A Renaissance in Camera Design

TK-47

Fully Automatic Camera



AUTO

Touch a button and enter a new world of camera technology

TK-47

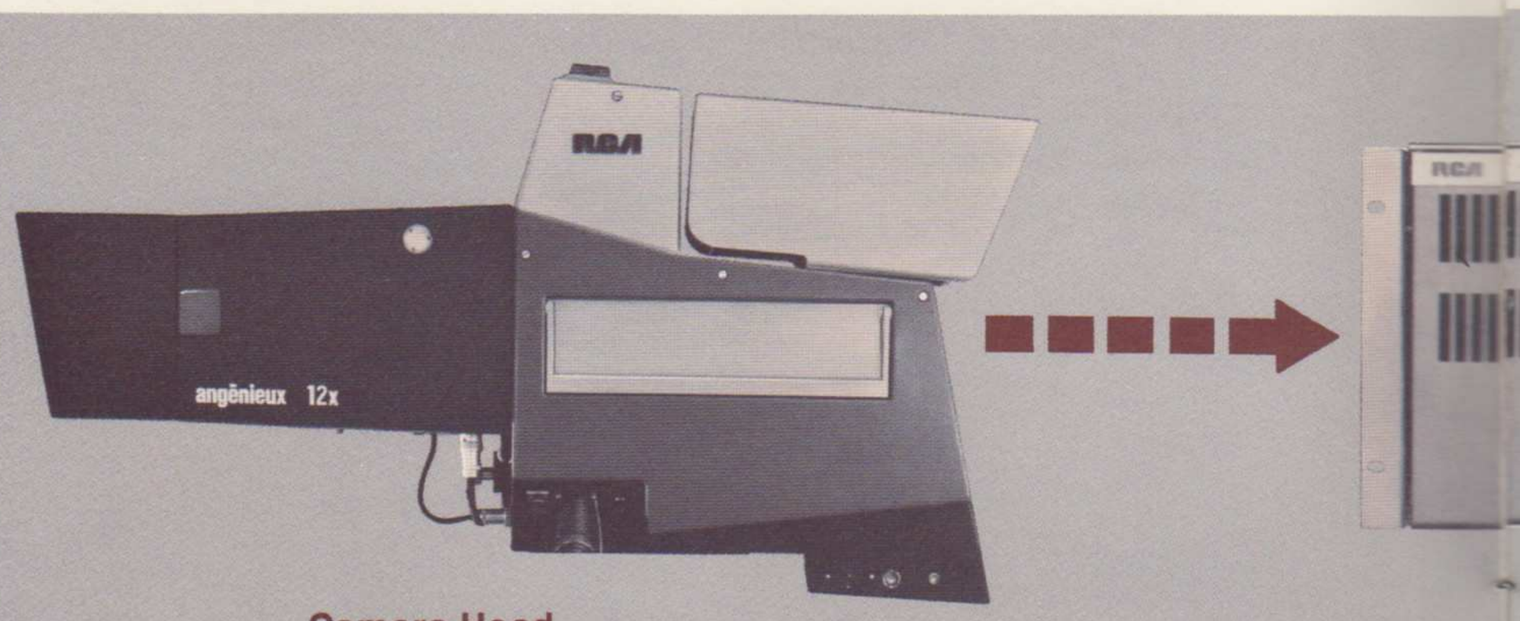
SIMPLICITY

Camera Head. The TK-47 Camera Head is a TV cameraman's dream come true. Operational functions have been automated so the camera operator enjoys full freedom to be creative. The large tiltable viewfinder aids in picture composition. And the TK-47 accepts the largest, highest optical quality lenses directly, using a simple, quick-change mount. The head is rugged, weatherized, and includes a new ultra-stable shock-mount optical system. In short, the TK-47 is designed with the end result in mind — achieving highest picture quality, in the studio or in the field.

Camera Processing Unit. As its name indicates, the CPU incorporates circuitry for video signal processing and encoding including contour enhancement and aperture correction. In function, the Camera Processing Unit is like the Camera Control Units of conventional cameras. However, the controls have been removed from the CPU, so that in effect it is a "black box" which serves as the system interface for the camera chain.

Remote Control Unit. The Remote Control Unit (RCU) provides full operational control for the TK-47 camera. It is a digital device which is connected to the Camera Processor Unit by a simple cable with only two twisted pairs. This simplifies the delegation of control to many different locations.

Set-Up Control Unit. The Set-Up Control Unit (SCU) is a digital device which functions as the technical control center. A single SCU can be used to control virtually any number of cameras. The SCU controls all adjustments relating to the Camera Head and the Camera Processing Unit. It is connected to the CPU by a cable with only three twisted pairs. After set-up has been completed the SCU can be disconnected.



