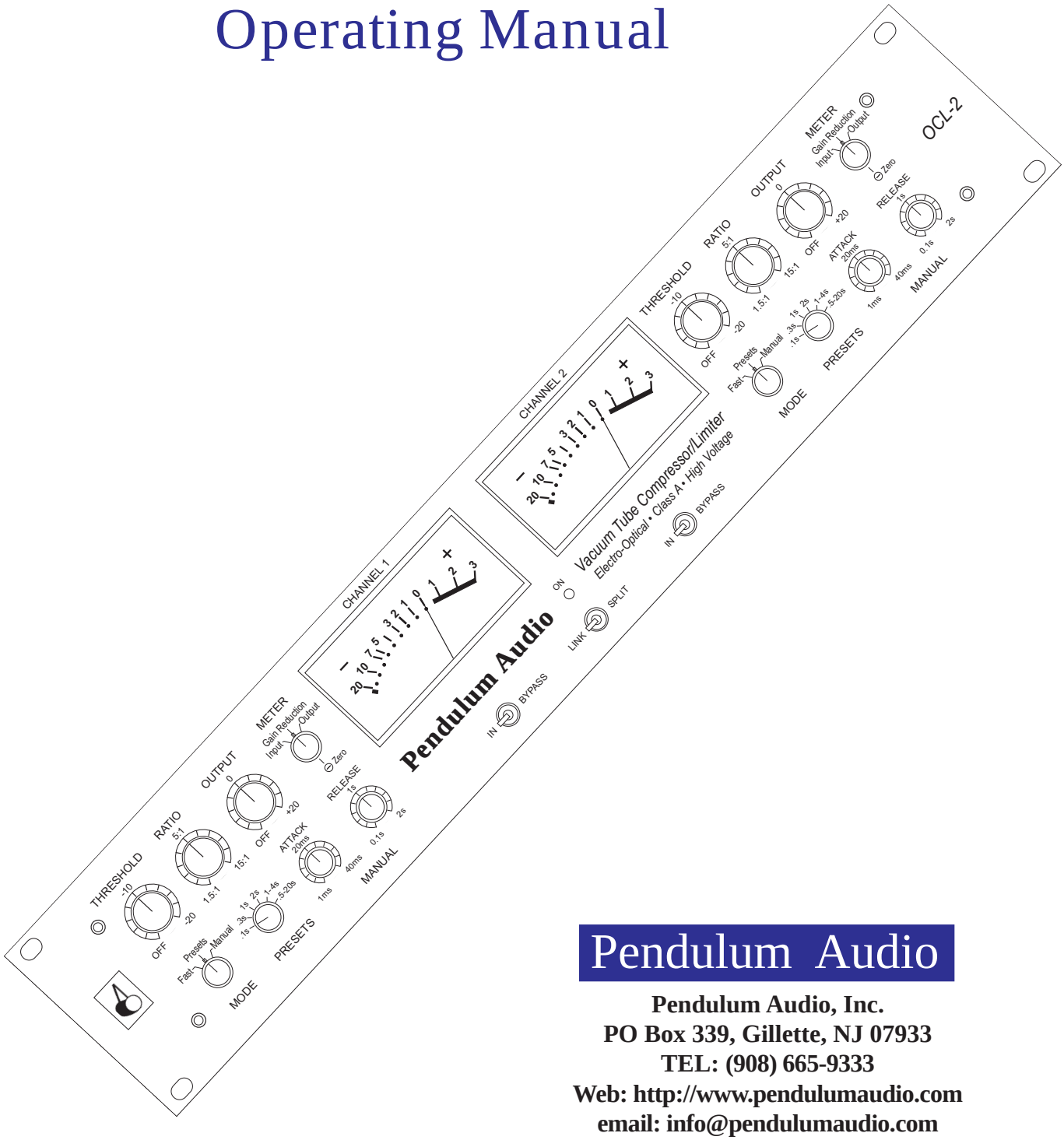
OCL-2

Vacuum Tube Compressor / Limiter

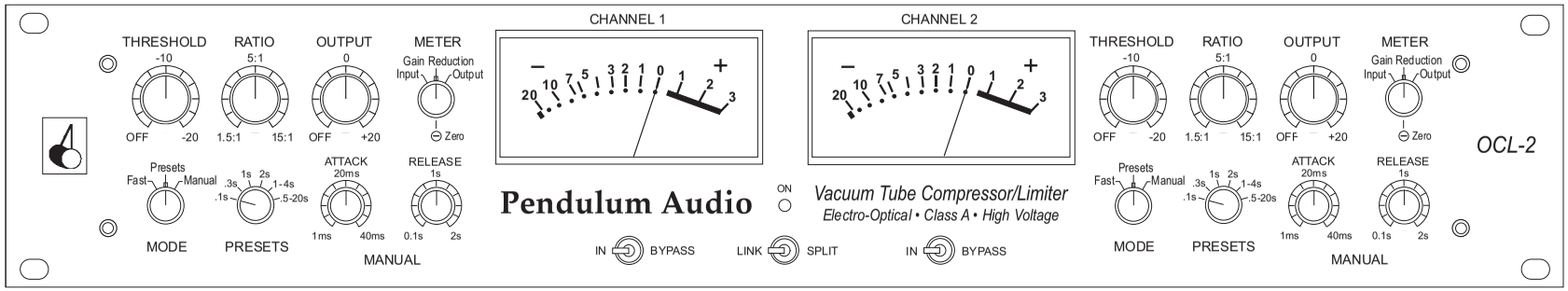
Operating Manual

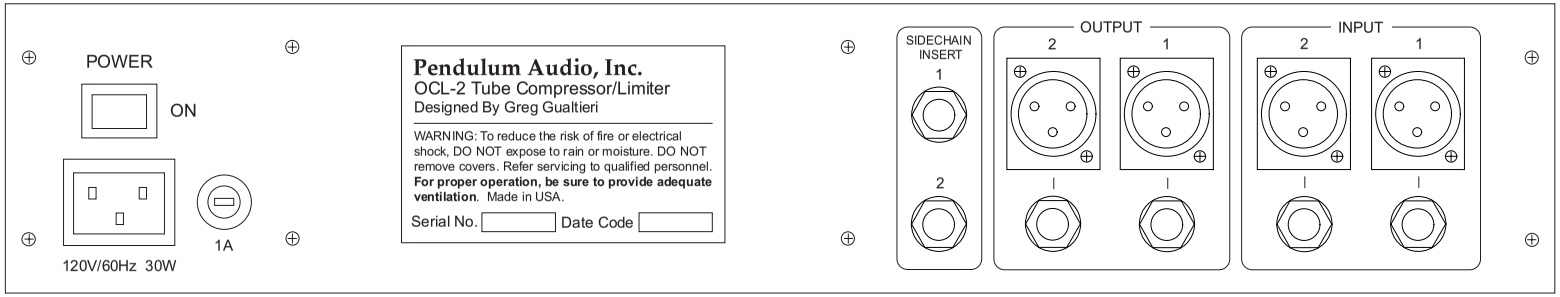


Pendulum Audio

Pendulum Audio, Inc.
PO Box 339, Gillette, NJ 07933
TEL: (908) 665-9333
Web: http://www.pendulumaudio.com
email: info@pendulumaudio.com

OCL-2 Condensed Operating Instructions





Threshold The amount of compression is adjustable over a wide range of signal levels (off to -20dB), to allow compression of +4dBu and -10 dbV source material.

Ratio The compression ratio is continuously variable from light compression to limiting (1.5:1 to 15:1).

Output The tube line stage will supply up to +20dB of gain make-up after compression.

Meter The VU meter can indicate input level, output level, or gain reduction. Input and output levels are referenced to +4dBu. The meter Zero trim for gain reduction is located below the selector switch.

In/Bypass 'Hard' bypass switches for comparing the processed sound directly with the original source.

Link/Split Links the two channels for stereo operation. When linked, the threshold and dynamics processing (fast, preset and manual modes) are controlled entirely by Channel 1. The ratio and output controls for the two channels should be set to the same values.

Mode Selects the three sidechain operating modes for dynamic control:

Fast: The optical element operates with very fast attack and release times, which are peak-averaged by the rapid operation of the optical cell.

