Progressive Scan Type Black and White Camera
(Frame Shutter)

KP-F100

Operation Guide

Hitachi Denshi , Ltd.

Table of Contents

1. General

The Hitachi KP-F100 is a full-frame shutter black and white camera using a 2/3" CCD of all pixels read-out type.

The KP-F100 features high performance, high sensitivity, and high resolution. The KP-F100 is provided with a variety of functions including a multiple step electronic shutter, integration mode switching, external HD/VD sync input, Frame-on-Demand functions.

A picture suitable for image processing systems is obtained, because a CCD of square lattice unit pixels is used.

● *Principal sales points*

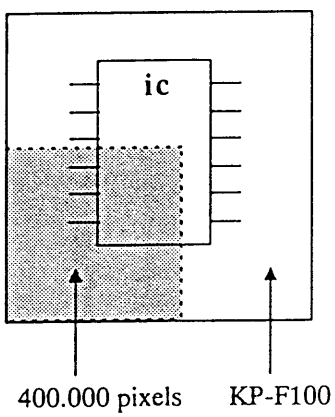
1) Frame shutter function

The CCD picture elements (pixels) are read sequentially. Compared with previous systems, vertical resolution is higher with respect to moving objects.

2) High resolution

Total pixels are 1.4 million; effective pixels are 1300 horizontal by 1030 vertical in a square lattice.

The most recent high grade CCD is adopted. (N.B., the CCD is not graded according to pixel defects.)



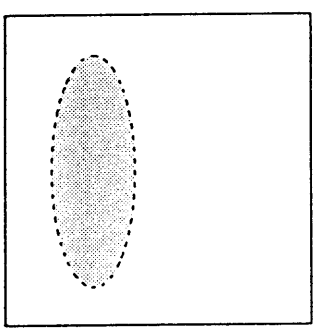
The field of view resolvable by a typical 400.000 pixel CCD is expanded about 3.5 times.

As the figure indicates, images that were previously divided among several exposures can be picked up with one.

Advantages

Reduced shifting for camera and/or subject

Data composing unnecessary



Within the same field of view, resolution is about 3.5 time greater (data more detailed).

Shaded area has large data amount.

Advantage

Improved precision

6) Video outputs

Digital

RS-422A

Data: signal channel 10 bits

20.2 MHz/channel

The digital out pin is not grounded. Connect the ground terminal of a frame grabber or other equipment to the shield of the digital out cable.

Standard cable length is 2 meters. If longer cable is necessary, use impedance matching to preserve waveform sharpness.

Analog

1.0Vp-p 75 Ω unbalanced

Video: 0.7Vp-p

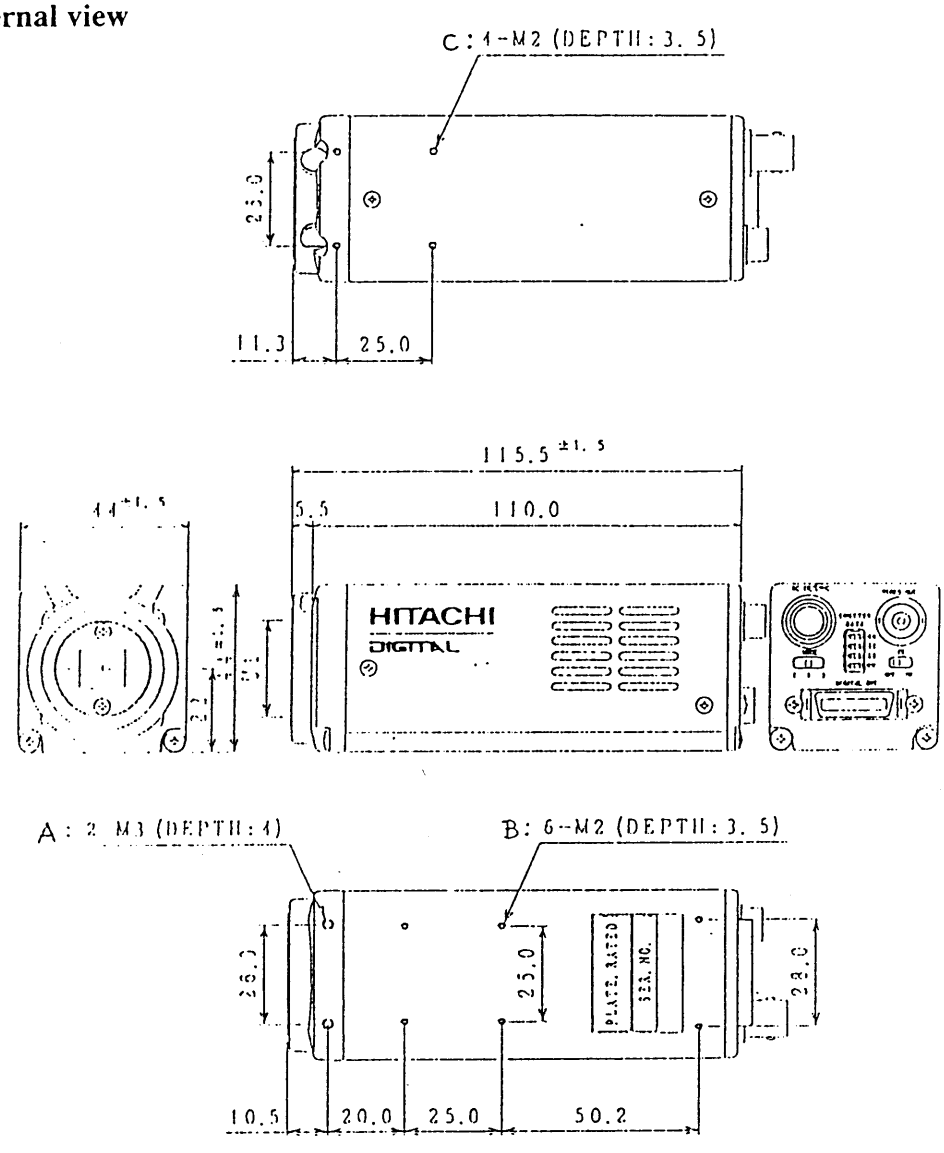
Sync: 0.3Vp-p negative

Internal on/off switch set to off at factory.

Do not use the digital and analog outputs simultaneously, except for brief periods (e.g., when adjusting the picture angle).

When not using the analog output, set the internal switch to off.

2. External view



Unit: mm

Mass : approx. 200g Color : black

Caution

For installation of the camera use camera mounting holes A, B and C.

When a heavy lens is used, or when excessive shock or vibration is applied, fix the lens to the equipment, too.

