IPD Vision Appliances

VA40 & VA41

Multi-Camera Vision Appliance

User's Reference Manual

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DALSA

VA40 & VA41 Multi-Camera Vision Appliance User's Reference Manual

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1. INTRODUCTION

Congratulations on your purchase of the VA4x Multi-Camera Vision Appliance! You now own a powerful, integrated system that can be applied to a diverse range of industrial vision applications. As a valued DALSA customer, you can now look forward to easily implementing robust solutions, *the Vision Appliance way.*

Overview

The VA4x is an integrated platform that includes processing, display, image capture, networking, communication and industrial I/O. These standard hardware components, encased within an aluminum chassis, provide the basis for a powerful industrial vision system.

About This Manual

This manual will assist you with the installation and setup of your Vision Appliance product and the inspection software. It describes what the product supports and how to connect the external interfaces. VA4x (or VA40/VA41) will be used to describe all simalar members of the Vision Appliance product line, including the VA40 and VA41. When a description applies to only one model, the name will be in Bold, for example **VA40** or **VA41** only.

If your Vision Appliance questions are not answered in this reference, please contact your local DALSA representative who will be happy to answer or direct your question to the appropriate factory resource.

In the unlikely event of failure, the warranty and return information is included in Section 3, starting on page 4.

The vertical bars are "change bars" and mark additions or changes from the previous version of this manual.

2. BEFORE YOU BEGIN

Product Verification

Before getting started, please take a few minutes to verify that your shipment is complete and in good condition. If your product has been visibly damaged during shipment or is missing parts, please contact your local DALSA representative immediately.

Handling and Operating Precautions

Care should always be exercised when handling and operating your VA4x system. Even though the system is encased within a rugged, industrial enclosure, incorrect use or handling can result in damage to your investment. To prevent this, we recommend you ***avoid the following***:

- "Hot-plugging" cables and devices. Be sure to shut the system down and remove power before connecting or disconnecting anything to it.
- "Free-standing" operation. Whenever possible, we advise mounting the system to prevent it from falling accidentally. Mounting holes are provided at the base of the unit. DIN mounting hardware is optionally available.
- "Pulling power while operating". Whenever possible, gracefully shutdown the system if at any time you need to remove power.
- "Operating the system in a hazardous environment". The system is not NEMA rated.

ElectroStatic Discharge

Avoid the damage that ESD can cause. Never expose the internal electronics to a potentially hazardous environment by opening the enclosure. Doing so may cause serious damage.

User Service Warning

This product has no field-replaceable components. Tampering with the unit will void the product warranty.

Environmental Requirements

For reliable operation, this product should be operated within the following environmental conditions:

- Stable ambient temperature from 10°C to 45°C
- Relative humidity to 90% non-condensing
- Stable ambient lighting
- No excessive vibration or mechanical shock
- No contact with corrosive agents
- No liquid splash
- Dust and dirt controlled (regular maintenance checks)

CAUTION: *The enclosure includes air intake holes at the rear of the unit and a small exhaust fan on the front. For the continued reliability of the system, it is important that these areas are not obstructed when the unit is mounted.*

3. SUPPORT AND MAINTENANCE

Warranty

DALSA warrants the VA4x against defects in materials and workmanship for a period of one year from the date of delivery. DALSA and its representatives expressly disclaim any and all other warranties.

Your sole remedy shall be repair or replacement of the VA4x product and associated optional components, provided that the defective product is returned within the warranty period.

If you need to return the system, you must contact the DALSA representative who sold you the system. Do not return your product to DALSA IPD without authorization.

DALSA assumes no liability for damages resulting from the use of this manual.

Support and Authorized Return Information

DALSA IPD provides the following support resources:

Documentation

In addition to this manual, the following information ships with the product:

Online help – fingertip help is available on every screen ("panel") of the User Interface.

PDF document – a copy of this manual is located on the hard drive, in directory "PDF Manuals".

IPD Website

Our **www.goipd.com** website is updated regularly with the latest information.

Factory Support

Call, fax, or email your local representative, or the DALSA IPD Headquarters, for product support.

DALSA IPD 700 Technology Park Drive Billerica, MA 01821	Main Number: +1.978.670.2002 FAX: +1.978.670.2010 Email: support@goipd.com Internet: http://www.goipd.com
Local Representative	Affix the business card of your local DALSA IPD representative here.

To assist our staff in supporting you better, please have the following information available:

1. Name of DALSA IPD representative who sold you the product.
2. Serial number of the unit.
3. Description of how the product is being used (application and environment).
4. Description of the problem and what you were doing when the problem occurred.
5. Exact wording of any error or warning messages that the product displayed.
6. What you have done to try and solve it.

Maintenance

For continued product health and reliable results, DALSA recommends regular maintenance checks to keep the equipment free of dust and dirt. Use anti-static compressed air to blow dust off the Lens and use a lens cloth or cleaner to wipe away grease, oil, or fingerprints.

Regulatory Compliance

FCC Compliance Statement

This product has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and may cause harmful interference to radio communication.

Declaration of Conformity of a Class B Digital Device According to the FCC Rules

We, the responsible party, DALSA Corporation, hereby declare that the product supported by this manual complies with Part 15 of the FCC Rules.

European Declaration of Conformity

This product has been tested to comply with the EC Directive for a class B digital device. It has been tested and found to comply with EN55022/CISPR22.

4. PRODUCT OVERVIEW

Product Description

The VA4x is an optical inspection appliance designed for high-speed applications requiring single or multiple views of a part. Both easy to learn and deploy, the VA4x is an ideal choice for manufacturers who need to ensure the best possible quality in their product.

The VA4xis a stand-alone product that does not require interfacing to a PC for setup. Remote connections are available for control and monitoring. All required software, user interfaces and communication controls are resident in the product.

Pre-inspection setup requires adjusting the sensor trigger-to-image delay, focusing the camera lens and adjusting the light source to optimize image picture quality (highlight features of interest). This is an important step to assure accurate and repeatable results.

Inspections are quickly set up by applying instances of tools to an image template captured by each of the cameras. Once configured with acceptable tolerances, the device is ready to start inspecting. In inspect mode, results and images are posted to the local display continuously. At the same time, outputs control downstream part handling and results are communicated to related equipment via RS-232 or Ethernet.

The VA4x accommodates both translation (X,Y) and 360° rotation of parts. While fixturing is recommended wherever possible, it is not a requirement for operation of this product. The VA4x can store over 256 solutions, 32 of which can be switched externally through user I/O for line changeovers.

Typical Applications

The VA4x can be applied to solve a diverse range of manufacturing problems across a multitude of industries. Typical applications include:

- Detect missing or incorrect components in a package or assembly
- Inspect front, back and top surfaces simultaneously
- Track or verify products – barcode or 2D matrix
- Align PCBs – locate and report position of multiple fiducials
- Locate and count objects
- Verify label position, fill level, cap and safety seal on bottles
- Check for surface defects
- Verify a label is not torn, smeared, stained or folded

Components

Figure 1 illustrates the physical components associated with a typical VA4x installation. Information on connector pinouts and electrical characteristics can be found in this Chapter, or in Appendix A starting on page 22.

