



# **T4x-Series Hardware Guide**

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## T4x-Series™ Hardware Guide

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## REFERENCES

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### CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using a T4x-Series camera.

"Camera" refers to a T4x-Series camera (T40, T47, or T49).

"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain, or troubleshoot a T4x-Series camera.

### REFERENCE DOCUMENTATION

For further details refer to the Impact Reference Guide provided as supplementary documentation on the installation CD.

### SERVICE AND SUPPORT

DLA provides several services as well as technical support through its website. Log on to **www.datalogic.com** and click on one of the following links for further information:

- **PRODUCTS**

Search through the links to arrive at your product page which describes specific Info, Features, Applications, Models, Accessories, and specific Downloads.

- **SUPPORT & SERVICES**

- Service Program
- Repair Centers
- On-Line RMA
- Technical Support
- Industrial Automation
- Partner Program
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### PATENTS

This product is covered by one or more of the following patents:

Design patents: EP 1,950,486.

Utility patents: US6,512,218 B1; US6,616,039 B1; US6,808,114 B1; US6,997,385 B2; US7,053,954 B1; US7,102,116 B2; US7,282,688 B2; US7,387,246 B2; US7,433,590 B2; US7,468,499 B2; US8,058,600 B2; US8,113,430 B2; EP996,284 B1; EP999,514 B1; EP1,014,292 B1; EP1,128,315 B1; EP1,396,811 B1; EP1,413,971 B1; EP1,804,089 B1; JP4,435,343 B2; CN ZL200680050007.8.

Additional patents pending.

## COMPLIANCE

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For installation, use, and maintenance, it is not necessary to open the camera. Opening the camera will void the warranty.

Connect Ethernet and dataport connections to a network which has routing only within the plant or building and no routing outside the plant or building.

## EMC COMPLIANCE

In order to meet the EMC requirements:

- connect the camera chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm;
- for CBX connections, connect the pin "Earth" to a good Earth Ground;
- for direct connections, connect the main interface cable shield to pin K of the 19-pin connector.

## POWER SUPPLY

ATTENTION: READ THIS INFORMATION BEFORE INSTALLING THE PRODUCT

This product is intended to be installed by Qualified Personnel only.

This product is intended to be connected to a UL Listed Direct Plug-in Power Unit marked LPS or "Class 2", rated 10-30Vdc 1-0.33A.

## CE COMPLIANCE

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

## FCC COMPLIANCE

Modifications or changes to this equipment without the expressed written approval of DLA could void the authority to use the equipment.

This device complies with PART 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference which may cause undesired operation.

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

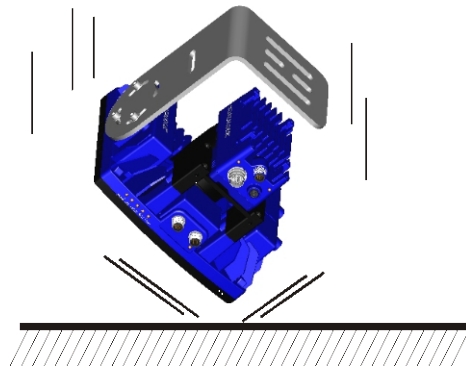
## HANDLING

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The T4x-Series™ camera is designed to be used in an industrial environment and is built to withstand vibration and shock when correctly installed. However, it is also a precision product and therefore it must be handled correctly before and during installation to avoid damage.

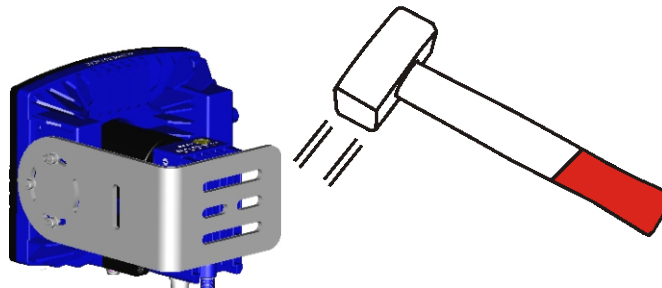
- Avoid dropping the camera (exceeding shock limits).

# NO

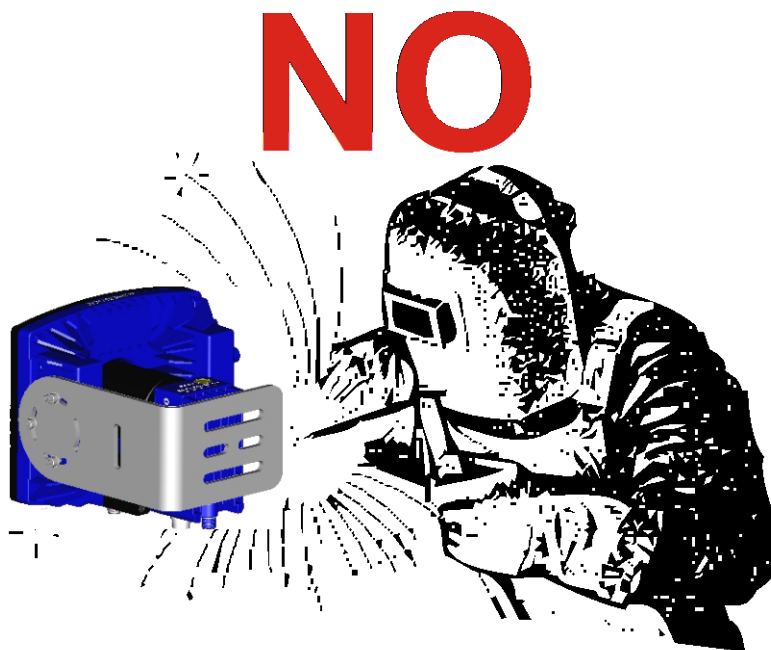


- Do not fine tune the positioning by striking the camera or bracket.

# NO



- Do not weld the camera into position. This can cause electrostatic, heat, or imager damage.



- Do not spray paint near the camera. This can cause imager damage.

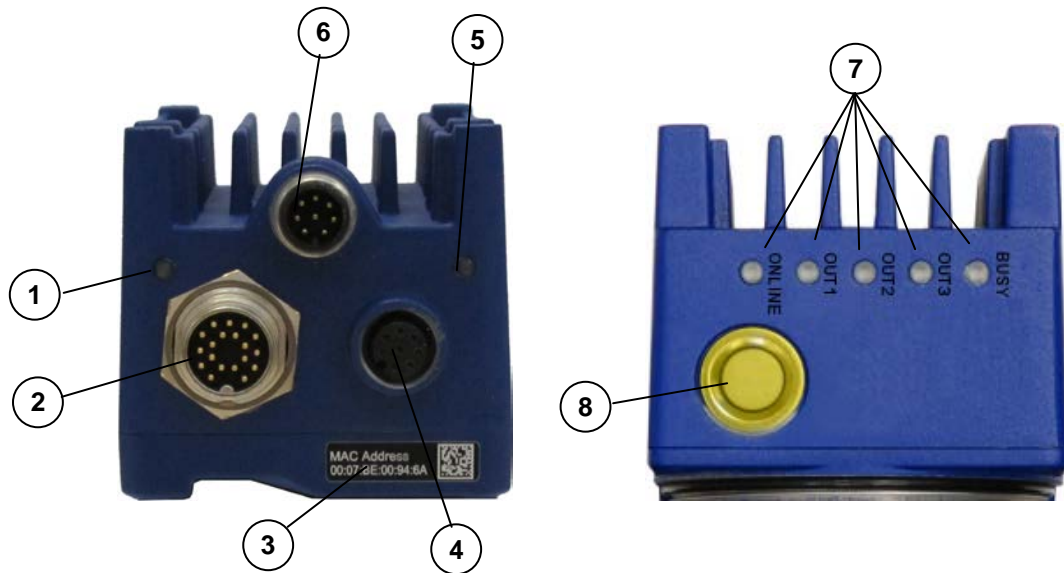




## GENERAL VIEW

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### T4x-Series™ Camera



1	Power Indicator LED
2	Power, Serial Interface, and I/O Connector
3	MAC Address label
4	Ethernet Connector
5	Ethernet Network Presence LED
6	Not Used – No Connection
7	Indicator Lights (see page 6)
8	Reset and Camera Button Event (see page 6)



# 1 RAPID CONFIGURATION

## STEP 1 – ASSEMBLE THE CAMERA

The first step to perform is to assemble any accessories that make up the T4x-Series™ camera. A lens must be used. A strobe or other external illuminator may be required.



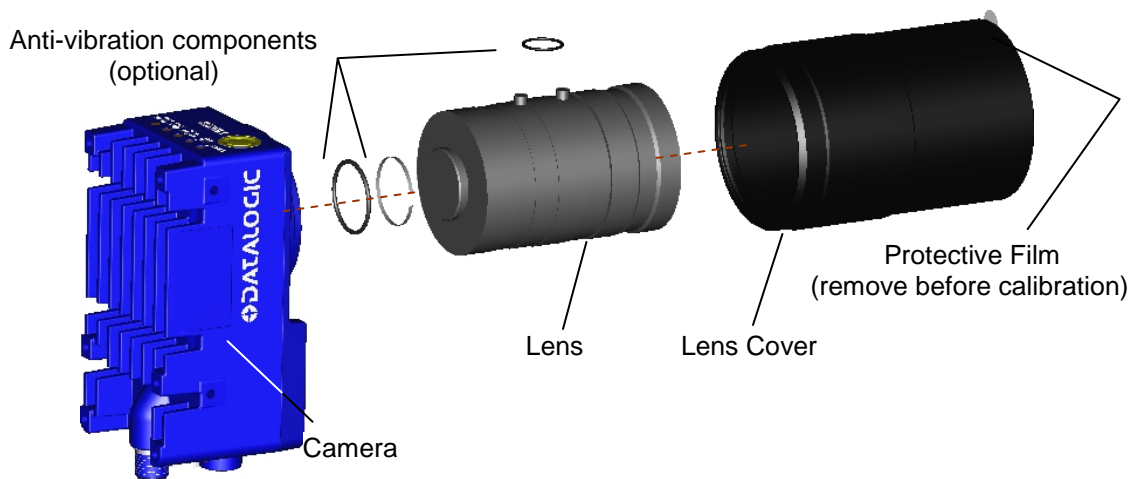
*The camera must be disconnected from the power supply during this procedure.*

1. In a dust-free environment, remove the Camera Lens Cover by unscrewing it.



*Do not touch the sensor aperture, lens glass or lens cover glass. These areas must be kept clean. Avoid any abrasive substances that might damage these surfaces during cleaning.*

2. Remove the sensor protection label (dust cap) by pulling it off of the base.
3. Mount a lens by slowly screwing it onto the base until it arrives at the mechanical stop.



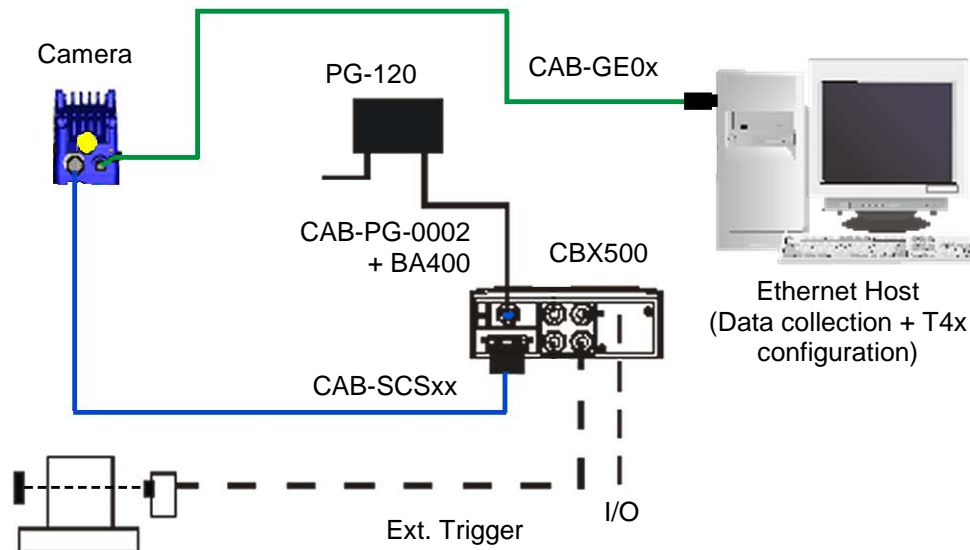
**Figure 1 – Assembling the Camera and Lens**

4. To keep dust and dirt off of the lens during mounting, temporarily replace the lens cover.

## STEP 2 – CONNECT THE SYSTEM

In the typical standalone layout shown in the figure below, an Ethernet host is connected to the camera. The camera can use an external trigger to signal image acquisition.

