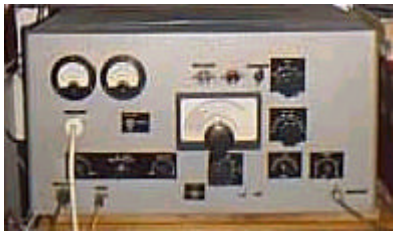
1950's Minimitter Deluxe Transmitter

Mike Hoddy, G0JXX

Having placed an advert in the VMARS Newsletter to sell or swap one of my radios for a suitable AM transmitter to back up my Vanguard I was pleased to get a call from Richard Studley, G3UNM, offering me his Minimitter Mercury. I had found an advert in a back copy of the RSGB Bulletin for 1958 showing what could be a later model with a slide rule dial so I became interested. Ironically having seen Roger '4BXM's 10m AM contribution on the Web this is actually a 'Deluxe' NOT a 'Mercury'!!!



A couple of reasons for the interest were, that the transmitter has high level modulation – Plate and Screen – and it's 150W DC input which usually means lots of heavy duty valves and components. What surprised me the most is the sheer physical size and weight. Overall the dimensions are approx. 19"D 25"W 13"H and I can only guess the weight at about 110lbs including the EHT transformer. In my small shack, that will mean a major reorganisation.

The transmitter covers the following frequencies (in Mc/s):

3.5	–	3.8
7.0	–	7.3
14.0	–	14.40
21.0	–	21.45
28.0	–	30.0

The modes of operation are C.W., A.M. and F.M. and can be 100% modulated.

The valve line up is:

Exciter Stage:	2 x EF91, 4 x 6AQ5
Power Amplifier:	2 x 807, 1 x 6L6
Modulator:	2 x 807, 1 x 12AX7, 1 x 6L6
Power Supply:	1 x 5U4G, 2 x 866A, 1 x VR150
2 pilot lamps: (modulation indicator)	1 x 6.3V 0.3A, 1 x 3.5V 0.15A

Power consumption is 300W when fully loaded, in phone mode.

The transmitter was in reasonable condition given that it had last been used in 1974 as the newspaper wrapping the valves proved. Richard had stored it in a garage since then but apart from some cosmetic wear and tear it looked a reasonable project. At some point in the past the PSU had died and the rectifiers, (2 x 866A, 5U4 plus the original mains transformer) had been replaced with silicone diodes and a removable EHT transformer arrangement. One day it is planned to rebuild this to the original design and G4DDI provided me with 2x 866A's to get started but at present I will be pleased just to get it on the air again.

On moving the transmitter around to get it into the shack I noticed a strange noise coming from the PSU section that sounded like a load of loose gravel. I was intrigued so I removed the base-plate very carefully and too my surprise there was about 1/2" of mouse droppings and nesting material. Before anything else I carefully cleaned out the unit and apart from a nibbled ceramic resistor and some corrosion caused by ammonia – you can guess where from – it was all still intact. I'm pleased I didn't jump in and turn the power on otherwise the smell would have been appalling!!

The original power supply utilised a single transformer for HT, EHT and heaters but this had been replaced with 2 x 250 – 0 – 250 feeding silicon diodes to give the 300V HT and 6.3 Volt heater supplies. The EHT transformer was a huge 700 – 0 – 700 500mA beast which had been fitted with a socket so that the transformer could be removed for transportation – thank goodness.

This gave me the opportunity to test each section prior to applying high voltage. So before reinserting all the valves and the EHT transformer I applied mains slowly through a Variac. This was done over a period of about an hour, as I wanted to make sure that the large capacitors were reformed slowly. The HT and heater supplies came up well and the 'power on' lamp lit. HT was measured at 310V with no load and the heater voltage was 6.3 V or thereabouts. Taking the bull by the horns I reinserted the valves and again brought the power up. Apart from one 807 all the heaters came up and the VR150 ignited when the controls were set for VFO Tune. VFO voltage regulator measured in at 150V and the HT stabilised at 300V

Now for the dangerous part. I reconnected the plug to the EHT transformer and again started the process of applying mains – with one hand on the big red switch. A gentle hum came from the transformer and there were no clicks or bangs from anywhere as I reached 100% on the variac. The voltages on the transformer were as expected as the capacitors started to charge fully and the DC volts came up to 750V. I left it in this state for a while to check for over heating and breakdown before going on to the next stage.

