ORNA User Manual

Intelligence-First Robotics Platform

For Universal Robots

Document Version	1.1
Release Date	19th May 2026
Software Version	ORNA v1.1
Compatible Robots	CB Series - UR3, UR5, UR10 e-Series - UR3e, UR5e, UR7e, UR10e, UR12e, UR16e UR Series – UR20, UR30
Minimum Polyscope version	PolyScope 3 – 3.15.0 or higher PolyScope 5 – 5.25 or higher PolyScope X – 10.11 or higher
Required OS version on Host Machine	Windows – Windows 10 or Windows 11 Linux – Ubuntu 22.04
Supported Browser	Chrome or any Chromium-based browser (e.g. Brave, Edge)

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1. INTRODUCTION

1.1 About This Guide

This user manual provides comprehensive instructions for installing, configuring, operating, and maintaining the ORNA Intelligence Platform for Universal Robots. ORNA transforms industrial robotics by providing behavior-based intelligence, 3D vision capabilities, and AI reasoning that enables companies without deep robotics expertise to deploy adaptive automation solutions in hours

Intended Audience

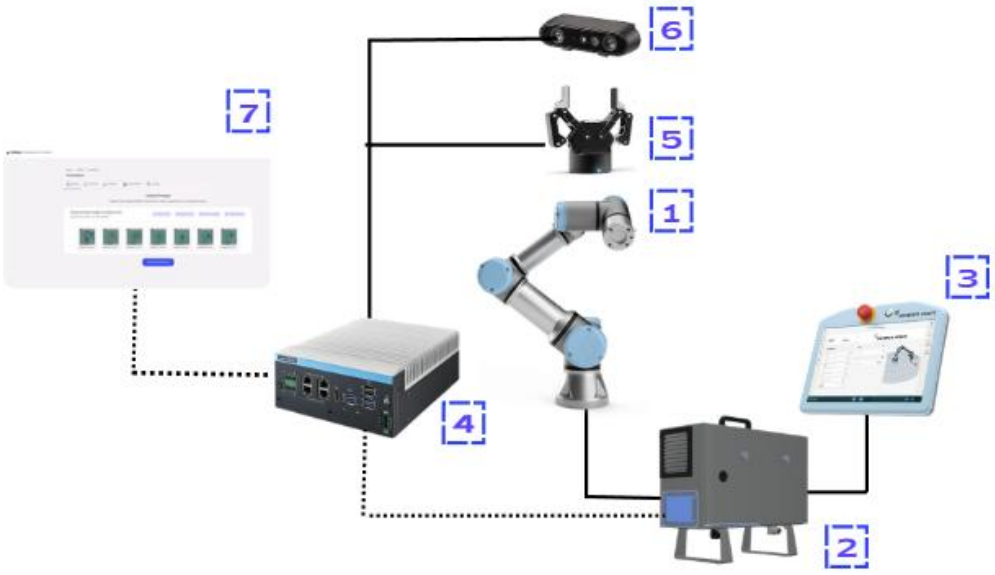
- AI developers and robotics engineers
- System integrators
- Production engineers
- Maintenance technicians

Product Description

ORNA Console is an AI-powered robotics development platform that enables developers to build custom vision-guided automation solutions without low-level programming. The platform consists of three integrated layers:

- ORNA SDK: Python SDK for Machine vision and Robotic manipulation
- ORNA Vision: ORNA Configurable Perception Service for Machine Vision
- ORNA Appication: Programming interface and configuration tools

1.2 System Overview



1. **UR Robots –** We support different generations of Industrial Robots from UR

2. **UR Teach Pendant -** Initiate Robot and monitors robot status, provides emergency stop and manual control

3. **UR Control Box**: Compatible with **CB-Series** and **e-Series** controllers. Built and tested with **CB3.1 (PolyScope 3.x)** and **e-Series CB5 (PolyScope 5.6 and above)**

4. **ORNA Edge Device -** NVIDIA Jetson Orin-based edge computer for vision processing, motion planning, real-time control

5. **3D Vision Camera –** Included in ORNA kit Depth camera providing 3D machine Vision

6. **Gripper/End Effector – Purchased separately and** ORNA provides pre-configured profiles for supported gripper models

7. **ORNA Web UI (Browser-Based) -** Development and runtime environment hosted on the ORNA Edge Device. Access via any web browser by entering the Edge device IP address – **no software installation required on the host machine**

Key architectural principles:

- **Single Robot Control**: Each ORNA Edge Device controls ONE UR Robot at a time
- **Single Edge Connection**: ORNA Desktop App connects to ONE ORNA Edge at a time for development and configuration
- **Edge-Based Real-Time Control**: ORNA Edge executes all real-time robot commands locally
- **Browser-Based Operation**: All programming, configuration, and runtime control is accessed via web browser – no desktop application installation required
- **Camera-Edge Connection**: Camera MUST be physically connected to the same Edge device controlling the robot

1.3 What's in the Box – ORNA AI Kit

ORNA AI Kit includes:

- ORNA Edge Device — Pre-installed AI software, ready to connect
- Orbbec Gemini 335L Camera — 3D depth perception
- UR Tool Flange Mount — Fits all CB3 and e-Series robots, includes fasteners
- Connection Cables — USB-C camera cable and power supply
- Getting Started Kit — Quick start guide, user manual, and setup instructions

2. System Setup and Safety Information

WARNING: Read all safety information before installing or operating ORNA. Failure to follow safety guidelines may result in serious injury or death.

