DEEPVIEW

User Guide

Deepview AI Camera

Read this manual before use.
Tech Support: Eli Davis, 586.854.7475 (cell)
Tech Support: Devin White, 586.231.4680 (cell)

Keep this manual in a safe place for future reference.
A video walk-through can be viewed at https://youtu.be/D46z0q3oqs0

Table of Contents

Standard System Configuration

Example of a standard production setup with one Deepview camera

Deepview X400

PLC

Camera/Laptop
ethernet connection via
switch

M12-24V + 24V I/O

M12 - Ethernet/IP

PC/Laptop

Ethernet
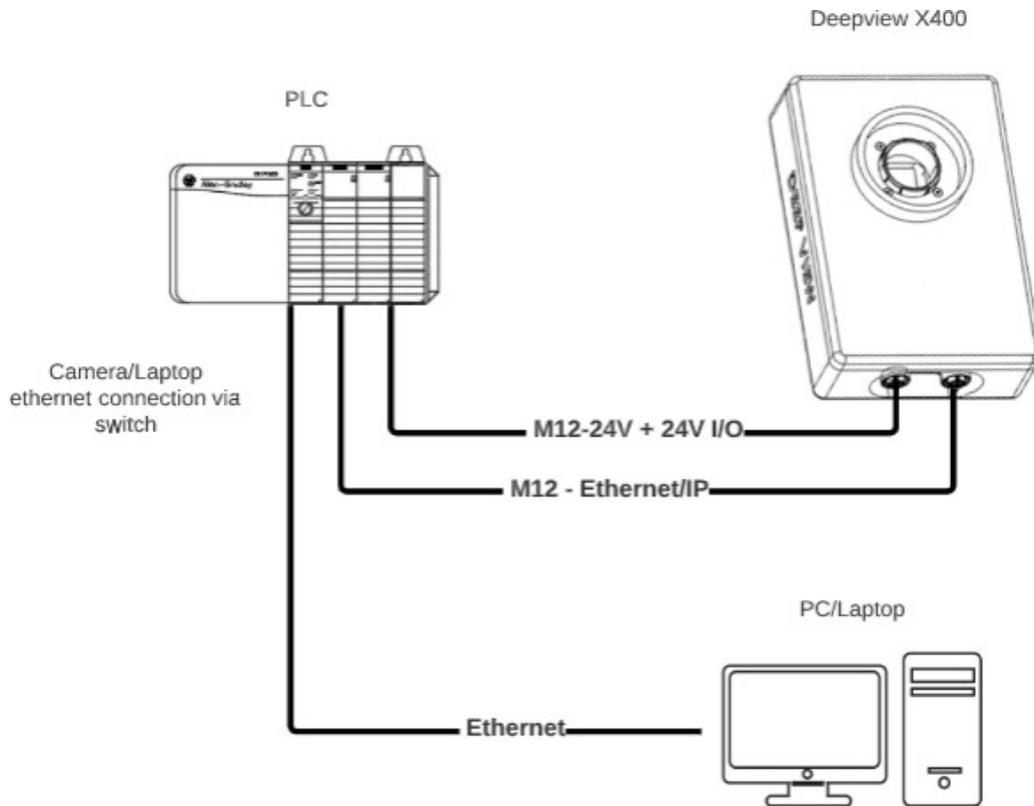
Example of a standard lab / pre-production setup with one Deepview camera

Deepview X400

120V AC Outlet

M12 - 120V AC

PC/Laptop
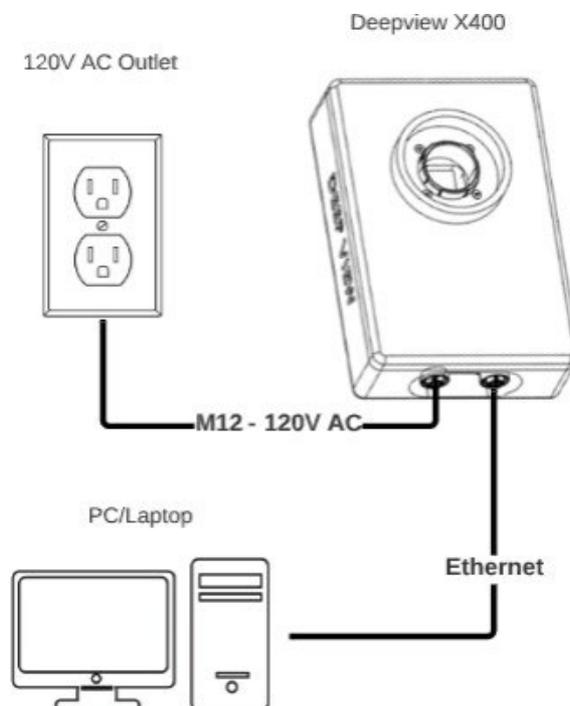
Ethernet

Connecting your PC to the camera

Before attempting to connect for the first time, first ensure that you have followed the standard system configuration and the green M12 - RJ45 cable is plugged into your ethernet port.

Now follow the steps below to set a static IP address for your PC (windows) to match the subnet of the camera.

NOTE: For more details on matching the subnet read step 2 on page 17

1. **Determine the IP address of the camera. This can be found on the camera's label.**
2. **In the windows search bar type "network connections" into the search bar and click the top result**
3. **Double click on your ethernet connection**
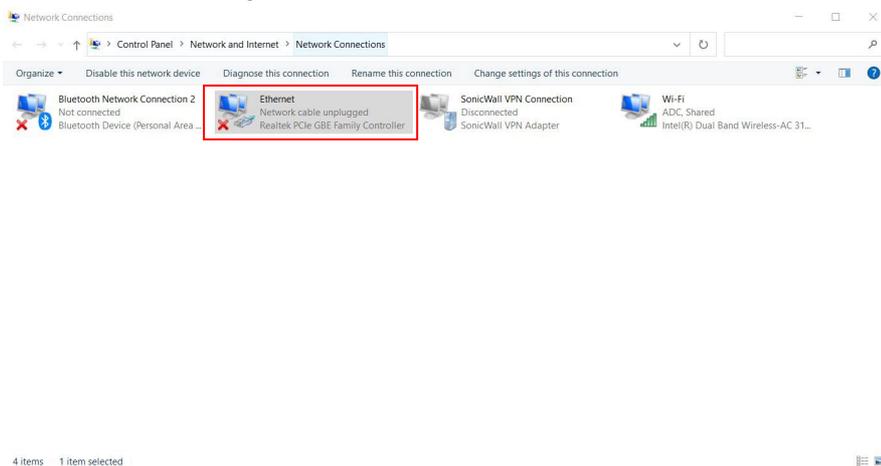
4. **Double click on the Internet Protocol Version 4 IPV4 option**

