DEEPVIEW

User Guide Deepview Al 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



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Standard System Configuration

Example of a standard production setup with one Deepview camera



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



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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

Thetwork connections				
$\leftrightarrow \rightarrow \checkmark \uparrow$ 🔄 > Control Panel > Network and Internet > Network Connection	ns	~ Ŭ	Q	
Organize - Disable this network device Diagnose this connection Renam	ne this connection Change settings of this connection		- 🔳 🕐	
Nuetconk Network Connection 2 Nuetwork able unplugged Bluetooth Device (Personal Area	itroller	Wi-Fi ADC, Shared Intel(R) Dual Band Wireless-AC 31		
4 items 1 item selected			III 🔳	Ethernet Properties
				Networking
Double click on the Intern	et Protocol Version	4 IPV4 optic	on	Connect using:
			<	PRealtek PCIe GBE Family Controller
			\mathbf{X}	Configure
				This connection uses the following items:
TE: Any number 1-255 can the IP address so long as i	t be assigned in the t does not match th	<mark>last "sectio</mark> e camera ∝ │	<mark>n"</mark>	Client for Microsoft Networks Gient for Microsoft Networks File and Printer Sharing for Microsoft Networks Popcap Packet Driver (NPCAP) QoS Packet Scheduler A Internet Protocol Version 4 (TCP/IPv4) A Microsoft Network Adapter Multiplexor Protocol A Microsoft LLDP Protocol Driver
	vi) rioperaes	~		< 7
General				Install Uninstall Properties
General You can get IP settings assigned au this capability. Otherwise, you need for the appropriate IP settings.	utomatically if your network s d to ask your network admini	supports istrator		Install Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
General You can get IP settings assigned au this capability. Otherwise, you need for the appropriate IP settings.	utomatically if your network s d to ask your network admini ically	supports istrator		Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. OK Car
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General You can get IP settings assigned au this capability. Otherwise, you need for the appropriate IP settings. Obtain an IP address automate Use the following IP address: IP address:	utomatically if your network s d to ask your network admin ically 192 . 168 . 2 . 144	supports istrator		Install Ininstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. OK Car
General You can get IP settings assigned au this capability. Otherwise, you need for the appropriate IP settings. Obtain an IP address automate Use the following IP address: IP address: Subnet mask:	utomatically if your network s d to ask your network admin ically 192 . 168 . 2 . 144 255 . 255 . 255 . 0	supports istrator		Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. OK Ca

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

$\leftrightarrow \rightarrow c$	A Not secure	192.168.2.50:5000		07	Q	☆
			LOGIN TO DEEPVIEW			
			EMAIL: sysadmin@deepviewai.com // PASSW0RD: x			
			EMAIL			
			PASSWORD			
			SUBMIT			

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

TRAINING	CAMERA

To return to this page and quickly switch between Training and Camera, click the Deepview logo in the top left from either screen.

	WEIVGEEG	
DEEPVIEW		📑 🕉 💠 💄
		RECENT IMAGES
PARTAL INDUER ROTO INDUER		Prediction N/A Confidence N/A Trigger PLC Inference time ms
CAMERA LIVE FEED OFF		Prediction N/A Confidence N/A Togor PLC Morrence time ms
		Prediction N/A Confidence N/A Troger PLC Inference Izne ms
LIVE VIDEO OFF LIVE VIDEO ON	AWAITING IMAGE CAPTURE	Prediction N/A Confidence N/A Trigger en Pro- Veterance time ma
CAPTURE IMAGE		Pesistion N/A
Current Job Edge Chips		Pendiction N/A Cenditoreo N/A Tigger PLC Inference time ms
		Prediction N/A Confidence N/A Trigger Inference time ms
	PREDICTION N/A CONFIDENCE N/A	Prediction N/A Confessoe N/A

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

DEEPVIEW APPLICATIONS / EXAMPLE / IMAGES		
	IMAGES	NETWORKS
STEP 1 UPLOAD IMAGES		
Images uploaded 0		
DROP IMAGES HERE OR SELECT FILES 🔭		
UPLOAD PASS FAIL		
PROCEED TO NEXT STEP →		

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

DEEPVIEW APPLICATIONS / EXAMPLE / IMAGES									
			VERVIEW IM	AGES NETWO					
STEP 2 LABEL IMAGES Images uploaded 142 100% labeling complete	Label: PASS	Label PASS	Label: PASS	Label: PASS	Label: PASS	Label: PASS	Label: PASS	Label: PASS	Label: PASS
 ✓ PASS images 79 ③ FAIL images 63 ③ FAIL detection labels 63/63 	Label: PASS	Label: FAIL	Label: FAIL						
DROP IMAGES HERE OR SELECT FILES M	Label: FAL	Label: FAIL	Label: FAIL	Labet: FAIL	Label: FAIL	Label: FAIL	Labet: FAIL	Label: FAIL	Laboi: FAIL
UPLOAD PASS FAIL	Label: FAL	Label FAL	Labe: FAIL	Label: FAIL	Labet: FAIL	Labei: FAL	Labet: FAIL	Label: FAIL	Label: FAIL
PROCEED TO NEXT STEP →	Label: FAIL	Labet FAIL	Label: FAIL	Label: FAIL					

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.

