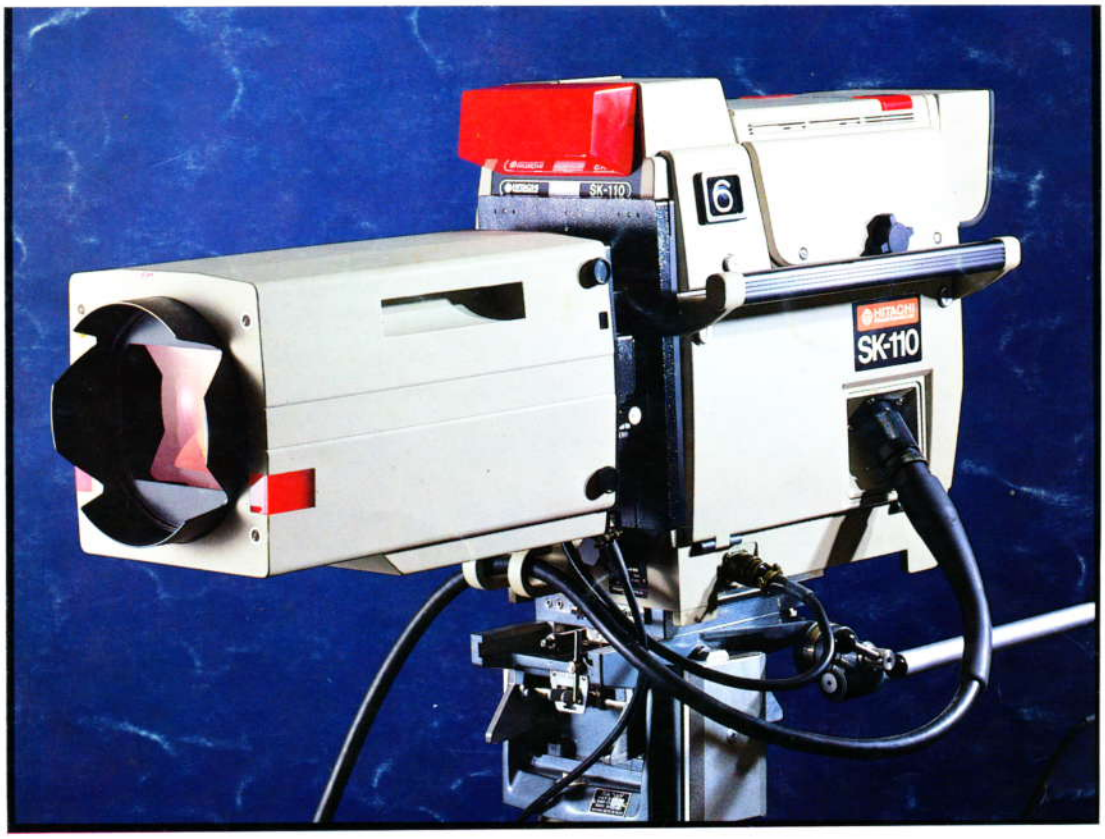
SK-110

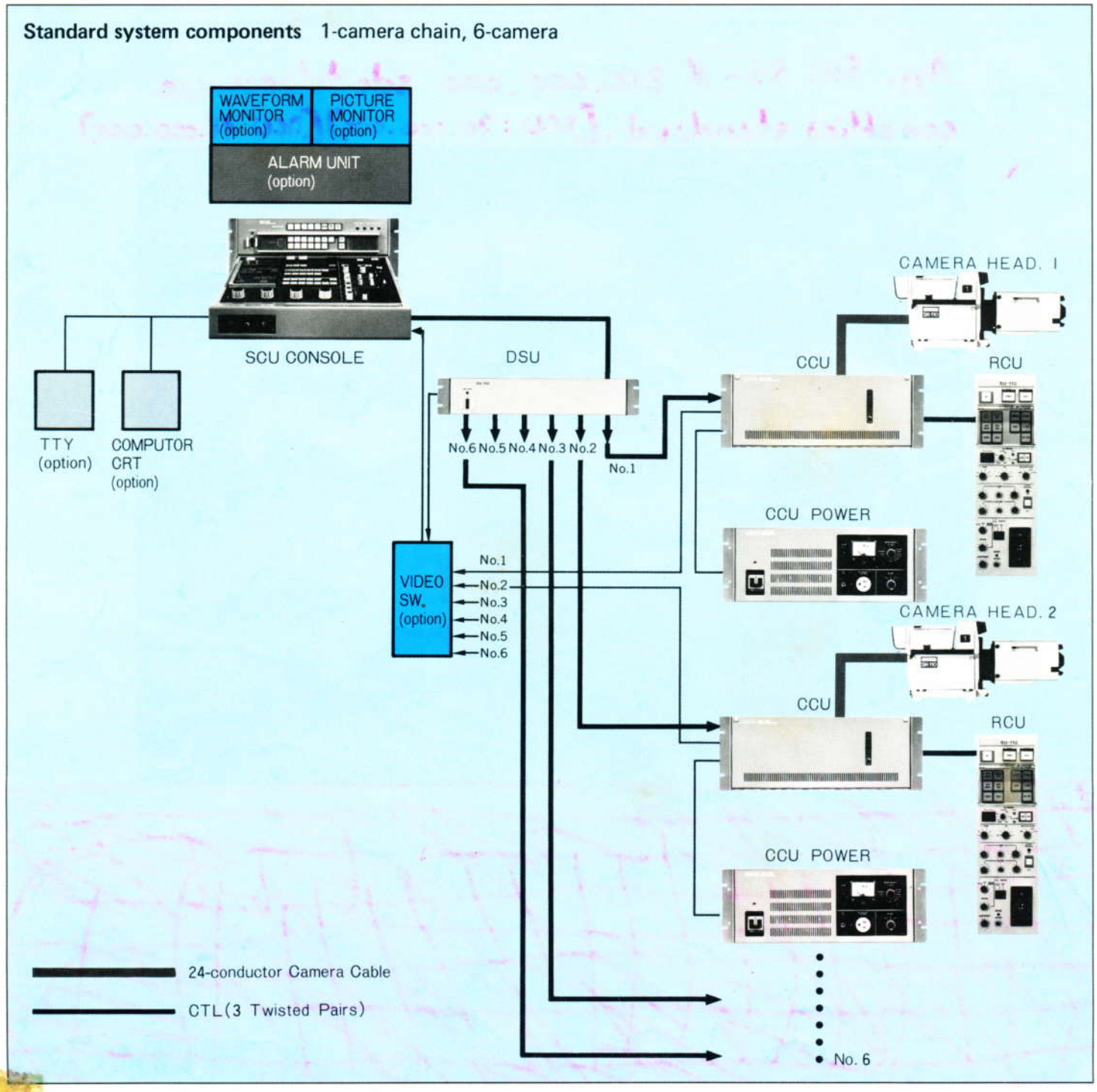
Hitachi Full Auto-Setup Colour TV Camera

