

*Instructions  
for*

## Model OB-133

### 1/3 Octave Band Filter

#### GENERAL DESCRIPTION

The Quest Model OB-133 1/3 Octave Band Filter is a plug-in module containing a selectable set of filters. It is used with the Quest Model 155 Impulse Precision Sound Level Meter forming the Model 155-133 1/3 Octave Band Analyzer. When so used, the OB-133 meets the requirements of ANSI S1.11-1971 and IEC R225-1966 for 1/3 Octave Band Filters. The unit contains thirty-three selectable filter bands from 12.5Hz to 20KHz center frequencies with 1/3 octave bandwidth. See Figure 1.

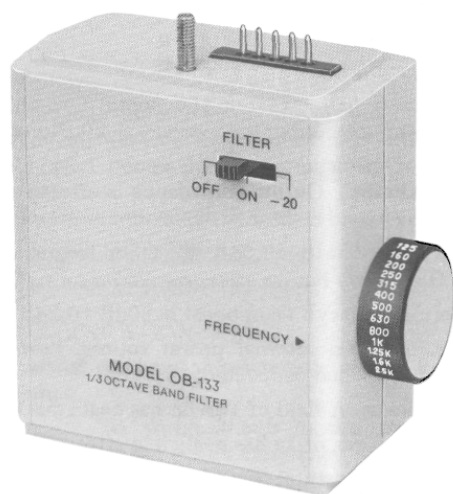


Figure 1.

Primary uses include frequency analysis of community noise, product noise emissions, structural and mechanical acoustics and audiometer calibration. Active filters are employed throughout the Model OB-133, thus permitting the unit to have both high accuracy and compact size.

#### SPECIFICATIONS

Standards: Meets ANSI S1.11-1971, Class III, Type E and IEC R225-1966.

Center Frequencies: Thirty-three frequencies: 12.5Hz (Band #11), 16Hz, 20Hz, 25Hz, 31.5Hz, 40Hz, 50Hz, 63Hz, 80Hz, 100Hz, 125Hz, 160Hz, 200Hz, 250Hz, 315Hz, 400Hz, 500Hz, 630Hz, 800Hz, 1KHz, 1.25KHz, 1.60KHz, 2KHz, 2.5KHz, 3.15KHz, 4KHz, 5KHz, 6.3KHz, 8KHz, 10KHz, 12.5KHz, 16KHz, 20KHz (Band #43).

Geometric Means Tolerance:  $\pm 3\%$  max.

Pass-Band Uniformity: within  $\pm 0.5$ dB

Peak-to-Valley Ripple: within  $\pm 0.5$ dB

Filter Skirt Attenuation:

Band Edge Frequencies	
(.891fc and 1.122fc) >	3dB
(.707fc and 1.414fc) >	25dB
(.5fc and 2fc) >	45dB
(.25fc and 4fc) >	68dB

Input Characteristics: (From 155 Sound Level Meter) 0 to 3.2 volts RMS (Maximum). Input impedance is 200Kohm  $\pm 10\%$  (AC).

Output Characteristics: (To 155 Sound Level Meter) 0 to 3.2 volts RMS (Maximum). Output impedance is effectively less than 1 ohm when driving a load resistance of 2Kohm or greater.

Insertion Loss: 0.0dB  $\pm 0.5$ dB at center frequency in the ON mode.

When OFF, filter has no effect on reading.

20dB Gain Accuracy: Gain boost is 20dB  $\pm 0.2$ dB.

Power Source: No internal power source. Power is obtained from the Model 155 when connected.

Magnetic Fields: A field of 10A/m has negligible effect. Vibration: A force of 1g has negligible effect.

Operating Temperature:  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  for specified tolerances.

Maximum Storage Temperature:  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ .

Operating Humidity: 0-95% relative humidity. Size: 3.7 x 3.5 x 2.0 inches (94 x 89 x 51 mm) Weight: 9 oz. (256g)

Construction: Solid state integrated circuitry in a high-impact plastic housing.

### CONTROLS

**FREQUENCY Switch:** A 33-position switch that changes the center frequency of the bandpass filter in one-third octave steps from 12.5Hz to 20KHz.

**OFF, ON, -20dB Switch:** A three-position slide switch that does the following:

**OFF:** Removes the filter electrically from the sound level meter circuit. No battery power is consumed.

**ON:** Connects the filter electrically to the sound level meter circuit.

Any function that is being monitored by the meter is passed through the filter circuit.

**-20dB Switch:** Connects the filter electrically to the meter and amplifies the output of the filter 10 times (20dB). Therefore, 20dB must be subtracted from the meter reading when using this switch position.