2.1 General Safety Requirements and Operating Environment

- ❑ Only qualified personnel should install, configure, and maintain ORNA
- ❑ Follow all Universal Robots safety guidelines for robot operation
- ❑ Conduct application-specific risk assessment before deployment
- ❑ Configure appropriate safety zones and speed limits
- ❑ Ensure emergency stop buttons are accessible and functional
- ❑ Keep workspace clear of obstacles and personnel during operation
- ❑ Never bypass safety functions or protective devices

2.2 First-time configuration of Universal Robot System

ORNA requires initial configuration of the Universal Robot controller to enable external control and establish communication between ORNA Edge and the robot. This one-time setup installs necessary URCaps, configures network settings, and creates the base program that ORNA will use to control robot movements. Once completed, this configuration remains persistent across robot power cycles and only needs to be repeated if the robot controller is reset to factory defaults.

Prerequisites:

Before beginning robot configuration, ensure:

- Robot is powered on with Minimum PolyScope version:
  - PolyScope 3 → 3.15 or higher
  - PolyScope 5 → 5.25 or higher
  - PolyScope X → 10.11 or higher
- Refer to UR's official website to upgrade your Polyscope version

Step 1: Setup the Robot's IP Address on the Teach Pendant

Depending on your Polyscope version, the user interface would be different but in general please go to the network setting - select Static address and configure the following network settings then click apply

- IP Address: 192.168.56.101
- Subnet Mask: 255.255.255.0
- Default gateway: 192.168.56.1
- Preferred DNS Server: 192.168.56.1
- Alternative DNS Server: 0.0.0.0

Step 2: Install External Control URCap (PolyScope 5 Only)

ORNA uses the standard Universal Robots **External Control URCap** to enable real-time communication between ORNA Edge and the robot controller. Additionally, **user should refer to** UR's official guide **for setting up External control** according to the Robot's Software version

1. **For Polyscope 5, you need externalcontrol-1.0.5.urcap -** https://github.com/UniversalRobots/Universal_Robots_ExternalControl_URCap/releases/tag/v1.0.5
2. **Download External Control URCap:**
   - Once you have determine the required external control URCap, download the repo
   - Save the `externalcontrol-X.X.X.urcap` file to a USB drive
3. **Install on Robot:**
   - Insert USB drive into robot controller
   - On teach pendant, Navigate to: Settings → System → URCaps
   - Tap the "+" button to add new URCap
   - Browse to USB drive and select `externalcontrol-X.X.X.urcap`
   - Tap "Install" and wait for installation to complete

4. **Restart PolyScope:**
    - After installation completes, tap "Restart"
    - Robot will return to normal operating mode

Step 3: Enable Services (Polyscope X only)

- Go to the hamburger menu → settings → Security → Services.
- Unlock the menu using the admin password.
- Enable the Primary Client Interface and Real-Time Data Exchange (RTDE) interfaces. Lock the menu and press exit.

Step 4: Create an ORNA Program for external control (Polyscope 5 only)

Navigate to Program Robot and Create an empty program then insert the external control program node and configure the following settings in their respective tabs:

External Control:

- Host IP: 192.168.56.1
- Custom Port: 50002
- Host Name: orna

TCP Configuration (Installation → TCP Configuration):

- Payload: Set to combined mass of end effector + camera mount + Camera

EtherNet/IP Adapter (Installation → EtherNet/IP):

- Status: Disabled

PROFINET IO Device (Installation → PROFINET):

- Status: Disabled

EtherNet/IP (Installation → PROFINET):

- Status: Disabled

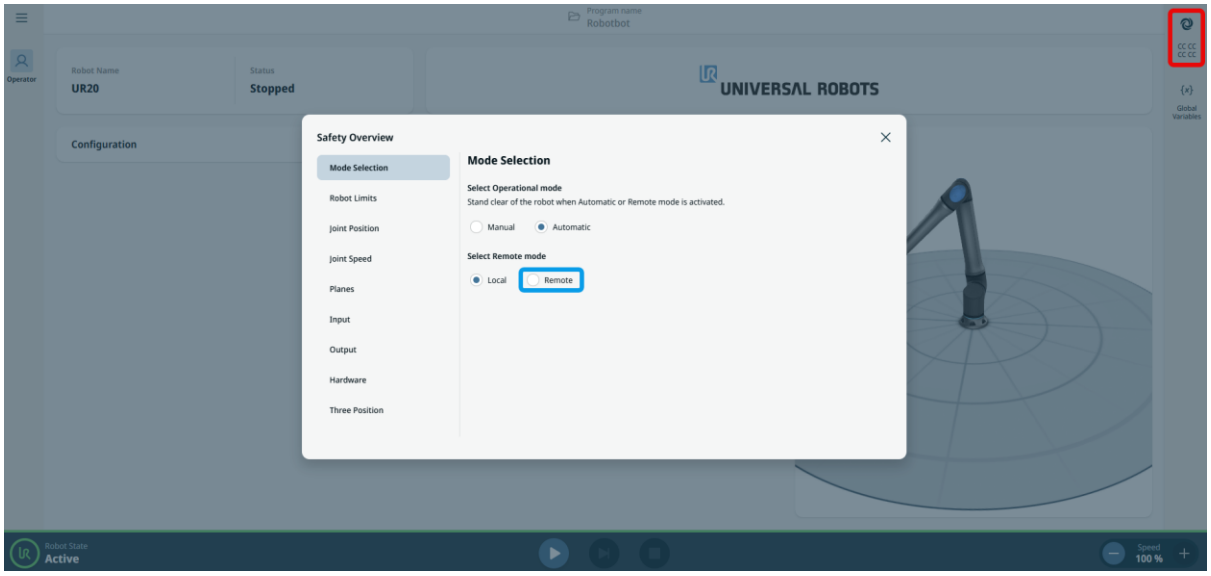
The node will appear in your program tree under Robot Program and your program tree should look like below regardless of Polyscope Version:

Robot Program
└─ External Control

Finally, Save the program as: **orna.urp and Load it**

Step 5: Enable Remote and Automatic Operational Mode on Polyscope X and Polyscope 5

- In Polyscope X: Tap the Safety Overview/Checksum icon. The Safety Overview screen appears. In the **Select Remote and Automatic Operational mode**, tick the Remote button.



- In Polyscope 5: I the Header, tap the Hamburger menu and select **Settings.** Under System, select **Remote Control**. Tap **Enable** to make the Remote Control feature available



Remote indicates the robot can be controlled from a remote location. Tap it to switch to Local control.

3. System Specifications

3.1 ORNA Edge Compute Module

Component	Specification
Processor	NVIDIA Jetson Orin 32GB (8-core ARM CPU)
GPU	1792-core NVIDIA Ampere GPU with 56 Tensor Cores, Maximum Operating Frequency: 930 MHz
Memory	32GB RAM
Storage	2TB NVMe SSD

3.2 3D Vision Camera

Component	Specification
Model	Orbbec Gemini 335L
Depth Resolution/FPS	Up to 1920x1080 @ 30fps
Depth Range	0.10-20m+ (Optional Range: 0.26-3m)
Depth Accuracy	A Spatial Precision (Root Mean Squared Error: RMSE) of 1.5% for depth measurements at 2 m

3.3 Camera Mount Hardware

The ORNA camera mount system provides secure, stable mounting of the vision camera to the Universal Robot tool flange. The mounting bracket attaches directly to the UR tool flange using four M6 bolts (included)

3.4 Compatible Grippers and End Effectors

As ORNA continues to support a wider range of industrial grippers and end effectors through its hardware abstraction layer in the future. Compatible options include:

- DH-Robotics
  - AG-160-95
  - AG-105-145
  - PGC-50-35
  - PGC-140-50
  - PGC-300-60
- Robotiq
  - Hand-E
  - 2F-85
  - 2F-140

4. Physical System Setup

Step 1: Connect ORNA Edge to Network and power

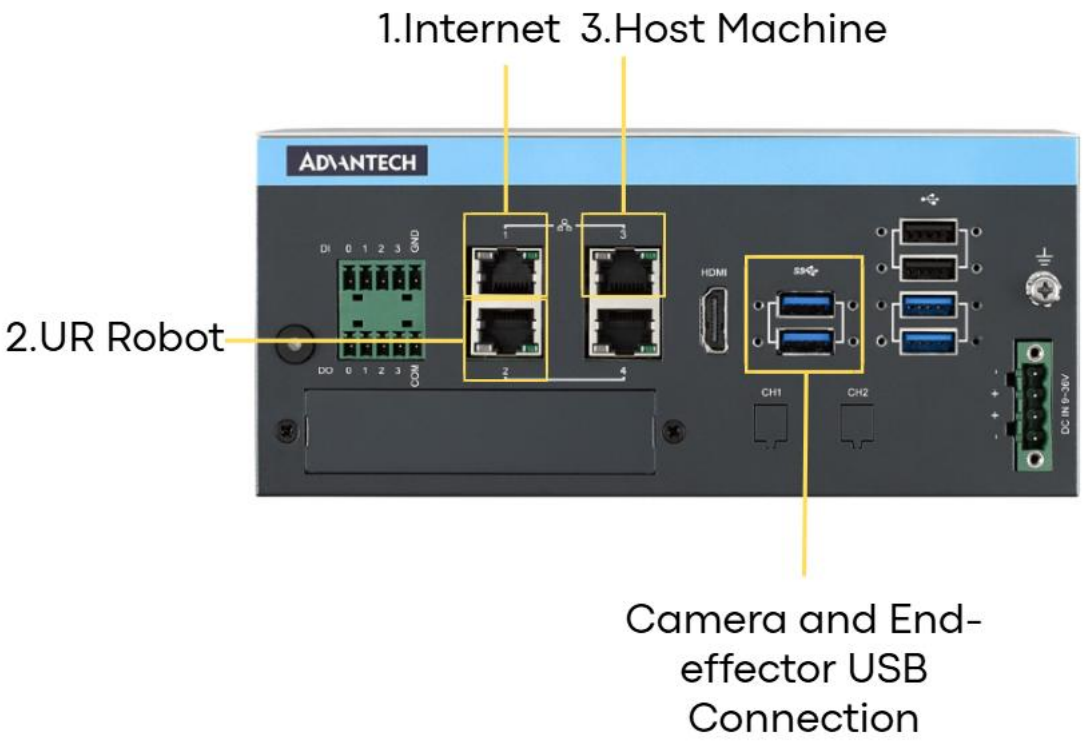
1. Connect the provided power supply to the ORNA edge; Press the power button and verify that the **Power LED indicator** is active
2. **Network Configuration:**
   - **LAN Port 1 (Internet):** Connect an Ethernet cable from **LAN 1** on the MIC-733 to your facility's internet source (router or switch).
   - **LAN Port 2 (UR Robot):** Connect an Ethernet cable from **LAN 2** on the MIC-733 directly to the Ethernet port located inside the UR Robot Control Box.
   - **LAN Port 3 (Host Machine):** Connect an Ethernet cable from **LAN 3** to the Host Machine for browser-based access to the ORNA Web UI.

