Marconi Broadcasting Systems

Mark VIII Automatic Colour Television Camera

B3215



Features

Automatic Line-Up
Automatic Colour Balance
Sensitivity 800 lux (75 fc) at *f*/4 (pictures down to 50 lux)
Lightweight (under 49kg (110lb) with lens)
13mm ($\frac{1}{2}$in)camera cable
Dynamic centring from picture information
Printed scanning coils
Wide choice of camera cables (up to 900m (3000ft) operation)
Visual Auto-test facility (31 point display)
Factory-matched optics

Facilities

Built-in aperture corrector with comb filter
Alternative studio/daylight colour correction matrices
Tilting viewfinder with bonded faceplate and crispener control
Alternative European or US intercom systems
Automatic iris control for standby operation
Built-in diascope
Manual or servo, 10:1, 15:1 or 16:1 zoom lenses
Remote-controlled filter turret
Easy servicing afforded by drawer construction
Chroma key output
Chroma adjustment facility

Introduction

Marconi, innovator of many notable advances in television camera techniques, now introduces the first Automatic Colour Camera, the Mark VIII, a worthy successor to the famous Mark VII camera.

Continuous research coupled with widespread operational experience has enabled the evolution of a camera which provides significant improvement both in performance and operational simplicity.

Users of the Mark VIII will find that the

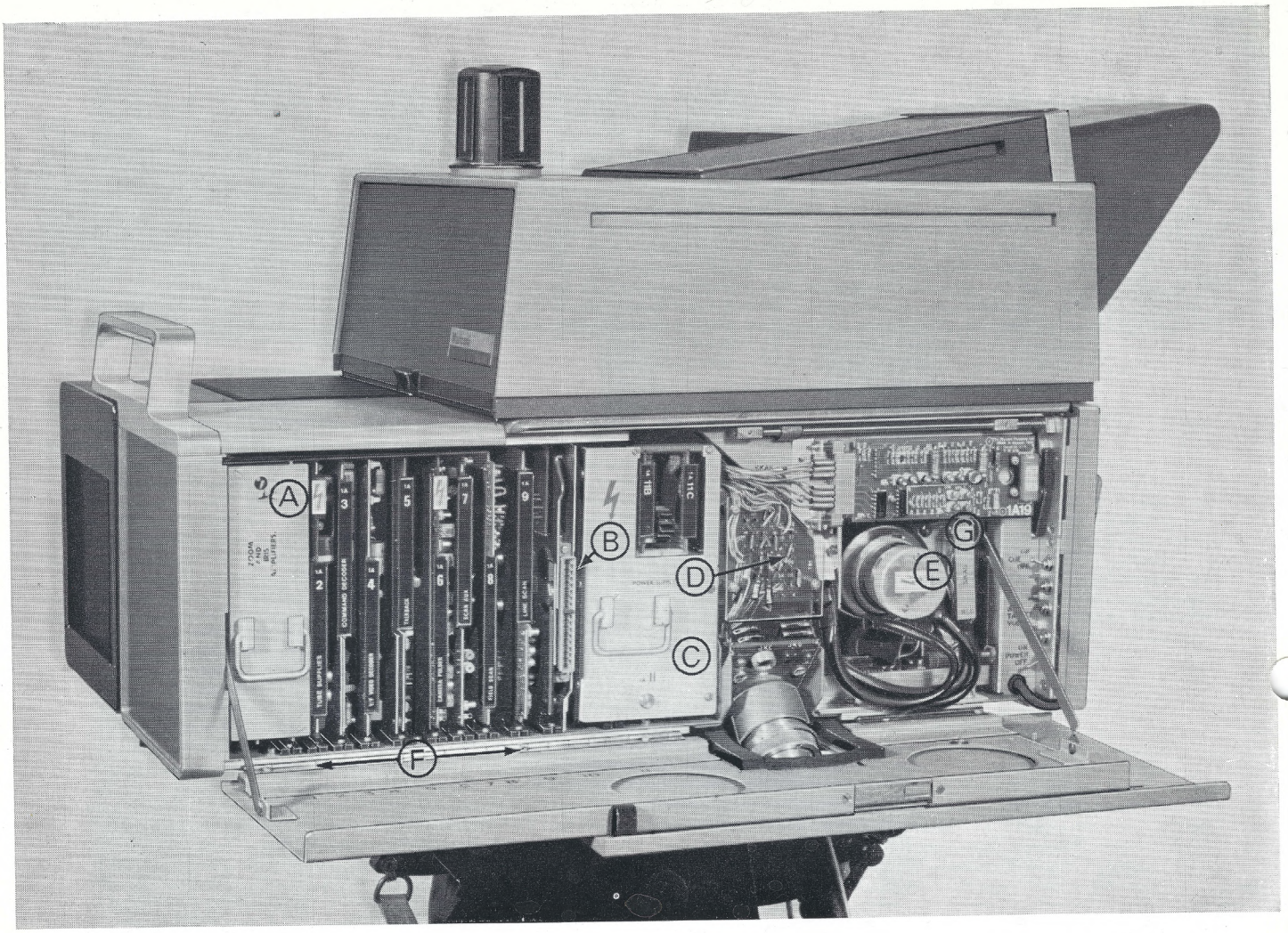


Fig.1. View of Mark VIII Camera from left-hand side.
A *Iris Servo Amp.* B *Built-in Extension Board.* C *Camera Power Supply.* D *Camera Cable Tagboard.* E *Red tube base.* F *Electronics printed boards* G *Red Head Amp.*

Automatic Line-up System offers quite remarkable savings in lining-up times, both in studios and outside broadcast applications.

The novel three-tube layout ensures a small lightweight easily handled camera head, whilst the 'drawer' construction of the Control Unit combines ready access for servicing with minimum rack height.

The camera uses standard 30mm lead-oxide camera tubes, and has been designed to use tubes incorporating the latest features such as light bias, enabling the camera to handle difficult scenes. Colour lag on fast moving objects in shadows will therefore be at a minimum.

To eliminate the possibility of registration drift over extended periods of use, dynamic centring circuits are provided which work continuously from picture information.

Registration precision is ensured by the use of scanning coils printed in cylindrical form enabling accuracies greater than one part in a thousand to be obtained.

The Mark VII camera is renowned for its colour fidelity and the Mark VIII is superior to the Mark VII. The use of optics factory-matched to a standard reference by a colour correction matrix ensures that each camera will have identical colorimetry.

Automatic line-up and colour balance may normally be obtained within two–three minutes of switch on and without the use of external test charts.

A full range of zoom lenses is available and the camera employs a 13mm diameter lightweight camera cable.

