NS42

Smart Vision Sensor

Product Reference Guide

ZEBRA

MN-005229-01EN Rev A

Copyright

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About this Guide

Notational Conventions

The following notational conventions make the content of this document easy to navigate.

- **Bold** text is used to highlight the following:
  - Dialog box, window, and screen names
  - Dropdown list and list box names
  - Checkbox and radio button names
  - Icons on a screen
  - Key names on a keypad
  - Button names on a screen
- Bullets (•) indicate:
  - Action items
  - List of alternatives
  - Lists of required steps that are not necessarily sequential.
- Sequential lists (for example, those that describe step-by-step procedures) appear as numbered lists.

Icon Conventions

The documentation set is designed to give the reader more visual clues. The following visual indicators are used throughout the documentation set.

NOTE: The text here indicates information that is supplemental for the user to know and that is not required to complete a task.

IMPORTANT: The text here indicates information that is important for the user to know.

CAUTION: If the precaution is not heeded, the user could receive a minor or moderate injury.

WARNING: If danger is not avoided, the user CAN be seriously injured or killed.

DANGER: If danger is not avoided, the user WILL be seriously injured or killed.

Service Information

If you have a problem with your equipment, contact Zebra Global Customer Support for your region. Contact information is available at: zebra.com/support.

When contacting support, please have the following information available:

- Serial number of the unit
- Model number or product name
- Software/firmware type and version number

Zebra responds to calls by email, telephone, or fax within the time limits set forth in support agreements.

If your problem cannot be solved by Zebra Customer Support, you may need to return your equipment for servicing and will be given specific directions. Zebra is not responsible for any damages incurred during shipment if the approved shipping container is not used. Shipping the units improperly can possibly void the warranty.

If you purchased your Zebra business product from a Zebra business partner, contact that business partner for support.

Getting Started

Configurations

This guide covers the following configurations.

Table 1 NS42 Configurations

SKU	Description
NS42-SR20N4-2C00K	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-SR20N4-2C00W	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-SR20N4-3C00K	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-SR20N4-3C00W	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-SR20Q4-2C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-SR20Q4-2C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-SR20Q4-3C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-SR20Q4-3C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-SR20T4-2C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-SR20T4-2C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-SR20T4-3C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-SR20T4-3C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-WA20N4-2C00K	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-WA20N4-2C00W	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-WA20N4-3C00K	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-WA20N4-3C00W	2.3 MP, Standard Machine Vision with Anomaly Detection
NS42-WA20Q4-2C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection

Table 1 NS42 Configurations (Continued)

SKU	Description
NS42-WA20Q4-2C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-WA20Q4-3C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-WA20Q4-3C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR and Anomaly Detection
NS42-WA20T4-2C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-WA20T4-2C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-WA20T4-3C00K	2.3 MP, Standard Machine Vision with Deep Learning OCR
NS42-WA20T4-3C00W	2.3 MP, Standard Machine Vision with Deep Learning OCR

Licenses

The NS42 utilizes the Essential Machine Vision toolset for Standard 2D barcodes.

For additional information on licenses and toolsets in Zebra Aurora Focus, refer to the Zebra Aurora Focus User Guide.

Installation

Mounting Instructions

The following sections describe the steps to mount the device to the L-bracket accessory.

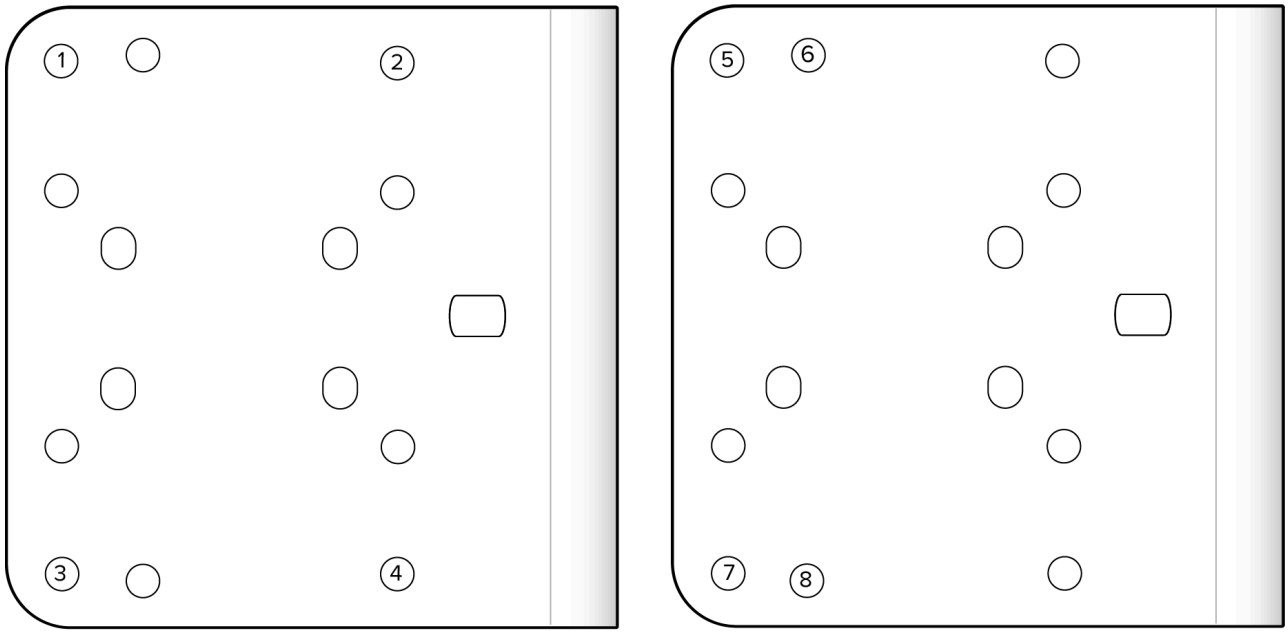
1. Align the holes on the mounting surface with the mounting holes on the device.
2. Insert screws into the mounting holes and tighten. It is recommended to use four M3 screws to attach the camera on the bottom surface. Torque screws to 6.9 kgf-cm (6.0 lbf-in).

Review the dimensional drawings for mounting hole placements on the devices to determine the proper screw lengths needed based on the provided tapping depths into the camera.

Mounting the Device Using the L-Bracket

1. Use the mounting screws provided with the kit to attach the camera to the bracket. Torque screws to 6.9 kgf-cm (6.0 lbf-in).
2. Refer to the L-bracket mounting options outlined below.

Figure 1 Bottom and Side Mounting Options

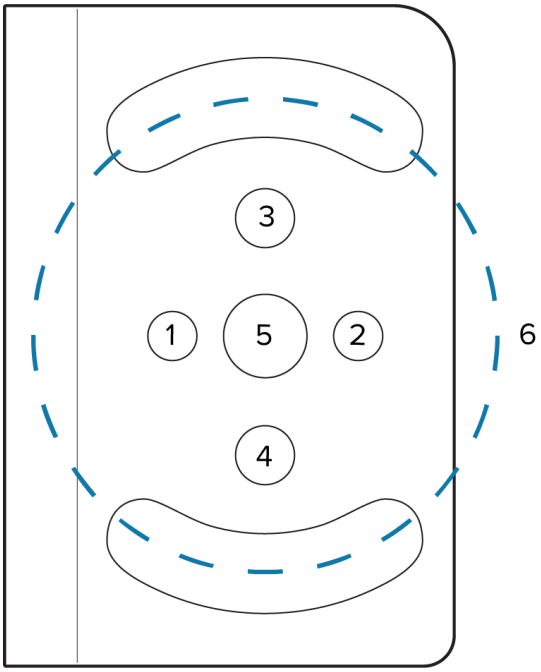


Bottom Mounting Holes

Side Mounting Holes

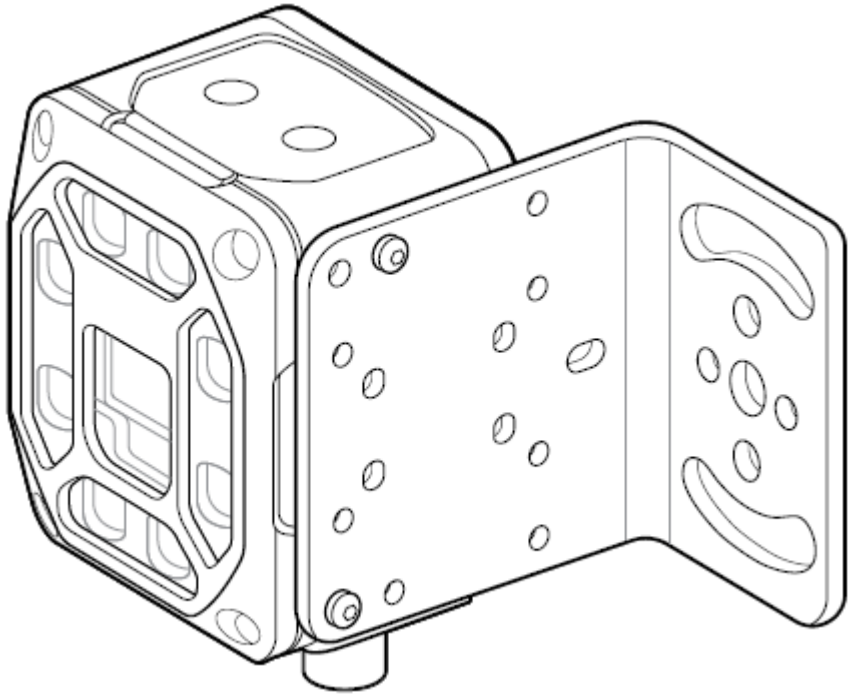
1-4	Bottom Surface Mounting Holes for both devices
5-8	Side Mounting Holes for the xS40 and xS42 Side Mounting Holes for xS40, xS42 and xS70 devices

Figure 2 Side Mounting Orientation



1-2	M5 Clearance
3-4	1/4-20 Clearance
5	M8 Clearance
6	M8 Clearance Slots

Figure 3 Side Mounting Orientation



Installing an Illumination System

Proper illumination improves detection capabilities in challenging lighting conditions.

To install the illumination system on the device, follow the steps below:

1. Place the gasket onto the camera.
2. Attach the Illumination PCB to the camera via the board-to-board connector and secure it with two screws. The recommended Torque is 6.9 kgf-cm (6.0 lbf-in) using the Torx T8 fasteners.
3. Place the filter onto the camera exit window, lining up the corner chamfer of the filter to the corner chamfer of the camera housing (if required).
4. Place the illumination plate assembly onto the camera.
5. Attach the top cover and secure it with four screws. The recommended Torque is 6.0 in-lbs using the Torx T8 fasteners.

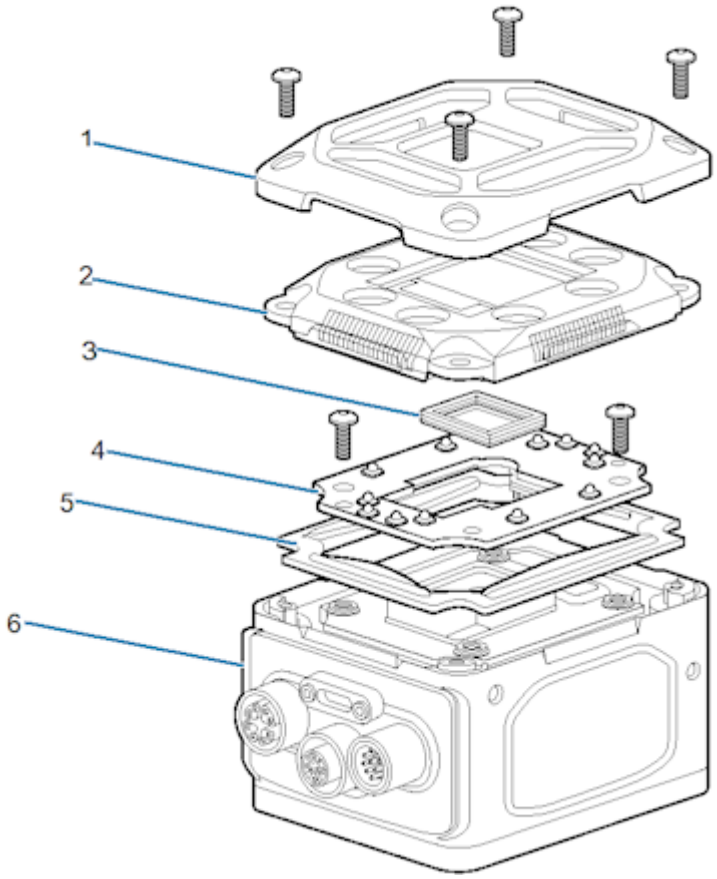
Disassembling the Illumination System

To disassemble the illumination system on the device, follow the steps below:

1. Remove the four screws and remove the top cover.
2. Remove the illumination plate assembly.
3. Remove the filter (if applicable).
4. Remove the two screws and gently lift the PCB to disconnect it from the device.

The gasket can be left in place unless damaged. Replace the gasket if it is damaged to maintain its IP67 specification.

