

**COGNEX**

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# In-Sight<sup>®</sup> 5000 Series Vision System

Installation Manual

**IN-SIGHT**  
Vision Systems



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# Regulations/Conformity

**Note:** For the most up-to-date regulations and conformity information, please refer to the In-Sight online support site: <http://www.cognex.com/Support/InSight>.

Declaration of Conformity	
Manufacturer	Cognex Corporation One Vision Drive Natick, MA 01760 USA
Declares this  -marked Machine Vision System Product	
Product Type	In-Sight 5100/5110/5400/5410: Type 821-0034-1R In-Sight 5100C/5400C: Type 821-0036-1R In-Sight 5401/5411: Type 821-0035-1R In-Sight 5403/5413: Type 821-0037-1R
Complies With	2004/108/EC Electromagnetic Compatibility Directive
Compliance Standards	EN 55022:2006 +A1:2007 Class A EN 61000-6-2:2005
European Representative	COGNEX INTERNATIONAL Immeuble "Le Patio" 104 Avenue Albert 1er 92563 Rueil Malmaison Cedex - France
Safety and Regulatory	
FCC	FCC Part 15, Class A This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
KCC 	In-Sight 5100/5110/5400/5410: CGX-IS5400-01(A) In-Sight 5100C/5400C: CGX-IS5400-C01(A) In-Sight 5401/5411: CGX-IS5401-01(A) In-Sight 5403/5413: CGX-IS5403-01(A)
NRTL	TÜV SÜD AM SCC/NRTL OSHA Scheme for UL/CAN 60950-1.
CB	TÜV SÜD AM, IEC/EN 60950-1. CB report available upon request.
RoHS	RoHS 6 Compliant.

<b>Declaration of Conformity</b>	
Manufacturer	Cognex Corporation One Vision Drive Natick, MA 01760 USA
Declares this  -marked Machine	Vision System Product
Product Type	In-Sight 5400S/5410S: Type 821-0038-1R In-Sight 5400CS: Type 821-0039-1R In-Sight 5403S: Type 821-0040-1R
Complies With	2004/108/EC Electromagnetic Compatibility Directive
Compliance Standards	EN 55022:2006 +A1:2007 Class A EN 61000-6-2:2005
European Representative	COGNEX INTERNATIONAL Immeuble "Le Patio" 104 Avenue Albert 1er 92563 Rueil Malmaison Cedex - France
<b>Safety and Regulatory</b>	
FCC	FCC Part 15, Class A This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
NRTL	TÜV SÜD AM SCC/NRTL OSHA Scheme for UL/CAN 60950-1.
CB	TÜV SÜD AM, IEC/EN 60950-1. CB report available upon request.
RoHS	RoHS 6 Compliant.

<b>Declaration of Conformity</b>	
Manufacturer	Cognex Corporation One Vision Drive Natick, MA 01760 USA
Declares this  -marked Machine	Vision System Product
Product Type	In-Sight 5600/5610: Type 821-0041-1R In-Sight 5603/5613: Type 821-0042-1R In-Sight 5604/5614: Type 821-0051-1R In-Sight 5605/5615: Type 821-0032-1R; Type 821-0032-2R
Complies With	2004/108/EC Electromagnetic Compatibility Directive
Compliance Standards	EN 55022:2006 +A1:2007 Class A EN 61000-3-2:2006 EN 61000-3-3:1995 +A1:2001 +A2:2005 EN 61000-6-2:2005
European Representative	COGNEX INTERNATIONAL Immeuble "Le Patio" 104 Avenue Albert 1er 92563 Rueil Malmaison Cedex - France
<b>Safety and Regulatory</b>	
FCC	FCC Part 15, Class A This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
KCC 	In-Sight 5600/5610: KCC-REM-CGX-IS5600-01 In-Sight 5603/5613: KCC-REM-CGX-IS5603-01 In-Sight 5604/5614: KCC-REM-CGX-IS5604-01 In-Sight 5605/5615: CGX-IS5605-01(A)
NRTL	TÜV SÜD AM SCC/NRTL OSHA Scheme for UL/CAN 60950-1.
CB	TÜV SÜD AM, IEC/EN 60950-1. CB report available upon request.
RoHS	RoHS 6 Compliant.



# Precautions

Observe these precautions when installing In-Sight 5000 series vision systems to reduce the risk of injury or equipment damage:

- In-Sight 5000 series vision systems are intended to be supplied by a UL or NRTL listed power supply with a 24VDC output rated for at least 600 mA continuous and a maximum short circuit current rating of less than 8A and a maximum power rating of less than 100VA and marked Class 2 or Limited Power Source (LPS). Any other voltage creates a risk of fire or shock and can damage the In-Sight components.
- Do not install In-Sight vision systems where they are directly exposed to environmental hazards such as excessive heat, dust, moisture, humidity, impact, vibration, corrosive substances, flammable substances, or static electricity.
- To reduce the risk of damage or malfunction due to over-voltage, line noise, electrostatic discharge (ESD), power surges, or other irregularities in the power supply, route all cables and wires away from high-voltage power sources.
- The housing of the vision system is internally connected to the system ground wire (pin 8 of the Breakout cable). Therefore, if the mounting surface of the vision system is at a non-zero ground potential, it is strongly recommended that the vision system be mounted on an isolated or non-conductive mount.
- Do not expose the CCD to laser light; CCDs can be damaged by direct, or reflected, laser light. If your application requires the use of laser light that may strike the CCD, a lens filter at the corresponding laser's wavelength is recommended. Contact your local integrator or application engineer for suggestions.
- The In-Sight vision system does not contain user-serviceable parts. Do not make electrical or mechanical modifications to In-Sight vision system components. Unauthorized modifications may void your warranty.
- Changes or modifications not expressly approved by the party responsible for regulatory compliance could void the user's authority to operate the equipment.
- Service loops should be included with all cable connections.
- Cable shielding can be degraded or cables can be damaged or wear out more quickly if a bend radius or service loop is tighter than 10X the cable diameter.
- This device is for business purposes and is qualified and registered for electromagnetic compatibility. The seller or purchaser should be notified if you incorrectly purchased these products; please exchange them for home use.
- This device should be used in accordance with the instructions in this manual.



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# Introduction

This manual describes how to install the In-Sight® 5000 series vision system.

The In-Sight vision system is a compact, network-ready, stand-alone machine vision system used for automated inspection, measurement, identification and robot guidance applications on the factory floor. All models can be easily configured remotely over a network using an intuitive user interface.

## Support

Many information resources are available to assist you in using the vision system:

- *In-Sight® Explorer Help*, an online HTML Help file provided on the In-Sight CD-ROM.
- In-Sight computer-based tutorials provided on CD-ROM with selected In-Sight starter accessories kits.
- The In-Sight online support site: <http://www.cognex.com/Support/InSight>.

## Standard Components

In-Sight 5000 series vision systems are shipped with the components listed in Table 1-1; component descriptions are given in Table 1-2.

**Note:** Cables are sold separately.

**Table 1-1: Standard Components**

Component	In-Sight 5100/5110 In-Sight 5100C In-Sight 5400C In-Sight 5400/5410	In-Sight 5401/5411 In-Sight 5403/5413 In-Sight 5600/5610 In-Sight 5603/ 5613	In-Sight 5400S/5410S In-Sight 5400CS In-Sight 5403S	In-Sight 5604/5614 In-Sight 5605/5615
50mm Lens Cover Kit (P/N 800-5842-xR)	X	X		
80mm Lens Cover Kit (P/N 823-0133-xR)				X
IP68 Lens Cover Kit (P/N 800-5892-xR)			X	
Thread Guard (P/N 370-0361)	X	X	X	X
Lens Cleaning Kit (P/N 195-0519R)	X	X	X	X
Mounting Screw Kit (P/N 800-5843-xR)	X	X	X	X

**Table 1-2: Standard Components Descriptions**

Component	Description
Vision System	Provides image acquisition, vision processing, job storage, serial and Ethernet connectivity and discrete I/O.
Lens Cover Kit (includes lens cover and O-Ring)	Provides environmental protection for the lens.
Thread Guard	Protects the In-Sight vision system lens cover threads when the lens cover is not used. Remove the thread guard prior to installing the lens cover.
Lens Cleaning Kit	Includes a lens cleaning cloth and instructions on cleaning the lens.
Mounting Screw Kit	Includes M4 screws for mounting the vision system (quantity 4).

## Optional Components

The following optional components can be purchased separately. For a complete list of options and accessories, contact your local Cognex sales representative.

## I/O Modules

Table 1-3 specifies the I/O modules that are compatible with your vision system, along with the number of discrete inputs/outputs available for each I/O module.

**Table 1-3: I/O Module Compatibility**

I/O Module	Vision System	Discrete Inputs	Discrete Outputs
CIO-1400	All In-Sight 5000 series vision systems (except In-Sight 5604)	7 general	2 high-speed, 6 general
CIO-1450	All In-Sight 5000 series vision systems (except In-Sight 5604)	8 general	2 high-speed, 8 general
CIO-MICRO	In-Sight 5600 series vision systems	8 general	2 high-speed, 8 general
CIO-MICRO-CC <sup>12</sup>	In-Sight 5600 series vision systems	8 general	2 high-speed, 8 general

<sup>1</sup> The CIO-MICRO and CIO-MICRO-CC I/O modules do not support 1000 BaseT pass-through operation. If 1000 BaseT operation is required when using the In-Sight 5600 series vision system, you must connect a LAN cable from a Gigabit Ethernet switch to the I/O module's LAN port and connect the vision system's Ethernet cable to the Gigabit Ethernet switch.

<sup>2</sup> The CIO-MICRO-CC I/O module also adds CC-link networking capability. For more information, refer to the *In-Sight® CIO-MICRO and CIO-MICRO-CC I/O Modules Installation Manual*.

# Installation

This section describes the connection of the vision system to its standard and optional components. For a complete list of options and accessories, contact your Cognex sales representative.

