MICROSCAN

Visionscape® 0800 Framegrabber Board Guide

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Microscan Systems, Inc.
Tel: +1.425.226.5700 / 800.762.1149
Fax: +1.425.226.8250

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Microscan Systems, Inc.

United States Corporate Headquarters
+1.425.226.5700 / 800.762.1149

United States Northeast Technology Center
+1.603.598.8400 / 800.468.9503

European Headquarters
+31.172.423360

Asia Pacific Headquarters
+65.6846.1214

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PREFACE

Welcome!

Purpose of This Manual

This manual contains detailed information about the Camera I/O 0800 Card, available options, and cabling.

Manual Conventions

The following typographical conventions are used throughout this manual:

- Items emphasizing important information are **bolded**.
- Menu selections, menu items and entries in screen images are indicated as: Run (triggered), Modify..., etc.

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CHAPTER 1 Introduction

Overview

The Camera I/O 0800 board captures digital video images from Camera Link cameras. It can accommodate pixel clock rates from 20 to 85 MHz, receiving one or two pixels per clock. Thus, maximum capture speed is up to 170 million pixels per second. An onboard 32 Mbyte memory array buffers image data for smooth transfer without critical system "tuning". The digitizer:

- Conforms to the Camera Link Specification (base level)
- Controls Digital I/O, Sensors, and Strobes
- Has a Flexible Encoder Interface for Linescan support
- Has a Master/Slave bus for synchronization of multiple capture boards

Pixel depth can be up to 16 bits (one tap) or 12 bits (2 taps). However, pixels will be scaled to 8 bits for subsequent processing. When two taps are present, they can be either "interleaved" (even and odd pixels), or "sequential" (for example, even and odd horizontal lines).

The 0800 board is a PCI 2.3 compliant card that plugs into the PC. It supports the Universal PCI Bus standard (3.3V). A single base Camera Link channel is provided. As with the other member (0740) of the PCI board offering, the 0800 has the identical complement of 16 IO, 4 sensors and 4 strobes.

The firmware for the 0800 board is part of Visionscape® software and is programmed into the board every time Visionscape® starts on a cold boot. This may cause a short delay during the boot process.

Note: The 0800 Universal PCI Bus card will also fit in older 5Volt PCI slots.

The 0800 board set is a universal PCI device; it can plug into all types of PCI card slots, whether 32 bit or 64 bit, 33 MHz or 66 MHz, PCI or PCI-x. Refer to the PCI local bus specification revision 3.0 or higher for more information on interoperability. A PCI or PCI-x bus segment operates at the frequency of the slowest adaptor card inserted. So, if you plug the 0800 into a 64 bit 66 MHz slot, and there are no 33 MHz adaptor cards plugged into the same segment, the 0800 will operate at 66 MHz. When plugged into a PCI-x slot, the entire segment will run at 66 MHz, even if 100 or 133 MHz PCI-x cards share that segment. PCI-x cards use split transactions for PCI-x read operations, and are more efficient when a lot of data flows from the host to the adapter card. Since the 0800 exclusively writes image data to the host, its performance should be similar to that of a 66 MHz PCI-x adapter card.

Regardless of operating speed, the 0800 performs 64 bit transfers when plugged into a 64 bit PCI slot. It can also be plugged into a 32 bit slot, in which case, only a portion of the board connector will mate with the motherboard connector. The 32 bit slot may operate either at 33 or 66 MHz, depending on its capabilities.

The 0800 can be plugged into PCI slots using either 5V or 3.3V signaling. Special connector pins provide a signaling reference voltage to the board. Also, both 5V and 3.3V keyways are cut into the card edge to permit it to be physically plugged into a slot operating at either signaling voltage.

Note: The 0800 will plug into any half- or full-sized PCI slot.

Basic Components

The module-level Camera I/O 0800 Card is configured and contains the cabling that connects your PC to the Camera I/O 0800 Card.

TABLE 1–1. Typical Camera I/O 0800 Card Components

Number	Component	Description
Main Board Set		
GMV-VS81-0FP0	PCI-30020 014-000800 A1-20266-1 A1-20298-1	Visionscape® 0800 Camera Link Board Set w/Internal Cables — includes: Camera Link Framegrabber I/O Filter Board Internal Digital I/O Interface Cable
Option for I/O Controls		
98-VS08-0EC0	A1-20670-1	Internal Encoder Interface Cable
98-VS10-0SM0	A1-20394-1 98-A1203701 A1-20298-1	Mini Opto I/O Board with Internal Cable - Includes: Mini Opto I/O Board Internal Digital I/O Interface Cable
98-VS24-0SM0	030-203000 030-159106	Combination I/O Control Board — includes: 6 Ft Digital I/O Interface Cable

Table 1–2 lists the supported cameras:

TABLE 1–2. 0800 Supported Cameras

Camera	Type	Resolution	PCI Bandwidth	Description
Basler A501k	Areascan	1280x1024	92.5 MB/sec	74 Hz Frame Rate
Pantera SA 4M15 (DS-2x-04M15)	Areascan	2048x2048	64 MB/sec	16 Hz Frame Rate
Dalsa Piranha 2 2k-22-02k40	Linescan	2048 wide	69 MB/sec Max	35.4 KHz Line Rate 2048x1800 Frame
Atmel Aviiva SM2CL 2010	Linescan	2048 wide	56 MB/sec Max	29 KHz Line Rate 2048x1800 Frame

The camera connected to the 0800 is programmed into the Job by selecting the corresponding camera definition entry in the VisionSystemStep properties page. The 0800 is detected when Visionscape® is started, and is added to the avp backplane application.

The Camera Link standard is offered in the following configuration:

- Base — This configuration uses one Channel Link transmitter/receiver pair to transmit up to 24 bits (maximum) of data from the camera to the framegrabber.

Linescan Support

The Linescan camera connected to the 0800 is programmed into the Job by selecting the corresponding camera definition entry in the VisionSystemStep properties page. Table 1–3 lists the standard Linescan cameras that are supported:

TABLE 1–3. 0800 Supported Linescan Cameras

Camera Name/Model	Type	Resolution	Description
Atmel Aviiva SM2CL 2010	Linescan	2048 wide	28 KHz max. line rate
Dalsa Piranha 2 2k-22-02k40	Linescan	2048 wide	35.4 KHz max. line rate

As a Linescan camera must acquire an image of a moving object, an encoder (see “Encoder” on page 1-5) must be connected to trigger each line capture in order to form the resulting 2 dimensional array image of the moving scene underneath. The 0800 has specific features to support the easy connection of encoder signals to the system.

Linescan Camera resolutions range from 512 pixels up to 8k. Data rates of up to 170MBytes per second are possible. Typically, maximum line rate is about 80% of the data rate divided by the sensor length. Because of the large image sizes typically seen with Linescan applications, a large amount of RAM and CPU resources is required. The Rack PC 847B high performance PC is an overall good candidate for support of Linescan cameras with the 0800 framegrabber.

Lighting

Linescan cameras have very little time in which to integrate a charge on their CCDs, so plenty of light is required. Specialized light sources, such as the NER 288mm long LALL devices, are available with linescan focus lenses to create an extremely bright light line. Because you only need to illuminate a linear CCD rather than a rectangular CCD, it is easier to make the light even. In addition, may of the new Linescan cameras have flat-field correction capabilities usually programmable with camera vendor UI utilities.

Lenses

Linescan cameras of more than 1k pixels in length do not use standard C mount lenses. Instead, F-mount or M72*0.75 lenses are required.

Encoder

To synchronize the line acquisition with the part motion, an encoder is required. For instance, to inspect BGA devices at 10 microns per pixel, two things must happen:

- You must choose the lens and camera stand-off distance to get that resolution across the image.
- You must provide pulses to the 0800 board. These can come at a higher frequency than the 10 microns needed as the 0800 board can divide this pulse-train down. With a 1 micron encoder, you can divide by 10 to get what is needed (you can also multiply the pulses by two or four if you have quadrature signals, but it is better to start with more information).

Note: Even though the hardware supports multiplying the pulses by 2 or by four, the software does not (see “Constraints” on page 1-5).

The encoder signals can be fed into the 0800 board either through the sensor inputs on the standard Visionscape® I/O board or through a special 9-pin D connector on a separate PCI slot bezel. The D connector can accept either TTL or RS-422 signal levels. There is also provision for an Index signal to tell the board exactly when to start acquiring lines. This is like the trigger signal in an Area Scan system.

All of these parameters can be (and are for the supported standard Linescan cameras) fixed in the camera definition for the specific camera (listed in Table 1–3, “0800 Supported Linescan Cameras,” on page 1-4).

Constraints

- No continuous Linescan support; this means that there is no special feature provided to make sure that there is no single line missed when capturing back to back images. In full pipeline, some lines between images will not be acquired, producing a gap in the image of one or more lines if the images captured were to be stacked one below the other.

- Camera definition files for the supported cameras will:
  - Be hardcoded to accept the encoder signal on the encoder connector only of the 0800 board.
  - Fix the image size (i.e., number of lines). There is no support in Visionscape® V3.7 to dynamically change the number of lines between acquires.
- Instead of the index signal specific to Linescan cameras and defined in the camera definition file, a normal trigger signal, as used for Area Scan cameras, must be used to trigger a Linescan camera.
  - There will be no support for x2 and x4 multipliers for the encoder; only single phase encoders are supported. The Prescale parameter that controls the encoder divider for the 0800 is also fixed in the camera definition.
  - Prescale and other important field of the camera definition are in Appendix A.

Changing Number of Lines Captured in Linescan Mode

Because different object sizes will be used, you need to be able to change the number of lines captured with a Linescan camera.

Note: The size of the line in pixels will not change, just how many lines are captured.

To change the number of lines, you need to modify the camera definition file. These files are found in the Vscape/Drivers/Camdefs folder of the Visionscape® installation. Camera definition files have the .cam file extension. The Linescan camera file names are:

atmel_aviiva_m2_cl_2kx2k_freerun_800.cam

dalsa_p2_2kx2k_freerun_800.cam

These files contain a field called Rows; changing this value changes how many lines are captured.

Note: Remember to rename the file you changed so you can keep track of what you are doing.

Determining Frame Rate with a Linescan Camera

Note: Determining the frame rate of a Linescan camera is different from determining the frame rate of an Area Scan camera.

Essentially, there is no timeout, since the acquisition of the image is determined by the connected encoder, not the camera itself.

- Dalsa Piranha 2: 30 Mhz Maximum line rate is 27 KHz
  Minimum line rate is 1 KHz

  40 Mhz Maximum line rate is 35.4 KHz
  Minimum line rate is 1 KHz
- Atmel Aviiva 2k, the maximum line rate is 28 KHz.

To calculate the theoretical frame rate, you need the encoder counts per second (line rate) and the number of lines in the image. The formula is:

$$\text{lineRate} = \frac{1}{\text{Stride} \times \frac{\text{TapSpeed}}{\text{NumberOfTaps}} + \text{ExposureTime}}$$

So, for the Dalsa Piranha 2 2K 40MHz camera, the calculated linerate is:

$$\text{lineRate} = \frac{1}{2048 \times \frac{25\text{n sec (40MHz)}}{2} + \text{ExposureTime}}$$

$$\text{lineRate} = \frac{1}{25.6\ \text{msec} + \text{ExposureTime}}$$

$$\text{FrameRate} = \frac{1}{\frac{\text{Rows}}{\text{lineRate}} + \text{InterruptLatency}}$$

For example, for the Dalsa Piranha 2, if the Exposure time is 500 µsecs and the interrupt latency is 1 msec and the number of rows is 2048, the line rate is 1.9 KHz and the frame rate is 0.926 fps.

Camera I/O 0800 Card

Figure 1–1 and Figure 1–3 show a Camera I/O 0800 Card, which consists of a Camera I/O 0800 card connected to the Visionscape® 1006 Vision Accelerator Board via two Camera I/O Card connectors.

FIGURE 1–1. Camera I/O 0800 Card

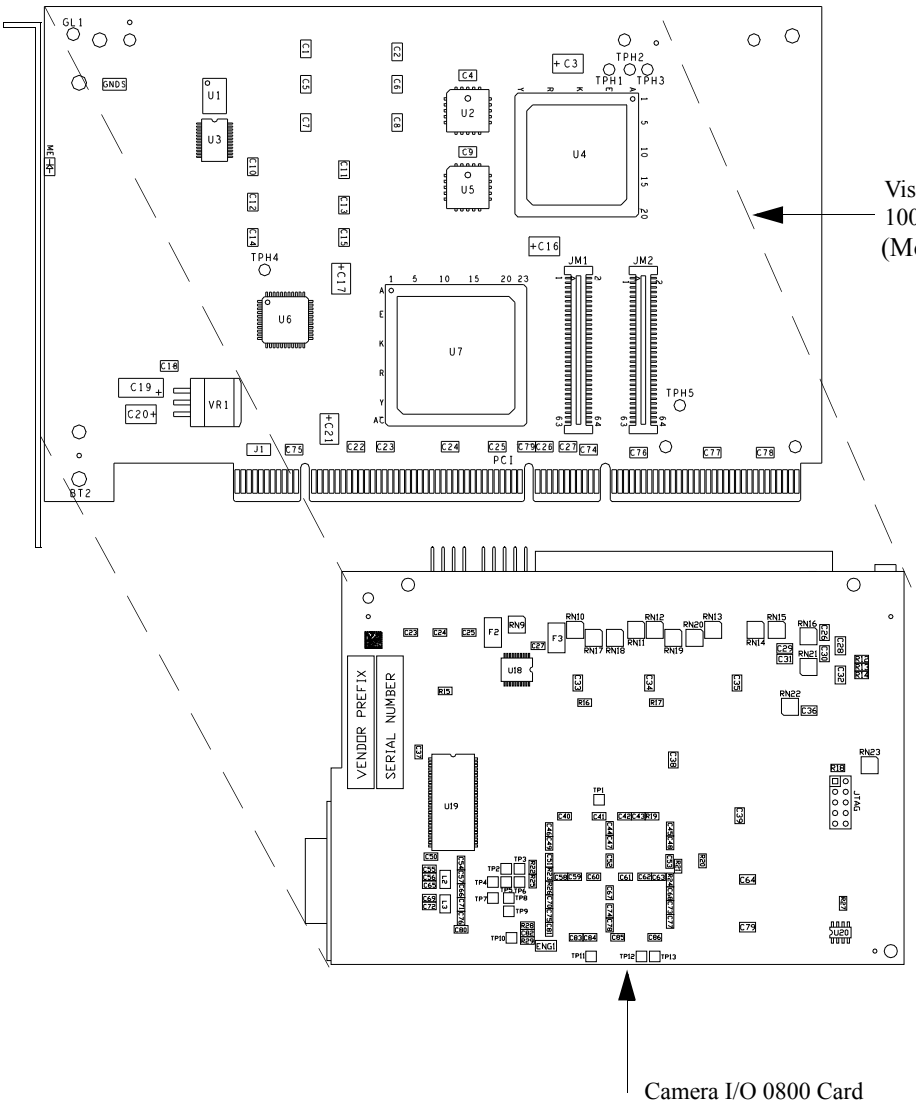


FIGURE 1–2. Camera I/O 0800 Card (Side 1)

