

# Cognex MVS-8000 Series

## MVS-8100D and CDC Cameras Hardware Manual

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# Contents

■ <b>Preface</b> .....	5
Style Conventions Used in This Manual .....	6
Cognex Offices .....	7
■ <b>Chapter 1: Installing the MVS-8100D</b> .....	9
Host PC Requirements .....	9
MVS-8100D Models .....	9
Installing the MVS-8100D .....	10
Connection Overview .....	10
Connecting Cognex CDC Series Cameras .....	11
Connecting a Single Camera .....	12
Connecting Two or Three Cameras .....	13
Selecting Camera Lenses .....	13
Avoid Internal Dust or Contamination .....	14
Connecting Triggers and Strobes .....	14
Connecting Parallel I/O Devices .....	15
Connecting TTL Devices .....	16
Connecting Opto-Isolated Devices .....	19
■ <b>Chapter 2: MVS-8100D Hardware Description</b> .....	25
Mechanical Specifications .....	26
Model Differences .....	27
Environmental Requirements .....	27
Electrical Specifications .....	28
Power Requirements .....	28
Fuses .....	28
Standards Compliance .....	28
International .....	29
European Community .....	29
Indicator LEDs .....	30
Camera Connector and Cables .....	30
Hardware Triggers and Strobes .....	32
Parallel I/O Connector .....	32
Pinout of Parallel I/O Connector .....	33
Cable 300-0358 .....	35
Cable 300-0359 .....	36
External I/O Module .....	37
Layout .....	38
Wiring Methods .....	39
Mechanical and Electrical Specifications .....	39
LED Numbering .....	40



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External I/O Module Adds Conversion Delay .....	41
External I/O Module Circuit Logic .....	41
<b>Chapter 3: Cognex CDC Series Camera Description .....</b>	<b>43</b>
CDC Series Camera Overview .....	44
CDC Series Camera Features .....	44
Global and Rolling Shutters .....	44
An Introduction to CogLink .....	45
Performance Factors .....	45
Serialized Data Stream .....	46
Addressable Camera Channels .....	46
Camera Usage Notes .....	46
Darker Initial Images .....	47
Image Shading Gradient: CDC-50 Only .....	47
CDC Series Camera Specifications .....	49
CDC Series Common Specifications .....	52
CDC Series Camera Models .....	53
Hardware Trigger and Strobe Connections .....	54
Trigger Input Features .....	55
Simultaneous Image Acquisition .....	56
Trigger Delay Added by Opto-Isolation .....	56
Strobe Output Features .....	56
Strobe Wiring Options .....	57
<b>Index .....</b>	<b>59</b>

# Preface

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This manual describes the Cognex CDC series video cameras and the MVS-8100D frame grabber that supports those cameras. This manual the following chapters:

Chapter 1, *Installing the MVS-8100D*, describes how you configure and install the MVS-8100D frame grabber.

Chapter 2, *MVS-8100D Hardware Description*, describes the Cognex MVS-8100D in detail, including environmental and power requirements, and mechanical and electrical specifications. This chapter also describes the electrical interface to the Cognex MVS-8100D.

Chapter 3, *Cognex CDC Series Camera Description*, describes the family of Cognex CMOS-based digital cameras.

Throughout this manual and in Cognex software documentation, the name of the MVS-8100D frame grabber may be abbreviated to 8100D.

# Style Conventions Used in This Manual

This manual uses the following style conventions:

<b>boldface</b>	Used for programming keywords, function names, class names, structures, enumerations, types, and macros. Also used for user interface elements such as button names, dialog box names, and menu choices.
<i>italic</i>	Used for names of variables, data members, arguments, enumerations, constants, program names, file names. Used for names of books, chapters, and sections. Occasionally used for emphasis.
<code>courier</code>	Used for programming code examples and for examples of program output.
<b>bold courier</b>	Used in illustrations of command sessions to show the commands that you would type.
< <i>italic</i> >	When enclosed in angle brackets, used to indicate keyboard keys such as <Tab> or <Enter>.



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# Cognex Offices

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# Installing the MVS-8100D

# 1

This chapter describes how to install an MVS-8100D into your PC, how you connect one or more Cognex CDC series camera to the MVS-8100D, and how you connect peripheral equipment such as triggers, strobes, or other I/O devices.

## Host PC Requirements

To install the MVS-8100D, the host PC should meet the following minimum requirements:

- The motherboard's chip set must be fully compliant with the PCI 2.1 specifications or later. Motherboards with Intel chip sets that support Intel Pentium MMX, Celeron, Pentium II, Pentium III, Pentium 4, and Xeon CPUs are known to be compliant. Motherboards with VIA chip sets that support the AMD K6-2 and Athlon CPUs are known to be compliant.
- One available short length PCI slot for the MVS-8100D.
- A CD-ROM drive (or access to one over a network) to install the Cognex software.

Additional requirements may be imposed by your Cognex software package. Check the Cognex software's release notes for the software's requirements, if any, on:

- Minimum recommended CPU speed
- Host operating system, including the supported service pack release level
- Supported video cards
- Desktop color depth (the number of colors displayable)
- Desktop size (the number of pixels displayable in width and height on your screen)
- The presence of a mouse or other pointing device

## MVS-8100D Models

There are three models of the MVS-8100D, as shown in Table 1.

<b>Model</b>	<b>Camera channels</b>
MVS-8100D1	1
MVS-8100D2	2
MVS-8100D3	3

*Table 1. MVS-8100D models*

Identify your MVS-8100D model as described in *Model Differences* on page 27.

# Installing the MVS-8100D

**Caution**      *Electrostatic discharge (ESD) can damage the electronic components of your Cognex hardware.*

To install the MVS-8100D frame grabber, follow these steps:

1. Wear a grounded, static-dissipating wrist strap for ESD protection.
2. Turn off the PC and remove its cover.
3. Select a PCI slot for the MVS-8100D. Remove the slot cover and store it for future use.
4. Press the MVS-8100D into its slot until it is seated firmly.
5. Replace the faceplate screw.

**Note**      Do not skip step 5. The MVS-8100D must be grounded to the PC's chassis through the faceplate screw. This is because each CDC series camera is grounded through its connecting cable to the faceplate. Improperly grounded cameras can produce intermittent video errors.

6. Replace your PC's cover.

**Caution**      *Do not power on the PC until you have connected cameras and any parallel I/O devices to the MVS-8100D.*

## Connection Overview

The figures in this section illustrate the connection options for the MVS-8100D models.

Figure 1 shows the connection options for the single-channel MVS-8100D1. (This option also works on multichannel MVS-8100D's.) Parallel I/O connection options are discussed in *Connecting Parallel I/O Devices* on page 15.

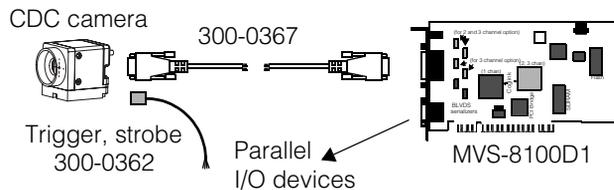


Figure 1. MVS-8100D1 connection options

Figure 2 shows the connection options for the two-channel MVS-8100D2. (This option also works on the three-channel MVS-8100D3.) Parallel I/O connection options are discussed in *Connecting Parallel I/O Devices* on page 15.

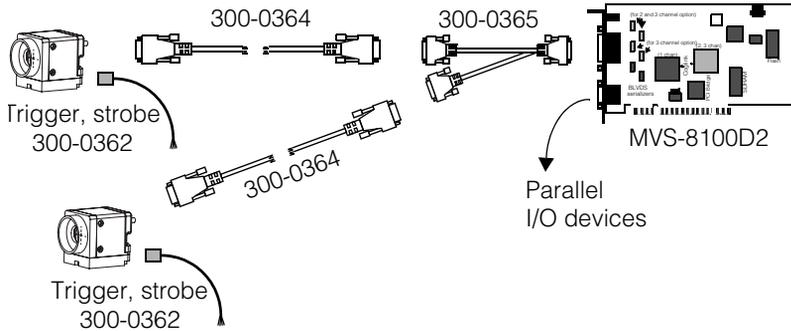


Figure 2. MVS-8100D2 connection options

Figure 3 shows the connection options for the three-channel MVS-8100D3. Parallel I/O connection options are discussed in *Connecting Parallel I/O Devices* on page 15.

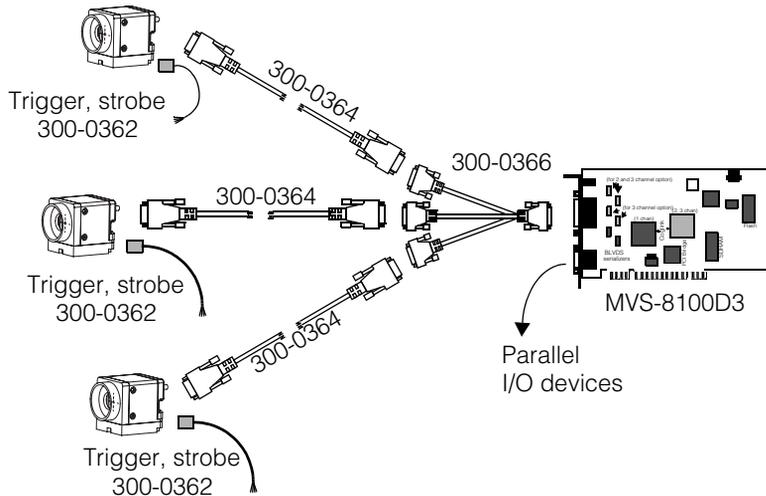


Figure 3. MVS-8100D3 connection options

## Connecting Cognex CDC Series Cameras

Cognex CDC series cameras connect to the MVS-8100D using the cable or combination of cables shown in Table 2 on page 12. The cables in the grey boxes of this table give you the maximum flexibility for each MVS-8100D model.

**Caution** *Cameras must be connected to the MVS-8100D using the Cognex camera cables shown in Table 2. Using non-Cognex camera cables could damage your MVS-8100D, your camera, or both. The use of non-Cognex camera cables may void your Cognex warranty, as listed on your sales agreement.*

Note that it is the circuitry on the different MVS-8100D models that allows for more than one camera, not the cable. For example, attaching a three-camera cable to the single channel model MVS-8100D1 does not support three camera channels on that model.

	1 camera	2 cameras	3 cameras
<b>MVS-8100D1</b>	300-0367 direct to camera	N/A	N/A
<b>MVS-8100D2</b>	300-0367	One 300-0365 Y-cable plus two 300-0364 cables	N/A
<b>MVS-8100D3</b>	300-0367	One 300-0365 Y-cable plus two 300-0364 cables	One 300-0366 breakout cable plus three 300-0364 cables

Table 2. CDC series camera cable combinations

**Caution** *The MVS-8100D does not support hot plugging of cameras or I/O devices. Before you attach cameras or I/O devices, be sure the PC's power is fully off. Attaching equipment to the MVS-8100D while it is powered on can result in electrical damage.*

## Connecting a Single Camera

To attach a camera with the single-camera cable, P/N 300-0367, follow these steps:

1. Make sure the host PC's power is off.
2. Wear a grounded, static-dissipating wrist strap for ESD protection.
3. Connect the cable's DB-26M connector to the MVS-8100D's DB-26F camera port.
4. Connect the cable's micro DB-9 connector to the CDC series camera.
5. If you plan to use hardware triggering and/or strobing, connect your trigger and/or strobe device to the camera while the PC's power is still off.
6. After power is restored to the PC, and the MVS-8100D's device driver loads, look on the faceplate of the MVS-8100D and make sure the link-success LED has illuminated for camera channel zero. See Figure 11 on page 30 to locate the correct LED.

