

Model 3955

Dual Channel, Low-Pass

170Hz to 25.6MHz, 24dB/Octave Slope

Tunable Active Filter



**KH KROHN-HITE
CORPORATION**

Operating Manual

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Model 3955

*Butterworth
4-Pole Dual Channel Filter
170Hz to 25.6MHz Cutoff Frequency Range*

Serial No. _____

Operating Manual



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MODEL 5805
1P BUTTERWORTH
DUAL CHANNEL FILTER

KLIKK-SHITE
KHI CORPORATION

CHANNEL CUTOFF FREQUENCY
1 25.00

INPUT GAIN(GB)
20

OUTPUT GAIN(GB)
20

POWER
OFF ON

△ 7 8 9
4 5 6
1 2 3
0
△

INPUT OHMS OVER LOAD

AC/DC OVERLID

KILO FREQ TYPE MODE
ALL ON RECALL STORE

INPUT CH 1 CH 2

OUTPUT CH 1 CH 2

LOCAL

DIGT SELECT

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Krohn-Hite Model 3955 programmable, dual channel, low-pass filter is the first dual low-pass programmable filter of its kind, covering the wide cutoff frequency range from 170Hz to 25.6MHz with $2\frac{1}{2}$ digits of resolution. The 3955 is a 4-pole, maximally flat (Butterworth) filter, with an attenuation slope of 24dB/octave and a stopband attenuation of >100dB.

The filter has selectable ac or dc coupling and selectable 1M or 50 ohm input impedance. Programmable input gains to 20dB and output gains to 26dB are standard.

The Model 3955 also has the capability to be used in an "amplifier bypass" mode to operate as an amplifier, bypassing the filter. This gives the user the ability to amplify without filtering when so desired.

1.2 SPECIFICATIONS (each channel)

1.2.1 Function

Two independent, low-pass filter channels; amplified bypass.

1.2.2 Filter Mode

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

Attenuation Slope: 24dB/Octave.

Tunable Frequency Range: 170Hz to 25.6MHz.

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

Frequency Control: Keypad entry or increment, decrement keys.

Cutoff Frequency Accuracy: $\pm 2\%$ to 2.56MHz, $\pm 5\%$ to 25.6MHz.

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

Stopband Attenuation: 100dB to 1MHz; 80dB at 10MHz; 70dB at 30MHz; 60dB at 50MHz; 50dB to 100MHz.

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

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

a wideband noise power or voltage for a 30MHz BW of below -53 dBm or 500mVrms referred to input.

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

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

DC Stability: ± 0.5 mV/ $^{\circ}$ C referred to input.

1.2.3 Amplifier Mode (each channel)

Bandwidth: > 50 MHz.

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

Input:

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

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

Maximum Signal: ± 1.5 V 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.

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, $+6$ dB, $+20$ dB, $+26$ dB; ± 0.1 dB.

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

Impedance: 50 ohms, $\pm 2\%$.

DC Level: Adjustable to Zero.

1.2.4 General

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

Overload Modes: 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: 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-488/1978 GPIB interface. Subsets: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0, C0, E1.

Operating Temperature: 0°C to 50°C.

Isolation to Chassis: $\pm 200\text{Vdc}$.

Storage Temperature: -20°C to 70°C.

Input/Output Connectors: BNC, front and rear.

Power Requirements: 90-132/180-264 volts ac, 50Hz-400Hz, 25 watts.

Dimensions: 3½" (9cm) high, 8½" (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 and maintenance manual.

1.2.5 Options

Rack Mount Kit: Part No. RK-37, permits installation of the Model 3955 into a standard 19" rack spacing.

Specifications apply at 25°C $\pm 10^\circ\text{C}$.

1.3 SHIPPING TO KROHN-HITE FOR REPAIR OR CALIBRATION

All shipments of Krohn-Hite Corporation instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original shipping carton; or if it not available, use any suitable container that is rigid and is of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least 4 inches of excelsior or similar shock-absorbing material.

