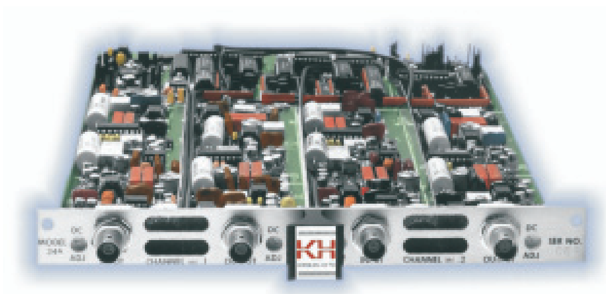
Model 34A

3Hz to 2MHz
2-Channel Butterworth/Bessel
HP, LP, BP, BR
Plug-In Filter Card
for Model 3905/3916 Chassis



KROHN-HITE CORPORATION

Operating Manual

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Krohn-Hite Instruments are designed and manufactured in accordance with sound engineering practices and should give long trouble-free service under normal operating conditions. If your instrument fails to provide satisfactory service and you are unable to locate the source of trouble, contact our Service Department at (508) 580-1660, giving all the information available concerning the failure.

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MODEL 34A

DUAL CHANNEL/BUTTERWORTH/BESSEL
LOW-PASS/HIGH-PASS/BAND-PASS/BAND-REJECT
PLUG-IN FILTER MODULE

OPERATING MANUAL

Serial No.	Serial No.

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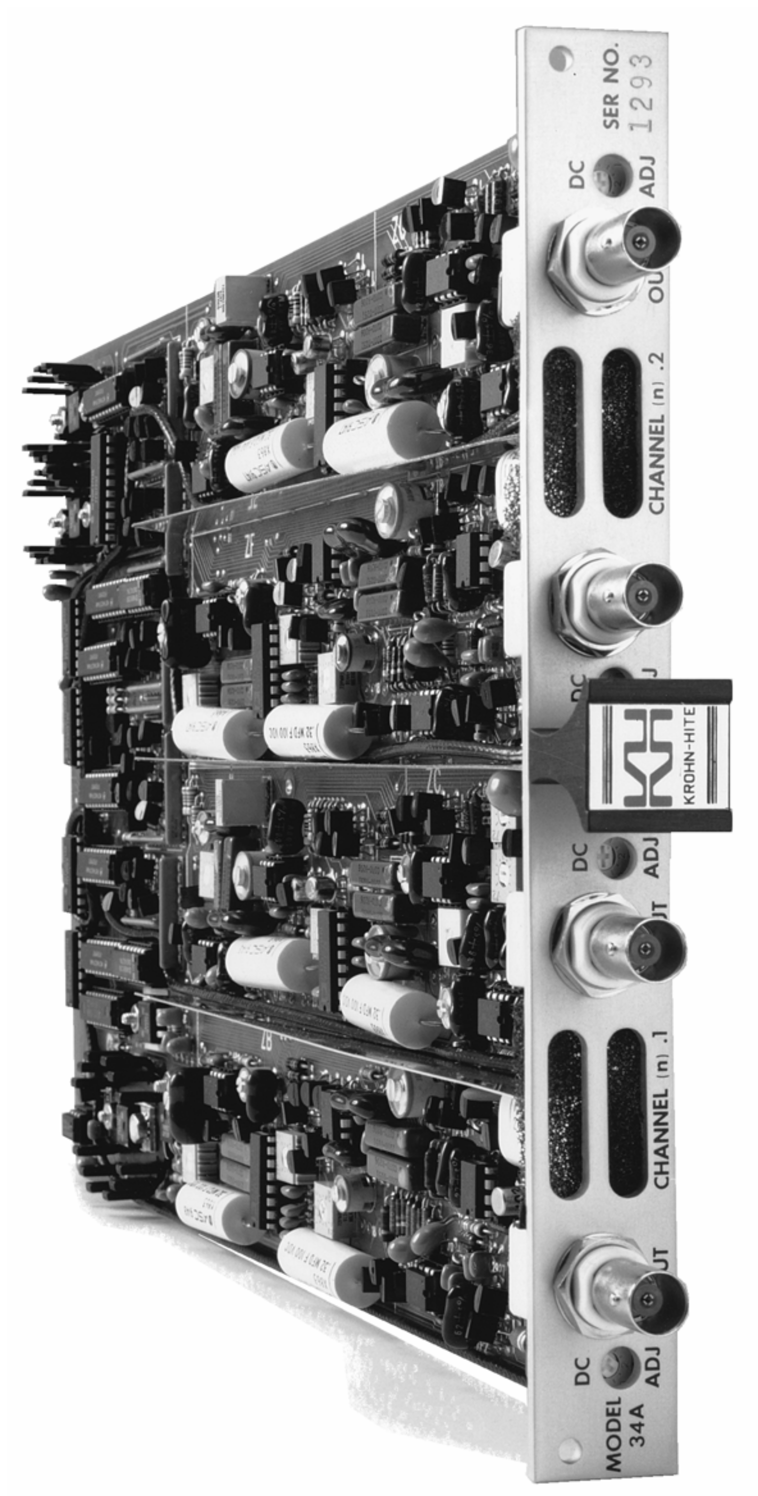
SER NO.
1293
DC ADJ
CHANNEL (n) .2
KROHN-HITE
DC ADJ
CHANNEL (n) .1
DC ADJ
MODEL 34A

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NOTES

SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The Model 34A is a dual filter with two identical channels covering a tunable frequency range from 3Hz to 2MHz. Each channel can function independently with either low-pass or high-pass response at 24dB/octave attenuation or connected in series in the same mode to provide 48dB/octave attenuation. Band-pass or band-reject operation at 24dB/octave can be obtained. Either maximally flat (Butterworth) response or linear phase (Bessel) operation for pulse signal filtering is selectable. Both input and output amplifiers provide either 0dB or 20dB of gain.