5. **Assign the static IP as shown in the image below**

NOTE: Any number 1-255 can be assigned in the last "section" of the IP address so long as it does not match the camera
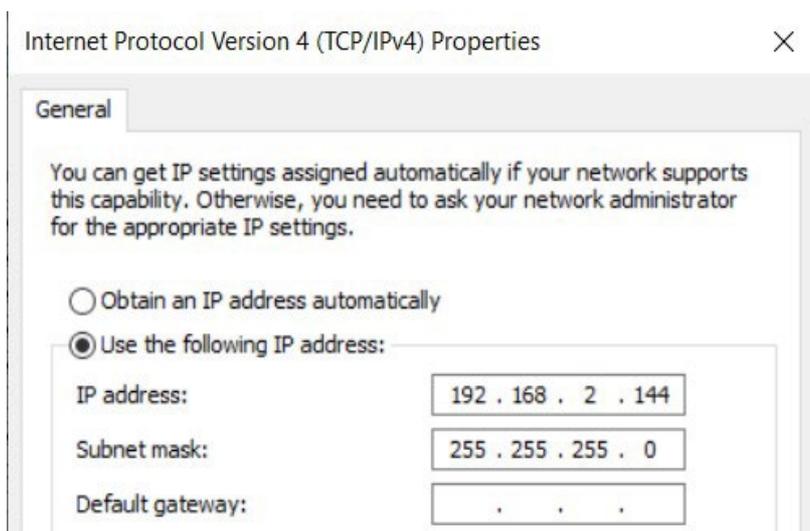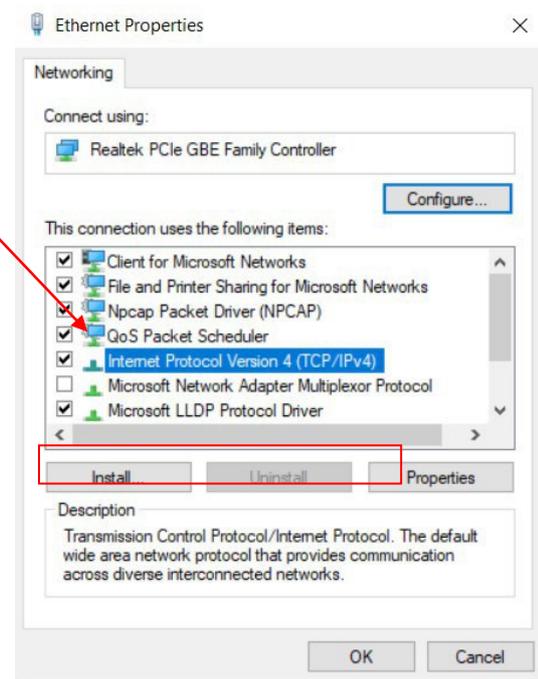
Logging in for the First Time

6. **In your internet browser's address bar (Chrome, Edge, etc.) type the cameras IP address in the format below:**
   192.168.2.xx:5000
   For example, if your cameras IP address is 192.168.2.50 type 192.168.2.50:5000 into your address bar

   The default login for the camera is User: sysadmin@deepviewai.com Password: x
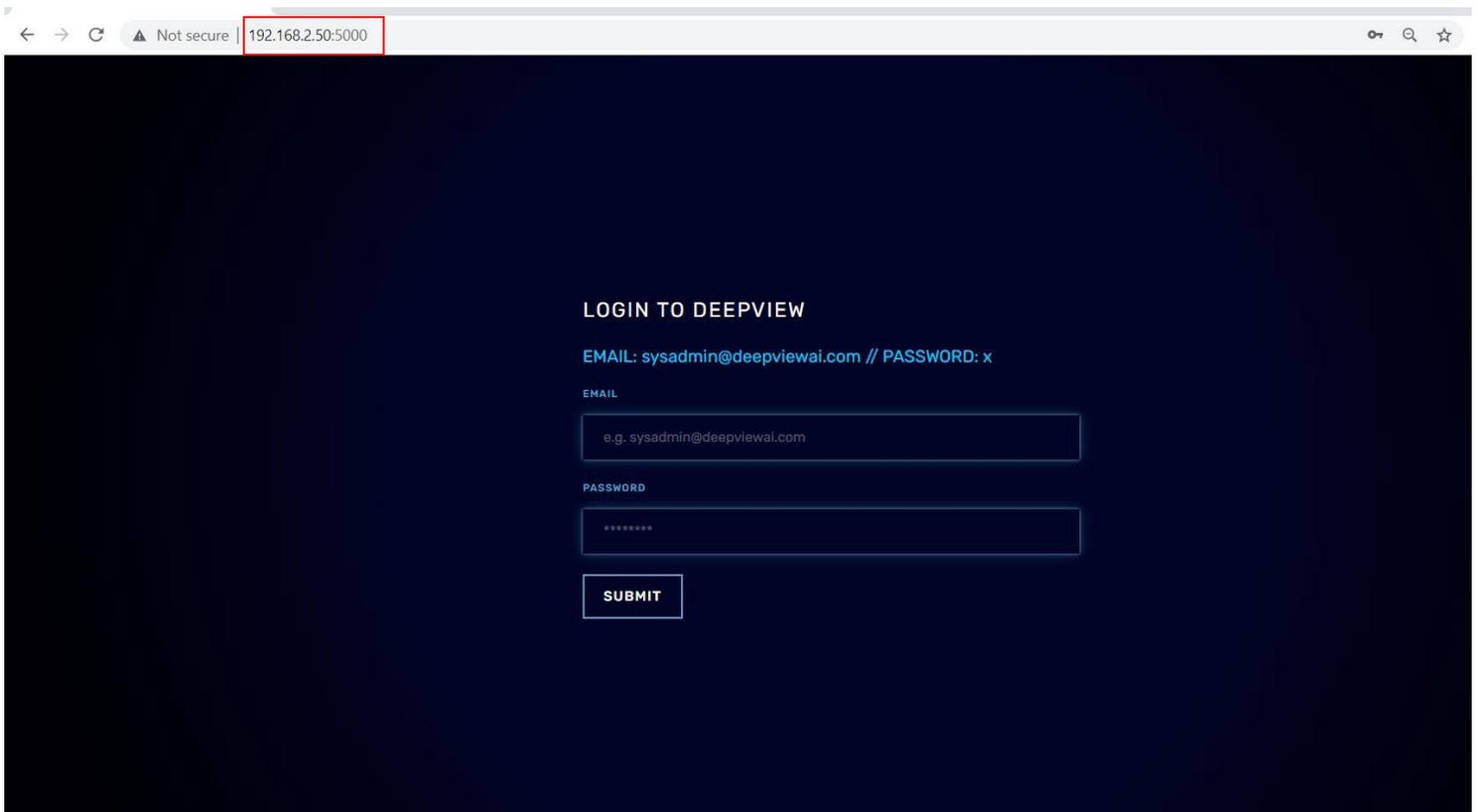
User Interface Overview

After logging in you will be greeted by the screen below. The camera's software is split into two main screens: Training and Camera.

Training is where you will create applications, upload and label images, and train neural networks.

