

STANDARD VOLTAGE CALIBRATION UNIT UN2/506

Introduction

The UN2/506 is a Sub-standard designed to facilitate the checking and calibration of other units. It contains four printed-circuit boards and has its own internal power supplier type PS2/22E. A CH1/26D chassis is used with index-peg positions 29 and 33.

The unit has three modes of operation:

(a) Calibrate

(b) Generate

The following alternative signals are provided from a 75-ohm source:

10-kHz square waveform at 1.0 volt, 0.7 volt, 0.3 volt

1-volt sinewave at 4.43 MHz

1-volt composite signal consisting of 0.5 volt each of 10-kHz square wave and 4.43-MHz sine-wave.

(c) Measure

The following signals can be measured:

1-volt, 0.7-volt, 0.3-volt across 75 ohms (external oscilloscope required)

1-volt p-p colour subcarrier across 75 ohms using internal meter

0.775-volt r.m.s. audio across 600 ohms using internal meter.

driving a centre-zero meter which has a scale reading between -0.5 and $+0.5$ dB with respect to the correct level.

There are facilities for checking all ranges before use; the various tests are controlled by a further set of front-panel pushbuttons.

The impedance is 75 ohms for video signals and 600 ohms for audio signals.

The impedance of the thermocouple circuit is standardised against an 0.1% resistor. A front panel control, R4, enables the standardisation to be checked whenever the thermocouple is replaced.

The unit is mains driven. A relay is included in the power unit to isolate the standard cell when the unit is switched off.

Circuit Description

The circuit diagram is given in Fig.2.

Level Comparator and Square Wave Generator

The comparator circuit consists of TR107/TR108 and TR110/TR109 with the meter M1, connected by various switch combinations, between the emitters of TR108 and TR109. Associated with the comparator transistors are the potential divider chains R116/R117/R118, R121/R122/R123 and R120/R124. These chains are in parallel and, with

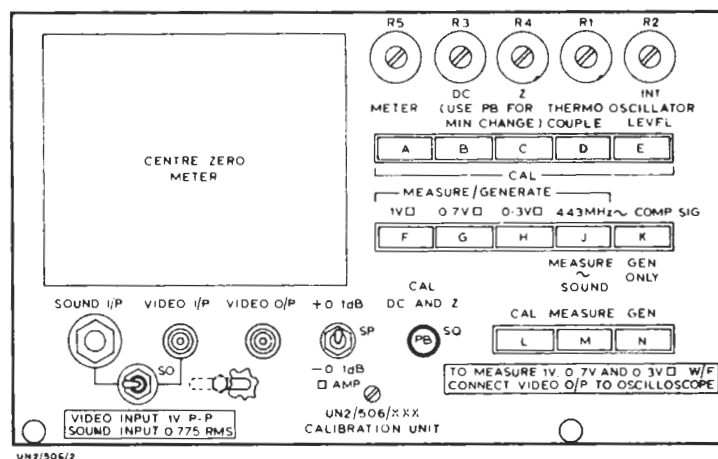


Fig. 1. Layout of Front Panel for UN2/506

General Description

Block diagrams for the three modes of operation are given in Figs. 3 and 4. Fig. 1 shows the layout of the front panel with switch designations. The unit is used to check the accuracy of other instruments and generators for which the various ranges and facilities are selected by front-panel push-buttons (see Fig.1).

The basic reference is a standard cell with an e.m.f. of 1.0184 volts. This is used to establish a 1-volt squarewave signal with which other signals can be compared using an external oscilloscope as indicator. Colour subcarrier signals at 4.43 MHz and audio signals are checked by a thermocouple and amplifier

TR104, R109 etc. also in parallel, present an impedance of 75 ohms from the common point to earth.

During initial manufacturing tests, the circuit is adjusted as follows. The potential at the junction of R119/R120 is set to be exactly 2 volts by adjustment of the value of R119 and with front panel control R3 in its central position and with switches A and L operated. This establishes the gate potentials of the F.E.T's TR107 and TR110 at exactly 1.0184 volts from the accurate potential dividers R120/R124 and R116/R117.

