

**User Manual**

# ICAM-7000 Series

fully integrated smart camera

**ADVANTECH**

*Enabling an Intelligent Planet*

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## Copyright

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## Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

# Declaration of Conformity

## CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

## CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

## FCC Class A

Note: 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 his own expense.

## FCC Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## FM

This equipment has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. This equipment is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

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## Technical Support and Assistance

1. Visit the Advantech web site at [www.advantech.com/support](http://www.advantech.com/support) where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
  - Product name and serial number
  - Description of your peripheral attachments
  - Description of your software (operating system, version, application software, etc.)
  - A complete description of the problem
  - The exact wording of any error messages

## Warnings, Cautions and Notes

**Warning!** *Warnings indicate conditions, which if not observed, can cause personal injury!*



**Caution!** *Cautions are included to help you avoid damaging hardware or losing data. e.g.*



*There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.*

**Note!** *Notes provide optional additional information.*



## Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: [support@advantech.com](mailto:support@advantech.com)

## Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- Item XXXXXXXXX
- Box XXXXXXXXX

# Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
  15. The power cord or plug is damaged.
  16. Liquid has penetrated into the equipment.
  17. The equipment has been exposed to moisture.
  18. The equipment does not work well, or you cannot get it to work according to the user's manual.
  19. The equipment has been dropped and damaged.
  20. The equipment has obvious signs of breakage.
21. **DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.**
22. **CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.**
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

**DISCLAIMER:** This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

## Wichtige Sicherheitshinweise

1. Bitte lesen sie Sich diese Hinweise sorgfältig durch.
2. Heben Sie diese Anleitung für den späteren Gebrauch auf.
3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Verwenden Sie Keine Flüssig-oder Aerosolreiniger. Am besten dient ein angefeuchtetes Tuch zur Reinigung.
4. Die Netzanschlussteckdose soll nahe dem Gerät angebracht und leicht zugänglich sein.
5. Das Gerät ist vor Feuchtigkeit zu schützen.
6. Bei der Aufstellung des Gerätes ist auf sicheren Stand zu achten. Ein Kippen oder Fallen könnte Verletzungen hervorrufen.
7. Die Belüftungsöffnungen dienen zur Luftzirkulation die das Gerät vor überhitzung schützt. Sorgen Sie dafür, daß diese Öffnungen nicht abgedeckt werden.
8. Beachten Sie beim. Anschluß an das Stromnetz die Anschlußwerte.
9. Verlegen Sie die Netzanschlusbleitung so, daß niemand darüber fallen kann. Es sollte auch nichts auf der Leitung abgestellt werden.
10. Alle Hinweise und Warnungen die sich am Geräten befinden sind zu beachten.
11. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.
12. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. elektrischen Schlag auslösen.
13. Öffnen Sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von autorisiertem Servicepersonal geöffnet werden.
14. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:
  15. Netzkabel oder Netzstecker sind beschädigt.
  16. Flüssigkeit ist in das Gerät eingedrungen.
  17. Das Gerät war Feuchtigkeit ausgesetzt.
  18. Wenn das Gerät nicht der Bedienungsanleitung entsprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.
  19. Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.
  20. Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.
21. **VORSICHT:** Explosionsgefahr bei unsachgemaben Austausch der Batterie.Ersatz nur durch denselben oder einem vom Hersteller empfohlene-männlichen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.
22. **ACHTUNG:** Es besteht die Explosionsgefahr, falls die Batterie auf nicht fachmännische Weise gewechselt wird. Verfassen Sie die Batterie nur gleicher oder entsprechender Type, wie vom Hersteller empfohlen. Entsorgen Sie Batterien nach Anweisung des Herstellers.
23. Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70dB(A) oder weiger.

Haftungsausschluss: Die Bedienungsanleitungen wurden entsprechend der IEC-704-1 erstellt. Advantech lehnt jegliche Verantwortung für die Richtigkeit der in diesem Zusammenhang getätigten Aussagen ab.

## Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.



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# Chapter 1

Product Overview

## 1.1 Introduction

Advantech ICAM-7000 series is a fully integrated smart camera that has been specifically designed for industrial automation. Packaged complete with industrial grade image sensor, multiple processor, co-processor and application software, ICAM-7000 provides an easy-to-use machine vision solution for the factory floor.

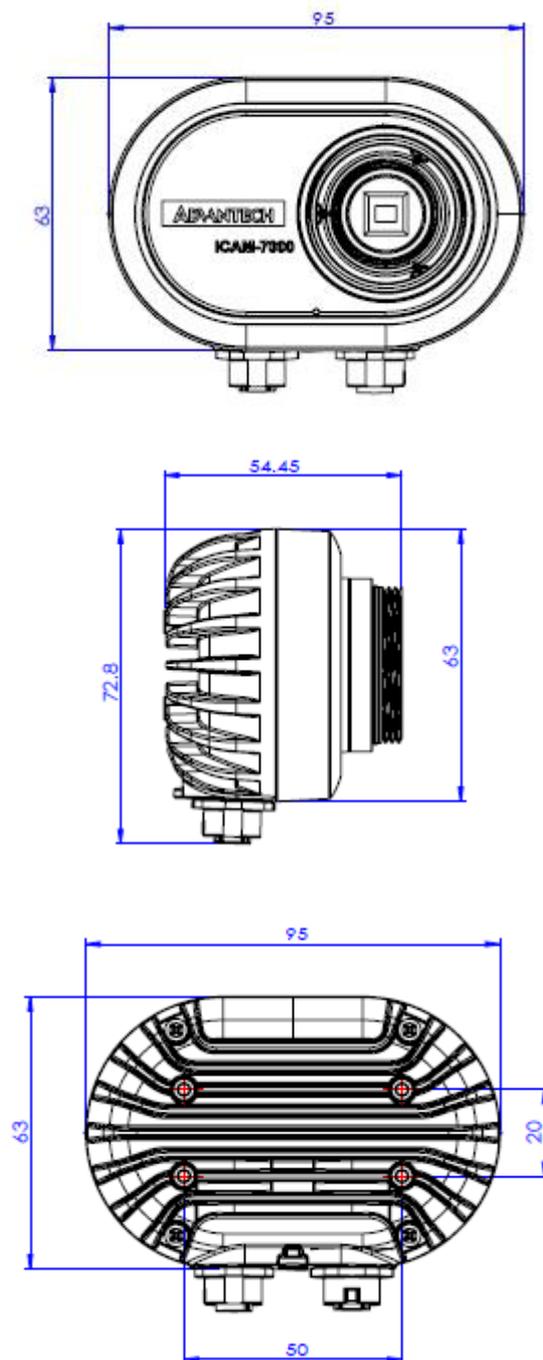
ICAM-7000 series is equipped with CAMNavi SDK, the former supports the most common programming languages C++ and the .NET framework and provides APIs to control the image acquisition, I/O, triggering and frame buffer management, as well as the viewer utilities. Advantech ICAM-7000 series is small, rugged devices that can be easily integrated into existing production lines, machinery or robotics. They are supported by standard industrial M12 connectors to further simplify and reduce implementation costs. Rated for IP67 deployment when fitted with a compatible lens cover, ICAM-7000 systems can be mounted in wash down factory environments without the need for additional protective enclosures.