The Model 34A is a plug-in filter card which is operational only when inserted in the five-card Model 3905A/3905B/3905C or the sixteen-card Model 3916A/3916B/3916C Mainframe. Each Mainframe includes a microprocessor plug-in card; the Model 39A-05 for the 3905A/3905B/3905C, and the 39A-16 for the 3916A/3916B/3916C. The filter and microprocessor cards are easily accessible from the rear of the Mainframe. The filer is controlled by the Mainframe which provides local/IEEE-488 programming, displays for the input and output gain, cutoff frequency and channel selection. Non-volatile, battery-backed, CMOS memory permits the storing and recalling of 85 selectable groups in the 3905A/3905B/3905C and 25 in the 3916A/3916B/3916C. Storing and recalling group settings is accomplished with only one command. Self-testing of the digital circuitry occurs upon power-up.

This Operating and Maintenance Manual is for the Model 34A filter module only. A separate manual is provided for the Model 3905A/3905B/3905C or 3916A/3916B/3916C Mainframe.

1.2 SPECIFICATIONS

FILTER CHARACTERISTICS

Functions: two independent channels of low-pass, high-pass or by-pass; one channel of band-pass or band-reject.
Type: 4-pole Butterworth (maximally flat) or Bessel (linear phase).
Frequency Range (f_c): 3Hz to 2MHz
Frequency Resolution: 1Hz from 3Hz to 1kHz; 10Hz up to 2kHz; 100Hz up to 100kHz; 1kHz up to 1MHz; 10kHz up to 2MHz.
Frequency Accuracy (f_c): ±2% or least significant digit (which ever is greater) 20Hz to 500kHz; ±5% to 2MHz.
Relative Gain at f_c: Butterworth, -3dB; Bessel, -7.58dB.
Bandwidth: dc to f_c, dc coupled; 0.2HZ to f_c, ac coupled (low-pass); f_c to 10MHz (high-pass).
Attenuation: 24B/octave per channel.
Stopband Attenuation: >80dB.
Insertion Loss (0dB Input/Output gain): ±0.5dB to 2MHz.

GAIN

Input (pre-filter): 0dB or 20dB ±0.2dB.
Output (post-filter): 0dB or 20dB ±0.2dB.

INPUT

Coupling: ac or dc.
Impedance: 1 megohm in parallel with <30pf (<100pf in a Model 3905B with front panel BNC's).
Maximum Signal (at 0dB gain): ±4.5V peak at f_c <1MHz; ±4V peak at 2MHz.
Maximum DC Component: ±200V in ac coupled mode.

OUTPUT

Impedance: 50 ohms.
Maximum Voltage: ±6.5V peak into $\geq$500 ohms; ±1.3V peak into $\geq$50 ohms.
Maximum Current: ±25mA.
Distortion: -80dB at 1kHz at 1V rms.
Noise (RTI): <200µV with 2MHz bandwidth detector (20µV w2ith 20dB input gain).
DC Offset: adjustable to 0V.
DC Stability: ±1mV/°C.
Input/Output Connectors: BNC.
Phase Match Between Channels*: 1° to 500kHz f_c (Bessel only); 2° to 1MHz; 3° to 2MHz (max difference between any two channels).

GENERAL

Power: 15 watts.
Weight: 1.75 lbs. (0.8kg) net.
Operating Temperature: 0° to 45°C.

Specifications apply at 25°C ±10C, 20Hz to 2MHz.

*For cards in same chassis, otherwise consult factory.

SECTION 2
OPERATION

2.1 INTRODUCTION

The Model 34A is a dual filter covering the frequency range from 3Hz to 2MHz. It is one of a series of plug-in filter cards available for the five-card Model 3905A/3905B/3905C or the sixteen-card Model 3916A/3916B/3916C Mainframes. All filter parameters are programmable via the Mainframe front panel controls or remotely over the IEEE-488 (GPIB) bus. For information on remote programming, refer to Section 3 of the Model 3905A/3905B or 3916A/3916B Operating and Instruction Manual and Section 3 of this manual.

Either channel of the 34A can operate independently in either the low-pass or high-pass mode and provide 24dB/octave attenuation. The two channels can be connected in series *externally* in the same mode to attain 48dB/octave attenuation when set to the same cutoff frequency.

If the two channels are interconnected externally with one channel set to high-pass and the other to low-pass, the filter will now function as a band-pass filter, passing the band of frequencies selected by the high and low cutoff frequencies.

