
1.2Mega CMOS USB Camera

ID1MB-BRDC-U (B/W)

ID1MC-BRDC-U (COLOR)

Technical Manual

iDule Corporation

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1. Product Outline

ID1MB-BRDC-U/ID1MC-BRDC-U is a USB3.0/2.0 interfaced and 1.2Mega resolution camera module. 1.2Mega pixels CMOS sensor with diagonal length 6.0mm is utilized. Entire pixels can be read out within 1/54s.

Features

- Global Shutter CMOS sensor is utilized.
- Fixed trigger shutter mode is operable.
- USB3.0 / 2.0 output
- USB UVC (YUV-RAW) / Y8(RAW)
- USB BUS POWER

2. Handling Precautions

The camera must not be used for any nuclear equipment or aerospace equipment with which mechanical failure or malfunction could result in serious bodily injury or loss of human life. Our warranty does not apply to damages or defects caused by irregular and /or abnormal use of the product.

Please observe all warnings and cautions stated below.

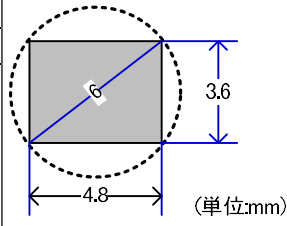
Our warranty does not apply to damages or malfunctions caused by neglecting these precautions.

Do not use or store the camera in the following extreme conditions :

- Extremely dusty or humid places.
 - Extremely hot or cold places (operating temperature -5°C to +45°C).
 - Close to generators of powerful electromagnetic radiation such as radio or TV transmitters.
 - Places subject to fluorescent light reflections.
 - Places subject to unstable (flickering, etc.) lighting conditions.
 - Places subject to strong vibration.
-
- Remove dust or dirt on the surface of the lens with a blower.
 - Do not apply excessive force or static electricity that could damage the camera.
 - Do not shoot direct images that are extremely bright (e.g., light source, sun, etc.), and when camera is not in use, put the lens cap on.
 - Confirm the mutual ground potential carefully and then connect the camera to monitors or computers. AC leaks from the connected devices may cause damages or destroy the camera.
 - Do not apply excessive voltage. (Use only the specified voltage.) Unstable or improper power supply voltage may cause damages or malfunction of the camera.
 - The voltage ripple of camera power DC +12V±10% shall be within ±50mV. Improper power supply voltage may cause noises on the video signals.
 - The rising time of camera power supply voltage shall be less than +10V, Max 60ms. Please avoid noises like chattering when rising.

3. Specification

3.1.General Specification

| | | | |
|---|--|---|--|
| (1) Image Sensor | Type | Diagonal length 6.0mm Global Shutter (OnSemi AR0135) | |
| | Effective Pixel Number | 1284(H) x 962(V) | |
| | Cell Size | 3.75 μ m(H) x 3.75 μ m(V) | |
| | Image Circle | Φ 6.0mm (SXGA) Φ 3.0mm (VGA) Φ 1.5mm (QVGA) | |
|  | | | |
| (2) Video Output Frequency | Pixel CLK | 74.25MHz | |
| | Output effective pixel number | SXGA : 1284(H) x 962(V) VGA : 644(H) x 482(V) QVGA : 324(H) x 242(V) | |
| | USB3.0 | SXGA : 54fps VGA : 105fps QVGA : 198fps | 1388(H) x 989(V) : with Blanking 1388(H) x 509(V) : with Blanking 1388(H) x 269(V) : with Blanking |
| USB2.0 | SXGA : 15 fps VGA : 29 fps QVGA : 55 fps | 5000(H) x 989(V) : with Blanking 5000(H) x 509(V) : with Blanking 5000(H) x 269(V) : with Blanking | |
| (3) Video Output | USB3.0/2.0 : UVC (YUV-RAW), Y8 (RAW) | | |
| (4) Output Format | Sensor AD | 12bit | |
| | USB3.0/2.0 | 8bit | |
| (5) Sensitivity | B/W | F8 | 2000lx |
| | Color | F5.6 | 2000lx |
| at shutter speed 1/54s(OFF), Gain 0dB | | | |
| (6) Minimum Illumination | B/W | F1.4 | 4lx |
| | Color | F1.4 | 8lx |
| at shutter speed 1/54s(OFF), Gain +12dB | | | |
| (7) Power Requirements | USB Bus Power : DC+5V \pm 5% | | |
| (8) Power Consumption | typ 0.9 W max 1.1 W | | |
| (9) Dimensions | W:35.0mm D:16.8mm H:35.0mm excluding projection | | |
| (10) Weights | Approx. 25g | | |
| (11) Lens Mount | C Mount | | |
| (12) Gain | 0dB ~ +12dB | | |
| (13) Shutter Speed | USB3.0 (Normal Mode) : OFF(1/54s) ~ 1/54000s | | |
| | USB3.0 (Trigger Mode) : OFF(1/45s) ~ 1/45000s | | |
| | USB2.0 : OFF(1/15s) ~ 1/15000s | | |
| (14) Trigger Mode | Fixed Trigger Shutter Mode | | |
| (15) Scan Mode | SXGA : Partial Scan 1/2, 1/4, 1/8 Binning : 2x2(VGA) | | |
| | VGA : Partial Scan 1/2, 1/4, 1/8 | | |
| (16) Safety/ Quality Standards | CE | To be applied for EN61000-6-3:2007+A1:2011 for Emission | |
| | | To be applied for EN61000-6-1:2007 for Immunity | |
| RoHS: Conform to RoHS | | | |
| (17) Durability | Vibration | 20~200 Hz, 98m/s ² (10G), X,Y and Z directions (120 min for each direction) | |
| | Shock | No malfunction shall be occurred with 980m/s ² (100G) for \pm X, \pm Y, \pm Z, 6 directions. (without package) | |
| (18) Environment | Operation | 0 $^{\circ}$ C ~ +40 $^{\circ}$ C Humidity 0 ~ 90%RH | |
| | Storage | -25 $^{\circ}$ C ~ +65 $^{\circ}$ C Humidity 0 ~ 90%RH | |