Figure 4 Lens Disassembly



1	ESD Safe Cover (Four Screws)
2	Illumination Plate Sub-Assembly
3	Filter Assembly
4	Illumination PCB (Two Screws)
5	Illumination Plate Gasket
6	Main Assembly

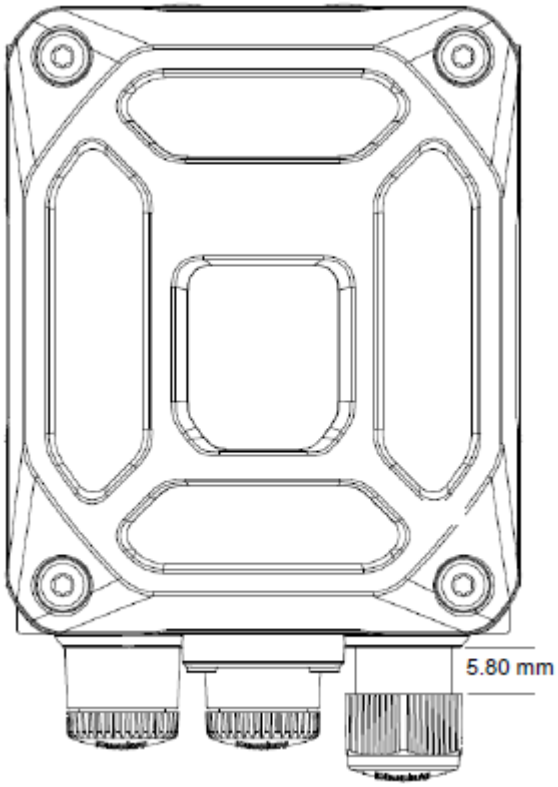
Torque Specification

To ensure an IP65 and IP67 product specification, Zebra cables and/or connector covers must be torqued to the following specification:

- Torque for M12 Zebra cables: 24.0 in-lbs
- Torque for connector covers: 10.0 in-lbs

NOTE: Connector covers are hand tightened from the factory to allow for easy hand removal. The covers must be torqued at installation to guarantee an IP65 and IP67 specification if cables are not used.

Refer to the following diagram for the reference dimension (in mm) of the 12-pin M12 cable:



Power Sources

Power the device through a 12-pin M12 connector, Power over Ethernet (PoE), or USB Type C to satisfy various use cases.

A power priority scheme selects power from the M12 connector over PoE and PoE over USB-C to ensure the device consumes the least restrictive power source. Changes to the power source trigger a reboot. This acts as a power budget for the device, dynamically allocating power to prevent an overload condition. Allocation is based on sensor type and enabled features such as Ethernet PHYs, digital outputs, and advertised USB Type C port current. Models with internal illumination reduce illumination intensity or duration to operate within budget and may disable internal illumination entirely if necessary.

NOTE: Develop jobs with power sources and auxiliary equipment that are representative of the final intended configuration to prevent a mismatch during deployment.

12 Pin M12 Power Input

If the input voltage exceeds 21.5 V, the vision system enables up to 1.5 A output to the USB Type C connector. If the external light connector is placed in external light mode, power is shunted from the power supply directly to the light through a bypass circuit that supports the high peak currents of strobe lights. A self-resettable fuse prevents physical overload of the 12-pin M12 connector.

If less than 21.5 V is provided to the device, the advertised USB Type C current is lowered to 500 mA, and the overall power budget is reduced. This may impact allowable internal illumination configurations. As a result, a 24 V industrial power supply capable of high pulse currents of long duration is recommended for optimal performance.

Power Over Ethernet

The devices support operation from power sourcing equipment meeting the 802.3at class 4 (30 W) or 802.3af class 3 (15.4 W) IEEE Power Over Ethernet (PoE) standards. These are commonly referred to as PoE + and PoE, respectively by equipment providers.

Peak power draw must be strictly maintained within the power envelope of the power-sourcing equipment. If the external light connector is enabled in external light mode, the vision system generates 24 V to power the external light with the following limitations in place:

- Simultaneous activation of the internal and external illumination is not permitted.
- Auto-strobe lights with high pulse current are not supported and trip over current protection in the vision system, disabling the external light connector.
- External lights with adjustable intensity may be used, provided the peak current draw is below the over-current protection limit. It is recommended to start with the lowest intensity setting and work upwards or to use the auto-tune feature.

Power over Ethernet requires an extra regulation step which incurs additional thermal buildup within the device. As a result, the specified operating temperature range is reduced when powered by PoE.

USB Type C

USB Type C allows for novel and cost-effective installations provided the following constraints are acceptable:

- Digital GPIO are unavailable.
- Optocoupled GPIO is still functional, provided the COMMON_IN and COMMON_OUT are properly terminated.
- The External Light Connector is disabled and cannot be used in GPIO or External Light modes.
- 0 V to 10 V analog output is disabled.
- Illumination is limited or requires a USB power source with further capabilities to be enabled at any capacity.

NOTE: The device boots from legacy USB host ports. However, the current draw is not guaranteed to be under 500 mA, and device functionality may be restricted to the extent that performance can be impaired. An override mode can be enabled for legacy host ports that are known by the operator to be capable of supplying up to 1.5 A. Ports of this type are often described as having USB BC1.2 or USB charging support.

USB Type C Operation

The devices implement a full capability 5 Gbps USB 3.0 USB Type C port with support for DisplayPort Alt Mode. The sealed port implements a standard USB Type C dual screw lock mechanism for secure connections. When paired with the IP67 series of Zebra screw locking cables, the interface maintains a full IP67 seal.

NOTE: The sealing gasket on IP67 series Zebra USB Type C cables requires adequate pressure for proper seal and connector engagement. Always tighten the locking screws when using these cables, even if IP67 sealing is not required.

When connected as a peripheral to a USB host, the devices can be configured to support the following functionality:

- RNDIS Ethernet over USB
- USB-CDC or HID keyboard (configurable using Windows device settings)

When operating as a host, the USB Type C port supports many types of accessories and functionality, including:

- Native USB-C displays
- USB-C to Display Port and USB-C to HDMI adaptors
- HID-compliant keyboards and trackpads
- USB mass storage devices for firmware updates
- USB docks and hubs

NOTE: DisplayPort output is only supported over USB Type C to Type C cables capable of SuperSpeed data rates. High-speed charging cables typically do not have the necessary data wires for DisplayPort functionality.

Grounding for Electro-Magnetic Compliance and ESD Safe

The vision system is designed with a rugged metal chassis connected internally to ground for robust Electro-Magnetic Compliance (EMC) and ESD Safe operation. Do not mount to any conductive object, body, structure, or mechanism that may become connected to line voltage or a voltage potential other than Protected Earth Ground. Chassis grounding via cable shield, mounting screws, or low inductance ground strap to a local Protected Earth Ground is acceptable.

NOTE: There is no galvanic connection to Earth Ground when the device is powered over an unshielded Ethernet cable. In this scenario, grounding to local Earth Ground through another cable shield, mounting screw, or ground strap is required for ESD Safe compliance and best practice for EMC.

Using the Device

User Interface

The device is compatible with 24VDC power supplies and PoE injectors.

User Interface Label

The User Interface (UI) label uses LEDs to provide information on device state and feedback. Two sensor PCB switches control the device's trigger and tune buttons. The TRIG switch acts as a trigger, and the TUNE switch adjusts and optimizes focus.

Figure 5 UI Label

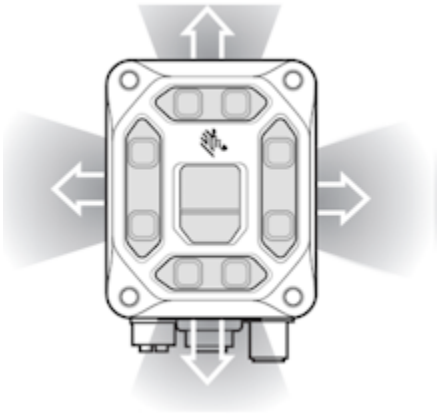
1	Power

2	Power over Ethernet
3	Device Status
4	Focus Status
5	Warning

Decode LEDs

The device has a 360° LED decode indicator that flashes green upon successful decode and red upon job failure.

Figure 6 360° LEDs



LED and Beeper Indicators

The following table describes the LED and beeper indications of the FS/VS Smart Camera upon device events such as power-up, running a job, maintenance operations, and parameter programming.

Table 2 LED and Beeper Indications

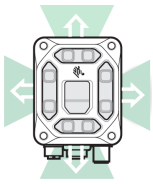
Event	Beeper	360° LED	Power LED	Device Status LED	Focus Status LED	Warning LED
Power Up						
Power up with Low Power	 Low, Medium, High Tone	 Single Green Blink	 Solid Red	-	-	-

Table 2 LED and Beeper Indications (Continued)

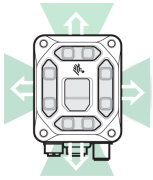
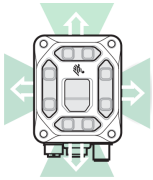
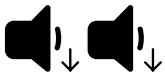
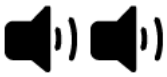
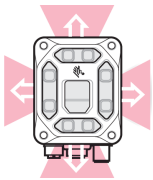
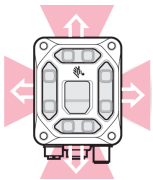
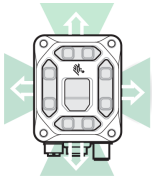
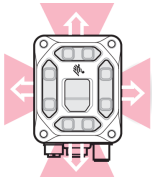
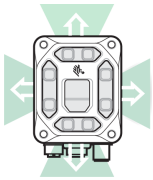
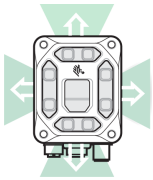
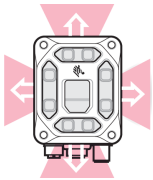
Event	Beeper	360° LED	Power LED	Device Status LED	Focus Status LED	Warning LED
Power up with Limited Power (USB or 15W PoE)	 Low, Medium, High Tone	 Single Green Blink	 Solid Amber	-	-	-
Power up with Full Power (24V or 30W PoE)	 Low, Medium, High Tone	 Single Green Blink	 Solid Green	-	-	-
Job Error	 Low, Low Tone	-	 Solid Green	 Solid Red	-	 Solid Red
Device Maintenance						
Factory Reset	 Medium, Medium Tone	 Continuous Red Flash (5hz)	 Solid Green	-	-	-
Firmware Operations						
Firmware Update Start	-	 Continuous Red Flash (2hz)	 Solid Green	 Continuous Red Flash (2hz)	-	-

Table 2 LED and Beeper Indications (Continued)

Event	Beeper	360° LED	Power LED	Device Status LED	Focus Status LED	Warning LED
Firmware Update Success	-	-	Solid Green	-	-	-
Firmware Update Fail	Low Tone	Continuous Red Flash (5hz)	Solid Green	Continuous Red Flash (5hz)	-	-
Autotune Operations						
AutoTune Start	Medium Tone	-	Solid Green	-	Continuous Green (2Hz)	-
AutoTune Success	High Tone	-	Solid Green	-	Solid Green	-
AutoTune Fail	Low Tone	-	Solid Green	-	Solid Red	-
Decode						
Barcode Decode Start[1]	-	-	Solid Green	Solid Amber	-	-

Table 2 LED and Beeper Indications (Continued)

Event	Beeper	360° LED	Power LED	Device Status LED	Focus Status LED	Warning LED
Barcode Decode Success[1]	 Medium Tone	 Single Green Flash	 Solid Green	-	-	-
Barcode Decode Failure	-	 Single Red Flash	 Solid Green	-	-	-
Parameter Programming						
Parameter Entry Accepted	 High, Low, High, Low Tone	 Single Green Blink	-	 Solid Green	-	-
Parameter Number Entry Expecting Barcodes	 High, Low Tone	 Single Green Blink	-	 Solid Green	-	-
Parameter Entry Error	 Low, High Tone	 Single Red Blink	-	 Solid Green	-	-

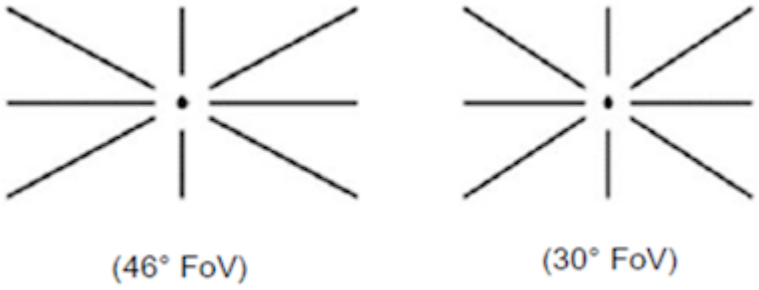
NOTE: [1] This is the default, Barcode Decode Success and Barcode Decode Failure beeper UI feedback is configurable in Aurora Focus.

Aiming Patterns

The aimer indicates the center and size of the field of view including diagonal corners 24 in. away from the subject.

The device has a red Class II laser aimer that generates the pattern shown in the following figure.

Figure 7 Aiming Patterns



NOTE: FS40-WA5 (5MP) configurations do not have a laser aimer.

General Purpose Input and Outputs

The device has two types of general-purpose inputs and outputs (GPIO).

GPIO0 through GPIO3 are optically coupled to provide electrical isolation and wiring flexibility. GPIO4 through GPIO8 are 24 V Digital GPIO, which are not isolated and source power from the external power supply or Power over Ethernet (PoE). Digital GPIO is unavailable when the system is powered by USB. However, optocoupled GPIOs remain functional when COMMON_IN and COMMON_OUT are terminated appropriately.

