



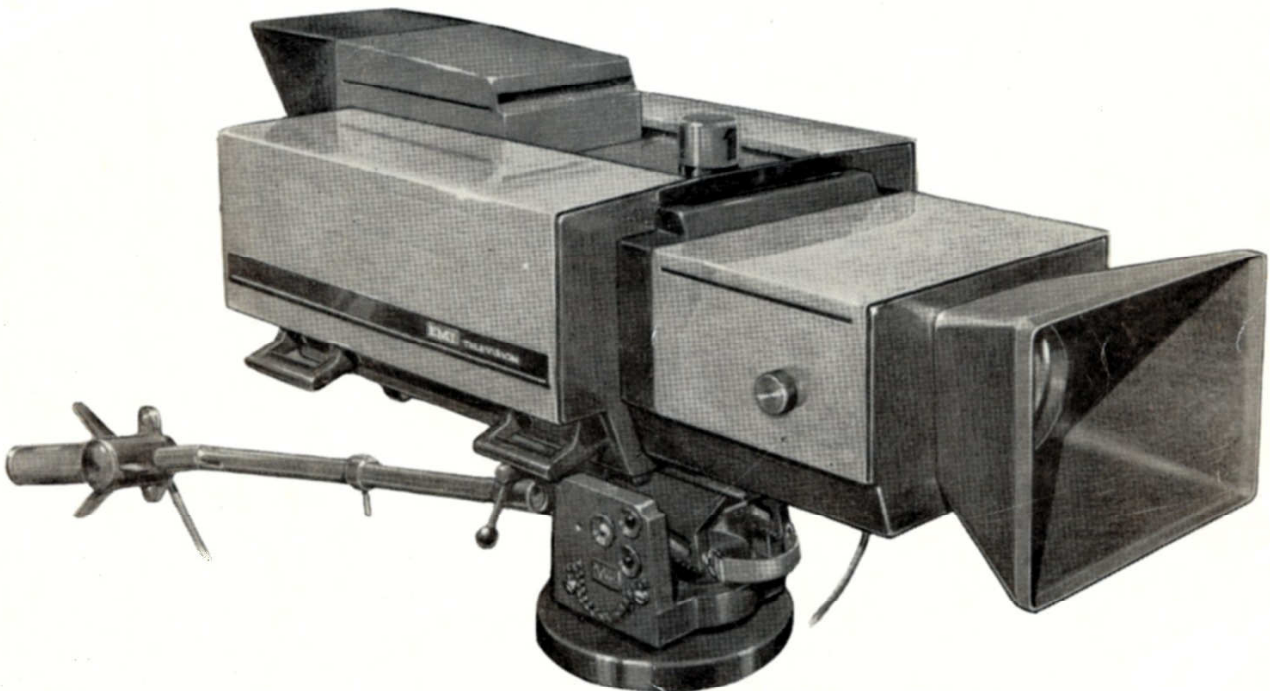
Television Equipment Division
EMI Electronics Limited

Colour Camera Channel Type 2005

The Colour Television Camera Channel type 2005 is the latest in the line of E.M.I. produced broadcast quality colour cameras.

The signals from the three lead oxide vidicon tubes are pro-

cessed to give standard R.G. & B. outputs for application to standard NTSC, PAL or SECAM colour television encoders. Camera channel 2005 is a version using an American standard camera cable. The 2005/1 uses standard European cable.



Side view photo of complete camera head.

Features

- ★ Uses three 30 mm (≈ 1.2 in) lead oxide vidicon tubes
- ★ Auto Centering provides excellent long term stability
- ★ Bias lighting gives reduced lag
- ★ Internal diascope available
- ★ Remote capping
- ★ Built in six position filter wheel
- ★ Up to 600 metres (2,000 ft) of camera cable can be used
- ★ Balancing adjustment included in camera head
- ★ Manual or servo zoom lens option
- ★ Zoom lens shot box mounted on pan handle
- ★ 7 inch tilting viewfinder
- ★ Three isolated outputs of each of the R, G & B signals
- ★ External viewfinder mixing input
- ★ Viewfinder indication of lens focal length
- ★ Showerproof construction
- ★ Standby mode for tube economy

