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SONY

CCD COLOR CAMERA MODULE

XC-711/711P

JUNCTION BOX

JB-77

STANDARD LENS

VCL-16Y-M

4-PIN M CONNECTOR

PC-XC04

12-PIN F CONNECTOR

PC-XC12

CAMERA CABLE

CCXC-12P02/12P05
CCXC-12P10/12P25
CCXC-9DB
CCXC-9DD



SERVICE MANUAL

XCM-711

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For the customers in the USA

WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

To avoid electrical shock, do not open the cabinet. Refer servicing to qualified personnel only.

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.
Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart J of Part 15 of FCC rules.

For the customers in Canada
This apparatus complies with the Class A limits for radio noise emissions set out in radio interference regulations.

Pour les utilisateurs au Canada
Cet appareil est conforme aux normes Classe A, pour bruits radioélectriques.
Tel que spécifiér dans le règlement sur le brouillage radioélectrique.

Bescheinigung des Herstellers
Hiermit wird bescheinigt, daß die Farb-Videokamera XC-711P in Übereinstimmung mit den Bestimmungen der Amtsblattverfügung Nr. 1046/1984 funkentstört ist. Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.
Sony Corporation

Hinweis
Gemäß dem Amtsblatt des Bundesministers für das Post-und Fernmeldewesen Nr. 163/1984 wird der Betreiber darauf aufmerksam gemacht, daß die von ihm mit diesem Gerät zusammengestellte Anlage auch den technischen Bestimmungen dieses Amtsblattes genügen muß.

Note
This appliance conforms with EEC Directives 76/889 and 82/499 regarding interference suppression.

Remarque
Cet appareil est conforme aux Directives 76/889 et 82/499 de la CEE en ce qui concerne la suppression des interférences.

Hinweis
Dieses Gerät erfüllt bezüglich Störstrahlungsunterdrückung die EEC-Richtlinien 76/889 und 82/499.

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SECTION 1
OPERATION

1-1. FEATURES

The XC-711 (NTSC model)/XC-711P (PAL model) is a color video camera module, which uses a CCD (Charge Coupled Device) for the pick up device. With application of a CCD, the camera produces an image with little geometric distortion and has high resistance to vibration and mechanical shocks. These features, together with compact size and light weight, make the XC-711/XC-711P suitable for application in a monitoring or surveillance system, or as an input device in an image processing system.

High resolution and natural color
The camera module can produce a high-quality, fine image having a large number of picture elements : 768 × 493 (XC-711)/756 × 581 (XC-711P).
The CCD has filters for the three primary colors (RGB), which allow the camera to achieve a high-fidelity color reproduction.

RGB output
In addition to a composite video signal output, the camera module has an RGB signal output, which can be used for connection with an RGB monitor or an image processing device such as a TARGA board.

Adaptability to diversified signal processing
Gain control can be internally set to the AGC (Automatic Gain Control) or Fixed, the γ (gamma) compensation can be set to ON or OFF, and the white balance can be adjusted automatically or manually. The integration mode of the electrical charge can be internally changed from the frame integration to the field integration. This enables the non-interlace mode sensitivity to be elevated to the level equivalent to the sensitivity of the interlace mode even when entering signals into the external sync input for the setting of the non-interlace mode.

Three types of external sync signals
Synchronization with other cameras is possible by entering the three types of signals from the external sync signal generator. The frequency lock range is set as wide as ±1% of the horizontal frequency.

HD and VD Signals: The unit automatically identifies by the HD (Horizontal Drive) or VD (Vertical Drive) signal whether it is the interlace or non-interlace type and applies the external synchronization in accordance with the identified synchronization type.

S/VS/VBS Signal: The unit is synchronized with the S (composite Sync) signal, VS (Video/composite Sync) signal, or VBS (Video/Burst/composite Sync) signal. (The synch system, whether by HD and VD signals or S/VS/VBS signal, is automatically selected accordingly.)

Internal sync signal output
Internally generated clock signal, HD and VD signals can be output to synchronize connected equipment with this camera module. (This function is activated by modifying the circuit connections inside the camera.)

Electronic shutter
The camera module has an electronic shutter. The shutter speed can be set to 1/60, 1/120, 1/250, 1/500, 1/1000, 1/2000, 1/4000, or 1/10000 seconds. In addition, the shutter can be set to the flickerless mode (1/100 or 1/120 seconds) to avoid the flickering image caused by the lighting with fluorescent lamps.

Usable with an auto iris lens
The lens mount is a standard C mount. Beside the VCL-16Y-M standard lens (manual iris), the VCL-08Y/VCL-16Y auto iris lens is usable for the camera module.

Solid body
The body consists of aluminum die cast and steel panel. On the bottom are 2 screw holes (reference holes) which can be used to keep deviation of the optical axis at a minimum.

Long life and high stability

Precise image geometry

Low lag and little image sticking

High resistance to vibration and mechanical shock

Quick start-up

Shooting in a strong magnetic field

Low power consumption (5.5 W)

**When the GAIN mode is set to AUTO or FIX-6dB for shooting an object with overall high brightness, flicker might occur in the picture.
In this case, reset the GAIN mode to FIX 0dB, FIX+6dB or FIX+12dB before continuing operation.**

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1-2. COMPOSITION

The CCD camera module system consists of the XC-711/711P and other optional products as shown below.

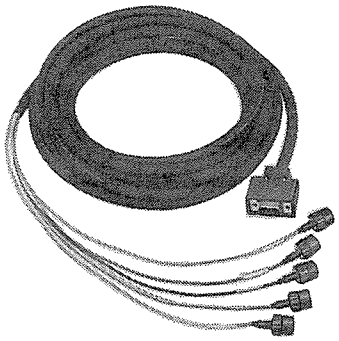
XC-711/711P
CCD camera module



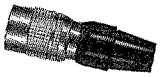
PC-XC12 12-pin connector



CCXC-9DB camera cable



PC-XC04 4-pin connector



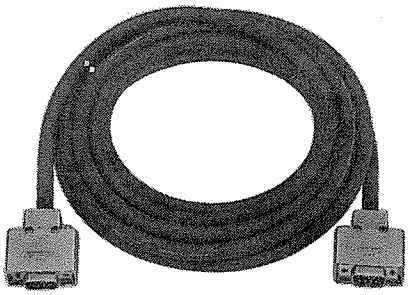
VCL-16Y-M standard lens



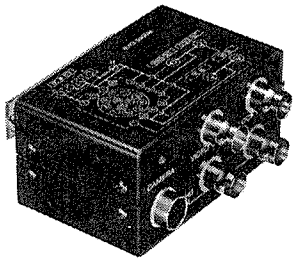
Camera cables
CCXC-12P02 (2m)
CCXC-12P05 (5m)
CCXC-12P10 (10m)
CCXC-12P25 (25m)



CCXC-9DD camera cable



JB-77 junction box



XC-711/711P CCD camera module

VCL-16Y-M standard lens
This is a standard lens of f = 16 mm, F1.4. The iris and focus are adjusted manually.

JB-77 junction box
This is attached to the camera module using the CCXC-12P02/12P05/12P10/12P25 camera cable and will supply power, transmit video signals, and exchange external sync signals.

PC-XC12 12-pin connector
This connector is prepared for system set up, and used to connect to the DC IN/VBS connector of the camera module.

PC-XC04 4-pin connector
This is used to attach the lens cord of the auto iris lens to the LENS connector on the camera module.

CCXC-12P02 (2m), 12P05 (5m), 12P10 (10m) and 12P25 (25m) camera cables
These cables can be attached to the 12-pin DC IN/VBS connector on the rear of the camera module to supply power, transmit video signals and exchange sync signals.

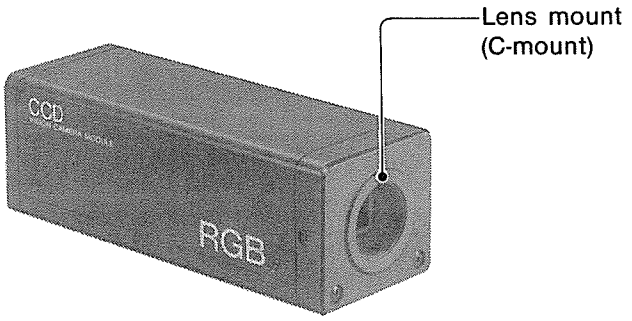
CCXC-9DD camera cable (DSUB-DSUB)
CCXC-9DB camera cable (DSUB-BNC)
Either of these cables can be attached to the 9-pin RGB/SYNC/YC connector on the rear of the camera module to transmit RGB, sync, and VBS (or Y/C) signals to an image processor, RGB monitor or other equipment which has RGB input connectors. For equipment having a DSUB 9-pin input connector, use the CCXC-9DD cable. For equipment having BNC-type input connectors, use the CCXC-9DB cable.

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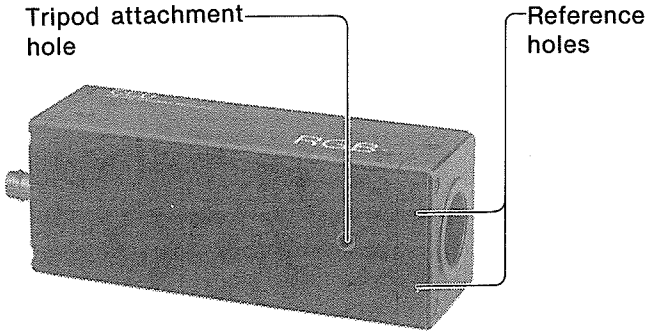
1.3. PARTS LOCATION, FUNCTION AND OPERATION

1-3-1. XC-711/711P CCD Camera Module

Front

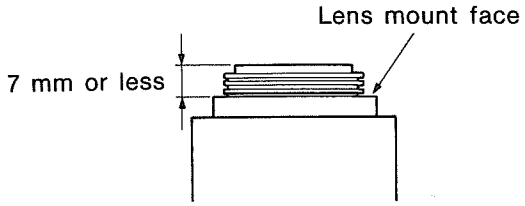


Bottom



Lens mount (C-mount)
Attach a C-mount lens, such as the VCL-16Y-M standard lens, or a piece of other optical equipment.

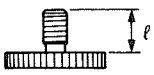
NOTE
Projection of the lens or other piece of optical equipment must be 7 mm or less from the lens mount face.



Reference holes
These are screw holes cut with high precision to affix the camera module. Affixing the module according to these reference holes keeps deviation of the optical axis at a minimum.
For details on dimensions, refer to the section 2 or later.

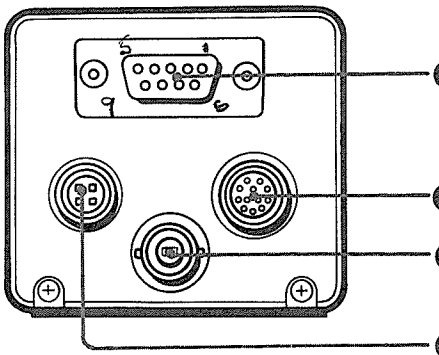
Tripod attachment hole
This hole (U1/4″-20 UNC) is used to attach the camera module to a tripod.

The screws to be used for attachment must be in accordance with the following specifications.
ISO standard: ℓ = 4.5 mm ±0.2 mm
ASA standard: ℓ = 0.197 inches



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Rear



❶ RGB/SYNC/YC connector (DSUB 9-pin)

❷ DC IN/VBS connector (12-pin)

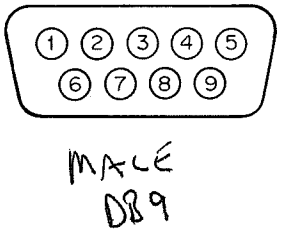
❸ VBS OUT connector (BNC)

❹ LENS connector (4-pin)

❶ RGB/SYNC/YC connector (DSUB 9-pin)

The RGB, sync, and VBS (or Y/C) signals are output from this connector. Connect to an RGB monitor or an image processor using a CCXC-9DD (DSUB-DSUB) or CCXC-9DB (DSUB-BNC) cable.

The pin assignment of this connector is shown in the chart below.



Pin No.	Sync mode	
	Internal	External
1	Ground	Ground
2	Ground	Ground
3	R output	R output
4*	G output	G output
5	B output	B output
6**	VBS output[1)]	Y output (NTSC)[1)] VBS output (PAL)[1)]
7***	Sync output	Sync output
8	Ground	Ground
9****	Ground	Ground

1): Signals output when γ compensation is on. When γ compensation is off, Y_L signal is output.

The pin settings can be changed as follows by modifying connections of the circuits inside the camera.

* The sync signal can be added to the G signal output from pin 4.

** The output from pin 6 can be set to the Y signal in all modes except when γ compensation is off. (When γ compensation is off, Y_L signal is output.)

*** The level of the sync signal output from pin 7 can be changed from 0.3 Vp-p (factory setting) to 2.0 Vp-p.

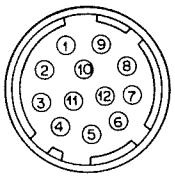
**** The output from pin 9 can be set to the chroma signal in the γ:on and internal sync mode. (For the XC-711P, this is effective in the external sync mode, too.)

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❷ DC IN/VBS (DC power input/VBS) connector (12-pin)

Connect a CCXC-12P02, CCXC-12P05, CCXC-12P10 or CCXC-12P25 camera cable to this connector to supply power (12 V DC) from an external power source and output the video signal from the video camera module. When a sync signal generator is connected to supply the HD and VD signals or S/VS/VBS signal, the camera module can be operated on external sync mode.

The pin assignment of this connector is shown in the chart below.



Pin No.	External Sync mode			Internal Sync mode
	HD, VD	S/VS/VBS	RESTART RESET	Camera Sync output
1	Ground	Ground	Ground	Ground
2	+ 12 V	+ 12 V	+ 12 V	+ 12 V
3	Video output* (ground)	Video output* (ground)	Video output* (ground)	Video output* (ground)
4	Video output* (signal)	Video output* (signal)	Video output* (signal)	Video output* (signal)
5	HD input (ground)	—	HD input (ground)	HD output (ground)
6	HD input (signal)	—	HD input (signal)	HD output (signal)
7	VD input (signal)	S/VS/VBS input (signal)	RESET PULSE (signal)	VD output (signal)
8	—	—	—	CLOCK output (ground)
9	—	—	—	CLOCK output (signal)
10	Ground	Ground	—	Ground
11	+ 12 V	+ 12 V	—	+ 12 V
12	VD input (ground)	S/VS/VBS input (ground)	RESET PULSE (ground)	VD output (ground)

*: When γ compensation is ON—VBS output.
When γ compensation is OFF—Y_L output.

❸ VBS OUT (output) connector (BNC connector)

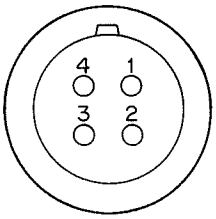
The video signal from the video camera module is output from this connector. This connector can be used only when a CCXC-12P02 camera cable is connected to the DC IN/VBS connector and the video output of the 12-pin connector of the CCXC-12P02 cable is not terminated with 75 ohms.

The output signal from this connector is shown in the chart below.

γ: ON		γ: OFF
Internal sync	External sync	Y_L output
VBS output	Y output (NTSC) VBS output (PAL)	

❹ LENS connector (4-pin)

When the plug of an auto iris lens is connected to this connector, the iris of the lens can automatically be adjusted.
The pin assignment of this connector is shown in the chart below.

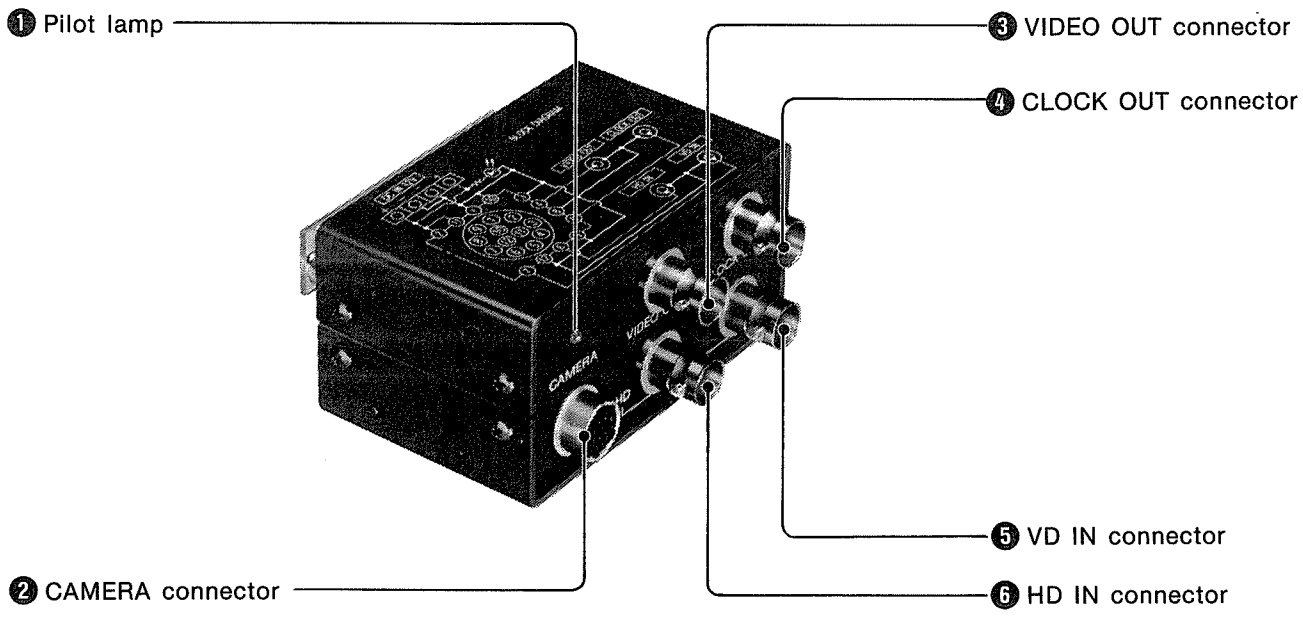


Pin No.	Signal
1	+ 12 V
2	Ground
3	—
4	Video signal

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1-3-2. JB-77 Junction Box

Front



❶ Pilot Lamp
Lights up when 12 V DC is input.

❷ CAMERA connector (12-pin)
Connect a CCXC-12P02/12P05/12P10 or CCXC-12P25 camera cable to this connector to supply power (12 V DC) from an external power source and external sync signals from an external sync system and to input the video signal from the video camera module.

❸ VIDEO OUT (output) connector (BNC connector)
The video signal from the video camera module is output from this connector when connected to a video monitor or VTR.

❹ CLOCK OUT (internal sync signal output) connector
Clock signal is output through this connector for the independent use of the camera module.

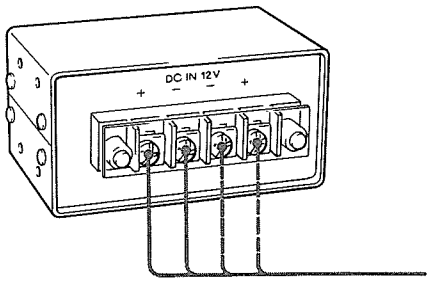
❺ VD IN connector (BNC connector)
Connect the sync signal generator to input the VD signal or the S/VS/VBS signal. This enables the camera module to be operated on external sync signals.
- When receiving VD signals, input HD signals to the HD IN connector.
- When receiving S/VS/VBS signals, do not input HD signals to the HD IN connector.

For the independent use of the camera module, the VD signal can be output by changing the camera module's internal wiring.

❻ HD IN connector
Connect the sync signal generator to input the HD signal. Combining it with the VD signal input from VD IN connector enables the camera module to be operated on external sync signals.
For the independent use of the camera module, the HD signal can be output by changing the camera module's internal wiring.

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Rear



DC IN (input) 12 V terminals

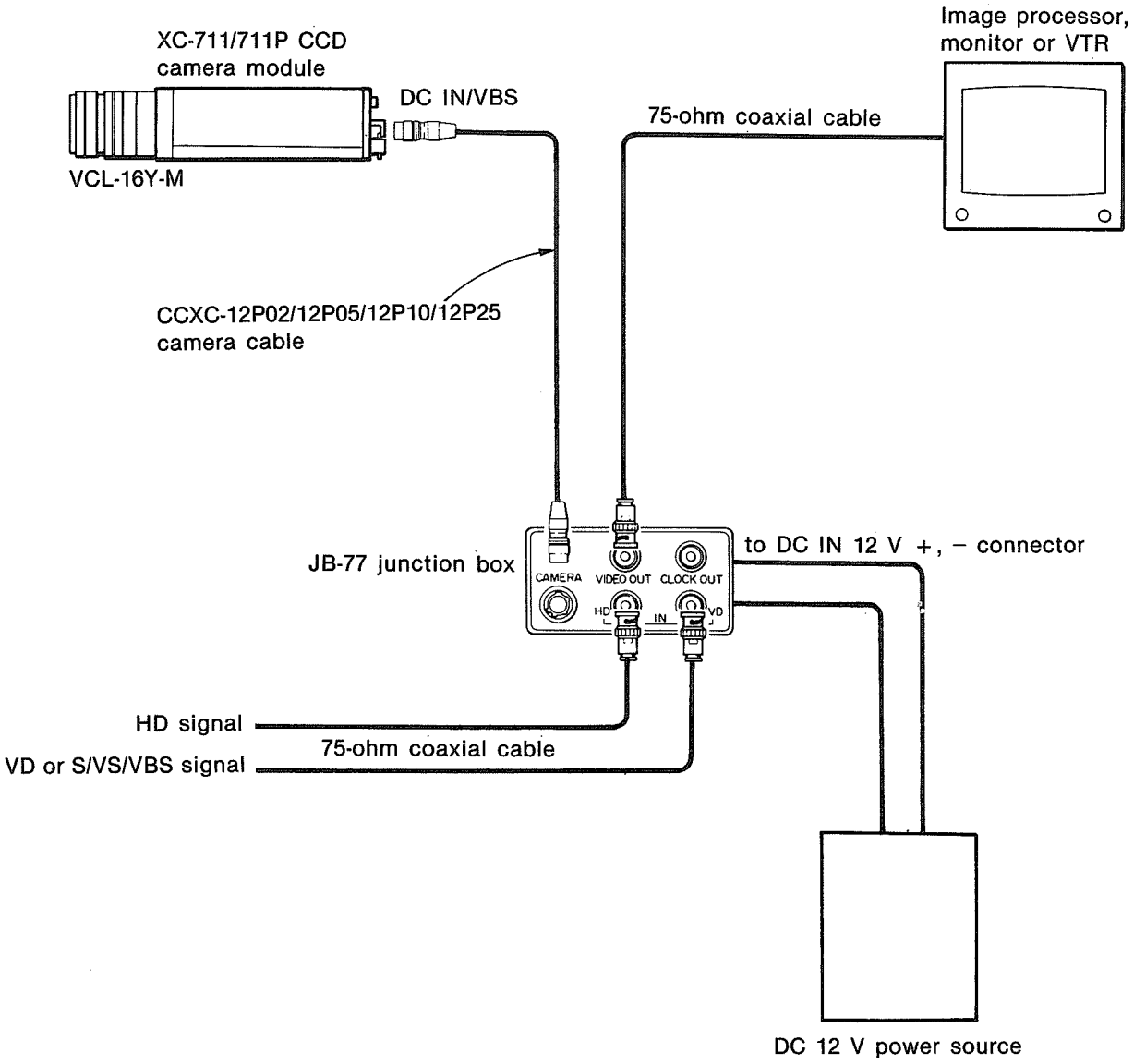
DC IN (input) 12 V terminals
DC 12 V power is received through one pair of these terminals. When connecting a multiple number of camera modules, connect other JB-77 to the other pair of terminals. Power can be supplied to the connected JB-77.

