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DC Source/Calibrators, Tunable Electronic Filters,
Wideband Power Amplifiers
Precision Phasemeters, Distortion Analyzers
Function Generators, RC Oscillators

Model 3945

3Hz to 25.6MHz, High-Pass/Low-Pass Butterworth/Bessel Programmable Filter



- **3 Independent Channels**
- **Frequency Range:** 3Hz to 25.6MHz
- **Response:** Bessel/Butterworth
- **Attenuation Slope:** 24dB/OctaveInput/Output Gain
- **Noise:** Typically <250µV referred to input
- **Remote Control:** GPIB
- **By-Pass Mode**

DESCRIPTION

The Krohn-Hite Model 3945 programmable filter provides one Butterworth channel of low-pass, tunable over the range from 170Hz to 25.6MHz; and two independent Butterworth or Bessel channels of low-pass, high-pass or bypass, one channel of band-pass or band-reject, tunable over the range from 3Hz to 2MHz.

The 3945 has been specifically designed for applications requiring high frequency band-pass filtering. The high cutoff may be set to any frequency between 170Hz and 10MHz, and the lower cutoff to any frequency between 3Hz and 2MHz.

50MHz LOW-NOISE AMPLIFIER

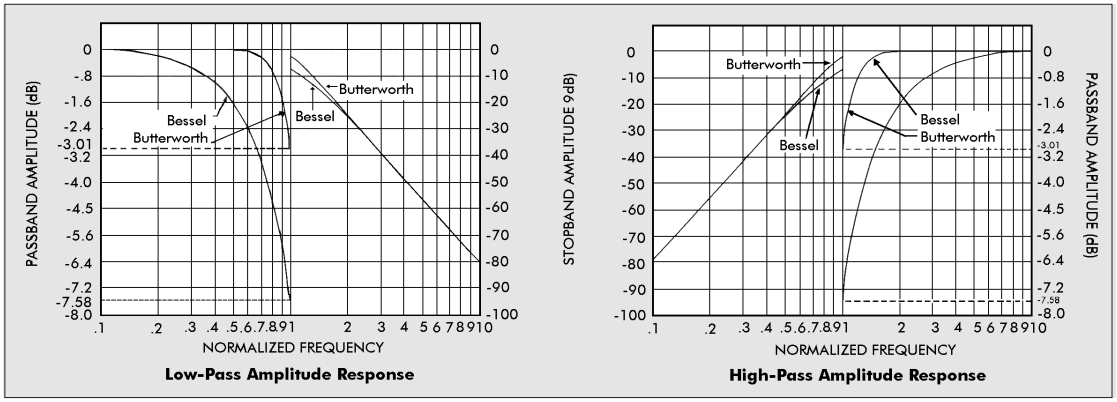
One channel of the 3945 can operate as a low-noise amplifier, bypassing the filter, delivering a bandwidth of 50MHz and gains up to 46dB. This is useful to users wanting to increase the gain of the signal and improve signal-to-noise ratio before filtering. The other two channels of the 3945 furnish Bessel or Butterworth transfer functions and can be programmed to operate as two low-pass, high-pass, one band-pass or band-reject filter with gains to 40dB per channel.

NON-VOLATILE MEMORY

The 3945 offers 99 groups of non-volatile memory for storage of front panel set-ups, which are stored in battery-backed CMOS. Set-ups can be recalled with a simple command. Self-test diagnostics occur upon power-up insuring that all internal memory is operating properly. If a failure occurs, the display will indicate which ROM or RAM has failed.

APPLICATIONS

The 3945 can provide filtering for many applications such as: high frequency anti-aliasing for digital signal processing, EMI testing, video recording and many more. The Model 3945 has been carefully designed with the user in mind, providing ease of operation, reliability and price competitiveness.



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SPECIFICATIONS

Specifications apply at 25°C ±10°C.

FUNCTION

Channel 1.1 and 1.2: Two independent channels of low-pass, high-pass or bypass; one channel of band-pass or band-reject.

Channel 2.1: One low-pass filter channel or amplified bypass.

CHANNELS 1.1 AND 1.2 FILTER CHARACTERISTICS

Type: 4-pole Butterworth (maximally flat) or Bessel (linear phase).

Attenuation Slope: 24dB/octave per channel.

Tunable Frequency Range (fc): 3Hz to 2MHz.

Frequency Resolution: 1Hz from 3Hz to 1kHz; 10Hz to 2kHz; 100Hz to 100kHz; 1kHz to 1MHz; 10kHz to 2MHz.

Cutoff Frequency Accuracy (fc): ±2% or least significant digit (which ever is greater) 20Hz to 500kHz; ±5% to 2MHz.

Relative Gain at fc: Butterworth, –3dB; Bessel, –7.58dB.

Bandwidth: dc to fc, dc coupled; 0.2Hz to fc, ac coupled (low-pass); fc to 10MHz (high-pass).

Passband Response (0dB, Input/ Output gain): ±0.5dB to 2MHz.

