



See the possibilities

Installation Manual

VIS-CAM System *Vehicle Imaging Subsystem*

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Immunity: EN55024: 1998 + A1: 2001 + A2: 2003

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WARNING

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1. VIS-CAM System Installation Manual

1 Introduction

1.1 Document Overview

This document describes the steps necessary to deploy an installation of the JAI Vehicle Imaging Subsystem, described as VIS from this point forward.

This manual also contains information about maintenance, troubleshooting and RMA (Return Material Authorization) procedures.

JAI strongly recommends that the installer read this manual thoroughly, in order to obtain sufficient knowledge about the VIS equipment, before initiating the actual installation.

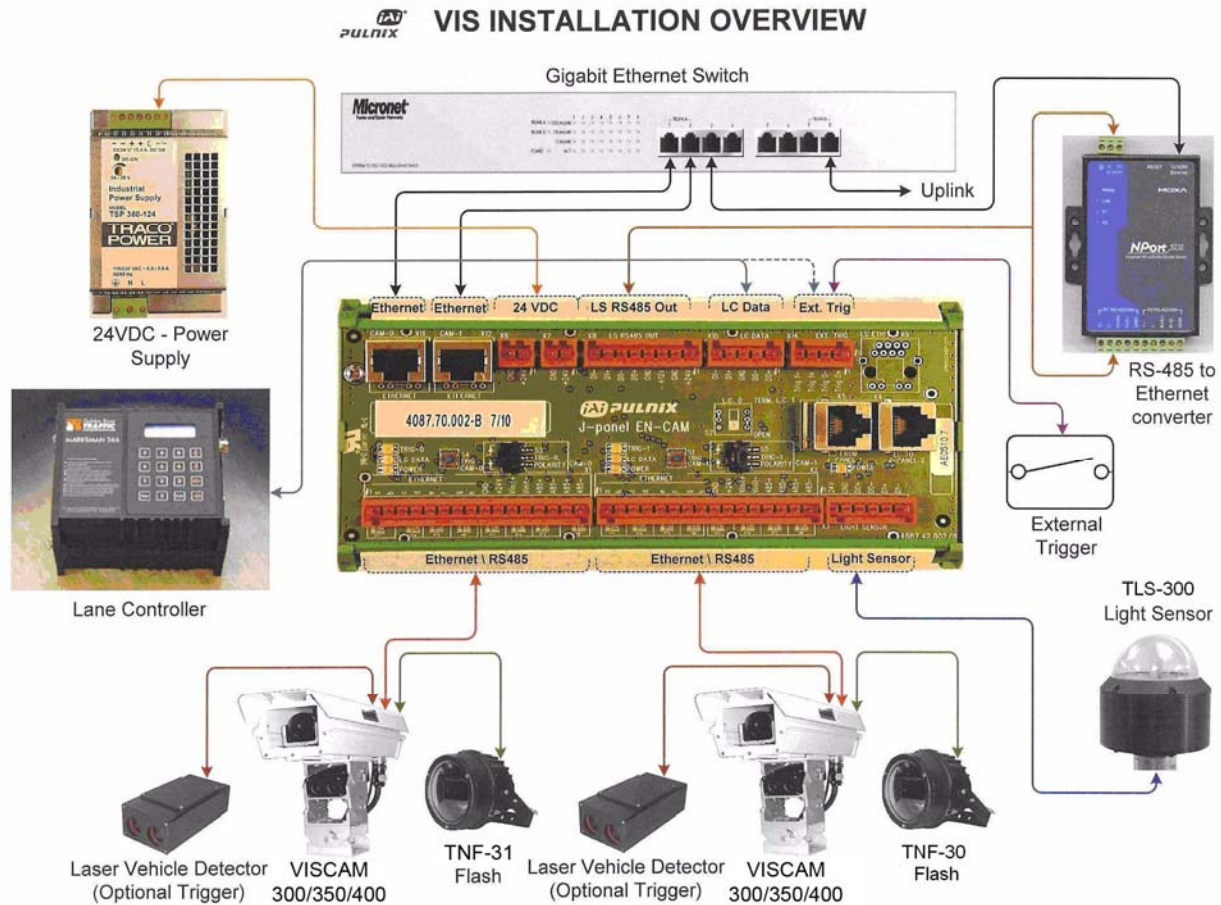
1.2 Product overview

The JAI VIS consists of the following components:

- TLS-300 Traffic light sensor.
- The VIS Camera, comprised of an EN- camera with zoom-lens or fixed focal length lens, and an anti-glare filter, a weatherproof housing with sun shield, heater resistors, interconnection PCB, and a pan-tilt-roll mounting bracket.
- TNF-31 Flash unit or optional TNC-60 permanent illumination.
- VJP-300 EN-Junction panel with terminal blocks and RJ-45 connectors and embedded diagnostics Features
- RS485-to-Ethernet Converter
- System interconnection cables
- Optional gigabit Ethernet switch
- Optional 24V DC Power Supply
- Optional Laser Vehicle Trigger
- ENSetup Program
- Installation Documentation

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Figure 1. VIS elements



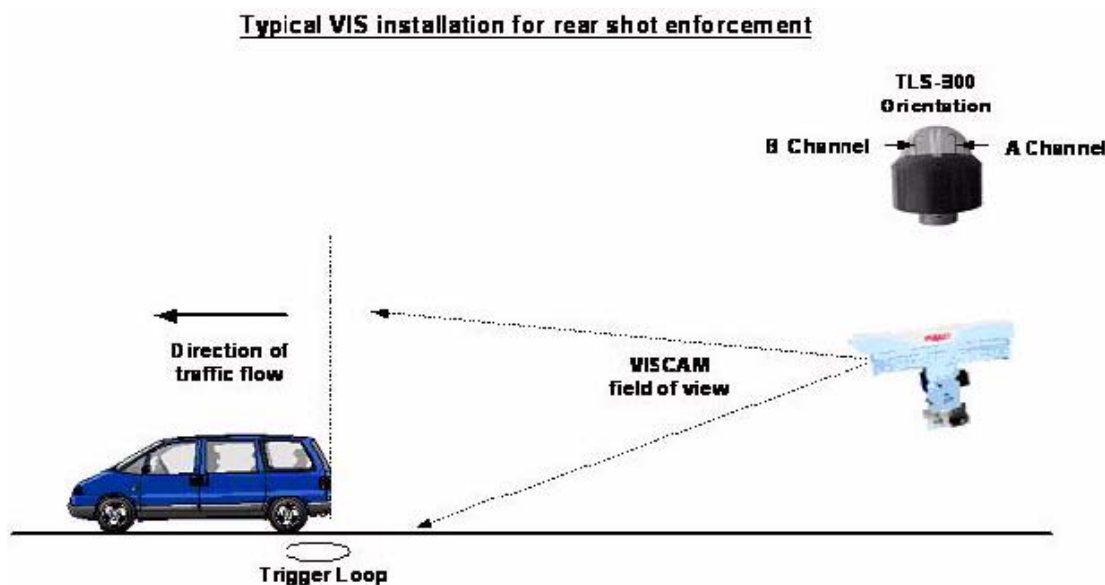
1.3 System Components description

1.3.1 Traffic Light Sensor - TLS300

The JAI traffic light sensor is the driver of the VIS control network. It controls video signal parameters of each camera to ensure high contrast images of passing vehicles and their license plates, regardless of vehicle speed, weather or ambient light conditions.

Under the clear plastic dome of the traffic light sensor are mounted, in opposing directions, two vertical plates and corresponding light collection staffs that protrude above a flat black base plate. The sensor measures the ambient light reflecting off the face of both vertical plates. The design is such that when the face of one plate is in direct sun, the other one is in shadow. These two measurements identify the range of light levels that the camera is required to image without saturation when a vehicle and its license plate are in the camera's field of view (FOV). To ensure correct functionality of the TLS-300, it is very important to ensure during installation, that the sensor's base plate is levelled with the road surface, and that the orientation of the sensor is rotated so that the direction from the vertical plate A to vertical plate B is the same as the direction of the traffic flow being observed by the traffic camera (see Figure 2).

Figure 2. Back shot VIS installation.



The TLS-300 light sensor is an essential component that ensures the VIS cameras will be ready to capture high quality images of any vehicle and its license plate in virtually all weather and light conditions.

It is very important to ensure that sensor positioning closely resembles real road conditions where the vehicle image is most likely to be captured.

The light sensor is connected by means of the J-Panel VJP-300 and an RS485-to-Ethernet converter to the Ethernet switch.

1.3.2 VISCAM

The VISCAM uses a state-of-the-art progressive interline transfer CCD that captures all of the vertical resolution at once, thereby eliminating field-to-field imaging delays. The use of progressive scanning allows the camera to freeze the motion of a rapidly moving vehicle at high resolution.

The VISCAM 300 houses a JAI TS-9720EN, the VISCAM 350 houses a JAI TS-1327EN, and the VISCAM 400 houses the TS-2030EN Ethernet camera with a built in IBM Power PC using an embedded Linux O/S and 64Mb memory for various operations, such as frame store, JPEG compression, vehicle fingerprint extraction, license plate find, running applications, and so on.

When the TLS-300 Traffic Light Sensor is used to control the VISCAM exposure settings, no moving parts (such as an auto-iris lens) are included in the VIS system. This helps ensure high reliability for the system.

A 12.5 mm to 75 mm manual zoom lens is provided as a standard with the VISCAM 300. This allows the VISCAM to be mounted in a wide range of positions while ensuring sufficient resolution on the vehicle license plates. A 35 mm fixed focal length lens is provided standard with the VISCAM 400. A zoom lens is also available as an option. An anti-glare polarizing filter is mounted in front of the lens to reduce smear in the picture caused by sun glints.

1.3.3 Illumination

1.3.3 (a) TNF-31 Flash

The TNF-31 Flash generates light in wavelengths that are invisible to the human eye, but visible to the camera. This makes the flash suitable for illuminating both oncoming and receding views of traffic. Unlike near-infrared illuminators, the TNF-31 yields high contrast images of license plates even if they have red characters on white or yellow backgrounds.

The TNF-31 Flash is automatically enabled whenever the TLS-300 Light Sensor determines that ambient light is insufficient to produce a picture of usable quality. When the TNF-31 is enabled, it fires every time the vehicle detector triggers the camera.

1.3.3 (b) White light LED.

JAI offers White LEDs mounted inside the camera enclosure. This option is usually employed when certain rare color combinations on license plates do not yield sufficient contrast with the TNF-31 Flash option alone.

1.3.4 VJP-300 Junction Panel.

The VIS J-Panel is the central connection point for the VIS components. The J-Panel is a DIN-Rail mounted PCB equipped with various interface terminals for interconnection of the VIS components; this can be Ethernet connection, serial connection, TTL trigger feed and power supply. It offers the possibility of manually selecting trigger polarity to the camera. Furthermore the J-Panel is equipped with status LED's and trigger switches for diagnostics and troubleshooting purposes.

1.3.5 RS485 Device Server.

The MOXA RS485 Device Server enables connection of RS485 serial devices to the Ethernet. The purpose for the MOXA RS485 Device Server in the VIS system is to convert Ethernet to RS485 communication for the TLS-300 Light Sensor.

1.3.6 ENSetup Program.

The ENSetup Program is an Ethernet based software tool specifically designed to assist the installer with VIS installation, and EN-Camera configuration and diagnostics. The program runs on a standard PC / Laptop with Windows XP installed. Refer to Section 4 on page 31 of this manual and the VISCAM 300/400 EN Setup Manual for details.

1.4 Operational Overview.

During installation, the VISCAM and the optional light source are aimed at the area of the road where vehicles and their license plates are most likely to pass through. The Traffic Light Sensor continually registers the ambient light. The camera uses this information to set up exposure variables to ensure an optimal image of the vehicle and license plate. During transition from day to night the camera enables the optional TNF-31 Flash and/or white light LED's to secure adequate image quality during low ambient light conditions.

1.4.1 Trigger Mode

- A vehicle passes by a vehicle detector, sending a trigger to the VIS.
- The VIS employs a trigger to snap a video image of the vehicle and license plate when they are optimally positioned in the camera field of view.
- The optional flash, if used, fires simultaneously with the camera to ensure correct exposure for the image if the ambient lighting is too low.

2 Preparing for installation

2.1 Installation Preparation

To prepare for installation, consider the fundamental requirements for an effective deployment of the Vehicle Imaging Subsystem. There are two basic ways to position the camera: over the lane or beside the lane. Figure 3 and Figure 4 depict a typical over-lane installation. Figure 7 and Figure 8 on page 13 depict a typical beside-lane camera installation.

2.1.1 Over Lane Positioning

Over lane camera mounting is always employed when the road width being monitored contains more than two lanes of traffic, when a convenient overhead structure is already in place, or when preventing vandalism is a paramount concern.

The VIS's varifocal (zoom) lens is adjusted during installation to create 135 pixels across a 1 foot wide license plate (standard for US style of plates, may differ by region) placed 2 feet above the ground level at the nominal trigger position (loop or light curtain, etc.). This resolution maximizes license plate reader, vehicle matcher, or other image processing techniques performance. The highest performance from the subsystem is achieved when the variation in plate size is kept to within $\pm 5\%$ which typically means that the vehicle trigger accuracy should be within ± 1 foot (@ trigger plane defined by client.) at all speeds. Low latency vehicle triggering is very important and should not be overlooked. Please contact JAI for support on this issue.

Figure 3. Typical Over Lane Site Layout

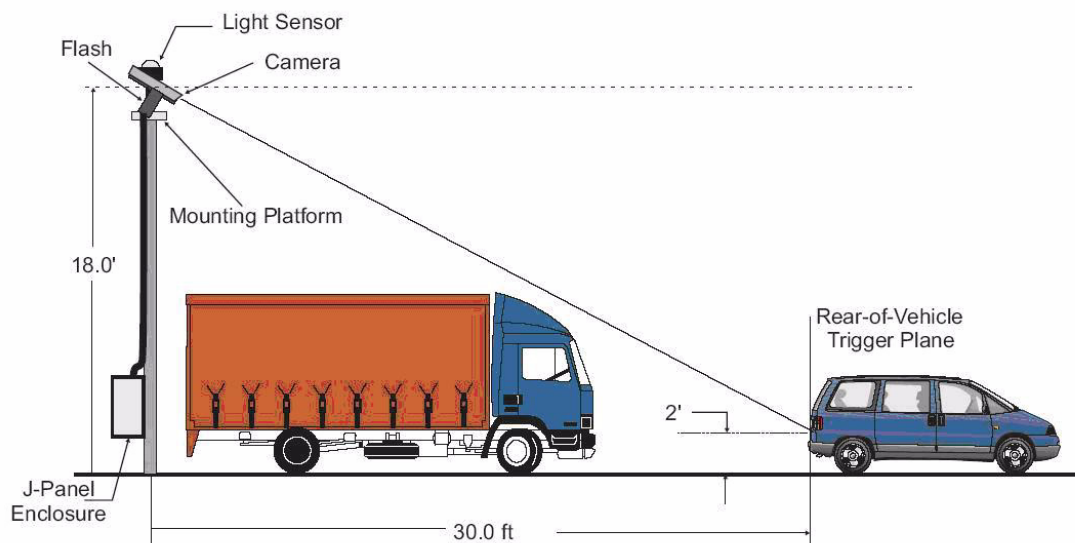
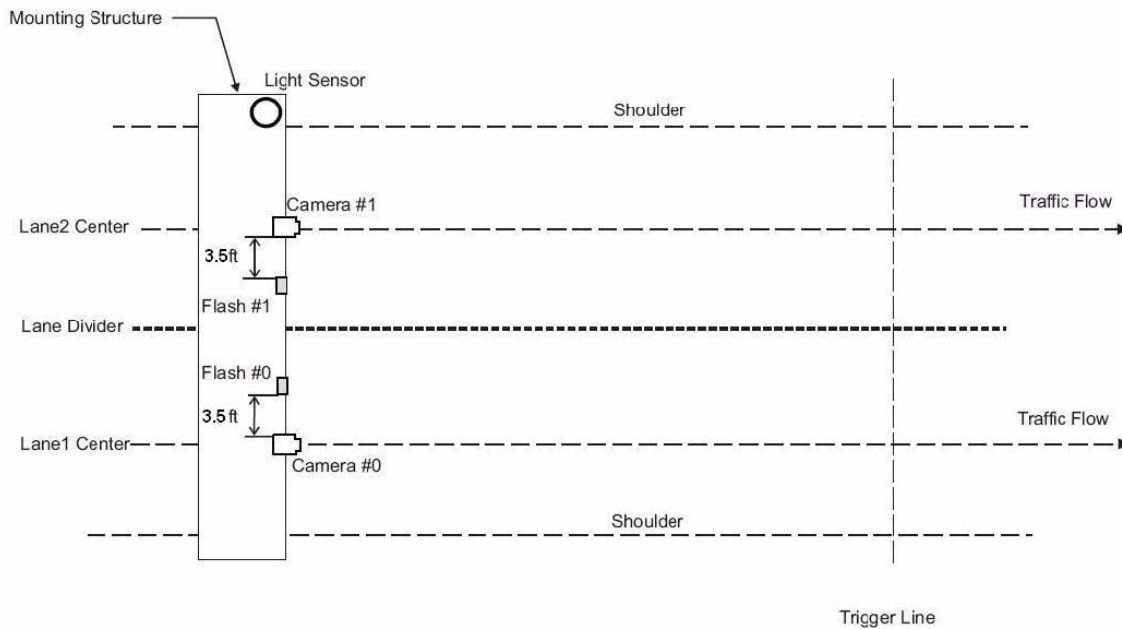


Figure 4. Typical Over Lane Site Layout Plan.



2.1.1 (a) Camera tilt considerations

The requirement to freeze the motion of high-speed vehicles limits how steep or shallow the tilt angle of the camera may be. For example, it is important to prevent the horizon from appearing in the image, and thereby allowing the sun to blind the camera. For over lane installations, a camera tilt between 20° to 30° is recommended—with 25° being considered the optimal angle. This angle of tilt is the best compromise between minimizing visibility blockages caused by closely spaced vehicles and maximizing plate visibility for plate mounts that are slightly recessed or tilted downwards.

2.1.1 (b) Asynchronous triggering considerations

When the VIS is operated in trigger mode, a vehicle detector is employed to cause the camera to capture an image at the precise moment the vehicle is in the best position to image both the vehicle and its license plate. The delay between the time the vehicle passes the trigger position on the road and when the trigger signal actually reaches the VIS must be kept to a minimum to prevent high-speed vehicles from moving out of the area viewed by the camera before the image is snapped.

2.1.1 (c) Camera height versus trigger distance considerations

It is critically important, to select the correct distance between the camera and the location on the road where the camera is triggered to capture an image. Minimizing the cost of installation is usually also an important concern. This means that whenever possible, it is best to use existing structures or previously installed elements. The following charts (Figure 5 and Figure 6) provide a wide range of trade-offs between camera height and trigger distance to enable the installer to select convenient camera and light sensor locations relative to existing mounting structures and vehicle trigger locations. Adhering to the installation options provided in the installation charts, yields camera images that are generally suitable for automatic license plate readers (ALPR).

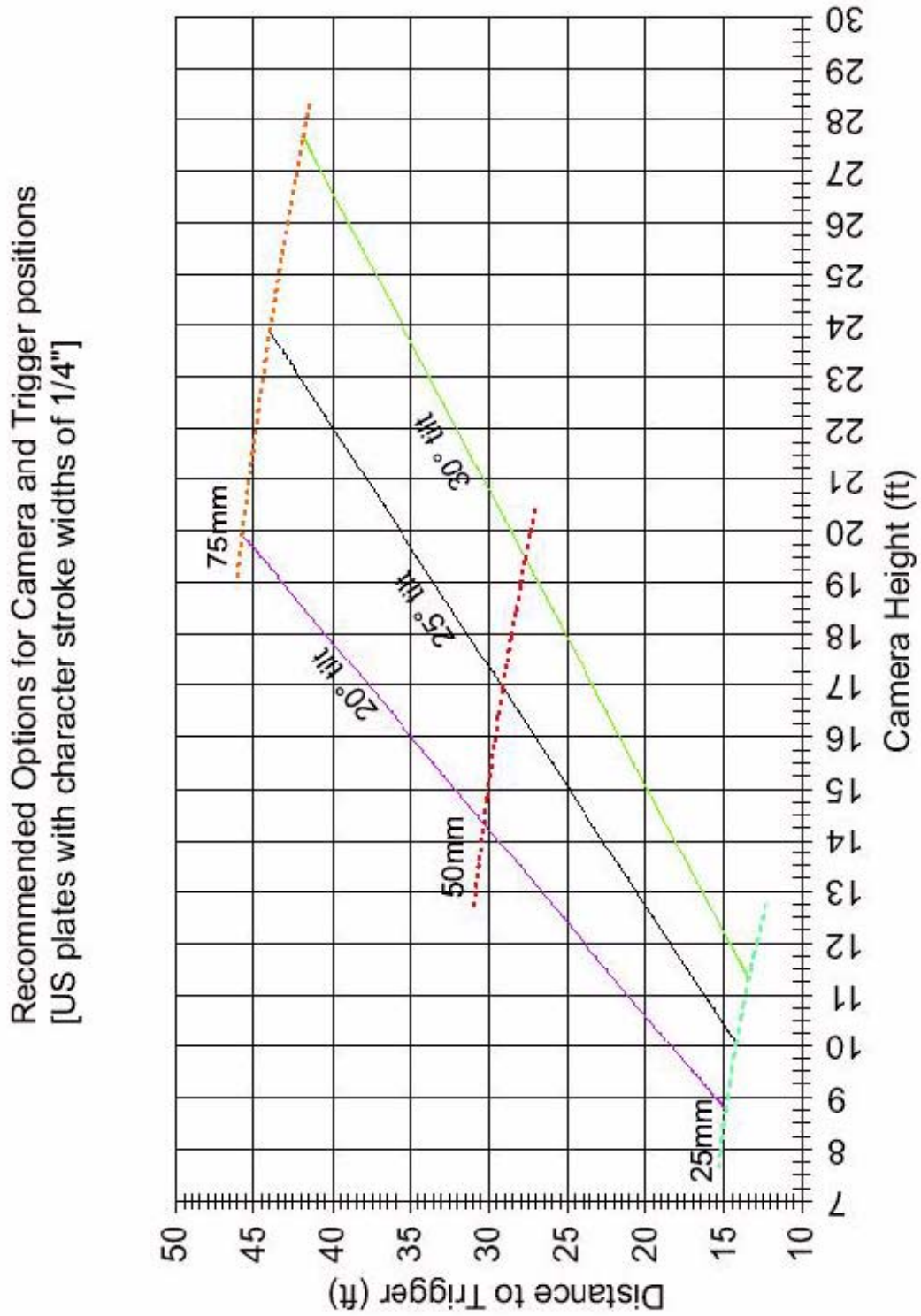
To use the charts correctly, please follow the steps below.

1. First measure the height above the road to convenient camera mounting locations.
2. Measure the distance along the road from directly beneath each candidate camera position to convenient trigger locations.

3. Select the appropriate installation chart for either USA or European style license plates. To obtain charts for license plates from other countries, please contact the JAI ITS division directly at (+1) 408 7470 300 - 102.
4. Plot the candidate camera-height / trigger-distance pairs on the chart and determine if the selected location lies within the wedge of recommended values.
5. If several locations are suitable, choose the one that yields the greatest overall slant range between camera and trigger location.

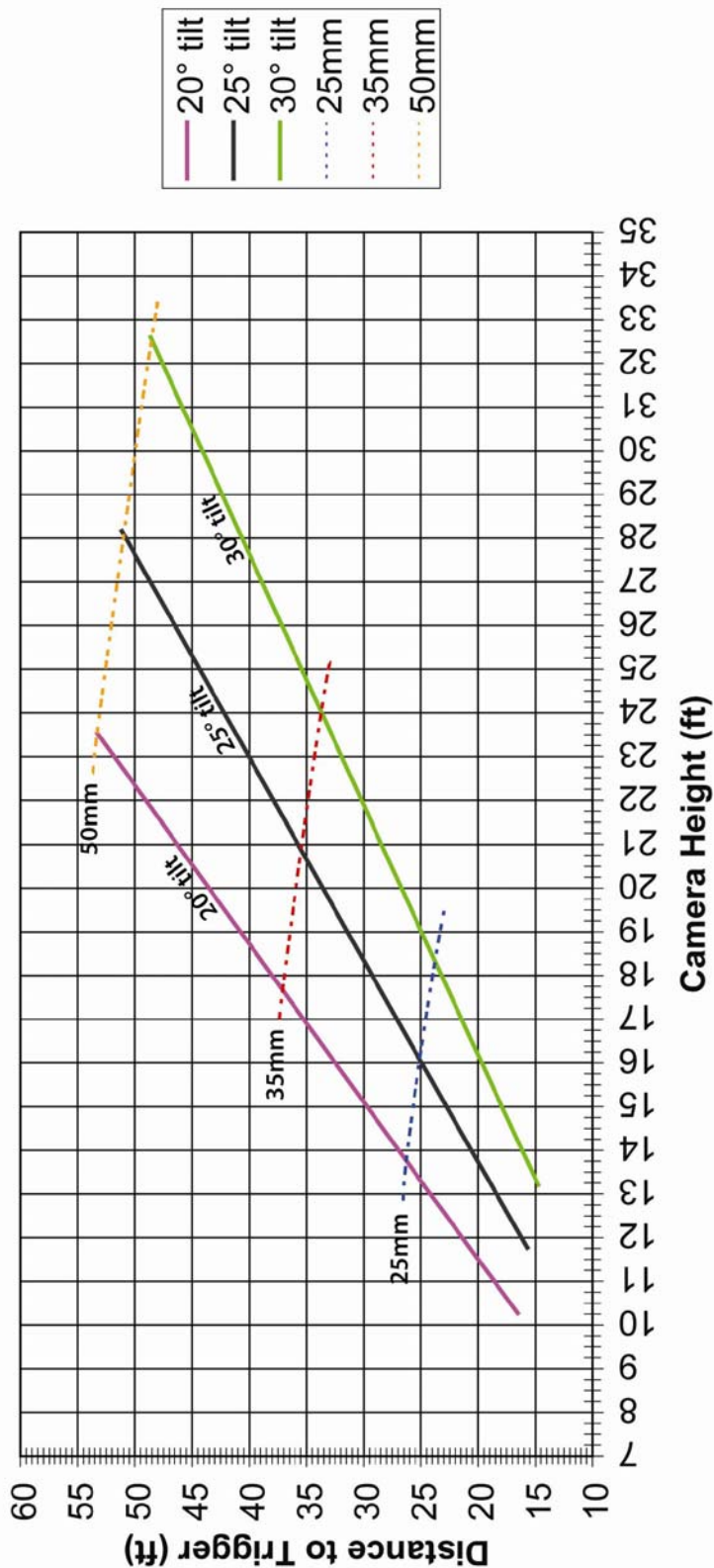
The standard VISCAM unit is equipped with a 25 - 75 mm zoom lens. This lens provides the full range of camera height and trigger distance listed in the installation charts.

Figure 5. VIS 300 U.S. Camera options chart.