1.4 CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing list unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the Krohn-Hite Service Department at (508) 580-1660.) Final claim and negotiations with the carrier must be completed by the customer.

1.5 EXTERNAL CLEANING

NOTE

To avoid electrical shock or instrument damage, never get water inside the case. To avoid instrument damage, never apply solvents to the instrument.

Should the Model 3955 case need cleaning, wipe the instrument with a cloth that is lightly dampened with water or a mild detergent solution.

SECTION 2

OPERATION

2.1 INTRODUCTION

The Model 3955 is a dual, low-pass, Butterworth filter covering the frequency range from 170Hz to 25.6MHz. All filter parameters are programmable via the front panel keyboard controls or remotely over the IEEE-488 (GPIB) bus.

The filter has two modes of operation: filter mode and amplifier mode. Each mode will be explained in detail in this section.

2.2 TURN-ON PROCEDURE

The Model 3955 line voltage range has been preset for either 115V or 230V operation. To change this setting, remove the bottom cover to expose the line switch. Be sure to change the fuse to the proper rating for the line switch setting selected.

Make certain the POWER switch on the front panel is off.

Plug the line cord into the unit, then the ac outlet.

If the Model 3955 is to be programmed remotely, connect the bus cable to the rear panel connector of the 3955.

After reading the Self-Test feature, described next, turn on the Model 3955.

2.3 SELF TEST

When the Model 3955 is turned on, the microprocessor performs a self-test routine whereby the entire RAM and ROM operation is verified. During the test, the front panel LEDs and DISPLAYS will light sequentially. If there is a malfunction on the microprocessor board, such as a defective RAM or ROM, the sequence will stop and the word "bad" will appear in the DISPLAY followed by a number 1, 2 or 3. Refer to Section 6, Maintenance, to find which RAM or ROM is defective.

When the self-test program is complete, the Model 3955 will return to the last set-up prior to turning the unit off. The Model 3955 is now ready to operate.

2.4 FRONT PANEL CONTROLS AND DISPLAY

2.4.1 Data Keys And Display

Data entry keyboard controls [0] to [9] and [.] set the numeric value of any parameter selected. To enter 1.5kHz press the [1][.][5] keys and the parameter key [KILO] and [FREQ]. The cutoff frequency will be indicated in the DISPLAY. To enter 6dB of Output Gain, press [6] key and either the up [Δ] or down [∇] control key below the Output Gain display.

2.4.2 Parameter And Control Keys

- [KILO]** When pressed, multiplies the numeric value of the keyboard entry by 10^3 .
- [MEGA]** When pressed, multiplies the numeric value of the keyboard entry by 10^6 .
- [FREQ]** When pressed, enters and/or displays frequency in Hertz.
- [TYPE]** When pressed, DISPLAY indicates the filter type, "bu." (Butterworth).
- [MODE]** When pressed, DISPLAY indicates the mode of operation for the channel displayed. "GAin" for amplifier mode, "L.P - 1." for low-pass mode.
- [RECLL]** When preceded by a number, it will recall the entire instrument set-up from the memory location selected.

When first pressed, the DISPLAY indicates the number of the memory location to be recalled. For example, the DISPLAY will indicate the following: "n=09". Pressing the [RECLL] key again will recall the entire instrument set-up from memory location "09".

When pressed to indicate the memory location to be recalled only, pressing the [CE] (clear entry key) will restore the DISPLAY to the cutoff frequency setting.

