Restoring an 830/4 – by Gerry O'Hara, G8GUH

I had no real intention of buying anything 'big' as I sauntered into the community hall one Saturday morning back in February, where the Burnaby Amateur Radio Club (http://www.ve7bar.org/) was hosting a 'swap meet' (flea market). I knew that SPARC (the Society for the Preservation of Antique Radio in Canada, based in Coquitlam, BC, Canada (http://www3.telus.net/radiomuseum/) had a stall there, so I thought I might buy something from them to 'support the cause' and take a look at what else there was on offer.

Epiphany!

The flea market was quite well attended and a line had formed at the entrance by the time I arrived. I did my usual 'quick-reccy' on entering – zooming around the entire place in around 10 minutes taking in what was on offer and then going back to where any interesting 'goodies' were located: several nice old valve radios on offer (including Halicrafters sets from the 1930's through 1950's), a couple of 1920's domestic sets, amateur rigs, antennas, book/journals, various bits of other electronic kit and the usual paraphanalia of cables, connectors, components and the like. I noticed a couple of Eddystones on the SPARC tables and they brought back a dim memory of an EC10 I had in my youth. I took a second look: there was an S770R and an 830/4. I recognized the S770R immediately as my girlfriends dad, Gordon (G3MNL), used to own one back in the 1970's, using it to receive AM and FM on 2-Metres. The 830/4 was more unfamiliar to me, but I recalled admiring the professional Eddystone HF receivers in my youth – of course ownership of one of these sets was out of the question in those days for me – as was the EA12 'flagship' amateur bands set. Then things started to click – I recalled discussing double-conversion sets with Gordon and how this technology (almost) eliminated images and could be used to 'bandspread' by making both oscillator stages tunable – he had used the EA12 and 830's as examples in these discussions (they share several features) – I believe he was familiar with the 830/2, 830/7 and 830/9 in particular (he serviced sets for the 'Ministry'), which were still pretty red-hot sets in the ealry 1970's – they sounded fantastic to me then (Gordon also regalled me with tales of Racal RA 17's and other exotic thermionic temples….). I had no clue what the 830/4 varient was, but on close inspection I noticed that the AM broadcast band was replaced by an extra LF band in its 9 tuning

The 830/4 on arrival at the G8GUH shack

scales….hmmmm. I asked what the sets were selling for? – turned out to be very reasonable prices – and if they worked? – yes, the 830/4 had been operating the previous evening and was noted to be 'quite lively' – though there was a caveat that 'a few of the controls might need a bit of a clean'. I pondered for a few minutes and decided to take the plunge – my first Eddystone purchase since 1972! - I staggered out with the 830/4 under my arm, bundled with a non-matching Hammarlund speaker (in very good nick) – suddenly I remembered what a boatanchor was…. I was also tempted by the S770R, but thought I would be pushing it a bit with my XYL, so decided to call it a day. Boy, oh, boy, I was the proud owner of a dream receiver of my youth – albeit 34 years later (and I now had arms three inches longer to boot!).

Yes, I had seen the light again after all those years.

Basic Preparation and Safety Checks

- On arriving at my QTH, I proudly showed off my new purchased to my XYL – somehow she could not see the beauty in the 'drab grey metal box with knobs on' that I was holding – she was ok with my restored wood-cased domestic sets as they have some aesthetic value even to the lay-person, but the 830/4 was just too utilitarian I guess.
- Unperturbed, I decided to retire to my workshop and take a closer look at the 830/4.
- Although I had been told that the set was in working condition – from a reliable source (with caveats as noted above), however, I thought I would play safe anyway and carry out my usual safety checks and 'soft start' that I do for all of my restoration and repair projects.
- I removed the case and was pleasantly surprised at how clean the chassis and components were – however, there were some signs of prolonged high temperatures in the psu compartment and a dropper resistor feeding one of the stabilizer valves (R95) had been replaced by two 10w ceramic resistors in parallel (see photo on next page), but no signs of any 'mods' except the installation of two

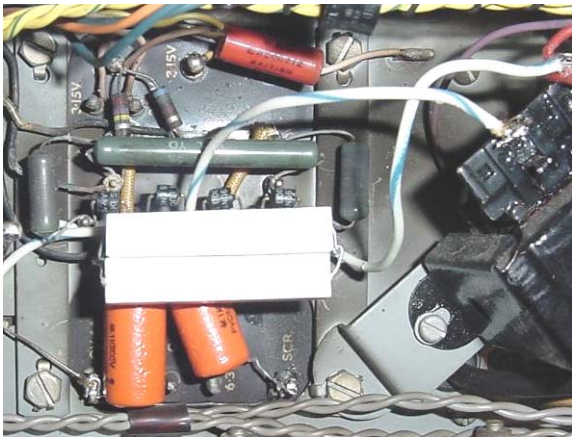
Replacement Mains Connector

I do not like using older electrical connections if they are the least suspect (eg. frayed or perished insulation). The 830/4 sported a 'hard-wired' mains cable tacked into the back of the original fitment chassis-mounted 'kettle plug'. Although functional, from a safety point of view I do not believe this arrangement is acceptable, as the exposed 'kettle plug' pins are live when the set is plugged in.

As in the case of my S770R, a modern connector (male socket) was fitted into the set directly behind the chassis cut-out for the older ('kettle') connector.

Simply unsolder and remove the old connector and fit the replacement with a 4BA nut and bolt at the bottom and similar at the top, the latter with a large washer or plate cut to cover the small gap. Solder in the new male socket and that's it. You will find that the female connector (plug) fitted to the mains lead will fit snugly through the chassis cut-out and mate with the chassis connector.

suppressor caps in the mains transformer secondary (as per 830/7 circuitry). These were high-quality 1600vw 'orange drop' types: a good start I thought…
- I do not like taking any chances with safety, so I decided to remove the chassis part of the 'kettle plug' and install of a 'modern' standard mains power connector (as found on modern rigs and computer psu's, sometimes called a 'euro' connector – see sidebar). This can be done with no butchering of the chassis and works very well – it can also be reversed in the future quite easily. I also installed an in-line fuseholder into the mains transformer centre-tap as an extra protection for the power transformer. I also re-wired the mains transformer primary for 120v instead of the 110v it was set at on arrival (our mains is ~117v).
- Checked the general electrical safety of the remainder of the psu unit and the power transformer for continuity and insulation – this seemed ok but I suspected some heat damage in the vicinity of the HT rectifiers – the stand-off posts were chipped and looked very brittle, though no obvious immediate safety hazards.