The CBX is used to facilitate the connection between the camera and the host interface, external trigger, and optional input and output devices.



**T4x-Series™ Standalone Layout to Ethernet Host**

- **Power Supply Connection**

Use the PG-120 power Kit (3 versions for European, UK or US plug) and CAB-PG-0002 + BA400 connector to connect the PG-120 to the CBX. An alternative power supply to the PG-120 is the PWR-120.

- **CBX Connection**

Use CAB-SCSxx between the T4x-Series camera and the CBX for power, external trigger device (photocell), and additional I/O connections.

Use the CAB-GE0x for the Gigabit Ethernet connection to the host.



**NOTE**

*The T4x-Series does not support sourcing power towards the CBX in order to power I/O devices. These devices must be powered through the CBX or from an external source.*

## CBX500 Terminals for T4x-Series™

The table below gives the CBX500 terminal block connectors. Use this table when the camera is connected using the CBX500.

CBX500 Terminal Block Connectors			
Input Power		Outputs	
Vdc	Power Supply Input Voltage +	+V	Power Source - Outputs
GND	Power Supply Input Voltage -	-V	Power Reference - Outputs
Earth	Protection Earth Ground	O1+	Output 1 +
		O1-	Output 1 -
Inputs		O2+	Output 2 +
+V	Power Source – External Trigger	O2-	Output 2 -
I1A	External Trigger + or - (polarity insensitive)	O3A	Strobe + / Output 3 + (See Note)
I1B	External Trigger + or - (polarity insensitive)	O3B	Strobe - / Output 3 -
-V	Power Reference – External Trigger	RS232 Interface	
+V	Power Source – Inputs	TX	Transmit
I2A	Input 2 + or - (polarity insensitive)	RX	Receive
I2B	Input 2 + or - (polarity insensitive)	SGND	Signal Ground
I3A	NOT USED		
I4A	NOT USED		
I34B	NOT USED		
-V	Power Reference – Inputs		
Shield			
Shield	Network Cable Shield		

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.



*Do not connect GND and SGND to different (external) ground references. GND and SGND are internally connected through filtering circuitry which can be permanently damaged if subjected to voltage drops over 0.8 Vdc.*

## **STEP 3 – MOUNT AND POSITION THE CAMERA**

1. Mounting solutions are provided in Chapter 3 of this Hardware Guide.

## **STEP 4 – FOCUS THE CAMERA**

1. Remove the lens cover.
2. Attach the correct accessory lens for your application.
3. Replace the lens cover, if needed.
4. Power the camera on. On the connector side of the camera near the cable, the “POWER ON” LED (blue) indicates the camera is correctly powered.
5. Start Impact Vision Program Manager (VPM) and use it to connect to the camera.
6. Direct the camera toward a correctly lighted calibration image or other clearly defined object.
7. Select the Settings tab, then click the Camera system object.
8. In the Camera Setup tab, click the Live button.
9. Adjust the lens until the image is clearly in focus in the VPM image window.

## **STEP 5 – CALIBRATE IMAGE DENSITY**

In order to function correctly when inspecting images, the camera needs the image resolution or PPI (pixels per inch). This calibration procedure is necessary for first time installation, if the lens type is changed, or if the focal distance is changed.

There are several methods available for calibrating the camera. Refer to the Calibration Panel section of the Impact Reference Guide (Publication # 843-0093) for complete details.

## 2 INTRODUCTION

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### 2.1 PRODUCT DESCRIPTION

The T4x-Series™ consists of 3 models—T40, T47, and T49. All models feature a 1.1 GHz processor, 256 megabytes of flash memory, integrated Gigabit Ethernet, and a right-angle mount.

The T40 provides a 640 x 480 pixel image at 60 frames per second using a 1/3" CCD imager.

The T47 provides a 1600 x 1200 pixel image at 15 frames per second using a 1/1.8" CCD imager.

The T49 provides a 2456 x 2058 pixel image at 15 frames per second using a 2/3" CCD imager.

#### **Excellent Performance**

- Up to 5.0 MPixels
- Adjustable focus through C-Mount lenses
- Frame Rate up to 60 frames/sec
- Partial Scan capabilities for higher frame rate

#### **Flexible Solution**

- Modular design
- Adjustable C-Mount lenses
- Complete set of Accessories like external lighting systems, mounting brackets, connection boxes, cables, and photocells
- Ethernet Connectivity to the host processor PC for parameter configuration, inspection program development, and data and image transfer.
- General purpose optocoupled I/Os

#### **Industrial Strength**

- Industrial compact camera
- Rugged full metal construction
- Sealed circular connectors
- IP65 protection class
- 45 °C (113 °F) max operating temperature
- Supply voltage ranges from 10 to 30 Vdc

## 2.2 INDICATORS AND KEYPAD BUTTON

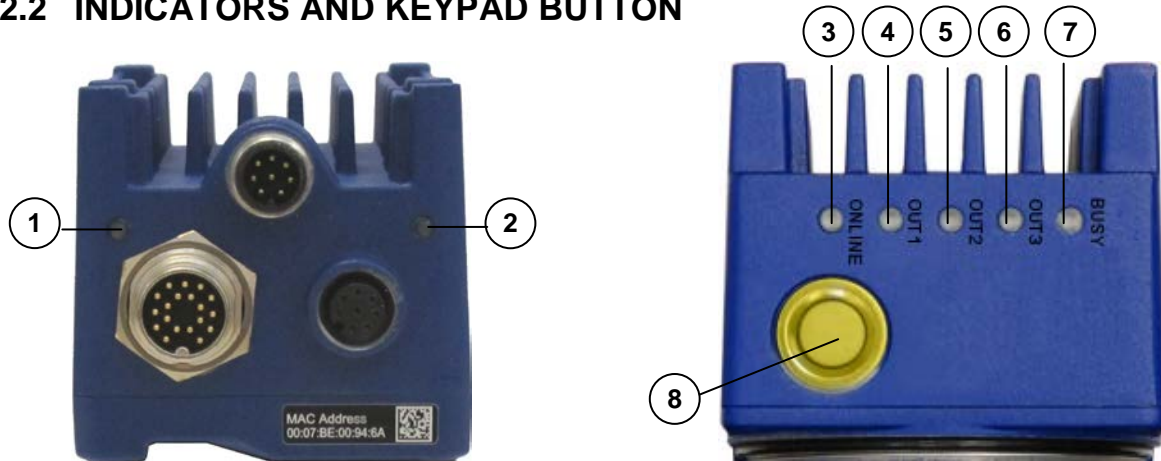


Figure 2 - Indicators

The following LED indicators are located on the camera (Figure 2):

1	POWER	On – camera is connected to power
2	NET	On – Ethernet link is established. Blinking - data transmission
3	ONLINE	On – Loaded tasks will be executed based on their trigger parameters
4	OUT1	On – Output 1 is on
5	OUT2	On – Output 2 is on
6	OUT3	On – Output 3 is on
7	BUSY	LED blinks during image and flash memory access
8	BUTTON	Camera Reset: See Note below Camera Button event: Press and release the button (Internal software event trigger only)

Note: Camera Reset restores the factory camera settings including deleting all user settings and resetting the camera's Mask and IP Address to the factory default (192.168.0.128).

### To Reset the Camera

1. Turn off camera power.
2. Press and hold the Camera Reset button.
3. Turn on power. Continue holding the Camera Reset button.
4. After about 30 seconds, all the LED indicators turn on for a few seconds. Continue holding the Camera Reset button.
5. The LED indicators turn off for about five seconds, then turn on.
6. When all the LED indicators have turned on and remain lit, release the Camera Reset button.
7. Wait approximately 30 seconds for the camera to restart.



## 2.3 ACCESSORIES

The following is a partial list of optional accessories for the T4x-Series camera.

Model	Description	Order No.
OCR Software License	OCR Software License	098-0223
CAB-SCS01 Cable, A30/T4x to CBX, 1M	T4x to CBX connection cable - 1 meter	95A906068
CAB-SCS03 Cable, A30/T4x to CBX, 3M	T4x to CBX connection cable - 3 meters	95A906069
CAB-SCS05 Cable, A30/T4x to CBX, 5M	T4x to CBX connection cable - 5 meters	95A906070
CAB-SCS10 Cable, A30/T4x to CBX, 10M	T4x to CBX connection cable - 10 meters	95A906071
CAB-GE01 M12-IP67 TO RJ45 1M	Gig-E Ethernet cable - 1 meter	93A050034
CAB-GE03 M12-IP67 TO RJ45 3M	Gig-E Ethernet cable - 3 meter	93A050035
CAB-GE05 M12-IP67 TO RJ45 5M	Gig-E Ethernet cable - 5 meter	93A050036
CAB-GE10 M12-IP67 TO RJ45 10M	Gig-E Ethernet cable - 10 meter	93A051389
I/O Board, A30/T4x, Female DB25, DIN Rail Mountable	I/O Board, DIN Rail Mountable	95A906346
CBX500 CONNECTION BOX MODULAR	CBX500 connection box	93A301068
CBX800 GATEWAY	CBX800 connection box	93A301077
BM300 PROFIBUS MODULE	Profibus module	93ACC1810
BM310 PROFIBUS IP65 MODULE	Profibus module with IP65 connector	93ACC1811
BA100 DIN RAIL ADAPTERS	CBX adapter for DIN rail mounting	93ACC1821
BA200 BOSCH ADAPTERS	CBX adapter for Bosch profile mounting	93ACC1822

## 3 INSTALLATION

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### 3.1 PACKAGE CONTENTS

Verify that the T4x-Series™ camera and all the parts supplied with the equipment are present and intact when opening the packaging. The list of parts includes:

- ☐ T4x-Series camera with Lens Cover
- ☐ Software and Documentation CD
- ☐ QuickStart Guide

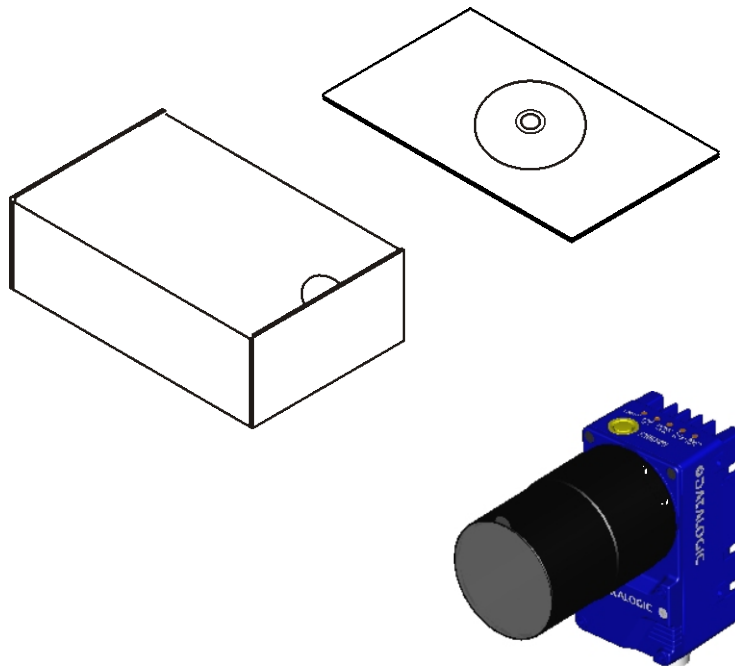


Figure 3 – T4x Series Package Contents

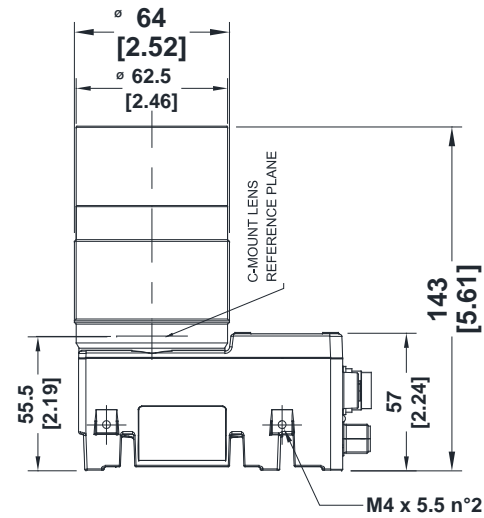
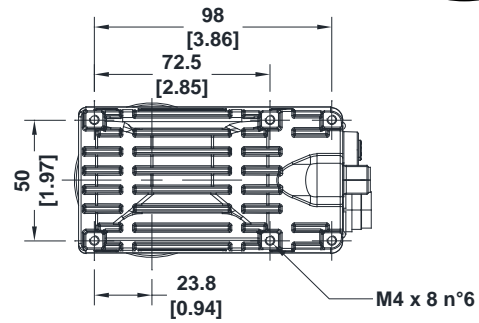
## 3.2 MECHANICAL DIMENSIONS

The T4x-Series can be installed in different positions using the body mounting bracket accessory shown in Figure 4.

