

COGNEX
Vision for Industry®



INSTALLING IN-SIGHT™ 4000 SERIES VISION SENSORS



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In-Sight	Patents pending
Hardware	4,972,359; 5,526,050; 5,657,403; 5,793,899
Vision Tools	5,495,537; 5,548,326; 5,583,954; 5,602,937; 5,640,200; 5,717,785; 5,742,037; 5,751,853; 5,768,443; 5,796,868; 5,818,443; 5,825,483; 5,825,913; 5,845,007; 5,859,466; 5,872,870; 5,909,504

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Installing In-Sight™ 4000 Series Vision Sensors

Regulations/Compliance

Declaration of Conformity

Manufacturer Cognex Corporation
One Vision Drive
Natick, MA 01760 USA

Declares this  -marked product

Product Number In-Sight 4000, 4001, 4100

Complies With 73/23/EEC Low Voltage Directive
89/336/EEC Electromagnetic Compatibility Directive

Compliance Standards

- EN 60950:1992
Electrical Safety
A1:1993, A2:1993, A3:1995
- EN 55022
RF Emissions
Information Technology
- EN 50082-1
EMC Immunity Standard

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France

Safety



LISTED
(UL 1950)
51KJ

CUL Certification marks are present on products

Installing In-Sight™ 4000 Series Vision Sensors

Precautions

Observe these precautions when installing the In-Sight 4000 to reduce the risk of injury or equipment damage:

- Never connect the In-Sight 4000 to a power source other than 24VDC. Any other voltage creates a risk of fire or shock and can damage the In-Sight hardware.
- Do not install the In-Sight 4000 in locations that directly expose it 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.
- Do not open the In-Sight 4000. This device does not contain user-serviceable parts. Do not make electrical or mechanical modifications to the In-Sight hardware. Unauthorized modifications violate your warranty.

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1 Introduction

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1.1 In-Sight 4000 Series Overview

The In-Sight™ 4000 series is a family of compact, high performance, networked machine vision sensors for high-speed automated inspection, measurement, identification, alignment, and robot guidance applications on the factory floor.

In-Sight 4000 sensors are configured remotely using an intuitive spreadsheet interface running on a networked In-Sight PC Host or In-Sight 3000. This spreadsheet also allows remote monitoring of sensor operation during runtime. In-Sight 4000 sensors may also be controlled remotely from users' custom application programs using In-Sight Native Mode commands to change settings and retrieve inspection results.

The In-Sight 4000 series include the following models:

- In-Sight 4000 integrated processor/camera (640 x 480 image resolution)
- In-Sight 4001 integrated processor/camera (1024 x 768 image resolution)
- In-Sight 4100 processor with remote head camera (640 x 480 image)

The In-Sight 4100 remote head camera is available in standard anodized aluminum. Optionally, a stainless steel version is available for applications where required (e.g. food services). The remote head enclosure is also available in stainless steel with a polycarbonate window.

Unless otherwise specified, references to the In-Sight 4000 in this document also apply to the In-Sight 4001 and 4100 models.

1.2 In-Sight Support

Many information resources are available to assist you in using the In-Sight 4000 sensor and its spreadsheet interface:

- *Getting Started with In-Sight*, Cognex P/N 590-6368 (English), 590-6368F (French), 590-6368G (German), or 590-6368J (Japanese).
- *In-Sight Guide & Reference*, an on-line HTML Help file provided on the In-Sight CD-ROM.
- In-Sight computer-based tutorials provided on CD-ROM with In-Sight starter accessories kits.
- The In-Sight Online Support and Learning Center at www.cognex.com/support/In-Sight.asp.

NOTE Only registered In-Sight users have access to the In-Sight Online Support and Learning Center website.

1.3 Networking an In-Sight 4000 Sensor

An In-Sight 4000 sensor is designed to operate as a host system on an Ethernet TCP/IP network. For the purposes of the instructions in this manual, an In-Sight network exists wherever any In-Sight sensor is connected by Ethernet to at least one other In-Sight sensor or personal computer running In-Sight PC Host software.

In-Sight 4000 sensors may be used in several possible network configurations. For each configuration, the In-Sight 4000 is configured from the user interface of another In-Sight system, which also provides the remote display for the In-Sight 4000.

1.3.1 Standalone In-Sight Network Configurations

The simplest In-Sight 4000 networks are shown in Figure 1-1 and Figure 1-2. In these basic configurations, a CAT5 cable with crossover coupler (P/N 185-0080) directly connects a single In-Sight 4000 to a standalone In-Sight PC Host equipped with a network card, or to an In-Sight 3000 processor. Neither the In-Sight PC Host nor the In-Sight 3000 is connected to the larger, factory-floor network.

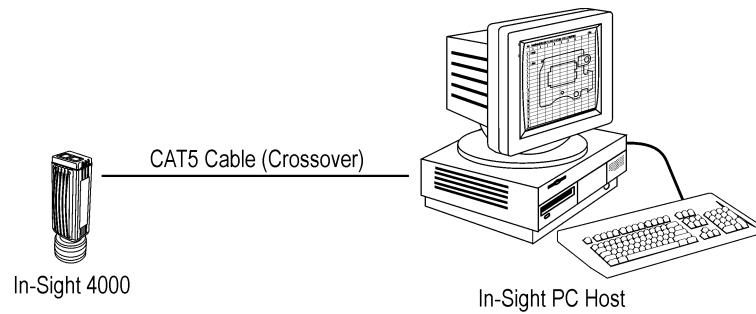


Figure 1-1: In-Sight 4000 – In-Sight PC Host Network

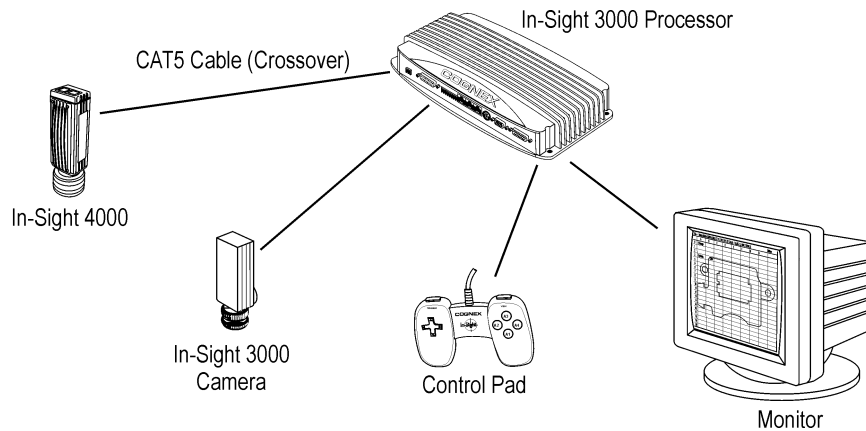


Figure 1-2: In-Sight 4000 – In-Sight 3000 Network

To install multiple In-Sight 4000 sensors onto a standalone In-Sight network, use an Ethernet switch between the In-Sight 4000 sensors and the In-Sight PC Host or In-Sight 3000 processor. Make all connections via standard, straight-pinned CAT5 cable (Figure 1-3 and Figure 1-4).