**External Connector:** A gold-plated, 5-pin in-line connector functioning as follows:

Pin 1 — (Located closest to centerline of filter)

Provides -6.45VDC to the filter from the 155 meter

Pin 2 — Provides +6.45VDC to the filter from the 155 meter

Pin 3 - (AC) input to the filter

Pin 4 — (AC) filtered output

Pin 5 — Circuit and signal common

### PRINCIPLES OF OPERATION

The normalized passband characteristic of any frequency band is shown in Figure 2.

The filters are flat within 0.5dB in the passband, one-sixth octave above and below the center frequency  $f_c$  approximately 3dB down, one-half and 2-octave points (.5 $f_c$  and 2 $f_c$ ) greater than 45dB down and one-quarter and 4-octave points (.25 $f_c$  and 4 $f_c$ ) greater than 68dB down. Figure 3 is an expansion of a typical passband.

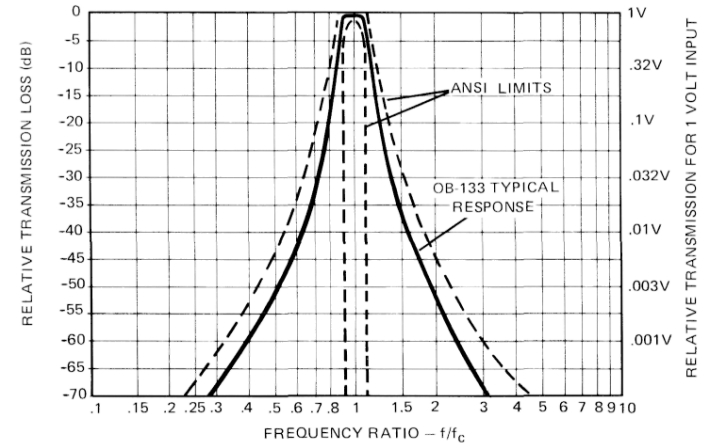


Figure 2. Normalized Amplitude Response - 1/3 Octave Band Filter OB-133

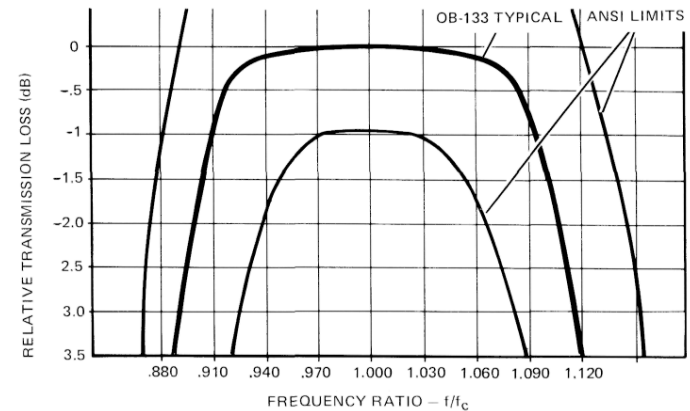


Figure 3. Expanded Passband Response Curve for OB-133

The block diagram of the OB-133 illustrated in Figure 4 traces the signal input from the sound level meter through the filters and back to the meter. The central element is the switched-capacitor 1/3 octave band filter chip (integrated circuit). The input signal from the sound level meter is buffered and pre-conditioned by automatically-selected 3 pole low-pass filters that prevent aliasing common to switched-capacitor filters. This signal is fed to the switched-capacitor 1/3 octave band filter. Its output is post-conditioned by additional low-pass filters, buffered, and, if desired, boosted by 20dB. The center frequency is selected by a crystal-controlled time-base generator which consists of an oscillator with divide-by  $10^n$  counters and a phase-locked-loop configured to multiply by  $n_2$ .  $n_1$  and  $n_2$  are selected by an eleven-bit thirty-three position encoded switch, which also selects the proper input and output conditioning.

## OPERATING PROCEDURE

### General

The Model 155-133 1/3 Octave Band Analyzer is made up of the Model 155 Sound-Level Meter and the OB-133 1/3 Octave Band.