Figure 8 Opto-Isolated Inputs

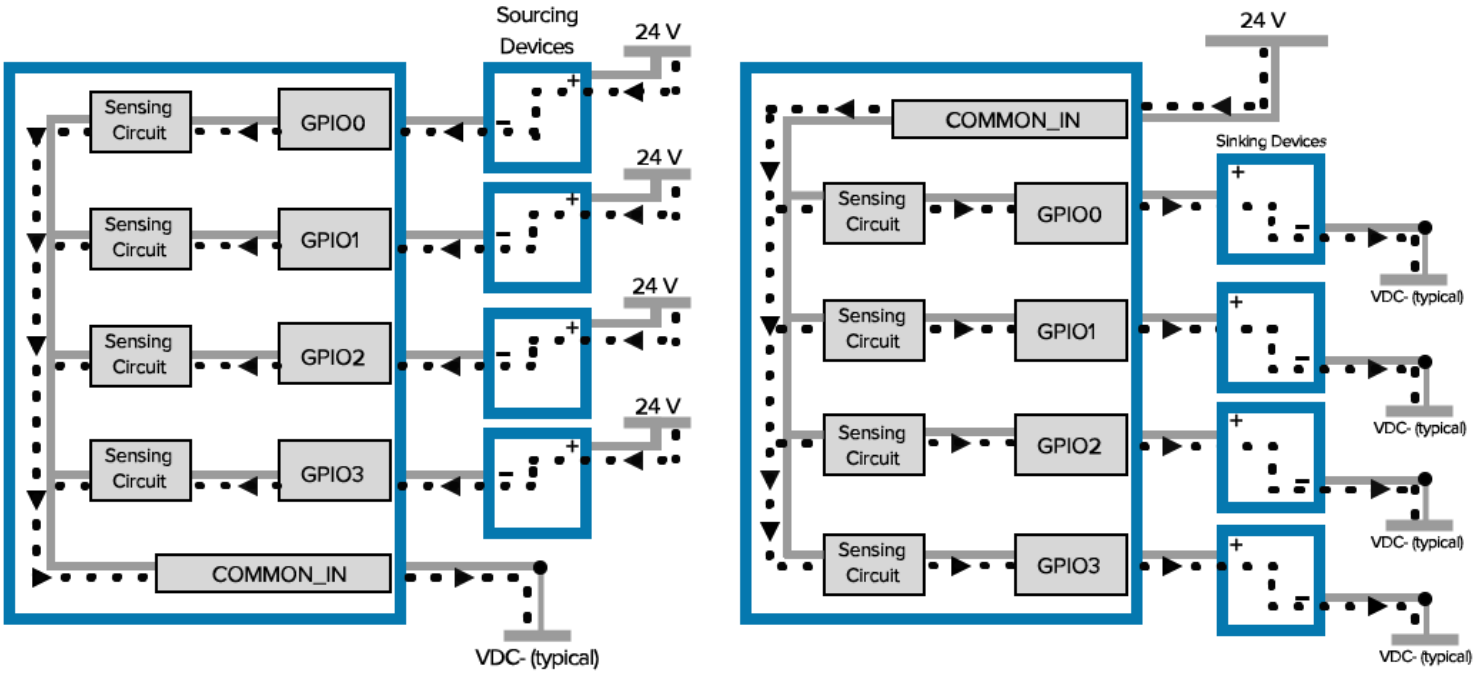
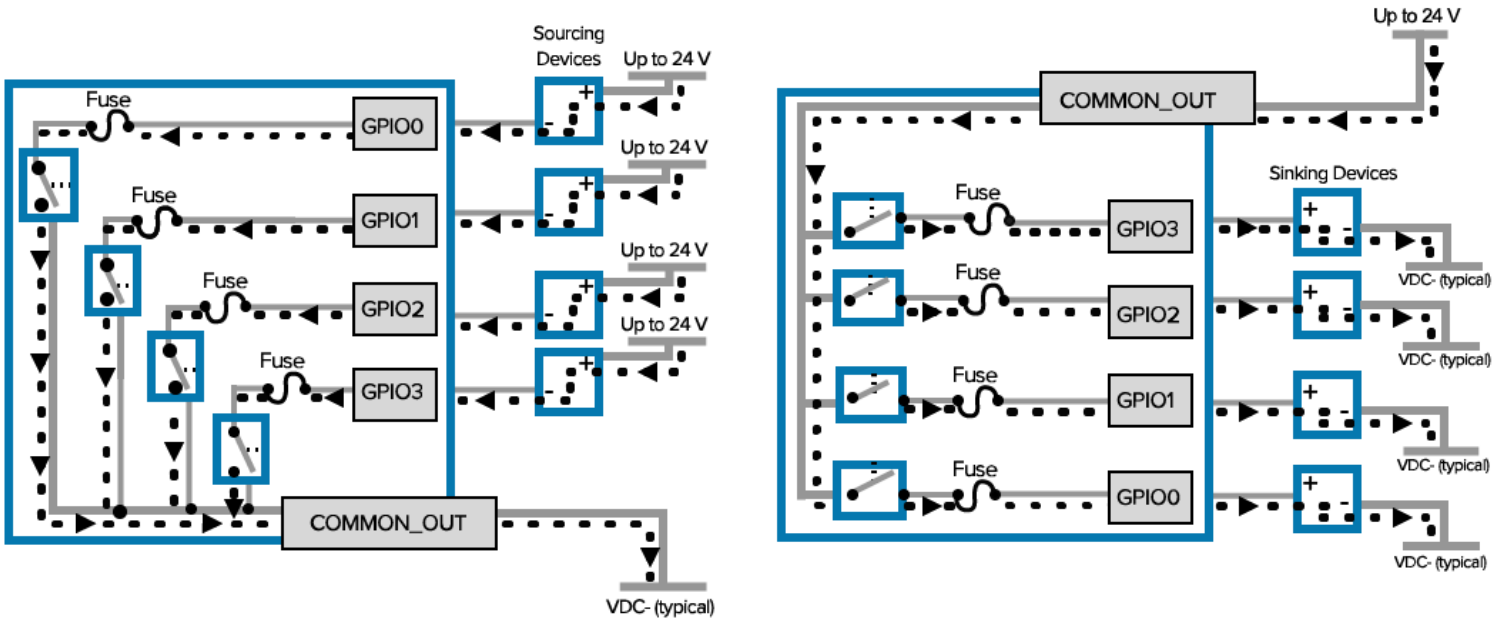


Figure 9 Opto-Isolated Outputs



GPIO Summary

The following table provides GPIO details such as connector, input, and output modes.

Table 3 GPIO Summary

Hardware	PIN	Conn.	Iso	Input Mode		Output Mode				
				Sink PNP	Source NPN	Sink NPN	Source PNP	Push-Pull	Max Current	USB Power
Opto	GPIO0	12 Pin	Yes	Yes	Yes	Yes	Yes	No	50mA	Yes
Opto	GPIO1	12 Pin	Yes	Yes	Yes	Yes	Yes	No	50mA	Yes
Opto	GPIO2	12 Pin	Yes	Yes	Yes	Yes	Yes	No	50mA	Yes
Opto	GPIO3	12 Pin	Yes	Yes	Yes	Yes	Yes	No	50mA	Yes
Digital	GPIO4	12 Pin	No	Yes	No	Yes[2]	Yes[2]	Yes	100mA[1]	No
Digital	GPIO5	12 Pin	No	Yes	No	Yes[2]	Yes[2]	Yes	100mA[1]	No
Digital	GPIO6	5 Pin	No	Yes	No	Yes[2]	Yes[2]	Yes	100mA[1]	No
Digital	GPIO7	5 Pin	No	Yes	No	Yes[2]	Yes[2]	Yes	100mA[1]	No
Digital	GPIO8	5 Pin	No	Yes	No	Yes[2]	Yes[2]	Yes	100mA[1]	No

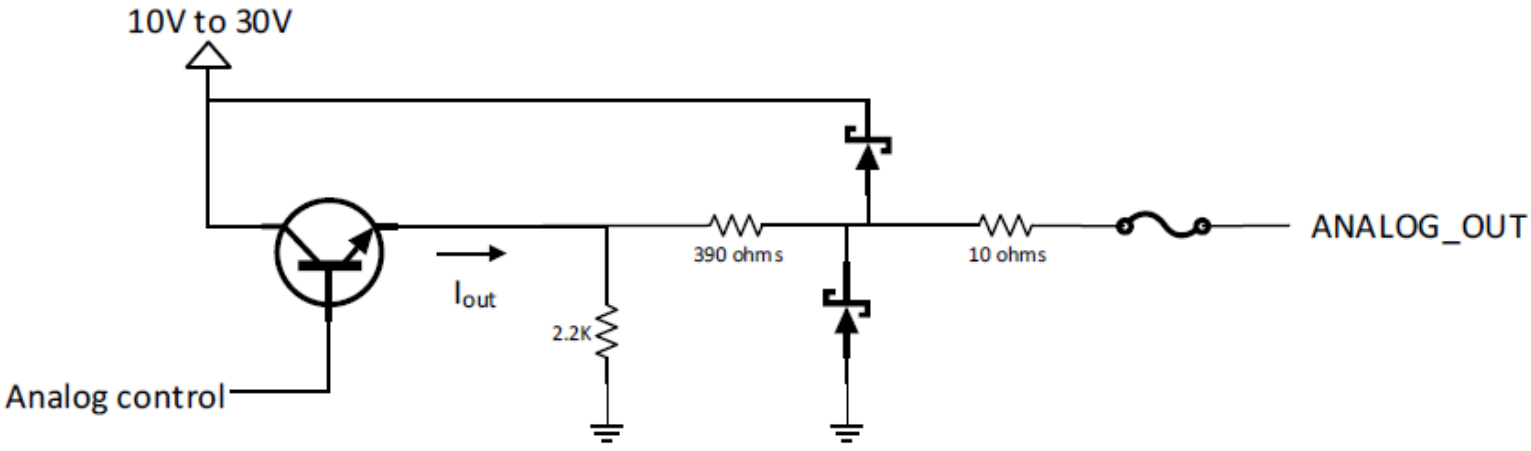
NOTE: [1]Digital outputs consume power and reduce the power budget available for illumination. Disabling unused output when using PoE is recommended.

NOTE: [2]Push-pull output is compatible with auxiliary equipment having NPN inputs referenced to GND or PNP inputs referenced to DC IN.

Analog Output

The system has an analog output on the External Light connector capable of generating between 0 V and 10 V.

An output impedance of approximately 400 ohms protects the analog output driver against overload conditions. However, this introduces an output voltage offset directly proportional to the output current. For optimal accuracy, connect devices with low input bias current.



GPIO Wire Diagrams

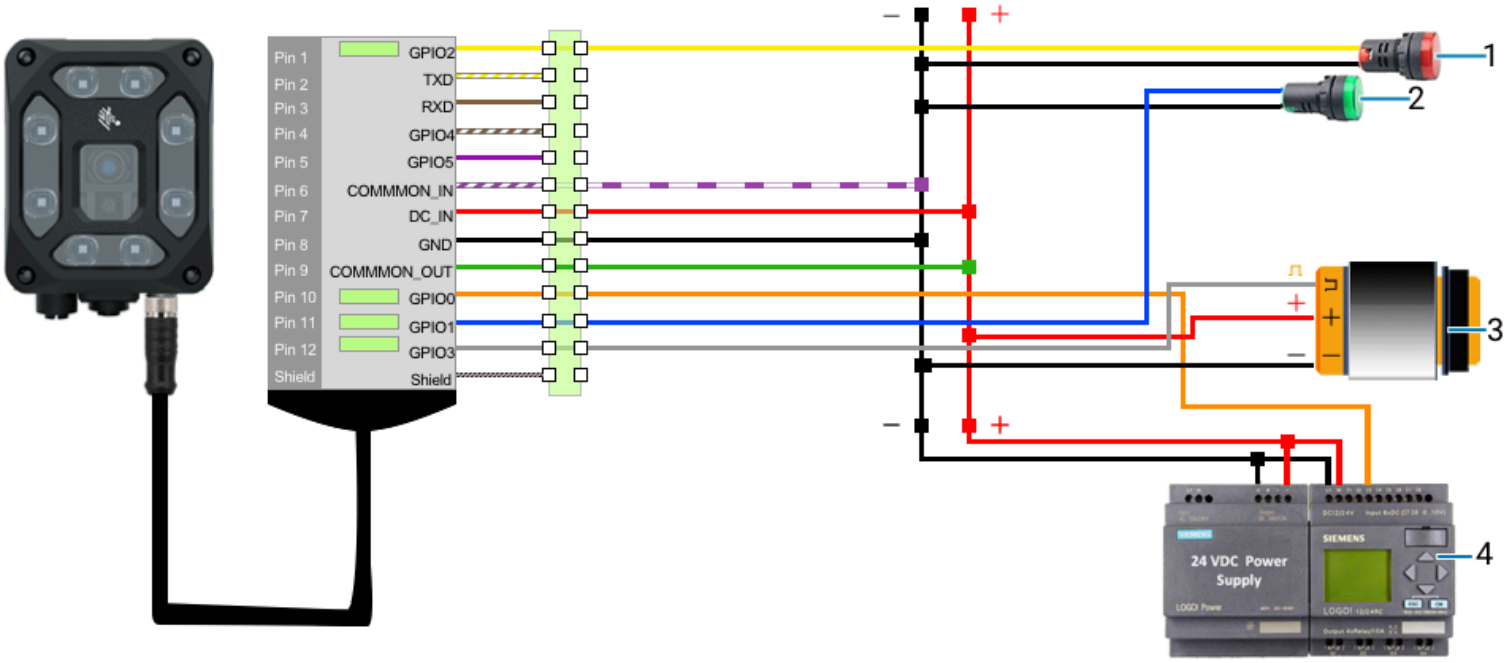
The diagrams in this section describe GPIO wiring with the Output as Current Source and as Current Sink.

Output as Current Source

The following diagram displays a configuration with GPIO 3 set to Input and GPIO0, GPIO1, and GPIO2 set to Output.

The GPIO Outputs are the Current Source (PNP), and the GPIO Input is the Current Sink (PNP). Input is received from a PNP proximity sensor. The power source is a PLC 24VDC PSU, and the GPIO functions are not opto-isolated.

