

# USB2.0 CMOS CAMERA

## ARTCAM-MI Series

### INSTRUCTION BOOKLET

0.36M pixels	ARTCAM-036MI2 Series
1.3M pixels	ARTCAM-130MI Series
3.0M pixels	ARTCAM-300MI Series
5.0M pixels	ARTCAM-500MI Series
9.0M pixels	ARTCAM-900MI Series
10.0M pixels	ARTCAM-1000MI Series

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# 1. Attention

## ■About this manual

1. Before using the camera, please read this manual thoroughly.
2. Please keep this manual reachable and always refer to the contents when needed.
3. Please contact us if the manual is lost or damaged. We will provide an replacement.
4. We cannot guarantee the safety of improper uses of the camera.
5. For your safety, please follow the directions of this manual.
6. All contents are subject to change.
7. Images in this manual may have been simplified to be easier comprehended.
8. Please contact us if you find any unclear points or mistakes in this manual.
9. Quoting, copying or altering some or all parts of the manual without our permission is prohibited.
10. We are not responsible for any lost or damages on your profits due to the use of our products.
11. Please understand that our oversea branches do not provide maintenance or repair services.

## ■About the Icons

To keep the safety of the user, other people and their properties, please pay attention to the following icons.



## Warning

If the user fails to follow the instruction, physical injury on human or damages on hardware may occur.



## Caution

If the user fails to follow the instruction, serious injury or death may occur.

#### ■For Safe Use



## Warning

●In following circumstances, please stop using the product and turn off the power immediately to prevent the risks of fires and electric shocks. If the product is defective, please contact us for repair or exchange. For your safety, please do not disassemble, modify or repair the camera on your own.

Please stop using the product and turn off the power immediately when:

- The product becomes smoky or gets extremely hot on the surface, or makes unusual smells or sounds.
- Foreign material or water gets into the product.
- The product falls and becomes damaged.

●Do not place the product on unstable surfaces. The product may be fallen and people may get hurt.



## Caution

●Do not expose the product to steam or fumes to avoid electric shocks and fires.

●Do not leave the product in high temperature places such as inside of vehicles or under direct sunlight. High temperature may cause damages to the camera, or even cause fires.

●Do not cover the product with cloth or other materials. The product may get extremely hot and the heat may cause deformations on the parts or even cause fires.

●Please avoid dropping or shocking the product as the product may be damaged.

●Do not touch the cable with a wet hand. Such action may cause electric shocks.

●Please avoid continuously contacting the surface of the camera to your skin when the camera is being used. The surface temperature of the camera may cause burns.

#### ■Other Notices

●Please do not use the camera under strong lights such as sun light for a long period. Also please do not expose the camera under strong lights even when the product is not being used because the sensor might be damaged.

#### Maintenance

●Wipe the dirt on surface with soft cloth or tissue paper. Do not use alcohol, thinner or benzene to avoid damaging the surface paints.

#### Electro Magnetic Interference

●The camera may interference with electronic devices such as TV and radio. Please do not place the camera next to such equipment.

## ■Export Control

The Government of Japan controls military sensitive goods and technologies including relevant dual-use goods and technologies.

This product is a Catch-all Control item subject to the Foreign Exchange and Foreign Trade Act and its relevant legislations. Except for exporting to the 27 white countries designated in the Cabinet Order, export licenses are required if the products are going to be used for military use or if the end user of the product is related to all kinds of military activities. If your circumstances cause the need to apply export licenses, please notify us before you place orders. Also, please notify us in advance if the end users or purposes of use change after the purchase and thus cause the need to apply export licenses.

\*The 27 white countries not under the UNSC Arms Embargo:

Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Republic of Korea, Luxemburg, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States

About the Japanese Security Export Controls, please refer to the webpage for Security Export Control Policy, The Ministry of Economy, Trade and Industry:

<http://www.meti.go.jp/policy/anpo/englishpage.html>

## ■Guarantee

To save the environment, we do not issue warranty in printed format. Instead, all records of the warranty periods, delivery dates and the customer information are well kept in our system.

For more details, please refer to the sites below:

Hardware Warranty: [http://www.artray.us/download/artray\\_warranty.pdf](http://www.artray.us/download/artray_warranty.pdf)

## 2. Introduction

ARTCAM-MI Series is CMOS cameras for industrial use.

This series adopt USB2.0 interface, so the data can be delivered to PC directly without a capture board.

We provide a variety including cased cameras, board cameras which can be easily incorporated to other equipment, and so on.

## 3. Main Features

- High Resolution, High Frame Rate

We provide high speed CMOS cameras of a wide range of resolutions from 0.36 mega pixels to 10 mega pixels.

- USB2.0 Interface

Our cameras adopt USB2.0 interface, so the data can be delivered to PC directly and no capture board is needed.

- Small and Light

Our cameras are small and light, thus can be easily installed according to your desires.

The board type camera with small type board lens is easy to be incorporated with other machines.

- Varieties to Your Needs

We provide a variety including cased cameras, board type cameras, C-Mount board type cameras.

For ARTCAM-036MI2 / 130MI / 500MI series, monochrome and near infrared types are also available upon your choice.

- ROI (Region Of Interest)

One major benefit of CMOS sensor is the ROI function which enables readout of designated partial images with a faster transmission speed.

- Sub-sampling function

This function results in a more pleasing output image with reduced subsampling artifacts and improves the frame rate.

- Global shutter (ARTCAM-036MI2 series)

ARTCAM-036MI2 series adopts global shutter which is very suitable for machine vision.

- External Trigger

ARTCAM-036MI2 / 130MI / 300MI / 500MI series are designed with external triggers.

- Bounded Viewer Software

We provide the Viewer Software - ART-Viewer (Windows XP/Vista/7).