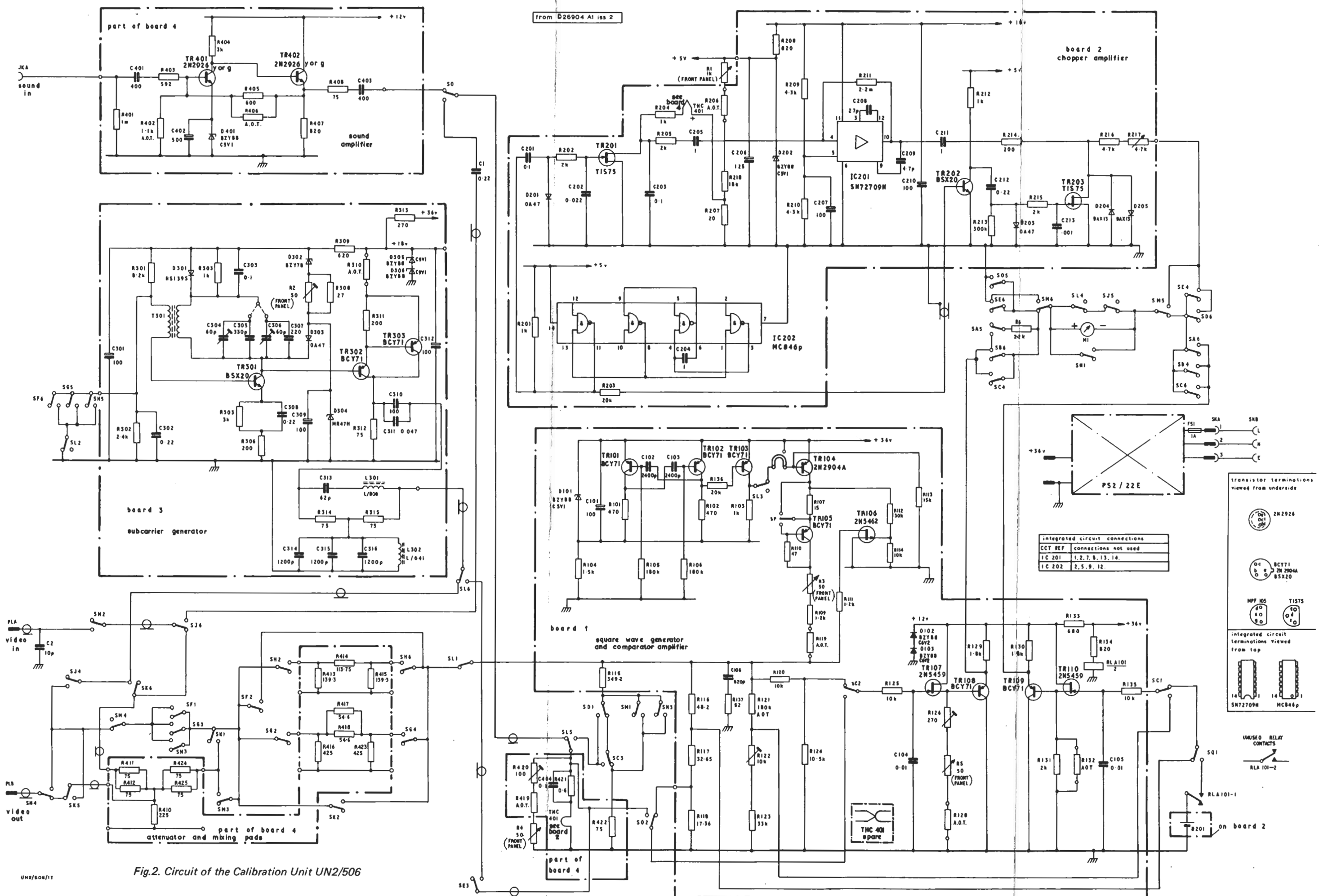
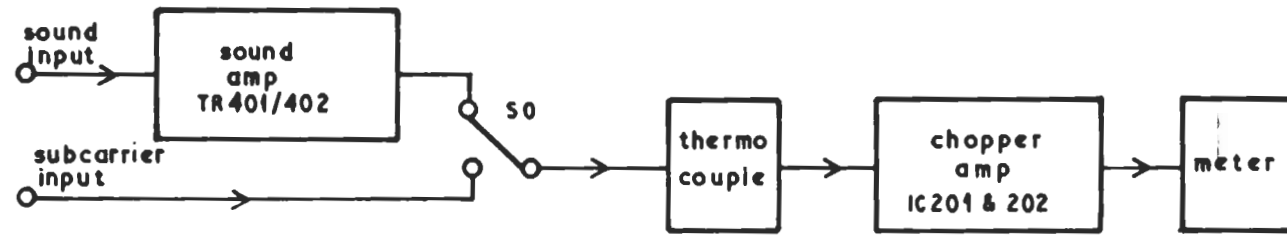