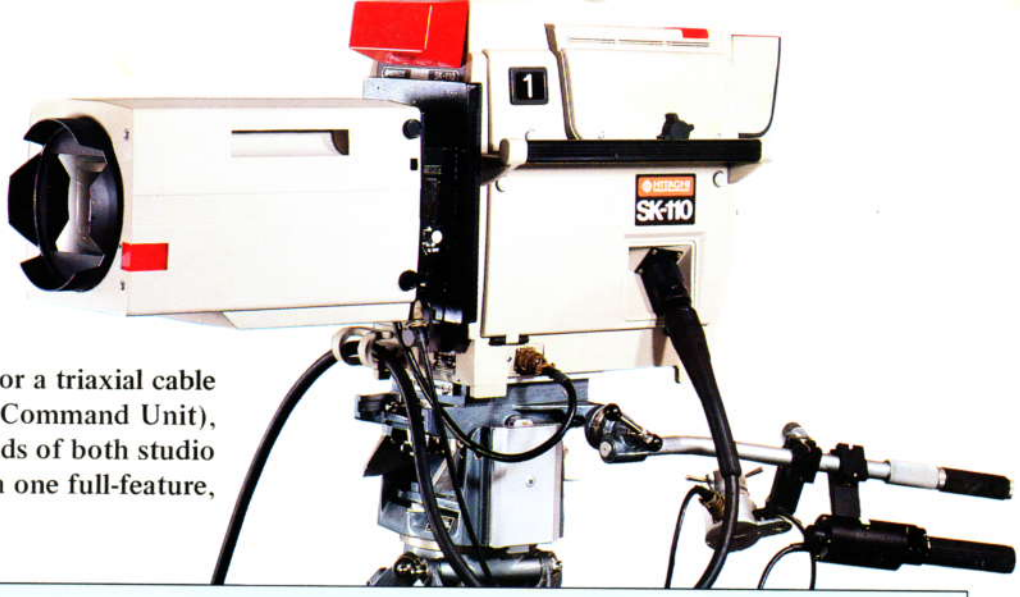
- type PAL -



The SK-110 Introduces a New Concept in Studio Cameras

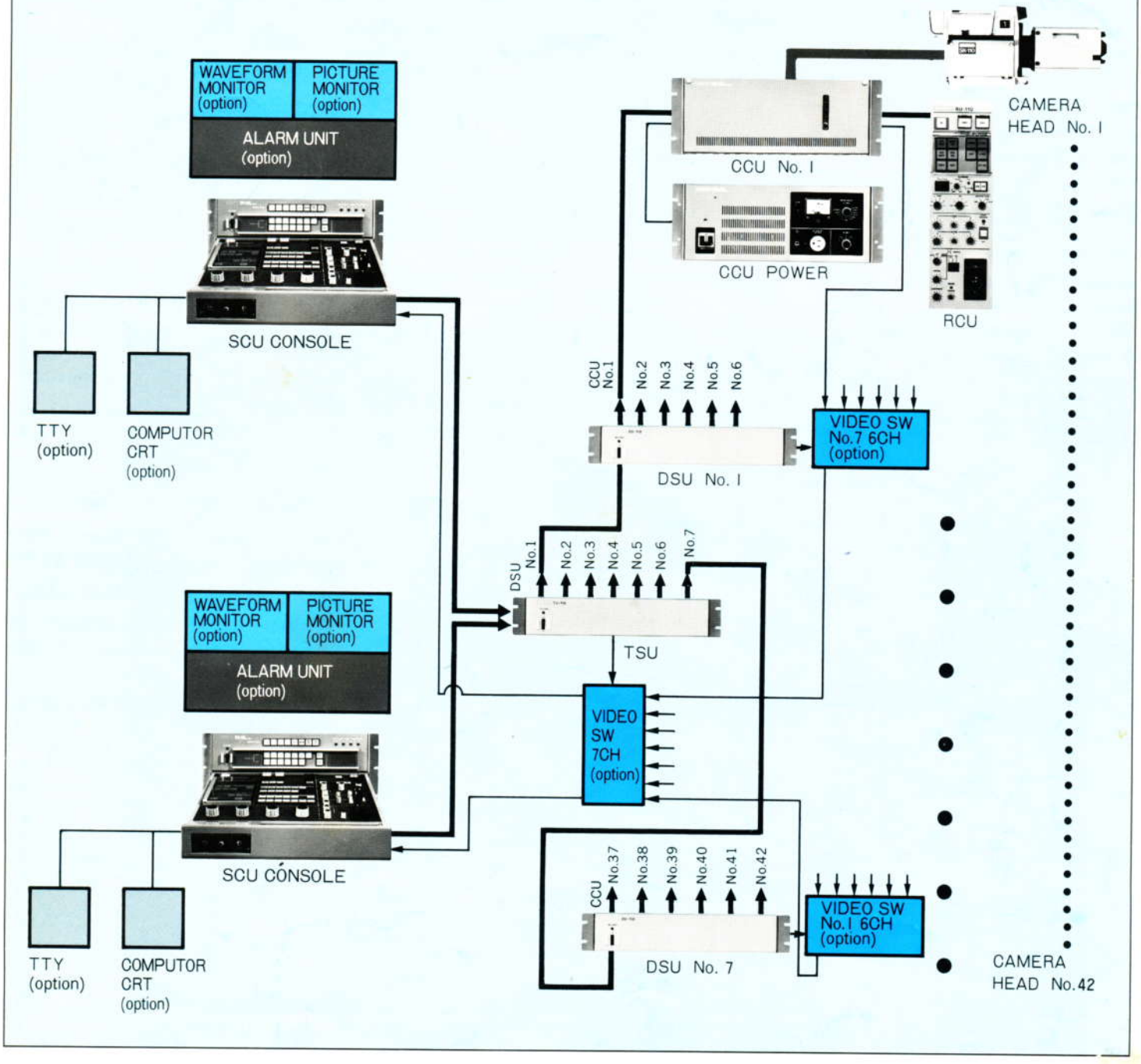
The SK-110 makes full use of the latest microcomputer technology with its μDDC (Microcomputerized Direct Digital Control) system of full auto-setup to ensure the highest picture quality.
This auto-setup system makes use of the zero method to control 31 parameters automatically enough capability to handle most operating controls and features a automatic fault diagnosis function as well.
Flexibility has been built into this building block configured system to allow it to handle basic camera chains as well as large-scale camera systems.
The SK-110 picture quality has been improved in sensitivity, S/N, and registration accuracy and this high-performance camera can be used with either a small-