VIS 350 U.S. Camera options chart

Recommended Options for Trigger and Overhead Camera positions
 [US plates with character stroke widths of 1/4"]



VIS 400 U.S. Camera options chart

Recommended Options for Trigger and Overhead Camera positions
 [US plates with character stroke widths of 1/4"]

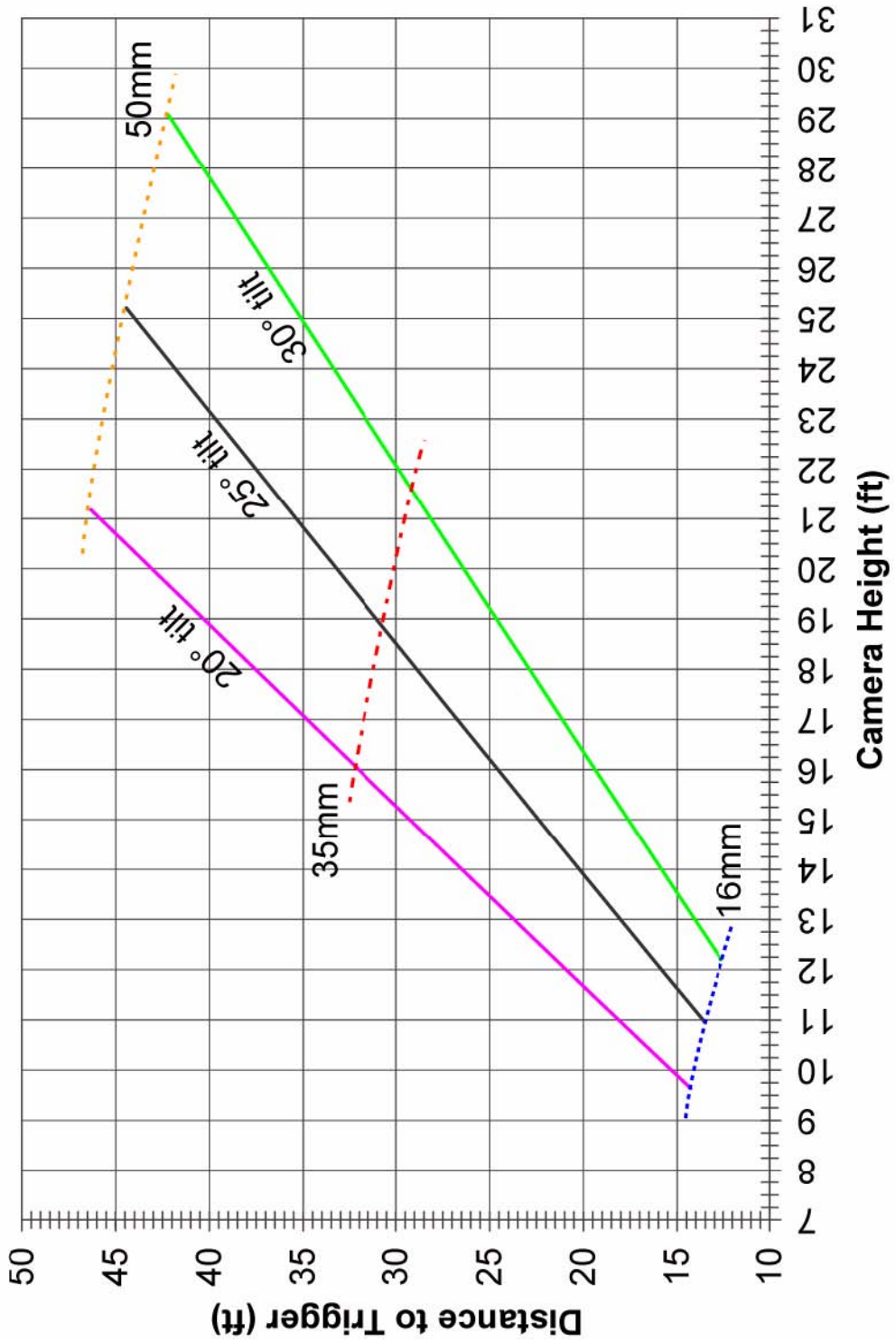
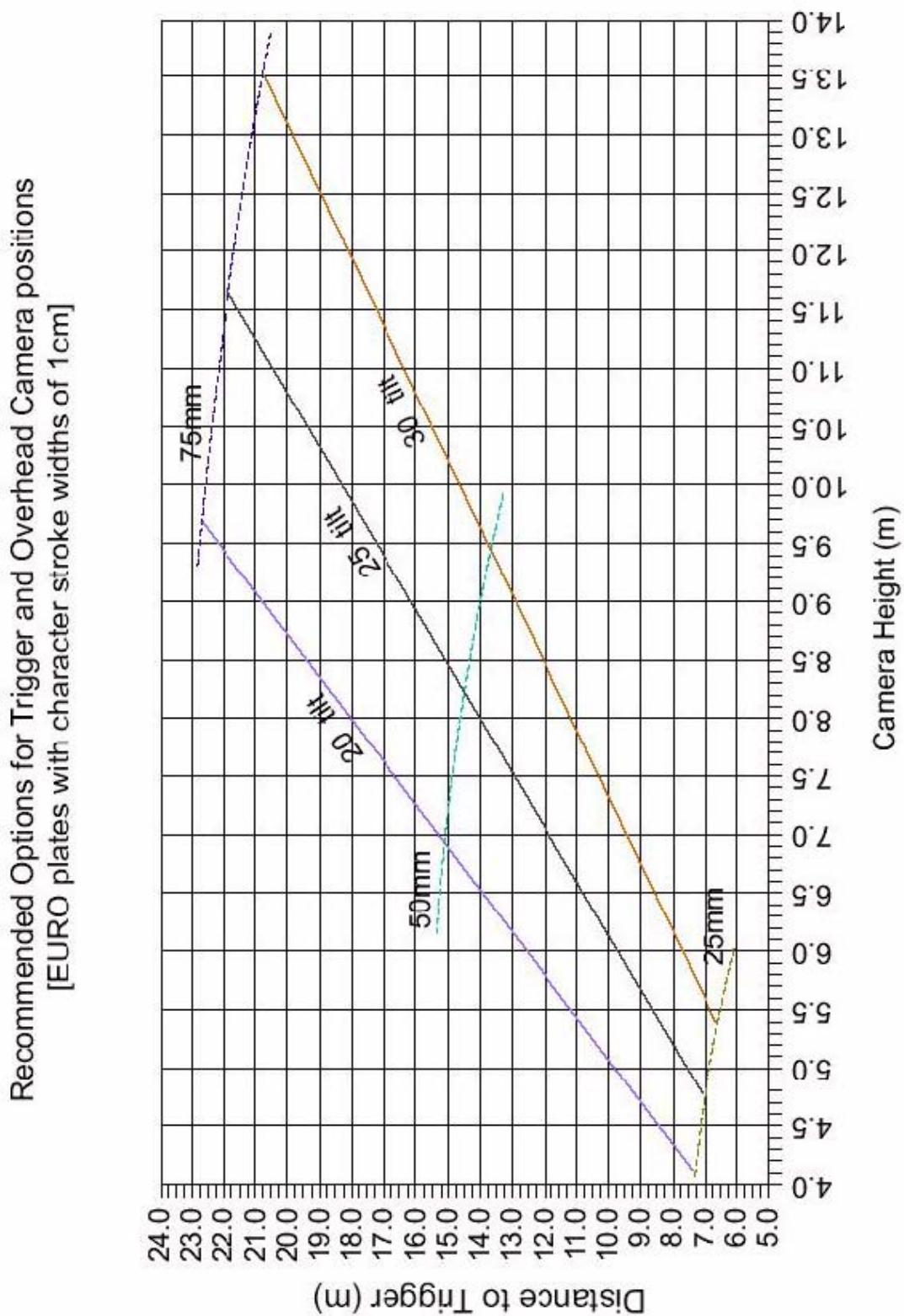
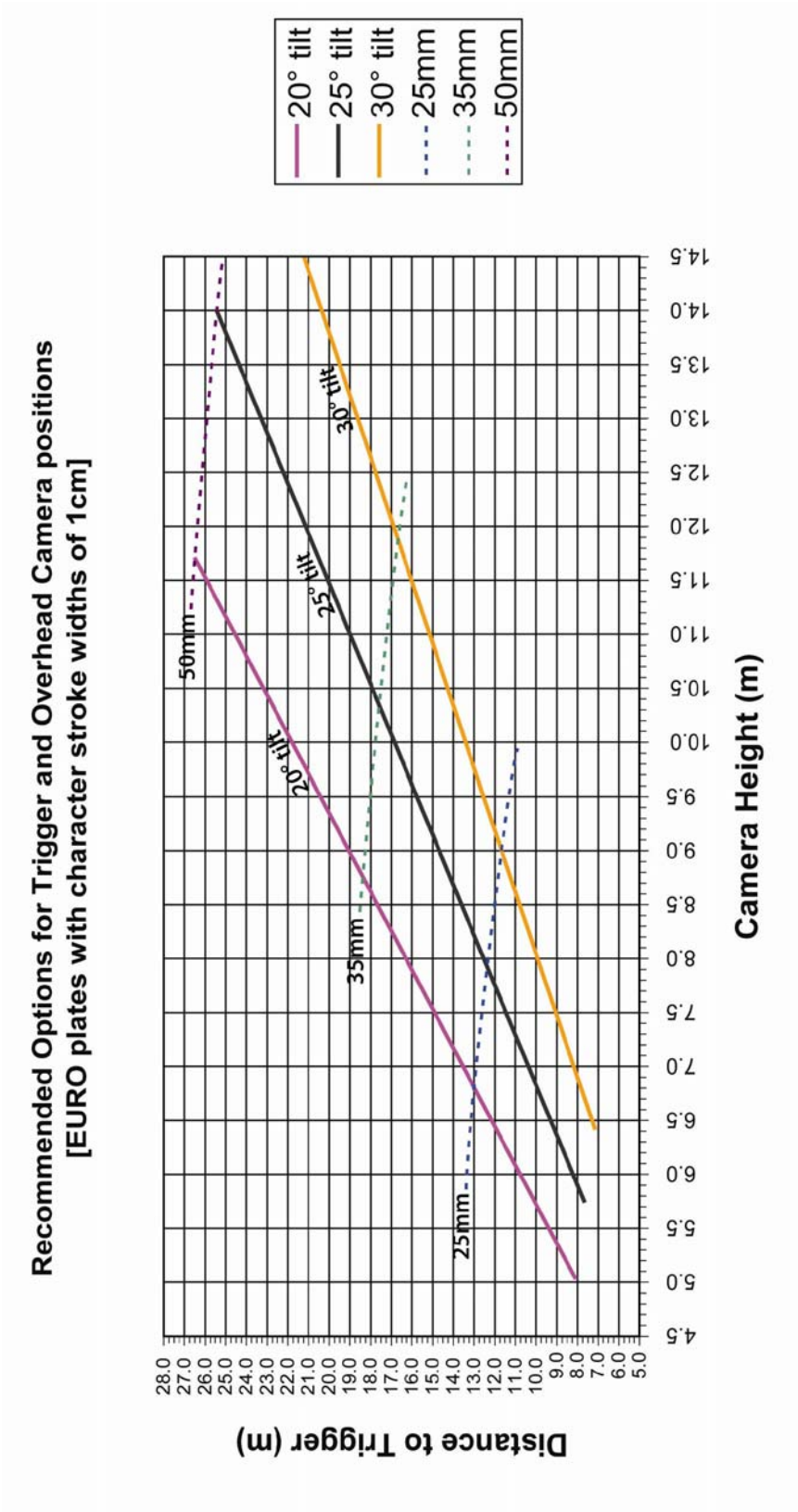


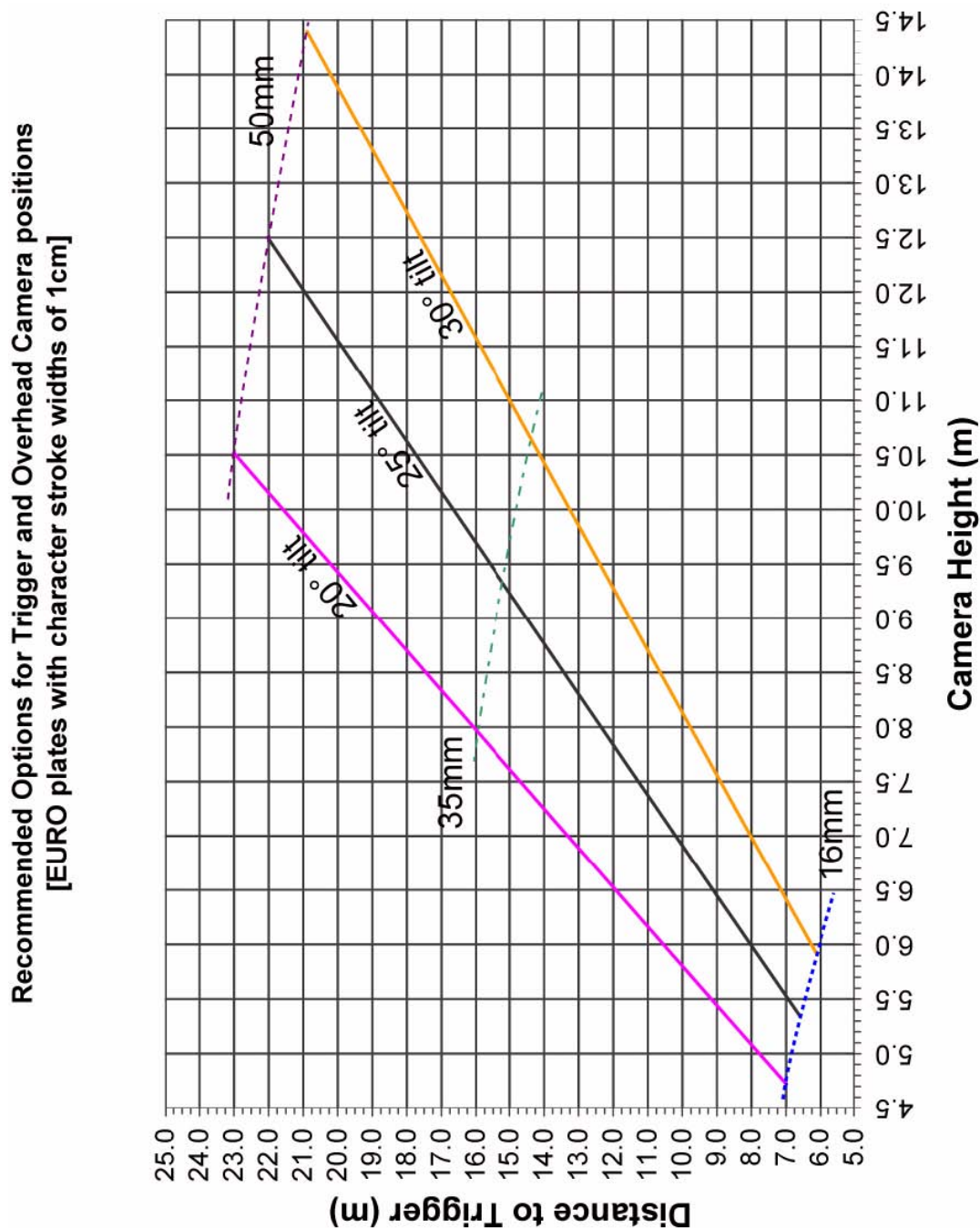
Figure 6. VIS 300 European Camera options chart.



VIS 350 European Camera options chart



VIS 400 European Camera options chart



2.1.2 Side of Road Installation

Figure 7. Typical side of road installation.

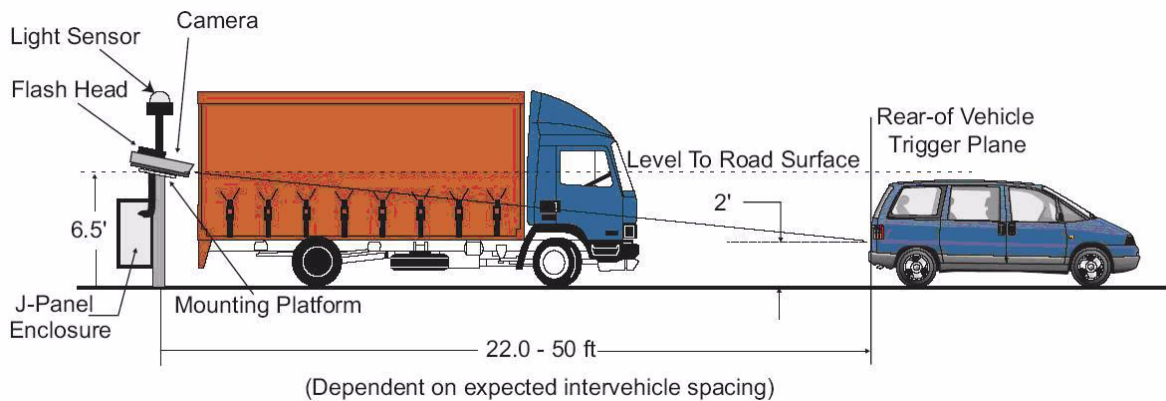
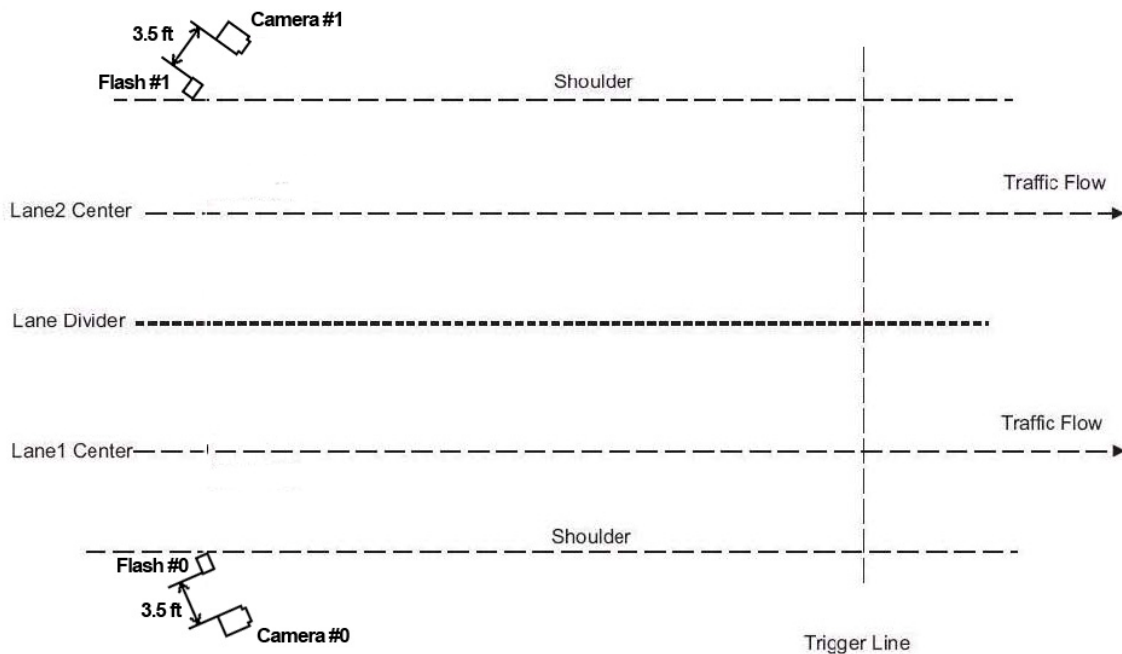


Figure 8. Typical side of road installation plan view with no canopy/overhead structure.

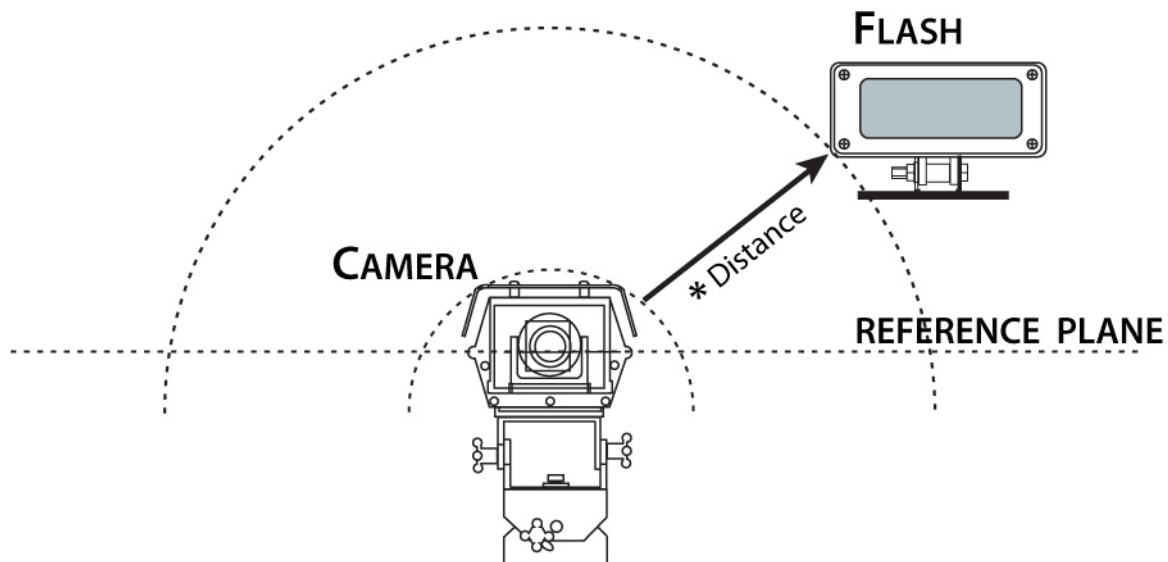


Generally the flash head must be separated from the camera by a radial distance of at least three and a half feet (1.2 meters).

If the flash is positioned closer to the camera, reflections from the license plate will cause overexposure.

If possible, position the flash head in level with the reference plane shown in Figure 9. This plane is in level with the top surface of the camera enclosure, but slices through the center of the lens.

Figure 9. Flash and camera distances.



* Distances measured from outer wall of camera housing to outer wall of Flash unit.

	TS-9720EN	TSC-9720EN	TS-2030EN	TSC-2030EN	TS-2076EN	TSC-2076EN	TS-1327EN	TSC-1327EN
Distance in Feet	3.5	TBD	2	1	TBD	TBD	TBD	TBD

3 Installing the Vehicle Imaging System

The individual components of the system is electrically linked together as shown in Figure 1, “VIS elements,” on page 2. The VIS CAM 300/400 camera has connections to the J-Panel and an optional Flash, Night Light and Laser Vehicle Detector. The J-Panel has connection to two VIS CAM 300/400 cameras, one Traffic Light Sensor, a 24V Power Supply, a Lane Controller, a RS485-to-ethernet converter for the light sensor signals, Trigger input, an optionally second J-Panel and finally a gigabit Ethernet switch.

3.1 Installing the TNF-300 Traffic Light Sensor.

When installing the Traffic Light Sensor ensure the unit is positioned higher than either the camera or the flash unit so the A-side is in direct sun whenever the targeted vehicles license plates are. See Section 2.1 on page 6 for general site layout guidelines.

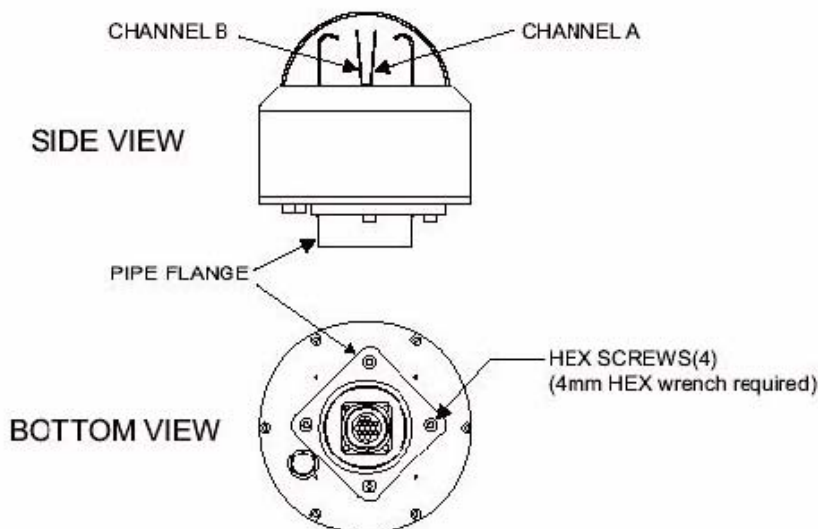
It is extremely important the light sensor be properly positioned at the site. The light sensor must be placed so that no shadows from surrounding structures are cast on side A when the license plates being imaged by the VISCAM are in direct sunlight.

Because sun angles at any given site can change according to time of day and time of year, it is important to verify that the proposed setup will function on the actual spot.

3.1.1 To install the Traffic Light Sensor:

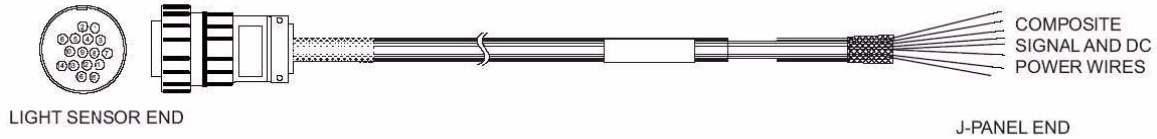
1. Disconnect Power
2. Loosen the four hex screws and remove the flange from the mounting base. See Figure 10.

Figure 10. Install the traffic light sensor.



VIS-CAM System

Figure 11. TLS-300 signal and power cable.



3. Route the Traffic Light Sensor end of the TLS-300 signal and power cable through the mounting pipe and the flange (see Figure 12)
4. Screw the flange onto the pipe, finger-tight, to allow subsequent minor adjustment
5. Attach the cable connector to the Traffic Light Sensor
6. Attach the Traffic Light Sensor body to the flange and secure it with the four Allen screws
7. Orient the Traffic Light Sensor such that the white reflectors are parallel to the trigger plane with side B facing (visible from) the trigger plane
8. Route the free end of the cable to the VIS J-Panel in accordance with the local code requirements
9. Connect the color-coded wires to J-Panel connector X3 as described in "X3, X7 Traffic Light Sensor" on page 22. Make sure that no power is applied when performing any wiring operation.

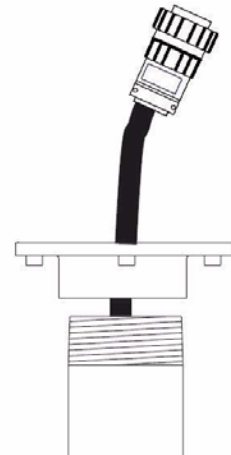


Figure 12. Installing the TLS-300 through the mounting pipe and flange.

Table 1 Light Sensor Cables

PIN#	Wire color	Signal
1	White/green	Heater gnd
2	Green	Heater gnd
3	Red/blue	Heater +24V dc
4	Blue/red	Heater +24V dc
5	-	nc
6	Yellow	+24V dc
7	-	nc
8	-	nc
9	-	nc
10	White	Gnd
11	-	nc
12	-	nc
13	Brown	D1-
14	White/brown	D1+
15	Orange	D0-
16	White/orange	D0+
-	Black	Shlds

3.1.2 Optional Side Mount

1. Attach the pipe clamps approximately 6-inches apart on a vertical mounting surface as shown in Figure 13.
2. Loosen the four Allen screws and remove the flange from the mounting base. Figure 10, "Install the traffic light sensor.," on page 15.
3. Route the Traffic Light Sensor end of the TLS-300 signal and the power cable through the pipe and flange.
4. Screw the flange onto the pipe somewhat tightly to allow subsequent minor adjustment
5. Place the pipe in the pipe clamps and tighten them to secure the pipe to the vertical mounting surface.
6. Attach the Traffic Light Sensor body to the flange and secure it with the four Allen screws.
7. Orient the Traffic Light Sensor such that the white reflectors are parallel to the trigger plane with side B facing (visible from) the trigger plane
8. Route the free end of the cable to the VIS J-Panel in accordance with local code requirements
9. Connect the color-coded wires to the J-Panel connector X3 as described in Section 3.3 on page 21. Make sure that no power is applied when performing any wiring operation.

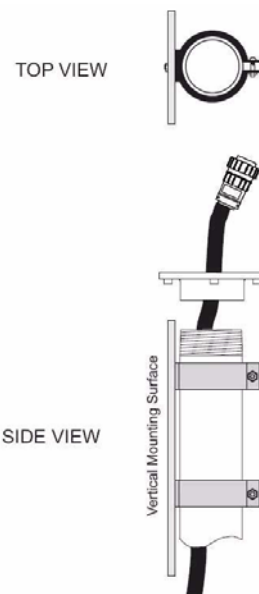


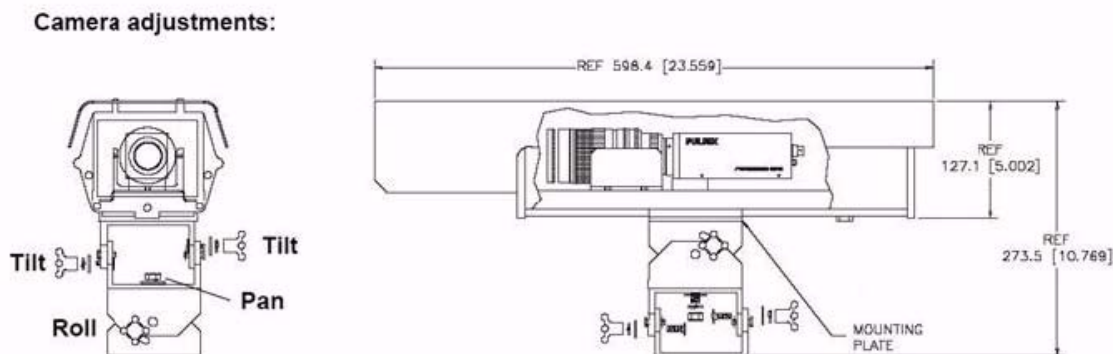
Figure 13. Pipe clamps should be about 6-inches apart on a vertical surface.

