COGNEX

In-Sight® 8405 Vision System

Reference Guide

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Precautions

Observe these precautions when installing the Cognex product, to reduce the risk of injury or equipment damage:

- An IEEE 802.3af compliant, and UL or NRTL listed, Power over Ethernet (PoE) power source rated Class 0, 2, 3 or 4 must be used. Any other voltage creates a risk of fire or shock and can damage the components. Applicable national and local wiring standards and rules must be followed.
- 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.
- 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.
- Do not expose the image sensor to laser light; image sensors can be damaged by direct, or reflected, laser light. If your application requires the use of laser light that may strike the image sensor, 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 service loop or bend radius is tighter than 10X the cable diameter. The bend radius must be at least six inches from the connector.
- Class A Equipment (broadcasting and communication equipment for office work): Seller and user shall be notified that this equipment is suitable for electromagnetic equipment for office work (Class A) and can be used outside the home.
- This device should be used in accordance with the instructions in this manual.
- All specifications are for reference purpose only and may be changed without notice.

Regulations/Conformity

Note: For the most up-to-date regulations and conformity information, please refer to the Cognex online support site: http://www.cognex.com/Support.

Safety and Regulatory	
CE	In-Sight 8405: Regulatory Model 1AAU
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 8405: Regulatory Model 1AAU: MSIP-REM-CGX-1AAU
NRTL	TÜV SÜD AM SCC/NRTL OSHA Scheme for UL/CAN 61010-1.
CB	TÜV SÜD AM, IEC/EN 61010-1. CB report available upon request.
RoHS	Compliant to the latest applicable Directive.

Table of Contents

Symbols

The following symbols indicate safety precautions and supplemental information.

WARNING: This symbol indicates the presence of a hazard that could result in death, serious personal injury or electrical shock.

CAUTION: This symbol indicates the presence of a hazard that could result in property damage.

Note: Notes provide supplemental information about a subject.

Tip: Tips provide helpful suggestions and shortcuts that may not otherwise be apparent.

Introduction

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

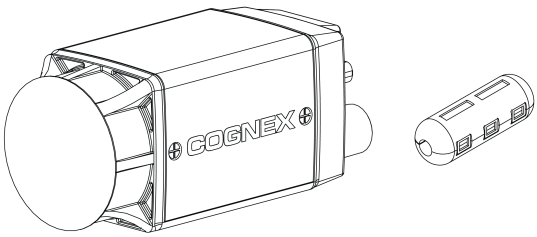
Many information resources are available to assist you in using the vision system:

- The *In-Sight® Explorer Help* and *EasyBuilder Help* files, provided with In-Sight Explorer software.
- On-demand training: http://www.cognex.com/on-demand-training.aspx.
- The In-Sight online support site: http://www.cognex.com/Support/InSight.

Standard Components

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.



Component	Description
Vision System	Provides image acquisition, vision processing, job storage, Ethernet connectivity and discrete I/O.
Ferrite	Ferrite included for attachment to the accessory Breakout cable.

Accessories

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

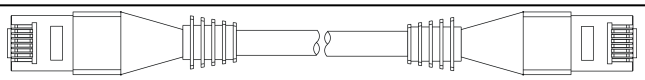
Cables

Note: Cables are sold separately.

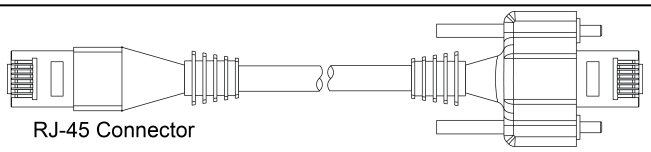
CAUTION: All cable connectors are “keyed” to fit the connectors on the vision system; do not force the connections or damage may occur.

Ethernet Cable

The shielded Ethernet cable provides Gigabit Ethernet connectivity and supplies power to the vision system. The pin-outs for the cable are listed in the *Ethernet Cable Specifications* on page 20. This cable is available in the lengths and styles listed below.



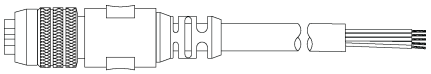
Length	Part Number
5m	CGE-CBL-SHLD-5M
10m	CGE-CBL-SHLD-10M
20m	CGE-CBL-SHLD-20M



Length	Part Number
5m	CGE-CBL-FLEX-H-5M
10m	CGE-CBL-FLEX-H-10M
20m	CGE-CBL-FLEX-H-20M

Breakout Cable

The Breakout cable provides access to the vision system's trigger and high-speed outputs. The Breakout cable can be connected to devices, such as a PLC, trigger sensor or strobe light. The pin-outs for the cable are listed in the *Breakout Cable Specifications* on page 19. This cable is available in the lengths listed below.

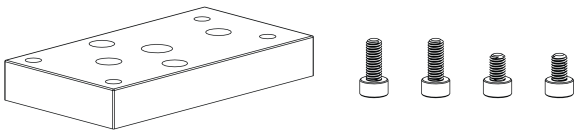


M8 Connector

Length	Part Number
0.6m	CCB-M8IO-00
2m	CCB-M8IO-02
5m	CCB-M8IO-05
10m	CCB-M8IO-10
15m	CCB-M8IO-15

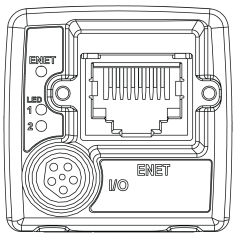
Mounting Block Kit

Includes M3 screws for mounting the vision system (quantity 4) and a mounting block for securing the vision system to a mounting surface.