- I decided that it was time to see if the set worked as described…
- I applied power to the set, slowly increasing to 117v through a variac over 30 minutes, monitoring HT current draw and voltage. All seemed in order – no excessive current draw that would indicate leaking or shorted filter caps in the psu or other serious component failure. There was the expected 'kick' in current-draw at around 155v HT as the two stabilizer valves entered service, then sound could be heard - looking good – finally up to full HT (~ 250v). I tried tuning across the bands – not too bad – something heard on most of them. I loosely-coupled my RF signal generator to the aerial socket, and the calibration was found to be ok on all bands (not perfect, but ok) – the 830/4 has an internal 100kHz calibration marker and a mechanical adjuster on the scale pointer to compensate for some degree of tracking error, plus a 'Peak RF' control (compensates for minor mis-tracking when the 2nd oscillator is tuned across its range).
- I did notice a few issues on this preliminary check though, including:
    - There was still audio output present when the AF gain was fully turned down,
    - The 'incremental' tuning control (2nd local oscillator) caused the set to crackle when turned, accompanied by small jumps in frequency,
    - The 'Peak RF' control was intermittent in operation,
    - The variable selectivity control was 'rough' in operation ('grating' feel),
    - The main tuning control was stiff and did not spin freely – almost sensuously - as 'good' Eddystones should…,
    - There was a noticeable hum with the noise limiter in circuit (controlled by the AF gain) and some faint hum present all the time,
    - The concentric RF and IF gain controls were noisy when turned,
    - A hissing and crackling noise (not controlled by the AF gain control); and
    - The S-Meter could not be zeroed.

Electronic Testing and Repairs

- I removed all valves, wiped them clean and cleaned up their pins with crocus paper and 'De-Oxit'.
- Cleaned up the valve sockets using 'De-Oxit'.
- I decided to tackle the noted faults as listed above.
- First the S-meter problem. This was traced to an out-of tolerance resistor in the bridge circuit (R34) – replaced this and the meter worked ok. That was too easy!
- Charged up with this early success, next up was that annoying inability to turn the audio fully down – it seemed like a straightforward issue to sort out. My first suspect was the cathode by-pass electrolytics (C114/115). Sure-enough, they were both open circuit and showed very low capacitance values. I replaced them both and also the cathode by-pass cap in the output stage for good measure:

Replacement cathode by-pass caps and a few replacement resistors in the audio and IF cathode-follower stages

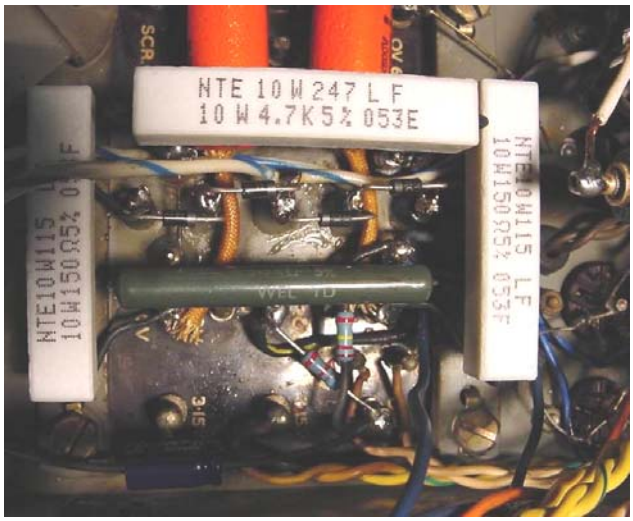
much better, and it helped reduce the hum problem also, but there was still some audio present with the AF gain fully down. I checked the operation of the AF gain pot and whether it was grounded well – it was ok. The voltages around the 6AT6 dual-diode-triode valve were then re-checked. The anode voltage was slightly low. I decided to check all the passive components in that stage. The anode load resistor (R48) was found to be out of tolerance (high) and was replaced. No change in the audio problem, but the hiss and crackling noises stopped – that was something anyway. R50 was also out of tolerance (high) and was replaced. No other components were found to be out of tolerance. The remaining suspect was the 6AT6 itself or its socket. I checked the socket very closely and it appeared ok – no tracking marks etc. I then suspected that the 'gobs' of 100kHz IF 'floating about' in the vicinity of the 6AT6 wiring was resulting in leakage and rectification in its triode circuitry or even the output stage (my scope indicated over a volt of IF on the output stage grid!) – I tried additional screening and decoupling etc – not much improvement. I then tried replacing the 6AT6 – no change. By this time I was becoming extremely frustrated…. My final conclusion was that the 'fault' was actually caused by internal capacitance within the 6AT6 – a deficiency in the actual valve design. This suspicion was later confirmed by Graeme (G3GGL), who noted that 'all 830's do this – it is normal', and by comments in several articles in the EUG Newsletters/

Lighthouse. I reckon I 'wasted' a full day on this issue. Still annoyed at not being able to fully mute the set using the AF gain control alone, I resorted to installing an additional (220muf) cathode decoupling cap on the 6AT6 and an IF decoupler (4700 puff) on the grid of the output stage (slight change in audio tone, but acceptable). This resulted in almost complete silence when the AF gain was fully off (these 'mods' can be reversed in seconds).

2nd Local Oscillator

- Next, I cleaned the IF/RF gain pots using De-Oxit – much better in just 30 seconds.
- The crackling/jumping incremental tuning was tackled next. I removed the cover on the 2nd local oscillator and closely checked the tuning capacitor, drive mechanism and mechanical linkages. I could not see any obvious reason for the crackling and frequency jumps. Starting with possible mechanical causes and noting that the mechanism was dirty and could have poor/intermittent grounding, I cleaned the drive gears and linkages, spraying contact points with De-Oxit. It worked – the crackling vanished and no more frequency jumps were noticed.

- The 'rough' and 'gritty' feel on the variable selectivity control was then addressed. This system is all mechanical, so the fault lay with either the shaft bearings, SSB/CW detent plate or within the IF cans. The shaft bearings were cleaned by spraying with penetrating oil and wiping away any dirt residues that were flushed out. The bearings were then lubricated with light machine oil (<u>not</u> 3-in-One) and the detent plate cleaned and lubricated with lithium grease - a significant improvement was noted – though still not as smooth as I would like. However, I decided to leave any investigation inside the IF cans for another day: the system was controlling the selectivity well and the control 'feel' was reasonably ok.
- Now for the noise limiter hum. This was easy – the potential divider on one of the 150v stabilized lines used to apply a small positive bias to the heater centre-tap for the noise limiter valve was not working (R97/98): one of the resistors (R97) was way out of tolerance, reading several megs, resulting in no bias. I replaced both resistors and that cured that source of hum.
- Whilst in the psu area, I decided to investigate the apparent effects of

