# AISDetector

## AI-based Application Software

## User Manual v1.0

AI Solution BU
2021/8/18

# About this manual

This manual provides an overview of the key features of this software and gives step-by-step instructions for making full use of them.

## How this manual is organized

Chapter 1 Getting to know AISDetector
This chapter gives an overview of the key features and functions of the software.

Chapter 2 Using AISDetector
This chapter provides information on how to use the software.

Chapter 3 Upgrading AISDetector
This chapter provides information on how to upgrade the software, pre-trained models, and other necessary functions.

Chapter 4 Support for AISDetector
This chapter provides information for troubleshooting and contacting ASUS for support.

Appendix This section includes the notices and safety statements for this software.

# Conventions used in this manual

Throughout this manual, blocks of text as shown below are used to emphasize important information.

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**IMPORTANT!** This message contains vital information that must be followed to complete a task.

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**NOTE:** This message contains additional information and tips that can help to complete a task.

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**WARNING!** This message contains important information that must be followed to keep you safe while performing certain tasks and prevent damage to AISDetector data and functions.

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# Typography

| | |
|---|---|
| Bold | Indicates a menu or an item to select |
| *Italics* | Indicates a section in this manual with additional information |

# Package contents

Inside the package is a USB dongle, which contains the activation key for AISDetector.

# Chapter 1: Getting to know AISDetector

## 1.1 Introduction

AISDetector is an Artificial Neural Network (ANN) based application software that together with a unique ASUS Artificial Intelligence (AI) user interface is designed to detect anomalies in sound and vibration. The ability to detect these anomalies on the factory production floors allows manufacturing challenges to be addressed promptly for time and cost savings.

## 1.2 Software

AISDetector is an AI-based end-to-end signal anomaly detection software for collecting signals, training models using data sets, verifying and testing models, and presenting results visually. AISDetector detects anomalies to help determine whether products or equipment are running in a normal state.

With a friendly visual user interface (UI), AISDetector is extremely easy-to-use and comes with a series of embedded tutorials that can be accessed at any time.
Simply label training signal data as OK or NG for various options of hardware type for AI training without the need for data pre-processing. By following the uniquely pre-defined ASUS AI software workflow, you can quickly train, verify, and test the target to get results in a matter of minutes and easily become a second-to-none signal analyst. With the data waveform displayed in the UI, you can narrow down the root cause of any anomaly and conduct further analysis for process optimization.

## 1.3 System Requirements

Your computer must meet the minimum system requirements below to run the artificial intelligence model training and inference functions in this software.

| | |
|---|---|
| CPU: | Intel Core i3 or higher |
| DRAM: | 8GB or more |
| USB: | 2 free USB ports (For the license dongle or USB microphone) |
| Storage device: | SSD (recommended) |
| Storage storage: | 800 MB |
| Operating System: | Windows 10 (64 bit) |


## 1.4 Features

- New target/project set up with just a few clicks
- Using fast AI modeling technology, users can create a new AI model within 1 min, and this makes production-line changeover easy.
- Designed to work seamlessly with sensors for real-time data collection and testing
- Dataset source flexibility - accepting either sound from a microphone or vibration from an accelerometer
- Variable frequency source allowable and anomaly detection with time-frequency techniques
- No AI accelerator needed: AISDetector only requires computing power from a typical CPU. This means that an AI-based manufacturing system can be adopted without significant investment.

### 1.4.1 Training

The training module includes Project, Train, Verification, and Testing for you to create your own AI project.

### 1.4.2 Inference

In this section, you can create, configure, or import a project for various detection targets.

# Chapter 2: Using AISDetector

## 2.1 Download the software

Go to the ASUS IoT website and find the AISDetector product download page.

### 2.1.1 Install the software

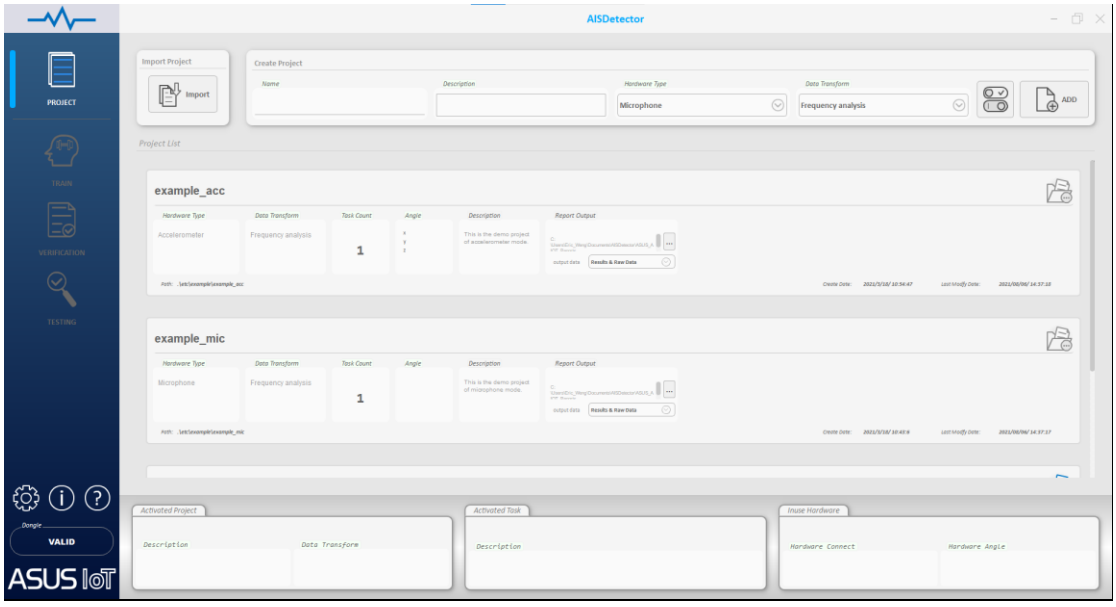
Run AISDetector.msi once the image file is downloaded.

### 2.1.2 Activate the software

When prompted for the activation key, plug the ASUS IoT USB dongle into the computer that you have installed the AISDetector.

## 2.2 Project

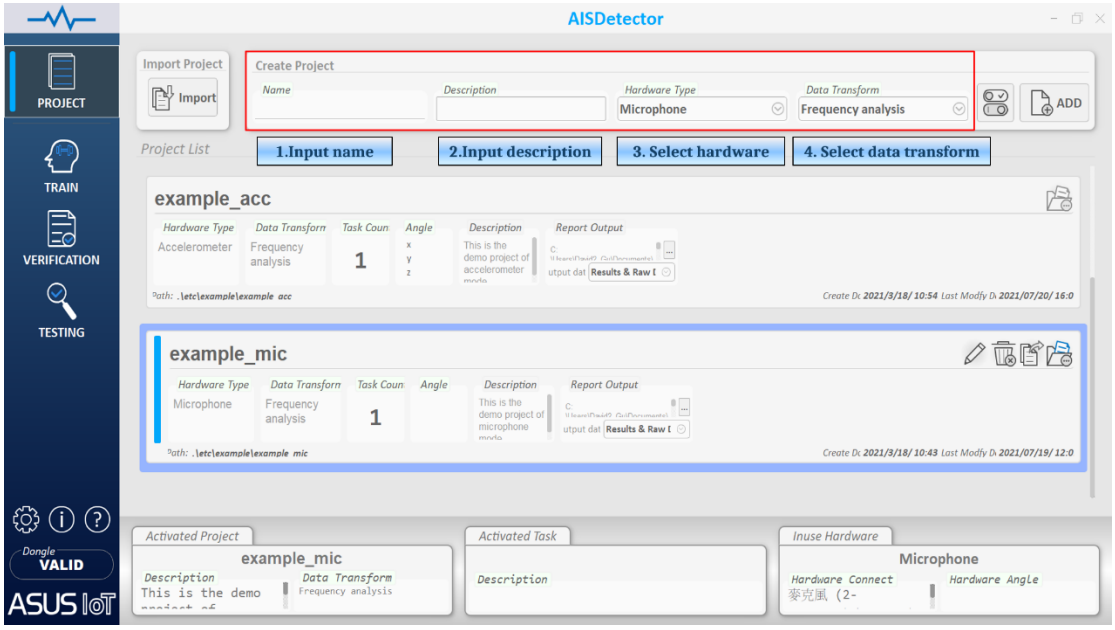
This section is to help you create, configure, or import a project for each different detection target. You can select the data source angle and define the hardware category for a new AI project to be used for subsequent steps.