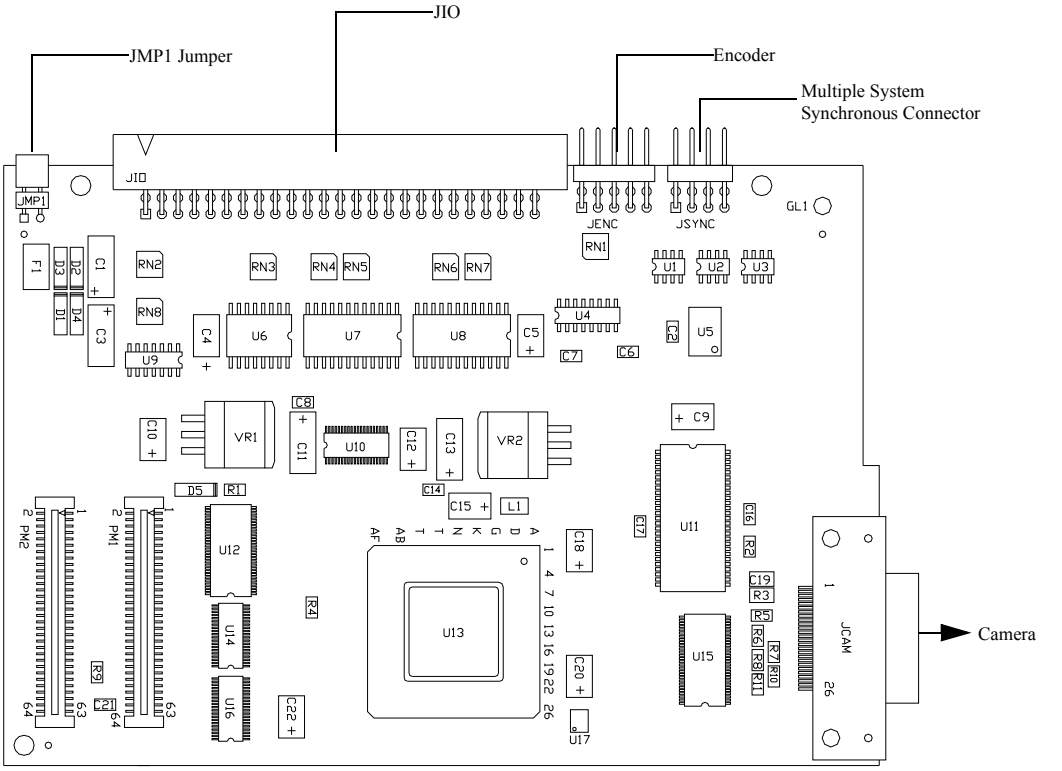
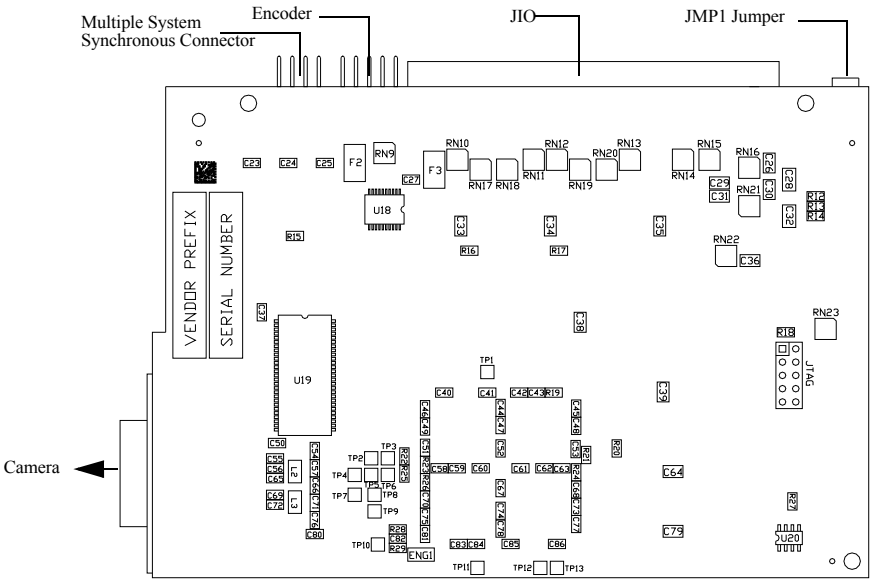


FIGURE 1–3. Camera I/O 0800 Card (Side 2)



- Camera Connector — Standard Camera Link. The Camera Link specification can be obtained from various camera vendors. For example:

  `www.machinevisiononline.org/public/articles/Pulnix_CameraLink5_Specs.pdf`

- JIO — This connector provides 16 discrete I/O points, 4 Sensor Inputs, 4 Strobe Outputs and a VREF Input that sets Sensor operations and threshold voltage. It gets connected to I/O boards in one of two ways:

  – A 50-pin ribbon cable connects JIO to the internally mounted Mini Opto I/O board that's mounted to the I/O Port, as shown in Figure 1–5.

  – A 50-pin ribbon cable connects JIO to the internally mounted I/O filter board that's mounted to the I/O Port, as shown in Figure 1–4. In turn, the I/O Port is connected to the Combination I/O Board via a 50-pin ribbon cable.

- JMP1 Jumper — 12V Sensor Power Jumper.

Caution: All Visionscape® Camera I/O boards ship with the JMP1 jumper installed. This is only compatible with Visionscape® Combo I/O and Mini Opto I/O boards. If you are using other I/O equipment, see Chapter 2, "Hardware Specifications".

- Multiple System Synchronous Connector — Connects the Multiple System Synchronous Cable for Master/Slave Multi-Board Configurations.
- Encoder Connector — Provides three differential RS422 or single ended TTL encoder inputs for general purpose triggering or Linescan support.
  - A 9-pin ribbon cable w/bezel connects the encoder connector to the encoder port, as shown in Figure 1–4 and Figure 1–5.

Fuses

- +5V for Discrete I/O is fused with an auto-resetting 0.5A fuse, located on the Camera I/O Card, which requires no maintenance.
- +12V for Sensor Inputs is fused with an auto-resetting 0.5A fuse, located on the Camera I/O Card, which requires no maintenance.

Field I/O Signal Specification

- Inputs — TTL levels
- Outputs — TTL levels; outputs 15 and 16 can be optionally switched to control 8 analog outputs
- Quantity — 16, each programmable as an input or output

Strobe/Sensors Signal Specification

- Sensor
  - Input Range — 0V<vin<24V.
  - Input Impedance — >10k ohms.
  - Ext. Threshold Range — 0V<vin<24V Defaults to 1.4V (TTL) when unconnected. Threshold voltage is Vin/2 when Vin>5V.

  - Ext. Threshold Source Impedance — <100 ohms.
  - Quantity — 4.

- Strobe
  - Outputs — TTL levels.
  - Output Impedance — <100 ohms.
  - Strobe Rate — <1kHz.
  - Quantity — 4.

I/O Connector

Connector mate of JIO — 3M P/N 3425-6650, as shown in Figure 1–3. Refer to Figure 2–2, “I/O Connector - Camera I/O Card & Combination I/O Board,” on page 2-3 for I/O connector pinout.

Port Access Panel & Connectors

Port access is available through the rear of your PC, as shown in Figure 1–4 and Figure 1–5.

FIGURE 1–4. Rear Port Access with Mini Opto I/O Board and Encoder

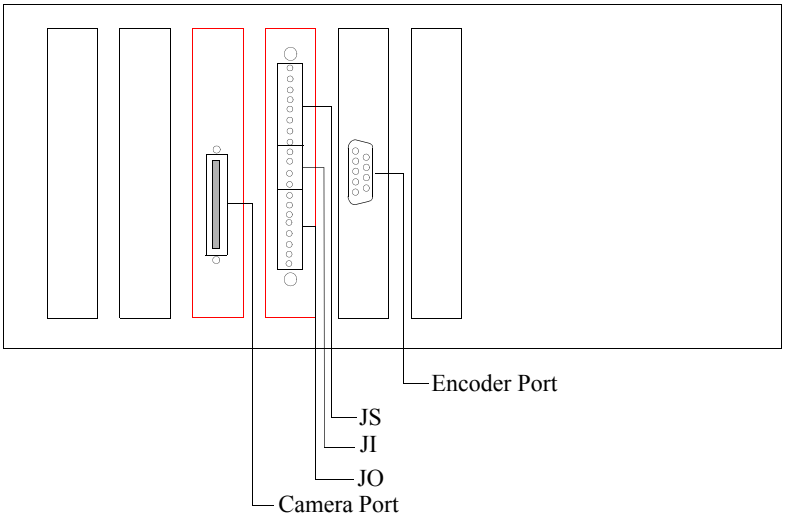
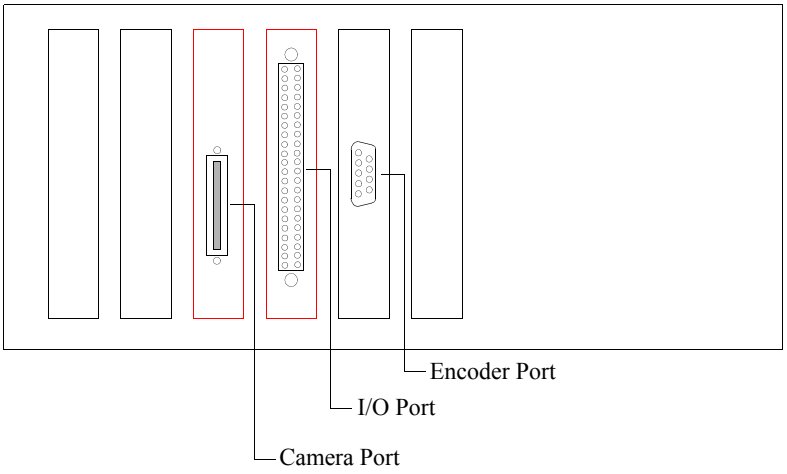


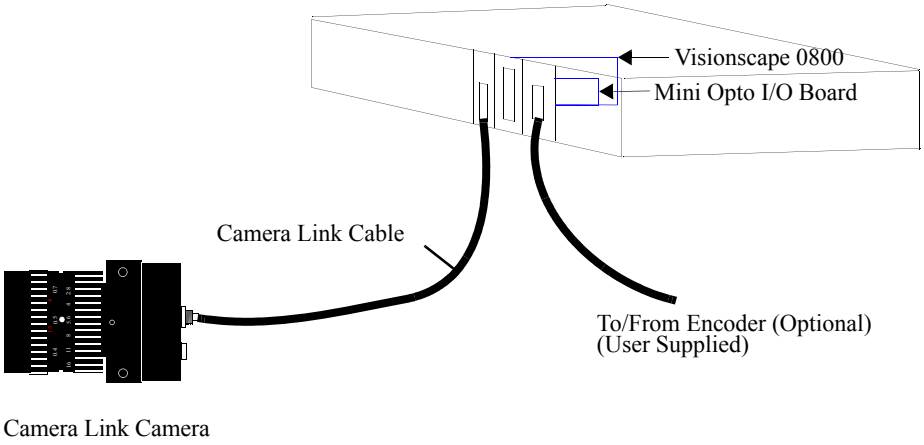
FIGURE 1–5. Rear Port Access with I/O and Encoder Port Connectors



System Configuration

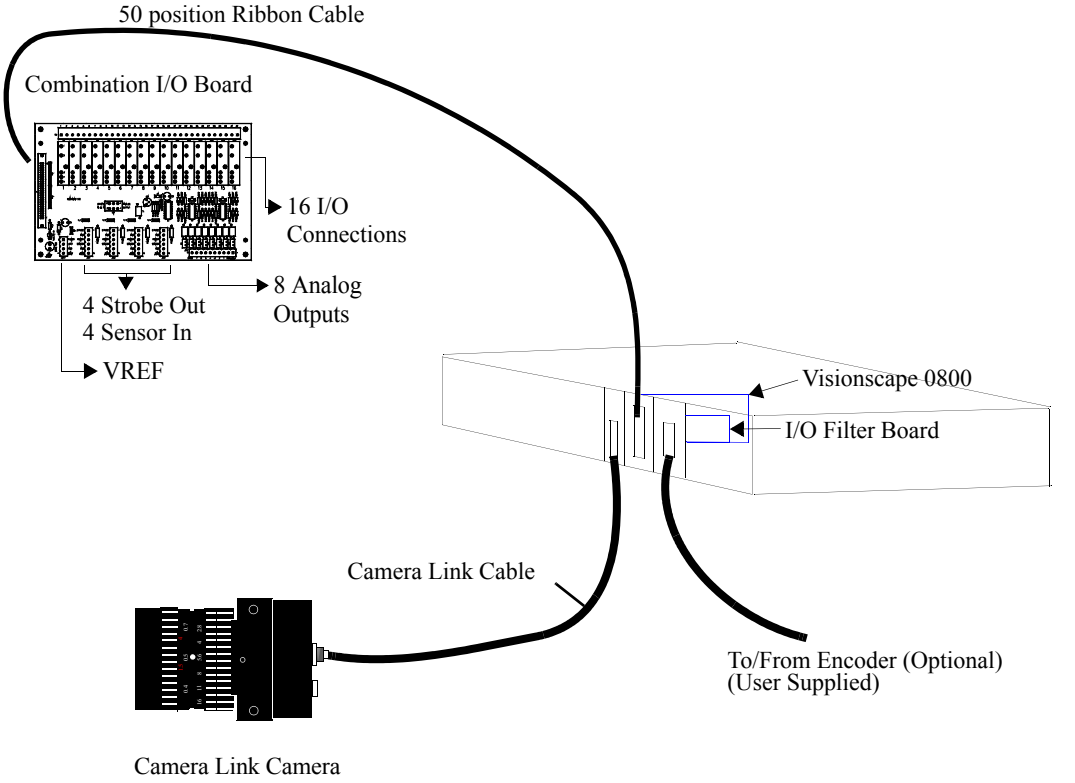
The Camera I/O 0800 Card, camera, and Mini Opto I/O Board are configured as shown in Figure 1–6.

FIGURE 1–6. System Configuration with Camera Link I/O Card



The Camera I/O 0800 Card, Camera(s), and Combination I/O Board are configured as shown in Figure 1–7.