Construction

The basic units of the camera channel are:

Colour Camera Type 2005

Zoom Lens Package Type 10 × 18 L31 (or alternative)

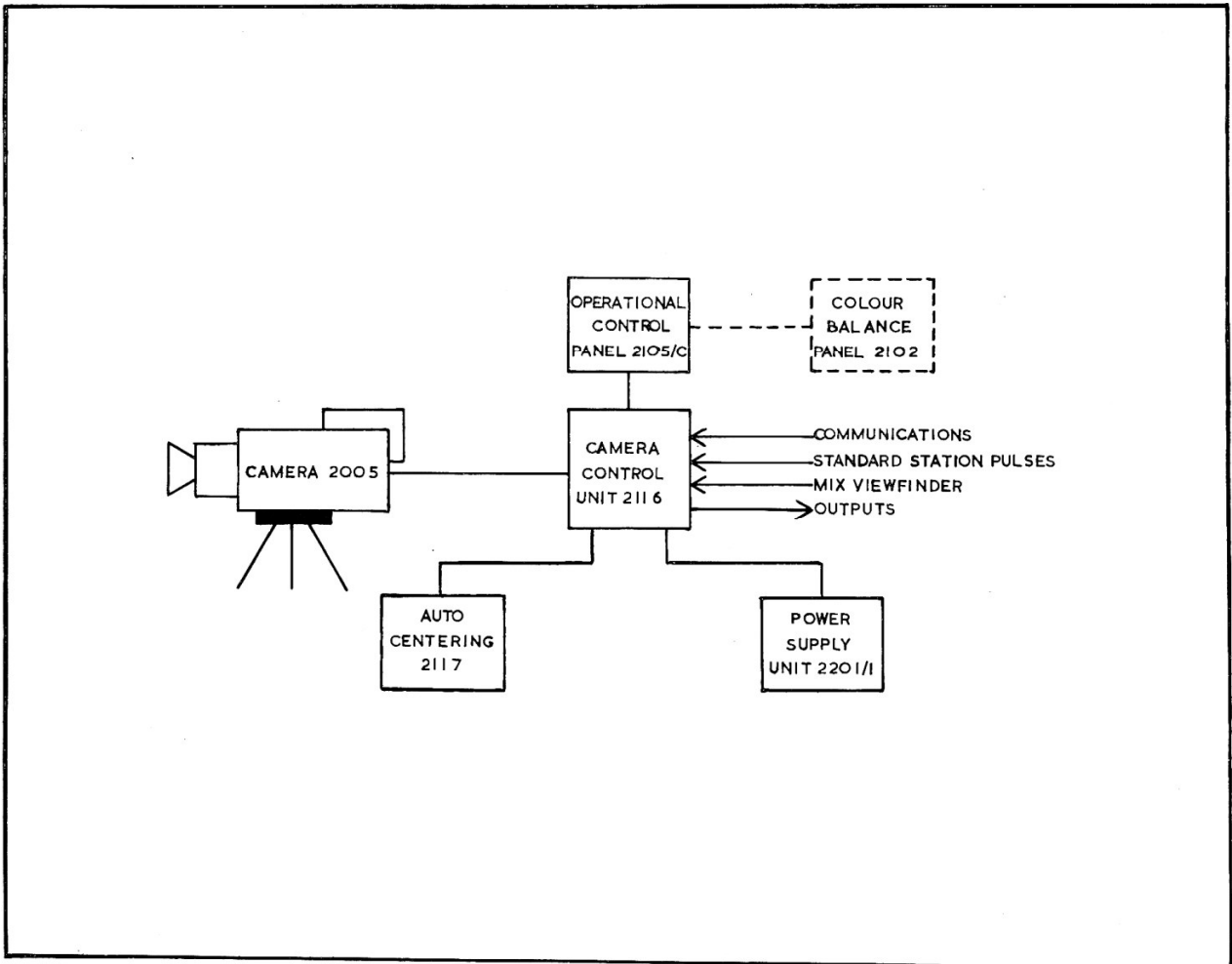
Camera Control Unit Type 2116

Power Supply Unit Type 2201/1

Operational Control Panel Type 2105

Auto Centering Unit Type 2117

Colour Balance Panel Type 2102 (optional extra)



Block Schematic



Rear view of camera head

The Colour Camera Type 2005 is the latest in the line of E.M.I. broadcast colour cameras utilising three lead oxide vidicon pick-up tubes.

