

# Dual HI/LO Variable Analog Filters

- **Frequency Range: 0.01 Hz to 111 kHz**
- **Resolution: 3 Digits**
- **Cutoff Frequency Accuracy:  $\pm 2\%$**
- **Responses: Butterworth and Flat Delay**
- **Dynamic Range: 90 dB**
- **Low Noise**

## Design

The Models 452 and 852 Dual HI/LO Filters each consist of two identical filter channels contained in a common cabinet. Each filter channel has separate input/output terminals, offers high pass and low pass functions, 0 dB and 20 dB gain, Butterworth/Flat Delay responses and 3-digit resolution for cutoff frequency selection.

## Versatility

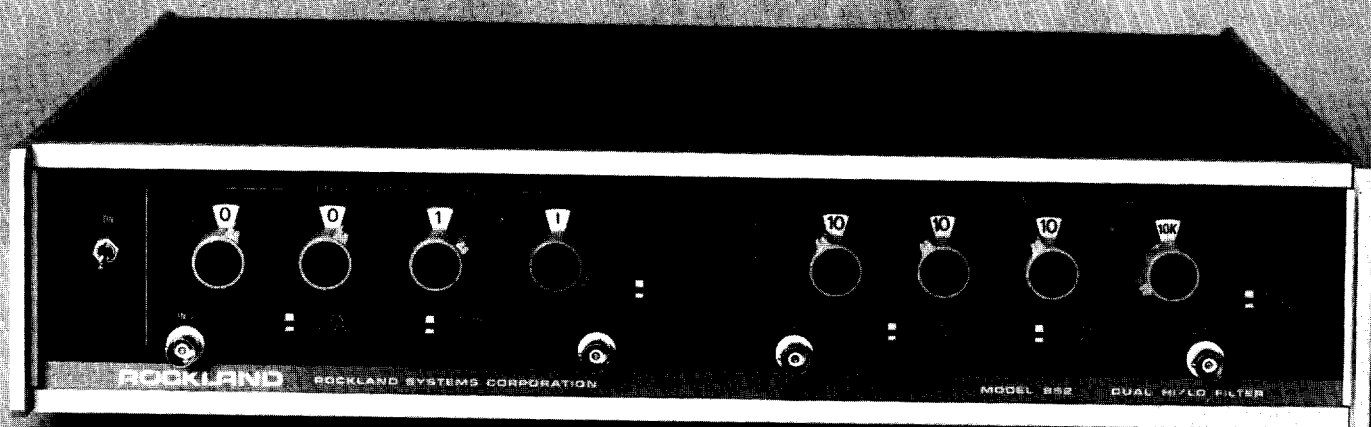
Individual channels may be readily interconnected for series or parallel operation, resulting in bandpass (or doubled rolloff) and band reject functions respectively.

Each filter channel provides switch selectable Flat Amplitude (Butterworth) response for frequency domain applications and Flat Delay response for transient-free time domain applications.

The Models 452 and 852 are electrically and mechanically similar, each covering the cutoff frequency range of 0.1 Hz to 111 kHz. Rolloff of the Model 452 is 24 dB/octave/channel, while the Model 852 is 48 dB/octave/channel. The factory installed Option 01 will extend the cutoff frequency range and resolution on the Models 452 and 852 to 0.01 Hz.

## Implementation

Frequency determining passive elements of the filters are stable precision metal film resistors and close tolerance polycarbonate or mica film capacitors. The active elements are FET-input IC operational amplifiers which provide highly stable gain, and very low noise and distortion. This combination of active and passive elements produces a filter having high cutoff frequency accuracy and resettability, excellent temperature stability and long term stability. Another result of precise control of frequency-determining elements is close amplitude and phase match between channels.



**FUNCTIONS**

Low Pass, High Pass, Band Pass, Band Reject, Notch (452/452-01 only).

**Frequency Range and Resolution**

Three 11-position switches and one 4-position multiplier (option 01 adds fifth position to multiplier).

Multiplier	Frequency (Hz)	Resolution (Hz)
×1*	0.01 to 11.1	0.01
×10	0.1 to 111	0.1
×100	1 to 1.1k	1
×1k	10 to 11.1k	10
×10k	100 to 111k	100

\*Option 01 only.

**Attenuation Rate per channel**

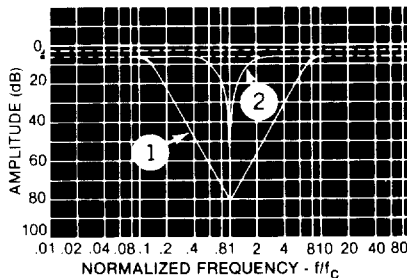
452/452-01: 24 dB/octave  
852/852-01: 48 dB/octave

**FLAT AMPLITUDE (BUTTERWORTH)****RESPONSE****Passband Gain (452/452-01)**

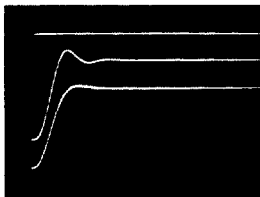
Low Pass: 0 dB/20 dB, ±0.25 dB.  
High Pass: 0 dB/20 dB, ±0.25 dB.  
(±0.5 dB in ×10k Multiplier position); -3 dB at approx. 2 MHz.