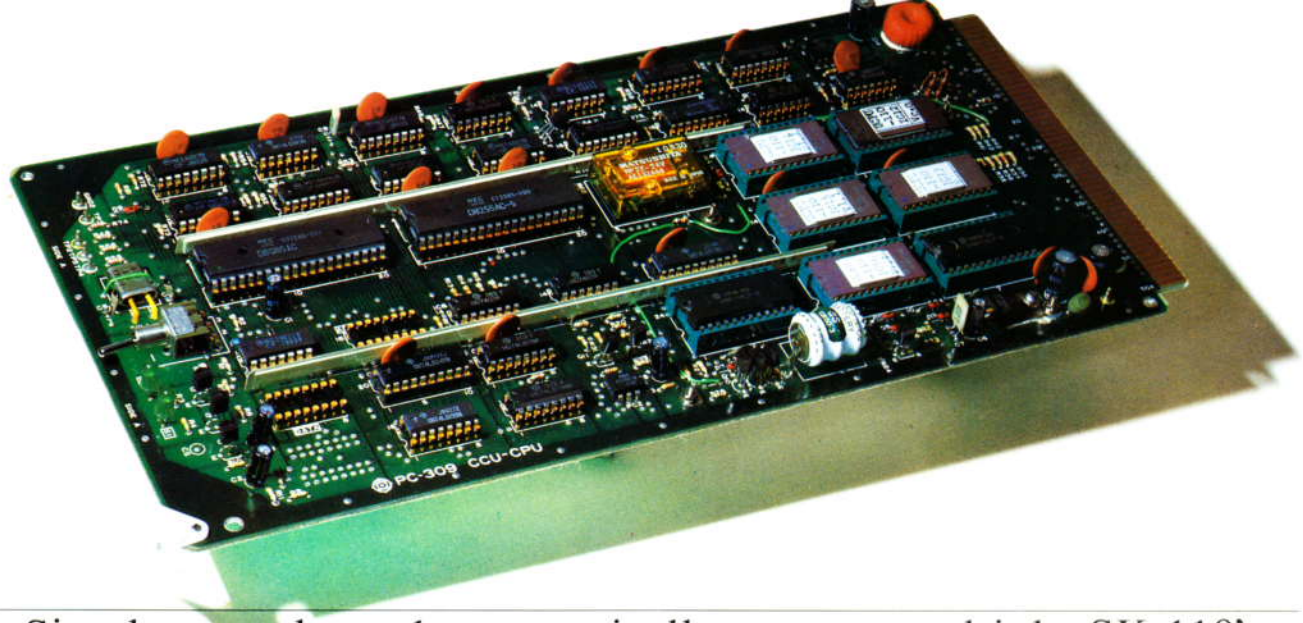




diameter, 24-conductor camera cable or a triaxial cable in combination with a DCU (Digital Command Unit), making it possible to satisfy the demands of both studio and remote location applications with one full-feature, high performance camera.