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1-4. CONNECTIONS

1-4-1. To Use Video Signal Output

When Junction Box is used

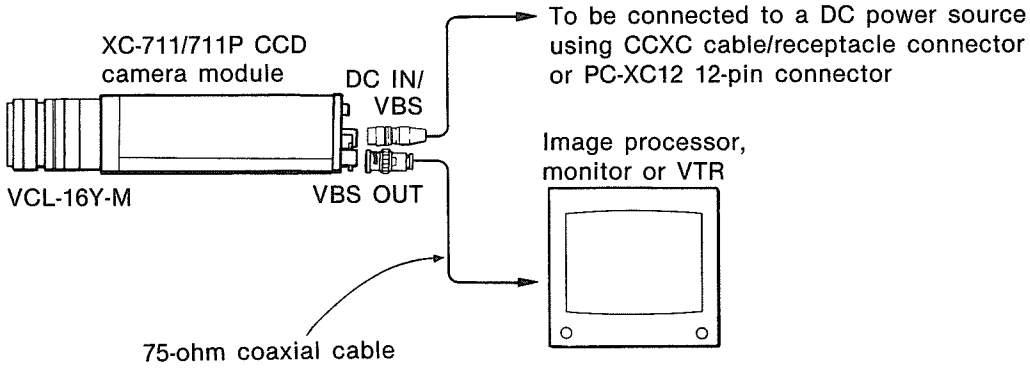


NOTE

When applying external sync through the VS or VBS signal, the image may be affected by the VS or VBS signal during gen lock if a long type CCXC cable (CCXC-12P25) is used. When this occurs, use only S (composite Sync) signal.

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When Junction Box is not used

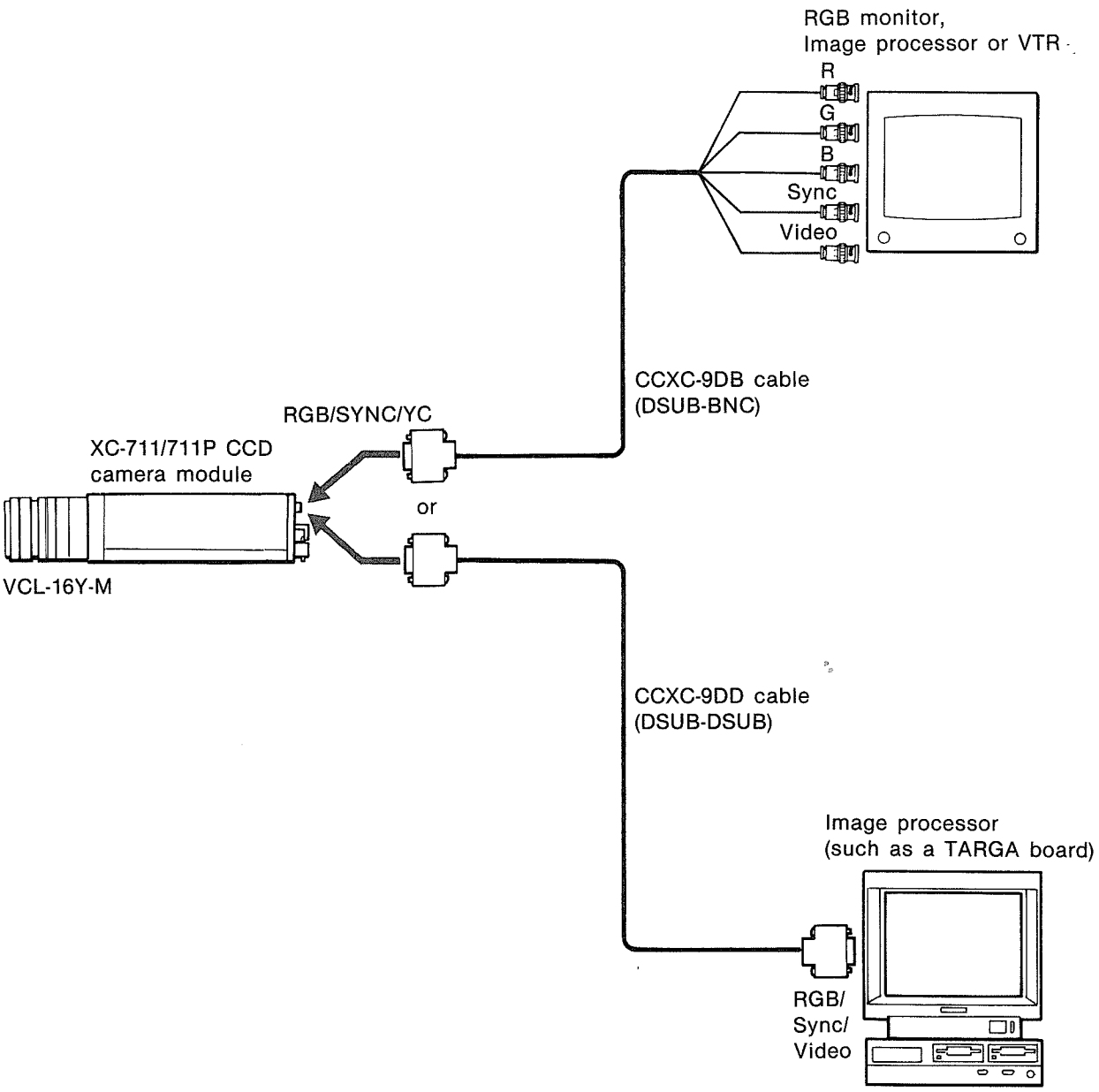


NOTES

- When using the VBS OUT connector for video signal output, use the DC IN/VBS connector for power supply. Connect only the CCXC-12P02 cable to the DC IN/VBS connector, and do not terminate its video output.
- When a cable longer than 5 m is connected to the DC IN/VBS connector, video output signals cannot be obtained through the VBS OUT connector.

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1-4-2. To Use RGB Signal Output



NOTE

Supply with power souce from DC IN/VBS terminal.

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1-5. INITIALIZATION OF MODE

Modes for the following 13 items can be switched. At the factory, each item is set to the mode shown upper in the list below.
For details on the mode, refer to the chapter 2.

Item	Mode	Remarks
GAIN	FIX (0 dB)	Selection from −6,0, +6, +12 dB
	AUTO	Automatic control
γ	ON	Make γ compensation
	OFF	No γ compensation
FIELD	NORMAL	Normal scanning
	INVERSE	Even and odd number fields are inversed
INTEGRATION	FRAME	Frame integration mode
	FIELD	Field integration mode
RESTART RESET	NORMAL	Frame not synchronizing
	RESET	Frame synchronizing
WHITE BALANCE	AUTO	Automatic adjustment
	PRESET	Fixed (3200°K) or variable preset (2600° to 9000°K)
Y/C	COMPOSITE	VBS (or Y) output
	SEPARATE	Y (and C) output
G ON SYNC	NO	Normal G signal
	YES	Sync signal mixed into G signal
HUE PRESET	NO	Make hue compensation
	YES	No hue compensation
ELECTRONIC SHUTTER	OFF	No flikerless
	ON	Speed selected from *1/60, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000 and 1/10000 sec.
FLICKERLESS	OFF	
	ON	Speed selected from 1/100 and 1/120 sec.
SYNC LEVEL	0.3 Vp-p	
	2.0 Vp-p	
SYNC	EXTERNAL	Input external synchronization signals
	INTERNAL	Output internal synchronization signals

*: Shutter speed of 1/60 sec. is not possible in XC-711.

1-6. PRECAUTIONS

Power source
Operates on 12 V DC. Use a regulated power source, free from ripples or noise.

Foreign objects
Do not spill any liquid, drop any inflammable or metal objects inside. This could result in a fire, electrification, malfunction or accident.

Do not wrap in cloth while operating the unit.

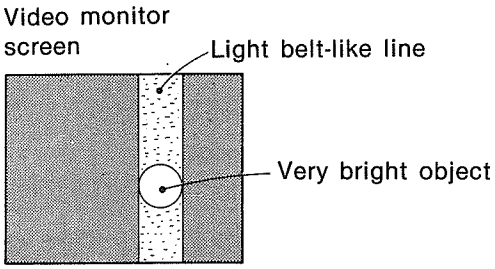
Locations for operation and storage
Avoid operating or storing in the following places.
- An extremely hot or cold location.
  Operating temperature: 0°C to 40°C (32°F to 104°F)
- A location exposed to high humidity or dust.
- A location exposed to rain.
- A location subjected to strong vibrations.
- A location near a TV or radio station which radiates high powered radio signal.

Care
Clean the dust on the surface of the lens and optical filter with a blower. Clean the exterior with a soft, dry cloth. If it becomes very dirty, clean with a cloth slightly moistened with a mild detergent solution. Do not use any type of solvent, such as alcohol or benzine, which may damage the finish.

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1-7. PHENOMENON PECULIAR TO CCD

Smear phenomenon
This phenomenon occurs when shooting a very bright object (such as electric light, fluorescent lamp, the sun or a strong reflection).



Smear phenomenon
This phenomenon occurs when shooting a very bright object (such as electric light, fluorescent lamp, the sun or a strong reflection).

False signal
When vertical stripes or straight lines are shot, they may look wavy.

Blemishes
The CCD consists of many photosensor elements aligned horizontally and vertically. If the CCD has a defective element (even when it is with the specifications) will appear as a blemish on the monitor screen.

White micro dots
At high temperatures, numerous white dots may appear on the screen when shooting a dark object.

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SECTION 2
COMPREHENSIVE SPECIFICATIONS

2-1. SPECIFICATIONS

<CAMERA MODULE XC-711>

Pickup Device	Interline transfer CCD
Picture elements	768 (H) x 493 (V)
Sensing area	8.8 mm x 6.6 mm (the same as the 2/3-inch camera tube)
Optical black	50 pixels each horizontal line
Vertical drive frequency	15.734 kHz
Horizontal drive frequency	14.318 MHz
Signal system	EIA standard
Cell size	17 μm (H) x 11 μm (V)
Chip size	10.0 mm (H) x 8.2 mm (V)
Optical System	
Lens mount	C mount
Frange back length	17.526 mm
Sync System	Internal/External automatic change
External sync input	S/VBS/VS (sync level: 0.3 Vp-p ± 6 dB) HD and VD (HD, VD level: 2 to 5 Vp-p)
External sync frequency tolerance	± 1%
Jitter	Within ± 100 n sec
Locking time when power is on.	Within 10 sec
Scanning System	2 : 1 Interface; 525 lines
Video Output	VBS (1.0 Vp-p sync negative, 75 ohms unbalanced.) RGB (0.7 Vp-p)
Horizontal Resolution	330 TV lines
Vertical Effective lines	2 : 1 Interlace; 485 lines
Sensitivity	2000 Luxes with F4 (γ ON/0 dB)
Minimum Illumination	25 Luxes, F1.4, + 12 dB
S/N ratio	50 dB
Power Requirement (Tolerance)	DC 12 V (10.5 V to 15 V)
Power Consumption	5.5 W
Weight	
Camera module	380 g (XC-711)
Junction box	170 g (JB-77)
Storage Temperature	−20°C to +50°C
Operating Temperature	0°C to 40°C
Shock resistance	70 G
Storage Humidity	Within 90%
Operating Humidity	Within 70%

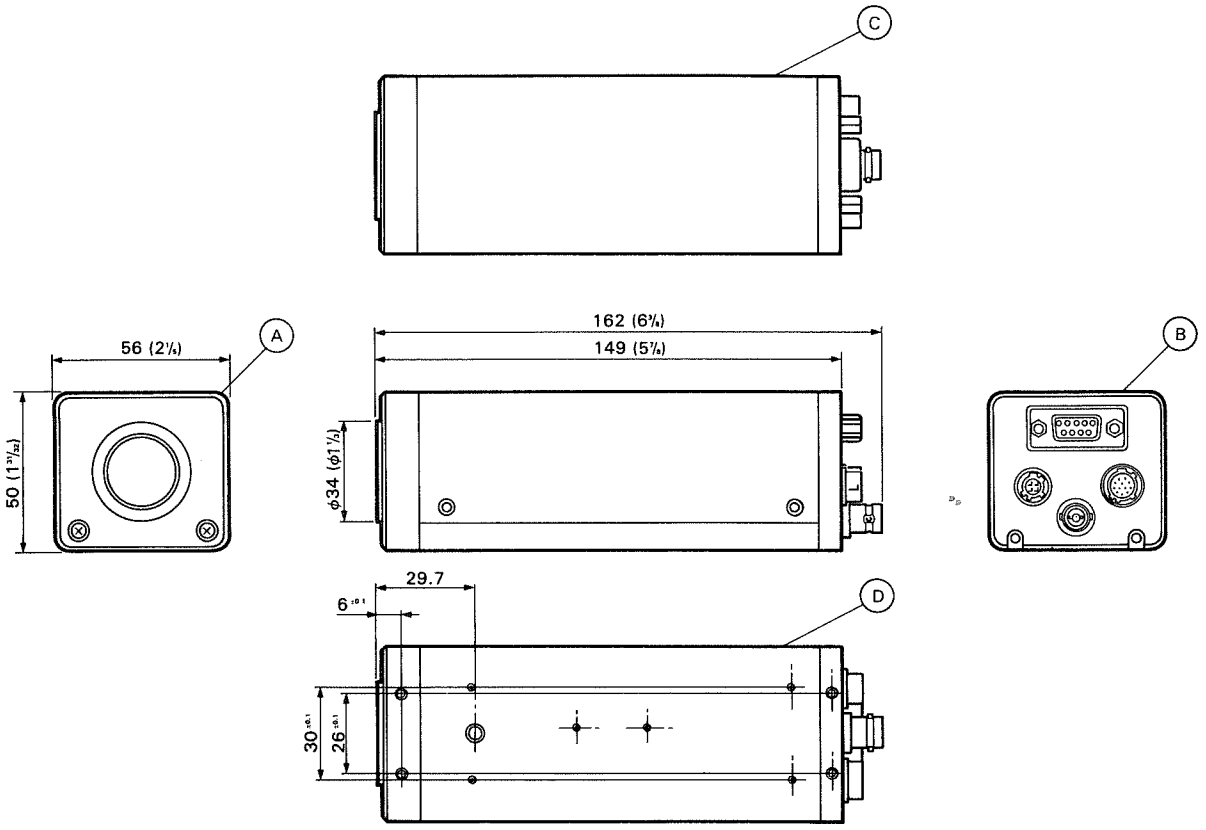
<STANDARD LENS VCL-16Y-M>

Focal Length	16 mm
Maximum Aperture Ratio	1 : 1.4
Iris Control	F1.4 to F16
Filter Thread	M 25.5 mm x P 0.5 mm
Mount	C mount
Weight	50 g

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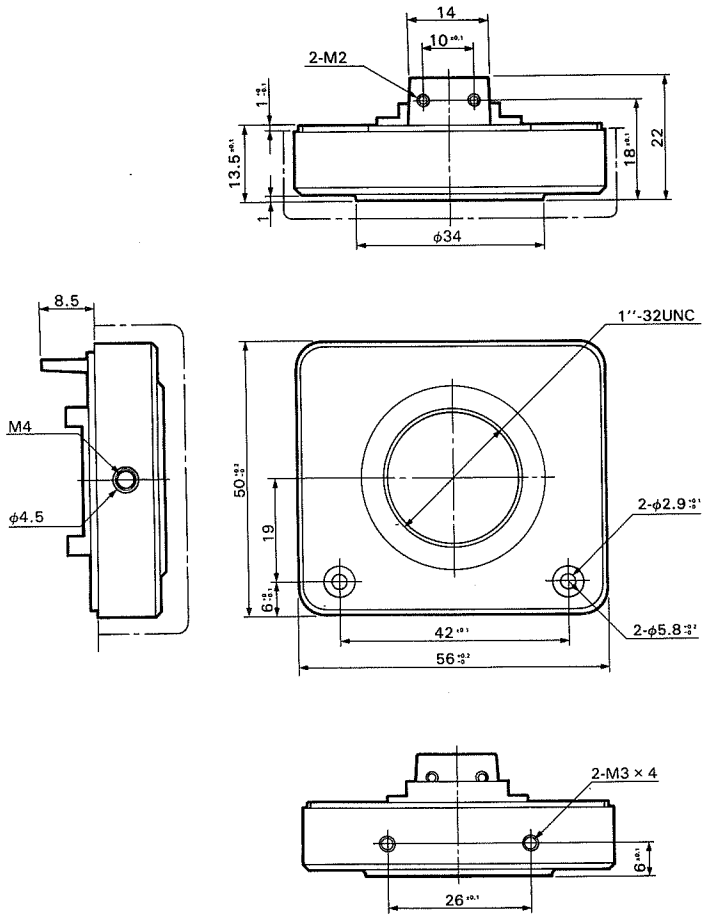
Dimensions:

Camera Module <XC-711>

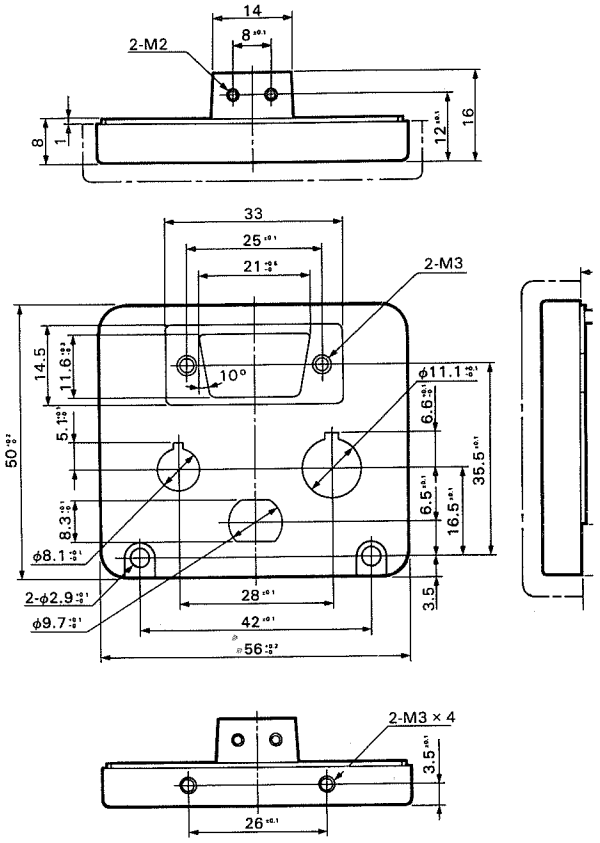


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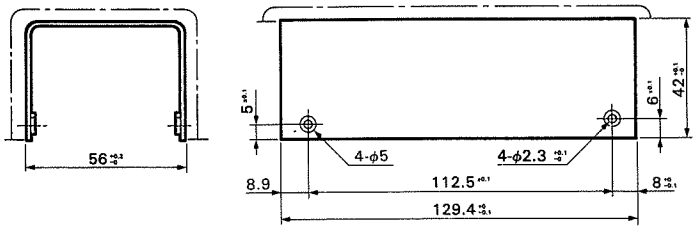


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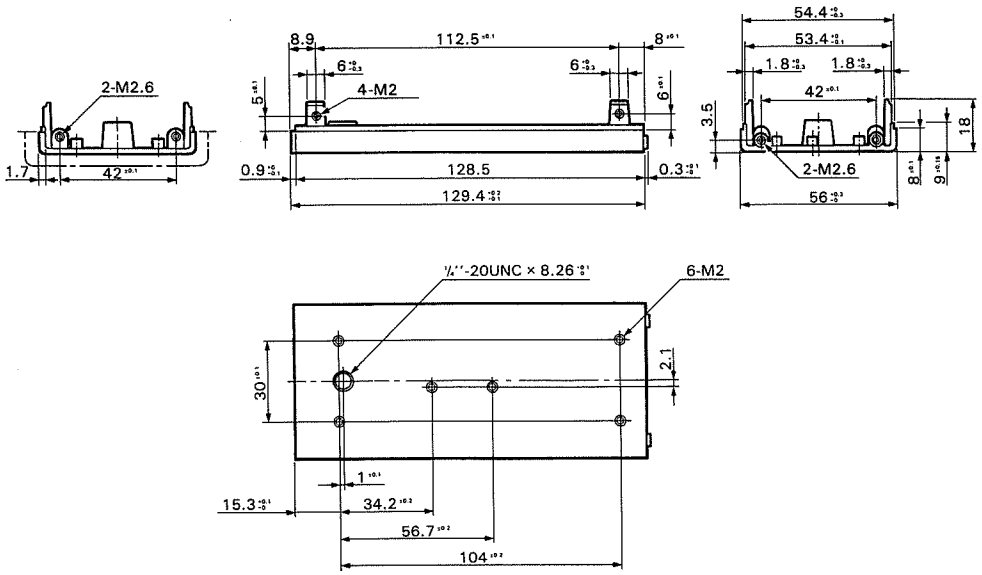


