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TELEVISION MONOCHROME CAMERA
MARCONI VIDICON TYPE V321 SERIES
AND CONTROL EQUIPMENT

BY COMMAND OF THE DEFENCE COUNCIL

(Ministry of Defence)

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Procurement Executive, Ministry of Defence)

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FIRST AID IN CASE OF ELECTRIC SHOCK

DO NOT TOUCH THE VICTIM WITH YOUR BARE HANDS until the circuit is broken.

SWITCH OFF. If this is not possible, PROTECT YOURSELF with dry insulating material and pull the victim clear of the conductor.

THE EXPIRED AIR METHOD OF ARTIFICIAL RESPIRATION

(Approved by the Royal Life Saving Society)

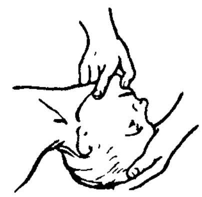
1. Lay the patient on his back with his arms to his sides. If on a slope have the stomach slightly lower than the chest. Make a brief inspection of the mouth and throat to ensure that they are clear of obvious obstruction.

2. Kneel on one side of the patient level with his head, place one hand under his neck and the other on top of his head (Fig.1).
   LIFT THE NECK AND TILT THE HEAD BACK AS FAR AS POSSIBLE.


FIG 1

3. Move the hand from under the neck and place it on the chin of the patient, the thumb between the chin and mouth, the index finger along the line of the jaw, the remaining fingers curled (Fig.2). Whilst positioning the patient, open your mouth and take deep breaths.

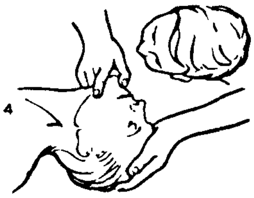
4. Using the thumb of your hand on the chin to keep the lips sealed, open your mouth wide and make a seal round the patient's nose and blow into it (Fig.3).

FIG 2


5. After blowing, turn your head to observe the rise of the chest (Fig.4). If no air enters the patient's lungs, the nose may be blocked and the mouth should be opened using the hand on the chin; open your mouth wide and making a seal round his mouth blow into it. Turn the head to observe the chest rise. This may be used as an alternative to blowing into the nose even when the nose is not blocked, but the nose must be sealed either with the cheek or by moving the hand from the top of the head and pinching the nostrils.
   THE HEAD MUST BE KEPT AT FULL BACKWARDS TILT.


FIG 3

6. Start with ten quick deep breaths and then continue at the rate of twelve to fifteen breaths per minute. This should be continued until the patient revives or a doctor certifies death.

FIG 4


7. In the case of facial injuries it may be necessary to do a manual method of artificial respiration (Holger Nielsen).

8. It is ESSENTIAL to commence artificial respiration without delay and to send for medical assistance immediately.

TREATMENT FOR BURNS

If the patient is also suffering from burns, then, without hindrance to artificial respiration, observe the following:

(a) DO NOT ATTEMPT TO REMOVE CLOTHING ADHERING TO THE BURN.

(b) If help is available or as soon as artificial respiration is no longer required the wound should be covered with a DRY dressing.

(c) Oil or grease in any form should NOT be applied.

Further details of charts and books on artificial respiration may be obtained from:

The Royal Life Saving Society, 14 Devonshire Street, Portland Place, London, W.1

PREFACE

1. This Technical Manual is intended to ensure satisfactory operation of Marconi equipment over its working life. It is intended for use by skilled technicians who have had adequate basic training in this general type of equipment, and does not aim to provide information for basic training. This type of information is only included where new or complicated techniques are used. Those sections dealing with day to day operation are, however, specially written with the needs and experience of operating staff in mind.

2. Marconi Technical Manuals are normally divided into Sections and Chapters; each chapter is sub-divided into numbered paragraphs. Illustrations and circuit diagrams are located immediately following the final chapter. Each manual includes consolidated lists of those parts which are replaceable in the event of failure. These lists, which are cross-referred to the individual diagrams, define each part fully in terms of a Marconi part reference number, which may be used for ordering spare parts. A glossary is available from Central Division (price 5/-) giving NSN references where available.

3. This manual includes an amendment record sheet. Amendments will normally be by the issue of replacement pages and drawings. On these, changes in the text will be indicated by means of a heavy line in the margin alongside the amended material. Where the amendment relates to a modification, the equipment should be checked to see if the modification has been incorporated before the manual is amended.

4. The equipment covered by this manual is subject to modification control. The Modification State of the Equipment sheet defines the modification zones into which the equipment is divided, and shows the modification state of each zone to which the manual relates. Manual amendment will be in terms of modification state and equipment should be checked before manual amendments are made.

MODIFICATION STATE OF THE EQUIPMENT

Modification Record Labels are fitted to the units of the equipment listed below. Embodiment of a modification is indicated by scoring through the relevant number on the appropriate label.

The amendment state of this manual is related to the modification state of the equipment. To ensure that this relationship may be determined at any time, the following table is re-issued with successive amendments to the manual.

Unit No.	Unit or Sub-Unit Title	Modification State of Unit or Sub-Unit Related to Amendment State of Manual												
	Frame Assembly B99-0525-01	0	1											
	Back Panel VB10-3216-01	0	1											
	Back Panel VB11-3216-01	0	1											
	Back Panel VB11-3216-02	0	1											
	Control Panel B99-0872-01	0	1											
	Power Supply VB01-3216-01	0	1											
	Frame and Control Assembly B99-0786-01	0	1											
	Power Supply VB01-3215-01	0	1											
	Power Supply VB02-3215-01	0	1											
	Power Supply VB03-3215-01	0	1											
	Camera VB00-3211-01	0	1											
Amendment State of Manual		4	5											

V321 SERIES

VIDICON CAMERA CHANNEL

Contents

Part 1

TECHNICAL DESCRIPTION

List of Illustrations

PART I

Chapter 1

INTRODUCTION

INTRODUCTION

1. The Vidicon Camera Channel Type V321 comprises a Camera Type V3211 and a Camera Control Unit Type V3215, V3216 or V3217 depending upon the application. In addition to these basic units a number of ancillary units may be supplied to increase the versatility of the channel in specialized applications.

2. The channel is almost completely transistorized, the CCU being constructed in modules in which the majority of components are mounted upon printed wiring boards which are readily removed for ease of servicing.

3. The channel is designed to give an extremely high performance with long-term stability of operation.

4. The camera uses a vidicon tube, the type depending upon whether a rugged or light-duty application is required (see equipment characteristics). The camera is an extremely compact unit having a cylindrical construction and is normally fitted with a mounting block designed for fixing on a standard tripod.

5. The stainless steel cover is sealed at both ends to make it dust and moisture proof and the addition of a simple waterproof lens cover to the front of the camera makes it suitable for operation in unfavourable weather conditions.

6. The lens mount is designed to take the Broadcast or C type lenses, a simple adaptor insert being provided to convert from the former to the latter.

7. A manual focus control is provided on the camera and where desired it may be replaced by an electrical focus drive (optional) operated from the Control Unit. When manual focus is used a focus lock is provided for fixed focus applications.

8. To increase the light-handling range of the camera a neutral density lens filter assembly may be fitted and a sun shutter may be used to protect the vidicon tube from intense light sources. An electrical feature of the camera is the 'High Flux Mode' of vidicon operation providing a much sharper focused beam giving an improved resolution with a consequent improvement in signal/noise ratio since less aperture correction is required for a given resolution.

9. Three types of Camera Control Unit are available. They are:-

Type V3215	This is a free-standing ruggedized unit which is either airtight or forced ventilated. The printed boards are clamped to the frame ensuring reliability under vibration and acceleration.

INTRODUCTION

Type V3216	This is a 19 in (48.5 cm) rack mounted unit.
Type V3217	This is a rack mounted unit designed for airborne applications and is of similar construction to V3215 but complying with ARINC Specification 404.

10. The Camera Control Unit houses the video processing circuits, the timebase circuits and the synchronizing circuits. The operational and preset controls are mounted on the front panel of the control unit. Provision is made for fitting the additional controls for remote optical focus and sun shutter/filter selection. The preset controls are fitted with a protective cover to prevent accidental disturbance.

11. Connection from camera to control unit is made by means of a multicore cable which may be up to 1000 ft in length. A cable-compensation circuit in the camera control unit provides correction to the video signal for the length of camera cable employed.

12. The timebase circuits may be driven from standard external drive pulses (broadcast applications) or by internal generators having no fixed relationship between the line and field frequencies, giving a random interlace, but with the necessary facilities for crystal controlled line oscillator and mains locked field timing.

13. In applications where it is necessary to have a fixed relationship between the line and field frequencies to produce an accurately interlaced picture, synchronizing circuits may be installed in the Control Unit. This unit can then be arranged to drive other channels. A shading generator may be fitted to give an optimum quality of picture when operating the camera at high light levels with vidicon tubes not having a separate mesh connection and also to provide an auto-alignment output to ease the adjustment of the alignment controls.

Chapter 2

EQUIPMENT CHARACTERISTICS

EQUIPMENT CHARACTERISTICS

Inputs

1. (a) Power

The camera will operate from the following supplies:-

100-125V	200-250V	48-62 c/s.
100-125V	200-250V	380-420 c/s.
24V	+6V -2V D.C.	

Power consumption 50-60VA.

(b) Synchronizing Pulses

Line Drive, Field Drive, Mixed Blanking, Mixed Sync	Standard negative pulses -6 dB. to +12 dB ref. 2V peak-to-peak. High impedance, bridging output.
(c) Locking Signal	6.3V RMS into 3,300 ohms.

Outputs

2. (a) Vision — 1V to 1.5V composite or equivalent non-composite into 75 ohms.

(b) Synchronizing

Pulses from internal sync pulse generator Line Drive, Field Drive, Mixed Blanking, Mixed Sync.	Standard negative pulses 2V ±2 dB into 75 ohms for use with other channels. Equalizing pulses are not incorporated in the mixed sync signal.

NOTE: *No pulse outputs are available when the channel is operated from the simple internal pulse generator giving unrelated line and field frequencies.*

Performance

3. All performance figures are quoted for operation on 525/625 line systems. Although the channel is designed to operate in an ambient temperature up to 55°C the performance specified is obtainable at ambients in the range 20°C-30°C. Outside this range the degradation of circuit performance is negligible compared with the performance of the Vidicon.

EQUIPMENT CHARACTERISTICS

Sensitivity

4. The channel is designed to operate, with the performance specified, under the following conditions. The specified Vidicon is a 7263A, P831, or equivalent.

(a) Low Light-level condition (Vidicon sensitivity at maximum).

Scene highlight brightness:	3 ft L.
Lens aperture:	T 2.8
Signal Current:	0.1 μA
Dark Current:	0.2 μA approximately.

(b) 'Average' Light-Level condition

Scene hightlight brightness:	50 ft L.
Lens aperture:	T 2.8
Signal Current:	0.3 μA
Dark Current:	0.02 μA approximately.

Sensitivity will be reduced when Vidicons of a less sensitive type are used, e.g. 7038, P810, etc. The average light-level conditions are those for which other aspects of the performance are specified below. A T.T.H. 3 cm Vidital lens is used.

5. **Resolution**

Centre Resolution: (Average tube with 750V on focus electrode).	Loss at 400 T.V. lines per picture height less than 6 dB without aperture correction. With aperture correction full modulation may be achieved at 500 lines per picture height.
Corner Resolution:	Loss at 400 lines less than 4 dB below centre resolution depending upon the type of vidicon tube employed.
Limiting Resolution:	Bandwidth limited (9 Mc/s) on all standard systems except 405 lines which will resolve 800 lines per picture height in the centre.

6. **Vision amplifier**

(a)	H.F. response	Flat ±0.5 dB to 8 Mc/s -3 dB at 9 Mc/s
(b)	Aperture correction:	Phaseless correction with peaking frequency adjustable according to system. Amount of correction variable up to 12 dB at 600 lines/ picture height.
(c)	Hum on vision signal:	R.M.S. hum output at least -55 dB ref. 1.0V peak-to-peak vision output.

Automatic sensitivity

7. Using the parameters given in para.4 sub-item (b) above, a variation of scene highlight brightness from 10,000 ft. L. to 10 ft. L does not cause the peak vision output level to alter by more than 40% ref. 1.0V. When subjected to this change the circuit re-establishes itself in approximately 1 second. Operation in the condition quoted in para.4 sub-item (a) reduces the above brightness figures by a factor of approximately 3:1.

Automatic dark current compensation

8. If the Vidicon dark current changes from zero to 0.2 μA the shift in level of picture black information is not more than 15% ref.1.0V.

Contrast correction

9. It is possible to apply a contrast correcting law of γ (gamma) <1 to improve observation of scenes of exceptionally high contrast.

EQUIPMENT CHARACTERISTICS

Long term stability

10. During 7 days continuous operation in the conditions quoted in para.4 sub-item (b) there is no significant change in picture quality on a picture monitor. The picture black level and peak vision signal output does not change by more than 1% ref. 1.5V. During this period the ambient temperature may vary between 20°C and 50°C, the mains input by +7%/-10% and the scene brightness between 20 ft. L. and 1000 ft. L.

Immunity to pulse variations

11. Input pulse amplitude variation of ±6 dB about the nominal and width variation of ±10% of nominal do not cause a visible change of picture levels on a picture monitor. Superimposed hum up to 30% of pulse amplitude on line drive or field drive (15% for blanking and syncs) causes no visible effect when the output is observed on a picture monitor.

12. Scanning circuits

(a) Standards.

The channel will operate on the following scanning standards either internally or externally driven:-

(i) 405 lines, 50 field 2:1 interlace.

(ii) 525 lines, 60 field 2:1 interlace.

(iii) 625 lines, 50 field 2:1 interlace.

(iv) 819 lines, 50 field 2:1 interlace.

(v) 875 lines, 60 field 2:1 interlace.

(vi) The above standards, but with no fixed relationship between line and field frequencies, and single field pulse only.

NOTE: *Where no fixed relationship exists between line and field frequencies, the actual number of lines may vary between the number quoted above and half that number. Internally generated systems do not have equalizing pulses but otherwise can be set to conform to C.C.I.R. widths and timings.*

(b) Amplitude.

With nominal blanking periods the Vidicon scan sizes are adjustable over the range 15% of nominal.

(c) Stability.

With a mains input variation of +7%/-10% of nominal and an ambient temperature variation from 20°C to 50°C the scan size or position does not change by more than 3% of nominal scan size. A limit of 2% of scan size is independently applicable to the warm up period in an ambient temperature of 20°C.

(d) Positional scanning errors.

The maximum displacement of any picture point from the ideal is less than 1% of picture height or width. The maximum error builds up over not less than 1/3rd picture height or width.

(d) Positional hum

Less than 0.1% of picture height or width.

13. Transistors, etc.

NOTE: *All transistor types and quantities are liable to alteration.*

Camera. Vidicon 1 inch types with magnetic focus and deflection.

Input stage: 7586 Nuvistor. (R.C.A. 7586)

Commercial Type	C.V. Type	American Equivalent
4-BSY 27	-	2N708
3-AFZ12	7335	2N1495
1-BFY 18	-	2N2484
1-OC205	-	2N1475
1-A1704	-	2N2893

C.C.U. (Less S.P.G. Boards)

Commercial Type	C.V. Type	American Equivalent
1-2N 711	-	2N1495
3-BFY 17	-	2N2477
3-AFZ 12	7335	2N1495
2-2S305	-	2N2551
10-BSY 27	-	2N708
14-ASY 27	7087	2N1305
1-OC 23	7054	2N1908
4-OC 28	7085	2N2870
1-OC 35	7084	2N2870
1-OC 44	7003	2N1305
13-OC 84	7074	2N527
14-OC 140	7112	2N1302
3-OC 202	-	2N1475
9-OC 205	7188	2N1475

P.U. Rectifiers

Commerical Type	C.V. Type	American Equivalent
4-20AS	7045	IN3194
2-80AS	7356	IN3196
1-40AS	7013	IN3196
4-8G7	7356	IN3196
4-BYZ38-300		

S.P.G. Boards

Commerical Type	C.V. Type	American Equivalent
24-ASY 26	7004	2N1303
14-ASY 27	7077	2N1305
2-OC 76	7007	2N527
1-AFZ 12	7089	2N1495

14. **Mechanical**

	Length	Diameter	Weight
Camera:	14.5 in. (37 cm)	3.5 in. (8.8 cm)	9.5 lbs. (4.3 kg)

	Width	Depth	Height	Weight
V3215 Control Unit:	8 in. (20.5 cm)	16 in. (41 cm)	10.5 in. (26.7 cm)	30 lbs. (13.6 kg)
V3216 Control Unit:	19 in. (48.5 cm)	12 in. (30.5 cm)	7 in. (17.8 cm)	33 lbs. (15 kg)

Camera finish: Stainless steel case with black anodized end plates.

Control units finish: Two tone textured P.V.C. paint (Light and Dark Grey).

Equipment List

15. The Industrial Television Camera Channel Type V321 comprises:-

1 - Industrial Television Camera Type V3211

Either 1 - Camera Control Unit V3215

or 1 - Camera Control Unit V3216 (for rack mounting)

Cables required (subject to extra charge)

1 - 37-way camera cable fitted with connectors:-

For use with V3215 or with V3216 having VB11-3216 back panel.

Either Straight Entry Socket and Straight Entry plug. B99-1051-01.

or Side Entry Socket and Straight Entry plug. B99-1051-03

GM

or	Straight Entry Socket and Side Entry Plug. For use with V3216 having VB10-3216 back panel	B99-1051-04
Either	Side Entry Socket and Crimped Connectors.	B99-1051-05
or	Straight Entry Socket and Crimped Connectors.	B99-1051-06

1 power cable with connectors:-

Either	Straight Entry Plug and Straight Entry Socket (unscreened cable).	B99-1053-01
or	Straight Entry Plug and Straight Entry Socket (screened cable).	B99-1053-02
or	Straight Entry Plug and free end, (unscreened cable).	B99-1053-03
or	Straight Entry Plug and free end, (screened cable).	B99-1053-04

The following features may be incorporated, subject to extra charge:-

Remote Focus Unit Type V4012
Sun Shutter Assembly Type V4033
Neutral Density Lens Filter Assembly Type V4034
Fibreglass Sun Shield Type V4202
Waterproof Lens Cover Type V4281
Zoom Lens Type V4024
Shading Generator and Auto-Alignment Type B99-0033-01
Synchronizing Pulse Generator Types B99-0028-01 & B99-0029-01

In addition, a Remote Control Unit can be supplied to provide for remote operation of the following features:-

Remote Focus
Neutral Density Lens Filter/Sun Shutter Operation

The remote control unit can house controls for operating Picture Polarity Reversal and Line Scan Reversal relays. Full details of these facilities are to be found in the Appendices. When a remote control unit is supplied a 19-way cable will be required with connectors as detailed below:-

Either	Straight Entry Socket and Straight Entry Plug.	B99-1052-01
or	Straight Entry Socket and Crimped Connectors.	B99-1052-02
or	No Socket and Straight Entry Plug.	B99-1052-03
or	Straight Entry Socket and No Plug.	B99-1052-04

SECTION 2

Chapter 1

MECHANICAL

MECHANICAL

Reference should be made to Figs.119 and Figs.123-126.

Camera tube

1. The camera uses a $5\frac{1}{8}$ inch ruggedized Vidicon, type 7263-A or P831. These tubes are pipless and have a completely uniform photo-conductive layer. It is also possible to use the standard $6\frac{1}{4}$ inch Vidicon with or without a side pip. The Vidicon heater supply is adjustable for a current requirement from 90 mA to 600 mA with a camera cable up to 1000 ft long.

Camera

2. The camera is housed in a cylindrical case $3\frac{1}{2}$ inch (8.8 cm) in diameter and $14\frac{1}{2}$ inch (37 cm) long excluding the lens and cable connector. Space is provided for the remote focus motor, sun shutter and filter solenoids without the necessity for fitting additional external components. It is possible, however, to reduce the length by 2 inch for special applications if remote focus is not required. For manual focus an extension shaft is fitted to the focus drive and this shaft protrudes from the rear of the camera to provide manual control. A focus lock is provided. The case is dust and moisture proof. Inlet and outlet connections may be provided for forced cooling or pressurization by conditioned gas, when required. An over-temperature indicator may also be fitted.

3. As a result of operating the Vidicon focus electrode at 750V the line scanning current generator is housed in the camera. The maximum dissipation in the camera is approximately 13W when a Vidicon with 600 mA heater is used. This reduces to approximately 10 watts when a 90 mA heater is used. The maximum ambient temperature is limited to 55°C. A sealed multi-way outlet is fitted to give access to the camera for inter-communication and to provide power for a limited number of camera accessories.

Camera control unit

4. The Camera Control Unit (CCU) is transistorized with the exception of the Vidicon H.T. stabilizer and includes all circuits necessary to produce a 1.5 volt composite, or equivalent non-composite, vision signal. The mobile unit Type V3215 is housed in a case approximately 8 inch (20.5 cm) wide x $10\frac{1}{2}$ inch (26.7 cm) high x 16 inch (41 cm) deep. The case is sealed, all cable connectors being situated on the front panel. The printed wiring boards are mounted vertically and are held rigid to the structure by bolts with spacers fitted to the boards. The power supply unit is removable from the main structure and is available in versions suitable for operation on 50/60 c/s, 400 c/s and d.c. mains. Operation direct from lightweight storage cells is also possible.

5. The V3216 version of the CCU is designed to fit a standard 19 inch rack. The printed wiring boards are plugged in from the front and occupy the left-hand side of the unit. Provision is made for an extension board (for test purposes) to be retained in a socket at the extreme left-hand end of the unit. The power unit and panel controls form a separate unit occupying the right-hand side. This unit is plugged into two multi-way connectors mounted at the rear of the case. Access to the panel controls is obtained by removing the escutcheon which is attached by four captive screws. All cables are brought into the rear of the unit and two methods of connection are possible as follows:-

(a) Plugs and sockets, as on the mobile version, using back panel VB11-3216-01.

(b) With no back panel, wired to the existing sockets.

The Power Supply Unit (PSU) is removable from the main structure and is available for operation from 50/60 c/s mains only.

6. The only exposed controls are the ON/OFF switch and accessory controls when fitted. All circuits are designed for excellent long and short term stability including automatic compensation for variation of ambient illumination and temperature.

On the heavy duty unit, setting-up controls, which will need adjusting when a Vidicon is changed, are located under a hinged sealed cover at the top of the front panel. Air inlet and outlet connections may be provided to allow forced cooling or pressurization, especially at high altitudes. A number of cases exist to suit various environments. These include:-

(a) Sealed sheet metal case Type V4230.

(b) Ventilated sheet metal case Type V4232.

(c) Sealed cast case with fins Type V4231.

All cases will provide space for the inclusion of a circulating fan to improve cooling and ambient capability. An over-temperature indicator can also be fitted.

Camera channel accessories

7. The mechanical design of the camera allows the inclusion of an optional remote focus motor and/or neutral density lens filter and sun shutter with operating solenoids. Focusing may be carried out at two rates to suit the focal lengths of lens in use. The shutter is a 'fail safe' device which will protect the Vidicon when the camera is not powered and may be used in conjunction with a photocell unit to provide automatic protection against exposure of the vidicon face to the sun.

MECHANICAL

The front casting of the camera is removable to allow easy attachment to the camera body of externally fitted accessories, e.g. lens turret, zoom lens and special optical systems. The addition of a simple lens protecting cover makes the camera suitable for a wide range of environmental conditions without further protection.

Chapter 2

PRINCIPLES OF OPERATION

PRINCIPLES OF OPERATION

Reference should be made to the block diagram Figs.101 and 102.

1. The Industrial Camera Channel Type V321 comprises the Vidicon Camera Type V3211 and its associated Camera Control Unit Type V3215 (mobile) or V3216 (rack mounted).

Camera

2. The camera houses the vidicon pick-up tube V2, its deflection and alignment coils, the head amplifier and the line scan generator. The output from the target of the vidicon is applied to the input stage of the head amplifier which consists of a Nuvistor (V1) and a transistor (VT1) in a cascode circuit. This circuit gives a good signal to noise ratio and is followed by three amplifiers (VT2-7) in cascade and an emitter follower output VT8 feeding the coaxial line in the camera cable at a level of 250 mV for a signal current of 0.3 μA.

3. The scanning waveform applied to the line deflection coils is generated from the line drive pulses fed from the control unit which are used to fire a silicon controlled rectifier circuit.

4. Shading and blanking waveforms are combined by VT9 and MR9-11 and are fed to the grid and the cathode of the vidicon tube.

CAMERA CONTROL UNIT

Video amplifier

5. The video amplifier in the Camera Control Unit amplifies and processes the signal from the camera to produce a standard level signal at the output, which should always be terminated in 75 ohms.

6. The video amplifier stages are mounted on two printed wiring boards Video 1 - B99-0038 and Video 2 - B99-0037, with functions as indicated in the following paragraphs.

Video 1 (B99-0038)

7. The Hum Stripper stage (VT1), removes hum on the signal from the camera introduced by different a.c. potentials between the camera and camera control cases.

8. The Aperture Corrector stage (VT3-VT5) provides a high frequency boost to the signal to improve the overall resolution of the channel and is followed by an inverter stage (VT6) from which either a positive or negative polarity picture may be selected.

9. To compensate for the frequency attenuation characteristic of the coaxial line in the camera cable the cable length corrector stage VT8 provides a boost which is preset by the CABLE CORRECTION control RV2 to correct for the length of cable in use.

10. The corrected signal is further amplified by VT9, VT10 and an emitter follower output VT11 feeding the Video 2 board.

11. The Video 1 board also incorporates a clamp pulse generator (VT13-VT15, VT7) and a camera blanking mixer circuit (VT16-19). In addition to providing clamp pulses to the line clamp VT1 on Video Board 2, the clamp pulse generator also feeds an output to the video amplifier VT9, VT10 to provide a positive black level on the signal which is clear of any spurious noise.

12. The LINE SCAN RESET transistor VT12 provides an output to protect the line scan generator on the camera should the silicon controlled rectifier X1 stick in the ON condition when switching on or changing sync. sources. VT12 and SCR1 are only fitted on early camera channels.

Video 2 (B99-0037)

13. The input to the Video 2 board is an emitter follower VT2 in which the black level of the signal is established by the line clamp VT1.

14. The emitter follower is followed by a blanking mixer and clipper VT3. Blanking pulses are provided by the blanking generator VT7-VT8 and are mixed with the video signal to provide the necessary blanking during the flyback periods.

15. The clipper circuit establishes the black level on the signal such that when the synchronizing pulses are mixed with the signal through the sync. clipper VT9, VT10 and the sync. mixer, (VT4,VT5) a composite standard level signal is provided from the output (VT6).

16. A sampling signal from the output stage is fed to the auto-target circuit (VT11, VT12, VT17 & VT19) which provides an automatic sensitivity correction for changes in the light level at the photo-conductive surface of the vidicon.

17. The auto-black level circuit VT13, VT14 and VT15 provides automatic compensation for changes in dark-current from the tube.

Field scan B99-0031

18. The scanning circuits of the camera may be operated from the following sources:-

(a) Internally generated drive pulses.

(b) Externally generated drive pulses.

(c) Under a random interlace condition where there is no fixed relationship between line and field frequencies.

When using internal or external drive pulses, line drive, field drive, blanking and sync. should be terminated in 75 ohms. When using random interlace these pulses should not be terminated.

19. Field drive and line drive pulses are fed into the Field Scan Generator board. The field drive pulses operate a field delay circuit VT1,VT8,VT9,VT10,VT11, which makes possible an adjustment to the delay between the start of the field scan and blanking in order to remove the characteristic white line on the raster at the bottom of the field.

20. The output from the field delay circuit operates the field saw-tooth generator (VT2-VT4) and the scanning current for the deflection coils is obtained from the Field Scan Output stage consisting of VT5 and VT6 operating as a complementary pair. The scanning waveform is taken to the scanning coils via a bridge resistance network which is supplied with a d.c. potential for centring the raster on the tube.

21. Line drive pulses to trigger the line deflection circuits are taken via a buffer stage VT12 to a phase inverter VT15 which supplies three outputs of +5V, -5V and -2V, respectively. The -2V output provides the drive pulses to operate the silicon controlled rectifier or the transistor on the line scan generator of the camera via VT16.

22. The vidicon tube is protected from target damage in the event of scan failure by the scan protection circuits VT17-VT20. The field scan waveform is rectified and fed to the scan protection circuit. The d.c. voltage for charging the capacitor in the line scan generator is taken via a potential divider network, and a voltage from this potential divider is also taken to the scan protection circuit. Failure of either, or both, the field and line scan circuits will cause a change of d.c. level at the protection circuit. The protection circuit provides the d.c. return for the vidicon power supply circuit VT8-VT9 and the resulting change of d.c. level at the protection circuit switches off the generator, thus removing all the supplies to the tube with the exception of the heater supply.

23. Under the simplest conditions of operation, without synchronizing generator, the camera channel is operated on a random interlace system. In this case part of the field delay circuit is converted (by means of internal links) to a free-running multivibrator which may, if desired, be mains locked. The line frequency is generated by means of a crystal controlled blocking oscillator and there is no fixed relationship between the line and field frequencies.

Shading generator B99-0033

24. This unit produces a shading waveform and an auto-alignment waveform. The shading waveform is a combined line and field parabola which is fed to the vidicon to compensate for beam landing errors on the target which would cause deterioration of the picture when using tubes not having a separate mesh connection. The field component of this waveform is generated by the field frequency parabola generator (VT1, VT2) triggered from the output of the field sawtooth generator; the line component is generated through the line frequency sawtooth generator (VT3-VT5) and the line frequency parabola generator and mixer VT6.

PRINCIPLES OF OPERATION

The mixed shading signal is amplified by VT7, VT8 and fed to the grid and cathode electrodes of the vidicon tube through the emitter follower VT9 to correct any shading on the output of the tube.

25. The auto-alignment waveform is to facilitate the correct alignment of the beam as it emerges from the gun of the tube.

26. A pulse from the field scan board, at field frequency, is applied to the field drive switching stage VT10 whose output is then divided to half frequency by the auto-align bi-stable multivibrator VT11,VT12. The alignment pulses are then fed to the wall and mesh electrodes of the Vidicon through VT13 and produce a rotational movement of the picture if the beam is not correctly aligned. This movement is minimised by the correct setting of the alignment controls.

Sync pulse generator

Reference should be made to the Block Diagram Fig.102.

27. The Sync Pulse Generator consists of the two boards B99-0028 and B99-0029 which are fitted when an accurate interlace is required.

28. The first board contains a master oscillator running at twice the line frequency of the system. This oscillator may be locked to the 50/60 c/s mains frequency or, alternatively, may be crystal controlled. A divide-by-two circuit reduces the oscillator output to line frequency and a series of binary counters act as frequency dividers. These counters, together with the counters on the input of the second board, reduce the line frequency signal to field frequency. The second board also contains the shaper circuits to form the line drive, field drive, mixed sync and mixed blanking pulses.

Power supply

29. Power for the equipment may be supplied from the 50/60 c/s mains. V3215 and V3217 CCUs may be supplied from a 400 c/s supply, a d.c. supply, or from a battery source. The output is a smoothed d.c. supply which is applied to a stabilizer VT1-VT4.

30. The stabilizer provides outputs of -16.5V and +4.5V as reference supplies to the various boards in the channel. The combined output of 21 volts is taken, via a focus current regulator (VT5-VT7) to the focus coils and to the vidicon power supply VT8-VT9 which supplies all the voltages for the operation of the vidicon with the exception of the heaters.

Remote control unit

31. The remote control unit has facilities for reversing the line scan and the picture polarity. A line centring potentiometer for reverse scan operation is also provided.

V

SECTION 3

Chapter 1

CAMERA

List of Illustrations

CAMERA

Reference should be made to the circuit diagram Fig.103.

General

1. The camera incorporates the vidicon pick-up tube, the scanning, alignment and focus coils, the line scan generator circuit, a circuit for feeding blanking (and shading, if provided), to the camera tube and a head amplifier board Type B99-0447. The optional facilities, Remote Focus Motor, Neutral Density Lens Filter and/or Sun Shutter may be added, if required.

Head amplifier

2. The first stage is a cascode amplifier using a nuvistor triode valve V1 and a transistor VT1. In this way advantage is taken of the high input impedance of a valve having a gain roughly equivalent to that of a pentode valve. At the same time, partition noise is avoided by using a triode valve, and noise in the transistor is minimized by the negative feedback provided by the triode acting as an emitter load for the transistor. The base of the transistor is decoupled by C1 and the cathode resistor is bypassed by a small capacitor C4 to increase the amplifier bandwidth. The second, and succeeding stages, consist of complementary pairs of transistors. The second, third and fourth stages have gains of 7, 4 and 11 respectively. The emitter voltage of the output transistor in each pair is stabilized by zener diodes MZ1, MZ2 and MZ3. A frequency-conscious network is connected between the second and third stages. This is to compensate for the falling frequency characteristic of the amplifier caused by shunt capacitance across the 56K load resistor R1 into which the vidicon output is fed. The effective coupling impedance decreases as frequency increases until R20 is short-circuited by C9 and C10 in parallel. The inductor L1 tunes out the effect of the input capacitance of the final amplifier. The response of the amplifier is set up by the adjusting C9 and L1. C9 is normally adjusted for minimum streaking after horizontal low frequency edges. The capacitor C11 is to compensate for tilt in the waveform caused by loss of low frequency response resulting from the interstage coupling capacitors. The final amplifier stage makes up for the loss of gain which occurs in the frequency response correction network. The output is taken from transistor VT8, connected as an emitter-follower. The coaxial cable carrying the output to the video gain control on the Camera Control Unit is terminated by a 75Ω load and the cable forms part of the emitter load of VT8. The output impedance tends to increase as frequency increases and capacitor C15 compensates for this effect.

Field scan

3. The resistors R37, R38 and the thermistor R36 form a temperature dependent circuit the resistance of which varies inversely to the resistance of the copper scan coils. Thus the resistance of the loop is held constant over a wide range of temperature. Because of this, and because the field scan generator produces a linearly rising voltage, a linear sawtooth current having a constant swing is obtained in the scan coils.

Line scan

4. An ideal line scan coil appears as a pure inductance so that the required linearly rising scanning current is obtained when a rectangular voltage waveform is applied to the coils. Typical idealized waveforms are shown in Fig.1. below.

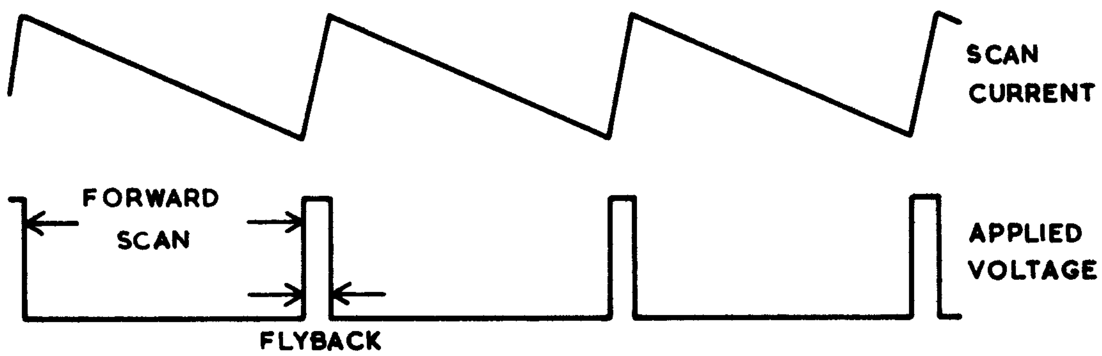


Fig. 1. Waveforms in ideal scan coils.

Because all coils include some resistance a constant voltage applied during the scan period, as indicated in Fig.1, would result in an exponential rise of current. The current would ultimately become constant but is interrupted by the flyback. To overcome this problem it is necessary to add a linearly rising voltage as indicated in Fig.2.

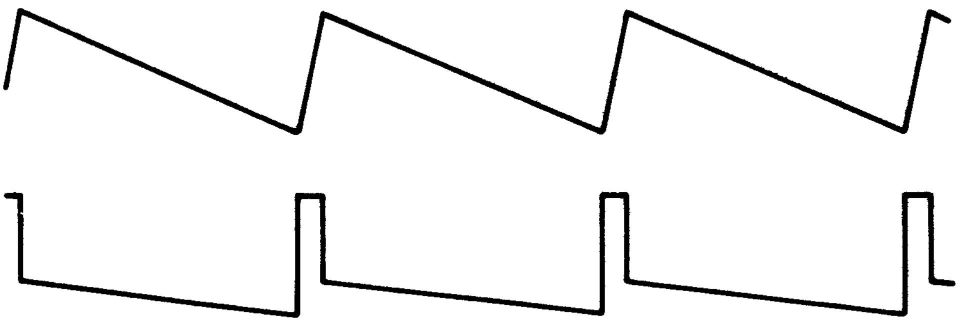


Fig. 2. Idealised waveforms allowing for coil resistance.

In the scanning circuit on the Camera the sawtooth component of the scanning waveform is generated across TR1 and the pulse across TR2. The two waveforms are added in the secondary windings and applied to the line scan coils.

5. A current from the +4.5V line is taken, via the line scan reset circuit VT12 on VIDEO 1 board to the horizontal amplitude control (on CCU) and then to the camera where it is decoupled by C32. The capacitor C33 is charged via the primary winding of TR1. The resonant period of this path is very long, compared with the line period so that an almost constant current flows into C33 during the scan period. Because of this a voltage sawtooth is developed across TR1 primary and will be transferred to the secondary.

6. C33 is discharged, at line frequency, through the primary winding of TR2 by the transistor VT10 or rectifier X1. This path has a resonant period approximately four times as long as the desired flyback time of the scan current waveform. The voltage on the secondary winding of TR2 is clamped by diode MR12 to the d.c. potential acquired by C34. After a few initial scanning cycles the capacitor C34 acquires a charge sufficient to clamp TR2 secondary at the end of the first quarter-cycle of oscillation of the C33-TR2-X1 loop. This coincides with the end of the flyback period so that a substantially constant voltage appears across TR2 secondary during the flyback period. The sum of the sawtooth voltage across TR1 and the rectangular voltage across TR2 provide a

voltage of the desired form as indicated in Fig.3.

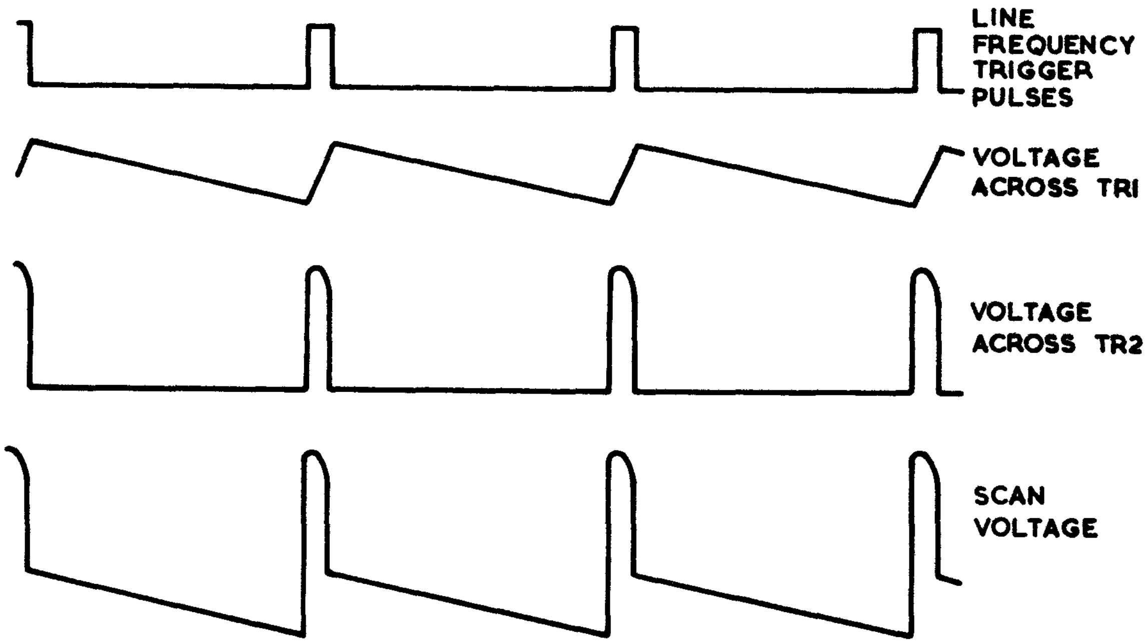


Fig. 3. Addition of voltages to provide scan voltage.

7. RV1 should be adjusted so that the current in the secondary of TR2 just decays to zero at the end of the scanning period. RV1 can be further reduced in value beyond this optimum by a small amount and, over this range, acts as a linearity control. Note that a change in the setting of RV1 changes the scan amplitude. A change in the amplitude setting will not alter the linearity.

Line scan reversal

8. Line scan reversal can be obtained by operating relay RLA. The contacts change over to reverse the direction of current flow through the line scanning coils. Full details will be found in Appendix 3.

Shading and blanking

9. The shading waveform is applied to both grid and cathode electrodes of the vidicon while the blanking is fed to the cathode only. During blanking, transistor VT9 and diode MR10 conduct, but MR9 is cut off so that blanking does not reach the beam electrode. During the unblanked period the transistor VT9 is cut off and its collector is at -16.5V. The instantaneous voltage at the output of the shading generator is always less than -16.5V i.e. nearer to earth potential and as a result MR9 will conduct and MR10 will cut off. Consequently the shading waveform will be fed to both grid and cathode electrodes.

Chapter 2

VIDEO 1

VIDEO 1

General

Reference should be made to circuit diagram Fig.104.

1. The Video 1 board includes a hum stripper circuit, aperture correction, phase reversal circuit, cable correction amplifier, feedback amplifier and driver stage. Ancillary circuits incorporated are clamp pulse generator, camera blanking mixer and line scan reset circuit.

Hum stripper

2. The camera output is fed, via a 75Ω gain control, to transistor VT1 to remove hum and other low frequency disturbances which may occur as a result of the camera and camera control unit frames being connected mechanically to points at different earth potentials. Spurious hum voltages which appear between camera and CCU earths are developed across R3 and are not applied across base-emitter junction of VT1. C6 is the only trimming control in the CCU video amplifier and is adjusted for flattest overall response. The output from VT1 collector is taken to an emitter follower stage VT3 which is used to drive the aperture correction circuit.

Aperture correction

3. The resolution of the vidicon tube is limited by the finite diameter of the scanning beam and can be improved by introducing a rising frequency response on the signal, whilst maintaining a linear phase response. Transistors VT3, VT4 and associated circuit provide the required response adjustment. An output from VT3 is fed through a π-section low-pass filter L1, C9 and C10. A second output is taken from the slider of RV1 to transistor VT4, which has R13 as collector load. The output from VT4 is fed through capacitor C7 and combined with the output from the filter. The short time-constant of R13, C7, VT4 collector and VT5 emitter circuits, ensure that only the high-frequency components are fed via VT4. The signal at VT4 collector will be in anti-phase to the signal fed to the filter. The signal path from the collector of VT4 gives a leading phase response by virtue of capacitor C7 while the signal path through the filter gives a lagging phase response as a result of inductor L4. At the junction of these paths the signals are combined to give a rising response with increase of frequency. The circuit is normally set up during test to give minimum h.f. boost (RV1 fully anti-clockwise) and L1 adjusted to peak at 9.5 Mc/s.

Picture polarity reversal

4. A conventional emitter follower stage, VT5, drives the phase reversal circuit associated with transistor VT6. This circuit has loads in both emitter and collector, i.e. R21 and R20 in parallel with R22, respectively. The slight difference in value is necessitated by the differences in output impedance. Polarity reversal is obtained with the aid of RLB. The contacts RLB1 are shown in the normal position. Operation of RLB will invert the video signal.

Cable correction

5. The RC network in the emitter circuit of VT8 provides a rising frequency characteristic to compensate for the falling characteristic of the cable. The amount of compensation may be adjusted by RV2. The potentiometer RV3 in the collector circuit of this transistor is an auxiliary gain control which is adjusted on test so that, with the main gain control at minimum, the vidicon target current is standardized at 0.3 µA.

Amplifier and clamp driver

6. A pulse is added to the signal at the output of VT8. A relatively small pulse is added with normal video polarity to ensure that any spurious signals during the dark current period do not affect the auto-black level circuit. With reversed picture polarity the black level is now represented by the peak signal so that to establish the black level a large pulse, greater than the peak-to-peak signal, is added. Contact RLB2 modifies the collector load of VT7 (shorting R65) and thus controls the amplitude of pulse added to the video signal after the cable correction circuit.

The major part of the gain is obtained from a complementary pair of transistors VT9 and VT10. The bandwidth can be extended, if required, by putting C23 in parallel with R34. This will have the effect of decreasing the negative feedback on VT9, at high frequencies. The output from VT10 is taken to Video 2 through an emitter follower stage VT11.

Line scan reset. VT12

7. The silicon controlled rectifier which provides the line scanning waveform is normally switched off by the pulse which appears at its anode. Should this pulse fail to turn the device off, as could possibly happen during a change of line drive with the unit switched on, the rectifier could 'stick' in the fully conducting condition. The transistor VT12 and associated circuit is designed to prevent this from occurring. If the silicon controlled rectifier goes into continuous conduction the voltage across R39, R40 will become more negative; the base voltage of VT12 will be greater than the voltage across MZ1 and the transistor will conduct. This will actuate RLA, the contact RLA1

will open and the circuit to the silicon controlled rectifier on the Line Scan Generator will be broken. Once the circuit is broken VT12 base voltage will return to normal, the transistor will cut off and the relay contacts close again. The whole operation is completed within a few lines. The potential divider R39, R40, is also used to provide the voltage which operates the scan failure protection circuit. If the scan fails the voltage at the junction of R39, R40 will become less negative and operate the protection circuit to stop the h.t. generator. When VT10 in the camera is fitted, VT12 is not used.

Clamp pulse generator

8. Negative line drive pulses are applied to C24 and differentiated by C24, R41. Transistor VT13, which is normally conducting, will be cut-off for a period determined by the differentiating circuit. A positive pulse will appear at the collector and will be d.c. restored by diode MR12. Transistor VT14 is held cut-off by the voltage drop across R44 and is switched on by the trailing edge of the pulse at VT13 collector. The resulting positive pulse at VT14 collector produces a pulse across L2 which switches VT15 into conduction for a period determined by L2. The output pulse at VT15 collector is timed to occur during the dark current period for all lengths of cable. It is approximately 2 microseconds wide, and is negative going. Transistor VT7 supplies the pulse which is added to the signal after the cable correction stage to ensure that clamping is not affected by spurious signals occurring during the dark current period. Where picture polarity reversal facilities are provided contact RLB2 of relay RLB short circuits R65 to reduce the pulse amplitude for pictures of normal polarity.

Camera blanking

9. Field pulses are fed to emitter follower VT16, and the output is mixed with line drive pulses fed via MR14. The mixed blanking signal is amplified by VT17 and fed to a complementary pair VT18 and VT19 which form the output stage. The output stage is switched from cut-off to the bottomed condition and drives a common base stage in the camera which blanks the cathode of the vidicon. The transistor VT17 is bottomed to such an extent that the trailing edge is slightly delayed and this ensures complete blanking of the line scan waveform. The start of camera blanking is delayed with respect to the start of system blanking. The camera blanking pulse suffers additional delay when very long camera cables are used so that the end of the pulse may occur later than the end of system blanking. Under these conditions it is advantageous to restrict camera blanking to the minimum width. The pulse can be shortened by breaking the link between tag No.52 and tag No.53.

Chapter 3

VIDEO 2

List of Illustrations

VIDEO 2

General

Reference should be made to circuit diagram Fig.105 and Fig.118.

1. The circuit functions of the Video 2 board are as follows: the dark current tips of the signal are clamped, the signal is then blanked and a black level established, controlled manually or automatically, as required; a peak white clipping circuit follows which may, alternatively, be used to provide gamma correction; sync pulses are then added and a composite signal fed out of the unit at an impedance of 75 ohms. Ancillary circuits on this board are the system blanking generator and the sync pulse clipper, circuits for automatic control of target potential and black level, and a shaper circuit for sync and blanking when operating under a random interlace condition.

Black level clamping

2. The output of the Video 1 board (which is negative signal for positive picture output) is clamped at the base of VT2, by VT1. The d.c. level is determined by the setting of the BLACK LEVEL control RV6 on the front panel. The level may be entirely manually controlled or be maintained automatically,at a preset level,by the AUTO BLACK LEVEL circuit. Fig.1 is a simplified diagram showing the AUTO BLACK LEVEL circuit. The clamping pulse is generated on the Video 1 board and applied to the base of VT1 as a negative pulse during the dark current period. The clamp pulse will drive the collector of VT1 (and the base of VT2) to a potential determined directly by the setting of RV6 (MANUAL) or to a potential determined by transistor VT15 (AUTO). Transistor VT2 is an emitter follower and an unblanked video output from the emitter is taken to a second emitter follower VT13. The output from VT13 is a.c. coupled to a gated d.c. restorer, diode MR13. This diode is gated by transistor VT14, which receives line and field frequency pulses. These gating pulses cut the transistor off during the dark-current period to d.c. restore the signal on the picture black or the vidicon mask. The unblanked video applied to MR13 will therefore be d.c. restored to the potential at VT14 emitter except during the vidicon blanking period. The signal is thus restored to the blackest part of the picture instead of to the dark current tips. This restoration level corresponds to 'true black' and any signal beyond this level represents the dark current. The signal is now peak rectified by transistor VT15 and the resulting potential used as the reference level for the clamp transistor, VT1. In this way the clamping level is automatically adjusted should the vidicon current change. Note, however, that the initial clamping level is still controlled by BLACK LEVEL CONTROL, RV6, which determines the potential at VT14 emitter and hence the restoration level at diode MR13. It is therefore possible to adjust the control to give any required set-up.

VIDEO 2

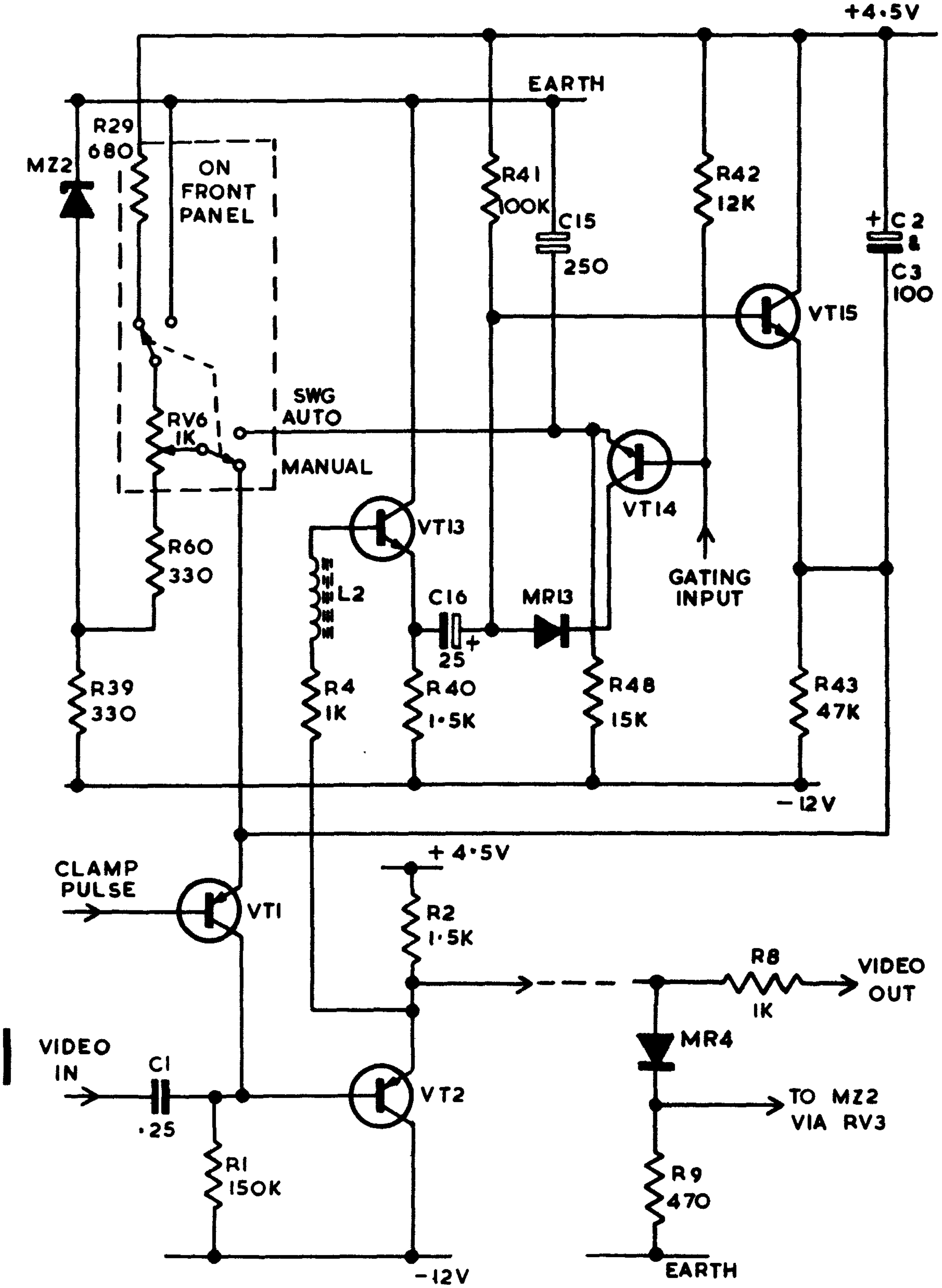


Fig. 1. Auto black level circuit.

I

3. The gating pulses for VT14 are obtained from field drive via MR14 and from line drive via VT16 and MR15. The +5V line drive is d.c. restored by diode MR16, to the +4.5V rail and taken, via MR17, to the base of VT16. Transistor VT16 is thus held cut-off between pulses until the base potential falls sufficiently to allow conduction to occur. A lengthened, negative, line frequency pulse, greater in width than camera line blanking, is produced at VT16 collector and fed to VT14 via MR15. This method of gating VT14 produces d.c. restoration to blacks which are inside system blanking but outside the gating pulse period and is achieved by linking tag No.6 to tag No.7. In practice, the method results in a constant reference level because the scanned area includes the mask in the vidicon tube mount. The mask will not appear in the final picture because system blanking removes this part of the video information. Alternatively tag No.6 may be linked to tag No.8 and the gating pulses to VT14 will be system blanking. The d.c. restoration now takes place on the blackest part of the picture. This is the normal condition but the former method will be advantageous when viewing, say, an all white surface.

Black level and peak white clipping

4. Emitter follower VT3 acts as a buffer between the clamping circuit and the clipping circuits. Positive going system blanking from VT8 cuts off MR3 during the blanking period and MR4 acts as black level clipper. The positive side of MR4 is returned to zener diode MZ2 which also supplies the reference potential for black level setting. The video information will thus be eliminated during blanking by MR3 and any signal more positive than the reference potential at the junction of MR4 and R9 will be removed by MR4. The level at which peak white clipping occurs is determined by MR5 and the setting of potentiometer RV3. However, MR5 acts as a peak white clipper only when tags 15 and 16 are short-circuited. When R10 is included, as shown on the circuit, gamma correction is provided. The level at which correction starts is determined by the setting of RV3 while the amount of correction depends on the value of R10.

Output stages

5. VT4 and VT5 form a conventional feedback pair having a high input and a low output impedance. The emitter of VT4 is a suitable point for the addition of sync from VT10 via the sync amplitude control RV1. VT6 is an emitter follower whose output impedance is built out to 75Ω by R21 and C8. The capacitor C5 provides a boosted l.f. response to enable a reasonable value to be used for the output capacitor C23 on the main chassis.

VIDEO 2

Blanking and sync pulse clipping

6. VT7 emitter follower, feeding VT8, provides a high input impedance and prevents variations of input level affecting the blanking amplitude. Negative blanking pulses at its base make VT7 conduct, VT8 is therefore cut off and positive going pulses appear on its collector. VT8 is prevented from bottoming by MR9 which conducts when the collector of VT8 falls below the potential at the junction of R24 and R25, giving a defined blanking width. The output waveform is thus not delayed by hole storage effects. VT9 provides a high input impedance and is prevented from bottoming by diode MR10. The transistor is normally cut-off; negative sync pulses cause conduction but its collector is not able to rise above the potential set by zener diode MZ1. The current in VT9 is limited by R28. Clipping of the pulses to VT10 in this way prevents it bottoming and a negative sync pulse of constant width appears at its collector.

Auto-target circuit

7. The Auto-Target circuit, shown on Fig.2, maintains a constant output level over wide changes of scene brightness and may be operated either from the blanked signal at VT4 emitter or the unblanked signal at VT13 emitter. The signal is d.c. restored to approximately earth potential by MR12 which is returned to earth through VT17. VT17 can be cut off during system blanking so that d.c. restoration occurs only during the picture period. Where positive picture only is being used the blanked signal at VT4 emitter is preferred for operating the Auto-Target circuit. Where negative pictures are being used, or where picture polarity reversal facilities are provided, it is preferable to use the unblanked signal at VT13 emitter and to gate VT17 with system blanking.

8. The transistor VT11 and the capacitor C14 form a peak rectifier circuit and, effectively, measure the amplitude of the video signal. The potential to which C14 is charged, in conjunction with the setting of RV2, determines the potential at VT12 collector. In the AUTO position of AUTO-TARGET switch SWE on the CCU the collector of VT12 is connected, via the artificial earth line, to the vidicon cathode. As a result any changes in signal amplitude will alter the cathode potential. The vidicon target is returned to earth potential so that changes in cathode potential will produce a corresponding change in signal current. The control RV2 is adjusted during test to give a video output at the CCU of 1V, 0.75V or 0.7V dependent on the value of R15. Dark current limiting may be incorporated by linking tag No.36 to tag No.37. The transistor VT19 is fed with unblanked video and the level at which the transistor conducts is determined by the setting of RV4. When VT19 conducts the potential at VT12 base will be limited so that the target potential is reduced and prevents the vidicon overrunning the maximum target current specified by the manufacturer of the vidicon tube. Limitation of vidicon output is advisable as a result of the wide range of target voltage available when operating the camera using automatic target control.

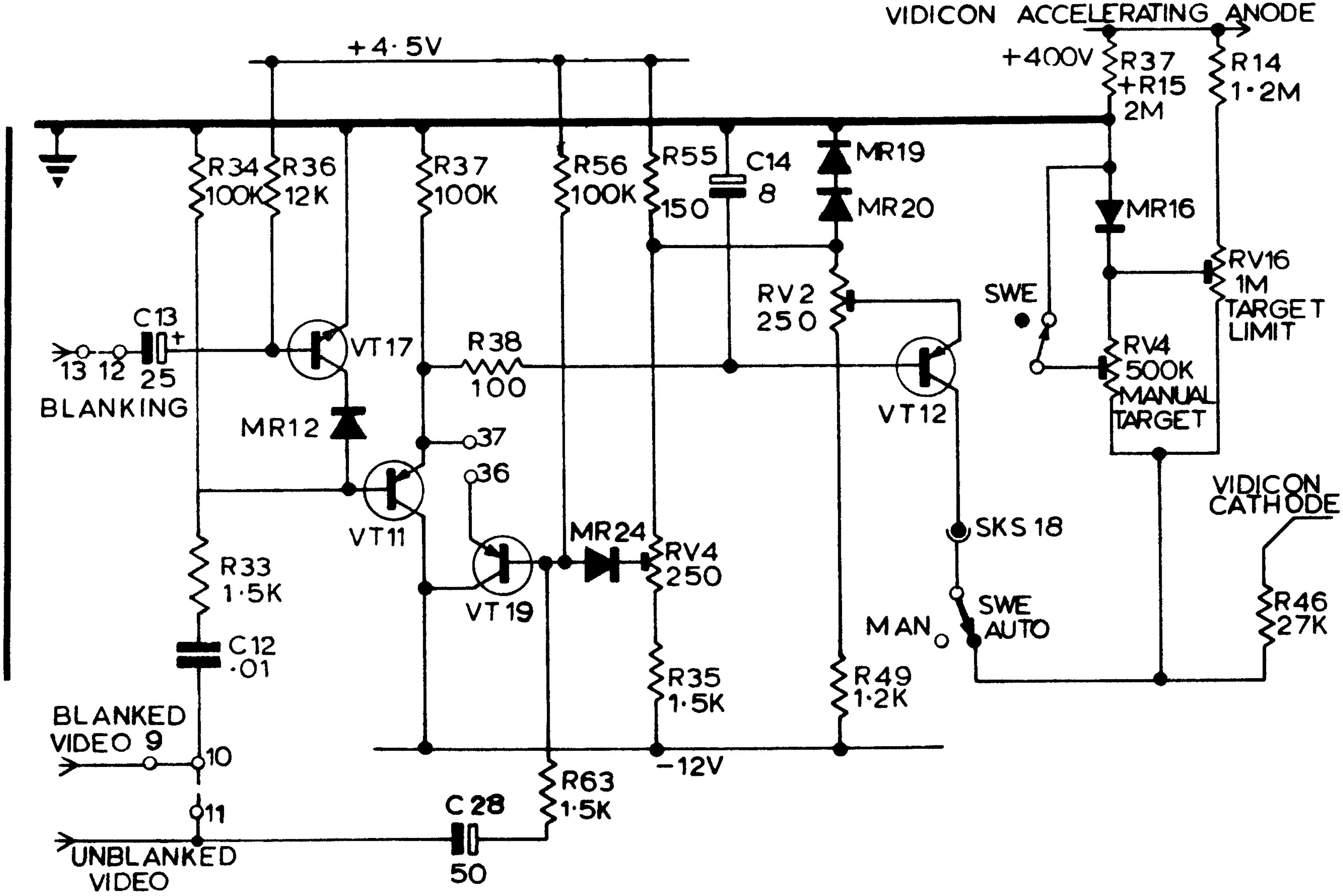


Fig.2 Auto-Target circuit

Chapter 4

FIELD SCAN

FIELD SCAN

General

Reference should be made to circuit diagram Fig.106 and 118.

1. The field scan board incorporates a circuit to delay the start of field scan and thus mask the characteristic white line which occurs at the bottom of the picture when using vidicon pick-up tubes. Alternatively, when the camera is operated under random interlace conditions, the delay circuit may be operated as a free-running multivibrator. Details of random interlace operation are given in Section 3, Chapter 6. The output from the delay circuit is used to operate the field scan generator and the resulting sawtooth is taken to the output stage. The board includes a line pulse buffer circuit and an inverter stage. The line pulse buffer may be converted to a crystal controlled oscillator when using random interlace. In addition a scan protection circuit removes the h.t. supplies to the vidicon in the event of scan failure.

Delayed field drive

2. Transistors VT8,VT9,VT10 and VT11 are used to provide a field scan pulse delayed by a predetermined time. The transistors VT8 and VT9 form a monostable multivibrator which is triggered by the negative Field Drive input pulses. The period of the multivibrator may be varied by means of RV4. The rear edge of the output from VT8 is used to trigger the monostable multivibrator formed by VT10 and VT11. The duration of the output pulse is chosen to be similar to the field drive and is fed to the base of VT1. VT1 is a high input impedance, non-bottoming, stage which provides a current pulse to base of VT2. VT2 bottoms and a negative pulse of approximately 17 volts appears at VT1 collector. A camera blanking output is taken from the collector while MR1 ensures a good rear edge for this output.

Field scan

3. VT2,VT3 and VT4 form a bootstrap scan generator. The scan voltage is generated by charging C3,C4,C5 and C6 through the HEIGHT control, R7, RV1 and R8. VT2 acts as a switch to discharge the capacitor when the 17 volt negative pulse from VT1 arrives. RV1 determines how effectively C3 to C6 are discharged during the time VT2 is switched on. This slightly alters the voltage waveform at the emitter of VT2 in the ratio of 'spike to sawtooth'. Adjustment of RV1 alters the sawtooth linearity at the start of the scan and is effective during the first few milliseconds only. VT3 and VT4 act together as an emitter follower. Normally, in such a circuit, there would be no emitter resistor in VT3. However, in this circuit, amplitude changes with temperatures make R11 necessary. Feedback from the emitter circuit of VT4 is taken to the HEIGHT control. As the gain of an emitter follower is almost unity the voltage across R7 and the HEIGHT control remains almost constant

throughout the sweep period. The charging current for C3 to C6 is thus almost constant so that a high degree of linearity is obtained. A further improvement in linearity is obtained by taking a feedback path via RV2 and R10 to the junction of C5 and C6. The feedback voltage is integrated across C3 and C5 and will have opposite curvature to the waveform across C4 and C6. By adjusting RV2 the resultant output can be made linear. An output to the shading generator is taken from VT4 emitter and is preset to give the correct ratio of line to field parabola. The Field Scan output uses a complementary pair, VT5 and VT6. These are biased to Class A by the zener diode MZ1 and the emitter resistors R14 and R15. The output to the scan coils is taken between the emitter of VT6 and the -16.5V rail via the centring circuit.

Line pulse buffer and inverter

4. Line drive input pulses from Sync Pulse Generator No.2 or an external source are fed to VT12. VT12 is a high input impedance, non-bottoming amplifier stage. The collector waveform is clamped at -7 volts by the 5 volt zener diode MZ2. VT15 is a phase inverter which provides low impedance outputs of -5V at the collector and +5 volts at the emitter. A -2 volt output is also available at a tap on the collector resistor. The transistor VT16 is a driver stage which provides a current pule for triggering either VT10 or X1, whichever is fitted. The collector of VT16 is connected to VT10 or X1 in the camera via C35 in the CCU. VT13 is used only on random interlace.

