ASRock Industrial

RBK-100 Robotics-in-a-Box AiRoboStarter User Manual

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Introduction

AiRoboStarter supports robotic demonstration recording and AI model training on the NUC BOX-358H. All operations are performed locally without requiring a cloud connection or user account. Recorded data remains on the device.

The RBK-100 kit includes the following primary components:

- **Robotic arms:** The Leader Arm is manually operated to control the Follower Arm, which reproduces the demonstrated movements.
- ***NUC BOX-358H* edge computing system:** Runs the pre-installed RoboStarter software and performs recording, training, and inference locally.
- **AiRoboStarter Software Image:** Provides a setup wizard, dashboard, and Physical AI Studio for training and inference using ACT and Pi0.5 models.



This manual describes the procedures shown in Operation Demo Videos 1–3. The reference task, "pick red block," involves guiding the Follower Arm with the Leader Arm to pick up a red block and place it in the designated PLACE AREA on the workspace mat.

Workflow overview: Launch setup wizard → Open dashboard → Open Physical AI Studio → Create project → Configure robotic arms → Configure cameras → Configure recording environment → Record dataset → Verify episodes → Train model → Monitor training → Run inference.

Before You Begin

Enter password: **asrirobotic**. Connect the following hardware to the *NUC BOX-358H* before starting. Refer to the demonstration videos for the connection arrangement.

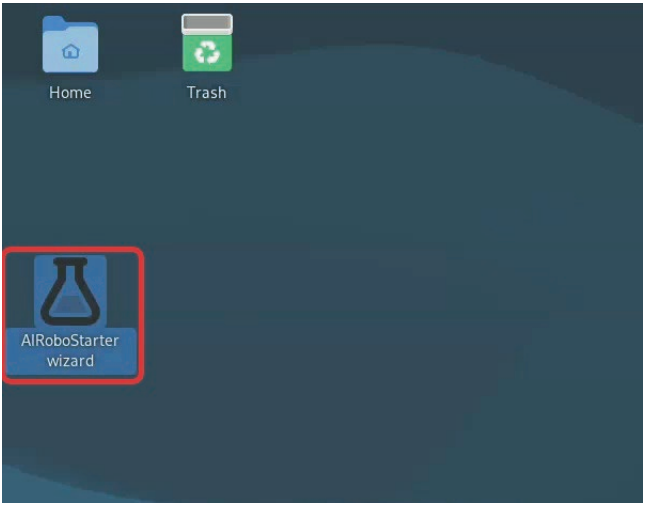
Item	Demo Configuration	Purpose
NUC BOX-358H	AiRoboStarter installed; "AIRoboStarter wizard" desktop icon	Runs the software and supports recording and training
Follower robotic arm	USB connection; /dev/ttyACM0 in the demo	Executes the demonstrated task
Leader robotic arm	USB connection; /dev/ttyACM1 in the demo	Provides manual control of the Follower Arm
Overhead camera	RGB-D CAM (RGB stream)	Captures an overhead view of the workspace
Wrist camera	USB2.0_CAM1	Mounted near the Follower gripper for close-up video
Workspace mat and Play cubes	ASRock Robotics Workspace mat (includes PLACE AREA)	Workspace for the demonstration task

Ensure that the system sudo password is available before proceeding. The setup wizard requires this password to start services. Robotic arm port assignments may differ from those shown in the demonstration; use the identification procedure in Step 4.

Step 1: Start Services with the AiRoboStarter Wizard

1. Connect all devices (leader, follower, headcam, wristcam) to the I/O ports recommended by the specifications.
   https://download.asrock.com/IPC/Download/e-catalog/RBK-100_Robotics-in-a-box.pdf
2. After powering on, enter the default password “asrirobotic” at the login screen to log in to the operating system.
3. Services do not start automatically at system boot. Run the desktop setup wizard at the be- ginning of each session. The SKU2 wizard contains five pages—one more than SKU1 (**Agent- Flow package**)—and starts both Physical AI Studio and AgentFlow Studio.

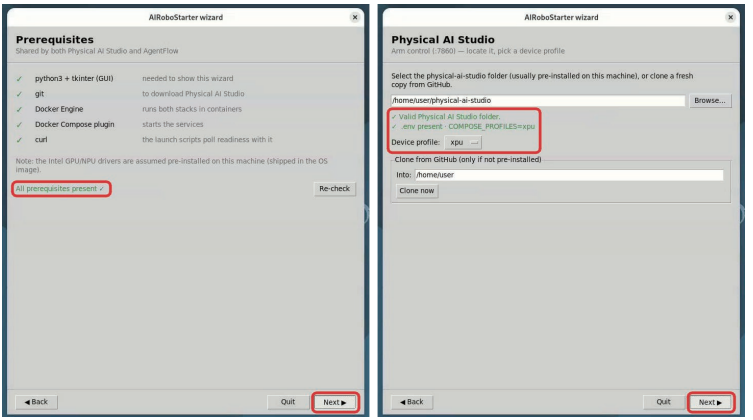
1. Double-click the **AIRoboStarter wizard** icon on the desktop.



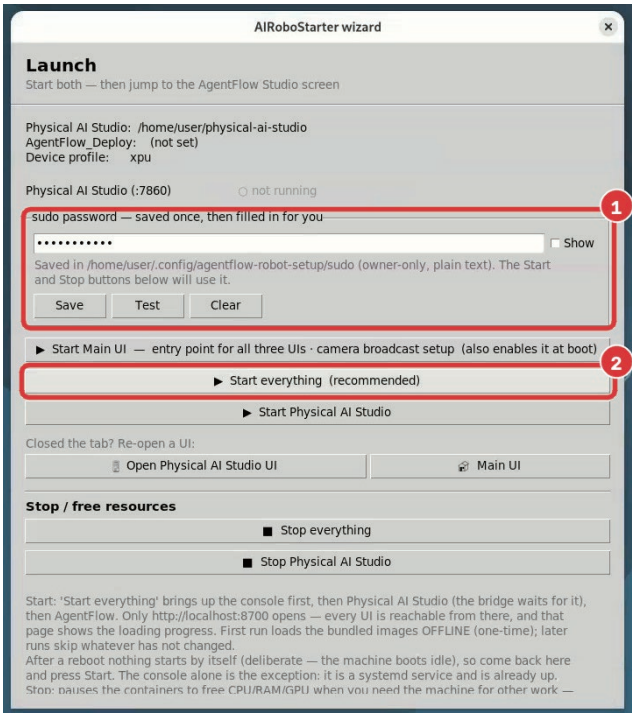
2. On the **Welcome** page, click **Next**. The wizard checks the environment, locates Physical AI Studio, and starts the application.