If the two channels are interconnected externally using a band-reject kit (BR-30), the filter will then function as a band-reject filter, rejecting the band selected by the high and low cutoff frequencies.

2.2 OPERATING PROCEDURE

2.2.1 Channel Selection

Up and down controls [↑] and [↓] increase or decrease channel setting shown on the DISPLAY. When held, channels will cycle through all active channels continuously. Channel selection can also be accomplished by entering the desired channel number in the keyboard and momentarily pressing either up [↑] or down [↓] channel controls.

2.2.2 All Channel Key Procedure

When frequency, input/output gain, type, mode or coupling are entered or changed, and the LED in the [ALL CHAN] key is on, the new setting will also be entered in all other filters of the same card type.

2.2.3 Cutoff Frequency

Data entry keyboard controls [0] to [9] and [.] set the numeric value of the cutoff frequency desired. To program 1.5kHz press the [1][.][5] data keys and parameter keys [KILO] and [FREQ]. The cutoff frequency will be entered only in the channel displayed and indicated in Hertz in the four digit DISPLAY.

2.2.4 Input Gain (Pre-Filter)

Up and down GAIN SET controls [↑] and [↓] increase or decrease the input amplifier by 20dB. The two digit DISPLAY will indicate either 00 or 20dB.

2.2.5 Output Gain (Post-Filter)

Up and down GAI SET controls [↑] and [↓] increase or decrease the output amplifier by 20dB. The two digit DISPLAY will indicate either 00 or 20dB.

2.2.6 Mode of Operation

When the [MODE] key is pressed, the DISPLAY indicates the mode of operation in the channel displayed, alternating as the [MODE] key is pressed between low-pass “L.P.”, high-pass “h.P.”, band-pass “b.P.”, band-reject “b.r.” and by-pass “bYP.” which connect input to output.

2.2.7 Filter Type

The DISPLAY will indicate the filter type in the channel displayed when the [TYPE] key is pressed, alternating between Butterworth “bu.” and Bessel “bES.” response.

2.2.8 Input Coupling

Pressing the [SECONF FUNCTN] key followed by the [TYPE] key will display the input coupling, indicating “AC” or “dC”, and will alternate when the two key are pressed again only when in the low-pas and band-reject mode. High-pass and band-pass mode are AC only.

2.2.9 Clear Entry Key Operation

When entering a numeric value in the keyboard, but not specifying a parameter, pressing the clear entry key will function as an error correction procedure and restore DISPLAY to its previous set-up.

When a numeric value and its parameter has been entered and the numeric value is then changed, pressing the [CE] key will restore DISPLAY to the previous value of that parameter.

When either the [SECOND FUNCTN][STORE] or [RECALL] key is pressed, the next memory location will be indicated on the DISPLAY. Pressing the [CE] key will restore DISPLAY to its previous setting.

When the DISPLAY contains information other than the frequency, pressing the [CE] key will restore the DISPLAY to the current frequency.

If the Model 3905B or 3916B is operating via the IEEE-488 bus (the front panel REMOTE LED is ‘on’), pressing the [CE] key will return unit to LOCAL operation.

2.2.10 Storing Set-Ups

If a memory location is entered into the keyboard, pressing the [SECOND FUNCTN][STORE] key will store the entire five card (Model 3905B) or sixteen card (Model 3916B) set-ups into the memory location selected. The maximum number of memory locations is 85 in the Model 3905B and 25 in the Model 3916B.

When the [SECOND FUNCTN][STORE] key is first pressed, the DISPLAY indicates the number of the next memory location available. For example, the DISPLAY will indicate the following: “n=09”. Pressing the [SECOND FUNTN][STORE] key again will store the set-up currently in all channels into that memory location. If another memory location is desired enter that location on the keyboard and then press the [SECOND FUNTN][STORE] key.

When the [SECOND FUNCTN][STORE] key is pressed to indicate the next memory location only, pressing the clear entry key [CE] will restore the DISPLAY to the current frequency.

2.2.11 Recalling Set-Ups

If a memory location is entered into the keyboard, pressing the [RECALL] key will recall the entire five (Model 3905B) or sixteen (Model 3916B) card set-ups from the memory location selected.

When the [RECALL] key is first pressed, the DISPLAY indicates the number of the next memory location to be recalled. For example, the DISPLAY will indicate the following: “n=09”. Pressing the [RECALL] key again will recall the se-up of all five (Model 3905B) or sixteen (Model 3916B) cards from that memory location.

When the [RECALL] key is pressed to indicate the next memory location to be recalled only, pressing the clear entry key [CE] will restore the DISPLAY back to the previous setting.

2.2.12 Second Function Key Operation

The [SECOND FUNCTN] key in conjunction with other keys provides additional filter characteristics and permits GPIB front panel data entry.

Pressing the [SECOND FUNCTN] key followed by the [AC/DC] key will display the input coupling, indicating “AC” or “dC”, and will alternate when the two keys are pressed again only in the low-pass and band-reject mode. High-pass and band-pass modes are AC only.

When the [SECOND FUNCTN] key followed by the [ADDR] key are pressed, the DISPLAY will indicate the existing GPIB address setting. To select a different one, enter it in the data keys from [0] to [30] and press the [SECOND FUNCTN] and [ADDR] keys (See Section 3.2.1 of the 3905B or 3916B manual).

