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HIGH PERFORMANCE VIDICON CAMERA

C2400-01 to 16

C2741-01 to 16

INSTRUCTION MANUAL

HAMAMATSU

55110-260

PRECAUTIONS

Adhere to the following points to ensure safe use of the system.

- Before using this system, read this instruction manual thoroughly.
  After you have read the manual, keep it in a safe place for quick reference whenever a question arises.

- If any damage to the system is found when it is unpacked, do not operate it. Contact HAMAMATSU as soon as possible.

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2. For Safety

2-1 Safety Precautions

Input Voltage

- Make sure that the input voltage to be supplied to the system is within the voltage range stated on the rear panel of the camera control unit.
- Do not put heavy items on the power cable or bend it excessively.
- When disconnecting the power cable, do not pull the cable itself. Take hold of the plug and pull it.
- If you are not going to use the system for a long period of time, disconnect the power cable from the AC outlet.

Do not Disassemble the System.

- Do not remove the top cover from the system. Some internal parts of the system use high voltage, which are extremely dangerous. Touching these parts may result in injury or breakdown of the system.

Do not Drop any Items inside the System.

- Entry of flammable items, metal or water into the system may result in injury or breakdown of the system.

In Case of an Abnormality

- If there is a sudden non-production of image or if abnormal noise, smell or smoke is observed, immediately turn OFF the power switch and disconnect the power cable from the AC outlet.

2-2 Handling Precautions

Never Use or Store the System in the Following Areas.

- Areas where the ambient temperature is 0°C or below or 40°C or higher (except for -16)
- Areas where the ambient temperature is 0°C or below or 30°C or higher (for -16)
- Areas where the system is exposed to direct sunlight or near a heater

Do not Block the Vent Holes.

- To prevent temperature increase inside the system, do not wrap the system with a blanket etc. during operation nor operate it in areas where there is insufficient ventilation.

Do not Expose the System to Shocks.

- If the system is exposed to a shock, for instance, by dropping it, damage to the system may result.
- In particular, handle the camera head with special care since it incorporates a video tube.

Connecting or Disconnecting the Cables

- Before connecting or disconnecting the cables, make sure that the power to the camera control unit is turned OFF.

Fixing the Camera Head

- The camera head is attached to a tripod using the screw (1/4-20UNC) located at the center of the pan head or the M4 screw located at the peripheral area. Make sure that the screw is projecting more than 5 mm above the pan head, otherwise the camera head may not move round properly.

Burn-in

Some video tubes are burnt or become unusable if the camera is exposed directly to sunshine or strong light. Adhere to the following points to prevent burn-in.

- Never expose the lens to the sunshine or a strong light source.
- If fluorescent lighting, bulb or reflecting mirror is observed for a long period of time, use a light reducing filter or narrow the iris.

When the Camera is not Used

Take one of the following measures to prevent entry of light into the video tube.

- Put on the lens cap.
- Close the iris.
- Turn OFF the light source. In particular, if the light source is attached to the microscope, make sure that the light source switch on the microscope is turned OFF.
- If the lens or other optical parts are removed from the camera, put on the protection cap on the C-mount.

3. Features

The C2400/C2741 surpass in various aspects such as a high resolution, high geometric stability and low geometric distortion, compared to vidicon cameras generally used for purposes of observation. In addition, employment of a contrast enhancement circuit and shading corrector circuit has drastically improved the detecting ability. A wide range of camera heads with different spectral response (sensitive spectral range), sensitivity and lag characteristic allows selection of the camera head most suitable for your application.

1. Contrast Enhancement Circuit

This circuit provides an offset level (threshold level) and amplifies video signals which exceed this offset level. This allows low contrast images to be visualized clearly due to increased contrast. Moreover, use of a video converter (intensity inversion) increases contrast for low intensity areas of the image.

2. Shading Corrector

Increase in contrast normally results in uneven brightness (shading) across the field of vision. The shading corrector is provided to correct such shading, including the one present in the optics, thus contrast can be increased effectively.

Two correction modes are available: normal correction (horizontal/vertical) and diagonal correction (diagonal).

3. Video Booster

The video booster is useful when dark areas of the image are difficult to observe because their contrast is lower than that of bright areas. The video booster increases the contrast of the dark areas, thereby making their observation easier.

4. Video Inverter

Some images may contain important information in the dark areas of the images, rather than in the bright areas. The video inverter is useful in these cases. It reverses the intensity level of the image and increases the contrast to produce a clear image of the dark areas.

5. Automatic Gain Control

This circuit detects the intensity of the input light, and automatically adjusts the amp gain to maintain the video signal at a constant level.

6. Video Level Indicator

Two lamps (red and green) are provided to indicate whether the video level is appropriate or not. The best image can be produced constantly by adjusting the brightness of the object according to the lamps.

7. Video Tube Protection Circuit

This circuit is activated in case either vertical or horizontal synchronization signal stops, to prevent damage to the video tube.

8. SIT Protection Circuit

This circuit stops supply of high voltage to the SIT tube in case an excessive quantity of light is input during operation of the C2400/C2741-08, to prevent damage to the SIT tube.

9. A Wide Range of Camera Heads

A wide range of camera heads with different spectral response (sensitivity spectral range), sensitivity and lag characteristic is available. This allows selection of the camera head most suitable for your application.

10. Options

The following options are available.

• External Synchronization (M6283)

Horizontal and vertical synchronization signals can be supplied from an external equipment to control the camera.

• Automatic Sensitivity Control (ASC) for SIT (M6284)

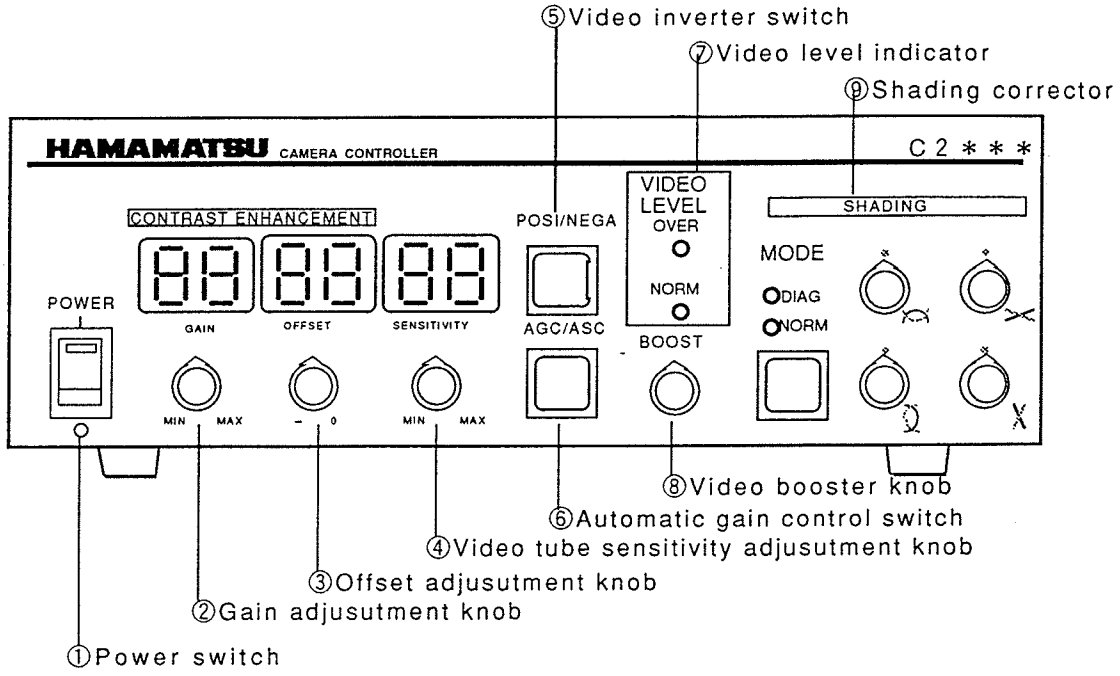
This function is useful when you want to maintain a constant video output signal even if the input light to the SIT fluctuates or when you want to increase the dynamic range for the input light. This function detects the intensity of the input light and automatically adjusts the control voltage for the video tube sensitivity. The correction range is more than 64:1 (equivalent to the iris at 6 levels). When the ASC is activated, it is not possible to use the automatic gain control function.

• Operational Video Output (M6285)

A video signal (operation signal) containing no synchronization signals is output. This function is useful when image process is carried out by external equipment.

4. Name and Function of Controls

4-1 Front Panel



① Power switch (POWER)

This switch is used to turn ON and OFF the power to the system.
Pressing the "I" side of the switch turns ON the power and lights up the lamp.
Pressing the "O" side of the switch turns OFF the power.

② Gain adjustment knob (GAIN)

This knob is used to adjust the gain of the video signal, continually from 1 to 10 times. Use of this knob in conjunction with the offset adjustment knob (OFFSET) increases the contrast of the image. Turning the knob clockwise increases the gain. The current gain is displayed in a digital value, from 0.0 to 10.

③ Offset adjustment knob (OFFSET)

This knob is used to adjust the offset level for the video signal.
Turning the knob counter-clockwise increases the threshold level for the video signal. The current offset level is displayed in a digital value, from 0.0 to 10.

④ Video tube sensitivity adjustment knob (SENSITIVITY)

(Can be operated only when connected to the C2741-03, 08 or 16 camera head)
This knob is used to adjust the sensitivity of the video tube.
Turning the knob clockwise increases the sensitivity of the video tube. The current sensitivity is displayed in a digital value, from 0.0 to 10.
Do not increase sensitivity excessively, otherwise damage such as burn to the video tube may result.

⑤ Video inverter switch (POSI/NEGA)

Pressing this switch inverts the video signal and lights up the switch lamp. Pressing the switch again resumes the original video signal.

⑥ Automatic gain control switch (AGC/ASC)

Pressing this switch activates the automatic gain control function (AGC) or the optional automatic sensitivity control function for SIT (ASC), and lights up the switch lamp. Pressing the switch again cancels the function.

⑦ Video level indicator (VIDEO LEVEL)

These lamps monitor the quantity of input light.
The green lamp lights up if the quantity is appropriate, and the red lamp lights up if the quantity is excessive. If the quantity is insufficient, neither green nor red lamps light up. In this case, adjust the iris or the brightness of the object

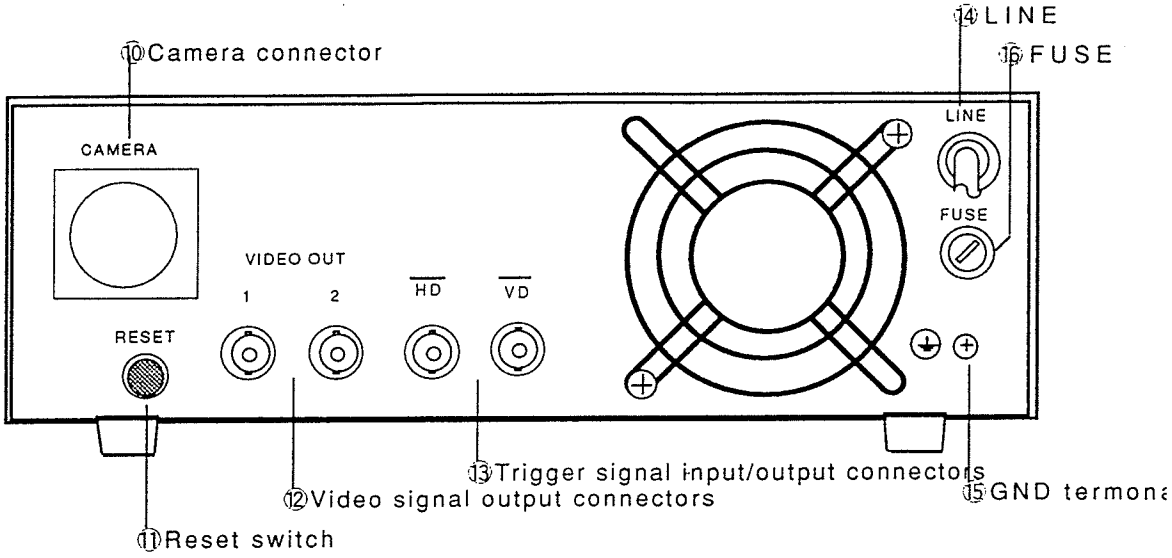
⑧ Video booster knob (BOOST)

This knob is used to modify the contrast in dark areas of the image, revealing details which were lost due to their low intensity. Turning the knob clockwise increases the contrast in dark areas of the image.