Camera is where you will capture images, view history, and run production
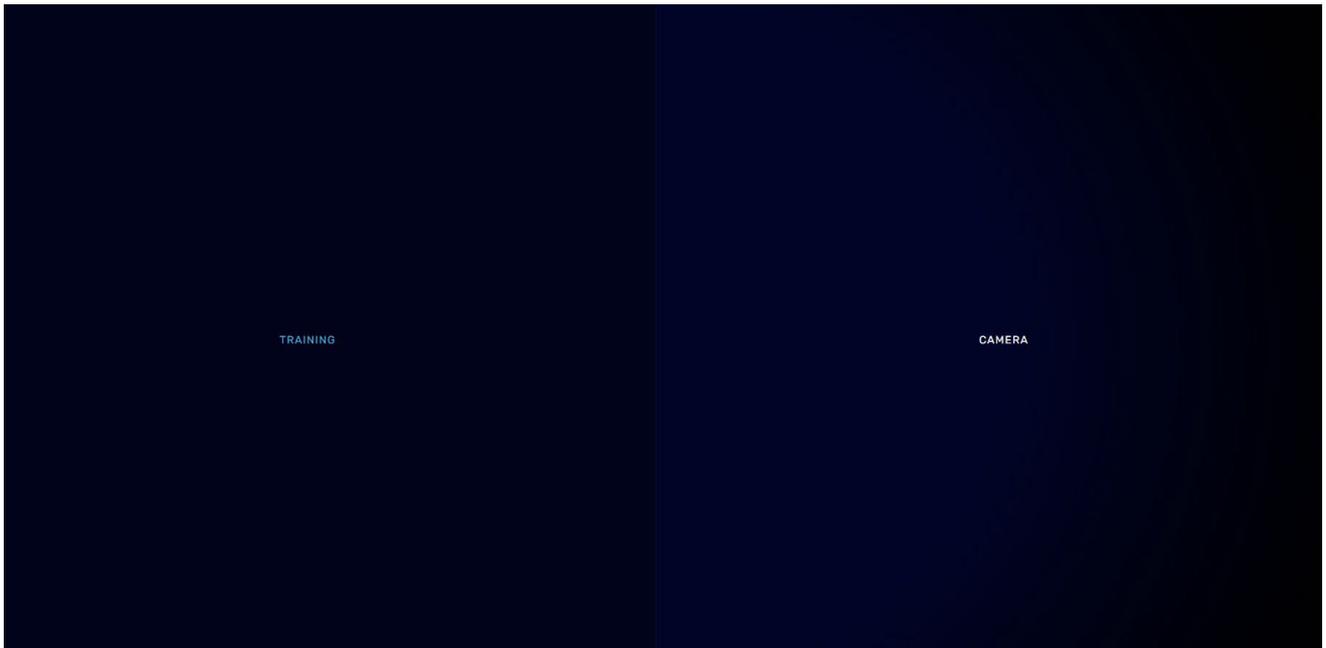
To return to this page and quickly switch between Training and Camera, click the Deepview logo in the top left from either screen.
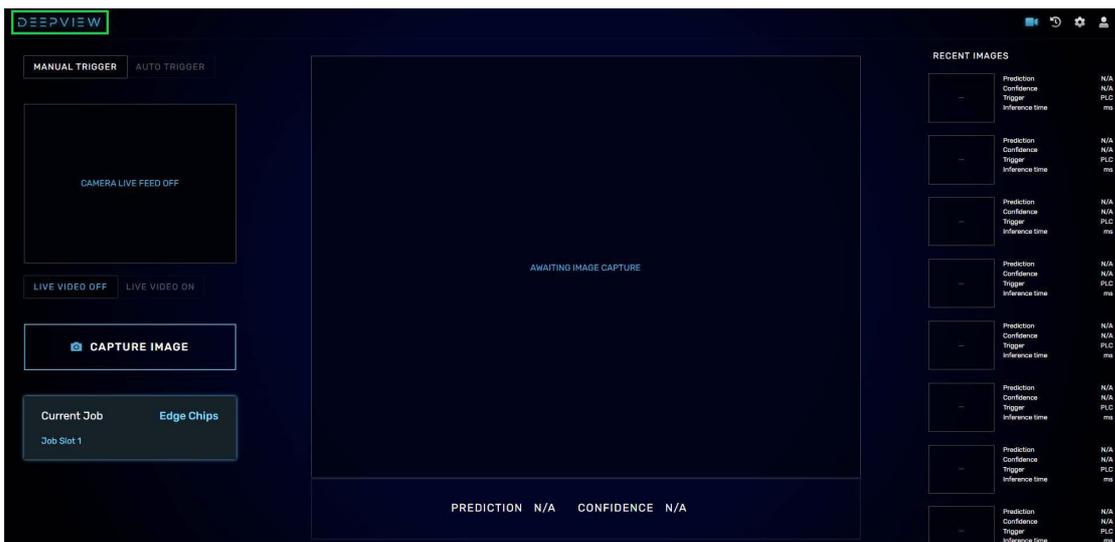
Training Screen and Creating Datasets

The training screen is where you will create applications, upload and label images, and train neural networks
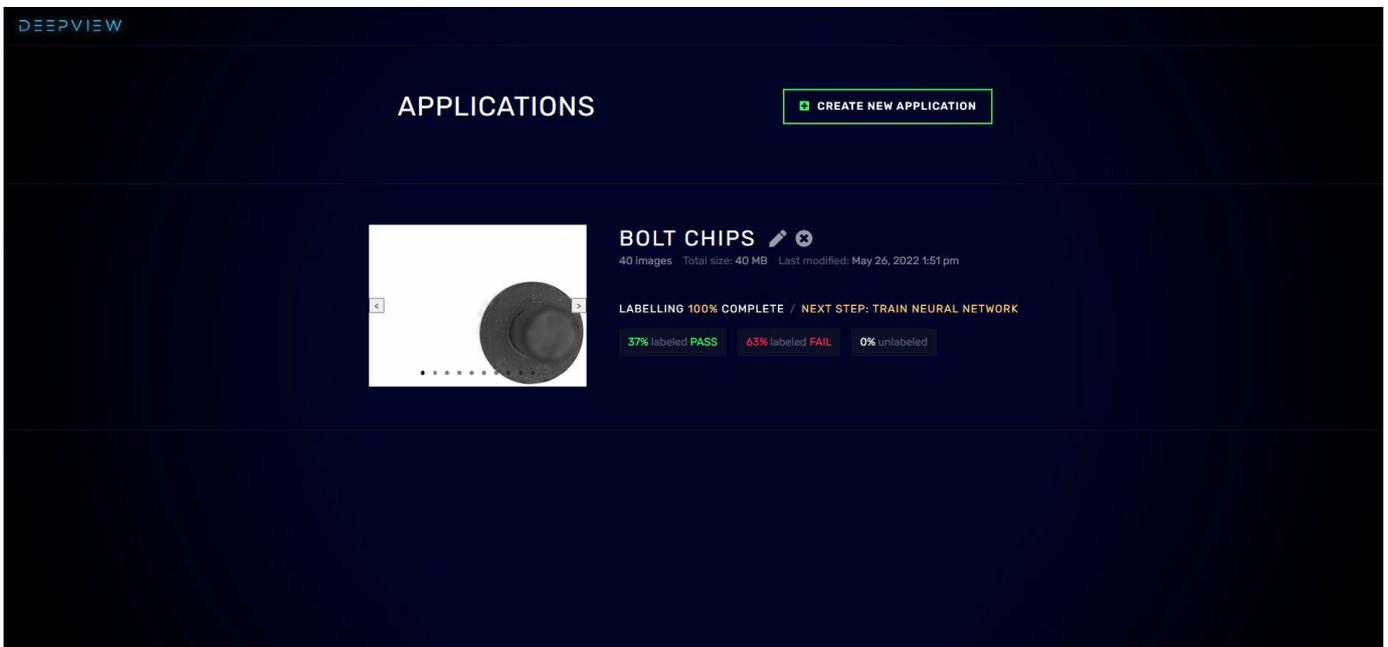
Click Create New Application to create a new dataset

You will be asked to name the new dataset, as well as choose which type of dataset you want.

The dataset types are explained below.

1. **Pass/Fail: a pass or fail dataset where there are no detection boxes.**

2. **Classification: a dataset for sorting multiple classes of objects (No Boxes)**

3. **Pass Detection: a dataset for determining the presence of something in an image, where the GREEN detection box is drawn around the passing region of interest.**

4. **Fail Detection: a dataset for finding the presence of a defect in an image, where the RED detection box is drawn around the failing region on interest**
   In the following example we will be using a Fail detection dataset

Uploading and Labeling Images

Once your dataset is created you will be taken to a new screen where you can upload and label images
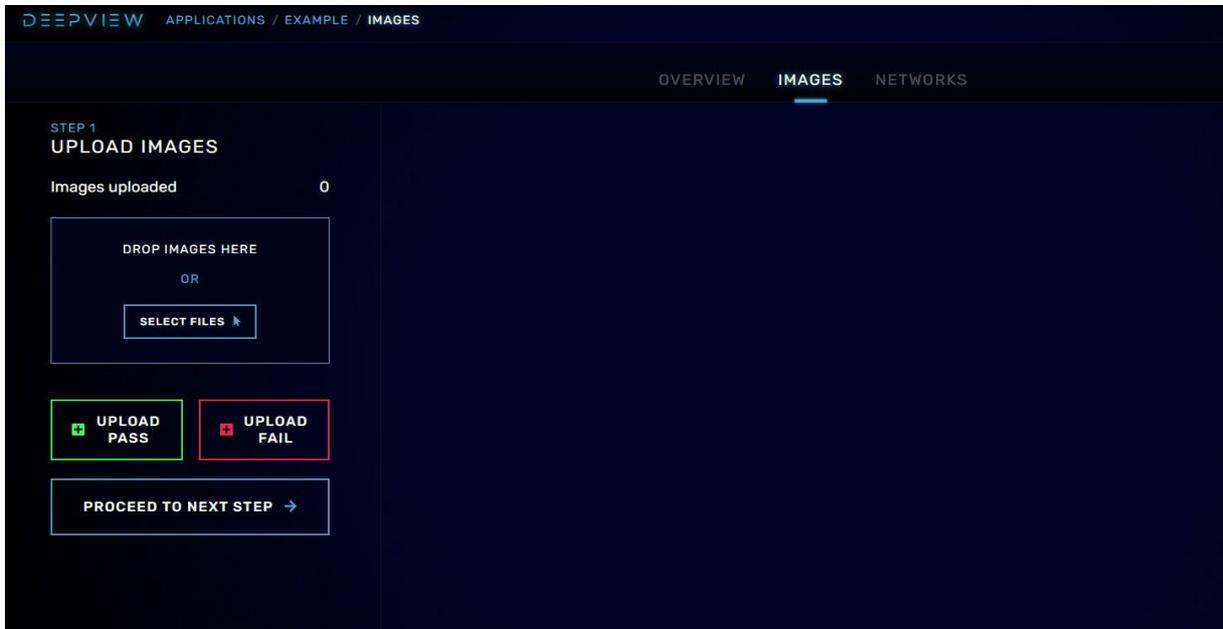
You can upload images from your file browser by clicking select files, or upload them pre-labeled if you already have sorted folders by clicking the upload pass or upload fail buttons.