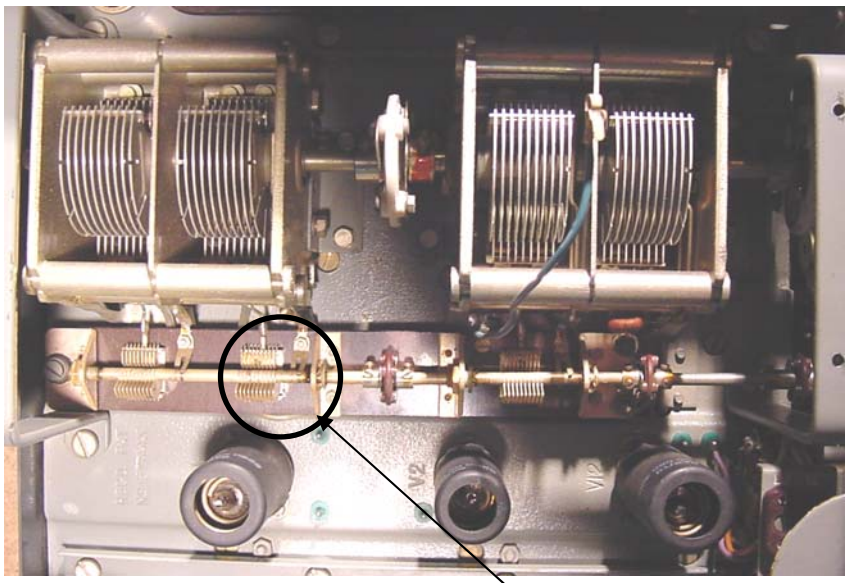


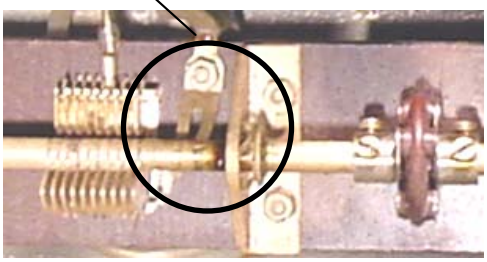
PSU after repairs

prolonged high temperatures. I noticed some cracks in the cases of the rectifier diodes and on some of the stand-off insulators they and the dropper/limiter resistors were mounted on. I touched one of the stand-offs and the insulation dropped off.. I also noticed that the 140 ohm (6w) surge-limiting resistors (R100/101) in the transformer secondary ran extremely hot and suspected that these were a significant contributory factor to the heat damage. I decided to repair the stand-off insulators as no suitable replacement could be found – an alternative would have been to completely re-configure the psu using tagstrip. I removed all the broken or cracked insulation material from the stand-off insulators, leaving the pins exposed. I then mixed a batch of epoxy putty and moulded this as new insulating material around the pins – not too pretty, but functional (see photo above). I also decided to replace all the rectifiers with 1N4007's (D2/3/4/5) and also the two limiting resistors with 150 ohm 10w ceramic types. I also noted that the replacement ceramic dropper (R95) that was already in the set (actually two resistors in parallel) was of the incorrect value, and I replaced this also and did some minor re-wiring (replacing some wires that had brittle and/or damaged insulation). Also, R99 (HT2 dropper) was marginally out of tolerance and was replaced.

- Checked psu operation – seemed fine, with all voltages within tolerance.

- The 'Peak RF' tuning cap was looked at next: I removed the tuning cap cover and looked carefully at the main tuning cap and the 'Peak RF' variable cap. The bearings looked dry and the contact surfaces were tarnished and dirty. I carefully cleaned the dirt off using Q-tips and De-Oxit and re-greased the ball-bearings. This cured the problem.





'Peak RF' variable cap rotor contacts

- Well, that was my 'shopping list' of obvious defects sorted out.

- The set was then configured for voltage checks as per the handbook. I found most were within tolerance, however, there were some discrepancies, including the output stage cathode, IF cathode follower anode, 1st IF cathode,1st mixer screen, RF amp cathode and grid 2. I ended up replacing another 8 out-of tolerance resistors associated with these stages (R56, R58, R47, R30, R31, R15, R5, R6). Some of the ones in the coil box are rather difficult to access… though surprisingly, the

two 100k resistors (R7/8) associated with the cascode RF stage were ok, and replacing R6 resulted in the correct grid 2 bias for the cascode stage.
- I checked a few of the various by-pass caps (especially the notorious 'red-Hunts') and, surprisingly, found them to be ok (see comments in postscript), so I did not replace them at this stage.
- To be honest, I did not notice much of an improvement in operation after replacing the resistors, even though all voltages were now within tolerance, except that the RF and IF gain controls now worked much better (replacing R30 made this improvement). As Graeme notes, these sets will 'soldier on' even with many faults or out of tolerance components present.
- I then checked HT current draw at ~158mA – well within tolerance.
- Finally I looked at the operation of the main tuning control. On close inspection, I observed that the friction drive pinch wheel was out of alignment with its mating drive plate. Simply loosening the tuning knob and flywheel and carefully re-aligning the components before re-tightening worked wonders – a single spin now easily covered a couple of inches of the slide rule dial – beautiful.
- Soak tested the set for 1 day – everything appeared good and with reasonable temperatures in the psu compartment (I used a small temperature probe inserted into the case with the set 'boxed up').

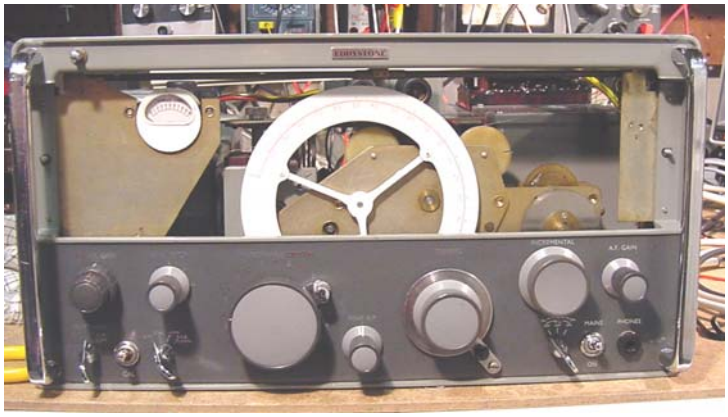
Preliminary Alignment Checks

- I checked the dial calibration accuracy using a signal generator, crystal calibrator (set to a standard frequency station) and a digital frequency meter. The calibration on all bands appeared close enough to use for general listening without adjustment, and sensitivity on my main bands of interest (1.5 MHz through 30 MHz) appeared ok, so I decided not to re-align the RF or IF sections – at least for now. Also, between them, the scale cursor adjustor, built-in 100kHz crystal calibrator and incremental tuning system allow very accurate and reproducible scale settings to be made – within 1kHz – excellent for an analogue valve receiver with free-running oscillators.

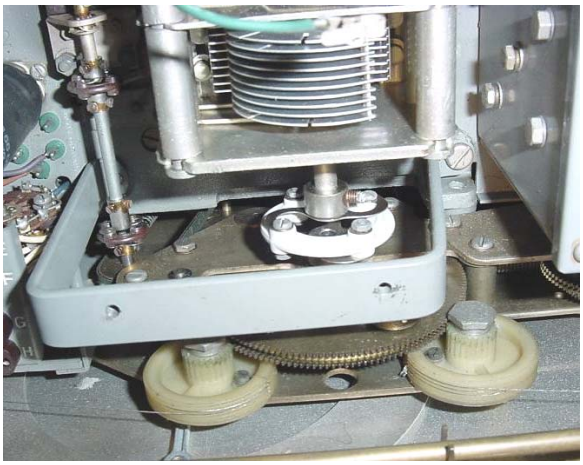
Cosmetic Touches

- I vacuum-cleaned the chassis and case, using a small paintbrush to penetrate nooks and crannies. I wiped the case and front panel with cotton wool wipes and warm soapy water, and wiped the chassis with alcohol (using Q-tips and cloths) to remove grime.
- Removed the knobs: some of the grub screws were a bit tight, especially in the tuning and band selector knobs. I noticed that there were slight cracks in some of the knobs (on the side and quite inconspicuous) – it appeared as though the plastic had shrunk slightly over the years and had split – not serious (I think) and you cannot see this unless you look really close. I note that this phenomenon has been reported several times in the EUG Newsletter/Lighthouse. If it develops further I will consider filling the cracks with either epoxy putty or Plas-T-Pair (http://www.rawnamerica.com/products.php) or similar product (the latter is obtainable from AES at http://www.tubesandmore.com).