Add new project information → Define data saving path → Create or import a project → Configure detailed setting

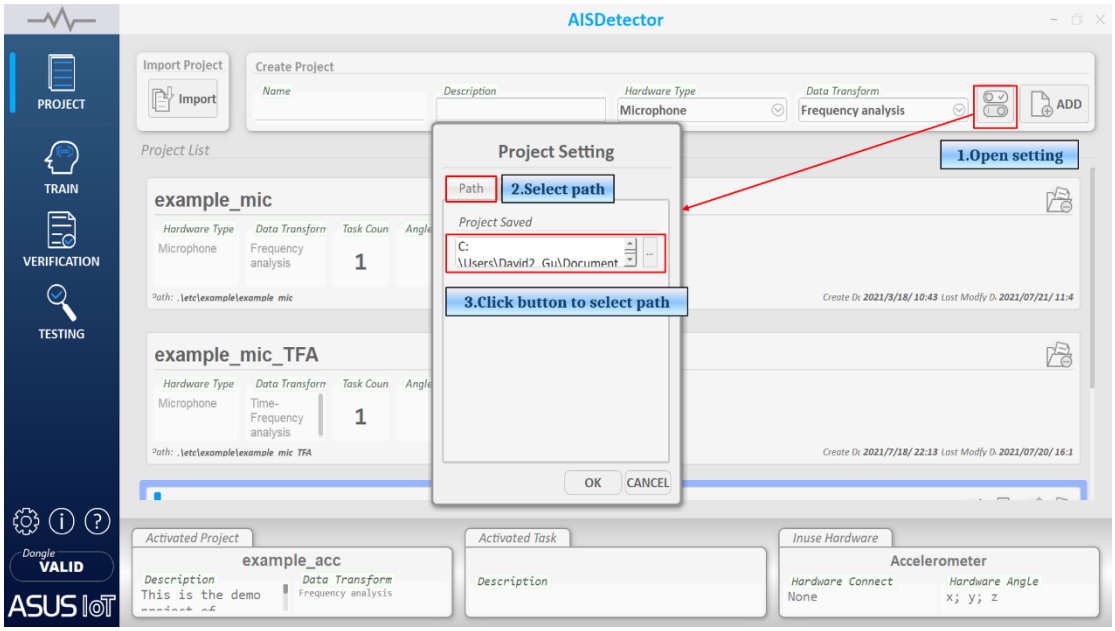
## 2.2.1 Add new project information

- Allows you to name the project, **add** a description (optional), and select a hardware type in the red box below.



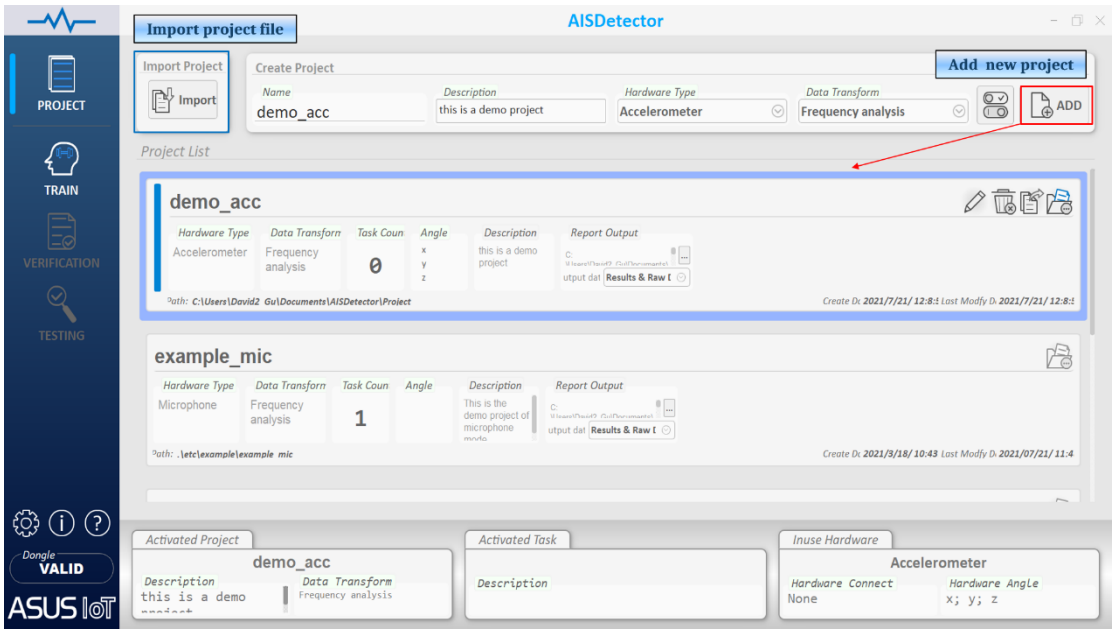

## 2.2.2 Define data saving path

- Allows you to define and manage test data location.
- Click the sign at the top right corner to access project settings, select the **Path** tab, set the path, and click **OK**.



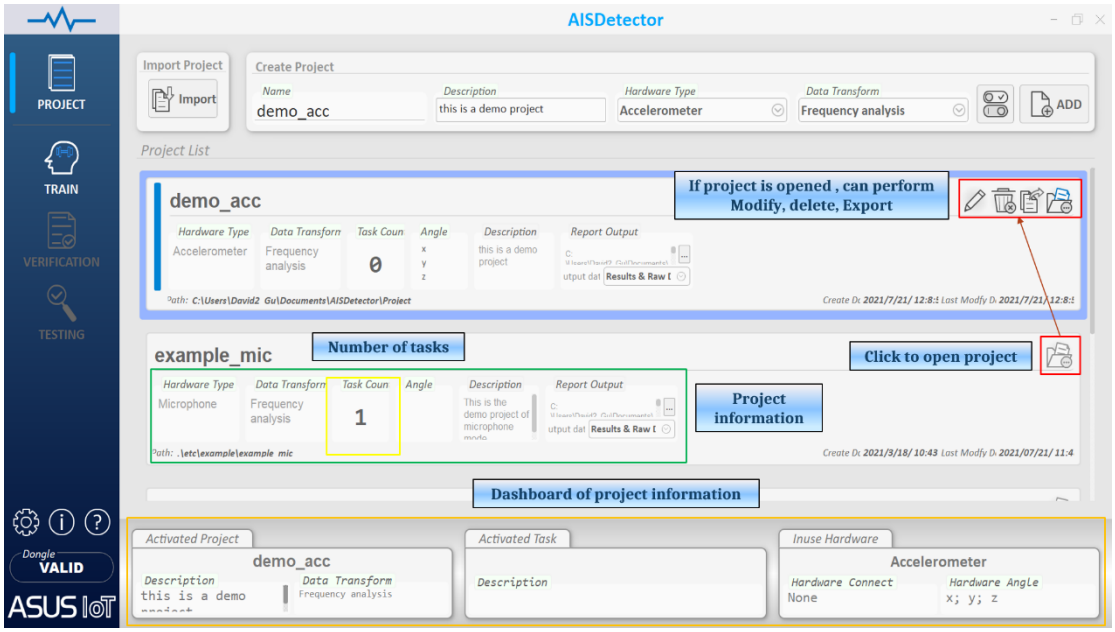
### 2.2.3 Create or import a project

- Create a new project or import a previously defined or an existing project.
- When all information is successfully selected in the **Create Project** box, click **ADD** at the top right corner to create the new project.
- To import an existing project, click **Import** at the top left corner.