Figure 10 Output as Current Source / Input as Current Sink



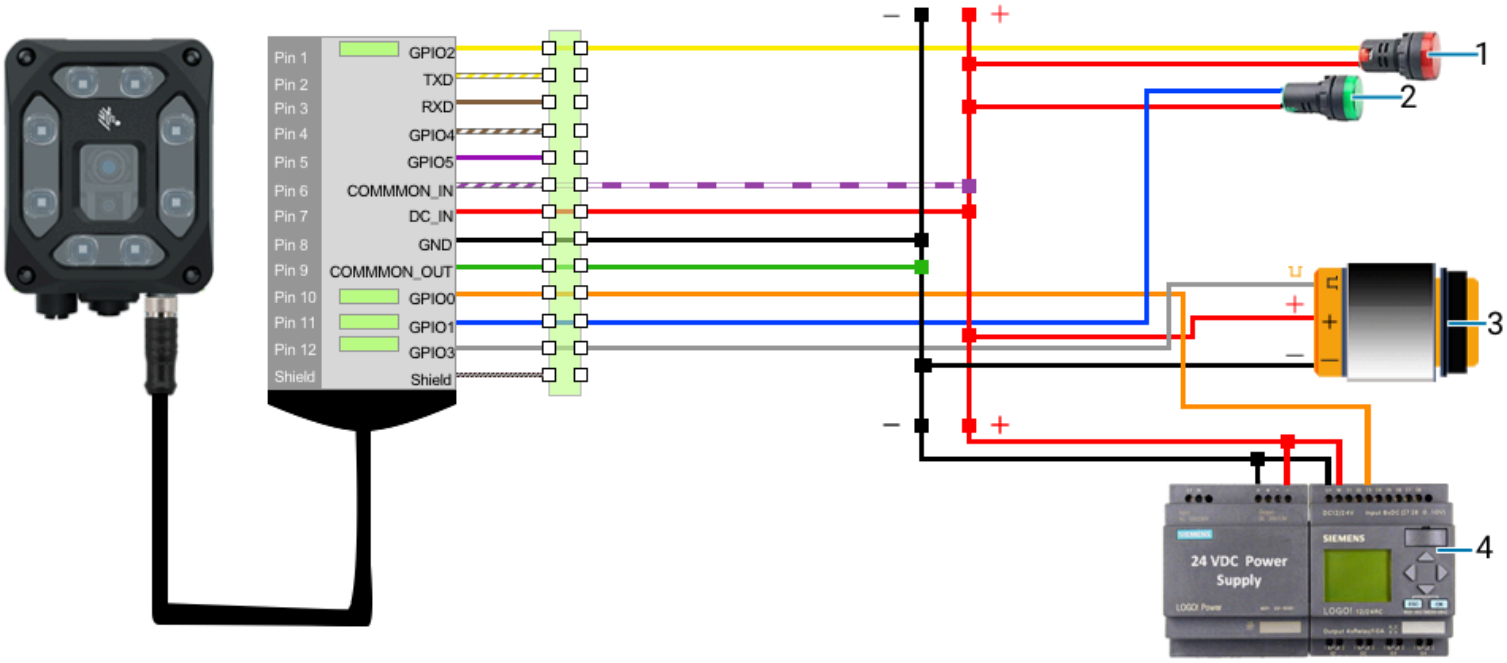
1	Job Fail
2	Job Pass
3	PNP Proximity Sensor
4	Power Supply

Output as Current Sink

The following diagram displays a configuration with GPIO 3 set to Input and GPIO1, GPIO2, and GPIO3 set to Output.

The GPIO Outputs are the Current Sink (NPN), and the GPIO Input is the Current Source (NPN). Input is received from an NPN proximity sensor. The power source is a PLC 24VDC PSU, and the GPIO functions are not opto-isolated.

Figure 11 Output as Current Sink / Input as Current Source



1	Job Fail
2	Job Pass
3	NPN Proximity Sensor
4	Power Supply

Power and Thermal Management

Algorithms keep the system within acceptable power and thermal parameters to ensure reliable operation over the device's lifetime.

CAUTION: A warning indicates if the available power budget is inadequate for the configured settings. In some cases, the user can choose to ignore or override the warning. In this case, the integrator should evaluate the operational stability of the system.

If the device temperature exceeds a safe limit, the system response may include disabling certain features, reducing processor performance, or stopping active jobs.

If overheating is a problem, effective mitigation strategies include:

- Reducing the average system power consumption
- Using external illumination
- Avoiding operating from PoE
- Operating in a cooler environment
- Actively cooling with a fan

- Heatsinking the chassis to a large thermally conductive mounting surface through a thermally conductive mounting system

For optimal performance, ensure that the device does not exceed the recommended operating ranges stated below.

Table 4 Operating Temperature

Temperature	Operating Range
Ambient Temperature	0°C to 40°C (POE, duty cycle-dependent) 0°C to 45°C (non-POE, duty cycle-dependent)

NOTE: If temperatures exceed the operating range, additional heatsinking strategies may be necessary, for example, mounting to a metal infrastructure or forced convection via an external fan. The Zebra Universal Mounting Bracket (BRKT-LMNT-U000) provides multiple mounting options for a metal infrastructure.

Power Cycling the Device

Power cycling the device can help in troubleshooting potential network discoverability issues.

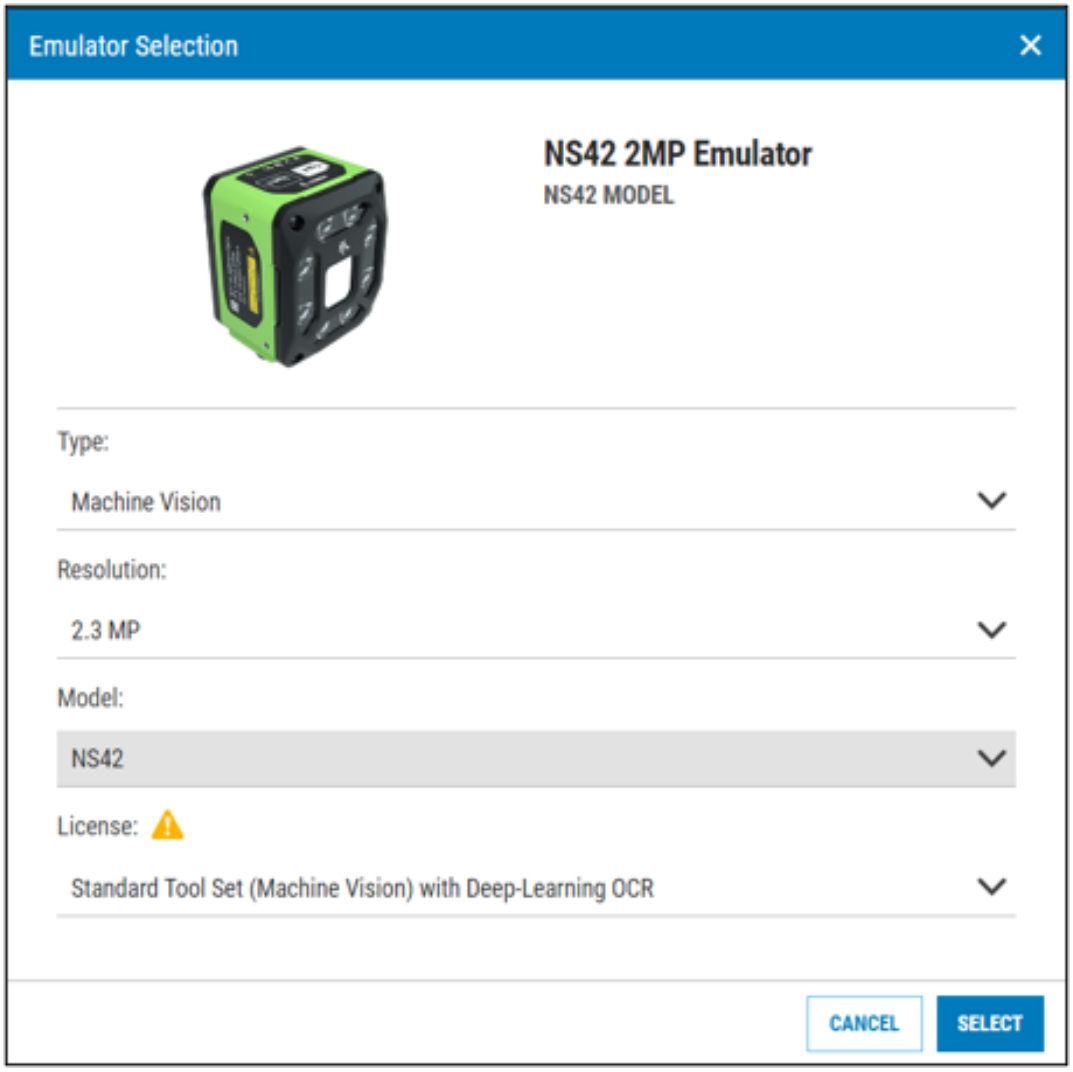
1. Remove all cables to ensure no power is being directed to the device.
2. Reinsert a power source and allow the device approximately one minute to boot up.
3. Re-attempt to:
   - Discover a device in Zebra Aurora Focus by restarting the application and clicking **View Devices**.
   - View a device in the Windows Network.
   - Access a device using the Zebra Web HMI.

If failure persists, repeat the steps above for all of the connection types being used with the device, including:

- Ethernet directly to the PC.
- Ethernet connection to a network via switch or hub.

Using Machine Vision Tools

The NS42 Smart Vision Sensor utilizes Deep Learning OCR and Anomaly Detection in Zebra Aurora Focus. These tools are also available using an emulator.



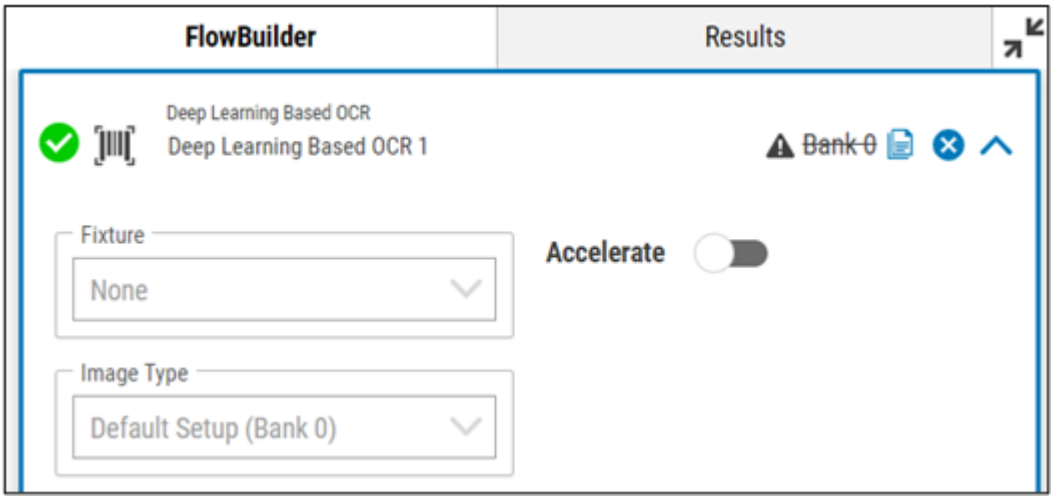
NOTE: To access additional tools, enter a device emulator license key.

Using Accelerated Tools

Deep Learning Object Character Recognition (OCR) and Anomaly Detection tools can be accelerated to speed up a specified tool during job execution and reduce overall tool time.

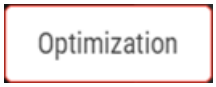
NOTE: Acceleration is available on FS42 and NS42 devices only.

1. Enable acceleration by sliding the **Accelerate** toggle to the right.



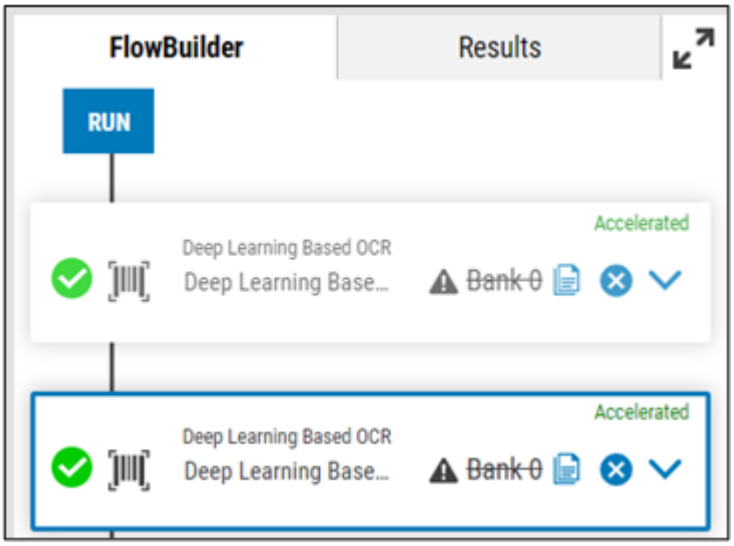
NOTE: In this mode, the Region of Interest (ROI) can be moved or rotated but not resized. Tool settings **Average Character Height** and **Character Width Scale %** are not editable while in Accelerate mode. Move the slider to the left to disable Accelerated mode and edit tool settings.

2. After **Accelerate** is enabled, the **Optimization** overlay displays, and all settings are blocked and transferred to the device.



NOTE: For optimal performance, jobs should contain only one accelerated tool. Jobs containing more than one accelerated tool can negatively impact performance and increase execution time.

3. All accelerated tools are marked on the **FlowBuilder** by the green **Accelerated** indication.



NOTE: If a job is saved with the **Accelerate** setting enabled and later opened on a device that does not support this setting, it is automatically switched back to its standard state without acceleration.

Deep Learning OCR

The Deep Learning Optical Character Recognition (OCR) tool reads text from images using Deep Learning.

This tool locates and recognizes characters without additional training:

- Horizontally-oriented
- Height between 85% and 115% of Char Height (in pixels)
- Contain Latin letters (upper case or lower case), digits, or one of: !#$%&()*+,-./:;<=>?@[]^_`{|}~"'\€£¥

Use the Deep Learning OCR region of interest to limit the analyzed area, which can lead to improved performance. Moreover, it may be used to adjust to text that is not displayed horizontally.

