

## FEATURES

- ★ Twelve poles of tuneable active filtering bring a new standard of performance to receiver pass-band control.
- ★ Independent low and high-pass filters beat crystal filter standards of skirt selectivity yet cut-off frequencies are continuously variable from 200 to 3500 Hz.
- ★ Built-in independent notch filter.
- ★ Designed specifically to improve reception of SSB, CW, RTTY, AM signals in interference conditions.
- ★ Simple push-button selection of operating modes; three calibrated tuning controls with colour-keyed dual mode tuning.
- ★ All functions and controls are designed for convenient and natural operation.
- ★ Works with any receiver, no internal connection required. Simply connect in series with an external loudspeaker or phones.
- ★ Protected 2W output stage built-in.
- ★ 21 multi-function IC's including 32 op.amps.

## CONGESTION IS INCREASING

Today's crowded band conditions demand more control of a receiver's selectivity than most receivers provide. Conventional fixed bandwidth crystal filters are quite inadequate to cope with problems such as partially overlapping SSB stations, over-modulation splatter, very close-spaced CW stations, RTTY reception through interference, heterodyne whistles.

Model FL2 is designed especially to help in situations such as these and represents an important advance in current communications filter technology. It requires no internal modifications to the receiver and yet adds razor-sharp adjustable selectivity, plus notch filtering and has operating characteristics tailored to suit reception of SSB, CW, RTTY, SSTV and AM signals.

Not only does Model FL2 give independent control of upper and lower cut-off frequencies it has skirts which are noticeably steeper than the best current crystal filters. This gives a superb ability to separate wanted from unwanted signals and is especially effective in improving SSB reception in the presence of adjacent channel interference.

## APPLICATIONS

- ★ Removal of "monkey chatter" or "splatter" interference to SSB reception.
- ★ Removal of heterodyne interference to SSB or AM.
- ★ True single-signal CW reception.
- ★ Optimal bandwidth selection for RTTY and SSTV reception.
- ★ DX AM broadcast reception.
- ★ Gives the benefits of "IF shift" or "pass-band tuning" techniques without the drawbacks.
- ★ Any variable audio frequency filtering application where very sharp cut-off and continuous adjustment are important.

## STEEP SKIRTS ARE THE KEY

When an off-tune SSB station interferes with a wanted SSB station very sharp selectivity is vital if the interference is to be removed without also removing too much of the wanted signal.

It is equally vital that the selectivity curve can be smoothly adjusted to match the actual prevailing conditions.

Using modern active filter technology, Model FL2 gives upper and lower pass-band edges which can be placed anywhere between 200 and 3500 Hz, and which are steeper even than those of high quality crystal filters.

Not only does Model FL2 beat techniques such as "IF shift" and "Pass-band tuning" on sheer performance, it has the extra advantage that it can easily be added to any existing receiver since all the signal processing takes place in the audio output line between the receiver and its loudspeaker.

## THREE FILTERS IN ONE

The secret of Model FL2's knife-edge skirt selectivity is a pair of computer optimised 5-pole elliptic function filters, one high-pass and one low-pass.

A 2-pole notch or peak filter is also built-in, and is used either in combination with the low and high-pass filters for CW and RTTY reception, or alone as an independent notch filter.

Each of the three filters is continuously tuneable from 200 to 3500 Hz. Tuning is by voltage control and precision tracking between the three filters allows them to be used ganged together or independently. They are used independently for SSB modes and in combination for CW and RTTY modes. This simplifies operation of the unit.

## SUPERB FOR SSB RECEPTION

For SSB reception the three filters are controlled separately by three knobs directly calibrated in cut-off frequency. These allow the pass-band edges and the notch filter to be positioned anywhere between 200 and 3500 Hz.

For example, while the low-pass filter is removing 'monkey chatter' from an off-tune SSB station on the HF side, the high-pass filter can be removing similar noises from the LF side. Meanwhile the notch filter is always ready to deal with tune-up whistles as and when needed.

## SPECIAL TUNING MODE FOR CW AND RTTY

For CW and RTTY modes special op.amp. circuitry controls the three separate filters in such a way that one knob sets the centre frequency of the pass-band and a second knob sets its

width. This is highly convenient for CW and RTTY reception since one can first tune the filter to the signal and then expand or contract the bandwidth symmetrically to suit conditions.

