Eddystone 1830 Receiver – 100 KHz IF Filter –Alignment- Tests – Vinkors – VK4GV - June 2019 - Issue 1

Please allow for possible errors in this article, and advise me of them, and also of your suggestions.

Caution - I very strongly suggest that if you do not have appropriate test equipment which is accurate and has high stability, it might be worth considering to leave the 100 KHz IF Filter adjustment totally alone, and to just peak the adjustments on the 100 KHz IF Amp Circuit Board. Once you start with filter alignment, it must be fully carried out. One selectivity Setting or one stage cannot be adjusted in isolation, as all sections and Settings interact.

If you have no time to read anything detailed about alignment, read the caution above, and this –

Align the 100 KHz IF Filter very carefully, and exactly as per the Eddystone Handbook method, using a stable signal generator and a visual indication method, not by ear. Ensure AGC is OFF, IF Gain at MAX. Repeat three times. The Eddystone Handbook method is satisfactory.

This article details my findings with the 100 KHz IF Filter in my Eddystone 1830/1 receiver, and is a supplement to my other article -

"Eddystone 1830 Receiver – Renovation – Full Alignment - Tests – Review – VK4GV - June 2019 - Issue 2"

This IF Filter article is presented here separately in detailed form. The IF Filter or variant is also used in other Eddystone Receivers, eg EC958.

There are various types of this filter used in the 1830 series, and in other receivers.

My IF Filter is Eddystone type LP3298 for receiver 1830/1 (as per page 59 of Appendix D of my Eddystone Manual).

Reason for this article.

I started investigation into my filter as I believed it may have had a fault on Setting VN. It did not.

The IF filter is a design compromise of many factors; it is difficult to physically work with, and at times a little difficult to align, and the handbook does not elaborate on a few aspects, including its use for Radio Operators.

Although I have some experience in receivers, I am not an expert on filters nor their design. This article is about my practical findings, and gives some suggestions.

I don't believe that Selectivity Setting "VN" works very well, and probably is more a marketing feature for Eddystone than a Radio Operators useful setting. It may have even been better designed as a classic notch filter for Setting VN.

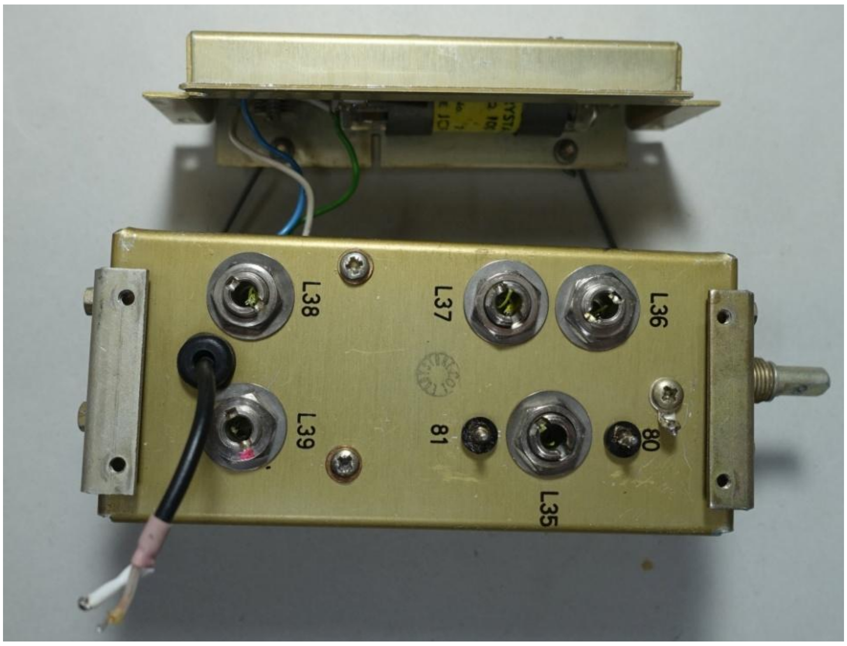
Manuals

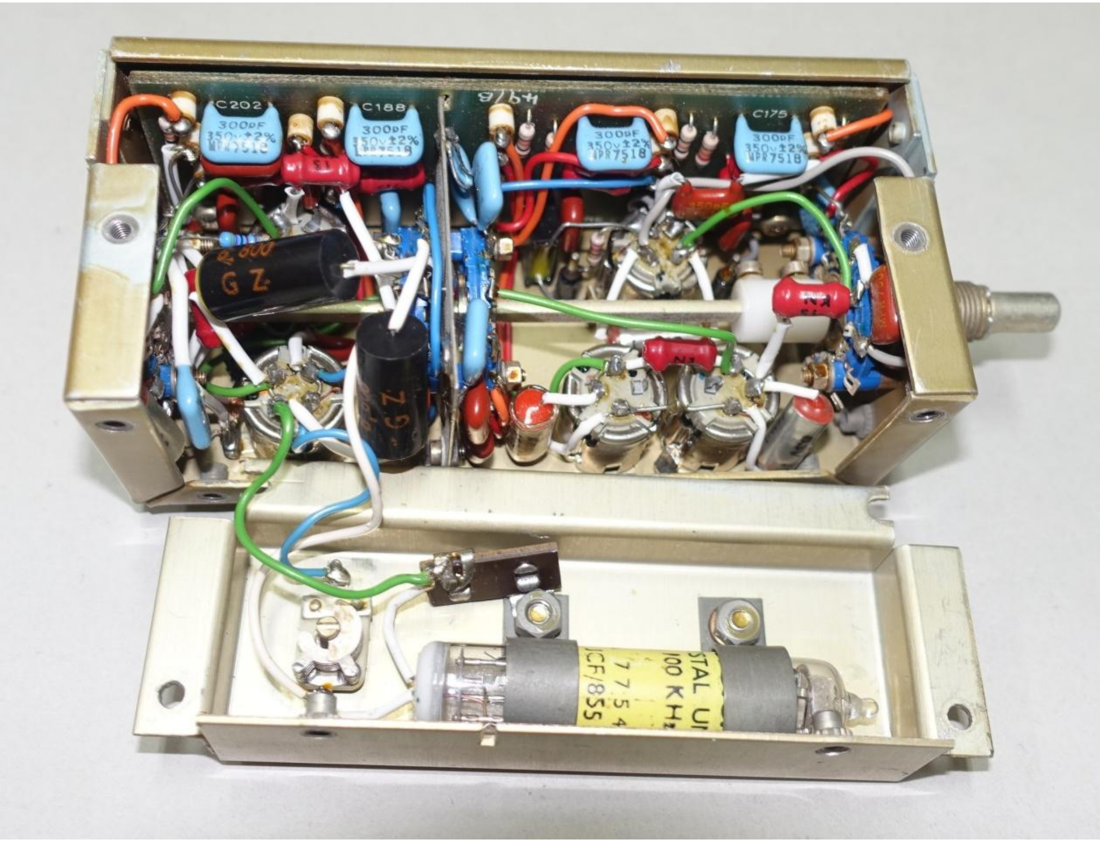
These are available for download from the Eddystone User Group website.

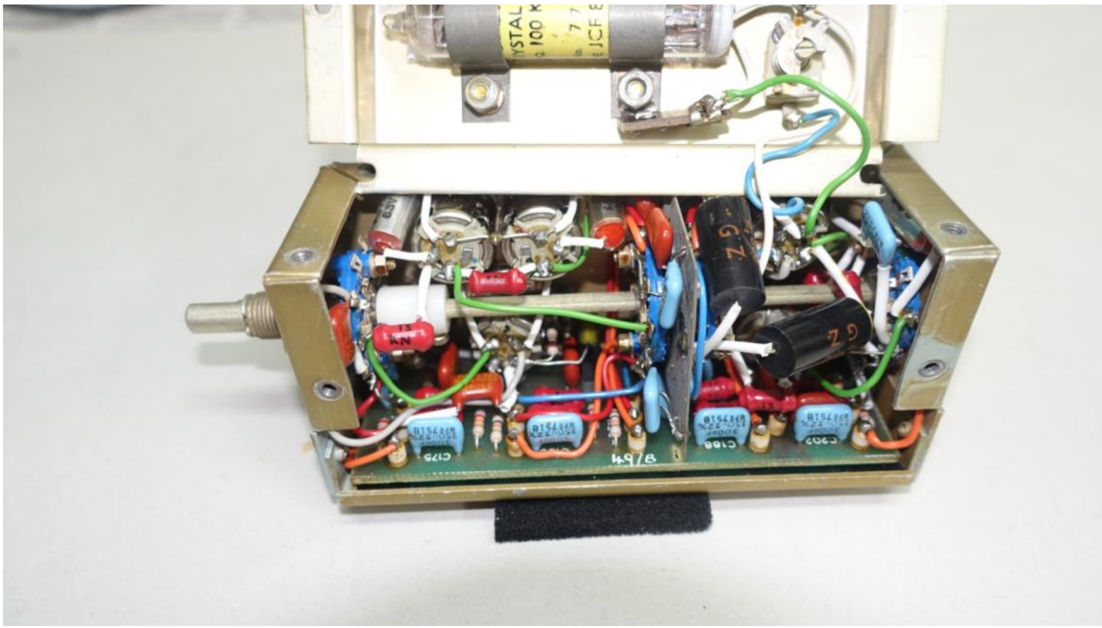
Beware of circuit changes, which are listed throughout the Manual, and on the schematic diagrams, usually in the diagram corners.

Caution – my Eddystone Manual Issue 3, Sept 1973, page 12, has incorrect component designations for Inductors, and possibly some capacitors (not fully checked). The Schematic diagrams at the rear of the same manual appear to be correct for my receiver. The page 12 component designations are possibly correct for receivers other than the 1830/1.

