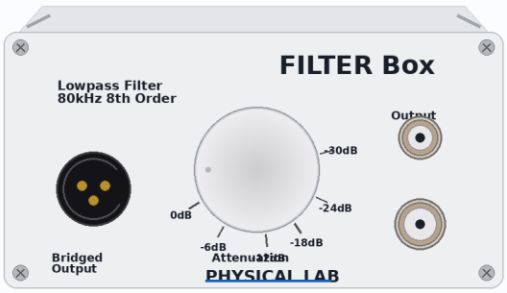
PHYSICAL LAB

SCIENCE SHAPING SOUND

PRECISION AMPLIFIER

FILTER & ATTENUATOR

80 kHz 8th-order low-pass filtering for accurate audio measurements



USER MANUAL

Operation • Connections • Safety • Technical Data

REVISION 1.3 | JULY 2026

www.physical-lab.com

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Read This First

Safety, intended use and high-level measurement precautions

The PHYSICAL LAB FILTER Box is a passive dual-channel 80 kHz low-pass filter and precision attenuator for amplifier measurements. It suppresses high-frequency switching components from Class-D, PWM and related amplifier outputs while reducing the signal to a safe and useful level for an audio analyzer or voltmeter.

! **HIGH VOLTAGE AND POWER** Power amplifiers can produce hazardous voltages and currents. Verify every connection at low level before increasing the output. The FILTER Box does not replace safe laboratory procedures or the input protection limits of the connected analyzer.

Essential safety rules

- Switch the power amplifier off before changing any amplifier, load or measurement connection.
- Begin with the attenuator at -30 dB and the generator level at minimum.
- Do not exceed 90 Vrms on either single-ended channel or 180 Vrms in bridged/differential mode.
- Connect a suitable dummy load or loudspeaker load to the dedicated LOAD terminals.
- Confirm whether the amplifier output is ground-referenced, floating or bridged before selecting the measurement mode.
- Use the balanced XLR output only for differential/bridged measurements and connect it to a balanced analyzer input.
- Use cables, connectors, loads and instruments rated for the expected voltage, current and power.

! **PASSIVE DEVICE** The FILTER Box requires no mains supply. Signal energy is supplied entirely by the amplifier under test.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Contents and Product Overview

Document structure and principal capabilities

Section	Topic	Page
1	Read This First	1
2	Contents and Product Overview	2
3	Filtering Principle and Precision Attenuation	3
4	Front Panel Controls and Outputs	4
5	Rear Panel Connections	5
6	Ground-Referenced Single and Dual Channel Modes	6
7	Differential and Bridged Measurement Mode	7
8	Measurement Procedure and Level Selection	8
9	Technical Specifications	9
10	Troubleshooting, Maintenance and Contact	11

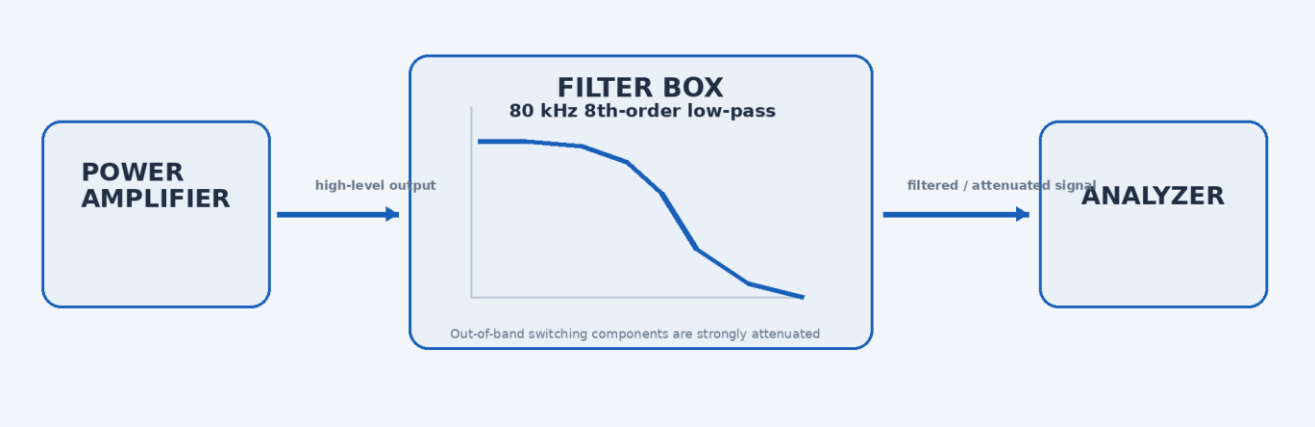
The FILTER Box combines two passive precision filter channels with a six-position attenuator. The two BNC outputs provide individual single-ended channel signals. The front XLR output provides the differential signal required for bridged or floating amplifier measurements.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Filtering Principle and Precision Attenuation