The discrimination achievable in the "CW" mode is remarkable and results from the use of a total of 12-poles of filtering. Extreme skirt selectivity is achieved yet with minimum ringing effects.

An alternative CW mode, "CW(2)" uses 10-poles of filtering to give a 'flat' rather than peaked response. This mode is also ideal for narrow deviation RTTY reception.

For wide deviation RTTY a special mode is provided in which a notch is situated centrally in a 'flat' pass-band. This gives even greater interference protection.

## EASE OF OPERATION

The controls of Model FL2 have been designed to be self-explanatory and the unit is exceptionally easy to use despite its great versatility.

Single push-button selection is provided for the four main operating modes: "SSB", "SSB + NOTCH", "SSB + PEAK" and "CW". By depressing two buttons at once the additional modes of "CW(2)", "RTTY" and "OUT" are available. ("SSB + PEAK" is used for tuning the notch onto weak interfering tones. After tuning onto the whistle "SSB + NOTCH" would be selected to remove it).

When "OFF" is pressed power is removed and the complete filter is bypassed.

As discussed earlier the tuning arrangements for SSB differ from those for "CW", "RTTY" and "CW(2)". For clarity panel markings referring to the latter modes are printed in yellow. All others are printed white.

## INSTALLATION

### POWER

*FL2-10 to 15V*

A DC power supply of 10 to 20 volts is required. Connect the 3.5 mm rear panel jack with positive to jack tip. Incorrect polarity will not harm the FL2 but will stop it from working.

A suitable power supply can often be taken from the associated receiver.

**CAUTION** The jack will momentarily short circuit the power source as it is inserted or withdrawn. Therefore switch on the power unit only after connecting the jack, or check that the power supply is short-circuit proof.

### INPUT AND OUTPUT

Connect the "Input" phono socket of Model FL2 to the external loudspeaker terminal of the main receiver, or if preferred, to the phones jack of the main receiver. Connect a loudspeaker to the "Output" phono socket. Any impedance from 4 to 16 ohms is suitable but for maximum power output a 4 ohm speaker is recommended.

Two identical leads are supplied with Model FL2 for making the connections. They are supplied fitted at one end with a phono plug to suit the FL2. A connection to suit the receiver and loudspeaker should be fitted to the free end as required.

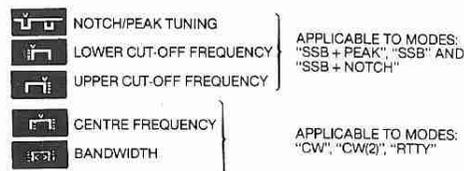
### TAPE OUTPUT

The "Tape Output" phono socket provides a separate output suitable for tape recording. The source impedance is 680 ohms.

## OPERATING INSTRUCTIONS

Model FL2 is very easy to operate. Simply select the desired operating mode using the push-buttons and then adjust the pass-band as desired using the knobs.

The knobs are labelled as follows with symbols representing the associated frequency response curve:



Labels which apply only to "CW", "CW(2)" and "RTTY" modes are printed in yellow.

Modes "OUT", "RTTY" and "CW(2)" require two buttons to be pressed simultaneously. All other modes are selected by a single button.

### "OFF" AND "OUT"

When the "OFF" button is pressed power to the filter is removed and the input signal goes straight through to the output.

When "OUT" is selected ("SSB + PEAK" and "SSB" both pressed in) the low and high-pass filters are in circuit but the overall bandwidth is set to maximum (200 to 3500 Hz) and the knobs have no effect.

Both "OFF" and "OUT" can be used for 'before and after' demonstrations of the effectiveness of Model FL2.

### SSB, AM AND SSTV RECEPTION

Press the "SSB" button and start with the lower cut-off frequency at minimum (200 Hz) and the upper cut-off frequency at maximum (3500 Hz). These controls can then be adjusted for best results on individual signals. "Monkey

chatter" interference to SSB signals can often be totally eliminated by lowering the upper cut-off frequency. Note the sharpness of the filter edges. Pressing "SSB + NOTCH" gives the same effects as in "SSB" except that a 200 Hz wide rejection notch is introduced which can be moved using the left hand knob to any point in the pass-band to remove interfering whistles.

