COMPUTACAM

SK-97

Hitachi Full Auto-Setup EFP Camera



HITACHI

Full Auto Setup EFP Camera
The Ultimate in Automated Portable Cameras

The Hitachi SK-97 is an epoch-making, 2/3-inch, 3-tube, portable color camera with full auto setup functions. The camera satisfies all the requirements necessary for a portable camera in EFP and studio 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-97 employs the same auto setup system as that of the sister camera SK-970 for studio portable use, and can be used in combination with the SK-970. In addition, the SK-97 can be controlled by the SK-110 full auto setup studio camera system too.

The SK-97 weighs approximately 6.8 kg (15 lb) excluding a lens in spite of improvement in performances and addition of the auto setup functions.

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), *f* 4 owing to a newly developed low-noise preamplifier and a new low-noise FET.

- **Improved Prism Optics**

Newly developed, high speed (*f* 1.4) 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

FEATURES

Great Ease of Operation

- **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, natual 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.

- **High-Brightness, High-Resolution Viewfinder**

A 1.5-inch, tiltable, high-brightness, high-resolution viewfinder with a magnifying eyepiece assures precise focusing and picture composition. A built-in peaking circuit further serves for attaining sharp optical focus of the lens.

An optional 5-inch viewfinder is also available for studio or field use.

- **Viewfinder Character Display**

The following indications and alarms are displayed on the 1.5-inch or 5-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.

- **Power Supply Options**

The SK-97 can be powered by a battery belt, an attachable battery pack,a car battery, an AC power adaptor or from a battery of the VTR connected to the camera.

- **PREHEAT/CAM ON Switch**

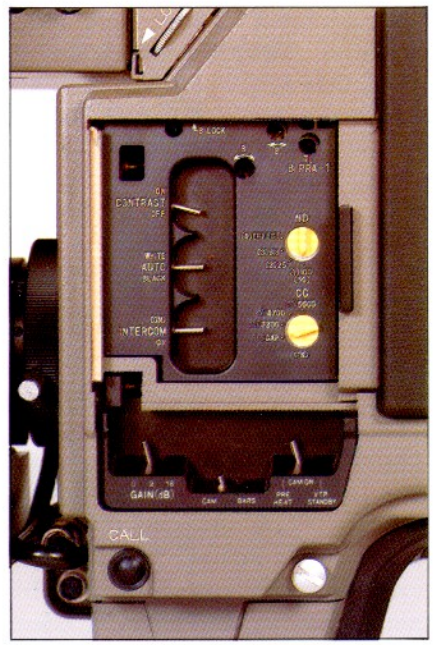
In the preheat mode, the camera draws only a few percent of the normal power for energizing the heater of the pickup tube and the CRT, and the lens driving mechanism. After switching to the cam on mode, normal operation is accomplished in only 5 to 6 seconds.

- **+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 lower front part of the left side for ease of operation. Controls unnecessary during live shooting such as ND and color filter selection can be



covered with a sliding protection cover to prevent accidental operation.

- **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.

- **Selectable YIQ/RGB Outputs**

A YIQ output circuit including an I sync generator is incorporated and the R, G and B signal outputs for chroma keying can be switched to the Y, I and Q signals for recording on a 1/2-inch M-format VTR.

- **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 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 portable 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-970 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-97'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 occassion 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 data 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**

