MODIFICATIONS FOR THE KW-2000 TRANSCEIVER SERIES

PSU IMPROVEMENTS FOR BETTER FREQUENCY STABILITY

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THE KW-2000 transceiver and its successors the '2000A and the '2000B have been very popular in the U.K. since their introduction in the mid 1960's. The main reasons for their popularity are compact appearance, the availability of both AC and DC power supplies and, of course, the inclusion of 160-metre coverage (a bonus most other transceivers of that period lacked).

However, as with most budget-priced amateur equipment it has some drawbacks. Some of these would involve a considerable amount of work to overcome, but others may be reduced to a couple of evenings' effort and a very satisfactory improvement can be obtained. One criticism that is often levelled at the KW range is its inability to maintain good frequency stability over long periods. This was noticed on the '2000A at G3ZSU, and enquiries were made of other owners in order to find a cure for the problem. Several ideas were accumulated, but perhaps the most effective was put forward by G3OUV, to whom all credit for the main part of these notes must go.

Tests made at both stations showed that the drift at the VFO was due to fairly small changes in mains supply voltage, and the following descriptions give details of a cheap, simple but effective solution. Although the basis of the article refers to the KW-2000A in particular, there are notes at the end regarding the earlier '2000 and the later '2000B.

The modifications are in two steps: The first part is relevant to the heater chain to the VFO and HF oscillator which in itself gives much improved stability under most conditions, and may well suffice for home-station use. The second part gives details of stabilisation to the 245-volt HF rail which in turn feeds 150 volts to the VFO and HFO. This provides almost complete stability of supply to the frequency-controlling components within the transceiver.

TABLE OF VALUES (Fig. 1)

OLD COMPONENT	VALUE	NEW COMPONENT	VALUE
R9	9 ohm	R9A	22 ohm
		R9B	100 ohm
C7	100 μF	C7(a)	6400 μF 16 v.w.
C8	100 μF	C8(a)	0·01 μF
		VR	LM309K

Procedure

It is best if the modifications to the heater line are described in step-by-step form.

(1) Take the PSU from its cabinet by removing the cabinet feet retaining screws and sliding the chassis from the rear of the cabinet. Note that the speaker leads are still connected and should be unsoldered prior to walking the PSU away from the cabinet.

(2) With the aid of the circuit diagram identify the following components:

(*a*) 9-ohm resistor R9; (*b*) 100 μF capacitors C7/C8, mounted near centre of chassis directly under T1; (*c*) D13/14 rectifier diode type 1K2 mounted to tag board between HT and E.H.T. rectifiers.

(3) Remove C7 and C8.

(4) Cut grey wire on R9 and leave *in situ*.

(5) Cut yellow wire at R9 and remove from cable form.

(6) Remove D13/14 and the pink wire which goes to it and pull it from cable form.

(7) Disconnect blue/white wire from D13/14 and extract from cable form.

(8) Remove R9, 9-ohm resistor, and its mounting screw.

(9) Drill a 6 BA clearance hole between T1 and T2

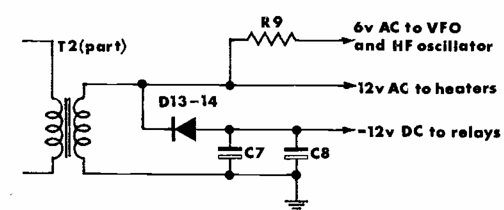

Fig 1(A).

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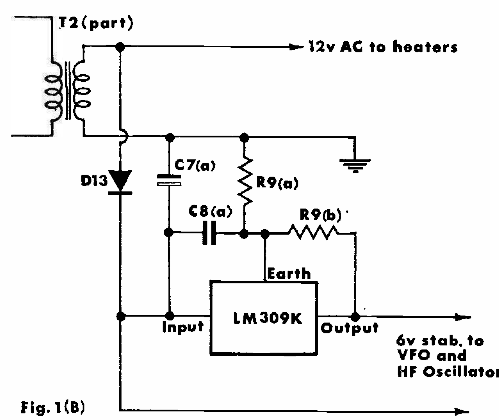

Fig. 1(B)

Fig. 1(A). Simplified diagram of existing KW-2000A PSU showing the low-voltage outputs. Fig. 1(B). Showing modifications to the low-voltage outputs.

and mount the capacitor clip for C7A.

(10) Using the original hole for R9 as a starting point, mark out and mount the monolithic stabiliser LM309. It is necessary to insulate this from the chassis, and two "top hat" nylon insulating bushes are required for this together with a TO3 type mica washer. Also prior to mounting the LM309 coat the mica washer with a liberal amount of MS4 silicone grease; this aids heat conduction. Ensure that all parts of the LM309 are insulated from chassis.