With this software, users can easily preview, save images and change camera settings.

- Direct Show compatible

Except for being recognized as a standard USB device on the PC, some of the cameras may also be recognized as a DirectShow device.

(Please check if the model is DirectShow compatible with the sales representative before purchase)

- 2D Measurement & Filing Software(Optional)

Useful 2D measuring functions are available with the optional 2D Measuring & Filing Software - ART-MEASURE.

- Recording Software(Optional)

The optional recording software - ART-REC allows the user to save movies in AVI format.

- Software Development Kit(Optional)

For customer who prefers to create their own image processing software or use our camera with other applications, we provide SDK upon requests.

## 4. The Product

1) Camera

2) USB Cable      MI series: One end of the cable integrated to the camera, 1.8m approx.  
                         Board Type: Type A USB cable, 1.8m approx.

3) Instruction Booklet

4) Viewer software/Device Driver CD

<Options>

1) C Mount lens

2) 2 Measurement & Filing Software [ART-MEASURE]

3) Recording Software [ART-REC]

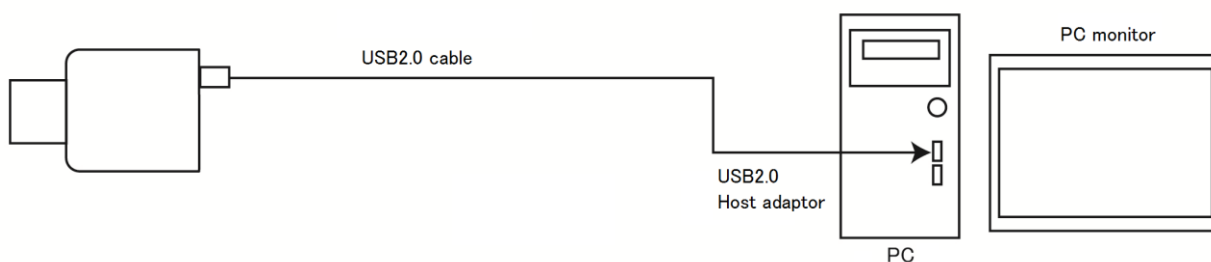
4) Software Development Kit [ARTCCM-SDK]

5) LabView DLL

6) 5m extension cable with USB2.0 repeater

## 5. Connect the Camera

### 5-1 How to connect a camera



### 5-2 Shutter Speed

Shutter speed can be changed on the standard viewer software ART-Viewer.

The shutter speed is set directly on the sensor register, so please refer to the following formulas for the real exposure time.

Model	Method
036MI2 Series	Range : 1~32767(Exposure Time : 1/32967~1sec) Exposure Time=(Shutter Valuex(640+88))x0.0417 [μsec] *640x480 pixels at 24MHz
130MI Series	Range : 1~16383(Exposure Time : 1/17991~1.033sec) Exposure Time=(Shutter Valuex(1280+234) - 180)x0.0417 [μsec] *1280x1024 pixels at 24MHz
300MI Series	Range : 1~16383(Exposure Time : 1/9760~1.679sec) Exposure Time=(Shutter Valuex(2048+411))x0.0417 [μsec] *2048x1536 pixels at 24MHz
500MI Series	Range : 1~16383(Exposure Time : 1/8702~2.173sec) Exposure Time=(Shutter Valuex(2592+592) - 426)x0.0417 [μsec] *2592x1944 pixels at 24MHz
900MI Series	Range : 1~8191(Exposure Time : 1/3805~1.21sec) Exposure Time=(Shutter Valuex(3486+60)+2761)x0.0417 [μsec] *3488x2616 pixels at 24MHz
1000MI Series	Range : 1~8191(Exposure Time : 1/3507~1.348sec) Exposure Time=(Shutter Valuex3952+2891)x0.0417 [μsec] *3840x2748 pixels at 24MHz



## 6. Specifications

### 6-1 Color Model(1)

	ARTCAM- 036MI2 036MI2-OP 036MI2-OP-CM	ARTCAM- 130MI 130MI-OP 130MI-OP-CM	ARTCAM- 300MI 300MI-OP 300MI-OP-CM
Sensor Type	CMOS Color Image Sensor		
Active Pixels	752(H)x480(V)	1280(H)x1024(V)	2048(H)x1536(V)
Active Imager Size	4.51(H)x2.88(V)mm 1/3"	6.66(H)x5.32(V)mm 1/2"	6.55(H)x4.92(V)mm 1/2"
Scan Mode	Progressive Scan		
Pixel Size	6.0(H)x6.0(V) $\mu$ m	5.2(H)x5.2(V) $\mu$ m	3.2(H)x3.2(V) $\mu$ m
Shutter Type	Global Shutter	Rolling Shutter	
Color Filter Array	RGB Bayer Pattern		
Frame Rate	60fps	15fps	6fps
Shutter Speed	1/32967~1s	1/17991~1s	1/9760~1.679s
Interface	USB2.0 Bulk transfer		
Synchronization System	Internal Synchronization		
Lens Mount	C Mount (036MI2, 036MI2-OP-CM) Board Lens MountM12 P0.5(036MI2-OP)	C Mount (130MI, 130MI-OP-CM) Board Lens MountM12 P0.5(130MI-OP)	C Mount (300MI, 300MI- OP-CM) Board Lens MountM12 P0.5 (300MI-OP)
Power	DC5V(Supplied by USB port)		
Power Consumption	Under Approx. 2W		
Ambient Conditions	Operating Temperature/Humidity : 0~35°C/10~80%(Non condensing) Storage Temperature/Humidity : 0~60°C /10~95%(Non condensing)		
External Dimensions	50(W)x47(H)x59.4(D)mm(036MI2) 43.5(W)x43.5(H)x25.7(D)mm(036MI2-OP) 50(W)x47(H)x27.1(D)mm(036MI2-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm(130MI) 43.5(W)x43.5(H)x25.7(D)mm(130MI-OP) 50(W)x47(H)x27.1(D)mm(130MI-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm(300MI) 43.5(W)x43.5(H)x25.7(D)mm(300MI-OP) 50(W)x47(H)x27.1(D)mm(300MI-OP-CM) *Lens, tripod, cable not included.
Weight	Approx.100g(036MI2) Approx.20g(036MI2-OP) Approx.60g(036MI2-OP-CM) *Lens, tripod, cable not included.	Approx.100g(130MI) Approx.20g(130MI-OP) Approx.60g(130MI-OP-CM) *Lens, tripod, cable not included.	Approx.100g(300MI) Approx.20g(300MI-OP) Approx.60g(300MI-OP-CM) *Lens, tripod, cable not included.