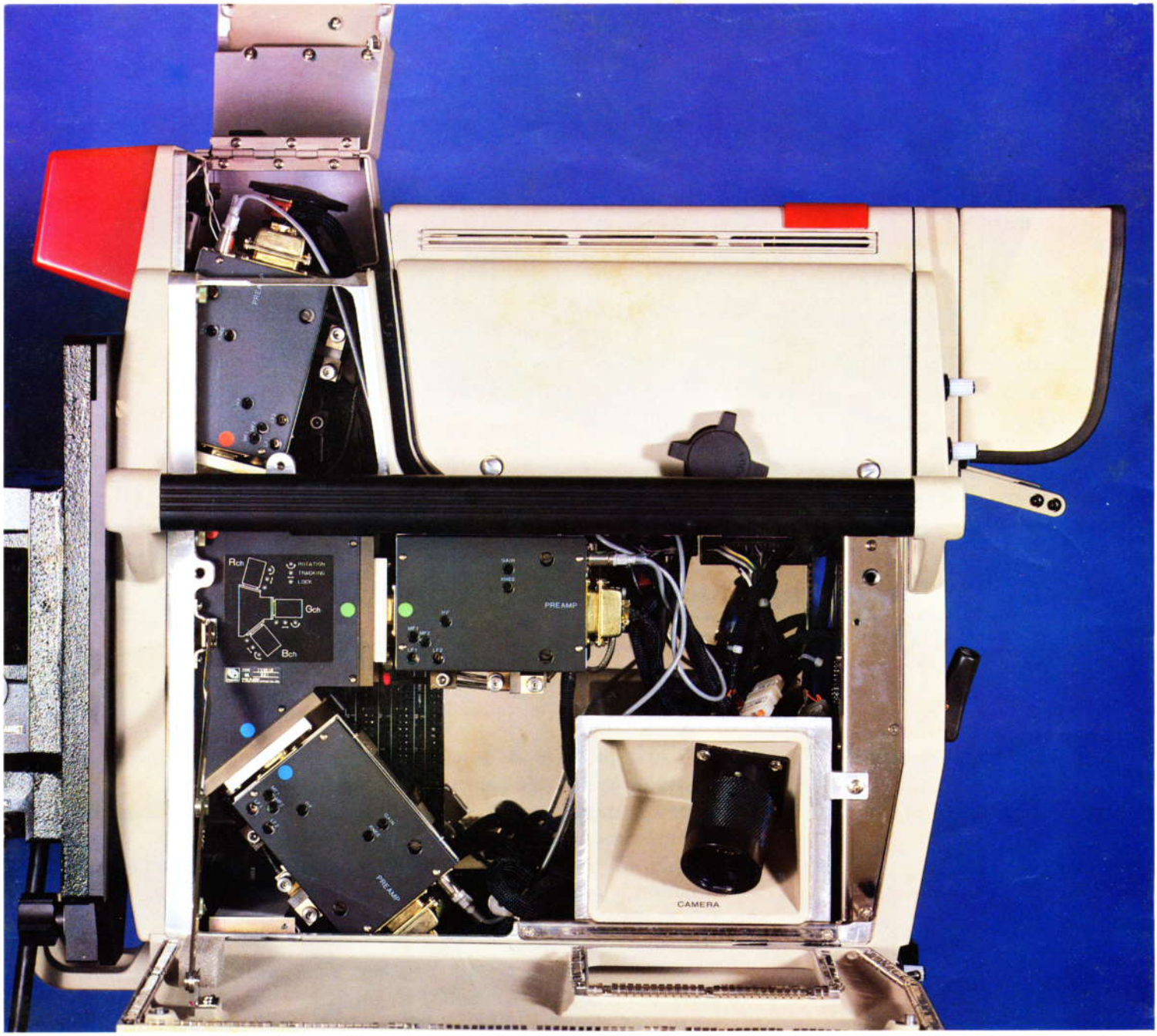
Large-scale system 2 setup stations

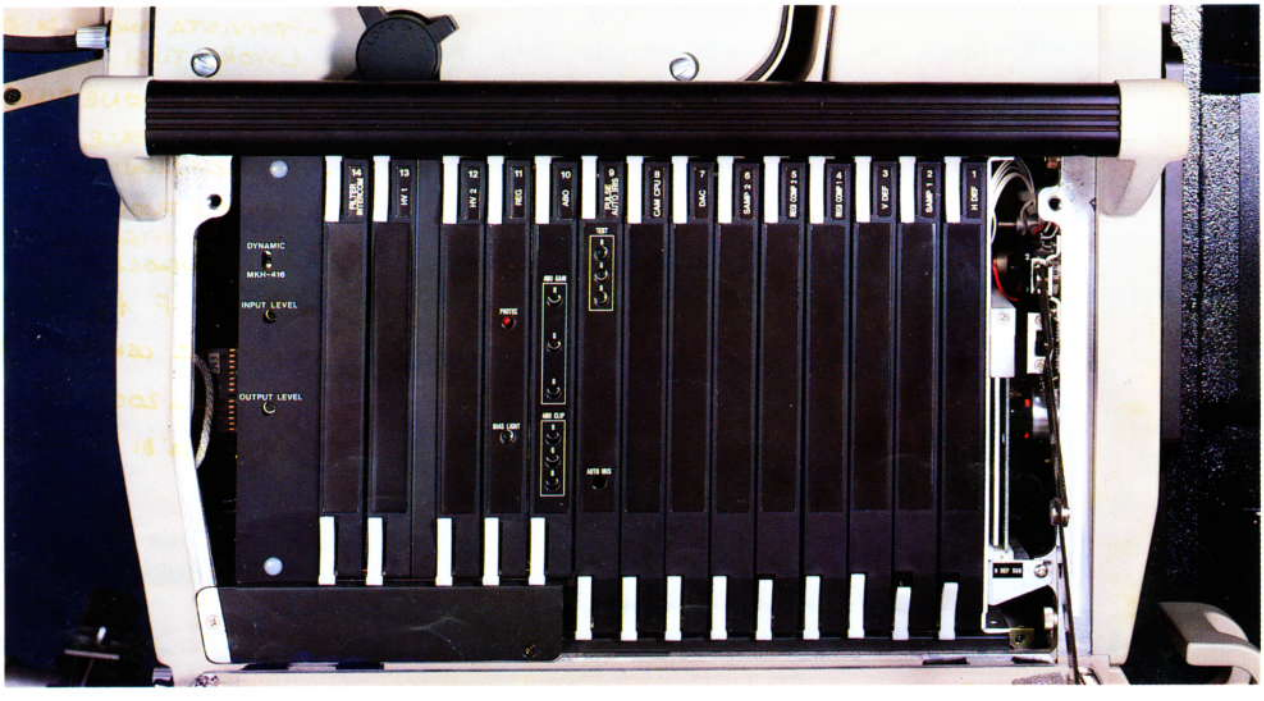




Simultaneously and automatically sets up multiple SK-110's in just 2 minutes by microprocessors. Building block configuration maximizes cost performance to handle single cameras to large-scale camera systems.

- **SCU (Setup Control Unit)**
  This unit provides all camera control functions and is capable of providing centralized control of multiple cameras.
  A power supply on/off, auto-setup, quick check, fault diagnosis, manual control, typeout, picture monitor character display, digital display of lens f-Number, monitor picture selection and RCU function is provided for each camera. The picture monitor character display includes controlled paramenters and percentage of controlled quantities.
- **DSU (Delegation Switch Unit)**
  This unit serves as a data line and video switching unit when several cameras are controlled by an SCU. It is possible to assign up to 6 CCUs to one DSU which can be located anywhere between the SCU and CCU.
- **TSU (Transfer Switch Unit)**
  This unit provides data line and video switching when several camera groups are controlled by two SCUs. The group is selected in a block of a DSU and each camera is controlled through the DSU.
- **FA (Fault Alarm Unit)**
  This centralized fault display unit monitors individually the results of the automatic setup of each camera and on/off condition of their power supplies and is used in the same location as the SCU.
- **CCU (Camera Control Unit)**
  In addition to the basic CCU functions, the following functions have been provided:
  1. Automatic setup operation
  2. Data storage by 5 types of data files
     1) Normal 2) Painting 3) H reverse 4) V reverse 5) H/V reverse
  3. RAM storage of data used to compensate for registration error caused by lens aberration.
- **RCU (Remote Control Unit)**
  In addition to automatic setup commands and data file selection commands, this unit provides all the remote control functions ever needed for normal everyday operation.
- **Camera Head**
  The camera head is provided with a built-in transmitter/receiver interface for setup data and A-D conversion interface.


Rch
Gch
Bch
ROTATION
TRACKING
LOCK
PREAMP
PREAMP
CAMERA


DYNAMIC
MKH-416
INPUT LEVEL
OUTPUT LEVEL

CAMERA HEAD

- **Highly efficient prism optics**

A newly developed f1.8 prism optics are used in conjunction with 1-1/4-inch Plumbicon* tubes to provide a high signal-to-noise ratio of 52 dB at 2,000 lux and f4+½. The optical filters have been dust-proofed to virtually eliminate dust problems.

- **Six-position ND and colour filter discs**

Two filter discs, one for ND filters and the other for colour filters have been provided, with independent filter selection possible from both the RCU and the SCU. The discs are servomotor driven and may be rotated in either direction.

