1.1 INTRODUCTION

The KW108 "Monitorscope" is a convenient instrument allowing "on-the-air" monitoring and testing of an amateur radio transmission on all bands from 160M through 10M. The Monitorscope is designed to be connected between the Transmitter or Linear Amplifier antenna socket and the antenna or ATU and gives a visual display of the transmitted envelope which will allow the Tx to be "talked up" to full power output whilst watching for flat-topping which would cause the signal to "splatter" causing interference to Stations on adjacent frequencies and TVI. By using the 2-tone Test Generator the Transmitter may be adjusted to ensure that it is operating in a linear condition, necessary for good quality SSB transmission.

The KW108 is designed in the attractive KW G-Line style and matches all other of the famous G-Line products:-

KW2000A, KW2000B, KW2000CA, KW2000E, KW204, KW1000 etc.

1.2 SPECIFICATION

Frequency coverage	1.5 - 30 MHz
Input Impedance	High, For use with 50 or 75 ohm Transmitters.
Sensitivity	Useful with 10W input.
Maximum Input	1kW CW. 2kW PEP.
Sweep Speed	20 - 200 Hz.
Tone Oscillators	Nominally 1.3 KHz & 2.3 KHz.
Tone Level Output	0 - 50 mv rms per tone @ 50k ohm.
Front Panel Controls	Focus Intensity/on/off. Horizontal Shift. Horizontal Gain. Single/Two tone. Vertical Gain. Tone Level. Sweep Speed.
Rear Panel Controls	Astigmatism
Power Requirements	115/230v $\pm$20% 10 watts.

1.3 C.R.T. and Semiconductor Complement

SYMBOL	FUNCTION	TYPE
CRT1	Display Tube	D7-200GH
TR1	Deflection Amplifier	BFR88
TR2	" "	BFR88
TR3	Tone Oscillator	BC108
TR4	Buffer Amplifier	BC108
TR5	" "	BC108
TR6	Tone Oscillator	BC108
TR7	Constant Current Source	BC183K
TR8	Sweep Buffer Amplifier	BC183K
TR9	Sweep Generator	T1S43
D1,2	E.H.T. Rectifiers	DI830C
D3	H.T. Rectifier	BY238
D4-7	L.T. Bridge Rectifier	A1505
D8	Voltage Stabiliser	BZY88C 24V
D9	Temperature Compensation	BAX13

2.1 Sweep Generator

The sweep speed is determined by the position of the sweep speed variable resistor VR9 in series with R40, which charges C27 from the H.T. Line. When C27 charges to approx. 15v the emitter-base 1 junction of the uni-junction changes from very high to very low impedance, discharging C27 and allowing it to re-charge, thus generating a linear sawtooth across C27. This sawtooth is fed through TR8 which is connected as an emitter follower giving a large current gain and reproducing the sawtooth across R39. This signal is A.C. coupled to the deflection amplifier through C10.

2.2 Horizontal Deflection Amplifier

TR1 and TR2 are high voltage tansistors connected as a long tailed pair whose gain is adjusted by variable resistor VR4 (horizontal-gain). The constant tail current necessary for true differential operation of this circuit is provided by TR7 and the value of constant current required is approx. 4mA, which is adjusted by VR8. D9 provides temperatur compensation for the base bias circuit of TR7. The sawtooth is A.C. coupled to the base of TR1 through C10 and the amplified signal appears across R16 and R18, the collector loads of TR1 and TR2, in antiphase. The two collectors are D.C. coupled to the X-plates of the CRT to produce the horizontal trace. By adjusting the bias on the base of TR2 with potentiometer VR5 (horizontal-shift) the trace may be centred on the screen.

For adjustment of VR8 see section 5.3.

2.3 Vertical Deflection Circuit

R.F. is tapped from the junction of SK1 and SK2 and voltage divided by VC1 and the capacitance between the Y-plates, one of which is grounded. With VC1 fully meshed (maximum capacity) the monitorscope is operating at maximum sensitivity.

2.4 CRT Circuit

The CRT is operated with the cathode approximately 1.5 kV negative with respect to ground. A resistive divider chain comprising R8, VR2, R9 and VR3 allows the correct electrode voltages to be delivered to the CRT. VR3 controls the intensity of the display and the voltage across this potentiometer is stabilised by a neon tube LP1. VR2 adjusts the focus of the trace. VR1 adjust the final anode voltage and acts as the astigmatism control.

