



Mark IX Colour Camera

B3265

Features

- Lightweight compact camera
- Sensitive (pictures to 50 lux)
- Low power consumption
- Small CCU (integral P.S.U. and coder)
- Optional automatics
- Wide range of lenses (10:1 to 42:1)
- Dynamic gain (auto and manual)
- Lightweight multicore camera cable
- Triax option
- Two line aperture corrector
- Two programme microphone circuits option
- Field proven prism optics
- Tilting viewfinder ($\pm 60^\circ$)
- Highlight overload protection tubes option
- Extended red tubes option
- Local or remote control
- Short camera (balances well)



Facilities

Variable gamma	Automatic cable compensation (P.S.U. timing and viewfinder)
Two filter wheels	H & V scan protection on all tubes (LED verification)
High quality talkback system	Comprehensive cameraman's controls
Shading compensation	Script board holder
Individually variable light bias	Chroma key output
Auto iris and auto black	Tube hour meter
Plug-in P.C.Bs	Camera mounted shot box
Comprehensive monitoring	Internal sawtooth/staircase test generator
Mechanical focus with positive end stops	

Marconi has been involved in the design and production of television cameras since the late 1940's with the debut of the Mark I camera. Since that date nearly 3,000 cameras have been sold to more than fifty countries.

Now Marconi is proud to offer the Mark IX colour camera; the evolutionary development of this accumulated camera experience.

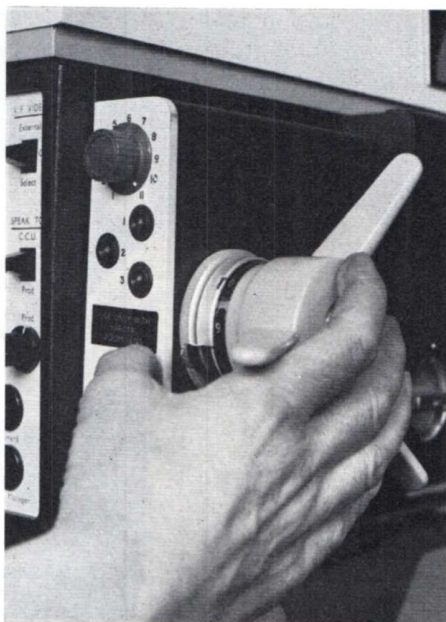
Nevertheless, many of the outstanding technical features of its predecessor, the Mark VIII camera, such as compact optics, automatic registration and exceptional sensitivity have been retained. The result is a compact camera channel which offers considerable operational advantages both in studios and OBs.

The camera pick-up tubes are 30 mm lead oxide types and several varieties can be fitted. These include standard tubes, light bias, extended red, HOP, and high resolution tubes.

The basic camera channel is designed for manual registration, but for those customers who prefer the advantages of rapid line-up an optional automatic

A major advantage of the Mark IX camera over most other colour cameras is the inclusion of a built-in diascopes or test pattern. This diascopes enables the camera to be automatically lined up without the use of an external pattern in front of the lens.

The extremely compact CCU includes all video circuitry, coder and power supply contained within a frame only 5 rack units high.

