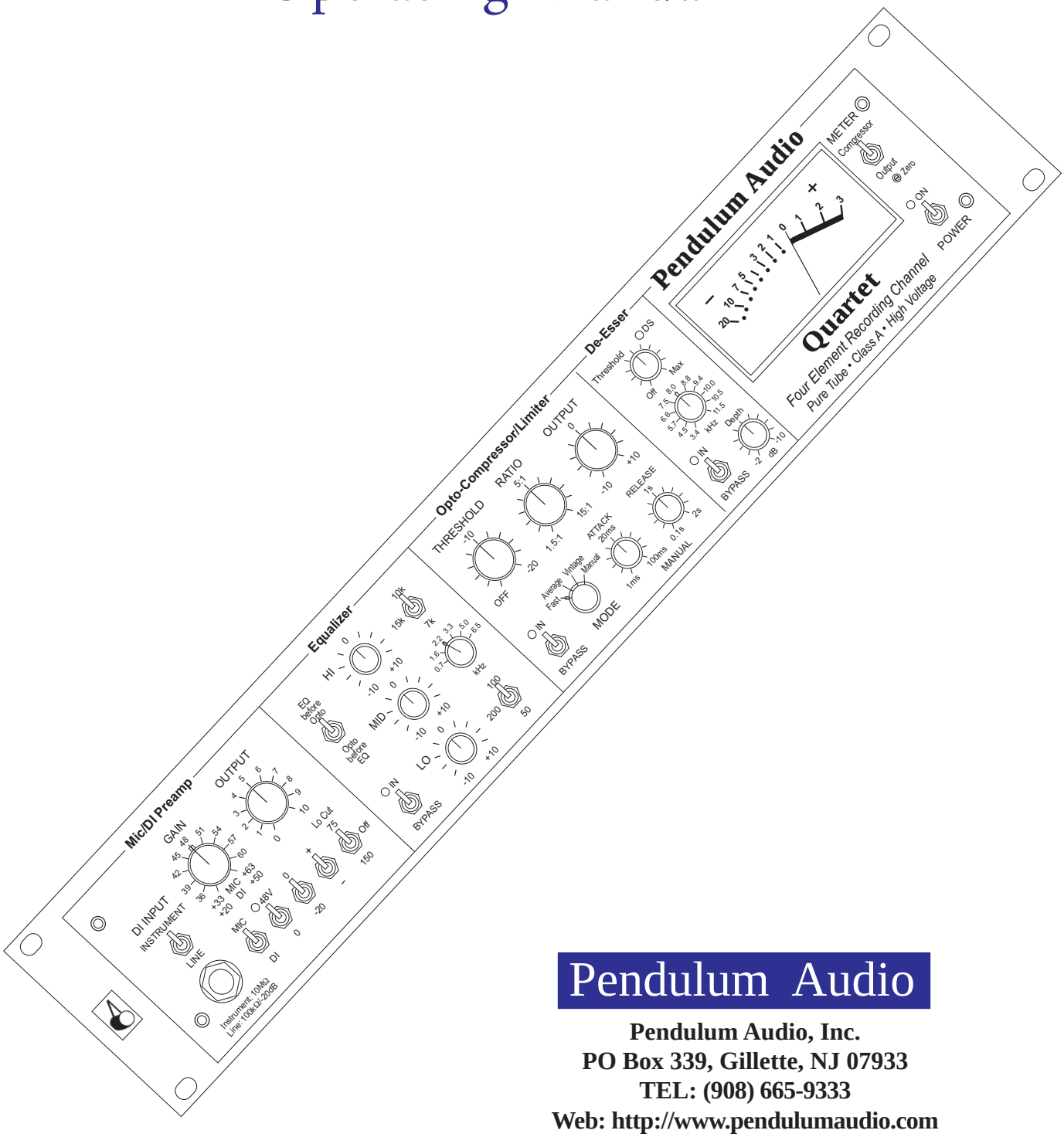
Quartet
Four Element Tube Recording Channel
Operating Manual



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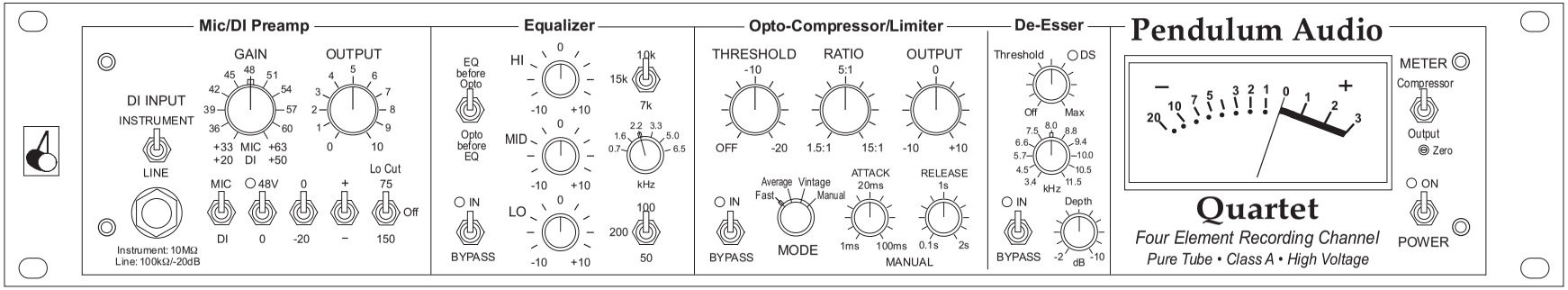
Quartet Condensed Operating Instructions - Front Panel



MIC/DI Preamp

DI input: Selects between Instrument (with 10 MΩ input impedance at the front 1/4" jack, or 1MΩ at the rear jack) and Line (100KΩ input impedance, with a -20dB pad at both inputs). The 1/4" front and rear panel jacks are wired so that the rear jack is disabled when the front jack is used.