Physical Aspects







The 100 KHz IF Filter is made with four Selectivity Settings using Mullard 14 mm (diameter) “Vinkor” pot-core inductors, one 100 KHz Crystal, a four wafer rotary switch S4 arranged using eight sub-sections. It is made with one PCB which is screwed to the bottom of a metal box case.

It must have been difficult to assemble, as it is a test and repair nightmare.

The filter was probably designed to be replaced as a complete unit, not repaired.

Resist the urge for “exploration” or repair unless you are confident about your skills.

There is limited access to some components, and the PCB bottom solder joints cannot be checked without partial or complete disassembly. Even then, the bottom metal side of the case would probably have to be milled off at the corner edge, or cut off somehow, and four rivets drilled out, and all being replaced by small screws on reassembly. Access to most switch sections is very difficult or impossible.

The filter is a physical jumble of components, and visual and electrical checking is impossible for about 50% of items.

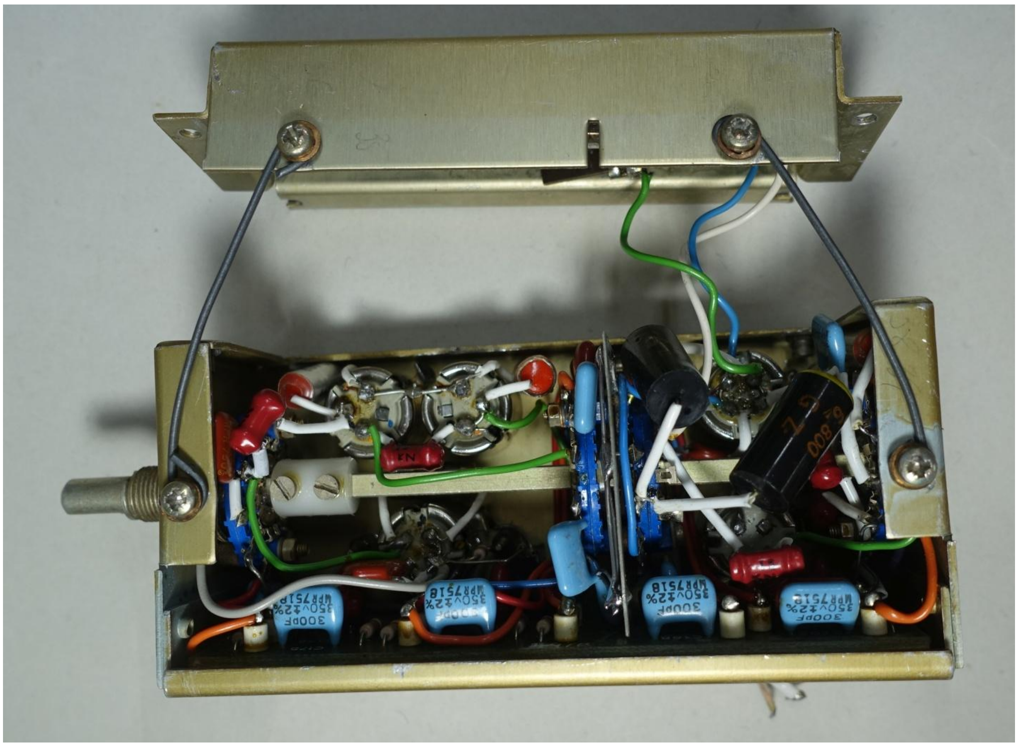
You just cannot see some components, let alone check or replace them. Thank you Mr Designer.

If you are removing the side metal cover on the filter unit to check the crystal, do not disturb the two screws in the middle of the cover, which are for the crystal mount clips. Only remove the four side cover peripheral screws.

Removal of the whole unit is possible by first removing the screws for the “NL, Meter and Neg Supply PCB” and slightly moving it to one side. If you are to unsolder the IF input and output cables, some PCB shields have to be removed first.

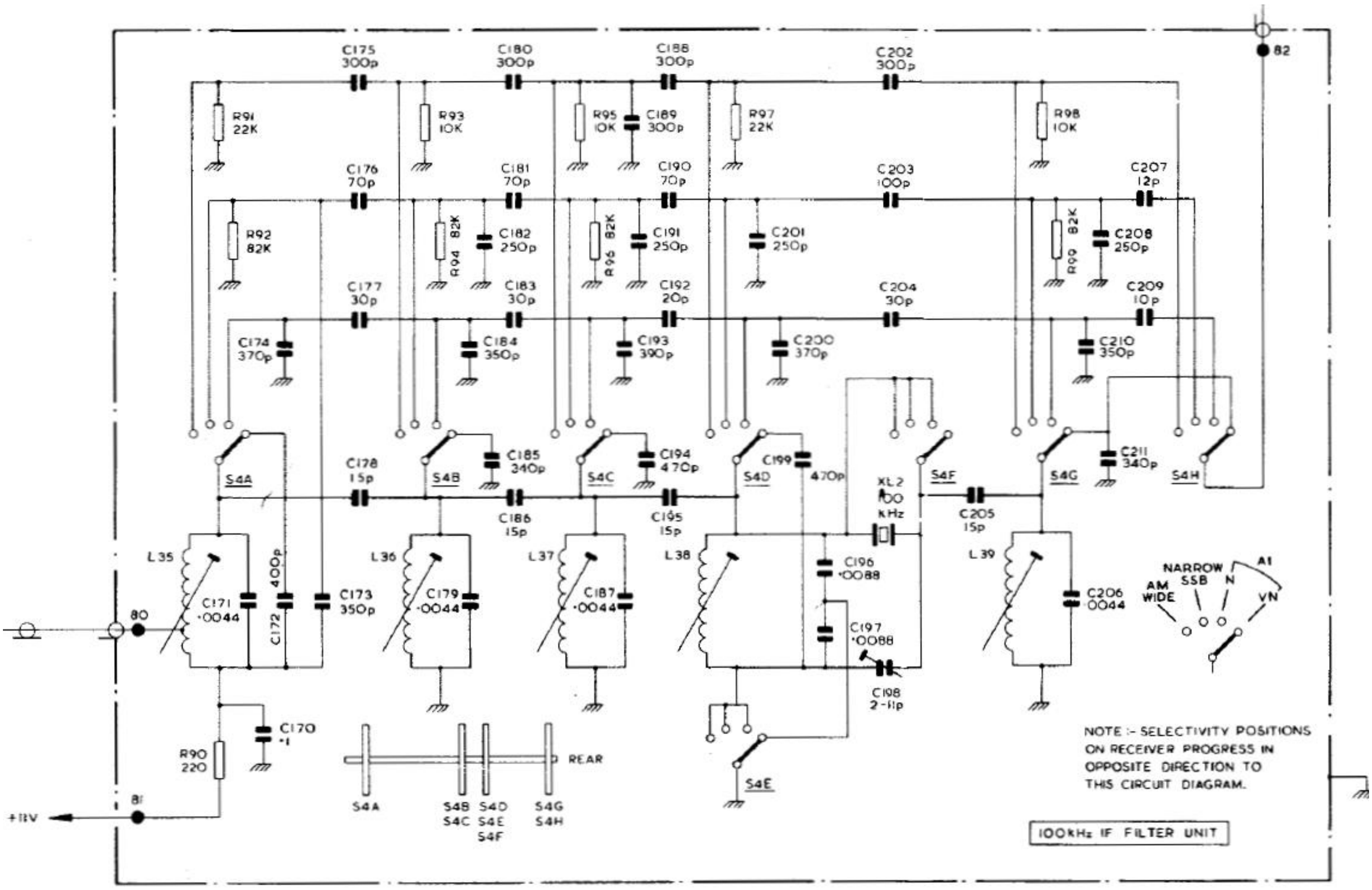
You may find it useful to remove the Front Panel Headphone Socket to gain physical access to the grubscrews in the switch coupling. The associated Headphone Socket nut is 1/2 inch or 13 mm AF, and the grubscrews are Allen type 1/16 inch AF. If the grubscrews are very tight, add a dab of your favourite thin lubricant 24 hrs before work. Do not spray the lubricant, just add a tiny drop to each screw. I normally use CRC 2-26 for this purpose.

In the next photo you can see that I have attached two temporary pieces of iron wire to hold the crystal side panel, whilst I worked on the filter unit. This avoids strain on wiring etc.



Electrical Aspects

Circuit ex Handbook Issue 3 for 1830/1 type receiver.



The filter is a five stage LC and single element crystal filter, with different top coupling for each selectivity Setting.

The crystal section is operated as a series pass narrow filter, with “pre-set phasing” (Eddystone’s words), and does not seem to have been designed with a peak and notch in the pass band, just a signal peak.

Historically, this might be the last use of a single crystal as a filter element in a UK built commercial coms receiver? First used in the 1930s, they were somewhat effective in notch type form, but manufacturers ceased use, when better filter options were available.

My opinion is that it’s very sharp bandwidth is not required even for CW, as a radio operator can use the sharp N Setting to reduce interfering stations, or even use Setting SSB, and “tune” the receiver to the “other side of the signal” if required.

This filter unit is an electrical compromise of many factors for a mid-range priced communications receiver.

The performance results reflect the compromises, and you should not expect excellent test figures with text book band pass shape with The Handbook Alignment procedure.

Even considering its design date, it might have been cheaper and easier for Eddystone to use discrete filters for each setting of selectivity, and would have been much easier to align.

There is some clever design switching when the crystal is brought into action.

All stages and settings interact and this can make alignment a little tedious.