Camera Head

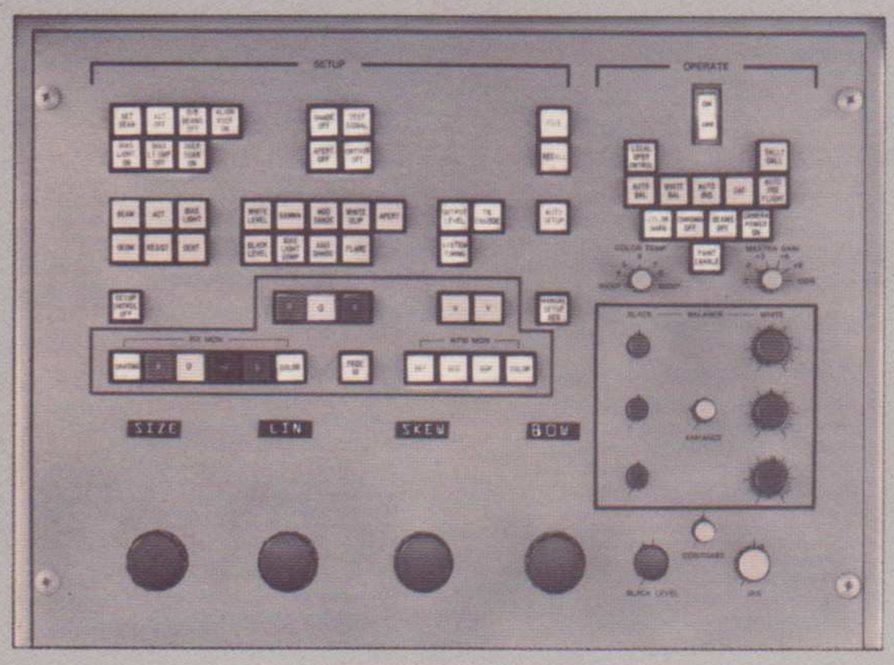
Three units are required for normal operation of the TK-47 camera system: the Camera Head; the Camera Processing Unit (CPU) and a Remote Control Unit (RCU). For set-up adjustment, the Set-Up Control Unit (SCU) is added, but once the required adjustments are made, it can be disconnected from the system.



