

6160/P

**160Wx6 Multi-Channel Power
Amplifier**

Owners Manual





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Introducing the Perreaux 6160 Power Amplifier

Congratulations on your Perreaux 6160 purchase. To realise the full potential of your unit you need to appreciate all aspects of its operation.

Before installing the 6160 into your system, read the entire manual carefully. Endeavor to understand every detail by familiarising yourself with the controls and features as you read. You will find it easier to install using the relevant sections of this manual as a reference.

We have attempted to explain every feature and operational facet clearly and concisely. Your Perreaux dealer will be happy to assist if you encounter any unforeseen problems.

Read this manual, install your unit correctly and realise the sonic significance of your investment in Perreaux.

Perreaux products are designed to provide the utmost in sonic realism and electronic reliability with a functional yet elegant appearance that reflects the care and craftsmanship applied during all stages of construction.

Features at a Glance

- Rugged build quality
- Ultra-stiff power supply
- Soft-Start circuit
- Hybrid Class A/AB output stages
- MOSFET output devices
- Highly powered
- Clipping indicators
- Bridgeable outputs
- Remote trigger input and output
- Multiple protection systems
- Advanced PCB design and earthing techniques
- Earth isolation switch

To maintain the consistently high quality that you expect from us, and we expect from ourselves, Perreaux products are essentially handcrafted.

We maintain the human-link throughout, from design and construction, through to the ultimate test, your music, your system, your ears.

Because we too listen to our products, we know that with your Perreaux you will discover many more of the musical secrets we strive to reveal.

Note:

All references to the 6160 Classic series are also applicable to the 6160P P-Series product.

From all of us at Perreaux Industries Limited, thank you for choosing the Perreaux Reference Series 6160 power amplifier.

Important Safety Instructions

Note: All safety and operating instructions should be read carefully before the 6160 is used. Keep the Owners Manual in a safe place for future reference.

- The 6160 should not be used near water, for example near a bathtub, kitchen sink, in a wet basement, near a swimming pool, etc.
- The 6160 should be rack mounted only in a heavy-duty rack or stand that is recommended for audio equipment use.
- Mounting to a wall or ceiling should be via a heavy-duty bracket or shelf designed for audio equipment use.
- The 6160 should be situated away from heat sources such as radiators, stoves, or other appliances that produce excessive amounts of heat.
- Always ensure the 6160 heat sinks have adequate ventilation enabling air circulation both above and below.
- DO NOT place the 6160 directly onto carpeted surfaces.
- Avoid exposing the 6160 to extremely high or low temperatures.
- The 6160 should be connected to a mains power supply only of the type described in the operating instructions, or as marked on the rear of the unit.
- DO NOT disconnect the mains earth from the system.
- The mains power supply cord should be routed so that it is not likely to be walked on or pinched by items placed on or against it.
- The power cord of the 6160 should be unplugged from the mains outlet when the unit is to be left unused for long periods or when attempting to connect or disconnect cables and before cleaning your unit.
- Care should be taken so that objects and/or liquids do not accidentally fall inside the 6160.
- Please keep electrical equipment out of reach of children.
- Please unplug sensitive electronic equipment during electrical storms.
- Please replace any fuse with the value and type specified.
- Avoid operating the 6160 with the cover removed.
- DO NOT bypass any fuse.



- DO NOT attempt to repair the 6160. In the event of a problem, please contact your Perreux dealer.
- DO NOT operate this product in an explosive atmosphere.

Caution!

The 6160 is an extremely high powered, convection cooled amplifier. The finned outer heat sinks may become very hot when delivering high volume levels – to avoid injury; care should be taken not to touch the heat sinks during operation.

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1

Unpacking and Placement

Unpacking Procedure

The 6160 is packaged for maximum protection. Please carefully read the instructions below before proceeding to unpack the unit. Be extremely careful.

- Inspect both ends of the cardboard box and open at the end without the central staple by slitting the reinforced tape at either side.
- Fold back the flaps and tip the package on end and the inner box will slide out.
- Lay the inner box down flat and upright, open it conventionally by separating the top tray from the bottom.
- The product can now be removed from the bottom packaging. This will be easier if you have someone to help you by holding the base of the box.
- Alternately, the bottom tray and amplifier could be tipped upside down and the bottom packaging removed. If opened in this manner, please ensure that you turn the contents over again.

Note: Be very careful to secure the unit if you are planning to flip the package upside down.

- Remove the two white polystyrene protectors off either side of the amplifier, leaving the black material covering.
- Pull back the material and remove the protective black tissue from the front panel.

The amplifier is now unpacked and ready for further installation.

Note: Please retain all packaging material for future transport.

Box Contents

1 x 6160 Power amplifier
1 x 6160 Product manual
1 x Detachable AC power cord

Placing Your 6160

The 6160 should generally be placed close to your preamplifier, keeping the interconnect cabling short.

We strongly recommend keeping the 6160 on it's own separate shelf to allow for proper ventilation.



Ventilation Requirements

The 6160 is a high-powered amplifier. For optimal performance, the unit MUST receive adequate ventilation.

- Please do not install in a sealed cabinet.
- Please do not stack products directly on top of the unit.
- Please do not cover the product with a cloth or similar.
- Please do not mount the 6160 directly onto carpeted surfaces.
- As a “rule of thumb”, allow 80-100mm (3-4 inches) around all sides of the product and mount the 6160 on a flat surface, ensuring that the unit has adequate access to free flowing air.
- In the event that the 6160 is to be incorporated into custom cabinetry, please refer to Chapter 15 “Physical Dimensions”.

Note: Please take all necessary steps to ensure that the unit receives adequate ventilation

If you are like us, the first thing you will want to do is to play your favourite piece of music through your new 6160. The following instructions are written to enable you to achieve this as quickly as possible. These are not comprehensive instructions, but are designed to enable you to play music now!

Note: Please take the time to read the 6160 manual thoroughly as it incorporates many features, which will enhance its operation.

Placement

The 6160 is a high-power amplifier and best results will be achieved when placed on a solid surface with adequate ventilation. DO NOT place on a carpeted floor or cover the amplifier!

Turn off associated components

This minimises the potential to damage any other components when connecting your 6160 into the system.

Connect preamplifier to 6160

Connect the output of your preamplifier/processor to the inputs at the rear of the 6160 and ensure that the three toggle switches are all set to NORMAL.

Note: Try to keep all interconnect cables as far from loudspeaker cables as possible and well away from all AC mains leads.

Connect speaker cables to the left and right speaker terminals

We recommend using high quality connectors for your speaker cables, spade lugs are the preferable option as they combine a larger surface area with the possibility of a strong mechanical connection; however, high quality banana terminals are also acceptable.

Note: Be careful to maintain channel integrity, i.e. left to left, right to right, and phase integrity, positive (+) to positive (+), negative (-) to negative (-).

Switch on preamplifier

Turn on the preamplifier/processor and set the volume to the minimum level. Select the respective input to which your source component is connected.

Switch on 6160

After checking the supply voltage compatibility with the voltage rating on the 6160 rear panel, insert the power cord-set supplied into the rear of the unit and into the wall. Switch on the socket at the wall and power up the 6160 using the switch on the rear panel.

Start your source component

Switch on the source component both at the wall and on its front panel. Ensure you have some source material inserted and press play.