3. Specifications

3.1 Specifications

1) Imaging device	Interline CCD (2/3 inch size)
No. of total pixels	1360(H) × 1034(V)
Pixel pitch	6.7(H) × 6.7(V) μm
No. of effective pixels	1300(H) × 1030(V)
2) Sensing area	8.71(H) × 6.90(V) mm
3) Lens mount	C-mount
4) Flange focal distance	17.526mm (Not adjustable)
5) Hor. scanning frequency	12.528kHz
6) Vert. scanning frequency	12Hz
7) Sync system	Internal/external (automatically switchable)
8) Int. sync operation	non-interlaced
9) Ext. sync input	HD/VD: 5Vp-p, negative Input impedance: 1k Ω Frequency deviation: ±1%
10) Video outputs	Digital RS-422A Data: signal channel 10 bits 20.2 MHz/channel Analog 1.0Vp-p 75 Ω nunbalanced Video: 0.7Vp-p Sync: 0.3Vp-p negative Internal on/off switch set to off at factory. Do not use the digital and analog outputs simultaneously, except for brief periods (e.g., when adjusting the picture angle). When not using the analog output, set the internal switch to off.
11) Sensitivity	400 lx, f4, 3200K
12) Minimum illumination	1x, f1.4, no IR cut filter
13) Signal-to-noise ratio	50dB
14) Electronic shutter	1/10000, 1/4000, 1/2000, 1/1000, 1/250,1/125, 1/60, 1/30 (External switch selectable) OFF mode: Normal exposure (Factory setting)

15) Gamma correction	1 (Analog output only)
16) Frame-on-Demand	External on/off switch External trigger input required Settings for fixed shutter, two trigger, sync non-reset External switch settings off at factory.
17) Power supply	12VDC±1V
18) Power consumption	500mA or less
19) Ambient conditions	Operating: 0 to 40°C, 90%RH or less Storage: -10 to 50°C, 70%RH or less

Caution: For continued stable operation, the camera should be used under 40°C or less when it is used continuously for extended period of time.

20) Anti-vibration	3G (sweep: 1 min, XYZ, 30 min.)
21) Resistance to shock	30G (Drop test, once each top, bottom, left and right)
22) Dimensions	44(W)×44(H)×110(D)mm
23) Mass	200g approx.

3.2 Composition

1) Camera body (w/IR cut filter)
2) Operation manual

3.3 Optional accessories

1) LENS
2) Tripod adaptor, TA-M1 (23855AX*)
3) 12-pin plug, HR10A-10P-12S(01) (23810AX*)
4) Junction box, JU-F1 (23832AX*)
   JU-M1A (23831AX*)
5) Dummy grass (AR coated) (XMD0009*)
6) Camera cables

	Mould type	Assy type
2m	C-201KSM (23861AX*)	C-201KS (23856AX*)
5m	C-501KSM (23862AX*)	C-501KS (23857AX*)
10m	C-102KSM (23863AX*)	C-102KS (23858AX*)

Assy type: Produced upon request.

JU-F1 notes

1) Write enable (WEN) pulse output from the Video 1 connector.

2) Trigger B pulse output from the Video 2 connector.

JU-M1A note

Write enable (WEN) pulse output from the Video 1 connector.

* indicates part code or part number

Caution

The specifications of this equipment are subject to change without notice for improvement. Prior to placing your order, be sure to confirm that these specifications are the latest ones.

Hitachi Denshi guarantee that the equipment shipped from our factory conforms to the Hitachi Denshi's standard warranty conditions and perform quality control within the range necessary to perform the warranty.

Warranty and After-sales Service

1) The guarantee period is one year after the date of purchase. However, the defects due to erroneous use orintentional act are excluded.

2) As the defect after expiration of the guarantee period, Hitachi Denshi will repair the equipment if the intended function is restored by the repair work, and the cost is charged to a customer.

3) Hitachi Denshi is not liable for the losses caused when the equipment is used in a system used for business trades, production process, medical fields, crime prevention applications, etc.

4) The parts used in the equipment have their respective lives. The lives of such parts will be shortened under the environments of high temperature or high humidity.

When the stable operation is required for a long time, it is recommended to perform periodical maintenance and inspection every year or every two years.

4. Operating precautions

4-1 Power supply

Connect 12V±1V DC from an external power supply.

Use the stable pstable power supply without ripple and noise.

4-2 To protect CCD(sensor)

1) Do not touch the glass surface of the sensor to avoid dirt and scratches.
2) If the glass surface of the sensor should become dusty or dirty, wipe off dust or dirt carefully with a cotton-tipped applicator. Never use dry cloth or paper.

   The surface may be scratched and further the sensor may be damaged by static electricity.
3) Be sure to mount a lens or the supplied mount cap on the camera to protect the sensor from dust.

4-3 To protect camera

1) Do not use or store the camera under direct sunlight, in environments exposed to rain, or snow, or at a place exposed to flammable or corrosive gas.
2) The camera operates in the temperature range between -10 and 50°C.

   If the camera is used or left at a high temperature(40°C or more)for hours, the life of the camera may be shortened.

   When using the camera continuously for hours, avoid using the camera in such a high temperature or high humidity.
3) Do not drop the camera. Do not apply strong shock or vibration to the camera.
4) Before connecting or disconnecting a connector, turn off the camera.

   Be sure to hold the connector body to connect or disconnect the connector.

4-4 Arrangement of camera

When several cameras are installed very close with each other, the cameras may interfere with each other to cause noise. Install the cameras as far as possible from each other or operate the cameras by an external sync signal.

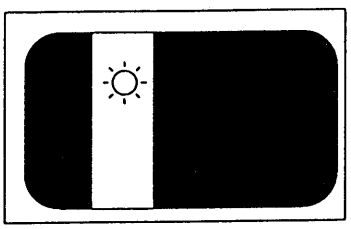
4-6 Phenomena inherent to CCD imaging device

Following are phenomena inherent to a CCD imaging device, and not defects.

1)Smear and blooming

When strong light (lamp, fluorescent lamp, reflected light, etc.)is shot, pale bands are displayed vertically above and below the light.

In this case, change the angle of the camera so that such strong light does not enter the camera through the lens.



2)Fixed pattern noise

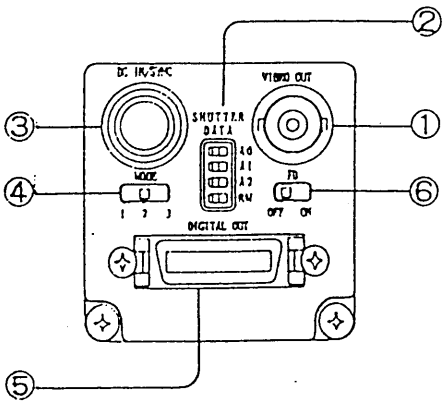
When the camera is operated in a high temperature, fixed pattern noise may appear on the entire screen.

The higher the sensitivity of camera, the more this fixed pattern noise appears.

3)Moire

When fine patterns are shot, moire may be displayed.

5. Name and function of each section



① Video Out (BNC)

Composite video signal (VS) output (VIDEO OUT 1).

② Shutter speed switches (A0 - A2)

Shutter speed setting switches

Read mode (RM) switch

Sets the readout speed

③ Manual gain control

Adjustable when switch 4 is set to M (effective only for Video Out 1).

④ Mode switch

FD switch off:

(1) Electronic shutter off

(2) Electronic shutter on

(3) Not used (avoid setting to this position)

FD switch on:

(1) Fixed shutter

(2) Two trigger

(3) Sync non-reset

⑤ Digital output connector

Output for RS-422A digital data (10 bit data, vertical drive VD, horizontal drive HD, clock CLK)

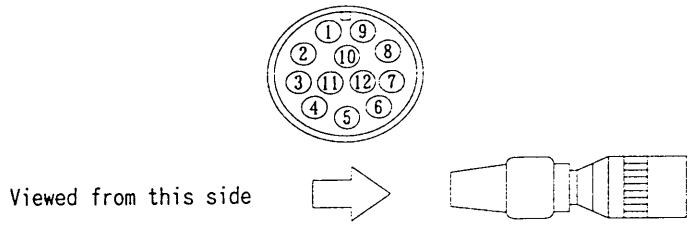
⑥ Frame on demand (FD) switch

set to On for frame on demand function.

