SMART VISION SENSOR

# NS42

# Product Reference Guide

MN-005229-04EN Rev A

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2026/07/13

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# About this Guide

This guide provides information on configurations, specifications, power sources, connectivity options, LED indicators, and maintenance guidelines for using the scanner.

## Notational Conventions

The following 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 you to know and that is not required to complete a task.



**IMPORTANT:** The text here indicates information that is important for you to know.



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

**WARNING:** If danger is not avoided, you CAN be seriously injured or killed.

**DANGER:** If danger is not avoided, you 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

The scanner is available in various configurations that support Deep Learning OCR and Anomaly Detection software tools.

## Configurations

This guide covers the following configurations.

**Table 1** NS42 Configurations

| SKU | Description |
|---|---|
| NS42-SR20N4-2C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S.Korea |
| NS42-SR20N4-2C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-SR20N4-3C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, India / S. Korea |
| NS42-SR20N4-3C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-SR20Q4-2C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV, Deep Learning OCR, and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Kora |
| NS42-SR20Q4-2C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV, Deep Learning OCR and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-SR20Q4-3C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV, Deep Learning OCR and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Korea |
| NS42-SR20Q4-3C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV, Deep Learning OCR and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |

**Table 1** NS42 Configurations (Continued)

| SKU | Description |
|---|---|
| NS42-SR20T4-2C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Korea |
| NS42-SR20T4-2C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-SR20T4-3C00K | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, India / S. Korea |
| NS42-SR20T4-3C00W | 2.3 MP, Standard Range Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-WA20N4-2C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Korea |
| NS42-WA20N4-2C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-WA20N4-3C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, India / S. Korea |
| NS42-WA20N4-3C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-WA20Q4-2C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV, Deep Learning OCR, and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Korea |
| NS42-WA20Q4-2C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV, Deep Learning OCR, and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-WA20Q4-3C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV, Deep Learning OCR, and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, India / S. Korea |
| NS42-WA20Q4-3C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV, Deep Learning OCR, and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-WA20T4-2C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, India / S. Korea |

**Table 1** NS42 Configurations (Continued)

| SKU | Description |
|---|---|
| NS42-WA20T4-2C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, Red Illumination, No Filter, Worldwide |
| NS42-WA20T4-3C00K | 2.3 MP, Wide Angle Machine Vision Scanner with Essential MV and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, India / S. Korea |
| NS42-WA20T4-3C00W | 2.3 MP, Wide Angle Machine Vision Scanner with Essential Machine Vision and Deep Learning OCR, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-SR20X4-3C00W | 2.3 MP, Standard Range Machine Vision Scanner with Fast 1D/2D Decode, DPM Full, Standard MV Toolset + Deep Learning OCR and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |
| NS42-SR50X4-3C00W | 5 MP, Standard Range Machine Vision Scanner with Fast 1D/2D Decode, DPM Full, Standard MV Toolset + Deep Learning OCR and Anomaly Detection, Ethernet with PoE, Serial, USB, and Industrial Protocols, White Illumination, No Filter, Worldwide |

## Zebra Integrated Multifunction Light Configurations

| ZIML Version | SKU | Description |
|---|---|---|
| **Zebra Integrated Multifunction Light (ZIML)** | | |
| Zebra Integrated Multifunction Light (ZIML) Standard Model with 360° LED Indicator | LGHT-X020WH-0000 | LED Integrated Ring Light, White Wavelength, 20° Fan Angle, 360° Green/Red Feedback |
| | LGHT-X040WH-0000 | LED Integrated Ring Light, White Wavelength, 40° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X060WH-0000 | LED Integrated Ring Light, White Wavelength, 60° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X080WH-0000 | LED Integrated Ring Light, White Wavelength, 80° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X020RD-0000 | LED Integrated Ring Light, Red Wavelength, 20° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X040RD-0000 | LED Integrated Ring Light, Red Wavelength, 40° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X060RD-0000 | LED Integrated Ring Light, Red Wavelength, 60° Fan Angle. 360° Green/Red Feedback |

| ZIML Version | SKU | Description |
|---|---|---|
| | LGHT-X080RD-0000 | LED Integrated Ring Light, Red Wavelength, 80° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X020IR-0000 | LED Integrated Ring Light, IR Wavelength, 20° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X040IR-0000 | LED Integrated Ring Light, IR Wavelength, 40° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X060IR-0000 | LED Integrated Ring Light, IR Wavelength, 60° Fan Angle. 360° Green/Red Feedback |
| | LGHT-X080IR-0000 | LED Integrated Ring Light, IR Wavelength, 80° Fan Angle. 360° Green/Red Feedback |
| Zebra Integrated Multifunction Light (ZIML) Premium Model with 360° LED Indicator, Precision Aimer, and Beeper | LGHT-X020WH-0100 | LED Integrated Ring Light, 20° Fan Angle, White Wavelength, 360° Green/Red Feedback, Precision Aimer, Beeper |
| | LGHT-X040WH-0100 | LED Integrated Ring Light, 40° Fan Angle, White Wavelength, Precision Aimer, Beeper |
| | LGHT-X060WH-0100 | LED Integrated Ring Light, 60° Fan Angle, White Wavelength, Precision Aimer, Beeper |
| | LGHT-X080WH-0100 | LED Integrated Ring Light, 80° Fan Angle, White Wavelength, Precision Aimer, Beeper |
| | LGHT-X020RD-0100 | LED Integrated Ring Light, 20° Fan Angle, Red Wavelength, Precision Aimer, Beeper |
| | LGHT-X040RD-0100 | LED Integrated Ring Light, 40° Fan Angle, Red Wavelength, Precision Aimer, Beeper |
| | LGHT-X060RD-0100 | LED Integrated Ring Light, 60° Fan Angle, Red Wavelength, Precision Aimer, Beeper |
| | LGHT-X080RD-0100 | LED Integrated Ring Light, 80° Fan Angle, Red Wavelength, Precision Aimer, Beeper |
| | LGHT-X020IR-0100 | LED Integrated Ring Light, 20° Fan Angle, IR Wavelength, Precision Aimer, Beeper |
| | LGHT-X040IR-0100 | LED Integrated Ring Light, 40° Fan Angle, IR Wavelength, Precision Aimer, Beeper |

| ZIML Version | SKU | Description |
|---|---|---|
| | LGHT-X060IR-0100 | LED Integrated Ring Light, 60° Fan Angle, IR Wavelength, Precision Aimer, Beeper |
| | LGHT-X080IR-0100 | LED Integrated Ring Light, 80° Fan Angle, IR Wavelength, Precision Aimer, Beeper |

## NS42 and ZIML Compatibility

The following table provides the recommended compatibility for pairing the FS42 and the Zebra Integrated Multifunction Light (ZIML).

**Table 2** FS42 / ZIML Configuration

| NS42 Configuration | Field of View (Diagonal) | ZIML Configuration |
|---|---|---|
| **NS42 2MP (Wide Angle)** | | |
| NS42-WA20N4-2C00K<br>NS42-WA20N4-2C00W<br>NS42-WA20N4-3C00K<br>NS42-WA20N4-3C00W<br>NS42-WA20Q4-2C00K<br>NS42-WA20Q4-2C00W<br>NS42-WA20Q4-3C00K<br>NS42-WA20Q4-3C00W<br>NS42-WA20T4-2C00K<br>NS42-WA20T4-2C00W<br>NS42-WA20T4-3C00K<br>NS42-WA20T4-3C00W | 55° | 60°<br>LGHT-X060RD<br>LGHT-X060IR<br>LGHT-X060WH<br>80°<br>LGHT-X080RD<br>LGHT-X080IR<br>LGHT-X080WH |
| **NS42 2MP (Standard Range)** | | |
| NS42-SR20N4-2C00K<br>NS42-SR20N4-2C00W<br>NS42-SR20N4-3C00K<br>NS42-SR20N4-3C00W<br>NS42-SR20Q4-2C00K<br>NS42-SR20Q4-2C00W<br>NS42-SR20Q4-3C00K<br>NS42-SR20Q4-3C00W<br>NS42-SR20T4-2C00K<br>NS42-SR20T4-2C00W<br>NS42-SR20T4-3C00K<br>NS42-SR20T4-3C00W | 37° | 40°<br>LGHT-X040RD<br>LGHT-X040IR<br>LGHT-X040WH<br>60°<br>LGHT-X060RD<br>LGHT-X060IR<br>LGHT-X060WH<br>80°<br>LGHT-X080RD<br>LGHT-X080IR<br>LGHT-X080WH |

**Table 2** FS42 / ZIML Configuration (Continued)

| NS42 Configuration | Field of View (Diagonal) | ZIML Configuration |
|---|---|---|
| **NS42 5MP (Standard Range)** | | |
| NS42-SR50X4-3C00W | 38° | 40°<br>LGHT-X040RD<br>LGHT-X040IR<br>LGHT-X040WH<br>60°<br>LGHT-X060RD<br>LGHT-X060IR<br>LGHT-X060WH<br>80°<br>LGHT-X080RD<br>LGHT-X080IR<br>LGHT-X080WH |

## License Types and Toolsets

The following table outlines available licenses for the NS42. Each license is associated with a toolset.

**Table 3** License Types and Toolsets

| Part Number | Web HMI Name | Description | Toolset |
|---|---|---|---|
| LIC-OCR002-0100 | Deep Learning Based OCR | Deep Learning OCR for VS devices | Deep Learning OCR and MV Essential |
| LIC-DL002-0100 | Deep Learning MV Tools | Deep Learning MV Tools upgrade license for NS42 devices | Deep Learning MV Tools and MV Essential |
| LIC-DL003-0100 | Standard Toolset (Machine Vision) with Deep Learning MV Tools and Deep Learning OCR | Standard Toolset (Machine Vision) with Deep Learning MV Tools and Deep Learning OCR upgrade license for FS42 devices | Deep Learning Anomaly Detection and MV Standard |

**NOTE:** Deep Learning MV tools include all Anomaly Detection and Deep Learning tools.

# Installation

If you are using the scanner in a deployment environment, fasten it to a support structure using its provided mounting holes. View the dimensional drawings to understand how to mount the scanner.

## Mounting Instructions

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

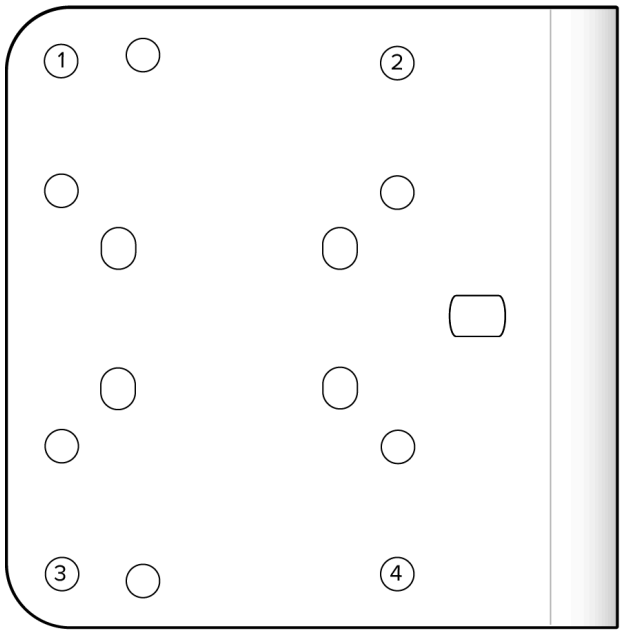
1. Align the holes on the mounting surface with the mounting holes on the device.
2. Insert screws into the mounting holes and tighten. It is recommended to use four M3 screws to attach the camera on the bottom surface. Torque screws to 6.9 kgf-cm (6.0 lbf-in).

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.

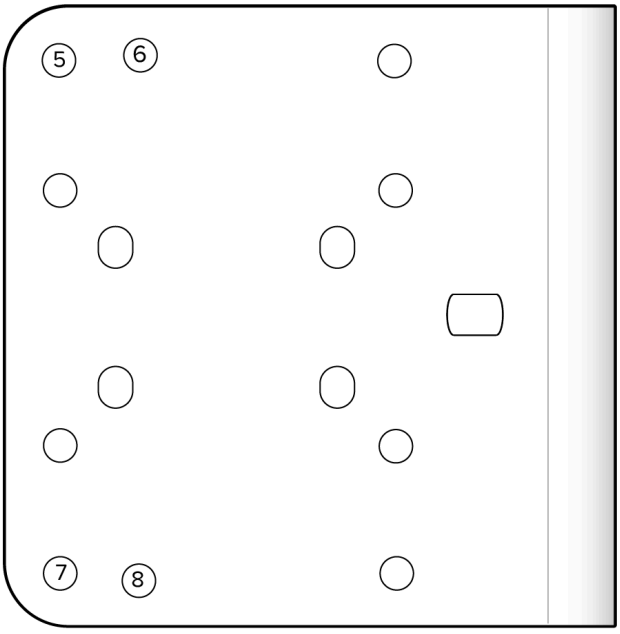
### Mounting the Device Using the L-Bracket

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



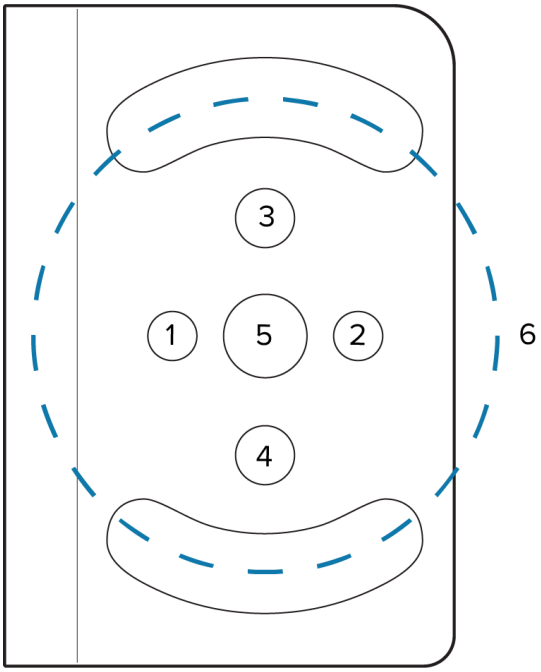

Bottom Mounting Holes




Side Mounting Holes

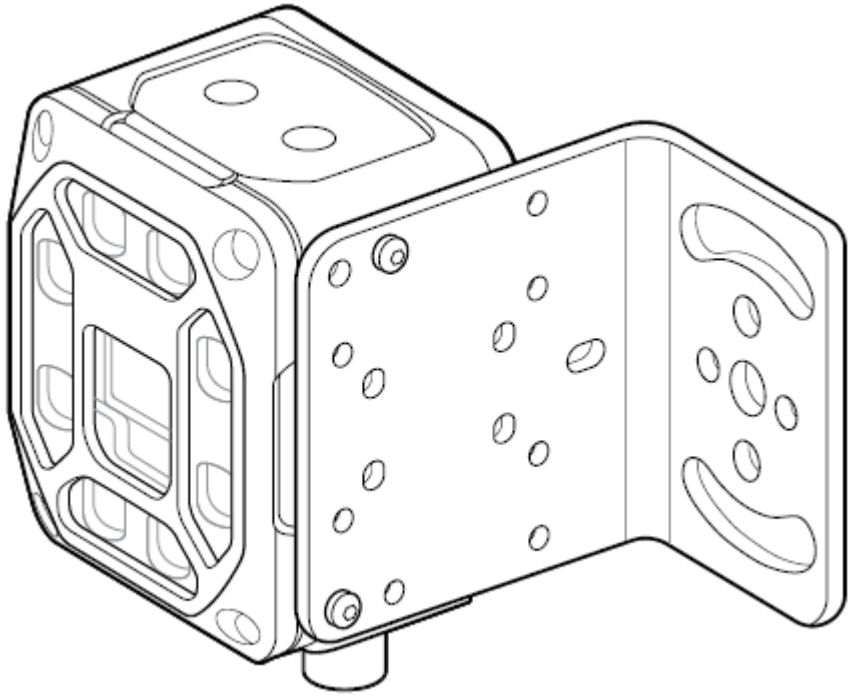
| | |
|---|---|
| 1-4 | Bottom Surface Mounting Holes for both devices |
| 5-8 | Side Mounting Holes for the xS40 and xS42<br>Side Mounting Holes for xS40, xS42 and xS70 devices |

**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.

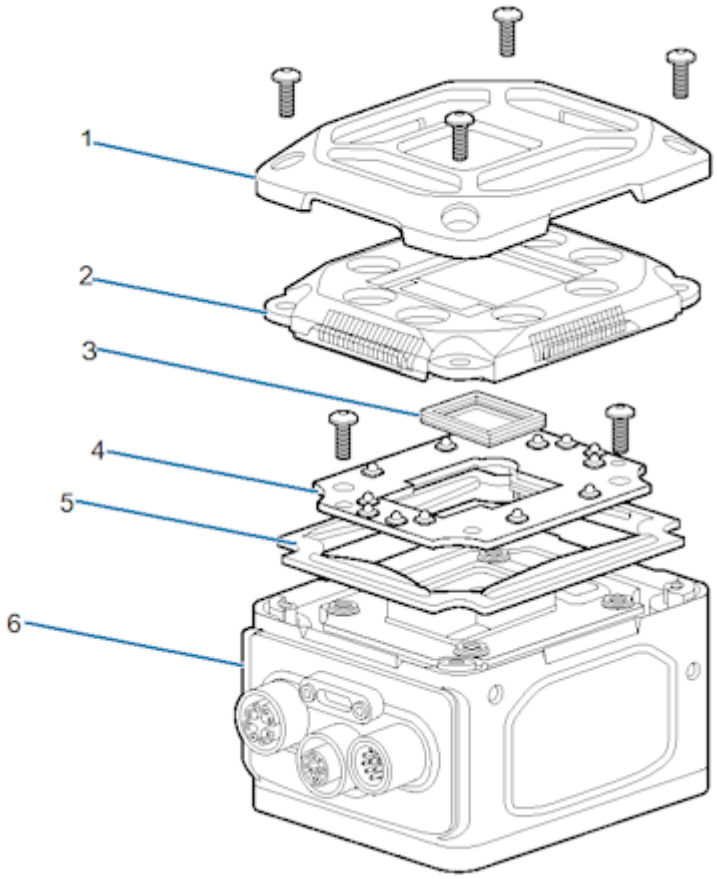
### Disassembling the Illumination System

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 |

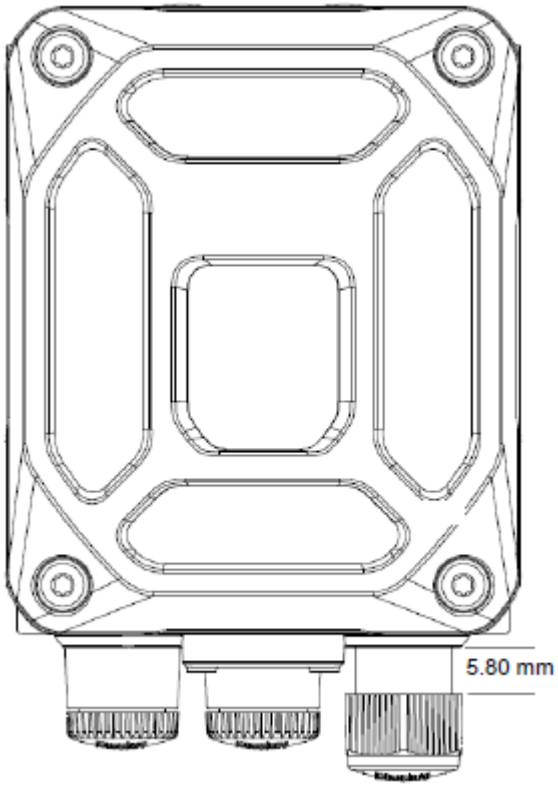
## Torque Specification

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 that meets the IEEE 802.3at class 4 (25.5 W) or 802.3af class 3 (13 W) Power Over Ethernet (PoE) standards. These are commonly referred to as PoE+ and PoE by equipment providers, respectively.