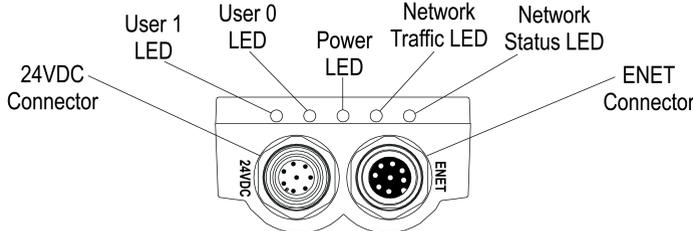
**Note:**

- Cables are sold separately.
- If any of the standard components appear to be missing or damaged, immediately contact your Cognex Authorized Service Provider (ASP) or Cognex Technical Support.

**CAUTION:** All cable connectors are “keyed” to fit the connectors on the vision system; do not force the connections or damage may occur.

## Connectors and Indicators

Table 2-1: Vision System Connectors and Indicators



Connector/Indicator	Function
24VDC Connector	Connects the Breakout cable, which provides connections to an external power supply, the acquisition trigger input, high-speed outputs and RS-232 serial communications. Refer to <i>Breakout Cable Specifications</i> on page 20. Alternately, this connector is used to attach the I/O Module cable to an optional In-Sight I/O module, which adds general-purpose discrete I/O and light control functionality. Refer to <i>I/O Module Cable Specifications</i> on page 21.
User 1 LED	Green when active. User configurable using Discrete Output Line 4 (Line 10 for all I/O modules, except the CIO-1400, which uses Line 9).
User 0 LED	Red when active. User configurable using Discrete Output Line 5 (Line 11 for all I/O modules, except the CIO-1400, which uses Line 10).
Power LED	Green when power is applied.
Network Traffic LED	Flashes green while transmitting and receiving data.
Network Status LED	Green when a network connection is detected.
ENET Connector	Connects the vision system to a network. The ENET connector provides the Ethernet connection to external network devices. Refer to <i>Ethernet Cable Specifications</i> on page 19.

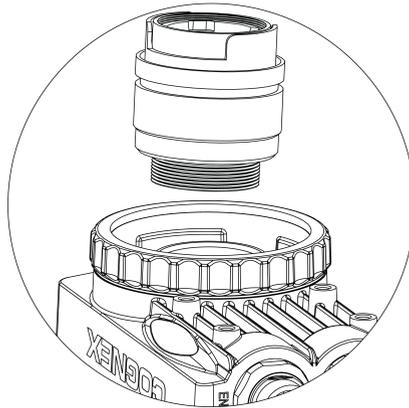
**Note:**

- For the In-Sight 5100 and 5400 series, when the vision system is powered up, User 0 LED and User 1 LED both momentarily turn on. Then, User 0 LED turns off and User 1 LED stays on. Next, User 0 LED turns on and User 1 LED turns off. Finally, both LEDs momentarily light up and then turn off.
- For the In-Sight 5600 series, when the vision system is powered up, User 0 LED and User 1 LED both momentarily turn on. Then, User 1 LED turns off and User 0 LED stays on. Next, User 1 LED turns on and User 0 LED turns off. Finally, both LEDs momentarily light up and then turn off.

## Install the Lens

The exact lens focal length needed depends on the working distance and the field of view required for your machine vision application.

1. Remove the protective lens cap and the protective film covering the CCD, if present.
2. Attach a C-Mount lens to the vision system.



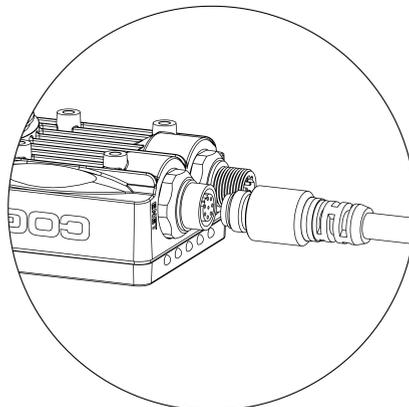
**Figure 2-1: Install the Lens**

## Connect the Ethernet and Power

The vision system has an ENET connector and 24VDC connector. The ENET connector provides the Ethernet connection for network communications. The 24VDC connector supplies connections for the 24VDC power source, I/O, acquisition trigger, and serial communications.

## Connect the Ethernet Cable

1. Attach the Ethernet cable's M12 connector to the vision system's M12 ENET connector.



**Figure 2-2: Connect the Ethernet cable**

2. Connect the Ethernet cable's RJ-45 connector to a switch/router or PC, as applicable.

## Connect the Breakout Cable

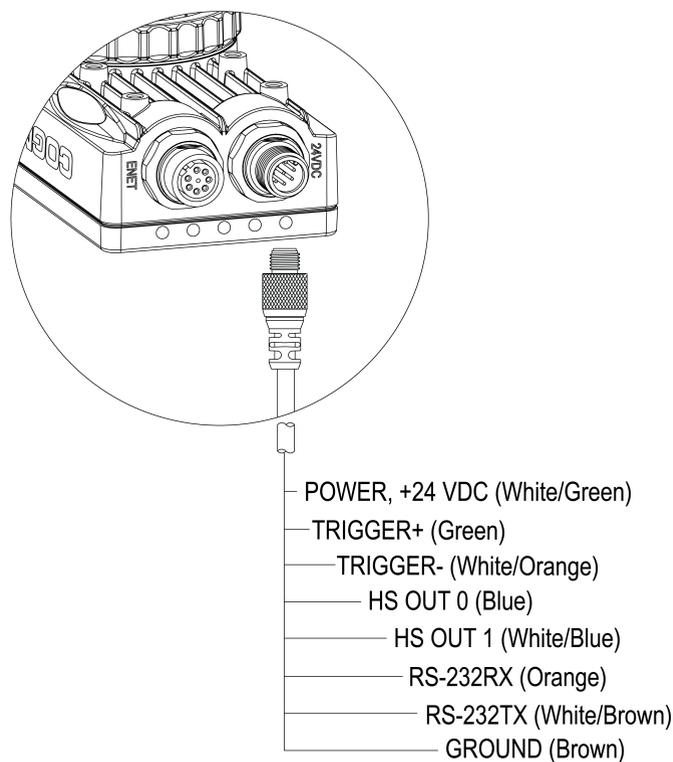
1. Verify that the 24VDC power supply being used is unplugged and not receiving power.
2. Connect the power supply to the Breakout cable. The pin-outs for the cable are listed in the *Breakout Cable Specifications* on page 20.

**Note:**

- When using an In-Sight 5604 line scan vision system, the RS-232RX wire is used as Encoder A and the RS-232TX wire is used as Encoder B. Refer to *Encoder Inputs (In-Sight 5604 only)* on page 16.
- Unused bare wires can be clipped short or tied back using a tie made of non-conductive material. Keep all bare wires separated from the +24VDC wire.

**CAUTION:** Never connect voltages other than 24VDC. Always observe the polarity shown.

3. Attach the Breakout cable to the 24VDC connector on the vision system.



**Figure 2-3: Power Connections**

4. Restore power to the 24VDC power supply and turn it on if necessary.



# Specifications

The following sections list general specifications for the In-Sight 5000 series vision systems.

## 5100, 5100C, 5401, 5400C, 5403 and 5400 Vision System Specifications

Table 3-1: 5100, 5100C, 5401, 5400C, 5403 and 5400 Vision System Specifications

Specification	5100/5110	5100C	5401/5411	5400C	5403/5413	5400/5410
Minimum Firmware Requirement	In-Sight version 4.4.3					
Job/Program Memory	128MB non-volatile flash memory; unlimited storage via remote network device.					
Image Processing Memory	256MB					
Sensor Type	1/3-inch CCD				1/1.8-inch CCD	1/3-inch CCD
Sensor Properties	5.92mm diagonal, 7.4 x 7.4µm sq. pixels		5.952mm diagonal, 4.65 x 4.65µm sq. pixels	5.92mm diagonal, 7.4 x 7.4µm sq. pixels	8.8mm diagonal, 4.4 x 4.4µm sq. pixels	5.92mm diagonal, 7.4 x 7.4µm sq. pixels
Resolution (pixels)	640 x 480		1024 x 768	640 x 480	1600 x 1200	640 x 480
Electronic Shutter Speed	16µs to 1000ms		32µs to 1000ms	16µs to 1000ms	27µs to 1000ms	16µs to 1000ms
Acquisition	Rapid reset, progressive scan, full-frame integration.					
Bit Depth	256 grey levels (8 bits/pixel)	24 bit color	256 grey levels (8 bits/pixel)	24 bit color	256 grey levels (8 bits/pixel)	
Image Gain/Offset	Controlled by software.					
Frames Per Second	60 full frames per second. <sup>1</sup>		17 full frames per second. <sup>2</sup>	60 full frames per second. <sup>3</sup>	14 full frames per second. <sup>4</sup>	60 full frames per second. <sup>5</sup>
Lens Type	C-mount					
CCD Alignment Variability <sup>6</sup>	±0.127mm (0.005in), (both x and y) from lens C-mount axis to center of imager.					
Trigger	1 opto-isolated, acquisition trigger input. Remote software commands via Ethernet and RS-232C.					
Discrete Inputs	None built-in. Additional inputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited inputs when using an Ethernet I/O system.					
Discrete Outputs	2 built-in, high-speed outputs. Additional outputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited outputs when using an Ethernet I/O system.					
Status LEDs	Power, Network Status, Network Traffic, 2 user configurable.					

<sup>1</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>2</sup> Maximum frames per second is job dependent and based on an 8ms exposure and a full image frame capture.