Component	Part Number
Mounting Kit	BKT-IS8K-01

Connectors and Indicators



Connector/Indicator	Description
ENET LED	1000-BaseT: LED turns on when the vision system is receiving power during startup, and blinks green once network traffic is detected. 100-BaseT: LED turns on when the vision system is receiving power during startup, and blinks green and red (appears orange) once network traffic is detected. 10-BaseT: LED turns on when the vision system is receiving power during startup, and blinks red once network traffic is detected.
LED 1	Green when active. User-configurable within the In-Sight Explorer Discrete Output Settings dialog, using Discrete Output Line 4.
LED 2	Red when active. User-configurable within the In-Sight Explorer Discrete Output Settings dialog, using Discrete Output Line 5.
I/O Port	The I/O port is an M8 port that provides connection to the acquisition trigger input and high-speed outputs via the Breakout cable. For more information, refer to *Breakout Cable Specifications* on page 19.
ENET Port	The ENET port is a 10/100/1000 RJ-45 port that provides Gigabit Ethernet connectivity and supplies Power over Ethernet (PoE) via the Ethernet cable. For more information, refer to *Ethernet Cable Specifications* on page 20.

Note:

- When the vision system is initially powered up, the ENET LED turns on and is orange and LED 1 turn on and is steady green for approximately 10 seconds. Next, LED 2 flashes green and then red, and then both LED 1 and LED 2 turn off. Next, the ENET LED turns off and then momentarily flashes when a network connection is established, and then begins blinking once network traffic is detected.
- If both LED 1 and LED 2 are solid red, the vision system's firmware update was interrupted. For more information, refer to the Update Firmware Dialog topic in the *In-Sight® Explorer Help* file.

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.

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

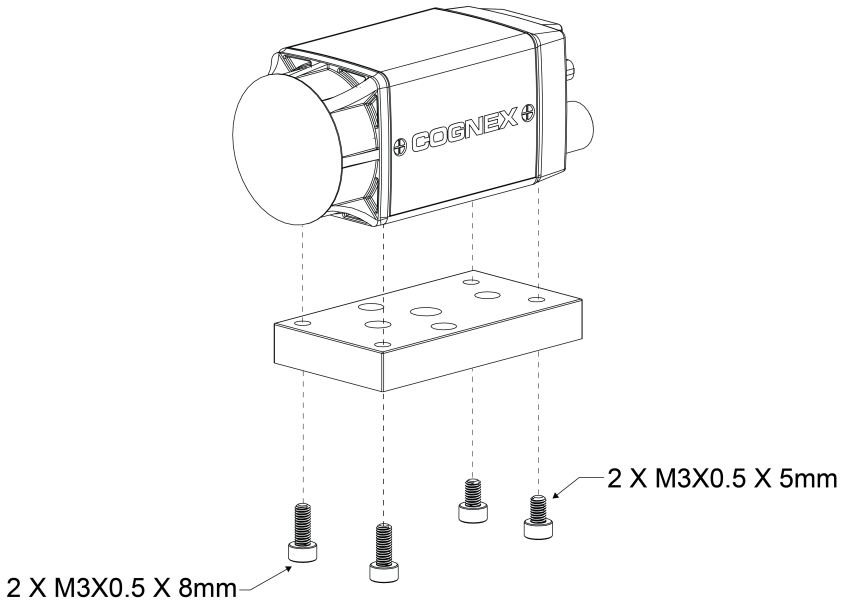
Mount the Vision System

The vision system provides mounting holes for attachment to a mounting surface.

Note:

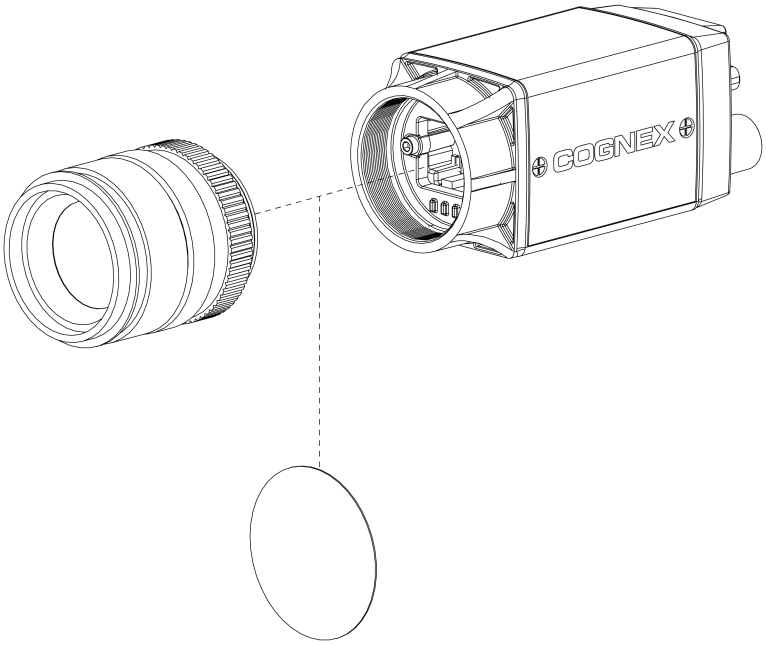
- For the mounting holes closest to the lens opening, the thread length of the M3 screw should not exceed 4.5mm. For the mounting holes closest to the connectors, the thread length of the M3 screw should not exceed 1.6mm. This does not include the thickness of the mounting material used. For more information, refer to *Dimensional Drawings* on page 21.
- The accessory mounting kit includes a mounting block and M3 screws (quantity 4) for mounting the vision system and securing it to a mounting surface. The mounting block also provides 1/4-20 and M6 mounting holes for attaching the vision system to a mounting surface. For more information, refer to *Dimensional Drawings (with Accessory Mounting Block)* on page 22.
- It is recommended that the vision system be grounded, either by mounting the vision system to a fixture that is electrically grounded or by attaching a wire from the vision system's mounting fixture to frame ground or Earth ground.