2.5 Two Tone Generator

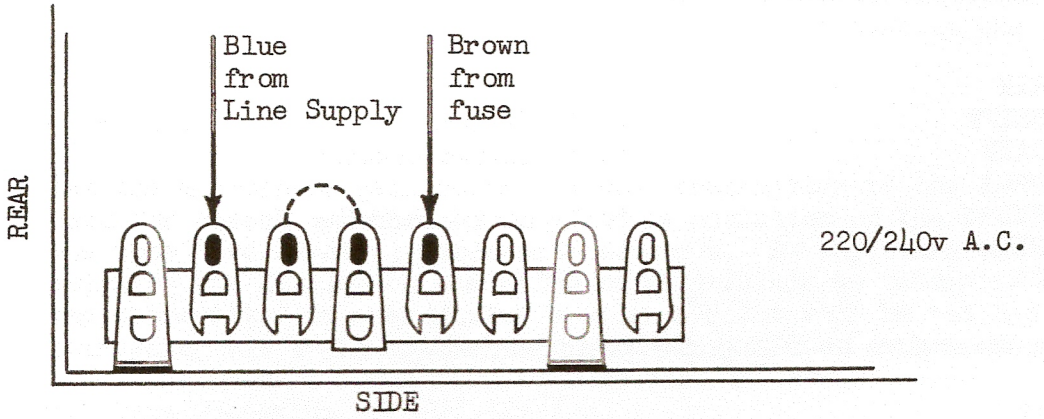
The circuitry of Tr3 comprises a tuned LC audio oscillator of nominal frequency 1300 Hz. Output from the oscillator is from the base of TR3 and this is D.C. coupled into the base of TR4 which is a common emitter buffer amplifier; L.T. is permanently connected to TR3 and TR4. TR6 is an identical oscillator but of nominal frequency 2300 Hz, followed by its own buffer amplifier TR5. L.T. can be switched on or off to these two transistors by switch S2, giving either single or two tone output. The two tones are coupled together through C17 and C19 to VR6, and appear across VR7 which adjusts the tone level output. VR6 is adjusted so that at its wiper the amplitude of the two tones is equal.

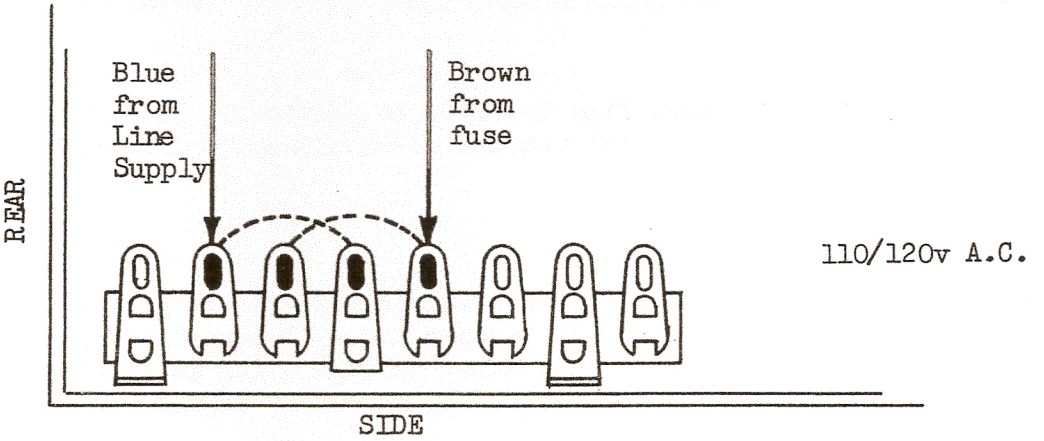
For adjustment of VR6 see section 5.4.

2.6 Power Supply

Four separate voltage rails are supplied from one transformer, T1. Mains input is fused at FS1 and is fed into the two primary windings in series for 230v operation, or in parallel for 115v operation. D1 and D2 full wave rectify the EHT winding which is smoothed by C1 through C4 in series. R2 through R5 act as voltage sharing resistors ensuring that no capacitor has more than its rated D.C. voltage across it. D3 half wave rectifies the HT supply which is smoothed by C5 and R6. D4 through D7 bridge rectifies the LT winding which is smoothed by R7, C7 and C8 and voltage stabilised by zener diode D8. The heater of the CRT is supplied from an A.C. heater winding.