[ALL CH]	When frequency, input/output gain, type, mode or coupling are entered or changed, and the LED in the [ALL CH] key is lit, the new setting will be entered in both channels of the filter.	GPIOB Line Termination	When the [SHIFT] key followed by the [ALL CH] key are pressed, the DISPLAY will indicate the existing GPIOB Line Termination Code sequence. To select a different one, enter a number from [0] to [4] and press [SHIFT] [ALL CH] keys (see Section 3.2.1 for line termination information).
[SHIFT]	The [SHIFT] key in conjunction with other keys (keys with red lettering under them) provide additional filter characteristics, and permits front panel entry of the type of GPIOB line termination and address.	Software Version	When the [SHIFT] key followed by the [KILO] key are pressed, the DISPLAY will indicate the software version installed (i.e. 3.7).
Overload Detection	<p>When [SHIFT][MODE] is first pressed, the DISPLAY will indicate the overload mode currently selected. Pressing a number from [1] to [3] then [SHIFT][MODE] will select the following overload conditions:</p> <p>[1][SHIFT][MODE] will select no overload indication.</p> <p>[2][SHIFT][MODE] will select the non-latching mode. The unit will monitor all channels and display the first channel to have an overload.</p> <p>[3][SHIFT][MODE] will select the latching mode. In this mode, the unit will maintain the overload display until it is cleared.</p>	[CE]	<p>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 the current numeric setting.</p> <p>When a numeric value and its parameter has been entered, pressing the [CE] key will restore DISPLAY to the previous value of that parameter.</p> <p>When either the [SHIFT][STORE] or [RECALL] keys are pressed, the next memory location will be indicated on the DISPLAY. Pressing the [CE] key will restore DISPLAY to the current parameter setting.</p> <p>If the Model 3955 is operating via the IEEE-488 bus (the front panel REMOTE LED is "on"), pressing the [CE] key will return unit to LOCAL operation.</p> <p>Pressing [CE] will toggle between present parameter setting and the previous parameter setting.</p>
Store	<p>When [SHIFT] [RECLL] 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 [RECLL] again will store the entire instrument set-up into that memory location. If another memory location is desired, enter that location on the keyboard and then press [SHIFT] [RECLL].</p> <p>When [SHIFT] [RECLL] is preceded by a number (0-98), the filter will store the entire instrument set-up into the memory location selected. The maximum number of memory groups is 99.</p> <p>When [SHIFT] [RECLL] is pressed to indicate the next memory location only, pressing the clear entry key [CE] will restore the DISPLAY to the cutoff frequency setting.</p>		
AC/DC Coupling	Pressing the [SHIFT] key followed by the [TYPE] key will display the input coupling, indicating "AC" or "dC", and will alternate between the two.		
GPIOB Address	When the [SHIFT] key followed by the [MEGA] key are pressed, the DISPLAY will indicate the existing GPIOB address setting. To select a different address setting, enter the address number in the data keys from [0] to [30] and press the [SHIFT] followed by the [MEGA] key (see Section 3.2.1 for GPIOB addressing information).		

2.4.3 Channel Selection
The up [Δ] or down [▽] control key below the CHANNEL display alternates the channel settings.
2.4.4 Cutoff Frequency
Data entry keyboard controls [0] to [9] and [.] set the numeric value of the cutoff frequency desired. To select 1.5kHz, press the [1][.][5] data keys and parameter keys [KILO] and [FREQ] . The cutoff frequency for the channel selected will be indicated in Hertz on the four digit DISPLAY (when [ALL CH] mode is selected, the frequency will be changed on both channels). The KILO and FREQ keys will be lit. Also see 2.4.7.
2.4.5 Input Gain (Pre-Filter)
Up [Δ] and down [▽] INPUT GAIN SET controls increase or decrease the input amplifier by 10dB. The two digit DISPLAY will indicate either 0dB, 10dB or 20dB.
2.4.6 Output Gain (Post Filter)
Up [Δ] and down [▽] OUTPUT GAIN SET controls increase or decrease the output amplifier. The two digit DISPLAY will indicate the following selection 0dB, 6dB, 20dB or 26dB.