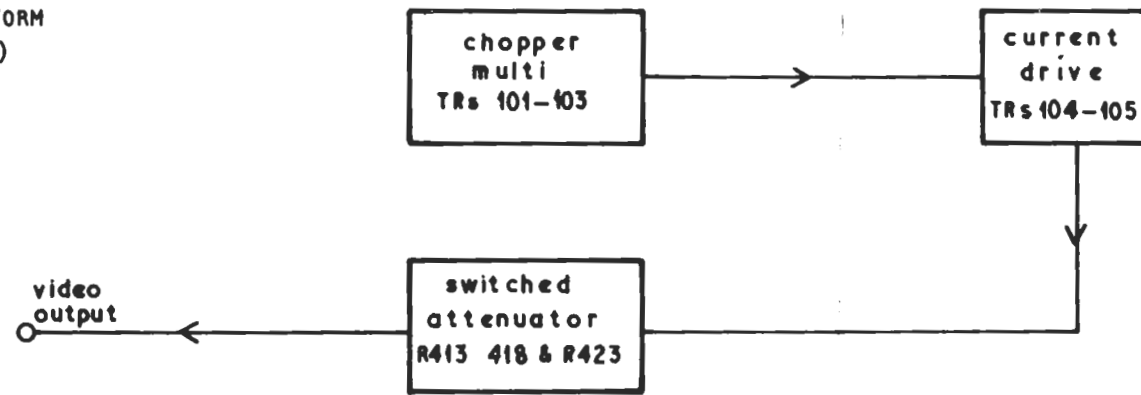
Fig.2. Circuit of the Calibration Unit UN2/506

UN2/506/1T

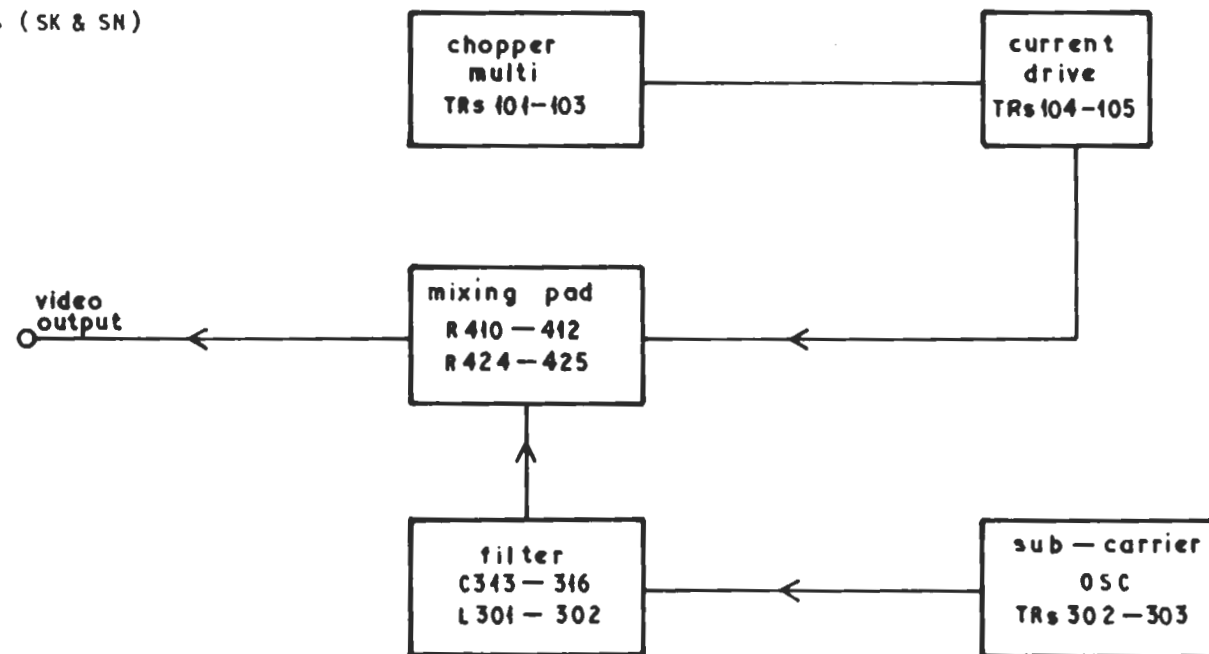
MEASURE SOUND AND SUBCARRIER (SJ & SM)
FIG. 3e