LINE INPUT CONNECTIONS TO TRANSFORMER





3.1 Station Installation

The KW108 is equipped with two type SO259 sockets on the chassis reardrop. These are the input and output connections and are wired in parallel. A coaxial link is taken from the transmitter output to either of the sockets and the artenna is connected to the other. If an antenna tuning unit, such as the matching KW107 is used this should be placed after the KW108.

When single or two-tone facilities are required the microphone is unplugged and the audio lead coming from the chassis reardrop is jacked in its place. At all other times this cable is not used.

3.2 Initial Checks

The KW108 is designed to operate from 200-250v AC 45-65 Hz when on the nominal 230v mains input, or to special order from 100-125v AC 45-65 Hz when on the nominal 115v mains input. Check that the unit is on the correct mains voltage for your supply. This is shown on a label attached to the mains cable.

Set the controls to the following positions.

FOCUS	to 12 o'clock
VERT. GAIN	to 12 o'clock
HORIZ. SHIFT	to 12 o'clock
HORIZ. GAIN	fully anti-clockwise
AUDIO TONE	to 1
TONE LEVEL	fully anti-clockwise
SWEEP SPEED	to 12 o'clock
INTENSITY	to OFF.

Now plug the mains lead into the power socket.

3.3 Intensity

This control incorporates the mains on/off switch. Switch on and set the intensity control to about 12 o'clock. Allow about 30 seconds for the unit to warm-up. A horizontal trace will appear across the centre of the screen. Adjust the intensity to a suitable level. It is important to note that if the intensity is left at too high a level the phosphor coating on the face of the cathode ray tube will eventually burn and leave a permanent mark.

3.4 Focus

The focus control enables a very fine trace to be obtained. This should be adjusted for optimum and will not require re-adjustment unless the mains voltage varies significantly.

3.5 Astigmatism

This is a preset control on the back panel and is adjusted to give a minimum overall spot size. This is set at the factory and will normally ony require adjustment if the unit is operated on a mains voltage which is significantly different from the nominal 230v (or 115v). If necessary adjust for optimum.

3.6 Horizontal Shift

Operation of this control allows the trace to be set equally about the centre of the graticule.

3.7 Horizontal Gain

This control allows the modulated envelope displayed to be expanded horizontally so that it may be examined in more detail. As the gain is increased the brightness of the display will be decreased and this is compensated by increasing the intensity control.

3.8 Sweep Speed

When monitoring transmitted speech the sweep speed is best set at a low frequency (turn the control anti-clockwise) as this will allow individual syllables to be seen. When operating under single or two tone test conditions a higher speed (turn the control clockwise) is necessary so that the carrier rejection or two tone pattern may be inspected. See section 4 for interpretation of these envelopes.

3.9 Vertical Gain

Adjustment of this control allows the height of the display to be adjusted so that it fills the screen. This control is a variable capacitor without end stops and so can be rotated continuously. In its most sensitive position it allows a useful display of signals down to about 10 watts output, although at this power level the display will not take up the full height of the screen.

3.10 Tone Level

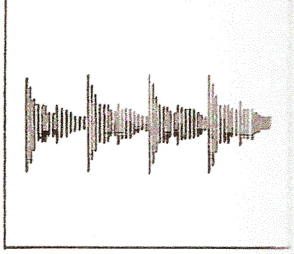
Set the microphone gain control on the transmitter to the level normally used for speech. Switch to single tone operation on the KW108. Now adjust the tone level control for required output. By adjusting this control and watching the display on the KW108 it is possible to determine at what level the transmitter is overdriving because a point will be reached after which increasing the audio input from the KW108 produces no increase in RF output.

3.11 Two Tone Operation

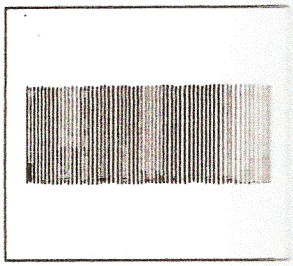
Switch the KW108 to 2-tone and adjust the tone level until a two-tone pattern with no flat-topping is displayed. Consult section 4 for an analysis of the display. The two tones are balanced for equal amplitude by adjusting a preset resistor before the unit leaves the factory. However if the sideband filter in your transmitter does not have a particularly flat passband then this preset resistor will require adjustment. See section 5.4 for details.

