

Quartet II ME Tube Recording Channel

Features

- The tube Mic/DI Preamp from the MDP-1 with switchable mic input transformers and mic loading
- The Delta-Mu tube Compressor/Limiter from the ES-8 with five operating modes and sidechain filter.
- A new three band inductor-based Passive EQ with Aggressive mode.
- A new Peak Limiter design with JFET and MOSFET modes and accurate led metering.
- The Mic/DI, EQ, Delta-Mu compressor and Peak Limiter can be patched out and used independently.
- The EQ can be placed before or after the compressor
- Transformerless or transformer output
- Short-signal path design with pure class A 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 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 II Mercenary Edition, an all-purpose recording tool with attitude designed to be the ultimate way to get your mic or source directly to tape or hard disk. It is *not* an update nor a replacement for our very popular Quartet. It *is* a complementary unit that incorporates a substantially different combination of elements. Designed with the input of Fletcher and the crew at Mercenary Audio, many additional options have been provided to tailor the texture of the audio character for maximum musical flexibility.

The tube Mic/DI preamp has the unique option of being able to switch between two markedly different sounding input transformers and loading options. The DI can handle pickups, keyboards, or line-level signals. Independent gain and output controls permit overdrive of the tube stage to vary the harmonic content.

The Delta -Mu (μ) tube compressor, derived from the ES-8, has the classic compression profile of the Fairchild 660 and 670 limiters. It can be used in one of five modes: Fast, Faster, Vintage (program-dependent), Average (rms), or full Manual operation. It also features a switchable sidechain high pass filter.

The new 3 band tube Passive/Aggressive Equalizer is a modern take on the classic inductor-based passive EQ. It features simultaneous Lo Shelf Boost and Cut, Mid Dip and Hi Peak bands. The Aggressive mode increases the saturation of the EQ circuit to add harmonic content. In addition, the EQ can be placed before or after the compressor with the flip of a switch.

The new JFET/MOSFET Peak Limiter uses a novel approach to brickwall analog limiting, with JFET and MOSFET modes for two different characters of peak limiting, and accurate led metering. Unlike other designs, distortion below threshold is negligible.

We have combined these four elements into a fully integrated package that it makes it easy to

track any source. Unlike other designs, the Quartet II 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 Quartet II 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
- Delta-Mu Compressor/Limiter In/Out with linking
- JFET/MOSFET Peak Limiter In/Out.

And all four elements can be patched out and used completely independently!

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

Mounting

The Quartet II uses two EIA-standard rack spaces, and can be mounted in any standard 19 inch (483mm) equipment rack. If the Quartet II 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 II below a rack unit with a depth greater than 7 inches (178mm). Do not mount the Quartet II 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 II inside a road case where the side panels are cushioned in foam.

Preventing Ground Loop Hum

One of the reasons the Quartet II 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 II and the metal rails of the equipment rack.

- Isolate the Quartet II 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 II 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 II 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 II does not hum. Please, take the time to do this right, and you will be rewarded with hum-free operation. Contact us if you have any questions. Please note that pin 2 is hot.

Power Requirements

The Quartet II is equipped with a 3-prong IEC power connector and detachable cord. Never operate the Quartet II 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 within the rear panel IEC input jack and is rated at 1.5A/250V (5x20mm) SLO-BLO. To check or replace the fuse, unplug the power cable from the IEC input jack.

Servicing

Other than changing the tubes, the user should not attempt to service the Quartet II 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 II 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 II 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 II 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 1M when the DI input switch on the front panel is set to Instrument, or 100K 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 II to an unbalanced patch bay. The 1/4" input on the front panel can be used for either instrument (10M) or line level (100k/-20dB) signals.

Individual I/O, Patching, and Link

There are nine 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, Compressor and peak limiter, 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 II 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 II, or to return the Mic/DI preamp signal into the Quartet II 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.

Compressor In/Out: Use these jacks to patch the Delta-Mu compressor out for external processing. Make sure the IN/BYPASS switch on the front panel is in BYPASS.

Link: A TRS jack for linking two Quartet II 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, Ring 1 to Tip 2, Ground 1 to Ground 2. Set the Threshold, Output and dynamics 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 II.

- The 1/4" jack below the XLR connector is unbalanced output connector with Tip = + phase, Ring + Sleeve = ground. Use it for connecting the Quartet II 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 II. Set the ac voltage switch for the correct line voltage before connecting the Quartet II 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-hand 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 II 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 supplies are slowly increased to 250 and 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 II to warm up for 10 minutes or longer before using it.