- **Improved registration and optical axis accuracy**

By using an independent four-corner adjustable dynamic registration compensation unit, compensation to within 0.05% over the entire picture area is possible. This can be achieved by means of either the auto-setup or the remote control from the SCU. The compensation data is stored in RAM memory with a back-up battery. The optics, coil assemblies and zoom lens are mounted as a unit to ensure that mechanical distortion does not affect the optical system or coil assemblies and to eliminate the effects of external mechanical stresses on registration and optical axis accuracy.

- **Comet tails eliminated by ABO (Automatic Beam Optimizer)**

The Hitachi developed ABO circuit greatly extends dynamic range, reduces comet-tailing and thereby guarantees easy highlight handling.

- **High-performance viewfinder**

A bright, high-resolution CRT has been used in the viewfinder to provide an easy-to-view image even for outdoor shooting. The viewfinder can be tilted from +25° to -45° and rotated ±90° to set it at any arbitrary angle.

- **Easy-to-use video select button**

R, G, B, minus G, and two return video signals (AUX-1 and AUX-2) can be switch-selected as the viewfinder video signal.

- **Convenient monitor output on the camera head**

A separate video output has been provided on the camera head to be used for floor monitors, etc.

- **Red and green tallies**

The viewfinder is provided with both red and green tallies, the red one for live shooting and the green one used for VTR recording.

- **Built-in microphone amplifier**

The camera head is provided with a built-in microphone amplifier with limiter. The audio output is balanced to prevent the pickup of noise from the camera cable.

- **Test signals provided to simplify setup**

Test signals are used for easy calibration of the output of each amplifier stage. The signals are applied in sequence, starting from the process amplifier and walking back until the preamplifier is calibrated. The test signals may be applied to the input of the preamplifier first stage, process amplifier-1 and process amplifier-2, and consist of a 100% and 200% level sawtooth waveform which can be used for level calibration as well as verification of gamma, knee point, slope and clipping point.

- **Designed for easy servicing**

The camera head and CCU PC boards are simple to remove and are marked on both sides, making parts easy-to-find for quick servicing or inspection. Another serviceability feature is a coil assembly that can be removed while the camera is mounted to the dolly.

*® N.V. Philips



CCU

• Compact design

The CCU is designed as a dedicated camera control unit for computer controlled cameras. Both the video processing section and the computer section have been housed in one compact package.

• Linear matrix masking

A built-in linear matrix masking circuit is provided and ensures faithful colour reproduction and easy tone matching among cameras.

• High-performance contour corrector

Compensation signals derived from the R and G channels provide clear, crisp images of even red subjects. The contour correction signals are automatically processed to match the type of subject, maintain optimum compensation and ensure natural images.

• Standby mode operation

Three operating modes have been provided to reduce power consumption and extend the life of the pickup tubes and CRT.

(1) CCU POWER: Main power supply is switched on; the CCU is operating.

(2) POWER: The camera head is on and the heaters of the pickup tubes and CRT are supplied with 50% of the normal voltage.

(3) BEAM: The pickup tube beams are switched on and the camera operates.

• Genlock

The SK-110 is genlocked to a black burst signal. Horizontal and subcarrier phases can be adjusted manually.

• High-reliability LSI process amplifier

Camera picture quality is greatly effected by the stability of the process amplifiers used. LSI process amplifiers have been used in the SK-110 camera to provide stable operation with respect to temperature variations and eliminate variations between channels. They provide both picture quality and high reliability and represent the most advanced step in a camera of this class.

• Alarms and safety features

If the camera cable is left unconnected to the camera head and an attempt is made to power the camera head, an alarm lamp flashes on the SCU as a warning. If a power supply overload is detected, a protective circuit takes over until the overload condition is removed and the camera is restored to normal operating condition. In addition, abnormal power supply overheating or fan failures are detected and cause an audible alarm to sound.

• Special effects

(1) The horizontal and vertical deflection currents can be independently reversed, a feature useful in picking up mirror images.

(2) The video polarity of the R, G, and B signals can be independently inverted.

(3) A circuit has been provided which can be used to provide swinging of horizontal deflection by means of an externally applied low frequency signal.

• Encoder with variable gamma (contrast); Option

Gamma control of luminance and chrominance signals is linked and can be adjusted by remote control, making adjustment of the picture contrast very easy, even under such difficult conditions as those encountered outdoors.

• Iris

In the Auto Iris mode the lens iris is automatically adjusted according to subject illumination. In manual mode, the center value and adjustment range of the iris are set by the sense and range controls of the SCU or RCU. This feature makes operation in the studio where light variations are small extremely simple. The iris values are visible on the SCU and RCU LED display.

CAMERA CABLE

• Reduction in diameter

A built-in microprocessor in the camera head and time division multiplexing are used to transmit serially analog and on/off control signals, so that the cables other than the coaxial, power supply, audio and intercom cables have been greatly reduced in number. By using multicore cable with 24 conductors, connector reliability has been greatly improved. Compared with previously used 78-conductor cable systems, operation has been significantly simplified.

• Automatic camera cable length compensation

Picture quality degradation caused by the camera cable is automatically compensated for in the SK-110 camera system. The camera head can be separated from the CCU by up to 600m (2,000ft).

• DCU/triaxial cable combination

A DCU is available as an option. The DCU module at the camera head has been greatly reduced in size and weight and built into the camera head. By using the DCU with a triaxial cable, the SK-110 usefulness can be extended to include remote location shooting. For further information refer to the brochure on "Hitachi Digital Command System for SK-110".

AUTOMATIC SETUP

• Zero method control

The zero method of control is capable of controlling the R, G, and B channels, thus eliminating the troublesome manual adjustment of the G channel required in the G channel reference method. The system has been completely automated, and a parallel control system can set up multiple cameras simultaneously in just 2 minutes.