## 1.2 Product Features

- Up to 5.0 MP industrial grade image sensors
- Advanced image preprocessing
- Intuitive application software with individual license
- IP67 rating ultra small form factor (93 x 63 x 40.5 mm)
- High performance multi-core processor and FPGA heterogeneous computing

## 1.3 Product Features

- Sensor:
  - Aptina AR0134, 1.2MP@54fps , Global shutter, C-mount , Monochrome/Color
  - e2v EV76C570, 2.0MP@60fps , Global shutter, C-mount , Monochrome/Color
  - Aptina MT9P031, 5.0MP@14fps , Rolling shutter, C-mount , Monochrome/Color
- Processor: Intel® ATOM® Processor E3930, 1.30 GHz
- Image Preprocessing:
  - 5 × 5 Bayer Decoding, Noise Reduction and Sharpness Enhancement
  - X,Y Image Flip
- Memory, Storage: 4GB LPDDR4/ 32GB eMMC
- Display: DP(USB Type C connector, Bi-direction): Supports resolution up to 3840x2160 @ 30 Hz
- USB interface: 1x USB 3.1, Type-C connector
- Digital I/O
  - 1 x Isolated Digital Input with Digital Filter and Interrupt
  - 2 x Isolated Digital Output
- Lighting control: 1 x PWM, Max Frequency 100 KHz
- LAN
  - 1x 10/100/1000 Mbps
  - Boot on LAN
- Power Requirements: 12-24VDC, 400 mA maximum @ 24V (9.6 Watts)
- Dimension: 95mm (W) x 63mm (H) x54.45mm (D)



- O.S Support The ICAM-7000 is compatible with Windows\* 10 Enterprise (64-bit) which is pre-installed.

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## 1.4 Environment Specification

- Operating temperature: 0 ~ 50 °C
- Relative humidity: ~95% @ 40 °C (non-condensing)
- Storage temperature: -40 ~ 85 °C (-40 ~ 185 °F)
- Vibration during operation: 3 Grms, IEC 60068-2-64, random, 5 ~ 500 Hz, 1 Oct/min., 1 hr/axis, x,y,z 3 axes.
- Shock during operation: 20 G, IEC 60068-2-27, half sine, 11 ms duration.
- Safety: CCC, CB
- EMC: CE, FCC, CCC, KCC, BSMI

# Chapter 2

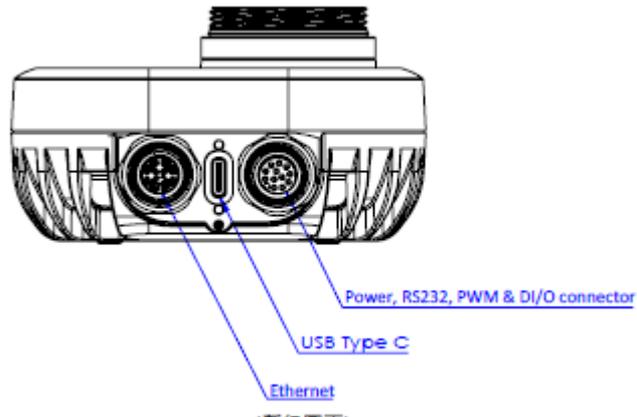
H/W Installation

## 2.1 Introduction

The following sections show the external connectors and pins assignment for applications.

