



# Portico™ 5016

MIC PRE/DI

# USER GUIDE

Serial No:

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### IMPORTANT

For your convenience, write your serial number on the box above and keep this guide in a safe place. The number can be found on the bottom of the product and also on the packaging materials.

This number must be quoted in all communications in order to obtain technical support and spare parts from either the factory or your dealer.

Thank you for your purchase of the Portico™ 5016 Microphone Pre-amplifier and DI module. Everyone at Rupert Neve Designs hope you enjoy using this tool as much as we have enjoyed designing and building it. Please take note of the following list of safety concerns and power requirements before the use of this or any Portico™ Series product.

## Safety

It's usual to provide a list of "do's and don'ts" under this heading but mostly these amount to common sense issues. However here are some reminders:

The Portico™ 5016 dissipates about 9 watts, which means that it will get warm in use. The heat generated is radiated through the case work and by convection through the ventilation holes. Therefore the holes should not be covered or blocked. Portico™ modules may be stacked horizontally on a desktop or mounted vertically in a rack without heat problems. The anti-slip feet may be removed while used in a rack, but should be retained for desktop use. To avoid overheating, Portico™ modules should not be stacked immediately above or adjacent to other equipment that gets hot. Also bear in mind that other equipment may radiate strong hum fields which could spoil the performance of your Portico module.

Don't operate your Portico™ module in or around water! Electronic equipment and liquids are not good friends. If any liquid is spilled, such as soda, coffee, alcoholic or other drink, the sugars and acids will have a very detrimental effect. Sugar crystals act like little rectifiers and can produce noise (crackles, etc.). SWITCH OFF IMMEDIATELY because once current starts to flow the mixture hardens, can get very hot (burnt toffee!) and cause permanent and costly damage. If it gets wet and you suspect that good clean water may have gotten in, immediately unplug the unit, and remove it from the source of water. Please contact support as soon as possible at [support@rupertneve.com](mailto:support@rupertneve.com) for resolution.

Don't be tempted to operate a Portico™ with the cover removed. The cover provides magnetic screening from hum and R.F. stray fields.