3.2 Installing the Camera(s)

In general, the camera(s) should be aimed at the most likely cross-lane position of the vehicle license plates. See "Installation Preparation" on page 6 for general site layout guidelines. To install the camera(s):

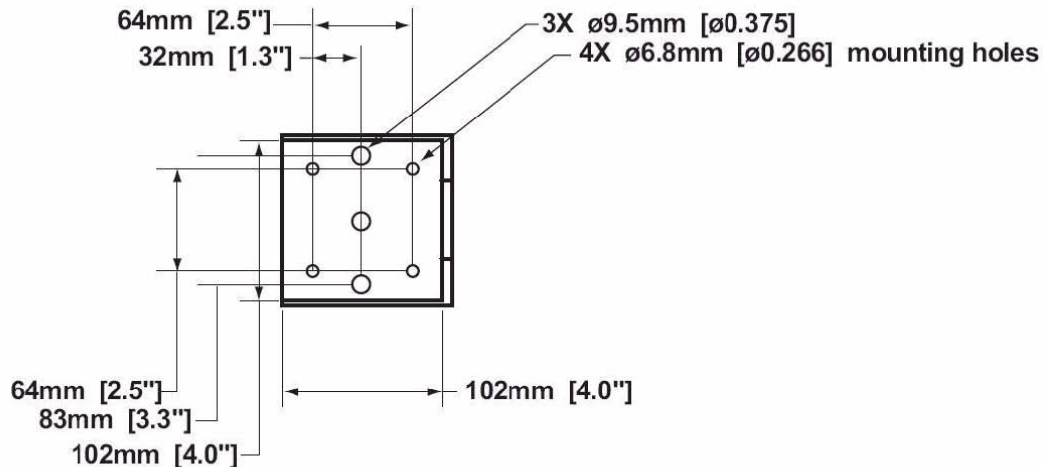
1. Attach the camera mount to the camera enclosure using the included mounting bolts and washers. Refer to Figure 14.

Figure 14. Camera Installation



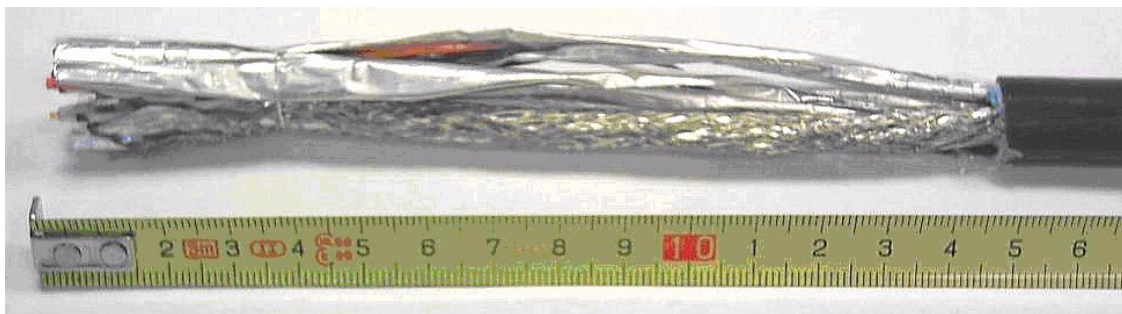
2. Align the camera enclosure mounting surface with the hole pattern of the camera mount and secure it to the camera mount with the five provided ¼-20 hex bolts.
3. Attach the camera, with mount, to the mounting structure. The hole pattern is shown in Figure 15 Below

Figure 15. Camera mount template.



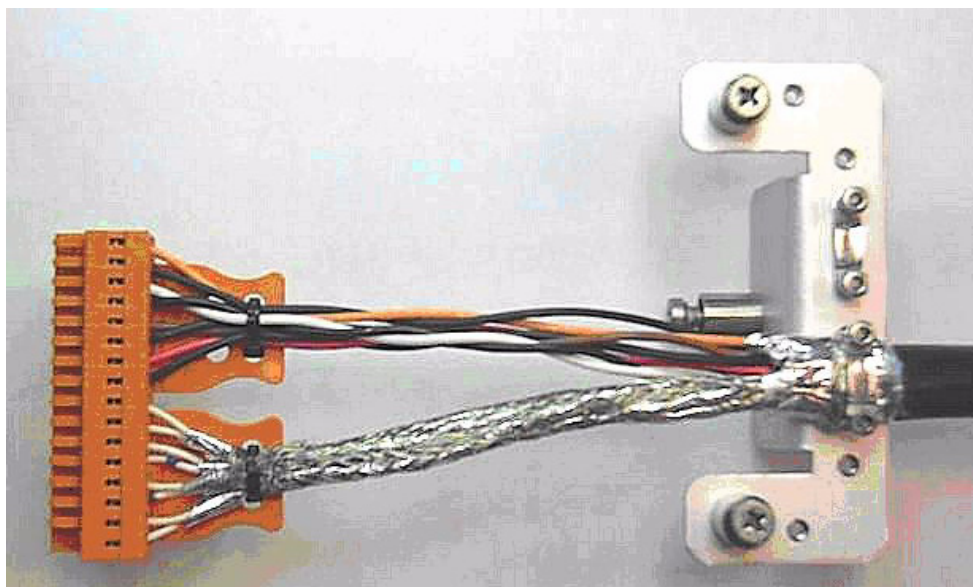
4. Route the camera end of the camera cable according to the camera IAW local electrical code Requirements
5. The jacket is removed from the cable in the camera end and the wires are stripped as shown in the Figure 16 below. There are two sets of four twisted pairs. Four of the pairs are for ethernet signals. These pairs are individually foil shielded and have a common braid shield. The other four pairs are individually foil shielded without the common braid shield. The shield on the Ethernet pairs must be run as close to the connector as possible. All wires must be stripped for insulation app. 7mm.

Figure 16. Camera cabling as it appears before electrical installation.



6. The cable is separated into the Ethernet part (with the braid shield) and the power and control part (the rest). Each part is fastened with cable ties to the respective cable relief's on the terminal block X4 on the VIS-CAM I/O Board.

Figure 17. Cable final wiring.

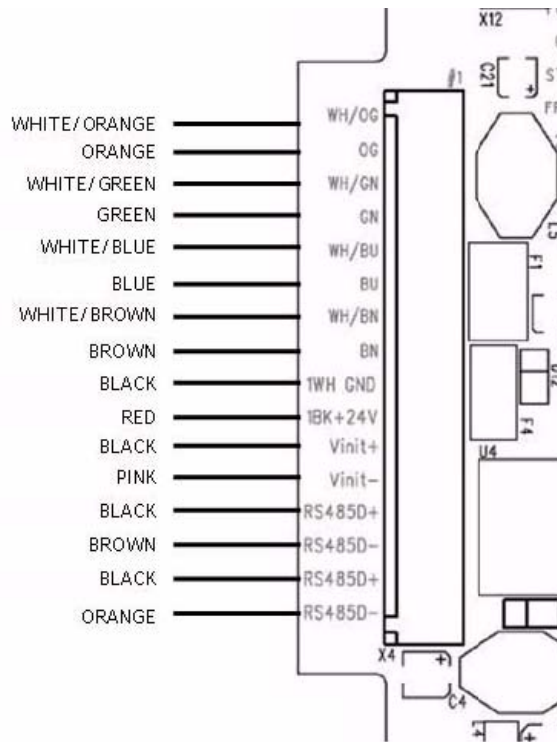


7. The wires are inserted into X4 as shown in Table 2 and Figure 18. A mounting tool for releasing the spring enabling insertion of the wire is enclosed together with the connectors. (Mounting the wires can be eased by separating the terminal block in the middle - just “break” it into two blocks of eight terminals - and then re-join it when the wires are mounted)

Table 2 Electrical wiring for the VIS CAM installation.

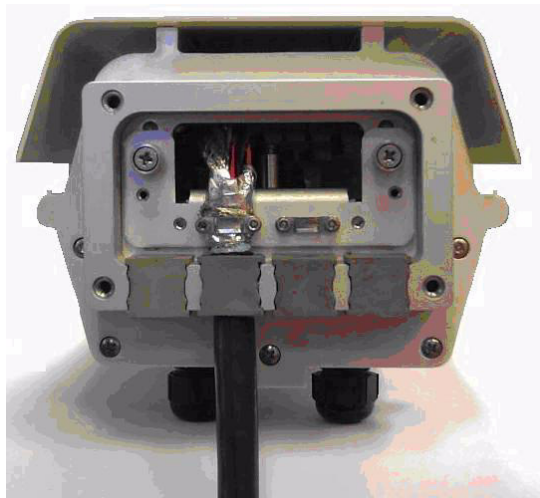
X4 Pin #	Wire Color	Signal	Remarks
1	White/orange in Cat5e/6 cable	Ethernet A+	
2	Orange in Cat5e/6 cable	Ethernet A-	
3	White/green in Cat5e/6 cable	Ethernet B+	
4	Green in Cat5e/6 cable	Ethernet B-	
5	White/blue in Cat5e/6 cable	Ethernet C+	not used with VIS CAM
6	Blue in Cat5e/6 cable	Ethernet C-	not used with VIS CAM
7	White/brown in Cat5e/6 cable	Ethernet D+	not used with VIS CAM
8	Brown in Cat5e/6 cable	Ethernet D-	not used with VIS CAM
9	Black	Gnd	
10	Red	+24V dc	
11	Black	Vinit+	Trigger signal
12	Pink	Vinit-	Trigger signal
13	Black	RS485D+	Lane Controller
14	Brown	RS485D-	Lane Controller
15	Black	RS485D+	Lane Controller
16	Orange	RS485D-	Lane Controller

Figure 18. Properly wired X-4 connector.



- The cable is mounted in the cable entry on the back side of the camera as shown in the Figure 19 below. The rubber bushing is mounted around the jacket and the metal brace is mounted around the shield securing proper electrical connection from the shield to the metal housing (see figure Figure 19).

Figure 19. Back of the video camera.



For a detailed description of the VIS CAM 300/400 interface please refer to See “ Appendix A: Camera Functional and Connector Description” on page 43 in this manual.

3.3 Installing the J-Panel

The J-panel layout is shown in Appendix A, See “Connection requirements.” on page 43. This Appendix has a detailed description of the J-Panel function and connectors.

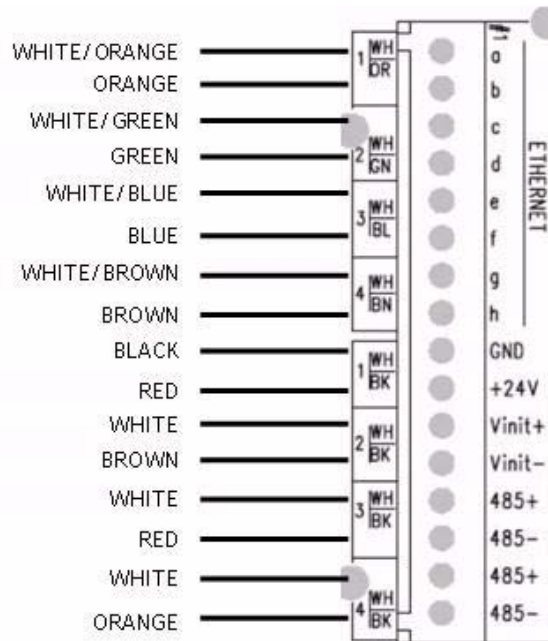
3.3.1 X1 and X2 VIS CAM 300/400

The VIS CAM connections to the J-Panel are shown in Table 3 and Figure 20

Table 3 VIS CAM connections to the J-Panel.

X1, X2 Pin #	Wire Color	Signal	Remarks
1	White/orange in Cat5e/6 cable	Ethernet A+	
2	Orange in Cat5e/6 cable	Ethernet A-	
3	White/green in Cat5e/6 cable	Ethernet B+	
4	Green in Cat5e/6 cable	Ethernet B-	
5	White/blue in Cat5e/6 cable	Ethernet C+	not used with VIS CAM
6	Blue in Cat5e/6 cable	Ethernet C-	not used with VIS CAM
7	White/brown in Cat5e/6 cable	Ethernet D+	not used with VIS CAM
8	Brown in Cat5e/6 cable	Ethernet D-	not used with VIS CAM
9	Black wire in Red/Black pair	Gnd	
10	Red wire in Red/Black pair	+24V dc	
11	White wire in Brown/White pair	Vinit+	Trigger signal
12	Brown wire in Brown/White pair	Vinit-	Trigger signal
13	White wire in Red/White pair	RS485D+	Lane Controller
14	Red wire in Red/White pair	RS485D-	Lane Controller
15	White wire in Orange/White pair	RS485D+	Lane Controller
16	Orange wire in Orange/White pair	RS485D-	Lane Controller

Figure 20. VIS CAM connections.



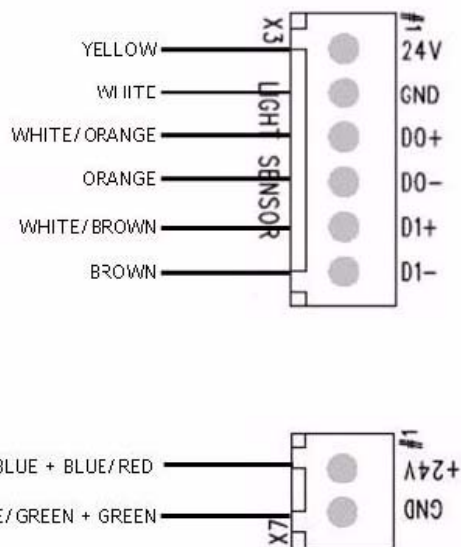
3.3.2 X3, X7 Traffic Light Sensor

The Traffic Light Sensor TLS-300 connection to the J-Panel is shown in Table 4 and Figure 21.

Table 4 TLS 300 to J-Panel connections.

X3 Pin X	Signal	Description	Connection to Light Sensor Cable wire color
1	+24V dc	Power output	Yellow
2	Gnd	Power return	White
3	D0+	RS485 databus D0+	White/orange
4	D0-	RS485 databus D0-	Orange
5	D1+	RS485 databus D1+	White/brown
6	D1-	RS485 databus D1-	Brown
X7 Pin X			
1	Heater +24V dc	Power output	Red/blue and Blue/red
2	Heater gnd	Power return	White/green and Green

Figure 21. TLS 300 to J-Panel wiring.



3.3.3 X6 Power Input Connector

The Power Input connection to the J-Panel is shown in Table 5 and Figure 22.

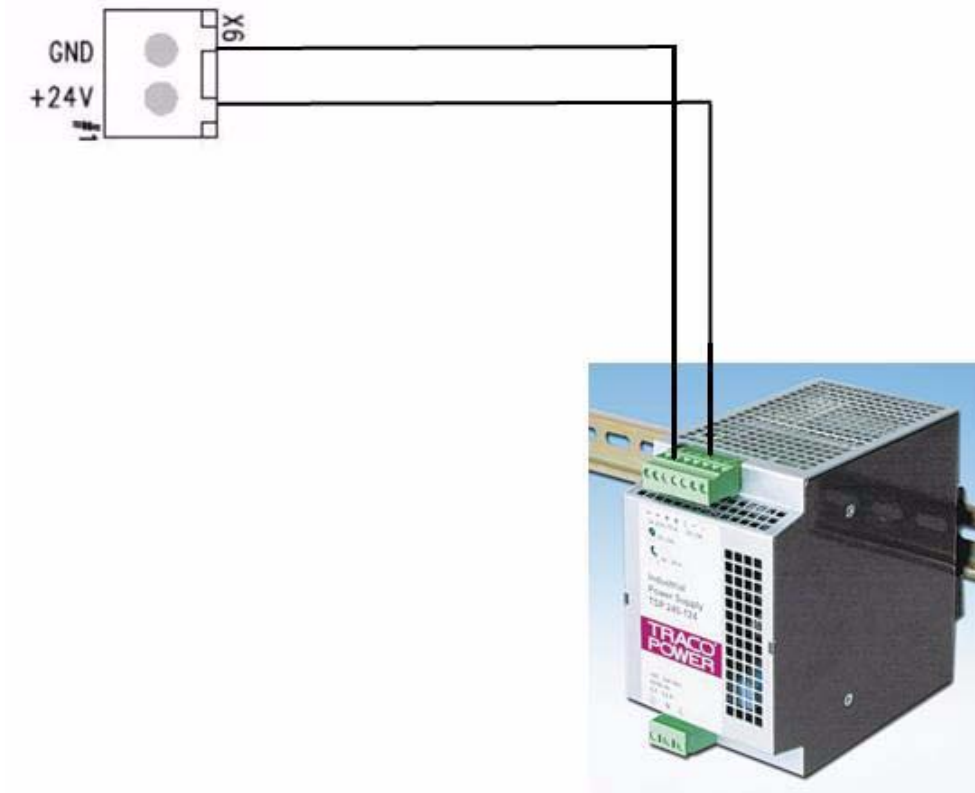
The maximum power to a J-Panel is:

Camera #0	2.0A
Camera #1	2.0A
Traffic Light Sensor	2.0A
<u>RS485-to-Ethernet conv</u>	0.3A
Total	6.3A

Table 5 Power input to the J-Panel

X6 Pin #	Signal	Description	Connection to
1	+24V	+24V dc	24V DC power supply + output
2	GND	+24V return	24V DC power supply return

Figure 22. X-6 Power input connection.



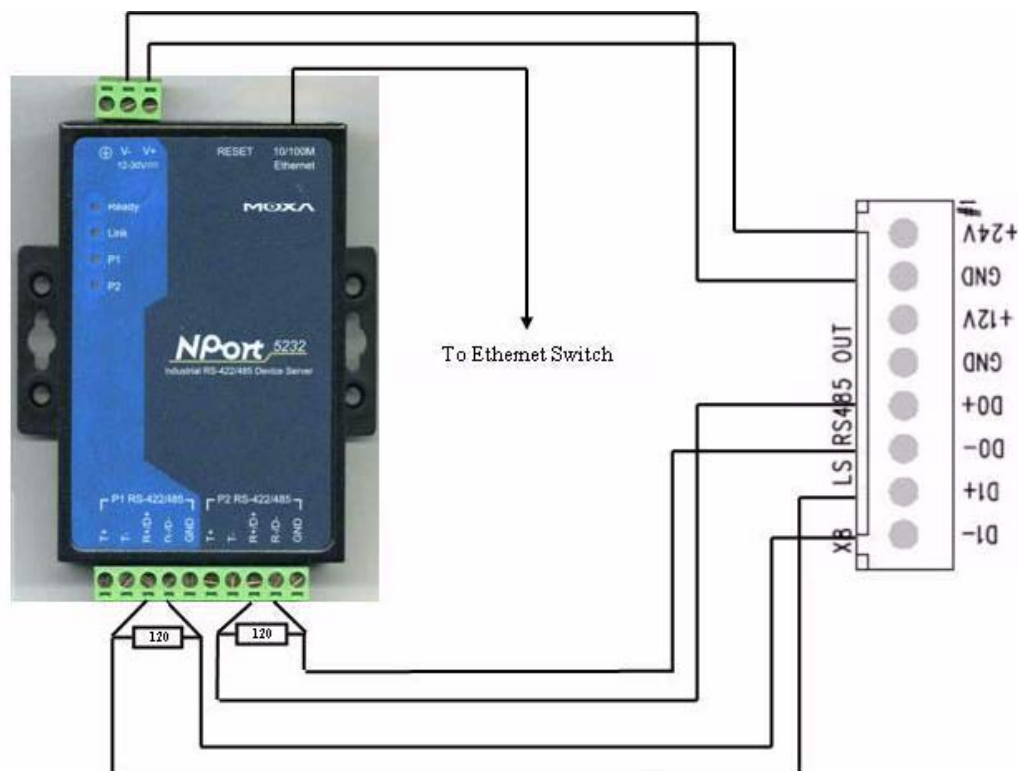
3.3.4 X8 LS RS485 Out Connector

The RS485 output from the Light Sensor to the RS485-to-Ethernet converter connector is X8. The connections from X8 to the converter are shown in Table 6 and Figure 23

Table 6 X8 to converter connector

X8 Pin #	Signal	Description	Connection to RS485-to-Ethernet converter
1	+24V dc	24V Power output	V+ power input
2	Gnd	Power return	V- power input
3	+12V dc	12V Power output	
4	Gnd	Power return	
5	D0+	RS485 databus D0+	D+ Port 2
6	D0-	RS485 databus D0-	D- Port 2
7	D1+	RS485 databus D1+	D+ Port 1
8	D1-	RS485 databus D1-	D- Port1

Figure 23. Wiring for the X8 to converter connector.



Up to four cameras can be connected to one Light Sensor using one Moxa Nport 5232 Device Server. If more than four cameras need to be connected to the same Light Sensor please refer to “Appendix E: Moxa N-Port 5232 Configuration” on page 93 in this Manual.

3.3.5 X14 Trigger Input Connector

The Trigger input connection to the J-Panel is connector X14. The connections are listed in Table 7

Table 7 Trigger input connector.

X14 Pin #	Signal	Description	Connection to
1	Trig0+	Positive Trigger input to camera 0	Trigger device positive terminal
2	Trig0-	Negative Trigger input to camera 0	Trigger device negative terminal
3	Trig1+	Positive Trigger input to camera 1	Trigger device positive terminal
4	Trig1-	Negative Trigger input to camera 1	Trigger device negative terminal

3.3.5 (a) Trigger polarity

The switches S3 and S5 sets the trigger polarity:

If the trigger signal is normally low (no voltage at trigger input) the switch shall be in position
 Arrow up - positive going

If the trigger signal is normally high (voltage at trigger input) the switch shall be in position

Arrow down - negative going

As a guideline the two LEDs marked TRIG-0 and TRIG-1 shall be off when no trigger pulse is present.

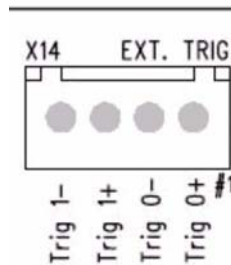
3.3.5 (b) Test Trigger

Activating switches S1 and S4 generates a trigger pulse for test purposes. Only one trigger pulse is generated each time the switch is activated.

The duration of the trigger pulse is approximately 4 ms.

The trigger indicator LEDs flash when the test trigger switch is activated.

Figure 24. Test trigger



3.3.6 X15 Lane Controller Connector (X4 and X5)

The Lane Controller connection to the J-Panel is connector X15. The connections are listed in Table 8.

Table 8 X15 Lane Controller

X15 Pin #	Signal	Description	Connection to
1	D0+	RS485 databus D0+	Lane Controller databus 0+
2	D0-	RS485 databus D0-	Lane Controller databus 0-
3	Gnd	gnd	gnd
4	D1+	RS485 databus D1+	Lane Controller databus 1+
5	D1-	RS485 databus D1-	Lane Controller databus 1-

It is possible to have one Lane Controller connected to several cameras or one Lane Controller to each camera:

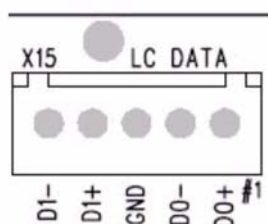
One Lane Controller for two or more cameras

1. The Lane Controller is connected to the X15 pin 1 and 2 (no connections to pin 4 and 5)
2. Switch S2 position "OPEN"
3. The Lane Controller can be connected to more J-Panels by connecting RJ45 patch cables between connector X4 and connector X5 on the next J-Panel (and from X4 on the next J-Panel to X5 on the third J-Panel). Switch S2 on the other J-Panels must also be in the "OPEN" position.

Two Lane Controller to two cameras

1. The Lane Controller for camera 0 is connected to X15 pin 1 and 2
2. The Lane Controller for camera 1 is connected to X15 pin 4 and 5
3. Switch S2 position "TERM"
4. Do not connect any cables to X4 and X5

Figure 25. Two lane controller.



3.4 Illumination Options

3.4.1 Installing the TNF-31 Flash

The connection to the Flash unit in the VIS CAM 300 is shown in Table 9 and Figure 26.

Figure 26. TNF-31 flash unit

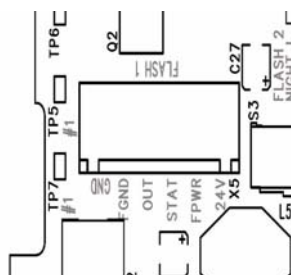


Table 9 Flash unit connection in VIS CAM 400.

Pin	Signal	Description	Connection to
1	I/O Gnd	IO Board Gnd	Pin 2 when no power is available from the flash
2	Gnd	Flash Gnd	Flash ground (negative power terminal)
3	Out	Strobe out	Strobe input on flash unit
4	Stat	Strobe status	Status output from flash unit
5	FPWR	Flash power	Power from flash to output circuit on I/O Board
6	24V	IO board 24V (Fused 0.5A)	Pin 5 when no power is available from the flash

The cable from the flash unit is connected to the VIS CAM 300 I/O Board as shown in figure 3.17 and 3.18. There are two examples shown: one where the output circuit on the I/O Board is powered from the flash unit and one where the output circuit is powered from the I/O Board.

It is recommended that I/O Board output circuit be powered from the flash unit in order to obtain galvanic isolation between the two units. In cases where this is not possible (such as when using mains supplied flash units) power is taken from the I/O Board.

The cable must be shielded and the shield connected to the metal at the cable entry in the camera house. The switch labelled S3 on the VIS CAM 300 I/O Board must be in position "NIGHT L" (away from connector X5 as shown below).

Table 10 Optimal Illumination Distance Between Camera and TNF

	TS-9720EN	TSC-9720EN	TS-2030EN	TSC-2030EN	TS-2076EN	TSC-2076EN	TS-1327EN	TSC-1327EN
Distance in Feet	3.5	TBD	2	1	TBD	TBD	TBD	TBD

Distance measured from outer wall of Camera housing to outer wall of Flash unit.

Figure 27. S3 switch setting

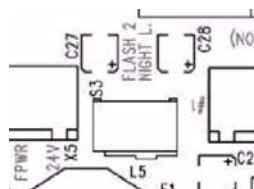
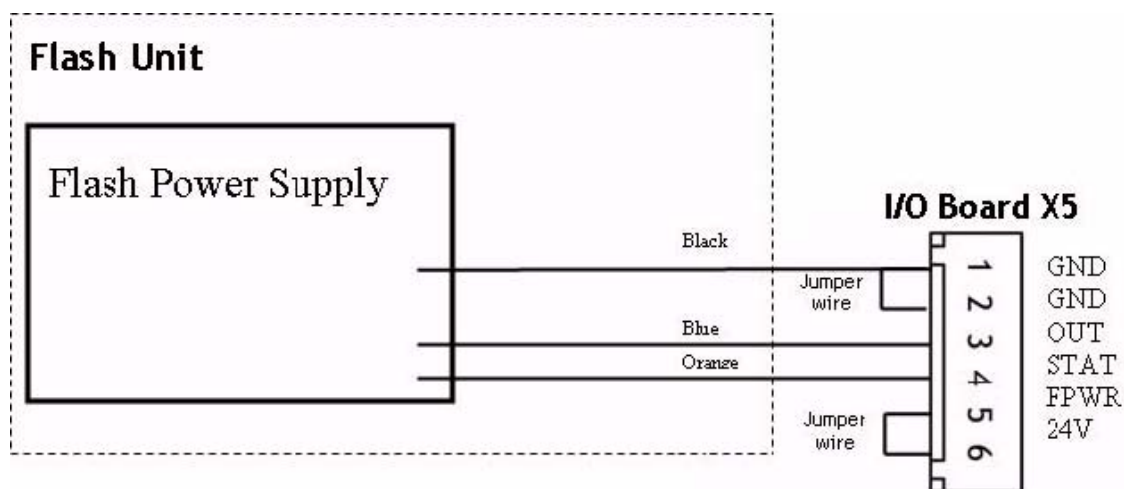


Figure 28 shows how to connect to an AC powered Flash unit with the I/O Board interface electronics internally powered by the I/O Board. The Flash AC power connection is not shown.

Figure 28. Connecting an AC flash.



Other Flash connection examples are found in “ Appendix A: Camera Functional and Connector Description” on page 43.

The VIS CAM 300 has an interface for two flashes. When this option is selected (S3 position “FLASH 2”) and the other flash is connected to connector X6, the two flashes fire alternately. Please refer to “ Appendix B: J-Panel Functional and Connector Description” on page 67 for details.

3.5 Trigger Options

3.5.1 Installing The Laser Vehicle Detector

The connection from the Laser Vehicle Detector to the VIS CAM 300 is shown in Figure 29 and Table 10

Figure 29. Connection for LVD to VIS CAM 400.

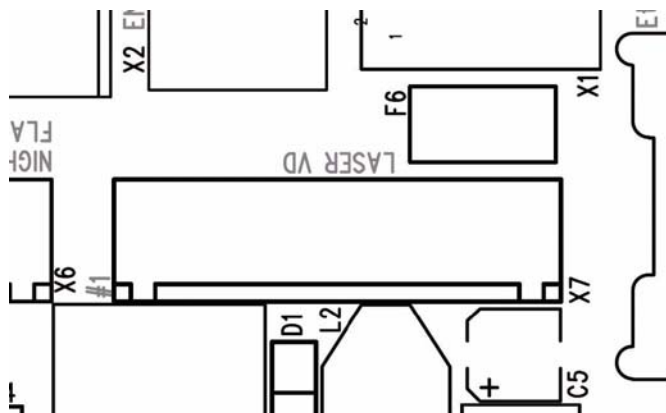


Table 11 Wiring for LVD to VIS CAM 400.

X7 Pin #	Signal	Description	Connection to
1	24V (Fused 0.5A)	Power to laser	Laser power input
2	Gnd	Power gnd	Laser ground
3	Trigger	Trigger from laser	Trigger out on laser
4	RS485-	Transmit to laser	Receive input on laser
5	RS485+	Receive from laser	Transmit output on laser
6	Gnd	Communication gnd	Communication gnd on laser
7	nc	No connection -	-
8	nc	No connection	-

The cable must be shielded and the shield connected to the metal at the cable entry in the camera house.