● Plug

DC IN/SYNC　　Hirose HR10A-10P-12S(01)

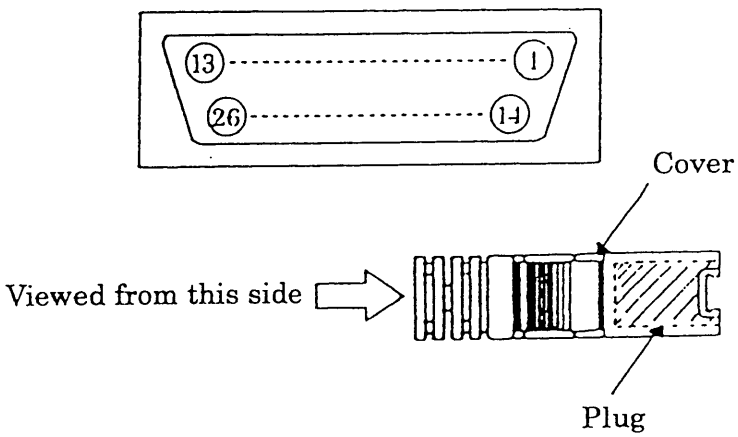
Product code : 23810AX



Digital out

Plug: Hirose DX30AM-26F or equivalent, part code JMD0240　*1

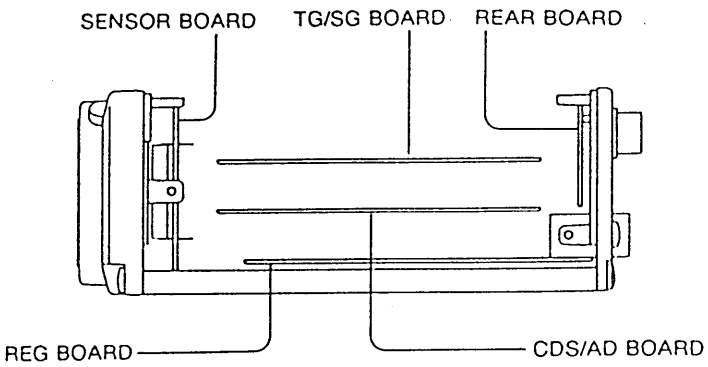
Cover: Hirose DX30M-260V or equivalent, part code JMD0239　*2

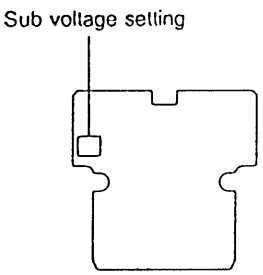


*1　2-175677-4 (AMP) etc.

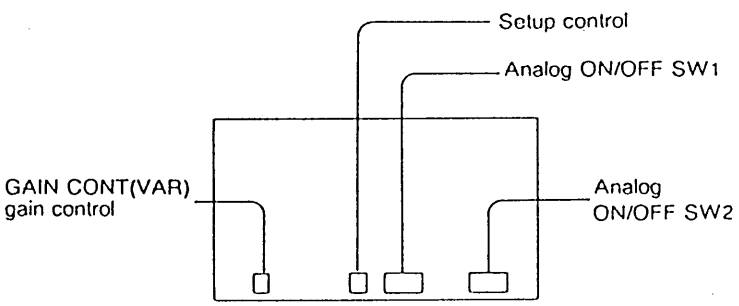
*2　175753 (AMP) etc.

7. Arrangement of Internal controls





Sensor board interior



CDS/AD board top

8. Function settings

◆Gain control

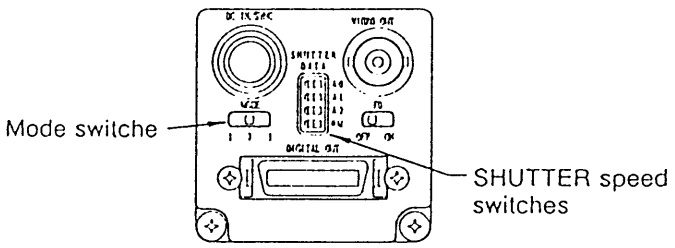
Adjusts video output gain. Factory setting at F4,400 lx is 0.70 Vp-p analog and 85 % digital (10 bits 1023 tones)

◆ Setup control

Factory setting is 50 mVp-p.

◆ Shutter speed switches

First set the FD switch to off and the Mode switch to 0, then set the shutter speed switches as indicated in the figure.



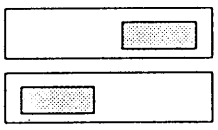
Setting of shutter speed

Speed (second)	1/30	1/60	1/125	1/250	1/1000
Setting position					
Speed (second)	1/2000	1/4000	1/10000		
Setting position					

As the shutter speed increases, the sensitivity decreases and may necessitate adjusting the lens iris or lighting conditions. The shutter can also make flicker more prominent. It is suggested to use DC or other flicker-free lighting. Note the shutter speeds are approximate and do not indicate the precise time.

◆ Readout speed

Set with the rear panel RM switch.



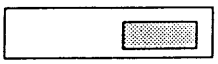
1/12 s (all pixels)

1/24 s (2 vertical pixels read simultaneously)

Note: Resolution at 1/24 s is 1/2 that of 1/12 s. Also, frame on demand cannot be used.

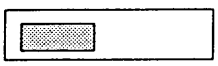
◆Frame on demand settings

First set the FD switch to off, then set the function as follows.

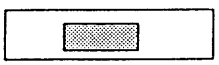
1. 

Set the FD switch to on.

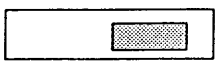
2. Set the Mode switch to the appropriate position.



1: Fixed shutter



2: Two trigger



3: Sync non-reset

Note: The exposure time in the fixed shutter and sync non-reset modes is set by the shutter speed switches.

9. External synchronization

When operating the camera by external drive signals, connect sync drive signals (HD,VD) to the DC IN/SYNC connector. When sync signals are supplied, the mode is automatically switched from the internal sync mode to the external sync mode.