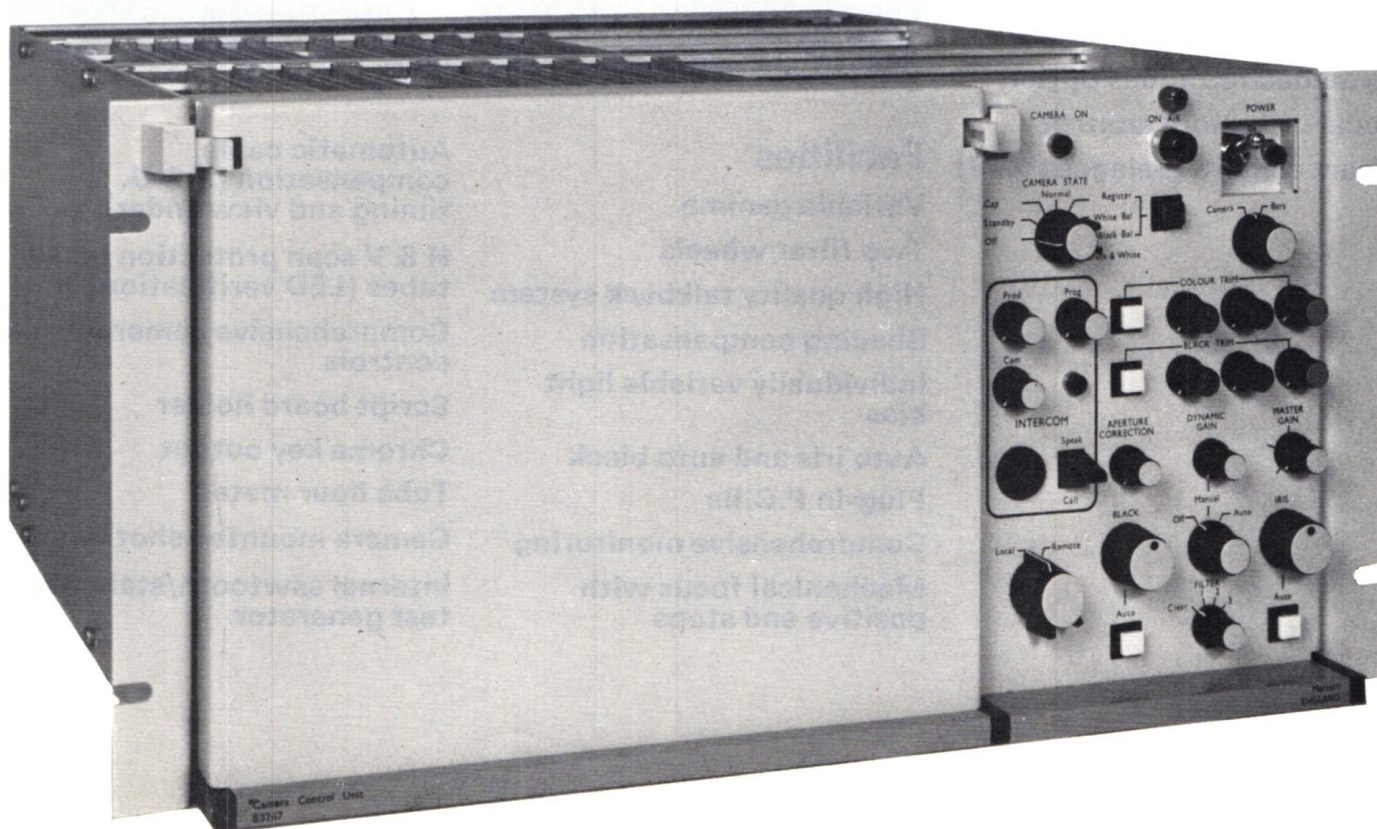


The camera body is constructed so that by simply removing eight screws the complete electronics frame can be removed from the optical assembly. This is mounted on a rugged cast base. When the viewfinder and lens have been removed the total weight is only 30 kg (68 lbs) enabling one man to carry it, if required.

Circuitry is contained on plug-in circuit boards and extender boards are available for servicing.

The pick-up tube yokes are fully screened by mumetal and contain scanning coils printed in cylindrical form enabling an extremely high degree of accuracy to be achieved. A comprehensive talkback system is provided which is suitable for both European and U.S. systems. Headset jack sockets are fitted for both the cameraman and a floor manager. Two quality microphone circuits with individual level controls can be provided at the camera head for commentator and effects mics. Test input, monitoring outlet, and communications sockets are all provided on the camera base.

The camera focus handle is situated at the right hand rear of the camera and drives the lens through a gear.



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Lenses

The camera can accept a wide range of lenses designed for the 30 mm pick-up tube format. These range from 10:1 to 42:1. Either manual or servo zooms can be provided.

An optional shot box with integral focus handle may be fitted to the right-hand rear quarter of the camera.

A variety of lens attachments such as ray shields, close-up adaptors and range extenders are available for most lenses.

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. Two filter wheels are fitted, the first containing three neutral density filters (.33ND, .75ND and 1.5ND) and the second containing two colour correction filters. These provide conversion for incident light at 4,100 K and 6,000 K. A third position on the second filter wheel is available for special effects such as star filters. The first filter wheel may be controlled either from the camera, the CCU or the remote control panel. The second

filter wheel is controlled manually by the cameraman.

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

During automatic 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 prism. The optical system employs a reduced size of image on the red and blue tubes to increase the intensity of illumination on the pick-up tube faceplate, which reduces the effect of differential coloured lag.

Highlight Overload Protection

Televised scenes frequently contain highlights from such items as jewellery, mirrors, musical instruments, etc. The Mark IX camera is designed to accept the HOP Leddicon range of tubes. Standard tubes can be fitted by a simple link change. The principle of the HOP tube is that during the normal read process the target is scanned in the normal way with a beam current of 1-2 microamps, but during the line flyback period the next line to be

scanned is pre-scanned with a high intensity beam. During this flyback period the cathode is pulsed positively so that those target elements which have been exposed to a very high illumination are restored to a potential which the normal scanning beam can subsequently handle. This introduces a knee into the light transfer characteristic such that a tube with the HOP gun can handle an over exposure of up to five stops without overloading.