1. Align the holes on the mounting surface with the mounting holes on the vision system.
2. Insert the M3 screws into the mounting holes and tighten using a 2.5mm hex wrench; the maximum torque is 0.3 Nm (2.5 in-lb).



Install the Lens

1. Remove the protective film covering the threaded lens opening, if present.
2. Attach a C-Mount lens to the vision system. The exact lens focal length needed depends on the working distance and the field of view required for your machine vision application.



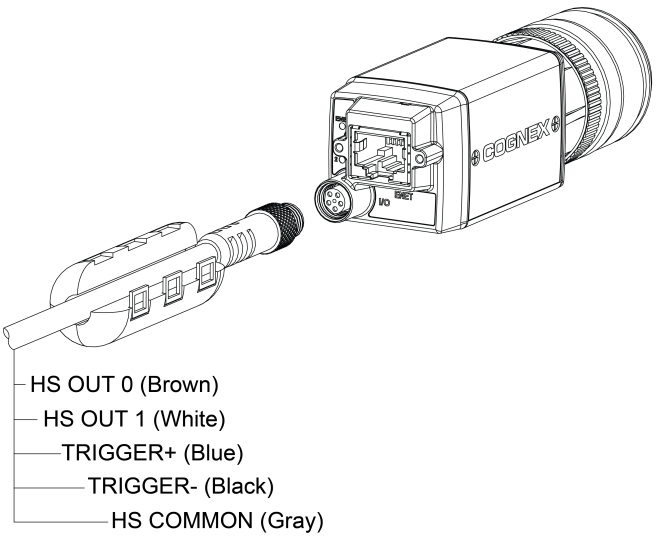
Connect the Breakout Cable (Optional)

CAUTION: A ferrite is included with the vision system standard components. To reduce emissions, the ferrite must be attached to the Breakout cable.

Note:

- I/O wiring or adjustments to I/O devices should be performed when the vision system is not receiving power.
- The Ethernet cable should be unplugged or the PoE source powered down before making adjustments to the connections at the far end of the Breakout cable.
- Unused bare wires can be clipped short or tied back using a tie made of non-conductive material.

1. Verify that the vision system's power supply is unplugged and not receiving power.
2. Attach the ferrite around the Breakout cable, adjacent to the strain relief on the cable.
3. Connect the Breakout cable's M8 connector to the vision system's I/O connector.
4. Connect the trigger and high-speed I/O wires to an appropriate device (for example, a PLC, trigger sensor or strobe light). For more information, refer to *Breakout Cable Specifications* on page 19.



Connect the Ethernet Cable

The vision system's ENET connector provides the Ethernet connection for network communications and supplies power to the vision system.

1. Verify that the PoE injector or PoE switch is unplugged and not receiving power.
2. Connect one end of the Ethernet cable to the PoE switch or PoE injector.

CAUTION:

- The Ethernet cable must be shielded. Cognex strongly recommends Cat 6 or Cat 7 Ethernet cables with S/STP shielding.

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- The Ethernet cable shield must be grounded at the far end. If using a PoE injector, a ground wire should be connected from the Ethernet shield at the PoE injector to frame ground or Earth ground, and a digital voltmeter used to validate the grounding. If using a PoE switch, it should have a metal case, with the case grounded to frame ground or Earth ground.

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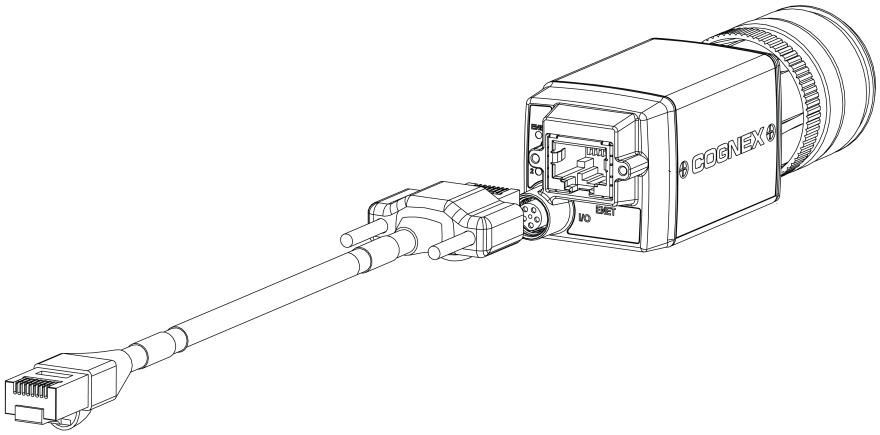
3. Connect the other end of the cable to the vision system's ENET connector. If using a compatible horizontal screw-locking Ethernet cable, use a screw driver to tighten the connector screws until snug, to secure it to the vision system. Screws must be tight to assure a reliable connection.