Increase the volume

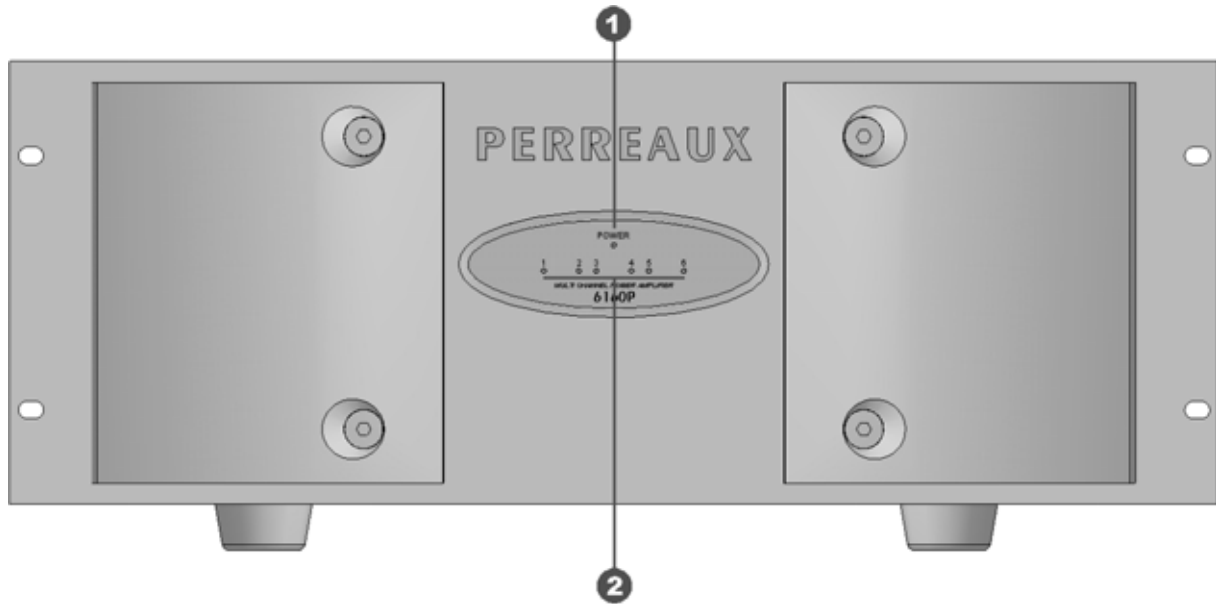
Slowly increase the preamplifier/processor volume control to achieve a comfortable listening level.

CONGRATULATIONS!

Now that you have achieved your first objective, sit back, relax and please read the rest of the manual at your own pace, in your favourite armchair, whilst sipping a hot cup of coffee. You'll find the whole experience much more pleasurable whilst listening to music.

3

Front Panel Functions



1 Power Indicator

The indicator light is an LED that shows the status of your 6160 multi-channel power amplifier.

Off

This indicates that the amplifier is not connected to the mains supply. This could be due to the power switch being set to OFF or power not being supplied to the mains power cord (e.g. unplugged, switched OFF at wall socket, tripped circuit breaker, etc.).

Orange

If the LED is glowing orange, it indicates that the soft-start circuitry is enabled and the capacitors are being slowly charged. The soft-start circuitry prevents large in-rush current upon power-up, which is detrimental to capacitor life and can trip circuit breakers unnecessarily. The LED should only illuminate orange for 1-2 seconds.

Red

When the LED is red, the amplifier is ON and ready to be used.

Green

Shows that the unit is in standby. This occurs when a master device is connected via the remote trigger input at the rear of the unit and the master device is OFF.

② Clipping Indicators

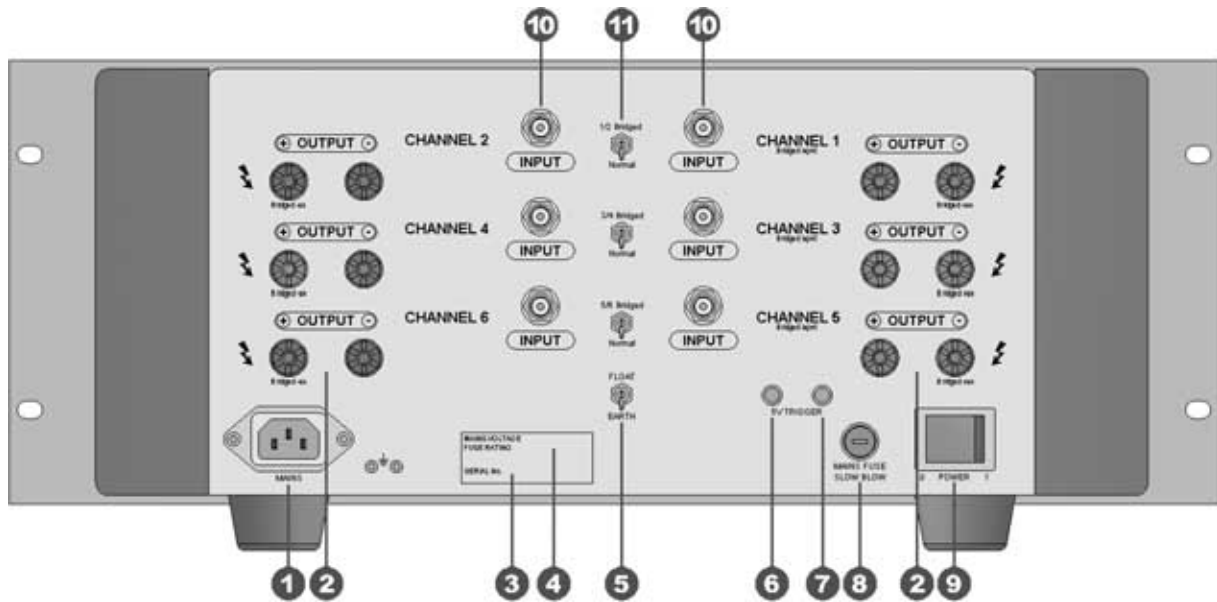
Under the numbered indication on the front panel insert screen, each of the six channels of the 6160 have an independent LED indicator which will illuminate if the input signal is too high, potentially causing damaging distortion and is a warning to reduce volume to the indicated channel(s).

Caution!

When an indicator illuminates, that channel is approaching clipping. This should be avoided, as clipping is the main reason for damage to both amplifiers and loudspeakers.

4

Rear Panel Functions



Caution! Please make all changes at minimum volume setting. Only increase the volume after the connections have been made.

1 AC Mains Input

An IEC-standard mains input is provided at the rear of the unit. The AC cord set is removable, allowing you to upgrade to a cord set of your preference.

Caution! Prior to connection to the AC mains, please check the voltage label on the rear panel to ensure that your unit conforms to the power supply in your area. Never attempt to connect the unit to the incorrect voltage. Severe damage can result from applying incorrect voltage to the unit.

2 Speaker Output Terminals

The 6160 is equipped with one pair of output terminals per channel. All terminals are clearly marked and colour coded RED Positive (+) and BLACK Negative (-). This polarity must be observed when connecting loudspeakers, i.e. positive terminal of the 6160 to the positive terminal of the loudspeaker and negative terminal of the 6160 to the negative terminal of the loudspeaker.

When bridging two channels, the positive loudspeaker terminals of the bridged pair form the loudspeaker terminals for the bridged channel, i.e. the positive terminal of the odd numbered channel becomes the POSITIVE terminal of the bridged pair; the positive terminal of the second channel becomes the NEGATIVE terminal of the bridged pair (*refer labeling on Rear Panel*).