The Deluxe has a switch to turn the VFO on for netting and tuning. In the instruction manual it suggests that this is a one handed affair as the switch is auto return, but in practice it isn't easy to use when you are manually switching the aerial over from RX to TX!!. The transmitter has 2 large meters on the front panel one for the Anode Current and one for Grid Current. The Grid is set to 7mA using the drive control and this was easy to do. Monitoring the VFO on a nearby receiver showed that the VFO was operating but was unstable. After connecting a power meter and dummy load I briefly applied full power and all the voltages came up but no Anode current and about 5W of RF, obviously something sadly wrong.

I didn't have the time to find out exactly what until about a week later so I was looking forward to getting stuck into the problem when disaster struck. I was still using the variac to power up the unit and as I got to about 50% of mains input there was a crackle and bang and the fuses went in the variac and the mains trip fired. My first thought was the EHT transformer had died.

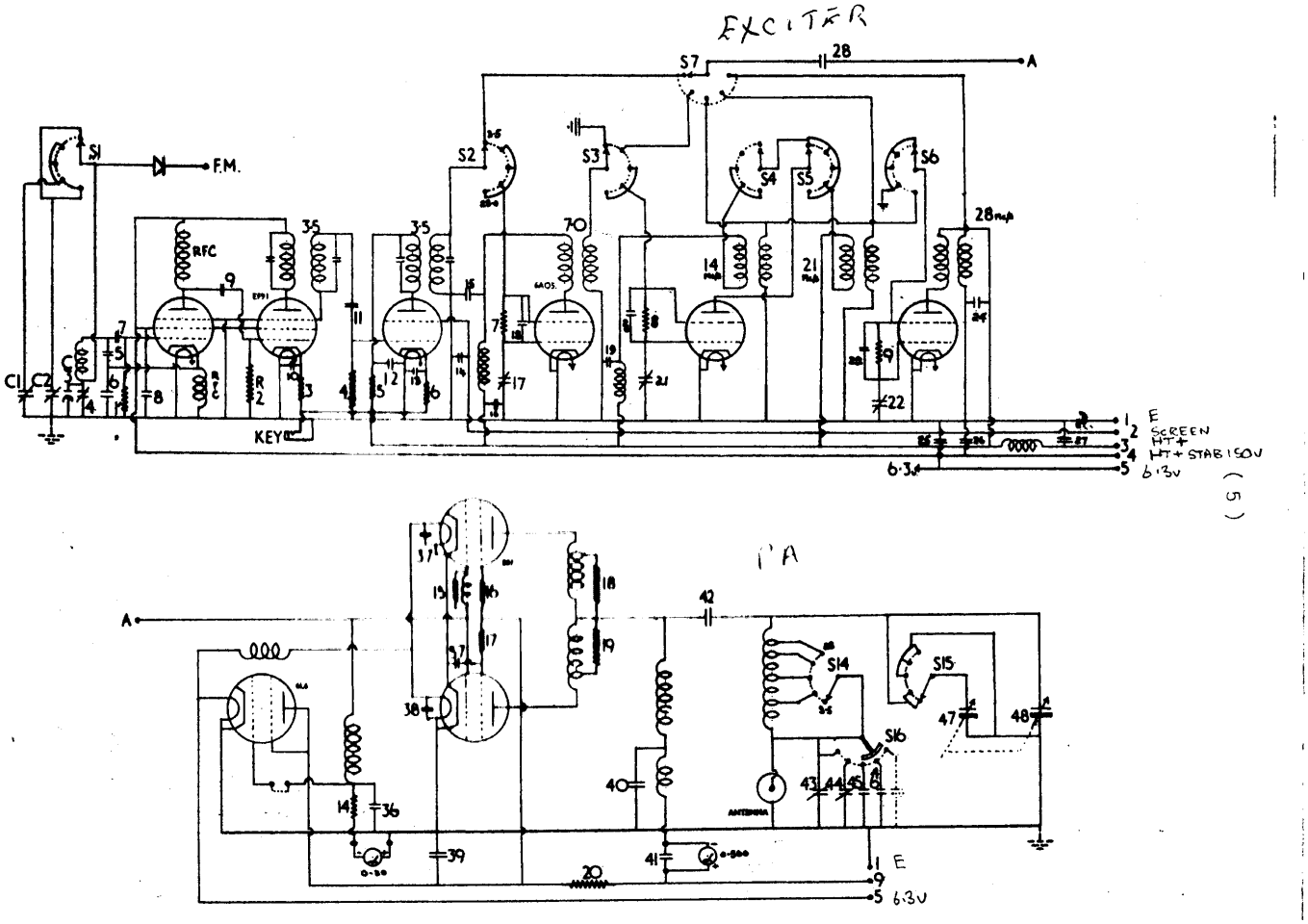
With the modifications in place it was easy to remove the EHT transformer and test the 300V HT circuit and this was OK.