## 6-2 Color Model (2)

	ARTCAM- 500MI 500MI-OP 500MI-OP-CM	ARTCAM- 900MI 900MI-OP 900MI-OP-CM	ARTCAM- 1000MI 1000MI-OP 1000MI-OP-CM
Sensor Type	CMOS Color Image Sensor		
Active Pixels	2592(H)x1944(V)	3488(H)x2616(V)	3840(H)x2768(V)
Active Imager Size	5.70(H)x4.28(V)mm 1/2.5"	6.10(H)x4.58(V)mm 1/2.3"	6.41(H)x4.59(V)mm 1/2.3"
Scan Mode	Progressive Scan		
Pixel Size	2.2(H)x2.2(V) $\mu$ m	1.75(H)x1.75(V) $\mu$ m	1.67(H)x1.67(V) $\mu$ m
Shutter Type	Rolling Shutter		
Color Filter Array	RGB Bayer Pattern		
Frame Rate	3.75fps	3.2fps	2.2fps
Shutter Speed	1/8702~2.173s	1/3805~1.21s	1/3502~1.348s
Interface	USB2.0 Bulk transfer		
Synchronization System	Internal Synchronization		
Lens Mount	C Mount (500MI, 500MI-OP-CM) Board Lens MountM12 P0.5(500MI-OP)	C Mount (900MI, 900MI-OP-CM) Board Lens MountM12 P0.5(900MI-OP)	C Mount (1000MI, 1000MI-OP-CM) Board Lens MountM12 P0.5(1000MI-OP)
Power	DC5V(Supplied by USB port)		
Power Consumption	Under Approx. 2W		
Ambient Conditions	Operating Temperature/Humidity : 0~35°C /10~80%(Non condensing) Storage Temperature/Humidity : 0~60°C /10~95%(Non condensing)		
External Dimensions	50(W)x47(H)x59.4(D)mm(500MI) 43.5(W)x43.5(H)x25.7(D)mm(500MI-OP) 50(W)x47(H)x27.1(D)mm(500MI-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm(900MI) 43.5(W)x43.5(H)x25.7(D)mm(900MI-OP) 50(W)x47(H)x27.1(D)mm(900MI-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm(1000MI) 43.5(W)x43.5(H)x25.7(D)mm(1000MI-OP) 50(W)x47(H)x27.1(D)mm(1000MI-OP-CM) *Lens, tripod, cable not included.
Weight	Approx.100g(500MI) Approx.20g(500MI-OP) Approx.60g(500MI-OP-CM) *Lens, tripod, cable not included.	Approx.100g(900MI) Approx.20g(900MI-OP) Approx.60g(900MI-OP-CM) *Lens, tripod, cable not included.	Approx.100g(1000MI) Approx.20g(1000MI-OP) Approx.60g(1000MI-OP-CM) *Lens, tripod, cable not included.

## 6-2 Monochrome Model

	ARTCAM- 036MI2-BW 036MI2-BW-OP 036MI2-BW-OP-CM	ARTCAM- 130MI-BW 130MI-BW-OP 130MI- BW-OP-CM	ARTCAM- 500MI-BW 500MI-BW-OP 500MI-BW-OP-CM
Sensor Type	CMOS Monochrome Image Sensor		
Active Pixels	752(H)x480(V)	1280(H)x1024(V)	2592(H)x1944(V)
Active Imager Size	4.51(H)x2.88(V)mm 1/3"	6.66(H)x5.32(V)mm 1/2"	5.70(H)x4.28(V)mm 1/2.5"
Scan Mode	Progressive Scan		
Pixel Size	6.0(H)x6.0(V) μm	5.2 (H)x5.2(V) μm	1.67(H)x1.67(V) μm
Shutter Type	Global Shutter	Rolling Shutter	
Frame Rate	60fps	15fps	3.75fps
Shutter Speed	1/32967~1s	1/17991~1s	1/8702~2.173s
Interface	USB2.0 Bulk transfer		
Synchronization System	Internal Synchronization		
Lens Mount	C Mount (036MI2-BW, 036MI2-BW-OP-CM) Board Lens MountM12 P0.5 (036MI2-BW-OP)	C Mount (130MI-BW, 130MI-BW-OP-CM) Board Lens MountM12 P0.5 (130MI-BW-OP)	C Mount (500MI-BW, 500MI-BW-OP-CM) Board Lens MountM12 P0.5 (500MI-BW-OP)
Power	DC5V(Supplied by USB port)		
Power Consumption	Under Approx. 2W		
Ambient Conditions	Operating Temperature/Humidity : 0~35°C /10~80%(Non condensing) Storage Temperature/Humidity : 0~60°C /10~95%(Non condensing)		
External Dimensions	50(W)x47(H)x59.4(D)mm (036MI2-BW) 43.5(W)x43.5(H)x25.7(D)mm (036MI2-BW-OP) 50(W)x47(H)x27.1(D)mm (036MI2-BW-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm (130MI-BW) 43.5(W)x43.5(H)x25.7(D)mm (130MI-BW-OP) 50(W)x47(H)x27.1(D)mm (130MI-BW-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm (500MI-BW) 43.5(W)x43.5(H)x25.7(D)mm (500MI-BW-OP) 50(W)x47(H)x27.1(D)mm (500MI-BW-OP-CM) *Lens, tripod, cable not included.
Weight	Approx.100g(036MI2-BW) Approx.20g(036MI2-BW-OP) Approx.60g(036MI2-BW-OP-CM) *Lens, tripod, cable not included.	Approx.100g(130MI-BW) Approx.20g(130MI-BW-OP) Approx.60g(130MI-BW-OP-CM) *Lens, tripod, cable not included.	Approx.100g(500MI-BW) Approx.20g(500MI-BW -OP) Approx.60g(500MI-BW-OP-CM) *Lens, tripod, cable not included.