<sup>3</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>4</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>5</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>6</sup> Expected variability in the physical position of the CCD, from vision system-to-vision system. This equates to ~ ±17 pixels on a 640 x 480 resolution CCD, ~ ±27 pixels on a 1024 x 768 resolution vision system

Specification	5100/5110	5100C	5401/5411	5400C	5403/5413	5400/5410
Network Communication	1 Ethernet port, 10/100 BaseT, TCP/IP protocol. Supports DHCP (factory default), static and link-local IP address configuration.					
1588 Support <sup>1</sup>	Timestamp Resolution: 8ns Synchronization Accuracy Through Transparent Clock: 5µs					
Serial Communication	RS-232C when connected to a compatible I/O module (see Table 1-3 on page 2).					
Power Consumption	24VDC ±10%, 500mA maximum.					
Material	Die-cast aluminum housing.					
Finish	Painted.					
Mounting	Eight M4 threaded mounting holes (four front and four back).					
Dimensions	83.4mm (3.28in) x 124.2mm (4.89in) x 61.4mm (2.42in) with lens cover installed. 43.5mm (1.71in) x 124.2mm (4.89in) x 61.4mm (2.42in) without lens cover installed (includes Thread Guard).					
Weight	350 g (12.3 oz.) Lens cover installed, without lens.					
Operating Temperature	0°C to 45°C (32°F to 113°F)					
Storage Temperature	-30°C to 80°C (22°F to 176°F)					
Humidity	95%, non-condensing (Operating and Storage)					
Protection	IP67 (with appropriate lens cover properly installed).					
Shock	80 G Shock with 150 gram lens attached per IEC 68-2-27.					
Vibration	10 G from 10-500 Hz with 150 gram lens per IEC 68-2-6.					
Regulatory Compliance	CE, FCC, KCC, TÜV SÜD NRTL, RoHS					

<sup>1</sup> 1588 is only supported on vision systems running firmware version 4.5.0 and higher.

## 5400CS, 5403S and 5400S Vision System Specifications

Table 3-2: 5400CS, 5403S, 5400S Vision System Specifications

Specification	5400CS	5403S	5400S
Minimum Firmware Requirement	In-Sight version 4.4.3		
Job/Program Memory	128MB non-volatile flash memory; unlimited storage via remote network device.		
Image Processing Memory	256MB		
Sensor Type	1/3-inch CCD	1/1.8-inch CCD	1/3-inch CCD
Sensor Properties	5.92mm diagonal, 7.4 x 7.4 $\mu$ m sq. pixels	8.80mm diagonal, 4.4 x 4.4 $\mu$ m sq. pixels	5.92mm diagonal, 7.4 x 7.4 $\mu$ m sq. pixels
Resolution (pixels)	640 x 480	1600 x 1200	640 x 480
Electronic Shutter Speed	16 $\mu$ s to 1000ms	27 $\mu$ s to 1000ms	16 $\mu$ s to 1000ms
Acquisition	Rapid reset, progressive scan, full-frame integration.		
Bit Depth	24 bit color	256 grey levels (8 bits/pixel)	
Image Gain/Offset	Controlled by software.		
Frames Per Second <sup>1</sup>	60 full frames per second.	14 full frames per second.	60 full frames per second.
Lens Type	C-mount		
CCD Alignment Variability <sup>2</sup>	$\pm$ 0.127mm (0.005in), (both x and y) from lens C-mount axis to center of imager.		
Trigger	1 opto-isolated, acquisition trigger input. Remote software commands via Ethernet and RS-232C.		
Discrete Inputs	None built-in. Additional inputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited inputs when using an Ethernet I/O system.		
Discrete Outputs	2 built-in, high-speed outputs. Additional outputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited outputs when using an Ethernet I/O system.		
Status LEDs	Power, Network Status, Network Traffic, 2 user configurable.		
Network Communication	1 Ethernet port, 10/100 BaseT, TCP/IP protocol. Supports DHCP (factory default), static and link-local IP address configuration.		
1588 Support	Timestamp Resolution: 8ns Synchronization Accuracy Through Transparent Clock: 5 $\mu$ s		
Serial Communication	RS-232C when connected to a compatible I/O module (see Table 1-3 on page 2).		
Power Consumption	24VDC $\pm$ 10%, 500mA maximum.		
Material	ASTM 316L Stainless Steel.		
Finish	Electropolish Passivated.		
Mounting	Four M4 threaded mounting holes on back of vision system.		

<sup>1</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>2</sup> Expected variability in the physical position of the CCD, from vision system-to-vision system. This equates to  $\sim$   $\pm$ 17 pixels on a 640 x 480 resolution CCD and  $\sim$   $\pm$ 29 pixels on a 1600 x 1200 resolution CCD.

Specification	5400CS	5403S	5400S
Dimensions	90.6mm (3.57in) x 124.0mm (4.88in) x 61.4mm (2.42in) with lens cover installed. 43.5mm (1.71in) x 124.0mm (4.88in) x 61.4mm (2.42in) without lens cover installed.		
Weight	907 g (32.0 oz.) Lens cover installed, without lens.		
Operating Temperature	0°C to 45°C (32°F to 113°F)		
Storage Temperature	-30°C to 80°C (22°F to 176°F)		
Humidity	95%, non-condensing (Operating and Storage)		
Protection	IP68 (with appropriate lens cover properly installed).		
Shock	80 G Shock with 150 gram lens attached per IEC 68-2-27.		
Vibration	10 G from 10-500 Hz with 150 gram lens per IEC 68-2-6.		
Regulatory Compliance	CE, FCC, TÜV SÜD NRTL, RoHS		

## 5603, 5600 and 5605 Vision System Specifications

Table 3-3: 5603, 5600 and 5605 Vision System Specifications

Specification	5603/5613	5600/5610	5605/5615
Minimum Firmware Requirement	In-Sight version 4.4.3		In-Sight version 4.4.1
Job/Program Memory	128MB non-volatile flash memory; unlimited storage via remote network device.		
Image Processing Memory	256MB		
Sensor Type	1/1.8-inch CCD	1/3-inch CCD	2/3-inch CCD
Sensor Properties	8.8mm diagonal, 4.4 x 4.4 $\mu$ m sq. pixels	5.92mm diagonal, 7.4 x 7.4 $\mu$ m sq. pixels	11.01mm diagonal, 3.45 x 3.45 $\mu$ m sq. pixels
Resolution (pixels)	1600 x 1200	640 x 480	2448 x 2048
Electronic Shutter Speed	27 $\mu$ s to 1000ms	16 $\mu$ s to 1000ms	28.8 $\mu$ s to 1000ms
Acquisition	Rapid reset, progressive scan, full-frame integration.		
Bit Depth	256 grey levels (8 bits/pixel)		
Image Gain/Offset	Controlled by software.		
Frames Per Second <sup>1</sup>	14 full frames per second.	60 full frames per second.	16 full frames per second.
Lens Type	C-mount		
CCD Alignment Variability <sup>2</sup>	$\pm$ 0.127mm (0.005in), (both x and y) from lens C-mount axis to center of imager.		
Trigger	1 opto-isolated, acquisition trigger input. Remote software commands via Ethernet and RS-232C.		
Discrete Inputs	None built-in. Additional inputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited inputs when using an Ethernet I/O system.		
Discrete Outputs	2 built-in, high-speed outputs. Additional outputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited outputs when using an Ethernet I/O system.		
Status LEDs	Power, Network Status, Network Traffic, 2 user configurable.		
Network Communication	1 Ethernet port, 10/100/1000 <sup>3</sup> BaseT with auto MDIX. IEEE 802.3 TCP/IP protocol. Supports DHCP (factory default), static and link-local IP address configuration.		
1588 Support <sup>4</sup>	Timestamp Resolution: 8ns Synchronization Accuracy Through Transparent Clock: 5 $\mu$ s		
Serial Communication	RS-232C when connected to a compatible I/O module (see Table 1-3 on page 2).		
Power Consumption	24VDC $\pm$ 10%, 600mA maximum.		

<sup>1</sup> Maximum frames per second is job-dependent and based on the minimum exposure for a full image frame capture.

<sup>2</sup> Expected variability in the physical position of the CCD, from vision system-to-vision system. This equates to  $\sim \pm 17$  pixels on a 640 x 480 resolution CCD,  $\sim \pm 29$  pixels on a 1600 x 1200 resolution CCD and  $\sim \pm 37$  pixels on a 2448 x 2048 resolution CCD.

<sup>3</sup> To ensure reliable communication using 1000 BaseT operation, the Ethernet cable must not exceed 75 meters (from the vision system to the endpoint).

<sup>4</sup> 1588 is only supported on vision systems running firmware version 4.5.0 and higher.

Specification	5603/5613	5600/5610	5605/5615
Material	Die-cast aluminum housing.		
Finish	Painted/Powder coat (back plate).		
Mounting	Eight M4 threaded mounting holes (four front and four back).		
Dimensions	99.9mm (3.93in) x 124.2mm (4.89in) x 61.4mm (2.42in) with lens cover installed. 60.1mm (2.37in) x 124.2m (4.89in) x 61.4mm (2.42in) without lens cover installed.		134.4mm (5.29in) x 124.1mm (4.88in) x 61.4mm (2.42in) with lens cover installed. 53.2mm (2.09in) x 124.1mm (4.88in) x 61.4mm (2.42in) without lens cover installed.
Weight	463 g (16.3 oz.) Lens cover installed, without lens.	409 g (14.4 oz.) Lens cover installed, without lens.	538 g (19.0 oz.) Lens cover installed, without lens.
Operating Temperature (non-circulating air)	0°C to 45°C (32°F to 113°F) <sup>1</sup>		
Operating Temperature (circulating air)	0°C to 50°C (32°F to 122°F) <sup>2</sup>	0°C to 50°C (32°F to 122°F) <sup>3</sup>	0°C to 50°C (32°F to 122°F) <sup>4</sup>
Storage Temperature	-30°C to 80°C (22°F to 176°F)		
Humidity	95%, non-condensing (Operating and Storage)		
Protection	IP67 (with appropriate lens cover properly installed).		
Shock	80 G Shock with 150 gram lens attached per IEC 68-2-27.		
Vibration	10 G from 10-500 Hz with 150 gram lens per IEC 68-2-6.		
Regulatory Compliance	CE, FCC, KCC, TÜV SÜD NRTL, RoHS		

<sup>1</sup> The vision system should be mounted with sufficient clearance on all sides to allow air circulation around and through the cooling posts on the black heat sink. If the vision system is not mounted with sufficient clearance, a fan is recommended.

<sup>2</sup> Additional cooling from a fan is recommended for operation above 40°C. For operation up to 50°C, there must be ≥16 CFM of air moving through the cooling posts on the black heat sink.