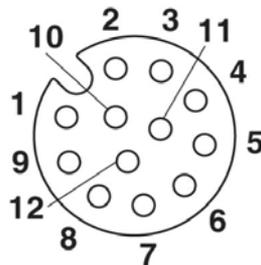
## 2.2 External connector

### 2.2.1 ICAM-7000 series External I/O Connector



#### 2.2.1.1 Power/I/O,

Power, Digital I/O, RS232 and PWM Connector

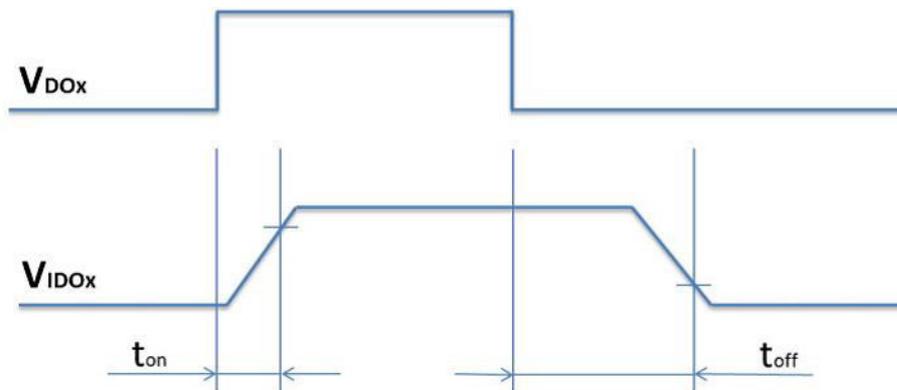
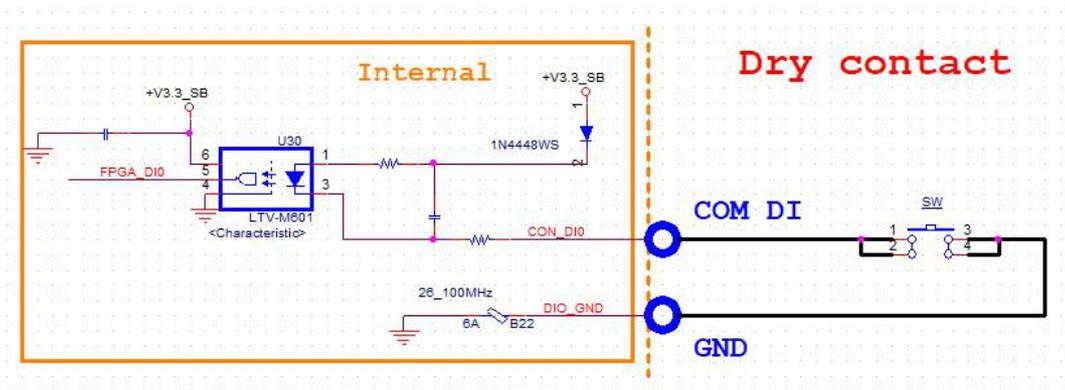


Pin	Pigtail	Description
1	Brown	Digital Input 0
2	Blue	COM, RS232 RX
3	White	COM, DATA
4	Green	COM, DATA
5	Pink	System power in +24V
6	Yellow	System power in GND
7	Black	DI/DO GND
8	Gray	Digital output 0
9	Red	Digital output 1
10	Violet	COM, RS232 TX
11	Gray/Pink	PWR BTn
12	Red/Blue	PWM DO

**Signal Connections:**

ICAM-7000 series support sink type Digital I/O and PWM. Please follow the following instruction to wire the DI/O and PWM.

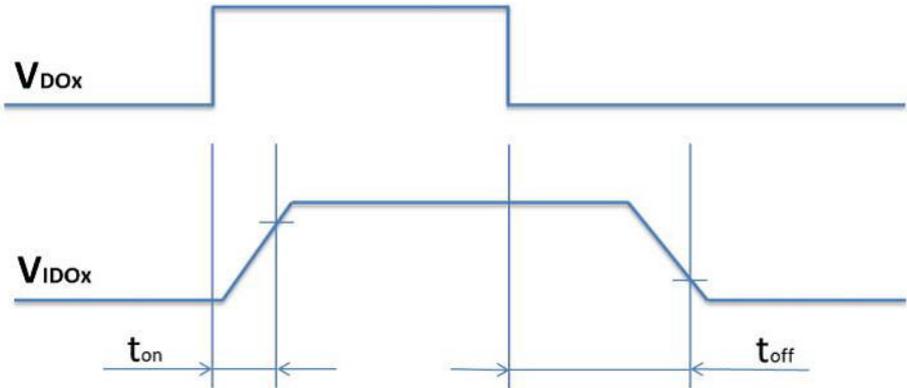
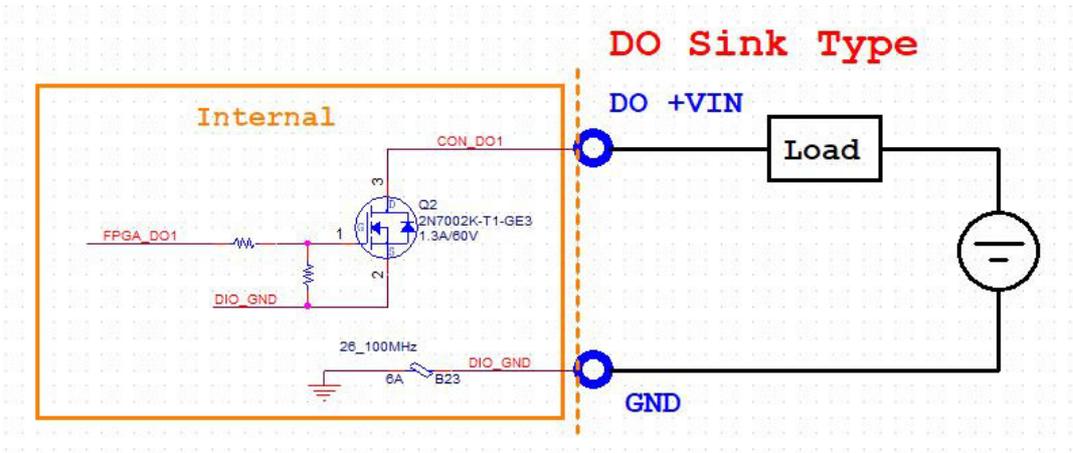
**Isolate Digital Input:**



$t_{on}$ : 10us Typ. ;  $t_{off}$ : 60us Typ.  
( $V_{DC}$  settling time is not included)

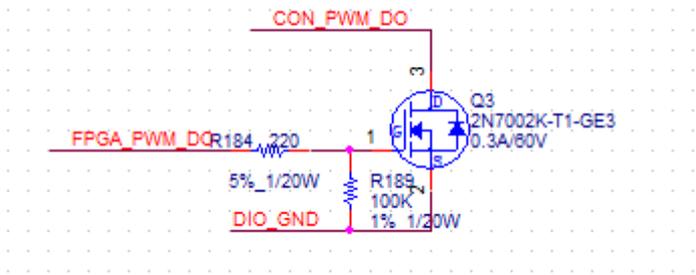
$T_{on}$ : 60 ns Typ ;  $T_{off}$ : 25 ns  
( $V_{in}$  settling time is not included)