⑨ Shading corrector (SHADING)

Pressing the MODE switch activates the shading corrector and lights up the switch lamp.
The shading correction level is adjusted by turning the knob.
The mode changes in the order NORM (normal) -> DIAG (diagonal) -> OFF, each time the MODE switch is pressed. The lamp of the currently selected mode light up.
Shading correction is performed horizontally and vertically in NORM mode, while it is performed diagonally in DIAG mode.

4-2 Rear Panel



⑩ Camera connector (CAMERA)

This connector is used to connect a camera to the CCU.

⑪ Reset switch (RESET)

This switch is used to cancel the SIT protection function.

⑫ Video signal output connectors (VIDEO OUT 1,2)

This connector outputs a composite video signal.

⑬ Trigger signal input/output connectors (HD, VD)

These connectors are used as input/output connectors for VD and HD synchronization signals.
The VD and HD synchronization signals (negative logic) are output from these connectors when synchronization is carried out internally, while they are input to these connectors when synchronization is carried out externally (optional).

⑭ LINE

This cable is used to supply power to the CCU.

⑮ GND terminal

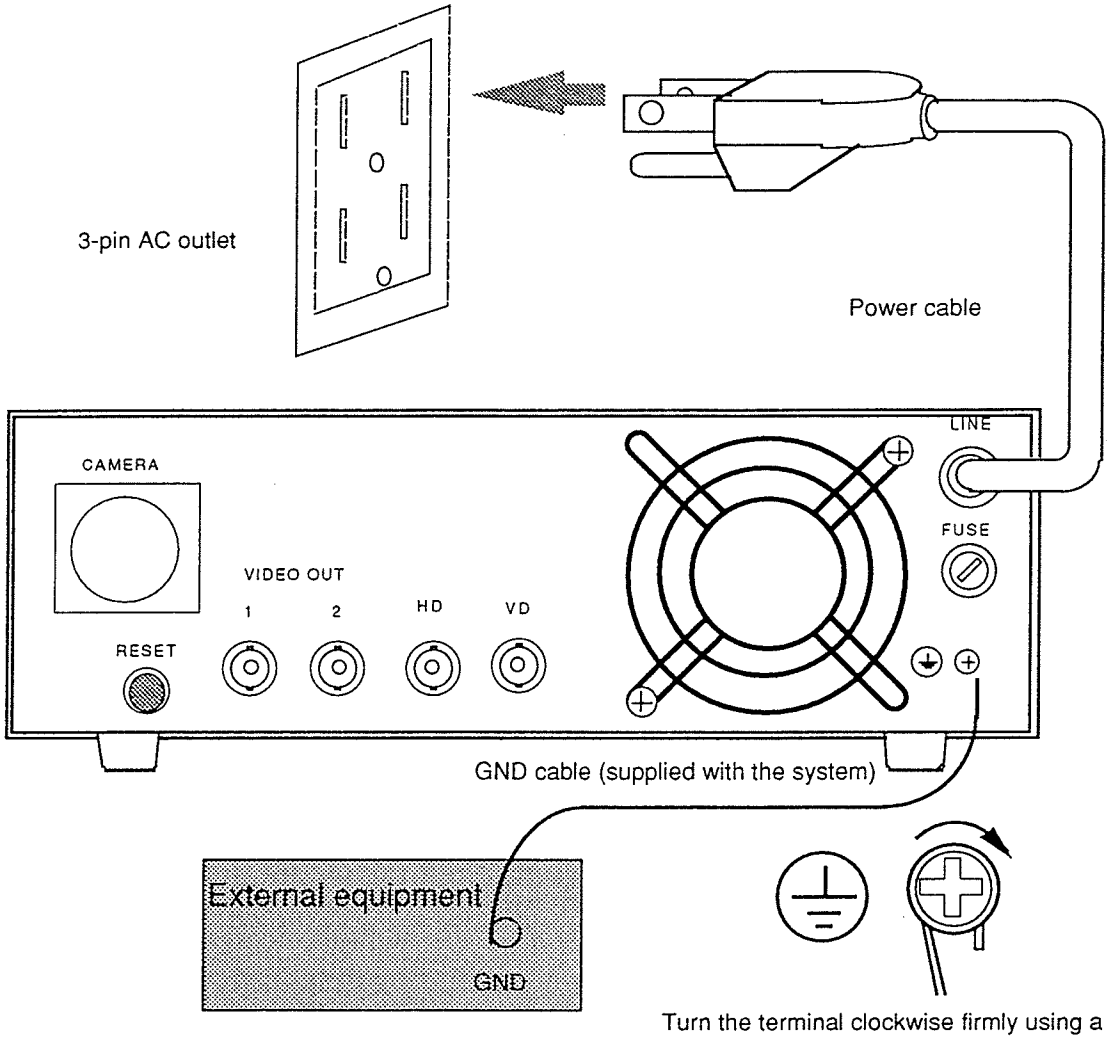
This terminal is used as the frame ground of the CCU. Use the GND cable supplied with the system to connect the CCU to the earth. If the CCU can be grounded using the power cable, it is not necessary to use this terminal.

⑯ FUSE

This fuse cuts off the power in case of an excessive current in the power line.

5. Connecting the System

5-1 Connecting the Power and GND Cables



1. GND cable (supplied with the system)

Ground both the CCU and external equipment using this GND cable.
In particular, if the external equipment is equipped with a pulse motor or thyristor, make sure both system and external equipment are grounded properly.
If the CCU is installed in a rack, connect the CCU to the frame of the rack.
If the CCU is grounded via a 3-pin plug power cable, it is not necessary to ground the CCU using the GND cable.

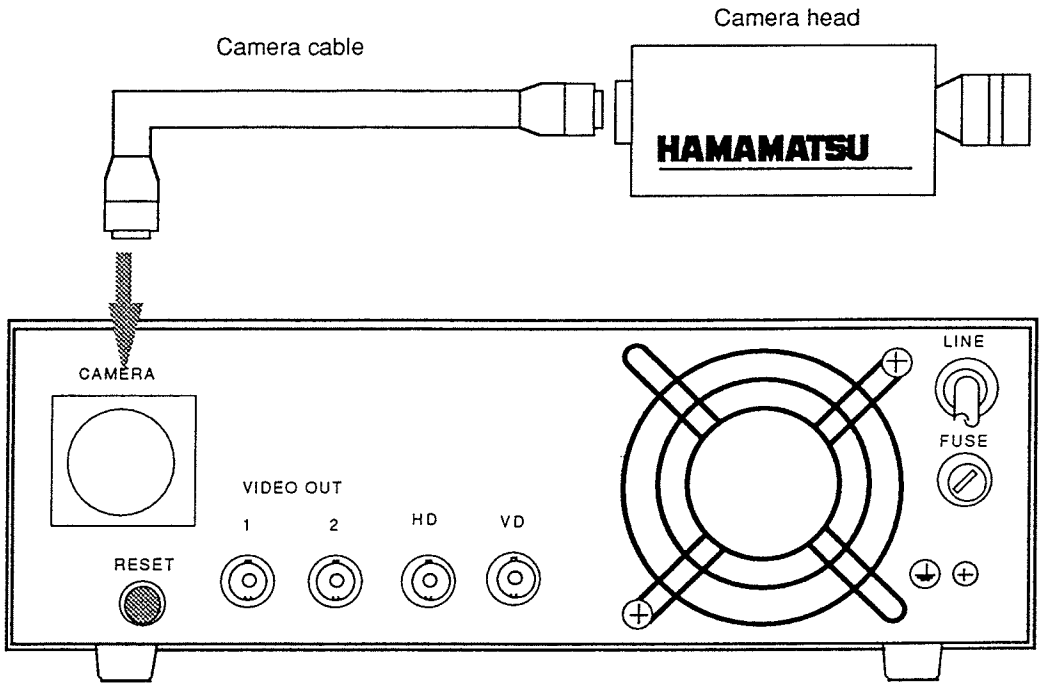
2. Power cable

Connect the power cable to a 3-pin AC outlet.
If no 3-pin AC outlet is available, use the 3-pin to 2-pin adaptor (supplied with the system).

CAUTION

Before connecting the cables, make sure that the POWER switch is turned OFF.

5-2 Connecting the Video Camera

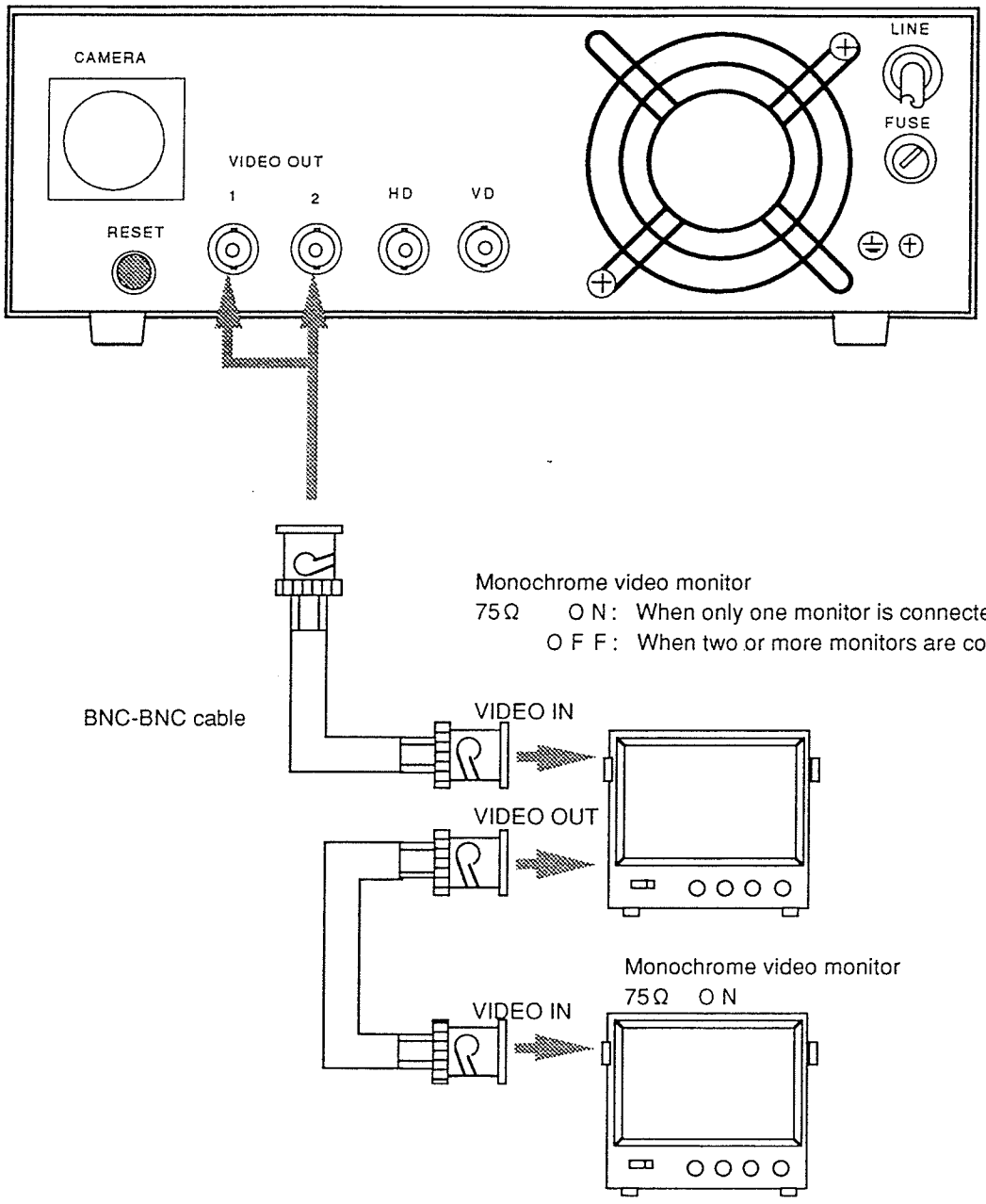


Connect the camera head to the CAMERA connector of the camera control unit (CCU) using the camera cable supplied with the CCU.
Make sure that the male connector of the camera cable is connected to the CCU and the female connector to the camera head. Each connector has an insertion index, so make sure that the index of the male connector matches that of the female connector.