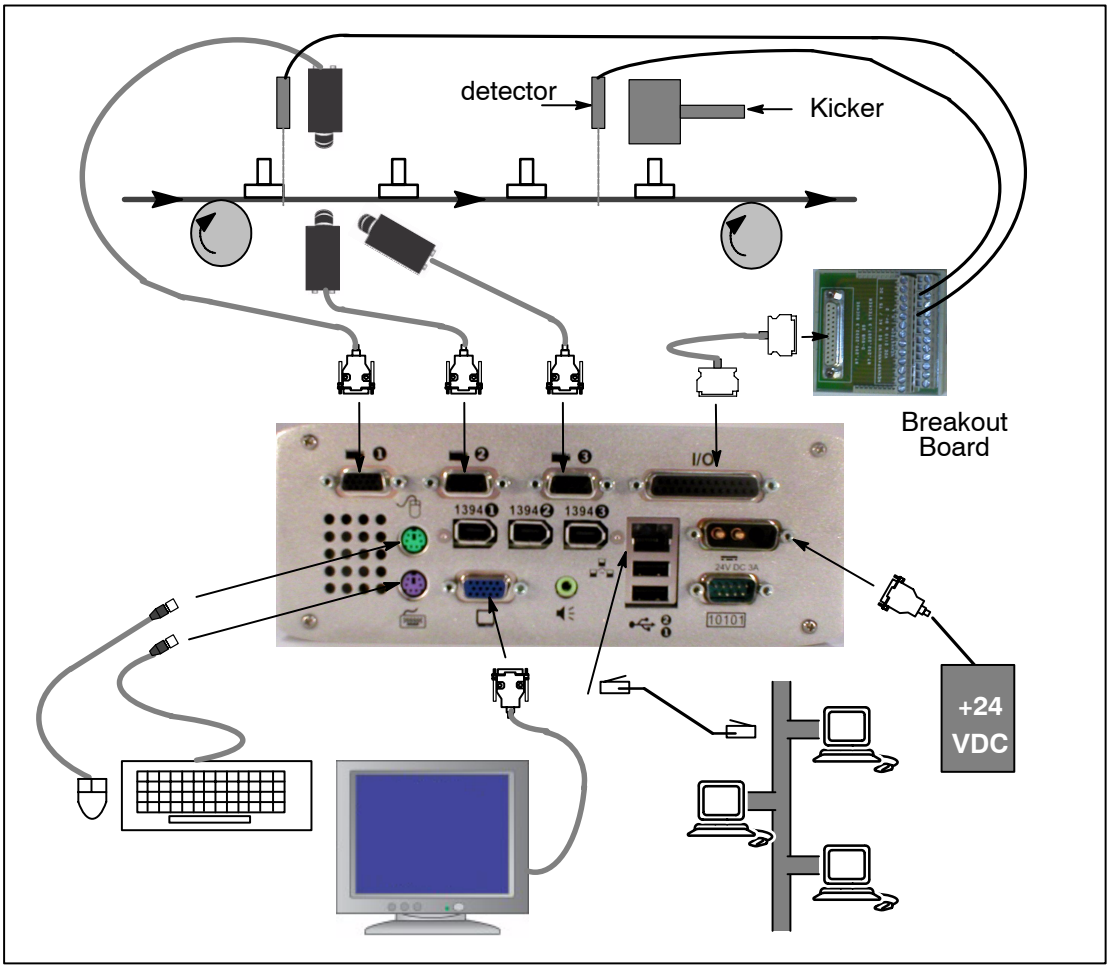


Figure 1. VA4x Installation

NOTE: *Not all of the physical interfaces are used by the VA4x software. They are, however, available to the user for interfacing with third party products, if required.*

CAUTION: *The enclosure includes air intake holes at the rear of the unit and a small exhaust fan on the front. For the continued reliability of the system, it is important that these areas are not obstructed when the unit is mounted.*

5. INSTALLATION

Pre-Installation Checks

1. Read the handling and operating precautions in Section 2.
2. Check that all essential components are present:
   a. The VA4x unit
   b. Display, keyboard and mouse
   c. Camera(s) and associated cable(s)
   d. C-Mount Lens for each camera
   e. 24VDC power supply with 3.3 A output
   f. Light Source, cable and power supply if necessary
   g. Sensor trigger and cable (if required)
   h. Decision trigger and cable (if required)
   i. I/O breakout hardware

Interface Specifications

Before attempting installation, familiarize yourself with the various hardware interfaces detailed below. The **VA41** is pictured. The arrangement of connectors is slightly different on the **VA40**.

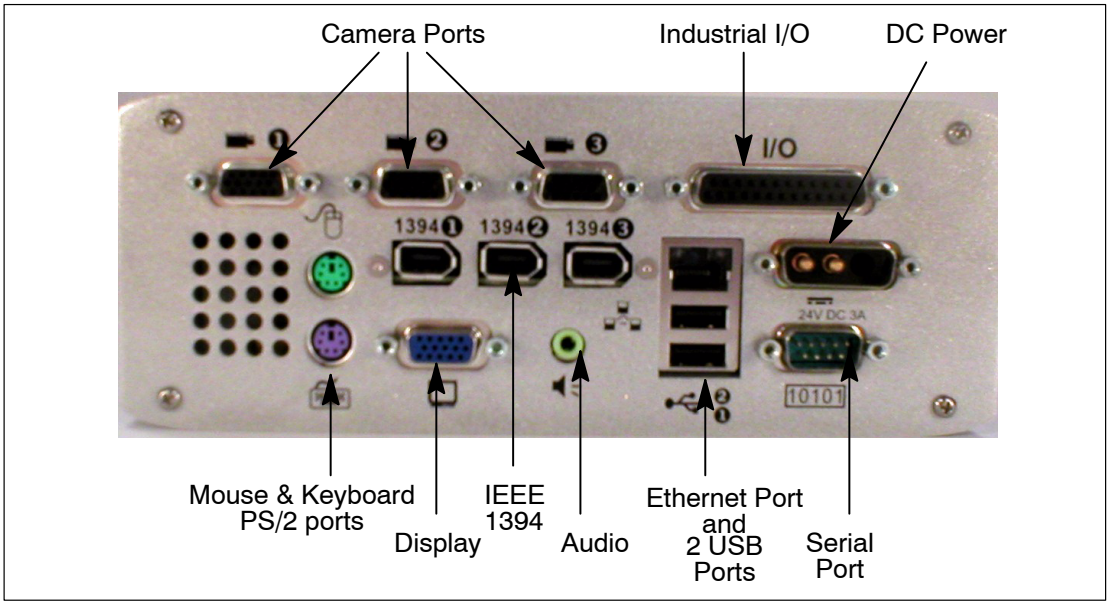


Figure 2. VA4x Rear Panel

Camera (Video) Connections

One of the benefits of the VA4x is that it supports different format cameras. This means that the hardware can be easily adapted to changing inspection requirements. The standard camera that ships with the product has a resolution of 640x480 pixels, but this is expandable up to 1300x1080. Furthermore, different size cameras are available to suit application space constraints.

DALSA offers cameras for use with our vision systems, some of which are referenced below. See also directory: D:\PDF Manuals for available camera manuals.

NOTE *When you select the camera from DALSA, it will be tested with the cables and Vision Appliance that are being shipped to you. Furthermore, the* VA4x*will have the appropriate configuration file loaded, making for a smooth out-of-the-box experience.*

The camera interface supports:

- 3 synchronous camera inputs, supporting progressive scan analog cameras with standard or double-speed capabilities.

Recommended Camera List

The following cameras are offered by DALSA. Consult DALSA for alternate choices if required.

Model	*Resolution*	*Type*	*Full frame speed*	*Body Size*
TM1& TM2*	640x480	Analog-mono	60 fps	1"x1"x1.5"
SM2	1024x768	Analog-mono	29 fps	1.16"x1.16"x1.2"
CV-A11	640x480	Analog-mono	30 fps	1"x1.5"x2.5"
CV-A1	1380x1035	Analog-mono	16 fps	1"x1.5"x2.5"

* Standard camera that ships with the VA4x.

Camera Configuration File

The iNspect and iLabel application software use a Camera Configuration file "NSPtest.txt" in the \iNspect software directory. It defines the image size and parameters required to interface a particular camera. The file associated with the camera specified at the time of order is loaded as the default when the product ships from the factory.

Sherlock uses a separate configuration file, usually found in the \IFC\Config directory.

Camera Switches

The settings of the switches on the back of the cameras should not be changed. For reference only:
TM1 switches 1, 6, and 10 are On, all other switches are Off.
TM2 switches 2, 7, and 10 are On, all other switches are Off.
SM2 switches 1 through 7, 9 and 10 are Off, 8 is On; 75Ω is Off, HD/VD set to EXT.

TM Camera Cable

This cable is compatible with the standard miniature series progressive scan analog cameras that ship with the product (TM1, TM2 and SM2).

TM Cable Pin-Out

12-pin Video/sync	*Signal Description*	*15-pin*
1	12 Volt Return (ground)	10
2	+12 Volts DC	15
3	Analog ground	7
4	Video input (single-ended)	2
5	Digital ground	4
6	HDRIVE horizontal sync	13
7	VDRIVE Vertical sync	14
8	Digital ground	5
9, 10	no connection	–
11	Frame Reset to camera (Exposure)	9
12	Digital ground	5

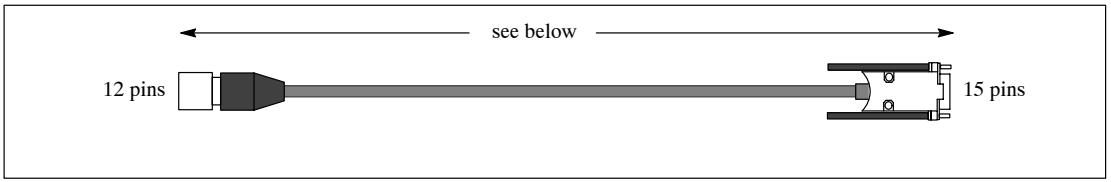


Figure 3. TM Camera Cable

Part Number	*Cable Length*
A-CAB-NSII-C30	3 meters
A-CAB-NSII-C31	5 meters
A-CAB-NSII-C32	10 meters

Network Connection

If your system is to be connected to a LAN (Local Area Network), connect a network cable to the RJ45 Ethernet jack.

The VA4x supports Fast Ethernet (100BaseT) and Twisted Pair Ethernet (10BaseT). If you plan to use Fast Ethernet, use a Category 5 (UTP5) cable.

Serial Port Connection

The VA4x has one RS-232/485 compliant serial port. The serial port is typically used for passing results to a third party device, such as a PLC.

The analog camera interface also includes a serial port that is used to control camera functions directly, like gain and exposure, for supported JAI cameras.