<sup>3</sup> Additional cooling from a fan is recommended for operation above 40°C. For operation up to 50°C, there must be ≥4 CFM of air moving through the cooling posts on the black heat sink.

<sup>4</sup> Additional cooling from a fan is recommended for operation above 40°C. For operation up to 50°C, there must be ≥16 CFM of air moving through the cooling posts on the black heat sink.

## 5604 Line Scan Vision System Specifications

Table 3-4: 5604 Line Scan Vision System Specifications

Specification	5604/5614
Minimum Firmware Requirement	In-Sight version 4.4.3
Job/Program Memory	128MB non-volatile flash memory; unlimited storage via remote network device.
Image Processing Memory	256MB
Sensor Type	1-inch CCD
Sensor Properties	14.3 mm x 14 $\mu$ m active area, 14 $\mu$ m x 14 $\mu$ m sq. pixels.
Resolution (pixels)	1024 x 1 (CCD); 1024 x 8192 (up to 8192 lines for full resolution image).
Acquisition	Line Scan integration.
Bit Depth	256 grey levels (8 bits/pixel).
Image Gain/Offset	Controlled by software.
Lines Per Second	44K lines per second. <sup>1</sup>
Lens Type	C-mount
CCD Alignment Variability <sup>2</sup>	$\pm$ 0.127mm (0.005in), (both x and y) from lens C-mount axis to center of imager.
Trigger	1 opto-isolated, acquisition trigger input. Remote software commands via Ethernet and RS-232C.
Discrete Inputs	None built-in. Additional inputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited inputs when using an Ethernet I/O system.
Discrete Outputs	2 built-in, high-speed outputs. Additional outputs available using a compatible I/O module (see Table 1-3 on page 2). Unlimited outputs when using an Ethernet I/O system.
Encoder Inputs	2 built-in, encoder inputs for use with a 24V signal.
Status LEDs	Power, Network Status, Network Traffic, 2 user configurable.
Network Communication	1 Ethernet port, 10/100/1000 <sup>3</sup> BaseT with auto MDIX. IEEE 802.3 TCP/IP protocol. Supports DHCP (factory default), static and link-local IP address configuration.
1588 Support <sup>4</sup>	Timestamp Resolution: 8ns Synchronization Accuracy Through Transparent Clock: 5 $\mu$ s
Serial Communication	RS-232C when connected to a compatible I/O module (see Table 1-3 on page 2).
Power Consumption	24VDC $\pm$ 10%, 600mA maximum.
Material	Die-cast aluminum housing.
Finish	Painted/Powder coat (back plate).

<sup>1</sup> Maximum lines per second are based on the minimum exposure.

<sup>2</sup> Expected variability in the physical position of the CCD, from vision system-to-vision system. This equates to  $\sim$   $\pm$ 8 pixels on a 1024 x 1 resolution CCD.

<sup>3</sup> To ensure reliable communication using 1000 BaseT operation, the Ethernet cable must not exceed 75 meters (from the vision system to the endpoint).

<sup>4</sup> 1588 is only supported on vision systems running firmware version 4.5.0 and higher.

Specification	5604/5614
Mounting	Eight M4 threaded mounting holes (four front and four back).
Dimensions	134.4mm (5.29in) x 124.1mm (4.88in) x 61.4mm (2.42in) with lens cover installed. 53.2mm (2.09in) x 124.1mm (4.88in) x 61.4mm (2.42in) without lens cover installed.
Weight	585 g (20.6 oz.) Lens cover installed, without lens.
Operating Temperature (non-circulating air)	0°C to 45°C (32°F to 113°F) <sup>1</sup>
Operating Temperature (circulating air)	0°C to 50°C (32°F to 122°F) <sup>2</sup>
Storage Temperature	-30°C to 80°C (22°F to 176°F)
Humidity	95%, non-condensing (Operating and Storage)
Protection	For environments where protection is required, use an optional protective enclosure.
Shock	80 G Shock with 150 gram lens attached per IEC 68-2-27.
Vibration	10 G from 10-500 Hz with 150 gram lens per IEC 68-2-6.
Regulatory Compliance	CE, FCC, KCC, TÜV SÜD NRTL, RoHS

<sup>1</sup> The vision system should be mounted with sufficient clearance on all sides to allow air circulation around and through the cooling posts on the black heat sink. If the vision system is not mounted with sufficient clearance, a fan is recommended.

<sup>2</sup> Additional cooling from a fan is recommended for operation above 40°C. For operation up to 50°C, there must be ≥16 CFM of air moving through the cooling posts on the black heat sink.

## I/O Specifications

Cable and connector specifications and connection examples for the acquisition trigger input, encoder inputs (In-Sight 5604 only) and the high-speed outputs are provided in the following sections.

### Acquisition Trigger Input

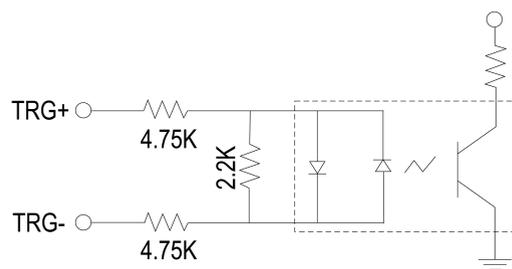
**Table 3-5: Acquisition Trigger Input**

Specification	Description	
Voltage	ON: 20 to 28V (24V nominal) OFF: 0 to 3V (8V nominal threshold)	
Current	ON: 2.0 to 2.9mA OFF: <250µA Resistance: ~10,000 Ohms	
Delay <sup>1</sup>	In-Sight 5100, 5110, 5100C, 5400C, 5400CS, 5400, 5410, 5400S, 5410S, 5600, 5610	62µs maximum latency between leading edge of trigger and start of acquisition. Input pulse should be a minimum of 1 ms wide.
	In-Sight 5403, 5413, 5403S, 5603, 5613	66µs maximum latency between leading edge of trigger and start of acquisition. Input pulse should be a minimum of 1 ms wide.
	In-Sight 5401, 5411	76µs maximum latency between leading edge of trigger and start of acquisition. Input pulse should be a minimum of 1 ms wide.
	In-Sight 5604, 5614	1 line (approximately equivalent to 23µs, based on a 1.4µs Exposure) is the maximum latency between leading edge of trigger and start of acquisition. Input pulse should be a minimum of 1 ms wide.
	In-Sight 5605, 5615	58µs maximum latency between leading edge of trigger and start of acquisition. Input pulse should be a minimum of 1 ms wide.

The acquisition trigger input is opto-isolated. To trigger from an NPN (pull-down) type photoelectric sensor or PLC output, connect pin 2 (TRG+) to +24V and connect pin 3 (TRG-) to the output of the photoelectric sensor. When the output turns ON, it pulls TRG- down to 0V, turning the opto-coupler ON.

To trigger from a PNP (pull-up) photoelectric sensor or PLC output, connect pin 2 (TRG+) to the output of the photoelectric sensor and connect pin 3 (TRG-) to 0V. When the output turns ON, it pulls TRG+ up to 24V, turning the opto-coupler ON.

**Note:** When using the vision system with the Breakout cable, the polarity of the input trigger (pins 2 and 3) is not critical. However, when using an optional I/O module, the polarity of the TRG+ and TRG- terminals should be observed.



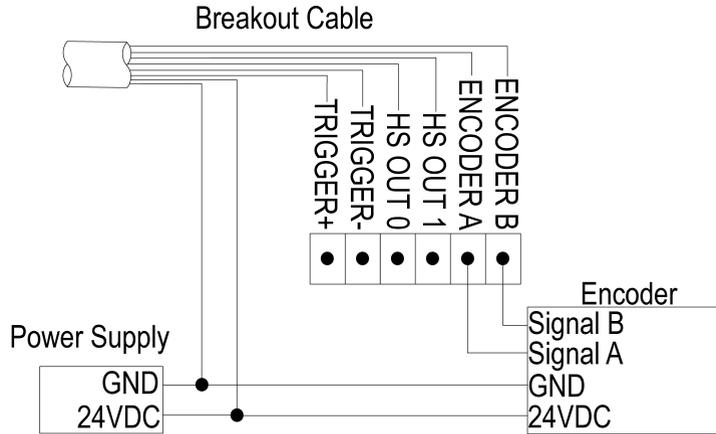
28V Max. Across input pins - Transition approx. 8V (Nom).

**Figure 3-1: Acquisition Trigger Input Schematic**

<sup>1</sup> Maximum latency is based on a 1µs trigger debounce.

## Encoder Inputs (In-Sight 5604 only)

The Breakout cable (see Table 3-9 on page 20) can be used for communication between the vision system and a single or quadrature encoder. For single encoders, Pin 6 must be used; for quadrature encoders, pins 6 or 7 can be used. The signal from the encoder must be 24V (other input specifications are listed in Table 3-6 on page 16).



**Figure 3-2: Connect the Encoder**

**Table 3-6: Encoder Input Specifications (In-Sight 5604 only)**

Specification	Description
Voltage	ON: 20 to 28V (24V nominal) OFF: 0 to 3V (9.6V nominal threshold)
Current	ON: 84 to 118µA OFF: <11µA Resistance: ~233,000 Ohms
Maximum Encoder Frequency	99.2KHz (assuming a 50/50 duty cycle)

## High-Speed Outputs

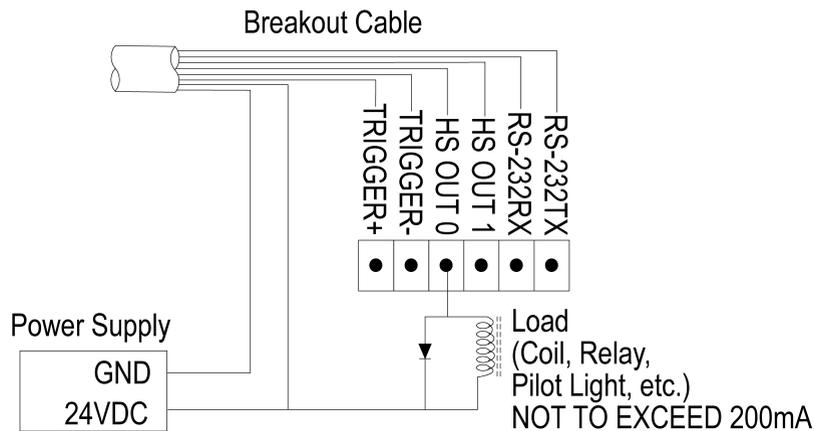
In-Sight 5000 series vision systems feature two built-in, high-speed outputs. Both of the high-speed outputs are NPN (pull-down) lines. The external load should be connected between the output and the positive supply voltage (<28V). The outputs pull down to <0.1V when ON (<1.25V for In-Sight 5604 only), which causes current to flow through the load. When the outputs are OFF, no current flows through the load.