·Input signals

HD and VD signals

HD : f(H)=12.528kHz ± 1%

VD : f(V)=12Hz[f(V)=f(H)÷1044]

·Input level

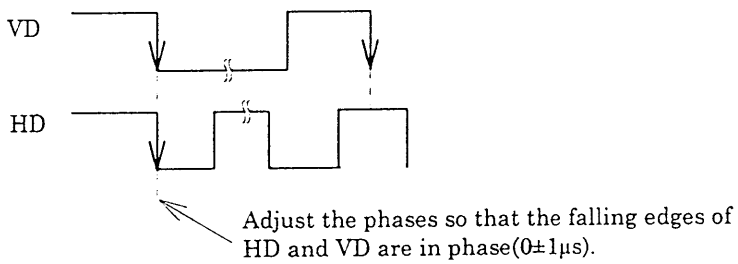
HD 5Vp-p ± 1±, negative

VD 5Vp-p ± 1Vp-p, negative

·Input impedance

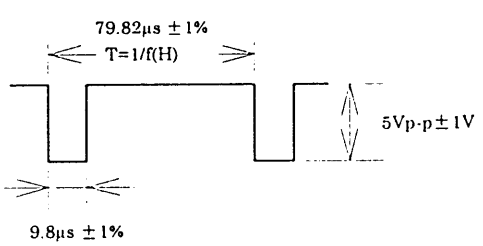
1k ohms

Phase relatio ship between horizontal drive signal (HD) and vertical drive signal (VD)

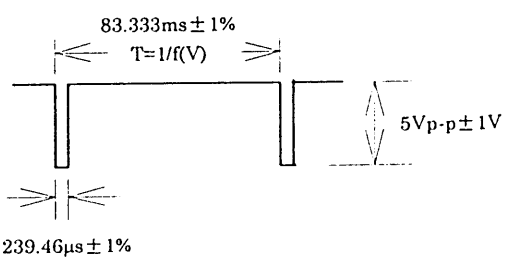


● Input waveforms

Horizontal drive signal(HD)



Vertical drive signal(VD)



Caution:

Use care to avoid noise in the sync signal. Hitachi Denshi bears no responsibility for impaired performance or accident caused by the sync signal generator.

10. Frame on demand function

Frame on demand refers to a function for picking up rapidly moving objects by applying a trigger pulse input at a desired timing to provide a desired or a fixed exposure time. The function is effective since the object is always taken at the same position in the picture.
Three modes are provided: fixed shutter, two trigger and sync non-reset.

Notes

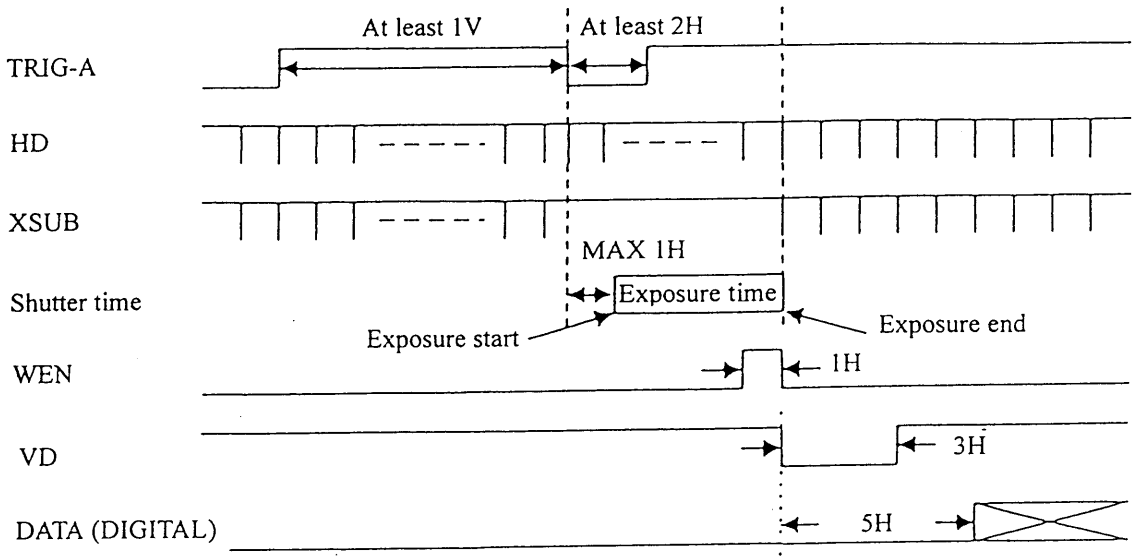
The output of a single frame is produced at one trigger. Afterwards, a video output is not produced unless another trigger input is applied. (Cannot be used with 2 vertical pixel simultaneous readout.)

If precision is not needed, the trigger input can be asynchronous with respect to HD. However, a maximum of 1H delay can occur since the frame on demand function is synchronized to horizontal drive.

Avoid applying a trigger input until the video output is completed.
A proper image will not be obtained.

Fixed shutter mode

A first trigger pulse (TRIG-A) input is applied. Exposure starts at the falling edge of the pulse and ends at the time set by the shutter speed switches. The video output is produced immediately after exposure completion.



Sync signal specifications

HD: 79.821 μs ±1 %

VD: 83.333 ms ±1 %

Trigger specifications

Level: 5 ± 1 Vp-p

Duration: At least 1 V period (83.3 ms)

Notes: Avoid applying the trigger input during the frame used for video output (normal picture will not be obtained).

Use a trigger signal free from noise.

Exposure start is synchronized to horizontal drive. Thus, exposure does not start at TRIG-A fall, but at the next HD fall.

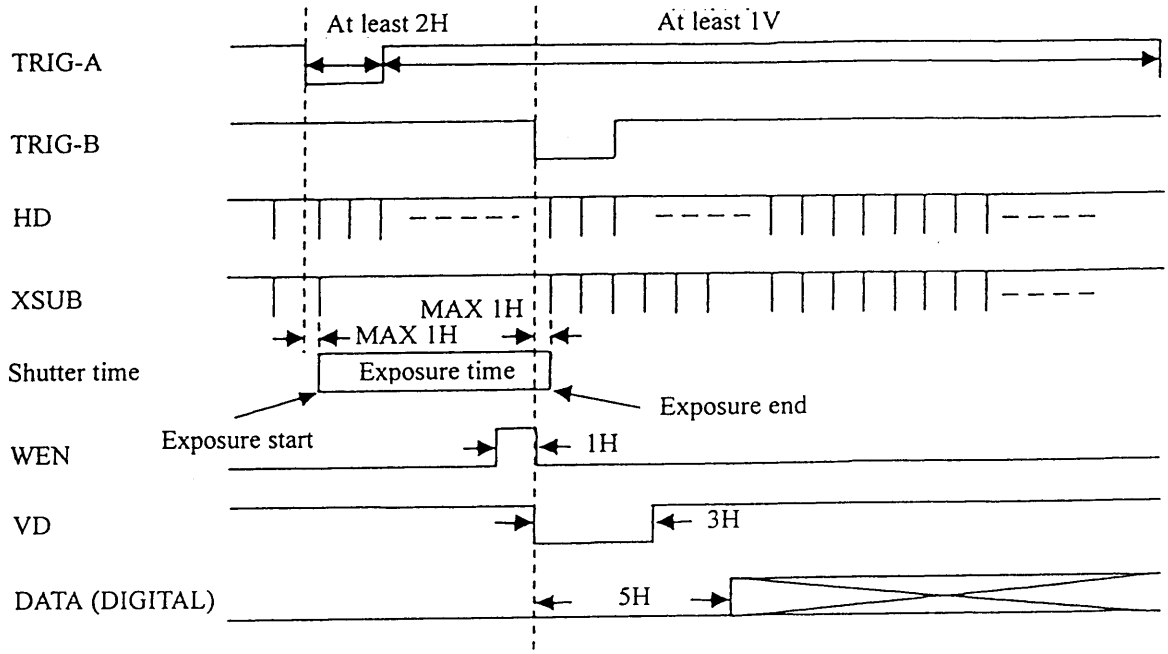
Therefore a maximum difference of 1H occurs until exposure start.

Exposure end is also synchronized to HD.

The shutter speed switch settings are approximate and do not indicate the exact timing.