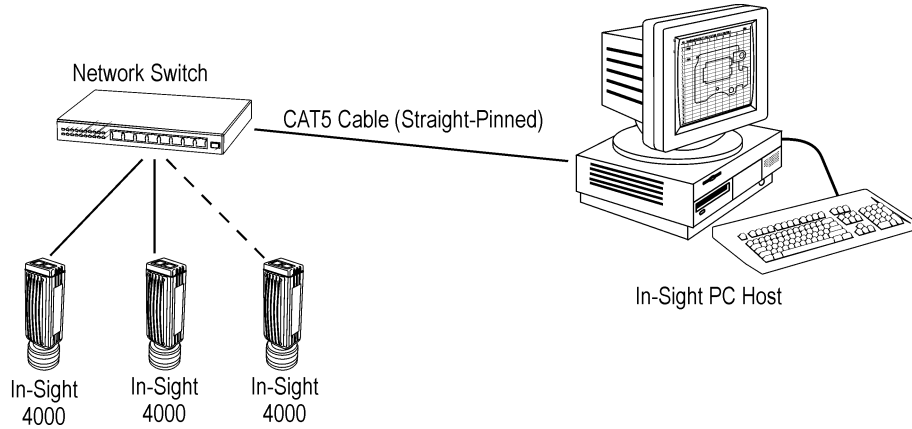


Figure 1-3: Multiple In-Sight 4000 Sensors – In-Sight PC Host Network

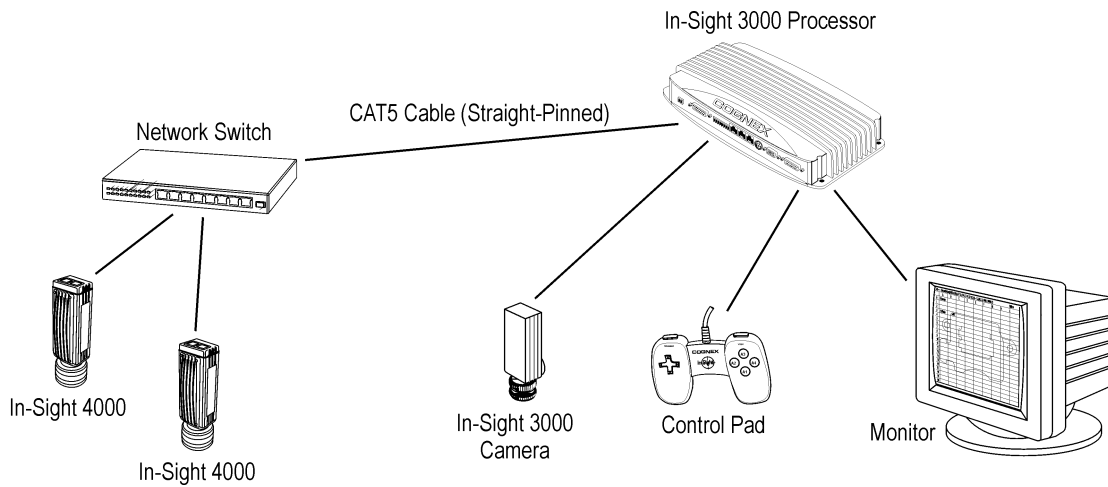


Figure 1-4: Multiple In-Sight 4000 Sensors – In-Sight 3000 Network

The number of In-Sight sensors and In-Sight PC Hosts that may be installed on a standalone In-Sight network are limited only by the number of ports available on the Ethernet switch. To expand a standalone In-Sight network, add Ethernet switches as needed to increase the number of available network ports.

1.3.2 Factory-Floor In-Sight Network Configurations

To take full advantage of their data sharing and remote monitoring capabilities, In-Sight sensors should be connected to the larger, factory-floor network. The only physical difference between factory-networked In-Sight sensors and a standalone In-Sight network is that the Ethernet switch is itself connected to the factory-floor network.

Groups of In-Sight systems connected to the factory-floor network through a common Ethernet switch are referred to as a local network, or subnet. Figure 1-5 shows a subnet that includes two In-Sight 4000 sensors, an In-Sight 3000, and an In-Sight PC Host.

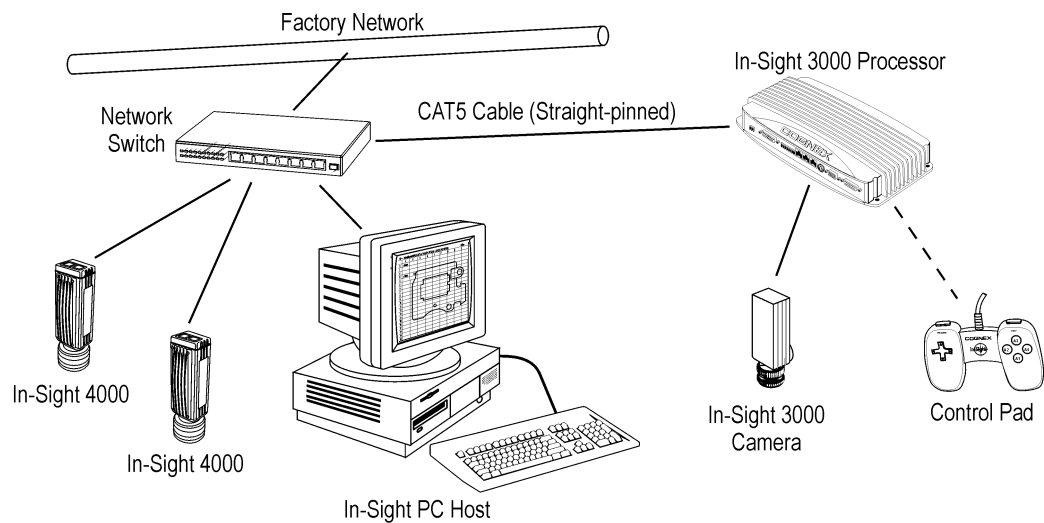


Figure 1-5: Multiple In-Sight 4000 Sensors with In-Sight 3000 and PC Host

NOTE In-Sight 4000 sensors can be connected to the factory network even if there is no In-Sight PC Host or In-Sight 3000 processor on the same subnet. In this configuration, any In-Sight 3000 processor or PC Host on any other subnet on the network can provide remote configuration and display service to the In-Sight 4000 sensors on a different subnet.

2 Installing the In-Sight 4000

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2.1 Connecting the In-Sight 4000

The In-Sight 4000 has two RJ-45 connector ports opposite the lens mount on a 4000/4001 or the remote head connector on the 4100 processor, as shown in Figure 2-1: the network port (left, labeled **ENET**) and the breakout port (right, labeled **24VDC**). The network port provides the Ethernet connection for network communications. The breakout port supplies connections for power, I/O, and serial communications.

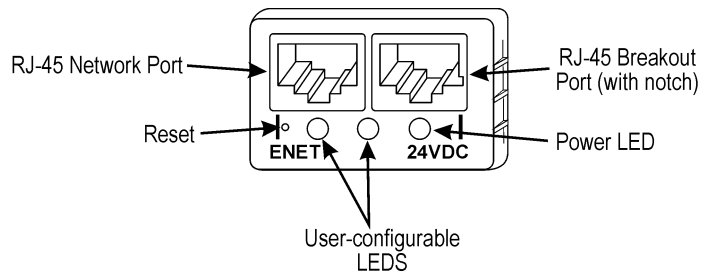


Figure 2-1: In-Sight 4000 Network and Breakout Ports

2.1.1 Connecting the Network Cable

If you are connecting to an Ethernet switch:

- 1 Plug one of the RJ-45 connectors on a CAT5 straight-pinned cable into the ENET port.
- 2 Plug the other end of the CAT5 straight-pinned cable into an available port on the switch.

If you are connecting directly to an In-Sight sensor or In-Sight PC Host:

- 1 Plug one of the RJ-45 connectors on a CAT5 cable into the ENET port on the In-Sight 4000.
- 2 Plug the other end of the CAT5 cable into the crossover coupler (P/N 185-0080).
- 3 Connect the crossover coupler into the other system's Ethernet port.

2.1.2 Connecting the Breakout Cable

The In-Sight Breakout Cable (P/N 300-0340-15/30) included with every In-Sight sensor provides access to the In-Sight 4000 sensor's power, serial communications, and I/O lines. The RJ-45 connector on this cable is "keyed" to the notch in the breakout port, and cannot be inadvertently plugged in to the network port.

See Section 3.2.1: Breakout Port Pin Assignments on page 30 for the Breakout Cable's wiring details.

To connect the Breakout Cable to the In-Sight 4000:

- 1 Verify the 24VDC power supply being used is switched off.
- 2 Attach the Breakout Cable's power (white-green wire) and ground (brown wire) to the corresponding terminals on the power supply.
- 3 Connect the wires for the acquisition trigger, discrete outputs, and serial communications to their corresponding terminals on remote devices.
- 4 Plug the RJ-45 connector into the In-Sight 4000 sensor's breakout port (labeled 24VDC).
- 5 Restore power to the 24V supply. The green power LED will indicate that the 4000 is receiving power.

2.1.3 Connecting the Breakout Module

The optional In-Sight Breakout Module (P/N 800-5743) is more convenient than using the standard Breakout Cable to connect the In-Sight 4000 sensor's power, serial communications, and I/O lines.

For additional information on connecting a Breakout module, see Section 3.2.1: Breakout Port Pin Assignments on page 30 or the *Breakout Module Installation and Reference* manual (P/N 597-0008-xx).

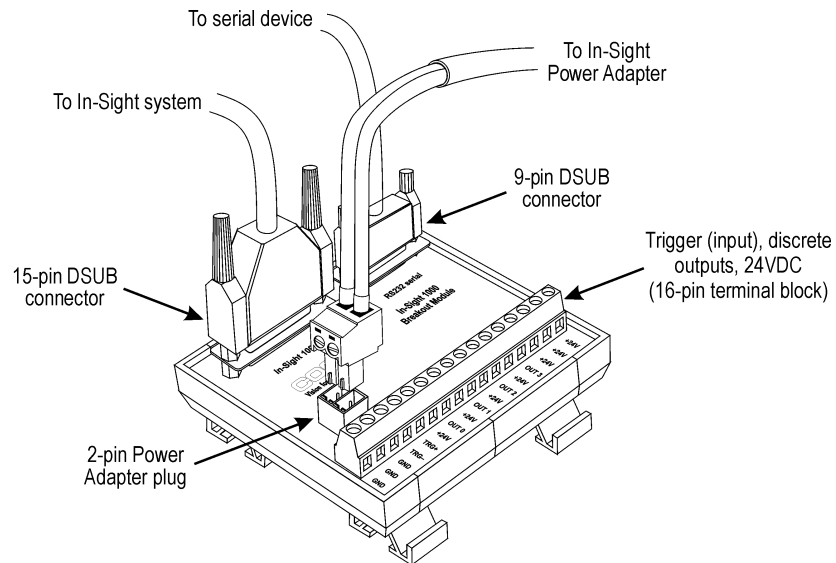


Figure 2-2: Breakout Module Connections

To connect the Breakout Module to the In-Sight 4000:

- 1 Verify the 24VDC power supply being used is switched off.
- 2 Optionally, connect the power and ground wires for the acquisition trigger input and the discrete outputs into their corresponding terminals on the Breakout Module.
- 3 Optionally, connect the 9-pin male D-sub connector of an RS232 serial cable into the corresponding 9-pin female connector on the Breakout Module.
- 4 Plug the Breakout Module Cable's 15-pin male D-sub connector into the corresponding female connector on the Breakout Module.
- 5 Plug the RJ-45 connector of the Breakout Module Cable (P/N 300-0341-15) into the In-Sight 4000 sensor's breakout port. The cable's connectors are "keyed" to the notch in the Breakout port.
- 6 Plug the wire leads from a 24VDC supply for the +24V power and ground into the 2-pin terminal plug on the Breakout Module. Alternatively, remove the terminal plug and insert the 2-pin terminal plug attached to the In-Sight power adapter into the keyed power adapter port on the Breakout Module (Figure 2-2).
- 7 Restore power to the 24V supply. The red power LED on the In-Sight 4000 and the orange +24V LED on the Breakout Module will indicate that the In-Sight 4000 and Breakout Module are receiving power.