### 6-3 NIR Model

	ARTCAM- 036MI2-NIR 036MI2-NIR-OP 036MI2-NIR-OP-CM	ARTCAM- 130MI-NIR 130MI-NIR-OP 130MI-NIR-OP-CM	ARTCAM- 500MI-NIR 500MI-NIR-OP 500MI-NIR-OP-CM
Sensor Type	CMOS Monochrome Image Sensor		
Active Pixels	752(H)x480(V)	1280 (H)x1024(V)	2592(H)x1944(V)
Active Imager Size	4.51(H)x2.88(V)mm 1/3"	6.66(H)x5.32(V)mm 1/2"	5.70(H)x4.28(V)mm 1/2.5"
Scan Mode	Progressive Scan		
Pixel Size	6.0(H)x6.0(V) $\mu$ m	5.2 (H)x5.2(V) $\mu$ m	1.67(H)x1.67(V) $\mu$ m
Shutter Type	Global Shutter	Rolling Shutter	
Frame Rate	60fps	15fps	3.75fps
Shutter Speed	1/32967~1s	1/17991~1s	1/8702~2.173s
Interface	USB2.0 Bulk transfer		
Synchronization System	Internal Synchronization		
Lens Mount	C Mount (036MI2-NIR, 036MI2-NIR-OP-CM) Board Lens MountM12 P0.5 (036MI2-NIR-OP)	C Mount (130MI-NIR, 130MI-NIR-OP-CM) Board Lens MountM12 P0.5 (130MI-NIR- OP)	C Mount (500MI-NIR, 500MI-NIR-OP-CM) Board Lens MountM12 P0.5 (500MI-NIR- OP)
Power	DC5V(Supplied by USB port)		
Power Consumption	Under Approx. 2W		
Ambient Conditions	Operating Temperature/Humidity : 0~35°C /10~80%(Non condensing) Storage Temperature/Humidity : 0~60°C /10~95%(Non condensing)		
External Dimensions	50(W)x47(H)x59.4(D)mm (036MI2-NIR) 43.5(W)x43.5(H)x25.7(D)mm (036MI2-NIR-OP) 50(W)x47(H)x27.1(D)mm (036MI2-NIR-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm (130MI-NIR) 43.5(W)x43.5(H)x25.7(D)mm (130MI-NIR-OP) 50(W)x47(H)x27.1(D)mm (130MI-NIR-OP-CM) *Lens, tripod, cable not included.	50(W)x47(H)x59.4(D)mm (500MI-NIR) 43.5(W)x43.5(H)x25.7(D)mm (500MI-NIR-OP) 50(W)x47(H)x27.1(D)mm (500MI-NIR-OP-CM) *Lens, tripod, cable not included.
Weight	Approx.100g(036MI2-NIR) Approx.20g(036MI2-NIR-OP) Approx.60g(036MI2-NIR-OP-CM) *Lens, tripod, cable not included.	Approx.100g(130MI-NIR) Approx.20g(130MI-NIR-OP) Approx.60g(130MI-NIR-OP-CM) *Lens, tripod, cable not included.	Approx.100g(500MI-NIR) Approx.20g(500MI-NIR-OP) Approx.60g(500MI-NIR-OP-CM) *Lens, tripod, cable not included.