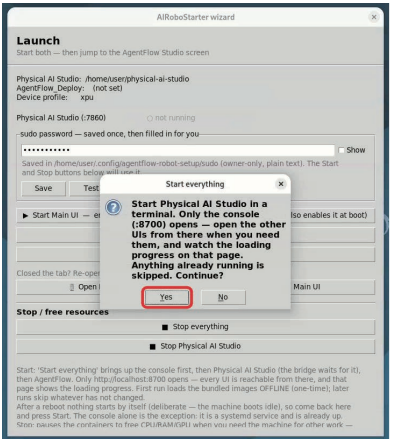
3. The next two pages perform automatic checks. Verify the indicated results, and then click Next:
   - **Prerequisites (left):** Confirm that "All prerequisites present ✓" is displayed.
   - **Physical AI Studio (right):** Confirm that "Valid Physical AI Studio folder" is displayed and Device profile is set to xpu.

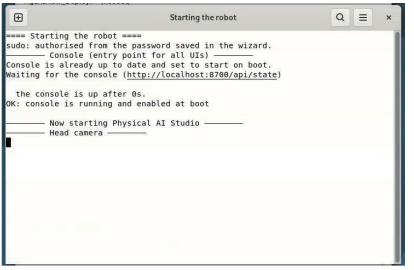


4. On the **Launch** page, complete the following steps:
   ① During initial setup, enter the sudo password and click **Save**. The wizard stores the password for subsequent sessions
   ② Click **Start everything (recommended)**.



5. Click **Yes** in the confirmation dialog. The “Starting the robot” terminal displays startup progress. The dashboard then opens automatically in the browser.

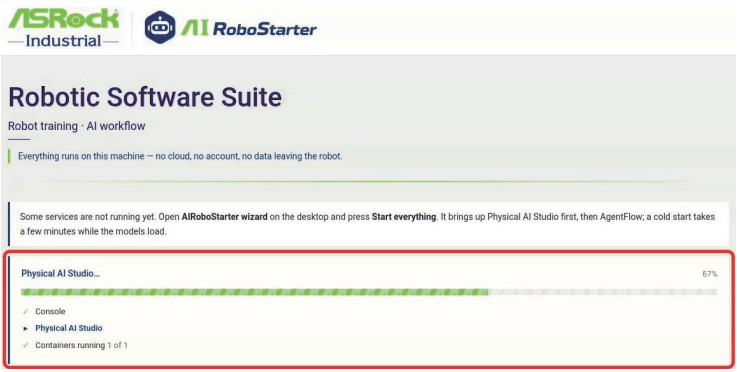




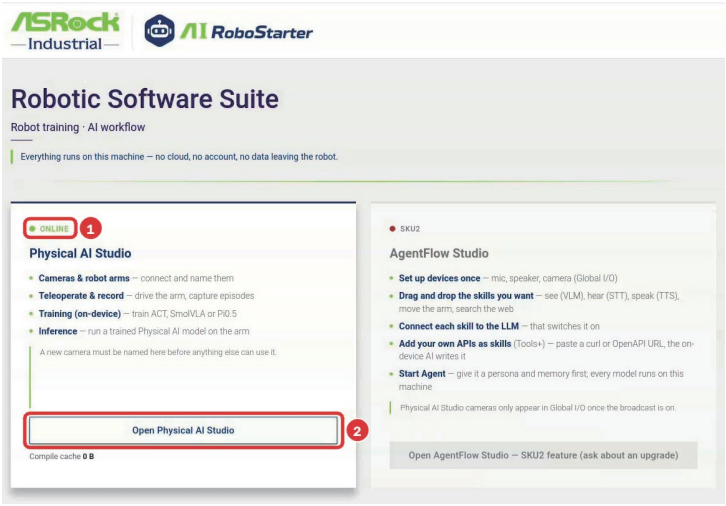
Step 2: Open Physical AI Studio from the Dashboard

After Start everything is selected, the dashboard opens automatically at http://localhost:8700. Use the dashboard to access the application interfaces.

1. The dashboard displays Physical AI Studio startup progress. During initial startup, local container images are loaded, which may take several minutes. Startup takes approximately 12 seconds in the demonstration.



2. When the Physical AI Studio card displays ① **ONLINE**, click ② **Open Physical AI Studio**.

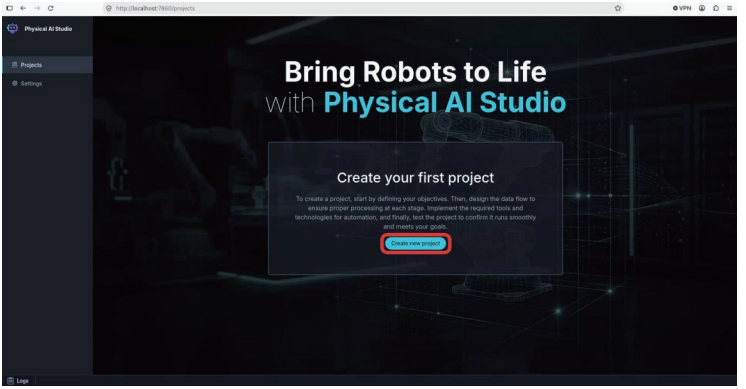


AgentFlow Studio, shown on the right, is available with SKU2 and is outside the scope of this manual.