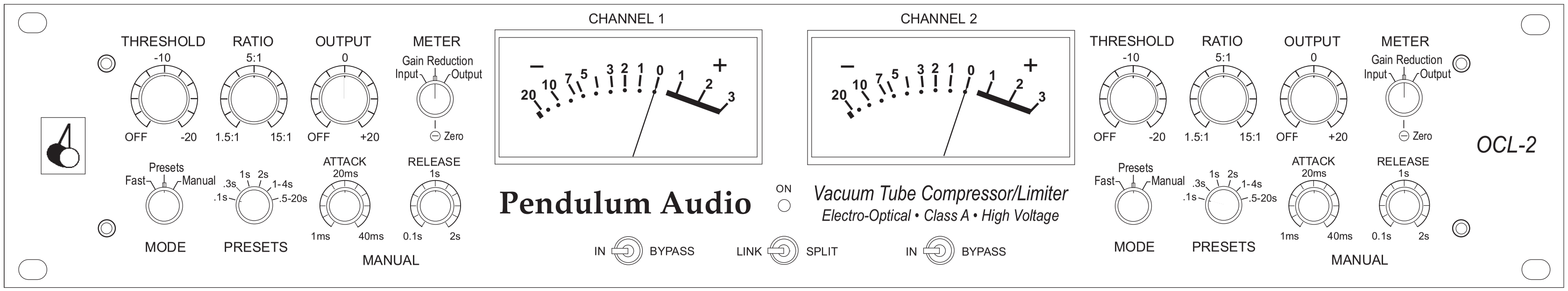
Presets: These six attack/release time settings are identical to the presets on the classic Fairchild 670 limiter. Presets 5 and 6 are program-dependent.

Manual: The attack and release times are continuously variable from 1-40ms and 0.1-2s respectively.

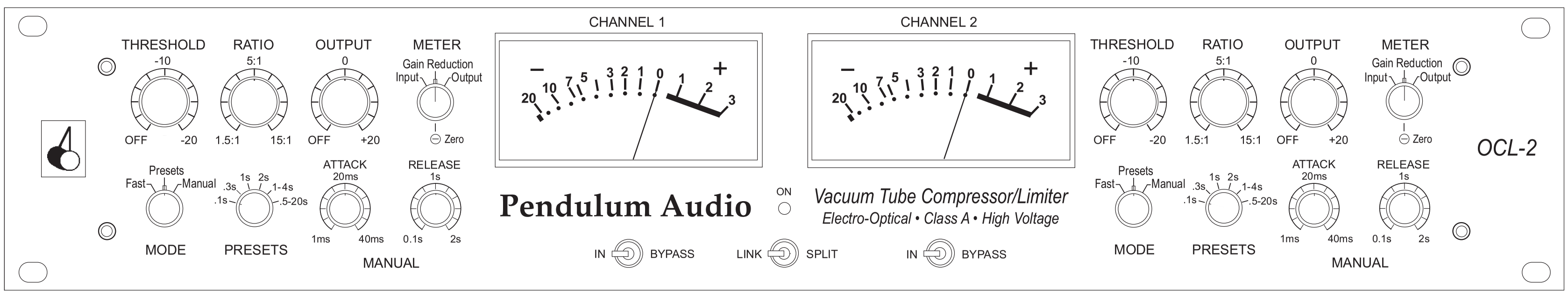
Sidechain Inserts TRS 1/4" jacks for inserting an outboard EQ into the sidechain. Use for frequency-dependent compression or de-essing. Tip is send, and Ring is return. In Link mode, only the channel 1 insert is active.

Inputs and Outputs The XLR and 1/4" connectors for each channel are wired in parallel. Pin 2 is positive phase. Input is 10kΩ. Output is 600Ω.

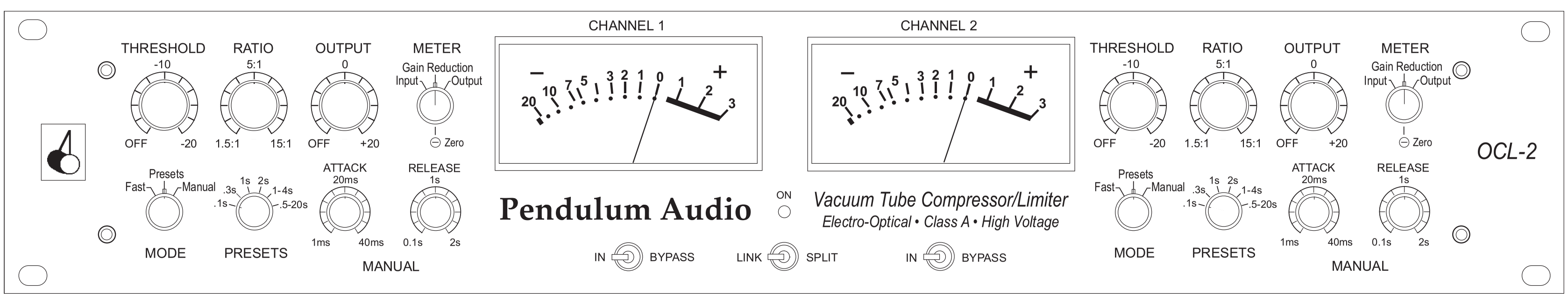
OCL-2 Front Panel Templates



Session: ____________________ Date: ____________ Source: ________________________ Notes: _______________________