I re-tested (carefully) the EHT transformer on the bench and there were no signs of problems with all the AC volts present. The rectifier was set up as a bi-phase and I discovered that 2 of the diodes in one leg of the EHT circuit had gone short. I had some high voltage semiconductor diodes in my junk box but after replacing the duff ones they blew as well. Following an on-air conversation I obtained some IN5408 diodes that are capable of handling 1.1kV at 3A and these were fitted and the PSU is working within a good tolerance. Also there is evidence of some insulation breakdown around the EHT transformer plug and the chokes, as the PVC wiring seems not to be man enough for the task. The worst offenders have been replaced and this seems to have cured the break down problems. There is an odd problem though that when the EHT transformer is mounted vertically there is a clicking that sounds like insulation breakdown somewhere in the PSU. After extensive investigation I couldn't trace the culprit but remarkably if the transformer is mounted horizontally the clicking stops and I have no problems with RF feedback or hum? No idea why, but as it works I am tempted to leave it alone until I can rebuild it to the original spec.

I decided that for the time being I would concentrate on the VFO problems and resolve the EHT problem later. The VFO is a standard Colpitts VFO very similar to the Vanguard and the component values are pretty much the same – see diagram. The VFO valve is an EF91 and is followed by a buffer amp also an EF91. The stabilised voltage was 150V and showed no signs of fluctuation so my initial suspicion was the frequency determining capacitors but after a conversation on the early VMARS net with Alan G4GEN I simply swapped out the EF91's and the VFO was happily on frequency and the note was clean. There is a further problem with the VFO in that when fully loaded the frequency will shift between 25Kc/s to 100Kc/s of the dial frequency almost at random and without warning, a fault I didn't discover until I was using the transmitter for the first time on the VMARS net. The 6AQ5's following the 2nd EF91 act as buffer / multipliers to give the 80,40,20,15 and 10m ranges and these appear to give a good level of drive to the PA section.

Having rebuilt the PSU there seemed to be a further problem, as I could only get about 5W of RF even with a Grid current of 7 to 10mA. I traced the signal through to the PA without any failure and I tried replacing the clamp valve (6L6) and the two 807 but without improvement. Following through the EHT I noticed that the clamp valve anode was fed via a 20K 50W resistor that also fed the screen grid of the 807s from the secondary of the modulation transformer. On measuring the voltages however there was no EHT appearing at either point.

On removing the resistor this was found to be open circuit! In my junk box I had a 22K 20W resistor and with much trepidation I replaced the original and on power up I had 150 - 200mA Anode current and 120W of RF into the dummy load! The resistor does get hot to touch (not that I have tried with the EHT turned on!) but has survived the testing phase so far.