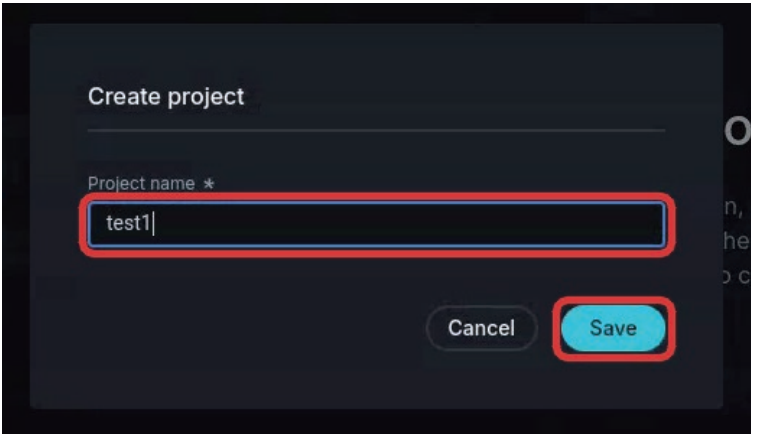
Step 3: Open Physical AI Studio and Create a Project

Physical AI Studio provides the interface for robotic arm control, demonstration recording, and model training. Access it at http://localhost:7860.

1. During initial setup, the “Create your first project” prompt appears. **Click Create new project**.



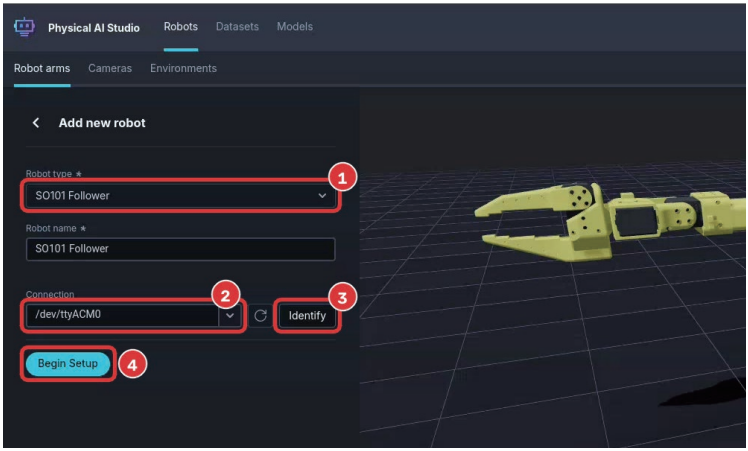
2. Enter a project name (test1 in the demonstration), and then click **Save**. The **Robots** page opens for the new project.



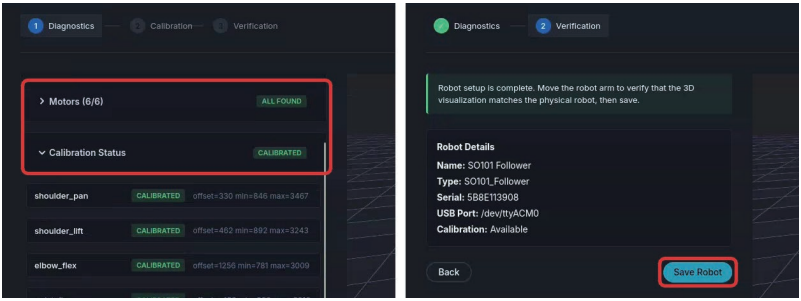
Step 4: Add the Follower and Leader Arms

Configure each robotic arm separately, beginning with the Follower Arm and then the Leader Arm.

1. Navigate to **Robots → Robot arms**. In the "Add new robot" form, configure the Follower Arm as follows:
   ① **Set Robot type to SO101 Follower**. Robot name is populated automatically.
   ② **Under Connection**, select the appropriate arm port. The menu lists serial numbers and port assignments (Follower Arm in the demonstration: 5B8E113908, /dev/ttyACM0).
   ③ Click **Identify** and observe which arm gripper moves to verify the selected port. The Follower Arm has a gripper; the Leader Arm has a finger ring.
   ④ Click **Begin Setup**.

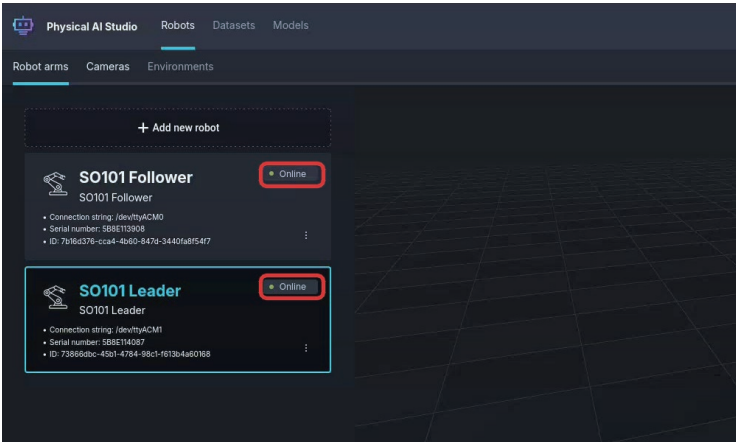


2. The system performs **Diagnostics** first. Verify that Motors (6/6) displays ALL FOUND and Calibration Status displays CALIBRATED (left). Under Verification, move the physical arm and confirm that the 3D model follows its motion. Click **Save Robot** (right).



The arms used in the demonstration are pre-calibrated, so setup proceeds directly to Verification. An additional Calibration step is required for uncalibrated arms.

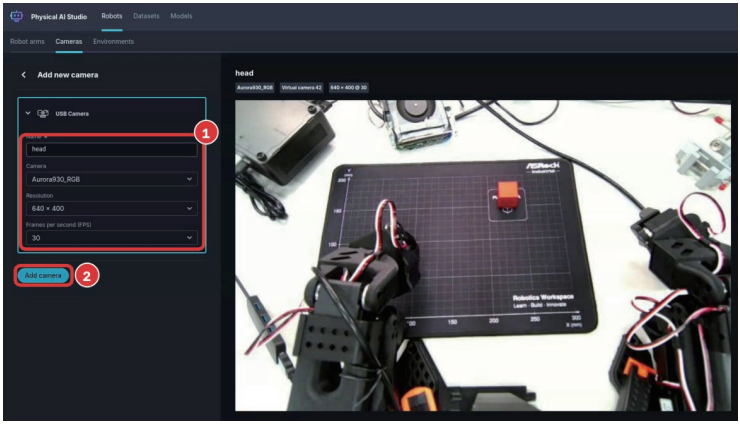
3. Click + **Add new robot** to configure the Leader Arm. Set Robot type to **SO101 Leader** and select the remaining port (/dev/ttyACM1 in the demonstration).
4. Verify that both arms are listed with **Online** status.



