KROHN-HITE CORPORATION

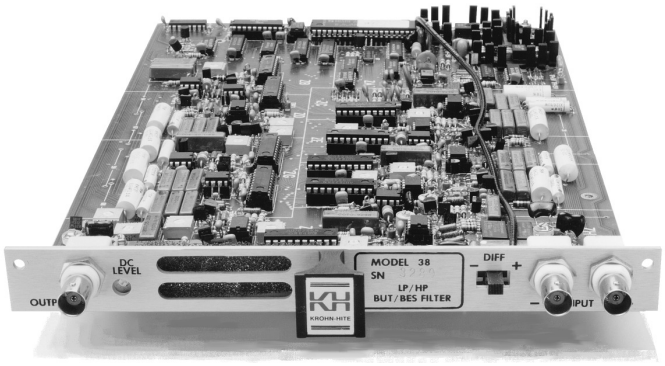
*"Quality" in Test and Measurement Since 1949*

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

# *Model 38*

## *0.03Hz to 1MHz, High-Pass/Low-Pass Butterworth/Bessel Plug-In Filter Card*

- Cutoff Tunable Range: 0.03Hz to 1MHz
- Attenuation: 48dB/Octave
- Filter Modes: Low-Pass and High-Pass
- Response: Butterworth and Bessel
- Input Gain (pre-filter): 50dB in 10dB Steps
- Output Gain (post-filter): 20dB in 0.1dB Steps
- Input Type: Differential and Single-Ended
- Gain Only Mode: 70dB Pre-Amplifier




## DESCRIPTION

The Krohn-Hite Model 38 Butterworth/Bessel, plug-in filter card is one of a family of filter cards used in Krohn-Hite Programmable Filter System Mainframes. It is carefully designed with the user in mind, providing ease of operation, reliability and price competitiveness.

The 38 provides a tunable frequency range from 0.03Hz to 1MHz in the low-pass mode and 0.03Hz to 300kHz in the high-pass mode. Both modes are extended down to 0.003Hz with the 002 option. The frequency response characteristic is either maximally flat (Butterworth) for clean filtering in the frequency domain, or linear phase (Bessel) to provide superior pulse or complex filtering is operator selectable.

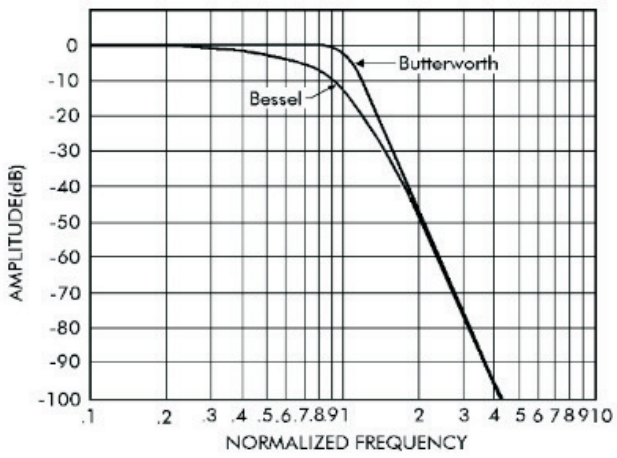
The 38 is an 8-pole, wide range, low-pass/high-pass filter or an amplifier providing gains to 70dB in 0.1dB steps. The 38 will accept input signals of ±10V peak at 0dB gain and has selectable ac or dc coupling. Overload detectors are standard and assist the user in detecting input signals or incorrect gain settings.

## APPLICATIONS

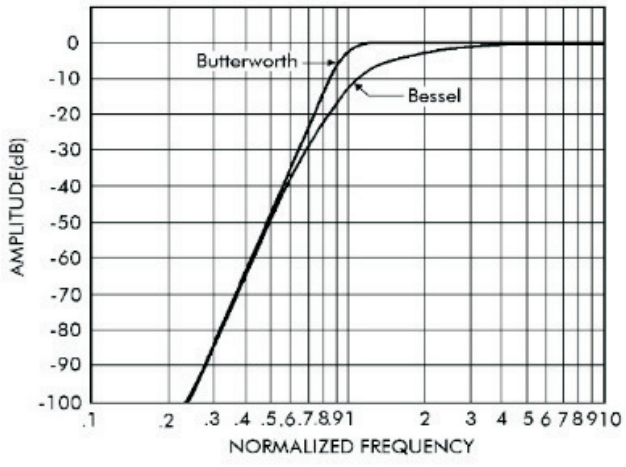
Applications of the Model 38 are ultra-sound measurements, random noise testing, sound recording, suppressing interference in audio communications and related fields of medical, geological, geophysical, oceanographic, military and many more.