Eddystone has used good quality components and I did not have to replace a single component. Most capacitors test close to original parameters.

The Vinkor inductors have a design weakness in the “adjuster” and will be discussed later.

It is possible to fully remove the IF Filter Unit and extend it by cables, and work with it on the bench.

Faults In My Filter

I found no electrical faults with my filter, but I did find suspect solder joints on two “joints” where a plated steel shield has been through drilled and used as an earth plate for two capacitors, C189 and another. This was resoldered after cleaning with a hot solder iron (Weller TCP with 1/4 inch 800 deg F tip).

I replaced the cushion foam mount under the crystal, as the original foam had disintegrated. I made a very careful total cleanup with methylated spirits (alcohol). I made a new foam mount from 3.0 mm thick, soft poly foam, 13 x 60mm. My foam mount is free floating under the crystal, with about 0.5 mm compression by the crystal itself. The original foam was adhesive backed, and if deteriorated, cleans up well with the methylated spirits.

I did find what I think MAY have been an assembly issue, with the wiper of one switch wafer having been solder repaired close to the wiping “fingers”. On finding this, I had a very close look to see if it wasn’t just an assembly time “dropped solder dag”, but it seems to be a deliberate repair on a vital part of the switch. All hard to believe, but rather than junk the whole item being assembled, I think Eddystone has elected a substandard commercial approach.

I was disappointed to find this. I do not know the future implications of this situation for my filter.

If you consider that you have a fault in your filter, it is absolutely imperative that it is repaired first before alignment is attempted, otherwise you are just wasting your time.

In my filter, I found that Vinkor L39 had a sticking adjuster. Discussed later.

In my article for the whole 1830 Receiver, I added an extra resistor to reduce ringing on Setting VN. I have now removed the resistor on my filter, but I will still include the details in that article for interest. Refer to the other article for details.

Assessment of Filter Performance – Before and After Alignment

If you do not think you have any faults, and your receiver has overall sensitivity figures which meet specification, and you think that the selectivity is OK on all settings, then the filter is probably OK and will not benefit from any alignment.

Indeed, it is best left alone. See the caution at the start of this article. And you might wear out the Vinkor adjuster internal "thread" which is flimsy. These adjusters are not designed for continuous twiddling.

The handbook gives the method of measuring the 100 KHz IF Channel sensitivity, which includes the 100 KHz IF filter, so let this be your guide as to the initial filter performance.

With my receiver, I found originally that selectivity on AM, SSB, and N seemed to be normal on reception, but that sensitivity was reduced on Setting VN (Crystal), and it sounded different, and had audible "ringing" at times.

This now appears to be normal.

My receiver had some pass band ripple on AM and SSB selectivity, and I find that this cannot be fully eliminated but is reduced to a minimum by alignment, and probably is a result of the design compromises. It is just a little more than I expected. You will not notice any of this during normal reception, and it is relatively academic, but worthy of noting here. The AM Setting centre response appears to be off frequency when you use the Handbook Alignment, but this is actually due to the peaky nature of the response. This can be mostly eliminated with sweep alignment.

Generally speaking, my receiver and the filter met specifications for selectivity on all Settings, and I found that is rather pointless in testing and recording the band pass characteristic test results in complete detail.

I will not be elaborating on Selectivity Test Results of my receiver more than this. Some filter response photos later in this article should suffice, as the sweep frequency as displayed on the CRO is quite accurate, and shows the -6 dB points visually.

Test Equipment

You will need at least one and possibly two good signal generators, a high impedance voltmeter, an oscilloscope, and a DVM.

A meter to measure amplitude at 100 KHz is useful, particularly if it is tuneable with a narrow, ie 20 or 50 Hz filter.

If you don't have the ability to measure the IF Output as per the Handbook Alignment method, you can use a CRO and 10X probe, DC coupled, connected to the !830 receiver AM Detector PCB Wiring Point 96.

This works well. I soldered a wire loop test point to this WP96.

A hybrid splitter- combiner is also useful. I use it to elegantly combine two RF signals, one a very accurate marker at 100 KHz centre frequency, the other being a sweep or standard test signal. I constructed my hybrid from an article in the 1981 – 2002 ARRL Handbooks, "Test Equipment" section.

Because the hybrid is used at the low IF frequency of 100 KHz, I used a 25mm OD core, L8 ferrite material, and 25 turns of bifilar #28 wire instead of the original design of 10 turns. My hybrid is OK from 35 KHz to about 25 MHz.

To measure components, you will need an LC meter, capable of measuring small values. Keep in mind that some LC meters may require both ends of a component to be free of any associated equipment, otherwise the reading may be affected by stray signal pickup.

And, if possible, it is nice to have a high performance Sweep Generator. Not essential, but extremely useful to observe and confirm band pass shape.

I recently constructed such an instrument, 40 to 2500 KHz centre carrier frequency, using a DDS generation and Touch Screen parameter input, frequency accurate to 1.0 Hz, start and stop settable to 1.0 Hz, and with adjustable Sweep Intervals from 50 mSec to 2.0 Sec. You need a CRO as well for this use.

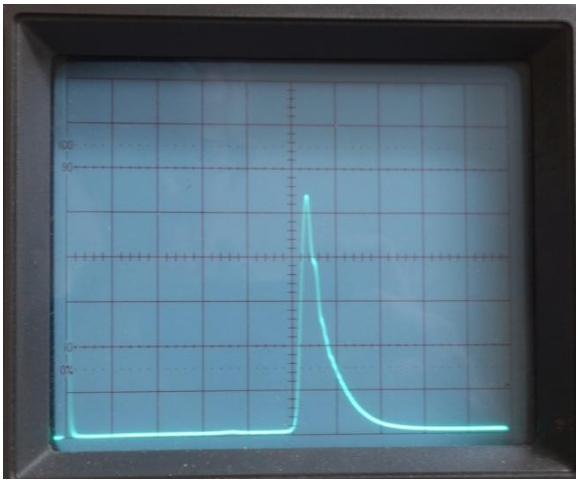
Sweep Alignment of Crystals and Associated LC Sections. Some Discussion.

If you use a standard Sweep Generator setup to observe the Frequency Response of a series operated crystal, or single crystal filter section, you will normally only observe the response of any associated LC sections, or observe the crystal "ringing", or a combination of both. This is because the crystal itself has very high "Q" and does not respond accurately to the relatively high rate of frequency change during the sweep. A very slow rate of sweep frequency change is required for the response to be visualised correctly on a CRO.

A single crystal filter like the one in the 1830 will respond to a fast sweep generator incorrectly and will display as wider in bandwidth than normal, and with incorrect skirts, and also with lower amplitude. There may also be "ringing".

Below is a CRO photo of what you might normally see with a Sweep Gen when the sweep rate is normal for LC circuits, ie 50 mSec, or relatively fast. This is my 1830 receiver on Setting VN, after Handbook Method Alignment using a sig gen only, and it is the visual response of the whole 100 KHz IF Filter, mostly due to the response of the LC sections, and not just the crystal itself.

It is as if the crystal is acting only as a very low impedance to this sweep signal, and not as a filter element.



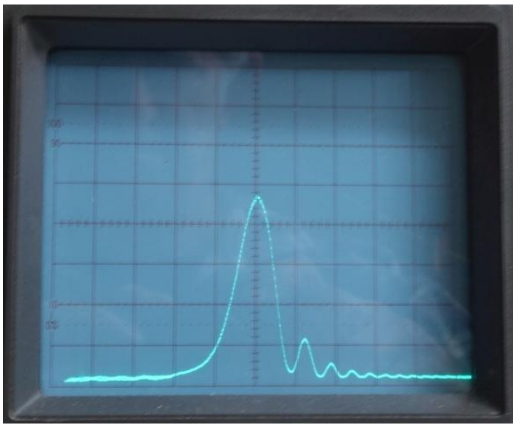
Sweep Interval is 50 mSec, Start 95.000 KHz, Stop 105.000 KHz, ie 1 KHz per cm of CRO H display, and a sweep rate of 200 KHz per second. Camera exposure 0.25 sec.

Note the "slow trailing edge", which is partially due to ringing, and is not actually "real".

The CRO response is a little too wide to represent the actual crystal response shape.

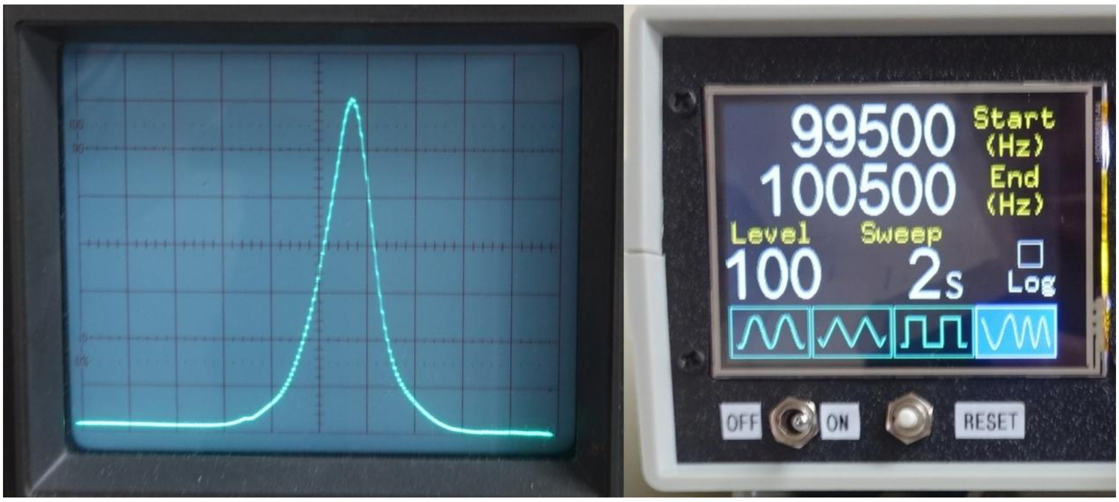
Ringing

Under some combinations of sweep range, sweep speed, and CRO H settings, the Setting VN will display with a degree of ringing as per the photo below.



