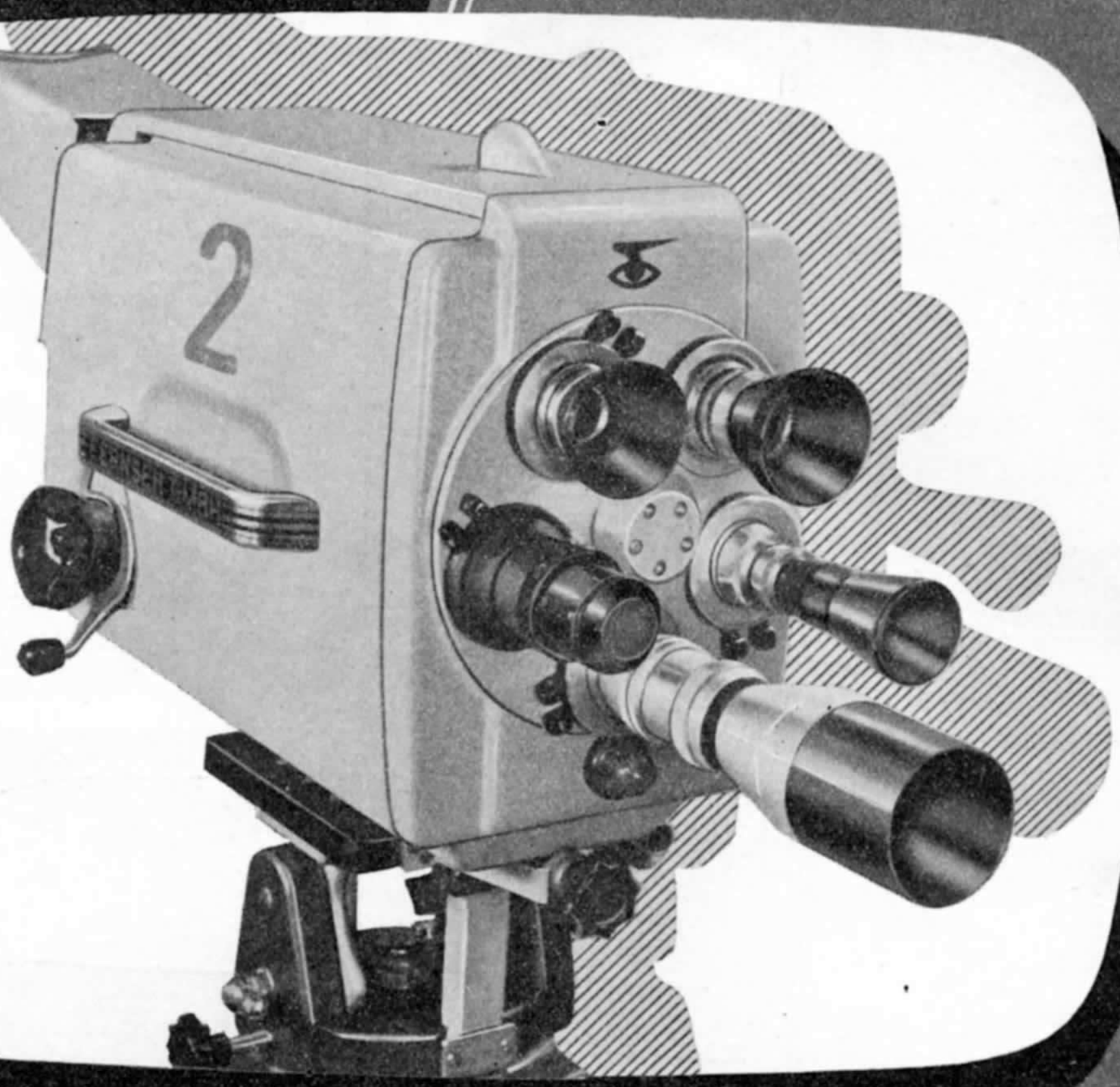
TELEVISION STUDIO EQUIPMENT



Camera Chains • Television Vans

Film Scanners • Kinescope Recording

Equipment • Standards Converters

Mixing and Auxiliary Equipment

Monitors • Special Measuring Appa-

ratus • Pick-up and Monitor Tubes

FERNSEH

G M B H

DARMSTADT • GERMANY

Image Orthicon Camera Chain KOD 15

Image Orthicon Camera Chain KOD 15 may be used especially for television recording in the studio. The construction of the apparatus is suitable for studio use. While fully maintaining the necessary stability and easy accessibility to all components, the image orthicon camera is of particularly light weight. It therefore allows the maximum mobility, rapid assembly and disassembly and requires only a relatively light tripod. The camera control equipment is built in cubicle form with separate control desk.

With the same camera is obtainable also the Image Orthicon Camera Chain KOD 75, the camera control equipment and monitor of which are built in transportable form, and which is preferred for outdoor pickup. Since the circuitry of the Image Orthicon Camera Chains KOD 15 and KOD 75 is practically not differing, the Image Orthicon Chain KOD 75 built in transportable form can be reocmmended also for studio use.

