COMPUTACAM

SK-970

Hitachi Full Auto-Setup Compact Studio Camera



HITACHI

Full Auto Setup Compact Studio Camera
A New Standard for Studio Production

The Hitachi SK-970 is an epoch-making, 2/3-inch, 3-tube, studio camera with full auto setup functions built into a compact size and a light weight of 25 kg (55 lb). The camera satisfies all the requirements necessary for studio and field applications; ie. excellent picture quality, great ease of operation and extremely high reliability.

The auto setup system controls every parameter related to color balance and registration to provide the highest picture quality at all times. In addition, the system controls on-line, real-time compensation for registration errors caused by a change in lens zooming and focusing and in prism temperature, ensuring high picture quality.

Since a microcomputer is built into the camera, the camera can be set up automatically either at the camera itself or from an RCU (Remote Control Unit) through a BSU (Base Station Unit). A DCU (Digital Command Unit) is also provided to constitute a system configuration best suited to each application anywhere at any time. The SK-970 employs the same auto setup system as that of the sister camera SK-97 EFP camera, and can be used in combination with the SK-97. In addition, the SK-970 can be controlled by the SK-110 full auto setup studio camera system.

FEATURES

Excellent Picture Quality

- **Pickup Tube Selection**

Any of 2/3-inch high performance pickup tubes in the market such as SATICONs,[*1] DG SATICONs/Plumbicons[*2] or LOC DG SATICONs/Plumbicons can be used.

- **High Resolution over Entire Screen**

High voltage operation of the pickup tube, together with a wideband preamplifier, fully utilizes the tube resolution. In addition, a dynamic focus circuit greatly improves the resolution at 4 corners independently.

- **High Signal-to-Noise Ratio**

High signal-to-noise ratio of 59 dB (NTSC) or 56 dB (PAL) is obtained at 2,000 lux (200 fc), f4 owing to a newly developed low-noise preamplifier and a new low-noise FET.

- **Improved Prism Optics**

Newly developed, high speed (f1.4) prism optics with a quartz filter guarantee high sensitivity and excellent color rendition.

- **ABO (Automatic Beam Optimizer)**

A built-in ABO circuit eliminates comet tails, extends the dynamic range of the camera and thereby makes highlight shooting very easy.

- **Encoder with Dynamic Contrast (Variable Gamma)**

Gamma control for highlight compression and black stretch of the luminance and chrominance signals makes it easy to shoot a high contrast scene such as a portrait with a backlight, in combination with a video amplifier having a wide dynamic range.

- **High-Precision Static and Dynamic Registration**

An auto setup control for camera registration including that for a bow and skew distortions in both the horizontal and vertical directions guarantees a high-precision static registration, in combination with the auto setup control of corner registration compensation which controls four corners independently.

In addition, the auto setup system controls on-line, real-time compensation for registration errors caused by a change in lens zooming and focusing and in prism temperature, ensuring a consistently high precision dynamic registration.

- **3DTL system**

Though the contour correction circuit employs the out-of-green system, the 3DTL system is employed for the horizontal correction. The 3DTL system performs the optimum corrections for RGB channels and ensures the most effective edge correction for any kind of color tone.

- **Linear Matrix Masking**

A built-in linear matrix masking amplifier ensures high-fidelity color rendition and easy tone-matching among the cameras. Two modes of operation; FIX (standard setting) and MANUAL; and ON/OFF control are provided.

*1 ® Hitachi, Ltd.
*2 ® N.V. Philips

Great Ease of Operation

• Compact and Lightweight System

The camera is compact and weighs only 25 kg (55 lb) excluding a lens. The BSU of half-rack size and the compact RCU which constitutes a base station contribute to space saving in a studio or in an OB van.

• Auto Iris

Lens iris is automatically controlled through an NAM (Non-Additive Mixing) circuit by detecting the highest video level among the R, G and B channels. This feature provides proper control even under monochromatic illumination. The level is detected from a mixed signal of a peak and an average value and the mixing ratio is adjustable. In addition, a position weighting circuit yields a soft response at the upper right and left corners in a picture screen. As a result, natural and smooth iris control is obtained.

• Two Filter Discs

Two filter discs, one for ND filters and the other for color filters, are provided with independent filter selection possible both at the camera and remotely from the RCU through the BSU.

• 7-inch VF with Various Functions

A 7-inch, high-brightness, high-resolution viewfinder assures precise focusing and picture composition in combination with a built-in peaking circuit and a graticule marker. When an exclusive lens is used, a zoom indicator showing the degree of tele/wide by a bar is provided above the screen. The viewfinder is tiltable from ±45 degrees to the horizontal and rotatable ±90 degrees with the gravity center as a revolving center.