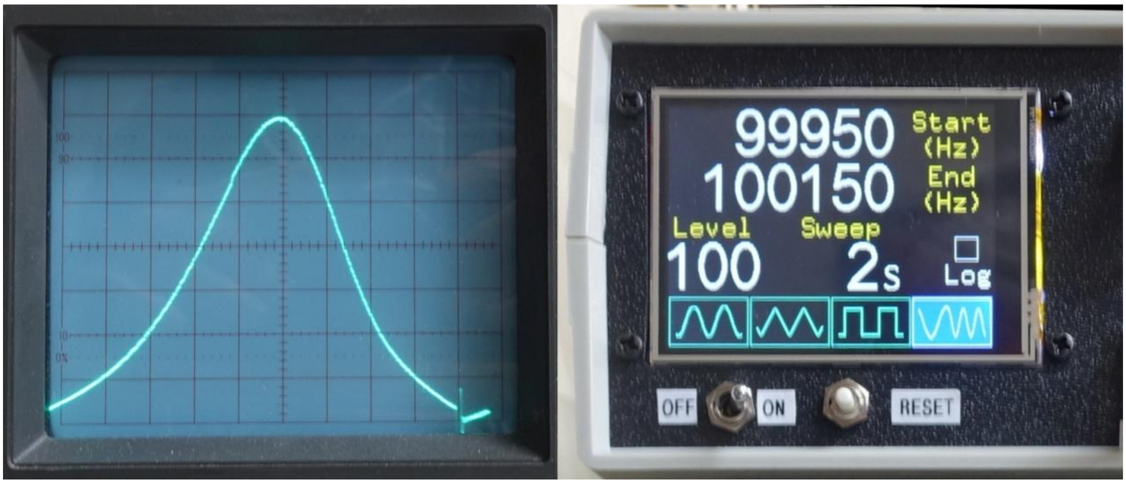
Real Response

Below is a more accurate VN Setting bandwidth response, start 99.500 KHz stop 100.500 KHz, ie 100 Hz per cm, and with a slow sweep of 2 sec. My crystal is 100.050 KHz and varies about +/- 5 Hz depending on workshop temperature.



Actual Response

The next photo below is a sweep 100 Hz below and above my crystal frequency, a sweep rate of 20 Hz per cm, and with a slow scan of 2 secs, and shows the real crystal response.



The above two photos of my 1830 receiver on Setting VN show the response of the whole 100 KHz IF Filter, but now, dominated by the response of the crystal, instead of the combined response of crystal and the VN channel LC sections.

You can prove to yourself that the responses are those with crystal dominating, by simply shorting the crystal with a wire link, and with possibly a little retuning.

Above last two photos were taken with 3.5 seconds camera exposure, and much patience.

During alignment, and when on Setting VN, you are just peaking for *amplitude*, and so if you do use a Sweep Gen, you do not need to see the real *frequency* response of Setting VN, only the *amplitude* response. You cannot alter the response of the crystal stage, except for very small changes with the "phasing" capacitor, and to an even lesser extent, with the inductors.

So you can normally use a Sweep Interval of 50 mSec and a relatively high Sweep Rate, to adjust the shape of the other three Settings. Although the shape of VN response will be not quite correct, you are able to see and peak the amplitude.

This is to make it easier to see all Settings by switching between them, and you can peak it all, without changing the Sweep Rate just for Setting VN.

Tools

Apart from normal hand tools you may need –

Square drive Hex sockets, 11mm, 13mm, and or, 7/16, 1/2 inch.

Allen key wrench 1/16 inch (for the BW switch rod coupling).

TrimTools

You will need an insulated brass tip type trimtool for the Crystal "Phasing" capacitor C198.

Also you will need a trimtool for the Mullard Vinkor "adjuster" which is the Mullard name for the little ferrite tuning slug. The tool required should have a non magnetic tip to suit the adjuster "slot", which is actually a rectangular depression, of 0.8 x 1.75 mm, and preferably with a very slight taper on all tip sides, to aid tip engagement into the slot.

I cannot find an image or dimensions for the original correct trimtool for the Mullard 14 mm Vinkor.

The Eddystone handbook seems to indicate that this is a Neosid TT1 (Eddystone part 8451P).

I believe that Mullard call this tool a DT2168 for 14 mm Vinkors with Mullard LA1505 adjusters.

In an earlier article, I referred to using an Australian made proprietary trimtool, a Jabel WT9, and gave dimensions so one could be made. Although this will work, it is not the correct tool, which I found out later when I fully dismantled a Vinkor.

I use a trimtool from my ProsKit 10 Piece Adjustment set, Part No1PK-A001. This is widely available around the globe.

Vinkors - a Primer

In order to align or “fault find” the filter, you need to know now just a little about the filter section inductors.

I will leave a more detailed coverage at the end of this article.

All inductors in the 100 KHz IF filter Box are Mullard 14 mm Vinkor pot cores.

The first inductor L35 has a winding tap, and is Eddystone Part D3840A. This inductor winding is live to DC.

The following inductors L36 to L39 are identical, and are Eddystone Part D3841A. These inductors are not live to DC.

The IF Rejector inductor in the RF Box, L11, is also a 14 mm Vinkor with a different part number, D4528.

Interestingly, the inductors L36 to L39 are marked with a small coloured paint dot, and all are different. The significance is not known, and may have been associated with assembly.

I found that the inductors are normally set to approx 540 nH for normal filter alignment, and are adjustable with about 10-15 %, from about 480 to 560 nH. Inductance is increased with clockwise turning (inwards) of the adjuster.

Caution – If you turn the adjuster slug fully anticlockwise multiple turns, the adjuster may separate from the pot core centre threaded spigot. In this case, the slug may be fully loose in the Vinkor, and may even be found wedged on the tip end of your trimtool. Conversely, if you turn the adjuster clockwise too many turns, you will ruin the internal thread of the adjuster. Salvation to a degree is at hand; refer later to the Vinkor Heading.

These adjusters are so tiny, only 7 mm long and 3 mm diameter, that you may not even see it being removed by your trimtool, and worse, you may lose it. These things are so rare, that you will then have a real problem.

And, eventually the threaded inner of the adjuster will wear out, as it is such a small wearing surface of a soft material.

See my Vinkor notes section later, if your adjusters are loose on the spigot, and adjustment is sloppy and difficult.

You will need to do this before final alignment tweaking.

Fault Finding

I started out on this particular filter journey after listening to actual signals on my 1830 receiver with the Selectivity Setting on VN, the crystal filter Setting. It sounded so different to what I expected that I thought this section may have a fault, and worthy of investigation. In the end, I concluded there was no fault, and that I was just listening to a normal response from this type of circuit. In my case, I worked on the filter after removing it from the receiver, and connected by DC and shielded cables.

You may be able to determine a faulty section by injecting a test signal and bypassing each section in turn with say a 0.1 MFD ceramic capacitor, and noting effects. You may have to inject a relatively high level to start with.

You can use a signal generator on 100 KHz, and a detector and high impedance DC voltmeter, or a CRO, at the input and output of each section of the filter, and determine if the tuning slug has some effect. If so, then the section is probably working.

Note, again, that the first inductor L35 is live to DC.

You can test the crystal with a signal generator and CRO. And if your receiver has an audible ringing effect on Setting VN when tuned to a signal, then the crystal is probably OK, but its “activity” will be unknown.

You may have to resort to individual capacitor testing in the end. I tested about 30 % of capacitors in my filter and all tested OK for value and leakage. Check bypass cap C170, which in my unit was a rectangular shaped capacitor next to inductor L35.

You may be able to find open circuit top coupling capacitors with changed capacitance, by temporarily adding an extra parallel capacitor eg 15 pF for the VN Setting.

If your crystal is faulty, consider bypassing it with a 0.1 mfd ceramic capacitor, or just wire, and use Alignment Option "D". See later notes. Leave a note for the next owner inside the receiver outlining your changes.

Alignment and Adjustment

This is not a five minute job.

When you are satisfied that your filter is fault free, you can proceed to adjustment and final alignment.

You have to decide now, just how your filter, and your receiver, is to be used, because it determines how the filter is aligned.

The 100 KHz filter alignment is dominated by the presence of the crystal. The crystal is used as a band pass section, not as a notch filter. The crystal centre frequency, when used in the band pass mode such as here, determines the overall alignment frequency for all selectivity Settings. This is the essence of The Handbook Alignment Method.

You have a number of alignment options and choices.

A -The filter can be used in a "Heritage Receiver" which is restored with little or no modification, and in this case, aligned to the Handbook Method, and maybe with just a signal generator. This is quite an acceptable choice.

B - The filter can be aligned for best performance for use in actual reception service, mainly for SSB and AM modes.

C - The filter can be aligned as a compromise of the above.

D - The filter can be slightly modified so as to not use the crystal, but to then just use only inductors in the VN (Very Narrow) section.

E – Other arrangements, even modifications to use discrete mechanical or crystal filters. Refer to other Eddystone variants for this filter for ideas and suggestions.

I chose Option C for my "Heritage Receiver", using a Sweep Gen, and with a minor final tweak to ensure Setting VN was workable. I am quite content with the result, and it is a little better than I originally expected.