I/O Connections

The VA4x interfaces I/O through the 25-pin D-Sub connector on the back panel (Figure 2, page 8). The I/O pin designations are as follows:

I/O Connector Definitions

Pin #	*Direction*	*iNspect/iLabel Definition*	*Sherlock Definition*
1 & 25	–	Ground	
2	In	Sensor Trigger input or GPI0	Channel 14 or Sensor Trigger
3	In	Decision Trigger input or GPI2	Channel 16 in
4	In	Solution ID bit 1 or GPI4	Channel 18 in
5	In	Solution ID bit 3 or GPI6	Channel 20 in
6 & 19	–	Ground	
7	Out	Strobe output	Channel 0 or Strobe output
8	Out	Decision Output 1	Channel 2 out
9	Out	GPO4	Channel 4 out
10	Out	GPO6	Channel 6 out
11	–	not connected on standard NPN (User Power input on PNP option)	
12	Out	Fused +12V at 0.7A	
13 & 14	–	Ground	
15	In	Change Solution input or GPI1	Channel 15 in
16	In	Solution ID bit 0 or GPI3	Channel 17 in
17	In	Solution ID bit 2 or GPI5	Channel 19 in
18	In	Solution ID bit 4 or GPI7	channel 21 in
20	Out	Decision Output 0	Channel 1 out
21	Out	Inspection / Running Status	Channel 3 out
22	Out	GPO5	Channel 5 out
23	Out	GPO7	Channel 7 out
24	Out	Fused +5 V at .75 A	

The application software (iNspect and iLabel) overrides I/O settings in the Camera Configuration File, defining the trigger inputs, strobe output, and decision outputs.

Connecting a Firewire camera may reassign the I/O channel numbers in Sherlock.

Input Electrical Specifications

All VA4x inputs are single-ended, with the following specification:

Signal state	*Min.*	*Max*
Low (Inactive)	0 V	0.8 V
High (Active)	2.4 V	30 V
Turn ON current	1 mA	

Output Electrical Specifications

All VA4x outputs are single-ended, open collector, current sinking (NPN), with the following specification:

Parameter	*Max*
Output Voltage	30 V
Output Sink Current	500 mA
Short Circuit Protection	25 V

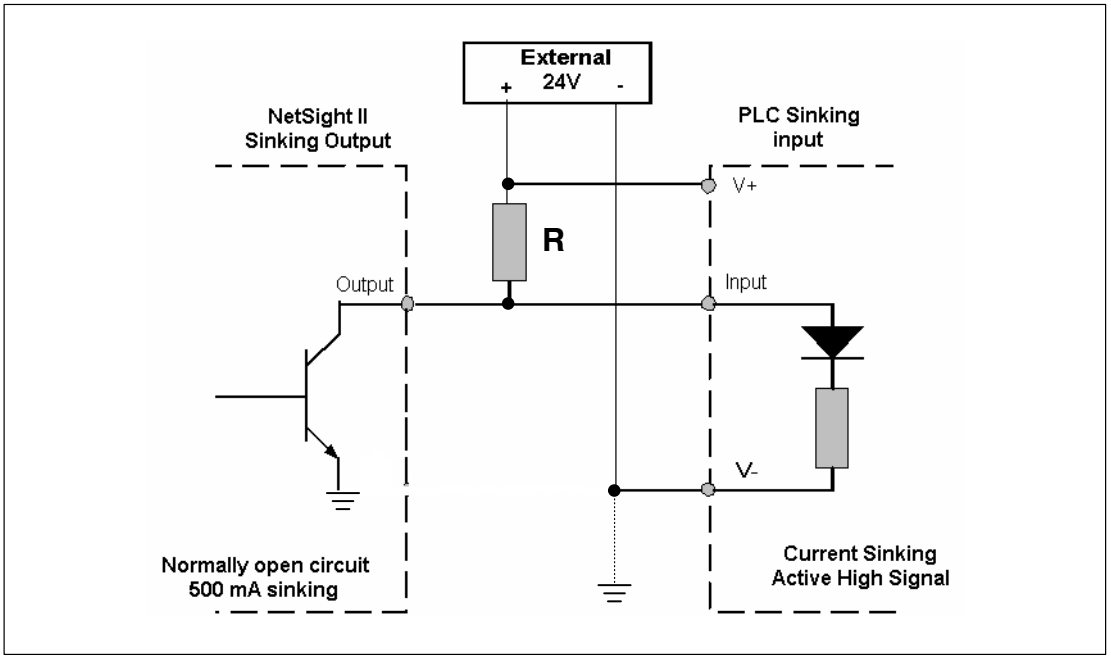


Figure 4. Typical Output Wiring Diagram

NOTE *The outputs are Open Collector. A pull-up resistor is needed to test the outputs.*

Example Load Resistance (based on 10 mA load)

Voltage Source	*Load* **R**
24 V	4.8 K ohms
30 V	6 K ohms

I/O Breakout Options

Two choices of breakout modules are available, for standard terminal block and opto-isolated connections. Both modules provide standard DIN rail mounting. The terminal breakout option ships with the VA4x bundle, the isolation board is available as an optional accessory.

Standard Terminal Breakout (A-IOB-011)

The terminal breakout module (Figure 5) ships as part of the standard product bundle. It provides a simple means to wire inputs and outputs to the VA4x. The pinout is a direct 1–1 correlation with the 25-pin connector on the back panel (pin-out on page 11).

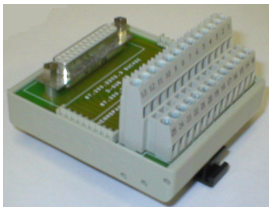


Figure 5. Terminal Breakout Module

Optional Isolation Breakout (A-IOB-100)

The isolation breakout module (Figure 6) provides opto-isolation for all of the I/O. It supports standard "Openline" modules from Grayhill. The breakout provides easy wiring to industrial controls, while providing protection from potentially harmful power sources. Each module supports either 2 inputs or 2 outputs. Output modules are fused and provide status LED indicators. Modules M0 to M3 are DC Inputs, Modules M4 to M7 are DC Outputs (see following table).

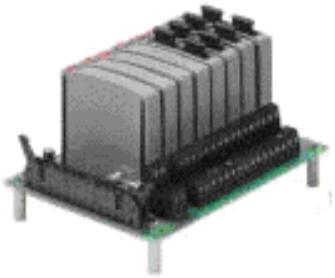


Figure 6. Isolation Breakout Module

Terminal Block Definitions for Opto-Isolation Breakout

Pin #	Function	Pin #	Function	Pin #	Function	Pin #	Function
1	IN0	9	IN4	17	OUT0+	25	OUT4+
2	GND	10	GND	18	OUT0–	26	OUT4–
3	IN1	11	IN5	19	OUT1+	27	OUT5+
4	GND	12	GND	20	OUT1–	28	OUT5–
5	IN2	13	IN6	21	OUT2+	29	OUT6+
6	GND	14	GND	22	OUT2–	30	OUT6–
7	IN3	15	IN7	23	OUT3+	31	OUT7+
8	GND	16	GND	24	OUT3–	32	OUT7–

Solution Switching Using I/O

Up to 32 Solutions can be switched through the I/O Connector or the Breakout board, for line changeovers. You supply a 5-bit "Solution ID" number, 00 through 31, and a "load" signal, using 5 switches and a button. The necessary circuit is illustrated below, and the I/O Connector pin numbers are given.

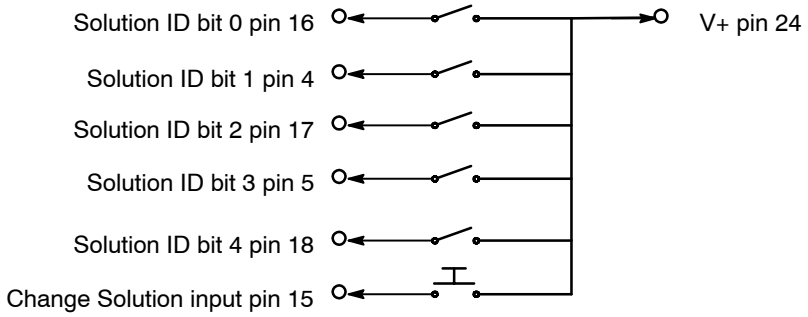


Figure 7. Solution ID Switching Circuit

If there is no ID switch circuit attached, the application opens with Solution 00 running. If an ID switch circuit is attached, the application starts/opens running the Solution ID indicated by the switch.

NOTE *Do Not change the running Solution when in the History Recall panel, or when any dialog boxes or message windows are open, such as image save, file or directory browse, Reject Restart Count, alarm messages.*

If there is no ID switch attached, the Solution ID inputs 0–4 may be used as General Purpose inputs GPI3–GPI7 in Conditional Outputs and Equation Assignments.

Unused Connections

There are several connections exposed on the rear panel that are not used by the VA4x. These connections (printer port, IEE 1394 and audio) are available to companion third party software packages at the user's discretion. DALSA does not support problems arising from the use of these interfaces.

Status LEDs and RESET Switch

The VA4x provides 7 LEDs on the front panel, as visual health and status indicators (shown in Figure 8).