When the [SECOND FUNCTN] key followed by the [ALL CHAN] key are pressed, the DISPLAY will indicate the existing Line Termination Code Sequence. To select a different one, enter it in the data keys from [0] to [30] and press the [SECOND FUNCTN] and [ALL CHAN] keys (See Section 3.2.1 of the 3905B or 3916B manual).

2.3 FILTER CHARACTERISTICS

2.3.1 Introduction

The Model 34A, as shown in Figure 2.1, is a dual filter with two identical channels that can function independently. Each channel can operate in either the low-pass mode or high-pass mode and provide 24dB/octave attenuation, or both channels can be set to the same mode and connected in series *externally* to obtain 48dB/octave attenuation. The interconnection of the two channels, by front panel data key entry, to provide band-pass, band-reject or null operation is shown in simplified format in Figures 2.2 and 2.3.

2.3.2 Variable Band-Pass and Band-Reject Operation

Variable band-pas response is obtained by applying the input signal to channel n.1 (i.e. 1.1, 2.1, 3.1, etc.), setting the channel number to “n.1”, setting the filter to the band-pass mode “b.P.” using the [MODE] key, and entering the desired low-cutoff frequency. Set the filter to channel n.2 and enter the desired high-cutoff frequency. The band-pass response appears at the channel n.1 output BNC connector only.

Note. In the band-pass mode, there is a phase shift of 180° from input to output. To achieve a 0° phase shift through the filter connected Channel n.1 output to Channel n.2 input externally, and set n.1 to high-pass and n.2 to low-pass.

For band-reject response, set the filter to channel n.1, the band-reject mode to ”b.r” and enter the desired low-cutoff frequency. Set the filter to channel n.2 and enter the desired high-cutoff frequency. A null can be obtained by setting the low cutoff frequency to approximately 0.58 of the desired null frequency, the high cutoff frequency to approximately 1.7 of the null frequency and fine tune both cutoff frequencies. The resolution of the Model 34A will limit the extent of the null. The channel 1.2 output is the high-pass section only.

2.3.3 Amplitude Response

Each channel of the Model 34A can operate in either the low-pass or high-pass mode at 24dB/octave attenuation and provide either maximally flat (Butterworth) amplitude response or linear phase (Bessel) operation. Comparative amplitude response characteristics in both modes are shown in Figure 2.4 and Figure 2.5.

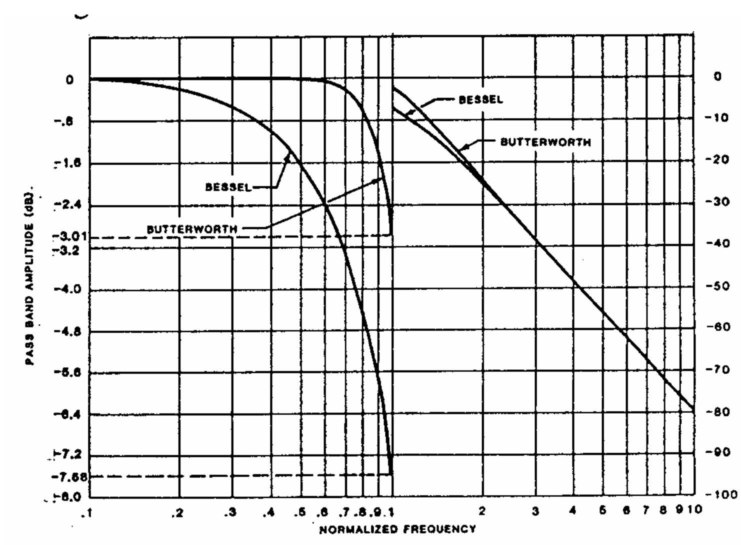


Figure 2.4 Low-Pas Response

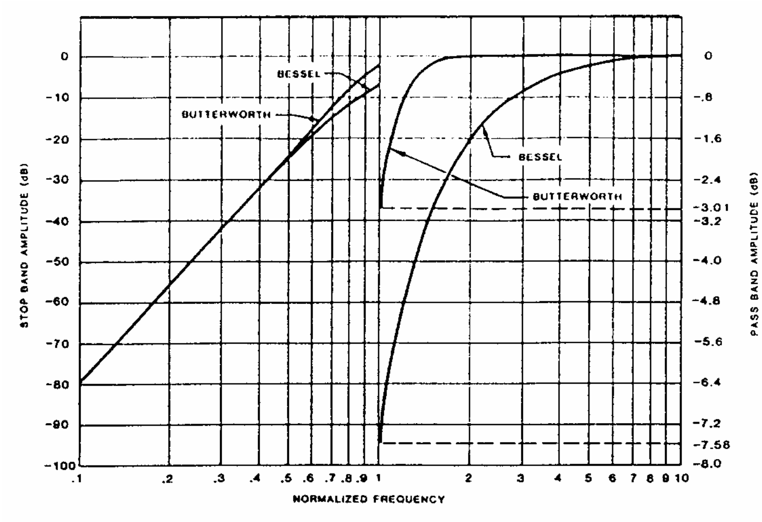


Figure 2.5 High-Pass Response

2.3.4 Phase Response

Phase characteristics of the Model 34A are shown in Figure 2.6. It provides output phase relative to the input with the filter operating in the low-pass mode with Butterworth and Bessel response.