Crystal Phasing Control Capacitor

Capacitor C198 supposedly balances the crystal and holder capacitances with itself, and shifts the crystal series frequency slightly, which I found was about 20 Hz either side of nominal centre. This shift is not symmetrical around the centre frequency. Its variation affects the selectivity of Setting VN only very slightly. It can be left alone during actual alignment, perhaps left midrange, and possibly tweaked for compromise at the end. The effect of the capacitor is quite hard to see, and best seen on a slow Sweep Method. If you are in any doubt, adjust it to half mesh, and leave it alone. The spindle is live to RF.

This tiny variable capacitor has very closely spaced plates, and is vulnerable to old age wear through use. If your capacitor is damaged, consider leaving it physically in situ, but replace it electrically, with a 12 pfd fixed ceramic type.

You should use a “High K” capacitor for low loss. If you cannot source a High K capacitor, use an ordinary ceramic type, but checked first for high leakage resistance.

The variable capacitor benefits from a tiny drop of non drying lubricant (Not WD40 et al) on the spindle.

IF Alignment – Receiver Settings

The Handbook is a little vague on a few aspects.

The receiver is set up for 100 KHz IF alignment so that it is operating as a single conversion receiver, with only a 100 KHz IF.

Follow the Handbook. You should switch AGC OFF and turn the IF Gain to MAX.

The sig gen RF level should be as low as is reasonable to enable tuning for a response, and high enough so as to not have too much noise. Start with 50 uV, then if too high, try 10 uV.

Overall Receiver AGC Onset is about 3.0 uV, so leave AGC OFF.

To take some Sweep Gen photos, I normally raised the sig gen level 5 dB or so above alignment level to partially suppress visible noise on the CRO trace.

Sig gen should be CW only.

Sig gen must be very stable, especially for the adjustment in VN or N modes. An analog sig gen may be unsuitable.

Caution with Trimtool Pressure

When using the trimtool for adjusting inductors, use as low a hand pressure on the adjuster as possible to avoid stripping the adjuster internal “thread”. It is flimsy and vulnerable to damage.

Do not ignore this cautionary advice.

Alignment Option A – Handbook Method

This method works, and possibly like me, you will keep coming back to this as a standard sequence.

The idea is that you first find the actual filter crystal frequency, as used in this particular filter circuit, as its frequency changes a little when used with other components. The filter is first switched to Setting VN, then the sig gen is slowly and very carefully tuned for peak amplitude response, and the frequency is noted. Caution as some digital sig gens have a minimum step of 10 Hz, which may be too much. My crystal frequency is 100.050 KHz and varies about 5 Hz with temperature of my workshop. I was lucky that my new Sweep Generator frequency can be manually stepped up and down with 1.0 Hz steps.

Note that you do not adjust the filter in any way on Setting VN.

You are just finding the crystal frequency. And you must use the handbook method, as the crystal frequency will be different in circuit, to that when it is checked out of circuit.

Then, the filter is switched to Setting N and all inductors are peaked very, very, carefully, then repeated. It is absolutely imperative that you use a visual device for indication the peak, and not do this by ear.

This Handbook Method will give an acceptable alignment, but the centre frequency for peak amplitude response of the four selectivity settings will be different, especially on Setting VN. There will be some band pass ripple, especially on Setting SSB, and the AM (Wide) band pass may be lopsided.

It does not matter that the centre frequency for peak amplitude response of each of the four selectivity settings will be slightly different, and off-centred from 100.000 KHz. With a fully analog receiver like the 1830, it just means that in normal reception, you very slightly adjust the Main Tuning off the exact Transmission Centre Frequency. For more modern receivers with much more exact oscillators and dial frequency readout, the demodulation oscillators are set precisely to Fc +/- zero Hz for CW, and then for SSB, the IF BW response of say 300-3000Hz is positioned exactly either side of Fc for USB and LSB.

My filter originally had the following "centre" frequency response –

VN	100.09 KHz	N	100.3 KHz	SSB	100.3 KHz	AM	101.5 KHz

Note that the centre frequency of the crystal Setting VN is just higher than the natural crystal frequency.

The final selectivity for each Setting was very close to Handbook Specification, except that VN was very susceptible to some variation.

Eddystone must have adopted this alignment procedure as they knew the filter was a compromise and a little difficult to align, and with a crystal setting, and they knew that few maintainers would have a sweep generator.

Anyway, as a matter of process, with my filter, if I got out of step, or had to start all over, I always came back to the Handbook Method.

After alignment, and in normal receiver use, the AGC action will compensate somewhat for the various responses of the IF. Any lopsided shape of Setting AM is not of any real consequence, and you will not hear it on reception.

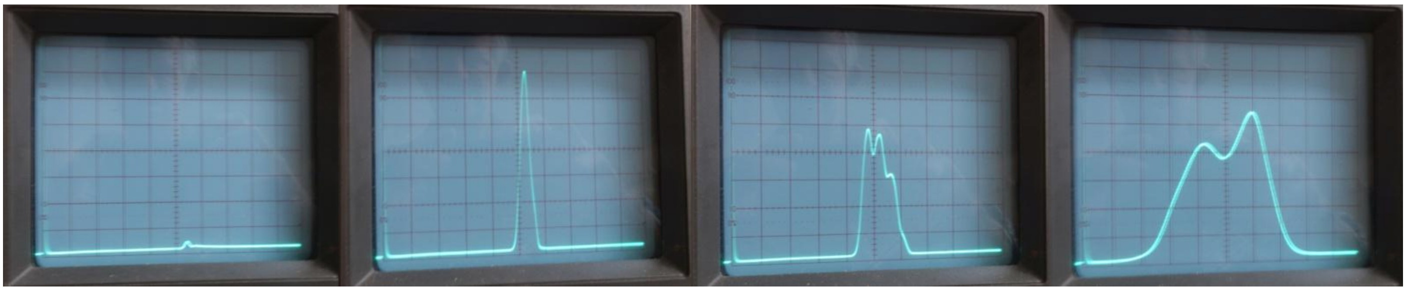
Sweep Photos for Alignment Option A from left to right, VN, N, SSB, AM

The following quad photo was taken after a Handbook Method only, and using a signal generator only.

Start 90 KHz End 110 KHz, ie 2 KHz per cm, Sweep Interval 50mSec. Camera 0.25 sec. Using 1830 "detected" IF OUT.

Note the quite low amplitude for VN, but AGC action will mostly overcome this for signals more than 10 uV. The actual receiver performance is better than it looks here for VN. I was using a relatively low RF injection level.

The CRO Y axis amplitude differences reflect real differences for all four Settings, with the receiver AGC OFF.



Alignment Option B – Handbook Method Modified For Best Receiver Performance for SSB and AM ONLY.

This requires a sweep alignment, and the filter is then adjusted for better SSB and AM response, and compromise for actual CW reception mainly using Setting "N". Setting VN is almost ignored.

Start with a Handbook alignment.

Switching between the four BW Settings, Tweak inductors primarily for minimum ripple on SSB, flatten the AM, and obtain a compromise with N. It is all a compromise; do not expect excellent or textbook results

The filter response centre frequencies will be different for each BW Setting; ignore this aspect, as in Option A.

To a degree, ignore the VN response, but ensure that there is sufficient amplitude response to actually still function.

If you do not have a Sweep Generator, start with a Handbook alignment, very carefully peak on Setting N, then tweak for some response on Setting VN, whilst not affecting the peak on other Settings too much. Then, optimise for peak response on Setting SSB. Setting AM should then be quite OK, as Setting AM is broader with adjustment.

On Setting VN, rock the sig gen frequency a very small amount around centre response to see if it not too flat on the high side. If so, tweak L38 and L39 just a tiny amount for less flattening response, whilst maintaining all other compromises.

Again tweak for a peak on SSB, provided that you do not have to turn the adjusters too far.

Recheck all Settings for an acceptable response.

Sweep photos will be very similar to those for Setting SSB and AM for Option C.

Alignment Option C – Handbook Method, With Some Alignment Compromises

Start with a Handbook alignment, then check Option B details if you do not have a sweep gen.

Then, switching between the four BW Settings, tweak all inductors for minimum ripple on SSB, flatten the AM, and obtain an acceptable response with Setting N. It is all a compromise; do not expect perfect or textbook results.

Recheck that Setting VN is still useable, and that all Settings are OK. Optimise VN with capacitor C198.

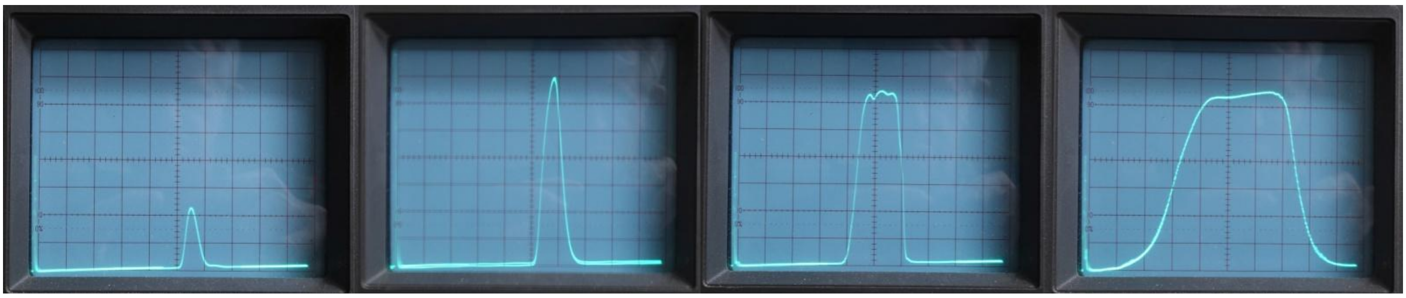
You probably do need a Sweep Generator for this option, and it is the best way to align the filter, and to give you confidence.