Using the Quartet II 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. The Mic/DI preamp features an all-tube signal path.

Full/Focused

This switch allows you to choose between two very different-sounding input transformers. The 'Full' transformer is a Jensen 13K7A, which has a 1:5 turns ratio (13 dB of voltage gain) and has a very open sound with extended high and low end response. It's the ideal choice for recording many instrumental and vocal sources, particularly if you're looking for 'truer' reproduction.

The 'Focused' transformer is custom-wound for us, with a (1:10) turns ratio (+20 dB of voltage gain) and has a 'push' or emphasis in the midrange that can make some sources, especially vocals and electric guitar, sit easily in a busy mix with greater definition. The additional gain also makes it the ideal choice for low output mics such as passive ribbon microphones.

1500/10K

This switch allows you to select the load impedance presented to the microphone by the input transformer. Depending on the mic, the amount of loading can alter the tone and overload characteristics of the mic. This is especially true with microphones that have an output transformer, including vintage (or vintage-style) tube condenser mics, dynamic mics, and ribbon mics. Active mics, particularly phantom-powered condenser mics, may be less sensitive to loading. The standard load specified by most mic manufacturers is 1500 ohms. Our experience is that loading the mic more lightly, at 10kohms, can open up the top end and may also increase the output level. The mic signal is muted for about 1 second when switching between Full and Focused transformers, to eliminate any 'popping' when the phantom power is engaged.

Input Mode: MIC

With the input switch in the 'MIC' position, the Quartet II 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.

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 6.81k 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/Full or +40dB/focused). For the best noise performance, use only when necessary. The input pad may limit the effectiveness of the Loading switch. Use the pad when the XLR input is used with +4dBu line-level balanced sources. **Note: with the DI input in LINE position, the Mic input pad is increased to 40dB.**

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, 75 Hz 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 +63dB (Full), or +40 to +70dB (Focused)

The GAIN Control is an 11 position rotary switch that adjusts the gain of the tube stage from +33dB to +63dB (Full) or +40dB to +70dB (Focused) 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 II. It can be used in conjunction with the GAIN control to adjust the level that is sent to the EQ, Compressor or Peak Limiter (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 10k.

Using the Mic Preamp Without the Input Transformer

Here's another thing that's fun to try. The Quartet II 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 1500 load impedance. To do this, place a 1500 resistor across pin 2 and 3 of the XLR to 1/4" adapter.

Using the Quartet II as a DI Preamp

The Quartet II 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 II 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 transformerless output at the Mic/DI Send output, and a transformerless or transformer-balanced output at the main outputs. The input impedance is 100k for line level inputs, or 1M and 10M 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 10M, 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 1M, 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 1M 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 100k 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. With the DI input in LINE position, the Mic input pad is increased to 40dB.

Gain and Output Controls

See 'Using the Quartet II 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 II can in principle be softly 'overdriven' like an guitar preamp, it doesn't have the same radical tone-shaping EQ. However, the Quartet II can be used to overdrive the front end of a tube guitar amp.

Using the Passive/Aggressive Tube EQ

The three band tube EQ in the Quartet II is a passive, inductor-based EQ network followed by an all-tube class A line stage. The 'Aggressive' mode increases the saturation of the EQ circuit to add harmonic content. It combines the features most often need when tracking a wide variety of sources. 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 equalizer is placed in the Quartet II'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 -> μ / μ ->EQ

With the switch in the EQ -> μ position, the EQ stage is placed before the Delta-Mu Compressor/Limiter in the Quartet II's signal path. Use this position to contour the frequency response of the source material before compression. In the μ -> EQ position, the EQ stage is placed after the Delta-Mu Compressor/Limiter in the Quartet II'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. Or, use the Sidechain Lo Cut filter (described below) to reduce the compressor's sensitivity to low frequency content.

Passive/Aggressive

When the switch in the 'Aggressive' position, a custom-designed transformer is inserted into the EQ circuit, which adds harmonic content to the source. By varying degrees, it fattens the

bottom end, pushes the midrange forward, and adds sizzle to the high end. The degree of 'aggression' depends on how hard the EQ is driven, and how much boost is applied.

LO Shelf

The LO band (shelving response) has separate BOOST and CUT controls, and a rotary switch for frequency selection. The controls are continuously variable with up to 20dB of boost or cut (full counter-clockwise rotation) at one of five turnover frequencies: 20, 30, 50, 100, 120 Hz. The controls can be used simultaneously, to create unusual contours in the low frequency response.