• Viewfinder Character Display

The following indications and alarms are displayed on the 7-inch viewfinder screen with characters for 5 seconds after each setup or selection has been completed.

1 High-gain selection
2 ND filter selection
3 CC filter selection
4 Video level
5 Auto setup mode
6 Results of auto setup
7 ON/OFF control
8 Control channel: control mode and control amount of analog control items
9 Fault diagnosis

The above items 1-4 are displayed continuously.

• +9/+18 dB High-Gain Switch

A +9/+18 dB high-gain switch provides a broadcastable picture even under low lighting conditions, in combination with the low noise preamplifier.

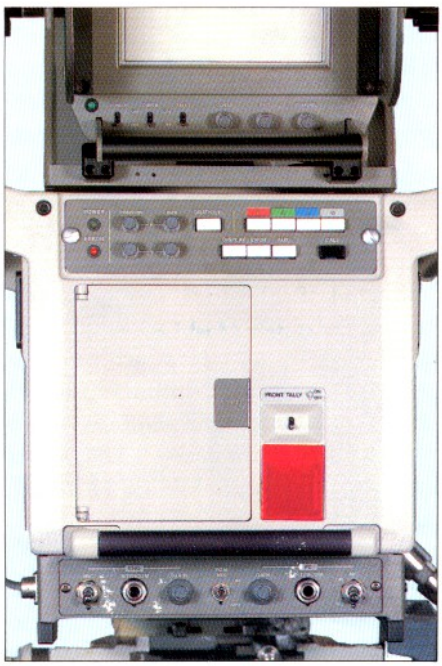
• Centralized Control Panel

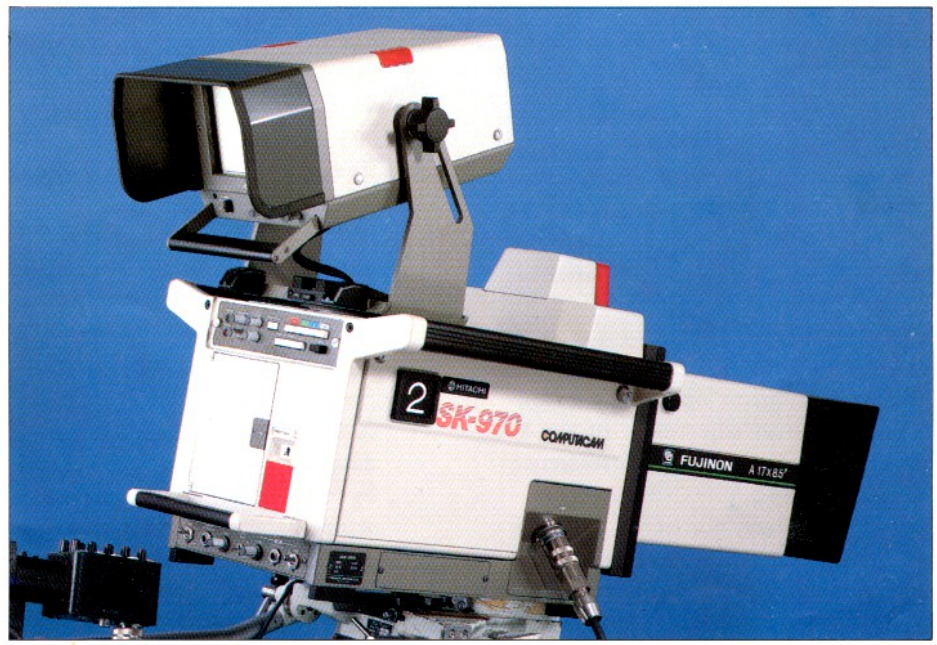
All the controls necessary for camera operation are centralized on a control panel at the rear of the camera for ease of operation.



• Four Video Outputs

The camera is provided with four video outputs; camera out, monitor out, auxiliary out and prompter out.





- **Chroma Keying Outputs**

A built-in chroma keying circuit provides a chroma keying signal output plus R, G and B video signal outputs at the BSU.

- **SMPTE/EBU Color Bar Output**

A built-in color bar generator produces split-field color bars in accordance with the SMPTE (NTSC) or EBU (PAL) standard. This makes it easy to adjust color monitors or to set 100% modulation level in VTR recording.

- **Hi-Fi Microphone Amplifier**

A built-in high-fidelity microphone amplifier accepts a mike with -45 to -60 dBs output level.

- **Two-Wire/Four-Wire Intercom System**

Either 2-wire or 4-wire intercom system can be selected at the BSU.

Versatile Auto Setup System

The auto setup system utilizing a built-in microcomputer greatly reduces routine setup time and provides the highest picture quality at all times.