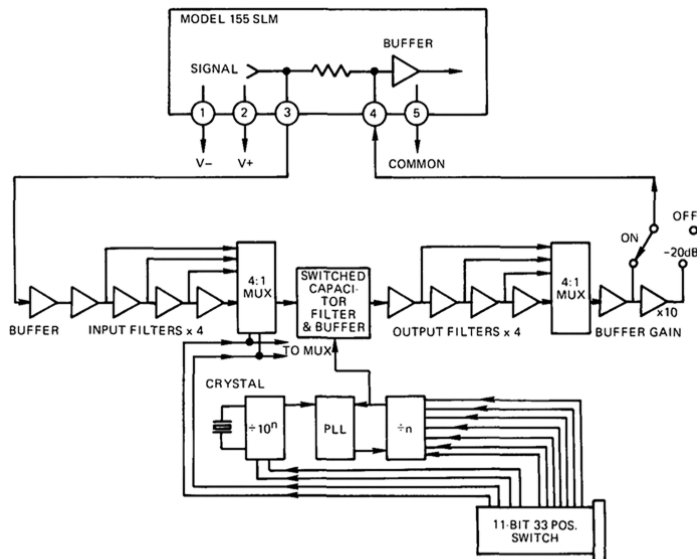


Figure 4. Block Diagram, Model OB-133 1/3 Octave Band Filter Set

Filter Set. The two units are connected together with the captive screw provided in the filter box. Instructions for the Model 155 should be read before performing the following steps, in that all of the procedural information for the meter and/or filter set is applicable to the 1/3 octave band analyzer. The rules of holding the analyzer away from the body or on a tripod apply as when using the meter only.

## Operating Procedure

1. Switch the WEIGHTING knob of the Model 155 Sound Level Meter to A, B, C, or LIN to turn the meter power on. Most 1/3 octave band measurements are made in the LIN position. Depress the BATTERY button on the 155 Sound Level Meter and check to see that the meter needle deflects onto the green line marked BATTERY. If not, replace batteries. (See BATTERY REPLACEMENT, Model 155 instruction manual.) Note that the OB-133 should be switched to either ON or -20dB when checking batteries.
2. Check the operation of the analyzer as outlined under Operational Check.
3. Turn the dB RANGE knob to 100. Set the RESPONSE knob to either F or S, and the WEIGHTING knob to LIN. Slide the FILTER switch to OFF.
4. With the controls set as in Step 3, take a measurement of the sound field to be analyzed. Monitor the OL indicator to be certain it does not come on, thereby indicating that the microphone preamp and amplifiers are not being overloaded with amplitudes over 140dB. If the OL indicator does come on, the sound field is too intense for any kind of measurement to be made. If the indicator does not come on, proceed with the next step.
5. Select WEIGHTING - A, B, C, or LIN. Note that the filter's response is summed with the meter's weighting. Consequently, the LIN setting is usually used when making 1/3 octave band measurements.
6. Switch the 1/3 octave band FILTER switch to ON to engage filter. Turn dB RANGE knob down in 10dB steps until the OL indicator comes on, then reverse knob rotation one step. Be sure OL indicator has gone out. The AC output to the filter is now at its maximum undistorted level.
7. To determine the levels of all frequency bands present, start with the FREQUENCY knob at the lowest frequency desired.

8. With FILTER switch in the ON position, read the meter. If the reading is less than 0dB, move the FILTER switch to -20dB. This amplifies the filter's output by a factor of 10 (20dB). Subtract 20dB from the meter's reading. A reading can generally be made on one of the two ranges. If not, so indicate in the data.

9. Repeat Step 8 for each frequency band of interest. These readings can be plotted on a chart of dB vs. Frequency.

10. To determine the overall noise, turn the FILTER switch to OFF and take the measurement. This will be the noise sum of all bands within the capability of the meter.

### **Operational Check**

The 155 meter should be calibrated alone using the Quest CA-22 Calibrator (or equivalent) as outlined under CALIBRATION, page 21 of the 155 Manual. The OB-133 has no internal or external adjustments. Check the operation of the 155-133 analyzer as follows:

1. Set the 155 meter dB RANGE knob to 80dB, WEIGHTING knob to LIN, and RESPONSE knob to either F or S.
2. Set the OB-133 FREQUENCY knob to 1K and the FILTER switch to ON.
3. Place the CA-22 Calibrator (set to ON, 1K, 110dB) with proper adapter, onto the microphone. A meter deflection of approximately 30dB should result. Tolerance limits are 0.5dB.
4. Change the FREQUENCY selector to 800 then 1.25K. The reading should drop more than 13dB; typically 19-20dB or more.
5. Change the FREQUENCY knob to 1K, dB RANGE to 100, and the FILTER switch to -20dB. The meter should read  $30 \pm 0.7$  dB. This is equivalent to 130dB (reading on meter) -20dB (Filter gain) = 110dB.
6. Remove the Calibrator. The Analyzer is now ready to use.

### **Service Policy**

The Quest product you have purchased is one of the finest acoustic instruments available. It is backed by our full one year warranty which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at (800)245-0779 (USA) or Fax (262)567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 1060 Corporate Center Drive, Oconomowoc, WI 53066 U.S.A.

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 7 AM to 6 PM (Central Standard Time) Monday through Friday.

For service or recalibration outside the U.S.A., please contact your local Quest Dealer or fax Quest U.S.A. at 1-262-567-4047.