The switch S3 and/or S5 on the J-panel must be in position “positive going” (pushed towards X1/X2) to enable the laser trigger input on the IO Board.

4 System Set-Up

This section provides a generic procedure for aligning one or more VIS CAM 300/400 cameras and their associated equipment at a site. If you received a specific installation manual from JAI for your project then follow those instructions instead of the procedure described here.

The example installation process described in this section assumes that:

- The cameras are being mounted on an overhead structure directly over the lane(s) being observed. The process for aligning a camera mounted at the side of a lane is essentially the same as aligning a single camera mounted directly over the lane.
- The site employs an accurate vehicle detection device that outputs a discrete TTL signal to the VIS system whenever the back (or front) of a vehicle crosses a fixed line across the road. This line is referred to as the “trigger line” in this document. Examples of such triggering devices are: Peak’s trafficLoop, STI’s Vehicle Detector light curtain, and JAI’s Laser Vehicle Detector.
- License plate reading or vehicle matching is performed on the images produced by the VIS system. In these cases, precise location and alignment of the cameras is critical to project success. If the VIS images are only for human interpretation, then achieving the exact camera alignment is much less critical.
- The installer is familiar with using the ENSetup program supplied by JAI. Please refer to the ENSetup Program User’s Guide if you are unfamiliar with this software. JAI offers engineering support and software tools to help select the optimum camera and trigger locations to meet your specific project needs. Contact ITS Engineering Support at (408) 383-0300 for further information about obtaining JAI assistance.

4.1 Preparation for Alignment

4.1.1 Pre-Alignment Checklist

- Make sure you have a JAI supplied setup computer with the ENSetup program installed.
- The Setup computer needs to have an Ethernet network adapter installed (preferably 1 Gigabit Ethernet Adapter) and the TCP/IP network configured with the correct IP-address, subnet-mask and default-gateway.
- The Setup computer and the cameras need to be on the same subnet. The cameras are shipped with the standard IP-address “10.0.0.65” and subnet-address “255.255.255.0”, and the Setup computer needs to be assigned an IP-address “10.0.0.xx” in order to automatically discover the cameras using the ENSetup program (NB! “xx” must not be “65”).
- All cameras have to be given unique IP-addresses before the alignment begins. This is done using the ENSetup application.
- Confirm all VIS CAM components and cables are properly connected.

4.1.2 Select a Suitable Vehicle, License Plate, and Plate Stand for the Setup

To accurately set up the Vehicle Imaging Subsystem, the system installers need access to:

1. A vehicle that can be temporarily parked on the road
2. A plate that is:
 - a. typical in size and color for the site
 - b. clean, flat and in “like new” condition
3. An adjustable plate stand that allows the plate to be mounted in a vertical plane, at various heights above the road, and at variable roll angles. The stand must allow the plate to be placed at both the nominal plate height and the minimum expected plate height. The stand must also allow the plate to be rolled at least + or - 10 degrees from horizontal but held firmly in place once a specific roll angle is selected. The stand should be heavy enough so that the wind will not blow it over or move it.

Table 12 Typical minimum plate heights and nominal plate heights:

Plate Height	Front of Vehicle	Back of Vehicle
minimum (bottom edge)	8in or 20cm	15in or 38cm
nominal (middle)	16in or 40cm	24in or 60cm

4.1.3 Select the Camera to Align

- If the site employs a single camera per lane, then you can choose any lane to start the alignment procedure.
- If the site employs multiple cameras regularly spaced across a roadway to provide continuous fieldof- view coverage from edge to edge, select one of the cameras at either edge of the roadway to be the first camera to align.
- Align all remaining cameras in order from the first camera aligned to the last camera at the other side of the roadway. The next camera aligned is always the one adjacent to the camera most recently aligned.

4.1.4 Validate the Installation Geometry

The VIS cameras and vehicle trigger line should have been installed at the locations agreed to by you and JAI. Typically JAI utilizes a specially developed Excel worksheet to confirm the suitability of the equipment placement at the site from an image processing perspective. See Figure for an example worksheet. However, equipment is often not located where the worksheet specifies. It is therefore imperative that the actual equipment layout at any given site be measured to verify that the cameras and trigger are located at the desired locations relative to each other. If necessary, move the camera/trigger positions until the distances required in the worksheet are met. If it is not possible to move the equipment to the required locations, then the impact of any changes to the subsequent image processing must be assessed. Enter the actual camera locations into the Input section of the JAI worksheet and then note the changes in the Results section. If there are any questions about the suitability of a specific camera/trigger layout, contact your JAI representative for advice.

4.1.5 Edit the alignment settings on the Setup Computer

In order to carry out the alignment properly, the ENSetup program has to be configured with two values from the worksheet. See the ENSetup Program User’s Guide (Video Window Setup section) for details on changing Video Window properties.

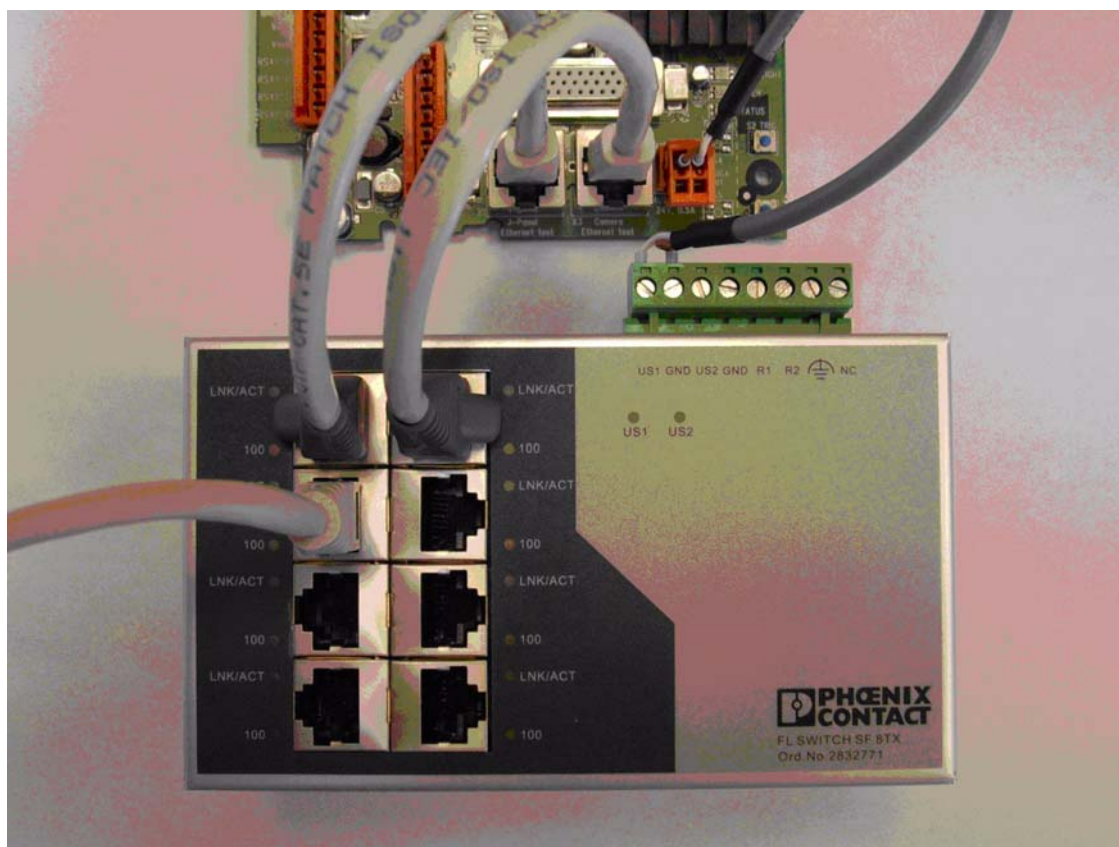
Using the ENSetup program, make sure the “tilt line” and “plate num cols” items on your Portable Setup computer are exactly the same as the measurements, including the proper plate size parameters measured in Section 4.1.4, “Validate the Installation Geometry,” on page 32. All other

camera settings should already be correct for the site installation, but it is a good idea to verify that this is true before proceeding. The Setup Computer is now properly configured to support lens adjustments and camera aiming.

4.1.6 Connect the Setup Computer to the Camera

- Position the Setup Computer next to the camera being aligned. If the alignment is conducted in bright sunlight, shield the monitor screen with a hood to make it visible. Make sure that no portion of the computer or cables interfere with the camera's view of the road.
- Connect the Setup Computer's network adapter with the camera network. This can be done directly to the I/O boards X1 and X3 connectors or using a local Ethernet switch. It is preferable to use a local Ethernet switch instead of a local direct connection to the I/O board. A direct connection between the Setup computer and the camera will disconnect the camera from the site LAN and thereby disconnect the light sensor as well.

Figure 30. Example of a network connection using a local switch.



The network connection between the Setup computer and the camera can be established using a local switch. Two separate ports of the Ethernet Switch are connected directly to the I/O board connectors X1 and X3. The Setup computer is then also connected to one of the free ports on the switch. If the switch is running on 24V dc, the I/O board is capable of supplying up to 0.5A on connector X15 located next to X1 and X3. The pin marked with #1 on X15 is +24V dc.

4.1.7 Drive and Park the Setup Vehicle Correctly

- Drive the setup vehicle slowly towards the trigger line through the center of the cameras field of view in the same manner (heading) as a typical driver would occupy this lane.

Note: This is important, make sure that the vehicle is driven exactly the same way as the average driver would through the section of roadway being viewed by the camera.

- Stop the vehicle approximately one foot (0.3 meter) past the trigger line. Make sure that the vehicle is parked aimed in the same direction as the average driver would point their car if they were driving through this section of roadway.
- To help the driver of the vehicle properly aim the car while driving, instruct him (or her) to always look forward down the road as they would normally. Use a sound to signal the driver when to stop.

4.1.8 Properly Position the License Plate Stand

Using your portable plate stand, position a license plate:

- at the minimum expected trigger distance from the camera.
- at the minimum expected plate height above the road.
- at the location along the trigger line where the center of the horizontal field-of-view of this camera is desired.

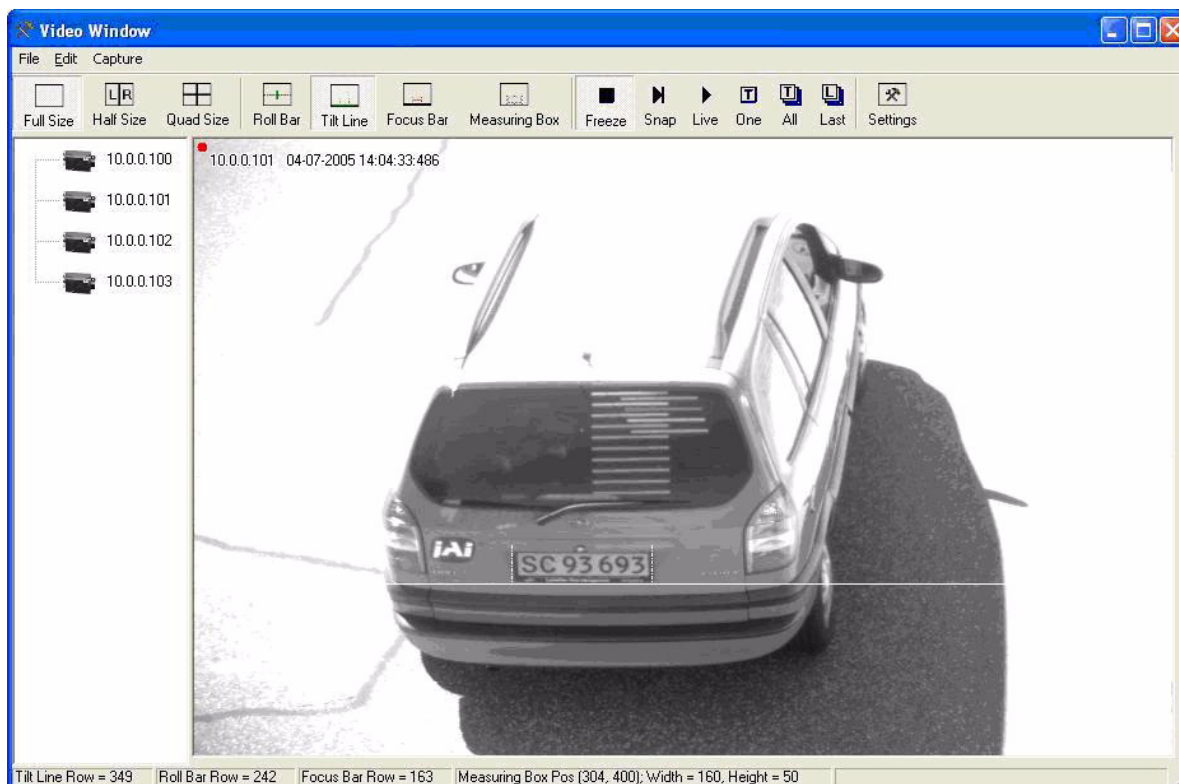
Rotate the plate on the stand until the top and bottom edges are level with the vehicle parked behind the trigger line (to within a + or - a couple of degrees). Secure the plate on the plate stand so that the adjustments you have just made do not change.

4.1.9 Perform Initial Lens Adjustment and Camera Aiming

1. Back away all of the thumbscrews on the lens holder until they do not touch the knurled adjustment rings on the lens.
2. Make sure the lens aperture adjustment is fully open (rotate the third ring from the front of the lens fully counter-clockwise until it stops at the f1.2 setting). Secure the thumbscrew that lines up with the aperture ring until it just presses against the ring. Next tighten the thumbscrew that lines up with the knurled ring closest to the camera body until it just presses against the lens. Do not tighten any Lens Holder thumbscrews beyond a slight pressure against the lens.
3. Loosen the roll, pan, and tilt bolts on the JAI camera mounting head until each axis can be easily adjusted by hand but any particular setting will stay in place after you let go.
4. Power on the Setup computer and then start the ENSetup program. Press the "Video Window" button to open the Video Window and then select the camera for adjustment from the tree-view on the left side of the window. Press the "Live" button in the toolbar to start the video streaming. Press the "Tilt Line" button to show the alignment guidelines. The "Tilt Line" can be moved using the mouse, or if the "Tilt Line" is selected, using the arrow-keys.
5. Interactively adjust the roll, pan, and tilt of the camera mount and the lens zoom and focus rings:
6. Adjust the lens focus ring (and camera pan and tilt as necessary) to obtain a focused image of the plate on the plate stand. If at any time you cannot fully focus the plate because the focus ring on the lens has reached the end of its turning movement, perform the back-focus procedure described in the JAI document titled "Zoom Lens Back-Focus Procedure."

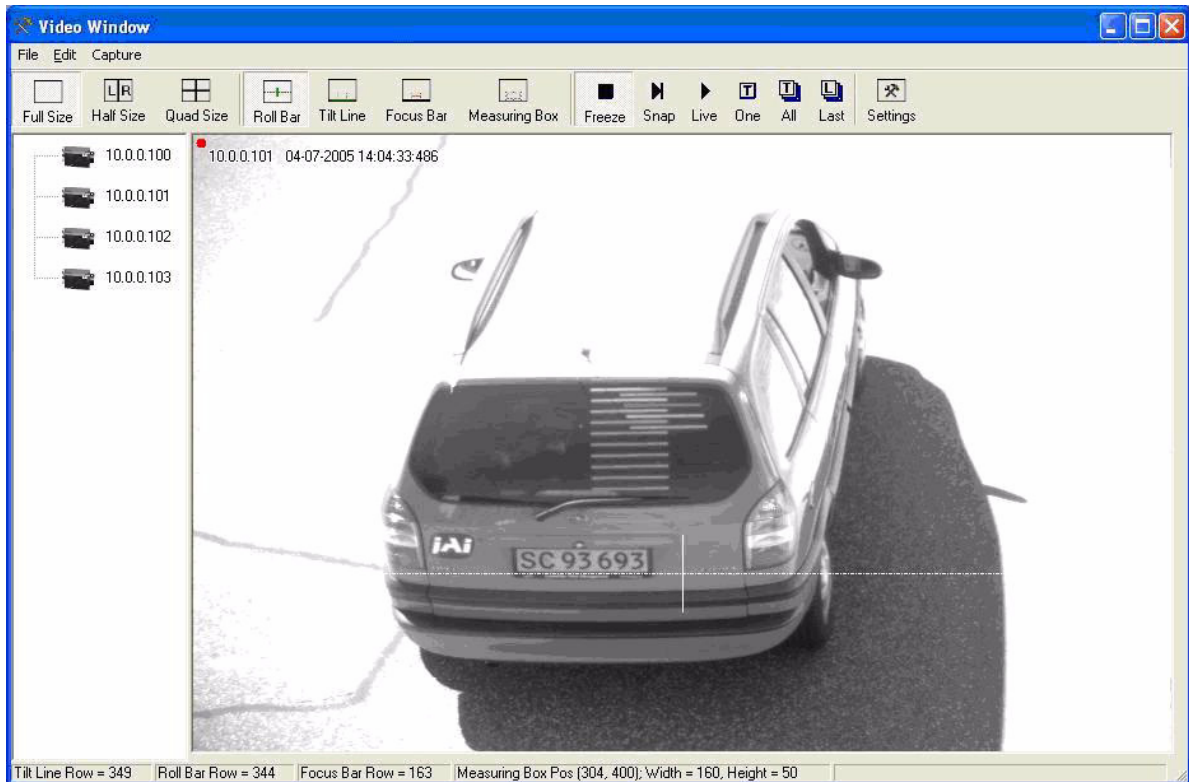
- Adjust the lens zoom ring to obtain a plate width approximately equal to the distance between the short vertical sizing marks that appear above the tilt line. Readjust focus as necessary. See Figure 31 for more information.

Figure 31. Initial Camera Alignment Display example.



- Turn on the “Roll Bar” display on the Setup computer and then roll the camera mount until the horizontal bumper and trunk seams on the vehicle appear perfectly level with the horizontal line of the display. Use one 7/16” closed-end wrench on the roll gear to fine-tune the roll angle. Hold the roll position with the wrench while you use a second wrench to gently tighten the other roll bolts. Then apply both wrenches to corresponding bolts on opposite sides of the mount. Twisting in opposite directions to fully secure all of the roll bolts. This approach prevents the roll adjustment from changing while you tighten the bolts. See Figure 32.

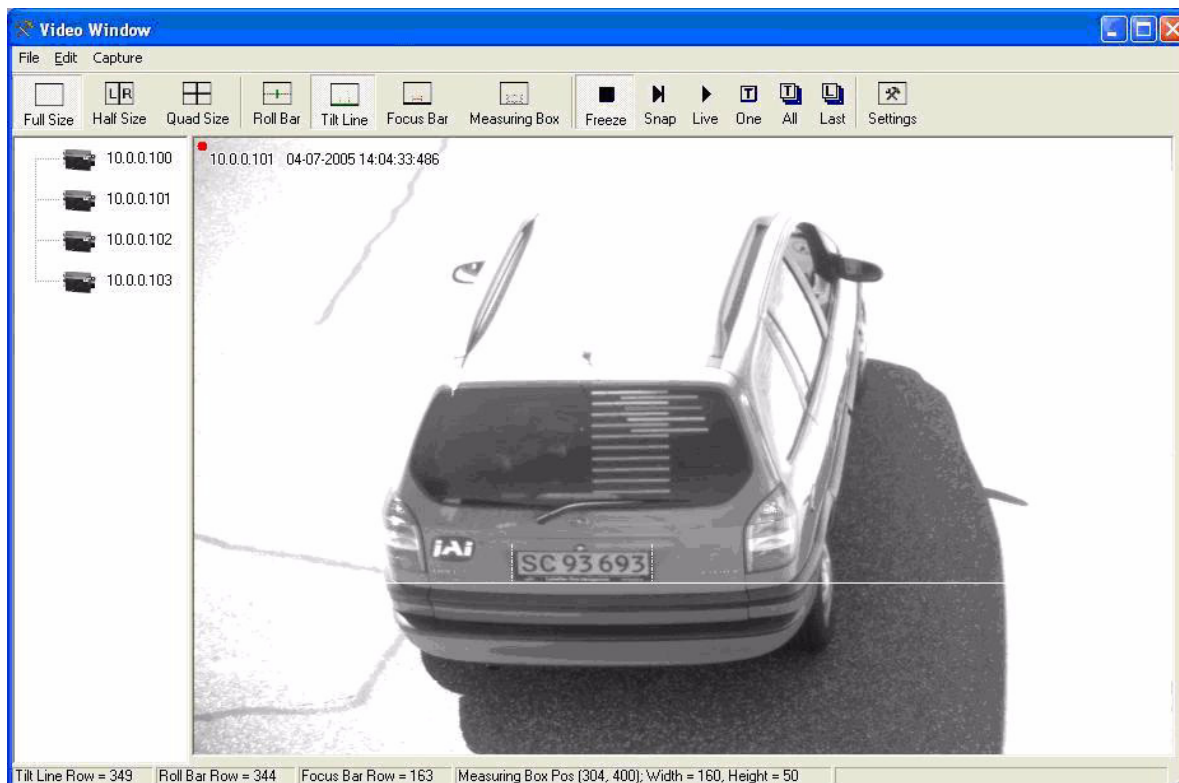
Figure 32. Roll Bar Display example.



Pan the camera mount until the plate stand is centered under the default position of the vertical line in the middle of the “Roll Bar” display. Securely tighten the pan bolt. Be careful not to change the pan of the camera while you tighten the bolt. Oppositely twisting two 9/16" closed-end wrenches is recommended (one for the bolt head and one for the nut) to help prevent the pan from moving while you tighten the bolt.

Switch back to the “Tilt Line” display. Tilt the camera mount until the plate is positioned just above the tilt line. Re-adjust the zoom as necessary until the plate just fits in between the zoom markers on the “Tilt Line”. Changing zoom usually requires that the tilt adjustment be modified also. Do not tighten the Tilt bolts until after the final lens adjustment. See Figure 33.

Figure 33. Readjustment of camera tilt and zoom display.



The camera mount and lens are now ready for final adjustment.

4.1.10 Finalize Lens Adjustments and Camera Aiming

4.1.10 (a) Reposition the License Plate Stand at the Nominal Trigger Line

Use your portable plate stand to position the license plate:

1. at the normally expected (nominal) trigger distance from the camera.
2. at the nominal plate height above the road.
3. at the location along the trigger line where the center of the horizontal field-of-view of this camera is desired.

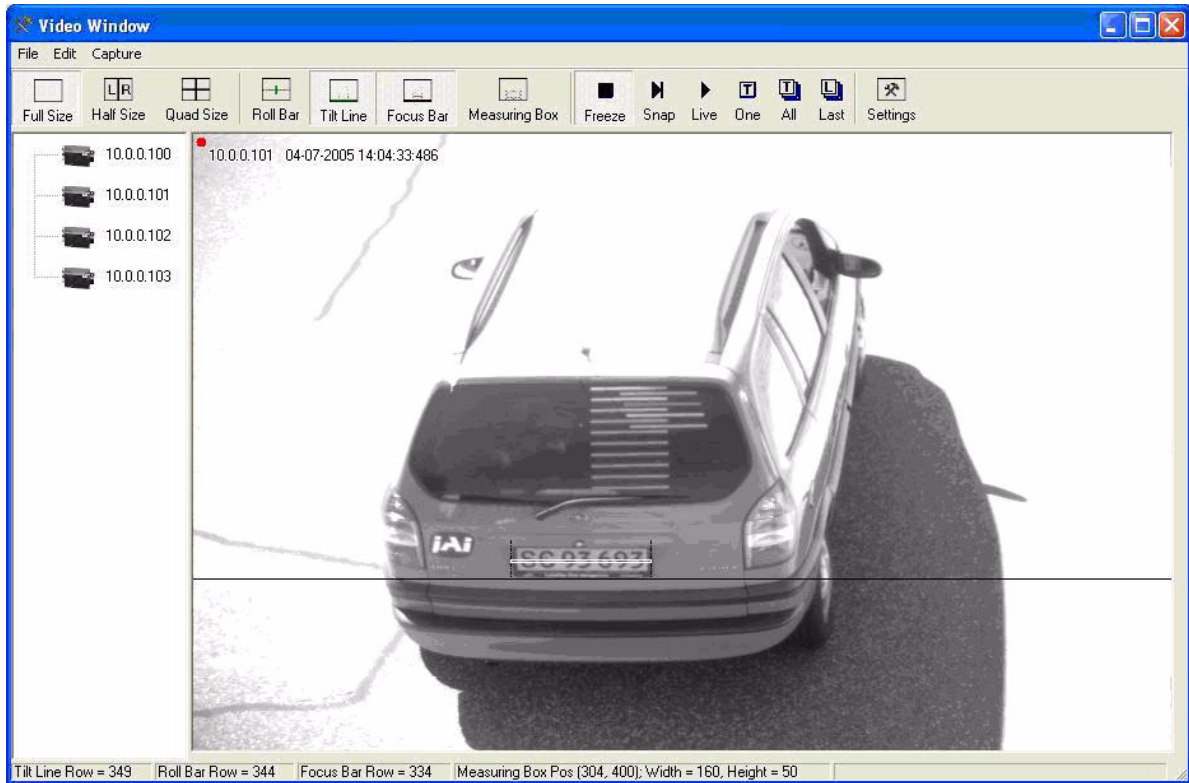
Rotate the plate on the stand until the top and bottom edges are perfectly level with the vehicle parked behind the trigger line. Secure the plate on the plate stand so that the adjustments you have just made do not change.

4.1.10 (b) Perform Final Camera Mount and Lens Adjustments

The final focus adjustment is facilitated using the “Focus Bar” display on the Video Window. Press the “Focus Bar” button on the toolbar. This displays a “Focus Bar” marker on the Video Window that will open a separate “Focus Bar” window where the pixel-values taken from the focus bar marker is displayed. The “Focus Bar” marker can be moved with the mouse pointer, or if the “Focus Bar” marker is selected, using the arrow-keys.

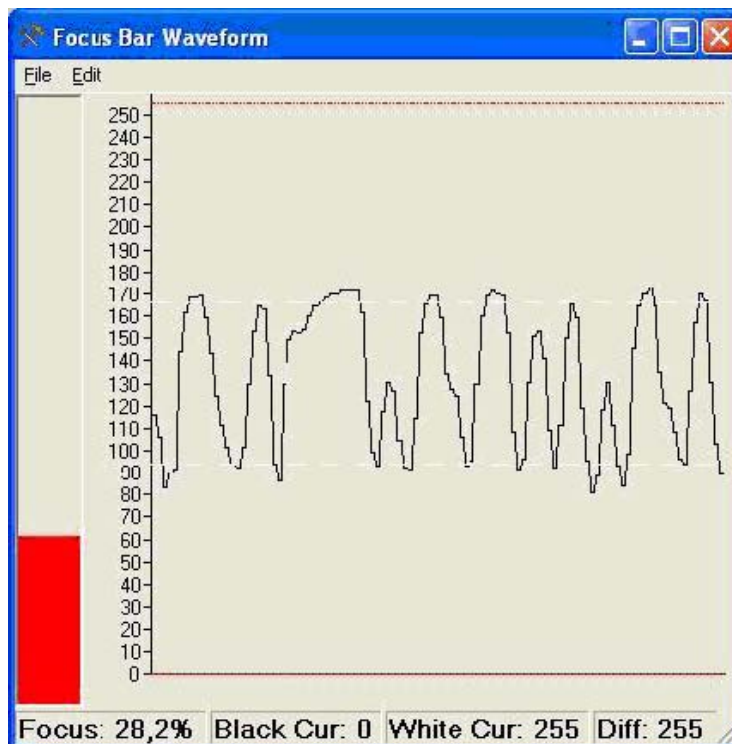
1. Position the “Focus Bar” marker directly over the license plate.

Figure 34. Focus Bar marker display.