Removing out-of-band switching noise without compromising the audio band

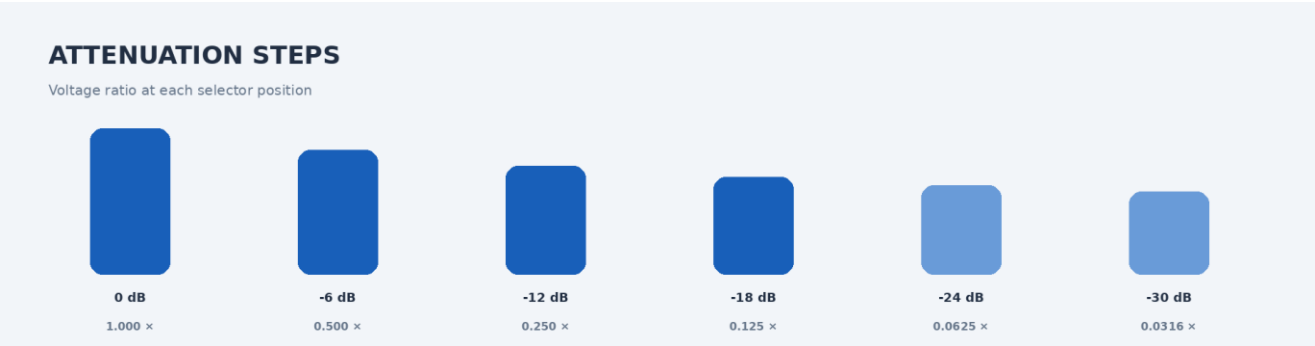


Why an external amplifier filter is useful

Class-D and other switching amplifiers can contain strong ultrasonic switching products. These components may overload an analyzer input, reduce measurement dynamic range or influence in-band readings when the analyzer does not provide sufficient input filtering. The FILTER Box applies a steep passive 80 kHz, 8th-order low-pass response before the signal reaches the measurement instrument.

Precision attenuator

The attenuator provides 0, -6, -12, -18, -24 and -30 dB settings. In addition to reducing high amplifier voltages, attenuation isolates the filter from cable capacitance and analyzer input loading. For the best passband flatness with typical cables and instruments, use -12 dB or greater attenuation whenever the available signal level permits.