CAUTION:

- Before connecting the camera head, make sure that the POWER switch is turned OFF.
- To attach the camera head to a tripod, use the screw (1/4-20UNC) located at the center of the pan head or the M4 screw located at the peripheral area. Make sure that the screw is projecting more than 5 mm above the pan head, otherwise the camera head may not move round properly.

5-3 Connecting the Video Monitor



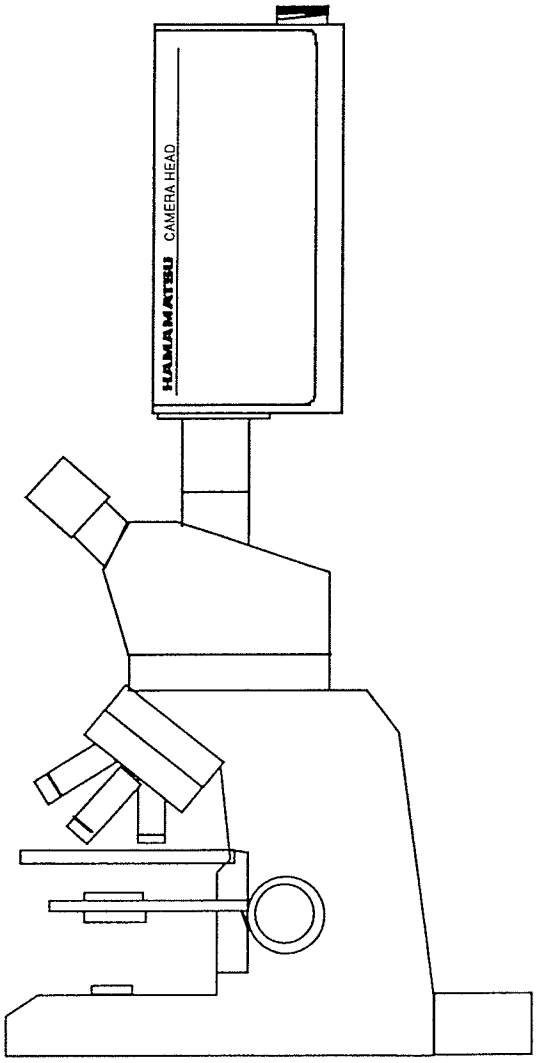
Connect the video monitor to the VIDEO OUT 1 or 2 connector of the CCU. If only one video monitor is connected, turn the 75Ω terminator switch ON. If two or more monitors are connected, turn the last terminator ON and other terminator switches OFF. Only one video monitor cable is supplied with the system, so purchase extra monitor cables if two or more video monitors are to be connected.

5-4 Connecting to a Microscope

To connect the camera head to a microscope, a C-mount adaptor suitable for the microscope must be used. Mount the C-mount adaptor to the camera head as follows.

1) Place the camera head horizontally on a table.
2) Remove the C-mount cap from the camera head.
3) Hold the camera head by hand, and screw in the C-mount adaptor to the camera head. Take care not to touch the camera faceplate of the camera head and do not allow dust to adhere to it.

Mounting method differs according to the type of microscope, so refer to the microscope's instruction manual. If, after the camera head is connected to the microscope, the camera head and microscope assembly is unstable (i.e. likely to fall over) due to imbalance between the microscope's weight and camera head's weight, erect a scaffold to support the assembly.

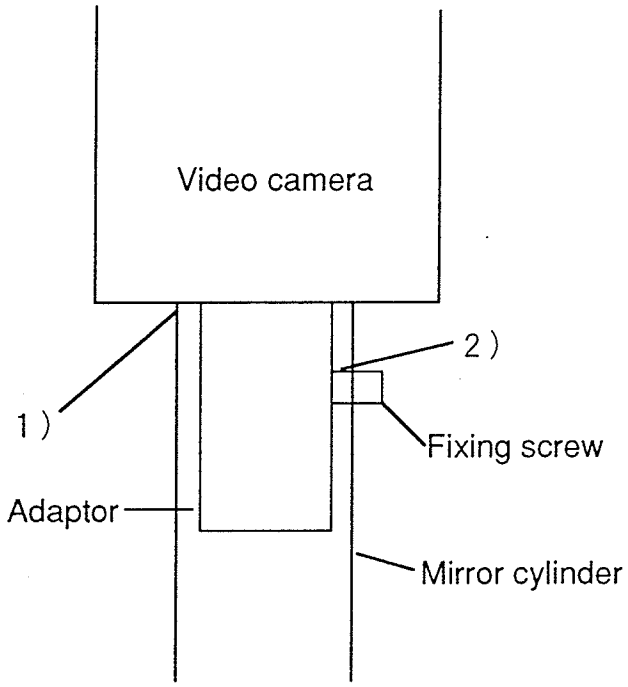


In Case of Noise

After the video camera is connected to the microscope, induction noise is sometimes observed on the video monitor screen due to improper continuity between the video camera and microscope's chassis. In this case, implement the following measures.

Corrective Measures:

- Improve the continuity as follows.



1) Remove the paint from the threaded part of the adaptor. If the threaded part is not painted but alumite-plated, no continuity is provided, so scratch the plated part or use sand paper etc. to expose the base material.

2) Remove the paint from the contact part (mainly the fixing screw) between the adaptor and mirror cylinder.

Make sure that the C-mount adaptor is tightened more strongly to the video camera.

6. Preparation Before Operating the System

6-1 Operating the C2400/C2471-03, 08 or 16

1. Checking cable connections

Check that each cable is connected properly. Also make sure that the power cable of each equipment is connected to an AC outlet.

2. Turning ON the power to the video monitor

Turn ON the power and check that the power lamp of the video monitor lights up.

3. Turning ON the power to the camera control unit (CCU)

Before turning ON the power, adjust the following adjustment knobs on the front panel as described below.

GAIN : Turn the knob counter-clockwise fully.
OFFSET : Turn the knob clockwise fully.
SENSITIVITY : Turn the knob counter-clockwise fully.

Turn ON the POWER switch and check that the lamp lights up.

4. Displaying an image on the video monitor

Turn the SENSITIVITY adjustment knob clockwise gradually to display an image on the video monitor. If the displayed image rolls, turn the H-HOLD and V-HOLD knobs of the monitor to synchronize the image. When the image no longer rolls, turn the BRIGHTNESS and CONTRAST knobs of the monitor to adjust the brightness of the image.

5. When an image is displayed

Adjust the lens focus to make the image clear. Adjust the iris or the SENSITIVITY adjustment knob so that the VIDEO LEVEL lamp (green) on the front panel lights up.
If the red lamp is lit, narrow the iris or turn the SENSITIVITY adjustment knob counter-clockwise. Make sure that the green lamp is always lit when the CCU is operated.
Turning the SENSITIVITY adjustment knob clockwise excessively may cause burn-in or increase lag. In this case (particularly with the C2741-03), turn the SENSITIVITY adjustment knob counter-clockwise, then widen the iris or increase light radiation on the object to increase the quantity of input light to the camera.

Points to Note when Using the C2741-08 Camera Head

1) A video tube (SIT) incorporating ultra high sensitivity, so take special care not to allow excessive light to enter the camera while the power is supplied.
When a landscape is observed using room lighting, it is necessary to reduce lighting or attach a light reducing filter with a transmittance of approximately 1% to the lens.

2) No image appears for approximately 10 seconds after the power is turned ON, since no high voltage is supplied to the SIT during this period. Wait for approximately 20 seconds before allowing light to enter the camera.

3) If excessive light enters the camera, the protection circuit is activated, causing the image on the monitor to disappear. To resume the image, refer to "SIT Protection Circuit" on page 25.

6-2 Operating the C2400/C2741-01, 02. 05. 07 or 07ER

1. Checking cable connections

Check that each cable is connected properly. Also make sure that the power cable of each equipment is connected to an AC outlet.

2. Turning ON the power to the video monitor

Turn ON the power and check that the power lamp of the video monitor lights up.

3. Turning ON the power to the camera control unit (CCU)

Before turning ON the power, adjust the following adjustment knobs on the front panel as described below.

GAIN : Turn the knob counter-clockwise fully.
OFFSET : Turn the knob clockwise fully.
SENSITIVITY : Turn the knob counter-clockwise fully.

Turn ON the POWER switch and check that the lamp lights up.

4. Displaying an image on the video monitor

If the displayed image rolls, turn the H-HOLD and V-HOLD knobs of the monitor to synchronize the image. When the image no longer rolls, turn the BRIGHTNESS and CONTRAST knobs of the monitor to adjust the brightness of the image.

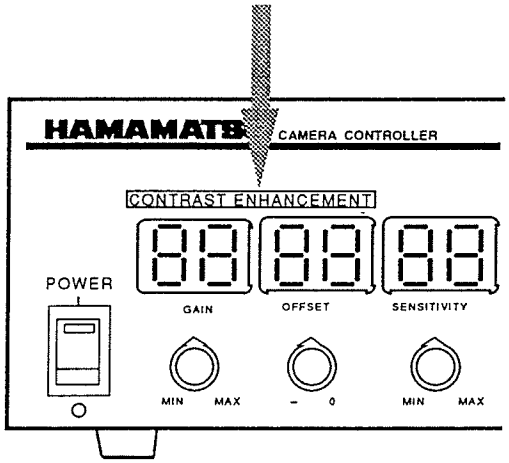
5. When an image is displayed

Adjust the lens focus to make the image clear. Adjust the iris so that the VIDEO LEVEL lamp (green) on the front panel lights up.
If the red lamp is lit, narrow the iris or use a light reducing filter.
If the green lamp is unlit, widen the iris or increase light radiation on the object.
Make sure that the green lamp is always lit when the CCU is operated.

7. Standard Operations

7-1 Contrast Enhancement

When observing a low contrast object, the image contrast can be increased by adjusting the contrast enhancement circuit.