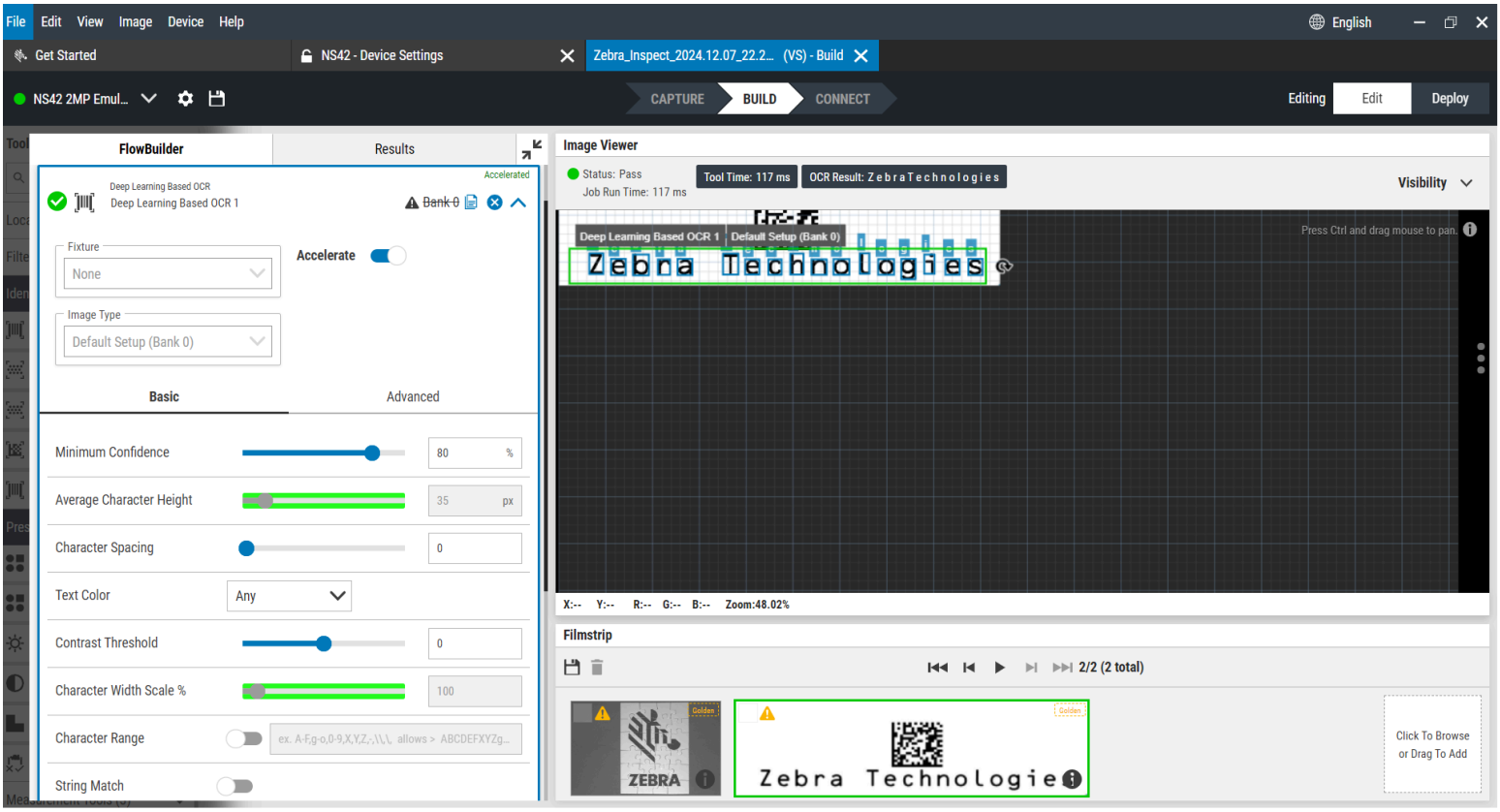


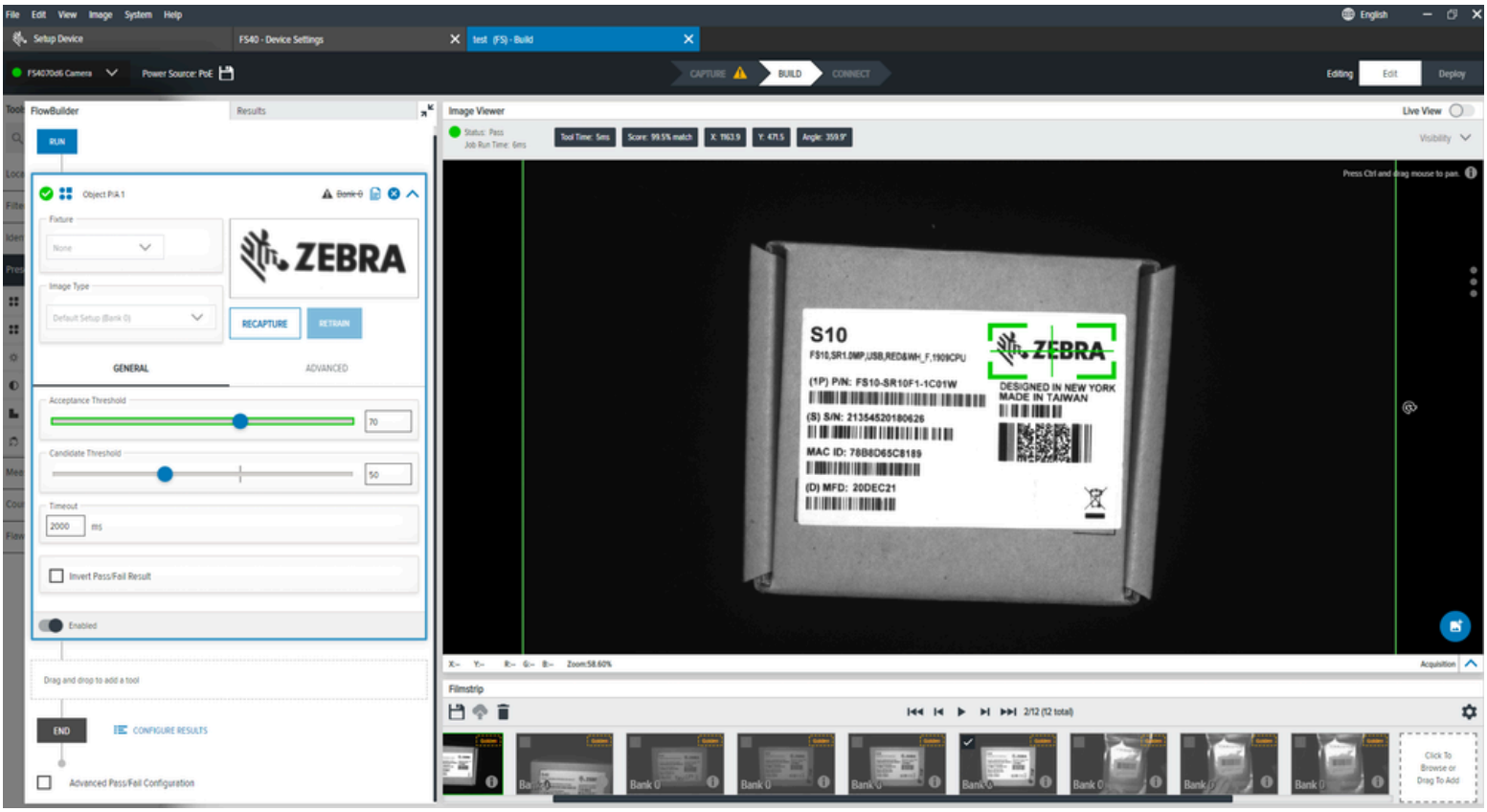
Table 5 Deep Learning OCR Settings

Setting	Description
Minimum Confidence	The Minimum Confidence parameter may be used to change a character's minimum score. By default, this threshold is set to 80%. **NOTE:** Adjusting this value downward can help include decodes of slightly lesser confidence to get the desired output. For example, the above example is too strict and does not decode various characters. Lowering this value from 99 to 98 yields a favorable result.
Average Character Height	The Average Character Height should be set to the average height of characters (specifically, capital letters) in the analyzed area. For example, if an image contains two kinds of characters: one is 24 pixels high and the second is 40 pixels high, the Average Character Height should be set to 32, irrespective of the number of characters of each kind. Use the slider to select a value that is close to the average pixel height of text that is trying to be decoded. Performance improves when this value is closer to the average character height (in pixels). • Minimum Value: 8 • Default Value: 25 • Maximum Value: 200

Table 5 Deep Learning OCR Settings (Continued)

Setting	Description
Character Spacing	Distance between characters denoted as a fraction of CharHeight.
Text Color	Set a required polarity for a character to be returned. • Bright: Only characters with contrast greater than Contrast Threshold are returned. • Dark: Only characters with contrast lower than Contrast Threshold are returned. • Any: Only characters with contrast lower than Contrast Threshold or greater than Contrast Threshold is returned. Default Value: Any
Contrast Threshold	Sets a threshold for a contrast of found characters. Default value: 0
Character Width Scale Percentage	Scales image width by the given factor (%). • Minimum Value: 10% • Default Value: 100% • Maximum Value: 1000%
Character Range	Enable Character Range to limit the set of recognized characters. This string must be formatted according to the following rules: • Allowed characters must be separated with commas. • For ease of use, a continuous range of letters or digits may be written as starting_character-ending_character, for example: A-Z or 1-6. • Comma and backslash have to be prepended with a backslash. For example, Character Range equal to A-F,g-o,0-9,X,Y,Z,-,\\,\, results in recognizing only ABCDEFXYZghijklmno0123456789-\, characters.
Character Range	Provides the option to limit the set of desired characters when returning the result.
String Match	Defines a string that must be contained within the decoded OCR output for the tool to pass (for example, substring). By default, the tool passes if the match string is contained in the resulting OCR output. This allows additional characters to be added before and after the string. Enable the RegEx checkbox and use the syntax `^<stringToExactMatch$` to implement the exact match behavior. RegEx can also be used for complex string match logic. Refer to the RegEx section for more details.
Timeout	Sets a time after which the tool fails.
Invert Pass/Fail Result	Flips the results of this tool.

To use Deep Learning Based OCR with RegEx, enable the RegEx checkbox and provide an expression for the OCR tool to locate. The following example searches for the expression ^22\d{3}.



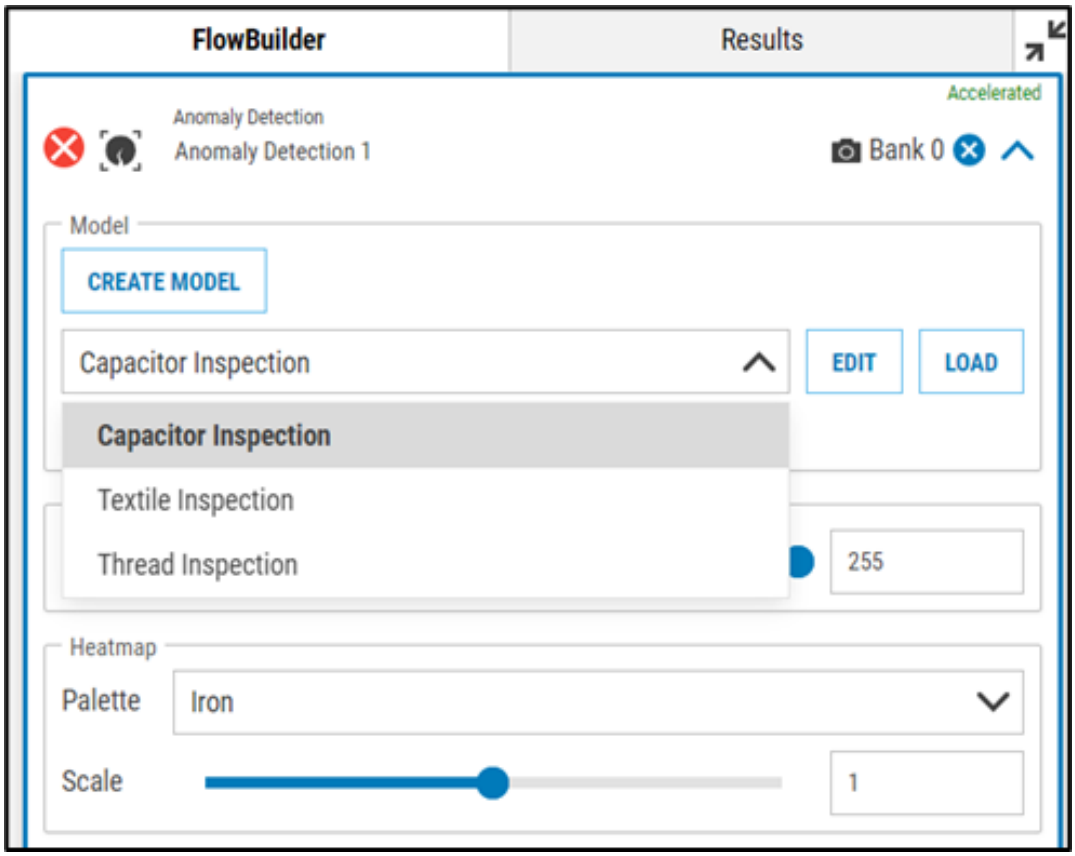
Using Anomaly Detection

Aurora Deep Learning Editor is required to run Anomaly Detection in Aurora Focus.