FIGURE 1–7. System Configuration with Combination I/O Board



Other System Components

Cameras

The Camera I/O 0800 card provides a single Camera Link channel, and supports "Base" level Camera Link cameras. Area Scan cameras and Linescan cameras are supported.

Strobe & Sensor

For continuous motion or high-speed indexing applications, a sensor and strobe are required to freeze each part before the image can be acquired. The strobe unit may include a fiber-optic light pipe. Refer to "Strobe & Sensor" on page 2-31 for more detailed information.

CHAPTER 2

Hardware Specifications

Rear Port Connectors

Camera Link Connector

FIGURE 2–1. Camera Link Connector — Camera I/O 0800 Card

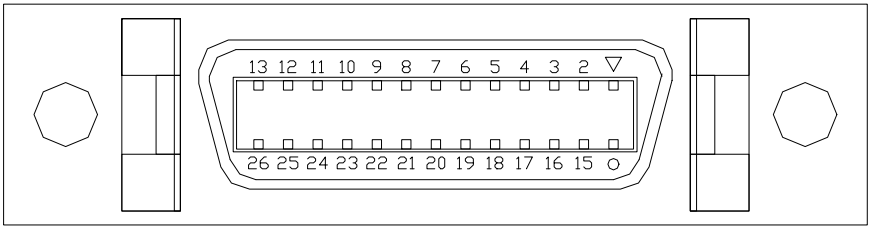


TABLE 2–1. Pinouts — Camera Link

Camera Link Signal Name	Pin #
inner shield	1
inner shield	14
X0-	25
X0+	12
X1-	24
X1+	11

TABLE 2–1. Pinouts — Camera Link (Continued)

Camera Link Signal Name	Pin #
X2-	23
X2+	10
Xclk-	22
Xclk+	9
X3-	21
X3+	8
SerTC+	20
SerTC-	7
SerFG-	19
SerFG+	6
CC1-	18
CC1+	5
CC2+	17
CC2-	4
CC3-	16
CC3+	3
CC4+	15
CC4-	2
inner shield	13
inner shield	26

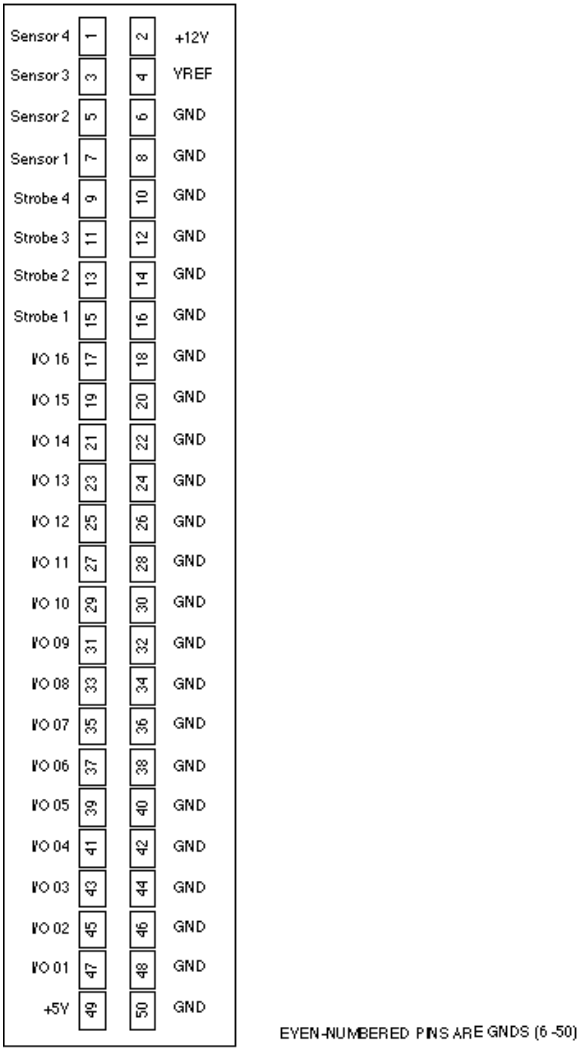
I/O Connector

I/O signals are accessed via the Mini Opto I/O board or the I/O Port, as shown in Figure 1–4 through Figure 1–7, starting on page 1–15.

- The Mini Opto I/O board is connected to JIO, as shown in Figure 1–3 on page 1–10, using a 50-position flat ribbon cable, which is supplied.
- The I/O Port is optionally connected to JIO via the I/O filter board, as shown in Figure 1–3 on page 1–10, using a 50-position flat ribbon cable, which is supplied.

The pinout for the I/O port and I/O filter board is shown in Figure 2–2, “I/O Connector - Camera I/O Card & Combination I/O Board,” on page 2-3.

FIGURE 2–2. I/O Connector - Camera I/O Card & Combination I/O Board



Note: The I/O connector is linked to the Combination I/O Board via a 50-conductor (0.050 ctrs) flat cable (part number 030-159106).

Encoder Connector

FIGURE 2–3. Encoder Connector

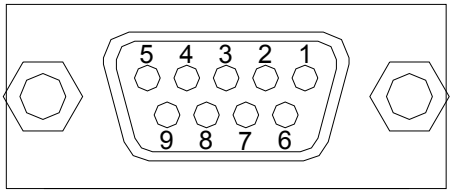


TABLE 2–2. Connector Pinouts

Pin #	RS422 Signal Name	TTL Signal Name
1	ENC0+	ENC0
6	ENC0-	N/C
2	ENC1+	ENC1
7	ENC1-	N/C
3	ENC2+	ENC2
8	ENC2-	N/C
4	+5V (0.2A)	+5V (0.2A)
9	5V Return	5V Return
5	Signal Gnd	Signal Gnd
Shell	Chassis Gnd	Chassis Gnd

Notes:

1. Encoder phases and index may be wired to any signal set.

2. Encoder signals may also be wired to sensor inputs 1 - 4.

Mini Opto I/O Board

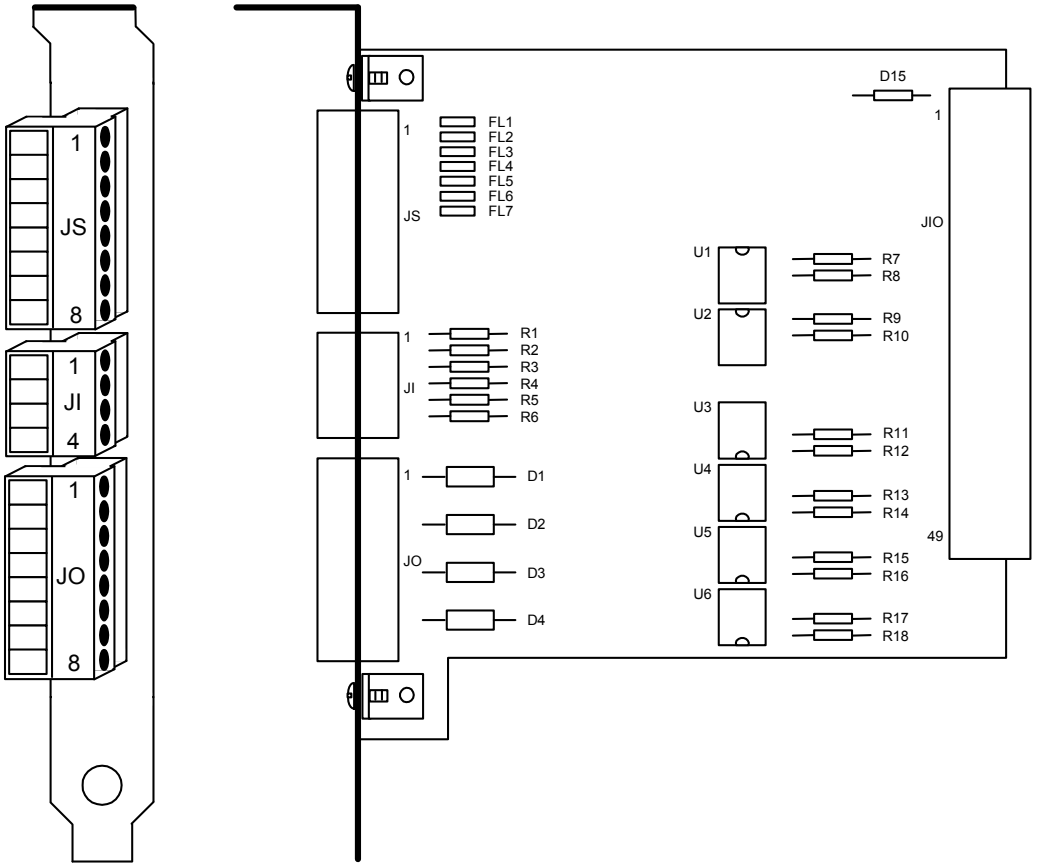
Overview

The Mini Opto I/O Board provides:

- 2 discrete input points
- 4 discrete output points
- 2 sensor inputs
- 2 strobe outputs

See Figure 2–4.

FIGURE 2–4. Mini Opto I/O Board



The Sensor/Strobe connector JS is shown in Figure 2–4. This connector is supplied with an 8-position mating screw terminal plug that provides:

TABLE 2–3. JS Inputs and Outputs

Pin	Description
Inputs[1]	
1	+12V for sensor power (SENSOR_PWR)
2	Non-isolated sensor input SENSOR2
3	Non-isolated sensor input SENSOR1
4	A sensor return
Outputs	
5	Non-isolated TTL strobe output (STROBE2)
6	Non-isolated TTL strobe output (STROBE1)
7	A strobe return
8	CHASSIS GND

[1]Each sensor input can operate from TTL to 30V DC

The internal voltage reference signal VREF is connected to SENSOR_PWR on the board, and is used to properly bias the sensor inputs.

For 12V sensors, supply power to your sensor using the sensor power SENSOR_PWR on pin 1 on the sensor strobe connector JS.

For 24V sensors (30 volts maximum), you must provide an external +24V power supply, which also sets the internal reference voltage VREF. Connect external +24V to sensor power SENSOR_PWR pin 1 on connector JS and supply power to your sensor using the sensor power SENSOR_PWR pin 1 on connector JS.

For TTL sensors, do not connect power to the sensor power SENSOR_PWR pin 1 on connector JS. You must remove jumper JMP1 on the Camera I/O Card. This will properly bias the sensor inputs for TTL levels. See Figure 2–4, “Mini Opto I/O Board,” on page 2-6.

Caution: Whenever the Sensor Power pin on JS is less than 12V, jumper JMP1 on the Camera I/O Card MUST be removed.

Caution: If you are using a non-Microscan I/O board, pin 2 of the 50-ribbon cable will most likely be grounded. Therefore, you must remove the 12V sensor power jumper (JMP) from the Camera I/O Card before installing a non-Microscan I/O board. This jumper places +12V power on pin 2. Failure to remove the jumper will damage the Camera I/O Card.

Digital I/O

There are two dedicated optically-isolated input and four dedicated optically-isolated output points. The field wiring is terminated on the two screw terminal connectors JI and JO.

There is a digital input connector JI, as shown in Figure 2–4. This connector is supplied with a 4-position mating screw terminal plug. It provides two bi-directional opto inputs:

- IN1 on pins 3 and 4.
- IN2 on pins 1 and 2, corresponding to GPIO points 5 and 6 (see “General Purpose I/O” on page 2-9).

Each input can operate with non-polarized DC signals from 5 - 50 volts with DC currents from 0.5 - 5 mA.

There is a digital output connector JO, as shown in Figure 2–4. This connector is supplied with an 8-position mating screw terminal plug. It provides four non-polarized opto outputs:

- OUT1 on pins 7 and 8.
- OUT2 on pins 5 and 6.
- OUT3 on pins 3 and 4.
- OUT4 on pins 1 and 2, corresponding to GPIO points 1 through 4 (see “General Purpose I/O” on page 2-9).

Each output has a contact resistance of less than 20 ohms and can operate with AC or DC signals up to 50 volts at 100 mA. Each output is protected by a current limiting foldback circuit.

The I/O connector supplies the necessary +5 volts DC to operate the I/O board via the I/O cable. There is no external power supply connector.

Caution: Do not attempt to connect an external +5 volts DC power supply to the Mini Opto I/O Board. There is no connector provided for this function. This board receives its power via the I/O cable. Connecting an external power supply will cause serious problems: the two power supplies will conflict with each other to produce unpredictable results and the external power supply's ground may cause ground loops to occur.

In designing your vision application, you must decide which mix of input and output ports you require.

To program your vision application, use the AppFactory/FrontRunner user interface software. Refer to your Visionscape® Tools Reference for more specific information on how to assign the I/O.

General Purpose I/O

Visionscape® provides a complement of optically-isolated I/O communications points called general purpose I/O (GPIO). You can configure the GPIO in the Vision System Step properties page by setting the GPIO Input Mask property. This mask defines which I/O points are programmed as inputs and which are defined as outputs.

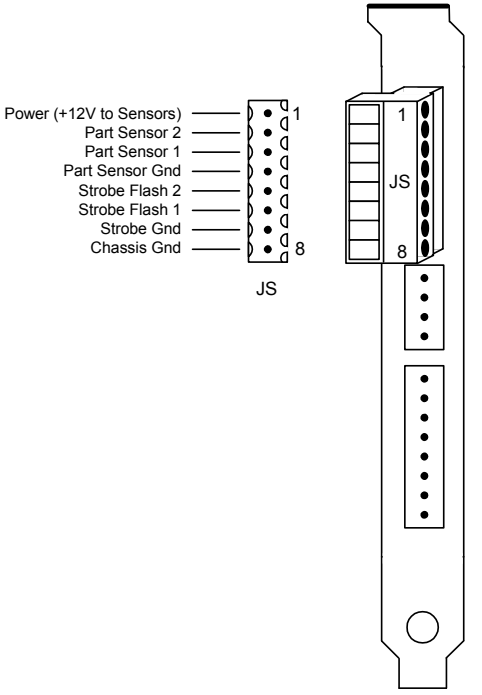
For the Mini Opto I/O board, you **must** set the GPIO points as follows:

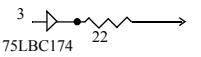
TABLE 2–4. Settings for GPIO Points

GPIO Points	Input/Output
1 - 4	Output (Not Selected)
5 - 6	Input (Selected)
7 - 16	N/A

Connector Pinouts — I/O Connector

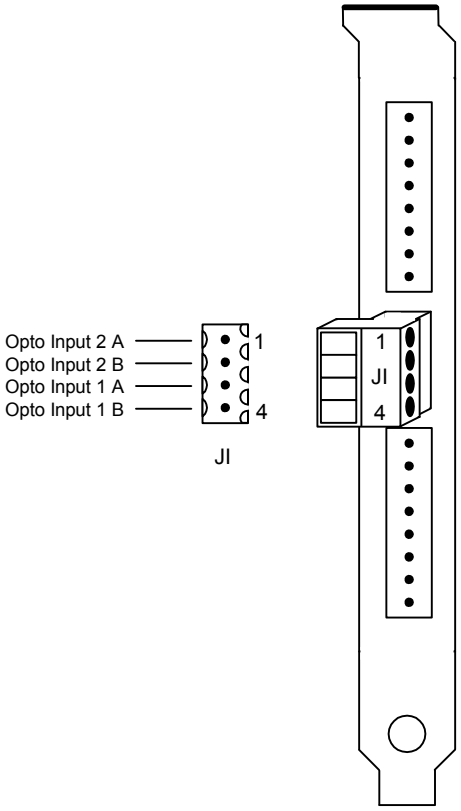
FIGURE 2–5. Mini Opto I/O Board Sensor/Strobe Connector - JS



Signal	Characteristic
Part Sense	Sense input signals have 11k ohm pullup to +5V.
Strobe Flash	Output to strobe lamp positive +5 V pulse with 20 mA current source at +3V. 
+12 Volts	Power available for most photoelectric and proximity devices. (100 mA max.) Fused by F1 on CIOC (auto-resetting).