Caution!	<p>Never connect the amplifier's output terminals to any device other than a loudspeaker.</p> <p>Please do not short circuit the amplifier's output terminals.</p> <p>Never connect the output of one amplifier to the output terminals of another amplifier.</p>
	<p>For more information please refer to Chapter 8 "Maximising System Potential".</p>
	<p>3 Serial Number</p>
	<p>The serial number is unique to your 6160. Please record this number and store it in a safe place. For any service related enquiry, please be prepared to quote the product serial number to Perreaux personnel or their service representative.</p>
	<p>4 Input Voltage and Fuse Rating</p>
	<p>Input Voltage</p>
	<p>It is important that the 6160 be operated from the correct AC mains voltage. This unit is factory set for the voltage applicable to the original country of destination.</p>
	<p>The 6160 will operate satisfactorily within a voltage variation of up to $\pm 5\%$ of that voltage at which the unit has been set.</p>
	<p>If you require the voltage setting to be altered, e.g. relocation to another area, city or country, or extraordinarily high or low voltages, please contact your Perreaux dealer. Qualified service personnel can only perform this modification.</p>
Caution!	<p>Never attempt to connect the unit to the incorrect voltage. Severe damage can result from applying incorrect voltage to the unit.</p>
	<p>Fuse Rating</p>
	<p>The fuse rating displayed here, refers to the rating of the mains inlet fuse.</p>
	<p>For more information on fuse ratings, please refer to Chapter 14 "Specifications".</p>
Caution!	<p>Never replace the fuse with any other ratings other than the one specified.</p>
	<p>5 Earth Lift Switch</p>
	<p>This switch enables the user to isolate the internal signal earth of the amplifier from the mains earth and is useful if system hum is a problem. Setting this switch DOWN connects the internal signal earth to mains earth and is the normal position. Setting to UP disconnects the signal earth from the mains earth.</p>
Note:	<p>Activating this switch has no effect on chassis earth, maintaining the connection to mains earth.</p>

6 Master Remote Trigger Input

The master trigger input is used to take the 6160 in and out of standby. The master trigger input is designed to accept a 3.5mm diameter male plug. The voltage rating is +5V to +12V DC level ON and 0V DC level OFF.

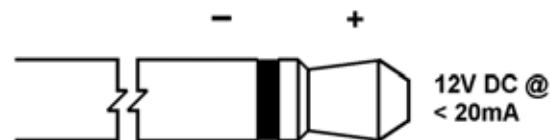
The plug must follow the specifications as per the following diagram:



7 Slave Remote Trigger Outputs

A parallel slave trigger output is provided to switch on or off any connected peripherals to the 6160. The slave trigger output is designed to accept a 3.5mm diameter male plug. The voltage rating is +12V DC level ON and 0V DC level OFF.

The plug must follow the specifications as per the diagram below:



8 AC Mains Fuse

The 6160 is equipped with a user serviceable AC mains fuse. In the event of fuse failure, always replace with the same type and value fuse. Remember, fuses do not usually blow without a reason. Any doubts about fuse failure should be conveyed directly to your Perreaux dealer.

For more information on fuse ratings, please refer to Chapter 14 "Specifications".

Caution!

This is the ONLY user accessible fuse.

Never replace the fuses with any other ratings other than the one specified on the rear panel.

Always ensure your 6160 is disconnected from the mains supply before attempting to change the mains fuse.

9 Power Switch

Set this switch right (I) to turn power ON. Mute relay circuitry is employed in the 6160 so output is muted momentarily after the power switch is actuated. Set the switch left (O) to turn the unit off, at which time the outputs will be disconnected.

10 Input Sockets

Accepts a standard single-ended input (RCA) from a preamplifier/processor with single-ended outputs. These high quality gold plated sockets are highly conductive, corrosion resistant, and provide less potential for corrosion induced distortion. All inputs are clearly marked channel 1 through 6.

By associating the channel inputs as pairs, the 6160 can be configured as three 160W stereo power amplifiers. Care should be taken to maintain channel integrity.

Refer to Chapter 14 “Specifications”, for detail on input sensitivity and impedance.

11 Bridging Switch

The bridging switch allows the combining of two channels together to form a single higher output channel. When in NORMAL mode, the individual inputs correspond directly to the respective loudspeaker outputs. When in BRIDGED mode, the input channel is the odd numbered channel of the bridged pair, and loudspeaker outputs correspond to the 'positive terminals' of the bridged pair. Bridged channels offer considerably more power than two channels individually.

For more information on channel bridging, please refer to Chapter 5 “Bridging Channels”.

Caution!

ALWAYS disconnect the unit from the mains power before any modifications to inputs, outputs, and bridging switches are performed.

Bridging Channels

Under typical conditions, for surround-sound or home theatre applications, there are two channels available for the front loudspeakers, a channel for the center loudspeaker, a pair of channels for the rear effects, and an extra channel to drive either a subwoofer or a second center channel loudspeaker.

The Perreaux 6160 multi-channel amplifier can be thought of as three stereo amplifiers built into a single box. Each pair of channels within the unit can be bridged to form a single channel with approximately three times the potential output of a single channel. This facility allows this 6160 to be used in a number of configurations. For example, bridging two of the 6160 pairs of amplifiers will provide two channels of approximately 425W into 8Ω, suitable for the main loudspeakers of the system, and two channels of 160W into 8Ω for a remote set of loudspeakers.

Ultimately, two 6160 units both operating with all channels bridged, will offer six channels of high power amplification (6 x 425W into 8Ω) for home theatre applications.

To configure for bridged mode:

- Ensure the power switch on the 6160 is switched to the OFF position and disconnect unit from mains supply. Allow a minute to discharge stored potential.
- Select the pair of channels to be bridged. For this example, we will use channels 5&6. (Other pairs 1&2 and 3&4 are bridged similarly.)
- Disconnect ALL input and output cables (interconnect cables and loudspeaker cables) from channels 5&6.
- Set the Bridging Switch to the bridged position. This converts internal circuitry from normal to bridged mode.
- Connect the loudspeaker cable across the POSITIVE terminals of channels 5&6 loudspeaker output terminals. When bridging two channels, the positive loudspeaker terminals of the bridged pair form the loudspeaker terminals for the bridged channel, i.e. the positive output terminal of the odd numbered channel becomes the POSITIVE terminal of the bridged pair; the positive terminal of the even numbered channel becomes the NEGATIVE terminal of the bridged pair. To explain further, connect the positive conductor to the positive terminal of channel 5 and the negative conductor to the positive terminal of channel 6, i.e. the two red terminals. DO NOT connect any cables to the black terminals; channel 5 negative terminal (-) and channel 6 negative terminal (-).

Caution!	<p>When in bridged mode, loudspeaker cables must be connected directly from the amplifier to the loudspeakers. DO NOT connect to a speaker switch, headphone adapter, or any other device that shares a common ground between channels.</p>
	<ul style="list-style-type: none">□ Connect the signal lead from the desired source to the bridged input. In this instance, the bridged input for channels 5&6 is input 5.
Note:	<p>Do not connect anything to input 6.</p> <p>Input 1 and input 3 are to be used if bridging other channels.</p>
	<ul style="list-style-type: none">□ Reconnect the mains power supply to your 6160, and turn the power switch ON.
Note:	<p>When in bridged mode, we recommend that the loudspeakers have a nominal impedance no less than 8Ω.</p>

6

Special Design Philosophies

Minimalist Design

Perreaux has been designing and manufacturing only the highest quality audio componentry for more than a quarter of a century. Technology has continued to evolve rapidly over that time and our knowledge and application of design, materials and manufacturing techniques has advanced in tandem with this. Today's Perreaux range comes closer to fulfilling our shared vision than at any other time in the past.

To follow is a discussion on some of Perreaux design philosophies that have been incorporated into the entire range.

Leading British architect, John Pawson, writes:

“The Minimum can be defined as the perfection that an object achieves when it is no longer possible to improve it by subtraction. This is the quality that an object has when every component, every detail, and every junction has been reduced or condensed to the essentials. It is the result of the omission of the inessentials”.