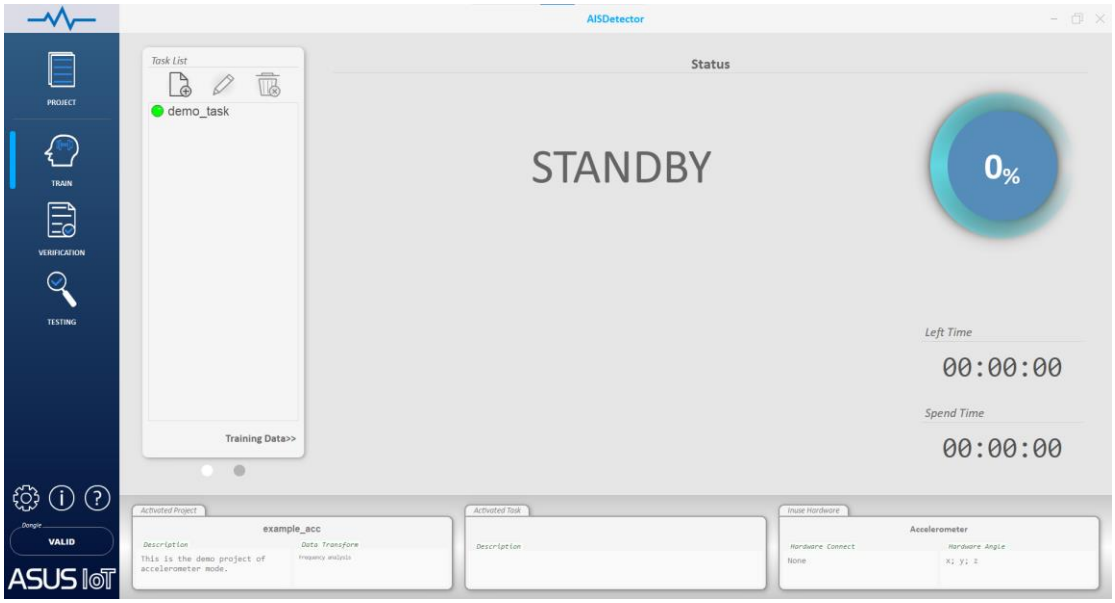
### 2.2.4 Configure detailed setting

- Once a project is created or imported, the corresponding project information will be shown in the **Project List** that is boxed in blue.
- When you select a project, the project details are shown boxed in green. The pre-trained model will be shown boxed in yellow as a task count.
- Project summary will be shown in the area boxed in orange once a project is activated.



## 2.3 Train

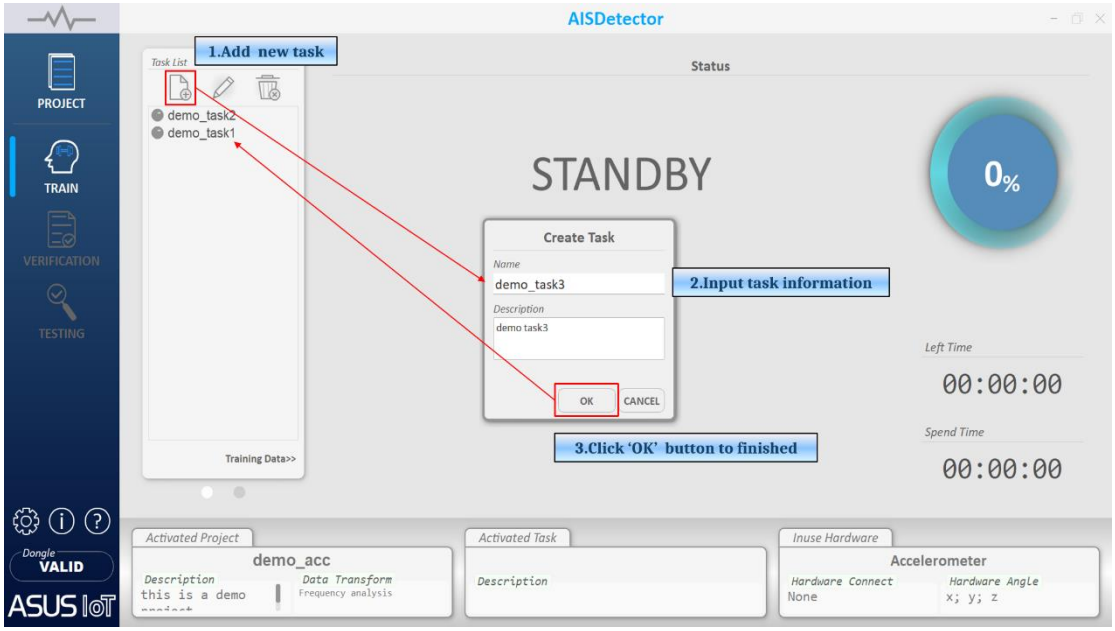
In this section, you are walked through the training process from creating a new training task to finishing the training.





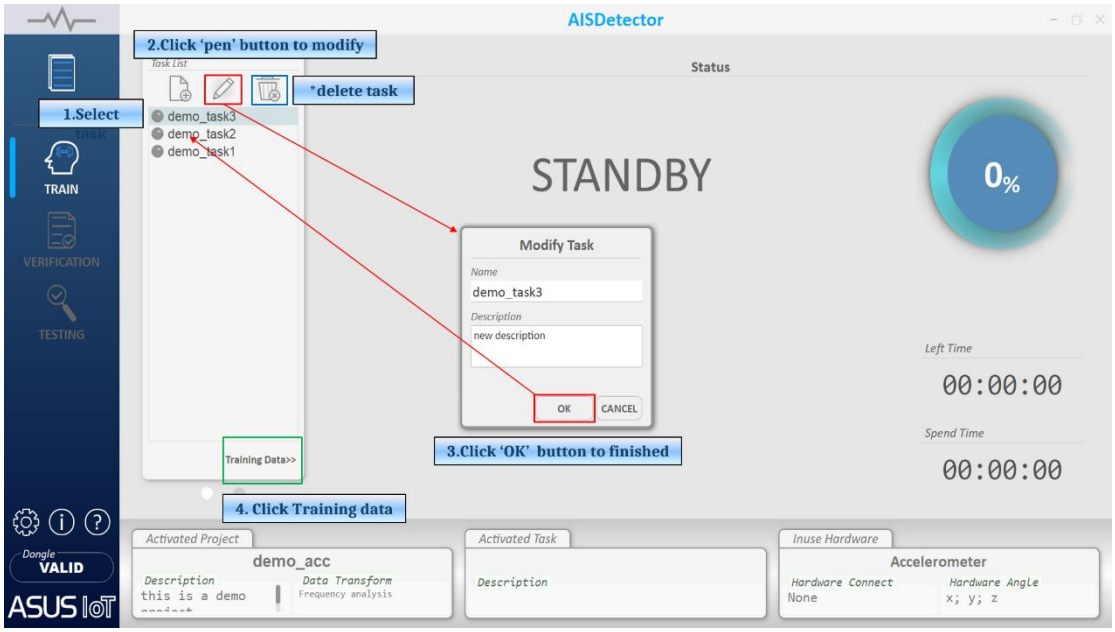
### 2.3.1 Create a new training task

- Allows you to create a **new task** in Task List by entering a new task name and description (optional).
- Click the **Create new task** icon in Task List. Enter a new task name and description (optional), and then click **OK**.