In addition to conventional setup parameters, the dynamic registration compensation by on-line, real-time processing is introduced to correct registration errors caused by a change in lens zooming and focusing and in prism temperature.

A diascope chart built into an exclusive zoom lens is normally used for auto setup, however, an external setup chart can also be used.

The auto setup system has a great deal of flexibility since it can also be combined with the auto setup system either of the SK-97 or of the SK-110.

- **Zero Method Control**

The zero method of control is capable of setting up the R, G and B channels automatically, thus eliminating a troublesome manual adjustment of the G channel required in the G-reference method.

In addition, a large number of SK-970's can be set up simultaneously in only 2 minutes by the parallel control method when combined with the SCU (Setup Control Unit) in the SK-110 auto setup system.

- **Auto Setup Mode Selection**

The following eight setup modes can be selected according to picture conditions on that occasion and a setup chart available.

1 Auto white
2 Auto black
3 Color balance auto
4 Registration auto
5 Full auto
6 Color balance auto (R, B) with external chart
7 Registration auto (R,B) with external chart
8 Full auto (R,B) with external chart

A typical scene is shot in modes 1 and 2 for the automatic setup of white balance and black balance respectively. A diascope chart built into the lens is used in modes 3, 4 and 5 for the automatic setup of color balance, registration and full parameters (color balance and registration) respectively. In modes 6, 7 and 8, an external setup chart is used for the same setup as in modes 3, 4 and 5. In this case, the picture of the chart should be made to coincide with the frame marker displayed on the viewfinder screen.

- **Data Files**

The following data files are provided for various types of operation. Once data have been stored in the data files, the data are maintained in the files even when the camera power is turned off. This allows you to recall a particular set of data simply and repeatedly.

(1) Auto data file : 1
Automatically stores auto setup data every time the setup of each parameter is completed.

(2) Normal data files : 4
Stores the "difference" in every parameter between the auto setup data and manual setup data, and controls the camera by offset addition to the auto setup data. The manual setup data can be obtained from any of the camera's control panel, RCU and SK-110's SCU. The stored data can also be erased by a CLEAR switch.

(3) Lens data files : 7
Stores lens data for registration errors caused by lens zooming and focusing. The data have been written in ROMs (at the factory) and are used for on-line, real-time compensation for the errors.

(4) Temperature data file : 1
Stores the data for registration errors in centering caused by temperature change inside the prism. The data write-in and usage are the same as in item (3).

- **Fault diagnosis**

Built-in fault diagnosis detects camera failures both in real time and at auto setup time, and provides a character display of the result on the viewfinder screen. The auto setup results are displayed for 5 seconds after setup completion.

(1) On-line real-time diagnosis
  a) Pickup tube deflection protection
  b) Battery voltage
  c) Tube temperature

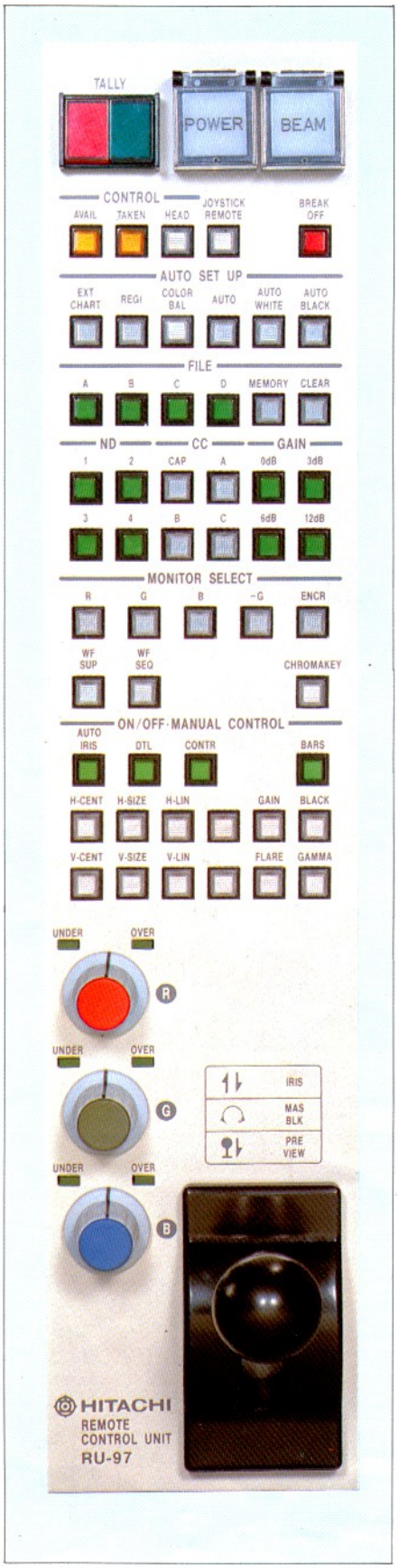
(2) Auto setup diagnosis
  a) Every auto setup parameter

- **RCU (Remote Control Unit)**

The RCU can remotely control all the operations necessary for routine setup through the BSU (Base Station Unit). The operations include auto setup command, data file selection command, data write-in for manual setup, etc.