MID Dip

The MID Cut band (peaking inductor response) has a CUT control, a 5-position rotary switch for frequency selection, and a Bandwidth control. The CUT control is continuously variable with up to 25dB ('Sharp') or 10dB ('Broad') of attenuation at one of six frequencies: 200, 350, 500, 650 or 800 Hz. The range of the Bandwidth control is 0.7 (Sharp) to 3.7 (Broad).

HI Peak

The HI band (Peaking inductor response) has a BOOST control, an 11-position rotary switch for frequency selection, and a Bandwidth control. The BOOST control is continuously variable with up to 20dB ('Sharp') or 10dB ('Broad') of boost at one of 11 turnover frequencies: 0.8, 1.4, 2, 3, 4, 5, 8, 10, 12, 15 or 18 kHz. The range of the Bandwidth control is 0.7 (Sharp) to 3.0 (Broad).

Using the Delta/Mu Compressor/Limiter

The Delta-Mu Compressor, derived from the popular ES-8, has a sound all its own. It can be used in one of five modes: Fast, Faster, Vintage (with program-dependent response), Average (rms responding), 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 Delta-Mu Compressor is placed in the Quartet II'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 Max

The THRESHOLD control determines how much gain reduction is applied to the source material. A maximum of 15dB of gain reduction is available from the remote cutoff gain control tube. The range of the THRESHOLD control is off to -20dB, which permits a steady-state input level as low as -5dBu to achieve the full 15 dB of gain reduction.

Output: Off to Max

Use the OUTPUT control to increase 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 20% audio taper potentiometer, which permits finer adjustment of output level in the critical 0-15dB range.

Sidechain Lo Cut Filter

This switch inserts a 150 Hz high pass filter (12dB/Octave) into the sidechain detector. This is useful for reducing the sensitivity of the compressor to low frequency content. It prevents the compressor from over-responding to low frequency content, like that generated from microphone proximity effect and plosives in a vocal track. It may also be used creatively on sources like kick drum, bass, or program material.

Mode: Fast/Faster/Average/Vintage/Manual

The Quartet incorporates a solid-state sidechain circuit to provide a wide range of dynamic control. For maximum versatility, there are five distinctly different modes of operation.

Fast

In the FAST mode, the gain control tube operates with fast attack and release times (1 ms and 50ms respectively). 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 it working, particularly on vocal tracks.

Faster

In the FASTER mode, the gain control tube operates with very fast attack and release times (0.1 ms and 50ms respectively). This mode grabs the signal very aggressively, like an hot-rodged Fairchild. It's definitely a sound you can hear and feel. However it should be used with caution, since the amount of control voltage artifacts impressed on your audio are maximized in his mode. In addition, it can add considerable distortion to signals with lots of low frequency content, like bass guitar. Listen and judge carefully.

Vintage

The Vintage mode emulates program-dependent action of vintage compressors. Early opto-style units 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.

Average

In the AVERAGE mode, the detector 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.

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!

JFET/MOSFET Peak Limiter

The new JFET/MOSFET Peak Limiter uses a novel approach to brickwall analog limiting, with JFET and MOSFET modes for two different characters of peak limiting, and accurate led metering. Unlike other designs, distortion below threshold is negligible. When not triggered, the Peak Limiter is out of the signal path entirely. The peak limiter uses a class A, solid-state signal path.

A Few General Comments About Peak Limiting

- All peak limiters add distortion when limiting. By their very nature, they change the shape of the waveform, which is, by definition, distortion. However, some peak limiters begin distorting well below threshold. The active devices doing the peak limiting in the JFET/MOSFET Peak Limiter are entirely out of the circuit until the threshold for limiting is achieved, and switched out again after limiting. This keeps distortion negligible when no limiting is occurring.
- The amount of distortion depends on how the peak limiting is accomplished. The trick is to do it in a way that sounds inaudible. In the JFET/MOSFET Peak Limiter, a certain amount of 'compliance' is built-in to the limiting action. This means that instead of chopping off the peaks and losing all dynamic information, some 'wiggle' is left at the top. This makes the limiting more inaudible. The JFET and MOSFET devices have differing amounts of compliance, which results in differences in the character of limiting. The JFET tends to produce 'harder' limiting, with less compliance, while the MOSFET produces 'softer' limiting, or more compliance.
- Peak limiting should be used to avoid a worse-sounding alternative. For example, clipping distortion from digital 'overs' will always sound worse than a good peak limiter.
- Peak limiting does not take the place of a compressor. Use the Delta-Mu compressor to raise the average program level, and the peak limiter to catch transients. Any peak limiter will be audible when trying to act on steady-state program material (e.g. bass guitar). The LED display can serve as a guide to how audible the peak limiting might be. If the leds are lit continuously, you can be certain that significant distortion is occurring.
- Ignore all of the above when using the peak limiter as an effect. Heavy limiting of an acoustic guitar might sound nasty, but heavy limiting of distorted tracks, like electric guitar, can be a beautiful thing. Same goes for percussion tracks.