## MAINFRAMES

The 38 is a plug-in card for two mainframes; Models 3905B/3905C and 3916B. The 3905B/C is a 3" high chassis, allowing up to 5 filter/amplifier cards. The 3916B allows up to 16 cards.




**Low-Pass Amplitude Response**




**High-Pass Amplitude Response**

## SPECIFICATIONS

**FUNCTION:** Low-pass filter, high-pass filter; voltage gain amplifier.

## FILTER MODE

**Type:** 8-pole, Butterworth, Bessel.

**Attenuation Slope:** 48dB/octave.

**Tunable Frequency Range fc:**

**Low-Pass:** 0.03Hz to 1MHz

**High-Pass:** 0.03Hz to 300kHz

**Option 002:** Tuning range from 0.03Hz to 0.003Hz.

**Frequency Resolution:** 3 digits, 0.1Hz to max fc; 2 digits, 0.03Hz to 0.099Hz; (option 002, 1 digit, 0.003Hz to 0.009Hz; 2 digits, 0.01Hz to 0.099Hz).

**Cutoff Frequency Accuracy:** ±1%, 0.5Hz to 50kHz; ±2%, 50.1kHz to max fc; ±5%, 0.03Hz to 0.5Hz (option 002, ±5%, 0.003Hz to 0.5Hz).

**Relative Gain at fc:** –3dB, Butterworth; –12.6dB, Bessel.

**High-Pass Bandwidth (0dB gain):** >4MHz.

**Stopband Attenuation:** >100dB.

**Maximum Input:** ±10V peak at 0dB gain reduced in proportion to gain setting; ±7 peak for LP, fc >500kHz, fsig >500kHz.

**Pre-Filter Gain:** 0dB, 10dB, 20dB, 30dB, 40dB, 50dB, ±0.2dB.

**Post-Filter Gain:** 0dB to 20dB in 0.1dB steps, ±0.2dB.

**Wideband Noise (2MHz bandwidth detector):** 0dB gain, <300µVrms for fc ≤5kHz, <500µVrms for fc ≤50kHz, ≤1mVrms for fc >50kHz. Max. gain, <25µVrms RTI.

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

**DC Stability (RTI):** Typically ±2mV/°C.

## AMPLIFIER MODE

**Bandwidth:** >7MHz min. gain; >700kHz max. gain.

**Response:** ±0.1dB typical, ±0.5dB max.

**Gain:** 0dB to 70dB in 0.1dB steps, ±0.2dB.

**Input:** Differential or single-ended +(in phase), –(inverted).

**CMRR:** >60dB to 10kHz; >50dB to 100kHz.

**Sensitivity:** 3mV peak with 70dB total gain for 10V peak output.

**Maximum Input:** ±10V peak at 0dB gain reduced in proportion to gain setting.

**Impedance:** 1 megohm in parallel with 100pf.

**Coupling:** ac (0.16Hz) or dc.

**Maximum DC Component:** ±100V in ac coupled mode.

**Output:**

**Maximum Voltage (open circuit):** ±10V peak.

**Maximum Current:** ±80mA peak.

**Impedance:** 50 ohms.

**DC Offset:** Adjustable to zero volts.

**Harmonic Distortion (1V output):** –80dB (0.01%) to 10kHz; –60dB (0.1%) to 100kHz..

**Wideband Noise (RTI, 2MHz BW detector):** 200µVrms min. gain; 25µVrms max. gain.

**DC Stability (RTI):** Typically ±10mV/°C.

## GENERAL

**Crosstalk Between Channels:** –85dB below full scale with input source <50 ohms.

**Low-Pass Phase Match Between Channels:** ±2° to 500kHz, ±5° to 1MHz. Only for cards purchased at the same time.

**High-Pass Phase Match Between Channels:** For fc ≤100kHz, ±2° for fsig ≤500kHz, 2° times fsig/500kHz for fsig to 2MHz; for fc >100kHz, ±5° for fsig ≤500kHz, 5° times fsig/500kHz for fsig to 2MHz. Only cards purchased at the same time.