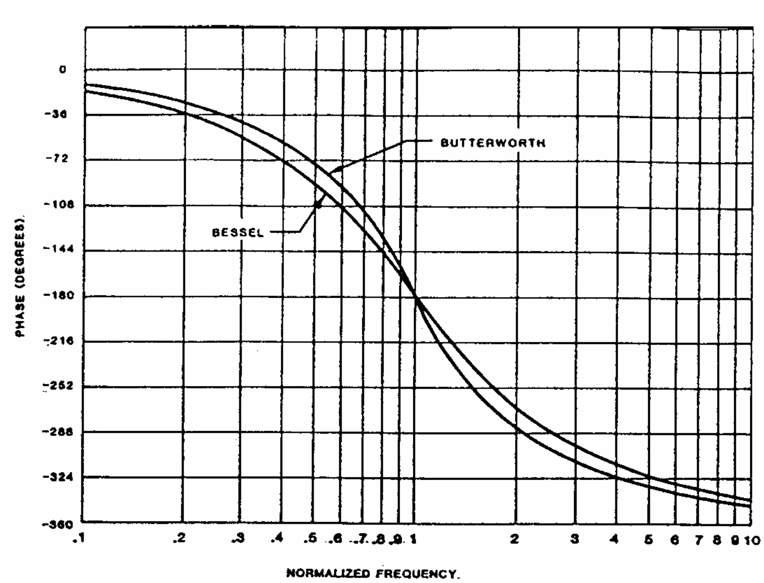
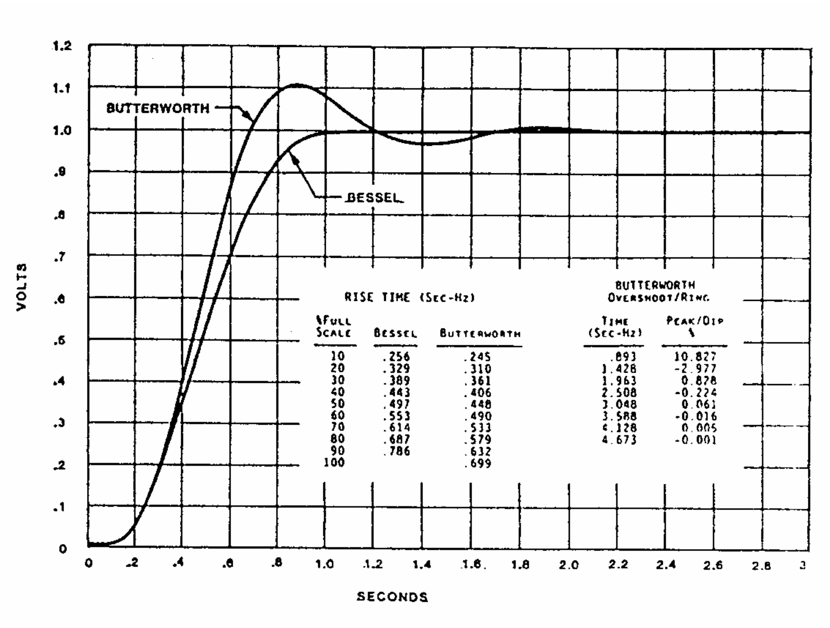


Figure 2.6 Low-Pass Phase Response

2.3.5 Transient Response

The normalized response for a unit step voltage applied to the input of the Model 34A operating in the low-pass mode with both Butterworth and Bessel response is shown in Figure 2.7.



RISE TIME (Sec-Hz)			BUTTERWORTH Overshoot/Ring	
%Full Scale	Bessel	Butterworth	Time (Sec-Hz)	Peak/Dip %
10	.256	.245	.893	10.827
20	.329	.310	1.428	-2.977
30	.389	.361	1.963	0.878
40	.443	.406	2.508	-0.224
50	.497	.448	3.048	0.061
60	.553	.490	3.588	-0.016
70	.614	.533	4.128	0.005
80	.687	.579	4.673	-0.001
90	.786	.632		
100		.699		

Figure 2.7 Normalized Step Response

2.3.6 Group Delay

Group delay[1], shown in Figure 2.8, is defined as the derivative of radian phase with respect to radian frequency, which is the slope of the phase curve. A flat group delay is considered a linear phase response which corresponds to a constant slope of the phase curve. With linear phase response the distortion of complex data signals will be minimized because their various frequency components, due to a constant time delay, will not shift relative phase

