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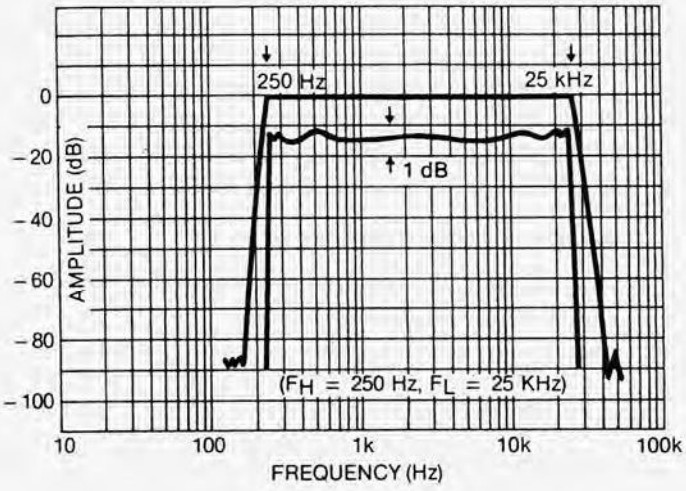


Figure 3-7. Model 751A Typical Bandpass Response

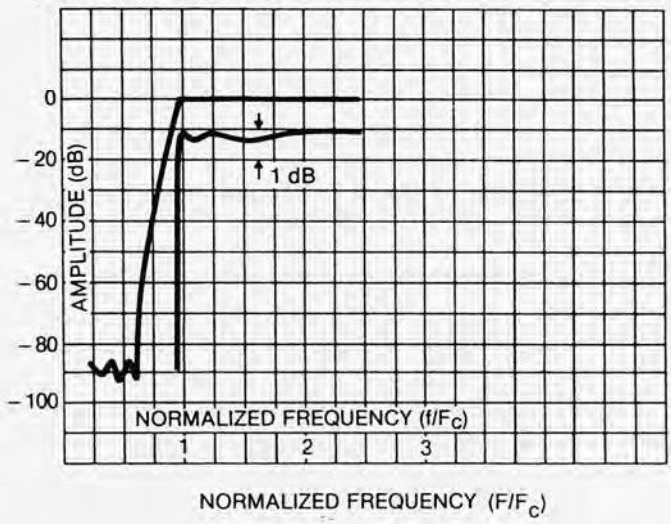


Figure 3-8. Model 751A High-Pass Frequency Response

3.3.2 Model 752A

Low-Pass Filter

The two channels of the instrument may be used independently to process two different input signals.

If the input coupling switch is set to DC, the passband of the filter extends from dc to the cutoff frequency which is defined by the cutoff frequency dials and the multiplier.

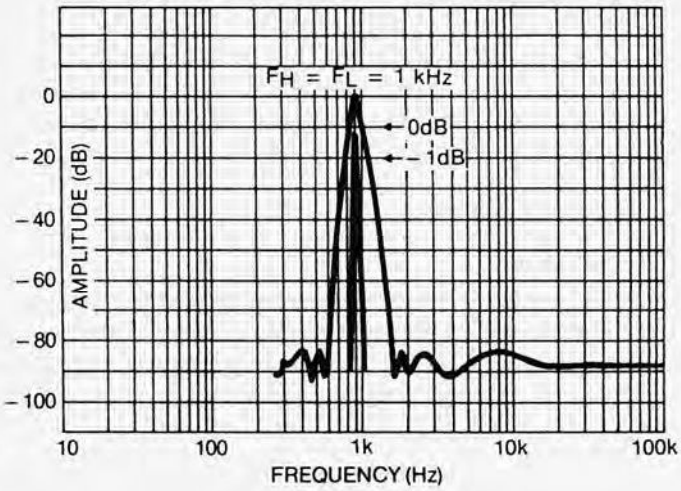


Figure 3-9. Model 751A Minimal Bandpass Response

Switching the coupling to AC causes a 6 dB/oct. rolloff below 0.3 Hz. This position should be used when large dc offsets are present in the input signal and response to dc is not required.

The passband gain of each channel may be selected to be 0, 10, 20, 30 or 40 dB using the Gain switch. To maximize the useful dynamic range, the maximum gain should be used without causing the overload LED to light. Overload "On" indicates that the input signal has exceeded the maximum safe desirable amplitude. If the signal exceeds this range, a ± 10 Volt A/D converter connected to the output of the 752A will overflow; however, no distortion occurs in the instrument until the signal exceeds full-scale by 10%.

The maximum desirable full-scale signal is ± 10V (7.1 Vrms) for 0dB gain. When gain is employed, the maximum input signal decreases in direct proportion to the increase in gain. For example, with 20 dB gain, the maximum desirable input amplitude is ± 1.0V (0.71 Vrms).

Low-Pass Filter with Doubled Rolloff

The two channels of the instrument may be cascaded by connecting the output of channel 1 to the input of channel 2. The cutoff frequency of both channels is set to the same value. Gain controls of both channels may be used. However, to maximize the usable dynamic range, the gain setting of channel 1 should be used before applying gain in channel 2. For example, if 50 dB gain is needed, set channel 1 to 40 dB and Channel 2 to 10 dB.

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Response Characteristics

The following figures show examples of typical Model 752A response characteristics.

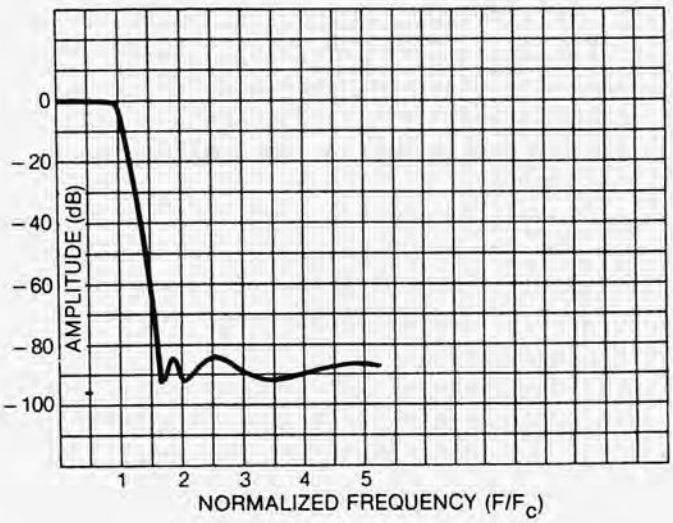


Figure 3-10. Model 752A Frequency Response

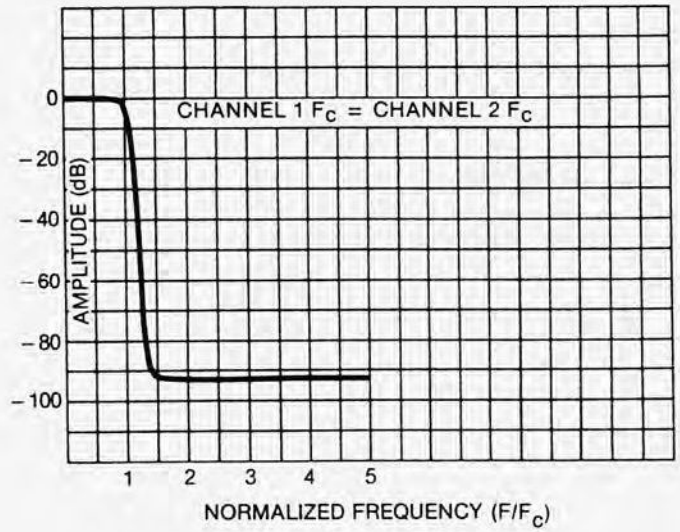


Figure 3-11. Model 752A Cascaded Channel Frequency Response

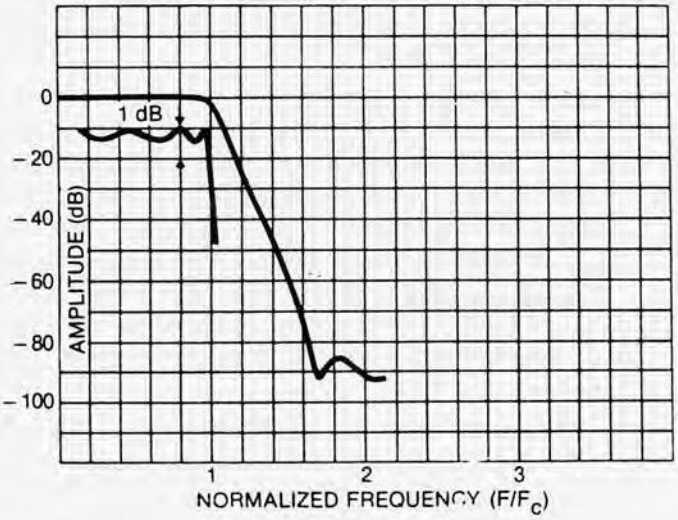


Figure 3-12. Model 752A Low-Pass Freuency Response

3.3.3 Model 753A

High-Pass Filter

The passband of the filter extends from the cutoff frequency setting to the upper 3 dB point of its active elements, which is around 400 kHz. The cutoff frequency is defined by the two cutoff frequency dials and the multiplier.