Perreaux has historically embraced the minimalist ethic from an audio design perspective only. The concept of “less equating to more” has been at the heart of all Perreaux audio designs for more than a quarter of a century.

Minimalist Electronics

We wish to maximise the quality of your listening pleasure by keeping the componentry and signal path as uncluttered, short and clean possible. All components in the signal path, even those of the highest quality have an effect on the signal, thereby altering the quality of the reproduction in some way. Our aim is to recreate in its entirety, the original performance by not adding or subtracting anything, irrespective of the source.

Minimalist User Interface

We carefully study the user interface and par down the number of buttons and associated clutter leaving just the essential and no more. How tempting it has been over the years to loose sight of our core values as technology or trends have made it possible. That is one of the reasons why our older products still have such a high resale value today. The user interface has and always will remain simple, free from adornments, clean and uncluttered.

Minimalist Aesthetics

Our products appeal to those who seek the ultimate in audio exclusivity, namely the perfect blend of “form and function”.

“Form and function” are both tough masters. That is why our amplifier heat sinks are not hidden, but instead feature prominently in all our designs. We make no excuses for producing some of the most distinctive high-end audio products on the planet. We let “form and function” blend together in perfect harmony. This surely is the essence of true minimalist utilisation.

Minimalism in a Wider Context

John Pawson writes:

“Clearly simplicity has dimensions to it that go beyond the purely aesthetic: it can be seen as the reflection of some innate, inner quality, or the pursuit of philosophical or literary insight into the nature of harmony, reason, and truth”.

7

Special Design Features

Rugged Build Quality

Mechanical strength has been a hallmark of Perreaux products since the company first started production back in 1974. The concept behind the physical design and construction is that each structural member should contribute to both rigidity and performance.

Ultra Stiff Power Supply

The 6160 incorporates a massive custom designed, toroidal power transformer, employing unusually heavy gauge wire that reduces copper losses to a minimum. An electrostatic shield prevents AC line borne interference from entering the signal path. The power supply filter capacitors, totaling 60,000 μ F, have exceptionally low inductance and internal resistance. They charge and discharge in response to load demand far more rapidly than conventional storage capacitors and are capable of delivering the instantaneous current required by the output stages, providing optimum dynamic range and transient response. The wiring from the power supplies to the output boards is designed for unimpeded transmission of the required current and voltage and utilizes heavy gauge, tinned copper wire cables. Since power supply leads radiate at signal frequencies, all signal wiring is carefully loomed to minimise this effect.

Hybrid Class A/AB

The bi-polar transistors used in the 6160 are run in Class A mode. This avoids the crossover notch distortion and the resulting odd-order harmonics present, to some degree, in all other classes of operation. The devices used in the 6160 output stage are MOSFETs, which with high quiescent current circuitry, are run in the equivalent of Class A to 10 watts. Beyond this point the output class is technically Class AB (hence the hybrid nomenclature), but with a major difference. The combination of MOSFET characteristics and their application in this circuitry, result in crossover distortion so minimal that it is virtually non-existent.

MOSFET Output Stage

The 6160 output stage takes full advantage of the unique qualities of MOSFET devices and in many ways they are superior to bi-polar transistors. A major advantage is their tendency to draw less current over a large section of the power bandwidth as their temperature rises (Negative Temperature Coefficient), hence self stabilising thermally, whereas bi-polar transistors draw more current as their temperature rises (Positive Temperature Coefficient) and protection circuits become mandatory to prevent thermal runaway and eventual self destruction. MOSFETs have the ability to swing fully across the amplifier's internal DC voltage and are therefore true "rail-to-rail" devices. Using MOSFETs encourages the highest performance from the balance of the internal amplifier circuitry.

Clipping Indicators	Each of the six channels of the 6160 have an independent LED indicator which will illuminate if the output approaches clipping, potentially causing damaging distortion and is a warning to reduce volume to the indicated channel(s).
Caution!	When the clip indicator illuminates, that channel is approaching clipping. This should be avoided, as clipping is the main reason for damage to both amplifiers and loudspeakers.
Bridgeable Outputs	The 6160 has the facility to combine two independent channels into a single higher output channel. The bridging switch allows the selection of two independent channels, or the combining of two channels to form a single higher output channel. Bridged channels offer considerably more power than two channels individually.
Protection Systems	<p>AC Sense</p> <p>The 6160 monitors the AC voltage at the secondary windings of the toroidal transformer, that in turn supply the rectification stages. In the event that the toroidal transformer AC output should fail, the protection circuitry will disconnect the output. The output will be reconnected once the AC voltage has been restored.</p> <p>DC Rail Fuse</p> <p>Each of the +VE and -VE DC rails supplying the output stages of each channel are protected with a fuse. In the event that any one of the fuses should fail, the protection circuitry will automatically detect the fault and disconnect the output of the respective channel(s).</p>
Earthing	Perreux engineers pay particular attention to designing the product to ensure maximum separation between internal signal and power earths, only meeting at a central starred point.
Earth Isolation Switch	The toggle switch on the rear of the 6160 allows the internal circuitry to be isolated from the mains earth, whilst still maintaining an earth connection to the chassis. This ensures the potentially fatal practice of using an AC cord-set with no earth connection, to alleviate system hum, is not required.
Highest Quality PCBs and Components	Quality fiberglass PCBs, featuring heavy copper tracks and high-grade components, are used throughout the 6160. This provides added stability under variable thermal or electrical loads and assures maximum signal integrity, separation and product life.
Soft-Start Circuitry	The 6160 utilises soft-start circuitry to protect the fuses and/or circuit breakers in your home's mains power supply. Without this circuit, the huge inrush current required to charge the 60,000 μ F of power supply capacitance can blow the fuses or trip the circuit breakers.
Highly Powered	Capable of continuously delivering 160W _{RMS} into 8 Ω (225W _{RMS} into 4 Ω), the 6160 is highly powered. Utilising six high current Hitachi MOSFETs per channel, the 6160 handles even the most difficult loads with ease.

8

Maximising System Potential

Interconnects and Speaker Cables	<p>An often-ignored area in high fidelity systems is the cabling connecting the various components. Interconnect leads should be high quality cable with substantial terminations. Gold plate is inherently resistant to corrosion, and an excellent conductor. The presence of corrosion induces distortion and poor conductivity will seriously interfere with sound quality. Terminations must plug snugly into sockets to maintain maximum conductivity and to avoid annoying earthing problems.</p> <p>Speaker cabling is equally critical. Use only solidly constructed cable of high purity copper or silver content. Again, gold plated terminations are recommended, of the spade or banana plug type. Use cables of equal length and as short as possible to maintain uniform electrical resistance at the lowest possible level. If your amplifier is closer to one of your speakers than the other, avoid coiling the longer lead as this can create inductance, with the potential of reduced high frequency performance. Keep all connections clean, firm and tight. The traditional adage that a chain is only as strong as its weakest link most certainly applies to audio systems.</p>
Bi-amping	<p>Bi-amping uses two similarly powered amplifiers, with exactly the same input sensitivity so that, when the same input signal is provided to each of them, the output level will be exactly the same. This can often be done with one power amplifier connected to the tweeters and another to the woofers, as it spreads the power requirement between the two amplifiers. Bi-amping can achieve greater control, dynamics and resolution than if you try to run everything from a single stereo amplifier.</p>
Positioning Ancillary Equipment	<p>Positioning of your source equipment (tuner, video, disc, tape, record, decks) is important. To avoid airborne frequency peaks, place them well away from your loudspeakers.</p>
Loudspeaker Placement	<p>Loudspeaker placement is a controversial issue; suffice to say that room corners are generally the worst situation. Everything which constitutes your listening area, including the materials used in its construction, will affect the sound itself and the sound stage created. Equally, you have to live with your system and therefore compromises will have to be made in line with your particular priorities. The best advice we can give concerning the choice of loudspeakers is, establish clearly in your mind your requirements; listen to many makes and models, and if at all possible audition your preferred choice in your own listening area and trust your own ears.</p>
Matching Amplifier and Speaker Ratings	<p>When matching speakers to amplifier wattage – ordinarily, the amplifier should have a continuous RMS output power rating the same as or higher than the speakers at the same impedance rating. For example, 100W_{RMS}, 8Ω speakers driven by a 100W_{RMS} at 8Ω amplifier is not as ideal as 100W_{RMS}, 8Ω speakers driven by a 160W_{RMS} at 8Ω amplifier.</p>

Note: 100 Watts is twice as loud as 10 Watts, not ten times as loud.