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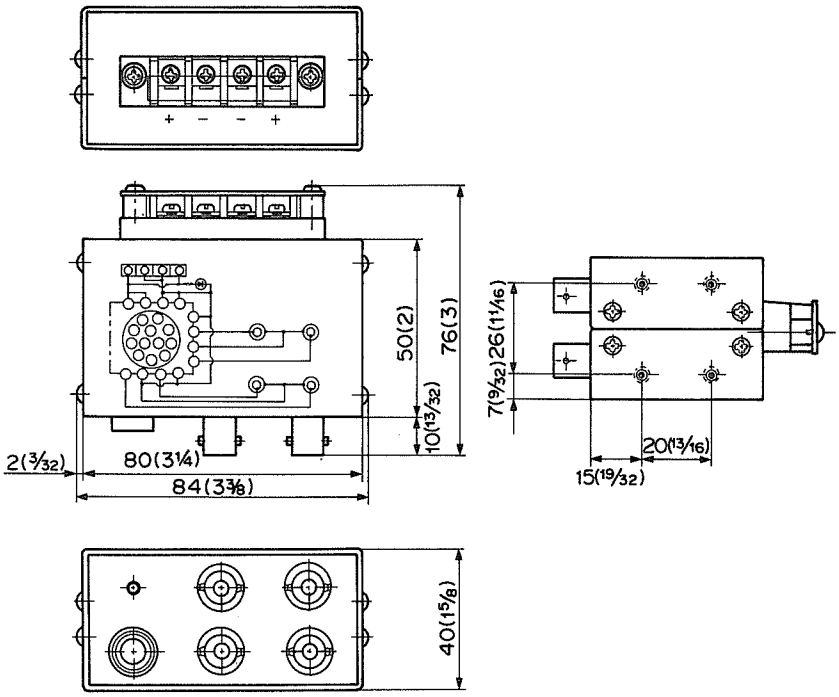


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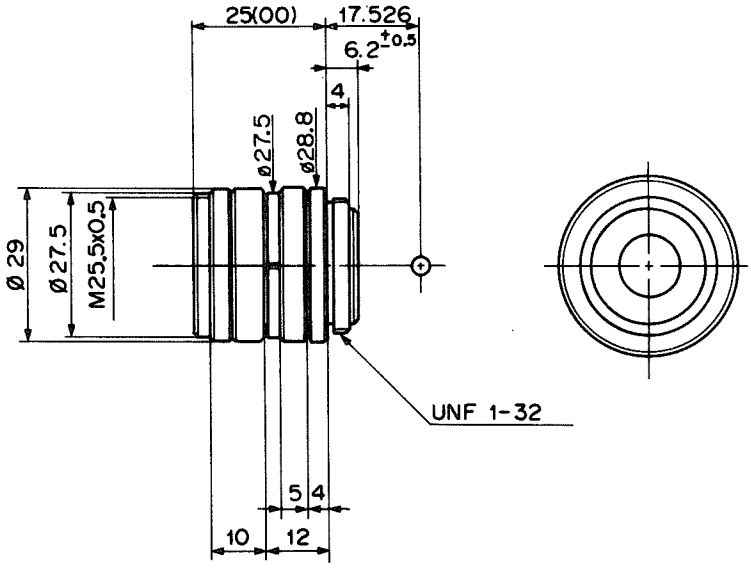


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Junction box <JB-77>

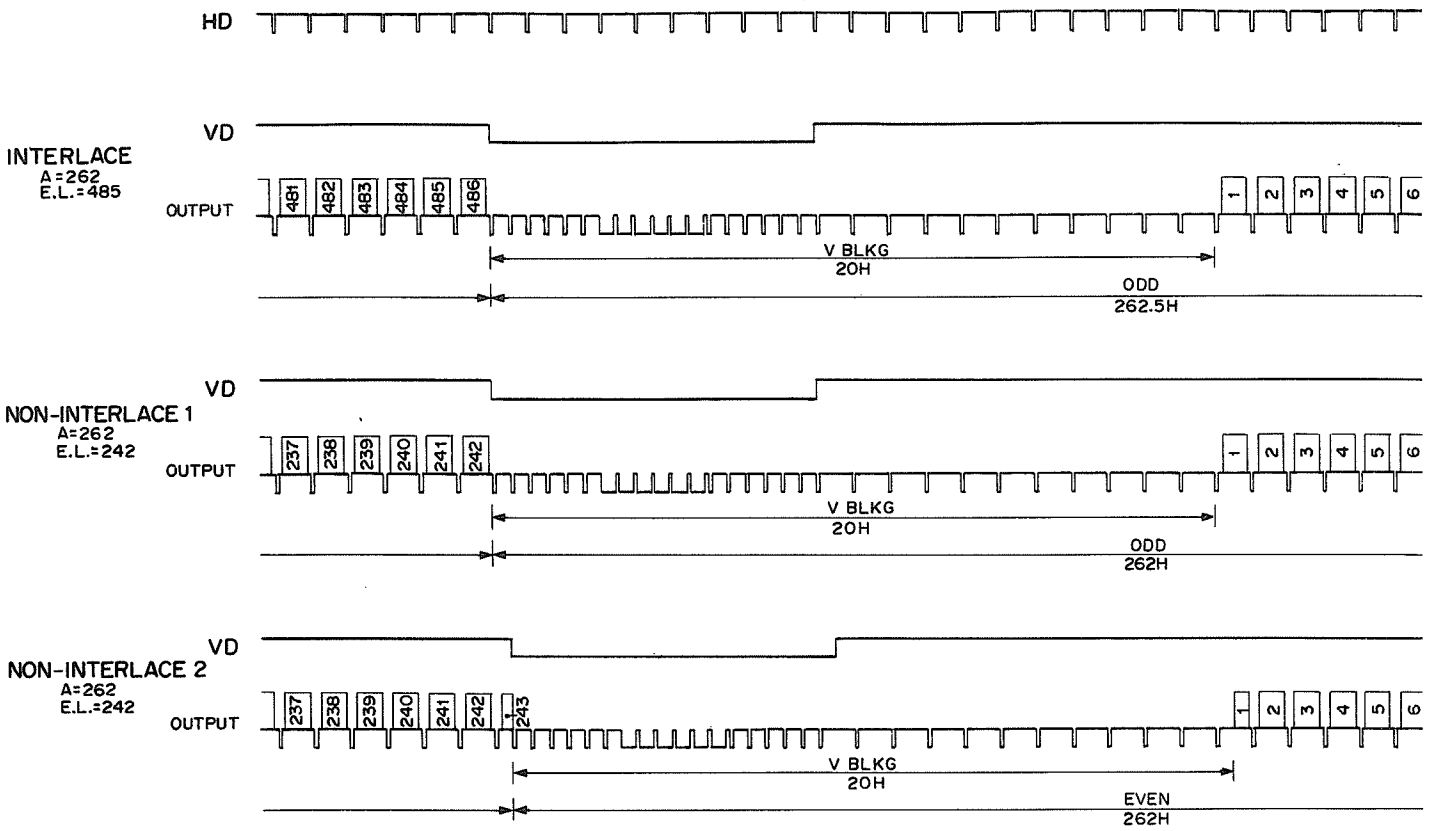


Lens <VCL-16Y-M>

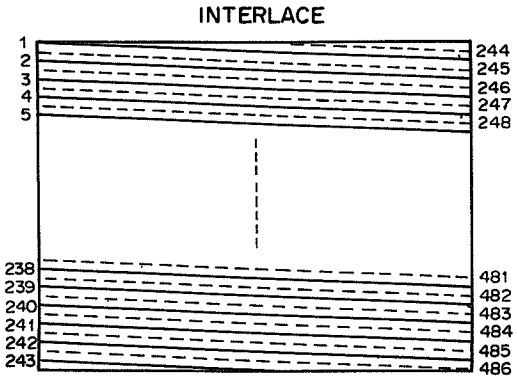


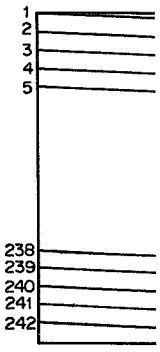
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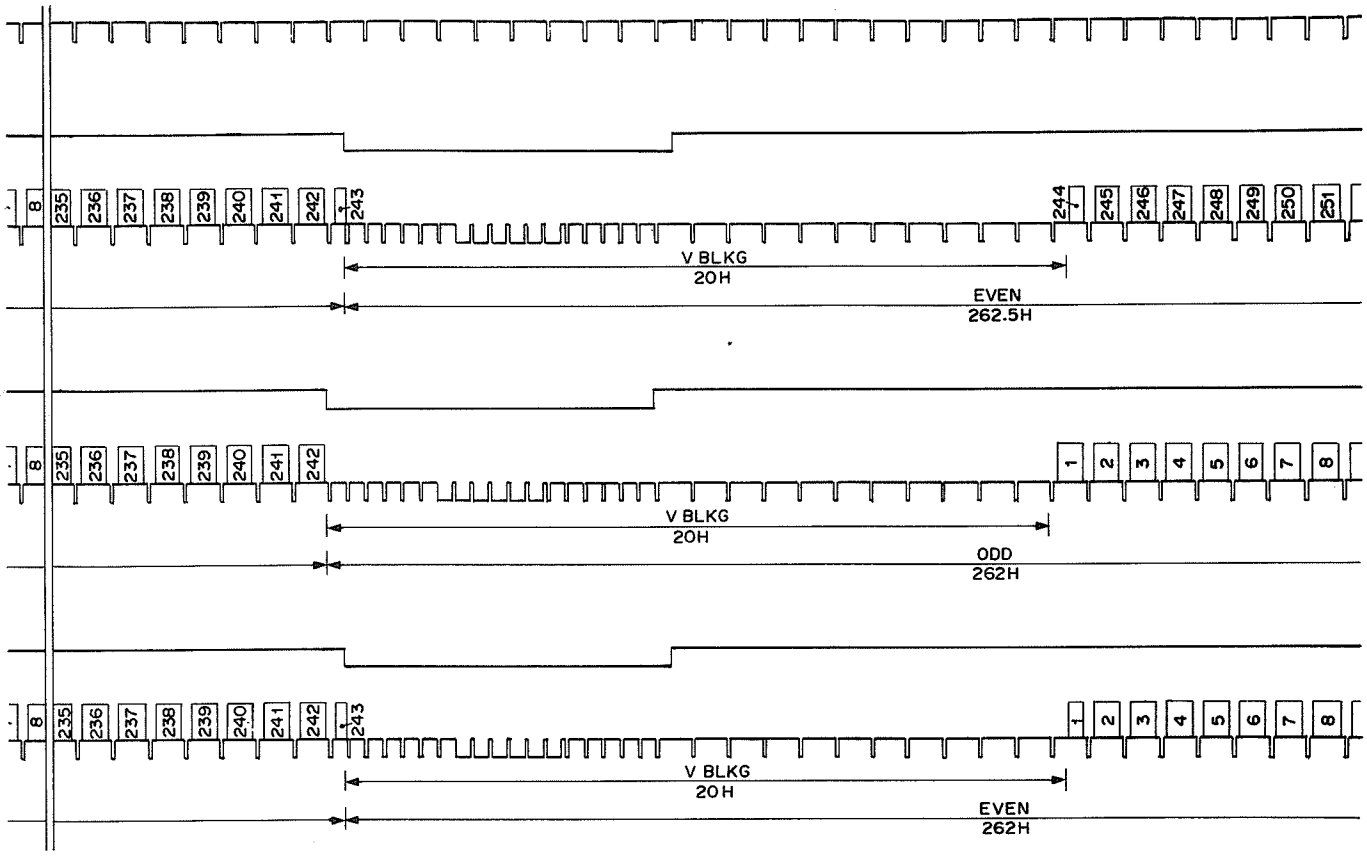
Note:EL means ettective line



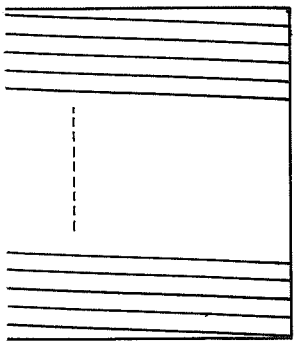


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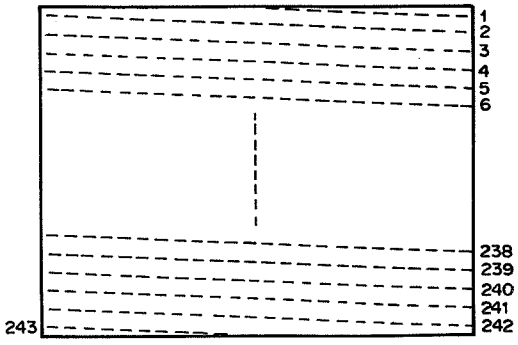
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ON-INTERLACE 1

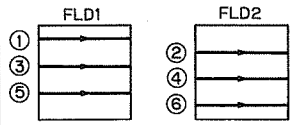
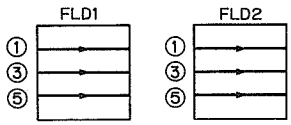
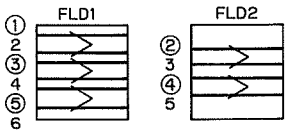
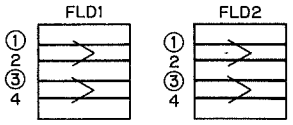
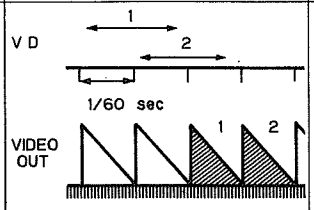
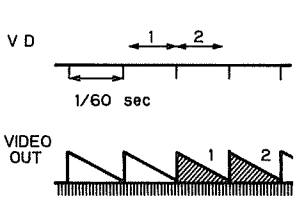
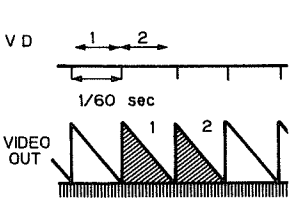
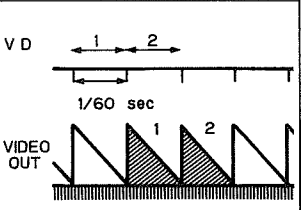
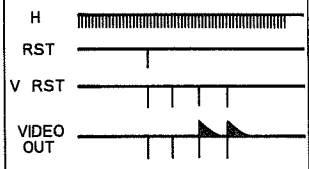
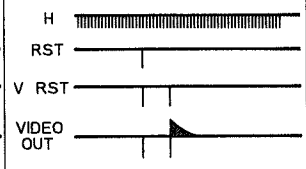
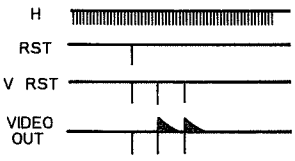
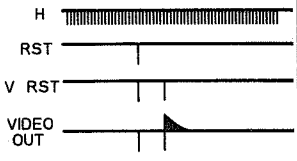


NON-INTERLACE 2



1]

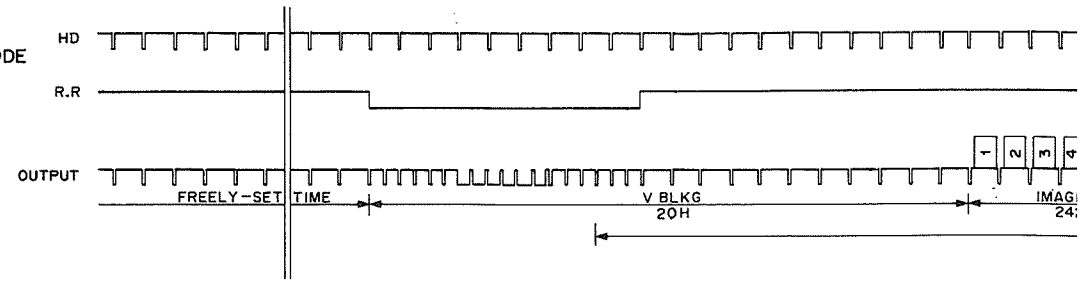
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out mode setting	Frame integration mode (XC-711 initial setting)		Field integration mode	
ıning mode	Interlace	Non-interlace	Interlace	Non-interlace
ORMAL MODE				
IVERSE MODE	FLD 1 and FLD 2 are inverted.	FLD 1 and FLD 2 become ②, ④, ⑥....	FLD 1 and FLD 2 are inverted.	FLD 1 and FLD 2 become ②, ④, ⑥....
age time and O OUT correlation				
ical effective lines lines)	485	242	350	242
ESTART RESET				
ures and cation	As the highest possible resolution is obtained, it is adapted to the measurements of the frame memory.	Same system as XC-39. Operates per 1 vertical line. Note: The operation is field integration mode.	Due to the storage of 1/60 seconds, a picture with even less disturbances than the frame integration mode is obtained. Adapted to pick up a moving object.	This system obtains all the vertical information without decreasing the sensitivity in non-interlace mode.

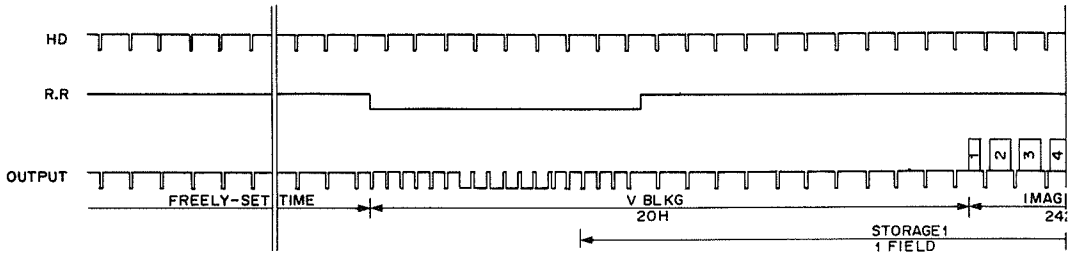
[Fig. 2] Relation between scanning mode and integration mode

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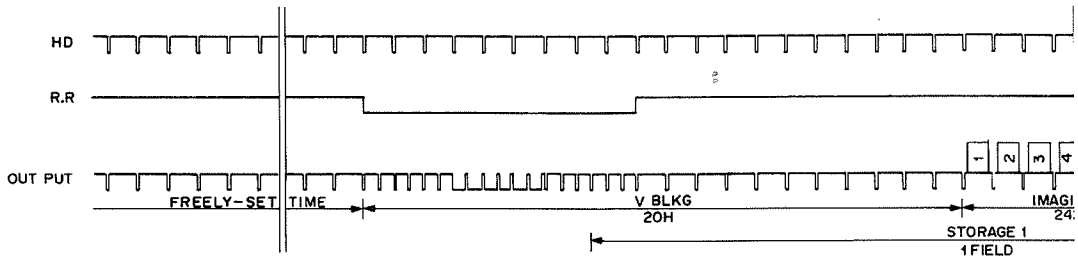
FRAME INTEGRATION MODE
INTERLACE
A=262
E.L.=485



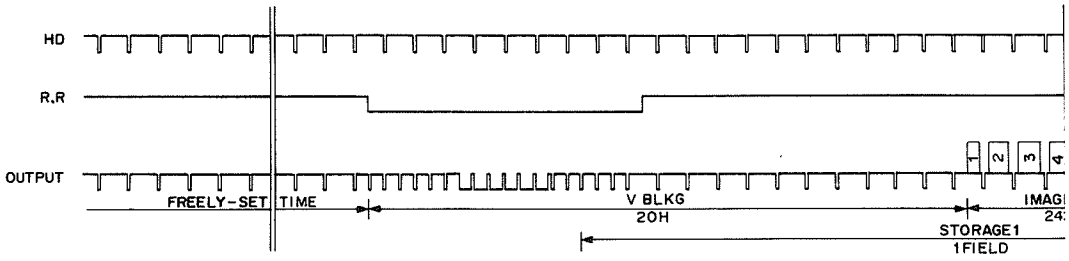
FIELD INTEGRATION MODE
INTERLACE
A=262
E.L.=485