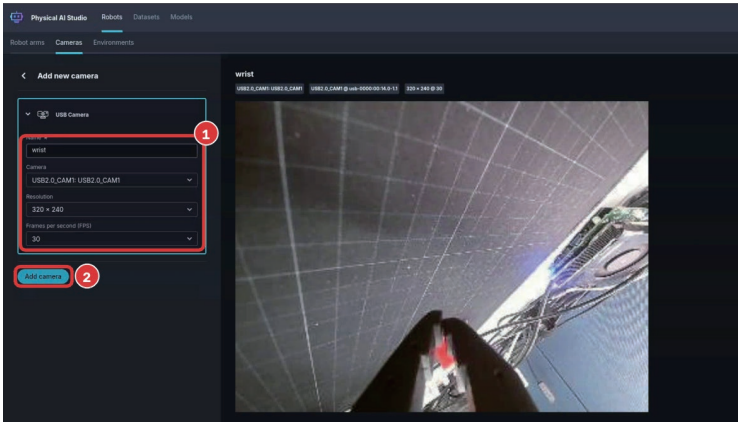
Step 5: Add the Overhead and Wrist Cameras

Two cameras are required for recording: an overhead camera covering the workspace and a wrist camera mounted on the Follower Arm for close-up views.

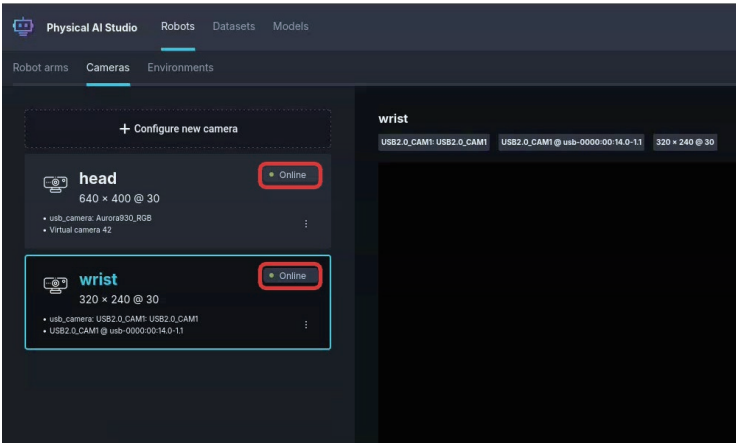
1. Navigate to **Robots** → **Cameras**. Configure the overhead camera in the "Add new camera" form:
   ① Set Name to **head**, Camera to **Aurora930_RGB**, Resolution to **640 × 400**, and FPS to **30**. The Aurora930 provides Depth, IR, and RGB streams; select RGB.
   ② Verify that the live preview displays the entire workspace mat, and then click **Add camera**.



2. Configure the wrist camera. Set Name to **wrist**, Camera to **USB2.0_CAM1**, Resolution to **320 × 240**, and FPS to **30**. Click **Add camera**.



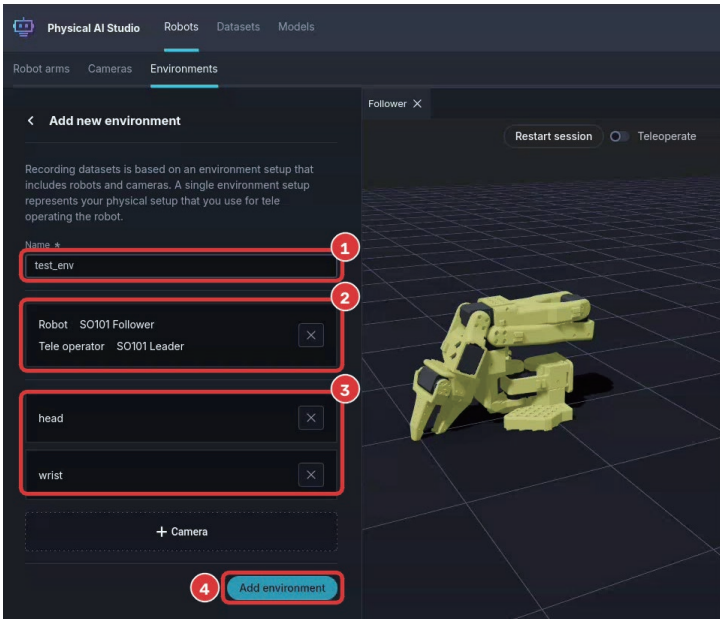
3. Verify that both cameras are listed with Online status.



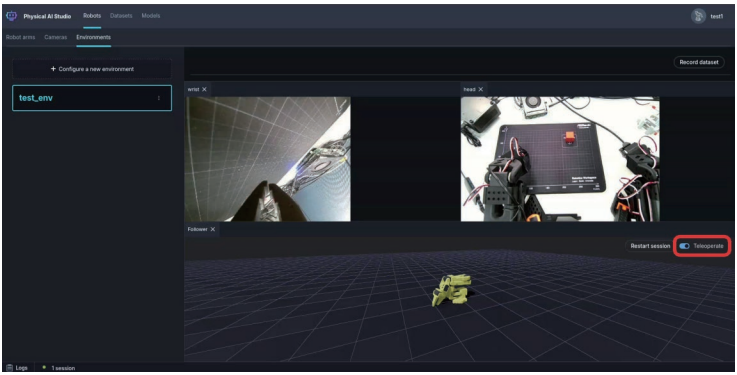
Step 6: Configure a Teleoperation Recording Environment

An Environment defines a reusable configuration of robotic arms and cameras for dataset recording.

1. Navigate to **Robots** → **Environments** and click **Configure a new environment**. Specify the following settings:
   ① **Name:** Enter an environment name (test_env in the demonstration).
   ② **Robot:** Select SO101 Follower under Robot (Follower) and SO101 Leader under Robot (Leader, optional). Click Add.
   Leader: Although the Leader field is labeled optional, select the Leader Arm for this procedure. Teleoperation and demonstration recording require Leader Arm control of the Follower Arm.
   ③ **Add camera:** Select **head** and click **Add**. Click **+ Camera** to add **wrist**.
   ④ Click **Add environment**.