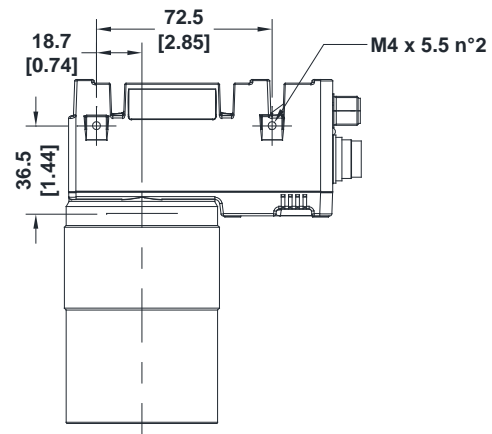
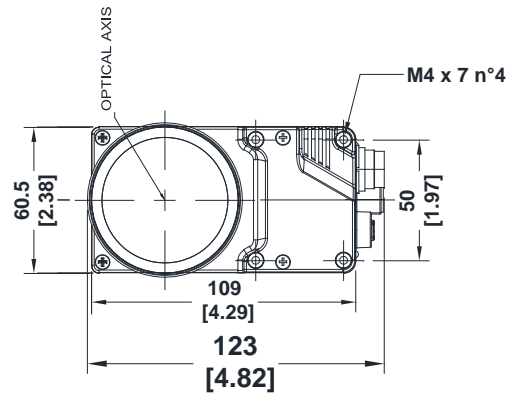
The diagram on this page gives the overall dimensions of the camera.

The fourteen screw holes (M4) on the body of the camera can also be used for custom mounting solutions.

Refer to section 3.3 for various mounting solutions and correct positioning.



mm  
[in]



### 3.3 MOUNTING AND POSITIONING THE CAMERA

Using the mounting brackets, you can obtain rotation on the various axes of the camera as shown in the diagrams below.



Figure 4 –Positioning with Body Mounting Bracket (Back)

The T4x-Series camera is able to capture images at a variety of angles.

When mounting the camera, take into consideration that significant pitch, skew, or tilt may degrade accuracy.

The **Pitch and Skew** angles are represented by the values **P** and **S** in Figure 5 and Figure 6. Position the camera to avoid the direct reflection of the light emitted by the camera or other lighting. In some cases, such as low contrast or low illumination, the **Pitch or Skew** angle should be adjusted.

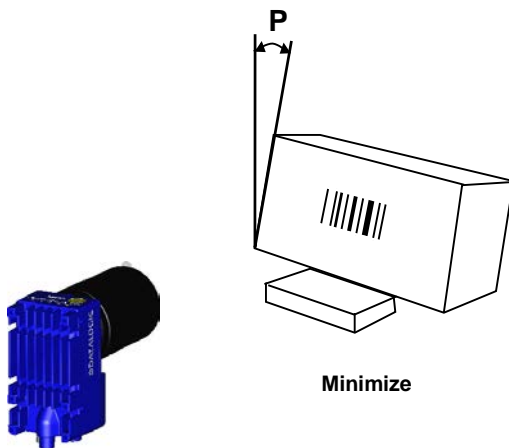


Figure 5 - Pitch angle

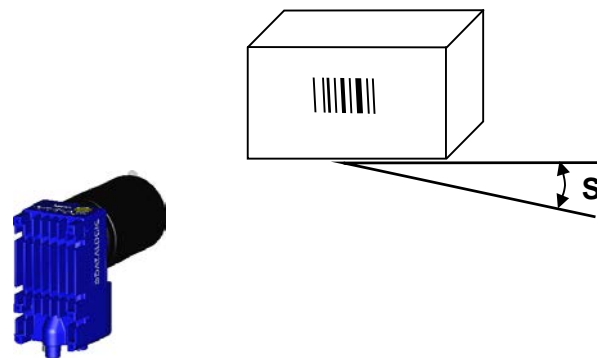


Figure 6 - Skew angle

The **Tilt** angle is represented by the value **T** in Figure 7.

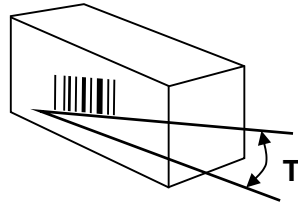


Figure 7 - Tilt angle

## 4 CBX ELECTRICAL CONNECTIONS

All T4x-Series cameras can be connected to a CBX500 connection box using a **CAB-SCSxx** accessory cable. These accessory cables terminate in a 19-pin connector on the camera side and in a 25-pin male D-sub connector on the CBX side.

We recommend making system connections through one of the CBX connection boxes since they offer the advantages of easy connection, easy device replacement and filtered reference signals.



### NOTE

*If you require direct wiring to the camera, for connection details see Chapter 5.*

The table below shows the terminal block connections for the CBX500.

CBX500 Terminal Block Connectors	
Input Power	
Vdc	Power Supply Input Voltage +
GND	Power Supply Input Voltage -
Earth	Protection Earth Ground
Inputs	
+V	Power Source – External Trigger
I1A	External Trigger + or - (polarity insensitive)
I1B	External Trigger + or - (polarity insensitive)
-V	Power Reference – External Trigger
+V	Power Source – Inputs
I2A	Input 2 + or - (polarity insensitive)
I2B	Input 2 + or - (polarity insensitive)
I3A	NOT USED
I4A	NOT USED
I34B	NOT USED
-V	Power Reference – Inputs
Outputs	
+V	Power Source - Outputs
-V	Power Reference - Outputs
O1+	Output 1 +
O1-	Output 1 -
O2+	Output 2 +
O2-	Output 2 -
O3A	Strobe + / Output 3 + (See Note)
O3B	Strobe - / Output 3 -
RS232 Interface	
TX	Transmit
RX	Receive
SGND	Signal Ground

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.

**NOTE**

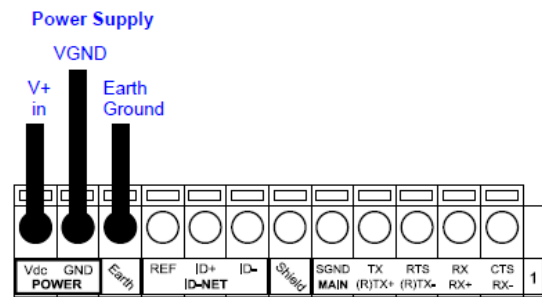
To avoid electromagnetic interference when the camera is connected to a CBX connection box, verify the jumper positions in the CBX as indicated in its Installation Manual.

## 4.1 POWER SUPPLY

**NOTE**

The T4x does not support sourcing power towards the CBX through the CBX "power from device" source jumper setting. Power must be supplied to the CBX as shown below.

To power the camera and/or I/O devices through the CBX, power must be supplied to the CBX500 spring clamp terminal pins as shown in Figure 8:



**Figure 8 - Power Supply Connections**

The power must be between 10 and 30 Vdc only.

It is recommended to connect the device CHASSIS to earth ground (Earth) by setting the appropriate jumper in the CBX connection box. See the CBX Installation Manual for details.

### 4.1.1 Recommended Power Supplies

The following optional accessory power supplies are recommended for T4x cameras:

Power Supplies	
Power Supply	Number of Cameras Supported
PG-120	2
PWR-120	2
PWR-240	4
PWR-480A	8

## 4.2 RS232 SERIAL INTERFACE

The signals relative to the following serial interface types are available on the CBX spring clamp terminal blocks.

The serial interface parameters (baud rate, data bits, etc.) are defined in Vision Program Manager (VPM) software. Refer to the Serial Port section of the Impact Reference Guide (Publication # 843-0093).

The following pins are used for RS232 interface connection. The Impact software does not support hardware (CTS/RTS) or software (Xon/Xoff) data flow control.

CBX500	Function
TX	Transmit Data
RX	Receive Data
SGND	Signal Ground

It is always advisable to use shielded cables. The overall maximum cable length must be less than 15 m (49.2 ft.).

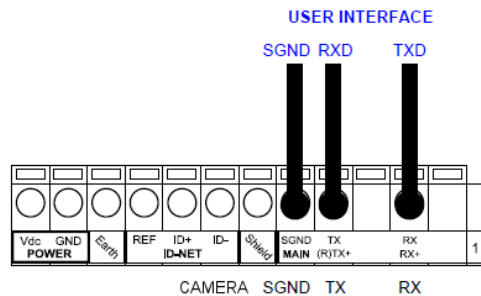


Figure 9 – RS232 Main Interface Connections Using Hardware Handshaking

### 4.2.1 RS485 Full-Duplex Interface

The Impact software does not support RS485 protocol.

## 4.3 AUXILIARY RS232 SERIAL INTERFACE

The 9-pin female Auxiliary Interface connector inside the CBX is to be used by Factory and Support personnel only.



**NOTE**

*Do not make any connections to the Aux Interface.*



## 4.4 INPUTS

There are two optocoupled polarity insensitive inputs available on the camera: Input 1 (Trigger) and Input 2, a generic input:

The Trigger is used to trigger the camera so that it will acquire an image.

Input 2 can be used as a signal to a software task to perform an action.

The electrical features of both inputs are:

$$V_{AB} = 30 \text{ Vdc max.}$$

$$I_{IN} = 10 \text{ mA (camera) + 12 mA (CBX) max.}$$

The active state of these inputs are selected in software. Refer to the Camera Setup tab and Discrete Input tool sections of the Impact Reference Guide (Publication # 843-0093).

An anti-disturbance filter is implemented in software on both inputs so that the minimum pulse duration is  $\cong 0.5$  milliseconds. This value can be increased through the software parameter Debounce Filter. Refer to the Camera Setup tab section in the Impact Reference Guide for further details.

These inputs are optocoupled and can be driven by both NPN and PNP type commands.

**NOTE**

*Polarity insensitive inputs assure full functionality even if pins A and B are exchanged.*

The connections are indicated in the following diagrams:

### EXTERNAL TRIGGER INPUT CONNECTIONS USING CBX POWER

CBX500	Function
+V	Power Source - External Trigger
I1A	External Trigger + or - (polarity insensitive)
I1B	External Trigger + or - (polarity insensitive)
-V	Power Reference - External Trigger



*Power is available directly to the Input Device, independently from the Power Supply Switch inside the CBX.*

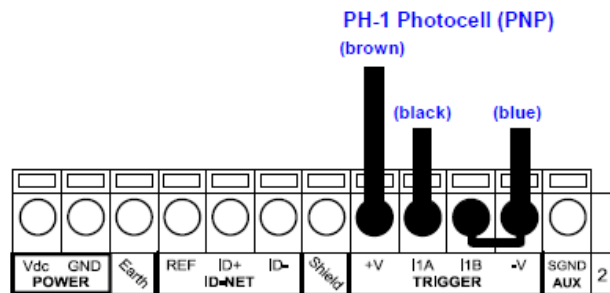


Figure 10 – PH-1 External Trigger Using CBX Power

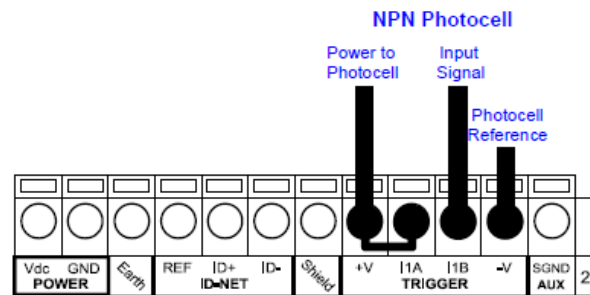


Figure 11 - NPN External Trigger Using CBX Power

### EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

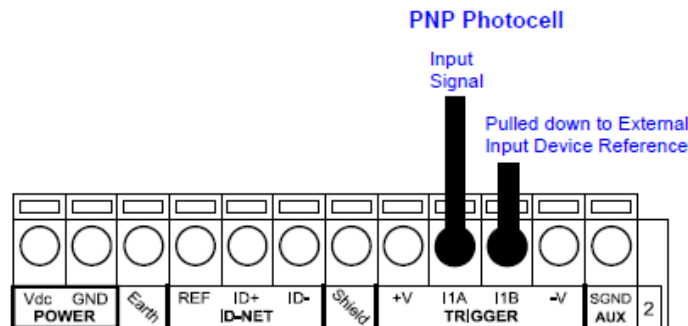


Figure 12 - PNP External Trigger Using External Power

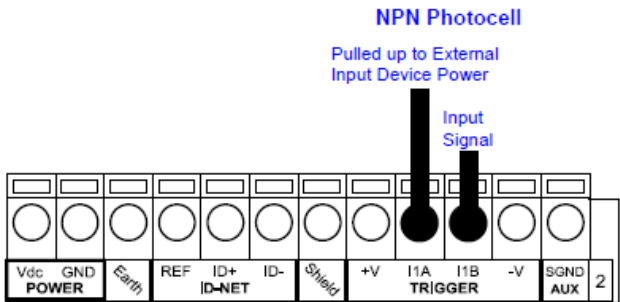


Figure 13 - NPN External Trigger Using External Power

## INPUT 2 CONNECTIONS USING CBX POWER

CBX500	Function
+V	Power Source - Inputs
I2A	Input 2 + or - (polarity insensitive)
I2B	Input 2 + or - (polarity insensitive)
-V	Power Reference - Inputs