Sweep Photos for Alignment Option C from left to right, VN, N, SSB, AM

Start 90 KHz End 110 KHz, ie 2 KHz per cm, Sweep Interval 50mSec. Using 1830 IF OUT, and an external detector.

Note low amplitude for VN, but again, AGC action will mostly overcome this for receiver signals more than 10 uV.

Note also that the bandwidth of VN in reality is actually narrower than this visualisation, which is using a fast sweep rate.



There are some compromises here, but this is how I have left my receiver IF Filter alignment.

Alignment Option D – Filter Modified to Bypass the Crystal

Only applicable to Setting VN.

Consider this approach if your crystal is faulty.

First modify the crystal stage so the circuit looks like Setting N instead of VN. Circuit is on page 12 of the Handbook.

This bypasses the crystal, and uses inductor L38 as just one more LC filter element.

No tried in full, but I did have a temporary lash up which gave good amplitude response and a -6dB "visual" bandwidth of about half that of Setting N.

This looks very promising for a user receiver, and removes that "ringing" effect.

For interest, whilst I was experimenting with this Option D, I wired the crystal out, and fed the sig gen into the top of L39, and was able to tune L39 for a response peak on both sides of the nominal 100 KHz.

Alignment Option E – Other – Modifications, Including Discrete Filters

Not tried.

Eddystone has some variants of this filter with discrete mechanical and crystal filters.

Collins made 100 KHz mechanical filters at one time, and these may be available ex equipment suppliers.

This Option is mentioned for suggestion and completeness only.

Alignment with Setting VN Frequency Only, Instead of Setting N

You might wonder what happens if you adjust all the inductors with Setting VN selected.

In this case, it all will peak, but the response on all other Settings is well down, as the centre frequency peaks are all at different frequencies, and performance is not good and the receiver sensitivity suffers..

Alignment at say 5.0 MHz

You might wonder what happens if you align the 100 KHz IF unit by injecting signals into the receiver antenna socket at say 1, 2, 5, 10 MHz, but you will just get much the same response as at 100 KHz. It does work, and it also works with a sweep gen. It is somewhat affected by frequency drift of the 1830 mixer oscillators. These days, your digital signal generator is likely to be much more stable than your receiver oscillators. The IF Filter is best aligned at 100 KHz.

Alignment Test Results

Generally speaking, my receiver and the filter met specifications for selectivity on all Settings, and I found that is rather pointless in testing and recording the exact band pass characteristics here in complete detail. You can gauge the bandwidth from the photos.

I will not be elaborating here on Selectivity Test Results of my receiver more than this.

There is a little more detail in the Receiver Article.

Vinkors

This Eddystone 100 KHz IF filter uses Mullard brand pot core inductors called “Vinkors”.

There is a range of pot core sizes, and this Eddystone 100 KHz Filter uses the 14 mm diameter range, Mullard part LA1230. The assembly comes with two ferrite half cores, a plastic winding bobbin and an outer metal case holder, and sometimes with an adjuster, as in our filter. The adjuster is supplied separately.

ADJUSTABLE POT CORE
for high quality inductors
to BS4061—range 1—ref 3

14mm VINKOR
LA1230
μ_e 100

AVAILABLE FOR CURRENT PRODUCTION;
FOR NEW DESIGNS REFER TO RM INDUCTOR CORES, BOOK 3 PART 4

Frequency range for which the Q-factor is normally greater than 100 .. .. 8 to 700kHz

Material .. .. Ferroxcube grade A13

Standard adjuster LA1505

ELECTRICAL AND MAGNETIC DESIGN DATA FOR CORE ASSEMBLY

Parameter		Symbol	Measuring frequency (kHz)	Value without adjuster	Derived value with standard adjuster (note 1)
Effective permeability		μ_e	<10	92.04	100
Turns factor (turns for 1mH)		α	<10	78.90 ±1.5%	75.69
Inductance factor (nH for 1 turn)		A_L	<10	160.6 ±3%	174.5
Residual plus eddy current core loss tangent		$\tan\delta_{r+F}$	30	$<0.31 \times 10^{-3}$	$<0.32 \times 10^{-3}$
			100	$<0.57 \times 10^{-3}$	$<0.60 \times 10^{-3}$
Hysteresis loss tangent at $\hat{B}_e$ = 1mT (note 5)		$\tan\delta_h$	4	$<0.11 \times 10^{-3}$	$<0.12 \times 10^{-3}$
Temperature coefficient (ppm per degC)	5 to 25°C	α_L	<100	0 to 143	0 to 150
	25 to 55°C				

Ferroxcube

Vinkor pot cores (

Violet range
Ferroxcube grade A13 (3H1)

Size (mm)	Type No.	Standard adjuster	Effective permeability (μ_e) with adjuster in mid-range position
10	LA1421	LA1383	100
	LA1422	LA1383	63
	LA1423	LA1383	40
12	LA1418	LA1383	100
	LA1419	LA1383	63
	LA1420	LA1383	40
14	LA1228	LA1505	250
	LA1229	LA1505	160
	LA1230	LA1505	100
	LA1417	LA1506	63

I removed Vinkor L39 totally from my IF filter box, as I had an adjuster which was stuck at the bottom of adjustment range and it could not be adjusted back out ie counter clockwise.

I resolved to disassemble the L39 Vinkor for repair.

I removed the Vinkor from the IF Filter Assembly, and this was a real test of dexterity, but it is possible.

(I now know that the adjuster can be “renovated” in situ in the filter, and without removal or disassembly of the Vinkor. Such is life).

Photo of IF Filter with one of the Vinkors, L39, ringed in dark blue, and also shows the cramped filter box.

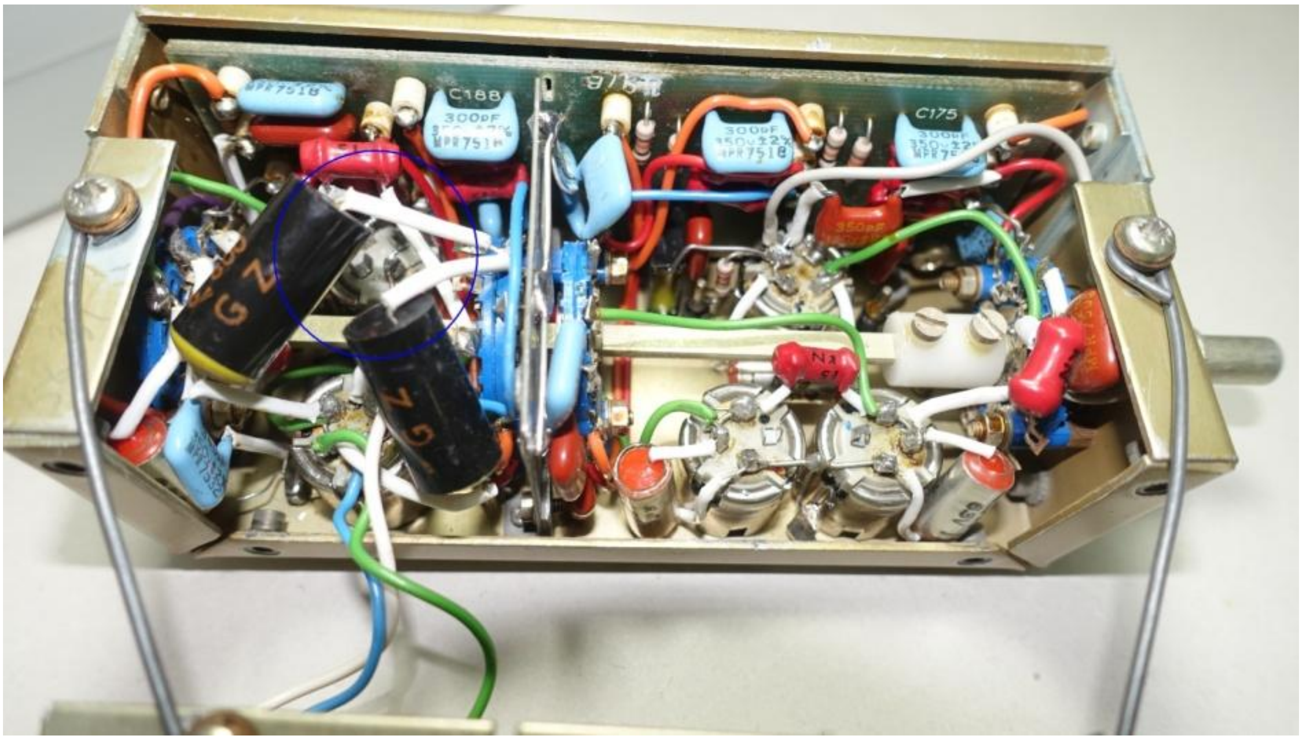
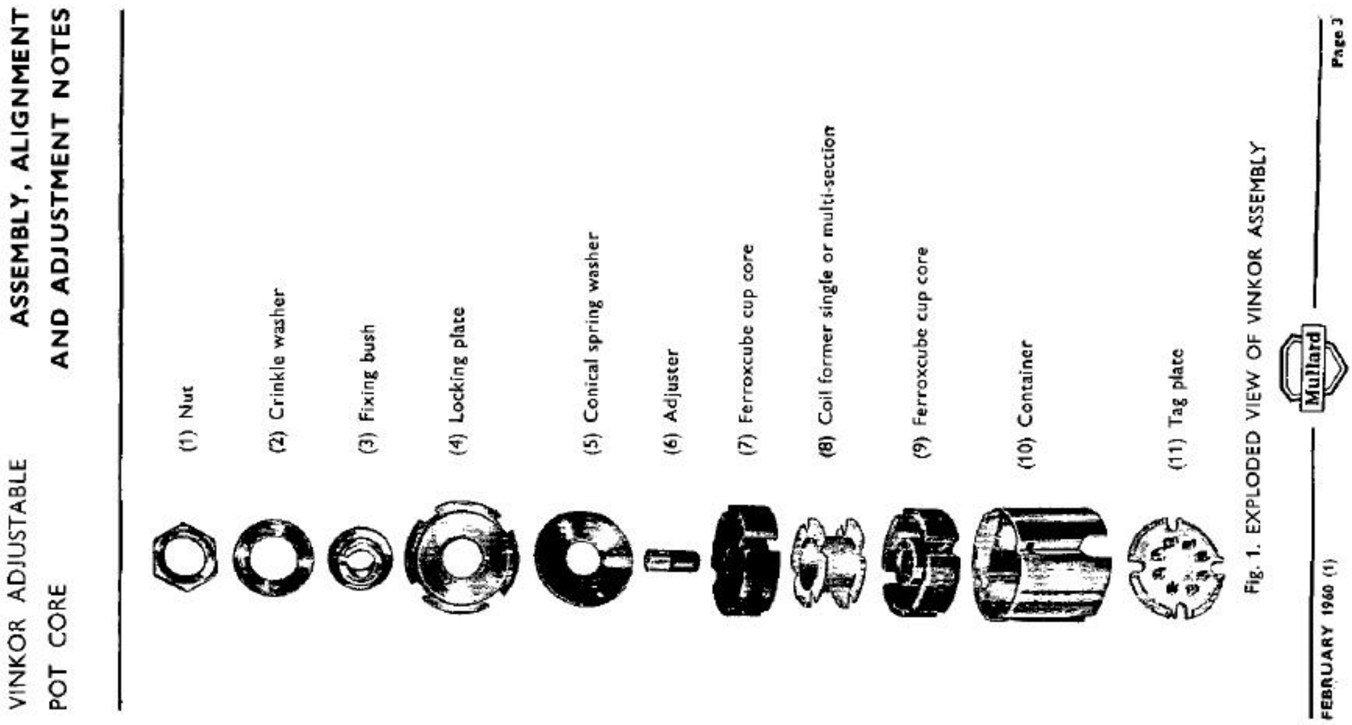