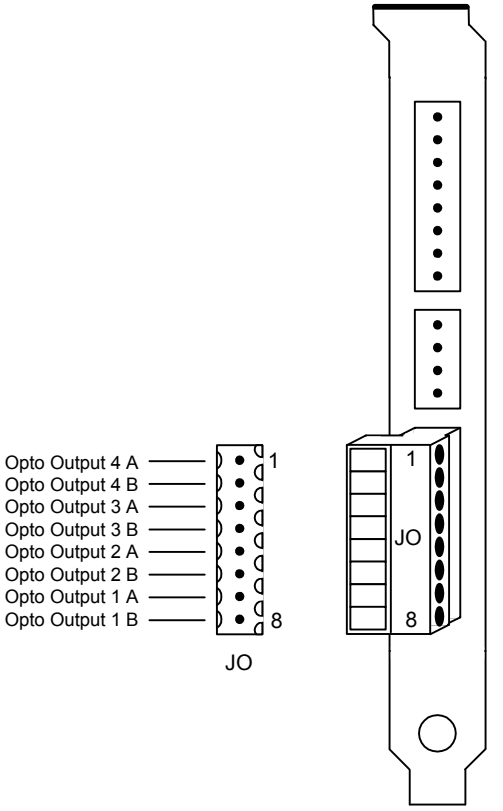
Caution: Avoid continuous shorts, as these will damage the fuse.

FIGURE 2–6. Mini Opto I/O Board Input Opto Connector - JI



Voltage	5 - 50 volts DC (**Bi-directional**)
Current	0.5 - 5 mA
Switching Time	1 ms maximum
Common Mode isolation rating	1500 volts

FIGURE 2–7. Mini Opto I/O Board Output Opto Connector - JO

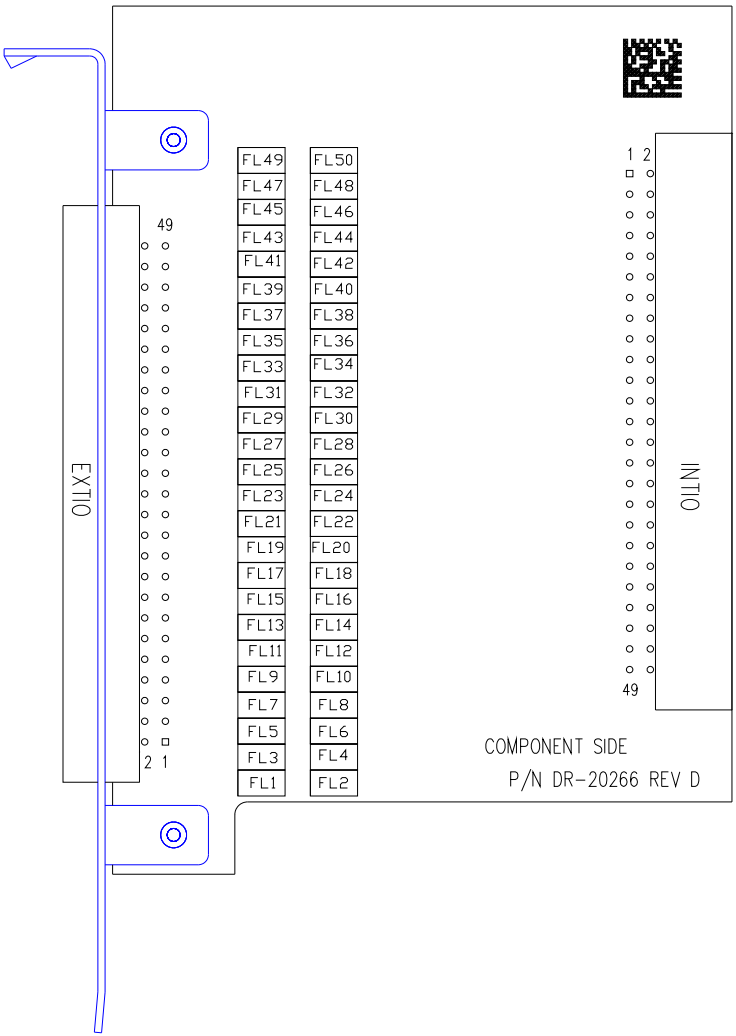


Voltage	3 - 50 volts AC/DC (**Bi-directional**)
Current	Up to 100 mA
Contact Resistance	Less than 20 ohms
Switching Time	1 ms maximum
Common Mode isolation rating	1500 volts

Digital I/O Filter Board

The digital I/O filter board minimizes radio frequency noise emanating from the external I/O ribbon cable and Combo I/O board that can interfere with other electronic hardware. This allows you to install the PC, I/O ribbon cable, and Combo I/O board without the need to mount the system within a metallic enclosure. See Figure 2–8.

FIGURE 2–8. Digital I/O Filter Board

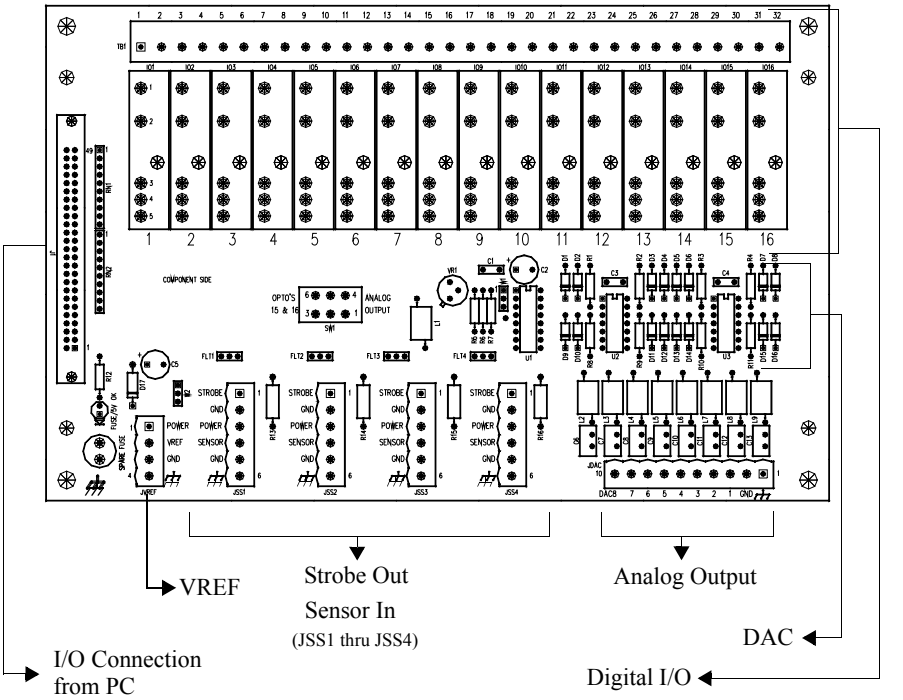


Combination I/O Board

The Combination I/O Board provides up to 16 discrete I/O points, 4 Strobe and Sensor connections, and 8 channels for analog outputs, as shown in Figure 2–9.

Using a Combination I/O Board, the Camera I/O 0800 Card can communicate with other devices. For example, you can have three input modules that provide input signals to the Camera I/O 0800 Card, and you can have four output modules that send signals to external control devices.

FIGURE 2–9. Combination I/O Board Connections



- Digital I/O — Connects the Combination I/O Board to the Visionscape® Vision Processor and provides 16 I/O points. Digital I/O allows you to connect to switches, lights, controls, PLC's, etc., and accepts 5-volt-logic solid-state relays (Opto 22™ G4-type isolator modules).
- Sensor In — This is used if you need to connect a parts sensor to your Camera I/O 0800 Card.

- Strobe Out — This is used if you run the Camera I/O 0800 Card in a strobed application and need to connect your strobe to the Strobe Out connector.
- Analog Output — This has 8 analog outputs that are jumper-selectable for 0-5V or 0-10V outputs with 6-bit (64 level) of resolution. The last two Digital I/O points control the analog outputs, which are typically used for controlling light sources. There are 14 Digital I/O ports available (1-14) when Analog Output is selected by SW1.
- I/O Connection from PC — Connects the Combination I/O Board to the Camera I/O Card via a 50-pin ribbon cable. You can attach your own industry standard I/O board to the I/O Connector. Only 16 bits of I/O are available. Microscan suggests that you use optically-isolated I/O, such as Opto 22™ G4-type optos.
- VREF — When disconnected, the sensor reference voltage defaults to TTL levels (1.4V). By applying a voltage between VREF and VREF_GND, the reference voltage will change to VREF/2. VREF should be greater than or equal to 5V.

Caution: If you are using a non-Microscan I/O board, pin 2 of the 50-ribbon cable will most likely be grounded. Therefore, you must remove the 12V sensor power jumper (JMP) from the Camera I/O Card before installing a non-Microscan I/O board. This jumper places +12V power on pin 2. Failure to remove the jumper will damage the Camera I/O Card.

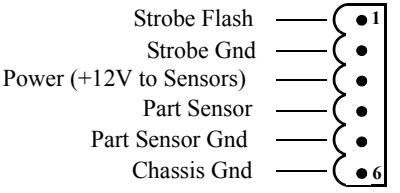
Connector Pinouts

I/O Connector

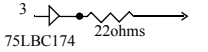
Refer to the “Rear Port Connectors” on page 2-1 for more information.

Sensor/Strobe Connector

FIGURE 2–10. Sensor/Strobe Connector



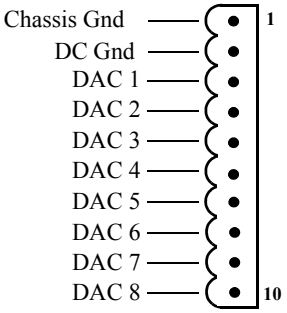
JSS1 through JSS4

Signal	Characteristic
Part Sense	Sense input signals have 11k ohm pullup to +5V.
Strobe Flash	Output to strobe lamp positive +5 V pulse with 20 mA current source at +3V. 
+12 Volts	Power available for most photoelectric and proximity devices. (100 mA max.) Fused by F1 on CIOC (auto-resetting).

Caution: Avoid continuous shorts, as these will damage the fuse.

Analog Output Connector

FIGURE 2–11. Analog Output Connector

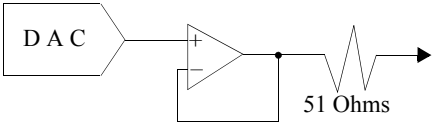


DAC Outputs

DAC Outputs are jumper selectable. For 0 - 5 volts or 0 - 10 volts operation:

Jumper W1	Voltage Range
Pins 1 + 2	0 - 10V
Pins 2 + 3	0 - 5V

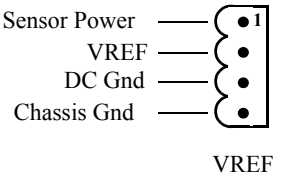
DAC (analog) Outputs are selected by setting switch S1 to the analog position. The analog output uses a 6-bit DAC (64 levels). Its resolution is 0.078 volts per level in the 0-5V range and 0.156 volts per level in the 0-10V range.



TLC 274

VREF Connector

FIGURE 2–12. VREF Connector



Signal	Characteristic
VREF	Sensor input voltage reference. Used to properly bias sensor input signal. Up to 30VDC. Connect to Sensor Power, either hardwire or use jumper *W2*, pins 1 + 2. Do not connect to Sensor Power when using TTL sensor signals and set jumper *W2*, pins 2 + 3.
Sensor Power +12V	Provides power to the Sensor inputs and to the VREF input. For Sensors that use a voltage other than +12V, connect an external power supply. The external power supply shall not to exceed 30VDC.

Caution: Whenever the Sensor Power pin on JS is less than 12V, jumper JMP1 on the Camera I/O Card MUST be removed.

Cameras

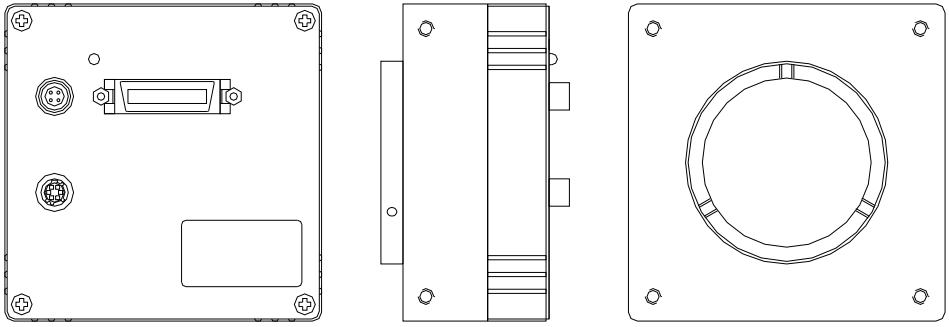
The Camera I/O 0800 Card supports the following cameras:

TABLE 2–5. Camera Types & Descriptions

Camera Name/Model	Type	Resolution	Description
Basler A501k	Area Scan	1280x1024	74 fps maximum
Dalsa Pantera SA 4M15 DS-2x-04M15	Area Scan	2048x2048	16 fps maximum
Dalsa Piranha2 2k-22-02k40	Linescan	2048x1	35.4 KHz Line Rate
Atmel AViiVA SCM2CC 1010	Linescan	2048x1	29 KHz Line Rate

Configuring the Basler A501k Camera

FIGURE 2–13. Basler A501k Camera



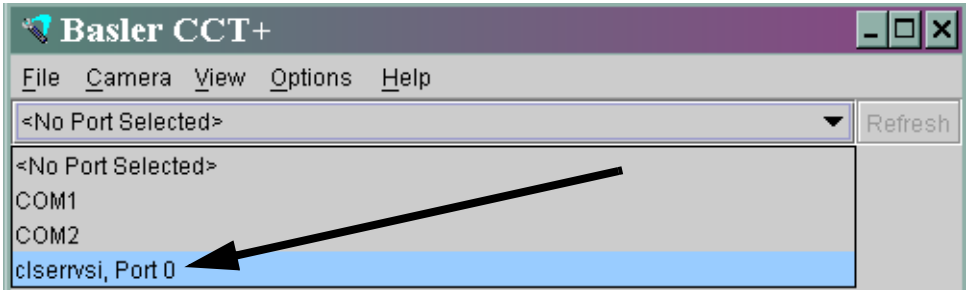
This camera is configured using the Camera Link internal serial port. To obtain the required software:

1. Go to www.baslerweb.com.
2. Select the “vision components” link.
3. Select the “A500” link under Area Scan Cameras.
4. Select Download the Camera Configuration Tool Plus.
5. Install using the instructions given.