Power over Ethernet requires an extra regulation step, which incurs additional thermal buildup within the device. As a result, the specified operating temperature range narrows when powered via 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 sufficient pressure for proper sealing 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 adapters
- HID-compliant keyboards and trackpads
- USB mass storage devices for firmware updates
- USB docks and hubs

**NOTE:** 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

This section includes GPIO wire diagrams to connect the scanner and power and thermal management strategies to ensure its efficient operation.

## 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

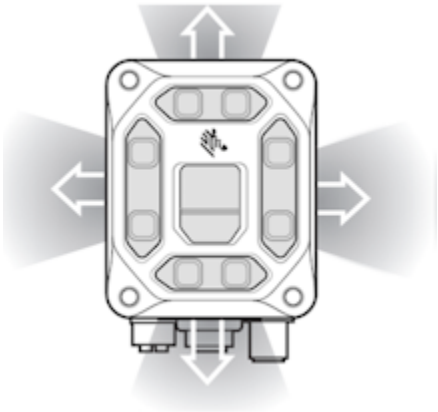


| | |
|---|---|
| 1 | Power |
| 2 | Power over Ethernet |
| 3 | Device Status |
| 4 | Focus Status |
| 5 | Warning |

## 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 4** LED and Beeper Indications

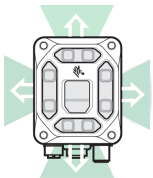
| Event | Beeper | 360° LED | Power LED | Device Status LED | Focus Status LED | Warning LED |
|---|---|---|---|---|---|---|
| **Power Up** | | | | | | |
| Power up with Low Power |  Low, Medium, High Tone |  Single Green Blink |  Solid Red | - | - | - |

**Table 4** 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 4** LED and Beeper Indications (Continued)

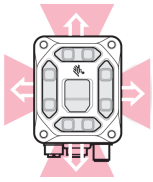
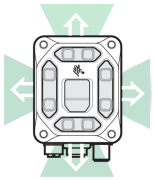
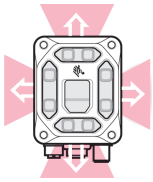
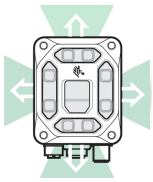
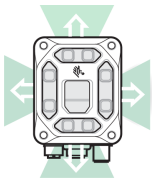
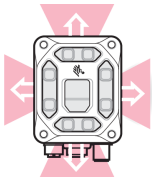
| Event | Beeper | 360° LED | Power LED | Device Status LED | Focus Status LED | Warning LED |
|---|---|---|---|---|---|---|
| Firmware Update Success | - | - | Solid Green | - | - | - |
| Firmware Update Fail | Low Tone |  Continuous Red Flash (5hz) | Solid Green | Continuous Red Flash (5hz) | - | - |
| **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 4** 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 | - | - |

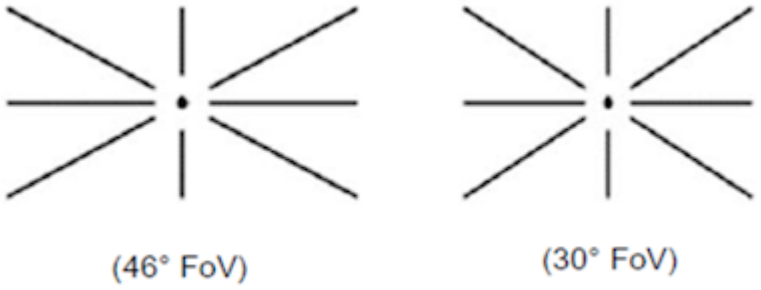
**NOTE:** [1] This is the default, Barcode Decode Success and Barcode Decode Failure beeper UI feedback is configurable in Aurora Focus.

## 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




## 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

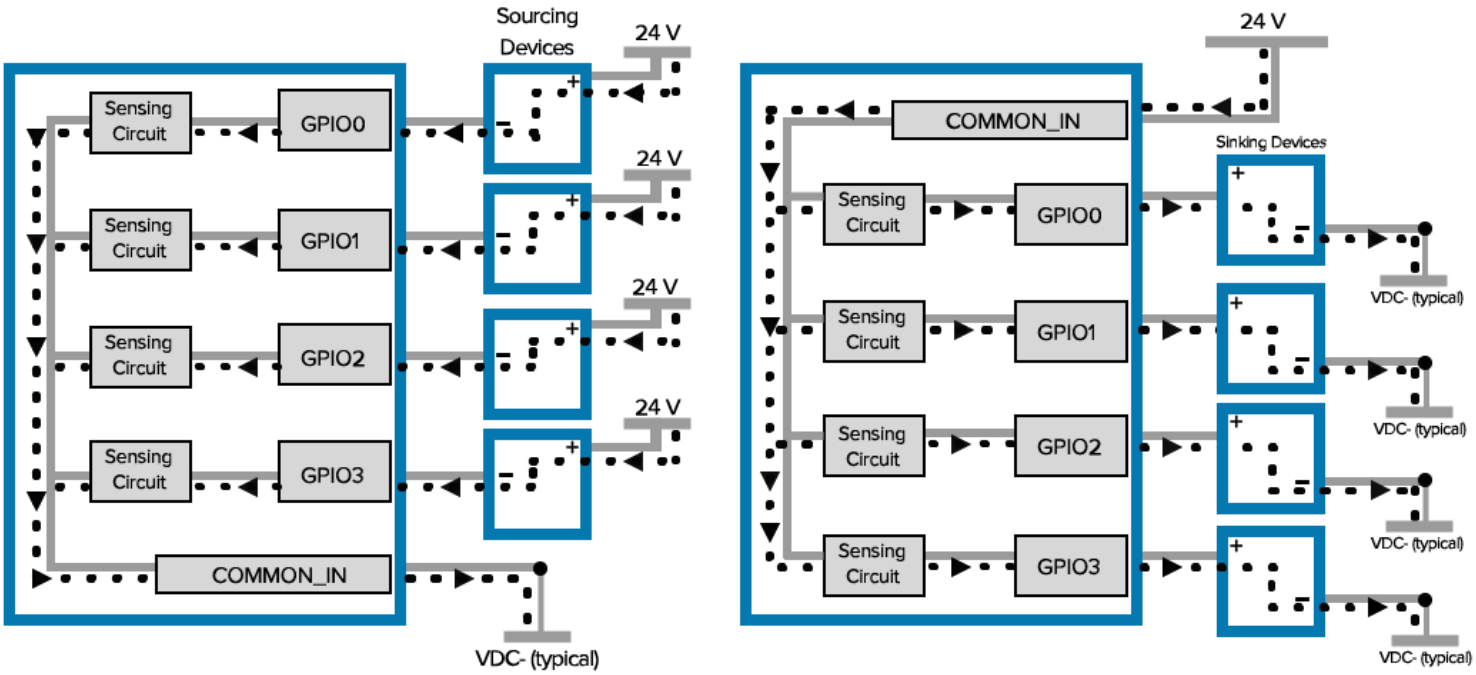
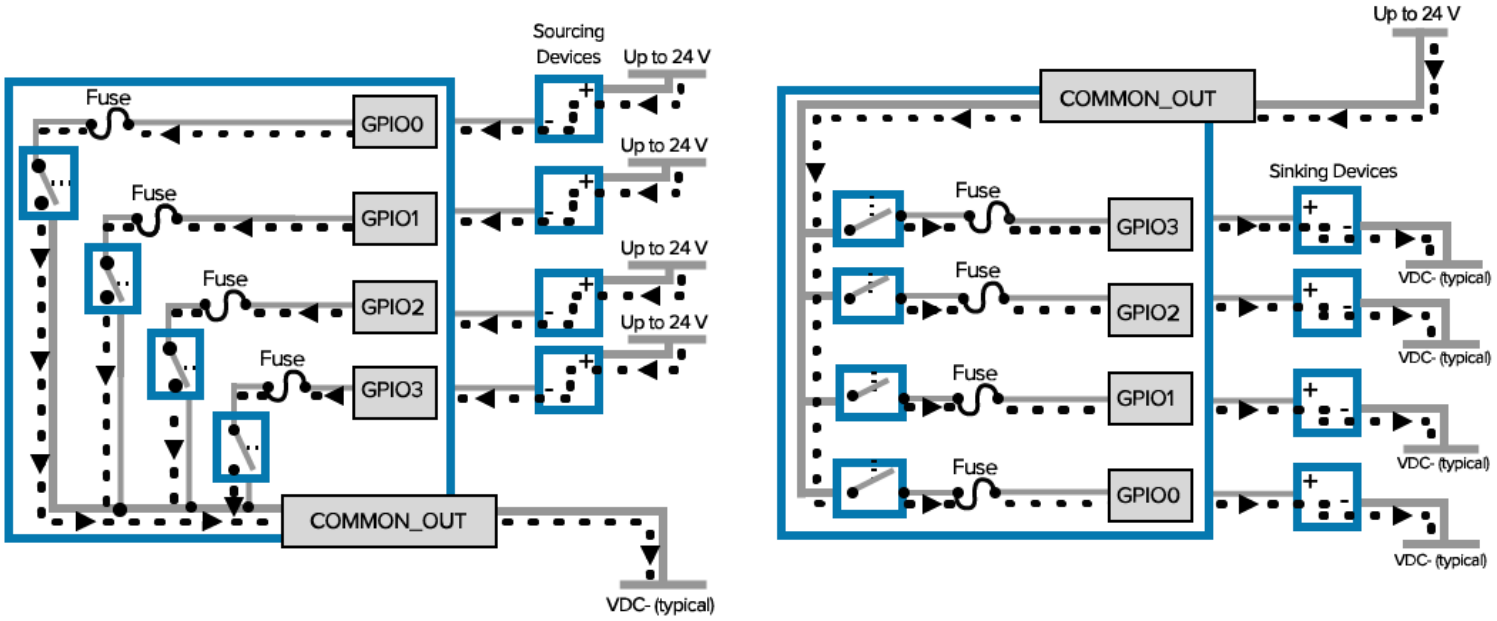


**Figure 9** Opto-Isolated Outputs




## GPIO Summary

**Table 5** 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 |

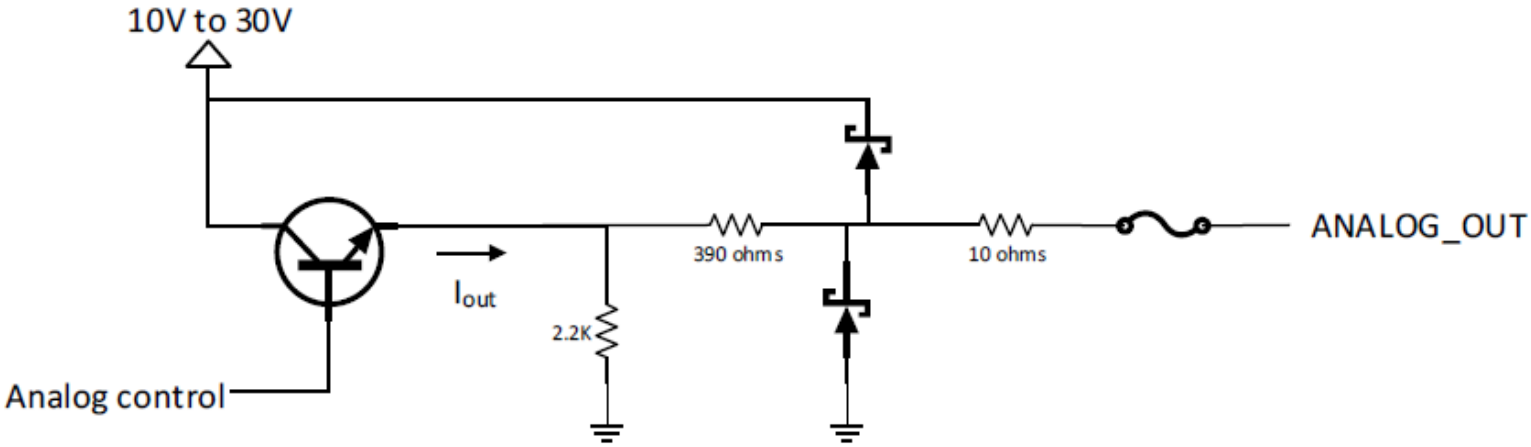
**NOTE:** [1] Digital outputs consume power, reducing the available power budget for illumination. It is recommended to disable unused outputs when using PoE.

**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

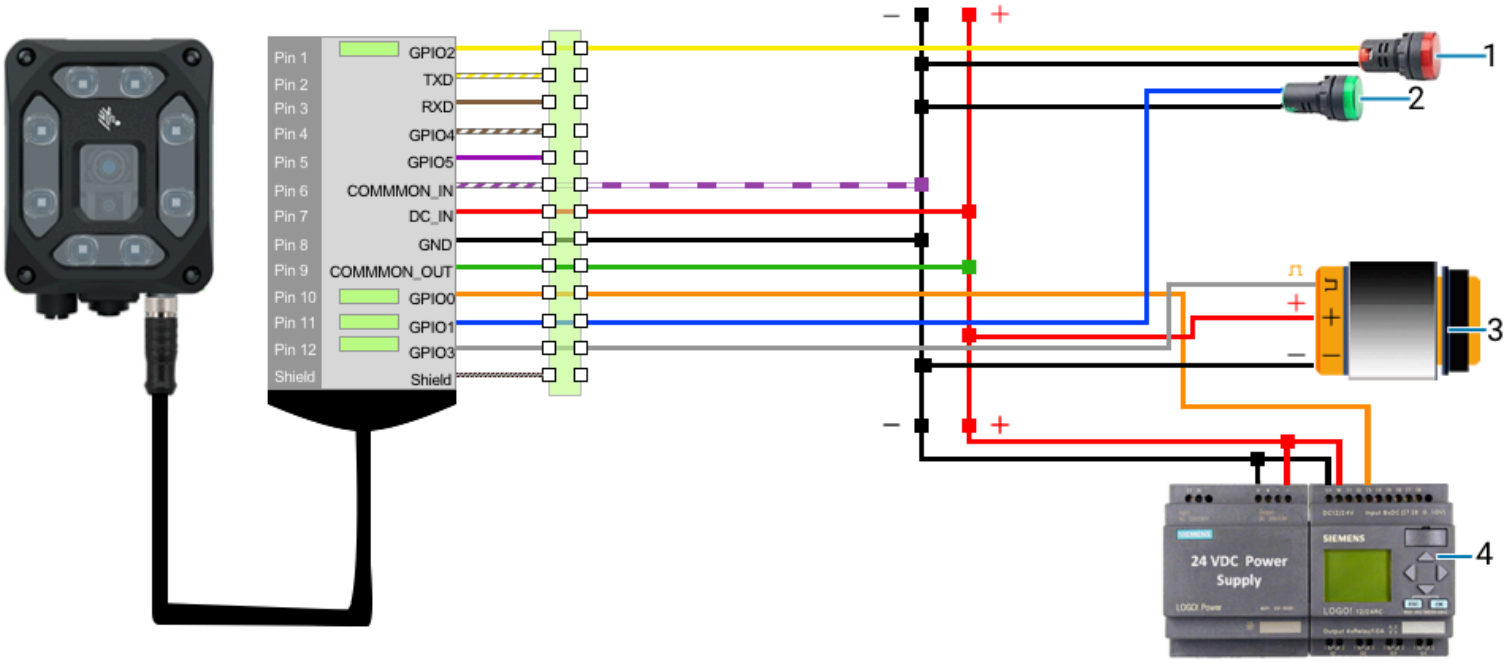
The diagrams in this section describe GPIO wiring with the Output as Current Source and as Current Sink.