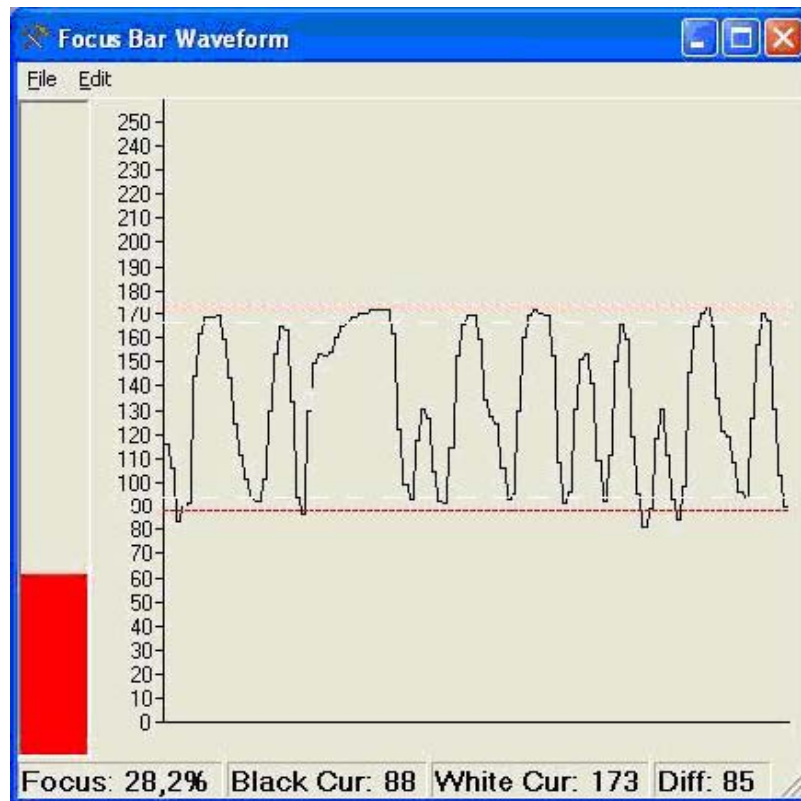
2. Adjust the lens zoom ring until the plate width just barely fits in between the short vertical zoom markers on the display.
3. Have your assistant tape the lens front-focus chart to the stand so that it appears in-between the zoom markers. Make sure the black and white bars are vertical in the image.
4. Carefully adjust the lens focus ring until the focus bar waveform display is maximized in amplitude spread. The "Focus percentage" display shown on the left side of the "Focus Bar Waveform" window should then be maximized when the picture has got the best focus. If necessary, readjust the zoom and focus until the width of the plate is just inside the zoom markers and the waveform spread of the bars is maximized.

Figure 35. Focus Bar Waveform display.



5. Gently snug the zoom and focus lens holder thumbscrews against the lens without changing any of the lens settings.
6. Uncover the license plate by removing the lens focus chart.
7. Use the mouse to move the waveform cursors to the top and bottom of the waveform amplitude variation. The "Black Cursor" is located at the bottom of the waveform display, and the "White Cursor" is located on the top of the waveform display.
8. Verify that the waveform amplitude variation (for characters in both direct light and shadow, if possible) is at least 25 and that no portion of the waveform fully saturates either black or white.

Figure 36. Focus Bar Waveform Display with waveform cursors.



9. Use one hand to carefully hold the focus ring of the lens in place while you rotate the filter ring on the very front of the lens with your other hand. Turn the filter ring until the white mark on the ring is oriented straight up (or down). Secure the filter ring in place with a small dab of RTV glue.
10. Printout the image of the screen using the "File -> Print..." menus on both the "Video Window" and the "Focus Bar Waveform" windows to document the settings. If no printers are connected, the "PDFCreator" printer driver can be used to save the pictures as PDF-files.
11. Have your assistant move the plate stand back to the near trigger line and re-position the plate at the minimum plate height.
12. Drive the setup vehicle slowly towards the trigger line in the same heading as normal traffic flow and center it directly between the camera being aligned and the adjacent camera that has already been aligned. Marking the position halfway between adjacent cameras at the trigger line with some marker is advisable to help the driver properly aim the vehicle.
13. Park the vehicle at the location where it just barely causes the trigger to cause an image to be captured. For loop triggers, park the vehicle where a vehicle would normally be located when the loop trigger signals the VIS to capture an image.

4.1.11 Flash Head Alignment

The following section provides a general procedure to align the VIS flash head. Be sure to follow any specific alignment procedure provided with your system.

Align the flash head at night and after aligning the cameras. Park a light colored vehicle underneath the camera and where the vehicle detector triggers the camera.



- Press the “Repetitive Trigger” button on the ENSetup toolbar. This will trigger the camera every second. Make sure that the “Ethernet” external hardware trigger is enabled in the “Camera Properties” section “2 - Trigger”, property “External Trigger Source”.
- Adjust the flash head tilt and pan control until the entire back of the vehicle is well illuminated. If necessary, adjust the flash-head pan control to center the flash beam over the vehicle.
- If the flash illumination is too bright for your installation, contact JAI for instructions on how to adapt VIS system parameters to reduce sensitivity to nighttime illumination.

Repeat pressing the “Repetitive Trigger” button on the ENSetup toolbar to stop flash firing. Repeat the above steps for each camera/flash.

Table 13 Optimal Illumination Distance Between Camera and TNF

	TS-9720EN	TSC-9720EN	TS-2030EN	TSC-2030EN	TS-2076EN	TSC-2076EN	TS-1327EN	TSC-1327EN
Distance in Feet	3.5	TBD	2	1	TBD	TBD	TBD	TBD

Distance measured from outer wall of Camera housing to outer wall of Flash unit.

5 Appendix A: Camera Functional and Connector Description

The camera has connections to the EN J-Panel, Light sensor, Flash, Night Light and Laser Vehicle Detector as shown in the system overview Figure 37.

Appendix A describes the camera connectors for these units, the signal specifications, output circuits and test facilities. It also covers cable requirements.

Figure 37. Connection requirements.

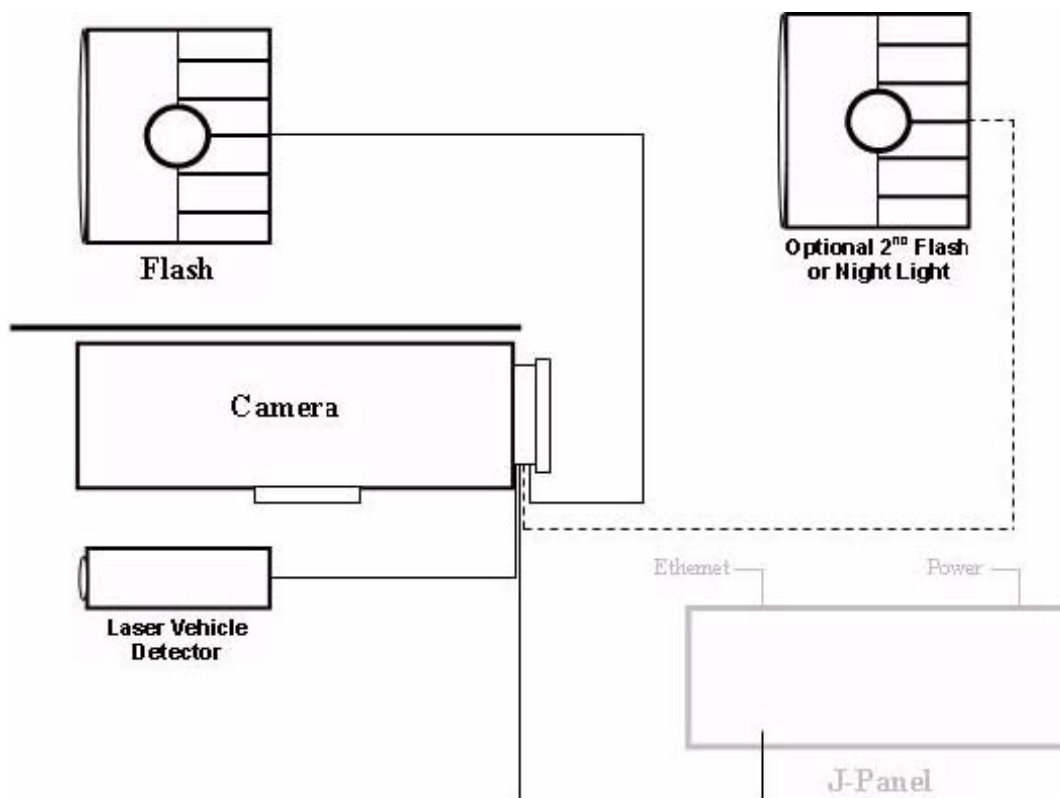
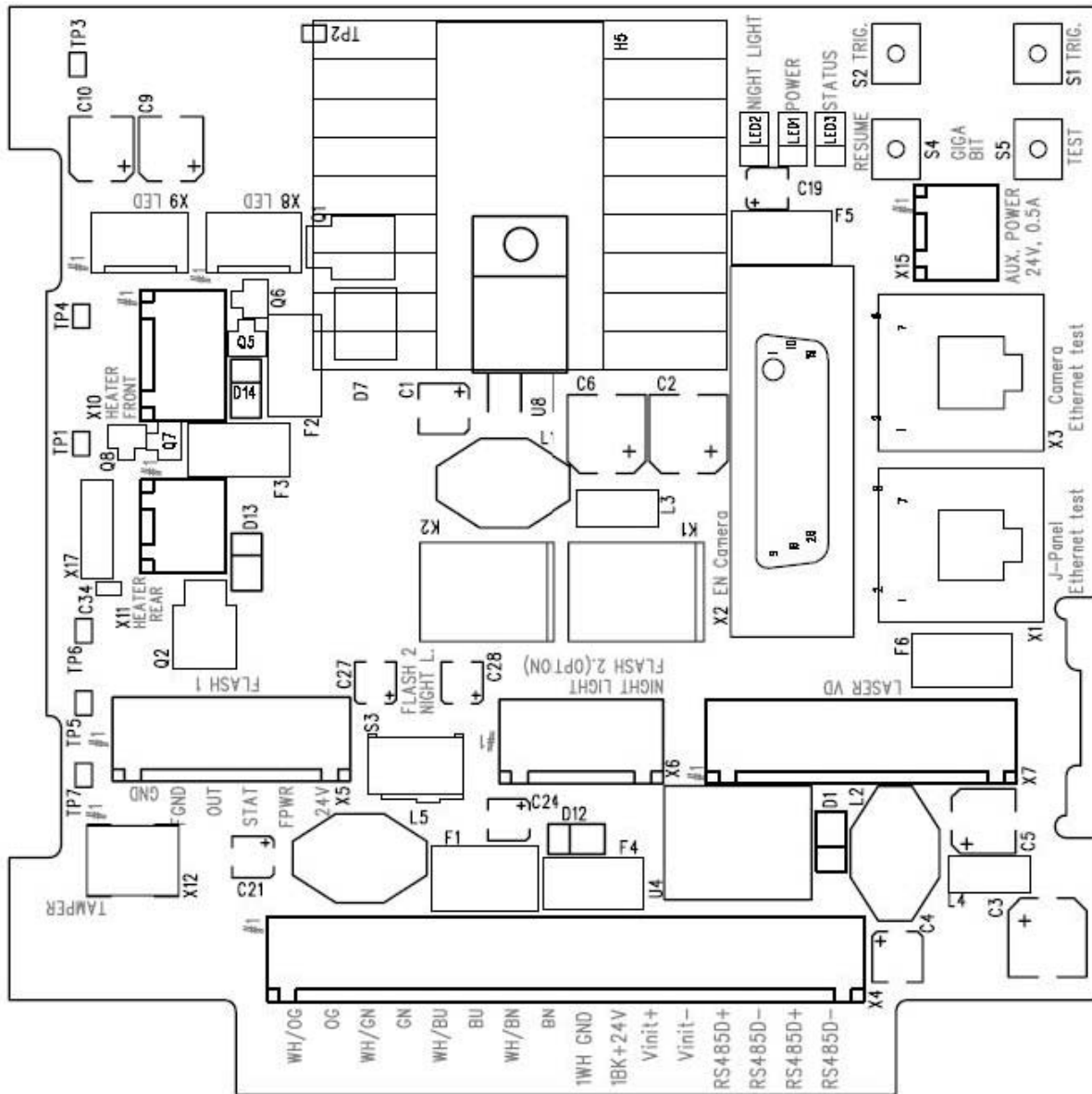


Figure 5.1

5.1 I/O Board Layout

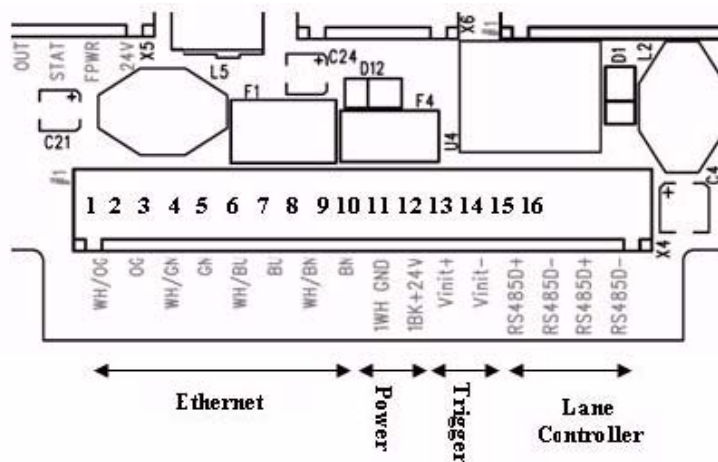
Connections to the camera are made through the EN I/O Board located in the back of the camera housing. Figure 38 shows the board layout.

Figure 38. Component layout of the EN board.



5.2 X4: I/O Board Connection to J-panel

Figure 39. Board connections



5.2.1 Functionality

Power and data connection to the camera. The 24V power supply for all camera functions (Camera, I/O Board, light and heaters), Ethernet and RS485 data communication is connected using this connector.

5.2.2 Connector specification

Connector type: 16 pole WAGO pluggable terminal block

Connector on board: WAGO 734-246

Cable part: WAGO 734-216

5.2.3 Connector signal specifications

5.2.3 (a) Lane Controller interface

Description

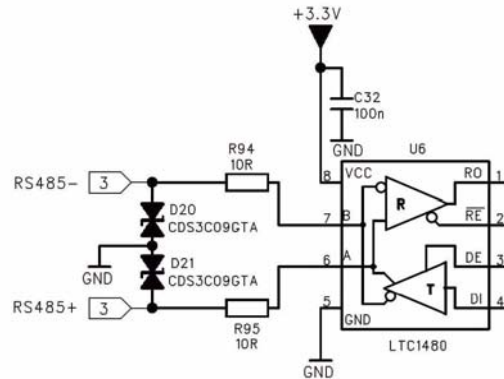
RS485 two wire half-duplex multi-drop communication network. The I/O Board has connections that allow for daisy chain configuration. The two signal pairs (RS485D+ and RS485D-) can be reversed. The signal is terminated on the J-Panel.

Signal levels:

Standard RS485 communication levels. Common mode range -7 to +12V.

Electrical interface on the I/O board:

Figure 40. Interface drawing.



5.2.3 (b) Trigger input

Description

The trigger input is balanced and the input circuit is a RS485 receiver.

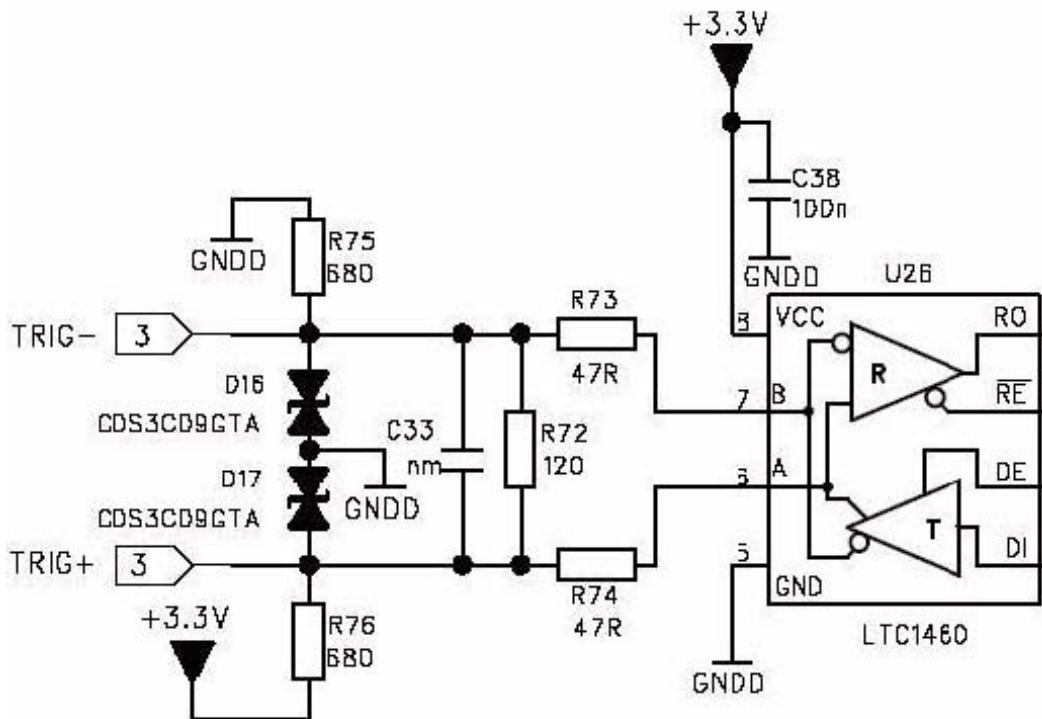
Signal levels

The signal levels are standard RS485 signals. The specification below is taken from Linear Technologies datasheet for LTC1480:

The common mode range is -7 to +12V.

5.2.4 Electrical interface on the I/O board:

Figure 41. Electrical interface



5.2.4 (a) Ethernet Interface

Description: 100 Mb Ethernet interface. The signal must be connected to a gigabit Ethernet switch for best performance. The cable must be a Cat 5e or preferably a Cat 6 cable. The wire color marking on the PCB is standard Ethernet wire colors.

5.2.4 (b) Power input

Voltage	24VDC±20%
Current	0.3A with heaters and LED light off
Max current	inrush app 2.5A
Heaters on	1.3A totally

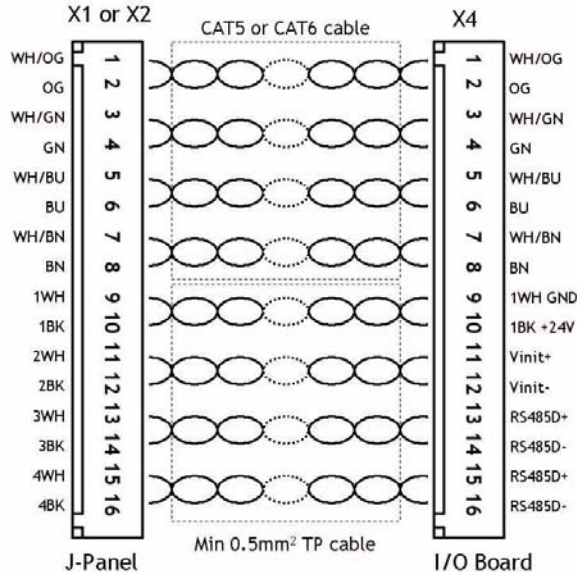
5.2.5 Connector physical Interface

Figure 42. Physical interface table.

Pin	Signal	Description	Connection to J-Panel X1 or X2	Remarks
1	Ethernet A+	Ethernet signal to gigabit switch	pin 1	Cat5e/6 cable white/orange
2	Ethernet A-	Ethernet signal to gigabit switch	Pin 2	Cat5e/6 cable orange
3	Ethernet B+	Ethernet signal to gigabit switch	Pin 3	Cat5e/6 cable white/green
4	Ethernet B-	Ethernet signal to gigabit switch	Pin 4	Cat5e/6 cable green
5	Ethernet C+	Ethernet signal to gigabit switch	Pin 5	Cat5e/6 cable white/blue not used with VIS CAM
6	Ethernet C-	Ethernet signal to gigabit switch	Pin 6	Cat5e/6 cable blue not used with VIS CAM
7	Ethernet D+	Ethernet signal to gigabit switch	Pin 7	Cat5e/6 cable white/brown not used with VIS CAM
8	Ethernet D-	Ethernet signal to gigabit switch	Pin 8	Cat5e/6 cable brown not used with VIS CAM
9	Gnd	Power ground	Pin 9	Black wire in Red/Black pair
10	+24V dc	Supply voltage	Pin 10	Red wire in Red/Black pair
11	Vinit +	Balanced trigger pulse positive	Pin 11	White wire in Brown/White pair
12	Vinit -	Balance tripper pulse negative	Pin 12	Brown wire in Brown/White pair
13	RS485D+	RS485 Data+ for Lane Controller	Pin 13	White wire in Red/White pair
14	RS485D-	RS485 Data- for Lane Controller	Pin 14	Red wire in Red/White pair
15	RS485D=	RS485 Data+ for Lane Controller	Pin 15	White wire in Orange/White pair
16	RS485D-	RS485 Data- for Lane Controller	Pin 16	Orange wire in Orange/White pair

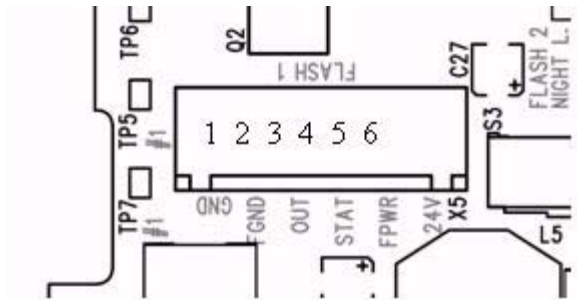
5.2.6 Typical wiring diagram.

Figure 43. Category 5 or 6 wiring diagram.



5.3 I/O Board Flash Connection

Figure 44. Flash connections.



5.3.1 Functionality

Output to flash unit. This output is used when only one flash unit is connected. The output is galvanically isolated using an optocoupler. The isolated part of the electronics on the board can be powered from the flash unit or from the I/O Board using a 24V DC output on the connector.

5.3.2 Connector specification

Connector type: 6 pole WAGO pluggable terminal block
 Connector on board: WAGO 734-236
 Cable part: WAGO 734-206

5.3.3 Connector signal specifications

Description

Logic inverter powered by 5V drives the output. The inverter is a HCMOS type 74AHC14.

Output signal specification

Signal amplitude 5V TTL
 Output impedance 100 Ω
 Pulse width 5 ms ± 1 ms
 Signal polarity active high

External power requirement

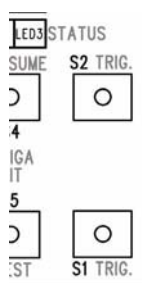
Voltage 8-26V DC
 Current max 25µA

Electrical Interface on the I/O board:

Figure 45. I/O board electrical interface. Test

A push button switch S1 can be activated for generation of an output pulse for test purposes. The flash output is high as long as the switch is activated. The switch is located as shown on Figure 46:

Figure 46. Switch location.



5.3.4 Connector physical Interface

Table 14 Wiring diagram.

Pin	Signal	Description	Connection to
1	I/O Gnd	IO Board Gnd	Pin 2 when no power is available from the flash
2	GND	Flash Gnd	Flash ground (negative power terminal)
3	Out	Strobe Out	Strobe input on flash unit
4	Stat	Strobe status	Status output from flash unit
5	FPWR	Flash power	Power from flash to output circuit on I/O Board
6	24V	IO board 24V (Fused 0.5A)	Pin 5 when no power is available from the flash

5.3.5 Typical Wiring Diagram

Figure 47 shows how to connect to the DC Flash unit having the I/O Board electronics powered from the Flash Power Supply.

Figure 47. Connecting DC Flash to a board powered from the Flash power supply.

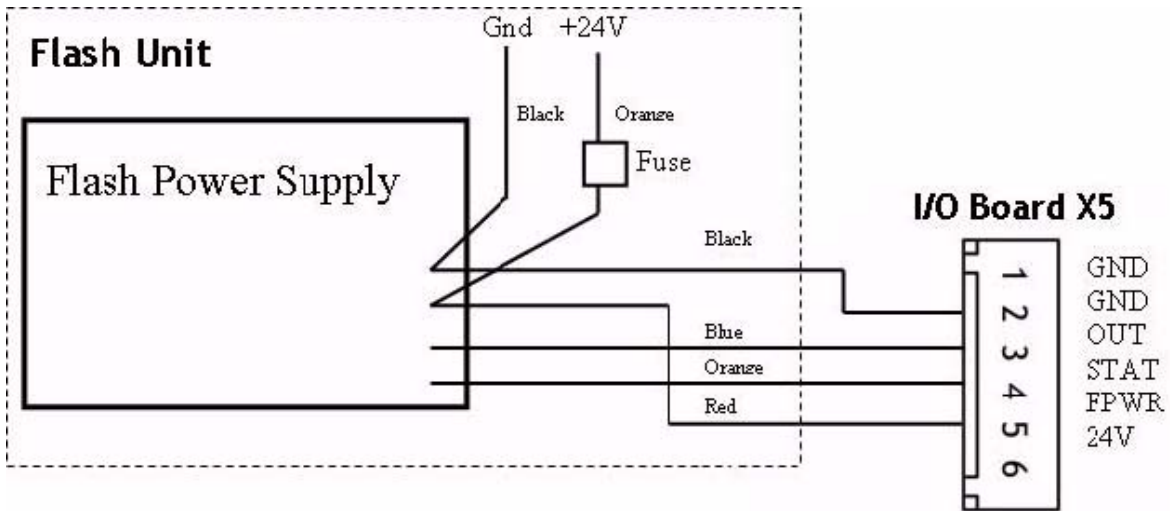


Figure 48 shows how to connect to the DC Flash unit with the I/O Board electronics internally powered.

Figure 48. Connection DC Flash to an internally powered board.

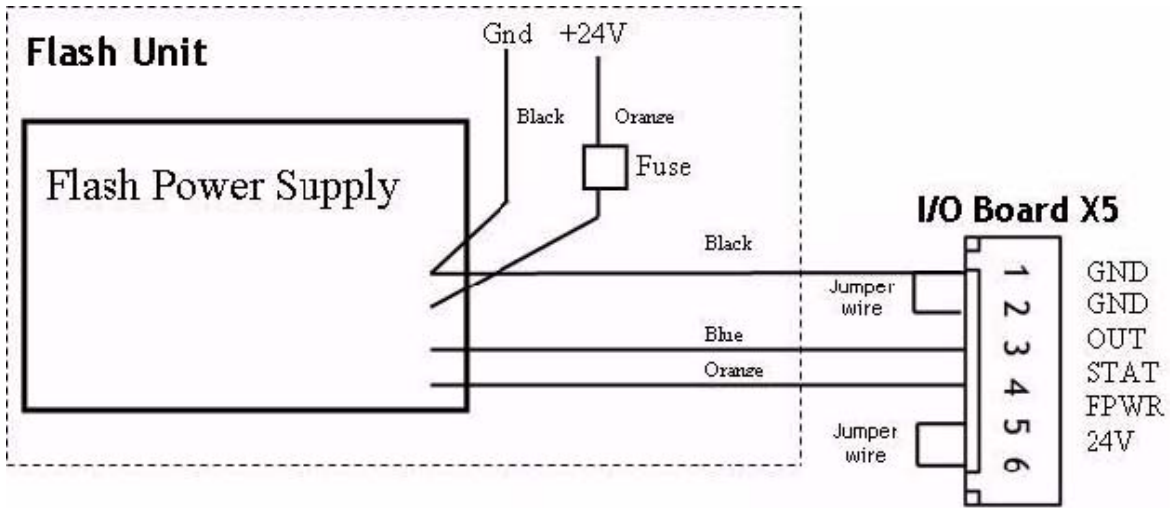
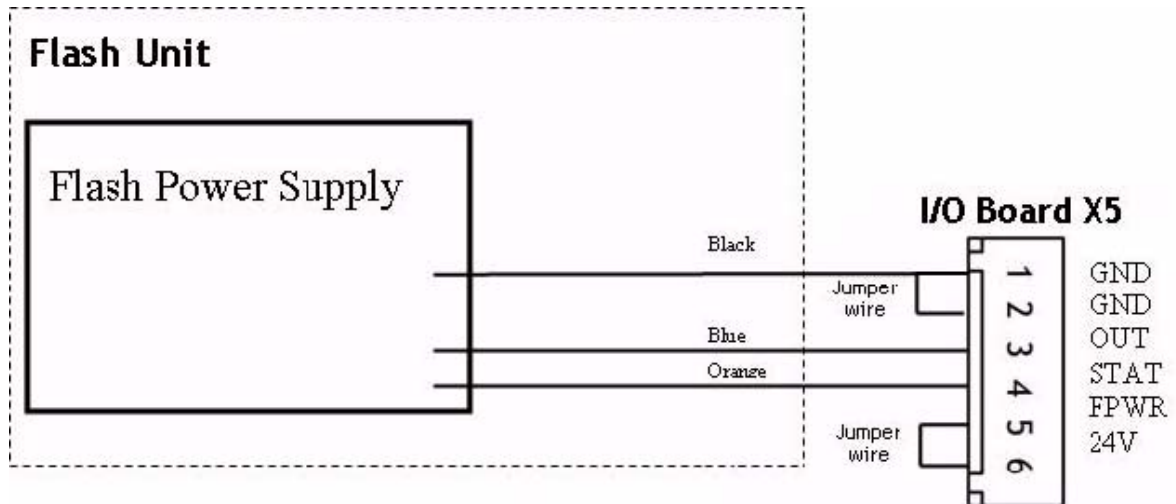


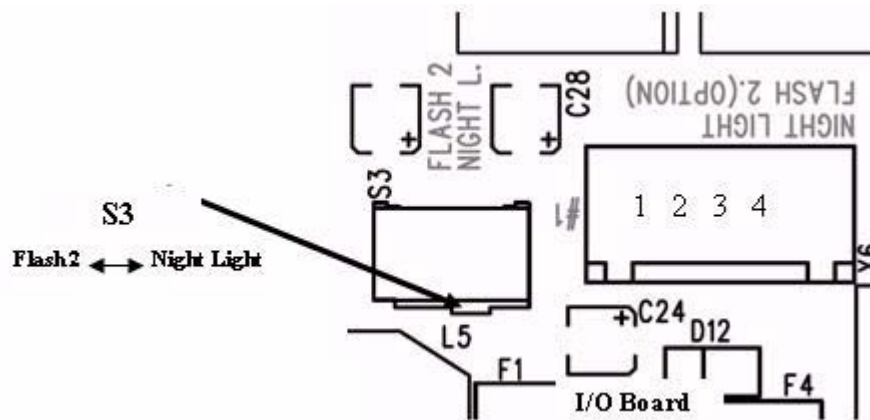
Figure 49 shows how to connect to the AC Flash unit. Flash Power connections not shown.