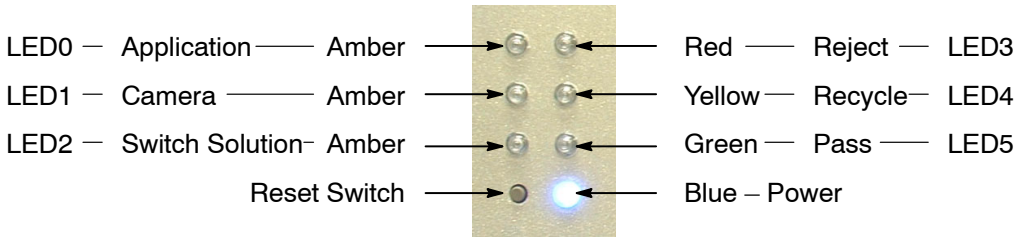


Figure 8. Front Panel Status LEDs and Reset Switch

The Reset button, when depressed, will initiate a system reset/reboot. The button is recessed in the front panel to prevent accidental contact.

As the iNspect or iLabel application opens, two of the LEDs start flashing. These represent "application" and "camera" health. The application "heartbeat" has a 2 second cycle, at 50% duty. The camera "heartbeat" rate is dependent upon the type of camera and external event time or line speed, and can be rapidly flashing, or may seem to be constantly on.

The other LED indicators represent "switch solution command" and inspection results (Pass/Recycle/Reject). The inspection results are updated with every inspection and visually indicate the state of the outputs on the I/O connector. The inspection results LEDs are latched after a decision, and stay latched until the next decision is available.

The LEDs are available in Sherlock as Digital I/O output channels 8 through 13.

LED	*Sherlock Digital Output*	*LED*	*Sherlock Digital Output*
LED0	Channel 8	LED3	Channel 11
LED1	Channel 9	LED4	Channel 12
LED2	Channel 10	LED5	Channel 13

Connecting a FireWire camera can reassign channel numbers in Sherlock, if the camera communicates its registers to the driver.

Mounting Options

VA4x Chassis

The VA4x provides the means to mount to a standard DIN rail or custom assembly. The mounting holes are located on the base plate of the unit. Location and size of the mounting holes are shown in Figure 9.

- Cabinet dimensions: W 20 cm x L 21.56 cm x H 7.5 cm; W 8 inches x L 8.6 inches x H 3 inches.
- Weight: 2.62 kg; 5.75 lb.

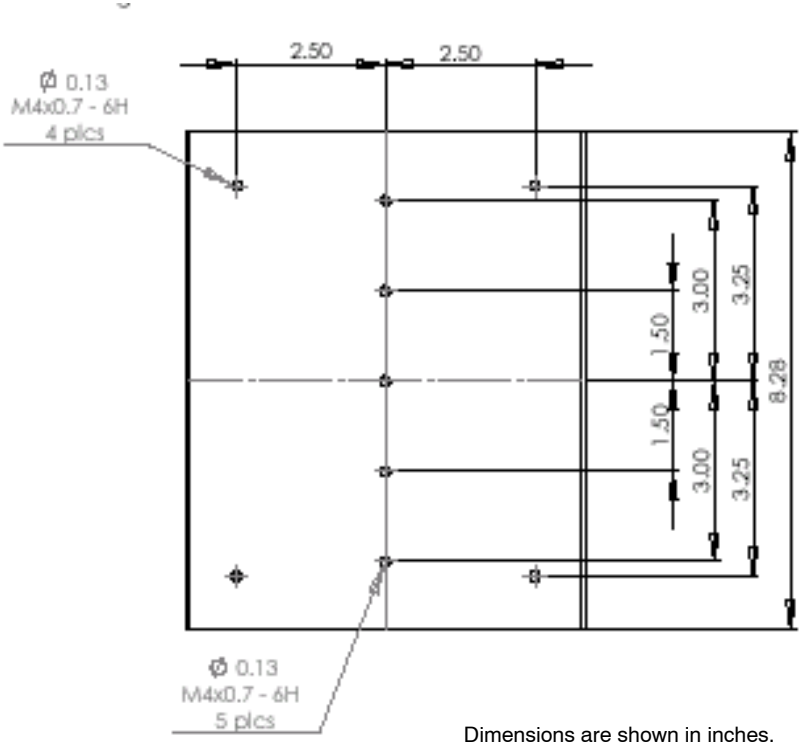


Figure 9. VA4x Mounting Holes

Cameras

The camera provide mounting holes on the bottom of the camera. The location and size of the mounting holes are shown in Figure 10, 11 and 12.

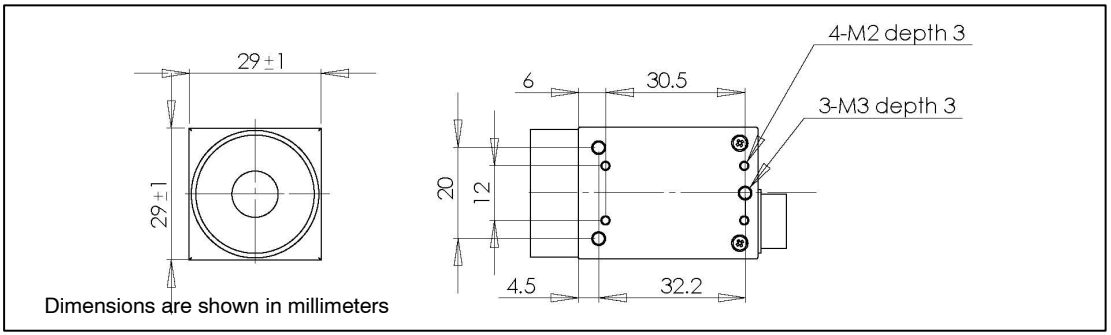


Figure 10. TM1 Camera Mounting Holes

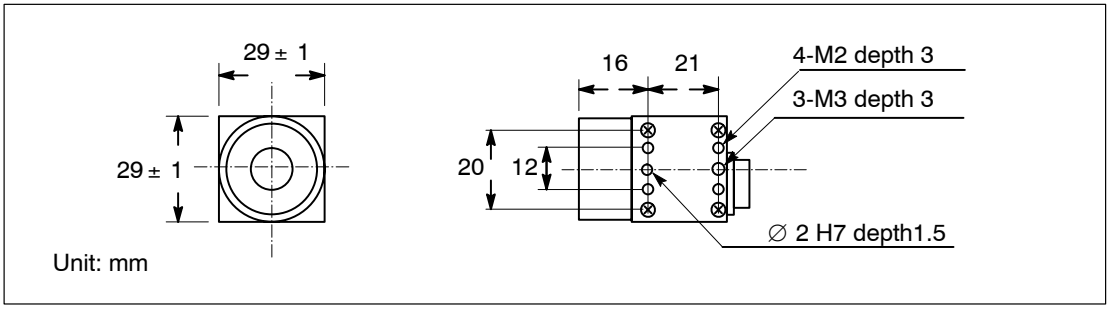


Figure 11. TM2 Camera Mounting Holes

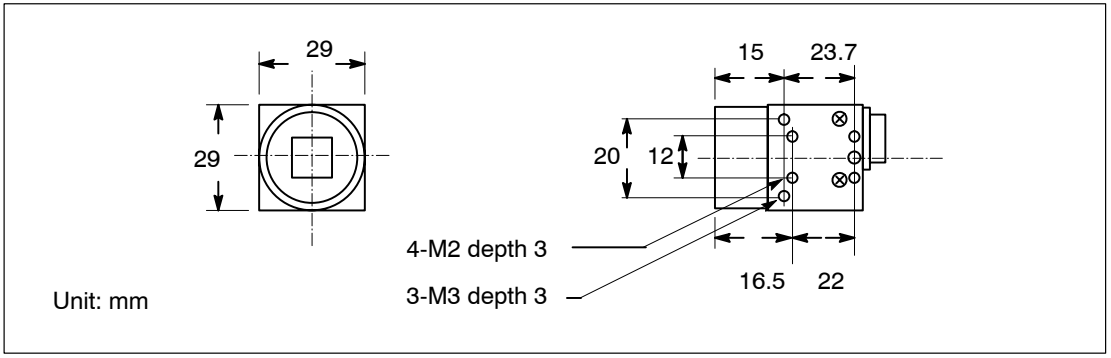
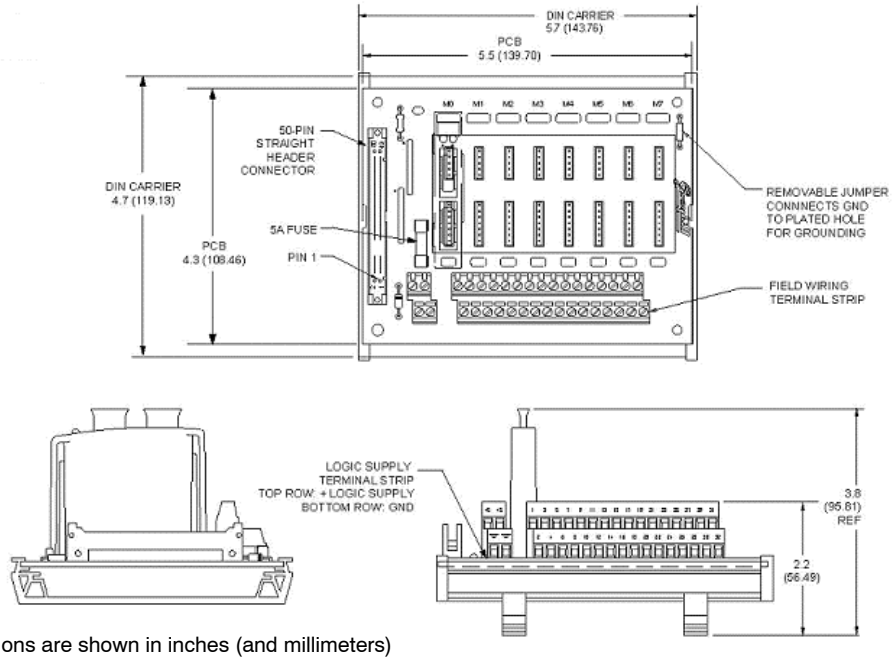


Figure 12. SM2 Camera Mounting Holes

Breakout Boards

The Breakout Boards provide the means to mount to a standard DIN rail. Standard DIN mounting brackets are located on the bottom of the Breakout Board assembly. The Isolated Breakout Board Assembly is shown in Figure 13.