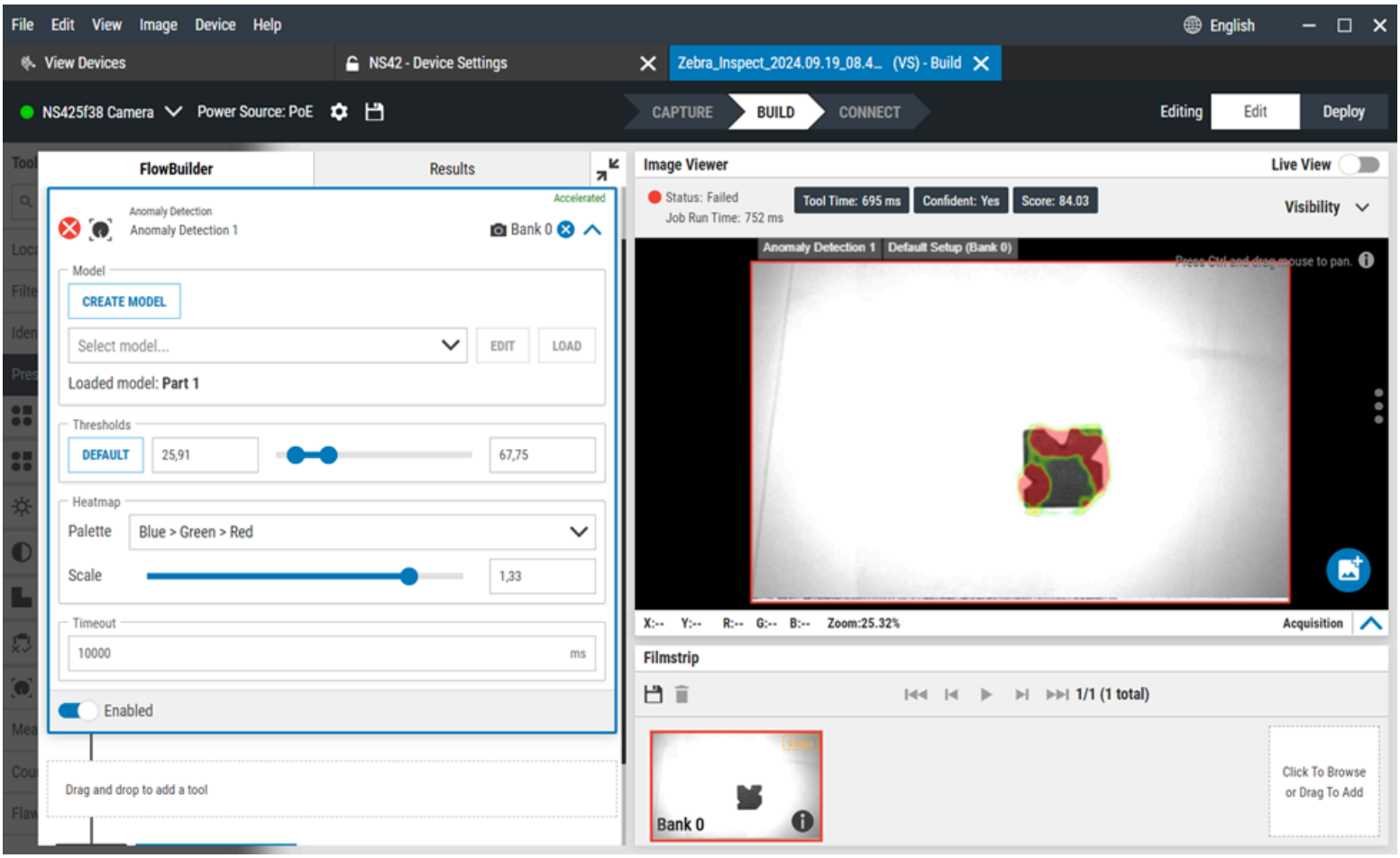
NOTE: Anomaly Detection is available on FS24 and NS42 devices only.

1. Add the **Anomaly Detection** tool from **Presence/Absence** tools list.

2. Select a model from the drop-down menu and click **Edit** to edit the model in Aurora Deep Learning Editor or click **Load** to implement a specific model type.



3. View Results:
   a. The score is a numeric representation of how flawed the processed image is when compared to the reference model. A higher score indicates a greater number of defects.
   b. Threshold values can be set to define what scores are considered as pass or fail with high or low confidence.
      a. For details on the exact mechanism of thresholds, go to: https://docs.adaptive-vision.com/deep_learning/user_interface/DeepLearningTraining.html#anomalies .
   c. Heatmap provides a graphical representation of the anomalies. The higher the color intensity (according to the chosen palette), the stronger the anomaly detected in the image.
   d. The Scale parameter is used to adjust the intensity of colors when an anomaly is detected.



Using Aurora Deep Learning Editor

Zebra Aurora Focus and Deep Learning Editor are directly connected and require compatible versions.

To download the latest version, open Zebra Aurora Focus while connected to an FS42 or NS42 device and add the Anomaly Detection tool. The resulting pop up window provides a direct link to download the latest version of Deep Learning Editor.

Creating a Model

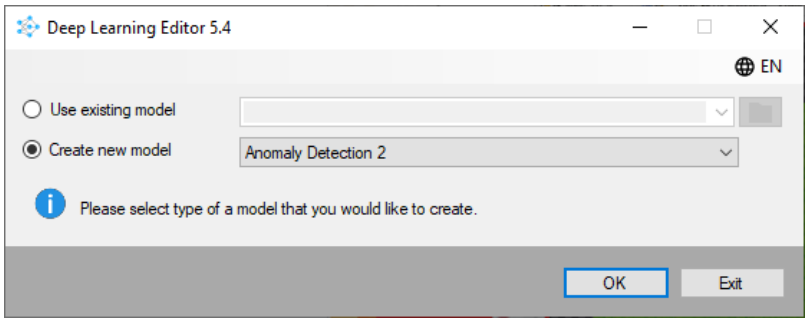
The Anomaly Detection tool in Aurora Focus uses the Aurora Deep Learning Editor.

Before running the editor, provide the folder where the created models are stored. The folder you create is the model's name in Aurora Focus.

1. In Aurora Focus, click **Create Model** to launch the editor. After running the editor, you can create a new model or edit an existing one.

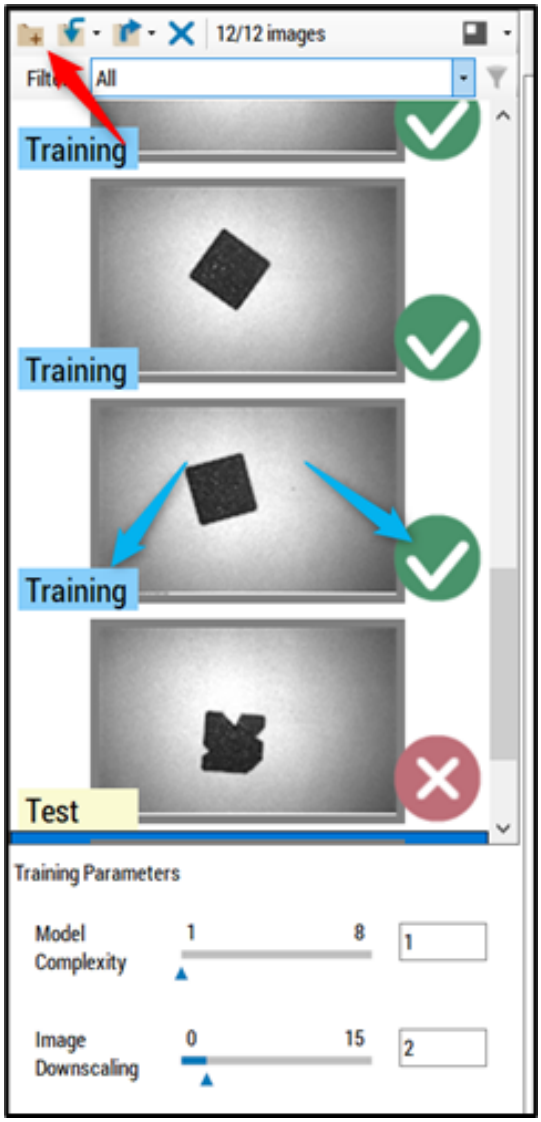
NOTE: If an existing model is not shown in Aurora Focus, select it from the drop-down and click **Edit**.

2. In Deep Learning Editor, you can use an existing model or create a new one by selecting a model type from the drop-down menu.



3. The upper left corner of the home screen provides tools for training images. Click **Add** to add new images to the Editor.
4. Images added using **Toggle Class** and **Select type** can be marked as ready to be trained on.

5. Images with a model are marked as training with a green checkmark.

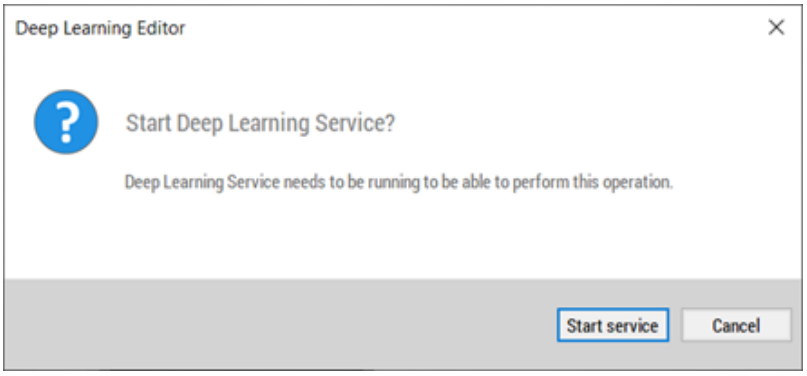


NOTE: In some cases, it may be helpful to include irregular images marked as test images to train the model.

6. The **Training Parameters** to decrease or increase the complexity and downscaling of the model. Both contribute to the training time and the working time of the model. The effect of enabling these settings is observable by clicking **Pre-processing** above the previewed image.

7. After the settings are configured, click **Run** to start generating the model.

NOTE: If the Deep Learning Editor is being run for the first time, the first click launches the Deep Learning Service. The second starts generating the model.



Deep Learning Editor for Aurora Focus is designed for simple applications using a few parameters. For information on creating advanced models, go to: https://docs.adaptive-vision.com/deep_learning/user_interface/DeepLearningTraining.html#anomalies

Training Images

Anomaly Detection inspection works only on images of the same size as those used in training.

NOTE: Do not crop the image in external tools.

Provide images directly from the camera. If the trained model is too big, set a smaller ROI in Deep Learning Editor or use the Downscaling parameter to lower the image resolution. The settings are applied automatically during an inspection.

Maintenance

Known Harmful Ingredients

The following chemicals are known to damage the plastics on Zebra devices and should not come in contact with the device:

- Acetone
- Ammonia solutions
- Aqueous or alcoholic alkaline solutions
- Aromatic and chlorinated hydrocarbons
- Benzene
- Bleach
- Carbolic acid
- Compounds of amines or ammonia
- Ethanolamine
- Ethers
- Ketones
- TB-lysoform
- Toluene
- Trichloroethylene

Approved Cleaning Agents

The following cleaning agents are approved for cleaning the plastics on Zebra devices:

- Pre-moistened wipes
- Isopropyl alcohol 70%

Tolerable Industrial Fluids and Chemicals

The following industrial fluids and chemicals were evaluated and deemed tolerable for Zebra devices.

NOTE: Not all fluid variants and brands have been tested.

- Motor/Engine Oil
- Automatic Transmission Fluid (ATF)
- Continuously Variable Transmission Fluid (CVT)
- Industrial De-Greaser (Engine Brite Heavy Duty)

Cleaning the Device

Routinely cleaning the exit window is required. A dirty window may affect scanning accuracy. Do not allow any abrasive material to touch the window.

1. Dampen a soft cloth with one of the approved cleaning agents listed above, or use pre-moistened wipes.
2. Gently wipe all surfaces, including the front, back, sides, top, and bottom. Never apply the liquid directly to the device. Be careful not to let liquid pool around the scanner window, trigger, cable connector, or any other area on the device.
3. Clean the trigger area by carefully wiping the surface to prevent the label from lifting from the device.
4. Do not spray water or other cleaning liquids directly into the exit window.
5. Wipe the scanner exit window with lens tissue or other material suitable for cleaning optical material, such as eyeglasses.
6. Immediately dry the scanner window after cleaning with a soft, non-abrasive cloth to prevent streaking.
7. Allow the unit to air dry before use.
8. To clean the device connectors:
   a. Dip the cotton portion of a cotton-tipped applicator in isopropyl alcohol.
   b. Rub the cotton portion of the cotton-tipped applicator back and forth across the device's connector at least thrice, leaving no cotton residue.
   c. Use the cotton-tipped applicator dipped in alcohol to remove grease and dirt near the connector area.
   d. Do not leave any cotton residue on the connectors.

Troubleshooting

Troubleshooting

This section describes potential issues that could arise while using the device and solutions that could correct the problem, such as power cycling and pinging the device.

Table 6 Troubleshooting

Problem	Cause	Solution
The device is not connecting to the network when using Device Discovery.	The application blocks specific ports that Windows Defender Firewall utilizes.	Ensure that Zebra Aurora can access Domain, Public, and Private networks.
	Ensure the device is visible in the Windows Network by viewing the File Explorer and selecting a network.	If the device is not viewable under the Network drop-down or listed under Other Devices, it is not connected.
	There is no RNDIS driver available to the device when connected via USB.	To verify an NDIS driver, go to the Windows Device Manager and search under the Network Adapters drop-down.
	There are too many NIC devices other than the Ethernet NIC attempting to connect to the device.	Disable all NIC devices other than the Ethernet NIC to narrow down the number of devices attempting to connect in Network Discovery.
	ARP Cache is full.	Clear ARP cache by opening Command Prompt as an Administrator and entering `netsh interface IP delete arpcache` and refresh the Network in File Explorer.
The device cycles power or has a data connection on a USB port.	The USB cable may be loose or intermittent.	Reseat the USB cable and tighten the locking screws firmly.
	USB port does not source enough power.	Use another USB port that is BC1.2, USB charging, USB-C or has enough power. Use an appropriate cable that utilizes an external power supply.

Technical Reference

Specifications

The following table describes the device's physical attributes, performance and user environment specifications, and regulatory certifications.