The passband gain may be selected to be 0, 10, 20, 30 or 40 dB using the gain switch. To maximize the useful dynamic range, the maximum gain should be used without causing the overload LED to light. Overload "On" indicates that the input signal has exceeded the maximum safe desirable amplitude. If the signal exceeds this range, a ± 10 Volt A/D converter connected to the output of the 753A will overflow; however, no distortion occurs in the instrument until the signal exceeds full-scale by 10%.

The maximum desirable full-scale signal is ± 10V (7.1 Vrms) for 0 dB gain. When gain is employed, the maximum input signal decreases in direct proportion to the increase in gain. For example, with 20 dB gain, the maximum desirable input amplitude is ± 1.0 V (0.71 Vrms).

Low-Pass Filter

If the input coupling switch is set to DC, the passband of the filter extends from dc to the cutoff frequency which is defined by the cutoff frequency dials and the multiplier.

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Switching the coupling to AC causes a 6 dB/oct. rolloff below 0.3 Hz. This position should be used when large dc offsets are present in the input signal and response to dc is not required.

The passband gain may be selected to be 0, 10, 20, 30 or 40 dB using the gain switch. To maximize the useful dynamic range, the maximum gain should be used without causing the overload LED to light. Overload "On" indicates that the input signal has exceeded the maximum safe desirable amplitude. If the signal exceeds this range, a ±10 Volt A/D converter connected to the output of the 753A will overflow; however, no distortion occurs in the instrument until the signal exceeds full-scale by 10%.

The maximum desirable full-scale signal is ±10V (7.1 Vrms) for 0 dB gain. When gain is employed, the maximum input signal decreases in proportion to the increase in gain. For example, with 20 dB gain, the maximum desirable input amplitude is ±1.0V (0.71 Vrms).

Bandpass Filter

The two channels of the Model 752A may be cascaded by connecting the output of channel 1 to the input of channel 2 as shown in figure 3-13.

The passband of the filter extends from the high-pass cutoff frequency setting to the low-pass cutoff frequency setting. These are determined by the two cutoff frequency dials and the corresponding multiplier switches.

The narrowest passband is obtained by setting high-pass and low-pass cutoff frequencies to the same value, f_o. In this case, the insertion loss is nominally 0dB; the −3 dB bandwidth extends from approximately 0.95 f_o to approximately 1.05 f_o and is equal to 0.1 f_o. This corresponds to a Q or 10. In this mode the instrument operates as a constant −Q (or constant % − Bandwidth) Filter.

Gain may be selected in either, or both high-pass and low-pass sections. To maximize the useful dynamic range, the maximum gain should be used without causing the corresponding overload LED to light.

Band-Reject Filter

The two channels of the instrument may be connected in parallel by applying the input signal to both channels and summing the output signals, as shown in figure 3-14.

The rejection band of the filter extends from the low-pass cutoff frequency setting to the high-pass cutoff frequency setting. These are determined by the cutoff frequency dials and multiplier switches.

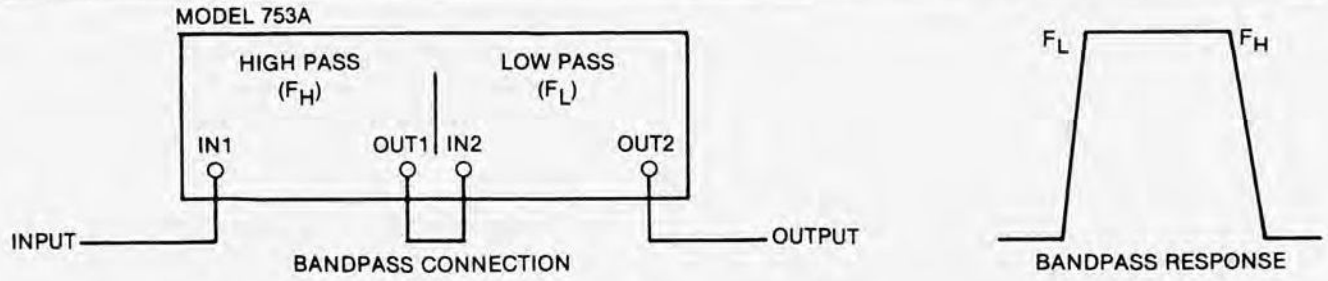


Figure 3-13. Band-Pass

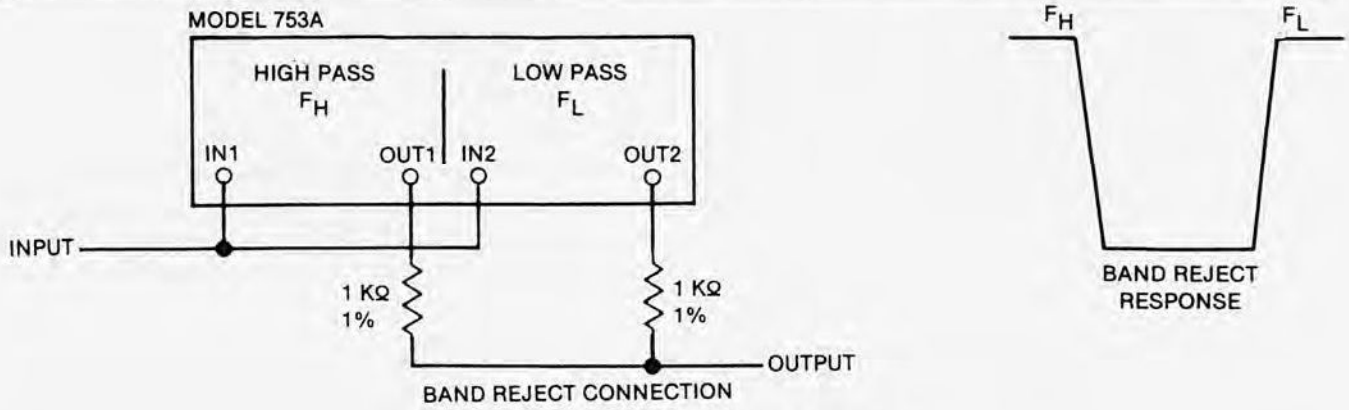


Figure 3-14. Band Reject

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Because of the summation network at the output, this connection has an inherent 6dB insertion loss. If gain is necessary, both channel gains must be increased and set to the same value, when equal response outside the rejection band is desired. Unequal responses may be obtained by using different gains. For example, the low-pass side of the rejection band may be made higher in amplitude by setting the low-pass gain higher.

In either case, gain in the respective passbands will be 6dB less than the selected gain settings.

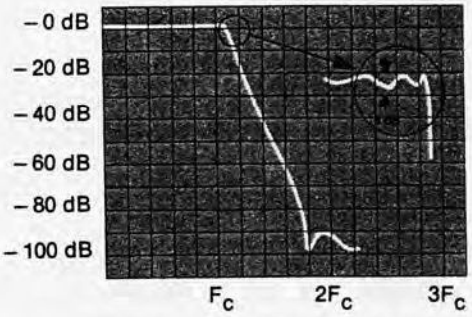


Figure 3-15. Low-Pass Response

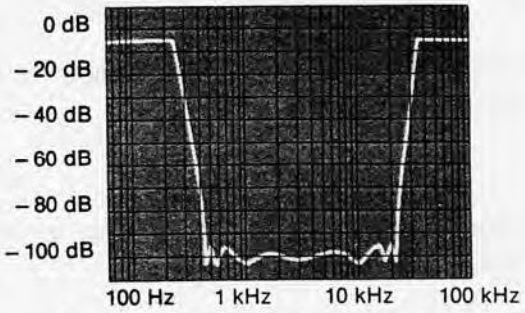


Figure 3-16. Band-Reject Response

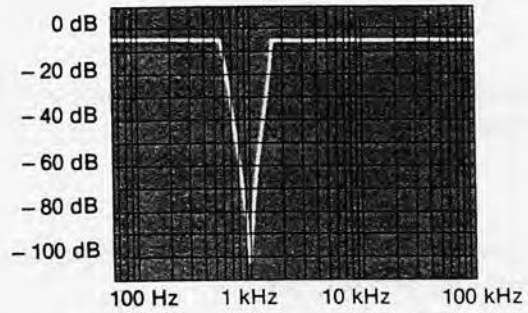


Figure 3-17. Minimum Band-Reject (Notch) Response

A Notch response is a particular case of Band-Reject response. To obtain the minimum-width notch, set the low-pass cutoff at 59% and the high-pass cutoff at 167% of the desired notch frequency.

Response Characteristics

The following figures show examples of typical Model 753A response characteristics.