## Connecting Two or Three Cameras

To attach cameras with one of the two breakout cables, follow the steps in this section. The camera breakout cables, Cognex part numbers 300-0365 and 300-0366, are described in Table 2 on page 12.

1. Make sure the host PC's power is off.
2. Wear a grounded, static-dissipating wrist strap for ESD protection.
3. Select the appropriate breakout cable to support two or three cameras, as described in Table 2 on page 12.
4. Connect the DB-26M connector on the breakout cable to the MVS-8100D's DB-26F camera port.
5. Connect the DB-9 end of a 300-0364 cable to one of the branches of the breakout cable. Do the same for all branches of your breakout cable.
6. Connect the micro DB-9 end of each 300-0364 cable to a CDC series camera.
7. If you plan to use hardware triggering and/or strobing, connect your trigger and/or strobe devices to the cameras while the PC's power is still off.
8. After power is restored to the PC, and the MVS-8100D's device driver loads, look on the faceplate of the MVS-8100D and make sure the link-success LED has illuminated for each camera channel you connected. See Figure 11 on page 30 to locate the correct LEDs.

## Selecting Camera Lenses

The CDC-50 camera accepts standard CS-mount lenses, or C-mount lenses with the CS-to-C-mount adapter. The CDC-100 camera will normally use the CS-to-C-mount adapter, and accepts standard C-mount lenses. (The CDC-100 camera can be used with CS-mount lenses without the adapter, but lenses that match this sensor size are almost never CS-mount.)

For the CDC-50, lenses designed for 1/3" or 1/2" CCD sizes will work best.

In the CDC-100, the sensor size is 23% larger than standard 1/2" sensors, so the best results will be obtained with lenses designed for 2/3" or 1" CCD sizes. In applications where the region of interest does not extend to the corners of the image, you may obtain acceptable results with lenses designed for 1/2" CCD sizes.

For the CDC-200, lenses designed for 2/3" CCD sizes will work best.

## Avoid Internal Dust or Contamination

The CDC camera is shipped with an end cap over the lens mount to keep the glass free of contaminants. Use care when mounting a lens. Ensure that the area in which you are mounting the lens to the camera is as clean and dust-free as possible to avoid contamination between the glass surface and the lens. When mounting the lens to the camera, place the camera in a horizontal position to limit the number of particles that might settle onto the glass or lens surface.

If the anti-reflective glass surface does become contaminated follow the directions below to ensure the surface is not compromised.

1. Blow away any loose dirt or dust with a bulb brush or a can of compressed air.
2. If debris is still present, use a lint-free lens tissue intended for photographic equipment or a microfiber lens cleaning cloth in a circular motion, followed by the use of compressed air. Never reuse tissues and do not press hard when cleaning.

### **Caution**

*Do not use alcohol-based cleaning solutions, spray water, or cleaning fluids directly onto the glass window, which could allow moisture to enter the CDC camera body and damage the anti-reflective coating on the window.*

## Connecting Triggers and Strobes

Cognex software supports both software-controlled and hardware-controlled triggering of image acquisition and firing of a photo strobe to illuminate the scene under the camera at the moment of acquisition. Consult your software package's documentation to determine whether software or hardware-controlled triggers and strobes are best for your application.

If you will use hardware-controlled triggers and/or strobes, connect your trigger and strobe devices directly to the Cognex CDC series camera, not to the MVS-8100D. The CDC series cameras provide optical isolation for both trigger input circuits and strobe output circuits.

To connect trigger and strobe devices to a Cognex CDC series camera, follow these steps:

1. Make sure the host PC's power is off.
2. Wear a grounded, static-dissipating wrist strap for ESD protection.
3. Cognex cable 300-0362 has four labeled bare wires on one end, and a Molex connector with shield ground wire on the other end.

4. Unscrew the ground screw on the back panel of the CDC camera for one rotation, leaving the screw attached to the camera. Wrap the end of cable 300-0062's shield ground wire around the screw and retighten it.
5. Attach cable 300-0362's 4-pin female Molex connector to the male Molex connector on the back of the CDC series camera. The Molex connector on the cable snaps into place and locks to the camera.
6. The other end of cable 300-0362 terminates in four wires with tinned ends, in two twisted pairs, labeled Strobe +/- and Trigger +/-.
7. Connect the Trigger +/- wires to the positive and negative terminals of your trigger device, respectively.

If your trigger device terminates in bare wires, then twist the camera's Trigger+ wire to the trigger device's plus wire, then cover the joined wires with a wire nut or another insulator. Join the camera's Trigger- wire to the device's minus wire in the same way.

8. Connect the Strobe +/- wires to the positive and negative terminals or wires of your strobe device, respectively.

See *Hardware Trigger and Strobe Connections* on page 54 for more on the requirements of your trigger and strobe devices, and for diagrams of the opto-isolated circuitry of the camera's trigger and strobe connector.

## Connecting Parallel I/O Devices

The MVS-8100D supports the connection of general use I/O devices such as status LEDs, part reject switches, and so on. The MVS-8100D provides 8 or 12 parallel I/O lines that can be controlled by Cognex software. You can use the MVS-8100D's I/O lines as TTL lines, or, when used with the Cognex external I/O module, as opto-isolated lines. Table 3 shows the available I/O lines for the two connection options by model.

<b>MVS-8100D model</b>	<b>TTL I/O lines</b>	<b>Opto-isolated I/O lines (with external I/O module)</b>
<b>MVS-8100D1</b>	8 bidirectional	6 output +/-, 2 input +/-
<b>MVS-8100D2 and MVS-8100D3</b>	12 bidirectional	8 output +/-, 4 input +/-

Table 3. Parallel I/O connection options

Table 4 summarizes the cable and hookup requirements of the two I/O line connection options.

	<b>Cognex cable</b>	<b>Connects to ...</b>	<b>Then to ...</b>
<b>TTL Option</b>	300-0358	I/O devices	
<b>Opto Option</b>	300-0359	External I/O module, P/N 800-5712-3	I/O devices

Table 4. I/O connection option cables and equipment

**Caution**

*The MVS-8100D does not support hot plugging of I/O devices. Before you attach I/O devices, be sure the PC's power is fully off. Attaching equipment to the MVS-8100D while it is powered on can result in electrical damage.*

## Connecting TTL Devices

Figure 4 illustrates the connection of parallel I/O devices to an MVS-8100D using the TTL option.

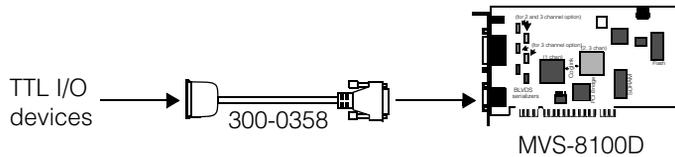


Figure 4. TTL connection option

Eight bidirectional TTL lines are provided on the single channel MVS-8100D1; twelve bidirectional lines are provided on the MVS-8100D2 and MVS-8100D3. Your vision processing application determines with software commands whether a bidirectional line is used for input or output. Each line is independently controlled; any line can be either input or output.

To connect TTL devices to the MVS-8100D, follow these steps:

1. Connect Cognex cable 300-0358 to the HD-15M port on the faceplate of the MVS-8100D.

**Caution**

*The MVS-8100D's parallel I/O port resembles the industry standard VGA connector, but is wired differently. Do not connect a monitor to this port, or you may damage your MVS-8100D, your monitor, or both.*

2. Cable 300-0358 ends in a block of 16 screw terminals. The number of active terminals of the 16 is shown in the following table.

<b>Model</b>	<b>Active bidirectional TTL terminals</b>	<b>TTL Ground terminals</b>	<b>No connect</b>
MVS-8100D1	Pins 1 - 8	Pins 13, 14	Pins 9 - 12, 15, 16
MVS-8100D2 and MVS-8100D3	Pins 1 - 12	Pins 13, 14	Pins 15, 16

*Table 5. Active pins on cable 300-0358*

3. Connect wires from your TTL devices to the signal and ground terminals of cable 300-0358 using the pin numbering in Table 6

Pin	Signal Name on MVS-8100D1	Signal Name on MVS-8100D2 and MVS-8100D3
1	TTL_BI_1	TTL_BI_1
2	TTL_BI_2	TTL_BI_2
3	TTL_BI_3	TTL_BI_3
4	TTL_BI_4	TTL_BI_4
5	TTL_BI_5	TTL_BI_5
6	TTL_BI_6	TTL_BI_6
7	TTL_BI_7	TTL_BI_7
8	TTL_BI_8	TTL_BI_8
9	NC	TTL_BI_9
10	NC	TTL_BI_10
11	NC	TTL_BI_11
12	NC	TTL_BI_12
13	TTL Ground	TTL Ground
14	TTL Ground	TTL Ground
15	NC	NC
16	NC	NC

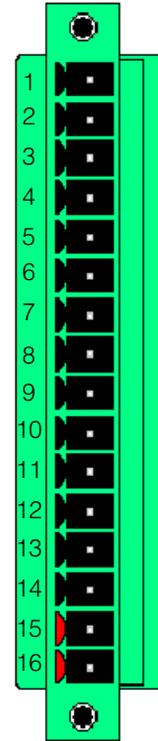


Table 6. Pin numbering of cable 300-0358's 16-pin terminal end

4. Use your Cognex software documentation to map the signal name from Table 6 to the software commands that enable, disable, set the value of, toggle, and set the input/output direction of each line.

**Caution** The 16-pin terminal block at the end of cable 300-0358 resembles the terminal blocks at the end of other Cognex parallel I/O cables for other products. However, the signal name and pin numbering on cable 300-0358 is unique to the MVS-8100D series. Do not connect a terminal block that works on another Cognex product into the terminal end of cable 300-0358, or electrical damage may result.

## Connecting Opto-Isolated Devices

Figure 5 illustrates the connection of parallel I/O devices to an MVS-8100D using the opto-isolated option.

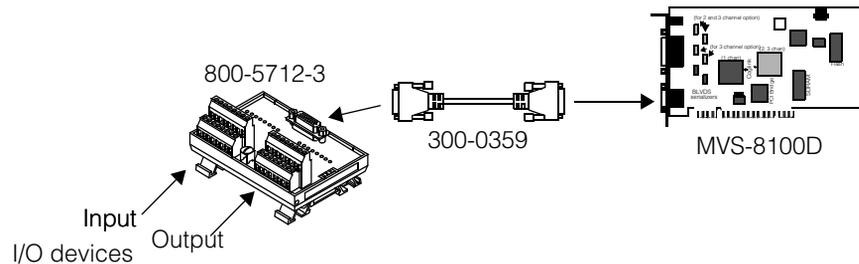


Figure 5. Opto-isolated connection option

For the opto-isolated connection option, use cable 300-0359 to connect your MVS-8100D to the Cognex external I/O module, P/N 800-5712-3. The external I/O module takes the TTL signals from the MVS-8100D and passes them through optical isolation circuitry, splitting each TTL bidirectional line into a plus and minus pair of either input or output lines. You then connect parallel I/O devices to screw terminals on the external I/O module.

The Cognex external I/O module is described in more detail in *External I/O Module* on page 37.

To connect opto-isolated parallel I/O devices to the MVS-8100D, follow these steps:

1. Connect Cognex cable 300-0359 to the HD-15M port on the faceplate of the MVS-8100D.

**Caution** The MVS-8100D's parallel I/O port resembles the industry standard VGA connector, but is wired differently. Do not connect a monitor to this port, or you may damage your MVS-8100D, your monitor, or both.