Note: Website layout is subject to change, so the **following** instructions are a general guide. Contact Basler support as necessary.

The following instructions are based on Camera Configuration Tool CCT+ Version 1.0.0227. The software links to Microscan "clserrvsi," which is part of your Visionscape® software installation. The configuration window should indicate "clserrvsi, Port 0" (see Figure 2–14).

FIGURE 2–14. Basler Configuration Window



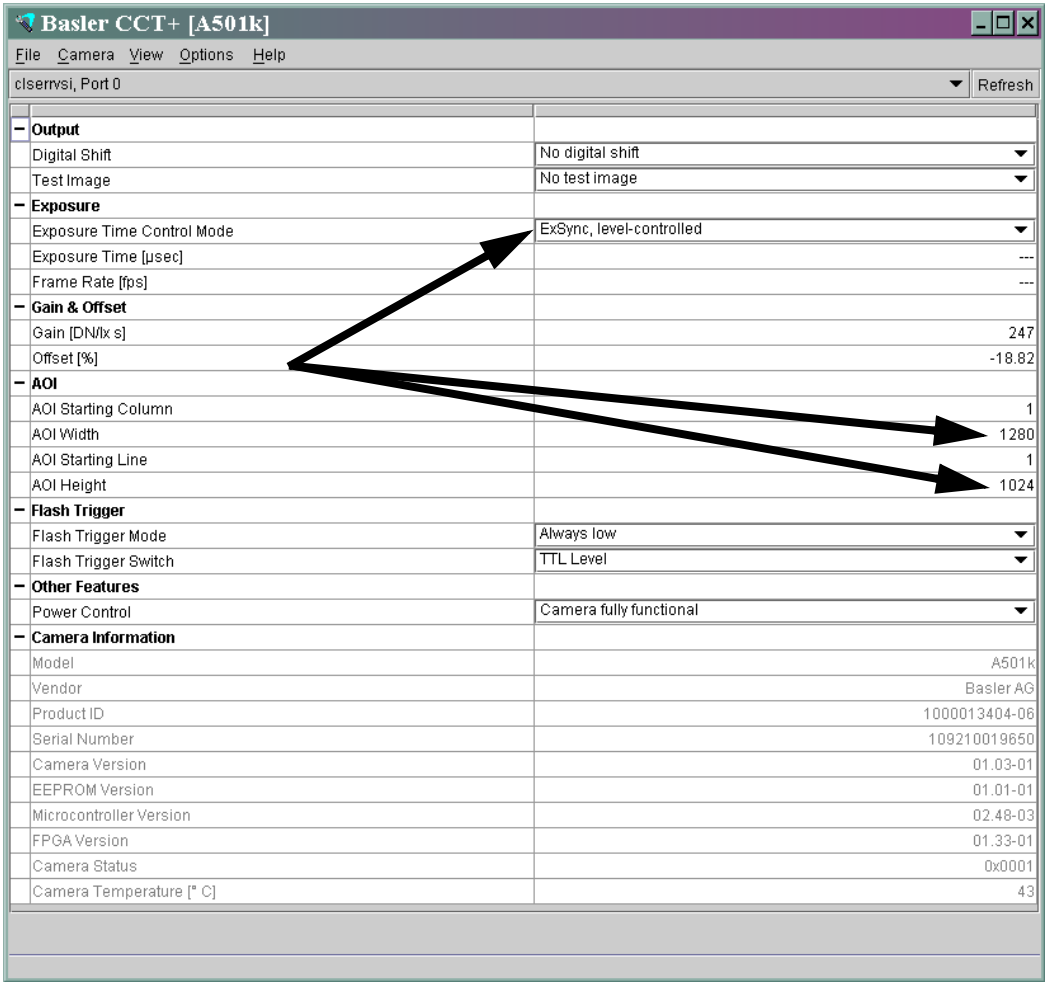
1. Install the Camera I/O 0800 board.
2. Connect the Camera Link and camera power cables.
3. Apply power to the PC and camera.
4. When the Windows desktop is visible, find the CCT+ icon and launch the configuration program.

   Note: AppFactory need not be running.

5. Set the camera exposure mode to ExSync, level-controlled, as shown in Figure 2–15.

   Set other settings as needed. Most will be as they appear in Figure 2–15.

FIGURE 2–15. Basler Configuration Window



6. AOI must be set to 1280xl024, as shown, to work with the default AppFactory camera definition.

7. After making the settings, you may want to confirm that the camera is working properly with AppFactory before saving them; this is optional.

8. To save the settings, go to the Camera menu and select Copy User Set into Work Set.

9. A dialog box will appear asking you to choose a work set (default is #1), and confirm.

10. After confirming, go to the Camera menu and select Select Startup Pointer.

11. A dialog box will appear asking you to choose the set to be used (default is #1).

    Note: Be sure to choose the same set as the previous step, then confirm.

    After you do this, the camera should power up with the correct settings each time.

12. To put the camera back into normal operation after this step, press refresh.

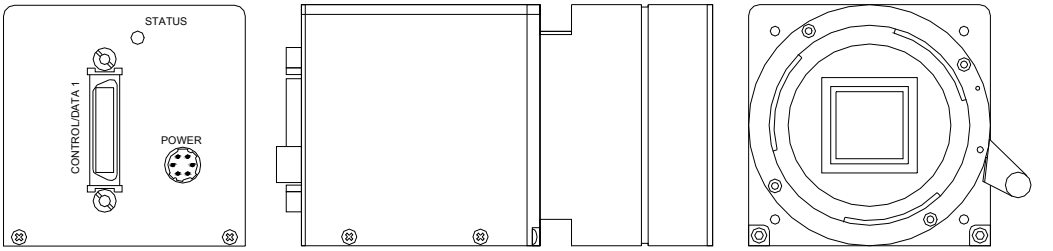
Restrictions

If a camera is selected for image capture by a vision application, it must be physically connected to the Camera I/O Card. A non-existent or faulty connection to the camera will result in a capture timeout.

Caution: Do not twist and pull the cables when connecting them to the camera.

Configuring the Dalsa Pantera SA-4M15 Camera

FIGURE 2–16. Dalsa Pantera SA-4M15 Area Scan Camera



Use StringTerminal.exe to communicate with the Pantera SA-4M15 camera. This is installed with Visionscape®. It is located in the Vscape/Drivers folder.

When executed, StringTerminal displays a prompt, asking which type of camera you want to communicate with. Choose Dalsa (option 1).

Setting to 8-Bit Mode (Data Mode 1)

To work with Visionscape®, the Pantera SA-4M15 camera must be in 8 bit mode (data mode 1).

To output the current camera settings, type:

```
gcp<cr>
```

If the camera is not the correct data mode, type:

```
sdm 1<cr>
```

To validate that the camera accepted the command, type:

```
gcp<cr>
```

Setting to Exposure Mode 4

To work with Visionscape®, the Pantera SA-4M15 camera must be in exposure mode 4.

To output the current camera settings, type:

```
gcp<cr>
```

If the camera is not in the correct exposure mode, type:

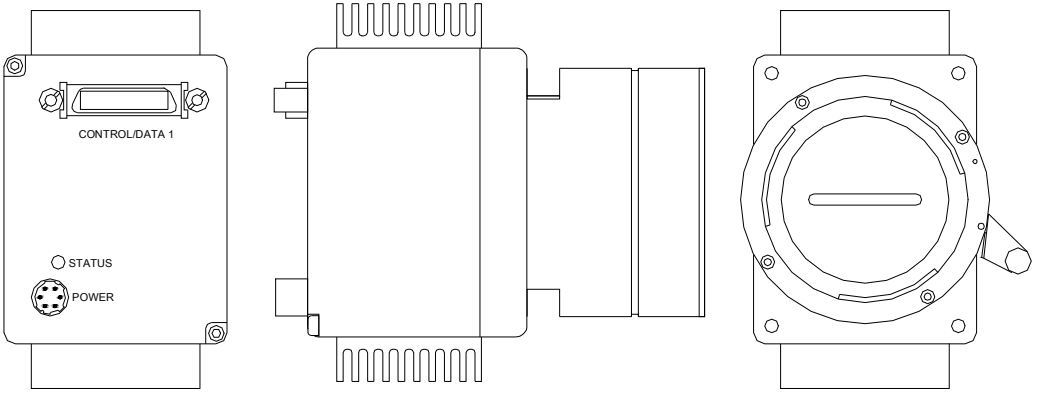
```
sem 4<cr>
```

To validate that the camera accepted the command, type:

```
gcp<cr>
```

Configuring the Dalsa Piranha 2k-22-2k40 Camera

FIGURE 2–17. Dalsa Piranha 2k-22-2k40 Line Scan Camera



Use StringTerminal.exe to communicate with the Piranha 2k-22-2k40 Camera. This is installed with Visionscape®. It is located in the Vscape/Drivers folder.

When executed, StringTerminal displays a prompt, asking which type of camera you want to communicate with. Choose Dalsa (option 1).

Setting to 10-Bit Mode (Data Mode 1)

To work with Visionscape®, the Piranha 2k-22-2k40 camera must be in 10 bit mode (data mode 1).

To output the current camera settings, type:

```
gcp<cr>
```

If the camera is not the correct data mode, type:

```
sdm 1<cr>
```

To validate that the camera accepted the command, type:

```
gcp<cr>
```

Setting to Exposure Mode 6

To work with Visionscape®, the Piranha 2k-22-2k40 camera must be in exposure mode 6.

To output the current camera settings, type:

```
gcp<cr>
```

If the camera is not in the correct exposure mode, type:

```
sem 6<cr>
```

To validate that the camera accepted the command, type:

```
gcp<cr>
```

Setting Exposure Time

Use StringTerminal (not Visionscape® FrontRunnner) to set the exposure time of the Piranha 2k-22-2k40 camera.

To output the current camera settings, type:

```
gcp<cr>
```

To change the exposure time, type:

```
set f <cr>
```

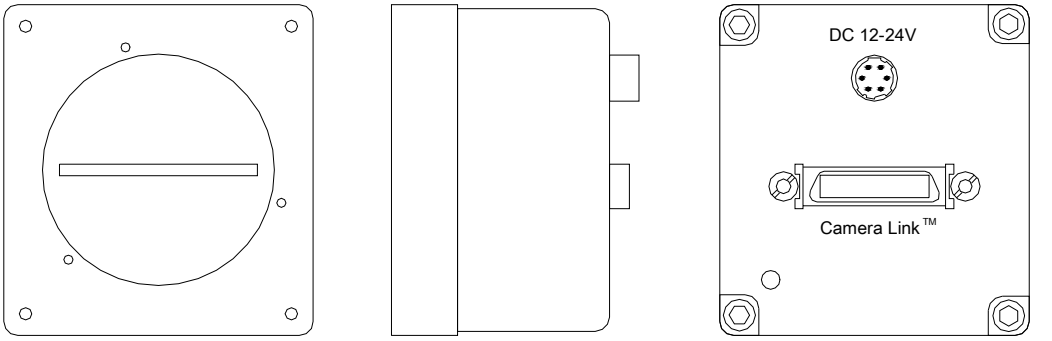
where f is a real number whose units are in µsecs

To validate that the camera accepted the command, type:

```
gcp<cr>
```

Configuring the Atmel AViiVA SMC2CC 1010 Camera

FIGURE 2–18. Atmel AViiVA SMC2CC 1010 Line Scan Camera



Configure this camera using the Camera Link internal serial port. To obtain the required software, install the COMMCAM8 software from the Atmel AViiVA product cd. If the cd is not available, you can also download the software from web:

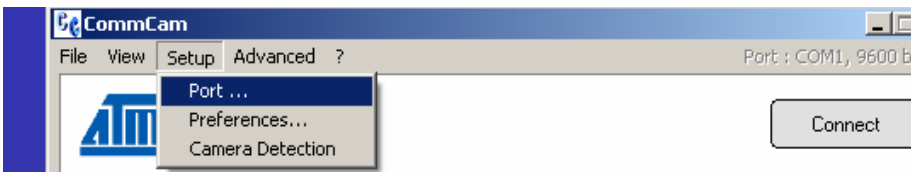
1. Go to www.atmel.com.
2. Click the Products button.
3. From the Multimedia and Imaging Menu item, select CCD and CMOS Industrial Cameras.
4. Select the Tools and Software Menu item.
5. Under Software Files, download and run the COMMCAM8 setup executable.

Use Commcam.exe to communicate with the Aviiva camera (provided by Atmel). When started, this program displays the screen displayed in :

FIGURE 2–19. Initial Atmel Display

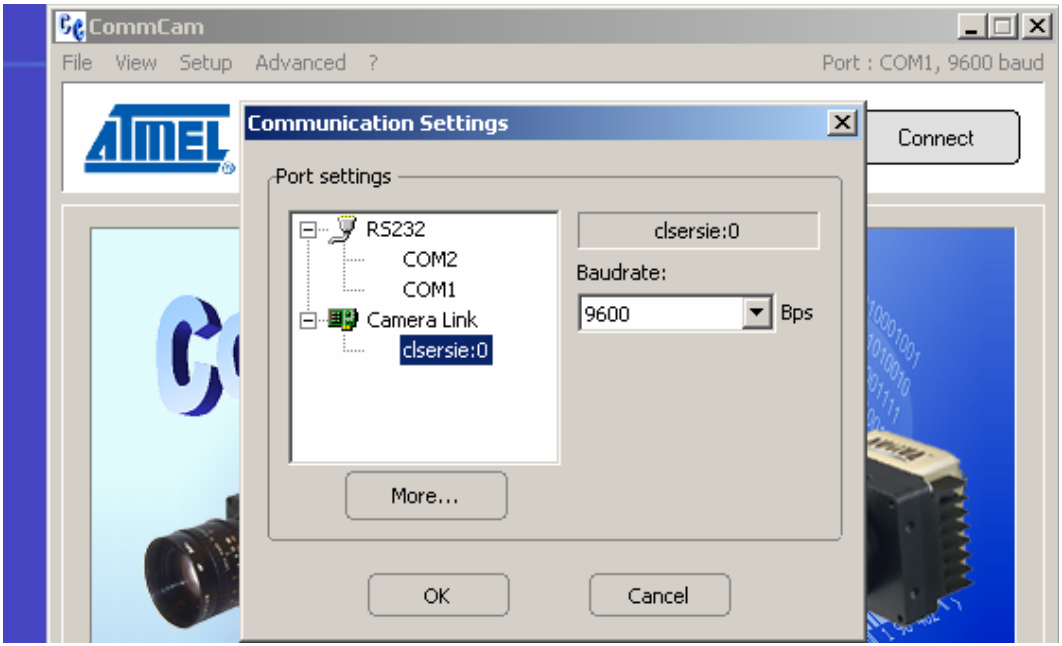
Now, we need to determine if the camera link port is the one used to communicate with the camera. From the Setup menu, select Port, as shown in Figure 2–20.

