WARNING – DO NOT READ THIS ARTICLE IF YOU ARE OF A NERVOUS DISPOSITION!

'Sins of my Youth Revisited' – A Sorry Tale of an Unfeasibly Much-Modified Eddystone EC10 MkI, by Gerry O'Hara, G8GUH/VE7GUH

Introduction

Well, I said I was going to do it and I finally have – what? Rescue my poor EC10 MkI from my Mother-in-Law's garage in Burton-on-Trent. It had been residing there for some ten years since it was removed from the attic of my UK house in 1999 when I decided to sell-up in the UK and emigrate to Canada. The EC10 had sat idle for years in the garage and attic at that house in Bottesford, near Nottingham and at one in Yate, near Bristol prior to that. Why? - me having no time to become involved with any radio-related stuff while the family were young and due to pressure of work – much of it away from home – taking almost all of my time. Now that I have the set back in my sticky mitts I thought a description of the set and a synopsis of its history might be of some interest to other EC10 owners – which I know there are many, this being one of the most popular models Eddystone ever made.

My unmodified EC10 MkI (look it even says it's a MkI on the dial!) – just so you know what one of these sets should look like…

There it is on the floor in my Mother-in-Laws garage - complete with two battery packs and a WG16 straight sitting atop it (along with a BC221 wavemeter on the floor to its left)

Background

As I have mentioned before in previous articles on the EUG site, this EC10 MkI was bought by me back in around 1972 as a replacement for the Murphy B40 navy receiver that I had been using for short-wave listening. As physically impressive and good a receiver as the B40 was (is), a number of factors combined to make me decide to 'downsize' to the comparatively diminutive EC10, including:

- The B40 was having ongoing problems with poor contacts in the turret tuner – someone had cleaned them with emery paper and a file at some point and the silver plating had been removed. No amount of Servisol or Electrolube would cure that;

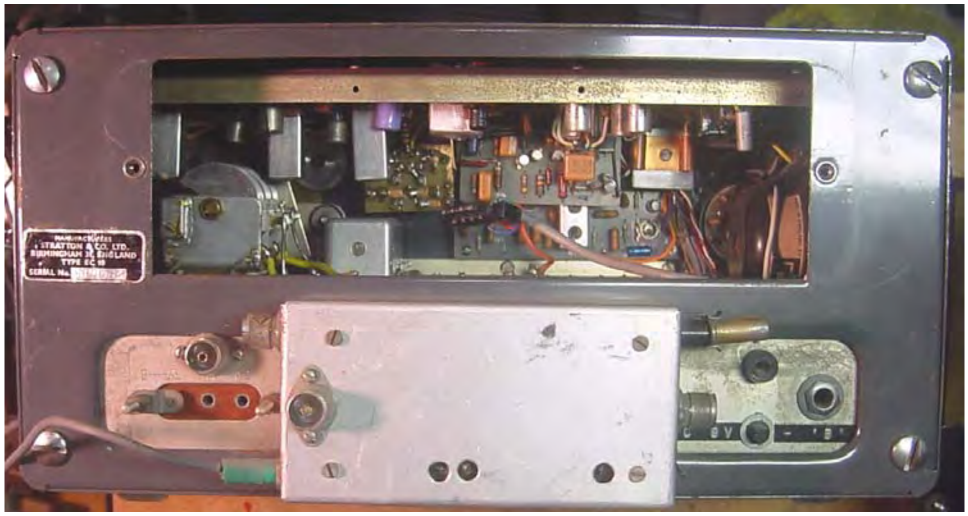
- The B40 garnered comments from my peers and even my physics teacher that it 'belonged back on a battleship' and it could 'do with a rest in 40 feet of water' (oh, people can be so cruel…);
- I was newly-licensed with my G8GUH call and wanted a 2 Meter receive capability, including one that could be transported to remote sites to work 'portable'. Range 3 on an EC10 covers 4 to 6MHz, making it a good choice as a tunable IF for the 2 Meter 'converters' that were popular at the time; and
- I was planning to go to university and needed a more easily-transported receiver that could be taken into my 'digs' (imagine a landlady's face on seeing a B40!).

I looked-around (only locally in them days) and did not find anything suitable – I recall a cheap and nasty 'Lafayette' receiver being viewed as well as a 'Codar' – both tube sets I think, but still much smaller than the B40 (most things were, even some cars). So, when one of my radio friends told me that there was a transistorized communications receiver for sale locally I was very keen to see it – especially when the seller told me it was an Eddystone, as I had been so impressed with the Eddystone sets that Gordon (G3MNL) had in his shack and with the Eddystone sales literature for sets that were way beyond my price range (I was earning the princely sum of two quid for my Saturday job at Mison's in Citadel Row in Carlisle). So, the deal was done – I saw the set: it was in good nick, I liked it and bought it, complete with a Type 924 mains power supply and spare battery pack. I probably paid a little over the odds, but it was everything (I thought) I wanted… quality construction, good name, small, transistorized, rugged, battery or mains, broadcast and short wave bands through to 30MHz, BFO etc.

Murphy B40 – a battleship without the funnels. There is a 16'' MkI gun in the top right compartment

I sold the B40 for the same price as I had paid for it a couple of years earlier and that funded half the cost of the EC10 (the remainder was 10 weeks wages!).
At the time I was a member of the Carlisle and District Amateur Radio Club. I recall a meeting where one of the members was trying to whip-up interest for a bulk order of 2 Meter converter kits from Burns Electronics. I ordered one of these and built it very carefully – it even worked first time (phew!). It was duly bolted to the rear of the EC10 case (where it remains to this day). It worked a treat using Band 3 on the EC10 with the 4 to 6MHz tunable IF – just as I had hoped (over 26 turns of the Eddystone tuning knob covering 144 – 146MHz!). I had been given the loan of a (tube) homebrew 1Watt 2 Meter AM transmitter from G3MNL when I received my license and I was 'up and

running' with a 4 element beam (also on loan) affixed to a pole secured to my gran's washing line post at the bottom of the garden and some cheap TV coax connecting the two[1].



Rear view of the modified EC10 with battery pack removed – the aluminium carbuncle on the case is the Burns electronics 2 Meter converter

That was fine, but most stations I was hearing on 2 Meters were FM and they were having difficulty copying me and vice-versa as I was using slope-detection of the FM signals on the EC10 – which is a bit 'limiting' (or not, as the case may be!) – noisy and poor audio quality. Over time I started to identify other shortcomings in the EC10 when used for shortwave reception – in particular on the amateur bands – especially the lack of good selectivity, poor frequency stability and very cramped/critical tuning on the higher shortwave bands. Inevitably I was comparing its facilities and performance with more expensive shortwave receivers of the day, noting that they had variable-width IFs, bandspread tuning, fast/slow AGC, product detectors for SSB, crystal calibrators, S-Meters, Q-Multipliers, notch filters, etc. It also occurred to me that an FM detector and squelch circuit would be very useful for my 2 Meter operation. Hmmm… my fertile young mind decided that I could have some of that sexiness in my EC10. So, I started to read and re-read all my Rad-Coms, Shortwave Magazines, handbooks and just about every piece of radio-related literature I could lay my hands on for

My Hammarlund HQ-180 – a dream receiver? This puppy just about has it all… maybe I should have saved-up for one of these in 1972? – hell no, the feel of the flywheel tuning on the HQ-180 is crap!

[1] I soon upgraded to a crossed 10 element yagi with a phasing control that allowed for horizontal, vertical or clockwise/anticlockwise polarization mounted on a 25' aluminum pole and some RG58 coax. I also built the 2Meter FM transmitter described in the 1972 edition of the ARRL Handbook.

circuit ideas I could adopt and use in my EC10 to improve on its performance.

Before long the fate of the EC10 was in my hands, my imagination, a handful of old hand tools and my trusty Antex 15W soldering iron (still in use today in the VE7GUH shack – and only two new handles, four new elements and many, many bits in nearly 40 years – a bit like Trigger's road sweeping brush in Only Fools and Horses). Oh dear…

Summary of the Mods

The mods to the set started in a modest way, largely retaining the external appearance of the EC10, but as time went on the fingerplate had to be modified (replaced) with one that eventually had more holes in it than a piece of Swiss Cheese. These mods were undertaken over a period of around 5 years between 1973 and 1978. Most of my original notes, sketches, hand-drawn schematics and circuit layouts survive, and even the original Burn's electronics FM module literature. Some of these are reproduced for posterity at the end of this article for those that may be interested (I have already passed these out to some folks I have corresponded with in recent years – on the proviso that they do not molest their EC10s!). **Please, do NOT attempt these mods on your EC10, instead, I encourage you to retain your set in original condition as a time-capsule of early-1960's solid-state technology in the UK and as an icon of the Eddystone marque.**

Stabilized Power Supply

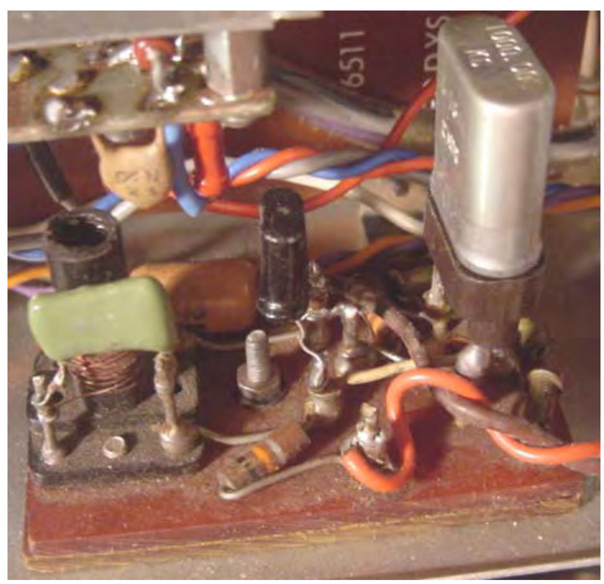
This was an obvious one to me at the time: the Eddystone Type 924 regulated power supply is a rather crude affair, with the 9v supply being fixed by a high-wattage zener diode (OAZ227). I thought that a series transistor regulator would be a better solution and may improve the sets frequency stability. So, the Type 924 was partly gutted and a simple series-regulated stabilized power supply built into it using a circuit largely cribbed from the Radio Communication Handbook. Hey, and it worked well (and still does), though I didn't find much improvement in the frequency stability of the set as a result of these changes…

Product Detector

I found a circuit for a neat little balanced product detector using two OC44 transistors – I think in an old copy of RadCom (Technical Topics?). This was built originally on a piece of Veroboard, but later rebuilt[2] on a homebrew printed circuit board, mounted on one of the IF/AF sub-chassis ribs and connected into the circuit in lieu of the standard AM detector diode, with the BFO fed into one OC44 and signal from the last IF being fed into the other. The original detector diode now provided only AGC voltage. The product detector worked a treat (and still does) – SSB reception was much-improved and without having to carefully set the RF gain control. The problem of a drifting local oscillator remained though.

