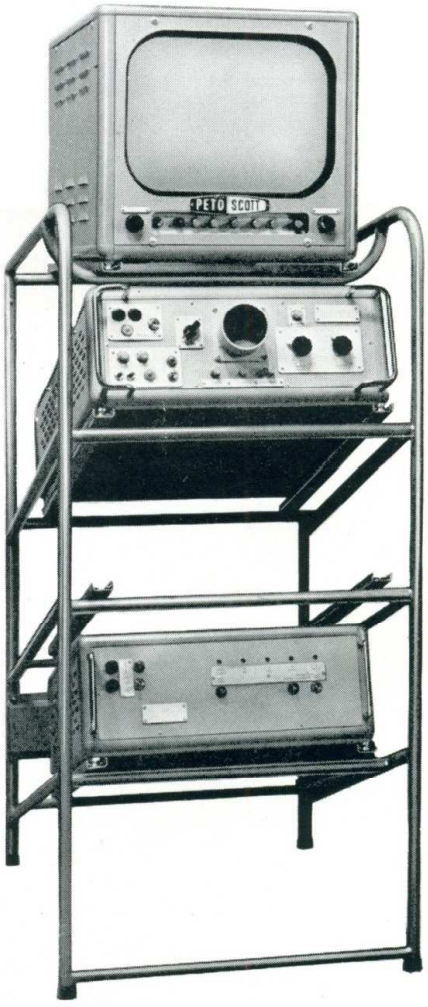
peto-scott

television camera equipment



Manufactured by

PETO SCOTT

introduction

Representing the trend for a small, lightweight, yet inexpensive television programming unit, the Peto Scott camera channel has been produced to meet the rigid specifications of the British Broadcasting authorities. It has been designed for the maximum flexibility, performance and ease of operation, which is essential for programming talks, lectures, fashion shows, plays, etc.

Using the current British or American 1-inch photoconductive type camera tube, the excellent electrical and mechanical features ensure that full use is made of the characteristics of this type of tube.

The equipment is available both in portable form (as illustrated) and as rack-mounted units for fixed operation.

Other units available include distribution amplifiers, tele-cine equipment for 16 and 35 mm. film, and master control equipment. Vehicles fitted completely for outside broadcasts can be supplied.

general

the camera channel

This consists of three units :

Camera.

Electronic Viewfinder.

Camera Control Unit, including Waveform Monitor.

dimensions

Unit	Height	Width	Length	Weight
Camera (less lens) ..	7 in. (17·8 cm.)	7 in. (17·8 cm.)	17 in. (43·2 cm.)	25 lb. (11·4 kg.)
Viewfinder (less visor) ..	6 in. (15·3 cm.)	6 in. (15·3 cm.)	16 in. (40·6 cm.)	15 lb. (6·8 kg.)
Camera and Viewfinder	$12\frac{1}{4}$ in. (31·2 cm.)	As Camera	As Camera	40 lb. (18·2 kg.)
Camera Control Unit ..	$6\frac{3}{4}$ in. (17·2 cm.)	$16\frac{5}{8}$ in. (42·9 cm.)	26 in. (66·0cm.)	85 lb. (38·6 kg.)

power requirements

A.C. Mains, 50 c/s, 190–250 volts.

Input plug type EP4 (Films & Equipment Ltd.).

Consumption approximately 600 VA max.

input requirements

Standard pulses (B.B.C. Ref. PID. 100.7.87B). Input plug type EP8. Output plug type EP8.

Communications and Cueing information :

Inputs : Programme sound.

' On-air ' cueing.

Output : Camera talkback.

Test Input :

Input for non-composite video, 0·7V peak-to-peak.

Input impedance 75Ω.

Input socket, coaxial, type S0239.

output signals

Composite video signal (B.B.C. Ref. PID. 1000.7.1B, Sheet 2).

Two independent outputs, of 75Ω source impedance.