The framework is constructed of light alloy and has a high quality textured finish in tones of grey and black. Hinged side covers permit easy access to the sub-units. A wide range of zoom lenses can be easily mounted on the front of the camera. A red cue light is mounted on the top of the camera and is visible from all directions. Twin cue lamps are provided in the viewfinder. Space is available on the side of the camera for station identity and camera number signs. The camera can be mounted on a pan and tilt head by means of a standard Vinten wedge. The camera mounting assembly can be racked backwards and forwards to achieve perfect camera balance with various types of lens packages. A series of tapped holes (0.375 in. dia.) is provided in the wedge to facilitate the mounting of the camera on U.S.A. types of tripod. Strong carrying handles are provided.

Provision is made for mounting a visual prompter and a cue card holder can be located on the rear of the camera head.

On the side of the camera are mounted several outlet sockets. One provides the viewfinder signal, another the camera talk-back and on air cues for the tracker's monitor. An a.c. power utility output is included (up to 1.0 amp.), this can be used for an 'eye light' and can be controlled from the lighting console as this outlet is fed via a separate connector on the rear of the Camera Control Unit 2116.

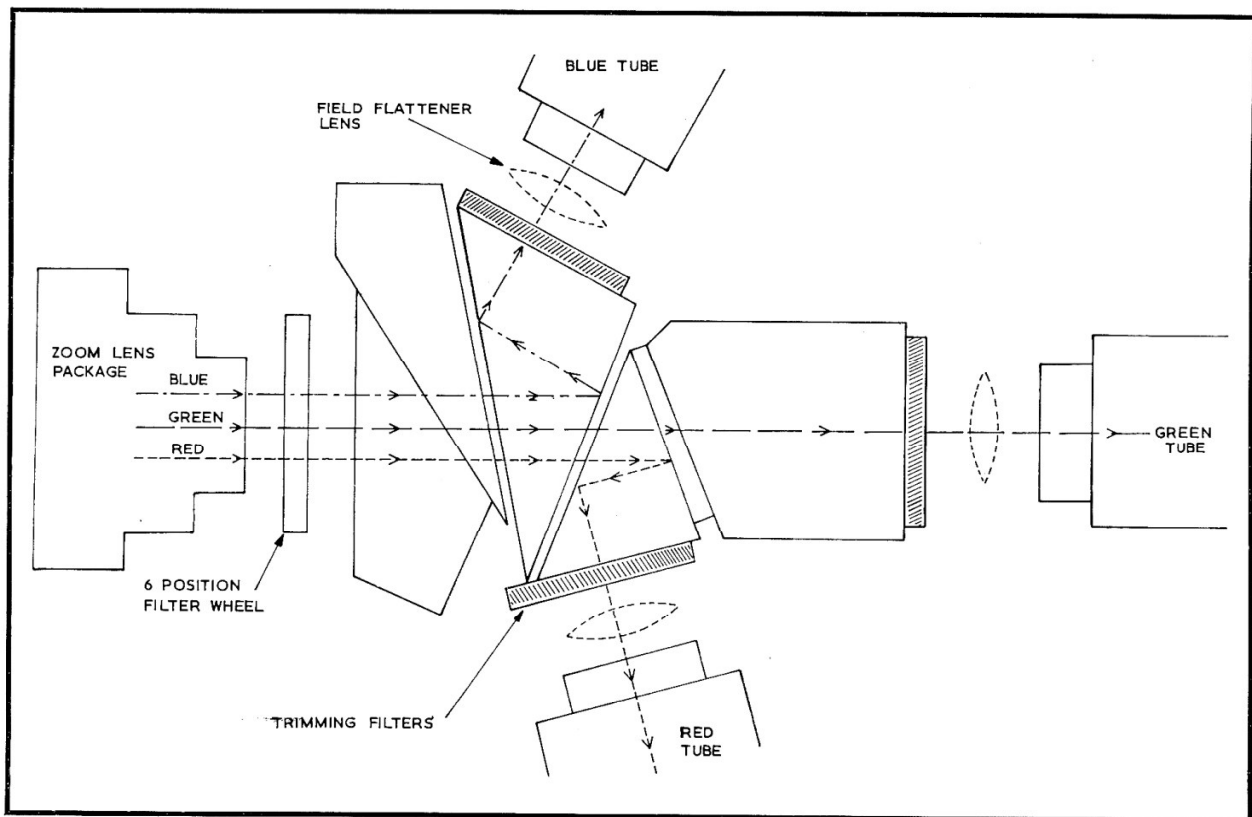
The camera cable, which can be a maximum of 600 metres (2,000 ft.) long, is connected to the camera on the left-hand side.