Table 7 Specifications

Specification	Description
Physical Characteristics	
Dimensions	2.1 in. H x 2.5 in. W x 3.6 in. D 54.0 mm H x 64.0 mm W x 91.4 mm D
Weight	14.1 oz./400.0 g
Power	10 to 30 VDC external power supply, 36W max at 24V Class 4 PoE+ source, 25.5W max Class 3 PoE source, 13W max USB Type-C host, 7.5W max at 5V 1.5A or 15W max at 5V 3.0A
Configurable IO	(4) Four optoisolated GPIO: GPIO0,1,2,3 (5) Five non-isolated GPIO: GPIO4,5,6*,7*,8* *Unavailable when External Light Mode is enabled
Interface Ports	(1) M12 X-Coded 1000/100/10 Mbps Ethernet (1) M12 12-pin Power/GPIO (1) M12 5-pin External Light Power & Control/GPIO (1) USB 3.0 SuperSpeed Type-C with DisplayPort Alt Mode
Communication Protocols	Ethernet/IP, PROFINET, CC-Link, Modbus TCP, TCP/IP
Performance Characteristics	

Table 7 Specifications (Continued)

Specification	Description
Image Sensor	Monochrome: 2.3 MP (1920 x 1200 pixels), 3.0µm pixel size CMOS Sensor Monochrome 5.1MP (2592 x 1944 pixels), 2.2µm pixel size CMOS Sensor
Acquisition Rate	Up to 60 frames/second
Aimer	Red Class II Laser; 8-point sunburst pattern **NOTE:** FS40-WA5 (5MP) configurations do not have a laser aimer.
Illumination	Field replaceable modules: (8) 660nm Red LEDs (8) 850nm IR LEDs (8) 2700K (Color Temperature) White LEDs (4) 660nm Red LEDs + (8) 850nm IR LEDs + (8) 2700K (Color Temperature) White LEDs
Imager Field of View	SR (Standard Range): 10.8mm Liquid Lens (30° H x 19° V Nominal) WA (Wide Angle): 6.8mm Liquid Lens (46° H x 29° V Nominal)
User Environment	
Operating Temperature	32° F to 113° F/0° C to 45° C (10-30VDC external power supply, duty cycle-dependent) 32° F to 104° F/0° C to 40° C (POE, duty cycle dependent)
Storage Temperature	-40°F to 158°F / -40° to 70°C
Vibration Resistance	EN 60068-2-6, 14 mm @ 2 to 10 Hz, 1.5 mm @ 13 to 55 Hz; 2 g @ 70 to 500 Hz; 2 hours on each axis
Shock Resistance	EN 60068-2-27, 30g; 11 ms; 3 shocks on each axis
Environmental Sealing	IP65 and IP67
Humidity	5% to 90% RH (Non-Condensing)
Light Immunity	The product operates in Incandescent 450 ft candles, Sunlight <6000 ft candles, Florescent 450 ft candles, LED 450 ft candles
Electrostatic Discharge	±15 kV Air, ±8 kV Contact, ±8 kV Indirect
Regulatory	
Environmental	EN 50581:2012 EN IEC 63000:2018
Electrical Safety	IEC 62368-1 (Ed.2) EN 62368-1:2014/A11:2017
Laser Safety (xS42 Only)	21CFR1040.10 & 21CFR1040.11 IEC/EN 60825-1:2014 (Ed.3)

Table 7 Specifications (Continued)

Specification	Description
LED Safety	IEC 62471: 2006 (Ed.1) EN 62471: 2008
EMI/EMS	EN 55032:2015/A11: 2020 EN 55032:2015/A1: 2020 EN 55035:2017/A11: 2020 EN IEC 61000-3-2: 2019/A1:2021 EN 61000-3-3: 2013/A2:2021/AC:2022-01 EN 61000-6-2: 2005,2019 FCC 47 CFR Part 15, Subpart B ICES-003, Issue 7
EU Declaration of Conformity	2014/30/EU; 2014/35/EU; 2011/65/EU. Refer to the Declaration of Conformity (DoC) for details of compliance with the current standards. The DoC is available at: zebra.com/doc

Accessories

This section provides details on compatible external lights, ring lights, and polarizers for the device.

External Lighting

The following table lists all compatible external lighting accessories for the device.

Table 8 External Lighting Accessories

Part Number	Description	
LGHT-B100RD-0000	LED Bar light, 100MM, red-625 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B100BL-0000	LED Bar light, 100MM, blue-465 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B100WH-0000	LED Bar light, 100MM, white wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B100IR-0000	LED Bar light, 100MM, IR-850 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B300RD-0000	LED Bar light, 300MM, red-625 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B300BL-0000	LED Bar light, 300MM, blue-465 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B300WH-0000	LED Bar light, 300MM, white wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-B300IR-0000	LED Bar light, 300MM, IR-850 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
Ring Lights		

Table 8 External Lighting Accessories (Continued)

Part Number	Description	
LGHT-R100BL-0000	LED Ring light, 100MM, blue-465 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-R100WH-0000	LED Ring light, 100MM, white wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-R100IR-0000	LED Ring light, 100MM, IR-850 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
LGHT-R100RD-0000	LED Ring light, 100MM, red-625 wavelength, 5-Pin male M12 connector, semi-diffused, includes transparent and opaque diffusers.	
Polarizers		
LGHT-A100BP-0000	100MM Bar Light Polarizer, for use with 100mm External Light Bars (LGHT-B100xx-0000). Not for use with IR-850 wavelengths or when IR image capture is required.	
LGHT-A300BP-0000	300MM Bar Light Polarizer, for use with 300mm External Light Bars (LGHT-B300xx-0000). Not for use with IR-850 wavelengths or when IR image capture is required.	
LGHT-A100RP-0000	Light Polarizer, for use with 100mm External Ring Lights (LGHT-R100xx-0000). Not for use when IR image capture is required.	

Internal Ring Lighting

The following table provides information on compatible internal lighting accessories and replacement ring light covers.

Table 9 Internal Lighting Accessories

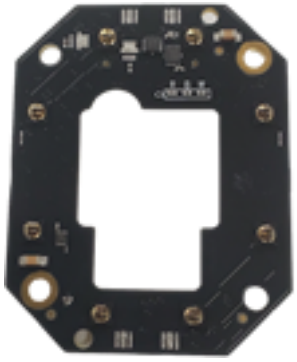
Part Number	Description	
ZLED-XS40WH-000	Internal Ring Light, White LED For use with 100mm External Ring Lights (LGHT-R100xx-0000). Not for use when IR image capture is required.	
ZLED-XS40RD-0000	Internal Ring Light, Red LED Red lighting is typically used to capture images on paper.	
ZLED-XS40IR-0000	Internal Ring Light, IR LED IR lighting is typically used in environments where users do not want to see external lighting when detecting clear liquids or inspecting produce.	
ZLED-XS40MC-0000	Internal Ring Light Multi-Color - White, Red, IR, Blue, and Green LEDs. White LEDs are controllable in individual banks of 4 LEDs. IR and Red are controllable in individual banks of 2 LEDs.	
Replacement Ring Light Covers		

Table 9 Internal Lighting Accessories (Continued)

Part Number	Description	
ZLED-XS40PW-0000	Integrated Light Cover (Replacement) Cross Polarizer. For use with Wide Angle (WA) configurations only. Not for use when IR image capture is required.	
ZLED-XS40PS-0000	Integrated Light Cover (Replacement) Cross Polarizer. For use with Standard Range (SR) configurations only. Not for use when IR image capture is required.	
ZLED-XS40CW-0000	Integrated Light Cover (Replacement) For use with Wide Angle (WA) configurations only.	
ZLED-XS40CS-0000	Integrated Light Cover (Replacement) For use with Standard Range (SR) configurations only.	

Internal Filters

The device supports red, blue, IR bandpass, and IR blocker filters.

Table 10 Internal Filters

Part Number	Description	
ZFLT-XS40RD-0000	Red Bandpass Zebra Filter	
ZFLT-XS40BL-0000	Blue Bandpass Zebra Filter	
ZFLT-XS40IR-0000	IR Bandpass Zebra Filter	
ZFLT-XS40MC-0000	IR Blocker Zebra Filter	

Spectral Transmission Data

The following table provides spectral transmission data while using supported internal filters for the device.

NOTE: The spectral transmission table applies to the following filters on the device:

- ZFLT-XS40RD-0000 Red Bandpass Zebra Filter
- ZFLT-XS40BL-0000 Blue Bandpass Zebra Filter
- ZFLT-XS40IR-0000 IR Bandpass Zebra Filter
- ZFLT-XS40MC-0000 IR Blocker Zebra Filter

Spectral Transmission	Blue	Red	IR	RGB (IR Block)	Clear
Normal Incident Angle					
3% Maximum		400-565 nm	400-720 nm		
10% Maximum	400 nm	600 nm	755 nm		
90% Minimum	425-525 nm	625-700 nm	780-925 nm	400-700 nm	400-925 nm
Maximum (Reference)	465-495 nm	650-680 nm	855-895 nm		
10% Maximum	550 nm	725 nm	950 nm	725 nm	950 nm

Spectral Transmission	Blue	Red	IR	RGB (IR Block)	Clear
3% Maximum	585-1050 nm	760-1050 nm	985-1050 nm	760-1050 nm	985-1050 nm
30° Incident Angle					
88% Minimum	465-495 nm	650-670 nm	855-890 nm	400-665 nm	465-890 nm

NOTE: Filter coating is applied to one side only.

Cables

The device is compatible with various USB, Ethernet, external light control, and power cables.

Table 11 Cables

Part Number	Description
USB Cables	
CBL-USB00200-USC00	USB 2M, IP67 locking USB-C to USB C (SuperSpeed), Compatible with all FS/VS devices.
CBL-USB00400-USC00	USB 4M, IP67 locking USB-C to USB C, Compatible with all FS/VS devices.
CBL-USB00200-USA00	USB 2M, IP67 locking USB-C to USB-A (SuperSpeed), Compatible with all FS/VS devices.
CBL-USB00400-USA00	USB 4M, IP67 locking USB-C to USB-A, Compatible with all FS/VS devices.
Ethernet Cables	
CBL-ENT00500-M1200	5M length, X-Coded M12 to RJ45 connectors, Compatible with all FS/VS devices that include an Ethernet port.
CBL-ENT01500-M1200	15M length, X-Coded M12 to RJ45 connectors, Compatible with all FS/VS devices that include an Ethernet port.
External Light Control Cables	
CBL-LGT00000-M1200	5-pin M12 to 5-pin M12 External Light Control C, 0.3M length. Only compatible with devices that include an external light port.
CBL-LGT00200-M1200	5-pin M12 to 5-pin M12 External Light Control C, 2M length. Only compatible with devices that include an external light port.
Power Cables	
CBL-PWR00500-M1200	12-pin M12 to flying lead breakout cable, 5M length.
CBL-PWR01500-M1200	12-pin M12 to flying lead breakout cable, 15M length.

Brackets

All Zebra FS/VS devices support mounting with a standard L-Mount bracket.

Table 12 Brackets

Part Number	Description	
BRKT-LMNT-U000	L-Mount Bracket	

See Also

Mounting the Device Using the L-Bracket

Power Supplies

The device is compatible with 24VDC power supplies and PoE injectors.

Table 13 Power Supplies

Part Number	Description	
PWR-24V03A-0000	Power Supply, 24VDC 3AMP	
PWR-24V05A-0000	Power Supply, 24VDC 5AMP	

Table 13 Power Supplies (Continued)

Part Number	Description	
PWR-POE30W-0000	Power over Ethernet Injector, 30W POE+, AC Input	
PWR-POE60W-0000	Power over Ethernet Injector, 60W POE+, AC Input	

Dimensional Drawings

The following diagrams outline the mounting holes and dimensions of the devices.

Mounting Bracket Dimensions

The following diagrams provide dimensions for the mounting bracket.