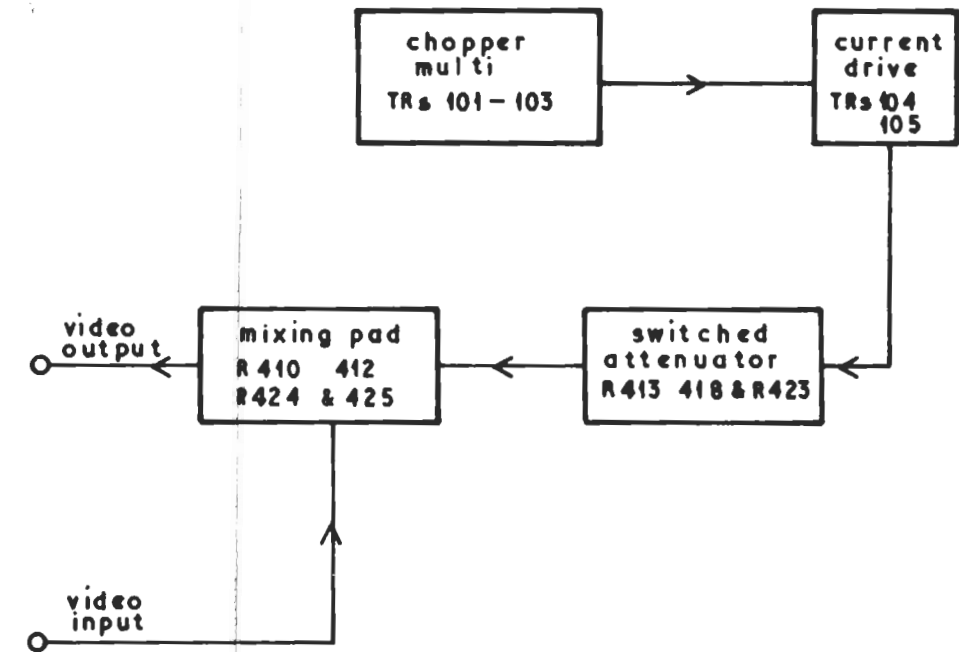
GENERATE SQUARE WAVEFORM
(SF OR SG OR SH & SN)
FIG. 3a



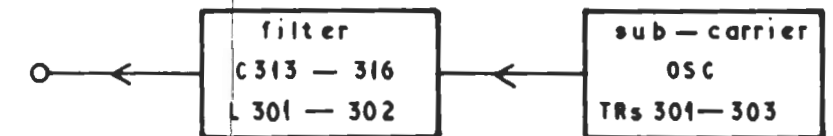
GENERATE COMPOSITE SIG (SK & SN)
FIG. 3c



MEASURE SQUARE WAVEFORM
(SF OR SG OR SH & SM)
FIG. 3d



GENERATE SUBCARRIER (SJ & SN)
FIG. 3b



from DSK13398 A3 sht 1

Fig.3 Block Diagram Showing Modes of Operation

SET METER. (SA & SL)