IN/BYPASS Switch

With the switch in the 'IN' position, the Peak Limiter activated, and the blue LED near the switch is illuminated. When in 'BYPASS', the Peak Limiter is entirely out of the signal path.

Ceiling

The CEILING control determines the reference output level at which the peak limiter is activated. It can be set from +22dBu to +12dBu. This encompasses the range of 'digital zero' most often encountered with typical A/D converters, as well as having additional 'margin' for using the peak limiter creatively.

JFET/MOSFET

The JFET/MOSFET switch determines which type of device is doing the peak limiting. As discussed above, the JFET gives a stiffer form of limiting, while the MOSFET is more forgiving. Due to the differing nature of the JFET and MOSFET devices, slight re-adjustment

of the CEILING control may be necessary when switching between the two modes.

LED Display

The 9 segment LED display gives a true indication of the amount of peak limiting applied to the signal. It is obtained by continuously comparing the input and output levels, and scaling this difference in dB relative to the CEILING reference level. It displays the amount of peak reduction in

1 dB increments from 0 to greater than -8 dB. The LED ladder uses a 3 color scheme to indicate how audible the peak limiting might be on transient source material. Green (0 to -4) is the 'safe' region of operation, with yellow (-5) and red (-6 to >-8) indicating caution is required.

VU 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 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 II 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 Delta-Mu compressor is responding to peaks faster than the meter's response time. This is particularly true when using the FAST and FASTER modes. 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. 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 in the bulb. The life of the preamp tubes in the Quartet II 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. 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 II 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 five tubes (V1-V5) in the porcelain tube sockets.
 - The input tubes are 12AX7A/ECC83 (V1, V3)
 - The output tubes are 6922/6DJ8 (V2, V4)
 - The gain control tube is a 6ES8/ECC189 (V5)
- NOTE: THERE ARE NO SUBSTITUTES FOR THE 6ES8/ECC189!
ONLY THE EXACT REPLACEMENT WILL WORK!
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 II than the 12AX7A input tube.

Note: In most cases, tube DC and AC rebalancing and gain calibration and will be required when replacing the 6ES8/ECC189. Although this not a difficult process, it should be performed only by qualified service personnel that are familiar with servicing vacuum tube equipment. Potentially lethal voltages are present inside the unit. Detailed instructions for performing these procedures will be provided on request.

Internal Adjustments

There are several adjustments to the Quartet II that are only accessible by removing the top cover:

- Adjustment of the EQ output level..
- Calibration of the meter when measuring gain reduction
- AC and DC balance of the gain control tube for control voltage rejection.
- Adjustment of symmetry, detector gain and reference voltage of the Peak Limiter (THESE SHOULD NEVER NEED ADJUSTMENT).

These adjustments are required only if one of the tubes 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.

Quartet II Specifications

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

Mic/DI Preamp

Mic Preamp

Input Gain: +33 to +63dB (Full) or +40 to +70dB (Focused) in 3dB steps

Input Impedance: 1500 or 10K (switchable), transformer balanced and floating

Frequency Response:

Full: -1.0dB 12Hz and 65kHz with 10K load, +45dB gain, unbalanced or transformer-balanced

-1.0dB 24Hz and 60kHz with 600 load, +45dB gain, unbalanced or transformer-balanced

Focused: -1.0dB 30Hz and 40kHz with 600 or 10K load,

+45dB gain, unbalanced or transformer-balanced output

Noise: EIN less than -124dBu with 150 input load (> 85dB below +4dBu), 0-30Khz bandwidth

Distortion: Full: THD+N less than 0.03%, +45dB gain, unbalanced output;

less than 0.06% from 200Hz-20kHz (< 0.2% at 20Hz), transformer-balanced output

Focused: THD+N less than 0.07%, +52dB gain, 200Hz-20kHz, 1.5% at 20Hz.