If the whistles are weak, tuning the notch to the whistle may be awkward. If so, first select "SSB + PEAK", tune the undesired whistle for maximum audibility and then go back to "SSB + NOTCH".

The SSB modes are also ideal for improving results on AM stations, and for receiving slow-scan television signals (SSTV). In the latter case the calibrated controls allow the correct pass-band limits to be easily set.

### CW RECEPTION

In the main "CW" mode the low- and high-pass filters are combined with the "peak" filter to give a composite response having extremely good skirt selectivity plus a "peaked" frequency response. The latter helps when tuning a signal to the centre of the pass-band.

The alternative mode "CW(2)", obtained by pressing both "SSB" and "CW" buttons together, differs in that only the low- and high-pass filters are used. The response shape in this mode is "flat". In fact the response is exactly the same as in the "SSB" mode, only the method of tuning differs.

In both CW modes, tune the filter to the desired signal using the centre knob and adjust the bandwidth for best results. The bandwidth calibration (i.e. 100 to 1750 Hz) only applies in "CW(2)" and "RTTY" modes. In "CW" mode the bandwidth of the main skirts is as indicated on the knob calibration but the response of the narrower "PEAK" filter is superimposed. Its bandwidth is varied automatically in step with the skirt bandwidth.

At the minimum bandwidth setting in "CW" mode, the 3 db bandwidth is typically 40 Hz while the corresponding 40 db bandwidth is only 280 Hz. This kind of selectivity allows very effective discrimination between CW signals.

### RTTY RECEPTION

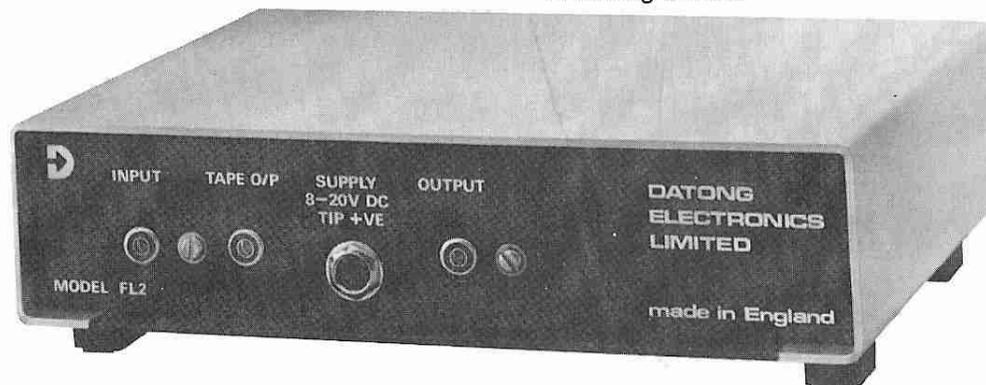
For narrow deviation RTTY signals the "CW(2)" mode is best. Simply set the bandwidth just sufficiently wide to include both the mark and space signals.

Initial tuning may be simplest if "CW" is first selected. With minimum bandwidth tune the filter to a point midway between the mark and space tones. Then select "CW(2)" and expand the bandwidth to the desired degree.

For wide deviation RTTY the special "RTTY" mode gives even greater interference rejection. This mode is like "CW(2)" but with the addition of a notch at the centre of the pass-band. As the bandwidth is varied, the notch width varies in step.

Since the FL2 frequency dials are calibrated, tuning to wide deviation RTTY may conveniently be done as follows:

1. Select "CW" with minimum bandwidth.
2. Tune separately to mark and space signals using the centre knob and note their frequencies.
3. Reset the centre knob to the frequency midway between the two measured frequencies.
4. Select "RTTY" (or "CW(2)") and set a bandwidth equal to the measured separation between the tones.