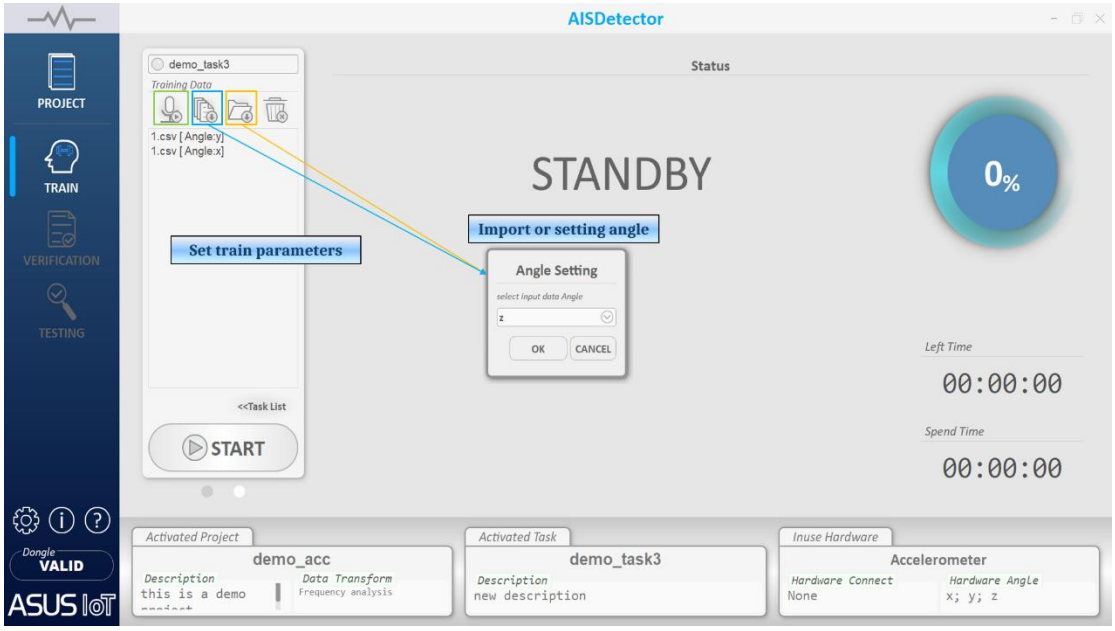
### 2.3.2 Modify and delete task

- Allows you to modify and delete task information
- Click the **Pen** icon in Task List to make modifications. When done, click **OK**.
- To delete a training task, select the task that you want to delete, click the **Recycle Bin** icon in Task List.
- Once the setup is complete, click **Training Data**, which is shown boxed in green below, to select the training data source.



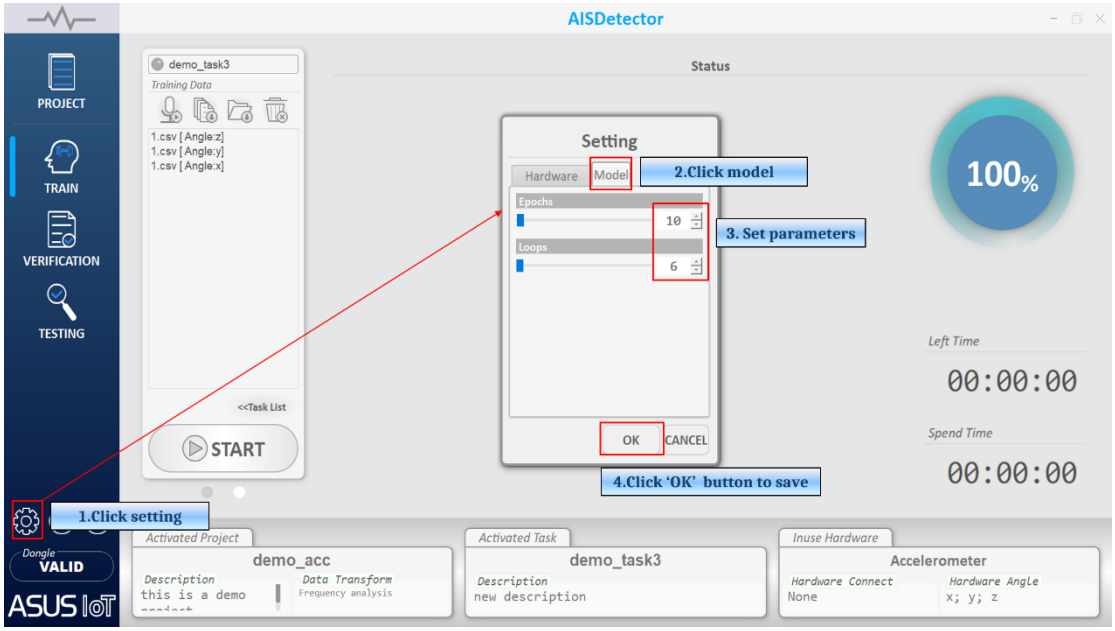
### 2.3.3 Select training data source

- You can select training data from the following three (3) data sources.
  1. Use on-site accelerometer.
  2. Load or select single or multiple recording files
  3. Import an entire folder of sound recordings.
- For all sound recording using a microphone, you can define the recording angle.
- Even after the setup is complete, you can still change the training parameters prior to training if needed.
- Click **Start** to initiate the training. During the training process, the loss curves on the X, Y, and Z axes, as well as the elapsed and remaining time, are displayed in the main pane.



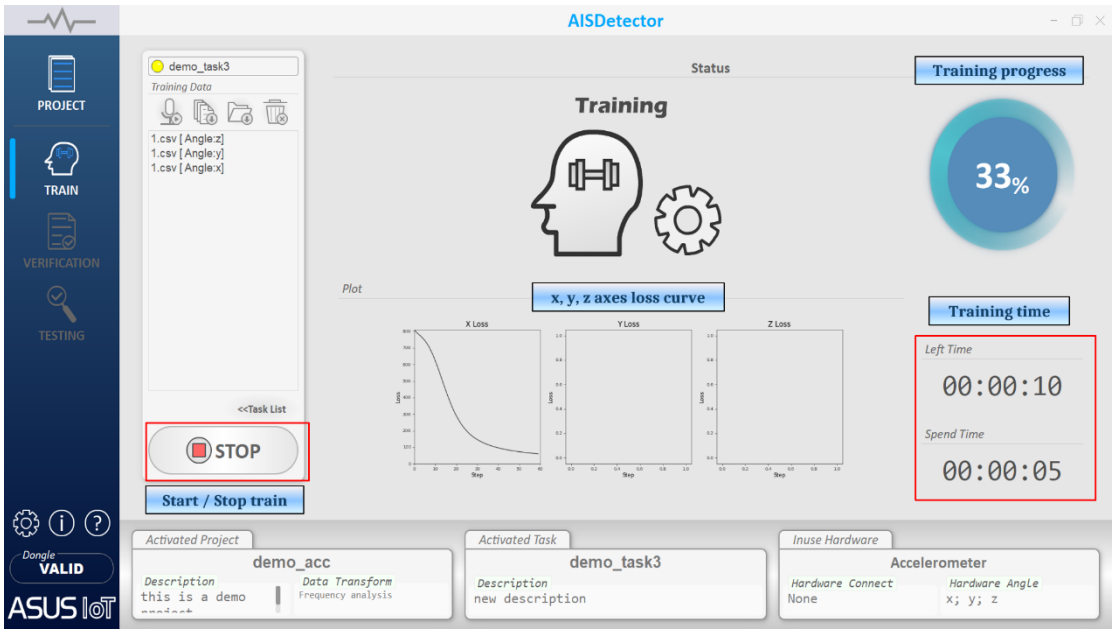
### 2.3.4 Set training parameters

- Click **Setting** to modify parameters.
- Click the **Model** tab in the Setting dialog box.
- Update the training **Epochs** or **Loops**, and then click **OK** to save.