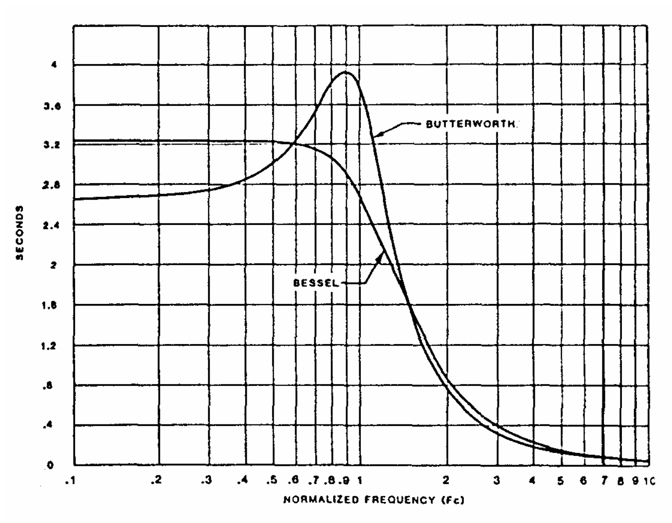


Figure 2.8 Low-Pass Group Delay

In numeric terms, zero frequency phase slope is –149.7°/Hz for Butterworth and –183.4°/Hz for Bessel, when normalized for a cutoff frequency of 1Hz. This will be 2π times greater in °/Hz for a cutoff of 1 radian/sec or –940.7°/H and –1152.4°/Hz respectively. Dividing by 360, converts °/Hz to radians/radians-per-sec yields a group delay time of 2.61s for Butterworth and 3.20s for Bessel.

[1] *IEEE Standard Dictionary of Electrical and Electronic Terms*, Institute of Electrical and Electronic Engineers, IEEE-SDSTD 100-1977, Second Edition, 1977, page 296.

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SECTION 3
IEEE-488 STD (GPIB) PROGRAMMING

3.1 INTRODUCTION

Complete information on remote programming is incorporated in the Model 3905B/3916B Mainframe operating and instruction manual. Detailed information about the filter type, modes of operation and device clear command not described in the 3905A/3905B/3905C or 3916A/3916B/3916C manual are specified below.

3.2 FILTER TYPE

1 Butterworth
2 Bessel

3.3 MODE OF OPERATION

1 Low-Pass
2 High-Pass
3 Band-Pass
4 Band-Reject
5 By-Pass

3.4 DEVICE CLEAR

When the device clear command is sent the following parameters, irregardless of their existing setting, are set as follows:

INPUT GAIN	0dB
OUTPUT GAIN	0dB
RESPONSE	Butterworth
MODE	Low-Pass
CUTOFF FREQUENCY	100kHz
COUPLING	AC

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SECTION 4
INCOMING ACCEPTANCE

4.1 INTRODUCTION

The following procedure should be used to verify that the Model 34A filter card, inserted in a Model 3905A/3905B/3905C or 3916A/3916B/3916C Mainframe, is operating within specifications. These checks may be used for incoming acceptance and periodic performance checks. Tests must be made with all covers in place on the Model 3905A/3905B/3905C or 3916A/3916B/3916C, with filter cards inserted, operating for a minimum tie of ½ hour to reach thermal equilibrium. If not operating within specifications refer to Section 5, Calibration, before attempting any detailed maintenance. Before testing, follow the initial set-up and operating procedure in Section2 of this manual and the Model 3905A/3905B/3905C or 3916A/3916B/3916C Operating and Maintenance Manual.

4.2 TEST EQUIPMENT REQUIRED

The test equipment below is required to perform the following tests:

a. Low Distortion RC Oscillator: Krohn-Hite Model 4400A or equivalent.

b. RC Oscillator: 10Hz to 10MHz, frequency response of ±0.025dB from 10Hz to 500kHz. Krohn-Hite Model 4200B/4300B or equivalent.

c. AC Voltmeter: capable of measuring 100μV to 10Vrms, 10MHz bandwidth, Fluke Model 8920A or equivalent.

d. Frequency Counter.

e. Distortion Analyzer: Krohn-Hite Model 6900B or equivalent.

4.3 FILTER CHARACTERISTICS

4.3.1 Low Pass/High Pass Response

The Model 34A has two independent channels in either the low-pass, high-pass or by-pass mode; or one channel in the band-pas or band-reject mode. Either Butterworth (maximally flat) or Bessel (linear phase) response is selectable.

Set filter cutoff frequency to 1kHz in the low-pass mode “L.P.” with Butterworth response “bu.” and with 0dB Input and Output gain. Apply 1Vrms at 100Hz to the INPUT of the channel whose second digit ends in one (n.1). These settings can be entered into all cards of the same type simultaneously by pressing the [ALL CHAN] key (so its LED is on) prior to entering the above settings. When this LED is off, these settings will be entered only in the channel indicated in the channel DISPLAY.

Monitor the OUTPUT of the filter with an ac voltmeter and record the OUTPUT voltage. Set the oscillator frequency to 1kHz. The OUTPUT voltage should be approximately –3db. Set the frequency to 2kHz. The OUTPUT voltage should be approximately –24dB. Set the filter to

Bessel response “bES” and repeat the above. The OUTPUT voltage should be approximately –7.6dB and –25.4dB respectively.

Set the filter cutoff frequency to 1kHz in high-pass mode “h.P.” with Butterworth response and with 0dB Input and Output gain. Apply 1Vrms at 10kHz to the INPUT of the filter. Monitor the OUTPUT of the filter with an ac voltmeter and record the OUTPUT voltage. Set the oscillator frequency to 1kHz. The OUTPUT voltage should be approximately –3dB. Set the frequency to 500Hz. The OUTPUT voltage should be approximately –24dB. Set he filter to Bessel response and repeat the above. The OUTPUT voltage should be approximately –7.6dB and –25.4dB respectively.