3.2. Camera Output Signal Specification

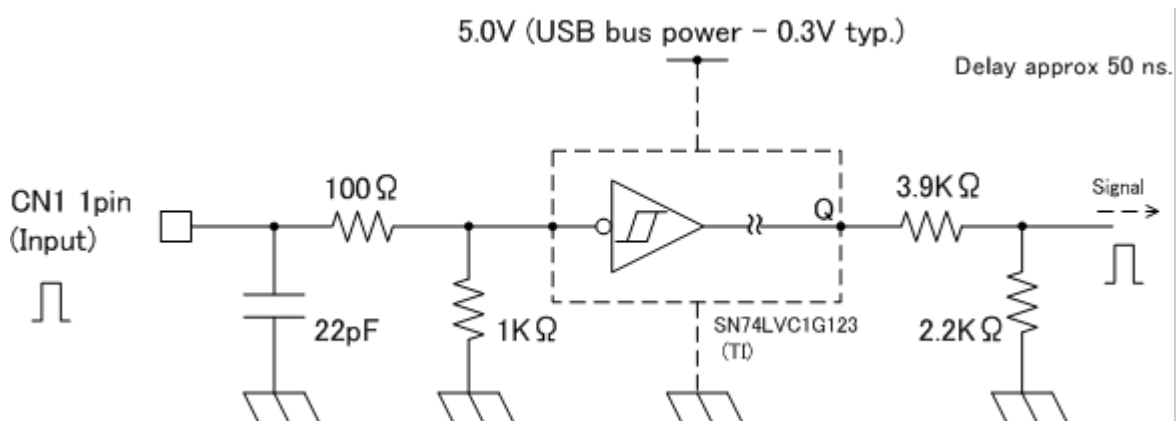
3.2.1. USB3.0 / 2.0

| | | | |
|-----------------------|------------------------|---|---------------|
| (1) Video Output Data | Effective Video Output | 1284(H) × 962(V) | |
| (2) Video Signals | White Clip Level | FFh | (at gain 0dB) |
| | Setup Level | Under 0Ch | |
| | Dark Sharding | Both horizontal and vertical should be under 00Fh | |

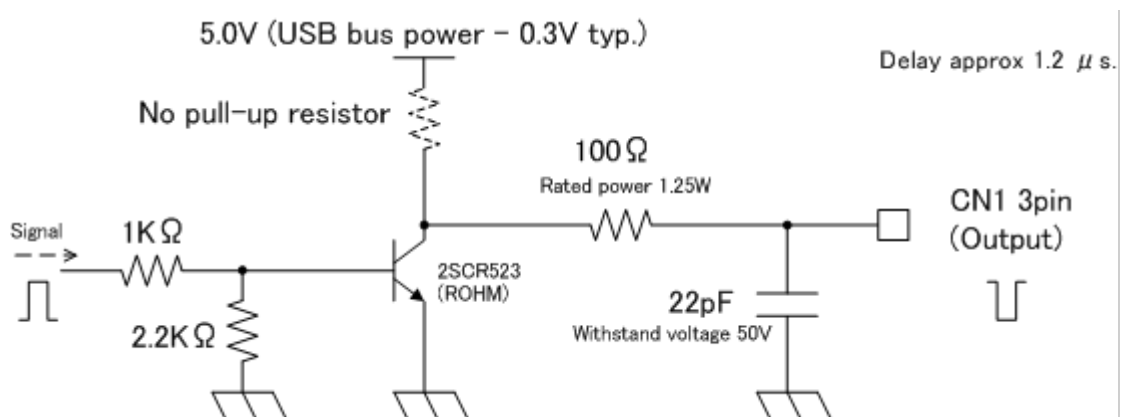
3.2.2. External Input / Output

| | | | |
|---------------------|------------|-------------------------------|----------------------------------|
| (1) Trigger in | CN1 : 1pin | Low 1.4V(max), High 3.3V~5.0V | 5.0V : USB bus power - 0.3V typ. |
| | Polarity | Positive | |
| (2) Exposure signal | CN1 : 3pin | No pull-up resistor | Max 30V (under 0.12W) |
| | Polarity | Positive / Negative | Address 0D |