**Digital Output:**



$t_{on}$ : 10us Typ. ;  $t_{off}$ : 60us Typ.  
 ( $V_{dc}$  settling time is not included)

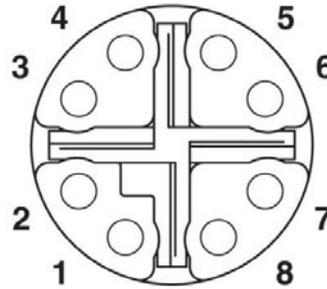
PWM (Pulse width Modulation)  
 PWM support max 100 mA



**2.2.1.2 Ethernet/LAN**

**Ethernet Connector (LAN)**

ICAM-7000 series is equipped with one Ethernet controllers that are fully compliant with IEEE 802.3u 10/100/1000 Mbps CSMA/CD standards. LAN1 is equipped with Intel i210IT. The Ethernet port provides a M12 connector.

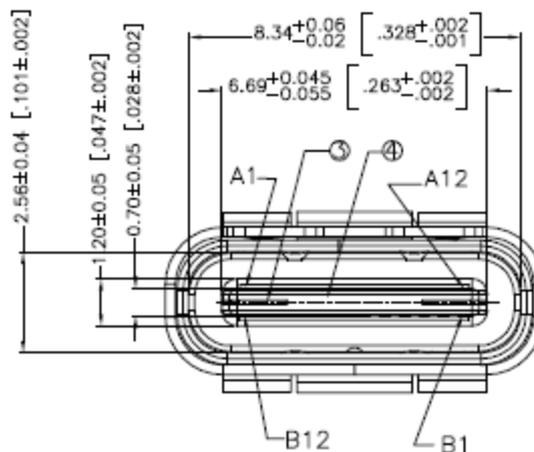


Pin	Signal
1	MDI_0_P
2	MDI_0_N
3	MDI_1_P
4	MDI_1_N
5	MDI_3_P
6	MDI_3_N
7	MDI_2_N
8	MDI_2_P

**2.2.1.3 Display**

**USB type C connector**

ICAM-7000 provides 1 USB type C interface connector for DisplayPort and USB 2.0 connection. Please refer to the table below for pin assignments.



<b>Pin No.</b>	<b>Signal</b>	<b>Pin No.</b>	<b>Signal</b>
A1	GND	B1	GND
A2	SSTXp1	B2	SSTXp1
A3	SSTXn1	B3	SSTXn1
A4	VBUS	B4	VBUS
A5	CC1	B5	SBU2
A6	Dp1	B6	Dn2
A7	Dn1	B7	Dp2
A8	SBU1	B8	CC2
A9	VBUS	B9	VBUS
A10	SSRXn2	B10	SSTXn2
A11	SSRXp2	B11	SSTXp2
A12	GND	B12	GND

# Chapter 3

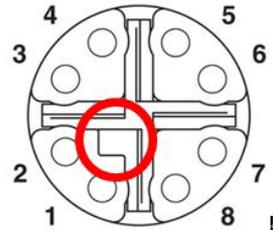
Getting started

This chapter describes connection, configuration of ICAM-7000 and start capture from ICAM-7000

### 3.1 Connection a USB type C adaptor/cable

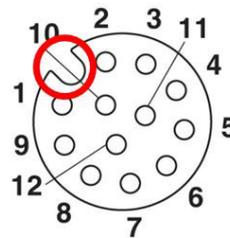
- Insert the USB type C adaptor/cable to USB type C connector directly.

### 3.2 Connection an Ethernet cable



- Align the alignment pin (Cable side) with the alignment channel (Device side)
- Inset the cable connector and tighten the threaded collar to fix the connection.

### 3.3 Connection a Power, D I/O and PWM cable.



- Align the alignment pin (Cable side) with the alignment channel (Device side)
- Inset the cable connector and tighten the threaded collar to fix the connection.