Session: ____________________ Date: ____________ Source: ________________________ Notes: _______________________



Session: ____________________ Date: ____________ Source: ________________________ Notes: _______________________

OCL-2 Vacuum Tube Compressor/Limiter

Features

- Fast electro-optical input attenuator with an all tube gain stage
- Soft-knee design with fully adjustable compression ratio
- Transformerless high voltage class A signal path
- Low noise, wide bandwidth and superior transient response
- Custom optical cells matched for precise stereo balance
- Three sidechain operating modes: Fast, Presets and Manual
- Two completely independent channels with stereo linking
- Hard bypass switches for each channel
- Sidechain inserts for frequency-dependent compression and de-essing
- Transformerless output stage capable of delivering +35dBu
- Soft-start warm-up with output muting
- Gold-plated switch contacts, I/O connectors and tube sockets
- Fully regulated high voltage (300V), filament and bipolar power supplies
- Custom toroidal power transformer with shield for minimum hum
- Polypropylene capacitors and metal film resistors
- Single-sided audio pc boards to minimize capacitive interaction

Introduction

Thank you for purchasing the Pendulum OCL-2, a modern two channel electro-optical compressor/limiter designed for the utmost in transparency, detail and versatility. Our short signal path design uses a custom optical input attenuation network in front of an all tube class A gain stage. Since the signal path is entirely transformerless, we've eliminated the coloration inherent in traditional transformer-coupled tube designs. The result is an open, detailed sound with an expanded sound stage and clarity that can only be achieved with modern tube circuitry.

The OCL-2's soft-knee design offers smooth, effortless dynamic control with the ratio adjustable from light compression to limiting. Our unique sidechain circuit linearizes the optical gain element to reduce distortion, and achieves much faster attack and release times than encountered with conventional optical compressors. Stereo linking is accomplished with the flip of a switch .

For maximum versatility, the OCL-2 has three modes of dynamics processing: In the FAST mode, the compressor works as fast as the optical element will allow, and is remarkably free of the 'pumping' artifacts normally encountered with slower optical compressors. It's the ideal choice for invisible dynamics processing, either for tracking or tight program compression.

The PRESET mode consists of six classic attack/release time settings that are optimized for program compression, including two settings with program-dependent release times.

The MANUAL mode offers total control over the attack and release times, which is particularly useful for creative compression effects or for processing bass guitar.

Most important, the hard bypass switches on the front panel conveniently allow a quick determination of exactly what the OCL-2 is, or in most cases, isn't doing to your signal.

Unpacking

The unit was carefully packed at the factory to protect against damage in transit. Nevertheless, be sure to inspect the unit and shipping carton for any signs of damage that may have occurred during shipment. If there is any damage, notify us immediately for further instructions. It’s also a good idea to save the carton and packing materials should you ever need to return the unit for repair. The shipping carton should contain the following items: the OCL-2 Vacuum Tube Compressor/Limiter, a 3 prong IEC power cord, and this operating manual.

Mounting

The OCL-2 uses two EIA-standard rack spaces, and can be mounted in any standard 19 inch (483mm) equipment rack. If the OCL-2 is mounted in a mobile rack or road case, it is important that the rear of the chassis is supported to prevent possible damage from mechanical shock and vibration. Excessive shock and vibration can cause damage or premature failure of the vacuum tubes, or cause them to shaken loose from their sockets. Please avoid rough handling.

Ventilation

For proper operation, it is *very* important that adequate ventilation is provided. Vacuum tubes produce a significant amount of heat that must be removed from inside the chassis. The side panel vent holes and top panel slit vents should never be blocked in any way. Never mount the OCL-2 below a rack unit with a depth greater than 7 inches (178mm). Do not mount the OCL-2 near other heat-producing equipment such as power amplifiers or other vacuum tube products. If possible, leave open at least one rack space above the unit, and use a rack spacer with a ventilation grille. Never operate the OCL-2 inside a road case where the side panels are cushioned in foam.