**CAUTION**

*Power is available directly to the Input Device, independently from the Power Supply Switch inside the CBX.*

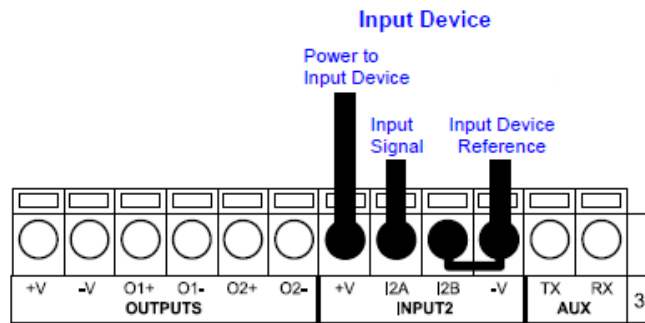


Figure 14 - PNP Input 2 Using CBX Power

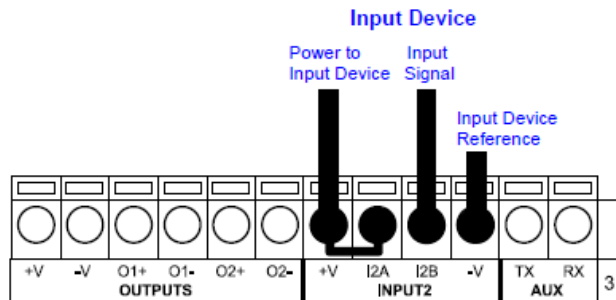


Figure 15 - NPN Input 2 Using CBX Power

## INPUT 2 CONNECTIONS USING EXTERNAL POWER

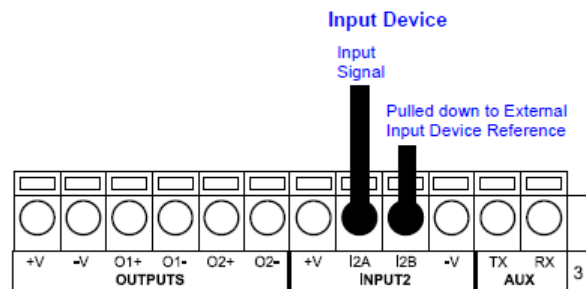


Figure 16 - PNP Input 2 Using External Power

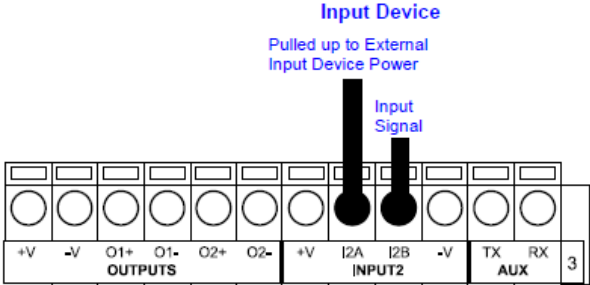


Figure 17 - NPN Input 2 Using External Power

## 4.5 OUTPUTS

Three optocoupled general purpose outputs are available. The meaning of the outputs can be defined by the user. They are typically used either to signal the data collection result or to control an external lighting system.

The electrical features of the two outputs are the following:

$$V_{CE} = 30 \text{ Vdc max.}$$

$$I_{CE} = 40 \text{ mA continuous max.; } 130 \text{ mA pulsed max.}$$

$$V_{CE \text{ saturation}} = 1 \text{ Vdc max. @ } 10 \text{ mA}$$

$$P_D = 80 \text{ mW Max. @ } 45 \text{ }^\circ\text{C ambient temp.}$$

The output signals are fully programmable. Refer to the Discrete Output tool section in the Impact Reference Guide for further details.

### OUTPUT CONNECTIONS USING CBX POWER

CBX500	Function
+V	Power Source - Outputs
O1+	Output 1 +
O1-	Output 1 -
O2+	Output 2 +
O2-	Output 2 -
O3A	Strobe + / Output 3 + (See Note)
O3B	Strobe - / Output 3 -
-V	Power Reference Outputs

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.



*Power is available directly to the Output Device, independently from the Power Supply Switch inside the CBX.*

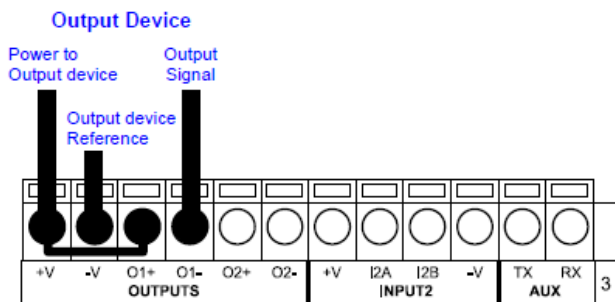
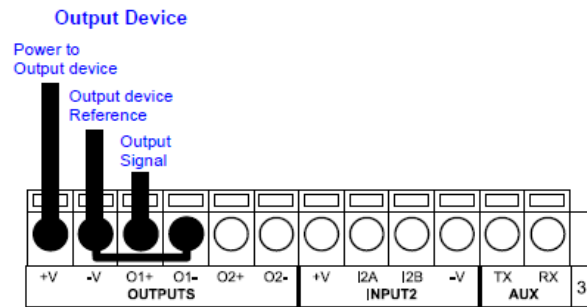
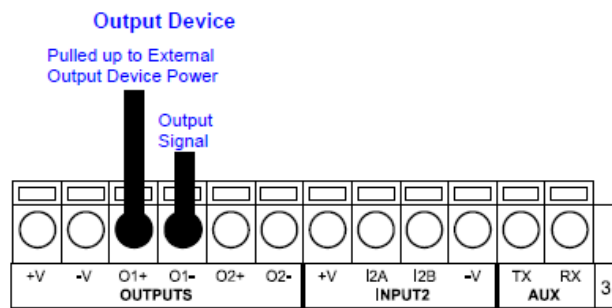


Figure 18 - Open Emitter Output Using CBX Power

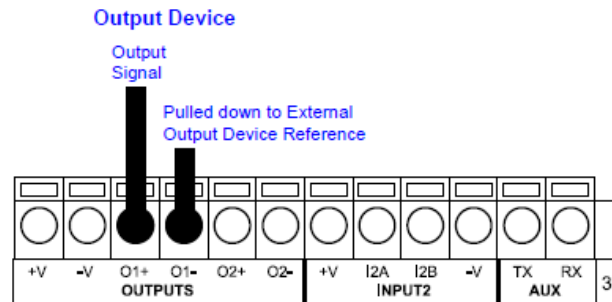


### Figure 19 - Open Collector Output Using CBX Power

## OUTPUT CONNECTIONS USING EXTERNAL POWER



### Figure 20 - Output Open Emitter Using External Power



### Figure 21 - Output Open Collector Using External Power

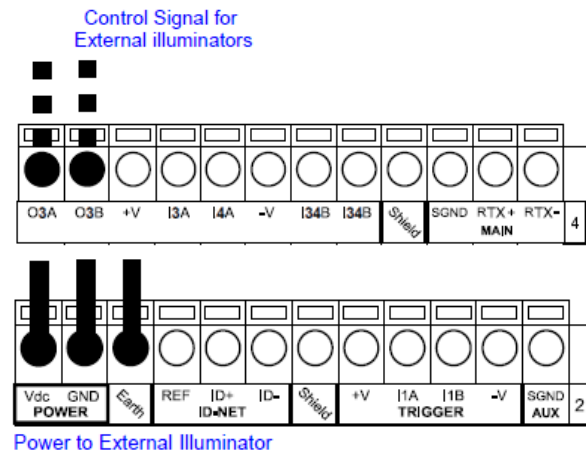
## 4.6 EXTERNAL ILLUMINATORS

If an External Illuminator (strobe light) is used, it can be powered from the CBX connection box. It must be connected to the **Vdc** and **GND** terminal clamps. The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.



*Power is available directly to the strobe, independently from the Power Supply Switch inside the CBX.*

Configure the Strobe Signal in the VPM software. Refer to the Camera Setup tab section of the Impact Reference Guide.



**Figure 22 – External Illuminator Connections**

Below is a table summarizing the External Illuminator wiring and power requirements.

CBX/Camera Signal	Meaning
Vdc	10 to 30 Vdc
GND	Ground
Earth	Shield/Earth Ground
O3B	Control Signal – (See Note)
O3A	Control Signal +

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.

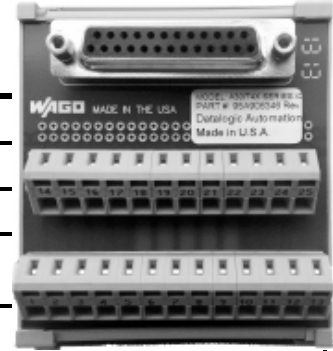


## 5 CAMERA ELECTRICAL CONNECTIONS

### 5.1 POWER, SERIAL, AND I/O TERMINAL BLOCK

Connect camera power, trigger signals, and strobe triggers to the camera using a terminal block and cable. Use a terminal block (95A906346) and the optional camera cable (CAB-SCSxx). (To use an unterminated cable, see page 24.) **The camera cannot source power through this connector.**

Figure 23 – A30/T4x-Series I/O Block



Terminal	Name	Function
9 & 13	Vdc	Power supply input voltage +
7 & 25	GND	Power supply input voltage -
18	I1A	External Trigger + or - (polarity insensitive)
19	I1B	External Trigger + or - (polarity insensitive)
6	I2A	Input 2 + or - (polarity insensitive)
10	I2B	Input 2 + or - (polarity insensitive)
22	O1-	Output 1 -
11	O2+	Output 2 +
8	O1+	Output 1 +
12	O2-	Output 2 -
2	TX	RS232 Transmit
3	RX	RS232 Receive
4	Not Used	Not Used
5	Not Used	Not Used
21	Not Used	Not Used
20	Not Used	Not Used
17	Strobe-/O3B	Strobe - / Output 3 – (See Note)
16	Strobe+/O3A	Strobe + / Output 3 +
1	CHASSIS	Cable shield internally connected by capacitor to the chassis in CBX500

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.

## 5.2 POWER, SERIAL, AND I/O CONNECTOR

To connect power supply, serial interface and input/output signals to the camera with an unterminated cable, use the M16 19-pin male connector (Binder, 423 Series). The 19-pin camera and 25-pin terminal block connector details are indicated in the following table. **The camera cannot source power through this connector.**

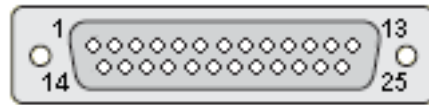
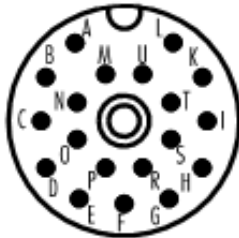


Figure 24 – M16 19-pin Connector (Pin Side)

25-pin D-Sub Connector (Pin Side)

Connector Pinout				
25-Pin	19-Pin	Wire Color	Name	Function
9 & 13	A	Red	Vdc	Power supply input voltage +
7 & 25	L	Black	GND	Power supply input voltage -
18	B	Orange	I1A	External Trigger + or - (polarity insensitive)
19	C	Green-Black	I1B	External Trigger + or - (polarity insensitive)
6	D	Grey	I2A	Input 2 + or - (polarity insensitive)
10	E	Green-Red	I2B	Input 2 + or - (polarity insensitive)
22	F	Black-White	O1-	Output 1 -
11	G	White-Red	O2+	Output 2 +
8	H	Purple	O1+	Output 1 +
12	I	White-Blue	O2-	Output 2 -
2	M	Yellow	TX	RS232 Transmit
3	U	Brown	RX	RS232 Receive
4	N	Pink		Not Used
5	T	Green		Not Used
21	O	Yellow-White		Not Used
20	S	Yellow-Blue		Not Used
17	R	White	Strobe-/O3B	Strobe - / Output 3 – (See Note)
16	P	Blue	Strobe+/O3A	Strobe + / Output 3 +
1	K	Shields	CHASSIS	Cable shield internally connected by capacitor to the chassis in CBX500

Note: The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.