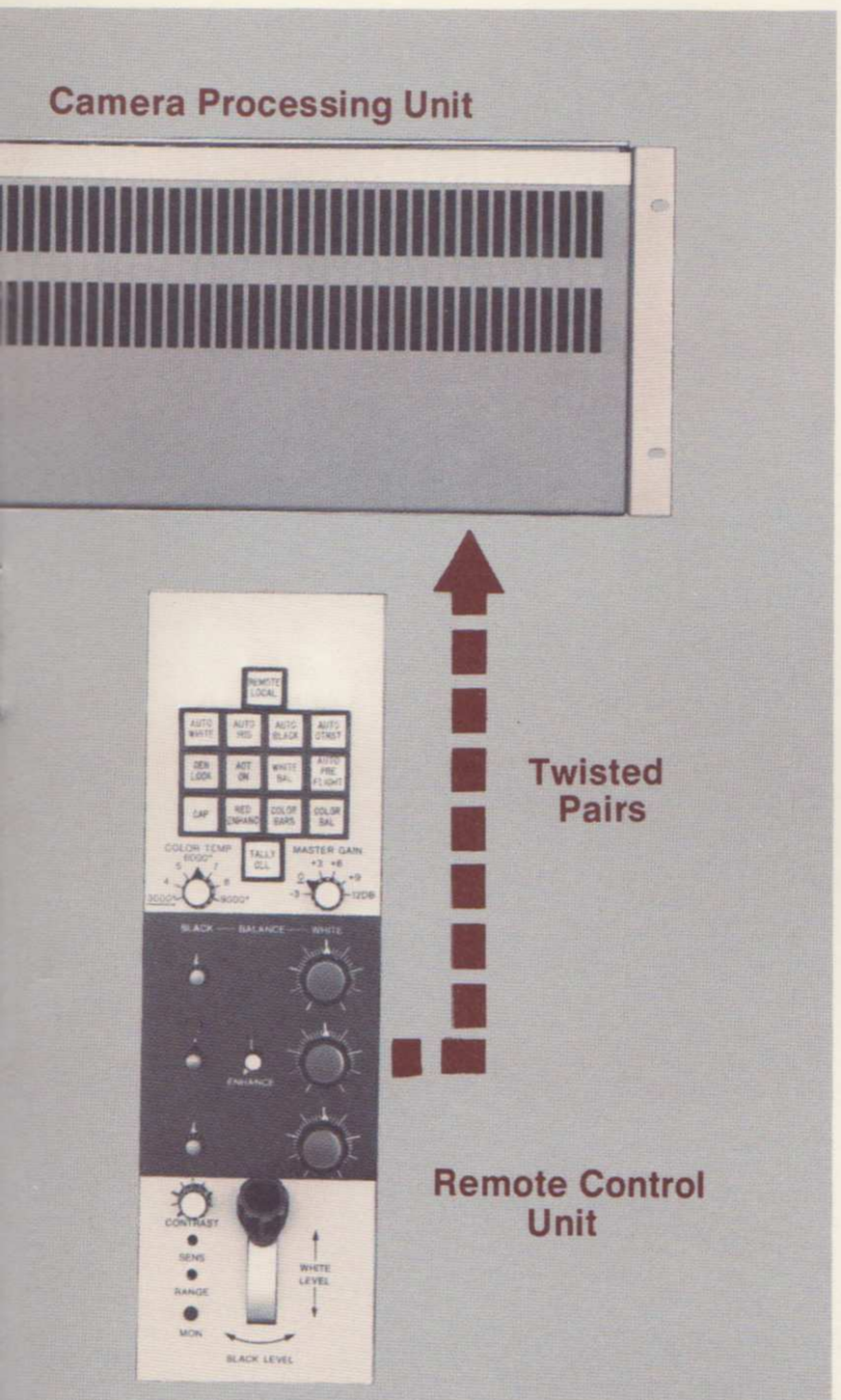
Camera Head

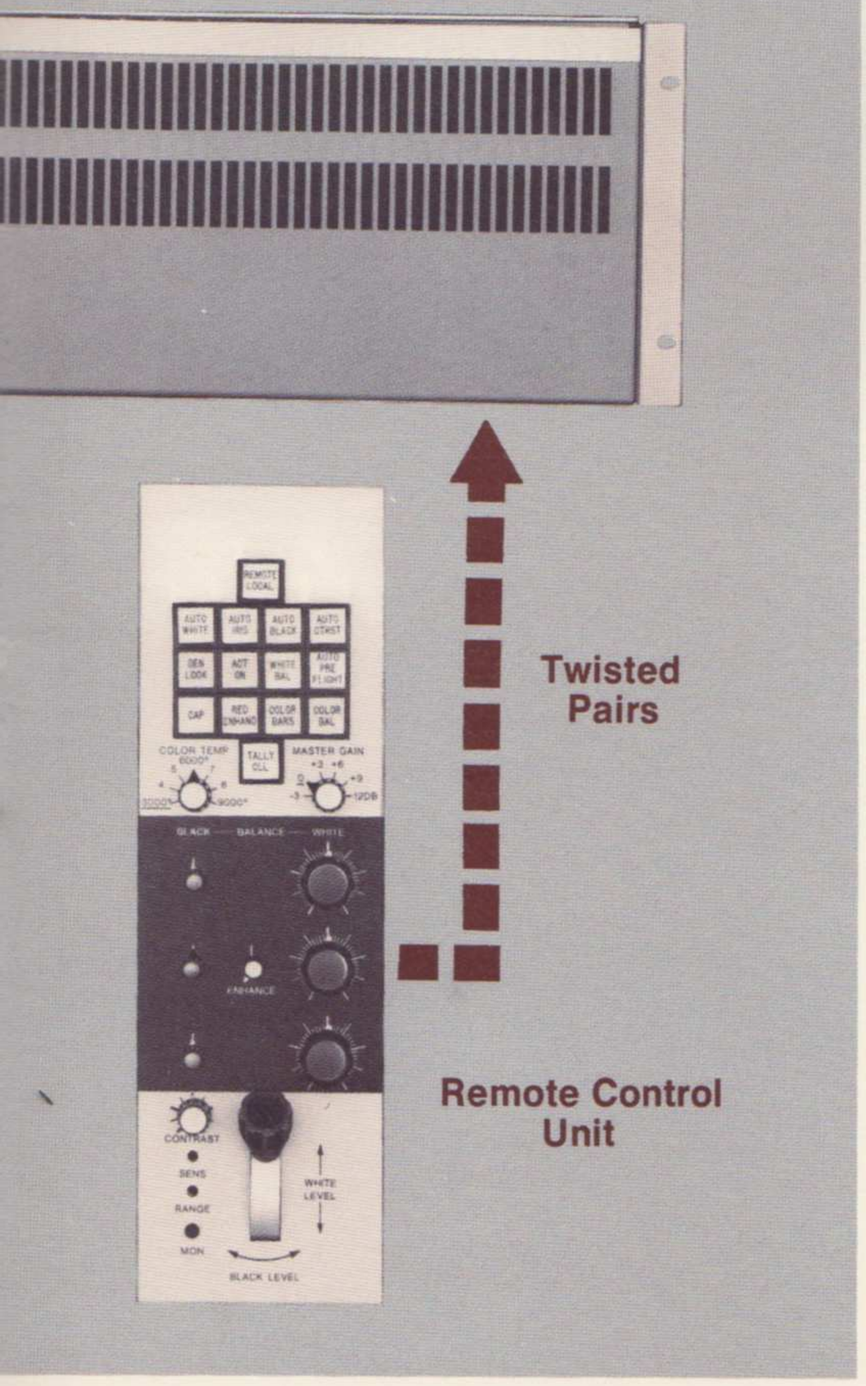
Twisted Pairs

Set-Up Control Unit



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TK-47

RCA'S ONE-BUTTON AUTOMATIC CAMERA SET-UP



With the unique "Automatics" option, setting up the TK-47 for optimum performance is done at the touch of the "Auto" pushbutton. This microprocessor-controlled system automatically adjusts a multiplicity of control functions, cycling through the complete camera set-up sequence. The result is uncompromised picture quality, because the pre-programmed "brain" monitors, compares and corrects itself with data measured from key points in the picture — automatically adjusting registration; shading; level set; gamma tracking; electronic focus and beam alignment.