2.1.4 Connecting the I/O Expansion Module

Like the Breakout Module, the optional I/O Expansion Module provides convenient access to the In-Sight 4000 sensor's power, serial communications, and discrete I/O lines. In addition to the two discrete outputs, acquisition trigger, and serial transmit/receive that are standard on the 4000, the I/O Expansion module provides the following:

- 8 discrete outputs
- 8 discrete inputs
- RS232 hardware handshaking

For additional information on connecting an In-Sight I/O Expansion module, see section 3.2.1: Breakout Port Pin Assignments on page 30 or the *In-Sight Expansion Module Installation and Reference* manual (P/N 597-0013-xx).

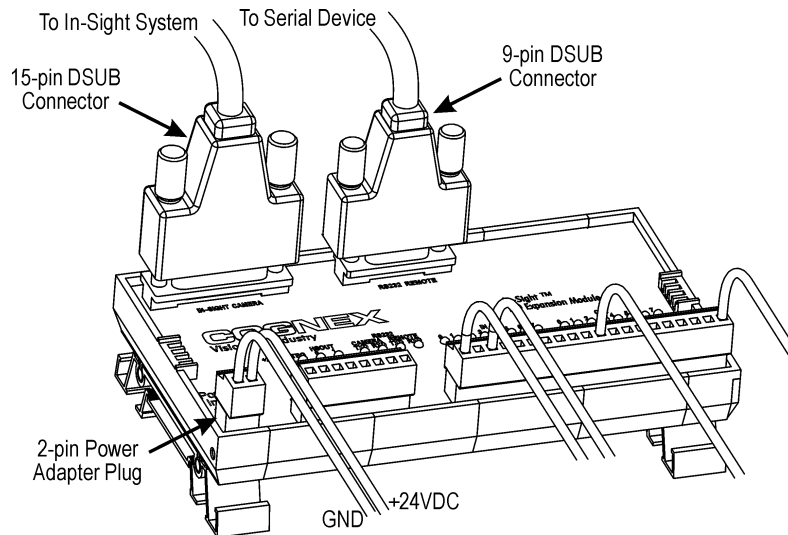


Figure 2-3: I/O Expansion Module Connections

To connect an I/O Expansion Module to the In-Sight 4000:

- 1 Verify the 24VDC power supply being used is switched off.
- 2 Optionally, connect the power and ground wires for the acquisition trigger input, discrete outputs, and discrete inputs into their corresponding terminals on the Expansion Module.

NOTE The outputs labeled HSOUT0 and HSOUT1 are high-speed outputs direct from the In-Sight 4000 and pass through the Expansion Module. The outputs labeled OUT0 through OUT7 are lower speed because their signals are processed by the Expansion Module processor before being sent to remote devices.

- 3 Optionally, connect the 9-pin male D-sub connector of an RS232 serial cable into the corresponding 9-pin female connector on the Expansion Module.
- 4 Plug the Expansion Module Cable's 15-pin male D-sub connector into the corresponding female connector on the Expansion Module.
- 5 Plug the RJ-45 connector of the Expansion Module Cable (P/N 300-0341-15) into the In-Sight 4000 sensor's breakout port. The cable's connectors are "keyed" to the notch in the Breakout port.
- 6 Plug wire leads from a 24VDC supply for the +24V power and ground into the 2-pin terminal plug labeled "Power Input" on the Expansion Module. Alternatively, remove the terminal plug and insert the 2-pin terminal plug attached to the In-Sight power adapter into the keyed power adapter port on the Expansion Module (Figure 2-3).
- 7 Restore power to the 24V supply. The green power LED on the 4000 and the +24V LED on the Expansion Module will indicate that the 4000 is receiving power.

2.2 Installing In-Sight PC Host Software

The In-Sight 4000 is configured, and its operation monitored, over an Ethernet network from an In-Sight 3000 or from a PC. An In-Sight 4000 accessed from a networked In-Sight 3000 is configured using a control pad.

An In-Sight 4000 accessed from a networked PC is configured using mouse and keyboard input. The following must be installed on the PC:

- A Microsoft® Windows™ XP, 2000, NT 4.0 (with Service Pack 4 or later), Me, or 98SE operating system.
- A network card that supports 10/100 Base-T Ethernet TCP/IP communications.
- In-Sight PC Host software version 2.30 or later (included on the CD-ROM shipped with your system).
- Internet Explorer 4.0 or higher to display the *In-Sight Guide & Reference*.

NOTE In-Sight PC Host software can be used only on a local subnet that includes a networked In-Sight sensor.

To install In-Sight PC Host software on a Windows PC:

- 1 Shut down any applications running on your PC.
- 2 Insert the In-Sight installation CD-ROM into your PC's CD-ROM drive. If the install program starts automatically, follow the setup dialogs as they appear on screen. If the install program does not start automatically:
- 3 Click the **Start** menu, click **Run**, and then click **Browse**.

- 4 In the browse window, select the PC's CD-ROM drive, and then select the **SETUP.EXE** file.
- 5 Click **Open**, and then click **OK** to begin the installation. The default installation directory is C:\INSIGHT2.
- 6 When the installation program is complete, remove the CD from the CD-ROM drive.
- 7 Verify the In-Sight PC Host software installation by opening the Start menu, opening the Programs menu, opening the In-Sight program group, and then selecting In-Sight PC Host. The In-Sight PC Host window will appear, displaying the In-Sight spreadsheet.
- 8 Verify the *In-Sight Guide & Reference* installation by opening the Start menu, opening the Programs menu, opening the In-Sight program group, and then selecting In-Sight Help. If you are running Windows NT 4.0 and the *In-Sight Guide and Reference* does not open, verify you are using Internet Explorer version 4.0 or higher. If not, use Service Pack 4 to update your browser.

NOTE Open the RELNOTES.DOC file for current information about In-Sight software, including new features, fixes, and known issues. Registered In-Sight PC Host users can download updated versions of In-Sight documentation at www.cognex.com/insight/support/support.asp.

2.3 Adding the In-Sight 4000 to a Network

The In-Sight 4000 is ready to be installed as a network host once it has power and is physically connected to the network.

As previously described, there are many possible In-Sight network configurations. The specific procedure for adding an In-Sight 4000 to a network depends on whether or not a **Dynamic Host Configuration Protocol** (DHCP) server is available. The DHCP server automatically assigns the In-Sight 4000 sensor a network IP address and Subnet Mask.

NOTE When installing the In-Sight 4000 to an existing network, consult your network administrator to determine whether a DHCP server is available.

2.3.1 Installing to a DHCP Network

The In-Sight 4000 is factory-configured for installation on an existing network with a DHCP server. To add an In-Sight 4000 to a network using a DHCP server requires only connecting the sensor to the network and supplying power; no manual configuration of the network settings is required.

NOTE After adding an In-Sight 4000 to a network with a DHCP server, disabling DHCP on the sensor and assigning it a static IP Address is strongly recommended. For more information on disabling DHCP and assigning a static IP address, refer to the “Network Dialog” topic in the In-Sight Guide & Reference HTML Help file.

The Host Name is the only configurable network setting when using DHCP. This Host Name is an “alias” for the In-Sight 4000 sensor’s IP Address, and appears in any list of host names in the In-Sight interface. If you do not assign a new Host Name, the In-Sight 4000 will appear on the network with the default Host Name.

After adding the In-Sight 4000 to the network using DHCP, proceed to section 2.4: Logging On to the In-Sight 4000 (page 19).

2.3.2 Installing to a Non-DHCP Network

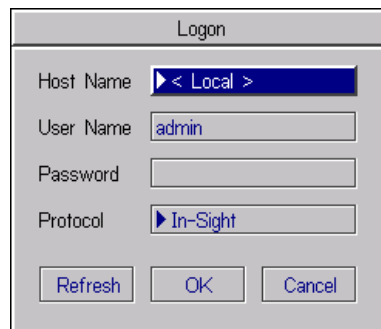
To install an In-Sight 4000 sensor on a network that does not use a DHCP server, use an In-Sight 3000 or an In-Sight PC Host to manually configure the 4000 sensor’s network settings. This installation may also require changes to network settings in Microsoft Windows (see Appendix A, page 39).