- Having removed the knobs, I removed the front panel. To do this, simply remove the four bolts retaining the handles then loosen the switch bezel and phones socket nuts. I then cleaned the dial glass with alcohol and then lens-cleaner.



- Removed the scale plate and vernier scale. I cleaned these gently using warm soapy water and cotton wool pads. The vernier scale was slightly warped and this was 'encouraged' gently back into shape.
- Cleaned the drive train gears with alcohol and more Q-tips. Applied light machine oil (not '3-in-One') to the various metal bearings (very sparingly), avoiding plastic pulleys and the metal dial cord. Cleaned the plastic pulleys and gears. Applied a light coating of silicone grease to the plastic gears and pulley bearings.



- Removed the rack mount flanges and stored these away. This leaves machined 'slots' exposed on either side of the set once it is 'boxed up', however, this looks acceptable (see photos of the boxed-up set later) and is better than the sharp edges of the rack mounts when the set is bench mounted.
- The case was quite badly scratched and scuffed, so I decided that a fresh powder coat was the only real solution – cost $30 cash as a 'moonlight' at a local powder coat shop (not quite perfect, but much better than before).
- The front panel had a number of minor scuffs on the edges – I decided to touch these up using a colour-match made by mixing some model (enamel) paints. Again, not perfect, but quite acceptable until I decide to dismantle the set again and have it powder coated.
- Cleaned the finger plate with alcohol and polished it with silicone polish.
- Cleaned the knobs (with alcohol) and polished them using "Armor-All' (plastic polish for car interiors). Re-installed knobs and fabricated a new knurled nut for the main tuning knob locking mechanism.

That's it for now – the set looks and performs much better than when purchased and it feels really good to operate. I will be re-visiting the set for alignment checks in the not-too-distant future. In the meantime, lets get spinning that dial and listening….