(11) Connect BYX42/300 anode to the outgoing 12 volt AC lead from T2.

(12) Take BYX42/300 cathode to the positive terminal of C7A.

(13) Connect the short pink wire which was originally on the old C7/C8 to the positive terminal of C7A. This feeds the relay supply.

(14) Feed the long pink wire which was on D13/14 round the chassis to the LM309.

(15) Connect this wire to the input terminal of the LM309 and connect a 0·1 μF disc ceramic capacitor with short leads between the input and negative terminals of the LM309.

(16) Between output and negative of LM309 connect a 100-ohm resistor.

(17) Between LM309 negative and chassis connect a 22-ohm resistor.

(18) Earth the negative terminal of C7A.

(19) Connect grey wire to output of LM309.

This completes the first part of the modifications. The circuits both before and after are shown in Figs. 1(A) and 1(B) respectively. The connections to the LM309 are as in Fig. 2 and the method of mounting is shown in Fig.2(B). It will be noted that there lay supply has been changed from negative to positive supply. This does not entail any changes to the transceiver, and further no apparent reasons could be found for the supply being negative.

The LM309

This is an integrated circuit monolithic voltage regulator. Designed for logic power supply units (5 volt) it can supply an output current of 1·2 amps. It is overload, short circuit and thermally protected and is available from major component suppliers including *R. S. Components*. Other integrated circuit voltage regulators are available which will directly deliver 6 volts, but these tend to be rather more expensive than the 5-volt types. (7806KC—LM340k-6).

One problem which is sometimes encountered with this type of regulator is oscillation. Two types may occur, one is low frequency oscillation often at audio or sub audio frequencies, in much the same way as neon relaxation oscillators function; the other is a very high frequency oscillation (which for some reason often appears to be in the order of 50 to 60 MHz). However, both types can be eliminated by adjustment of decoupling components.

Appraisement

The preceding notes give details of the first part of the power supply regulation procedure. Following the installation of the first part, objective tests were made and the results were very surprising. First of all stability

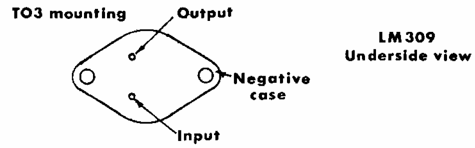

Fig. 2 (A) LM309 identification diagram

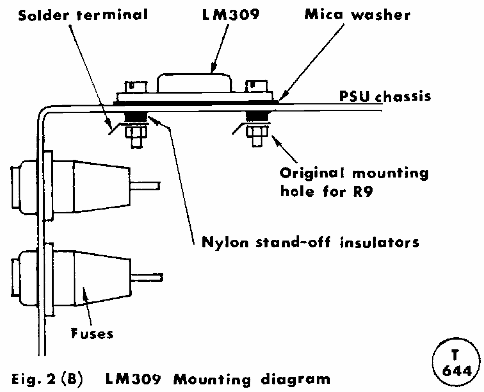

Fig. 2 (B) LM309 Mounting diagram

was checked using ship-to-shore Coast Stations as a stability reference. Initial checks ovei several hours showed that the VFO would stay within audible zero beat. This was taken to be satisfactory as QSO's from G3ZSU seldom last much more than 30 minutes at any one time. Of course the transceiver must be allowed to reach its normal operating temperature before any checks can be carried out.

However, further checks were made under heavy mains load and unload. This was achieved by switching some 15 kW on and off (night-storage heaters) and some frequency change was still present. As it is intended to use the transceiver for portable work, and is likely to be run from a generator not renowned for its constant output, the next step was to regulate the 245-volt HT line.

Stabilising the 245-Volt Rail

Once the heater line modifications have been completed the 245-volt rail can be stabilised if required (and if the transceiver is to be used portable, this is recommended). The circuit is shown in Fig. 3. It is fairly usual type of series-regulator circuit. The circuit is referred back to the newly regulated heater supply. Most of the components are mounted on an etched circuit board, a recommended layout being shown in Fig. 4. The only component not mounted on this board is the series regulator transistor 2N3739. This is fitted on a matt black, finned, heat sink, which is cut to the same length as the existing HT choke L1.

The choke is removed and the two HT smoothing capacitors C5 and C6 are connected in parallel. The heat sink can be drilled and tapped to take the original holes that the HT choke was mounted through, or alternatively two small aluminium brackets could be

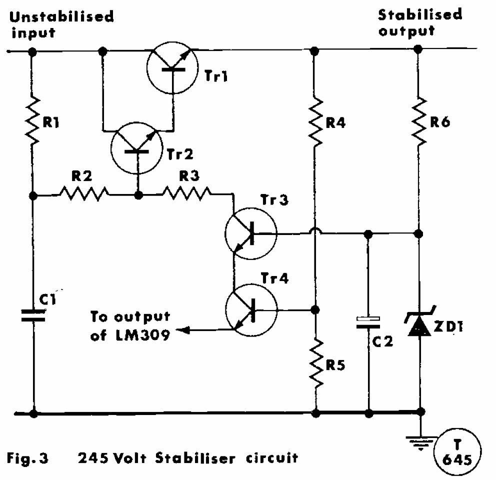

Fig. 3. Circuit for stabilising the 245v. line in the KW-2000A PSU.