Two trigger mode

Two trigger pulses (TRIG-A and TRIG-B) are applied. Exposure starts at TRIG-A fall and ends at TRIG-B fall. The exposure time is the interval between the pulses and can be set to an arbitrary value.



Sync signal specifications

HD: 79.821 μs ±1 %

VD: 83.333 ms ±1 %

Trigger specifications

Level: 5 ± 1 Vp-p

Duration: At least 1 V period (83.3 ms)

Exposure: 1/30 to 1/10,000 second

Notes: Avoid applying the trigger input during the frame used for video output (normal picture will not be obtained).

Use a trigger signals free from noise.

Exposure start is synchronized to horizontal drive. Thus, exposure does not start at TRIG-A fall, but at the next HD fall.

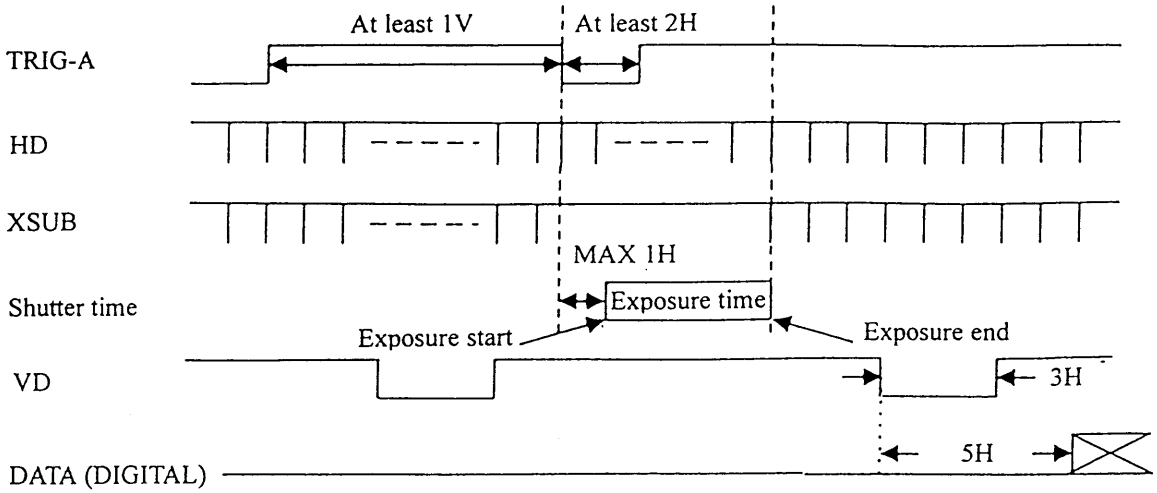
Therefore a maximum difference of 1H occurs until exposure start.

Exposure end is also synchronized to HD and thus a maximum delay of 1H occurs between TRIG-B fall and the end of exposure.

Avoid overlapping TRIG-A and TRIG-B.

Sync non-reset mode

A trigger pulse (TRIG-A) is applied and exposure starts at the pulse falling edge. Exposure continues for the time set by the shutter speed switches. After the end of exposure, the video output is produced at the next frame (vertical sync is not reset).



Sync signal specifications

HD: 79.821 μs ±1 %

VD: 83.333 ms ±1 %

Trigger specifications

Level: 5 ± 1 Vp-p

Notes: Avoid applying the trigger input during the frame used for video output (normal picutre will not be obtained).

Use a trigger signal free from noise.

Exposure start is synchronized to horizontal drive. Thus, exposure does not start at TRIG-A fall, but at the next HD fall.

Therefore a maximum difference of 1H occurs until exposure start.

Exposure end is also synchronized to HD.

The shutter speed switch settings are approximate and do not indicate the exact timing.

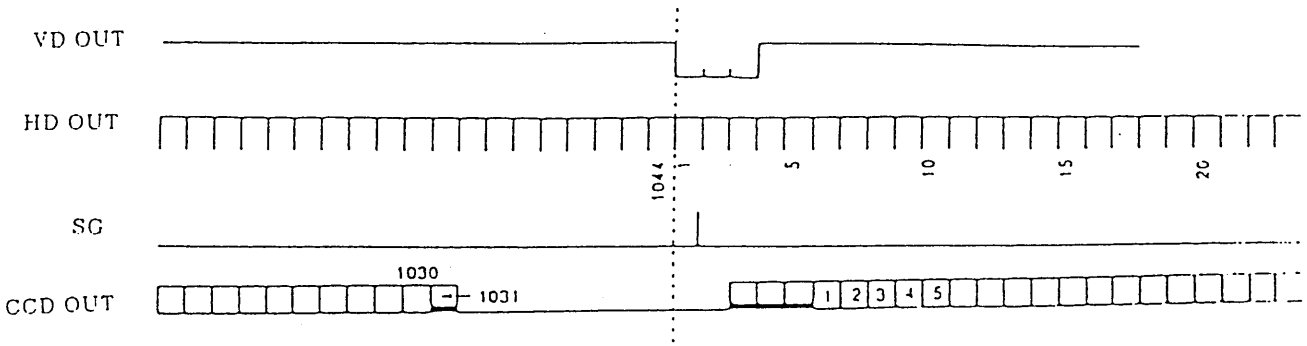
In the fixed shutter mode, the camera VD is immediately reset at the end of exposure and the video output is obtained. But in the non-reset mode, exposure ends without VD reset and the video output is synchronized to the next VD pulse.

Shutter speed switches and actual time

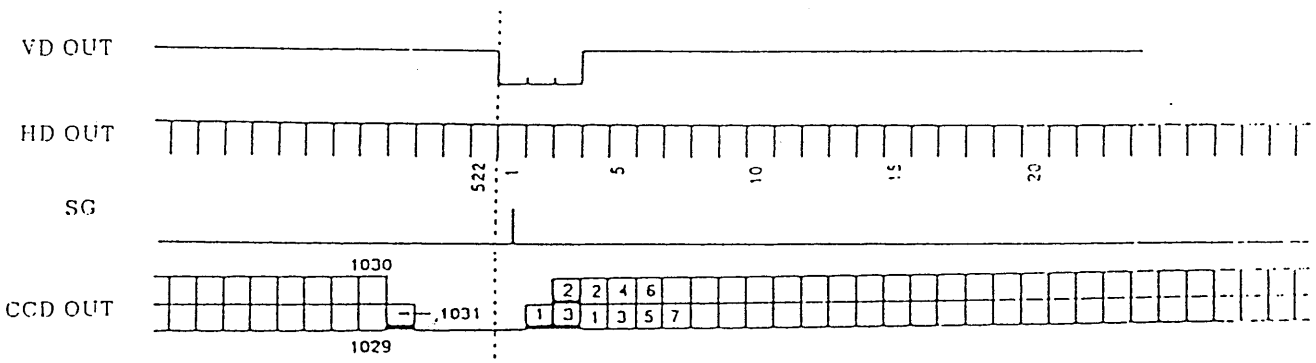
Time set by switches	Actual time
1/30s	1/30.020s (33.311ms)
1/60s	1/60.140s (16.628ms)
1/125s	1/124.886s (8.007ms)
1/250s	1/248.989s (4.016ms)
1/1000s	1/1017.250s (983.043μs)
1/2000s	1/1983.666s (504.117μs)
1/4000s	1/3778.518s (264.654μs)
1/10000s	1/9522.721s (105.012μs)