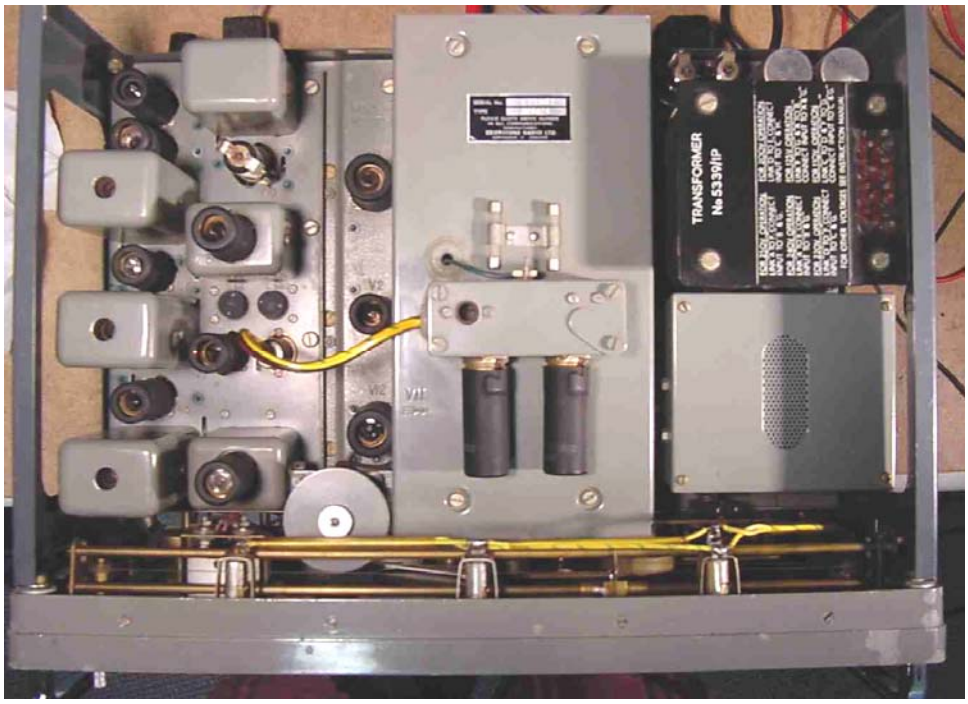
73's

Gerry O'Hara, G8GUH (gerryohara@telus.net), Vancouver, BC, Canada, July, 2006

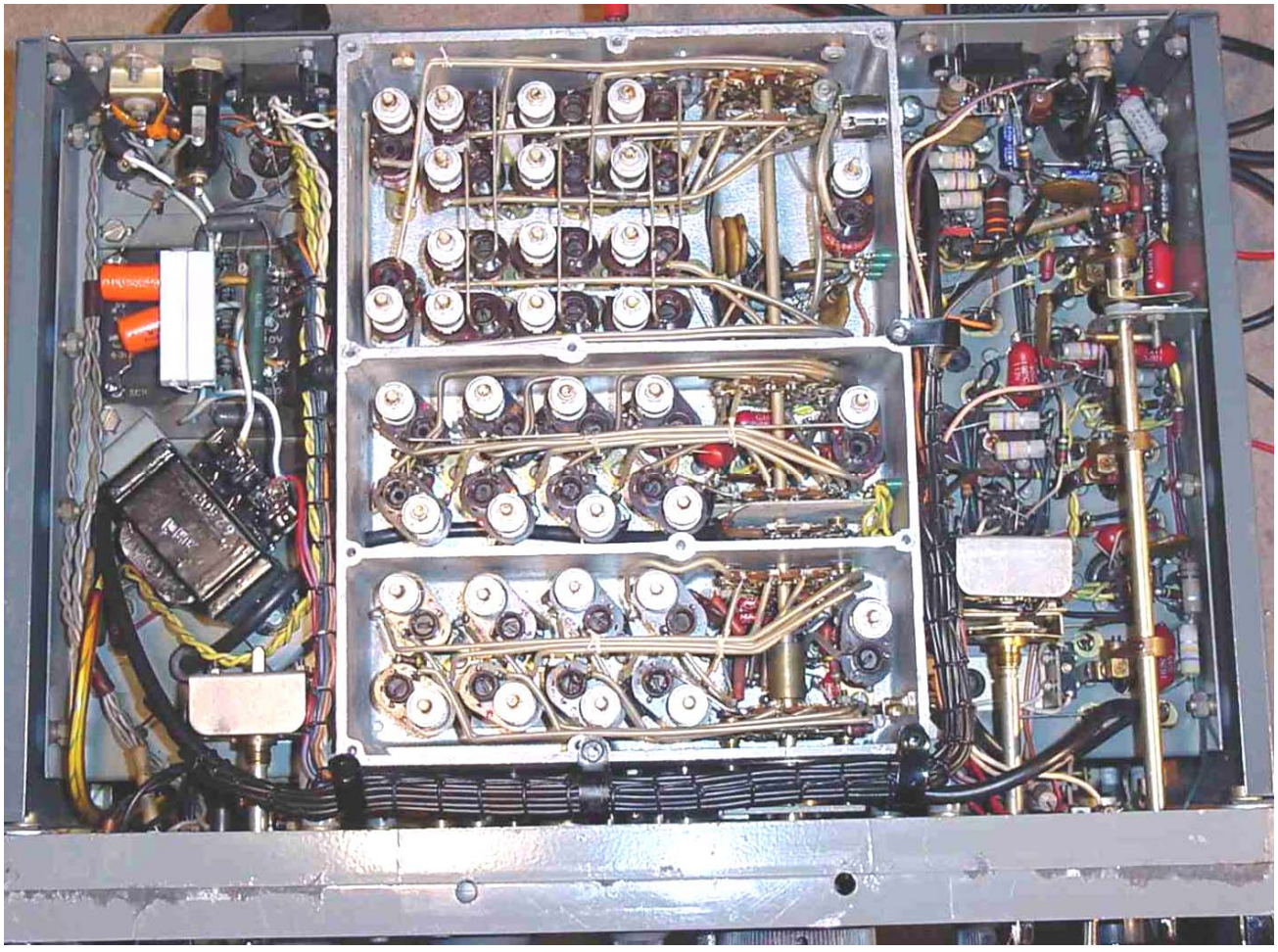
Postscript

The 830/4 has been in use almost every day since March and continues to generally perform very well. However, I have noticed that its performance on the lowest three bands is not particularly good (lower sensitivity than other bands) and a few 'birdies' are present on the upper two bands when the RF and IF gain controls are fully on. I suspect that the latter problem may result from below-spec decoupling caps (likely the infamous red-Hunts variety, though a selection of these tested during the restoration work appeared ok both in terms of leakage and on measured capacitance – however, these may be leaky or lower capacitance under working voltage conditions). The relatively low sensitivity on the lower frequency bands could be related to this issue, but I suspect this may be a bit more problematic and will need some further investigation – even though I am not that interested in listening on these frequencies, I am interested in having a fully-functional example of an 830! Any suggestions would be welcome.

Starting too look good… (but see after the 'Post-Postscript below!)…



Above-chassis view – this is one solid receiver!



Below-chassis view with coil box cover removed – after AF section repairs and before the psu work

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References

From EUG Newsletter/Lighthouse 'Super Index'

Web:

http://www.eddystoneusergroup.org.uk/Manuals/
http://www.jvgavila.com/eddy830.htm
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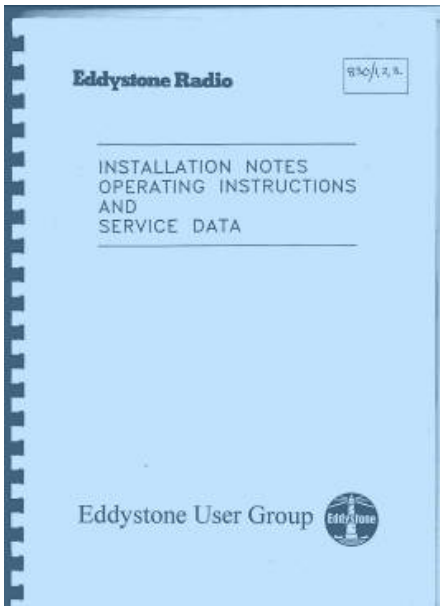
Post-Postscript

Obtaining a manual and circuit for the 830/4 deserves mention: the 830/4, being a 'special' made for the Canadian forces/RCMP, does not appear in the two 'mainstream' manuals generally available covering the 830 series - one covers the 830, 830/1 – 830/3 (1962 – 1966), the other covers the 830/5 – 830/7 (1966 – 1973). I understand that the 830/2 and 830/7 models are the most common in the UK, though with the series extending to the 830/12 (see the EUG Ultimate Quick Reference Guide 2nd Ed. , p38). These two major series differ slightly in circuit detail: the 830/4 model being more akin to the earlier series, but with an extra LF band instead of the AM broadcast band ('medium wave'). The main circuit differences include a varicap-tuned BFO (earlier model), isolation amplifier on 2nd local oscillator (later model) and a heptode 2nd mixer (later model). The EUG Ultimate Quick Reference Guide notes that 415 of the 830/4 series were made: the one featured here (Serial No. LT1507), according to the 'standard' Eddystone serial number dating code, was manufactured in December 1968, ie two years into the production run for the later circuitry (830/7 etc). This date is born out by the date stamped on the psu filter caps – perhaps the Canadian forces/RCMP order was still being supplied with the older specification until the 830/10 model was available? If anyone can shed any light on this I would appreciate an answer…

To compound the mystery, Ted at the EUG – surely one of the worlds most knowledgeable 'Eddystonephiles' - forwarded me the manual for what he believed to be the 830/4 circuit for a 1968-production set – which covered the later circuitry models – he took some convincing that the set I owned sported the older circuit. Ted sent me the circuit diagram for the older model but did not have the manual on file. Then one of those strange coincidences happened. I had bid on an 830/1-3 manual on Ebay and lost to someone bidding in the UK. I contacted the winner (thanks James!) and found out that he actually owned an 830/7, so the manual he had just bought was not the right one – we traded scanned versions of our manuals (these are the manuals now available for download on the EUG website). All's well that ends well. I understand that Dave Simmons may have an actual 830/4 manual – perhaps one day I will ask him?



…and better…..

…and better…..

…and better! - note the internal speaker fitted above (easily removed) and the new powder coated case. Spot the rack-mount cut outs in the photo below, also the neat little gadget (I believe original fitment for the 830/4) for locking the main tuning knob.

EDDYSTONE MODEL 830/1/2/3
HF/MF COMMUNICATIONS RECEIVER

The EDDYSTONE Model 830 is a general purpose HF/MF communications receiver covering the frequency band 300 kc/s to 30 Mc/s in nine ranges. Double conversion is used on the frequencies above 1.5 Mc/s and the 1st IF is variable to provide an incremental tuning facility with a coverage of ± 100 kc/s. Both Local Oscillators can be crystal controlled for high stability applications on frequencies above 1.5 Mc/s.

Provision is made for reception of CW, AM and SSB, the IF bandwidth is continuously variable and a separate detector is employed for CW/SSB reception. A crystal filter is provided for selective CW reception and when taking SSB the BFO pitch adjustor serves as a fine tuning control with an approximate swing of ± 100 c/s.

Audio outputs are available for connection to an external loudspeaker, telephones and remote lines. Other facilities include a low impedance IF output (100 kc/s), an efficient noise limiter, a carrier level meter and a built-in crystal calibrator. The AGC line is brought out to a socket at the rear to permit interconnection of receivers in diversity, while other terminations on the same socket allow the receiver to be muted when an associated transmitter is in operation.

The power supply arrangement is such that the receiver can be operated direct from any standard AC mains supply or alternatively from any external source capable of giving the appropriate HT and LT voltages. Ancillary supplies are available when operating from the mains.

The Model 830 can be supplied either as a standard unit for surface mounted installations or as a rack mounting unit (830/RM) for use in a 19" rack. Either version can be fitted with shock-absorbent mountings for use in mobile installations.

LIST OF CONTENTS

The Company reserve the right to vary the information contained in this publication

Sole Manufacturers:- STRATTON & CO., LTD., ALVECHURCH ROAD, BIRMINGHAM 31, ENGLAND.

TECHNICAL DATA

GENERAL

Frequency Coverage.

300 kc/s to 30 Mc/s in nine ranges.

Range 1	. .	18.0 - 30.0 Mc/s.	Range 6	. .	1.5 - 2.5 Mc/s.
Range 2	. .	11.0 - 18.0 Mc/s.	Range 7	. .	860 - 1500 kc/s.
Range 3	. .	6.7 - 11.0 Mc/s.	Range 8	. .	480 - 860 kc/s.
Range 4	. .	4.0 - 6.7 Mc/s.	Range 9	. .	300 - 520 kc/s.
Range 5	. .	2.5 - 4.0 Mc/s.			