Output sockets, coaxial, type S0239.

Pedestal adjustable from 0 to 10%.

Peak-white limit adjustable from 90 to 130%.

Sync. level adjustable from 0·2 to 0·4V peak-to-peak.

camera channels *FOR R.M.A. AND C.C.I.R. SPECIFICATIONS*

A camera channel is available designed for operation according to the standards of the R.M.A. and C.C.I.R. specifications.

The modifications necessary to the following specification include changes in pulse durations and increased bandwidths, etc.

The R.M.A. (American) system of 525 lines, 60 fields, is designed for supplies of 117V, 60 c/s.

The C.C.I.R. (International) system is designed for supplies of 230V, 50 c/s.

camera

The camera is fitted with a four-lens turret operated by rotating a handgrip at the rear of the camera and an arca around the handgrip is suitable for a pencilled indication of the lens in each position.

A pneumatically damped indexing system is employed which permits noiseless and positive lens position changing. The turret has a quick-release action. The lenses are spaced equally around a circle of 4 inches diameter.

suitable lenses

The requirements for lens to be used in television are of a special nature because of the limited bandwidth available in a television channel. Ideally a lens used with any television system should have a frequency response curve which is high and uniform out to a frequency corresponding to the number of picture elements contained in one television picture line. The British 405 line system is capable of transmitting 490 picture elements along each line and, in the case of the Vidicon picture area, this corresponds to a pattern frequency of about 20 lines (one line considered as a line and space) per millimetre. The United States 525 line system contains 427 picture elements per line and the CCIR West European system 520 picture elements. Thus, in terms of optical performance, there is no appreciable difference between these three systems.

The Taylor-Hobson "Vidital" Lenses.

This range of lenses is intended for use with Vidicon type television camera tubes having a picture format of $\frac{1}{2}'' \times \frac{3}{8}''$ (16 mm. diagonal). At present the range comprises four lenses having focal lengths of 2, 3, 5 and 8 cms. providing exactly the same choice of angular field of view as 2, 3, 5 and 8 inch lenses on Image Orthicon cameras.

The relative aperture of these lenses is wide enough to match the sensitivity of Vidicon type tubes and considerable attention has been given to the attainment of high levels of image illumination right out to the corners of the picture rather than high levels in the centre only. The 3, 5 and 8 cm. lenses have a relative aperture of f/1.4 and the 2 cm. lens is f/1.7. The unusual vignetting characteristics of the 2 cm. lens at full aperture provides an average illumination throughout the whole picture format as high as that provided by the 3 cm. lens at full aperture.

Although the resolving power of these lenses in the true photographic sense is greatly in excess of the capacity of any known television channel, considerable attention has been given to improving their definition and contrast characteristics at all the levels of resolution which can be transmitted. This ensures that the transmitted image information is both sharply defined and modulated as accurately as possible to reproduce the true contrast levels of the original object.

The same care and attention has been given to the mechanical parts of these lenses and in particular a special iris mechanism has been designed to yield linear change of image illumination with linear rotation of the iris drive and to facilitate the operation of all four lenses on one camera turret.

The complete camera

mechanical features

A rim and groove, formed on the front casting and turret disc respectively, provide an efficient light and water trap.

A front 'on-air' cueing light is fitted adjacent to the 'taking' lens and another is fitted to the rear panel.

The camera structure consists of front and rear castings firmly fixed to a solid base-plate which accommodates the tripod mountings ($\frac{3}{8}$-in. Whitworth). The side panels have quick-release catches and hinge downwards, but can be detached easily if required.

The camera cable is attached to the camera at the operator's left-hand side, near the front of the camera, and leaves at an angle of approximately 30° to the vertical.