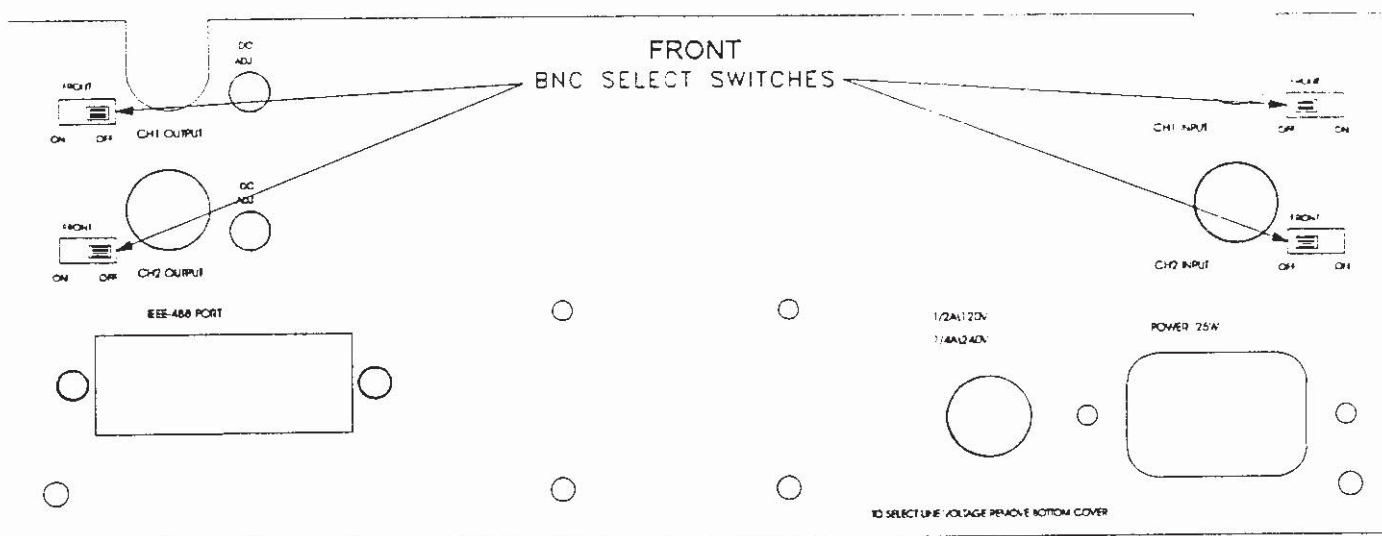


Figure 2.1 Rear Panel of Model 3955

2.4.7 Digit Select/Increment and Decrement

When the [SHIFT] key is pressed, followed by the DIGIT SELECT [Δ] or [∇] keys, the DISPLAY will intensify the first or second digit. Pressing the [SHIFT] followed by the [Δ] or [∇] key again, will intensify the next digit or will turn the DIGIT SELECT off. Pressing the [Δ] or [∇] keys will then increment or decrement the intensified digit.

NOTE: The intensified digit will only increment or decrement within the resolution in that band.

2.4.8 Key Click Feature On/Off

When the [SHIFT] key is pressed, followed by the [Δ] key under the CHANNEL display, the key click feature will either toggle on or off.

2.5 REAR PANEL CONTROLS AND CONNECTORS

2.5.1 Introduction

Model 3955 rear panel consists of the following: two input and two output BNC connectors, front panel terminal selection switches and dc level adjustments, a fuse holder, GPIB bus connector and an ac receptacle.

2.5.1.1 Front Terminal Selection Switches

The Model 3955 has an input and output front panel BNC connector selection switch for each channel. For optimum performance, this switch should be in the on position when using the front panel connectors, and off when using the rear BNC connectors.

2.5.2 BNC Connectors and Indicators

2.5.2.1 Input Connectors

The Model 3955 has two input BNC connectors on both the front and rear panels. The inputs are labeled CH1 and CH2.

2.5.2.2 Output Connectors

The Model 3955 has two output BNC connectors on both the front and rear panels.

2.5.3 DC Level Adj (Rear Panel)

Proper procedure for adjusting input and output dc levels can be found in the Calibration section of this manual.