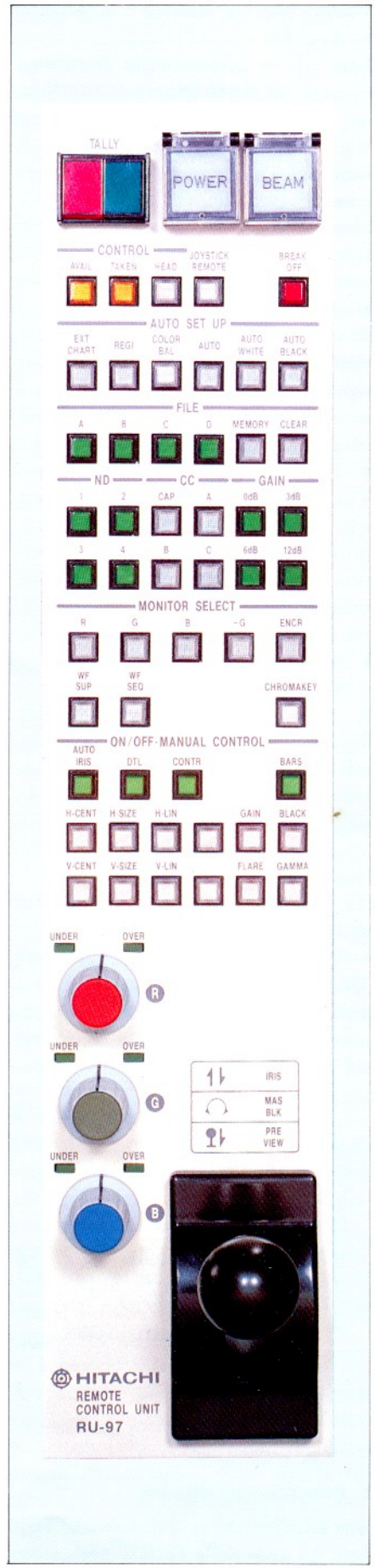
Built-in fault diagnosis detects camera failures both in real time and at auto setup time, and provides a character display of the result on the viewfinder screen. The auto setup results are displayed for 5 seconds after setup completion.

(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)**

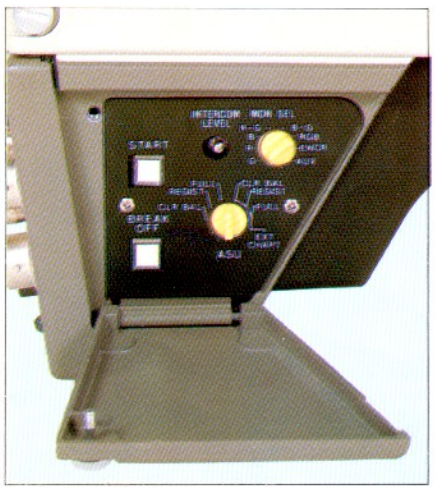
The RCU can remotely control all the operations necessary for routine setup through the BSU (Base Station Unit). The operations include auto setup command, data file selection command, data write-in for manual setup, etc.



- **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 a data panel provides 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.





Digital Command System Available

When an optional digital command system consisting of the MU-97 multi adaptor and the DU-97 DCU is used, all the camera operations can be remotely controlled from the RCU or the SK-110's SCU through a single coaxial cable. The MU-97 is attached to the camera side cover and the DU-97 of half-rack size is located near the BSU.

In addition, when a TX-97 triaxial adaptor is used together with the above units, power transmission as well as camera control is possible through a single triaxial cable of up to 2.3 km (1.4 miles) in case of using a FELTEN 2.5 LS/11.5 cable.

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 also available as an option.

Advanced Mechanical Design

- **Rugged and Lightweight**

Advanced design of the camera housing with magnesium alloy casting, new construction of the optical and mechanical sub-assemblies and careful selection of the electronic parts have realized ruggedness to withstand rough handlings and environmental extremes. The camera weighs approximately 6.8 kg (15.0 lb) including the 1.5-inch viewfinder in spite of inclusion of the new auto setup system.

- **Shock- and Vibration- Free**

A new shock- mounted optical system, with prism, yokes and tubes packaged as a single assembly, assures registration stability, making the camera virtually impervious even to severe shocks, vibrations and jolts encountered in transportation.

- **RF Interference- Free**

Inproved electromagnetic shield for tubes, yokes and preamplifiers, together with a mesh strip on the circumference of the side cover inside, guarantees practically interference- free operation even in the electric field of 130 dB from MF to UHF.

- **Improved Weight Balance**

Lens mounting position is lowered to reduce the front and rear weight unbalance by the zoom lens.



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.

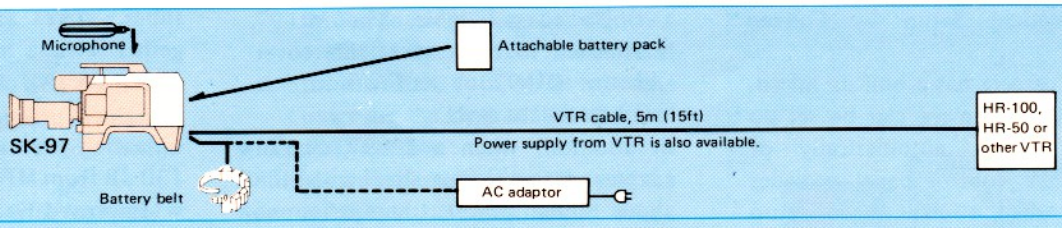
All electronic circuits are divided by function into printed circuit boards with silk screen identification on both sides, and major circuit boards are inserted into a PCB harness with mother board connection.