Preventing Ground Loop Hum

One of the reasons the OCL-2 sounds so good is that unlike many other vacuum tube products, it operates single-ended, Class A, and has a signal path that is completely transformerless. However, it does not benefit from the galvanic isolation provided by input or output transformers. For this reason, a few precautions are necessary to insure hum-free operation:

- Isolate the front panel from the rack rails. Use plastic shoulder washers to prevent electrical contact between the rack ears of the OCL-2 and the metal rails of the equipment rack.
- Isolate the OCL-2 from units mounted above or below it in the rack. Make sure the front panels are not in electrical contact and that the top or bottom cover screws of the OCL-2 are not touching those of any other units.
- Connect the 3 prong IEC power cord to the single-point star grounded electrical source for your facility.

The idea here is to make sure the OCL-2 seeks ground at only one point. For safety reasons, do not lift the ground at the IEC power cord. Keep in mind that in a properly grounded hookup, the OCL-2 does not hum. Please, take the time to do this right, and you will be rewarded with hum-free operation. Call us if you have any questions. Please note that pin 2 is hot**.**

Power Requirements

The OCL-2 is equipped with a 3-prong IEC power connector and detachable cord. Never operate the OCL-2 with the ground on the power cord defeated. Unless otherwise stated, this unit operates from 120V/60 Hz at 30W. The ac fuse is accessible from the rear panel and is rated at 1A/250V (3AG) SLO-BLO. To check or replace the fuse, make sure the unit is unplugged. Operation at 240V/50Hz is available as an option. Please contact us for more information.

Servicing

Other than changing the tubes, the user should not attempt to service the OCL-2 beyond that described in this manual. Never remove the covers or attempt to replace the tubes until the unit has been disconnected from the ac power source, and all circuits inside have been allowed to discharge for a period of at least 30 minutes. The vacuum tubes become very hot once the unit has been turned on, and they should not be touched until they have cooled to room temperature. To reduce the risk of fire or electrical shock, do not expose to rain or moisture, or operate it where it is exposed to water. Since potentially lethal voltages are present inside the unit, it should only be opened by qualified service personnel. Refer all servicing, or any questions about servicing, to Pendulum Audio, Inc.

Operation

While the operation of the OCL-2 may appear to be rather straightforward, there are a few features which may differ from what you're accustomed to seeing on other vacuum tube compressors. You may find it useful to refer to the Condensed Operating Instructions at the beginning of this manual to quickly identify the operation of the front panel controls. However, we suggest you read through this section to take advantage of all its features, and to make sure you are operating the OCL-2 in the way most appropriate for the type of dynamics processing you're doing.

Hookup

Please refer to the rear panel layout (see the Condensed Operating Instructions) for the location of the inputs, outputs, and ac power. Make all connections to the OCL-2 before applying power.

Inputs

On the right hand side of the rear panel are the input jacks for channels 1 and 2. The female XLR connectors on top are 3 pin unbalanced inputs with Pin 1 + Pin 3 = ground, and Pin 2 = positive phase input (+).Use them for connecting the OCL-2 to +4dBu transformer-balanced or active-balanced sources. If you encounter ground loop hum when connecting to transformer-balanced outputs, lift the shield from Pin 1 on the input end of the cable. The input impedance is 10kΩ.

The two 1/4" jacks below the XLR connectors are unbalanced input connectors, wired in parallel to the XLR inputs, with Tip = Pin 2, Sleeve = Pin 1. Use them for connecting the OCL-2 to unbalanced (-10dBV) sources. Do not attempt to use the XLR and 1/4" inputs simultaneously.

Outputs

To the left of the input jacks are the output jacks for channels 1 and 2. The male XLR connectors on top are 3 pin unbalanced outputs, with Pin 1 + Pin 3 = ground, and Pin 2 = output. Connect these outputs to XLR- or TRS-balanced line-level inputs. If you encounter ground loop hum when connecting to balanced inputs, lift the shield from Pin 1 on the input end of the cable. When connecting to a balanced patch bay, be sure that Pin 2 = Tip.

The two 1/4" jacks below the XLR connectors are unbalanced output connectors, wired in parallel to the XLR outputs, with Tip = Pin 2, Sleeve = Pin 1. Use them for connecting the OCL-2 to unbalanced (-10dBV) inputs or mixer inserts.

AC Power

On the left side of the rear panel is the IEC input socket. Connect to a 120V/60Hz receptacle with the 3 prong IEC power cable supplied with the OCL-2. For safety reasons, do not lift the ground on the power plug by using a 3-to-2 ground lift adapter.

Turn on the power to the unit using the ac power switch located above the power inlet socket. Although it might seem a bit awkward to put the ac power switch on the rear panel of the OCL-2, there is a very good reason for it. By keeping the ac away from the front panel, hum induced by the ac line into the front panel circuitry can be virtually eliminated. This is especially important with the OCL-2, since the optical gain control circuit is located on one of the front panel circuit boards.