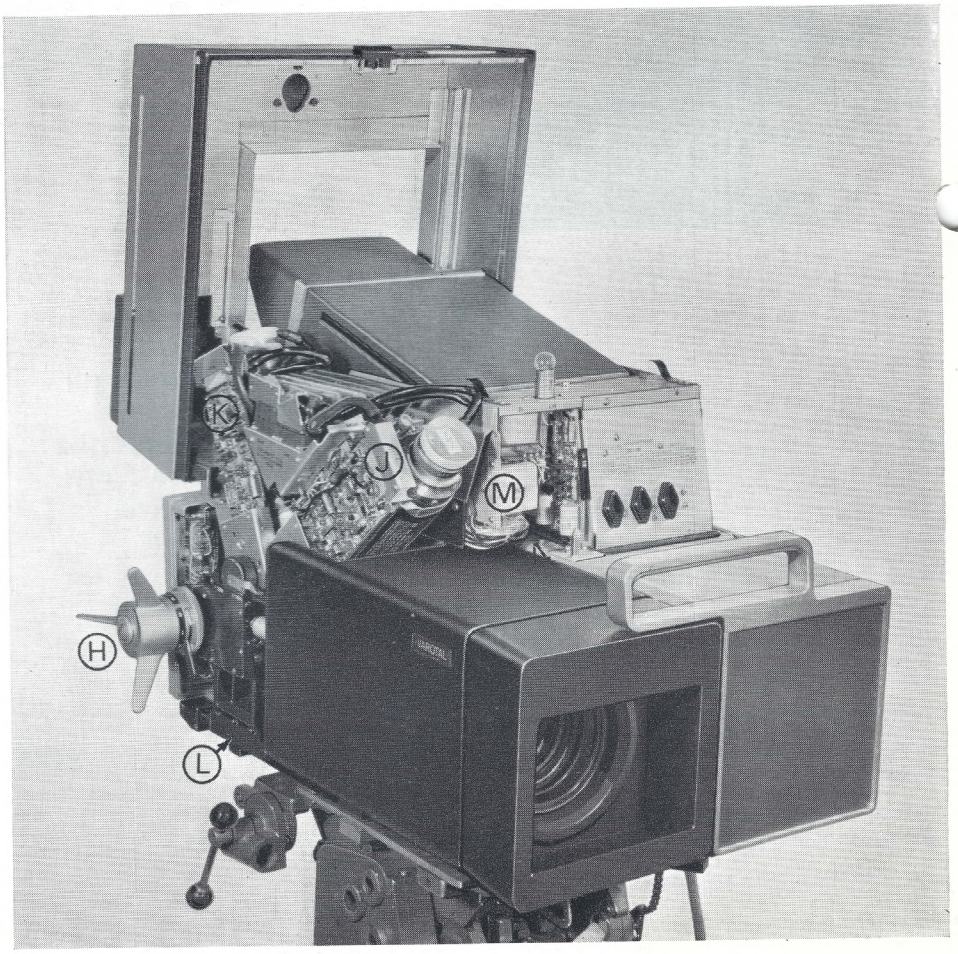


Fig.2. View of Mark VIII Camera from right-hand side.
H *Focus Handle.* J *Green Head Amp.* K *Blue Head Amp.* L *Focus gearbox.* M *Hour Meter.*

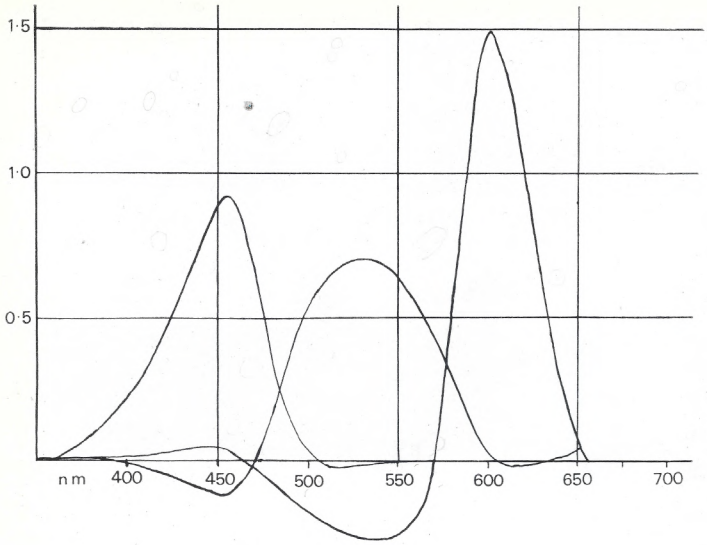


Fig.3. Camera taking responses.

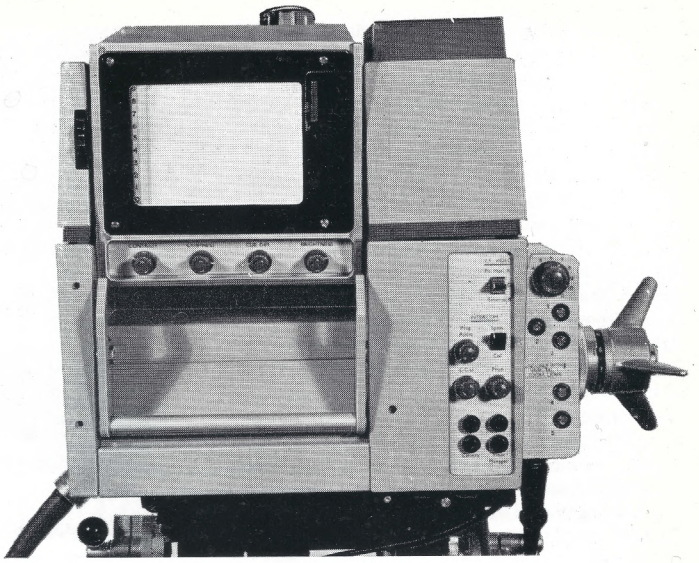


Fig.4. Rear view of camera.

Equipment

The basic Mark VIII Colour Camera Channel, type B3215, comprises:
Camera Type B3216
Camera Viewfinder Type B3128
Camera Control Unit Type B3217
Power Supply Unit Type B3218
Operational Control Panel Type B3219
Accessories Kit Type B3221

Optional Items
Auxiliary Control Panel Type B3220
Zoom Shot Box Type B3222
Test Devices

Camera Type B3216

This unit is constructed so that by removing eight screws the electronics frame can be removed from the optical assembly which is mounted on the camera base. With the viewfinder and lens removed, the weight is only 29kg (65lb), enabling one man to carry it up a staircase or ladder.

The standard camera works on up to 900m (3000ft) of camera cable.

All the circuitry is contained on printed boards. A built-in extension board is provided for servicing purposes on the camera head.

The pick-up tube yokes are fully screened and contain scanning coils printed in cylindrical form enabling great accuracy to be achieved.

European (four-wire) or US (two-wire) alternative communication systems can be provided. Headset jack sockets are fitted for use by the cameraman, and a headphone outlet for a floor manager.

Test input and monitoring outlet sockets are provided on the camera base.

The camera focus handle is situated at the right-hand rear of the camera. However, if a twist-grip control is preferred, a teleflex cable may be fitted and if required the focus handle may be removed.