Crystal Calibrator

I had been given a small (and old) 1MHz transistor crystal calibrator that worked well. It was constructed on a piece of Paxolin sheet with pins through it onto which the components were soldered – not too pretty, but functional. I mounted it under the chassis of the EC10 in the section behind the tuning flywheel (plenty of room in there). I used the momentary dial light switch to operate this unit – wiring a small switch internally to operate the dial lights, which were normally left on, unless I was operating the set on batteries, in which case I opened the case and switched them off. So, no mods to the external appearance of the EC10 -

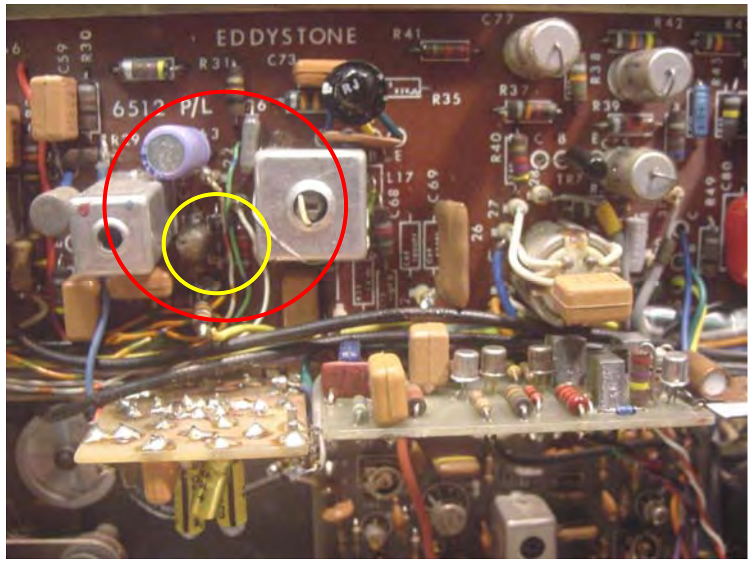


[2] I had started to experiment with designing and etching my own printed circuit boards, thinking they looked more 'professional' than Veroboard or 'dead bug' construction. Maybe so, but my efforts (with a masking pen and ferric chloride bath in my gran's kitchen) don't look too professional to me now! Still, they work…

as long as I remembered about the new role of the light switch.

AGC Improvements

Another obvious mod, and a simple one to implement, was a fast/slow AGC function, just a switch needed and an extra capacitor to change the time constant of the AGC circuit (actually a 'pump' diode circuit was also fitted to provide more AGC voltage when in the slow position). OhOh though, I needed an extra switch – or did I? Instead, I decided to reconfigure the AGC switch on the front panel to leave the AGC on all the time and to switch between fast and slow time constants (since fitting the product detector, I had found that I was not switching the AGC off and manually adjusting the RF gain nearly as much). Still no mods to the front panel appearance – yet… I just had to remember that fast was out and slow was in.



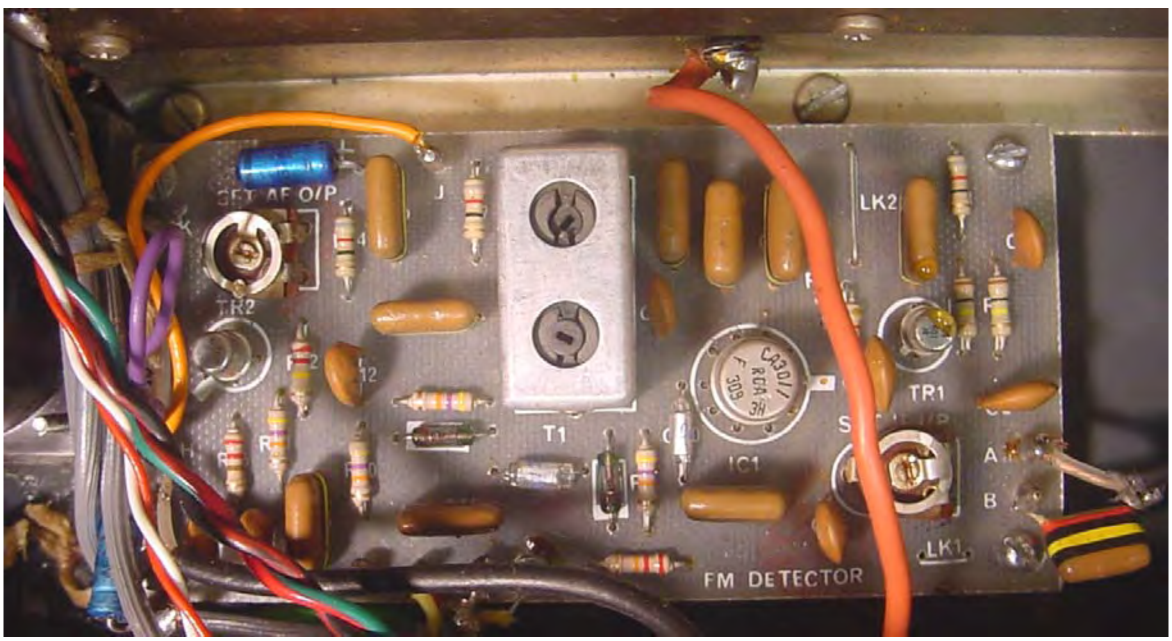
Section of the IF strip with mods to the AGC circuit circled red – the blue capacitor is a 220uF electrolytic used in the slow AGC pump diode circuit (the pump diode is located to the right of the choke circled yellow. The product detector board is located below (left) and the squelch circuit board below right. The NBFM detector board can be seen behind

Bandspread tuning

The limitations of using the set on the higher HF bands were getting to me (remember, this was my only HF receiver at the time). I noticed that the newer-model EC10 (MkII) had a fine tuning control. Somehow I managed to find out the circuit for this – a simple varicap (BA111) loosely-coupled (via a 27pF capacitor) across the LO section of the main tuning gang - and I decided to implement this in my EC10. Now, this would need a hole to be drilled in the front panel. With much trepidation I dismantled the EC10 further than ever I had done before and decided to install the fine tuning control pot to the lower-right of the main tuning control. I drilled the necessary hole in the cast aluminium front panel, but before I drilled the fingerplate and re-assembled the set, it occurred to me that it may be a good idea to make a replacement fingerplate from a piece of scrap aluminium – that way I could reverse the set's appearance in the future if I ever wanted to (eg. for re-sale) by re-installing the original fingerplate – brilliant idea! An added bonus to this approach was that it would allow me to make more mods to the set, including a better AGC control arrangement, re-installation of the dial light switch on the front panel etc. I also installed a remote-tuning facility, comprising a ¼'' jack mounted on the rear panel (more holes!) – I have no clue now as to why I thought that remote tuning was a good idea at the time.

NBFM/Phase Detector

I mentioned earlier that I had constructed a Burns Electronics 2 Meter converter kit. Well, Burns were by now advertizing a narrow band FM (NBFM) detector kit – sounded ideal for what I needed. The Burns circuit included an integrated circuit limiter amplifier (wow, high-tech), discriminator and input/output buffer amplifiers. So a kit was duly purchased and constructed (photo, below), installed in the EC10 (affixed to the rear of the plate behind the dial glass) and a mode selection switch mounted on the front panel to the lower-left of the main tuning control, with a small LED to indicate when the FM detector was in circuit (I thought LEDs looked high-tech at the time). This allowed for switching between Phase, NBFM and AM/CW/DSB/SSB modes. It worked very well, but the inter-station noise on FM was deafening – now I had to have a squelch control!