2. The new environment displays the wrist and head camera feeds and a 3D model of the Follower Arm. Enable Teleoperate, move the Leader Arm, and verify that the Follower Arm reproduces its movements.

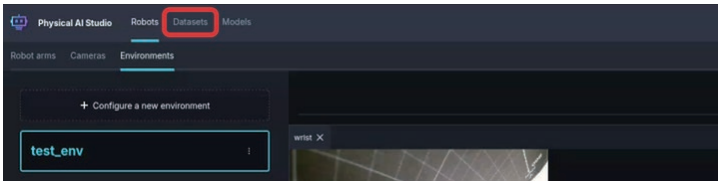


Disable **Teleoperate** after completing verification.

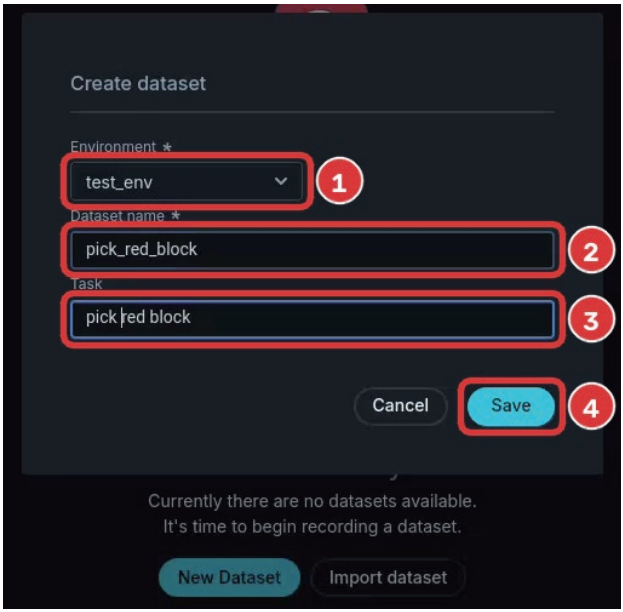
Step 7: Create a Dataset and Record Demonstrations

Each demonstration is recorded as one episode. Use the Leader Arm to guide the Follower Arm through the complete task of "picking up the red block and placing it in the PLACE AREA". The demonstration contains 28 saved episodes, each approximately 10–20 seconds long.

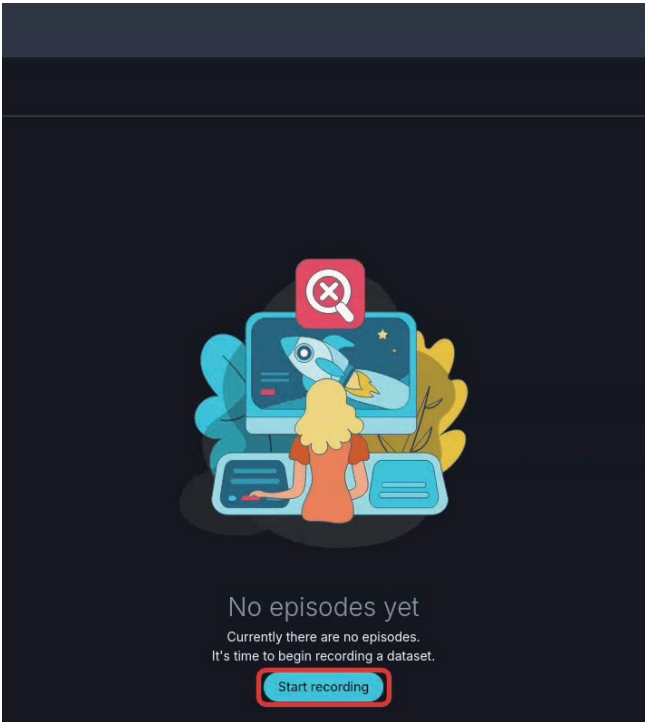
1. Open the **Datasets** tab, click **New Dataset**, and configure the following fields:



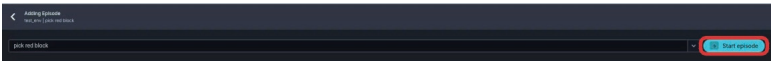
① **Environment:** Select the previously configured test_env environment.
② **Dataset name:** Enter a name (pick_red_block in the demonstration).
③ **Task:** Enter a one-sentence task description (pick red block in the demonstration).
④ Click **Save**.



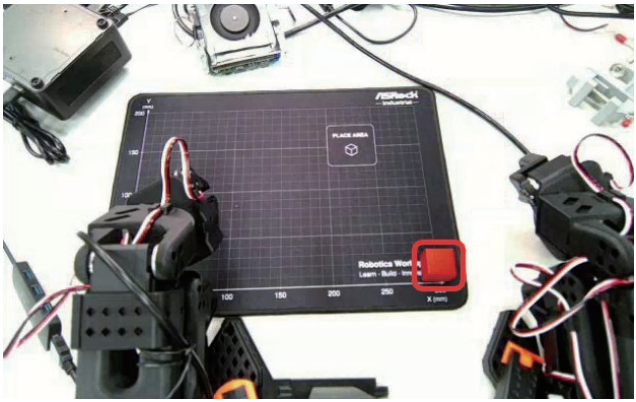
2. The newly created dataset contains no episodes. Click **Start recording** to open the recording interface.



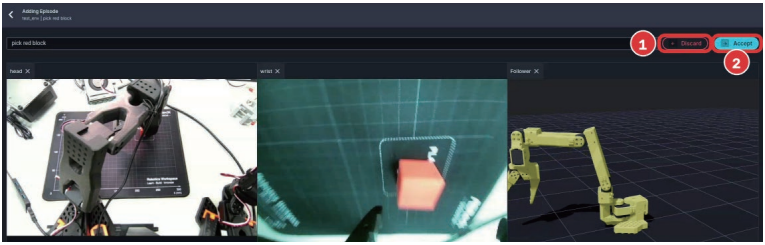
3. Position the red block at its starting location, and then click **Start episode** in the upper-right corner.