- **Auto/Manual Setup by Camera Itself**

Since the camera has a built-in microcomputer, the camera can be set up by itself either automatically or manually. A control panel provides selection of the eight auto setup modes and writing of manual setup data into the normal data files. The latter includes GAIN, BLACK, FLARE, GAMMA, H/V CENT, H/V SIZE, H/V LIN, H/V SKEW, H/V BOW, PULCAN and H/V DYNAMIC REGISTRATION (R, B), UL, UR, LL, LR.



Triaxial Digital Command System Available

When an optional digital command system consisting of the MU-970 multi adaptor and the DU-970 DCU is used, all the camera operations can be remotely controlled from the RCU or the SK-110's SCU through a single triaxial cable and also the camera power can be transmitted through the cable.

The MU-970 is built into the camera and the DU-970 of half-rack size is located near the BSU. When a FELTEN 2.5 LS/11.5 cable is used, both are separated by up to 1.8 km (1.1 miles).

Since an FM frequency multiplexed transmission is used for video, audio and command signals, the system ensures excellent transmission quality, especially high signal-to-noise ratio for video and audio signals and high reliability for command signals.

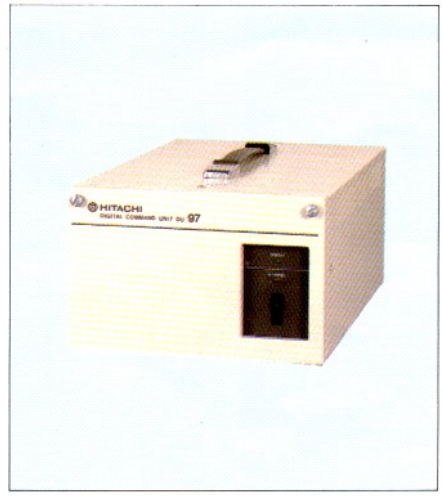
Transmission of the selected monitoring video signal (PIX/WFM/CK) is possible as a standard.

Superior Serviceability

The pickup tubes are rear-loaded for ease of replacement. In particular, the R and the B channel tube can be simply replaced by removing the top and the bottom cover of the camera respectively.

All electronic circuits are divided by function into printed circuit boards with silk screen identification on both sides, and major circuit boards are inserted into a PCB harness with mother board connection.

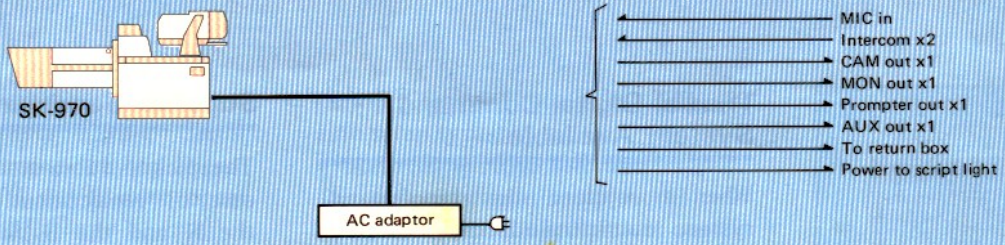
General-purpose electrical parts are selected for ease of maintenance and particularlly, ICs having a second source are used.