To install the In-Sight 4000 on a non-DHCP network:

- 1 Logon to an In-Sight 3000 or In-Sight PC Host program on the local network.
- 2 From the In-Sight spreadsheet, open the **System** menu (Figure 2-4).

**Figure 2-4: System Menu**

- 3 Select **Logon** to open the Logon dialog (Figure 2-5).

**Figure 2-5: Logon Dialog**

- 4 Select the **Host Name** drop-down list to see the names of any In-Sight systems already installed on the network.

- 5 Select **<New>** from the list to open the New Host Configuration dialog (Figure 2-6).

The image shows a 'New Host Configuration' dialog box. It contains the following fields and options:

- MAC Address: 00D024
- Safe Mode only
- Use DHCP
- IP Address: 192 168 0 1
- Subnet Mask: 255 255 255 0
- Buttons: OK and Cancel

Figure 2-6: New Host Configuration Dialog

- 6 Enter the last six characters of the In-Sight 4000's 12-character **Media Access Control** (MAC) address, without spaces or dashes. Do not delete or change the first six characters that are already entered.

NOTE The MAC address is located on the serial number label affixed to one side of the In-Sight 4000. This identifier is factory-assigned, unique for every In-Sight system, and cannot be changed or deleted.

- 7 Verify that the **Use DHCP Server** check box is disabled. Refer to section 2.5.1: Use DHCP Server (page 21) for more information about using DHCP.
- 8 Enter a valid **IP Address** for the In-Sight 4000. Every In-Sight sensor must be assigned a unique IP Address consistent with the addressing scheme in use on the network. Refer to the table in section 2.5.2: IP Address (page 22) for a description of common IP Address schemes.
- 9 Enter a **Subnet Mask** for the local network. The Subnet Mask specifies which parts of the In-Sight 4000's IP Address are the same for all hosts on the local network, and which are unique to each host. The default Subnet Mask 255.255.255.0 is appropriate for most users, as described in section 2.5.3: Subnet Mask (page 22). Consult your network administrator for more information.

NOTE When the Safe Mode only checkbox is disabled (the default setting), the IP Address and Subnet Mask entered overwrite the target In-Sight 4000 sensor's Network settings. If the checkbox is enabled, the Use DHCP, IP Address, and Subnet Mask fields will be grayed out, and the target sensors network settings will be preserved.

- 10 Click **OK**. The message box shown in Figure 2-7 appears.

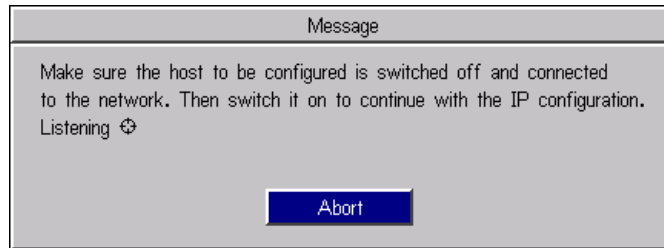


Figure 2-7: IP Configuration Message Box

- 11 Cycle power on the In-Sight 4000 by removing, then reinserting, the RJ-45 connector from the sensor's Breakout port. The message in Figure 2-8 appears when the In-Sight 4000 is located on the network.

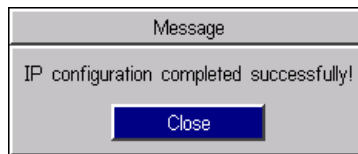


Figure 2-8: IP Configuration Successful Message Box

If the message in step 11 does not appear within one minute of cycling power, click **Abort**. The New Host Configuration dialog will reappear. Verify that the IP Address is valid and the Subnet Mask is appropriate for the local network. Make corrections as necessary, and retry steps 1 through 11. Contact your network administrator if problems persist.

2.4 Logging On to the In-Sight 4000

After the In-Sight 4000 has been added to the network, log on to the sensor to verify the installation and to configure additional network settings.

- 1 Attach a lens to the In-Sight 4000 you installed to verify the acquisition of live video images. The exact focal length needed depends on the working distance and the field of view required in your machine vision application. For now, any compatible lens may be used.

NOTE The In-Sight 4000 and 4001 sensors use C-Mount lenses. The In-Sight 4100 remote head camera uses CS-Mount lenses or C-Mount lenses (with 5mm extension).

- 2 Cycle power on the In-Sight 4000.
- 3 Logon to a networked In-Sight 3000 or In-Sight PC Host and open the **System** menu.
- 4 Select **Logon** to open the Logon dialog.
- 5 Select the **Host Name** field to open the drop-down list of In-Sight systems on the network.
- 6 Locate and select the host name of the In-Sight 4000 you added to the network in the list, then click **OK**. A message will temporarily appear while you are logging on to the In-Sight 4000.
- 7 Look in the lower-left corner of the spreadsheet and verify the Host Name of the system you are logged on to. This Host Name should be the same as the In-Sight 4000 you added to the network.
- 8 If you attached a lens to the In-Sight 4000, you will see an image beneath the transparent spreadsheet overlay. To see image acquisition over the network, open the System menu and select **Live**.

This completes the basic installation procedure of an In-Sight 4000 onto a network. Optional network settings may be configured as described in the following section. For information on using your networked In-Sight 4000, refer to the *In-Sight Guide & Reference* HTML Help file.

2.5 Changing In-Sight 4000 Network Settings

You may need to change the In-Sight 4000 sensor's Network settings when installing it to a non-DHCP network where a Default Gateway, DNS Server, and Domain name are used, or when moving the In-Sight 4000 from one network to another.

To modify In-Sight 4000 network settings:

- 1 Logon to an In-Sight PC Host or In-Sight 3000 on the network.
- 2 Select **Logon** to open the Logon dialog.
- 3 Select the **Host Name** field to open a drop-down list showing the In-Sight systems on the network.
- 4 Select the In-Sight 4000 sensor's Host Name and click **OK**. The In-Sight 4000 spreadsheet will appear.
- 5 Open the In-Sight System menu and select **Settings**.
- 6 Select **Network** to open the Network dialog (Figure 2-9).

Network	
<input checked="" type="checkbox"/> Use DHCP Server	Host Name: is4k010203
IP Address: 192 168 0 1	Domain: []
Subnet Mask: 255 255 255 0	Settings: Host Table
Default Gateway: 0 0 0 0	FTP Time
DNS Server: 0 0 0 0	OK Cancel

Figure 2-9: Network Dialog

Each of the Network dialog settings is explained in the following sections. For more information, refer to the *In-Sight Guide & Reference* HTML Help file.

2.5.1 Use DHCP Server

The Use DHCP Server checkbox determines whether the 4000 sensor uses DHCP on start up or if the values in the Network settings dialog configure TCP/IP.

NOTE This box should be checked only if a DHCP server is running on the local network. If a DHCP server does not respond within 60 seconds, the system will boot without network support enabled.

If the network has a DHCP server and the Use DHCP Server check box is enabled, the DHCP server will automatically configure the In-Sight 4000's network settings on startup. Optionally, a new Host Name may be assigned, but all other fields in the Network dialog will be grayed out and cannot be modified.

When the Use DHCP Server checkbox is disabled, all Network dialog settings are enabled and must be configured manually. If the 4000 was previously assigned an IP Address by a DHCP server, then disabling the Use DHCP Server checkbox will retain the same IP Address.

In a production environment it is recommended that a static IP address number be used instead of DHCP. Using a static IP address removes the need for a DHCP server on the local network and eliminates intermittent DHCP traffic.

NOTE The In-Sight 4000 can also be forced to use a DHCP Server or a static IP address by using the IP Address switch on the back of the sensor. For more information, see Appendix A: Using the IP Address Switch on page 43.

2.5.2 IP Address

The IP Address assigns a unique identifier for each In-Sight system on the network, which must be consistent with the IP address-numbering scheme of the local network.

NOTE The IP Address setting is grayed out when the Use DHCP Server checkbox is enabled.

Unlike the factory-set MAC address, the IP address is assigned automatically by a DHCP server or must be manually assigned by the user (also referred to as static IP address). The following IP addressing schemes are recommended:

Table 2-1: IP Address Schemes

ADDRESSING SCHEME	DESCRIPTION
10.0.0.0/8	The 10.0.0.0/8 private network is a class A network ID that allows valid IP addresses from 10.0.0.1 to 10.255.255.254. The 10.0.0.0/8 private network has 24 host bits, which can be used for any subnetting scheme within the private organization. The default Subnet Mask is 255.0.0.0.
172.16.0.0/12	The 172.16.0.0/12 private network can be interpreted either as a block of 16 class B network IDs or as a 20-bit assignable address space (20 host bits) which can be used for any subnetting scheme within the private organization. The 172.16.0.0/12 private network allows valid IP addresses from 172.16.0.1 to 172.31.255.254. The default Subnet Mask is 255.255.240.0.
192.168.0.0/16	The 192.168.0.0/16 private network can be interpreted either as a block of 256 class C network IDs or as a 16-bit assignable address space (16 host bits), which can be used for any subnetting scheme within the private organization. The 192.168.0.0/16 private network allows valid IP addresses from 192.168.0.1 to 192.168.255.254. The default Subnet Mask is 255.255.0.0.

2.5.3 Subnet Mask

The Subnet Mask defines which part of the In-Sight 4000 sensor's IP address refers to the network and which part refers to the host.