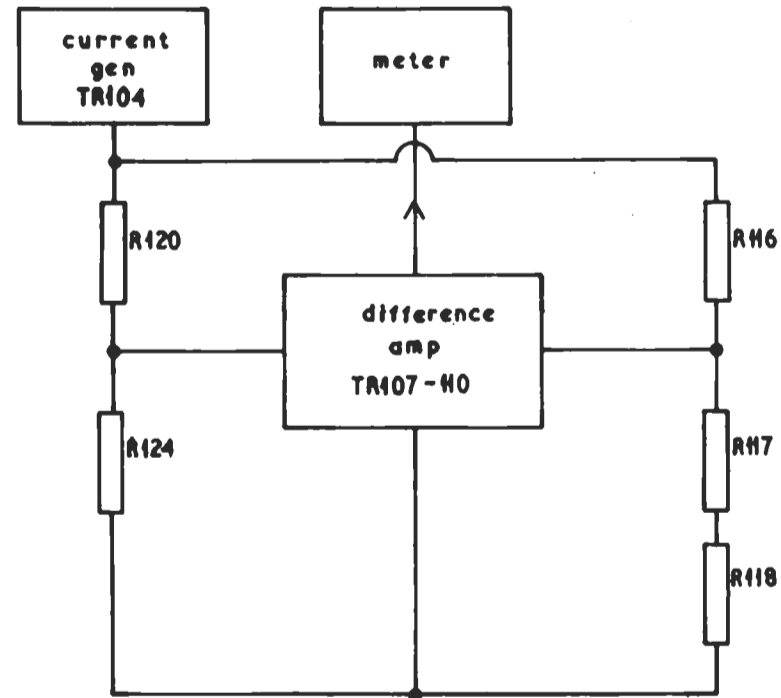


FIG. 4a

SET DC (SB & SL)

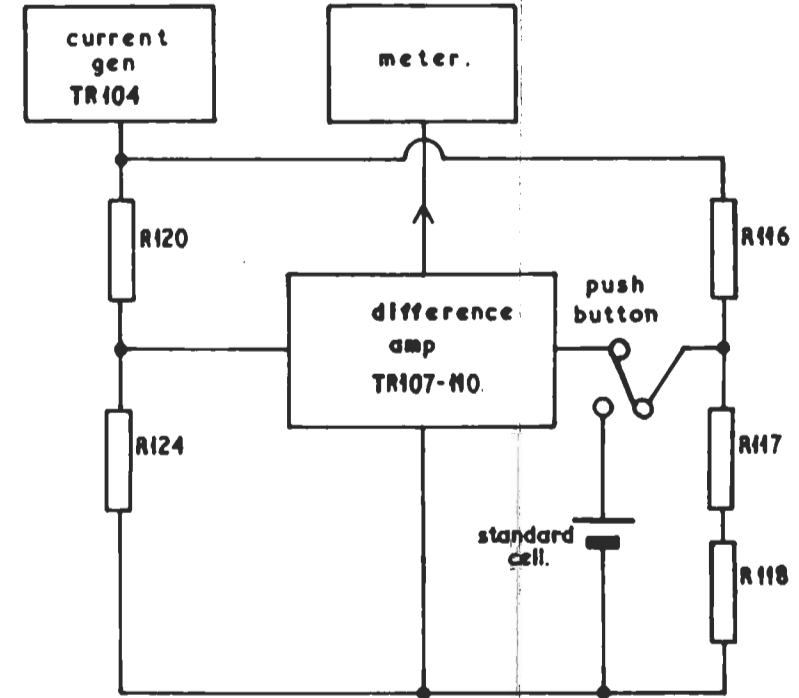


FIG. 4b

SET Z (SC & SL)