In addition to saving time, RCA's one-button Automatic Camera Set-up system delivers performance consistency beyond compare. The variable of individual operator skills is eliminated, and uniform picture quality is assured.



As a part of the "Automatics" option, a second level of automated camera operational set-up is also available with the TK-47 — the pre-operational performance check. This is also accomplished by one control — the "Check" pushbutton.

On conventional cameras, this routine performance optimization check is a time-consuming ritual which is initiated by first misadjusting the camera, and then fine-tuning it back into adjustment.

The unique TK-47 "Check" procedure doesn't misadjust — it corrects, if necessary, and confirms, instantly, that the camera is set for optimum performance. And it does so consistently and unerringly.

In the Automatic "Check" mode, dozens of control functions are checked, using the green channel as a reference, making all necessary adjustments to the red and the blue channels.

For flexibility, "Check" controls are located on the Set-Up Control Unit, on the Remote Control Unit, and on the Camera Head, and can be initiated from any of these positions.

TK-47

HOW IT WORKS

Even in the manual mode, performing set-up adjustments has been made easier. For example, in adjusting pickup tube Geometry:

First, the operator pushes the "Geometry" button on the "Primary Function" row on the SCU keyboard.

To check the Green tube for Horizontal Geometry, the "G" and "H" buttons on the *Primary Modifier* row of controls are pushed. These buttons light, and, on the *Monitor* bank below, the appropriate buttons also light automatically.

The alpha-numeric displays show that the Green tube geometry is being adjusted for Size, Linearity, Skew and Bow. The operator adjusts for optimum settings, using each of the four rotatable control knobs at the bottom of the panel.

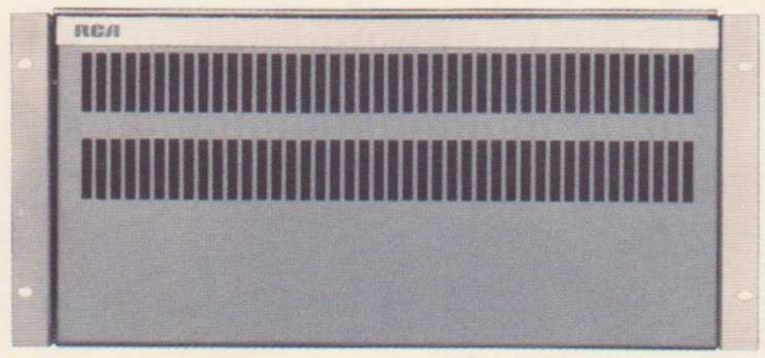
When these adjustments have been made, the "V" button is pushed to make the proper Vertical component settings. By depressing the "R" button next (on the "Primary Modifiers" row), the procedure repeats for the Red tube.