Circuit diagram of the RF section, Minimitter Deluxe Transmitter. Component values on the next page.

One of the reasons for the frequency shift seems to be the lower limit of the grid voltage causing the buffer amplifier to introduce FM type hum below about 120V at the screen of the first 6AQ5. I also found that using a scope to test the waveform loads the output and stops the grid drive from reaching the needed 7 –10mA. This only happens when the scope lead is on x 10 setting.

Having replaced further suspect wiring and secured some floating components to prevent future problems I ran the transmitter up into a dummy load and managed to get 200mA with 7mA of drive but the actual RF output struggled to reach 90 / 100W into 50 Ohms. Monitoring the audio on my AR88D there was some hum but the proximity of the test leads and the dummy load may have been a factor. I tested the rig in CW mode and found that although the circuitry worked in 'key up' position the PA current was in excess of 250mA. The fault was traced to the Clamp valve, 6L6, that had failed but in a peculiar way. The heaters did not light up but initially tested OK using an Ohm meter but after a couple of seconds the resistance went from almost short circuit to a few 100Ù – clearly not happy. I replaced this with a 6L6GC and all was well with the normal operation restored. The power output is now in the region of 100W into my doublet and seems to be stable.

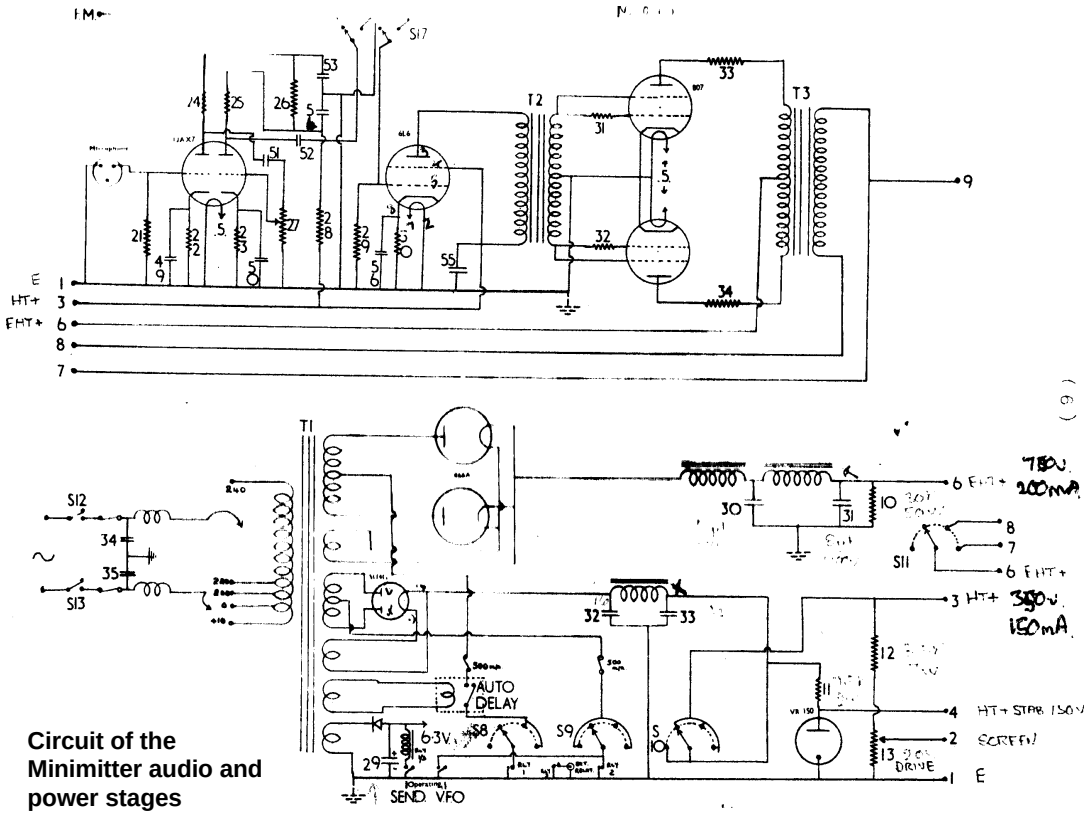
The transmitter is fitted with a Belling Lee socket on the front that shorts out to ground on transmit for controlling the station receiver but with my current station I need this to be reversed – i.e. normally closed and open on transmit. To achieve this I fitted a relay internally powered off the 6.3V heater supply and connected to the original relay and routed this back to the Belling Lee socket to keep the original design.