2. Connect the other end of cable 300-0359 to the HD-26F port labeled "Vision Processor" on the Cognex external I/O module.

- The external I/O module is used with several Cognex product lines. When used with the MVS-8100D, not all its terminal pairs are used. The I/O module has 8 pairs of input lines and 8 pairs of output lines. The number of active terminal pairs for the MVS-8100D is shown in the following table.

Model	Opto-isolated terminal pairs (+/-)	No connect	Illustration
MVS-8100D1	IN0 and IN1 OUT0 through OUT5	IN2 through IN7 OUT6 and OUT7	Figure 6
MVS-8100D2 and MVS-8100D3	IN0 through IN3 OUT0 through OUT7	IN4 through IN7	Figure 7

Table 7. Active terminals on external I/O module

Figure 6 shows the connections to the external I/O module when used with the MVS-8100D1.

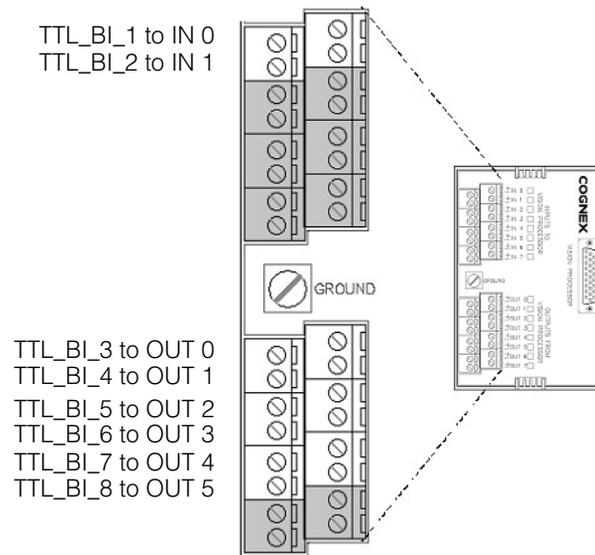


Figure 6. External I/O module connections with MVS-8100D1

Figure 7 shows the connections to the external I/O module when used with the MVS-8100D2 and MVS-8100D3.

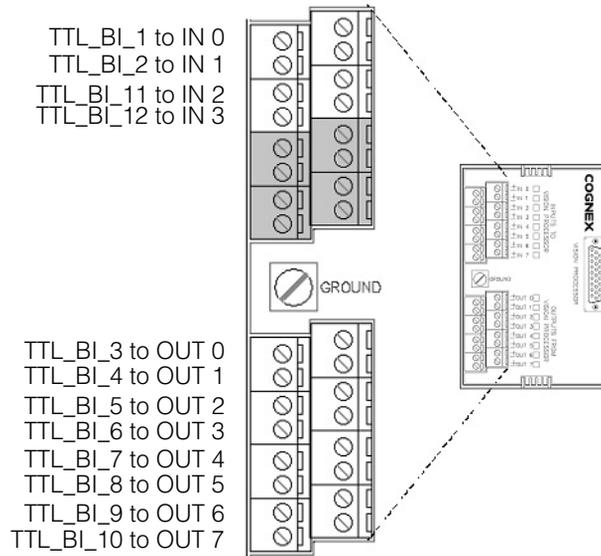


Figure 7. External I/O module connections with MVS-8100D2 and D3

4. Attach the external I/O module to a convenient surface. It is configured for a standard #3 DIN rail mounting.
5. Connect a ground wire from the external I/O module's screw terminal labeled "Ground" to a ground point.

**Caution**

*The external I/O module must have the same ground potential as the chassis of the PC containing the MVS-8100D. Any difference in potential can damage the equipment. If you connect a ground wire to the I/O module ground screw, then that ground must have the same potential as the MVS-8100D host's ground.*

6. Connect wires from your I/O input devices to the plus and minus terminals of the input block of the external I/O module. Use the pin numbering in Table 8 as a guideline. Figure 8 shows the pin numbering for the input terminal block.

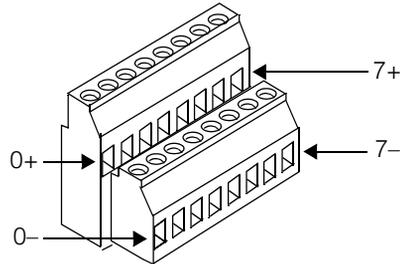


Figure 8. Pin numbering for input terminal block

Table 8 lists the pinout for the input terminal block.

TTL signal from MVS-8100D	Opto-isolated and used as	Pin Number	MVS-8100D1	MVS-8100D2 MVS-8100D3
TTL_BI_1	TTL_BI_1+	IN 0+	Any input device	Any input device
	TTL_BI_1-	IN 0-		
TTL_BI_2	TTL_BI_2+	IN 1+	Any input device	Any input device
	TTL_BI_2-	IN 1-		
TTL_BI_11	TTL_BI_11+	IN 2+	Not used	Any input device
	TTL_BI_11-	IN 2-		
TTL_BI_12	TTL_BI_12+	IN 3+	Not used	Any input device
	TTL_BI_12-	IN 3-		

Table 8. Pinout for input block of external I/O option

Pins IN 4 through IN 7 of the input terminal block are not used with the MVS-8100D.

Note that after opto-isolation of the TTL signal from the MVS-8100D, the connections are for inputs only, and are no longer bidirectional.

7. Connect wires from your I/O output devices to the plus and minus terminals of the output block of the external I/O module. Use the pin numbering in Table 9 as a guideline. Figure 9 shows the pin numbering for the output terminal block.

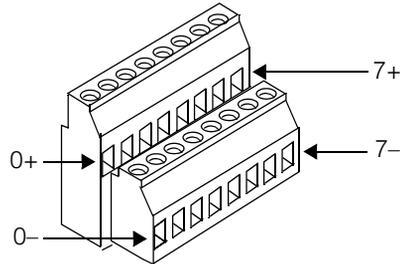


Figure 9. Pin numbering for output terminal block

Table 9 lists the pinout for the output terminal block.

TTL signal from MVS-8100D	Opto-isolated and used as	Pin Number	MVS-8100D1	MVS-8100D2 MVS-8100D3
TTL_BI_3	TTL_BI_3+	OUT 0+	Any output device	Any output device
	TTL_BI_3-	OUT 0-		
TTL_BI_4	TTL_BI_4+	OUT 1+	Any output device	Any output device
	TTL_BI_4-	OUT 1-		
TTL_BI_5	TTL_BI_5+	OUT 2+	Any output device	Any output device
	TTL_BI_5-	OUT 2-		
TTL_BI_6	TTL_BI_6+	OUT 3+	Any output device	Any output device
	TTL_BI_6-	OUT 3-		
TTL_BI_7	TTL_BI_7+	OUT 4+	Any output device	Any output device
	TTL_BI_7-	OUT 4-		
TTL_BI_8	TTL_BI_8+	OUT 5+	Any output device	Any output device
	TTL_BI_8-	OUT 5-		
TTL_BI_9	TTL_BI_9+	OUT 6+	Not used	Any output device
	TTL_BI_9-	OUT 6-		

Table 9. Pinout for output block of external I/O option

TTL signal from MVS-8100D	Opto-isolated and used as	Pin Number	MVS-8100D1	MVS-8100D2 MVS-8100D3
TTL_BI_10	TTL_BI_10+	OUT 7+	Not used	Any output device
	TTL_BI_10-	OUT 7-		

Table 9. Pinout for output block of external I/O option

Note that after opto-isolation of the TTL signal from the MVS-8100D, the connections are for outputs only, and are no longer bidirectional.

- Use your Cognex software documentation to map the signal names from Table 8 and Table 9 to the software commands that enable, disable, set, and toggle each line.

# MVS-8100D Hardware Description

# 2

This chapter describes the Cognex MVS-8100D frame grabber board that can be used with Cognex 8000 series software.

The Cognex MVS-8100D is a 32-bit PCI bus frame grabber that fits into a single slot in your PC. The MVS-8100D is available in three models, supporting one, two, or three cameras. The MVS-8100D is designed to capture video images from Cognex CDC series digital cameras, and communicates with the CDC series cameras using the CogLink digital camera communication interface.

Table 10 summarizes the capabilities of the MVS-8100D. More detail about each feature is provided later in this chapter.

<b>Frame Grabber Feature</b>	<b>Cognex MVS-8100D</b>
Image acquisition timing supported	Cognex proprietary high-speed serial protocol
Camera type supported	Cognex CDC series digital cameras
Maximum acquired image size with Cognex software	640 x480 with the CDC-50 1280 x1024 with the CDC-100 or CDC-200
Support for region of interest image captures	Yes
Acquired monochrome image depth	8 bits per pixel
Camera input ports	One 26-pin camera port supports one to three CDC series camera, depending on MVS-8100D model and camera cable used
Camera power supplied by board	Yes
External trigger support	Trigger connects directly to CDC series camera head unit
Strobe support	Strobe connects directly to CDC series camera head unit

*Table 10. MVS-8100D features*

Frame Grabber Feature	Cognex MVS-8100D
Parallel I/O	Bidirectional TTL lines connecting to MVS-8100D: 8 lines on single channel model, 12 lines on multiple channel models
Board power requirements	Universal PCI signaling. The PCI connector is slotted for either 3.3 V or 5 V signaling and can be placed in either PCI slot type.

Table 10. MVS-8100D features

## Mechanical Specifications

The Cognex MVS-8100D is 107 mm (4.2 inches) high by 189 mm (7.4 inches) long and occupies a single PCI bus slot. Figure 10 shows the major components on the MVS-8100D's circuit board.

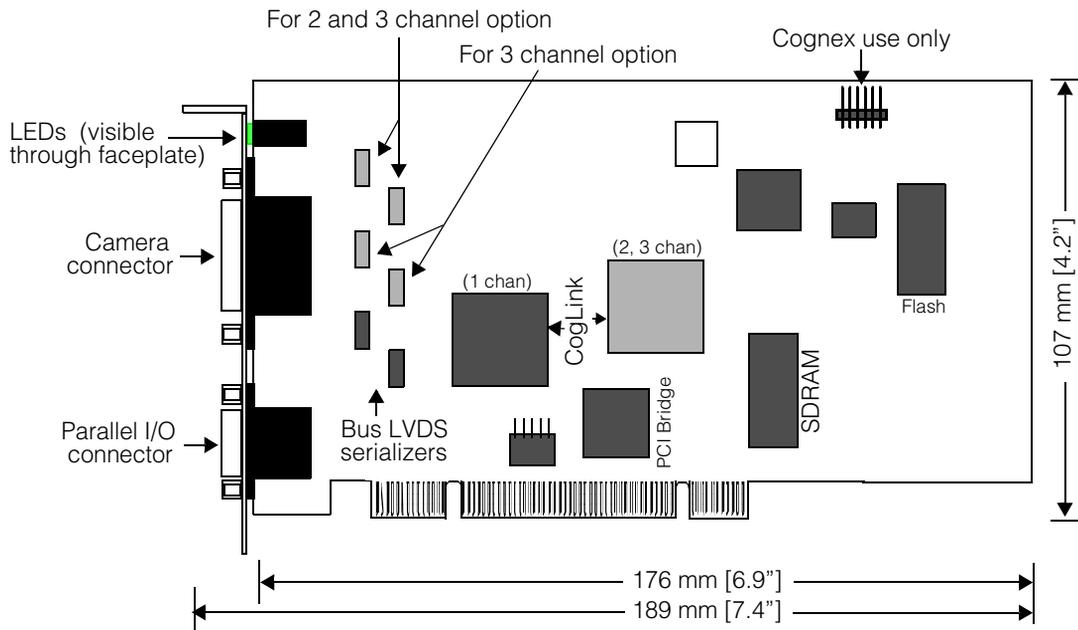


Figure 10. MVS-8100D component location

## Model Differences

The MVS-8100D has three models, supporting one, two, or three CDC series cameras. The board layouts are identical except where noted in Figure 10.