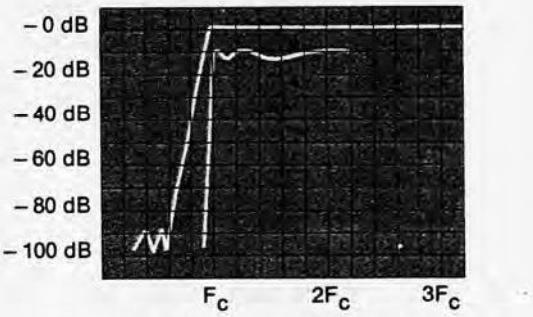


Figure 3-18. High-Pass Response

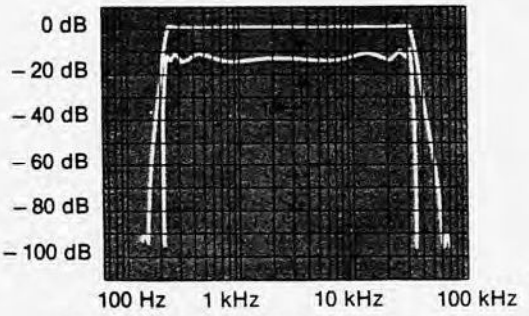


Figure 3-19. Pass-Band Response

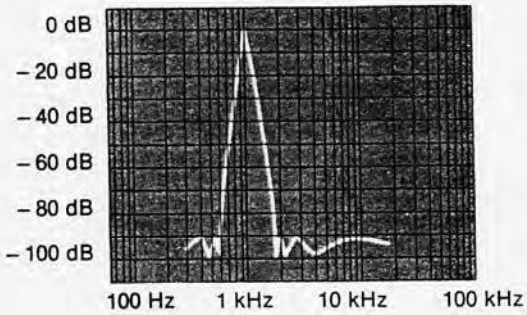


Figure 3-17. Minimum Pass-Band Response

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3.4 REMOTE PROGRAMMING: BCD INTERFACE (OPTION 01)

A 50-pin connector is provided on the rear panel. Table 3-5 lists the pin connections and describes each signal. Remote programming inputs are low active ("1" State). A "1" is 0 V to 0.8 V, and a "0" is +2 V to +5 V.

Table 3-5. BCD Interface Programming Connector[a]

Pin	Function	Description
1	×1 Cutoff Frequency Multiplier	Low active. Selects the cutoff frequency multiplier for Channel 1.
2	×10 Cutoff Frequency Multiplier	
3	×100 Cutoff Frequency Multiplier	
4	×1k Cutoff Frequency Multiplier	
5	Cutoff Frequency 1 Bit	Low active. Selects the units digits for the cutoff frequency for Channel 1 in 8, 4, 2, 1 binary code.
6	Cutoff Frequency 2 Bit	
7	Cutoff Frequency 4 Bit	
8	Cutoff Frequency 8 Bit	
9	Cutoff Frequency 10 Bit	Low active. Selects the tens digit for the cutoff frequency for Channel 1 in 8, 4, 2, 1 binary code.
10	Cutoff Frequency 20 Bit	
11	Cutoff Frequency 40 Bit	
12	Cutoff Frequency 80 Bit	
13	Gain 1 Bit	Low active. Selects the gain for Channel 1 in 4, 2, 1 binary code. Programmed as follows: 0 dB-000, 10 dB-001, 20 dB-010, 30 dB-011, 40 dB-100.
14	Gain 2 Bit	
15	Gain 4 Bit	
16	Overload	Low active. Indicates amplitude of input signal exceeds the maximum value in Channel 1.
17-22	Ground	
23	Load Command	Low active. Loads cutoff frequency and gain into the digital registers of Channel 1.
24	Ground	
25-26	Remote Enable	Low active. Disables front panel control of both channels and enables remote control.
27	Ground	
28	Load Command	Low active. Loads cutoff frequency and gain into the digital registers of Channel 2.
29-34	Ground	
35	Overload	Low active. Indicates amplitude of input signal exceeds the maximum value in Channel 2.
36	Gain 4 Bit[b]	Low active. Selects the gain setting for Channel 2 in 4, 2, 1 binary code. Programmed as follows: 0 dB-000, 10 dB-001, 20 dB-010, 30 dB-011, 40 dB-100.
37	Gain 2 Bit	
38	Gain 1 Bit	

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Table 3-5. BCD Interface Programming Connector[a] (Continued)

Pin	Function	Description
39 40 41 42	Cutoff Frequency 80 Bit Cutoff Frequency 40 Bit Cutoff Frequency 20 Bit Cutoff Frequency 10 Bit	Low active. Selects the tens digit for the cutoff frequency for Channel 2 in 8, 4, 2, 1 binary code.
43 44 45 46	Cutoff Frequency 8 Bit Cutoff Frequency 4 Bit Cutoff Frequency 2 Bit Cutoff Frequency 1 Bit	Low active. Selects cutoff frequency multiplier for Channel 2.
47 48 49 50	×1k Cutoff Frequency Multiplier ×100 Cutoff Frequency Multiplier ×10 Cutoff Frequency Multiplier ×1 Cutoff Frequency Multiplier	Low active. Selects cutoff frequency multiplier for Channel 2.

[a] Applies to all Models except the 751A/753A, where "Channel 1" relates to the high pass controls; "Channel 2" relates to the low-pass controls.

[b] Not used in the 751A; Post-Filter Gain is limited to 20 dB.

3.5 REMOTE PROGRAMMING: GPIB INTERFACE (OPTION 02)

3.5.1 Introduction

The reader is assumed to be familiar with the IEEE 488-1978 standard. If not, a detailed description of the bus system and its parameters, IEEE STD 488-1978 is available from:

IEEE Standards
347 East 47th Street
New York, New York 10017

3.5.2 Device Address Code and Mode Select Switches

A row of eight miniature rocker switches on the rear panel sets the device address code and other operating modes.

3.5.2.1 Device Address Code Selection — Switches #1 through #5

The five left-most switches allow the selection of the device address in the system. The range of addresses is from 0 — 30 (decimal) corresponding to the ASCII characters "SPACE" through ">" see table 2-1.

The switches have binary weights of "1", "2", "4", "8" and "16". When the top edge of the rocker is pressed, the binary weight of that switch contributes to the address. When the bottom edge of the rocker is pressed, that weight is off. For example, to set a listen address of 11 (decimal), the rocker switch pattern would be (left-to-right) on-on-off-on-off, or up-up-down-up-down.

3.5.2.2 Listen Always (Listen Only) Mode — Switch #6

The Listen Always (or Listen only) mode allows the instrument to only function as a listener. This eliminates the need for addressing the unit as a listener in simpler systems. When the Listen Always rocker switch is in the up (top depressed) position the Listen Always (Listen only) mode is selected. When this rocker switch is down (bottom depressed), the unit must be explicitly made a listener to receive data.

3.5.2.3 Shield Ground — Switch #8

When this switch is in the up position the shield of the IEEE Bus cable is electrically connected to the circuit ground of the instrument. When the switch is in the down position, the shield is not connected.

Use of this switch may be necessary in achieving optimum noise performance in a multi-instrument system.

3.5.3 Initialization

After power has been applied to all devices in the system, the Controller should:

1. Send REM (Remote Enable) active (low).
2. Send IFC (Interface Clear) active (low).

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3. Send IFC (Interface Clear) inactive (high)

This will initialize all bus devices and set them to an idle state. Exercising the IFC line as above is also useful in reinitializing the system whenever it may be necessary. The instrument will assume the UNLISTEN state after this sequence.

3.5.4 Listen State

In order to receive data, the instrument must be in the LISTEN state, indicated by the LOCAL/LISTEN LED on the front panel. When in the LISTEN state, the unit handshakes and inspects all data sent over the bus. When not in the LISTEN state, the unit does not participate in the handshake and ignores data. Two methods are available for effecting the LISTEN state:

1. Sending the LISTEN command.
2. Setting the LISTEN ALWAYS switch on.

LISTEN Command

The LISTEN command is a universal bus command sent by the contoller containing the address of the device to be affected. After sending this command, the green LISTEN LED on the front panel of the instrument should be lit.

LISTEN ALWAYS

If the rear panel LISTEN ALWAYS switch #6 is set to ON, then the first prefix character handshake cycle on the bus will place the instrument in the LISTEN mode, lighting the green LISTEN LED.

UNLISTEN STATE

If the LISTEN ALWAYS switch is OFF, the instrument will leave the LISTEN state if the universal command UNLISTEN or, IFC is issued or, power is removed. If the LISTEN ALWAYS switch is ON, the instrument will leave the listen state only if power is removed or IFC is issued.

3.5.5 Sending Data

All control and input data are sent in ASCII character format, which is prevalent in GPIB systems. When in the LISTEN mode, the instrument will handshake all characters sent over the bus, but only the characters in table 3-6 are meaningful to filters operation.

If any characters other than these are sent, the instrument will ignore them.