Step 2: Install Camera

1. Mount the Camera to the Bracket: Align the mounting holes of the camera and secure with M4 Screws
2. Place the **ORNA Camera Mount** onto the **Tool Flange Extender and secure with screws**
3. **Data Connection:** Connect the USB-C end of the provided data cable to the camera. Connect the other end to the **provided USB Extender**.
4. **Power Connection:** Connect the **provided power cable** to the camera's power input. Plug the other end into the **provided charger** and connect it to a power outlet.
5. Cable Routing (Cable Management): Route both the USB extender cable and the power cable along the robot arm. Secure with velcro straps.
6. Connect the USB Extender cable into a **USB 3.0** port on the ORNA edge

Step 3: Attach End-effector to the Robot

1. ORNA supports a range of plug-and-play end-effectors out of the box. For the full list of supported grippers and connection protocols (USB, Modbus etc), see **Section 3.4: Supported End-Effectors**.
2. If you need assistance with wiring, protocol configuration, or a gripper not on the list, reach out to us at **support@orna.tech** — we're happy to help get you set up.



5. Software Instructions

5.1 Configure the Edge Machine IP on your PC

ORNA runs entirely on the Edge device. No software installation is required on your host machine. Simply connect your computer to LAN 3 of the ORNA Edge device, set a static IP on the same subnet, and open a web browser to access the ORNA Web UI.

Step 1: Set a Static IP on Your Host Machine

1. On your host machine, configure the network adapter connected to LAN 3 of the ORNA Edge with the following static IP settings:

- **IP address:** `192.168.65.101`
- **Subnet mask:** `255.255.255.0`
- **Default gateway:** `192.168.65.1`

Step 2: Open the ORNA Web UI

2. Open a web browser (Chrome, Edge, or Firefox recommended).
3. In the address bar, enter the ORNA Edge device IP: **`http://192.168.65.1:4173`**

4. The ORNA Web UI will load. You are now ready to configure your workcell and create projects.

Step 3: Load the orna.urp Program on the teach pendant (Polyscope 5 Only)

- load the program containing the **External Control** node and you don't need to run it, the robot is now ready to receive your external commands
- Refer to section 2.2 step 5

5.2 System Checklist before you start

- ❑ **UR Robot:** Installed, powered on, and in "Normal" operational state. Settings Configured according to section 2
- ❑ **Edge Device:** Connected to the **User's PC**, **UR Controller**, **3D Camera**, and **End-Effector**.
- ❑ **Cable Management:** All cables securely **cable-tied to the robot arm** to prevent tangling or snagging during motion
- ❑ **Workspace:** ensure the workcell is clear of obstructions and safe for full-range robot movement.
- ❑ **Web Browser:** Open a browser and navigate to `http://192.168.65.1:4173` to confirm connection to the ORNA Web UI
- ❑ **UR Program:** if you're running **Polyscope 5**, make sure that you have loaded the program configured in section 2.2 step 5

5.3 Connect to ORNA Edge and Configure Workcell

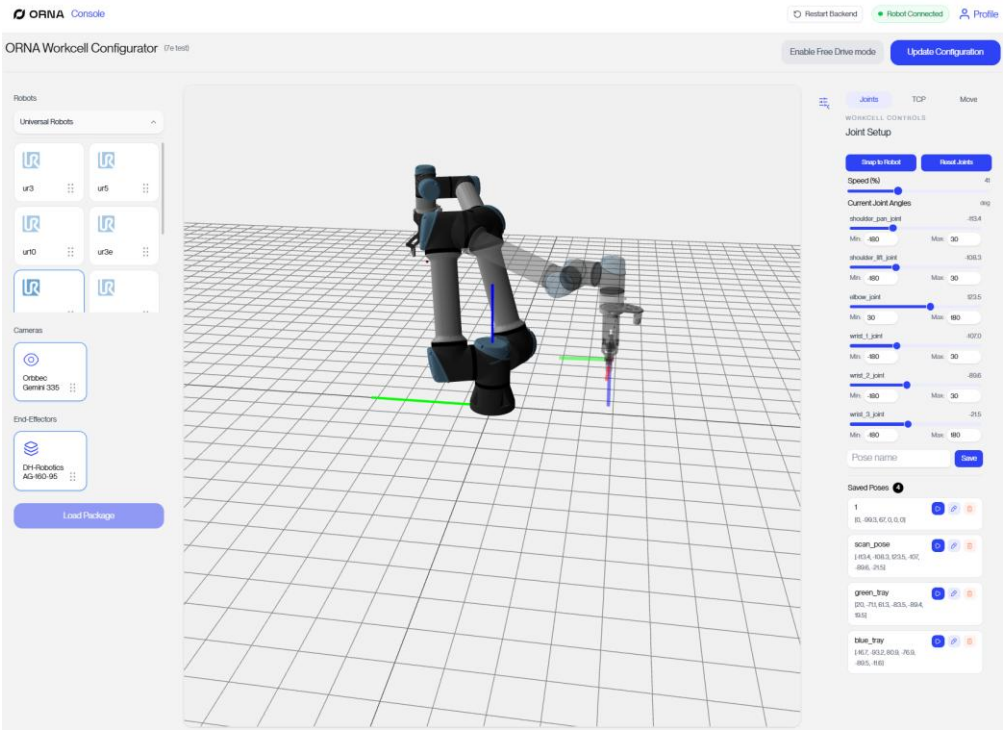
ORNA runs entirely on the ORNA Edge device. Open your browser and navigate to the Edge device IP to access the ORNA Web UI — no software installation required on your host machine.