4. Restore power to the PoE injector or PoE switch's power supply, and turn it on if necessary.

Specifications

The following sections list general specifications for the In-Sight 8405 vision system.

Vision System Specifications

Specifications	In-Sight 8405
Minimum Firmware Requirement	In-Sight version 5.1.1
Job/Program Memory	512MB non-volatile flash memory; unlimited storage via remote network device.
Image Processing Memory	512MB SDRAM
Sensor Type	1/2.5 inch CMOS, rolling-shutter
Sensor Properties	7.13mm diagonal, 2.2 x 2.2µm sq. pixels
Maximum Resolution (pixels)[1]	2592 x 1944
Electronic Shutter Speed	32µs to 1000ms
Acquisition	Rapid reset, progressive scan, full-frame integration.
Bit Depth	256 grey levels (8 bits/pixel).
Frames Per Second[2]	10 full frames per second.
Lens Type	C-Mount
Trigger	1 opto-isolated, acquisition trigger input. Remote software commands via Ethernet.
Discrete Inputs	None.
Discrete Outputs	2 opto-isolated, NPN/PNP high-speed output lines.
Status LEDs	Network, 2 user-configurable.
Network Communication	1 RJ-45 Ethernet port, 10/100/1000 BaseT with auto MDIX. IEEE 802.3af TCP/IP Protocol. Supports DHCP, static and link-local IP address configuration.
Serial Communication	None.
Power	Class 2 Power over Ethernet (PoE) device.
Power Type	PoE Type A and Type B.
Power Consumption	6.49 W maximum per Class 2 PoE.
Current	Per Class 2 PoE requirements.
Voltage	48VDC nominal, applied from a Class 2 PoE injector, which is typically powered from some other voltage.
Material	Die-cast zinc housing.
Finish	Painted.
Mounting	Four M3 threaded mounting holes (1/4-20 and M6 mounting holes also available on accessory mounting block).
Dimensions	31.0mm (1.22in) x 31.2mm (1.23in) x 71.6mm (2.82in) without accessory mounting block. 39.0mm (1.54in) x 31.2mm (1.23in) x 71.6mm (2.82in) with accessory mounting block.

[1] The number of image sensor rows are configurable and can be set within the In-Sight Explorer software. Decreasing the number of rows will increase the number of frames per second acquired by the vision system. Refer to the AcquireImage topic in the *In-Sight® Explorer Help* file for more information.

[2] Maximum frames per second is job-dependent, based on the minimum exposure for a full image frame capture using the dedicated acquisition trigger, and assumes there is no user interface connection to the vision system.

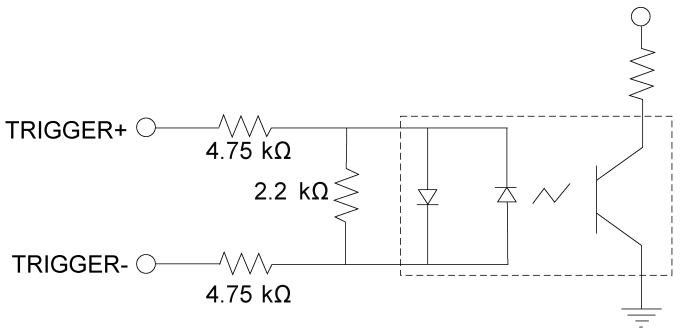
Specifications	In-Sight 8405
Weight	78 g (2.75 oz.) without accessory mounting block 109 g (3.84 oz.) with accessory mounting block
Case Temperature[1]	0°C to 50°C (32°F to 122°F)
Storage Temperature	-20°C to 80°C (-4°F to 176°F)
Humidity	< 80% non-condensing
Protection	IP30 with cables and lens attached.
Shock (Shipping and Storage)	IEC 60068-2-27: 18 shocks (3 shocks in each polarity in each (X, Y, Z) axis) 80 Gs (800 M/S^2 at 11 MS, half-sinusoidal)
Vibration (Shipping and Storage)	IEC 60068-2-6: vibration test in each of the three main axis for 2 hours @ 10 Gs (10 to 500 Hz at 100m/s2 / 15mm)
Regulations/Conformity	CE, FCC, KCC, TÜV SÜD NRTL, RoHS

Acquisition Trigger Input

The vision system features one acquisition trigger input, which is optically isolated. The acquisition trigger input can be configured to trigger from either an NPN (current sinking) or PNP (current sourcing) device.

Specification	Description
Voltage	ON: 20 to 28VDC (24VDC nominal) OFF: 0 to 3VDC (8VDC nominal threshold)
Current	ON: 2.0 to 2.9mA OFF: < 250µA Resistance: ~10 kOhms
Delay[2]	72µs maximum latency between leading edge of trigger and start of acquisition. Input pulse should be minimum of 1 ms wide.