Sliding doors at the same side cover camera and communication controls, namely :

Line Amplitude
Line Shift
Frame Amplitude
Frame Shift
Volume Level (2)
Microphone Switch
Headset Socket
Call C.C.U. Button

Optical focusing is achieved by movement of the camera tube and scanning assembly on a slide with PTFE bearings. The focusing movement is approximately $\frac{5}{8}$ in. from a back focus of 0·69 in. for a 270-degree rotation of the focusing handle. The slide is moved forward for a counter-clockwise rotation of the focusing handle. This handle can be set to any desired position relative to the focusing carriage and is removable, facilitating the later attachment of a remote servo-operated focusing control.

The camera tube is held in the scanning assembly by a masking plate with a quick-release bayonet action, allowing easy replacement of the camera tube. The mask is cut accurately to the raster size used (0·5 in. × 0·375 in.).

To ensure optimum raster geometry, the frame and line scanning coils can be rotated relative to each other and are clamped by two knurled screws.

The electrical circuits, which include the camera video amplifier, camera time-bases, blanking and safety circuits, are all contained on a chassis-assembly which can be removed easily from the main camera body when a few connections are unsoldered.

camera circuits

Video Head Amplifier.

The Video Head Amplifier consists of five stages and one double-diode clamp. The input stage uses a Mullard E88CC low-noise double triode in a cascode circuit. Negative feedback is applied from the second stage over the camera tube load of 0·5 megohm. The third stage is a high-frequency peaker, using a cathode-shunt circuit.

The fourth stage is aperture-corrected, providing a maximum boost of 9dB at 3 Mc/s which, in conjunction with the amplifier input coil, provides 1·5 dB more boost than is required by an EMI photoconductive camera tube with a TTH f 1·4 1-inch lens set to f 2. Control of aperture correction is by means of a variable inductor. The range of control is from + 1·5 dB to — 2 dB under the conditions stated above.

The corrected video signal is line-by-line clamped at the grid of the fifth stage. This stage feeds video to the C.C.U. at a level of approximately 0·7V peak-to-peak, with a source impedance of 75 ohms. It also feeds video to the viewfinder at a level of approximately 0·5V peak-to-peak.

A test point is provided at the input for feeding-in a test waveform to the channel. A pulse of 1V peak-to-peak produces a waveform equivalent to a signal current of 0·2 μA. The camera channel video gain is sufficient to provide a full output with a signal current of 0·1 μA.

Line and Frame Time-bases.

The Line and Frame Time-bases each employ a double triode and a single pentode, using negative feedback to ensure good linearity, no linearity controls being necessary.

Safety Circuit.

The safety circuit removes the wall anode voltage and biases the camera-tube control grid to cut-off in the event of a scan failure, whether due to loss of trigger pulses or failure of valves in the channel, including the time-base output valves. The circuit employs a short-suppressor-base pentode, a triode valve and a relay. Failure of these components puts the circuit to ' safe '.

camera cable

The B.I. Callender's Mk. IVb cable system is used and the length can be up to 1,200 ft. Compensation for delay and frequency response is incorporated in the C.C.U., being controlled in steps of 200 ft.

Mains voltage drops in the camera cable are swamped by supplying the mains to the camera and viewfinder via resistors whose value is large relative to the total change of cable resistance.

viewfinder

The viewfinder is designed to incorporate the Mullard six-inch-diagonal c.r.t. type 17CDD26/0 and is arranged to be removable from the camera and used remotely ; a connecting cable is available.

The removal of the viewfinder has been incorporated to provide maximum flexibility. Many uses of the camera (*e.g.* captions, tele-cine, and other fixed-focus positions) will not warrant the cost of the viewfinder ; also, the later addition of a remote pan and tilt tray in place of the viewfinder will provide one-man operation of the channel.

A swivel-type viewing hood is fitted, which is arranged to position the operator's eyes not closer than ten inches from the viewing screen of the c.r.t. (this is easily removed from the viewfinder.) A graticule is fitted, divided into nine rectangular sections, and a cueing lamp is arranged to illuminate in red the engraved lines when the camera is ' on-air '.