MIC/DI: Selects between the MIC input (via the XLR input connectors on the rear panel) or DI input signals (via the front or rear 1/4" input jacks).

+48V: Supplies 48 volts to the XLR inputs for condenser microphones requiring phantom power. Do not use with dynamic, ribbon or tube mics.

0/-20: The -20 position inserts a 20 dB pad in front of the mic input transformer.

+/-: Mic phase reverse switch, where '+' is normal phase (input pin 2 hot), and '-' is inverted phase (input pin 3 hot).

Lo Cut: A 3 position switch that provides a 12dB/octave low frequency rolloff at 75 or 150 Hz. Center postion is off.

Gain: An 11 position rotary switch that controls the gain of the tube stage in 3dB steps. The range is: +33 to +63dB for the mic input, +20dB to + 50dB for the DI instrument input, and 0 to + 30dB for the DI line input.

Output: A passive attenuator that controls the output level. By increasing the Gain (driving the tubes harder) and lowering the Output level, subtle variations in the character of sound are possible. For the 'cleanest' sound, set the OUTPUT control to 10.

Equalizer

EQ Before Opto/ Opto before EQ: Places the EQ stage is before or after the Opto-Compressor.

HI: The HI band (shelving response) has a boost/cut control and a toggle switch for frequency selection. Up to ±10dB of boost or cut is available at 15kHz, 10kHz or 7 kHz.

MID: The MID band (peaking response) has a boost/cut control and a 6-position rotary switch for frequency selection. Up to ±10dB of boost or cut is available at one of six frequencies: 0.7, 1.6, 2.2, 3.3, 5.0 or 6.5 kHz. The bandwidth is fixed at 1.0.

LO: The LO band (shelving response) has a boost/cut control and a toggle switch for frequency selection. Up to ±10dB of boost or cut is available at one of three turnover frequencies: 200Hz, 100Hz or 50Hz.

In/Bypass: A 'hard' bypass switch for comparing the processed sound directly with the original source.

Opto-Compresor/Limiter

Threshold: The amount of compression is adjustable over a wide range of signal levels (off to -20dB).

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 +10dB of gain make-up after compression.

Mode: Selects one of four sidechain modes:

Fast: Fast attack and release times, which are peak-averaged by the rapid operation of the cell.

Average: The optical cell operates with rms response, which more accurately reflects the average loudness of the waveform.

Vintage: Three-stage program-dependent time constants, which emulate the response of a vintage opto-compressor.

Manual: The attack and release times are continuously variable from 1-100ms and 0.1-2s.

Meter: The VU meter can indicate output level, or compresion (gain reduction). The output levels is referenced to +4dBu. The meter Zero trim for gain reduction is located below the switch.

In/Bypass: A 'hard' bypass switch for comparing the processed sound directly with the original source.

De-Esser

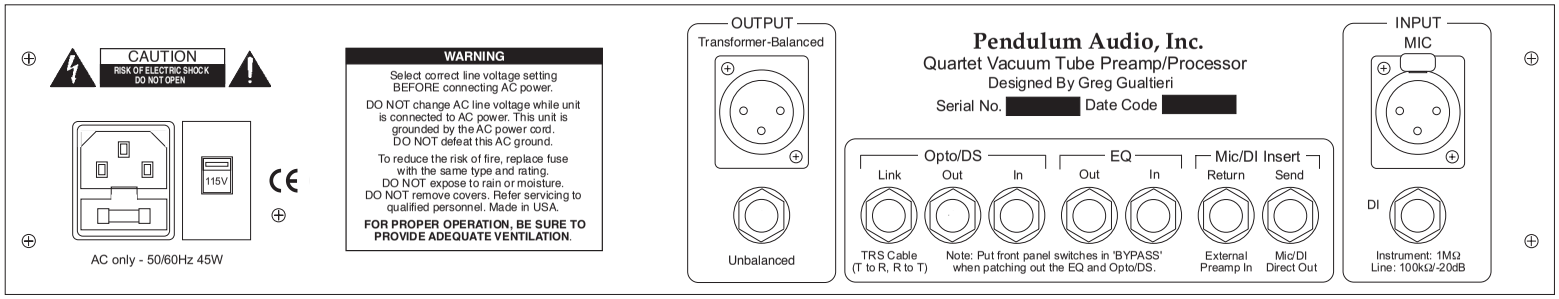
Threshold: Determines at what level the notch filter is activated, and de-essing is applied to the source material. The red DS LED near the threshold control will flash when de-essing occurs.

DS Frequency: An 11 position rotary switch which selects the frequency for sibilance detection. The frequencies are: 3.4, 4.5, 5.7, 6.6, 7.5, 8.0, 8.8, 9.4, 10.0, 10.5 or 11.5 kHz.

Depth: Sets the depth of the notch filter from -2 to -10 dB.

In/Bypass: Activates the De-esser within opto-compressor. Note that the de-esser is activated only if the compressor's In/Bypass switch is also 'In'.

Quartet Condensed Operating Instructions - Rear Panel



Inputs

MIC: A Female XLR input for connecting microphones using standard balanced XLR mic cables. Pin 1 = ground. Pin 2 = + (positive phase), pin 3 = - (negative phase). Note: this input may be +48v phantom powered, as selected by the '+48' switches on the front panel. Do not use phantom power on a microphone that does not require it! (e.g. dynamic, ribbon, or tube microphones). Make all mic connections before applying phantom power!

DI: An unbalanced 1/4" input for connecting an instrument directly to the rear panel, or for connecting the Quartet to an unbalanced patch bay.The input impedance of this jack is 1MΩ when the DI input switch on the front panel is set to Instrument, or 100KΩ with a 20dB pad when the DI input switch is set to Line.

Mic/DI Insert

Send or MIC/DI Direct Out: Use this jack to obtain a direct output from the Mic/DI preamp, or to send the Mic/DI preamp signal out of the Quartet for outboard processing. This jack is normalled to the Mic/DI insert Return. This jack is normalled to the Mic/DI insert Return.