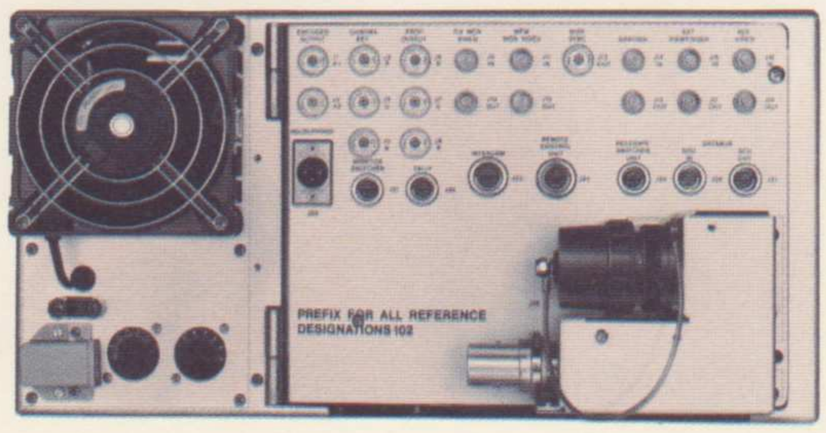
CAMERA PROCESSOR UNIT–THE "BLACK BOX" WITH MEMORY

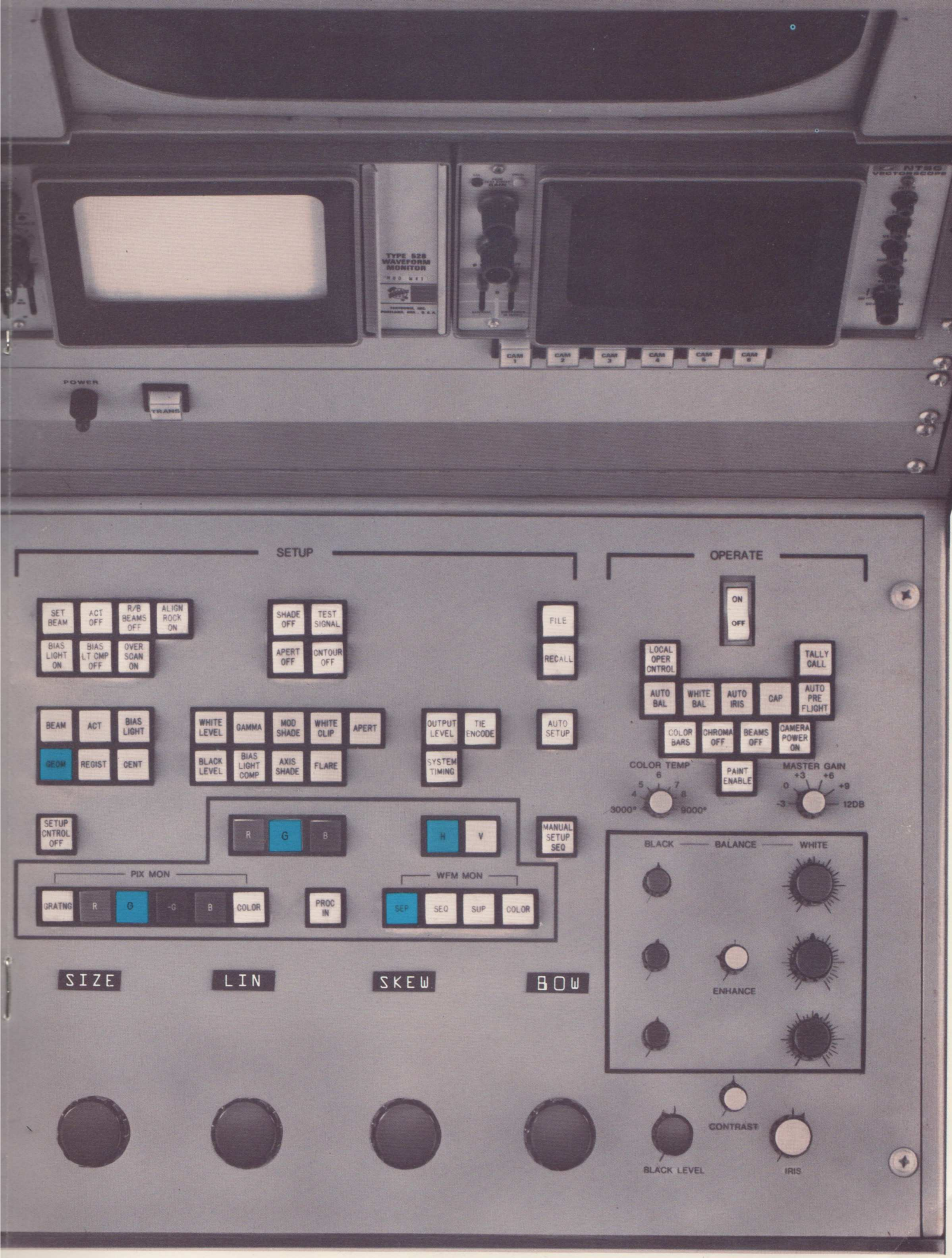
The Camera Processor Unit is the interface and video processing center for the TK-47 system — the connection point between the Camera Head, the Remote Control Unit, the Set-up Control Unit and the external system. It consists of a number of plug-in modules which connect directly into a backplane. These include the encoder, video processor, sync generator and power supply for the system.

The CPU contains the digital memory circuits which provide the information handling and storage capability that give the camera its versatility, reliability and high degree of automated functions.

Significantly, the CPU has no controls which require routine adjustment. All controls requiring periodic adjustment or check are remoted to the Set-Up Control Unit. The CPU is rack-mounted, requiring just 8¾ x 19 inches of rack space.






TYPE 528
WAVEFORM
MONITOR
NTSC
VECTORSCOPE
CAM 1
CAM 2
CAM 3
CAM 4
CAM 5
CAM 6
POWER
TRANS
SETUP
SET BEAM
ACT OFF
R/B BEAMS OFF
ALIGN ROCK ON
BIAS LIGHT ON
BIAS LT CMP OFF
OVER SCAN ON
SHADE OFF
TEST SIGNAL
APERT OFF
CNTOUR OFF
FILE
RECALL
BEAM
ACT
BIAS LIGHT
GEOM
REGIST
CENT
WHITE LEVEL
GAMMA
MOD SHADE
WHITE CLIP
APERT
BLACK LEVEL
BIAS LIGHT COMP
AXIS SHADE
FLARE
OUTPUT LEVEL
TIE ENCODE
SYSTEM TIMING
AUTO SETUP
SETUP CNTROL OFF
R
G
B
H
V
MANUAL SETUP SEQ
PIX MON
GRATING
R
G
-G
B
COLOR
PROC IN
WFM MON
SEP
SEQ
SUP
COLOR
SIZE
LIN
SKEW
BOW
OPERATE
ON
OFF
LOCAL OPER CNTROL
TALLY CALL
AUTO BAL
WHITE BAL
AUTO IRIS
CAP
AUTO PRE FLIGHT
COLOR BARS
CHROMA OFF
BEAMS OFF
CAMERA POWER ON
PAINT ENABLE
COLOR TEMP
6
5
7
4
8
3000°
9000°
MASTER GAIN
+3
+6
0
+9
-3
12DB
BLACK
BALANCE
WHITE
ENHANCE
BLACK LEVEL
CONTRAST
IRIS

TK-47

CAMERA HEAD

Ease of operation has been a prime consideration in the TK-47 Camera Head design. For example, no technical controls are located in the Camera Head, so the operator is free to concentrate on picture composition.