### 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



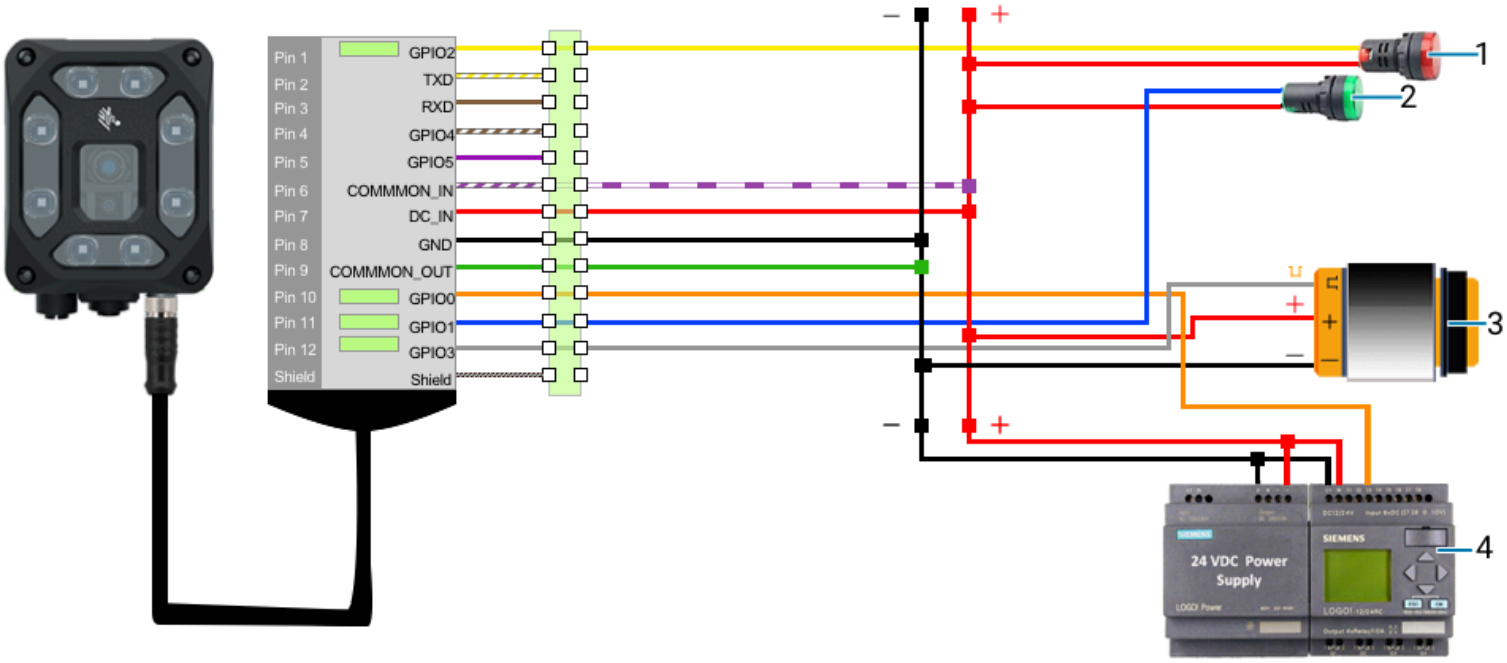

| | |
|---|---|
| 1 | Job Fail |
| 2 | Job Pass |
| 3 | PNP Proximity Sensor |
| 4 | Power Supply |

## 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 6** Operating Temperature

| Temperature | Operating Range |
|---|---|
| Ambient Temperature | 0°C to 40°C (POE, duty cycle-dependent)<br>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.

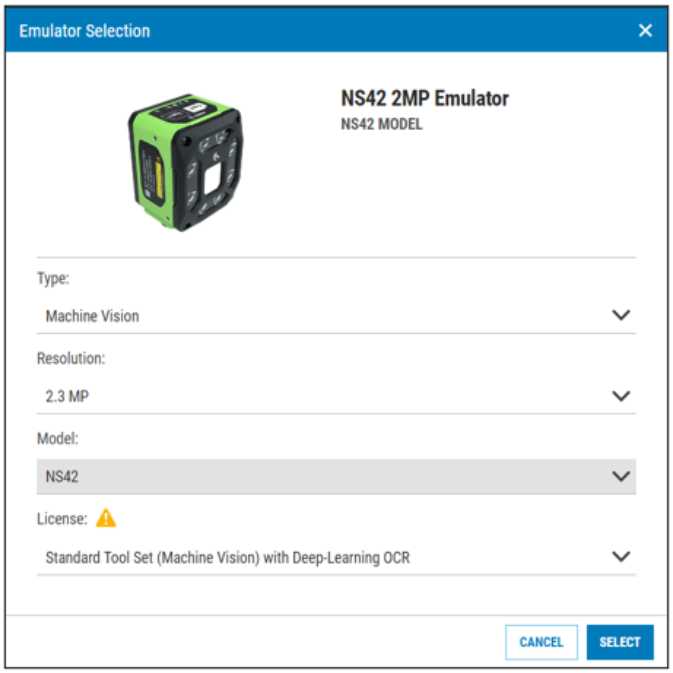
If failure persists, repeat the steps above for all of the connection types being used with the device, including:

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

# Using Machine Vision Tools

The NS42 Neural Sensor utilizes Deep Learning OCR and Anomaly Detection tools in Zebra Aurora Focus.

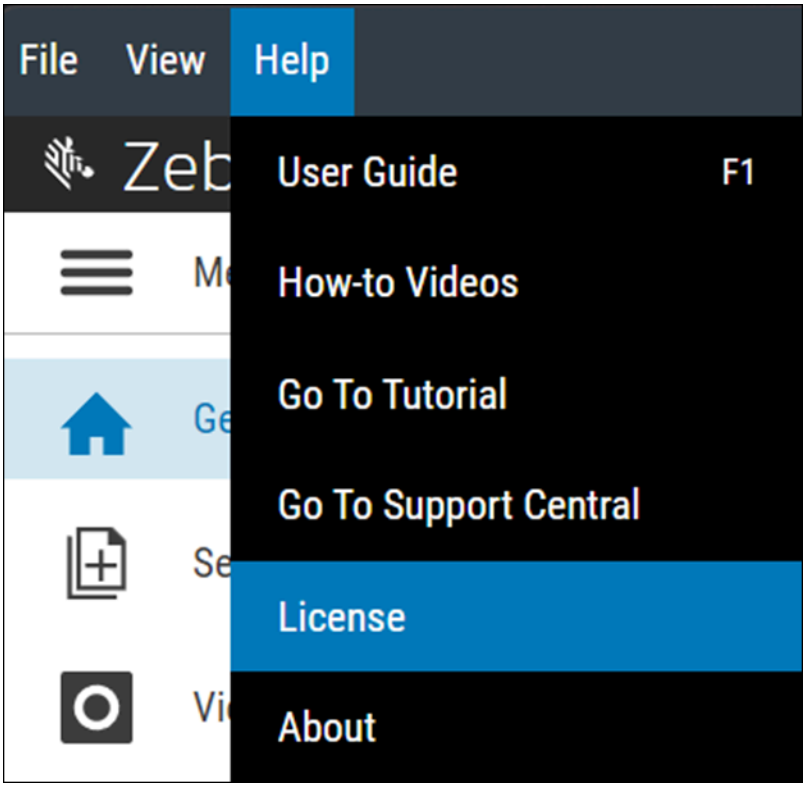
**NOTE:** These tools are also available using an emulator. For information on acquiring an emulator license key, refer to Acquiring an Emulator License Key.



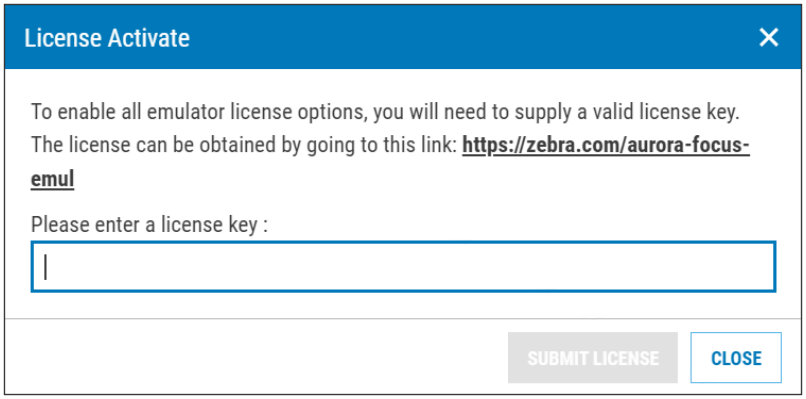

## Obtaining an Emulator License Key

Use Aurora Focus to obtain an emulator license key.

1. Click **Help** from the top navigation menu in Aurora Focus.
2. Select **License** from the drop-down menu.

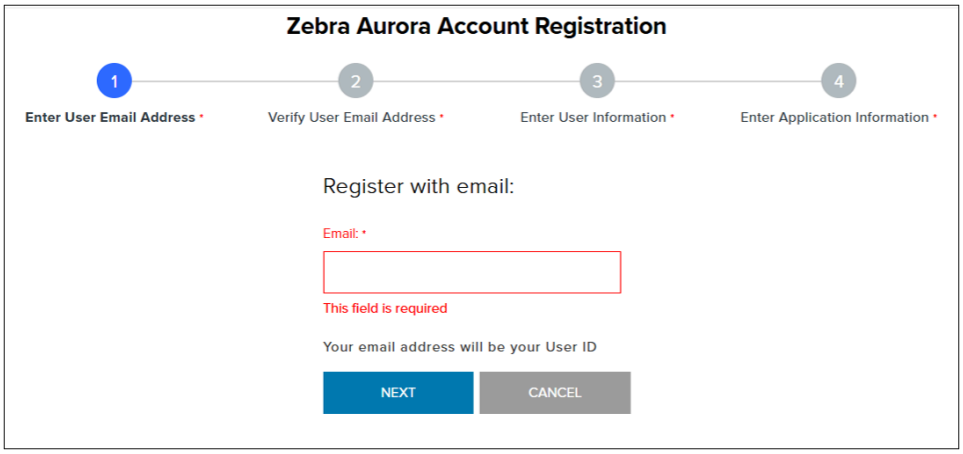



3. Observe the **License Activate** popup and click the link:

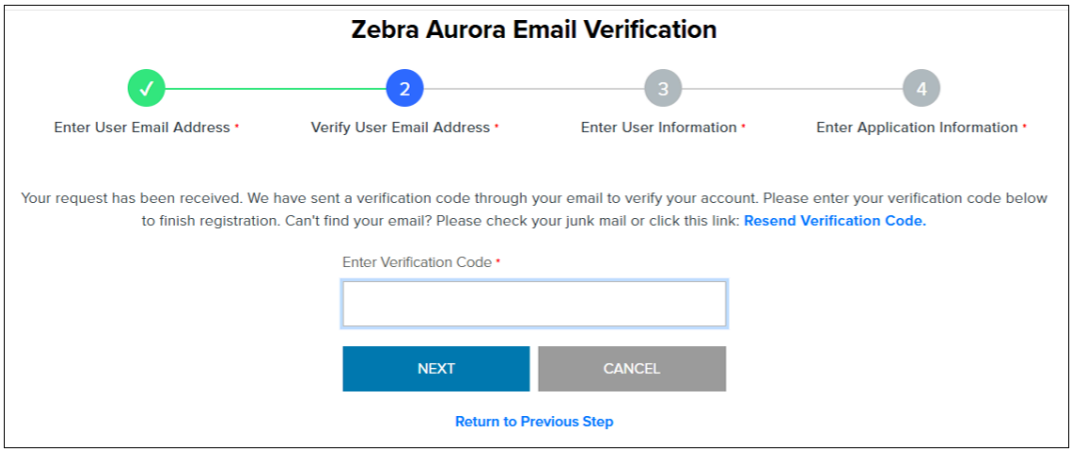



4. Enter your email address.

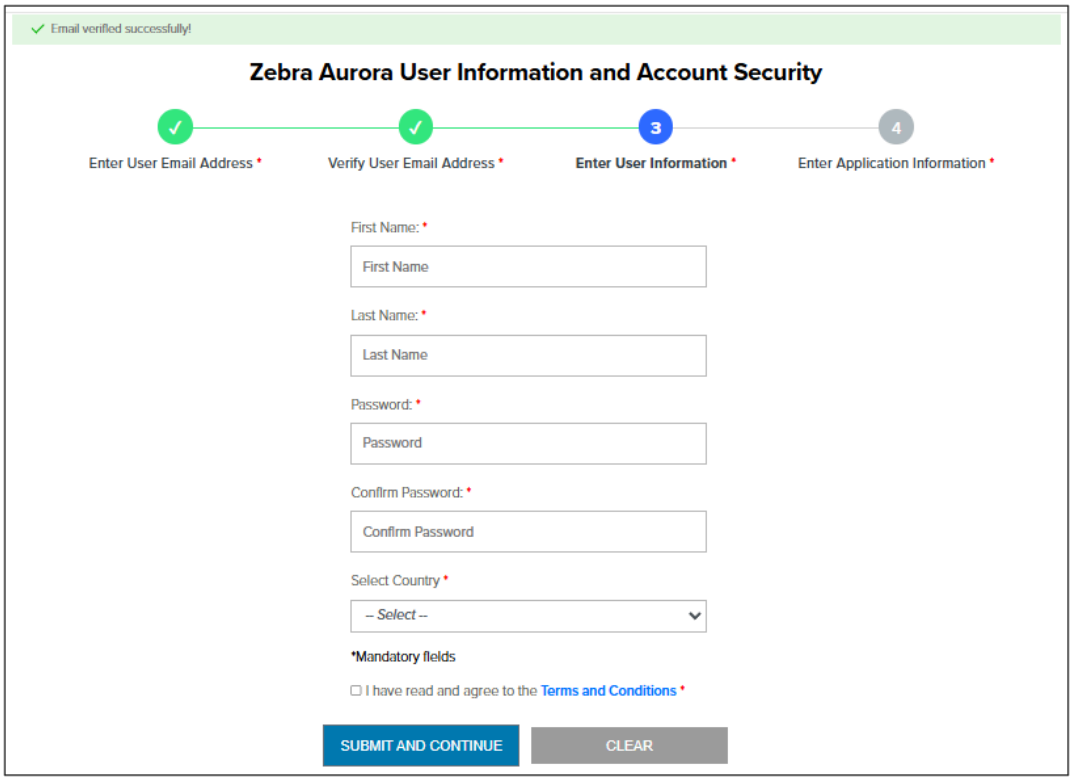
**NOTE:** This becomes your User ID.




5. Click **Next**.
6. Verify your email address by entering the verification code sent to your inbox.

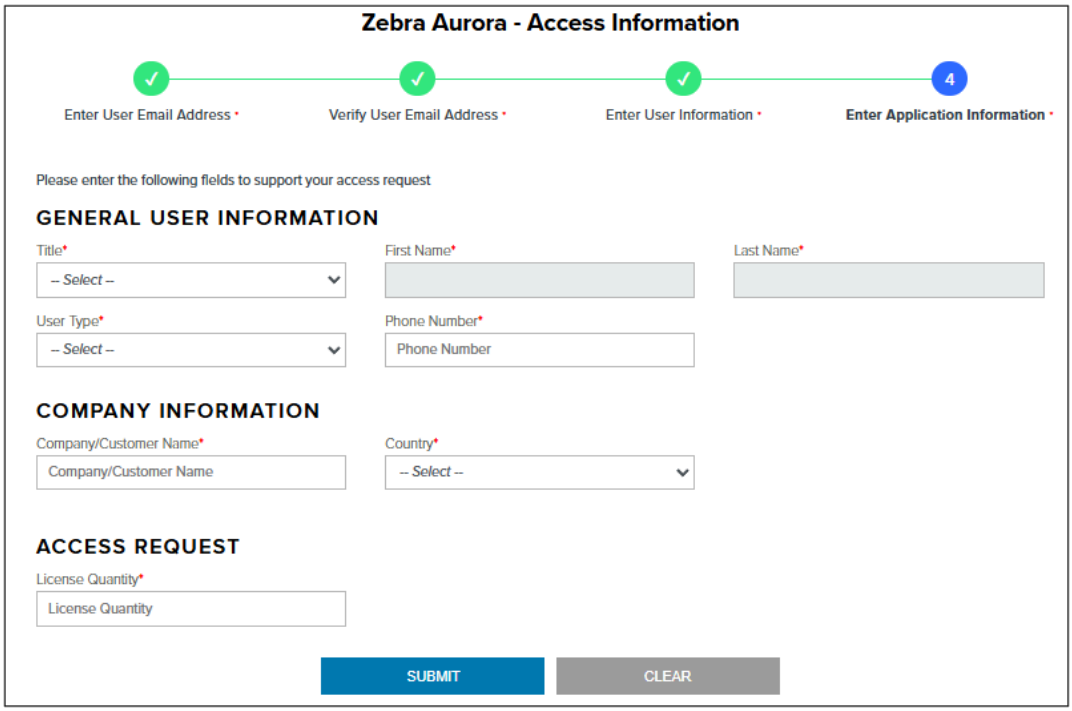



7. Click **Next**.
8. Enter your name and password, then select your country from the drop-down menu.




9. Click **Submit and Continue**.

10. Enter your user and company information and provide the number of licenses you are requesting.




11. Click **Submit**.

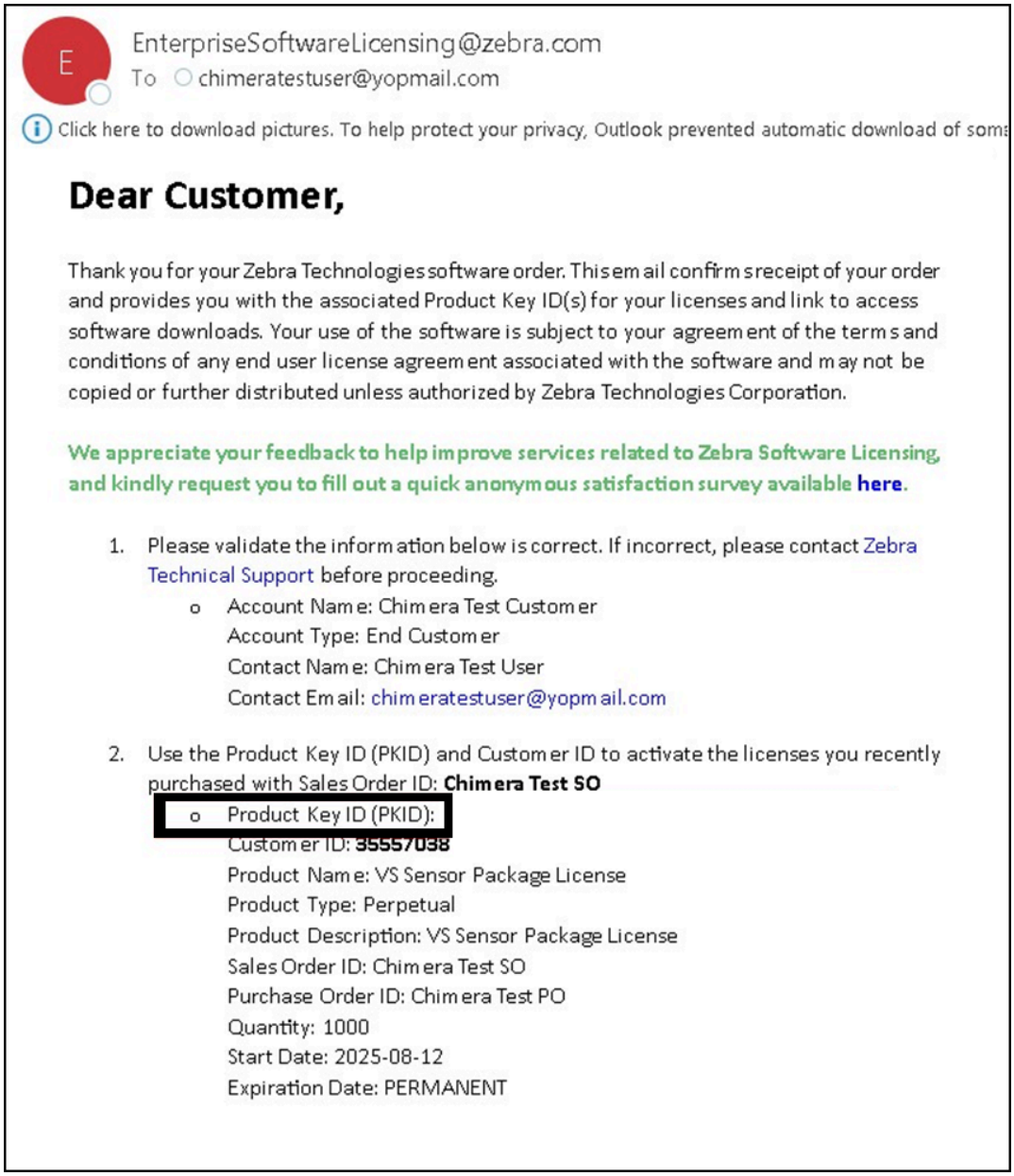
**NOTE:** Enter the Activation ID into the License Key field after registration to activate the license.