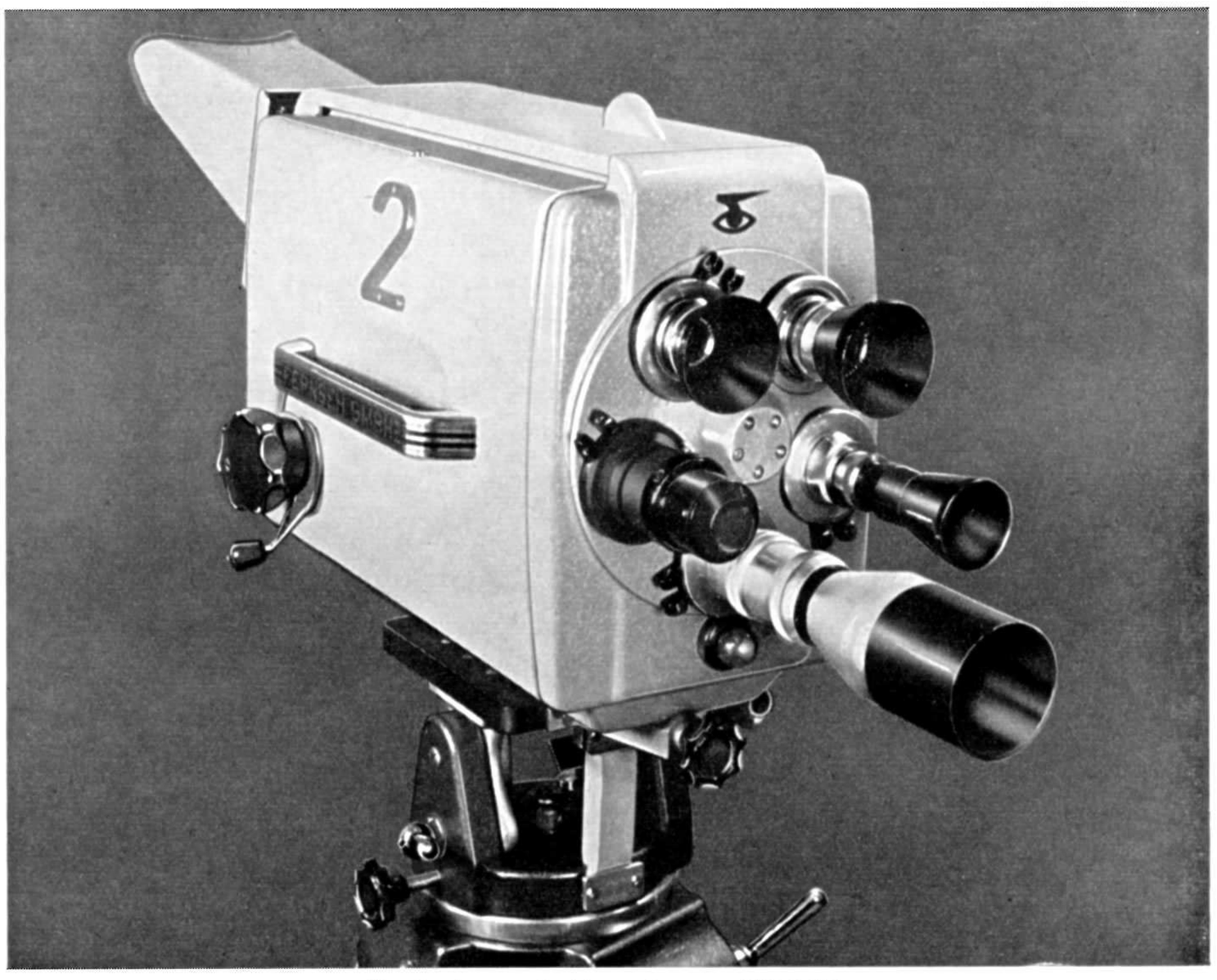


Fig. 1: Image Orthicon Camera KKOB 101
Front view. At the side wall rotary knob for focusing and crank for lens turret

The whole of the electrical operation of the camera is controlled from the control desk on the camera-control unit, so that the cameraman can devote the whole of his efforts to training the camera. A novel automatic temperature control in the camera, as well as a series of other features, aid the control of the equipment and lead to improved picture quality. The circuitry, planned on the most modern principles, allows full use to be made of the characteristics of the camera tube. Strong construction, the use of the best components and easy accessibility to all components result in great reliability, simple servicing and a long working life.

59 Rudolf Rother, Munich (6458)

Features:

1. Very light and handy camera, suitable for studio and outdoor pickup.
2. Novel automatic temperature control for the camera tube. Noiseless fan, heater equipment for rapid starting up.
3. Continuous illumination control, driven by a noiseless servomotor; remote control and remote indication at the control position.
4. Five-way lens turret with mounting for test-projector; all lenses in rapid-change mounting, no screw fixing.
5. Focus adjustment with variable gear ratio. Easily movable side crank for lens changing.
6. Bright finder picture from a 17 cm rectangular tube. A short screening tube may be pulled out for studio operation. For outdoor pickup a viewing visor may be attached.
7. Lens indicator and signal lamps directly below the finder screen.
8. Dynamic focus correction gives optimum focus and a clean background in the picture.
9. Auxiliary focus circuit for simplifying the operation of setting-up the beam alignment; fully operative protection circuit for the pickup tube.
10. New and clear construction of camera and camera control equipment.

Image Orthicon Camera Chain KOD 15 consists of the Image Orthicon Camera KKOB 101, the Amplifier Unit KVsOB 15 and the Control Desk with Monitor EOB 31/125.