**Table 3-7: High-Speed Output Specifications**

Specification	Description	
Voltage	28V maximum through external load.	
Current	All In-Sight 5000 series (except In-Sight 5600 series)	200mA maximum sink current.
		OFF state leakage current 200µA maximum.
		External load resistance 140 Ohms to 10K Ohms.
		Each line rated at a maximum 200mA, protected against over-current, short circuit and transients from switching inductive loads. High current inductive loads require external protection diode.
	In-Sight 5600 series	100mA maximum sink current.
		OFF state leakage current 200µA maximum.
		External load resistance 280 Ohms to 10K Ohms.
		Each line rated at a maximum 100mA, protected against over-current, short circuit and transients from switching inductive loads. High current inductive loads require external protection diode.

### Example 1

The Breakout cable (see Table 3-9 on page 20) can be used to connect the high-speed outputs to a relay, LED or similar load. Connect the negative side of the load to the output and the positive side to +24V. When the output switches on, the negative side of the load is pulled down to 0V, and 24V appears across the load. Use a protection diode for a large inductive load, with the anode connected to the output and the cathode connected to +24V.



**Figure 3-3: High-Speed Output Connection Example 1**

## Example 2

The Breakout cable (see Table 3-9 on page 20) can be used to connect to an NPN-compatible PLC input. Connect Output 0 or Output 1 directly to the PLC input. When enabled, the output pulls down the PLC input to 0V.

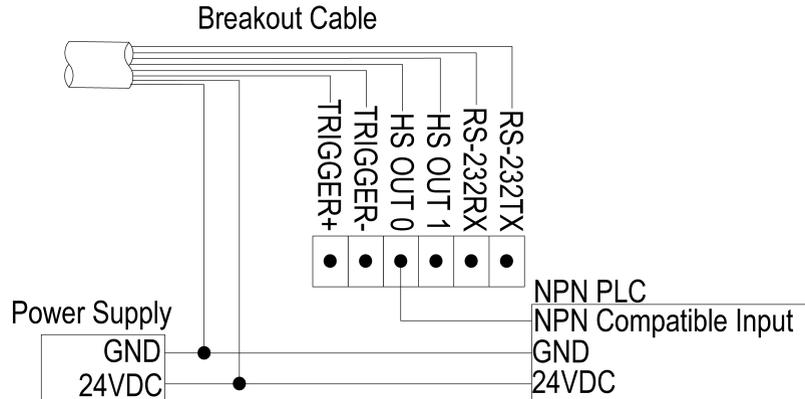


Figure 3-4: High-Speed Output Connection Example 2

## Example 3

The Breakout cable (see Table 3-9 on page 20) can be used to connect high-speed outputs with a PNP-compatible PLC input, if a pull-up resistor (for example, 2.2k 0.5W) is connected from the output to +24V. In this case, the resistor supplies 24V to the PLC input. The output will pull the voltage down to 0V, turning off the PLC input. This creates an inversion, with the PLC input ON when the vision system output is OFF, and vice-versa. Use an external NPN to PNP converter when this inversion is not desired.

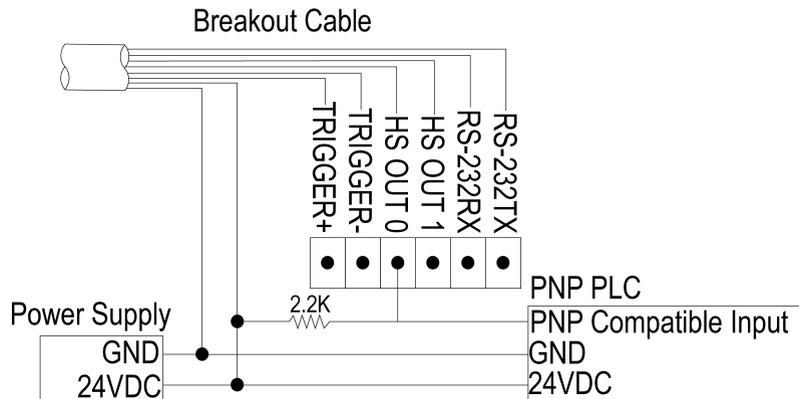
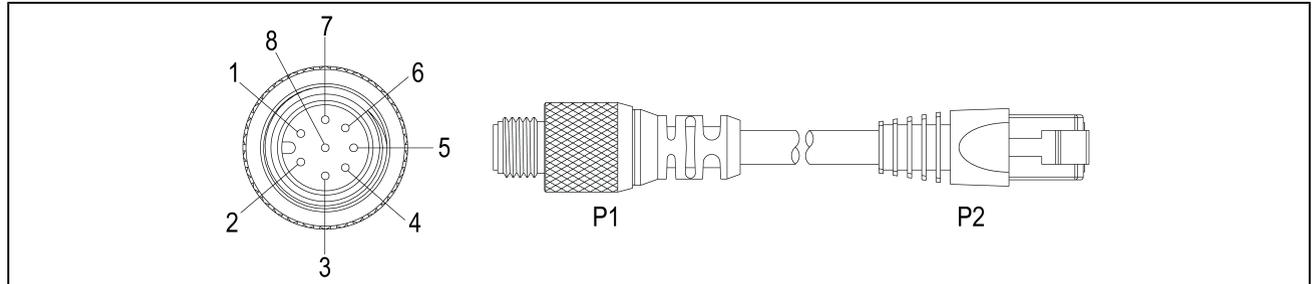


Figure 3-5: High-Speed Output Connection Example 3

## Ethernet Cable Specifications

The Ethernet cable is used to connect the vision system to other network devices. The Ethernet cable can be connected to a single device or provide connections to multiple devices via a network switch or router.

**Table 3-8: Ethernet Cable Pin-Out**



P1 Pin#	Signal Name	Wire Color	P2 Pin#
6	TPO+	White/Orange	1
4	TPO-	Orange	2
5	TPI+	White/Green	3
7	TRMA	Blue	4
1	TRMB	White/Blue	5
8	TPI-	Green	6
2	TRMC	White/Brown	7
3	TRMD	Brown	8

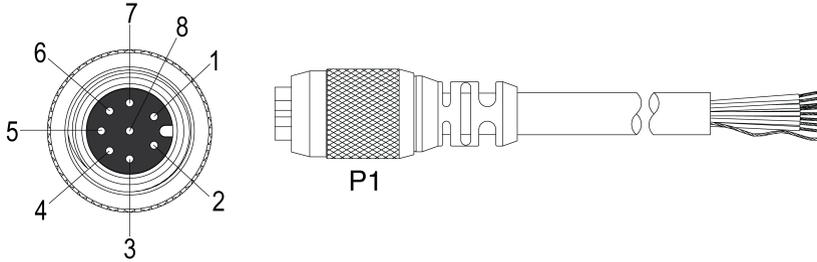
**Note:**

- Cables are sold separately.
- The wiring for this cable follows standard industrial Ethernet M12 specifications. This varies from the 568B standard.

## Breakout Cable Specifications

The 24VDC Breakout connector provides access to power, serial communications, trigger and high-speed outputs. The Breakout cable is not terminated. When using the In-Sight 5604, refer to *Encoder Inputs (In-Sight 5604 only)* on page 16.

**Table 3-9: Breakout Cable Pin-Out**



Pin#	Signal Name	Wire Color
1	POWER, +24 VDC	White/Green
2	TRIGGER+	Green
3	TRIGGER-	White/Orange
4	HS OUT 0	Blue
5	HS OUT 1	White/Blue
6	RS-232 RECEIVE (RxD) <sup>1</sup> (In-Sight 5604 Only: Encoder A)	Orange
7	RS-232 TRANSMIT (TxD) <sup>2</sup> (In-Sight 5604 Only: Encoder B)	White/Brown
8	GROUND	Brown

**Note:**

- Cables are sold separately.
- Unused bare wires can be clipped short or tied back using a tie made of non-conductive material. Keep all bare wires separated from the +24VDC wire.
- The housing of the vision system is internally connected to the system ground wire (pin 8 of the Breakout cable). Therefore, if the mounting surface of the vision system is at a non-zero ground potential, it is strongly recommended that the vision system be mounted on an isolated or non-conductive mount.

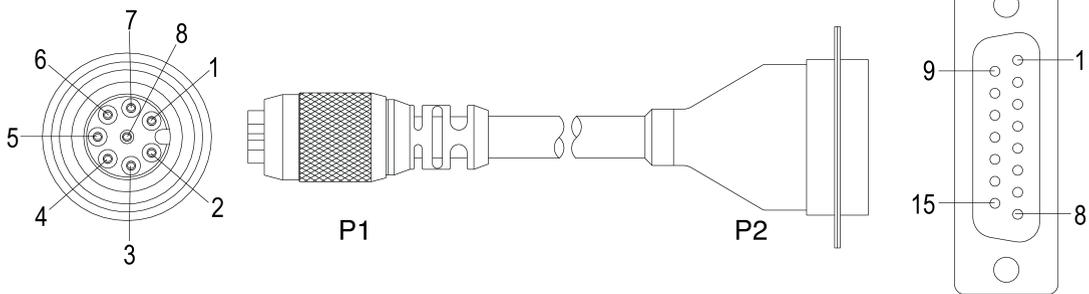
<sup>1</sup> If hardware handshaking is required, an I/O module must be used.

<sup>2</sup> If hardware handshaking is required, an I/O module must be used.