Dimensions are shown in inches (and millimeters)

Figure 13. Isolated Breakout Board

Installation

1. Mount the Camera(s) and VA4x in a location free from excessive shock, moisture, and vibration. The VA4x can be used with a standard DIN rail mount. Mounting holes are located on the base plate. See Figure 9 on page 16.
2. Connect a standard VGA Monitor to the Display connector.
3. Connect a mouse and keyboard, using either the PS/2 or USB connectors.
4. Thread the lens onto each camera lens mount.
5. Attach camera cables to each camera and connect them to the camera ports on the VA4x. See "Camera (Video) Connections" on page 9.
6. Connect the sensor trigger and decision trigger inputs to the I/O breakout board (see pin-out, page 11).
7. Mount the light source. Connect the strobe controller (if required) to the strobe output of the I/O breakout board (see pinout, page 11).
8. Wire the required outputs from the I/O breakout board to the PLC or pass/reject mechanisms (see pinout, page 11).
9. Connect network as required (see "Network Connection" on page 10).
10. Connect Serial connections as required (see "Serial Port Connection" on page 10).

Before powering on the unit, take a couple of minutes to verify your hardware installation:

11. Verify all cable connections
12. Verify all electrical connections
13. Verify all components are securely mounted.

Complete the installation by applying power to the unit. The VA4x is powered from an external supply (option A-PWR-NSII) that connects to the 3-pin D-Sub connector. The power requirements are:

- +24 Volts at +/– 3 Amperes

When the VA4x has booted, you can launch the application by clicking on one of the icons located on the desktop, or using the "Start" button. With the application launched, you should see an image representing the camera view and two of the amber LEDs flashing on the front panel of the unit. See Figure 8 on page 15.

The hardware installation is now complete, and you can proceed to setting up the inspection. Refer to the separate User's Reference Manuals for iNspect, iLabel, or Sherlock.

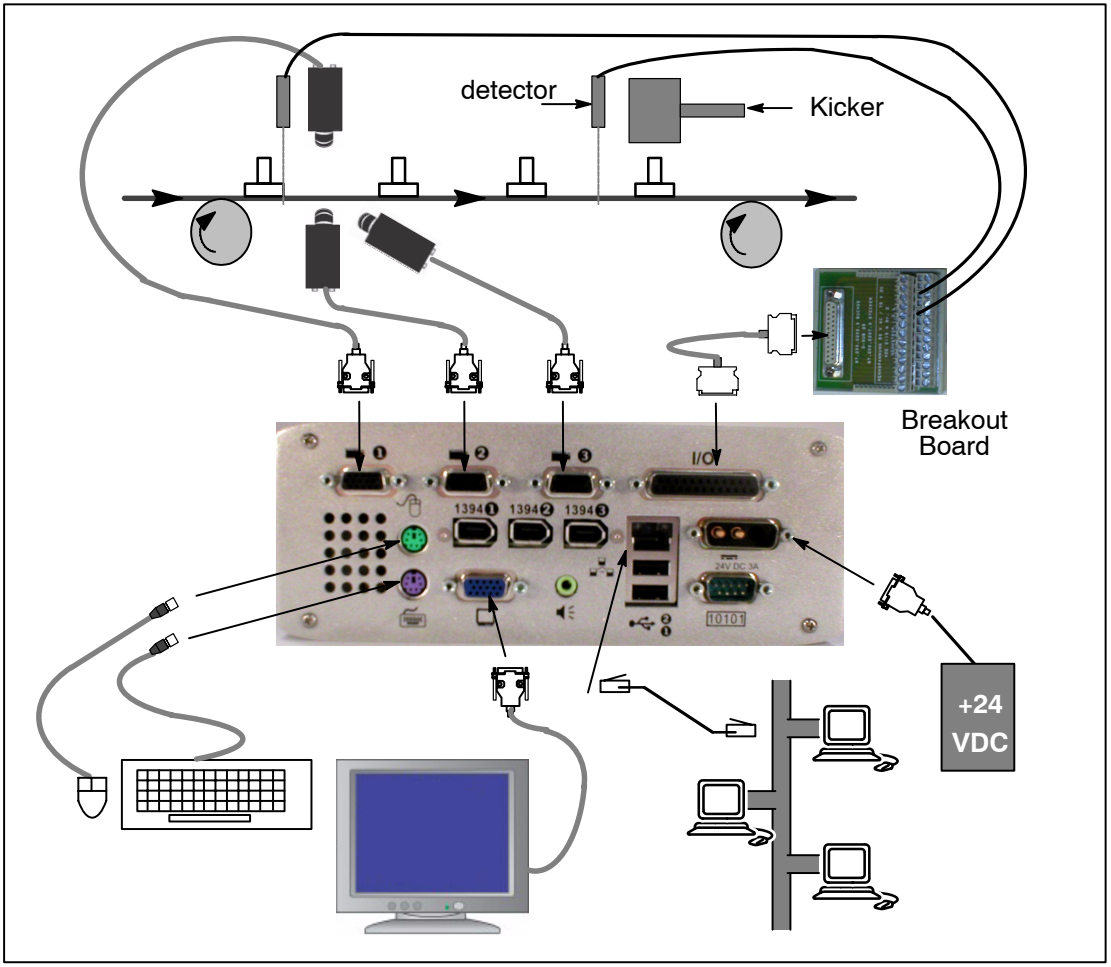


Figure 14. VA4x Installation

NOTE: *Not all of the physical interfaces are used by the VA4x software. They are, however, available to the user for interfacing with third party products, if required.*

CAUTION: *The enclosure includes air intake holes at the rear of the unit and a small exhaust fan on the front. For the continued reliability of the system, it is important that these areas are not obstructed when the unit is mounted.*

Troubleshooting

1. You have powered the VA4x and launched iNspect or iLabel, but you do not see an image on the display.
   a. Verify the acquisition heartbeat is flashing. If it is not, a connection problem is likely. Verify the cables again.
   b. Verify that the lens aperture is not closed.
   c. Verify that the inspection area (meaning the area that the camera is viewing) is correctly illuminated.
   d. Verify that the camera and configuration file match. The configuration file is found at: D:\inspect\nsptest.txt or C:\inspect\nsptest.txt The VA4x was configured before shipping from DALSA, to match the cameras ordered with the VA4x. If the file does not match your camera, contact your DALSA local representitive, or DALSA IPD headquarters, for help.

APPENDIX A
CONNECTORS AND PINOUTS

This section provides the connector pinout information for each of the VA4x external interfaces.

Camera Connectors

Cameras interface through three 15-pin D-Sub connectors on the rear panel (labeled Video 1, 2 and 3). Simultaneous capture and processing from 3 monochrome cameras is supported.

The location and pinout for the D-Sub connectors are shown below.

NOTE: Each D-Sub cable can supply up to 0.5 A at +12 Volts from chassis power.

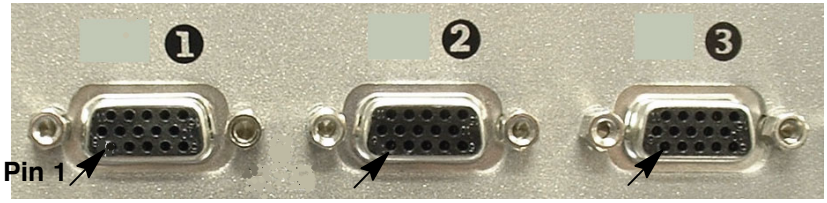


Figure 15. Video Ports

Video Connector Pinout

Pin	*Name*	*Direction*	*Description*
1	NC or Green	–	Green on port 1 only, not connected on ports 2 & 3
2	Video or Blue	In	Monochrome Video, or Blue on port 1 only
3	NC or Red	–	Red on port 1 only, not connected on ports 2 & 3
4, 5	DGND	–	Digital ground
6,7,8	AGND	–	Video signal ground
9	Camera TRIG	Out	Frame Reset (exposure control)
10	DGND	–	Digital ground
11	RX	In	Serial receive data (CV-A cameras only)
12	TX	Out	Serial transmit data (CV-A cameras only)
13	HD	Out	Horizontal Drive
14	VD	Out	Vertical Drive
15	Power	Out	+12 V @ 0.5 A

Camera Electrical Specifications

Pin	*Electrical Specification*			
Video Inputs	AC coupled, 75 ohm terminated			
	Logic 0		Logic 1	
	Min.	*Max*	*Min.*	*Max*
Trigger Input	0	0.8 V	2	5.5 V
HD/VD Outputs	0	0.5 V	2.4 V	5.5 V

Power Connector

The VA4x is powered from an external supply (option A-PWR-NSII) that connects to the 3-pin male D-Sub connector on the back panel. The power requirements are:

+24 V +/–10% @ 2.5 A maximum.