## 7. External Dimensions

### 7-1 C-MOUNT, CASED, USB CABLE TYPE

ARTCAM-036MI2/036MI2-BW/036MI2-NIR

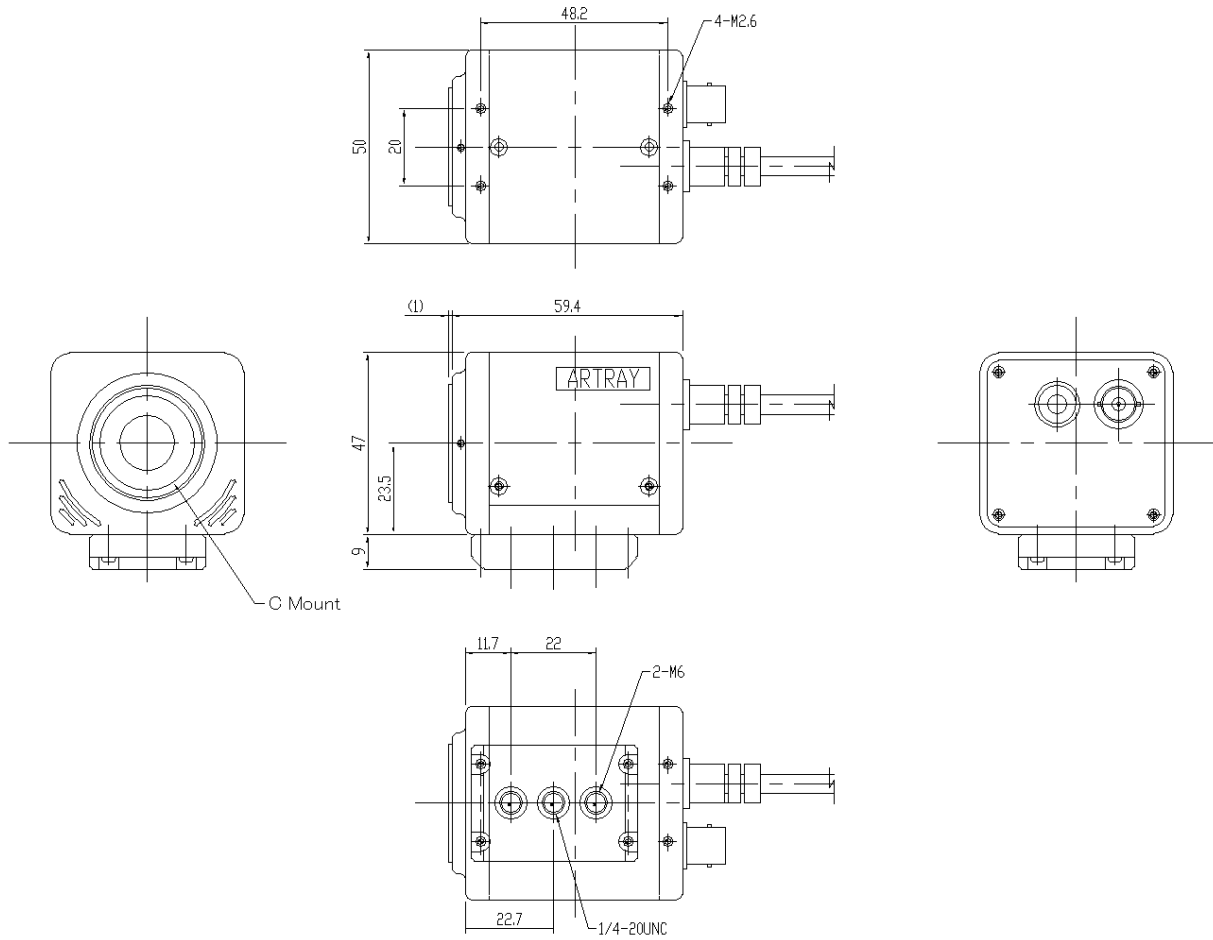
ARTCAM-130MI/130MI-BW/130MI-NIR

ARTCAM-300MI

ARTCAM-500MI/500MI-BW/500MI-NIR

ARTCAM-900MI

ARTCAM-1000MI



7-2 BOARD LENS, BOARD TYPE

ARTCAM-036MI2-OP/036MI2-BW-OP/036MI2-NIR-OP

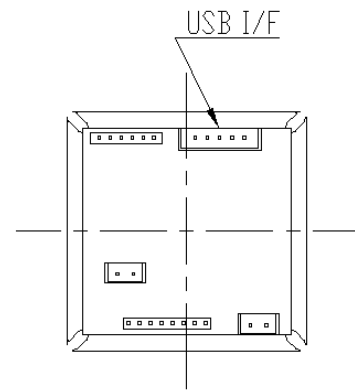
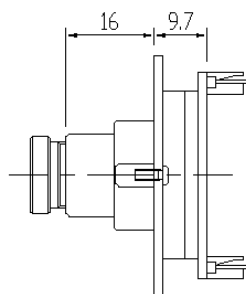
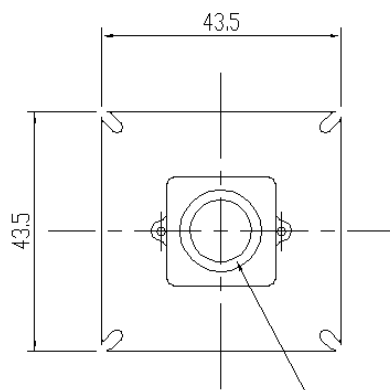
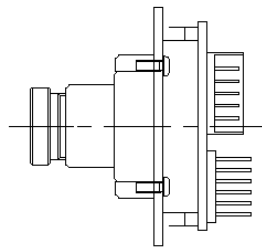
ARTCAM-130MI-OP/130MI-BW-OP/130MI-NIR-OP

ARTCAM-300MI-OP

ARTCAM-500MI-OP/500MI-BW-OP/500MI-NIR-OP

ARTCAM-900MI-OP

ARTCAM-1000MI-OP



Board lens (Mount M12 P0.5)