Trigger Input circuit

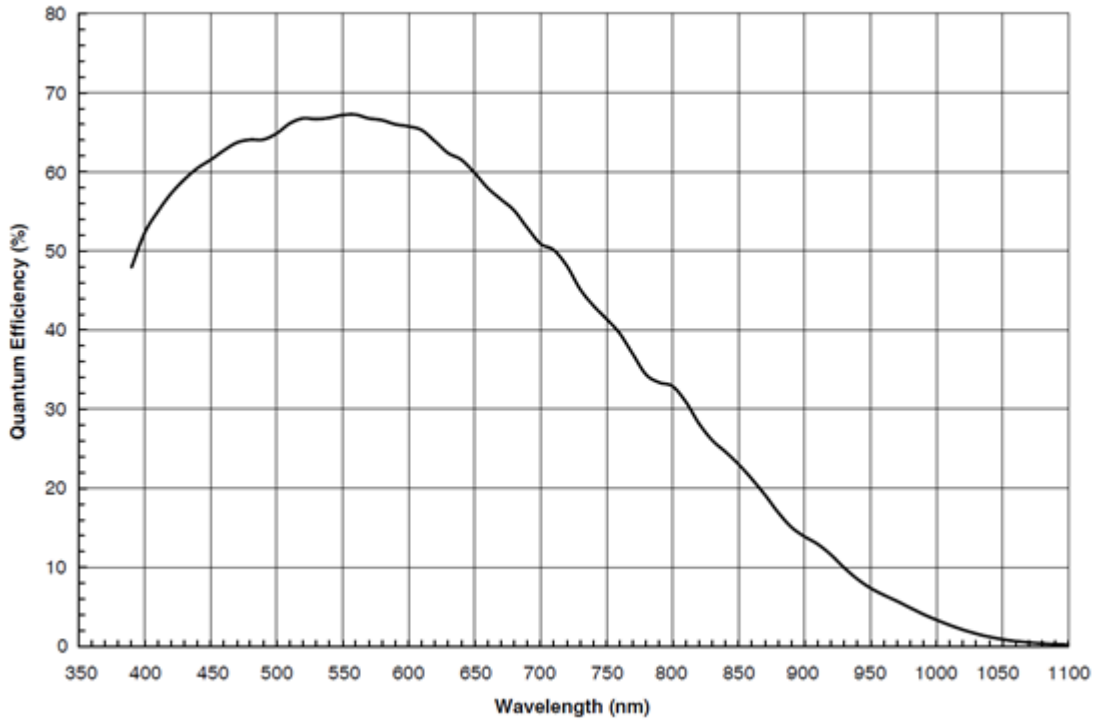


Exposure Output circuit

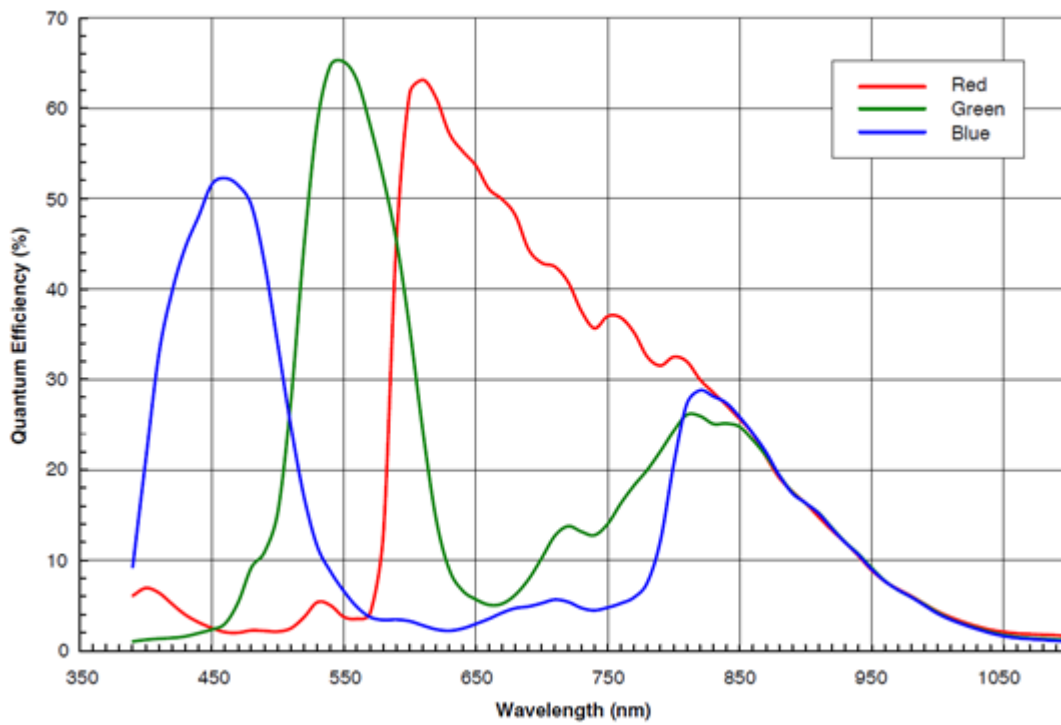


3.3.Spectral Response (Representative Value)

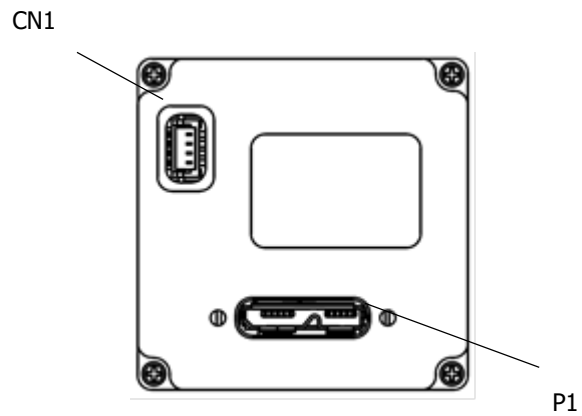
ID1MB-BRDC-U (B/W)



ID1MC-BRDC-U (Color)



4. Connector



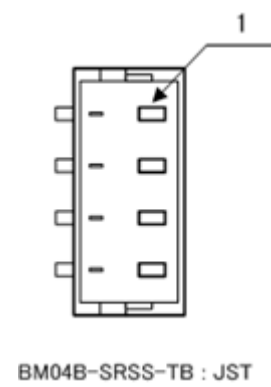
4.1.Connector P1

USB3.0 Micro B Connector
USB Bus Power

4.2.Connector CN1

External input and output connector BM04B-SRSS-TB (JST)

| PIN No | Name |
|--------|--------------|
| 1 | Trigger IN |
| 2 | GND |
| 3 | Exposure OUT |
| 4 | GND |

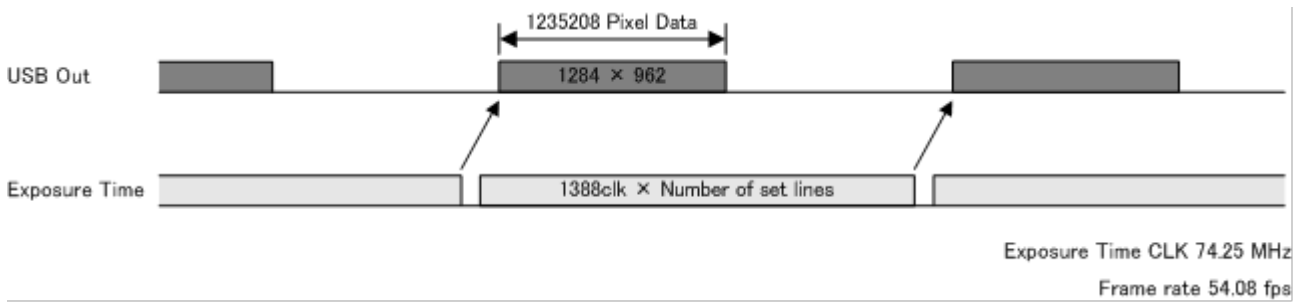


5. Timing Chart

5.1.USB3.0 Normal Shutter Mode

After CMOS sensor is finished to expose, start to translate USB data.

USB translate timing is not fixed.