Channel Select Commands

To select the filter channel to be loaded, the character **C** must be sent followed by either:

A for Channel 1 (or H — Models 751A/753A).
B for Channel 2 (or L — Models 751A/753A).
D for both Channels

For example, to select Channel 1 send:

CA

In order to make the string more intelligible to the user, extra characters may be inserted:

CH:A
CHNL = A

Table 3-6. ASCII Codes

ASCII Character	Function
A	Code for Channel 1; high pass (751A)
B	Code for Channel 2; low.pass (751A)
D	Code for both Channels
G	Gain Digit Prefix
0,1,2,3,4,5,6,7,8, 9	Data Value
F	Cutoff Frequency Digit Prefix
M	Cutoff Frequency Multiplier Prefix
C	Channel Select Prefix
CR	Carriage Return for Loading
GET	Group Execute Trigger for Loading

Frequency Digit Commands

The frequency digit is loaded by sending **F** followed by up to two digits between 0 and 99. For example, to send a frequency digit of 6, send:

F6

By inserting extra characters, the string can be more readable:

FREQ = 6
FREQ DIGIT: 6

Notice that both of these last examples contain the same key characters, F6. The other characters are simply ignored.

If more than two digits are sent, only the last two will be retained.

It is advisable never to send a frequency digit of 0 since this may cause a large dc offset to appear at the filter outputs.

Frequency Multiplier Commands

The frequency multiplier is treated like an exponent of 10. To enter the multiplier, send **M** followed by one digit from 0 to 3 which represents the power of ten of the multiplier. For example, M3 corresponds to a multiplier setting of × 1k.

Any digit greater than 3 will be ignored and not loaded and if more than one digit is entered, only the last one will be retained if it is 3 or less.

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By adding characters, alternate strings may be issued:

MULT = 3
MULT RNGE: 3

Gain Commands

The gain is loaded by sending **G** followed by 1 digit between 0 and 4 specifying the gain in multiples of 10 dB. For example, to set a maximum gain of 40 dB send:

G4

By inserting extra characters, the string can be more readable:

GAIN = 4
GAIN: 4

The type of filter gain used (i.e., Channel 1, Channel 2, Pre-filter or post-filter) is determined by the last channel select command that was sent over the system.

Notice that all these examples contain the same key characters "G4". The other characters are ignored. The maximum post-filter gain of the 751A's channel 2 is 20 dB (G2).

Terminator Commands

To terminate a digital value following a prefix character, send another prefix character (such as C, F, M, etc.), or CR or GET commands.

For example:

F28M.

The CR (Carriage Return) or GET (Group Execute Trigger) commands at the end of a command-value string loads the string into the instrument.

The GET command is a universal command the controller sends to initiate a simultaneously activity by more than one bus device. The interface interprets the GET command exactly as a CR character, causing loading of the data to the instrument.

Combining Commands

Channel number and gain commands may be entered in one ASCII string followed by a CR or GET which transfers all data simultaneously to the unit. The order of command is unimportant. If one or more of the commands is omitted, the last value entered will be retained (as long as power is maintained). If more than one occurrence of a command is present in a string, only the last one will be retained.

For example, to program Channel 2 with 60 kHz cutoff-frequency and 10 dB gain send:

CBF60M3G1 (CR)

Alternatives for the same parameters are:

F60M3G1CB (CR)
M3CBG1F60 (CR)

In addition, if the channel select, multiplier digit, and gain do not change from the previous entry but the frequency digit changes to 40, then it is only necessary to send:

F40 (CR)

Extra characters may be included for easier programming:

"CHNL = A, FREQ = 60, MULT = 3, GAIN = 1 (CR)"

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SECTION 4
CIRCUIT DESCRIPTION

4.1 INTRODUCTION

This section gives a functional description of the Models 751A, 752A, and 753A Brickwall filters. Following this is a detailed explanation of the seventh-order elliptic filter.

4.2 MODEL 751A

For the following description, refer to figure 4-1. The input signal is applied to a low-noise input amplifier with programmable gain (Prefilter gain) of 0dB to 40 dB in 10 dB steps. An overload detector at the output of this amplifier indicates when input signal levels exceed $\pm 10\ V_{pk}$ or $7V_{rms}$. This signal is applied to an active RC seventh order high pass elliptic filter (see paragraph 4.5) whose cutoff frequency is programmed by changing the resistors in 8, 4, 2, 1 BCD steps and changing in the capacitors in decade steps.

The output of the high pass section is connected to an active RC seventh-order low pass elliptic filter. The high pass cutoff frequency is programmed the same as the low pass filter.

The high pass filters output is applied to an output amplifier with programmable gain (postfilter gain) of 0dB, 10 dB, or 20 dB. An overload detector at the output indicates when the output signal level exceeds $\pm 10\ V_{pk}$ or $7V_{rms}$, which is the rated input for most A/D converters.

All filter parameters can be controlled by the front panel controls or optional GPIB and BCD interfaces.

A regulated and shielded power supply provides all the filters power requirements.