The tilting viewfinder is powered from the camera but is otherwise self contained. It may be removed and operated up to 10 metres (33 ft.) from the camera. The monochrome picture is produced on a flat faced 18 cm. (7 in.) diagonal, rectangular cathode ray tube. This gives a high resolution display with sufficient brightness to permit the use of an implosion and X-ray proof neutral density filter. The zoom lens focal length is indicated by a vertical marker which moves horizontally across the top edge of the viewfinder display.

An external video feed can be displayed independently of or mixed with the viewfinder signal. This can be used for engineering set up and production matte purposes.

The optical arrangement of the camera consists fundamentally of a zoom lens the light from which enters a beam-splitting prism assembly. The dichroic surfaces of this prism assembly are so arranged as to separate the light into red, green and blue components. This arrangement gives the advantages of direct imaging optics.

There is a range of zoom lenses available for use with the camera, these may be either servo or manually controlled. The zoom lens package is easily detachable from the front of the camera for transportation purposes and permits the use of alternative lenses having different characteristics.



Manual or servo zoom and focus controls are mounted in conventional positions on the panning handles.

The servo controlled iris may be controlled from the CCU or remotely from the operational control panel.

A six position, manually operated, filter wheel is provided to allow the insertion of colour and neutral density filters. The camera may be capped mechanically by a control at the Camera Control Unit.

Camera Control Unit Type 2116

The Camera Control Unit 2116 is designed for standard 48 cm. (19 in.) rack mounting. It has a control panel hinged at the left-hand side; this permits easy access to the rear of the panel and to the plug-in circuit boards. The printed circuit boards are mounted vertically, giving excellent convection cooling. Board extenders ease servicing of these boards and the unit is designed so that all normal servicing can be done from the front. The camera and other interconnecting cables enter the unit from the rear.

Operational Control Panel Type 2105

The Operational Control Panel 2105 is a compact unit designed for remote "hands-off" operation of the camera. It includes only those controls necessary for programme operation. A number of these panels may be mounted side by side on a vision control desk for control by one operator.

Iris and Master Black controls are combined in a "joystick". Rotation of the Joystick knob controls master black. When the joystick is depressed a micro switch is actuated. This switch can be used for preview monitor selection. Coarse iris adjustment is made by a knurled edge control, located at the side of the joystick. Movement of the joystick in the quadrant mode gives fine iris control, the range of which is indicated by the engraving on the coarse control.

Simultaneous movement of the coarse and fine iris controls enables the centre of the fine iris range to be reset without causing any picture disturbance.