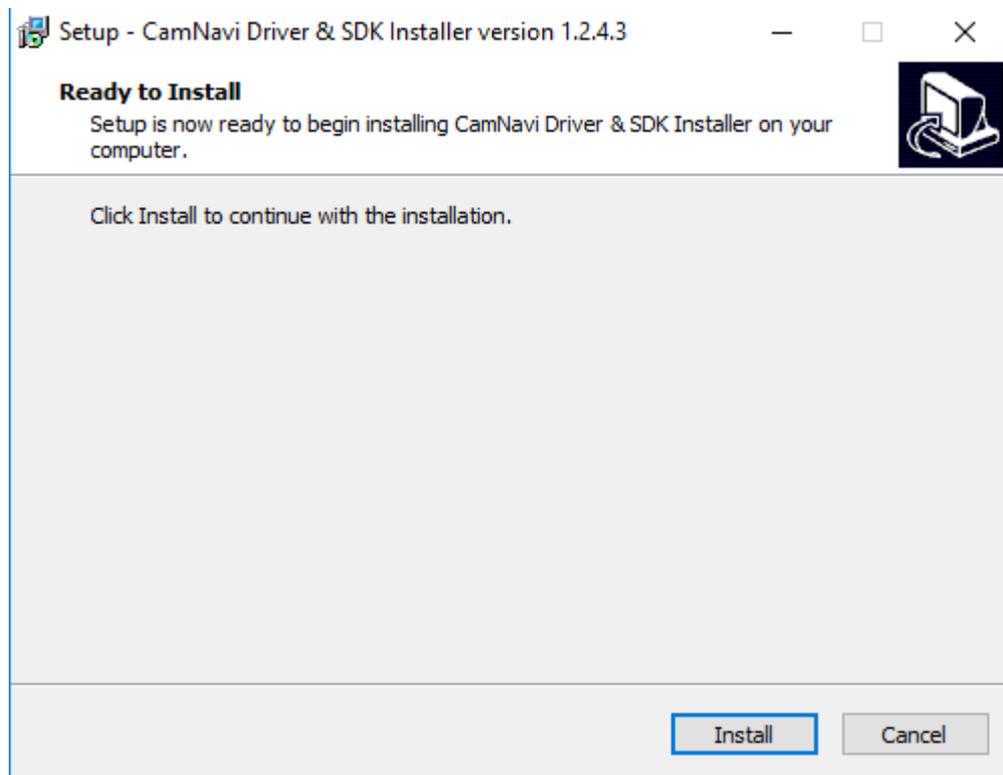
### 3.4 Install the lenses

ICAM-7000 supports C-mount lenses and please selects the suitable optical specification of lenses base on your application.

## 3.5 Latest Driver Installation

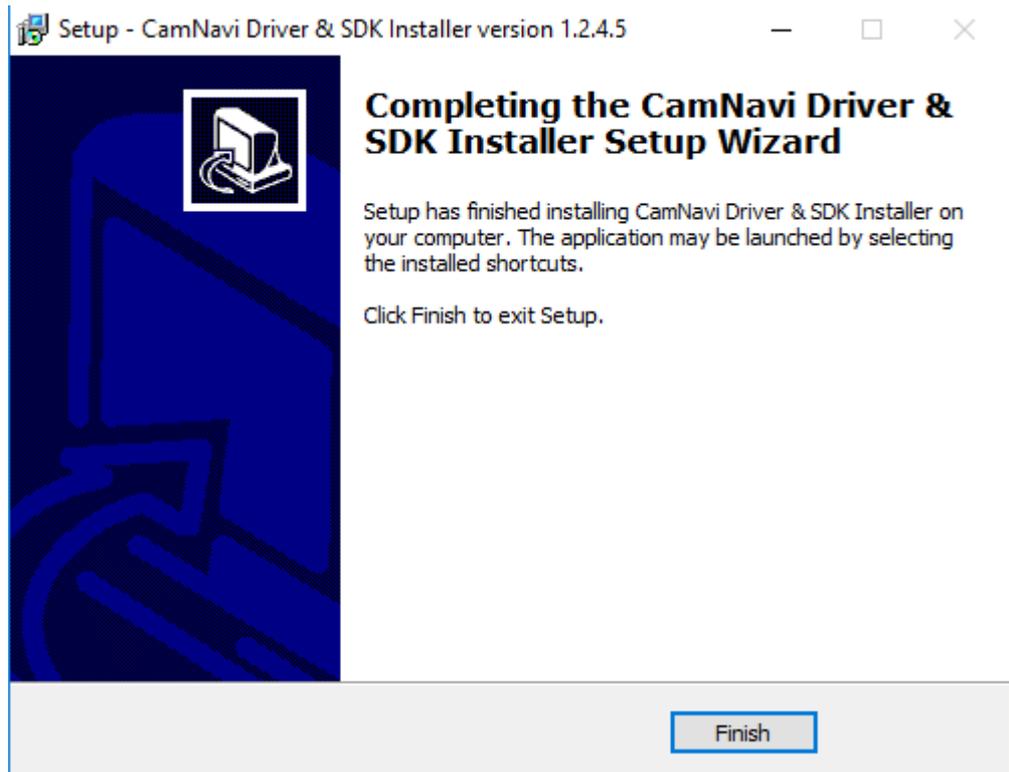
Please download the latest driver of ICAM-7000 series from Advantech website and follow the instruction to install the driver of ICM-7000 series.