Place the block within the workspace but outside the PLACE AREA. The following image shows the overhead camera view before Episode 1, with the block in the lower-right corner:



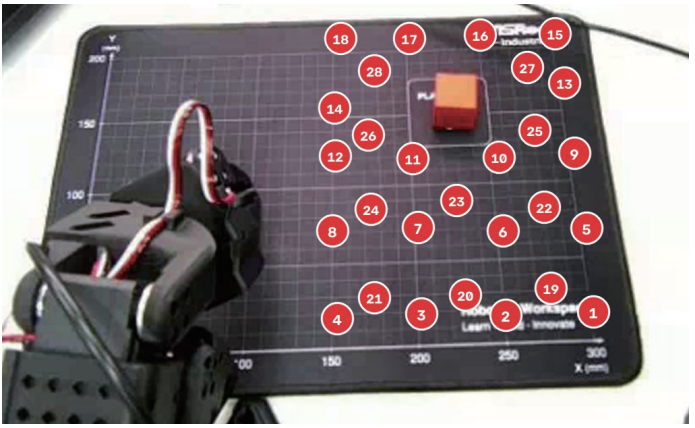
4. Use the Leader Arm to guide the Follower Arm in placing the red block in the PLACE AREA. Click ② **Accept** to save a successful demonstration or ① **Discard** to reject an unsuccessful recording.



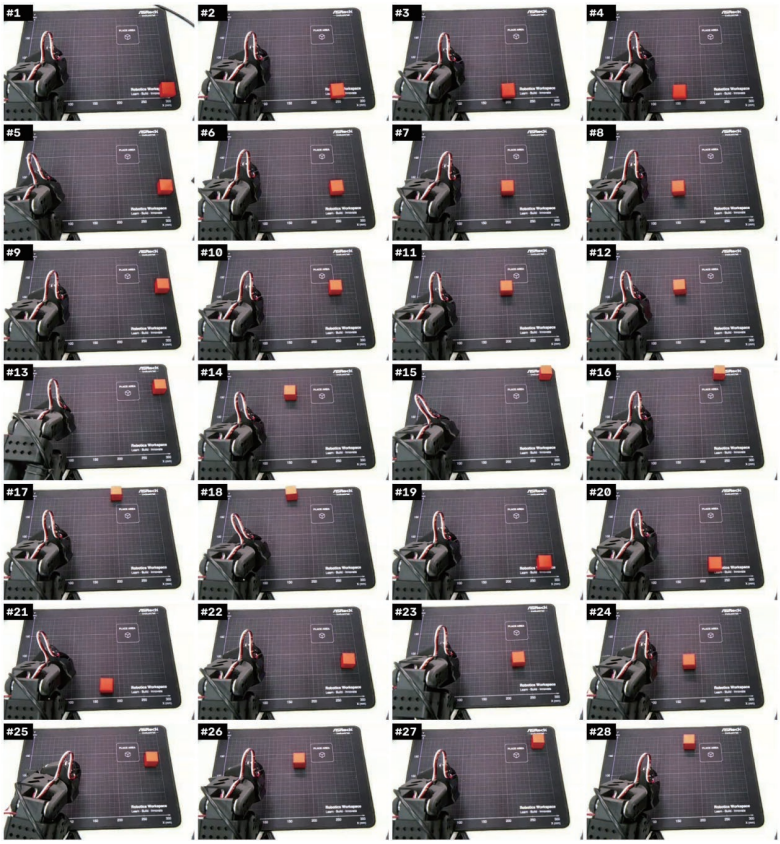
5. **Reset the workspace:** After each accepted episode, move the red block to a different starting location before selecting Start episode again. Vary the starting positions across the workspace to capture demonstrations from multiple locations. Repeat until the required episodes have been recorded.

Starting Positions for the 28 Episodes

The following image identifies the starting locations for all 28 demonstration episodes. Numbers indicate episode order. Starting locations are distributed around the PLACE AREA; the block shown in the diagram identifies the target PLACE AREA.



The following overhead camera images show the initial block position for each episode.

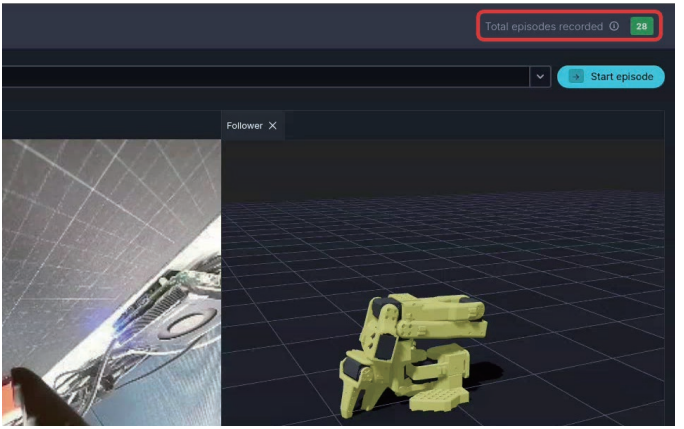


In the demonstration, Start episode was selected 30 times; two recordings were discarded and 28 episodes were saved.

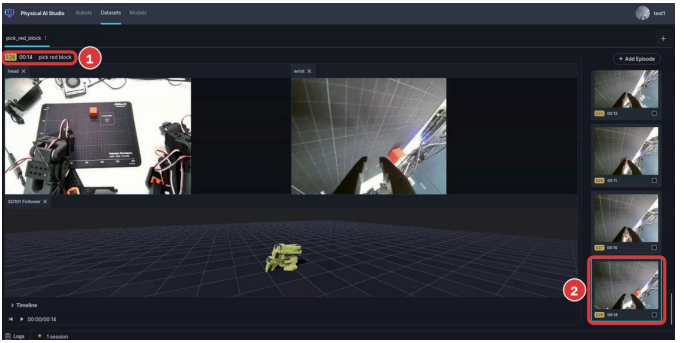
Step 8: Verify the Dataset Episode Count

After recording, verify the saved episode count (28 in the demonstration).

1. **Total episodes recorded**, in the upper-right corner of the recording interface, displays the number of saved episodes.