Stopband Attenuation: >80dB.

Harmonic Distortion: –80dB at 1kHz at 1Vrms.

Noise (referred to input): <200µV with 2MHz bandwidth detector.

Input:

Pre-Filter Gain: 0dB or 20dB; ±0.2dB.

Coupling: ac or dc.

Impedance: 1M ohm in parallel with 100pf.

Maximum Signal (at 0dB gain): ±4.5V peak at fc <1MHz; ±4V peak at 2MHz.

Maximum DC Blocking Voltage: ±200V in ac coupled mode.

Output:

Post-Filter Gain: 0dB or 20dB; ±0.2dB.

Impedance: 50 ohms.

Maximum Voltage: ±6.5V peak into ≥500 ohms; ±1.3V peak into ≥50 ohms.

Maximum Current: ±25mA.

DC Level: Adjustable to zero.

DC Stability: ±0.5mV/°C typical; ±1mV/°C max.

CHANNEL 2.1 FILTER CHARACTERISTICS

Filter Type: 4-Pole, Butterworth, low-pass.

Attenuation Slope: 24dB/Octave.

Tunable Cutoff Frequency Range: 170Hz to 25.6MHz.

Frequency Resolution: 10Hz from 170Hz to 2.56kHz; 100Hz from 2.6kHz to 25.6kHz; 1kHz from 26kHz to 256kHz; 10kHz from 260kHz to 2.56MHz; 100kHz from 2.6MHz to 25.6MHz.

Cutoff Frequency Accuracy: ±2% to 2.56MHz, ±5% to 25.6MHz.

Passband Response: ±0.2dB up to 2.56MHz, ±0.5dB to 25.6MHz.

Stopband Attenuation: -100dB to 1MHz; -75dB at 10MHz; -55dB at 30MHz; -50dB at 50MHz; -40dB to 100MHz.

Input/Output Coupling: AC or DC. AC coupling cutoff is approximately 16Hz at the input and 10Hz at the output with a 50Ω termination. *Note that the internal 50Ω input termination is before the AC coupling.*

Noise Spectral Density (10kHz to 100MHz referred to input): Below –128dBm/Hz into 50 ohms.

This translates into a wideband noise power or voltage for a 30MHz BW of below –53dBm or 500µVrms referred to input.

Harmonic Distortion (1Vrms sinewave): >–60dB below signal up to 100kHz (0.1%). All harmonics below 50dB to 1MHz; below 40dB above 1MHz.

Spurious Signals: Below –80dBm to 65MHz; below –75dBm to 100MHz. Referred to input represented in voltage form: 22mV and 40mV respectively.

DC Stability: ±0.5mV/°C referred to input.

Input:

Pre-Filter Gain: 0dB, +10dB, +20dB; ±0.1dB.

Impedance: Selectable 1M ohms or 50 ohms, ±2%, shunted by 65pF.

Maximum Signal: ±1.5V peak with 0dB input gain, reduced in proportion to input gain selected.

Maximum Input Without Damage: 12Vrms with input terminator OFF, 7Vrms with input terminator ON.

Maximum DC Blocking Voltage: 200V. Note that the internal input termination is before the AC coupling and can only tolerate 7Vrms when ON.

Output:

Post-Filter Gain: 0dB, +6dB, +20dB, +26dB; ±0.1dB.

Impedance: 50 ohms, ±2%.

Maximum Signal: ±3V peak open circuit; ±1.5V peak into 50 ohms.

DC Level: Adjustable to Zero.

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AMPLIFIER MODE CHARACTERISTICS

(Channel 2.1 only)

Bandwidth: >50MHz.

Input:

Pre-Filter Gain: 0dB, +10dB, +20dB; ±0.1dB.

Impedance: Selectable 1M ohm or 50 ohms, ±2%, shunted by 65pF.

Maximum Signal: ±1.5V peak with 0dB input gain, reduced in proportion to input gain selected.

Maximum Input Without Damage: 12Vrms with input terminator OFF, 7Vrms with input terminator ON.

Maximum DC Blocking Voltage: 200V. Note that the internal input termination is before the AC coupling and can only tolerate 7Vrms when ON.

Output:

Post-Filter Gain: 0dB, +6dB, +20dB, +26dB; ±0.1dB.

Impedance: 50 ohms, ±2%.

Maximum Signal: ±3V peak open circuit; ±1.5V peak into 50 ohms.

DC Level: Adjustable to Zero.

Rise and Fall Time: <7ns with 0dB input gain 6dB output gain; <10ns with +20dB input or output gain; <5% ringing or overshoot.

GENERAL

Frequency Control: Keypad entry or increment, decrement keys.

Memory: 99 selectable groups; memory is non-volatile battery-backed CMOS.

Overload Modes (Channel 2.1 only): Three selectable modes; non-latching, that monitors all channels and displays the first channel to have an overload; latching, that maintains the overload display until it is cleared; and no indications.