Intermediate Frequencies.

1st IF . . Nominally 1350 kc/s but variable over the range 1250-1450 kc/s to provide the incremental tuning facility on Ranges 1-6. The 2nd IF becomes the 1st and only IF on Ranges 7, 8 and 9.

2nd IF . . 100 kc/s with crystal filter and variable selectivity. The BFO is controlled by a capacity diode and provides a 'fine' tuning facility on SSB (± 100 c/s). Pitch adjustment on CW is approximately ± 3 kc/s.

Valve Complement.

Ref	Type		Circuit Function
V1	6ES8 or ECC189	(CV5331)	RF Amplifier (cascode).
V2	6AK5 or EF95	(CV850)	1st Mixer.
V3	6C4 or EC90	(CV133)	2nd Local Oscillator (VFO and CRYSTAL).
V4	6AK5 or EF95	(CV850)	2nd Mixer.
V5	6BA6 or EF93	(CV454)	1st 100 kc/s IF Amplifier.
V6	6BA6 or EF93	(CV454)	2nd 100 kc/s IF Amplifier.
V7	6AL5 or EB91	(CV140)	Noise Limiter.
V8	6AU6 or EF94	(CV2524)	Cathode Follower (IF OUTPUT).
V9	6AT6 or EBC90	(CV452)	AM Detector/AGC Rectifier/Audio Amplifier.
V10	6AQ5 or EL90	(CV1862)	Audio Output.
V11	6AU6 or EF94	(CV2524)	Crystal Calibrator.
V12	6U8 or ECF82	(CV5065)	1st Local Oscillator (VFO and CRYSTAL).
V13	6BE6 or EK90	(CV453)	CW/SSB Detector.
V14	0A2 or 150C4	(CV1832)	HT Stabiliser (1).
V15	0A2 or 150C4	(CV1832)	HT Stabiliser (2).
D1	100SC2	-	Variable Capacity Diode (BFO).
D2/5	*DD006	-	HT Rectifier.

Input and Output Impedances.

Aerial Input . . 75Ω (nominal) unbalanced.

IF Output . . 250Ω (nominal) unbalanced. Suitable for terminating impedances in the range 75-300Ω.

Audio Outputs . . Loudspeaker : 2.5/3Ω.

Lines : 600Ω (balanced or unbalanced).

Telephones : Nominally 2000Ω but suitable for a wide range of impedances.

*2 x DD058 may be fitted in lieu.

Power Supplies.

Mains Operation ..... 100/125V and 200/250V AC (40-60 c/s).
Consumption : 85 volt-amperes.

External Power Supplies ..... External HT and LT supplies required to operate the receiver in the absence of AC mains are as follows:-

HT : 250V @ 160mA. LT : 6.3V @ 4.8A (approx.).

Accessory Supplies ..... The following supplies are available for powering external units when the receiver is mains operated:-

HT . . 250V @ 15mA (unsmoothed).
LT . . 6.3V @ 1.2A (earthed centre-tap).

Fusing ..... 830 and 830/1 . . Both sides of the mains input are fused at 2A.

830/2 . . The live side of the mains input is protected by a 1.5A thermal storage delay fuse.

Fuses are standard cartridge types, these being 20mm long in the case of the 830 and 830/1, 1¼" long in the case of the 830/2.

External supplies should be switched and fused at their source.

TYPICAL PERFORMANCE FIGURES

Sensitivity.

With an IF bandwidth of 3 kc/s, the sensitivity is better than 3μV for a 15dB signal to noise ratio at all frequencies throughout the range.

IF Selectivity.

The overall bandwidth at 6dB down is continuously variable within the limits 1.3 kc/s to 6 kc/s and is narrowed to 50 c/s when using the 100 kc/s crystal filter.

Markings on the selectivity control indicate the appropriate bandwidths for 'AM' 'SSB' and 'CW'. The extreme 'CW' position is marked 'N' (narrow) and moving the control to this setting introduces the pre-phased crystal filter. Click stops are provided for positive selection of the 'SSB' and 1.3 kc/s 'CW' positions.

Typical overall bandwidths are given in the Table below.

Position	-6dB	-50dB
CRYSTAL (N)	50 c/s	2 kc/s
CW	1.3 kc/s	5 kc/s
SSB	3 kc/s	8 kc/s
AM	6 kc/s	12 kc/s

IF Breakthrough. (1st IF)

Greater than 70dB down except at 1.5 Mc/s on Range 6 where a figure of -60dB is obtained.

Any given breakthrough at the 1st IF (1350 kc/s ± 100 kc/s) can be eliminated by de-tuning the incremental control and re-setting the main tuning to re-tune the wanted signal.

IF Breakthrough. (2nd IF)

Greater than 85dB down at all frequencies except Range 9 (300-520 kc/s) where a figure of greater than -60dB obtains.

Image Rejection.

On Ranges 7, 8 and 9 (300 kc/s - 1.5 Mc/s) where the image is 200 kc/s removed from the signal frequency, a rejection of at least 50dB is obtained.

At frequencies in the range 1.5-10 Mc/s the image rejection is greater than 70dB and at 30 Mc/s the figure does not drop below 50dB.

As with breakthrough at the 1st IF, any given image occurring in the band 1.5-30 Mc/s can be eliminated by adjustment of the incremental control.

Calibration and Re-setting Accuracy.

The main scale accuracy on all ranges without use of the calibrator and with the cursor adjustor at mid-travel is within 0.5%, provided that on Ranges 1-6 (1.5-30 Mc/s) the 1st IF is set to the centre of its coverage (1350 kc/s).

When the main scales are standardised against the built-in calibrator, frequencies can be set to within one kilocycle by adjustment of the incremental control.

The incremental facility is not available on Ranges 7, 8 or 9 (300-1500 kc/s).

Frequency Stability.

After a 10 minute warm-up period, drift with free running oscillator is approximately 25 kc/s in the first hour at 28 Mc/s. After a further 30 minutes operation, drift at any frequency will not exceed 4 parts in 10^4.

With crystal control of the 1st Local Oscillator, drift during the first 30 minutes of operation does not exceed 2 kc/s. After this time the drift will be considerably less than one kilocycle in any one hour period.

AGC Characteristic.

The audio output level does not change by more than 9dB when the carrier level is increased 90dB above 3μV. (Taken at 8 Mc/s with an IF bandwidth of 3 kc/s).

The normal AGC discharge time constant (0.15 sec.) becomes 10 seconds when the Mode switch is moved to the 'SSB' positions. The AGC delay is also reduced under this condition of operation.

AGC is available for diversity working. (Socket at rear of receiver).

Audio Output and Response.

The Audio Output Stage will deliver a maximum output of 2.5 watts at either the 2.5Ω or 600Ω outputs when these are used independently.

The audio response is level within 6dB over the range 200 c/s to 6 kc/s.

Distortion.

5% at 1 watt in 2.5Ω at 1000 c/s.

Hum Level.

Greater than 50dB down on 2.5 watts.

IF Output.

An input of 3μV at the aerial socket will produce an output of at least 50mV across 75Ω (100 kc/s).