Scan protection

5. The vidicon is protected against scan failure by removing the h.t. voltages from its electrodes. These voltages are all supplied by a push-pull transistor oscillator controlled by VT17. In the normal condition, with field and line scan operating, VT18, VT19 and VT20 are cut off whilst VT17 is conducting. VT19 and VT20 are held cut off by d.c. voltages derived from the field scan generator and line scan protection circuit respectively. Base current for VT18 is obtained from the common collector load, R59, of VT19 and VT20, so that as long as these latter transistors are off VT18 remains off and VT17 is able to conduct.

6. If the field scan should fail VT19 will conduct and VT18 collector will assume earth potential and remove the base current from VT17. This will cut off VT17 and the oscillator will stop. Similarly if the line scan fails VT20 will conduct, VT18 collector will assume earth potential, VT17 will cut off and the oscillator will stop.

7. To ensure that VT17 is held in conduction under normal conditions a positive 14.5V supply is taken from the oscillator, through MR12, to VT17 base.

MZ3 and R53 supply base current to the oscillator and ensure correct starting conditions if field and line scan are present. During scan failure MZ3 prevents current flowing through R53, the voltage across the zener network in this condition being insufficient to allow conduction.

Scan protection rectifier circuit

8. Rectifiers MR4 and MR5 with capacitors C9 and C10 form a cascade doubler to rectify the field scan waveform and generate the field scan protection voltage. During the negative-going part of the field scan waveform, VT7 is conducting and the charging path for C9 is via VT7, R16 and MR4. C10 will also charge via MR5 and R17. During the positive going period of the field scan waveform VT7 will stop conducting but a current will pass through MR3. MR4 will now be reverse biased but C10 will continue to charge via MR5, R17, C9, R16 and MR3. During conducting periods of VT7 the input impedance will be given approximately by R16 times the current gain of the transistor, i.e. about 500 ohms. During non-conducting periods of VT7, the impedance is approximately equal to R17, i.e. 560Ω. The circuit thus provides a constant impedance at point T5 and does not affect the field scan waveform. The output from C10 is fed to the scan protection circuit (see Part 1, Sect.3, Chap.5).

Chapter 5

CAMERA CONTROL UNIT

CAMERA CONTROL UNIT

Reference should be made to circuit diagrams Figs.107 and 108 and the interconnection diagrams Figs.114 and 115.

50/60 c/s Power supply unit and stabilizer

1. AC mains is connected to the unit via plug PLA and fed to double pole on-off switch SWA1. Both neutral and line are fused by FS1 and FS2 respectively. Mains transformer TR1 primaries may be connected in series for operation on 200-250 volt supplies or in parallel for operation on 100-125 volt supplies. The secondaries of TR1 supply the a.c. for the vidicon heater, a 7.5 volts supply for internal mains lock and the a.c. for the bridge rectifiers MR1 to MR4. The output from the rectifier is taken to the reservoir formed by C2 and C3 in parallel and then to the series regulator transistors VT1 and VT2. These are connected in a composite circuit which provides a high gain and thus gives much greater control than could be obtained with a single transistor, while still retaining a low impedance. The base of VT1 is directly connected to the collector of VT3, the control transistor. The base of VT3 is held at a fixed potential relative to the -16.5 line by zener diode MZ2 while the emitter potential is fixed with reference to the +4.5 volt line by zener diode MZ3. Any change in the potential difference between the -16.5 volt and the +4.5 volt lines will thus alter the emitter-base voltage of VT3, change the collector voltage and alter the impedance of VT1-VT2.

2. The earth line is taken from the emitter of transistor VT4. As a result any load placed between earth and the -16.5 volt line will draw current through emitter resistor R8 while a load between earth and +4.5 volt line will draw current through VT4. In either event a change in the load current will alter the emitter voltage of VT4. Because the base voltage is fixed by zener diode MZ2 changes in load will alter VT4 emitter-base voltage and consequently the transistor impedance. The collector current for VT3 is normally supplied from a tapping on inverter transformer TR2 which supplies power for the vidicon. The a.c. is rectified by MR7 and filtered by C11, R5 and C5. This method of supplying current to VT3 ensures good regulation over the maximum range of input voltages. However, should the field or line scan fail the scan protection circuit will stop the oscillator associated with TR2. Power for the inverter is obtained from the stabilizer. If the stabilizer should fail, an alternative supply to VT3 is made available, via MR5, direct from the bridge rectifier MR1 to MR4. When the inverter is operating, MR5 is reverse biased so that VT3 collector supply is isolated from the bridge rectifier

3. Decoupling is provided across the -16.5 volt lines by C8. Two other negative outputs are taken from the -16.5 volt line, a -5.5 volt supply stabilized by MZ5, and a -12.5 volt supply, stabilized by MZ6 and decoupled by C7.

Inverter

4. A number of d.c. supplies, particularly those for the Vidicon, are obtained from a push-pull common-emitter chopper comprising transistors VT8, VT9 and transformer TR2. The bases of these transistors are returned to the scan protection circuit and the oscillator will stop if either of the scanning circuits fail (see Chap.4.para.7). Power for oscillator is obtained from the regulated output of transistors VT1 and VT2. The circuit diagram shows the d.c. supplies for the vidicon. Approximately 400V positive are provided for the accelerating anode from a winding on TR2 via rectifier MR10 and reservoir capacitor C14. The negative side of this supply is referred to as ARTIFICIAL EARTH and the vidicon cathode resistor is returned to this line. The target is returned to the true earth and is maintained positive with respect to cathode by a manual control or by the AUTO-TARGET control transistor. A conventional cascode doubler using capacitors C15 and C16 and rectifiers MR11 to MR14 has its output added to the 400 volt accelerating anode supply. The total voltage is about 750 and is used to supply the wall focus electrode. The supply for the control grid is obtained from half-wave rectifier circuit MR9 and reservoir C13. Two other supplies are obtained from secondaries on TR2; a 14.5 volt supply, rectified by MR15 and filtered by C17 and a 100V supply, rectified by MR8 and filtered by C12, R25 and C24.

Focus current regulator

5. Variations in focus current are prevented by transistors VT5, VT6, VT7 and associated circuit.VT5 and VT6 in a 'Super-Alpha' pair connection forms a series regulator controlled by transistor VT7. The supply has previously been stabilized and may be assumed constant. The emitter voltage is maintained constant by zener diode MZ4. If the focus current tends to increase, the voltage drop across R11 will increase and make the base of VT7 more negative. The resulting increase in current through VT7 will cause the collector voltage to fall, i.e. to go less negative. VT7 collector is directly coupled to VT5 base and if the base voltage of the composite pair is reduced their effective resistance will increase and bring the focus current back to normal. Under conditions of low input voltage and long cables the supply to the focus regulator may be taken from the unregulated supply.

Auto-target

6. In the ON position of the auto-target switch SWE, the artificial earth is linked to the true earth by the auto-target control transistor which is situated on the video 2 board. This transistor is part of a potential divider which includes R15 and R37, and is connected across the 400 volt d.c. supply. The difference of potential between artificial earth and true earth i.e. between the vidicon cathode and target, is thus dependent on the base potential of the control transistor. This, in turn, is controlled by the brightness

of the scene being viewed by the camera. (For a description of the circuit see Sect.3, Chap.3). The auto-target circuit is so arranged that an increase in scene brightness causes an increase in the current through the control transistor and, as a result, a reduction in target volts.

7. Under conditions of very low brightness it is possible that the target potential could rise undersirably high. The control RV16 limits the maximum target voltage. This is necessary with vidicon tubes which run into secondary emission before the maximum available target voltage is reached. In this condition a Vidicon tube output commences to fall with increase of target voltage thus making it necessary to restrict the maximum range with auto-target operation. The diode MR16 is arranged to clamp the target at a limiting potential which is determined by the setting of the potentiometer RV16. Under normal conditions the diode is reverse biased because the cathode is held more positive than the anode. However, should the target potential rise above the diode cathode potential the diode will conduct and the target volts will then be limited. As an alternative, manual control may be selected. The auto-target circuit is switched off by open-circuiting the control transistor collector and target volts are then set manually by RV4.

Wall focus and auto-align

8. The focus voltage is applied across a potential divider network consisting of R13, RV3, R30 and R16 and is stabilized by V1, SC1/800. The slider of RV3 is taken via R21 to the wall focus electrode. Under normal operating conditions R21 is short-circuited by the AUTO-ALIGN switch SWF. An electromagnetic focusing system causes the electrons in the electron beam to come to a focus over a helical path. Thus, in a combination of electromagnetic and electrostatic focusing, as used in the vidicon, a change in Beam focus volts will cause the picture to rotate through a small angle. The function of the alignment coils is to ensure that the beam leaving the gun is accurately aligned with the axis of the tube. Adjustment of the alignment is achieved by altering the alignment and focus controls until an alteration in focus volts does not move the centre of the picture. To simplify this operation a square-wave from the auto-align generator, at half field frequency, may be superimposed on the focus voltage by switching the auto-align switch SWF to ON. Adjustment of alignment can now be made without recourse to adjustment of the focus volts.

Width, height, alignment and centring

9. The WIDTH and HEIGHT controls are rheostats in series with the respective scan generators. Adjustment of the controls alters the amplitude by altering the charging voltage available. Alignment current is obtained by connecting potentiometers RV11 (X ALIGN) and RV12 (Y ALIGN) between +4.5V and -5.5V. The sliders are taken to the X and Y alignment coils and the common returns from the coils are taken to earth. Thus a current may be passed through coils in either

direction, depending on the setting of the controls. Field centring is obtained from a bridge circuit which includes R17 to R20 and potentiometer RV7. Field blanking makes it necessary to offset the bridge slightly in order to obtain similar shifts in each direction. The scan current from the FIELD SCAN GENERATOR is fed to the scanning coils via C20 and C21 in series and returned via the -16.5V line. R18 is by-passed by C19 to provide a low impedance path for the scan current.

Line centring and scan reversing

10. The facilities for scan reversing and for line centring operate in conjunction. Scan reversal is obtained with the aid of a double-pole changeover switch in the remote control unit which operates a relay RLA in the camera. As can be seen from figure 103 the relay contacts simply reverse the direction of current in the line scan coils. The relay is energized in the reverse-scan position of the switch. Two separate line centring controls, RV13 for forward scan and RV14 for reverse scan, are connected between a positive and negative supply.

Picture polarity reversal

11. The PICTURE POLARITY REVERSAL switch SWH operates relay RLB on Video 1. The contact RLB1 changes the video connection from the collector to the emitter of VT6 thus reversing the polarity of the signal.

Remote optical focus

12. Provision for remote focus is made by means of the motor X3 on the camera. This motor is controlled by SWC and SWD, giving two speeds of operation. These speeds are obtained by putting zener diode MZ1 in series with the supply to the focus motor. This has the effect of reducing the motor speed by supplying a reduced voltage, but maintains a high starting torque as relatively large currents can flow without a significant change in voltage. Switch SWC short-circuits MZ1 to provide a higher speed. Switch SWD reverses the supply polarity to drive the motor in the opposite direction.

Sun Shutter/filter

13. To protect the Vidicon when not in use a sun shutter can be provided in the camera. A neutral density lens filter may also be fitted to extend the light handling range of the camera. These are operated by solenoids which are switched at either the CCU or remote Control Unit. The unregulated d.c. supply is taken to switch SWB which is a double-pole changeover switch with an off position.

400 c/s and 22-30V d.c. Power supplies

Reference should be made to Figs.112, 113, 131 and 132.

14. Alternative power supplies are available to make operation possible from 115V/200V 400 c/s. (VB02-3215) or from 22-30V d.c. (VB03-3215). Both units use the same basic chassis and the main difference between them is that the 22-30V d.c. version incorporates a transistorized chopper circuit. In both circuits the transformer TR1 has two secondaries each connected to a bridge rectifier circuit. The outputs from the unit are filtered and taken out on corresponding terminals to those used on the 50 c/s power supply unit. The d.c. version supplies a 400 c/s supply to TR1 with the aid of VT1, VT2, transformer TR2 and associated circuit. TR2 provides feedback from collector to base of each transistor and the circuit acts as a push-pull oscillator. The circuit differs from the usual push-pull d.c. converter in that the small drive transformer TR2 is allowed to saturate while TR1 steps up the output to the required value. When the supply is connected one of the transistors (say VT1) will conduct, owing to unbalance in the circuit, causing its collector voltage to swing by an amount almost equal to the supply voltage. The resulting voltage across TR1 is applied to TR2 via R4 and R5. When TR2 saturates the primary current will increase rapidly and because of R4, R5, the applied voltage will fall. This will reduce the drives to VT1, decrease the collector current and consequently reverse the polarities to all the transformer windings. VT1 will now be driven rapidly to cut off and VT2 will become bottomed. The cycle of operations will now repeat at a frequency determined by TR2 and the value of R4-R5. To ensure starting the transistors are biased into conduction by diode MR10 and resistor R1. MR1 protects the circuit against accidental connection of incorrect supply polarities.

Chapter 6

RANDOM INTERLACE

List of Illustrations

RANDOM INTERLACE

Reference should be made to circuit diagram Fig.105 and 106 to 118.

1. In the random interlace condition there is no fixed relationship between line and field frequencies. The crystal is fitted and connected to the field scan board where it controls the line frequency generator. The field frequency may be free running or locked to the mains.

Line drive generator (Field scan board)

2. The crystal is connected between C19 and VT12 collector, and VT12 operates as an oscillator at twice line frequency. The output is fed to VT13 base. This stage, which is not used in the driven condition, is a blocking oscillator which divides by two, the division ratio being controlled by RV6 and the pulse width by RV5. The output winding of the blocking oscillator transformer is connected to VT15 which drives VT16 and the line scanning circuit in the normal way.

Field pulse generator VT8 and VT9

3. The delay multivibrator is converted to a field frequency, free running oscillator. The frequency is controlled by RV4. To obtain this condition linkages are required as shown in Table 4 of Part 2 Sect.2 Chap.1. A mains locking voltage may be obtained through the filter R28, L3, C25 in the power supply. The circuit of VT8 and VT9 is then as shown in Fig.1. An output is taken from VT8 collector and fed to VT10 as in the normal circuit.

Sync. circuit video 2 board

4. All the facilities available on direct drive are incorporated on random interlace. Sync is obtained by mixing line and field pulses at MR22 and MR23, T33 and T34 are linked. The mixed signal is delayed by L1, C25 in order to provide a front porch. The link T27-T28 is necessary to feed the mixed line and field pulses into the sync pulse clipper. It should be noted that terminations must not be fitted to the drive coaxial sockets. The link between T41 and T43 provides the correct operating condition for VT9.

Blanking, Video 2 board. VT7 and VT8

5. T23 and T24 are linked and the combined line and field waveform is applied to VT7. As the field pulse is not wide enough for blanking the pulse is applied to MR11, R52. The leading edge passes through diode MR11 but the diode cuts off on the trailing edge. C27, therefore, has a large effect on the trailing edge which is given a slow rise time VT18 clips the waveform at a level which will give a wise output pulse. This pulse is added to the blanking waveform by linking T25 and T26. C23 lengthens the line pulse to the required line blanking width.

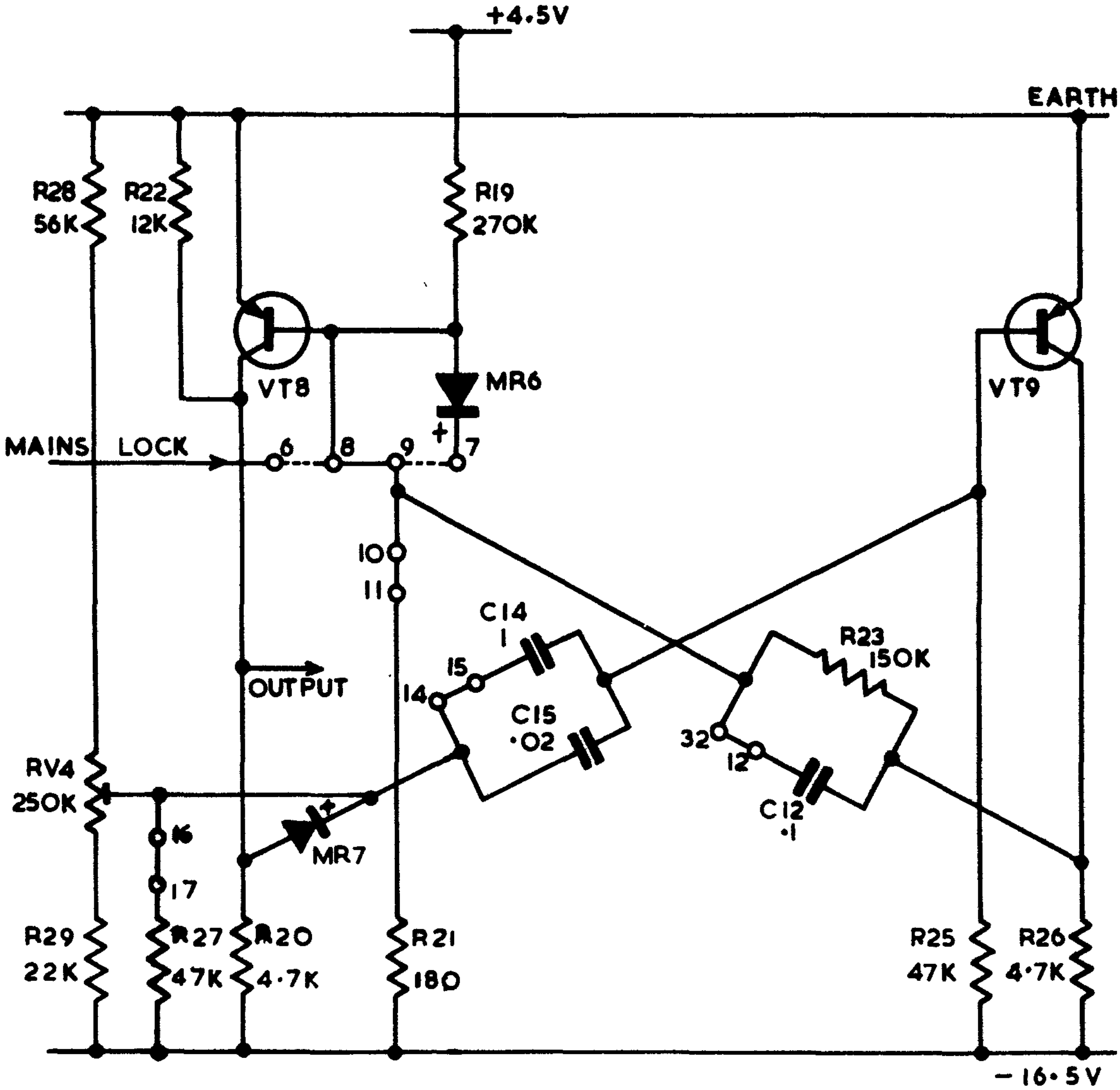


Fig.1 Field frequency multivibrator circuit
(Random Interlace)

Chapter 7

SHADING GENERATOR

SHADING GENERATOR

Reference should be made to circuit diagram Fig.109.

General

1. The shading generator board provides a waveform for application to the vidicon tube to counteract the beam landing errors which give rise to horizontal and vertical shading when vidicons without a separate mesh connection are used. The correcting signal is a composite parabolic waveform at line and field frequency together with a line sawtooth of either polarity. In addition to the above, the shading generator includes the multivibrator which provides the square wave at half field frequency for auto-alignment of the beam in the vidicon tube.

Shading generator

2. Each parabolic waveform is obtained by integration of a sawtooth. A field frequency sawtooth is fed to VT1 base and integrated at the collector by R5, R4, C3 and C4. The resulting parabola is transferred to emitter follower VT2 and a high impedance is maintained by feedback via C2. A line frequency sawtooth is generated across C7 which is charged from the +4.5 rail. The incoming 5V negative line drive pulses are differentiated by C5, R9 and the positive going spike switches VT3 on. The resulting negative pulse at the collector is squared and limited by MR1 and used to switch VT4 on. VT4 thus discharges C7 at line frequency and the resulting sawtooth waveform is applied to VT5 base. The collector output is integrated by R10, R16 and C9 to form a line frequency parabola. The collector supply to VT5 is taken from the emitter of VT2 so that both line and field parabolas appear at the base of VT6. VT7 amplifies the composite parabola and following this, line sawtooth is added before final amplification in the output stages VT8 and VT9. There is a choice of polarity of line sawtooth at VT14 and the relative amplitude of this and the parabolic waveform may be set up by the preset controls RV2 and RV3. The output transistor VT9 is an emitter follower feeding a load of 2.8K in the camera. The maximum peak-to-peak amplitude of composite signal across this load is 12 volts. The shading output is controlled by switch SWM on the chassis, this switch must be set to OFF when the shading board is not fitted.

Auto-align generator

3. A half field frequency pulse is generated by the bistable multivibrator VT11 and VT12. This circuit requires a positive pulse so that VT10 is necessary to invert the incoming negative field pulse. The square wave generated by the multivibrator is passed to the output stage VT13. This is a high voltage transistor operating from a 100V supply in order to provide a large amplitude square wave capable of producing the desired rotational effect on the picture.

Chapter 8

SYNC PULSE GENERATOR

List of Tables

SYNC PULSE GENERATOR

Reference should be made to circuit diagrams Figs.110 and 111 and also the position of the various links on Fig.118.

S.P.G. 1. Master oscillator and buffers

1. The Master Oscillator is a blocking oscillator built around transistor VT4. Feedback is applied from collector to base via transformer TR1 which has a turns ratio of 4:1. The frequency of operation of the oscillator is governed by the time-constant of RV3, R20, C10 and C11 in the emitter circuit, and by the potential applied to the base of VT4 through R17 and the transformer winding 3-1. This potential is provided by the control transistor VT3 on mains lock only and is adjusted by means of RV1 to correct the master oscillator frequency. A d.c. control voltage, derived from the discriminator transistor VT2, is applied to the emitter of VT3 to adjust the oscillator when locking to mains frequency. Internal mains lock is obtained by linking T26 to T27 and T4 to T2.

2. The width of the pulse at the collector is governed by the inductance in the circuit. The peak value of the current attained, however, is limited by RV3, R20. The interval between the pulses is controlled by the discharge time-constant RV3, R20, C10 and C11 in the emitter circuit, while VT4 is cut-off. This is arranged so that the output at the collector has a mark-space ratio suitable for forming broad pulses in the mixed sync waveform. The diode MR4 limits the negative excursion following the positive pulse on the collector. R23, in parallel with the collector inductance, provides sufficient resistance to maintain a low value of L/R and so enables the current to decay within the broad pulse period.

3. The positive output pulse from VT4 is coupled via R22 and R21 to buffers VT6 and VT5 respectively. These transistors are normally conducting and will both be driven towards cut-off by the input pulses. A positive-going output will be obtained at the emitters. These buffers are intended to isolate the master oscillator from the divider circuits thus preventing lower frequency components from modulating the oscillator.

S.P.G. 1. Crystal oscillator

4. Where an accurate reference with a high degree of stability is essential the master oscillator may be synchronized by a quartz crystal oscillator providing a reference output of twice line frequency. The oscillator comprises VT1 and associated circuit. The crystal is connected in the series mode between base and collector and gives an output of twice the line frequency of the system on which the unit is operating. Crystal control is obtained by linking T6 to T7, T8 to T9 and T25 to T26.

SYNC PULSE GENERATOR

5. The base of the transistor is biased by R2,R3 and the emitter by R4, decoupled by C3. The voltage swing on the base is sufficient to drive the transistor into saturation on the negative peaks and to cut-off on the positive peaks giving a resultant clipped sine wave of 8 volts peak-to-peak. This output is coupled via C4 to the base of the master oscillator transistor VT4 which is thus synchronized to twice-line frequency. RV5 (Crystal lock) is adjusted to the centre of the range which locks the master oscillator to the crystal frequency.

Count to field frequency (Counters 1 to 5)

6. The count from twice-line frequency to field frequency, which establishes the number of lines per field, is made by a series of ten binary counters arranged in two sections of five. Counters 1-5 are on Sync Pulse Generator No.1 (VT8-VT17). The remainder are on S.P.G. No.2. In each section feedback is applied to reduce the natural count to that required to produce the desired field frequency.

7. In a normal cascade arrangement of n counters without feedback, the natural count of each binary unit is 2 giving an overall count of 2^n. By injecting a pulse from the output binary to the input, or to an intermediate stage within the section, the count is reduced by a factor depending upon the position in the counter chain to which the feedback pulse is applied. If the pulse is applied from output to input the count is reduced by 1, applied to the second counter it is reduced by 2 and to the third by 4 etc. In general, where the feedback is applied to the m^{th} counter, with a suitable delay in the feedback path, the overall count 'C', becomes :-

$$C = 2^n - 2^{m-1}$$

and if, in addition, feedback is applied to the p^{th} counter the overall count becomes :-

$$C = 2^m - 2^{m-1} - 2^{p-1}$$

The feedback connections are made by means of links on the printed wiring boards, the connections to which are shown at the bottom of the circuit diagram (see Figs.110 and 111). The arrangement of the feedback connections changes according to the system on which the unit is being employed.

8. In the first section the feedback pulse is taken from the collector of VT16 in counter 5 and is applied to the earlier stages through the delay network L2,R67, C34. The purpose of the delay network is to ensure that the feedback occurs shortly after the normal transition in the counter stage to which it is being applied and so causes the counter to revert to the state preceding the normal trigger. The output of the counter chain is taken from the collector of VT17 and is fed to the second section in S.P.G.2. via pin 2 on the boards connector.

SYNC PULSE GENERATOR

S.P.G.1 Frequency control and mains lock circuit

9. The Frequency Control and Mains Lock circuit consists of a Discriminator VT2 and Control Transistor VT3 which supplies a d.c. potential to control the frequency of the Master Oscillator. VT2 operates as a bi-directional switch with a mains frequency sine-wave applied to the collector, either from an internal, 7.5V source, supplied by mains transformer TR1, or an external 6.3V source. The voltage is supplied via T1 or T2 to T4 and then via R12 and R8. A third terminal T3 earths the collector of VT2 to give a free running condition.

10. During the intervals between field pulses, VT2 is conducting heavily since the base is returned to -6V through R7. In this condition the transistor presents a low impedance to the sine-wave applied to the collector since the potential between emitter and collector is only a few millivolts. When a positive output pulse at field frequency is applied to the base of VT2 the incoming sine-wave is sampled for the duration of the pulse since the transistor is cut-off for this period. A current builds up in the coil L1 which is a function of the voltage at the junction R8 and R10. This coil has a very large inductance and integrates the current pulses appearing at the emitter of VT2 to build up a d.c. which is applied to the emitter of VT3. This d.c. modifies the normal current flowing into the emitter of VT3, which is defined by the manual frequency control RV1, being either added to, or subtracted from it.

11. The current flowing from the emitter to the collector of VT3 provides a voltage at the collector which is transferred through the diodes MR2, MR3, the resistor R17 and the winding of TR1 to the base of the Master Oscillator transistor VT4. This voltage is normally adjusted by RV1 to provide a base voltage of +0.5V. As the field frequency pulses from the output of the counter chain vary their phase with respect to the incoming sine-wave so a varying voltage is applied to the base of the oscillator.

12. This change of voltage causes the oscillator frequency to change until the field frequency output of the counter chain pulls into the same frequency as the incoming mains signal and the two signals become locked. When the free-running field frequency is close to the mains frequency the pulse is phased approximately at the centre of the sine-wave and no current is delivered to the control circuit. The free-running frequency of the Master Oscillator is governed mainly by the setting of the FREQUENCY control RV1 and it is essential that this control be set to approximately the correct position. To maintain the field component locked to the mains frequency the control circuit provides a range of oscillator frequency ±5% about the frequency determined by the FREQUENCY control. A convenient point for monitoring the locking signal is provided by the test point T5 situated near to L1.

SYNC PULSE GENERATOR

S.P.G. 1 Divide-by-two stage

13. The Divide-by-two stage includes the blocking oscillator VT7 and the counter circuit MR5, MR6, C14 and C15. Twice-line frequency pulses from buffer VT6 are fed through capacitor C14 to d.c. restoration diode MR6 whose positive end is supplied from RV5 between +4.5V and earth. The d.c. restored pulses are fed to the reservoir capacitor C15 through the second diode MR5. The capacitance divider C14, C15 is appropriate to divide-by-two, i.e. the blocking oscillator is triggered on alternate input pulses. The blocking oscillator provides +ve output pulses whose width is approximately equal to that of line blanking for the system upon which the unit is operating. This width is determined mainly by the primary inductance of transformer TR1 and the collector resistors RV4 and R26. RV4 is adjustable to accommodate the several line standards available.

S.P.G. 2 Count to field frequency (Counters 6 to 10)

14. Input pulses from the Synchronizing Pulse Generator No.1 are fed via C1. The binary units are similar to those in the first section. Delay for the feedback is provided by L1, R103 and C20. Tables 1, 2, 3, 4 and 5 summarise the count in each section, the feedback paths being used, and the overall count achieved in each section as a result of the feedback.

Table 1. 405 Line standard

Section	1st	2nd
Counters in Section	2nd to 5th (4) 1st Counter Not Used.	6th to 10th (5)
Applied Feedback	5th to 2nd (4th Counter to 1st of section)	10th to 6th and 8th (5th Counter of section to 1st and 3rd counters of section.
Feedback Connection Tags	T24 - T23 T20 - T18 T15 - T12	T5 - T4 and T2 T8-T9
Count without Feedback	2^4 = 16	2^5 = 32
Count with Feedback	16-1 = 15	32-4-1 = 27

Table 2. 525 line standard

Section	1st	2nd
Counters in Section	1st to 5th (5)	6th to 10th (5)
Applied Feedback	5th to 4th (2nd and 1st of section)	10th to 6th,7th and 8th (5th to 3rd,2nd and 1st of section).
Feedback Connection Tags	T24 to T23 T21 to T20, T18 and T17, T15 to T14, T13 to T12	T5 to T4, T3 and T2 T6-T7 T8-T9
Count without Feedback	$2^5 = 32$	$2^5 = 32$
Count with Feedback	32-8-2-1 = 21	32-4-2-1 = 25

Table 3. 625 line standard

Section	1st	2nd
Counters in Section	1st to 5th (5)	6th to 10th (5)
Applied feedback	5th to 3rd (2nd and 1st of section)	10th to 8th, 7th and 6th (5th to 3rd, 2nd and 1st of section).
Feedback connection Tags	T24 - T23 T20 to T19, T18 and T17 T15 to T14 T13 to T12	T5 to T4, T3 and T2 T6-T7 T8-T9
Count without Feedback	$2^5 = 32$	$2^5 = 32$
Count with Feedback	32-4-2-1 = 25	32-4-2-1 = 25

Table 4. 819 line standard

Section	1st	2nd
Counters in Section	1st to 5th (5)	6th to 10th (5)
Applied Feedback	3rd to 1st	10th to 7th and to 5th and 4th in 1st section. Effectively 7th to 4th, 2nd and 1st of section.
Feedback Connection Tags	T23 to T22, T21 to T16. T20 to T17, T14 to T15 T31 to T12	T1 to T3 and T5
Count without Feedback	$2^3 = 8$	$2^7 = 128$
Count with Feedback	$2^3-1 = 7$ $8-1 = 7$	$2^7-2^3-2-1 = 117$ $128-8-2-1 = 117$

Table 5. 875 line standard

Section	1st	2nd
Counters in Section	1st to 5th (5)	6th to 10th (5)
Applied Feedback	3rd to 1st	10th to 5th and 4th in 1st section. Effectively 7th to 2nd and 1st of section.
Feedback connection Tags	T23 to T22, T2 to T16 T20 to T17 T14 to T15 T13 to T12	T1 to T5
Count without Feedback	$2^3 = 8$	$2^7 = 128$
Count with Feedback	$2^3-1 = 7$ $8-1 = 7$	$2^7-2-1 = 125$ $128-2-1 = 125$

15. The remainder of S.P.G.No.2 may be considered as a separate shaper unit which provides four sets of output pulses as follows:-

Line drive
Field drive
Mixed Blanking
Mixed Sync

S.P.G.2 Field pulse M.V.

16. The output of the counter chain is taken from the collector of VT9 and is a square wave at field frequency. This output is fed, via C26 to the base of VT12. VT11 and VT12 are connected as a monostable multivibrator which, in the stable condition, has VT11 cut-off and VT12 bottomed. The duration of the output pulse is normally determined by the timing capacitors C28 and C29, in conjunction with RV1. However, this tends to produce an indeterminate number of broad pulses. To overcome this problem a terminating pulse is obtained from an appropriate point in the counter chain and applied to the base of VT12. A link is required between terminals T6 and T7, if it is desired to operate with a fixed pulse width. If the link is removed the pulse width can then be varied by adjustment of RV1. The pulse at the collector of VT12 is transferred to transistor VT13 which inverts the pulse before it is applied to VT25.

S.P.G.2 Field drive output

17. Field drive pulses are derived directly from the field pulse output transistor VT13. An output is fed, via C46, to transistor VT25 which inverts the pulse and provides fast edges. The resultant output at the collector is a negative pulse at field frequency which is used to drive the field scan generator and provide a 75Ω output for external use.

Line drive output

18. Similar arrangements are made for obtaining line drive. Pulses at line frequency derived from the Divide-by-two stage in S.P.G.No.1 are brought into S.P.G.No.2 to the base of transistor VT15, the line drive output stage. The inverted pulses developed at the collector are fed out to the field scan generator board and provide a 75Ω output for external use.

Mixed blanking

19. The mixed blanking signal comprises two sets of pulses, line blanking and field blanking. The line blanking pulses are produced by the divide-by-two circuit, the width of the output pulse from this circuit being suitable for direct use as a line blanking signal.

20. The field blanking is obtained from a monostable multivibrator built around transistors VT22 and VT23. The multivibrator is triggered by field frequency pulses from VT13. This multivibrator is very similar to the field pulse m.v., the period is mainly controlled by capacitors C43 and C44 but may be adjusted by RV3. The output is taken from VT22 collector, diode MR18 and resistor R90 ensure a sharp negative transition.

21. The line and field blanking pulses are combined at the base of Blanking Output Stage VT24. The line blanking signal is fed through C45 to the base of VT24 and, being positive pulses, cut off VT24 during the pulse. Between pulses VT24 is bottomed due to the low value of base resistor R87. During the field blanking period the positive pulses from the collector of VT22 cause MR16 to conduct. This feeds sufficient current into the base resistor R87 to lift the base of VT24 positive with respect to its emitter and so cut the transistor off. Between the field blanking pulses from the collector VT22, diode MR16 remains off as a result of the negative potential transferred through C40 from VT22 collector. VT24 is therefore cut-off during the line blanking pulses and for the duration of the field blanking period. The output from the collector is therefore a normal mixed blanking signal which is fed into an impedance of 75Ω through the series resistor R91.

S.P.G.2 Mixed sync

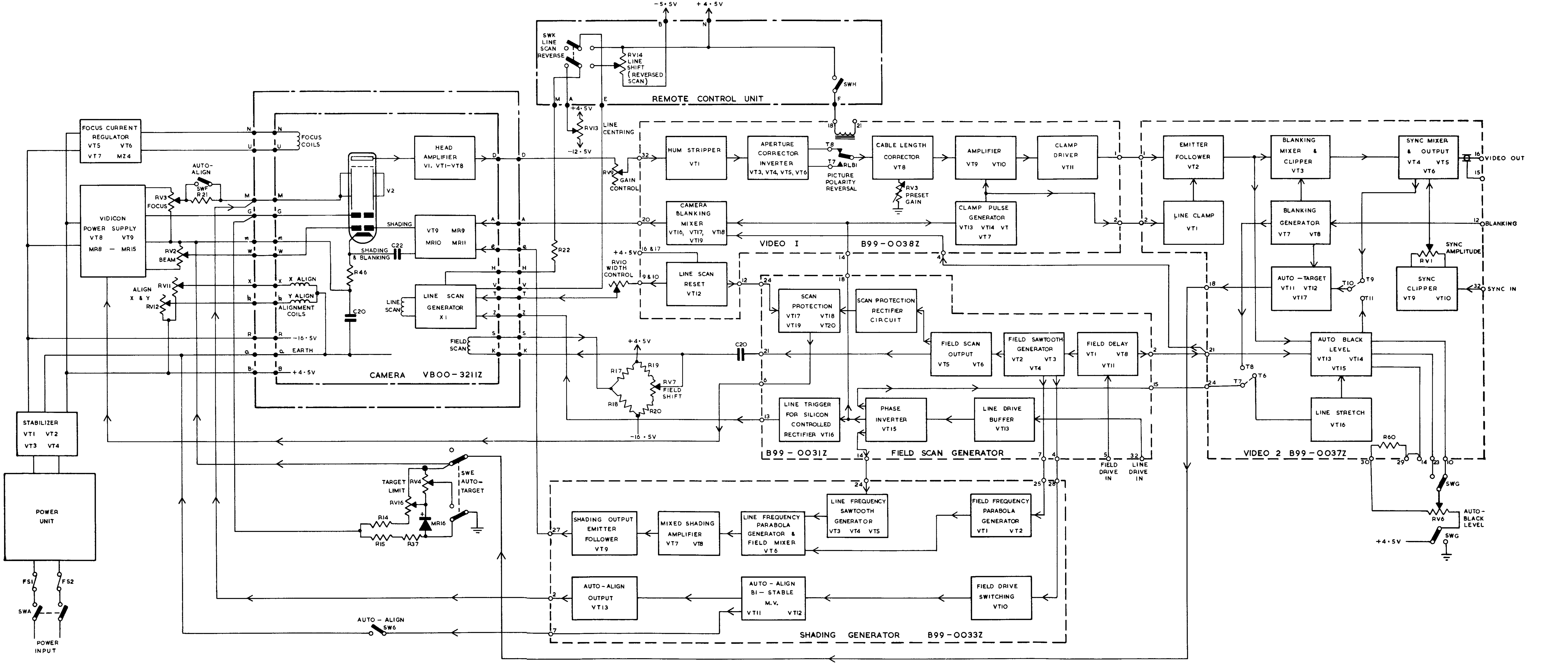
22. Line synchronizing pulses are obtained from the line frequency input by differentiation across the networks C33, R64 and RV2, and using the differentiated pulse to drive VT14. The positive pulses drive VT14 into cut-off but during the interval between pulses VT14 is bottomed, the value of R64, RV2, being low enough to allow this. VT14 is cut-off for a duration equal to the width of a sync pulse. The resulting pulses appearing via the collector of VT14 are applied to the emitter of VT16 where they are combined with the broad pulses fed from the timer unit as a twice line-frequency pulse to form the mixed sync signal. These broad pulses are gated into the signal at field-frequency by a gating pulse derived from the field-blanking multivibrator.

23. The field drive multivibrator provides a pulse which is applied to the circuit C39, R81, the latter having a sufficiently low value to ensure bottoming of VT20 between input pulses. The gating circuit consists of the two diodes MR14 and MR15, which are driven by twice line-frequency pulses from the timer and field-frequency pulses from VT20 respectively. The potential at the junction of R76 and R77 is such that MR14 is conducting and sufficient current flows into R79 to cut-off VT19 between the broad pulses. However, during the period of each broad pulse from the timer, the potential at the junction of R76 and R77 is driven sufficiently negative to cut-off MR14. Similarly, MR15 is driven to cut-off during the period of the field sync pulse.

24. When either MR14 or MR15 is conducting sufficient current is applied through these diodes to drive the base potential of VT9 above that of the emitter and so cut the transistor off. The transistor cannot conduct, therefore, except during the period when pulses are applied to the two diodes during the field gating period and, within this period, for the duration of each broad pulse period. The output at the collector of VT19 consists of a series of positive-going broad pulses. Between these pulses VT19 collector takes the base of VT16 sufficiently negative to cause VT16 to conduct and combine the broad pulses with the line sync pulses.

25. VT16 is normally conducting but is cut-off either when VT14 is cut-off or, when its base is driven positive by the collector of VT19 during each broad pulse. During the active field period VT14 is cut-off for the duration of each line sync pulse thus, in turn, cutting off VT16 and causing the collector potential to fall to -6V. During the field sync period the positive pulses applied to the base cut-off VT16, again causing the collector potential to drop to -6V. The collector output consists, therefore, of two signals combined to form a mixed sync waveform with the pulses having an amplitude of approximately 6V. This output is applied to the delay network C35,L2,C36 which delays the pulses, relative to the blanking output, to produce a front porch of approximately 1.5µS. The characteristic impedance of the delay network is approximately 3.3kΩ so that resistors R68 and R73 are used to terminate the line at each end.

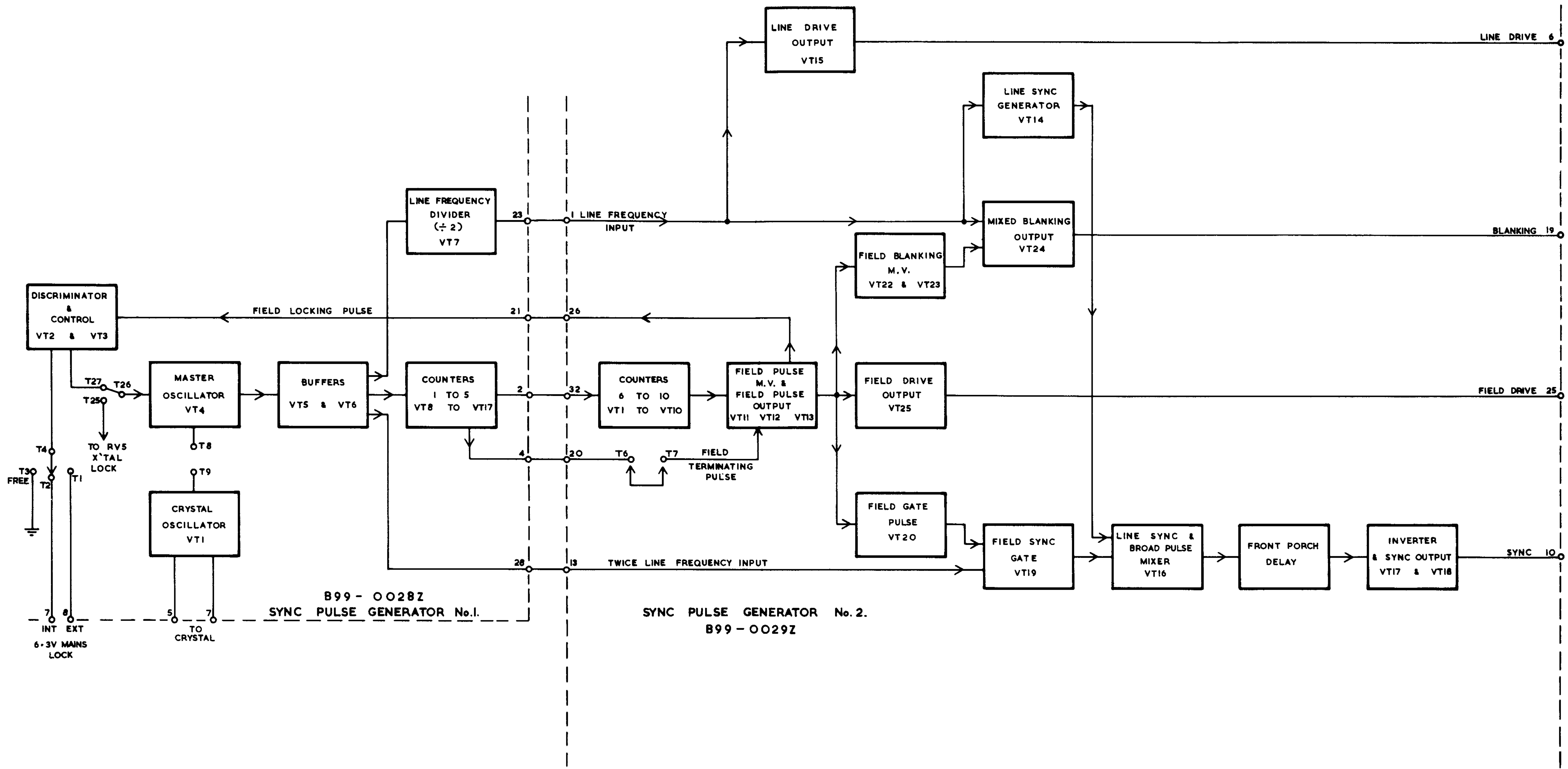
26. The delayed sync waveform is coupled to the base of VT17 through C37. This transistor is normally cut off since the base is returned to earth, through R72, and is driven into conduction by the negative input pulses. These are of sufficient amplitude to make the transistor bottom. The collector of VT17 then rises to approximately earth potential and gives an inverted signal across R74. This signal is coupled through C38, to the base of the sync output transistor VT18. C38 is large enough to prevent any tilt being introduced on the signal. The base resistor, R71, is small enough to allow VT18 to bottom between pulses. The output has been inverted again at the collector and is matched to a 75Ω co-axial cable by series resistor R69.



B99-0854. SH.1.
ISSUE. 2

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA & C.C.U.
LESS SYNC PULSE GENERATOR
BLOCK DIAGRAM. FIG. 101.



B99-0855 SH.I.
ISSUE.I.

V321 SERIES
VIDICON CAMERA CHANNEL

SYNC PULSE GENERATOR
BLOCK DIAGRAM FIG. 102.

HEAVY DUTY CAMERA 321 SERIES
(VB00-3211-01)
(Refer to Master Components List T6768 List 1)

Cross Reference List

for VB00-3211Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	13	C19	5			MR12	56	R10	74	R28	73	R46	63	V2	•118
C2	14	C20	8					R11	75	R29	80	R47	60		
C3	14							R12	76	R30	78	R48	67	VT1	105
C4	22	C22	9	L1	42	MZ1	112	R13	73	R31	84	R49	58	VT2	106
C5	15	C23	119			MZ2	112	R14	77	R32	85	R50	57	VT3	107
C6	16	C24	5			MZ3	112	R15	73	R33	86	R51	88	VT4	106
C7	17	C25						R16	78	R34	65	R52	114	VT5	107
C8	15	C26		MR1		PLA	48	R17	79	R35	87	R53	115	VT6	106
C9	26	C27		MR2	55			R18	80	R36	89	R54	116	VT7	107
C10	18	C28		MR3	55	R1	63	R19	73	R37	65			VT8	106
C11	19	C29		MR4	55	R2		R20	81	R38	66	RV1	117	VT9	108
C12	16	C30	11	MR5	55	R3	83	R21		R39	68			VT10	121
C13	15	C31	11	MR6	55	R4	71	R22	82	R40	62	SKA	90		
C14	20	C32	10	MR7	55	R5	69	R23	83	R41	64			X1	121
C15	24	C33	8	MR8	55	R6	70	R24	74	R42	62	TR1	104		
C16	21	C34	12	MR9	53	R7	71	R25	78	R43	62	TR2	104		
C17	15	C35		MR10	53	R8	72	R26	74	R44	61				
C18	23	C36	25	MR11	54	R9	73	R27	75	R45	59	V1	109		

• Or as specified by customer

MISCELLANEOUS ITEMS

Bearing Block	No. 1
Bearing Bush	No. 2
Board Assembly (Head Amplifier) including:	No. 3
Terminals	No.101
Bush	No. 4
Circlip	No. 27
Clamp Ring Assembly including:	No. 29
Clamp Ring	No. 28

HEAVY DUTY CAMERA 321 SERIES
(VB00-3211-01)
(Refer to Master Components List T6768 List 1)
Cross Reference List
for VB00-3211Z Sh.1

MISCELLANEOUS ITEMS (Contd.)

Coil Assembly (Focus/Alignment) including:	No. 32
Alignment Coil	No. 31
Former	No. 40
Split Ring	No. 93
Coil Assembly (Field) including:	No. 33
Coil Assembly (Vertical)	No. 36
Heat Sink	No. 41
Coil Assembly (Line) including:	No. 35
Coil Assembly (Horizontal)	No. 34
Collector Ring	No. 37
Drive Screw	No. 38
Focus Shaft (Manual)	No. 39
Insulator (Stand-Off)	No. 43
Knob (Fluted)	No. 44
Lens Mount	No. 45
Mounting Ring Assembly (Front)	No. 46
Mounting Ring Assembly (Rear)	No. 47
Plug Button for Lens Mount	No. 49
Pot Core Assembly	No. 50
Pot Core Assembly	No. 51
Socket Assembly including:	No. 91
Socket	No. 92
Spring	No. 94
Tag Board Assembly including:	No. 97
Tag Board Assembly	No. 99
Tag Board Assembly including:	No. 98
Tag Board	No. 96
Tag Board Assembly	No.100
Terminal	No.101
Terminal Board Assembly including:	No.103
Terminal	No.102
Vidicon Mount Assembly	No.110
Yoke Assembly	No.111

HEAVY DUTY CAMERA 321 SERIES
(VB00-3211-01)
(Refer to Master Components List T6768 List 1)
Cross Reference List
for VB00-3211Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
						LINE SCAN REVERSAL ASSY.									
						KIT OF PARTS									
										RLA	3001				
						MISCELLANEOUS ITEMS									
			Screws									No.3002			
						SUN SHUTTER ASSY.									
						KIT OF PARTS									
						L5	4007			R55	4010			SWV	4019
						MISCELLANEOUS ITEMS									
			Adaptor									No.4001			
			Adaptor Plate									No.4002			
			Bracket									No.4003			
			Circlip									No.4004			
			Collar									No.4005			
			Cover									No.4006			
			Nut									No.4008			
			Nuts									No.4009			
			Screws									No.4011			
			Screws									No.4012			
			Screws									No.4013			
			Screws									No.4014			
			Shutter									No.4015			
			Shutter Shaft									No.4016			
			Spacer									No.4017			
			Spur Gear									No.4018			
			Washers									No.4020			
			Washer									No.4021			

HEAVY DUTY CAMERA 321 SERIES
(VB00-321J-01)
(Refer to Master Components List T6768 List 1)
Cross Reference List
for VB00-3211Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
						LENS FILTER ASSY.									
						KIT OF PARTS									
				L6				R56	5012			SWX	5020		
						MISCELLANEOUS ITEMS									
				Adaptor						No.	5001				
				Adaptor						No.	5002				
				Adaptor Plate						No.	5003				
				Bracket Assy.						No.	5004				
				Circlip						No.	5005				
				Collar						No.	5006				
				Cover						No.	5007				
				Filter Frame						No.	5008				
				Nut						No.	5010				
				Nuts						No.	5011				
				Screw						No.	5013				
				Screw						No.	5014				
				Screws						No.	5015				
				Screw						No.	5016				
				Shutter Shaft						No.	5017				
				Spacer						No.	5018				
				Spur Gear						No.	5019				
				Washers						No.	5020				
				Washer						No.	5021				

HEAVY DUTY CAMERA 321 SERIES
(VBOO-3211-01)
(Refer to Master Components List T6768 List 1)
Cross Reference List
for VBOO-3211Z Sh.1

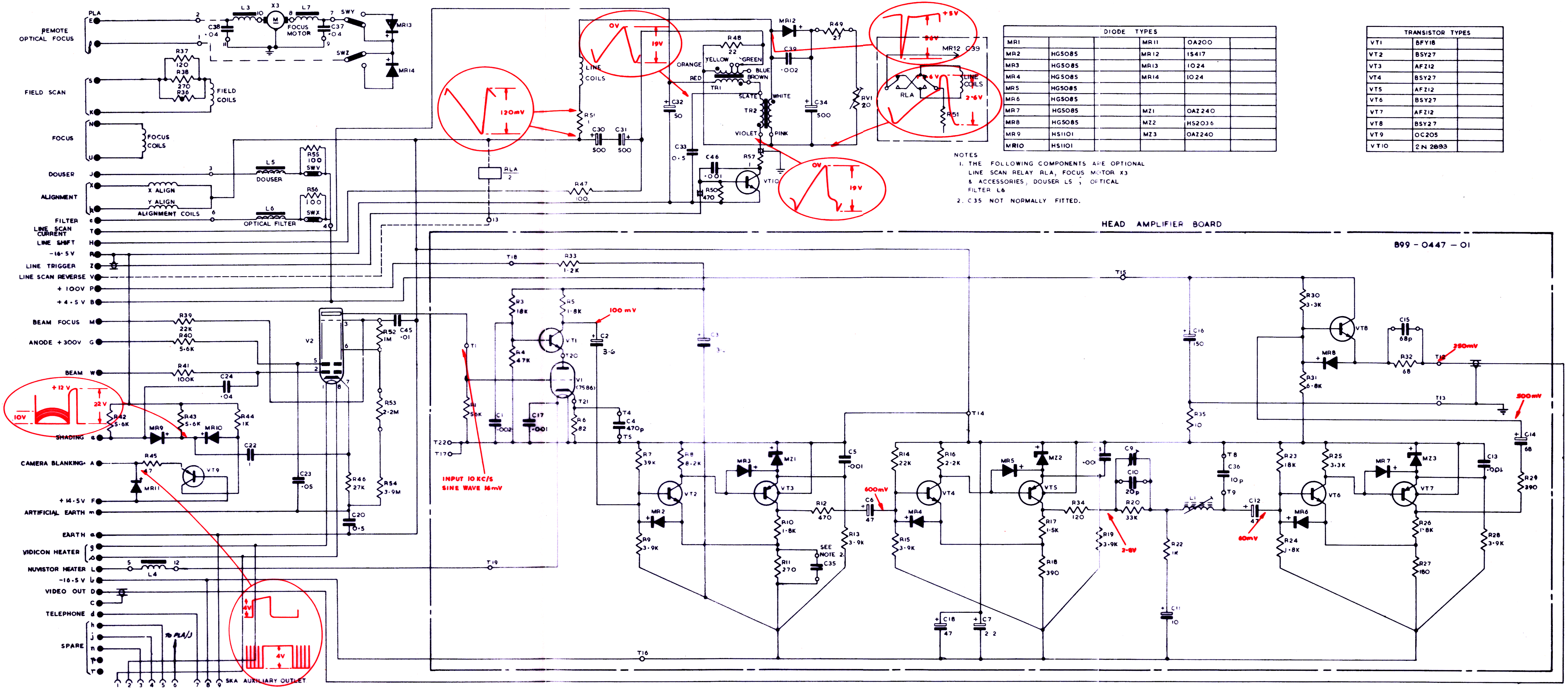
REMOTE FOCUS UNIT

KIT OF PARTS

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C37	6004			L3	6005			MR13	6009						
C38	6004			L7	6005			MR14	6009						

MISCELLANEOUS ITEMS

Actuator	No. 6001
Cam Assy L.H.	No. 6002
Cam Assy R.H.	No. 6003
Lock Washer	No. 6006
Motor Bracket Assy.	No. 6007
Nut	No. 6008
Screws 10-32 Socket	No. 6010
Screws $\frac{3}{8}$ in.	No. 6011
Screws $\frac{5}{8}$ in.	No. 6012
Screws $\frac{1}{4}$ in.	No. 6013
Screws 7/8 in.	No. 6014
Solder Tag	No. 6015
Stiff-nuts	No. 6016
Stops	No. 6017
Washers 6BA	No. 6019
Washer 8BA	No. 6020



DIODE TYPES					
MR1			MR11	OA200	
MR2	HG5085		MR12	1S417	
MR3	HG5085		MR13	1024	
MR4	HG5085		MR14	1024	
MR5	HG5085				
MR6	HG5085				
MR7	HG5085		MZ1	OAZ240	
MR8	HG5085		MZ2	HS2036	
MR9	HS1101		MZ3	OAZ240	
MR10	HS1101				

TRANSISTOR TYPES		
VT1	BFY18	
VT2	BSY27	
VT3	AFZ12	
VT4	BSY27	
VT5	AFZ12	
VT6	BSY27	
VT7	AFZ12	
VT8	BSY27	
VT9	OC205	
VT10	2N 2893	

NOTES
1. THE FOLLOWING COMPONENTS ARE OPTIONAL LINE SCAN RELAY RLA, FOCUS MOTOR X3 & ACCESSORIES, DOUSER L5 ; OPTICAL FILTER L6
2. C35 NOT NORMALLY FITTED.

VBOO-32112 SH.1.
ISSUE 8

V321 SERIES
VIDICON CAMERA CHANNEL.

CAMERA TYPE V321-1
VBOO-3211-01. CIRCUIT. FIG. 103.

VIDEO BOARD 1
(B99-0038-01)
(Refer to Master Components List T6768 List 2)
Cross Reference List
for B99-0038Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	21	C21	21			R6	106	R26	114	R46	106	R66	121	VT4	210
C2	22	C22	23	MR7	84	R7	109	R27	123	R47	103			VT5	210
C3				MR8	84	R8	110	R28	124	R48	102	R68	105	VT6	210
		C24	37	MR9	84	R9	111	R29	102	R49	103	R69		VT7	211
C5	29	C25	38	MR10	84			R30	125	R50	106			VT8	210
C6	49	C26	24	MR11		R11	112	R31	126	R51	106			VT9	210
C7	21			MR12	85	R12	113	R32	127	R52	113			VT10	209
C8	22	C28	37	MR13	85	R13	114	R33	118	R53	104			VT11	210
C9	23			MR14	85	R14	111	R34	120	R54	129			VT12	
C10	31			MR15	85	R15	115	R35	99	R55	104			VT13	207
C11	14					R16	107	R36	109	R56	102			VT14	211
		L1	69			R17	116	R37	107	R57	104	RV1	173	VT15	212
		L2	70			R18	117	R38	118	R58	98	RV2	174	VT16	211
C14	14			MZ1		R19	118	R39	162	R59	130	RV3	175	VT17	211
C15	14					R20	119	R40	161					VT18	212
		MR1	84	R1	131	R21	120	R41	128	R61	103	RLA		VT19	211
C17	14			R2	132	R22	104	R42	104	R62	113				
C18	34	MR3	84	R3	99			R43	106	R63	105	VT1	209		
C19	35	MR4	84	R4	99	R24	121	R44	114	R64	120				
C20	36	MR5	84	R5	109	R25	122	R45	240	R65	118	VT3	210		

MISCELLANEOUS ITEMS

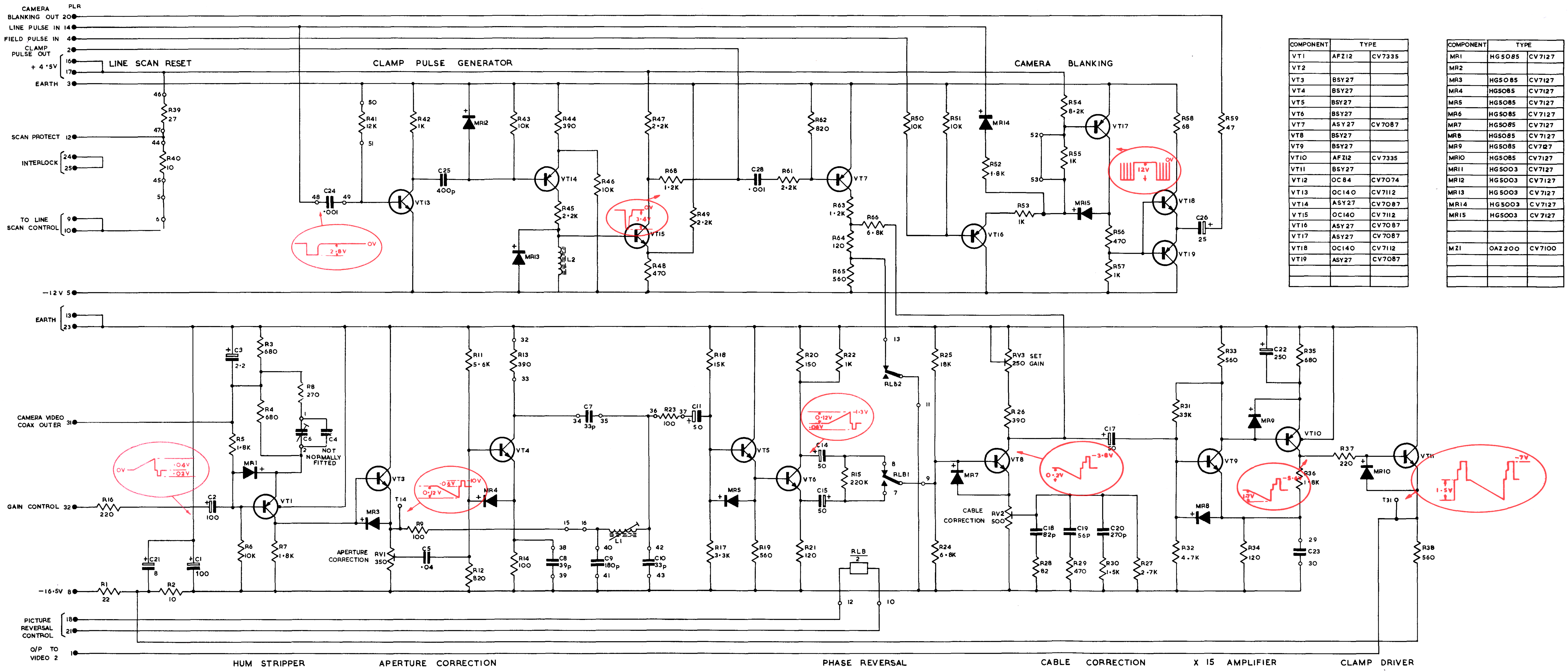
Board	No. 1
Clip (Transistor)	No. 51
Terminal	No.200

VIDEO BOARD
(B99-0038-01)
(Refer to Master Components List T6768 List 3)
Cross Reference List
for B99-0038Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	130	C22	129	MR7	155	R9	179	R30	160	R51	37			VT8	226
C2	128	C23		MR8	155	R10		R31	202	R52	164			VT9	226
C3		C24	131	MR9	155	R11	177	R32	185	R53	45			VT10	227
C4		C25	147	MR10	155	R12	164	R33	208	R54	186			VT11	226
C5	3	C26	9	MR11		R13	192	R34	47	R55	45			VT12	
C6	148	C27		MR12	157	R14	179	R35	53	R56	190			VT13	79
C7	130	C28	131	MR13	157	R15	209	R36	180	R57	45	RV1	212	VT14	223
C8	128			MR14	157	R16	55	R37	55	R58	38	RV2	211	VT15	221
C9	129			MR15	157	R17	161	R38	208	R59	201	RV3	213	VT16	223
C10	143					R18	200	R39	189	R60				VT17	223
C11	126					R19	208	R40	188	R61	42			VT18	221
C12		L1	152			R20	197	R41	174	R62	164			VT19	223
C13		L2	150			R21	47	R42	45	R63	50				
C14	126			R1	184	R22	45	R43	37	R64	47				
C15	126			R2	181	R23	234	R44	192	R65	208	VT1	227		
C16		MR1	155	R3	53	R24	168	R45	187	R66	168	VT2			
C17	126	MR2		R4	53	R25	166	R46	37	R67		VT3	226		
C18	144	MR3	155	R5	180	R26	192	R47	42	R68	50	VT4	226		
C19	145	MR4	155	R6	37	R27	159	R48	180			VT5	226		
C20	146	MR5	155	R7	180	R28	56	R49	42			VT6	226		
C21	130	MR6		R8	195	R29	190	R50	37			VT7	223		

MISCELLANEOUS ITEMS

Board	No. 87
Clip (transistor)	No.149
Terminals	No.219



COMPONENT	TYPE	
VT1	AFZ12	CV7335
VT2		
VT3	BSY27	
VT4	BSY27	
VT5	BSY27	
VT6	BSY27	
VT7	ASY27	CV7087
VT8	BSY27	
VT9	BSY27	
VT10	AFZ12	CV7335
VT11	BSY27	
VT12	OC84	CV7074
VT13	OC140	CV7112
VT14	ASY27	CV7087
VT15	OC140	CV7112
VT16	ASY27	CV7087
VT17	ASY27	CV7087
VT18	OC140	CV7112
VT19	ASY27	CV7087

COMPONENT	TYPE	
MR1	HG5085	CV7127
MR2		
MR3	HG5085	CV7127
MR4	HG5085	CV7127
MR5	HG5085	CV7127
MR6	HG5085	CV7127
MR7	HG5085	CV7127
MR8	HG5085	CV7127
MR9	HG5085	CV7127
MR10	HG5085	CV7127
MR11	HG5003	CV7127
MR12	HG5003	CV7127
MR13	HG5003	CV7127
MR14	HG5003	CV7127
MR15	HG5003	CV7127
MZ1	OAZ200	CV7100

V321 SERIES
CAMERA CONTROL UNIT.

VIDEO 1. B99-0038-01
CIRCUIT FIG. 104.