Figure 49. AC flash unit connection.



5.3.6 X6: I/O Board Night Light/2nd Flash Connection

Figure 50. Second flash connection.



5.3.7 Functionality

Output to Night Light or second Flash unit.

When switch S3 is positioned as shown in Figure 50 (to the right), X6 outputs the night light control signal. When S3 is pushed to the left, X6 outputs the signal for a second flash unit. In this mode the strobe signal is fed alternately to X5 and X6.

The output is galvanically isolated using an optocoupler. The isolated part of the electronics on the board is powered from the Night Light or Flash unit. If no power is available from the unit's power, it can be taken from X5.

5.3.8 Connector specification

Connector type: 4 pole WAGO pluggable terminal block

Connector on board: WAGO 734-234

Cable part: WAGO 734-204

5.3.9 Connector signal specifications

Description

A 5V logic inverter drives the output. The inverter is a HCMOS type 74AHC14.

Output signal specification:

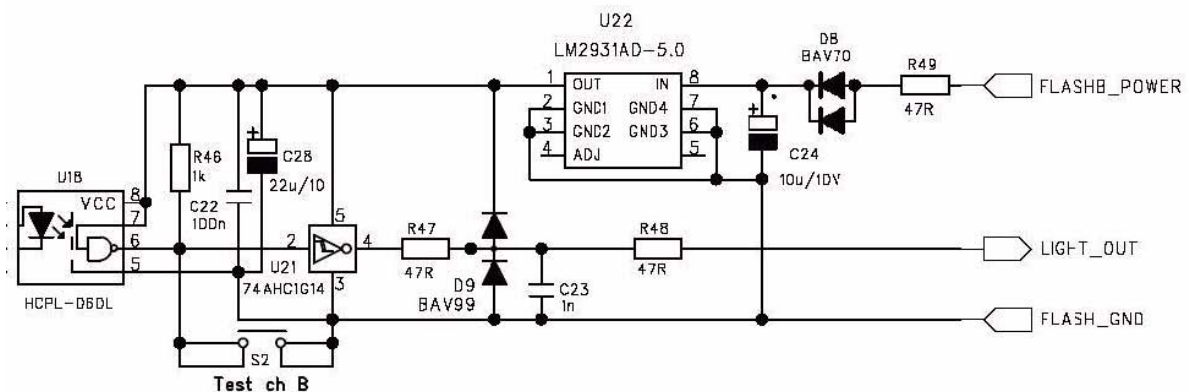
Signal amplitude 5V TTL
 Output impedance 100 Ω
 Pulse width 5 ms ± 1 ms
 Signal polarity active high

External power requirement

Voltage 8-26Vdc
 Current max 25mA

Electrical interface on the I/O board:

Figure 51. IO board electrical interface.



Test

A push button switch S2 can be activated to generate an output pulse for test purposes. The light/flash 2 output is high as long as the switch is activated. The switch is located as shown on Figure 51:

5.3.9 (a) Connector physical Interface

Table 15 Physical interface pinouts.

Pin	Signal	Description	Connection to
1	Gnd	Light/Flash Gnd	Light/Flash ground (negative power terminal)
2	Out	Light control/Strobe out	Light control input or strobe input on flash unit
3	Stat	Light/Strobe status	Light/Flash Status output from unit
4	FPWR	Light/Flash power	Power from Light/Flash unit to output circuit on I/O Board

The Gnd signal on pin 1 is connected to the Gnd signal on X5 (pin 2) internally on the board.

5.3.10 Typical Wiring Diagram

Figure 52 shows how to connect to the 2nd DC Flash unit having the I/O Board electronics powered from the Flash Power Supply.

Figure 52. Wiring a second DC flash from the flash power supply.

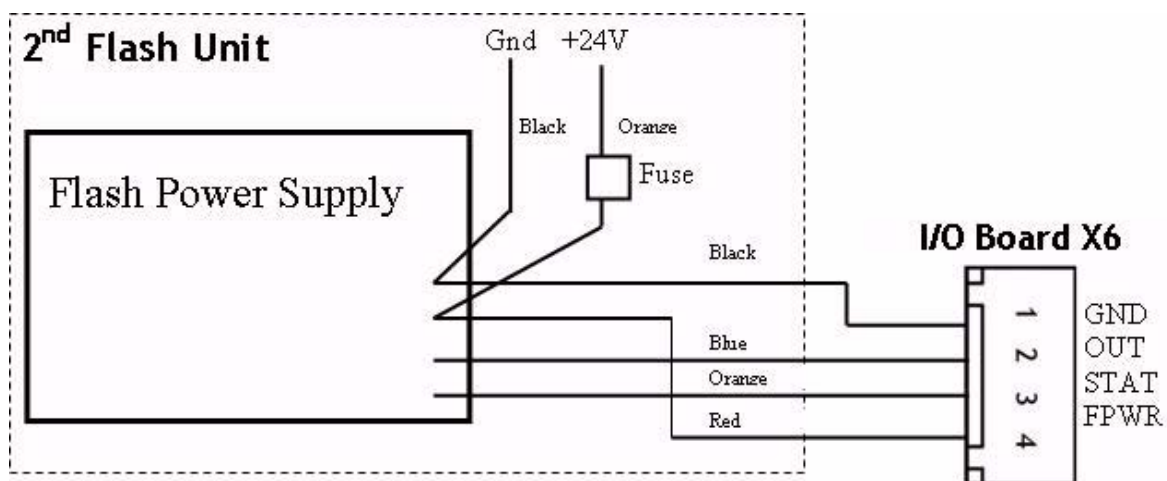


Figure 53. Connecting to a 2nd DC Flash unit with the I/O Board electronics internally powered..

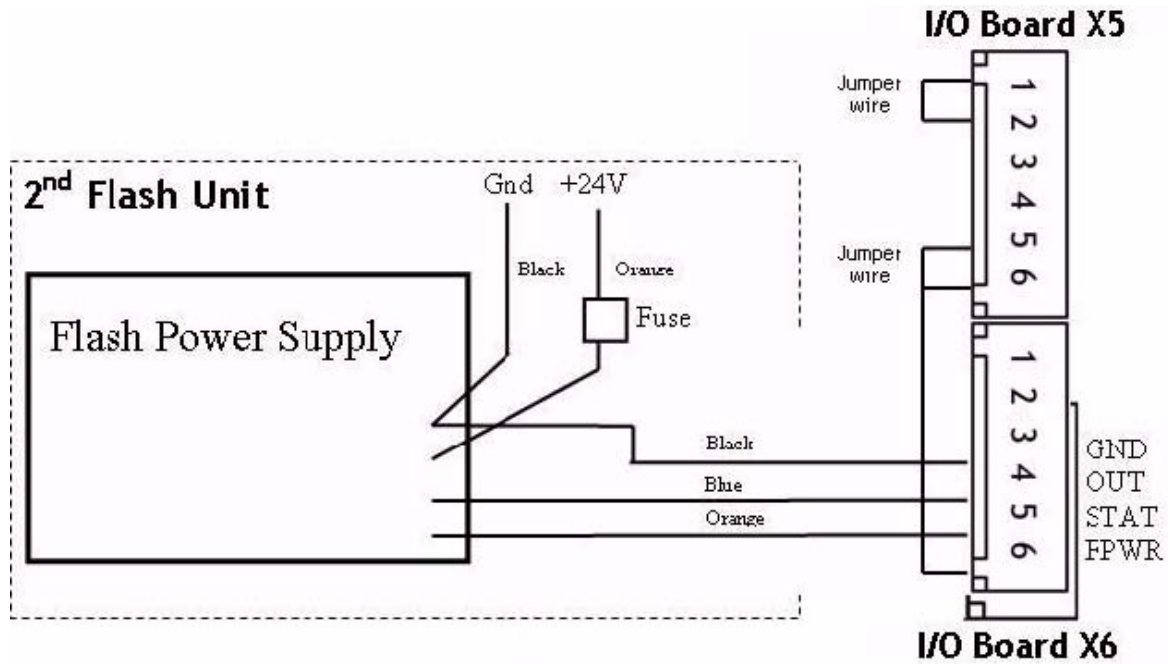
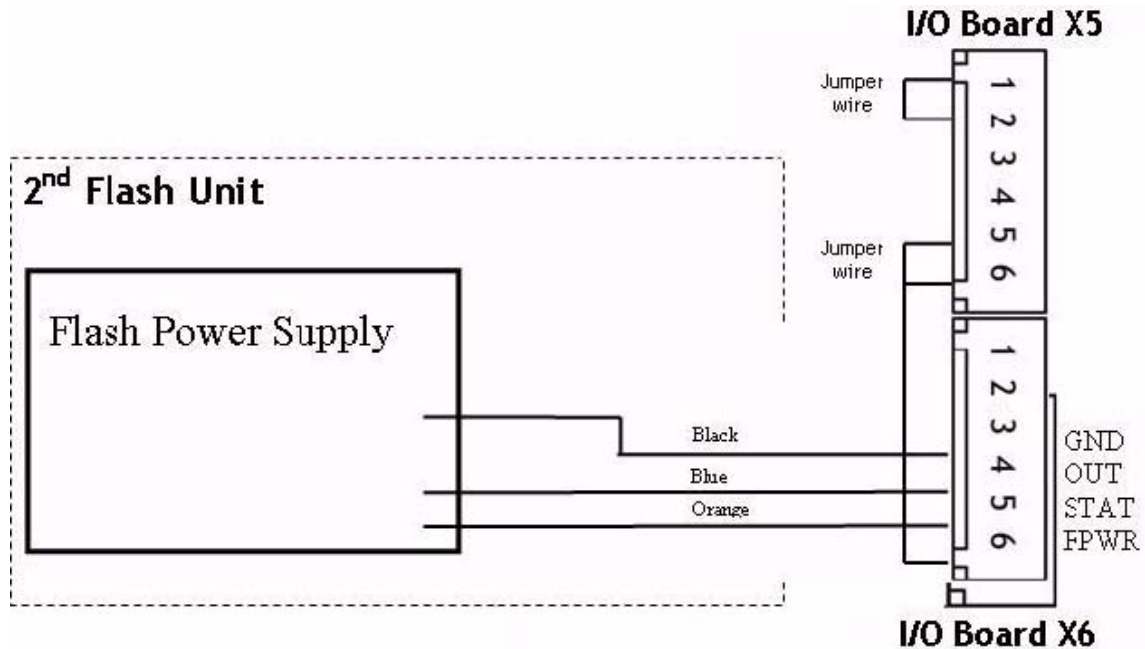


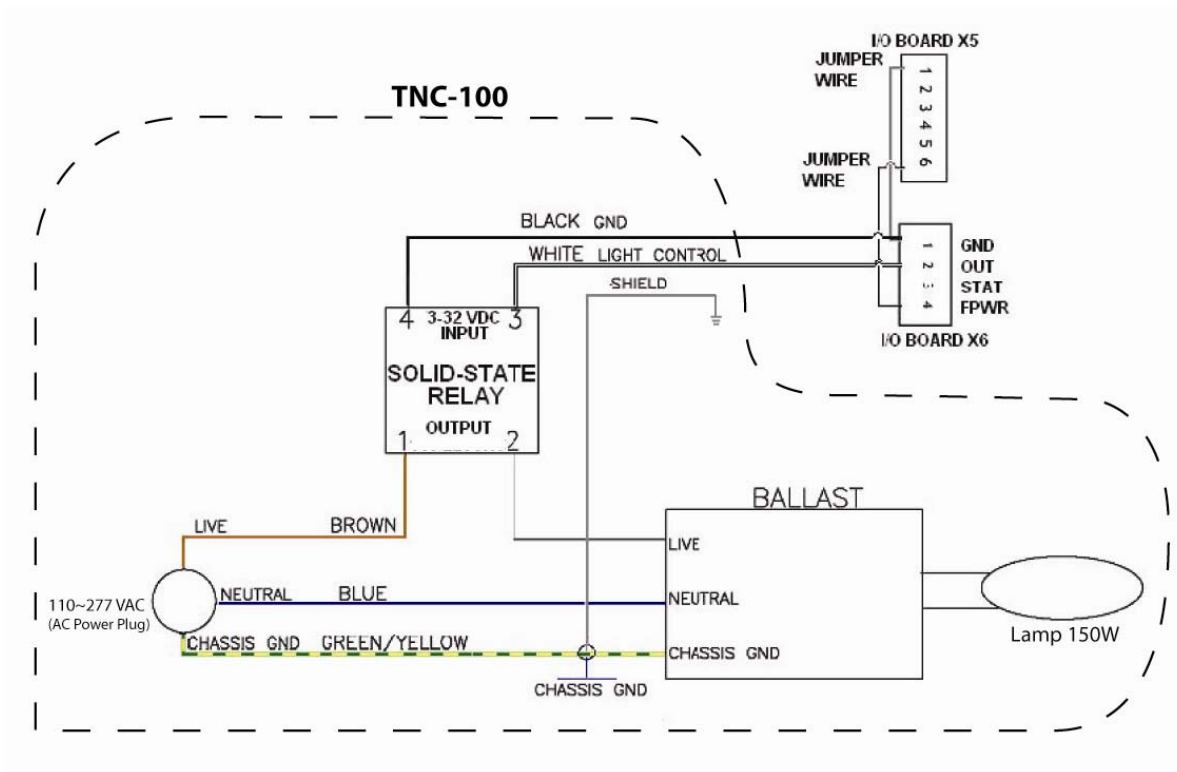
Figure 54 shows how to connect to the 2nd AC Flash unit. Flash Mains power not shown.

Figure 54. Connecting the second AC flash.



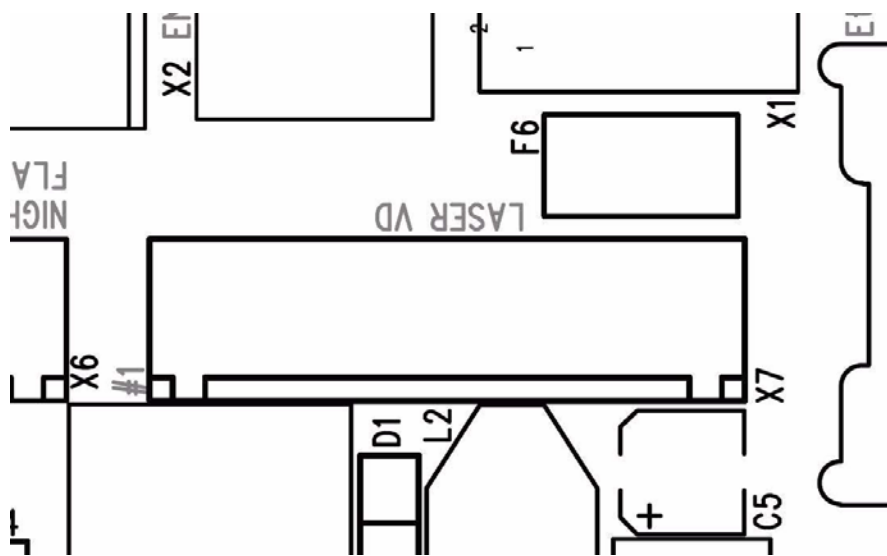
5.4 Night Light TNC 100 Connection

Figure 55. Connecting to the night light (TNC 100)



5.5 X7:I/O Board Laser Vehicle Detector Connection

Figure 56. Detection board



5.5.1 Functionality

Connection to the Laser Vehicle Detector (LVD).

5.5.2 Connector specification

Connector type: 8 pole WAGO pluggable terminal block

Connector on board: WAGO 734-238

Cable part: WAGO 734-208

5.5.3 Connector signal specifications

5.5.3 (a) Power Output

Voltage 24V DC

Fuse 0.5A (PTC fuse, self resetable)

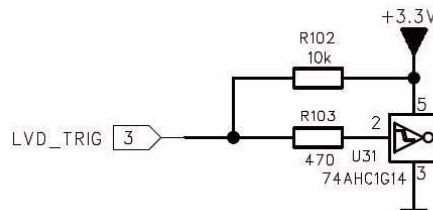
5.5.3 (b) Trigger Input

The LVD trigger input is shown in Figure 57. The input specification is

Input impedance 10k pull-up

Signal level 3.3V logic

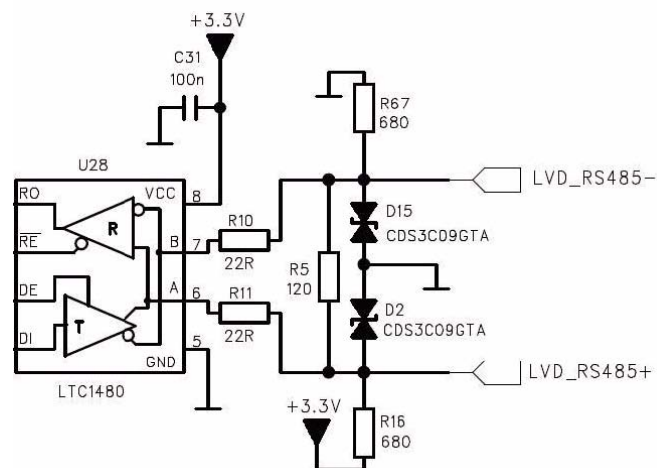
Figure 57. LVD Trigger Input



5.5.3 (c) Communication

The communication with the Laser Vehicle Detector is RS485 signal levels.

Figure 58. Electrical interface on the I/O board:



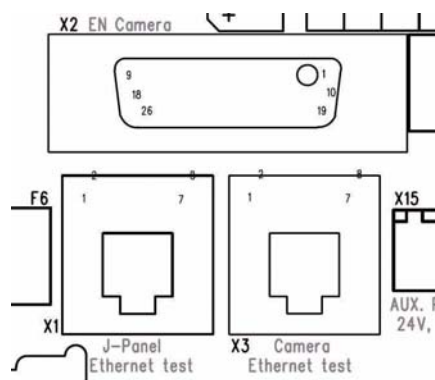
5.5.4 Connector physical Interface

Table 16 Connector table

Pin	Signal	Description	Connection to
1	24V (Fused 0.5A)	Power to laser	Laser power input
2	Tnd	Power gnd	Laser groundd
3	Trigger	Trigger from laser	Trigger out on laser
4	RS485-	Communication interface	RS-485- on laser
5	RS485+	Communication interface	RS-485+ on laser
6	Gnd	Communication gnd	Communication gnd on laser
7	NC	No connection	--
8	NC	No connection	--

5.6 X1, X3: I/O Board Ethernet Test Connectors

Figure 59. Ethernet test connectors.



5.6.1 Functionality

Connection to Ethernet switch for test purposes. The connectors have integral switches that disconnect the signal path from the camera to the X2 connector when plugs are inserted and it is therefore important always to insert plugs in both connectors when testing.

5.6.2 Connector specification

Connector types: 8 pole RJ45 with integral switches

Connector on board: Kinsun ST3009F-880

Cable part: Standard RJ45 plug

5.6.3 Connector signal specifications

Standard Ethernet signals.

5.6.4 Connector physical Interface

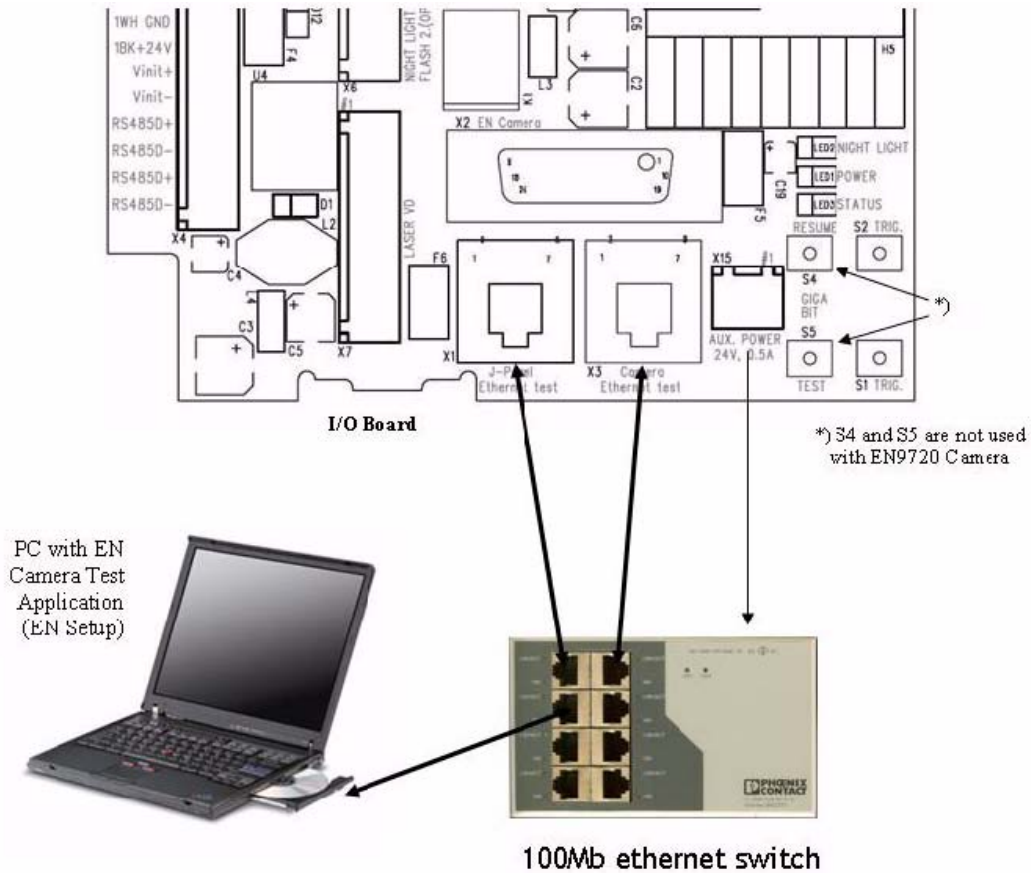
Ethernet test connections.

Pin	Signal	Description	Connection to	Remarks
1	A+ (wh/org)	Ethernet A+	Gigabit switch	Connected when testing
2	A- (org)	Ethernet A-	Gigabit switch	Connected when testing
3	B+ (wht/grn)	Ethernet B+	Gigabit switch	Connected when testing
4	Nu (wht/blu)	Not used	—	—
5	Nu (blu)	Not used	—	—
6	B- (grn)	Ethernet B-	Gigabit switch	Connected when testing
7	Nu (wht/brn)	Not used	—	—
8	Nu (brn)	Not used	—	—

5.6.5 Test setup 1

The test setup for communication with the EN Camera and the network is shown in Figure 60. The patch cables can be twisted or not twisted.

Figure 60. EN network test configuration setup.



The test setup does not work properly with a gigabit ethernet switch.

The following 100Mb Ethernet switch has been tested successfully:
Phoenix Contact type FL Switch SF 8TX (JAI Inc. no. 2900.00.255)

5.6.6 Test setup 2

The test setup for communication only with the EN Camera is shown in Figure 61. The patch cable must be twisted.

The patch cable to the PC is plugged into connector X3. A dummy cable (or plug) is plugged into connector X1.

Figure 61. Test setup 2.

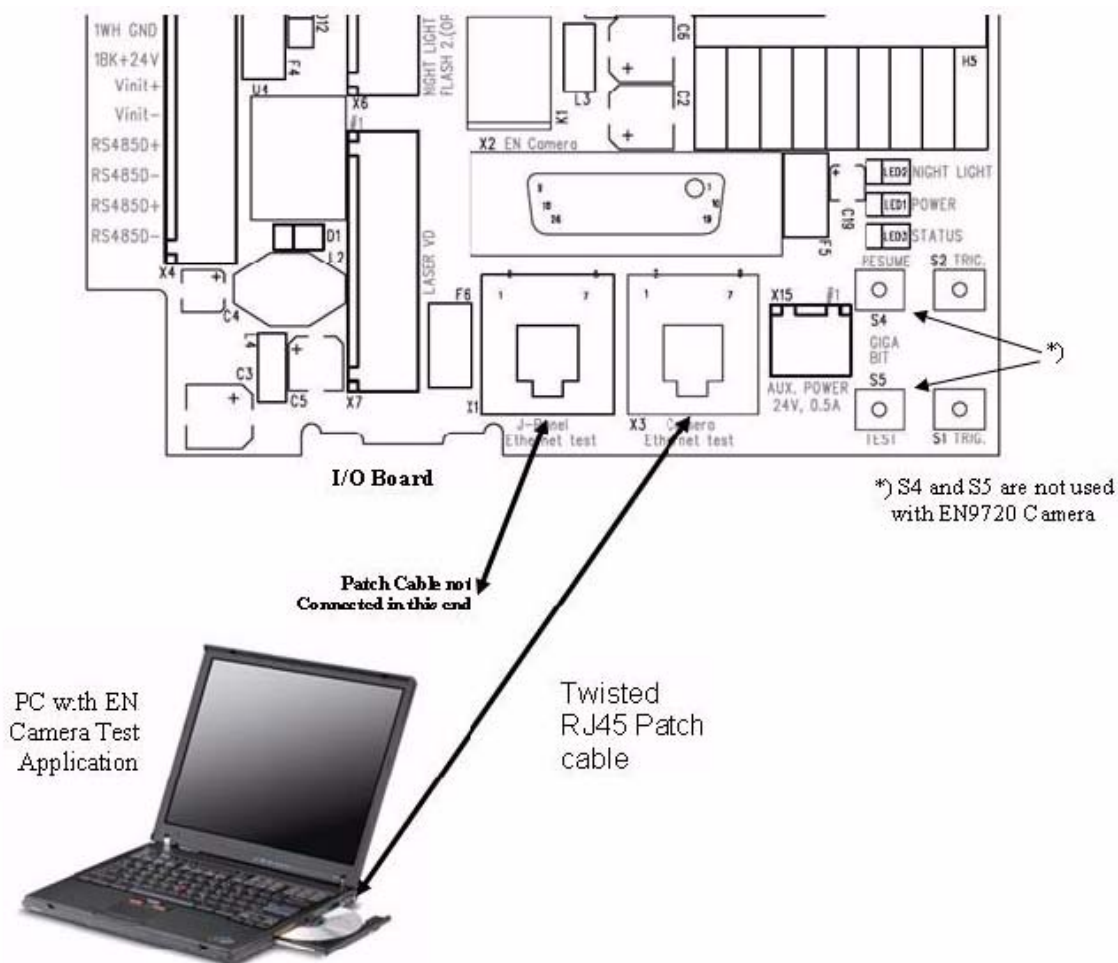
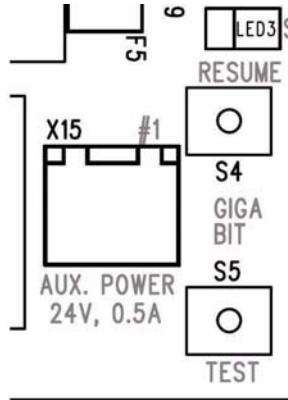


Figure 5.24

5.7 X15: I/O Board Auxiliary power connector

Figure 62. Auxiliary power connector



5.7.1 Functionality

Power outlet for auxiliary equipment.

5.7.2 Connector physical Interface

- Connector: 2 pole WAGO pluggable terminal block
- PCB part: WAGO 734-232
- Cable part: WAGO 734-202

Connector pin #	Signal
1	+24V (fused 0.5A) (self resetable)
2	Gnd

5.8 Cables

In order to comply with EMC regulations the cable must be shielded and the wires must be twisted pairs. The cable used for the Ethernet signals must be minimum Cat 5e and preferably Cat 6. The wires used for power must be a minimum 0.5 mm².