Return or External Preamp In: Use this jack to patch an external preamp into the Quartet, or to return the Mic/DI preamp signal into the Quartet after outboard processing. This jack is normalled to the Mic/DI insert Send.

EQ In/Out: Use these jacks to patch the tube EQ out for external processing. Make sure the IN/BYPASS switch on the front panel is in BYPASS.

Opto/DS In/Out: Use these jacks to patch the Opto-compressor/ De-Esser out for external processing. Make sure the IN/BYPASS switch on the front panel is in BYPASS.

Opto/DS Link: A TRS jack for linking two Quartet compressors for stereo operation. Linking requires a TRS 'crossover' cable, in which the tip and ring connections are inverted on the opposite side of the cable.

Main Outputs

Transformer-Balanced: A male XLR connector with Pin 1 = ground, Pin 2 = + phase, Pin 3 = - phase. Connect this output to 3 pin balanced console, converter, or tape input.

Unbalanced: A 1/4" jack with Tip = + phase, Sleeve = ground. Use it for connecting the Quartet to an unbalanced input, or to a balanced input with Tip = pin 2, Ring = pin 3, Sleeve = ground.

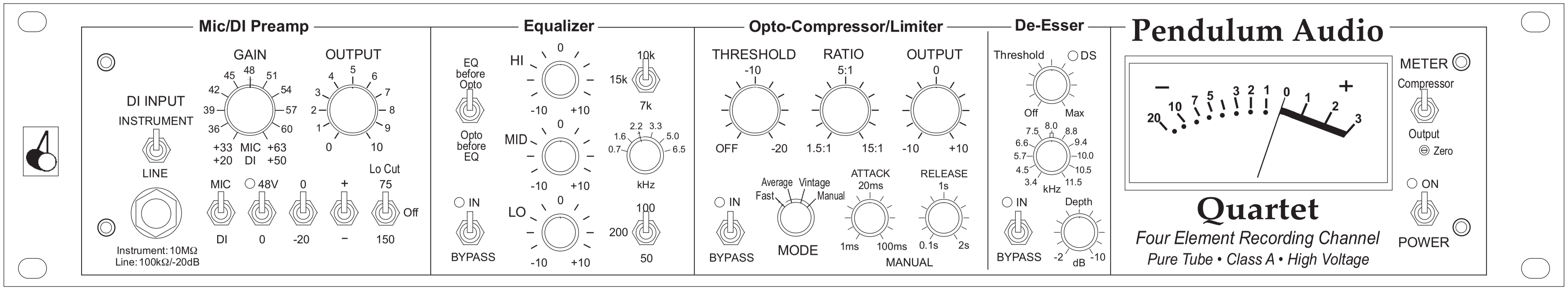
AC Power

AC IN: On the left side of the rear panel is the IEC input socket Connect to a 120V/60Hz or 230V/50Hz receptacle with the 3 prong IEC power cable.

Voltage Selector (115/230V): Set the ac voltage switch for the correct line voltage before connecting the Quartet to the ac line. For safety reasons, do not lift the ground on the power plug by using a 3-to-2 ground lift adapter.

Fuse: If necessary, replace the 1.5A/250V (5x20mm) SLO-BLO fuse (inside the IEC input socket) only with the same type and rating.

Quartet Front Panel Templates



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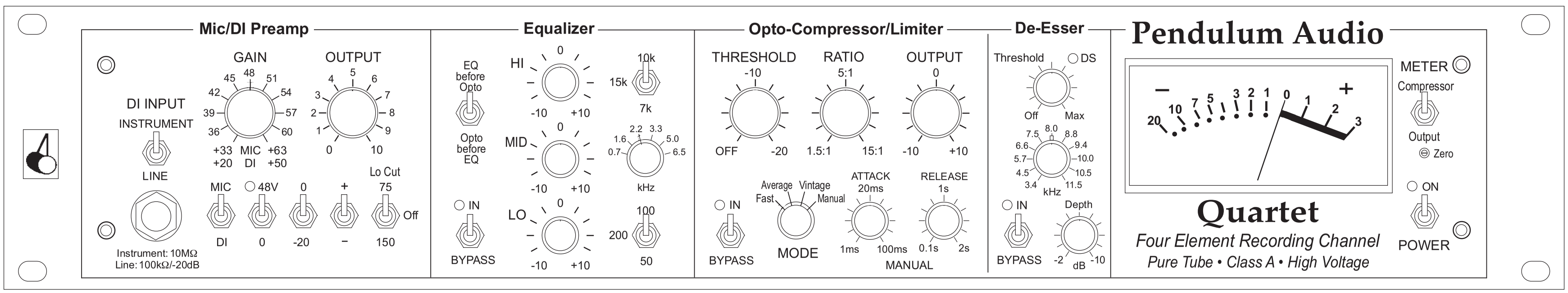

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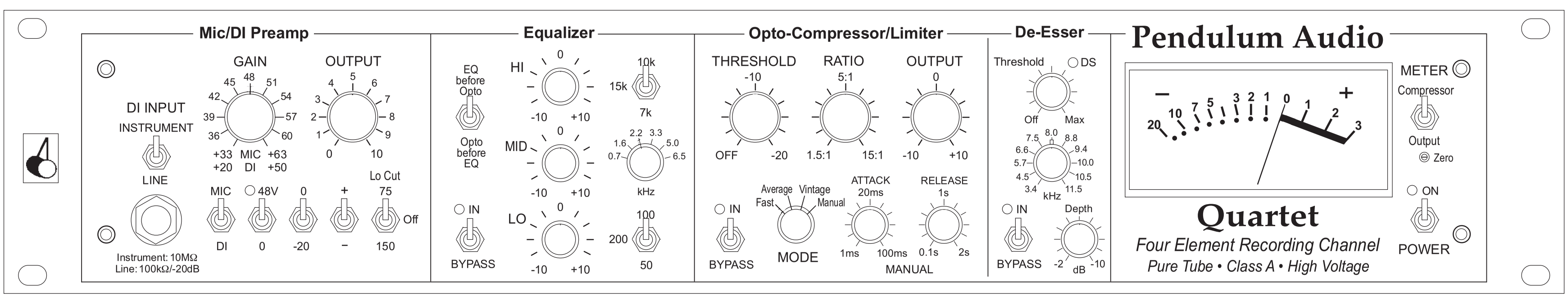