FIGURE 2–20. Selecting the Port Menu Item



Once selected, a dialogue box is displayed where you can select the appropriate port. In our case, the ports are numbered clsersie:X, where X is the board number.

FIGURE 2–21. Setup Menu

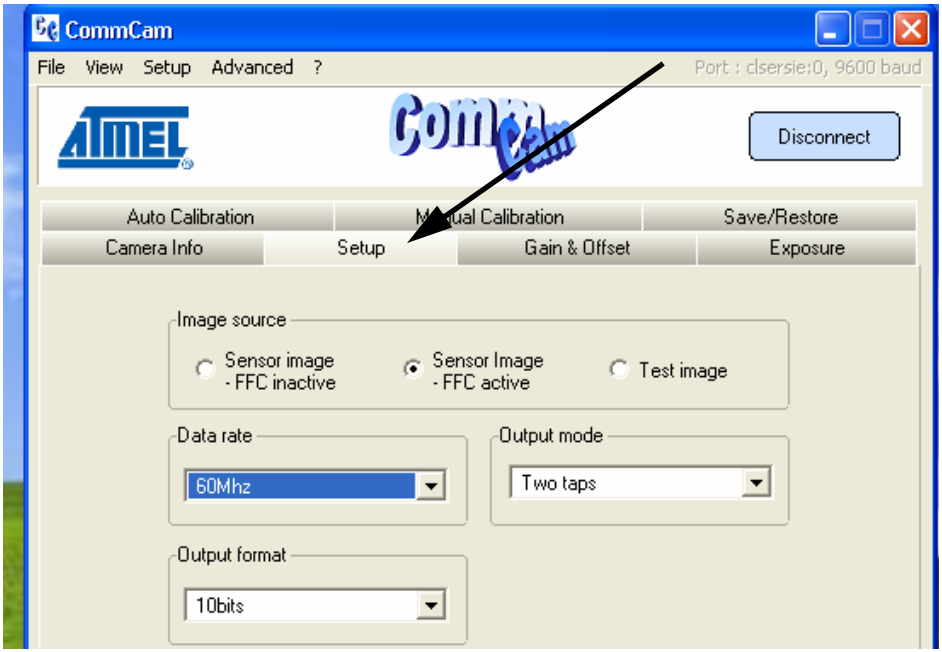


Selected the appropriate camera link port, save, and then click the Connect button. You should see a screen similar to the one in Figure 2–22.

FIGURE 2–22. Camera Info Tab

To work with Visionscape®, this camera must be in 10 bit mode with two taps running at 60Mhz data rate. To verify this, click the setup tab of the CommCam program, as shown in Figure 2–23.

FIGURE 2–23. Setup Tab



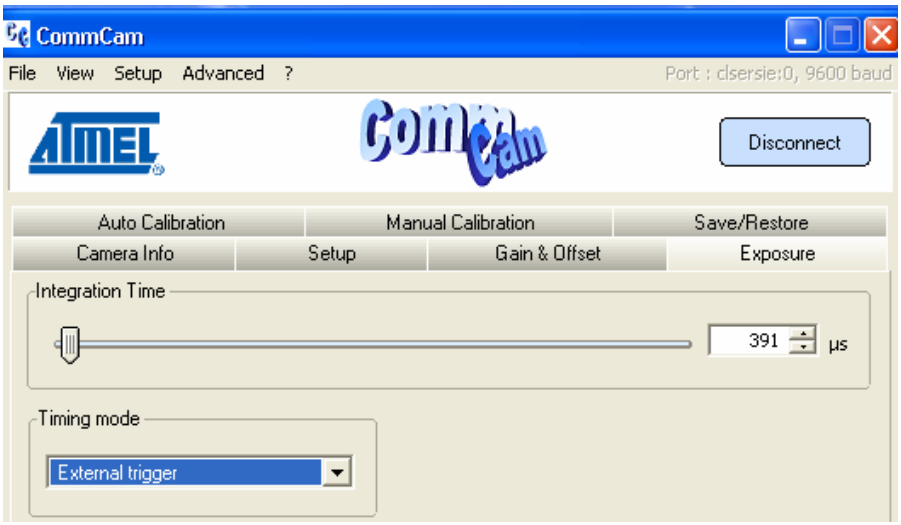
If the values are not correct, then set them to the proper values.

Note: When FFC is active, the frame rate will be slower, since a camera internal hardware calculation is performed. Set this to inactive so that max line rate can be achieved.

To set the exposure time of the camera, use CommCam (not the Acquire Step). Select the Exposure tab, as shown in Figure 2–24. This displays the integration time and the Timing mode. Use the slider to set the integration time.

Note: For Visionscape® to run properly, the timing mode must be set to External trigger.

FIGURE 2–24. Exposure Tab



Strobe & Sensor

When choosing your part sensor, you must consider the time interval between the part passing into the sensing zone and an electrical signal being generated. When there is a large variation in process speed, considerable apparent motion of the part within the FOV may result. The Camera I/O 0800 Card can compensate for this motion over a considerable range. However, the sensor should be fast enough to minimize this apparent shift.

To connect your sensor and strobe, refer to Figure 2–25 through Figure 2–27.

FIGURE 2–25. Mini Opto I/O High Speed Sensor and Strobe Connections

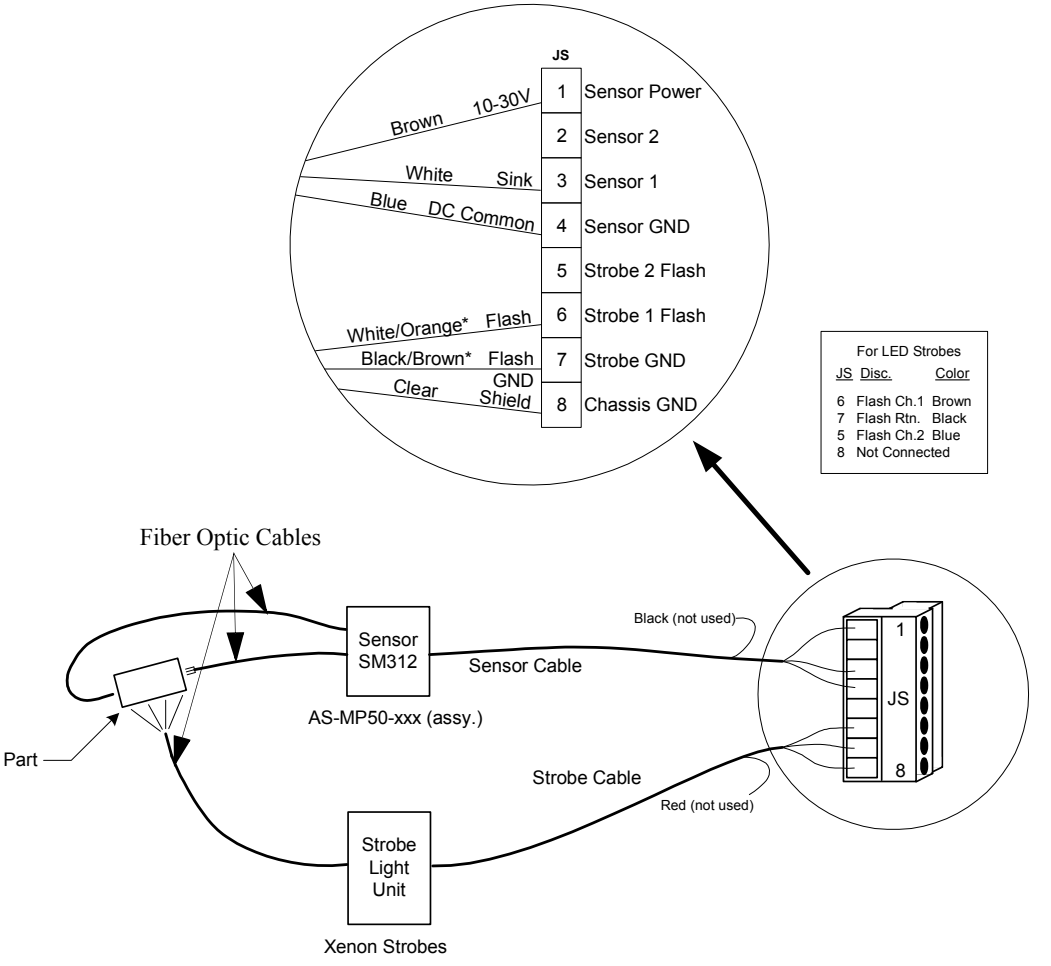


FIGURE 2–26. Combination I/O High Speed Sensor and Strobe Connections

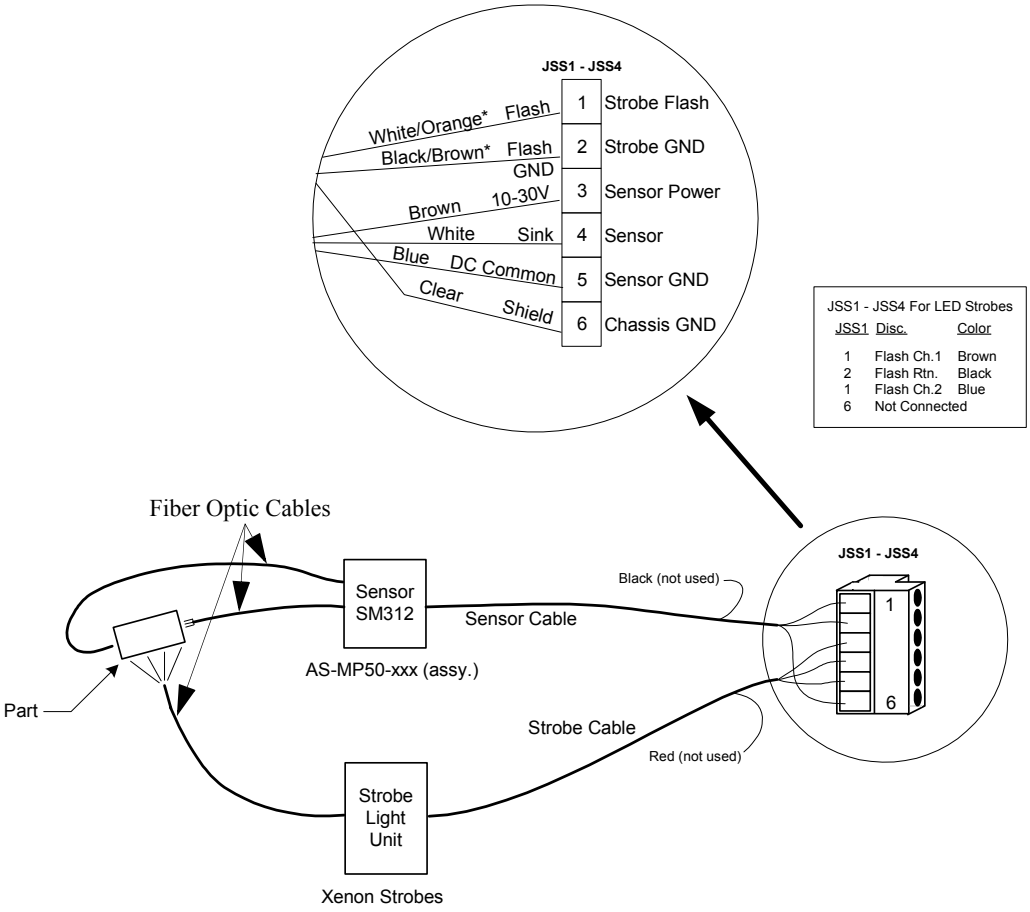
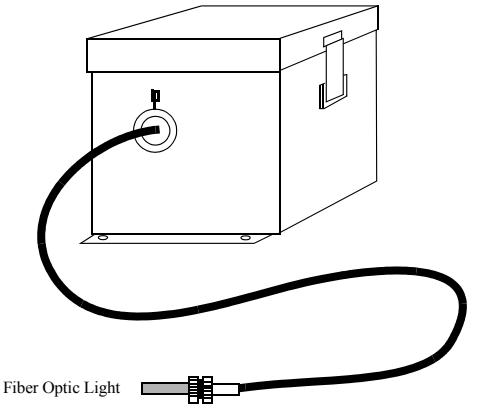


FIGURE 2–27. Strobe Unit



Power Requirements

The Visionscape® 0800 Board is powered from the PCI bus in your PC. Refer to Table 2–6 when determining the power supply requirements for your Visionscape® 0800 Board. There is a separate +12V power interface for the cameras and I/O board.

TABLE 2–6. Visionscape® 0800 Board Power Requirements

Component	+3.3Vdc[1]	+5Vdc	+12Vdc
Camera I/O 0800 Card	0.2A	**1.5A**	
Per typical photoelectric sensor			0.1A

[1]Applies to any PCI slot that is keyed for 3.3Vdc

See Table 2–7 for the complete PCI voltage specification.

TABLE 2–7. PCI Bus Voltage Specification[1]

Description	Allowed Variation
+3.3 Vdc	±10%
+5 Vdc	±5%
+12 Vdc power	±5%
Ground	REFERENCE

[1]PCI Local Bus Specification (REV 3.0, February 2004)

Caution: Make sure no part of the system is plugged into live current before connecting any cables or components. Failure to do so may result in damage to your system.

Cooling Requirements

- Fan Performance — 38 CFM minimum.
- Typical Temperature Rise — 6.0°C, on every component.

CHAPTER 3 Cable Specifications

This chapter contains complete cable specifications.

Note: Cable specifications are published for information only. Microscan does not guarantee the performance or quality of cables that are not provided by Microscan.