In order to meet EMC requirements:

- connect the camera chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm
- connect the main interface cable shield to pin K of the 19-pin connector



*Do not connect GND and SGND to different (external) ground references. GND and SGND are internally connected through filtering circuitry which can be permanently damaged if subjected to voltage drops over 0.8 Vdc.*

### 5.3 GIGAETHERNET CONNECTOR

An M12 8-pin female connector is provided for the on-board GigaEthernet connection\*\*. This interface is 1000BASE-T (also known as IEEE 802.3ab) compliant. See section 5.4.2 for connection details.

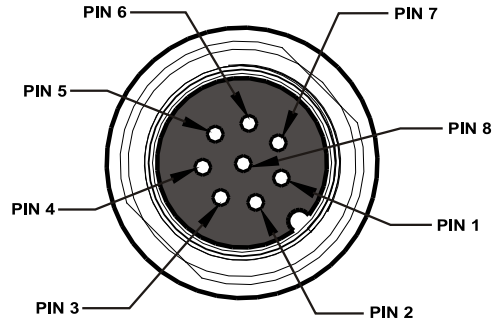


Figure 25 - M12 8-Pin Female GigaEthernet Network Connector

M12 8-Pin GigaEthernet Network Connector pinout		
Pin	Name	Function
1	DB-	Channel B bi-directional data (negative pin)
2	DD+	Channel D bi-directional data (positive pin)
3	DD-	Channel D bi-directional data (negative pin)
4	DA-	Channel A bi-directional data (negative pin)
5	DC+	Channel C bi-directional data (positive pin)
6	DA+	Channel A bi-directional data (positive pin)
7	DB+	Channel B bi-directional data (positive pin)
8	DC-	Channel C bi-directional data (negative pin)

(\*\*) Due to the high speed signals, it is strongly suggested that you use CAT5e or CAT6 cables.

### 5.4 POWER SUPPLY

Power is supplied to the camera through the pins provided on the M16 19-pin connector (see Figure 25). **The camera cannot source power through this connector.**

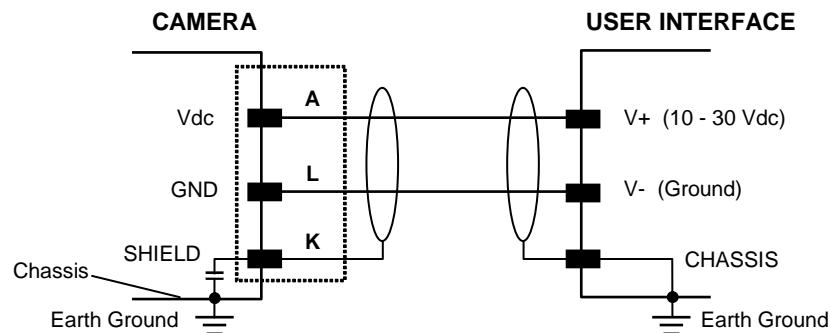


Figure 26 - Power Supply Connection

The allowed supply voltage range for the camera is 10 to 30 Vdc.

### 5.4.1 Recommended Power Supplies

The following optional accessory power supplies are recommended for T4x cameras:

Power Supplies	
Power Supply	Number of Cameras Supported
PG-120	2
PWR-120	2
PWR-240	4
PWR-480A	8

## 5.5 RS232 SERIAL INTERFACE

The signals relative to the following serial interface types are available on the M16 19-pin connector:

The main serial interface parameters (baud rate, data bits, etc.) are defined using Impact VPM software.

The following pins of the M16 19-pin connector are used for RS232 interface connection. The Impact software does not support hardware (CTS/RTS) or software (Xon/Xoff) data flow control.

Pin	Name	Function
M	TX	Transmit Data
U	RX	Receive Data
L	GND	Ground

It is always advisable to use shielded cables. The overall maximum cable length must be less than 15 m (49.2 ft.).

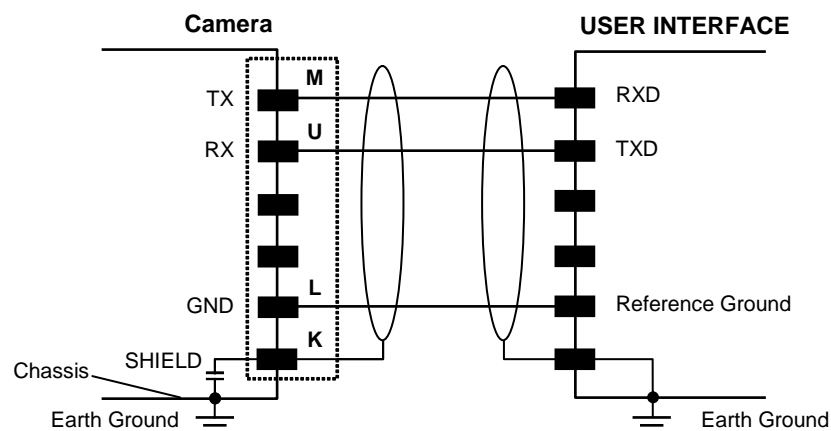


Figure 27 - RS232 Interface Connections

### 5.5.1 RS485 Full-Duplex Interface

The Impact software does not support RS485 protocol.

### 5.5.2 Auxiliary RS232 Serial Interface

The 9-pin female Auxiliary Interface connector inside the CBX is to be used by Factory and Support personnel only.



**NOTE**

*Do not make any connections to the Aux Interface.*

## 5.6 ETHERNET INTERFACE

The Ethernet Interface can be used for TCP/IP communication with a remote or local host computer by connecting the camera to either a LAN or directly to a host PC. There is no need to use a crossover adapter since the camera incorporates an auto-cross function.

The following is an example of a connection to a LAN using a **CAB-GE0x** straight through cable:

M12 8-Pin GigaEthernet Connector Pinout		
Pin	Name	Function
1	DB-	Channel B bi-directional data (negative pin)
2	DD+	Channel D bi-directional data (positive pin)
3	DD-	Channel D bi-directional data (negative pin)
4	DA-	Channel A bi-directional data (negative pin)
5	DC+	Channel C bi-directional data (positive pin)
6	DA+	Channel A bi-directional data (positive pin)
7	DB+	Channel B bi-directional data (positive pin)
8	DC-	Channel C bi-directional data (negative pin)

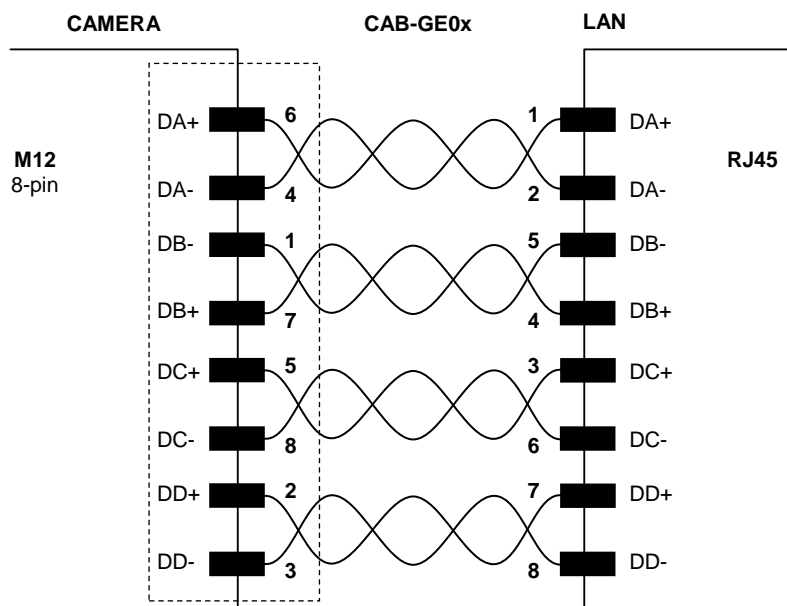


Figure 28 - CAB-GE0x GigaEthernet Cable

On the camera Ethernet interface the following communication channels are available:

- Data Socket
- Image Socket
- WebSentinel Socket
- Image FTP Client
- HTTP Server
- Ethernet IP
- Modbus TCP

## 5.7 INPUTS

There are two optocoupled polarity insensitive inputs available on the M16 19-pin connector of the camera: Input 1 (External Trigger) and Input 2, a generic input.

The External Trigger is the image acquisition trigger.

The main function of the general purpose Input 2 is to detect an input signal.

The electrical features of both inputs are:

INPUT	V <sub>AB</sub>   Min.	V <sub>AB</sub>   Max.	I <sub>IN</sub> Max.
Open	0 V	2 V	0 mA
Closed	4.5 V	30 V	10 mA

The active states of these inputs are selected in software.

An anti-disturbance filter is implemented in software on both inputs so that the minimum pulse duration is  $\cong 0.5$  milliseconds. This value can be increased through the software parameter Debounce Filter. Refer to the Camera Setup tab section in the Impact Reference Guide for further details.

These inputs are optocoupled and can be driven by both NPN and PNP type commands.



### NOTE

*Polarity insensitive inputs assure full functionality even if pins A and B are exchanged.*

The connections are indicated in the following diagrams:

Pin	Name	Function
A	Vdc	Power Supply input voltage +
B	I1A	External Trigger + or - (polarity insensitive)
C	I1B	External Trigger + or - (polarity insensitive)
L	GND	Power Supply input voltage -

The Busy LED is on when the active state of the External Trigger corresponds to ON.



### EXTERNAL TRIGGER INPUT PNP PH-1

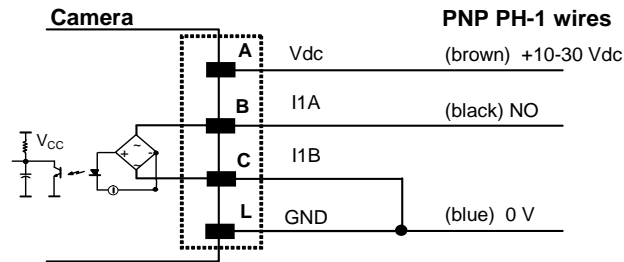


Figure 29 - External Trigger Using PNP PH-1 Photocell

### EXTERNAL TRIGGER INPUT CONNECTIONS USING T4x-Series POWER

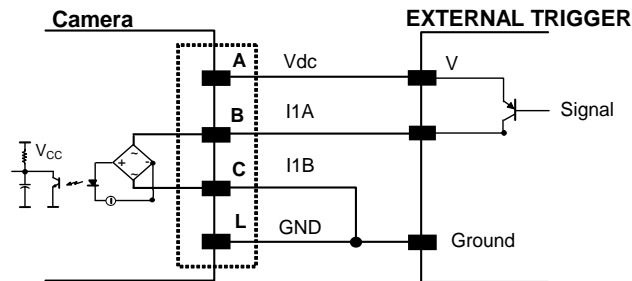


Figure 30 – External Trigger PNP Using T4x-Series Power

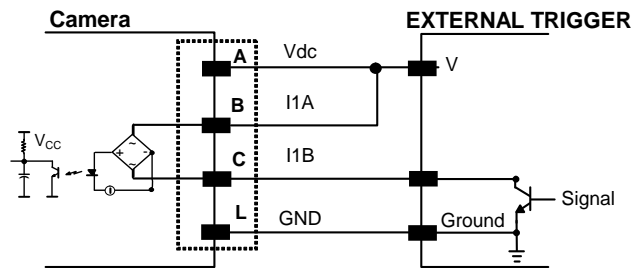


Figure 31 - External Trigger NPN Using Camera Power

### EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

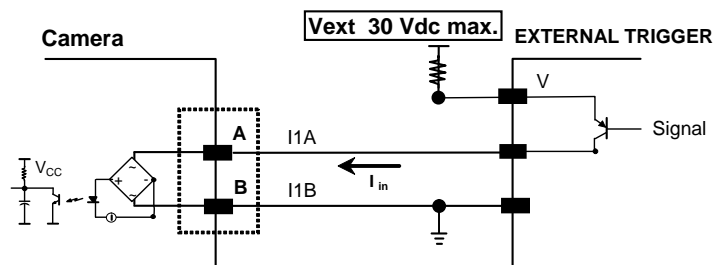


Figure 32 - External Trigger PNP Using Camera Power

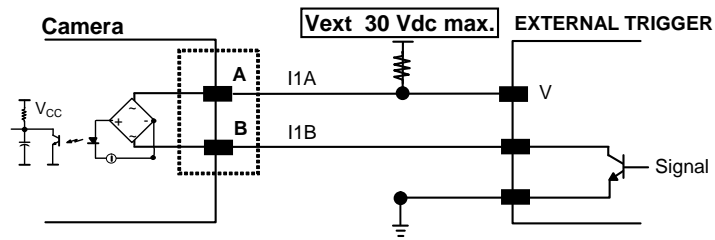


Figure 33 - External Trigger NPN Using Camera Power

## INPUT 2 CONNECTIONS USING CAMERA POWER

Pin	Name	Function
A	Vdc	Power Supply input voltage +
D	I2A	Input 2 + or - (polarity insensitive)
E	I2B	Input 2 + or - (polarity insensitive)
L	GND	Power Supply input voltage -