Lenses

The camera employs a variety of lenses designed for 30mm pick-up tube format. Either manual or servo zooms can be provided. The servo amplifier for iris and zoom is contained within a unit fitted in the electronics section of the camera, and may be easily withdrawn for servicing. An optional shot box with integral focus handle may be fitted to the right-hand rear quarter of the camera.

Manual focus is employed throughout with a short coupling into the lens assembly. The focus handle is coupled to a two-speed gearbox providing either 1 :1 or 2 :1 ratios.

Iris calibration is provided within the lens housing and also on the CCU and OCP. Reference marks are provided on the Operational Control Panel fine control. Alternative calibrated iris knobs are provided on the CCU for different lens types.

Optical System

The optical system is rigidly mounted to the camera base and precisely aligned to the lens so that no operational adjustment for lens tracking is required.

A broad G, R, B response together with a suitable electrical matrix is employed as shown in Fig.3. Optical systems are factory-matched to a standard reference by matrix adjustment based on a computer print out.

Alternative colour correction matrices are provided for studio and daylight operation. Because of this feature there is no necessity to introduce a second filter turret containing colour filters. The single turret used has four ports containing respectively, clear glass, a 2 stops, 4 stops and 6 stops neutral density filter.

When the lens is withdrawn from the camera a shutter is automatically placed across the lens port to prevent the intrusion of dust.

During line-up an internal diascope is brought into use. Light from the diascope illuminates a special slide. At the same time a remotely controlled shutter containing a mirror is drawn across the optical axis blanking off the scene light and reflecting the diascope light into the light splitting prism.

A feature of the optical system is that it employs reduced-size images on the red and blue tubes to increase the intensity of illumination on the pick-up tube faceplate, thereby reducing the effect of differential colour lag.

Viewfinder B3128

This unit, which weighs only 12lb, is capable of tilting over 100° range. It may be locked in any position. Alternatively the viewfinder may be detached and operated away from the camera up to a distance of 9m (30ft).

The viewfinder uses a 180mm (7in) rectangular tube with a bonded faceplate. The highlight brightness is 2150 lumens/m² (200ft lamberts) and it is thus well able to compete with bright studio lighting. For outside broadcast conditions, such as bright sunlight, an alternative long viewfinder hood can be provided. The viewfinder incorporates an adjustable 'crispener' control as an aid to focusing, and an electronic zoom angle indicator on the left-hand side of the picture. A cameraman's cue light is also provided.

Controls for contrast, brightness, crispener and cue dim are mounted below the screen. Further preset controls for height, width, centring, and gain are situated at the bottom of the unit.

A three-position switch is fitted at the rear of the camera for selection of the signal to be displayed on the viewfinder. For normal operation a Y signal, formed by matrixing the output signals, is displayed. The alternatives are either an external signal fed into the CCU, or the video to the picture monitor.

By means of a further switch at the CCU the Y, picture monitor, and external feeds can be exchanged for the green, red and blue signals respectively.

Camera Control Unit Type B3217

The Camera Control Unit is suitable for mounting in a 483mm (19in) rack or console. The unit is constructed of five horizontal drawers plus the camera control panel. Flexible cableforms allow the drawers to be pulled out with the power on, and tilted either up or down for adjustment or servicing.

The individual drawers from top to bottom are

a) The Aperture Corrector containing two glass delay lines plus the necessary modulator and demodulator circuits. In addition it contains the circuits required for the comb filter, level dependent high-frequency correction, etc.

b) The Video 'A' drawer containing circuits which provide cable correction, clamping, the colour correction matrix, and chroma adjustment.

c) The Video 'B' drawer which contains the gamma correctors, flare corrector, white clip, output stages, pulses processing and multiplex command coder.

d) The Motors Unit which houses the circuits associated with registration control, and motor driven potentiometers for registration and colour balance together with Auto-test.

e) The Automatic Line-up Unit which houses circuits associated with auto balance, beam

alignment, registration sequence control and dynamic centring.
f) The Camera Control Panel is a pull-out drawer which contains all the preset controls associated with a monochrome camera, such as height and width, together with test facility switches and monitoring buttons. It also contains circuits for monitoring, talkback and viewfinder video. On the front of the panel are those controls purely associated with the operational function of the Camera, namely Master Black, Iris, Filter Control, Local/Remote and On/Off buttons. The intercom controls for Camera, Producer, and Programme Audio together with a headset jack and On Air Cue Light are also included. The Control Unit contains its own blower and all connections are taken from the rear panel.

Test facilities provided include the Auto-test (31-point display), together with a built-in line sawtooth and numerous test points on the individual printed boards. An output bridging switch is also available. An internal meter is provided in the motors unit for measurement of pick-up tube signal currents.

Power Supply Unit Type B3218

The Power Supply Unit is designed to mount on runners in a 483mm (19in) rack. It can be remoted up to 1·8m (6ft) from the CCU. The power supply provides the necessary stabilized supplies for the CCU and an unregulated 180V supply for the camera d.c/d.c converter. Automatic voltage compensation for camera cable length adjustment is included.

A meter on the front panel is provided to enable ready examination of the important potentials employed in the camera channel. The meter scale is marked in coloured bands, similar bands being marked against each meter switch position. The voltage reading is correct if the meter pointer lies within the appropriate band on the meter scale.

Automatic Operation

When the sequential line-up button on the CCU or OCP is pressed the following actions take place automatically.
i) The internal diascope is brought into operation by a remotely controlled motor driving a sliding shutter containing a mirror. The diascope illuminates a special test slide.
ii) The gains of the red and blue video paths are adjusted to make the respective peak signals equal to that of the green.
iii) A focus rocking voltage is applied to each tube and the tube alignment currents are adjusted sequentially for minimum displacement at the centre of the picture.
iv) The picture is examined for relative displacements of green and red, and green and blue video signals. Correction is then applied to the appropriate parameters of the red and blue channels: width, height, rotation, skew, horizontal linearity, horizontal and vertical centring.

The entire sequence normally takes under three minutes and may frequently take a great deal less, depending upon the previous state of the camera. The progression of the adjustments are indicated by lamps on the front of the unit.

If desired, it is possible to line up the camera manually by methods currently used on other cameras. Each motor driven potentiometer is equipped with a thumb wheel control to facilitate this adjustment.