**Gain Match Between Channels:** ±0.2dB max. to 100kHz.

**Switch:** For selection of Input, +(in phase), Differential or –(inverted).

**Input/Output Connectors:** BNC.

**Power:** 15 watts.

**Weights:** 1.75 lbs (.79kg).

**Accessories:** Operating manual.

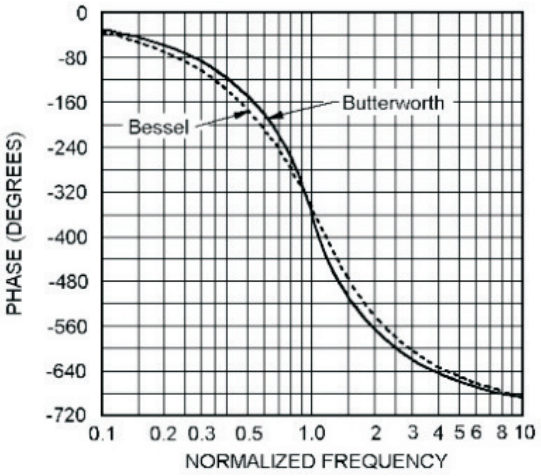
## OPTIONS

**002:** extends low end cutoff to 0.003Hz.

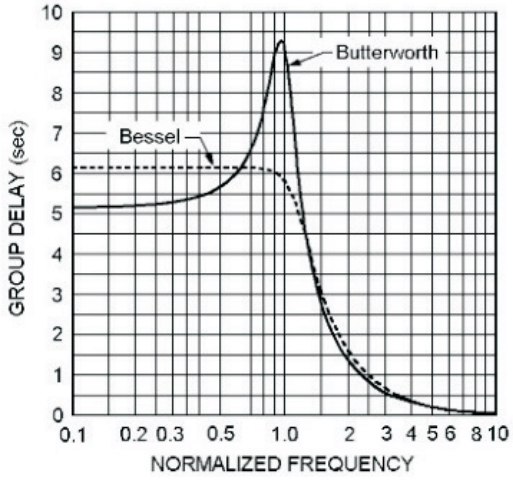
**Extended 1 Year Warranty:** Part No. EW38.

Specifications apply at 25°C, ±5°C.

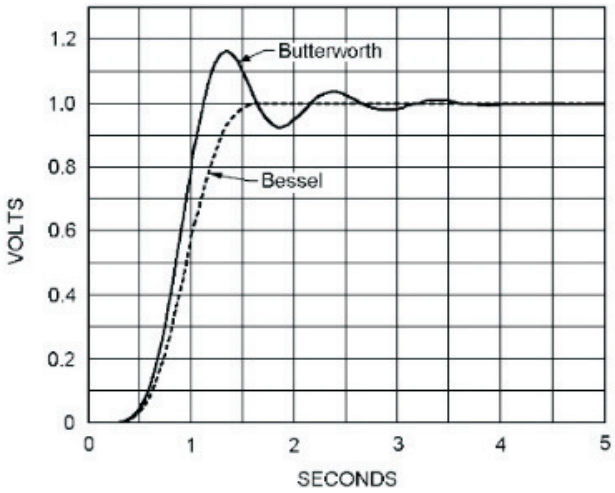
Specifications subject to change without notice.