- The Breakout cable can be used to trigger from an NPN photoelectric sensor or PLC output. Connect TRIGGER+ to +24VDC and connect TRIGGER- to the output of the photoelectric sensor. When the output turns ON, it pulls TRIGGER- down to 0VDC, turning the opto-coupler ON. For more information, refer to *Breakout Cable Specifications* on page 19.
- The Breakout cable can also be used to trigger from a PNP photoelectric sensor or PLC output. Connect TRIGGER+ to the output of the photoelectric sensor and connect TRIGGER- to 0VDC. When the output turns ON, it pulls TRIGGER+ up to +24VDC, turning the opto-coupler ON. For more information, refer to *Breakout Cable Specifications* on page 19.



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

[1] Case temperature can be verified using the EV GetSystemConfig("Internal.Temperature") Extended Native Mode command. When issued, it returns the vision system's internal temperature in degrees Celsius, which will be ±5 degrees above the vision system case temperature. Refer to the *In-Sight® Explorer Help* file for more information. Additional cooling measures are required if the case temperature cannot be kept below 50°C. Examples of such measures include: mounting the vision system to a heat sink using the M3 mounting screws, reducing the ambient temperature and ensuring there is air flow over the vision system.

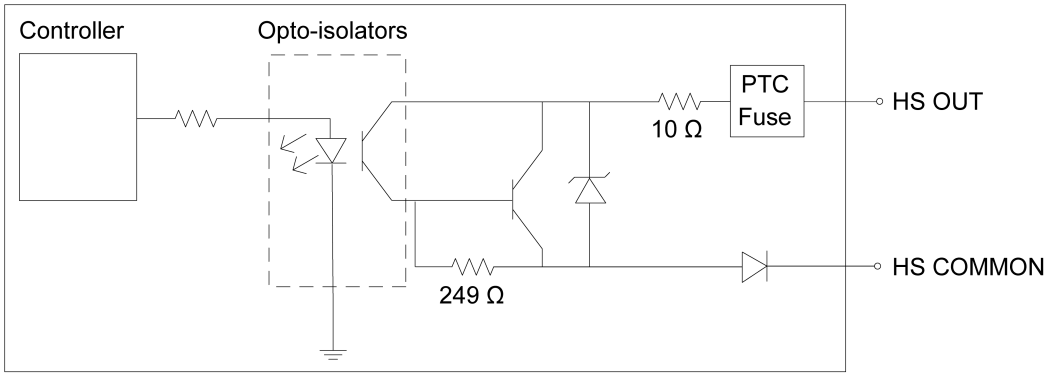
[2] Maximum latency is based on a 1µs trigger debounce.

High-Speed Outputs

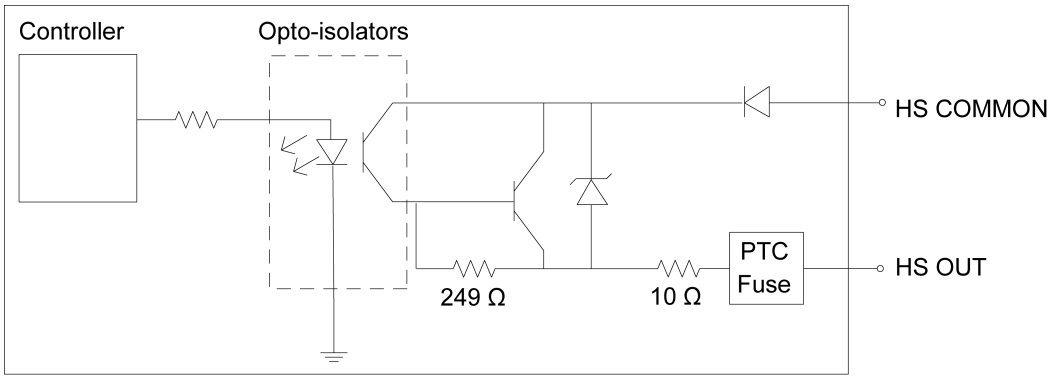
The vision system features two built-in, high-speed outputs, which are optically isolated. The high-speed outputs can be used as either NPN (current sinking) or PNP (current sourcing) lines.

Specification	Description
Voltage	28VDC maximum through external load.
Current	100mA maximum sink current.
	OFF state leakage current 100µA maximum.
	External load resistance 240 Ohms to 10 kOhms.
	Each line rated at a maximum 100mA, protected against over-current, short circuit and transients from switching inductive loads. High current inductive loads require an external protection diode.
Delay[1]	30µs (maximum due to opto-isolators turning ON).

For NPN lines, the external load should be connected between the output and the positive supply voltage (+24VDC nominal). HS COMMON should be connected to the negative supply voltage (0VDC). The outputs pull down to less than 3VDC when ON, which causes current to flow through the load. When the outputs are OFF, no current flows through the load.