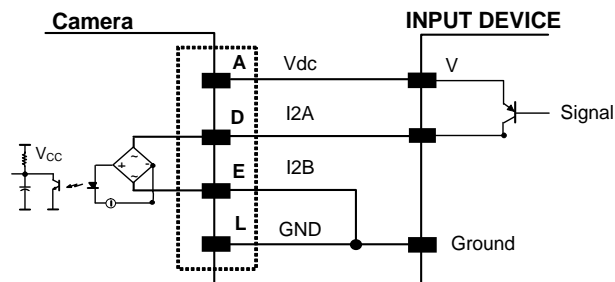


Figure 34 - Input PNP Using Camera Power

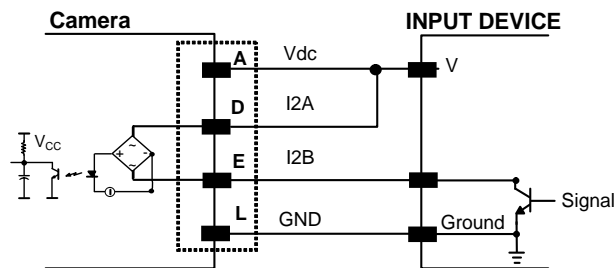
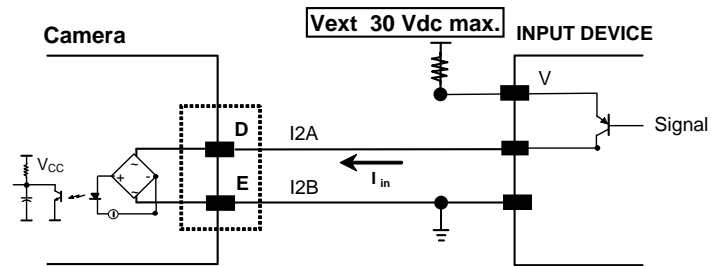
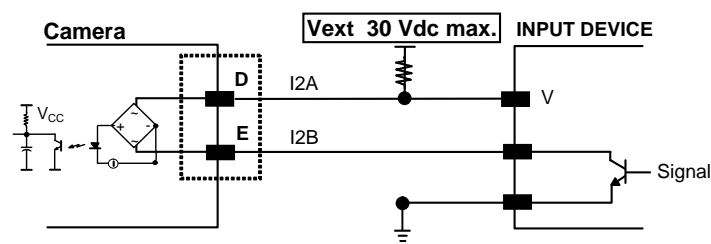


Figure 35 - Input NPN Using Camera Power

**INPUT 2 CONNECTIONS USING EXTERNAL POWER****Figure 36 - Input PNP Using External Power****Figure 37 - Input NPN Using External Power**

## 5.8 OUTPUTS

Three opto-coupled general purpose outputs are available on the M16 19-pin connector. The meaning of the outputs can be defined by the user. They are typically used either to signal the data collection result or to control an external lighting system.

The pinout is the following:

Pin	Name	Function
H	O1+	Configurable digital output 1 - positive pin
F	O1-	Configurable digital output 1 - negative pin
G	O2+	Configurable digital output 2 - positive pin
I	O2-	Configurable digital output 2 - negative pin
P	Strobe+/O3A	Configurable digital strobe/output 3 - positive pin*
R	Strobe-/O3B	Configurable digital strobe/output 3 - negative pin*

\*The strobe signal connection is shared with Output 3. If a non-zero value is defined for the Strobe Pulse Length value (in VPM – Impact – General), the strobe is active. If the value is zero, Output 3 is active.

The electrical features of the outputs are the following:

OUTPUT	$I_{Load}$	$V_{Out}$
Open	0 mA	30 Vdc Max
Closed	10 mA	1.8 Vdc Max

$$P_D = V_{Out} \times I_{oLoad} = 170 \text{ mW Max.}$$

The output signals are fully programmable. Refer to the Discrete Output tool section in the Impact Reference Guide for further details.

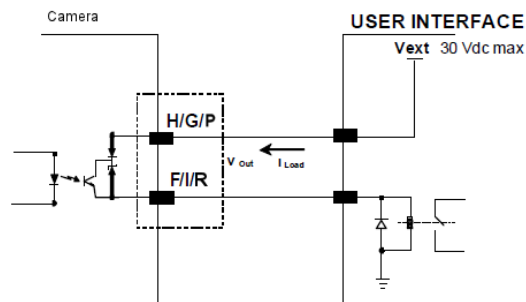


Figure 38 - Open Emitter Output Connection

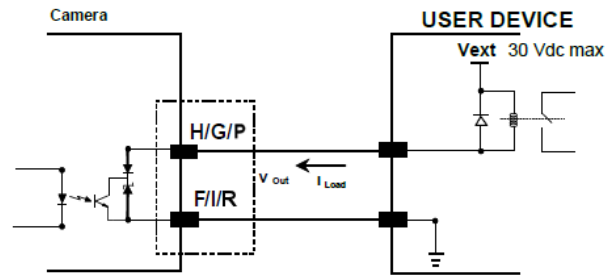


Figure 39 - Open Collector Output Connection

### How To Build A Simple Interface Test Cable:

The following wiring diagram shows a simple test cable including power and external (push-button) trigger and Input 2 connections.

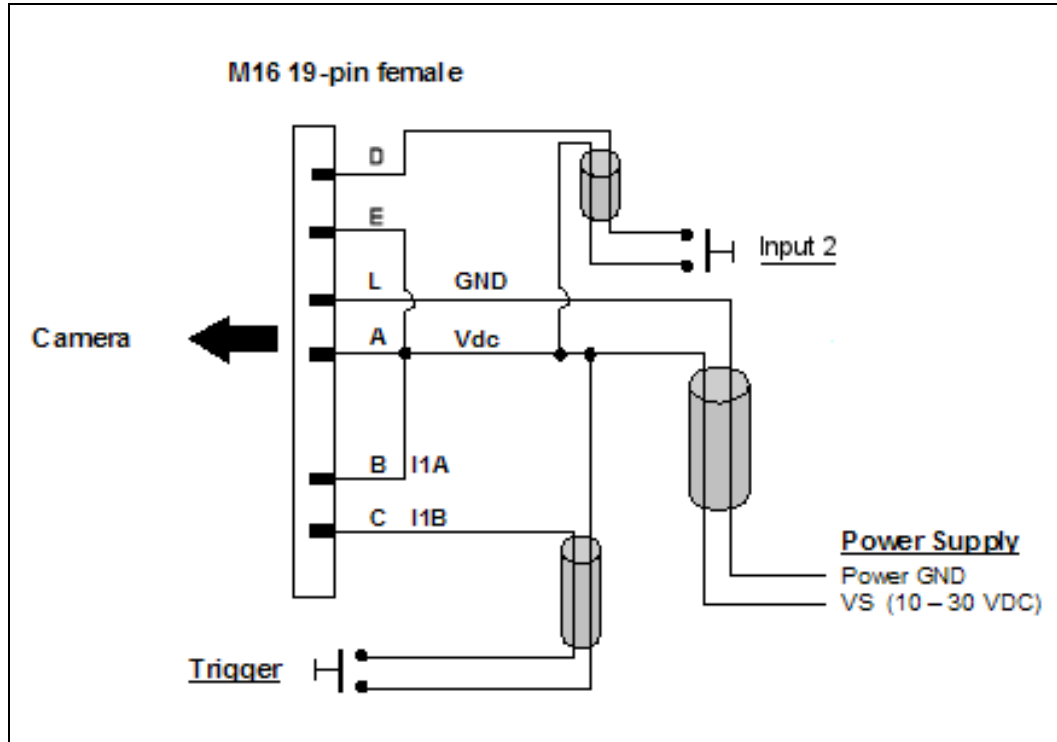


Figure 40- Test Cable for the Camera

## 6 TYPICAL LAYOUTS

The following typical layouts refers to system hardware configurations. However, these layouts also require the correct setup of the software configuration parameters.

### 6.1 EMBEDDED (ON-BOARD) GIGAETHERNET

A point-to-point configuration can be made to the on-board Ethernet connection. In order to be recognized by VPM, it is necessary to align the camera's Ethernet parameters using VPM. For further details, refer to Configuring the Impact Device or Camera in the Impact Reference Guide.

In a Point-to-Point layout the camera is connected to a local host by using a **CAB-GE0x** cable. There is no need to use a crossover adapter since the camera incorporates an autocross function.

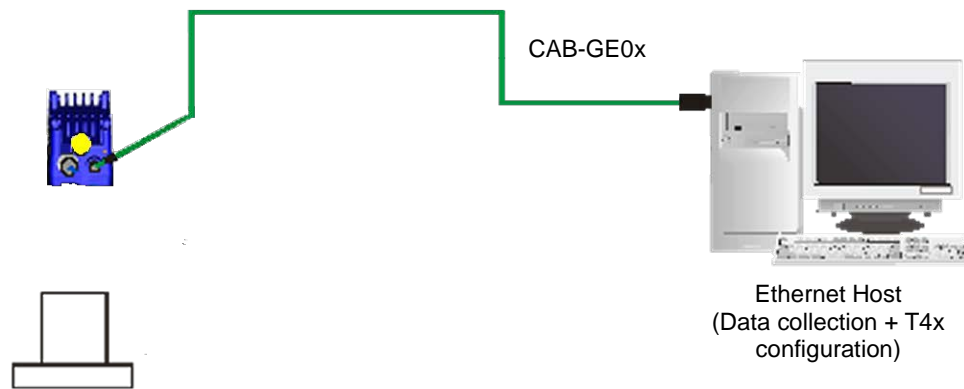


Figure 41 - Standalone Layout to Ethernet Host (Point-to-Point)

## 6.2 ETHERNET NETWORKS

### 6.2.1 External Trigger Ethernet Host

When using a Local Area Network (LAN), one or more cameras can be connected to the network by using **CAB-GE0x** cables. In the example below an External Trigger is used which is connected through a CBX connection box.