Step 1: Connect to Edge Device and Robot

Open your browser and enter the ORNA Edge IP address. The ORNA Web UI will load and you can then login with the provided credentials



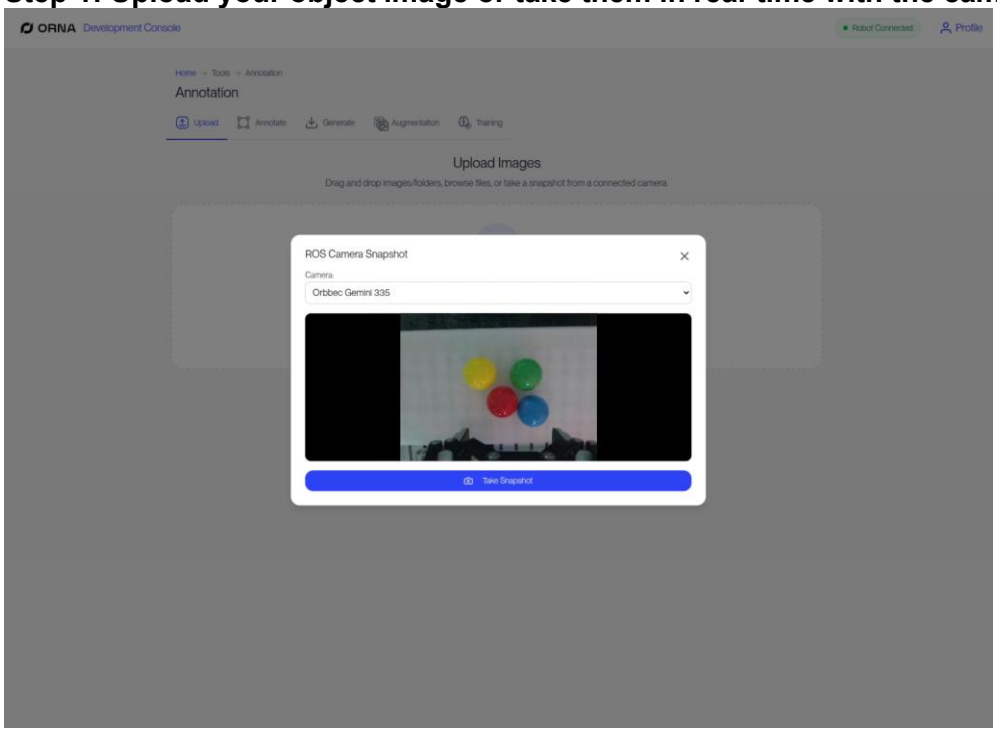
Step 2: Configure your Workcell



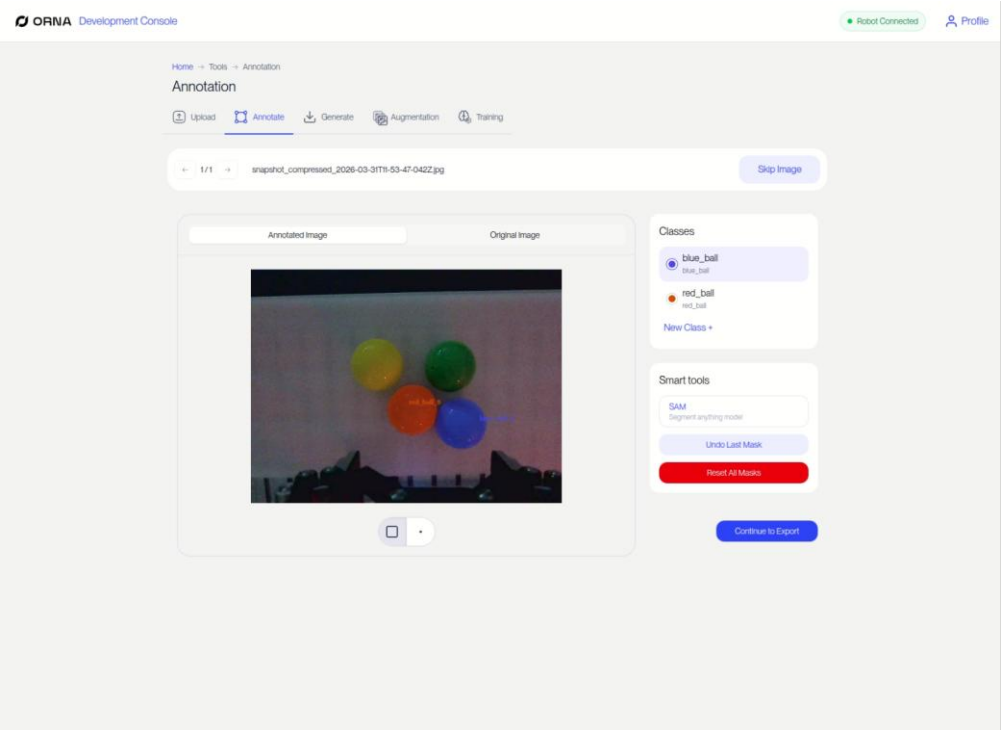
Select your Robot Model, Camera, End-effector, and configure the following workcell parameters: Gripper configuration (gripper model and parameters), Speed settings (maximum joint and TCP speed limits), Payload configuration (combined mass of end-effector, camera mount, and camera), TCP (Tool Centre Point) offset for your end-effector, and Freedrive mode (manually guide the robot arm to define and save named poses). Save pre-defined poses to be used in your projects, then click Save Configuration.

