

THE DATONG FL-3 MULTIMODE FILTER

Rowland Archer

INTRODUCTION

Prior to using the Datong FL3 Multi-Mode audio filter, my experience with signal improvement with an audio filter was mixed at best. The typical scenario ran like this: tuning around with the audio filter switched off, I'd find an interesting signal that was bothered by a heterodyne or slop from an adjacent channel. OK, flip on the audio filter and start playing with the controls. Bring down the highpass cutoff to get rid of the interference...and there goes the desired signal at the same time! Notch out the heterodyne...and say goodbye to the useful audio portion of the DX target. After a couple of minutes of tweaking, I'd do an "A/B" comparison between the raw signal from the receiver and the filtered signal...and at best, it was usually a coin toss as to which signal would deliver more useful copy.

I am eternally optimistic, so when I read the advertising copy for the Datong FL3 audio filter I decided to give it a try. The especially attractive thing was the automatic heterodyne killer. Advertisements said this little critter could find heterodynes and notch them out by turning the unit on and pushing a button. Jeanne Ferrell at Gilfer promised I could return it if not satisfied, so the downside risk was under control. One surprise was that the already pricey \$259.95 filter did not include an AC adapter; it requires 10-15VDC at 400mA. Gilfer will sell you the appropriate adapter for \$15.95. If you don't want the auto-notch feature, you can buy the FL2, which is an FL3 without auto-notch, for \$179.95. Check with Gilfer or Electronic Equipment Bank for current prices.

So what do you get from an audio filter that costs more than a good portable receiver? You get a unique, automatic notch filter that kills hets in under a second with NO KNOB TWIDDLING. There's a second, manual notch filter so you can kill TWO hets with one FL3. You get a pair of independent 5 pole high pass / low pass filters which can tune from 200 to 3500 Hz, providing a cut off rate of 40 db in 500 Hz at 2 kHz, and 40 db in 120 Hz at 500 Hz. These are excellent specs.

The skirts of these filters are very steep and the top of the filter response curve is quite flat, as seen in Figure 1. It's difficult and expensive to design a filter with a response curve like this. It takes multiple stages of filtration and high quality parts. This, plus the auto-notch, accounts for the premium price of the Datong FL3.

The flat top of the filter curve means that the FL3 provides linear response across the passband, or the portion of the signal that you want to hear. The steep skirts mean excellent selectivity. You have a much greater chance of eliminating the QRM without eliminating the desired signal than with a filter having less steep skirts.

In practice, if the QRM you want to eliminate is higher or lower in audio frequency than the signal you want to hear, the FL3 can probably get rid of it. If the QRM covers the same audio frequency range as your desired signal, no high pass / low pass filter arrangement, including the FL3, can help.

SETTING UP THE FL-3

Setting up the Datong FL3 is very simple. The speaker or headphone OUT jack from your receiver goes into the INPUT phono jack of the FL3. The output phono jack goes to a 4 to 16 ohm speaker, 4 ohms preferred for max output. Datong includes two cables terminated with RCA phono plugs to fit

the FL3, and tinned leads on the other end. You have to connect the tinned leads to the appropriate connector for your receiver. If you order an FL3, you may want to get the appropriate cable ahead of time from your favorite local electronics outlet.

The FL3 also has a 680 ohm TAPE OUTPUT RCA phono jack, which produces filtered, non-adjustable LINE level audio (as opposed to MIC level) for your tape deck or recorder. I prefer to record raw audio directly from the receiver; this way you get "all" of the signal, including QRM and hets. I run all my receivers through an old Dynaco stereo amplifier, and the output of the Dynaco goes into the FL3. When I'm finished taping my DX session, I can replay the tape over and over, trying different settings on the FL3 until I get the best copy. With this setup you can still use the FL3 to filter audio while you are DXing—but what you RECORD comes directly out of the receiver, ahead of the FL3 and untouched by it.

There's a 1/4" phone jack on the front panel of the FL3 for headphones. When you plug your headphones in, the speaker output is disabled.

OPERATION

Let's review the front panel of the FL3, to get a feel for the controls. From the left, you will find:

Auto notch pushbutton and LED: When engaged, the FL3's automatic notch filter "het killer" is in operation. The het killer sweeps the audio range from 200-4000 Hz, looking for a het. If it finds one, it locks on in less than one second and notches it out. The auto-notch LED lights up to tell you the filter is engaged. The auto-notch uses a voltage tuned 2 pole notch filter in a phase lock loop system. The notch is 40 db down, and it's very sharp and effective.

If there is more than one het present, the one that gets notched is simply the first one encountered in the (audio) frequency sweep search. This may or may not be the louder of the two. You can use the manual notch to eliminate the other one. If there are more than two annoying hets, try again tomorrow!