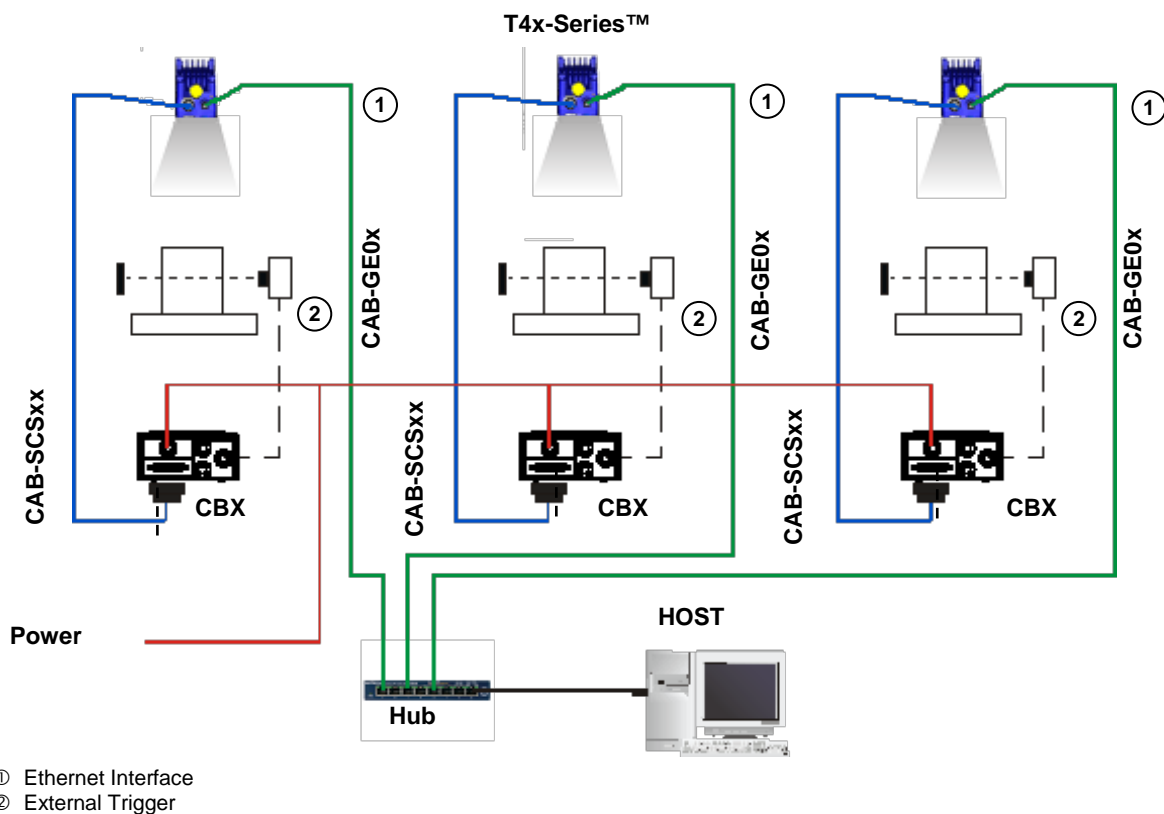


Figure 42 - Ethernet Network Layout



#### NOTE

*The camera does not support sourcing power towards the CBX in order to power I/O devices (including the External Trigger). These devices must be powered from the CBX or from an external source.*



## 6.2.2 Software Trigger Ethernet Host

The LAN connections are simplified when a software Trigger is supplied by the host. In this case, the CBX connection box is not necessary.

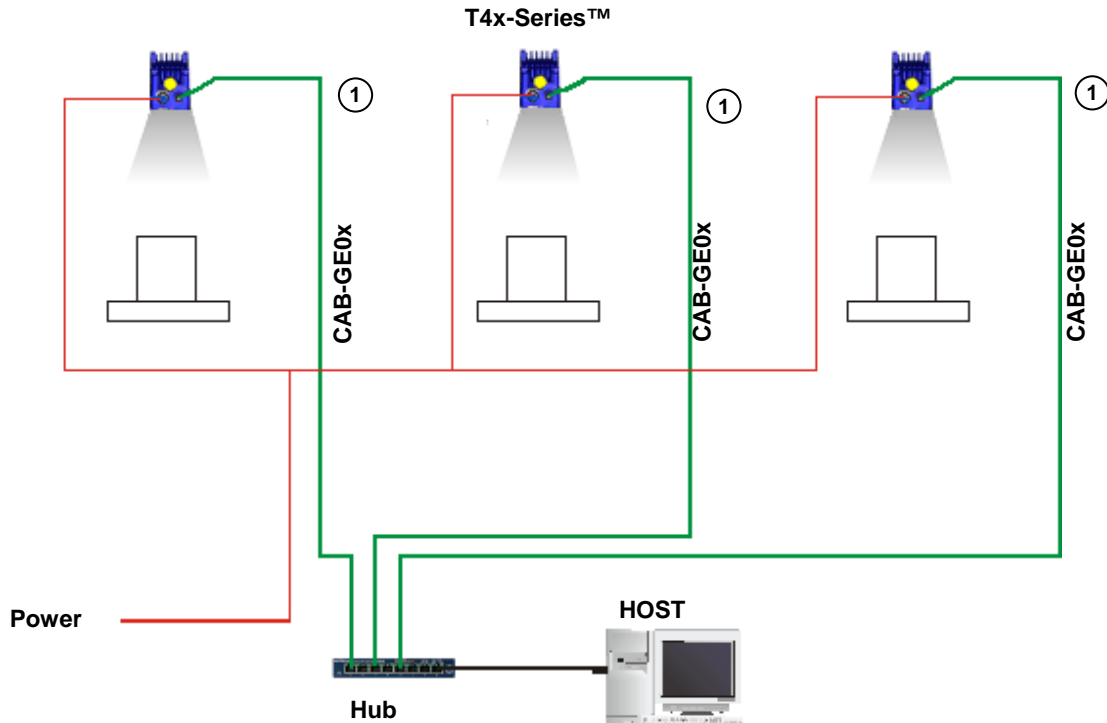


Figure 43 - Ethernet Network Layout

① Ethernet Interface

## 7 IMAGE CAPTURE FEATURES

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### 7.1 MAXIMUM LINE SPEED AND EXPOSURE TIME CALCULATIONS

The **Exposure Time** (or **Shutter**) parameter defines the time during which the image will be exposed to the image sensor to be acquired. This parameter depends heavily on the environmental conditions (external lighting system, image contrast etc.).

In general, a longer time corresponds to a lighter image but is susceptible to blurring due to the part movement; a shorter exposure time corresponds to a darker image.

Assuming:

- **X**: Part Resolution (mm)
- **T<sub>exp</sub>**: Exposure Time (s)
- **LS**: Line Speed (mm/s)

The essential condition to avoid blurring effects between two adjacent elements in a dynamic inspection application is:

$$LS * T_{exp} \leq X$$

The maximum (theoretical) line speed **LS** can be calculated as follows:

$$X / T_{exp (max)} = LS_{(max)}$$

#### Example:

Using:

*Lighting Mode = Very High Power Strobe*

*Exposure Time (x10  $\mu$ s) = 10 (100  $\mu$ s)*

*Part Resolution (X) = 0.254 mm (10 mils)*

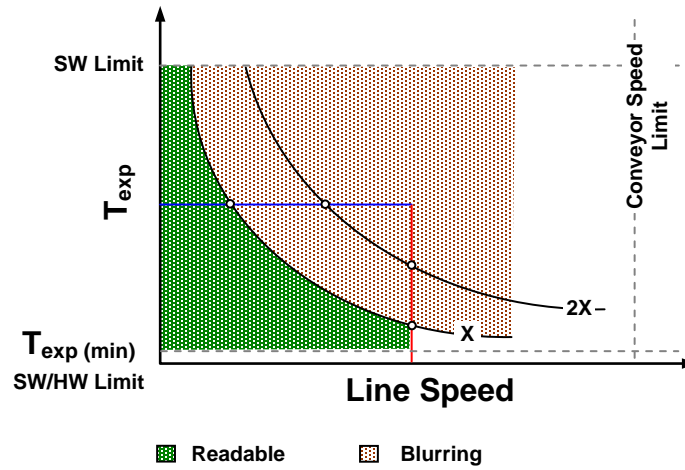
has a maximum line speed of:

$$0.254 \text{ (mm)} / 0.0001 \text{ (s)} = 2540 \text{ mm/s}$$

Likewise, **T<sub>exp (max)</sub>** is the maximum **Exposure Time** value that can be used without blurring for the given application line speed and code resolution. Therefore:

$$X / LS_{(max)} = T_{exp (max)}$$

$T_{\text{exp (max)}}$  and  $LS_{\text{(max)}}$  are represented in the graph below as the curved line for  $X$  (image resolution). Values above the curve result in blurring. In practice, the application values are somewhere below the theoretical line due to environmental and other conditions.



For example, the maximum target speed in the application is also affected by these conditions:

- **Part/Background Contrast:** maximum speed decreases when decreasing image contrast (poor quality images, reflective transparent coverings, different supports and printing techniques).
- **Part Resolution:** maximum speed increases when decreasing part resolution, (i.e. **2X**). There is a decrement of overlapping effects between two adjacent elements.
- **Tilt Angle:** maximum speed decreases when increasing Tilt angle (from 0 to 45 degrees).

$T_{\text{exp (min)}}$  is the minimum **Exposure Time** value obtainable for the specific application. It can be evaluated in static inspection conditions and depends on the camera hardware selected for the application (lighting system, optical lens, diaphragm aperture, distance) and on any external lighting system. It may also depend on part clarity and camera position.

## 8 SOFTWARE CONFIGURATION

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Software configuration of your T4x-Series camera can be accomplished by the procedures described in the Impact Reference Guide. VPM is used to configure the camera for specific applications, and provides the tools to create vision programs.

### 8.1 VPM™ SYSTEM REQUIREMENTS

To install and run Vision Program Manager™ you should have a Laptop or PC that meets or exceeds the requirements defined in the system requirements section of the Impact Reference Guide.

### 8.2 INSTALLING IMPACT SOFTWARE

To install Impact Software, proceed as follows:

1. Turn on the Laptop or PC that will be used for configuration (connected to the Ethernet port of the T4x-Series camera).
2. You may need to turn off automatic virus checking during the install if it causes installation problems.
3. You must log in to an operating system account that has administrative privileges in order to install or run Impact software on a Windows operating system.
4. Insert the Impact Installation CD in the drive.
5. The installation program should start. Select the language you want the install to use, then click OK.
6. Follow the on-screen instructions. You will have the option to install Impact software to the client, camera, or both.  
Note: If security is enabled on the camera, you cannot install new software on it. You must exit the install program, disable security on the camera, then restart the install.
7. When the installation has completed, you can start VPM.

## 8.3 STARTUP

After completing the mechanical and electrical connections to T4x-Series camera, you can begin software configuration as follows:

1. Power on the camera. Wait for the camera startup. The system bootstrap requires a few seconds to complete.
2. Start VPM. It will automatically search for any cameras on the network. Select the desired camera from the list, then click Connect to Device. The PC will automatically connect to the camera.

Upon connection, VPM is in Edit mode with all the tools necessary to create vision programs. Refer to the Impact Reference Guide for more details.

### 8.3.1 Calibration

VPM provides calibration software to insure that the measurements indicated in VPM tools accurately relate to the inspected object's measurements. You may calibrate a camera using a calibrated target, a part with known dimensions, or you can enter the camera's units-per-pixel factor manually.

Refer to the Calibration Panel section of the Impact Reference Guide for details.

#### Under-exposure:

To correct this result, change the parameters in the following order:

1. increase the **Exposure Time**
2. increase the **Gain**



#### NOTE

*In general, a longer exposure time corresponds to a lighter image but is susceptible to blurring due to code movement. Exposure time is also limited by the lighting. **Longer exposure times can be set if the power strobe level is lowered.***

*High gain settings may produce a grainy image that may affect the inspection process.*

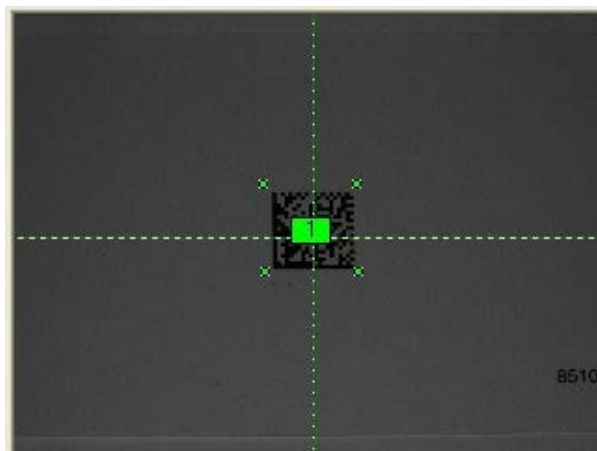


Figure 44 - Example Under Exposure: Too Dark

**Over-exposure:**

To correct this result, change the parameters in the following order:

1. decrease the **Gain**
2. decrease the **Exposure Time**

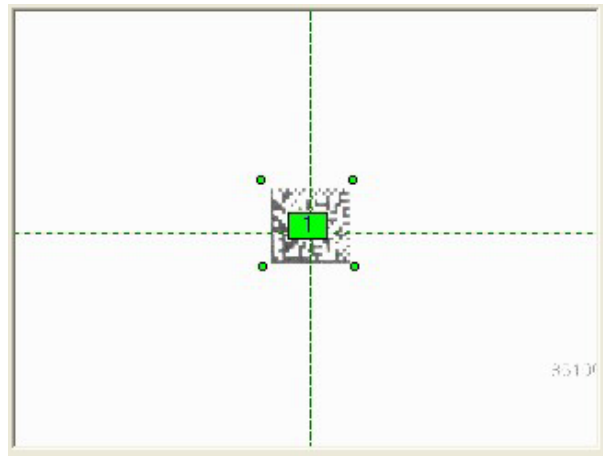


Figure 45 - Example Over Exposure: Too Light

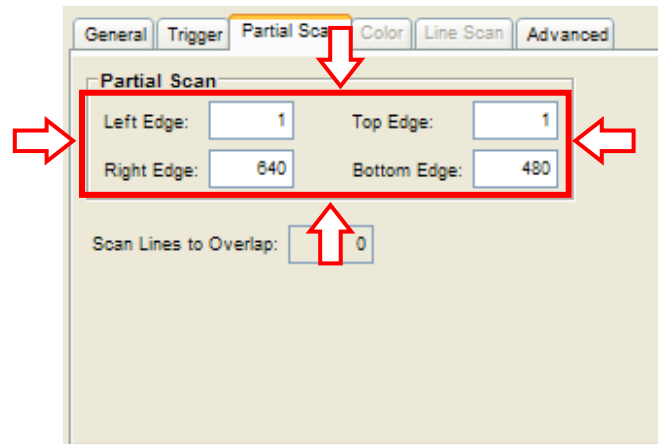
### 8.3.2 Partial Scan

In order to satisfy very high throughput applications, higher frame rates can be achieved using the powerful **Partial Scan** parameters in the Camera setup menu.