5.8.1 Cable Specifications

5.8.1 (a) Ethernet:

- Category Cat 5e or preferably Cat 6
- Characteristic impedance 100 Ω
- Number of twisted pairs 4
- Maximum cable diameter 15 mm
- Maximum cable length 100 meters

5.8.1 (b) RS485 and power:

- Characteristic impedance 120 Ω
- Number of twisted pairs 4
- Wire dimension ≥ 0.5mm²
- Maximum cable diameter 15 mm
- Maximum cable length 100 meters

5.8.1 (c) Combined cable (Ethernet, RS485 and power):

Number of twisted pairs	8
Maximum cable diameter	15 mm
Maximum cable length	100 meters

5.8.2 Recommended Cables

Ethernet:	Cable, Cat 6 S-FTP 4x2xAWG24	JAI No. 2900.00.262
Power and RS485:	Cable Twisted Pair 4x2x0.5mm2	JAI No. 2900.00.267
Combined cable Cat 6, RS485 and power:		JAI No. 2900.00.268

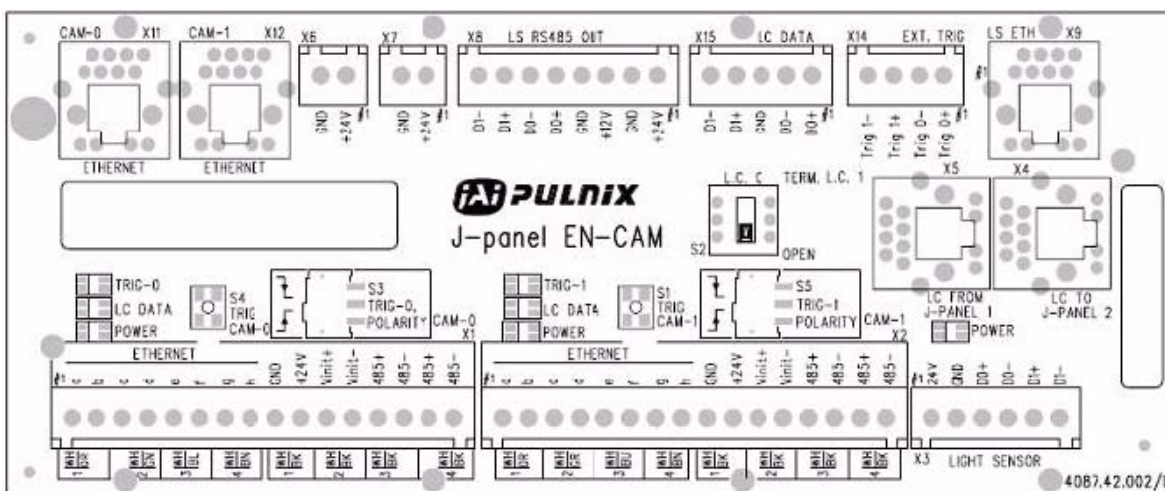
5.8.3 Mounting the cables

Please refer to Section 3 on page 15 of this manual.

6 Appendix B: J-Panel Functional and Connector Description

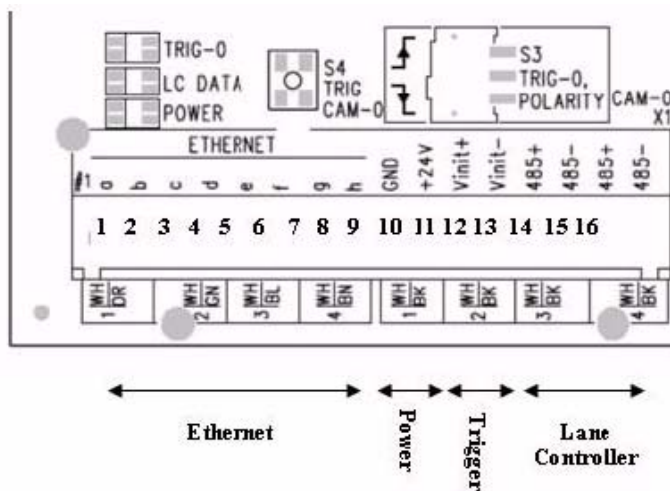
6.1 J-Panel Layout

Figure 63. EN-CAM component layout.



6.2 X1: J-panel connection to Camera 0

Figure 64. Connecting from J-Panel to camera zero.



6.2.1 Functionality

Power and data connection to the EN camera. The 24V power supply for all camera functions (Camera, I/O Board, light and heaters), Ethernet and RS485 data communication is connected by means of this connector.

6.2.2 Connector specification

Connector type: 16 pole WAGO pluggable terminal block

Connector on board: WAGO 734-246

Cable part: WAGO 734-216

6.2.3 Connector signal specifications

6.2.3 (a) Lane Controller interface

Description

RS485 two wire half-duplex multi-drop communication network. The I/O Board has connections for daisy chain configuration. The two signal pairs (RS485D+ and RS485D-) can be reversed.

Signal levels:

Standard RS485 communication levels. Electrical interface on the J-Panel: The signals are connected to J-Panel X15 pin 1 and 2. There are termination resistors on the board. See Figure 49 on page 53 for a description of the signal path.

6.2.3 (b) Trigger output

Description

The trigger output is balanced and the driver is a RS485 transmitter (LTC1480).

Signal levels

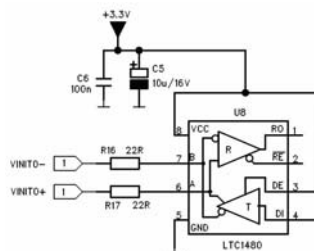
The signal levels are at standard RS485 levels. The specification below is taken from Linear Technologies datasheet for LTC1480:

Table 17 Signal parameters and conditions.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V _{OD1}	Differential Driver Output Voltage (Unloaded)	I _O = 0V	●		3.3	V
V _{OD2}	Differential Driver Output Voltage (with Load)	R = 27Ω (RS485) R = 50Ω (RS422)	● ●	1.5 2.0	3.3	V V
ΔV _{OD}	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	R = 27Ω or R = 50Ω	●		0.2	V
V _{OC}	Driver Common Mode Output Voltage	R = 27Ω or R = 50Ω	●		2	V
V _{OH}	Receiver Output HIGH Voltage	I _O = -4mA, V _{ID} = 200mV	●	2		V
V _{OL}	Receiver Output LOW Voltage	I _O = 4mA, V _{ID} = -200mV	●		0.4	V

Electrical interface on the J-Panel:

Figure 65. J-Panel electrical interface



6.2.3 (c) Ethernet Interface

100 Mb Ethernet interface. The signals are routed directly to RJ45 connector X11. The cable to the camera must be a Cat 5e or preferably a Cat 6 cable. The wire color marking on the PCB uses standard Ethernet wire colors.

6.2.3 (d) Power output

Voltage	24VDC from power supply connected to X6 or X7
Current	2A fused

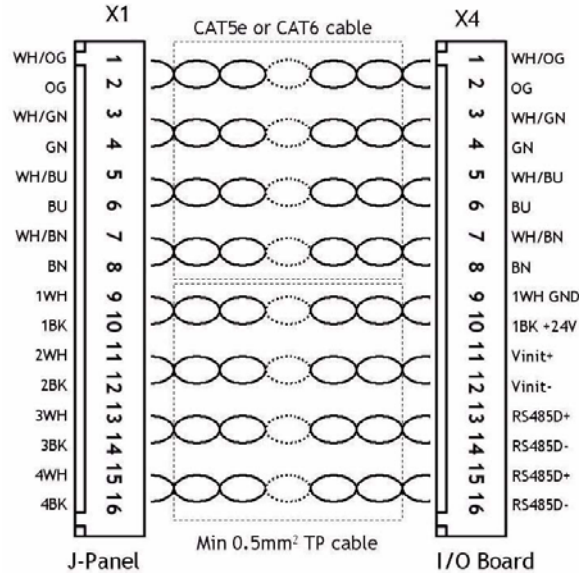
6.2.4 Connector physical Interface

Table 18 Physical interface table

Pin	Signal	Description	Connection to I/O Board X4	Remarks
1	Ethernet A+	Ethernet signal to gigabit switch	pin 1	Cat5e/6 cable white/orange
2	Ethernet A-	Ethernet signal to gigabit switch	Pin 2	Cat5e/6 cable orange
3	Ethernet B+	Ethernet signal to gigabit switch	Pin 3	Cat5e/6 cable white/green
4	Ethernet B-	Ethernet signal to gigabit switch	Pin 4	Cat5e/6 cable green
5	Ethernet C+	Ethernet signal to gigabit switch	Pin 5	Cat5e/6 cable white/blue
6	Ethernet C-	Ethernet signal to gigabit switch	Pin 6	Cat5e/6 cable blue
7	Ethernet D+	Ethernet signal to gigabit switch	Pin 7	Cat5e/6 cable white/brown
8	Ethernet D-	Ethernet signal to gigabit switch	Pin 8	Cat5e/6 cable brown
9	Gnd	Power ground	Pin 9	Black wire in Red/Black pair
10	+24V dc	Supply voltage	Pin 10	Red wire in Red/Black pair
11	Vinit +	Balanced trigger pulse positive	Pin 11	White wire in Brown/White pair
12	Vinit -	Balance tripper pulse negative	Pin 12	Brown wire in Brown/White pair
13	RS485D+	RS485 Data+ for Lane Controller	Pin 13	White wire in Red/White pair
14	RS485D-	RS485 Data- for Lane Controller	Pin 14	Red wire in Red/White pair
15	RS485D=	RS485 Data+ for Lane Controller	Pin 15	White wire in Orange/White pair
16	RS485D-	RS485 Data- for Lane Controller	Pin 16	Orange wire in Orange/White pair

6.2.5 Typical Wiring diagram

Figure 66. Ethernet wiring diagram.



6.2.6 Indicators

There are two LED indicators mounted by the connector:

Table 19 LED indicators

LED label	LED color	Indication
Trig-0	Green	Indicates generation of trigger pulse to camera
	Off	No trigger pulse
LC DATA		LED not mounted
Power	Green	24V present at connector pin 10
	red	No 24V at connector pin 10

6.2.7 Switches

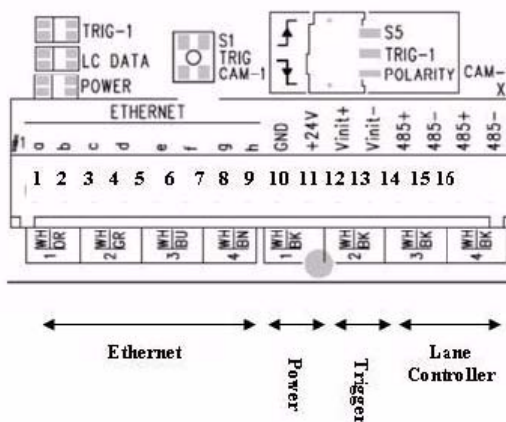
There are two switches located at the connector:

Table 20 Switch labels

Switch label	Switch color	Function
S4 TRIG CAM-0	Push bottom	Generates a trigger pulse to the camera
S3 TRIG POLARITY	Slide	Selects trigger polarity

6.3 X2: J-panel connection to Camera 1

Figure 67. Board and camera J-panel connection to camera 1.



6.3.1 Functionality

Power and data connection to the EN camera. The 24V power supply for all camera functions (Camera, I/O Board, light and heaters), Ethernet and RS485 data communication is connected by means of this connector.

6.3.2 Connector specification

Connector type: 16 pole WAGO pluggable terminal block
 Connector on board: WAGO 734-246
 Cable part: WAGO 734-216

6.3.3 Connector signal specifications

6.3.3 (a) Lane Controller interface

Description

RS485 two wire half-duplex multi-drop communication network. The I/O Board has connections for daisy chain configuration. The two signal pairs (RS485D+ and RS485D-) can be reversed.

Signal levels:

Standard RS485 communication levels.

Electrical interface on the J-Panel:

The signals are connected to J-Panel X15 pin 4 and 5. There are termination resistors on the board. See Figure 49 on page 53 for a description of the signal path.

6.3.3 (b) Trigger output

Description

The trigger output is balanced and the driver is a RS485 transmitter (LTC1480).

Signal levels

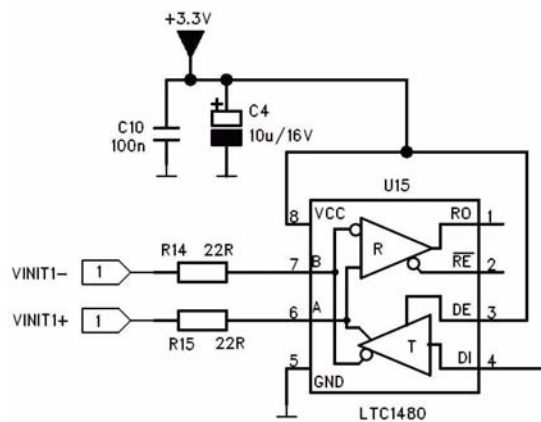
The signals are standard RS485 levels. The specification below is taken from Linear Technologies datasheet for LTC1480:

Table 21 Signal table

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OD1}	Differential Driver Output Voltage (Unloaded)	$I_O = 0V$	●		3.3	V
V_{OD2}	Differential Driver Output Voltage (with Load)	$R = 27\Omega$ (RS485) $R = 50\Omega$ (RS422)	●	1.5 2.0	3.3	V
ΔV_{OD}	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	$R = 27\Omega$ or $R = 50\Omega$	●		0.2	V
V_{OC}	Driver Common Mode Output Voltage	$R = 27\Omega$ or $R = 50\Omega$	●		2	V
V_{OH}	Receiver Output HIGH Voltage	$I_O = -4mA$, $V_{ID} = 200mV$	●	2		V
V_{OL}	Receiver Output LOW Voltage	$I_O = 4mA$, $V_{ID} = -200mV$	●		0.4	V

Electrical interface on the J-Panel:

Figure 68. J-panel electrical interface



6.3.3 (c) Ethernet Interface

100 Mb Ethernet interface. The signals are routed directly to RJ45 connector X12. The cable to the camera must be a Cat 5e or preferably a Cat 6 cable. The wire color marking on the PCB uses standard Ethernet wire colors.

6.3.3 (d) Power output

Voltage: 24VDC from power supply connected to X6 or X7
 Current: 2A fused

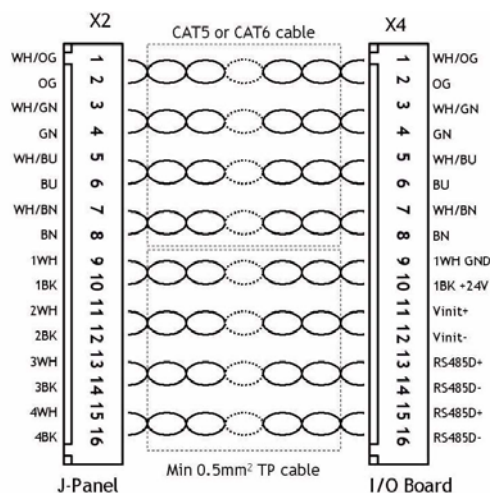
6.3.4 Connector physical Interface

Table 22 Ethernet physical connections

Pin	Signal	Description	Connection to I/O Board X4	Remarks
1	Ethernet A+	Ethernet signal to gigabit switch	pin 1	Cat5e/6 cable white/orange
2	Ethernet A-	Ethernet signal to gigabit switch	Pin 2	Cat5e/6 cable orange
3	Ethernet B+	Ethernet signal to gigabit switch	Pin 3	Cat5e/6 cable white/green
4	Ethernet B-	Ethernet signal to gigabit switch	Pin 4	Cat5e/6 cable green
5	Ethernet C+	Ethernet signal to gigabit switch	Pin 5	Cat5e/6 cable white/blue
6	Ethernet C-	Ethernet signal to gigabit switch	Pin 6	Cat5e/6 cable blue
7	Ethernet D+	Ethernet signal to gigabit switch	Pin 7	Cat5e/6 cable white/brown
8	Ethernet D-	Ethernet signal to gigabit switch	Pin 8	Cat5e/6 cable brown
9	Gnd	Power ground	Pin 9	Black wire in Red/Black pair
10	+24V dc	Supply voltage	Pin 10	Red wire in Red/Black pair
11	Vinit +	Balanced trigger pulse positive	Pin 11	White wire in Brown/White pair
12	Vinit -	Balance tripper pulse negative	Pin 12	Brown wire in Brown/White pair
13	RS485D+	RS485 Data+ for Lane Controller	Pin 13	White wire in Red/White pair
14	RS485D-	RS485 Data- for Lane Controller	Pin 14	Red wire in Red/White pair
15	RS485D=	RS485 Data+ for Lane Controller	Pin 15	White wire in Orange/White pair
16	RS485D-	RS485 Data- for Lane Controller	Pin 16	Orange wire in Orange/White pair

6.3.5 Typical Wiring diagram

Figure 69. Category 5 or 6 ethernet wiring diagram.



6.3.6 Indicators

There are two LED indicators mounted at the connector:

Table 23 LED indicators

LED label	LED color	Indication
Trig-1	Green	Indicates generation of trigger pulse to camera
	Off	No trigger pulse
LC DATA		LED not mounted
Power	Green	24V present at connector pin 10
	red	No 24V at connector pin 10

6.3.7 Switches

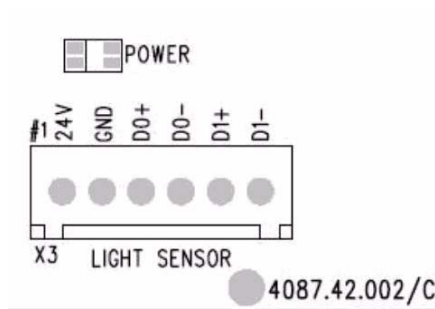
There are two switches located at the connector:

Table 24 Connector switches

Switch label	Switch color	Function
S1 TRIG CAM-1	Push bottom	Generates a trigger pulse to the camera
S5 TRIG POLARITY	Slide	Selects trigger polarity

6.4 X3: Light Sensor Connection

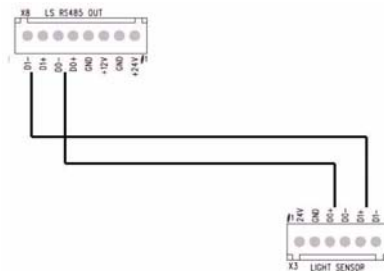
Figure 70. Light sensor indicator on the board



6.4.1 Functionality

The Light Sensor connector is labelled X3. The D0 and D1 RS485 bus is connected to X8 where the RS485 to ethernet converter is to be connected.

Figure 71. Light sensor connector



6.4.2 Connector specification

Connector type: 6 pole WAGO pluggable terminal block
 Connector on board: WAGO 734-236
 Cable part: WAGO 734-206

6.4.3 Connector signal specifications

6.4.3 (a) Power output

Voltage: 24V DC from power supply connected to X6 or X7
 Current: 2A fused

6.4.3 (b) Databus D0 and D1

D0 and D1 are RS485 databus signals from the light sensor.

6.4.4 Connector physical Interface

Table 25 Physical interface connections

Pin	Signal	Description	Connection to
1	24V dc	Power output	
2	Gnd	Power return	
3	D0+	RS485 databus D0+	
4	D0-	RS485 databus D0-	
5	D1+	RS485 databus D1+	
6	D1-	RS485 databus D1+	

6.4.5 Indicators

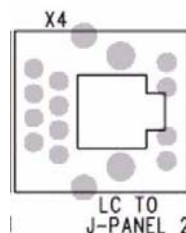
There are two LED indicators mounted at the connector:

Table 26 LED physical indicators

LED label	LED color	Indication
Power	Green	24V present at connector 1
	red	No 24V at connector pin 1

6.5 X4: Lane Controller Signal to J-Panel #2

Figure 72. Signal to J-panel #2



6.5.1 Functionality

Lane Controller RS485 signal to a second J-Panel. The Lane Controller connected to X15 pin 1 and pin 2 or a Lane Controller signal coming from another J-Panel can be connected by means of this connector. If no plug is inserted into the connector a build-in switch activates a 120 Ω termination resistor.

6.5.2 Connector specification

Connector type: 8 pole shielded RJ45
 Connector on board: Taitek/Kinsun ST3009S-880
 Cable part: Standard RJ45 connector

6.5.3 Connector signal specifications

Datasignal
 RS485 databus signals from the Lane Controller.

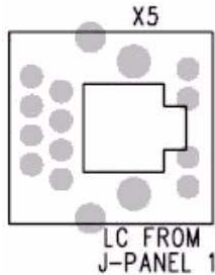
6.5.4 Connector physical Interface

Table 27 Physical connector table for J-panel 2.

Pin	Signal	Description	Connection to
1	RS485+	RS485 databus D+	
2	RS485-	RS485 databus D-	
3	-	NC	
4	-	NC	
5	-	NC	
6	-	NC	

6.6 X5: Lane Controller Signal from J-Panel #1

Figure 73. Signal from J-panel #1



6.6.1 Functionality

Lane Controller RS485 signal from a first J-Panel. If more than one J-Panel is connected to the same Lane Controller, the signal can be routed from J-Panel #1 X4 to J-Panel #2 X5.

6.6.2 Connector specification

Connector type: 8 pole shielded RJ45
 Connector on board: Taitek/Kinsun ST3009S-880
 Cable part: Standard RJ45 connector

6.6.3 Connector signal specifications

6.6.3 (a) Data signal

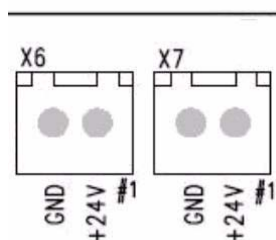
RS485 databus signals from a Lane Controller connected to another J-Panel . 6.6.4 Connector physical Interface

Table 28 Physical pin connections J-panel #1.

Pin	Signal	Description	Connection to
1	RS485+	RS485 databus D+	
2	RS485-	RS485 databus D-	
3	-	NC	
4	-	NC	
5	-	NC	
6	-	NC	

6.7 X6, X7: 24V DC Power

Figure 74. Signal from J-panel #1

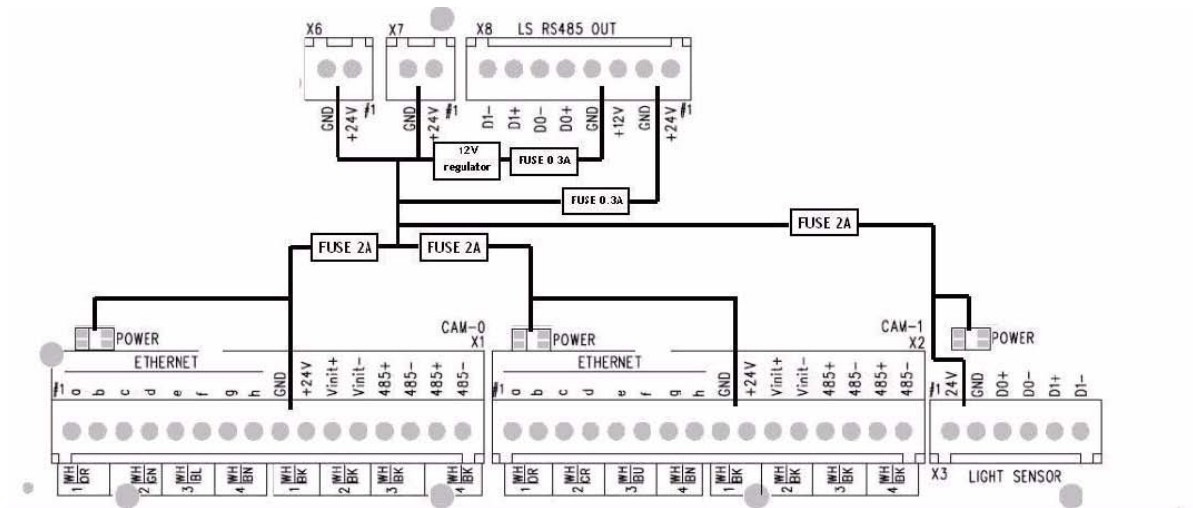


6.7.1 Functionality

The J-Panel has one input for 24V DC (X6). There is one unfused output (X7) and four fused outputs for Camera 0 (connector X1, fused 2A), Camera 1 (connector X2, fused 2A), Light Sensor (connector X3, fused 2A) and RS485-to-ethernet Converter (connector X8, fused 300mA).

It is possible to reset all fuses and they also reset automatically (PTC type) after removal of excessive load. The three power LED indicators are electrically located between the fuse and connector and the status of the fuse is therefore indicated on the LED: when the LED is green the load is ok, when the LED is red an overload condition is present.

Figure 75. Principle in the power distribution.



6.7.2 Connector specification

Connector type: 2 pole WAGO pluggable terminal block

Connector on board: WAGO 734-232

Cable part: WAGO 734-202

6.7.3 Connector signal specifications

24V DC power input. The two connectors are connected in parallel (unfused).

Maximum total current to X1, X2, X3 and X8: 6,3 A (fused value)

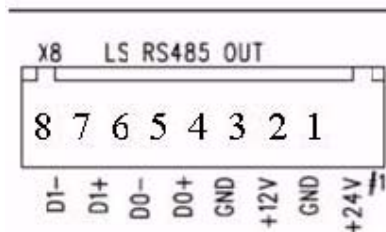
6.7.4 Connector physical Interface

Table 29 Physical connection for pins.

Pin	Signal	Description	Connection to
1	+24V	+24V DC	24V DC power supply
2	GND	+24V return	24V DC power supply

6.8 X8: RS485 signal to Ethernet interface

Figure 76. RS485 to Ethernet



6.8.1 Functionality

Interface to RS485-to-Ethernet converter. The signals come from the Light Sensor connection (X3). Two power outputs for supplying the converter are available.

6.8.2 Connector specification

Connector type: 8 pole WAGO pluggable terminal block
 Connector on board: WAGO 734-238
 Cable part: WAGO 734-208

6.8.3 Connector signal specifications

6.8.3 (a) Power output

Voltage: 24 V DC from power supply connected to X6 or X7
 12 V DC from regulator on board
 Current: 0.3A fused

6.8.3 (b) Databus D0 and D1

D0 and D1 are RS485 databus signals from the light sensor.

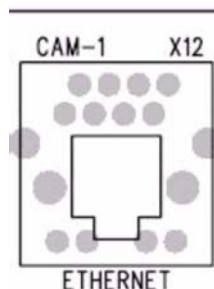
6.8.4 Connector physical Interface

Table 30 RS485 physical connections

Pin	Signal	Description	Connection to
1	24V dc	24v Power output	
2	Gnd	Power return	
3	+12V dc	12V power output	
4	Gnd	Power return	
5	D0+	RS485 databus D0+	
6	D0-	RS485 databus D0-	
7	D1+	RS485 databus D1+	
8	D1-	RS485 databus D1+	

6.9 X11: Ethernet Interface from Camera 0

Figure 77. Interface from Camera 0



6.9.1 Functionality

Ethernet interface from Camera 0 to Ethernet switch.

6.9.2 Connector specification

Connector type: 8 pole shielded RJ45
 Connector on board: Taitek/Kinsun ST3009S-880
 Cable part: Standard RJ45 connector

6.9.3 Connector signal specifications

6.9.3 (a) Data signal

Ethernet signals on two pairs (Rx and Tx).

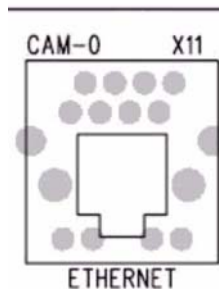
6.9.4 Connector physical Interface

Table 31 Physical connector description

Pin	Signal	Description	Connection to
1	Ethernet A+	Ethernet signal	Gigabit switch
2	Ethernet A-	Ethernet signal	Gigabit switch
3	Ethernet B+	Ethernet signal	Gigabit switch
4	(Ethernet C+)	Ethernet signal	Gigabit switch
5	(Ethernet C-)	Ethernet signal	Gigabit switch
6	Ethernet B-	Ethernet signal	Gigabit switch
7	(Ethernet D+)	Ethernet signal	Gigabit switch
8	(Ethernet D-)	Ethernet signal	Gigabit switch

6.10 X12: Ethernet Interface from Camera 1

Figure 78. Interface from Camera 1



6.10.1 Functionality

Ethernet interface from Camera 1 to Ethernet switch.

6.10.2 Connector specification

Connector type: 8 pole shielded RJ45
 Connector on board: Taitek/Kinsun ST3009S-880
 Cable part: Standard RJ45 connector

6.10.3 Connector signal specifications

6.10.3 (a) Data signal

Ethernet signals on two pairs (Rx and Tx) .

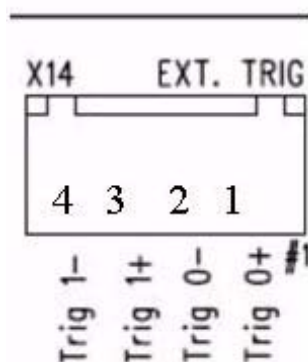
6.10.4 Connector physical Interface

Table 32 Pin connections for Ethernet from Camera 1.