less than 0.08% from 200Hz-20kHz (< 1.7% at 20Hz), transformer-balanced output

DI Preamp

Input Gain: +20 to +50dB (Instrument), 0 to +20dB (Line) in 3dB steps

Input Impedance: 10M or 1M (Instrument), 100k with 20dB pad (Line)

Frequency Response: -1.0dB 12Hz and 110kHz, with 10K load, + 20dB gain, unbalanced or transformer-balanced

-1.0dB 20Hz and 95kHz, with 600 load, + 20dB gain, unbalanced or transformer-balanced

Noise: EIN less than -116dBu with input shorted (> 87dB below +4dBu)

Distortion: THD+N less than 0.015%, 20Hz-20kHz, +20dB gain, unbalanced output;

less than 0.05% from 200Hz-20kHz (< 0.5% at 20Hz), transformer-balanced output

Max. Output Level: +34dBu into 10k load, Output control at maximum, unbalanced or transformer-balanced

+25dBu into 600 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 (-40dB with DI input switched to 'Line').

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: Inductor-based passive EQ network with all-tube gain makeup stage, with

'aggressive' mode

Input Sensitivity:+4dBu

Input Impedance:10kohms

Frequency Bands

Hi Peak: +10 to +20dB peaking at 0.8, 1.4, 2, 3, 4, 5, 8, 10, 12, 15 or 18 kHz, BW = 0.7 to 3.0

Mid Dip:-10 to -25dB notching at 200, 350, 500, 650, or 800 Hz, BW = 0.7 to 3.7

Lo Boost/Cut: \pm 20dB shelving Boost or Cut at 20, 30, 50, 100, or 120 Hz

Freq. Response:-1.0dB 5Hz and 200kHz with 10K output load, unbalanced or transformer-balanced

-1.0dB 20Hz and 370kHz with 600 output load, unbalanced or transformer-balanced

Noise:> 87dB below +4dBu

Distortion:THD+N less than 0.015% from 20Hz-20kHz, +20dB gain, unbalanced output; less than 0.06% from 100Hz-20kHz (< 0.2% at 20Hz), transformer-balanced output

Passive/Aggressive: THD+N less than 1% @ 20Hz at +4 dBu, EQ controls set flat.

Max. Output Level:+34dBu into 10k load, +24dBu into 600 load, unbalanced or transformer-balanced

Delta-Mu Compressor

Circuit Type:Remote-cutoff gain control tube with class A solid-state gain makeup stage

Input Sensitivity:+4dBu

Input Impedance:10k (nominal) with 1:1 input transformer

Freq. Response: -1.0dB 16Hz and 56kHz with 600 output load

Noise:>89dB below +4dBu output level

with Output control at unity gain (12:00)

Distortion:less than 0.1% THD+N, 20Hz to 20kHz, below threshold

Output: +22 dBu into 10k load

Max. Gain Reduction:greater than 15dB

Threshold: up to 15dB of gain reduction at -5dBu input level

Ratio:1:1 to limiting, program-dependent

Output: off to +15dB

Modes: fast, faster, vintage, average or manual operation

Fast: 1.0 ms attack, 50ms release

Faster: 0.1 ms attack, 50ms release

Average: rms responding

Vintage multi-stage attack and release times, program dependent

Manual: attack time variable from 1.0ms to 100ms

release time variable from 0.1s to 2s

Peak Limiter

Circuit Type: Class A solid-state line amp with JFET or MOSFET limiting

Input Sensitivity:+4dBu

Input Impedance:10kohms

Freq. Response: -1.0dB 10Hz and 50kHz with 600 output load

Noise: >90dB below +4dBu

Distortion:less than 0.01% THD+N, 20Hz to 20kHz, with limiter below threshold

Output: +22dBu into 10k load

Display: 9 segment led ladder in 1 dB intervals from 0 to -8dB

General

Vacuum Tubes: (2) ECC83/12AX7A, (2) 6922/6DJ8, (1) 6ES8/ECC189

Power: 120V or 240Vac, 45W

Power Supplies: +300Vdc, + 250Vdc, +6.3Vdc, +12.6Vdc, ± 18 Vdc, +15Vdc, +10Vdc, 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: 15.8 lb. (7.2kg)

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 II 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 or Fed Ex, not US postal service), 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.

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