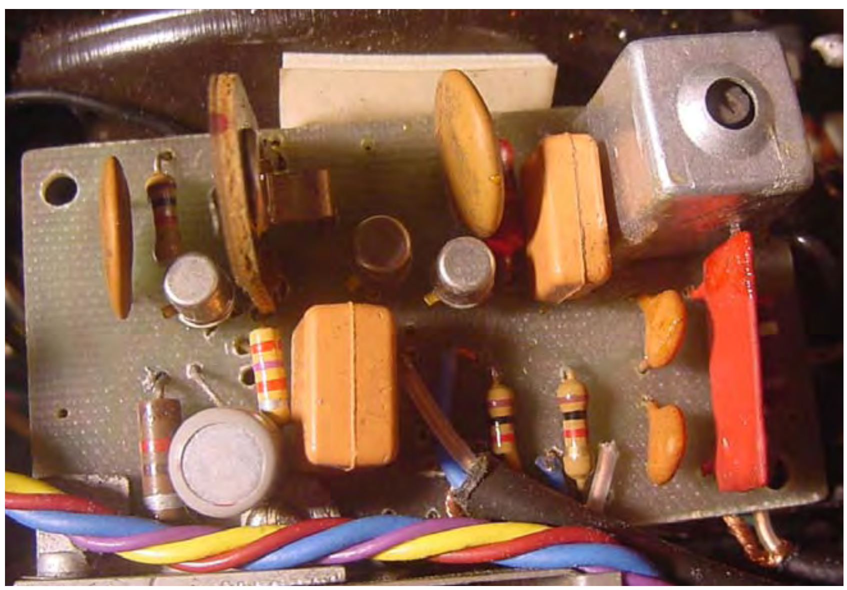


Squelch

I again scanned all my radio literature and came across an audio (noise) operated squelch control circuit. This circuit comprised a noise amplifier feeding a Schmitt trigger connected to an FET noise gate. It was constructed on a homebrew printed circuit board and incorporated into the EC10, mounted adjacent to the product detector, the squelch threshold control and a small LED indicator being installed to the left of the switch bank. It worked like a dream – silence between stations (well, at least only the constant low-level hiss of the EC10 audio stages…).

The noise-operated squelch board – a simple but effective circuit. Hey look – I even bought some TCC capacitors to match those in the EC10…

Q-Multiplier



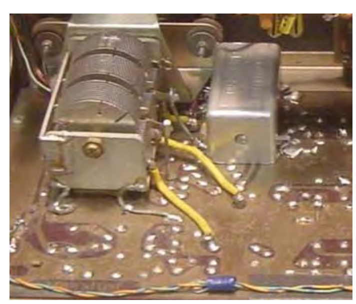
I recall reading an article on how useful a Q-Multiplier was in a receiver that was not fitted with a crystal filter. As I thought that I could not afford a suitable high-grade crystal or mechanical filter (and rather liked the idea of a circuit that could be used to either peak a signal or to null-out an unwanted signal) I eventually selected a circuit that would suit my needs (or desires?). It was constructed on another homebrew printed circuit board and installed in the EC10 in the space beneath the speaker. However, the controls for this gadget needed some very careful thought: it had five controls in all – on/off, null/peak (both switches), tuning (variable capacitor), 'Q' and bandwidth (both potentiometers). I decided to use concentric pots for the

'Q' and bandwidth controls, the selected control for which conveniently also had a (push) switch that could control the Q-Multiplier on/off function. This was mounted on the extreme upper left of the control panel, with the tuning control beneath (handy for a short connection to the Q-Multiplier circuit board) and the Peak/Null (slide) switch to the left of the squelch control. An LED was also fitted to indicate when the Q-Multiplier was operating (as it was not too evident from the controls). In operation, this gadget transformed the EC10 on the HF bands – it took a bit of getting used to, but once mastered I was able to winkle out a really weak signal or null-out a nearby strong unwanted signal with ease.

S-Meter

Well, all 'real' communications receivers have S-Meter's don't they? I thought so in the mid-1970's, so I just had to install one in my EC10. I found a suitable meter and replaced the scale with a homebrew one 'calibrated' in S-Units. I once again dismantled the EC10 and hacked away at the panel behind the scale, making a kidney-shaped cut-out to mount the meter movement behind. The meter was connected into the EC10 per the EC10MkII circuit, but I don't think my meter's sensitivity was right (should be 100uA) as it damped the AGC significantly. I decided to change things and found a circuit for an AGC amplifier with meter adjustment (zero/sensitivity) and built it onto a round circuit board mounted directly on the rear of the meter (photo, above right). This worked much better.

Local oscillator stability improvement



The problem of the local oscillator drifting was still present. I recall trying many mods to the LO circuit in attempts to improve things, in the end settling for a different type of LO transistor (BF115[3]) mounted on the track side of the RF circuit board such that a

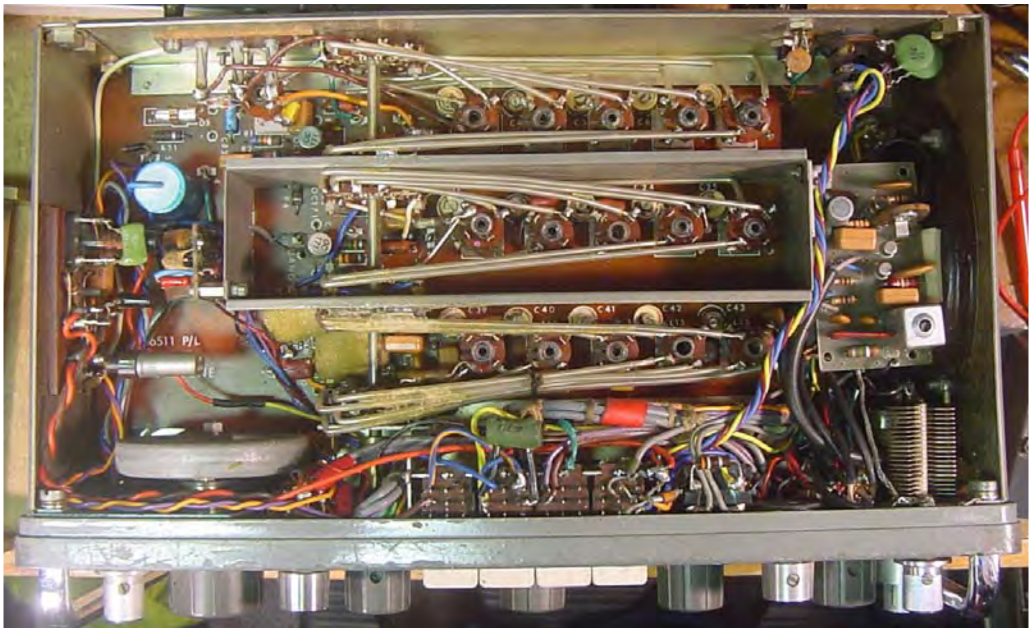
[3] Using the BF115 (an NPN type) necessitated changes to the bias arrangements of the local oscillator stage – specifically connecting the ground end of the emitter windings of the coils to the negative supply line (instead of positive ground) via a 1kohm resistor in lieu of 390 ohms (R11), and the collector load resistor (R15) to (positive) ground, changing the base bias resistors to 5.6kohms (R16) and 6.8kohms (R17) and adding additional decoupling capacitors to the base (100pF and 1000pF ceramics in parallel).

silver-painted thermally-insulated enclosure could shroud the transistor to

improve its thermal stability after initial 'warm-up'. The thermal enclosure is still in place (photo, base of previous page) and when compared to my unmodified EC10 does provide a noticeable improvement (though it is still not great). I also installed a buffer amplifier between the local oscillator and the mixer stage to reduce oscillator 'pulling' by strong signals. This comprised a directly-coupled pair of BC178As mounted on a small homebrew printed circuit board (photo, left), along with the varicap tuning hardware. This small board was attached to the outside wall of the mixer screening trough (opposite the crystal calibrator).

Back Home Again – Testing and Repair

On the receiver reaching my workbench in Vancouver, I first checked that the power supply was working ok – it was, with very little ripple and spot on 9.5v DC. I connected the set to the power supply and switched on – the hiss from the audio stages was still there, but no stations. I injected some modulated 465kHz signal into the IF stage – almost blew the speaker out – no problem there! I tried injecting RF at high level into the aerial socket – nothing… but when I listened carefully at the injected frequency I could just hear a signal, indicating that the LO was working. I injected the signal into the RF stage collector circuit – nothing heard this time. I therefore suspected the mixer stage transistor could be defective. A quick check on the voltages confirmed



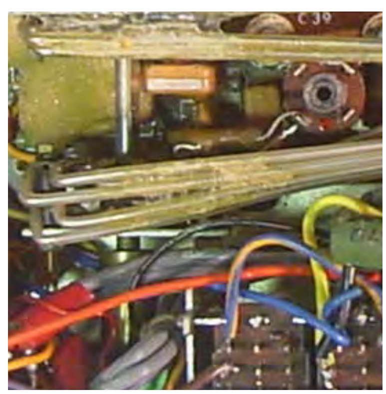
this to be the case. I swapped a known good OC171 in from my junk box and… no improvement. On checking the voltages again there was now no voltage at all on the collector – this problem was traced to the screened lead coupling the mixer to the IF strip having detached itself when I moved the IF strip to gain better access to install the replacement mixer transistor. I re-connected the lead, switched on and the receiver now functioned ok on all bands. Strong stations were distorted though – this was traced to the

AGC being off all the time due to a faulty AGC on/off switch (one of those nasty little 'Eagle' slide switches from the early 1970's) – a poke about with a needle and a squirt of De-Oxit soon cured that. The Q-Multiplier switch was also intermittent and received the same treatment – up it came, working nicely. The crystal calibrator worked (and the dial calibration was not far out), as did the product detector, FM detector and squelch systems. The only item that was not working was the S-Meter (not a big deal, but worth fixing).