1. Turn the GAIN knob counter-clockwise fully and the OFFSET knob clockwise fully.

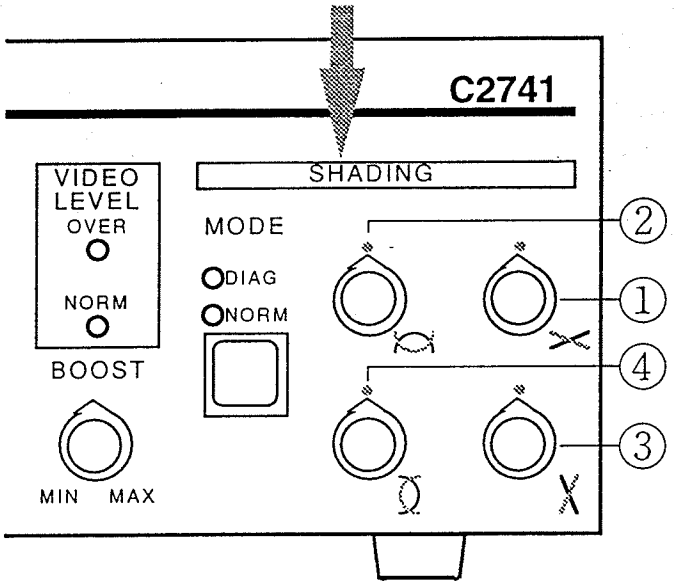
2. While observing the video monitor, turn the GAIN knob clockwise gradually until the brightness of the image is slightly more than suitable.

3. Turn the OFFSET knob counter-clockwise until the image is displayed as desired.

4. Repeat steps 2) and 3) until the desired part of the image is displayed most clearly.
   It is not possible to increase contrast sufficiently if shading (uneven brightness) is present in the image obtained from the object. In this case, adjust the lighting so that the brightness of the object is even or perform shading correction. (Refer to 7-2, "Shading Corrector".)

7-2 Shading Corrector

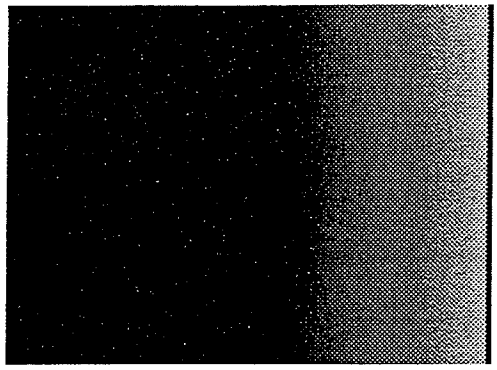
Four knobs are provided on the front panel to perform shading correction. Shading introduced in the optics can also be corrected. Two correction modes are available: normal correction (horizontal/vertical) and diagonal correction (diagonal).



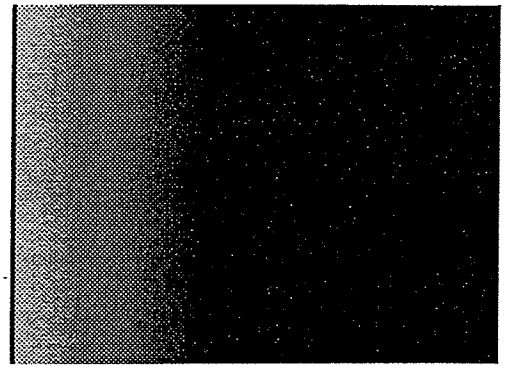
1. Normal Correction

Pressing the MODE switch once when neither the NORM nor DIAG lamp is lit will light up the NORM lamp, indicating that the normal correction mode is activated.

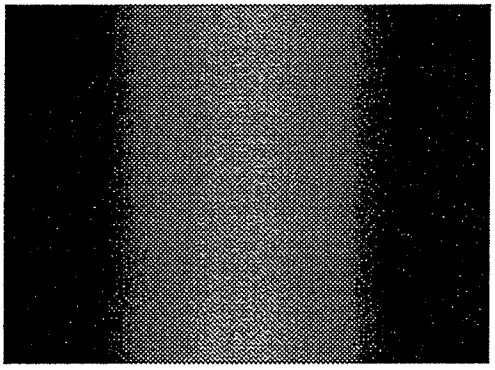
When knob ① is turned clockwise:



When knob ① is turned counter-clockwise:



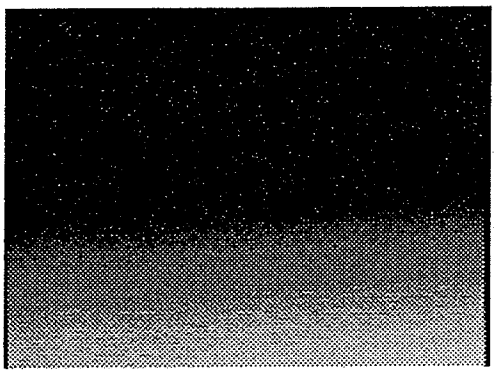
When knob ② is turned clockwise:



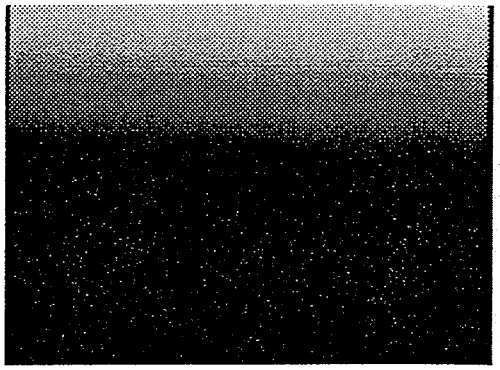
When knob ② is turned counter-clockwise:



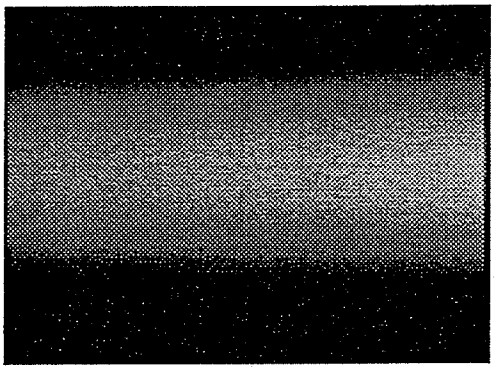
When knob ③ is turned clockwise:



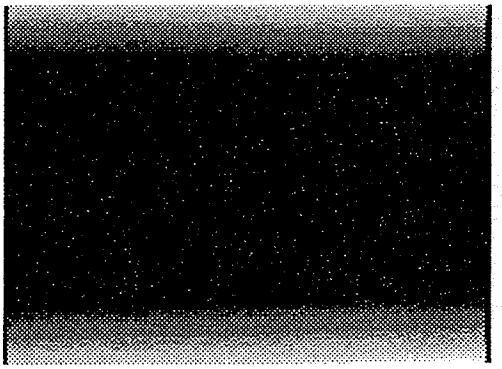
When knob ③ is turned counter-clockwise:



When knob ④ is turned clockwise:



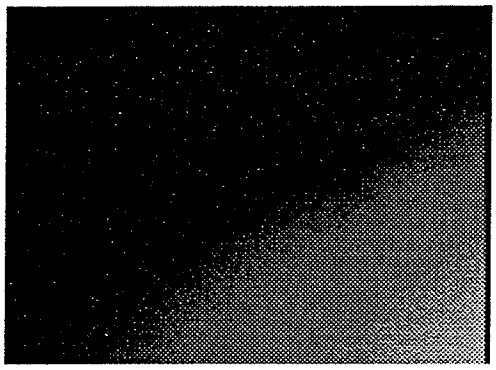
When knob ④ is turned counter-clockwise:



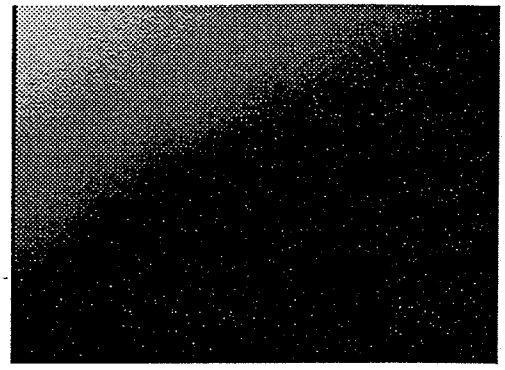
2. Diagonal Correction

Pressing the MODE switch twice when neither the NORM nor DIAG lamp is lit will light up the DIAG lamp, indicating that the diagonal correction mode is activated.

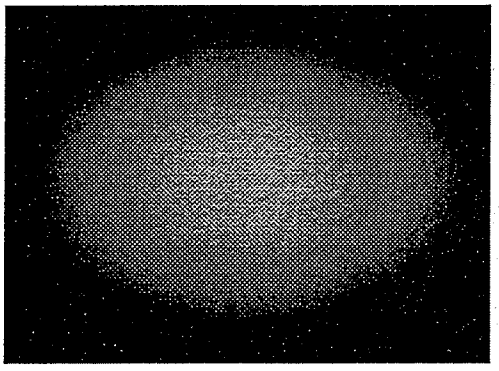
When knob ① is turned clockwise:



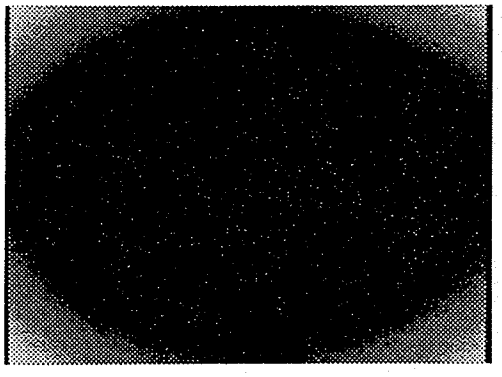
When knob ① is turned counter-clockwise:



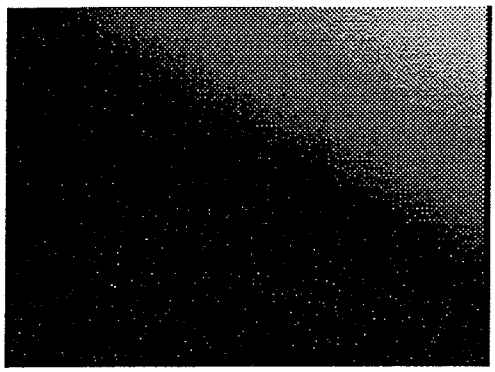
When knob ② is turned clockwise:



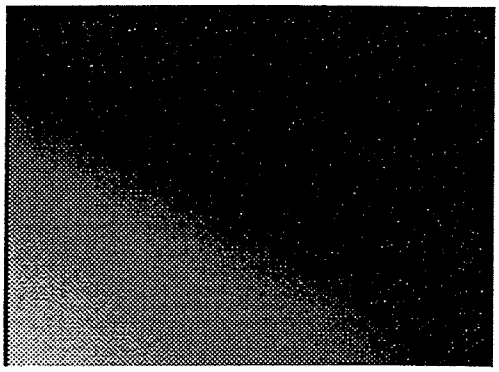
When knob ② is turned counter-clockwise:



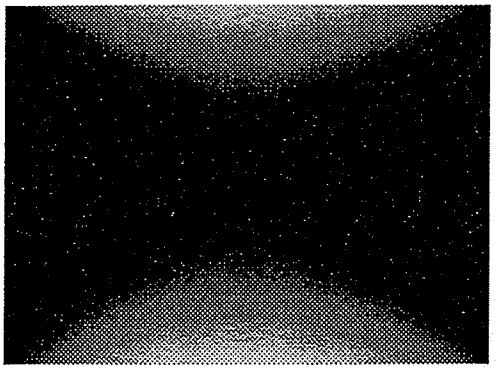
When knob ③ is turned clockwise:



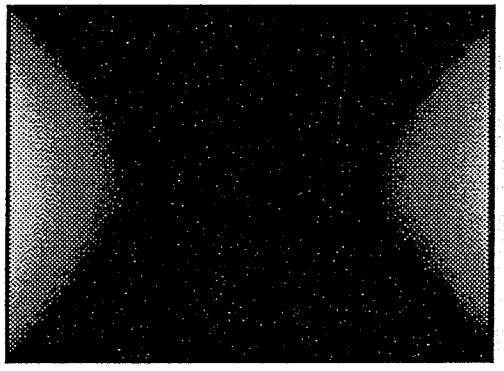
When knob ③ is turned counter-clockwise:



When knob ④ is turned clockwise:

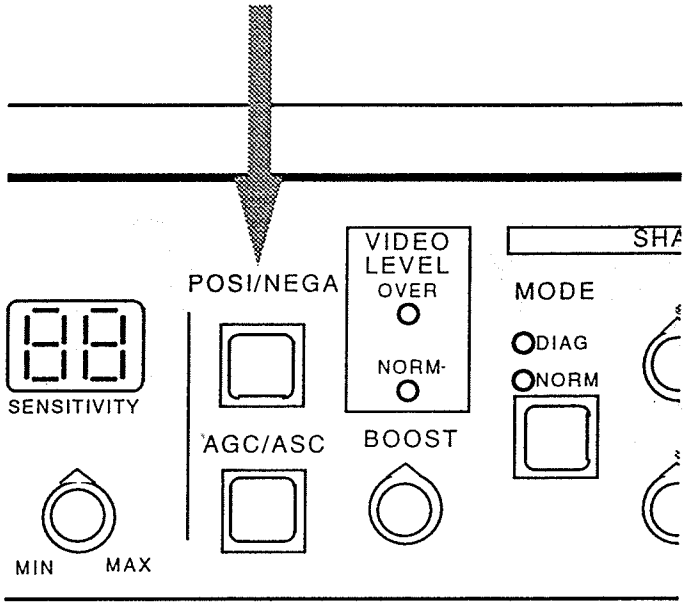


When knob ④ is turned counter-clockwise:



7-3 Video Inverter (POSI/NEGA)

The video inverter reverses the intensity level of the image. Select POSI or NEGA according to your application.

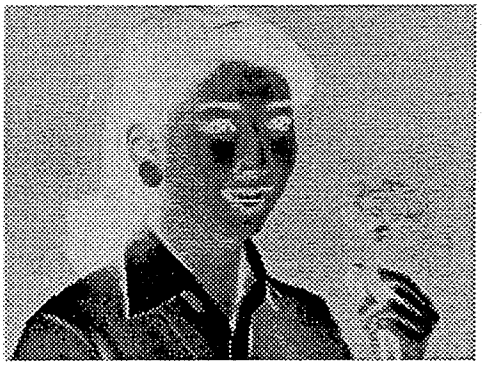


Pressing the POSI/NEGA switch lights up the switch lamp and inverts the image displayed on the monitor. Pressing the switch again resumes the original (normal) image.
If the contrast is increased with the image inverted, the dark areas of the image can be displayed clearly.

Examples:



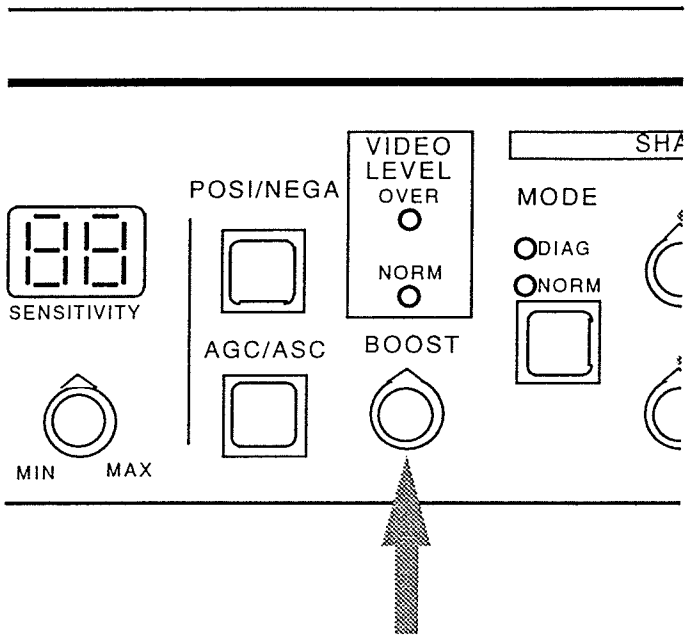
Normal image



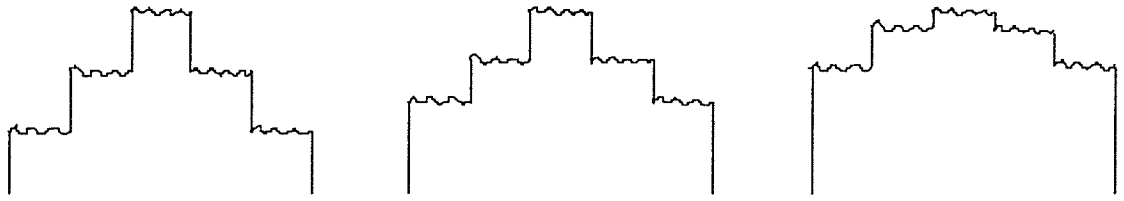
Inverted image

7-4 Video Booster (BOOST)

The video booster increases the contrast of the dark areas by modifying the contrast in those areas.



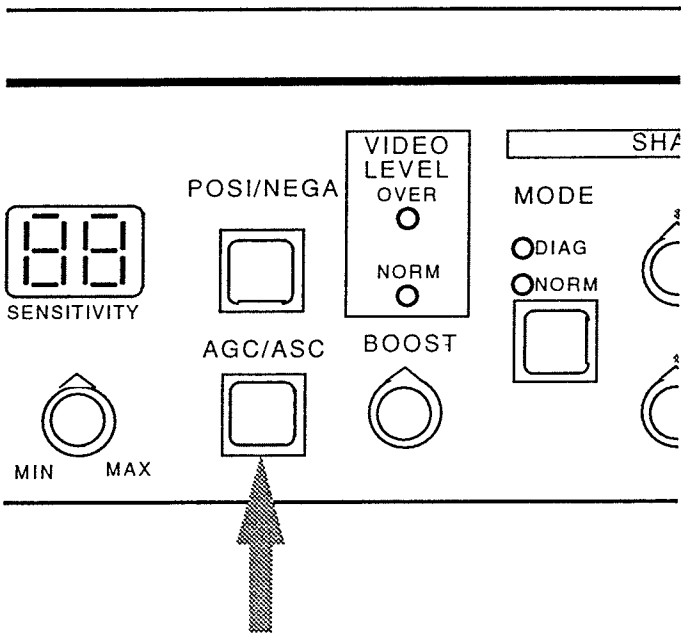
Turning the BOOST knob clockwise changes the intensity conversion characteristic to increase the contrast of the low intensity video signal.



Knob is turned counter-clockwisw fully | Knob is located at the middle point | Knob is turned clockwise fully

7-5 Automatic Gain Control (AGC)

The automatic gain control maintains the output video signal at constant level even if input light fluctuates.



AGC Procedure:

While the AGC is OFF (the lamp is not lit), adjust the light quantity or iris so that the green VIDEO LEVEL lamp lights up.
Pressing the AGC/ASC switch will light up the switch lamp, indicating that automatic gain control is activated. The amp gain will be automatically adjusted to output a constant video signal.

CAUTION

If no light is entered or the quantity of input light is insufficient, the amp gain will be adjusted to the maximum, resulting in a low S/N (signal to noise) ratio. If the red VIDEO LEVEL lamp is lit, the quantity of input light is excessive, so narrow the iris or reduce light radiation on the object.

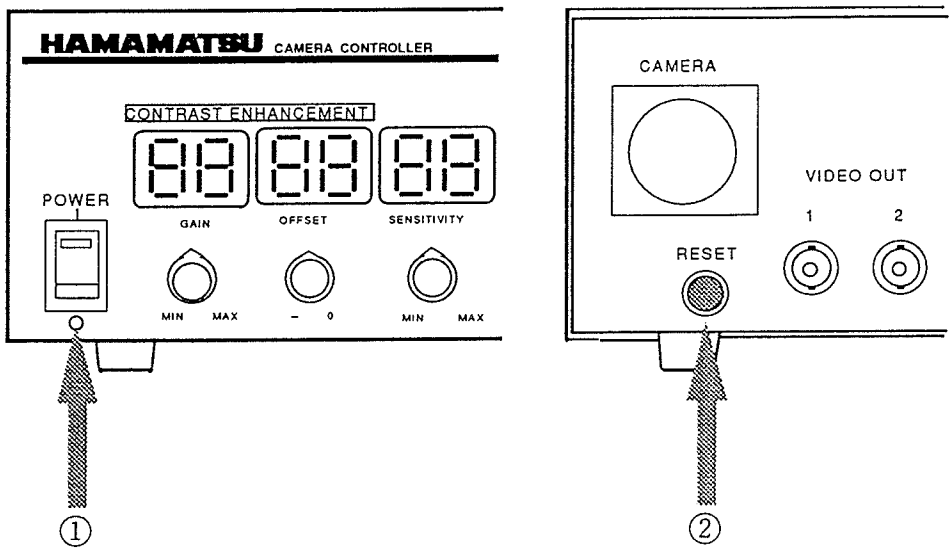
7-6 SIT Protection Circuit (C2400/2741-08 Only)

If an excessive quantity of light is input to the camera, this circuit stops supply of a high voltage to the SIT tube to prevent damage to the SIT tube. Therefore, no image is displayed on the monitor while this circuit is activated. The red lamp (OVER) lights up to indicate that the SIT protection circuit is activated.

Canceling the SIT Protection

To cancel the SIT protection, follow the procedure given below.

①Turn ON the POWER switch again.
②Press the RESET switch on the rear panel.



CAUTION:

1) If the SIT protection is canceled by turning ON the POWER switch, no image will be displayed for approximately 10 seconds after the power is turned ON, to prevent burn-in of the SIT tube.
   However, the image will be resumed immediately if the SIT protection is canceled by pressing the RESET switch.

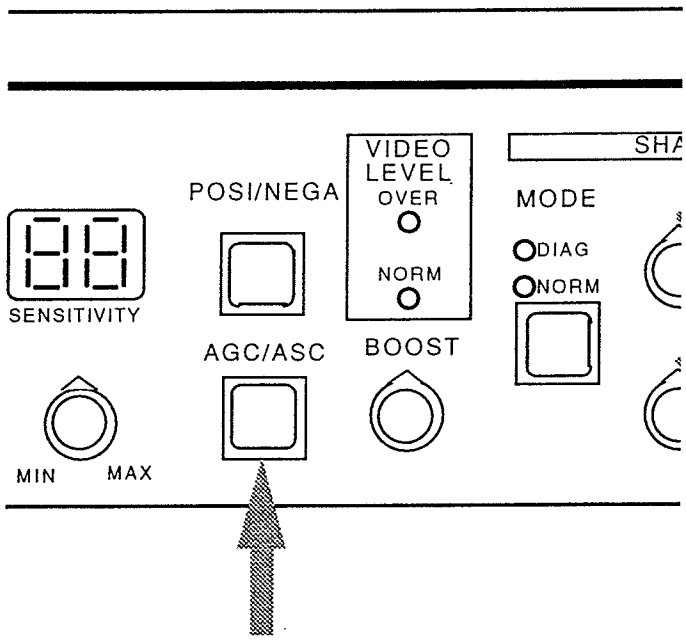
2) Before canceling the SIT protection, make sure that the following actions are taken.
   - Reduce quantity of input light to the camera (by narrowing the iris or reducing light radiation).
   - Decrease the SIT sensitivity (by turning the SENSITIVITY knob counter-clockwise).