B99-00382 SH.1.
ISSUE. 9

VIDEO BOARD 2
(B99-0037-01)
(Refer to Master Components List T6768 List 2)
Cross Reference List
for B99-0037Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	39	C21	15	MR6	84			R16	136	R36	128	R56	144	VT2	214
C2	25	C22	43	MR7	84			R17	110	R37	139	R57	143	VT3	210
C3	25	C23	28	MR8	84	MZ1	229	R18	105	R38	140	R58	99	VT4	209
C4	22	C24	21	MR9	85	MZ2	230	R19	160	R39	101	R59	102	VT5	210
C5	22	C25	33	MR10	85			R20	119	R40	125	R60	145	VT6	215
C6	253	C26	21	MR11	85	R1	133	R21	137	R41	139	R61	110	VT7	211
C7	29	C27	29	MR12	85	R2	125	R22	138	R42	147	R62	146	VT8	212
C8	7	C28	8	MR13	85	R3	120	R23	106	R43	141	R63	125	VT9	211
C9	21	C29	40	MR14	85	R4	104	R24	116	R44	127			VT10	212
C10	21			MR15	85	R5	114	R25	125	R45	116			VT11	216
C11	8			MR16	85	R6	104	R26	130	R46	142			VT12	217
C12	41			MR17	85	R7	112	R27	106	R47	102			VT13	210
C13	15	L1	70	MR18	84	R8	104	R28	135	R48	117			VT14	212
C14	21	L2	71	MR19	87	R9	102	R29	123	R49	125			VT15	212
C15	23			MR20	87	R10	114	R30	121	R50	116	RV1	176	VT16	211
C16	15	MR1	84	MR21	85	R11	101	R31	107	R51	126	RV2	175	VT17	212
C17	42	MR2	86	MR22	85	R12	114	R32	135	R52	143	RV3	174	VT18	211
C18	29	MR3	88	MR23	85	R13	134	R33	125	R53	123	RV4	175	VT19	216
C19	21	MR4	86	MR24	85	R14	112	R34	126	R54	99				
C20	8	MR5	86			R15	135	R35	125	R55	119	VT1	213		

MISCELLANEOUS ITEMS

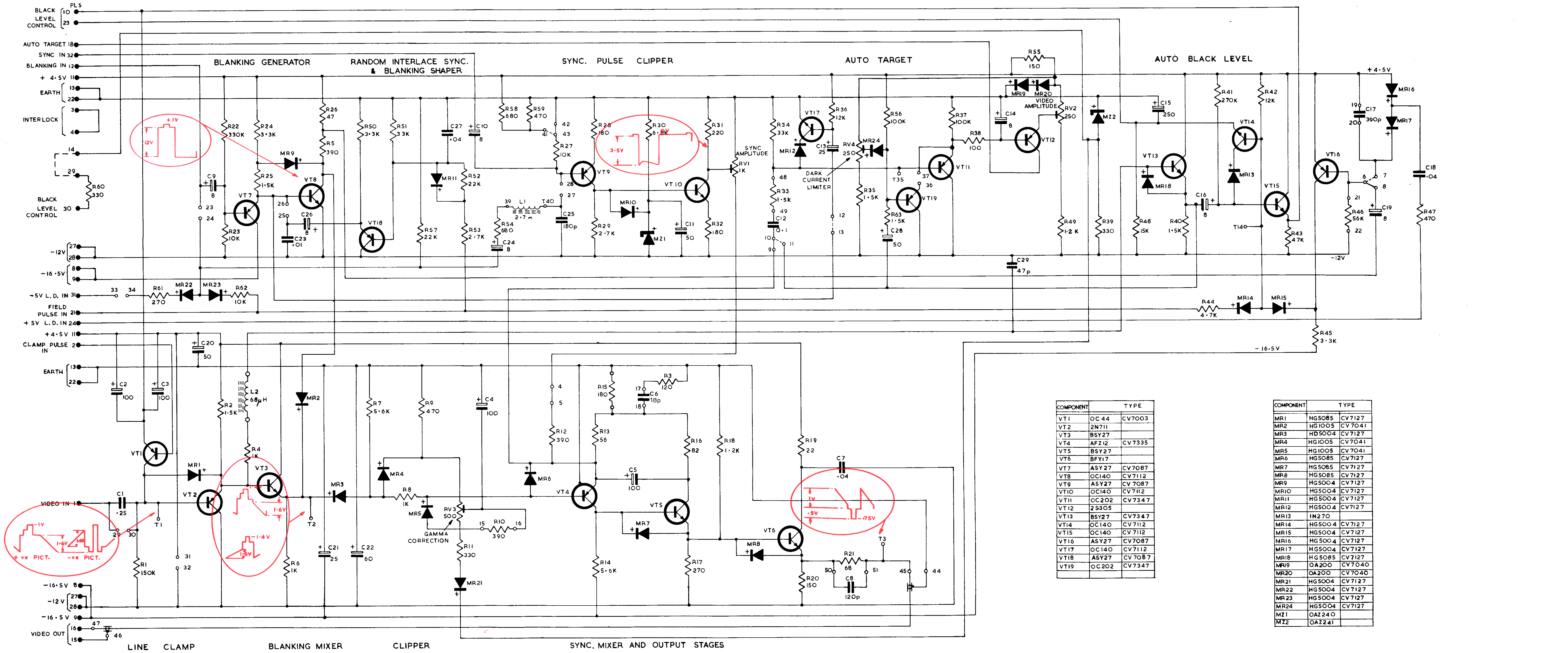
Board	No. 2
Clip (Transistor)	No. 51
Screen	No.180
Terminal	No.200

VIDEO BOARD 2
(B99-0037-01)
(Refer to Master Components List T6768 List 3)
Cross Reference List
for B99-0037Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	138	C21	10	MR5	156			R14	177	R34	202	R54	53	VT1	224
C2	136	C22	142	MR6	155			R15	183	R35	160	R55	197	VT2	225
C3	136	C23	2	MR7	155			R16	194	R36	174	R56	205	VT3	226
C4	128	C24	130	MR8	155	MZ1	230	R17	195	R37	169	R57	172	VT4	227
C5	128	C25	141	MR9	153	MZ2	231	R18	50	R38	203	R58	53	VT5	226
C6	139	C26	130	MR10	153			R19	196	R39	39	R59	41	VT6	222
C7	3	C27	3	MR11	153			R20	197	R40	160	R60	206	VT7	223
C8	17	C28	4	MR12	153	R1	171	R21	198	R41	169	R61	195	VT8	221
C9	130	C29	139	MR13	153	R2	160	R22	199	R42	204	R62	207	VT9	223
C10	130			MR14	153	R3	191	R23	37	R43	173	R63	163	VT10	221
C11	4			MR15	153	R4	45	R24	161	R44	185			VT11	228
C12	132			MR16	153	R5	192	R25	160	R45	161			VT12	229
C13	10	L1	150	MR17	153	R6	45	R26	201	R46	170			VT13	226
C14	130	L2	151	MR18	155	R7	177	R27	37	R47	41			VT14	221
C15	129			MR19	158	R8	45	R28	183	R48	200			VT15	221
C16	10			MR20	158	R9	41	R29	159	R49	160	RV1	215	VT16	223
C17	140	MR1	155	MR21	153	R10	192	R30	168	R50	161	RV2	213	VT17	221
C18	3	MR2	156	MR22	153	R11	39	R31	55	R51	202	RV3	211	VT18	223
C19	130	MR3	157	MR23	153	R12	192	R32	183	R52	172	RV4	213	VT19	228
C20	4	MR4	156	MR24	153	R13	193	R33	160	R53	159				

MISCELLANEOUS ITEMS

Board	No. 88
Clip (Transistor)	No.149
Terminals	No.219
Screen	No.218



COMPONENT	TYPE	
VT1	OC44	CV7003
VT2	2N711	
VT3	BSY27	
VT4	AFZ12	CV7335
VT5	BSY27	
VT6	BFY17	
VT7	ASY27	CV7087
VT8	OC140	CV7112
VT9	ASY27	CV 7087
VT10	OC140	CV7112
VT11	OC202	CV7347
VT12	2S305	
VT13	BSY27	CV7347
VT14	OC140	CV7112
VT15	OC140	CV 7112
VT16	ASY27	CV7087
VT17	OC140	CV7112
VT18	ASY27	CV 7087
VT19	OC202	CV7347

COMPONENT	TYPE	
MR1	HG5085	CV7127
MR2	HG1005	CV7041
MR3	HD5004	CV7127
MR4	HG1005	CV7041
MR5	HG1005	CV7041
MR6	HG5085	CV7127
MR7	HG5085	CV7127
MR8	HG5085	CV7127
MR9	HG5004	CV7127
MR10	HG5004	CV7127
MR11	HG5004	CV7127
MR12	HG5004	CV7127
MR13	IN270	
MR14	HG5004	CV7127
MR15	HG5004	CV7127
MR16	HG5004	CV7127
MR17	HG5004	CV7127
MR18	HG5085	CV7127
MR19	OA200	CV7040
MR20	OA200	CV7040
MR21	HG5004	CV7127
MR22	HG5004	CV7127
MR23	HG5004	CV7127
MR24	HG5004	CV7127
MZ1	OAZ240	
MZ2	OAZ241	

B99 - 0037Z SH.1.
ISSUE. 5

V321 SERIES
CAMERA CONTROL UNIT.

VIDEO 2. B99-0037-01
CIRCUIT. FIG. 105.

FIELD SCAN BOARD
(B99-0031-01)
(Refer to Master Components List T6768 List 2)
Cross Reference List
for B99-0031Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	44	C19	47	MR11	89	R9	131	R27	141	R49	120			VT5	207
C2	14	C20	29	MR12	89	R10	127	R28	142	R50	107			VT6	215
C3	45	C21	14			R11	112	R29	143	R51	153			VT7	207
C4	45	C22	48	MR14	79	R12	109	R30	139	R52	120			VT8	243
C5	45					R13	106	R31	151	R53	121			VT9	242
C6	45	C24	25			R14	111	R32	113	R54	152	RV1	175	VT10	208
C7	22			MZ1	229	R15	111	R33	148	R55	116	RV2	177	VT11	208
C8	23			MZ2	229	R16	132	R34	139	R56	125	RV3	176	VT12	211
C9	21	MR1	85	MZ3	229	R17	100	R35	141	R57	123	RV4	178	VT13	211
C10	21	MR2	89			R18	127	R36	127	R58	141	RV5	175		
C11	37	MR3	89	R1	106	R19	149	R37	122	R59	121	RV6	179	VT15	212
C12	39	MR4	89	R2	163	R20	127	R38	149	R60	111			VT16	207
C13	233	MR5	85	R3	103	R21	244	R39	135	R61	141	TR1	203	VT17	212
C14	45	MR6	85	R4	106	R22	128	R40	123					VT18	212
C15	44	MR7	79	R5	104	R23	244	R41	121			VT1	212	VT19	207
C16	37	MR8	85	R6	103	R24	143	R42	98			VT2	207	VT20	207
C17	28	MR9	85	R7	148	R25	141	R43	116			VT3	208		
C18	15	MR10	89	R8	252	R26	127	R48	111			VT4	207		

MISCELLANEOUS ITEMS

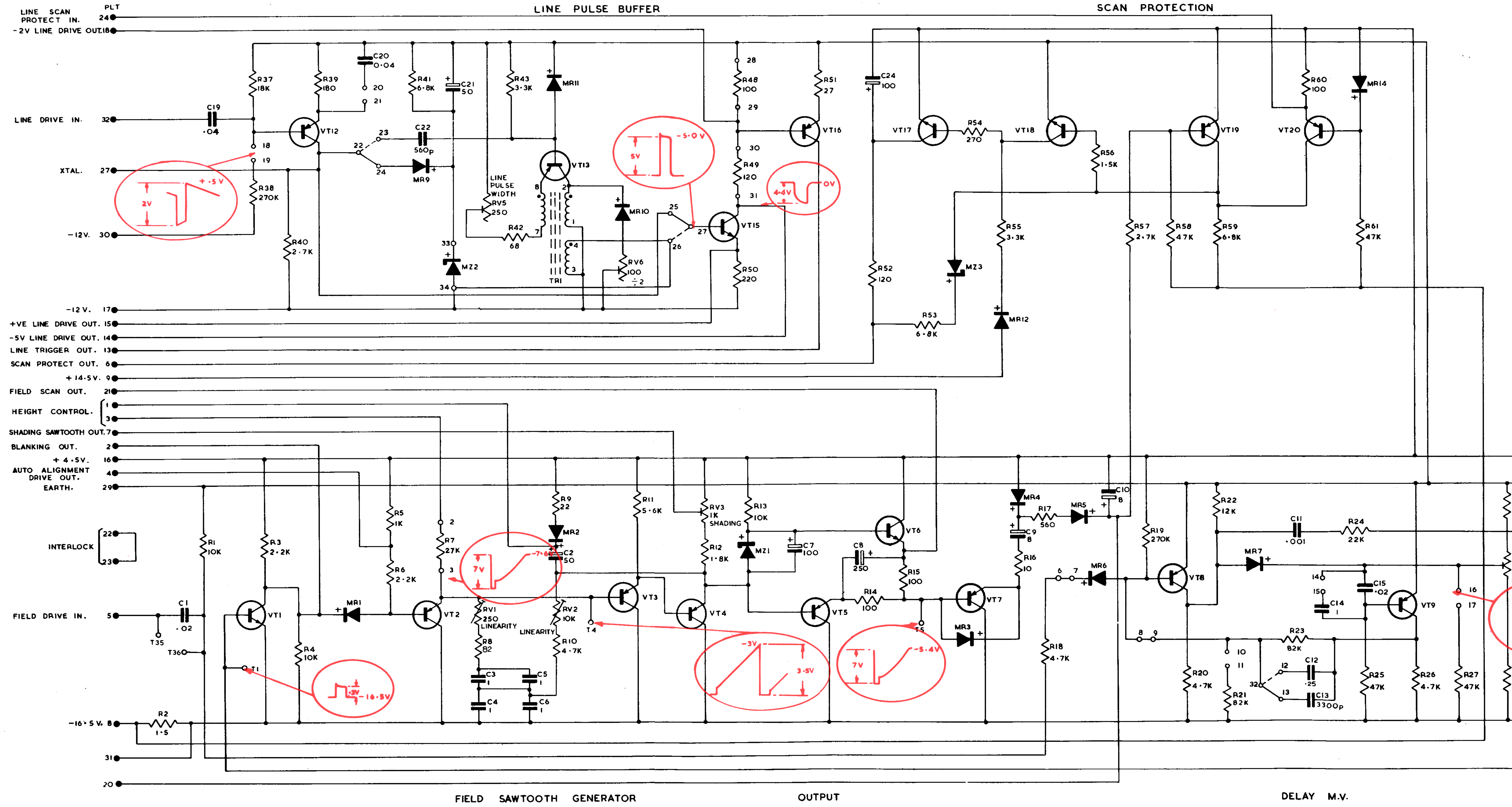
Board	No. 2
Clip (Transistor)	No. 51
Terminal	No.200

FIELD SCAN BOARD
(B99-0031-01)
(Refer to Master Components List T6768 List 3)
Cross Reference List
for B99-0031Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	125	C20	3	MR12	154	R9	184	R28	170	R47	-			VT5	79
C2	126	C21	126	MR13	154	R10	185	R29	172	R48	179			VT6	222
C3	127	C22	137	MR14	62	R11	177	R30	169	R49	47			VT7	79
C4	127	C23	-			R12	180	R31	162	R50	55			VT8	223
C5	127	C24	136			R13	37	R32	164	R51	167	RV1	213	VT9	79
C6	127					R14	179	R33	165	R52	47	RV2	214	VT10	121
C7	128			MZ1	230	R15	179	R34	169	R53	168	RV3	215	VT11	121
C8	129			MZ2	230	R16	181	R35	173	R54	163	RV4	216	VT12	223
C9	130	MR1	153	MZ3	230	R17	40	R36	185	R55	161	RV5	213	VT13	223
C10	130	MR2	154			R18	185	R37	166	R56	160	RV6	217	VT14	-
C11	131	MR3	154			R19	176	R38	176	R57	159			VT15	221
C12	132	MR4	154	R1	37	R20	185	R39	183	R58	173			VT16	79
C13	134	MR5	153	R2	178	R21	175	R40	159	R59	168	TR1	220	VT17	221
C14	127	MR6	153	R3	42	R22	174	R41	168	R60	179			VT18	221
C15	125	MR7	153	R4	37	R23	171	R42	38	R61	173			VT19	79
C16	131	MR8	153	R5	45	R24	172	R43	161			VT1	221	VT20	79
C17	2	MR9	153	R6	42	R25	173	R44	-			VT2	79		
C18	133	MR10	154	R7	182	R26	185	R45	-			VT3	121		
C19	135	MR11	154	R8	183	R27	173	R46	-			VT4	79		

MISCELLANEOUS ITEMS

Board	No. 24
Clip (Transistor)	No.219
Terminal	No.218



COMPONENT	TYPE	
VT1	OC140	CV7112
VT2	OC84	CV7074
VT3	OC205	CV7188
VT4	OC84	CV7074
VT5	OC84	CV7074
VT6	BFY17	
VT7	OC84	CV7074
VT8	2S304	
VT9	2S303	
VT10	OC205	CV7188
VT11	OC205	CV7188
VT12	ASY27	
VT13	ASY27	
VT14		
VT15	OC140	CV7112
VT16	OC84	CV7074
VT17	OC140	CV7112
VT18	OC140	CV7112
VT19	OC84	CV7074
VT20	OC84	CV7074

COMPONENT	TYPE	
MR1	HG5004	CV7127
MR2	OA10	CV7049
MR3	OA10	CV7049
MR4	OA10	CV7049
MR5	HG5004	CV7127
MR6	HG5004	CV7127
MR7	OA202	CV7127
MR8	HG5004	CV7127
MR9	HG5004	CV7127
MR10	OA10	CV7049
MR11	OA10	CV7127
MR12	OA10	CV7049
MR14	OA202	CV7040
MZ1	OAZ240	CV7100
MZ2	OAZ240	CV7100
MZ3	OAZ240	CV7100

B99-0031.Z SH.I.
ISSUE. 9

V321 SERIES
CAMERA CONTROL UNIT

FIELD SCAN. CIRCUIT B99-0031-01.

FIG. 106.

POWER SUPPLY UNIT
(VB01-3215-01)
(Refer to Master Components Lists T6768 List 2A
Cross Reference List
for VB20-3215Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
BL1	14	C30	5	LKA	37	MR3	45	R2	40	RV1	43	SKAC	36		
				LKB	37	MR4	45	R35	41	RV15	28	SKAD	36	X2	
C1	38							R36	40						
C2	3	FS3	17	MR1	45					SKAA	36				
C3	3			MR2	45	R1	39			SKAB	36	TR1	33		

MISCELLANEOUS ITEMS

Clamp Assembly	No. 6
Clip	No. 9
Cover	No.13
Grommet	No.19
Nut (Spindle Gripping)	No.24
Terminal	No.31

CAMERA CONTROL UNIT V321-5
(VB20-3215-01)
(Refer t Master Components List T.6768 List 2)
Cross Reference List
for VB20-3215Z (Fig.107)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
		C22	7					R21	94	R43	236	SKB	185	SWF	192
		C23	19	MR5	80	PLA	75			R44	235	SKC	186	SWG	191
		C24	16	MR6	80			R23	106	RV1	ø	SKD	186	SWM	193
C4	8			MR7	80	R3	101	R24	158	RV2	164	SKE	186		
C5	9	C26	14	MR8	81	R4	101	R25	104	RV3	165	SKF	186	TP1	187
		C27		MR9	82	R5	100	R26	97	RV4	165	SKG	186	TP2	188
C7	11	C28	20	MR10	232	R6	102	R27	95	RV5	166	SKH	186		
C8	12	C29	28	MR11	83	R7	103			RV6	167	SKJ	186		
C9	13			MR12	83	R8	105	R29	238	RV7	168	SKK	186		
C10	15	C35	251	MR13	83	R9	103	R30	159			SKL	186	VT1	204
C11	15			MR14	83	R10	107	R31	107	RV9	172	SKM	189	VT2	204
C12	16	FS1	*	MR15	80	R11	231	R32	154	RV10	169	SKR	57	VT3	207
C13	26	FS2	*	MR16	79	R12	108	R33	96	RV11	170	SKS	57	VT4	206
C14	241					R13	156	R34	100	RV12	170	SKT	57	VT5	208
C15	27	L1	68			R14	250			RV13	171	SKU	57	VT6	205
C16	27					R15	94					SKV	57	VT7	207
C17	15			MZ2	224	R16	157	R37	94			SKW	57	VT8	204
C18	18	L4	68	MZ3	225	R17	105	R38	107	RV16	164			VT9	204
C19	12	L5	68	MZ4	227	R18	105	R39							
C20	12			MZ5	223	R19	105	R41	237			SWA	190		
C21	12	LP1	73	MZ6	226	R20	104	R42	237	SKA	184	SWE	191		

MISCELLANEOUS ITEMS

	Component Board Assembly including:	No. 56
Ref.36	Tag Board Assembly	No.195
Ref.25	Tag Strip Assembly	No.199
Ref. 9	Dust Cap	No. 59
	Fuseboard Assembly including:	No. 62
Ref.24	Fuseholder	No. 63
	Tag Board Assembly	No.196
	Clip	No. 50
Ref. 5	Gasket	No. 64
Ref.12	Gasket	No. 65
Ref.10	Gasket	No. 66

* For 240V use No. 61
For 120V use No.239

ø For power supply unit 220/110V 50/60 c/s use No.245
For power supply unit 400 c/s use No.249

CAMERA CONTROL UNIT V321-5
(VB20-3215-01)
(Refer to Master Components List T6768 List 2)
Cross Reference List
for VB20-3215Z(Fig.107)

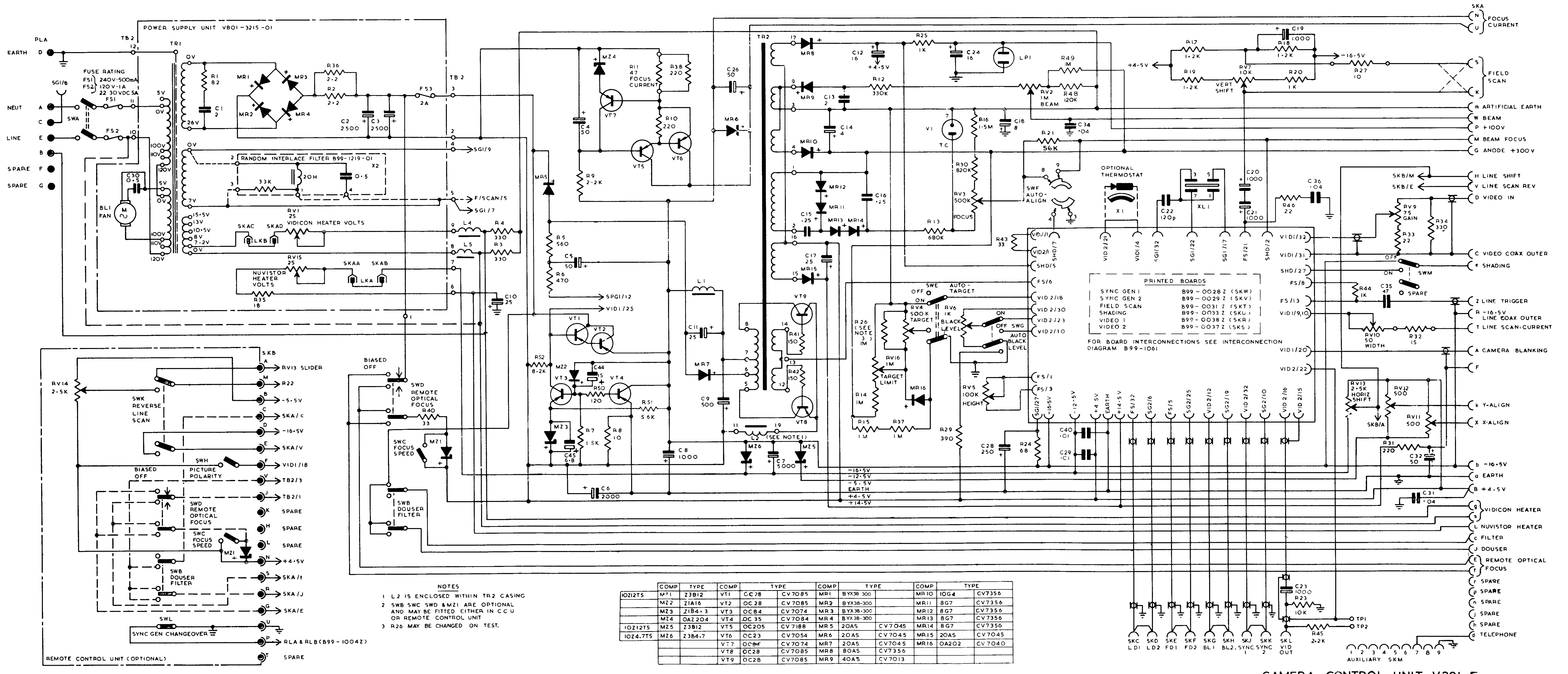
MISCELLANEOUS ITEMS (Contd.)

	Insulators	No.72
Ref.1	Nut (Spindle Gripping)	No.74
	Rectifier Board Assembly including:	No.92
Ref.27	Gasket	No.67
Ref.30	Rectifier Block	No.90
Ref.31	Rectifier Block	No.91
Ref.28	Tag Board Assembly	No.197
	Screw Captive	No.181
	Screw Captive	No.182
Ref.7	Tag Strip Assembly	No.198
	Terminal Block	No.201
	Transformer Assembly (TR2) including:	No.202
	Coil Assembly	No.52
	Coil Assembly	No.53
	Coil Assembly	No.54
	Coil Assembly	No.55
Ref.17	Valveholder	No.218
Ref.19	Valve Mount	No.219
Ref.20	Valve Retainer	No.220
Ref.15	Valve Retainer	No.221
Ref.16	Valve Top Can	No.222
	Power Supply Unit (50c/s)	No.76ø
	Power Supply Unit (400 c/s)	No.77ø
	Power Supply Unit (22-30V d.c)	No.78ø
	Board Assembly (Video 1)	No. 5/
	Board Assembly (Video 2)	No. 6/
	Board Assembly (Field Scan)	No. 4/
	Frame & Control Panel Assembly	No.60/

ø Alternative Units see MCL 2A
/ Individual components included in MCL

CAMERA CONTROL UNIT V321-5
(VB20-3215-01)
(Refer to Master Components List T6768 List 2)
Cross Reference List
for VB20-3215Z (Fig.107)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
				RANDOM INTERLACE CHOKE KIT OF PARTS											
														XL1	1003
														XL2	1001
				MISCELLANEOUS ITEMS											
			Choke Bracket						No.	1002					
			Nuts						No.	1004					
			Screws						No.	1005					
			Washers						No.	1006					
				PICTURE POLARITY REVERSAL KIT OF PARTS											
										RLB	2001	SWA	2004		
				MISCELLANEOUS ITEMS											
			Screws						No.	2002					
			Stiff-nuts						No.	2003					
			Washers						No.	2005					
				LINE SCAN REVERSAL ASSY KIT OF PARTS											
										RV14	3001	SWK	3002		
				SUN SHUTTER ASSY KIT OF PARTS											
												SWB	4001		
				LENS FILTER ASSY											
												SWB	5001		
				REMOTE FOCUS UNIT KIT OF PARTS											
						MZ1	6005			R40	6002	SWC	6004		
												SWD	6003		
				MISCELLANEOUS ITEMS											
			Cover						No.	6001					



NOTES

1 L2 IS ENCLOSED WITHIN TR2 CASING
2 SWB SWC SWD & MZ1 ARE OPTIONAL AND MAY BE FITTED EITHER IN C C U OR REMOTE CONTROL UNIT
3 R26 MAY BE CHANGED ON TEST.

	COMP	TYPE	COMP	TYPE		COMP	TYPE		COMP	TYPE	
10Z12T5	MZ1	Z3B12	VT1	OC28	CV7085	MR1	BYX38 300		MR10	10G4	CV7356
	MZ2	Z1A16	VT2	OC28	CV7085	MR2	BYX38-300		MR11	8G7	CV7356
	MZ3	Z1B4·3	VT3	OC84	CV7074	MR3	BYX38-300		MR12	8G7	CV7356
	MZ4	OAZ204	VT4	OC35	CV7084	MR4	BYX38-300		MR13	8G7	CV7356
10Z12T5	MZ5	Z3B12	VT5	OC205	CV7188	MR5	20AS	CV7045	MR14	8G7	CV7356
10Z4.7T5	MZ6	Z3B4·7	VT6	OC23	CV7054	MR6	20AS	CV7045	MR15	20AS	CV7045
			VT7	OC84	CV7074	MR7	20AS	CV7045	MR16	OA202	CV7040
			VT8	OC28	CV7085	MR8	80AS	CV7356			
			VT9	OC28	CV7085	MR9	40AS	CV7013			

V321 SERIES
VIDICON CAMERA CHANNEL.

CAMERA CONTROL UNIT V321-5
VB20-3215-01 CIRCUIT.

FIG. 107.

VB20-3215Z SH.1
ISSUE 12

CAMERA CONTROL UNIT
(VB00-3216-01)
(Refer to Master Components List T6768 List 3)
Cross Reference List
for VB20-3216Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	13	C23	1	MR4	236	PLN	36	R20	45			SKP	66		
C2	19	C24	11	MR5	58	PLP	36	R21	48			SKQ	65	V1	82
C3	19			MR6	58					RV1	104	SKR	65		
C4	4	C26	4	MR7	58	R1	56	R23	37	RV2	105	SKS	65	VT1	78
C5	5	C27	8	MR8	59	R2	57	R24	51	RV3	106	SKT	65	VT2	78
C6	6	C28	18	MR9	60	R3	39	R25	45	RV4	106	SKU	65	VT3	79
C7	7	C29	2	MR10	59	R4	39			RV5	107	SKV	65	VT4	80
C8	8	C30	3	MR11	61	R5	40	R27	52	RV6	108	SKW	65	VT5	121
C9	12			MR12	61	R6	41			RV7	109			VT6	81
C10	9	C33	235	MR13	61	R7	42	R29	53					VT7	79
C11	10			MR14	61	R8	43	R30	54	RV9	110	SWA	117	VT8	78
C12	11	FS1	*	MR15	58	R9	42	R31	55	RV10	111			VT9	78
C13	13	FS2	*	MR16	62	R10	45	R32	99	RV11	112				
C14	232	FS3	27			R11	102	R33	100	RV12	112				
C15	15					R12	46	R34	39	RV13	113	SWE	118		
C16	15	L1	34			R13	47	R35	101			SWF	119		
C17	10			MZ2	90	R14	44	R36	57	RV15	114	SWG	118		
C18	16	LP1	97	MZ3	91	R15	48	R37	48	RV16	115				
C19	8			MZ4	94	R16	19	R38	103			SWM	118		
C20	8	MR1	236	MZ5	92	R17	50	R39	38						
C21	8	MR2	236	MZ6	93	R18	50			SKM	116	TR1	76		
C22	17	MR3	236			R19	50			SKN	66	TR2	77		

MISCELLANEOUS MECHANICAL ITEMS

Clamp Assembly	No.20
Clip	No.21
Clip	No.22
Clip	No.23
Clip (Transistor)	No.95
Field Scan Board	No.24
Frame Assembly	No.25
Fuseholder	No.28

* For 240V use No.26
For 120V use No.233

MISCELLANEOUS MECHANICAL ITEMS (Contd.)

Grommet	No.30
Grommet	No.31
Grommet	No.32
Grommet	No.29
Handle	No.33
Insulator	No.35
Nut (Spindle Gripping)	No.98
Shading Generator	No.64
Sync Pulse Generator (Board 1)	No.67
Sync Pulse Generator (Board 2)	No.68
Tag Strip Assembly	No.69
Tag Strip Assembly	No.70
Tag Strip Assembly	No.71
Tag Strip Assembly	No.72
Tag Strip Assembly	No.73
Tag Strip Assembly	No.74
Terminal	No.120
Terminal Block	No.75
Valveholder for V1	No.83
Valve Retainer for V1	No.84
Valve Retainer for XL1	No.85
Valve Top Cap	No.86
Video Amplifier 1	No.87
Video Amplifier 2	No.88
Washer	No.89

CAMERA CONTROL UNIT
(VB00-3216-01)
(Refer to Master Components List T6768 List 3)
Cross Reference List
for VB20-3216Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
RANDOM INTERFACE FILTER KIT OF PARTS															
												X1	1001	XL1	1003
MISCELLANEOUS ITEMS															
		Choke Bracket										No.1002			
		Nuts										No.1004			
		Screws										No.1005			
		Washers										No.1006			
PICTURE POLARITY REVERSAL KIT OF PARTS															
										RLB	2001	SWA	2004		
MISCELLANEOUS ITEMS															
		Screw										No.2002			
		Stiff-nuts										No.2003			
		Washers										No.2005			
LINE SCAN REVERSAL ASSY. KIT OF PARTS															
RLA	3003			RV14	3001	SWK	3002								
MISCELLANEOUS ITEMS															
		Screws										No.3004			
REMOTE SUN SHUTTER ASSY. KIT OF PARTS															
L5	4008			R55	4011							SWB	4001	SWV	4021
MISCELLANEOUS ITEMS															
		Adaptor										No.4002			
		Adaptor Plate										No.4003			
		Bracket										No.4004			
		Circlip										No.4005			
		Collar										No.4006			
		Cover										No.4007			
		Nut										No.4009			
		Nut										No.4010			
		Screw										No.4012			

CAMERA CONTROL UNIT
(VB00-3216-01)
(Refer to Master Components List T6768 List 3)

Cross Reference List
for VB20-3216Z Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.

REMOTE FOCUS UNIT
KIT OF PARTS

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C37	6010	L3	6015	MR13	6012					R40	6002	SWC	6004	SWY	6026
C38	6010	L7	6015	MR14	6012							SWD	6003	SWZ	6026
C39	6011	L8	6014												
		L9	6014	MZ1	6013										

MISCELLANEOUS ITEMS

Item	No.
Actuator	No.6006
Bush	No.6007
Can Assy. L.H.	No.6008
Can Assy. R.H.	No.6009
Cover	No.6001
Lock Washer	No.6016
Motor Bracket Assy.	No.6017
Nut	No.6018
Screw	No.6019
Screw	No.6020
Screw	No.6021
Screw	No.6022
Screw	No.6033
Stiff-nut	No.6024
Stop	No.6025
Tag Solder	No.6027
Washer	No.6028
Washer	No.6029
Washer	No.6030

CAMERA CONTROL UNIT V321-5
(VB20-3215-01)
(Refer to Master Components List T.6768 List 2)
Cross Reference List
for VB20-3215Z (Fig.107)

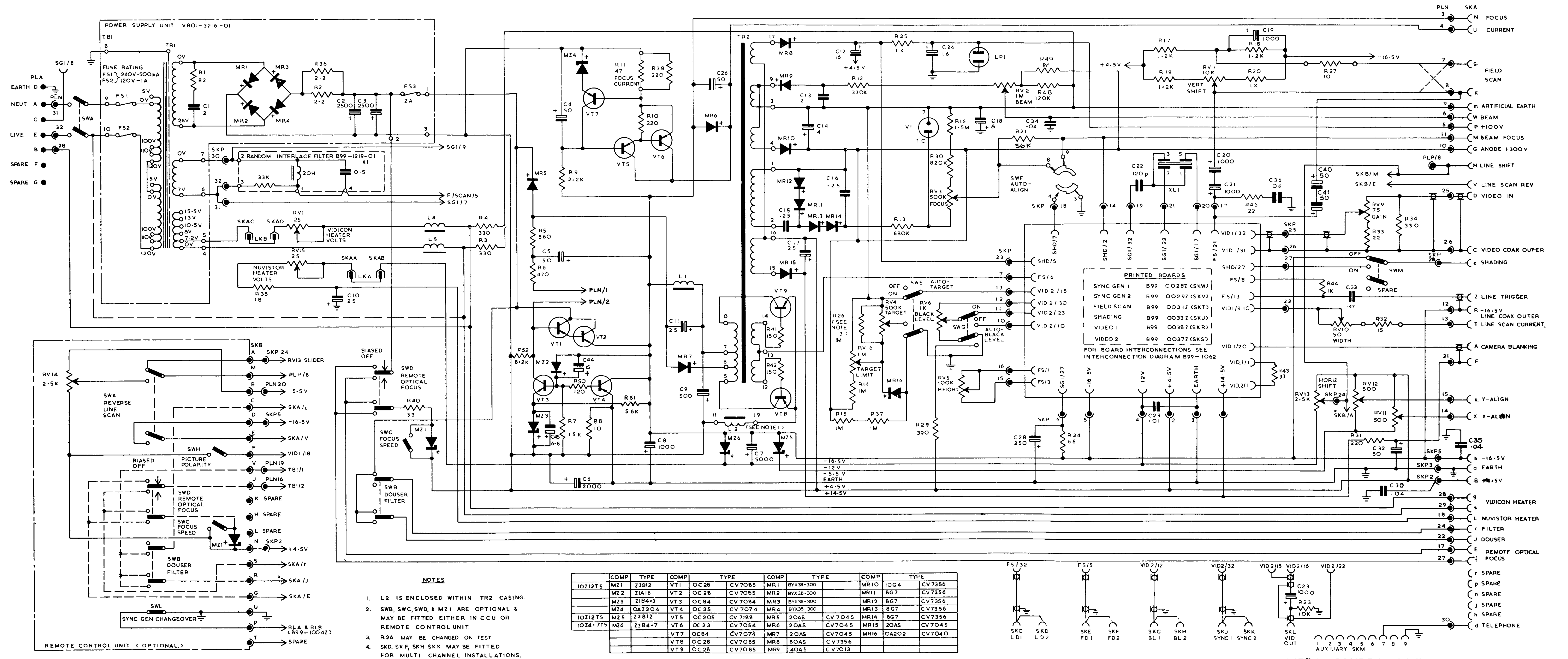
Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
		C22	7					R21	94	R43	236	SKB	185	SWF	192
		C23	19	MR5	80	PLA	75			R44	235	SKC	186	SWG	191
		C24	16	MR6	80			R23	106	RV1	ϕ	SKD	186	SWM	193
C4	8			MR7	80	R3	101	R24	158	RV2	164	SKE	186		
C5	9	C26	14	MR8	81	R4	101	R25	104	RV3	165	SKF	186	TP1	187
		C27		MR9	82	R5	100	R26	97	RV4	165	SKG	186	TP2	188
C7	11	C28	20	MR10	232	R6	102	R27	95	RV5	166	SKH	186		
C8	12	C29	28	MR11	83	R7	103			RV6	167	SKJ	186		
C9	13			MR12	83	R8	105	R29	238	RV7	168	SKK	186		
C10	15	C35	251	MR13	83	R9	103	R30	159			SKL	186	VT1	204
C11	15			MR14	83	R10	107	R31	107	RV9	172	SKM	189	VT2	204
C12	16	FS1	*	MR15	80	R11	231	R32	154	RV10	169	SKR	57	VT3	207
C13	26	FS2	*	MR16	79	R12	108	R33	96	RV11	170	SKS	57	VT4	206
C14	241					R13	156	R34	100	RV12	170	SKT	57	VT5	208
C15	27	L1	68			R14	250			RV13	171	SKU	57	VT6	205
C16	27					R15	94					SKV	57	VT7	207
C17	15			MZ2	224	R16	157	R37	94			SKW	57	VT8	204
C18	18	L4	68	MZ3	225	R17	105	R38	107	RV16	164			VT9	204
C19	12	L5	68	MZ4	227	R18	105	R39							
C20	12			MZ5	223	R19	105	R41	237			SWA	190		
C21	12	LP1	73	MZ6	226	R20	104	R42	237	SKA	184	SWE	191		

MISCELLANEOUS ITEMS

	Component Board Assembly including:	No. 56
Ref.36	Tag Board Assembly	No.195
Ref.25	Tag Strip Assembly	No.199
Ref. 9	Dust Cap	No. 59
	Fuseboard Assembly including:	No. 62
Ref.24	Fuseholder	No. 63
	Tag Board Assembly	No.196
	Clip	No. 50
Ref. 5	Gasket	No. 64
Ref.12	Gasket	No. 65
Ref.10	Gasket	No. 66

* For 240V use No. 61
For 120V use No.239

ϕ For power supply unit 220/110V 50/60 c/s use No.245
For power supply unit 400 c/s use No.249



NOTES

1. L2 IS ENCLOSED WITHIN TR2 CASING.
2. SWB, SWC, SWD, & MZ1 ARE OPTIONAL & MAY BE FITTED EITHER IN CCU OR REMOTE CONTROL UNIT.
3. R26 MAY BE CHANGED ON TEST
4. SKD, SKF, SKH SKK MAY BE FITTED FOR MULTI CHANNEL INSTALLATIONS.

	COMP	TYPE	COMP	TYPE		COMP	TYPE		COMP	TYPE	
10Z12T5	MZ1	Z3B12	VT1	OC28	CV7085	MR1	BYX38-300		MR10	10G4	CV7356
	MZ2	Z1A16	VT2	OC28	CV7085	MR2	BYX38-300		MR11	8G7	CV7356
	MZ3	Z1B4·3	VT3	OC84	CV7084	MR3	BYX38-300		MR12	8G7	CV7356
	MZ4	OAZ204	VT4	OC35	CV7074	MR4	BYX38 300		MR13	8G7	CV7356
10Z12T5	MZ5	Z3B12	VT5	OC205	CV7188	MR5	20AS	CV7045	MR14	8G7	CV7356
10Z4·7T5	MZ6	Z3B4·7	VT6	OC23	CV7054	MR6	20AS	CV7045	MR15	20AS	CV7045
			VT7	OC84	CV7074	MR7	20AS	CV7045	MR16	OA202	CV7040
			VT8	OC28	CV7085	MR8	80AS	CV7356			
			VT9	OC28	CV7085	MR9	40A5	CV7013			

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA CONTROL UNIT. V321-6
VB20-3216-01. CIRCUIT. FIG.108

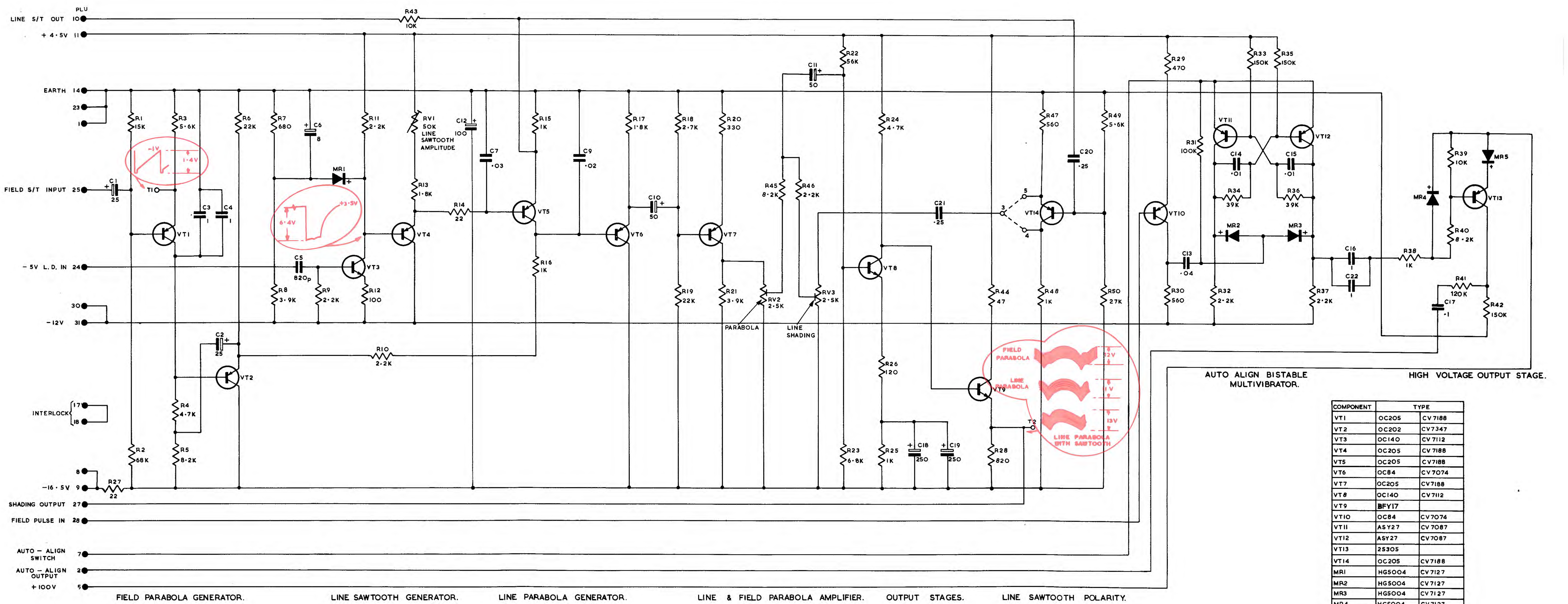
VB20-32162. SH. 1
ISSUE 12

SHADING GENERATOR
(B99-0033-01)
(Refer to Master Components List T6768 List 2C)
Cross Reference List
for B99-0033Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	2	C15	12	MR4	18	R12	29	R26	38	R40	24			VT9	57
C2	2	C16	3	MR5	19	R13	30	R27	43	R41	46			VT10	56
C3	3	C17	13			R14	31	R28	39	R42	44	RV1	50	VT11	58
C4	3	C18	14	R1	20	R15	32	R29	40	R43	46	RV2	51	VT12	58
C5	4	C19	14	R2	21	R16	32	R30	41	R44	48	RV3	51	VT13	59
C6	5	C20	7	R3	22	R17	33	R31	42	R45	24			VT14	53
C7	6	C21	7	R4	23	R18	34	R32	28	R46	28	VT1	53		
C8	7	C22	3	R5	24	R19	25	R33	44	R47	41	VT2	54		
C9	8			R6	25	R20	35	R34	45	R48	32	VT3	55		
C10	9			R7	26	R21	27	R35	44	R49	47	VT4	53		
C11	9			R8	27	R22	36	R36	45	R50	49	VT5	53		
C12	10	MR1	18	R9	28	R23	37	R37	28			VT6	56		
C13	11	MR2	18	R10	28	R24	23	R38	32			VT7	53		
C14	12	MR3	18	R11	28	R25	32	R39	46			VT8	55		

MISCELLANEOUS MECHANICAL ITEMS

Board	No. 1
Clip (Transistor)	No.15
Mounting Pads	No.16
Mounting Pad	No.17
Terminal	No.52



COMPONENT	TYPE	
VT1	OC205	CV7188
VT2	OC202	CV7347
VT3	OC140	CV7112
VT4	OC205	CV7188
VT5	OC205	CV7188
VT6	OC84	CV7074
VT7	OC205	CV7188
VT8	OC140	CV7112
VT9	BFY17	
VT10	OC84	CV7074
VT11	ASY27	CV7087
VT12	ASY27	CV7087
VT13	2S305	
VT14	OC205	CV7188
MR1	HG5004	CV7127
MR2	HG5004	CV7127
MR3	HG5004	CV7127
MR4	HG5004	CV7127
MR5	OA200	CV7040

NOTE.
ENSURE THAT C17 IS DISCHARGED AFTER REMOVING BOARD

V321 SERIES
CAMERA CONTROL UNIT

B99-0033Z SH.1
ISSUE. 4

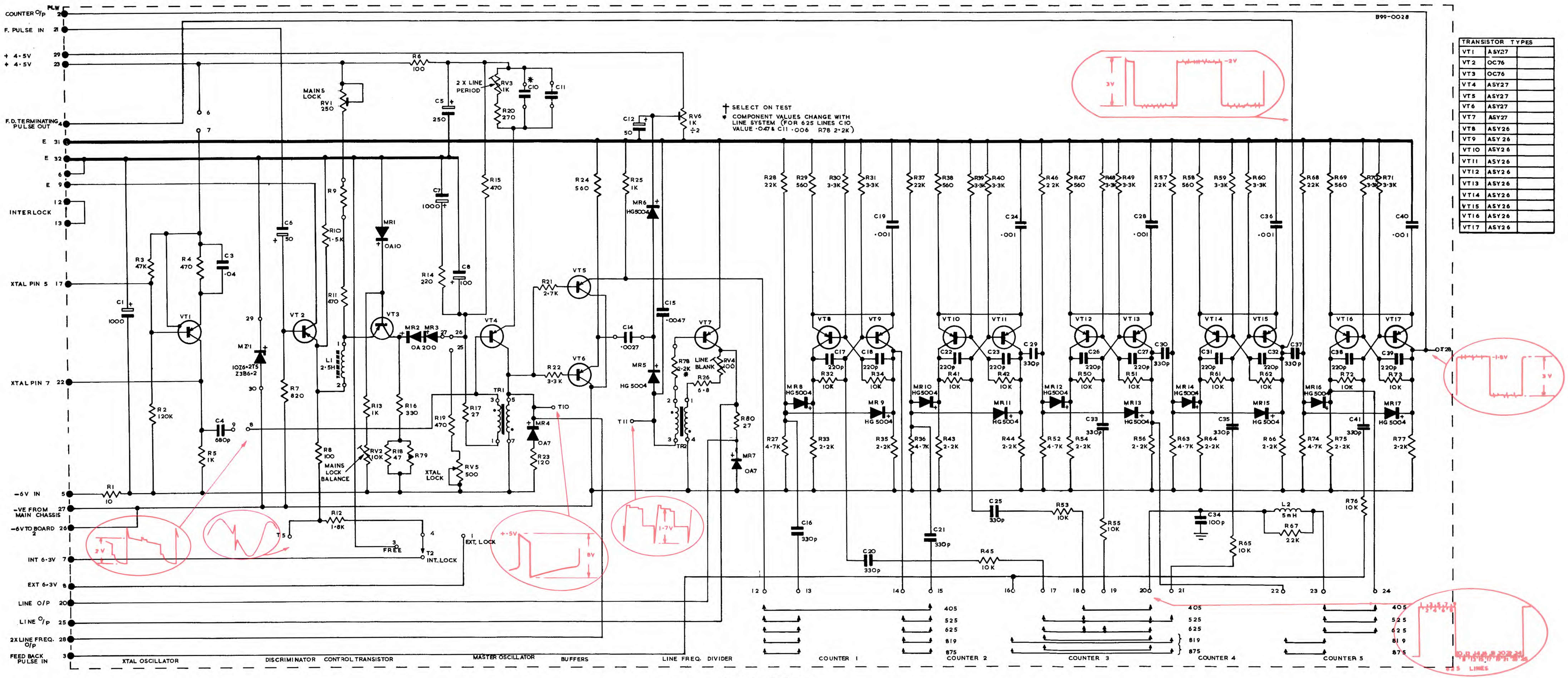
SHADING GENERATOR B99-0033-01 FIG. 109.
CIRCUIT

SYNC PULSE GENERATOR (BOARD 1)
(B99-0028-01)
(Refer to Master Components List T6768 List 2B)
Cross Reference List
for B99-0028Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	3	C25	13			R2	36	R26	87	R50	56	R74	53	TR2	78
		C26	14	MR1	30	R3	37	R27	53	R51	56	R75	57		
C3	5	C27	14	MR2	31	R4	38	R28	54	R52	53	R76	56	VT1	81
C4	6	C28	15	MR3	31	R5	39	R29	55	R53	56	R77	57	VT2	80
C5	7	C29	13	MR4	32	R6	41	R30	44	R54	57	R78	57	VT3	80
C6	8	C30	13	MR5	33	R7	40	R31	44	R55	56	R79	76	VT4	81
C7	3	C31	14	MR6	33	R8	41	R32	56	R56	57	R80	47	VT5	81
C8	9	C32	14	MR7	32	R9	42	R33	57	R57	54			VT6	81
		C33	13	MR8	33	R10	43	R34	56	R58	55			VT7	81
C10	10	C34	16	MR9	33	R11	38	R35	57	R59	44			VT8	82
C11	4	C35	13	MR10	33	R12	44	R36	53	R60	44			VT9	82
C12	8	C36	15	MR11	33	R13	39	R37	54	R61	56			VT10	82
		C37	13	MR12	33	R14	45	R38	55	R62	56			VT11	82
C14	11	C38	14	MR13	33	R15	38	R39	44	R63	53			VT12	82
C15	12	C39	14	MR14	33	R16	46	R40	44	R64	57			VT13	82
C16	13	C40	15	MR15	33	R17	47	R41	56	R65	56	RV1	70	VT14	82
C17	14	C41	13	MR16	33	R18	48	R42	56	R66	57	RV2	71	VT15	82
C18	14			MR17	33	R19	38	R43	57	R67	54	RV3	72	VT16	82
C19	15					R20	49	R44	57	R68	54	RV4	89	VT17	82
C20	13					R21	50	R45	56	R69	55	RV5	73		
C21	13					R22	44	R46	54	R70	44	RV6	72		
C22	14			MZ1	83	R23	51	R47	55	R71	44				
C23	14	L1	25			R24	88	R48	44	R72	56				
C24	15	L2	26	R1	35	R25	39	R49	44	R73	56	TR1	77		

MISCELLANEOUS MECHANICAL ITEMS

Board	No. 1
Clip	No.24
Mounting Pad	No.28
Mounting Pad	No.29
Terminal	No.75



TRANSISTOR TYPES	
VT1	ASY27
VT2	OC76
VT3	OC76
VT4	ASY27
VT5	ASY27
VT6	ASY27
VT7	ASY27
VT8	ASY26
VT9	ASY26
VT10	ASY26
VT11	ASY26
VT12	ASY26
VT13	ASY26
VT14	ASY26
VT15	ASY26
VT16	ASY26
VT17	ASY26

B99-0028Z SH.1
ISSUE. 9

V321 SERIES
CAMERA CONTROL UNIT

SYNC. PULSE GENERATOR BOARD 1. B99-0028-01
CIRCUIT

FIG. 110.

SYNC PULSE GENERATOR (BOARD 2)
(B99-0029-01)
(Refer to Master Components List T6768 List 2B)
Cross Reference List
for B99-0029Z

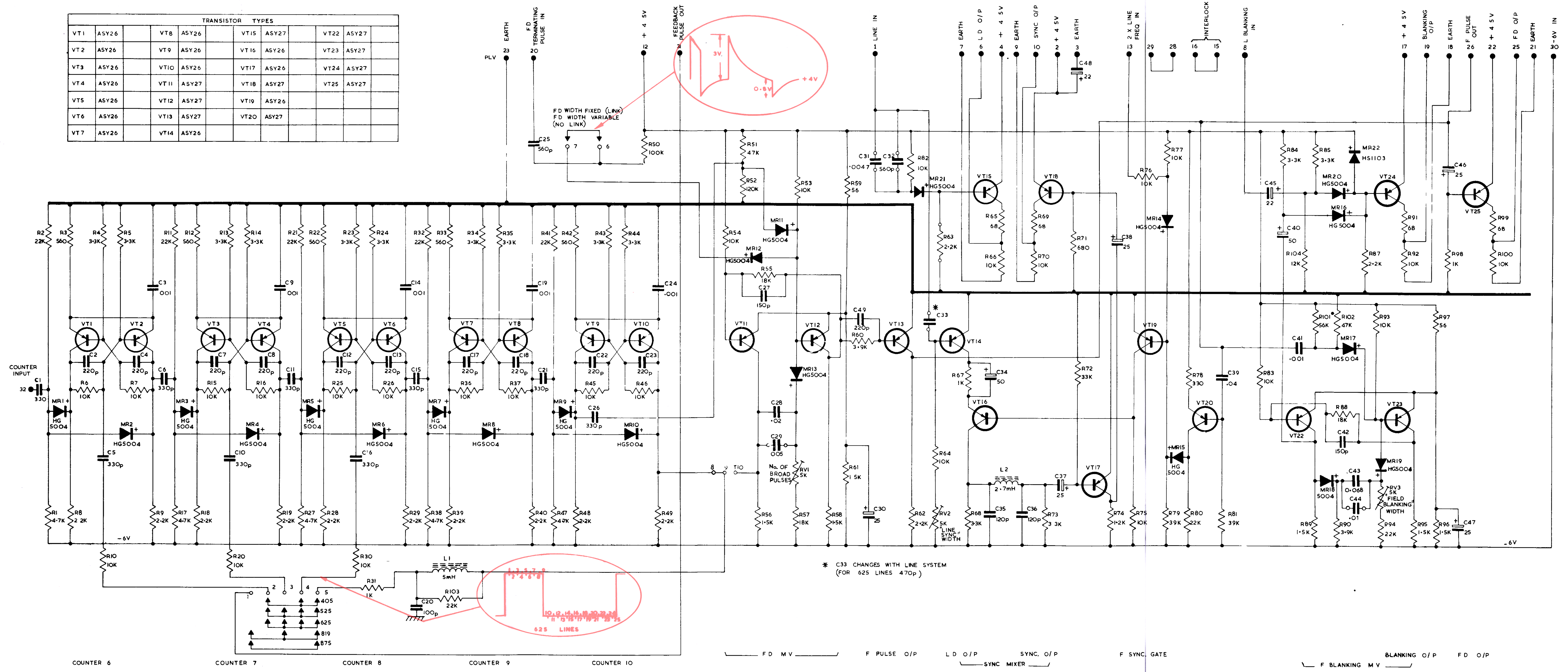
Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	13	C30	22			R4	44	R33	55	R62	57	R91	67	VT2	82
C2	14	C31	12	MR1	33	R5	44	R34	44	R63	57	R92	56	VT3	82
C3	15	C32	21	MR2	33	R6	56	R35	44	R64	56	R93	56	VT4	82
C4	14	C33	18	MR3	33	R7	56	R36	56	R65	67	R94	36	VT5	82
C5	13	C34	8	MR4	33	R8	57	R37	56	R66	56	R95	43	VT6	82
C6	13	C35	19	MR5	33	R9	57	R38	53	R67	39	R96	43	VT7	82
C7	14	C36	19	MR6	33	R10	56	R39	57	R68	44	R97	65	VT8	82
C8	14	C37	22	MR7	33	R11	54	R40	57	R69	67	R98	39	VT9	82
C9	15	C38	22	MR8	33	R12	55	R41	54	R70	56	R99	67	VT10	82
C10	13	C39	5	MR9	33	R13	44	R42	55	R71	60	R100	56	VT11	81
C11	13	C40	8	MR10	33	R14	44	R43	44	R72	61	R101	69	VT12	81
C12	14	C41	15	MR11	33	R15	56	R44	44	R73	44	R102	37	VT13	81
C13	14	C42	17	MR12	33	R16	56	R45	56	R74	62	R103	54	VT14	82
C14	15	C43	5	MR13	33	R17	53	R46	56	R75	56	R104	68	VT15	81
C15	13	C44	90	MR14	33	R18	57	R47	53	R76	56			VT16	82
C16	13	C45	85	MR15	33	R19	57	R48	57	R77	56			VT17	82
C17	14	C46	22	MR16	33	R20	56	R49	57	R78	46			VT18	81
C18	14	C47	22	MR17	33	R21	54	R50	59	R79	63			VT19	82
C19	15			MR18	33	R22	55	R51	37	R80	54			VT20	81
C20	16	C49	14	MR19	33	R23	44	R52	36	R81	63				
C21	13			MR20	33	R24	44	R53	56	R82	56			VT22	81
C22	14			MR21	33	R25	56	R54	56	R83	56			VT23	81
C23	14			MR22	34	R26	56	R55	64	R84	44			VT24	81
C24	15					R27	53	R56	43	R85	44			VT25	81
C25	21					R28	57	R57	64			RV1	74		
C26	13					R29	57	R58	43	R87	57	RV2	74		
C27	17			R1	53	R30	56	R59	65	R88	64	RV3	74		
C28	20	L1	26	R2	54	R31	39	R60	66	R89	43				
C29	23	L2	27	R3	55	R32	54	R61	43	R90	66	VT1	82		

MISCELLANEOUS MECHANICAL ITEMS

Board	No. 2
Mounting Pad	No.29
Terminal	No.75

TRANSISTOR TYPES

VT1	ASY26	VT8	ASY26	VT15	ASY27	VT22	ASY27
VT2	ASY26	VT9	ASY26	VT16	ASY26	VT23	ASY27
VT3	ASY26	VT10	ASY26	VT17	ASY26	VT24	ASY27
VT4	ASY26	VT11	ASY27	VT18	ASY27	VT25	ASY27
VT5	ASY26	VT12	ASY27	VT19	ASY26		
VT6	ASY26	VT13	ASY27	VT20	ASY27		
VT7	ASY26	VT14	ASY26				



B99 – 0029Z. SH.1.
ISSUE. 5

V321 SERIES
CAMERA CONTROL UNIT

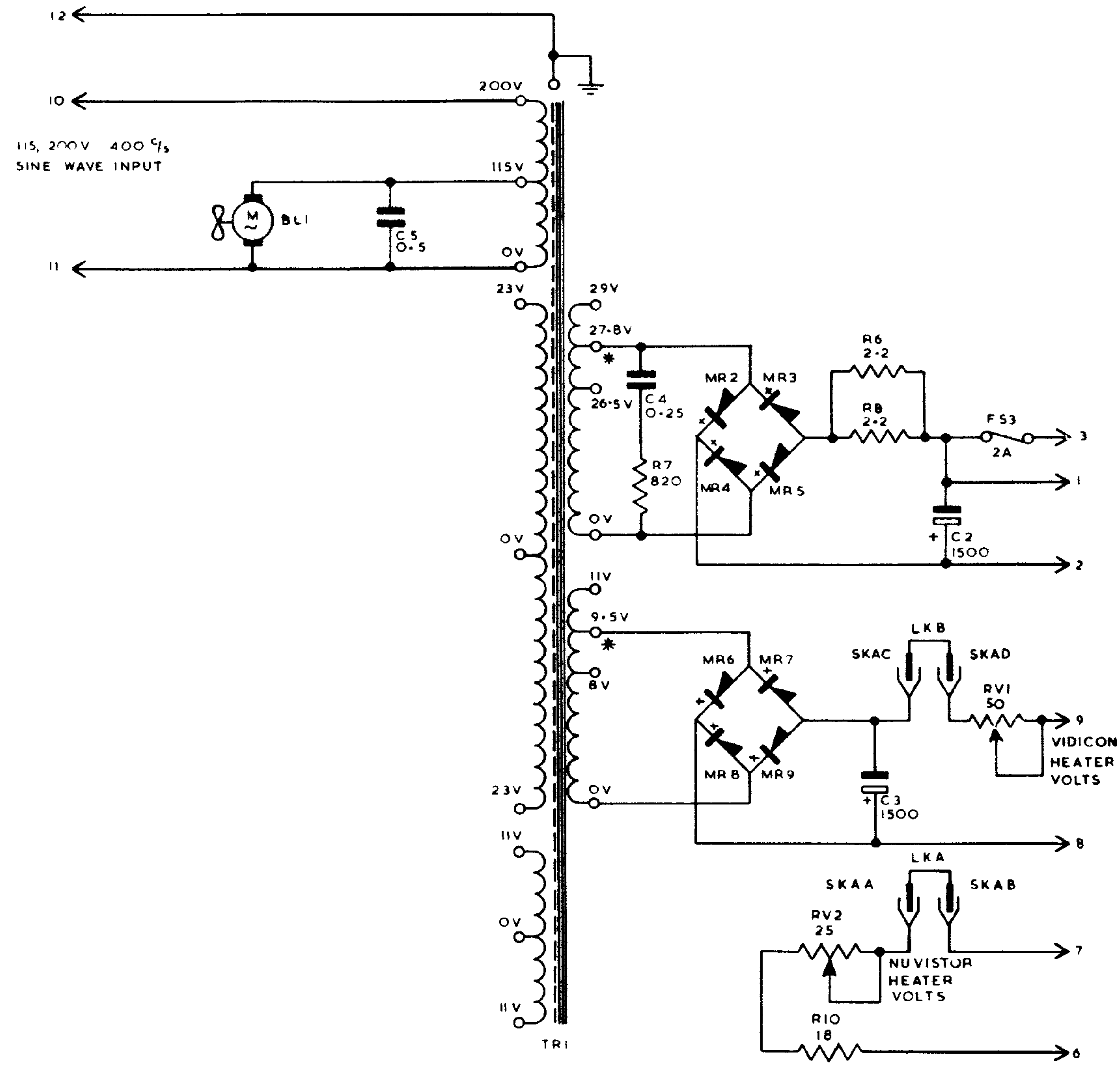
SYNC. PULSE GENERATOR BOARD 2. B99-0029-01. FIG. III.
CIRCUIT

POWER SUPPLY UNIT
(VB02-3215-01)
(Refer to Master Components List T6768 List 2A)
Cross Reference List
for VB02-3215Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C2	4			M1	15	MR3	45	MR6	45	MR9	45	RV1	44	TR1	34
C3	4	FS3	17			MR4	45	MR7	45			RV2	28		
C5	5			MR2	45	MR5	45	MR8	45						

MISCELLANEOUS MECHANICAL ITEMS

Board Assembly	No. 1
Clamp Assembly	No. 7
Cleat	No. 8
Clip	No.10
Cover	No.12
Fuseholder	No.18
Grommet	No.20
Grommet	No.21
Insulator	No.22
Mounting Plate	No.23
Rectifier Fittings	No.26
Tag Board Assembly	No.29
Terminals	No.31



NOTES

1 ✱ ADJUST TO GIVE CORRECT OUTPUT VOLTAGE

2 EXTERNAL CONNECTIONS GO TO TB2 ON CAMERA CONTROL UNIT SEE VB20-3215Z SH 1 THE LEAD Nos GOING TO CORRESPONDING Nos ON TB2

COMP	TYPE		COMP	TYPE	
MR2	BYX38-300		MR7	BYX38-300	
MR3	BYX38-300		MR8	BYX38-300	
MR4	BYX38-300		MR9	BYX38 300	
MR5	BYX38-300				
MR6	BYX38-300				

VB02-3215Z SH 1.
ISSUE 3

POWER SUPPLY UNIT 400 c/s
VB02-3215-01 CIRCUIT
V321 SERIES CAMERA CHANNEL

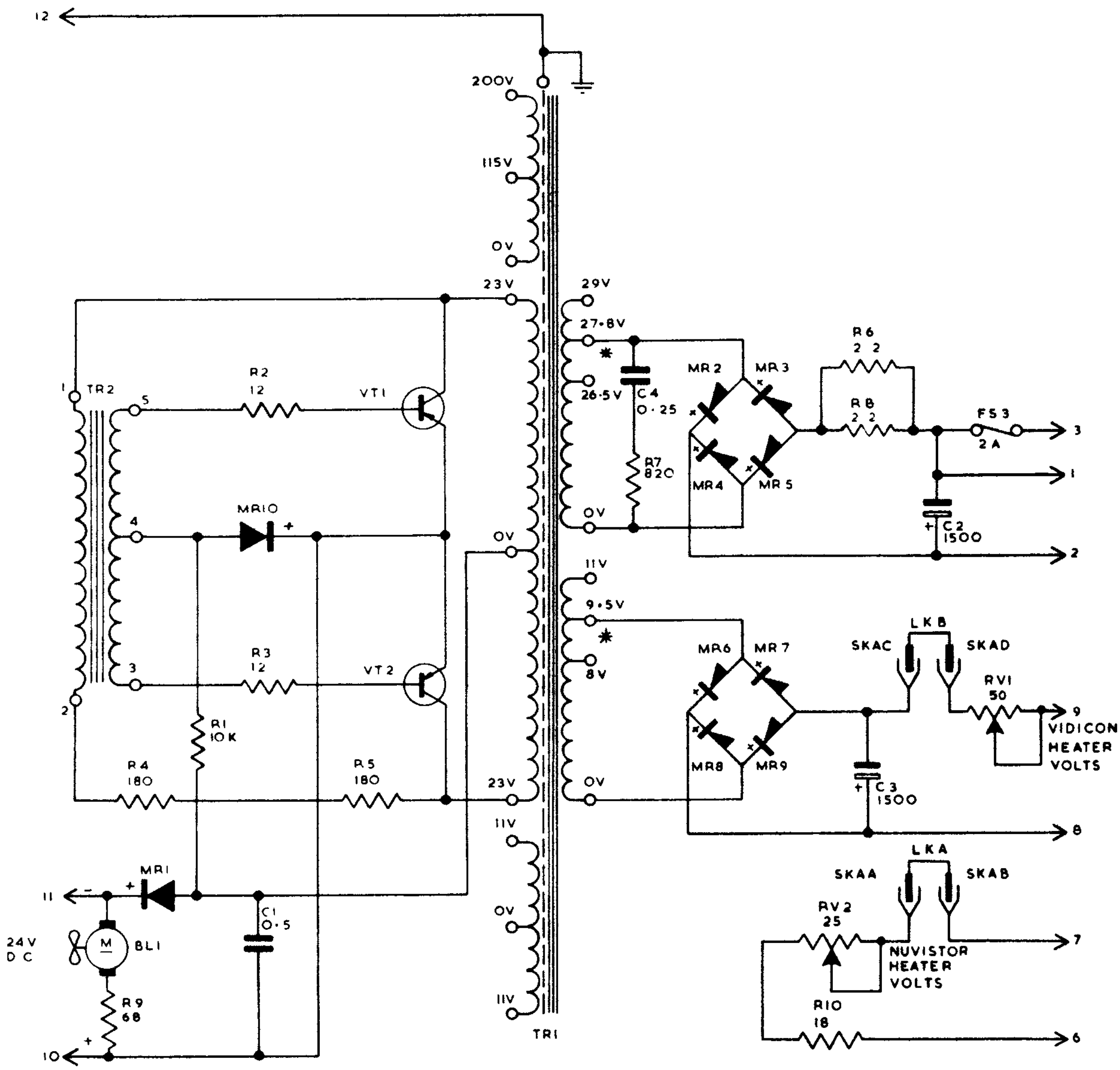
FIG.112.