Other Observations

While inspecting the circuit boards and chassis in the EC10 I noticed several other changes – either repairs or minor mods to try improving the set's performance, including:

- at some time I had replaced the BFO coil assembly for 'mongrel' one with a much fatter and squatter can, along with replacing the BFO transistor (OC171) with an Ediswan PXA102 'top hat' type. These changes are probably a repair – I seem to recall the slug in the BFO jammed at some point in the dim distant past and I broke the former of the original coil. The OC171 had probably grown whiskers;
- C69 (470pF) had been replaced with a 270pF silver mica and a 180pF silver mica cap had been added between the emitter and collector of the BFO transistor. These changes were most likely made to bring the BFO back on tune with the mongrel coil and ensure operation with the different transistor type;
- the first audio transistor (OC71) had been replaced with an AC107 (black glass type). This is probably a repair, though maybe an attempt to lower the hiss in the audio stages (I must check the bias resistors around that transistor as these are often the primary source of such noise);
- the audio driver stage transistor (OC83) had been replaced with a metal-can CV7044 type. This is probably a repair.
- C54 (0.1uF emitter bypass capacitor on the first IF stage) had been replaced with a 5uF electrolytic – I have no idea why;
- the RF amplifier transistor (OC171) had been replaced (with one of the same type) – I recall experimenting with alternative 'hotter' types, including an FET, but reverted to the original when I could not find anything that worked better (and that remained stable);
- sponge pads had been added beneath the location of the local oscillator transistor and what appears to be modeling cement spread over nearby components and the wires in the coilbox. These were probably aimed at improving mechanical and thermal stability (photo, right);



- a two-pole 9v DC output socket on the rear panel;
- a 12v output (two Wandas) on the power supply unit to feed power to the Burns 2 Meter converter;
- a Belling-Lee coax socket had been added to the A2 aerial connection (almost everyone made this mod did they not?);
- back to back protection diodes had been added across the A2 aerial connection and ground (as fitted to the EC10 MkII);

- an extra dial light (Lilliput) had been added to illuminate the S-Meter;
- a black Wanda socket had been added to the rear panel providing an AGC output (purpose lost in the mists of time);
- several additional power supply decoupling capacitors (ceramic types) had been added here and there; and
- the serial number plate had been removed from the chassis and stuck onto the left-hand rear of the case.

Decision Time…

So, what to do? My original intent was to reverse all these mods and restore the EC10 to as original a condition as I could – feeling guilty about the abuse I had inflicted on this poor, innocent receiver. But I already have an EC10 MkI restored to (almost) 'Bath Tub fresh' condition and over the intervening 36 years or so the original fingerplate for the modified set has been lost(!). So, instead, I have decided to retain the set as modified, repairing and maintaining as necessary to restore its performance to how it was in its heyday and the days before my radio interests moved from VHF/HF to microwaves in 1979 through 1983, when the EC10 was (almost) relegated to my junk box. However, it did have a renaissance in 1984/1985 when I took a position in the Falkland Islands for 14 months – the EC10 duly accompanied me, serving as a general-coverage shortwave set until one day it just stopped working (hiss only) and I had no facilities there to repair it. However, I also had a Sommerkamp FT767DX and accessories for HF working under my VP8BDE callsign and another shortwave receiver that brought in the BBC World Service ok. So, on return to the UK in late-1985, into the junk box it went – I was just too busy with the rest of my life to give it a second thought, never mind trying to repair it.

The much-modified EC10 MkI on return to the VE7GUH shack in 2010 – rather unkempt but now working quite well considering the abuse it had, the complexity/ad-hoc nature of the mods and that I only had to replace one OC171 that had gone duff way back in 1985 in the Falkland Islands

Conclusion

Well, there you have it – background and summary description of perhaps the most hideous collection of atrocities ever inflicted on an innocent Eddystone EC10 (unless you know of a worse one!) and for which I now feel rather ashamed given 20/20 hindsight and the current way of the world. But at the time it all seemed like the best thing for me to do, ie. bring a somewhat outdated transistor radio to the highest specification and functionality that I could within my means and within my limited technical and constructional abilities. And the set throughout (and after) its period of extensive modifications, did see a lot of use over the years in a variety of circumstances, including as a great tunable IF for my 2 Meter set-up (fixed-station, portable and mobile), amateur and broadcast DX'ing and bringer of news to me in the Falkland Islands. And amazingly, it still works – almost 46 years since leaving the Bath Tub. What's more, despite all the abuse and extensive modifications – under all of it the radio is still an EC10 MkI, Serial No. KP0064 (November, 1964) and proud of it. God Bless it and all those of its marque.

73

PS – Thinking about it, that fingerplate is looking a tad shabby, with the polyurethane varnish having yellowed with age and the aluminium control knobs looking a bit '1970's'. I wonder if I should rethink the fingerplate finish and find some knobs more in keeping with the originals? Or maybe I could make it microprocessor-controlled with simulated knobs and switches on a touch-pad screen in lieu of the fingerplate - aaargggghhhhhh!! PLEASE SOMEONE HELP ME!!! (just kidding, honest…).

PPS – I forgot to mention that my Mother-in-Law had used my prized 4' parabolic dish as a frog pond in her garden (photo, next page)… another year or two and the EC10 could easily have found a new life as a garden gnome or bird feeder

Left: close-up of the Q-Multiplier control section with the squelch control to the right next to the phones jack

Above: close-up of the tuning, AGC and mode controls. Left: to the right of the pedestal birdbath is my 4' parabolic dish – wrapped in plastic and adopted for service as a frog pond in my Mother-in-Law's back garden in Burton-on-Trent… (didn't believe me did you?)

References

- EC10 MkI and EC10 MkII manuals downloaded from the EUG website
- RadCom, RSGB (Technical Topics by Pat Hawker)
- Radio Communications Handbook, RSGB, 4th Ed. 1968
- ARRL Handbook, ARRL, 49th Ed. 1972 (pp 342-345)
- Improving the Eddystone EC10 Receiver, JM Osborne, Short Wave Magazine, August 1973 (a comparatively feeble attempt I would say…)

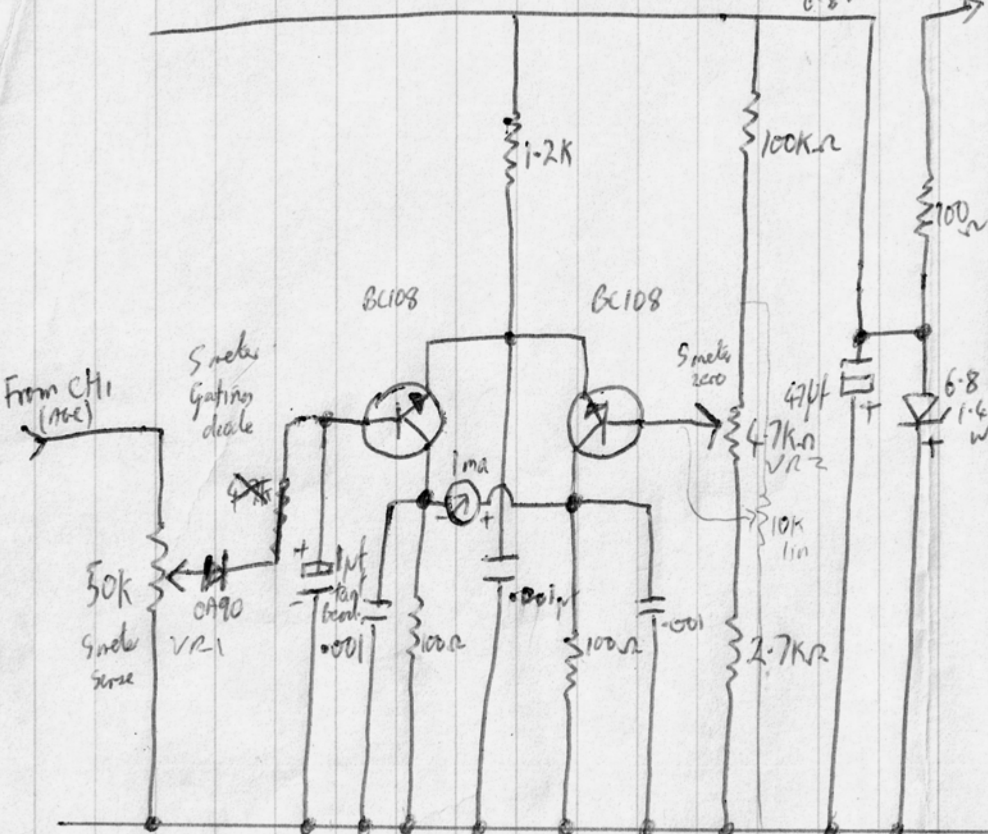
	Unmodified EC10	Modified EC10
Transistors	10	22
Diodes	3	18
FETs	0	1
ICs	0	1

Table comparing semiconductor complement of the original and my much-modified EC10 MkI