Viewfinder

This unit, which weighs only 12 lbs, is capable of tilting over 120° range and may be locked in any position. Alternatively it may be detached and operated away from the camera up to a distance of 9 m (30 ft).

The viewfinder uses a 180 mm (7 in) rectangular tube with a bonded faceplate. The highlight brightness is 2150 lumens/m² (200 ft 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 is available.

The viewfinder incorporates an adjustable 'crispener' control as an aid to focusing. A cameraman's cue light (adjustable intensity) is positioned at the top right corner of the picture.

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.

Any one of eight signals may be displayed on the viewfinder. These are Green, Red, Blue, External, R-G, B-G, G+Ext, and coded + Ext.



Camera with top cover in open position

Triax

An alternative version of the camera head is available for operation with triax cable instead of multicore. The additional triax modules are accommodated within the camera head. The triax version can work with up to 1.5 km of 13 mm triax cable. At the CCU the triax cable is connected to a small base station which is only 3 rack units high and a half rack width. This unit enables a standard CCU to be used for the essential signal processing.

All the facilities available on the standard camera are also available on the triax version, including chroma key.

If the weight of cable is the prime consideration, 9 mm triaxial cable can be supplied. In this case operation is limited to 900 m.

Triax cable is normally supplied with Fischer connectors unless otherwise specified. If required a standard multicore head can also be used with triax cable by employing a portable triax converter. This unit can also be used with the Mark IX portable camera.

Camera Control Unit

This is a 19 in rack mounted unit 222 mm (8.75 in) high. It contains all the video circuitry, including the coder, together with a switched mode power supply and camera control panel. The unit is constructed so that access to the video modules is obtained behind the left hand cover. Access to the power supply is obtained behind the Camera Control Panel on the right. The individual modules reading from left to right are:

- (1) Manual registration (or automatic alternative)
- (2) Optional automatic centring
- (3) Pulses
- (4) Shading and communications
- (5) Manual colour balance (or automatic alternative)
- (6) Aperture corrector
- (7) Green video
- (8) Red video
- (9) Blue video
- (10) Coder
- (11) Monitoring

For normal operation the left hand cover is in position so that all preset controls on the front of the video boards are protected from accidental misadjustment. All operational controls are grouped on the CCP on the right hand side.