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Quartet Four Element Tube Recording Channel

Features

- The tube Mic/DI Preamp from the MDP-1A
- The tube Opto-Compressor from the OCL-2 using our proprietary optoelectronic cell
- A new three band tube EQ with HI and LO shelving and peaking MID band
- A new de-esser design using opto-inductive filtering and a highly selective detector
- The Mic/DI, EQ and Compressor/De-Esser can be patched out and used independently.
- The EQ can be placed before or after the Opto-compressor
- Transformerless or transformer output
- All tube, short signal path design with pure class A, high voltage circuitry
- Gold-plated switch contacts, I/O connectors and tube sockets
- Polypropylene caps and metal film resistors (pairs matched to 0.1%)
- Fully regulated high voltage (300V) and filament power supplies with soft-start warm-up and muting
- Custom toroidal power transformer with shield for minimum hum
- 120V or 240V ac voltage switch on the rear panel.

Introduction

Thank you for purchasing the Pendulum Quartet, an all-purpose recording tool designed to be the ultimate way to get your mic or source directly to tape or hard disk. We have combined four elements - Mic/DI preamp, Opto-compressor, EQ, and De-esser -into a fully integrated package that it makes it easy to track any source. Unlike other designs, the Quartet uses a modern tube, class A high voltage circuit topology to deliver an open, intimate sound with a level of detail that meets the requirements of the most demanding recording applications. Our short signal path design excels in audio performance, delivering extremely wide bandwidth, low noise, and high headroom.

The Mic/DI preamp, borrowed from our acclaimed MDP-1A, can handle mics, pickups, keyboards, or line-level signals. It features phantom power, input pad, phase reversal, and a switchable lo-cut filter. Independent gain and output controls permit overdrive of the tube stage to vary the harmonic content of the preamp.

The Opto-Compressor, derived from the popular OCL-2, uses our proprietary optoelectronic cell, and has a sound all its own. It can be used in one of four modes: Fast (for 'invisible' compression), Average (rms responding), a new Vintage mode (with program-dependent response), or full manual operation.

Our new 3 band tube EQ, a modified Baxandall design, is simple but very effective. The HI and LO bands have up to ±10dB of shelving at 15, 10 and 7 kHz, and 50, 100 and 200 Hz respectively. The MID band has a broad ±10dB peaking response centered at 0.7, 1.6, 2.2, 3.3, 5.0 and 6.5 kHz. The EQ can be placed before or after the compressor with the flip of a switch.

The new De-esser, which is implemented within the opto-compressor, uses a novel approach. A highly selective inductor-based detector triggers a very fast opto-inductive notch filter. The user can control the depth of the notch, which in turn controls amount of sibilance to be removed. When not triggered, the de-esser is out of the signal path entirely.

The Quartet also has a host of I/O options:

- Transformerless or transformer-coupled main outputs.
- Post-Mic/DI loop for patching out the preamp separately or for using an external mic preamp.
- Tube EQ In/Out
- Opto-compressor and De-Esser In/Out.

The Mic/DI preamp, EQ, and Compressor/De-Esser can be patched out separately and used simultaneously. In addition, the Opto-compressor can be linked to another Quartet (via a 1/4” TRS jack on the rear panel) for stereo operation.

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 Quartet Preamp/Processor, an IEC 3 prong power cord, and this operating manual.

Mounting

The Quartet uses two EIA-standard rack spaces, and can be mounted in any standard 19 inch (483mm) equipment rack. If the Quartet 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 and top panel vents should never be blocked in any way. Never mount the Quartet below a rack unit with a depth greater than 7 inches (178mm). Do not mount the Quartet 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 Quartet inside a road case where the side panels are cushioned in foam.

Preventing Ground Loop Hum

One of the reasons the Quartet sounds so good is that unlike many other vacuum tube products, it operates single-ended, Class A and can be operated unbalanced without the output transformer via the 1/4" output jack. However, when used unbalanced it does not benefit from the galvanic isolation provided by the output transformer. 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 Quartet and the metal rails of the equipment rack.
- Isolate the Quartet 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 Quartet 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 Quartet 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 Quartet 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 Quartet is equipped with a 3-prong IEC power connector and detachable cord. Never operate the Quartet with the ground on the power cord defeated. Unless otherwise stated, this unit operates from either 115-120V/60 Hz or 230-240V/50 Hz at 45W. Before the unit is plugged in, select the correct ac voltage using the switch adjacent to the IEC inlet on the rear panel. The ac fuse is accessible from the rear panel IEC input jack and is rated at 1.5A/250V (5x20mm) SLO-BLO. To check or replace the fuse, make sure the unit is unplugged.

Servicing

Other than changing the tubes, the user should not attempt to service the Quartet 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 Quartet may appear to be rather straightforward, there are a few features which may differ from what you're accustomed to seeing on other stand-alone preamp/processors. 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 Quartet in the way most appropriate for the type of recording you're doing.

Hookup

Please refer to the rear panel layout (see the Condensed Operating Instructions) for the location of the inputs, outputs, ac power inlet and power switch. Make all connections to the Quartet and select the proper ac voltage before applying power.

Mic/DI Inputs

- On the right hand side of the rear panel are the input jacks for the Mic/DI preamp. The female XLR connector on top is the transformer-balanced mic input. Connect microphones to this input using standard balanced XLR mic cables. Pin 1 = ground. Pin 2 = + (positive phase), pin 3 = - (negative phase). Note: this input may be +48v phantom powered, as selected by the '+48' switches on the front panel. Do not use phantom power on a microphone that does not require it! (e.g. dynamic, ribbon, or tube microphones). Make all mic connections before applying phantom power!