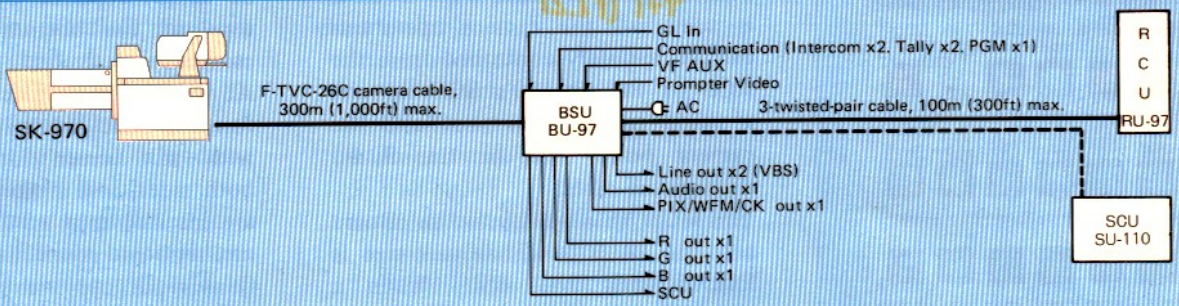


OPERATING SYSTEMS

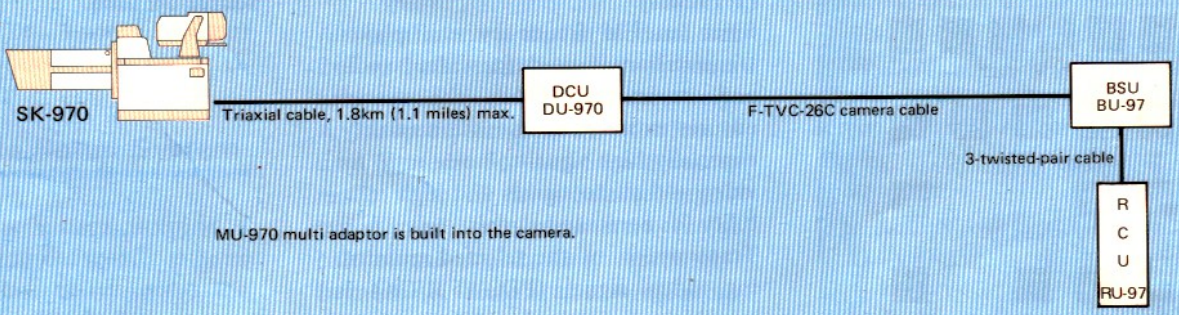
System 1



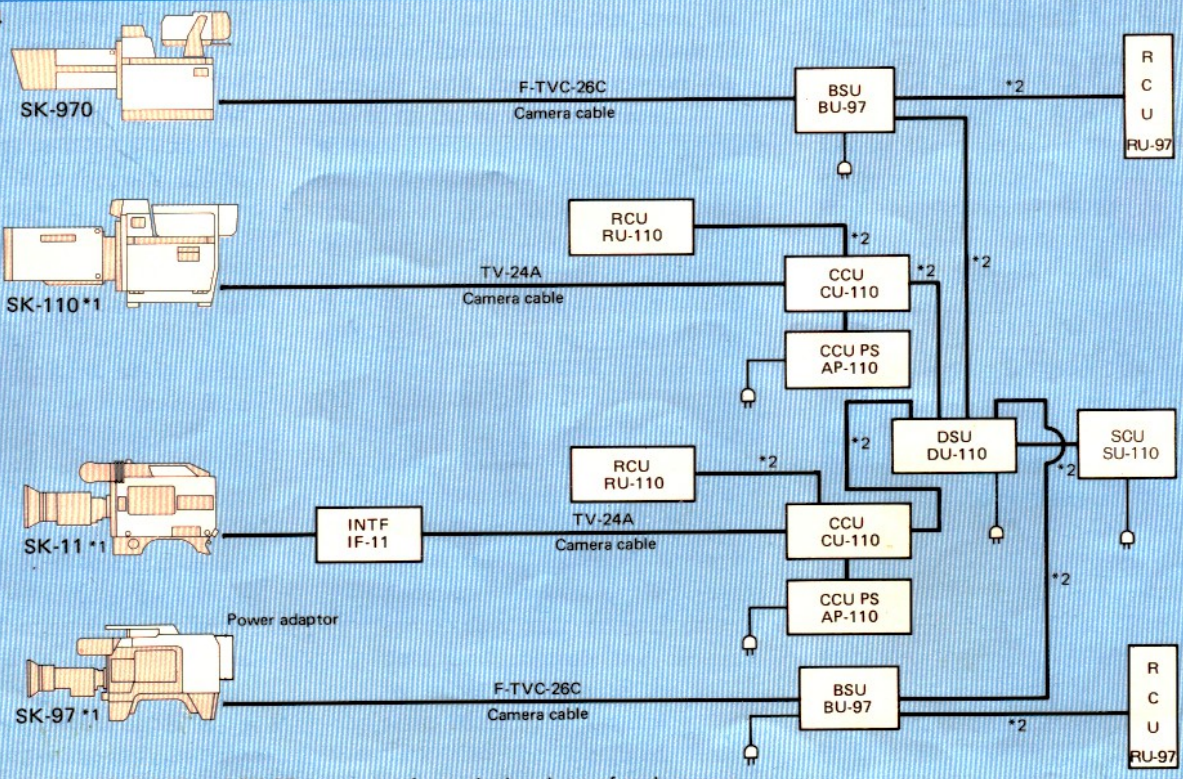
System 2



System 3



System 4



*1: As for the SK-110, SK-11 and SK-97 cameras, refer to the brochure of each camera.
*2: 3-twisted-pair-cable.