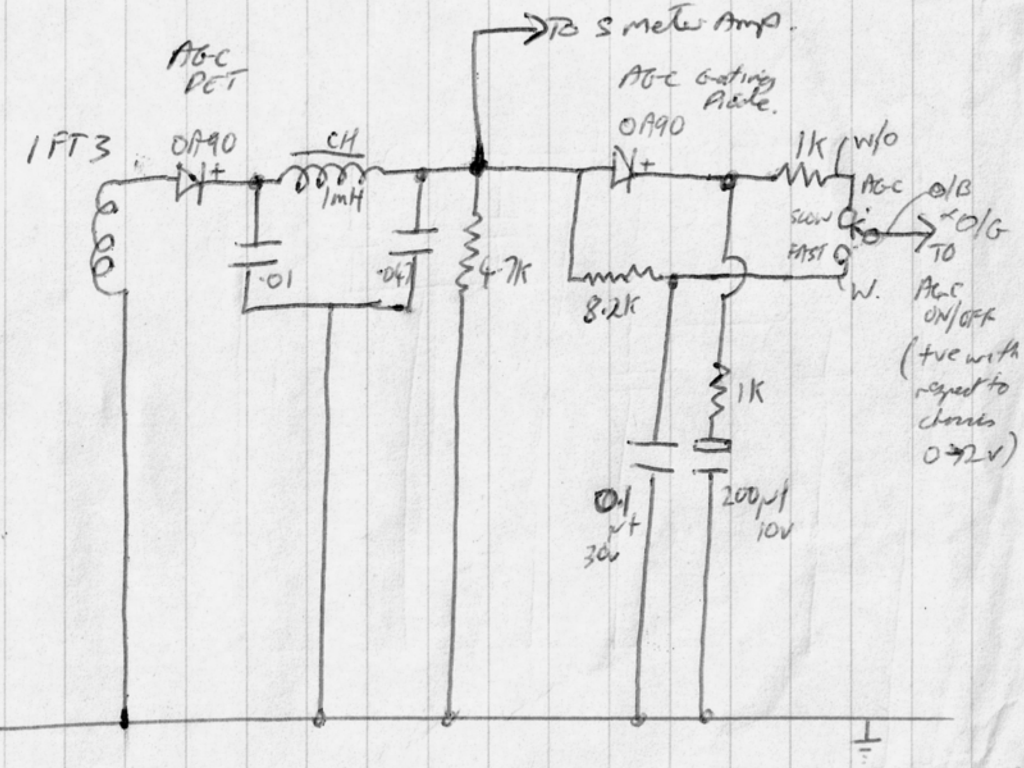
And finally…

Me standing outside what used to be Mison's radio shop in Citadel Row, Carlisle where I worked in the early/mid-1970's – happy days (photo taken on July 19, 2010). I can recall staring into the window at the (totally unaffordable) wonders of the transistor age – radios, tape-recorders, HiFi, accessories. One day, bold as brass, I walked in and asked Miriam for a Saturday job and I was asked by Mr McKinley, the owner, when I could start! Of course, I would have worked there for free but he offered me two quid a day so I took it…

EC10 Modified S-Meter Amp.

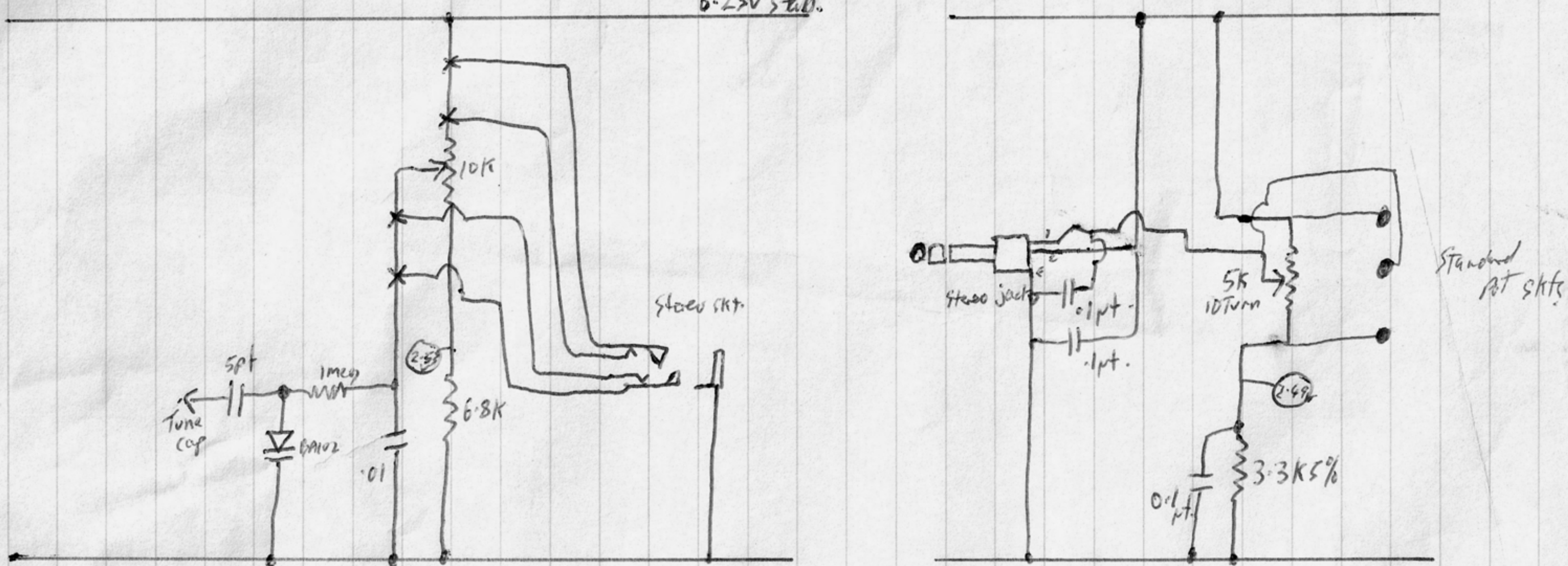


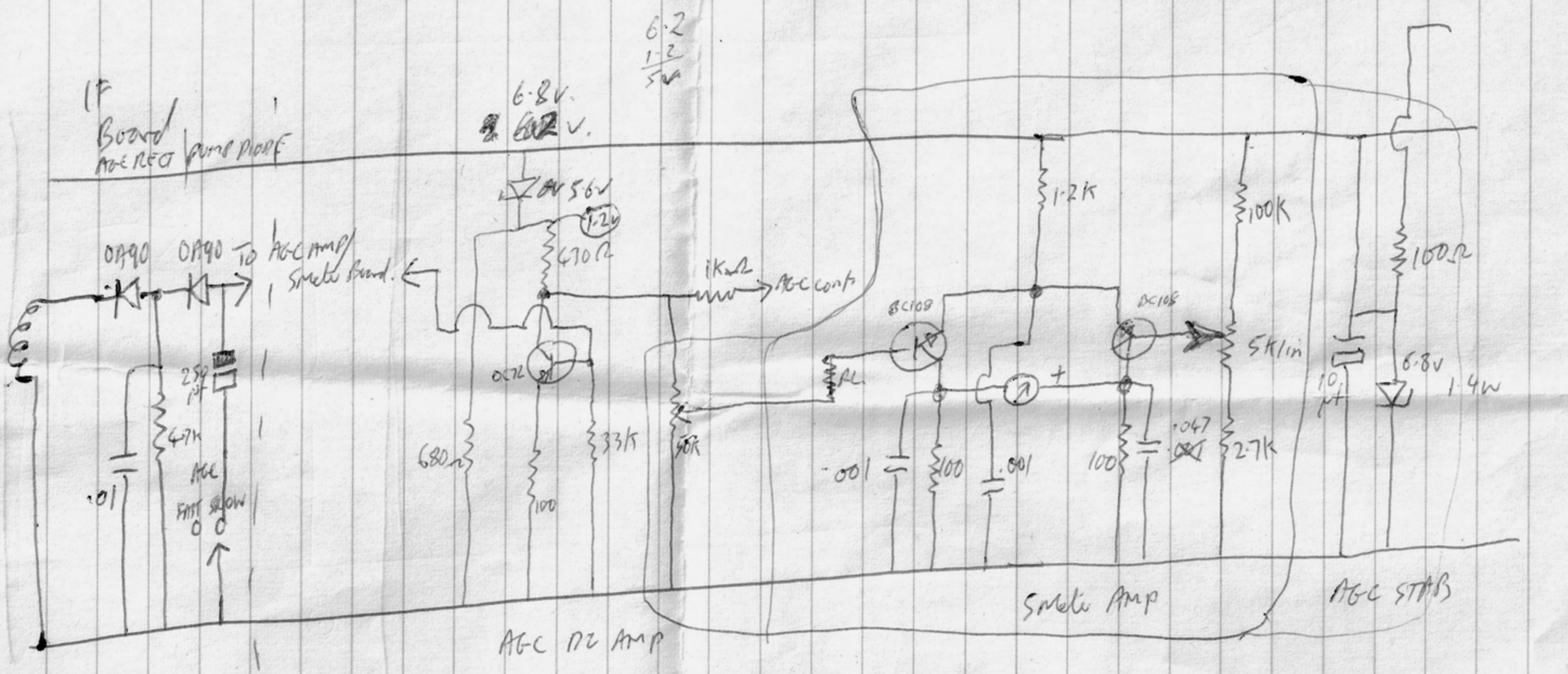
EC10. Modified AGC circuit



EXTERNAL FINE TUNE / ~~TEMP~~ UNIT (+ EC10 mods)

EC10.





Remove
existing
OA90; choke,
little caps (check 0·01)
& load resistor (4·7K).
install above circuit

change polarity
existing diode ← or
... RF choke.
install new diode
250μF cap into
fast/slow circuit & disconnect existing fast slow switching.

(1) Change R23 for 1KΩ

(2) Disconnect R20

(3) Change R21 to 18K Ω

(4) change R2 to 3.9KΩ

(5) Disconnect RF Gain control.
– replace with 5K log with switch – wire as overleaf.

(6) Replace TR1 with BF 180

(6) Short out R4 & R5.