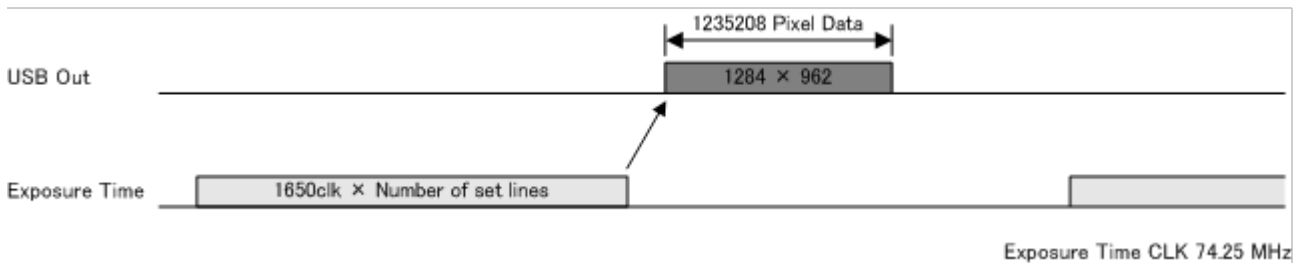


5.2. USB3.0 Fixed Trigger Shutter Mode

After CMOS sensor is finished to expose, start to translate USB data.

Frame Rate depend on trigger timing and exposure time.

USB translate timing is not fixed.

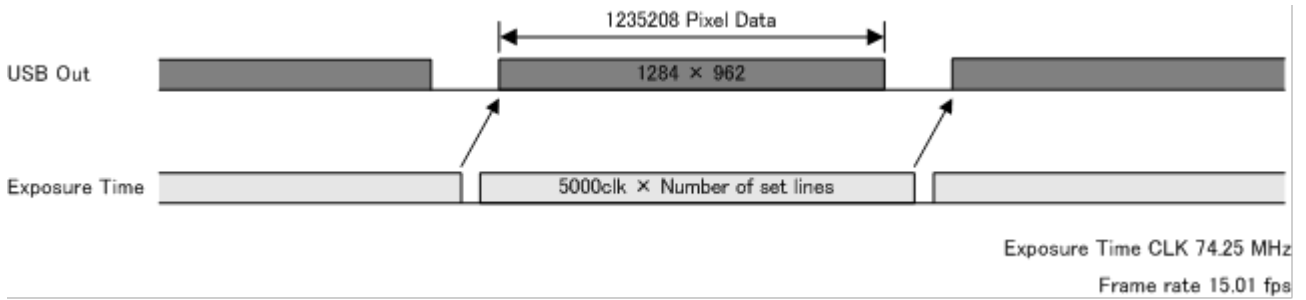


5.3.USB2.0 Normal Shutter Mode

TBD

After CMOS sensor is finished to expose, start to translate USB data.

USB translate timing is not fixed.

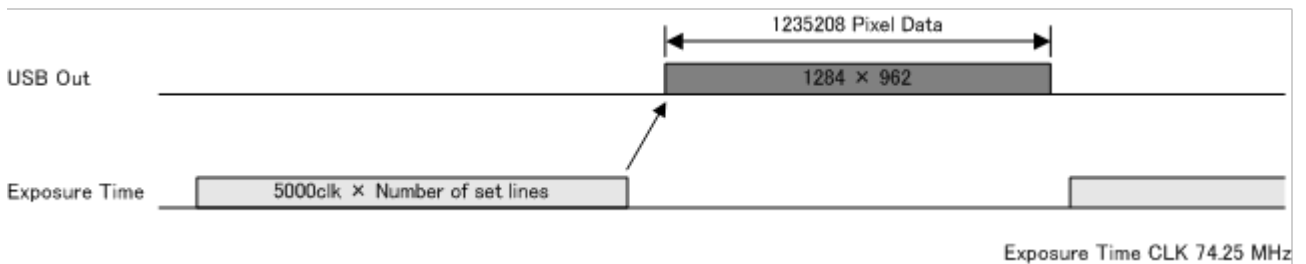


5.4.USB2.0 Fixed Trigger Shutter Mode

After CMOS sensor is finished to expose, start to translate USB data.

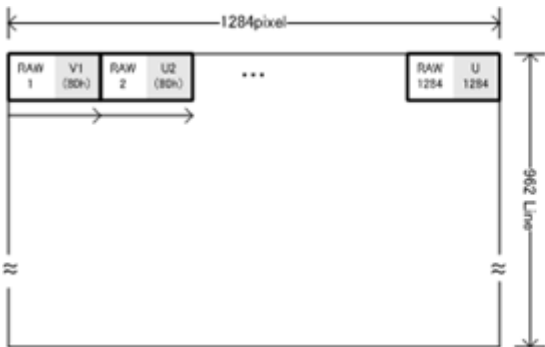
Frame Rate depend on trigger timing and exposure time.

USB translate timing is not fixed.