SPECIFICATIONS

CAMERA SYSTEM

•Scan standard:	EIA 525/60 fields (NTSC) CCIR 625/50 fields (PAL)
•Pickup tubes:	Three 2/3-inch tubes of SATICON, DG SATICON/Plumbicon, or LOC DG SATICON/Plumbicon
•Optical system:	Dichroic prism (f1.4) with built-in bias light 971 (f1.2)
•Optical filters	
ND:	6.3, 25, 100% and an optional special effect filter
Color:	3200, 4700, 5600°K and capped
•Viewfinder:	7-inch
•BSU input signals	
Genlock:	Color composite 1.0Vp-p or black burst 0.3/0.3Vp-p
VF AUX:	Color composite 1.0Vp-p or B/W composite 1.0Vp-p
Prompter video:	Color composite 1.0Vp-p or B/W composite 1.0Vp-p
Intercom:	0dBm x 2 for PD/ENG'R
•BSU output signals	
Line:	Color composite 1.0Vp-p x 2
Monitor:	PIX (R, G, B, R-G, B-G or encoded video 1.0Vp-p), WFM (superposed/sequential), or CK (keying signal), switch-selectable
RGB:	R, G, B 0.7Vp-p
Audio:	0 or -20dBm
Intercom:	0dBm x 2 for PD/ENG'R
•Sensitivity:	f4, 2000 lux (200fc) at 3200°K, for gray chart of 89.9% reflectance
•SN ratio(typical):	59dB NTSC, 56dB PAL (LOC DG SATICON/Plumbicon) 57dB NTSC, 54dB PAL (DG SATICON/Plumbicon, SATICON) for output luminance signal, with gamma off, detail off **[Instrument used]** Rohde & Schwarz noise meter with 100kHz HPF, 4.2MHz LPF (NTSC), 5.0MHz LPF (PAL), SC trap and blanking gate on.
•Horizontal resolution:	700TV lines at center (LOC DG SATICON. DG SATICON) 650TV lines at center (LOC DG Plumbicon, DG Plumbicon) 600TV lines at center (SATICON)
•Registration	
Zone 1 (within a circle of a diameter equal to 80% picture hieght):	0.05% of picture height
Zone 2 (within a circle of a diameter equal to picture height):	0.1% of picture height
Zone 3 (elsewhere):	0.2% of picture height
•Geometric distortion:	1.0% of picture height in entire area

AUTO SETUP SYSTEM

•Control method:	Zero method
•Control parameters	
Color balance:	5 parameters for R, G and B channels; gain, black level, gamma, flare and pulse cancel
Registration:	5 parameters for R, G and B channels; centering, size, linearity, skew and bow for H and V directions, and 4-corner compensation for R, B channels
•Operating modes	
Auto white:	White balance only
Auto black:	Black balance only
Color balance auto:	Color balance-related parameters as in the preceding item
Registration auto:	Registration-related parameters as in the preceding item
Full auto:	All parameters for color balance and registration
Color balance auto/ext. chart:	color balance auto (R, B) with external chart
Registration auto/ ext. chart:	Registration auto(R,B)with external chart
Full auto/ext. chart:	Full auto (R,B) with external chart
•Data files	
Auto data file:	1 for auto setup data
Normal data files:	4 for manual setup data
Lens data files:	7 lens data files in ROM for dynamic registration compensation
Temperature data file:	1 data file in ROM for temperature characteristics data of prism for dynamic registration compensation
•Fault diagnosis	
Real time diagnosis:	Deflection protection, battery voltage and tube temperature
Auto setup diagnosis:	Every auto setup parameter

GENERAL RATINGS

•Power requirement:	100/117/220/240V AC ±10% 50/60 ±5Hz, approx. 250VA
•Environmental conditions	
Ambient temperature:	-20 to + 45°C (-4 to + 113°F) with SATICONs -20 to + 50°C (-4 to + 122°F) with Plumbicons
Relative humidity:	35 to 90%
Operating altitude:	Up to 3000m (10,000ft) ASL
RF Interference:	130dBμ from MF to UHF

SPECIFICATIONS

DIMENSIONS AND WEIGHT

(* Handles included)