Table of Values

Fig. 3. Stabilising the 245v. Line

C1	= 1 μF, 300v.	Tr1	= 2N3739, *or* 2N3584, HEP240
C2	= 500 μF, 15v.		
R1	= 1,000 ohms, ½w.		
R2, R3	= 22,000 ohms, ½w.	Tr2, Tr3	= 2N3440, or 40327, 40321, BF258, BF259
R4	= 220,000 ohms, ½w.		
R5	= 6,800 ohms, ½w.		
R6	= 68,000 ohms, 1w.		
ZD1	= 12v. 400 mW zener diode	Tr4	= BC107, BC182

used for it. The ECB may be mounted on stand-off's attached to the heat sink. This leaves only four wires to pass back under the chassis (through the existing grommet hole). These are the input and output leads to the regulator, the 6 volts from the low voltage stabilised supply, and earth.

The orange/brown and orange wires from the HT choke can be disconnected at the tag strip almost directly beneath the choke. The brown/orange lead from the output capacitor should be transferred to the same tag as the orange lead from the first capacitor. The 150K bleed resistor can now be transferred to the two capacitors, and the collector lead to the new stabiliser taken to this point. The emitter lead (output) of the regulator is connected to the orange/brown lead on the tag strip which then feeds the output to the transceiver. The earth lead goes to any convenient grounding point on the tag strip. The 6-volt reference can be connected directly on the output of the LM309.

Setting Up

On switch-on the output voltage should be checked; this will probably not be exactly 245 volts. Before proceeding further, check the output voltage of the LM309. At G3ZSU 6·2 volts gave 220 volts. However, increasing the output to 6·3 volts (change R9A from 22 to 27 ohms) gave an output from the stabiliser of 235 volts. This was considered to be adequate and has proved to be very successful in service. Should the output be less than 235 volts it can be adjusted by verying R4 and R5 (potential divider network) by small amounts until a satisfactory voltage is achieved.

Should parasitic oscillation occur with this unit, adequate roll-off at high frequency can be achieved by connecting a 100-ohm resistor and 0·33 μF capacitor in series between the junction of R2 and R3 and earth. A ·01 μF capacitor (disc ceramic) across the output is also advisable as a precaution against HF oscillation.

Be sure to adjust the PA standing current after initial setting up has been completed.

Results

With this part of the circuit *in situ* the ripple on the HT rail was measured at less than 100 mV pk-pk, which before modification was at nearly 1 volt pk-pk. The voltage was also checked under full-load conditions. On "transmit" from key-up to key-down the voltage only dropped about two volts. There is also the added advantage that the PA screen voltage is stabilised under these conditions. This is normal practise with SSB transmitters if the standard text books are to be believed!

The KW-2000B

The modifications are equally applicable to the '2000B, but the method of achieving them is slightly different. First of all, the rectifiers are mounted on a printed circuit board above the chassis. There is also only one mains transformer in the '2000B. The relay supply is already positive with respect to the chassis although even in the '2000A this is no problem. The components are designated differently in the '2000B AC/PSU and the table gives details of the main differences.

The mechanical layout of the two chassis is also different and as there is far more room in the '2000B PSU individuals will of course have more freedom in deciding on the position of the new components. Using existing wiring where possible will help in making the

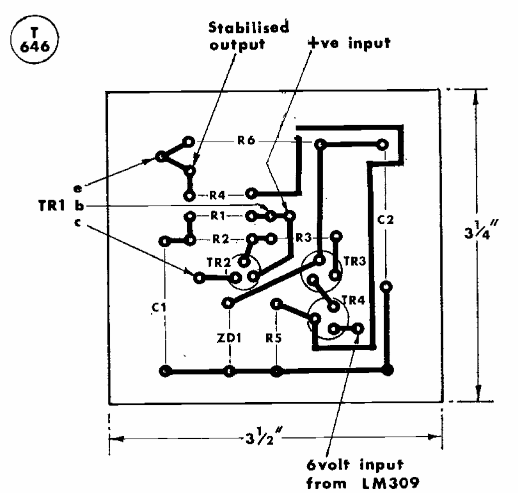

Fig. 4

Fig. 4. Layout for etched circuit board, copper side up. This is a recommended arrangement, to scale size.

completed job look neat. The circuits are basically similar but reference to Fig. 1 and the table should help clarify matters.