5.4 Train your first object detection model

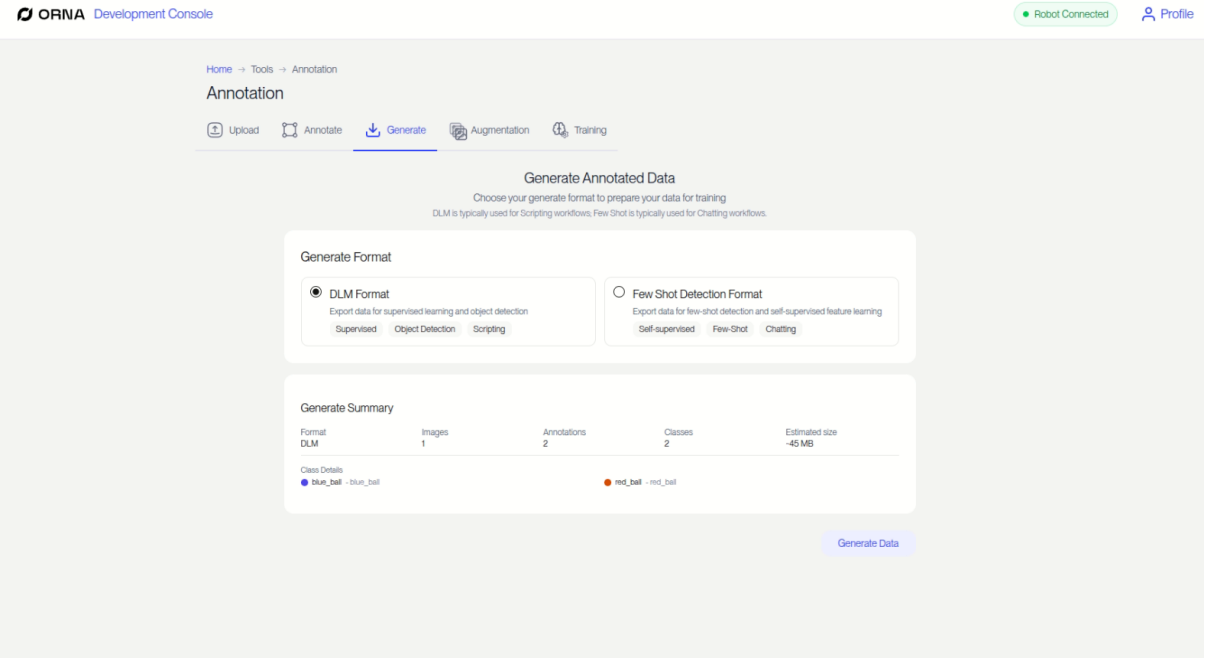
Step 1: Upload your object image or take them in real-time with the camera