You can identify your MVS-8100D model by counting the pairs of Bus LVDS serializer chips. There will be one pair of serializer chips for each camera channel. You can also check the board assembly number, printed on a barcoded sticker on the board, as listed in Table 11 on page 27.

Table 11 shows the differences between the three models.

<b>MVS-8100D model</b>	<b>Camera channels</b>	<b>FIFO per channel</b>	<b>Parallel I/O lines</b>	<b>Board assembly number</b>
MVS-8100D1	1	8 megabytes	8	200-0167-1
MVS-8100D2	2	4 megabytes	12	200-0167-2
MVS-8100D3	3	2 megabytes	12	200-0167-3

*Table 11. Differences between MVS-8100D models*

## Environmental Requirements

Table 12 lists the environmental requirements for the MVS-8100D. These specifications are for the environment inside the PC where the MVS-8100D is installed.

	<b>Operating Conditions</b>	<b>Storage Conditions</b>
<b>Temperature</b>	10° to 50° C	–40° to 65° C
<b>Humidity</b> (non-condensing)	10% to 90%	10% to 90%

*Table 12. Environmental requirements*

# Electrical Specifications

This section describes the electrical specifications of the MVS-8100D including power requirements and signal descriptions. Refer to Figure 10 on page 26 for the location of the ports and LEDs described in this section.

## Power Requirements

Power to the board is provided through the PCI bus for +5 VDC.

Table 13 shows the +5 VDC draw from the MVS-8100D and from each attached CDC series cameras. The voltage requirements in this table have a tolerance of  $\pm 5\%$ .

Hardware	+5 VDC Requirement
<b>MVS-8100D1</b>	600 mA
<b>MVS-8100D2</b>	850 mA
<b>MVS-8100D3</b>	1050 mA
<b>Add per CDC camera</b>	450 mA

Table 13. MVS-8100D power requirements

## Fuses

There are no user-replaceable fuses on the MVS-8100D.

Each camera input channel is protected by a PolySwitch resettable fuse at 750 mA per channel. Each parallel I/O line is individually protected by a PolySwitch fuse at 200 mA per line.

If an over voltage or over current condition occurs on a camera input channel or on any parallel I/O line, the PolySwitch fuse trips, opening the circuit. You need only remove the device, correct the overcurrent condition, wait a few minutes for the PolySwitch circuitry to cool down, then plug your device back in. The fuse resets itself.

## Standards Compliance

The MVS-8100D meets the following worldwide standards for safety, electromagnetic compatibility, and electrostatic sensitivity.

## International

Compliance with the following electromagnetic emissions standards:

- United States Code of Federal Regulations Part 15: Federal Communications Commission Class A radio frequency emissions standard
- European Union emissions standard EN55022:1994+ A1:1995+ A2:1997
- Japanese VCCI standard
- Australia and New Zealand standard 3548

## European Community

MVS-8100D frame grabbers are in conformance with the EN61326:1998 Council Directive on immunity for measurement, control, and laboratory equipment, encompassing the following tests:

- EN61000-4-2:1995
- EN61000-4-3:1998
- EN61000-4-4:1995
- EN61000-4-5:2001
- EN61000-4-6:1996
- EN61000-4-8:1998
- EN61000-4-11:1994

MVS-8100D frame grabbers are in conformance with the following Council Directive on electromagnetic emissions:

- EN61000-3-2:2000
- EN61000-3-3:2000

The manufacturer of the MVS-8100D is:

Cognex Corporation  
1 Vision Drive  
Natick, MA 01760

The European representative is:

Cognex France  
Immeuble Le Patio  
104 Avenue Albert 1er  
92563 Rueil Malmaison  
France

## Indicator LEDs

There are four LEDs on the faceplate of the MVS-8100D. Looking directly at the faceplate, the LEDs are one red and three green LEDs, left to right, as shown in Figure 11.

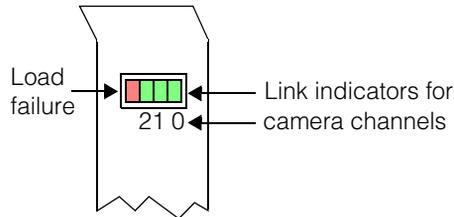


Figure 11. Indicator LEDs on faceplate

The LEDs indicate the conditions shown in Table 14.

LED	Condition
Red	In normal operation, this LED is off. When first powered on, the MVS-8100D loads instructions stored in flash memory into an onboard chip. This red LED stays on while the load is in progress, which should take less than one second. If this LED stays on after power-up, turn off the PC and restart it. If the LED remains on, contact Cognex Technical Support.
Left green	When the MVS-8100D's device driver is loaded and enabled, this LED indicates a successful link with a CDC series camera over the CogLink bus, for camera channel two (on three camera models).
Middle green	Same, for camera channel one (on two or three camera models).
Right green	Same, for camera channel zero (on all models).

Table 14. Faceplate LEDs and conditions indicated

## Camera Connector and Cables

The MVS-8100D receives streams of digital video signals from one or more Cognex CDC series cameras through the 26-pin camera connector. You connect a camera cable or breakout cable from Table 15 to the camera connector. Note that Cognex CDC series cameras use a micro DB-9 connector.

**Caution**

Cameras must be connected using the Cognex cables shown in this table. Using non-Cognex camera cables could damage your vision system, your camera, or both.

Cognex cable part number	Description	Use with
300-0364	Standard DB-9F to micro DB-9	Connects between a branch of breakout cables 300-0365 and 300-0366 to a Cognex CDC series camera
300-0365	DB-26M to two branches, each with standard DB-9M	Breakout cable for MVS-8100D2 or MVS-8100D3
300-0366	DB-26M to three branches, each with standard DB-9M	Breakout cable for MVS-8100D3
300-0367	DB-26M to micro DB-9	Connects directly between any model MVS-8100D and one Cognex CDC series camera

Table 15. Camera breakout cables for MVS-8100D

Cognex does not support building your own camera cables for the MVS-8100D. Figure 12 shows, for reference only, the pin numbering of the 26-pin camera connector.

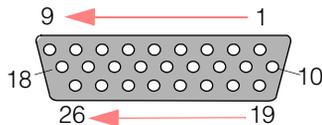


Figure 12. Pin numbering of camera connector

Table 16 shows, for reference only, the pinout of the 26-pin camera connector.

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	CH0_+5V	10	GND	19	BLVDS0_TX_M
2	BLVDS0_RX_P	11	GND	20	BLVDS0_TX_P
3	BLVDS0_RX_M	12	CH2_+5V	21	BLVDS2_TX_M
4	BLVDS2_RX_M	13	GND	22	BLVDS2_TX_P
5	BLVDS2_RX_P	14	GND	23	BLVDS1_TX_M

Table 16. Pinout of camera connector

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
6	BLVDS1_RX_P	15	CH1_+5V	24	BLVDS1_TX_P
7	BLVDS1_RX_M	16	GND	25	No connect
8	No connect	17	GND	26	No connect
9	No connect	18	No connect		

Table 16. Pinout of camera connector

## Hardware Triggers and Strobes

The MVS-8100D's default setting is to expect software triggered image acquisition. Using Cognex software, you can specify hardware triggered acquisitions and/or the simultaneous firing of a strobe device for illumination.

If you use hardware triggering and strobing, connect wiring from trigger and strobe devices directly to each Cognex CDC series camera, not to the MVS-8100D. The trigger initiates an image acquisition and fires the strobe, all without the participation of the MVS-8100D. The MVS-8100D then receives and processes the acquired image from the camera.

The connection of triggers and strobes to the camera is discussed in *Connecting Triggers and Strobes* on page 14 and in *Hardware Trigger and Strobe Connections* on page 54.

## Parallel I/O Connector

The MVS-8100D supports the connection of parallel I/O devices. The devices you connect depend on your vision processing application, and can include, for example, status-reporting LEDs or parts reject switches.

The MVS-8100D provides eight or twelve bidirectional TTL parallel I/O lines. Model MVS-8100D1 supports eight lines; models MVS-8100D2 and MVS-8100D3 each support twelve lines. When used with the Cognex external I/O module, the MVS-8100D's bidirectional TTL lines are converted to opto-isolated input and output lines.

When connecting TTL devices, use Cognex cable 300-0358, which connects to the MVS-8100D's parallel I/O port and terminates in a block of screw terminal connectors. You can connect either incoming or outgoing devices to any I/O line on the MVS-8100D. Cognex software is used to specify whether each TTL line is to be used as an input or output line. The direction of each I/O line can be set independently of other lines. Cable 300-0358 and the connection of TTL devices is discussed in *Cable 300-0358* on page 35.

When connecting I/O devices with opto-isolation, use Cognex cable 300-0359, which connects between the MVS-8100D and the Cognex external I/O module (P/N 800-5712-3). You connect your I/O devices to screw terminal connectors on the external I/O module. Cable 300-0359 and the connection of opto-isolated devices is discussed in *Cable 300-0359* on page 36.

## Pinout of Parallel I/O Connector

Parallel I/O devices are attached through the MVS-8100D's HD-15M connector. The pin numbering of this connector is shown in Figure 13.

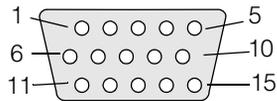


Figure 13. Pin numbering of parallel I/O connector

### Caution

The MVS-8100D's parallel I/O port resembles the industry standard VGA connector, but is wired very differently. Do not connect a monitor to this port, or you may damage your MVS-8100D, your monitor, or both.

The pinout of the parallel I/O connector for the single camera MVS-8100D1 is shown in Table 17.

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	+5V_PIO	6	TTL_GND	11	NC
2	TTL_BI_8	7	TTL_BI_7	12	TTL_BI_6
3	TTL_BI_5	8	TTL_BI_4	13	TTL_BI_3
4	TTL_BI_2	9	TTL_BI_1	14	NC
5	NC	10	NC	15	TTL_GND

Table 17. Pinout of parallel I/O connector on MVS-8100D1

The pinout of the parallel I/O connector for the MVS-8100D2 and MVS-8100D3 is shown in Table 18.

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	+5V_PIO	6	TTL_GND	11	TTL_BI_10
2	TTL_BI_8	7	TTL_BI_7	12	TTL_BI_6

Table 18. Pinout of parallel I/O connector on MVS-8100D2 and MVS-8100D3

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
3	TTL_BI_5	8	TTL_BI_4	13	TTL_BI_3
4	TTL_BI_2	9	TTL_BI_1	14	TTL_BI_9
5	TTL_BI_12	10	TTL_BI_11	15	TTL GND

Table 18. Pinout of parallel I/O connector on MVS-8100D2 and MVS-8100D3

Figure 14 shows the bidirectional parallel I/O circuit for each TTL\_BI\_n line.