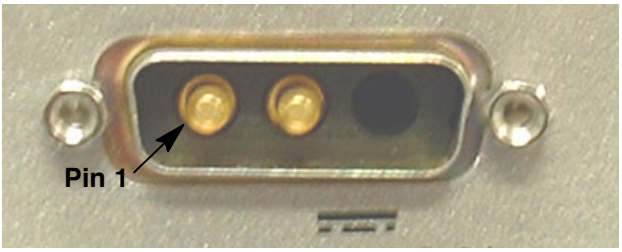


Figure 16. Power Connector

I/O Connector Pinout

Pin	*Name*	*Direction*	*Description*
1	GND	–	Ground
2	+24V	Input	DC Power
3	NC	–	not connected

A power cable (A-CAB-NSII-PWR), with open leads on one end and a mating connector plug on the other, is shipped standard with the product.

I/O Connector

The general purpose I/O is available through the female 25-pin D-Sub connector.

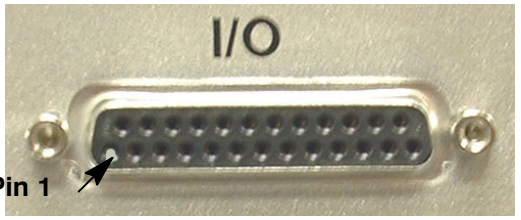


Figure 17. I/O Connector

I/O Connector Definitions

Pin	*Direction*	*Description*
1 & 25	–	Ground
2	In	Sensor Trigger input or GPI0
3	In	Decision Trigger input or GPI2
4	In	Solution ID bit 1 or GPI4
5	In	Solution ID bit 3 or GPI6
6 & 19	–	Ground
7	Out	Strobe output
8	Out	Decision Output 1
9	Out	GPO4
10	Out	GPO6
11	–	not connected on standard systems (User Power input on PNP option)
12	Out	Fused +12V at 0.7A
13 & 14	–	Ground
15	In	Change Solution input or GPI1
16	In	Solution ID bit 0 or GPI3
17	In	Solution ID bit 2 or GPI5
18	In	Solution ID bit 4 of GPI7
20	Out	Decision Output 0
21	Out	Inspection / Running Status
22	Out	GPO5
23	Out	GPO7
24	Out	Fused +5 V at .75 A

Ethernet and USB Connectors

The Ethernet RJ-45 connector is an 8-pin male connector. The two USB 1.1 connectors reside below the Ethernet connector. They are identical, rectangular type-A, 4-pin sockets.

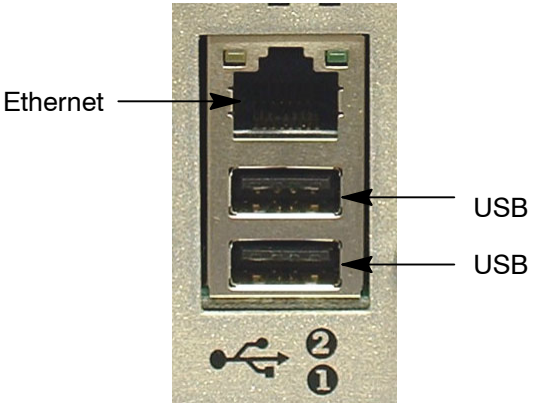


Figure 18. Ethernet and USB Connectors

Ethernet Pinout

Pin	Name	Direction	Description
1	TD+	Out	Transmit Data+
2	TD–	Out	Transmit Data–
3	RD+	In	Receive Data+
4–5	NC	–	not connected
6	RD–	In	Receive Data–
7–8	NC	–	not connected

USB Pinout

Pin	Name	Direction	Description
1	VCC	Out	Power, +5 V (1 A max)
2	DATA–	I/O	Data–
3	DATA+	I/O	Data+
4	GND	–	Ground

Display Connector

The VA4x provides standard 15-pin female D-Sub connection for Display.

Display Pinout

Pin	*Name*	*Direction*	*Description*
1	RED	Out	Red
2	GREEN	Out	Green
3	BLUE	Out	Blue
4	NC	–	not connected
5–8	GND	–	Ground
9	+5V	Out	+5 V
10	GND	–	Ground
11	NC	–	not connected
12	SDA	I/O	Serial data
13	HS	Out	Horizontal Sync
14	VS	Out	Vertical Sync
15	SCL	I/O	Serial data clock

Serial Connector

The VA4x provides standard 9-pin male D-Sub connection for serial port.

Serial Pinout

Pin	*Name*	*Direction*	*Description*
1	DCD	In	Data Carrier Detect
2	RXD	In	Receive Data
3	TXD	Out	Transmit Data
4	DTR	In	Data Terminal Ready
5	GND	–	Ground
6	DTS	Out	Data Set Ready
7	RTS	Out	Request to Send
8	CTS	In	Clear to send
9	RI	In	Ring Indicator

Parallel Connector

The **VA40** provides standard connections for Parallel (25-pin female D-Sub). The **VA41** does not have a parallel port connection.

Parallel Pinout

Pin	*Name*	*Direction*	*Description*
1	/STROBE	I/O	Strobe
2	D0	I/O	Data Bit 0
3	D1	I/O	Data Bit 1
4	D2	I/O	Data Bit 2
5	D3	I/O	Data Bit 3
6	D4	I/O	Data Bit 4
7	D5	I/O	Data Bit 5
8	D6	I/O	Data Bit 6
9	D7	I/O	Data Bit 7
10	/ACK	I	Acknowledge
11	BUSY	I	Busy
12	PE	I	Paper End
13	SEL	I	Select
14	/AUTOFD	I/O	Autofeed
15	/ERROR	I	Error
16	/INIT	I/O	Initialize
17	/SELIN	I/O	Select In
18–25	GND	–	Ground

IEEE 1394 Connector

The **VA41** provides three standard 6-wire IEEE 1394 ports. The **VA40** does not have a IEEE 1394 port.

IEEE 1394 Pinout

Pin	*Name*	*Direction*	*Description*
1	PWR	Out	Power, +12V
2	GND	–	Ground
3	/TPB	In/Out	Data and strobe
4	TPB	In/Out	Data and strobe
5	/TPA	In/Out	Data and strobe
6	TPA	In/Out	Data and strobe

APPENDIX B
STAGING AND PRESENTATION

To measure or inspect a part or object, it must be positioned so the camera can see it. Positioning, sometimes called *staging*, *presentation*, or *fixturing*, puts the part in the camera's field of view (FOV), signals the Vision Appliance that a part is available, and helps hold the part steady while an image is being taken.

The camera is responsible for generating an electronic image of the part for processing by the Vision Appliance. The camera and lighting help with the part positioning because they are used to "freeze" or "stop" the motion of a moving part.

An Example

Figure 19 illustrates a bottle inspection line, seen from above. The bottles move along a conveyer belt, past the camera. The conveyer belt positions the bottle in front of the camera, so that the camera can capture an image of the threading on top of the bottle's neck.