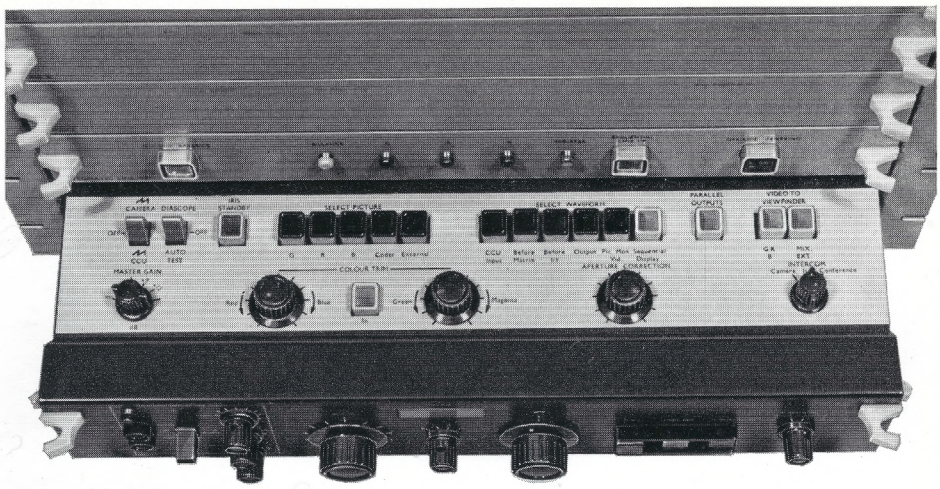


Fig.5. Camera Control Unit with CCP open.

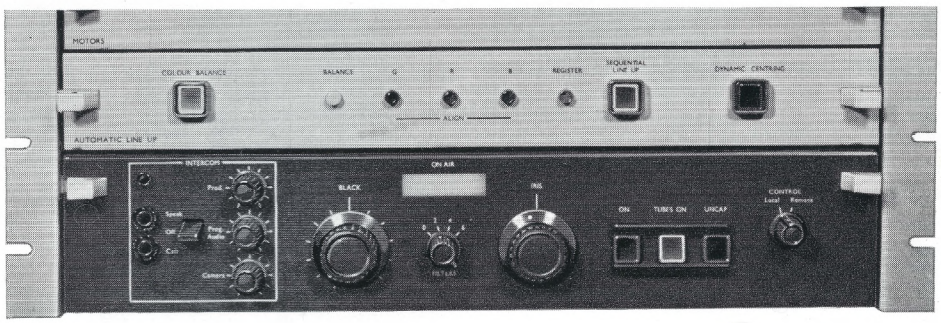


Fig.6. Operational controls on front of CCU.

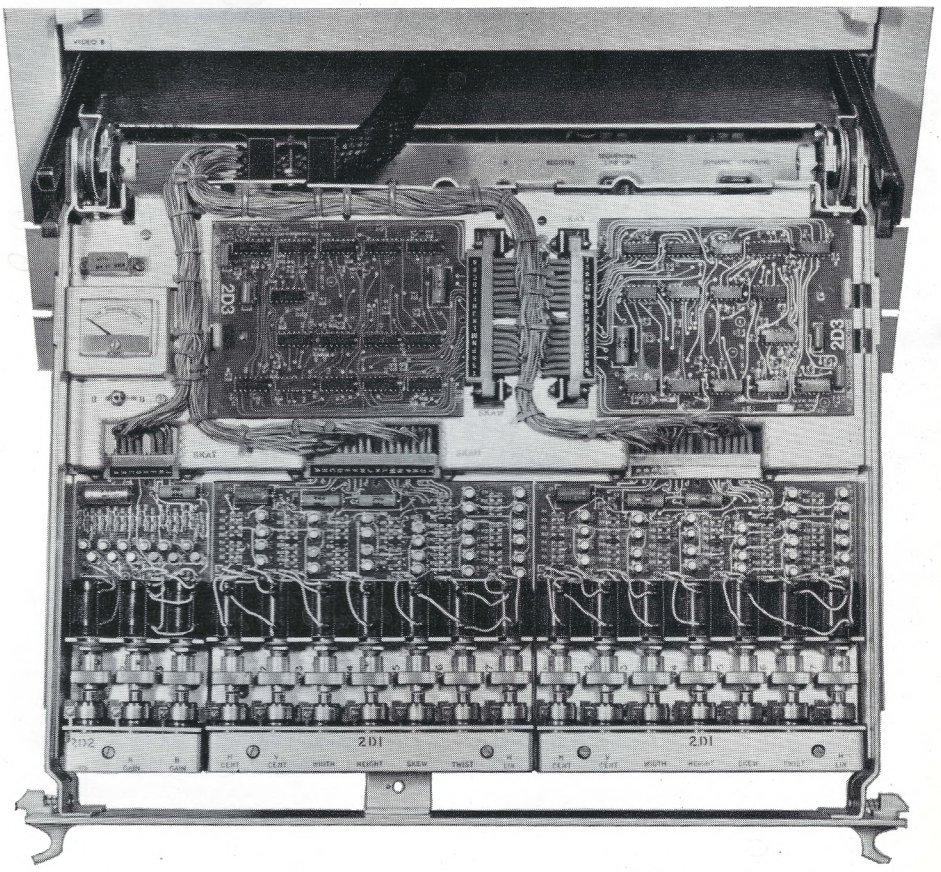


Fig.7. CCU showing accessibility to one of the drawers, in this case the Motors Unit.

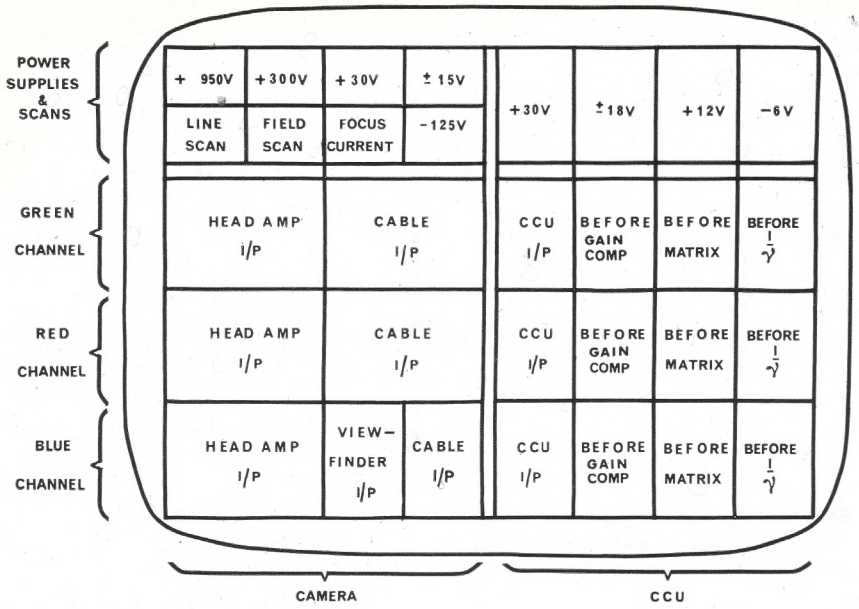


Fig.8. Diagram of Auto-test display.

Colour Balance

Before starting this operation the camera should be framed up with a white subject in the centre of the picture. This should occupy at least 10% of the total picture area.

When the colour balance button is pressed the iris is automatically controlled to set the peak level of the green signal to 0·6V and the gains of the red and blue channels are adjusted so that their respective peak signal levels match the green channel.