DEEPVIEW APPLICATIONS / EXAMPLE / NETWORKS / NEW NETWORKS	ETWORK
	🔳 x: 8, y: 100
TRAINING PROGRESS	
16% complete 1 hours, 5 minutes remaining	
KEY ACCURACY TERMS	
Accuracy 100% % of defects found	
	e Br
False Negatives 0% % of GOOD PARTS failed by the network	
False Positives 0%	
% of BAD PARTS passed by the network	
	• • •
	0 5 10 15 20 25 30 35 40 45 5
	Number of epochs (training iterations)

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.

LOAD NEURAL NETWORK TO JOB SLOT						
0	CAMERA_SETUP		ACTIVATE			
1	Edge Chips		ACTIVE			
2	LOAD NETWORK TO JOB SLOT					
3	LOAD NETWORK TO JOB SLOT					
4	LOAD NETWORK TO JOB SLOT					
5	LOAD NETWORK TO JOB SLOT					
6	LOAD NETWORK TO JOB SLOT					
7	LOAD NETWORK TO JOB SLOT					
8	LOAD NETWORK TO JOB SLOT					

Camera Screen Overview

WEIVGEEG		📑 🔊 🂠 💄
MANUAL TRIGGER AUTO TRIGGER		RECENT IMAGES
		Prediction N/A Confidence N/A Inger PLC Inference time ms
CAMERA LIVE FEED OFF		Prediction N/A Confidence N/A Trigger PLC Inference time ms
		Prediction N/A Confidence N/A Trigger PLC Inference Sime ms
LIVE VIDEO OFF LIVE VIDEO ON	AWAITING IMAGE CAPTURE	Prediction N/A Confidence N/A Trigger PLC Inference time ms
CAPTURE IMAGE		Prediction N/A Confidence N/A
Current Job CAMERA_SETUP		Prediction N/A Confidence N/A
Job Slot 0		Prediction N/A Confidence N/A Trager PLC Inference time ms
	PREDICTION N/A CONFIDENCE N/A	Prediction N/A Confidence N/A - Trigger PLC Inference time ms

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

DEEPVIEW HISTORY			= 5 ¢ 2
	BROWSE HISTORY: SELECT JOB		
	JOB NAME	JOB SLOT	
	CAMERA_SETUP	0	
	Edge Chips	1	

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.

CAMERA SETTINGS I/O SETTINGS PROGRAM SELECT				
	CAMERA SETTINGS	I/O SETTINGS	PROGRAM SELECT	

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.

CAMERA S	ETTINGS	I/O SETTINGS	PROGRAM SELECT	
LIVE VIDEO ON/OFF VIDEO OFF VIDEO ON				
CAMERA EXPOSURE Amount of time camera spends capturing an image, measured in milliseconds of light exposure 13.262 Oms	20ms	CAMERA	LIVE FEED OFF	
CROP IMAGE Crop image to focus neural networ Click within image to crop. Crops saved by job (each job may have a different crop). • Click within image to crop. • Use delete key to remove crop	prk. are a			

I/O Settings

The second section is I/O and communications settings.

CAMERA SETTINGS	I/O SETTINGS	PROGRAM SELECT
	AVAILABLE DEVICES	
ControlLogix / CompactLogix ODVA EtherNet/IP 24V I/0 OFFLINE (Manual Trigger)	IPV4 MAC ADDRESS	CONNECTION STATUS
AUTO-TRIGGER INTERVAL During continuous trigger, set trigger frequency 250		
250ms 5000ms		
EDIT CAMERA IP ADDRESS		
EDIT PLC/IO SETTINGS		
MONITOR I/O SIGNALS		

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.

	CAMERA SETTINGS	I/O SETTINGS	PROGRAM SELECT
SLOT	JOB NAME	ACTIVATE JOB	DELETE JOB
0	CAMERA_SETUP	ACTIVATE	
1	Edge Chips	ACTIVE	
2	LOAD JOB		
3	LOAD JOB		
4	LOAD JOB		
5	LOAD JOB		
6	LOAD JOB		
7	LOAD JOB		
8	LOAD JOB		

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

CAMERA SETTINGS		I/O SETTINGS	PROGRAM SELECT
I/O DEVICE COMMUNICATIONS	AVAII	ABLE DEVICES	CONNECTION STATUS
ODVA EtherNet/IP 24V I/O OFFLINE (Manual Trigger)			
EDIT CAMERA IP ADDRESS			
EDIT PLC/IO SETTINGS			
EDIT PLC TAGS			



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		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

0	INPUT_TRIGGER_CONDITION	TRIGGER
1	RESULTS_READY	PASS OUTPUT_PASS_CONDITION
(End)		

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.

0	INPUT_TRIGGER_CONDITION	
1	TRIGGER_ACK	
2	RESULTS_READY	
e 3 e e		CLEAR_RESULTS
(End)		

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

0		Move Source 1 Dest JOB_CHANGE 1 ← TRIGGER
2	RESULTS_READY	PUT_PASS_CONDITION
(End)	FAIL OU	

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

0	INPUT_TRIGGER_COND	ITION	TRIGGER
1	RESULTS_READY	Equal	
		Source A CLASS_PREDICTION 3 € Source B 1	
2	RESULTS_READY	EQU-	
	,	Source B 2	Ŭ
	RESULTS READY		OUTPUT CLASS CONDITION[3]
3		Equil Source A CLASS_PREDICTION 3 €	
		Sonce 8 3	

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



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