**Passband Gain (852/852-01)**

Low Pass: 0 dB/20 dB, ±0.5 dB.  
High Pass: 0 dB/20 dB, ±0.5 dB  
(±1 dB in ×10k Multiplier position);  
-3 dB at approx. 1 MHz.



Band Reject (1) and Sharp Notch (2) Obtained by Parallel Connection of 24 dB/Octave Filter Channels



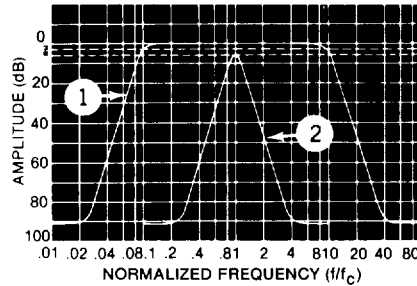
Transient Response - Low Pass Mode

**Attenuation at Cutoff**

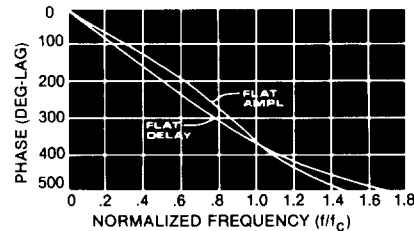
3 dB.

**Maximum Stopband Attenuation**

90 dB.



Band Pass (1) with LP = 0.01 HP and Minimum Bandwidth Band Pass (2) with LP = HP Obtained by Series Connection of 48/Octave Filter Channels.



Phase Characteristics - Low Pass Mode

**Phase Match Between Channels (Typical)**

452/452-01: 1° or 1%, whichever is greater.  
852/852-01: 2° or 2%, whichever is greater.

**FLAT DELAY RESPONSE****Low Pass Delay (Typical)**

452/452-01: 1/(2f<sub>c</sub>) sec.  
852/852-01: 1/f<sub>c</sub> sec.

**Attenuation Cutoff**

452/452-01: Approx 9 dB.  
852/852-01: Approx 17 dB.

**INPUT CHARACTERISTICS****Circuit**

Single-ended, diode protected.

**Impedance**

1 MΩ shunted to 50 pF; 75 pF in 20 dB gain (852/852-01).

**Full-Scale Signal at 0 dB Gain**

±10V (7.1 Vrms), DC to 300 kHz, decreasing to ±4V (2.8 Vrms) at 1 MHz (divide these by 10 at 20 dB gain).

**Absolute Max Input**

±100 Volts.

**Max. DC Component (High Pass)**

±100V, 0 dB gain.  
±10V, 20 dB Gain.

**OUTPUT CHARACTERISTICS****Circuits**

Single-ended. Short-circuit protected may be DC isolated from power ground by rear panel switch.

**Impedance**

50Ω.

**Full-Scale Signal**

±10V (7.1 Vrms), DC to 300 kHz, decreasing to ±4V (2.8 Vrms) at 1 MHz (R<sub>L</sub> ≥ 5 kΩ), ±15 mA max. current.

**Broadband Noise at Either Gain Setting (100 kHz detector bandwidth)**

452/452-01: 100 μVrms.  
852/852-01: 200 μVrms.

**Harmonic Components**

(Input f = 1 kHz)

452/452-01: 90 dB below full-scale.  
852/852-01: 80 dB below full-scale.

**DC Offset at 25°C**

452/452-01: 0 ±2.5 mV dc.  
852/852-01: 0 ±2.5 mV dc.

**GENERAL****Environmental**

Operating Temperature: 0°C to +50°C.  
Storage Temperature: -20°C to +70°C.

**Dimensions**

43.2 cm (17 in.) wide; 8.9 cm (3½ in.) high; 33 cm (13 in.) deep.

**Weight**

Model 452: 4.5 kg (10 lb) net.  
6.4 kg (14 lb) shipping.  
Model 852: 5.5 kg (12 lb) net.  
6.8 kg (15 lb) shipping.

**Power**

115/230V ±10%, 50 to 500 Hz, 5 watts.

**OPTIONS****01: Range Extension**

Extends low frequency range and resolution to 0.01 Hz; performance specifications remain the same, except AC line-related spurious components degraded by 6 dB when operating in the optional range. Factory installed.

**02: 600Ω Output Impedance****04: Rack-Mount Kit**

Field-installable.

**PRICE (FOB Rockleigh)**

<b>Model 452</b>	<b>\$1700</b>
<b>Model 852</b>	<b>\$2300</b>
<b>Model 452-01</b>	<b>\$1900</b>
<b>Model 852-01</b>	<b>\$2650</b>
<b>Option 02</b>	<b>\$50</b>
<b>Option 04</b>	<b>\$25</b>