INTERPRETING THE DISPLAY

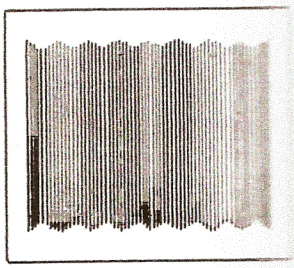
a) SSB signal, correctly adjusted, with voice input.



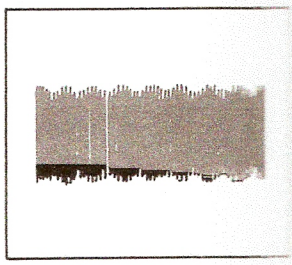
b) Pure CW carrier or sinusoidal single-tone (no harmonic content) input on SSB. Could also occur on single-tone SSB with excessive drive which results in amplifier "flat-topping". Note absence of ripple at top and bottom of display.



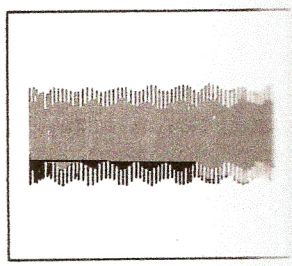
c) SSB signal, single tone input, sideband suppression down approximately 40db or CW signal with spurious radiation down approximately 40db.



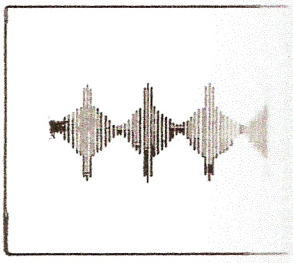
d) Same as c) except down approximately 20db. In SSB, the poor suppression may be due to audio unbalance or improper RF phase shift.



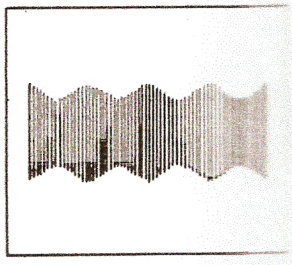
e) Same as c) except sideband suppression down approximately 10db.



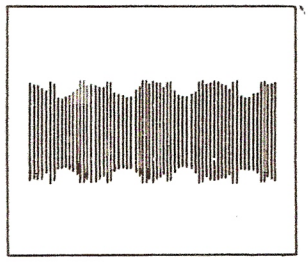
f) SSB signal, voice input, slightly excessive speech gain, or insufficient amplifier loading. (Linear Amplifiers should be quite heavily loaded - very small PA current "dip").



g) SSB signal, single tone input with carrier leakage. This pattern will have half the number of ripples due to poor sideband suppression. (See waveform d)).



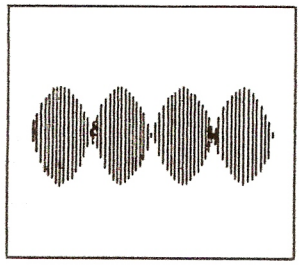
h) SSB signal, single tone input. Possible distortion in audio-tone oscillator or speech amplifier, balanced modulator detuned, or insufficient RF in balanced modulator.



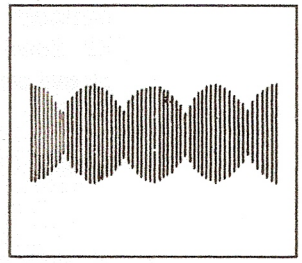
i) Normal SSB signal, 2-tone input, tones properly adjusted for equal amplitude.

SSB signal, single tone input with no sideband suppression. May be due to defective crystal or mechanical bandpass filter.

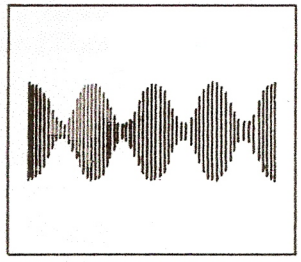
Normal double sideband, single tone input.



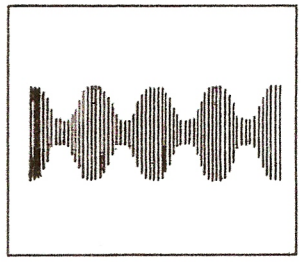
j) SSB with inserted carrier, single tone input. Incorrect value of carrier or modulation. Excessively rounded tops would indicate too much carrier.



k) Plate modulated AM, or double sideband with carrier inserted, single tone input. Nearly 100% modulated. Excellent waveform.



l) Double sideband with carrier insertion (low level AM), single tone input. Too much carrier inserted. Note that the positive peaks flatten before a fine base line is obtained. Peak flattening may also be caused by insufficient antenna loading, an over-driven linear amplifier, poor power supply regulation, etc.



m) Double sideband with carrier inserted (low level AM), single tone input. Insufficient carrier insertion or excessive audio, resulting in high distortion (over-modulated). Also called Double-Sideband-Reduced-Carrier.