2. Click the back arrow in the upper-left corner to return to the dataset page. The list on the right displays episode thumbnails and durations. Scroll to the final entry, ② **E28**. Select an episode to review the head and wrist camera feeds and Follower Arm motion in the left pane ① .

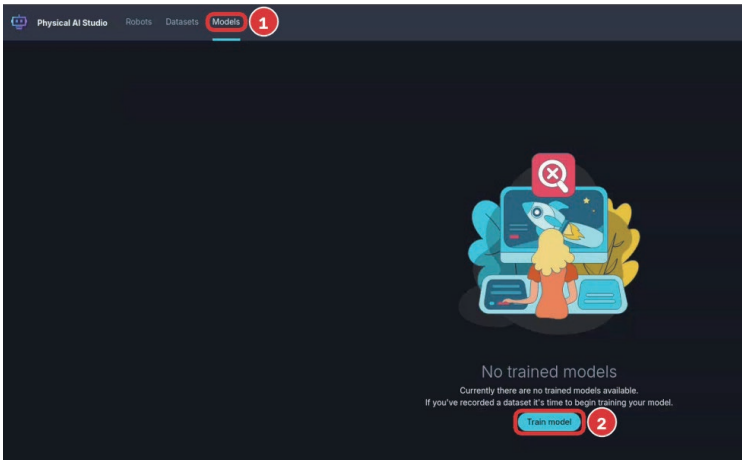


To record additional demonstrations, click **+ Add Episode** above the episode list.

Step 9: Train an ACT Model

After verifying the dataset, train the model locally on the NUC BOX-358H. Cloud upload is not required.

1. Open the ① **Models** tab and click ② **Train model**.

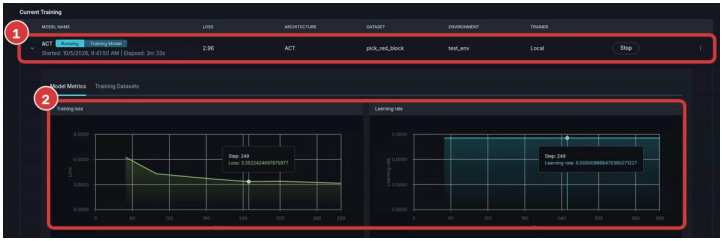


2. In the Train model dialog, specify the following settings:
   ① **Dataset:** Select pick_red_block.
   ② **Run on:** Select This machine (local).
   ③ **Policy:** Select **ACT**, a lightweight model with a shorter training time. **Pi0.5** is also available. Training Steps is calculated automatically after a model is selected.
   ④ **Advanced settings:** Training Steps is calculated based on the selected dataset. The demonstration uses 53,474 steps (Batch Size 8), with an estimated duration of approximately 6 hours 59 minutes. Keep Precision set to 32-bit (recommended for XPU).
   ⑤ Click **Train**.



The upper-right corner displays the compute device (Intel(R) Graphics, 29 GB VRAM in the demonstration). Selecting Pi0.5 recalculates the training steps (5,781 steps and approximately 36 hours for the demonstration dataset). Pi0.5 training uses nearly all available system memory. Close other memory-intensive applications before training.

3. During training, Current Training displays ① status (Running), Loss, dataset, and environment. Model Metrics plots ② Training loss and Learning rate. In the demonstration, the curves appear after approximately 3.5 minutes, and Loss decreases from approximately 6.3 to 3. Click Stop to cancel training if required.



Step 10: Monitor Training in Real Time

Return to the **Models** tab to monitor training progress and changes in Loss. The following image shows the training status after 1 hour 16 minutes.

① **Training status:** Displays Running, the start time, and Elapsed time.
② **Loss:** Displays the current Loss value (approximately 0.19 in the demonstration, down from approximately 6.3).
③ **Model Metrics:** Displays Training loss, Validation loss, and Learning rate charts. Hover over a curve to display the value at a specific Step.
④ **Overall progress:** The Status field in the lower-left corner displays "Training model (ACT) 16%" in the demonstration.

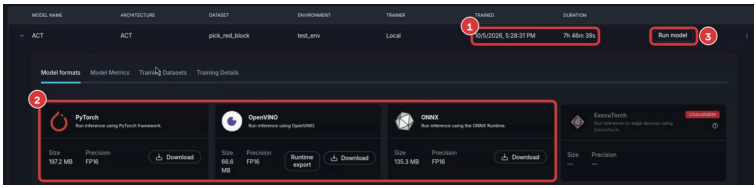


The Training loss curve indicates the change in Loss over time. In the demonstration, the steepest decrease occurs during the first 1,500 steps, followed by a gradual leveling off. Validation loss is calculated every 1,213 steps; other steps display Not available.

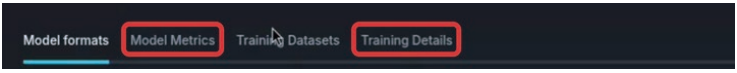
Step 11: Verify the Model and Run Inference

After training is complete, verify that the model was exported successfully and run inference to execute the task autonomously. In the demonstration, the arm completes 11 successful pick-and-place cycles over approximately 6 minutes.

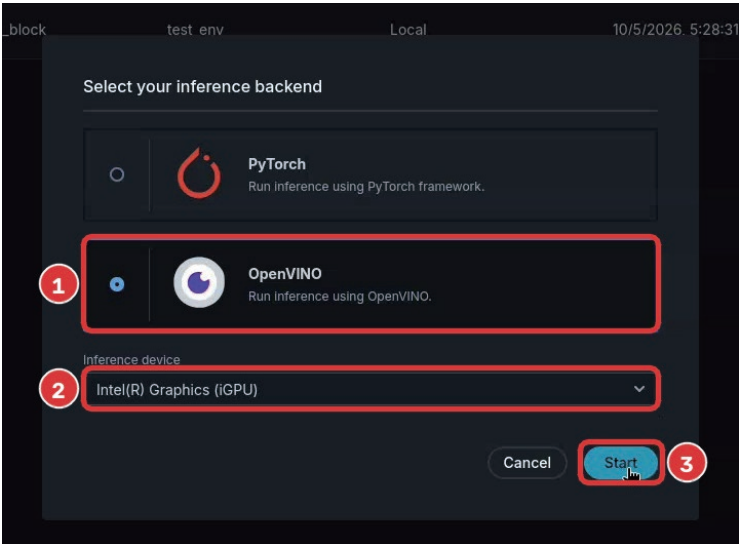
1. **Verify training and export**: Confirm that the completed model appears in the Models list.
   ① Trained displays the completion time; Duration displays total training time (7h 46m 39s in the demonstration).
   ② Open the model and select **Model formats**. Verify that PyTorch (197.2 MB), OpenVINO (66.6 MB), and ONNX (135.3 MB) are listed, indicating successful export. Click Download to save the required format.
   ③ Click **Run model**.