APPENDIX 'B'

TABLE OF VOLTAGE VALUES

The following 'Table of Voltage Values' will prove useful in the event of the receiver developing a fault which necessitates carrying out voltage checks. All readings are typical and were taken with a meter having a sensitivity of 20,000Ω/V and an applied mains voltage of 240V. A nominal tolerance of 10% will apply to readings taken with a meter of the sensitivity quoted and this tolerance should be increased accordingly if readings are taken with a meter of lower sensitivity.

Readings should be taken under 'no-signal' conditions with the receiver controls set as follows:-

WAVECHANGE	Range 1.	RF/IF GAIN CONTROLS . .	Maximum.
CRYSTAL SELECTOR . .	'M' (Manual).	AF GAIN CONTROL	Minimum.
SIGNAL MODE SWITCH . .	'CW'.	AGC/NL SWITCH	Off.

The link between PL4/1 and PL4/4 must be in position.

Ref	Anode		Screen		Cathode		Note
	Pin	Reading	Pin	Reading	Pin	Reading	
V1A	6	90V	-	-	8	1.5V	NOTE 1.
V1B	1	178V	2 (g1)	87V	3	90V	
V2	5	186V	6	40V	2	0.7V	
V3	1	90V	-	-	7	0V	
V4	5	185V	6	25V	2	0.45V	
V5	5	220V	6	95V	7	1.1V	NOTE 2.
V6	5	220V	6	95V	7	1.1V	
V7	2/7	10V	-	-	1/5	10V	
V8	5	188V	6	188V	7	2.2V	
V9	7	110V	-	-	2	13V	NOTE 3.
V10	5	230V	6	227V	2	12V	
V11	5	30V	6	160V	7	0V	NOTE 4.
V12A	6	128V	3	112V	7	0V	
V12B	1	96V	-	-	8	1.2V	NOTE 5.
V13	-	-	-	-	-	-	NOTE 6.
V14	1	150V	-	-	7	0V	
V15	1	150V	-	-	7	0V	

NOTE 1. Cathode voltage increases to 46V with RF GAIN at minimum.

NOTE 2. Cathode voltage increases to 45V with IF GAIN at minimum.

NOTE 3. Cathode voltage decreases to 4.9V when the SIGNAL MODE SWITCH is moved to 'SSB'.

NOTE 4. CALIBRATOR SWITCH to 'ON' position. The Calibrator Unit must be removed from the gang cover to allow readings to be taken.

NOTE 5. CRYSTAL SELECTOR SWITCH to any 'CRYSTAL' position and with crystal in place.

NOTE 6. This stage is inaccessible for direct voltage checks. Voltages can be checked on the leads entering the unit as follows:

(a) Anode feed (measured at orange lead) : 226V (CW/SSB), 231V (AM).

(b) Screen feed (measured at blue lead) : 138V.

(c) Diode control voltage (measured at green lead). Reading depends on the position of the SIGNAL MODE SWITCH.

'AM' position	0V.
'CW' position	10.5V to 19V for full swing of the BFO PITCH ADJUSTOR. (Nominally 14.5V at centre setting).
'SSB UPPER'	In the range 12V to 24V (nominal).
'SSB LOWER'	In the range 8V to 20V (nominal).

HT voltages are as follows:-

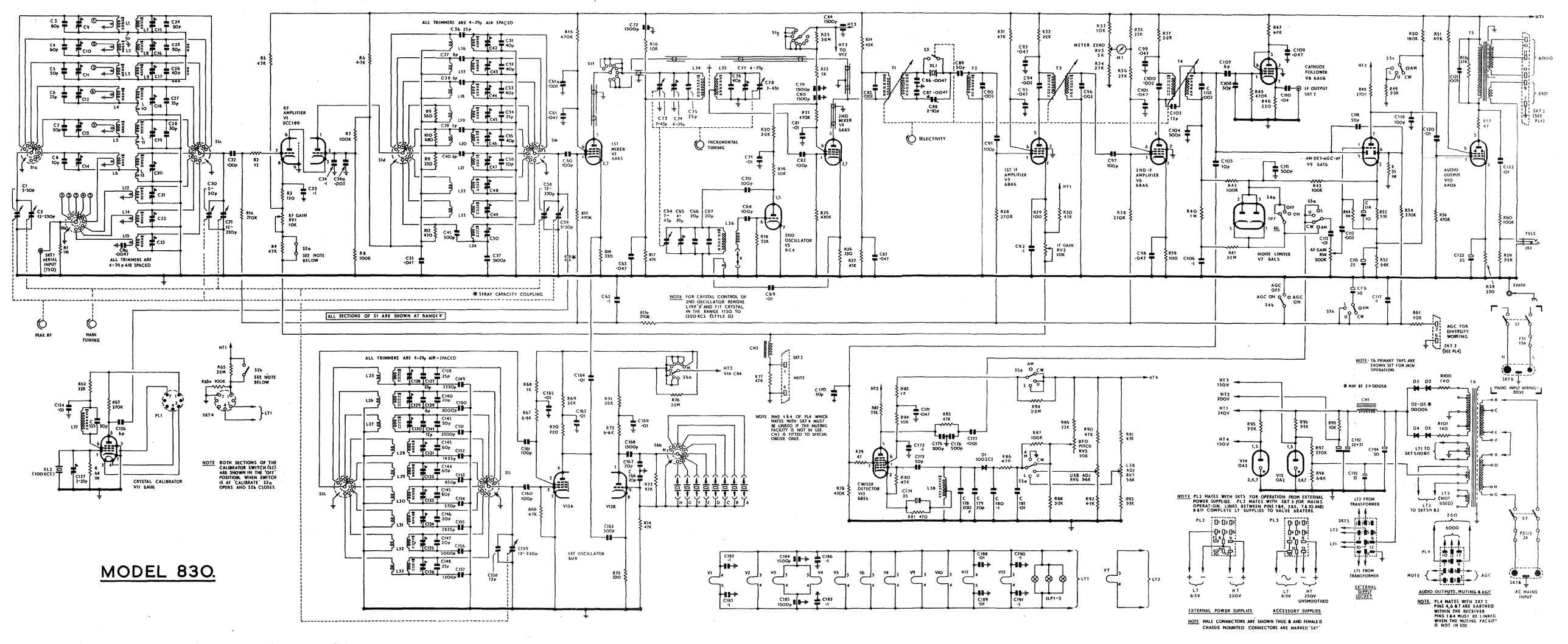
HT1 . . 238V.
HT2 . . 226V (MODE SWITCH to 'CW')
HT3 and HT4 . . 150V.