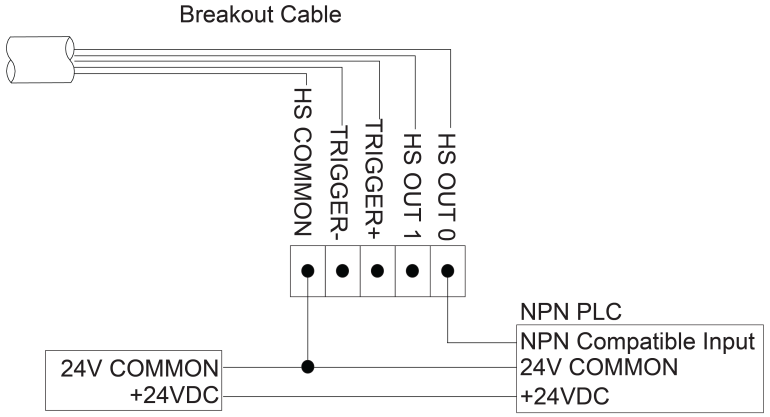
For PNP lines, the external load should be connected between the output and the negative supply voltage (0VDC). When HS COMMON is connected to the positive supply voltage (+24VDC nominal), the outputs pull up to greater than 21VDC when ON, and current flows through the load. When the outputs are OFF, no current flows through the load.



[1] Delay when opto-isolators turn OFF depends on the load to which the output is connected. With a 240 Ohm load, the maximum delay will be 35µs.

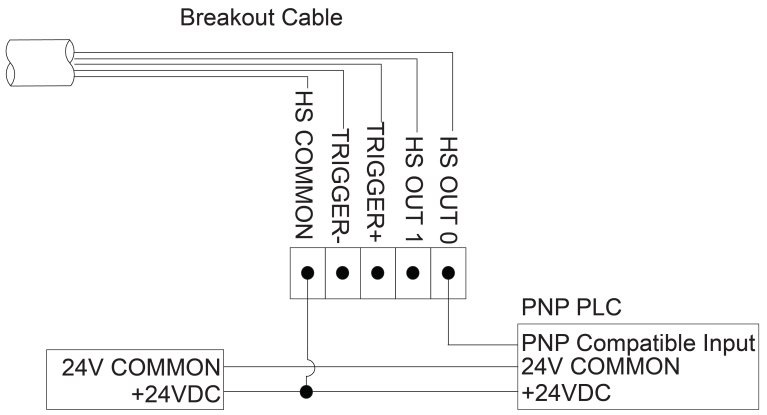
High-Speed Output - NPN Configuration

The Breakout cable can be used to connect to an NPN-compatible PLC input. Connect HS OUT 0 or HS OUT 1 directly to the PLC input. When enabled, the output pulls the PLC input down to less than 3VDC. For more information, refer to *Breakout Cable Specifications* on page 19.



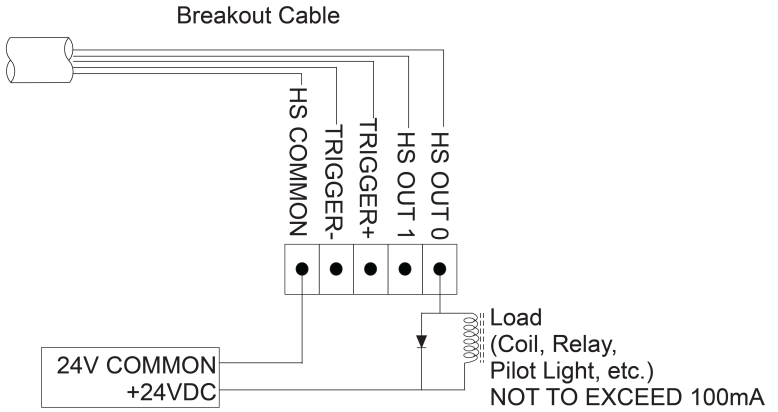
High-Speed Output - PNP Configuration

The Breakout cable can be used to connect to a PNP-compatible PLC input. Connect HS OUT 0 or HS OUT 1 directly to the PLC input. When enabled, the output pulls the PLC input up to greater than 21VDC. For more information, refer to *Breakout Cable Specifications* on page 19.



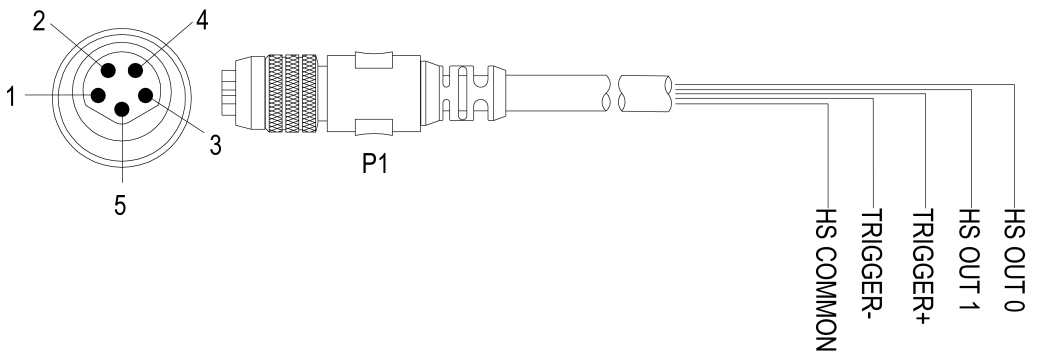
High-Speed Output - Relay/LED Configuration

The Breakout cable 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 +24VDC. When the output switches on, the negative side of the load is pulled down to less than 3VDC, and greater than 21VDC 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 +24VDC. For more information, refer to *Breakout Cable Specifications* on page 19.