• Control of multiple cameras

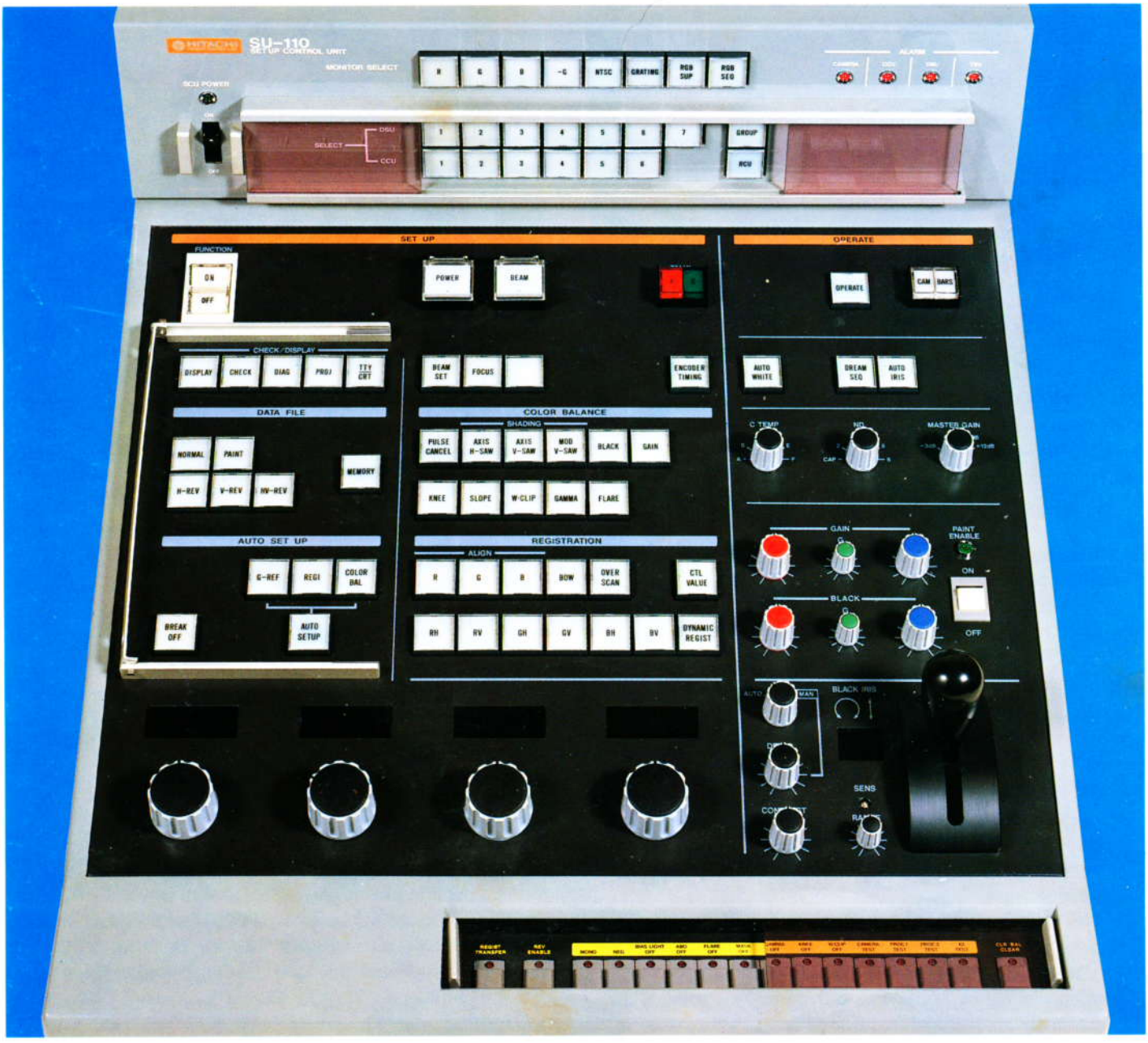
By using a DSU for every group of six cameras, up to 42 cameras can be controlled with just one SCU. By adding a TSU control capabilities can be expanded to up to 42 cameras using two SCUs, providing all the flexibility you will ever need.

• Automatic Setup modes

Five automatic setup modes have been provided; full, registration, colour balance, G-reference, and white balance. These can be selected from to suit the picture conditions at the time. In addition, manual control from either the SCU or RCU is possible, with all normal operational controls accessible manually.

• Data files

Five data files are provided except for the AUTO data file. Automatic setup data is automatically stored in the AUTO data file. It is possible to store or erase the manual setup data from the SCU in the five data files by operating the entry or reject switch. Once data has been stored in the data files, it is maintained in memory even when the camera power is turned off. This allows you to recall a particular set of data simply and repeatedly. By using the registration transfer switch, lens data in the NORMAL data file can be transfered to any of the other three data files. The Colour Bal Clear switch allows only colour balance data to be replaced with the auto setup data.



• Fault diagnosis

Fault diagnosis of the camera video system, power supply and pulse system is performed automatically to detect failures. Diagnosed results are printed out on the typewriter. This system has greatly simplified camera maintenance by providing quick and accurate information on failures.

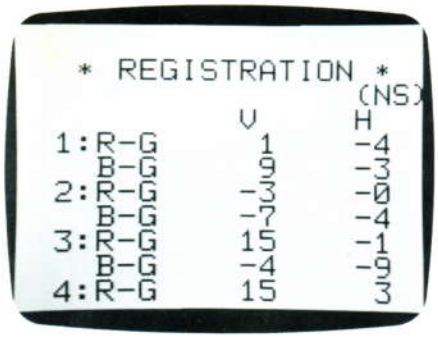
• Quick check

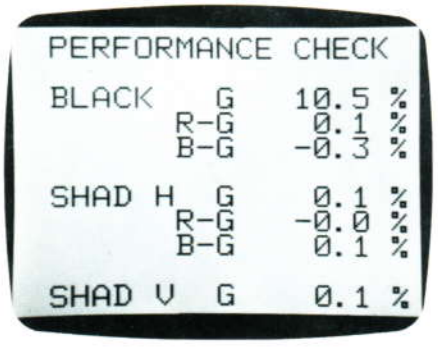
When the SCU Check switch is depressed, registration (G-reference) and colour balance (G-reference) are automatically checked and, if the required accuracy is not being obtained, the readjustment is automatically made.

• Scroll display and automatic setup status display

The results of the fault diagnosis and the quick check are displayed on a scrolled picture monitor character display. The scrolling display may be stopped at any desired point for viewing.

The status of the automatic setup function (controlled parameters and their status) may also be viewed on the picture monitor character display. These man/machine interfaces have been provided to further enhance the ease-of-use of the SK-110 camera system.





• Break Off

If during either automatic setup or manual adjustment the camera must be readied quickly for use, simply press the Break Off switch on the SCU to use the previous set of automatic setup data to control the camera(s).

• Remote control

The SCU, TSU, DSU, and CCU may be connected with just three twisted-pair cables and be separated from one another by up to 1,000m (3,000ft). The CCU and RCU may be connected using three twisted-pair cables and separated up to 100m (300ft). If the power supply is provided externally to the RCU the distance to the CCU can be extended up to 1,000m (3,000ft).