You can also add images to the application from the camera history as shown on page 10.

Once your images are added, if unlabeled you must go through and label each image. This can be done by first selecting an image, and then clicking on the pass or fail button, or using the up or down arrow keys.

Also, because this example is a fail detection dataset, you must draw a box or boxes around the region of interest where the failure is in each failing image - as seen in the image below.
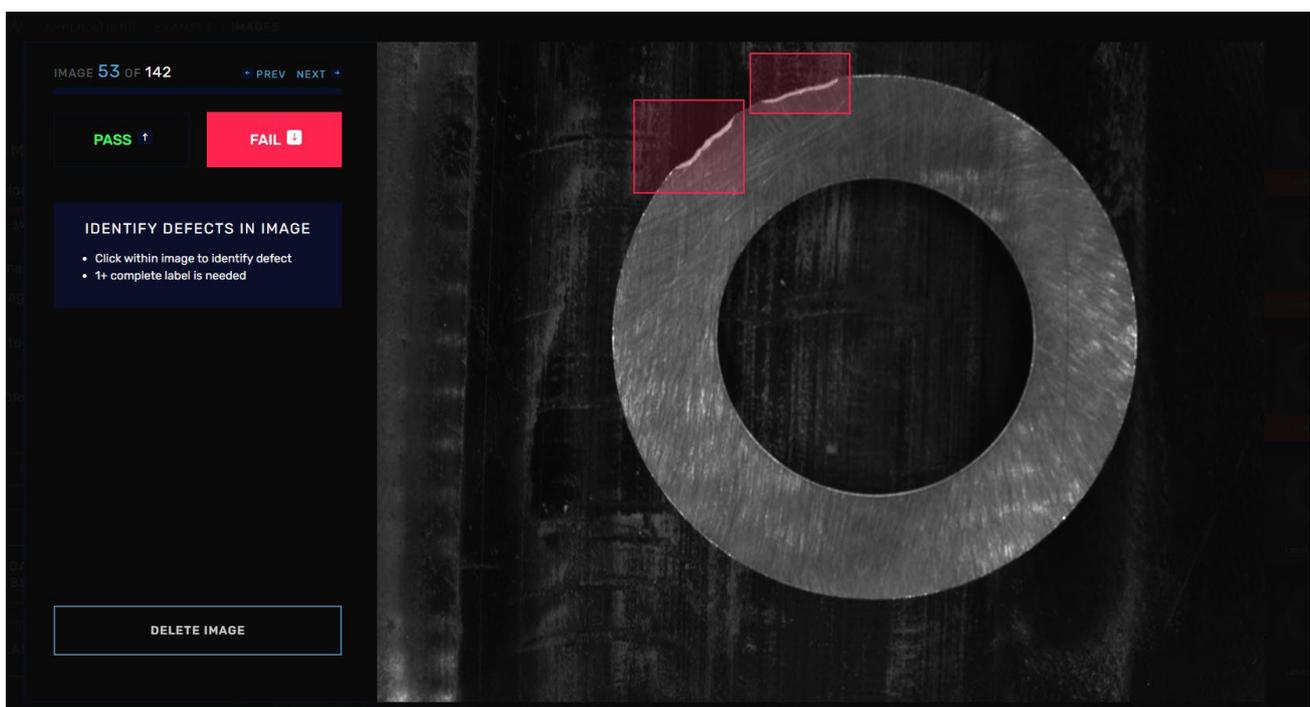
Labeling Images and Training a Network
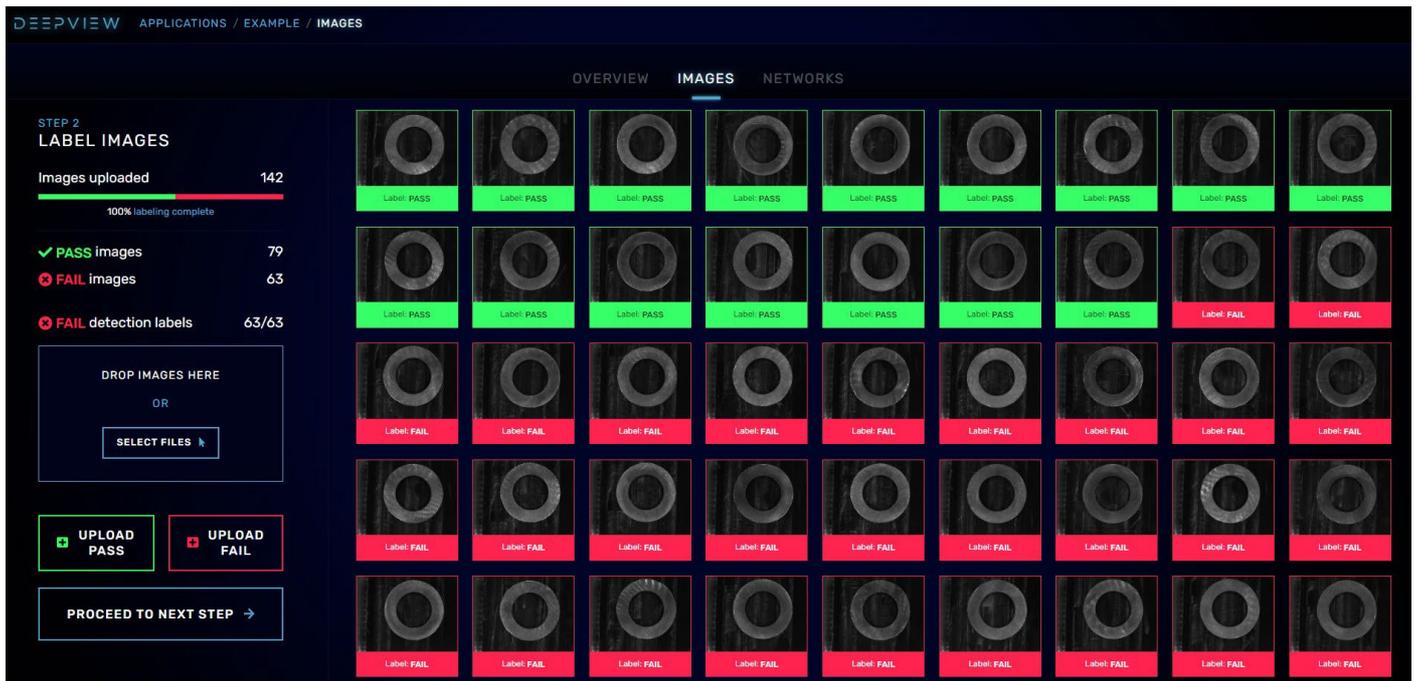
Once all images are labeled you can train a network by clicking Proceed To Next Step in the bottom right. There are some settings in the training screen but it is recommended to use the default settings.

To begin training the network click the Start Training button in the top right. Fully training a network can take as little as 5 minutes, to upwards of two hours depending on factors such as number of images and difficulty of the application.