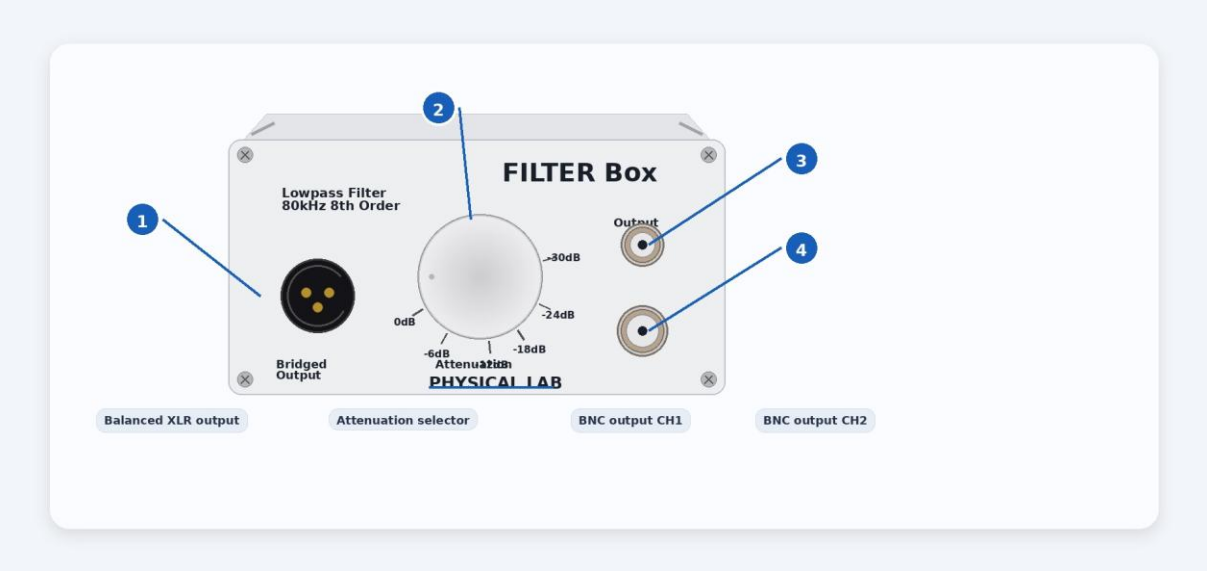


! **START SAFELY** Use -30 dB for the first test. Reduce attenuation only after confirming that the filtered output remains within the analyzer input range.

PHYSICAL LAB

Front Panel Controls and Outputs

Attenuation selector, BNC channel outputs and balanced bridged output



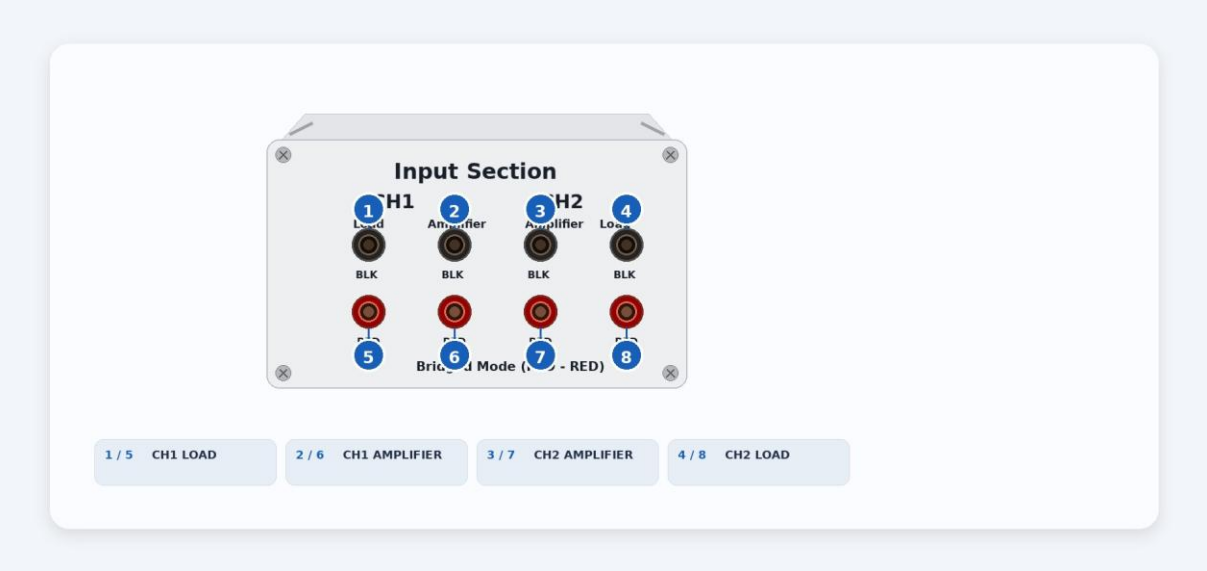
No.	Control / connection	Function
1	Bridged / balanced XLR output	Differential output derived from both filter channels. Use for bridged or floating amplifier measurements.
2	Attenuation selector	Six positions: 0, -6, -12, -18, -24 and -30 dB. The selected attenuation applies to the measurement outputs.
3	BNC output CH1	Single-ended filtered output for channel 1.
4	BNC output CH2	Single-ended filtered output for channel 2.
!	**OUTPUT SELECTION** For a normal ground-referenced amplifier channel, use the corresponding BNC output. For a bridged or floating output, use the front XLR output and a balanced analyzer input.	