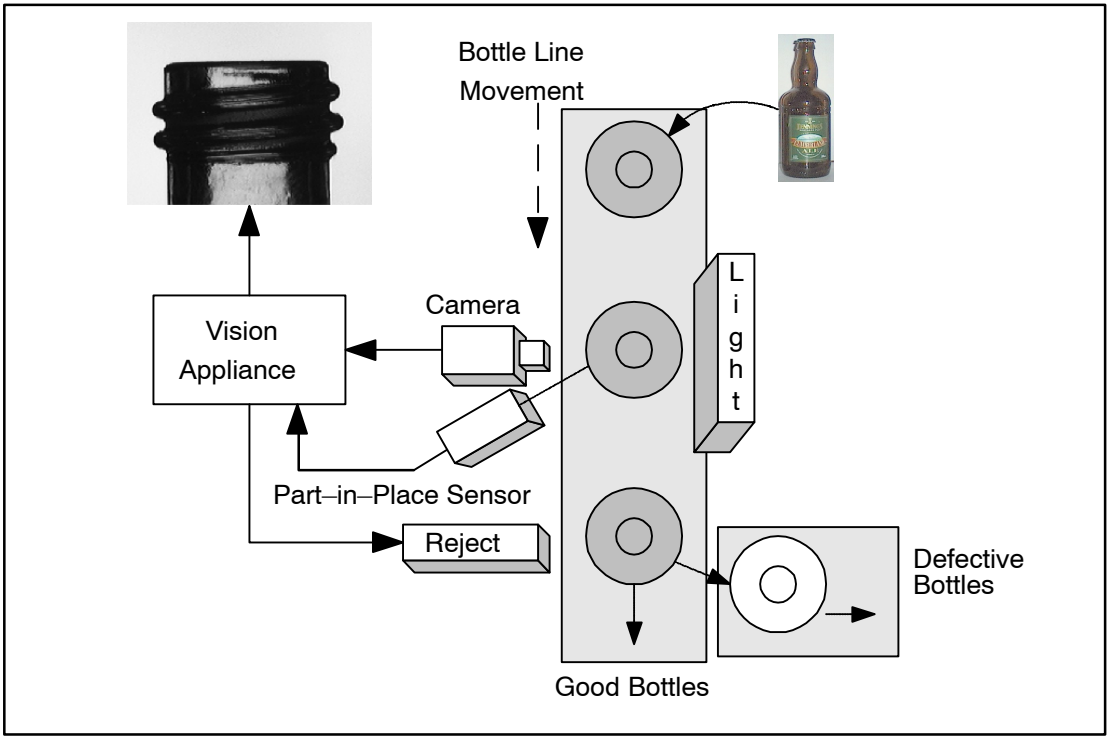


Figure 19. Bottle Inspection Line

A diffuse, uniform light behind the threads gives a sharp, high-contrast image of the threads. The Vision Appliance inspects this image and signals a rejection "kicker" to move defective product off the production line.

Part-in-Place Sensor

In this example we have two problems because the parts (bottles) move. We first have to know when a bottle is in front of the camera so it can "see" the threads. One solution is to have the Vision Appliance look for the threads, and only take an inspection image when the thread is centered in the field of view. A simpler approach is to have a separate Part-in-Place (PiP) sensor that detects when the bottle is in the correct position. A PiP sensor allows the Appliance to work at higher part speeds. We have used inexpensive, PiP sensors from HTM Electronics Industries (http://www.htm–sensors.com) and from Banner Engineering (www.bannerengineering.com).

Reducing Blurring Caused by Part Motion

The second problem is blurring caused by motion of the part. When the part is in place, the motion of the part must be "frozen" so that the image of the part is not blurred by the motion. Sometimes the part is stopped while a picture is taken. This is ideal for the best measurement accuracy. With continuous motion, as on a conveyer belt, we rely on the camera and lighting to "freeze" the motion.

The camera used with the Vision Appliance has a programmable exposure time so you can set the part viewing time. Selecting the viewing time depends on the part speed, the amount of blurring due to motion that can be tolerated, and the amount of available light. The shorter the viewing time, the more light is needed to see the part. The camera also has an electronic shutter, but this is automatically adjusted for you.

Assuming that only one part is in the field of view at a time, an estimate of the viewing time can be derived from the following equation:

View Time in seconds = B/(P*I)

where:

B is the amount of blur you can tolerate (in pixels),

P is the number of pixels per image (image size) in the direction of motion,

I is the number of images taken per second, or the number of parts per second.

For example, if the motion is horizontal with respect to the camera, and the picture size is 640 pixels per horizontal line, then P=640. If you are inspecting 5 parts per second (I=5), and can tolerate one pixel of blurring (B=1) then:

View Time = 1/(640*5) = 315 microseconds

This is within the camera exposure range (and shutter speeds) but will require good illumination, perhaps by an LED strobe, because the exposure time is brief.

In iNspect/iLabel, you adjust the camera's exposure time using the Exposure Control slider on the Vision Appliance's Sensor Setup screen. For Sherlock and IFC programs, you adjust the exposure time by changing the Frame Reset pulse width, using the Camera Configurator (see Appendix D, page 35).

In practice, you will adjust the exposure to balance good image contrast against visible blur due to part motion.

Blurring of the image caused by the motion of the part (*motion blur*), even when not visible to the human eye looking at the camera image, will reduce the accuracy of measurements. Ideally, measurements should be performed on a part that is not moving, so there is no motion blur and so that a longer exposure (and smaller lens aperture) can be used.

Progressive Scan Cameras

In addition to programmable exposure, the camera is non-interlaced (usually called *progressive scan*). If you intend to use a different camera with your Vision Appliance, call ipd for supported cameras. Make sure that it is progressive scan, has an electronic shutter, and is compatible with the control signals, power, and cabling.

Strobe Lighting

A strobe light provides a brief, high-intensity pulse of light that can help reduce motion blur and still provide adequate illumination to the part being inspected. Traditional xenon strobe lights are bright and can be very short in duration, less than 100 microseconds, to "freeze" the part motion. Xenon strobes have substantial variability in intensity. This can create variations in the image quality, which could be mistaken for variation in the part quality. Xenon strobe lights are used only when there is no easier way to get short, high-intensity light. LEDs (Light Emitting Diodes) can also be used as a strobe, and over-driven to give a short, bright pulse of light.

Even with a strobe illumination source, you need a camera with an electronic shutter and exposure time to prevent ambient light from contaminating the image. The Vision Appliance has a dedicated I/O line for firing a fast strobe, because this must be done at a certain time after the exposure has been triggered. Longer duration light, for example LEDs again, can be controlled using a standard I/O line, and are turned on before the camera's exposure is triggered and turned off after the exposure is done. This minimizes the intensity variation on different exposures.

Using Contact Closures

Mechanical contacts, such as switches or relays, typically exhibit "bounce." The moving contact makes the electrical circuit by touching a fixed contact, but then bounces off this fixed contact. The result is a series of rapid closing and openings of the contact until the moving contact stops bouncing. Bouncing typically continues for less than 10 milliseconds, but the duration depends on mechanical factors of the switch. This oscilloscope trace shows about 5 ms (milliseconds) of bounce when a switch is closed:

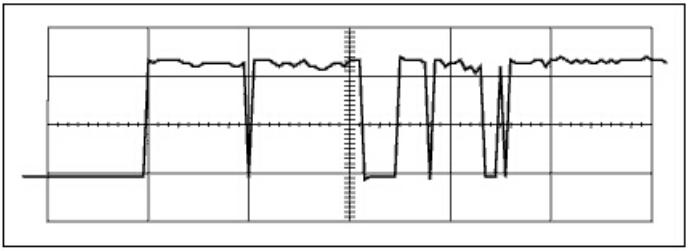


Figure 20. Example of switch "bounce" during a contact closure

From *Switch Bounce and Other Dirty Secrets*, Maxim Integrated Products, Inc., Sept. 2000

The problem is, the Vision Appliance "sees" the bouncing as multiple, rapid input signals. For example, if your "part in place" sensor is a mechanical switch (say, a photocell running a relay), the contact bounce will make it appear as if many parts were being presented to the Vision Appliance in a few milliseconds.

Here are three ways to deal with bounce. (1) Use a signal that does not bounce; for example, from a photoelectric sensor. (2) Use the built-in de-bouncing circuits. The de-bounce circuit delays the VA4x from responding to the input for some number of microseconds (us) to allow time for the contact to settle. The de-bounce time can be programmed through the camera configuration file. (3) Externally de-bounce the switch closure using commercial de-bounce chips (for example, the Maxim MAX6816), or a low-pass filter and Schmitt trigger.

Both the Vision Appliance and external de-bounce circuits delay the input signal by the de-bounce period. This delay is rarely long enough to be a problem, but might have to be considered in very high-speed applications where any delay might mean the parts being inspected move partially out of the field of view.

Using Photo-Sensors

HTM Electronics Industries (http://www.htm–sensors.com) and Banner Engineering Corp. (http://www.bannerengineering.com) and several other manufacturers make photoelectric sensors that do not require de-bouncing. The HTM Electronics MP-D0380D-CX9Q4UE infrared sensor, and the Banner Engineering R55F series photoelectric sensors and the SM312 LVAGMHSQD photoelectric sensor have been used successfully with the Vision Appliance. These sensors are rated to operate on 10 to 30 VDC; but *do not exceed* 24 VDC or you will damage the Vision Appliance.

The following diagram shows how to connect these photoelectric sensors. The wiring is:

Brown - Power (+16 to +24 Volts DC)

Blue - Ground

Black - Signal from photoelectric sensor. Goes high (to about the power voltage) when triggered.

The other two wires are *not needed* for using the sensor with the Breakout Board. These two wires are:

White - Signal from photoelectric sensor – connects a small load to ground (see sensor specification)

Gray - Can be connected to a switch to ground; when closed, enables Remote Teach

The photoelectric sensor draws power from the brown and blue leads. When the photoelectric sensor is triggered the output (black lead) goes high (to about the power supply voltage).