There are two DC Adj potentiometers located on the rear panel of the Model 3955. They are for adjusting the DC level at the output BNC connector.

2.5.4 Power

Receptacle: Standard 3 pin.

Fuse: 1/2 amp slow-blow for 120V operation; 1/4 amp slow-blow for 230V operation. To change this setting, refer to Section 2.2.

2.5.5 GPIB Connector

Standard IEEE-488 interface. Subsets are SH1, AH1, T6, L4, SR1, RL1, PPI, DC1, DT0, C0 and E1.

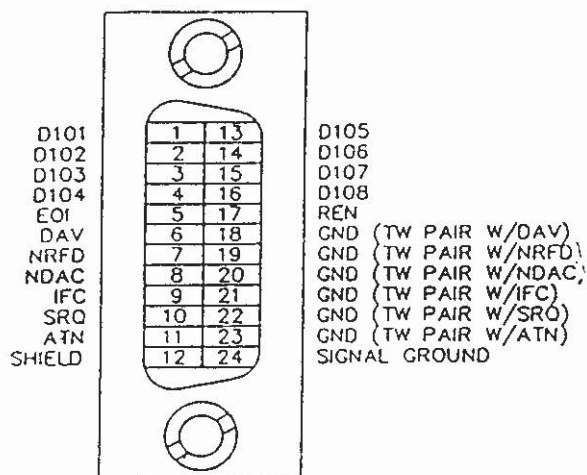


Figure 2-2 GPIB Connector

2.6 FILTER OPERATION

2.6.1 Introduction

The Model 3955 is a filter with two identical channels that can function independently. Each channel is a low-pass filter with 24dB/octave rolloff or a voltage gain amplifier with up to 46dB of gain.

2.6.2 Amplitude Response

Each channel of the Model 3955 has a rolloff rate of 24dB/octave. The amplitude response characteristics of each channel are shown in Figure 2.3.

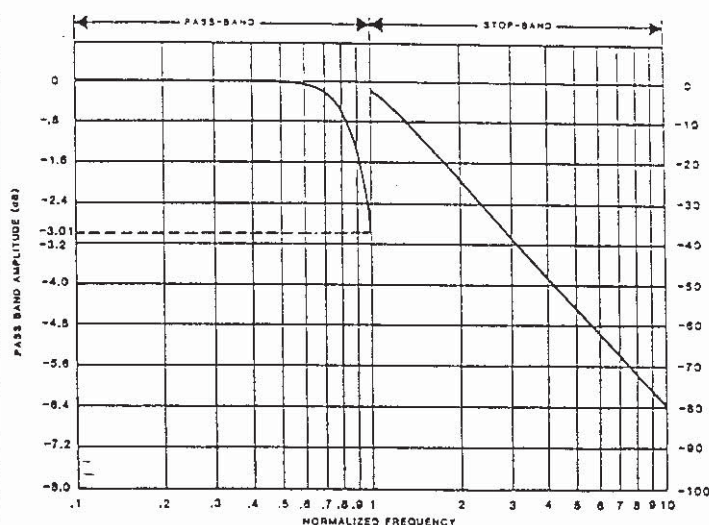


Figure 2-3 Amplitude Response

2.6.3 Operating Procedure

Plug the Model 3955 into the power line. Connect the signal to be filtered to channel 1 or 2. Select the channel where the signal is connected. Set the filter to the desired MODE (gAin or L.P.). Enter the desired cutoff frequency. The output signal will be at the corresponding output channel.

2.6.4 Jumper Settings For Front And Rear Panel BNC Operation

To achieve clean high frequency signal performance from the rear input and output BNCs, it is necessary to change each rear panel FRONT switch to OFF (shown in Figure 2.1). This will disconnect the front panel BNC input and output BNC connectors.

SECTION 3

IEEE-488 STD (GPIB) PROGRAMMING

3.1 INTRODUCTION

The Model 3955 remote programming interface accepts both ASCII data commands and IEEE-488 standard commands (ATN true) for control of the unit.