POWER SUPPLY UNIT
(VB03-3215-01)
(Refer to Master Components List T6768 List 2A)
Cross Reference List
for VB03-3215Z

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	5	FS3	17	MR1	45	MR5	45	MR9	45	RV2	28				
C2	4			MR2	45	MR6	45								
C3	4	M1	16	MR3	45	MR7	45			TR1	34	VT1	32		
				MR4	45	MR8	45	RV1	27	TR2	35	VT2	32		

MISCELLANEOUS MECHANICAL ITEMS

Board Assembly	No. 2
Clamp Assembly	No. 7
Cleat	No. 8
Clip	No.11
Cover	No.12
Fuseholder	No.18
Grommet	No.20
Grommet	No.21
Insulator	No.22
Mounting Plate	No.23
Rectifier Fittings	No.26
Tag Board Assembly	No.30
Terminal	No.31



NOTES

1 ✱ ADJUST TO GIVE CORRECT OUTPUT VOLTAGE

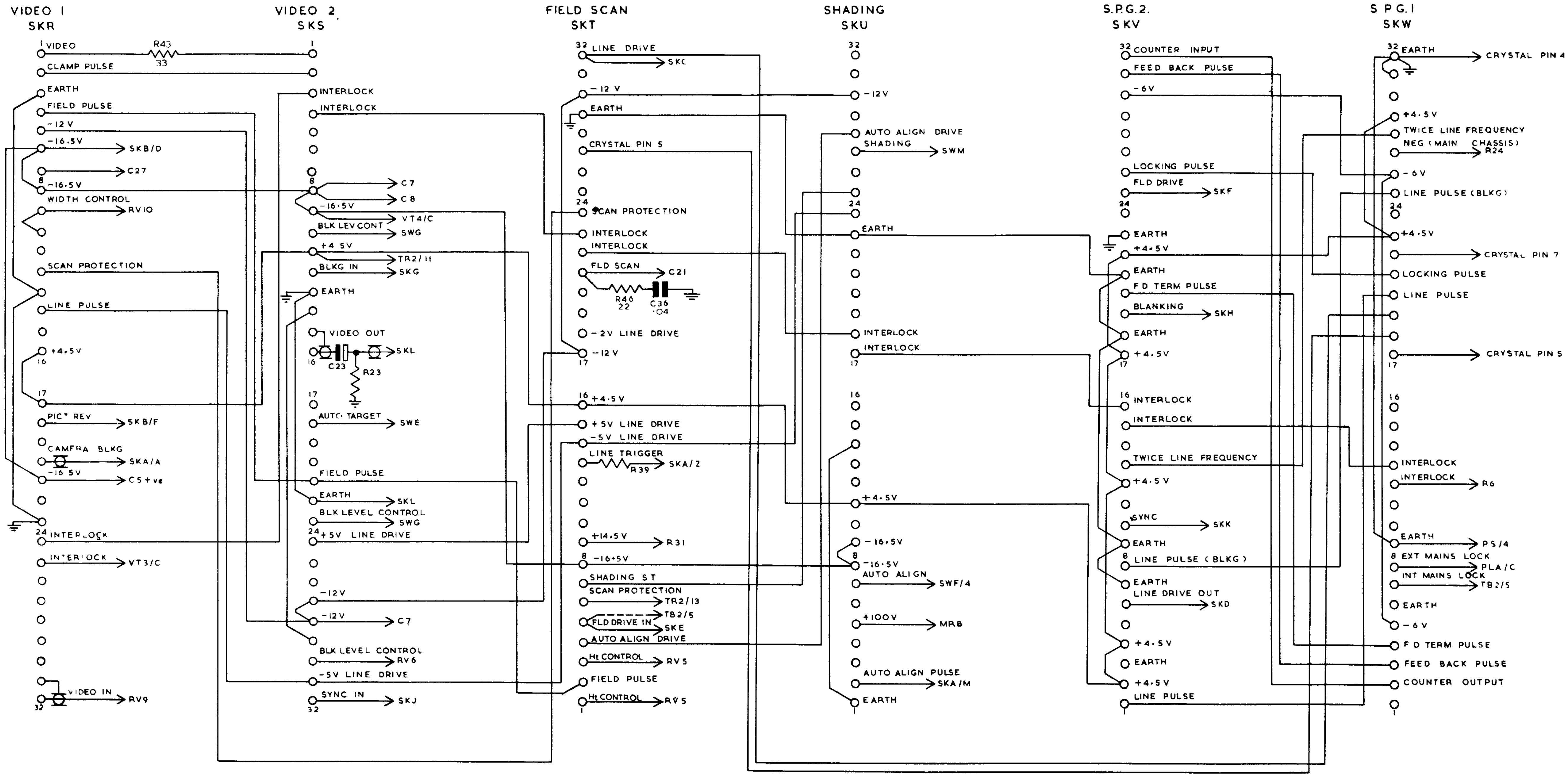
2 EXTERNAL CONNECTIONS GO TO TB2 ON CAMERA CONTROL UNIT SEE VB20-3215Z SH 1 THE LEAD Nos GOING TO CORRESPONDING Nos ON TB2

COMP	TYPE		COMP	TYPE	
MR1	BYX38-300		MR7	BYX38-300	
MR2	BYX38-300		MR8	BYX38-300	
MR3	BYX38-300		MR9	BYX38 300	
MR4	BYX38-300		MR10	1G8	CV7026
MR5	BYX38-300		VT1	OC28	CV7085
MR6	BYX38 300		VT2	OC28	CV7085

VB03-3215Z SH 1.
ISSUE 2

POWER SUPPLY UNIT. 22-30V d.c.
VB03-3215-01 CIRCUIT
V321 SERIES CAMERA CHANNEL

FIG. 113.

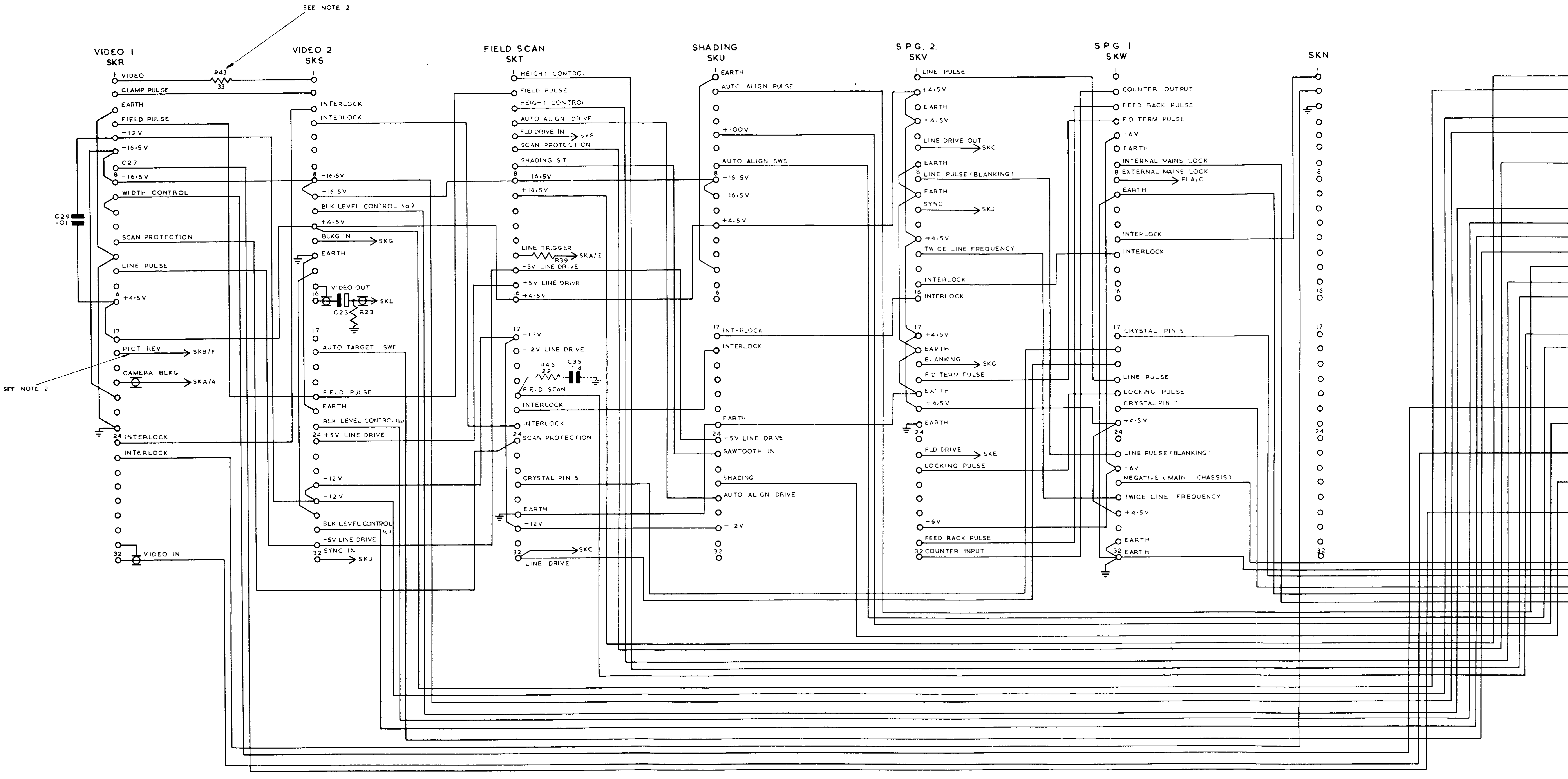


B99-1061 SH.1
ISSUE 4

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA CONTROL UNIT. V321-5
INTERCONNECTIONS.

FIG. 114.



NOTES

1 FOR OTHER CONNECTIONS TO SKN & PLP SEE DRAWING No. VB20-3216Z

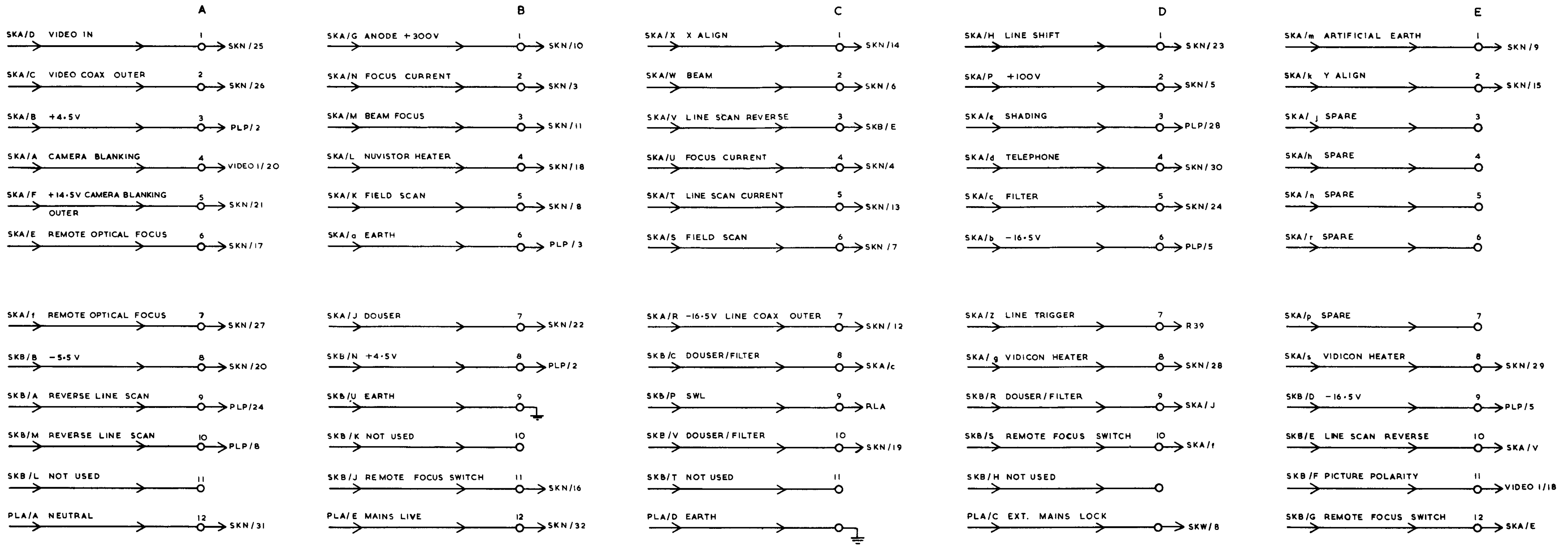
2 ITEM R43, SHOWN BETWEEN SKR/1 & SKS/1 & PICTURE REVERSAL FACILITY SKR/18, ARE NOT REQUIRED ON VB20-3216-02

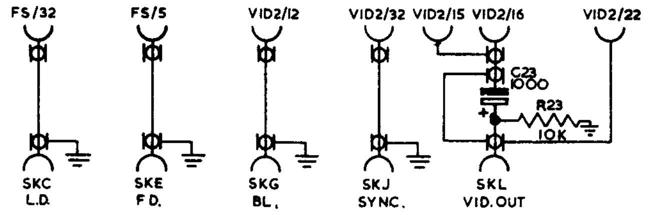
V321 SERIES
VIDICON CAMERA CHANNEL.

CAMERA CONTROL UNIT. V321-6
INTERCONNECTIONS.

FIG. 115.

B99-1062 SH1
ISSUE 4

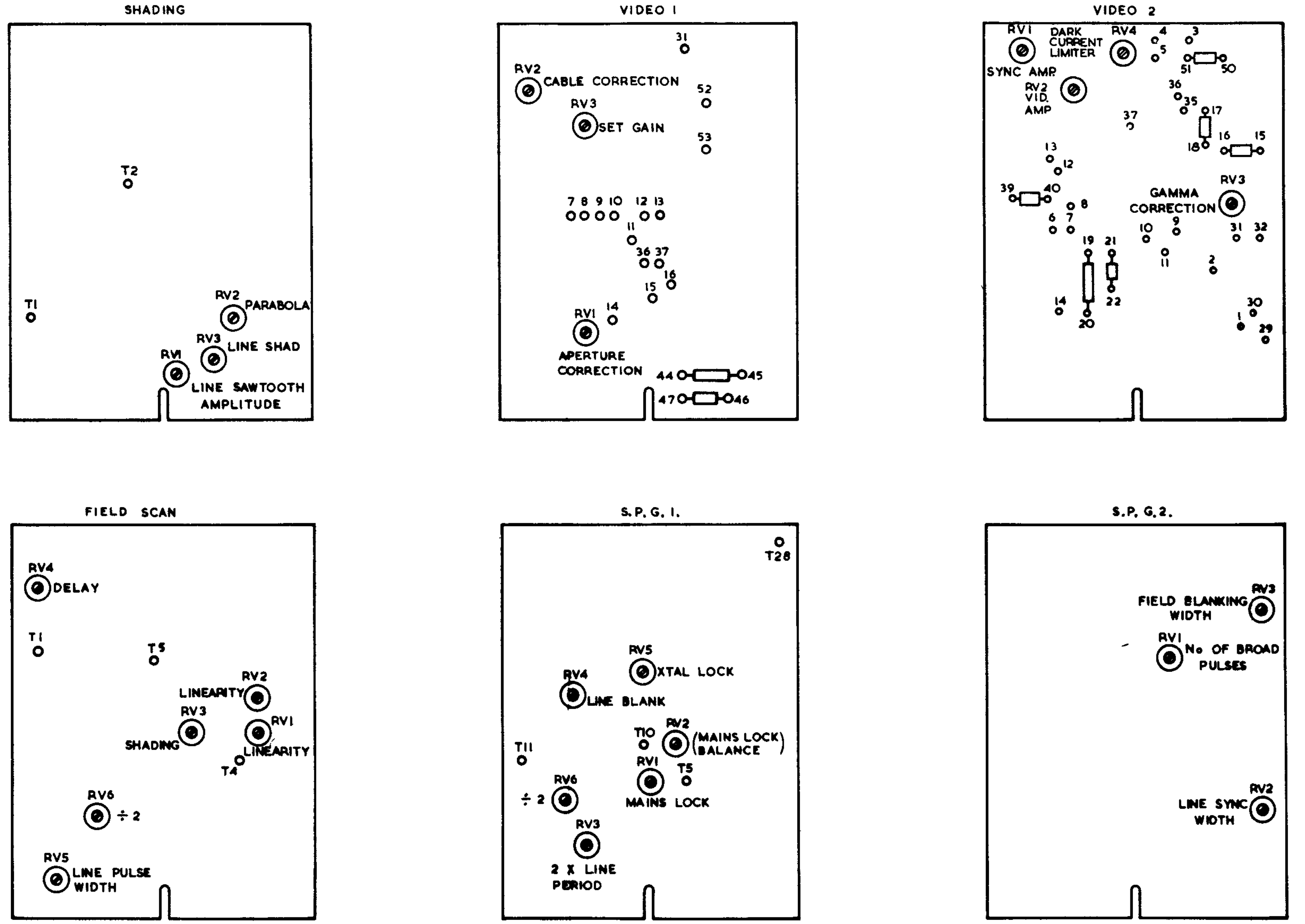




VB10-3216Z SH1
ISSUE 2

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA CONTROL UNIT.
BACK PANEL SPADE TERMINATIONS.
VB10-3216-01 CIRCUIT FIG. 116.

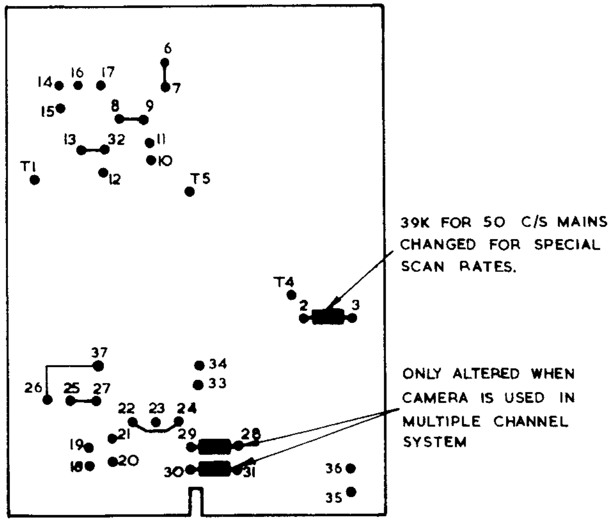


B99 - 0897 SH. 1.
ISSUE 1.

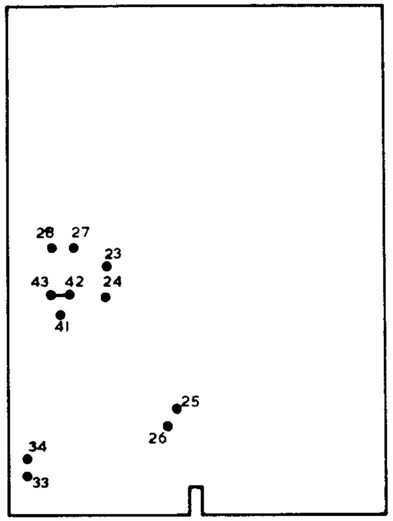
V321 SERIES
VIDICON CAMERA CHANNEL

PRE - SET CONTROLS
& TEST POINTS FOR C.C.U. FIG. 117.

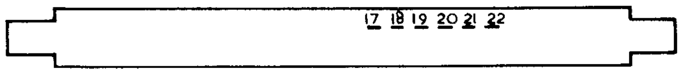
LINKS ON FIELD SCAN BOARD
WHEN DRIVEN BY SYNC PULSE
GENERATOR



LINK ON VIDEO 2 WHEN DRIVEN
BY SYNC PULSE GENERATOR



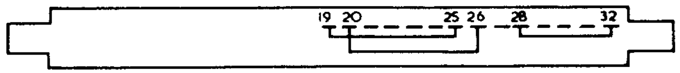
SYNC PULSE GENERATOR 1 SOCKET



V3215 ONLY

WHEN USING SYNC PULSE GENERATOR

FIELD SCAN BOARD SOCKET SKT



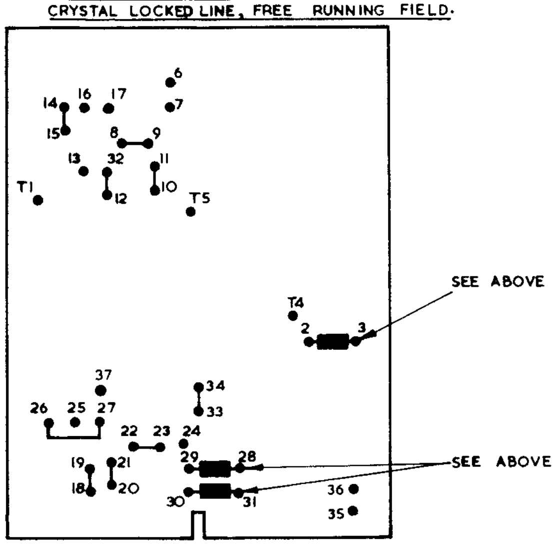
V3216 ONLY

WHEN USING S.P.G. AND EXTERNAL DRIVES.

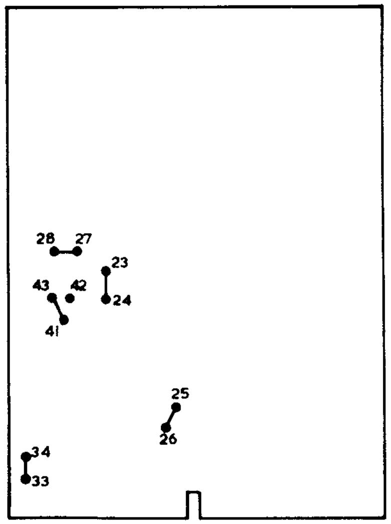
NOTE.
WHEN USING RANDOM INTERLACE, CRYSTAL LOCKED LINE, MAINS LOCKED FIELD. THE CONNECTIONS ARE AS FOR FREE RUNNING FIELD. WITH THE FOLLOWING EXCEPTIONS.

T6 LINKED TO T8
T7 LINKED TO T9
T16 LINKED TO T17
T35 LINKED TO T36
T8 NOT LINKED TO T9

LINKS ON FIELD SCAN BOARD
WHEN USING RANDOM INTERLACE,
CRYSTAL LOCKED LINE, FREE RUNNING FIELD.



LINKS ON VIDEO 2 WHEN USING
RANDOM INTERLACE (BOTH TYPES)

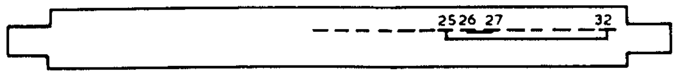


SYNC PULSE GENERATOR 1 SOCKET

V3215 ONLY

CONNECTIONS TO BE MADE WHEN
USING RANDOM INTERLACE,
CRYSTAL LOCKED LINE, FREE RUNNING
FIELD AND ALSO MAINS LOCKED FIELD.

FIELD SCAN BOARD SOCKET SKT



V3216 ONLY

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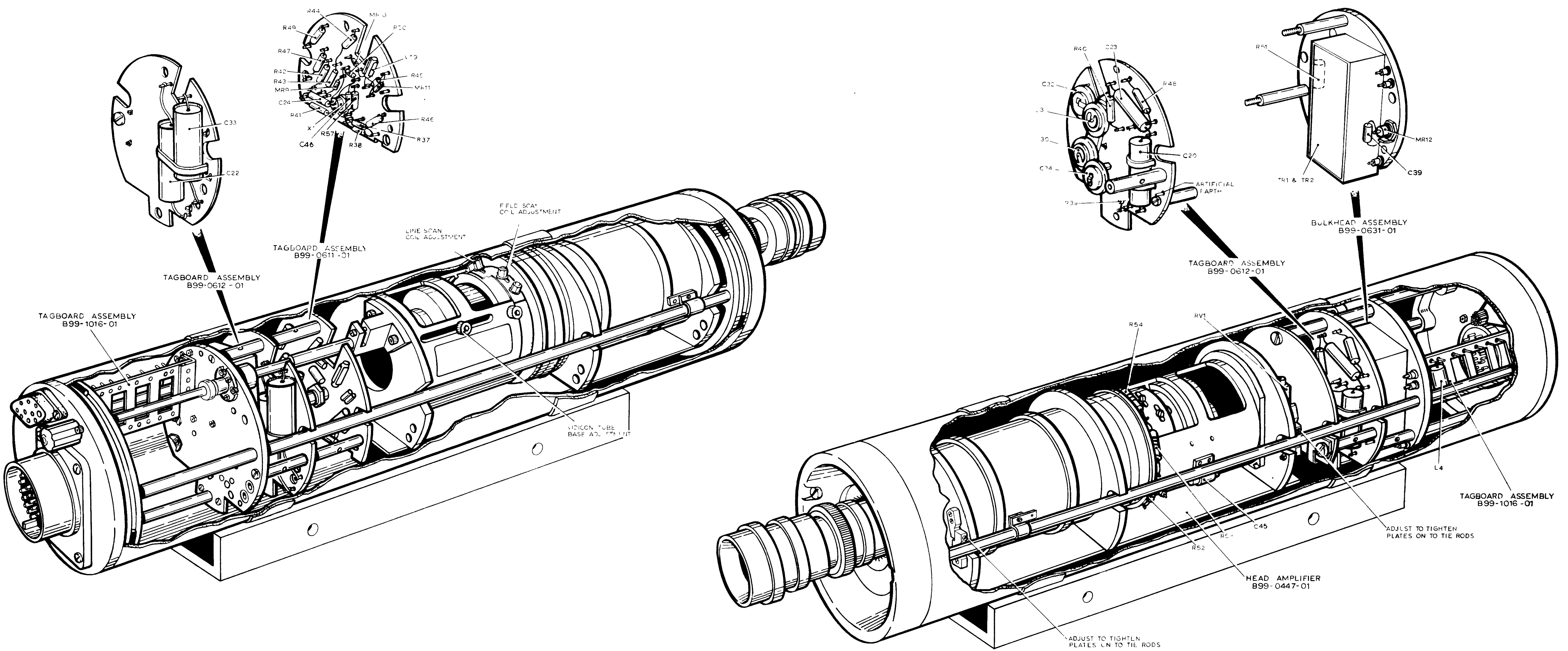
ISSUE 2

V321 SERIES
VIDICON CAMERA CHANNEL

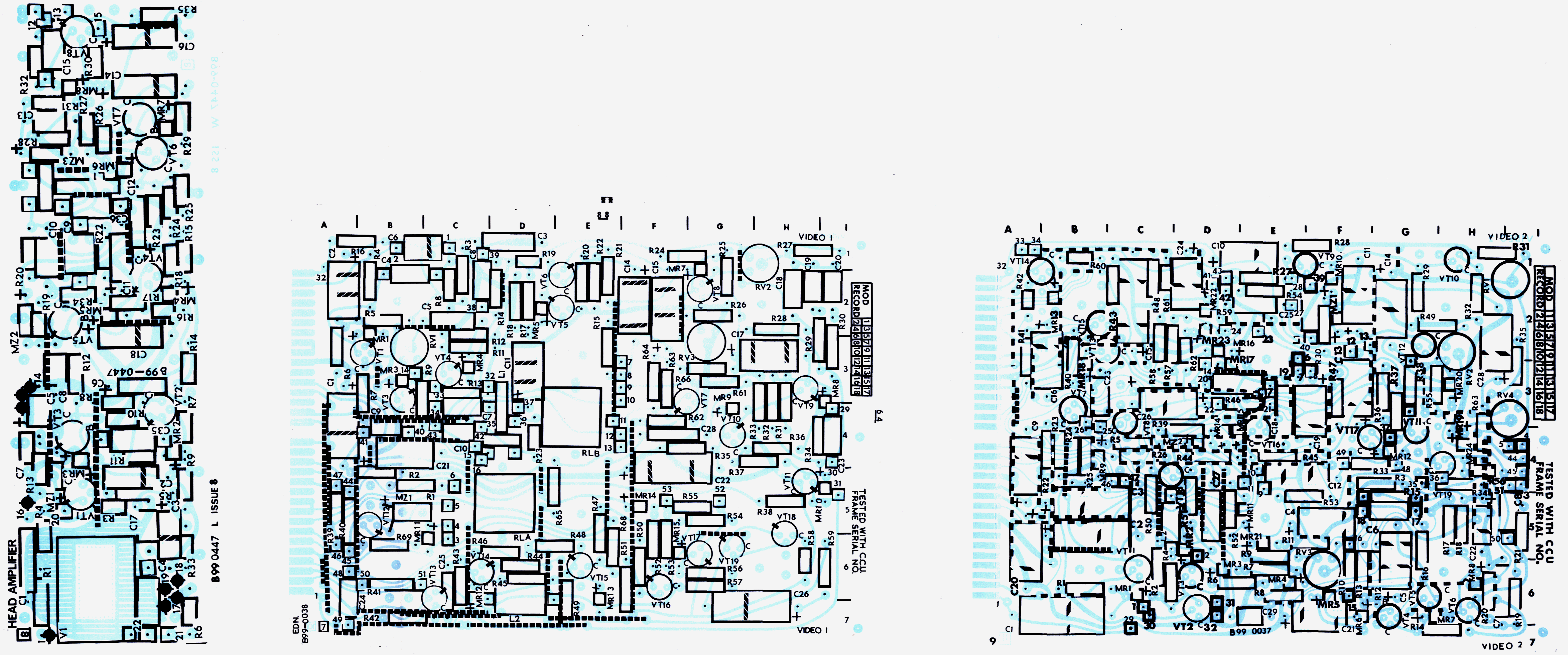
LINKS FOR VARIOUS
MODES OF OPERATION FOR C.C.U. FIG.118.



V321 SERIES
VIDICON CAMERA CHANNEL

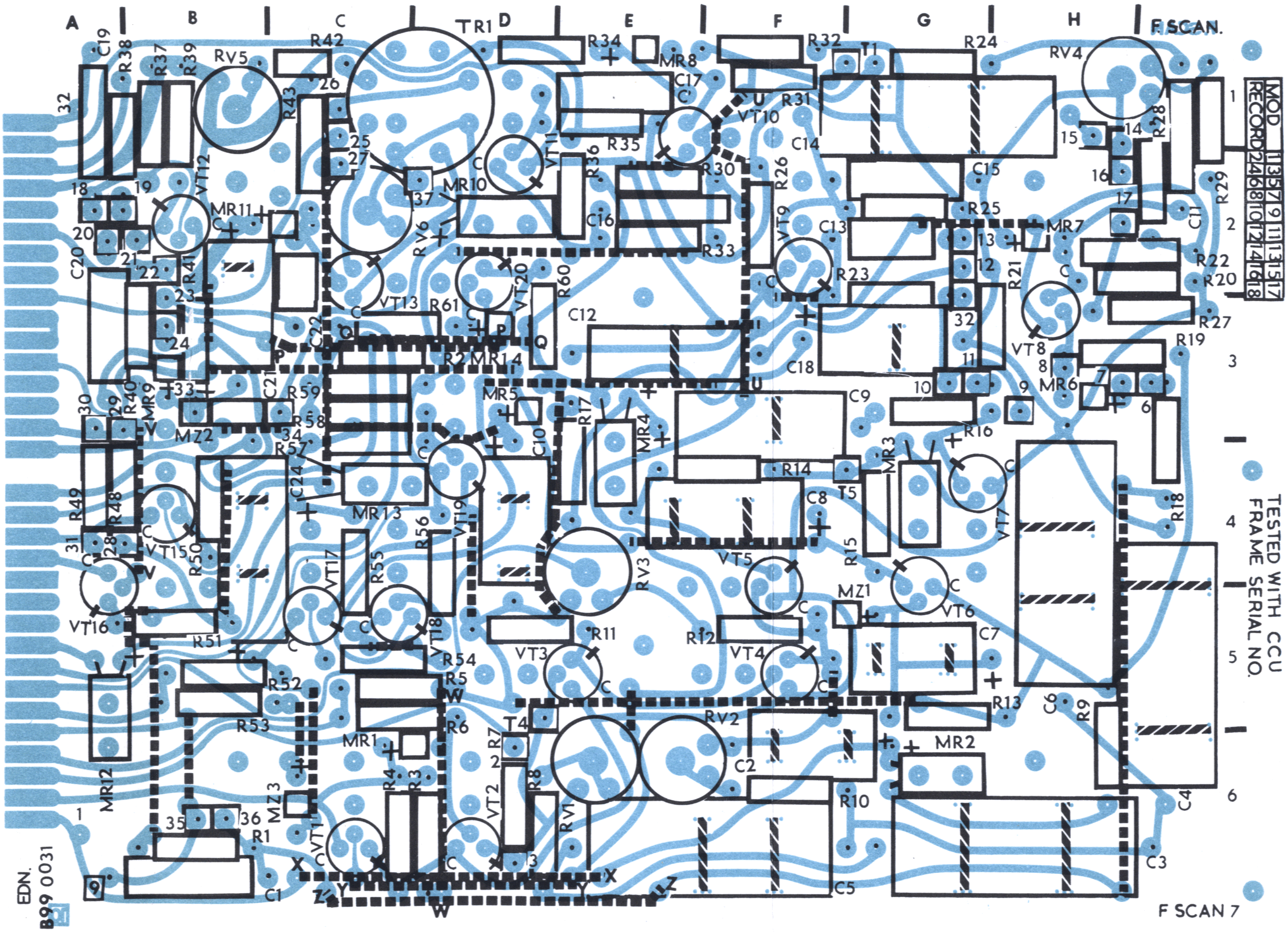
CAMERA. TYPE V321-1.
MECHANICAL LAYOUT. FIG.119.

B99-1278 Sh 1
ISSUE 5



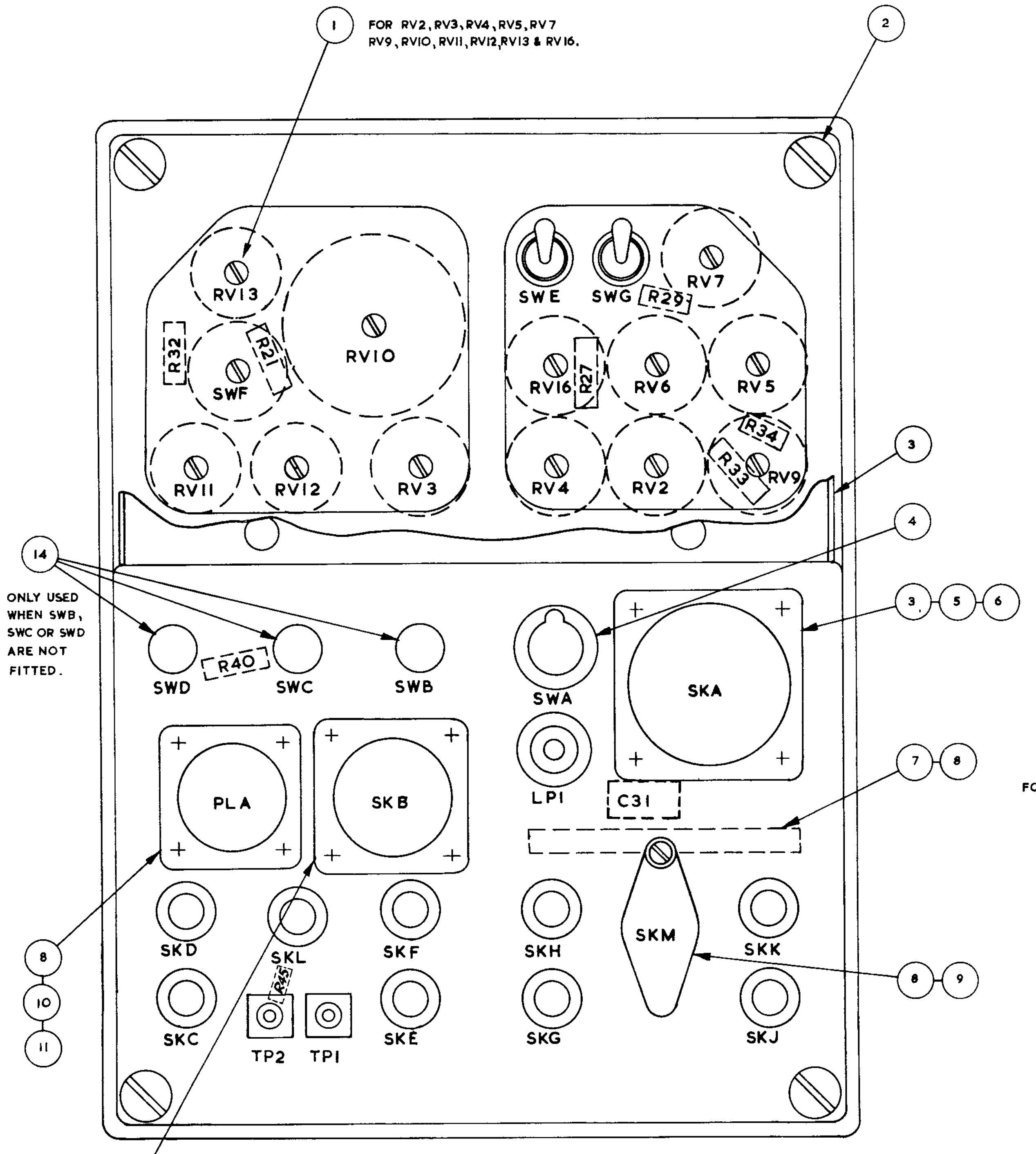
COMPONENT LAYOUT
VIDEO CIRCUITS

FIG.120

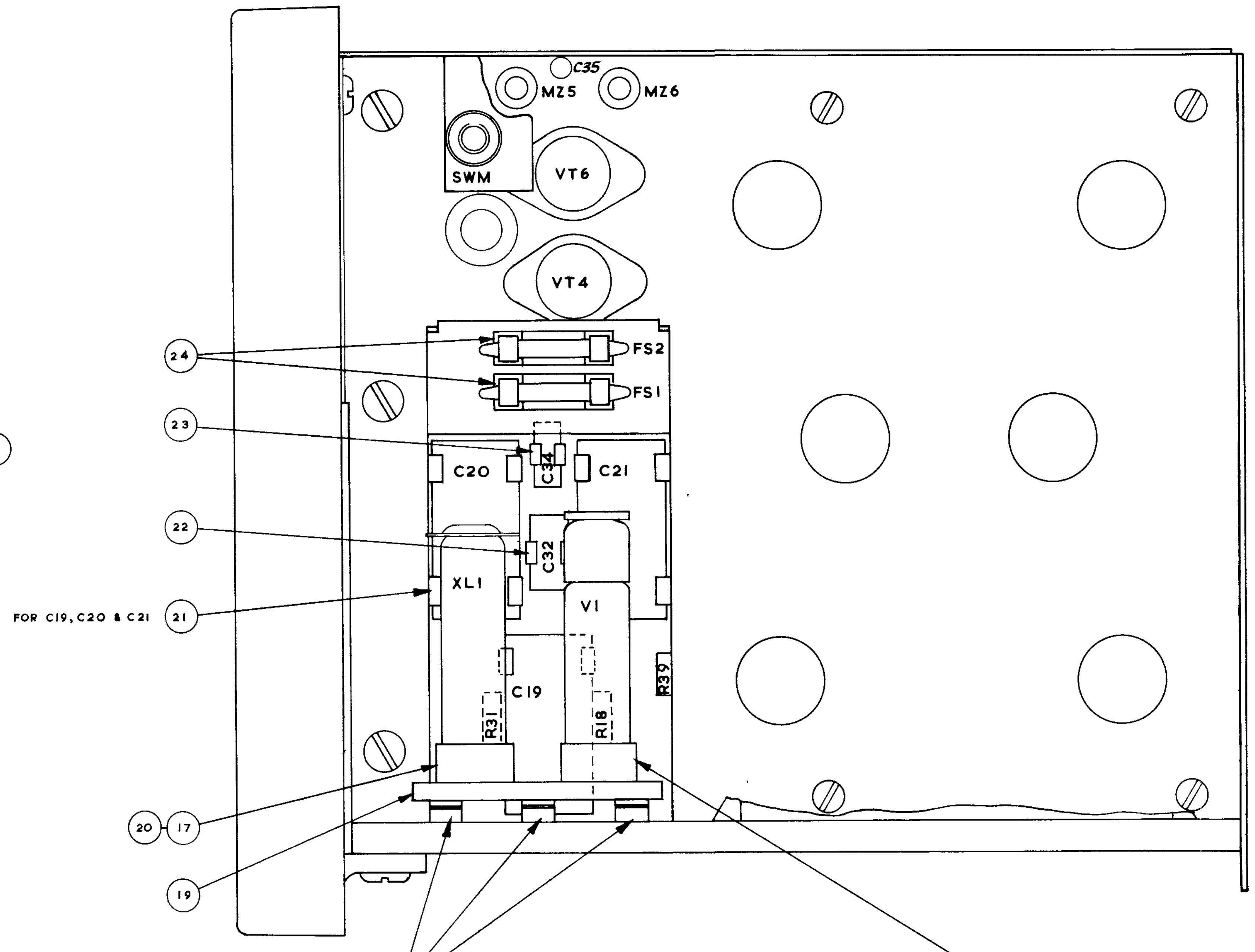


COMPONENT LAYOUT
FIELD SCAN

FIG.121



VIEW ON FRONT
OF UNIT



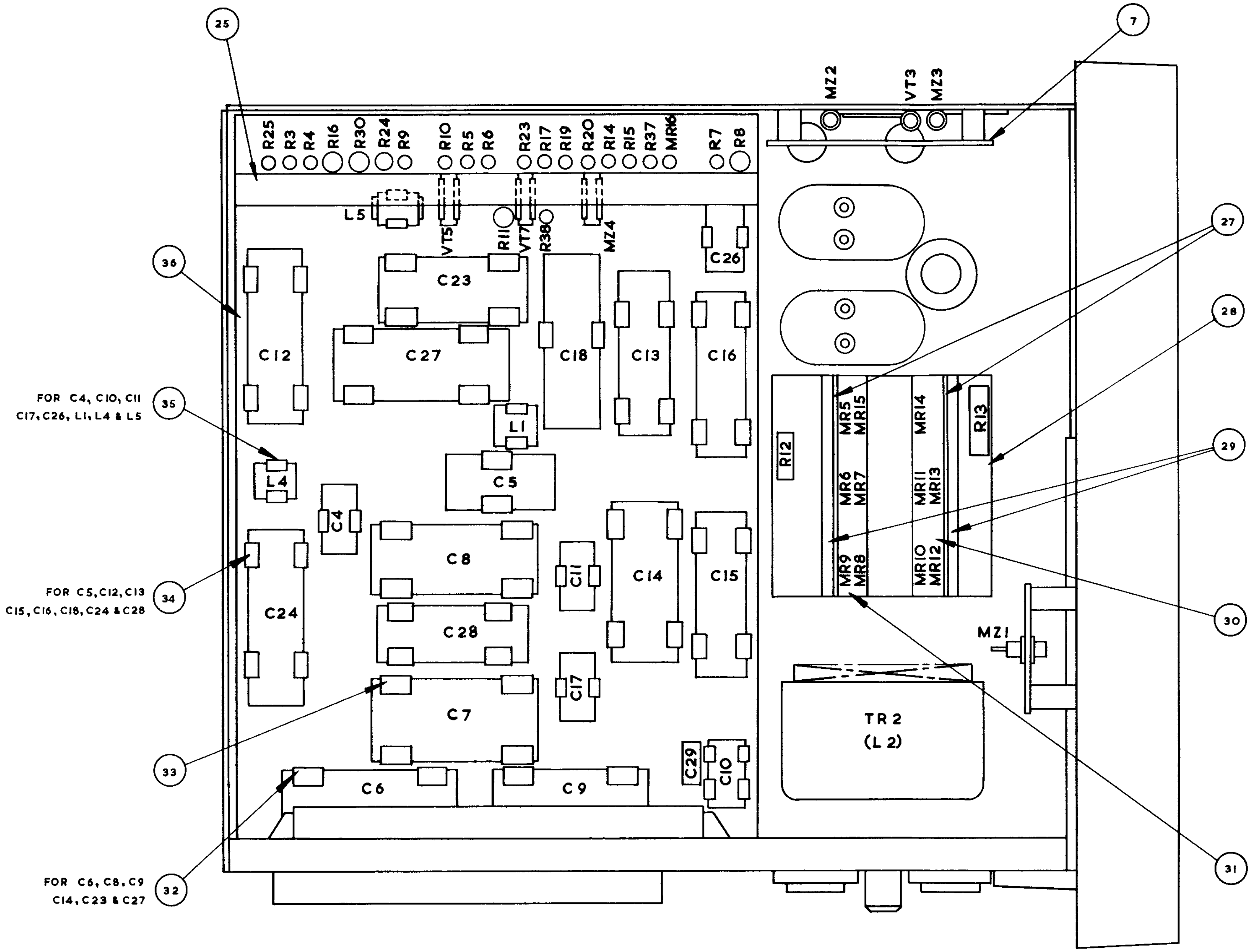
VIEW ON R.H. SIDE
OF UNIT

CONTROL & CONNECTOR FUNCTIONS		
REF.	FUNCTION	SHOWN ON SHT.
SWA	SUPPLY ON—OFF	1.
SWB	DOUSER FILTER — UNCAP	1.
SWC	FOCUS FAST — SLOW	1.
SWD	FOCUS FAR — NEAR	1.
SWE	AUTO TARGET ON — OFF	1,
SWF	AUTO ALIGN ON — OFF	1.
SWG	AUTO BLACK LEVEL ON — OFF	1
SWM	SHADING ON — OFF	1.
PLA	SUPPLY	1.
SKA	CAMERA	1.
SKB	REMOTE CONTROL	1.
SKC	LINE DRIVE 1	1.
SKD	LINE DRIVE 2	1
SKE	FIELD DRIVE 1	1.
SKF	FIELD DRIVE 2	1
SKG	BLANKING 1	1.
SKH	BLANKING 2	1.
SKJ	SYNC 1	1
SKK	SYNC 2	1
SKL	VIDEO OUT	1.
SKM	AUXILIARY	1.
SKR	VIDEO 1	2.
SKS	VIDEO 2	2
SKT	FIELD SCAN	2.
SKU	SHADING	2.
SKV	SYNC GEN 2	2.
SKW	SYNC GEN 1	2.
RV2	BEAM	1
RV3	FOCUS	1.
RV4	TARGET	1.
RV5	HEIGHT	1.
RV6	BLACK LEVEL	1.
RV7	VERTICAL SHIFT	1
RV9	GAIN	1.
RV10	WIDTH	1.
RV11	'X' ALIGN.	1
RV12	'Y' ALIGN	1.
RV13	HORIZONTAL SHIFT	1.
RV16	TARGET LIMIT	1.

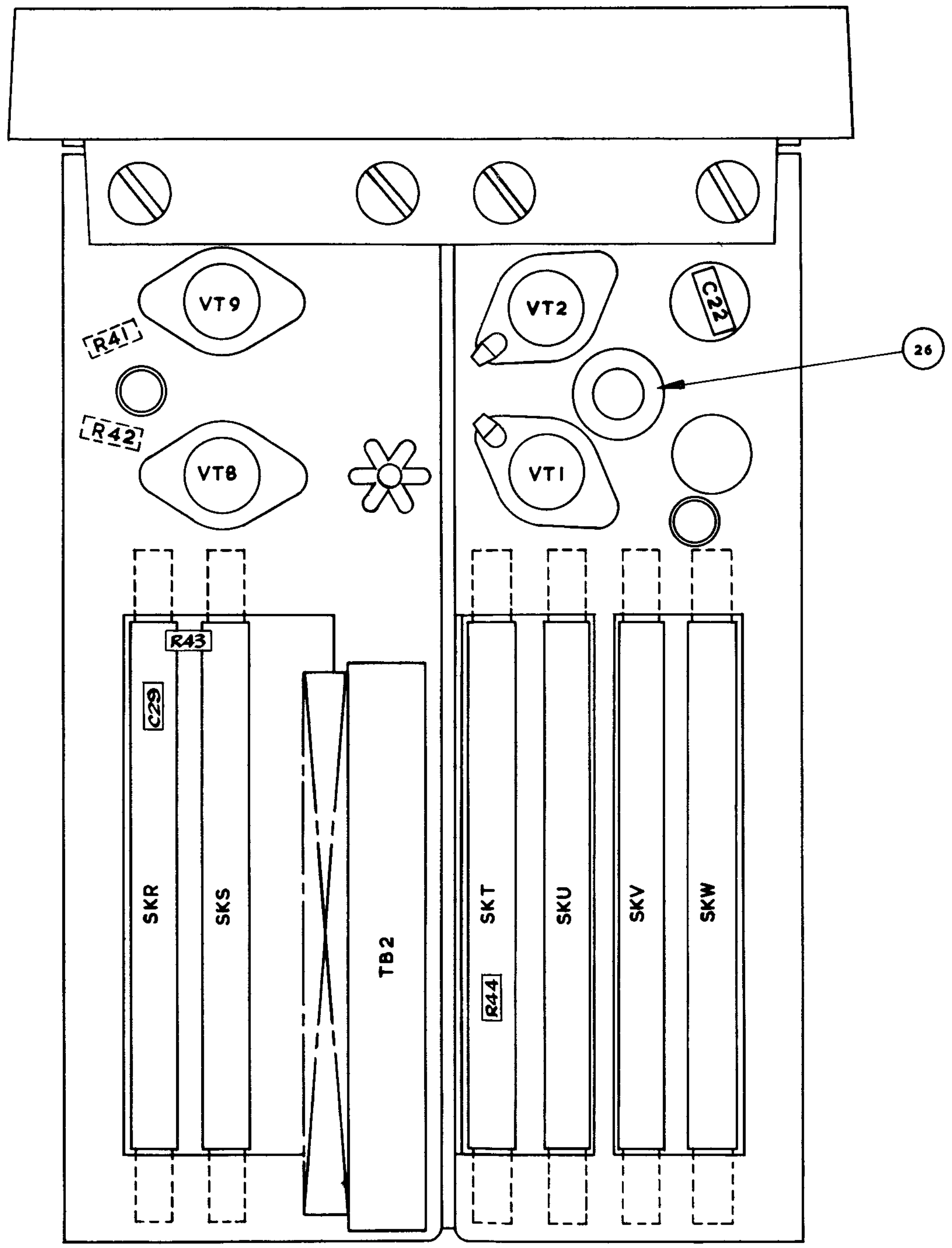
VB20-3215M SH.1
ISSUE 2.

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA CONTROL UNIT V321-5
VB20-3215-01 COMPONENT LAYOUT FIG.122



VIEW ON L.H. SIDE
OF UNIT



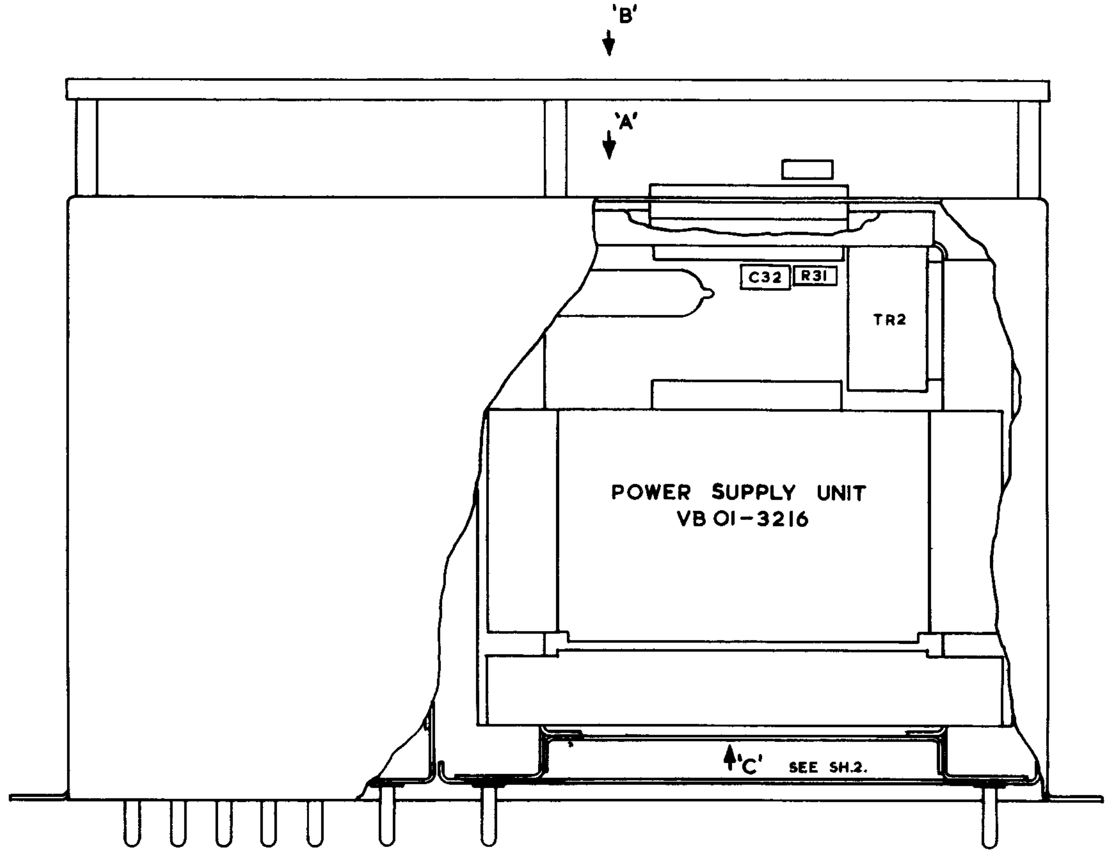
VIEW ON UNDERSIDE
OF UNIT

MISCELLANEOUS MECHANICAL ITEMS.	
REF.	DESCRIPTION.
1	NUT SPINDLE GRIPPING
2	SEALING WASHER
3	SEALING WASHER
4	COVER SPLASH PROOF
5	GASKET
6	PROTECTIVE CAP
7	TAGSTRIP ASSY.
8	SEALING WASHER
9	DUST CAP
10	GASKET
11	PROTECTIVE CAP
12	GASKET
13	PROTECTIVE CAP
14	BUTTON PLUG
15	VALVE RETAINER
16	VALVE TOP CAP
17	VALVEHOLDER
18	SHOCK ABSORBER
19	VALVE MOUNT
20	VALVE RETAINER
21	CLIP
22	CLIP
23	CLIP
24	FUSEHOLDER
25	TAGSTRIP ASSY.
26	GROMMET
27	GASKET
28	TAGBOARD ASSY.
29	CLAMP
30	RECTIFIER BLOCK
31	RECTIFIER BLOCK
32	CLIP
33	CLIP
34	CLIP
35	CLIP
36	TAGBOARD ASSY.

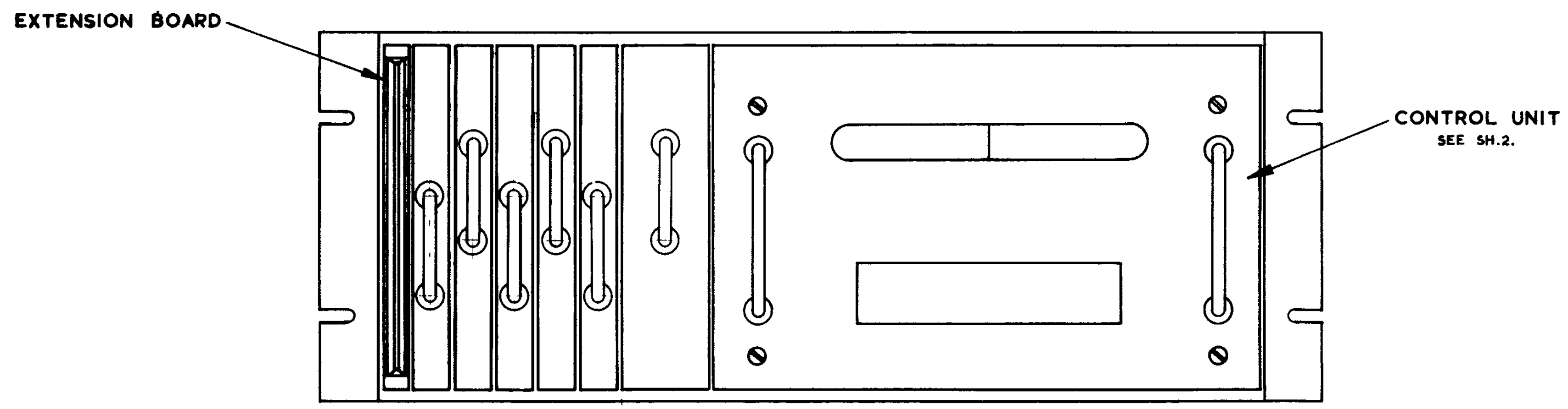
VB20-3215 M SH 2.
ISSUE 2

V321 SERIES
VIDICON CAMERA CHANNEL

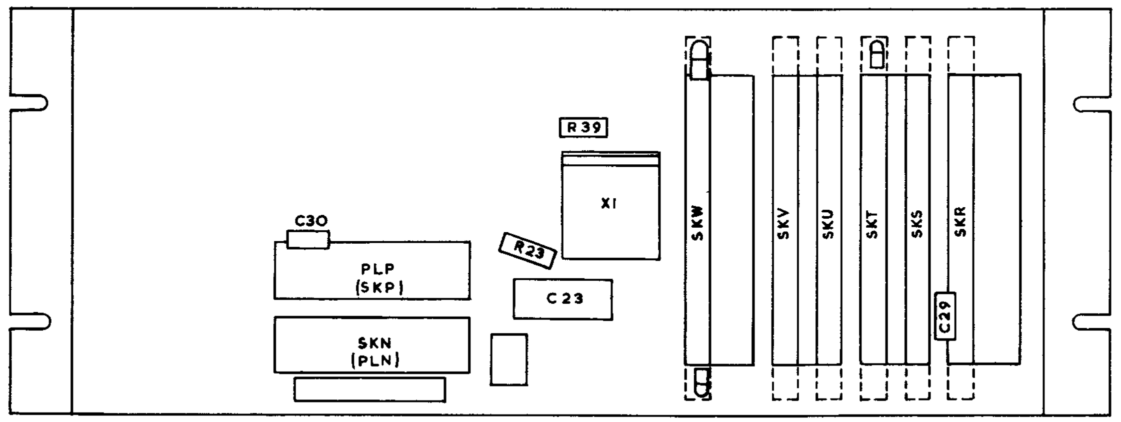
CAMERA CONTROL UNIT V321-5
VB20-3215-01 COMPONENT LAYOUT FIG.123



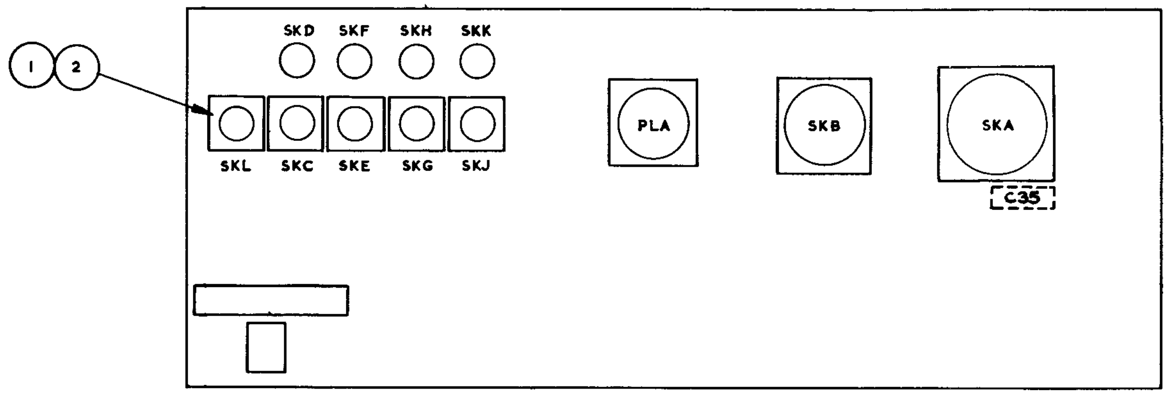
VIEW ON TOP OF UNIT.



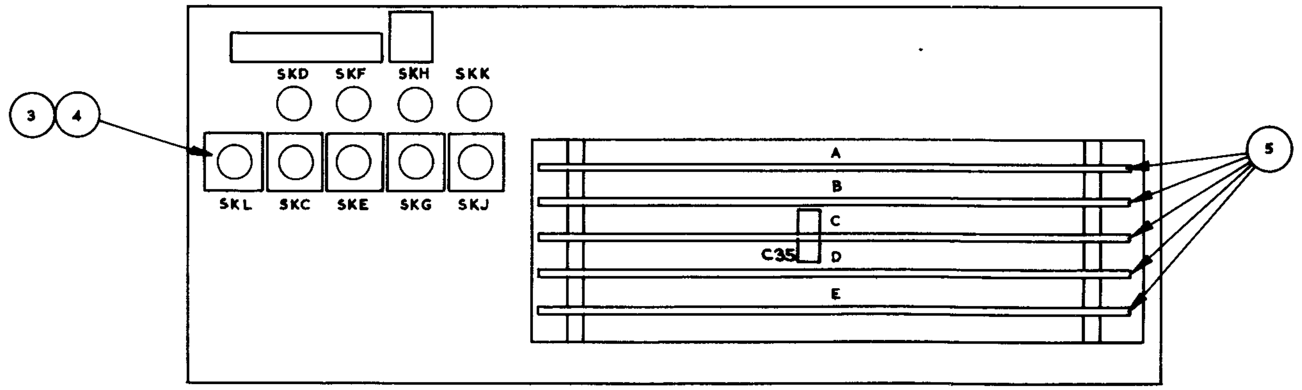
VIEW ON FRONT OF UNIT.