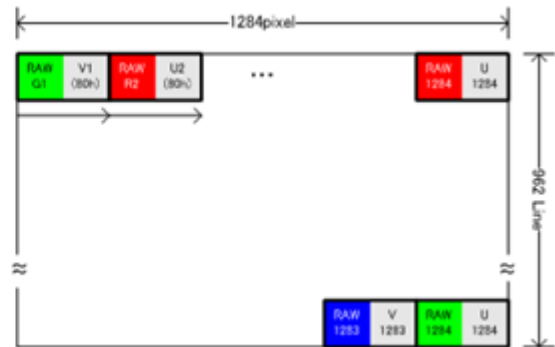


5.5. Output Format

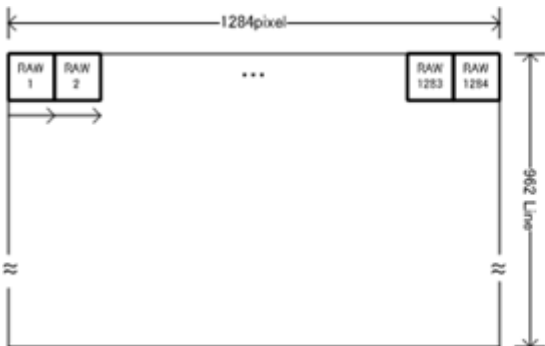
UVC (YUV-RAW)
ID1MB-BRDC-U



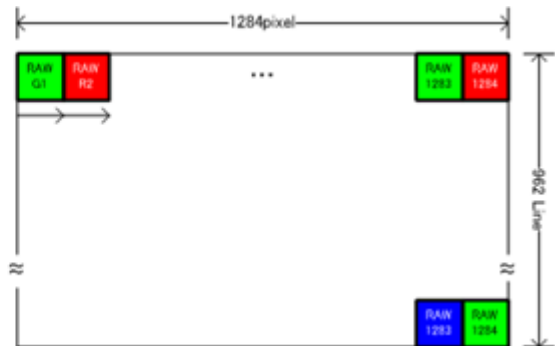
ID1MC-BRDC-U



Y8 (RAW)
ID1MB-BRDC-U

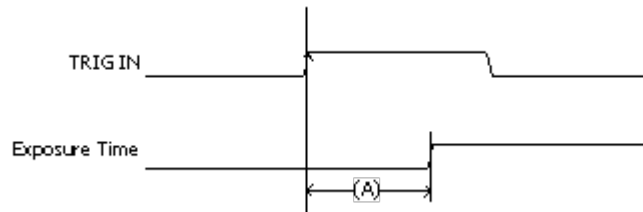


ID1MC-BRDC-U



5.6.Fixed Trigger Shutter Mode

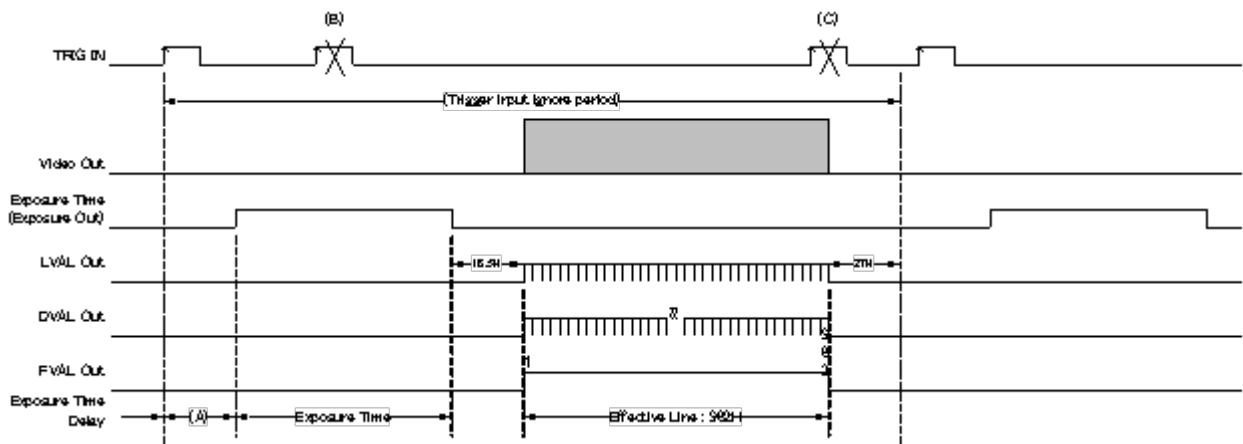
- This is the mode to start exposure with external input trigger signals, and set the exposure time with serial commands.
- Delay time (Exposure Time Delay) from detecting trigger edge in the camera to starting exposure is as below.



Exposure Time Delay (A)

| | | | |
|---------|-------|--------|------------|
| •USB3.0 | 188us | (8.5H) | 1H=22.22us |
| •USB2.0 | 572us | (8.5H) | 1H=67.34us |

- Triggers cannot be accepted even when exposing and outputting video signals.
Trigger input during exposure time should be ignored. (Refer to the below B and C)



6. Scan Mode

6.1. Partial Scan Mode

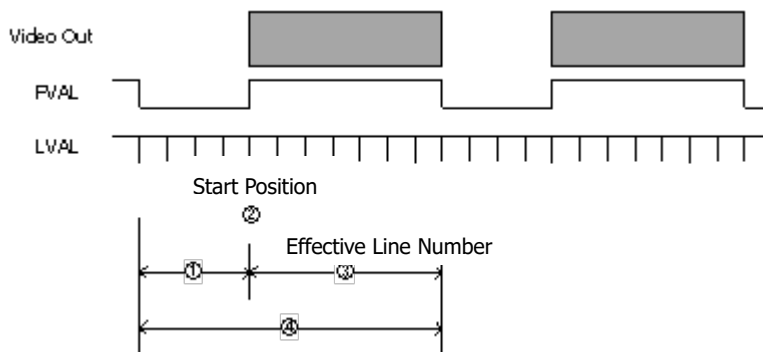
- In SXGA and VGA modes, the frame rate can be increased by limiting the vertical scan area.
- Set the mode and start position using UVC Commit Control and communication commands.

Partial Scan Setting

Partial Scan Area 1/2, 1/4, 1/8 (by UVC Commit Control)
 Partial Scan Start Position Address : 40 – 41h

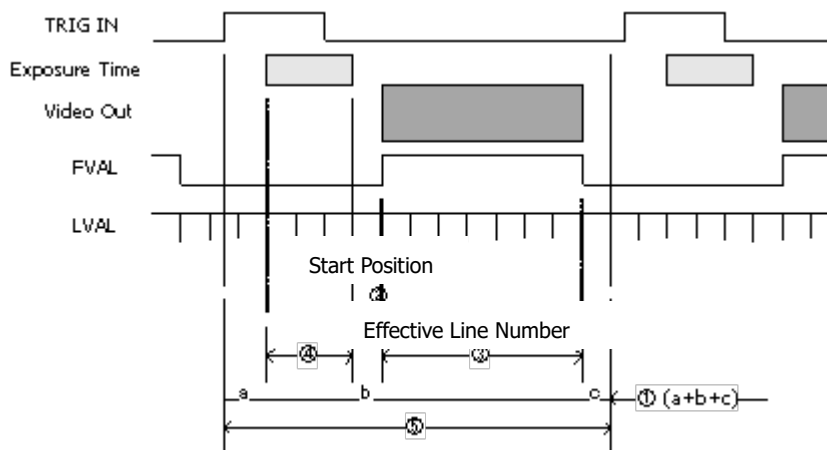
Example

Normal Shutter Mode



- | | |
|--|------------------|
| ① : V Blanking | : 27H fixed |
| ② : Partial Scan Start Position | : 120H |
| ③ : Partial Scan Effective Line Number | : 482H(Mode 1/2) |
| ④ : Total Lines | : 509H(①+③) |

Fixed Trigger Shutter Mode (USB3.0 Shutter speed 1/1000s (45H))



- | | |
|--|------------------|
| ① : V Blanking | : 54H fixed |
| ② : Partial Scan Start Position | : 120H |
| ③ : Partial Scan Effective Line Number | : 482H(Mode 1/2) |
| ④ : Shutter Speed Line Number | : 45H |
| ⑤ : Total Lines | : 581H(①+③+④) |

- Please set the start position $2 \times n$.