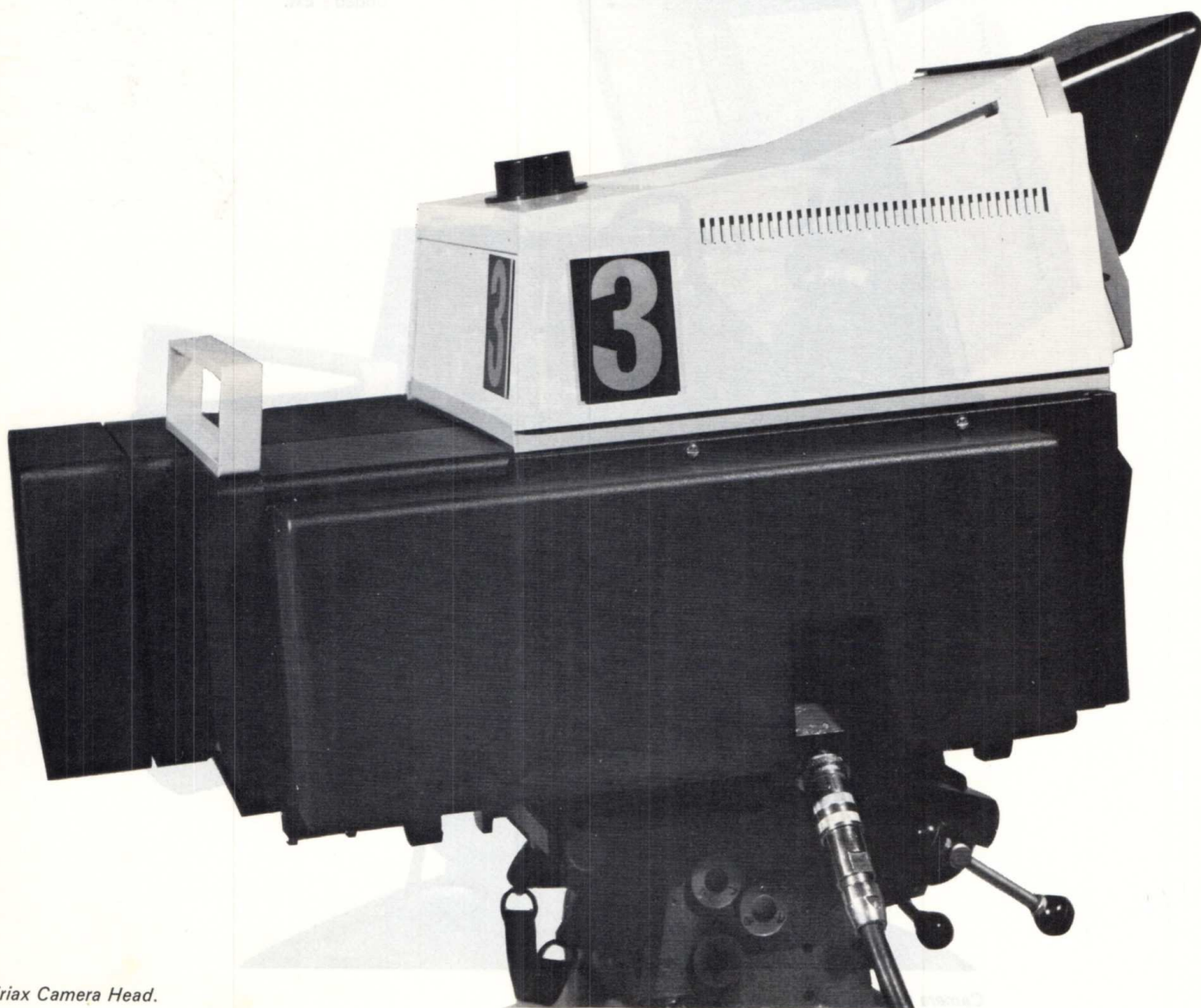
Automatic Facilities

- (1) Automatic dynamic gain is provided as standard on the coder module.
- (2) The following are provided on the optional automatic balance module:
 - (a) Automatic white balance (when viewing a suitable white area)
 - (b) Automatic black balance (when the camera is capped)
 - (c) Automatic iris (when selected at CCP or RCP)
 - (d) Automatic master black (when selected at CCP or RCP sets master black to blackest part of G, R or B picture).
- (3) When the auto balance module is fitted an optional automatic registration module may also be fitted.
- (4) If the auto registration module is fitted the auto centring module may also be fitted.

Automatic Registration

When the sequential line-up button on the CCP or RCP is pressed the following actions take place automatically:

- (i) The internal diascope is brought into action.
 - (ii) The gains of the red and blue video paths are adjusted to make the respective peak signals equal to that of the green signal.
 - (iii) The picture is examined for relative displacement of green and red, and green and blue video signals. Correction is then applied to the appropriate parameters of the red and blue channels.
- The entire sequence takes under three minutes.



Triax Camera Head.

Automatic Centring

When an automatic registration module is fitted a further optional automatic centring module may be added. This unit examines the normal video information and compares the timing of the three videos. Any misregistration present gives rise to timing differences and this information is used to generate centring correction voltages.

As a safeguard, errors must be confirmed in two different places, before corrective action is taken. In this way, the system is effectively proof against false signals derived from unusual picture patterns.

Automatic Colour Balance

The cameraman frames a white subject in the centre of the picture. Automatic white balance is then achieved by red and blue video gain adjustment so that the red and blue video levels are equal to that of the green video.

When the automatic black balance is initiated the camera is automatically capped. The red, green and blue black levels are balanced and the circuit is then switched off.

Automatic Master Black

This facility automatically adjusts the master black to give zero output at the blackest part of the green, red or blue picture. Switching between automatic master black and manual master black does not produce a sudden change in black level.

Automatic Iris

This facility is capable of providing correctly exposed pictures for live transmission. The circuit examines the video in respect of both peak and mean signal and adjusts the iris accordingly. The circuit is relatively insensitive to small area highlights, e.g. speculars.

All the facilities mentioned above may be controlled at the CCP or RCP.

Automatic Dynamic Gain

Some scenes of high contrast contain detail in the shadows which is lost when the camera iris is correctly set. The automatic dynamic gain circuit provides rapid adjustment of the transfer characteristic so that this detail is brought out without over exposure in the high luminance areas. Automatic dynamic gain can also improve scenes of very low contrast.

Manual Version

Manual replacements for the automatic modules are available for those customers who prefer this mode of operation. In this version of the camera automatic dynamic gain is still provided on the coder.

Aperture Corrector

This unit provides two line aperture correction with coring and combing facilities. Before vertical correction the green signal is first passed through a horizontal corrector with a theoretical peak boost at 10.0 MHz to compensate for pick-up tube losses.

A continuous correction signal is obtained by summing the vertical correction signal with an in-band peak signal to give equal enhancement of horizontal and vertical picture contours. The amount of combined signal is controlled by the CCP aperture correction control.