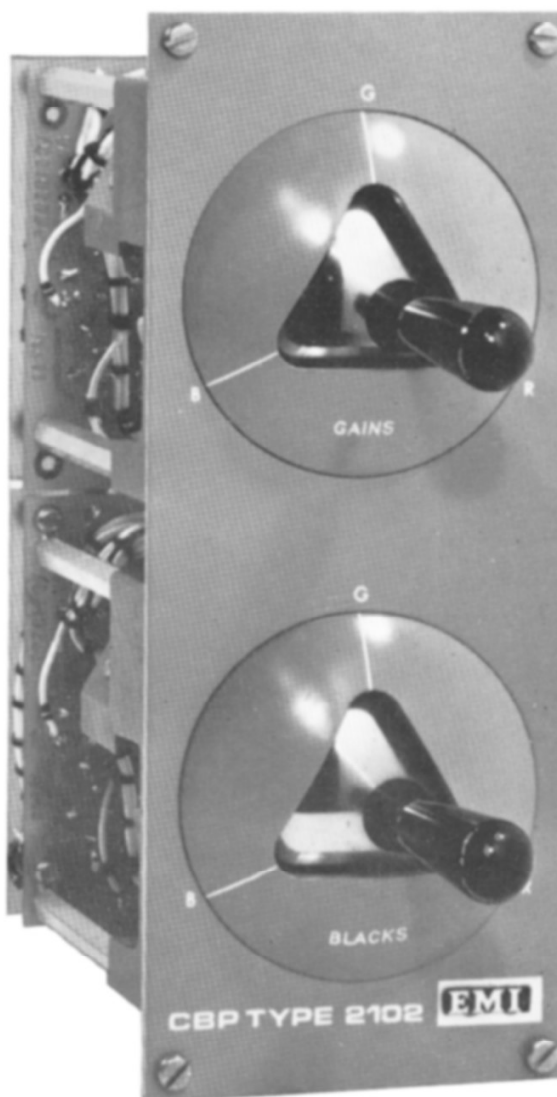
Front view of O.C.P.



Colour Balance Panel Type 2102 (optional extra)

The Colour Balance Panel 2102 contains two joystick controls. One enables the gain to be altered in the red, green or blue channels without affecting the overall gain. The other enables the black level to be altered in the red, green or blue channels. With these controls, colour balance can be easily adjusted when changes occur in lighting conditions. The joystick controls can quickly be returned to the neutral position. Microswitches are actuated on depressing either joystick. These switches can be used for preview monitor selection.

Front view of C.B.P.



Power Supply Unit Type 2201/1

The 19 in. (48 cm.) rack mounting Power Supply Unit 2201/1 provides the nine stabilized voltage supplies and one stabilized current supply required by the channel.

Two printed boards are used for the high voltage and the constant current supplies.

The six remaining supply boards are identical. Their individual function is determined by the socket into which each is plugged. Depending on the function required, these boards can provide

18V, 28V, or 40V at currents ranging up to 2A and stabilities better than 0.1%. They incorporate remote sensing to handle PSU-CCU connecting cables up to 30 metres (100 ft.) and camera cables up to 600 metres (2,000 ft.) in length, without readjustment.

All the supplies are fully protected against inadvertent overloads and short circuits; the voltages returning to their normal value on removal of the fault condition.

Circuits

Camera 2005

The electronic sub-units in the camera, including scanning circuits, pulse circuits and F.E.T. pre-amplifiers, are of plug-in design and are readily accessible for replacement.

A standby switch at the CCU reduces the pick-up tube heater supply to 4V, switches off the tube beams and caps mechanically. On "switch on", the heater voltage is instantaneously restored to normal but the beam currents are held off for approximately one minute.

The channel amplifiers in the camera carry out the following functions:

Low noise preamplification

Low pass band filtering to reduce noise and crosstalk

Individual R & B channel gain controls (controlled from CCU) for equality balance

Master Gain Control. Range 18 dB with tracking accurate to 0.1 dB (controlled from CCU)

Clamping and limiting

Outputs to camera cable

Built-in test and bridging facilities are included and are remotely operated from the CCU, so that test signals can be passed through the entire video processing chain of the channel.

Bias lighting is applied to the camera pick-up tubes. When this is switched in, preset black level compensation is automatically applied.

Precision scanning and focus yokes in conjunction with highly stabilized scanning and pick-up tube supplies ensure maximum stability and accuracy of geometrical registration. Comprehensive screening is provided so that the camera can be operated in magnetic fields without significant deterioration in picture quality. Principal registration adjustments are remotely controlled from the CCU.

Voltage sensing circuits are provided to maintain stable supply voltages at the camera independent of cable length.

Extensive use is made of stage-by-stage and overall negative feedback techniques, together with high quality components, to ensure long term stability.

The camera includes a stabilized d.c. supply for the heaters of the pick-up tubes.