Start position + Effective Line number ≤ 962

- Flame Total Lines Time

Normal Shutter Mode

= V blanking line number 27H fixed) + Partial Scan Effective line numbers

Fixed Trigger Shutter Mode

= Shutter Speed (s) + V blanking line number 54H fixed) + Partial Scan Effective line numbers

- Frame Rate = $1 / (\text{Total lines} \times \text{Time for 1 line})$

Time for 1 line =

USB3.0 :Normal Mode : 18.69us Fixed Trigger Shutter Mode : 22.22us

USB2.0 : 67.34us

- Normal Shutter Mode

| Mode | Effective Line Number | Frame Rate (Total Line number) | |
|-------------------------|-----------------------|--------------------------------|----------------|
| | | USB3.0 | USB2.0 |
| VGA1/8 | 62H | 601.05fps (89H) | 166.8fps (89H) |
| 1/8, VGA1/4 | 122H | 359.02 (149) | 99.6 (149) |
| 1/4, VGA1/2 (QVGA Mode) | 242H | 198.8 (269) | 55.2 (269) |
| 1/2 (VGA Mode) | 482H | 105.09 (509) | 29.1 (509) |

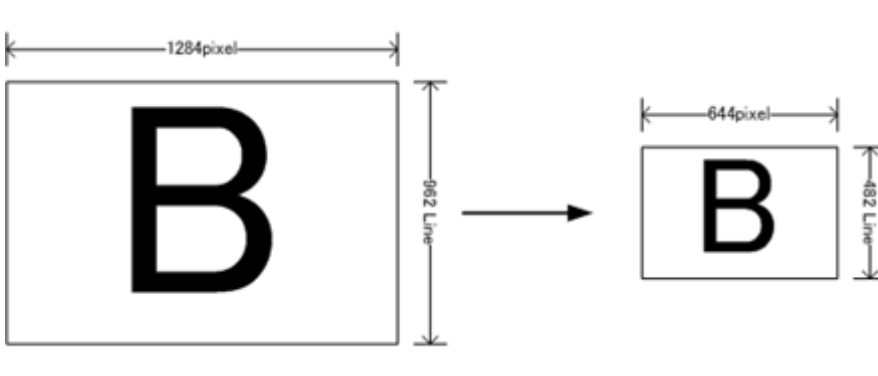
- Fixed Trigger Shutter Mode Shutter Speed 1/1000s (45H)

| Mode | Effective Line Numer | Shutter Speed Line Numer | Frame Rate (Total Shutter Line number) | |
|--------------------|----------------------|--------------------------|--|----------------|
| | | | USB3.0 | USB2.0 |
| VGA1/8 | 62H | 45H | 279.5fps (161H) | 92.2fps (161H) |
| 1/8, VGA1/4 | 122H | 45H | 203.6 (221) | 67.1 (221) |
| 1/4, VGA1/2 (QVGA) | 242H | 45H | 131.9 (341) | 43.5 (341) |
| 1/2 (VGA) | 482H | 45H | 77.4 (581) | 25.5 (581) |

7. Binning Mode

- Two horizontal pixels and two vertical pixels are added to one pixel for output.
- The number of pixels (transfer data amount) can be reduced without changing the angle of view.
- Frame rate is the same as all pixel output.
- Select 644 x 482 (VGA mode) in UVC Commit Control, and set the binning mode by communication command.

Binning Mode Address : 11 h



8. VGA Mode

- VGA mode 644 x 482 pixels are cut out from all pixels and output.
- There are fewer lines and the frame rate goes up to 88.4 fps.
- Select 644 x 482 in UVC Commit Control and set to VGA mode.
- The start position can be set by communication command for both horizontal and vertical.

Partial Scan

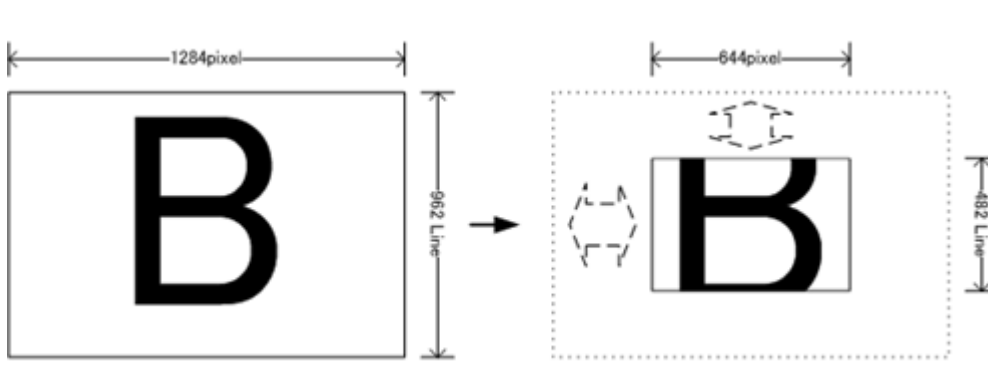
Horizontal Start Position Address : 42 – 43 h
Vertical Start Position Address : 40 – 41 h

- Please set the start position $2 \times n$.

Horizontal Start position +644 <= 1284

Vertical Start position +482 <= 962

*The data FFFF h (initial value) is the center position (320,240).



9. QVGA Mode

- Cut out QVGA 324 x 242 pixels from all pixels and output.
- There are fewer lines and the frame rate goes up to 167.28fps.
- Select 324 x 242 in UVC Commit Control and set to QVGA mode.
- The start position can be set by communication command for both horizontal and vertical.

Partial Scan

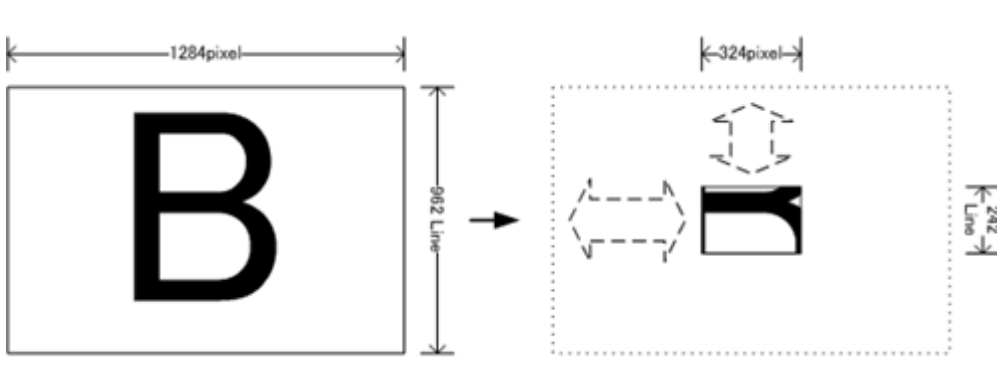
Horizontal Start Position Address : 42 – 43 h
Vertical Start Position Address : 40 – 41 h

- Please set the start position $2 \times n$.