VIEW ON ARROW 'A'



VIEW ON ARROW 'B'
BACK PANEL CONNECTORS VB11-3216



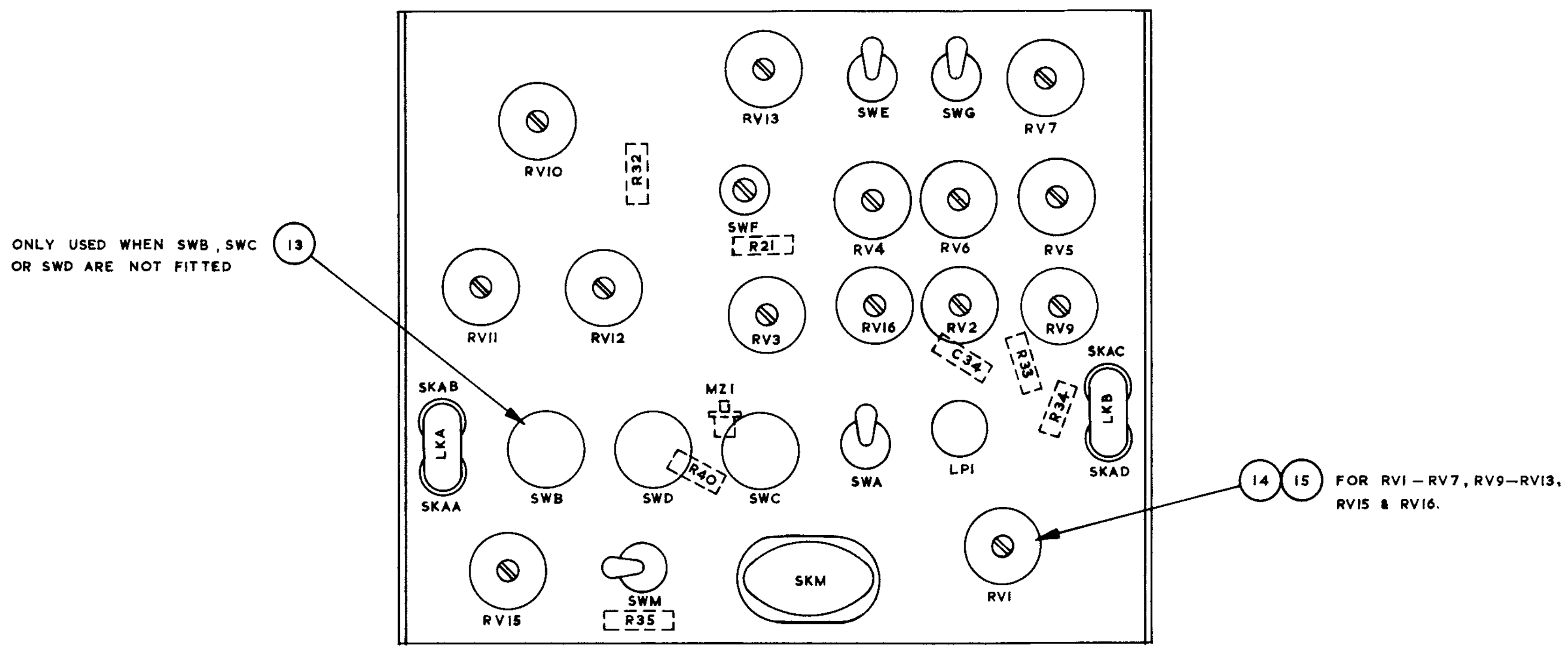
VIEW ON ARROW 'B'
BACK PANEL SPADE TERMINATIONS VB10-3216

CONTROL & CONNECTOR FUNCTION		
REF.	FUNCTION	SHOWN ON SH.
SWA	SUPPLY ON-OFF.	2.
SWB	DOUSER FILTER - UNCAP.	2.
SWC	FOCUS FAST - SLOW.	2.
SWD	FOCUS FAR - NEAR	2.
SWE	AUTO TARGET ON - OFF.	2.
SWF	AUTO ALIGN ON - OFF.	2.
SWG	AUTO BLACK LEVEL ON-OFF.	2.
SWM	SHADING ON - OFF.	2.
PLA	SUPPLY	1.
SKA	CAMERA.	1.
SKB	REMOTE CONTROL.	1.
SKC	LINE DRIVE 1.	1.
SKD	LINE DRIVE 2.	1
SKE	FIELD DRIVE 1.	1.
SKF	FIELD DRIVE 2.	1.
SKG	BLANKING 1.	1.
SKH	BLANKING 2.	1.
SKJ	SYNC 1.	1.
SKK	SYNC 2.	1.
SKL	VIDEO OUT.	1.
SKM	AUXILIARY.	2.
SKN	C.C.U.—C.U. INTERCONNECTION.	1.
PLN	C.C.U.—C.U. INTERCONNECTION.	1.
SKP	C.C.U.—C.U INTERCONNECTION	1.
PLP	C.C.U —C.U INTERCONNECTION	1.
SKR	VIDEO 1.	1.
SKS	VIDEO 2.	1.
SKT	FIELD SCAN.	1.
SKU	SHADING.	1.
SKV	SYNC GEN. 2.	1.
SKW	SYNC GEN. 1.	1.
RV1	VIDICON HEATER VOLTS.	2.
RV2	BEAM.	2.
RV3	FOCUS.	2.
RV4	TARGET.	2.
RV5	HEIGHT.	2.
RV6	BLACK LEVEL.	2.
RV7	VERTICAL SHIFT.	2.
RV9	GAIN.	2.
RV10	WIDTH.	2.
RV11	'X' ALIGN.	2.
RV12	'Y' ALIGN.	2.
RV13	HORIZONTAL SHIFT.	2.
RV15	NUVISTOR HEATER VOLTS.	2.
RV16	TARGET LIMIT.	2.

VB20-3216 M SH.1.
ISSUE 1.

V321 SERIES
VIDICON CAMERA CHANNEL

CAMERA CONTROL UNIT V321-6
VB20-3216-01 COMPONENT LAYOUT FIG.124

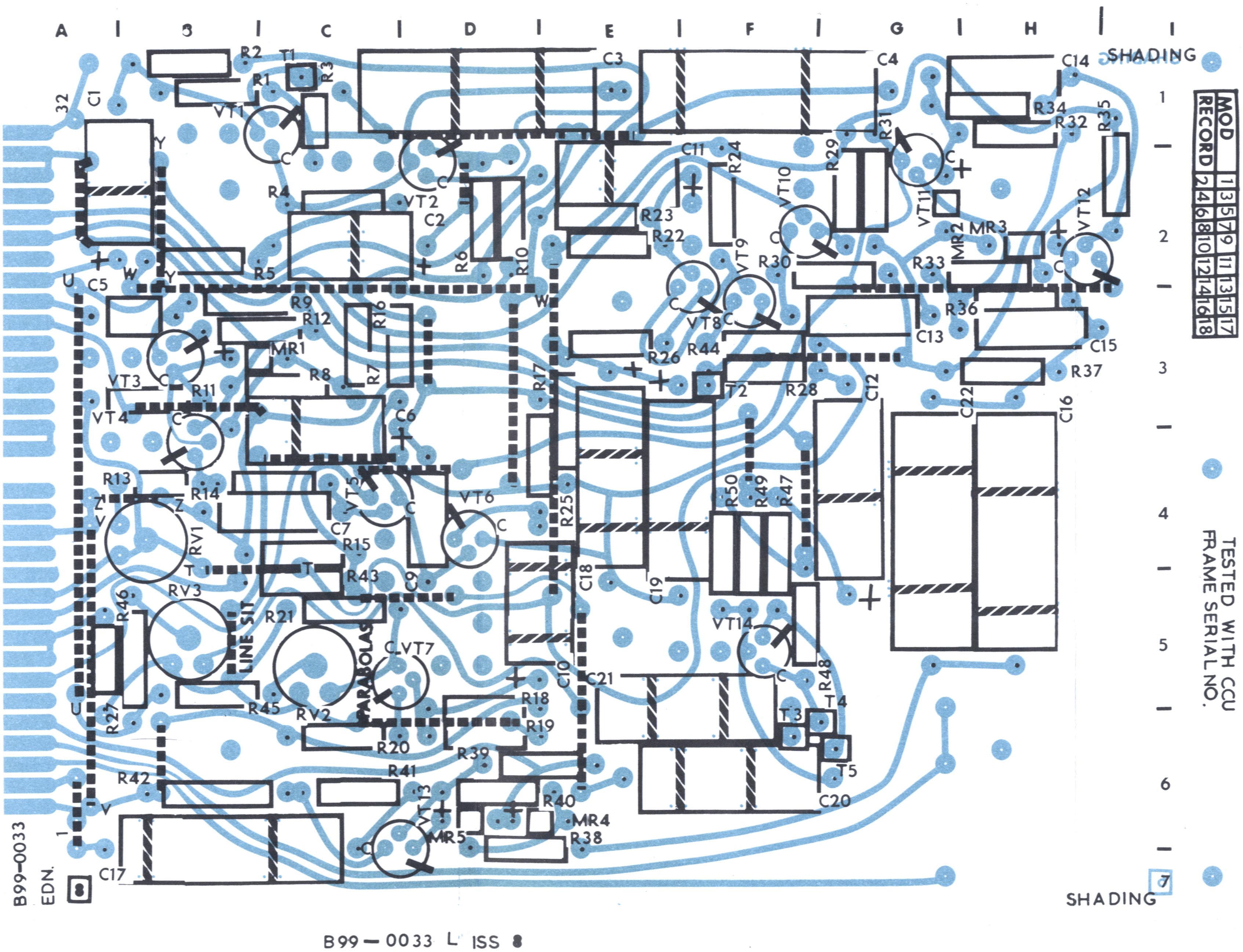


VIEW ON ARROW 'C'.
SEE SH 1

MISCELLANEOUS MECHANICAL ITEMS.	
REF	DESCRIPTION
1	BUSH INSULATING.
2	PLATE INSULATING.
3	BUSH INSULATING.
4	PLATE INSULATING
5	TERMINAL STRIP ASSY.
6	VALVE TOP CAP.
7	VALVE RETAINER.
8	VALVEHOLDER.
9	VALVE RETAINER.
10	TAGSTRIP ASSY.
11	TAGSTRIP ASSY.
12	TAGSTRIP ASSY.
13	BUTTON PLUG.
14	NUT SPINDLE GRIPPING.
15	WASHER.
16	TAG BOARD.
17	TAGSTRIP ASSY.
18	TAGSTRIP ASSY.
19	TAGSTRIP ASSY.

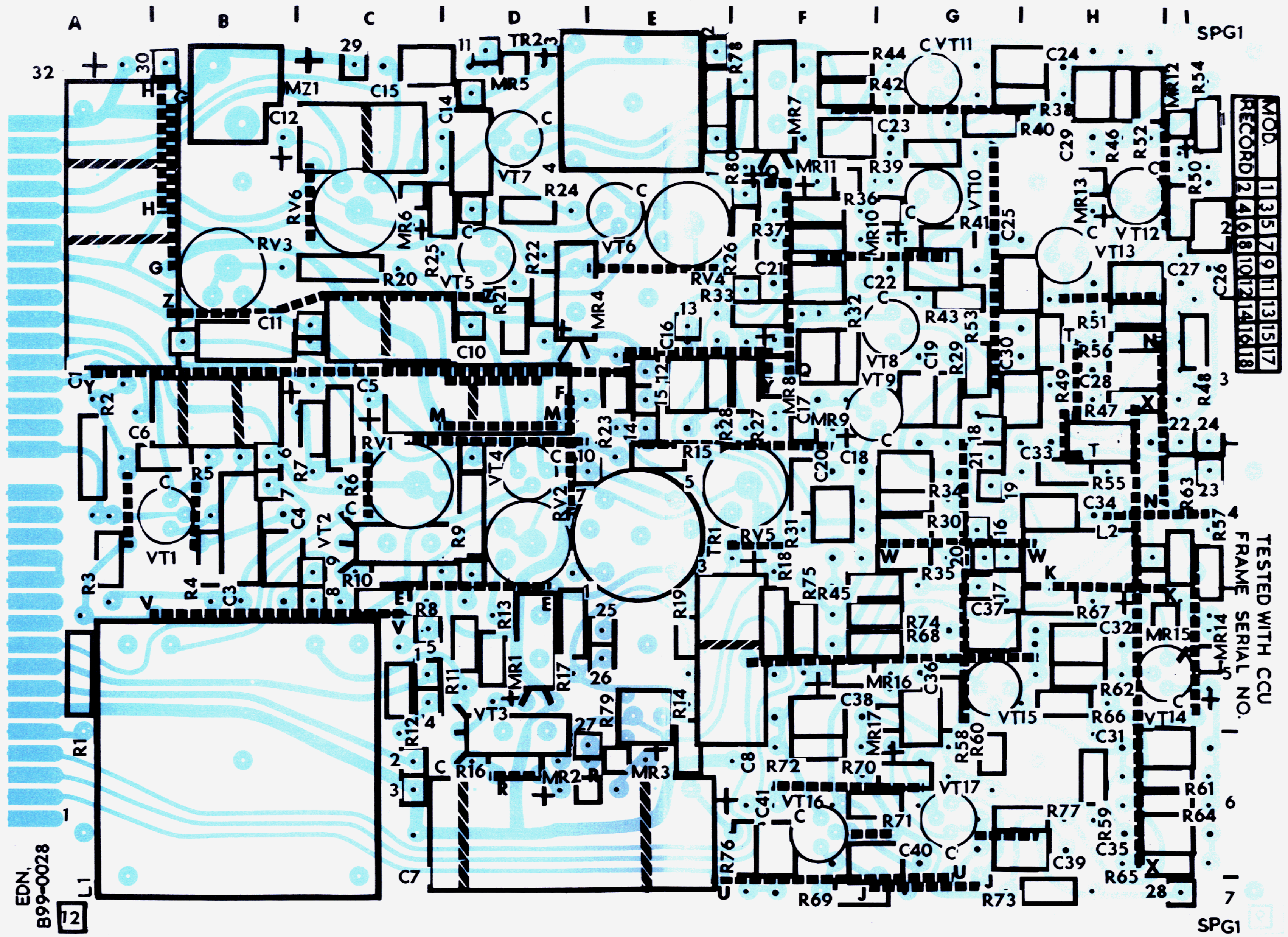
V321 SERIES
VIDICON CAMERA CHANNEL

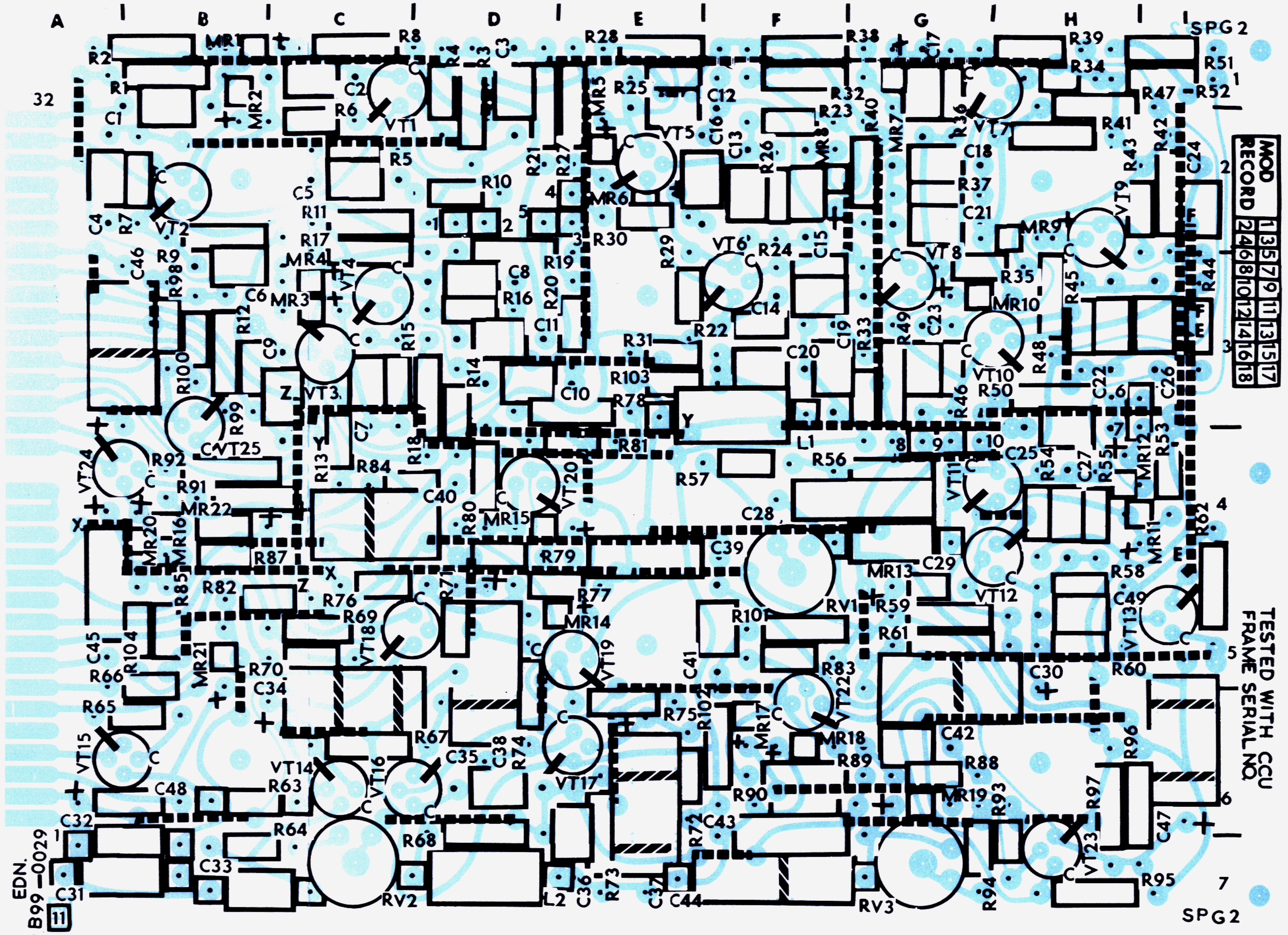
CAMERA CONTROL UNIT V 321-6
VB20-3216-01 COMPONENT LAYOUT FIG.125



COMPONENT LAYOUT
SHADING GENERATOR

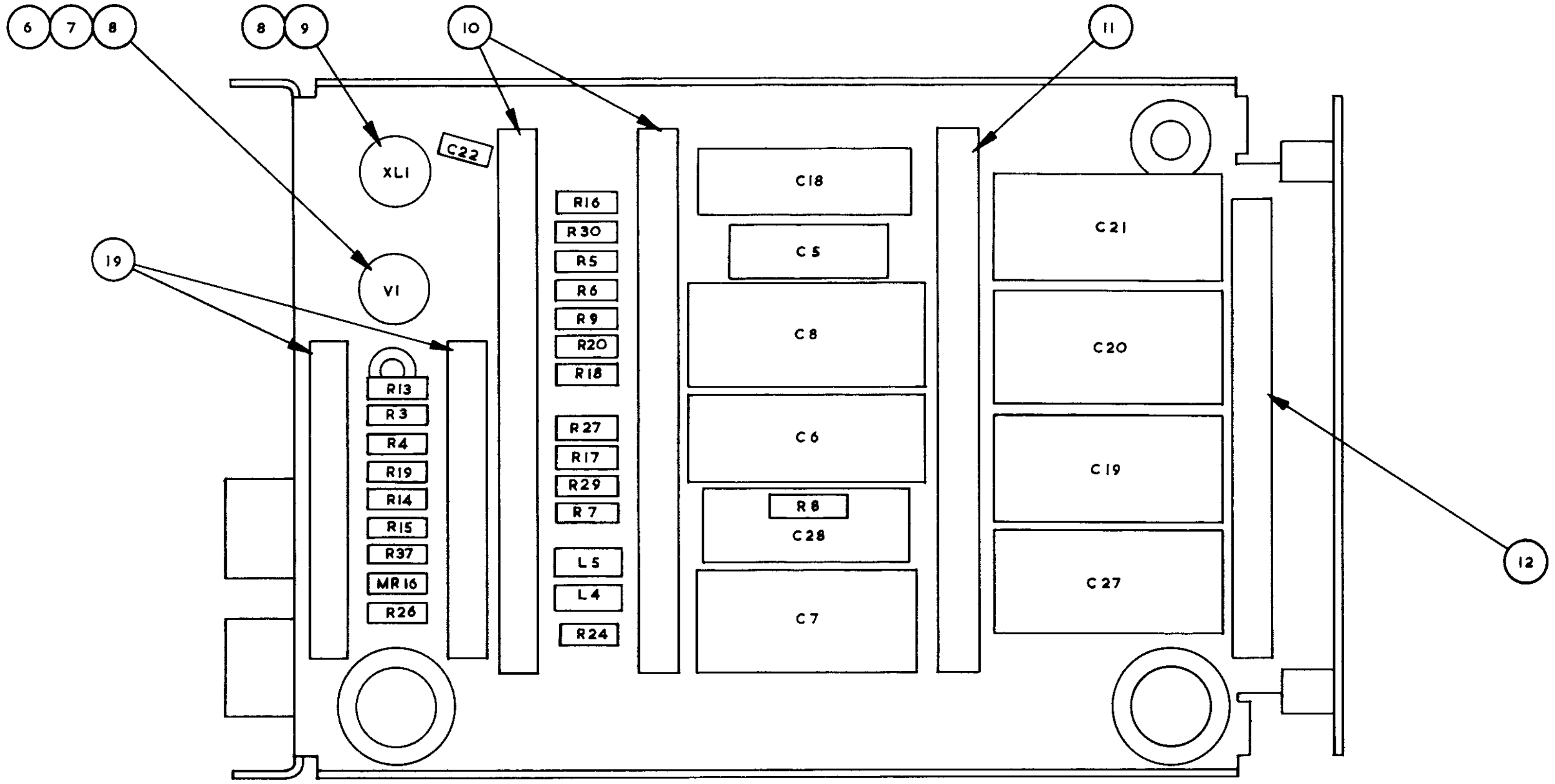
FIG.126



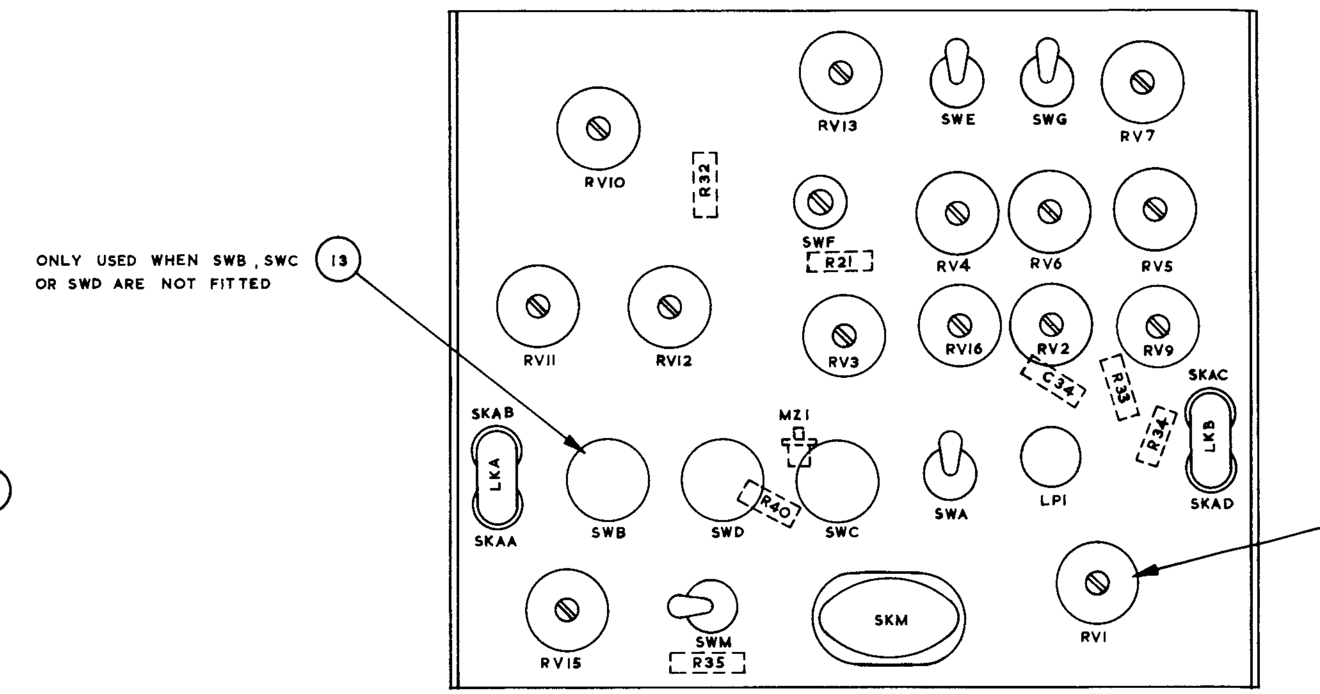


COMPONENT LAYOUT
SYNC. PULSE GENERATOR CIRCUITS

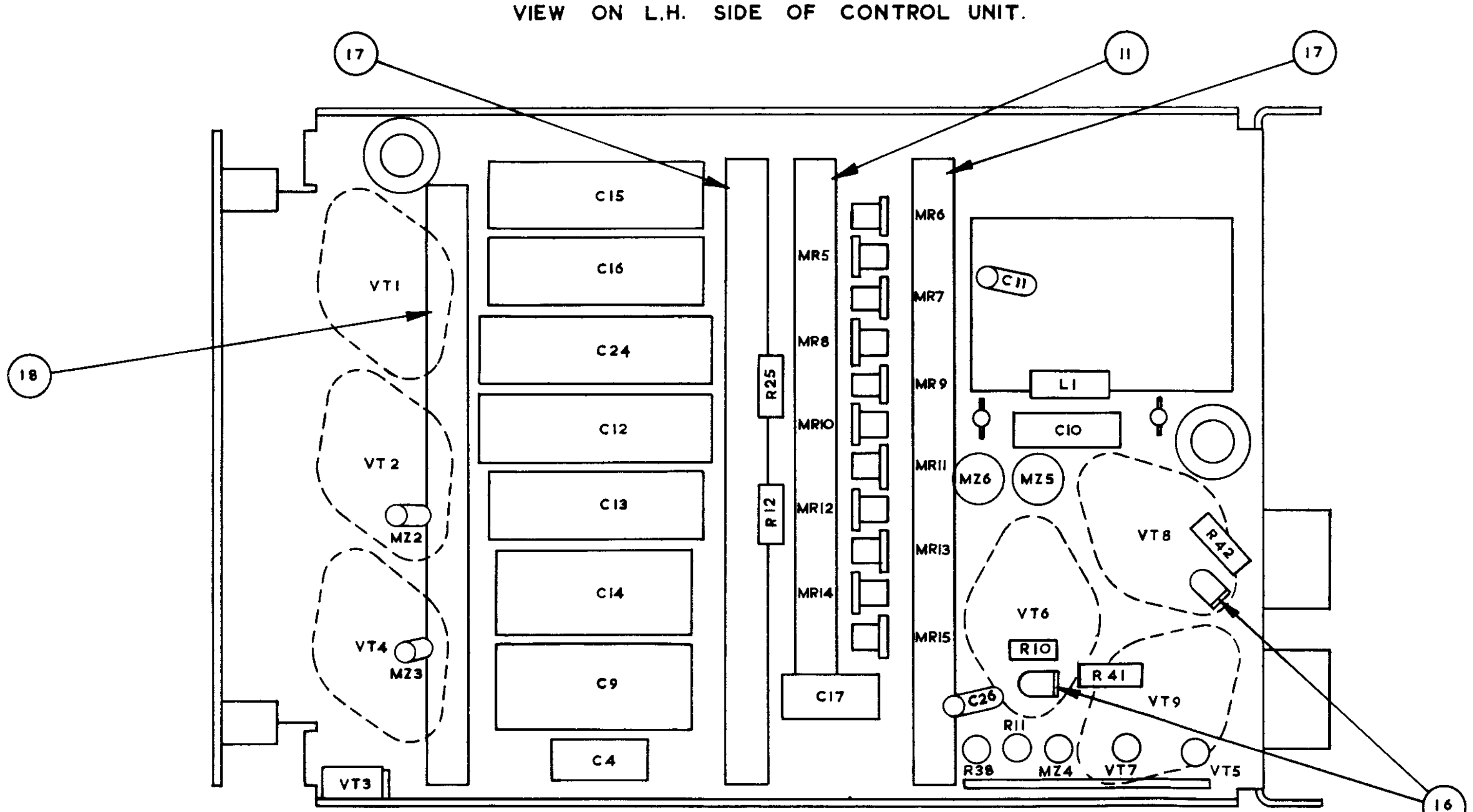
FIG.127



VIEW ON L.H. SIDE OF CONTROL UNIT.



VIEW ON ARROW 'C'.
SEE SH 1



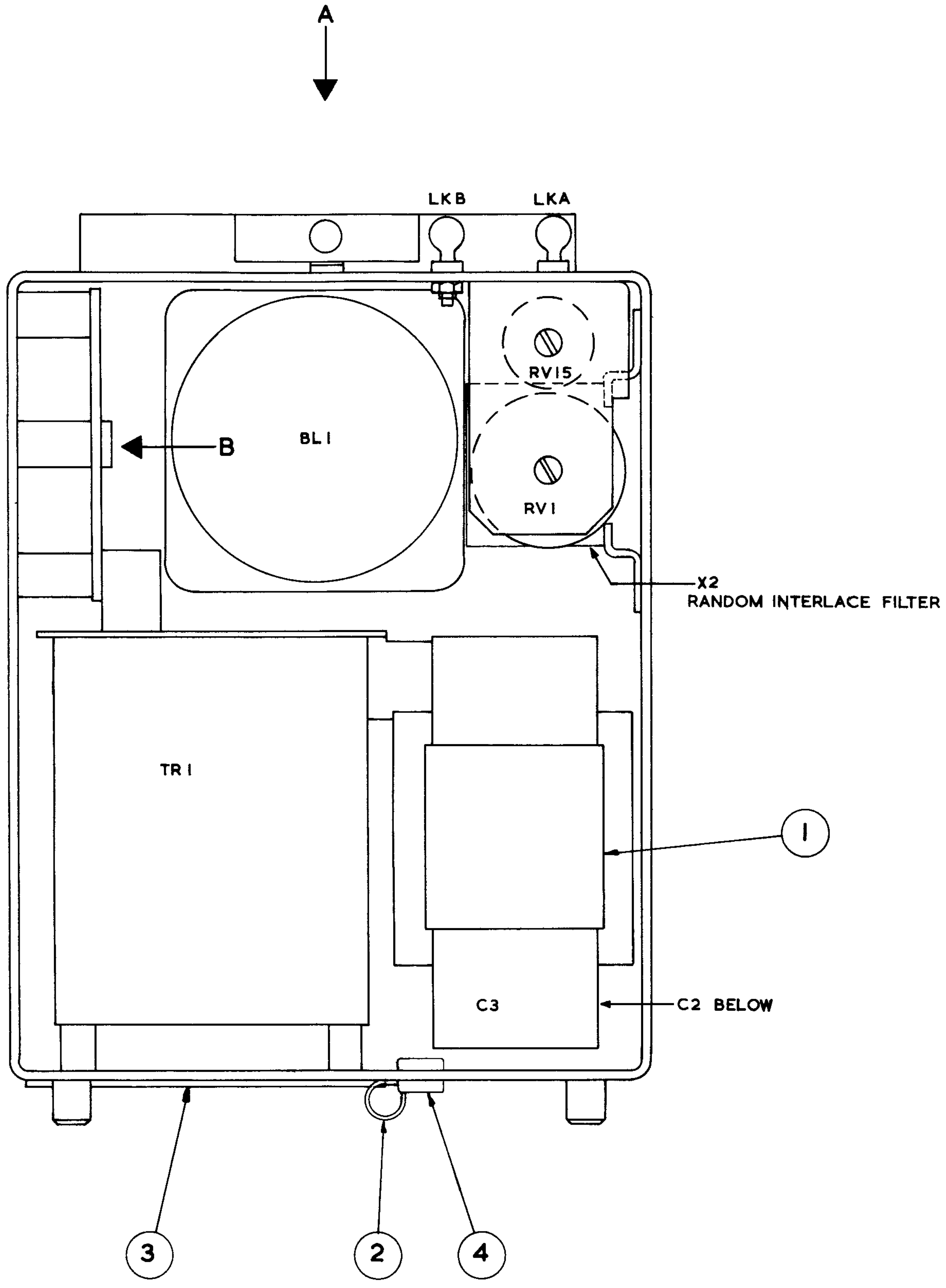
VIEW ON R.H. SIDE OF CONTROL UNIT.

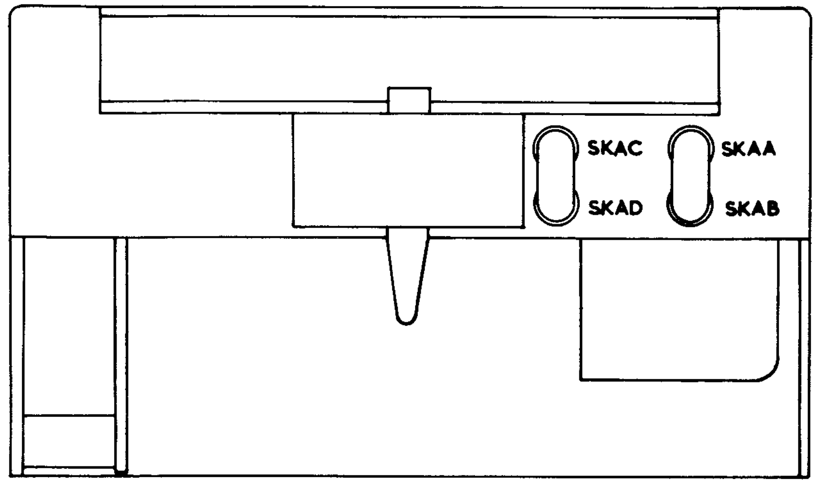
V321 SERIES
VIDICON CAMERA CHANNEL

VB20-3216 M SH.2.
ISSUE 1.

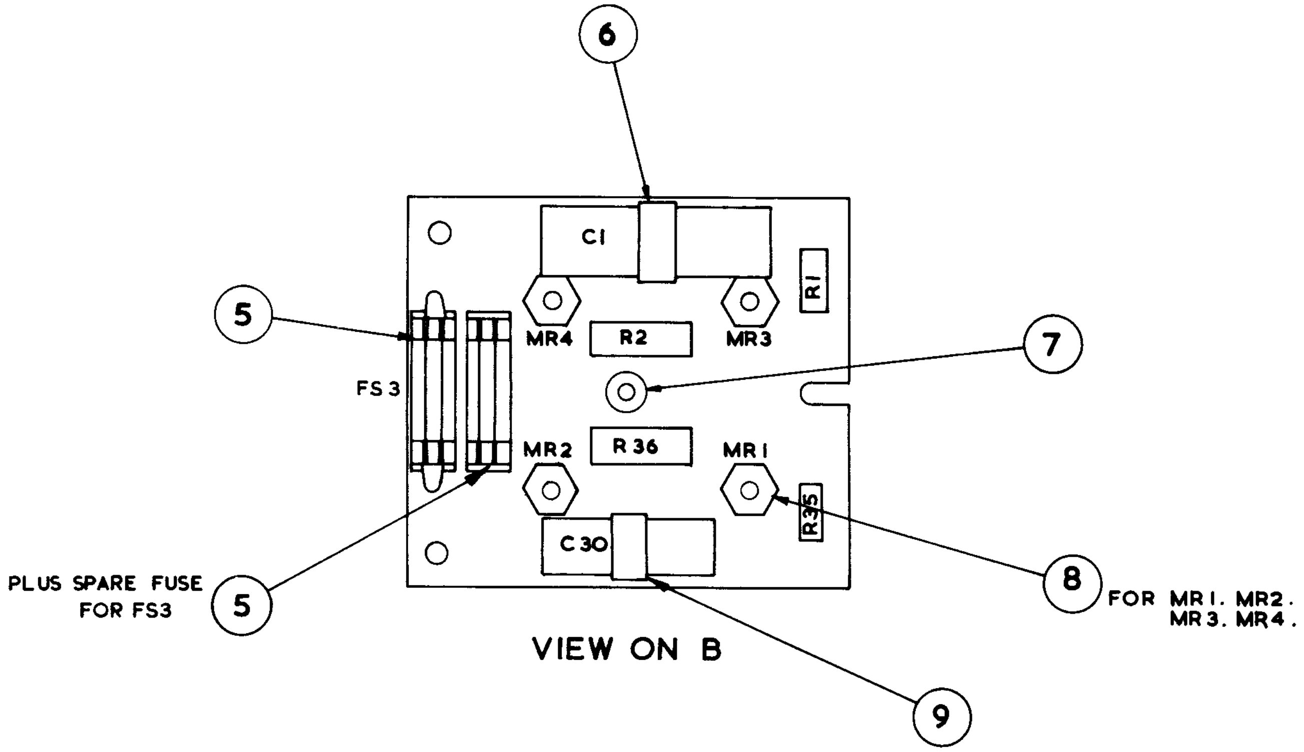
MISCELLANEOUS MECHANICAL ITEMS.	
REF	DESCRIPTION
1.	CLAMP ASSEMBLY
2.	CLIP
3.	COVER
4.	GROMMET
5.	FUSE HOLDER
6.	CLIP
7.	GROMMET
8.	RECTIFIER FITTINGS
9.	CLIP

CONTROL & CONECTOR FUNCTIONS	
REF.	FUNCTION
RV1	VIDICON HEATER VOLTS
RV15	NUVISTOR HEATER VOLTS
SKAA	NUVISTOR HEATER
SKAB	CURRENT METERING
SKAC	VIDICON HEATER
SKAD	CURRENT METERING
LKA	NUVISTOR HEATER VOLTS
LKB	VIDICON HEATER VOLTS
FS3	FUSE, OUTPUT





VIEW ON A

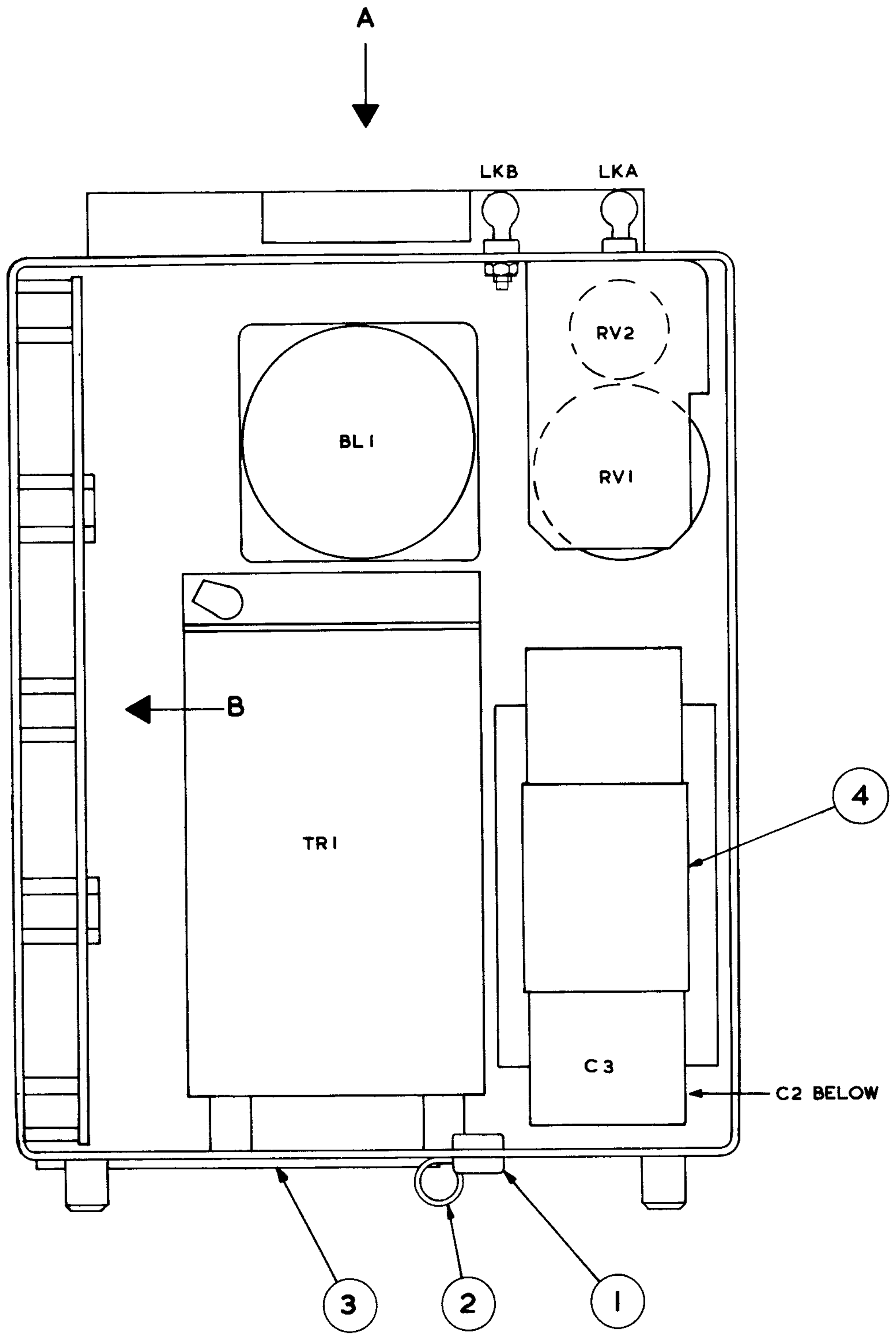


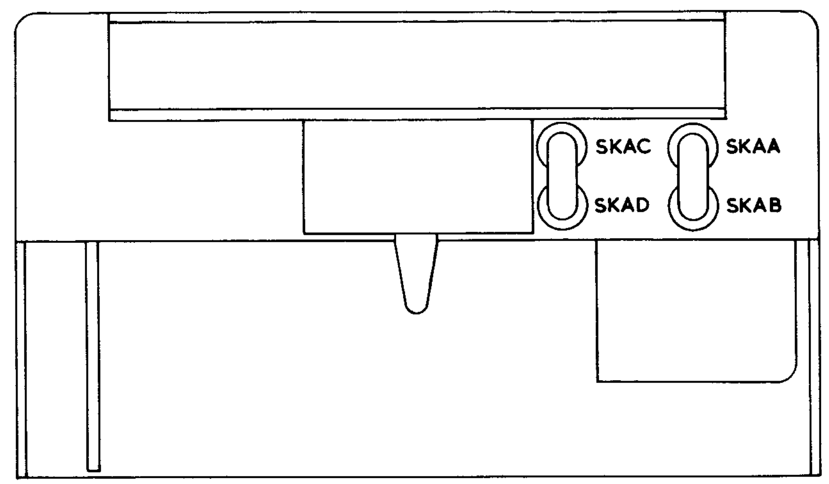
VIEW ON B

VB 01-3215M SH.1.
ISSUE.1.

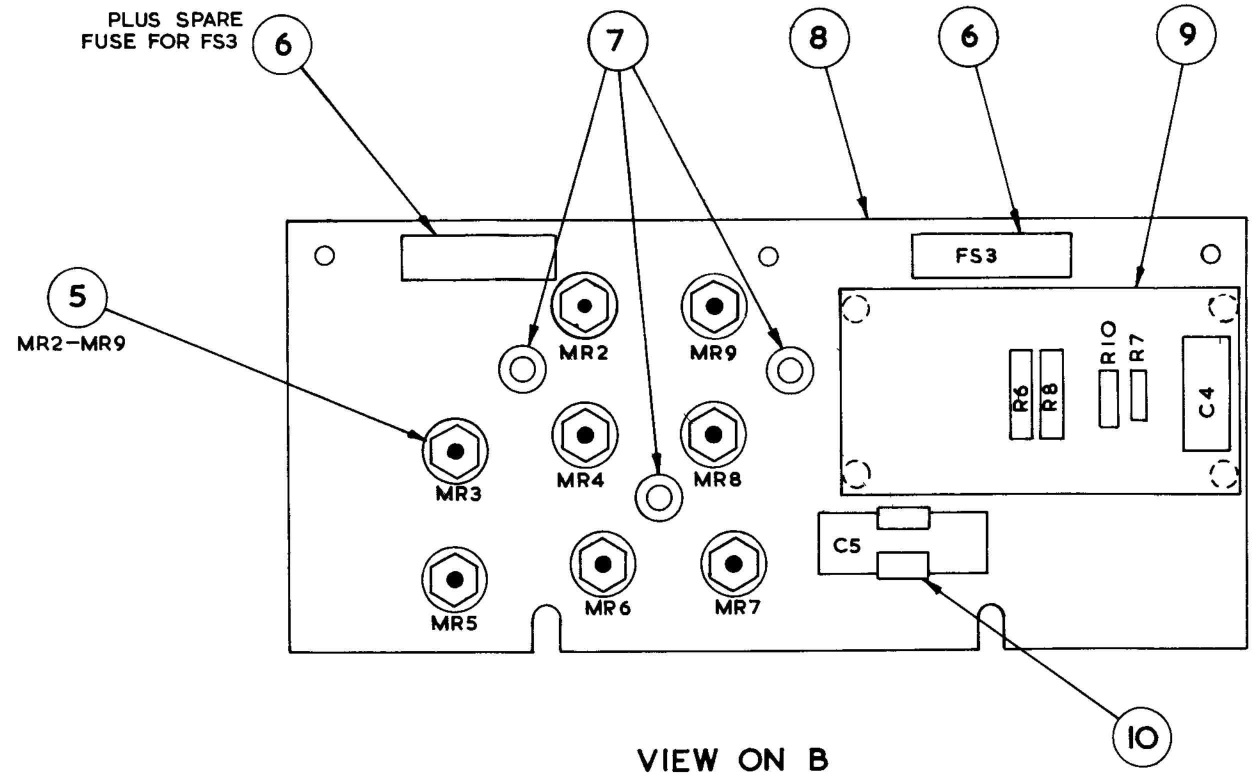
V 321 SERIES
VIDICON CAMERA CHANNEL

POWER SUPPLY UNIT 50/60 C/S
VB 01-3215-01 COMPONENT LAYOUT FIG 128





VIEW ON A



VIEW ON B

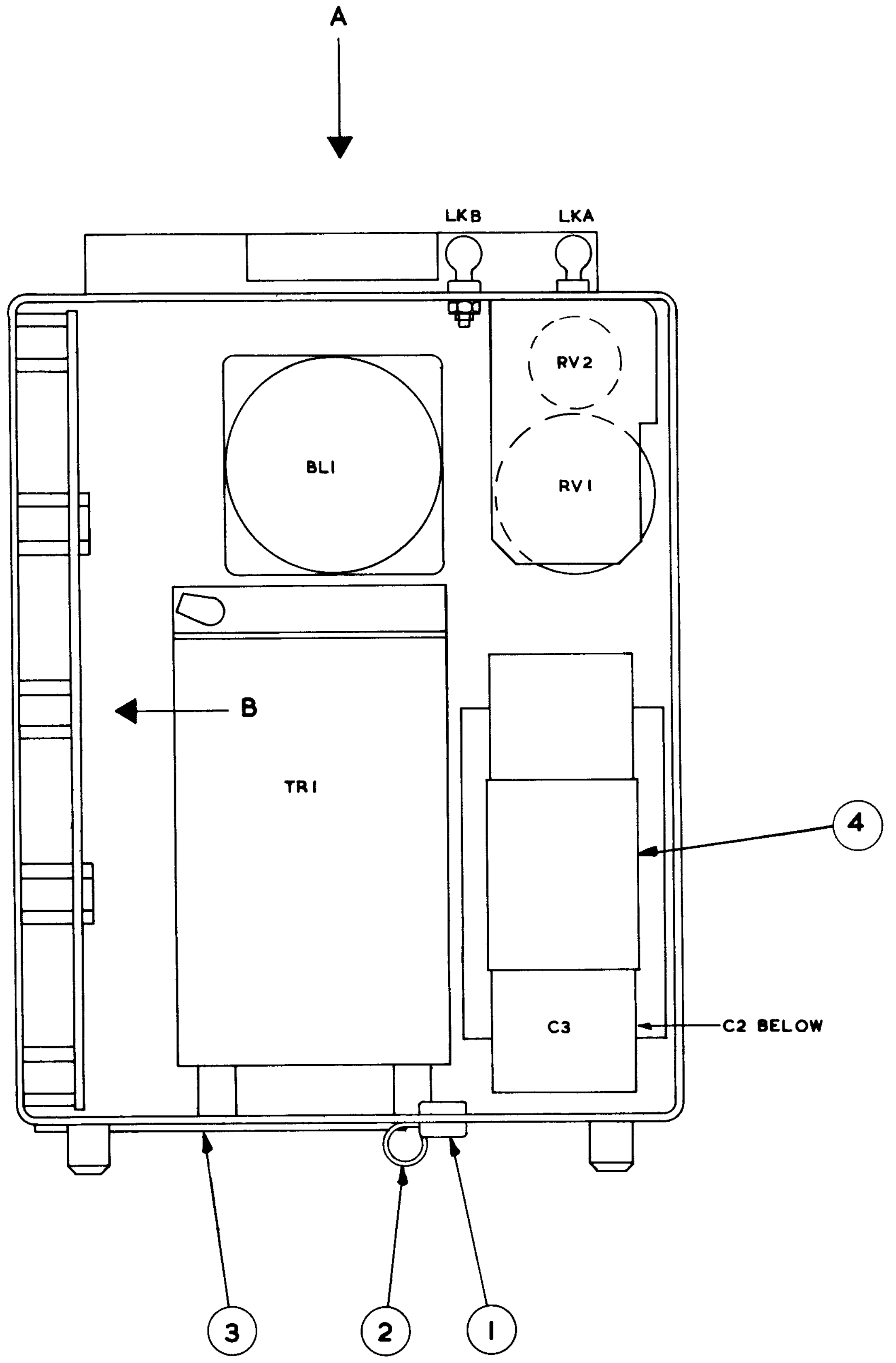
REF	DESCRIPTION
1.	GROMMET
2.	CLEAT
3.	COVER
4.	CLAMP ASSEMBLY
5.	RECTIFIER FITTINGS
6.	FUSE HOLDER
7.	GROMMET
8.	MOUNTING PLATE
9.	TAGBOARD ASSY
10.	CLIP

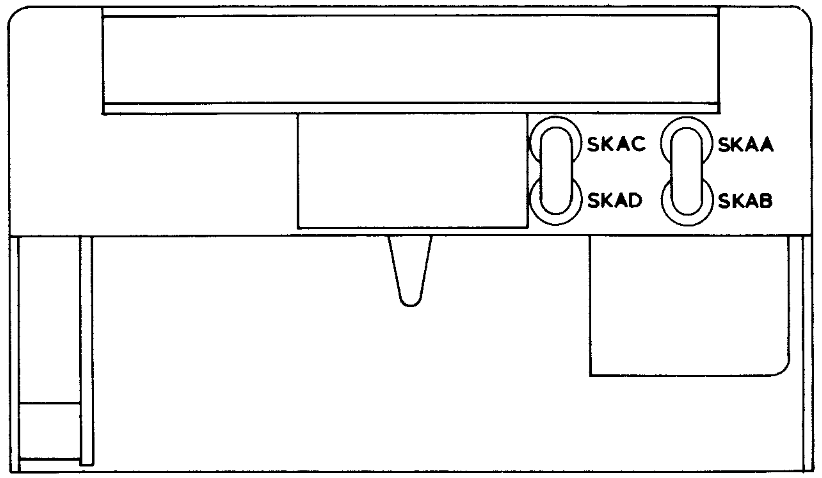
CONTROL & CONNECTOR FUNCTIONS	
REF.	FUNCTION.
RV 1	VIDICON HEATER VOLTS
RV 2	NUVISTOR HEATER VOLTS
SKAA	NUVISTOR HEATER
SKAB	CURRENT METERING
SKAC	VIDICON HEATER
SKAD	CURRENT METERING
LKA	NUVISTOR HEATER LINK
LKB	VIDICON HEATER LINK
FS3	FUSE, OUTPUT

VB02-3215M SH.1.
ISSUE. 1.

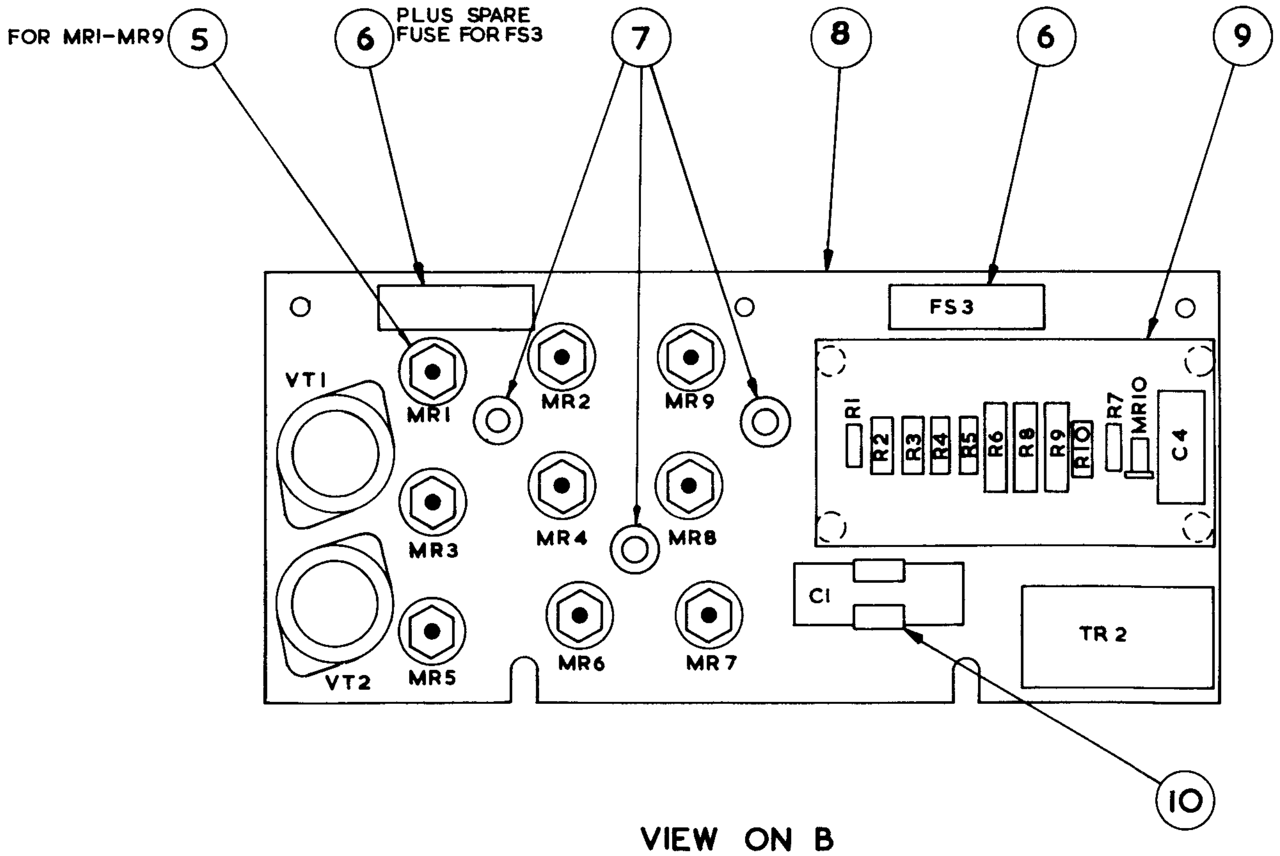
V321 SERIES
VIDICON CAMERA CHANNEL

POWER SUPPLY UNIT 400 C/S
VB02-3215-01 COMPONENT LAYOUT FIG 129





VIEW ON A



VIEW ON B

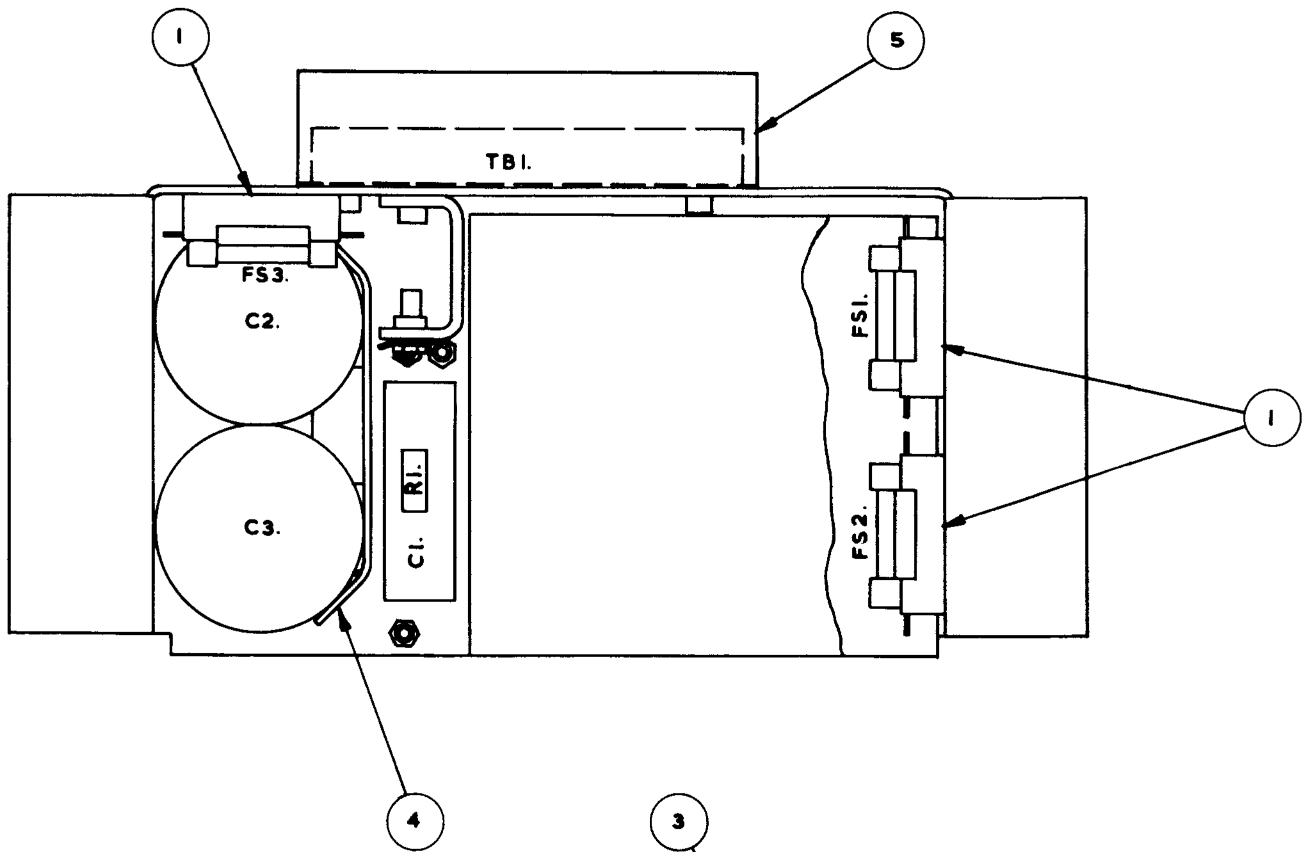
MISCELLANEOUS MECHANICAL ITEMS	
REF.	DESCRIPTION
1.	GROMMET
2.	CLEAT
3.	COVER
4.	CLAMPASSEMBLY
5.	RECTIFIER FITTINGS
6.	FUSE HOLDER
7.	GROMMET
8.	MOUNTING PLATE
9.	TAGBOARD ASSY
10.	CLIP

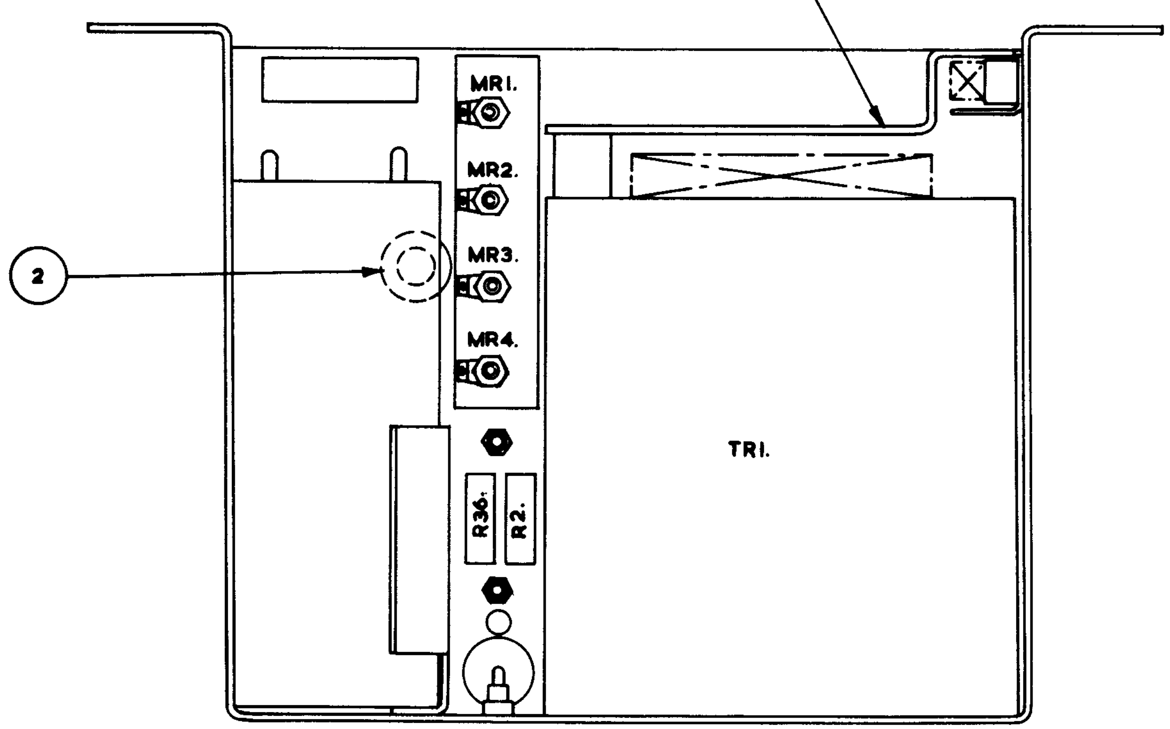
CONTROL	
REF	FUNCTION
RV1	VIDICON HEATER VOLTS
RV2	NUVISTOR HEATER VOLTS
SKAA	NUVISTOR HEATER
SKAB	CURRENT METERING
SKAC	VIDICON HEATER
SKAD	CURRENT METERING
LKA	NUVISTOR HEATER LINK
LKB	VIDICON HEATER LINK
FS3	FUSE, OUTPUT

VB03-3215M SH.1.
ISSUE 1.

V321 SERIES
VIDICON CAMERA CHANNEL

POWER SUPPLY UNIT 22-30V D.C.
VB03-3215-01 COMPONENT LAYOUT FIG 130





MISCELLANEOUS MECHANICAL ITEMS	
REF.	DESCRIPTION.
1.	FUSE HOLDER.
2.	GROMMET.
3.	COVER.
4.	CLAMP ASSY.
5.	COVER.

VB01-3216 M SH.1.
ISSUE 1.

V 321 SERIES
VIDICON CAMERA CHANNEL

POWER SUPPLY UNIT 50/60 C/S.
VB01-3216-01. FIG. 131
COMPONENT LAYOUT.

PART 2

Part 2

OPERATION AND MAINTENANCE

Master Components Lists

The Master Components List at the end of this manual includes all the electrical components and selected mechanical components used in the equipment.

Components shown on individual circuit diagrams may be identified in the master list by means of the cross reference lists located adjacent to the circuit diagrams to which they refer.

Chapter 1

OPERATION

OPERATION

General

1. It is assumed that the installation has been completed and that all preliminary adjustments have been made as detailed in Section 2, Chapter 1. It should be remembered that any alteration made to the installation involving different lengths of camera cable will require a re-adjustment of the preset CABLE CORRECTION, VIDICON HEATER and NUVISTOR HEATER controls.

Operational controls

2. The 321 series camera channel has only two basic operational controls. These are the ON/OFF switch at the control unit and a manual FOCUS control at the camera. When the optional remote focusing facility is provided the manual focus control is not required. Focus motor speed and focus motor reversing are controlled by two switches, SWC and SWD, mounted on the control unit front panel. Similarly, if the shutter and/or filter are fitted, these are controlled by switch SWB on the control unit. For details of these facilities see Appendices.

Pre-set front panel controls

3. The following controls are mounted on a panel recessed into the front of the control unit and are normally covered by a metal plate. Access to them is obtained by undoing the four captive securing screws:-

TARGET (RV4) (Manual only)	Controls the sensitivity of the vidicon.
TARGET LIMIT (RV16)	Determines the maximum possible target volts under auto-target condition.
BEAM (RV2)	Varies the beam current density in the vidicon to control the peak-white detail. Set to a point just clockwise of that at which the whites commence crushing in maximum sensitivity condition.

OPERATION

GAIN (RV9)	Controls the gain of the video amplifiers in the control unit. Only used under low light conditions to produce a standard level output. Normally set to minimum in average conditions.
HEIGHT (RV5)	Adjusts the picture height.
BLACK LEVEL (RV6)	Determines the difference in potential between blanking level and picture black level.
VERTICAL SHIFT (RV7)	Moves the picture in the vertical direction.
WIDTH (RV10)	Adjusts the picture width.
HORIZONTAL SHIFT (RV13)	Moves the picture in the horizontal direction.
X-ALIGN. (RV11) Y-ALIGN (RV12)	Used to align the vidicon beam accurately, in conjunction with the focus field to give optimum resolution.
FOCUS (RV3)	Focuses the scanning beam in the vidicon.
AUTO-TARGET SWITCH (SWE)	When SWE is switched ON automatic compensation is provided for changes in scene brightness.
AUTO-BLACK LEVEL SWITCH (SWG)	When SWG is ON the black level is automatically held constant to the level set by the black level control.
AUTO-ALIGN SWITCH (SWF)	Used, in conjunction with the X and Y ALIGN controls to simplify beam alignment during setting up. Note: The AUTO-ALIGN facility is only available when the SHADING GENERATOR is fitted.

Note that the above controls should normally only require adjustment when the equipment is initially set up or after the vidicon tube has been changed.

Chapter 2

INITIAL SETTING UP

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INITIAL SETTING UP

General

Reference should be made to component layouts Figs.124 and 125.

1. The purpose of this procedure is to obtain the correct setting of the preset controls. Once these settings have been obtained no benefit will result from a readjustment unless it becomes necessary to change the vidicon tube. However, it is advisable to check the settings at intervals of approximately three months. The procedure will be most readily carried out if the camera, the control unit and the associated monitor are grouped together and connected by the same lengths of cable which will be employed in the installation. In addition, setting up will be greatly facilitated if a good quality oscilloscope is available.