• Typeout

The results of automatic setup, quick check and fault diagnosis can be printed out on an optional typewriter at a speed of 110, 300, 1,200 or 4,800 BPS (selectable). By checking the printed out values against the standard values, drift can be detected and used to determine the affects of aging on the camera's performance, a means of predicting camera failures as well.



SPECIFICATIONS

CAMERA

RATINGS

•**Scan standard:**	CCIR: 625 lines/50 fields
•**Colour standard:**	PAL
•**Pickup tubes:**	1-1/4-inch Plumbicon*[1] or equivalent (G, B: XQ-1430, R: XQ-1435)
•**Viewfinder CRT:**	7-inch (170FB-4)
•**Optical filters:**	
ND:	0, 1.6, 6.3, 25, 100% and one special effect filter (standard: starfilter)
Colour:	3,200, 4,000, 5,000, 6,000, 7,000, 8,000°K
•**Input signals**	
Black burst:	0.45Vp-p, 75Ω, bridging
ENCR in:	0.7Vp-p, 75Ω
VF Aux:	AUX-1 and AUX-2 VBS or VS 1Vp-p, positive, 75Ω, bridging
G-REF:	0.7Vp-p, positive, 75Ω, bridging
Mix:	0.7Vp-p, positive, 75Ω, bridging
•**Output signals**	
Video out:	R, G, B: 0.7Vp-p, 75Ω two out puts
Audio:	-20dBm, 600Ω, balanced
Internal sync:	
Sync,BL,BF,PAL-P:	2Vp-p, negative, 75Ω each
Subcarrier:	2Vp-p, sinewave, 75Ω
•**Power requirements**	
Line voltage:	100/117/220/240VAC ±10%, 50/60Hz
Power consumption:	Approx. 600VA
Tally power supply:	21~24V DC (R & G, 2 systems)

PERFORMANCE SPECIFICATIONS

•**Resolution:**	600 lines (center) min. 700 (SK110D) 500 lines (corners) min. 600 (SK110D)
•**Modulation depth:**	Greater than 50% at 400 TV lines, gamma off, enhancer off, aperture off. 60%
•**S/N:**	Greater than 52dB (p-p/rms) for the output luminance signal, under the following conditions; G ch. signal current 0.3μA, gamma off, enhancer off, using RS*[2] noise meter, LPF ON, SC trap in and the blanking gate on. (Nominal) 56dB PAL 59dB NTSC
•**Sensitivity:**	f=4+½ (min) for 2,000 lux at 3,200°K colour temperature under normal shooting conditions for a gray scale chart (reflectivity 60%) center white area.
•**Registration:**	Within 0.05% over entire picture area (Nominal)
•**Geometric distortion:**	Measured using a RETMA linearity chart superimposed with the grating signal (excluding lens distortion) Zone 1: (in a circle of diameter equal to 80% of the picture height) within 0.5% of picture height Zone 2: (within a circle of diameter equal to the picture width) within 0.8% of picture height Zone 3: (area outside of Zone 2) within 1.0% of picture height
•**Frequency response** (with all compensation circuits off)	60Hz ~ 6MHz ±1dB Below 60Hz and above 6MHz roll-off characteristics
•**Waveform Distortion** (with all compensation circuits off and an input signal risetime of 0.07μs)	
60Hz sag	Within 2%
Risetime at 15kHz and 250kHz	Within 0.1μs
Overshoot at 15kHz and 250kHz (Excluding ringing above 10MHz)	Within 10%
Sag at 15kHz and 250kHz	Within 1%
•**Linearity:**	Up to a rated output level of 0.7Vp-p Within 5% for changes of APL 10%, 50% and 90%
•**Ambient temperature:**	
(1) Temperature range	-20 ~ +50°C (-4 ~ +122°F)
(2) Temperature stability	After a 30-minute warmup period, with the adjusted values as a reference and excluding the following listed parameters, all specifications should be met without readjustment with a temperature change of ±10°C (±18°F) in the range 0 ~ 40°C (32 ~ 104°F).
(a) Video signal level change	Within ±2%
(b) Pedestal change	Within ±2%
(c) Colour phase change	Within ±3°
(d) Registration change	Within ±0.1% in zone 1
(e) Genlock	Horizontal phase ±0.05μs (max)

*1 ® NV. Philips *2 Rhode & Schwarz

AUTOMATIC SETUP

•Control method:	Zero method/simultaneous control of multiple cameras
•Number of cameras controllable:	42 max. (6 cameras for each DSU; by using a TSU, 42 cameras may be controlled by 2 SCUs)

•Control mode

Mode	Description	Control location
(1)FULL AUTO	Automatic setup of all control parameters	SCU, RCU
(2)REGI AUTO	Automatic registration setup	SCU
(3)COLOUR AUTO	Automatic colour balance setup	SCU
(4)G-REF AUTO	Automatic colour balance G-channel of a separate camera as a reference	SCU
(5)QUICK CHECK	Setup of BLACK, GAIN, FLARE, GAMMA, SHADING, WHITE CLIP, and R-G/B-G SIZE, CENT, LIN, and SKEW only	SCU, RCU
(6)DIAG	CCU POWER, Pulse Unit PRE AMP PROC AMP-1 PROC AMP-2	SCU
(7)WHITE BAL	WHITE BALANCE only	SCU,RCU
(8)MANUAL	Manual adjustment	SCU,RCU

•Data files	(1)NORM (2)PAINT (3)A(H-REV) (4)B(V-REV) (5)C(HV-REV) Lens compensation data in the file(1) can be transfered to any of the files(3), (4) and (5).
•Auto setup parameters:	31 parameters (Refer to table of control parameters, control locations, and operating modes)
•Auto setup time:	2 minutes (average)
•Display:	Setup/fault diagnosis results are displayed on the TTY, the picture monitor, and the computer CRT display.
•Controlled quantity display:	Digital display, 0 ~ 100% (at SCU)
•Cable length between units (max):	(1)SCU-TSU 1 km (3,000 ft) (2)TSU-DSU 1 km (3,000 ft) (3)DSU-CCU 1 km (3,000 ft) (4)CCU-RCU 100 m (300 ft) (1 km using an external power supply for RCU)
•Special effects:	(1)H-REV (2)V-REV (3)HV-REV (4)PAINT (5)NEGA