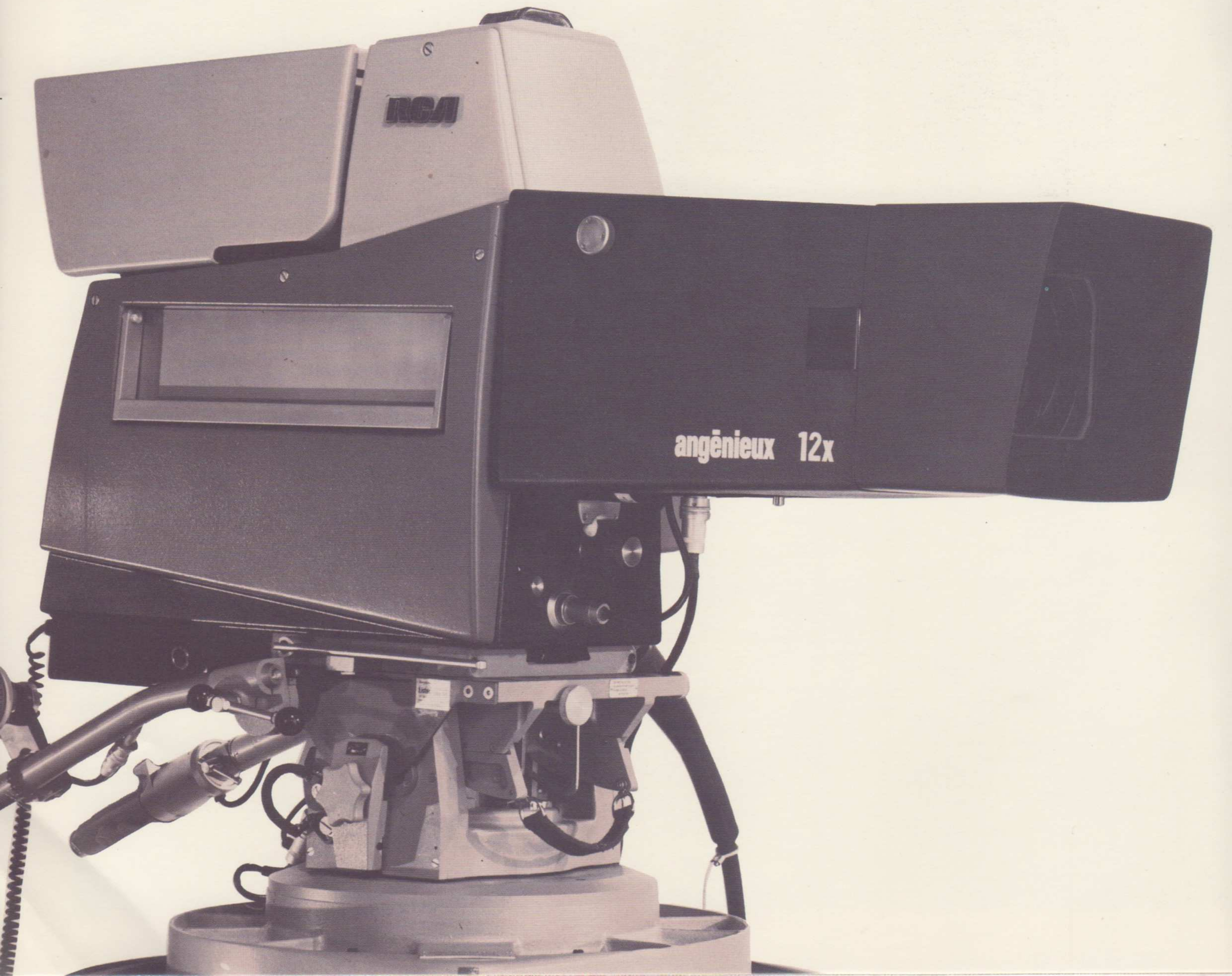
But operational simplicity is only the beginning. The TK-47 is a rugged performer; built to take the bumps and jolts of field operation. A unique shock-mounted optical system assures registration stability, even under rough handling. The camera head is weatherized for outdoor use, and can operate in extreme conditions of heat and cold. A unique RCA-developed damping system makes the camera virtually impervious to microphonic disturbance — even the pounding acoustic impact of "Rock" music.

The camera employs 30mm Plumbicon tubes, with colorimetry matching that of the TK-46. The unique prism design is such that it can adapt to other tube sizes and designs, should future tube developments make such a change advantageous.

The TK-47 accepts the largest and highest optical quality lenses directly using a simple, quick-change lens mount. A wide choice of lenses is available to meet all studio and field requirements.