Breakout Cable Specifications

The Breakout cable provides access to the vision system's trigger and high-speed outputs. The Breakout cable can be connected to devices, such as a PLC, trigger sensor or strobe light. The Breakout cable is not terminated.



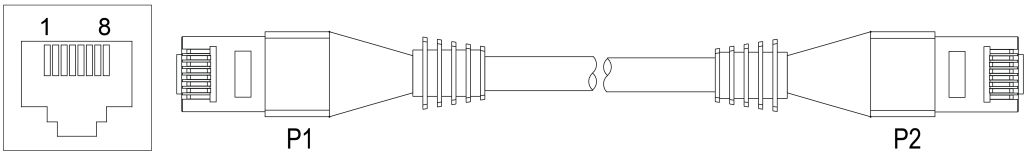
P1 Pin Number	Signal	Wire Color
1	HS OUT 0	Brown
2	HS OUT 1	White
3	TRIGGER+	Blue
4	TRIGGER-	Black
5	HS COMMON	Gray

Note:

- Cables are sold separately.
- Unused bare wires can be clipped short or tied back using a tie made of non-conductive material.

Ethernet Cable Specifications

The Ethernet cable provides Ethernet connectivity and supplies power to the vision system.



P1 Pin Number	Signal Name	P2 Pin Number
1	TxRx A +	1
2	TxRx A -	2
3	TxRx B +	3
4	TxRx C +	4
5	TxRx C -	5
6	TxRx B -	6
7	TxRx D +	7
8	TxRx D -	8

Note: Cables are sold separately.

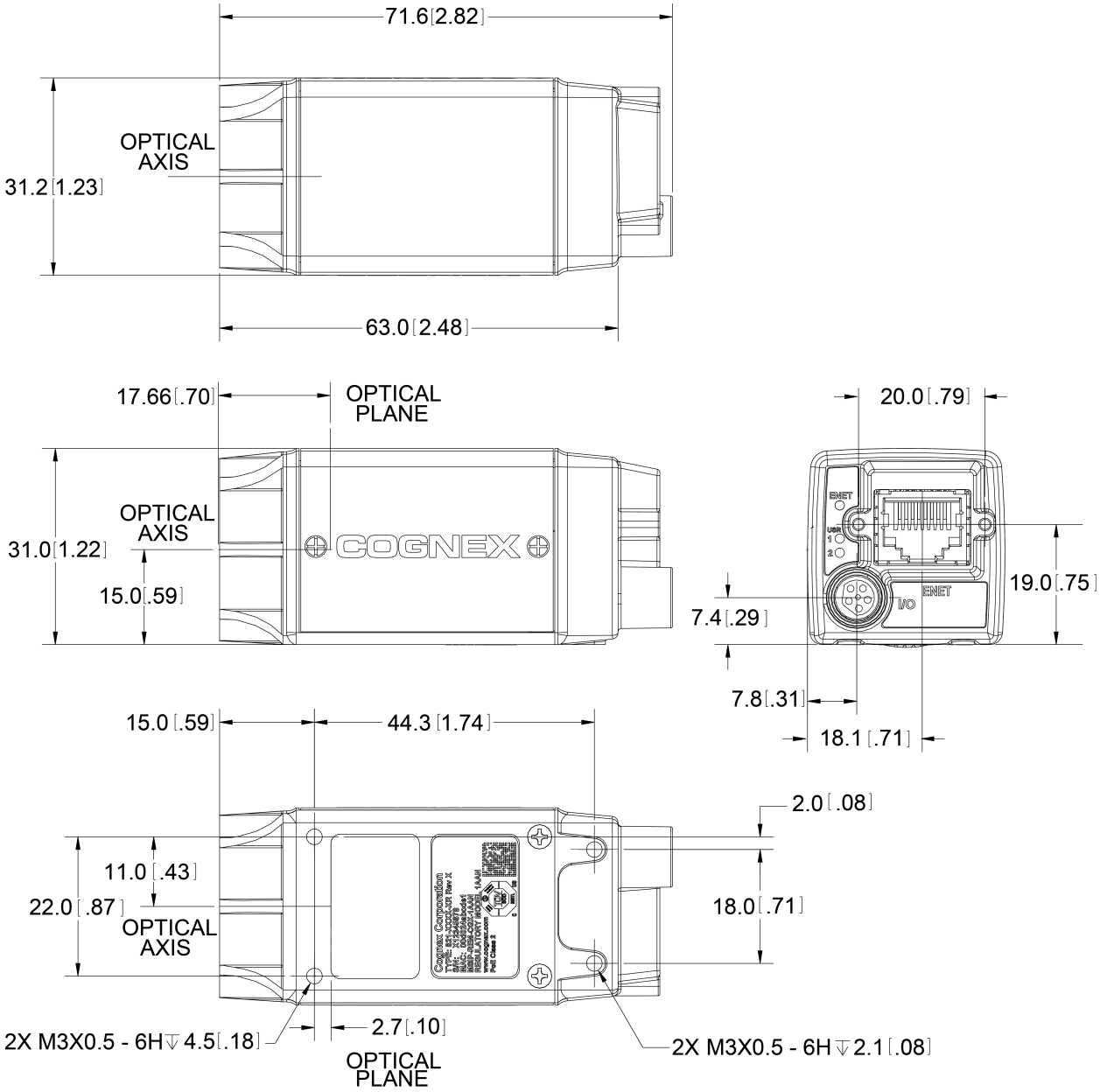
CAUTION:

- The Ethernet cable must be shielded. Cognex strongly recommends Cat 6 or Cat 7 Ethernet cables with S/STP shielding.
- The Ethernet cable shield must be grounded at the far end. If using a PoE injector, a ground wire should be connected from the Ethernet shield at the PoE injector to frame ground or Earth ground, and a digital voltmeter used to validate the grounding. If using a PoE switch, it should have a metal case, with the case grounded to frame ground or Earth ground.

Dimensional Drawings

Note:

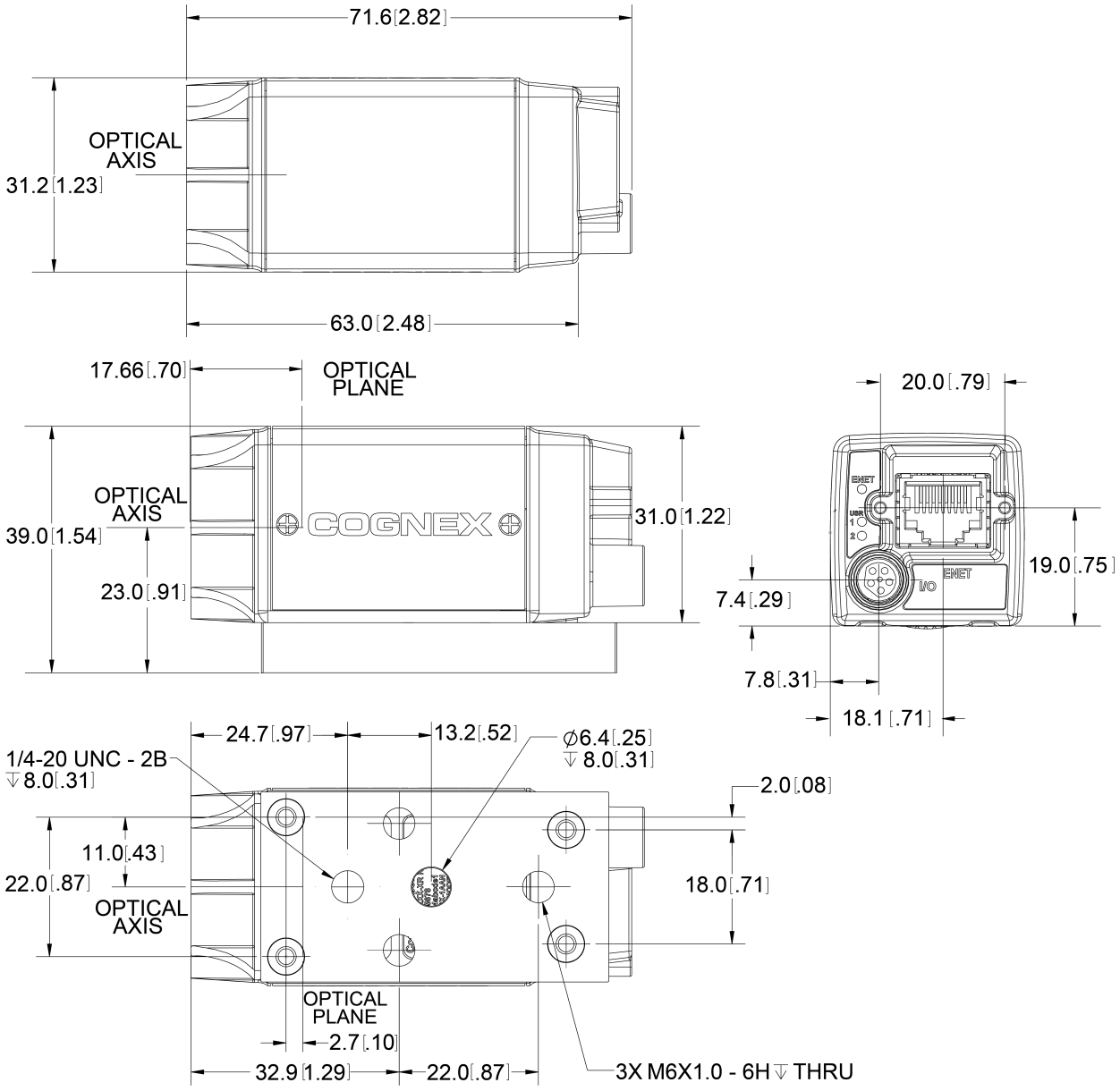
- All dimensions are in millimeters [inches] and are for reference purposes only.
- All specifications are for reference purpose only and may be changed without notice.



Dimensional Drawings (with Accessory Mounting Block)

Note:

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



Cleaning/Maintenance

Clean the Housing

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

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

Clean the Image Sensor Window

To remove dust from the outside of the image sensor 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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