## Obtaining the Product Key ID

The Product Key ID (PKID) is the unique 32-bit alphanumeric value provided in the Zebra License Notification email when the license is procured.

Use this key to activate a purchased upgradable feature in Aurora Focus. An example of the PKID is **xssn-ixa3-tdgb-elsi-mxd8-q2kq-cw30-01bp**.

**Figure 12** Zebra License Notification Email



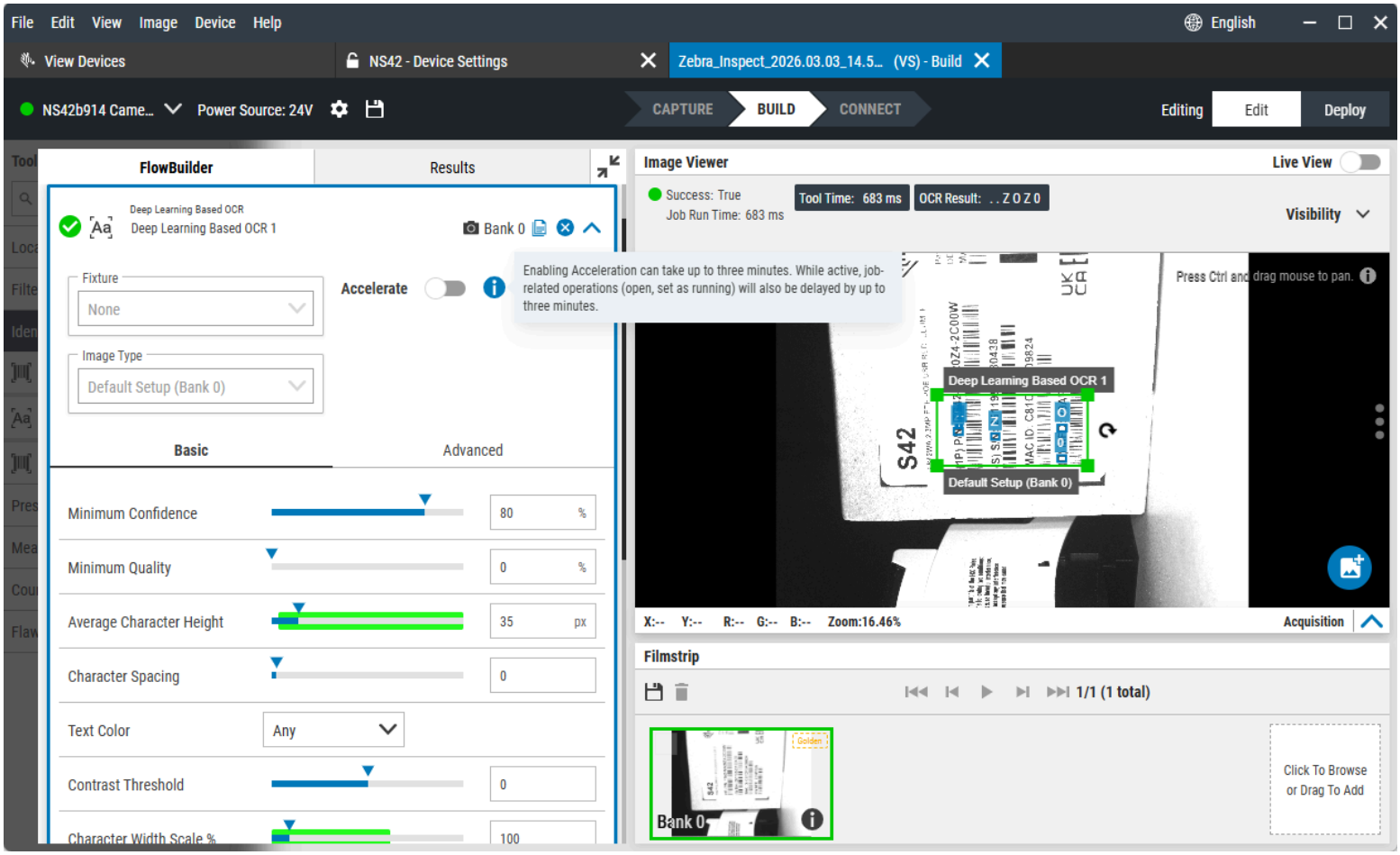
**NOTE:** Refer to the link shared in the Zebra License Notification email when the license is procured for additional license information.

## Using Accelerated Tools

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

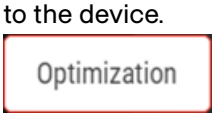
**NOTE:** Acceleration is available on FS42 and NS42 devices only.

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



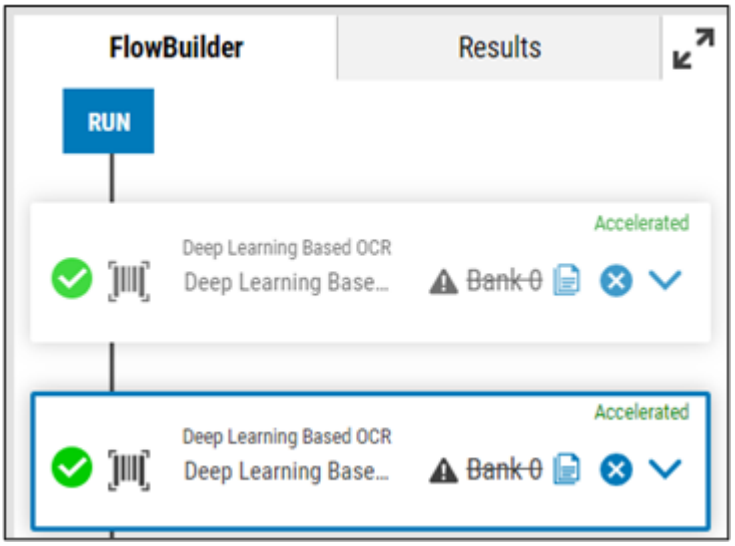

**NOTE:** In this mode, the Region of Interest (ROI) can be moved or rotated but not resized. Tool settings **Average Character Height** and **Character Width Scale %** are not editable while in Accelerate mode. Move the slider to the left to disable Accelerated mode and edit tool settings.

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 Optical Character Recognition (OCR)

The Deep Learning 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 text not displayed horizontally.

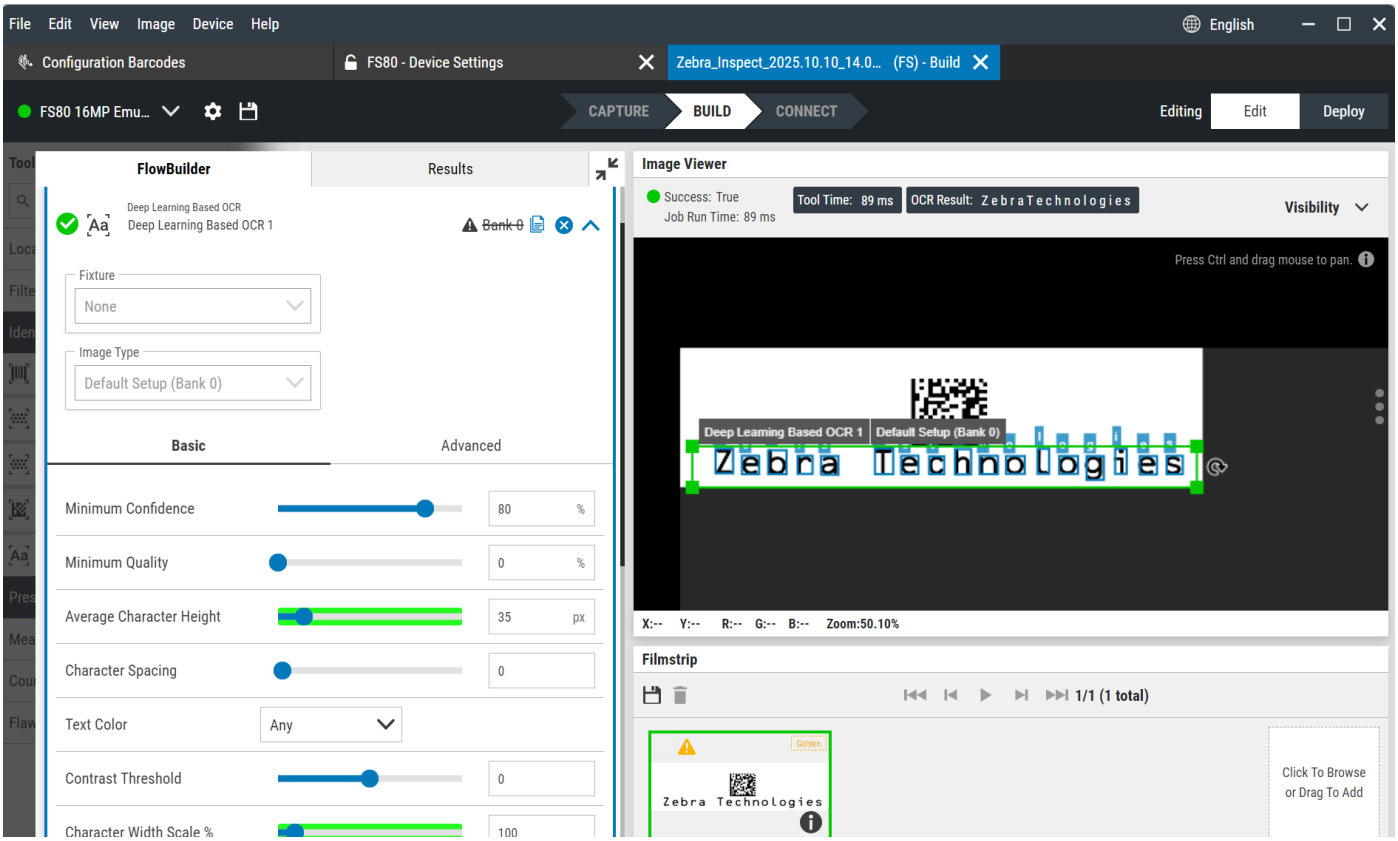



**Table 7** Deep Learning OCR Settings

| Setting | Description |
|---|---|
| Minimum Confidence | The Minimum Confidence parameter may change a character's minimum score. By default, this threshold is set to 80%.<br><br>**NOTE:** Adjusting this value lower 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. |
| Minimum Quality | Sets a minimum required quality for a character to include in the algorithm or output. |

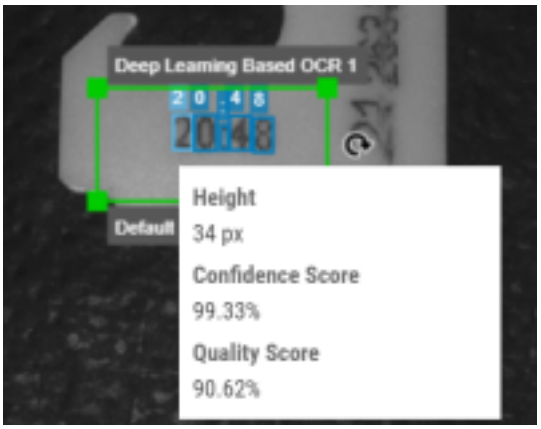
**Table 7** Deep Learning OCR Settings (Continued)

| Setting | Description |
|---|---|
| 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.<br>Use the slider to select a value close to the average pixel height of text trying to be decoded. Performance improves when this value is closer to the average character height (in pixels).<br>• Minimum Value: 8<br>• Default Value: 25<br>• Maximum Value: 200 |
| Character Spacing | Distance between characters is denoted as a fraction of CharHeight. |
| Text Color | Set a required polarity for a character to be returned.<br>• Bright: Only characters with contrast greater than Contrast Threshold are returned.<br>• Dark: Only characters with contrast lower than Contrast Threshold are returned.<br>• Any: Only characters with contrast lower than Contrast Threshold or greater than Contrast Threshold are returned.<br>Default Value: Any |
| Contrast Threshold | Sets a threshold for a contrast of found characters.<br>Default value: 0 |
| Character Width Scale Percentage | Scales the image width by the given factor (%).<br>• Minimum Value: 10%<br>• Default Value: 100%<br>• Maximum Value: 1000% |
| Character Range | Enable Character Range to limit the set of recognized characters.<br>This string must be formatted according to the following rules:<br>• Allowed characters must be separated with commas.<br>• 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.<br>• Comma and backslash have to be prepended with a backslash.<br>For example, Character Range equal to A-F,g-o,0-9,X,Y,Z,-,\\,\, recognizes only ABCDEFXYZghijklmno0123456789-\, characters. |

**Table 7** Deep Learning OCR Settings (Continued)

| Setting | Description |
|---|---|
| String Match | Defines a string that must be contained within the decoded OCR output for the tool to pass (for example, a 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.<br>Enable the RegEx checkbox and use the syntax `^<stringToExactMatch$` to implement the exact match behavior.<br>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. |

**NOTE:** Obtain character height, confidence score, and quality score by hovering over the characters of the decoded image.




## Using Anomaly Detection

Aurora Deep Learning Editor is required to run Anomaly Detection in Aurora Focus. It requires a license stored on the device or a valid emulator license key.

**NOTE:** Anomaly Detection is available on FS42 and NS42 devices only.

### Acquiring Images

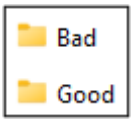
Images can be acquired and saved via FTP or directly onto the device.

1. If you acquire the images live in an industrial environment, use Image Saving via FTP to copy the image from the FTP server to your PC. For more information on setting up image saving, refer to the FTP File Saving section in the Aurora Focus User Guide.
2. If you save the images directly onto the device, access them using the Aurora Focus Web HMI. For more information, refer to the Accessing the Web HMI section in the Aurora Focus User Guide.

## Preparing Images

It is important to properly organize and label the images when training the model.

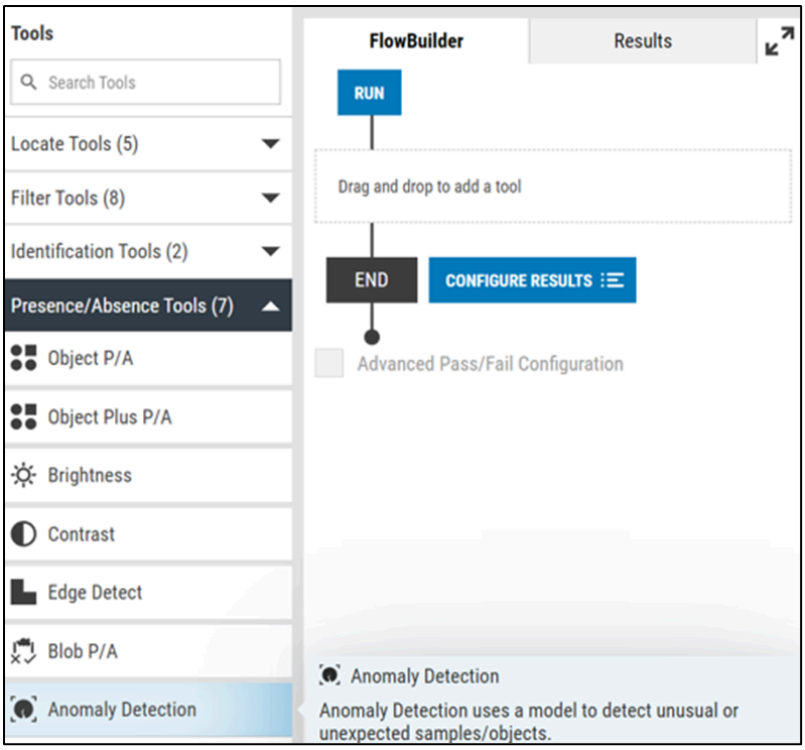
1. Collect a series of images using periodic single-shot mode in Aurora Focus.
2. Save the images to the local host/PC.
3. Create separate folders for Bad and Good images for testing purposes.