TABLE 3–1. Cable Part Numbers & Descriptions

Number	Components	Description
98-VS08-0EC0	A1-20670-1	Internal Encoder Interface Cable
	A1-20298-1	Single Camera Adapter Cable — D-Sub
	030-159106	6 Ft Digital I/O Interface Cable

A1-20670-1 — Encoder Interface Cable (Internal)

TABLE 3–2. Connector Type

Connector Type	Ref.	Mfg. P/N
Samtec, 0.100” pitch, Double Row Socket, 10 positions	JENC	IDSD-05-S-7-P10-G-R (includes 7” cable and polarizing key)
D-SUBMINIATURE 3M (female Pins) 9 pos.	P1	8309-6003 (Threaded inserts) or equiv.
Miscellaneous		
BEZEL Globe Manufacturing	P1	G172 (or G1155 or G1412) w/ qty 2, Female Screw locks or equiv.

Cable Type

28 AWG Stranded
10 Conductor Ribbon SPECTRA STRIP #455-240-10 or equivalent

Connections

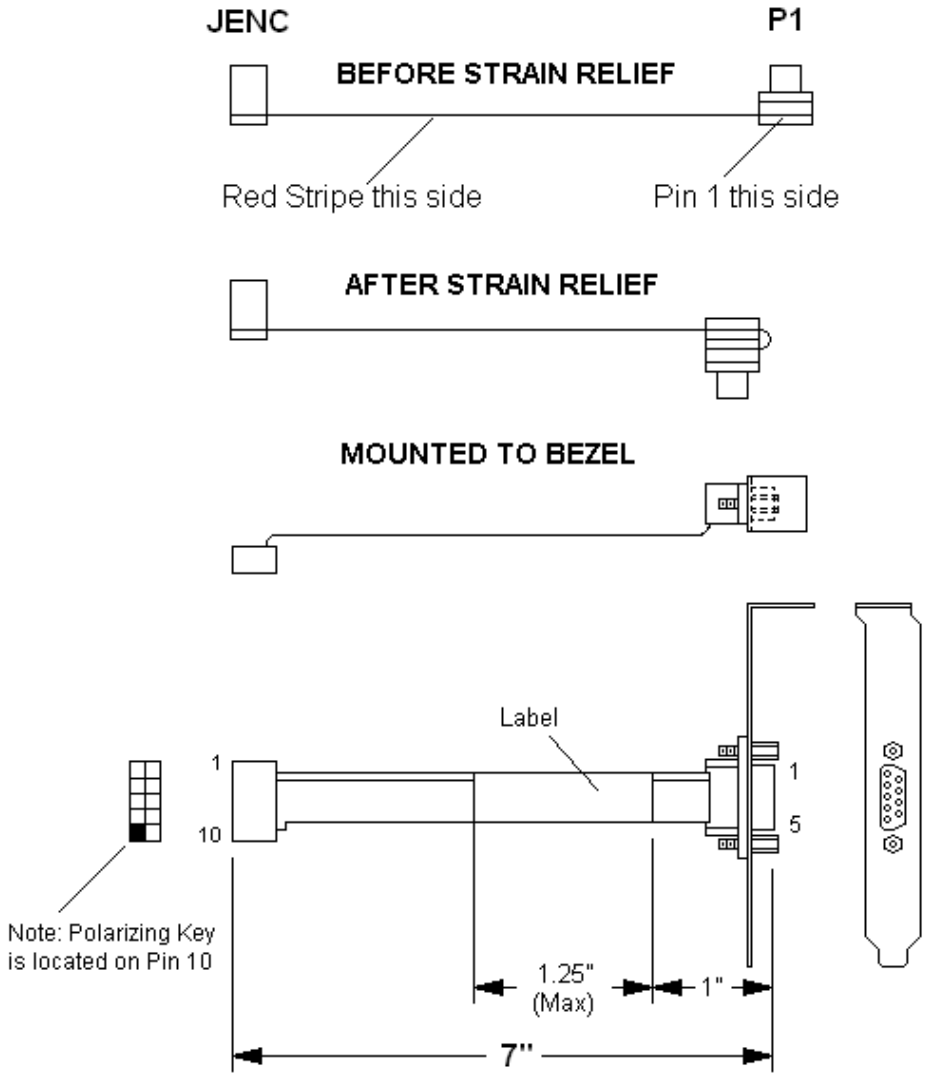
TABLE 3–3. Connection Run List

JENC Pin #	P1 Pin #	Signal Name
1	1	ENC0+
2	6	ENC0-
3	2	ENC1+
4	7	ENC1-
5	3	ENC2+
6	8	ENC2-
7	4	+5 VOLTS
8	9	5V RTN
9	5	SHIELD
10	N/C	N/C

Length

7 inches

FIGURE 3–1. Cable Assembly



A1-20298-1 — Internal Digital I/O Interface Cable

TABLE 3–4. Connector Type

Connector Type	Reference	Mfg. P/N
.100x.100 Center Flat Ribbon Cable w/Strain Relief w/Pull Tab 50 pos.	FG I/O	3M #3425-6650 Pull Tab 3M #3490-5 or equivalent

Cable Type

28 AWG Stranded
50 Conductor Ribbon Cable. SPECTRA STRIP #455-240-50 or equivalent.

Connections

TABLE 3–5. Connection Run List

FG - Pin#	Signal Name	I/O - Pin#
1	SENSOR4_IN	1
2	SENSOR_PWR	2
3	SENSOR3_IN	3
4	VREF	4
5	SENSOR2_IN	5
6	SENSOR2_GND	6
7	SENSOR1_IN	7
8	SENSOR1_GND	8
9	STROBE4_OUT	9
10	STROBE4_GND	10
11	STROBE3_OUT	11
12	STROBE3_GND	12
13	STROBE2_OUT	13
14	STROBE2_GND	14
15	STROBE1_OUT	15
16	STROBE1_GND	16
17	FIO15	17
18	FIO15_GND	18

TABLE 3–5. Connection Run List (Continued)

FG - Pin#	Signal Name	I/O - Pin#
19	FIO14	19
20	FIO14_GND	20
21	FIO13	21
22	FIO13_GND	22
23	FIO12	23
24	FIO12_GND	24
25	FIO11	25
26	FIO11_GND	26
27	FIO10	27
28	FIO10_GND	28
29	FIO9	29
30	FIO9_GND	30
31	FIO8	31
32	FIO8_GND	32
33	FIO7	33
34	FIO7_GND	34
35	FIO6	35
36	FIO6_GND	36
37	FIO5	37
39	FIO5_GND	38
39	FIO4	39
40	FIO4_GND	40
41	FIO3	41
42	FIO3_GND	42
43	FIO2	43
44	FIO2_GND	44
45	FIO1	45
46	FIO1_GND	46

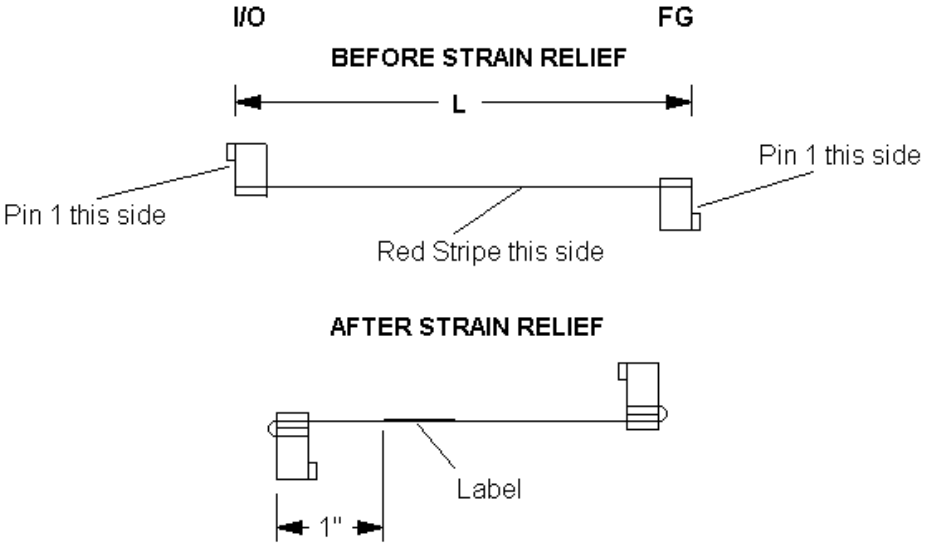
TABLE 3–5. Connection Run List (Continued)

FG - Pin#	Signal Name	I/O - Pin#
47	FIO0	47
48	FIO0_GND	48
49	+5 Volts	49
50	GND	50

Length

- 9 inches

FIGURE 3–2. Cable Assembly



030-159106 — Digital I/O Interface Cable

TABLE 3–6. Connector Type

Connector Type	Reference	Mfg. P/N
3M .100 x .100 Center Flat Ribbon Cable w/Strain Relief w/Pull Tab 50 pos.	JIO / PIO	P/N 3425-6650, Pull Tab P/N 3490-5.

Cable Type

28 AWG Stranded
50 Conductor Ribbon Spectra Strip P/N 455-240-50.

Connections

TABLE 3–7. Connection Run List

JIO - Pin #	PIO - Pin #	Signal Name
1	1	SENSOR4_IN
2	2	SENSOR_PWR
3	3	SENSOR3_IN
4	4	VREF
5	5	SENSOR2_IN
6	6	SENSOR2_GND
7	7	SENSOR1_IN
8	8	SENSOR1_GND
9	9	STROBE4_OUT
10	10	STROBE4_GND
11	11	STROBE3_OUT
12	12	STROBE3_GND
13	13	STROBE2_OUT
14	14	STROBE2_GND
15	15	STROBE1_OUT
16	16	STROBE1_GND
17	17	FIO15
18	18	FIO15_GND

TABLE 3–7. Connection Run List (Continued)

JIO - Pin #	PIO - Pin #	Signal Name
19	19	FIO14
20	20	FIO14_GND
21	21	FIO13
22	22	FIO13_GND
23	23	FIO12
24	24	FIO12_GND
25	25	FIO11
26	26	FIO11_GND
27	27	FIO10
28	28	FIO10_GND
29	29	FIO9
30	30	FIO9_GND
31	31	FIO8
32	32	FIO8_GND
33	33	FIO7
34	34	FIO7_GND
35	35	FIO6
36	36	FIO6_GND
37	37	FIO5
38	38	FIO5_GND
39	39	FIO4
40	40	FIO4_GND
41	41	FIO3
42	42	FIO3_GND
43	43	FIO2
44	44	FIO2_GND
45	45	FIO1
46	46	FIO1_GND

TABLE 3–7. Connection Run List (Continued)

JIO - Pin #	PIO - Pin #	Signal Name
47	47	FIO0
48	48	FIO0_GND
49	49	+5 Volts
50	50	GND

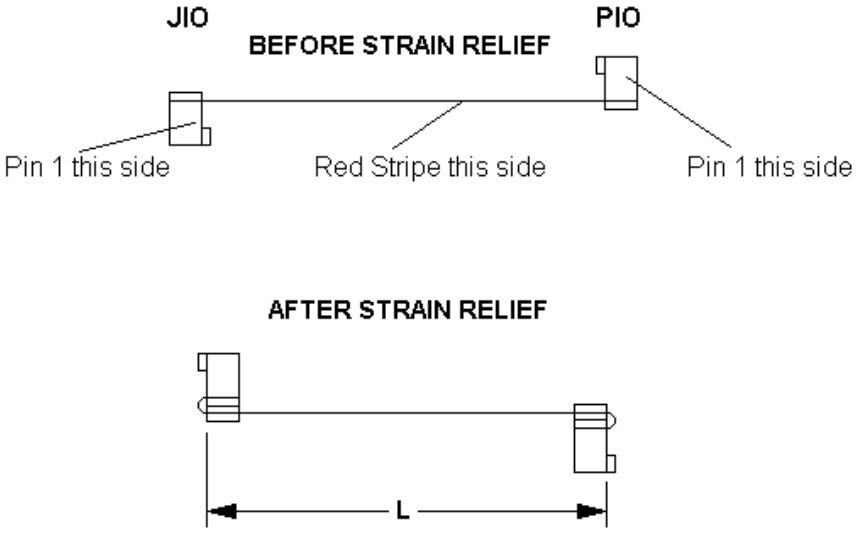
Length

6 feet

Part Numbering — Complete cable assemblies will be ordered under the following numbering system description:

- 6 feet — 030-159106

FIGURE 3–3. Cable Assembly



A

APPENDIX A Camera Definitions Files

The 0800 framegrabber board is configured via camera definition files. A camera definition file completely describes important parameters for successfully interfacing a specific digital camera to the 0800 framegrabber board. Even though creating a camera definition file from scratch for a new camera is beyond the scope of this Appendix, there are important user parameters,. especially for Linescan cameras that can be changed by editing the camera definition file with a Text editor such as Notepad or Wordpad. These are describe in this Appendix. In particular, the number of lines, trigger mode and encoder signals can be changed and programmed by the Camera definition file.

An example camera definition file is shown below. This is for a Dalsa Piranha 2 linescan camera, and includes comments on how to use encoders and set delays.

Note: In the event where a specific camera is required to solve the application for which Visionscape® does not have a pre-defined camera definition file, please contact your local Solutions Engineer or Promoter for support.

Camera Name	Dalsa P2 2Kx1800	
Digitizer Type	800	

// SETUP (000) System Setup Register

Camera Format	3	// two 9 to 12-bit interleaved taps
Pixel Packing	0	// 4 pel/wd
Funnel Shift	2	// shift 2 bits (10-bit) output
Tap Mode	0	// 0=Interleaved 1=Sequential
Taps Reversed	1	
Little Endian	1	
Pretrig Lines	0	
Use Chaining	1	

Line Scan Mode	1	// 2=Readout starts immediately on acq.
		// enable and continues indefinitely
		// "Web" style
		// 1=Readout starts immediately on acq.
		// enable
		// 0=Readout starts on FVAL after acq.
		// enable

// HSYNC (004) Horizontal Sync Generator

HTIME Register	0x00000800	// freerun, start exsync on h-reset

// note that you will also need to set the bottom four bytes of the HTIME
// register above to suit the integration time you set on the camera. If it
// is too low then the camera will not finish integrating and sending out data
// before the next LVAL signal is produced. Too high and the camera runs
// slower. 0x0800 is about as fast as you can go with 100 microseconds
// integration time on the camera.
// If you want to use encoders then set the register to 0x80000000.