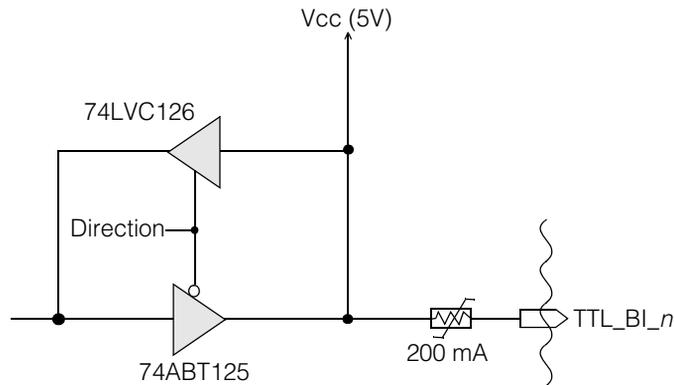


Figure 14. Bidirectional parallel I/O circuit

Notes on the parallel I/O circuitry:

- The minimum allowable Vcc is 4.75 V.
- If *direction* is high, the circuit is an input; if *direction* is low, an output.
- In output mode, the 74ABT125 drives the TTL\_BI\_n signal high and low. That is, it is not an open-collector output.

When a bidirectional line is configured as an output line, the output current for logic high voltage (VOH) for each TTL line is 32 mA, and for logic low voltage (VOL) is 64 mA.

When a bidirectional line is configured as an input line, it is the responsibility of the application to drive the circuit both high and low. Do not let the circuit float to signal low.

## Cable 300-0358

Connect Cognex cable 300-0358 to the MVS-8100D's parallel I/O port. This cable has an HD-15F connector on one end and a block of 16 screw terminals on the other. Figure 15 shows the cable.



Figure 15. Parallel I/O cable 300-0358

The screw terminal connector shell is Phoenix part number 18 34 48 2. The matching female plug with the screw terminals is Phoenix 18 58 17 0. The male connector shell is a 16-terminal connector, but the last two positions are blocked with key plugs. The female plug has the last two terminal positions removed so that it will fit with the key plugs in place. The key plugs are primarily to prevent the connection of a female terminal plug from any other Cognex vision product.

### Caution

*The 16-pin terminal block at the end of cable 300-0358 resembles the terminal blocks at the end of other Cognex parallel I/O cables for other products. However, the signal name and pin numbering on cable 300-0358 is unique to the MVS-8100D series. Do not connect a terminal block that works on another Cognex product into the terminal end of cable 300-0358, or electrical damage may result.*

Table 6 on page 18 shows the pinout of the screw terminal connector on cable 300-0358. Connect wires from your TTL devices to these terminals.

## Cable 300-0359

Cognex cable 300-0359 connects the MVS-8100D’s parallel I/O port to the 26-pin input on the Cognex external I/O module. Figure 16 shows the cable.

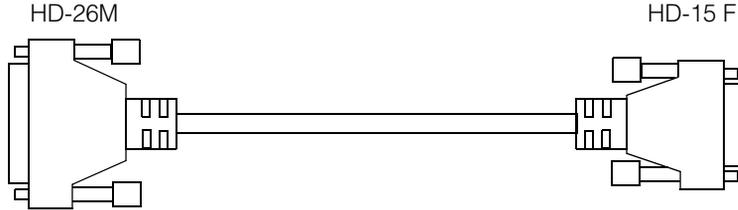


Figure 16. Parallel I/O cable 300-0359

The HD-15F side of the cable connects to the MVS-8100D’s parallel I/O port. The HD-26M side of the cable connects to the external I/O module’s HD-26F connector labeled “Vision Processor.”

Cognex does not support the connection of devices to the pins of cable 300-0359. The opto-isolation circuitry is added by circuitry in the external I/O module, not in the cable. The pinout guide for cable 300-0359 in Table 19 is shown only for reference.

Signal Name	Pin on HD-26M	Pin on HD-15F
IN_1	1	9
IN_2	2	4
IN_3	3	10
IN_4	4	5
NC	5	NC
NC	6	NC
NC	7	NC
NC	8	NC
OUT_1	9	13
OUT_2	10	8
OUT_3	11	3
OUT_4	12	12

Table 19. Pin numbering of cable 300-0359

Signal Name	Pin on HD-26M	Pin on HD-15F
OUT_5	13	7
OUT_6	14	2
OUT_7	15	14
OUT_8	16	11
VCC_5V	17	1
VCC_5V	18	1
GND	19	6
GND	20	6
NC	21	NC
GND	22	15
GND	23	15
GND	24	15
NC	25	NC
NC	26	NC

Table 19. Pin numbering of cable 300-0359

## External I/O Module

The Cognex external I/O module, P/N 800-5712-3, connects to the 15-pin I/O port of the MVS-8100D. It serves as an opto-isolated connection point for parallel I/O signal lines originating in the MVS-8100D.

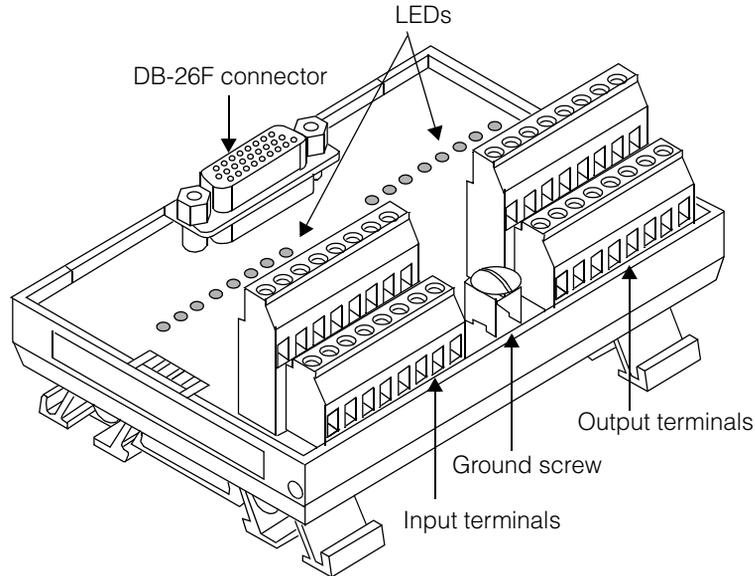
Capabilities of the external I/O module include:

- 4 optically isolated inputs and 8 optically isolated outputs for the MVS-8100D2 and MVS-8100D3
- 2 optically isolated inputs and 6 optically isolated outputs for the MVS-8100D1
- Signal voltage, 5 V to 24 V DC at 15 mA
- Optical isolation for the both inputs and outputs
- LEDs to indicate the state of each line

- Powered from the host vision processor
- DIN standard rail mounting

## Layout

Figure 17 shows the layout and major components of the external I/O module.



*Figure 17. Parts layout of external I/O module*

The DB-26F connector provides a connection from the MVS-8100D through Cognex cable 300-0359. The input and output terminals provide connection points for connecting wires from parallel I/O devices. The LEDs indicate the availability of power to the input and output lines.

## Wiring Methods

Figure 18 shows the methods for connecting input and output signal lines to the respective terminal plugs of the external I/O module.

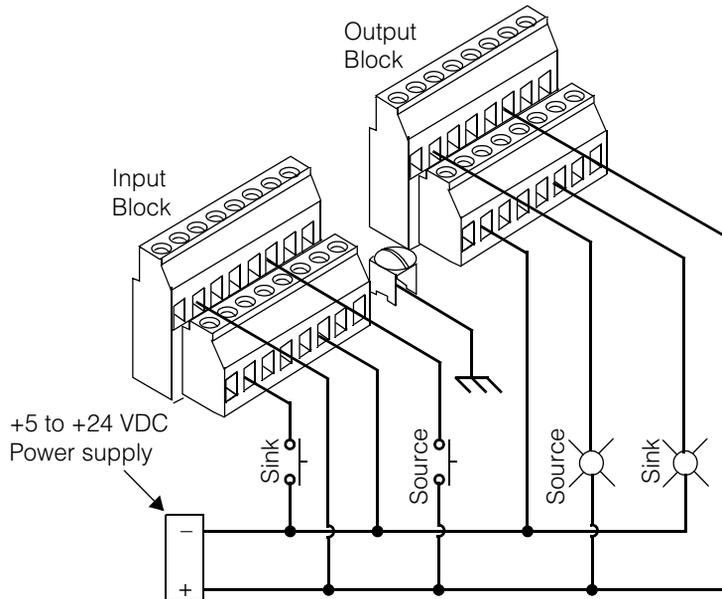


Figure 18. Wiring methods for connecting to the external I/O module

For both input and output signal lines, connect the source side of the signal to a positive-numbered terminal and the sink side to a negative-numbered terminal.

## Mechanical and Electrical Specifications

The following table lists the mechanical and electrical specifications for the external I/O module:

Specification	Description
Dimensions	4.688 in (width) X 2.375 in (height) X 3.25 in (depth) 1.91 cm (width) X 6.03 cm (height) X 8.26 cm (depth)
Mounting	#3 DIN rail mountable
Operating Voltage (Field Side)	5 V to 24 V DC

Table 20. External I/O module specifications

Specification	Description
Power	+5 V DC, supplied from the vision system
Maximum Output Current	24 mA (sink or source)
ON State Voltage Drop	0.8 V DC @ 10 mA, 2.6 V DC @ 24 mA
OFF State Leakage Current	100 $\mu$ A maximum @ 15 V DC
Output Delay	ON: 6 $\mu$ Sec OFF: 130 $\mu$ Sec @ 5 mA; 95 $\mu$ Sec @ 10 mA; 85 $\mu$ Sec @ 15 mA
Input Resistance	~1000 Ohms
Input State Current	ON: 3.5 to 24 mA OFF: 500 $\mu$ A
Input Delay	ON: 30 $\mu$ Sec @ 3.5 mA; 8 $\mu$ Sec @ 15 mA OFF: 45 $\mu$ Sec @ 3.5 mA; 80 $\mu$ Sec @ 15 mA
Field Wiring Size	26 to 12 AWG
Terminal Block Torque	Maximum 0.8 (7) N-M (in-lbf)
Cable	7 feet (2.1 meter, supplied)
Environmental	Operating Temperature: 0 to 50° C Storage Temperature: -20 to 85° C Relative Humidity: 5 to 95 percent non-condensing

Table 20. External I/O module specifications

## LED Numbering

The external I/O module has silk-screened labels identifying the LEDs for each input and output plus/minus connection pair. The labels identify the connection points with zero-based numbers, IN0 through IN7, and OUT0 through OUT7.

Cognex software uses one-based numbers in the names of parallel I/O signals. Remember to transpose the connection point numbers to the Cognex signal numbers, as shown in Table 8 on page 22 and Table 9 on page 23.

## External I/O Module Adds Conversion Delay

The external I/O module converts all digital TTL signals from the MVS-8100D into opto-isolated signal pairs. The opto-isolation circuitry of the external I/O module adds a delay of 100 to 300 microseconds, compared to a pure TTL signal. For comparison, the response time of a typical TTL signal is about 1 microsecond.

The same output device, connected to both the external I/O module directly to the MVS-8100D's I/O port with cable 300-0358 will receive its signal 100 to 300 microseconds slower on the external I/O module compared to the 300-0358 cable.

A delay of this small magnitude is not visible to the naked eye, but may have a cumulative effect when multiplied over many rapid image acquisitions. Take this delay into account when calculating your maximum image processing throughput if you plan to use the external I/O module.

## External I/O Module Circuit Logic

Figure 19 shows a typical input schematic to help you determine how to wire your input devices to the external I/O module.