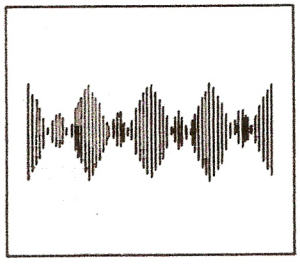


TABLE 1

		EMITTER	BASE	COLLECTOR
TR1	BFR88	27v	28v	110v
TR2	BFR88	27v	28v	110v
TR3	BC108	5.2v	5.6v	14v
TR4	BC108	5.1v	5.6v	8.5v
TR5	BC108	5.1v	5.6v	8.5v
TR6	BC108	5.2v	5.6v	14v
TR7	BC183K	3.3v	3.9v	18v
TR8	BC183K	9.6v	10.3v	24v

		EMITTER	BASE 1	BASE 2
TR9	T1S43	10.3v	0v	24v
CRT	D7-200GH			

Pin 1)	6.3v A.C.	at -1350v D.C. with respect to ground.
2)		
3	-1500v	
4	-1530v	
5	-1350v	
6	0v	
7	0v	
8	+ 160v	
9	+ 110v	
10	-	
11	+ 110v	
12	-	
13	-	

Supply Rails

EHT	-1530v
HT	+ 200v
LT	+ 24v
HEATERS	6.3v AC.

COMPONENTS LIST

KW108 MONITORSCOPE

Circuit No.	Description	Details	Location
C1	Capacitor Electrolytic	8mfd 450v	Chassis
C2	Capacitor Electrolytic	8mfd 450v	Chassis
C3	Capacitor Electrolytic	8mfd 450v	Chassis
C4	Capacitor Electrolytic	8mfd 450v	Chassis
C5 a & b	Capacitor Electrolytic	32+32mfd 275v	PC Board
C6	NOT USED	-	-
C7	Capacitor Electrolytic	250mfd 40v	PC Board
C8	Capacitor Electrolytic	250mfd 40v	PC Board
C9	Capacitor Polyester	0.1mfd 160v	Tag Strip
C10	Capacitor Electrolytic	100mfd 50v	PC Board
C11	Capacitor Electrolytic	80mfd 16v	PC Board
C12	Capacitor Ceramic Disc	0.1mfd 30v	PC Board
C13	Capacitor Polyester	1mfd 100v	PC Board
C14	Capacitor Tantalum Bead	4.7mfd 16v	PC Board
C15	Capacitor Polyester	0.47mfd 100v	PC Board
C16	Capacitor Electrolytic	100mfd 6.4v	PC Board
C17	Capacitor Ceramic Disc	0.1mfd 30v	PC Board
C18	Capacitor Ceramic Disc	5000 pF 500v	Front Panel
C19	Capacitor Ceramic Disc	0.1mfd 30v	PC Board
C20	NOT USED	-	-
C21	Capacitor Electrolytic	100mfd 6.4v	PC Board
C22	Capacitor Polyester	1mfd 100v	PC Board
C23	Capacitor Tantalum Bead	22mfd 16v	PC Board
C24	Capacitor Polyester	0.1mfd 160v	PC Board
C25	Capacitor Ceramic Disc	0.1mfd 30v	PC Board
C26	Capacitor Electrolytic	80mfd 16v	PC Board
C27	Capacitor Polyester	0.47mfd 100v	PC Board
CRT1	Cathode Ray Tube	-	Front Panel
D1	Diode	-	Chassis
D2	Diode	-	
D3	Diode	-	PC Board
D4) D5) D6) D7)	Bridge Rectifier	-	PC Board
D8	Diode Zener	-	PC Board
D9	Diode	-	PC Board
FS1	Class Fuse $1\frac{1}{4}$" x $\frac{1}{4}$"	1 amp	Rear Panel
L1	Choke	68 mH	PC Board
L2	Choke	68 mH	PC Board
LP1	Lamp	Neon	Tag Strip