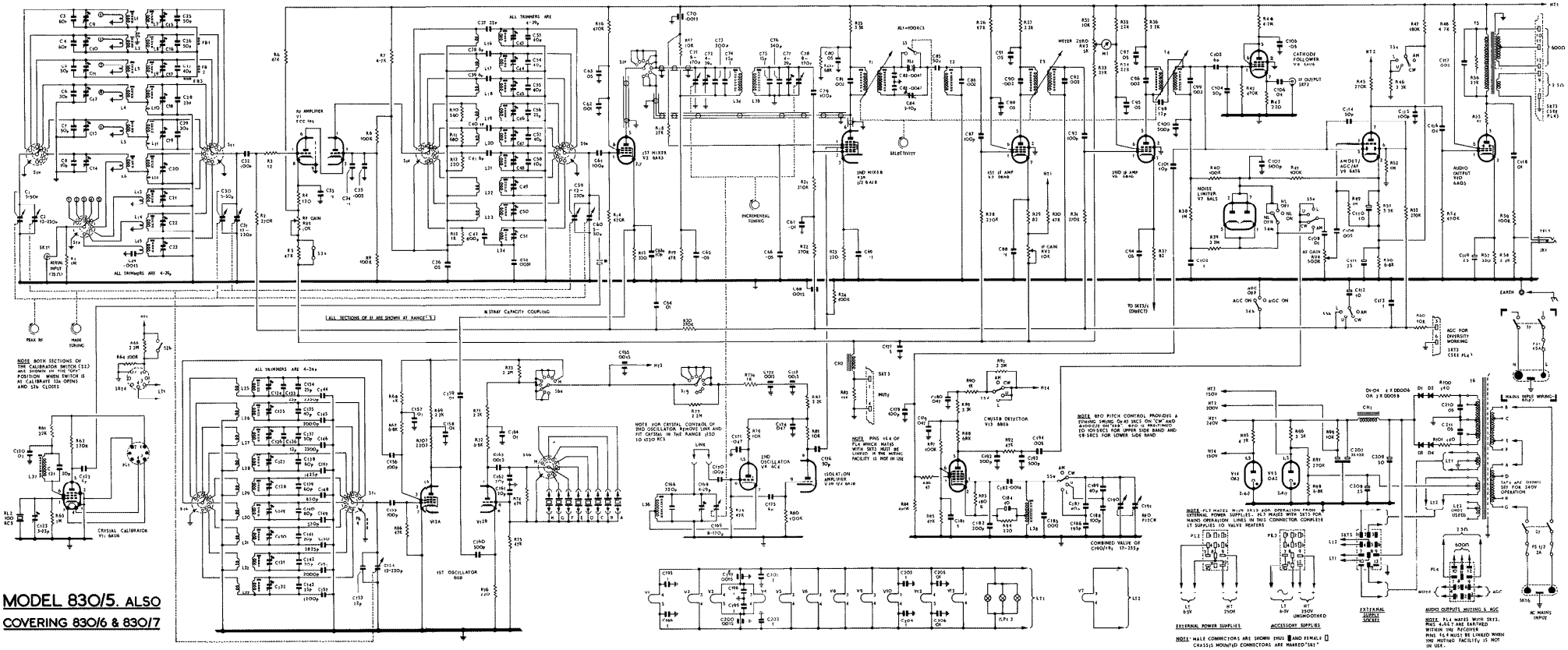
APPENDIX 'C'

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors.

Ref	Value	Type	Tolerance	Wkg. V.
C1	5-50pF	Air-spaced variable	-	-
C2	12-230pF	Air-spaced variable	-	-
C3	60pF	Silvered Mica	10%	350V
C4	60pF	Silvered Mica	10%	350V
C5	50pF	Silvered Mica	10%	350V
C6	25pF	Silvered Mica	10%	350V
C7	50pF	Silvered Mica	10%	350V
C8	10pF	Silvered Mica	10%	350V
C8a	0.0047μF	Polystyrene	5%	125V
C9	4-29pF	Air Trimmer	-	-
C10	4-29pF	Air Trimmer	-	-
C11	4-29pF	Air Trimmer	-	-
C12	4-29pF	Air Trimmer	-	-
C13	4-29pF	Air Trimmer	-	-
C14	4-29pF	Air Trimmer	-	-
C15	4-29pF	Air Trimmer	-	-
C16	4-29pF	Air Trimmer	-	-
C17	4-29pF	Air Trimmer	-	-
C18	4-29pF	Air Trimmer	-	-
C19	4-29pF	Air Trimmer	-	-


MODEL 830.
ALL TRIMMERS ARE 4-29p AIR SPACED
RF AMPLIFIER V1 ECC189
1ST MIXER V2 6AK5
2ND MIXER V4 6AK5
2ND OSCILLATOR V3 6C4
1ST OSCILLATOR 6U8
INCREMENTAL TUNING
SELECTIVITY
1ST IF AMPLIFIER V5 6BA6
2ND IF AMPLIFIER V6 6BA6
AM-DET-AGC-AF V9 6AT6
CATHODE FOLLOWER V8 6AU6
IF OUTPUT SKT 2
NOISE LIMITER V7 6AL5
AUDIO OUTPUT V10 6AQ5
METER ZERO RV3 5K
RF GAIN RV1 10K
IF GAIN RV2 10K
BFO PITCH RV5 20K
USB ADJ RV6 56K
LSB ADJ RV7 56K
AF GAIN RV4 500K
CRYSTAL CALIBRATOR V11 6AU6
CW/SSB DETECTOR V13 6BE6
AERIAL INPUT (75Ω)
PEAK RF
MAIN TUNING
ALL SECTIONS OF S1 ARE SHOWN AT RANGE 4
* STRAY CAPACITY COUPLING
NOTE FOR CRYSTAL CONTROL OF 2ND OSCILLATOR REMOVE LINK 'X' AND FIT CRYSTAL IN THE RANGE 1150 TO 1350 KCS (STYLE D)
NOTE BOTH SECTIONS OF THE CALIBRATOR SWITCH (S2) ARE SHOWN IN THE 'OFF' POSITION. WHEN SWITCH IS AT 'CALIBRATE' S2a OPENS AND S2b CLOSES.
NOTE PINS 1 & 4 OF PL4 WHICH MATES WITH SKT 4 MUST BE LINKED IF THE MUTING FACILITY IS NOT IN USE. CW2 IS FITTED TO SPECIAL ORDER ONLY.
NOTE - T6 PRIMARY TAPS ARE SHOWN SET FOR 240V OPERATION.
* MAY BE 2 x DDO58
NOTE PL2 MATES WITH SKT5 FOR OPERATION FROM EXTERNAL POWER SUPPLIES. PL3 MATES WITH SKT 5 FOR MAINS OPERATION. LINKS BETWEEN PINS 1 & 4, 2 & 5, 7 & 10 AND 8 & 11 COMPLETE LT SUPPLIES TO VALVE HEATERS.
EXTERNAL POWER SUPPLIES
ACCESSORY SUPPLIES
NOTE MALE CONNECTORS ARE SHOWN THUS ♂ AND FEMALE ♀ CHASSIS MOUNTED CONNECTORS ARE MARKED 'SKT'
AUDIO OUTPUTS, MUTING & AGC
NOTE PL4 MATES WITH SKT 3. PINS 4, 6 & 7 ARE EARTHED WITHIN THE RECEIVER. PINS 1 & 4 MUST BE LINKED WHEN THE MUTING FACILITY IS NOT IN USE
AC MAINS INPUT
MAINS INPUT WIRING - 83/V2
EXTERNAL SUPPLY SOCKET
LT1 FROM TRANSFORMER
LT2 FROM TRANSFORMER
LT2 TO SKT5 PI 8
LT1 TO SKT5 P10 & 11
AGC FOR DIVERSITY WORKING
AGC OFF
AGC ON
EARTH
TELS
JK1



Later circuit - compare with that for the 830 (and /1, /2, /3 & /4)