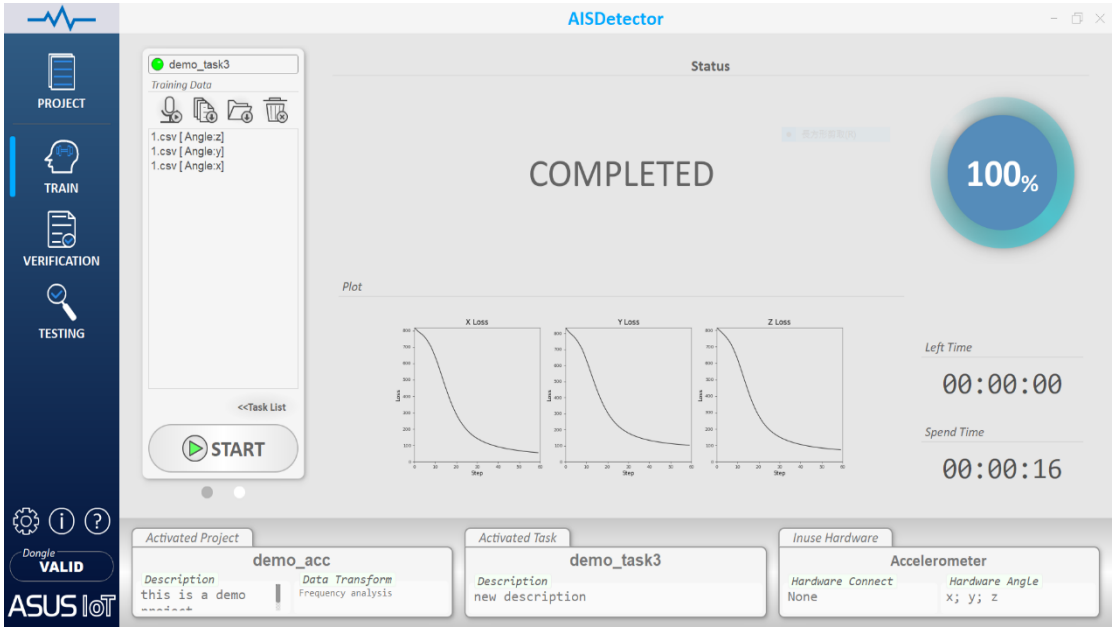

### 2.3.5 Start Training

- Once the setup is complete with parameter settings, click **START** to start the training.
- During training, the loss curves for the X, Y, and Z axes, as well as the training time and progress will be shown for reference.



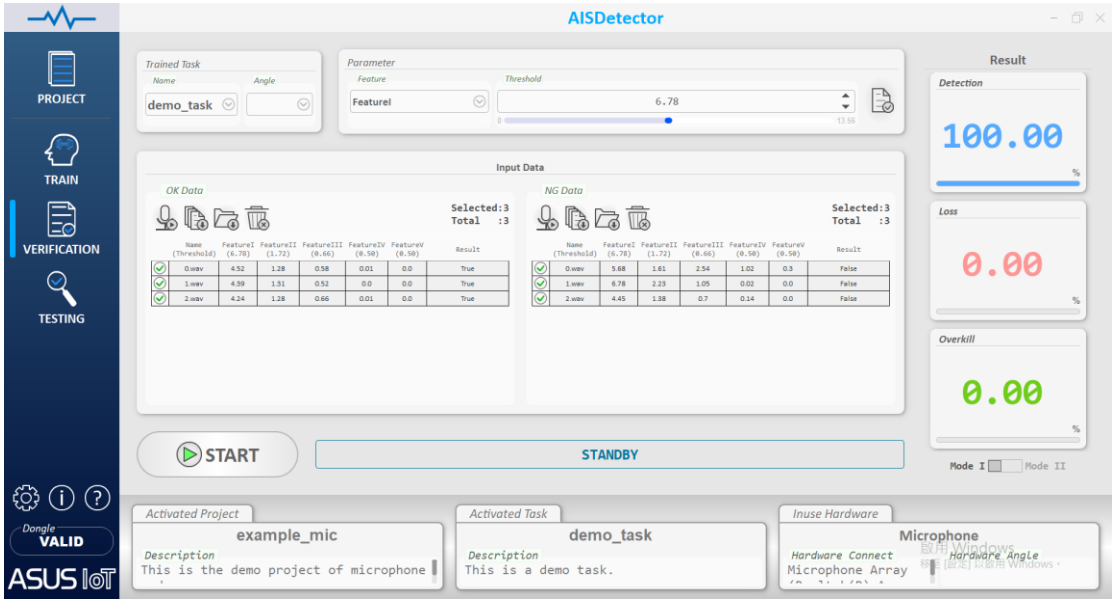
### 2.3.6 Training complete

- Once the progress percentage shows 100%, training is complete and ready for verification and testing.



## 2.4 Verification

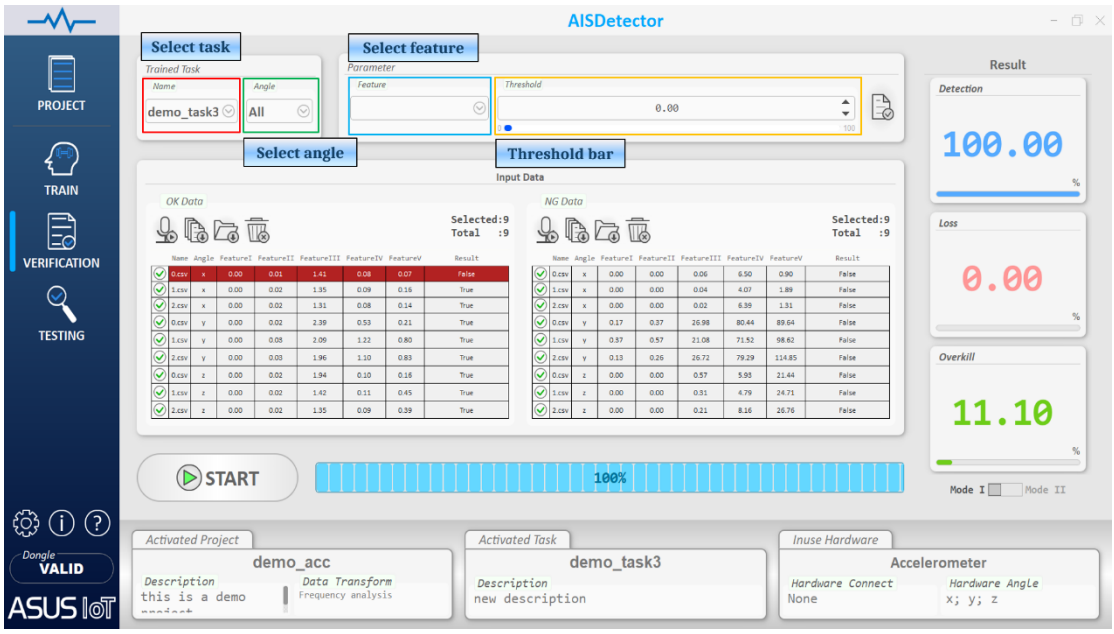
This section takes you through the evaluation and verification of the model.