Test card and lighting

2. For accurate setting of the height and width of the scanning raster on the vidicon tube it is recommended that the camera be positioned to view a brightly lit test chart (Marconi Resolution Chart No.1). Adequate lighting will be obtained from two 100 watt lamps, in reflectors, placed at a distance of two feet from the resolution chart so that the incident light strikes the test card at an angle of $45^{o}C$.

Positioning of camera

3. Place the camera on a suitable mounting tripod or bracket and clamp it securely in a horizontal position. Direct the camera towards a test chart and set about three feet away. Set the following controls on the camera control unit front panel as indicated.

AUTO-TARGET switch SWE to AUTO.
TARGET LIMIT control RV16 FULLY CLOCKWISE
BEAM control RV2 FULLY ANTICLOCKWISE
GAIN control RV9 FULLY ANTICLOCKWISE
AUTO-BLACK LEVEL switch SWG to AUTO
BLACK LEVEL control RV6 SLIGHTLY CLOCKWISE
Set the lens aperture to maximum.

Switching on

4. Before switching the channel on check the following points:-

(a) Ensure that the installation is in accordance with the instructions given in Sect.2. Chap.1. It is important that, where possible, the correct cable lengths be used to connect the three units as the setting of some of the internal preset controls is dependent on these lengths.

(b) Ensure that the camera and camera control unit are installed in a position to allow air to circulate around them. Failure to do this may result in the equipment operating at too high an ambient temperature resulting in poor picture quality and an incorrect setting of the controls.

Switch on the local mains supply and put the MAINS switch SWA on the control unit to ON. Switch on the light source and the monitor and allow a warming up period of 4-5 minutes. Final adjustments should be made after a running time of 1 hour. If an oscilloscope is available monitor the video output at the test points on the C.C.U. front panel.

Focus adjustment

5. Turn up the display monitor brightness and adjust the line and field hold controls, if necessary, to obtain a locked raster. Rotate the camera BEAM control clockwise until an image of the test chart appears on the monitor. The image may appear very blurred and show only as a change of brightness over different parts of the screen. Adjust the camera FOCUS controls for the best resolution of the test chart. A slight adjustment of BLACK LEVEL may be necessary at this point. The camera should be positioned so that the test chart fills the picture area on the monitor. Recheck optical focus after any movement of the camera. A final adjustment of the monitor focus may be necessary for the best result.

Adjustment of HEIGHT and WIDTH

6. This operation will be simplified if the test chart is replaced by a plain white card of similar dimensions. Move the camera close enough to the card to ensure that the edges of the card do not appear on the monitor. Set the lens aperture to T11. The scanned area of the camera tube is defined by a mask fitted over the end of the tube. Rotate the HEIGHT and WIDTH controls so that the outline of the mask appears on the monitor and then adjust them until the mask edges are just outside the picture area. Centring can be checked by noting whether any one edge disappears from view before its opposite edge. This is rectified by adjusting the HORIZONTAL OR VERTICAL SHIFT control, whichever is appropriate.

Focusing and Alignment

7. To obtain correct operation of the vidicon tube it is necessary to ensure that the electron beam is properly aligned with respect to the magnetic focusing field. When alignment is correct alternate clockwise and anticlockwise rotation of the electrical FOCUS control (RV3), through a few degrees, will cause the picture to rotate slightly about its centre. This focus 'rocking' action is simulated by the Auto-Align Circuit. To correct the alignment replace the test chart and observe the centre of the picture. Now adjust the X and Y ALIGNMENT controls (RV11 & RV12) alternately until the picture GM

rotates about the centre. Readjustment of picture centring may be necessary. When satisfactory alignment and centring are obtained switch off AUTO-ALIGN and make a final adjustment to the focus controls.

AUTO TARGET operation

8. When operating under AUTO TARGET conditions a standard level output is maintained automatically, having been preset by RV2 on Video 2. The video output level may be changed, without readjusting RV2, by altering the value of R15 on Video 2. The sync level will require adjustment by means of RV1. Typical output levels for video and sync are given below:-

Video	Sync	Value of R15
1V	0.5V	180Ω
0.75V	0.25V	240Ω (270Ω and 2.2 kΩ in parallel)
0.7V	0.3V	260Ω (270Ω and 5.6 kΩ in parallel)

9. Automatic limitation of the target voltage is achieved by the dark current limiter, RV4 on Video 2, which is set to control the level at which VT19 conducts.

MANUAL TARGET operation

10. With the AUTO TARGET switch OFF, the standard level video output is set by the TARGET control RV4. The appropriate sync amplitude is set by RV1 on Video 2, and R15 on this board must be selected according to the table in paragraph 8.

BEAM control setting

11. Monitor the terminated video output at field frequency and adjust the black level for the required amount of set up (normally 0.05V). Rotate the BEAM control clockwise to discharge the target. This will be indicated by the signal amplitude remaining constant and the lack of clipping of the positive tips of the video signal.

12. Rotate the BEAM control 45° clockwise, readjusting FOCUS control (RV3) if necessary.

13. If, during the life of the tube or when the channel is first switched on, the picture is clipped or negative, the beam can be increased by turning the BEAM control clockwise. Note, however, that excess beam will tend to impair resolution.

TARGET LIMIT control

14. This control is primarily intended to limit the target voltage excursion under AUTO-TARGET conditions. To set the control correctly, close the iris or reduce scene brightness to the minimum level anticipated, but do not reduce beyond the point at which the video level just commences to decrease. Rotate the TARGET LIMIT control counterclockwise until the video amplitude just commences to decrease.

15. The TARGET LIMIT control should not be used to set the video output to the correct level. Video amplitude is set by means of RV2 on Video 2.

SECTION 2

Chapter 1

INSTALLATION

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INSTALLATION

General

1. The camera and control unit should always be mounted where they receive adequate ventilation. When exposed to temperatures below -20°C (CCU)/-40°C (CAMERA) or above +55°C a special housing will be necessary.

2. The maximum distance between the camera and its control unit is governed by the h.f. attenuation and delay time of the video coaxial line in the camera cable. Provision is made on the control unit for correcting the attenuation of cable lengths up to a maximum of 1000 ft. Connections to the camera cable are shown in Table 2, Fig.1. The cable correction control is RV2 on Video 1. Minimum correction is fully anti-clockwise, while fully clockwise corrects for 1000 ft of cable. Set the control proportionally for shorter cables.

3. Certain changes are required if it is necessary to change the line standard. These are as follows:-

	405 lines	Other standards
R49 in the camera	10 ohms	27 ohms
R32 on the camera control unit	47 ohms	15 ohms
R39 on Video 1	33 ohms	22 ohms

A change in the value of R39 is only necessary where the camera is fitted with a silicon controlled rectifier. In addition to the changes above, where the sync. pulse generator boards are fitted changes are required as indicated in Table 1.

Table 1

Changes to Sync. Pulse Generator

LINE SYSTEM	405	525	625	819	875
S.P.G.1 B99-0028- C10	-	6000 pf	6000 pf	6000 pf	6000 pf
C11	0.15 µF	0.047 µF	0.047 µF	0.047 µF	0.047 µF
R78	100Ω	2.2 kΩ	2.2 kΩ	2.2 kΩ	2.2 kΩ
R26	180Ω	6.8Ω	6.8Ω	6.8Ω	180Ω
LINKS	12-15	12-13	12-13	12-13	12-13
	-	14-15	14-15	14-15	14-15
	18-20	17-18,20,21	17-18,19,20	17-20	17-20
	-	-	-	16-21	16-21
	23-24	23-24	23-24	22-23	22-23
S.P.G.2 B99-0029 C33*	820 pf	470 pf	470 pf	470 pf	470 pf
C44*	0.1 µF	0.03 µF	0.03 µF	0.03 µF	0.03 µF

Table 1 (Contd.)

LINE SYSTEM	405	525	625	819	875
LINKS	2-4,5	2-3,4,5	2-3,4,5	1-3,5	1-5
	-	6-7	6-7	-	-
	8-9	8-9	8-9	-	-

* Nominal values, adjusted on Test.

Power supplies

4. The heavy duty Camera Control Unit V3215 may be operated from 50-60 c/s mains, from 400 c/s supply or from 24V d.c. The power supply units are interchangeable and are mounted at the rear of the camera control unit. On both versions the mains transformer, TR1, for the 50-60 c/s supply is provided with a range of taps on the primary winding. These may be selected to set the channel working on any nominal voltage likely to be encountered within the range 100-125V or 200-250V. The windings are connected in series for operation in the range 200-250 volt or in parallel for operation in the range 100-125 volts. Adjustment to the appropriate setting is made by altering the position of wire links on top of TR1. The 400 c/s power supply unit makes provision for only two nominal voltages i.e. 115V and 200V. However there is adjustment on the two secondary windings which will take up transformer and component tolerances within the supply. The 24V d.c. unit is similar to the 400 c/s power supply unit but incorporates a transistor chopper.

5. Stabilizing circuits have been incorporated to compensate for mains voltage variations up to +7%, -10% of the nominal value. If the equipment is to be used in the vicinity of heavy electrical equipment the stability of the mains supply should be measured over one working period. If the measurements indicate a variation greater than +7% or -10% the channel should be connected to a known 'quiet' line or the mains supply should be run through a voltage regulator unit. If a regulator is used it should be of a type which will respond sufficiently rapidly to prevent voltage excursions outside these limits.

CONNECTORS AND CABLES

Camera

6. The camera cable is a 37-core cable. In addition to carrying the video signal, the cable also supplies the field scanning waveform, the line pulse for operating the line scan generator in the camera and power for the camera and head amplifier. Where the optional facilities, i.e. remote focus, lens filter/sun shutter are incorporated, control

voltages for these are also fed along the camera cable. The cable also makes provision for remote line scan reversal and for a telephone line between camera and CCU. Connections to the camera cable are shown in Table 2 & Fig.1 and the various types of connector that may be used can be found in the equipment list in Part 1, Sect.1, Chap.2 of the manual.

Table 2 Connections to camera cable

Group	Pin.	Colour	Function	Remarks
	U	Red	Focus Current	
1	N	Blue	Focus Current	
	G	Black	Anode. +300V	
	M	White	Beam Focus	
	a	Black	Earth	
	L	Brown	Nuvistor heater	
2	b	Orange	-16.5V	
	S	Green	Field Scan	
	T	Blue	Line Scan	
	K	Grey	Field Scan	
3	E	Black	Remote optical focus	Optional facility
	X	Screen		
4	A	Co-axial)		
		Blue Tracer)	Camera Blanking	Coaxial outer
	F	Screen)		at +14.5V
5	B	Unscreened		
		Blue	+4.5V	
6	D	Co-axial		
		(No Tracer))	Video in.	
	C	Screen)		
7	J	Unscreened		
		Orange	Douser	Optional facility
8	Z	Co-axial)		
		(Orange)	Line Trigger	
		Tracer)		
	R	Screen)		Co-axial outer at -16.5V.
9	f	Green	Remote optical focus	Optional facility
	X	Screen		

M

Table 2. (Contd.)

Group	Pin	Colour	Function	Remarks
	d	Blue	Telephone	
	X	Orange	X alignment	
	e	Green	Shading	Optional facility.
10	m	Brown	Artificial earth	
	k	Grey	Y alignment	
	W	Black	Beam	
	V	White	Line Scan reverse	Optional facility.
	H	Pink	Horizontal Shift	
	P	Yellow	+100V	
11	s	Brown	Vidicon Heater	
	✠	Screen		
	c	Blue	Filter	Optional facility.
	h	Orange	Spare	
	r	Green	Spare	
12	p	Brown	spare	
	n	Grey	spare	
	j	Black	spare	
	✠	Screen		
13	g	Grey	Vidicon heater	
	✠	Screen		

✠ All screens are taken to a bonding clip together with outer screen and connected to pin 'a'.

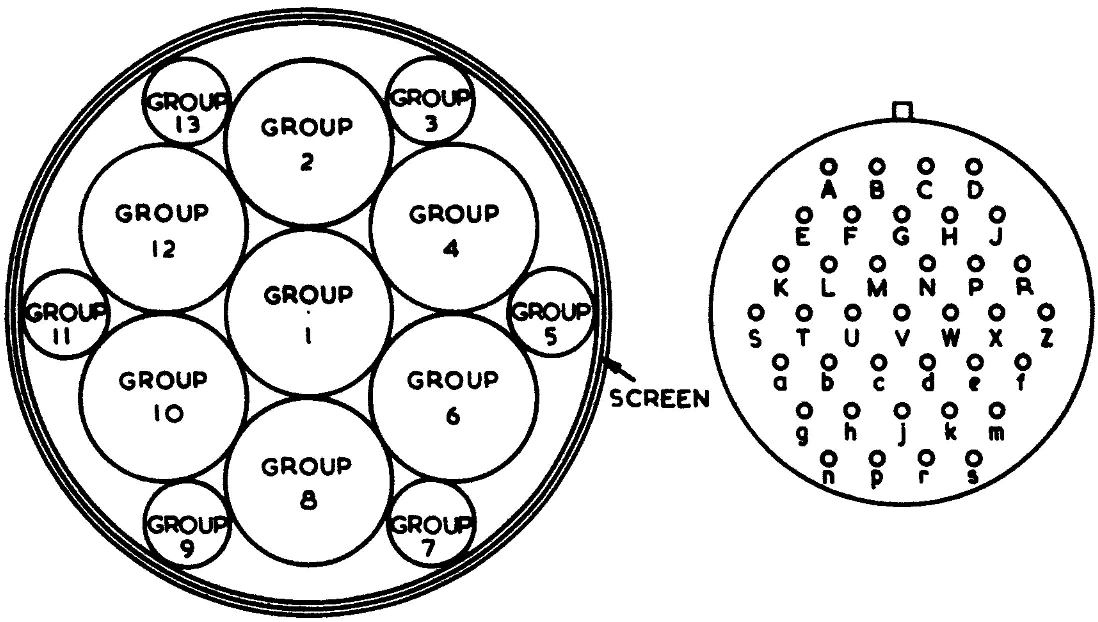

Fig. 1. Camera cable and connector.

Power

7. Power to the CCU is supplied on a seven-way cable (for editions see equipment list). Normally only three ways in the cable are used. However, if it is desired to lock the field frequency to a separate (6.3V) supply the necessary voltage is brought into pin C of PLA (see CCU circuit diagrams Figs.107 & 108). Note that this facility is only available when the synchronizing pulse generator boards B99-0028 and B99-0029 are fitted.

Remote control

8. The optional facilities which are fully described in the Appendices may, to special order, be operated from a remote control unit. For this purpose a 19-way remote control cable will be required. Connections to the remote control cable are shown in Table 3 and Fig.2. Editions of the cable are included in the equipment list.

NOTE: *The connections shown may be allocated to other functions according to the requirements of individual applications.*

Table 3. Connections to remote control cable. (SK8)

Socket Pin.	Colour	Function	Remarks
A	Light Green	Horizontal Shift (RV13)	Optional Reverse Line Scan Facility.
B	Pink	-5.5V	Optional Reverse Line Scan Facility.
C	Orange	Shutter/Filter Switch	Alternative to C.C.U. panel mount.
D	Violet	-16.5	Optional Reverse Line Scan facility.
E	Brown	To camera cable	Optional Reverse Line Scan facility.
F	Red/Brown	Picture polarity reversal.	Optional facility.
G	Red/Black	Remote optical focus switch	Alternative to C.C.U. panel mount.
H	Red/White	Spare	-
J	Black	Remote optical focus switch	Alternative to C.C.U. panel mount.
K	Red/Green	Spare	-
L	Red/Blue	Spare	-
M	Grey	Horizontal Shift (R22)	Optional Reverse Line Scan facility.

Table 3. (Contd.)

Socket Pin	Colour	Function	Remarks
N	Yellow	+4.5V	-
P	Green	S.P.G. Changeover Relay (RLA)	Optional Multi-Channel Facility.
R	Blue	Douser/Filter Switch	Alternative to C.C.U. panel mount.
S	Red	Remote Optical Focus	Alternative to C.C.U. panel mount.
T	Red/Yellow	Spare	-
U	Screen	Earth	
V	White	Douser/Filter Switch	Alternative to C.C.U. panel mount.

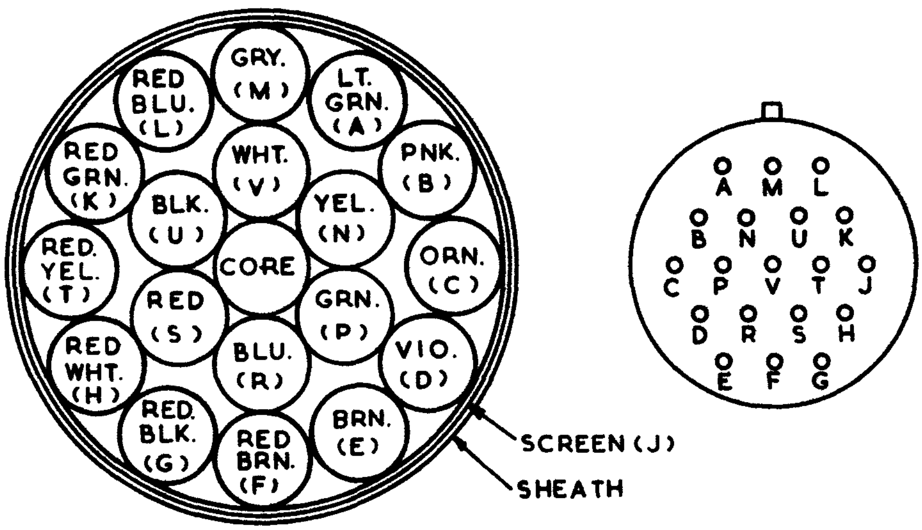

Fig. 2. Remote control cable and connector.

Control unit to monitor

9. The connection between the control unit and monitor is made with a standard 75 ohm coaxial connector. The type of cable used will be determined by the length and by the degree of picture degradation which can be tolerated. In general, an equalizer network will be required if the full bandwidth is to be maintained. In addition a distribution amplifier will be needed with very long cables to make up the l.f. losses associated with passive equalizer networks.

Fuses

10. The control unit is fitted with three fuses; two for the mains supply and one for the d.c. output from the power supply unit. On the 100-125V range, 50 c/s and 400 c/s the rating of the mains fuses FS1 and FS2 is 1 amp. while on the 200-250 volt ranges the rating is 500 mA. For 24V d.c. supplies the rating is 3 amps. The rating of the output fuse FS3 is 2 amps. The main fuses are fitted inside the unit, near the front on the right hand side. The power unit output fuse is situated in the power unit, together with a spare.

Connection of channel to supply

11. Check that the local mains supply and the control unit MAINS ON-OFF switches are both in the OFF position. Connect the mains lead of the control unit to the local supply using a connector of appropriate rating. The leads of the mains cable should be connected as follows:-

RED lead to MAINS live
BLUE lead to MAINS NEUTRAL
GREEN lead to EARTH

The connections are exactly the same whether the supply is 50/60 c/s, 400 c/s or 24V d.c. using a transistor chopper. It is possible, however, to operate the mobile camera control unit direct from a 24V d.c. supply. Under these conditions an entirely separate source is required to provide 6.3V at the vidicon heater. In addition some links must be made on the terminal block TB1 on the underside of the control unit chassis (see component layout Fig.124). The links required are as follows:-

Link 11 to 3	Take 24V negative to PLA-A
Link 2 to PLA-F	Take 24V positive to PLA-F
Link 10 to 8	Take 6V negative to PLA-E
-	Take 6V positive to PLA-B

Insertion of vidicon into camera

12. It is possible to replace vidicon tubes of the same length without removing the camera from its case. However, on initial installation and when fitting a different type of tube the position of the tube base holder will require adjustment and for this purpose the camera must be removed from its case. This is achieved by first removing the front mounting plate which is secured by two captive screws. The camera may now be removed from its case by pulling on the rear mounting plate.

WARNING: ***When inserting or removing the Vidicon HANDLE WITH EXTREME CARE.***

The Vidicon tube is fitted as follows:-

(a) Slacken the screws holding the vidicon base and move the base as far forward as possible. The base should be temporarily fixed in this position.

(b) Unscrew the front retaining ring.

(c) Remove the vidicon tube mount assembly (Refer to Fig.3). It may be necessary to insert a screwdriver blade between the front housing and its seating and prise gently to remove the mount.

(d) The vidicon mount assembly can now be dismantled by undoing the lock ring at the rear.

(e) Assemble the parts of the tube mount assembly in the order shown in Fig.3. Tighten the assembly with the lock ring ensuring that the target connector is making good contact with the target connection on the vidicon tube. DO NOT OVERTIGHTEN.

(f) To ensure correct alignment of the vidicon base with the holder, the short pin on the tube should be lined up with the locating hole in the front housing. To avoid overtightening it is advisable to produce the adjustment by rotating the lock ring.

(g) The tube may now be inserted with the position of the holder adjusted until the front housing seats against the front bulkhead. Tighten the fixing screws.

Heater voltage adjustments

13. Before proceeding with the initial setting-up of the channel it is necessary to adjust the voltages on the vidicon and nuvistor heaters by means of the controls RV1 and RV15, respectively, on the control unit. Monitoring points are provided on both mobile and rack mounted control units and are labelled LKB and LKA. On the mobile units they are located on the power supply unit near the potentiometers and on the rack mounted version they are situated on the control panel. The adjustment should be made by removing the appropriate link and connecting a meter (Avo Model 8 or similar) between the sockets with the meter set to a current range. Switch on the mains and adjust RV15 (nuvistor heater)

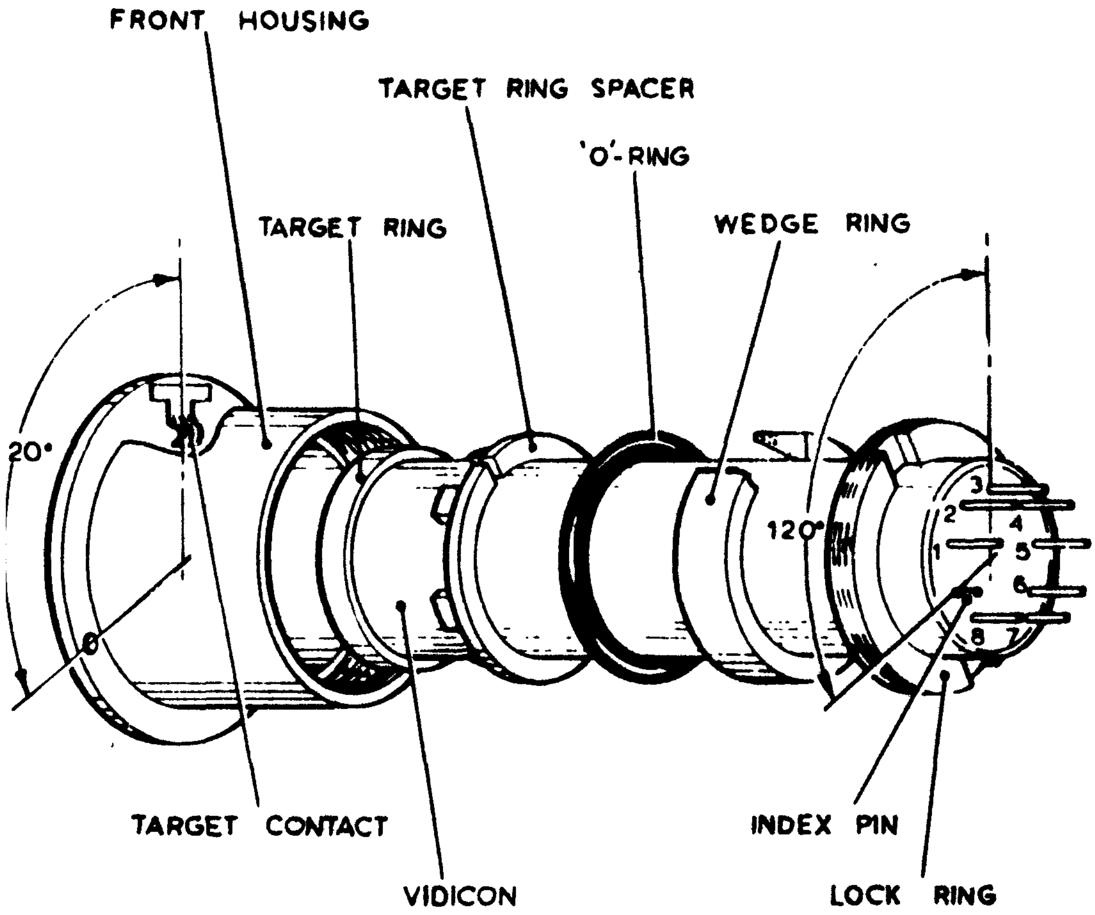

Fig.3 Detail of vidicon mount

to give a reading of 135 mA d.c. Adjust RV1 to give a value of current appropriate to the vidicon tube type being used. It should be remembered that the nuvistor heater is fed from a d.c. supply while the vidicon is fed from an a.c. supply on 50 c/s mains.

NOTE: *Rack mounted units from serial No.102 to 121 inclusive are not fitted with monitoring points. The meter may be connected into the heater lines by breaking the circuit at the potentiometers. Access to these can be obtained by connecting the control panel assembly to the unit by means of the test leads B99-0682-01 (4 ft long) or B99-0682-02 (18 inch long).*

14. If the heater voltage cannot be measured at the camera, the heater current may be set at LKA on the camera control unit according to table 4.

Table 4

Heater current settings

Cable Length	95 mA	150 mA	300 mA	600 mA	Heater Currents
0 ft	105 mA	160 mA	310 mA	610 mA	)
500 ft	106 mA	161 mA	312 mA	616 mA	) Link Currents
1000 ft	107 mA	163 mA	316 mA	622 mA	)

Operating Conditions

15. A number of link changes are required if it is desired to change the operating conditions. These are indicated in Table 5.

Table 5

Operating Conditions

Video 2 Board B99-0037					
Operating Condition	Link Tags				
(a) External drive	-	-	-	-	42-43
(b) Sync. pulse generator	-	-	-	-	42-43
(c) Random interlace (free running)	23-24	25-26	27-28	33-34	41-43
(d) Random interlace (mains locked)	23-24	25-26	27-28	33-34	41-43

Field Scan Board B99-0031						
Operating Condition	Link Tags					
(a) External drive	6-7	8-9	13-32	22-24	25-27	26-37
(b) Sync. pulse generator	6-7	8-9	13-32	22-24	25-37	26-37
(c) Random interlace (free running)	8-9 22-23	10-11 26-27	12-32 33-34	14-15	18-19	20-21
(d) Random interlace (mains locked)	6-8 18-19	7-9 20-21	10-11 22-23	12-32 26-27	14-15 33-34	16-17 35-36

16. In addition to those mentioned in Table 4, the following links may be required on Video 2 Board:-

Auto-target operation, positive picture only, link 9-10.
Auto-target operation, negative picture only, or picture polarity reversal link 10-11, 12-13. Break 36-37 (DO NOT OPERATE TARGET LIMIT AT MAXIMUM).
Auto-black level operation, signal restored to mask, link 6-7.
Auto-black level operation, signal restored to picture blocks, link 6-8.
Dark current limiting, link 36-37.

Chapter 2

MAINTENANCE

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Camera Control Unit

1. Two extension boards are available to give free access to the modules when carrying out measurements on the CCU. Type B99-0030-01 may be used for all modules except the sync. pulse generators, for which B99-0030-02 should be used. Voltages in Table 1 were taken with the camera cable disconnected, but with the boards fitted. A 270 ohms, 3W resistor should be fitted between SKA-T and SKA-R to simulate line scan current.

Table 1

Voltages at Camera Control Unit Socket SKA

Measure at SKA	Function	Nominal	Min.	Max.	Control	
					Clockwise	Anti-clockwise
a-R	Line Co-ax Outer(-16.5V)	16.2V	-15.8V	-16.8V	-	-
a-B	+4.5V	4.3V	3.9V	4.7V	-	-
a-F	+14.5V	14.0V	11.6V	16.0V	-	-
a-P	+100V	93V	79V	107V	-	-
					MINIMUM RANGE	
m-a	Artificial earth		SWE DOWN, RV4 clockwise adjust RV16		100-130	<5
			SWE DOWN, RV16 clockwise adjust RV4		100-130	<5
m-G	Anode	284	260	312	-	-
W-m	Beam		adjust RV2		<1	63-100
m-M	Beam Focus		adjust RV3		768-838	490-700
N-U	Focus Current	-	175 mA	185 mA	-	-

NOTE: *Focus current is measured between SKA-N and SKA-U with a multirange meter on a current range.*

Waveforms

2. Waveforms should be obtainable as indicated in the following paragraphs. When the unit is operated from external drive it is essential that each input is terminated in 75 ohms.

(a) A field scan waveform should be obtainable between SKA-S and SKA-K. The h.t. indicator lamp should go out when either Field drive or Line drive is removed, showing that the scan protection circuit is operating. The lamp should also go out when the 270 ohm resistor between SKA-T and SKA-R is removed and light when the resistor is replaced.

(b) Terminate the Video Output socket, SJK, in 75 ohms and monitor the waveform. With the Black Level Switch in either the ON (automatic) position or OFF (manual) position it should be possible to set the black level to the correct setting i.e. 50 mV above blanking level. The PEAK WHITE Control, RV3 on Video 2 should be fully anti-clockwise and the sync amplitude should be set to 0.5V for a 1.5V composite output. Alternative sync levels are 0.3V and 0.25V for a 1 volt composite signal having 0.7V video and 0.75V video respectively. The value of R15 on Video 2 shows the level for which the channel is set (see Part 2.Sect.1.Chap.2). Adjust the level, if necessary, by means of RV1 on Video 2.

(c) Camera blanking should be present at SKA-A and line trigger at SKA-Z. When a Shading Generator is fitted a shading signal should be present at SKA-C when the Shading ON-OFF switch (SWM) is ON.

Differential Measurement of Video Response

3. On Video 1 board turn the CABLE CORRECTION Control (RV2) fully anti-clockwise. Add a bias potentiometer to Video 2 board as shown in Fig.1.

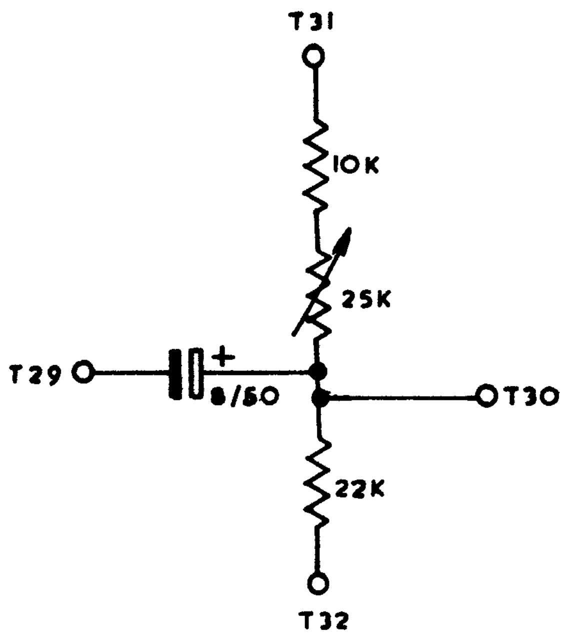


Fig.1 Bias Potentiometer

I

Insert the output from a video sweep generator between pins C and D of SKA and earth pin C to the control unit chassis. Adjust the input to the unit for an output at SKL (terminated in 75 ohms) of 0.5V peak-to-peak. Now set the external potentiometer to give an unclipped output. Readjust input if necessary. The video response should show a peak at approximately 9.5 Mc/s having a lift of 3 dB. It is possible to adjust RV2 (Cable Correction), if desired, by inserting the video at the camera end of the camera cable. Attenuate the input by 12 dB and turn RV1 (Aperture Correction) fully anti-clockwise. C7,C9,C10 and R13 are selected according to the line standard in use and L1 on Video 1 is adjusted to produce a peak in the response, as shown in Table 2.

Table 2
Aperture Correction

Line System	C7	C9	C10	R13	Peaking Frequency	Lift (dB)
405	105p	390p	68p	270 ohms	4 Mc/s	9
625/525	47p	220p	39p	390 ohms	7.75 Mc/s	12
625/525 maximum resolution	33p	180p	33p	390 ohms	9.5 Mc/s	12
625	82p	330p	56p	390 ohms	5.5 Mc/s	12

The Aperture Correction control (RV1) is normally left fully clockwise i.e. no aperture correction.

Auto Black Level Circuit

4. There is no quick method of checking the operation of the auto black level circuit, but the following method gives a complete check.

(a) Remove the 75 ohm termination from the line drive socket and connect the Dark Current Simulator circuit shown in Fig.2.

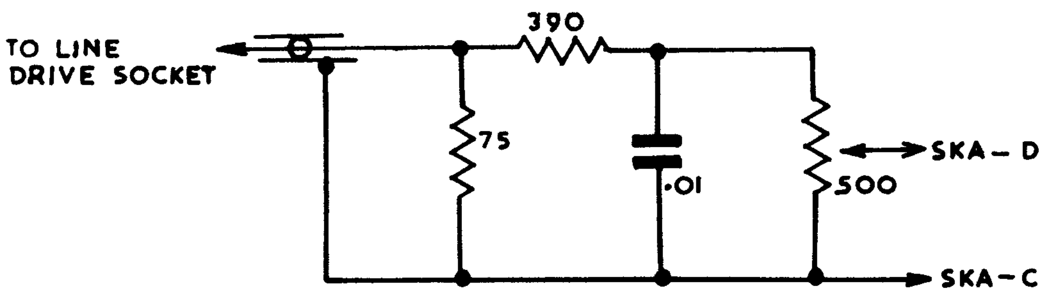


Fig.2 Dark Current Simulator

(b) Connect the slider of the 500 ohm potentiometer to SKA-D and the common line to SKA-C. Monitor the waveform at the Video Output socket, SKL, and switch to Manual Black Level control.

(c) Determine the range required on the 500 ohm potentiometer to give a shift in black level of 500 mV. Switch to Auto Black Level control and reset black level to 50 mV above blanking level.

(d) For the same range on the potentiometer, determine the shift in black level. This should not exceed 30 mV and is typically 15 mV. The measurement is best performed with the oscilloscope time base locked to line frequency.

Camera Tests

5. Waveforms should be present as shown on the circuit diagram Fig.103. The Beam control, RV2 (Fig.107) should adjust the voltage on the Vidicon base pin 2 in a negative direction relative to pin 7. There should be between +260V and +213V on pin 5 relative to pin 7. Pin 6 should be positive to pin 7 and adjustable to +750V by the Focus Control RV3 (Fig.107).

Camera Response

6. Camera response is normally checked on a resolution chart. The camera should resolve a minimum of 700 lines. A method using a sweep generator is given below. Remove the camera from its case and take out the Vidicon tube. Connect the output of the Vidicon Simulator (Fig.3) between the grid pin of V1 and earthy end of C4 (Figs.103 and 123). The layout of the simulator is important. The capacitance to earth and end-to-end of the 15K resistors must be reduced to a minimum. Monitor the output between test points 12 and 13. Set up the sweep generator

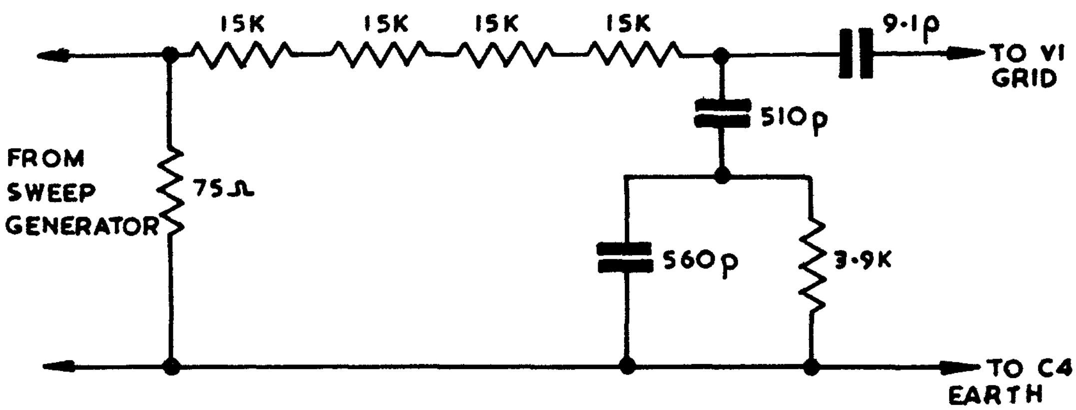


Fig.3 Vidicon Simulator

for differential gain measurements and adjust the output of the generator to 1V peak-to-peak. Set C9 to mid-position and adjust L1 with an insulated trimming tool for not more than 1 dB down to 9 Mc/s and approximately 3 dB down at 11 Mc/s. The response should roll off smoothly but earthly arrangements may affect the response at the high frequency end. The minimum acceptable bandwidth is 3 dB down at 9 Mc/s and +0.5 dB to 8 Mc/s. The peak-to-peak video envelope at T12 should lie between 200 and 300 mV.

7. Disconnect the sweep generator, replace the Vidicon tube and set up the camera to view a Marconi Resolution Chart No.1. Now examine streaking after the horizontal black lines. Set the monitor gain to maximum and adjust the monitor brightness control to show any shading immediately following the black-white transitions. Adjust C9 on the head amplifier for minimum streaking.

8. Setting Overall Gain

(a) Remove the sync pulse generator boards or drives if externally driven and replace the field scan board by a dummy board constructed as indicated in Fig.4.

(b) Remove the camera from its case and lift off one end of C10 on the head amplifier board. Add the bias potentiometer to Video 2 board as in Para.3. If this test is made with a Vidicon tube fitted, the vidicon heater link should be removed to avoid scan burns. Turn the front panel gain control fully anti-clockwise.

(c) Feed 6.3V r.m.s. at 50 c/s into a potential divider as shown in Fig.5. Adjust the 50K variable to give 0.5V peak-to-peak at the junction of the 50K variable and the 100Ω resistor. Connect the free end of the 3 x 1 MΩ resistor chain to the top of R1 on the head amplifier printed board. Connect the earth line to any convenient earth point of the camera. Ensure that the nuvistor heater current is 135 mA.

(d) Adjust the bias potentiometer for an unclipped sine wave at the video output socket SKL and then adjust RV3 on Video 1 for 500 mV peak-to-peak output, using a 1.5V composite signal (1V video, 0.5V sync). When the video output is to be 0.75V or 0.7V, the potentiometer RV3 should be adjusted to give 375 mV or 350 mV respectively. Ensure that the correct value of resistor is being used for R15 on Video 2. (See Part 2, Sect.1, Chap.2.)

Setting Dark Current Limiter

9. With the vidicon tube fitted, adjust the heater current to 105 mA. Switch to AUTO-TARGET and set the lens to T4. Set up the camera to view a resolution chart (Marconi test chart No.1. Fit a 390Ω resistor in place of the link between Tags 11 and 13 on Video 1. Use maximum light level on the vidicon faceplate to minimize dark current. Switch AUTO-BLACK ON and rotate TARGET LIMIT control fully clockwise.

10. Monitor the atrificial earth voltage to earth. (With Video 2 extended, this can be monitored at the collector of VT12.) Rotate RV4 on Video 2 until the target volts just start to decrease. Remove the 390Ω resistor, replace the link and cap the camera lens.

11. The artificial earth voltage will now rise to between -60 and -80V, dependent upon the cathode current and maximum target voltage taken by the vidicon. A low reading would indicate that the vidicon requires replacement.

12. Reset the TARGET LIMIT control as detailed in Part 2, Sect.1, Chap.2, Para.16 and lock RV4 with a dab of paint.

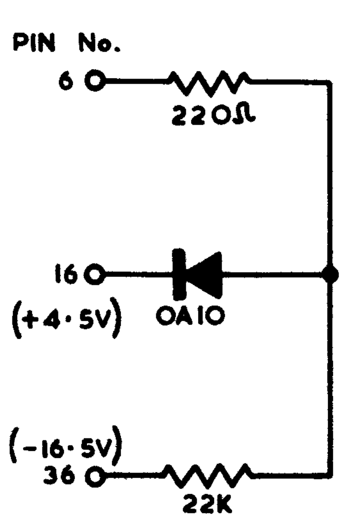


Fig.4 Dummy Scan Board

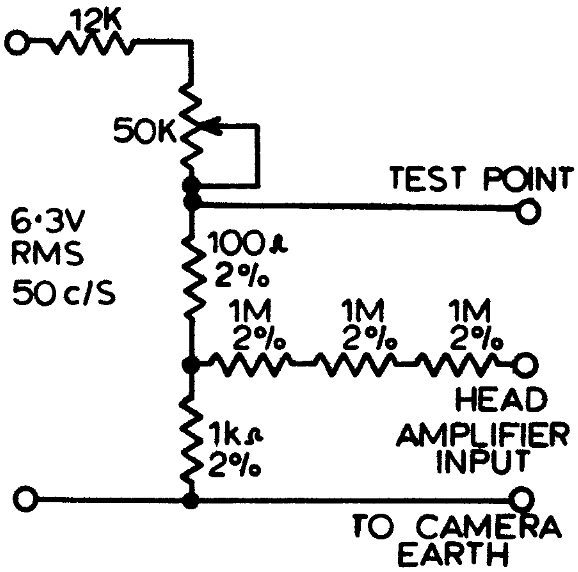


Fig.5 Gain Test Jig

Linearity and Geometry Tests

13. With the Vidicon tube fitted and the heater current adjusted to the correct value, set up the camera to view a grating chart (Marconi test Chart No.4). Now proceed as follows:-

(a) Connect in the output from a grating generator and adjust the number of vertical and horizontal grating generator bars to 25. It is essential that the grating generator should be synchronized from the same drives as the camera channel. Adjust the camera scans so that the mask is just not in view. The camera and chart should be positioned accurately so that the two outside vertical lines and the two outside horizontal lines of the two displays are coincident at their centres.

(b) The Field Linearity is adjusted by means of RV1 and RV2. on the scan board and the Line Linearity is adjusted by means of the taps on the transformer TR1 in the camera. This should only be necessary after a major component change. The degree of non-linearity should not exceed 1%. The resistor RV1 on the camera is set to the point which just avoids clipping the line scan waveform when the width is correctly set and must be set to avoid displacement of alternate lines.

SM

Video 1 (Figs.104 and 123)

Clamp Pulse

14. The width of the clamp pulse at PLR-2 should be between 2 and 3 μsecs. The leading edge, at the 50% amplitude point, should be delayed with respect to the leading edge of line drive by 3 to 4 μs. A similar, positive, pulse should be seen at T31.

Camera Blanking

15. Camera blanking, consisting of line frequency pulses and a single field frequency pulse of not less than 6.5V amplitude should be obtainable at C26. The line pulse width should be less than that of system blanking and the field pulse width approximately 400 μS.

Video 2

16. The auto-black level circuit may be checked as indicated in para.4. The auto-target circuit may be checked by viewing a brightly lit test chart at a lens setting of T4 and varying the black level manually between 0V and 0.8V as measured at the terminated output socket SKL. There should be no change in the level of peak white relative to blanking when operating with positive picture only i.e. Tags 9 and 10 linked. A check may also be obtained by viewing a reasonably well lit scene at a lens setting of about T4. If the lens stop is now closed by several stops the monitor should recover its normal brightness in about 1 sec. This test may be used with either positive or negative pictures. The video circuits are best checked with a camera as the signal source and typical amplitudes with a 1.5V composite output are shown on the circuit diagram. No adjustment for frequency response is provided.

17. The Scan Failure Protection Circuit is designed to protect the vidicon tube in the event of scan failure. Where the channel is operated from external drives the circuit may conveniently be checked by turning down the beam control RV2 and removing line or field drive. The h.t. generator should stop and the H.T. ON light go out. When investigating apparent failure of the h.t. generator it should be remembered that the fault may be due to field or line scan failure. Where the channel is operated from the sync pulse generator boards or on random interlace, there is no simple method of checking the protection circuit. It is not sufficient to attempt a check by removing, for example, the Field Scan board as this will break the interlock circuit and remove the feed to the series regulator, VT1 to VT4 on the Camera Control Unit chassis. A check may be applied by operating the Field Scan board in the extension board and adopting the following procedure:-

Reference should be made to Figs.106 and 118

(a) Random Interlace.

Break the link between tags 22 and 23. This will remove the feed from the Xtal Oscillator, VT12, to the blocking oscillator VT13 and thus check the operation of the line scan protection circuit. Field scan may be checked by breaking the link between tags 8 and 9 unless the channel is mains locked in which event the link between 7 and 9 should be broken. In each check the h.t. generator should stop and the H.T. ON light go out.

(b) Sync Pulse Generator Operation

Break the link between tags 25 and 27 to stop the feed of line drive to the line scan generator. Replace the link and break the link between tags 6 and 7 to stop field drive being fed to the delay multivibrator VT8 and VT9.

Field Scan

18. Field scan linearity adjustment (RV1 and RV2) is fully described in para.9. The field frequency pulse at T1 should be approximately 400 µS wide. The delay range, relative to field drive obtainable by means of RV4 should be, from less than 200 µsecs. to more than 400 µsecs. This delay determines the time interval between field drive and the start of field scan. The delay is normally set to approximately 300 µs between the leading edge of field drive and the leading edge of the pulse at T1.

19. When operating on random interlace the control RV4 is used to lock the field frequency multivibrator to the local mains frequency. Adjustment should be adequate to lock the multivibrator to either 50 or 60 c/s mains. The line frequency pulse width is adjusted by RV5 and should be at least 5 µsecs. The line frequency is adjusted by RV6. These two controls are slightly interdependent.

Shading

20. Waveforms should be obtainable as on the circuit diagram. With the auto-align switch ON there should be at least 60V half field frequency voltage at C17.

Sync Pulse Generators Nos.1 and 2

Master Oscillator

21. To set up the master oscillator it is recommended that sync pulse generator No.1 (B99-0028) be connected in the free running condition (i.e. tag 4 linked to tag 3) and that tag 25 be connected to tag 26.

Adjust RV5 (Xtal lock) to give 0.65 volt d.c. with respect to earth at T26. Now adjust the twice line period by means of RV3 (2 x line period), monitoring at T10, to the appropriate timing as indicated in Table 1. A typical waveform is shown in Fig.6.

Table 3

Twice Line Oscillator Period

Line System	Half Line Period (μsec).
405	49.40
525	31.75
625	32
819	24.42
875	19.45

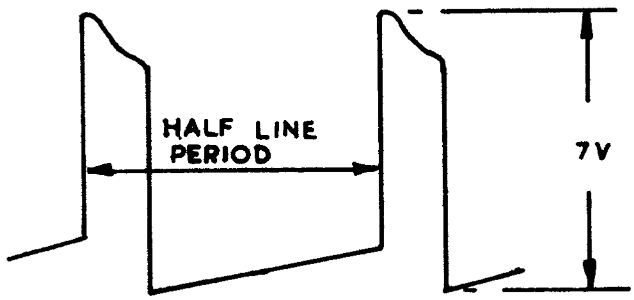


Fig.6 Master Oscillator Waveform

NOTE: *If the correct frequency is not obtainable with the potential at T26 set to 0.65V, RV5 may be adjusted, in conjunction with RV3, to obtain the correct frequency providing the final voltage is within the limits +0.5 to +0.8V. The final voltage should be noted, as the correct frequency will always be obtained with this value.*

Counter Chain

22. Check at T20 on sync pulse generator No.1 and T5 on sync pulse generator No.2, that the counter chain is indicating the correct division ratio for the system in use. (See Table 4 and Fig.7).

Table 4

Frequency Division

Line System	Number of Spikes	
	T20 (S.P.G.1)	T5 (S.P.G.2)
405	15	27
525	21	25
625	25	25
819	7	117
875	7	125

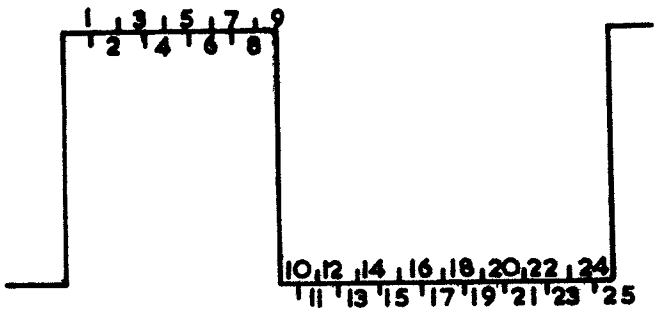


Fig.7 Typical Divider Waveform

Mains Locked Condition

23. The mains lock circuit is set up on test to lock to 50 c/s mains. To lock the circuit to 60 c/s mains ensure that T26 is linked to T27 and connect T4 to T3. Monitor the waveform at T5 using an oscilloscope triggered at mains frequency. Field pulses will be observed 'running through' at a rate corresponding to the difference frequency between that of the mains and the generator field pulse. Maintain a low pulse amplitude (less than 30 mV) by means of RV2 and adjust RV1 for zero slip rate. Disconnect T4-T3 and reconnect T4-T2. Check by monitoring at T5 that the field pulse is now locked to the mains.

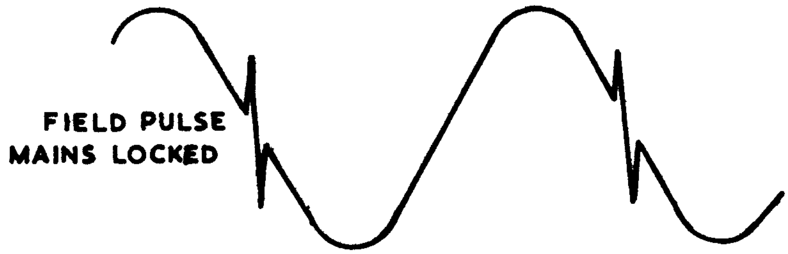


Fig.8 Mains Lock Waveform

24. RV6 (Divide by two) should be adjusted to provide two vertical step edges on the staircase waveform at T11 as indicated in Fig.9.

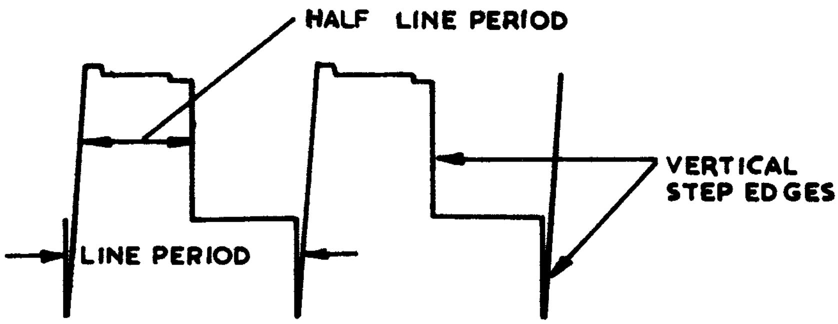


Fig.9 Divide-by-two

Line Blanking

25. Line blanking width is adjusted by means of RV4 on sync pulse generator 1 to be within the limits shown below:

Line System	Pulse Width (μsec).
405	17.5 to 20
Other Systems	11.5 to 14

Output amplitude should be between 1.9V and 2.5V peak-to-peak (nominally 2V). The rise time for the leading edge should be 0.25 μsecs. and for the trailing edge 0.3 μsecs.

Field Blanking

26. Field blanking width is adjusted by means of RV3 on sync pulse generator 2 to be within 1000 μsecs. and 2000 μsecs. The output amplitude should be between 1.9V and 2.5V peak-to-peak (nominally 2V). The rise time for the leading and trailing edges should be 0.5 μsecs. maximum.

Line Drive Output Pulse

27. No adjustment is provided for the line drive pulse width which should be between 6 μsecs, and 8.5 μsecs. with an amplitude between 1.9V and 2.5V (nominally 2V peak-to-peak). The rise time for the leading edge should be less than 0.25 μsecs. and for the trailing edge less than 0.6 μsecs.

Line Sync

28. The line sync pulse width is adjusted by means of RV2 on sync pulse generator 2 to be within the limits shown below:-

Line System	Pulse Width	
	Min.	Max.
405	6	11
Others	3.5	5.5

The output amplitude should be between 1.9V and 2.5V (nominally 2V peak-to-peak). The rise time for the leading edge should be less than 0.25 μsec. and for the trailing edge less than 0.3 μsec.

Field Drive Output Pulse and Field Sync

29. The field drive output pulses should have an amplitude between 1.9V and 2.5V (nominally 2V peak-to-peak) and rise times as follows:-

Leading edge, less than 0.5 μsec.
Trailing edge, less than 2 μsec.

The field drive width can be determined by RV1 in the field drive multivibrator VT11 and VT12 on sync pulse generator 2. However, it is recommended that the field pulse multivibrator be operated with a link between tags 6 and 7 on sync pulse generator 2. This ensures that the field sync includes exactly eight broad pulses and RV1 should have no effect. The output amplitude and rise times for field sync are as for line sync.

Front Porch

30. The sync pulses should be delayed with respect to the start of line blanking by an amount between 1.3 and 2 μsecs.

Operation with Crystal Lock

31. Sync pulse generator 1 should be adjusted as indicated in para.16. Now link T6 to T7 and T8 to T9. Monitor the waveform at T8 and adjust RV5 to the centre of the range in which the master oscillator waveform is locked to the crystal input trigger as shown in Fig.10.

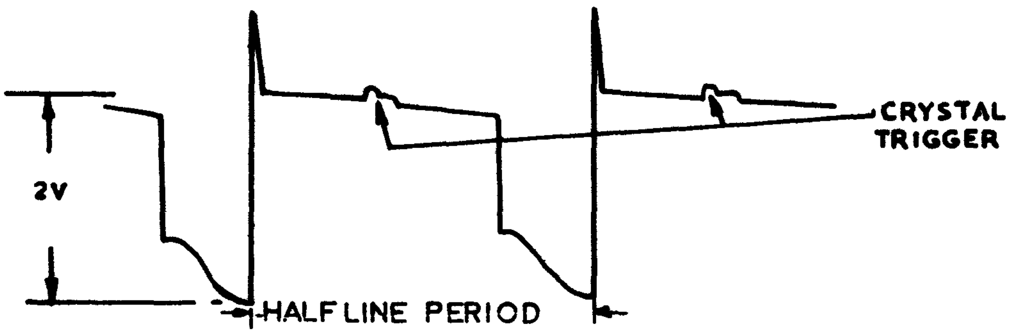


Fig.10 Crystal Lock

FITTING INSTRUCTIONS

RANDOM INTERLACE FILTER KIT

TYPE B99-1219-01

Introduction

1. The Random Interlace Filter Kit is used with the Vidicon Camera Channel Type V321 when the channel is operating under random interlace conditions and it is desired to lock the field frequency to the mains supply. The kit consists of the following items:-

Description and Identity		Quantity
Choke Bracket B99-1224-50		1
Choke Assembly B99-0040-01		1
Screw 2-56 UNC Pan Head, $\frac{1}{4}$''	PF47241/308	2
Nut 2-56 UNC	PF45101/302	6
Washer 8BA, single coil spring	PF74101/308	6
Wire 14/.0076 PVC	PW1213/66	24''
Wire copper tinned .0022D swg.	PW1131/8	$1\frac{1}{2}$''

2. Fitting Kit to Mobile Camera Control Unit Type V3215

Note that the 2 screws, 2 of the nuts, 2 of the washers and the choke bracket are not required.

(a) Remove the camera control unit from its case. The four fixing screws are located at the front of the control unit, one in each corner.

(b) View the unit, from the rear, i.e. the power unit end and a cut out will be seen at the right hand side of the power unit chassis adjacent to the potentiometer RV1. The choke assembly is mounted on two brackets immediately behind the cut out, by means of the nuts provided. An 8BA washer should be placed under each nut.

(c) The choke should be wired as shown in Fig.1. using P.V.C. covered flexible wire. The existing lead on the 7V tap should be unsoldered and reconnected to terminal 4 on the choke. Terminals 1 and 4 should be linked with the tinned copper wire while terminal 2 should be connected to the OV tap with the P.V.C. covered flexible wire. The other lead on the OV tap already exists. Connect a link between SG1/7 and F.Scan/5.

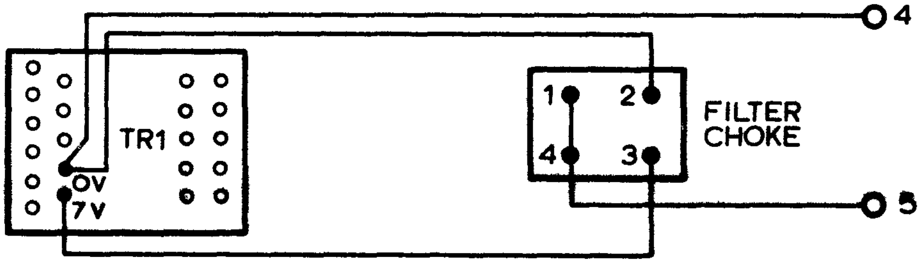


Fig.1.

3. Fitting Kit to Rack Mounted Camera Control Unit
Type V3216

Reference should be made to Figs.2 and 3.

(a) Remove the back panel to provide access to the mounting position for the filter.

(b) Fit the choke bracket to the camera control unit chassis using the holes near resistor R39 and the screws, washers and nuts provided.

(c) Fit the choke to the bracket and wire as shown in Fig.3 using P.V.C. covered flexible wire.

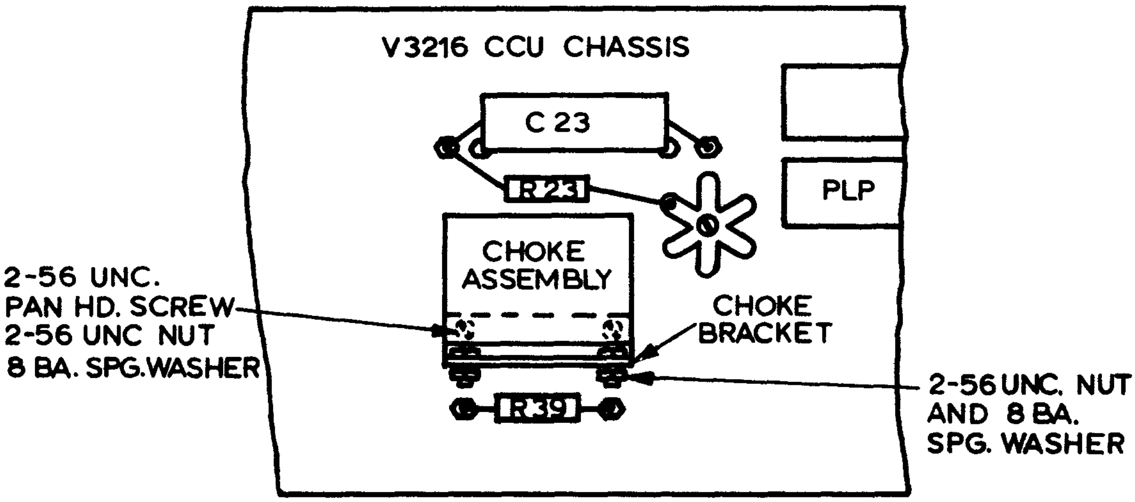


Fig.2.

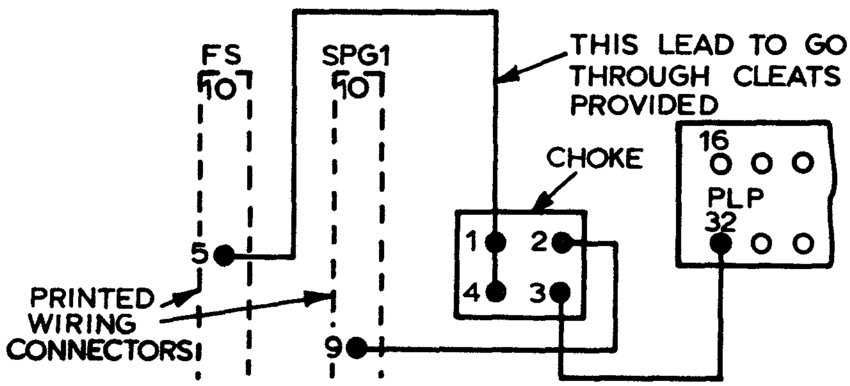


Fig.3.

Crystal Controlled Line Frequency

4. Where it is desired to operate with the line frequency crystal controlled a crystal Type Q01653A should be fitted in the C.C.U. For the position of the crystal holder reference should be made to Figs.122 and 123 for the Mobile Camera Control Unit Type V3215 and to Figs.124 and 125 for the Rack Mounted Camera Control Unit Type V3216. The frequency depends on the line standard in use and typical frequencies are:-

20.250 kc/s for 405 lines
31.500 kc/s for 525 lines
31.250 kc/s for 625 lines
40.950 kc/s for 819 lines

APPENDIX 2

FITTING INSTRUCTIONS

PICTURE POLARITY
REVERSAL KIT TYPE B99-1076

Introduction

1. The Picture Polarity Reversal Kit is used with the Vidicon Camera Channel Type V321 and makes provision for reversing picture polarity from a remote position. There is no provision for mounting the control switch on the Camera Control Units V3215 or V3216 and the switch must be connected via the remote control socket SKB. The kit consists of the following items:-

Description and Identity			Quantity
Relay WIS.11363/B Ref.1		RLB	1
Switch, Lever, 3 amp. 250V PC71301/1		SWH	1
Screw, 4-40 UNC Pan Head $\frac{1}{4}$"	PF47241/308		2
Stiffener 4-40 UNC	PF45402/2		2
Washer, shakeproof, 6BA			2
Sleeving, pink	PM9055/001		4''

Fitting Relay to Printed Wiring Board B99-0038-01 (Video 1)

2. Reference should be made to Figs.1 and 2.

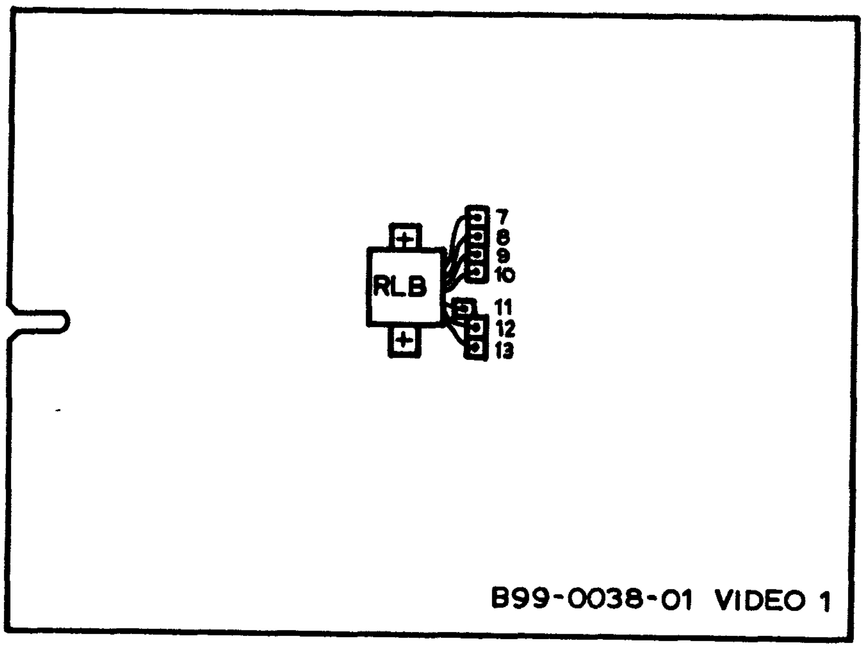


Fig.1.

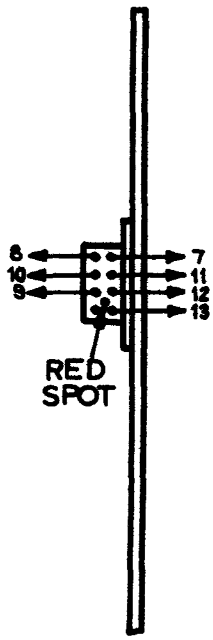


Fig.2.

The relay should be fixed to the printed wiring board B99-0038-01 (Video 1), with the screws provided, in the position shown in Fig.1. The relay should be wired to tags 7 to 13 as shown in Fig.2 and the wires should then be covered with P.V.C. sleeving and the unused wire cut back to approximately $\frac{1}{4}$ in, then bent to form a loop. The control switch, SWH should be connected between pins F and N of SKB on the camera control unit. For full details of connections to SKB reference should be made to table 2 in the Installation section of the manual and to Figs.107 (V3215) and 108 (V3216).

APPENDIX 3

FITTING INSTRUCTIONS

LINE SCAN REVERSAL KIT

TYPE B99-1067

Introduction

1. The Line Scan Reversal kit is used with the Vidicon Camera Channel Type V321 and makes provision for reversing line scan from a remote position. There is no provision for mounting the control switch on the Camera Control Units V3215 or V3216 and the switch must be connected via the Remote Control socket SKB. The kit consists of the following items:-

Description and Identity		Circuit Designation	Quantity
Relay WIS.11363/B Ref.1		RLA	1
Switch, Lever, Double Pole Changeover, PC71301/2		SWK	1
Resistor, variable, 2.5K PC67401/25		RV14	1
Screw, 4-40 UNC Pan Head	-	-	2
Sleeve	PH70501/26	-	8

Fitting Relay to Camera Type V3211

2. Reference should be made to Fig.1.

(a) Remove the front mounting ring by undoing the two stainless steel screws and remove the camera from its case.