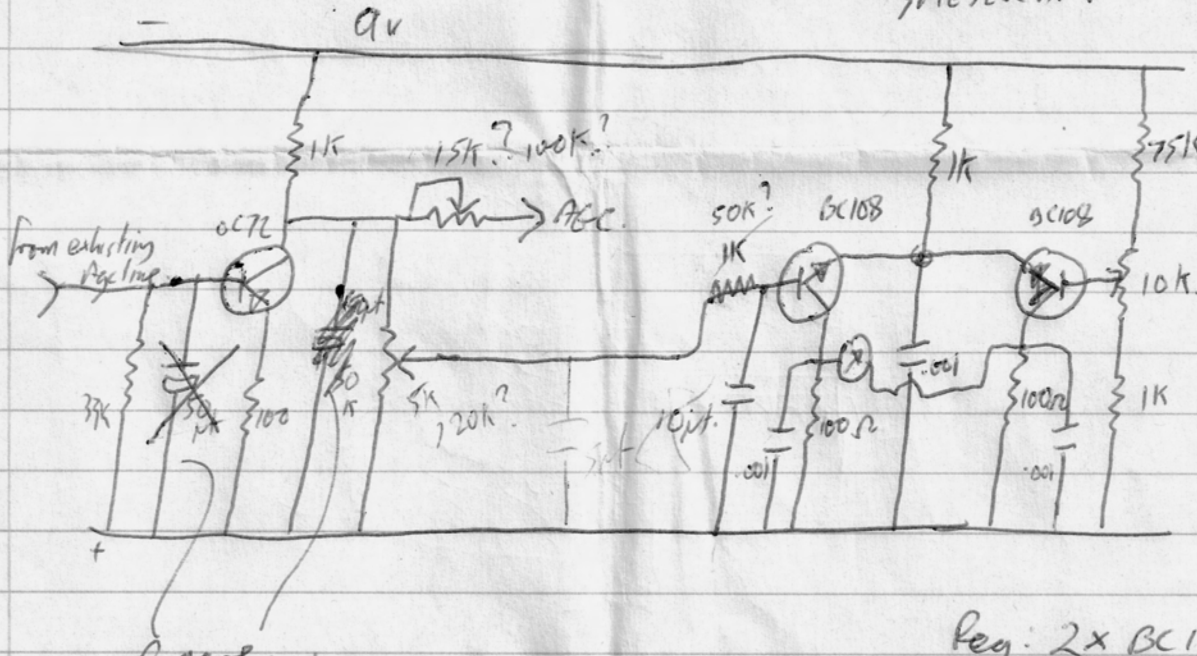
IOM

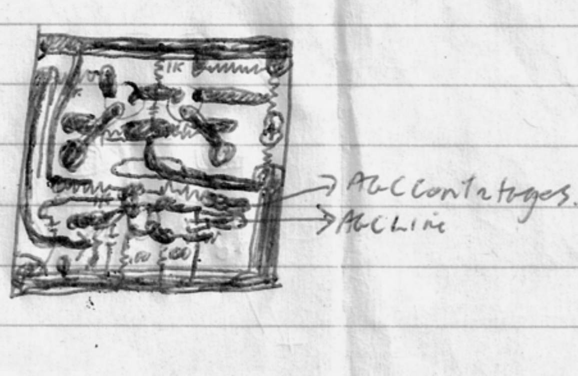
500Kcs unit freq

5·0 Megs. osc freq = 5.5 Megs.
5·1 Megs osc freq = 5.6 Megs.

AGC DC AMP.

S METER AMP

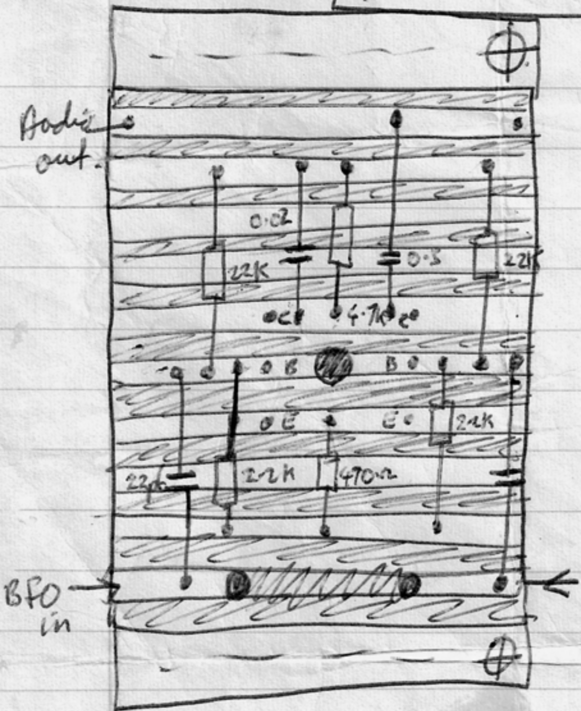




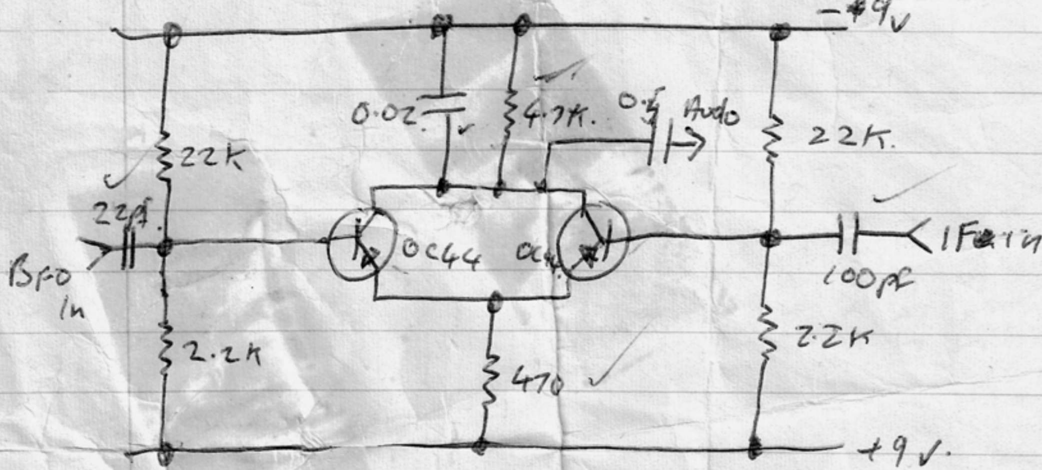
Req: 2 × BC109
1 × OC72
1 × 33k
3 × 100Ω
3 × 1KΩ
1 × 75KΩ
1 × 47KΩ
1 × 50K lin var
1 × 25K lin var
1 × 10K lin var.
3 × 1000pF.

Product Detector

for EC10.

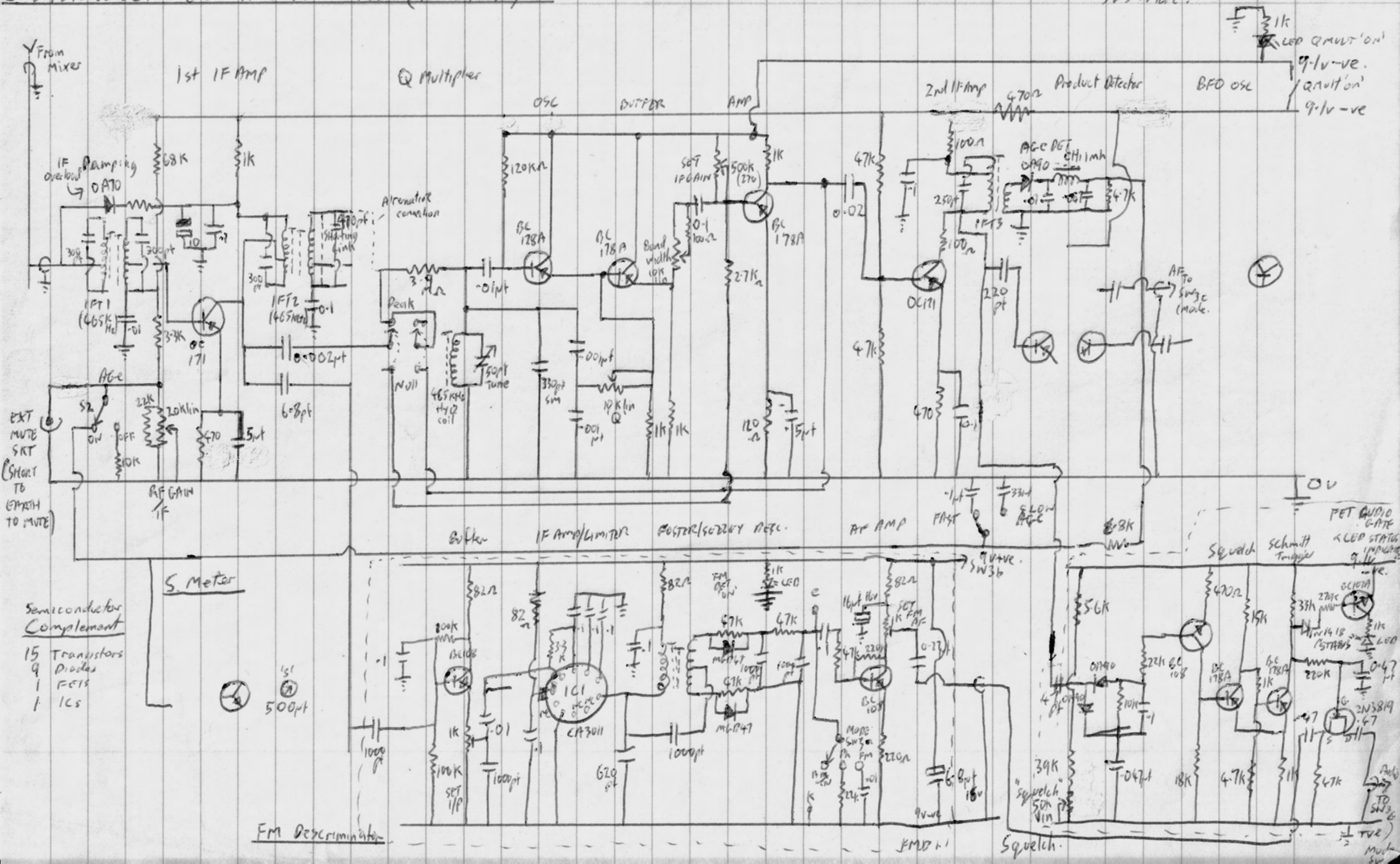


Layout -



circuit.