## I/O Module Cable Specifications

The I/O Module cable connects the vision system directly to a compatible In-Sight I/O module via the DB15 connector. When the I/O module is used, all power and communication lines used by the vision system are connected using the I/O Module cable. Table 1-3 on page 2 specifies which I/O modules are compatible with your vision system.

**Table 3-10: I/O Module Cable Pin-Out**



P1 Pin#	Signal Name	P2 Pin#
1	POWER, +24 VDC	1
2	TRIGGER+	2
3	TRIGGER-	3
4	HS OUT 0	4
5	HS OUT 1	5
6	RS-232 RECEIVE (RxD) (In-Sight 5604 Only: Encoder A)	6
7	RS-232 TRANSMIT (TxD) (In-Sight 5604 Only: Encoder B)	7
8	GROUND	8

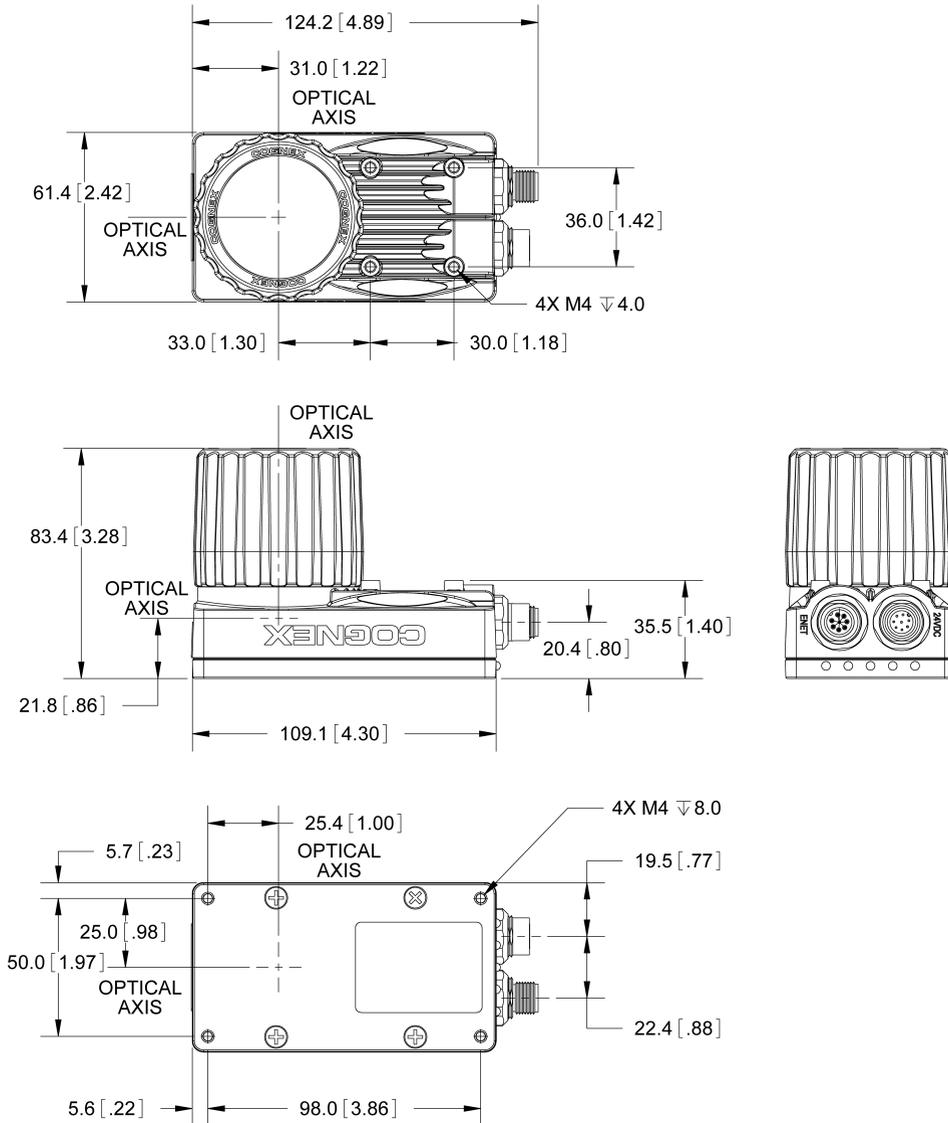
**Note:**

- Cables are sold separately.
- Refer to your specific I/O module installation manual for more connection information.

# 5100, 5100C, 5400, 5401, 5400C and 5403 Vision System Dimensions

**Note:**

- All dimensions are in millimeters [inches] and are for reference purposes only.
- All specifications may be changed without notice.



**Figure 3-6: 5100, 5100C, 5400, 5401, 5400C and 5403 Vision System Dimensions (With Lens Cover)**

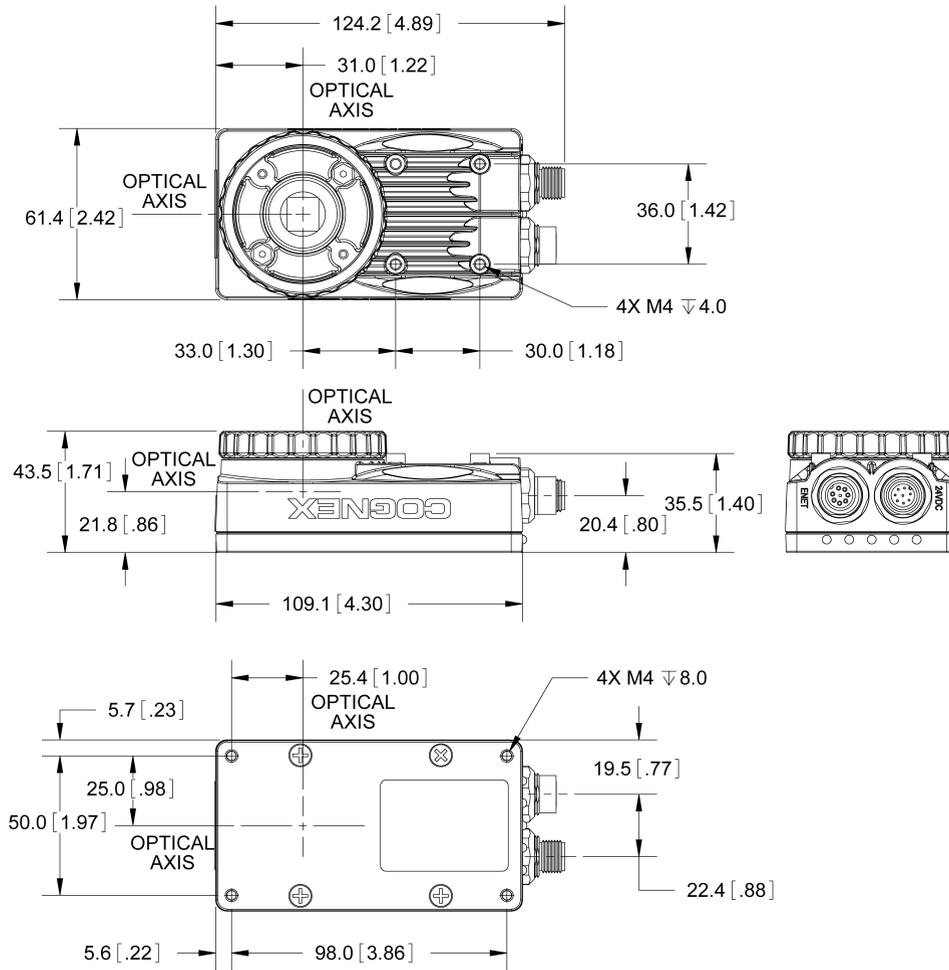
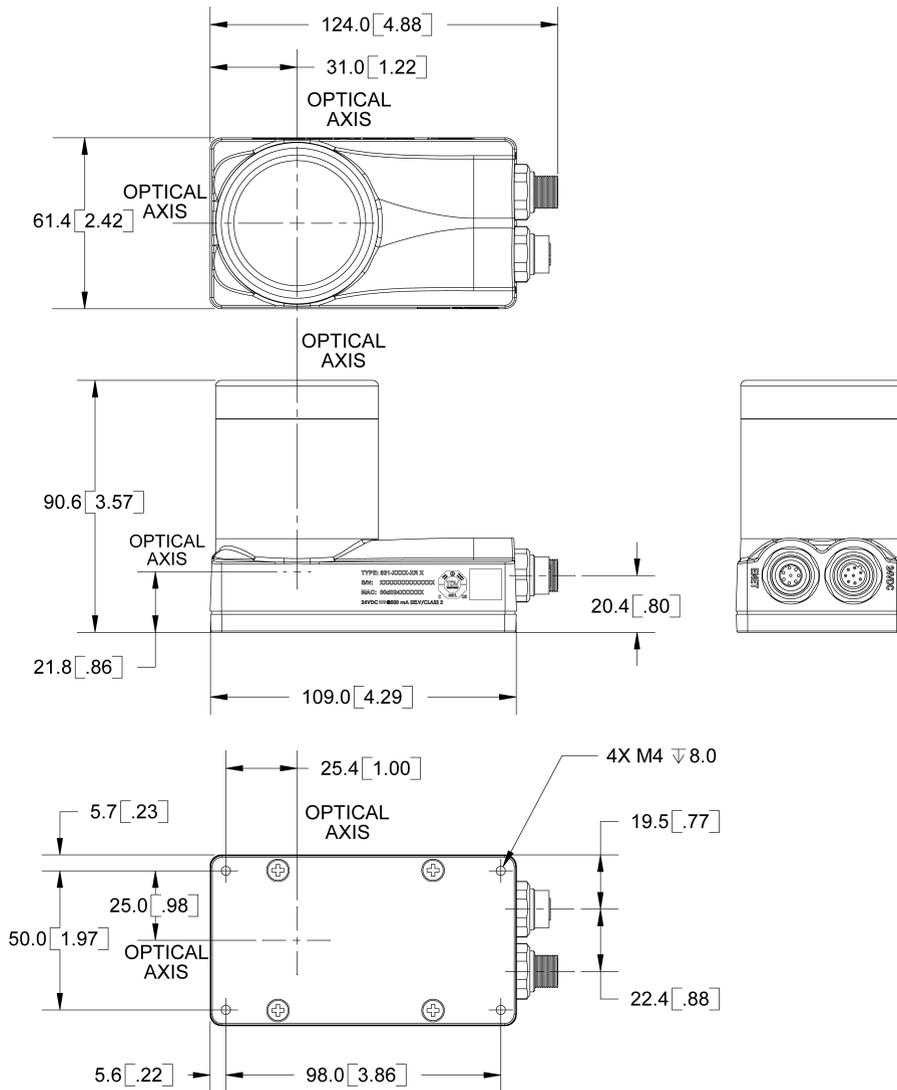


Figure 3-7: 5100, 5100C, 5400, 5401, 5400C and 5403 Vision System Dimensions (Without Lens Cover)

## 5403S, 5400CS and 5400S Vision System Dimensions

**Note:**

- All dimensions are in millimeters [inches] and are for reference purposes only.
- All specifications may be changed without notice.