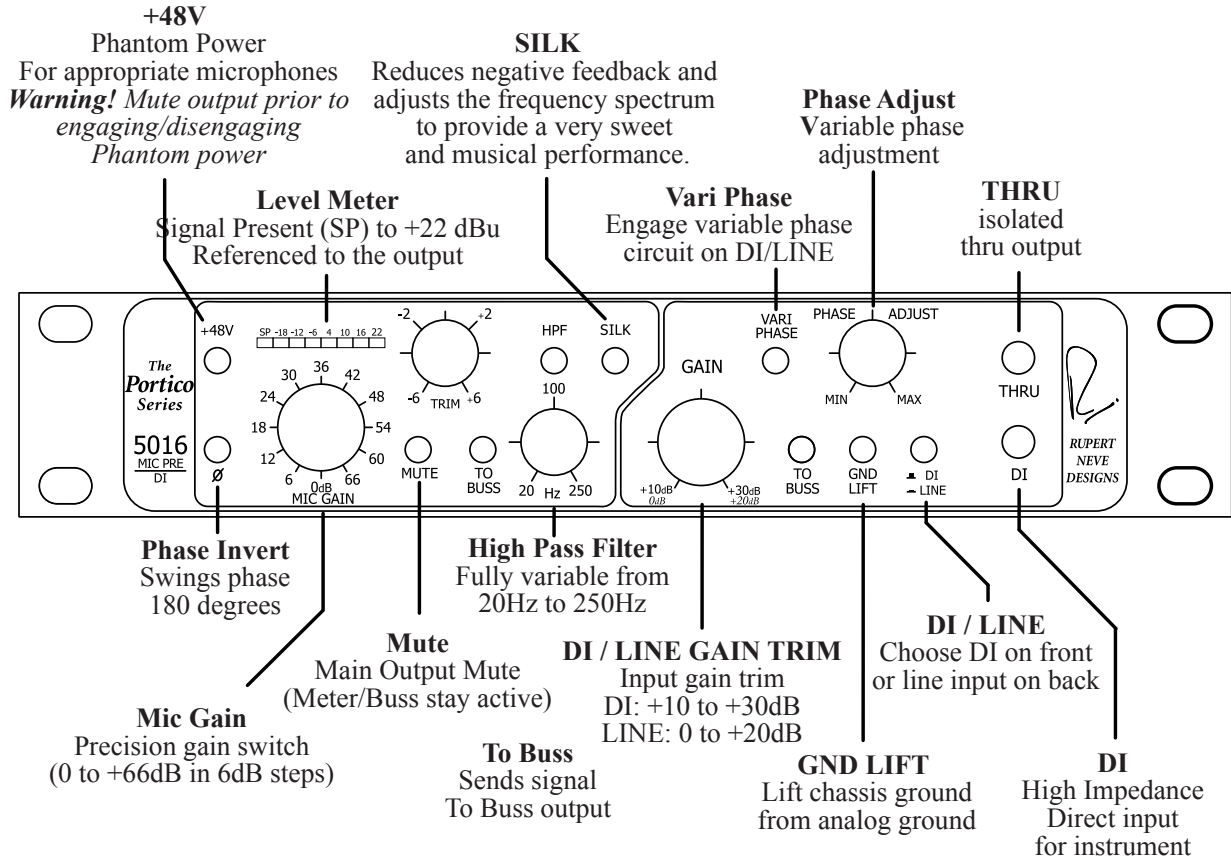
## Power Requirements

Each Portico™ 5016 module has two built-in DC to DC converters that provide +/- 17.5 VDC for the amplifiers and + 48 VDC for microphone Phantom Power. The input is protected from reverse polarity. The connector center pin must be positive. The converters will work from virtually any DC supply from 9 to 18 volts that is reasonably "clean". Avoid using a Power Outlet on the same circuit as air conditioning or other equipment that regularly switches on and off. Unplug the Portico™ power unit(s) during a thunder storm or if it will be unused for a long period.

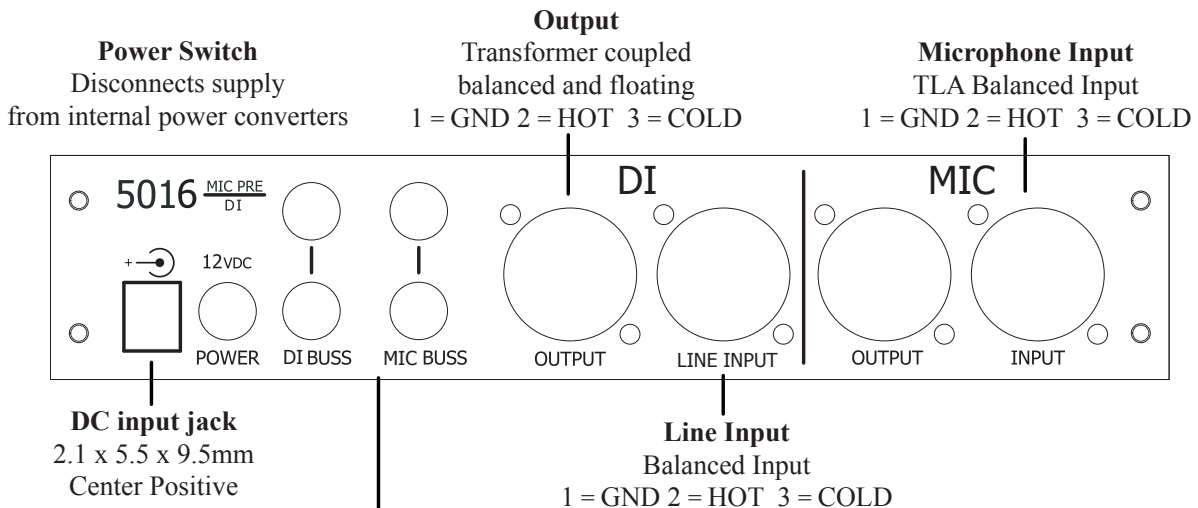
When using a 12-volt battery, choose one that has enough capacity to power your Portico™ 5016 - or your complete assembly of Portico™ modules – for the expected duration of your session. For example, a 48 ampere-hour battery will power 8 Portico™ 5016 modules for 9 hours.