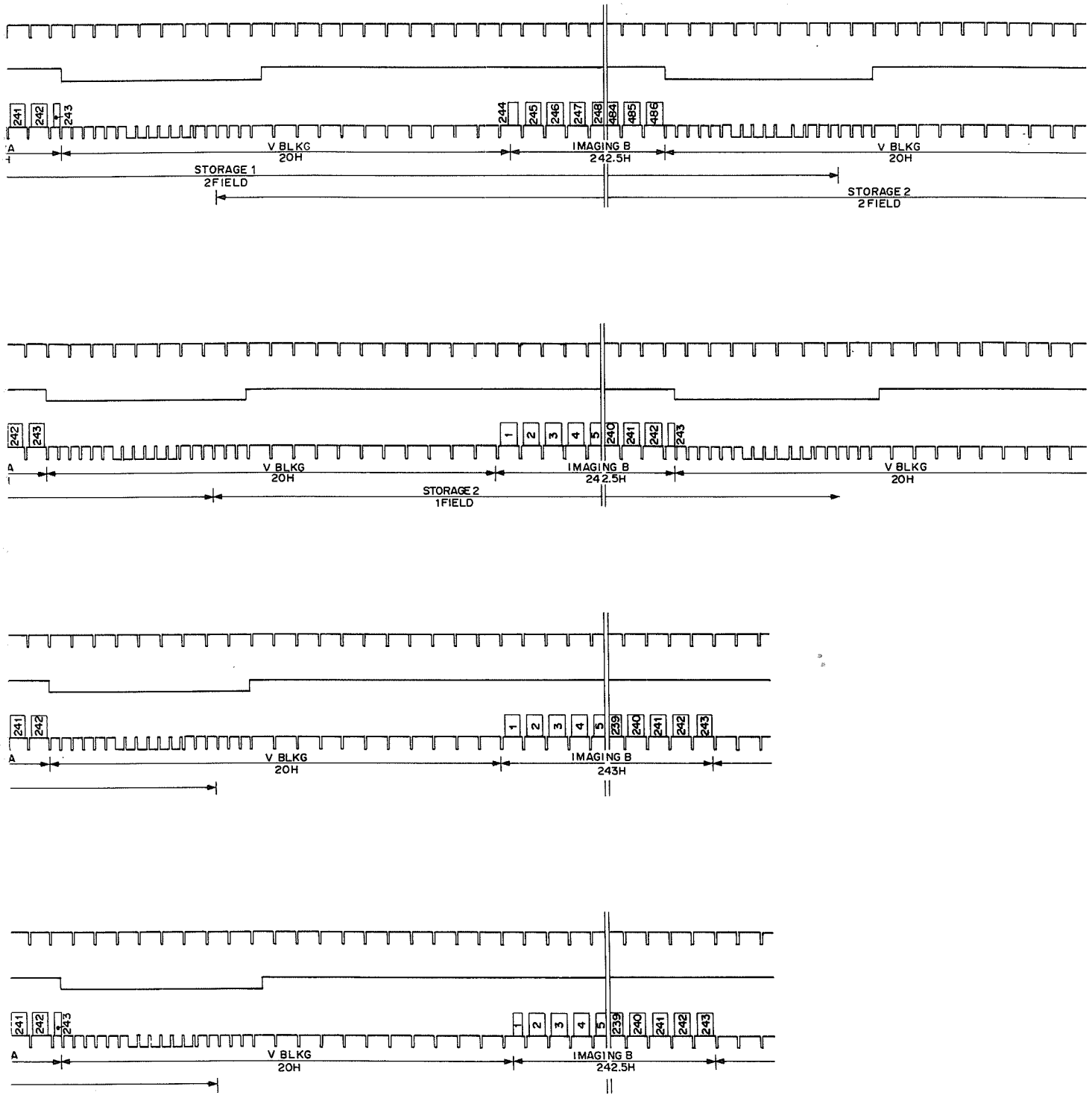
NON-INTERLACE 1
A=262
E.L.=243



NON-INTERLACE2
A=262
E.L.=242

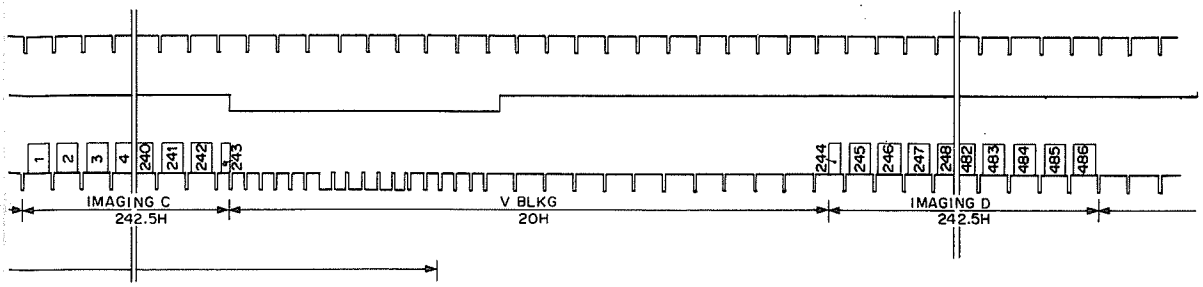


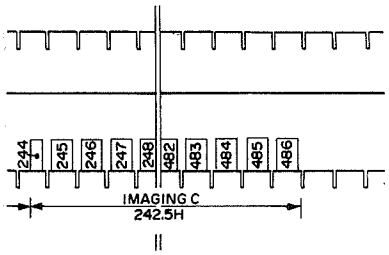
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[Fig. 3]

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2-3-3. RESTART RESET Mode

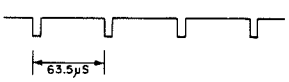
In the RESTART RESET (R.R) mode, information for one screen can be retrieved at any time. It is necessary to internally set the R.R mode in the camera to provide the R.R mode. See Section 2-4 "OPERATION MODE SETTING". Supply the HD and R.R signals to pin 6 and pin 7 of the 12-pin connector to obtain output.

● Input conditions for the HD and R.R signals

• Frequency (period)

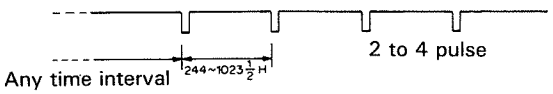
HD signal: 15.734 KHz ± 1% (63.56 μs ± 1%)

Continuous pulse



R.R signal: 244 to 1023 1/2 H

2 to 4 pulses depending on the mode

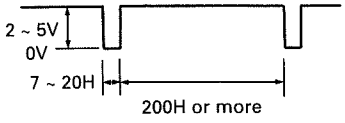


• Phase

The same phase conditions as for the HD and VD mode are applied to this mode. See Section 2-3-2.

Note

To operate after the power is just turn on, be sure to feed the two reset pulses as shown below to pin 7 of the 12-pin connector.



● Explanation of the timing chart

Figure 3 is the timing charts for each operation mode. The details of these timing charts are given below:

• Frame integration interlace mode

The R.R requires four pulses. Set the period of the R.R to (A + 1/2) H. A is an integer, 244 to 1023. It is 262 in the figure.

Shooting information during STORAGE 1 and STORAGE 2 is output in the intervals of IMAGING C (ODD) and IMAGING D (EVEN). The CCD is reset in the intervals of IMAGING A and IMAGING B. Therefore, signals output during these intervals are meaningless.

• Field integration interlace mode

The R.R requires three pulses. Set the period of the R.R to (A + 1/2) H. A is an integer, 244 to 1023. It is 262 in the figure.

Shooting information during STORAGE 1 and STORAGE 2 is output in the intervals of IMAGING B (ODD) and IMAGING C (EVEN). The CCD is reset in the interval of IMAGING A; therefore, signals output during this interval are irrelevant.

• Non-interlace mode

The R.R requires two pulses regardless of the storage mode. Set the period of the R.R to A H. A is an integer, 244 to 1023. It is 262 in the figure.

Shooting information in STORAGE 1 is output in the interval of IMAGING B. The CCD is reset in the interval of IMAGING A; therefore, signals output during this period are irrelevant.

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2-4. OPERATION MODE SETTING

The XC-711 can switch the operation mode, depending on the use.

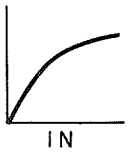
No.	Item	Board Name	Means
1	Gamma compensation mode	EN-72	Switch
2	White balance mode		
3	Y/C separation mode		Jumper
4	Chroma OFF mode*		
5	Gain mode	YC-38	Switch
6	G ON SYNC mode	RD-14	Jumper
7	SYNC output level		
8	Hue preset mode	PR-122	
9	Electronic Shutter mode	DR-83	Switch and jumper
10	Integration mode	TG-48	Jumper
11	Field inversion mode*		
12	Restart reset mode*	MB-222	
13	Synchronization mode		

*Chroma OFF mode, field inversion mode and restart reset mode can only be set in external synchronization mode.

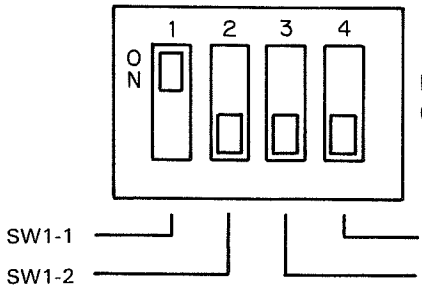
● Explanation of all operation modes

1. Gamma compensation mode (γ ON/γ OFF)
Set the gamma compensation of the RGB and VBS output signals by this mode. When the gamma compensation is set to ON, RGB and VBS signals for which gamma compensation is performed are output.
When it is set to OFF, no gamma compensation is performed for RGB and VBS signals. This setting provides RGB signals proportional to the amount of light from the object. The VBS output signal does not contain the chroma component when the gamma compensation is set to OFF. It is therefore a signal with only the luminance component.
The setting is performed with the DIP switch (SW1-1) on the EN-72 board. When this switch is set to ON, gamma compensation is ON. When it is set to OFF, gamma compensation is OFF. The factory setting is gamma ON.

2. White balance mode (AUTO/PRESET)
Set the color temperature for the white balance adjustment.
When the white balance is set to AUTO, the white balance is adjusted automatically depending on the color temperature of the object. If it is set to PRESET, the white balance is adjusted according to a preset color temperature of 3200°K or 5600°K.
The setting of AUTO/PRESET is performed with the DIP switch (SW1-2) on the EN-72 board. When SW1-2 is set to ON, the mode is AUTO. When it is set to OFF, the mode is PRESET. And the setting of 3200°K/5600°K is performed with the DIP switch (SW1-3) on the same board. When SW1-3 is set to ON, 5600°K is preset. When it is set to OFF, 3200°K is preset. The factory settings are PRESET and 3200°K.
The color temperature of "5600°K" in PRESET is adjusted at the factory to comply with 5600°K. However, it is possible to change it with RV5 and RV6 of the MD-61 board.

SW1-1	Mode	Input/Output Characteristics
ON	γ ON (0.45)	
OFF	γ OFF (1.0)	

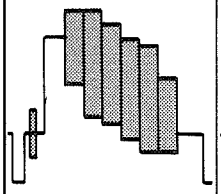
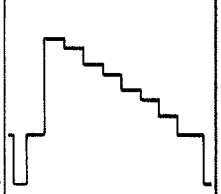
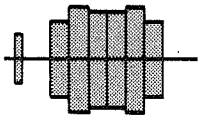
SW1-2	Mode	SW1-3	Color Temperature
ON	AUTO	ON	2600°K through 9000°K
		OFF	
OFF	PRESET	ON	5600°K (variable)
		OFF	3200°K (fixed)



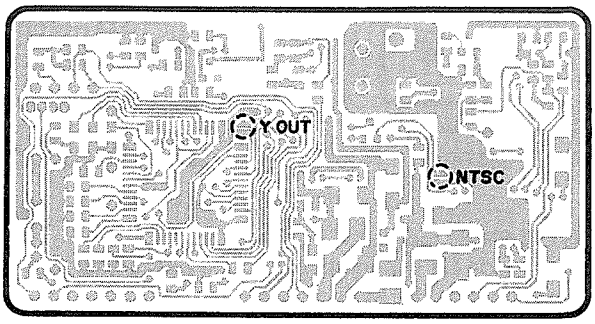
EN-72 board switches (SW1)
(Factory setting)

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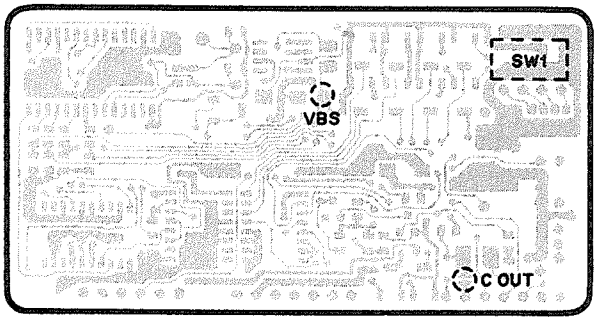
3. Y/C separate mode (COMPOSITE/SEPARATE)
Set the signal format of the video output signal from the D-SUB connector (rear pannel).
When it is set to COMPOSITE, the VBS signal is output from pin 6 of the DSUB connector.
However, in chroma signal OFF mode and in γ OFF mode, only the Y (luminance) signal is output.
When it is set to SEPARATE, the Y signal is output from pin 6, and the C (chroma) signal is output from pin 9 of the DSUB connector. However, in chroma signal OFF mode and in γ OFF mode no C signal is output from pin 9.
The setting is performed with the VBS, Y OUT, and C OUT traces on the EN-72 board.
To set to COMPOSITE, short-circuit VBS, and open Y OUT and C OUT. To set to SEPARATE, open VBS, and short-circuit Y OUT and C OUT.
The factory setting is COMPOSITE.

Mode		COMPOSITE	SEPARATE
VBS		Short	Open
Y OUT		Open	Short
C OUT			
DSUB output (example)	Pin 6		
	Pin 9		

4. Chroma signal OFF mode
Set this mode for cutting the chroma component of the video signal output in the external synchronization mode. The setting is performed with the NTSC trace on the EN-72 board.
To set the chroma signal OFF mode, short-circuit NTSC. If not, open NTSC.
The factory setting is chroma signal OFF mode and NTSC is short-circuited.



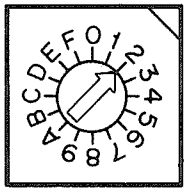
EN-72 BOARD A SIDE



EN-72 BOARD B SIDE

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5. GAIN mode (AUTO/FIX)
Set the gain of the RGB and VBS output signals.
If it is set to AUTO, the AGC (Automatic Gain Control) functions. The maximum gain of AGC is +12 dB.
In FIX mode, the gain can be set to −6 dB, 0 dB, +6 dB or +12 dB.
The setting is performed by the rotary digital switch (SW1) on the YC-38 board.
The factory setting is 0 dB mode.



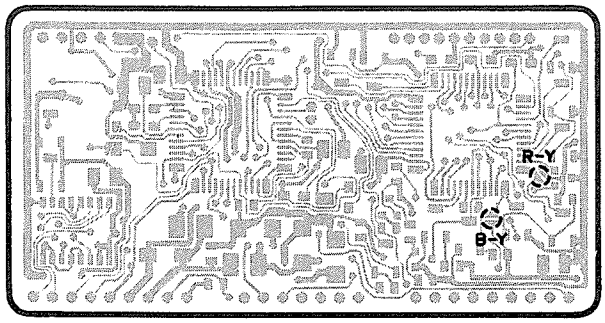
YC-38 board switch (SW1)
(Factory setting)

Position	Mode
0	AUTO
1	FIX −6 dB
2	FIX 0 dB
3	FIX +6 dB
4	FIX +12 dB

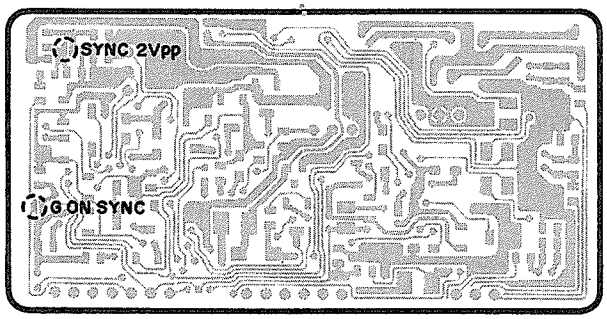
6. G ON SYNC mode
Set this mode for superimposing the SYNC signal to the G (Green) signal in the RGB output signal.
The setting is performed with the G ON SYNC trace on the RD-14 board.
To set to G ON SYNC mode, short-circuit this jumper. If you do not want to set to G ON SYNC mode, open the jumper.
The factory setting is not G ON SYNC mode. (G ON SYNC is open.)

7. SYNC output level (0.3 Vp-p/2.0 Vp-p)
Set the level of the SYNC output signal to be output from pin 7 of the DSUB connector.
The setting is performed with the SYNC 2 Vp-p trace on the RD-14 board.
When the jumper is short-circuited, the SYNC signal of about 2.0 Vp-p is output. When it is opened, the SYNC signal of about 0.3 Vp-p is output.
The sync output level is factory-set to 0.3 Vp-p.

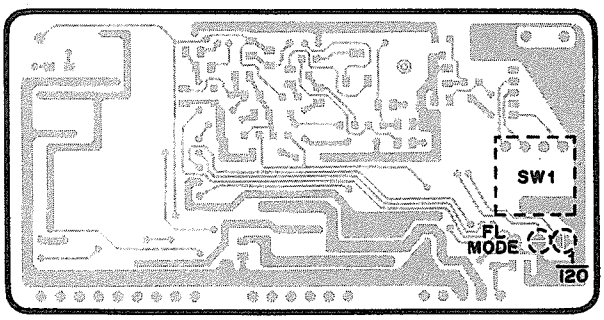
8. HUE PRESET mode
Set this mode for outputting the RGB and VBS output signals without HUE compensation.
The setting is performed with the R-Y and B-Y traces on the PR-122 board.
To set the HUE PRESET mode, short-circuit these two jumpers. When it is not to be set, open both jumpers.
The factory setting is not HUE PRESET mode. (R-Y and B-Y are both open.)



PR-122 BOARD A SIDE



RD-14 BOARD A SIDE



DR-83 BOARD (SUFFIX-12) B SIDE

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SECTION 3
THEORY OF OPERATION

3-1. OPERATION PRINCIPLE OF THE CCD

A CCD (Charge Coupled Device) consists of MOS (Metal-Oxide-Semiconductor) capacitors arranged in a regular array.
It basically performs three functions connected with handling charges.

1. Photoelectric conversion (photosensor)
Incident light generates charges on the MOS capacitors, with the quantity of charge being proportional to the brightness.

2. Accumulation of charges
When a voltage is applied to the electrodes of the MOS capacitors, an electric potential well is formed in the silicon layer. The charge is accumulated in this well.

3. Transmission of charge
When a high voltage is applied to the electrodes, a deeper well is formed; when a low voltage is applied, a shallower well is formed, In the CCD, this property is used to transmit the charge. When a high voltage is applied to the electrodes, a deep electric potential well is formed, and charge flows in from neighboring well. When this is repeated over and over among the regularly arranged electrodes, the charge is transferred from ones MOS capacitor to another. This is the principle of CCD charge transmission.

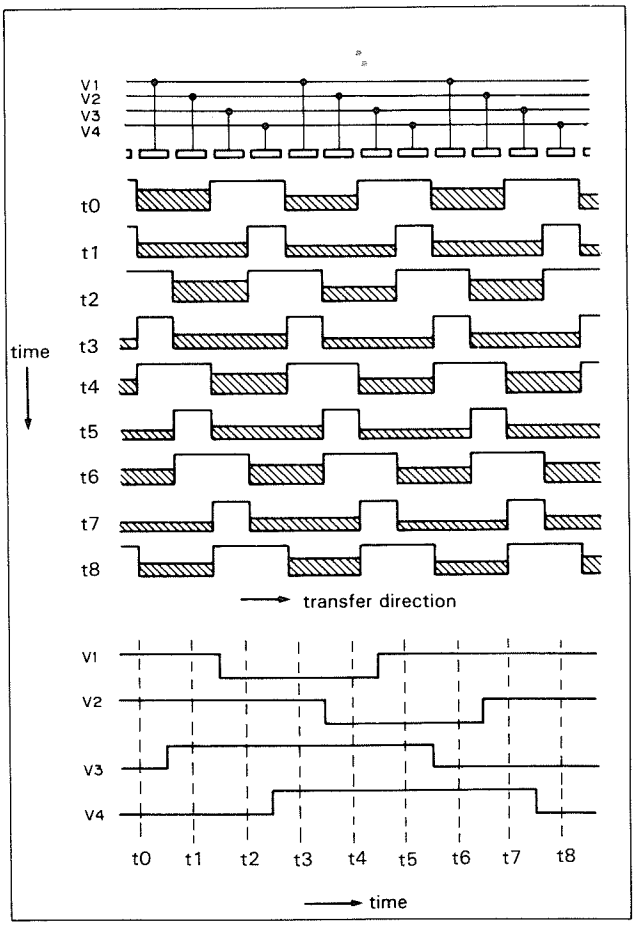
3-2. MECHANISM OF CCD CHARGE TRANSFER

The interline transfer system employed by the XC-711 transfers the charges proportional to the brightness of the image produced on the CCD sequentially as shown in Figure 3 on page 3-2. The charge proportional to the brightness of the object is detected by the photo sensor, and transfered to the neighboring vertical shift register. Then this charge is transfered to the horizontal shift register in vertical sequence. Then it is output through the output section in horizontal sequence.

1. Vertical transfer
The vertical shift register transfers charges using a four-phase drive mode. Figure 1 shows an example of the changes which can occur in potential wells in successive time intervals.
At t0, the electrode voltages are (V1 = V2) > (V3 = V4), so the potential wells are deeper toward the electrode at the higher voltages V1 and V2. Charges accumulate in these deep wells.
At t1, the electrode voltages are (V1 = V2 = V3) > (V4), so the charges accumulate in the wells toward the electrode at V1, V2 and V3.
At t2, the electrode voltages are (V2 = V3) > (V4 = V1), so the charges accumulate in the wells toward the electrode at V2 and V3.
Electrode voltage states at t3 and after are shown below.

t3 (V2 = V3 = V4) > (V1)
t4 (V3 = V4) > (V1 = V2)
t5 (V4) > (V1 = V2 = V3)
t6 (V4 = V1) > (V2 = V3)
t7 (V4 = V1 = V2) > (V3)
t8 (V1 = V2) > (V3 = V4) (Initial state)

These operations are repeated to execute the vertical transfer.



[Fig.1] Vertical transfer

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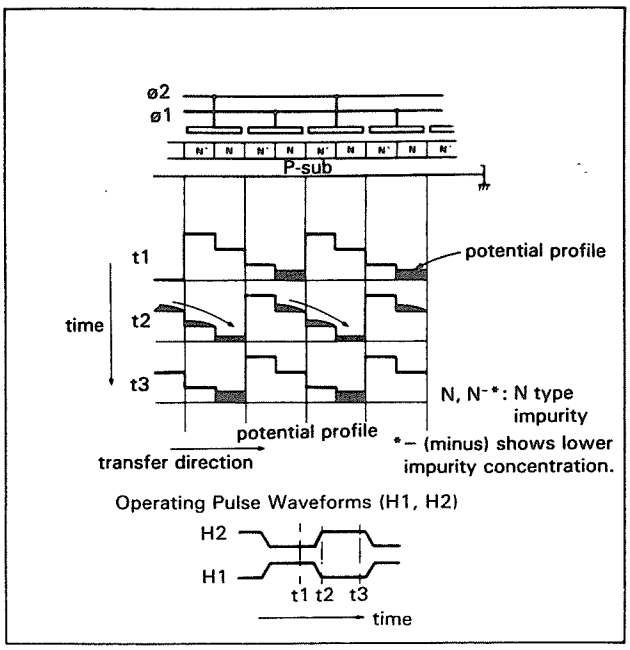
2. Horizontal transfer

The horizontal shift register transfers charges using a two-phase drive mode. Figure 2 shows an example of the changes which can occur in the potential wells in successive time intervals.

At t1, the electrode voltages are H1 > H2, so the potential wells are deeper toward the electrode of the higher voltage H1. The charges accumulate in these wells.