I have combined this transmitter with an the Eddystone 680X receiver as my example is about a year younger (1958, the Tx being 1957) and is a good example of a late 50's set up. I'm not sure what microphones would have been used, but at present the 'blue' Pye one works well.

Minimitter Deluxe – Components List

Capacitors

C1	30 pf variable	C20	100 pf Ceramic	C39	.001 µF Ceramic	R1	47KΩ	R20	20KΩ 50W
C2	50pf var	C21	30pf Var.	C40	.001 µF Ceramic	R2	47KΩ	R21	3.5 MΩ
C3	150pf Var	C22	30 pf Var.	C41	.001 uF Ceramic	R3	330Ω	R22	3.3KΩ
C4	50pf Var	C23	100 pf Ceramic	C42	.002 200v Mica	R4	22KΩ	R23	3.3KΩ
C5	.001 µF S/M	C24	.001 Ceramic	C43	340pf var	R5	1.5KΩ	R24	270KΩ
C6	.001 ditto	C25	.001 Ceramic	C44	340pf var.	R6	560Ω	R25	270KΩ
C7	100 pf Ceramic	C26	.001 Ceramic	C45	500pf Mica 2000v	R7	33KΩ	R26	20KΩ
C8	.001 µF Ceramic	C27	.001 Ceramic	C46	500pf Mica 2000v	R8	27KΩ 5W	R27	500KΩ Variable gain
C9	100 pf	C28	100pf	C47	150pf Var.	R9	33KΩ	R28	20KΩ
C10	.001 µF	C29	50 µF 12v Elect.	C48	150pf var.	R10	30KΩ 50W	R29	560KΩ
C11	100 pf	C30	4 µF 1000v	C49	50 uF 12v Elect	R11	7.5KΩ 2W	R30	200Ω 5W
C12	.001 Ceramic	C31	8 µF 1000v	C50	50 uF 12v Elect.	R12	3.5KΩ 7W	R31	20KΩ
C13	.001 Ceramic	C32	16 µF Elect. 450v	C51	.03 uF Paper	R13	20KΩ Var.Drive	R32	20KΩ
C14	.001 Ceramic	C33	32 µF Elect. 450v	C52	.03 uF Paper	R14	7.5KΩ2W	R33	100Ω
C15	.001 Ceramic	C34	.001 µF Ceramic	C53	32 uF Elect. 350v	R15	47Ω	R34	100Ω
C16	.001 Ceramic	C35	.001 µF Ceramic	C54	32 uF Elect. 350v	R16	47Ω		
C17	30 pf Var	C36	.001 µF Ceramic	C55	8 uF elect. 350v	R17	47Ω		
C18	100 pf Ceramic	C37	.001 µF Ceramic	C56	50 uF Elect. 50v	R18	100Ω 1W		
C19	.001 µF Ceramic	C38	.001 µF Ceramic	C57	.001 uF ceramic	R19	100Ω 1W		



Circuit of the Minimitter audio and power stages

The transmitter works well and on air tests are encouraging – both on AM and CW. Further work is needed but for now the set is up and running and has been used on the Saturday net (plus the Sunday CW session if I get the opportunity). I'm not happy about the 'bulb' fuse idea for the modulation monitor as with the original 3V one a small cough or sneeze at the wrong moment would take you off the air immediately and I have replaced it with a 12V one to give me some margin for safety!! The set isn't particularly attractive, lacking the styling of the KW and Panda rigs of the same era (in my view), but still is well worth preserving.