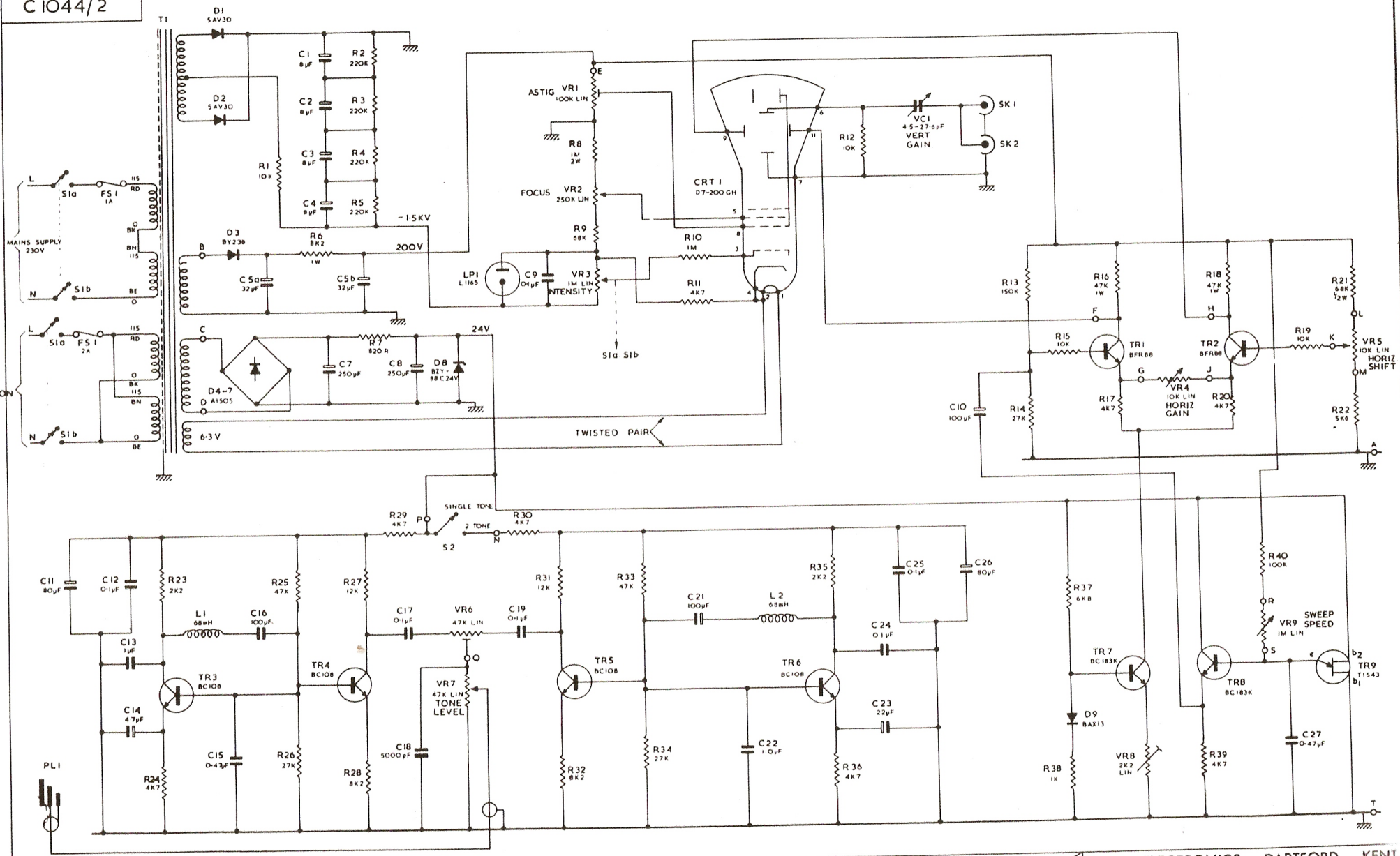
Circuit No.	Description		Details		Location
R1	Resistor	10K	½W	10%	Chassis
R2	Resistor	220K	½W	10%	Chassis
R3	Resistor	220K	½W	10%	Chassis
R4	Resistor	220K	½W	10%	Chassis
R5	Resistor	220K	½W	10%	Chassis
R6	Resistor	8K2	1W	10%	PC Board
R7	Resistor	82DR	⅓W	5%	PC Board
R8	Resistor	1M	2W	10%	Front Panel
R9	Resistor	68K	½W	10%	Front Panel
R10	Resistor	1M	½W	10%	Tag Strip
R11	Resistor	4K7	½W	10%	Tag Strip
R12	Resistor	10K	½W	10%	Tag Strip
R13	Resistor	150K	⅓W	5%	PC Board
R14	Resistor	27K	⅓W	5%	PC Board
R15	Resistor	10K	⅓W	5%	PC Board
R16	Resistor	47K	1W	10%	PC Board
R17	Resistor	47K	⅓W	5%	PC Board
R18	Resistor	47K	1W	10%	PC Board
R19	Resistor	10K	⅓W	5%	PC Board
R20	Resistor	4K7	⅓W	5%	PC Board
R21	Resistor	68K	½W	10%	PC Board
R22	Resistor	5K6	⅓W	5%	PC Board
R23	Resistor	2K2	⅓W	5%	PC Board
R24	Resistor	4K7	⅓W	5%	PC Board
R25	Resistor	47K	⅓W	5%	PC Board
R26	Resistor	27K	⅓W	5%	PC Board
R27	Resistor	12K	⅓W	5%	PC Board
R28	Resistor	8K2	⅓W	5%	PC Board
R29	Resistor	4K7	⅓W	5%	PC Board
R30	Resistor	4K7	⅓W	5%	PC Board
R31	Resistor	12K	⅓W	5%	PC Board
R32	Resistor	8K2	⅓W	5%	PC Board
R33	Resistor	47K	⅓W	5%	PC Board
R34	Resistor	27K	⅓W	5%	PC Board
R35	Resistor	2K2	⅓W	5%	PC Board
R36	Resistor	4K7	⅓W	5%	PC Board
R37	Resistor	6K8	⅓W	5%	PC Board
R38	Resistor	1K	⅓W	5%	PC Board
R39	Resistor	4K7	⅓W	5%	PC Board
R40	Resistor	100K	⅓W	5%	PC Board