- The 1/4" jack below the XLR connector is the unbalanced DI input. The input impedance of this jack is 1MΩ when the DI input switch on the front panel is set to Instrument, or 100KΩ with a 20dB pad when the DI input switch is set to Line. This input can be used for connecting an instrument directly to the rear panel, or for connecting the Quartet to an unbalanced patch bay. The 1/4" input on the front panel can be used for either instrument (10MΩ) or line level (100kΩ/-20dB) signals.

Individual I/O, Patching, and Link

There are seven 1/4" jacks on the rear panel located between the input and output jacks. These are used to patch out the Mic/DI preamp, EQ and Opto-Compressor/De-Esser, or to patch other equipment into the signal chain.

Mic/DI Insert (Send): Use this jack to obtain a direct output from the Mic/DI preamp, or to send the Mic/DI preamp signal out of the Quartet for outboard processing. This jack is normalled to the Mic/DI insert Return.

Mic/DI Insert (Return): Use this jack to patch an external preamp into the Quartet, or to return the Mic/DI preamp signal into the Quartet after outboard processing. This jack is normalled to the Mic/DI insert Send.

EQ In/Out: Use these jacks to patch the tube EQ out for external processing. Make sure the IN/BYPASS switch on the front panel is in BYPASS.

Opto/DS In/Out: Use these jacks to patch the Opto-compressor/De-Esser out for external processing. Make sure the IN/BYPASS switch on the front panel is in BYPASS.

Opto/DS Link: A TRS jack for linking two Quartet compressors for stereo operation. Linking requires a TRS 'crossover' cable, in which the tip and ring connections are inverted on the opposite side of the cable. It is wired as follows: Tip 1 to Ring 2, Ring1 to Tip2, Ground 1 to Ground 2. Set the Ratio, Threshold, and Output controls on each unit to the same settings.

Main Outputs

- To the far left of the input jacks are the main output jacks. The male XLR connector on top is a 3 pin transformer-balanced output, with Pin = ground, Pin 2 = + phase, Pin 3 = - phase. Connect this output to 3 pin balanced console, converter, or tape input. When connecting to a balanced patch bay, be sure that Pin 2 = Tip. If you encounter ground loop hum when connecting to active-balanced or transformer-balanced inputs, lift the ground at the end of the XLR connecting cable opposite from the Quartet..
- The 1/4" jack below the XLR connector is unbalanced output connector with Tip = + phase, Ring = ground. Use it for connecting the Quartet to an unbalanced input, or to a balanced input with Tip = pin 2, Ring = pin 3, Sleeve = ground.

AC Power

- On the left side of the rear panel is the IEC input socket. Connect to a 120V/60Hz or 230V/50Hz receptacle with the 3 prong IEC power cable supplied with the Quartet. Set the ac voltage switch for the correct line voltage before connecting the Quartet to the ac line. 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 on the lower right-had side of the front panel. The meters will illuminate immediately. The blue 'ON" LED will illuminate after the power-up sequence is completed (see below).
- If necessary, replace the 1.5A/250V (5x20mm) SLO-BLO fuse (inside the IEC input socket) only with the same type and rating.

Power-up Sequence

- To prolong tube life, the Quartet 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 6.3 and 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 relay lifts the outputs from ground and the blue 'on' led on the front panel is illuminated. For best results, please allow the Quartet to warm up for 10 minutes or longer before using it.

Using the Quartet Mic/DI as a Mic Preamp

Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of all switches and controls discussed below.

Input Mode: MIC

With the input switch in the 'MIC' position, the Quartet is configured as a mic preamp, with the XLR input connector enabled and the DI inputs on both the front and rear panels disabled. In this mode the signal path consists of the input transformer followed by a Class A tube gain stage with a transformerless output. The nominal source impedance is 150Ω. When the Quartet is used with a transformerless microphone with a very low output impedance (50Ω or less), an external impedance-matching network (available from us) may be necessary to improve transient response.

Phantom Power: +48V/0

In the +48V position, 48 volts is supplied to pins 2 and 3 of the XLR input. The phantom voltage is applied via two 6.81kΩ metal-film resistors that are hand-matched to better than 0.1%.

Mic Input Pad: 0/-20

In the -20 position, a 20dB impedance-matched resistive pad is inserted in front of the input transformer to prevent overload. To optimize common-mode rejection, the metal-film resistors are hand-matched to better than 0.1%. Use this position when recording with mics placed on sources with high sound pressure levels such as drums, guitar amps, or when close-micing a singer with a high output mic. Use if distortion is heard, or if the output level of the preamp is too high with the GAIN selector switch at its lowest setting (+33dB). For the best noise performance, use only when necessary. Use the pad when the XLR input is used with +4dBu line-level balanced sources.

Phase: +/-

In the - position, the phase of the mic signal is inverted at the secondary of the input transformer. Configured this way, the phase of the mic can be switched without interrupting the dc voltage to a mic requiring phantom power. Positive phase is Pin 2 hot.

Lo Cut: Off, 75Hz and 150 Hz

The LO CUT is an 3 position toggle switch that provides a 12dB per octave rolloff for the Mic input at 75 or 150Hz. In the center 'Off' position, the filter circuit is removed from the signal path. Flip the switch 'up' for 75Hz rolloff, and down for 150Hz rolloff. Note that the Lo Cut filter affects only the mic input, and not the DI input.

GAIN: +33 to +66dB

The GAIN Control is an 11 position rotary switch that adjusts the gain of the tube stage from +33dB to +66dB in 3dB steps. The 1% metal-film resistors that determine gain are selected for precise 3dB increments. At low gain settings, there is more global feedback in the tube circuit, which offers a more 'accurate' and 'controlled' sound. At higher gain settings, the sound is a little more 'open' and 'harmonically rich'. Used in conjunction with the OUTPUT control (discussed below), subtle variations in the character of sound can be achieved.