A high quality 7-inch tiltable, rotatable viewfinder is employed, the optimum size for picture composition and focusing. The viewfinder can be operated either in a fixed nested position, or raised for full tilt operation. The camera's dual interphone system is operable with either dynamic or carbon microphone headsets.

Since the memory is non-volatile, the camera can be disconnected from the system without disrupting settings. This feature is particularly useful when the camera is used in the field, permitting rapid transfer between studio and field without time-consuming re-alignment.



OPERATIONAL FREEDOM

In keeping with its advanced design concepts, the TK-47 camera is extensively automated in its operational control functions as well as in the set-up procedures.

Automatic iris control maintains constant video level under wide variations of lighting conditions. Sensing is weighted for the center portion of the picture to prevent skylight or highlights at the edges from actuating the iris.

White balance is achieved at the touch of a button, which puts a cursor on the viewfinder. When the camera is focused so that this cursor falls on a white object in the scene, white balance is achieved automatically — in a matter of seconds.

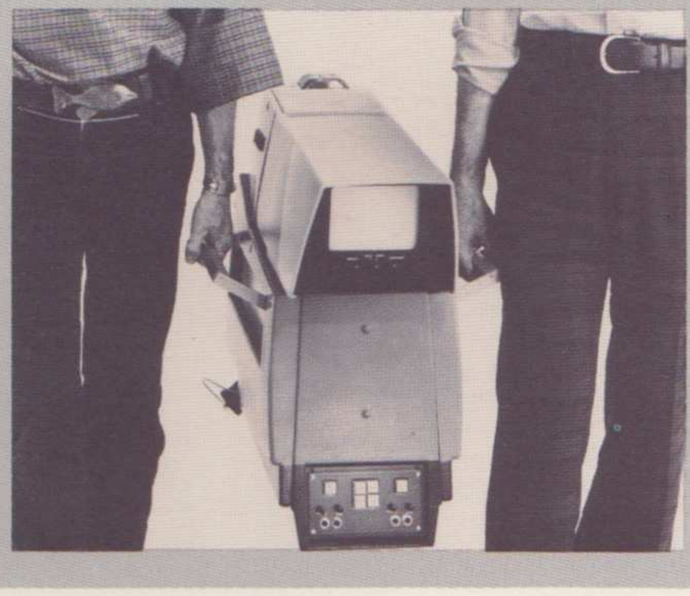
Black balance is also automatic, whenever the "lens cap" function button is pushed. If the balance error is beyond the capability of the automatic system, an indicator warns of this condition.

Automatic cable equalization in the TK-47 eliminates the need to check and make adjustments when camera cable lengths are changed. Timing and equalization are adjusted automatically for any length of cable up to 2,000 feet, with full compensation for cable non-uniformity and temperature effects.









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TK-47

ULTRA-STABLE... SUPER-RELIABLE

Stability and reliability have long been hallmarks in RCA camera design and performance. The new TK-47 extends these performance standards to new limits.

New circuits, components and assembly methods combine to stabilize operation. Feedback techniques are used extensively to keep signals and voltages constant regardless of environmental conditions. More than 50 LSI circuits are incorporated in the TK-47, and the inherent stability of these devices further contributes to overall stability.

A major contributor to instability in conventional cameras is the potentiometer. Being mechanical devices, "pots" are subject to wear and are adversely affected by moisture dust, and vibration.

This source of instability has been eliminated in the TK-47 by using semi-conductors in place of the vulnerable potentiometers. The digital memory is non-volatile and maintains adjustment electronically.

Registration stability has been improved to the extent that the TK-47 is practically impervious to the shocks, vibrations and jolts encountered in normal camera operation.

This superior registration stability stems from:

- New shock-mount optical system, with prism, yokes and tubes packaged as a single assembly, on specially developed vibration isolators.
- New RCA-designed and manufactured precision deflection yokes.
- Hard-mounting of pickup tubes in yokes.
- Advanced circuit design for superior electrical stability.
- New constraint damping system to eliminate microphonic effects.

The new optical system not only achieves outstanding registration stability — it also results in substantial technical performance improvements.

Further reliability is built into the TK-47 in its assembly and testing methods. Computer technology is used throughout — in checking and matching components; in testing individual circuits, subassemblies, and the entire camera system.
Components are selected to withstand environmental extremes, and all elements of construction are carefully monitored to assure product reliability. Automatic insertion of parts, using latest techniques, further enhances the camera's reliability and long-term performance capability.

Before shipment, all TK-47 cameras are operated for a break-in period, and are subjected to a battery of manual and computerized quality and performance tests.

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Preliminary Specifications
TK-47 Camera

Scan Standards
EIA ..... 625/60 Fields
CCIR ..... 525/50 Fields

Color Standards
Types available for NTSC, PAL, PAL-M or SECAM.

Power Requirements
Input Voltage ..... Switchable: 100/120/200/220/240 Volts ±10%
Frequency ..... 45 to 66 Hz
Power Consumption ..... 390 watts max.