If the SIT protection is canceled without the above actions taken, the SIT protection circuit may be reactivated.

8. Optional Operations

8-1 Automatic Video Tube Sensitivity Control (ASC) (Optional for the C2400/C2741-08)

The automatic sensitivity control adjusts the sensitivity of the SIT tube automatically so that the output video signal is maintained at constant level even if input light fluctuates.



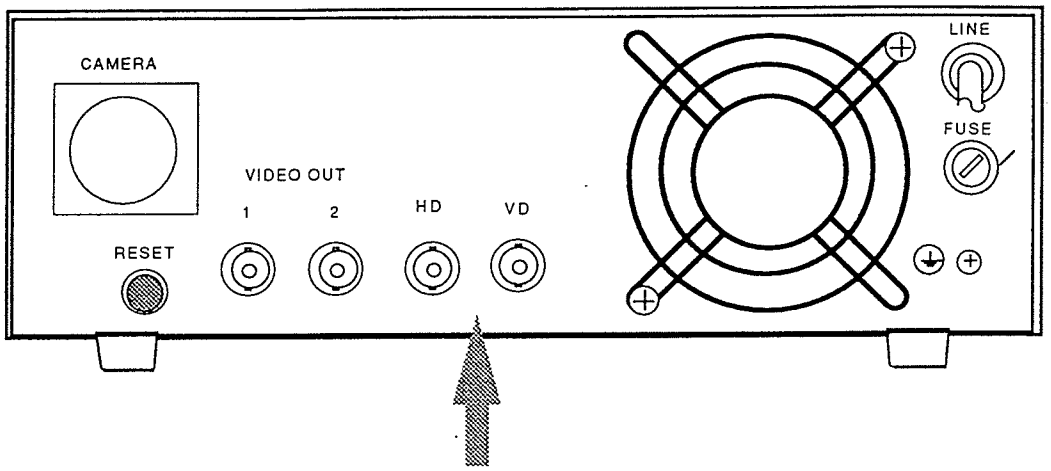
ASC Procedure

Pressing the AGC/ASC switch will light up the switch lamp, indicating that automatic sensitivity control is activated.
This function adjusts the control voltage for the SIT sensitivity automatically, so it is useful when you want to maintain a constant video output signal even if the input light to the SIT fluctuates or when you want to increase the dynamic range for the input light.
When the ASC is activated, both the AGC and the SENSITIVITY knob are disabled

The ASC is an option available for the C2400/C2741-08. It needs to be installed before shipment of the system, since modification of the circuits in the CCU is required. If you want to install this option after purchase of the system, the system must be sent to HAMAMATSU for installation.

8-2 External Synchronization (HD, VD) (Optional for the C2400/C2741)

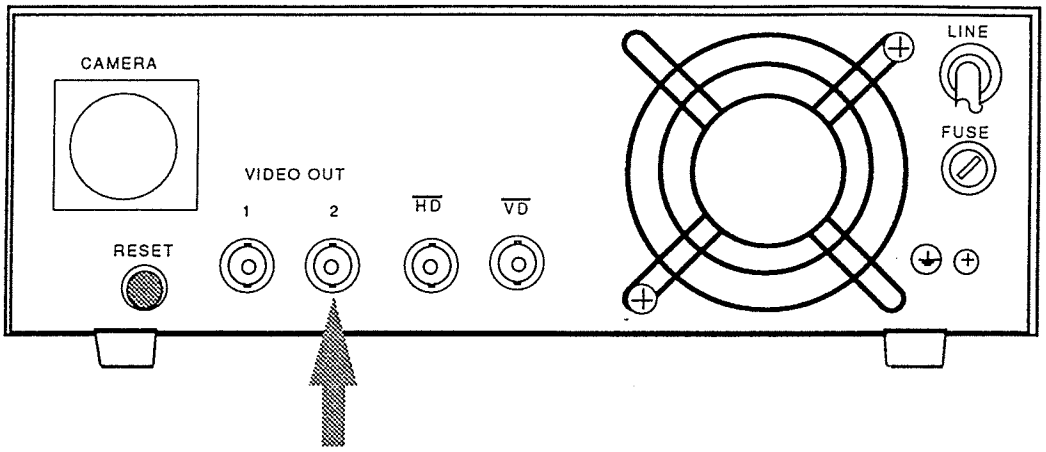
This function allows the HD (horizontal synchronization) and VD (vertical synchronization) signals to be supplied from an external equipment, to synchronize the image with the external equipment. Moreover, this function is also useful when you use two pieces of this CCU.

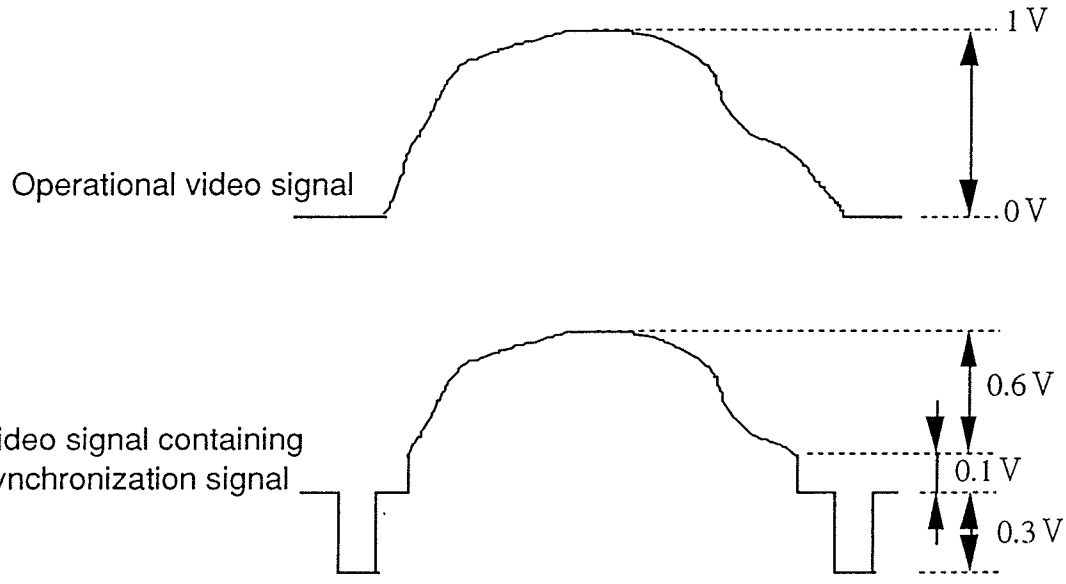


The external synchronization function needs to be installed before shipment of the system, since modification of the circuits in the CCU is required. If you want to install this option after purchase of the system, the system must be sent to HAMAMATSU for installation.

8-3 Operational Video Output

A video signal (operational video signal) containing no synchronization signals is output. This function is useful when image process is carried out by an external equipment.





Since the operational video signal is output from VIDEO OUT 2, the video signal containing synchronization signals can be output only from VIDEO OUT 1.

The operational video output function needs to be installed before shipment of the system, since modification of the circuits in the CCU is required. If you want to install this option after purchase of the system, the system must be sent to HAMAMATSU for installation.

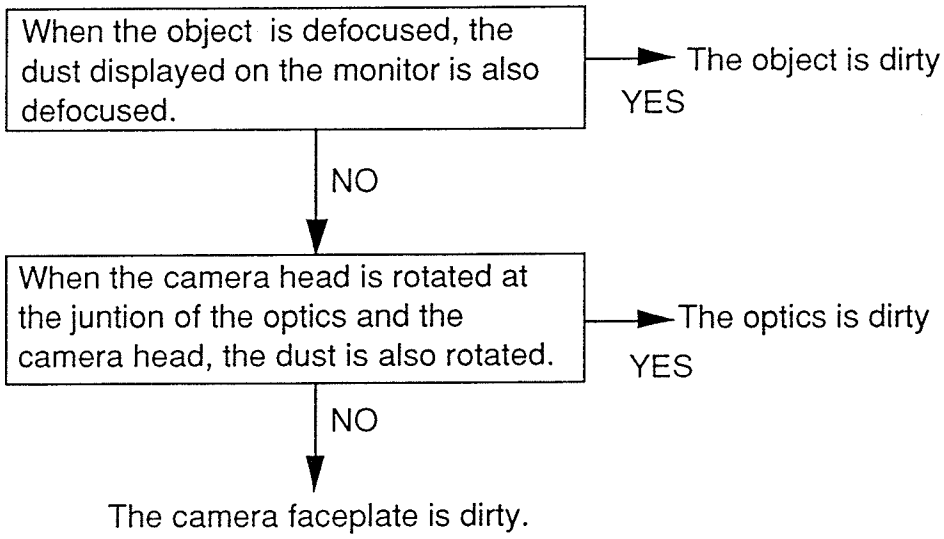
9. Maintenance

9-1 Cleaning the Camera Control Unit

If the camera control unit (CCU) becomes dirty, wipe it with a soft, dry cloth. If it is extremely dirty, first wipe it with a cloth dampened with neutral detergent, then with a dry cloth.

9-2 Cleaning the Camera Faceplate

Dust on the camera faceplate was removed at the time of shipment. However, dust may have collected on the faceplate over a long period of usage or while connecting the camera to the optics. In addition, dust may also enter the optics. Thus, follow the flow chart given below to identify the location of any contamination. If the faceplate is found to be dirty, clean it according to the cleaning procedure given below.



Cleaning Procedure:

- Rough cleaning
  Wet a cotton swab or lens cleaning paper with ethanol, then wipe the faceplate with it, wiping from the center outwards.

- Finish cleaning
  Wet a lens cleaning paper with a very small amount of ethanol, then lightly run over the faceplate with it.
  Reflect fluorescent lighting etc. onto the faceplate to check for presence of dust, then clean until all dust is removed.

- Confirmation
  Attach the camera head to the optics, and observe an evenly white object (? etc.) to check for presence of dust. If dust is detected, repeat the above steps from "Finish cleaning".

10. Before Requesting Repairs

If the system does not operate properly or an operational problem occurs, check the following points before contacting your nearest sales office or HAMAMATSU.

Symptom	Check Points
No image on the video monitor	Is the power supplied to both the camera control unit (CCU) and video monitor? Are the CCU connected and the camera head connected with the camera cable? Is the OFFSET knob on the front panel turned clockwise fully? Is the GAIN knob on the front panel turned counter-clockwise fully? Is the optical path between the object and camera head clear of any obstruction? Is the object bright enough? Is the object dark enough? Is the SENSITIVITY knob adjusted? (For -03, -08 and -16) Is the SIT protection circuit OFF? (For -08)
Image is not clear.	Is the object bright enough? Is the contrast on the video monitor adjusted correctly? Is the optics focused correctly? Is the resolution of the optics satisfactory? Is the optics or faceplate clean?
Noise on the image	Is the object bright enough? (If the object is dark and the intensity is adjusted by the GAIN knob, noise level will increase, so increase lighting radiation on the object.) Is the AGC OFF when the object is dark? (If the object is dark and the AGC is ON, noise level will increase since the amp gain is set to the maximum.) Is the terminator (75Ω) of the video monitor ON? Are the camera head and optics connected correctly and is electrical continuity secured? Is the system clear of noise sources (pulse motor, thyristor, high-frequency generator etc.) in the vicinity?
Distorted image	Are the camera head and video monitor clear of any source of magnetic field in the vicinity? Is the optics free of any distortion problem? Are the H.HOLD and V.HOLD of the video monitor adjusted correctly?
Excessive shading	Is the shading correction adjusted properly? Is the shading of the optics satisfactory?