At t2, the electrode voltages H1 and H2 are inverted, the wells toward the electrode at voltage H2 becomes deeper while the wells toward the electrode at voltage H1 become shallower. So the wells at H2 are deeper than those at H1, the charge flows into the deeper wells toward the electrode at H2.

At t3, the electrode voltage have not changed since t2, so the charge flows into the wells at H2 and one transfer of charge is completed. These operations are repeated to execute the horizontal transfer.



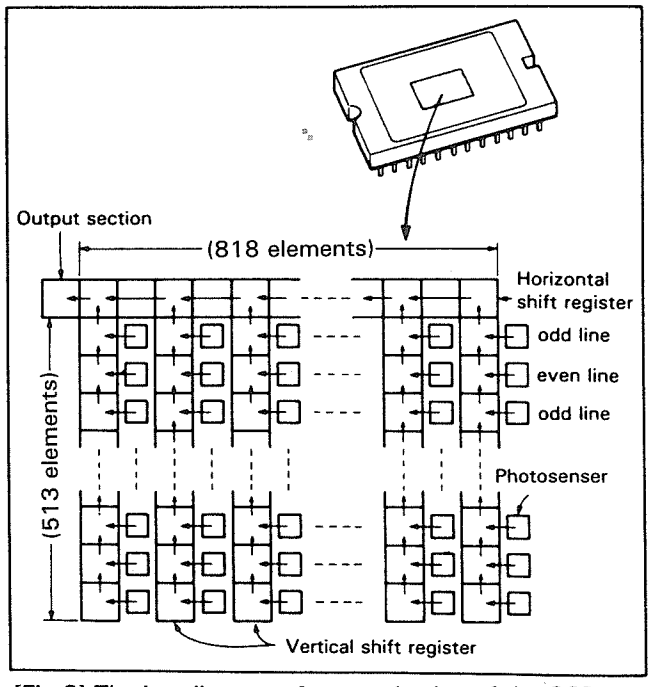
[Fig.2] Horizontal transfer

3-3. BI-26 BOARD

Light which comes through the camera lens strikes the CCD chip surface of IC1 on the BI-26 board. The surface of the CCD contains a number of photosensors.

The array is 818 horizontal photosensors by 513 vertical photosensors, so that there are a total of 419,634. The effective number of them is 768 photosensors by 493 photosensors, so there are total of 378,624. The color filters of R (Red), G (Green) and B (Blue) are formed on the effective picture elements in vertical stripe configuration. When the incident light passes the color filters, it is divided into the color elements R, G and B. The divided colors are converted into electrical charge proportional to the brightness of each color. The converted signal charge is read out by a register from the photosensor, and is transferred in sequence and fed to the output section. The register is subdivided into horizontal and vertical shift registrs. As shown in Fig. 3, there are 818 vertical rows of registers, while there is only one horizontal row of registers, across the top. Each converted charge is transmitted every field (frequency of VD) to the vertical shift register adjoining to the photosensor. The signal charge is then vertically transferred in sequence at the vertical transfer clock V1, V2, V3 and V4 (frequency of HD ;fH) to the horizontal register. The horizontal registers transfer charges horizontally at the horizontal transfer clock H1, H2 (= 910 fH) to the output section. The output from IC1 is output after the electrical charge has been converted to a voltage signal by the capacitor at the output section. It is then sent to the PR-122 board after passing buffer Q1.

IC2 is a horizontal clock driver. Q2 to Q7 are PG drivers which reset the electrical charge read out by one picture element.



[Fig.3] The interline-transfer organization of the CCD image sensors

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3-4. PR-122 BOARD

This PC board has the function of generating the color difference signal and the luminance signal by the color signal of RGB from the CCD output signal.
Furthermore, it can perform white balance adjustment and gamma compensation for the RGB signal, and the hue compensation for the color difference signal.
In order to remove the noise component peculiar to the CCD output signal, the CCD output signal of the BI-26 board first passes through the sample and hold circuit (the double compensation sampling method) within IC1. Then it is divided into two signals, one of which is amplified in IC1, passes through Q1, Q2 and Q3 and is output as the signal that controls the lens iris. The other one passes through the AGC circuit in IC1 and is divided into two signals. One of the divided signals detects the auto gain, passes through the AGC detection circuit (consisting of Q5 and Q6, and the operational amplifier 1 within IC1), and is output to the YC-38 board via the MB-222 board (DET DC). The other signal passes through R3, decodes color signals of RGB at the sample and hold circuit for each color in IC1, and is output from IC1.
The gain of the AGC circuit is determined by the DC voltage (AGC CTL) transmitted from the YC-38 board. If there is no YC-38 board, it is determined by the DC voltage output from IC3. IC3 only operates at the time of adjustments.
Each color signal of RGB output from IC1 is input to IC2 after being passed through the LPF consisting of condenser and resistor, and is divided into two groups.
One of which is input to the white balance circuit. The white balance circuit is controlled by the DC voltage (R CONT and B CONT) created at the MD-61 board.
Then, it passes through the gamma compensation circuit and forms the R-Y and B-Y color difference signals at the matrix operation circuit. These color difference signals are output from IC2 after being passed through the hue compensation circuit.
If the gamma compensation mode is OFF, the gamma correction circuit, the matrix operation circuit and the hue correction circuit are bypassed and the RGB signals are output directly.
The other group is input to the luminance balance circuit. Then it is divided into two groups, one of which forms the luminance-balanced Y_H signal (R = G = B). The other forms the Y_L signal at the matrix operation circuit. Then these signals are output from IC2 as the Y_H signal and the Y_L-Y_H signal.
If the gamma compensation mode is OFF, Y_H is output as the Y_L signal and Y_L-Y_H is output as the G component.
The Y_L-Y_H signal output from IC2 passes through the active LPF (Q7 and Q8) and is output together with the Y_H signal to the EN-72 board via the MB-222 board. After being passed through the buffers (R-Y; Q19,B-Y; Q20), the color difference signals are output to the MD-61 and the EN-72 boards via the MB-222 board. However, the signals are output to the EN-72 board only after the band limitation has been performed by the each active LPF (R-Y; Q11 and Q12,R-Y; Q9 and Q10).

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3-5. MD-61 BOARD

This PC board has the functions of reproducing RGB signals from the color difference signal and the G signal, and of generating the control signal of the white balance circuit (PR-122 board).

• Reproduction circuit for RGB signals
The color difference signal and the G signal transmitted from the PR-122 board are inversely amplified, and then the R signal and the B signal are reproduced by the linear matrix operation circuit. The R signal is output from IC1, the B signal is output from IC5. The G signal is separated from the Q10 emitter before being inversely amplified.
The RGB signals reproduced in this way, is then input into the group 0 of the analog switch IC3.
When the gamma compensation mode is OFF, the color difference signals (R-Y and B-Y) and the G signal transmitted from the PR-122 board are directly input into the group 1 of IC3.
IC3 is switched by the gamma compensation mode set by SW1 of the EN-72 board.
If gamma is ON, the group 0 is selected, and if gamma is OFF, the group 1 is selected.
All signals of group 0 or 1 output from IC3, are amplified. Then, they pass through the trap LPF (4.77 MHz) to remove the clock noise, and are output to the RD-14 board via the MB-222 board.

• White Balance Control Signal Generation Circuit
This circuit has the following 3 modes.

a. Preset White Balance (3200°K) Mode
It is preset by R47 to R50 in order to obtain the white balance when the object has a color temperature of 3200°K.

b. Preset White Balance (5600°K) Mode
It is preset by RV5 and RV6 in order to obtain the white balance when the object has a color temperature of 5600°K. However, by adjusting RV5 and RV6, the preset value of the color temperature can be changed to a range of 2600°K to 9000°K.

c. Auto White Balance (2600°K to 9000°K) Mode
The white balance detection signals (DET R, DET G and DET B) transmitted from the PR-122 board are each peak-held. Then, the detection voltage of G is compared to that of R and it is compared to that of B, at IC2. If there is a difference in the results of this operation, the output of IC2 changes.
If the detection voltage of G is lower, the output of IC2 (R; pin 7,B; pin 1) increases, and the amplifier gain of the R and B signals in the white balance circuit in IC2 of the PR-122 board, is decreased. (This amplifier gain is inversely proportional to the voltage applied.)
With this operation, the white balance is adjusted automatically according to the color temperature of the object.
RV2 is for offset adjustment of the detection voltage of R (pin 7 of IC2), RV4 is for offset adjustment of the detection voltage of B (pin 1 of IC2).

These three white balance control signals are input into analog switch IC4. IC4 is switched by SW1 of the EN-72 board.

Mode	EN-72 board SW1	
	SW1-2	SW1-3
a	OFF	OFF
b	OFF	ON
c	ON	OFF/ON

The output of IC4 is output to the PR-14 board via the MB-222 board.

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3-6. RD-14 BOARD

This PC board processes the RGB signals transmitted from the MD-61 board, and the SYNC signal transmitted from the TG-48 board to be output to the external equipment.
The RGB signals are input into signal processors IC1 to IC3 respectively. (These ICs are for video signal processing. However, at this PC board, the only luminance system processing is used.)
At all ICs, the signals are output after contour compensation, level amplification, white clipping and setup addition have been performed.
The signals are then output to the CN-295 board via the MB-222 board after being passed through video amplifiers IC4 to IC6.
The SYNC signal is divided into two signals and sent to the CN-295 board in two ways. The one way is the G ON SYNC mode that adds the SYNC signal to the G signal and outputs it. This is performed by inputting the sync signal into IC2. Simultaneously, the SYNC level is adjusted at RV12.
The other one is outputting the SYNC signal independently: the divided SYNC signal is buffered (Q1) and then voltage-divided at R16 and R17, passed through the drive buffer (Q2 to Q5) and output. The SYNC output level at that time is 0.3 Vp-p, but it can be changed to 2 Vp-p by short-circuiting R16 (jumper 2Vpp).

3-7. EN-72 BOARD

This PC board is an encoder that forms the VBS signal from the luminance signals (Y_H and Y_L-Y_H) and the color difference signals (R-Y and B-Y) output from the PR-122 board. It contains the signal generation circuit that generates all synchronization signals and clocks for the encoder, and the switches (SW1) for setting the gamma compensation mode and the white balance mode.
The Y_H signal is input into IC2 after the 4.2 MHz band limitation was performed at LPF. The Y_L-Y_H signal is input into IC2 after being passed through analog switch IC1.
The Y_H signal is added with the Y_L-Y_H signal after passing the contour compensation circuit, and becomes the Y signal. The Y signal consists of the low-frequency component (Y_L) which determines the visibility, and the high-frequency component (Y_H) which determines the resolution.
The Y signal is sent to the encoder circuit after signal processing such as level amplification, white clipping, and setup addition have been performed.
The R-Y and B-Y signals are directly input into IC2. They are added with the burst signal to become the chroma signal after clamping and balanced modulation have been performed. This balanced modulation can provide a stable carrier balance due to the auto carrier balance function, the circuit being a nonadjustable circuit.
The chroma signal is once output from IC2 and then input into IC2 again after being passed through the BPF (L6 and C45). At that time, it is possible to divide the chroma signal before BPF and output it to the YC-38 board. The chroma signal which is again input into IC2 is composited with the Y signal, becomes the VBS signal and is output from IC2. Then it is divided into two signals, one of which passes through video amplifier IC3 and is output to the CN-295 board via the MB-222 board. The other one is directly output to the YC-38 board via the MB-222 board.
As the Y signal itself is also output from IC2 at the same time, it can be output to the YC-38 board instead of the VBS signal. IC1 switches over the control voltage in order to perform the level amplification at IC2 suitable for the gamma compensation mode (γON/γOFF).
When gamma is ON, the voltage divided at RV1 is output from IC1, when gamma is OFF, the voltage divided at RV2 is output from IC1.
With gamma OFF, analog switch Q4 is set to ON so that no chroma signal is output from IC2. In this mode, the VBS output does not contain the chroma component but only the luminance component.
IC6 is a synchronization signal generator that generates the timing pulse necessary at IC2. This is a double synchronization generator that uses IC4 of the TG-48 board as master generator and IC6 of the EN-72 board as slave generator.
The SYNC signal (M SYNC) transmitted from the master generator is input into IC4 to create the H reset pulse and the V reset pulse. The H reset pulse is input to IC6 after phase adjustment by IC5. The V reset pulse is input into IC6 directly. The EXT/$\overline{\text{INT}}$ signal of IC4 is input into the EXT terminal of IC6 so that IC6 becomes the slave SYNC generator for the master SYNC generator.
The clock (CLK) transmitted from the TG-48 board is input into the 4FSC input of IC2 after having been inverted in IC6.

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3-8. YC-38 BOARD

This PC board has a Y amplifier and a C amplifier to correspond to the Y/C separate outputs, and a circuit that sets and outputs the control voltage for the AGC circuit of the PR-122 board.
If the Y/C separate mode is set, the Y signal and the C signal are transmitted from the EN-72 board. If it is not set, VBS signal instead of Y signal is transmitted. In that case, the C signal is not transmitted. IC1 is the video amplifier for the Y signal. IC2 is the video amplifier for the C signal. The outputs of these amplifiers are sent to the CN-295 board via the MB-222 board.
The INHIBIT signal output from this PC board disables analog switch IC3 of the PR-122 board so that the camera gain setting can be performed on the YC-38 board. RV3 to RV6 set the gain control voltage. The DET DC signal is a gain control voltage signal in AGC mode. They are switched at analog switch IC3 depending upon the setting of SW1. The output (AGC CTL) of IC3 is sent to the PR-122 board via the MB-222 board.

3-9. CN-295 BOARD

This PC board is united with connectors of the rear panel. All the signal exchanges with the external equipment is performed here.
The RGB signal, the SYNC signal and the VBS signal (or the luminance signal and the chroma signal) are output from the 9-pin DSUB connector.
The VBS signal (or luminance signal) is output from the BNC connector.
At the 12-pin multi connector, the power supply voltage (+12 V) and the external synchronization signal (EXT HD, EXT VD or VBS and VS) are input, and the VBS signal and the synchronization signal (CLK, HD, VD) are output.
The 4-pin female connector outputs the power (+12 V) and the detection video signal for the auto iris lens.
For details, refer to 1-3. PARTS LOCATION, FUNCTION AND OPERATION.

3-10. MB-222 BOARD

This PC board contains the external synchronization signal separation circuit, the synchronization signal output buffer and the DC-DC converter. Furthermore, it serves as the mother PC board.

• External Synchronization Signal Separation Circuit
The VBS signal, the VS signal or the VD signal can be input into the EXT VD line from the external equipment. With the VBS signal or the VS signal, pass through buffer Q2, and the chroma component is suppressed by the LPF (R31 and C19).
Then, the SYNC component in the signal is separated and detected by Q3. This SYNC signal is wave-shaped in IC1 and then output to the TG-48 board (EX VD).
With the VD signal, the above circuit works simply as a wave-shape circuit so that the signal has the sufficient amplitude. When there is no signal, it is set to High level.
The HD signal is input into the EXT HD line from the external equipment. The HD signal passes through buffer Q1 and is output (EX HD) to the TG-48 board after being inversely wave-shaped at IC1. When there is no signal, it becomes Low level.

• Synchronization Signal Output Buffer
The VD signal, HD signal and CLK signal sent from the TG-48 board, are output to the CN-295 board after being buffered at this PC board. Q4 is the buffer for the VD signal, Q5 for the HD signal and Q6 for the CLK signal. If the internal synchronization mode is not set, the VD signal and the HD signal cannot be output to the CN-295 board.

• DC-DC Converter
The power (+12 V) provided from the external equipment is switched to different voltages of −5 V, +5 V, +7 V, +15 V and +25 V by the DC-DC converter and supplied to every PC board.

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3-11. TG-48 BOARD

This PC board contains a synchronization signal generator circuit for external synchronization modes, a timing pulse generator circuit for driving the CCD and for signal processing.
IC4 detects whether there is the external synchronization signal or not. If external synchronization signal is input, it is automatically switched to external synchronization mode. It outputs synchronization signals synchronized to this signal.

SYNC: composite SYNC signal (master SYNC)
BLK: blanking signal
HD, VD: horizontal and vertical synchronization signals
FLD: field discrimination signal
INT/EXT: synchronization mode discrimination flag

In the 28 MHz oscillator circuit there are two kinds of oscillations: the liquid cristal oscillation and the quartz oscillation.
In external synchronization mode, the liquid crystal oscillator circuit operates. This liquid crystal oscillator circuit is a VCO and composes the PLL by IC4 and phase comparator IC6. Therefore, it outputs a clock completely locked- in to the external synchronization signal.
In internal synchronization signal mode, the quartz oscillator circuit operates and outputs a clock of 28.6363 MHz. One of these clocks is input into IC2 together with the HD and VD signals of IC4, and the timing pulses for driving the CCD and for signal processing are generated.

CLK: 14 MHz (910 fH) clock
XPG: CCD precharge gate clock
XH1, XH2: 2-phase clock for horizontal CCD transfer
XV1 to XV4: 4-phase clock for vertical CCD transfer
SHP, SHD: double correlation sampling pulse for the CCD output signal

IC1 is the system data writing completion ROM supplied with the CCD. If the ROM has the address for compensation of defects in the CCD, the same serial number as the CCD is attached on it.
IC3 makes the WINDOW signal from the VD signal.

3-12. DR-83 BOARD

This PC board contains the clock drive circuit for vertical transfer of the CCD and the electronic shutter control circuit.

• Clock Drive Circuit for Vertical Transfer of CCD
After pulses XV1 to XV4, XSG1 and XSG2 sent from the TG-48 board have been amplified at clock driver IC1, CCD drive pulses V1 to V4 are output. These drive pulses are clamped at D7 to D9 and output to the BI-26 board via the MB-222 board. The clamp voltage at this time is a negative voltage VL created by the VL output of IC1 and D6. The negative voltage VL is also output to the BI-26 board via the MB-222 board.
Q1 to Q3 are the regulators that form the power supply voltage necessary for IC1.

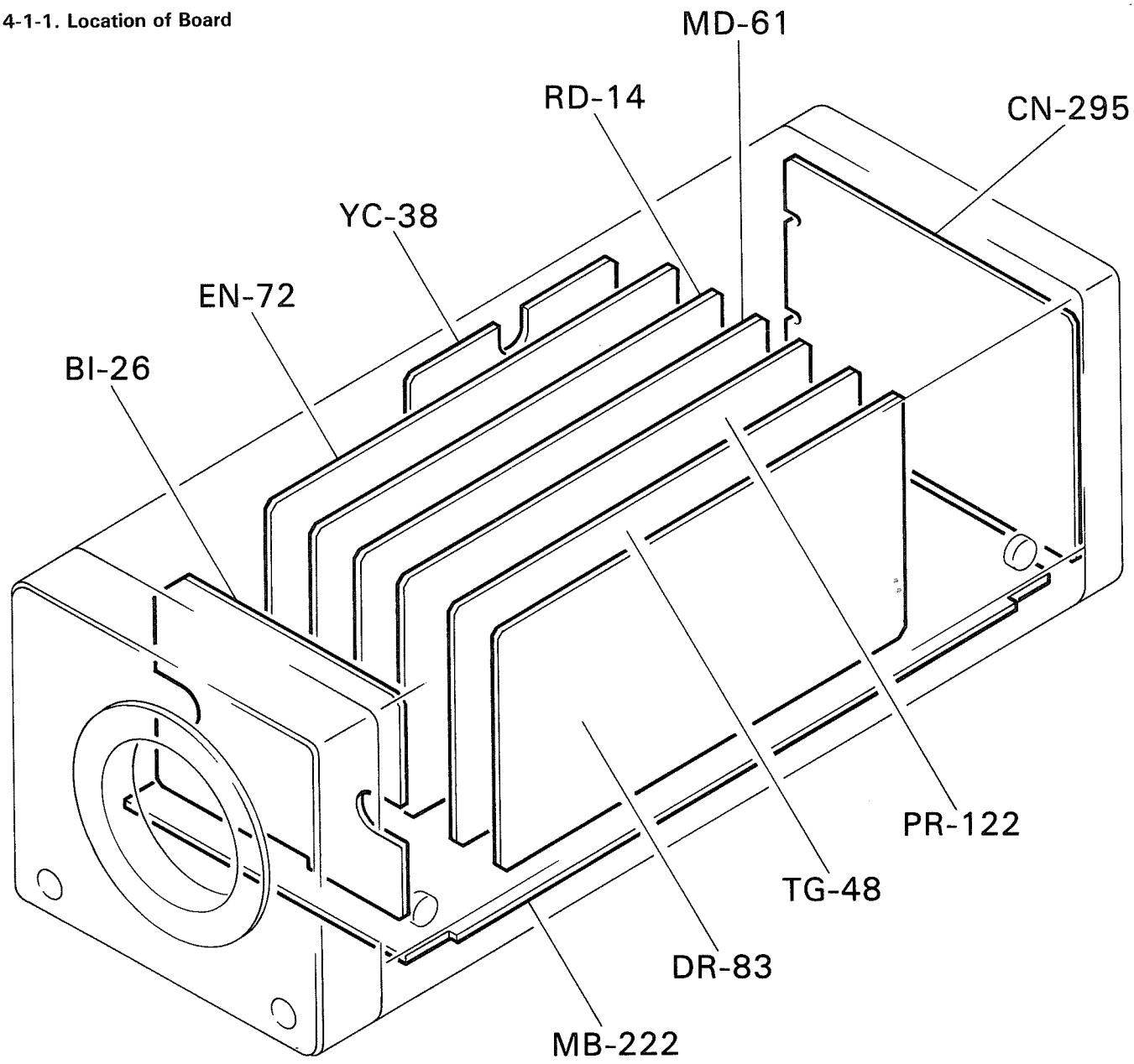
• Electronic Shutter Control Circuit
The signals XV4, XSG1, PS, HD and VD sent from the TG-48 board are input here, and the pulse (XSUB) for the electronic shutter is generated at IC3. XSUB passes through the drive buffer of Q7 to Q10 and is output (SUB CTL) to the BI-26 board via the MB-222 board after being clamped (D1). The clamp voltage at that time has been created by regulator (Q4 to Q6), and becomes the normal bias voltage for the SUB terminal of the CCD.
The electronic shutter is operated by modulating the bias voltage for the SUB terminal with XSUB.
The speed of the electronic shutter (time of storage of electrical charge) is set by SW1.