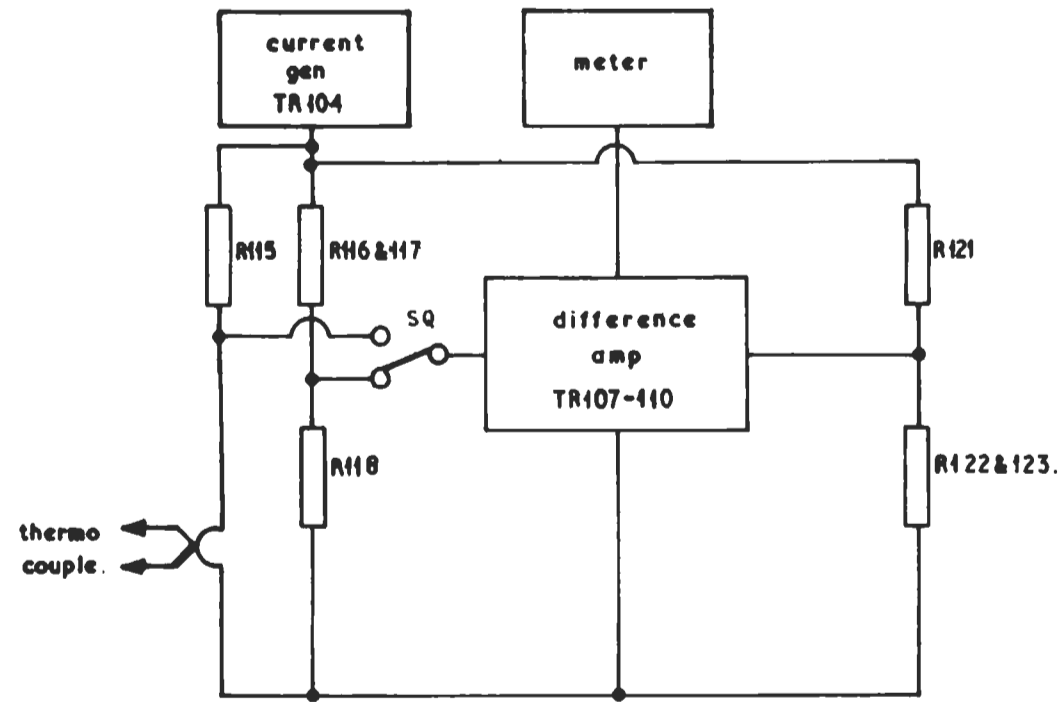


FIG. 4c

SET RI THERMOCOUPLE (SD & SL)

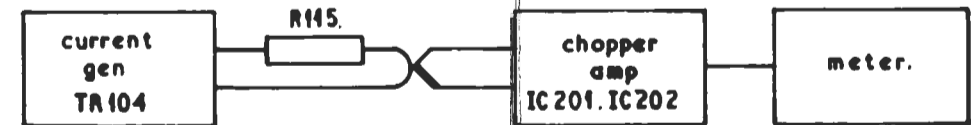


FIG. 4d

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SET INT. OSC LEVEL (SE & SL)



FIG. 4e

The value of R132 is then adjusted so that the source/earth voltage of TR110 lies between 2.6 volts and 3 volts. Resistor R128 is set so that the source/earth voltage of TR107 is the same to within ± 50 mV.

Operationally, the voltage of the 2-volt line (junction of R116 and R119) is set by reference to the standard cell. This is done by operating the calibrate and DC switches L and B and then repeatedly pressing and releasing the spring-loaded switch Q while adjusting R3 for minimum change of reading on M1.

The squarewave generator consists of a multivibrator TR101/TR102 free running at about 10 kHz. Transistor TR103 is driven hard on and off by the multivibrator and, in turn, drives TR104 off and on. When TR104 is conducting the 2 volt potential is set up across the 75 ohms of the potential divider chains; with TR104 cut off, the potential falls to zero. Thus, at the junction of R119, R116 etc., there is a square waveform signal swinging between +2 volts and earth on open circuit and between +1 volt and earth when terminated at the video output.

Transistor TR105 and the toggle switch SP provide a ± 0.1 -dB change in the amplitude of the squarewave signal. This facility is used when assessing any error in amplitude of a signal being measured.

TR106 maintains the impedance of the two-volt line at 75 ohms when TR104 is cut off, removing R109 from circuit. Transistor TR106, an N-channel F.E.T., is itself cut off by a positive potential on its gate while TR104 is conducting. When this potential is removed the F.E.T. acts as a low resistance which connects R111 into circuit to replace R109.

Attenuator and Mixing Pads

The pads provide facilities for mixing the input signals to be measured with the internal squarewave signal, the amplitude of which is set to 1.0 volt, 0.7 volt or 0.3 volt depending on the switch positions.

The signal to be measured is connected to the video-in terminal and appears at the video-out terminal mixed with the reference signal. An oscilloscope is used as indicator.

The mixing pad is formed by R411/412, R410,

R424/425 and, with a terminated oscilloscope across R410, it presents 75 ohms to the incoming signal and to the reference signal. The other two pads adjust the amplitude of the reference signal for comparison with incoming signals of 0.7 volt and 0.3 volt and maintain the impedance match.

4.43-MHz Reference Oscillator

This is a Hartly type oscillator. Diode D301 provides temperature compensation. Diode D303 prevents the collector of TR301 from becoming more negative than the potential established by D304. Resistor R3 provides some adjustment of amplitude. The output from the oscillator is fed by TR302 and TR303 to the tuned output filter. The output level is 1V p-p when terminated with 75 ohms.