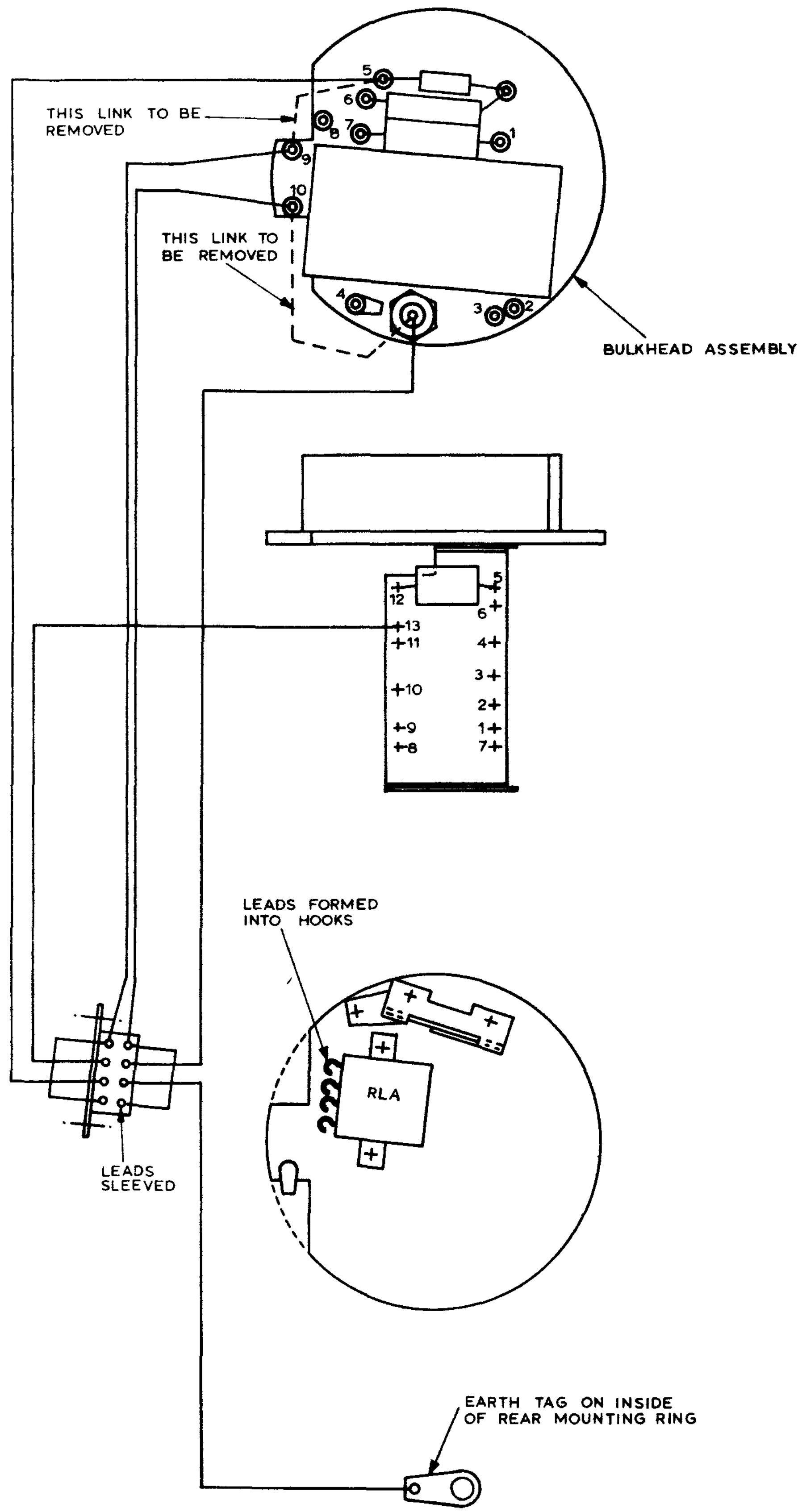
(b) Shorten the leads on the relay and form into hooks as indicated in Fig.1. Fit relay to the rear of the bulkhead using the screws provided and the tapped holes close to the tagboard. A single drop of 'Loctite', grade H should be applied to the screw threads before insertion.

(c) Connect as shown in Fig.1. using P.V.C. covered flexible wire. Ensure that all wiring lies within the circumference of the bulkhead.

(d) Replace camera in case and fit the front mounting ring.

Control Switch SWK and Line Shift Control RV14

3. SWK and RV14 should be wired as shown in Fig.107 (V3215) or Fig.108 (V3216).



B99- 2178 SH.1.
ISSUE. 1

FITTING LINE SCAN REVERSAL RELAY
V321 SERIES CAMERA CHANNEL. FIG. 1.

APPENDIX 4

FITTING INSTRUCTIONS

REMOTE SUN SHUTTER KIT

TYPE VB00-4033

Introduction

1. **The Remote Sun Shutter Kit is used with the Vidicon Camera Channel** Type V321 and makes provision for operating a sun shutter which protects the Vidicon faceplate from intense light sources. The sun shutter is a fail-safe device and is operated by a three position switch having a central off position. The shutter is in position between the lens and the Vidicon faceplate when the switch is in the central position. Provision is made for fitting the control switch to the front panel of either Camera Control Unit V3215 or Camera Control Unit V3216. The kit comprises the following items:-

Description and Identity		Circuit Designation	Qty
Shutter Shaft	B99-0498-50	-	1
Shutter	B99-0610-50	-	1
Spur Gear	B99-0613-51	-	1
Spacer	B99-0948-50	-	1
Collar	W.11812/C Sh.1.Ref.2	25HA	1
Adaptor Plate	B99-0630-50	-	1 *
Adaptor	B99-0609-50	-	2 *
Circlip, External	PH64702/7	-	1
Bracket	B99-0839-50	-	1 *
Cover, Splash-proof	WIS.9495/C Ref.1	-	1
Resistor, Wire Wound	PC67008/7, 100 ohms 3W,5%	R55	1
Switch Double Pole, 3 Positions	WIS.9025/C Ref.4	SWB	1
Switch Micro, 5 amp.	WIS.6908/C Ref.1	SWV	1 *
Ledex Assembly	B99-0893-02	L5	1 *
Screw 6BA.Csk.Hd.	PF13611/308		3 *
Screw 2-56 UNC Pan Hd.	PF47241/308		1
Screw 2-56 UNC Pan Hd.	PF47241/316		2 *
Screw 4-40 UNC Socket (Hex). Set	PF47471/2		1
Nut 6BA Hex.Full	PF12101/306		1 *
Nut 2-56 Hex.	PF45101/302		2 *
Washer 8BA Small	PF74011/308		2 *
Washer 8BA Crinkle	PF74121/1		1
Cable 14/.0048 Insul.Pink			18 ins

Items shown thus * are supplied already assembled.

To Assemble Sun Shutter in Camera V3211

Reference should be made to Fig.4.

2. The Front Mounting assembly is removed by unscrewing the two stainless steel screws at the front. This allows the case to be slid off the front end.

3. The earth clamps on the main tie rods are slackened by undoing the clamping screws and the lead screw is unscrewed from the yoke assembly. In the case of the manual focus, this is achieved by anti-clockwise rotation of the focua knob. If a remote focus unit is fitted, cam assemblies on the tie rods must also be slackened and the lead screw is disengated from the yoke assembly by applying 28V d.c. to terminals 1 and 2 of the terminal board at the rear of the camera. Remove main tie rods.

4. The pillars supporting the tagboard assemblies and the short tie rods are disengaged from the bulkhead to allow access to it from both sides. The preassembled part of the sun shutter (containing the ledex assembly) is fitted to the bulkhead and secured with the appropriate screw after applying a single drop of 'Loctite' grade H to the screw threads.

5. The following parts are assembled as shown in Fig.3:- shutter shaft; shutter; collar; 8BA crinkle washer; 2-56 UNC pan head screw. The camera is reassembled except for the case and front mounting ring; the cam assemblies are reassembled on the main tie rods and adjusted so that one is positioned to operate its microswitch when the yoke assembly is just short of coming into contact with the front ring assembly. The other is positioned to obtain $\frac{1}{2}$ inch movement of the yoke from its maximum forward position. This is described in more detail in the instruction for fitting the remote focus unit (Appendix 6). The lead screw is re-engaged.

6. The spur gear is held in position in mesh with the solenoid gear and the shutter shaft assembly inserted through the appropriate hole in the front cheek of the yoke assembly to pass through the 'oilite' bush in the bulkhead and into the gear. The circlip is fitted into the groove provided on the shaft which is then checked for free rotation with the front ring assembly temporarily attached. The spur gear, positioned against the shoulder on the shaft is secured with the set screw (4-40 UNC) after positioning it so that the shutter is placed centrally under the lens mount hole in the front ring when the solenoid is not energized. A single drop of 'Loctite' grade H is applied to the thread of the screw.

7. The shutter assembly is wired as shown in Fig.1. and tested by applying 24V d.c. to terminals 3 and 4 of the terminal board. The shutter should fully uncap the lens mount hole and hold when the supply voltage drops to 21V.

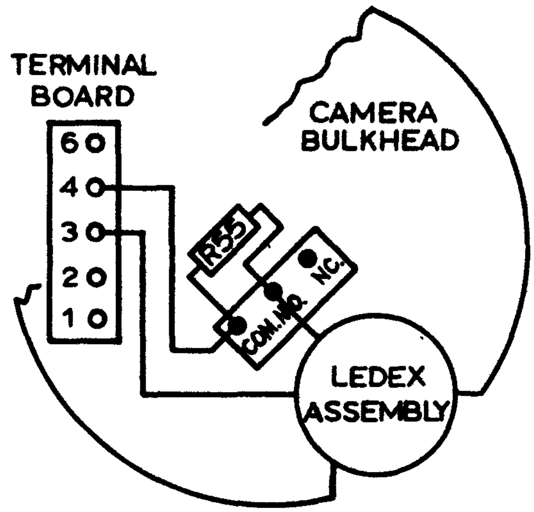


Fig.1.

8. The front mounting ring is removed, the camera assembled in the case and the mounting ring is secured in position.

The shutter operation is tested as before by applying 24V d.c. to pins J and B of the camera connector and checking that it holds when the supply drops to 21V.

9. The remaining items of the sun shutter are fitted to the camera control units V3215 or V3216. The three position switch is fixed in the hole provided in the camera control unit and connected to SKB as indicated in Fig.2. If a remote control unit is in use the switch is connected electrically to the same points via the Remote Control cable (B99-1052) from the plug inserted in SKB, the switch being mounted in a remote unit and wired to convenient tags which are connected to the outgoing cable.

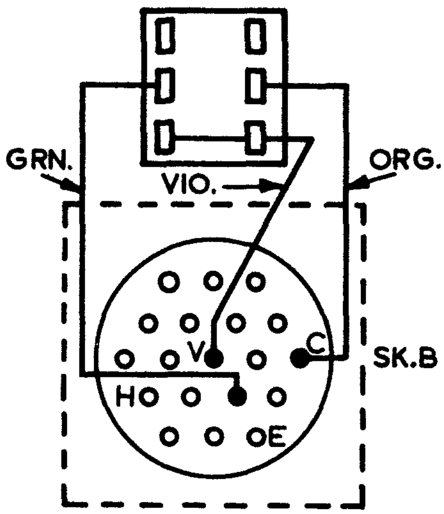


Fig.2.

Additional Information on fitting both
Sun Shutter and Lens Filter in Camera V321

10. The bracket and microswitch are removed from the sun shutter assembly and a 1 inch diameter spacer fitted in place. The sun shutter microswitch is then fitted to the bracket on the filter ledex assembly.

The sun shutter and lens filter are then assembled as described in their separate fitting instructions and wired as indicated in Fig.3.

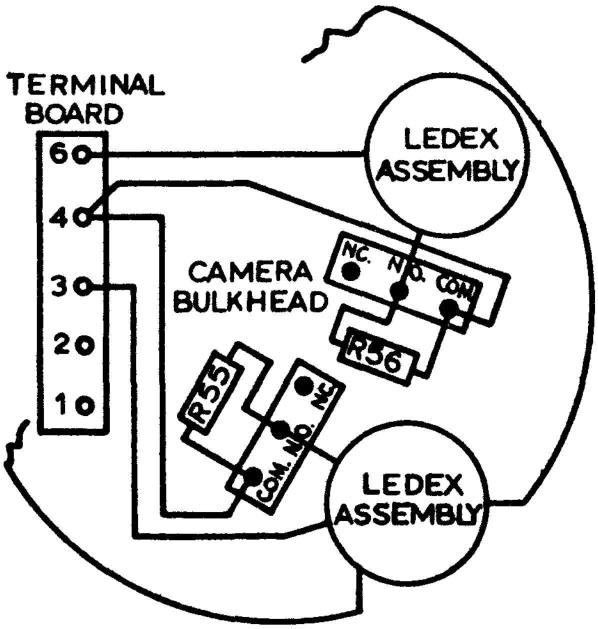
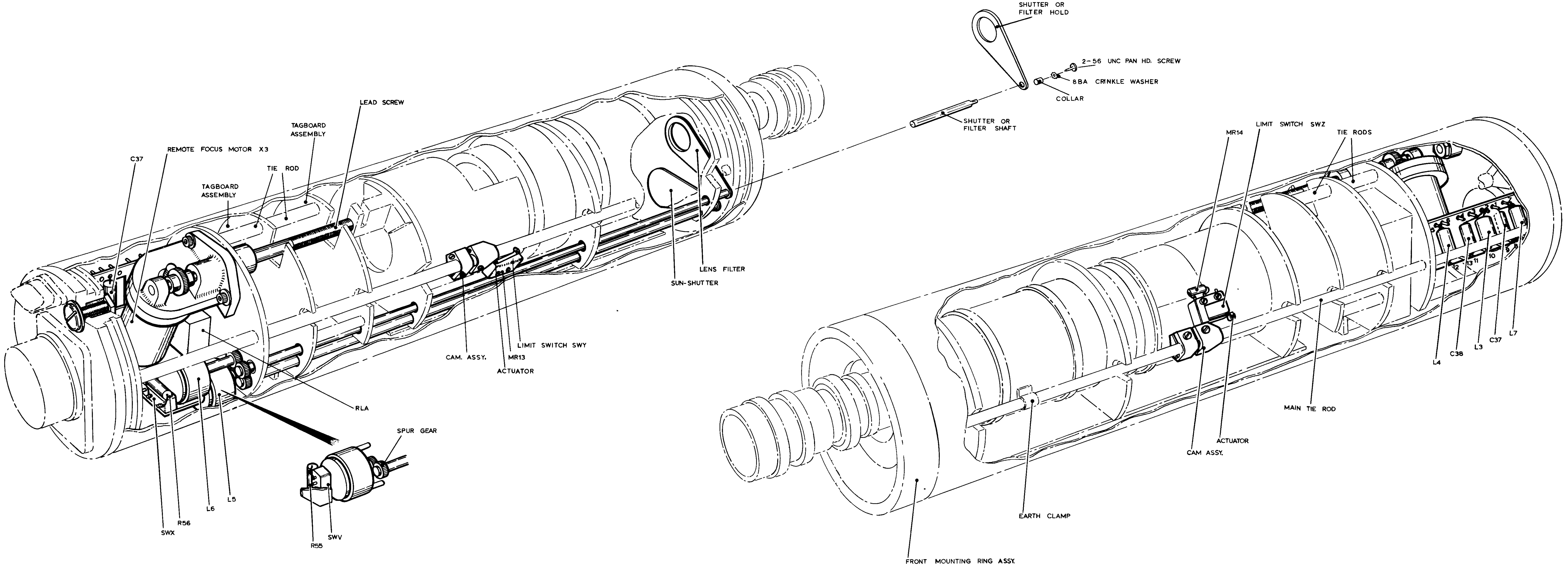


Fig.3.

The operation of both assemblies is tested as described in the separate fitting instructions and the camera is reassembled.

If the lens filter is to be fitted with a sun shutter already in position, the sun shutter is removed and the procedure as above is followed. In a similar way, the above procedure is carried out if a sun shutter is to be fitted to a camera already having a lens filter.

It is to be noted that when a sun shutter and filter are both fitted, they both operate from the same switch, the centre off position moving the sun shutter in front of the vidicon tube. One of the 'on' positions removes the sun shutter away from the front of the tube and the other position does this and, in addition, moves the filter in front of the tube. Thus, one of the three position switches supplied with each kit of parts will not be required. The bracket supplied with the sun shutter is not used.



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V321 SERIES
VIDICON CAMERA CHANNEL

V321 CAMERA
OPTIONAL FACILITIES LAYOUT FIG. 4

APPENDIX 5

FITTING INSTRUCTIONS

LENS FILTER ASSEMBLY

TYPE VB00-4034

Introduction

1. The Lens Filter Assembly is used with the Vidicon Camera Channel Type V321 and makes provision for operating a neutral density filter to increase the light handling range of the camera. The filter is operated by a three position switch having a central off position. The filter is in position between the lens and vidicon faceplate when the switch is operated from the central position. Provision is made for fitting the control switch to the front panel of either Camera Control Unit V3215 or V3216. The kit comprises the following itens:-

Description and Identity		Circuit Designation	Quantity
Shutter Shaft	B99-0498-51	-	1
Filter Frame	B99-0901-50	-	1
Circlip, External	PH64702/7	-	1
Spur Gear	B99-0613-51	-	1
Spacer	B99-0948-50	-	1
Collar	W.11812/C Sh.1.Ref.1	25HA	1
Adaptor Plate	B99-0630-50	-	1 *
Adaptor	B99-0910-50	-	1 *
Adaptor	B99-0664-50	-	1 *
Bracket Assembly	B99-0923-01	-	1 *
Cover Splash-proof	WIS.9495/C Ref.1	-	1
Cable 14/.0048 Insul.Pink		-	18 ins.
Resistor Wire Wound,	PC67008/7 100 ohms 3W,5%	R56	1
Switch D.P. 3 positions	WIS.9025/C Ref.4	SWB	1
Switch Micro 5 amp	WIS.6908/C Ref.1	SWX	1 *
Ledex Assembly	B99-0893-01	L6	1 *
Screw 6BA Round Hd.	PF13641/310	-	1 *
Screw 2-56 UNC Pan.Hd.	PF47241/308	-	1
Screw 2-56 UNC Pan Hd.	PF47241/316	-	2 *
Screw 4-40 UNC Socket (Hex). Set	PF47471/2	-	1
Nut 6BA Hex.Full	PF12101/306	-	1 *
Nut 2-56 Hex.	PF45101/302	-	2 *
Washer 8BA Small	PF74011/308	-	2 *
Washer 8BA Crinkle	PF74121/1	-	1
Screw 6BA Csk.Head.	PF13611/310	-	1

Items shown thus * are supplied already assembled.

To Assemble Lens Filter in Camera V3211

Reference should be made to Fig.4.

2. The Front Mounting ring assembly is removed by unscrewing the two stainless steel screws at the front. This allows the case to be slid off the front end.

3. The earth clamps on the main tie rods are slackened by undoing the clamping screws and the lead screw is unscrewed from the yoke assembly. In the case of manual focus, this is done by anti-clockwise turning of the focus knob. If a remote focus unit is fitted, cam assemblies on the tie rods must also be slackened and the lead screw is disengaged from the yoke assembly by applying 28V d.c. to terminals 1 and 2 of the terminal board at the rear of the camera. The long tie rods are removed.

4. The pillars supporting the tagboard assemblies and the short tie rods are disengaged from the bulkhead to allow access to it from both sides. The preassembled part of the filter (containing the Ledex assembly) is fitted to the bulkhead and secured with the appropriate screws after applying a single drop of 'loctite' grade H to the screw threads.

5. The following parts are assembled as shwon in Fig.3; filter shaft; filter holder; collar; 8BA crinkle washer; 2-56 UNC pan head screw. The camera is reassembled except for the case and front mounting ring, the cam assemblies are reassembled on the main tie rods and adjusted so that one is positioned to operate its microswitch when the yoke assembly is just short of coming into contact with the front ring assembly. The other is positioned to obtain $\frac{1}{2}$ inch movement of the yoke from its maximum forward position. This is described in more detail in the instructions for fitting the remote focus unit. The lead screw is re-engaged.

6. The spur gear is held in position in mesh with the solenoid gear and the Filter shaft assembly is inserted through the appropriate hole in the front cheek of the yoke assembly to pass through the 'oilite' bush in the bulkhead into the gear. The circlip is fitted into the groove provided on the shaft which is then checked for free rotation with the front ring assembly temporarily attached. The spur gear, positioned against the shoulder on the shaft is secured with the set screw (4-40 UNC) after positioning it so that the filter is placed centrally under the lens mount hole in the front ring when the solenoid is energized. A single drop of 'Loctite' grade H is applied to the thread of the screw.

7. The filter assembly is wired as shown in Fig.1. The wiring is tested by applying 24V d.c. to terminals 4 and 6 of the terminal board when the filter frame should lie centrally under the lens mount hole and hold when the supply drops to 21V.

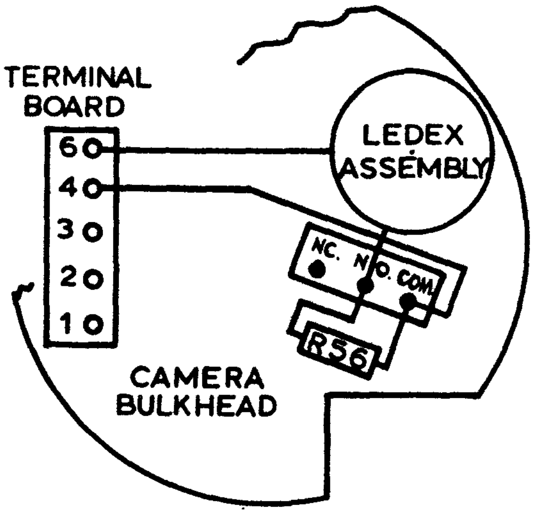


Fig.1.

8. The front mounting ring is removed, the camera assembled in the case and the front mounting is secured in position.

The operation of the filter assembly is tested as before by applying 24V d.c. to pins C and B of the camera connector and checking that it holds when the supply drops to 21V.

9. The remaining items of the filter assembly are fitted to the camera control units V3215 or V3216. The three position switch is fixed in the hole provided in the camera control unit and connected to SKB as indicated in Fig.2. If a remote control unit is in use, the switch is connected electrically to the same points via the Remote control cable (B99-1052) from the plug inserted in SKB, the switch being mounted in a remote unit and wired to convenient tags which are connected to the outgoing cable.

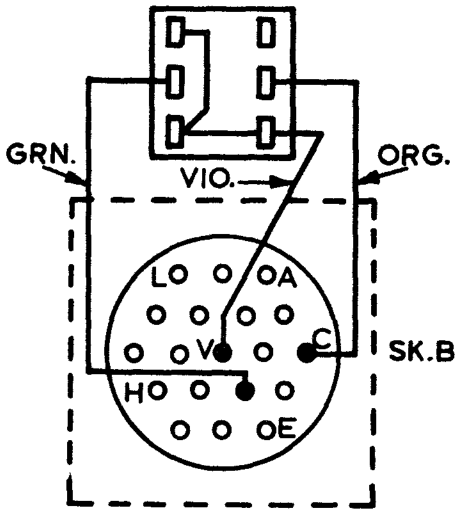


Fig.2.

Additional Information on fitting both
Sun Shutter and Lens Filter in Camera V321

10. The bracket and microswitch are removed from the sun shutter assembly and a 1 inch diameter spacer fitted in place. The sun shutter microswitch is then fitted to the bracket on the filter ledex assembly.

The sun shutter and lens filter are then assembled as described in their separate fitting instructions and wired as indicated in Fig.3.

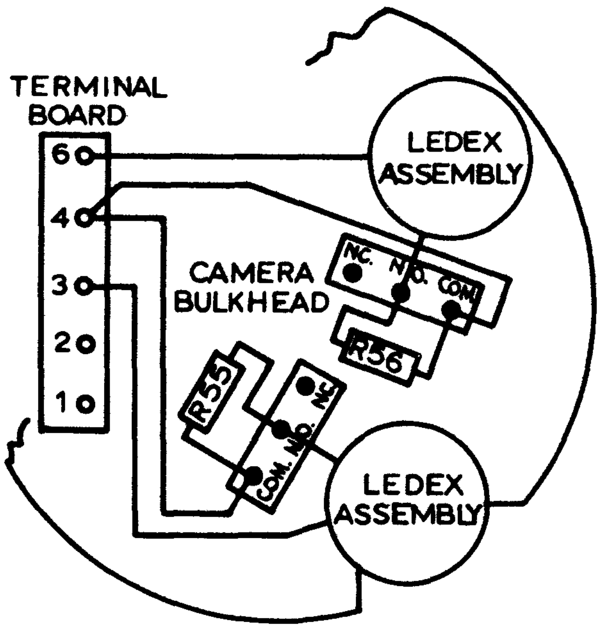
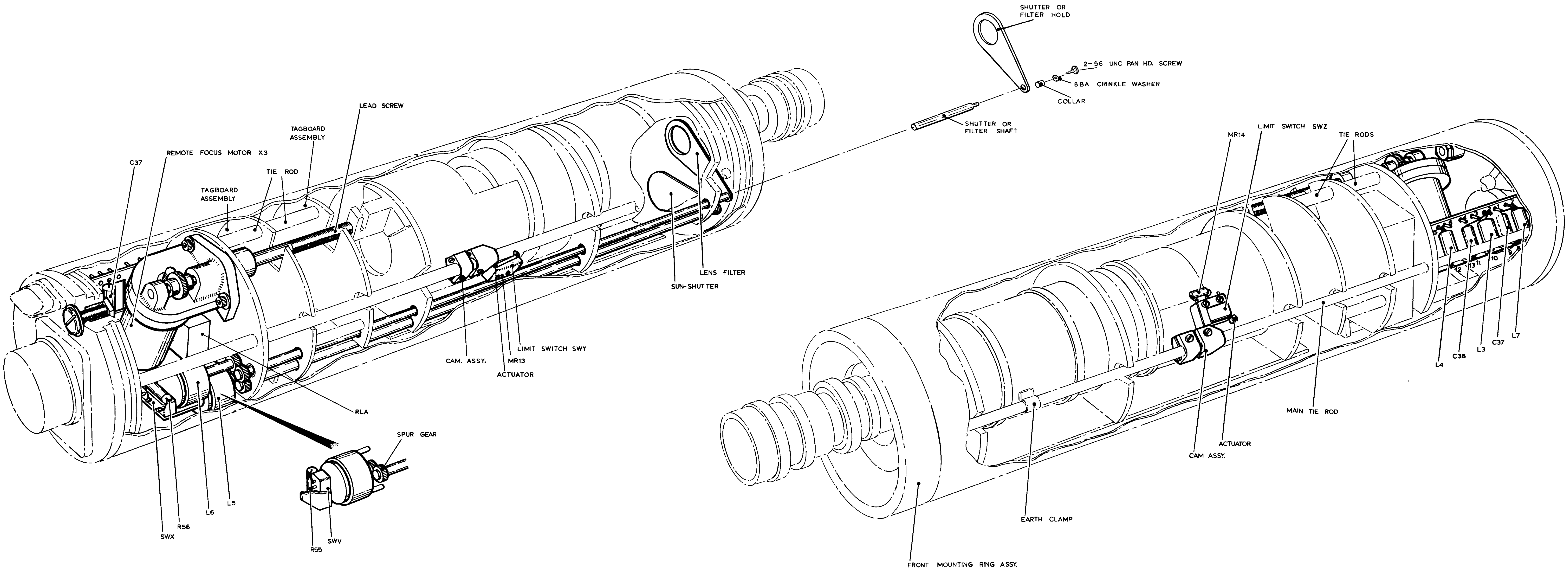


Fig.3.

The operation of both assemblies is tested as described in the separate fitting instructions and the camera is reassembled.

If the lens filter is to be fitted with a sun shutter already in position, the sun shutter is removed and the procedure as above is followed. In a similar way, the above procedure is carried out if a sun shutter is to be fitted to a camera already having a lens filter.

It is to be noted that when a sun shutter and filter are both fitted, they both operate from the same switch, the centre off position moving the sun shutter in front of the vidicon tube. One of the 'on' positions removes the sun shutter away from the front of the tube and the other position does this and, in addition, moves the filter in front of the tube. Thus, one of the three position switches supplied with each kit of parts will not be required. The bracket supplied with the sun shutter is not used.



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V321 CAMERA
OPTIONAL FACILITIES LAYOUT FIG. 4

APPENDIX 6

FITTING INSTRUCTIONS FOR REMOTE FOCUS UNIT TYPE V4012

Introduction

1. The Remote Focus Unit Type V4012 is used in conjunction with the V321 series Camera Channel where remote operation of the optical focusing is required. The unit is supplied as a kit of parts comprising a permanent magnet d.c. motor, switches and all necessary parts for fitting. For a complete item list see the Master Components Lists in the manual T.6768. A small quantity of Loctite is provided for sealing screws and nuts. This must not be applied to moving parts.

2. **Fitting Unit to Camera Type V3211**

Reference should be made to Fig.4 (B.99.1308/1/1)

(a) The Front Mounting Ring assembly should be removed by unscrewing the two stainless steel screws at the front of the camera. This allows the case to be slid off the camera.

(b) Disengage the lead screw by rotating the manual focus control anticlockwise.

(c) The earth clamps on the long tie rods must be slackened by undoing the clamping screws and the tie rods unscrewed with the aid of a tommy bar inserted into the holes provided.

(d) Join the two parts of the cam assembly by means of the 4-40 UNC, $\frac{5}{8}$ inch screws, placing a double coil spring washer between the two parts. Insert a 4-40 UNC, $\frac{1}{4}$ inch screw into each part of the two cam assemblies.

(e) Now view the camera from the rear and slide one of the tie rods through the earth clamp and the right-hand cam assembly positioning the assembly approximately as shown in Fig.4. Repeat for the left-hand assembly.

(f) Replace front mounting ring assembly.

(g) Assemble limit switches and actuators to yoke as shown in Fig.4 using the 2-56 UNC pan head screws.

(h) Remove the manual focus shaft and fluted knob from the rear mounting assembly after removing the circlip on the shaft.

(j) Fit the $\frac{1}{4}$-28 UNF pan head screw, the Seloc washer and the $\frac{1}{4}$-28 UNF nut to the rear mounting ring assembly as shown.

(k) Fit the remote focus motor assembly to the bulkhead using the 10-32 UNF screws and stiffnuts.

FITTING INSTRUCTIONS FOR REMOTE FOCUS UNIT TYPE V4012

Camera Wiring

3. Wire the unit as shown in Fig.1 using the cable provided. A green spot on the motor indicates the side to which the black lead is connected. The cables to the microswitches should be run along the existing cableform and be tied to it. Wire to SWZ first and take the wires to SWY under the head amplifier board. The positions of L3, L7, C37 and C38 are indicated on the tagboard at the rear of the camera.

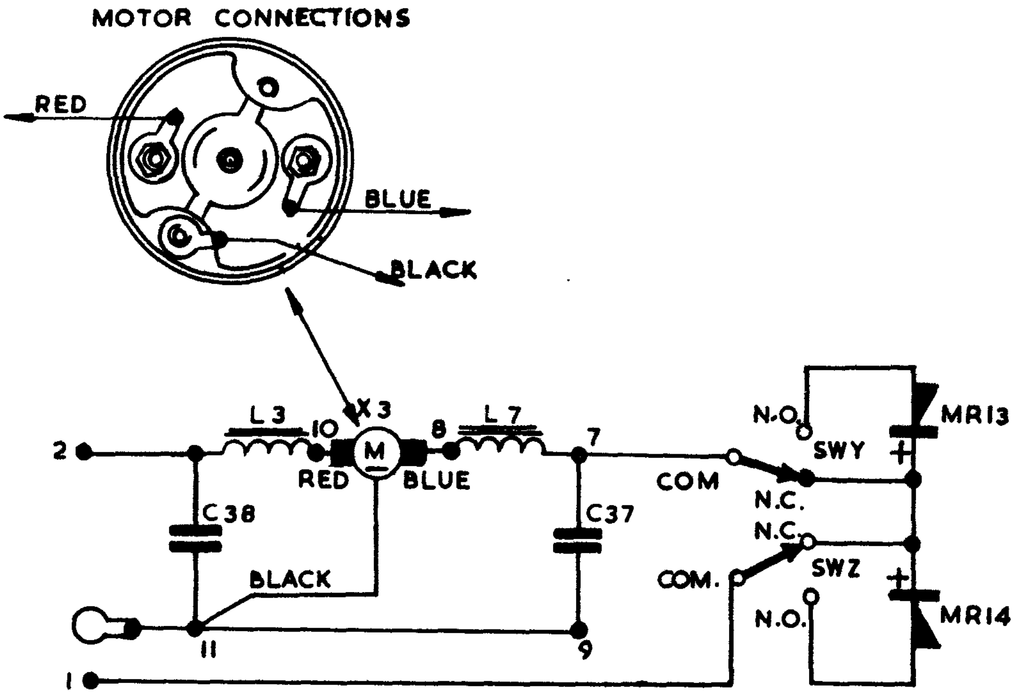

Fig.1 Camera Wiring

Positioning Cam Assemblies

4. Position the left-hand cam assembly approximately so that the microswitch operates when the yoke is just short of coming into contact with the front mounting ring assembly. Apply 28V d.c. to terminals 1 and 2 to drive the yoke assembly forward and position the cam assembly as accurately as possible. Clamp the stop to the tie rod. Clear the microswitch actuator from the cam by reversing the supply leads on terminals 1 and 2. Fine adjustment of cam position can now be made by means of the screw joining the cam to the stop. When the final position has been established clamp the cam to the tie rod. Repeat the above procedure for the right-hand cam assembly to obtain $\frac{1}{2}$ inch of yoke movement from the forward position.

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FITTING INSTRUCTIONS FOR REMOTE FOCUS UNIT TYPE V4012

5. Remove the front mounting ring assembly, replace the camera in its case and replace the front mounting ring assembly.

Fitting Switches to Camera Control Unit Type V3215

6. Fit SWD (Remote Optical Focus) and SWC (Focus speed) in appropriate positions on the panel and wire as shown in Fig.2. The colour coded cables will be found wired to SKB and sleeved ready for use. The zener diode is to be mounted on the heat sink located on pillars between SKB and PLA.

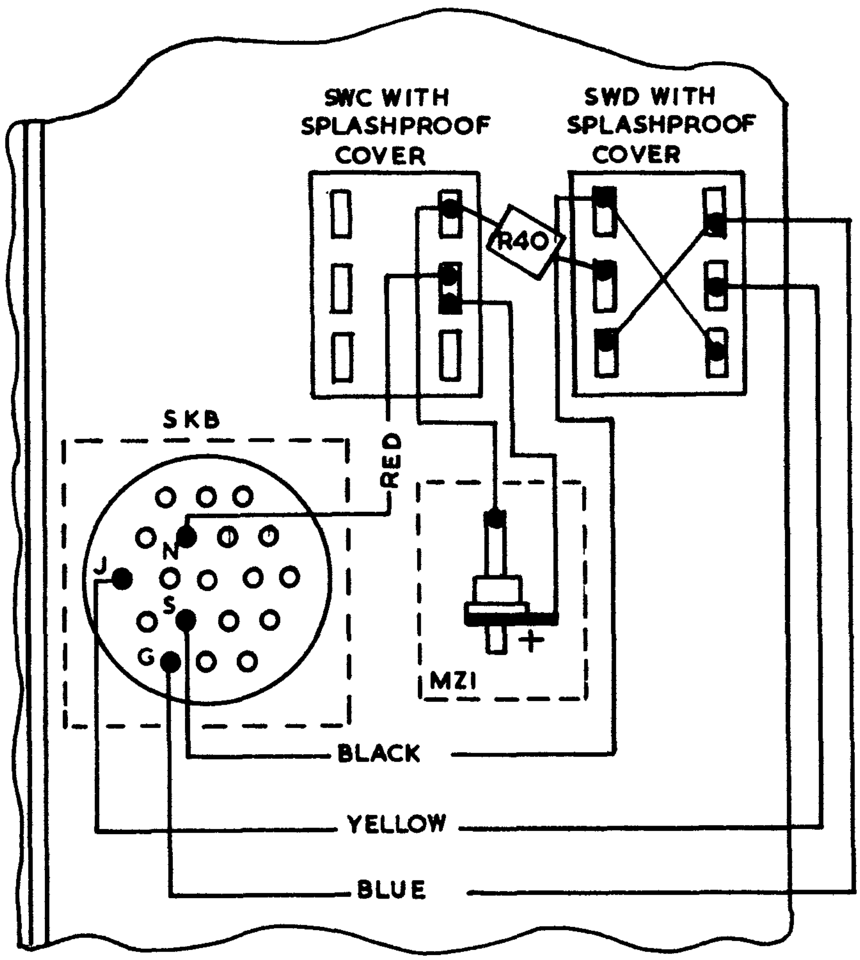


Fig.2 Wiring for Control Unit Type V3215

Fitting Switches to Camera Control Unit Type V3216

7. Fit SWD (Remote Optical Focus) and SWC (Focus speed) in appropriate positions on the control unit panel and wire as shown in Fig.3. The colour coded cables are brought out from the cableform and are sleeved ready for use. The zener diode is wired between the tags on switch SWC.

FITTING INSTRUCTIONS FOR REMOTE FOCUS UNIT TYPE V4012

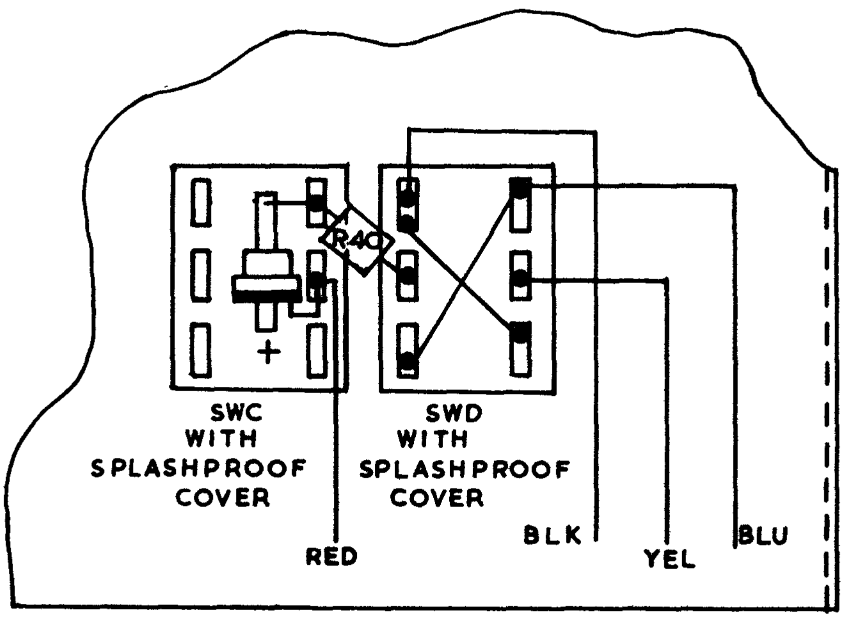
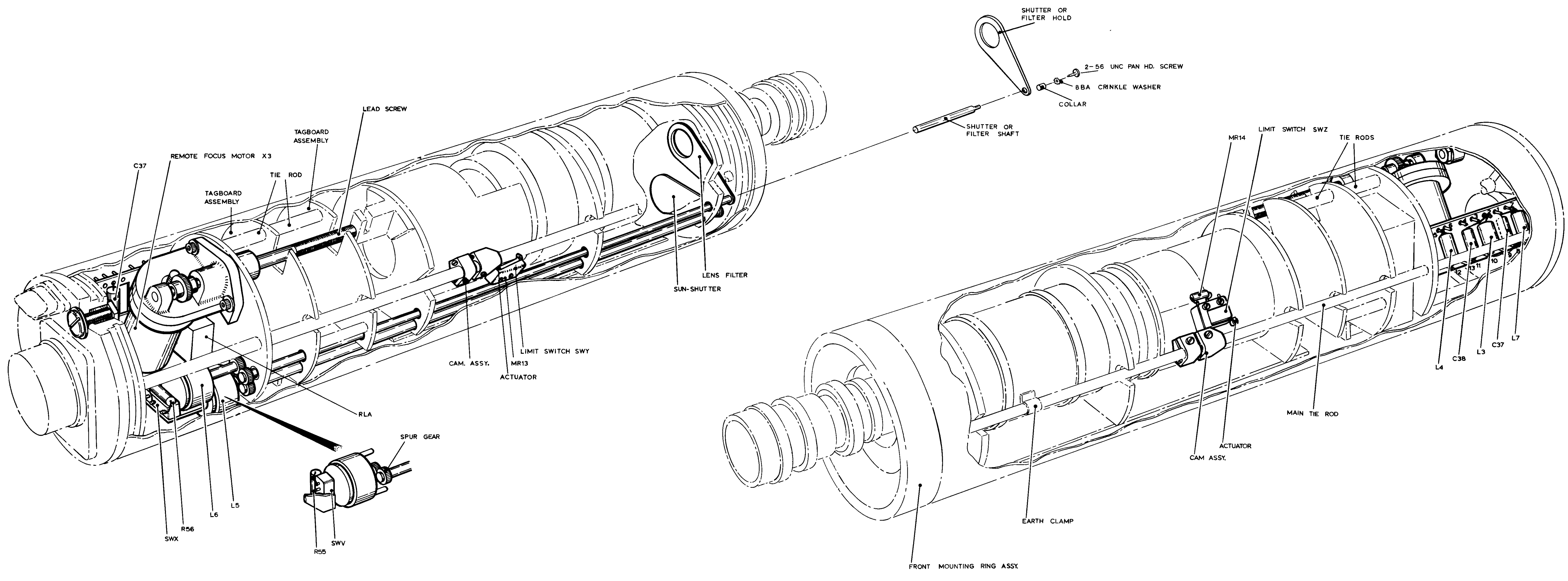


Fig.3 Wiring for Control Unit Type V3216

Remote Control Unit

8. It is possible to locate the control switches in a position remote from the camera control unit by making use of socket SWB. Wiring for this is shown on the Camera Control Unit circuit diagrams, Figs.107 and 108 of the manual T.6768.



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MASTER COMPONENTS LIST

FOR

HEAVY DUTY CAMERA (321 SERIES)

(VB00-3211-01)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1. in addition to the normal part identity.

2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.

3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but not necessary.

4. Prices are subject to change without notice.

5. All items reference PC are standardised items and comply with Government specifications where these exist.

6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.

7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

cap.	capacitor	uH	microhenry
carb.	carbon	pF	micromicrofarad
c.r.t.	cathode-ray tube	mH	millihenry
cer.	ceramic	mA	milliampere
c.o.	changeover	min	minute
coax.	coaxial	min.	minimum
coeff.	coefficient	m.c.	moving coil
CV	Common Valve	mld.	moulded
comp.	composition	neg.	negative
c/s	cycles per second	No.	number
dB	decibel	osc.	oscillator
dia.	diameter	pap.	paper
d.c.	direct current	%	per cent
d.p.	double pole	pos.	positive
d.t.	double throw	potr.	potentiometer
elyc.	electrolytic	prim.	primary (winding)
enam.	enamelled	r.f.	radio frequency
e.h.t.	extra high tension	rect.	rectifier
fig.	figure	ref.	reference
fil.	filament	res.	resistor
ft	foot (feet)	res.var.	resistor variable (potentiometer)
freq.	frequency		
f.s.d.	full scale deflection	rev/min	revolutions per minute
gal	gallon		
H	henry	sect.	section
h.s.	high stability	sil.mica	silver mica
h.p.	horse power	s.p.	single pole
h	hour	s.t.	single throw
in	inch	sp.gr.	specific gravity
indr.	inductance, self inductor	s.w.g.	standard wire gauge
		temp.	temperature
insul.	insulated	F	fahrenheit
insulr.	insulator	terml.	terminal
kc/s	kilocycles per second	transf.	transformer
k ohms	kilohm	tub.	tubular
kW	kilowatt	var.	variable
kV	kilovolt	vit.	vitreous
kVA	kilovolt-amp	V	volt
lin.	linear	VA	volt-ampere
lg.	long	W	watt
max.	maximum	w.w.	wirewound
Mc/s	megacycles per second	yd	yard
M ohms	megohms		
metd.	metallised		
u	micro		
uF	microfarad		

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
1	Bearing block B99-0469-50	1	23.50	
2	Bearing bush WIS.6948-C-1-3 (now PC.15552-3)	1	0.10	
3	Board assy. (head amplifier) B99-0447-01	/1	206.00	
4	Bush B99-0895-50	2	1.70	
5	Cap. pap. 0.04uF ±20% 250V PC.19307-10	2	0.25	
6	Cap. metd. 0.05uF ±20% 350V WIS.7190-C-1-5 (now PC.19814-5)	0		
7	Cap. metd. 0.05uF ±20% 1000V WIS.10399-C-R1 (now PC.19310-1)		0.35	
8	Cap. metd. 0.5uF ±20% 250V WIS.7190-C-1-9 (now PC.19813-9)	2	0.35	
9	Cap. metd. 1uF ±20% 250V WIS.7190-C-1-1 (now PC.19813-1)	1	0.50	
10	Cap. elyc. 50uF ±20% 70V PC.18438-1	1	6.30	
11	Cap. elyc. 500uF ±20% 6V PC.19441-10	2	7.45	
12	Cap. elyc. 500uF ±20% 6V PC.19406-9	1	7.50	
13	Cap. pap. 0.002uF 250V PC.19307-1	1	0.25	
14	Cap. elyc. 3.6uF ±20% 125V PC.19464-1	2	11.00	
15	Cap. resin encapsulated 1000pF ±5% 50V WIS.10076-B-R7 (now PC.18811-7)	4	0.55	
16	Cap.elyc. 47uF ±20% 6V WIS.11495-R10 (now 5/PC.18415-11)	2	0.80	
17	Cap. elyc. 2.2uF ±20% 20V WIS.11495-R5 (now 5/PC.18415-2)	1	0.75	
18	Cap. resin encapsulated 20pF ±2pF 50V WIS.0076-B-R42 (now PC.18979-42)	1	0.50	
19	Cap. elyc. 10uF ±20% 20V WIS.11495-R2 (now 5/PC.18415-22)	1	0.80	
20	Cap. elyc. 68uF ±20% 15V WIS.11495-R11 (now 5/PC.18415-14)	1	1.25	
21	Cap. elyc. 150uF ±20% 6V WIS.11495-R13 (now 5/PC.18415-17)	1	1.45	
22	Cap. resin encapsulated 820pF ±5% 50V WIS.10076-B-R29 (now PC.18811-29)	1	0.50	
23	Cap. elyc. 47uF ±20% 20V WIS.11495-R12 (now 5/PC.18415-12)	1	1.45	
24	Cap. 68pF ±2pF 50V WIS.10076-B-R19 (now PC.18979-19)	1	0.50	
25	Cap. 27pF ±2pF 50V WIS.10076-B-R41 (now PC.18979-41)	1	0.50	
26	Cap. var. 6.5pF WIS.5268-C-R2 (now PC.20090-2)	1	0.40	
27	Circlip PH.64702-9	1	0.20	
28	Calmp ring B99-0485-50	1	41.50	
29	Calmp ring assy. B99-0487-01	1	14.00	
30	Clip (transistor) WIS.10705-C-1-1	1	0.10	
31	Coil (align) W.53770-C-Ed.A	1	4.80	
32	Coil assy. (focus/align) B99-0462-01	/1	142.00	
33	Coil assy. (field) B99-0830-01	/1	95.50	
34	Coil assy. (horizontal) W.54249-B-1-A	2	12.00	
35	Coil assy. (line) B99-0831-01	/1	53.50	

/ Individual items in this list   + per ten   C

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
36	Coil assy. (vertical) W.54250-B-1-A	2	12.00	
37	Collector ring B99-0473-50	1	5.20	
38	Drive screw B99-0472-50	1	7.10	
39	Focus shaft (manual) B99-0582-50	1	4.55	
40	Former assy. B99-0463-01	1	45.50	
41	Heat sink B99-0900-50	1	3.60	
42	Indr. 11uH W.62309-B-S117	1	2.90	
43	Insulr. WIS.11699-B-1-2	11	0.10	
44	Knob (fluted) PH.46501-1	1	0.30	
45	Lens mount B99-0471-51	1	7.10	
46	Mounting ring assy. (front) B99-0686-01	1	16.50	
47	Mounting ring assy. (rear) B99-0674-01	1	26.00	
48	Plug 37-way Amphenol 69-3102E-28-21P (639) WIS.11429-B-1-1	1	4.85	
49	Plug button PC.15901-14	1	0.22	
50	Pot core assy. WIS.8968-C-S42	1	26.00	
51	Pot core assy. WIS.8968-C-S43	1	26.00	
52	Rect. Transitron 2N 1602	0		
53	Rect. Hughes HS1101 (now IN643)	2	0.55	
54	Rect. Mullard 0A200	1	0.10	
55	Rect. Hughes HG5085	7	0.20	
56	Rect. Texas IS417	1	0.80	
57	Res. metal oxide 1.5k ohms ±5% 0.125W PC.66626-18	1	0.10	
58	Res. w.w. 27 ohms ±5% 1.5W PC.67007-31	1	0.20	
59	Res. comp 47 ohms ±2% 0.125W PC.66623-9	1	0.10	
60	Res. metal oxide 100 ohms ±1% 0.5W PC.66637-89	1	0.10	
61	Res. metal oxide 1k ohm ±1% 0.5W WIS.9518-B-R3 (now PC.66637-4)	1	0.10	
62	Res. metal oxide 5.6k ohms ±1% 0.5W PC.66637-85	3	0.10	
63	Res. metal oxide 56k ohms ±1% 0.5W PC.66637-149	2	0.10	
64	Res. metal oxide 100k ohms ±1% 0.5W PC.66637-125	1	0.10	
65	Res. metal oxide 120 ohms ±5% 0.125W PC.66626-4	2	0.10	
66	Res. metal oxide 270 ohms ±5% 0.125W PC.66626-8	1	0.10	
67	Res. w.w. 22 ohms ±5% 1.5W PC.67007-3	1	0.10	
68	Res. metal oxide 22k ohms ±1% 0.5W WIS.9518-B-R39 (now PC.66637-110))	1	0.10	

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\+ per ten

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
69	Res. metal oxide 1.8k ohms ±1% 0.5W WIS.9518-B-R5 (now PC.66637-81)	1	0.10	
70	Res. metal oxide 82 ohms ±5% 0.125W PC.66626-2	1	0.10	
71	Res. metal oxide 47k ohms ±5% 0.25W PC.66626-36	2	0.10	
72	Res. metal oxide 8.2k ohms ±5% 0.125W PC.66626-27	1	0.10	
73	Res. metal oxide 3.9k ohms ±5% 0.125W PC.66626-23	5	0.10	
74	Res. metal oxide 1.8k ohms ±5% 0.125W PC.66626-19	3	0.10	
75	Res. metal oxide 180 ohms ±5% 0.125W PC.66626-6	2	0.10	
76	Res. metal oxide 470 ohms ±5% 0.125W PC.66626-11	1	0.10	
77	Res. metal oxide 22k ohms ±5% 0.125W PC.66626-32	1	0.10	
78	Res. metal oxide 3.3k ohms ±5% 0.125W PC.66626-22	3	0.10	
79	Res. metal oxide 1.5k ohms ±5% 0.125W PC.66626-18	1	0.10	
80	Res. metal oxide 390 ohms ±5% 0.125W PC.66626-10	2	0.10	
81	Res. metal oxide 33k ohms ±5% 0.125W PC.66626-34	1	0.10	
82	Res. metal oxide 1k ohm ±5% 0.125W PC.66626-16	1	0.10	
83	Res. metal oxide 18k ohms ±5% 0.125W PC.66626-31	2	0.10	
84	Res. metal oxide 6.8k ohms ±5% 0.125W PC.66626-26	1	0.10	
85	Res. metal oxide 68 ohms ±5% 0.125W PC.66626-1	1	0.10	
86	Res. metal oxide 1.2k ohms ±5% 0.125W PC.66626-17	1	0.10	
87	Res. comp. 10 ohms ±2% 0.125W PC.66623-1	1	0.10	
88	Res. w.w. 1 ohm ±5% 2.5W PC.67091-2	1	0.10	
89	Res. thermistor 200 ohms ±5% PC.66931-1	1	1.70	
90	Socket special 9-way WIS.11634-B-R1	1	7.75	
91	Socket assy. B99-0483-01	⌿1	11.00	
92	Socket WIS.6774-C-R2	1	1.20	
93	Split ring B99-0478-50	1	4.55	
94	Spring B99-0884-50	1	6.55	
95	Tag board B99-0579-50	1	45.50	
96	Tag board B99-0580-50	1	54.00	
97	Tag board assy. B99-0611-01	⌿1	43.00	
98	Tag board assy. B99-0612-01	⌿1	74.00	
99	Tag board assy. B99-0578-01	⌿1	13.00	
100	Tag board assy. B99-0577-01	⌿1	13.00	
101	Terml. PH.77001-1	54	+0.20	
102	Terml. WIS.4287-B-R6	5	+0.20	
103	Terml. board assy. B99-1016-01	1	20.00	
104	Transf. potting assy. B99-0632-01	⌿1	62.00	
105	Transistor BEY18 (PS-100143)	1	1.00	

⌿ Individual items included in this list   + per ten   E

	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
106	Transistor BSY27 S.T.C.	4	0.30	
107	Transistor AFZ12 Mullard	3	1.05	
108	Transistor OC205 Mullard	1	1.40	
109	Valve Mullard Nuvistor 7586	1		
110	Vidicon Mount assy. B99-0491-02	1	17.50	
111	Yoke assy. B99-0461-01	/1	194.00	
112	Zener diode Mullard OAZ240	3	0.40	
113	Indr. 1.2uH ±20% W.56565-C-S48	0		
114	Res. 1M ohm ±10% 0.25W PC.66610-61	1	0.10	
115	Res. 2.2M ohms ±10% 0.25W PC.66610-65	1	0.10	
116	Res. 3.9M ohms ±10% 0.25W PC.66610-68	1	0.10	
117	Res. var. 20 ohms ±10% 1W PC.67431-21	1	1.20	
118	Vidicon Tube P842G	1		
119	Cap. 0.025 ±20% 600V PC.19858-1	1	ø0.35	
120	Transistor A1704	0	10.00	
121	Transistor 2-N-2893 (PS-101202)	2	19.50	

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/ Individual items included in this list

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
	Appendix 3 **Line Scan Reversal Assy.** **Kit of Parts**		
3001	Relay WIS.11363-B-R1 (now PC.65421-1)	1	6.43
3002	Screws 4-40 UNC. PAN Hd. 0.125 ins.	2	
	Appendix 4 **Sun Shutter Assy.** **Kit of Parts**		
4001	Adaptor B99-0609-50	2	15.00
4002	Adaptor Plate B99-0630-50	1	21.50
4003	Bracket B99-0839-50	1	47.50
4004	Circlip PH.64702-7	1	+0.20
4005	Collar W.11812-C-1-25HA	1	5.55
4006	Cover WIS.9495-C-R1	1	0.70
4007	Ledex Assy. B99-0893-02	1	
4008	Nut 6BA HEX. Full PF.12101-306	1	+0.20
4009	Nut 2-56 HEX. PF.45101-302	2	+0.20
4010	Res. W/W 100 ohms ±5% 3W PC.67008-7	1	0.10
4011	Screw 6BA CSK. PF.13611-308	3	+0.20
4012	Screw 2-56 UNC. PAN PF.47241-308 ¼ in.	3	+0.20
4013	Screw 2-56 UNC. PAN PF.47241-316 ½ in.	2	+0.20
4014	Screw, Socket PF.47471-2	1	+0.20
4015	Shutter B99-1610-50	1	0.60
4016	Shutter Shaft B99-0498-50	1	32.00

1588

+ per ten

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
4017	Spacer B99-0948-50	1	21.50
4018	Spur Gear B99-0613-51	1	14.30
4019	Switch, Micro WIS.6908-C-R1	1	1.00
4020	Washer 8BA Small PF.74011-308	2	+0.20
4021	Washer 8BA Crinkle PF.74121-1	1	+0.20
	Appendix 5 Lens Filter Assy. Kit of Parts		
5001	Adaptor B99-0910-50	1	20.00
5002	Adaptor B99-0664-50	1	15.50
5003	Adaptor Plate B99-0630-50	1	21.50
5004	Bracket Assy. B99-0923-01	1	80.00
5005	Circlip PH.64702-7	1	+0.20
5006	Collar W.11512-C-1-25HA	1	4.50
5007	Cover WIS.9495-C-R1	1	0.10
5008	Filter Frame B99-0901-50	1	
5009	Ledex Assy. B99-0893-01	1	59.50
5010	Nut 6BA PF.12101-306	1	+0.20
5011	Nut 2-56 HEX. PF.45101-302	2	+0.20
5012	Res. W/W 100 ohms ±5% 3W PC.67008-/	1	0.10

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\+ per ten

No	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
5013	Screw 6BA CSK. PF.13611-308	1	+0.20
5014	Screw 2-56 PAN 1/4" PF.47241-308	1	+0.20
5015	Screw 2-56 PAN 1/2" PF.47241-316	2	+0.20
5016	Screw, Socket Hd. PF.47471-2	1	+0.20
5017	Shutter Shaft B99-0498-51	1	32.00
5018	Spacer B99-0498-50	1	16.50
5019	Spur Gear B99-0613-51	1	14.00
5020	Switch, Micro WIS.6908-C-R1	1	0.95
5021	Washer 8BA Small PF.74011-308	2	+0.20
5022	Washer 8BA Crinkle PF.74121-1	1	+0.20
	Appendix 6 **Remote Focus Unit** **Kit of Parts**		
6001	Actuator WIS.6908-C-2-4	2	0.35
6002	Cam Assy. L.H. B99-0845-01	1	109.00
6003	Cam Assy. R.H. B99-0846-01	1	109.00
6004	Cap. Pap. 0.04uF ±20% 250V PC.19307-10	2	0.25
6005	Indr. 1.2mH ±20% W.56565-C-S51	2	13.00
6006	Lock Washer WIS.6964-C-R8	1	0.10
6007	Motor and Bracket Assy. B99-2214-01	1	
6008	Nut PF.52101-350	1	+0.20

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+per ten

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
6009	Rectifier Plessey 1024	2	0.40
6010	Screw 10-32 UNF Socket PF.42861-3	2	+0.20
6011	Screw 2-56 UNC 3/8" PF.47241-312	4	+0.20
6012	Screw 4-40 UNC Socket 5/8" PF.47461-4	2	+0.20
6013	Screw 4-40 UNC Socket 1/4" PF.47461-1	4	+0.20
6014	Screw 1/4-28 7/8" PF.53041-428	1	0.10
6015	Solder Tag SP.11633-B 8BA	1	+0.20
6016	Stiff-nut PF.40402-1	2	+0.20
6017	Stop B99-0847-50	2	89.50
6018	Switch, Micro WIS.6908-C-1-1	2	1.00
6019	Washer 6BA Double Coil Phos-Br.	2	
6020	Washer 8BA Shakeproof M.S. CAD.	1	

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† + per ten

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T6768
List 1
CA

MASTER COMPONENTS LIST
FOR
MOBILE CAMERA CONTROL UNIT
(VB-20-3215-01)

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling
1	Board B-99-0038-50	1	49.00
2	Board B-99-0037-50	1	49.00
3	Board B-99-0031-50	1	55.50
4	Board assy. (F.scan) B-99-0031-01	≠1	240.00
5	Board assy. (Video 1) B-99-0038-01	≠1	285.00
6	Board assy. (Video 2) B-99-0037-01	≠1	279.00
7	Cap. sil. mica 120pF ±5% 50V WIS-10076-B-22 now PC-18811-22	2	0.50
8	Cap. elyc. 50uF +100% -20% 12V PC-18409-7	4	0.10
9	Cap. elyc. 50uF +100% -20% 50V PC-18409-24	1	0.10
10	Cap. elyc. 2000uF +50% -20% 6V PC-18409-5	1	0.10
11	Cap. elyc. 5000uF +50% -20% 6V PC-18409-6	1	0.30
12	Cap. elyc. 1000uF +50% -20% 25V PC-18409-19	4	0.20
13	Cap. elyc. 500uF +100% -20% 25V PC-18409-18	1	0.10
14	Cap. elyc. 50uF +100% -20% 25V PC-18409-15	7	0.10
15	Cap. elyc. 25uF +100% -20% 25V PC-18409-14	7	0.10
16	Cap. elyc. 16uF +100% -20% 150V PC-18406-9	2	0.20
17	Cap. elyc. 4uF +50% -20% 350V PC-18402-4	0	
18	Cap. elyc. 8uF +50% -20% 150V WIS-6333-C-25	1	1.10
19	Cap. elyc. 1000uF +50% -20% 12V PC-18409-11	1	0.10
20	Cap. elyc. 250uF +100% -20% 25V PC-18409-17	1	0.10
21	Cap. elyc. 8uF +100% -20% 50V PC-18409-21	10	0.10
22	Cap. elyc. 100uF +100% -20% 6V PC-18409-1	4	0.10
23	Cap. elyc. 250uF +100% -20% 6V PC-18409-2	3	0.10
24	Cap. elyc. 25uF +100% -20% 50V PC-18409-23	1	0.10
25	Cap. elyc. 100uF 12V PC-18409-8	3	0.10
26	Cap. metd. 2uF ±20% 250V WIS-7190-C-3 now PC-19813-3	1	0.65
27	Cap. 0.25uF ±20% 1000V WIS-10399-C-2 now PC-19310-2	2	0.60
28	Cap. pap. 0.01uF ±20% 250V PC-19307-7	3	0.20
29	Cap. pap. 0.04uF ±20% 250V PC-19307-10	5	0.25

≠ Individual components in this list

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling
93	Relay WIS-11363-B-1-1	0	
94	Res. comp. 1M ohm ±2% 0.25W PC-66624-61	3	0.10
95	Res. comp. 10 ohms ±2% 0.25W PC-66624-1	1	0.10
96	Res. comp. 12 ohms ±2% 0.25W PC-66624-2	1	0.10
97	Res. comp. 680k ohms ±2% 0.25W PC-66624-59	0	0.10
98	Res. metal oxide 68 ohms ±5% 0.5W PC-66626-1	3	0.10
99	Res. metal oxide 680 ohms ±1% 0.5W PC-66637-92	5	0.10
100	Res. metal oxide 560 ohms ±1% 0.5W PC-66637-78	3	0.10
101	Res. metal oxide 330 ohms ±1% 0.5W PC-66637-88	4	0.10
102	Res. metal oxide 470 ohms ±1% 0.5W PC-66637-93	6	0.10
103	Res. metal oxide 2.2k ohms ±1% 0.5W PC-66637-5	7	0.10
104	Res. metal oxide 1k ohm ±1% 0.5W WIS-9518-B-3 now PC-66637-4	11	0.10
105	Res. metal oxide 1.2k ohms ±1% 0.5W PC-66637-80	6	0.10
106	Res. metal oxide 10k ohms ±1% 0.5W PC-66637-86	11	0.10
107	Res. metal oxide 220 ohms ±1% 0.5W WIS-9518-B-78 now PC-66637-144	7	0.10
108	Res. metal oxide 330k ohms ±2% 0.5W WIS-9518-B-116 now PC-66331-14	1	0.20
109	Res. metal oxide 1.8k ohms ±1% 0.5W WIS-9518-B-5 now PC-66637-81	4	0.20
110	Res. metal oxide 270 ohms ±5% 0.125W PC-66626-8	3	0.10
111	Res. metal oxide 100 ohms ±1% 0.5W PC-66637-89	6	0.10
112	Res. metal oxide 5.6k ohms ±1% 0.5W PC-66637-85	4	0.10
113	Res. metal oxide 820 ohms ±1% 0.5W WIS-9518-B-2 now PC-66637-79	4	0.10
114	Res. metal oxide 390 ohms ±1% 0.5W WIS-9518-B-22 now PC-66637-96	6	0.10
115	Res. metal oxide 220k ohms ±1% 0.5W WIS-9518-B-14 now PC-66637-90	1	0.20
116	Res. metal oxide 3.3k ohms ±1% 0.5W WIS-9518-B-7 now PC-66637-83	6	0.10
117	Res. metal oxide 15k ohms ±1% 0.5W WIS-9518-B-37 now PC-66637-108	2	0.10
118	Res. metal oxide 560 ohms ±5% 0.125W PC-66626-12	4	0.10
119	Res. metal oxide 150 ohms ±1% 0.5W WIS-9518-B-86 now PC-66637-148	3	0.10
120	Res. metal oxide 120 ohms ±1% 0.5W WIS-9518-B-16 now PC-66637-91	6	0.10
121	Res. metal oxide 6.8k ohms ±1% 0.5W WIS-9518-B-34 now PC-66637-106	6	0.10
122	Res. metal oxide 18k ohms ±1% 0.5W WIS-9518-B-20 now PC-66637-94	2	0.10
123	Res. metal oxide 2.7k ohms ±1% 0.5W WIS-9518-B-6 now PC-66637-82	5	0.10
124	Res. comp. 82 ohms ±2% 0.125W PC-66623-12	1	0.10
125	Res. metal oxide 1.5k ohms ±1% 0.5W WIS-9518-B-27 now PC-66637-35	9	0.10
126	Res. metal oxide 33k ohms ±1% 0.5W WIS-9518-B-42 now PC-66637-113	3	0.10
127	Res. metal oxide 4.7k ohms ±1% 0.5W WIS-9518-B-8 now PC-66637-84	7	0.10
128	Res. metal oxide 12k ohms ±1% 0.5W WIS-9518-B-36 now PC-66637-107	3	0.10
129	Res. metal oxide 8.2k ohms ±1% 0.5W WIS-9518-B-35 now PC-66637-75	1	0.10
130	Res. comp. 47 ohms ±2% 0.125W PC-66623-9	2	0.10
131	Res. comp. 22 ohms ±2% 0.125W PC-66623-5	2	0.20
132	Res. comp. 10 ohms ±2% 0.125W PC-66623-1	2	0.10
133	Res. metal oxide 150k ohms ±1% 0.5W WIS-9518-B-15 now PC-66637-24	1	0.10