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Rear Panel Connections

Amplifier inputs and dedicated load terminals



No.	Connection	Function
1 / 5	CH1 LOAD black / red	Connect the channel-1 dummy load or loudspeaker load.
2 / 6	CH1 AMPLIFIER black / red	Connect the channel-1 amplifier output.
3 / 7	CH2 AMPLIFIER black / red	Connect the channel-2 amplifier output.
4 / 8	CH2 LOAD black / red	Connect the channel-2 dummy load or loudspeaker load.

Polarity and bridged-mode label

For normal single-ended measurements, connect red to red and black to black within the selected channel. For differential or bridged measurements, use the RED terminals of both channels as indicated by the rear-panel label “Bridged Mode (RED - RED)”.

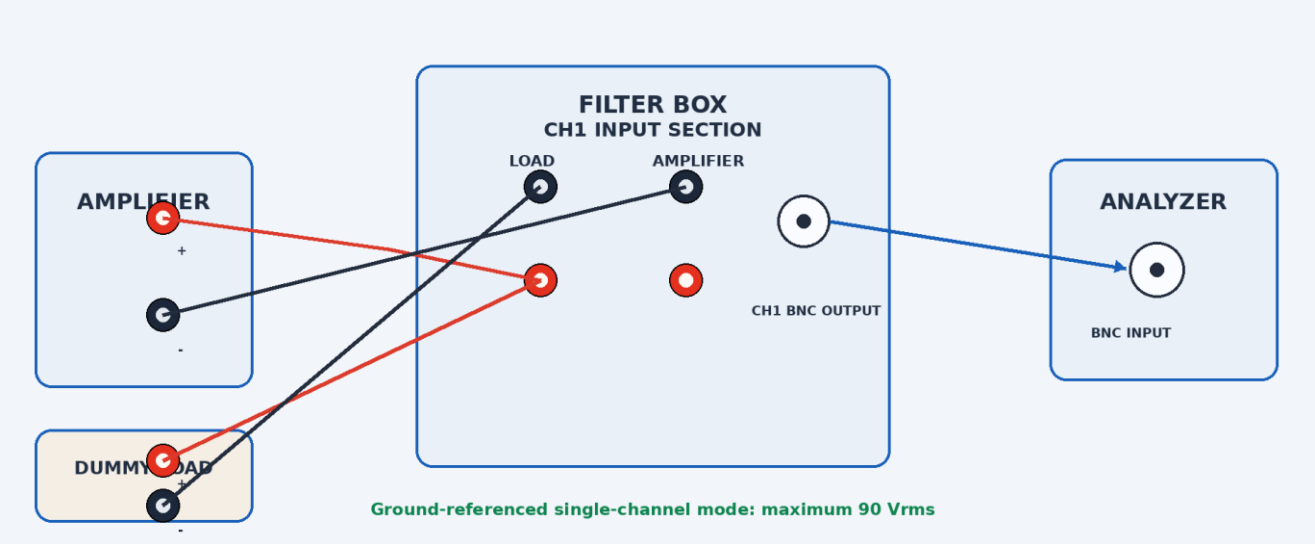
! **LOAD REQUIRED** The amplifier must operate into a suitable external load connected to the LOAD terminals. The FILTER Box is a measurement interface and is not a power dummy load.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Ground-Referenced Single and Dual Channel Modes

Using the BNC outputs for conventional amplifier channels



Single-channel measurement

- Connect the amplifier red and black outputs to the matching AMPLIFIER red and black terminals of CH1 or CH2.
- Connect the dummy load to the matching LOAD red and black terminals.
- Connect the corresponding front BNC output to the analyzer input.
- Set the attenuator to -30 dB, apply a low-level signal and verify the analyzer level.
- Reduce attenuation as required, while keeping the analyzer within its rated input range.