Pin	Signal	Description	Connection to
1	Ethernet A+	Ethernet signal	Gigabit switch
2	Ethernet A-	Ethernet signal	Gigabit switch
3	Ethernet B+	Ethernet signal	Gigabit switch
4	(Ethernet C+)	Ethernet signal	Gigabit switch
5	(Ethernet C-)	Ethernet signal	Gigabit switch
6	Ethernet B-	Ethernet signal	Gigabit switch
7	(Ethernet D+)	Ethernet signal	Gigabit switch
8	(Ethernet D-)	Ethernet signal	Gigabit switch

6.11 X14: External Trigger

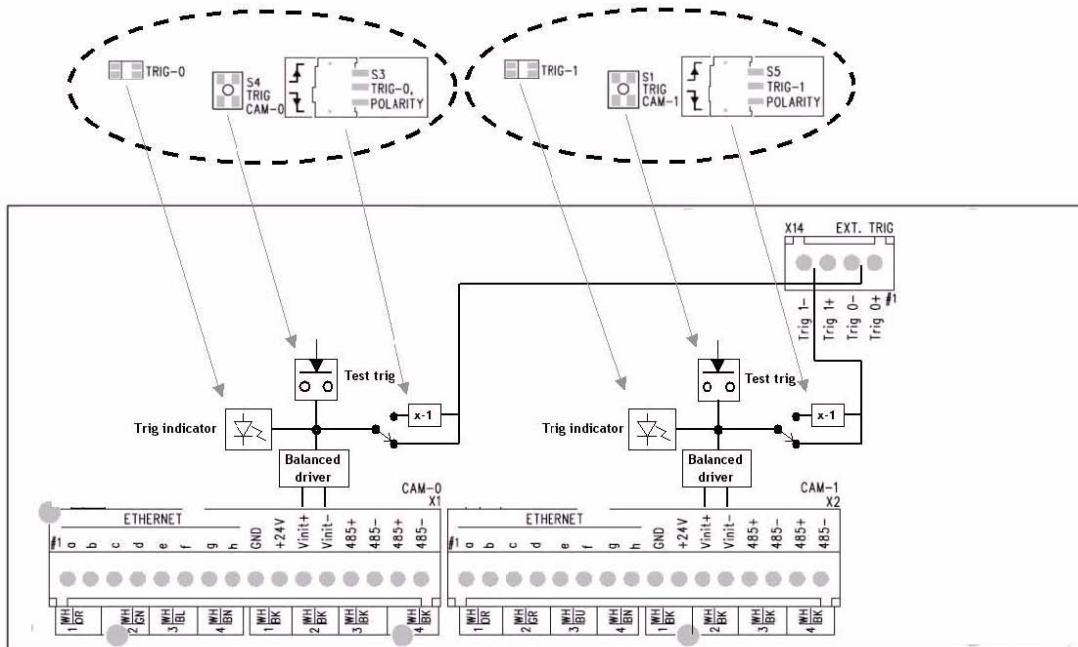
Figure 79. External Trigger connection.



6.11.1 Functionality

The trigger inputs on the J-Panel are galvanically isolated by optocouplers in the input. The trigger polarity can be selected on S3 and S5. Push button switches S1 and S4 are found for generating test trigger pulses. The presence of a trigger pulse is indicated on the green LED's marked TRIG-0 and TRIG-1.

Figure 80. Trigger polarity



6.11.2 Connector specification

Connector type: 4 pole WAGO pluggable terminal block

Connector on board: WAGO 734-234

Cable part: WAGO 734-204

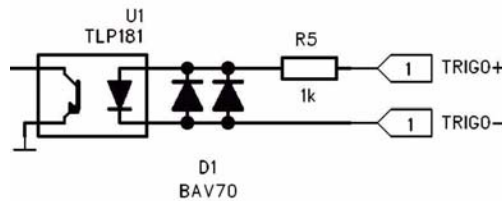
6.11.3 Connector signal specifications

6.11.3 (a) Signal levels

Input signal amplitude 3-24 V Input current app. 1-20 mA

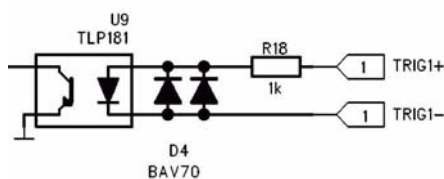
6.11.3 (b) Trigger 0 Electrical interface on the J-Panel

Figure 81. Trigger 0



6.11.3 (c) Trigger 1 Electrical interface on the J-Panel

Figure 82. Trigger 1



6.11.4 Connector physical Interface

Table 33 Connector table

Pin	Signal	Description	Connection to
1	Trig0+	Positive trigger input to camera 0	
2	Trig0-	Negative trigger input to camera 0	
3	Trig1+	Positive trigger input to camera 1	
4	Trig1-	Negative trigger input to camera 1	

6.12 X15: Lane Controller interface

6.12.1 Functionality

The signal path for the Lane Controller is shown in Figure 83. The signal lines symbolizes the two balanced RS485 wires.

6.12.1 (a) Common Lane Controller

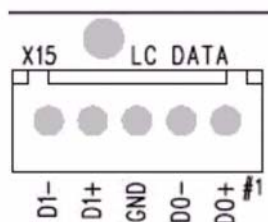
If one lane controller is to be connected to camera 0 and camera 1, LC DATA terminals labelled D0 on X15 is used.

The signal runs to Camera 0 and is daisy chained back. When S2 is in position "OPEN" D0 is connected to Camera 1 and daisy chained back to connector X4. X4 has connection to a termination resistor that is activated when no plug is inserted into X4. If more J-Panels are to be connected to the same lane controller, see Figure 6.12.5.

6.12.1 (b) Two Lane Controllers

If separate lane controllers are to be connected to the two cameras, databus D0 is connected to Camera #0 and databus D1 is connected to Camera #1. Switch S2 must then be in position "TERM". The 120 Ω termination resistor is then connected between the RS485 wires.

Figure 83. Lane controller setup diagram.



6.12.2 Connector specification

Connector type: 5 pole WAGO pluggable terminal block

Connector on board: WAGO 734-235

Cable part: WAGO 734-205

6.12.3 Connector signal specifications

D0 and D1 are RS485 data bus signals from the Lane Controller.

6.12.4 Connector physical Interface

Table 34 WAGO physical interface

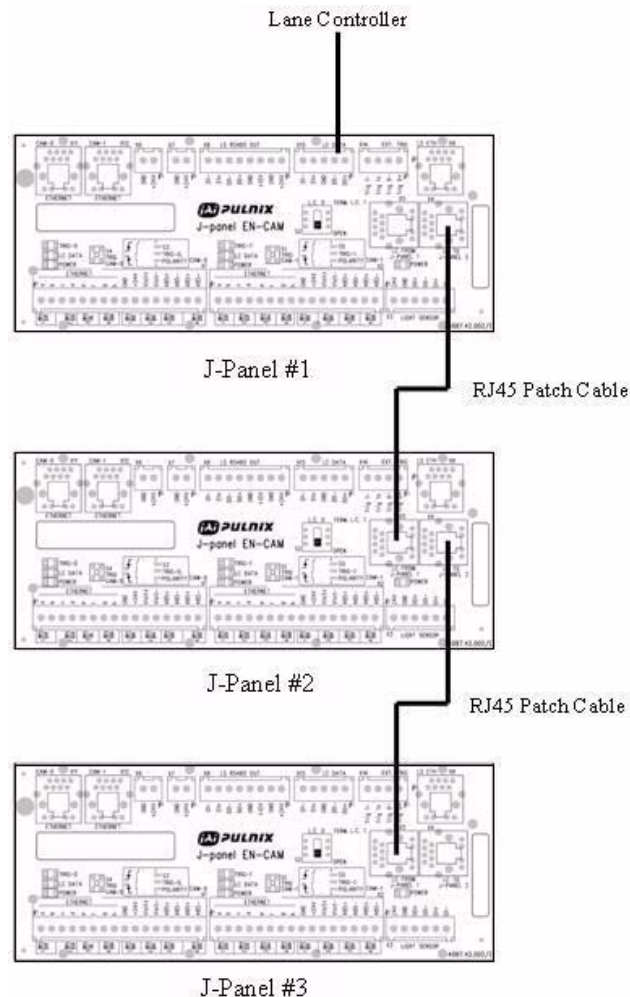
Pin	Signal	Description	Connection to
1	D0+	RS485 databus D0+	
2	D0-	RS485 databus D0-	
3	Gnd		
4	D1+	RS485 databus D1+	
5	D1-	RS485 databus D1-	

6.12.5 Connecting Lane Controller RS485 signal between J-Panels

The Lane Controller RS485 signal is connected from one J-Panel to another by connecting RJ45 Patch cables between X4 on the source J-Panel to X5 on the receive J-Panel. The RJ45 connectors have build-in switch function to disconnect the termination resistor when the plug is inserted. When no plug is inserted into the X4 connector the line is terminated with 120 Ω .

The Lane Controller is connected to D0 on X15 J-Panel #1.

Figure 84. Lane controller setup.

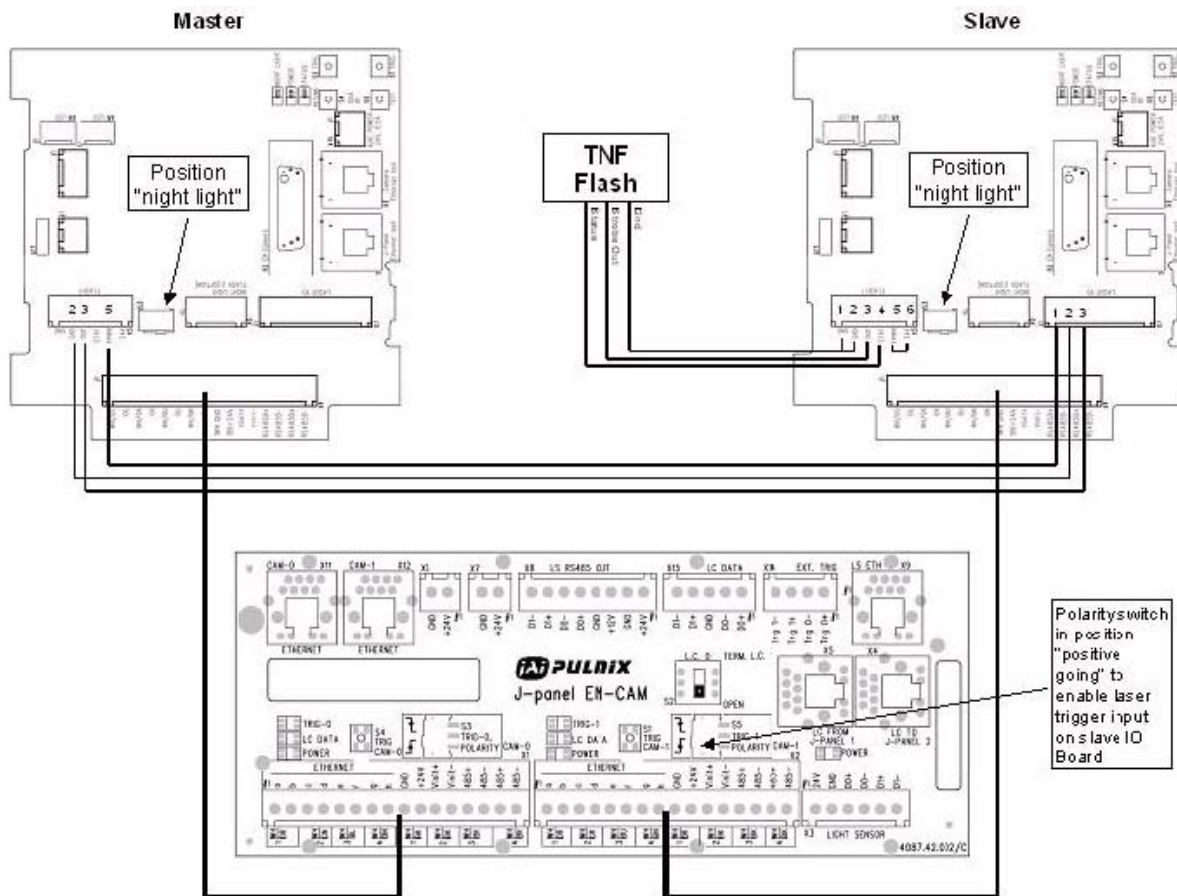


7 Appendix C: Two Cameras, One Flash Configuration

Figure 7.1 shows how to connect one flash to two VIS CAM 300 cameras. The flash output from camera 0, the master camera, is connected to the laser trigger input on camera 1, the slave camera. The Flash unit is connected to the slave camera.

The flash output must always be enabled on the master camera. The flash output on the slave camera is setup as normal (controlled by the values from the light sensor).

Figure 85. Two camera, one flash, configuration.



Three wires are connected from the flash connector on the IO Board of the Master camera to the laser (LVD) connector on the IO Board of the Slave camera:

Table 35 Master to slave connections.

Master Flash Connector (X5)	Slave Laser Connector (X7)
Pin 2	Pin 2
Pin 3	Pin 3
Pin 5	Pin 1

- Junction Panel trigger polarity switch in position “positive going edge”
- Master camera flash must be set to “auto” in Properties section of ENSetup software
- Slave camera flash must be set to “light sensor control” in properties section of ENSetup software

8 Appendix D: Pluggable Terminal Blocks

The connectors on the VIS CAM 300 IO Board and J-Panel are pluggable terminal blocks with pin spacing of 3.81 mm/ 0.15 inch from WAGO. The contacts are spring loaded.

Figure 86. Terminal block



Table 36 Essential specifications for the pluggable terminal block.

Cross section from [mm ²]	0,08 mm ²
Cross section to [mm ²]	1,5 mm ²
Cross section from [AWG]	28 AWG
Cross section to [AWG]	14 AWG
Measured voltage EN	250 V
Measured shock voltage	2,5 kV
*Pollution degree	2
Current intensity EN	10 A
Strip length from	7 mm
Strip length to	7 mm
Strip length	0,28 in

When mounting the wire into the connector the wire is stripped 7mm. The connector spring is released by using one of two tools:

WAGO 734-230
JAI 2900.00.249



WAGO 210-250
JAI 2900.00.250



The wire is inserted and the spring is activated.

9 Appendix E: Moxa N-Port 5232 Configuration

Configuration of the Moxa N-Port server is done through a standard web-browser or using Telnet.

If you are unfamiliar with the configuration terms, please consult the enclosed Moxa N-Port server manual.

To carry out the configuration using Internet Explorer, type the IP-address of the unit in the address field:

http://192.168.127.254 <CR>

You should now be able to configure the unit through the embedded web-server.

To carry out the configuration using Telnet, open the command prompt window - type the following:
Telnet 192.168.127.254 <CR>

You should now be able to configure the unit through the Telnet interface.

The necessary settings will be listed under its designated sub-menu. The items underlined in bold italics (example - Delimiter: D) must be configured as described.

Basic Settings:

Server name:	<i>Enter the desired name for the N-Port server.</i>
Time zone:	<i>Enter the correct time zone for the system location.</i>
Local time:	<i>Enter the correct time for the system location.</i>
Time server:	<i>Enter IP-Address or domain name for the desired time server.</i>
Web console:	<i>Enables / Disables the web configuration utility.</i>
Telnet console:	<i>Enables / Disables the Telnet configuration utility.</i>

Figure 87. Standard configuration of Basic Settings:



Basic Setting

Server name: TLS200

Time

Time zone: (GMT+01:00)Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna

Local time: 2005 / 7 / 13 12 : 49 : 43
Modify

Time server:

Console

Web console: Enable Disable

Telnet console: Enable Disable

Submit

Network Settings:

- IP address: *Enter the desired IP address of the unit. The default address from the factory is 192.168.127.254 unless otherwise specified.*
- Netmask: *Enter the subnet mask of the unit. The default subnet mask from the factory is 255.255.255.0 unless otherwise specified.*
- Gateway: *Enter the default gateway of the unit.*
- IP Configuration: *Specify whether the unit uses static or dynamic IP address.*
- DNS Server 1 *Specify primary DNS server to be used by the unit.*
- DNS Server 2 *Specify secondary DNS server to be used by the unit.*
- SNMP. *Enables / Disables the SNMP protocol.*
- Auto report to IP: Reports generated by the auto report function will be automatically be forwarded to IP address specified in this field.
- Auto report to TCP Port: Specify the TCP port number for the auto report function. The default port is 4002.
- Auto report period: Time interval for error reporting.

Figure 88. Standard configuration of Network Settings:

Network Settings	
IP address	192.168.127.254
Netmask	255.255.255.0
Gateway	
IP configuration	Static <input type="checkbox"/>
DNS server 1	
DNS server 2	
SNMP Setting	
SNMP	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
Community name	public
Contact	
Location	
IP Address report	
Auto report to IP	
Auto report to TCP port	4002
Auto report period	10 seconds
<input type="button" value="Submit"/>	

Serial port 1 settings:

Port alias:	D1 - enter desired name of this specific serial port.
Baud rate:	9600 - specify the desired baud rate of the serial port - the TLS200 light sensor requires 9600 as standard.
Data bits:	8 - specify the desired size of the data bits used - the TLS200 light sensor requires 8 as standard.
Stop bits:	2 - Specify the desired size of the stop bits used - the TLS200 light sensor requires 2 as standard.
Parity:	None - feature not used in communication with the light sensor.
Flow control:	None - feature not used in communication with the light sensor.
Fifo:	Enable - the TLS200 light sensor requires FIFO as standard.
Interface:	RS-485 2wire - the communication with the TLS-300 light sensor is standard 2-wire RS-485.

Enable - apply the above settings to all serial ports - rename port 2 port alias to D0.

Figure 89. Standard configuration of Serial settings for port 1:



Serial Settings	
Port = 01	
Port alias	D1
Serial Parameters	
Baud rate	9600
Data bits	8
Stop bits	2
Parity	None
Flow control	None
FIFO	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
Interface	RS-485 2Wire
<input checked="" type="checkbox"/> Apply the above settings to all serial ports	
Submit	

Figure 90. Standard configuration of Serial settings for port 2:

Serial Settings

Port = 02

Port alias:

Serial Parameters

Baud rate:

Data bits:

Stop bits:

Parity:

Flow control:

FIFO: Disable Enable

Interface:

Apply the above settings to all serial ports

To make sure that both serial channels are identically configured - check the serial settings sub-menu in the Moxa N-Port server.

Figure 91. Configuration overview of serial port 1 and 2.

Serial Settings								
	Alias	Baud rate	Data bits	Stop bits	Parity	FIFO	Flow ctrl	Interface
Port 1	D1	9600	8	2	None	Enable	None	RS-485 2Wire
Port 2	D0	9600	8	2	None	Enable	None	RS-485 2Wire

Operating settings port 1:

- Operation mode: *TCP* - specify the operation mode of the serial channel - currently TCP is required for communication with the TLS200 light sensor - UDP will be implemented in the nearer future.
- TCP alive check time: *1* - Specify the alive time for the TCP communication.
- Inactivity time: *0* - Specify the timeframe for closing an idle serial line.
- Max connections: *4* - Specify the amount of simultaneous TCP connections.
- Ignore jammed IP *Yes*
- Allow driver control *No*

Data Packing

- Delimiter 1: *D* - Specify the size of the delimiter (entry in Hex).
- Force transmit: *30* - Specify the time frame for forced transmit (entry in mS).

TCP Server Mode

- Local TCP port: *4001* - Specify the broadcast port. 4001 is default.
- Command port: *966* - Specify the command port. 966 is default.

Figure 92. Operation configuration of Serial port 1:

Operating Settings

Port = 01	
Operation mode	TCP Server Mode
TCP alive check time	1 (0 - 99 min)
Inactivity time	0 (0 - 65535 ms)
Max connection	4
Ignore jammed IP	<input type="radio"/> No <input checked="" type="radio"/> Yes
Allow driver control	<input checked="" type="radio"/> No <input type="radio"/> Yes
Data Packing	
Packing length	0 (0 - 1024)
Delimiter 1	d (Hex) <input checked="" type="checkbox"/> Enable
Delimiter 2	0 (Hex) <input type="checkbox"/> Enable
Delimiter process	Do Nothing (Processed only when Packing length is 3)
Force transmit	30 (0 - 65535 ms)
TCP Server Mode	
Local TCF port	4001
Command port	966
<input type="checkbox"/> Apply the above settings to all serial ports (Local listen port will be enumerated automatically).	
<input type="button" value="Submit"/>	

Figure 93. Operation configuration of Serial port 2:

Operating Settings

Port=02

Operation mode	TCP Server Mode
TCP alive check time	1 (0 - 99 min)
Inactivity time	0 (0 - 65535 ms)
Max connection	4
Ignore jammed IP	<input type="radio"/> No <input checked="" type="radio"/> Yes
Allow driver control	<input checked="" type="radio"/> No <input type="radio"/> Yes

Data Packing

Packing length	0 (0 - 1024)
Delimiter 1	d (Hex) <input checked="" type="checkbox"/> Enable
Delimiter 2	0 (Hex) <input type="checkbox"/> Enable
Delimiter process	Do Nothing (Processed only when Packing length is 0)
Force transmit	30 (0 - 65535 ms)

TCP Server Mode

Local TCP port	4002
Command port	967

Apply the above settings to all serial ports (Local listen port will be enumerated automatically).

To make sure that operation mode of both serial channels are identically configured - check the operating settings sub-menu in the Moxa N-Port server.

Figure 94. Configuration overview of operating settings for serial port 1 and 2.

Operating Settings

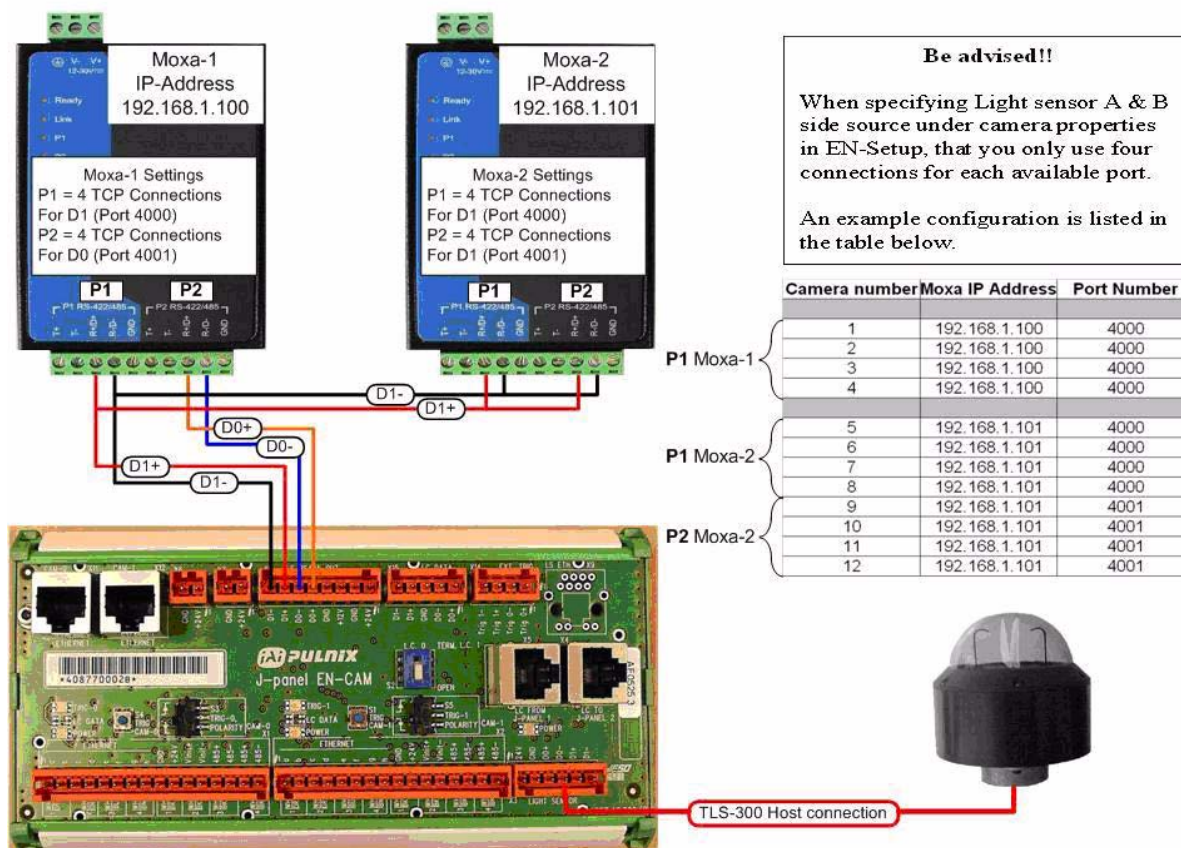
Operating Settings						
	Operating mode	TCP alive check time	Inactivity time	Delimiter 1	Delimiter 2	Force transmit
Port 1	TCP Server Mode	7	0	D (Enable)	0 (Disable)	30
		Max connection: 4 Local TCP port = 4001 Command port = 966				
Port 2	TCP Server Mode	7	0	D (Enable)	0 (Disable)	30
		Max connection: 4 Local TCP port = 4002 Command port = 967				

10 Appendix F: Multiple Moxa N-port Configuration Diagram

One Moxa N-port Device Server is capable of accommodating a maximum of four concurrent connections on port 1. (Port 2 is reserved for control). Whenever more than four cameras are pointed to one Light Sensor, it is necessary to connect multiple Moxa N-ports in parallel to support the number of cameras being deployed. The second Moxa is capable of eight concurrent connections (four on each port).

Figure 95. Moxa configuration example.

Moxa configuration example for 12 simultaneous TCP-Camera connections



*) 120 Ω termination resistors are mounted across R+ and R- on Moxa-2 (see Section 3.3.4 on page 25)

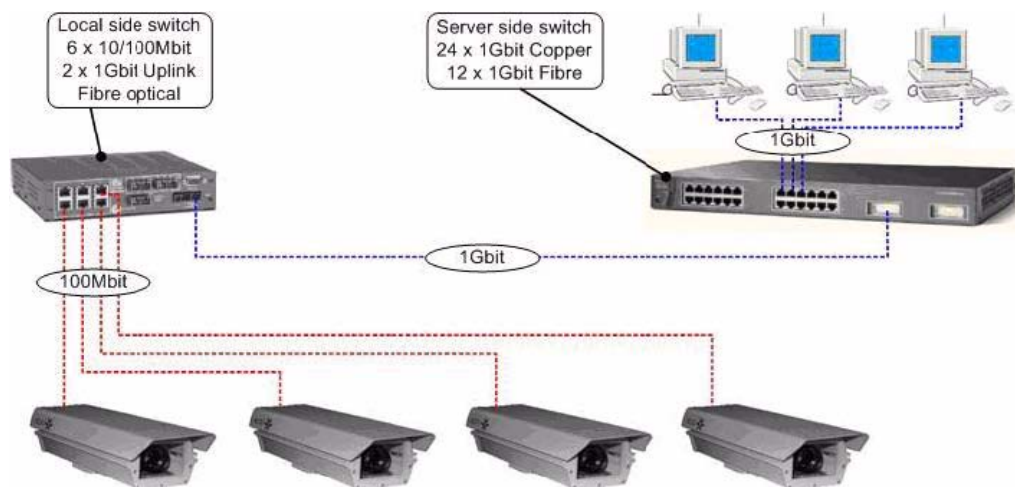
11 Appendix G: Ethernet Requirements.

The Ethernet media is the key component for data transmission in the VIS-300/400 system.

In order to ensure a smooth running system, install the Ethernet infrastructure with the following considerations in mind:

- Physical cabling - minimum Cat 5E is recommended - in larger systems, Cat 6 or fiber optic cables are recommended for backbones with high traffic loads. It is strongly recommended, that the quality of the installed Ethernet cabling is verified with a suitable network tester (certifier) such as Fluke Optiview, Fluke Etherscope, Lantek 6 or similar.
- Network speed - The minimum speed required is 100 Mbit - though 1000 Mbit (1Gbit) is the optimal speed and ensures sufficient bandwidth in most applications. In general, assessment of network speed is an important issue, and should have been taken into consideration in the design phase. The transmission speed on a local gantry with (for example) 4 EN-Camera units, could very well be based on a 100 Mbit network topology which then is linked externally with a 1 Gbit FO (Fiber Optic) uplink to the server location - see Figure 96

Figure 96. Network cabling example:



- The actual traffic load that the individual cameras inflict on the network depends heavily on the cameras current run mode - in a normal operable system, the cameras run in asynchronous mode, which means that the cameras only grab images when triggered. Converted to network load, asynchronous image triggering with a rate of 3600 incidents per hour (a car per second) will typically inflict a 3-4% load per camera on a 100 Mbit network. If the same camera is set to synchronous mode, which is the mode typically used during alignment and diagnostics procedures, the camera grabs the images with a speed of approximately 10 images per second (measured on a 1.4 Ghz Intel Centrino based laptop) - the load will now rise to around 30% per camera. Even the drastic increase in network load when using synchronous mode, will normally not be a problem, since the mode is only applied to the cameras of interest.

Throughput per lane: Four (4) vehicles per second for a five (5) second burst rate - not indefinitely sustainable. One vehicle per second sustainable indefinitely.

12 Appendix H: Troubleshooting

Table 37 Troubleshooting table.

Fault Symptom	Check/Possible Reason
Flash fires only every second time	Switch S3 on VIS CAM I/O Board is in position "Flash 2" and only one flash is installed to the camera. Set switch S3 to position "NIGHT L."
Camera(s) does not trigger	Switch S3 and/or S5 is set to the wrong trigger polarity. Please refer to section 3.3.6 for setting the switches.
Laser connected to IO board connector X7 does not trigger the camera	Check that switch S3 and/or S5 is set to "positive going" (pushed towards X1/X2 connector) on the J-Panel.





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