OUTPUT: 0 to 10

The OUTPUT Control is a passive attenuator positioned between the mic preamp tube stage and the other elements of the Quartet. It can be used in conjunction with the GAIN control to adjust the level that is sent to the EQ and Opto-De-esser (or a tape machine or hard disk recorder, if the other elements are bypassed). For the cleanest sound, set the OUTPUT control fully clockwise (completely out of the signal path) and use the GAIN control to set the overall signal level. To add more 'harmonic content' by driving the tubes at a higher signal level, set the GAIN control to a higher gain setting and use the OUTPUT attenuator to bring the output level down to a more useable range. Or, use the OUTPUT control to make fine adjustments (within the 3dB range of the GAIN switch settings) to the level sent to a tape machine. Used sparingly, this gentle tube 'overdrive' can create subtle changes in the harmonic balance of the source. Used to excess, it will cause audible distortion. Proceed with caution. With the OUTPUT attenuator set to mid-range, the level of attenuation is 20dB for load impedances greater than 10kΩ.

Using the Mic Preamp Without the Input Transformer

Here's another thing that's fun to try. The Quartet can be used with high output tube microphones as a fully transformerless mic preamp. Simply connect the mic to the rear panel DI input using an XLR to 1/4" adapter, and switch the input mode to DI (in instrument mode). Increase the GAIN about 18dB to compensate for the lack of transformer gain and the 6dB loss when running the mic

unbalanced. The noise performance suffers a bit, but when used for recording vocals with a high output microphone (e.g. Neumann M149), the results are superb. Keep the mic cable as short as possible. The output transformer of many tube mics (e.g. Neumann U47, U67, etc.) sound best when terminated into a 1500Ω load impedance. To do this, place a 1500Ω resistor across pin 2 and 3 of the XLR to 1/4" adapter.

Using the Quartet as a DI Preamp

The Quartet features a full-function, short-signal path DI. Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of the switches and inputs discussed below.

Input Mode: DI

With the input switch in the 'DI' position, the Quartet is configured as a line-level DI preamp, with the DI inputs on both the front and rear panels enabled and the XLR mic input connector disabled. In this mode the signal path of the DI preamp consists of a Class A tube line stage with a tranformerless output at the Mic/DI Send output, and a tranformerless or transformer-balanced output at the main outputs. The input impedance is 100kΩ for line level inputs, or 1MΩ and 10MΩ for instrument inputs. The front and rear panel jacks are wired so that the rear jack is disabled when a 1/4" plug is inserted into the front jack.

DI Input: Instrument

With the DI INPUT switch on the front panel in the INSTRUMENT position, the 1/4" input jacks on the front and rear panels are configured to accept unbalanced high impedance sources. The GAIN range is +20 to +50dB in 3dB increments.

- The front panel jack has an input impedance of 10MΩ, which ideal for very high impedance sources such as piezo transducers. Use this input when minimum loading of the source is desired.
- The rear panel jack has an input impedance of 1MΩ, which is ideal for moderate impedance sources such as passive magnetic guitar or bass pickups. Use this input when light loading of the source is desired. Loading the magnetic coil of a (passive) bass guitar pickup with 1MΩ can sometimes tighten up the low end, adding definition. Since this effect depends on the inductance any given pickup, try it both ways and see which sounds the best.

DI Input: Line

With the DI INPUT switch on the front panel in the LINE position, the 1/4" input jacks on the front and rear panels are configured to accept unbalanced high level sources.

- The input impedance is 100kΩ for both front and rear input jacks, with a -20dB resistive pad inserted between the input and the tube line stage.
- The range of the GAIN control is 0 to +30dB, which is ideal for line-level sources such as -10dBV unbalanced consumer audio equipment or keyboard outputs.
- Use the rear panel jacks to connect the DI inputs to an unbalanced patch bay.
- Note: For balanced line-level signals, use the Mic input with the 20dB pad engaged.

Gain and Output Controls

See 'Using the Quartet as a Mic Preamp' for a discussion of how to use the GAIN and OUTPUT controls to achieve subtle changes in the character of the sound of the DI. Note that while the Quartet can in principle be softly 'overdriven' like a guitar preamp, it doesn't have the same radical tone-shaping EQ. However, the Quartet can be used to overdrive the front end of a tube guitar amp.

Using the Three Band Tube EQ

The three band tube EQ in the Quartet is a modified Baxandall design, which is simple but very effective. Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of all switches and controls discussed below. All switch contacts that pass audio are gold-plated for high reliability, and the boost/cut controls use high quality conductive plastic elements.

IN/BYPASS Switch

With the switch in the 'IN' position, the equalizer is placed in the Quartet's signal path, and the blue LED near the switch is illuminated. The 'BYPASS' position removes the EQ from the signal path entirely (a 'hard' bypass). When patching the EQ out to use it separately on another source (see "Individual I/O Patching and Link" above), be sure this switch is set to BYPASS.

EQ Before Opto/Opto before EQ

With the switch in the 'EQ Before OPTO' position, the EQ stage is placed before the Opto-Compressor in the Quartet's signal path. Use this position to contour the frequency response of the source material before compression. In the 'Opto Before EQ' position, the EQ stage is placed after the Opto-Compressor in the Quartet's signal path. Use this position to contour the frequency response of the source material after compression. It is common, especially for vocal tracking, to use the 75 or 150Hz LO CUT filter on the Mic/DI preamp to reduce 'over-compression' on low frequencies due to proximity effect and breath noise ('popping'). Then, the EQ can be used to add more low end after compression, if desired.

HI

The HI band (shelving response) has a boost/cut control and a toggle switch for frequency selection. The control is continuously variable with up to +10dB of boost (full clockwise rotation) or -10dB of cut (full counter-clockwise rotation) at one of three turnover frequencies: 15kHz (center), 10kHz (up) or 7 kHz (down).