If necessary, replace the 1A/250v 3AG SLO-BLO fuse only with the same type and rating.

Power-up Sequence

To prolong tube life, the OCL-2 goes through a soft-start sequence for gently applying power to the tubes and stabilizing the circuit before engaging the outputs. When the power switch is turned on, the outputs are relay-muted to ground and the dc voltage on the tube filaments is ramped up to 12.6Vdc. Next, the high voltage supply is slowly increased to 300V and the circuit is allowed to stabilize for about 2 minutes. Finally, the relays lift the outputs from ground and the blue 'on' led on the front panel is illuminated. For best results, please allow the OCL-2 to warm up for 10 minutes or longer before use.

OCL-2 Front Panel Controls

Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of all switches and controls discussed below. The operation of both channels is identical, unless the two channels are linked. All toggle and rotary switch contacts are gold-plated for high reliability. All panel rotary controls are long-life conductive-plastic potentiometers.

Threshold: Off to -20dB

The THRESHOLD control determines how much gain reduction is applied to the source material. Since the OCL-2 is a 'soft-knee' compressor that uses both feedforward and feedback sensing, it does not have a strictly-defined 'threshold'. Rather, the dial markings indicate the amount of gain reduction that is applied to a steady-state input signal at +4dBu. Use higher settings for -10dBV inputs, and lower settings for input levels that exceed +4dBu. A maximum of 27dB of gain reduction is available.

Ratio: 1.5:1 to 15:1

The Ratio control sets the 'slope' of the gain reduction, defined as the signal level above threshold (in dB) that produces a 1dB increase in the compressor output. Since the OCL-2 is a soft-knee compressor, its ratio determines the degree of gain reduction that occurs for signal levels above the knee. In the case of the OCL-2, the ratio starts at 1:1 and makes a smooth transition to the value indicated by the ratio control after approximately 5 dB of gain reduction. So, at moderate compression levels, an adjustment to higher ratio will be heard as a greater amount of 'restraint' applied to peaks. At higher compression levels, the sound will become markedly more 'dense' as the ratio is increased.

Output: Off to +20dB

Use the OUTPUT control to boost the signal level after compression. Up to 20dB above the level of the input signal is possible. The unity-gain setting (0dB) is 12:00. The OUTPUT control on the OCL-2 is a passive level control that is positioned immediately after the electro-optical input attenuator. For this reason, it is impossible to overload the input of the OCL-2 tube line amp.

Meter: Input/Gain Reduction/Output

The illuminated ANSI VU meters are electronically isolated from the signal path, and can be switched to measure input, output or gain reduction. Keep in mind that a VU meter is a mechanical device, designed in accordance with a with a well-accepted ballistic standard, to indicate an average loudness level. On the other hand, the led meters on your mixer or digital recorder are reading a peak program level, and faithfully register all those short transient spikes that add little to the perceived loudness of the program material. The ratio of the peak to average levels can be 20dB or greater depending on the source (e.g. drums). So, if you're wondering why the led meters on your recorder are flashing near zero, but the input and output levels on the VU meters of the OCL-2 are hovering at or below -10, you're simply seeing the difference between the peak and average program level.

Input

When the METER switch is in the INPUT position, the VU meter indicates the signal level at the XLR and 1/4" input connectors. The meter is calibrated to 0dB = +4dBu (1.23vrms). Use this setting to monitor the average program level into the optical attenuator at the input of the OCL-2. For the best signal to noise ratio, the input level should be in the range of -10 to 0 VU.

Gain Reduction

When the METER switch is in the GAIN REDUCTION position, the VU meter indicates the amount of gain reduction applied to the input source. Keep in mind that the meter is indicating an *average* gain reduction, and does not reflect how the OCL-2 is responding to peaks faster than the meter's response time. When the peak to average ratio is high (e.g. drums), trust your ears to be the ultimate judge.

Zero

A screwdriver - adjustable trim control, located below the METER switch, is used for zeroing the meter when it is set to read GAIN REDUCTION. Use a small, flat-bladed screwdriver, and adjust the meter to indicate 0VU with the THRESHOLD control set to OFF. Gain Reduction is measured directly off the electro-optical cell, so it is normal for some drift of the meter to occur until the temperature of the cell stabilizes. Let the unit warm up at least 20 minutes before making any adjustment.