EDDYSTONE EC10. G8GUH CUSTOM 1979 (IF STRIP)



BURNS

BURNS ELECTRONICS

FMD-1 INSTRUCTION MANUAL

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F. M. DETECTOR MODULE FMD-1

General Description

The FMD-1 is a solid state printed circuit F.M. Detector Module to add on to an existing communications receiver or to be incorporated into a new design. The circuit comprises an Integrated Circuit I.F. Amplifier/Limiter, a modified Foster-Seeley detector and an audio amplifier with provision for a flat or de-emphasised audio frequency response. An emitter follower precedes the integrated circuit to provide a high input impedance and therefore reduce the loading on the receiver I.F. amplifier.

The module requires a DC supply of 6 - 9 volts maximum at about 15m/A. Provision is made for adjusting the input I.F. level for limiting and the A.F. output level.

Specification

Mode	Narrow band frequency modulation.
Sensitivity	300 uV I.F. input level to commence limiting.
A.F. Output	100mV minimum for 5 KHz peak deviation at 1 KHz.
A.F. Response	Flat or de-emphasised at 6dB/Octave from 3 Hz to 3 KHz.
Supply	6 - 9 volts DC. DO NOT EXCEED 10V
Construction	Fibre glass printed circuit board with component designations on reverse side. Supplied with four tapped mounting pillars (6 BA x ½").

Kit Preparation and Assembly

For maximum convenience and best results the constructor is recommended to follow the order of assembly set out below.

1. Separate components into groups of resistors, capacitors, etc.
2. To fit tapered connecting pins, insert each pin, tapered end first, into the copper side of holes labelled A - J (note that the letter 'I' is not used) and while supporting the P.C. Board, gently tap each pin with a SMALL hammer until approximately one sixteenth of an inch is left projecting above each copper pad. Solder the pin and copper pad using the minimum amount of solder and applied heat.
3. Certain of the components must have their leads carefully bent to a predetermined spacing as follows:-
   Cut a piece of wood or plastic, of greater than 1/8" thickness, to a width of 0.4" (4/10) for use as a bending block. Place the resistors and diodes one at a time across the block and bend the wires down parallel to each other.
4. Similarly, bend the electrolytic capacitor C 17 leads to a spacing of 0.6". All of the components will now fit the allocated spaces on the P.C.Board.
5. Fit resistors R1 to R16 excluding R4 and R13 into their respective positions. This is achieved by threading each component lead through from the white lettered side of the P.C. Board and pushing the component body down gently onto the Board surface. Do not use excessive force or damage will result. The component may be retained in position temporarily be slightly spreading the wires on the copper side of the board. Solder each wire to its surrounding copper pad using the minimum of heat and solder and cut off each wire flush with the solder.

6. Insert R4 and hold in position while soldering its three leads.
7. Repeat with R13
8. Insert capacitors C1 to C21, solder and cut each wire as with the resistors. The positive end of C17 must match the '+' sign on the P.C. Board.
9. Insert transistor TR1 (MST2009) with its three leads matching the triangular formation inside the circle labelled TR1 on the P.C.Board, leaving approximately ½" spacing between transistor body and the P.C. Board. Solder and cut off excess wire. Note that the MST2009 may not have a projecting tab as is indicated on the P.C. Board marking. Similarly add transistor TR2 - BC107 (8)
10. Insert integrated circuit IC1 (CA3011) making sure that the projecting tab matches that on the P.C. Board marking, no leads cross over and there is approximately ½" spacing between IC1 body and P.C. Board. Solder and cut off excess wire.
11. Insert link LK2 using 22 swg tinned copper wire, solder and cut off excess wire.
12. Insert diodes D1 and D2, matching red band on diode to the white band on the P.C. Board, solder and cut off excess wire.
13. Insert Transformer T1 with the coloured spot nearest to the 'SPOT' marking and hold in place while soldering the six connecting leads and two mounting wires.
14. Examine all soldered joints and if satisfactory, clean copper side of P.C. Board using a stiff bristle brush and carbon tetrachloride (or high grade paint thinners). DO NOT SMOKE IN THE PRESENCE OF ANY FUMES OF THE CLEANING FLUID. Also do not allow any thinners to splash onto C20 or C21.
15. Dry board completely.
15. Screw on four tapped pillars.

The Board is now ready for testing.

Test Procedure

With test meter positive lead on pin K measure the following resistance:-

Pin K to Pin J	Resistance - 1 Kohms to 10 Kohms
Pin K to Pin A	Resistance - greater than 100 Kohms
Pin K to Pin H	Resistance - greater than 1 Meg.

Mount the FMD-1 in the receiver making sure that it is not in close proximity to the RF, Mixer or early I.F. stages. Refer to interconnecting drawing A1069 for wiring instructions. If the interconnecting wires are more than 1 - 2 inches in length, it may be necessary to use screened cable. A length of screened cable is supplied for this purpose.

For negative earth systems OR where the FMD-1 DC supply is separate to that of the main receiver, wire in link LK1. When the FMD-1 is to be used with a common supply positive earth system link LK1 must not be connected and decoupling capacitors must be inserted in series with wires to Pin G and Pin B as shown on interconnecting diagram. After wiring to main receiver is complete, test as follows:-

1. Select AM on Switch S1 and receiver 'wide' bandwidth
2. Adjust set I.F. I/P and set AF O/P on FMD-1 to mid-travel
3. Switch on receiver (and FMD-1 supply if separate)
4. Tune in a strong, steady carrier to centre of receiver passband
5. Select FM (Flat)
6. Connect test meter, set to 50UA, to Pins C (−) and K (+). Reverse connections if necessary to get a positive reading.
7. GENTLY adjust the dust core nearest the colour spot for maximum reading, increasing the meter range if necessary.

NOTE If too much force is used the core will break and possibly damage the transformer.

8. Adjust the dust core furthest from the colour spot for zero reading on the meter.
9. Tune in a frequency modulated signal and if necessary slightly adjust either or both cores for maximum undistorted audio output.
10. Balance AF output of Receiver on FM to that on AM using set AF O/P on P.C. Board. In some receivers it may be necessary to reduce the output of the AM Detector with an attenuator or pre-set potentiometer to that of the FMD-1.
11. Set noise output with no signal for convenient level with receiver RF gain at normal setting.
12. Retune circuit in receiver to which 2C3 (33pF) is connected for maximum AM/CW output.

If a local frequency modulated signal is available, set it to 5KHz peak deviation, set the frequency to the centre of the I.F. passband of the receiver and adjust both cores of T1 an FMD-1 for maximum AF output. Both cores have been treated with an anti-vibration compound.

Notes The de-emphasised AF response position of S1 is to counteract the pre-emphasised noise output of the discriminator which is a normal by-product of any F.M. Detector. However, this position also requires a pre-limiter pre-emphasised response at the transmitter in order to achieve an overall flat audio response. As some transmitters may not have this facility it is recommended that the constructor/user selects the response position of S1 which sounds best on each occasion of use.

GUARANTEE - KIT

Burns Electronics hereby undertake to replace free of charge any component or part which fails in the first 90 days from purchase PROVIDING there is no evidence of misuse. Replacement parts will be issued on receipt of original damaged parts.

GUARANTEE OF UNIT SUPPLIED TESTED

Burns Electronics hereby guarantee to replace free of charge any component or part which fails in the first year from date of purchase PROVIDING there is no evidence of misuse. The unit must be returned for repair to Burns Electronics.

NOTE: In both guarantees Burns Electronics' total liability is expressly limited to the value of the replaced part/component and cannot be held liable for consequential claims.

TOOLS REQUIRED

1. Soldering iron - 25 watts or less
2. Screw driver (6BA)
3. Miniature Side Cutters
4. 60/40 solder with flux core
5. Trimming tool to fit transformer cores (DO NOT USE A SCREWDRIVER)
6. Pin Hammer
7. STIFF brush
8. Bottle of Carbon Tetrachloride or high grade cellulose thinners.