Image Orthicon Camera KKOB 101

Optical Equipment

The **lens turret** includes four mountings for lenses of 50 to 600 mm focal length and one mounting with contacts for a test projector, in which also an objective may be installed. All the lenses and the test projector are provided with rapid-change mountings which dispense with threads and screws and may be fitted to the camera quickly.

The lens turret is moved by turning a crank, which is fitted on the right-hand side of the camera, concentric with the focus adjustment knob. Each full turn of the crank effects a change to the next objective. Lens changing is rapid and practically noiseless. The position of the lens turret at any time is indicated in the camera finder by illuminated panels on which the focal lengths of the lenses are shown.

Adjustment of the **focus** is effected by means of a large rotary knob on the right-hand side of the camera, which moves the carriage holding the image-orthicon parallel to the optical axis through variable gearing which is free from backlash. A brake which is adjustable to suit the individual operator is provided for this control.

The camera may also be used in conjunction with a zoom lens. A base which holds the camera and the zoom lens can be supplied for this purpose. When using the zoom lens the focus adjustment is locked.

The **illumination control** allows the selection of the optimum working conditions for the Image Orthicon under all intensities of illumination which may arise, independent of the diaphragm aperture. In this way the diaphragm stop and with it the depth of focus may be chosen only with a view to the artistic effect.

The illumination control is formed by a variable-density liquid filter. A neutral-grey filter fluid is placed between two plane-parallel glass plates; the thickness of the layer of filter fluid may be altered by moving one of the plates in the direction of the optical axis. The effect of the filter may thus be continuously varied over the wide range of 1000 : 1. The adjustment of the filter is effected through gearing by a servomotor, which is controlled from the control desk by means of a bridge circuit. The control knob for the illumination control carries a scale of transparencies.

www.tvcameramuseum.org

Finder

The camera is equipped with an electronic finder which forms a self-contained unit. Controls enable the cameraman to adjust the brightness, focus and contrast of the finder image as required. The picture size is 90 x 120 mm has been chosen so that at the physiologically correct viewing distance of 300 mm the line structure of the picture can still be discerned. Both perfect supervision of the raster focus and estimation of the picture focus are thus possible.

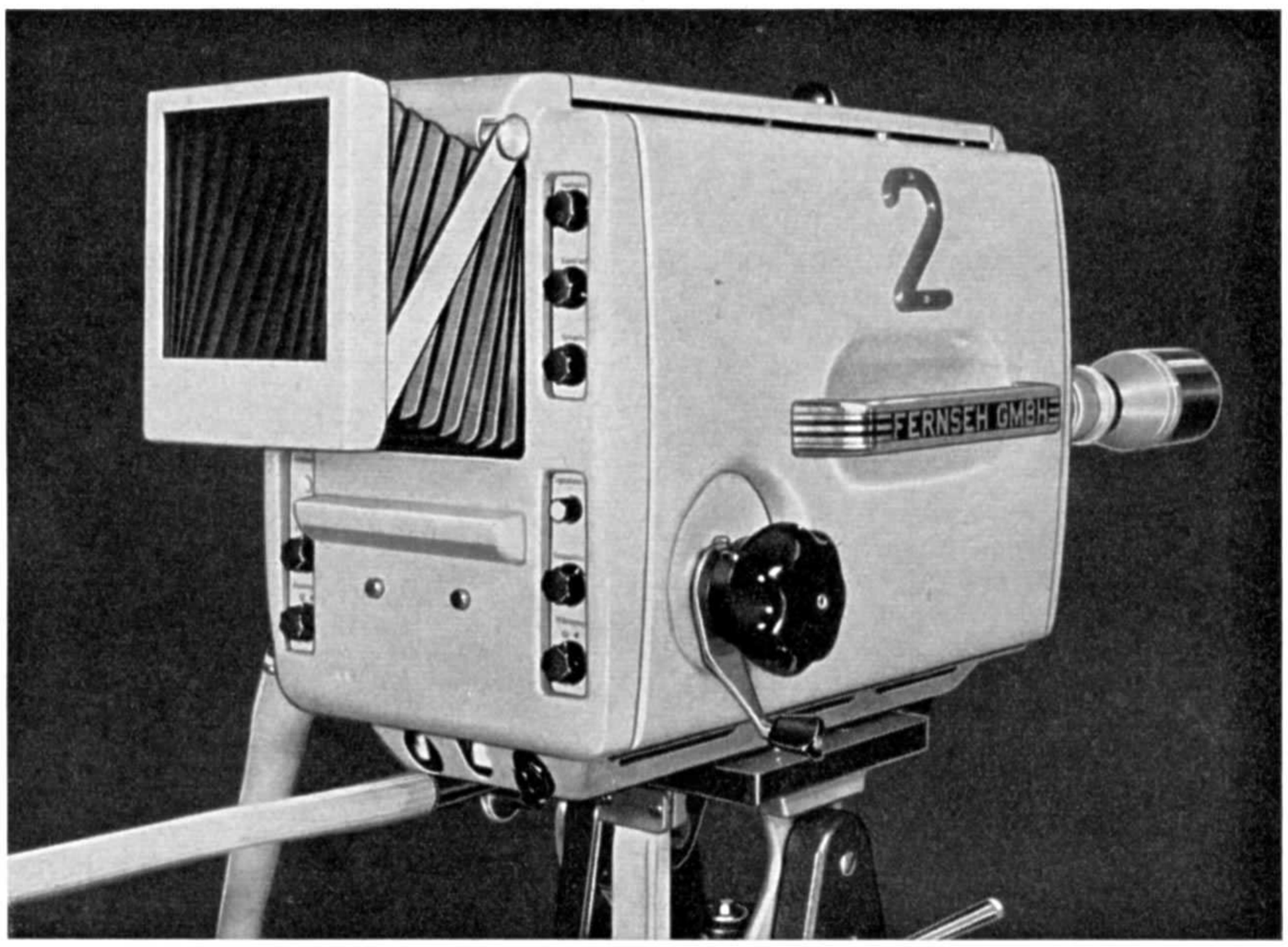


Fig. 2: Image Orthicon Camera KKOB 101
Rear view with short hood and control for signalling and talkback arrangement