Dynamic Centring

The dynamic centring circuits use normal picture information from the three videos to select and compare waveform transitions. These transitions give information on any misregistration present at the centre of the picture. Centring correction is then applied to eliminate such misregistration. As a safeguard, errors must be confirmed in two places at points in the image separated by a distance of at least 3% of picture height or width, before corrective action is taken. In this way the system is effectively proof from false error detection signals derived from unusual picture patterns.

Camera Cable

The standard cable employed is a 13mm (0·5in) flexible 34-way cable. This may be used up to a maximum of 900m (3000ft). The cable is terminated in a new version of the Mark IV camera cable connector which is compatible with the old Mark IV type.

Most types of colour cable may be employed by the use of suitable adaptors. Customers are invited to state their requirements.

Auto-test

A novel feature of the camera is the provision of an auto-test facility. When switched to this condition, a pattern of white rectangles appears on the black-and-white picture monitor. Each rectangle relates to a particular camera function as shown in Fig.8. The absence of any rectangle, namely the appearance of a black, indicates a failure in that area. The individual areas are broadly broken down into individual sub units or boards so that immediate indication is given as to which board should be replaced. Although intended as a servicing facility, the Auto-test facility is also available on a colour monitor, in which case the three video sections are displayed in the appropriate colour.

Aperture Corrector

This unit forms the top drawer in the camera control unit and performs both vertical and horizontal aperture correction. Two glass delay lines are used for vertical correction driven by piezzo electric transducers.

After cable correction the green video signal is first passed to a horizontal corrector with a theoretical peak boost at 6·25MHz which compensates for pick-up tube losses.

After modulation onto a 20MHz carrier the signal is then passed through two glass delay lines in order to form the one line (E1) and two line (E2) delayed signals.

Signal E1 is then passed through a 1·5MHz lowpass filter and fed to the main video path.

The correction signal is obtained by adding together three signals :

1) The high frequency component of the E1 input.
2) A horizontal correction signal obtained by summing $E_1+\frac{1}{2}(E_0+E_2)$ giving a 'comb' response (maxima at line frequency harmonics) ; this signal is given standard aperture correction by taking the difference signal between two different sinusoidal band shapes.
3) A contour correction signal obtained by summing a vertical correction signal $E_1-\frac{1}{2}(E_0+E_2)$ with an in-band peak signal at 3·125MHz to give equal enhancement of horizontal and vertical picture contours. The amount of the combined signal used is adjusted by the aperture correction control on the control panel.

Before the final adder the contour correction signal is fed to a 'corer' circuit which suppresses low-level modulation to reduce noise.

Next the combined correction signal is blanked and time delayed before being added to the l.f green, red and blue signals.

Operational Control Panel

This unit contains all the necessary controls associated with 'Hands Off' operation. Master Black, Iris (normal and preset range), Aperture Correction, On/Off, Standby and Operate. A new feature is a Standby Iris position. In this condition a reasonable camera picture may be obtained under differing light levels. By means of a peak level detector an approximately correct iris setting will be obtained. This feature is not intended as a full Automatic Iris facility.

In addition the camera may be registered and colour balanced from this panel. A switch on the joystick can be used to operate a picture matching matrix.

Auxiliary Control Panel

For normal studio use cameras will be accurately matched at the factory to a standard reference and no further adjustment should prove necessary if faithful scene reproduction is required. An alternative matrix is supplied for use under daylight conditions such that the camera will be optimized for a colour temperature of 5500K.

However, it is a natural phenomenon that the colour temperature under outside broadcast conditions varies throughout the day from the average figure of 5500K. The Auxiliary Control Panel (which is an optional unit) provides colour balance adjustment along the Red/Blue (four ranges) and Green/Magenta axes. Although the controls are independent they are mounted on the same joystick and may be operated with one hand. When adjustment is not required an automatic lock is provided for the neutral position. A switch on the joystick can be used to operate a picture matching matrix.

The range of temperatures which may be compensated is from 4500K to 7500K.

In addition to the Colour Balance Controls a master gain switch giving +3, +6, +9 and +12dB extra gain is provided.

The individual remote RGB black level controls are also provided on this panel. Both the operational and the Auxiliary Control Panels may be remoted up to 150m (500ft) from the CCU.

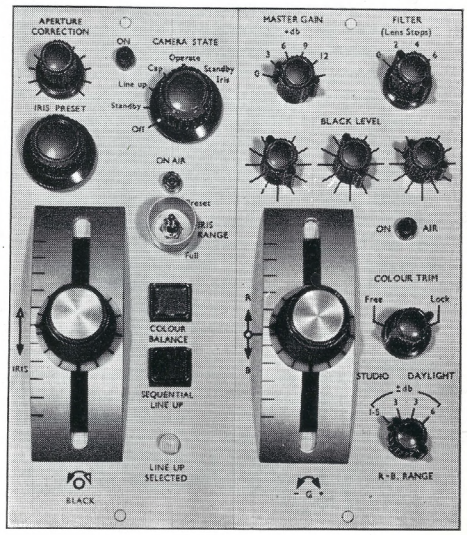
Test Facility

In addition to the Auto-test feature and metering facility on the Power Supply Unit, a test probe is provided.

This probe is built into the CCU and can be connected to the picture and waveform monitor feeds.

It provides a convenient means of examining video at test points throughout the CCU.

Fig.9. Auxiliary and operational control panels.