Configure task and parameter → Select the data source → Select the data for verification → Adjust Threshold → Confusion Matrix → Examples of Confusion Matrix

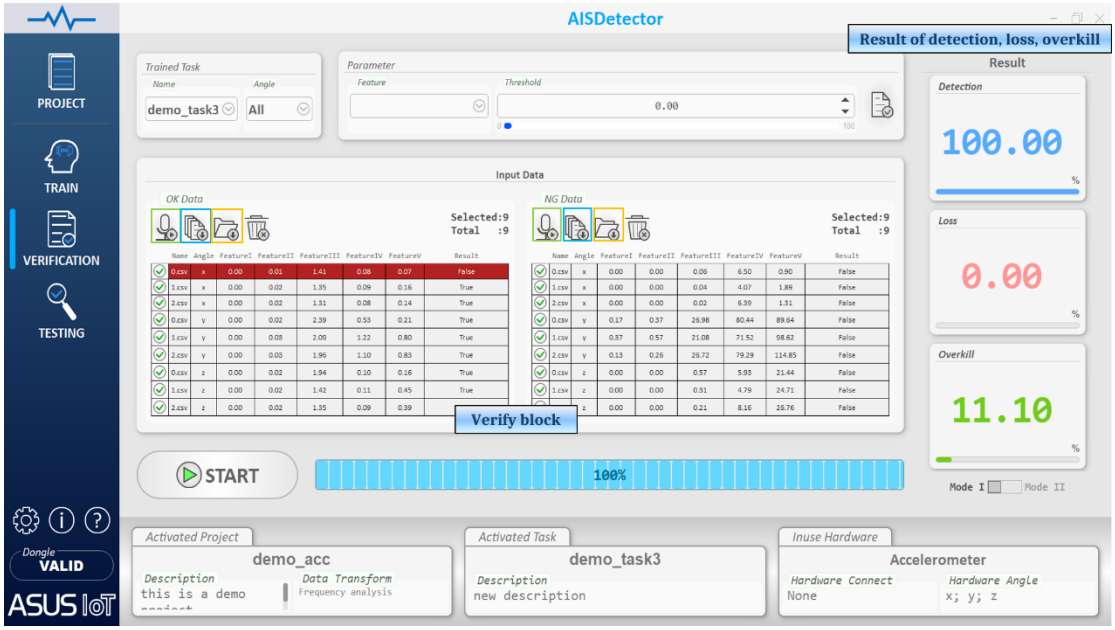
### 2.4.1 Configure task and parameter

- Select the tasks (boxed in red), angle (boxed in green), feature (boxed in blue), and threshold (boxed in orange), and then click **Start** to start the evaluation.



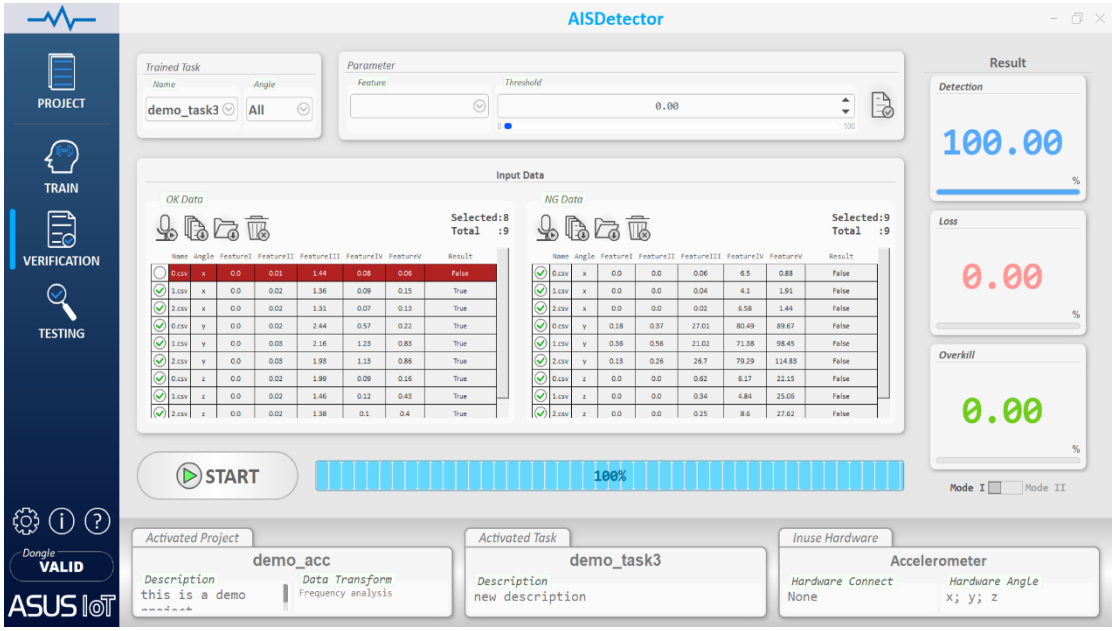
## 2.4.2 Select the data source

- Data source options include accelerometer on-site, load single or multiple source files, or import data from a folder to verify detection, loss, and overkill results.




## 2.4.3 Select data for verification

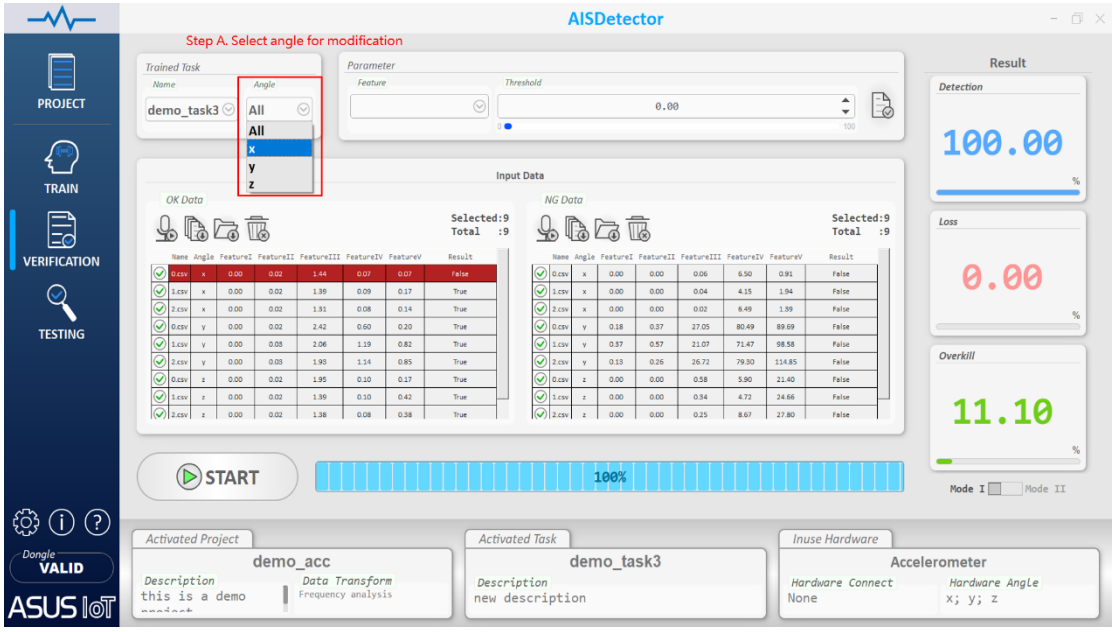
- You have the option to enable or disable each dataset for evaluation.