Dual-channel measurement

Both channels may be used simultaneously for a conventional stereo amplifier. Wire CH1 and CH2 independently and connect both BNC outputs to two analyzer inputs. The maximum input level is 90 Vrms per channel.

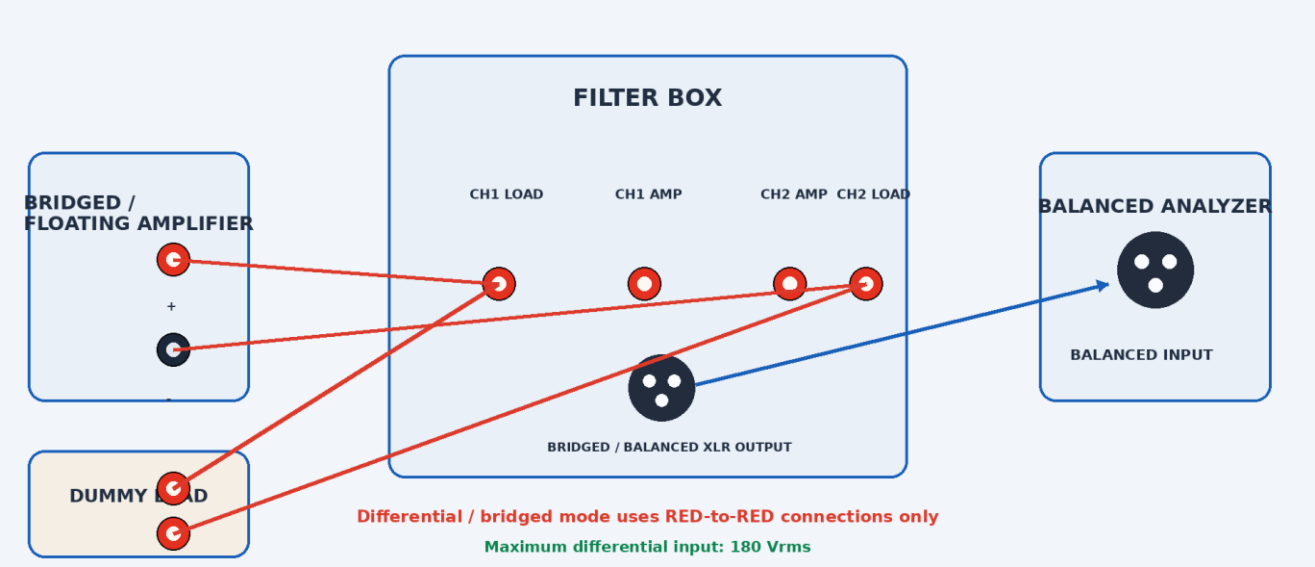
! **GROUND REFERENCE** Use the BNC outputs only when the amplifier black terminal is at signal ground or common potential. Do not connect a floating or bridged output to a grounded BNC measurement path.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Differential and Bridged Measurement Mode

Using both filter channels and the balanced XLR output



Connection method

- Connect one amplifier output conductor to the CH1 AMPLIFIER red terminal.
- Connect the other amplifier output conductor to the CH2 AMPLIFIER red terminal.
- Connect the load between the CH1 LOAD red and CH2 LOAD red terminals.
- Leave the black terminals unused unless a verified grounding scheme specifically requires them.
- Connect the front bridged-output XLR to a balanced analyzer input.
- Start at -30 dB attenuation and verify common-mode behaviour and analyzer input level.

! **COMMON-MODE PERFORMANCE** At high switching frequencies, analyzer common-mode rejection and bench grounding can limit dynamic range. Use short cables and a genuinely balanced or floating input.

The differential configuration permits measurement of bridged amplifiers and floating single-channel outputs. The maximum differential input is 180 Vrms.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Measurement Procedure and Level Selection

Recommended sequence for accurate and safe operation

Recommended procedure

- Identify the amplifier topology: ground-referenced, floating or bridged.
- Connect the amplifier, external load and analyzer for the selected mode while the amplifier is switched off.
- Select -30 dB attenuation and set the analyzer generator to minimum level.
- Switch on the amplifier and confirm correct load operation at low level.
- Observe the filtered analyzer input and increase the test level gradually.
- Reduce attenuation only when additional analyzer signal level is required.
- After the test, return the generator to minimum, switch off the amplifier and disconnect the setup.