TVI From the KW-2000 Series

At G3ZSU some TVI has been caused on BBC-1 Ch. 1 when operating on 14 MHz. Running the Tx into a dummy load, with a receiver in the shack tuned to the third harmonic of the transmission, showed that a high level of the third harmonic was present. Tests indicated that much of this was coming from the cabinet direct and also on the power cable back to the PSU. In the first place additional bonding from the chassis to the cabinet was attained by making up a brass contact spring, as shown in Fig. 5A. This ensures an improved bond between chassis and cabinet. Further, the lid of the cabinet was drilled and tapped over the front lid so that there is additional bonding of the lid. This was found to be particularly helpful (Fig. 5B).

The circuit diagram shows that there is a distinct lack of decoupling of the power leads to the PSU. This was tackled by removing each lead in turn from the male plug on the rear drop of the transceiver and placing a *Mullard* FX.1115 ferrite bead over each lead, close to the socket and a ·01μF disc ceramic capacitor from each lead to earth. This resulted in about 80% reduction of the level of the third harmonic! The PA HT lead is de-coupled in this manner as standard. Be sure that the capacitors are capable of handling the applied voltage and that the ferrite beads cannot come into contact with each other. A piece of p.t.f.e. sleeving slipped over each bead will help to insulate them.

These notes are not intended to be "followed blindly" but it is hoped to stimulate the generation of other ideas for additional improvements to the excellent KW range of transceivers.

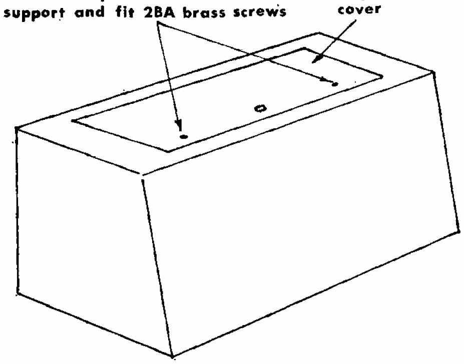

Fig. 5 (B) Improvement of cabinet lid earthing

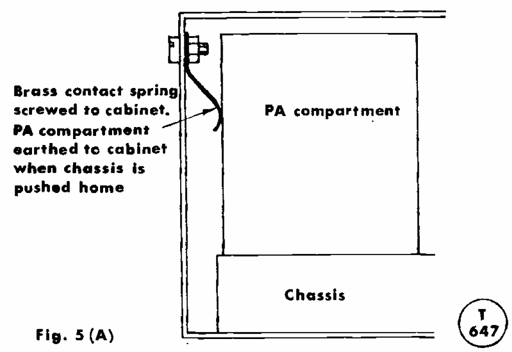

Fig. 5 (A)

ACTIVE AERIAL UNIT

FOR BOOSTING RECEIVER INPUT

G. C. DOBBS (G3RJV)

RECENTLY *Eddystone Radio* have marketed an active aerial unit, which consists basically of a small die cast case with a short whip aerial. The unit is designed for reception when limitations of space or other circumstances do not allow even a modest aerial to be erected. At least one American company also manufacture a similar unit.

Essentially the device is a high-gain broad-band RF amplifier accepting signals from a short whip aerial to feed into the receiver. Whilst such an "active aerial" is not of course suitable for transmitting, it allows listening over a wide range of frequencies without the need for a conventional aerial. As such, the device allows the SWL or licensed operator the opportunity to monitor the bands in a temporary QTH, for example a holiday hotel, or whilst the station antenna is out of action.

For some time the author has been using the *Amtron* range of module kits for a variety of amateur applications. (*see* the article Going QRP on Eighty, in *Short Wave Magazine* for August 1975). This range of small in-

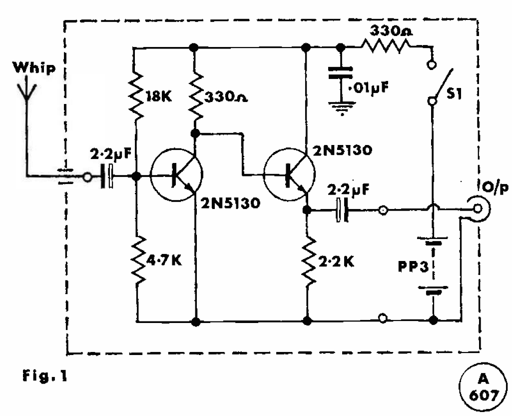

Fig. 1

Fig. 1. Circuit of the Active Aerial unit, using the Amtron UK-935 broad-band amplifier module, obtainable from Birkett of Lincoln, and shown opposite.