In the by-pass mode “bYP.” the INPUT is connected directly to the OUTPUT. Monitor the INPUT and OUTPUT to verify this mode of operation.

4.3.2 Cutoff Frequency Accuracy

Connect the oscillator at 1Vrms at 50Hz to the INPUT of a filter set to Butterworth response. Set the cutoff frequency to 1kHz in the low-pass mode wit 0dB Input and Output gain.

Monitor the OUTPUT of the filter with a frequency counter and an ac voltmeter, and record the OUTPUT voltage. Set the oscillator to 1kHz and adjust its frequency so the OUTPUT voltage is –3dB. The oscillator frequency should be within ±2% of the cutoff frequency of 1kHz. Repeat above at a filter cutoff frequency of 100kHz, 500kHz and 1MHz. The tolerance should be within ±2% at 100kHz and 500kHz, and ±5% at 1MHz.

Connect the oscillator at 1Vrms at 20kHz to the INPUT of the filter set to a cutoff frequency of 1kHz in the high-pass mode with 0dB Input and Output gain. Monitor the OUTPUT of the filter with a frequency counter and an ac voltmeter, and record the OUTPUT voltage. Set the oscillator to 1kHz and adjust its frequency so the OUTPUT voltage is –3dB. The oscillator frequency should be within ±2% of the cutoff frequency of 1kHz. Repeat above at a filter cutoff frequency of 100kHz, 500kHz and 1MHz. The tolerance should be within ±2% at 100kHz and 500kHz, and ±5% at 1MHz.

4.3.3 Band-Pass/Band-Reject Response

Variable band-pass response shown in Figure 4.1, is obtained by applying the input signal to channel n.1 INPUT, setting the channel DISPLAY to channel n.1 (or any channel where the second digit ends in one) and setting the filter to the band-pass mode (“b.P.”). In the band-pass mode it is necessary that the [ALL CHAN] LED is off.

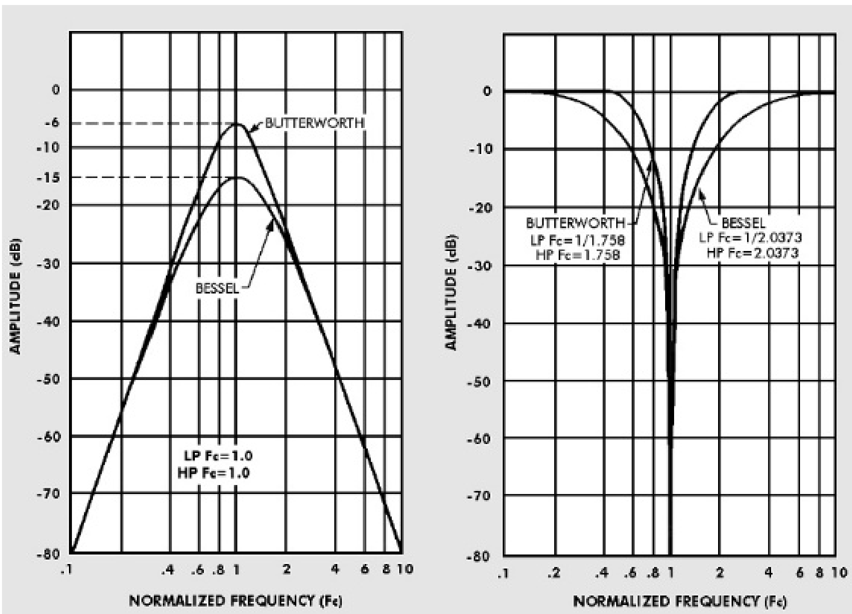

Figure 4.1 Band-Pass Response

Set the filter to Butterworth response and apply 1Vrms at 10kHz to the INPUT of channel n.1 set to a low cutoff frequency of 1kHz. Set the filter to channel n.2 and the high cutoff frequency to 100kHz.

Monitor the OUTPUT of channel n.1 with an ac voltmeter and record the voltage. Set the oscillator frequency to 1kHz and 100kHz. The OUTPUT voltage should be approximately –3dB at these frequencies. Set the oscillator frequency to 500Hz and 200kHz. The OUTPUT voltage should be approximately –24dB at these frequencies.

Variable band-reject response, shown in Figure 4.2, is obtained by applying the input signal to channel n.1 INPUT and setting the filter to the band-reject mode ("b.r.") with Butterworth response. Apply 1Vrms at 100Hz to the INPUT of channel n.1 and set the low cutoff frequency to 1kHz. Se the filter to channel n.2 and the high cutoff frequency to 100kHz.

Monitor the OUTPUT of channel n.1 with an ac voltmeter and record the voltage. Set the oscillator frequency to 1kHz and 100kHz. The OUTPUT voltage should be approximately –3dB at these frequencies. Set the oscillator frequency to 2kHz and 50kHz. The OUTPUT voltage should be –24dB at these frequencies.