Output

When the METER switch is in the OUTPUT position, the VU meter indicates the signal level at the XLR and 1/4” output connectors. The meter is calibrated to 0dB = +4dBu (1.23vrms). Use this setting to monitor the average program level sent to a tape machine, mixer input or channel insert.

Mode: Fast/Presets/Manual

The OCL-2 uses a unique sidechain circuit, which linearizes the optical gain element (reducing distortion) and achieves mush faster attack and release times than normally encountered with optical compressors. For maximum versatility, there are three distinctly different modes of operation.

Fast

In the FAST mode, the optical cell operates with very fast attack and release times, which are peak-averaged by the rapid operation of the cell. This mode is remarkably free of pumping artifacts even at high compression levels. It's the ideal choice for tracking or tight program compression. Use it whenever you don’t want to hear the OCL-2 working.

Presets

The PRESETS mode consists of six attack/release settings which are ideal for program compression. These presets are identical to those found on the classic Fairchild 670 Limiter. The first four presets offer a selection of fixed attack and release times, with the release times indicated on the dial markings. Presets 5 and 6 are program-dependent release times, where there is initially a quick release, followed by a longer decay time to zero gain reduction. Think of these settings as a ‘gated’ release time, where the compressor operates more rapidly at the average program level, but takes much longer to return back to zero gain reduction. In other words, the compressor does not immediately ‘suck back to zero’ when there is a brief pause in the program, e.g. between words in a vocal track.

Manual

The MANUAL mode offers total control over the attack and release times. The range of the attack and release controls is 1ms to 40ms and 0.1s to 2s respectively. Manual control is particularly useful for creative compression effects or for processing bass guitar. Quite often, a greater level of compression can be applied to program material if a very long attack time and a short release time are used. In this instance, the compressor is responding to the average program level, does not ‘over-compress’ on short peaks, and recovers quickly. In other words, it doesn’t ‘pump’ as much!

Sidechain Inserts

On the rear panel are two TRS 1/4" jacks (one for each channel) for inserting an outboard EQ into the sidechain detector circuit. This is useful for frequency-dependent compression or de-essing. The Tip is Send, and Ring is Return.

Link/Split

When this switch is set to SPLIT, the two channels of the OCL-2 operate independently. In LINK, the sidechain circuits for the two channels are coupled for stereo operation. The threshold and dynamics processing (fast, preset and manual modes) are controlled entirely by Channel 1. The ratio and output controls for the two channels should be set to the same values. NOTE: Although the optical elements for the two channels are matched, as they age some shift in the stereo image may occur at high

compression and ratio settings. To bring the channels back into balance, simply adjust one of the ratio controls to center the image in the stereo field.

Although linking the two channels will keep the stereo image centered, it may tend to collapse the stereo spread a bit too much on some program material. In this case, run the two channels of the OCL-2 split, and set all the controls for both channels to the same values. Listen carefully to verify that the degree of image shift that occurs is acceptable.

In/Bypass

These are 'hard' bypass switches for comparing the processed sound directly with the original source. IN connects the output of the OCL-2 tube line amp directly to the output connectors. BYPASS connects the input source directly to the output.

Other Issues

Internal Adjustments

There are two adjustments to the OCL-2 that are only accessible by removing the top cover:

- Calibration of the meter when measuring gain reduction
- Stereo balance of the optical elements

These adjustments are required only if one of the optical elements are replaced, or if they drift out of calibration with age. Since these adjustments must be made with the ac power on, and potentially lethal voltages are present inside the chassis, we recommend that they be made only by qualified service personnel who are familiar with working around high voltage tube circuitry.

For your safety, we strongly recommend that you contact us for servicing. On request, detailed instructions for performing these procedures will be provided to qualified service personnel.

Options

There OCL-2 is available with transformer-balanced inputs and/or outputs using high-quality Jensen transformers. However, we do not recommend this unless absolutely necessary, since the transformers will color the sound. If at all possible, try to make it work without them. See the section entitled ‘Preventing Ground Loop Hum’ for more information.

Replacing the Tubes

All vacuum tubes have a limited life due to reduced electron emission from the oxide coating on the cathode and/or a buildup of impurity gases is the bulb. The life of the preamp tubes in the OCL-2 is estimated to be several years. If you notice the sound quality deteriorating - higher distortion, muddiness, or microphonic behavior - it's time to change the tubes. We recommend changing all the tubes at once. If you are uncomfortable with replacing the tubes yourself, please have it done by qualified service personnel. Replacement tubes are available directly from us.