Horizontal Start position +324 <= 1284

Vertical Start position +242 <= 962

*The data FFFF h (initial value) is the center position (480,360).



10. UVC Extension Units (USB) Function

Set the function with the SetVal () and GetVal () functions in the software development kit.

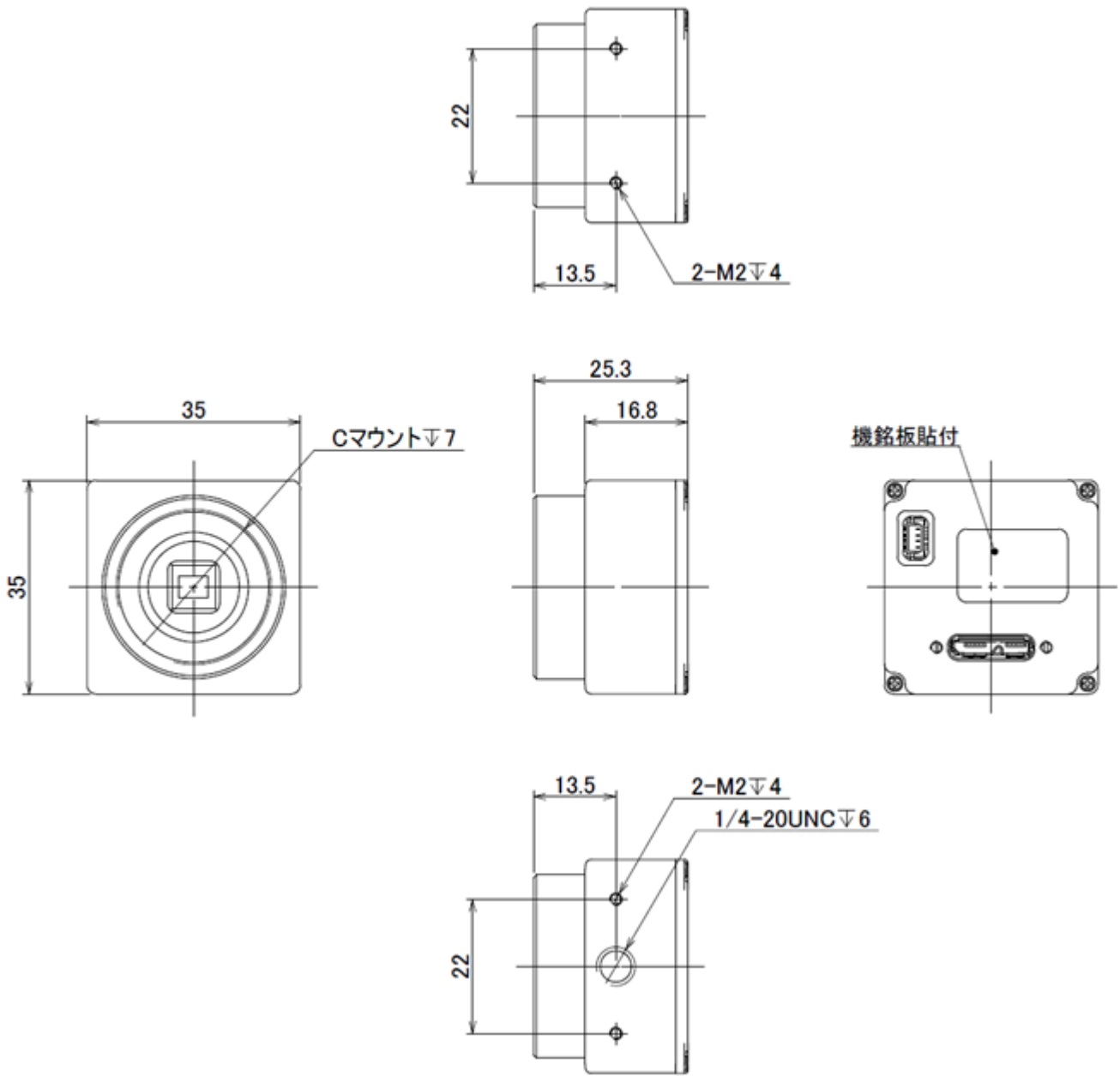
11. Function Setting

| Function | Address (Hex) | Data(Hex) | | | |
|----------------------|-----------------------|-----------|---|--------------------------------------|------------|
| Gain Mode | 00 | 00: | 0dB | | |
| | | 01: | 6dB | | |
| | | 02: | 12dB | | |
| | | 03: | Manual (Address20-21) | | |
| | | 04: | RGB Manual Gain (* 1) (R Address 28-29, B Address2 A-2B, G Address 2C-2D) Gain setting is possible for each RGB. | | |
| Shutter Mode | 01 | | USB3.0 Normal Shutter Mode | USB3.0 Fixed Trigger Shutter Mode | USB2.0 |
| | | 00: | 1/54s(OFF) | 1/45s(OFF) | 1/15s(OFF) |
| | | 01: | 1/75s | 1/75s | 1/30s |
| | | 02: | 1/100s | 1/100s | 1/45s |
| | | 03: | 1/150s | 1/150s | 1/75s |
| | | 04: | 1/350s | 1/350s | 1/100s |
| | | 05: | 1/500s | 1/500s | 1/150s |
| | | 06: | 1/1000s | 1/1000s | 1/350s |
| | | 07: | 1/2500s | 1/2500s | 1/500s |
| | | 08: | 1/5000s | 1/5000s | 1/1000s |
| | | 09: | 1/7500s | 1/7500s | 1/2500s |
| | | 0A: | 1/10500s | 1/9000s | 1/3000s |
| | | 0B: | 1/13000s | 1/11250s | 1/3700s |
| | | 0C: | 1/18000s | 1/15000s | 1/5000s |
| | | 0D: | 1/54000s | 1/45000s | 1/15000s |
| 0E: | 1/54000s | 1/45000s | 1/15000s | | |
| 0F: | Manual (Address24-25) | | | | |
| Trigger Shutter Mode | 04 | 00: | Normal Shutter Mode (Trigger OFF) | | |
| | | 01: | Fixed Trigger Shutter Mode (Address 01) | | |
| Trigger Input | 06 | 00: | CN1 | | |
| | | 01: | Soft trigger | | |
| Output Mode (* 2) | 0A | 00: | UVC YUV-RAW | | |
| | | 01: | Y8 RAW | | |
| | | 02: | UVC YUV-RAW | | |
| | | 03: | Y8 RAW (Original Format : for Windows) | | |