NOTE When DHCP is enabled, this field is grayed out and displays the value assigned by the DHCP server.

The network part of the IP address is the same for all hosts on the same subnet, and the remainder is unique to each host. As shown in Table 2-2, a Subnet Mask of 255.255.255.0 (a class C mask) identifies 24 bits for the network portion and 8 bits for the host portion.

Table 2-2: Subnet Mask Formats

MASK	CLASS	DESCRIPTION
255.0.0.0	A	8 network/24 host
255.255.0.0	B	16 network/16 host
255.255.255.0	C	24 network/8 host

Most users will not need to change the default Subnet Mask setting of 255.255.255.0.

2.5.4 Default Gateway

The Default Gateway specifies the IP address of the gateway host, if available on the network.

NOTE The Default Gateway setting will be grayed out when the Use DHCP Server checkbox is enabled. The value shown is the gateway assigned by the DHCP server.

The gateway host is responsible for sending and receiving data between hosts on different networks, routing data packets from a device on the local subnet to a device on another subnet.

For example, if a 4000 sensor will need to communicate with a remote host on a different subnet, enter the address of the gateway device in the Default Gateway field. However, if the sensor will need to communicate only with devices on the local subnet, do not enter an address for the Default Gateway (leave the field all zeros).

2.5.5 DNS Server

The DNS Server specifies the IP address of the host on the network providing DNS resolution, if available.

NOTE The DNS Server setting will be grayed out when the Use DHCP Server checkbox is enabled. The value shown is the DNS Server assigned by the DHCP server.

A Domain name (i.e., yourcorp.com) is an alias for an IP address (i.e., 192.168.0.0). A DNS (Domain Name Server) maintains the data on corresponding domain names and IP addresses. The DNS Server setting determines which host is contacted (by IP address) in response to a given Domain Name.

2.5.6 Host Name

The Host Name assigns a name, or “alias” for the In-Sight 4000 as it will appear when browsing the network using the In-Sight PC Host.

Each In-Sight 4000 has its host name set automatically the first time it boots. The format is “is4kxxxxx”, where “xxxxxx” consists of the last 24 bits of the In-Sight 4000’s unique MAC address. For example, an In-Sight 4000 with a MAC address 00-d0-24-01-02-03 will be assigned the host name “is4k010203”.

NOTE The Host Name setting is not automatically assigned by the DHCP server (if used) or referenced through the DNS server. If the Use DHCP Server checkbox is enabled and the DHCP server supplies the Host Name, it is ignored in favor of the default host name or the name entered by the user.

2.5.7 Domain

The Domain specifies the In-Sight 4000’s Fully Qualified Domain Name (FQDN) for the network on which it is installed.

NOTE When the Use DHCP Server check box is enabled, this field is grayed out and displays the value assigned by the DHCP server.

An In-Sight 4000 sensor must have a FQDN to be accessible from a remote host that is not part of the local network. The Domain setting sets the string that is appended to the host name to make a FQDN.

For example, setting Domain to **yourcorp.com** yields the following results:

- If a host name is system1, the FQDN for lookup is system1.yourcorp.com.
- If a host name is **system1.yourcorp.com.** (note the period at the end), the FQDN for lookup is **system1.yourcorp.com.**

Appending the period to the end of the host name prevents redundancy in appending the Domain name to the FQDN. For example, if the period is omitted, **system1.yourcorp.com** would become **system1.yourcorp.com.yourcorp.com.**

2.5.8 FTP Settings and Host Table

The FTP Settings button opens the FTP Settings dialog to configure the File Transfer Protocol (FTP). The Host Table button opens the Host Table dialog to specify a local mapping of host names to IP addresses. Neither FTP Settings nor Host Table settings are required for installing the In-Sight 4000 to a network.

3 Specifications

In this section...

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3.1 General Specifications

Table 3-1: In-Sight 4000/4001 General Specifications

SPECIFICATION		4000	4001
Firmware		In-Sight version 2.30 and later.	
Memory	Job/Program	8MB non-volatile flash memory; Unlimited storage via remote network device.	
	Image/Processing	16MB SDRAM	
Image	Sensor	1/3-inch CCD (5.84 x 4.94 mm, 6 mm diagonal)	1/3-inch CCD (5.80 x 4.92 mm, 6 mm diagonal)
		640 x 480 pixel display (307,200 sq. pixels, 7.4 x 7.4 μm)	1024 x 768 pixel display (786,432 sq. pixels, 4.65 x 4.65 μm)
		Electronic shutter speed: .025ms to 1000ms	Electronic shutter speed: .04ms to 1000ms
	Acquisition	Rapid reset, progressive scan (supports partial scan), full-frame integration.	
		256 gray levels (8 bits/sec)	
		Gain controlled by software.	
		Up to 38 frames per second	Up to 18 frames per second
Lens Type		C-mount	
I/O*	Trigger	1 opto-isolated, acquisition trigger input.	
		Remote software commands via Ethernet and RS232.	
	Discrete Inputs	None built-in.	
		8 inputs available using optional I/O Expansion Module (P/N 800-5758-1). Unlimited inputs using optional Ethernet I/O Module (P/N CIO-ENET-IN4).	
	Discrete Outputs	2 built-in, high-speed outputs	
		8 additional outputs available using optional I/O Expansion Module (P/N 800-5758-1). Unlimited outputs using optional Ethernet I/O Module (P/N CIO-ENET-OUT4).	
Status LEDs		2 configurable (1 green, 1 red)	
Communications	Network	1 Ethernet port, 10/100 BaseT, TCP/IP protocol. Supports DHCP (factory default) or static IP address. Manual reset switch disable DHCP and forces factory-assigned, static IP address.	
	Serial	1 RS-232C port (1200 to 115,200 baud rates)	
Power		24 ± 10% VDC, 200mA, 4.8W supply	
Mechanical	Material	Painted aluminum housing	
	Mounting	One ¼-20 and two M6 threaded holes	
	Dimensions	118.60 mm (4.66 in) x 43.18 mm (1.70 in) x 46.7 mm (1.84 in)	
	Weight	275.0 g (9.7 oz)	
Environmental	Temperature	10 to 45°C (Operating), -10 to 65°C (Storage)	
	Humidity	10 to 90%, non-condensing (Operating and Storage)	
Certifications		CE, CUL	

* See Section 3.2: Detailed I/O Specifications for more information.

Table 3-2: In-Sight 4100 General Specifications

SPECIFICATION		4100		
Firmware		In-Sight version 2.30 and later		
Memory	Job/Program	8MB non-volatile flash memory; Unlimited storage via remote network device		
	Image/Processing	16MB SDRAM		
Image	Sensor	1/3-inch CCD (5.84 x 4.94 mm, 6 mm diagonal)		
		640 x 480 pixel display (307,200 sq. pixels, 7.4 x 7.4 μm)		
		Electronic shutter speed: .025ms to 1000 ms		
	Acquisition	Rapid reset, progressive scan (supports partial scan), full-frame integration		
		256 gray levels (8 bits/sec)		
		Gain controlled by software		
Lens Type	Up to 38 frames per second			
Lens Type	CS-mount and C-mount (with 5mm extension, included)			
I/O*	Trigger	1 opto-isolated, acquisition trigger input.		
		Remote software commands via Ethernet and RS232.		
	Discrete Inputs	None built-in.		
		8 inputs available using optional I/O Expansion Module (P/N800-5758-1). Unlimited inputs using optional Ethernet I/O Module (P/N CIO-ENET-IN4).		
	Discrete Outputs	2 built-in, high-speed outputs		
8 additional outputs available using optional I/O Expansion Module (P/N 800-5758-1). Unlimited outputs using optional Ethernet I/O Module (P/N CIO-ENET-OUT4).				
Status LEDs	2 configurable (1 green, 1 red)			
Communications	Network	1 Ethernet port, 10/100 BaseT, TCP/IP protocol. Supports DHCP (factory default) or static IP address. Manual reset switch disables DHCP and forces factory-assigned, static IP address.		
	Serial	1 RS-232C port (1200 to 115,200 baud rates)		
Power	24 ± 10% VDC, 250mA, 6W supply			
Mechanical		Processor	Remote Head	
	Housing	Painted aluminum	Black anodized aluminum or Stainless steel (optional)	
	Mounting	One ¼-20 & two M6 threaded holes	Two M4 threaded holes	
	Dimensions	118.60 mm (4.66 in) x 43.18 mm (1.70 in) x 46.7 mm (1.84 in)	39.1 mm (1.54 in) x 30.00 mm (1.18 in) dia.	
			5 m (16.4 ft) cable, attached	
Weight	266.0 g (9.4 oz)	45.4 g (1.6 oz) without lens or cable		
Environmental	Temperature (Operating)	10 to 45°C	10 to 50°C	
	Temperature (Storage)	-10 to 65°C		
	Humidity	10 to 90%, non-condensing (Operating and Storage)		
Certifications	CE, CUL			

* See Section 3.2: Detailed I/O Specifications for more information.