The viewfinder provides a brilliant, sharply focused, high contrast picture. This is achieved by the use of a stable 15 kV final anode supply derived from the horizontal deflection circuit and by a high output level from the video amplifier. The scanning yoke is designed for excellent picture geometry and the tube is fully screened against high external magnetic fields. H.F. loss correction for up to 600 metres (2,000 ft.) of camera cable is provided on the viewfinder. Height and width controls are included. Contrast and brightness controls are easily accessible.

The viewfinder signal that may be selected by the camera operator is as selected at the CCU or an external viewfinder signal or a mixture of both.

Auto Centering Unit Type 2117

The inherently high centering stability of the camera is further enhanced by the inclusion of an Auto Centering Unit Type 2117*. After the camera horizontal and vertical centering controls have been optimised the Auto Centering Unit will maintain the camera centering over extended periods of operation.

* See brochure T/2117

Camera Control Unit 2116

The circuits perform the following functions:

Cable loss correction

Flare correction

Variable and level dependent horizontal aperture correction on all signals

Horizontal and vertical contouring

Signal amplification

3 × 3 matrixing

Black level clamping

Gamma correction

Peak limiting and blanking

Low impedance output isolating amplification

Monitor signal switching

Field scan generation

Alignment current stabilization

Special circuit design techniques have been employed to ensure long term operational stability. The three signals from the camera, R (red), G (green) and B (blue) enter the CCU at 0.7 V level and pass through the processing stages for camera cable loss correction, amplification and black level clamping. The black levels are then automatically adjusted by flare correction circuits to compensate for scattered light effects. Following this, horizontal aperture correction can be applied to all three signals. At this point the signals are routed through the contour corrector which gives an improvement in resolution. The three signals are then processed in a 3 × 3 matrix, providing colorimetry correction, then pass through gamma correction, blanking and limiting circuits.

Three independent non-composite outputs of each of the three signals are then provided at 0.7 V standard picture level into 75 ohms.

Monitor points permit inspection of the signals at various stages of the processing. A comprehensive switching arrangement allows a variety of signals to be fed to a picture monitor, a waveform monitor and the camera viewfinder.

A sequential output of R, G & B is supplied for monitoring purposes.

The front of the CCU carries controls enabling the entire setting up of the channel from this position. Once these have been adjusted the only controls which may require attention during a programme are: Lens Iris and Master Black Level.

The controls on the panel are as follows:

For pick-up tube supplies (G, R, B):

Beam Current, Focus, Alignment 1, Alignment 2, Beams On/Off, Normal/Standby, Focus Rock On/Off.

For pick-up tube registration:

R, B & Master Scan Height; R, B & Master Scan Width; Overscan On/Off; G, R, B Vertical Centre and Horizontal Centre.

For signal circuits:

G, R & B Black Levels (Cam); G, R & B Black Levels (CCU); R, B & Master Gains; Switch for Set Blacks, Normal, Calibrate & Test; Switch for Diascope, Cap & Normal; Test and Calibration Level (nanoamps); Bridging for Gamma In and Output 2; Bias Light On/Off.

For talkback:

Headset Jack; Producer Gain Control; Camera Operator Gain Control; Camera Operator Call Button with Camera Operator Calling Indicator Lamp.

For viewfinder and monitors:

Viewfinder: Normal/as Picture Monitor.

Select Signal: G, R, B, G', R', B', Y' and Off.

Picture Monitor Reference: G/Off

Waveform Monitor Reference: G/Off

Waveform Monitor: As Selected/Highest Output.

For programme operation:

Local/Remote Switch

Iris

Master Black Level

Gamma: Linear 1, 2, 3;

On Air Cue Lamp.

For power:

Power: On/Off with indicator lamp

Camera Power: On/Off

D.C. Supplies: On/Off with indicator lamp.

Data Summary

Systems

525 lines (I.R.E./E.I.A.) 60 fields
625 lines (C.C.I.R./O.I.R.T*) 50 fields

Pick-up Tubes

Three 30 mm. (≈ 1.2 in.) lead oxide vidicon tubes integral or separate mesh

Power Input

100 to 125 or 200 to 250V, 50 to 60 Hz

Permitted Variation

$\pm 5\%$

Consumption

500VA (excluding utility outlet) 0.9 p.f.