A short visor is secured to the camera, which may be pulled out to a length of some 130 mm and is sufficient for observation of the picture when the ambient illumination is not excessive. A longer visor is available which completely screens the picture from external light. It has a length of 300 mm and is readily attached to the camera so as to hinge about a horizontal axis.
The picture signal for the finder image is taken from the output of the camera amplifier and led to the camera by way of the camera cable. The finder image is thus identical with the output picture. In special cases, such as for trick shots, it is thus possible to apply to the finder a prepared picture from the mixer desk.

Camera Tube

All the types of 3-inch image orthicons being made at present may be employed in the camera. In addition to the standard type 5820 image orthicon, it is recommended for studio operation to use a tube with increased storage capacitance (e. g. the Fernseh OS 20), since improved signal-to-noise ratio and reduced halation are thus obtained.

Temperature Control

An automatically operating stabilizer arrangement keeps the temperature of the camera tube constant within a few degrees, independent of the ambient temperature. The temperature at which the target portion of the image orthicon is kept may be read on a meter at the control position and adjusted from thence by means of a control knob. The operation of the control circuit is monitored by pilot lamps.

www.tvcameramuseum.org

Cooling or heating to stabilize the temperature is effected so that the optimum working temperature for the image orthicon (35⁰...45⁰ C) will be obtained for temperatures of the ambient air between about −15⁰ to +35⁰ C. If, as may arise under abnormal conditions, the external temperature rises above +35⁰ C, then additional cooling may be switched on.

A special heating-up circuit allows the camera to be ready for operation in a very short time after switching on. The temperature control operates on the thermostat principle. Two temperature-dependent resistances in the neighbourhood of the target of the image orthicon are used to sense the temperature. The resistances are included in a bridge circuit which operates a relay by way of a transistor amplifier. The relay switches the heating and cooling circuits on and off. The camera tube is held at the desired temperature within about 3⁰ C.