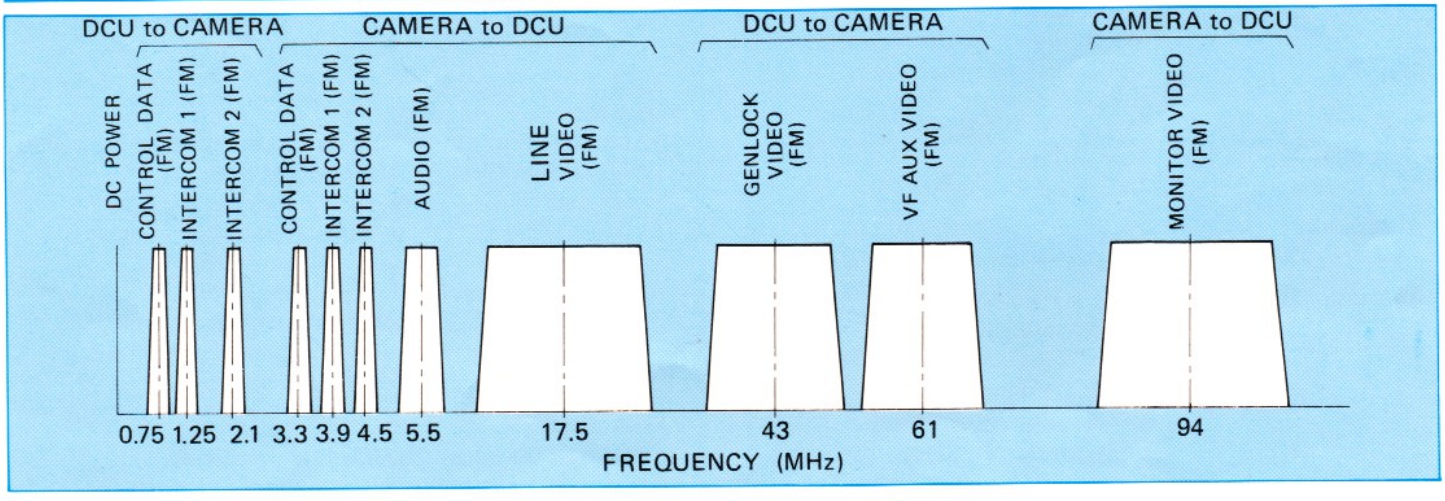
	Width		Height		Depth		Weight (approx.)	
	mm	in	mm	in	mm	in	kg	lb
Camera	369*	14.5	465	18.3	440	17.3	25	55.0
BSU	210	8.3	180	7.1	350	13.8	9	19.8
RCU	76	3.0	360	14.2	160	6.3	3.8	8.4

DIGITAL COMMAND SYSTEM

- **Signals transmitted from camera to BSU:**
  - Line video
  - Monitor video
  - Audio
  - Intercom
  - Control data
- **Signals transmitted from BSU to camera:**
  - Viewfinder video
  - Genlock input
  - Intercom
  - Control data

- **SN ratio**
  - **Line video:** 58dB (BELDEN 9232 400m 20°C)
  - **Audio:** 56dB
- **Power requirement**
  - **DU-970 DCU:** 100/117/220/240V AC ±10% 50/60Hz, 30VA
  - **MU-970 Multi adaptor:** 12V DC, 12W
- **Dimensions and wieght**
  - **DU-970:** 210 (W) x 133 (H) x 350 (D) mm (8.3 x 5.2 x 13.8 in), 8.5 kg (18.7 lb)
  - **MU-970:** Built into camera 3.5 kg (7.7 lb)

FREQUENCY SPECTRUM



MAXIMUM USABLE CABLE LENGTH

TYPE	Dia. (mm)	Maker	Length (m/ft)
1.0S/4.5S	8.5	Felten	600/2,000
1.4S/6.6S	11.0	Felten	900/3,000
2.1LS/10S	14.4	Felten	1,500/5,000
2.5LS/11.5	16.2	Felten	1,800/6,000
9267	9.1	Belden	500/1,650
9232	13.2	Belden	1,200/4,000
4.8/1.0 EFTXF	8.6	Fujikura	700/2,300
9.6/2.22 EFTXF	14.5	Fujikura	1,500/5,000

1. Use the supplied attenuator when employing a cable shorter than 20% of the standard length shown in the table.
2. Cable loss is 60dB at 100MHz
3. The DC resistance of the cable is less than 22 ohms.

SUGGESTED COMPOSITIONS

COMPONENT	Type	Camera Cable Operation	Triaxial Cable Operation
Camera Head w/Tubes (Tubes to be specified)	SK-970	●	●
Standard Accessories		●	●
a) 7" Viewfinder	VF-710		
b) Extension Board			
c) Spare Fuses			
d) Instruction Manual			
17 x Studio Lens	A17x8.5BESM-17P	●*1	●*1
14 x Studio Lens	A14x8BESM-17P	●*1	●*1
30 x Studio Lens	A30x11BESM-17P	●*1	●*1
15 x Studio Lens	J15x8.5B4IE-P	●*1	●*1
20 x Studio Lens	J20x8.5B4IE-P	●*1	●*1
25 x Studio Lens	J25x11.5B4IE-P	●*1	●*1
Base Station Unit	BU-97	●	●
Remote Control Unit	RU-97	●	●
Digital Command Unit	DU-970		●
Script Lamp			
Script Holder			
Return Box			
AC Adaptor	AP-90	●	●

*1 Select one among six exclusive lenses (with buil-in diascope for auto setup).