Hour Counter

Compatible with supply frequency

Channel Outputs

Three independent non-composite outputs of each of R, G & B of 0.7V at 75 ohms

Isolation Between Outputs

better than 48 dB at 1.0 MHz
better than 40 dB at 3.5 MHz
better than 30 dB at 5.0 MHz

Pulse Inputs

Horizontal and Vertical Drives, Blanking & Sync
High impedance looping inputs will accept levels of $-1.5V$ to $-6.0V$ p.p.

External Viewfinder Input

Standard level composite or non-composite signal.
High impedance looping input

Sensitivity

Excellent broadcast quality pictures are obtained with 125 to 150 foot candles scene illumination

Signal to Noise Ratio (peak signal to r.m.s. noise)

Not less than 47 dB in each channel at a bandwidth of 5.5 MHz for a signal current of 300 nA, excluding gamma and aperture correction

Amplitude/Frequency Response (R, G & B)

With zero aperture correction.
For 60 metres (200 ft.) of camera cable. Flat within ± 0.25 dB to 5.5 MHz.
For 600 metres (2,000 ft.) of camera cable. Flat within ± 1.5 dB to 5.5 MHz

Resolution

Depth of modulation at 5 MHz, 100% at the centre of the picture with aperture correction. This correction may be applied to all three colour channels

Lag

Excellent performance due to the incorporation of bias lighting

Colour Registration

Geometrical deviations between green and any other picture
Less than 0.05% of the picture height within a circle having a diameter of 0.8x picture height
Less than 0.2% outside this area

Gamma Correction

4 position switch selects gamma:
Linear, 0.72, 0.55, 0.45

Operating Temperature

$-10^{\circ}C$ to $+50^{\circ}C$

Magnetic Interference

A change of orientation of the camera axis with respect to the earth's magnetic field will cause negligible change of registration

Viewfinder

At a highlight brightness of 200 foot lamberts, fine picture detail and scan raster lines are clearly visible over the whole picture. The viewfinder is normally supplied with a 35% neutral density filter. This will reduce the highlight brightness to approximately 70 foot lamberts. The 15 kV final anode supply is so regulated that there is negligible change in picture and scanning spot size over the full range of modulation. Geometry errors are less than 1.5% within a circle equal to the picture width, and less than 2% outside that circle

Communications

Producer (input)	0.4 to 1.5V into greater than 2,000 ohms, balanced
Program Sound (input)	0.4 to 1.5V into greater than 2,000 ohms, balanced
Camera Talkback (output)	750 mV into 600 ohms, balanced

*Note Amplitude/Frequency specification

Overall Dimensions and Weight

	<i>Height</i>	<i>Width</i>	<i>Length</i>	<i>Weight</i>
Camera 2005	381 mm 15 in	467 mm 18.375 in	484 mm 19 in	38.6 kg excl. Zoom 85 lb lens package
Zoom lens package 10 × 18 L31			324 mm 12.75 in	18.1 kg servo 40 lb
Zoom lens package 18 × 27.5 L31			444 mm 17.5 in	22.5 kg servo 50 lb
Camera Control Unit 2116	355 mm 14 in	484 mm 19 in	434 mm 17 in	22.5 kg 50 lb
Power Supply Unit 2201/1	355 mm 14 in	484 mm 19 in	355 mm 14 in	31.5 kg 70 lb
Operational Control Panel 2105	155 mm 6.125 in	83 mm 3.25 in	127 mm 5 in	2.7 kg 6 lb
Colour Balance Panel 2102	205 mm 8.06 in	83 mm 3.25 in	127 mm 5 in	2.7 kg 6 lb
Auto Centering Unit Type 2117	44.5 mm 1.75 in	484 mm 19 in	433 mm 17 in	4.1 kg 9 lb

Connectors

	<i>Fixed</i>	<i>Mating</i>	
Camera			
Camera Cable Plug	TV-85C or 400-580	BIW (American) F & G (European)	
Auxiliary a.c.	EP-4-17S	Cannon	EPCG-4-16
Tracker outlet	62-GB-12E-12/10S	Amphenol	62-GB-16F-12/10P
Viewfinder Output	BNC/31-221	Amphenol	BNC/31-321