Circuit No.	Description	Details	Location
S1A	Switch DPST	-	VR.3
S2	Switch Rotary	ON/OFF	Front Panel
SK1	Socket	Co-axial	Rear Panel
SK2	Socket	Co-axial	Rear Panel
T1	Transformer	Mains	Chassis
TR1	Transistor	-	PC Board
TR2	Transistor	-	PC Board
TR3	Transistor	-	PC Board
TR4	Transistor	-	PC Board
TR5	Transistor	-	PC Board
TR6	Transistor	-	PC Board
TR7	Transistor	-	PC Board
TR8	Transistor	-	PC Board
TR9	Transistor	-	PC Board
VC1	Capacitor Variable	4.5pF - 27.6pF	Rear Panel
VR1	Potentiometer	100K Lin. P/Set	Rear Panel
VR2	Potentiometer	250K Lin.	Front Panel
VR3	Potentiometer	1M Lin.	Front Panel
VR4	Potentiometer	10K Lin.	Front Panel
VR5	Potentiometer	10K Lin.	Front Panel
VR6	Potentiometer	47K Lin. Skeleton	PC Board
VR7	Potentiometer	47K Lin.	Front Panel
VR8	Potentiometer	2K2 Lin. Skeleton	PC Board
VR9	Potentiometer	1M Lin.	Front Panel