Diagram of Mullard Vinkor Parts



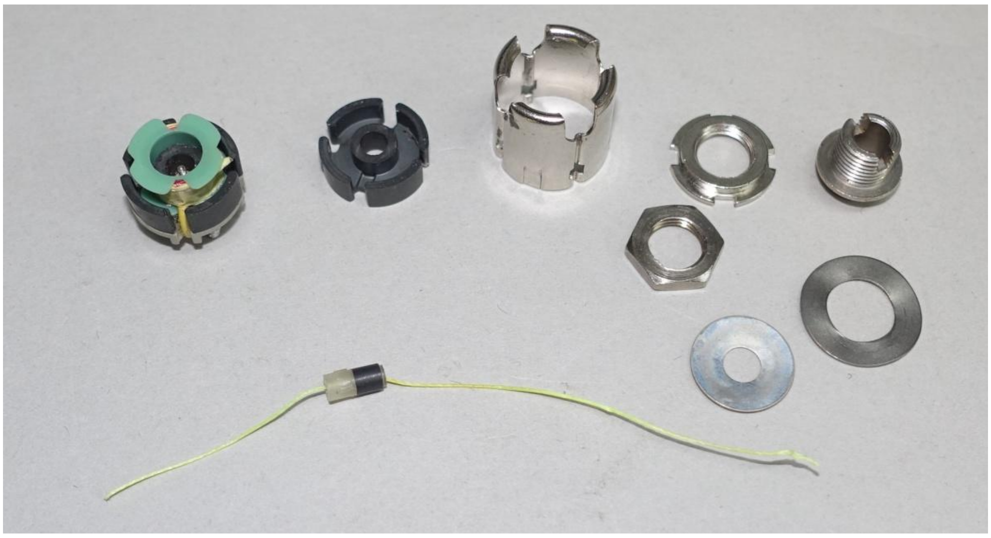
My Vinkor had a type of clear lacquer sealant through the entire device.

I removed the top metal attachments, including the rotating plate.

After a one hour trial soaking in methylated spirit, I discovered that the lacquer had softened.

I left it overnight in the mild solvent, and then next day, pushed out the cores from the metal case, with slight force. No solvent damage to Vinkor plastic bottom, plastic bobbin, adjuster, or to insulating tape over the winding. The softened lacquer soon dries hard again, so be mindful of this, and clean up all lacquer just after the solvent bath. Your Vinkors may not have lacquer, or have a different type, and thus require a different solvent; be very cautious!

Photo is my L39 Vinkor, disassembled.



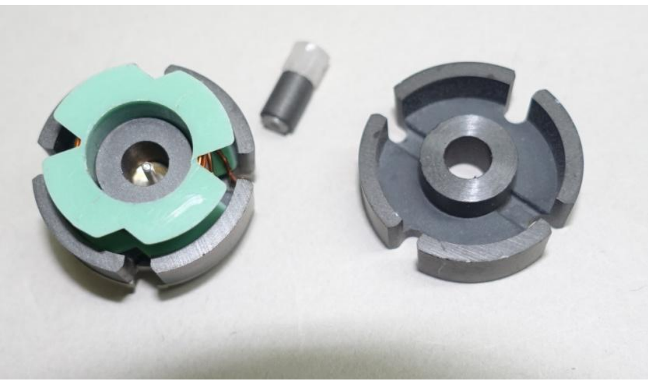
Note that the thin yellow stuff going through my "adjuster" is the braided fishing line referred to later, and is not in the original Vinkor.

I did not desolder the winding as there was no need.

The two Ferroxcube half cores are 14 mm outer diameter, each of 4.5 mm thickness, and with a 3.61 diameter mm inner hole. My cores were marked LA1229, 7445K. I assume that my adjusters are Mullard part LA1505. Refer Mullard notes for details.

The bottom core has a central threaded metal spigot of about 1.0 mm diameter and with a right hand thread, and it is glued to the inner bottom of the bottom core. Some core variants have this spigot glued to the outer bottom of the bottom core.

Photo of Cores and Adjuster



The adjuster is a small plastic part with a ferrite “skirt”. It is possibly moulded nylon, or a type of polyethylene.

The adjuster is 7.0 mm long and 3.2 mm outer diameter, and it has three tiny 0.25 mm protrusions on its outer surface at 120 degrees each, to presumably act as rotational guides when it is mounted in the centre hole of the outer cores.

Photo Mullard 14 mm Vinkor Adjuster LA1505

The adjuster has an adjustment depression in the top, which is of rectangular shape, and is 1.75 mm long, 0.8 mm wide, and 2.0 mm deep.

The adjuster bottom is moulded to have a central hole possibly about 0.8 mm diameter and about 5.0 mm deep, and with three very tiny (hard to see) internal protrusions at 120 degrees each to act as the internal “thread” section of the adjuster.

There is also a central hole of maybe 0.6 mm diameter through the whole length of the adjuster.

When you see the small Vinkor parts, and you see just how flimsy the adjustment mechanism is, you shake your head in horror. Mullard apparently made an even smaller Vinkors, the 10 and 12 mm ranges, but these had no adjusters.

I did some internet searches to find replacement whole Vinkors and particularly the adjusters, not expecting any availability of these items, and could not find the exact part, and only very limited information.

You possibly could buy some spare new or used adjustable 14 mm Vinkors. If you buy Vinkors, ensure that they have adjusters fitted, before purchase, as the adjusters were originally sold as separate items.

The Eddystone User Group Spares gentleman lists some items, and these MAY be available; not confirmed.

MMG Ferrites of India, who make modern copies of the Vinkor Range, and who acknowledge such heritage, list some adjusters but I cannot confirm suitability. MMG “adjusters” part numbers 64-4813-66 and 64-4814-66 are interesting.

So, I am trying to fix an adjuster with stripped inner “thread” from inductor L39.

I thought of filling the adjuster bottom with plastic glue or similar to renew the internal thread, but it would be difficult on such a small item. Few other solutions to the problem of a sloppy adjuster are feasible. If the Vinkor was a larger size, it might be possible to be creative and use a threaded Neosid ferrite or P.I. core in a plastic former somehow.

I thought about drilling out the core centres, (diamond drill required here) and use a larger standard type threaded ferrite or PI core, but I realised that the drilling action would alter the permeability so much as to completely change the inductance.

An Idea is cast.

Then, I bought some “braided fishing line”, threaded it through the adjuster central hole, and doubled it back along its outer length, and inserted the whole adjuster back into the assembled Vinkor. The inner line acts as material for adjuster internal thread use, and the outer line acts as a damper on adjuster rotation in the core hole. The line feels a little stiff to start with, but crushes slightly in this usage and becomes softer, and separates into strands.

No need to *cast* aspersions on this method, You will be *reely hooked* by its simplicity. I was *all at sea* beforehand, and most possible alternatives looked *fishy*.

You must use modern braided line, not ye old braided line of yesteryear’s “Ye Compleat Angler” with different material. Silk was sometimes used. You cannot use silk as it is too fragile, nor monofilament nylon line as it does not crush.