MID

The MID band (peaking response) has a boost/cut control and a 6-position rotary switch for frequency selection. The control is continuously variable with up to +10dB of boost (full clockwise rotation) or -10dB of cut (full counter-clockwise rotation) at one of six frequencies: 0.7, 1.6, 2.2, 3.3, 5.0 or 6.5 kHz. The Q of the filter is fairly broad (1.0), to provide a gentle, 'musical' response.

LO

The LO band (shelving response) has a boost/cut control and a toggle switch for frequency selection. The control is continuously variable with up to +10dB of boost (full clockwise rotation) or -10dB of cut (full counter-clockwise rotation) at one of three turnover frequencies: 200Hz (center), 100Hz (up) or 50Hz (down).

Using the Opto-Compressor/Limiter

The Opto-Compressor, derived from the popular OCL-2, uses our proprietary optoelectronic cell, and has a sound all its own. It can be used in one of four modes: Fast (for 'invisible' compression), Average (rms responding), Vintage (with program-dependent response), or full manual operation. Please refer to the front panel layout (see the Condensed Operating Instructions) for the location of all switches and controls discussed below.

IN/BYPASS Switch

With the switch in the 'IN' position, the Opto-compressor is placed in the Quartet's signal path, and the blue LED near the switch is illuminated. The 'BYPASS' position removes the compressor from the signal path entirely (a 'hard' bypass). When patching the compressor out to use it separately on another source (see "Individual I/O Patching and Link" above), be sure this switch is set to BYPASS.

Threshold: Off to -20dB

The THRESHOLD control determines how much gain reduction is applied to the source material. Since this 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 this is a soft-knee compressor, its ratio determines the degree of gain reduction that occurs for signal levels above the knee. Here 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: -5 to +15dB

Use the OUTPUT control to boost the signal level after compression. Up to 15dB above the level of the input signal is possible. The unity-gain setting (0dB) is 12:00. The OUTPUT control 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 Opto-Compressor tube line amp.

Mode: Fast/Average/Vintage/Manual

The Opto-Compressor 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 four 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 Opto-Compressor working.

Average

In the AVERAGE mode, the optical cell operates with RMS (root-mean-square) response. Rather than triggering on peak information, RMS detection more accurately reflects the average energy content of the waveform, which better approximates the loudness perceived by the human ear. The compressor responds more slowly than the FAST setting and can sound more 'open' on highly transient material such as electric bass and percussion. This setting can also work well on vocals.

Vintage

The Vintage mode emulates the response program-dependent action of vintage opto-compressors. Early opto cells had a built-in 'memory effect', where the attack and release times were dependent on previous levels of gain reduction. Here we use a three-stage program-dependent time constant, where there is initially a quick release, followed by a slower decay times approaching 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 100ms 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!

Using the De-Esser

The De-Esser, which operates within the opto-compressor circuit, uses a novel approach to eliminate sibilance. Rather than using level-dependent de-essing, where the level of the 's' is attenuated by additional compression, we use frequency-dependent filtering to attenuate the fundamental frequency of the 's'. We do this by using a highly selective inductor-based detector to trigger a very fast opto-inductive notch filter. Here you can control the depth of the notch, and in turn determine the amount of overall sibilance removed. When not triggered, the de-esser is out of the signal path entirely.

IN/BYPASS Switch

With the switch in the 'IN' position, the De-Esser activated, and the blue LED near the switch is illuminated. Note that the De-Esser is activated (and the blue LED on) only if the Opto-Compressor's In/Bypass switch is also in the 'IN' position. When in 'BYPASS', the de-esser is entirely out of the signal path.

DS Threshold

The THRESHOLD control determines at what level the notch filter is activated, and de-essing is applied to the source material. The red DS LED near the threshold control will flash when de-essing occurs. Note that the LED will not trigger when the de-esser is in BYPASS. The threshold is adjusted so the DS LED flashes only on the problematic 's'. Use the frequency control to target the proper frequency band for each vocalist.

DS Frequency

The DS frequency control is an 11 position rotary switch which selects the frequency for sibilance detection. The frequencies are: 3.4, 4.5, 5.7, 6.6, 7.5, 8.0, 8.8, 9.4, 10.0, 10.5 or 11.5 kHz.

Depth

Sets the depth of the notch filter from -2 to -10 dB. Allows the user to control how much sibilance is to be removed.

Meter

The illuminated ANSI VU meter is electronically isolated from the signal path, and can be switched to measure output or compression. 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 meter on your recorder is flashing near zero, but the output level on the VU meters of the Quartet are hovering at or below -10, you're simply seeing the difference between the peak and average program level.

Compression

When the METER switch is in the COMPRESSION 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 Opto-Compressor 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 COMPRESSION. 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 recorder, mixer input or channel insert.

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 Quartet 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 Quartet 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-V6) in the porcelain tube sockets.
   - The input tubes are ECC83/12AX7A (V1, V3, and V5)
   - The output tubes are 6922/6DJ8 (V2, V4 and V6)
4. Remove each tube and replace with the same type removed from the each socket. DO NOT install the tubes in the wrong positions!
5. Reinstall the top cover and screws.

There are a large variety of ECC83/12AX7s 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 Quartet than the 12AX7A input tube.