Perreux equipment is designed with substantial headroom built in – that is, the reserve necessary to reproduce musical peaks without clipping.

**Final
Thoughts**

High fidelity systems are an investment deserving of careful thought and personal time. Your preferences, priorities and constraints will dictate the parameters of your purchase, your ears will tell you what is the right choice for you. Our experience tells us that the bitterness of dissatisfaction lingers long after the fragrance of cheap price is forgotten, hence our use of the term – investment.

9

The Power MOSFET

Today with the vast number of technical achievements occurring around the world, many discoveries are overshadowed or obscured by some that may appear more important to the general media. One such discovery of importance, to the audiophile at least, is that of the power MOSFET device.

The MOSFET

The field effect transistor (FET) and then the MOSFET transistor have been around for a number of years, but only as a small signal-handling device, mostly employed in radio tuners and communications equipment. The electrical advantages of these have long been realised by manufacturers of hi-fi. If only they could be made to handle large amounts of power – what a benefit to the audiophile.

The term power MOSFET describes a device capable of handling reasonably large amounts of electrical energy as an amplifier itself – hence power. MOSFET stands for “Metal Oxide Silicon Field Effect Transistor”, this in turn means that the device is constructed of Silicon. Similar to a transistor – but the part that controls the power flow through the device is insulated from the remainder of the device by a metal oxide insulating layer and the controlling of the power is achieved by the development of an electrostatic field between the controlling element and the conducting element.

In a transistor, the control of the power through the device is effected by the application of a smaller, but nevertheless, significant amount of power to the controlling element. Whereas in the power MOSFET, the control of the power through the device is affected by the application of a very small and very insignificant amount of power to the controlling element – in fact, only the amount required to create a small electrostatic field. This makes the operation of a power MOSFET similar to that of a valve.

Other Field Effect Devices

There are basically three types of power field effect device, they are: the junction FET, the vertical FET and the power MOSFET, all of which were independently developed by three different hi-fi equipment manufacturers in Japan and all were major technological breakthroughs in their own right.

The first of these was the junction FET, the second the vertical FET and lastly, the power MOSFET. Although all these devices are vast improvements over power transistors, the junction FET and vertical FET cannot compare with the power MOSFET, in terms of simplicity of the supporting driver stages and power supply requirements.

The power MOSFET, though having similar characteristics to the valve, can be divided into 2 types of polarities of device – P-channel and N-channel. Broadly speaking only one of these types exists in valve operations. This means that complementary power MOSFETs – P and N channel – can be used in an audio output stage providing greater linearity of operation than can be achieved with valves. In addition, further advantages over the valve include

Audio Applications

their much smaller size, no filaments and greater reliability with reduced vulnerability to physical damage.

When used in an audio power amplifier, the advantages of the power MOSFET over the power transistor are much more difficult to describe and would require greater complexity than can be gone into here. However, they can be summarised as follows – the most important point is that the power MOSFET has a negative temperature coefficient whereas the power transistor has a positive temperature coefficient. This means that when a power transistor is handling power it heats up further and consumes more power. This characteristic, called thermal runaway, will result in the destruction of the power transistor if some means is not provided to control it. The power MOSFET on the other hand, although heating up due to the power flow through the device, does not continue to draw more and more power just because its temperature has risen. But in fact has a tendency to stabilize itself – provided adequate heat sinking is available to remove the heat generated during normal operation. Incidentally this is less heat sinking than is required for a similarly power rated standard transistor.

Secondary Breakdown

Then there is the appearance of secondary breakdown and ‘hot spots’ in a power transistor. This is related to thermal runaway. In order to understand this, one must imagine that the chip silicon inside the power transistor is in fact many smaller transistors connected in parallel. Now, if one of these smaller transistors or a spot on the chip has a greater gain (or amplification factor) than the rest, then that spot will heat up faster and to a greater temperature than the remainder of the transistor chip. This means that whole power dissipation capability of the transistor has been severely reduced and is a major cause of these unexplained output stage failures in large power amplifiers, i.e. over $80W_{\text{rms}}$.

The power MOSFET is largely immune to this problem because if a small part of this chip has a higher gain than the rest then its temperature will rise slightly causing that spot to reduce gain and hence stabilization occurs. The power is more evenly distributed throughout the chip and therefore reliability is maintained.

It can be seen from the above that the transistor power amplifier has to have a much larger margin of power dissipation capability and heat sinking in its output stage than the power MOSFET amplifier.

The transistor power amplifier of $100W_{\text{rms}}$ output into 8Ω can require a driver stage capable of delivering 10W at 1kHz and up to 20W at 20kHz into the input of the output device. The power MOSFET only requires a maximum of 0.01W so a major saving in driver stage componentry and associated noise and distortion can be eliminated.

High Frequency Response

Probably, from the sonic quality point of view, the most important improvement is the power MOSFETs vastly superior high frequency response. A large proportion of the power transistors used in modern hi-fi amplifiers start to show a decline in efficiency from 10kHz upwards. The efficiency of the power MOSFET does not start to decline until about 2MHz and is only down 3dB at 30MHz. This is due to the energy transfer being accomplished with minority charged carriers in the power MOSFET as opposed to majority charged carriers within the transistor, and results in hole storage at high frequencies causing the transistor to dissipate increasing amounts of energy within itself as the frequency increases.

Further sonic degradation of the transistor power amplifier occurs due to hole storage of the output transistors. As the output distortion increases with increasing signal frequency, it is obvious that the distortion products in the negative feedback path also increase.

Because the negative feedback system is employed to reduce distortion by cancellation, at high frequencies it causes even more power to be consumed within the output transistor just to cancel out the distortion.

Transient intermodulation (TIM) is also more prevalent in transistor power amplifiers because the signal transition in time is relatively slow. This means the distortion products in the signal of, say, a fast transient will not travel through the negative feedback system into the output stage fast enough to cancel at exactly 180 degrees out of phase – resulting in the amplifier being overloaded. This is not possible in power MOSFET amplifiers.

Other Advantages

Further sonic improvement is achieved in power MOSFET amplifiers due to reduced crossover distortion, as power MOSFETs have a sharper “knee” than transistors at cut-off and provide a greater linearity when crossing over from one device to the other. Because crossover distortion is a major cause of odd order harmonic distortion in transistor amplifiers (be it small, i.e. 0.05% total) they are usually considered to sound more harsh than valve amplifiers which generally have large amounts of even order harmonic distortion up to 5% and are thought to sound more pleasant and musical.

However, which is more accurate? The valve amplifier at 5% THD with a pleasant sound and even order harmonics; the transistor amplifier with 0.05% THD with relatively unpleasant sound with even and odd harmonic output, or a power MOSFET amplifier with 0.02% THD and relatively pleasant even order harmonic distortion? In our opinion, the power MOSFET amplifier because the THD generated is virtually all second or even order harmonic distortion total 0.02% or less at 20kHz and down to 0.004% or less at 1kHz.