**Phase Response**




**Group Delay**




**Transient Response**

# 8-Pole High-Pass Butterworth

**Theoretical Transfer Characteristics**

| f/fc (Hz) | Amp (dB) | Phase (Deg) | Delay (1) (sec) |
|---|---|---|---|
| 0.10 | -160.00 | 691.00 | 0.819 |
| 0.20 | -112.00 | 661.00 | 0.828 |
| 0.30 | -83.70 | 631.00 | 0.843 |
| 0.40 | -63.70 | 600.00 | 0.867 |
| 0.50 | -48.20 | 568.00 | 0.903 |
| 0.60 | -35.50 | 535.00 | 0.956 |
| 0.70 | -24.80 | 499.00 | 1.040 |
| 0.80 | -15.60 | 459.00 | 1.190 |
| 0.85 | -11.60 | 437.00 | 1.290 |
| 0.90 | -8.060 | 413.00 | 1.400 |
| 0.95 | -5.150 | 386.00 | 1.480 |
| 1.00 | -3.010 | 360.00 | 1.460 |
| 1.20 | -0.229 | 275.00 | 0.873 |
| 1.40 | -0.020 | 226.00 | 0.540 |
| 1.60 | -0.002 | 194.00 | 0.380 |
| 1.80 | 0.000 | 170.00 | 0.287 |
| 2.00 | 0.000 | 152.00 | 0.226 |
| 2.50 | 0.000 | 120.00 | 0.139 |
| 3.00 | 0.000 | 99.20 | 0.094 |
| 4.00 | 0.000 | 74.00 | 0.052 |
| 5.00 | 0.000 | 59.00 | 0.033 |
| 6.00 | 0.000 | 49.00 | 0.023 |
| 7.00 | 0.000 | 42.10 | 0.017 |
| 8.00 | 0.000 | 36.80 | 0.013 |
| 9.00 | 0.000 | 32.70 | 0.010 |
| 10.00 | 0.000 | 29.40 | 0.008 |

**Note (1)**

**Normailzed Group Delay:** is normailzed to a frequency of 1.0Hz. The actual delay is the normalized delay divided by the actual corner frequency (fc).

# 8-Pole Low-Pass Bessel

**Theoretical Transfer Characteristics**

| f/fc (Hz) | Amp (dB) | Phase (Deg) | Delay (1) (sec) |
|---|---|---|---|
| 0.00 | 0.000 | 0.00 | 0.506 |
| 0.10 | -0.029 | -18.20 | 0.506 |
| 0.20 | -0.117 | -36.40 | 0.506 |
| 0.30 | -0.264 | -54.70 | 0.506 |
| 0.40 | -0.470 | -72.90 | 0.506 |
| 0.50 | -0.737 | -91.10 | 0.506 |
| 0.60 | -1.06 | -109 | 0.506 |
| 0.70 | -1.45 | -128 | 0.506 |
| 0.80 | -1.91 | -146 | 0.506 |
| 0.85 | -2.16 | -155 | 0.506 |
| 0.90 | -2.42 | -164 | 0.506 |
| 0.95 | -2.71 | -173 | 0.506 |
| 1.00 | -3.01 | -182 | 0.506 |
| 1.10 | -3.67 | -200 | 0.506 |
| 1.20 | -4.40 | -219 | 0.506 |
| 1.30 | -5.20 | -237 | 0.506 |
| 1.40 | -6.10 | -255 | 0.505 |
| 1.50 | -7.08 | -273 | 0.504 |
| 1.60 | -8.16 | -291 | 0.502 |
| 1.70 | -9.36 | -309 | 0.498 |
| 1.80 | -10.7 | -327 | 0.492 |
| 1.90 | -12.1 | -345 | 0.482 |
| 2.00 | -13.7 | -362 | 0.468 |
| 2.25 | -18.1 | -402 | 0.417 |
| 2.50 | -23.1 | -436 | 0.352 |
| 2.75 | -28.3 | -465 | 0.291 |
| 3.00 | -33.4 | -489 | 0.241 |
| 3.25 | -38.3 | -509 | 0.201 |
| 3.50 | -43.1 | -526 | 0.170 |
| 4.00 | -51.8 | -552 | 0.126 |
| 5.00 | -66.8 | -587 | 0.077 |
| 6.00 | -79.2 | -610 | 0.052 |
| 7.00 | -89.8 | -626 | 0.038 |
| 8.00 | -99.0 | -638 | 0.029 |
| 9.00 | -107.0 | -647 | 0.023 |
| 10.00 | -114.0 | -655 | 0.018 |

**Note (1)**

**Normailzed Group Delay:** is normailzed to a frequency of 1.0Hz. The actual delay is the normalized delay divided by the actual corner frequency (fc).