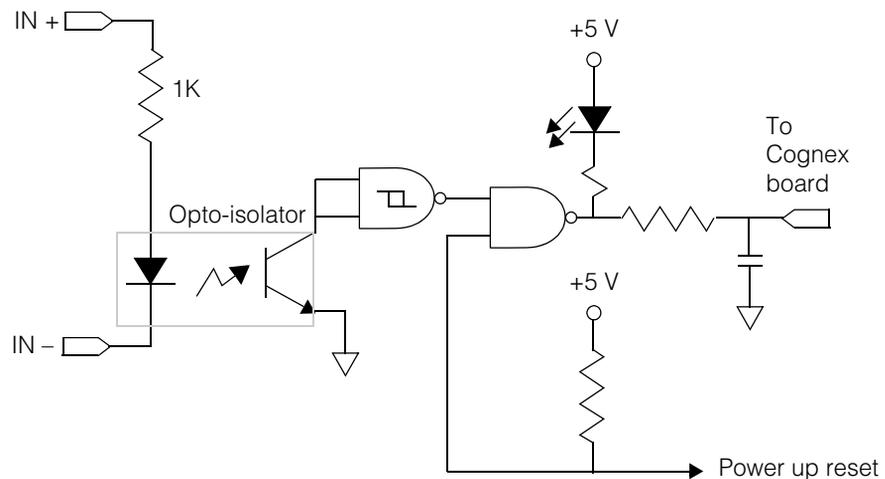


Figure 19. Typical input schematic for external I/O module

The following figure shows a typical output schematic to help you determine how to wire your output devices to the external I/O module.

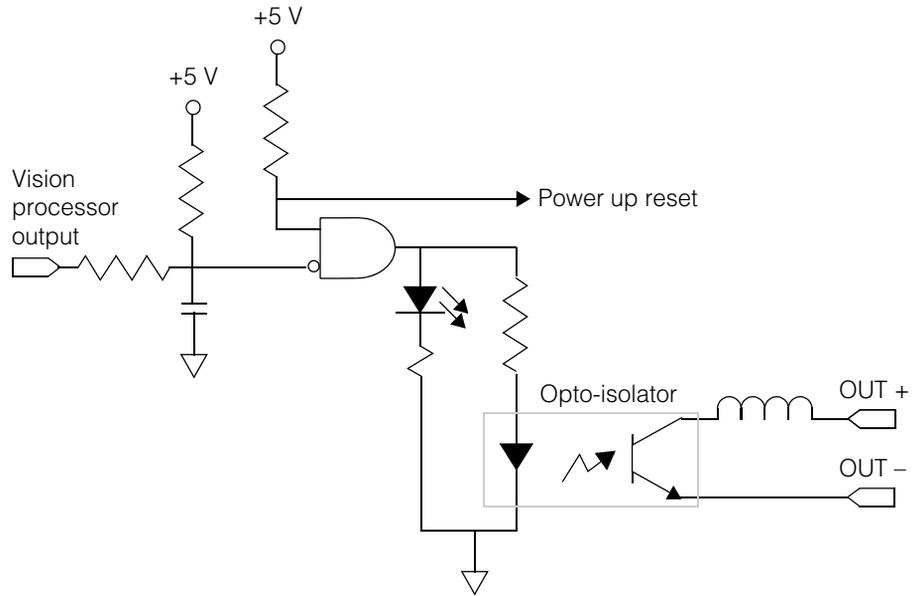


Figure 20. Typical output schematic for external I/O module

# Cognex CDC Series Camera Description

# 3

This chapter describes the Cognex CDC series of digital video cameras that are used with the Cognex MVS-8100D frame grabber. The chapter includes the following sections:

- *CDC Series Camera Overview* on page 44 provides an overview of the CDC camera series, distinguishes the camera models in the series, describes the CogLink communication protocol, and describes the rolling shutter feature.
- *CDC Series Camera Specifications* on page 49 lists the specifications of the CDC camera series.
- *Hardware Trigger and Strobe Connections* on page 54 describes the electrical specifications of the hardware trigger input and strobe output features of CDC series cameras.

# CDC Series Camera Overview

This section provides a high-level look at the CDC camera series, describes the CogLink communication protocol, and describes the rolling shutter feature.

## CDC Series Camera Features

Cognex CDC series cameras use CMOS active pixel sensor technology to convert light energy directly to digital image data. The camera converts the image data to a digital stream, split into data packets according to Cognex's CogLink camera communications protocol, and sends the digital stream over the CogLink high-speed serial bus to a Cognex MVS-8100D frame grabber. The MVS-8100D reassembles the packets of image data and makes the captured camera image available to Cognex software running on the host PC.

There are three models in the CDC camera series.

- The CDC-50 captures image sizes up to 640x480 pixels at a frame rate of up to 59 Hz per camera. A three channel MVS-8100D frame grabber combines the frame rates of all three camera channels for an aggregate frame rate of up to 177 Hz, limited only by PCI bus throughput. The CDC-50 camera can use either a global shutter or a rolling shutter, selectable by software. These shutter types are described in *Global and Rolling Shutters* on page 44.
- The CDC-100 camera captures images sizes up to 1280x1024 pixels at a frame rate of up to 13 Hz. The CDC-100 uses a rolling shutter.
- The CDC-200 camera captures images sizes up to 1280x1024 pixels at a frame rate of up to 26 Hz, and uses a global shutter.

## Global and Rolling Shutters

A global shutter is the standard full frame shutter, where the entire range of pixels in the image sensor is exposed at one time. Global shutter mode works well with strobed or unstrobed image captures of a moving target.

In rolling shutter mode, the exposure for each line is offset and occurs in parallel with the transfer of digitized pixel data. The exposure may be as small as a single line or it may be active for multiple lines. If the exposure is long enough, then all lines can be exposed for a specified time interval. Rolling shutter mode works best when the target object can be moved into the field of view and held stationary for the duration of the rolling shutter exposure time. Strobing can be used, but must be carefully timed to coincide with the point at which all the lines of the image are exposed. Both the CDC-50 and CDC-100 cameras support the precise placement of the strobe signal that allows strobed illumination to be used in conjunction with rolling shutter exposure.

CDC series cameras support these shutter modes as follows:

- The CDC-50 camera can be set with software commands to use either global or rolling shutter mode
- The CDC-100 camera always uses rolling shutter mode
- The CDC-200 camera always uses global shutter mode

## An Introduction to CogLink

CogLink is Cognex's proprietary high performance digital camera interface. CogLink specifies both a communications protocol and a high-speed serial bus interface for transmission of both camera image data and camera control commands.

Traditional analog and digital camera standards are faced with finding a way to separately transmit camera image data and camera control commands. The usual solution has been a two-cable system, with one cable carrying analog or digital data from the camera's sensors to the frame grabber's memory, and another cable carrying control commands through a slower serial or parallel connection, such as RS-232.

CogLink uses the Bus Low Voltage Differential Signaling (Bus LVDS) standard. Bus LVDS is a variation of the LVDS technology specified in the EIA 644 standard. Bus LVDS has about twice the current capability of standard LVDS, and is optimized for driving double-terminated cables or backplanes that present a large capacitive load. Some of the advantages of using Bus LVDS technology for CogLink are the following:

- It creates a highly reliable, high performance, full duplex communications conduit for connecting vision systems and cameras.
- It maximizes the usable cable length before a signal repeater is necessary.
- It uses readily available twisted-pair cable and connector technology to minimize costs.

## Performance Factors

Two factors influence the performance of any communications system:

- Inter-signal interference, or jitter
- Signal attenuation

The high current capability of Bus LVDS allows CogLink to minimize the impact of signal attenuation as a contributor to the bit error rate (BER) of the signal transmission. Bus LVDS supports the encoding of 10 bits of parallel data plus two bits of clock data into a serial stream. This stream is sent over a single twisted pair of wires, which minimizes the impact of jitter on the overall BER.

CogLink hardware uses a 40 MHz clock. The encoded 12 bits of serial data sent at a clock rate of 40 MHz results in a serial bit stream of 480 Megabit/second sent over a single twisted pair.

## **Serialized Data Stream**

The CDC camera series includes Bus LVDS serializers that break the image sensor data into packets and convert it into a 10-bit serial data stream for transmission across the CogLink bus. The MVS-8100D frame grabber has de-serializers that re-convert the serial data stream and combine the packets into image data.

For communicating camera control information to the camera, the MVS-8100D has serializers of its own. The CDC camera de-serializes the incoming serial stream and converts it to camera commands. Packets of command information can be mixed in with packets of image data in both directions of communication. The CDC camera and the MVS-8100D both recognize the difference in structure between command packets and image data packets, and keep the two packet types separate. Thus, CogLink allows image data and camera control data to flow on the same channel between frame grabber and camera at the same time.

## **Addressable Camera Channels**

A CogLink channel connection point is characterized as having a pair of Bus LVDS circuits, a serializer circuit for transmitting data and a de-serializer circuit for receiving data. A CogLink channel consists of two sets of serializer/de-serializer circuits connected by a cable.

Each CDC series camera represents one CogLink channel connection point. Various models of MVS-8100D frame grabbers have one, two, or three CogLink channel connection points. CogLink channels are counted from zero, so that a three-channel MVS-8100D has CogLink channels 0, 1, and 2.

Because each CogLink channel is a two-way communication channel, the frame grabber can query each channel to determine the characteristics and capabilities of the CogLink device on the other end. Thus, the MVS-8100D frame grabber “knows” which CDC series camera is connected to each of its channels.

## **Camera Usage Notes**

This section discusses conditions that can produce unexpected results and discusses ways to work around the conditions.

## Darker Initial Images

The information in this section applies to the CDC-50 and CDC-100, but not the CDC-200.

Under certain operating conditions, you may notice a small difference in the overall brightness of initial images, compared to succeeding images. When the conditions are met, the brightness of the initial image may be darker than that of succeeding images by no more than 5%. The conditions under which this might occur include:

- The first image acquired following system initialization
- The first image after a delay, if the acquire cycle is non-periodic and the delay between any two successive acquisitions exceeds two seconds

This brightness difference between the first and succeeding images should not affect the performance of Cognex software vision tools, but should be tested in your application. If your application is sensitive to brightness differences, you can write your application so as to discard the darker initial images.

## Image Shading Gradient: CDC-50 Only

When using the CDC-50 camera in global shutter mode, it is possible for the image to exhibit a shading gradient: normal at the top and getting progressively brighter towards the bottom. The operating conditions required to bring about this condition include:

- Operating in global shutter mode
- Very high contrast image (for example, one containing a combination of very dark regions with very bright, almost saturated regions)

$$T_{shutter(min)} < \frac{(ROI_{width} + 59) \times ROI_{height}}{44700 \times gain}$$

In this formula, the minimum shutter time,  $T_{shutter(min)}$ , is in milliseconds. ROI stands for region of interest, a rectangular subset of the overall image, settable in software.  $ROI_{width}$  is the width of the ROI in pixels, and is the number of columns in the ROI image.  $ROI_{height}$  is the height of the ROI, and represents the number of rows in the ROI image.

The greater the difference between your choice of exposure and  $T_{shutter(min)}$ , the more likely it is that you will observe the image shading gradient. If the gradient does occur and presents a problem in your application, the possible remedies include the following:

- Use rolling shutter mode if your application does not require capturing objects in motion
- Increase the exposure time to the maximum tolerable by your application
- Lower the contrast of the image by reducing the illumination and/or by increasing the lens' F-stop setting

- Use a strobe to illuminate the target
- Increase the camera's gain

The MVS-8100D acquisition system is optimized for a gain of 1.0 and most applications will perform best at this setting. Be aware that increasing the gain also decreases the signal-to-noise ratio and may introduce more noise into your acquired images.

## CDC Series Camera Specifications

This section describes the specifications for the Cognex CDC series cameras. Figure 21 shows the CDC-50 camera with lens and mounting block attached.



Figure 21. CDC-50 camera

Figure 22 shows a CDC series camera body from the side, both with and without the mounting block.