It can be seen that power MOSFETs are here to stay and that there are major sonic and electrical improvements to be had over other output devices.

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Care and Maintenance

The 6160 has been designed to provide many years of trouble free enjoyment. It's important to keep the exterior of the unit clean and to periodically ensure that the air-cooling grills remain clear from obstruction.

Note: Please switch the unit off and remove the cord-set from the rear of the amplifier before attempting to clean your 6160 in the manner described below.

Never apply liquid directly to the 6160.

Never use abrasives.

Never rub in a circular motion.

Cover The cover features a durable, high quality powder-coat finish. To remove finger marks and dirt, lightly rub the surface with a soft cloth.

If the dirt is not removed, dip your cloth in a mild solution of soap and water, squeeze excess moisture from it and then gently reapply to the surface.

Stubborn dirt may be removed by the application of a small quantity of methylated spirits, applied directly to the cleaning cloth only and reworking the effected area.

Front Panel The front panels differ between the Classic Series (6160) and P Series (6160P). The Classic Series front panel is finished in chrome electroplate, where as the P Series is finished in the same durable powder coat as the cover.

They both can be cleaned in a similar manner to the cover, as described above.



1 1

Warranty Information and Obtaining Service

1 Year Limited Warranty

The Perreaux 6160 is warranted to be free from defects in material and workmanship under normal use to the original purchaser for a period of 1-year (365) days from the date of purchase from an authorised dealer or distributor.

5 Year Extended Warranty

To extend the warranty on your Perreaux 6160 to five (5) years from date of purchase, please return a fully completed warranty registration form along with a copy of the original receipt of purchase to:

Perreaux Industries Ltd
PO Box 47413
Ponsonby
Auckland
New Zealand

For the Extended Warranty Registration Form, please refer to Chapter 12.

Warranty Transfer

Perreaux Industries Ltd may, at its discretion, allow the warranty on this product to be transferred. Please contact Perreaux on info@perreaux.com requesting a transfer.

Information on the 6160 Warranty

If during the warranty period the Perreaux 6160 exhibits defects in materials and/or workmanship, it will be repaired or replaced, at our option, without charge for either parts or labour. The warranty does not apply to any unit that has been misused, abused or altered.

Any unit that is not performing satisfactorily may be returned to the factory in Auckland, New Zealand for evaluation. Return authorisation must first be obtained by either calling or writing to Perreaux prior to shipping the unit. Perreaux Industries Ltd and its authorised distributors and dealers shall not be held liable for any freight or insurance charges. Freight and insurance charges to and from the Perreaux factory will be the sole responsibility of the owner of the unit.

There is no other express warranty on the 6160. Neither this warranty nor any other warranty, express or implied, including any implied warranties of merchantability of fitness, shall extend beyond the warranty period. No responsibility is assumed for any incidental or consequential damages.

Obtaining Service

In the event that you are experiencing difficulty with the 6160, please as a first step, follow the faultfinding procedures in Chapter 13. If after following this procedure, you require further assistance, please contact your Perreaux dealer.



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Extended Warranty Registration Form

Please complete this form and either fax, mail or scan and e-mail it to Perreux Industries Ltd.

Fax: +64 9 815 5981

Mail: Perreux Industries Ltd
PO Box 47 413
Ponsonby
Auckland
New Zealand

E-mail: info@perreux.com

Alternatively, complete the online Warranty Registration Form on our website
– www.perreux.com.



5 Year Extended Warranty Form



Name:

Address:

Suburb:

City:

Country:

Telephone:

E-mail:

Website:

Product Purchased:

Serial Number:

Dealer:

Purchase Date:

13

Faultfinding Your System

Cause and Elimination of Hum

Hum is a particularly annoying form of noise in any high fidelity system and at some time has been experienced by many of us.

Hum may result from a number of different situations and to make matters worse maybe caused by a seemingly illogical combination of circumstances.

One or more of three specific causes creates hum in the system.

Induced Hum

Hum can be induced into the system from one or more sources and is generally associated with the radiation of noise from one system into another.

Hum and noise can be radiated from any object or system involving AC voltage and current such as power supplies in amplifiers, motors, switching equipment etc. All of these may be found in your hi-fi system or within your own home.

Hum may be induced into any part of the system, so there are no specific instructions that can be given which will offer a guaranteed cure. A good practice to adopt is to keep low-level signal equipment such as phono systems, tuners etc. well away from high-level signal equipment such as power amplifiers. Alternatively, careful designs must be employed to negate these effects on low-level signal equipment. Another good practice to adopt is to keep all signal leads away from power leads.

The practice of neatly tying excess leads together for a tidy looking installation should be resisted, as this could be the cause of induced hum in the system.

Earth Loops

Earth loops are a particularly annoying cause of hum in the system. Earth loops are created by mains frequency current flowing in the screen of signal leads and becomes apparent with the lack of adequate earthing between the various pieces of equipment making up the hi-fi system. This is further compounded by the fact that the equipment earthing considerations vary between different manufacturers and countries.

Perreux products used with equipment manufactured by other manufacturers may cause an earth loop situation, but Perreux products used with other Perreux products will not cause an earth loop situation provided the following precautions are observed:

- The entire hi-fi system must be connected to the same mains/line power outlet. This will ensure that each piece of the system shares the same earth or ground. This rule applies to all installations of all brands of equipment. A preamplifier or power amplifier may be operated from an extension cord plugged into the same mains/line outlet.

- When a piece of equipment is supplied with a three pin mains/line supply lead all three pins must be connected in the correct fashion - see your dealer if in doubt.
- Check all interconnecting signal leads for good connections, both internal connections and firm contact with the sockets. While the centre pin may make firm contact, it is very important that the outer contact is also firm.
- Never remove the earth/ground wire from the mains/line supply of any piece of equipment. This could be hazardous.

Broken Earth Connections

This is a common cause of hum and noise in the system. In many instances, the only way to eliminate the possibility of hum problems arising through a broken earth connection somewhere in the system is to physically check every connection.

Identifying and Isolating Problems

When experiencing a problem, such as one channel not working, or a noise in one channel, it is good practice to adopt a method of isolating the problem to a specific item or area. This practice will assist in diagnosing, curing, or at least advising your technician of the problem and result in a saving of time, money and perhaps frustration.

A logical approach to isolating the probable cause of the problem is to start at the loudspeakers and work back to the music source, eliminating each piece of equipment in turn.

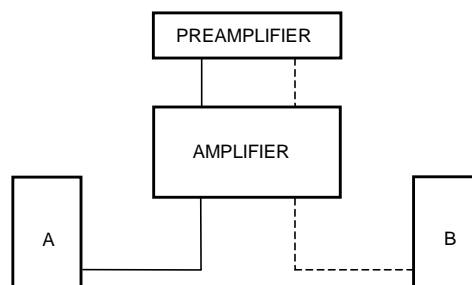
Caution!

Observe precautions regarding volume control settings. Please make all changes at minimum volume setting. Only increase the volume after the connections have been made.

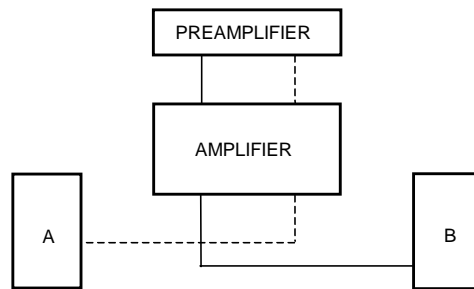
Check that the entire system is connected in the proper manner and that the mains/line supply is connected and switched on.