7-3 C-MOUNT, BOARD TYPE

ARTCAM-036MI2-OP-CM/036MI2-BW-OP-CM/036MI2-NIR-OP-CM

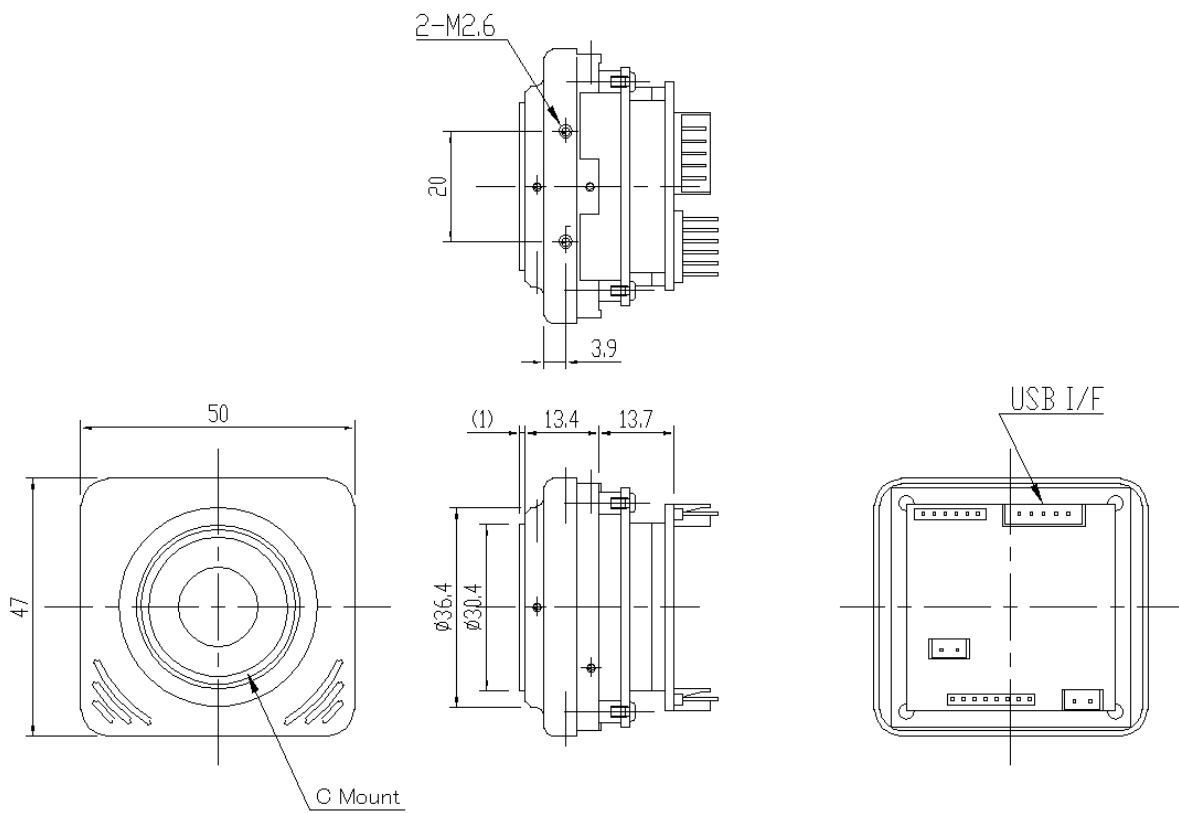
ARTCAM-130MI-OP-CM/130MI-BW-OP-CM/130MI-NIR-OP-CM