The corer circuit is used to suppress low-level modulation to reduce noise.

Coder

This unit forms one module of the CCU. Either PAL or NTSC versions are available. The unit generates three outputs of standard level of which two are available on the rear panel.

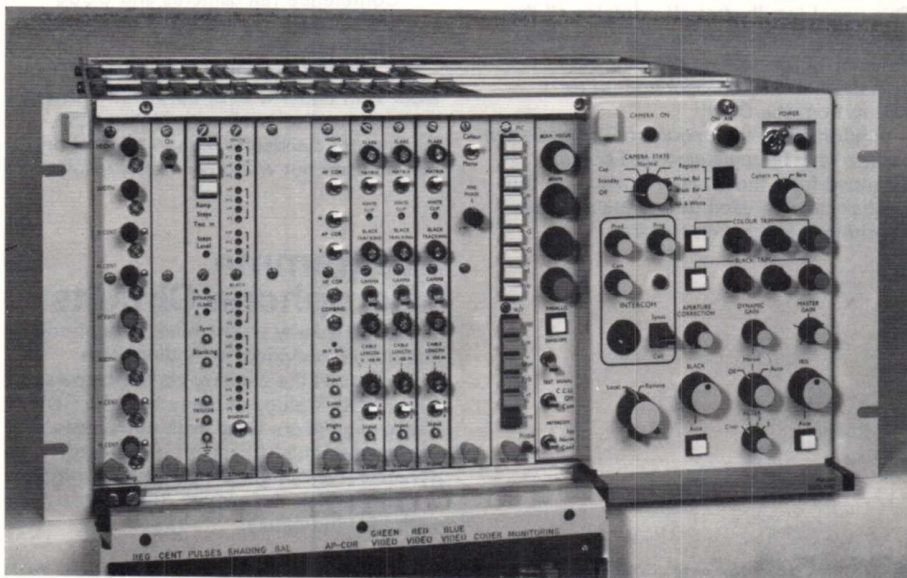
Green, red and blue colour bar signals are supplied from the pulses module and changeover from camera to bars signal may be controlled either from the CCP or RCP. Selection of mono or mono plus burst is also available remotely.

The coder can produce BBC, EBU, FCC or 100% bars. Either split or full field. I and Q signals are also available with FCC split field bars from the NTSC coder.

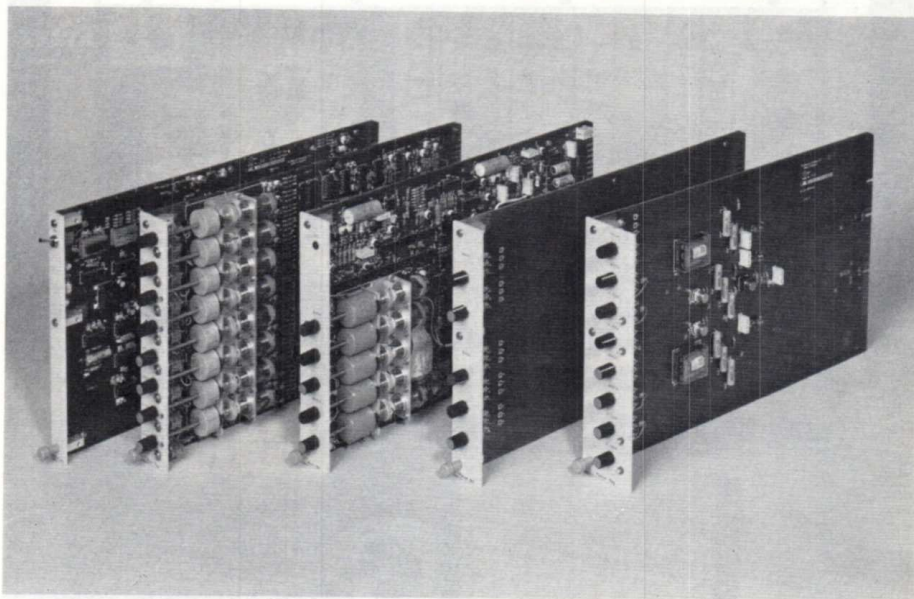
Changes of bar configuration are selected by links.

The coder can operate in a true monochrome mode in a mono plus burst mode.