For clarity during this section, we have labeled one loudspeaker 'A' and the other loudspeaker 'B'. In this example, loudspeaker 'A' appears faulty.

Initial system connections



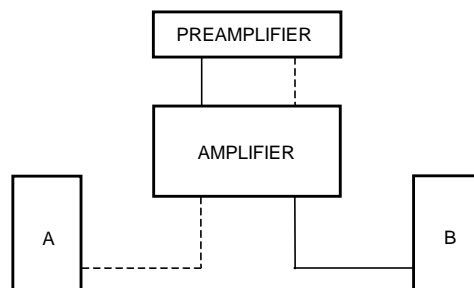
Step 1 – Loudspeakers



Change the loudspeaker leads from one loudspeaker to the other. If the fault remains in loudspeaker 'A', then loudspeaker 'A' is at fault, go no further.

If the fault now appears in loudspeaker 'B' then the problem lies further up the line. Move on to step 2.

Step 2 – Loudspeaker Leads



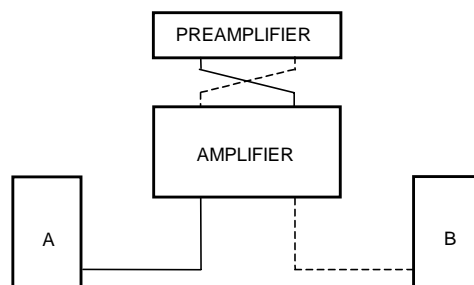
Change the loudspeaker leads completely from left channel to right and from right channel to left by now swapping them at the amplifier output. If the fault now appears in loudspeaker 'B', then that loudspeaker lead is at fault, go no further.

If the fault appears in loudspeaker 'A' then loudspeaker leads are OK. Move on to step 3.

Caution!

Restore the loudspeaker leads to their original connections at both ends.

Step 3a – Inputs (Channels)



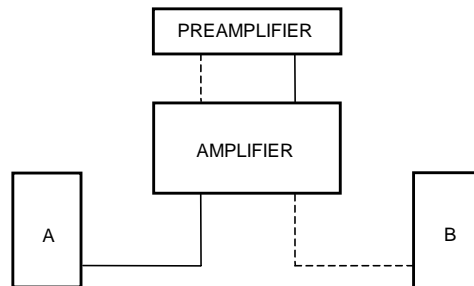
Change the input plugs on the rear of your amplifier, as follows: Change each input source in turn by swapping the plugs left to right and right to left. If the fault changes to loudspeaker 'B' on any one of the selected inputs, then that particular input source is possibly at fault. Move on to step 3b.

If the fault stays in loudspeaker 'A', then it is probable that the fault may exist within the amplifier.

Caution:

Changing of any connectors must be carried out at a minimum volume setting. Only increase the volume after the connections have been changed.

Step 3b – Inputs (Interconnects)



Change the interconnect leads completely from left channel to right and from right channel to left by now swapping them at the source component's output. If the fault stays in loudspeaker 'B', then the interconnect lead is at fault, go no further.

If the fault appears in loudspeaker 'A', then the interconnect lead is OK.

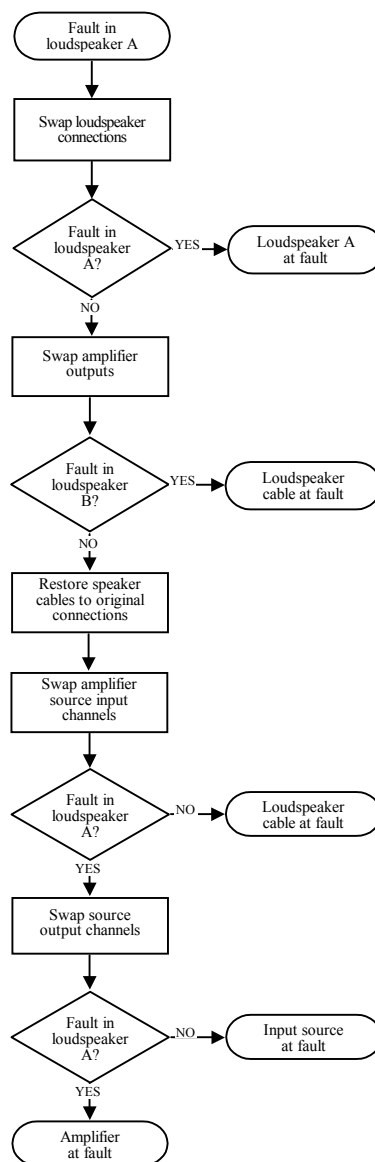
Caution!

Changing of any connectors must be carried out at a minimum volume setting. Only increase the volume after the connections have been changed.

Should the fault prove to be in the amplifier it will be necessary to determine where the fault actually lies. Most of this has been done, for instance, you now know what input/s and what channel is affected. This information will assist your Perreux dealer or service person when or if any service is required.

If the apparent fault is noise in one or both channels and has been localised to the amplifier, it will be necessary to determine whether or not the noise increases with the volume control; whether or not the noise exists when no input at all is connected to the amplifier; and what type of sound the noise is. For example, low frequency humming noise or high frequency hissing noise. This information will also assist your service person in making repairs or adjustments.

Faultfinding Flowchart



The 6160 specifications are detailed in brief and then subsequently in more detail. In the detailed version, we attempt to explain the significance of each specification.

The correlation between published specifications and sonic quality can be unreliable. A list of numbers reveals virtually nothing. All technical measurements must be subject to qualitative as well as quantitative interpretation. Measurements of the 6160 reveal excellent results by any standards. Tested at 115V and 230V after a 10 minute warm up period.

Specifications In Brief

Rated Power Output:	160W _{RMS} into 8Ω
	<i>(continuous, per channel, driven from 20Hz-20kHz at < 0.04% THD)</i>
	225W _{RMS} into 4Ω
	<i>(continuous, per channel, driven from 20Hz-20kHz at < 0.07% THD)</i>
Bridged	425W _{RMS} into 8Ω
	<i>(continuous, driven from 20Hz-20kHz at < 0.07% THD)</i>
Frequency Response:	5Hz – 40kHz, ±0.25dB
Total Harmonic Distortion (THD+N)	
Typically:	0.005%, @ 1kHz into 8Ω
20Hz to 20kHz:	<0.040%, into 8Ω
Voltage Gain:	27.6dB
Dynamic Headroom (rated with music):	>1.5dB
Voltage Swing:	160V _{p-p}
Maximum Current Output:	24A per channel
Damping Factor:	>500, @ 1kHz into 8Ω
Signal to Noise Ratio	
Rated Output (unweighted):	95dB
Input Sensitivity:	1.3V _{RMS}
Input Impedance:	36kΩ
Smoothing Capacitance:	60,000μF
Driver Stage:	Class A
Output Stage:	Class A/AB
Audio Inputs:	6 x RCA connectors
Audio Outputs:	6 pairs of speaker binding posts
Other Connections	
1 x IEC AC mains input receptacle	
1 x 3.5mm “mini” jack for master remote input (5 – 12V DC)	
1 x 3.5mm “mini” jack for slave remote output (12V DC)	
Power Consumption	
Idle	100W
Maximum	1600W
	<i>(at 4Ω rated output)</i>



Mains Input Voltage

100V, 110V, 120V, 220V, 230V or 240V AC at 50Hz or 60Hz
(Set within the 6160 at time of manufacture)

Dimensions

Width 482mm (19.0")
Height 176mm (6.9")
Depth 460mm (18.1")
(not including feet, terminals and handles)

Fuse Ratings

Mains input fuse

100 – 125V: 2SB slow blow 15A
200 – 250V: 2SB slow blow 10A
(user serviceable)

Internal DC rail fuses..... 12 x 2AG normal acting 6A
(NOT user serviceable)

Weight

Net: 30.0kg (66.1lb)
Gross: 34.0kg (74.8lb)

Specifications Explained

Rated Power Output (per channel)..... 160W_{RMS} into 8Ω

The 6160 has been designed around the industry standard 8Ω load. The 6160 delivers a staggering 160W_{RMS} continuously into 8Ω loads and 225W_{RMS} into 4Ω loads. The 6160 will also handle complex and 2Ω loads with stability and ease when operated in NORMAL mode. Load impedances lower than 8Ω are not recommended when operating in BRIDGED mode.