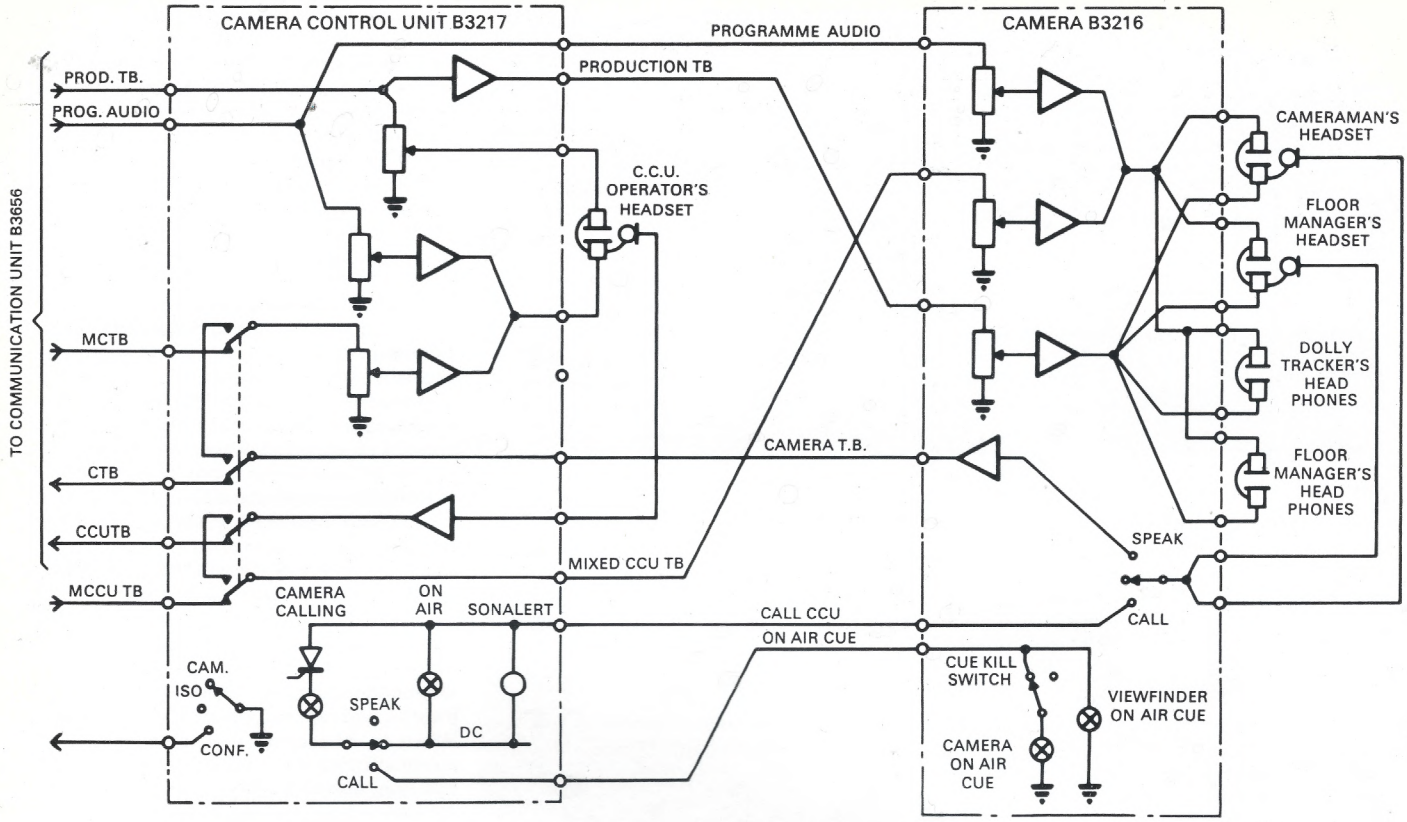


Fig.10. Cues and communications facilities.

Cues and Communications

A multiple Mark VIII Camera studio is designed to work with the B3656 Communications Equipment fully described in TD3656.

Each camera chain is equipped with the following facilities:

1 Adjacent to the camera cable outlet two headset outlets wired in parallel for the floor manager and dolly tracker.
2 A cameraman's headset outlet at the rear of the camera wired in parallel with a floor manager's headset outlet.
3 Volume controls for CCU Talkback, Programme Audio (in the same ear), and for Production Talkback in the other ear.
4 Cameraman's Speak/Call switch at the rear of the camera.
5 Cue light at the front of the camera and in the viewfinder. (The cue light at the front may be switched off from the camera for audience participation shows.)
6 At the CCU a Speak/Call switch.
7 A cameraman calling buzzer and 'Hold on' lamp.
8 CCU operator's headset socket.
9 Volume controls for Camera Talkback, Programme Audio and Production Talkback.
10 'On Air' lamps at the CCU.
11 On the CCP a three-positioned switch providing Camera (normal condition), Conference (all cameras and CCUs joined together), and Isolate (camera to CCU slave) positions.

An alternative two-wire communication system as used in the US can be provided if required.

Ordering Information

When ordering please state:

1) Length and type of camera cable required.
2) Television standard and system employed.
3) A.C supply voltage on which equipment is to operate.
4) Type of zoom lens required and whether servo or manual.
5) If a colour coder is required (Coder 3373 recommended for PAL or NTSC).
6) The type of cabinet in which the control unit will be mounted.
7) If ×2 range extenders are required (not available on Varotal XXII).
8) If spares are required.
9) If a friction head and tripod are required (state camera application, i.e studio or outside broadcast).
10) If test charts are required.
11) If additional handbooks are required.
12) If headsets and headphones are required.
13) If auxiliary control panels are required. (Not recommended for studio operation.)
14) If pick-up tubes are required, and type preferred.
15) Optional items required.
16) If training is required.
17) Talkback system required, i.e European (4 wire) or US (2 wire).
18) Any further items of equipment needed such as picture and waveform monitors, sync gens, communications unit etc.
19) Distance of operational control panel from CCU if over 15m (50ft).

Optional Items

Auxiliary Control Panel Type B3220
This unit is recommended for outside broadcast operations only. It contains controls for colour balance adjustment along the red/blue and green/magenta axis, plus the Master Gain Switch, Filter Wheel Control Switch, Black level Controls and picture selection microswitch.

Zoom Shot Box Type B3222
For customers with servo zoom only. Mounted on the right-hand side of camera.

Digital Test Unit B02–3221–01
This unit is recommended for customers who wish to service their own camera digital printed boards.

Tube Simulator, BB23–3206–04
Enables sweep signal to be fed directly into head amplifier allowing for pick-up tube capacity.

Universal Mounting Plate B41–4509–01
An adaptor which fits on the front of the camera to facilitate the attachment of lights, Autocue equipment etc.

Camera Cable Adaptors
The company will produce suitable adaptors dependent upon customer requirements.

Long Viewfinder Hood, B08–3128–01
Recommended for outside broadcast use and studio operation under bright lights.

Waterproof Cover
A tough plastic waterproof cover is available for outside broadcast use.

Data Summary

Systems
CCIR 625 lines, 50 fields/s 2 :1 interlaced or EIA 525 lines, 60 fields/s 2 :1 interlaced (not switchable).

Power Supply
Transformer tapped for 100–125V and 200–250V in 5V steps, 48–60Hz.
Consumption approx. 650VA (dependent on cable length). A.C voltage variations within ±5% of the nominal voltage do not affect performance data specified. Cannon E.P.4 connector.

Inputs
Mixed blanking 1·5V–6V, bridging input. BNC connector. (Return loss 30dB to 625T pulse and bar.)
Mixed sync same as for mixed blanking.
Colour step sync same as for colour step output.
Remote video 1·0V composite signal, bridging input. BNC connector.
Coder video 1·0V composite signal bridging input. BNC connector.
Test input 0·7V signal bridging input. BNC connector.
Audio input (for dream effects) 0dB. XLR connector.

Outputs*
2 × (G, R, & B) gamma corrected video signals 0·7V across 75Ω.
Colour step waveform adjustable from 2·0V to 15·0V for different waveform monitors, high impedance.
Colour step sync.
Picture monitor video 0·7V non-composite signal 75Ω.
Waveform monitor video 0·7V non-composite signal 75Ω.
Waveform monitor sequence (parade) relay earth.
Chroma key video B–R–G signal 0·7V into 75Ω.
*All outputs on BNC connectors.

Sensitivity
800 lux (75ft candles) lens iris *f*/4, incident on a white chip of 60% reflectance.
Under these conditions a depth of modulation of at least 40% should be obtained at 5MHz at the camera output (without correction).
The peak signal to r.m.s noise ratio over a 5MHz band will not be less than 45dB measured in a flat channel.
Just acceptable pictures (with lens iris set to *f*2·2 and master gain at +12dB), down to 50 lux (5ft candles).