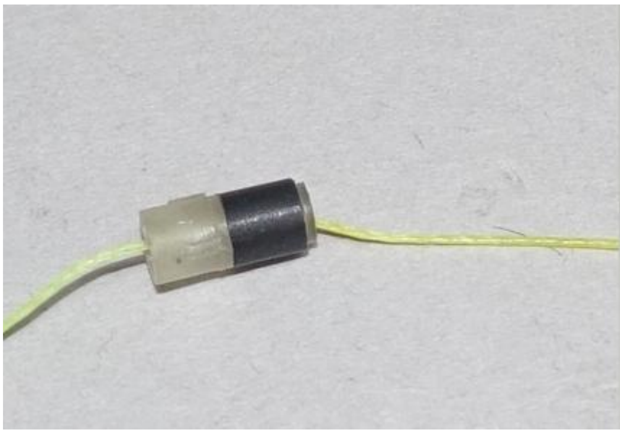
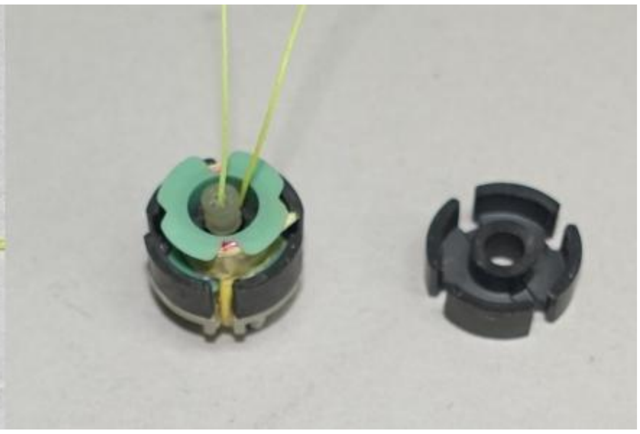
I used 0.3 mm diameter (30 lb strain) braided fishing line made from “Dyneema” material, a type of tough polyethylene (UHMWPE), and I chose this deliberately as it is strong, durable in this “threaded” situation, and slightly slippery.

The exact type that I used was USA made “SpiderWire” Ultracast, Ultimate Braid 30 lb, 0.3 mm dia., and made with 8 strands.

Before inserting the line, I “drilled” out the adjuster central hole with a 0.8 mm diameter drill (common for PCB work) and held in a Jeweller’s Hand Drill Holder. This makes insertion of the line easier.

To cut this type of line cleanly is quite a feat, as it resists scissors and wire cutters, so I used a small hand paper knife (like a scalpel) and with an angled cut.

I made my pieces of line quite long, perhaps 40 mm, and it hangs out the end of the adjuster and the Vinkor, but does not get in the road, and amazingly, does not impede adjuster use in tuning with a trimtool in any way. This also makes it easy to replace, as you can rotate the adjuster CCW all the way out, then use tweezers to extract the adjuster from the Vinkor.

This method worked so well, that after all work, and before final filter alignment, I inserted “line” into all my adjusters, as I had played with all adjusters at length, developing techniques.

And, this method is non-destructive and all can revert to original. The Vinkor is not modified in any way.

This type of fishing line is now common, and should be widely available.

Vinkor Adjuster Removal from Inductor Body

To remove the adjusters from the Vinkors whilst they are still in the IF Filter box, I suggest that you rotate each adjuster fully CCW, ie fully out, then push in with your trimtool with just a little more pressure, and see if the adjuster wedges itself onto the tip of the trimtool. This worked with all but one of my adjusters, and I had to use a slightly different trimtool, and it then also worked. Failing this method, I had resolved to make up a micro tube adapter for a vacuum type process, using mouth vacuum as a start, then reduced power vacuum as a last resort. Be careful with this method!

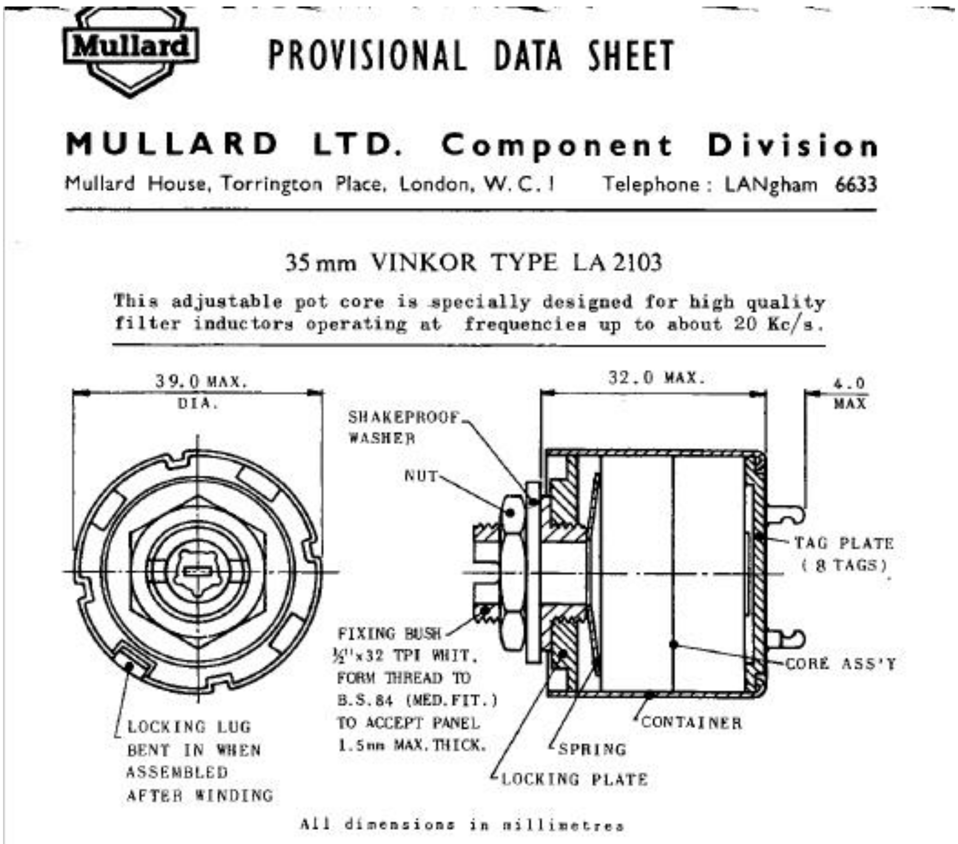
You might also try using a hypodermic syringe needle of say 0.8mm diameter, and insert the tapered point into the adjuster central hole, slightly jamming it until removal by rotation is achievable. Also, try various sizes of stiff wire, after angle cutting a point on one end. Not tried, but these may work.

Again, take caution when you are aligning the filter and are adjusting the inductors. If you are at the CCW outer end of adjuster travel, there is a risk that the adjustor will be accidentally totally withdrawn from the inductor, and then dropped or lost. This once happened to me. I found it on the bench. Deo Gratia.

Vinkor Assembly

If you actually disassemble a Vinkor, and there is normally no need to do so with the IF Filter, then there is a correct way to reassemble.

Refer to drawing. (This is really for a 35 mm Vinkor, but assembly is the same. Ignore types and dimensions on the diagram).

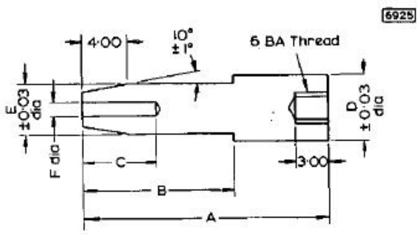


The “belled” tension washer must point outwards. The tab in the outer case should be pushed in to lock just a little, or else it will break off. The dual threaded part can be “firm” in the Vinkor metal “plate”, but the outer fixing hex nut should be “quite firm”. Oddly, I have Vinkors with both 11.0 mm and 11.50 mm AF nuts.

The threaded part for the 14 mm Vinkor is ISO metric 8.0 x 0.8 mm.

Mullard actually made and sold special assembly “alignment pins” for Vinkors which fitted over the core spigot during assembly, so that the two ferrite cores, and washer, aligned well along the axis of the spigot. I cannot determine if Mullard made such a device for 14 mm Vinkors. See applicable drawings.

The following photo of An Alignment Pin is NOT for our type, and is shown only for illustration.



You don’t really need this small tool for just a few Vinkors, but the bottom and top cores, and the bell washer must be aligned exactly centrally, or else the adjuster cannot be inserted or withdrawn, and that means that braided fishing line cannot be used to “restore” some adjuster thread. The bell washer particularly can partially obscure the Vinkor core holes.

So, after Vinkor reassembly, double check that adjusters will not snag on anything and can be inserted and withdrawn after assembly.

If you insert the adjuster AFTER Vinkor reassembly, and it inserts successfully and turns OK, then you are guaranteed that it can be also removed.

As a last part of “renovation”, and before final tuning of my filter, I renewed the “fishing line” in all my inductors.

Note that the IF Rejector L11 in the RF Box is also a 14 mm Vinkor. I left mine alone, after RF Box alignment was OK.

Good luck and best wishes to all.

VK4GV.

You can contact me via the Yahoo Groups Eddystone Forum.

References –

Check for possible additional files and photos on the Yahoo Eddystone forum, and for later issues of this doc.

Eddystone 1830/1 Handbook, Issue 3, available on the Eddystone User Group website.

Eddystone 1830 Receiver Notes by VK4GV Issue 2, available on the Eddystone User Group website.

Mullard Components Catalogue 1974 et alia, and various Vinkor articles, ex web search.

MMG India website for ferrites etc.

Neosid website.

ARRL Handbook, various years, for hybrid combiner construction details.