Aperture Correction
Horizontal combed aperture correction is derived from the green signal and is added to R, G and B prior to gamma correction. This can set response of luminance to provide a depth of modulation of 100% at 400 TV lines (relative to 50 TV lines) with an in-band ripple ≤ 1dB. Coring is employed to remove noise.

Contour Enhancement
Horizontal and vertical combed correction derived from green is added to the red, green and blue video signals after gamma. A horizontal contour derived from the red signal is automatically switched in whenever the green video drops below a predetermined level. The level of these contour signals is considered an operational control and is continuously adjustable from the RCU or the SCU. Coring is employed to remove noise.

Shading Correction
H/V sawtooth and parabolic modulation shading for each video channel. H/V sawtooth and parabolic axis shading for each video channel.

Gamma
0.4 adjustable ±0.05
0.5 adjustable ±0.05
0.6 adjustable ±0.05
1.0 fixed

Interphone
Will accommodate dynamic, carbon, and amplifier microphones. Can be connected for 4-wire, 2-wire balanced or 2-wire unbalanced operation. Requires Interphone Unit at control position and 24V dc. Interphone is operational with camera power off.

Viewfinder
CRT Size ..... 7 in. (178mm) 6.2 in. diagonal (157mm)
Resolution ..... 800 lines
Brightness ..... 150 footlamberts

Camera Cable Length
2,000-ft. (610m) maximum using 0.66 in. (16.8mm) diameter 30-core cable. Video equalization, pulse timing and voltage automatically adjusted for any length up to 2,000-ft.

Delegation Switcher Unit (DSU)
Assigns single Set-up Control Unit (SCU) to up to six cameras. Two DSU's may be stacked to address up to twelve cameras. Optional Transfer Switcher Unit (TSU) will transfer all signal and control lines involved between a set of camera chains and an SCU to a second similar system. In the transfer position SCU #1 will address cameras group #2 and SCU #2 will address cameras group #1.

Sensitivity and Signal/Noise
NTSC . . . 125 footcandles at f/4.0, luminance S/N 52dB (unweighted, 3200°K illumination, 0.7V white, measured on 14% reflectance chip, 0.45 gamma, bandwidth 10KHz to 4.2MHz, zero aperture correction). Low frequency S/N 53dB.
PAL . . . 1250 lux at f/4.0, luminance S/N 49dB (unweighted, 3200°K illumination, 0.7V white, measured on 14% reflectance chip, 0.45 gamma, bandwidth 10KHz to 5.5MHz, zero aperture correction). Low frequency S/N 50dB.

Registration Accuracy
Zone 1 (circle in center = 0.8 picture height) ..... 0.05% of picture height
Zone 2 (circle in center = 1.0 picture width ..... 0.1% of picture height
Zone 3 (area outside Zone 2) ..... 0.2% of picture height

Picture Geometry
Zone 1 (see Registration Accuracy) 0.5%
Zone 2 ..... 1.0%
Zone 3 ..... 1.5%

Ambient Temperature (Without Solar Radiation)
Camera Head (not including tubes) ..... −20°C to +50°C (−4°F to +122°F)
CPU, SCU, RCU ..... 0°C to +50°C (+32°F to 122°F)
Storage Temperature (not including tubes) ..... −40°C to +70°C (−40°F to +158°F)

Relative Humidity
0 to 95%, non-condensing.

Operating Altitude
Up to 10,000-ft. (3,050m) ASL.

Safety
Meets U.L., OSHA and CEE Requirements.

Dimensions and Weight

	Height	Width	Length/Depth	Weight
Camera Head (less lens)	21 in. (533mm)	11.2 in. (284mm)	22 in. (559mm)	88 lbs. (39.9kg)
Camera Processor Unit	8¾ in. (222mm)	19 in. (483mm)	22.4 in. (569mm)	88 lbs. (39.9kg)
Remote Control Unit	14 in. (356mm)	4¼ in. (108mm)	5 in. (127mm)	5.5 lbs. (2.5kg)
Set-up Control Unit	14 in. (356mm)	19 in. (483mm)	6¾ in. (171mm)	26 lbs. (11.7kg)
Delegate Switcher Unit	1¾ in. (44.4mm)	19 in. (483mm)	8½ in. (216mm)	7 lbs. (3.2kg)
Transfer Switcher Unit	1¾ in. (44.4mm)	19 in. (483mm)	8½ in. (216mm)	7.5 lbs. (3.4kg)

Renaissance in Camera Design . . . Fully Automatic TK-47

By every criterion of camera performance, the TK-47 Establishes new benchmarks.

- Unique one-button Automatic Camera Set-up.
- Picture quality is superior.
- The camera is simple to operate — no controls at the camera head.
- Computer technology and new circuitry have produced a significant upgrading in performance, stability and reliability.
- New construction features such as the shock-mount optical system and yoke assembly enhance registration stability and camera reliability.
- A new degree of system flexibility is achieved to meet a wide and varied range of operational requirements.

Throughout, the TK-47 confirms its credentials as the outstanding top-of-the-line camera available today — a full generation ahead of the best. It may be imitated, but never excelled.

RCA



In quest of the perfect picture