| Function | Address (Hex) | Data(Hex) | |
|---------------------|---------------|-----------|--|
| USB Mode | 0C | 00: | Auto USB3.0 / 2.0 is automatically detected and an image is output. |
| | | 01: | USB3.0 fixed |
| | | 02: | USB2.0 fixed |
| Exposure Signal | 0D | 00: | Positive |
| | | 01: | Negative |
| | | 02: | Low fixed |
| | | 03: | High fixed |
| Binning Mode | 11 | 00: | OFF |
| | | 01: | ON UVC Commit Control (VGA Mode: ON) |
| Manual Gain | 20-21 | LLHH: | min:0(0H) - max:144(90H) Gain Step 0.020833 (x1 = 0.20833 x 48) Gain (x) = (48 + Setting Value) x 0.020833 0: x1(0dB), 48: x2(+6dB), 144: x4(+12dB) |
| Manual Shutter | 24-25 | LLHH: | min:0(0H) - max:984(3D8H) USB3.0 Normal Shutter mode Shutter speed time = (985 - setting value) x 18.69us min:0= 18.41ms (1/54s), max:984 = 18.69us (1/54000s) USB3.0 Fixed trigger shutter mode Shutter speed time = (985 - setting value) x 22.22us min:0= 21.89ms (1/45s), max:984 = 22.22us (1/45000s) USB2.0 Shutter speed time = (985 - setting value) x 67.34us min:0= 66.33ms (1/15s), max:984 = 67.34us (1/15000s) * Only when the setting value is 983, it becomes an exception and does not apply to the above formula, Exposure time is the same as max value 984. |
| R Manual Gain (* 1) | 28-29 | LLHH: | min:0(0H) - max:144(90H) Gain step 0.020833 (x1 = 0.20833 x 48) Gain (x) = (48 + Setting value) x 0.020833 0: x1(0dB), 48: x2(+6dB), 144: x4(+12dB) |
| B Manual Gain (* 1) | 2A-2B | LLHH: | min:0(0H) - max:144(90H) 0: x1(0dB), 48: x2(+6dB), 144: x4(+12dB) |
| G Manual Gain (* 1) | 2C-2D | LLHH: | min:0(0H) - max:144(90H) 0: x1(0dB), 48: x2(+6dB), 144: x4(+12dB) |

| Function | Address (Hex) | Data(Hex) | |
|---------------------------|---------------|-----------|---|
| Vertical Start Position | 40-41 | LLHH: | UVC Commit Control Partial Scan / VGA / QVGA Mode min:0(0H) - max:900(384H) |
| Horizontal Start Position | 42-43 | LLHH: | UVC Commit Control VGA Mode / QVGA Mode min:0(0H) - max:960(3C0H) |

12. Dimensions



(mm)

13. Initial Setting

| Function | Address | Data | |
|--------------------------------------|---------|-------|----------------------|
| Gain Mode | 00 | 00: | 0dB |
| Shutter Mode | 01 | 00: | (OFF) *1 |
| Trigger Mode | 04 | 00: | Normal (Trigger OFF) |
| Trigger Input | 06 | 00: | CN1 |
| Camera Output Mode | 0A | 00: | UVC YUV-RAW |
| USB Mode | 0C | 00: | Auto |
| Exposure Signal | 0D | 01: | Negative |
| Binning Mode | 11 | 00: | OFF |
| Manual Gain | 20-21 | 0000: | 0dB |
| Manual Shutter | 24-23 | 0000: | Shutter(OFF) |
| Manual White Balance R (Color model) | 28-29 | 0000: | 0dB |
| Manual White Balance G (Color model) | 2A-2B | 0000: | 0dB |
| Manual White Balance B (Color model) | 2C-2D | 0000: | 0dB |
| Vertical Start Position | 40-41 | FFFF: | Center Position |
| Horizontal Start Position | 50-51 | FFFF: | Center Position |
| | | | |

* 1 USB3.0 Normal Shutter Mode : 1/54s, USB3.0 Fixed Trigger Shutter Mode : 1/45s, USB2.0 : 1/15s

14. **Cases for Indemnity (Limited Warranty)**

We shall be exempted from taking responsibility and held harmless for damage or losses incurred by the user in the following cases.

- In case damage or losses are caused by fire, earthquake, or other acts of God, acts by third party, deliberate or accidental misuse by the user, or use under extreme operating conditions.
- In case indirect, additional, consequential damages (loss of business interests, suspension of business activities) are incurred as result of malfunction or non-function of the equipment, we shall be exempted from responsibility for such damages.
- In case damage or losses are caused by failure to observe the information contained in the instructions in this product specification & operation manual.
- In case damage or losses are caused by use contrary to the instructions in this product specification & operation manual.
- In case damage or losses are caused by malfunction or other problems resulting from use of equipment or software that is not specified.
- In case damage or losses are caused by repair or modification conducted by the customer or any unauthorized third party (such as an unauthorized service representative).

15. **CMOS Pixel Defect**

IDULE compensates the noticeable CMOS pixel defects found at the shipping inspection prior to our shipment. On very rare occasions, however, CMOS pixel defects might be noted with time of usage of the products.

Cause of the CMOS pixel defects is the characteristic phenomenon of CMOS itself and IDULE is exempted from taking any responsibilities for them. Should you have any questions on CMOS pixel defects compensation, please contact us.

16. **Product Support**

When defects or malfunction of our products occur, and if you would like us to investigate on the cause and repair, please contact your distributors you purchased from to consult and coordinate.