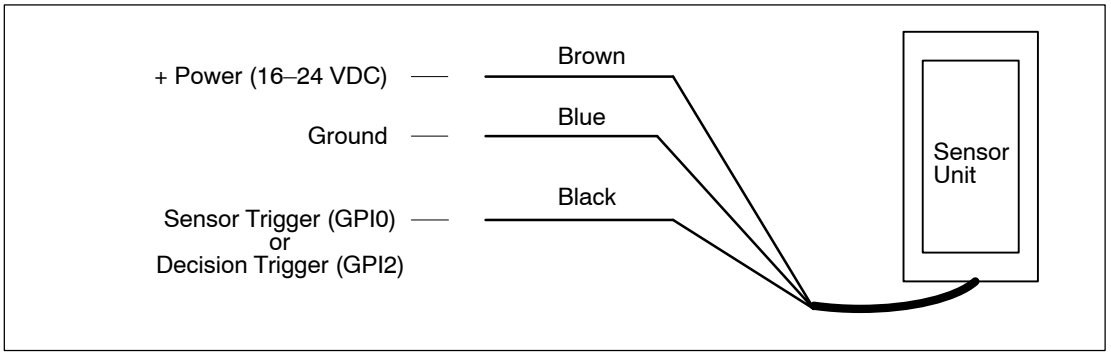


Figure 21. Photosensor Connections

APPENDIX C
SHERLOCK DIGITAL I/O ASSIGNMENTS

The Trigger input is assigned to GPI0 (channel 14) by default. The input is always available, even when assigned as a trigger. Strobe output is assigned to GPO0 (channel 0) by default, but can be reassigned to another pin (channel) or disabled, by the configuration file. You will get an error message in the Sherlock Monitor window if you attempt to program an output on the channel assigned to the strobe output.

Default Digital I/O Definitions

Sherlock Digital I/O	*Direction*	*Name*	*I/O Connector Pin*
Channel 0 / Strobe	out	GPO0	7
Channel 1	out	GPO1	20
Channel 2	out	GPO2	8
Channel 3	out	GPO3	21
Channel 4	out	GPO4	9
Channel 5	out	GPO5	22
Channel 6	out	GPO6	10
Channel 7	out	GPO7	23
Channel 8	out	LED0 (amber)	–
Channel 9	out	LED1 (amber)	–
Channel 10	out	LED2 (amber)	–
Channel 11	out	LED3 (red)	–
Channel 12	out	LED4 (yellow)	–
Channel 13	out	LED5 (green)	–
Channel 14 / Trigger	in	GPI0	2
Channel 15	in	GPI1	15
Channel 16	in	GPI2	3
Channel 17	in	GPI3	16
Channel 18	in	GPI4	4
Channel 19	in	GPI5	17
Channel 20	in	GPI6	5
Channel 21	in	GPI7	18

Connecting a Firewire camera may reassign the I/O channel numbers in Sherlock.

APPENDIX D
CAMERA EXPOSURE CONTROL

Cameras supplied by ipd are configured for Triggered Operation, and for Pulse Width Control (PWC or E-shutter) of the exposure. The camera takes a picture each time it receives a triggering signal (Frame Reset) from the Vision Appliance. The trigger signal is generated from an internal software trigger or from an external event (sensor, PLC, etc.) connected to the Vision Appliance.

The pulse width of the trigger (Frame Reset) signal to the camera, determines the exposure time. Exposure times can range between 1/30 second, to as high as 1/10000 (CV-A11) or 1/100000 second (TM1 & TM2 cameras only).

The following Table maps shutter speed to pulse width.

Shutter Speed	*Frame Reset Size (pulse width)* *
1/30	33,333 us
1/60	16,667 us
1/125	8,000 us (factory default)
1/250	4,000 us
1/500	2,000 us
1/1000	1,000 us
1/2000	500 us
1/4000	250 us
1/8000	125 us
1/10000	100 us
1/12000	83 us (TM1, TM2 & JAI CV-A1 1K cameras only)
1/20000	50 us (TM1 & TM2 double speed cameras only)
1/40000	25 us (TM1 & TM2 double speed cameras only)
1/80000	12 us (TM1 & TM2 double speed cameras only)
1/100000	10 us (TM1 & TM2 double speed cameras only)

* Frame Reset Size is the parameter that sets the pulse width out to the camera. This parameter must be modified in the camera configuration file.

** Exposure times in between the values in the table are also valid. The values in the table were chosen for quick reference and convenience.

Setting the Exposure Time

1. Run the IFC Camera Configurator utility, visible on the Windows desktop.

2. From the File menu, select ”Open Config File” to load in the proper configuration file. Below is a description of each file shipped on the system. Pick the one which matches your configuration:

NS2-JAI-CVA11-TRG-PWC-XTAL-STROBE-X1 (standard resolution, single camera)

NS2-JAI-CVA11-TRG-PWC-XTAL-STROBE-X3 (standard resolution, multi camera)

NS2-JAI-CVA1-TRG-PWC-XTAL-STROBE-X1 (high resolution 1K, single camera)

NS2-JAI-CVA1-TRG-PWC-XTAL-STROBE-X3 (high resolution 1K, multi camera)

NS2-AP-MC-P60-TRG-PWC-XTAL-STROBE-X1 (double speed, single camera)

NS2-AP-MC-P60-TRG-PWC-XTAL-STROBE-X3 (double speed, multi camera)

More camera files may be present on your system, or available from ipd.

3. To find the Frame Reset Size parameter, click on the TrigStrb tab at the bottom of the Parameter Name/Value listing, in the left panel (Config View) of the Configurator Window. Frame Reset Size is located halfway down the list. Refer to the Configurator Help of User Manual.

4. Edit the parameter by clicking inside the value text box and set it to the desired value from the above table.

5. ***Very Important:*** To save the file properly, go to the File menu and select ”Generate Portable Config File”. Several dialog boxes will pop up and prompt you to save and overwrite the existing files. Click on -> Yes, OK, Save, and Yes respectively to each of the 4 screens.

6. Restart Sherlock, and the new exposure setting will now take affect.

APPENDIX E
NON-STANDARD OPTIONS

JAI Camera Cable

This cable is compatible with the CV-A1, CV-A11 and CV-A2 Progressive Scan analog monochrome cameras.

JAI Cable Pin-Out

6-pin Serial	*12-pin Video/sync*	*Signal Description*	*15-pin*
1	–	RX receive	11
2	–	TX transmit	12
3,4,5,6	–	no connection	–
	1	+12 Volt return	10
	2	+12 Volts DC	15
	3	Analog ground	7
	4	Video input (single-ended)	2
	5	Digital ground	5
	6	HDRIVE horizontal sync	13
	7	VDRIVE Vertical sync	14
	8	Digital ground	5
	9,10	no connection	–
	11	Frame reset to camera	9
	12	Digital ground	5

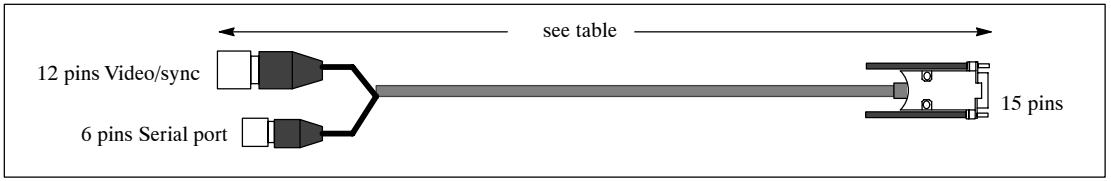


Figure 22. JAI Camera Cable

Part Number	*Cable Length*
A-CAB-NSII-C00	3 meters
A-CAB-NSII-C01	5 meters
A-CAB-NSII-C02	10 meters

Current Sourcing PNP Output

Current Sourcing PNP output is a special order option for the VA4x. The normal configuration is NPN Current Sinking outputs.

Current Sourcing (PNP) outputs are driven high when active. The specifications are as follows. Output Voltage is determined by the User supplied power 7–35 Volts on the User Power input (pin 11 on the I/O connector).

Parameter	*Max*
Output Voltage	UserPower (7–35 V)
Output Source Current	350 mA
Over Current Protection	500 ma

Figure 23 illustrates driving an active-high sinking input with the PNP outputs.

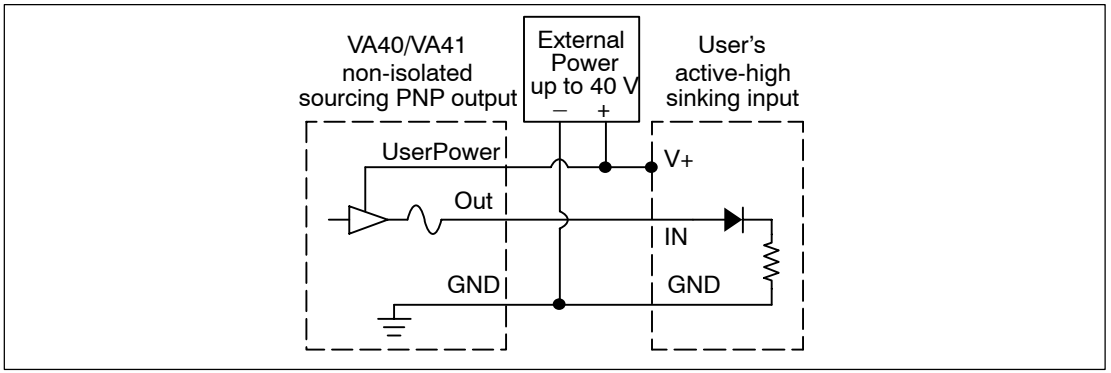


Figure 23. PNP Sourcing Outputs