Thermocouple and Chopper Amplifier

The output from the thermocouple is very small and requires considerable amplification before it can operate Meter M1. An a.c. amplifier is used to avoid the drift which would occur with a high gain d.c. amplifier. The d.c. signal developed by the thermocouple is chopped to form a squarewave by the action of the free running multivibrator IC202. Following the amplifier IC201, is a phase-sensitive detector operating synchronously with the input chopper. M1 indicates the average of the resulting unidirectional squarewave.

R1 adjusts the thermocouple back-off voltage to give a centre scale zero reading when the amplitude of the input signal being measured is correct. R217 provides the means for obtaining the correct scale law.

The impedance of the thermocouple circuit is standardised by reference to R118. R4 provides adjustment.

Sound Amplifier

This is a negative-feedback amplifier whose purpose is to convert the 600-ohm impedance of the sound-input circuit to the 75 ohms required by the UN2/506. The gain is set to unity by adjusting R406 during initial manufacturing tests.

Operation

Generate Mode (Switch SO at Video)

<i>Output</i>	<i>Operate Switches</i>	<i>See Figure:</i>
1.0-volt p-p squarewave 10 kHz	N and F	3(a)
0.7-volt p-p squarewave 10 kHz	N and G	
0.3-volt p-p squarewave 10 kHz	N and H	
1.0-volt p-p sinewave 4.43 MHz	N and J	3(b)
1.0-volt p-p composite signal	N and K	3(c)

All outputs at *Video Out* measured across 75-ohm termination

Measure Mode (Switch SO at Video)

<i>Input</i>	<i>Operation</i>	<i>Signal Path</i>	<i>See Figure:</i>
1 volt across 75 ohms	Set switches M and F. Connect oscilloscope and 75-ohm termination to output terminal. Assess magnitude of error by operating switch SP to change the level of the reference signal by ± 0.1 dB.	Via mixing pad to the output terminal. Reference signal is added via the mixing pad.	3(d)
0.7 volt across 75 ohms	Set switches M and G. As for 1-volt input.	As for 1-volt input but reference signal is attenuated.	3(d)
0.3 volt across 75 ohms	Set switches M and H. As for 1-volt input.	As for 1-volt input but reference signal is attenuated.	3(d)
1 volt p-p 4.43 MHz across 75 ohms	Set switches M and J. Assess errors from scale of internal meter M1.	Signal is applied to thermocouple.	3(e)
0.775 volt audio across 600 ohms	Set switches M and J. Set switch SO to <i>Sound</i> . Assess errors from scale of internal meter M1.	Signal is applied to thermocouple.	3(e)

Line-up

The following checks should be carried out before use. Switch L must be operated for checks 1 to 7.

1. Check that the output voltage from the power supplier is 36 volts.
2. Operate switch A and set meter M1 to its centre zero by adjustment of R5; Fig.4(a).
3. To set the d.c. output level of the square wave generator, operate switch B and, while repeatedly operating and releasing the spring-loaded push-button switch Q, set R3 for a minimum change in the reading of M1. Neglect any transient kicks; Fig.4(b).
4. To standardise the thermocouple, operate switch C and adjust R4 while operating the push button as described above; Fig.4(c)
5. Check the d.c. level again by repeating test 3 above.
6. Chopper amplifier adjustment. Operate switch D and set R1 so that meter M1 reads on its centre zero; Fig.4(d).

7. The setting of R217 can be checked by feeding a one volt p-p 4.43-MHz signal to the video input via an attenuator set to give an 0.4 dB loss. Switches M and J must be operated and switch O set to video. R217 is then set to give a reading on M1 of -0.4 dB. Increase the amplitude of the input signal until the meter reads zero. Now switch out the attenuator; M1 should read $+0.4$ dB ± 0.02 dB.
8. To check the amplitude of the 4.43 MHz signal, operate switch E and adjust R2 to obtain a zero reading on M1; Fig.4(e).
9. Occasionally check the frequency of the 4.43-MHz generator with a counter connected to the video output and with switches N and J operated. If necessary, adjust C306.

Reference

1. Designs Department Specification No.9.135(70)
AIB 7/71