11. Timing charts

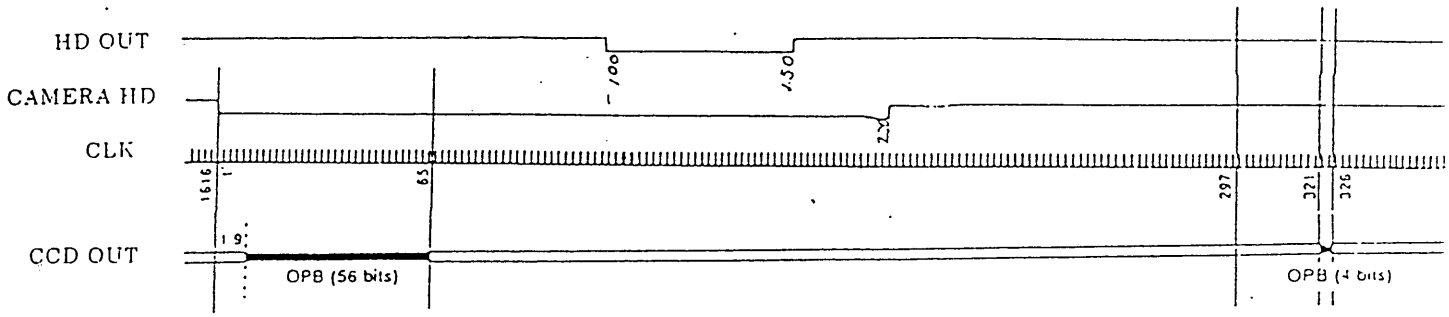
V sync normal readout mode

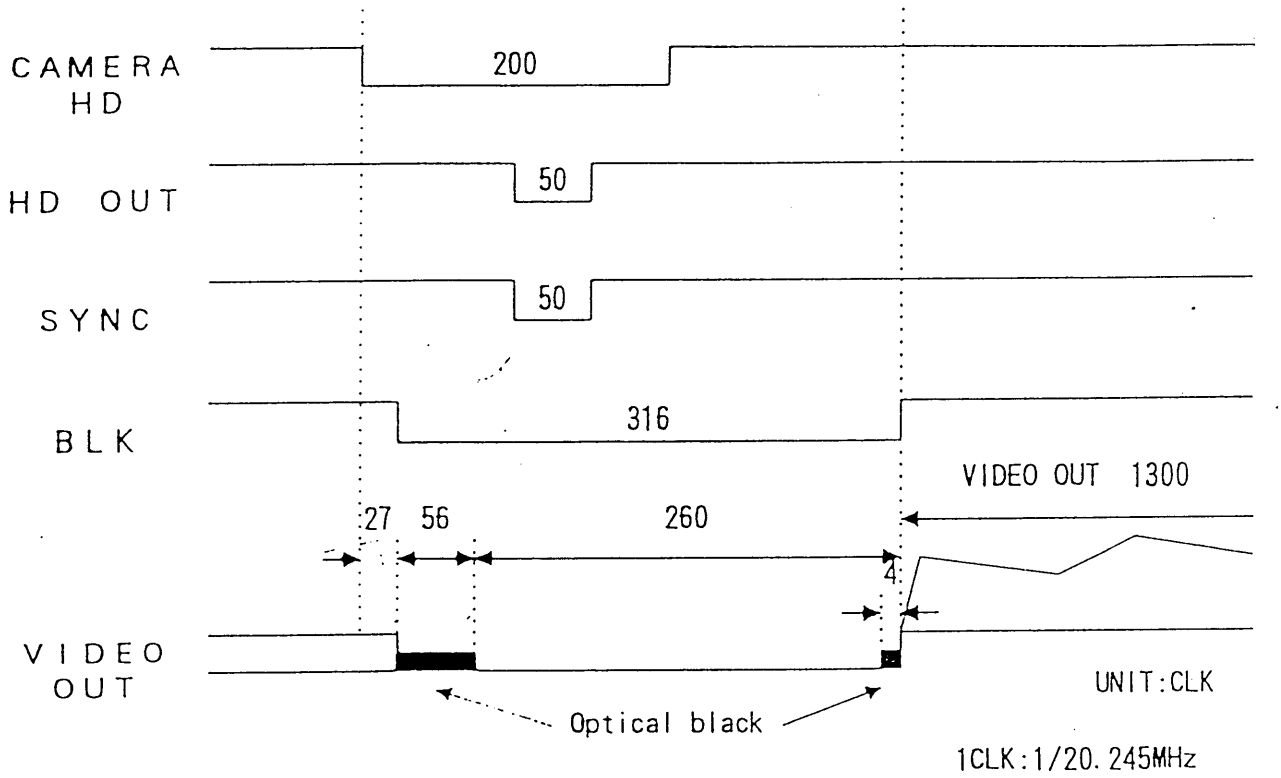


V sync 2 line readout mode



H sync normal and V 2 line readout modes



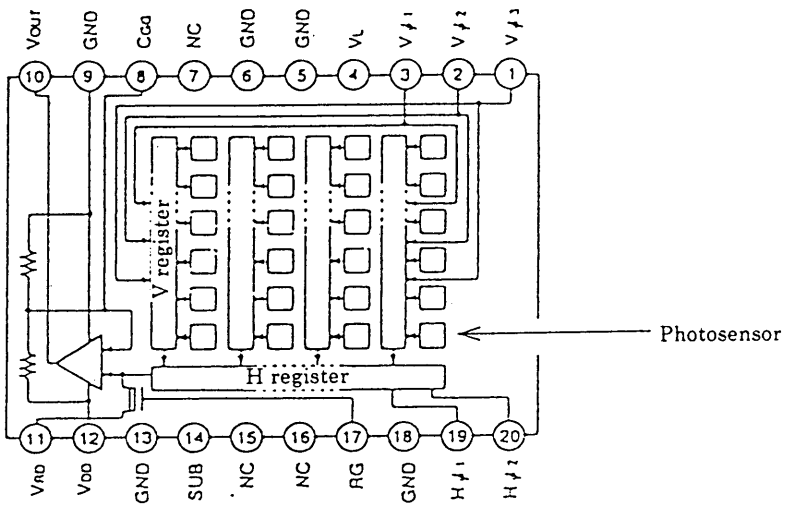


12. Image sensor

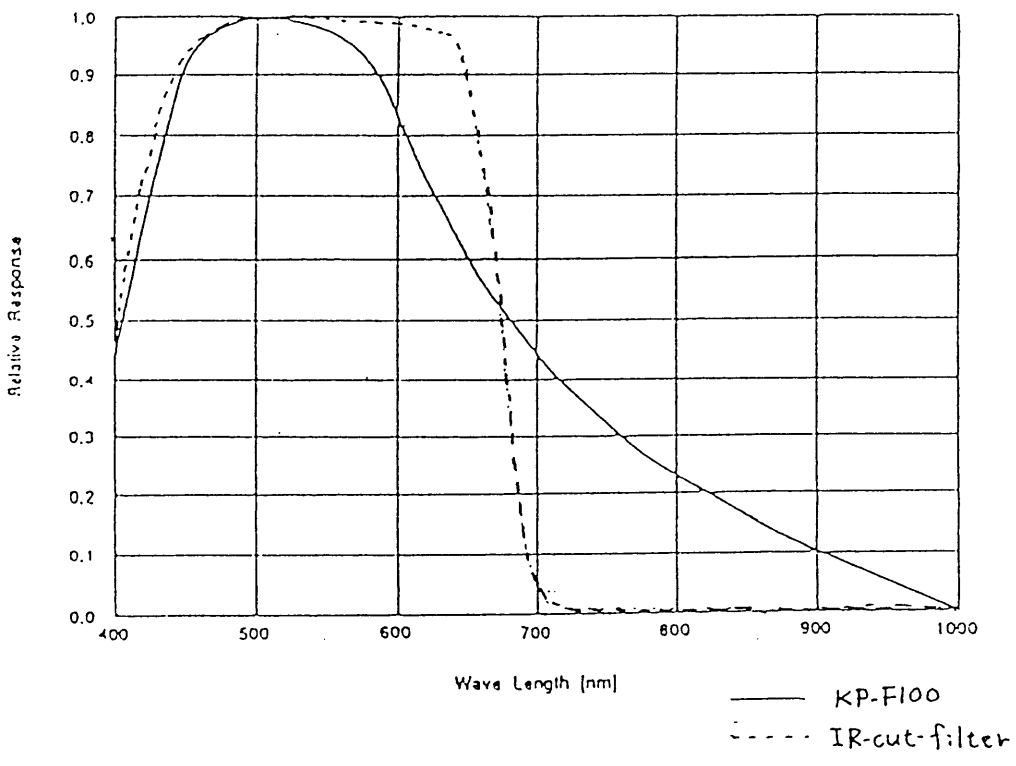
- 2/3 inch interline, all-pixel read out type CCD
- Total pixel number : 1360(H)×1034(V)
- Effective pixel number : 1300(H)×1030(V)
- Imaging area : 8.71(H)×6.90(V)mm
- Pixel size : 6.7(H)×6.7(V)μm

Block diagram and pin layout

(Top View)

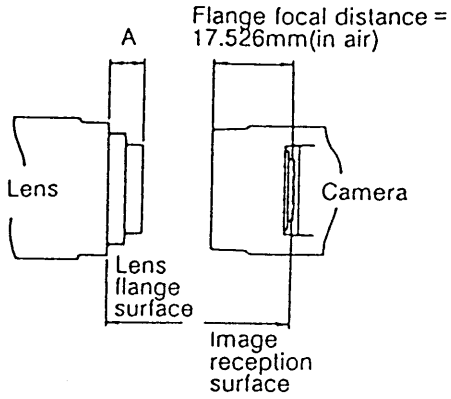


Spectral sensitivity example (incl. Lens, excl. light source)



13. Optical system

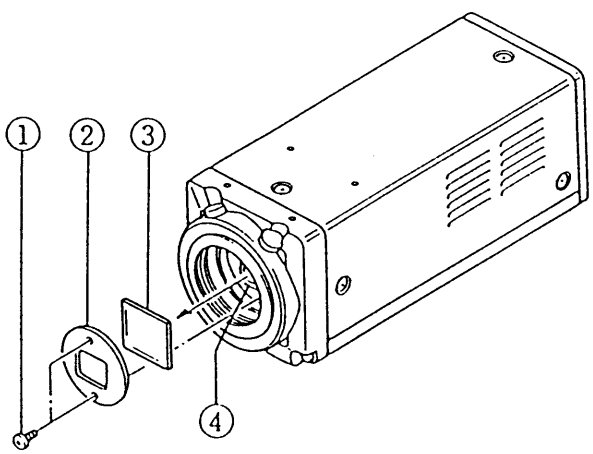
● Flange focal distance