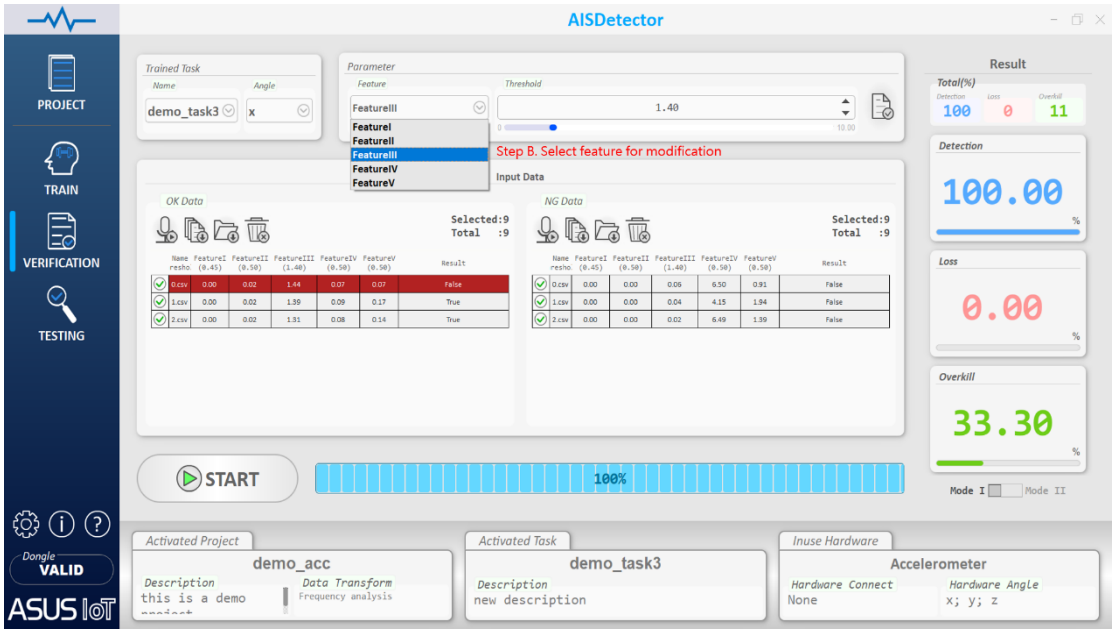
### 2.4.4 Adjust threshold

- You can also select a specific angle (All, X, Y, Z) for verification and further evaluation to verify detection, loss, overkill results. You can refer to steps A to D below.

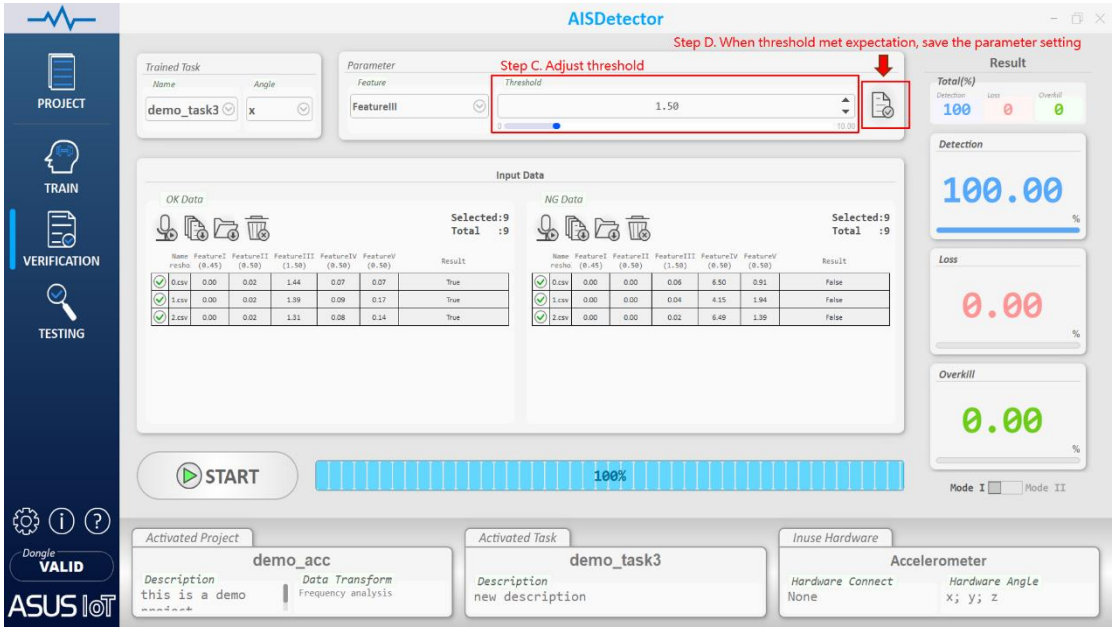
- Step A:




- Step B:



- Repeat steps A through C until you have completed the threshold adjustment.
- Steps C and D:



### 2.4.5 Confusion Matrix

- Refer to the figure below for the definition and explanation of the Confusion Matrix.

| | | True condition | |
|---|---|---|---|
| | | Condition positive | Condition negative |
| Predicted condition | Predicted condition positive | True positive | False positive |
| | Predicted condition negative | False negative | True negative |

- True Positives (TP): Predicted target event a **Positive**, and the actual event is a positive.
- True Negatives (TN): Predicted target event a **Negative**, and the actual event is a negative.
- False Positives (FP): Predicted target event a **Positive**, and the actual event is a negative.
- False Negatives (FN): Predicted target event a **Negative**, and the actual event is a positive.
- As mentioned above, we can use TP, TN, FP and FN values to calculate accuracy, recall, loss, detection and overkill:
  - Accuracy = (TP+TN) / (TP+FP+FN+TN)
    - Accuracy is the ratio of total sum of all true events predicted over total sum of all predicted events.
  - Precision = TP / (TP+FP)

- Precision is the ratio of true positive events predicted over total sum of all predicted positive events.

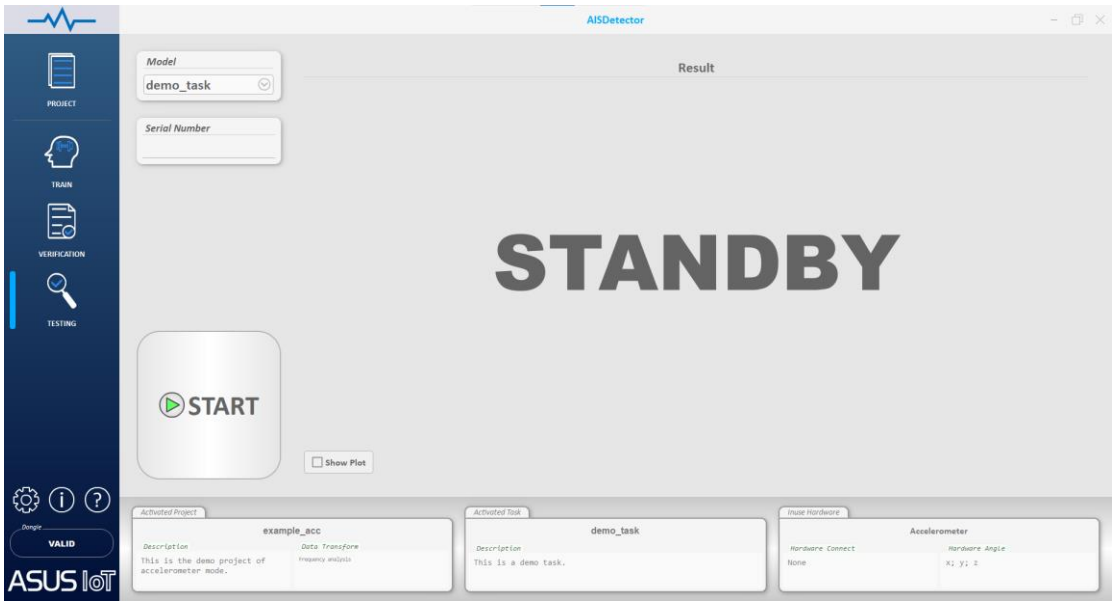
- Recall = TP / (TP+FN)
  - Recall is the ratio of true positive events predicted over total sum of actual positive events.
- Loss = FN / (TP+FN)
  - Loss is the ratio of FN events over total sum of actual positive events.
- Detection = TP / (TP+FN)
  - Detection is equal to Recall.
- Overkill = FP / (FP+TN)
  - Overkill is the ratio of false positive events over sum of total actual negative events.