Table 3-3: In-Sight 4100 Remote Head Enclosure Specifications

SPECIFICATION	DESCRIPTION
Material	Black anodized aluminum housing with glass window. Stainless steel housing with polycarbonate window (optional)
Dimensions	Without camera: 65.2 mm (2.57 in) high x 46.0 mm (1.81) diameter Nominal height with camera: 76.8 mm (3.03 in) to 93.0 mm (3.66 in)
Weight	136.1 g (4.8 oz), without camera
Protection	Sealed against dust and liquids to IP67 rating (NEMA 6 equivalent).

3.2 Detailed I/O Specifications

The In-Sight 4000 features one built-in acquisition trigger input and two configurable discrete outputs for general-purpose use.

The number of I/O lines may be increased using the optional I/O Expansion Module, which provides 8 additional discrete inputs and outputs.

3.2.1 Breakout Port Pin Assignments

Table 3-4 lists the pin assignment for each of the 8 signal lines of the In-Sight 4000 Breakout Port (labeled “24VDC”) according to each method of access.

Table 3-4: Breakout Port Pin Assignments

IN-SIGHT BREAKOUT PORT PIN	SIGNAL	BREAKOUT CABLE WIRE COLOR	BREAKOUT MODULE* TERMINALS	EXPANSION MODULE* TERMINALS
1	+24 VDC	White-Green	6, 8, 10, 12, 14, 15, 16 (+24V)	+24V
2	Trigger +	Green	5 (TRG+)	TRG+
3	Trigger –	White-Orange	4 (TRG-)	TRG-
4	Output 0	Blue	7 (OUT0)	HSOUT0
5	Output 1	White-Blue	9 (OUT1)	HSOUT1
6	Serial Receive	Orange	RS232 serial (9-pin D-sub connector)	RS232 remote (9-pin D-sub connector)
7	Serial Transmit	White-Brown	RS232 serial (9-pin D-sub connector)	RS232 remote (9-pin D-sub connector)
8	Ground	Brown	1, 2, 3 (GND)	GND

* Refer to the *In-Sight Breakout Module Installation and Reference* (P/N 597-0008-xx) and the *In-Sight I/O Expansion Module Installation and Reference* (P/N 597-0013-xx) for more detailed information.

3.2.2 Acquisition Trigger Input

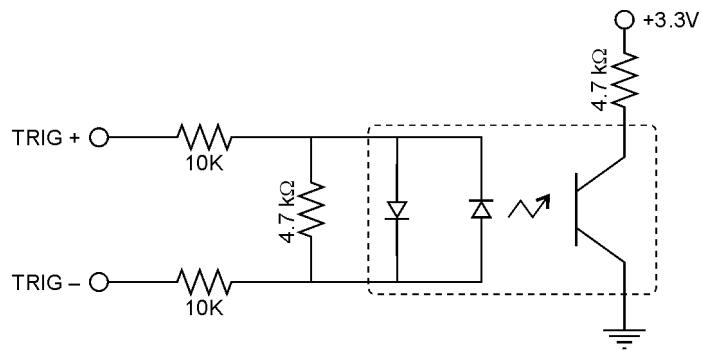
Table 3-5: Acquisition Trigger Input Specifications

SPECIFICATION	DESCRIPTION
Voltage	ON 20 to 28V (24V nominal)
	OFF 0 to 3V (12V nominal threshold)
Current	ON 0.9 to 1.3mA
	OFF <150µA
	Resistance ~22,000 Ohms
	For higher current add external resistor (for example, 2.2kΩ, 0.5W for 12mA) across inputs.
Delay	250 µSec latency between leading edge of trigger and start of acquisition. Input pulse should be minimum of 1 ms wide.

The acquisition trigger input on the 4000 is opto-isolated. To trigger from an NPN (pull-down) type photo-detector or PLC output, connect pin 2 (TRG+) to +24V and connect pin 3 (TRG-) to the output of the detector. When the output turns ON, it pulls TRG- down to 0V, turning the opto-coupler ON.

To trigger from a PNP (pull-up) photo-detector or PLC output, connect pin 2 (TRG+) to the output of the detector 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 In-Sight 4000 with the Breakout Cable, the polarity of the input trigger (pins 2 and 3) is not critical. However, when using the optional Breakout or I/O Expansion Modules, the polarity of the TRG+ and TRG- terminals should be observed.



28V MAXIMUM ACROSS INPUT PINS — TRANSITION APPROXIMATELY 12V (MIN).

Figure 3-1: Acquisition Trigger Input Schematic

3.2.3 Discrete Outputs

Table 3-6: Discrete Output Specifications

SPECIFICATION	DESCRIPTION
Voltage	28V maximum through external load.
Current	200mA maximum sink current.
	OFF state leakage current 200µA maximum
	External load resistance 120 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.

Both of the built-in discrete outputs (pins 4 and 5) on the In-Sight 4000 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 0V when ON, which causes current to flow through the load. When the outputs are OFF, no current flows through the load.

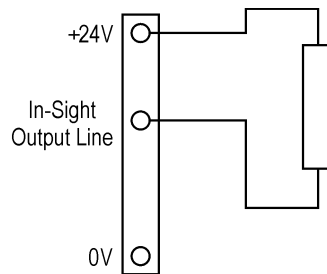


Figure 3-2: Discrete Output Connection Example 1

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.

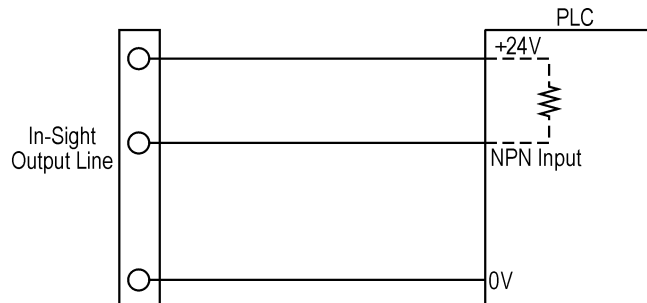


Figure 3-3: Discrete Output Connection Example 2

To connect Output 0 or Output 1 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.

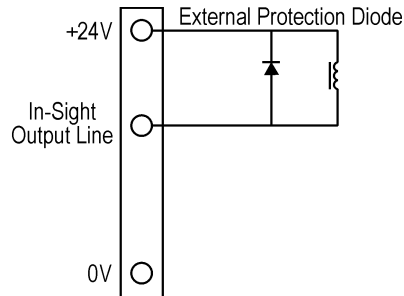


Figure 3-4: Discrete Output Connection Example 3

In-Sight 4000 outputs can also be used with PNP-compatible PLC input if a pull-up resistor (for example, 2.2kΩ 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 In-Sight output is OFF, and vice-versa. Use an external NPN to PNP converter when this inversion is not desired.

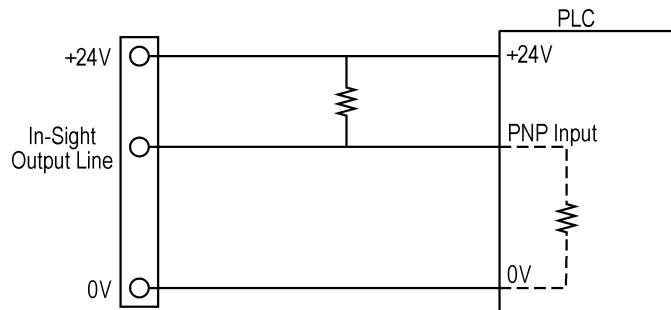


Figure 3-5: Discrete Output Connection Example 4

3.3 CAT5 Network Cable Specifications

Cognex-supplied network patch cables meet CAT5/CAT5e specifications using 568-B standard wire pairing.

Table 3-7: CAT5/CAT5e Network Cable Wiring

STRAIGHT-PINNED		CROSSOVER	
RJ-45 Connector (A)	RJ-45 Connector (B)	Connector (A)	Connector (B)
1	1	1	3
2	2	2	6
3	3	3	1
4	4	4	5
5	5	5	4
6	6	6	2
7	7	7	8
8	8	8	7

Table 3-8: CAT5/CAT5e Network Cable 568-B Wire Pairs

PAIR #	WIRE PAIRS
1	4 – 5
2	1 – 2
3	3 – 6
4	7 – 8

3.4 Mechanical Specifications

The following sections present dimensional drawings for the In-Sight 4000 series vision sensors.

NOTE All dimensions are shown in millimeters (inches).