Note : Flange focal distance cannot be adjusted.

● How to remove the IR cut filter

1) Remove two screws ,and filter holder ② will come off.
2) Remove the IR filter ③ from filter frame ④.
3) Then reinstall and secure filter holder ② with two screws ①.



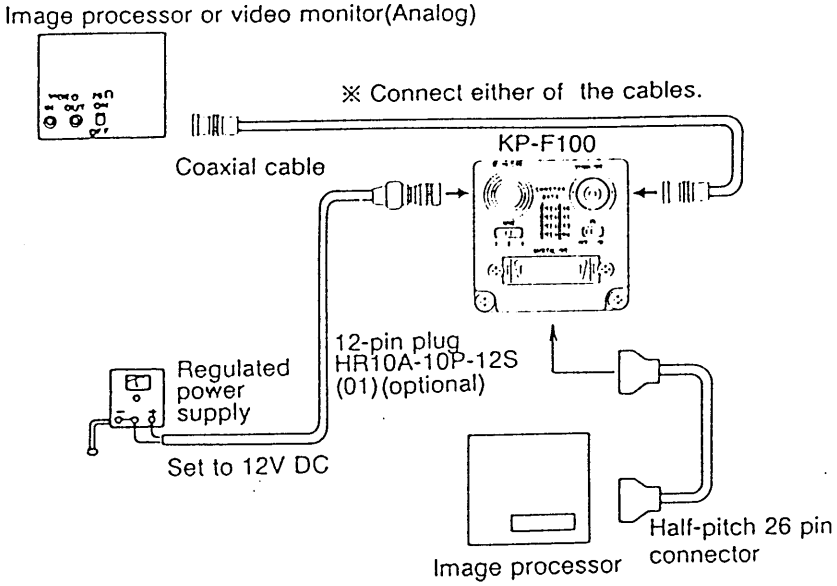
IR cut filter IRC650

Dimensions : 14 × 12 × 1.0t

Part code : XMD0006

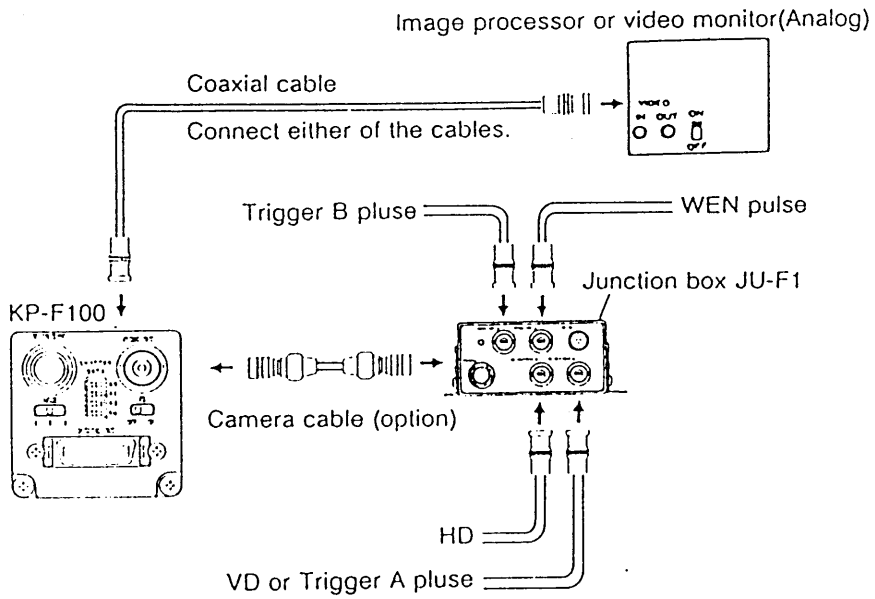
14. How to connect cables

14.1 Basic connection



- Avoid using digital and analog outputs simultaneously.
- Supply HD and VD pulses to the KP-F100 for external sync drive.
- Use stable external power supply within 11-13V DC free from ripples or noises.
- Make sure voltage polarity before connecting external power supply.