// VSYNC (008) Vertical Sync Generator

VTIME Register 0x00000000 // hdrive=exsync, vdrive=PRIN

// ENCODER (00C) Encoder Processor

ENC Register 0x02004210 // ph0=enc0,
// ph1=enc1,
// idx=enc2,
// RS422 in,
// prescale=0

// CAMIO (010) Camera Control Line Assignment

CAMIO Register 0x00FF7772// CC1 = Hd

// HCROP (038) Horizontal Cropping Register

Horizontal Delay 0
Horizontal Width 0x800 // 2048 clocks/line

// UART_TXDATA (0140) UART Received Data & Status

COMM Register 0x00000C7F // 9600 Baud,
// No Parity
// Transmitter/Receiver Enabled

// DMA_BCNT (064,164) DMA write page count

Starting Tap 1 // 1=Tap A first 0=Tap B first

Stride 2048
Rows 1800

Tap Width	1	// Sequential Only
Sensor Select	-1	// NOT USED
Usecs Per Frame	-1	// depends on encoder speed
Usecs Per Line x 10	1050	// depends on encoder speed
Post Initialize Wait	20	// Units in tenths of seconds
		// (2 Second Delay)
Horizontal Period x 10	100	// depends on encoder speed
Post Initialize Wait	20	// Units in tenths of seconds
		// (2 Second Delay)
Check Sync	1	// Specifies flag to indicate
		// camera presence/absence
		// 0 = no check,
		// 1 = FVAL,
		// 2 = LVAL,
		// 3 = Serial
Async Control	0	// 1=async
		// 0=continuous (formerly "shutter type")
Min Expose Lines	4	// not used
Exposure Start Delay	0	// not used
Exposure End Delay	0	// not used
Exposure Readout Delay	0	// not used
Strobe Delay	1	// not used
Exposure Control	0	// 0=1-line/gate,
		// 1=1-line/2 pulses,
		// 2=2-lines/2 pulses
Expose Signal	4	// line 1: 4=CC1, 5=CC2, 6=CC3, 7=CC4
Expose Polarity	0	// 0=low-to-high, 1=high-to-low
Readout Signal	0	// line 2: 4=CC1, 5=CC2, 6=CC3, 7=CC4
Readout Polarity	0	// 0=low-to-high, 1=high-to-low
Min Pulse Width	2	// not used

// sequencer scripts:

```
Start Initial Sequence
// SET_SIGNAL 4                          //CC1 High
End Initial Sequence

Start Picture Sequence
CLEAR_SENSOR_DETECT
WAIT_SENSOR
CROSS_TRIG
// WAIT FOR INDEX PULSE Signal (Encoder 2)
// START ACQUISITION
// pure freerun - no index pulse no encoders
//
INSERT_RAW_OPCODE 0x7D9F                 // 1F/0C/1F = start expose
//
//
// if you want index but no encoders use the following two lines
// instead of the one above
//
// INSERT_RAW_OPCODE 0x481E              // 12/00/1E = clear index flag
// (enc 2 falling)
// INSERT_RAW_OPCODE 0x4980              // 12/0C/00 = wait index flag
// (enc 2 falling), start expose
//
//
// if you want an index pulse and a delay then use the following instead
//
// INSERT_RAW_OPCODE 0x4800              // 12/00/00 = wait index flag
// (enc 2 falling)
// INSERT_RAW_OPCODE 0x7C20              // 1F/01/00 = Load timer
// INSERT_RAW_OPCODE 0x012C              // 300 Lines
// INSERT_RAW_OPCODE 0x7980              // 1E/0C/00 = wait step timer,
// start acquisition
```

```
//
//
// then just wait for the picture to finish
//
//
// WAIT FOR ACQUISITION TO COMPLETE
//
INSERT_RAW_OPCODE 0x081E                // 02/00/1E = clear acquisition done flag
INSERT_RAW_OPCODE 0x09A0                // 02/0D/00 = wait acquisition done flag,
                                        // set acquistion done irq
End Picture Sequence
```

Changing the Number of Lines to Acquire and Pixel Data

In a linescan application, you may want to change the number of horizontal lines to acquire. To do this, just change the Rows parameter of the camera definition file. Also, these line scan cameras can output more than 8 bits of data. For example, the Dalsa P2 outputs 10 bits of pixel information. Visionscape® only processes 8 bit pixels so, in the camera definition, we drop the 2 lsbs and keep the upper 8. To change this, you can modify the Funnel Shift parameter to change which 8 bits are captured by Visionscape®.

Encoder and Triggers

The camera definition file allows you to program the board so that acquisition can start immediately or wait for a hardware trigger, and also lets linescan cameras either freerun or synchronize to incoming pulses. There are several key registers that control this behavior.

The trigger source is controlled by the VSYNC register. The entry in the example file above is:

```
// VSYNC (008) Vertical Sync Generator
VTIME Register              0x00000000 // hdrive=exsync, vdrive=PRIN
```

Bits 21 and 20 of this register control the vertical event: 0 means freerun (don't wait for anything), 1 means wait for next FVAL (suitable for area scan cameras), and 2 means wait for encoder processor index output. So, if we want to use an

index pulse with a linescan camera, the register value would have to include 0x00200000.

This is not the whole story, though, as we would also need to set up the encoder index pulse. This is done in the ENCODER register. Referring to the example above again, this is:

// ENCODER (00C) Encoder Processor

```
ENC Register    0x02004210      // ph0=enc0,
                                // ph1=enc1,
                                // idx=enc2,
                                // RS422 in,
                                // prescale=0
```

Note that, even if the encoders are set up, they do not have to be used. This register configures the inputs for encoders and index pulses. These can be set to RS422, TTL or sensor inputs. The entire encoder processor table (Table A–1) is shown below to help explain how this works.

TABLE A–1. ENCODER (00C) Encoder Processor

Bits	R/W	@reset	Description
2:0	w	000	Phase 0 source: 0..2 = RS422/TTL input 0..2 (=3 reserved) 4..7 = Sensor input 0..3
3	w	0	Phase 0 Source Polarity: 0 = UpArrow , 1= DownArrow
6:4	w	000	0..2 = RS422/TTL input 0..2 (=3 reserved) 4..7 = Sensor input 0..3
7	w	0	Phase 1 Source Polarity: 0 = UpArrow , 1= DownArrow
10:8	w	000	Index source: 0..2 = RS422/TTL input 0..2 (=3 reserved) 4..7 = Sensor input 0..3
11	w	0	Index Source Polarity: 0 = UpArrow, 1= DownArrow
13:12	w	00	Encoder Event Select: 0 = phase 0, rising edge (single speed) 1 = phase 0 both edges (double speed) 2 = phase 0 & 1 both edges (quadrature) 3 = reserved

TABLE A–1. ENCODER (00C) Encoder Processor (Continued)

Bits	R/W	@reset	Description
14	w	0	Prescaler reset mode 0 = prescaler is not reset on index 1 = prescaler resets on 1st event after index
15	w	0	Direction change mode (quadrature) 0 = one event per phase change 1 = suppress multiple events per phase
23:16	w	0x00	encoder prescale value (00=>1/1…FF=>1/256)
24	(w)	0	write one to reset encoder prescaler
25	w	0	select RS422 (1) or TTL (0) encoder port inputs
31:26	-	0x00	reserved

So, referring to the value in our example:

0x02004210 = 0000 0010 0000 0000 0100 0010 0001 0000

and Table A–1, we see that:

Phase 0 source (bits 2:0)	= 0	= RS422/TTL input 0
Phase 0 polarity (bit 3)	= 0	= rising edge
Phase 1 source (bits 6:4)	= 1	= RS422/TTL input 1
Phase 1 polarity (bit 7)	= 0	= rising edge
Index source (bits 10:8)	= 2	= RS422/TTL input 2
Index polarity (bit 11)	= 0	= rising edge
Encoder event select (13:12)	= 0	= Phase 0, rising edge (single speed)
Prescaler reset mode (14)	= 1	= Prescaler resets on 1st event after index
Direction change mode (15)	= 0	= one event per phase change
Encoder prescale value (23:16)	= 0	= divide by 1
Bit 24 leave alone		
Select RS422 / TTL inputs	= 1	= RS422 inputs
Bits 31:26 - leave alone		

We could use the prescaler to divide down the encoder pulses coming in. For instance, if we were getting one pulse every 5 microns and wanted 25 microns per line, we would have to divide by 5, so we would put a 6 in bits 23:16.

We could also multiply the pulses - again, if we were getting a pulse on phase 0 every 5 microns but wanted 7.5 microns per line, we would need to change bits 13:12 to detect both edges, which would get us a pulse every 2.5 microns, and then divide this by 3 by writing 4 into bits 23:16.

RS422 signals are preferred, as these are more immune to noise than single-ended signals, but it would be perfectly ok to change the index pulse so that it came in on sensor 0 (on the combination IO board). To do this, we would put a 4 in bits 10:8.

To set up the Atmel, Basler, and Dalsa cameras to receive a PRIN signal, use the vendor specific software described in Chapter 2, “Hardware Specifications”. For assistance with other cameras, please call Technical Support (see page x of the Preface).

Programming the Autosequencer

The 0800 autosequencer instructions are loaded with the camera definition file. The instructions are laid out in Table A–2. The example above shows that some commands can be given in “English” - CLEAR_SENSOR_DETECT, for example, whereas others are written as a raw hex code - INSERT_RAW_OPCODE 0x7D9F (start expose), for instance.

Looking at the INSERT_RAW_OPCODE 0x7D9F //1F/0C/1F - start expose line above, the comment 1F/0C/1F equates to 31/12/31 in decimal. Referring to the autosequencer table, one can see that this instruction is as follows:

WAIT instruction = 31 = continue
SET instruction = 12 = Enable Acquisition
CLR instruction = 31 = NOP

An example of a more complex instruction - a delay of some lines, is given in the example above with the following lines:

```
// if you want an index pulse and a delay then use the following instead
//
// INSERT_RAW_OPCODE 0x4800      // 12/00/00 = wait index flag
                                 // (enc 2 falling)
// INSERT_RAW_OPCODE 0x7C20      // 1F/01/00 = Load timer
// INSERT_RAW_OPCODE 0x012C      // 300 Lines
// INSERT_RAW_OPCODE 0x7980      // 1E/0C/00 = wait step timer,
// start acquisition
```

Referring to Table A–2 again:

0x4800 = 12/00/00 = 18/00/00 = wait encoder 2 falling / NOP / NOP

0x7C20 = 1F/01/00 = 31/01/00 = continue / SET preset step timer / NOP

0x012C = 300 = number of lines to wait

0x7980 = 1E/0C/00 = 30/12/00 = WAIT for step timer / Enable Acquisition / NOP

TABLE A–2. Autosequencer Instruction Formats

Bits	Value	Name	Description
14:10	0 = halt (always false) 1 = pause (wait for GO) 2 = acquistion done 3 = Vertical reset 4..7 = sensor 1..4 rising 8-11 = sensor 1..4 falling 12-15 = encoder 0..3 rising 16-19 = encoder 0..3 falling 20 = slave sync rising 21 = slave sync falling 22 = slave trigger rising 23 = slave trigger falling 24 = enc dir change + 25 = enc dir change - 26 = FVAL rising 27 = FVAL falling 28-29 = reserved 30 = step timer 31 = continue (=true)	WAIT	Wait for specified event or select flag to clear

Bits	Value	Name	Description
9:5	0 = NOP 1 = preset step timer 2 = preset timeout timer 3 = preset Acq delay 4-7 = CC1..4 8-.11 = Strobe1..4 12 = Enable aquisition 13 = attention IRQ 14 = master trigger 15 = master sync 16 = sensor detected 17-30 = reserved (NOP) 31 = NOP	SET	Assert specified output
4:0	0 = NOP 1-3 = reserved 4-7 = CC1..4 8-11 = Strobe1..4 12 = Disable acquisition 13 = reserved 14 = Master Trigger 15 = master sync 16 = sensor detected 17-29 = reserved (NOP) 30 = clear selected flag 31 = NOP	CLR	Negate specified output or clear selected flag

Appendix A Camera Definitions Files

B

APPENDIX B

Certifications and Specifications

CE Compliance

The Visionscape® 0800 framegrabber board has been certified to conform to the requirements of Council Directives 2004/108/EC and 73/23/EEC to comply with the following European Standards:

- EN61326:1997 A3:2003 Class A
- EM61000-6-2:2001
- EM61000-6-4:2001

This is a Class A product: in a domestic environment, this product may cause radio interference in which case, the user may be required to make adequate measures.

All Microscan products bearing the CE mark have been declared to be in conformance with the applicable EEC Council Directives. However, certain factory installed options or customer requested modifications may compromise electromagnetic compatibility and prohibit use of the CE mark. Note that the use of interconnect cables that are not properly grounded and shielded may affect CE compliance.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

Specifications

Configuration:	Single-slot half-length Universal PCI 2.3 compliant bus board; 6.6” x 4.2” (168 mm x 107 mm)
On-Board Memory:	32 MB SDRAM image memory
Video Input:	Flexible chained bus master DMA; DMA to on-board image memory or to host PC or video memory
	One Camera Link digital camera; Camera Link Base level standard
	Hi-Resolution area, TDI, or line scan (up to 16k pixels/line)
	32 MB SDRAM FIFO Buffer
	Configurable – one tap 8…24 bits/pixel or two taps 8…12 bits/pixel; taps may be interleaved or sequential
	Pixels scaled up to eight places
	Pixel clock rate 20 to 85 MHz
Video Control:	Master/slave interface for multi-board synchronization and triggering
	Four LVDS control outputs
	LVDS serial communication

	Asynchronous reset, exposure control (PRIN) & ROI capture
	Multiple triggering modes
Encoder Interface:	Select from 3 RS-422 or TTL inputs on the encoder connector or 4 TTL to 24V sensor inputs
	Two phases for 1x, 2x, 4x pitch plus index input with direction sensing
	8 bit prescaler
Host Based Display:	PCI bus master; color graphics overlay
On-Board Digital I/O:	4 sensor inputs with user-supplied reference voltage thresholds and 5 to 24 V input range
	4 strobe outputs
	16 programmable bi-directional I/O
	Standard 50 pin I/O connection to external termination/isolation board (Visionscape® Combo I/O Board)
Analog Output:	On-board I^2C serial bus capability; 8 channels of analog output through external termination (Visionscape® Combo I/O board)
Power Consumption:	+12 V @ 1.0 A; +5 V @ 1,5 A; 3.3 V @ 0.2 A max
	Dissipates approx. 8 W
Environmental:	Operating temperature: 0 °C to 50 °C; Humidity: 10-90%, non-condensing
Host PC Requirements: (Recommended)	Pentium 4, 2.4 GHz or higher with minimum of 256 MB memory; one open PCI expansion slot
	VGA display adapter – 64K or true color
	Microsoft Windows 2000 SP4 or Windows XP SP2 or later

Appendix B Certifications and Specifications

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