4.3 MODEL 752A

For the following description, refer to figure 4-2. The

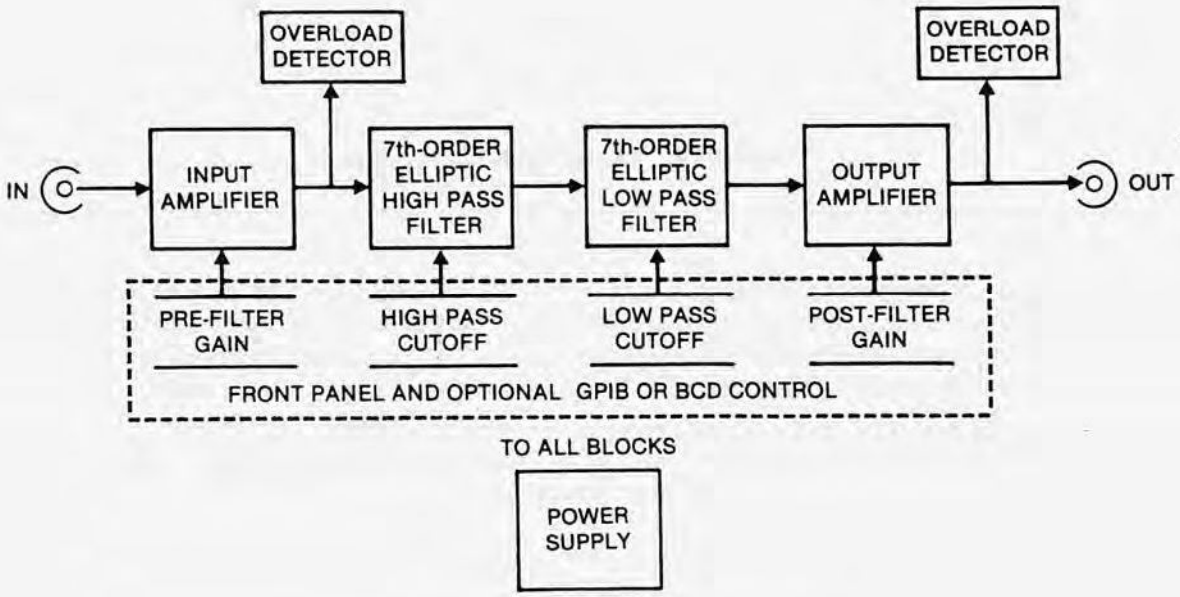


Figure 4-1. Model 751A Block Diagram

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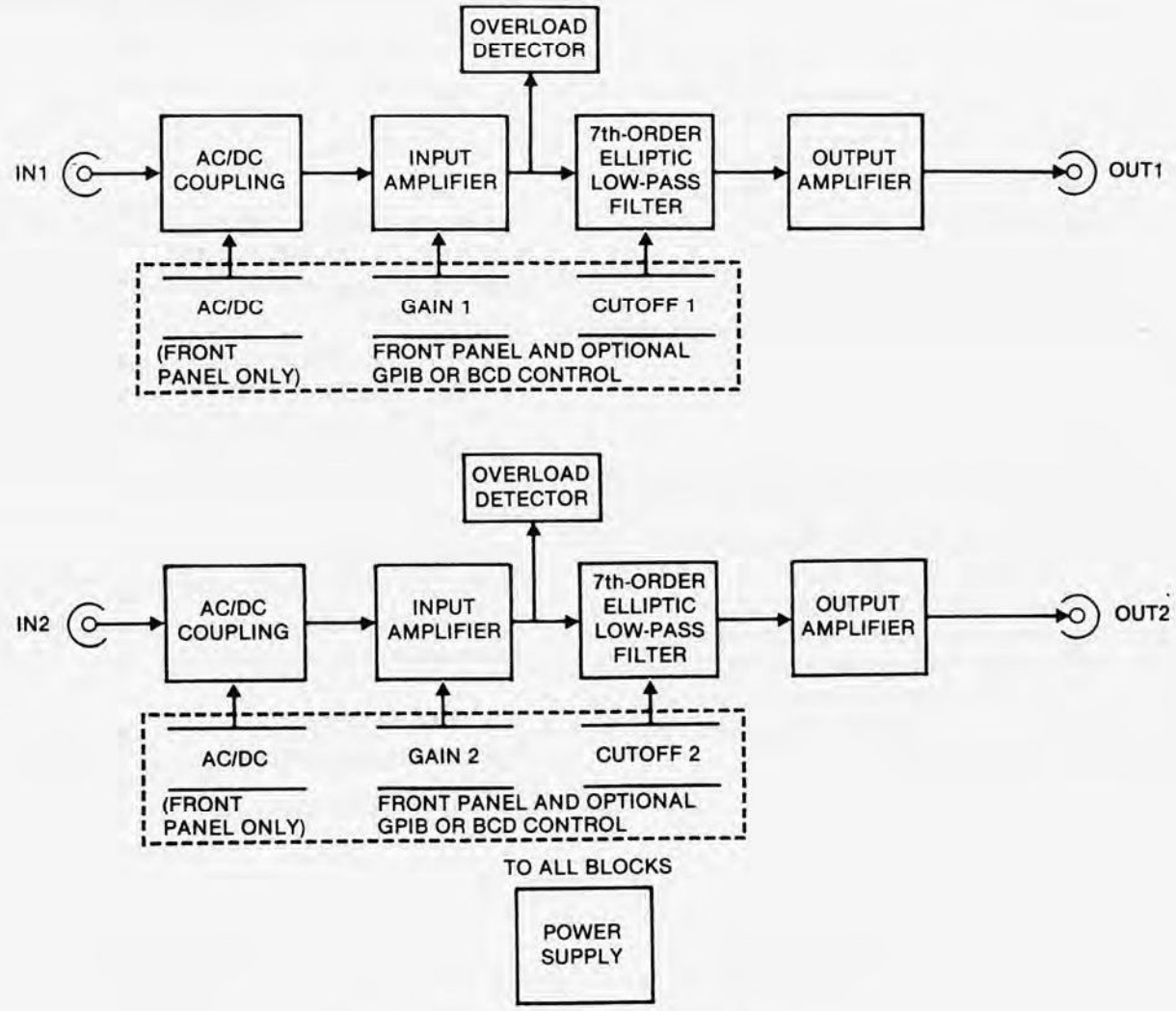


Figure 4-2. Model 752A Block Diagram

Model 752A consists of two identical, separate low pass filters which are amplitude and phase matched throughout the filter pass band. Since both channels are identical, only one channel will be described.

The input signal is applied through the AC/DC coupling switch (front panel control only) to the input of a low noise input amplifier with programmable gain of 0dB to 40 dB in 10 dB steps. An overload detector at the output of this amplifier indicates when input signal levels exceed ± 10 V_{pk} or $7V_{rms}$. This signal is applied to an active RC seventh order low pass elliptic filter (see paragraph 4.5) whose cutoff frequency is programmed by changing the resistors in 8, 4, 2, 1 BCD steps and changing in the capacitors in decade steps.

The low pass filter output is applied to the fixed gain output amplifier. This serves to isolate the filter section from the load connected to the output and defines the full scale output at ± 10 V_{pk} or $7V_{rms}$, which is the rated input of most A/D converters.

All filter parameters can be controlled by front panel controls or optional GPIB and BCD interfaces.

A regulated and shielded power supply provides all the filters power requirements.

4.4 MODEL 753A

For the following description, refer to figure 4-3. The Model 753A consists of a separate high pass filter (Channel 1) and low pass filter (Channel 2).

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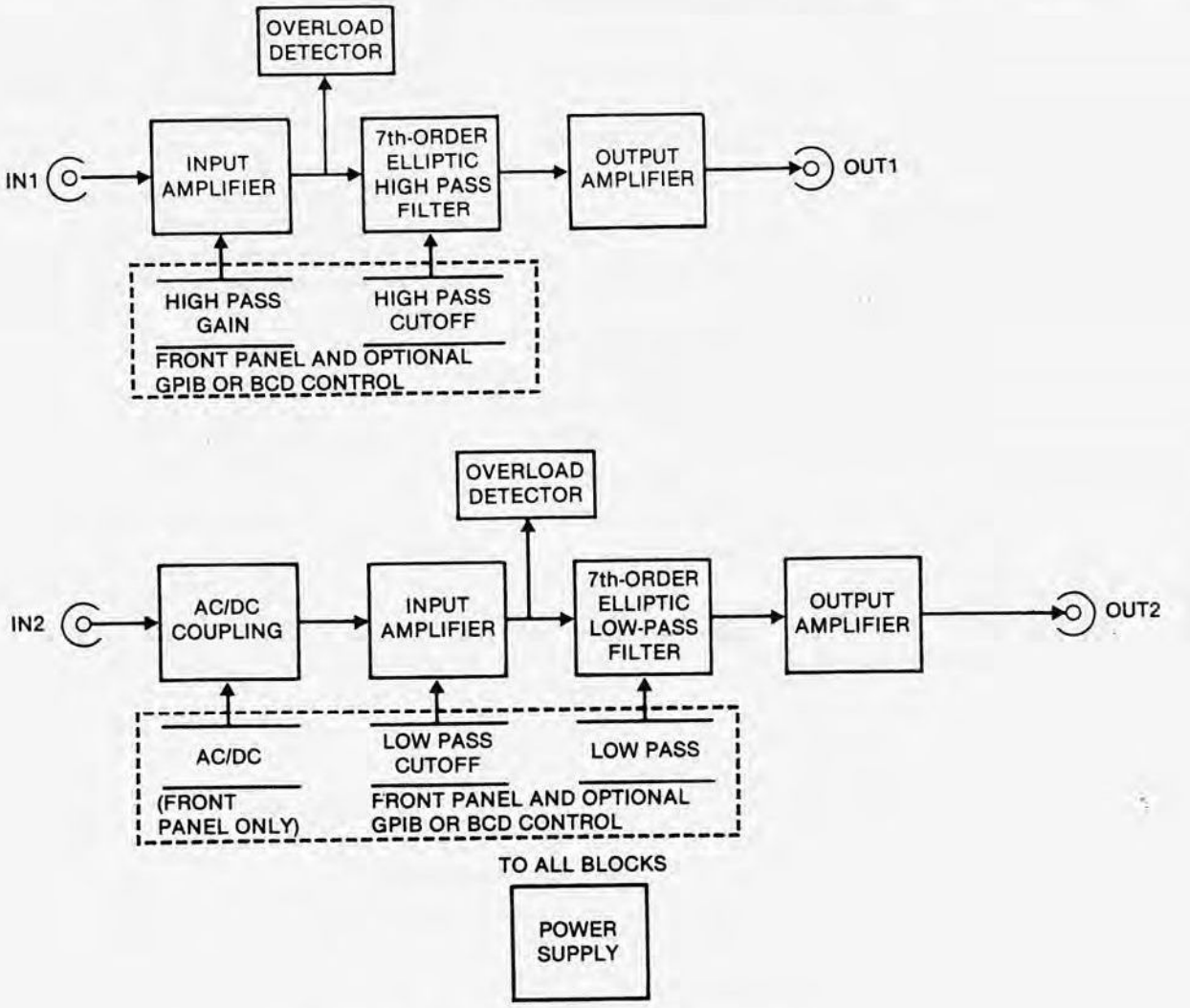


Figure 4-3. Model 753A Block Diagram

High Pass Filter

The input signal is applied to a low-noise input amplifier with programmable gain (Prefilter gain) of 0dB to 40 dB in 10 dB steps. An overload detector at the output of this amplifier indicates when input signal levels exceed ± 10 V_{pk} or $7V_{rms}$. This signal is applied to an active RC seventh order high pass elliptic filter (see paragraph 4.5) whose cutoff frequency is programmed by changing the resistors in 8, 4, 2, 1 BCD steps and changing in the capacitors in decade steps.

The high pass filters output is applied to the fixed gain output amplifier. This serves to isolate the filter section from the load connected to the output and defines the full scale output at ± 10 V_{pk} or $7V_{rms}$, which is the rated input of most A/D converters.

Low Pass Filter

The input signal is applied through the AC/DC coupling switch (front panel control only) to the input of a low noise input amplifier with programmable gain of 0dB to 40 dB in 10 dB steps. An overload detector at the output of this amplifier indicates when input signal levels exceed ± 10 V_{pk} or $7V_{rms}$. This signal is applied to an active RC seventh order low pass elliptic filter (see paragraph 4.5) whose cutoff frequency is programmed by changing the resistors in 8, 4, 2, 1 BCD steps and changing in the capacitors in decade steps.

The low pass filter output is applied to the fixed gain output amplifier. This serves to isolate the filter section from the load connected to the output and defines the full

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scale output at $\pm 10\ V_{pk}$ or $7V_{rms}$, which is the rated input of most A/D converters.

