the RFID read/write head's range.

7.5. Reading Tag Data

In this task, you will have the RFID read/write head read the tags that you wrote to in the previous task.

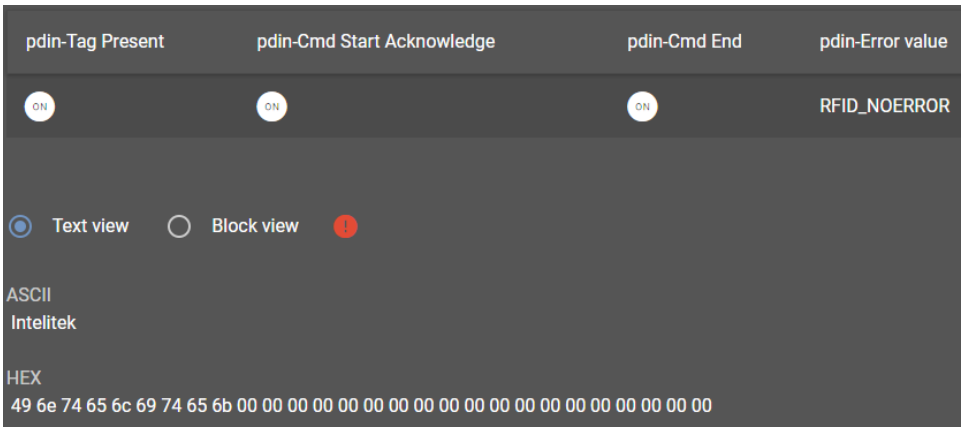
Perform these steps:

1. In the Dashboard, change the mode to **AUTO_READ_DATA**.



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2. Place a tag that you wrote to in the previous task into range of the device. Ensure that the **Cmd End** indicator changes to ON to indicate that the tag data has been read.



3. Remove the tag from the device's range.

4. Repeat the previous steps for the next tag that you wrote to. Note that the displayed data is different from that of the first tag.

5. Repeat the above steps and read all of the tags that you wrote to in the previous task. Show your instructor that all of the tags display different data.

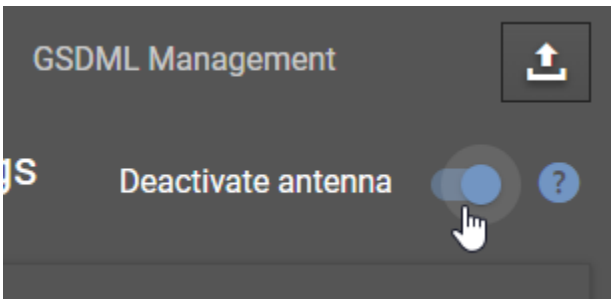
6. Remove all tags from the RFID read/write head's range.

7.6. Deactivating the Antenna

In this task, you will deactivate the RFID read/write head's antenna to disable both the device's reading and writing capabilities.

Perform these steps.

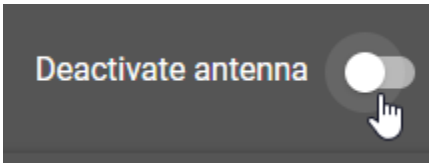
1. In the Dashboard, toggle **Deactivate Antenna** on.



2. Place a tag into range of the device. Note that the **Tag Present** indicator remains OFF. In a production environment, deactivating a RFID reader's antenna remotely is simple way to disable the reader in the event that the station where the device is located no longer requires tagging or tracking.

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3. Toggle **Deactivate Antenna** off again.



4. Place a tag into range of the device and confirm that it can be read.

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 **Setup > Restore Factory Settings > Execute**.
- ☐ Close the Moneo Configure application and, if necessary, the Ethernet Device Configuration application.
- ☐ Ensure the IO-Link master and any IO-Link devices are disconnected and stowed away.
- ☐ Ensure the connecting cables are stowed away.

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