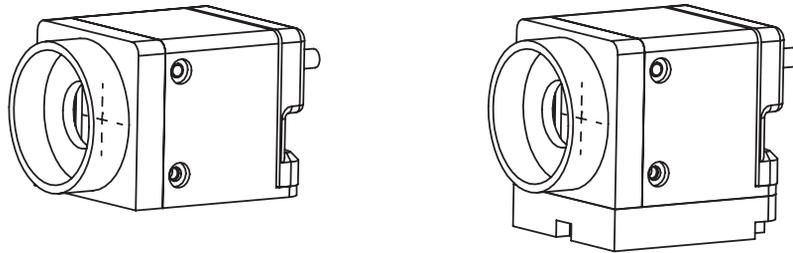


Figure 22. CDC series camera side views

In the following figures, measurements are shown in inches, with millimeters in brackets. Figure 23 shows a side view of the CDC camera series.

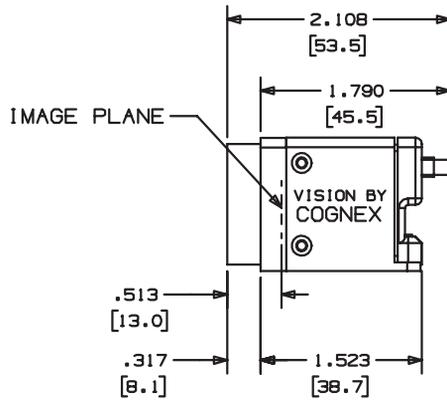


Figure 23. CDC camera, side view with measurements

Figure 24 shows the front view of the CDC camera series.

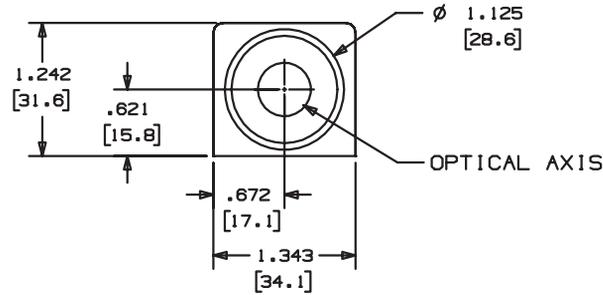


Figure 24. CDC camera, front view with measurements

Figure 25 shows the bottom view of the CDC camera series.

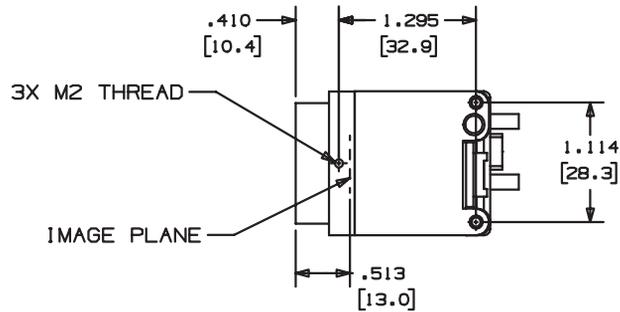


Figure 25. CDC camera, bottom view with measurements

Figure 26 shows the measurements and sizes of the camera mount holes in the mounting block.

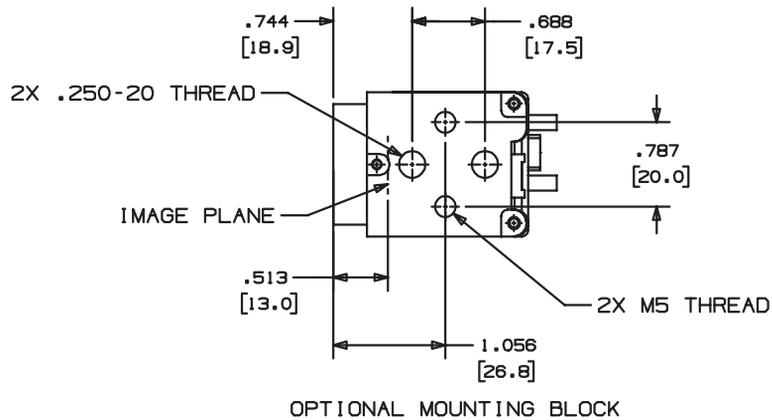


Figure 26. CDC camera, mounting block measurements

## CDC Series Common Specifications

The features listed in Table 21 are common to all CDC series cameras.

<b>Feature</b>	<b>Description</b>
<b>Camera body size</b>	34 mm W x 31 mm H x 47 mm D (1.3 inch x 1.2 inch x 1.8 inch) not including cable interface
<b>Camera body weight</b>	2.5 ounces (78.0 grams) with mounting block 2.18 ounces (61.6 grams) without mounting block
<b>Flange back distance</b>	12.52 mm
<b>Mounting brackets</b>	1/4-20 TPI and M5 tapped
<b>CogLink connector</b>	9-pin Micro DB-9 (Molex 1.27 mm pitch Ulti-Mate, p/n 83611-9006)
<b>Trigger and strobe connector</b>	4-pin locking discrete wire header (Molex Sherlock, p/n 35362-0410)
<b>External trigger input</b>	Optically isolated (5 to 24 volts peak to peak)
<b>Strobe output</b>	Optically isolated (5 to 24 volts peak to peak)
<b>Power requirement</b>	+5 VDC (supplied by CogLink cable)
<b>Power consumption</b>	2.5 W maximum (500 mA @ +5 VDC)
<b>Operating temperature</b>	10 to 45 degrees Centigrade
<b>Vibration</b>	10 G
<b>Shock</b>	70 G
<b>Signal format</b>	CogLink (digital)
<b>Scan type</b>	Progressive
<b>Gain</b>	Programmable
<b>Video signal</b>	Monochrome
<b>Image acquisition type</b>	Single frame capture (Rapid reset)

Table 21. CDC series camera features and specifications

Feature	Description
<b>Region of interest window</b>	Independent horizontal and vertical dimensions
<b>Image sensor type</b>	CMOS APS (active pixel sensor)

Table 21. CDC series camera features and specifications

## CDC Series Camera Models

Models of the Cognex CDC camera series are the CDC-50, CDC-100, and CDC-200. Table 22 describes the differences between these models.

Feature	CDC-50	CDC-100	CDC-200
<b>Resolution</b>	VGA: 640x480	SXGA: 1280x1024	SXGA: 1280x1024
<b>Frame Rate at full resolution</b>	Up to 59 fps	Up to 13 fps	Up to 26 fps
<b>Lens Mount</b>	CS-mount or C-mount with adapter	C-mount with adapter	CS-mount or C-mount with adapter
<b>Optical Format</b>	1/3 inch 5.0 x 3.7 mm	1/2 inch 7.68 x 6.14 mm	2/3 inch 8.58 x 6.86 mm
<b>Pixel size</b>	7.8 $\mu\text{m}$ square	6.0 $\mu\text{m}$ square	6.7 $\mu\text{m}$ square
<b>Saturation Signal</b>	45,000 electrons	40,000 electrons	60,000 electrons
<b>Minimum Sensitivity</b>	10 Lux @ 59 fps, F2 lens	5 Lux @ 13 fps, F2 lens	6 Lux @ 26 fps, F2 lens
<b>Shutter type</b>	Global or rolling, software selectable	Rolling	Global
<b>Sub-sampling</b>	Horizontally, vertically, or both at the same time		
<b>Sub-sampling ratios</b>	2:1, 4:1, or 8:1	2:1, 4:1, or 8:1	2:1

Table 22. CDC series camera model differences

See *Selecting Camera Lenses* on page 13 for more information on the optical format size and lens selection.

# Hardware Trigger and Strobe Connections

Cognex CDC series cameras support hardware-based trigger initiation of image acquisition and the simultaneous activation of a photo strobe to illuminate the scene under the camera at the instant of acquisition. Wire your trigger and strobe devices directly to each CDC series camera, not to the MVS-8100D frame grabber.

Cognex software determines whether the hardware trigger and strobe feature is enabled. You can enable hardware triggers and strobes independently of each other. Cognex software also provides software-based trigger and strobe control.

Figure 27 shows the pin numbering of the trigger-strobe connector on the back of CDC series cameras.

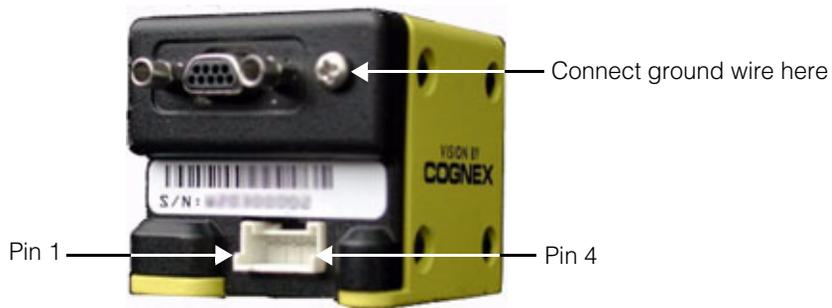


Figure 27. Pin numbering of trigger/strobe connector

Use Cognex cable 300-0362 to connect trigger and strobe devices. One end of this cable terminates in a Molex Sherlock 2.0 mm pitch (0.079" pitch) four-pin header, Molex part number 35507-0400. The Molex connector locks into place in the corresponding four-pin connector on each CDC-series camera. The other end of the cable terminates in four color-coded wires with tinned ends, each labeled as shown in Table 23.

Pin	Wire color	Label
1	Red	Trigger-
2	Black	Trigger+
3	White	Strobe-
4	Black	Strobe+

Table 23. Color coding of cable 300-0362

Cable 300-0362 has a shield ground wire extending from the base of its Molex connector. Connect this ground wire to the screw on the upper right corner of the back of the CDC series camera.

Installation of trigger and strobe devices is discussed in *Connecting Triggers and Strobes* on page 14.

## Trigger Input Features

The trigger input is used to initiate the acquisition of an image from the camera. A pair of connections, Trigger+ and Trigger-, provide optically isolated trigger inputs.

The schematic of the external trigger input circuit is shown in Figure 28.

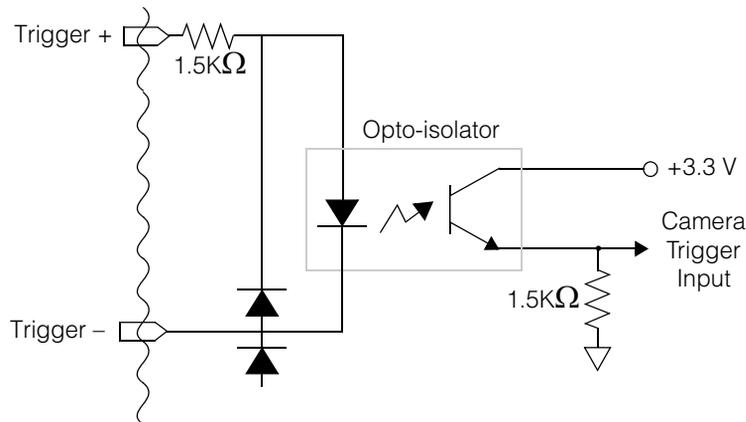


Figure 28. Trigger input schematic

To activate a trigger, between 5 and 24 V peak-to-peak must be applied to the terminals. Cognex software provides methods to enable triggers and to specify the following trigger properties:

- The polarity of the trigger pulse. That is, whether the image acquisition occurs on a rising or falling pulse.
- An acquisition delay period after acceptance of the trigger pulse. This feature allows each image acquisition to be delayed by a specified number of microseconds to take into account, for example, a light source's warm-up period, or the amount of time for an object to come into the camera's view on a moving assembly line.