CONTROL PARAMETERS, LOCATIONS, AND OPERATING MODES

CONTROL LOCATIONS AND OPERATING MODES / CONTROL PARAMETERS AND DISPLAY	CAMERA (SK-97/970)										BSU (BU-97)	RCU (RU-97)		SCU (SU-110)	
	MANUAL		AUTO SETUP												
	CTL PANEL	CHASSIS	AUTO WHT	AUTO BLK	COLOR BALANCE	REGIST	FULL	COLOR BALANCE / EXT	REGIST / EXT	FULL / EXT		MAN	AUTO	MAN	AUTO
ON/OFF CONTROL															
1. MON SEL															
G		●										●		●	
R		●										●		●	
B		●										●		●	
R-G		●										●		●	
B-G		●										●		●	
RGB		●										●		●	
ENCR		●										●		●	
AUX		●													
2. WFM															
SUPER												●		●	
SEQ												●		●	
3. POWER	●										●	●		●	
4. BEAM	●										●	●		●	
5. TALLY CALL	●											●		●	
6. CAM/BARS	●											●		●	
7. ND FILTER	●											●		●	
(1-4)															
8. CC FILTER	●											●		●	
(A-D)															
9. GAIN	●											●		●	
0, 9, 18 dB															
10. CONTRAST	●											●		●	
11. INTERCOM															
LEVEL	●														
12. BREAK OFF	●											●		●	
13. TEST															
(1) PRA TST	●													●	
(2) PRC TST	●													●	
14. DETAIL	●											●		●	
15. ABO	●													●	
16. WOBBLE(Focus)	●														
17. SCAN	●													●	
18. BIAS LIGIHT	●													●	
19. GAMMA	●													●	
20. WHT CLIP	●													●	
21. KNEE	●													●	
22. REGIST COMP	●														
23. MASK	●													●	
24. MASK 1or2	●														
25. FILE SELECT												●		●	
26. PROJECT	●													●	
27. VTR SEL -1	●														
28. VTR SEL -2	●														
29. LENS FILE SELECT	●														

CONTROL LOCATIONS AND OPERATING MODES / CONTROL PARAMETERS AND DISPLAY		CAMERA (SK-97/970)										B S U (BU-97)	R C U (RU-97)		S C U (SU-110)	
		MANUAL	AUTO SETUP													
		CTL PANEL	CHAS-SIS	AUTO WHT	AUTO BLK	COLOR BALANCE	REGIST	FULL	COLOR BALANCE / EXT	REGIST / EXT	FULL / EXT		MAN	AUTO	MAN	AUTO
AUTO CONTROL	1. AUTO WHT			●										●		●
	2. AUTO BLK				●									●		(●)
	3. COLOR BALANCE					●								●		●
	4. REGIST						●							●		●
	5. FULL							●						●		●
	6. COLOR BALANCE / EXT								●					●		(●)
	7. REGIST/EXT									●				●		(●)
	8. FULL/EXT										●			●		(●)
	9. G-REF															●
	10. AUTO IRIS												●	●		●
	11. AUTO BLK-L		●													
COLOR BALANCE	1. GAIN		●			●		●	●R.B		●R.B		●	●	●	●
	2. BLACK		●			●		●	●R.B		●R.B		●	●	●	●
	3. FLARE		●			●		●	●R.B		●R.B		●	●	●	●
	4. GAMMA		●			●		●	●R.B		●R.B		●	●	●	●
	5. PUL CAN		●			●		●						●	●	●
	6. MASTER BLK		●										●		●	
	7. IRIS												●		●	
REGISTRATION	1. H-CENT		●				●	●		●R.B	●R.B		●	●	●	●
	2. V-CENT		●				●	●		●R.B	●R.B		●	●	●	●
	3. H-SIZE		●				●	●		●R.B	●R.B		●	●	●	●
	4. V-SIZE		●				●	●		●R.B	●R.B		●	●	●	●
	5. H-LIN		●				●	●		●R.B	●R.B		●	●	●	●
	6. V-LIN		●				●	●		●R.B	●R.B		●	●	●	●
	7. H-SKEW		●				●	●		●R.B	●R.B			●	●	●
	8. V-SKEW		●				●	●		●R.B	●R.B			●	●	●
	9. H-BOW		●				●	●		●R.B	●R.B			●	●	●
	10. V-BOW		●				●	●		●R.B	●R.B			●	●	●
	11. DYNAMIC REGIST		●R.B				●R.B	●R.B		●R.B	●R.B			●R.B	●R.B	●R.B

( ) only for SU-110A