**Examples of Confusion Matrix**

- Let's say, there are a batch of examinees total of 100 pcs. The true event is that 92 are good and 8 are no-good with defect.
- The examination event is as below:
  1. 5pcs examined with defects, and they are defect parts (True Positive)
  2. 90pcs examined good, and they are actually good parts (True Negative)
  3. 3pcs examined with defects, and they are actually good parts (False Positive)
  4. 2pcs examined good, and they are defect parts (False Negative)"
- Hence, the result as below
  1. **Accuracy = (TP+TN) / (TP+TN+FP+FN) = (5+90) / (5+90+3+2) = 95%**, meaning 95% of total examination events are accurate result.
  2. **Precision = TP / (TP+FP) = 5 / (5+3) = 62.5%**, meaning 62.5% of total examined defect events are actually defect events.
  3. **Recall or Detection = TP/ (TP+FN) = 5 / (5+2) = 71.4%**, meaning 71.4% total actual defect parts examined as defect events.
  4. **Loss = FN/ (TP+FN) = 2 / (5+2) = 28.6%**, meaning 28.6% total defect parts are not examined as defect events.
  5. **Overkill = FP/ (FP+TN) = 3 / (3+90) = 3.2%**, meaning 3.2% of total good parts are examined as defect events.

## 2.5 Testing

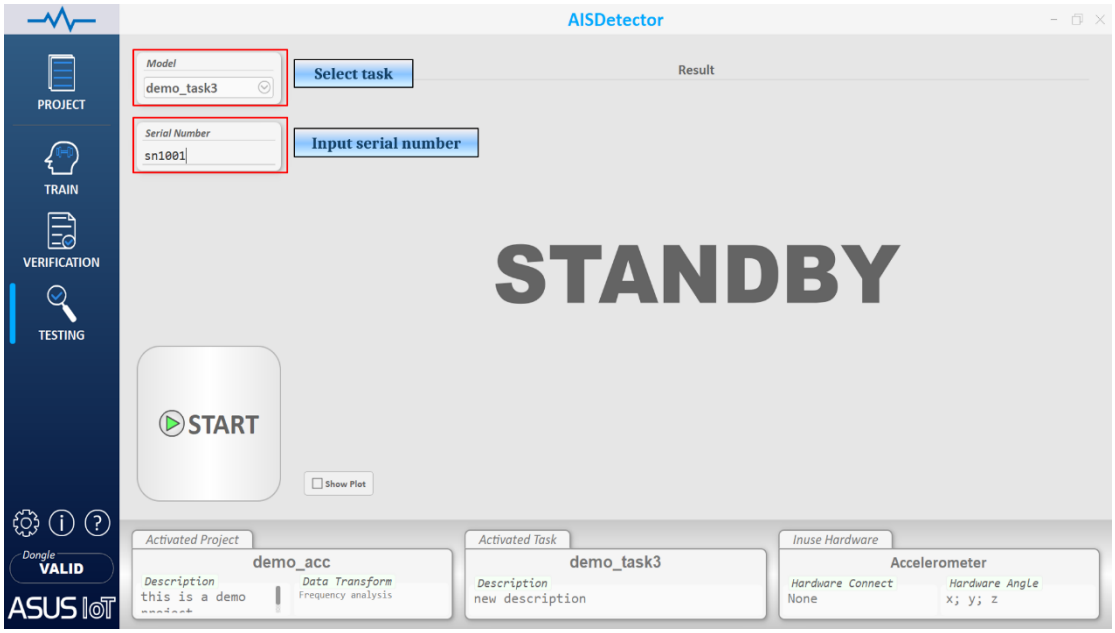
This section shows how to use a model to test and for further evaluation.





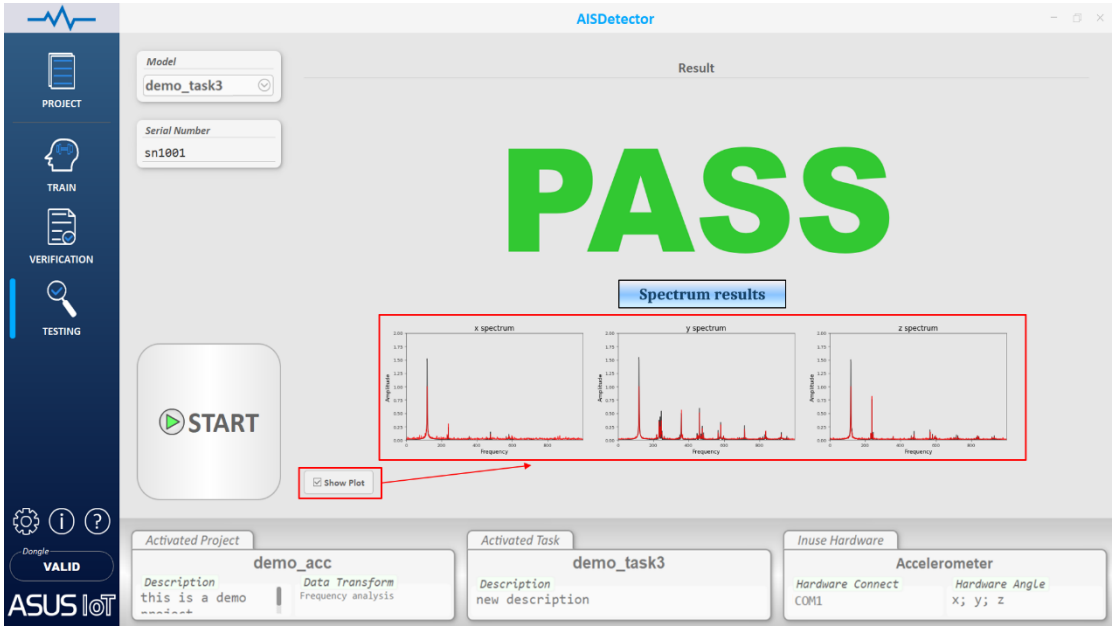
### 2.5.1 Select model

- Before performing any tests, double check that a model is selected and there is equipment input. Once confirmed, click **Start**.



## 2.5.2 Result – Pass/Fail

- Real-time result (Pass/Fail) is shown on the screen for the model selected. You can also select **Show Plot** to show the waveform for further analysis.



# Chapter 3: Upgrading AISDetector

## 3.1 Complimentary software upgrade policy

You are eligible for a complimentary upgrade under the following circumstances.

- A new version of AISDetector is released with bug fixes
- A new version of AISDetector is released with new features/functions/pre-trained models within 365 days of your AISDetector purchase

Otherwise, you will need to pay for an upgrade.

## 3.2 How to upgrade AISDetector

Go to the ASUS IoT website and find the AISDetector upgrade page.
Click **Upgrade**, and the website will check whether your AISDetector is eligible for an upgrade. If it is eligible for a complimentary upgrade, the system will automatically perform the upgrade.
Once the upgrade is complete, re-install and re-activate again by following the same instructions for first-time installation and activation of your AISDetector software.

## 3.3 Cost to upgrade AI Software

Check with your ASUS representative for more details.

# Chapter 4: Support for your AI software

## 4.1 Before you call customer support

### 4.1.1 Troubleshooting

Double check your hardware and software settings to make sure that they are set to run as designed.

### 4.1.2 Call for support

Find the phone number of the ASUS IoT support center that is nearest to or most convenient for you.

A log file will be generated and saved in the system file manager folder (AISDetector_version\etc\Log).

# Appendix

## Safety Information

CAN ICES-003(B) / NMB-003(B)

## Regulatory notice


## Contacting ASUS

**Taiwan**

Talk to us

AIS_support@asus.com

Call Us | Official Support | ASUS Global

**China**

官方支持 | ASUS 中国

**Germany**

Telefonische Produktunterstützung

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Telefon Österreich

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**USA**

Chat with us

1-888-678-3688

https://www.asus.com/us/support