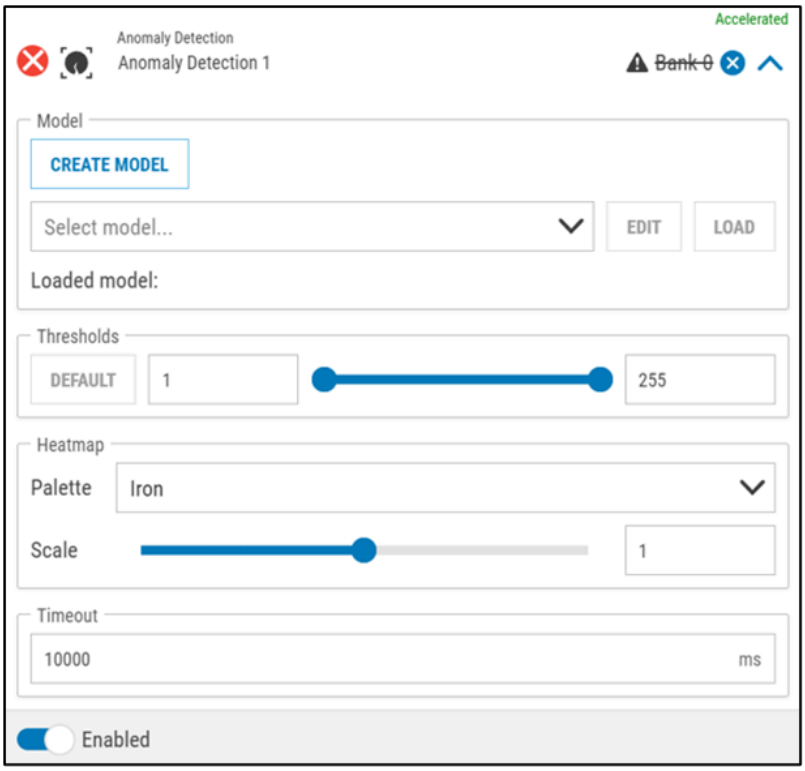

## Creating a Model

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

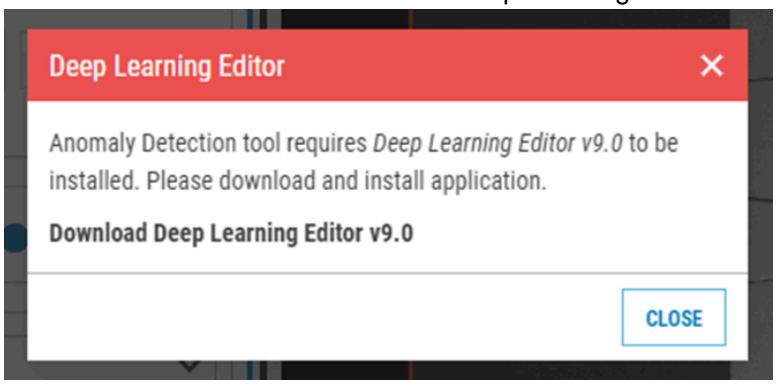
1. Add the **Anomaly Detection** tool from **Presence/Absence** tools list.



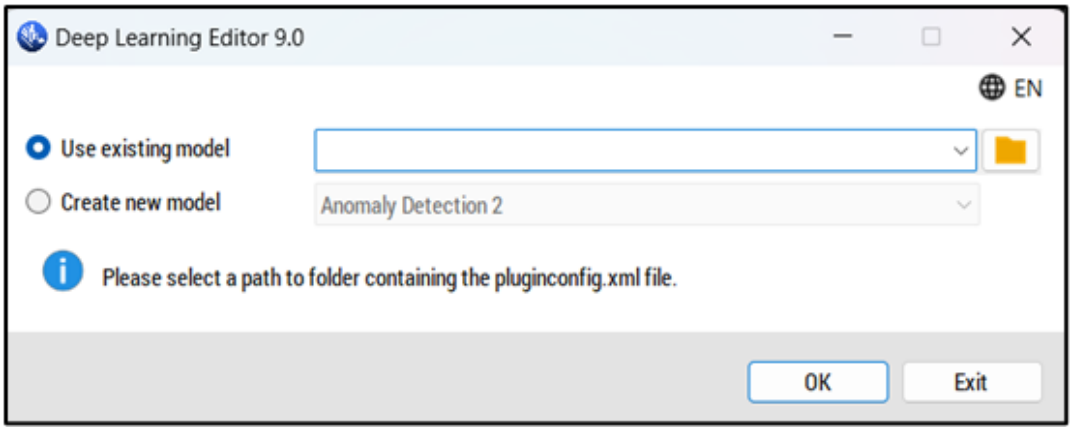

2. Click **Create Model** to use an existing model or create a new one.



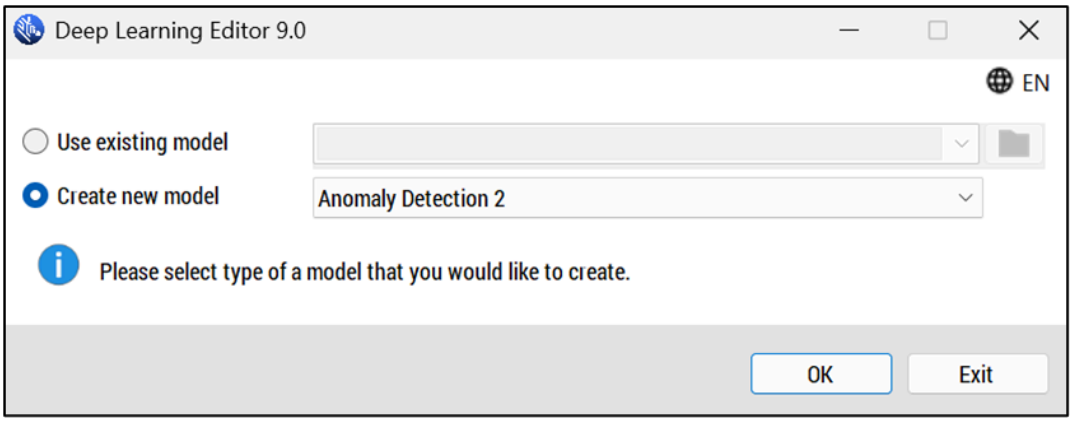

**NOTE:** Anomaly Detection requires the latest version of Aurora Deep Learning Editor. To download the latest version, open Aurora Focus while connected to an FS42 or NS42 device or emulator and add the Anomaly Detection tool. The dialog box provides a direct link to download the latest version of Deep Learning Editor.



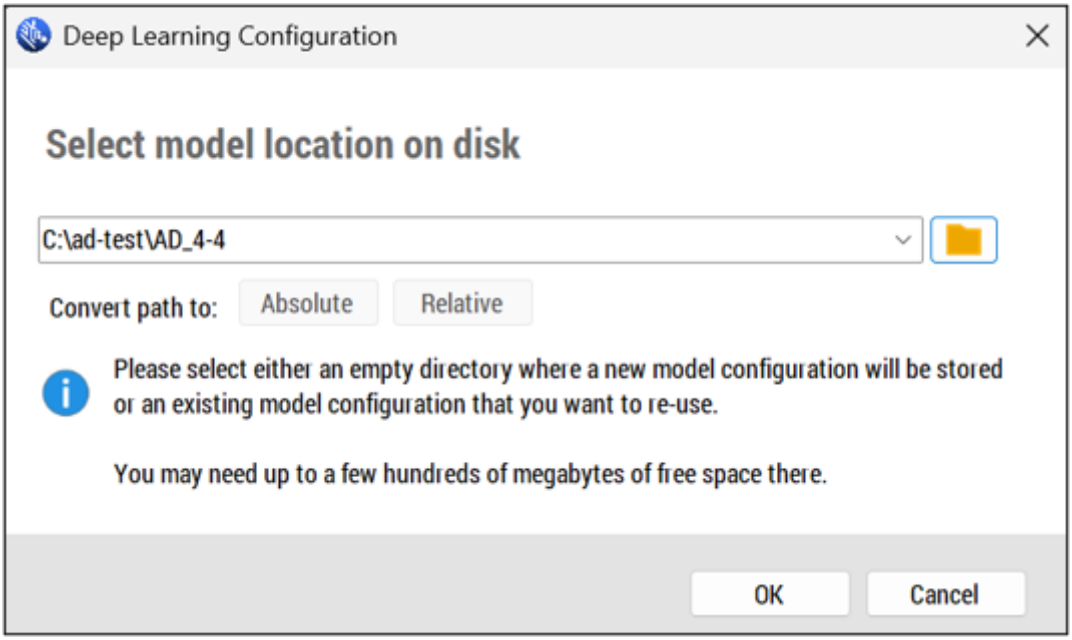

3. If you are using an existing model, click and navigate to the location of the model on your PC, and click the folder icon.




4. If you are creating a new model, select the model type from the dropdown and click **OK**.




5. Click  to select a location for the model on your PC.

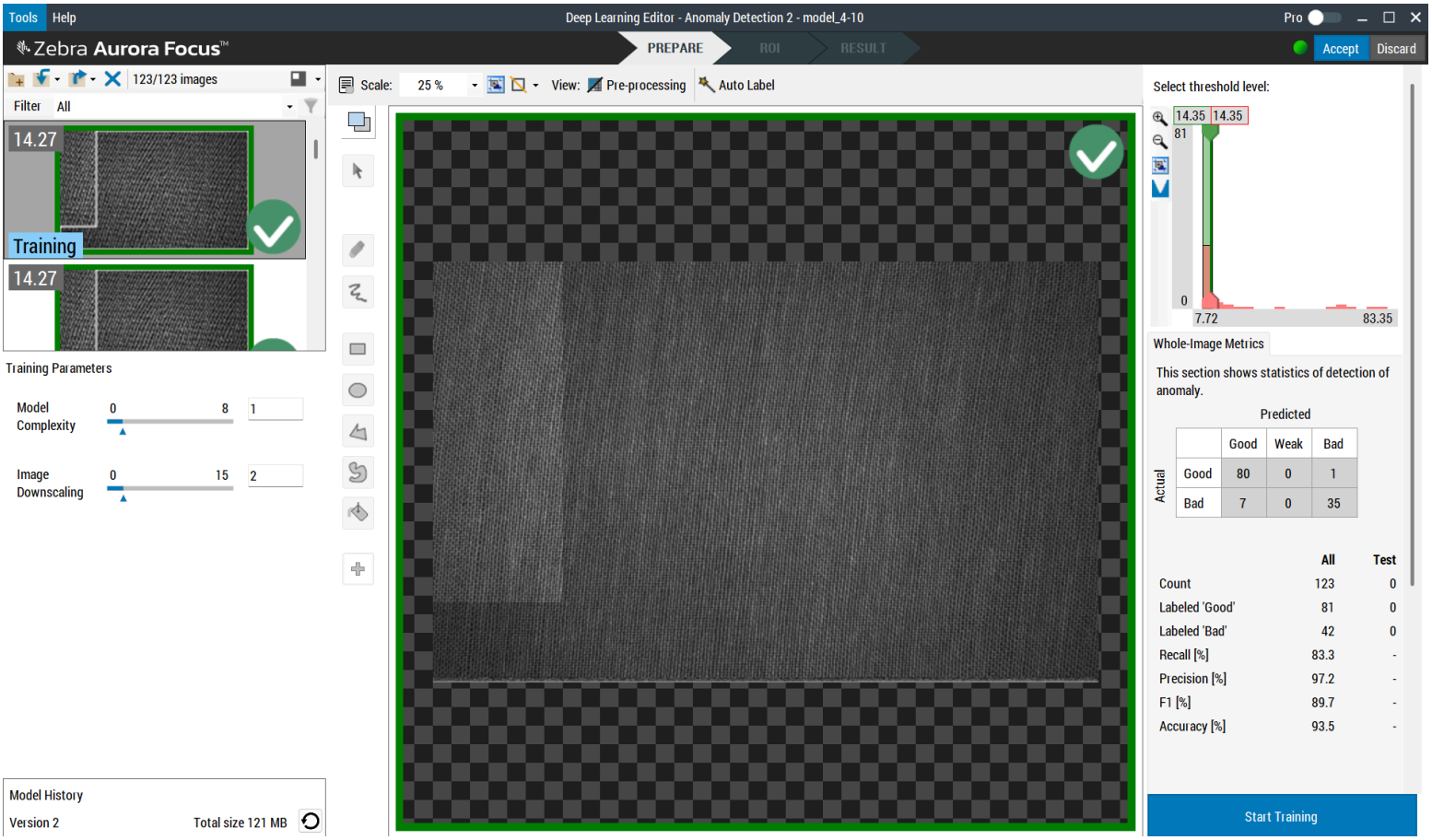


**NOTE:** Model editing is done in Deep Learning Editor.

## Using Aurora Deep Learning Editor

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

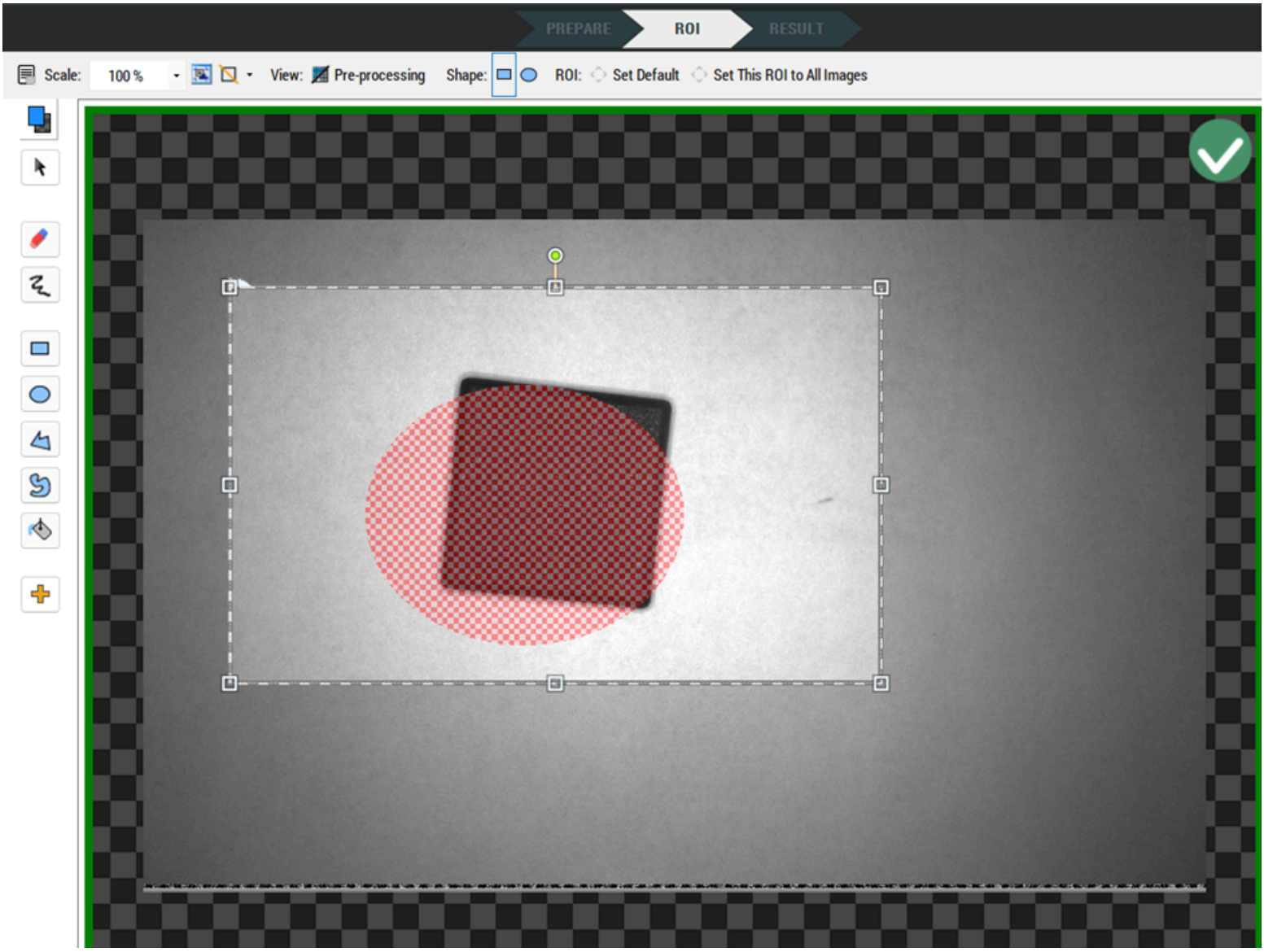
1. Click to add new images to the editor, or click to add a new image and mark it as good or bad.




2. Observe the **Training Parameters** to understand the complexity and downscaling of the model. Both contribute to the training time and the working time of the model.
   - Model Complexity - as density increases, the precision of the heatmap data visualization also increases, which in turn increases execution time.
   - Image Downscaling - each level reduces the width and height of the image by a factor of 2.

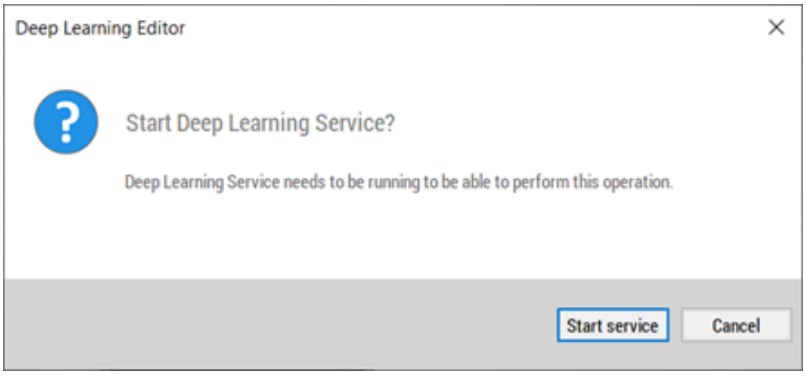
   **NOTE:** Go to Using Pro Mode to understand how to use advanced parameters.