Five controls are located in a horizontal row beneath the viewing tube : Brightness, Contrast, Focus, Height and Width. The viewing end of the viewfinder is removable to permit replacement of the c.r.t.

Viewfinder mounted on camera

The circuit employs eight valves and consists of :

Video Amplifier.

The Video Amplifier uses two triode-pentodes and provides sufficient gain to overmodulate the c.r.t. The response is maintained within $\pm$ 1 dB up to 3 Mc/s. The video signal is d.c.-restored by the c.r.t., this being found adequate because of the line-by-line clamping in the camera circuits.

Frame Time-base.

The Frame Time-base uses a double triode and a triode-pentode, the scan linearity being maintained by a frequency-conscious feedback network.

Line Time-base and e.h.t. generator.

The Line Time-base uses a pentode, an energy-recovery diode, a double triode and an e.h.t. diode. The circuit functions on the direct drive principle, e.h.t. being derived from the line flyback. The e.h.t. regulation is maintained over the working range of current required by the c.r.t. by means of d.c. feedback applied to the output valve.

camera control unit

The Camera Control Unit is built into a framework of light alloy sections and contains :

Channel Power Supplies.

Camera Control Chassis.

Waveform Monitor Chassis.

The rear panel carries all input and output sockets and plugs, mains selector panel, INT./TEST switch and a fan. The front panel houses the waveform monitor and all operational controls, namely :

communication and cueing

Headset jacks.

Programme sound / Producer talkback volume level.

Camera talkback volume level.

Camera calling lamp.

EXT./INT. cueing switch.

' On-air ' cueing lamp.

power supply

Mains on/off switch.

Fuse 1.

Fuse 2.

Mains ' on ' indicator lamp.

waveform monitor

Sweep duration (Display) switch.

Focus.

Astigmatism.

Brightness.

camera control

Beam current.

Black level.

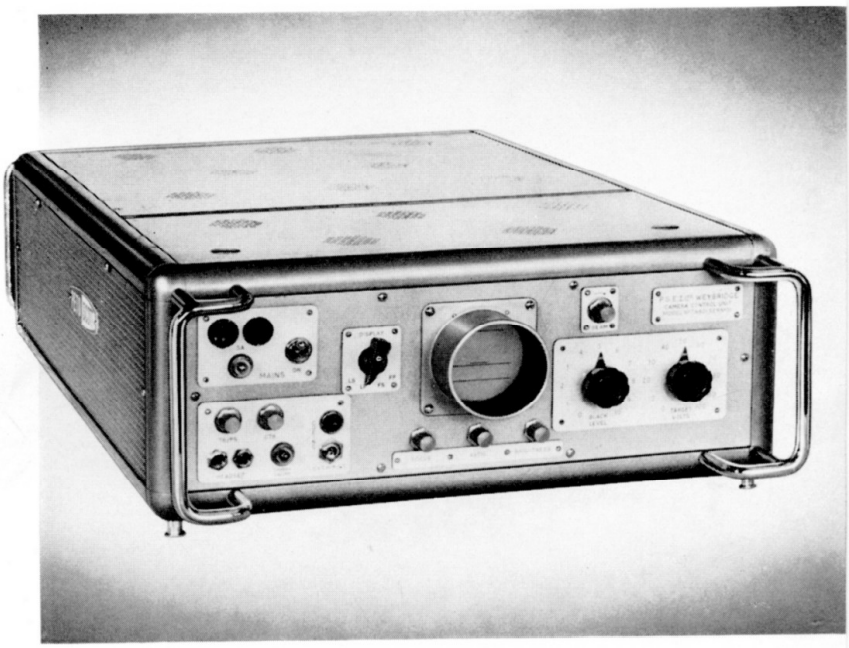
Target volts (0–100V scaled into ten).

Front and rear panels are protected by rails, which are also used as carrying handles. Locating studs are fitted to the underside of the unit, enabling it to slide and locate in runners.