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SECTION 4
ALIGNMENT

4-1. PREPARATOR INFORMATION ADJUSTMENT

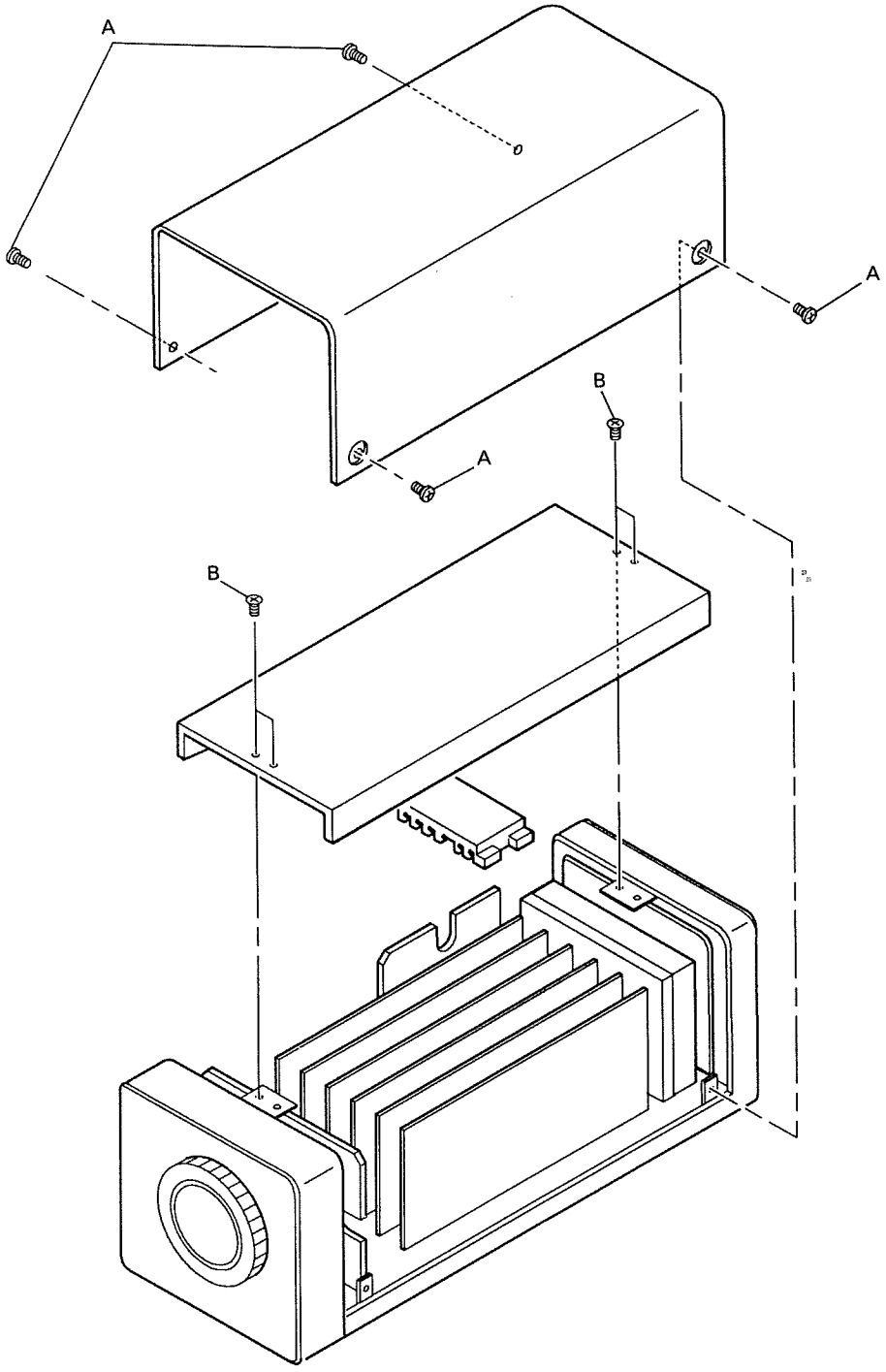
4-1-1. Location of Board



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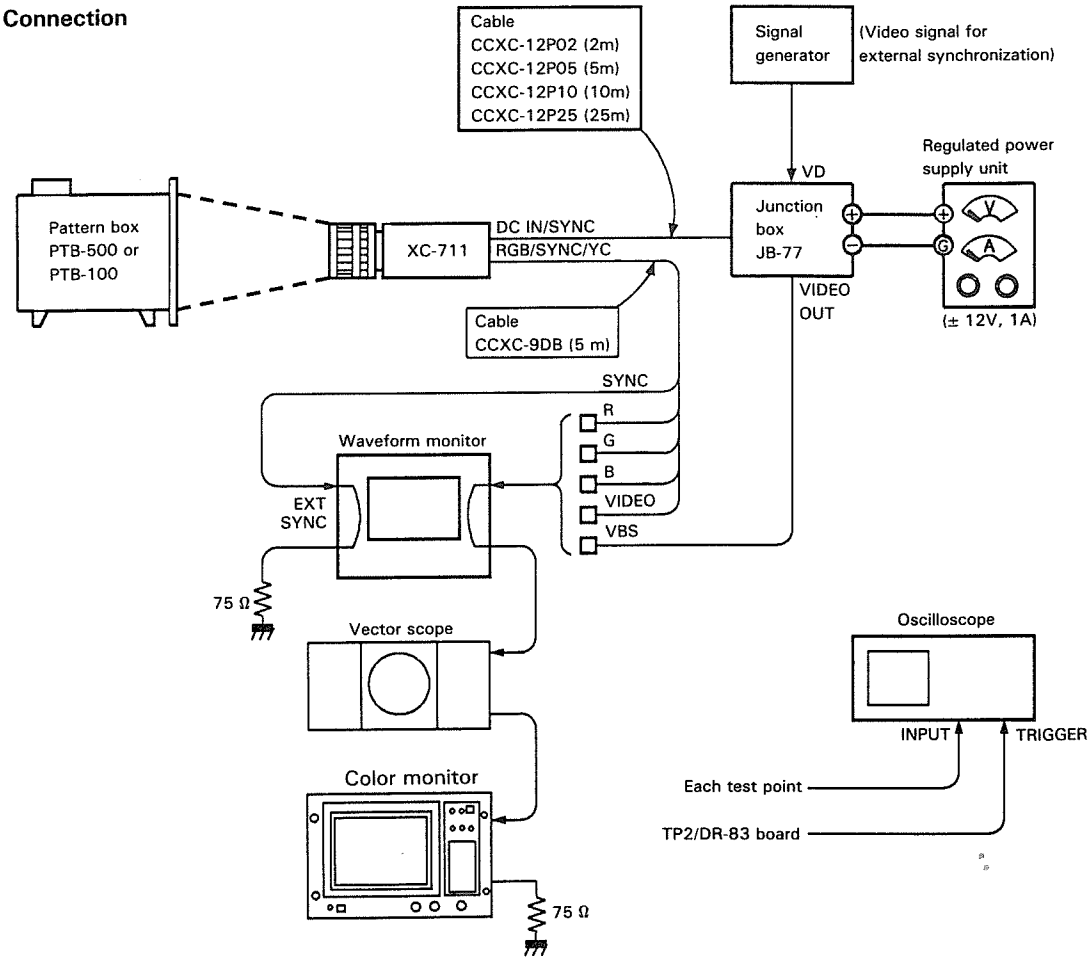
4-1-2. Removal of Outer Panels

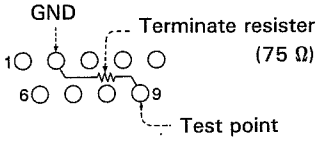
Remove the four fixing screws A (Precision + P2 x 4), and remove the camera cover.
Remove the four fixing screws B (Precision + K2 x 4), which is fixing the STAY to the chassis, then remove the PC BOARD HOLDER.



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4-1-3. Connection

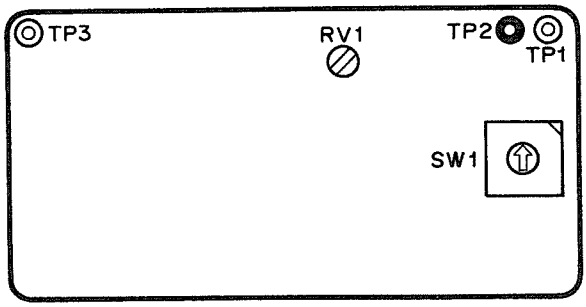




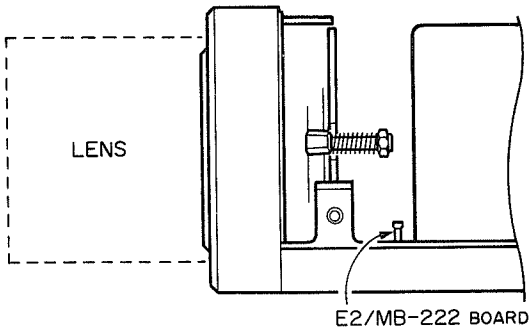
CN-295 board A side
(DSUB connector)

- Termination at the oscilloscope
  For "4-4-8. C Gain Adjustment (YC-38 Board)", terminate the measuring point at 75 ohms, then observe the waveform and adjust it. (Refer to the Fig. on the right.)

- Trigger input of the oscilloscope
  For observing the waveform by using an oscilloscope, a trigger input is necessary.
  Input the HD signal (TP2/DR-83 board) to the trigger input.
  Connect the GND to the E2/MB-222 board.



DR-83 BOARD (B SIDE)

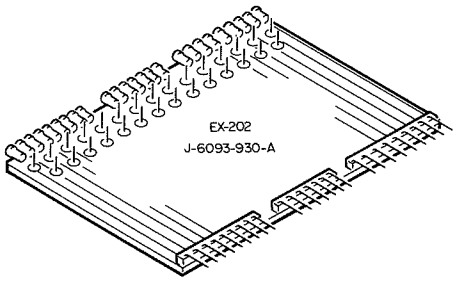


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4-1-4. Adjustment Fixtures and Equipment

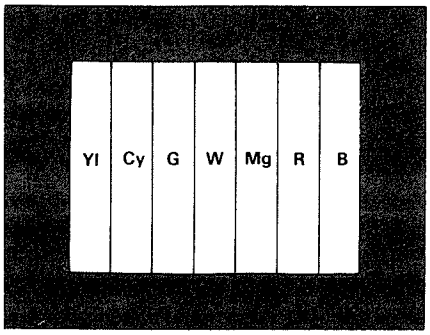
J-6093-930-A	Extension Board (EX-202)

- For PR-122 board adjustment



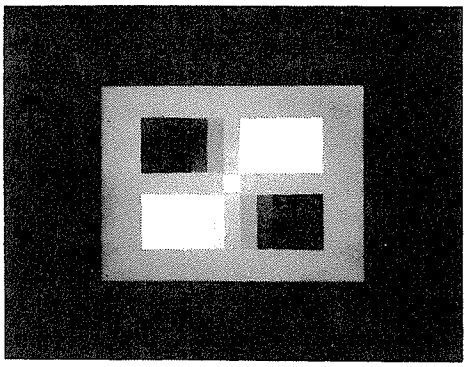
J-6020-250-A	Color-Bar Chart

- For color adjustment.



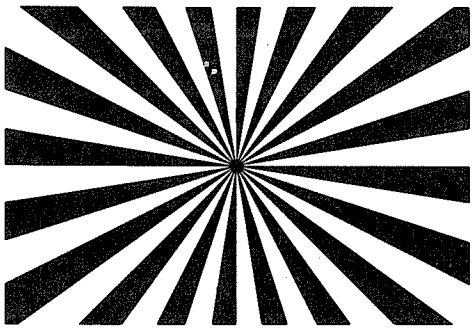
J-6026-130-B	Grayscale Chart

- For video level and gamma adjustment, etc.



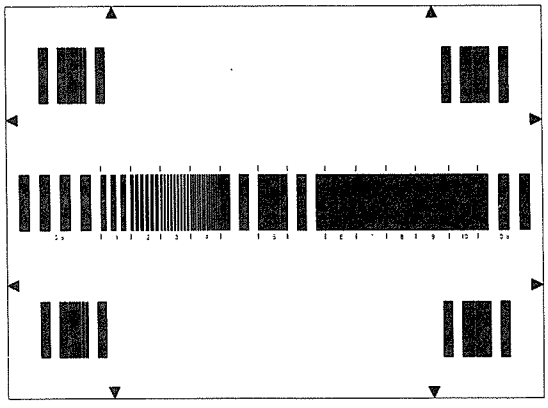
J-6024-340-B	Siemens Star chart

- For back focus adjustment

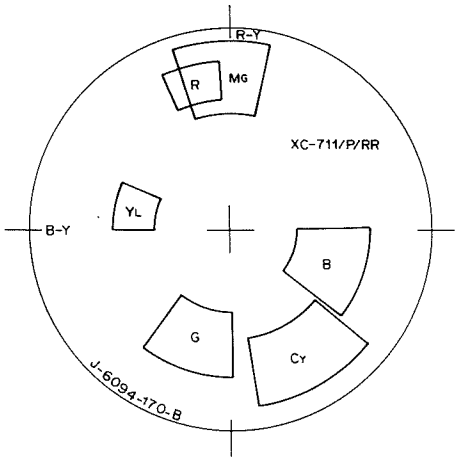


J-6021-910-A	Inmega Chart

- For aparture Adjustment



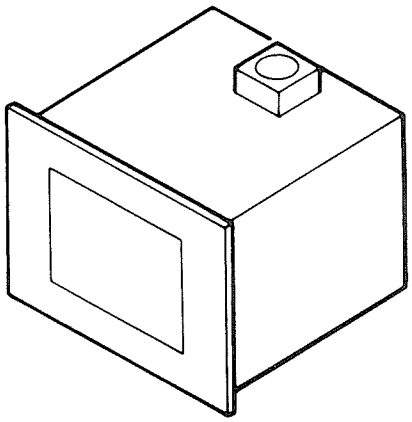
J-6094-170-B	Vectorscope Scale



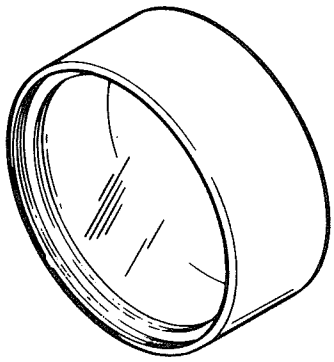
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J-6020-490-A	Pattern Box PTB-100 (90 to 130 V)
J-6020-140-A	Pattern Box PTB-500 (90 to 240 V)

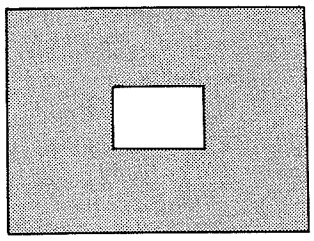
• Light source for test charts



J-6080-058-A	LB140 Filter
J-6029-590-A	LB200 Filter



White Window Chart



Make a hole in the center of black paper as shown in the figure.

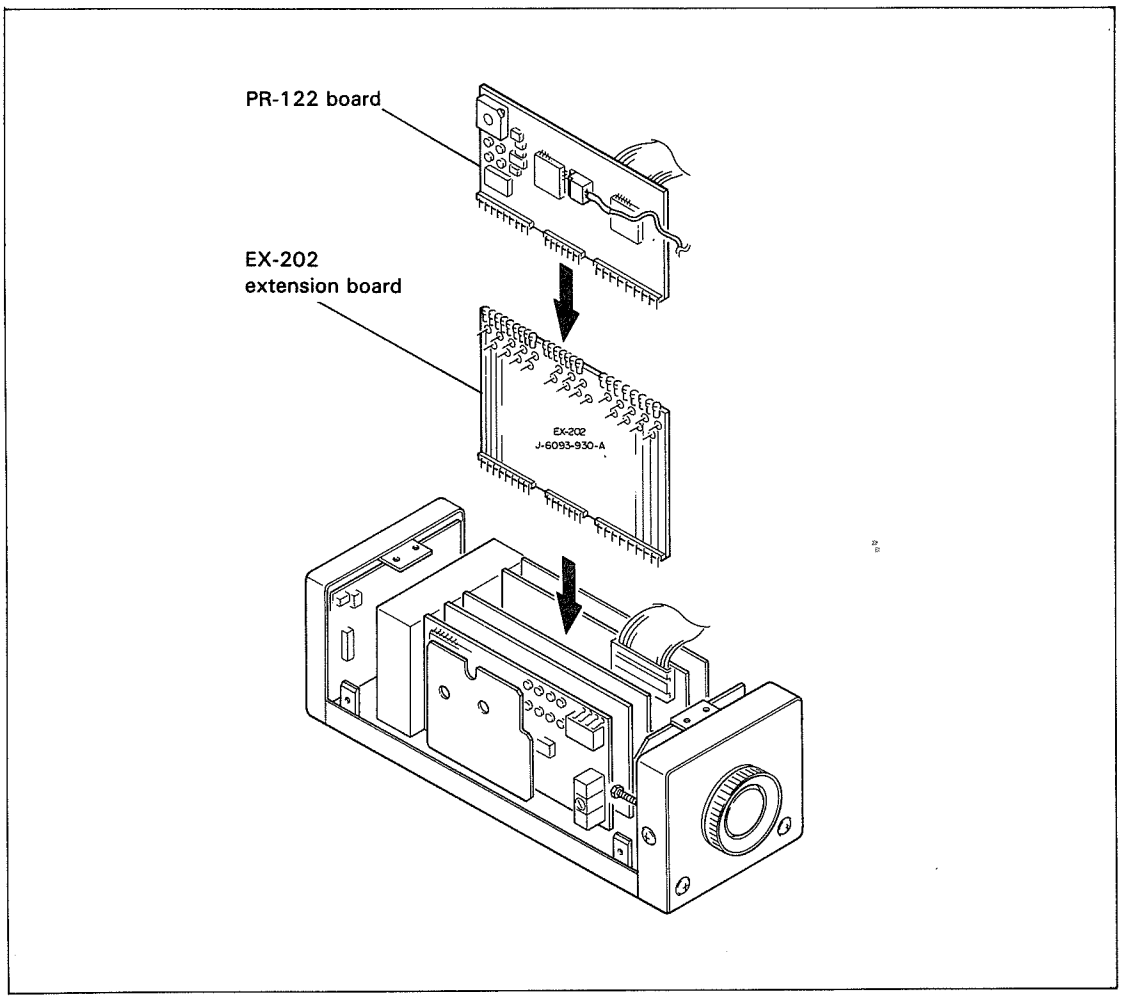
Commercial measuring equipment and fixture

- Dual Trace Oscilloscope
- Vectorscope
- Wareform Monitor (WFM)
- Frequency Counter
- Digital Voltmeter
- Color Monitor
- Lens (C mount and manual iris type)

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4-1-5. Mounting of EX-202 Extension Board

1. Remove the outer panels by ''4-1-2. Removal of Outer Panels''.
2. Remove the DR-83 board.
3. Remove the TG-48 board.
4. Remove the PR-122 board.
5. Mount the extension board to the position where the PR-122 board has been removed from.
6. Mount the PR-122 board on the extension board.



7. Mount the TG-48 board in place.
8. Mount the DR-83 board in place.

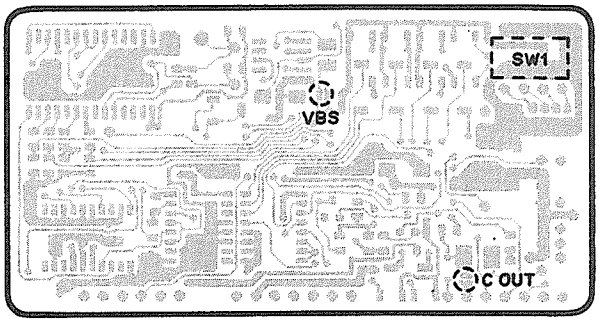
NOTE: EX-202 can be used not only for extension of the PR-122 board but also for the DR-83, TG-48, MD-61, RD-14 and EN-72 boards.

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4-2. PREPARATION

4-2-1. Operation Before Adjustment.

Remove the YC-38 board from the MB-222 board, and short-circuit the "C OUT" jumper of the EN-72 board.



EN-72 BOARD B SIDE

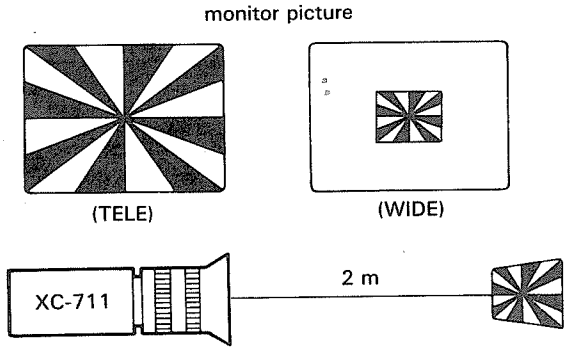
Mount the PR-122 board to the MB-222 board via the EX-202 extension board.
Refer to "4-1-5. Mounting of EX-202 Extension Board".
Set the switches as follows

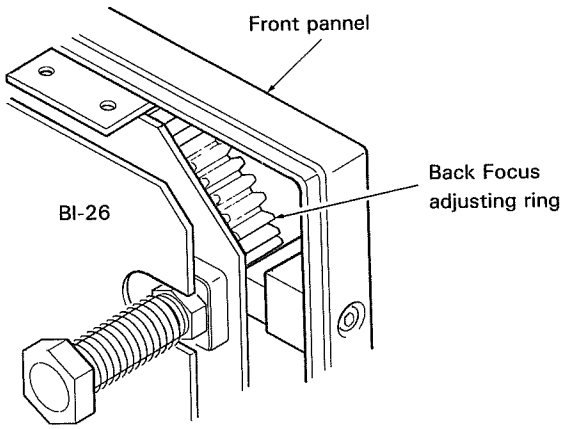
- PR-122 board. SW1 ..... "2"
- DR-83 board. SW1 ..... "0"
- EN-72 board. SW1-1 ..... "OFF"
  -2 ..... "OFF"
  -3 ..... "OFF"
  -4 ..... "OFF"

4-2-2. Mechanical Back Focus Adjustment

Subject: Siemens Star chart
Lens iris: Open
Equipment: Color monitor
Test point: VBS OUT
Adjust:

1. Set the zoom control at TELE so as to obtain the maximum multiplication factor. Optically focus the image so as to obtain the maximum resolution.
2. Set the zoom control at WIDE so as to obtain the minimum multiplication factor. Do not optically focus the image at thie time.
   Check whether the image is focused, on the monitor while turning the zoom control from TELE to WIDE.
   If the image is not focused, properly set at back focus as follows.
3. When the zooming mechanism is set at WIDE, turn the back focus adjusting ring.
4. Repeat step 1 through 3 several times.