Camera Control Unit

Stabilized mains input	DO3/EC/32/M/TG	Smiths	DO3/P/32/F/TG
Auxiliary mains input	DO3/EC/32/M/TG	Smiths	DO3/P/32/F/TG
Communications selector	MS 3102A-18-1S	Cannon	MS3106B-18-1P
Communications	MS 3102A-20-27P	Cannon	MS3108B-20-27S
Operational Control Panel	MS 3102A-28-12S	Cannon	MS3108B-28-12P
Power Supply Unit	MS 3102A-18-11S	Cannon	MS3106B-18-11P
Power Supply Unit	MS 3102A-28-21P	Cannon	MS3108B-28-21S
Auto Centering Unit	MS 3102A-20-27S	Cannon	MS3106B-20-27P
Coaxial Connectors	BNC/31-221	Amphenol	BNC/31-321
Camera Cable Socket	TV 85C or 405-580	BIW (American) F & G (European)	

Power Supply Unit

CCU	MS 3102A-18-11P	Cannon	MS3108B-18-11S
CCU	MS 3102A-28-21S	Cannon	MS3108B-28-21P

Operational Control Panel

CCU	MP 134	McMurdo	MS134
Colour Balance Panel	MS 118	McMurdo	MP118

Auto Centering Unit

Stabilized a.c. power input	DO3/EC/32/M/TG	Smiths	DO3/P/32/F/TG
CCU	MS 3102A-20-27P	Cannon	MS3106B-20-27S
Coaxial Connectors	BNC/31-221	Amphenol	BNC/31-321

Schedule of Equipment

1 Basic camera channel comprising

a Colour Camera type 2005 (American Camera Cable)	1
or	
Colour Camera type 2005/1 (European Camera Cable)	1
b Zoom Lens Package type 10 × 18 L31	1
or	
Zoom Lens Package type 18 × 27·5 L31	1
c Camera Control Unit type 2116 (American Camera Cable)	1
or	
Camera Control Unit type 2116/1 (European Camera Cable)	1
d Power Supply Unit type 2201/1	1
e Operational Control Panel type 2105	1
f CCU/Power Supply inter unit cables 7·6 metres (25 ft) set of 2	
g OCP/CCU inter unit cable 7·6 metres (25 ft)	1
h Auto Centering Unit type 2117	1
i ACU/CCU inter unit cable 1·5 metres (5 ft)	set of 5

2 Ancillary equipment for camera channel

a BIW TV-8IN-MOD 2B. Up to 600 metres (2,000 ft)	
For 2005 camera	as required
or	
F & G 756/1. Up to 600 metres (2,000 ft)	
For 2005/1 camera	as required
b Headsets	3
c Headphones	1
d Viewfinder Hood	1
e Viewfinder Shade	1
f Lead Oxide Vidicon Camera Tubes (integral mesh)	3
or	
Lead Oxide Vidicon Camera Tubes (separate mesh)	3
g Colour Balance Panel type 2102	1
h Lens Hood (for Zoom Lens 10 × 18 L31)	1
or	
Lens Hood (for Zoom Lens 18 × 27·5 L31)	1
i Waterproof cover	1
j Degaussing Coil	1
k Camera Tube Simulator	1

3 Recommended additional items

a Camera Pedestal	1
b Pan and Tilt Head with wedge adaptor plate	1
c Internal Diascope	1
d Mains Supply Stabilizer	1

Ordering Information

When ordering please state:

- 1 Your equipment requirements by quoting from the Schedule of Equipment. Specify either manual or servo zoom lens package. If servo state if shot box is required.
- 2 The supply voltage and frequency from which the equipment will be run.
- 3 Camera cable requirements.
- 4 The distance between the camera control unit and the power supply if the inter unit cable required is longer than 7·6 metres (25 ft).
- 5 The distance between the camera control unit and operational control panel if the inter unit cable required is longer than 7·6 metres (25 ft).
- 6 The distance between the camera control unit and auto centring unit if the cable required is longer than 1·5 metres (5 ft).

The company reserves the right to modify the design or specification without notice.



T/2005 Issue 1



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