The training screen will display the training progress.
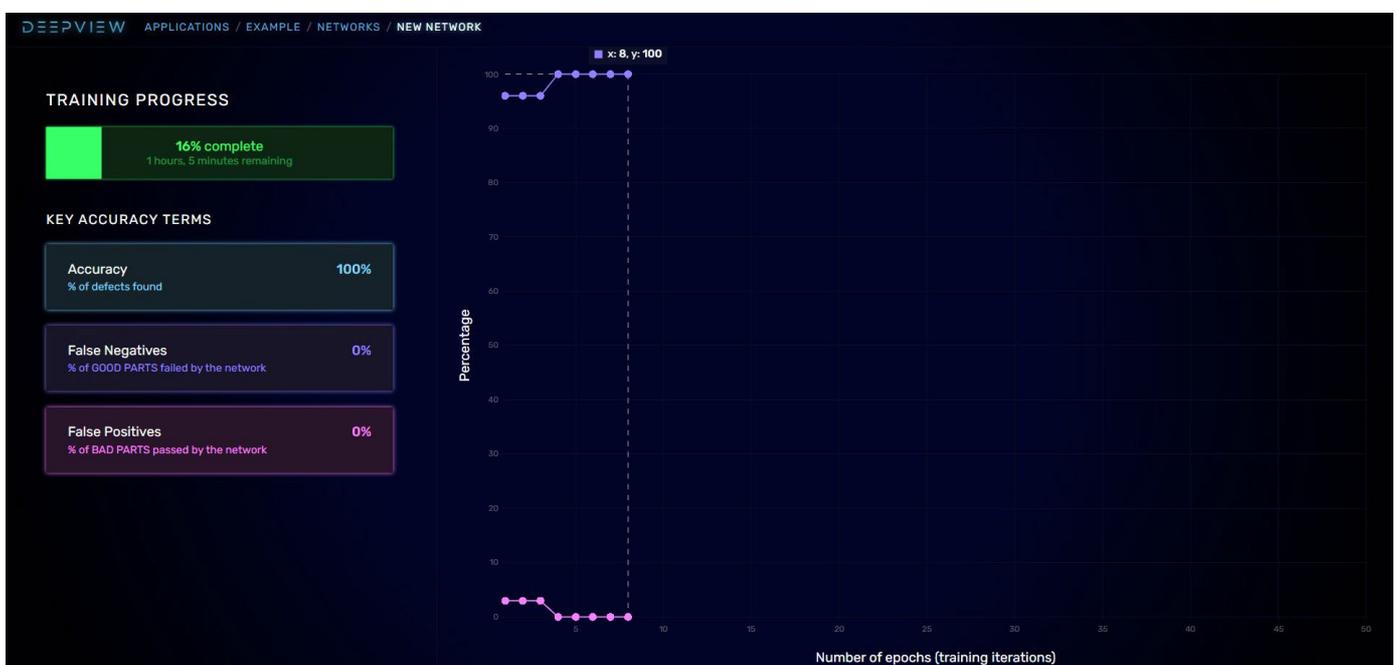
Training Network and Loading to Job Slot

When the training is finished you will automatically be show the Networks screen. Here, you will be shown the camera's predictions and training accuracy.

If you are satisfied with the network and want to run it in production, click LOAD NEURAL NETWORK TO JOB SLOT in the bottom left-hand corner of the screen.

Click LOAD NETWORK TO JOB SLOT on any of the 8 open job slots.

Once it is loaded click ACTIVATE. The neural network will now be running in production on the camera screen.

You also have the option to name the network from the job slots screen if desired.

Camera Screen Overview

The Camera screen is where you will capture images, view history, and run production.

In the top right you will notice 4 buttons which correspond with 4 different screens:

The camera icon corresponds with the main camera screen where images are captured. This is the screen shown in the image above, and is open by default.

Clicking the history icon will open a screen displaying all the captured images sorted by network and time taken

Clicking the gear icon will open a settings screen.
Here you can change several important settings including image exposure, communication and I/O, and job change.

Clicking on the person icon will open an info screen.
This screen will display some information on the camera such as storage and IP address

Camera Screen Overview

The Main Camera Screen is where you will capture and view images live as the camera is running in production

Note in the top left the camera has two modes: MANUAL TRIGGER and AUTO TRIGGER

MANUAL TRIGGER requires you to click the CAPTURE IMAGE button or press space bar each time you want to capture an image

AUTO TRIGGER mode means the camera is running on it's own, and is capturing images based on your settings. It can either be triggered on a continuously set interval, or by a PLC or other I/O device. This is explained further on page 15.

NOTE: The camera MUST be in auto trigger mode to receive a trigger from any external device.

Note in the bottom left, the Current Job is displayed.

By default, the job is CAMERA_SETUP, which is used to capture images prior to training.

The Current Job can be changed in the settings screen, which is explained further on PAGE X

If you are following along with the manual in order, the job/network you trained earlier with be active instead of CAMERA_SETUP

Note on the right side of your screen there is a column of recently captured images and predictions. These images are also be saved to your history, where they can be viewed at any time.

History Screen Overview

The History Screen is where you can view images and their prediction results.

Images are organized in folders by job, and then by date
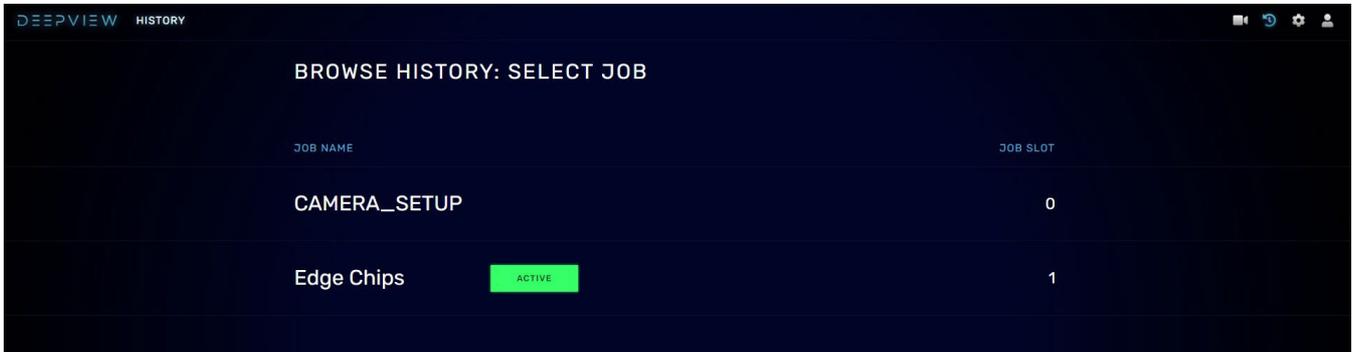
Once in a folder you can click on an image to see it full screen, with it's timestamp and prediction confidence.

From this screen you can also download your images onto your PC, or copy them back into a Training Dataset.

Settings Overview

The Settings Screen is split into three sections which can be switched between by clicking on the name of each section in the bar at the top.
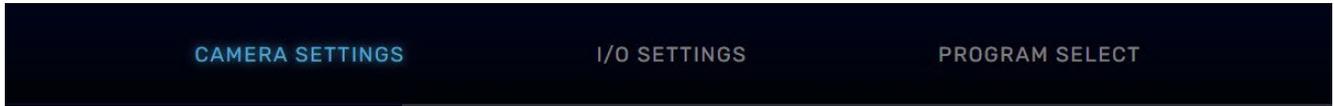
The first section is Camera Settings, which includes a slider bar to adjust the exposure, and buttons to enable/disable live video.