Quartet Specifications

Circuit Type: Class A vacuum tube design with transformerless or transformer-balanced output

Mic/DI Preamp

Mic Preamp

Input Gain:	+33 to +63dB in 3dB steps
Input Impedance:	1500Ω transformer balanced and floating
Frequency Response:	-1.0dB 15Hz and 65kHz with 10KΩ load, +45dB gain, unbalanced or transformer-balanced
	-1.0dB 22Hz and 60kHz with 600Ω load, +45dB gain, unbalanced or transformer-balanced
Noise:	EIN less than -125dBu with 150Ω input load (> 83dB below +4dBu)
Distortion:	THD+N less than 0.025%, +45dB gain, unbalanced output;
	less than 0.06% from 200Hz-20kHz (< 0.6% at 20Hz), transformer-balanced output

DI Preamp

Input Gain:	+20 to +50dB (Instrument), 0 to +20dB (Line) in 3dB steps
Input Impedance:	10MΩ or 1MΩ (Instrument), 100kΩ with 20dB pad (Line)
Frequency Response:	-1.0dB 10Hz and 85kHz, with 10KΩ load, + 20dB gain, unbalanced or transformer-balanced
	-1.0dB 22Hz and 75kHz, with 600Ω load, + 20dB gain, unbalanced or transformer-balanced
Noise:	EIN less than -113dBu with input shorted (> 83dB below +4dBu)
Distortion:	THD+N less than 0.015%, 20Hz-20kHz, +20dB gain, unbalanced output;
	less than 0.05% from 200Hz-20kHz (< 0.6% at 20Hz), transformer-balanced output
Max. Output Level:	+32dBu into 10kΩ load, Output control at maximum, unbalanced or transformer-balanced
	+24dBu into 600Ω load, Output control at maximum, unbalanced or transformer-balanced
Phantom Power:	+48Vdc applied to pins 2 and 3
Mic Pad:	-20dB pad at the primary of the mic input transformer
Mic Phase:	inverts the phase at the secondary of the mic input transformer
Mic Lo Cut:	12dB/octave rolloff at 75 or 150Hz
Polarity:	input and output XLR connectors are pin 2 hot

Equalizer

Circuit Type:	modified Baxandall-style feedback equalizer
Input Sensitivity:	+4dBu
Input Impedance:	10kΩ
Frequency Bands	
Hi:	±10dB shelving at 7, 10, or 15 kHz
Mid:	±10dB peaking at 0.7, 1.6, 2.2, 3.3, 5.0 and 6.5 kHz, Q=1.0
Lo:	±10dB shelving at 50, 100, or 200 Hz
Freq. Response:	-1.0dB 16Hz and 45kHz with 10KΩ output load, unbalanced or transformer-balanced
	-1.0dB 20Hz and 45kHz with 600Ω output load, unbalanced or transformer-balanced
Noise:	> 79dB below +4dBu
Distortion:	THD+N less than 0.015% from 20Hz-20kHz, +20dB gain, unbalanced output;
	less than 0.06% from 200Hz-20kHz (< 0.6% at 20Hz), transformer-balanced output
Max. Output Level:	+32dBu into 10kΩ load, Output control at maximum, unbalanced or transformer-balanced
	+24dBu into 600Ω load, Output control at maximum, unbalanced or transformer-balanced

Opto-Compressor

Circuit Type:	optical input attenuator and class A vacuum tube gain stage
Input Sensitivity:	+4dBu
Input Impedance:	10kΩ
Freq. Response:	-1.0dB 8Hz and 100kHz with 10KΩ output load, unbalanced or transformer-balanced
	-1.0dB 20Hz and 100kHz with 600Ω output load, unbalanced or transformer-balanced
Noise:	> 76dB below +4dBu , output control at unity gain
	> 76dB below +4dBu , output control at +15dB
Distortion:	THD+N less than 0.016% from 20Hz-20kHz, +20dB gain, unbalanced output;
	less than 0.06% from 200Hz-20kHz (< 0.6% at 20Hz), transformer-balanced output
Max. Output Level:	+32dBu into 10kΩ load, Output control at maximum, unbalanced or transformer-balanced
	+24dBu into 600Ω load, Output control at maximum, unbalanced or transformer-balanced
Max. Gain Reduction:	> 30dB
Threshold:	off to -20dB
Ratio:	1.5:1 to 15:1
Output:	-5 to +15dB
Modes:	fast (peak-averaged), average (rms), vintage (program-dependent) or
	manual operation;
	attack time varaible from 1.0ms to 100ms
	release time varaible from 0.1s to 2s

General

Vacuum Tubes:	(3) ECC83/12AX7A, (3) 6922/6DJ8
Power:	120V or 240Vac, 45W
Power Supplies:	+300Vdc, +6.3Vdc, +12.6Vdc and ± 18Vdc, 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:	14.5 lbs (6.6kg)

Note: Operating level is +4dBu = 0VU = 1.228v
Unless otherwise stated, all measurements are referenced to +4dBu, 0-80 kHz bandwidth.
All specifications are subject to change without notice.

As with all tube circuits, specifications will vary with tube brand, age or differences in internal structure.

Limited Warranty

Pendulum Audio, Inc. warrants to the first purchaser of a new Pendulum Quartet Tube Recording Channel 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 or meter lights.

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.

Using the Quartet in a Patch Bay

To use the Quartet in a patch bay, connect as follows:

Quartet Jack	=>>>> Patch Bay Jack	
Mic/DI Insert Send	=>>>>> Mic/DI Preamp Output	---/ (These are normalled).
Mic/DI Insert Return	=>>>>> EQ input	- - - /
EQ Output	=>>>> EQ Output	---/ (These are normalled.)
Opto/DS Input	=>>>> Opto/DS Input	- - - /
Opto/DS output	=>>>> Opto/DS output	(also acts as “channel strip” output)
Main Output	=>>>> Main Output	(disabled unless EQ output and Opto/DS input patch cables removed from Quartet)

Put the EQ and Opto switches in **Bypass**, and set EQ pre/post switch for **EQ before Opto**. This configuration allows you to use each element separately. With no patch cables inserted into the patch bay, the unit acts as a channel strip with Pre/EQ/Opto signal chain. The Opto/DS output at the end of the chain acts as the ‘channel strip’ output (the Main output is disabled). While you lose the ability to use the EQ after Opto switch position, you can use the patch bay to manually put the EQ after the Opto. To use the De-Esser, put its In/Bypass switch in the IN position

To return to using the Quartet in its stand-alone mode, unplug the patch cables from the EQ output and Opto/DS input on the rear of the Quartet. The Main Output is now active.