In practice there are two minor annoyances with this otherwise super feature: a quiet "whooshing", sweeping sound is heard as the het killer searches for a het to kill. This is subtle enough that you might



not notice it; if it bothers you, you can just turn it off until you encounter a heterodyne whistle. In fact, if you tune in ECSSB most of the time you will probably want to leave the auto-notch off until you need it, so you don't accidentally notch out a het that indicates the presence of a desired weak signal.

The second problem may indicate a need for adjustment of my unit. The overall volume of the signal going into the FL3, and thus into your headphones, has to be a bit high for my taste before the het killer will lock onto the het. I've never found a het that couldn't be notched out with the FL3. I do find the total volume needed before the het killer will engage to be louder than a comfortable listening level.

Low and high pass filters: The heart of the FL3 is a very versatile set of audio filters. There are two independent 5 pole filters, one low pass and one high pass, that can work in three different modes: SSB, CW, and RTTY. SSB mode really means "voice", as it works fine for AM mode signals, too. In fact, according to Datong, it's even useful for SSTV reception.

The four pushbuttons just to the right of the on/off pushbutton let you choose between the various filter modes. There are three different SSB modes: SSB alone, SSB + NOTCH, and SSB + PEAK. The notch/peak settings switch in a separate, manually tuned, 2 pole filter. This filter is 200 Hz wide at 6 db down, and tunes from 200 to 3500 Hz. If the station you want to hear is bothered by two hets, you can eliminate one with the auto-notch filter and the other with the manual notch filter. The SSB + PEAK setting is not for listening, but instead is a tuning aid for the manual notch. Select SSB + PEAK, tune for maximum strength of the het, then select SSB + NOTCH, and voila!, the het is gone.

On the righthand side of the front panel there are three knobs, calibrated from 200 to 3500 Hz. The function of these knobs depends on the configuration of the SSB/CW/RTTY mode pushbuttons.

In SSB mode, the middle knob controls the cut-off frequency of the low-pass filter. In other words, frequencies lower than the indicated frequency are suppressed. The rightmost knob controls the setting of the high-pass filter; frequencies higher than indicated are eliminated. Both of these controls are smooth and precise with minimal backlash. The knobs are on the small side, but this is not a problem.

The left-most knob controls the manual notch or peak frequency. It is calibrated from 200 Hz to 3500 kHz in 500 Hz steps except for the first step, which goes from 200 Hz to 500 Hz.

In CW mode, the low and high pass filters are combined with the peak filter to provide a 12-pole signal with a peak on the desired CW tone. Alternatively, you can choose CW(2) mode, which eliminates the peak filter and just gives you the low and high pass filters. The function of the tuning knobs changes in CW mode: the middle knob shifts the center frequency of the filter, and the righthand knob controls the width of the passband. In CW mode, the frequency range tuned is half that of SSB mode: 100 to 1750 Hz. This combination of filters is very effective at digging out a single CW tone from a pileup, as long as the interfering signals are of different audio frequencies at the input to the FL3.

RTTY mode superimposes a notch at the center of the passband. I am not set up to receive RTTY so I can't comment on the FL3's effectiveness at digging RTTY out of the QRM.

There are two ways to BYPASS the FL3 in operation; when you turn the power off, your receiver audio passes straight through to the headphone jack. The second approach is to leave the power on but press the "SSB+PEAK" and "SSB" buttons together; this leaves the FL3's electronics in line but gives you level response, i.e. no amplification or attenuation.

IN PRACTICE

I am very impressed with the effectiveness and quality of the FL3. When I ordered this filter, I knew Datong had a good reputation; now I know why. It's expensive but I think it's worth it. This audio filter gets used instead of gathering dust. It's especially good at eliminating high pitched splatter from nearby signals and is deadly on hets. It doesn't distort the desired signal and the steep selectivity skirts let you dial up the exact audio passband you want to hear. Highly recommended.

TYPICAL PERFORMANCE DATA

- Input impedance: 5000 ohms
- Nominal overall gain: unity
- Low-pass and high-pass filters
Frequency range: 200 to 3500 Hz, linear tuning
- Minimum stop band rejection: 40 db
- Rate of cut-off:
40 db in 500 Hz at 2 kHz
40 db in 120 Hz at 500 kHz
- Notch and Peak filter
Frequency range: 200 to 3500 Hz, linear tuning
Notch width at -6 db in "SSB + NOTCH" mode: 200 Hz
Notch depth: 30 db
- Bandwidth range in "CW(2)" and "RTTY" modes:
100 to 1750 Hz at -6 db
- Bandwidth range in "CW" mode:
70 to 700 Hz at -6 db