ARTCAM-300MI-OP-CM

ARTCAM-500MI-OP-CM/500MI-BW-OP-CM/500MI-NIR-OP-CM

ARTCAM-900MI-OP-CM

ARTCAM-1000MI-OP-CM

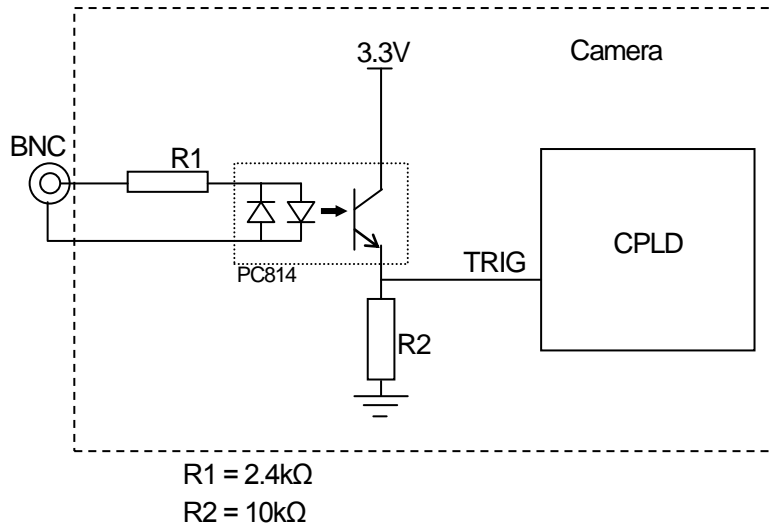


## 8. External Trigger

### 8-1. Trigger Input

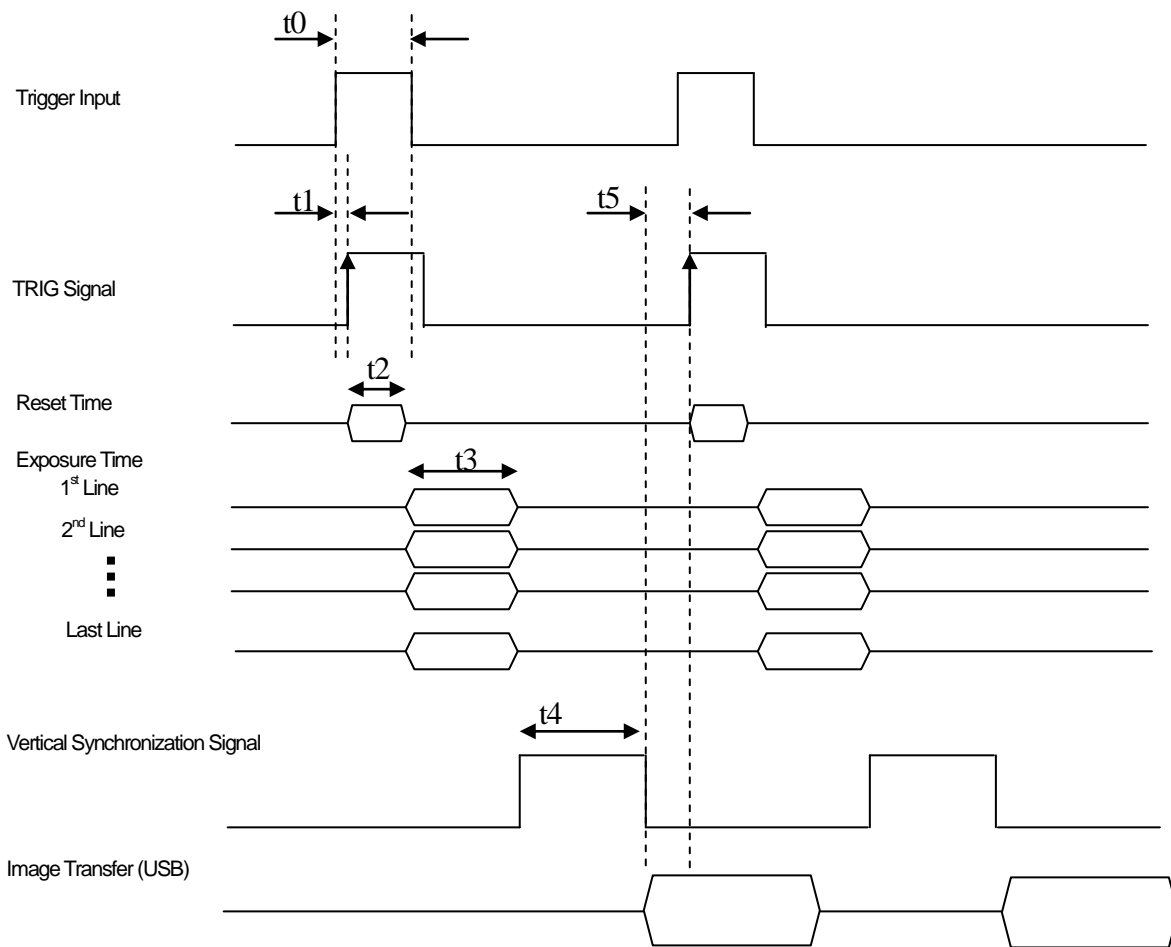
ARTCAM-036MI2 / 130MI / 300MI / 500MI series are designed with external trigger.

#### Trigger Input Circuit





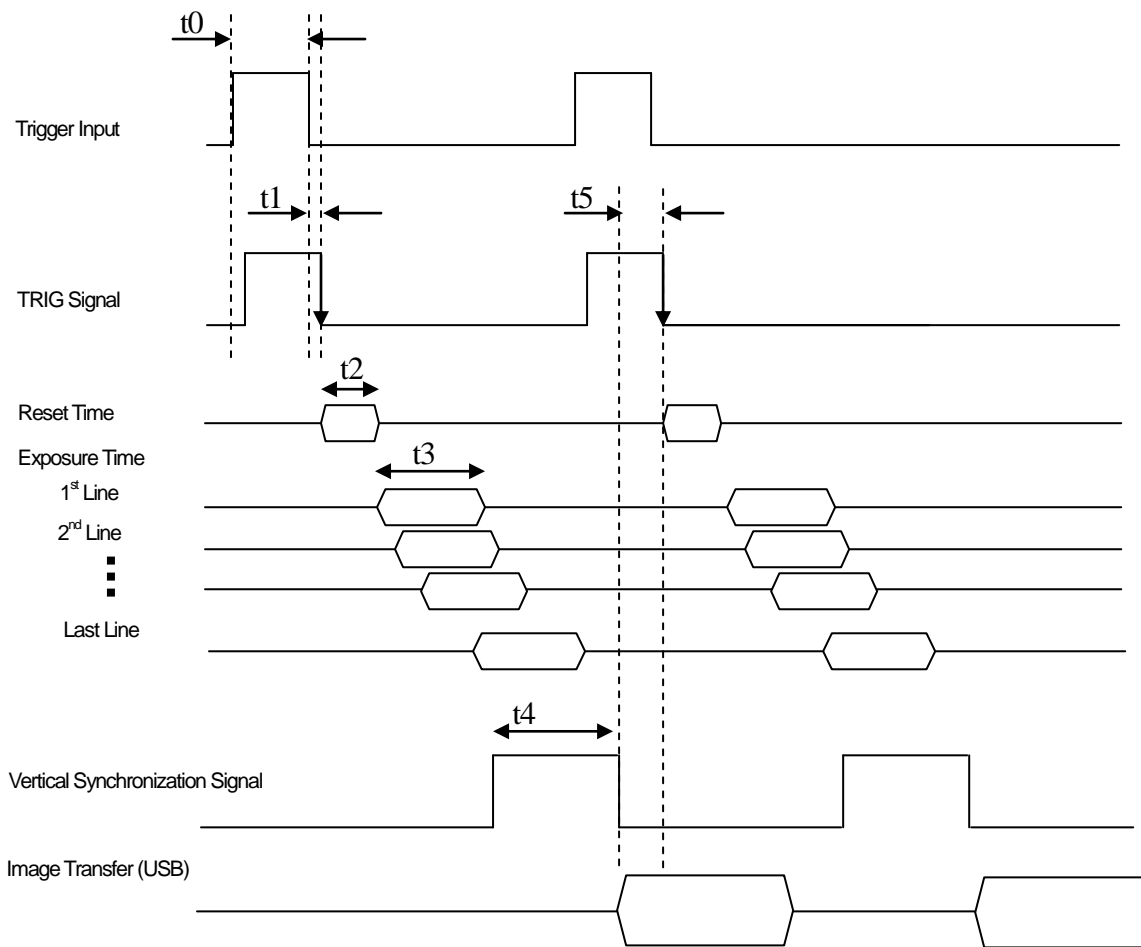
### 8-2-1 Trigger timing chart (ARTCAM-036MI2 series)



$t_0$	Input Pulse Width	Above 1ms
$t_1$	Photo Coupler Delay	1~99 $\mu$ s (Subject to Input Pulse Voltage)
$t_2$	Reset Time	6 * 1H
$t_3$	Exposure Time	Subject to Shutter Speed Settings
$t_4$	Frame Transfer	Subject to ROI Settings and Operation Clock
$t_5$	Effective Trigger for next frame	Approximate 100H after the Vertical Synchronization Signal transits to a low voltage

\*For ARTCAM-036MI2, the image will be acquired when the trigger signal transits from a low voltage to a high one. If the trigger signal stays at a high level, the trigger time cycle will repeat automatically and image will be acquired continuously.