1. Run Setup and start installation

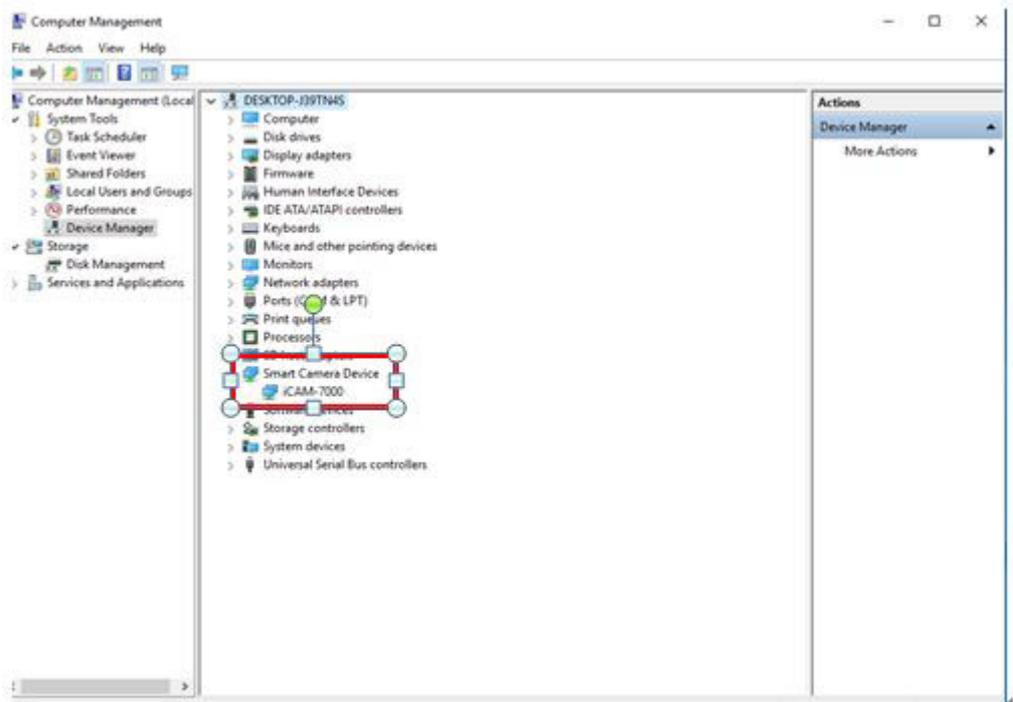


2. Press the Next button until installation is complete.

3. Select Finish, while installation is complete.



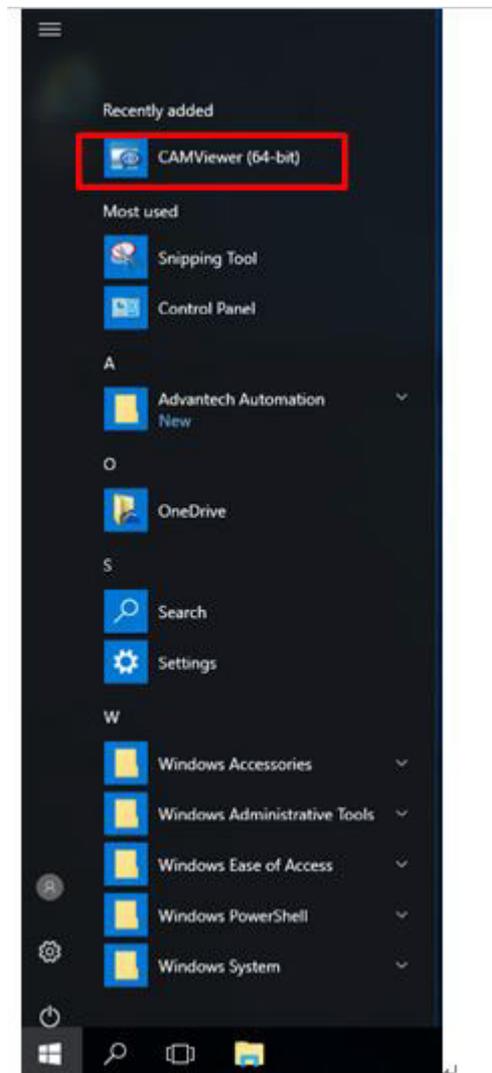
4. You can find ICAM device in the Device Manager, after finish the driver installation

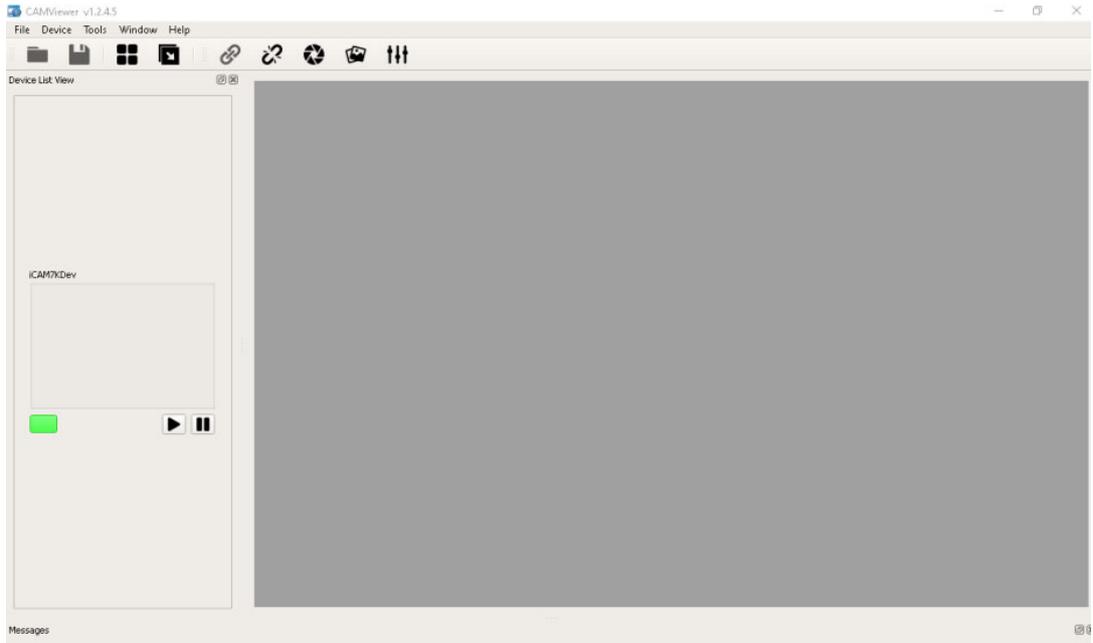


## 3.6 Performing the Capture

ICAM-7000 series had preinstalled the Camviewer Utility for customer easy to evaluation the function of ICAM-7000 series product.