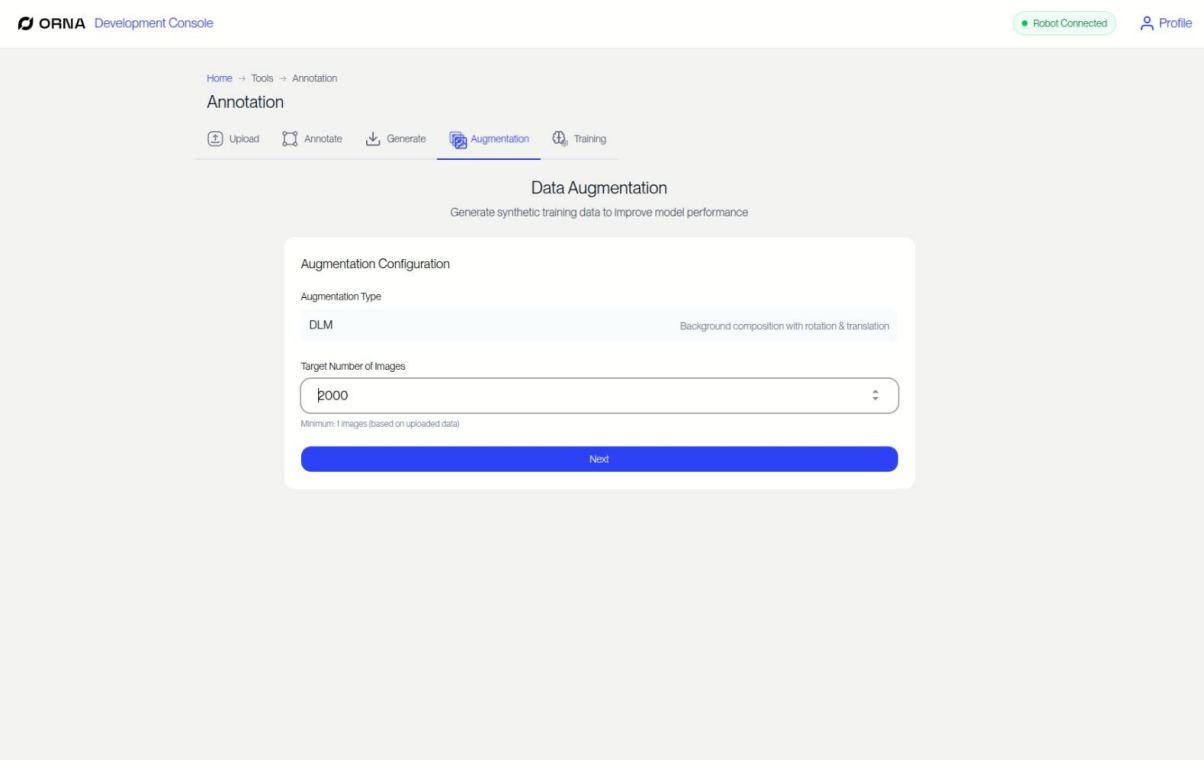


Step 2: Annotate your objects with our smart annotation tool

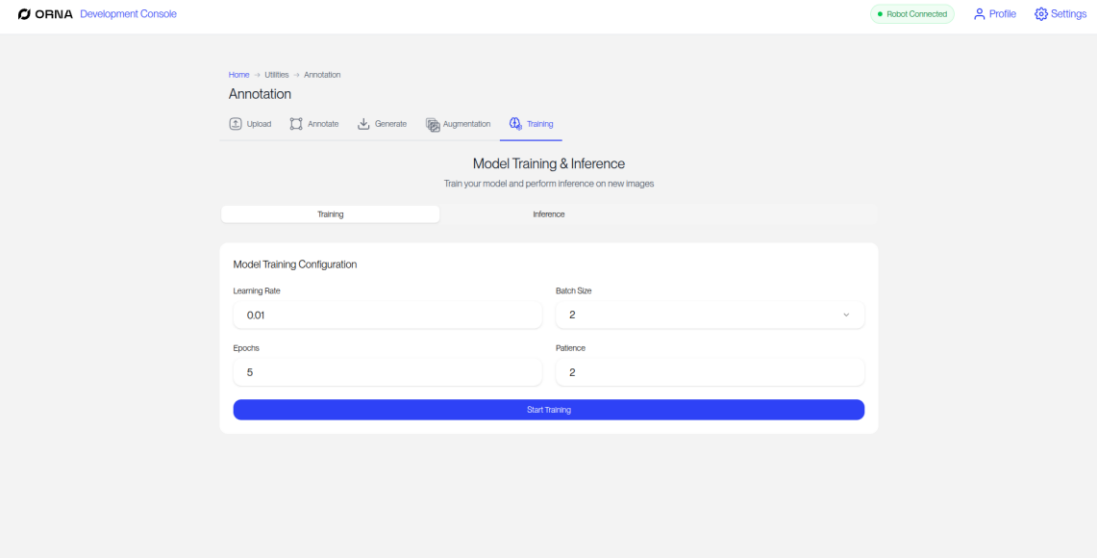


Step 3: Select DLM Format to Generate and Augment Images (1000+ images Suggested)





Step 4: Training - Configure your model training configuration

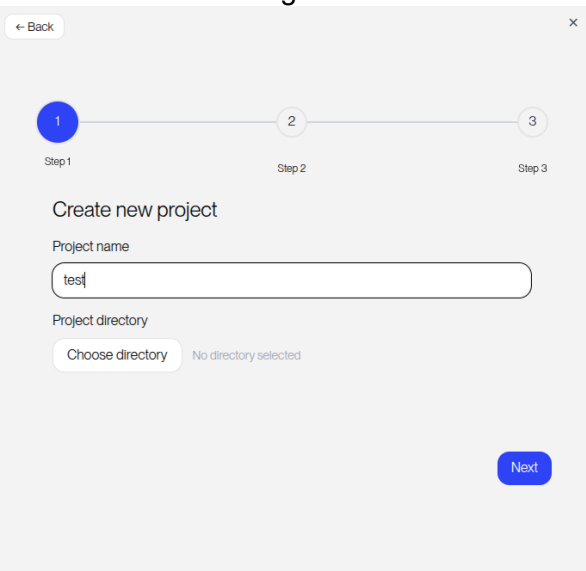


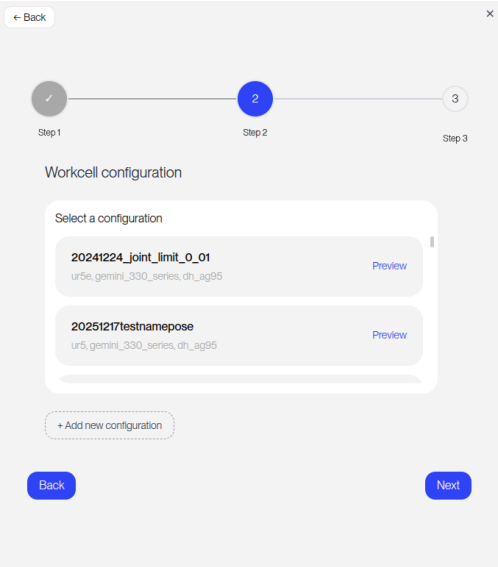
Suggested parameters as below:

- Epochs:10-20
- Learning Rate: 0.01
- Batch Size: 2-8
- Patience: 2-8

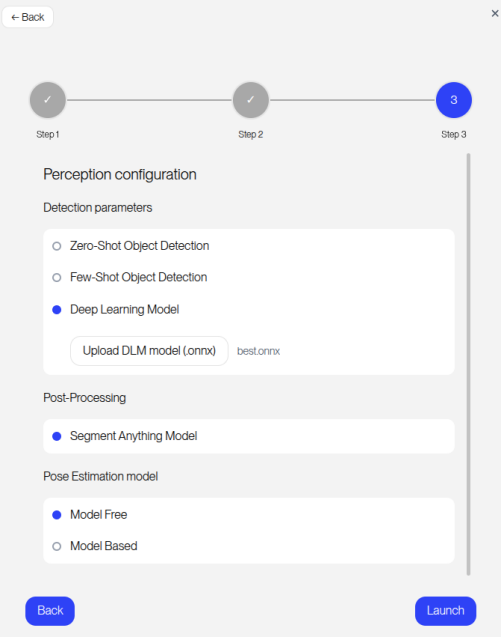
5.5 Create your first project – Script Mode

Step 1: Click Create project, select script mode and give the project a name. Select the desired workcell configuration and click next





Step 2: Select DLM, upload the trained model and select Model-free Pose estimation



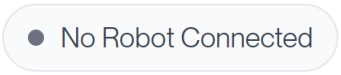
Step 3: Launching the Project usually takes around 3-5 minutes, once you're inside the IDE; you may start coding!

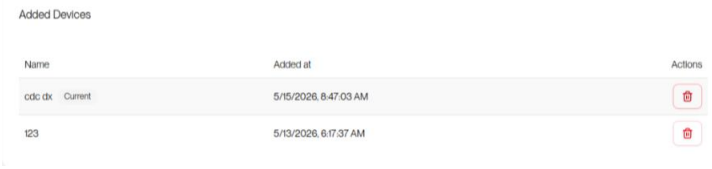
Example: Moving to a pre-defined pose

```
import os
from ornapy import ORNA
from ornapy.orna_types import PoseStamped, CaseOption, TraySelection,
GripperState

orna = ORNA()
#Replace with the pose name you configured in the workcell configuration
print(orna.move_to_named_pose("home"))
```

6. Common Error and Troubleshooting

Common Error	Troubleshooting and Solution
ORNA Edge not found or Connection lost	 Possible solutions: • Check network connection with ORNA Edge – make sure you connected to the correct port • Make sure you have configured the Edge device IP on your host machine (Section 6.1 step 3) • Verify ORNA Edge powered on or restart edge device • Close your Desktop application and open it again
Services not terminated / project fails to launch	ORNA automatically starts and stops all services (backend, hardware, camera, etc.) when navigating between different application. If a previous session was not terminated properly, residual services may prevent a new project from launching correctly. **To resolve:** Return to the homepage — services should terminate automatically. If they do not, open the **Robot Status dropdown** and manually terminate all running services before launching your project.
ORNA console behaves unexpectedly after navigating directly via browser address bar	**Do not navigate between ORNA pages by manually typing or modifying the URL in the browser address bar.** ORNA manages application state internally — bypassing this by changing the URL directly can leave services in an inconsistent state. **To resolve:** • Always use the in-app navigation buttons and menus • If the UI becomes unresponsive or behaves unexpectedly, restart the ORNA software/ORNA Edge device and reconnect
ORNA console behaves unexpectedly after switching to a different host machine	ORNA pairs the host machine with edge device during first-time setup. Connecting from a different machine (e.g. a new laptop or workstation) might cause error **To resolve:** • On the ORNA Edge web UI, go to **Profile** → **Added Devices** • Locate the previously registered device and click the • **Click the delete button** to remove all the registed device • Log in again from the new host machine to complete registration

Common Error	Troubleshooting and Solution
	

7. Revision table

This revision table tracks all changes to the ORNA system including hardware revisions, software updates, and documentation improvements.

Software Version	Date	Description of Changes	Author
1.0	2026-1-8	Initial release of ORNA User Manual	Henry Tam
1.1	2026-3-27	Architecture: ORNA now runs entirely on edge device; browser-based Web UI replaces Desktop App; no host machine installation required Added gripper support: expanded compatible gripper models via hardware abstraction layer Workcell configuration additions: speed settings, payload configuration, TCP configuration, freedrive mode for teach-in pose recording	Henry Tam
1.1	2026-5-19	Updated Common Error and Troubleshooting section and Supported Browser. Updated version numbering convention	Henry Tam

8. Contact Information

Email	support@orna.tech
Python SDK Documentation	https://orna.tech/docs
Office Hours	Monday - Friday, 9:00 AM - 6:00 PM (CST)

End of ORNA User Manual

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