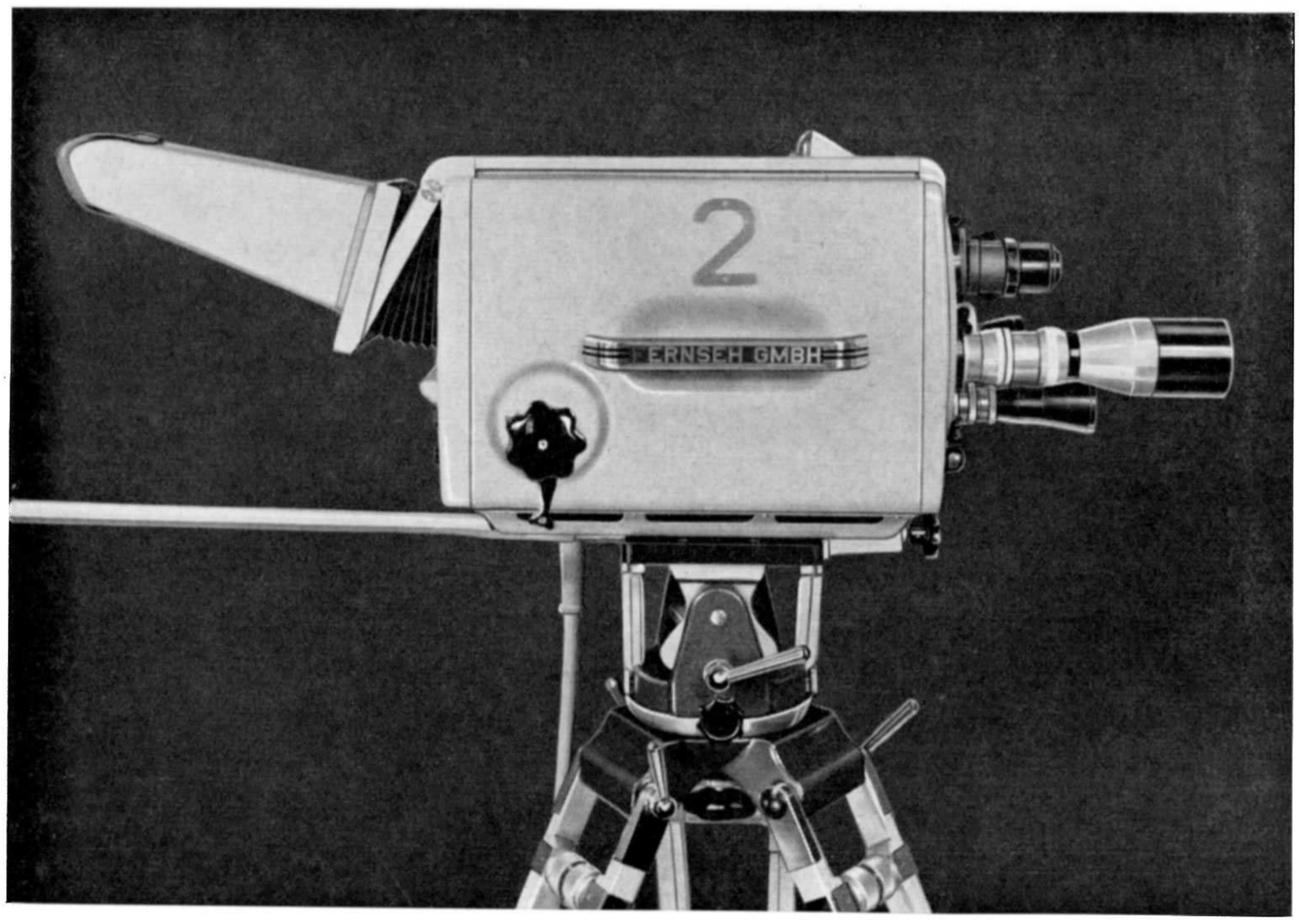


Fig. 3: Image Orthicon Camera KKOB 101, side view, eyepiece tube attached

Scan Generators

All the scan generator equipment is carried out very carefully in respect of accuracy and constancy with time. The frame timebase for the image orthicon operates with automatic linearization, so that setting-up is avoided. The line timebase is set up once for all during the manufacture of the camera. The size of the raster on the target of the image orthicon may be altered by about 10 % by means of a switch.

Construction

The camera is built on a cast-aluminum basic structure which carries the mounting plate for fitting to the tripod. The two side-walls and the front and rear panels may be hinged down; the drives for the lens turret and the focusing adjustment remaining fixed to the basic structure. When the camera is opened out, the image orthicon and the finder cathode ray tube may be replaced without special appliances.

www.tvcameramuseum.org

All the electrical components in the camera are accommodated upon one or other of three chassis, of which one may be hinged out to assure access to all the components.

The hinged chassis contains the circuits for the camera tube, preamplifier, time-bases, blanking circuit and dynamic focus correction, as well as the setting-up controls for the line and frame deflection, the beam shifts and the amplitude control for the focus correction.

The second chassis carries the finder tube with its focus and deflection unit, the time-bases with their associated setting-up controls and the video amplifier.

A third chassis contains the circuits for the signalling and talk-back arrangements and a working-hours meter.