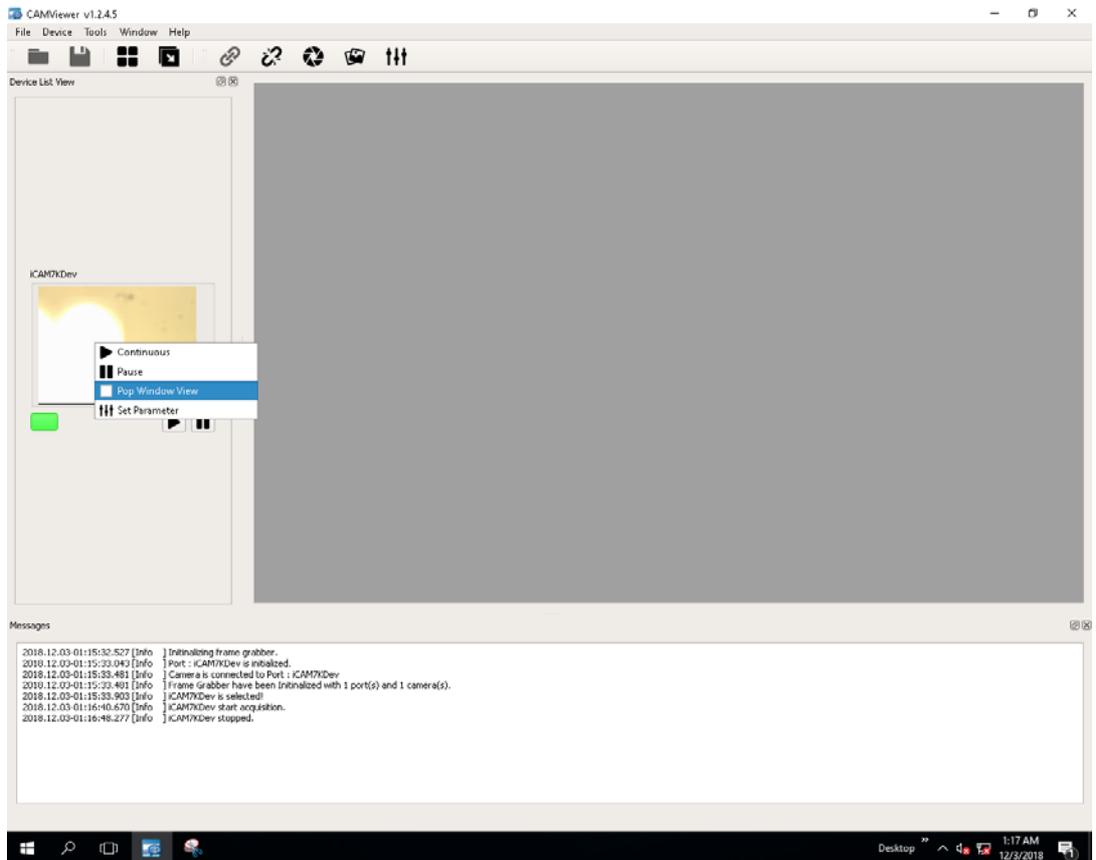
### 3.6.1 Launch the Camviewer Utility from the start menu.(Program file\Advantech Automation\Camviewer)

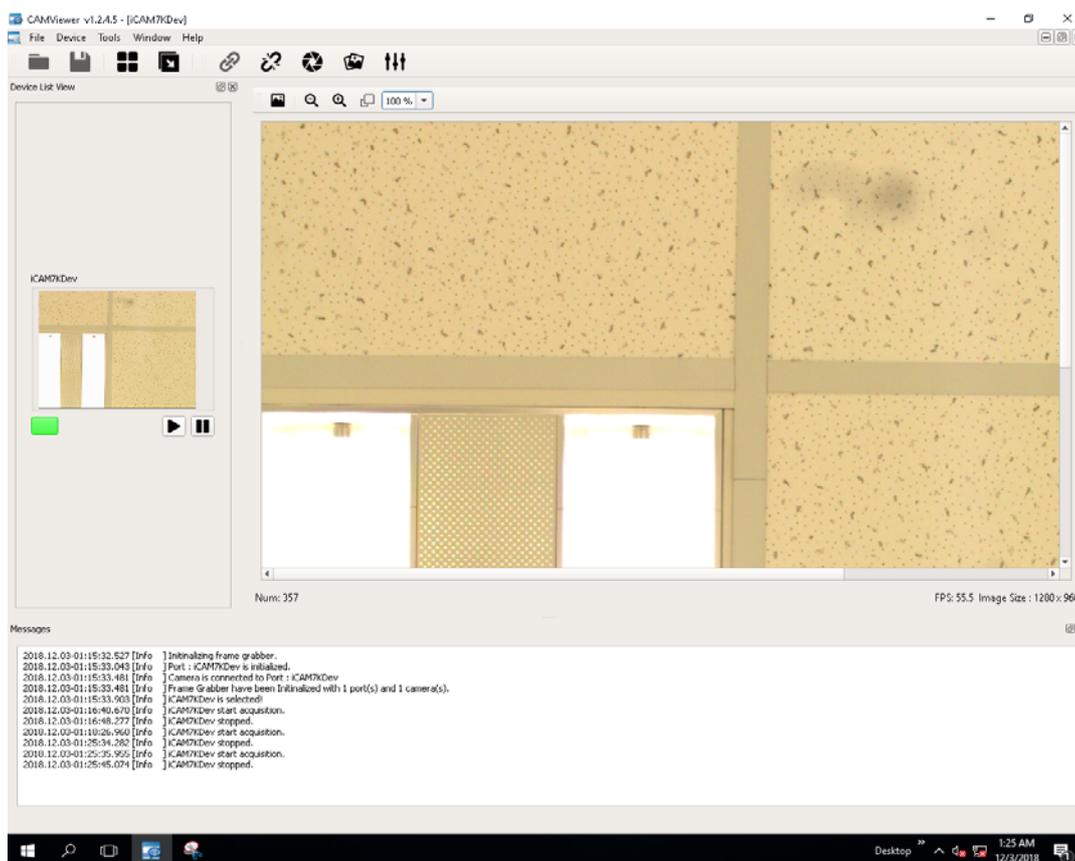




### 3.6.2 Start acquisition

1. Select the play button on the Device List View.
2. Click the right bottom of mouse on the thumbnail of the Device List View and select the Pop Window View then you can get real time image in your right hand side.





### 3.6.3 Configure ICAM 7000 series camera

1. Click the right bottom of mouse on the thumbnail of the Device List View and select the Set Parameter then you can see the parameter table shows in your right hand side.
2. Select Guru of Visibility, You can set full function of the ICAM camera. The following table shows all the parameters you can use in ICAM 7000 series camera.