In presenting the information required to program the Model 3955 via the IEEE-488 STD bus, this manual presupposes a user knowledge of both ASCII data and IEEE-488 bus commands.

3.2 PRELIMINARY PROGRAMMING INFORMATION

3.2.1 GPIB Primary Bus Address

The GPIB primary address and software line-termination-character-sequence (LTCS) selection is set via the front panel keyboard as listed in Tables 3.1 and 3.2. These two parameters are stored in non-volatile memory and will be remembered indefinitely, even when the power to the unit is removed. They do not need to be reentered each time the unit is turned on.

The LTCS affects the GPIB in the TALKER mode only (data output from the 3955 to the GPIB). After the printable characters have been sent, non-printable characters, such as carriage return (CR) and line feed (LF), are often required to achieve the desired results in various computers. Table 3.2 lists the various key sequences with the LTCS it selects.

SETTING AND DISPLAYING THE GPIB PRIMARY ADDRESS

	Function	Keyboard Entry
a.	To set a primary address from 0 to 30	[x][SHIFT][MEGA]
b.	To display the primary address	[SHIFT][MEGA]

Table 3.1

LINE-TERMINATION-CHARACTER-SEQUENCE

	Line-Termination Character-Sequence	Keyboard Entry
a.	None (EOI only)	[0][SHIFT] [ALL CH]
b.	Carriage return (with EOI)	[1][SHIFT] [ALL CH]
c.	Line Feed (with EOI)	[2][SHIFT] [ALL CH]
d.	Carriage return followed by line feed (with EOI)	[3][SHIFT] [ALL CH]
e.	Line feed followed by carriage return (with EOI)	[4][SHIFT] [ALL CH]
f.	Display present LTCS	[SHIFT] [ALL CH]

Table 3.2

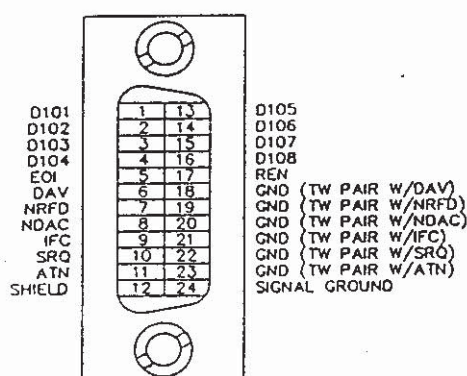


Figure 3.1 Rear Panel GPIB Connector

3.2.2 IEEE-488 Bus Interface Programming Connector

The rear panel programming connector, labeled "IEEE-488 PORT" (Figure 3.1), is the standard bus interface connector as specified in the IEEE-488 STD.

3.3 ASCII DATA COMMANDS

3.3.1 Format

The Model 3955 employs free-format software commands, allowing the user to program a specific function in several different ways. See Section 3.3.3.

3.3.2 Types Of Data Commands

- a. Commands fall into **two types**: Those involving numeric parameters and those that do not.
Commands which involve numeric data contain (3) types of fields:

1. Numeric: Numeric fields may be floating point or scientific notation.

1 = 1.0
1.0 = 1.0
2.7E3 = 2.7×10^3
-2E3 = -2×10^3
2E-3 = 2×10^{-3}

2. Multiplier: "KILO", "MEGA".

3. Parameter: Parameter (frequency, gain, channel, etc.) is included in Section 3.3.3.

- b. Delimiters which may separate commands are the following: (; : / \ .)
c. Two consecutive character strings (i.e. parameter and multiplier) must have a space between them or they will be treated as one string.
d. The Model 3955 uses an internal 32 character buffer for command processing. A line may be composed of multiple commands, separated by delimiters mentioned above. No commands are executed until the line is terminated with a line feed ASCII character (Hex 0A) or carriage return (Hex 0D) or by sending the end-of-identify (EOI) command with the last character.