Measurement quality

Cable and analyzer input capacitance can influence a passive filter. Attenuation settings of -12 dB or greater provide stronger isolation from external loading. For maximum reproducibility, record the attenuation setting, amplifier mode, load value, cable type and analyzer input configuration with every measurement.

! **CONTINUOUS HIGH-POWER TESTING** Ensure adequate ventilation around the FILTER Box and the load. Stop the test if the enclosure, connectors or cables become unusually hot.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Technical Specifications

Typical electrical and mechanical data

Filter / electrical specification	Typical value
Configuration	Dual single-ended channels / mono differential bridged mode
Maximum input, single-ended	90 Vrms per channel
Maximum input, bridged/differential	180 Vrms differential
Filter structure	Dual passive 8th-order low-pass
Filter response	80 kHz, Butterworth -6 dB
Insertion loss	-0.06 dB at 1 kHz
Passband flatness	±0.05 dB, 0 Hz to 40 kHz
Stopband attenuation	>70 dB above 240 kHz
Distortion	<0.01% below 10 kHz at less than 90 Vrms
Group delay	10 µs below 20 kHz
Input impedance	930 Ω per channel, ±2%
Output impedance	330 Ω per channel, ±2%
Attenuator position	**Nominal voltage ratio**
0 dB	1.000 ×
-6.02 dB	0.500 ×
-12.04 dB	0.250 ×
-18.06 dB	0.125 ×
-24.08 dB	0.0625 ×
-30.10 dB	0.0316 ×
Mechanical / connection data	**Value**

PHYSICAL LAB

Filter / electrical specification	Typical value
Input connectors	8 × 4 mm laboratory binding posts
Single-ended outputs	2 × BNC female
Differential output	1 × balanced 3-pin XLR male
Nominal enclosure dimensions	104 × 177 × 56 mm
Enclosure	Extruded aluminium housing
Power requirement	Passive; no mains supply

! **TECHNICAL VERIFICATION** Electrical performance values follow the supplied reference documentation. Confirm final production-unit measurements and mechanical tolerances before public release.

PHYSICAL LAB

FILTER BOX AMPLIFIER FILTER & ATTENUATOR

Troubleshooting, Maintenance and Contact

Common setup issues and service information

Symptom	Possible cause	Corrective action
No analyzer signal	Incorrect BNC/XLR selection or disconnected path	Confirm measurement mode, attenuation and all amplifier/load connections.
Analyzer overload	Attenuation too low or amplifier level too high	Return to -30 dB and reduce generator/amplifier level.
Incorrect bridged result	BNC output used or red-to-red wiring incorrect	Use the balanced XLR output and verify CH1/CH2 red-terminal connections.
Unexpected HF noise	Grounding/common-mode limitation or cable pickup	Use short cables, balanced input and check analyzer CMR performance.
Frequency-response error	Cable/analyzer loading at low attenuation	Use -12 dB or greater attenuation and minimize cable capacitance.
Amplifier protection triggers	Load or wiring fault	Power down immediately and verify load value, polarity and connection mode.

Cleaning and maintenance

- Disconnect the amplifier, load and analyzer before cleaning or inspection.
- Use a soft, dry cloth. Do not use liquids, solvents or abrasive materials.
- Inspect binding posts, BNC connectors, the XLR connector and the attenuation switch periodically.
- Do not open or modify the unit unless service is performed by qualified personnel.

Service and contact

PHYSICAL LAB
SCIENCE SHAPING SOUND

PHYSICAL LAB
Teutonenstrasse 4A
89250 Senden, Germany
Tel. +49 (0)7307 800627
www.physical-lab.com

Revision history

Revision	Date	Description
1.3	July 2026	Front and rear panel illustrations revised. Callout numbering visually checked and aligned with the connection tables.