**Figure 3-8: 5403S, 5400CS and 5400S Vision System Dimensions (With Lens Cover)**

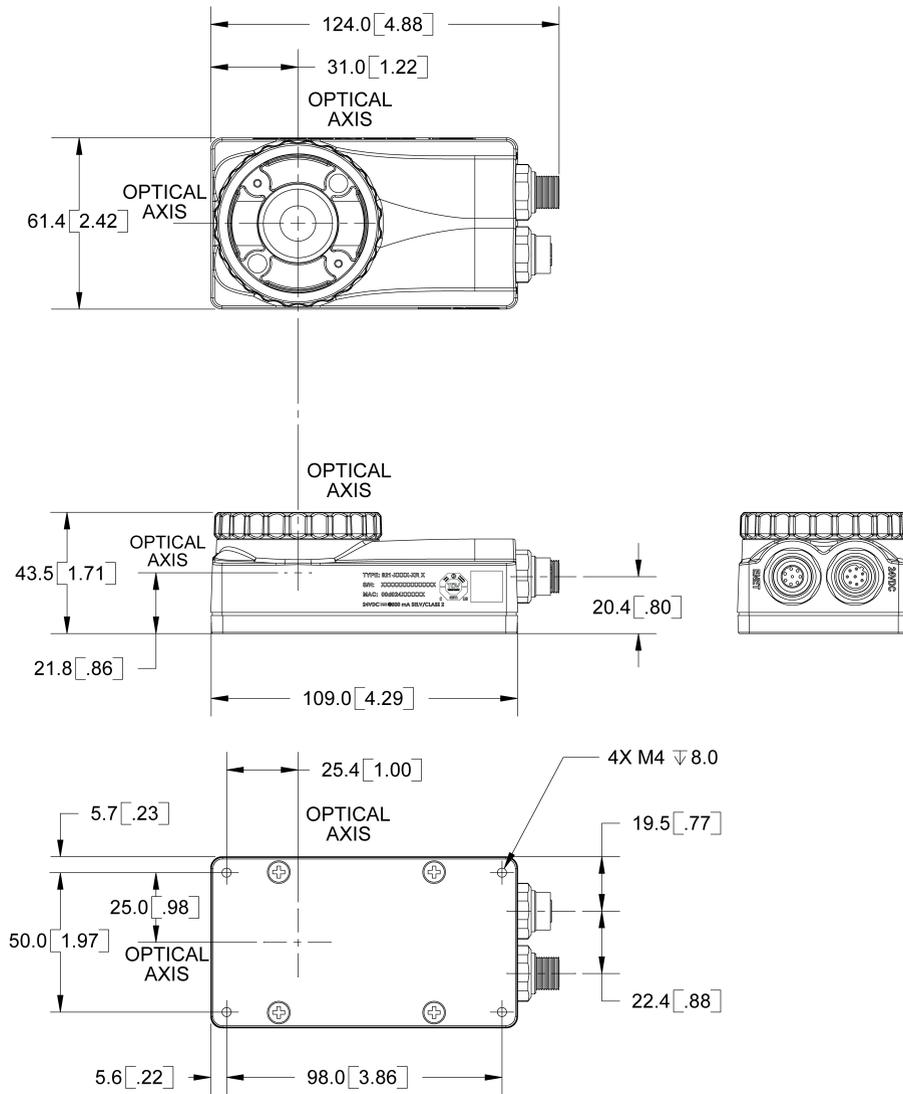
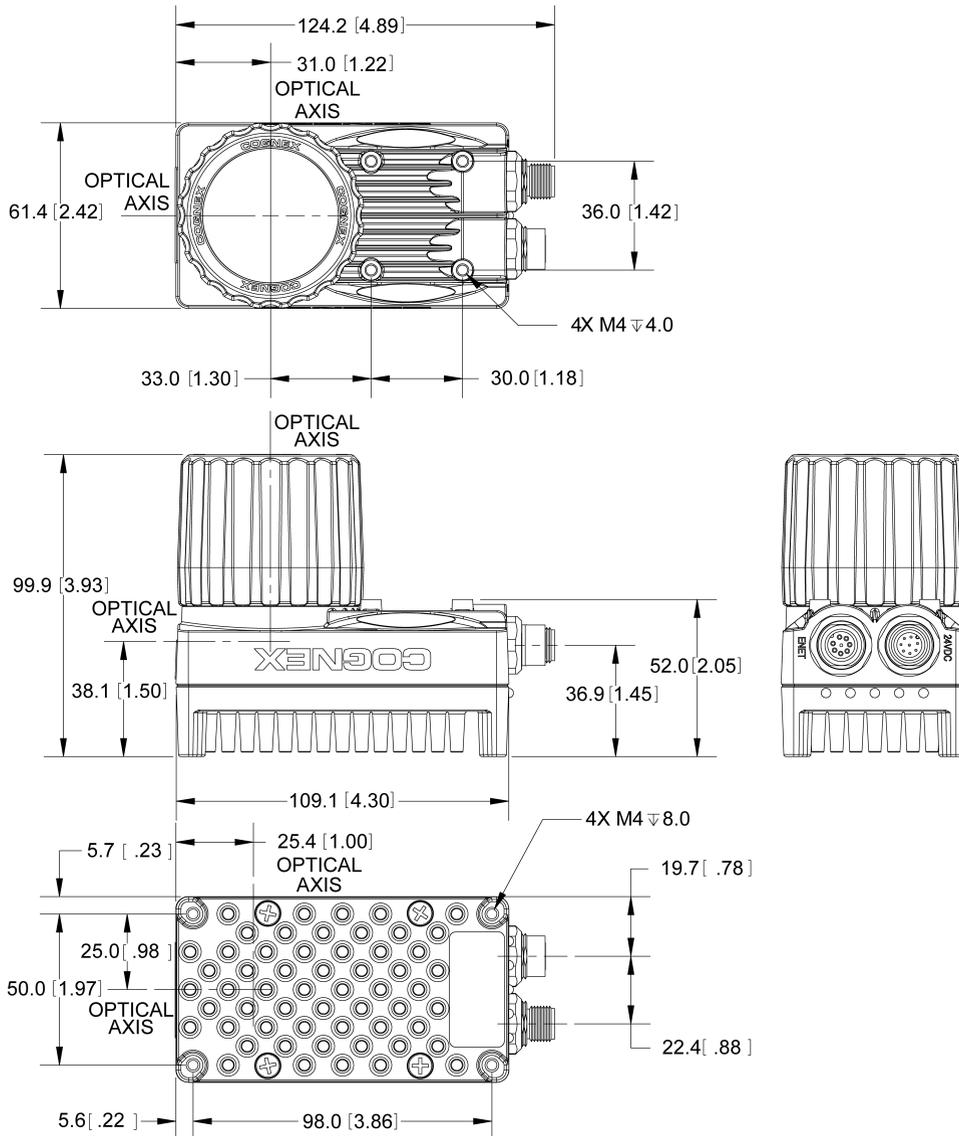


Figure 3-9: 5403S, 5400CS and 5400S Vision System Dimensions (Without Lens Cover)

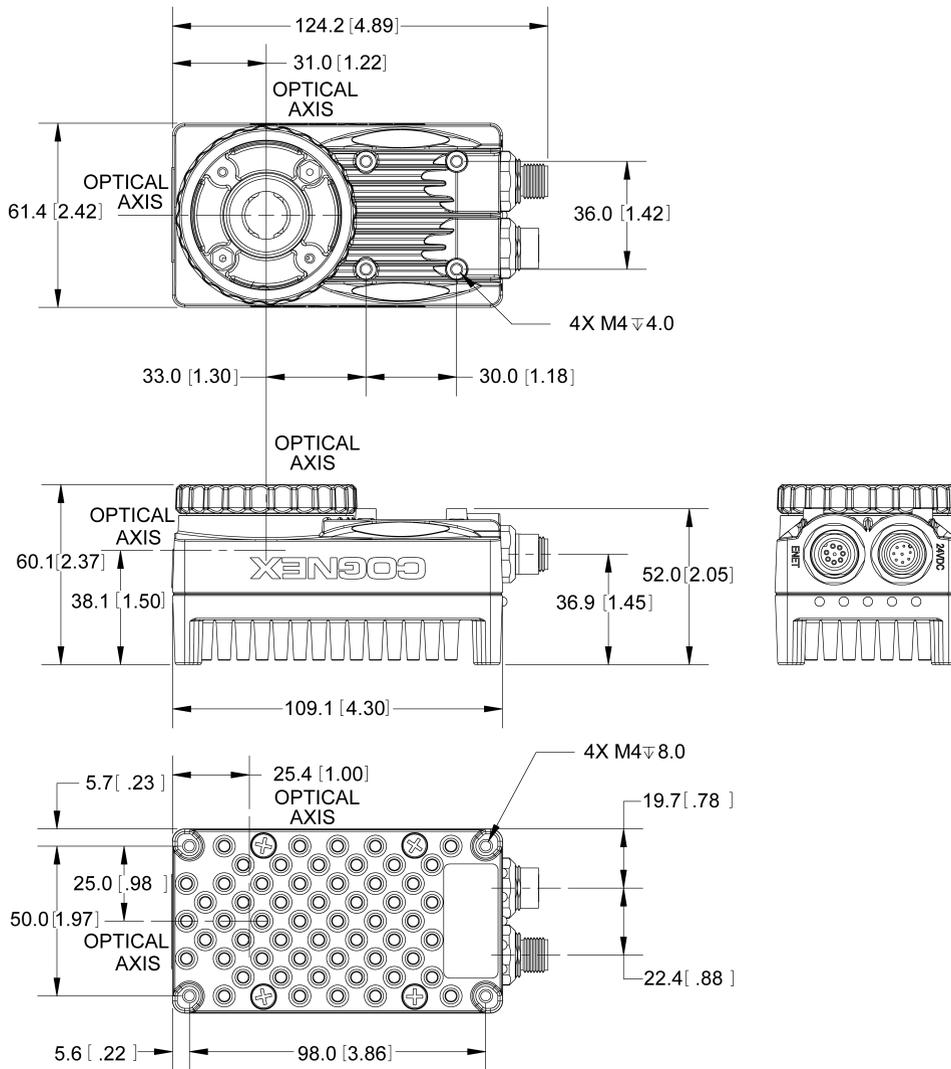
## 5600 and 5603 Vision System Dimensions

**Note:**

- All dimensions are in millimeters [inches] and are for reference purposes only.
- All specifications may be changed without notice.