Resolution
With aperture correction, 100% modulation depth can be obtained at 5MHz in each video channel.
Under these conditions the frequency response will be within ±0·5dB to 5MHz up to 1000ft of camera cable.

Registration
0·1% accuracy in Zone 1. 0·2% in Zone 2 and 0·3% in Zone 3 (with average tubes). (Zone 1 is an ellipse whose major and minor axes are equal to 80% of picture width and height.) Zone 2 is outside Zone 1, but within a circle of diameter equal to picture width. Zone 3 is the remainder.

Gamma Correction
Preset laws at either 0·4, 0·45, 0·5 or 0·55, selected by links.
Gamma correction may be switched off and also between any two of the four laws.

Scanning Geometry
Overall distortion less than 0·25% of picture width in Zone 1, less than 0·5% in Zone 2 and less than 1·0% in Zone 3.

Gain Control
Master gain selected from CCP or OCP to either 0dB, +3, +6, +9 or +12dB. Auxiliary control panel has 4 ranges on red/blue control.

Warming Up
Rehearsal quality pictures 5 min after switch on over the range +10° to +45°C.

Camera Cable
The following type can be employed up to a maximum length of 900m (3000ft) :
B.I.C.C. Type T1889 13mm, 34-way
B.I.C.C. Type T1854 (Mark IV) 17·5mm, 34-way.
And the following type can be employed up to a maximum of 600m (2000ft)
B.W. TV33P 14mm
The camera may also be used on most types of colour cable including TV81, with suitable adaptors

Pick-up Tubes
English Electric P8001 Leddicons or Philips XQ1020 Plumbicons.

Lenses
i) 10 :1 Varotal XXII, *f*/2·9, m.f.d. 1·2m (4ft), servo zoom and servo iris, weight 11·4kg (25lb).
ii) 10 :1 Varotal IX, *f*/2·2, m.f.d. 1·8m (6ft) servo zoom and servo iris, weight 16kg (35lb).
iii) 16 :1 Varotal XVI, *f*/2·2, m.f.d. 3·0m (10ft) servo zoom and servo iris, weight 22kg (48lb).
iv) 10 :1 Varotal XXX *f*/2·2, m.f.d. 0·45m (1·5ft), servo zoom and servo iris, weight 18kg (40lb).
v) 15 :1 Angenieux 15×18 L81 *f*/2·4, m.f.d. 0·55m (1ft 9in), servo zoom and servo iris, weight 15kg (34lb) ×1·5, ×2·0, ×2·5 range extenders on turret.
×2 range extenders available on Varotal IX and Varotal XVI.

Aperture Corrector
Vertical Aperture correction up to 1·5MHz to a maximum of 12dB is provided.
First horizontal corrector peaking at 10·0MHz adjustable to a maximum level of 12dB at 5MHz.
2nd horizontal corrector peaking at 3·6MHz to a maximum level of 6dB above the level set by the first horizontal corrector.
The aperture corrector control adjusts vertical and 2nd horizontal corrector simultaneously.

Ambient Temperature
i) Storage −20 to +60°C.
ii) Equipment may be switched on without damage over the range −20 to +45°C.
iii) No change in performance data will occur at ambient temperature variations of ±10°C with respect to the temperature during the line-up procedure, within a range of −10 to +40°C.

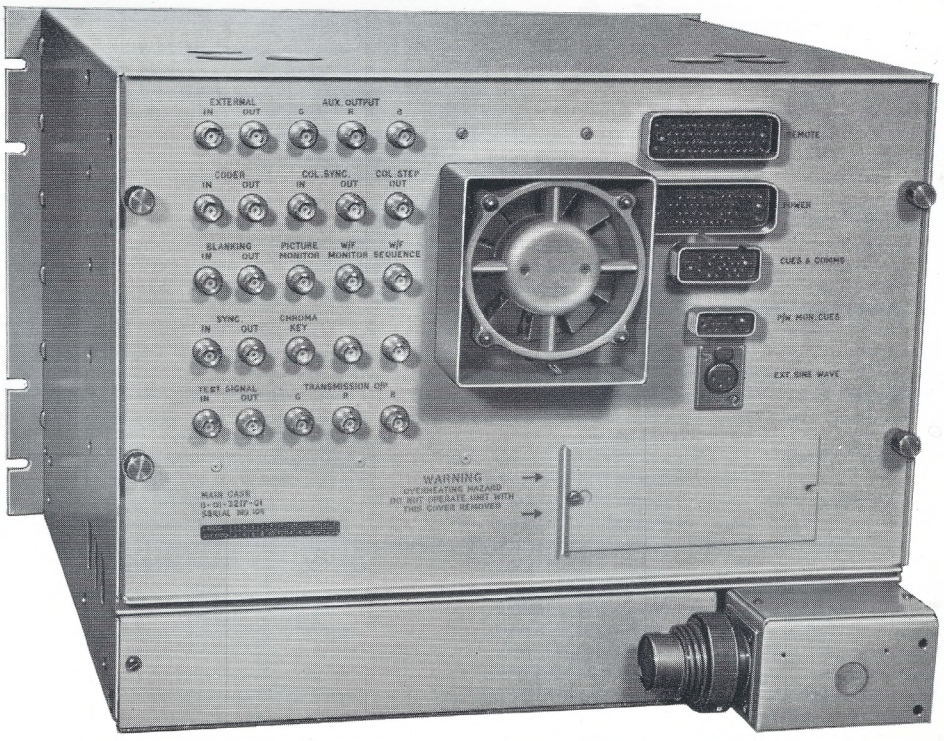
Dimensions

	Height	Width	Length	Weight
Camera	408mm (16in)	360mm (14·25in)	580mm (22·75in)	36kg (80lb)*
Camera Control Unit	356mm (14in)	483mm (19in)	556mm (21·9in)	36·3kg (80lb)
Power Supply	133mm (5·25in)	483mm (19in)	483mm (19in)	27·3kg (60lb)
Operational Control Unit	206mm (8·1in)	89mm (3·51in)	105mm (4·1in)	
Auxiliary Control Unit	as for operational control unit.			

*Weight includes viewfinder but excludes lenses.

The information contained herein is subject to confirmation at time of ordering.

Fig.11. Rear view of Camera Control Unit.