All controls required for setting-up the channel prior to operational use are located under a hinged lid in the top front of the camera control unit. Also located under the lid are the camera cable spanner and two spare mains fuses.

Channel Power Supplies

Channel Power Supplies of + 427V, + 142V and — 700V are all stabilised by series regulators with reference to the main highly regulated supply of + 285V. These supplies provide all the d.c. required by the channel and, also, all heater supplies required by the camera control unit are provided from this chassis.



Camera Control Unit (Front View)

Camera Control Chassis

The Camera Control Chassis contains all the circuits required to perform the following operations :

Establish the black level.
Add the pedestal.
Add suppression pulses.
Add synchronising pulses.
Peak white limit.
Stabilise camera tube focus current.
Delay of line trigger pulses.
Delay of frame trigger pulses.
Black stretch (gamma correction).

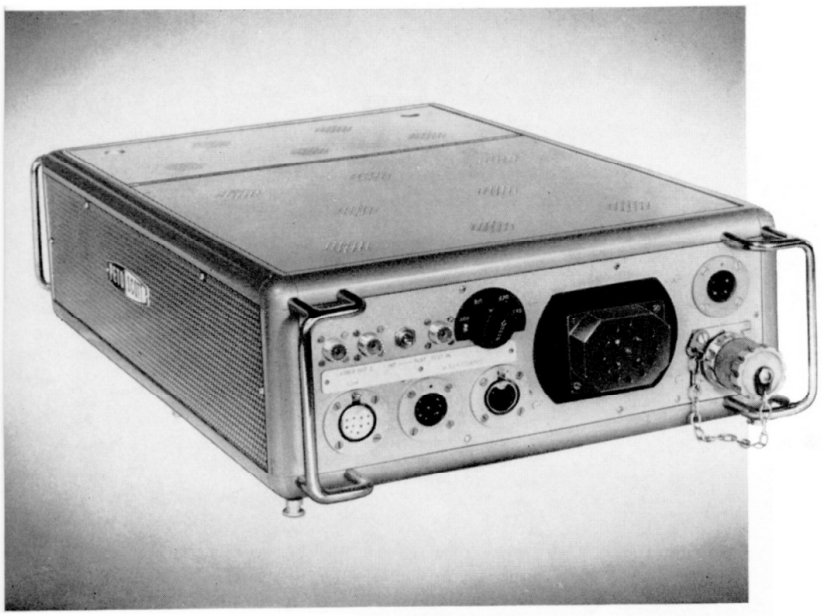
The pre-operational setting-up controls are mounted on a platform on this chassis and located under the hinged lid. They are :

Channel video gain.
Camera cable length compensation.
Black stretch control.
Pedestal level.
Peak white limiter.
Sync. level 1.
Sync. level 2.
Beam focus.
Beam alignment 1.
Beam alignment 2.

Waveform Monitor Chassis

The Waveform Monitor Chassis is designed for the Mullard $2\frac{3}{4}$ in. diameter c.r.t. type DG7/5. This chassis contains :

' Y ' Amplifier.
Triggered Time-base.
Calibration Bridge.
Communication Circuits.



Camera Control Unit (Rear View)

Mounted on a platform on the chassis are the setting-up controls :

Calibrate/fuse switch.
Set calibration voltage.
' Y ' shift.
' X ' shift.

The ' Y ' Amplifier has a constant gain, stabilised by negative feedback, and provides d.c.-restored push-pull signals to the ' Y ' plates of the c.r.t.

The Triggered Time-base employs a direct-coupled Miller rundown circuit and provides push-pull deflection. This is arranged (by means of a switch on the front panel) to display periods as below :

One whole frame (FP).
Frame suppression (FS).
One whole line (LP).
Line suppression (LS).

The Calibration Bridge provides a 1-volt peak-to-peak 50-c/s sine-wave for calibration purposes, and employs a bridge network with non-linear elements. This reduces the effect of mains input variations on the calibration voltage by approximately 20 : 1.