Function Name	Description
Analog control	The parameters of camera analog control.
Image Format Control	The parameters of image format
Acquisition Control	The acquisition mode and the parameters of the ICAM-7000 series.
Image Quality Control	The parameters of Image Quality setting
Device Control	The Device information of ICAM Smart Camera
Digital IO Control	The parameters of Digital IO control. Line 1 and Line 2 are Digital Output. Line3 is Digital Input.
LED Control	Control the LED and the LED flash mode
PWM Control	The parameters of PWM mode.
Auto function ROI control	To set up the ROI and related parameters
Auto function control	To set up the Auto function of ICAM-7000 series

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### 3.6.4 Camera Acquisition Mode

1. Single frame: The acquisition mode is configured as single frame, camera will perform acquisition process once, and return single frame by each acquisition start command.
2. Continuous frame: camera performs acquisition continuously until acquisition stop is executed.

### 3.6.5 Software Trigger Mode

In software trigger mode, users can use the software API to control the image acquisition, and the camera will not acquire frames unless a software acquisition command is executed, below are the operation procedures:

1. Configure the camera in software trigger mode.
2. Execute the image acquisition command through software API.
3. The camera will acquire the images and receive image data.
4. The camera will return to the standby mode, and wait for the next acquisition command.

### 3.6.6 Hardware Trigger Mode

In hardware trigger mode, the digital output pin of ICAM-7000 must be connected to the digital input or trigger input of the cameras, and the camera will begin the process of exposing and reading out a frame when the digital output is active, below are the operation procedures:

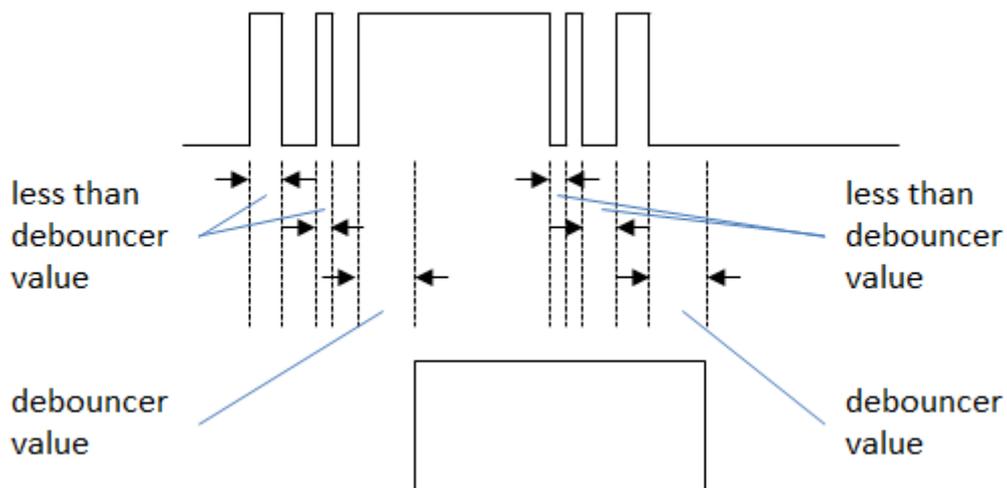
1. Configure the camera in hardware trigger mode.
2. Configure the digital input (Line3) signal of the camera as the trigger source.
3. The camera will acquire the images, then send out the image data.
4. The camera will return to the standby mode, and wait for the next valid trigger signal.

## 3.7 Set up the Digital I/O control

ICAM-7000 provides 1 port digital input and 2 ports digital output for external connection.

### 3.7.1 Digital Input.

There is one opto-isolated digital input for each Port, the digital input can act as the trigger start signal for the camera, and support debouncer and inverter features. The debouncer feature identifies the valid and invalid input signals via setting the debouncer value (the minimum period of time for the valid signal). In this way, the circuit will only respond to the signal that the pulse width is greater than debouncer value



### 3.7.2 Digital output

There are two opto-isolated digital output for each Port, each digital output supports inverter feature and can be configured as three different modes, including User Programmable Mode, Pass Mode and Counter Mode.

#### User Programmable Mode:

User can program the state of the digital output line.

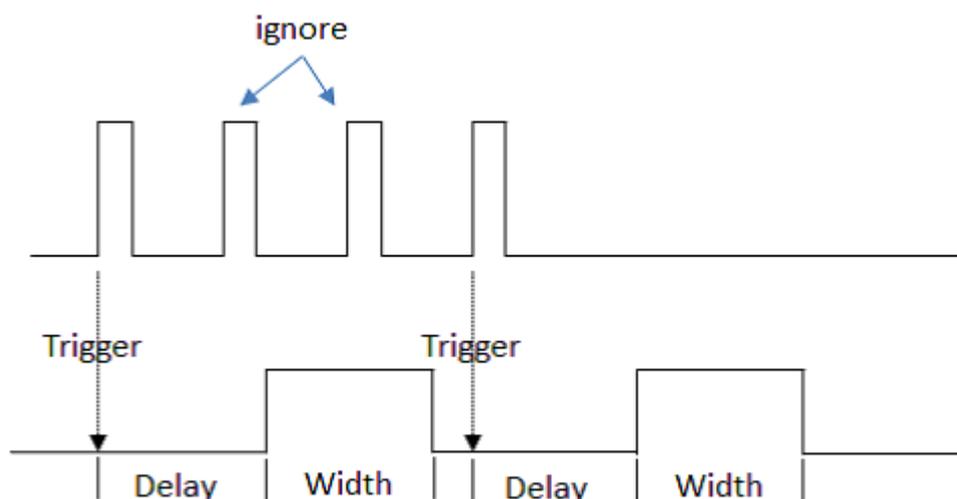
#### Pass Mode:

The digital output signal is active when a valid digital input occurs.

#### Counter Mode:

In this mode, the digital input acts as the trigger source, user can set the falling or raising edge as the trigger start signal, and the digital output acts as a pulse output, user can set the delay time, and pulse width for the digital output, the operation and timing chart for raising edge Counter Mode is as follows:

1. A raising edge of the digital input occurs.
2. When the delay expires, the digital output signal becomes high.
3. When the duration period expires, the digital output signal becomes low.



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