3. Use the **ROI** tab to configure the Region of Interest (ROI). The size, shape, and location of the ROI can be changed to fit every image. Drawing tools help to mark the quiet zone inside the ROI. Fields outside the marked ROI are not calculated.




4. After configuring the settings, click **Start Training** to start training the model.

**NOTE:** If the Deep Learning Editor is being run for the first time, the first click launches the Deep Learning Service, and the second starts generating the model. The Deep Learning Service runs for approximately 30 minutes after disconnecting the device or stopping the emulator.




## Understanding Thresholds

Threshold values inform the classification of the images in the dataset by providing scores and confidence levels.

After the training phase, scores are calculated for every training sample and presented as a histogram; good samples are marked with green bars, and bad samples with red bars. All images with scores between 0-T1 are marked good, and images above T2 are classified as bad. If the score is between T1 and T2, the result is [Confident: No].

Training with many samples from both groups is recommended to achieve a more robust threshold.

- Images that have scores within 0-T1 are marked as Good, [Confident: Yes]
- Images that have scores within T1-T are marked as Good, [Confident: No]
- Images that have scores within T-T2 are marked as Bad, [Confident: No]
- Images that have scores above T2 are marked as Bad, [Confident: Yes]
- If both thresholds are equal (T1=T2=T), there is no area of uncertainty. Results are marked as Confident: Yes.

**NOTE:** The image viewer in Aurora Focus provides information on Tool Time, Confident, and Score. [Confident: No] indicates the score is close to the threshold. In this case, perform another inspection.

**Figure 13** Job Fail, Confident: Yes

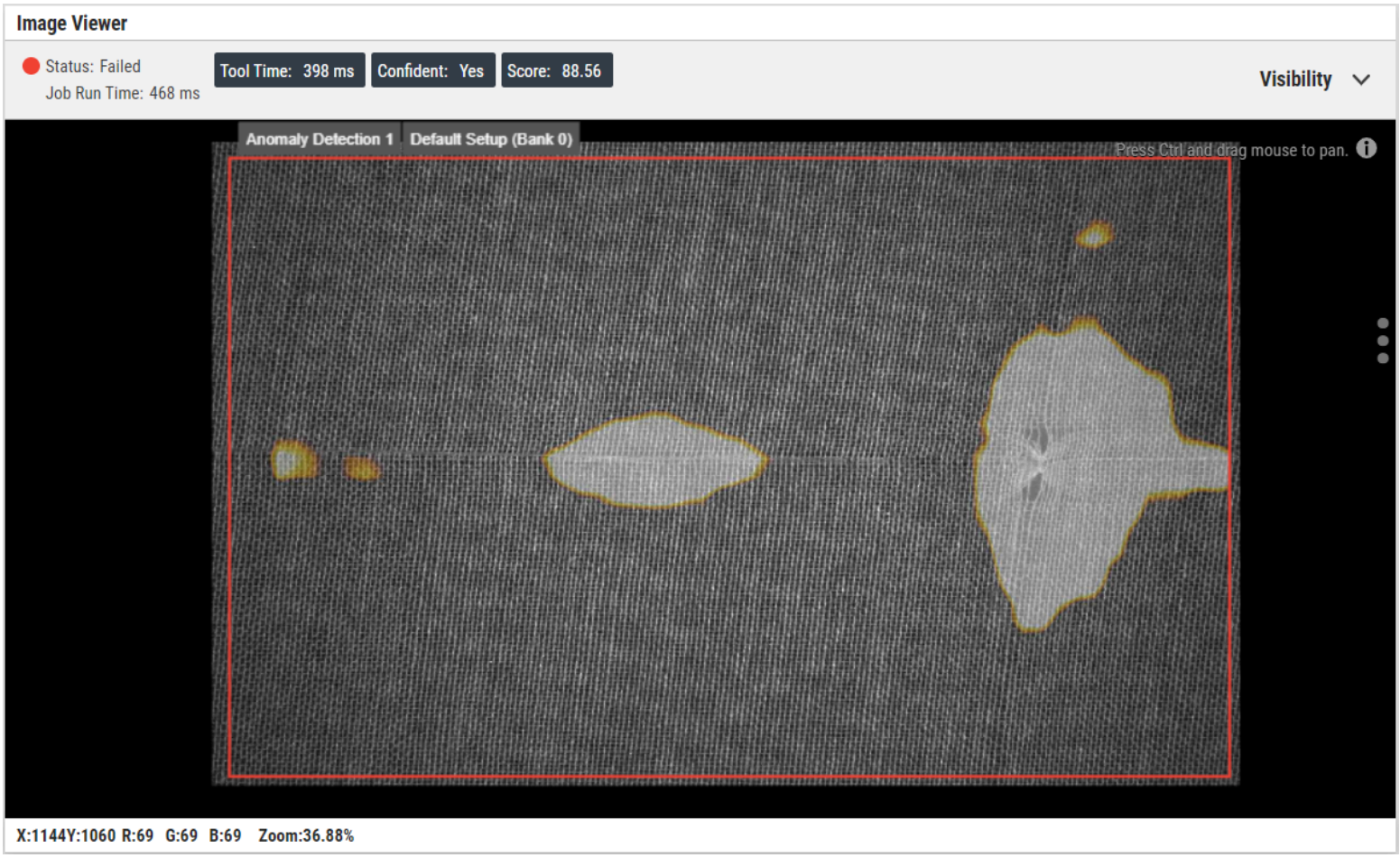


**Figure 14** Job Pass, Confident: No

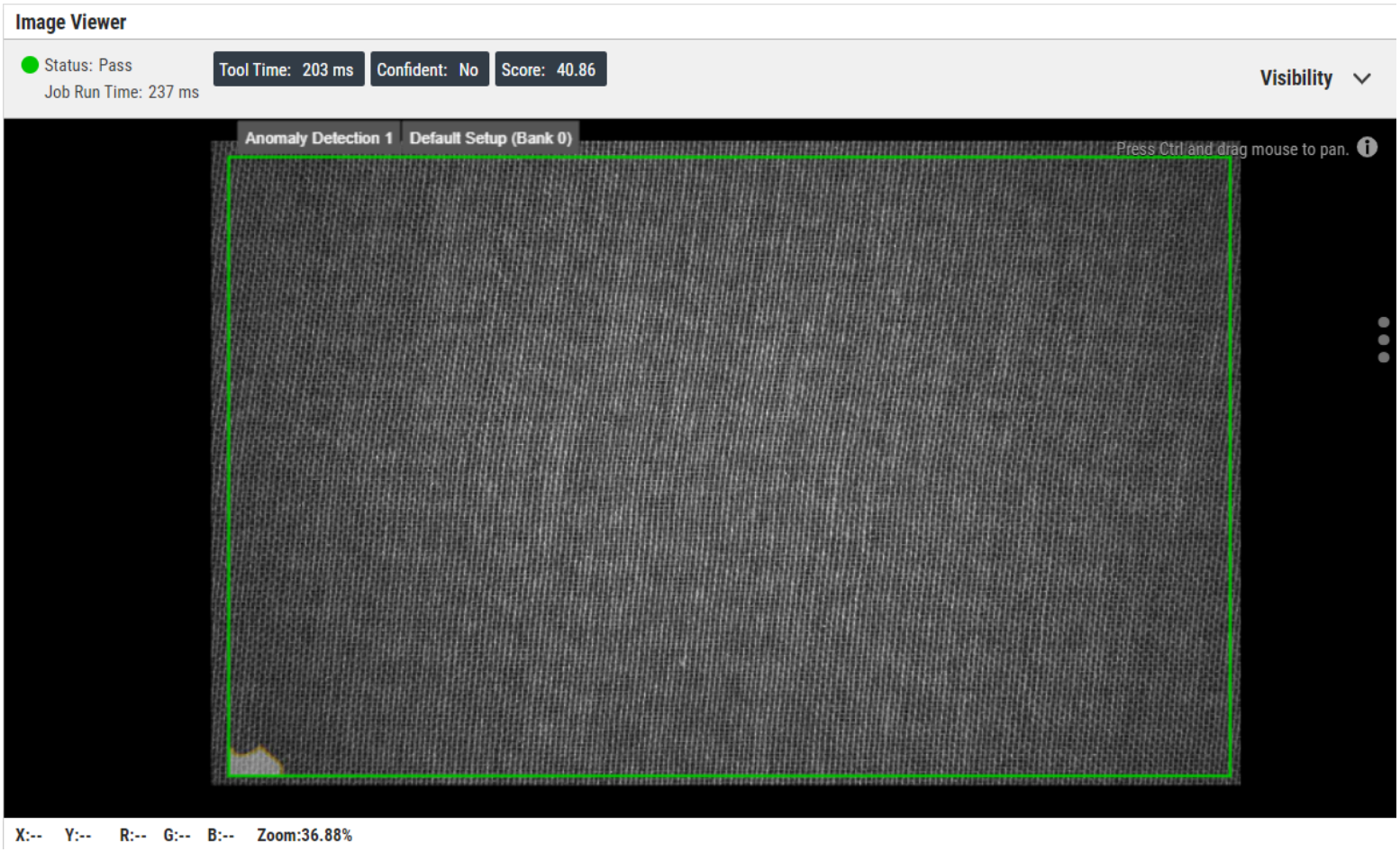
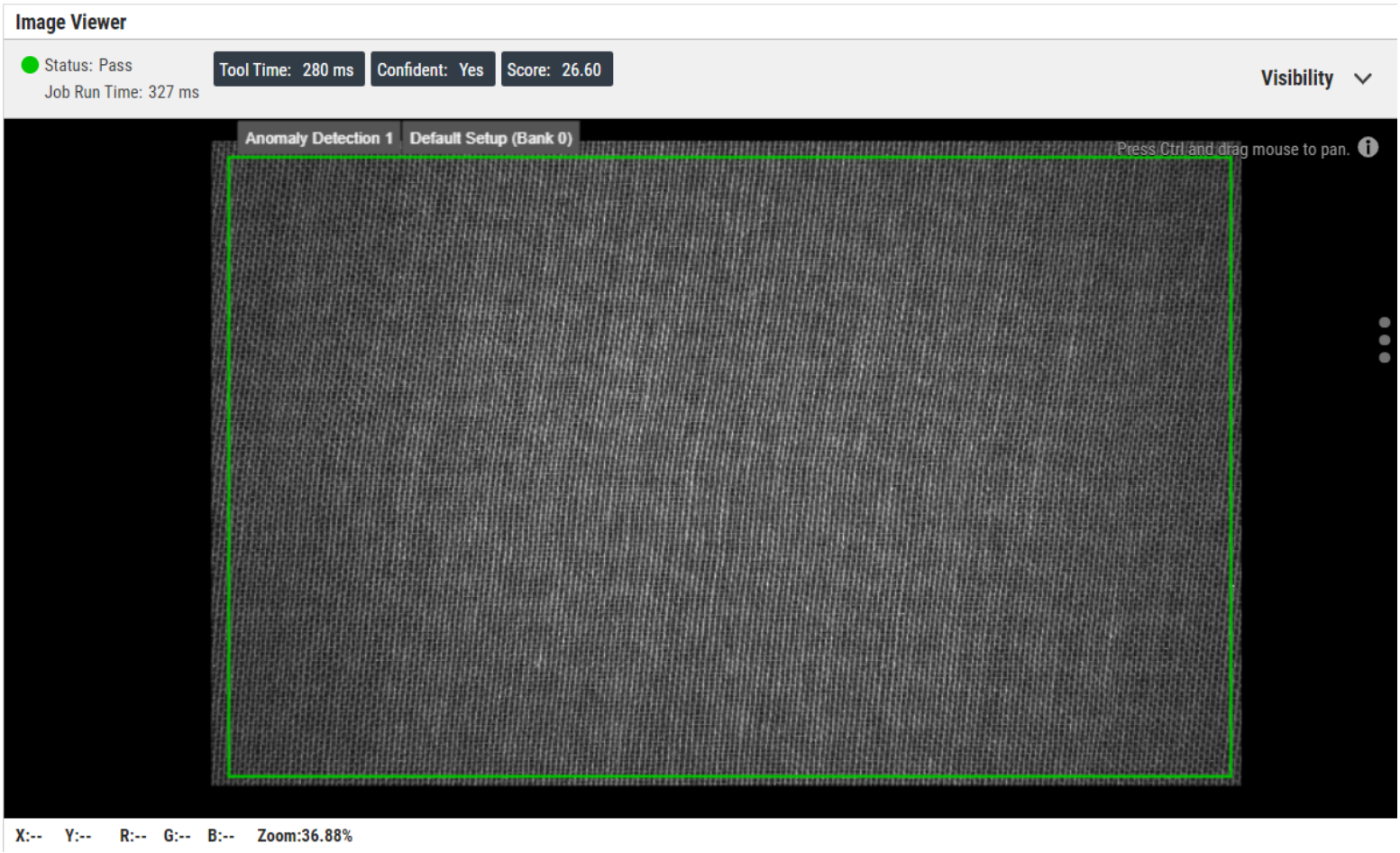


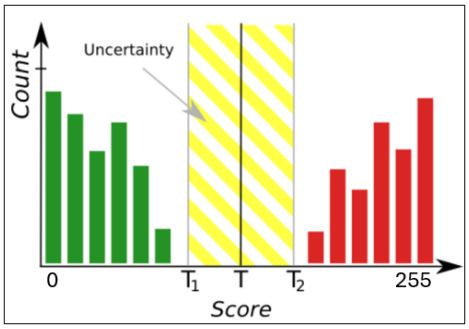
**Figure 15** Job Pass, Confident: Yes




The histogram tool displays green bars representing correct samples and red bars representing anomalous samples. T (the midpoint of T1 and T2) marks the main threshold, and T1 and T2 define the area of uncertainty [Confident: No].

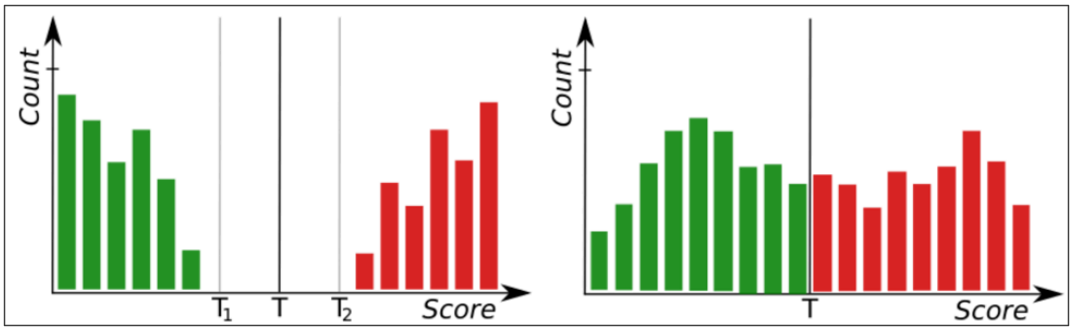
The following histogram displays well-separated groups, indicating that the model has good accuracy:

**Figure 16** Uncertainty Threshold



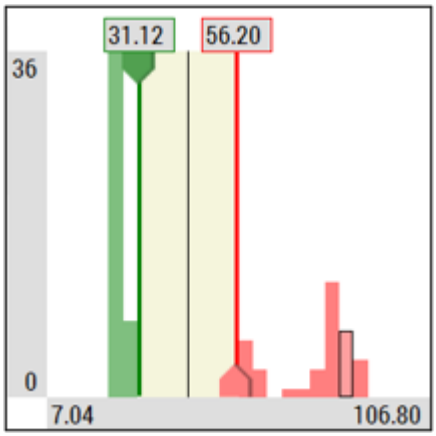

The following histogram displays groups in close proximity, indicating that the model has poor accuracy:

**Figure 17** Good and Bad Model Accuracy Examples




The following histogram provides a real-world example in Aurora Deep Learning Editor:

**Figure 18** Aurora Deep Learning Editor Example



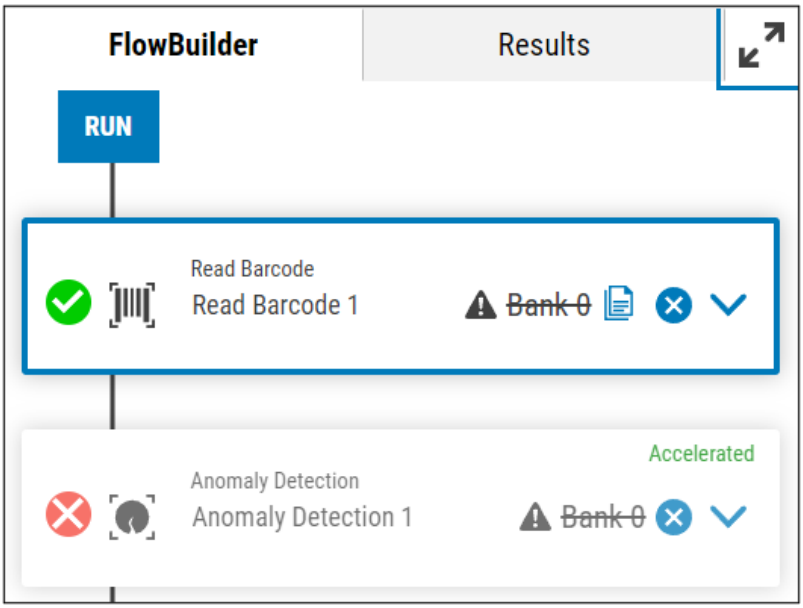

This example shows 36 images in the model with a clear separation between Good and Bad images. The range of scores for Good images is 7.04-31.12, and the range for Bad images is 56.20-106.80. The yellow separation between Good and Bad images indicates that the model has good accuracy.

## Fixturing in Anomaly Detection

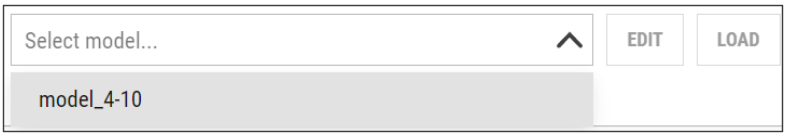
Use fixturing in Anomaly Detection to dynamically control the Region of Interest (ROI) using a fixture from a Locate or Read Barcode tool.