All filter parameters can be controlled by front panel controls or optional GPIB and BCD interfaces.

A regulated and shielded power supply provides all the filters power requirements.

4.5 ELLIPTIC FILTERS

This section provides general information relative to the filter sections used in the Models 751A, 752A, and 753A.

The seventh-order elliptic filter, as shown in figure 4-4, consists of a first order stage followed by three second-order stages. Also, figure 4-4 shows the zero/pole location for each stage, high pass and low pass filter amplitude responses, and transfer functions.

Figure 4-5 shows a simplified diagram for the first-order stage. This stage is a simple RC network followed by an unity gain noninverting operational amplifier. The R and C values determine the cutoff frequency. Notice the input and grounding connections for low pass and high pass filters.

Figure 4-6 shows a simplified diagram of the second order stage. This stage is a so-called state variable filter. The R and C values determine the cutoff frequency. R_Q sets the Q of the filter. R_L and R_H locates the zeros of the transfer function. The transfer function is represented by the general equation:

$$H_{(S)} = \frac{a_0 + a_1S + a_2S^2}{b_0 + b_1S + b_2S^2}$$

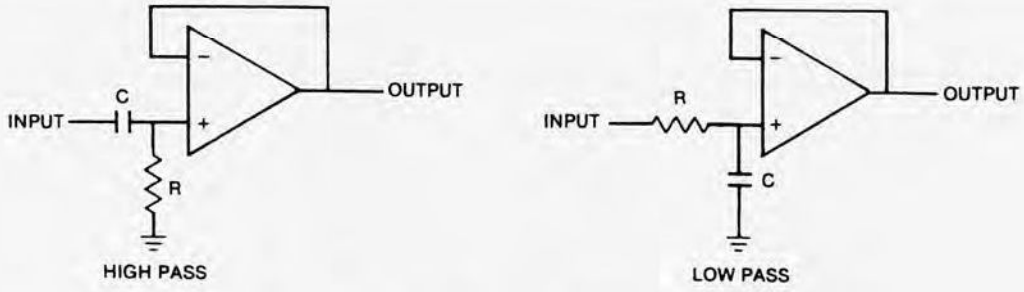


Figure 4-5. First-Order Stage

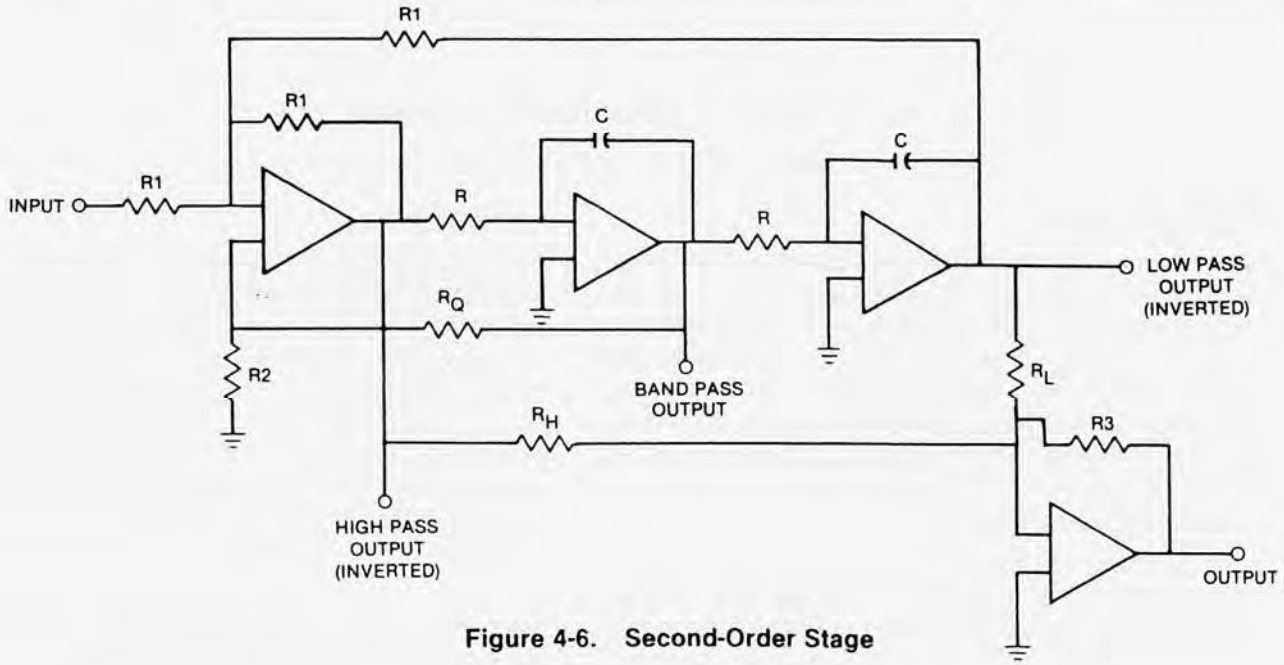


Figure 4-6. Second-Order Stage

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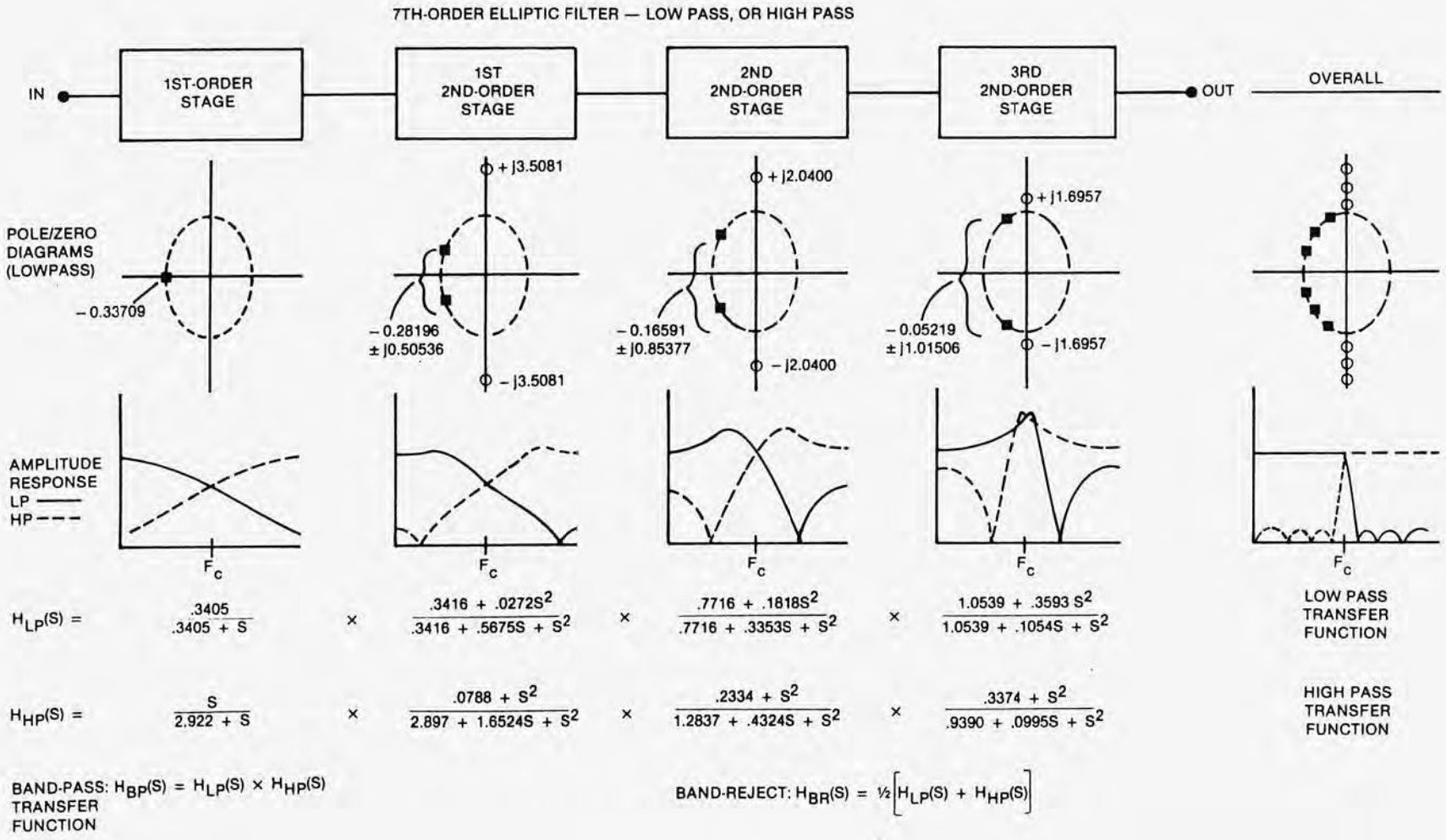


Figure 4-4. Seventh Order Elliptic Filter Parameters

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SECTION 5
CALIBRATION

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 CALIBRATION

Only limited calibration can be performed in the field, because these instruments are calibrated at the factory by comparing their response against the response of a "Factory Standard" instrument. The "Factory Standard", in turn, has been adjusted and is continuously maintained to provide a response which is essentially identical to the theoretical (or mathematical) response of these filters. As a result, it is recommended that any adjustments which alter the filter response be made only at the factory. The only adjustments that may be performed in the field are those pertaining to Gain Steps and DC Offsets.