**Figure 3-10: 5600 and 5603 Vision System Dimensions (With Lens Cover)**

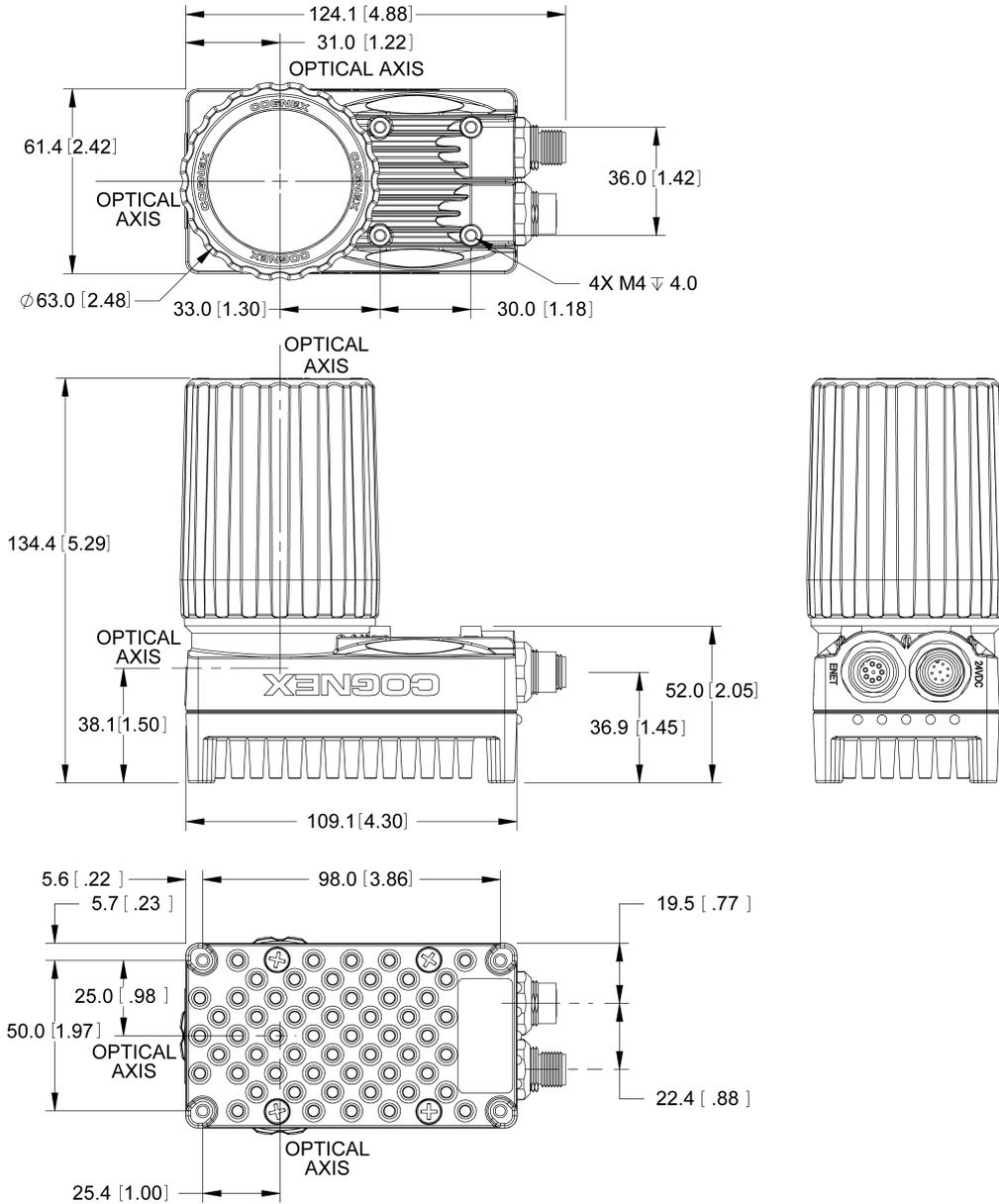


**Figure 3-11: 5600 and 5603 Vision System Dimensions (Without Lens Cover)**

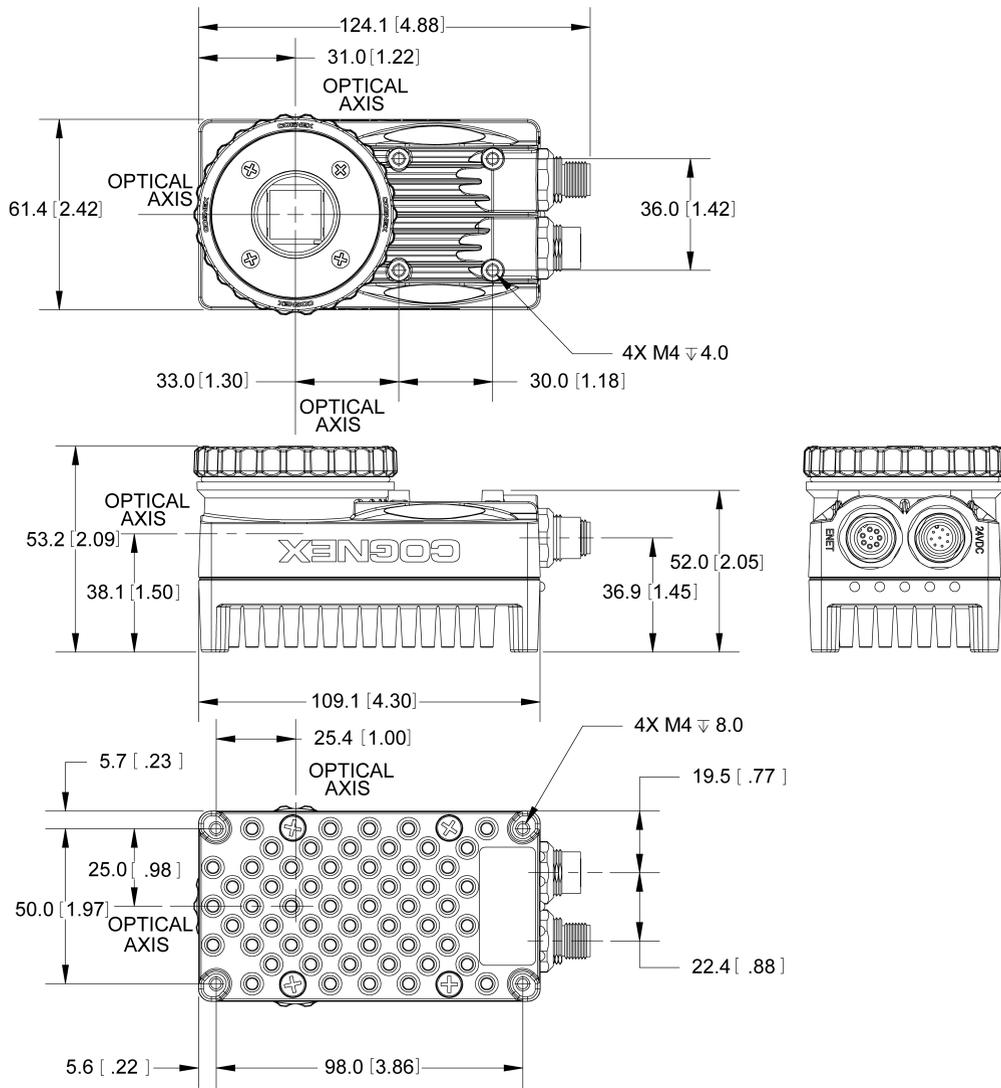
## 5604 and 5605 Vision System Dimensions

**Note:**

- All dimensions are in millimeters [inches] and are for reference purposes only.
- All specifications may be changed without notice.



**Figure 3-12: 5604 and 5605 Vision System Dimensions (With Lens Cover)**



**Figure 3-13: 5604 and 5605 Vision System Dimensions (Without Lens Cover)**



# Appendix A - Cleaning/Maintenance

## Cleaning the Vision System Housing

To clean the outside of the vision system housing, use a small amount of mild detergent cleaner or isopropyl alcohol on a cleaning cloth. Do not pour the cleaner directly onto the vision system housing.

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**CAUTION:** Do not attempt to clean any In-Sight product with harsh or corrosive solvents, including Lye, methyl ethyl ketone (MEK) or gasoline.

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## Cleaning the Vision System CCD Window

To remove dust from the outside of the CCD window, use a pressurized air duster. The air must be free of oil, moisture or other contaminants that could remain on the glass and possibly degrade the image. Do not touch the glass window. If oil/smudges still remain, clean the window with a cotton bud using alcohol (ethyl, methyl or isopropyl). Do not pour the alcohol directly on the window.







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