**NOTE:** Models created in Aurora Focus 9.3 and above can use fixturing.

1. Choose a Locate or **Read Barcode** tool and add it to the **FlowBuilder**.

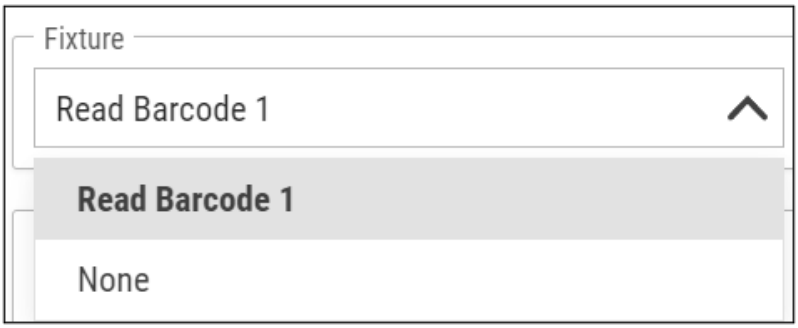



2. Select a model from the **Model** drop-down and click **Load**.




**NOTE:** Fixturing is not available until after the model loads.

3. Select a **Fixture** from the drop-down and select a fixture source.




4. Once the fixture is selected, the status indicator changes to Set.

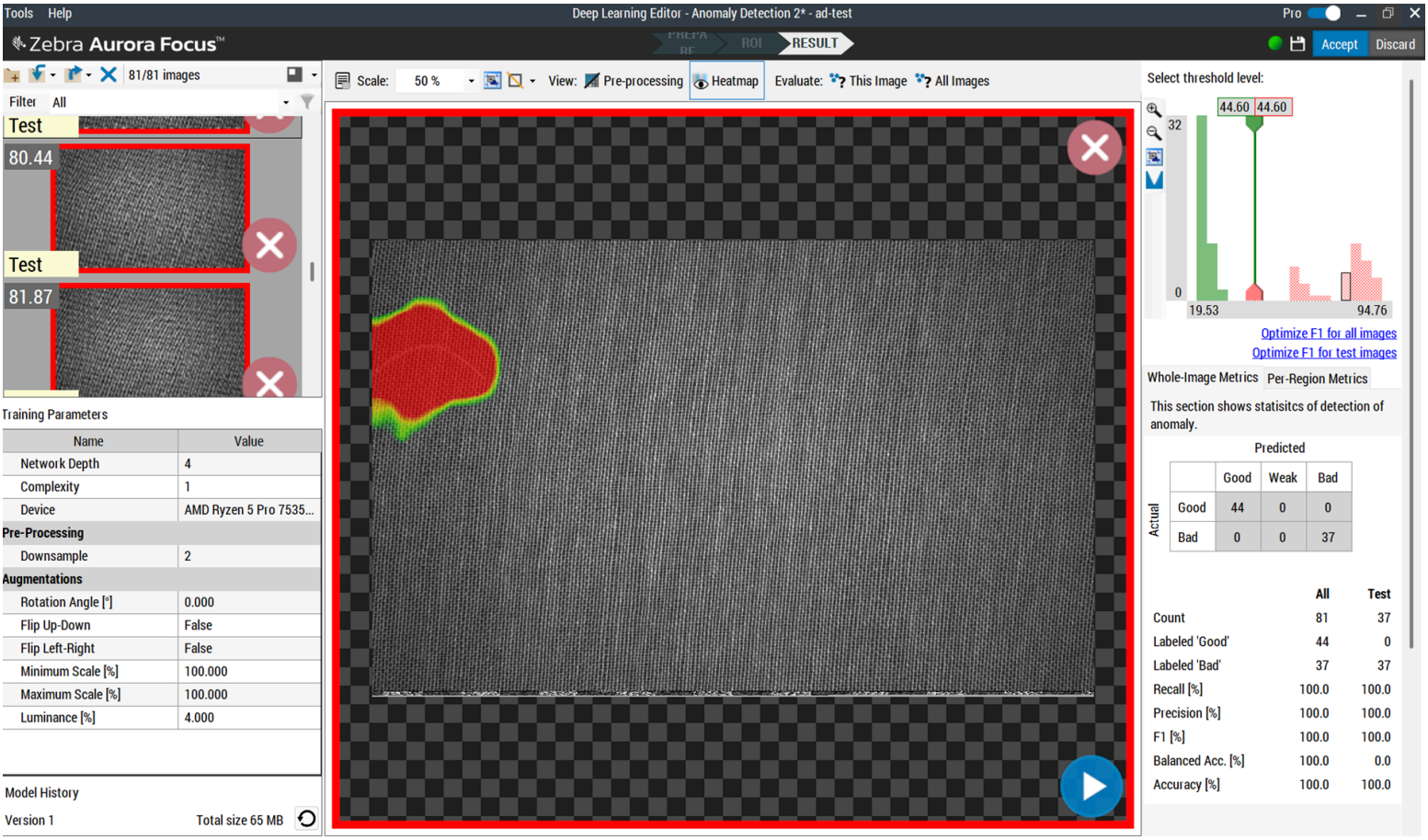



## Using Pro Mode

Enable Pro Mode to access advanced parameters such as Network Depth, Complexity, and Device.

1. Toggle the button to the right to enable Pro Mode 

.
2. Observe the following additional parameters:

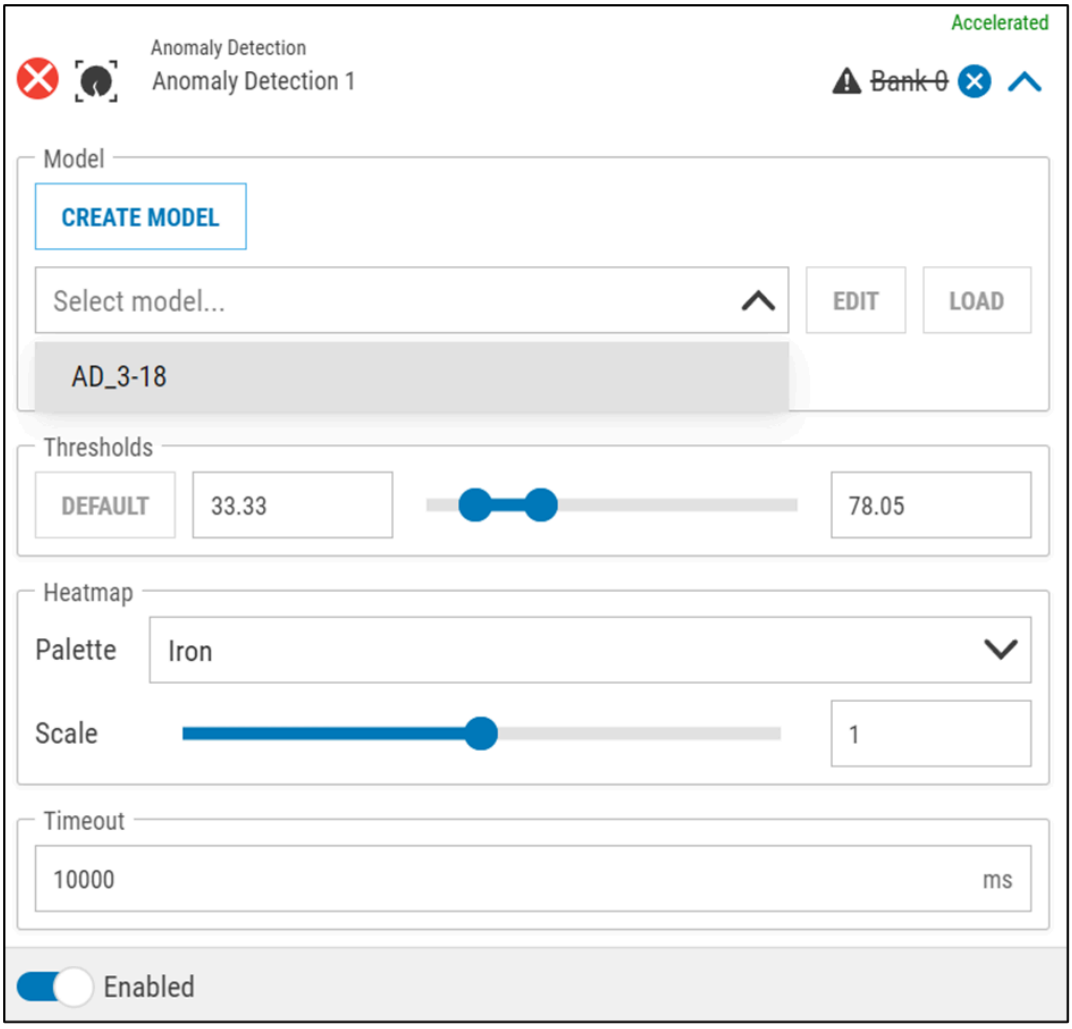



- Network Depth - the size of the network's internal memory. Use higher depth for images containing complex patterns or a wide variety of objects.
- Complexity - higher density provides more precise heatmaps but can increase execution time.
- Device - provides information on the device the training is being performed on.
- Pre-Processing
  - Downsample - each level reduces the width and height of the images by a factor of two.
- Augmentations
  - Rotate Angle - rotate samples by a random angle between 0 and the parameter value.
  - Flip Up-Down - reflect samples along the x-axis.
  - Flip Left-Right - reflect samples along the y-axis.
  - Minimum Scale Percentage - minimum value of random scale factor applied to samples.
  - Maximum Scale Percentage - maximum value of random scale factor applied to samples.
  - Luminance Percentage - change brightness of samples by a random percentage (between -ParameterValue and +ParameterValue) of pixel values (0-255).

## Editing and Deploying Models in Aurora Focus

Load an existing model in Aurora Focus to edit and deploy on a set of images.

1. Select the model from the drop-down menu.




   a) Click **Load** to deploy the model on a set of images in Aurora Focus.

   b) Click **Edit** to edit the model in Deep Learning Editor.

2. Configure the model settings as necessary:

   - The Pass and Fail state of the tool is defined by the Threshold T (mid-point of T1 & T2), which is defined in the Deep Learning Editor. For additional information on thresholds, go to Understanding Thresholds .
   - Heatmap - change the visualization settings of the heatmap that appears when reviewing results.

## Using Edge Detect

The Edge Detect tool identifies transitions based on the highest contrast in a Region of Interest (ROI).

**NOTE:** For more information on using Aurora Focus, refer to the Aurora Focus User Guide.

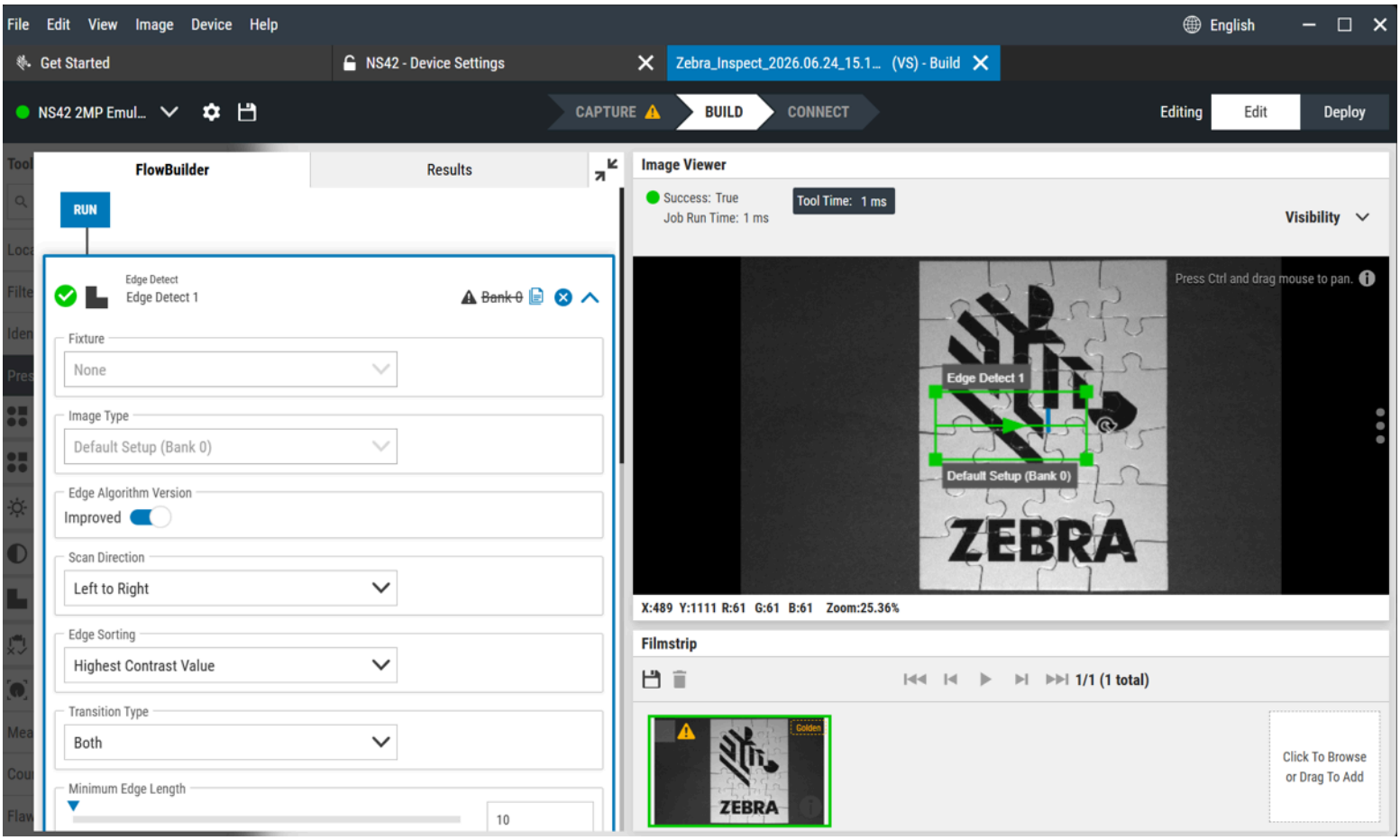



**Table 8** Edge Detect Settings

| Settings | Description |
|---|---|
| Fixture | Select a previous locate tool result to position this tool's Region of Interest (ROI). |
| Image Type | Select which image type this tool uses. |
| Edge Algorithm Version | Enable the Improved Edge Algorithm version to adjust the tools' settings to the latest version automatically.<br><br>**NOTE:** Tool time may increase when using the Legacy algorithm. |
| Scan Direction | Set the direction that the tool uses when searching for edges. |
| Edge Sorting | Refine a collection of found edges to a single optimal edge. |

**Table 8** Edge Detect Settings (Continued)

| Settings | Description |
|---|---|
| Transition Type | Select the type of edge transition used to find the edges. |
| Minimum Edge Length | The minimum length in pixels of an edge to use. |
| Maximum Gap | The maximum size in pixels to consider in gaps of the edge. |
| Skew Tolerance | Degrees to attempt to match the skew of the line if it is not straight. |
| Edge Contrast | Threshold acceptance to consider a line. |
| Edge Profile | Displays the contrast score of the features across the Region of Interest (ROI). |

# Maintenance

To maintain Zebra devices, avoid harmful chemicals such as acetone as they damage plastics. Only use approved cleaning agents such as pre-moistened wipes and 70% isopropyl alcohol. Use a dampened soft cloth for routine cleaning to avoid liquid pooling and direct spraying into the scanner exit window.

## 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

This section describes potential issues that could arise while using the device and solutions that could correct the problem.

## 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 9** 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. |

**Table 9** Troubleshooting (Continued)

| Problem | Cause | Solution |
|---|---|---|
| | 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

This section provides information on device specifications, supported accessories, dimensional drawings, pinouts, and reading diagrams to understand how to integrate the device into your industrial environment.