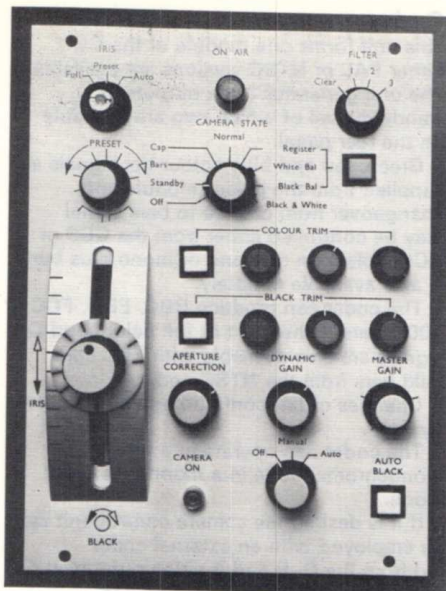
If it is desired the camera control unit can be employed with an external coder fed from the G, R and B video outputs at the rear panel, for example for SECAM.



CCU showing access to modules.



Automatic and manual CCU modules.



Remote Control Panel.

Remote Control Panel

This panel (as illustrated) contains all the controls necessary for remote control of the camera for both studio and OB operation. It may be operated up to 150 m from the CCU.

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

Cues and Communications

Each camera channel is equipped with the following facilities.

- 1) A cameraman's headset outlet at the rear of the camera and, wired in parallel, a floor manager's headset outlet.
- 2) Volume controls for CCU talkback, programme audio (in the same ear), and for production talkback in the other ear.
- 3) A camera calling button.
- 4) A cameraman's speak to CCU/or speak to producer switch.
- 5) Cue light at the front of the camera and in the viewfinder. (The front cue light may be switched off from the camera for audience participation shows).
- 6) A speak/call switch at the CCU.
- 7) A cameraman calling alarm 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 on the CCU and RCP.
- 11) On the CCU a three-positional switch providing Camera (normal condition), Conference (all cameras and CCUs joined together) and Isolate (camera to CCU) position.

The talkback system is universal and can work with either U.S. or European systems. It is designed to work with high quality moving coil headsets. Carbon microphones can be used but will give inferior results.

Programme Microphone Circuits

Two high quality programme microphone circuits are provided, extending from XLR plugs at the camera, via the camera cable to XLR plugs at the rear of the CCU. These circuits are fitted with compressors and are designed to accept a standard dynamic microphone input. Level controls are provided at the camera, together with LED indicators.

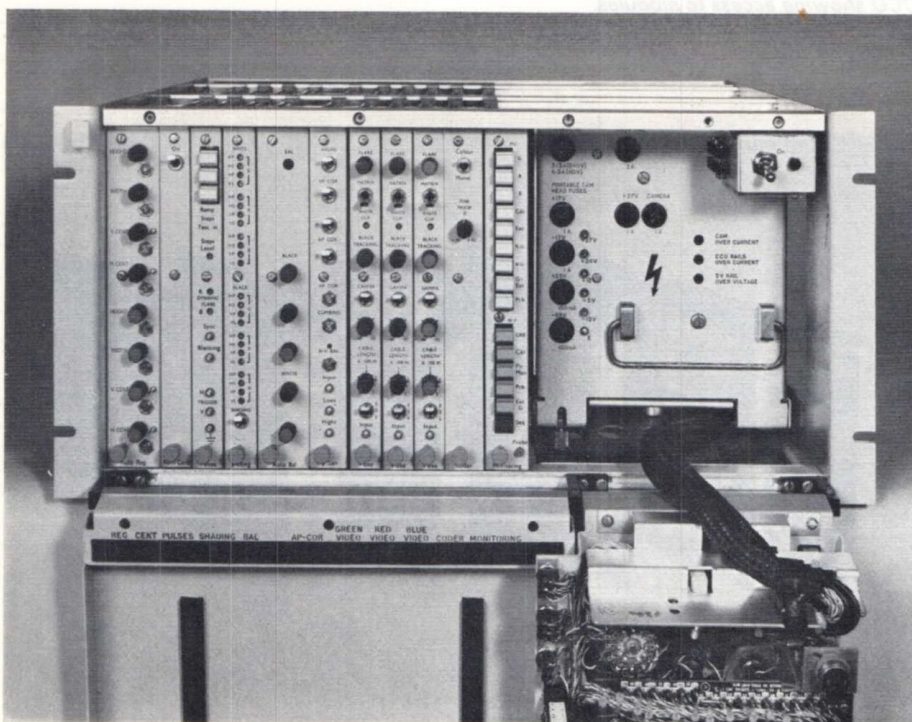
Ordering Information

To ensure that your order is quickly processed and that you receive the correct items, please specify:

- 1) Television standard and system required.
- 2) Length of camera cable.
- 3) AC supply voltage and tolerance
- 4) Type of zoom lens and whether servo or manual, range extenders, etc.
- 5) Cabinet/rack mounting arrangements
- 6) What options are required.
- 7) If a friction head and tripod/pedestal are required. (State camera application, i.e. studio or outside broadcast.)
- 8) If test charts are required.
- 9) If spares are required.
- 10) If camera tubes are required and type preferred.
- 11) If additional handbooks are required.
- 12) If headsets are required.
- 13) If training is required.
- 14) Distance of remote control panel from CCU.
- 15) Any additional items of equipment needed, such as picture and waveform monitors, sync gens., communication units, etc.
- 16) If triax camera, type of connector required.