Table 5-1 lists the required test equipment required to perform the tests and calibration procedures. Tables 5-2, 5-3, and 5-4 contain the dc offset and gain test for each model; perform these tests to identify calibration problems. Table 5-5 gives procedures for board access. Tables 5-6, 5-7, and 5-8 lists the actual calibration procedures for each model.

NOTE

The completion of these calibration procedures returns the instrument to correct calibration. All limits and tolerances given in these procedures are calibration guides and should not be interpreted as instrument specifications. Instrument specifications are given in section 1 of this manual.

Table 5-1. Required Test Equipment

Instrument	Suggested Model	Comments
Oscilloscope	Tektronix 475	Waveform viewing
Digital Voltmeter	Data Precision 2480	DC offset
RMS Voltmeter	Fluke 8921, 8922	Signal level
Signal Source	Wavetek 5100 Frequency Synthesizer	Gain accuracy
10 dB/Step Attenuator	Kay	Gain accuracy
50Ω BNC Termination	—	—

Table 5-2. 751A Gain and Offset Tests

Step	Test	Tester & Setup	Control	Desired Measurement	Measurement Record
1	0dB Gain	Connect the Model 751A as shown in figure 5-1. Model 5100: Freq 10.00 kHz, Output level 1.00 Vrms. Attenuator: 0dB	High Pass Cutoff: 01 × 1Hz Low Pass Cutoff: 99 × 1kHz Pre-Filter Gain: 0dB Post Filter Gain: 0dB	0 ± 0.2 dB	_____

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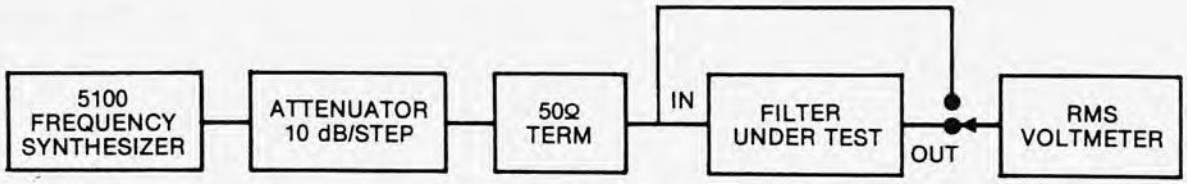


Figure 5-1. Gain Setup

Table 5-2. 751A Gain and Offset Tests (Continued)

Step	Test	Tester & Setup	Control	Desired Measurement	Measurement Record
2	10 dB Pre-filter Gain	Attenuator: 10 dB	Pre-filter: + 10 dB Post-filter: 0dB		_____
3	20 dB Pre-filter Gain	Attenuator: 20 dB	Pre-filter: + 20 dB Post-filter: 0dB		_____
4	30 dB Pre-filter Gain	Attenuator: 30 dB	Pre-filter: + 30 dB Post-filter: 0dB		_____
5	40 dB Pre-filter Gain	Attenuator: 40 dB	Pre-filter: + 40 dB Post-filter: 0dB		_____
6	10 dB Post-filter Gain	Attenuator: 10 dB	Pre-filter: 0dB Post-filter: + 10 dB		_____
7	20 dB Post-filter Gain	Attenuator: 20 dB	Pre-filter: 0dB Post-filter: + 20 dB		_____
8	0dB dc Offset	Connect Model 751A as shown in Figure 5-2	High Pass Cutoff: 01 × 1Hz. Low Pass Cutoff: 50 × 1kHz. Pre-filter Gain: 0dB Post-filter Gain: 0dB	Adjustable to 0Vdc	
9	+ 10 dB dc Offset		Pre-filter: + 10 dB Post-filter: 0dB		_____
10	+ 20 dB dc Offset		Pre-filter: + 20 dB Post-filter: 0dB		_____
11	+ 30 dB dc Offset		Pre-filter: + 30 dB Post-filter: 0dB		_____
12	+ 40 dB dc Offset		Pre-filter: + 40 dB Post-filter: 0dB		_____
13	+ 50 dB dc Offset		Pre-filter: + 40 dB Post-filter: + 10 dB		_____
14	+ 60 dB dc Offset		Pre-filter: + 40 dB Post-filter: + 20 dB		_____

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Figure 5-2. Offset Setup

Table 5-3. 752A Gain and Offset Tests

When making the tests on the 752A, set the controls for both channels. Make the tests for Channel 1, then switch the cables to Channel 2 and make those tests.

Step	Test	Tester & Setup	Control	Desired Measurement	Measurement Record
1	0dB Gain	Connect the Model 752A as shown in figure 5-1. Attenuator: 0dB Model 5100: Freq 10.00 kHz Output level 1.00 Vrms	Cutoff: 99 × 1kHz Gain: 0dB	0 ± 0.2 dB	Ch 1 _____ Ch 2 _____
2	10 dB Gain	Attenuator: 10 dB	Gain: + 10 dB		Ch 1 _____ Ch 2 _____
3	20 dB Gain	Attenuator: 20 dB	Gain: + 20 dB		Ch1 _____ Ch 2 _____
4	30 dB Gain	Attenuator: 30 dB	Gain: + 30 dB		Ch 1 _____ Ch 2 _____
5	40 dB Gain	Attenuator: 40 dB	Gain: + 40 dB		Ch 1 _____ Ch 2 _____
6	0dB dc Offset	Connect the Model 752A as shown in figure 5-2.	Cutoff: 50 × 1kHz Coupling: DC Gain: 0dB	Adjustable to 0Vdc	Ch 1 _____ Ch 2 _____
7	+ 10 dB dc Offset		Gain: + 10 dB		Ch 1 _____ Ch 2 _____
8	+ 20 dB dc Offset		Gain: + 20 dB		Ch 1 _____ Ch 2 _____
9	+ 30 dB dc Offset		Gain: + 30 dB		Ch 1 _____ Ch 2 _____
10	+ 40 dB dc Offset		Gain: + 40 dB		Ch 1 _____ Ch 2 _____

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Table 5-4. 753A Gain and Offset Tests

When making the tests on the 753A, set the controls for both channels. Make the tests for Channel 1, then switch the cables to Channel 2 and make those tests.

Step	Test	Tester & Setup	Control	Desired Measurement	Measurement Record
1	0dB Gain	Connect the Model 753A as shown in figure 5-1. Attenuator: 0dB Model 5100: Freq 10.00 kHz Output level 1.00 Vrms	High Pass Cutoff: 01 × 1Hz Low Pass Cutoff: 99 × 1kHz Gain: 0dB	0 ± 0.2 dB	Ch 1 _____ Ch 2 _____
2	10 dB Gain	Attenuator: 10 dB	Gain: + 10 dB		Ch 1 _____ Ch 2 _____
3	20 dB Gain	Attenuator: 20 dB	Gain: + 20 dB		Ch1 _____ Ch 2 _____
4	30 dB Gain	Attenuator: 30 dB	Gain: + 30 dB		Ch 1 _____ Ch 2 _____
5	40 dB Gain	Attenuator: 40 dB	Gain: + 40 dB		Ch 1 _____ Ch 2 _____
6	0dB dc Offset	Connect the Model 753A as shown in figure 5-2.	High Pass Cutoff: 01 × 1Hz. Low Pass Cutoff: 50 × 1kHz. Coupling: DC. Gain: 0dB	Adjustable to 0Vdc	Ch 1 _____ Ch 2 _____
7	10 dB dc Offset		Gain: 10 dB		Ch 1 _____ Ch 2 _____
8	20 dB dc Offset		Gain: 20 dB		Ch 1 _____ Ch 2 _____
9	30 dB dc Offset		Gain: 30 dB		Ch 1 _____ Ch 2 _____
10	40 dB dc Offset		Gain: 40 dB		Ch 1 _____ Ch 2 _____

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Table 5-5. Board Access

Step	Procedure	Associated Figure
1	Unplug power cord.	
2	Remove two screws at rear of top cover; slide the top cover off.	
3	Grasp the card cage, pull it up and forward towards the front panel. Card cage will sit at top of unit.	5-3.
4	Disconnect connectors at front of desired board.	5-4.
5	Release rear retainer.	5-5.
6	Slide desired board towards rear of instrument.	5-6.
7	Place nonconductive material (such as cardboard) on top of card cage. Place the board on top and reconnect the connectors.	5-7.
	To reassemble the unit, reverse the order of the steps in this table.	