Figure 12 L Bracket Dimensions

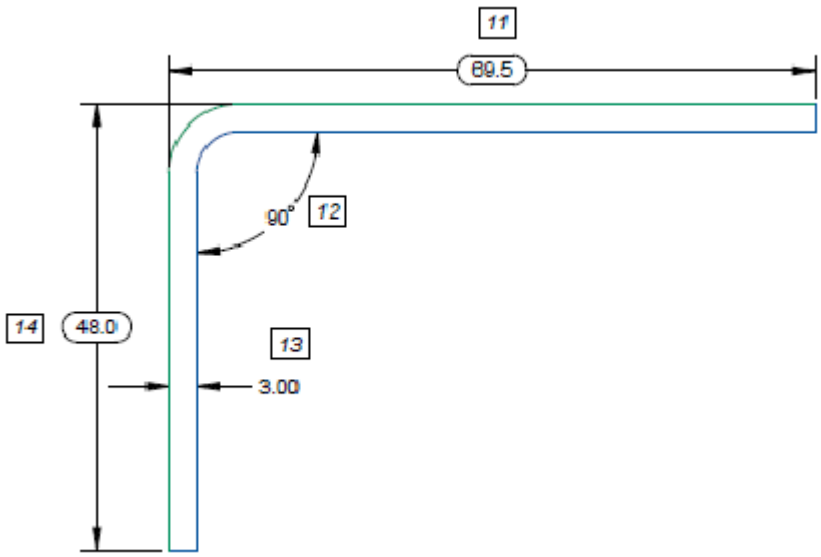


Figure 13 L Bracket Bottom Dimensions

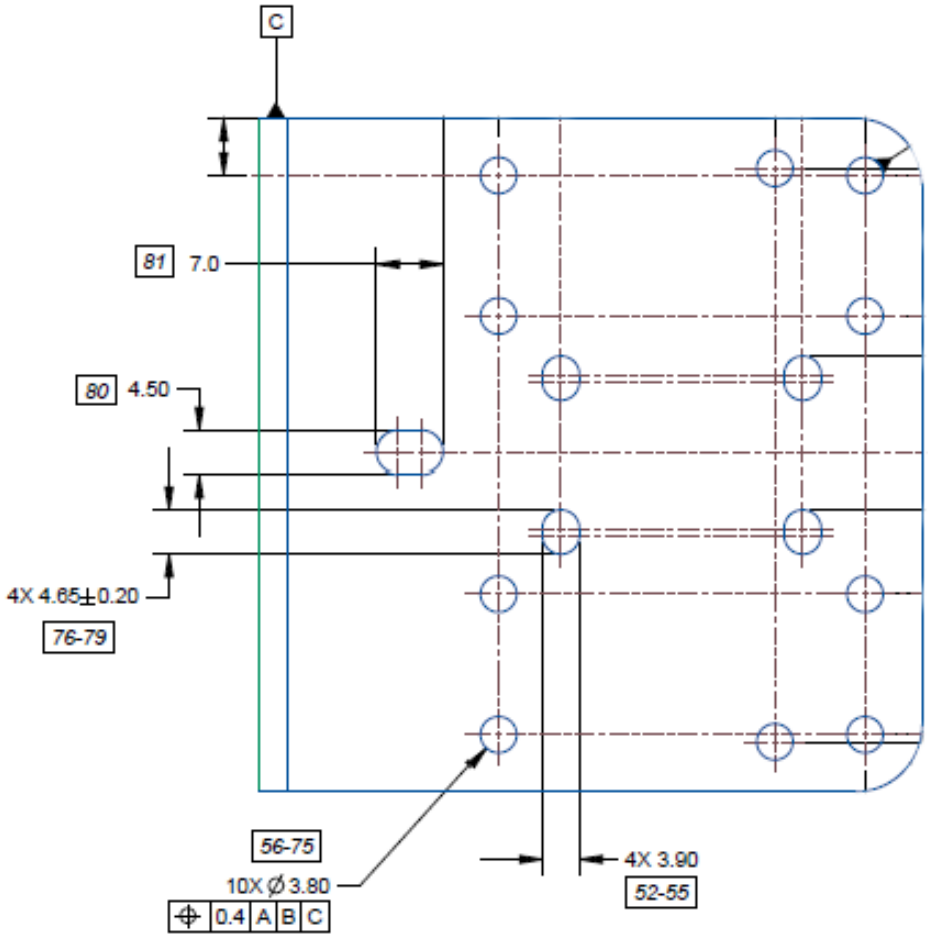
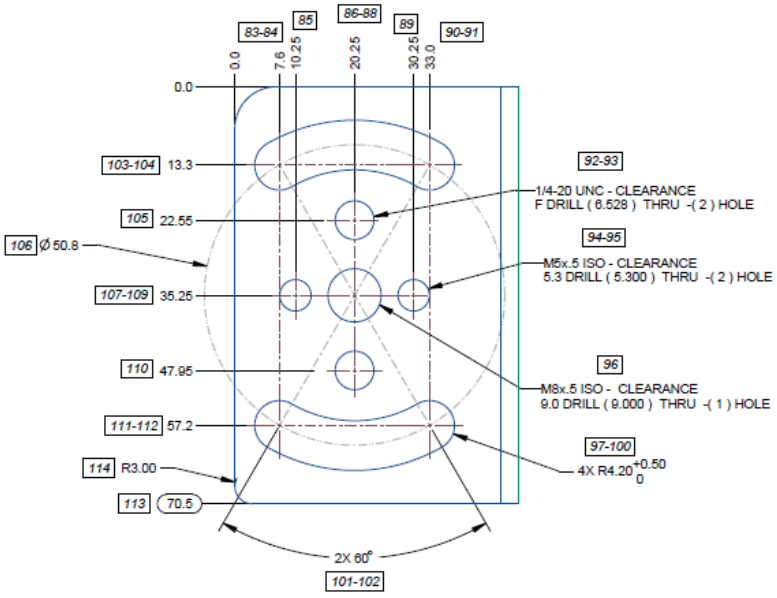


Figure 14 L Bracket Side Dimensions



Light Bracket Dimensions

The diagrams in this section describe the dimensions of the light bracket.

Figure 15 Light Bracket Dimensions

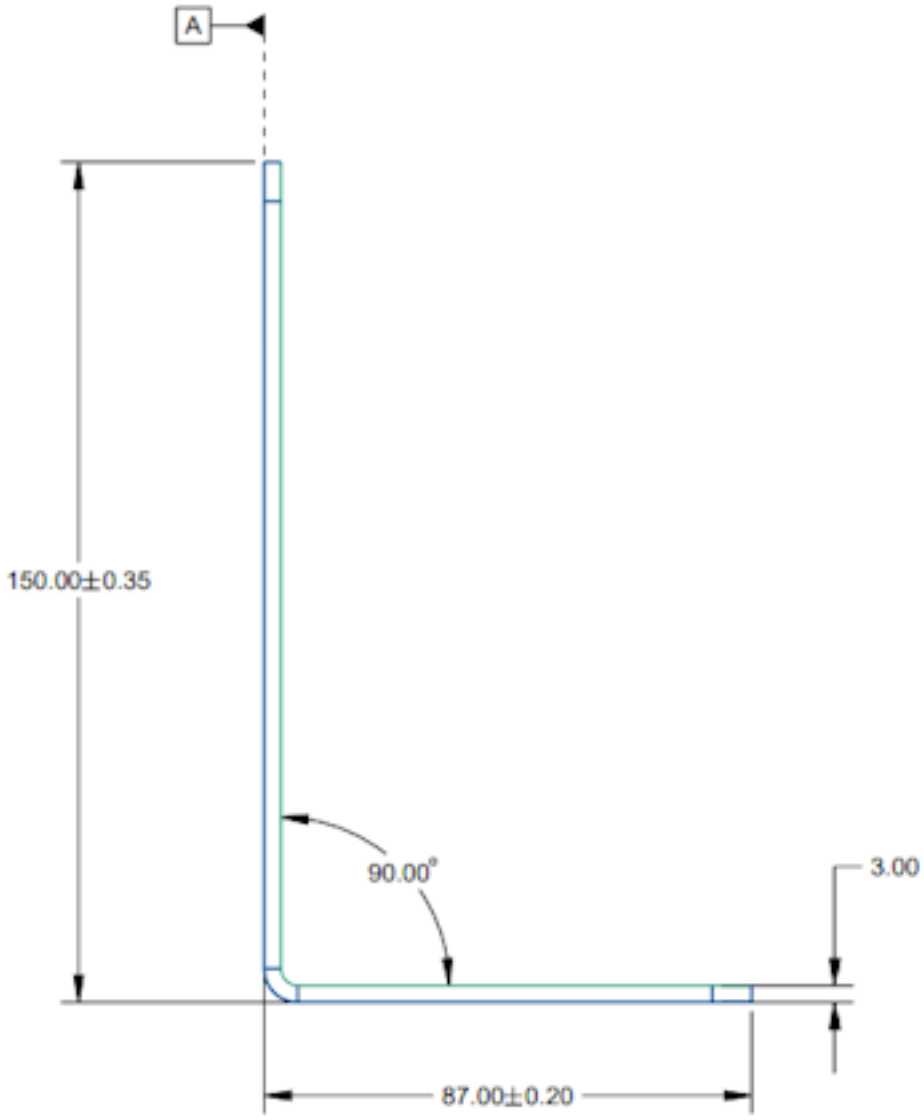


Figure 16 Light Bracket Dimensions

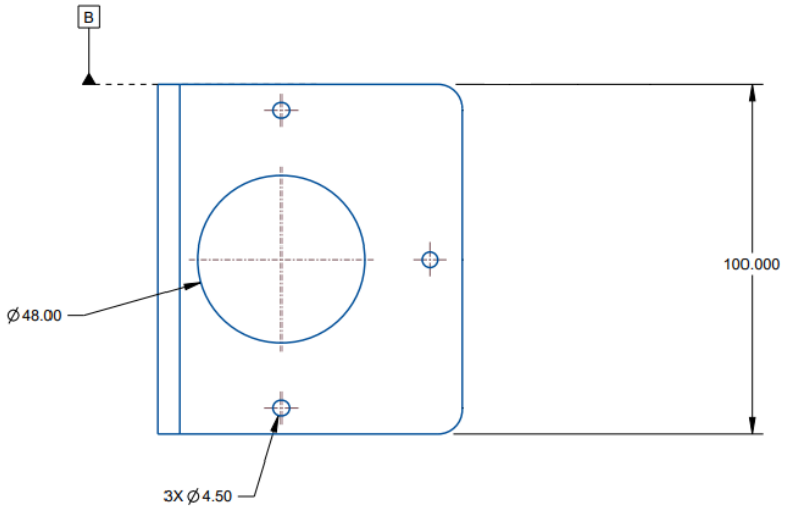
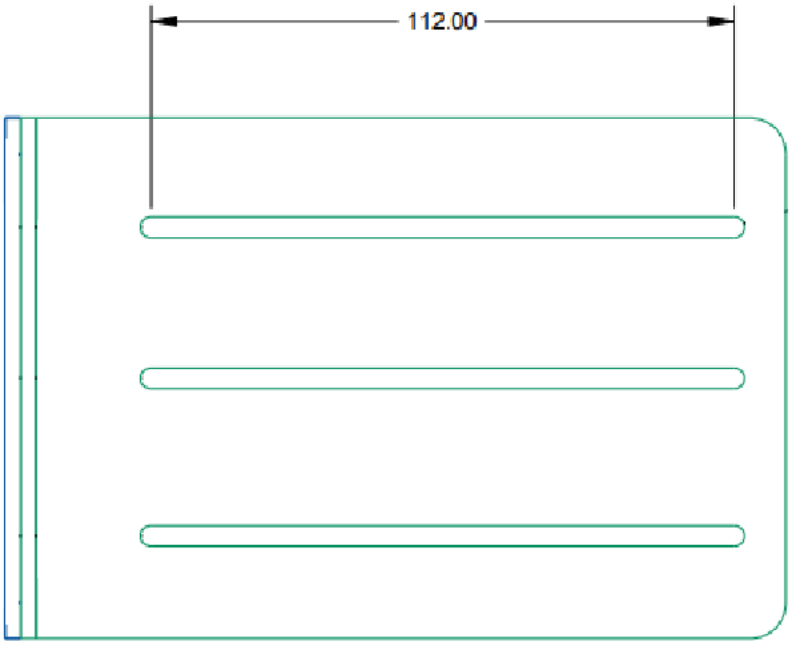


Figure 17 Light Bracket Dimensions



Cable Pin Outs

This section provides pin and cable color information for the power and I/O, Ethernet, and external lighting connectors.

Power and IO Connector

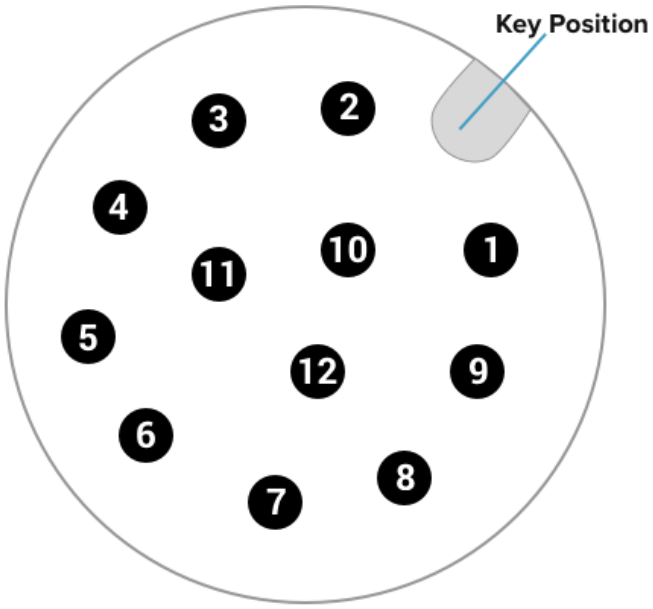


Table 14 Power and I/O Connector Pinout Diagram

Pin	Color	Description
1	Yellow	GPIO2
2	White/Yellow	TXD
3	Brown	RXD
4	White/Brown	GPIO4
5	Violet	GPIO5
6	White/Violet	COMMON_IN
7	Red	DC_IN
8	Black	GND
9	Green	COMMON_OUT
10	Orange	GPIO0
11	Blue	GPIO1
12	Grey	GPIO3
SHELL	Bare	SHIELD

Ethernet Connector

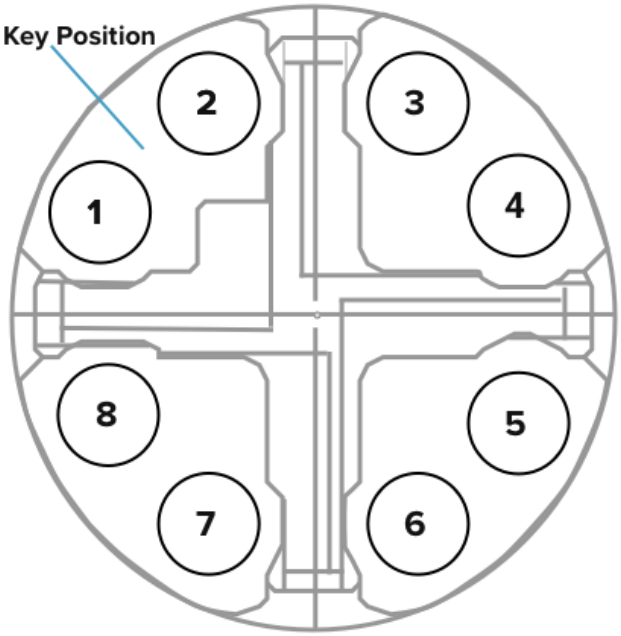


Table 15 Ethernet Connector Pinout Diagram

Pin	Description
1	TP1+
2	TP1-
3	TP2+
4	TP2-
5	TP4+
6	TP4-
7	TP3-
8	TP3+
SHELL	SHIELD

External Light Connector

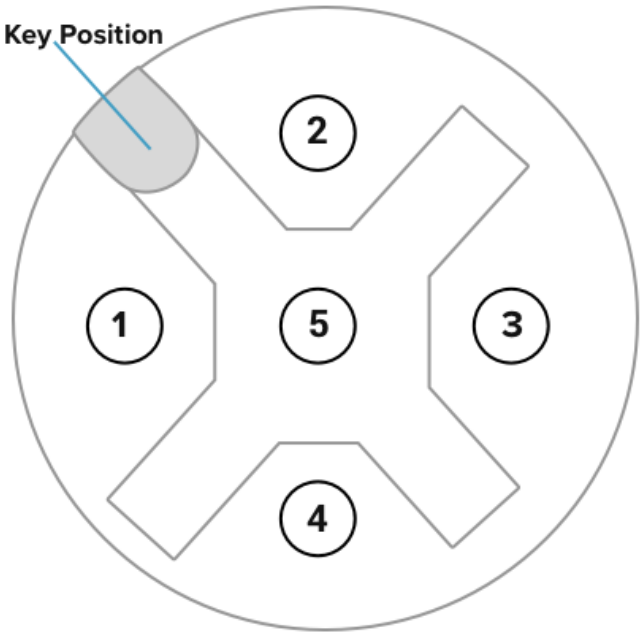


Table 16 External Light Connector Pinout Diagram

Pin	Color	Description
1	Brown	DC_OUT / GPIO8
2	White	GPIO7
3	Blue	GND
4	Black	GPIO6
5	Grey	ANALOG_OUT
SHELL	Bare	SHIELD