Power output:
2 watts into 8 ohms with 18 v supply
1.5 watts into 4 ohms with 10 v supply

Output protection:
The output stage (LM380) is short-circuit proof and over-dissipation proof

Supply current:
50 mA zero volume
350 mA max. output

Supply voltage:
10 to 20 volts DC. Protected against reverse polarity

Size:
184 mm wide x 153 mm deep x 44 mm high (7.2 x 6.0 x 1.7 inches)
Feet add 10 mm (0.4 inches) to height

Weight including packing:
1100 grammes (39 ounces)

Finish:
Anodised aluminium wrap-around case. Panels printed white and yellow on black

Accessories:
Supplied complete with input lead and output lead (Phono to bare end)

Optional extra:
Mains Power Unit for 220-240 volts AC. Order Model MPU or MPU1.

FREQUENCY RESPONSE CURVES

Computer generated response curves for Model FL2 are shown below to illustrate the results obtained in the various operating modes. The graphs were obtained by solving the overall filter transfer function. Actual filters may differ slightly from the curves shown due to component tolerances.

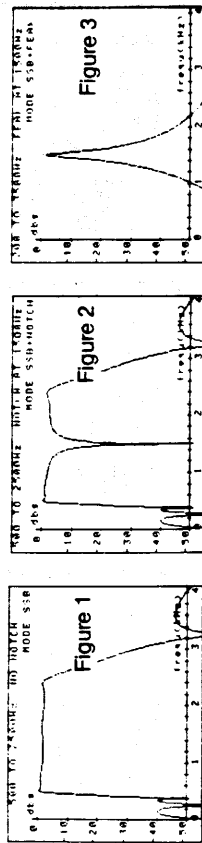


Figure 1 "SSB + NOTCH" - showing the steep skirts and the "flat-topped" response. Here only the low- and high-pass filters are in operation.

Figure 2 "SSB + NOTCH" - same conditions as figure 1 but the notch filter is also in circuit and set to 1500 Hz.

Figure 3 "SSB + PEAK" - conditions are identical to figure 2 but now the PEAK/NOTCH filter is set to PEAK instead of NOTCH. This mode is normally used simply as an aid in tuning the notch filter.

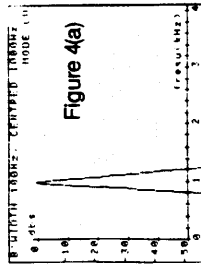


Figure 4(a), (b), (c) "CW" - showing the response in "CW" mode with a bandwidth setting of 100 Hz, 500 Hz and 1750 Hz. Note the "peaked" response and very steep skirts.

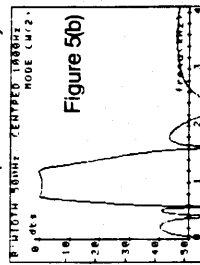
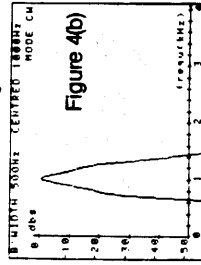


Figure 5(a), (b), (c) "CW(2)" - three graphs corresponding to those of figure 4 except that "CW(2)" mode was selected. Note the "flat" rather than "peaked" response.

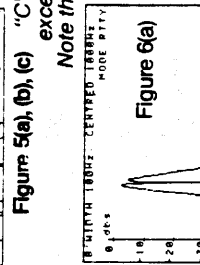
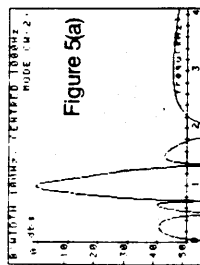
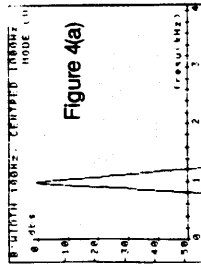
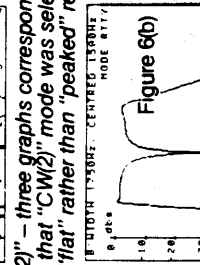
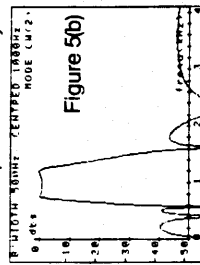
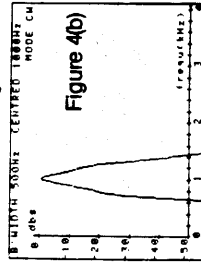


Figure 6(a), (b), (c) "RTTY" - three graphs using "RTTY" mode but otherwise with same bandwidth and centre frequency settings as figures 4 and 5.



Clayton Wood Close,
West Park,
Leeds LS16 6QE,
Telephone: (0532) 744822 (2 lines)