Overload Indicators (Channel 2.1 only): LEDs for input and output. Gain display flashes when overload occurs on displayed channel.

Self-Test Diagnostics: MPU checks unit upon power-up. Display indicates failure mode.

Displays: 7 segment, green, LED; 0.3" high.

Remote Programming: IEEE-488.1 interface. Subsets: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0, C0, E1.

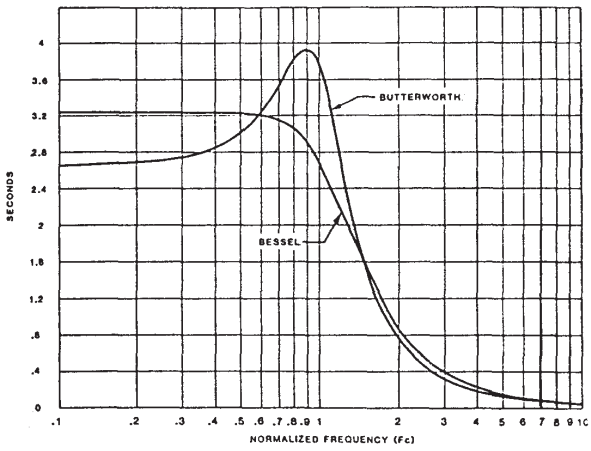
Operating Temperature: 0°C to 50°C.

Isolation to Chassis: ±200Vdc.

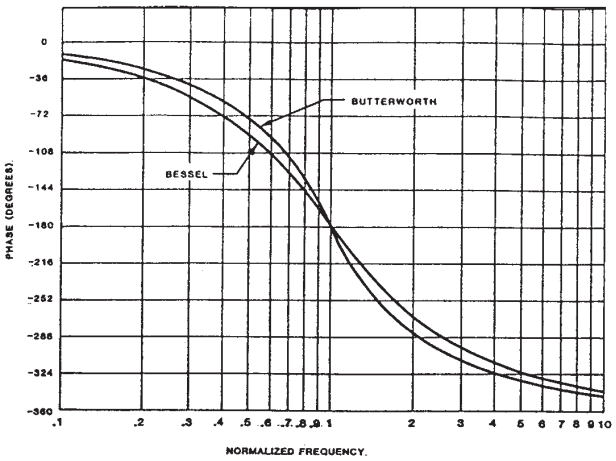
Storage Temperature: –20°C to 70°C.

Input/Output Connectors: BNC, front and rear.

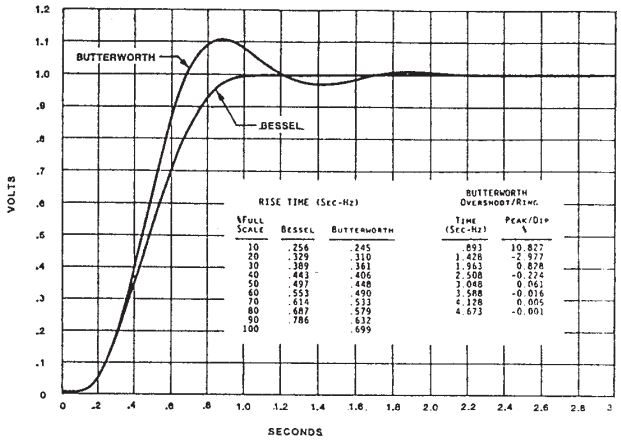
Power Requirements: 90-132/180-264 volts ac, 50Hz-400Hz, 35 watts.



Channels 1.1 and 1.2 Group Delay



Channels 1.1 and 1.2 Phase Response



Channels 1.1 and 1.2 Transient Response

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Dimensions: 3.5" (9cm) high, 8.5" (21.8cm) wide, 18" (46.2cm) deep.

Weights: 12 lbs (5.4kg) net; 14 lbs (6.3kg) shipping.

Accessories: 6 foot, 3 terminal line cord, operating manual.

OPTIONS

020: Lower frequency cutoff range to 0.3Hz to 200kHz for channels 1 and 2 only.

Rack Mount Kit: Part No. RK-37, permits installation of the Model 3945 into a standard 19" rack spacing.

Extended 1 Year Warranty: Part No. EW3945.

OPTIONAL ACCESSORIES

CAB-010: GPIB Cable with Connectors, 2-Meters

CAB-011: GPIB Cable with Connectors, 1-Meters

CAB-025: Cable, BNC, 3ft, Low Noise

HIGH FREQUENCY BAND-PASS OPERATION

Connecting the output of channel 1.1 or 1.2 (set to high-pass) to the input of channel 2.1 (set to low-pass, 50 ohm input impedance, 6dB output gain), provides a band-pass filter with 0dB insertion loss and the low-cutoff adjustable between 3Hz and 2MHz, and the high-cutoff adjustable between 170Hz and 10MHz. At high-cutoff settings above 10MHz, the passband response will deteriorate.

Specifications subject to change without notice.

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