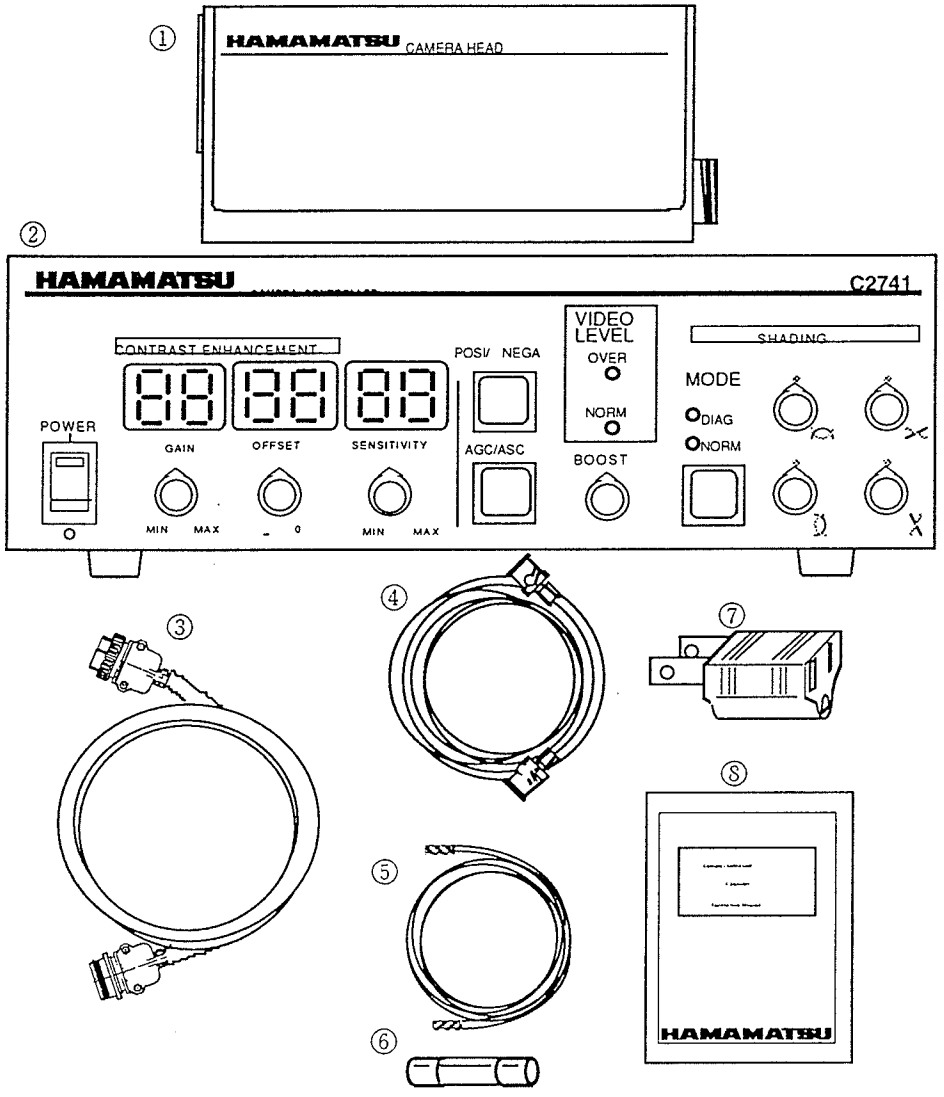
11. Specifications

11-1 Specifications

No.	Item		Broadcasting System	
			NTSC B/W	CCIR SYSTEM B
1	Horizontal Scanning Frequency		15.734KHz	15.625KHz
2	Vertical Scanning Frequency		59.94Hz	50.00Hz
3	Total No. of Scanning Lines		525	625
4	Effective No. of Scanning Lines		485	575
5	Interlace Ratio		2:1	
6	Aspect Ratio (H:V)		4:3	
7	Synchronization Method		Internal synchronization by crystal oscillator (Optional external synchronization available)	
8	Output	Signals Video Signals	1.0 Vp-p/75Ω, two output terminals	
		Horizontal and Vertical Synchronization Signals (HD and VD)	Negative logic (75Ω), TTL level (Low: 0.8 V or lower, High: 2.5 V or higher) When controlled in synchronization with an external source, no HD and VD signals will be output since these terminals are used for the external synchronization input signals.	
9	Lens Mount		C-mount (1 inch)	
10	Operating Temperature		0°C to 40°C (except for the -16) 0°C to 30°C (for the -16)	
11	Storage Temperature		-10°C to 50°C (except for the -16) -10°C to 30°C (for the -16)	
12	Operating and Storage Humidity		90% or less, non-condensing	
13	Input Voltage		100/117 VAC +/-10%, 50/60 Hz 220/240 VAC +/-10%, 50/60 Hz	
14	Power Consumption (with all the options installed)		Approx. 80 VA	
15	External Dimensions	Camera Head Camera Head -08 Camera Control Unit	104×98×204mm (W×H×D) 104×99×255mm (W×H×D) 232×74×308mm (W×H×D)	
	Weight	Camera Head: Camera Head -08: Camera Control Unit:	Approx. 2 kg Approx. 3 kg Approx. 4.5 kg	

11-2 Standard Accessories

Name	C2400	C2741
① Camera Head	1	1
② Camera Control Unit	1	1
③ Camera Cable	1 (3 m)	1 (5 m)
④ BNC-BNC Cable	1 (3 m)	1 (3 m)
⑤ GND Cable	1 (3 m)	1 (3 m)
⑥ Spare Fuse	1 (2 A)	1 (2 A)
⑦ 3-pin to 2-pin Adaptor	1	1
⑧ Instruction Manual	1	1



12. Performance

Geometric Precision (Deflecting Position and Dimension) ..... +/-0.2% or less (+10°C to +40°C)
Signal to Noise Ratio ..... 50dB (p-p/rms) typical
Video Bandwidth ..... 0 to 10 MHz or greater
Contrast Gain ..... 1 to 10 times
Spurious (video tube) ..... Conforms to the spurious specifications of the video tube used.

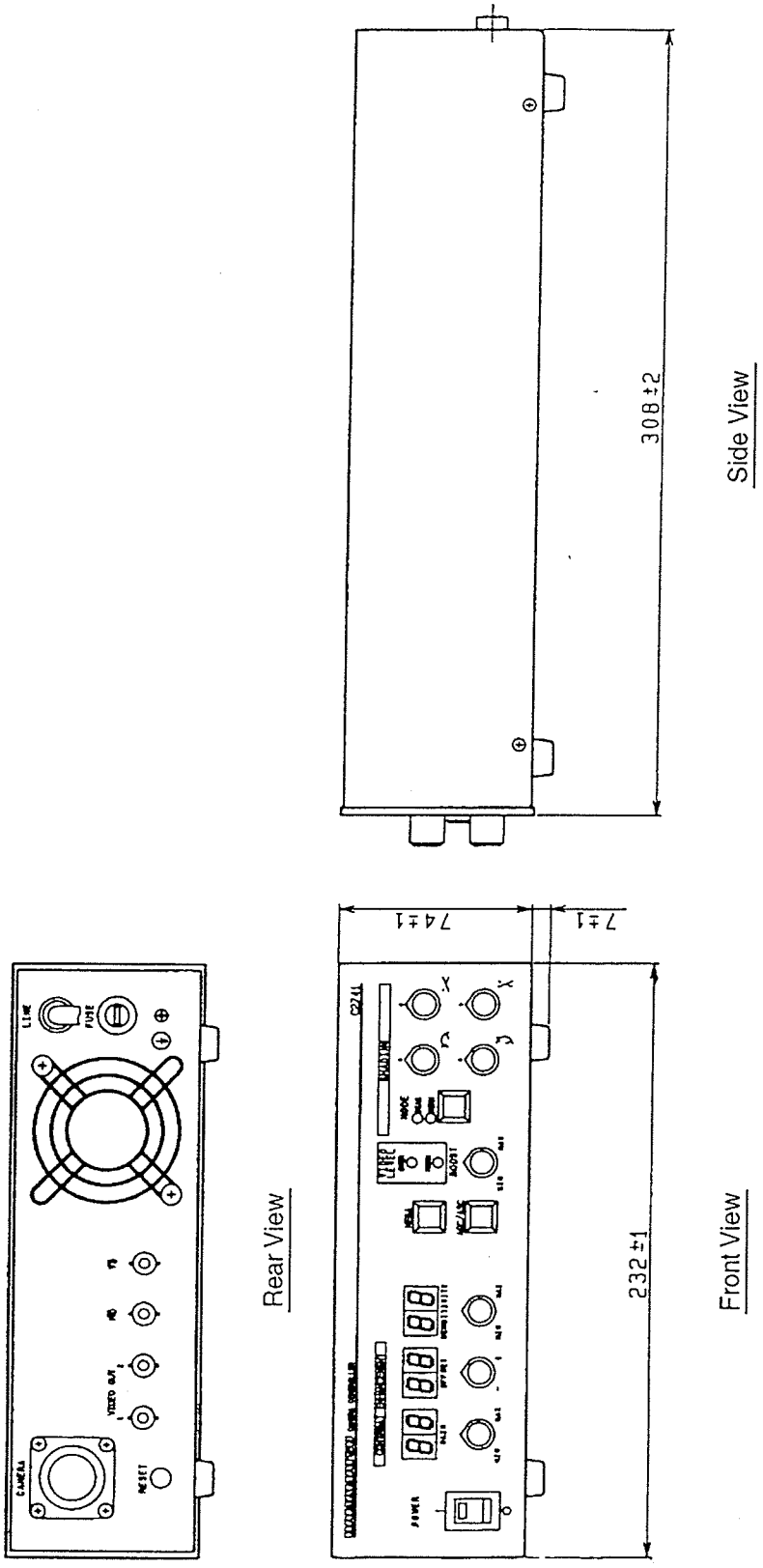
Type No.	Horizontal Center Resolution (TV line)	Geometric Distortion (% within inscribed circle)	Shading (% within inscribed circle) *1	Burn-in	Lag *2	Gamma *3
C2400-01 C2741-01	700	±1	10 (20)	No	20	0.95
-02	600	±1	10 (20)	No	12	1.0
-03	600	±2	20 (40)	Yes	60	0.6
-05	700	±1	10 (20)	No	20	0.95
-06	750	±1	10 (20)	Slightly	3	0.95
-07	700	±1	10 (20)	No	20	1.0
-07ER	700	±1	10 (20)	No	20	1.0
-08	500	±3	20 (40)	No	7	1.0
-16	800	±1	10 (20)	Slightly	3	1.0 ~ 0.8

*1: Values after correction of shading
Values in ( ) are those before correction.
*2: Values measured after 3 fields (50 ms) following the stop of input light
*3: Linearity of signal current relative to the intensity

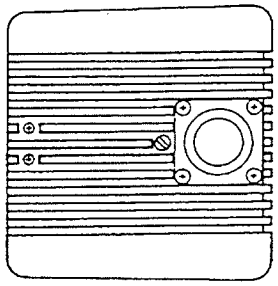
Type No.	Video Tube Used	Features
C2400/C2741-01	Chalnicon (N3111 etc.)	Visible, high sensitivity, high resolution
-02	Silicon Vidicon (4532U)	Visible to near infrared, high sensitivity
-03	Infrared Vidicon (N2606-11 etc.)	Visible to infrared
-05	UV Vidicon (N983-01 etc.)	UV to visible, high sensitivity, high resolution
-06	Saticon (H9324 etc.)	Visible, low lag, high resolution
-07	Newvicon (S4076 etc.)	Visible to near infrared, high sensitivity, high resolution
-07ER	Newvicon (S4119 etc.)	Visible to near infrared, high sensitivity, high resolution (Improved version of S4076, with improved sensitivity in infrared region)
-08	SIT (4804 etc.)	Visible, ultra-high sensitivity
-16	Super Harpicon (H4441 etc.)	UV to visible, ultra-high sensitivity, low lag, high resolution