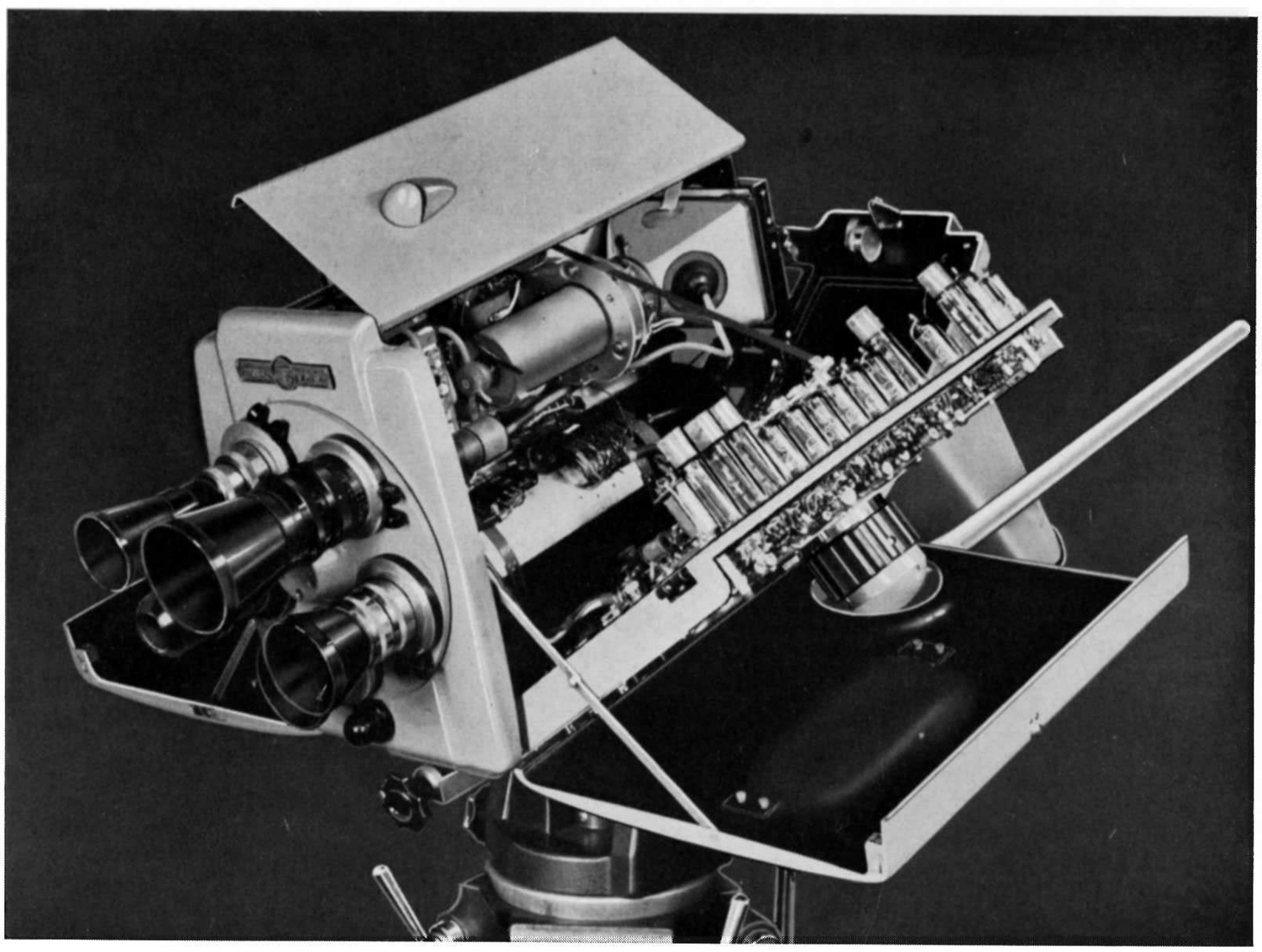


Fig. 4: Image Orthicon Camera KKOB 101, left Chassis swung out

Between the chassis is located the carriage for the image orthicon with its focus and deflection unit; this carriage also bears the voltage-divider for the electron multiplier in the image orthicon.

Below the camera-tube carriage, in special air-ways are situated the heater elements and two fans for temperature regulation. The fan motors, which are of the squirrel-cage type, have a long working life and are practically noiseless.

The cable connector for the camera cable is fitted on the left-hand side of the camera; it may easily be released without tools and is protected against jets of water.

The camera may conveniently be carried by means of two carrying-handles on the side walls.
On the back panel are placed only the controls for adjusting the finder picture to the operator's individual requirements and the controls and push-buttons for the signalling and talk-back arrangements. On the back panel there is also an arrangement for accepting a programme schedule, which may be illuminated with adjustable brightness.

www.tvcameramuseum.org

Control Desk with Monitor EOB 31/125 and Amplifier Cubicle KVsOB 15

In the Image Orthicon Camera Chain KOD 15 a control desk with monitor serves for the adjustment and supervision of the picture and picture signal delivered by the camera, whilst the camera amplifier itself is accommodated in a standard cubicle. For the switching on of the unit, mains switches for Ready and Operation with pilot lamps and working-hours meter are provided on the control desk and on the front of the cubicle. Two other pilot lamps on the control desk allow to check whether the mains switch on the cubicle is switched on since the apparatus is only under tension provided that both switches are switched on.

In addition to the usual controls for Focus 1 (image section) and Focus 2 (scanning beam) for the beam current, white level and black level, the control desk contains controls for spurious-signal compensation, the temperature adjustment and the switch for increased cooling. Three pilot lamps allow the operating condition of the automatic temperature stabilizing arrangements (Heating, cooling or heating up) to be noted. The left-hand one of the two indicating meters shows the temperature of the camera tube and may be changed over by a push-button to show the state of adjustment of the illumination control. The right-hand meter shows the voltage on the mesh electrode, or by operating a push-button it will show the focus-coil current for the camera tube. To assist in adjusting the correct working point for the camera tube the control for the mesh-electrode voltage comes into play on pushing-in a switch. The controls and switches for the talk-back arrangements are also fitted on the control desk.