The Communication Circuits comprise two isolation amplifiers in the form of a double triode and provide camera/C.C.U. talkback. The output impedance of each amplifier is approximately 600 ohms, enabling the camera sound to be used externally.

The circuits are designed to enable the Standard Telephones & Cables Ltd. headsets, type 66.LU.10A, to be used.

specification

Measurements referred to here were made with an English Electric Valve Co. Ltd. Photo-conductive Tube, type P.810.

sensitivity and signal/noise ratio

Sensitivity is a function of mainly two parameters : amplifier noise and photographic lag.

The amplifier noise in the channel is of a small order. Measured by the oscilloscope method, the ratio of peak-to-peak signal to peak-to-peak noise is approximately 20 : 1, with the channel video gain set to require 0·2 μA signal current for a composite output of standard levels.

Photographic lag is dependent on the camera tube used ; with samples of the E.E.V. Co. Ltd. tube, and using the pulsed light method of measurement, the average third frame amplitude was 20% of the first frame amplitude. The light level under these conditions was 80 foot-lamberts with a lens stops of f 2 (TTH 1-in. f 1·4 lens). The target bias was 45 to 65 volts, depending on the sample.

contrast range

The channel is able to resolve steps in a tone wedge whose total contrast exceeds 30 : 1.

contrast/gradient (GAMMA)

The gamma characteristic of the camera tube used is of the order of 0·6 to 0·7 and the electrical gamma is incorporated within the channel. This is in the form of black stretch and provides an increase in gain of 6 dB from 0% to 40% of the output signal voltage.

Set to 6 dB increase up to 20% of the output signal voltage, the overall gamma characteristic is a good approximation to the required characteristic of $\gamma = 0{\cdot}5$. The knee of the gamma curve is adjustable by the ' set gamma ' control over the range 0 to 40%.

resolution

Sufficient aperture correction control has been incorporated to enable the central resolution of the channel (using a transparency and a line strobe oscilloscope for measurement) to be set between + 1 dB and − 2 dB at 3 Mc/s relative to a black-to-white transition.

Using the TT&H 1-in. f 1·4 lens stopped to f 4, the corner resolution relative to a black-to-white transition in the corner has been found to be not worse than − 3 dB relative to the central response to the 3 Mc/s pattern.

geometry and scan linearity

Measurements using an electrical grid pattern and a cross pattern indicate that geometries and scan linearities are better than ± 1% positional error.

Note. To ensure that the face of the camera tube and the transparency plane are parallel, and their axes in line, the camera is fitted to a jig designed to incorporate the transparency and camera.

electrical stability

Long-term stability appears to be very good, while short-term variations of mains voltage produce negligible effects on the channel.

microphony

Microphonic effects have been kept to a very low level and may be neglected.

low-frequency response

No streaking apparent.
Tilt on output waveform less than 2%.

viewfinder

Frequency response ± 1 dB to 3 Mc/s.
L.F. tilt on 50 c/s square-wave less than 2%.
Linearity and geometry less than ± 2% positional error.
Mullard c.r.t. type 17CDD26/0. E.H.T. 11–12 kV.

waveform monitor

Frequency response — 3 dB at 1·5 Mc/s.
'Y' deflection 3·3 cm.
'X' deflection 4·5 cm.
Graticule indications : 0%, 30%, 35%, 100%, 110%.
Time-base speeds : 20 μsec., 120 μsec., 2 msec., 24 msec.
Mullard c.r.t. type DG7/5, $2\frac{3}{4}$ in. diameter.
Bridge-stabilised calibration.

lens complement *(STUDIO)*

Focal length	20 mm. (0·8 in.)	32 mm. ($1\frac{1}{4}$ in.)	51 mm. (2 in.)	83 mm. ($3\frac{1}{4}$ in.)
Viewing angle	33°	21°	13°	8°