General-purpose electrical parts are selected for ease of maintenance and particularly, IC's having a second source are used.

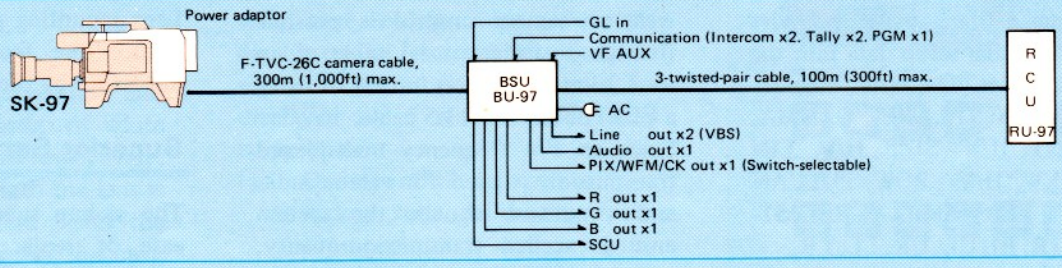


OPERATING SYSTEMS

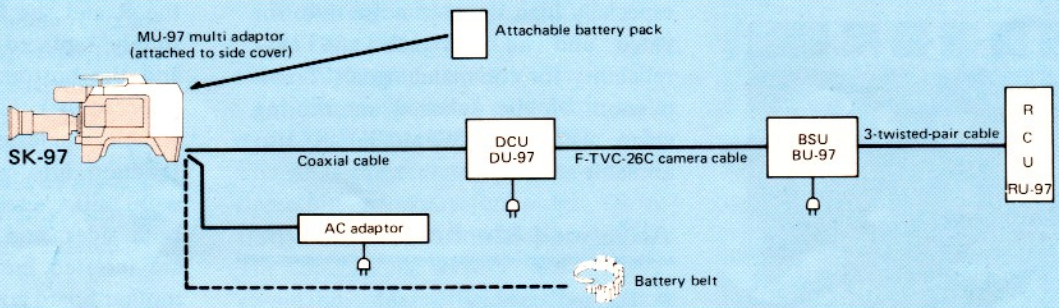
System 1



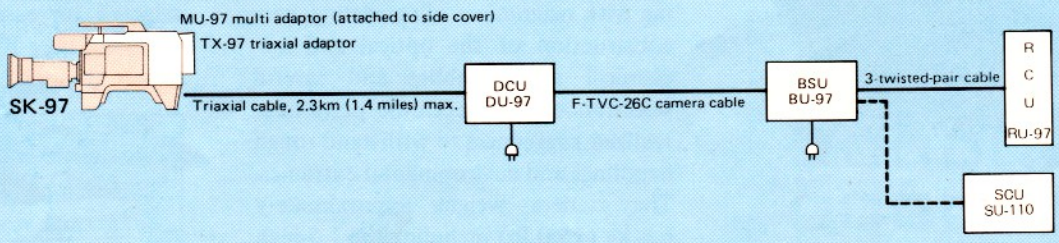
System 2



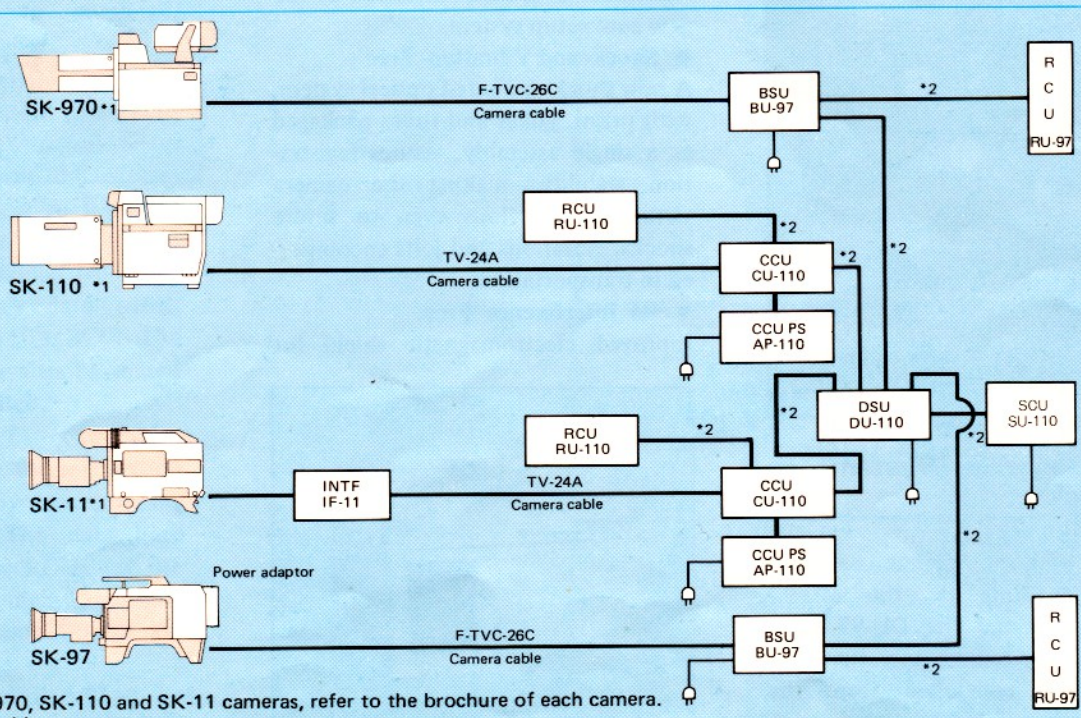
System 3



System 4



System 5



*1: As for the SK-970, SK-110 and SK-11 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
•Lens mount:	Bayonet
•Optical filters	
ND:	6.3, 25, 100% and an optional special effect filter
Color:	3200, 4700, 5600°K and capped
•Viewfinder:	1.5-inch (standard) 5-inch (option)
•Input signals	
Genlock:	Color composite 1.0Vp-p or black burst 0.3/0.3Vp-p
VF AUX in at BSU:	Color composite 1.0Vp-p
Audio in at camera:	-45 to -60 dBs (microphone)
•Output signals	
Line out at camera:	Color composite 1.0Vp-p x 1
Line out at BSU:	Color composite 1.0Vp-p x 2