Frequency Response 5Hz to 40kHz, ±0.25dB

This is the “standard” specification with which everyone is familiar. Actually, “frequency response” is a misnomer: technically, it should be called “amplitude response versus frequency” for it describes how uniform the amplitude or strength of signals of various frequencies is maintained. It is generally thought that a difference of 1db is the least that can be perceived by ear. To better that by a wide margin, the 6160 is specified four times higher, thus far exceeding the audible range of the human ear.

Total Harmonic Distortion (THD+N) 0.005%, @ 1kHz into 8Ω

Measurements are made with fixed, purely resistive loads. However, since speakers are not purely resistive, an amplifier’s distortion specifications do not indicate what performance will be with the actual loads presented by speakers. Perreux distortion measurements hold for any conditions presented by any known speaker. Further, any measurable distortion in the Perreux is second-order harmonics – the least offensive to the ear.

Voltage Gain..... 27.6dB

The amount of amplification the amplifier is asserting on the input signal. Gain can be calculated by dividing the rated output by the input sensitivity.



Dynamic Headroom.....>1.5dB

This indicates the 6160 can provide more than enough extra power to cope with the sharpest musical transients. Without adequate headroom, an amplifier can become unstable under clipping conditions. Perreux amplifiers are intrinsically stable under all dynamic conditions.

Voltage Swing..... 160V_{p-p}

Loud transients call for a sudden burst of power from the amplifier to drive the speakers. This force is voltage. Peak to peak voltage is a more useful specification than Watts when it comes to delivering power to a speaker.

Maximum Current Output..... 24A per channel

Current is the power reserve in the amplifier necessary to deliver the burst of voltage required by the ever-changing audio signal. With more than adequate continuous current per channel and high volts peak-to-peak, the 6160 can easily meet any challenge music can present to it – whether instantaneous or continuous. To be specific it can deliver high power into low-impedance loads and provide great dynamic headroom.

Damping Factor..... >500, @ 1kHz into 8Ω

Another specification not always provided. One reason perhaps, this specification is important when indicating an amplifier's ability to control the cone behavior of speaker systems, which are difficult to drive. Perreux power amplifiers have high damping factors. Thus exerting massive control over the speaker system.

Signal to Noise Ratio (*unweighted*)..... 95dB

The ratio of desired signal to noise signals present in the output. This figure is referenced to the rated output of the 6160, taking into full account all potentially annoying hum components.

Input Sensitivity..... 1.3V_{RMS}

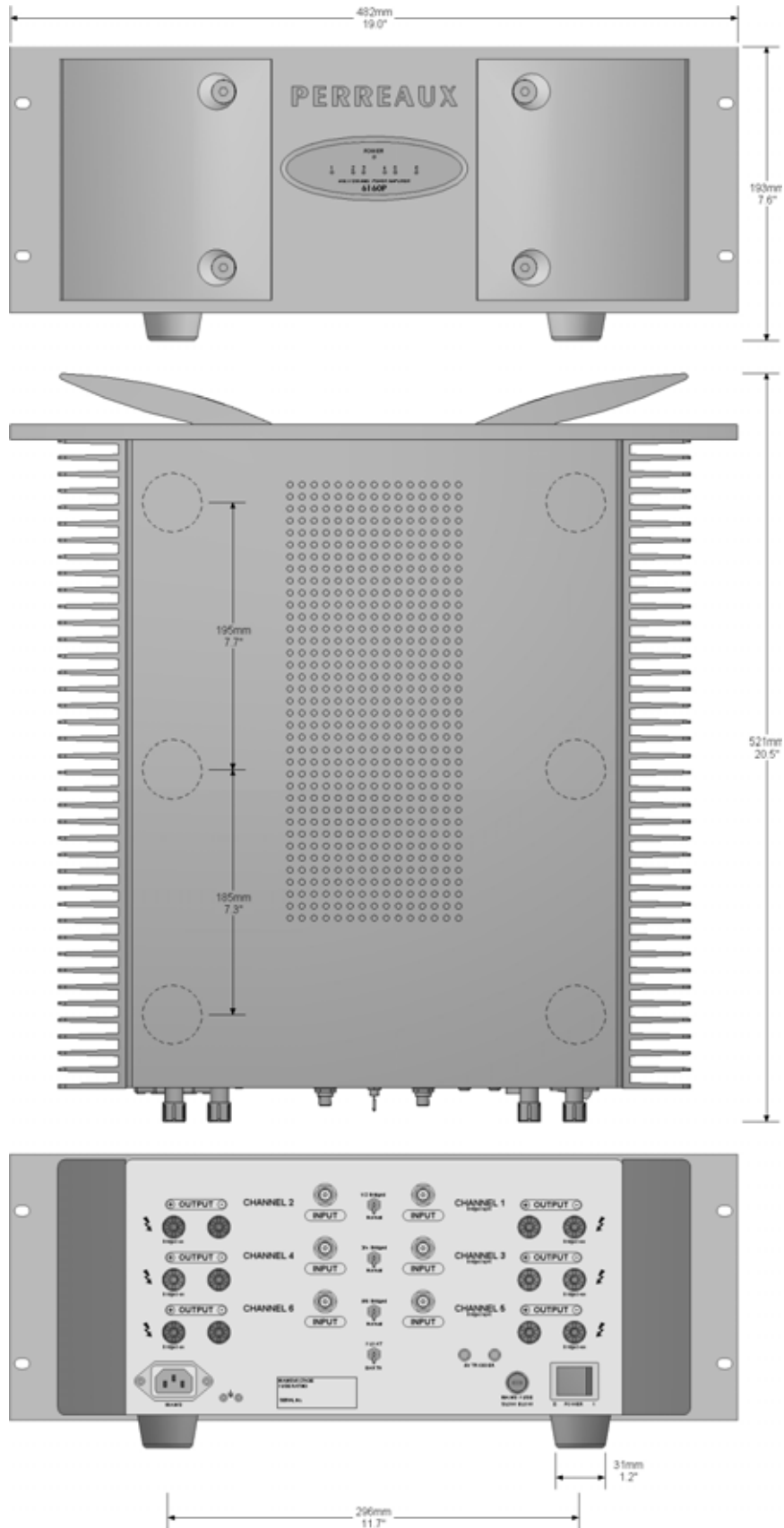
Indicates the amount of input voltage required to drive the unit to its rated output power (160W_{RMS} into 8Ω).

Input Impedance..... 36kΩ

The resistance "load" that is presented to the component that is driving it. The high value indicates that the power amplifier will not load down the output of most high quality preamplifiers.

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Physical Dimensions





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Contact Details

For more information please contact your Perreaux dealer, or contact:

Perreaux Industries Ltd
PO Box 47 413
Ponsonby
Auckland
New Zealand

Ph: +64 9 815-5452

Fax: +64 9 815-5981

E-mail: info@perreaux.com

Internet: www.perreaux.com



Installation Notes

A series of horizontal lines for taking notes, starting from the top left and extending across the page.

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