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PEN 106-4-58-1

PETO SCOTT

picture monitor

The Picture Monitor, type TB.205, is designed for control or general-purpose monitoring. It is housed in an attractive light alloy framework and provides good picture quality at a moderate price. Operation is from a standard composite or non-composite video signal, and a picture of approximately 11·5 × 8·6 inches is provided by the 14-inch electrostatically-focused cathode-ray tube.

dimensions

Height	14½ in. (36·8 cm.)	**Depth**	20 in. (50·8 cm.)
Width	14¾ in. (37·5 cm.)	**Feet Spacing** ..	12¼ in. × 18½ in. (31·1 cm. × 47 cm.)
Weight	55 lb. (25 kg.)		

abridged specification

Inputs (recessed at rear) :

(a) Mains Supply :
100, 105, 110, 115, 120, 125 volts
OR
200, 210, 220, 230, 240, 250 volts.
50 c/s or 60 c/s.

(b) Standard vision signal, composite waveform :
0·4V to 2V peak-to-peak, white positive.
Switched bridging input or terminated 75 ohms.

(c) Standard synchronising signal (switched internal or external) :
2V, negative polarity.
Switched bridging input or terminated 75 ohms.

Scan Linearities and Geometry
Not greater than ± 3% positional error.

H.F. Response
± 0·5 dB to 6 Mc/s. — 3 dB at 7·5 Mc/s.

Cathode-ray Tube
Mullard type AW36–48.

Positional Hum
Negligible.

circuit

The video input is from a 75-ohm co-axial line, and a bridging input is provided. A 75-ohm resistor can be switched across the input or it may be left unterminated at high impedance. Provision is made for balancing-out hum voltages superimposed on the input co-axial lead. The three-stage video amplifier has a maximally flat frequency response and uses inductance compensation in each stage. D.C.-restoration is effected by a line-by-line clamp at the grid of the output stage, which is d.c.-coupled via a cathode-follower to the c.r.t. cathode. The video gain control is connected at the cathode of the input stage. Negative feedback is applied from the cathode-follower to the cathode of the second stage.

A pentode sync. separator is fed from the anode of a pentode sync. amplifier, and a double-triode frame interlace filter is used to ensure excellent interlace.

The frame time-base consists of a triode blocking-oscillator and a pentode output stage. Excellent frame linearity is ensured by the use of a frequency-conscious feedback network.

The line time-base consists of a pentode blocking-oscillator feeding the direct-drive output circuit which incorporates a pentode and a booster diode. E.H.T. of 14 kV for the c.r.t. is derived from this circuit, and the regulation impedance of this supply is kept to a small value by means of d.c. feedback applied to the output pentode.

The power supply uses a selenium rectifier in a bridge circuit fed from a double-wound mains transformer. A two-stage choke-capacity filter ensures that very little positional or modulation hum occurs.

The cathode-ray tube is fitted with a small astigmatism-correction magnet.

controls

Contrast, brightness and (recessed) : mains on/off and pilot light, focus, line hold, width, frame hold and height.

Models are available for 525 lines, 60 fields, and 625 lines, 50 fields (type TB.215).

mounting trolley

The Mounting Trolley, type TB.801, is designed to house a 14-inch Picture Monitor, two Camera Control Units (or one C.C.U. and a 35-mm. film scanner), a synchronising generator and distribution amplifier.

The trolley is of tubular-steel construction and is fitted with four castors or rubber feet.

dimensions

Height	with feet	42½ in. (108 cm.).
	with castors	46½ in. (118 cm.).
Height	to top of Monitor—	
	with feet	52 in. (132 cm.).
	with castors	56 in. (142 cm.).
Width	.. ..	20 in. (50·8 cm.).
Depth	.. ..	27 in. (68·6 cm.).

A plate carrying five 5-amp. mains sockets at the rear of the trolley provides a mains supply for all units of the channel.

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