## Specifications

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

**Table 10** Specifications

| Specification | Description |
|---|---|
| **Physical Characteristics** | |
| Dimensions | 2.1 in. H x 2.5 in. W x 3.6 in. D<br>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<br>Class 4 PoE+ source, 25.5W max<br>Class 3 PoE source, 13W max<br>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<br>(5) Five non-isolated GPIO: GPIO4,5,6*,7*,8*<br>*Unavailable when External Light Mode is enabled |
| Interface Ports | (1) M12 X-Coded 1000/100/10 Mbps Ethernet<br>(1) M12 12-pin Power/GPIO<br>(1) M12 5-pin External Light Power & Control/GPIO<br>(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 10** Specifications (Continued)

| Specification | Description |
|---|---|
| Image Sensor | Monochrome: 2.3 MP (1920 x 1200 pixels), 3.0µm pixel size CMOS Sensor<br>Monochrome 5.1 MP (2592 x 1944 pixels), 2.2µm pixel size CMOS Sensor |
| Acquisition Rate | 2.3MP: 60 fps<br>5MP: 42 fps |
| Aimer | Red Class II Laser; 8-point sunburst pattern |
| Illumination | Field replaceable modules:<br>(8) 660 nm Red LEDs<br>(8) 850 nm IR LEDs<br>(8) 2700K (Color Temperature) White LEDs<br>(4) 660 nm Red LEDs + (8) 850 nm IR LEDs + (8) 2700K (Color Temperature) White LEDs |
| Imager Field of View | 2MP SR (Standard Range): 10.3 mm Liquid Lens (29° H x 19° V Nominal)<br>2MP WA (Wide Angle): 6.7 mm Liquid Lens (41° H x 28° V Nominal)<br>5MP SR (Standard Range): 10.3 mm Liquid Lens (29° H x 22° V Nominal)<br>5MP WA (Wide Angle): 6.7 mm Liquid Lens (40° H x 32° V Nominal) |
| **User Environment** | |
| Operating Temperature | 32° F to 113° F/0° C to 45° C (10-30VDC external power supply, duty cycle-dependent)<br>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, Fluorescent 450 ft candles, LED 450 ft candles |
| Electrostatic Discharge | ±15 kV Air, ±8 kV Contact, ±8 kV Indirect |
| **Regulatory** | |
| Environmental | EN 50581:2012<br>EN IEC 63000:2018 |
| Electrical Safety | IEC 62368-1 (Ed.2)<br>EN 62368-1:2014/A11:2017 |
| Laser Safety (xS42 Only) | 21CFR1040.10 & 21CFR1040.11<br>IEC/EN 60825-1:2014 (Ed.3) |

**Table 10** Specifications (Continued)

| Specification | Description |
|---|---|
| LED Safety | IEC 62471: 2006 (Ed.1)<br>EN 62471: 2008 |
| EMI/EMS | EN 55032:2015/A11: 2020<br>EN 55032:2015/A1: 2020<br>EN 55035:2017/A11: 2020<br>EN IEC 61000-3-2: 2019/A1:2021<br>EN 61000-3-3: 2013/A2:2021/AC:2022-01<br>EN 61000-6-2: 2005,2019<br>FCC 47 CFR Part 15, Subpart B<br>ICES-003, Issue 7 |
| EU Declaration of Conformity | 2014/30/EU; 2014/35/EU; 2011/65/EU.<br>Refer to the Declaration of Conformity (DoC) for details of compliance with the current standards.<br>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 11** 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 11** 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 12** Internal Lighting Accessories

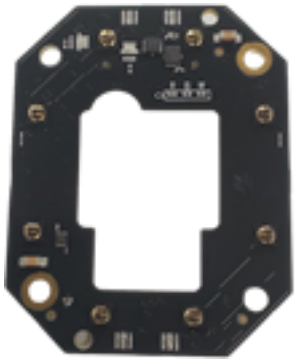
| Part Number | Description | |
|---|---|---|
| ZLED-XS40WH-0000 | Internal Ring Light, White LED<br>Not for use when IR image capture is required. |  |
| ZLED-XS40RD-0000 | Internal Ring Light, Red LED<br>Red lighting is typically used to capture images on paper. |  |
| ZLED-XS40IR-0000 | Internal Ring Light, IR<br>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<br>Multi-Color - White, Red, IR, Blue, and Green LEDs.<br>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 12** Internal Lighting Accessories (Continued)

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

## Internal Filters

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

**Table 13** 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 | | |

| Spectral Transmission | Blue | Red | IR | RGB (IR Block) | Clear |
|---|---|---|---|---|---|
| 10% Maximum | 550 nm | 725 nm | 950 nm | 725 nm | 950 nm |
| 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 for use with the FS42 and the Zebra Integrated Multifunction Light (ZIML).

**Table 14** 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, 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, 2M length. Only compatible with devices that include an external light port. |
| **Power Cables** | |
| CBL-PWR00500-M1220 | Power and I/O Y Cable, 5M, 12 Pin and 8 Pin M12 to Flying Leads, Standard Flex<br>**NOTE:** For use when integrating the FS42 with the ZIML. |
| 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 15** 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 16** Power Supplies

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

**Table 16** 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 19** L Bracket Dimensions

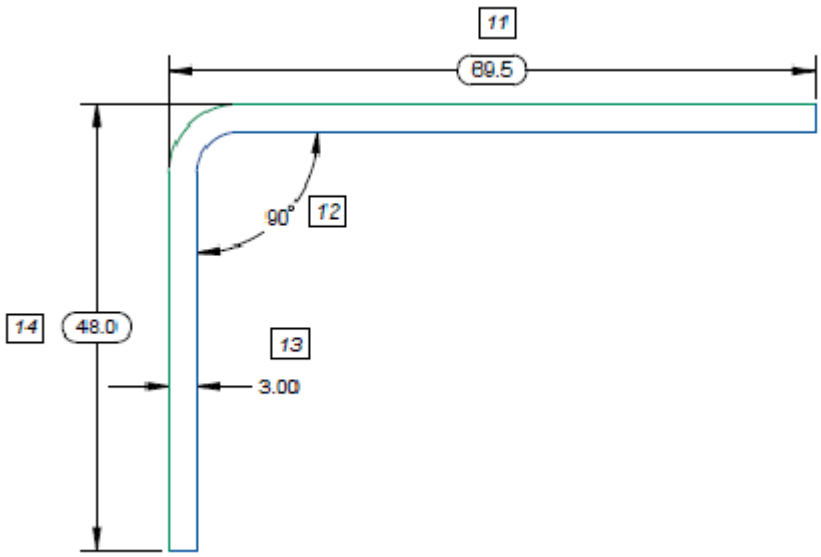


**Figure 20** L Bracket Bottom Dimensions

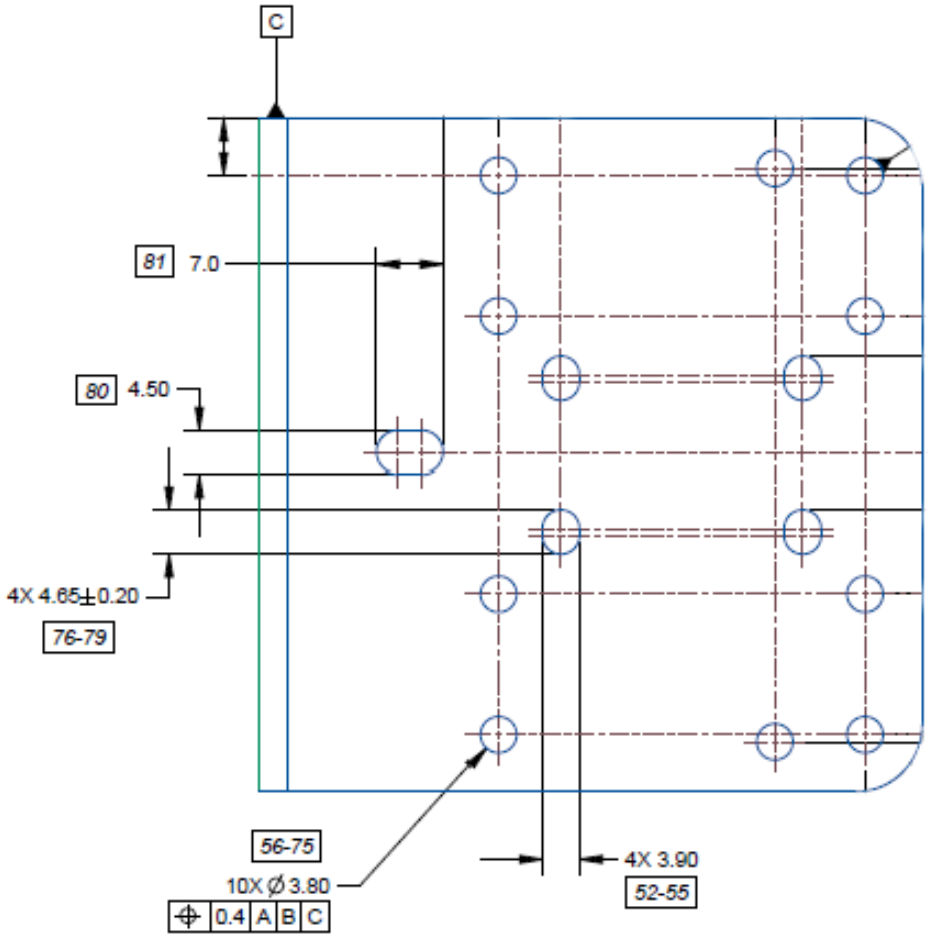
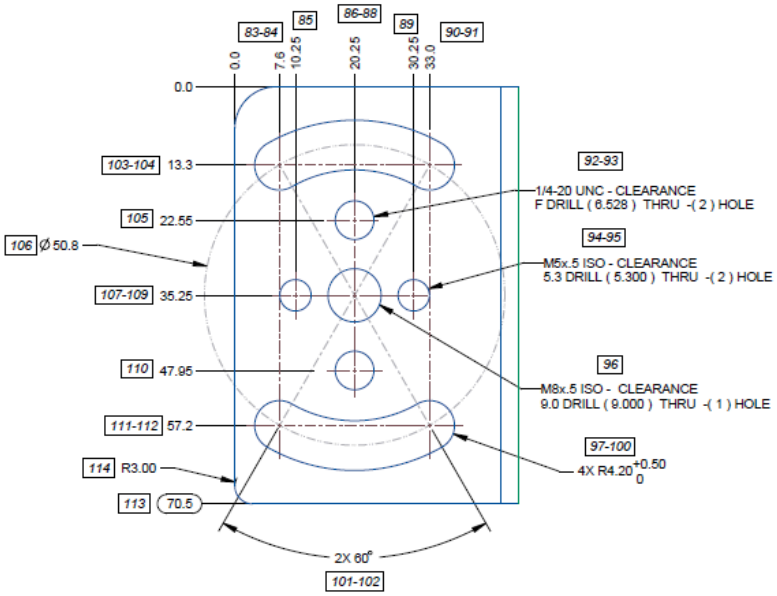


**Figure 21** L Bracket Side Dimensions



## Light Bracket Dimensions

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

**Figure 22** Light Bracket Dimensions

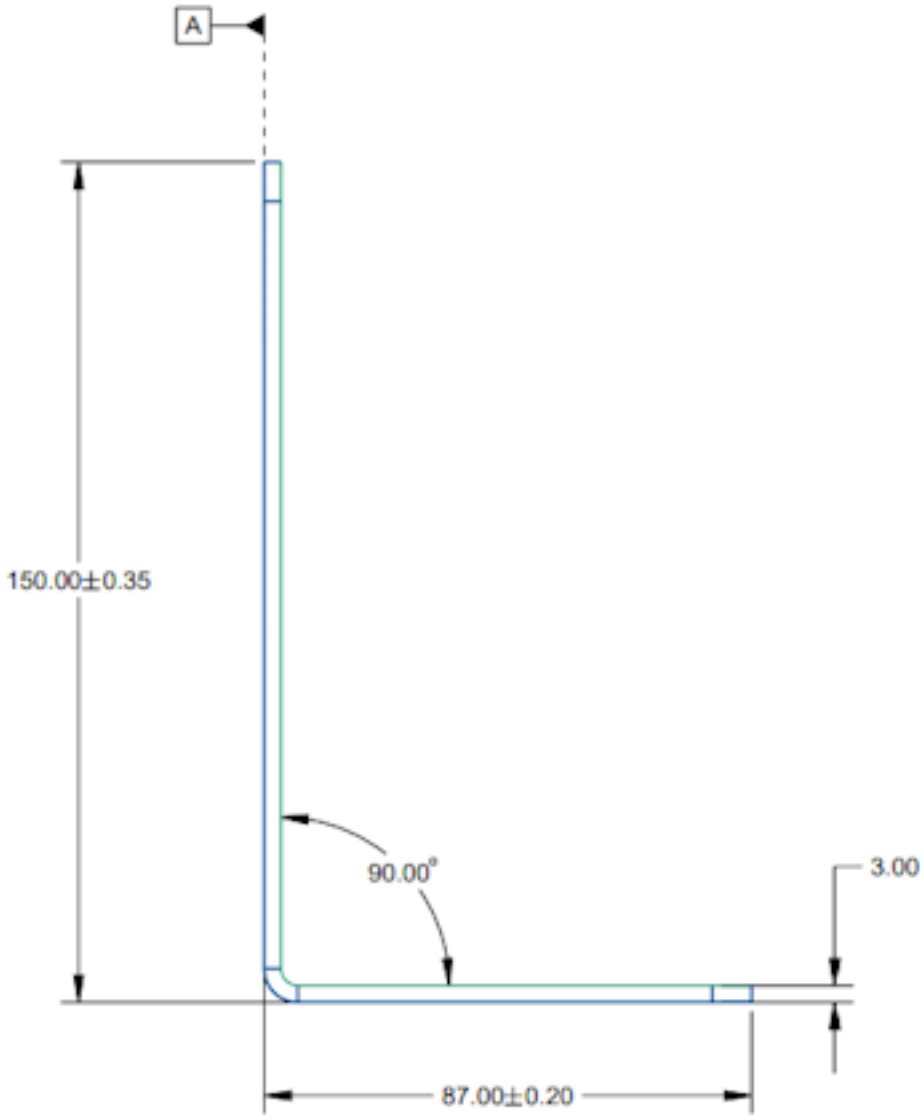


**Figure 23** Light Bracket Dimensions

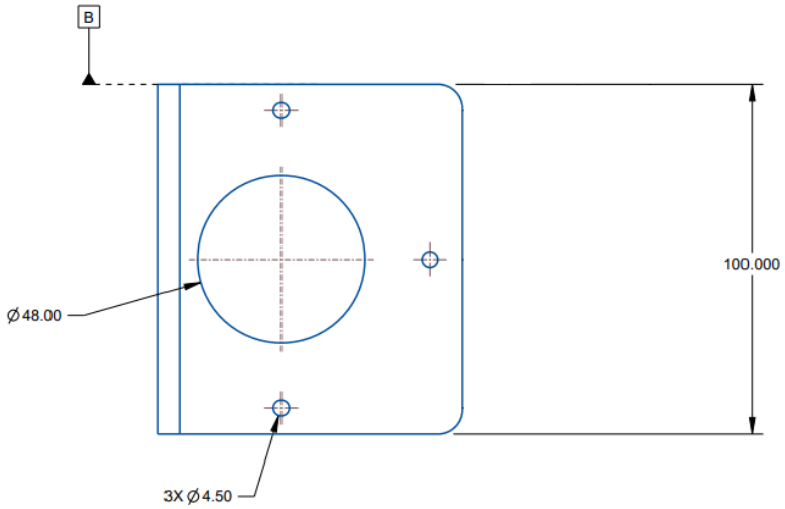
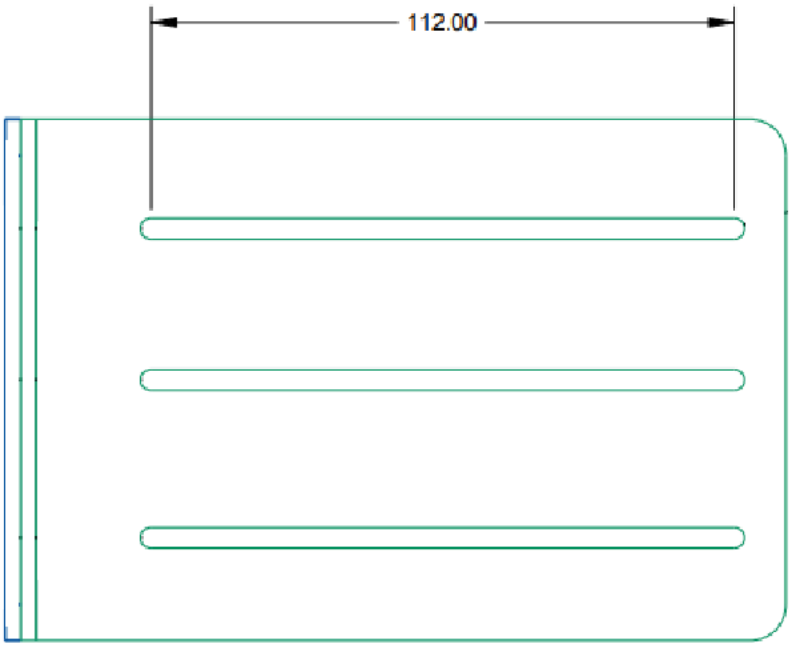



**Figure 24** Light Bracket Dimensions




## 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

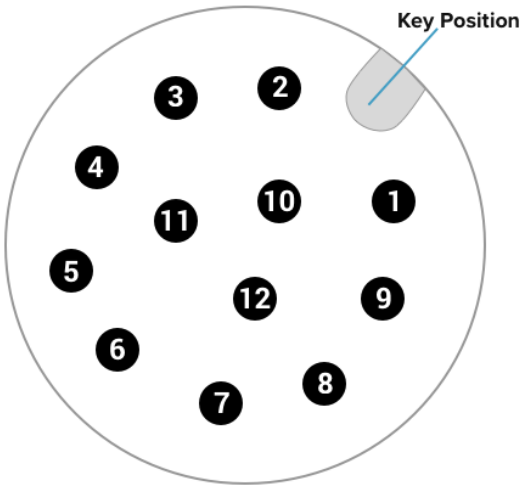



**Table 17** Power and I/O Connector Pinout Diagram

| 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

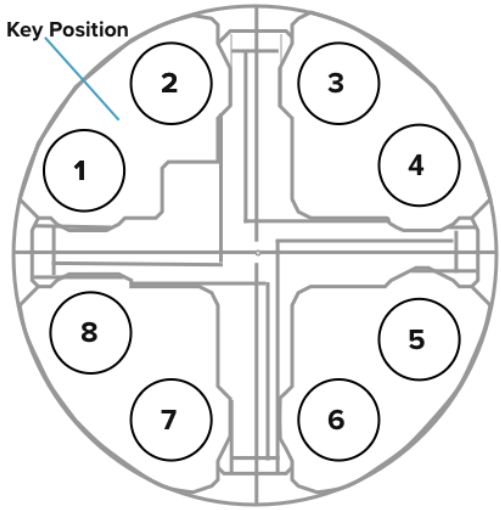



**Table 18** Ethernet Connector Pinout Diagram

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

## External Light Connector

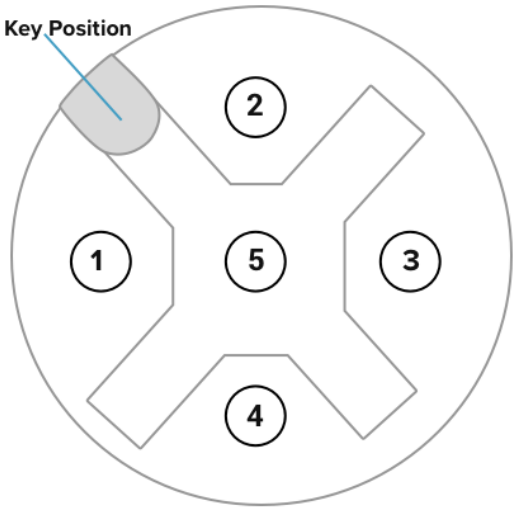



**Table 19** External Light Connector Pinout Diagram

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