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling
134	Res. comp. 56 ohms ±2% 0.125W PC-66623-10	1	0.10
135	Res. metal oxide 180 ohms ±1% 0.5W WIS-9518-B-76 now PC-66637-142	4	0.10
136	Res. metal oxide 82 ohms ±5% 0.125W PC-66626-2	1	0.10
137	Res. comp. 68 ohms ±2% 0.25W PC-66624-11	1	0.10
138	Res. metal oxide 330k ohms ±1% 0.5W WIS-9518-B-67 now PC-66637-137	2	0.10
139	Res. metal oxide 100k ohms ±1% 0.5W PC-66637-125	4	0.10
140	Res. comp. 100 ohms ±2% 0.125W PC-66623-13	1	0.10
141	Res. metal oxide 47k ohms ±1% 0.5W WIS-9518-B-45 now PC-66637-116	6	0.10
142	Res. metal oxide 56k ohms ±1% 0.5W PC-66637-149	2	0.10
143	Res. metal oxide 22k ohms ±1% 0.5W WIS-9518-B-39 now PC-66637-110	4	0.10
144	Res. metal oxide 100k ohms ±5% 0.125W PC-66626-40	1	0.10
145	Res. metal oxide 330 ohms ±5% 0.125W PC-66626-9	1	0.10
146	Res. metal oxide 10k ohms ±5% 0.125W PC-66626-28	1	0.10
147	Res. metal oxide 12k onms ±5% 0.125W PC-66626-29	1	0.10
148	Res. metal oxide 39k ohms ±1% 0.5W WIS-9518-B-44 now PC-66637-115	2	0.10
149	Res. metal oxide 270k ohms ±1% 0.5W WIS-9518-B-65 now PC-66637-135	2	0.10
150	Res. metal oxide 180k ohms ±1% 0.5W WIS-9518-B-60 now PC-66637-130	0	
151	Res. metal oxide 3.9k ohms ±1% 0.5W WIS-9518-B-33 now PC-66637-105	1	0.10
152	Res. metal oxide 270 ohms ±1% 0.5W WIS-9518-B-77 now PC-66637-143	1	0.10
153	Res. comp. 27 ohms ±2% 0.125W PC-66623-6	1	0.20
154	Res. w.w. 33 ohms ±5% 1.5W PC-67007-4	1	0.20
155	Res. w.w. 10 ohms ±5% 3W PC-67008-1	1	0.10
156	Res. 680k ohms ±2% ¼W PC-66714-16 now PC-66422-33 (Now PC-66331-16)	1	0.35
157	Res. 1.5M ohms ±1% 1W Morganite FC-75 (100 p.p.m. °C)	1	1.15
158	Res. w.w. 68 ohms ±5% 1.5W PC-67007-6	1	0.20
159	Res. 820k ohms ±2% 1-PC-66331-18	1	0.35
160	Res. w.w. 22 ohms ±5% 1.5W PC-67007-3	1	0.10
161	Res. w.w. 10 ohms ±5% 1.5W PC-67007-1	1	0.20
162	Res. w.w. 18 ohms ±5% 1.5W PC-67007-28	1	0.20
163	Res. w.w. 1.5 ohms ±5% 2.5W PC-67091-3	1	0.10
164	Res. var. 1M ohm 0.25W PC-67202-37	2	0.60
165	Res. var. 500k ohms 0.25W PC-67202-33	2	0.85
166	Res. var. 100k ohms 0.25W PC-67202-25	1	0.55
167	Res. var. 1k ohm 0.25W PC-67202-1	1	0.95
168	Res. var. 10k ohms 0.25W PC-67202-13	1	0.40
169	Res. var. 50 ohms 2.5W PC-67403-13 (Now PC-68233-5)	1	0.95
170	Res. var. 500 ohms 0.5W PC-67401-17	2	0.65
171	Res. var. 2.5k ohms 0.5W PC-67401-25	1	0.65
172	Res. var. 75 ohms ±5% 1W PC-67527-42	1	0.70
173	Res. var. 350 ohms ±20% 0.25W WIS-6707-C-14 now PC-67207-19	1	1.70
174	Res. var. 500 ohms ±20% 0.25W WIS-6707-C-7 now PC-67207-12	2	1.70
175	Res. var. 250 ohms ±20% 0.25W WIS-6707-C-13 now PC-67207-18	5	0.70

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling
176	Res. var. 1k ohm ±20% 0.25W PC-67207-1	2	0.80
177	Res. var. 10k ohms ±20% 0.25W PC-67207-4	1	0.80
178	Res. var. 250k ohms ±20% 0.25W PC-67207-8	1	0.85
179	Res. var. 100 ohms ±20% 0.25W WIS-6707-C-8 now PC-67207-13	1	0.65
180	Screen B-99-1073-50	1	0.85
181	Screw captive B-99-0695-50	4	1.50
182	Screw captive B-99-1036-50	4	1.45
183	Shading generator B-99-0033-01	✱1	
184	Socket 37-way WIS-11429-B-2	1	5.70
185	Socket 19-way WIS-11425-B-1 now PC-58261-1	1	3.90
186	Socket PC-60038-1	9	0.80
187	Socket WIS-6562-C-4 now PC-58167-4	1	0.10
188	Socket WIS-6562-C-6 now PC-58167-6	1	0.10
189	Socket & cable WIS-11634-B-1	1	6.70
190	Switch WIS-5103-C-28	1	0.60
191	Switch WIS-5103-C-2	2	0.50
192	Switch WIS-8730-C-40	1	2.90
193	Switch PC-71302-2	1	1.00
194	Sync. pulse generator B-99-0028-01 B-99-0029-01	×1	
195	Tag board assy. B-99-0506-01	1	42.50
196	Tag board assy. B-99-0691-01	1	36.50
197	Tag board assy. B-99-0598-01	1	30.00
198	Tag strip assy. B-99-0890-01	1	22.00
199	Tag strip assy. B-99-0507-01	1	23.00
200	Terml. PH-76801-1	134	+0.20
201	Terml. block 12-way Wecoway List No.WE-401-LFN	1	0.35
202	Transf. assy. B-99-0569-01	/1	33.50
203	Transf. WIS-11716-C-1	1	29.00
204	Transistor Mullard OC-28	4	1.00
205	Transistor Mullard OC-23	1	1.55
206	Transistor Mullard OC-35	1	0.80
207	Transistor Mullard OC-84	10	0.30
208	Transistor Mullard OC-205	4	1.40
209	Transistor Mullard AFZ-12	3	1.10
210	Transistor STC BSY-27	10	0.70

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F

/ Individual components in this list

× Optional - for details see MCL 2B

✱ Optional - for details see MCL 2C

+ per ten

T6768-2
CP

No.	Description and identity	Qty.	Price Each F.O.B. U.K. £ Sterling
211	Transistor Mullard ASY-27	11	0.50
212	Transistor Mullard OC-140	11	0.90
213	Transistor Mullard OC-44	1	0.30
214	Transistor Texas 2-N-711	1	0.55
215	Transistor STC BFY-17	2	1.10
216	Transistor Mullard OC-202	2	1.10
217	Transistor Texas 2-S-305	1	2.05
218	Valveholder PC-81823-1	2	0.10
219	Valve mount B-99-0558-50	1	2.15
220	Valve retainer PC-82501-2	1	0.10
221	Valve retainer PC-82502-2	1	0.25
222	Valve top cap PC-24510-1	1	0.30
223	Zener diode Semitron Z-3-B-12	1	1.45
224	Zener diode Semitron Z-1-A-16	1	2.05
225	Zener diode Semitron Z-1-B-4.3	1	0.60
226	Zener diode Semitron Z-3-B-4.7	1	1.45
227	Zener diode Mullard OAZ-204	1	0.35
228	Zener diode Mullard OAZ-200	0	
229	Zener diode Mullard OAZ-240	4	0.35
230	Zener diode Mullard OAZ-241	1	0.35
231	Res. w.w. 47 ohms ±5% 3W PC-67008-5	1	0.10
232	Rect. Plessey 10-G-4	1	1.50
233	Cap. resin encapsulated 3300pF ±5% 50V o/d PC-18811-50	1	0.55
234	Cap. metd. lacquer 0.5uF ±20% 63V WIS-11983-B-2 now PC-19593-2	1	1.10
235	Res. metal oxide 1k ohm ±2% 0.125W PC-66641-62	1	0.10
236	Res. metal oxide 100 ohms ±2% 0.125W PC-66641-23	1	0.10
237	Res. metal oxide 150 ohms ±5% 0.5W PC-66626-5	2	0.10
238	Res. metal oxide 390 ohms ±2% 0.25W PC-66331-19	1	0.10
239	Fuse 1A WIS-6501-C-4	≠2	0.10
240	Res. metal oxide 2.2k ohms ±2% 0.25W PC-66331-23	0	0.10
241	Cap. elyc. 4uF -20% +50% 450V PC-18406-1	1	0.10
242	Transistor 2-S-303	1	0.80
243	Transistor 2-S-304	1	1.30
244	Res. metal oxide 82k ohms ±2% 1W PC-66331-84	1	0.10

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T6768-2 ≠ for 120V G

CP

No.	Description and Identity	Qty.	Price Each F.O.B.U.K. £ Sterling
245	Res. var. 25 ohms PC-67405-35	1	
246	Res. 120k ohms PC-66641-148	1	0.10
247	Res. w.w. 220 ohms ±5% 1½W PC-67007-9	1	0.10
248	Cap. 18pF ±2pF 50V PC-18979-14	1	
249	Res. var. 50 ohms PC-67405-36	1	
250	Res. metal oxide 1M ohm ±2% 1W PC-66331-105	2	0.10
251	Cap. 0.47uF ±20% 63V PC-19899-2	1	0.80
252	Res. metal oxide 82 ohms ±2% 0.25W PC-66331-2	1	0.10
253	Cap. 18pF ±2pF 50V PC-18979-14	1	6.25

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling
		1	
	APPENDIX 1 **RANDOM INTERLACE CHOKE** **KIT OF PARTS**		
1001	Choke assy. B-99-0040-01	1	13.50
1002	Choke bracket B-99-1224-50	1	30.00
1003	Crystal Type Marconi 1653-A	∅1	
1004	Nut 2-56 UNC hex PF-45101-302	6	+0.20
1005	Screw 2-56 UNC Pan 0.25in. PF-47241-308	2	+0.20
1006	Washer 8BA spring PF-74101-308	6	+0.20
	APPENDIX 2 **PICTURE POLARITY REVERSAL** **KIT OF PARTS**		
2001	Relay WIS-11363-B-1 now PC-65421-1	1	6.20
2002	Screw Pan 4-40 UNC PF-47241-308	2	+0.20
2003	Stiff nuts hex thin 4-40 UNC PF-45402-2	2	+0.20
2004	Switch 3A 250V PC-71301-1	1	0.30
2005	Washer 6BA M.S. CAD Shakeproof	2	
	APPENDIX 3 **LINE SCAN REVERSAL ASSEMBLY** **KIT OF PARTS**		
3001	Res. var. 2.5k ohms 0.5W PC-67401-25	1	0.65
3002	Switch PC-71301-2	1	0.40

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∅ Frequency to customer's order + per ten

No.	Description and identity	Qty.	Price Each F.O.B. U.K. £ Sterling
	APPENDIX 4 **SUN SHUTTER ASSEMBLY** **KIT OF PARTS**		
4001	Switch d.p. 3 posn. WIS-9025-C-4	1	0.90
	APPENDIX 5 **LENS FILTER ASSEMBLY** **KIT OF PARTS**		
5001	Switch d.p. 3 posn. WIS-9025-C-4	1	0.90
	APPENDIX 6 **REMOTE FOCUS UNIT** **KIT OF PARTS**		
6001	Cover WIS-9495-C-1	2	0.20
6002	Res. w.w. 33 ohms ±5% 3W PC-67008-4	1	0.10
6003	Switch 3 posn. WIS-9025-C-1-2	1	0.70
6004	Switch WIS-5103-C-28	1	0.60
6005	Zener diode Z-3-B-12	1	1.45

MASTER COMPONENTS LIST

FOR

POWER SUPPLY UNIT (VB01-3215-01)
POWER SUPPLY UNIT (VB02-3215-01)
POWER SUPPLY UNIT (VB03-3215-01)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1. in addition to the normal part identity.

2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.

3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but not necessary.

4. Prices are subject to change without notice.

5. All items reference PC are standardised items and comply with Government specifications where these exist.

6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.

7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

cap.	capacitor	uH	microhenry
carb.	carbon	pF	micromicrofarad
c.r.t.	cathode-ray tube	mH	millihenry
cer.	ceramic	mA	milliampere
c.o.	changeover	min	minute
coax.	coaxial	min.	minimum
coeff.	coefficient	m.c.	moving coil
CV	Common Valve	mld.	moulded
comp.	composition	neg.	negative
c/s	cycles per second	No.	number
dB	decibel	osc.	oscillator
dia.	diameter	pap.	paper
d.c.	direct current	%	per cent
d.p.	double pole	pos.	positive
d.t.	double throw	potr.	potentiometer
elyc.	electrolytic	prim.	primary (winding)
enam.	enamelled	r.f.	radio frequency
e.h.t.	extra high tension	rect.	rectifier
fig.	figure	ref.	reference
fil.	filament	res.	resistor
ft	foot (feet)	res.var.	resistor variable (potentiometer)
freq.	frequency		
f.s.d.	full scale deflection	rev/min	revolutions per minute
gal	gallon		
H	henry	sect.	section
h.s.	high stability	sil.mica	silver mica
h.p.	horse power	s.p.	single pole
h	hour	s.t.	single throw
in	inch	sp.gr.	specific gravity
indr.	inductance, self inductor	s.w.g.	standard wire gauge
		temp.	temperature
insul.	insulated	F	fahrenheit
insulr.	insulator	terml.	terminal
kc/s	kilocycles per second	transf.	transformer
k ohms	kilohm	tub.	tubular
kW	kilowatt	var.	variable
kV	kilovolt	vit.	vitreous
kVA	kilovolt-amp	V	volt
lin.	linear	VA	volt-ampere
lg.	long	W	watt
max.	maximum	w.w.	wirewound
Mc/s	megacycles per second	yd	yard
M ohms	megohms		
metd.	metallised		
u	micro		
uF	microfarad		

T6768
List 2A
CP

No.	Description	Value	Tol. % ±	Rtg.	Identity	Quantity Ref.1	Ref.2	Ref.3	Price Each F.O.B.U.K £ Sterling	Scale
1	Board assembly				B99-1027-01		⁄1			
2	Board assembly				B99-1014-01			⁄1	76.00	
3	Cap. elyc.	2500uF	+100 - 20	50V	PC.18407-6	2			1.00	
4	Cap. elyc.	1500uF	+100 - 20	50V	PC.18407-5		2	2	0.65	
5	Cap. metd.	0.5uF	20	350V	WIS.7190-C-11 (now PC.19814-11)	1	1	1	0.70	
6	Clamp assembly				B99-0823-01	1			11.00	
7	Clamp assembly				B99-0806-01		1	1	15.00	
8	Cleat				PH.23801-10		2	2	0.10	
9	Clip				PH.23801-6	1			+0.20	
10	Clip				WIS.4056-C-1 (now PC.265535-2)		1		ø6.00	
11	Clip				PC.43308-1			1	0.10	
12	Cover				B99-1074-50		1	1	5.00	
13	Cover				B99-1015-50	1			2.90	
14	Fan				WIS.11554-B-1-1	1			63.50	
15	Fan				WIS.11555-B-1		1		82.00	
16	Fan			28Vdc	WIS.11333-B-1			1	46.00	
17	Fuse			2A	WIS.2947-B-R9	2	2	2	+0.20	
18	Fuseholder				WIS.1952-C-1	2	2	2	0.10	
19	Grommet				PH.36501-7	1			+0.20	
20	Grommet				PH.36501-9		1	1	+0.20	
21	Grommet				PH.36501-5		3	3	+0.20	
22	Insulr.				WIS.11699-B-1-3		2	2	0.10	

C

Ref.1 = Type VB01-3215-01 Ref.2 = Type VB02-3215-01 Ref.3 = Type VB03-3215-01

† ⁄ Components included in this list ø M.O.C. + per ten

D

No.	Description	Value	Tol. % ±	Rtg.	Identity	Quantity Ref. 1	Quantity Ref. 2	Quantity Ref. 3	Price Each F.O. U.K. £ Sterling	Scale
23	Mounting plate				B99-0811-50		1	1	13.00	
24	Nut (spindle gripping)				PH.71104-1	2			0.10	
25	Rect.				PS-100194	0	0	0	0.50	
26	Rect. fittings				WIS-8900-C-1		8	9	0.10	
27	Res. var.	25 ohms	10	20W	PC-67405-35	0	0	1		
28	Res. var.	25 ohms	10	0.5W	PC.67401-1	1	1	1	0.65	
29	Tag board assembly				B99-0804-02		1		13.00	
30	Tag board assembly				B99-0804-01			1	11.50	
31	Terml.				WIS.11533-B-1	12	10	10	ø11.00	
32	Transistor				PS-100503			2	1.00	
33	Transf.				WIS.5697-S511	1			12.00	
34	Transf.				WIS.5697-S512		1	1		
35	Transf.				B99-0583-01			1	26.00	
36	Socket				WIS.6562-C-R26 (now PC.57063-4)	4			0.10	
37	Plug (2 pin shorting)				WIS.5557-C-R1	2			0.10	
38	Cap.	2uF	20	250V	WIS.7190-1-3 (now PC.19813-3)	1			0.70	
39	Res.	82 ohms	2	0.125W	PC.66623-12	1			0.10	
40	Res.	2.2 ohms	5	3W	PC.67008-25	2			0.20	
41	Res.	18 ohms	5	1.5W	PC.67007-28	1			0.20	
42	Random Interlace Choke				B99-0040-01	0			16.00	

Ref.1 = Type VB01-3215-01 Ref.2 = Type VB02-3215-01 Ref.3 = Type VB03-3215-01

ø M.O.C. x per set + per doz

†

T6768
List 2A
CP

No.	Description	Value	Tol. % ±	Rtg.	Identity	Quantity Ref. 1	Quantity Ref. 2	Quantity Ref. 3	Price Each F.O.B. U.K. £ Sterling	ale
43	Res. Var.	25ohms	10	20W	PC.67405-35	1			1.90	
44	Res. Var.	50ohms	10	20W	PC.67405-36		1		2.10	
45	Transistor				BYX-38-300	4	8	9	14.50	
46	Transistor 1G8				CV-7026			1	0.40	

E

†

MASTER COMPONENTS LIST

FOR

SYNC PULSE GENERATOR (BOARDS 1&2)

(B99-0028-01 & B99-0029-01)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1. in addition to the normal part identity.
2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.
3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but not necessary.
4. Prices are subject to change without notice.
5. All items reference PC are standardised items and comply with Government specifications where these exist.
6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.
7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

cap.	capacitor
carb.	carbon
c.r.t.	cathode-ray tube
cer.	ceramic
c.o.	changeover
coax.	coaxial
coeff.	coefficient
CV	Common Valve
comp.	composition
c/s	cycles per second
dB	decibel
dia.	diameter
d.c.	direct current
d.p.	double pole
d.t.	double throw
elyc.	electrolytic
enam.	enamelled
e.h.t.	extra high tension
fig.	figure
fil.	filament
ft	foot (feet)
freq.	frequency
f.s.d.	full scale deflection
gal	gallon
H	henry
h.s.	high stability
h.p.	horse power
h	hour
in	inch
indr.	inductance, self inductor
insul.	insulated
insulr.	insulator
kc/s	kilocycles per second
k ohms	kilohm
kW	kilowatt
kV	kilovolt
kVA	kilovolt-amp
lin.	linear
lg.	long
max.	maximum
Mc/s	megacycles per second
M ohms	megohms
metd.	metallised
u	micro
uF	microfarad
uH	microhenry
pF	micromicrofarad
mH	millihenry
mA	milliampere
min	minute
min.	minimum
m.c.	moving coil
mld.	moulded
neg.	negative
No.	number
osc.	oscillator
pap.	paper
%	per cent
pos.	positive
potr.	potentiometer
prim.	primary (winding)
r.f.	radio frequency
rect.	rectifier
ref.	reference
res.	resistor
res.var.	resistor variable (potentiometer)
rev/min	revolutions per minute
sect.	section
sil.mica	silver mica
s.p.	single pole
s.t.	single throw
sp.gr.	specific gravity
s.w.g.	standard wire gauge
temp.	temperature
F	fahrenheit
terml.	terminal
transf.	transformer
tub.	tubular
var.	variable
vit.	vitreous
V	volt
VA	volt-ampere
W	watt
w.w.	wirewound
yd	yard

No.	Description and Identity	Qty.	Price Each F.OB. U.K. £ Sterling	Scale
1	Board B99-0028-50	1	27.00	
2	Board B99-0029-50	1	27.00	
3	Cap. elyc. 1000uF +50% -20% 12V PC.18409-11	2	0.10	
4	Cap. resin encapsulated 6000pF ±5% 50V PC.18811-44	1	/10.00	
5	Cap. pap. 0.04uF ±20% 250V PC.19307-10	3	0.25	
6	Cap. resin encapsulated 680pF ±5% 50V PC.18811-28	1	/10.00	
7	Cap. elyc. 250uF +100% -20% 12V PC.18409-9	1	0.10	
8	Cap. elyc. 50uF +100% -20% 12V PC.18409-7	4	0.10	
9	Cap. elyc. 100uF +100% -20% 6V PC.18409-1	1	0.10	
10	Cap. polyester 0.047uF ±10% 125V WIS.9584-C-R11 PC.19505-11	1	0.80	
11	Cap. resin encapsulated 2700pF ±5% 50V PC.18811-30	1	/10.00	
12	Cap. resin encapsulated 4700pF ±5% 50V PC.18811-31	2	/10.00	
13	Cap. resin encapsulated 330pF ±5% 50V o/d PC.19832-1	19	0.40	
14	Cap. resin encapsulated 220pF ±5% 50V PC.18811-10	21	/10.00	
15	Cap. pap. 0.001uF ±20% 750V PC.19309-11	11	0.35	
16	Cap. resin encapsulated 100pF ±5% 50V PC.18811-21	2	/10.00	
17	Cap. resin encapsulated 150pF ±5% 50V PC.18811-23	2	/10.00	
18	Cap. resin encapsulated 470pF ±5% 50V PC.18811-8	1	/10.00	
19	Cap. resin encapsulated 120pF ±5% 50V PC.18811-22	2	0.50	
20	Cap. resin encapsulated 0.02uF ±5% 50V PC.18811-32	1	/10.00	
21	Cap. resin encapsulated 560pF ±5% 50V PC.18811-27	2	0.50	
22	Cap. elyc. 25uF +100% -20% 25V PC.18409-14	5	0.10	
23	Cap. pap. 0.005uF ±20% 250V PC.19307-5	1	0.25	
24	Clip B40-0182-50	5	0.25	
25	Indr. 2.5H +50% -0% B99-0653-01	1	36.00	
26	Indr. 5mH W.56565-C-S9	2	3.10	
27	Indr. 2.7mH ±5% W.56565-C-S47	1	2.75	
28	Mounting pad WIS.11188-C-R1 now PC.787502-1	1	0.10	
29	Mounting pad WIS.10646-C-R1 now PC.787501-1	38	0.10	
30	Rect. Mullard OA10 (PS-100437)	1	0.35	
31	Rect. Mullard OA200 (PS-100448)	2	0.10	
32	Rect. Mullard OA7 (PS-100436)	2	0.30	
33	Rect. Hughes HG5004 (PS-100326)	33	0.20	
34	Rect. Hughes HS1103 (PS-100335)	1	0.65	
35	Res. comp. 10 ohms ±2% 0.125W PC.66623-1	1	0.10	
36	Res. comp. 120k ohms ±2% 0.125W PC.66623-50	2	0.10	
37	Res. metal oxide 47k ohms ±5% 0.125W PC.66626-36	3	0.10	
38	Res. metal oxide 470 ohms ±5% 0.125W PC.66626-11	4	0.10	
39	Res. metal oxide 1k ohm ±5% 0.125W PC.66626-16	6	0.10	

/ M.O.C.

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
40	Res. metal oxide 820 ohms ±2% 0.125W PC.66641-55	1	0.10	
41	Res. metal oxide 100 ohms ±5% 0.125W PC.66626-3	2	0.10	
42	Res. comp. ±2% 0.125W PC.66623-	ø1		
43	Res. metal oxide 1.5k ohms ±5% 0.125W PC.66626-18	7	0.10	
44	Res. metal oxide 3.3k ohms ±5% 0.125W PC.66626-22	26	0.10	
45	Res. metal oxide 220 ohms ±2% 0.125W PC.66641-57	1	0.10	
46	Res. metal oxide 330 ohms ±5% 0.125W PC.66626-9	2	0.10	
47	Res. comp. 27 ohms ±2% 0.125W PC.66623-6	2	0.20	
48	Res. comp. 47 ohms ±2% 0.125W PC.66623-9	1	0.10	
49	Res. comp. 270 ohms ±2% 0.125W PC.66623-18	1	0.10	
50	Res. metal oxide 2.7k ohms ±5% 0.125W PC.66626-21	1	0.10	
51	Res. metal oxide 120 ohms ±5% 0.125W PC.66626-4	1	0.10	
52	Res. comp. 18 ohms ±2% 0.125W PC.66623-4	0		
53	Res. metal oxide 4.7k ohms ±5% 0.125W PC.66626-24	10	0.10	
54	Res. metal oxide 22k ohms ±5% 0.125W PC.66626-32	13	0.10	
55	Res. metal oxide 560 ohms ±5% 0.125W PC.66626-12	10	0.10	
56	Res. metal oxide 10k ohms ±5% 0.125W PC.66626-28	41	0.10	
57	Res. metal oxide 2.2k ohms ±5% 0.125W PC.66626-20	24	0.10	
58	Res. metal oxide 150 ohms ±5% 0.125W PC.66626-5	0		
59	Res. metal oxide 100k ohms ±5% 0.125W PC.66626-40	1	0.10	
60	Res. metal oxide 680 ohms ±5% 0.125W PC.66626-14	1	0.10	
61	Res. metal oxide 33k ohms ±5% 0.125W PC.66626-34	1	0.10	
62	Res. metal oxide 1.2k ohms ±5% 0.125W PC.66626-17	1	0.10	
63	Res. metal oxide 39k ohms ±5% 0.125W PC.66626-35	2	0.10	
64	Res. metal oxide 18k ohms ±5% 0.125W PC.66626-31	3	0.10	
65	Res. comp. 56 ohms ±2% 0.125W PC.66623-10	2	0.10	
66	Res. metal oxide 3.9k ohms ±5% 0.125W PC.66626-23	2	0.10	
67	Res. metal oxide 68 ohms ±5% 0.125W PC.66626-1	4	0.10	
68	Res. metal oxide 12k ohms ±5% 0.125W PC.66626-29	1	0.10	
69	Res. metal oxide 56k ohms ±5% 0.125W PC.66626-37	1	0.10	
70	Res. var. 250 ohms ±20% 0.25W WIS.6707-B-R13 now PC.67207-20	1	≠10.00	
71	Res. var. 10k ohms ±20% 0.25W PC.67207-4	1	0.80	
72	Res. var. 1k ohm ±20% 0.25W PC.67207-1	2	0.80	
73	Res. var. 500 ohms ±20% 0.25W WIS.6707-B-R7 now PC.67207-12	1	1.75	
74	Res. var. 5k ohms ±20% 0.25W PC.67207-3	3	0.90	
75	Terml. PH.76801-1	70	0.10	
76	Thermistor assembly B99-0911-01	1	3.25	
77	Transf. B99-0652-01	1	9.60	
78	Transf. B99-0657-01	1	41.00	

ø Value selected on Test

≠ M.O.C.

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
79	Transistor Mullard AFZ12 (PS-100098)	0	1.10	
80	Transistor Mullard OC76 (PS-100518)	2	0.30	
81	Transistor Mullard ASY27 (PS-100100)	15	0.35	
82	Transistor Mullard ASY26 (PS-100099)	24	0.35	
83	Zener diode Semitron Z3B6.2	1	1.25	
84	Cap. Pap. 0.03uF ±20% 250V PC.19307-9	0		
85	Cap. Elyc. 22uF ±20% 15V PC.18415-8	1	0.20	
86	Res. Metal Oxide 22k ohms ±2% 0.125W PC.66641-75	1	0.10	
87	Res. w.w. 6.8 ohms ±10% 1.5W PC.67091-10	1	0.10	
88	Res. Metal Oxide 560 ohms ±2% 0.5W PC.66641-24	1	0.10	
89	Res. Var. 100 ohms ±20% 0.25W PC.67207-13	1	0.80	
90	Cap. 0.01uF ±20% 250V PC.19307-7	1	0.25	

MASTER COMPONENTS LIST

FOR

SHADING GENERATOR

(B99-0033-01)

OPTIONAL ITEM

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1. in addition to the normal part identity.

2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.

3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but not necessary.

4. Prices are subject to change without notice.

5. All items reference PC are standardised items and comply with Government specifications where these exist.

6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.

7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

cap.	capacitor
carb.	carbon
c.r.t.	cathode-ray tube
cer.	ceramic
c.o.	changeover
coax.	coaxial
coeff.	coefficient
CV	Common Valve
comp.	composition
c/s	cycles per second
dB	decibel
dia.	diameter
d.c.	direct current
d.p.	double pole
d.t.	double throw
elyc.	electrolytic
enam.	enamelled
e.h.t.	extra high tension
fig.	figure
fil.	filament
ft	foot (feet)
freq.	frequency
f.s.d.	full scale deflection
gal	gallon
H	henry
h.s.	high stability
h.p.	horse power
h	hour
in	inch
indr.	inductance, self inductor
insul.	insulated
insulr.	insulator
kc/s	kilocycles per second
k ohms	kilohm
kW	kilowatt
kV	kilovolt
kVA	kilovolt-amp
lin.	linear
lg.	long
max.	maximum
Mc/s	megacycles per second
M ohms	megohms
metd.	metallised
u	micro
uF	microfarad
uH	microhenry
pF	micromicrofarad
mH	millihenry
mA	milliampere
min	minute
min.	minimum
m.c.	moving coil
mld.	moulded
neg.	negative
No.	number
osc.	oscillator
pap.	paper
%	per cent
pos.	positive
potr.	potentiometer
prim.	primary (winding)
r.f.	radio frequency
rect.	rectifier
ref.	reference
res.	resistor
res.var.	resistor variable (potentiometer)
rev/min	revolutions per minute
sect.	section
sil.mica	silver mica
s.p.	single pole
s.t.	single throw
sp.gr.	specific gravity
s.w.g.	standard wire gauge
temp.	temperature
F	fahrenheit
terml.	terminal
transf.	transformer
tub.	tubular
var.	variable
vit.	vitreous
V	volt
VA	volt-ampere
W	watt
w.w.	wirewound
yd	yard

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
1	Board B99-0033-50	1	
2	Cap. elyc. 25uF +100% -20% 25V PC.18409-14	2	0.10
3	Cap. polyester 1uF ±20% 250V WIS.7190-C-R1(now PC.19813-1)	4	0.50
4	Cap. resin encapsulated 820pF ±5% 50V WIS.10076-B-R29 (now PC.18811-29)	1	0.50
5	Cap. elyc. 8uF +100% -20% 50V PC.18409-21	1	0.20
6	Cap. pap. 0.03uF ±20% 250V PC.19307-9	1	0.25
7	Cap. polyester 0.25uF ±20% 250V WIS.7190-C-R8 (now PC.19813-8)	3	0.30
8	Cap. pap. 0.02uF ±20% 250V PC.19307-8	1	0.25
9	Cap. elyc. 50uF +100% -20% 12V PC.18409-7	2	0.10
10	Cap. elyc. 100uF +100% -20% 25V PC.18409-16	1	0.10
11	Cap. pap. 0.04uF ±20% 250V PC.19307-10	1	0.25
12	Cap. pap. 0.01uF ±20% 250V PC.19307-7	2	0.25
13	Cap. elyc. 0.1uF ±20% 800V WIS.11343-B-R1 (now PC.19325-1)	1	4.00
14	Cap. elyc. 250uF +100% -20% 6V PC.18409-2	2	0.10
15	Clip B40-0182-50	10	0.20
16	Mounting pad WIS.10646-C-R1 (now PC.787502-1)	3	0.10
17	Mounting pad WIS.11188-C-R1 (now PC.787502-1)	1	0.10
18	Rect. PS.100326 (Hughes HG5004)	4	0.20
19	Rect. PS.100448 (Mullard OA200)	1	0.10
20	Res. metal oxide 15k ohms ±1% 0.5W WIS.9518-B-R37 (now PC.66637-108)	1	0.10
21	Res. metal oxide 68k ohms ±1% 0.5W WIS.9518-B-R48 (now PC.66637-119)	1	0.10
22	Res. metal oxide 5.6k ohms ±5% 0.125W PC.66626-25	1	0.10
23	Res. metal oxide 4.7k ohms ±1% 0.5W WIS.9518-B-R8 (now PC.66637-84)	2	0.10
24	Res. metal oxide 8.2k ohms ±1% 0.5W WIS.9518-B-R35 (now PC.66637-75)	3	0.10
25	Res. metal oxide 22k ohms ±1% 0.5W WIS.9518-B-R39 (now PC.66637-110)	2	0.10
26	Res. metal oxide 680 ohms ±1% 0.5W PC.66637-92	1	0.10
27	Res. metal oxide 3.9k ohms ±1% 0.5W WIS.9518-B-R33 (now PC.66637-105)	2	0.10
28	Res. metal oxide 2.2k ohms ±1% 0.5W PC.66637-5	6	0.10
29	Res. metal oxide 100 ohms ±1% 0.5W PC.66637-89	1	0.10
30	Res. metal oxide 1.8k ohms ±5% 0.125W PC.66626-19	1	0.10
31	Res. comp. 22 ohms ±2% 0.125W PC.66623-5	1	0.10
32	Res. metal oxide 1k ohm ±1% 0.5W WIS.9518-B-R3 (now PC.66637-4)	5	0.10
33	Res. metal oxide 1.8k ohms ±1% 0.5W WIS.9518-B-R5 (now PC.66637-81)	1	0.10
34	Res. metal oxide 2.7k ohms ±1% 0.5W WIS.9518-B-R6 (now PC.66637-82)	1	0.10
35	Res. metal oxide 330 ohms ±1% 0.5W PC.66637-88	1	0.10
36	Res. metal oxide 56k ohms ±1% 0.5W PC.66637-149	1	0.10
37	Res. metal oxide 6.8k ohms ±1% 0.5W WIS.9518-B-R34 (now PC.66637-106)	1	0.10
38	Res. metal oxide 120 ohms ±1% 0.5W WIS.9518-B-R16 (now PC.66637-91)	1	0.10

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
39	Res. metal oxide 820 ohms ±1% 0.5W WIS.9518-B-R2 (now PC.66637-79)	1	0.10
40	Res. metal oxide 470 ohms ±1% 0.5W PC.66637-93 (now PC.66637-93)	1	0.10
41	Res. metal oxide 560 ohms ±1% 0.5W PC.66637-78	2	0.10
42	Res. metal oxide 100k ohms ±1% 0.5W PC.66637-125	1	0.10
43	Res. w.w. 22 ohms ±5% 1.5W PC.67007-3	1	0.10
44	Res. metal oxide 150k ohms ±1% 0.5W WIS.9518-B-R15 (now PC.66637-24)	3	0.10
45	Res. metal oxide 39k ohms ±1% 0.5W WIS.9518-B-R44 (now PC.66637-115)	2	0.10
46	Res. metal oxide 10k ohms ±1% 0.5W PC.66637-86	3	0.10
47	Res. metal oxide 5.6k ohms ±1% 0.5W PC.66637-85	1	0.10
48	Res. comp. 47 ohms ±2% 0.125W PC.66623-9	1	0.10
49	Res. metal oxide 27k ohms ±1% 0.5W WIS.9518-B-R11 (now PC.66637-87)	1	0.10
50	Res. var. 50k ohms 0.25W PC.67207-6	1	0.80
51	Res. var. 2.5k ohms 0.25W PC.67207-2	2	0.90
52	Terml. PH.76801-1	5	0.10
53	Transistor PS.100533 (Mullard OC205)	5	1.40
54	Transistor PS.100530 (Mullard OC530)	1	1.10
55	Transistor PS.100524 (Mullard OC140)	2	0.90
56	Transistor PS.100521 (Mullard OC84)	2	0.30
57	Transistor PS.100142 2N2218	1	1.10
58	Transistor PS.100100 (Mullard ASY27)	2	0.35
59	Transistor PS.101272 (Texas 2S305)	1	1.60

1588

D †

+ per ten

T6768
List 2C
RD

MASTER COMPONENTS LIST

FOR

RACK MOUNTED CAMERA CONTROL UNIT TYPE V3216

(VB00-3216-01)

including

POWER UNIT

(VB01-3216-01)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1. in addition to the normal part identity.
2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.
3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but not necessary.
4. Prices are subject to change without notice.
5. All items reference PC are standardised items and comply with Government specifications where these exist.
6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.
7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.

P.T.O.

8. The following abbreviations are used throughout this Master List:

cap.	capacitor
carb.	carbon
c.r.t.	cathode-ray tube
cer.	ceramic
c.o.	changeover
coax.	coaxial
coeff.	coefficient
CV	Common Valve
comp.	composition
c/s	cycles per second
dB	decibel
dia.	diameter
d.c.	direct current
d.p.	double pole
d.t.	double throw
elyc.	electrolytic
enam.	enamelled
e.h.t.	extra high tension
fig.	figure
fil.	filament
ft	foot (feet)
freq.	frequency
f.s.d.	full scale deflection
gal	gallon
H	henry
h.s.	high stability
h.p.	horse power
h	hour
in	inch
indr.	inductance, self inductor
insul.	insulated
insulr.	insulator
kc/s	kilocycles per second
κ ohms	kilohm
kW	kilowatt
kV	kilovolt
kVA	kilovolt-amp
lin.	linear
lg.	long
max.	maximum
Mc/s	megacycles per second
m ohms	megohms
metd.	metallised
u	micro
uF	microfarad
uH	microhenry
pF	micromicrofarad
mH	millihenry
mA	milliampere
min	minute
min.	minimum
m.c.	moving coil
mld.	moulded
neg.	negative
No.	number
osc.	oscillator
pap.	paper
%	per cent
pos.	positive
potr.	potentiometer
prim.	primary (winding)
r.f.	radio frequency
rect.	rectifier
ref.	reference
res.	resistor
res.var.	resistor variable (potentiometer)
rev/min	revolutions per minute
sect.	section
sil.mica	silver mica
s.p.	single pole
s.t.	single throw
sp.gr.	specific gravity
s.w.g.	standard wire gauge
temp.	temperature
F	fahrenheit
terml.	terminal
transf.	transformer
tub.	tubular
var.	variable
vit.	vitreous
V	volt
VA	volt-ampere
W	watt
w.w.	wirewound
yd	yard

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
1	Cap. elyc. 1000uF +50% -20% 12V PC.18409-11	1	0.10	
2	Cap. pap. 0.01uF ±20% 250V PC.19307-7	3	0.20	
3	Cap. pap. 0.04uF ±20% 250V PC.19307-10	6	0.25	
4	Cap. elyc. 50uF +100% -20% 12V PC.18409-7	5	0.10	
5	Cap. elyc. 50uF +100% -20% 50V PC.18409-24	1	0.10	
6	Cap. elyc. 2000uF +50% -20% 6V PC.18409-5	1	0.10	
7	Cap. elyc. 5000uF +50% -20% 6V PC.18409-6	1	0.30	
8	Cap. elyc. 1000uF +50% -20% 25V PC.18409-19	5	0.20	
9	Cap. elyc. 25uF +100% -20% 50V PC.18409-23	2	0.10	
10	Cap. elyc. 25uF +100% -20% 25V PC.18409-14	5	0.10	
11	Cap. elyc. 16uF +100% -20% 150V PC.18406-9	2	0.20	
12	Cap. elyc. 500uF +100% -20% 25V PC.18409-18	1	0.10	
13	Cap. metd. 2uF ±20% 250V WIS.7190-C-R3 (now PC.19813-3)	2	0.65	
14	Cap. elyc. 4uF +50% -20% 350V PC.18402-4	0	0.25	
15	Cap. pap. 0.25uF ±20% 1000V WIS.10399-C-R2(now PC.19310-2)	2	0.60	
16	Cap. elyc. 8uF +50% -20% 150V WIS.6333-C-R25	1	1.10	
17	Cap. mica 120pF ±5% 50V WIS.10076-B-R22	2	0.50	
18	Cap. elyc. 250uF +100% -20% 25V PC.18409-17	1	0.10	
19	Cap. elyc. 2500uF +100% -20% 50V PC.18407-6	2	0.95	
20	Clamp assembly B99-0838-01	1	30.00	
21	Clip PH.23801-9	1	+0.20	
22	Clip PH.23801-4	2	+0.20	
23	Clip PH.23801-5	2	+0.20	
24	Field scan board B99-0031-01	≁1	240.00	
25	Frame assembly B99-0525-01	1	164.00	
26	Fuse 500mA WIS.6501-C-R3	*2	0.10	
27	Fuse 2A WIS.6501-C-R5	2	0.10	
28	Fuseholder WIS.1952-C-S1	3	0.10	
29	Grommet PH.36501-7	1	+0.20	
30	Grommet PH.36501-14	2	+0.20	
31	Grommet PH.36501-8	3	+0.20	
32	Grommet PH.36501-5	1	+0.20	
33	Handle WIS.6675-C-R6 (now PC.38819-6)	2	0.90	
34	Indr. W.56565-C-S48	1	1.50	
35	Insulr. WIS.11699-B-1-4	20	0.10	

T6768†
List 3
CP

* For 240V

+ per ten

≁ Components included in this list

C

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
36	Plug 32-way PC.57060-1	2	1.50	
37	Res. metal oxide 10k ohms ±1% 0.5W PC.66637/86	11	0.10	
38	Res. metal oxide 68 ohms ±5% 0.125W PC.66626-1	3	0.10	
39	Res. metal oxide 330 ohms ±1% 0.5W PC.66637/88	5	0.10	
40	Res. metal oxide 560 ohms ±1% 0.5W PC.66637/78	2	0.10	
41	Res. metal oxide 470 ohms ±1% 0.5W PC.66637/93	4	0.10	
42	Res. metal oxide 2.2k ohms ±1% 0.5W PC.66637/5	7	0.10	
43	Res. w.w. 10 ohms ±5% 3W PC.67008-1	1	0.10	
44	Res. comp. 680k ohms ±2% 0.25W PC.66624-59	1	0.10	
45	Res. metal oxide 1k ohm ±1% 0.5W WIS.9518-B-R3 (now PC.66637/4)	12	0.10	
46	Res. metal oxide 470k ohms ±1% 0.5W PC.66637/40	1	0.10	
47	Res. metal oxide 560k ohms ±1% 1W PC.66422-33	6	0.35	
48	Res. comp. 1M ohm ±2% 0.25W PC.66624-61	3	0.10	
49	Res. metal oxide 1.5M ohms ±1% 1W Morganite F.C.75 (100 P.P.M°C)	1	0.10	
50	Res. metal oxide 1.2k ohms ±2% 0.5W PC.66637/80	6	0.10	
51	Res. w.w. 68 ohms ±5% 1.5W PC.67007-6	1	0.20	
52	Res. comp. 10 ohms ±2% 0.25W PC.66624-1	1	0.10	
53	Res. metal oxide 680 ohms ±1% 0.5W PC.66637/92	6	0.10	
54	Res. metal oxide 820k ohms ±1% 1W PC.66714/21	1	0.25	
55	Res. metal oxide 220 ohms ±1% 0.5W WIS.9518-B-R78	5	0.10	
56	Res. comp. 82 ohms ±2% 0.125W PC.66623-12	2	0.10	
57	Res. w.w. 2.2 ohms ±5% 3W PC.67008-25	2	0.20	
58	Rect. Plessey 20AS	4	0.30	
59	Rect. Plessey 10G4 (now IS107)	2	0.50	
60	Rect. Plessey 40AS	1	0.35	
61	Rect. Plessey 8G7	4	0.70	
62	Rect. Mullard OA202	2	0.10	
63	Rect. Mullard BYZ13	0	0.50	
64	Shading generator B99-0033-01	ø1	222.00	
65	Socket WIS.9935-R1	7	2.80	
66	Socket 32-way PC.57061-1	2	1.75	
67	Sync pulse generator B99-0028-01	+1		
68	Sync pulse generator B99-0029-01	+1	340.00	
69	Tag strip assembly B99-0832-01	2	21.00	
70	Tag strip assembly B99-0833-01	2	21.00	
71	Tag strip assembly B99-0834-01	2	21.00	
72	Tag strip assembly B99-0835-01	2	21.00	
73	Tag strip assembly B99-0836-01	1	21.00	

ø Optional item - see MCL T6768 List 2C
\+ Optional item - see MCL T6768 List 2B

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
74	Tag strip assembly B99-0837-01	1	21.50	
75	Terml. block W.21970-C-R1	1	6.70	
76	Transf. WIS.5697-S511	1	12.00	
77	Transf. B99-0569-01	+1	33.50	
78	Transistor Mullard OC28	4	1.00	
79	Transistor Mullard OC84	11	0.30	
80	Transistor Mullard OC35	1	0.80	
81	Transistor Mullard OC23	1	1.75	
82	Valve G.E.C. SC1/800	1		
83	Valveholder PC.81811-1	1	0.10	
84	Valve retainer PC.82502-2	1	0.25	
85	Valve retainer PC.82504-1	1	0.10	
86	Valve top cap PC.24510-1	1	0.30	
87	Video amplifier No.1 B99-0038-01	≠1		
88	Video amplifier No.2 B99-0037-01	≠1		
89	Washer WIS.11539-C-R1	16	0.90	
90	Zener diode Semitron Z1A16	1	2.05	
91	Zener diode Semitron Z1B4.3	1	0.60	
92	Zener diode Semitron Z3B12	1	1.45	
93	Zener diode Semitron Z3B4.7	1	1.45	
94	Zener diode Mullard OAZ204	1	0.40	
95	Clip PC.265501-2	3	+0.20	
96	Crystal Q01653A	0		
97	Lamp WIS.9646-B-R9	1	0.50	
98	Nut (spindle gripping) PH.71104-1	14	0.10	
99	Res. w.w. 33 ohms ±5% 1.5W PC.67007-4	1	0.20	
100	Res. comp. 22 ohms ±2% 0.25W PC.66624-5	1	0.10	
101	Res. w.w. 56 ohms ±5% 1.5W PC.67007-37	1	0.10	
102	Res. w.w. 47 ohms ±5% 3W PC.67008-5	1	0.10	
103	Res. w.w. 220 ohms ±5% 1.5W PC.67007-9	1	0.10	
104	Res. var. 10 ohms ±10% 20W PC.67405-33	1	1.75	

≠ Components included in this list
\+ Optional item - see MCL.T6768 List 2B
x per ten

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
105	Res. var. 1M ohm ±20% 0.25W PC.67208-37	1	1.00	
106	Res. var. 500k ohms ±20% 0.25W PC.67202-33	2	0.85	
107	Res. var. 100k ohms ±20% 0.25W PC.67208-25	1	0.60	
108	Res. var. 1k ohm ±20% 0.25W PC.67208-2	1	0.60	
109	Res. var. 10k ohms ±20% 0.25W PC.67208-13	1	0.65	
110	Res. var. 75 ohms ±5% 1W PC.67527-42	1	0.60	
111	Res. var. 50 ohms ±10% 2.5W PC.67403-13	1	0.95	
112	Res. var. 500 ohms ±10% 3W PC.68238-8	2	0.65	
113	Res. var. 2.5k ohms ±10% 0.5W PC.67401-25	1	0.65	
114	Res. var. 25 ohms ±10% 0.5W PC.67401-1	1	0.65	
115	Res. var. 1M ohm ±10% 0.25W PC.67202-37	1	0.60	
116	Socket 9-way WIS.11634-B-R1	1	6.95	
117	Switch PC.71302-2	1	1.00	
118	Switch WIS.5103-C-R2	3	0.50	
119	Switch WIS.8730-C-S40	1	2.90	
120	Terml. PH.76902-1	10	+0.20	
121	Transistor Mullard OC205	4	1.40	
122	Random interlace choke B99-0040-01	0		
123	Cap. 0.5uF ±20% 63V WIS.11983-B-Ref.2 (now PC.19593-2)	1	0.55	
124	Cap. Elyc. 4uF +50% -20% 450V PC.18406-1	1	0.10	
125	Cap. Pap. 0.02uF ±20% 250V PC.19307-8	2	0.20	
126	Cap. Elyc. 50uF +100% -20% 25V PC.18409-15	6	0.10	
127	Cap. Metd. 1uF ±20% 250V PC.19813-1	5	0.40	
128	Cap. Elyc. 100uF +100% -20% 6V PC.18409-1	5	0.10	
129	Cap. Elyc. 250uF +100% -20% 6V PC.18409-2	4	0.10	
130	Cap. Elyc. 8uF +100% -20% 50V PC.18409-21	11	0.10	
131	Cap. Cap. 0.001uF ±20% 500V PC.19308-3	4	0.20	
132	Cap. Metd. 0.1uF 250V PC.19813-7	2	0.25	
133	Cap. Elyc. 25uF +100% -20% 25V PC.18409-14	1	0.10	
134	Cap. Resin Encapsulated 3300pF ±5% 50V o/d PC.18811-50	1	0.55	
135	Cap. Pap. 0.005UF ±20% 250V PC.19307-4	1	0.20	
136	Cap. Elyc. 100uF 12V PC.18409-8	3	0.10	
137	Cap. Resin Encapsulated 560pF ±5% 50V PC.18811-27	1	0.50	
138	Cap. Metd. 0.25uF ±20% 250V PC.19813-8	1	0.25	
139	Cap. Resin Encapsulated 47pF ±2pF ½pF 50V PC.18979-18)	2	0.40	
140	Cap. Resin Encapsulated 390pF ±5% 50V PC.18811-25	1	0.40	
141	Cap. Resin Encapsulated 180pF ±5% 50V PC.18811-24	1	0.40	
142	Cap. Tantalum 60uF ±20% 15V PC.18441-11	1	3.40	

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List 3
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No.	Description and Identity	Qty.	Price † Each £. s. d.	Scale
143	Cap. Resin Encapsulated 33pF ±2pF 50V PC.18979-16	1	0.65	
144	Cap. Resin Encapsulated 82pF ±2pF 50V PC.18979-20	1	0.70	
145	Cap. Resin Encapsulated 56pF ±2pF 50V PC.18979-46	1	0.50	
146	Cap. Resin Encapsulated 270pF ±5% 50V PC.18811-11	1	0.85	
147	Cap. Pap. 400pF ±20% 500V PC.19308-1	1	0.25	
148	Cap. Var. 1.5pF -10pF PC.20004-2	1	0.35	
149	Clip B40-0182-50	35	10.50	
150	Indr. 2.7mH ±5% W.56565-C-S47	2	2.75	
151	Indr. 68uH ±5% W.73984-C-S27	1	3.20	
152	Indr. 2.21uH W.62309-B-S117	1	2.90	
153	Rect. Hughes HG5004	19	0.20	
154	Rect. Mullard OA10	7	0.30	
155	Rect. Hughes HG5085	13	0.20	
156	Rect. Hughes HG1005	3	0.10	
157	Rect. Hughes HD5004	5	1.20	
158	Rect. Mullard OA200	2	0.10	
159	Res. Metal Oxide 2.7k ohms ±1% 0.5W PC.66637-82	5	0.10	
160	Res. Metal Oxide 1.5k ohms ±1% 0.5W PC.66637-35	9	0.10	
161	Res. Metal Oxide 3.3k ohms ±1% 0.5W PC.66637-83	6	0.10	
162	Res. Metal Oxide 3.9k ohms ±1% 0.5W PC.66637-105	1	0.10	
163	Res. Metal Oxide 270 ohms ±1% 0.5W PC.66637-143	1	0.10	
164	Res. Metal Oxide 82 ohms ±1% 0.5W PC.66637-79	4	0.10	
165	Res. Metal Oxide 390 ohms ±1% 0.5W PC.66637-96	1	0.10	
166	Res. Metal Oxide 18k ohms ±1% 0.5W PC.66637-94	2	0.10	
167	Res. Comp. 27 ohms ±2% 0.125W PC.66623-6	1	0.20	
168	Res. Metal Oxide 6.8k ohms ±1% P.5W PC.66637-106	6	0.10	
169	Res. Metal Oxide 100k ohms ±1% 0.5W PC.66637-125	4	0.10	
170	Res. Metal Oxide 56k ohms ±1% 0.5W PC.66637-149	2	0.10	
171	Res. Metal Oxide 150k ohms ±1% 0.5W PC.66637-24	2	0.10	
172	Res. Metal Oxide 22k ohms ±1% 0.5W PC.66637-110	7	0.10	
173	Res. Metal Oxide 47k ohms ±1% 0.5W PC.66637-116	6	0.10	
174	Res. Metal Oxide 12k ohms ±1% 0.5W PC.66637-107	3	0.10	
175	Res. Metal Oxide 180k ohms ±1% 0.5W PC.66637-130	1	0.10	
176	Res. Metal Oxide 270k ohms ±1% 0.5W PC.66637-135	2	0.10	
177	Res. Metal Oxide 5.6k ohms ±1% 0.5W PC.66637-85	4	0.10	
178	Res. W/W. 1.5 ohms ±10% 1.5W PC.67091-3	1	0.10	
179	Res. Metal Oxide 100 ohms ±10% 0.5W PC.66637-89	6	0.10	
180	Res. Metal Oxide 1.8k ohms ±1% 0.5W PC.66637-81	4	0.10	
181	Res. Comp. 10 ohms ±2% 0.125W PC.66623-1	2	0.10	
182	Res. Metal Oxide 39k ohms ±1% 0.5W PC.66637-115	1	0.10	

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling	Scale
183	Res. Metal Oxide 180k ohms ±1% 0.5W PC.66637-142	5	0.10	
184	Res. Comp. 22 ohms ±2% 0.125W PC.66623-5	2	0.20	
185	Res. Metal Oxide 4.7k ohms ±1% 0.5W PC.66637-84	7	0.10	
186	Res. Metal Oxide 8.2k ohms ±1% 0.5W PC.66637-75	1	0.10	
187	Res. Metal Oxide 2.2k ohms ±2% 1W PC.66331-23	1	0.10	
188	Res. W/W. 10 ohms ±5% 1.5W PC.67007-1	1	0.20	
189	Res. W/W. 18 ohms ±5% 1.5W PC.67007-28	1	0.20	
190	Res. Metal Oxide 470 ohms ±1% 0.5W PC.66637-93	3	0.10	
191	Res. Metal Oxide 120 ohms ±1% 0.5W PC.66637-91	1	0.10	
192	Res. Metal Oxide 390 ohms ±1% 0.5W PC.66637-96	6	0.10	
193	Res. Comp. 56 ohms ±2% 0.125W PC.66623-10	1	0.10	
194	Res. Metal Oxide 82 ohms ±5% 0.125W PC.66626-2	1	0.10	
195	Res. Metal Oxide 270 ohms ±5% 0.125W PC.66626-8	3	0.10	
196	Res. W/W. 22 ohms ±5% 1.5W PC.67007-3	1	0.10	
197	Res. Metal Oxide 150 ohms ±1% 0.5W PC.66637-148	3	0.10	
198	Res. Comp. 68 ohms ±2% 0.25W PC.66624-11	1	0.10	
199	Res. Metal Oxide 330k ohms ±1% 0.5W PC.66637-137	1	0.10	
200	Res. Metal Oxide 15k ohms ±1% 0.5W PC.66637-108	2	0.10	
201	Res. Comp. 47 ohms ±2% 0.125W PC.66623-9	2	0.10	
202	Res. Metal Oxide 33k ohms ±1% 0.5W PC.66637-113	3	0.10	
203	Res. Comp. 100 ohms ±2% 0.125W PC.66623-13	1	0.10	
204	Res. Metal Oxide 12k ohms ±5% 0.125W PC.66626-29	1	0.10	
205	Res. Metal Oxide 100k ohms ±5% 0.125W PC.66626-40	1	0.10	
206	Res. Metal Oxide 330 ohms ±5% 0.125W PC.66626-9	1	0.10	
207	Res. Metal Oxide 10k ohms ±5% 0.125W PC.66626-28	1	0.10	
208	Res. Metal Oxide 560 ohms ±5% 0.125W PC.66626-12	4	0.10	
209	Res. Metal Oxide 220k ohms ±1% 0.5W PC.66637-90	1	0.20	
210				
211	Res. Var. 500 ohms ±20% 0.25W PC.67207-12	2	1.70	
212	Res. Var. 350 ohms ±20% 0.25W PC.67207-19	1	2.05	
213	Res. Var. 250 ohms ±20% 0.25W PC.67207-18	5	0.85	
214	Res. Var. 10k ohms ±20% 0.25W PC.67207-4	1	0.80	
215	Res. Var. 14 ohms ±20% 0.25W PC.67207-1	2	0.80	
216	Res. Var. 250k ohms ±20% 0.25W PC.67207-8	1	1.25	
217	Res. Var. 100 ohms ±20% 0.25W PC.67207-13	1	0.65	
218	Screen B99-1073-50	1	0.85	
219	Terminals PH.76801-1	134	+0.20	
220	Transf. WIS.11716-C-S1	1	30.50	
221	Transistor Mullard OX140 (now OC140)	11	0.90	

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K. £ Sterling	Scale
222	Transistor STC BFY17 (now 2N2218)	2	3.30	
223	Transistor Mullard ASY27	12	0.40	
224	Transistor Mullard OC44	1	0.30	
225	Transistor Mullard 2N711	1	0.65	
226	Transistor STC BSY27	10	2.70	
227	Transistor Mullard AFZ12	3	1.10	
228	Transistor Mullard OC202	2	1.20	
229	Transistor TEXAS 2S305	1	1.60	
230	Zener Diode Mullard OAZ240	4	0.40	
231	Zener Diode Mullard OAZ241	1	0.35	
232	Cap. Elyo. 4uF +50% -20% 450V PC.18406-1	1	0.10	
233	Fuse 1A WIS.6501-C-R4	≠2	0.10	
234	Res. 100 ohms ±2% 0.125W PC.66641-23		0.10	
235	Cap. 0.47uF ±20% 63V PC-19899-2	1	0.80	
236	Rect. Mullard BYX38-300	4	14.50	
237	Res. 33 ohms ±2% 0.25 in. 0.125W PC-66641-16	1	0.10	

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
	Appendix 1 **Random Interlace Filter B-99-1219-01** **Kit of Parts**		
1001	Choke Assy B99-0040-01	1	13.50
1002	Choke Bracket B99-1224-50	1	28.50
1003	Crystal Type Marconi 1653A 200/A/S	⁄1	
1004	Nut 2-56 UNC HEX PF.45101-302	6	+0.20
1005	Screw 2-56 UNC PAN PF.47241-308	2	+0.20
1006	Washer 8BA S.C. Spring PF.74101-308	6	+0.20
	Appendix 2 **Picture Polarity Reversal B-99-1076-01** **Kit of Parts**		
2001	Relay WIS.11363-B-R1 (now PC.65421-1)	1	6.25
2002	Screw PAN 4-40 UNC PF.47241-308	2	+0.20
2003	Stiff-nuts HEX Thin 4-40 UNC PF.45402-2	2	+0.20
2004	Switch 3A, 250V PC.71301-1	1	0.30
2005	Washer 6BA M.S. CAD Shakeproof	2	

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No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
	Appendix 3 **Line Scan Rversal Assy. B-99-1067-01** **Kit of Parts**		
3001	Res. Vble. 2.5k ohms 0.5W PC.67401-25	1	0.65
3002	Switch 250V 3A PC.71301-2	1	0.40
3003	Relay PC-65421-1	1	6.25
3004	Screw 4-4 UNC PAN HD. 0.125 in.	2	0.20
	Appendix 4 **Remote Sun Shutter Assy. VB-00-4033-01** **Kit of Parts**		
4001	Switch D.P. 3 Position WIS.9025-C-R4	1	1.30
4002	Adaptor B-99-0609-50	2	14.50
4003	Adaptor plate B-99-0630-50	1	20.00
4004	Bracket B-99-0839-50	1	45.50
4005	Circlip PH-64702-7	1	0.10
4006	Collar W-11812-C-1-25HA	1	5.50
4007	Cover WIS-9495-C-1	1	0.90
4008	Ledex Assy. B-99-0893-02	1	93.50
4009	Nut 6BA HEX Full PF-12101-306	1	0.10
4010	Nut 2-56 HEX PF-45101-302	2	0.10
4011	Res. w.w. 100 ohms ±5% 3W PC-67008-7	1	0.10
4012	Screw 6BA Csk. Hd. 0.25 in. PF-13611-308	3	0.10
4013	Screw 2-56 UNC Pan Hd. 0.25 in. PF-47241-308	1	0.10
4014	Screw 2-56 UNC Pan Hd. 0.4375 in. PF-47241-314	2	0.10
4015	Screw 4-40 UNC Socket 0.1875 in. PF-47471-2	1	0.10
4016	Shutter B-99-0610-50	1	1.65

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
4017	Shutter Shaft B-99-0498-50	1	30.00
4018	Spacer B-99-0948-50	1	19.50
4019	Spring B-99-5160-50	1	18.00
4020	Spur Gear B-99-0613-51	1	42.00
4021	Switch-micro 5A WIS-6908-C-1	1	1.30
4022	Washer 8BA PF-74011-308	2	0.10
4023	Washer 8BA PF-74121-1	1	0.10
	Appendix 5 **Lens Filter Assy. VB-00-4034-01** **Kit of Parts**		
5001	Switch D.P. 3 Position WIS-9025-C-R4	1	1.30
5002	Adaptor B-99-0664-50	2	14.50
5003	Adaptor B-99-3642-50	1	14.50
5004	Adaptor Plate B-99-0630-50	1	
5005	Bracket Assy. B-99-0923-01	1	76.00
5006	Circlip PH-64702-7	1	0.10
5007	Collar W-11812-C-1-25NA	1	
5008	Cover WIS-9495-C-1	1	0.90
5009	Filter Frame B-99-0901-50	1	
5010	Filter Neutral Density B-99-2522-50 (Job Schedule Item)	1	7.85
5011	Ledex Assy. B-99-0893-01	1	93.50
5012	Nut 6BA HEX Full PF-12101-306	1	0.10
5013	Nut 2-56 HEX PF-45101-302	2	0.10
5014	Res. w.w. 100 ohms ±5% 3W PC-67008-7	1	0.10
5015			
5015	Screw 6BA Csk. Hd. 0.25 in. PF-13611-308	1	0.10
5016	Screw 6BA Rd. Hd. 0.375 in. PF-13641-312	2	0.10

No.	Description and Identity	Qty.	Price Each F.O.B.U.K. £ Sterling
5017	Screw 2-56 UNC Pan Hd. 0.25 in. PF-47241-308	1	0.10
5018	Screw 2-56 UNC Pan Hd. 0.5 in. PF-47241-316	2	0.10
5019	Screw 4-40 UNC Socket 0.1875 in. PF-47471-2	1	0.10
5020	Shutter Shaft B-99-0498-51	1	30.00
5021	Spacer B-99-0948-50	1	
5022	Spring B-99-5161-50	1	18.00
5023	Spur Gear B-99-0613-51	1	15.50
5024	Switch-micro 5A WIS-6908-C-1	1	1.30
5025	Washer 8BA PF-74011-308	2	0.10
5026	Washer 6BA PF-74001-306	2	0.10
5027	Washer 8BA Crinkle PF-74121-1	1	0.10
	Appendix 6 **Remote Focus Unit VB-00-4012-01** **Kit of Parts**		
6001	Cover WIS-9495-C-R1	2	0.80
6002	Res. w.w. 33 ohms PC-67008-4	0	0.10
6003	Switch 3 Position WIS-9025-C-1-2	1	1.30
6004	WIS-5103-C-R28	1	0.70
6005	Zener Diode Brush ZOB12	0	0.65
6006	Actuator WIS-6908-C-2-4	2	0.45
6007	Bush WIS-10503-C-1	1	
6008	Cam Assy. L.H. B-99-0846-01	1	104.00
6009	Cam Assy. R.H. B-99-0845-01	1	103.00
6010	Cap. pap. 0.04uF ±20% 250V PC-19307-10	2	0.25
6011	Cap. metd. 0.1uF ±20% 250V PC-19801-7	1	0.10
6012	Diode Plessey 1024	2	0.60
6013	Diode Zener Z3B12	1	1.25
6014	Indr. W.56565-C-48	2	2.30
6015	Indr. W.56565-C-51	2	11.50
6016	Lock Washer 0.25 in. I/D PF-74014-8	1	0.10

No.	Description and Identity	Qty.	Price Each F.O.B.U.K £ Sterling
6017	Motor Bracket Assy. B-99-0454-01	1	
6018	Nut 0.25-28 UNF HEX PF-52101-350	1	0.10
6019	Screw 10-32 UNF 0.625 in. PF-42861-3	2	0.10
6020	Screw 2-56 UNC Pan Hd. 0.375 in. PF-47241-312	4	0.10
6021	Screw 4-40 UNC 0.625 in. PF-47461-4	2	0.10
6022	Screw 4-40 UNC 0.25 in. PF-47461-1	4	0.10
6023	Screw 0.25-28 UNF Pan Hd. PF-53041-428	1	0.10
6024	Stiff nut 10-32 UNF PF-40402-1	2	0.10
6025	Stop B-99-0847-50	2	84.50
6026	Switch-micro WIS-6908-C-1-1	2	1.30
6027	Tag Solder 8BA SP-11633-B	1	0.10
6028	Washer Mica WIS-12483-C-1	2	0.10
6029	Washer SPG 6BA	2	0.10
6030	Washer Shakeproof 8BA	1	0.10

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List 3
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