## 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 MPU/1.

## 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.



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

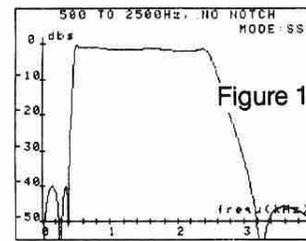


Figure 1 "SSB" - showing the steep skirts and the "flat-topped" response. Here only the low- and high-pass filters are in operation.

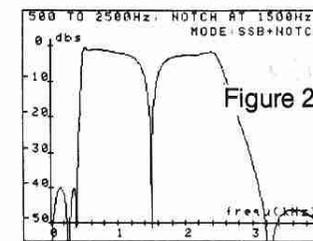


Figure 2 "SSB + NOTCH" - same conditions as figure 1 but the notch filter is also in circuit and set to 1500 Hz.

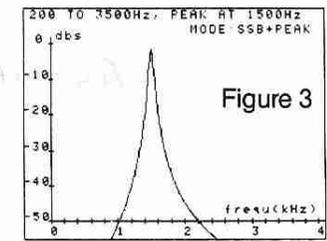


Figure 3 "SSB + PEAK" - conditions are identical to figure 2 but now the PEAK/NOTCH filter is set to PEAK instead of NOTCH. This mode is normally used simply as an aid in tuning the notch filter.

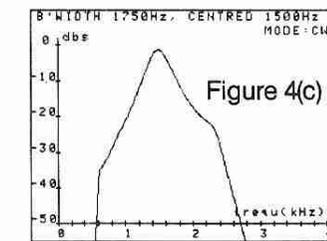
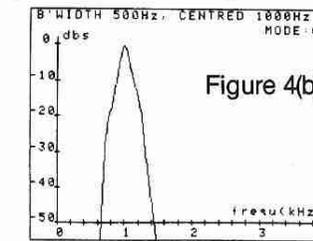
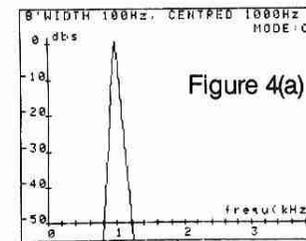


Figure 4(a), (b), (c) "CW" - showing the response in "CW" mode with a bandwidth setting of 100 Hz, 500 Hz and 1750 Hz. Note the "peaked" response and very steep skirts.

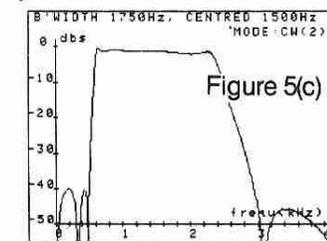
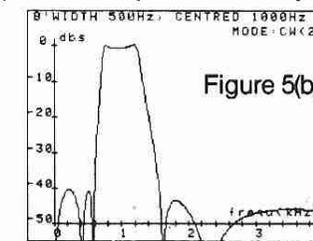
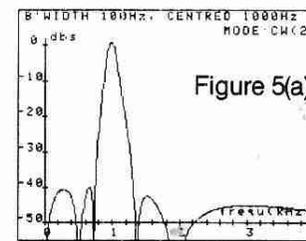


Figure 5(a), (b), (c) "CW(2)" - three graphs corresponding to those of figure 4 except that "CW(2)" mode was selected. Note the "flat" rather than "peaked" response.

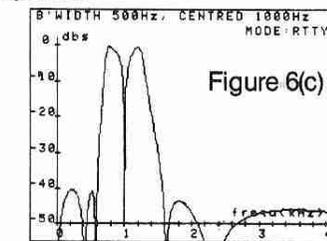
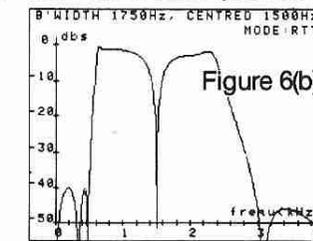
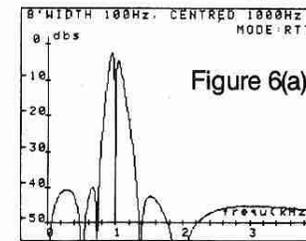


Figure 6(a), (b), (c) "RTTY" - three graphs using "RTTY" mode but otherwise with same bandwidth and centre frequency settings as figures 4 and 5.