RGB/YIQ out:	R, G, B or Y, I, Q selectable
MON out at camera:	R, G, B, R-G, B-G or encoded video 1.0Vp-p, switch-selectable
MON out at BSU:	PIX (same as above), WFM (superposed/sequential), or CK (keying signal), switch-selectable
Audio out:	-20dBm
•Sensitivity:	f4, 2000 lux (200 fc) 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 height):	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	
Camera:	12V (10.5 to 17.0V) DC, approx. 28W
BSU:	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

DIGITAL COMMAND SYSTEM

•Signals transmitted from camera to BSU:

Line video
Monitor video (option)
Audio
Intercom
Control data

•Signals transmitted from BSU to camera:

Viewfinder video
Genlock input
Intercom
Control data

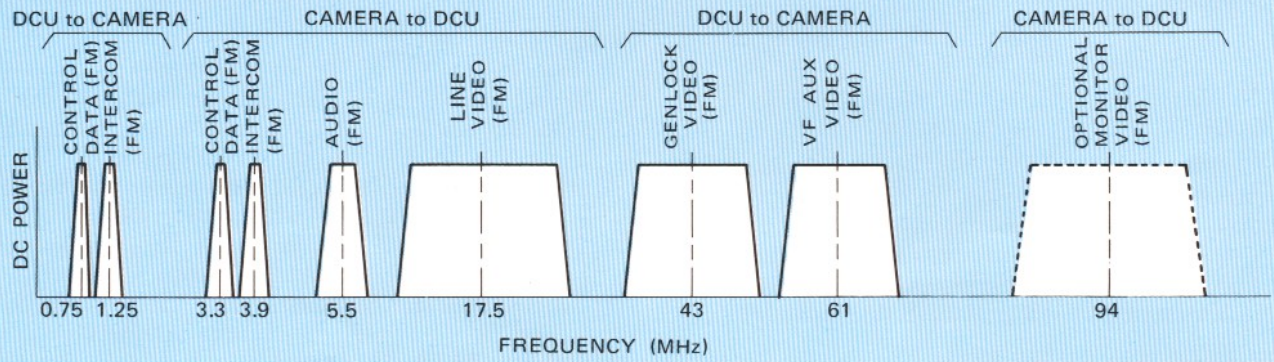
•SN ratio

Line video: 58dB (BELDEN 9232 600m 20°C)
Audio: 56dB

•Power requirement

DU-97 DCU: 100/117/220/240V AC ±10% 50/60Hz, 30VA
MU-97 Multi adaptor: 12V DC, 12W