3.3.3 Table Of ASCII Commands

In this Section there are characters that are underlined and characters that are **NOT** underlined. The characters that are underlined **MUST** be sent for the command to be recognized properly. Any additional characters may be sent once all the underlined letters are sent. Commands are case sensitive; upper case characters **MUST** be used.

MODEL 3955 GPIB COMMANDS

Command Desired	Allowable Character String	
Input Gain	<u>IG</u> <u>IU</u> <u>ID</u>	set input gain increase input gain (up) decrease input gain (down)
Frequency	<u>E</u> <u>H</u> <u>K</u> <u>ME</u>	frequency frequency (Hz) kilo (10^3 multiplier) Mega (10^6 multiplier)
Channel	<u>CH</u> <u>CU</u> <u>CD</u>	set channel next channel (up) previous channel (down)
Output Gain	<u>OG</u> <u>OU</u> <u>OD</u>	set output gain increase output gain (up) decrease output gain (down)
Type Mode	<u>TY1</u> <u>M1</u> <u>M2</u>	Butterworth Low-Pass Gain
Coupling	<u>AC</u> <u>D</u>	ac coupled dc coupled
Store	<u>ST</u>	store
Recall	<u>R</u>	recall
All Channel	<u>AL</u> <u>B</u>	all channel mode NOT all channel mode
Misc.	<u>CE</u> <u>OV</u> <u>Q</u> <u>SRQON</u> <u>SRQOF</u> <u>V</u>	clear entry overflow (1, 2, 3) reports board model number(s) (see Section 3.5.4) GPIB service request on GPIB service request off report model number and software version (see Section 3.5.3)
	<u>U</u>	Input unterminate (1M ohm Ch. 2.1 only)
	<u>TE</u>	Input terminate (50 ohms Ch. 2.1 only)

Alphabetical Listing of Model 3955 GPIB Commands

Character String	Command
<u>AC</u>	ac coupled
<u>AL</u>	all channel mode
<u>B</u>	NOT all channel mode
<u>CD</u>	channel down
<u>CE</u>	clear entry
<u>CH</u>	channel # n
<u>CU</u>	channel up
<u>D</u>	dc coupled
<u>F</u>	frequency
<u>H</u>	frequency (Hz)
<u>ID</u>	input gain down
<u>IG</u>	input gain
<u>IU</u>	input gain up
<u>K</u>	kilo
<u>M1</u>	Low-Pass mode
<u>M2</u>	Gain mode
<u>ME</u>	Mega (10^6 multiplier)
<u>OD</u>	output gain down
<u>OG</u>	output gain
<u>OU</u>	output gain up
<u>OV</u>	overflow mode
<u>Q</u>	report board model number(s) (see Section 3.5.4)
<u>R</u>	recall
<u>SRQON</u>	GPIB service request on
<u>SRQOF</u>	GPIB service request off
<u>ST</u>	store
<u>T1</u> <u>Butterworth Type</u>	Butterworth Type
<u>V</u>	report model number and software version (see Section 3.5.3)
<u>U</u>	Input unterminate (1M ohm Ch. 2.1 only)
<u>IE</u>	Input terminate (50 ohms Ch. 2.1 only)

3.3.4 Examples

3.3.4.1 Example 1

To set channel 1 to 10dB input gain, 2kHz, 0dB output gain:
CH1; 10IG,2K,0OG <LF>

NOTE: It is only necessary to send those parameters that change, all others remain unaffected.

3.3.4.2 Example 2

To change frequency to 150Hz:

150H or 150bHZ
or 150F
or .15K
or F150
or H150
or HZ150
or K0.15
or 1.5E2HZ
or F1.5E2

3.3.4.3 Example 3

To read back the settings of channel 1 (see Section 3.5.1):

Data sent to filter: CH1

Data received from filter: 10b150.0E+0b01.1b00bAC[†]

Interpretation: 10dB input gain
150Hz cutoff frequency
channel #1
0dB output gain
ac coupled

[†] b represents a space