Live video is useful during setup to ensure the framing is correct.
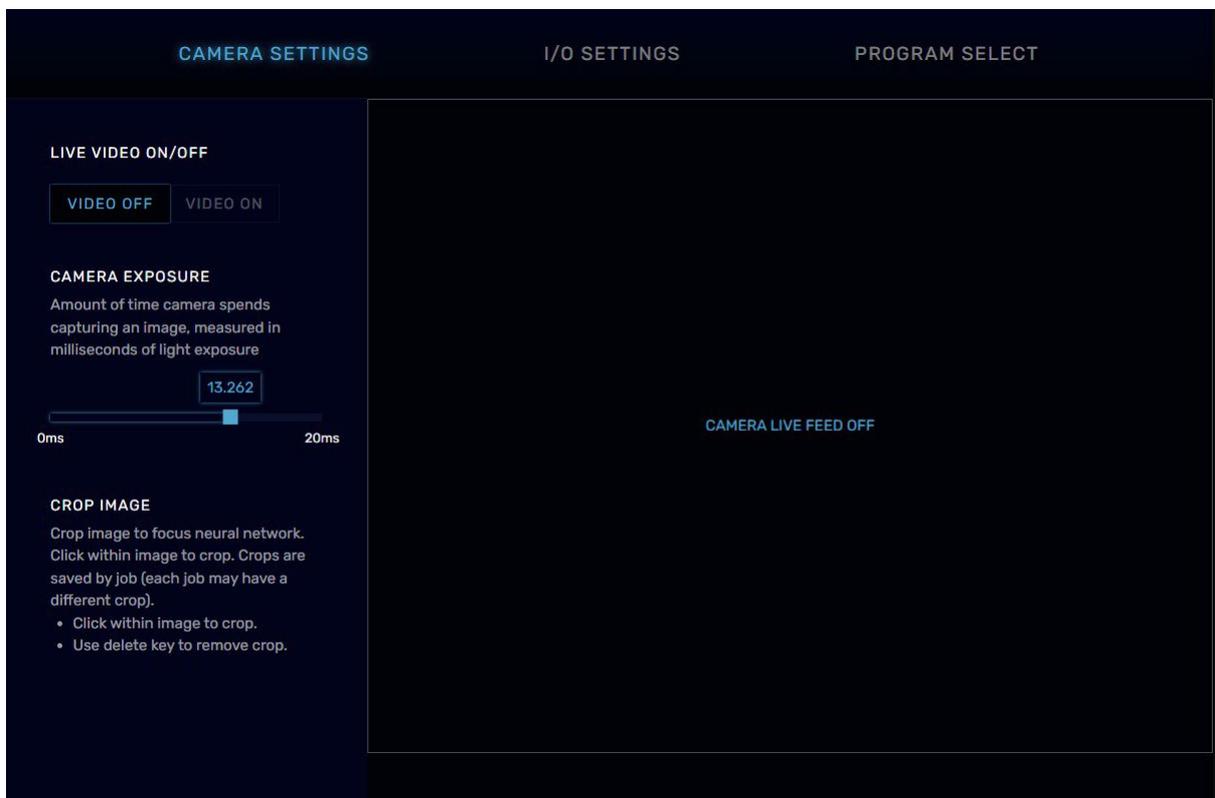
I/O Settings

The second section is I/O and communications settings.
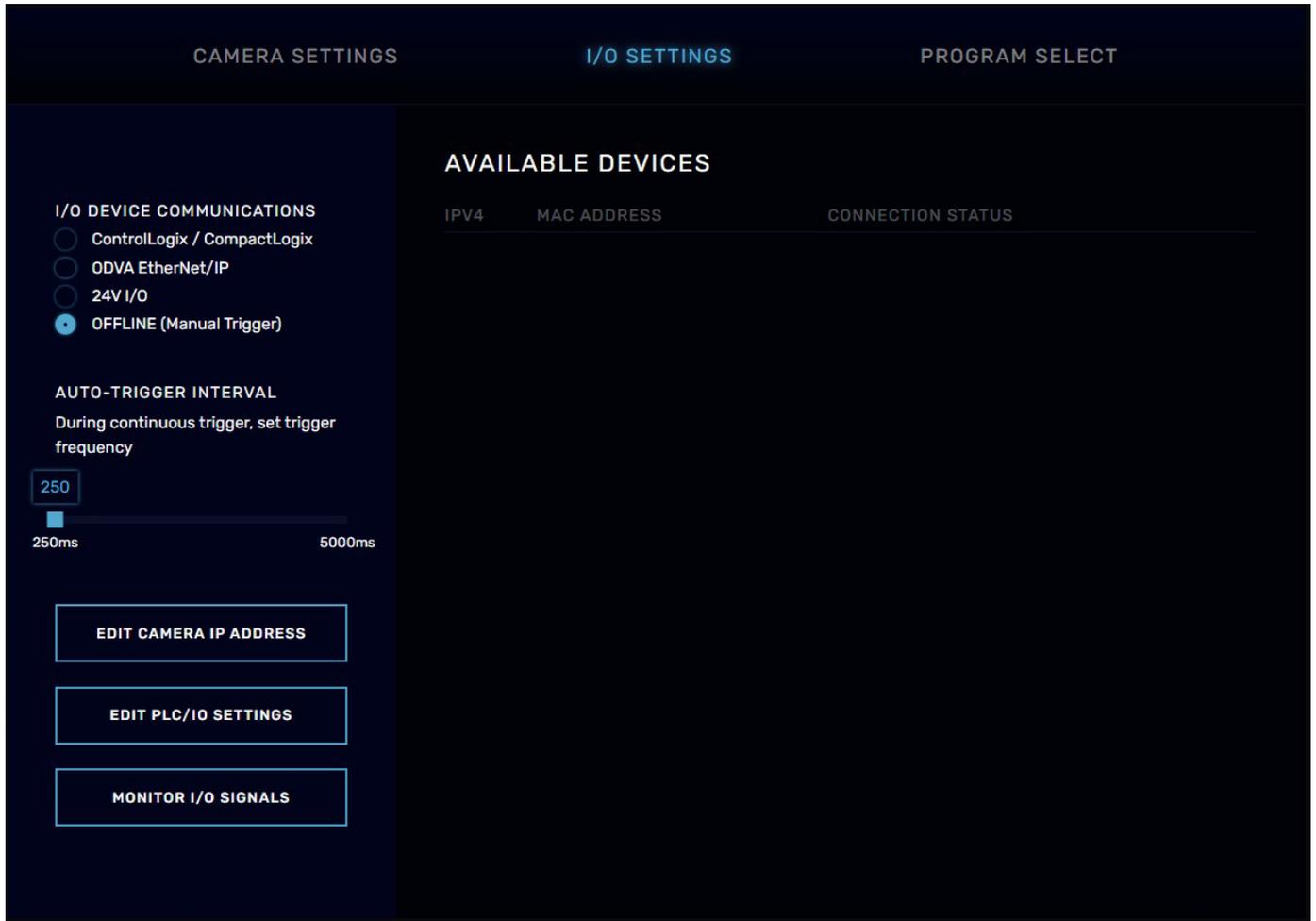
Here you can select the type of I/O you want to use from the 4 options in the top left:
1. Control/CompactLogix. Use this is you have a Rockwell PLC.
2. ODVA EtherNet/IP. This is a generic ethernet IP option for use with non-Rockwell devices.
3. 24 V I/O. This is a hard-wired I/O option. There are 4 inputs and 6 outputs. Pinout on page X
4. Offline. This is the default setting on a new camera. When in auto trigger it will trigger continously on the time interval set in the slider.

Setting up your communications is explained further in the final section of this guide beginning on page 17.

From this page you can also change the default IP address of the camera.

Note that if you change the IP address you will immediately lose connection to the camera. You need to type in the new IP address in your address bar to reconnect.

Program Selection / Changing Jobs

The final page of the settings screen is Program Select. Here is where you can manually change the active job running on the camera.

To change a job simply click Activate on the job you want to use. You can also rename jobs from this page.

Jobs can also be loaded from .job files which can be downloaded from the Networks Screen within Training, as seen on page 10.

Rockwell EtherNet/IP Setup

1. To communicate with a PLC the system must be setup as shown in the diagram on page 2.

2. Determine the IP address of the PLC.

   If the subnet of the PLC and camera IP address do not match, the camera's subnet must be changed. The first three "sections" of the IP address should be matching – highlighted in red in the examples below. If the camera's IP address is 192.168.2.50 and the PLC's is 192.168.2.10 then the subnets are matching, and nothing needs to be changed. However, if the PLC's IP address is 192.168.1.10 or any other address where the subnets do not match, follow the steps below to change the IP address of the camera.