FREQUENCY SPECTRUM



MAXIMUM USABLE CABLE LENGTH

	TYPE	Dia. (mm)	Maker	Length (m/ft)	
				Standard	Optional monitor
TRIAXIAL CABLE	1.0S/4.5S	8.5	Felten	800/2,650	600/2,000
	1.4S/6.6S	11.0	Felten	1,200/4,000	900/3,000
	2.1LS/10S	14.4	Felten	1,900/6,300	1,500/5,000
	2.5LS/11.5	16.2	Felten	2,300/7,650	1,800/6,000
	9.267	9.1	Belden	900/3,000	700/2,300
	9.232	13.2	Belden	1,600/5,300	1,200/4,000
	4.8/1.0 EFTXF	8.6	Fujikura	1,000/3,300	700/2,300
	9.6/2.22 EFTXF	14.5	Fujikura	2,000/6,650	1,500/5,000
COAXIAL CABLE	RG-59B/U	6.2		650/2,150	500/1,650
	RG-6A/U	8.4		850/2,800	600/2,000
	RG-11A/U	10.3		1,100/3,650	800/2,650

1. Use the supplied attenuator when employing a cable shorter than 20% of the standard length shown in the table.
2. Cable loss
   Standard unit Less than 80dB at 100MHz
   Optional monitor Less than 60dB at 100MHz

DIMENSIONS AND WEIGHT

	Width		Height		Depth		Weight (approx.)	
	mm	in	mm	in	mm	in	kg	lb
Camera	100	3.9	280	11.0	355	14.0	6.8	15.0
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
DU-97	210	8.3	133	5.2	350	13.8	8.0	17.6
MU-97	30	1.2	155	6.1	350	13.8	1.6	3.5
TX-97	111	4.3	171	6.7	42	1.7	0.9	2.0

SUGGESTED COMPOSITIONS

Component	Type	ENG	EFP	
			Camera Cable Operation	Triaxial Cable Operation
Camera Head w/Tubes (Tubes to be specified)	SK-97	●	●	●
Standard Accessories		●	●	●
a) 1.5" Viewfinder	VF-154			
b) Extension Board				
c) Shoulder Mount				
d) Camera Cover	DC-97			
e) Spare Fuses				
f) Instruction Manual				
14 x Portable Lens	A14x9BERM-7P	●*1	●*2	●*2
14 x Studio Lens	A14x8BESM-17P		●*2	●*2
17 x Studio Lens	A17x8.5BESM-17P		●*2	●*2
30 x Studio Lens	A30x11BESM-17P		●*2	●*2
13 x Portable Lens	J13x9B4IE-2P	●*1	●*2	●*2
15 x Studio Lens	J15x8.5B4IE-P		●*2	●*2
20 x Studio Lens	J20x8.5B4IE-P		●*2	●*2
25 x Studio Lens	J25x11.5B4IE-P		●*2	●*2
Base Station Unit	BU-97		●	●
Remote Control Unit	RU-97		●	●
Digital Command Unit	DU-97			●
Multi Adaptor	MU-97			●
Triaxial Adaptor	TX-97			●
Monitor Video Units	DM-97M/DM-97D			●
Tripod Mounting Attachment	TA-97	●	●	●
Battery Pack	BP-97	●*1		
Battery Belt	PB-97	●*1		
Battery Charger	BC-15	●		
AC Adaptor *4	AP-40	●	●*3	
5" Viewfinder	VF-502		●	●
Carrying Case	CL-97	●		
VTR Cable for HR-100 (available for another VTR)	C-501VC	●		
Camera Cable (100m)	C-103CR		●	
Triaxial Cable (200m)	C-204T5			●

*1 Select either one according to your choice.
*2 Select one among eight exclusive lenses (with built-in diascope for auto setup).
*3 It is necessary to use exclusive accessories when operating with full servo lens.
*4 AP-90 (AC adaptor) should be used in case of camera with 5" viewfinder.

CONTROL PARAMETERS, LOCATIONS, AND OPERATING MODES

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	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