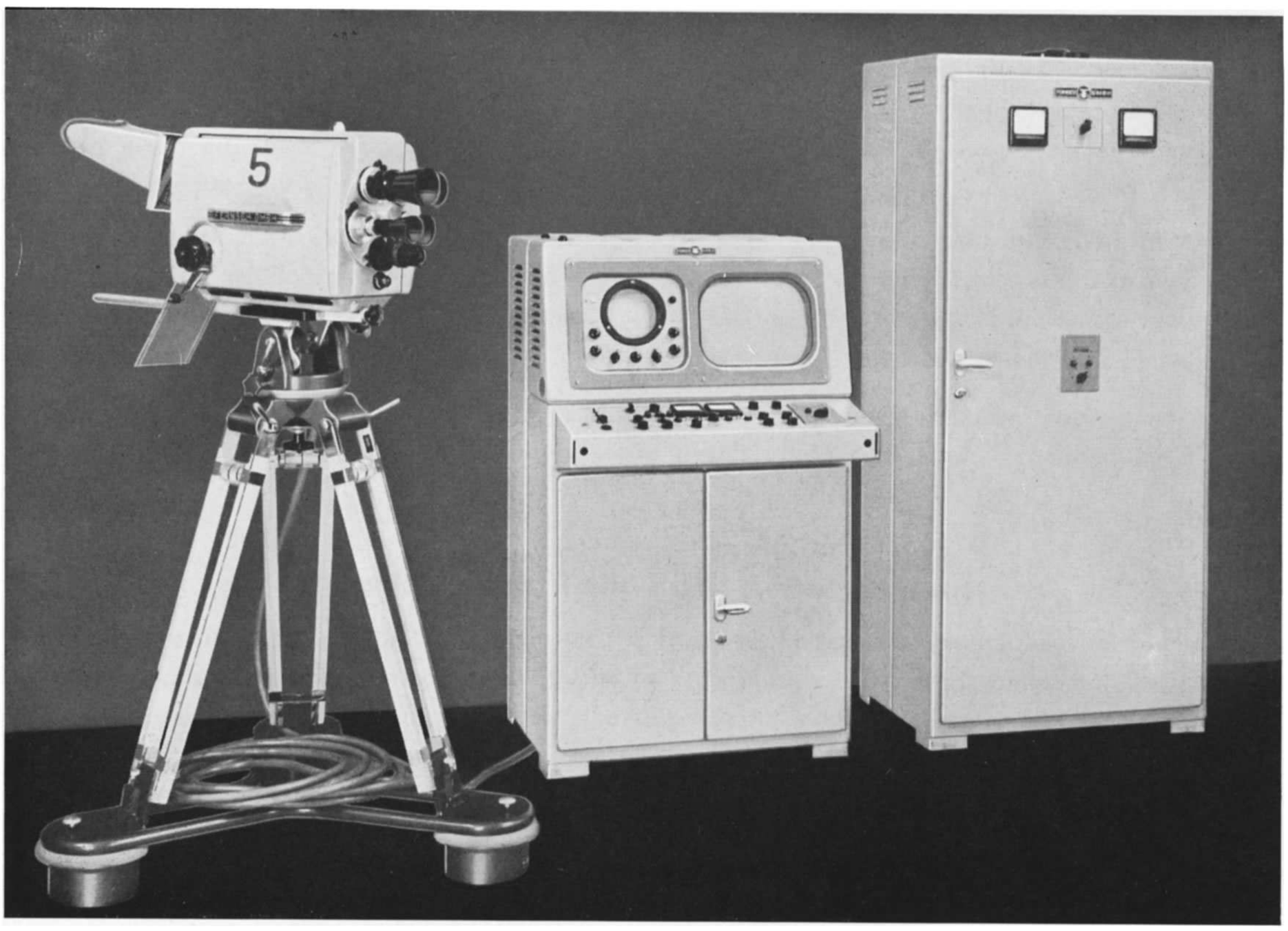


Fig. 5: Image Orthicon Camera Chain with camera, control desk with monitor and amplifier cubicle

www.tvcameramuseum.org

The amplifier cubicle includes the main amplifier, the pulse shaper the power pack and a distributor chassis. The whole amplifier chain is carefully and liberally designed. The frequency response is linear up to 5 Mc/s over the whole amplitude range (tolerance 5 %), for higher frequencies the droop of the camera amplifier is less than 1 dB at 6 Mc/s, while the main amplifier is less than 1 dB down at 7 Mc/s. Lag cannot be detected in operation and is less than 2 %.

The **Main Amplifier** is provided with an aperture corrector, which effects a controllable boost of the higher frequencies, free from phase error. Spurious signals can be corrected by the introduction of controllable compensating signals. Several clamp circuits at appropriate points in the amplifier circuit serve to suppress low-frequency disturbances. The blanking produces a standard picture signal (BA), in which the black level is defined. An adjustable white-level limiter definitely prevents the overmodulation of subsequent apparatus, even if the camera is incorrectly operated. It is also possible to apply black stretching in two stages.

The **Pulse Generator** provides the whole of the synchronizing, blanking and clamp pulses necessary for the operation of the equipment. Compensation for delay in the camera cable is provided, which is capable of altered by a switch to suit cables up to 300 m long.

All important stages are equipped with commercial valves of long working life. The anode voltages are electronically stabilized. The operation of the equipment is thus substantially independent of slow or rapid alterations in mains voltage.

Besides the mains switches with pilot lamps and the working-hours meter, two control instruments with a control switch are accommodated on the front of the cubicle.

The Picture and Waveform Monitor, Type EOv 31, is built-in at the upper part of the control desk in good view.

The Picture Monitor with its special tube Bm 31/5 provides a monitor picture 193 x 257 mm in size. The raster on the picture tube is sharply focused even at its corners, so that the character of the camera picture can be estimated without difficulty. The video amplifier in the monitor operates substantially linear over the modulation range and is provided with black-level control.

The Waveform Monitor includes a clearly writing oscillograph tube with post-deflection acceleration and provides an oscillogram 60 mm high of superior focus and high brightness, which allows a clear estimation of the signal waveform. The nominal values for the different signal levels are shown by a red-illuminated graticule. The frequency response can be brought to operate linear at 5 Mc/s.

Three different signals, which are taken from tapping filters, can be observed on the monitor. Two of these signals will be the BA and BAS outputs, while a calibration signal can also be applied to the monitor.

Signalling and Talk-Back Arrangements

Red lamps are fitted both in the finder and on the front of the camera immediately below the working lens to indicate that the camera is being used for transmission. The front lamp may be switched off. A green signal lamp fitted in the finder shows when the camera is ready for operation. A red and a green lamp are also arranged on the control desk and are switched on automatically with the corresponding signal lamps on the camera and on the mixer desk.

For **talk-back** between camera and control position there are two connections on the camera for microphone and headset. The volume in the headset is controllable and the microphone can be switched off. The main control desk may also be connected to this talk-back circuit, while it is also possible to superimpose the sound programme upon the talk-back circuit.

www.tvcameramuseum.org

Stands and Camera Cable

Thanks to the relatively light weight of the camera a normal tripod stand can be used to support it. Adaptors can be provided to match the camera to special stands or dollies. Baseplates can be provided when a zoom-lens is used.

The Ko-11-8f Special cable is used to connect the camera to the control unit. This cable contains three coaxial leads of 75 ohms impedance, 3 e. h. t. leads and the necessary cores for supply and control circuits. The external diameter for a plastic-sheathed cable is 18 mm, the least allowable radius of curvature is 200 mm. The maximum length of cable is 300 m.