14.2 Connection of options



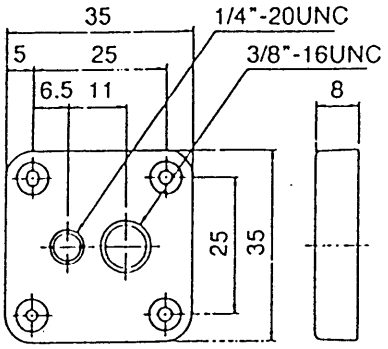
Note when using junction box

JU-F1: WEN pulse output from Video 1 connector
Trigger B pulse input to Video 2 connector

JU-M1A: WEN pulse output from Video 1 connector

15. Options

● Tripod adaptor TA-M1 Product code : 23855AX



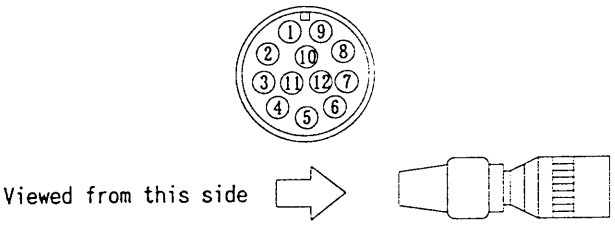
Unit : mm

Mount on tripod hole B or C of the camera.
Use supplied M2×5 four screws.

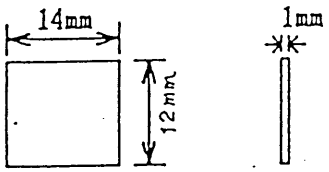
Caution :
Excessive length screw may damage the camera.
Make sure screw long the before using.

● Plug

HR10A-10P-12S(01)
Product code : 23810AX

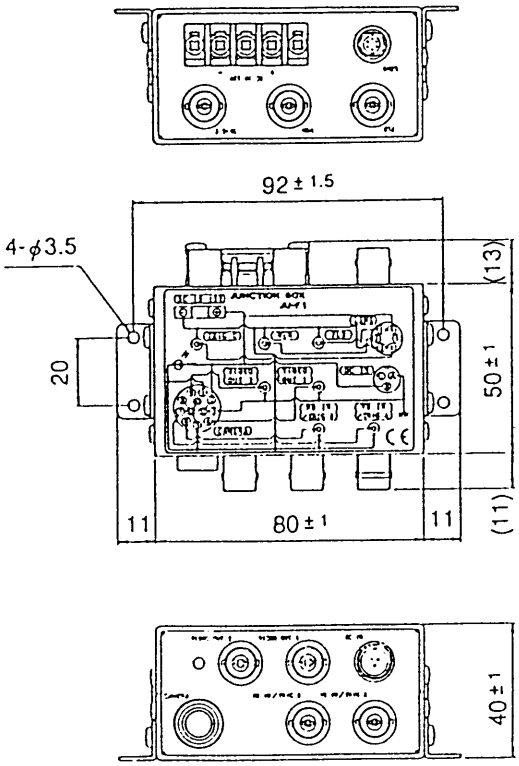


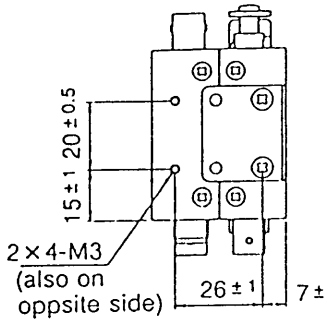
● Dummy glass (AR coated) (ARC1214) Part code: XMD009



External view

● Junction box JU-F1 Product code : 23832AX

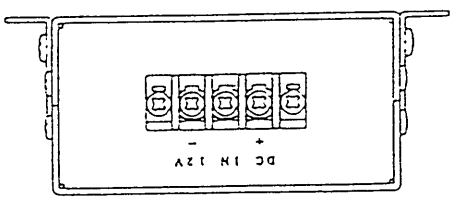


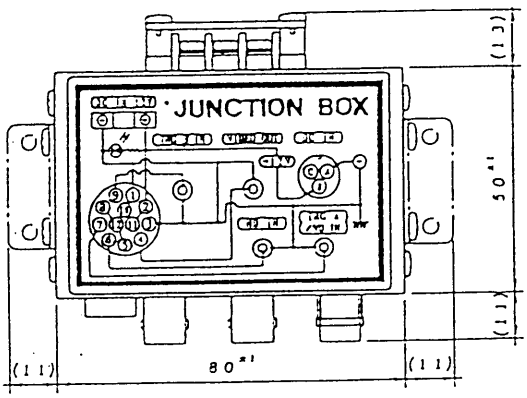


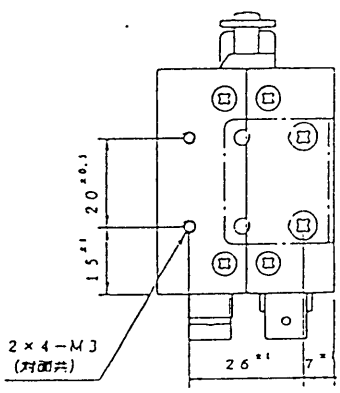
Notes :

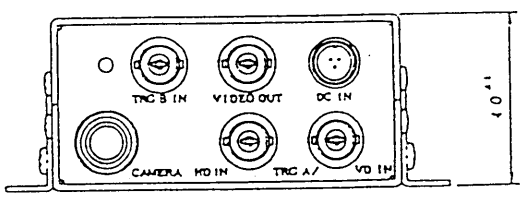
- Supply voltage ranged 11 to 13 V.
- Make sure voltage polarity before connection of an external power supply.

● Junction box JU-M1A Product code : 23831AX



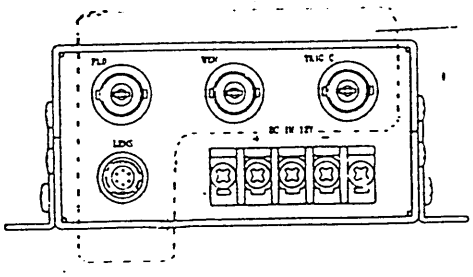


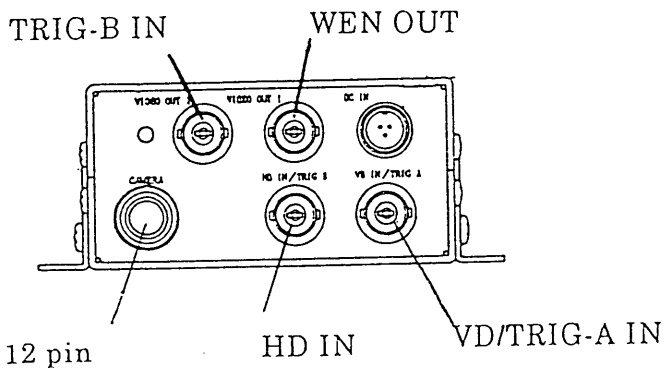




UNIT : mm

● JU-F1 connection chart





● JU-M1A connection chart