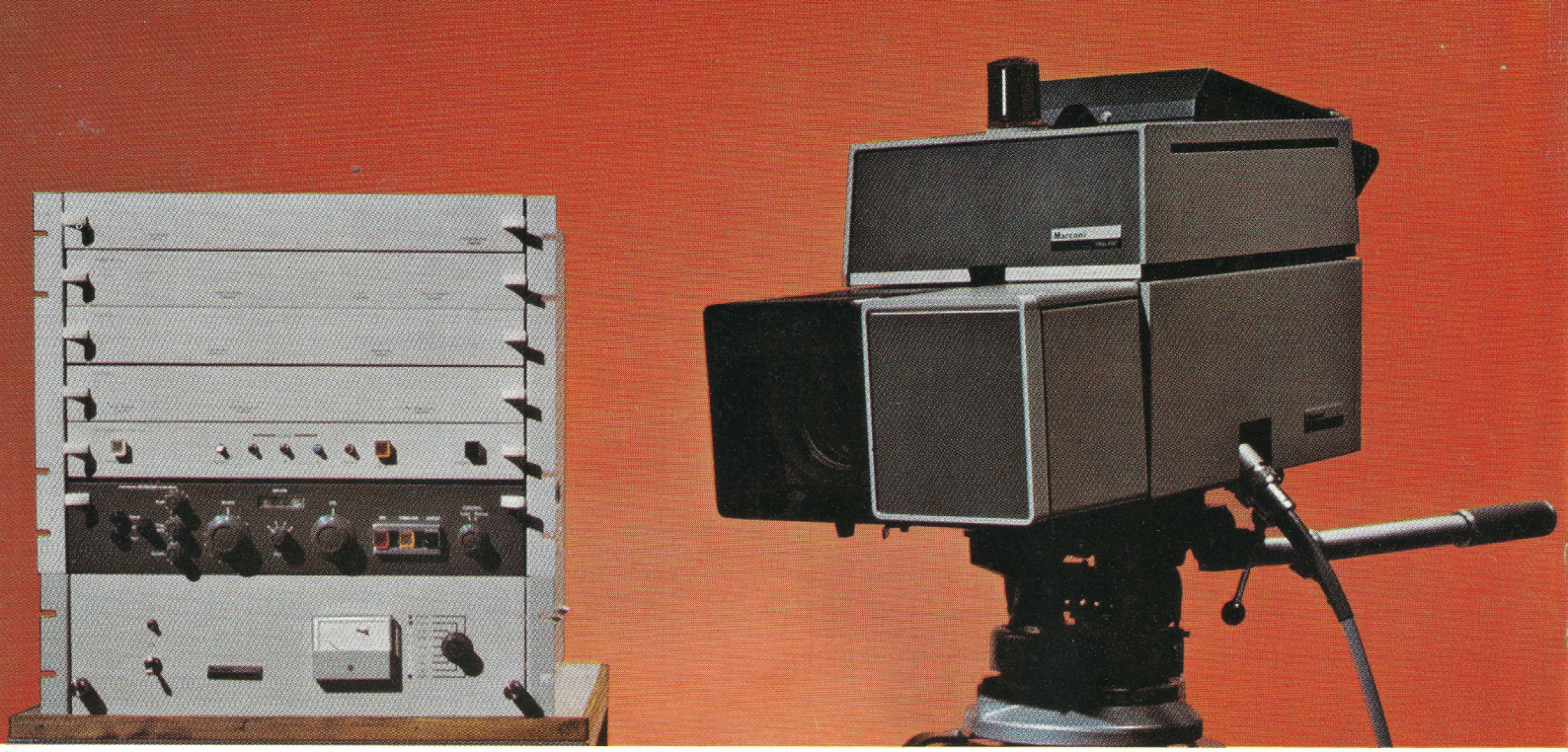
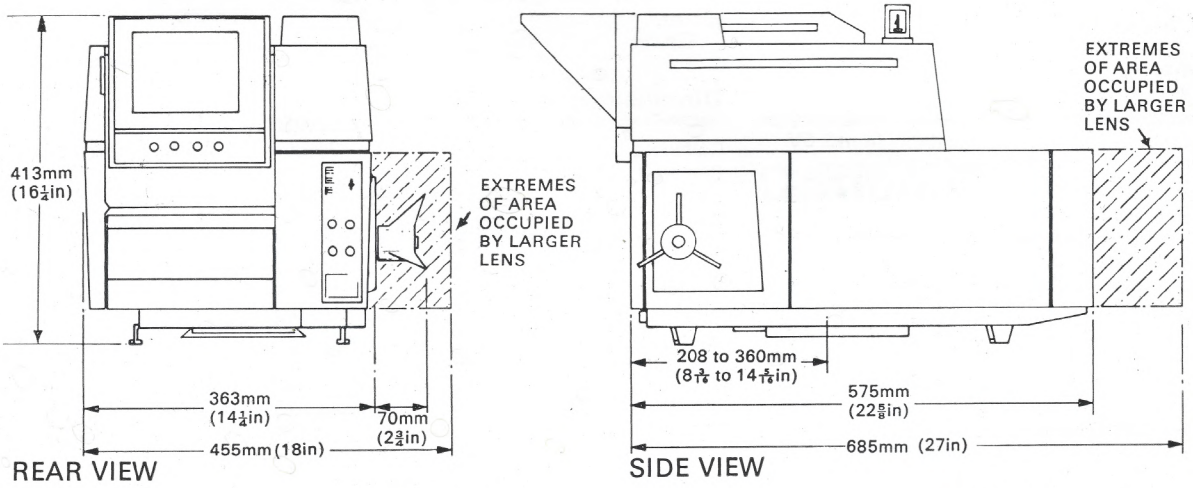


Fig.12. Mark VIII Camera Control Unit, Power Supply and Camera Head.

Mark VIII Television Camera Dimensions



Camera Control Unit and Power Supply Unit Dimensions

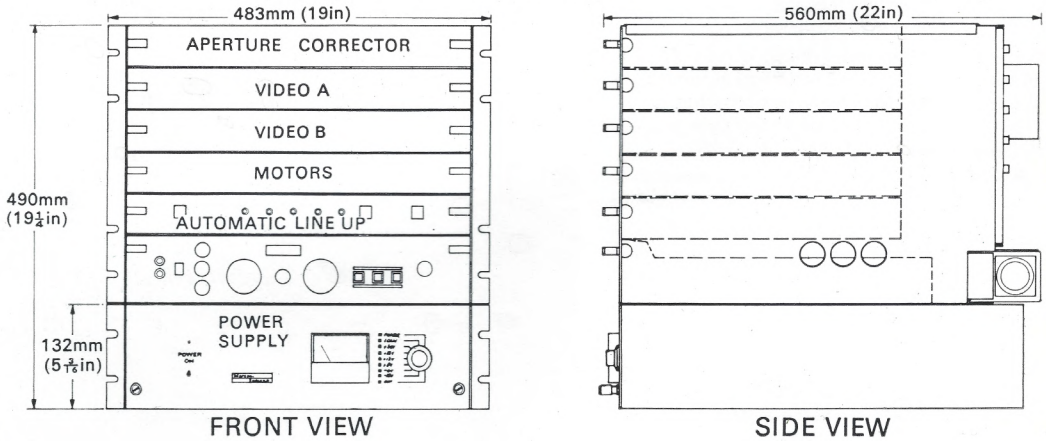


Fig.13. Mark VIII camera dimensions.

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