USED ON
KW 108
MONITORSCOPE

DRAWING NO
C 1044/2

THIRD ANGLE PROJECTION



ISSUE	DATE	
3	1-3-73	AM SHT 4455 C/N 706
2	10-11-72	AM SHT 4432 C/N 681
1	1-11-72	ORIGINAL ISSUE

APP'D
CHECKED
DRAWN N. Turner
30-8-72

MATERIAL
FINISH
SCALE

TOLERANCES
FRACTIONS ± 1/64
DECIMALS ± .005
ANGLES ± ½°
UNLESS STATED OTHERWISE
DIMENSIONS IN INCHES

K. W. ELECTRONICS DARTFORD KENT

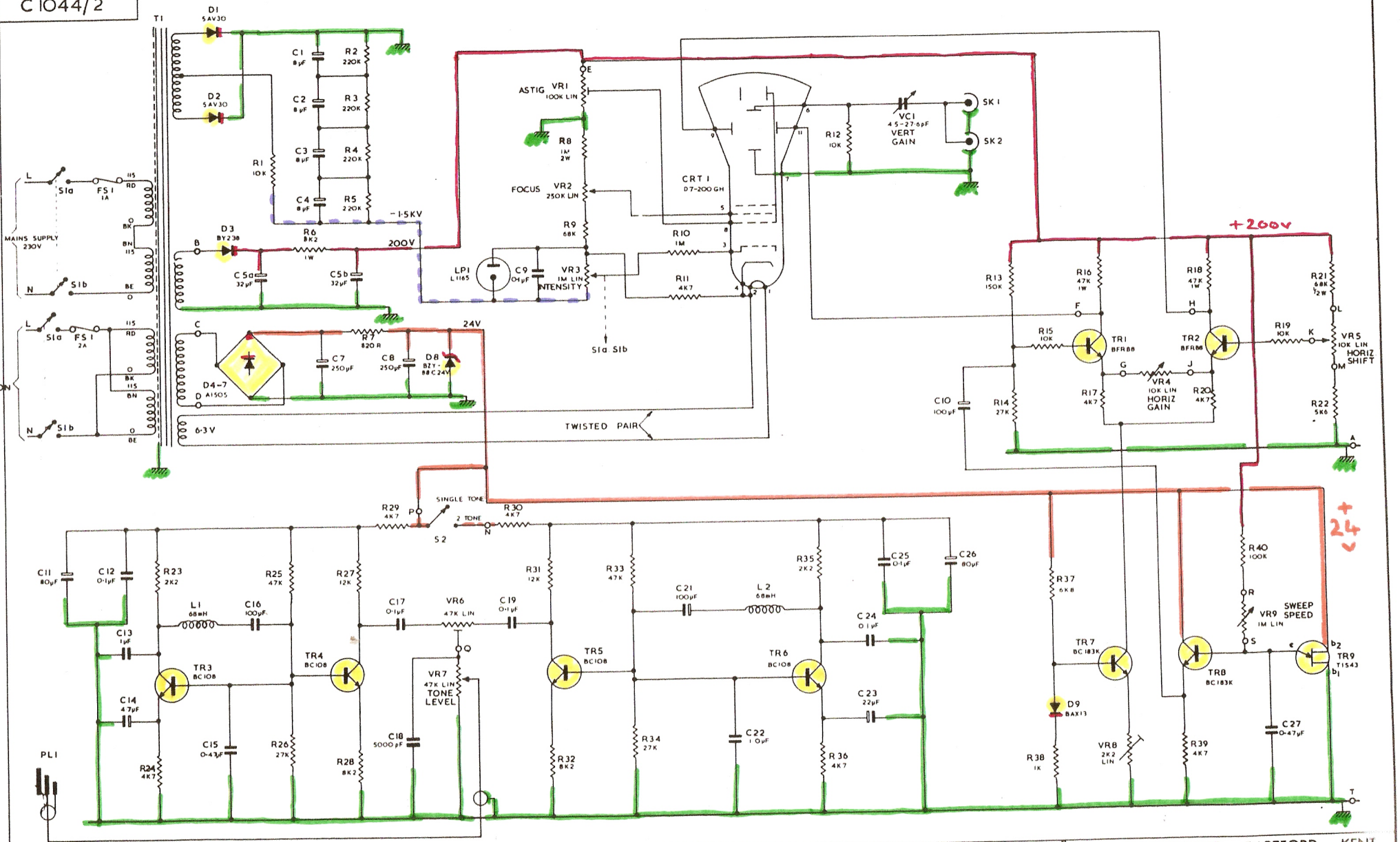
TITLE
CIRCUIT DIAGRAM
KW 108
MONITOR-SCOPE

DRG NO
C 1044/2

USED ON
KW 108
MONITORSCOPE

DRAWING Nº
C 1044/2

THIRD ANGLE PROJECTION



ISSUE	DATE	
3	1-3-73	AM. SHT 4455 C/N. 706
2	10-11-72	AM SHT 4432 C/N. 681
1	1-11-72	ORIGINAL ISSUE

APP'D
CHECKED
DRAWN N. Turner
30-8-72

MATERIAL
FINISH
SCALE

TOLERANCES
FRACTIONS ± 1/64
DECIMALS ± .005
ANGLES ± 1/2°
UNLESS STATED OTHERWISE
DIMENSIONS IN INCHES

K. W. ELECTRONICS DARTFORD KENT

TITLE
CIRCUIT DIAGRAM
KW 108
MONITOR-SCOPE

DRG Nº
C 1044/2