3. The camera's IP address can be changed in the UI by clicking on the camera settings icon in the top right.

4. Within the camera settings menu click on I/O settings and then edit camera IP address.
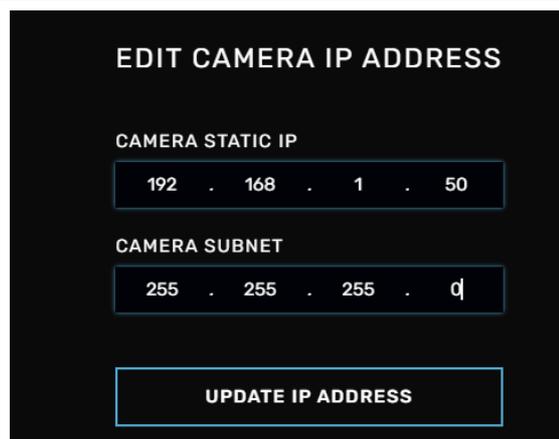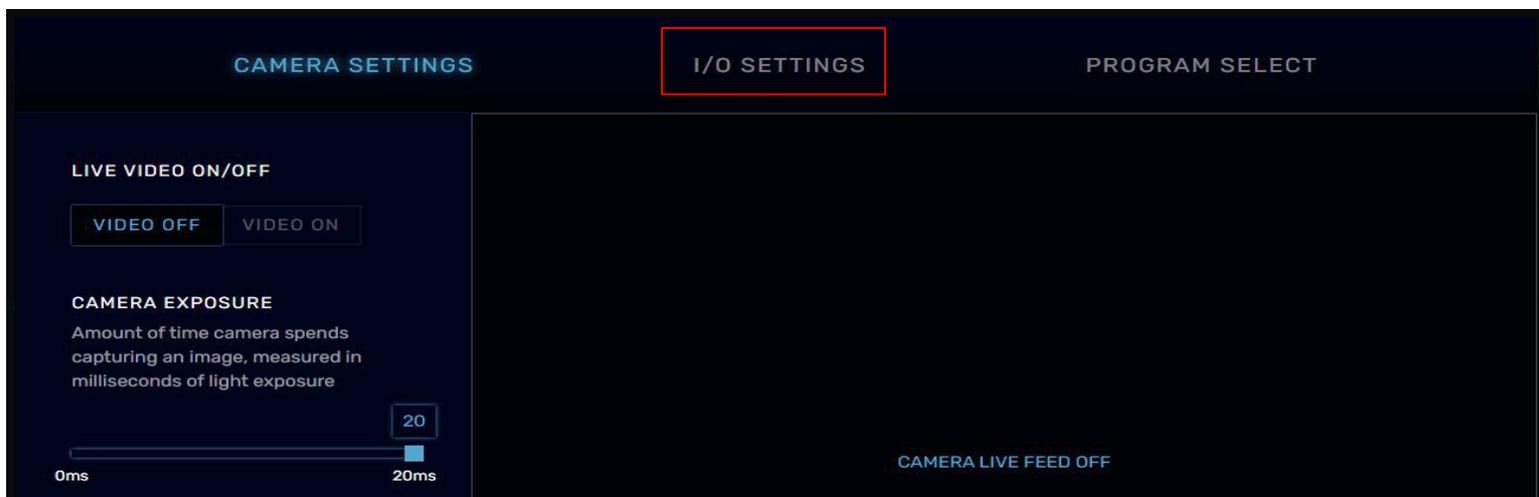
NOTE: If you change the camera's IP address write down the new IP address.
Upon changing the subnet, you will lose connection to the camera because your PC's subnet must also change to match the new subnet of the camera. This can be done by returning to the steps on page 3.

Rockwell EtherNet/IP Setup

5. **Within the I/O settings click Edit PLC/IO Settings and provide the PLC's IP address. You will now be connected to the PLC**
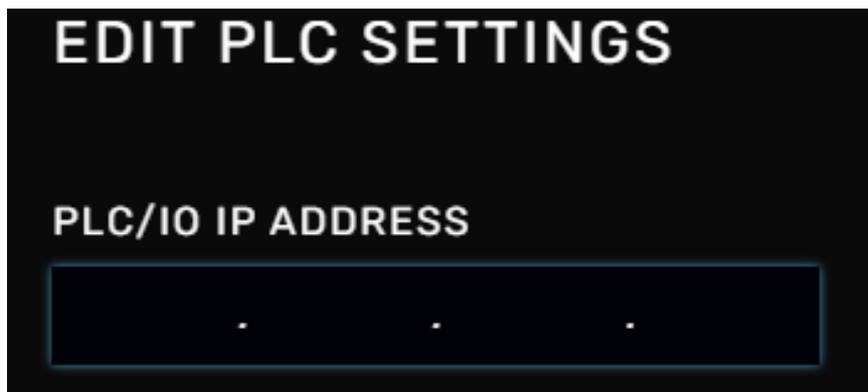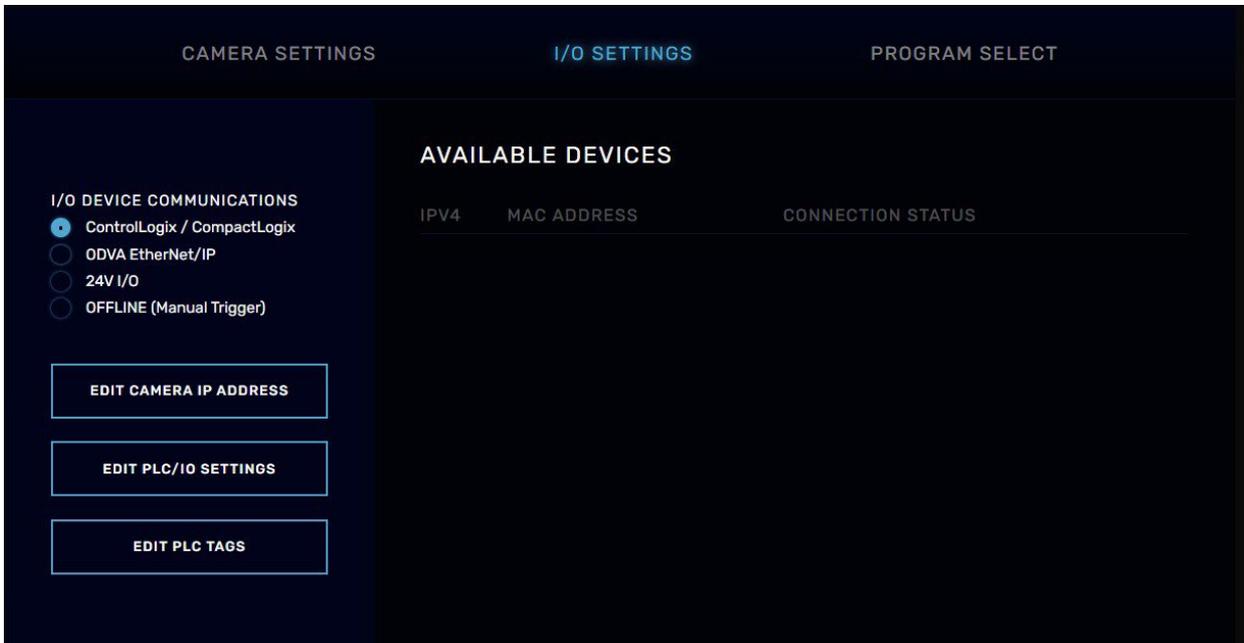
Communication with PLC using Ethernet/IP

6. After providing the PLC IP address you can write programs using the tags in the table below. There are sample programs on the following page explaining the purpose of each tag.

An Input is a signal sent to camera from the PLC, while Output is a signal sent from the camera.

You can view and edit these tags using the EDIT PLC TAGS button.

NOTE: The tags in your program must be in controller scope.