**Partial Scan** allows defining a region or window within the camera Field of View. The Top, Bottom, Left and Right parameters allow you to precisely define the image window to be processed.

In the camera the frame rate is dependent on the number of lines (or rows) in the defined window.

The smaller the window, the lower the frame period, and consequently the higher the frame rate. In general the Image Processing time can be reduced by reducing the window dimensions.



## 9 MAINTENANCE

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### 9.1 CLEANING

Use soft material and alcohol to clean the lens and cover and avoid any abrasive substances.

Clean the lens and lens cover periodically for continued correct operation of the camera.

Repeat the cleaning more frequently in particularly dirty environments.

Dust, dirt, etc. on the lens or cover may alter the image clarity.



## 10 TROUBLESHOOTING

### 10.1 GENERAL GUIDELINES

- When wiring the device, pay careful attention to the signal name on the CBX500 spring clamp connectors (chapter. 4). If you are connecting directly to the T4x-Series M16 19-pin connector, pay attention to the pin number of the signals (chapter. 5).
- If you need information about a certain camera parameter, you can refer to the Impact Reference Guide.
- If you're unable to fix the problem and you're going to contact your local DLA office, DLA Partner or ARC, we suggest providing (if possible) the Software version, Parameter Configuration file, Serial Number and Order Number of your camera. You can get some of this information in VPM while it is connected to the camera. The software version is shown in the About dialog and the Serial Number can be obtained from the Device Connection dialog.

TROUBLESHOOTING GUIDE	
Problem	Suggestion
<b>Power ON:</b> the "POWER" LED is not lit.	<ul style="list-style-type: none"> <li>• Is power connected?</li> <li>• If using a power adapter (like PG-120), is it connected to wall outlet?</li> <li>• If using rail power, does rail have power?</li> <li>• If using CBX, does it have power (check switch and LED)?</li> <li>• Check if you are using the M16 19-pin connector or the CBX spring clamp connectors.</li> <li>• Measure Voltage either at pin <b>A</b> and pin <b>L</b> (for 19-pin connector) or at spring clamp <b>Vdc</b> and <b>GND</b> (for CBX).</li> </ul>
<b>Using the Input 1 (External Trigger) or Input 2:</b> the "BUSY" LED is not blinking while the External Trigger is switching.	<ul style="list-style-type: none"> <li>• Check if you are using the 19-pin connector or the CBX spring clamp connectors.</li> <li>• Is the sensor connected to the Input 1 or Input 2?</li> <li>• Is power supplied to the photo sensor?</li> <li>• For NPN configuration, is power supplied to one of the two I1 or I2 signals (A or B)?</li> <li>• For PNP configuration, is one of the two I1 or I2 signals grounded (A or B)?</li> <li>• Is the sensor/reflector system aligned (if present)?</li> <li>• In VPM, check the EXTERNAL TRIGGER or INPUT 2 <b>Debounce Filter</b> parameter setting.</li> <li>• In VPM, check the Camera Trigger settings.</li> </ul>

TROUBLESHOOTING GUIDE	
Problem	Suggestion
<b>Using the Input 1 (External Trigger)</b> the "TRIGGER" LED is correctly blinking but no image is displayed in VPM.	<ul style="list-style-type: none"> <li>Is the Camera online?</li> </ul>
<b>Image not clear:</b>	<ul style="list-style-type: none"> <li>verify the camera focus</li> </ul>
<b>Image focused</b> but tool measurements are inaccurate	<ul style="list-style-type: none"> <li>verify the Image calibration.</li> </ul>
<b>Communication:</b> camera is not transmitting anything to the host.	<ul style="list-style-type: none"> <li>Is the Ethernet cable wiring correct?</li> <li>Is the Ethernet cable connected?</li> <li>Are the camera and host PC IP addresses set correctly?</li> </ul>
<b>Communication:</b> data transferred to the host are incorrect, corrupted or incomplete.	<ul style="list-style-type: none"> <li>Is the Ethernet cable intermittent?</li> </ul>
<b>How do I obtain my camera Serial Number?</b>	<ul style="list-style-type: none"> <li>The camera Serial Number consists of the character "C" followed by a series of numbers. It is printed on a label that is affixed to the side of the case.</li> <li>The Serial Number can also be obtained in the Device Connect dialog in VPM.</li> </ul>

## 11 TECHNICAL FEATURES

ELECTRICAL FEATURES	
<b>Power</b>	
Supply Voltage	10-30 Vdc $\pm$ 20%
Consumption (max)	T40 – 1 A ( Max); T47 – 1.05 A ( Max); T49 – 1.2 A ( Max)
<b>Communication Interfaces</b>	
RS232	2400 to 115200 bit/s
Ethernet	10/100/1000 Mbit/s, Gigabit Ethernet
<b>Inputs</b>	
Input 1(External Trigger) and Input 2	Opto-coupled and polarity insensitive
Max. Voltage	30 Vdc
Max. Input Current	10 mA
<b>Outputs</b>	
Output 1, Output 2 and Strobe/Output 3	Opto-coupled
$V_{Out}$ ( $I_{Load} = 0$ mA) Max.	30 Vdc
$V_{Out}$ ( $I_{Load} = 10$ mA) Max.	1.8 Vdc
$P_D = V_{Out} \times I_{Load}$ Max.	170 mW
OPTICAL FEATURES	
Image Sensor	CCD
Image Format	T40 – 640 x 480; T47 - 1600 x 1200; T49 - 2456 x 2058
Frame Rate	T40 – 60; T47 – 15; T49 - 15
ENVIRONMENTAL FEATURES	
Operating Temperature <sup>1</sup>	0 to 45 °C (32 to 113 °F)
Storage Temperature	-20 to 70 °C (-4 to 158 °F)
Max. Humidity	90% non-condensing
Vibration Resistance EN 60068-2-6	1.5 mm @ 5 to 9 Hz; 0.5 g @ 9 to 150 Hz 2 hours on each axis 2 g @ 70 to 200 Hz; 2 hours on each axis
Shock Resistance EN 60068-2-27	30g; 11 ms 3 shocks on each axis
Protection Class <sup>2</sup> EN 60529	IP65
PHYSICAL FEATURES	
Dimensions	123 x 60 x 101 mm (4.84 x 2.36 x 3.98 in)
Weight (with lens)	539 g. (19 oz.)
Material	Aluminum
<b>Parameter Storage</b>	Permanent memory (Flash)
USER INTERFACE	
LED Indicators	Power, Busy/Trigger, Out 1; Out 2; Out 3, Online
Keypad Button	Reset

<sup>1</sup> High ambient temperature applications should use metal mounting bracket for heat dissipation.

<sup>2</sup> Requires correct connection to IP67 cables with seals and Lens Cover mounting.

## GLOSSARY

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### **AIM**

(Association for Automatic Identification and Mobility): AIM Global is the international trade association representing automatic identification and mobility technology solution providers.

### **AIM DPM Quality Guideline**

Standard applicable to the symbol quality assessment of direct part marking (DPM) performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

### **AS9132**

Standard defining uniform quality and technical requirements for direct part marking (DPM) using Data Matrix symbologies.

### **Barcodes (1D Codes)**

A pattern of variable-width bars and spaces which represents numeric or alphanumeric data in machine-readable form. The general format of a barcode symbol consists of a leading margin, start character, data or message character, check character (if any), stop character, and trailing margin. Within this framework, each recognizable symbology uses its own unique format.

### **BIOS**

Basic Input Output System. A collection of ROM-based code with a standard API used to interface with standard PC hardware.

### **Bit**

Binary digit. One bit is the basic unit of binary information. Generally, eight consecutive bits compose one byte of data. The pattern of 0 and 1 values within the byte determines its meaning.

### **Bits per Second (bps)**

Number of bits transmitted or received per second.

### **Byte**

On an addressable boundary, eight adjacent binary digits (0 and 1) combined in a pattern to represent a specific character or numeric value. Bits are numbered from the right, 0 through 7, with bit 0 the low-order bit. One byte in memory can be used to store one ASCII character.

### **Composite Symbologies**

Consist of a linear component, which encodes the item's primary data, and an adjacent 2D composite component, which encodes supplementary data to the linear component.

### **Dark Field Illumination**

Lighting of surfaces at low angles used to avoid direct reflection of the light in the camera's lens.

### **Decode**

To recognize a barcode symbology (e.g., Codabar, Code 128, Code 3 of 9, UPC/EAN, etc.) and analyze the content of the barcode scanned.

**Depth of Field**

The difference between the minimum and the maximum distance of the object in the field of view that appears to be in focus.

**Diffused Illumination**

Distributed soft lighting from a wide variety of angles used to eliminate shadows and direct reflection effects from highly reflective surfaces.

**Direct Part Mark (DPM)**

A symbol marked on an object using specific techniques like dot peening, laser etching, chemical etching, etc.

**EEPROM**

Electrically Erasable Programmable Read-Only Memory. An on-board non-volatile memory chip.

**Element**

The basic unit of data encoding in a 1D or 2D symbol. A single bar, space, cell, dot.

**Exposure Time**

For digital cameras based on image sensors equipped with an electronic shutter, it defines the time during which the image will be exposed to the sensor to be acquired.

**Flash**

Non-volatile memory for storing application and configuration files.

**Host**

A computer that serves other terminals in a network, providing services such as network control, database access, special programs, supervisory programs, or programming languages.

**Image Processing**

Any form of information processing for which the input is an image and the output is for instance a set of features of the image.

**Image Resolution**

The number of rows and columns of pixels in an image. The total number of pixels of an image sensor.

**Image Sensor**

Device converting a visual image to an electric signal. It is usually an array of CCD (Charge Coupled Devices) or CMOS (Complementary Metal Oxide Semiconductor) pixel sensors.

**IEC**

(International Electrotechnical Commission): Global organization that publishes international standards for electrical, electronic, and other technologies.

**IP Address**

The terminal's network address. Networks use IP addresses to determine where to send data that is being transmitted over a network. An IP address is a 32-bit number referred to as a series of 8-bit numbers in decimal dot notation (e.g., 130.24.34.03). The highest 8-bit number you can use is 254.

**ISO**

(International Organization for Standardization): A network of the national standards institutes of several countries producing world-wide industrial and commercial standards.

**LED (Light Emitting Diode)**

A low power electronic light source commonly used as an indicator light. It uses less power than an incandescent light bulb but more than a Liquid Crystal Display (LCD).

**LED Illuminator**

LED technology used as an extended lighting source in which extra optics added to the chip allow it to emit a complex radiated light pattern.

**Matrix Symbolologies (2D Codes)**

An arrangement of regular polygon shaped cells where the center-to-center distance of adjacent elements is uniform. Matrix symbols may include recognition patterns which do not follow the same rules as the other elements within the symbol.

**Multidrop**

A communication protocol for connecting two or more cameras in a network with a concentrator (or controller) and characterized by the use of individual device addresses.

**Multi-row (or Stacked) Symbolologies**

Symbolologies where a long symbol is broken into sections and stacked one upon another similar to sentences in a paragraph.

**RAM**

Random Access Memory. Data in RAM can be accessed in random order, and quickly written and read.

**Transmission Control Protocol/Internet Protocol (TCP/IP)**

A suite of standard network protocols that were originally used in UNIX environments but are now used in many others. The TCP governs sequenced data; the IP governs packet forwarding. TCP/IP is the primary protocol that defines the Internet.

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