The next two trigger properties allow for noise spikes to be filtered out and not treated as trigger pulses.

- The width of the trigger pulse. That is, the minimum duration of the pulse to be considered a valid trigger.
- The period of the trigger pulse. That is, how long to expect between trigger pulses for a pulse to be considered valid.

## Simultaneous Image Acquisition

You can chain together the triggers of two or more CDC series cameras in order to generate simultaneous image acquisition on those cameras. To do so, wire the trigger input of two or more cameras to the same external trigger input device. Make sure to set your Cognex software to enable hardware triggering, and set the trigger filter properties of each chained camera to the same values.

## Trigger Delay Added by Opto-Isolation

The trigger input's opto-isolation circuitry adds a small delay period between the acceptance of the trigger pulse and the initiation of the image acquisition in the camera. The size of the delay period varies with the trigger input voltage. This trigger delay period is illustrated in Figure 29 and Table 24.

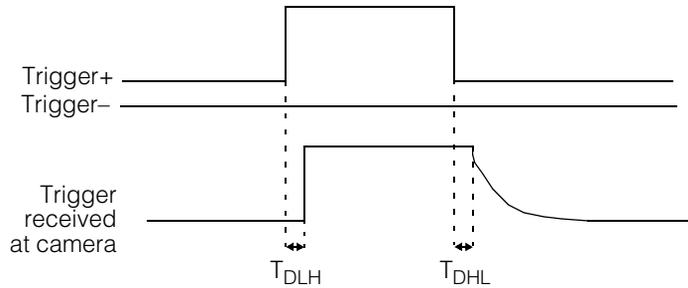


Figure 29. Delay added by trigger opto-isolation

DC Volts	$T_{DLH}$ ( $\mu\text{sec}$ )	$T_{DHL}$ ( $\mu\text{sec}$ )
5	8	9
12	3	18
24	< 3	> 18

Table 24. Delay added by trigger opto-isolation

## Strobe Output Features

The strobe output is used to activate a photo strobe at the instant of image acquisition. A pair of connections, Strobe+ and Strobe-, provide optically isolated outputs to a strobe device. The strobe output signal is a pulse of 5 to 24 V peak-to-peak, depending on your strobe device and wiring configuration.

Cognex software provides methods for enabling the strobe feature, for setting the strobe's pulse duration and pulse delay, and for setting the software to match the strobe device's polarity.

The schematic of the strobe output circuit is shown in Figure 30.

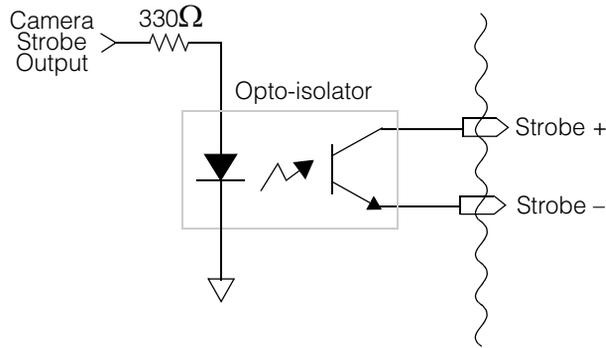


Figure 30. Strobe output schematic

## Strobe Wiring Options

You can wire the optically isolated outputs in one of two ways: *voltage source output wiring* or *contact closure output wiring*.

Figure 31 shows an example of the voltage source output wiring configuration. You connect an external power supply (for example, 24 VDC) to Strobe+. Connect Strobe- to the strobe device. The strobe device should present enough impedance so that no more than 125 mA flows through the circuit.

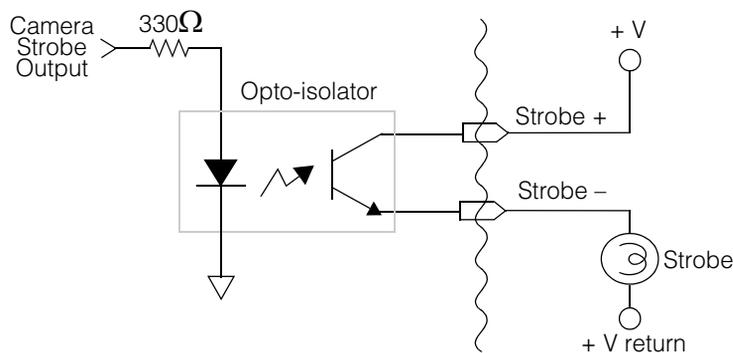


Figure 31. Source output wiring of strobe

Figure 32 shows an example using the contact closure output wiring configuration. Output is taken directly from Strobe+ and Strobe-. This output functions as a contact closure switch. Ensure that current (125 mA) and voltage (24 V) limits are not exceeded.

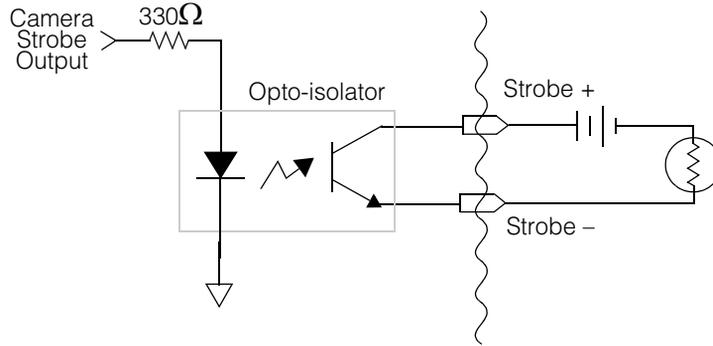


Figure 32. Contact closure wiring of strobe

# Index

---

## Numerics

300-0358 16, 17, 18, 19, 32, 35, 41  
300-0359 16, 19, 33, 36, 38  
300-0362 14, 15, 54  
300-0364 12, 13, 31  
300-0365 12, 13, 31  
300-0366 12, 13, 31  
300-0367 12, 31  
35507-0400 54  
800-5712-3 16, 19, 33, 37  
83611-9006 52

## A

acquisition timing 25  
AMD Athlon 9

## B

bidirectional TTL 15, 16, 17, 19, 26, 32  
    circuit diagram 34  
    no longer bidirectional 22, 24  
BLVDS  
    bus low voltage differential  
        signaling 27  
Bus LVDS 45, 46

## C

camera body  
    size 52  
    weight 52

### caution

cable 300-0358 not like other  
    Cognex PIO cables 19, 35  
do not power on PC before  
    connecting cameras and  
    devices 10  
electrostatic discharge can  
    damage 10  
hot plugging not supported 12, 16  
must use Cognex cables 12, 31  
PIO port is not a VGA port 16, 19, 33  
same ground potential with external  
    I/O module 21

### CDC camera

features overview 44  
model differences 53  
picture 49  
usage notes 46

### CE mark 29

### chip set 9

### circuit diagram

bidirectional TTL 34  
external I/O module 41, 42  
external I/O module, outputs 42  
external trigger input 55  
strobe contact closure wiring 58  
strobe output 57  
strobe source output wiring 57

### C-mount 13

CogLink 25, 30, 43, 44, 45, 46, 52  
    addressable camera channels 46  
    introduction 45  
    performance factors 45  
    serialized data stream 46

### component location

on MVS-8100D 26

### connecting

one camera 12  
opto-isolated devices 19  
parallel I/O devices 15

- triggers, strobes 14
- TTL devices 16
- two or three cameras 13
- contact closure 58
- Council Directives 29
- CS-mount 13

## **D**

- darker initial images 47

## **E**

- electrical specifications 28
- electromagnetic
  - compatibility standard 28
- electrostatic sensitivity standards 28
- environmental requirements 27
- European community standards 29
- European representative 29
- external I/O module 15, 19, 20, 21, 22, 23, 32, 33, 36, 37, 41
  - circuit logic 41, 42
  - layout 38
  - LED numbering 40
  - signal delay 41
  - specifications 39
  - wiring methods 39

## **F**

- FCC class A 29
- flange back distance 52
- fuses
  - PolySwitch 28

## **G**

- gain, programmable 52
- global shutter
  - and image shading gradient 47
- gradient images 47

## **H**

- hot plugging
  - not supported 12, 16
- humidity 27

## **I**

- image
  - resolution 25
  - size 25
- image sensor type 53
- image shading gradient 47
- installing
  - MVS-8100D 10
  - one camera 12
  - opto-isolated devices 19
  - parallel I/O devices 15
  - triggers, strobes 14
  - TTL devices 16
  - two or three cameras 13

## **L**

- LED 12, 13, 30
  - numbering, on external I/O module 40
  - on MVS-8100D faceplate 30
  - on MVS-8100D, meanings 30

lens  
 C-mount 13  
 CS-mount 13

lenses  
 selecting for CDC camera 13

## M

micro DB-9 12, 13, 30, 31, 52

model  
 identifying 27

Molex 15, 52, 54

monochrome 25, 52

MVS-8100D  
 board size 26  
 component location 26  
 features 25  
 hardware description 25  
 identifying models 27  
 LED 30  
 power requirements 28

## O

optical format 53

opto-isolated 15, 19, 20, 22, 23, 32, 33,  
 37, 41, 52

opto-isolated outputs  
 example of use 57

## P

part numbers  
 300-0358 16, 17, 18, 19, 32, 35, 41  
 300-0359 16, 19, 33, 36, 38  
 300-0362 14, 15, 54  
 300-0364 12, 13, 31

300-0365 12, 13, 31  
 300-0366 12, 13, 31  
 300-0367 12, 31  
 800-5712-3 16, 19, 33, 37  
 Molex 35507-0400 54  
 Molex 83611-9006 52

PC  
 requirements 9

Pentium 9

pin numbering  
 cable 300-0358 18, 19, 35  
 cable 300-0359 36  
 camera connector 31  
 input block, external I/O module 22  
 output block, external I/O module 23  
 parallel I/O connector 33  
 trigger/strobe connector on CDC  
 camera 54

pinout  
 cable 300-0359 36  
 camera connector 31  
 input block, external I/O module 22  
 output block, external I/O module 23  
 parallel I/O connector 33

PolySwitch fuse 28  
 resetting 28

power consumption  
 CDC camera 52

power requirements  
 CDC camera 52  
 MVS-8100D 28

progressive scan 52

## R

rapid reset 52

requirements  
 environmental 27  
 for host PC 9

resolution 25, 53  
ROI  
    region of interest 13, 25, 47, 53

## S

safety standards 28  
saturation 53  
sensitivity 53  
sensor type 53  
shading gradient 47  
shock 52  
shutter type 53  
source output 57  
specifications  
    common to CDC cameras 52  
    differences between camera  
        models 53  
    electrical, of MVS-8100D 28  
    environmental, inside host PC 27  
    for CDC series cameras 49  
    for external I/O module 39  
    mechanical, of MVS-8100D 26  
standards  
    electromagnetic compatibility 28  
    electrostatic sensitivity 28  
    European community 29  
    safety 28  
strobe 9, 12, 13, 14, 15, 25, 32, 48, 52, 56,  
    57  
    and rolling shutter 44

sub-sampling 53

## T

temperature 27, 52  
trigger 9, 12, 25, 52  
    chaining for master-slave 56  
    connecting 14  
    hardware 32  
    hardware triggers 13, 14  
    input signal 55  
    opto-isolation adds delay 56  
    properties 55  
    pulse 55  
    software 32  
TTL  
    bidirectional 15, 16, 17, 19, 26, 32  
    bidirectional, circuit diagram 34  
    no longer bidirectional 22, 24

## U

usage notes 46

## V

VIA 9  
vibration 52  
voltage  
    MVS-8100D 28

## W

weight  
    of CDC camera 52

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