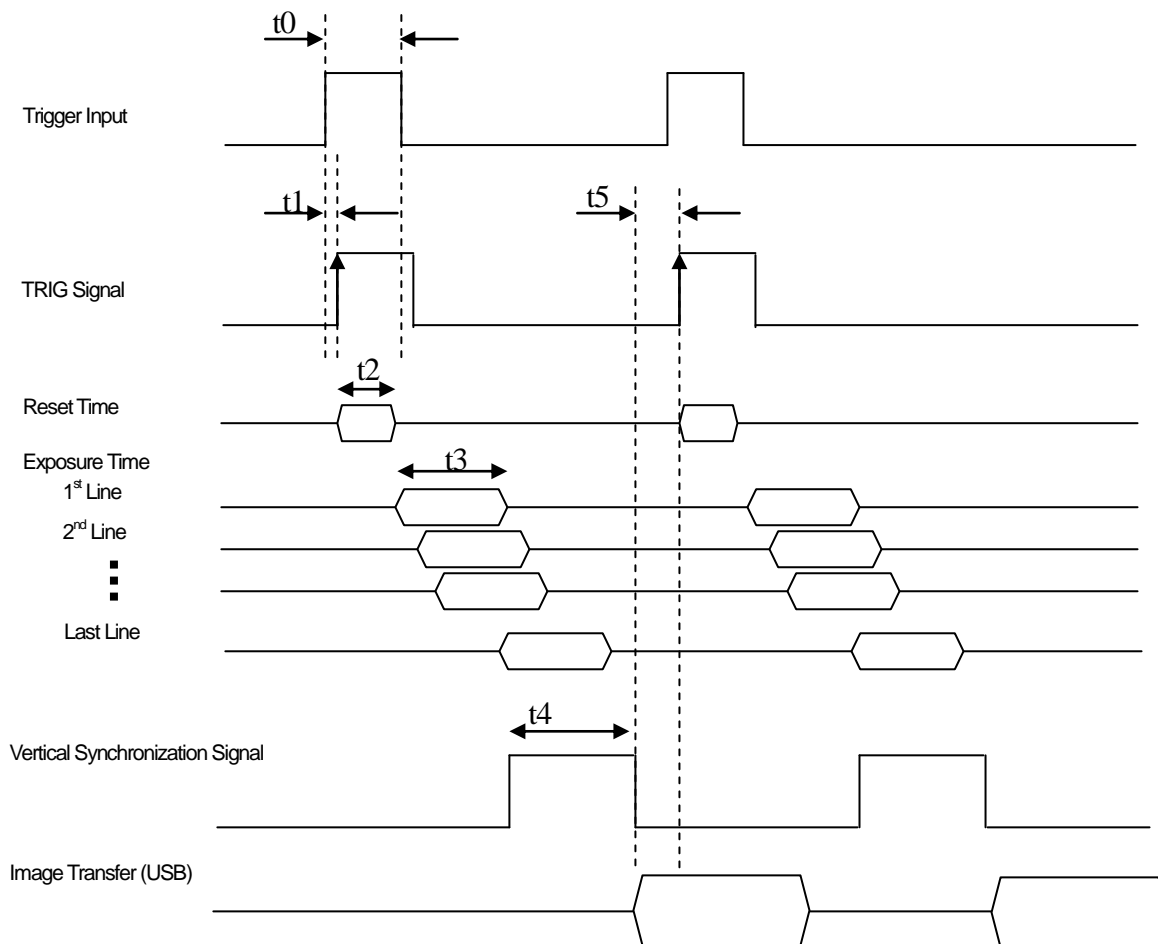
8-2-2 Trigger timing chart (ARTCAM-130MI/300MI series)



t0	Input Pulse Width	Above 1ms
t1	Photo Coupler Delay	1~99 $\mu$ s (Subject to Input Pulse Voltage)
t2	Reset Time	9 * 1H(ARTCAM-130MI series) 18 * 1H(ARTCAM-300MI series)
t3	Exposure Time	Subject to Shutter Speed Settings
t4	Frame Transfer	Subject to ROI Settings and Operation Clock
t5	Effective Trigger for next frame	Approximate 100H after the Vertical Synchronization Signal transits to a low voltage

\*For ARTCAM-130MI/300MI, the image will be acquired only when the trigger signal transits from a high voltage to a low one. If the trigger signal stays at a high level or at a low level, no image will be acquired.

### 8-2-3 Trigger timing chart (ARTCAM-500MI series)



t0	Input Pulse Width	Above 1ms
t1	Photo Coupler Delay	1~99 $\mu$ s (Subject to Input Pulse Voltage)
t2	Reset Time	8 * 1H
t3	Exposure Time	Subject to Shutter Speed Settings
t4	Frame Transfer	Subject to ROI Settings and Operation Clock
t5	Effective Trigger for next frame	Approximate 100H after the Vertical Synchronization Signal transits to a low voltage

\*For ARTCAM-500MI, the image will be acquired when the trigger signal transits from a low voltage to a high one. If the trigger signal stays at a high level, the trigger time cycle will repeat automatically and image will be acquired continuously.