COMPONENTS LIST

Ref	Value	Colour Code
R1	100K	Brown-black-yellow
R2	100K	" " "
R3	82 ohms	grey-red-black
R4	1K preset	white-white
R5	82 ohms	grey-red-black
R6	3.3K	orange-orange-red
R7	82 ohms	grey-red-black
R8	47K	yellow-violet-orange
R9	47K	" " "
R10	47K	" " "
R11	47K	" " "
R12	220K	red-red-yellow
R13	1K preset	white-white
R14	82 ohms	grey-red-black
R15	220 ohms	red-red-brown
R16	22K	red-red-orange

D1	MGD 47 or 0A90	
D2	MGD 47 or 0A90	
TR1	MST2009	
TR2	BC107 or BC108	
IC1	CA3011	
T1	Discriminator transformer	

Interconnecting Diagram

2C1	6.4 uF	Electrolytic
2C2	0.1 uF	Polyester
2C3	33 pF	Disc Ceramic

Ref	Value	
C1	1000 pF	Disc Ceramic
C2	0.01 uF	Disc Ceramic
C3	0.1 uF	Polyester
C4	1000 pF	Disc Ceramic
C5	0.01 uF	Disc Ceramic
C6	0.1 uF	Polyester
C7	0.1 uF	Polyester
C8	0.1 uF	Polyester
C9	0.1 uF	Polyester
C10	0.1 uF	Polyester
C11	1000 pF	Disc Ceramic
C12	1000 pF	Disc Ceramic
C13	1000 pF	Disc Ceramic
C14	0.01 uF	Polyester
C15	0.1 uF	Polyester
C16	0.1 uF	Polyester
C17	16 uF	Electrolytic
C18	0.22 uF	Polyester
C19	0.01 uF	Disc Ceramic

Printed Circuit Board
10 tapered pins
3" 22 swg tinned copper wire
4 6BA x ½" pillars

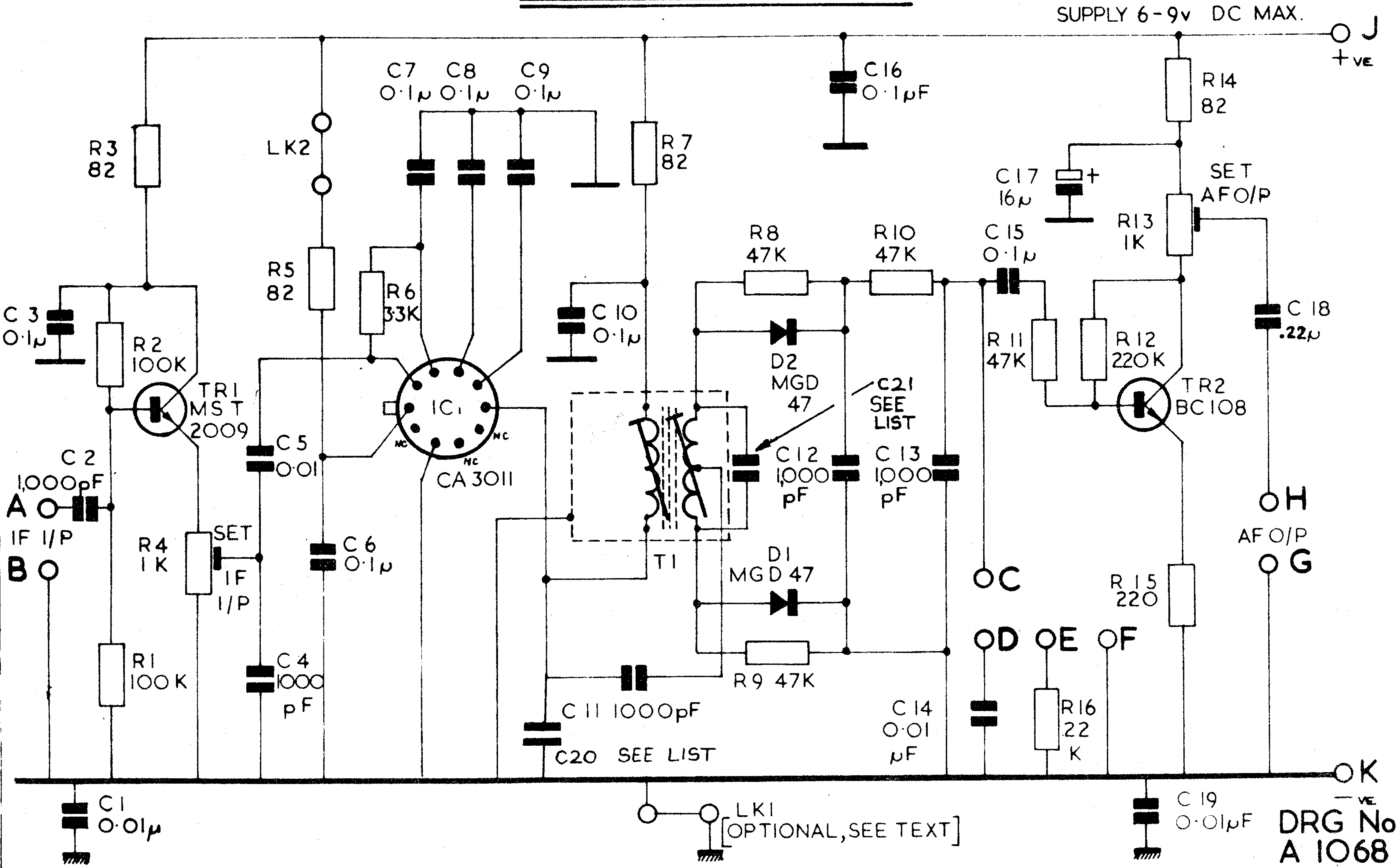
8 6BA x ¼" bolts
2ft screened cable

C20/21 supplied as follows:

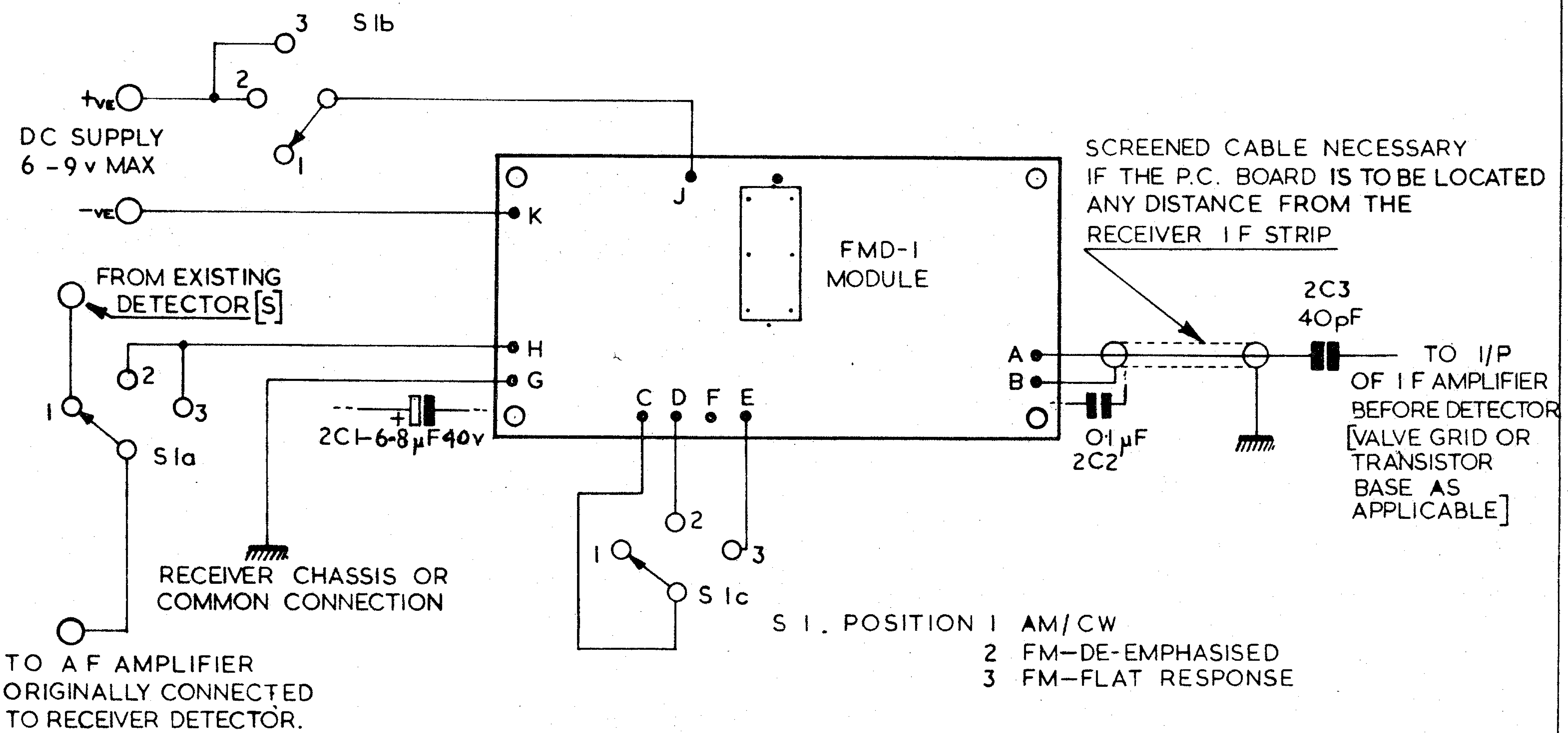
I.F.	C20/21
380KHz	680 pF
450 KHz	620 pF
500KHz	470 pF
580/600 KHz	330 pF
715	220 pF
800	150 pF
915	150 pF
1MHz	100 pF
1.6MHz *	220pF

(* Special transformer must be ordered for this frequency. Please enquire for extra charges)

FM DETECTOR FMD 1



INTERCONNECTING DIAGRAM FMD-I



S I. POSITION 1 AM/CW
2 FM—DE-EMPHASISED
3 FM—FLAT RESPONSE

FIT 2C1 & 2C2 IN SERIES WITH WIRES TO PINS G & B RESPECTIVELY ONLY WHEN USING A POSITIVE EARTH MAIN RECEIVER SUPPLY TO FEED THE FMD-1

NOTES:-

1. PINS G & K ARE INTERNALLY CONNECTED ON P C BOARD.
2. IF CABLES CONNECTED TO S Ia-c ARE MORE THAN 2" LONG SCREENED CABLE MAY BE NECESSARY. PIN F MAY BE USED TO RETURN C, D & E SCREENS TO FMD-1 GROUND PLANE.

DRG No A 1069