Optional Items

Programme microphone.
Camera shot box.
Headsets.
Long viewfinder hood.
Tube simulator.
Digital Test Set (not required for Manual Mark IX).
Waterproof cover.
Studio extender kit.
Remote Control Panel (supplied as standard with Automatic Mark IX).
Extended red matrix.
HOP tubes.
Attachment clamps.



CCU, showing access to power supply behind CCP.

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

95–130V and 190–260V 48–60 Hz.
Consumption approx. 350 VA.
At any voltage within the specified range, a swing of $\pm 5\%$ will not affect performance.
EP–LNE connector.

Inputs

Mixed blanking: (1.5–6V), bridging input, BNC connector. Return loss 30 dB to 2T pulse and bar.
Mixed sync input: same as for mixed blanking.
Colour step sync input: 1.5–6 V, BNC connector. Return loss 30 dB.
Remote video: 1.0V composite signal, bridging input, BNC connector. (Return loss 36 dB to 2T pulse and bar).
Burst gate (PAL): 1.5–6V, BNC connectors bridging input, return loss better than 30 dB to 2T pulse and bar.
Subcarrier: 0.5–3V, bridging input, BNC connectors. Return loss 30 dB at subcarrier frequency.
Test: 0.7V non composite signal bridging input. Return loss 36 dB to 2T pulse and bar.
External Green: as for test input

Outputs

Coded video: 2 outputs, each 75 Ω source impedance. Return loss better than 30 dB to 2T pulse and bar. GRB video: 0.7V peak-peak from 75 Ω source.
Picture monitoring video: 75 Ω source. Return loss better than 30 dB to 2T pulse and bar.
Waveform monitoring video: as for picture monitoring.
Colour step sync: 75 Ω source.
Colour step waveform: 2V to 15V adjustable. Output impedance less than 500 Ω .
Waveform monitor sequence: isolated relay contacts.
Chroma key signal (colour selection by links): 0.7V peak-peak from 75 Ω source.
Programme audio (2 circuits): 0 dBm.
XLR connector.

Sensitivity

With 800 lux (75ft candles) incident on a white chip of 60% reflectance and lens iris at f4, a signal current of 300nA will be obtained in the green channel using average tubes. This signal current produces 0.7V video output with master gain control at 0 dB.

By increasing gain to +12dB and opening the iris to f2.2, just acceptable pictures will be obtained down to 50 lux (5ft candles).

Signal-to-Noise Ratio

(Multicore Head).
Measurements with Rohde and Schwarz meter type UPSF
Zero gain, unity gamma, corrections off.
PAL (5.5 MHz bandwidth): luminance S/N 49 dB (unweighted).
NTSC (4.2 MHz bandwidth): luminance S/N 51 dB (unweighted).
By increasing light level and reducing gain by 3 dB further improvement in signal/noise ratio may be obtained.

Resolution

With aperture correction, 100% modulation depth can be obtained at 5 MHz.

Registration

40ns accuracy in Zone 1, 80ns in Zone 2, and 120ns in Zone 3, (with average tubes). Zone 1 is an ellipse whose major and minor axes are equal to 80% of picture height and width; Zone 2 is outside Zone 1, but within a circle of diameter equal to picture width; Zone 3 is the remainder.

Scanning Geometry (excluding lens)

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.

Gamma Correction

Continuously variable from 0.4–0.55, or 1.0.

Master Gain

Control is provided over the range 0 to +12 dB from either the CCP or RCP. This range may be changed to –3 dB to +9 dB by link adjustment.

Shading

Shading correction, line and field, sawtooth and parabola, black and white, is provided as standard.

Warming Up Time

Rehearsal quality pictures will be obtainable in less than 2 minutes after switch on in the ambient temperature range of +10°C to +45°C.

Camera Cable

Multicore

The following type can be employed up to a maximum length of 900m (3000ft): BICC T.1889 (13mm 34-way).

Suitable cable is also manufactured by B.I.W. and Mohawk. Other types of cable may also be used with adaptors.

Triax

BICC T.1894 (13mm) up to 1.5 km.
BICC T.1892 (9mm) up to 900m.

Pick-up Tubes

30mm lead oxide tubes either standard, extended red, HOP or variable light bias types.