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4-3. BASIS SYSTEM

4-3-1. VCO Voltage Adjustment

Preparation: Supplying the HD and VD signals (or VS/VBS signal)
Equipment: Digital voltmeter
Test point: TP1 (GND: E2/MB-222 board)/TG-48 board
Adj.point: ◐CV1/TG-48 board
Spec.: 2.8 ± 0.1 V

NOTE: When this adjustment is finished, no HD and VD signals are necessary any more. Turn off the power of the external synchronization signal generator.

4-3-2. CCD Substratum Voltage Adjustment

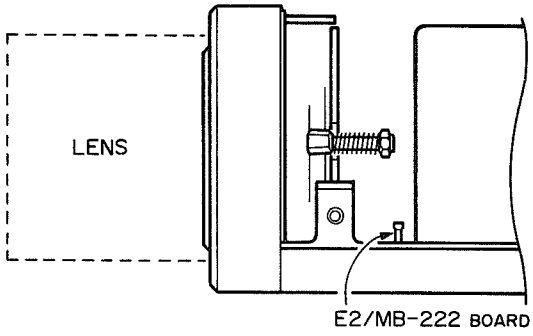
Equipment: Digital voltmeter
Test point: TP3 (GND: E2/MB-222 board)/DR-83 board
Adj.point: ◐RV1/DR-83 board
Spec.: Establishment value ± 0.1 V

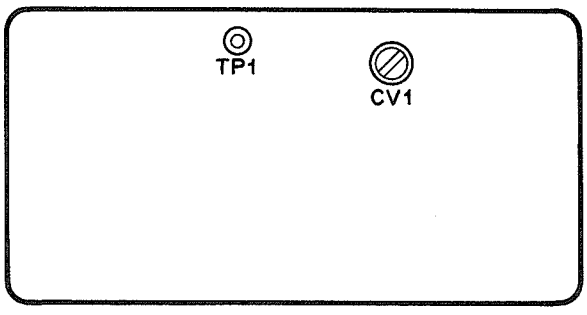
Establishment value
When you replace the CCD image device, refer to the 2-digit code indicated on the rear of the new CCD image device.
If you do not replace the CCD image device, refer to the 2-digit code indicated on the label stuck on the inside of the front panel.
When you replace the CCD image device, make sure to change the code, indicated on the label stuck on the inside of the front panel, to the code indicated on the rear of the new CCD image device.
2 digit-code display: □□ ← Decimal
Integral

The code integrals and the real value correspond with each other as follows:

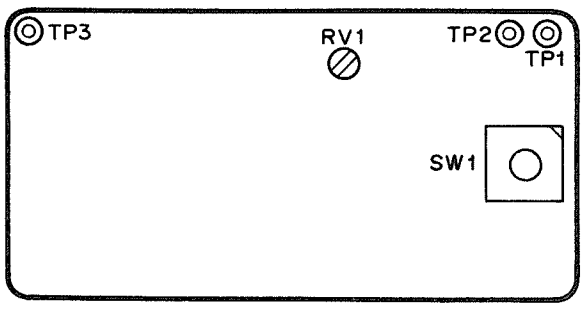
Code integral	9	A	B	C	D	E	F	G	H	I	J
Value	9	10	11	12	13	14	15	16	17	18	19

<Example> F5 → 15.5 (V)





TG-48 BOARD (A SIDE)



DR-83 BOARD (B SIDE)

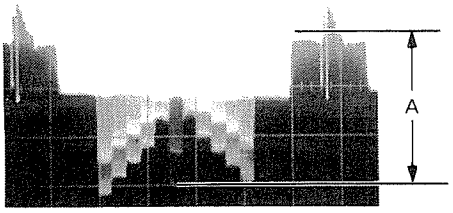
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4-4. PROCESS SYSTEM

4-4-1. Video Gain Adjustment (PR-122 Board)

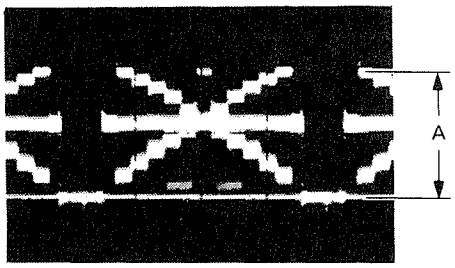
Subject: Grayscale chart
Adjust:

1. Equipment: Oscilloscope
   Test point: TP1 (GND: Pin 9/Extension board)/PR-122 board
   Adj. point: Lens iris
   Spec.: A = 94 ± 10 mV



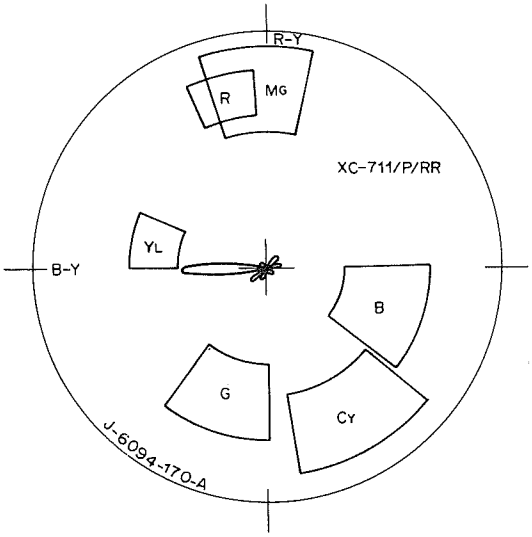
2. Preparation: SW1/PR-122 board .... "4"
   Equipment: Oscilloscope
   Test point: TP2 (GND: Pin 9/Extension board)/PR-122 board
   Adj. point: ◐RV14/PR-122 board
   Spec.: A = 1000 ± 40 mV

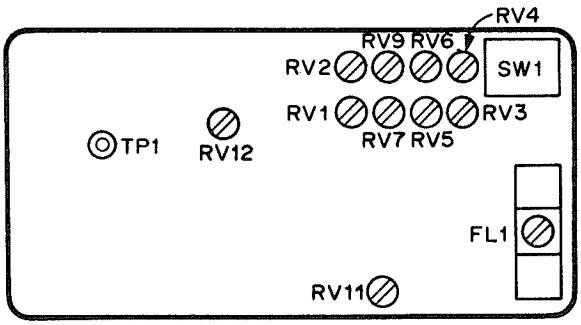
3. Preparation: SW1/PR-122 board .... "2"
   Equipment: Oscilloscope
   Test point: TP2 (GND: Pin 9/Extension board)/PR-122 board
   Adj. point: ◐RV12/PR-122 board
   Spec.: A = 250 ± 10 mV



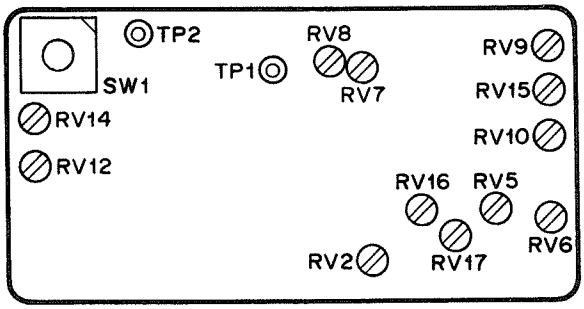
Adjust 2 and 3

4. Equipment: Vectorscope
   Test point: VBS OUT
   Adj. point: ◐RV7, ◐RV8/PR-122 board (alternately adjust)
   Spec.: Bright spot is at the center of the vectorscope screen.





EN-72 BOARD (B SIDE)



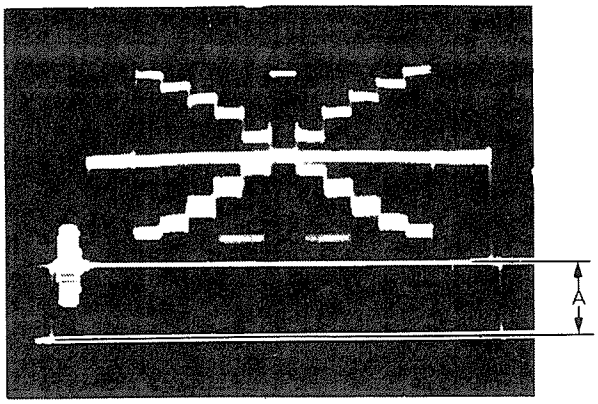
PR-122 BOARD (A SIDE)

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4-4-2. SYNC Level Adjustment (EN-72 Board)

Subject: Grayscale chart
Preparation: ◍RV9/PR-122 board .... counterclockwise full
◍RV16/PR-122 board... clockwise full
◍RV17/PR-122 board... mechanical center
◍RV4/EN-72 board .... clockwise full
◍RV5/EN-72 board .... clockwise full

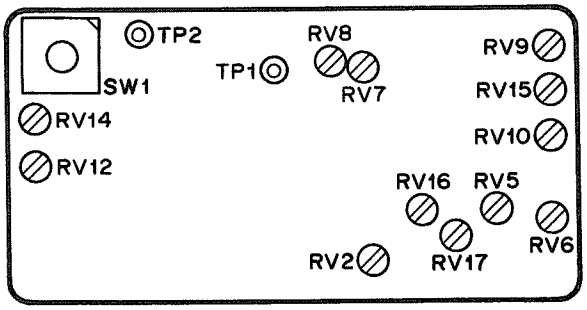
Adjust:
1. Equipment: Waveform monitor
Test point: VBS OUT
Adj. point: ◍RV7/EN-72 board
Spec.: A = 40 ± 1 IRE



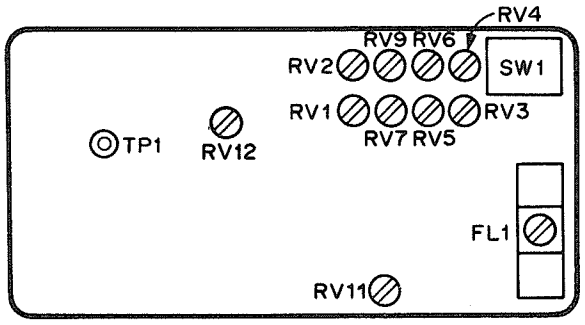
4-4-3. Setup Level Adjustment (EN-72 Board)

Lens iris: Closed "C"
Equipment: Waveform monitor
Test point: VBS OUT
Adj. point: ◍RV6/EN-72 board
Spec.: A = 7.5 ± 1 IRE





PR-122 BOARD (A SIDE)

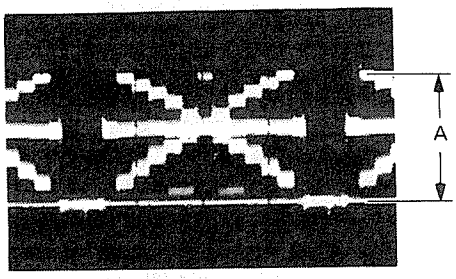


EN-72 BOARD (B SIDE)

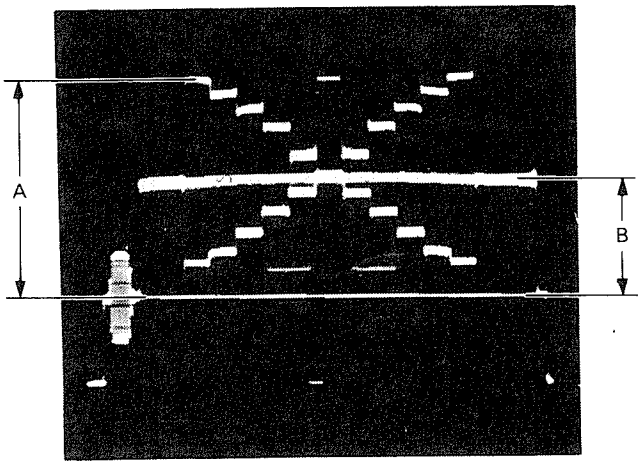
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4-4-4. Y Level Adjust (EN-72/PR-122 Boards)

Subject: Grayscale chart
Adjust:
1. Equipment: Oscilloscope
   Test point: TP2 (GND: Pin9/Extension board)/PR-122 board
   Adj. point: Lens iris
   Spec.: A = 400 ± 20 mV

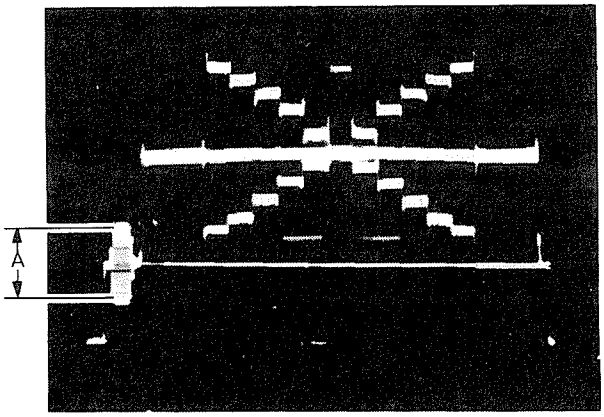


2. Equipment: Waveform monitor
   Preparation: SW1-1/EN-72 board .... "ON"
   Test point: VBS OUT
   Adj. point 1: ⊘ RV1/EN-72 board
   Spec. 1: A = 100 ± 2 IRE
   Adj. point 2: ⊘ RV17/PR-122 board
   Spec. 2: B = 50 ± 2 IRE
   Repeat adj. point 1 and adj point 2.



4-4-5. Burst Level Adjustment (EN-72 Board)

Subject: Grayscale chart
Equipment: Waveform monitor
Test point: VBS OUT
Adj. point: ⊘RV11/EN-72 board
Spec.: A = 40 ± 1 IRE



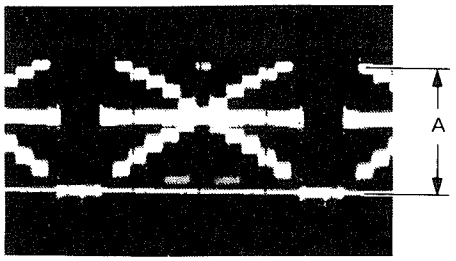
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4-4-6. Video Gain Adjustment (YC-38 Board)

Subject: Grayscale chart
Equipment: Oscilloscope
Test point: TP2 (GND: Pin9/Extension board)/PR-122 board
Adjust:
1. Adj. point: Lens iris
   Spec.: A = 250 ± 10 mV

2. Preparation: Mount the YC-38 board to the MB-222 board.
   * Be sure to turn off the power before mounting the PC boards.
   Turn the SW1/YC-38 board and adjust the level of A as follows:

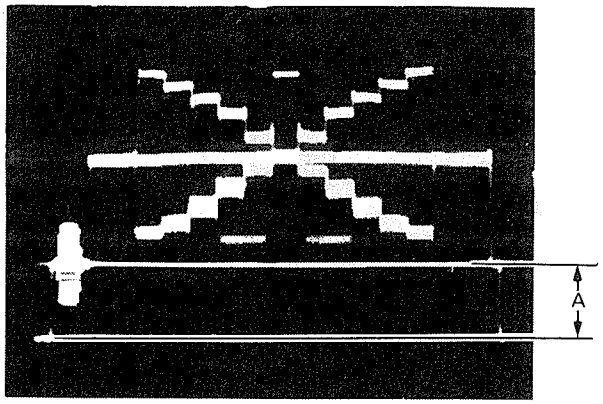
SW1 position	Adjustment point	Specification
"0" (AGC)	◐RV2/PR-122 board	A = 400 ± 20 mV
"1" (-6dB)	◐RV3/YC-38 board	A = 125 ± 10 mV
"2" (0dB)	◐RV4/YC-38 board	A = 250 ± 10 mV
"3" (+6dB)	◐RV5/YC-38 board	A = 500 ± 20 mV
"4" (+12dB)	◐RV6/YC-38 board	A = 1000 ± 40 mV

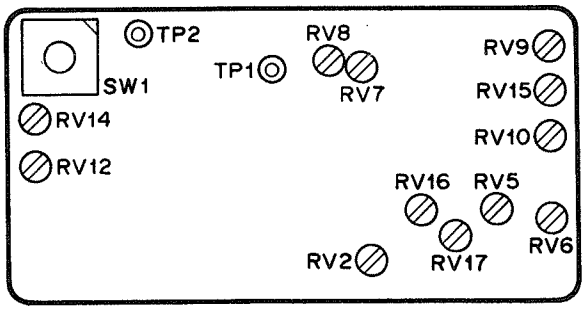


Adjust 1 and 2

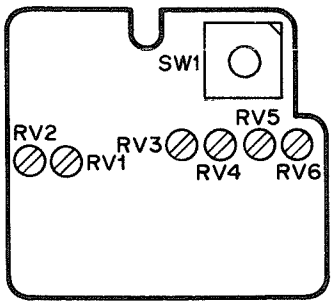
4-4-7. Y Gain Adjustment (YC-38 Board)

Preparation: SW1/YC-38 board .... "2"
Subject: Grayscale chart
Equipment: Waveform monitor
Test point: Cable CCXC-9DB, Y OUT
Adj.point: ◐RV1/YC-38 board
Spec.: A = 40 ± 1 IRE





PR-122 BOARD (A SIDE)

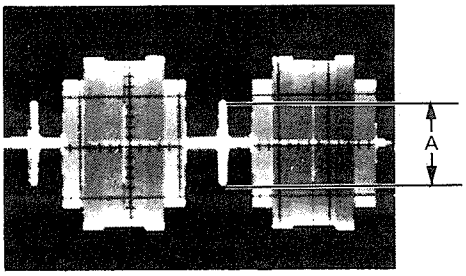


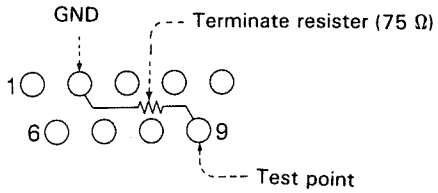
YC-38 BOARD (A SIDE)

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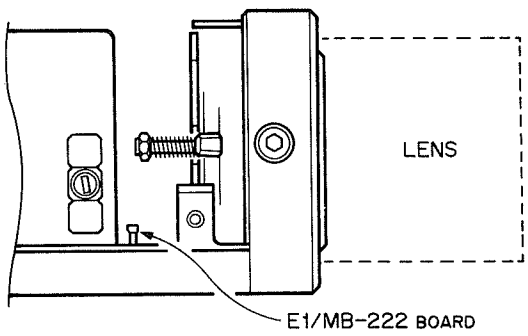
4-4-8. C Gain Adjustment (YC-38 board)

Preparation: SW1/PR-122 board .... "2"
Subject: Color-bar chart
Equipment: Oscilloscope (terminated 75 Ω)
Test point: DSUB connector, pin 9
(GND: E1/MB-222 board)
Adj. point: RV2/YC-38 board
Spec.: A = 286 ± 7 mV



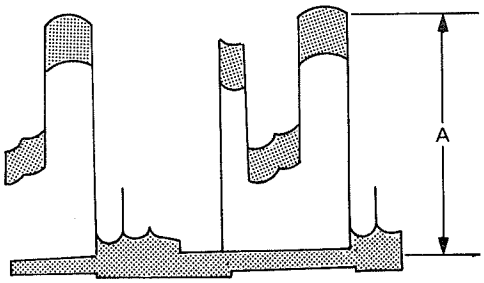


CN-295 board A side
(DSUB connector)

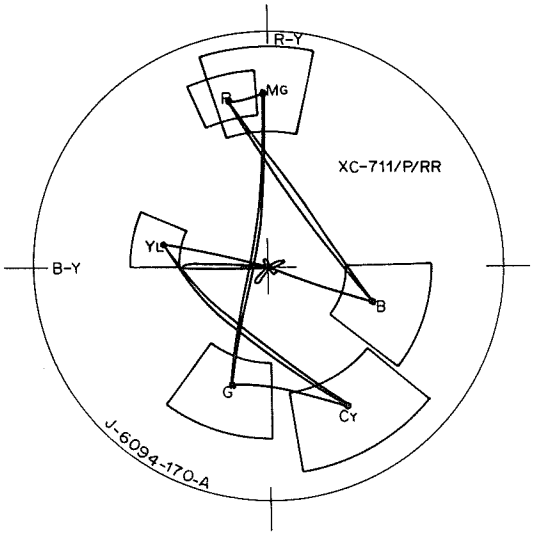


4-4-9. Hue Adjustment (PR-122 Board)

Preparation: SW1/PR-122 board .... ''2''
Subject: Color-bar chart
Adjust:
1. Equipment: Oscilloscope
Test point: TP2 (GND: Pin 9/Extension board)/PR-122 board
Adj. point: Lens iris
Spec.: A = 400 ± 10 mV



2. Equipment: Vectorscope
Test point: Cable CCXC-9DB, VIDEO OUT
Adj. point 1: ◐RV7, ◐RV8/PR-122 board (alternately adjust)
Spec. 1: White signal spot is at the center of the vectorscope screen.
Adj. point 2: ◐RV5, ◐RV6, ◐RV10, ◐RV15/PR-122 board (alternately adjust)
Spec. 2: The bright spots of R and Y1 have to be inside the specified frame.



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4-5. RGB SYSTEM

Preparation:
1. Take the YC-38 board and EN-72 board off the MB-222 board.
2. ⊘RV2, ⊘RV4, ⊘RV7, ⊘RV10/RD-14 board
   .... All clockwise full

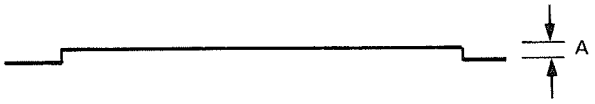
* Be sure to turn off the power before mounting the PC board.