4.3.4 Stopband Attenuation

Accurate stopband attenuation measurements require some simple precautions because of low level signals. The filter should be shielded with top and bottom covers of the Model 3905A/3905B or 3916A/3916B in place. BNC cables only should be used between oscillator, filter and voltmeter and no other instruments should be connected.

Connect the oscillator at 3Vrms at 20kHz to the INPUT of the filter set to a cutoff frequency of 1kHz with 0dB Input and Output gain. Connect the OUTPUT of the filter through a 6kHz passive high-pass filter, as shown in Figure 4.3, to the AC Voltmeter. Set the filter to the low-pass mode. The filter OUTPUT should be <300μVrms (-80dB).

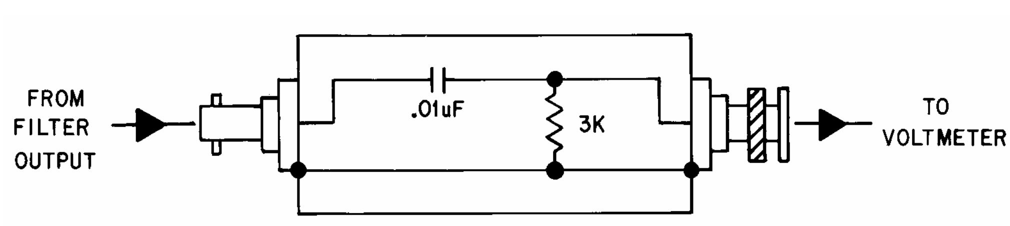

Figure 4.3 High-Pass Filter

4.3.5 Pre-Filter and Post-Filter Gain Accuracy

Set the filter to a cutoff frequency of 1kHz in the low-pass mode with 0dB Input and Output gain and apply 50mVrms at 100Hz to the INPUT.

Monitor the OUTPUT of the filter with an ac voltmeter and record the OUTPUT voltage. Set the GAIN of the pre-filter (Input) to 20dB. The OUTPUT of the filter should be a sinewave and within ±0.2dB of the pre-filter gain setting of 20dB. Set the gain of the pre-filter (Input) to zero and the gain of the filter post-filter (Output) to 20dB. The OUTPUT of the filter should be a sinewave and within ±0.2dB of the post-filter gain settings of 20dB.

4.3.6 Noise Check

Short the INPUT of the filter and set it to 0dB Input and Output gain, low-pass mode, Butterworth response at a cutoff frequency of 2MHz. Connect the OUTPUT of the filter using a shielded BNC cable in series with a 2MHz low-pass filter, shown in Figure 4.4, to the AC Voltmeter. Voltmeter reading should be <200µV. Set the cutoff frequency to 200kHz. Voltmeter reading should be <200µV. Set the filter to the high-pass mode at a cutoff frequency of 100Hz. Voltmeter reading should be <200µV. The 2MHz low-pass filter should be inserted in a shielded enclosure (Pomona Model 3231 or equivalent) and connected directly to the voltmeter. Nothing else should be connected to the filter and voltmeter.

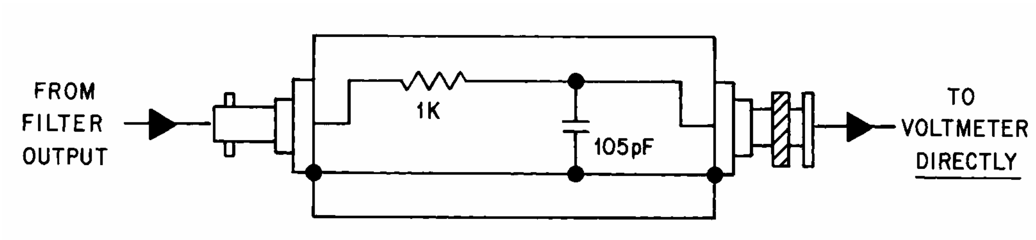

Figure 4.4 Low-Pass Filter

4.3.7 Distortion and Maximum Signal Checks

a. Set the filter to a cutoff frequency of 25.6kHz in the low-pass mode with 0dB Input and Output gain. Connect a low distortion oscillator to the Input and apply 1Vrms at 1kHz. Monitor the OUTPUT of the filter with a distortion analyzer. The distortion should be <0.01%.

CAUTION!
If the distortion is excessive, verify that the distortion of the oscillator being used is less than 0.005%.

b. Connect a 50 ohm terminator to OUTPUT of the filter. Distortion should be <0.01%. Remove terminator.
c. Set oscillator to 2.9Vrms. Distortion should be <0.1%.
d. Set oscillator to 460m Vrms and filter Output gain to 20dB. Distortion should be <0.1%. Set filter back to 0dB Output gain.
e. Set oscillator to 1Vrms and filter to 100Hz in HP mode. Distortion should be <0.01%.
f. Set oscillator to 2.8Vrms. Distortion should be <0.1%.
g. Disconnect oscillator and distortion analyzer.

4.3.8 AC/DC Coupling Check

Apply 1Vdc to the Input of the filter in the low-pass mode with 0dB of input and output gain. In the dc coupled mode, the Output of the filter should be approximately 1Vdc and approximately 0Vdc in the ac coupled mode.

All sections of this procedure, except Section 4.3.3, should be repeated to check the other channel where the channel number ends in two (2).

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