1. Unplug the OCL-2 and wait at least 30 minutes for the high voltage in the unit to discharge and for the tubes to cool to room temperature.
2. Remove the top cover by removing the nine #6-32 Phillips-head screws. DO NOT remove the bottom cover.
3. Note the position of the four tubes (V1-V4) in the porcelain sockets.
   - The input tubes are 6072A/12AY7 (V1 and V3)
   - The output tubes are 6922/6DJ8 (V2 and V4)
4. Remove each tube and replace with the same type removed from the each socket. Do not mix up the tube positions.
5. Reinstall the top cover and screws.

There are a large variety of 6072As available. Each type has slightly different internal structure and design. Consequently, each type has its own sonic signature. Sometimes the differences are subtle - sometime not. You are encouraged to sample the different varieties and pick the one that sounds the best to you.

The 6922 is a rugged, military style 6DJ8. Since it is used as a high current output driver, we recommend replacing it with the same type and rating. The 6922 used in this fashion has much less influence on the sound of the OCL-2 than the 6072A input tube.

OCL-2 Specifications

Circuit Type:	optical input attenuator and class A vacuum tube gain stage with transformerless output
Input Sensitivity:	+4dBu
Input Impedance:	10kΩ
Freq. Response:	-1.0dB 8Hz and 145kHz with 10KΩ output load
	-1.0dB 20Hz and 115kHz with 600Ω output load
Noise:	less than -78dB below +4dBu output level with Output control at 0dB
	less than -75dB below +4dBu output level with Output control at +20dB
Distortion:	less than 0.05% THD+N, 20Hz to 10kHz, measured with +4 dBu input, +10dBu output, 600Ω load
Output:	+35dBu into 10kΩ load
	+24dBu into 600Ω load
Max. Gain Reduction:	27dB
Threshold:	off to -20dB
Ratio:	1.5:1 to 15:1
Output:	off to +20dB
Modes:	fast (peak-averaged), preset or manual operation
Presets:	1ms/0.1s, 1ms/0.3s, 2ms/1.0s, 4ms/2s, 2ms/1 to 4s and 1ms/0.5 to 20s (program dependent)
Manual:	attack time varaible from 1.0ms to 40ms
	release time varaible from 0.1s to 2s
Meter:	selection of input level, gain reduction, or output level
	input and output levels are referenced to +4dBu = 0VU
In/Bypass:	hard bypass of input signal to output connector
Link/Split:	links channel 1 and channel 2 for stereo operation
Polarity:	input and output XLR connectors are pin 2 hot
Vacuum Tubes:	(2) 6072A, (2) 6922
Power:	120Vac, 30W (240Vac optional)
Power Supplies:	+300Vdc, +12.6Vdc and ±15Vdc, fully regulated with soft-start warm-up and output muting
Dimensions:	2U enclosure, 19" x 3.5" x 12.5" (48.2 x 8.8 x 31.8 cm)
Weight:	14lbs (6.4kg)

Limited Warranty

Pendulum Audio, Inc. warrants to the first purchaser of a new Pendulum OCL-2 Vacuum Tube Compressor/Limiter that the unit is free of manufacturing defects in materials and workmanship for a period of one (1) year from the date of purchase. Pendulum Audio, Inc.'s sole obligation under this warranty shall be to provide, without charge, parts and labor necessary to remedy defects, if any, which appear within one (1) year from the date of purchase. All warranties expressed or implied made by Pendulum Audio, Inc., including warranties of merchantability and fitness, are limited to the period of this warranty. Pendulum Audio, Inc. is not responsible for indirect, incidental or consequential damages arising from the use or failure of this product, including injury to persons or property.

This warranty does not cover damage due to: misuse, abuse, modification, accident or negligence. The warranty does not apply if the unit is repaired or altered by persons unauthorized by Pendulum Audio, Inc. in such a manner as to injure, in Pendulum's sole judgment, the performance, stability or reliability of the unit. The warranty does not apply if the unit is connected, installed or used otherwise than in accordance with the instructions furnished by Pendulum Audio, Inc. There is no warranty on vacuum tubes.

If the equipment requires warranty repair, return authorization must be obtained from Pendulum Audio, Inc. prior to shipment. Equipment should not be shipped to Pendulum Audio, Inc. until return authorization and the proper shipping address is obtained from us. The equipment (with all its components parts and connecting cables) must be suitably packaged, including a note with the owner's name, address, telephone number and a description of the reason for return. The owner pays two-way shipping (we recommend UPS), and we suggest that the shipment be insured for its full value.

This limited warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for us any liability in connection with the sale of our products than set forth herein. This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.