4-5-1. Setup Level Adjustment (RD-14 Board)

Lens iris: Closed "C"
Equipment: Waveform monitor (EXT SYNC mode)
Adjust:
1. Test point: Cable CCXC-9DB, R OUT
   Adj. point: ⊘RV5/RD-14 board
   Spec.: A = 7.5 ± 1 IRE

2. Test point: Cable CCXC-9DB, G OUT
   Adj. point: ⊘RV8/RD-14 board
   Spec.: A = 7.5 ± 1 IRE

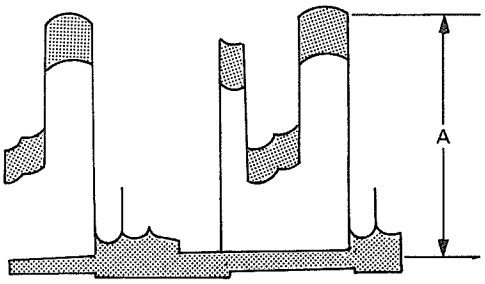
3. Test point: Cable CCXC-9DB, B OUT
   Adj. point: ⊘RV11/RD-14 board
   Spec.: A = 7.5 ± 1 IRE



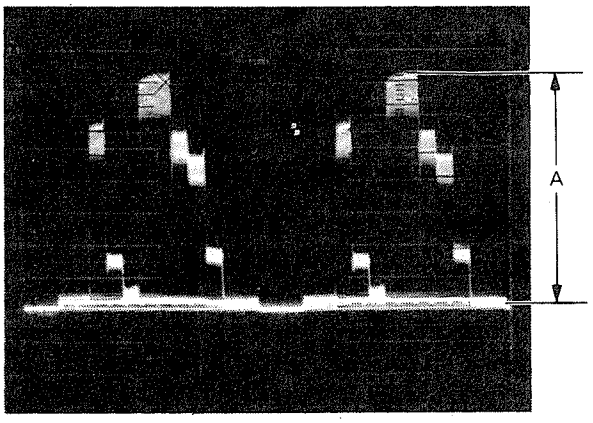
Adjust 1 to 3

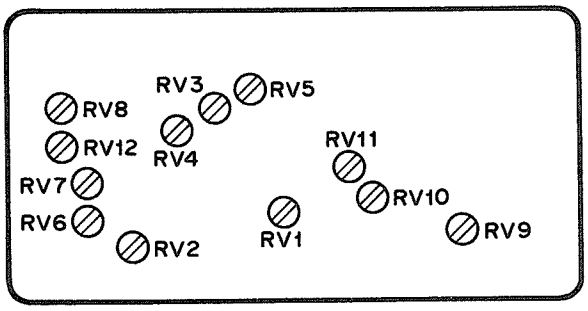
4-5-2. RGB Level Adjustment (RD-14 Board)

Subject: Color-bar chart
Adjust:
1. Equipment: Oscilloscope
   Test point: TP2 (GND: Pin 9/Extension board)/PR-122 board
   Adj. point: Lens iris
   Spec.: A = 400 ± 10 mV



2. Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, R OUT
   Adj. point: ⊘RV3/RD-14 board
   Spec.: A = 100 ± 2 IRE

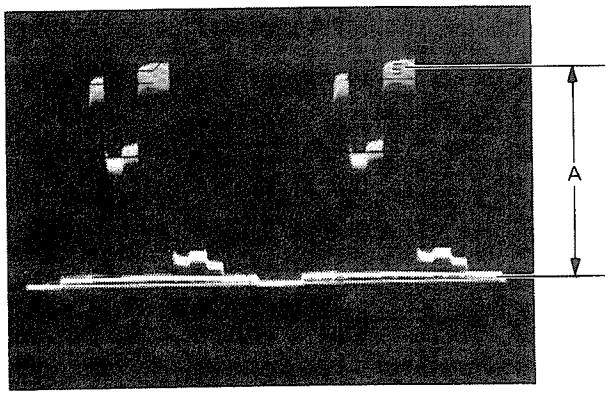




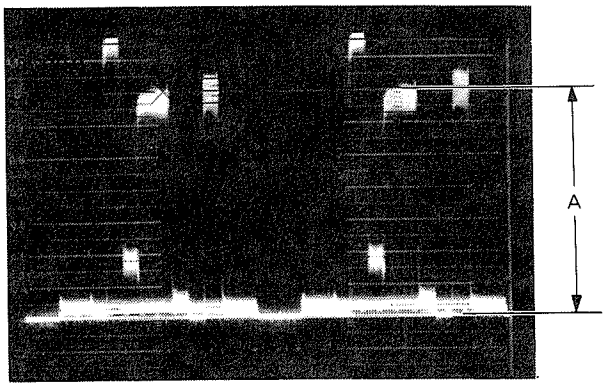
RD-14 BOARD (A SIDE)

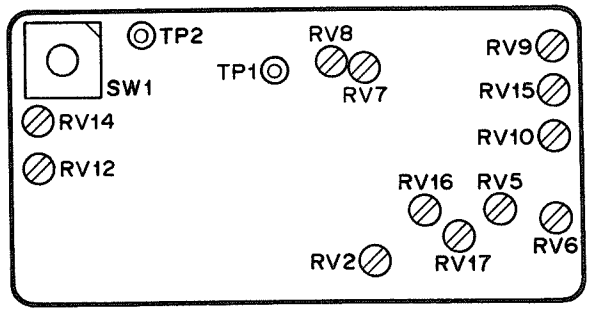
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3. Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, G OUT
   Adj. point: ◍RV6/RD-14 board
   Spec.: A = 100 ± 2 IRE



4. Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, B OUT
   Adj. point: ◍RV9/RD-14 board
   Spec.: A = 100 ± 2 IRE



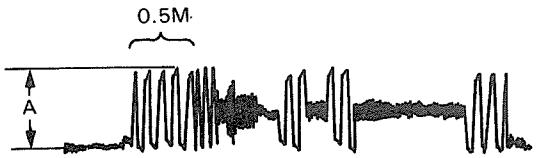


PR-122 BOARD (A SIDE)

4-5-3. Aperture Adjustment (RD-14/PR-122 Boards)

Subject: Inmega chart
Equipment: Waveform monitor (15 LINE mode)
Test point: Cable CCXC-9DB, G OUT
Adjust:

1. Adj. point: Lens iris
   Spec.: 0.5 MHz level A = 40 ± 2 IRE



2. Preparation: ◍RV2/RD-14 board
   .... counterclockwise full
   Adj. point: ◍RV1/RD-14 board
   Spec.: 1 MHz level A = 80 ± 2 IRE

3. Adj. point: ◍RV2/RD-14 board
   Spec.: 1 MHz level A = 45 ± 2 IRE

4. Adj. point: ◍RV1/RD-14 board
   Spec.: 1 MHz level A = 57 ± 2 IRE

5. Adj. point: ◍RV9/PR-122 board
   Spec.: 1 MHz level A = 55 ± 2 IRE



Adjust 2 to 5

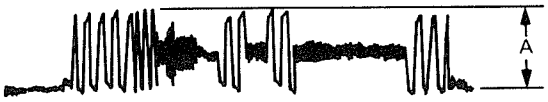
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4-5-4. White Clip Adjustment (RD-14 Board)

Subject: Inmega chart
Lens iris: Open
Equipment: Waveform monitor
Adjust:
1. Test point: Cable CCXC-9DB, G OUT
   Adj. point: ◐RV7/RD-14 board
   Spec.: A = 110 ± 2 IRE

2. Test point: Cable CCXC-9DB, R OUT
   Adj. point: ◐RV4/RD-14 board
   Spec.: A = 110 ± 2 IRE

3. Test point: Cable CCXC-9DB, B OUT
   Adj. point: ◐RV10/RD-14 board
   Spec.: A = 110 ± 2 IRE



Adjust 1 to 3

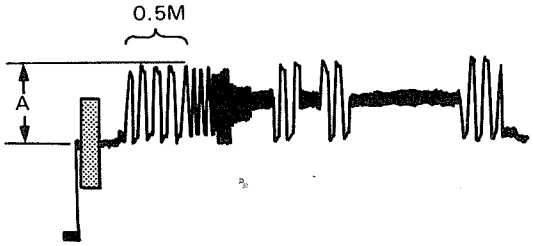
4-6. VBS SYSTEM

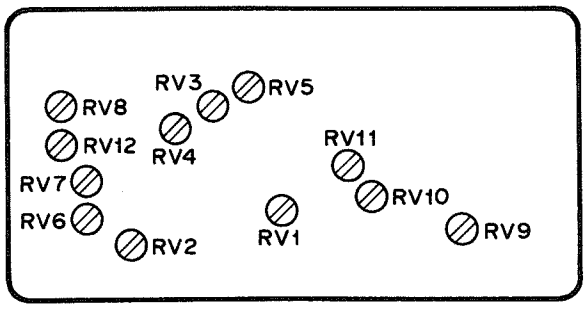
Preparation:
1. Remove the solder of the ''C-OUT'' pattern jumper of the EN-72 board that had been removed, and open it.
2. Mount the EN-72 board and the YC-38 board to the MB-222 board.
3. Insert the shield board that had been removed, between the EN-72 board and the RD-14 board.

* Be sure to turn off the power before mounting the PC boards.

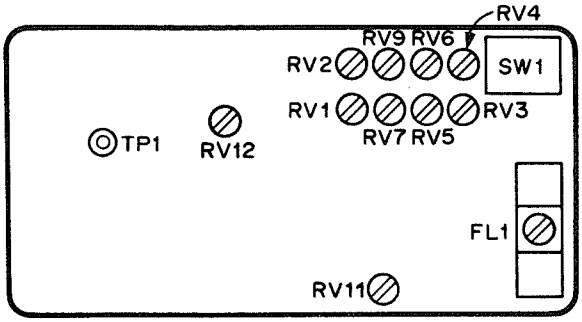
4-6-1. Aperture Adjustment (EN-72/PR-122 Boards)

Subject: Inmega chart
Equipment: Waveform monitor
Test point: Cable CCXC-9DB, VIDEO OUT
Adjust:
1. Adj. point: Lens iris
   Spec.: 0.5 MHz level A = 50 ± 2 IRE





RD-14 BOARD (A SIDE)



EN-72 BOARD (B SIDE)

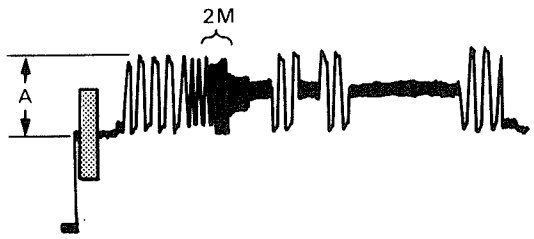
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2. Preparation: ◐RV4/EN-72 board
.... counterclockwise full
Adj. point: ◐RV3/EN-72 board
Spec.: 2 MHz level A = 80 ± 2 IRE

3. Adj. point: ◐RV4/EN-72 board
Spec.: 2 MHz level A = 50 ± 2 IRE

4. Adj. point: ◐RV3/EN-72 board
Spec.: 2 MHz level A = 57 ± 2 IRE

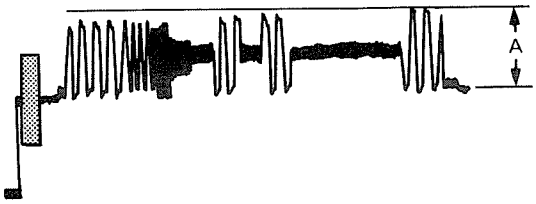
5. Adj. point: ◐RV16/PR-122 board
Spec.: 2 MHz level A = 55 ± 2 IRE

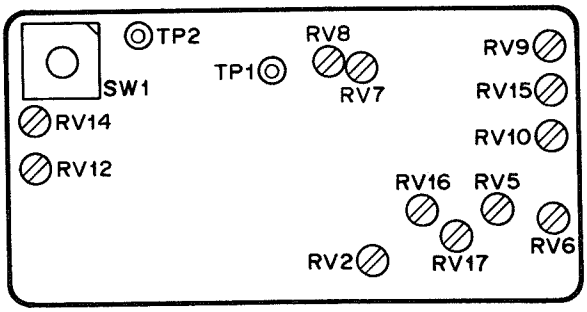


Adjust 2 to 5

4-6-2. White Clip Adjustment (EN-72 Board)'

Subject: Inmega chart
Lens iris: Open
Equipment: Waveform monitor
Test point: Cable CCXC-9DB, VIDEO OUT
Adj. point: ◐RV5/EN-72 board
Spec.: A = 110 ± 2 IRE





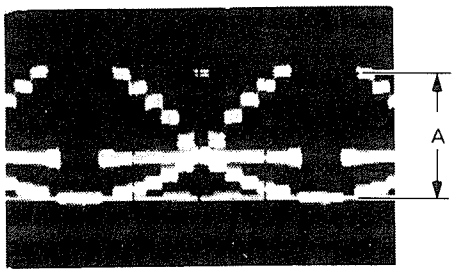
PR-122 BOARD (A SIDE)

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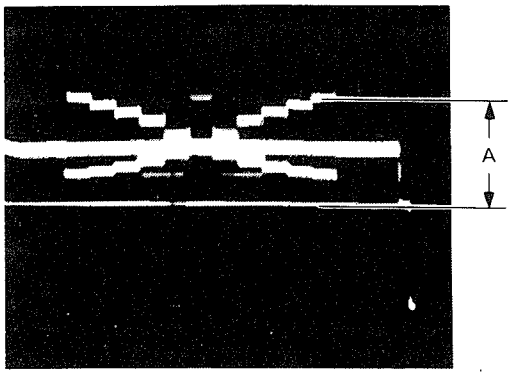
4-6-3. Chroma Level Adjustment (EN-72 Board)

Subject: Grayscale chart
Adjust:

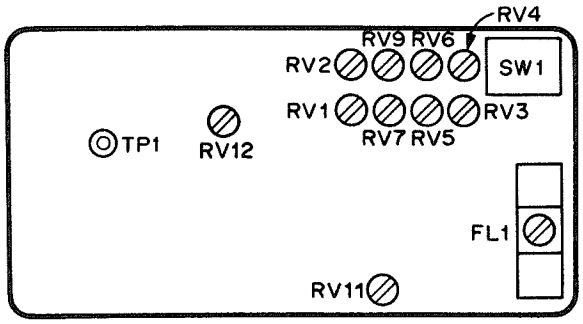
1. Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, G OUT
   Adj. point: Lens iris
   Spec.: A = 100 ± 2 IRE



2. Preparation: SW1/PR-122 board .... "A"
   Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, G OUT
   Adj. point: ◐ RV9/EN-72 board
   Spec.: A = 100 ± 5 IRE



3. Confirmation: Turn the SW1-1/EN-72 board to "ON"/"OFF" and confirm that the level of A is not changes.

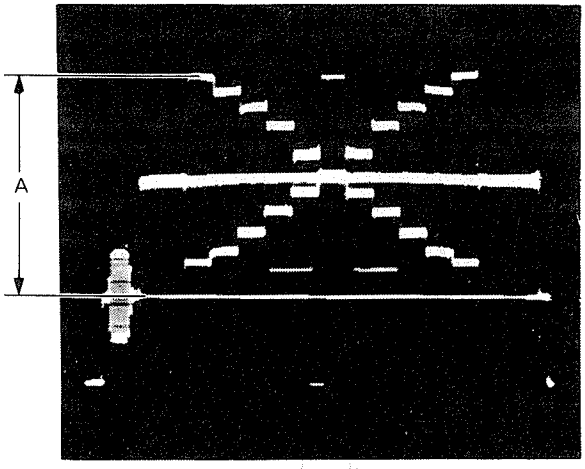


EN-72 BOARD (B SIDE)

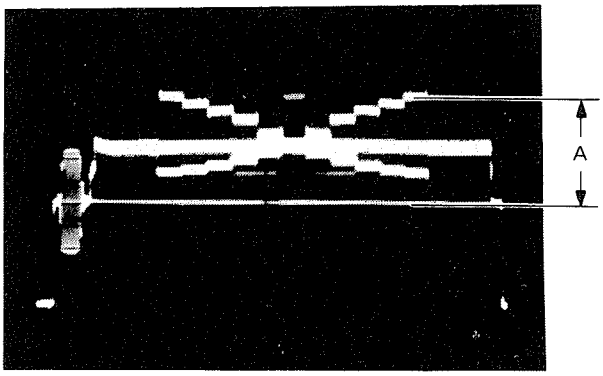
4-6-4. VBS Level Adjustment (EN-72 Board)

Subject: Grayscale chart
Adjust:

1. Preparation: SW1-1/EN-72 board .... "ON"
   Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, VIDEO OUT
   Adj. point: Lens iris
   Spec.: A = 100 ± 2 IRE



2. Preparation: SW1-1/EN-72 board .... "OFF"
   Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, VIDEO OUT
   Adj. point: ◐ RV2/EN-72 board
   Spec.: A = 100 ± 5 IRE

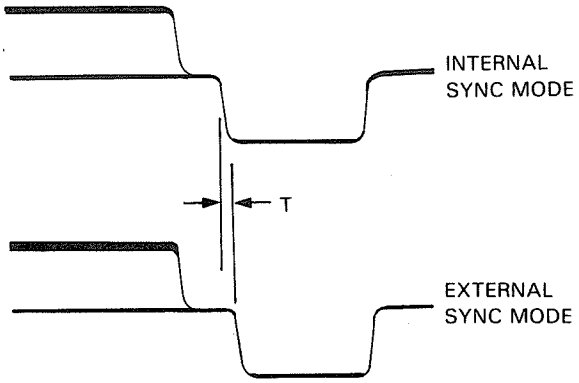


3. Confirmation: Turn the SW1-1/EN-72 board to "ON" and confirm that the level of A is not changes.

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4-6-5. SYNC Phase Adjustment (EN-72 board)

Subject: Grayscale monitor
Equipment: Waveform monitor (Measuring is performed by switching the waveform monitor between internal and external SYNC signals.)
Test point: Cable CCXC-9D, VIDEO OUT
Adj. point: ◐ RV12/EN-72 board
Spec.: T ≦ 100 ns



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4-7. WHITE BALANCE SYSTEM (MD-61 Board)

Preparation:

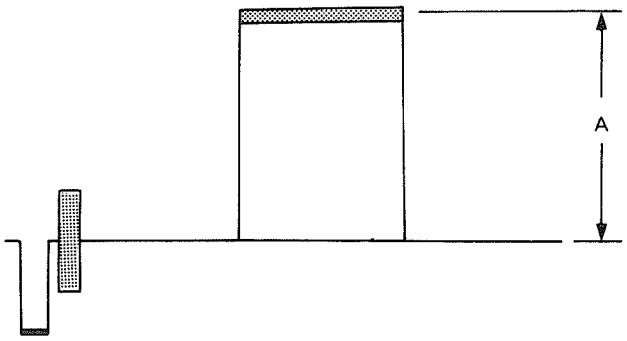
1. Remove the PC boards from the MB-222 board in the following order: DR-83 board, TG-48 board, PR-122 board and extension board.
2. Remount the PR-122 board to the MB-222 board.
3. Remount the TG-48 board to the MB-222 board, pulling the harness of the PR-122 board toward the front so that it is not pressed under the PC board.
4. Remount the DR-83 board to the MB-222 board.

* Be sure to turn off the power before removing and remounting the PC boards.

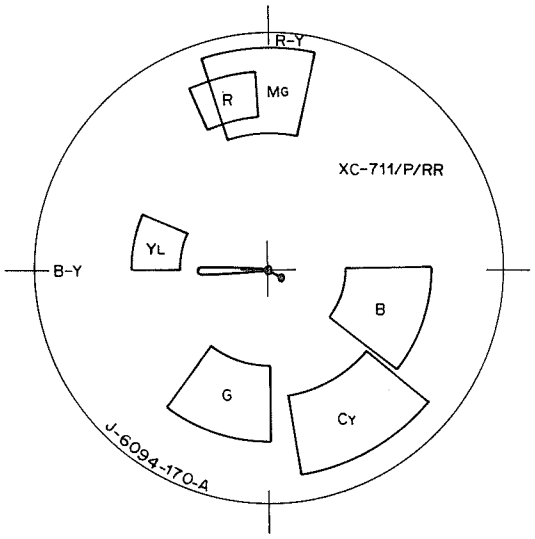
4-7-1. Color Temperature Adjustment (5600°K)

Subject: White window chart
Preparation: Cover the lens with a LB140 filter
SW1-1/EN-72 board .... "ON"
SW1-2/EN-72 board .... "OFF"
SW1-3/EN-72 board .... "ON"
Adjust:

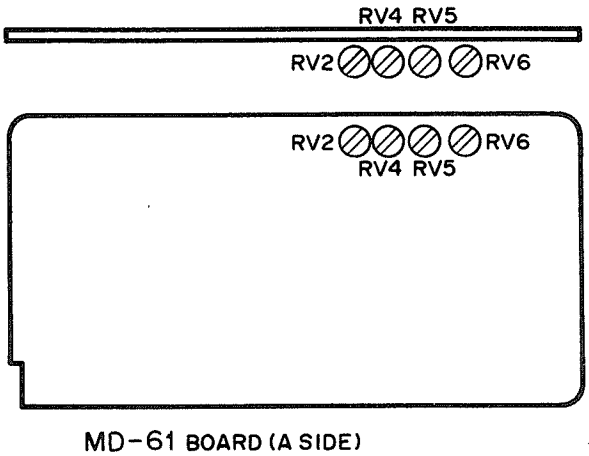
1. Equipment: Waveform monitor
   Test point: Cable CCXC-9DB, VIDEO OUT
   Adj. point: Lens iris
   Spec.: A = 90 ± 3 IRE



2. Equipment: Vectorscope
   Test point: Cable CCXC-9DB, VIDEO OUT
   Adj. point: ◪RV5, ◪RV6/MD-61 board (alternately adjust)
   Spec.: The bright spot is at the center of the vectorscope screen.



NOTE: Remove the LB140 filter from the lens after adjustment.



MD-61 BOARD (A SIDE)

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