SET PLC TAG NAMES

TAG DESCRIPTION	TAG NAME	INPUT/OUTPUT	TYPE
Trigger	TRIGGER	Input	BOOL
Results Ready	RESULTS_READY	Output	BOOL
Pass	PASS	Output	BOOL
Fail	FAIL	Output	BOOL
Class Prediction [1-N]	CLASS_PREDICTION	Output	DINT
Active Job [0-8]	ACTIVE_JOB	Output	DINT
Job Change[0-8]	JOB_CHANGE	Input	DINT
Clear Results	CLEAR_RESULTS	Input	BOOL
Trigger Ack	TRIGGER_ACK	Output	BOOL

NOTE: Tag names in PLC program must match the names in the table above

NOTE: As stated on page 12, the camera MUST be in Auto Trigger mode to receive a trigger from the PLC

Simple Pass/Fail PLC Program Example
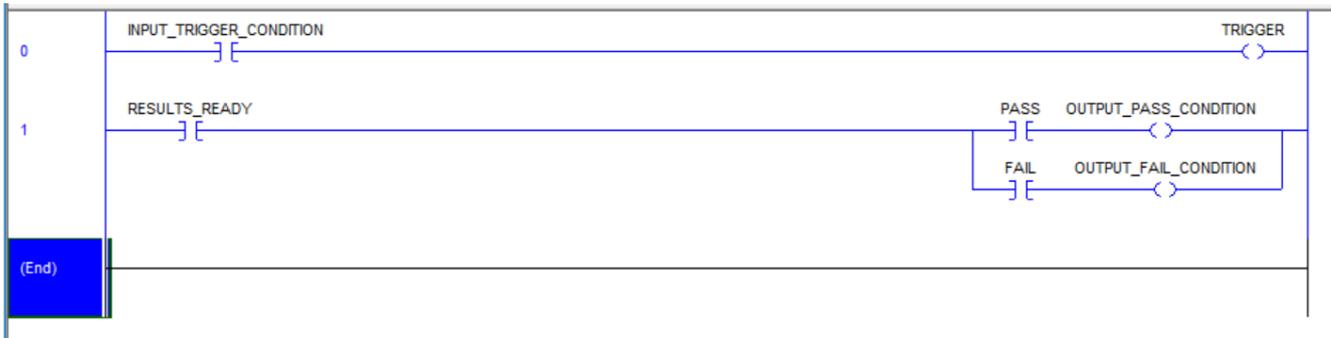
The image above is an example of a very common and simple PLC configuration with a pass and fail job running.

When desired the INPUT_TRIGGER_CONDITION is set by the PLC, sending a TRIGGER to the camera.

When the camera receives the trigger, it captures an image. Once the camera has a determination, RESULTS_READY will be set high, and either PASS or FAIL will also be set high.

NOTE: Each time TRIGGER is set high, RESULTS_READY, PASS, AND FAIL are set low

The OUTPUT_PASS and OUTPUT_FAIL_CONDITION outputs are desired outcomes of either determination e.g. if a part is deemed a fail, OUTPUT_FAIL_CONDITION sounds an alarm to notify an operator.

The image above is a very similar example adding in the optional tags TRIGGER_ACK AND CLEAR_RESULTS.

TRIGGER_ACK is an output from the camera acknowledging that is received a trigger from the PLC.

TRIGGER_ACK is automatically set low as soon as a determination is made, right before RESULTS_READY is set high.

CLEAR_RESULTS is an input, which is used if you would like the results to be set low prior to the next TRIGGER.

Changing Jobs over Ethernet/IP
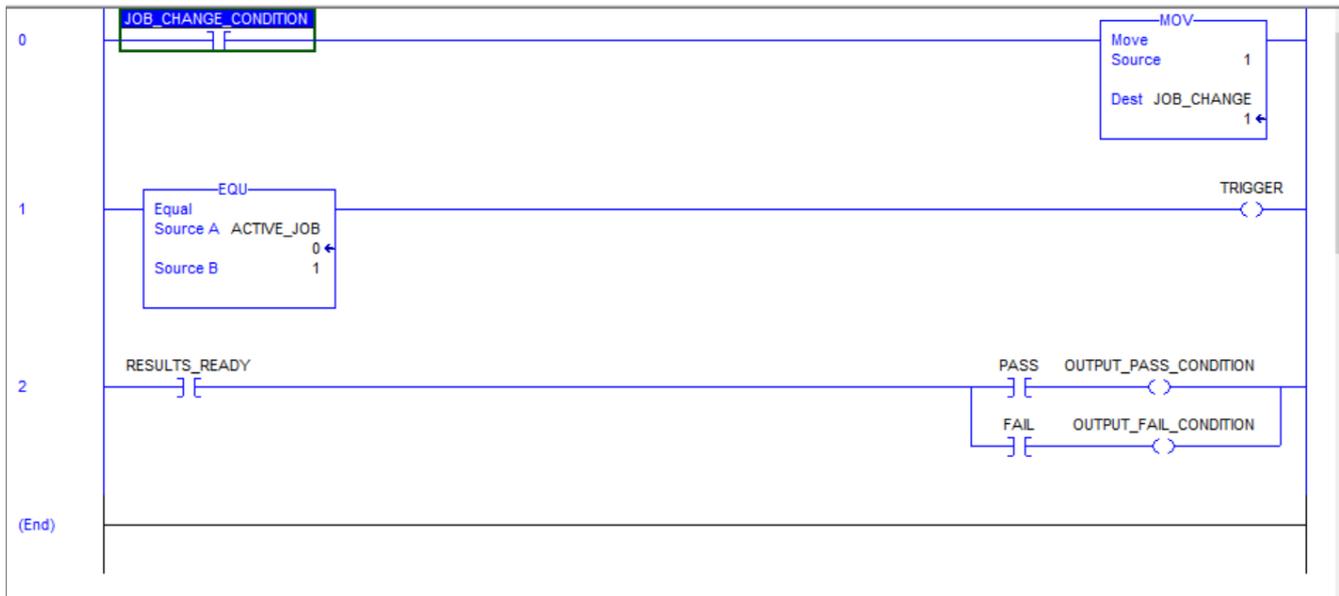
The image above is an example of performing a job change using a PLC. This allows you to quickly switch between jobs if you need to do multiple inspections of a part or run different parts consecutively.

When JOB_CHANGE_CONDITION is set high the MOV instruction sets JOB_CHANGE to the move source. In this example there is only 1 job change but this can be repeated up to 8 times to accommodate each job slot.

The EQU instruction will set TRIGGER high once the ACTIVE_JOB equals 1.

PLC Program Example for Classification

The image above is an example of a PLC program written to run a classification job. CLASS_PREDICTION is a DINT set by the camera.

In this program, when RESULTS_READY is high and the corresponding EQU instruction is satisfied, OUTPUT_CLASS_CONDITION will be set high for the class predicted by the camera.

M12 - 12 pin - Power/IO Cable

Male
```
      6
  7       5
8    12 11    4
       10
9             3
    1       2
```
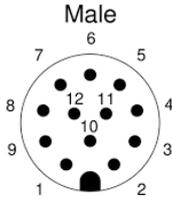
OUTPUTS
- Sent from camera

INPUTS
- Received by camera

Part Numbers (5M / 10M / 15M)
- DVT-CBL-PIO-A-12-05M
- DVT-CBL-PIO-A-12-10M
- DVT-CBL-PIO-A-12-15M

Base MI-F0-3-X

PIN	Wire Color	Function		Signal
1	BLACK	COMMON GROUND		Ground
2	BROWN	JOB CHANGE PIN #1 (IN)		24V IO
3	RED	24V POWER		+24VDC
4	ORANGE	CAMERA TRIGGER (IN)		24V IO
5	YELLOW	INDETERMINATE RESULT (OUT)		24V IO
6	GREEN	PASS RESULT (OUT)		24V IO
7	BLUE	HI=READY, LO=BUSY (OUT)		24V IO
8	VIOLET	PROGRAMMABLE (OUT)		24V IO
9	GRAY	JOB CHANGE PIN #2 (IN)		24V IO
10	WHITE	LIGHT TRIGGER (OUT)		24V IO
11	PINK	FAIL RESULT (OUT)		24V IO
12	LITE GREEN	JOB CHANGE PIN #3 (IN)		24V IO