	Top Board	Middle Board	Bottom Board
751A	GPIB/BCD Interface	High Pass	Low Pass
752A		Ch 1	Ch 2
753A		High Pass	Low Pass

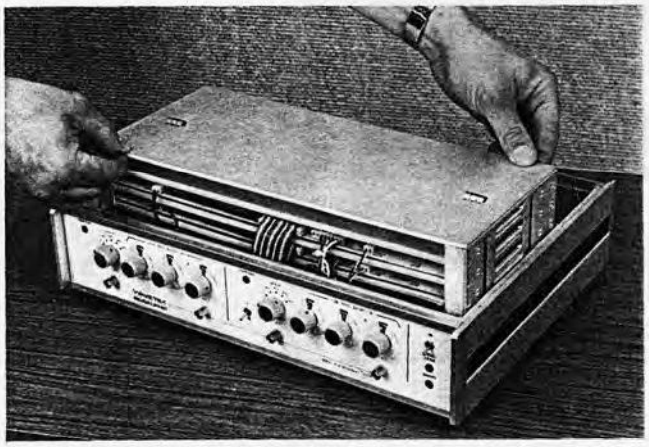


Figure 5-3. Moving Card Cage Out of Instrument

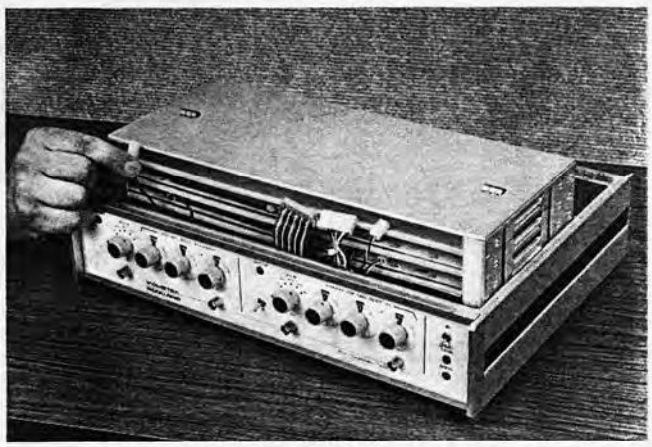


Figure 5-4. Disconnecting Board Connectors

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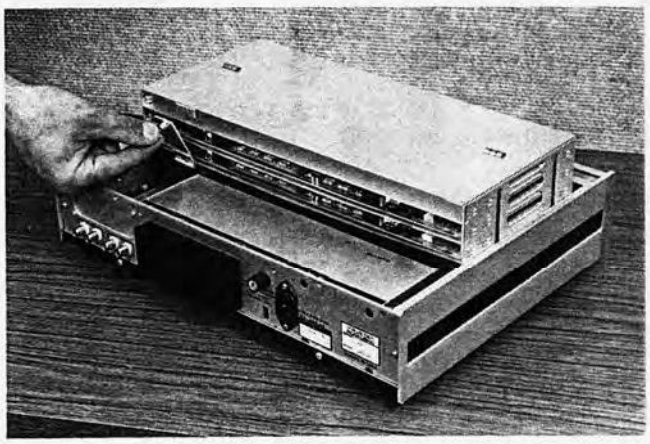


Figure 5-5. Releasing Rear Retainer

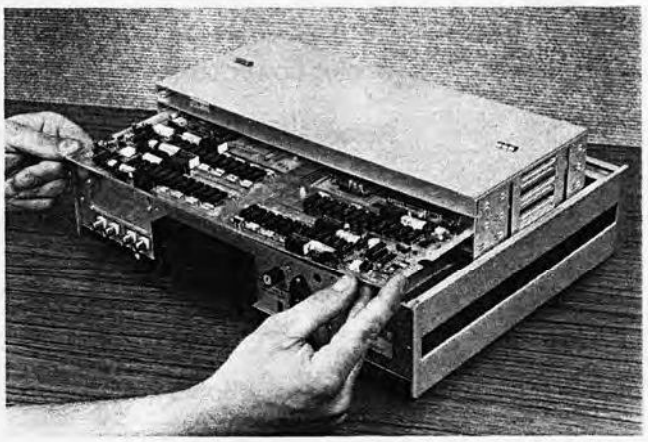


Figure 5-6. Sliding Out Board

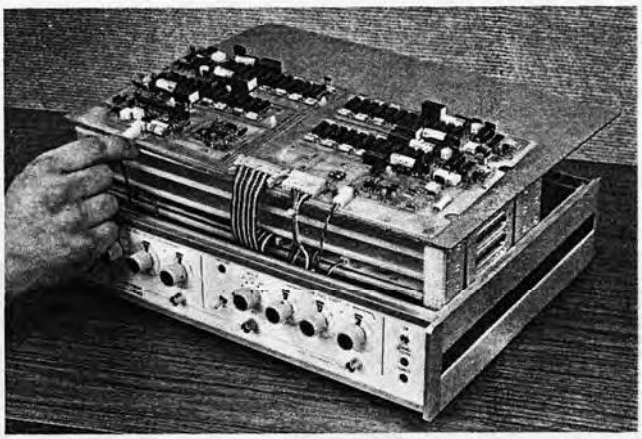


Figure 5-7. Reconnecting and Gaining Access to Board

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Table 5-6. 751A Calibration Procedure

Step	Test	Setup	Controls	Test Point	Tester	Adjust	Result	Comments
1a	Gain	Connect 751A as shown in figure 5-1. Attenuator: 0dB Model 5100: Freq 100 Hz Output level 1 Vrms	High Pass Cutoff: 01 × 1kHz Pre-filter Gain: 0dB	J14	RMS Voltmeter	R107	10.0 dB below	Access High Pass Filter board. Turn on, allow 10 min. warmup.
1b		Model 5100: Freq 10.0 kHz				C52		Replace high pass filter when finished.
2a	dc Offset	Connect 751A as shown in figure 5-2.	Pre-filter Gain: +40 dB	TP1	DVM	R106	0 ± 10 mVdc	Access low pass filter board. Turn power on, allow 10 min. warm-up. Replace low pass filter when finished.
2b			Low Pass Cutoff: 50 × 1kHz Post-filter Gain: +20 dB	OUT		R138		

Table 5-7. 752A Calibration Procedures

Before beginning, determine which channel requires calibration.

Step	Test	Setup	Controls	Test Point	Tester	Adjust	Result	Comments
1a	Gain	Connect Model 752A as shown in figure 5-1. Attenuator: 0dB Model 5100: Freq 100 Hz Output level 1.00 Vrms	Cutoff: 99 × 1kHz Gain: 0dB	J14	RMS Voltmeter	R107	1.00 Vrms	Remove channel to be calibrated. Turn power on. Allow 10 warmup.
1b		Model 5100: Freq 10.0 kHz				C52		
2a	dc Offset	Connect Model 752A as shown in figure 5-2.	Cutoff: 50 × 1kHz Gain: +40 dB Coupling: DC	TP1	DVM	R106	0 ± 10mV dc	
2b				OUT		R138		Replace channel when finished

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Table 5-8. 753A Calibration Procedures

Step	Test	Setup	Controls	Test Point	Tester	Adjust	Result	Comments
1a	High Pass Gain	Connect 753A as shown in figure 5-1 using IN1 and OUT 1. Attenuator: 0dB Model 5100: Freq 100 Hz Output level 1.00 Vrms	High Pass Cutoff: 01 × 1Hz Gain: 0 dB	J14	RMS Voltmeter	R107	1.00 Vrms	Remove the High Pass filter board. Turn power on. Allow 10 min. warmup.
1b		Model 5100: Freq 10.0 kHz				C52		Replace high pass filter when finished.
2a	Low Pass Gain	Connect 753A as shown in figure 5-1 using IN 2 and OUT 2. Attenuator: 0dB Model 5100: Freq 100 Hz Output level 1.00 Vrms	Low Pass Cutoff: 99 × 1kHz Gain: 0dB	J14		R107		Remove the low pass filter board. Turn power on. Allow 10 min. warmup.
2b		Model 5100: Freq 10.0 kHz				C52		Replace low pass filter board when finished.
3a	High Pass dc Offset	Connect 753A as shown in figure 5-2 using IN 1 and OUT 1.	High Pass Cutoff: 50 × 10 Hz Gain: + 40 dB	TP1	DVM	R106	0 ± 10mV	Remover the High Pass filter board. Turn power on. Allow a 10 min. warmup.
3b				OUT 1		R138		Replace high pass filter when finished.
4a	Low Pass dc Offset	Connect 753A as shown in figure 5-2 using IN 2 and OUT 2.	Low Pass Cutoff: 50 × 1kHz Gain: + 40 dB Coupling: DC	TP1		R106		Remove low pass filter. Turn power on. Allow a 10 min. warmup.
4b				OUT 2		R138		Replace low pass filter when finished.

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