3.4.1 In-Sight 4000/4001 Dimensions

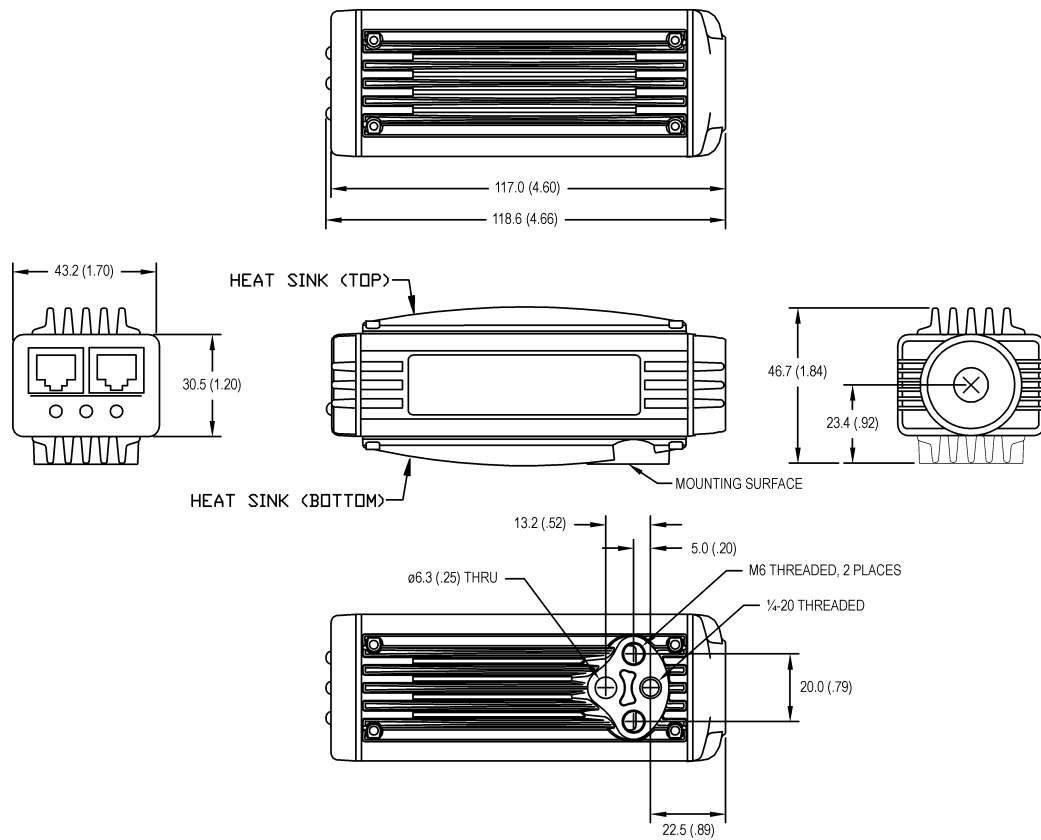


Figure 3-6: Dimensions, In-Sight 4000/4001

3.4.2 In-Sight 4100 Dimensions

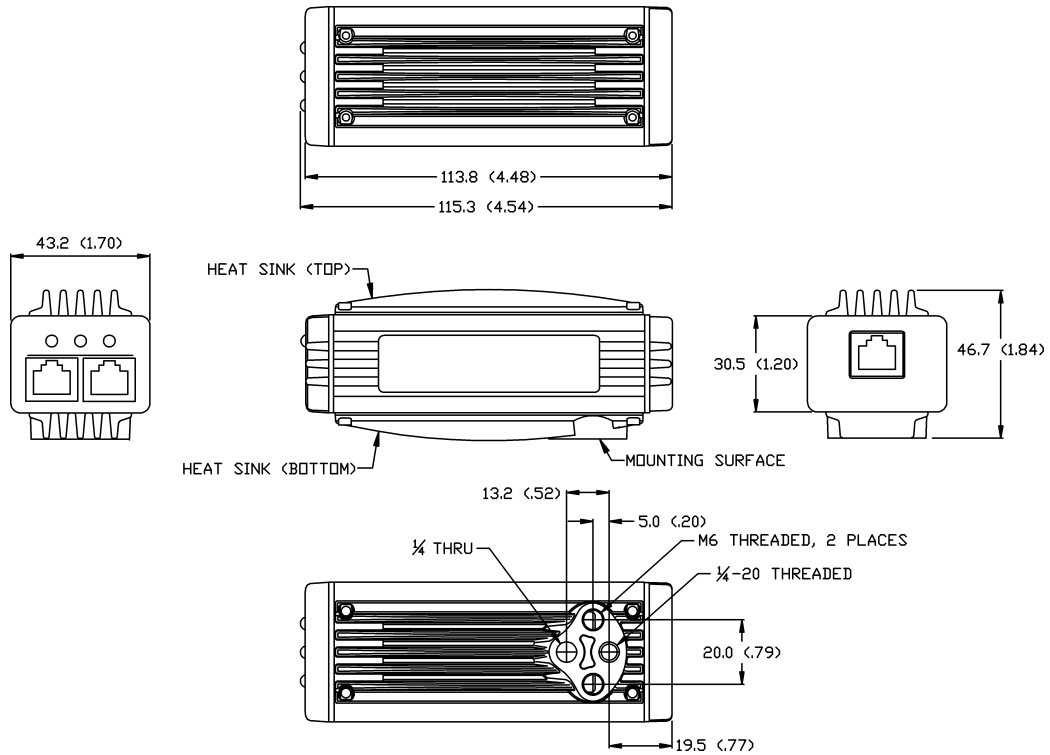


Figure 3-7: Dimensions, In-Sight 4100 Processor

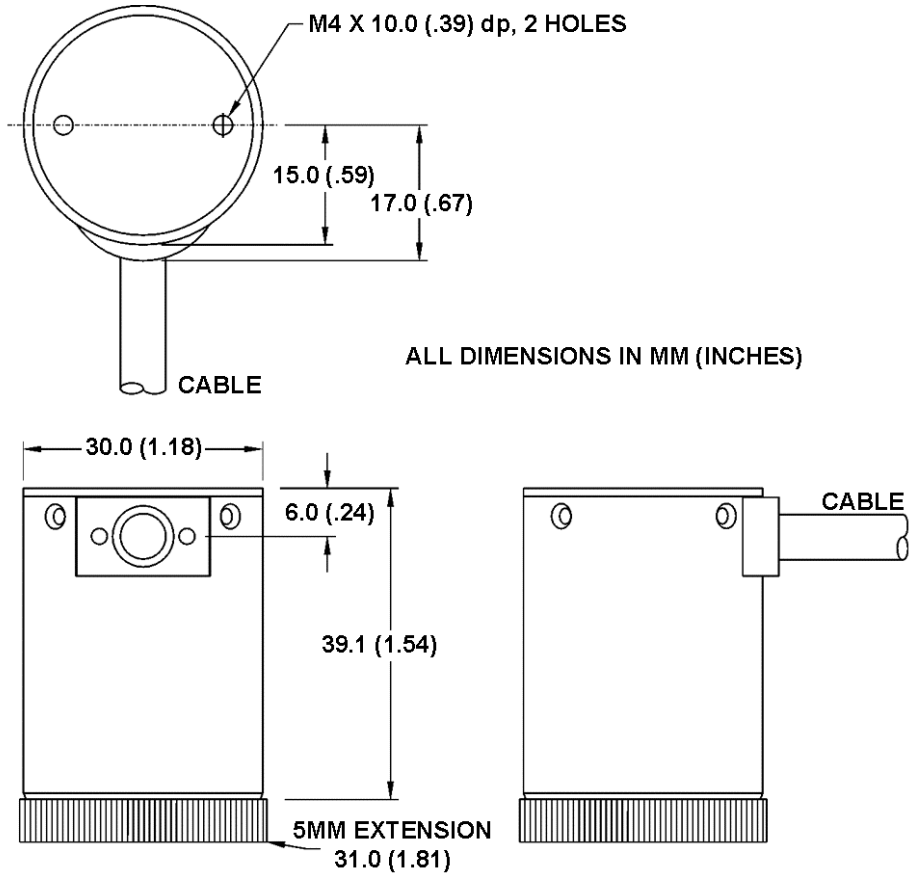


Figure 3-8: Dimensions, In-Sight 4100 Remote Head Camera

Section 3 - Specifications

Installing In-Sight™ 4000 Series Vision Sensors

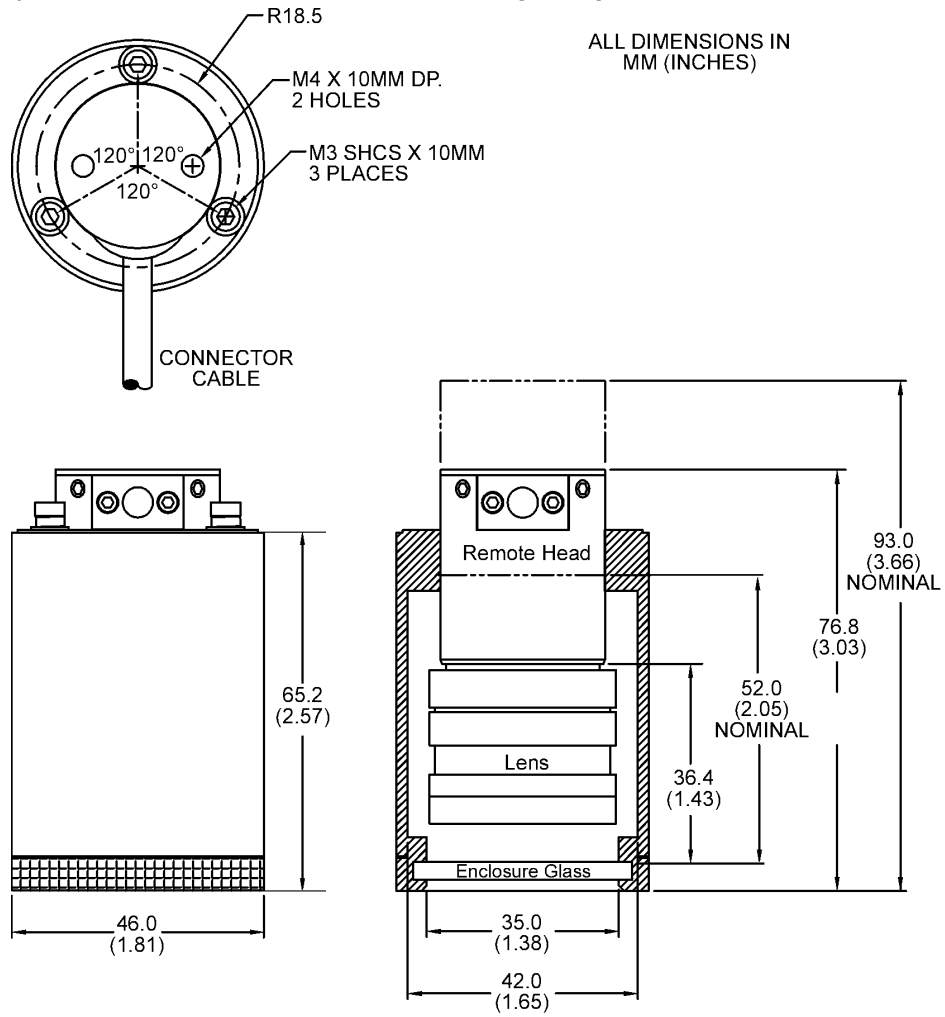


Figure 3-9: Dimensions, In-Sight 4100 Remote Head Camera with Enclosure

Appendix A

Configuring Microsoft Windows Network Settings

This section provides information on how to configure Microsoft Windows network settings in order to connect to an In-Sight 4000 using the In-Sight PC Host program. The steps listed below and the example dialogs are specific to Windows NT 4.0. The exact steps required may vary slightly in Windows XP, 2000, Me, and 98SE.

To configure Windows network settings:

- 1 Verify the PC has a TCP/IP protocol installed.
- 2 Close all programs on the PC except Windows NT.
- 3 Click **Start**, click **Settings**, and then click on the **Control Panel** shortcut to open the Control Panel icon group.
- 4 Click the **Network** icon to open the Network dialog.
- 5 Select the **Protocols** tab (Figure A-1). If TCP/IP Protocol appears in this list, skip steps 6 and 7.
- 6 If TCP/IP is not on the list of installed protocols, click **Add** to open the Select Network Protocol dialog (Figure A-2).
- 7 Select TCP/IP and click **OK**. Windows NT will install the protocol and return to the Network dialog.

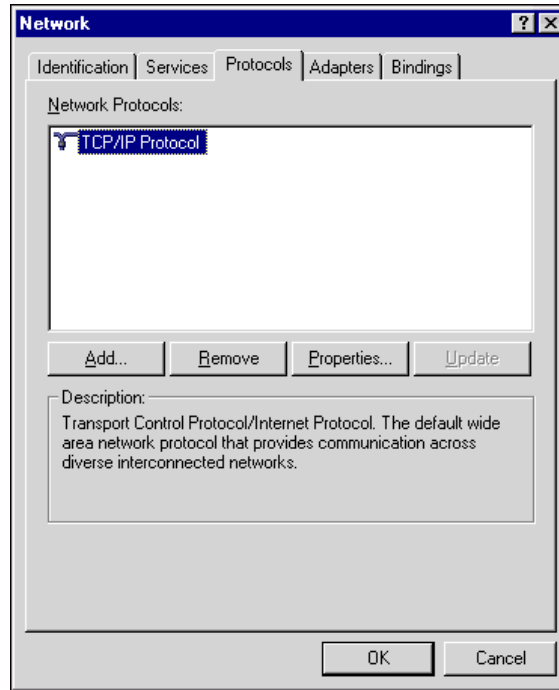


Figure A-1: Windows Network dialog, Protocols tab

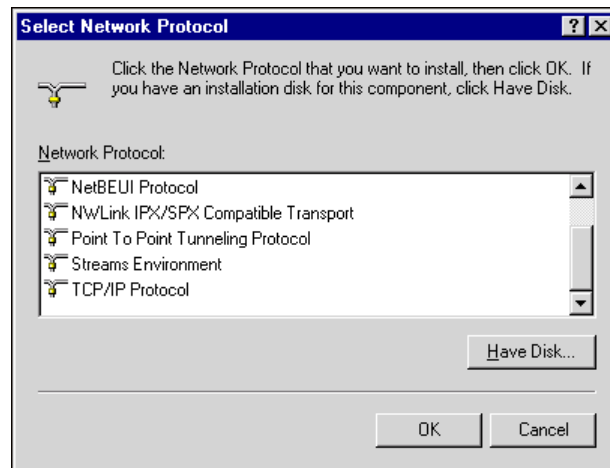


Figure A-2: Select Network Protocol dialog

- 8 Configure the IP Address and Subnet Mask.
- 9 Highlight **TCP/IP Protocol** in the Protocols tab and click **Properties** to open the Microsoft TCP/IP Properties dialog (Figure A-3):

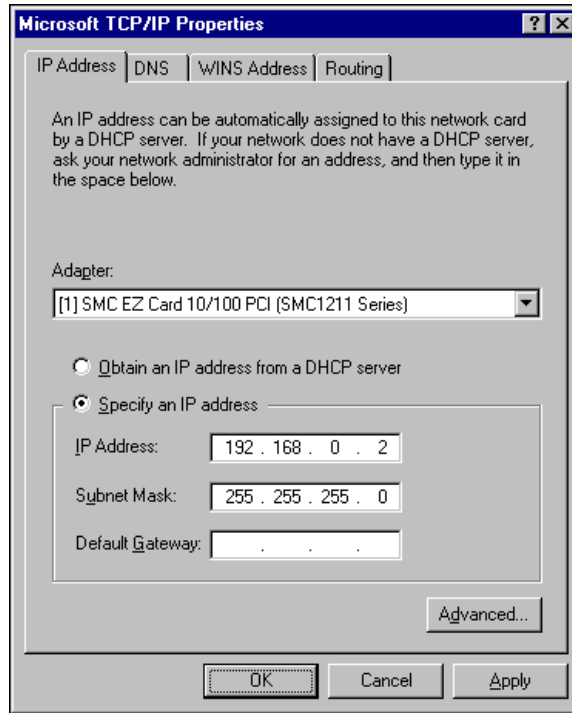


Figure A-3: Microsoft TCP/IP Properties Dialog

- 10 Click the **Specify an IP address** radio button. The IP Address and Subnet Mask fields, which are grayed-out when DHCP is enabled, become active.
- 11 Enter an appropriate Subnet Mask. The Subnet Mask defines which part of the In-Sight 4000's IP Address refers to the network and which part refers to the host. The network part of the IP address is the same for all hosts on the same subnet, and the remainder is unique to each host. The default Subnet Mask setting of 255.255.255.0 is usually appropriate.