DIMENTIONS AND WEIGHT

	Width		Height		Depth		Weight	
	mm	in	mm	in	mm	in	kg	lb
Camera Head	270	10.6	520	20.5	635	25.0	40	90.3
CCU	482	19.0	177	7.0	450	17.7	21.1	46.5
SCU	482	19.0	266	10.5	750	29.5	32.5	71.6
RCU	108	4.3	356	14.0	127	5.0	5	11.0
TSU	482	19.0	88	3.5	350	13.8	10	22.0
DSU	482	19.0	88	3.5	350	13.8	10	22.0
DCU	482	19.0	177	7.0	450	17.7	14	30.8
CCU Power	482	19.0	177	7.0	450	17.7	42	92.5


2


M7
M8
UTI
M1
M2
M3
M4
M5
M6
S1
S2
S3
S4
S5
C4
C5
C6
C1
C2
C3

CONTROL PARAMETERS, LOCATIONS, AND OPERATING MODES

CONTROL PARAMETERS AND DISPLAY \ CONTROL LOCATIONS AND OPERATING MODES	SCU							RCU				CCU	CAM HEAD
	MANUAL	AUTO SETUP						MANUAL	AUTO SETUP	AUTO CHECK	AUTO WHITE		
		FULL	REGI	COLOUR BAL	G-REF	CHECK	AUTO WHITE						
ON/OFF CONTROL													
1. GROUP	●												
2. RCU	●												
3. SELECT DSU (1~7)	●												
4. SELECT CCU (1~6)	●												
5. MONITOR SELECT													
(a) R	●												
(b) G	●												
(c) B	●												
(d) −G	●												
(e)NTSC	●												
(f)GRATING	●												
(g)RGB SUP	●												
(h)RGB SEQ	●												
6. INCOM PRIVATE / COMMON	●												
7. POWER	●							●				●	
8. BEAM	●							●					
9. FUNCTION	●												
10. TALLY CALL	●							●				●	●
11. AUTO SETUP		●							●				
12. REGI		●	●										
13. COLOUR BAL		●		●									
14. G-REF		●			●								
15. CHECK						●				●			
16. AUTO WHITE							●				●		
17. CAM/BARS	●							●					
18. C. TEMP (A~F)	●							●					
19. ND (1~6)	●												
20. OPERATE	●							●					
21. DREAM SEQ	●							●					
22. AUTO IRIS	●							●					
23. MASTER GAIN (−3, 0, +6, +12dB)	●							●					
24. PAINT ENABLE	●							●					
25. REGI TRANSFER	●												
26. REV ENABLE	●												
27. MONO	●												
28. NEG	●							●					
29. BIAS LIGHT OFF	●												
30. ABO OFF	●												
31. FLARE OFF	●												
32. MASK OFF	●												
33. GAMMA OFF	●												
34. KNEE OFF	●												
35. W. CLIP OFF	●												
36. CAM TEST	●												
37. PROC 1 TEST	●												
38. PROC 2 TEST	●												
39. ×2 TEST	●												
40. CLR BAL CLEAR	●												
41. REJECT	●												
42. BREAK OFF	●												
43. DETAIL (AUTO.OFF.MAN)	●							●					
44. MEMORY	●												
45. OVER SCAN	●												
46. AUTO ALIGN	●												
47. FILE SELECT	●							●					
48. CTL VALUE	●												

CONTROL PARAMETERS AND DISPLAY \ CONTROL LOCATIONS AND OPERATING MODES		SCU							RCU				CCU	CAM HEAD
		MANUAL	AUTO SETUP						MANUAL	AUTO SETUP	AUTO CHECK	AUTO WHITE		
			FULL	REGI	COLOUR BAL	G-REF	CHECK	AUTO WHITE						
COLOUR BALANCE SYSTEM(R,G,B)	1. GAIN	●	●		●	●	● (RGB)	● (RGB)		●	● (RGB)	● (RGB)		
	2. GAMMA	●	●		●	●	● "			●	● "			
	3. FLARE	●	●		●	●	● "			●	● "			
	4. BLACK LEVEL	●	●		●		● "			●	● "			
	5. KNEE	●	●		●		● "			●	● "			
	6. SLOPE	●	●		●		● "			●	● "			
	7. WHITE CLIP	●	●		●		● (RGB)			●	● (RGB)			
	8. PULSE CANCEL	●	●		●					●				
	9. AXIS SHAD HS	●	●		●		● (RGB)			●	● (RGB)			
	10. AXIS SHAD VS	●	●		●		● (RGB)			●	● (RGB)			
	11. IRIS	●												
	12. CONTRAST	●												
	13. MASTER BLK	●												
	14. DETAIL	●												
	15. MOD SHAD VS	●												
	16. IRIS RANGE	●							●					
	17. IRIS SENS	●							●					
	18. SC ϕ	●							●					
	19. HDϕ	●							●					
	20. BEAM SET	●												
REGISTRATION(R,G,B)	1. WIDTH	●	●	● (RGB)			● (RGB)			● (RGB)	● (RGB)			
	2. H-CENT	●	●	● "			● "			● "	● "			
	3. H-LIN	●	●	● "			● "			● "	● "			
	4. HEIGHT	●	●	● "			● "			● "	● "			
	5. V-CENT	●	●	● "			● "			● "	● "			
	6. V-LIN	●	●	● "			● "			● "	● "			
	7. V-SKEW	●	●	● "			● "			● "	● "			
	8. H-SKEW	●	●	● (RGB)			● (RGB)			● (RGB)	● (RGB)			
	9. FOCUS	●	●											
	10. ALIGN X	●	●											
	11. ALIGN Y	●	●											
	12. BOW													
	(a) H	●	●	● (RGB)						● (RGB)				
	(b) V	●	●	● "						● "				
	13. DYNAMIC REGIST													
	(a)UR	●	●	● "			● (RGB)			● "	● (RGB)			
	(b)UL	●	●	● "			● "			● "	● "			
	(c)LR	●	●	● "			● "			● "	● "			
	(d)LL	●	●	● (RGB)			● (RGB)			● (RGB)	● (RGB)			
DISPLAY/OTHERS	1. TALLY R	●							●				●	●
	2. TALLY G	●							●				●	●
	3. FAULT	●							●				●	
	Buzzer													
	4. TALLY CALL								●				●	●
	Buzzer													
	5. IRIS DISPLAY	●							●					
	6. CTL VALUE	●												
	7. CTL ITEM	●												
	8. ALARM													
	(a)CAMERA POWER	●												
	(b)CCU POWER	●												
	(c)DSU POWER	●												
	(d)TSU POWER	●												
	9. INCOM	●											●	● ENG PD