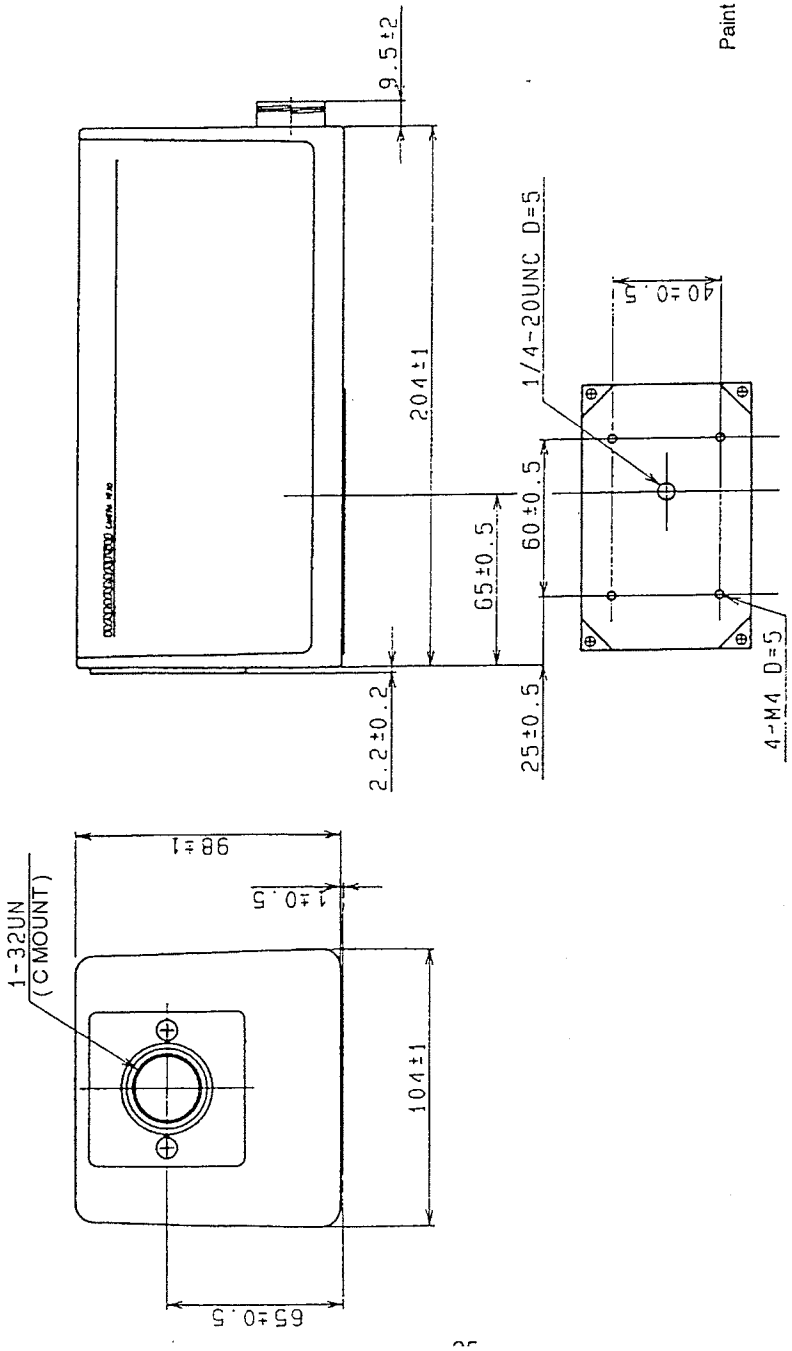
External Dimensions

Camera Control Unit (CCU)

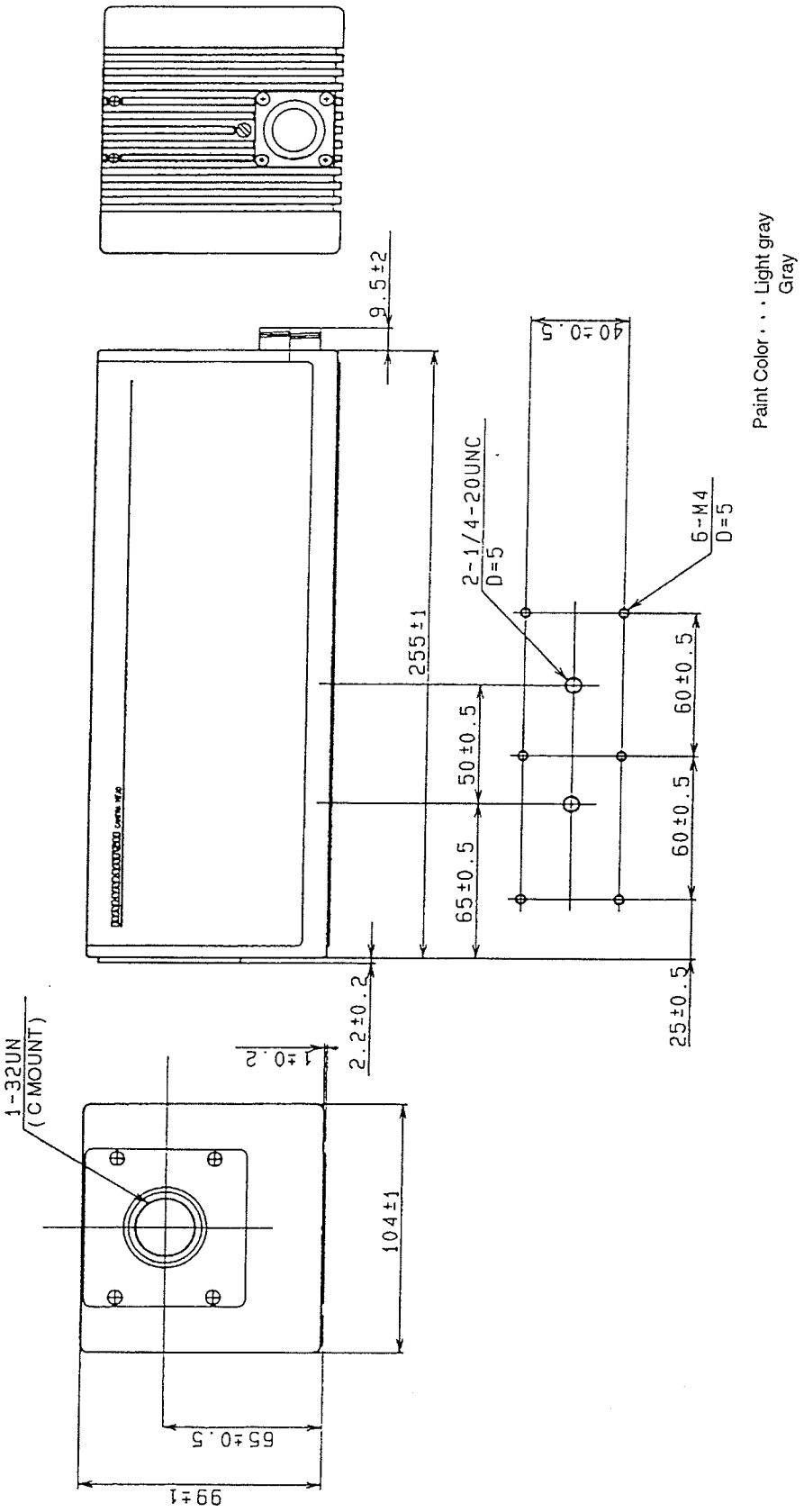


Camera Head (-01 to -07ER)

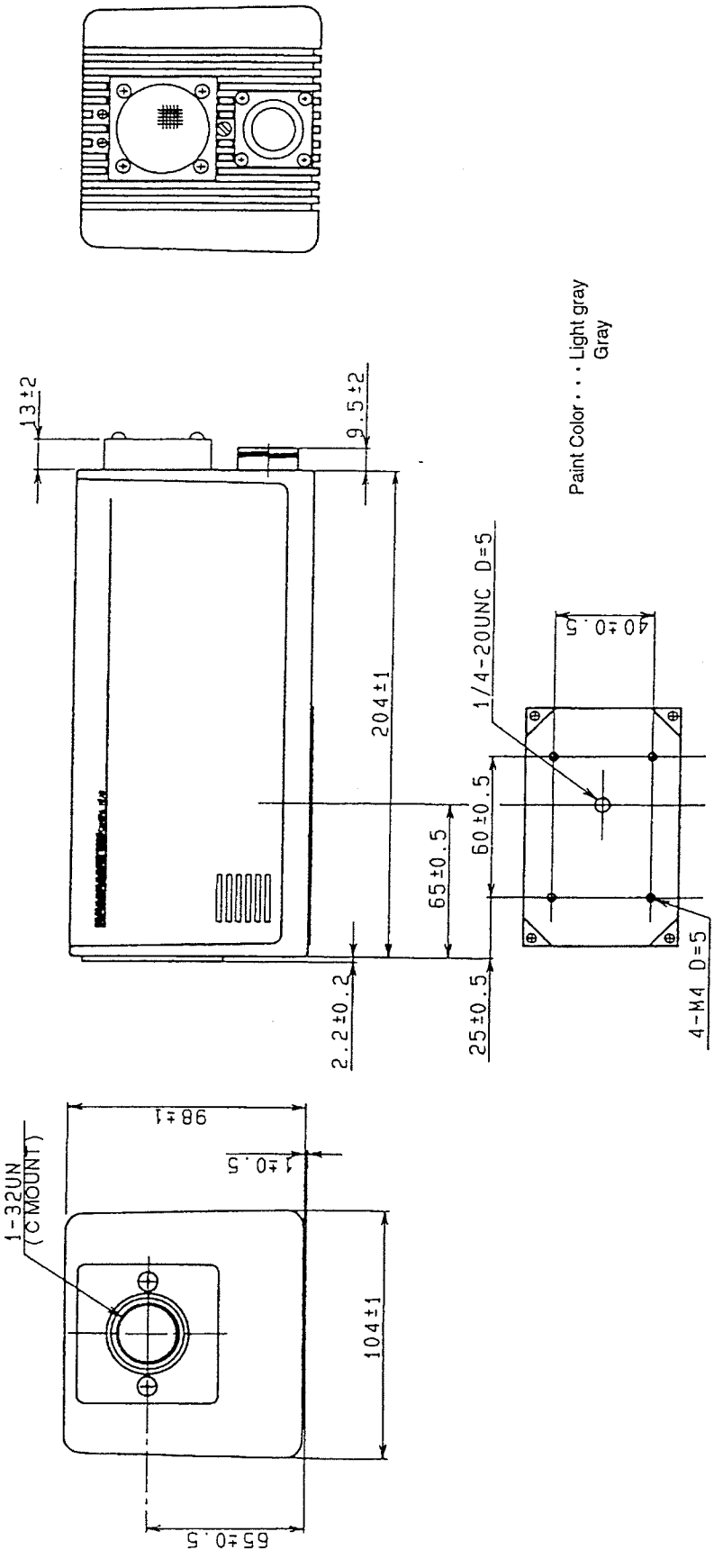




Camera Head (-08)



Camera Head (-16)



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