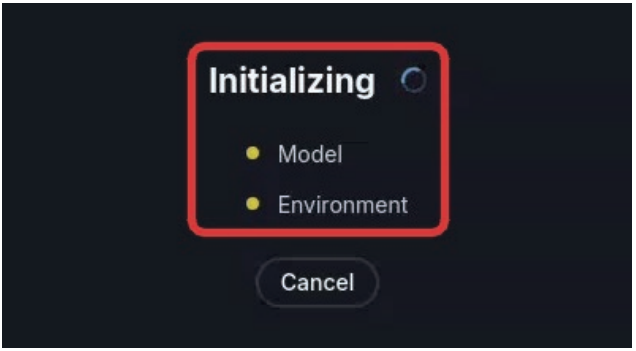
The same panel provides Model Metrics with the complete training curves and Training Details with model inputs, outputs, and training parameters.



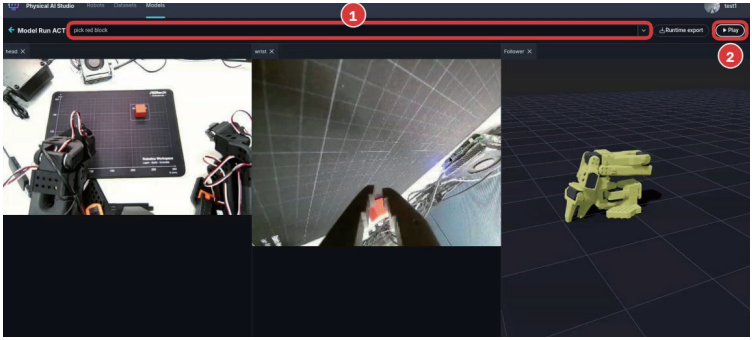
2. **Configure the inference backend**: ① Select **OpenVINO**, ② set Inference device **to Intel(R) Graphics (iGPU)**, and ③ click **Start**.



3. Wait for model compilation to complete. The interface displays Initializing while Model and Environment load sequentially (approximately 10 seconds in the demonstration).



4. On the Model Run page, ① verify that the task is pick red block and position the red block on the mat; then ② click **Play**. The button changes to **Stop** when inference starts.



5. The Follower Arm picks up the block, places it in the PLACE AREA, and returns to its starting position. During inference, reposition the block for subsequent attempts. Each cycle takes approximately 8–10 seconds in the demonstration. Click **Stop** to end inference.

Successful Examples

The following overhead camera images show three successful inference runs from different starting positions.

Example 1: Block on the right side of the mat



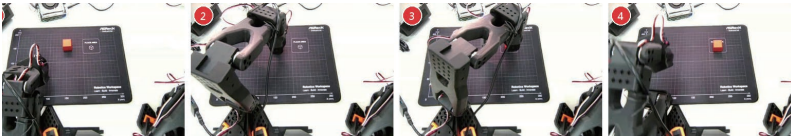
Block at the Starting Position | Grasp the Block with the Robotic Arm | Move the Block to the PLACE AREA | Release the Block and Return the Arm to its Initial Position

Example 2: Block near the middle-left of the mat



Block at the Starting Position | Grasp the Block with the Robotic Arm | Move the Block to the PLACE AREA | Release the Block and Return the Arm to its Initial Position

Example 3: Block in the upper-left corner of the mat



Block at the Starting Position | Grasp the Block with the Robotic Arm | Move the Block to the PLACE AREA | Release the Block and Return the Arm to its Initial Position

If the Arm Gets Stuck

If the arm becomes stuck within a limited area and repeatedly fails to pick up the block, click **Stop** and then **Play**. The arm returns to its starting position, allowing the model to retry from a known state.



Robotic arm is positioned next to the block but cannot grasp it | Click **Stop** to pause, then click **Play** to resume | Robotic arm returns to its initial position. Retry the operation

Notes and Troubleshooting

Issue	Recommended Action
Physical AI Studio does not open after system restart	Services do not start automatically. Return to the Launch page of the AIRoboStarter wizard and click **Start everything**. Open the dashboard at localhost:8700 from the wizard; click Main UI on the Launch page to reopen it.
Browser tab is closed	On the wizard's Launch page, click **Open Physical AI Studio UI** or **Main UI** to reopen the interface.
Computing resources are required for other tasks	On the wizard's Launch page, click **Stop everything** or **Stop Physical AI Studio** to pause containers and free CPU, memory, and GPU resources.
System performance decreases during Pi0.5 training	Pi0.5 training may make the system unresponsive. Avoid other work on the computer while training and exporting. If performance remains degraded after export, click **Stop everything** and then **Start everything** on the wizard's Launch page to release swap usage (especially important for the 32 GB SKU1); Alternatively, restart the system after confirming that Pi0.5 training has completed successfully to quickly free up memory.
Initial startup takes longer than subsequent startups	On first startup, the system loads the bundled images locally and offline. This is a one-time operation; subsequent starts skip unchanged components.
Robotic arm port assignment is unclear	When adding an arm, select a port and click **Identify** (see Step 4).
Demonstration recording is unsuccessful	Click **Discard**, reset the block, and record the episode again. Discard unsuccessful demonstrations.
Robotic arm becomes stuck during inference	Click Stop, then click Play. The arm returns to its starting position and retries from a known state (see Step 11).



The factory-default sudo password is asrirobotic. The password can be changed after setup.

The wizard stores the sudo password as plaintext in /home/user/.config/agentflow-robot-setup/sudo. The file is readable only by its owner.