- 12 Click **OK** twice, then restart Windows if prompted to do so.

Appendix B

Using the IP Address Switch

All In-Sight 4000 series sensors feature a manual switch that can be used to change IP address settings to a known state when performing one of the following actions:

- Using Native Mode commands to change network settings on a non-DHCP network (or serial port) when an In-Sight PC Host is unavailable;
- Troubleshooting network connection problems.

The IP Address switch has two modes of operation:

Force DHCP

Force DHCP mode enables the **Use DHCP Server** checkbox (see Section 2.5.1: Use DHCP Server on page 21), overriding the sensor's current Static IP address and allowing a DHCP server to automatically assign the In-Sight sensor a network IP address and Subnet Mask. If the **Use DHCP Server** checkbox is already enabled, no changes to the IP address will occur. The sensor's Serial Port 1 **Mode** setting is also changed to 'Native' to allow Network settings to be configured from a remote RS232 device.

To force DHCP mode, insert the end of a paper clip into the sensor's IP Address switch. Depress the switch once and remove the paper clip. When all three LEDs have stopped blinking, the sensor has been restarted. These settings will remain in effect even after the sensor is powered down.

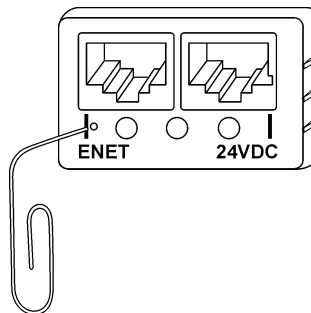


Figure B-1: IP Address Switch Operation

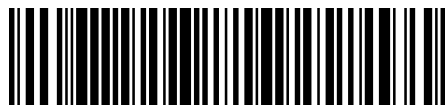
Force Static IP

Force Static IP mode disables the **Use DHCP Server** checkbox. If a static IP address and Subnet Mask were previously assigned to the In-Sight system, those settings will be used, otherwise, the factory default static IP Address (192.168.0.1) and Subnet Mask (255.255.255.0) will be used. If the **Use DHCP Server** checkbox is already disabled, no changes to the IP address will occur. Like force DHCP mode, force static IP mode changes the sensor's Serial Port 1 **Mode** setting to 'Native' to allow Network settings to be configured from an RS232 device.

To Force Static IP mode, insert the end of a paper clip into the sensor's reset switch. Depress the switch for at least five seconds, then remove the paper clip. When all three LEDs have stopped blinking, the sensor has been restarted. These settings will remain in effect even after the sensor is powered down.

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