Ambient Temperature

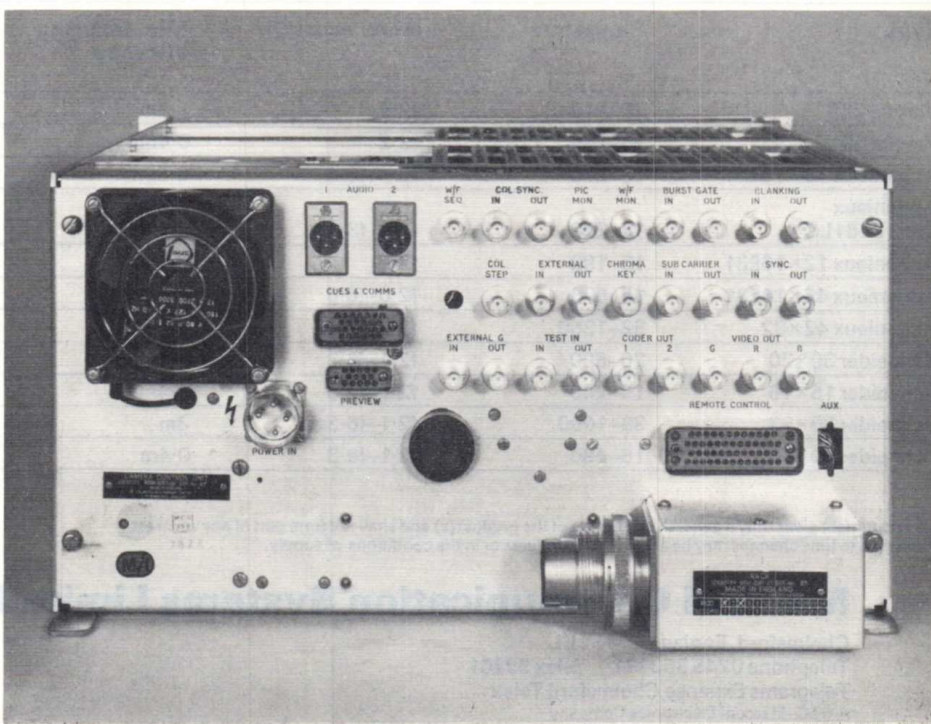
- Storage –20°C to +60°C.
- Equipment may be switched on without damage over the range –20°C to +40°C.
- No change in performance data will occur at ambient temperature variations of $\pm 10^\circ\text{C}$ with respect to the temperature during the line-up procedure, within a range of –10°C to +40°C.

Dimensions

	Height	Width	Length	Weight
Camera	408mm (16in)	360mm (14.25in)†	580mm (22.75in)	34kg (75lb)*
Camera Control Unit	222mm (8.75in)	483mm (19in)	556mm (21.9in)	24.5kg (54lb)
Remote Control Panel	206mm (8.1in)	149mm (5.87in)	105mm (4.1in)	1.4kg (3lb)
Triax Base Unit	133mm (5.25in)	242mm (9.5in)	556mm (21.9in)	10kg (22lb)
Portable Triax Converter	270mm (10.5in)	162mm (6.4in)	270mm (10.5in)	7.0kg (15lb)

*Weight includes viewfinder but excludes lenses.

†Increase to 410mm (16.25in) for triax head.



Rear view of CCU.



Lenses

A wide variety of lenses may be fitted.

Type	Range mm	Max. aperture	Min. focusing distance	Basic horizontal angle	Weight (kg)
Varotal 22B	21–210	f2.9	1.2m	44°–4.4°	10
Varotal 30	16–160	f2.2	0.45m	56°–6°	22
Angenieux 15×18L81	18–270	f2.4–f3.4	0.55m	51°–3.7°	18
Angenieux 15×18E81LC	18–270	f2.0–f3.0	0.64m	51°–3.7°	19
Angenieux 12×16E31	16–192	f2.0	0.95m	56°–5°	28
Angenieux 42×16E81	16–675	f2.0–f6.8	0.64m	56°–1.5°	24
Angenieux 42×32	32–1350	f2.3–f7.6	4m	22°–0.5°	34
Schneider 30×20	20–600	f2.1–f6.3	0.85m	45°–1.6°	16
Schneider 15×16	16–240	f2.1–f2.8	0.4m	56°–4.2°	17
Schneider 30×33	33–1000	f2.1–f6.3	3m	29°–0.98°	20
Schneider 30×16	16–480	f2.1–f6.3	0.4m	56°–2°	17.5

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Marconi Communication Systems Limited

Chelmsford, England CM1 1PL
 Telephone 0245 353221 Telex 99201
 Telegrams Expanse Chelmsford Telex
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