Technical Data

Dimensions and Weight:

Image Orthicon Camera KKOB 101:

Height	411 mm
Width	363 mm
Depth	551 mm
Weight (approx.)	40 kg

	Camera Amplifier (Cubicle) KVsOB 15:	Control Unit (Desk) EOB 31/125:
Height	1650 mm	1200 mm
Width	720 mm	720 mm
Depth	520 mm	770 mm
Weigth (approx.)	160 kg	(approx.) 150 kg

Mains Supply:

220 V $\pm \frac{5\%}{10\%}$
50 c/s ca. 3,5 A ca. 2 A

Picture Scanning:

CCIR standard	625	lines/picture, 25 pictures/sec.
	2 : 1	interlaced, 50 frames/sec.
Aspect ratio	3 : 4	

Can be supplied to other standards.

Optical Equipment:

Five-way turret head for four lenses in rapid-change mountings and test projector; a fifth lens can be fitted in place of the test projector. The following special lenses are available:

www.tvcameramuseum.org

Reference	Aperture	Focal Length mm	Horizontal Picture Angle
Xenon	2.0	50	40°
Xenon	2.0	75	26°
Xenon*)	2.0	100	20°
Xenotar	2.8	150	13°
Tele-Xenar	4.5	150	13°
Tele-Xenar	5.5	200	10°
Tele-Xenar	5.0	300	6.5°
Telagon	4.5	400	5°
Telon	5.0	600	3°

*) Another lens with a focal length of 100 mm will sometimes be supplied instead of this.

Zoom Lens:

A baseplate is provided for use when a zoom lens is to be used, which carries both the camera and the lens.

Illumination Control with variable liquid filter

The transmission of the filter is continuously controllable over the range 1000 : 1.
Remote adjustment by servomotor: remote indication by meter on the control desk.

Illumination (when using the 5820 image-orthicon)

Minimum scene lighting
for full modulation of the image-orthicon at an aperture of f : 2, assuming a reflection coefficient of 50 % in the highlights and a contrast of 20 : 1 in the transmitted scene. approx. 5 Lux

Suitable scene lighting
for an aperture of f : 8 500 . . . 1000 Lux

Maximum scene lighting
with an aperture of f: 32 and maximum attenuation (1000 : 1) in the illumination control approx. 100,000 Lux

Maximum allowable contrast in the transmitted scene approx. 30 : 1

Finder

Size of picture on screen of finder tube 90 x 120 mm

Inputs to camera control unit

Horizontal Pulse (H)
Vertical Pulse (V)
Blanking signal (A)
Synchronizing signal (S)
} $-4\ V_{pp} \pm 30\ \%$ at 75 Ω

www.tvcameramuseum.org

Outputs:

Blanked vision signal (BA)	$+0.7\ V_{pp}$ or $+1\ V_{pp}$ at 75 Ω
Composite signal (BAS)	$+1\ V_{pp}$ or $+1.4\ V_{pp}$ at 75 Ω

Amplifier Characteristics:

	Preamplifier (in the camera)	Main Amplifier (in the amplifier cubicle)
Frequency range	5 Mc/s ± 0.5 dB 6 Mc/s — 1 dB	5 Mc/s ± 0.5 dB 7 Mc/s — 1 dB
Overshoot (Rise time of test pulses 0.08 µsec)	< 5 %	< 5 %
Overshoot frequency	> 6.5 Mc/s	> 8 Mc/s

Overall Characteristic:

Depth of modulation, when transmitting a 5 Mc/s bar pattern, using a Type 5820 image-orthicon with optimum adjustments, in the centre of the picture

without aperture corrector	30 . . . 40 %
with aperture corrector	up to 100 % of the black-white interval.

Depth of modulation and signal-to-noise ratio are very dependent upon the camera tube which is employed. Image-orthicons with increased storage capacitance (e. g. Fernseh Type OS 20) give a higher signal-to-noise ratio and less halation.

The Signal-to-Noise Ratio, for a fully modulated Type 5820 image orthicon, taken in the white areas with the bandwidth limited to 5 Mc/s, amounts to

with respect to the noise peaks	about 20 dB
with respect to the r. m. s. noise	about 35 dB

assuming a ratio of 1 : 6 for the ratio of r. m. s. to peak noise.

The visual signal-to-noise ratio is approximately the same with and without aperture corrector.

Geometry:

At no point is the departure from ideal geometry in the picture field greater than ± 2 % of the line length.

Picture and Waveform Monitor

Picture Monitor:

Picture size	193 x 257 mm
Contrast (max.)	max. 100 : 1
Brightness (max.)	max. 400 asb

Waveform Monitor:

Size of the oscillogram	60 x 110 mm
Time-base frequencies	$5208\frac{1}{3}$ c/s (H/3) and $16\frac{2}{3}$ c/s (V/3)

Amplifier Characteristics:

	Video Amplifier in picture monitor	Oscillograph Amplifier in waveform monitor
Frequency range	7 Mc/s –2 dB	7 Mc/s –3 dB*)
Overshoot (Rise time of test pulses 0.08 µsec)	< 5 %	< 2 %
Overshoot frequency	> 7 Mc/s	> 10 Mc/s

*) By means of a switch the frequency characteristic can be brought to OdB at 5 Mc/s.

www.tvcameramuseum.org