\*See power requirement on specifications page.

### 5016 Mic Pre / DI - Front Panel



### 5016 Mic Pre / DI - Back Panel



#### Portico™ Bussing System

Connect as many units together as you'd like to create your own mixes using optional bussing modules  
Top and bottom rows are normalled together to allow for an IN / OUT / THRU configuration

## The Rupert Neve Designs Portico™ 5016 MICROPHONE PRE-AMPLIFIER AND DI MODULE

The Rupert Neve Designs 5016 module is a half rack width, 1.75" (1U) module in the now well-known Portico™ style. As with the entire Portico™ range, the construction is a heavy and robust steel shell that provides total magnetic screening and exceptional mechanical stability. The front panel is machined from a solid .20 inch aluminum plate with a steel sub panel behind it.

Alternative front panel layouts are available providing a choice of vertical or horizontal mounting. When the horizontal front panel is chosen, a single 5016 can sit firmly on a bench or desktop on its detachable rubber feet. Two 5016s can be joined with the optional Horizontal Joining Kit, model number 5221-RM, and mounted across a standard 19" rack.

When the vertical option is chosen, up to eight 5016s can be mounted in the optional vertical frame, model number 5285-RM. This leaves a 3" wide space that can be used to house a power supply or other future modules. The vertical frame assembly is designed for rack mounting and includes basic rear cable management. Blank panels are available to fill any unused spaces when the full complement of eight modules is not fitted into the vertical frame.

### MICROPHONE INPUT

The microphone input is balanced but not floating, being a variant of an instrumentation amplifier. My well-proven "Transformer-Like-Amplifier" (T.L.A.) configuration is used, which includes an accurate toroidal Common Mode Low Pass Filter that rejects Common Mode signals and excludes frequencies above 150 kHz. (There are high powered broadcast transmitters at and above this frequency in several Continents and, even if you can't hear them, any vestigial intermodulation products must be excluded!)

When the Mic Gain switch and Trim controls are set to Unity (0 dB) the Portico™ 5016 microphone pre-amplifier can handle a balanced input signal of more than +20 dBu without an input attenuator pad! This is a unique feature that enables this input to double as an additional line input.

## THE MIC PRE OUTPUT

The output stage is identical with that of the Portico™ 5012, using single-sided circuitry, driving a carefully configured output transformer that can deliver a full +25dBu from the balanced and ground-free secondary winding.

This maximum output level provides a large margin over and above the likely maximum requirement of any destination equipment to which the Portico™ 5016 may be connected. This is especially true when feeding digital equipment!

Freedom from the interference fields that are inevitably present in any control room is virtually guaranteed by the balanced, ground-free design used in the Portico™ modules. My original classic modules always used transformers, as do a number of other high quality vintage modules still in current use.

High quality transformer connectivity has been used for many years, enabling modular amplifier units to deliver the sonic performance for which they are famous.

Bear in mind that human ears are very sensitive and can perceive incredibly minute interference signals that are not part of the “desired” signal. If unbalanced connections are used, great care must be exercised to avoid ground loops and common signal paths. Reduced immunity from various forms of interference can be tolerated (sometimes) but usually results in a loss of that transparent musical resolution that we all love.

However, the output of any Portico™ transformer-coupled module may be used with one side grounded if necessary, for example to use with “Hi-Fi”, “consumer” or other unbalanced audio gear, without degrading the performance of such devices. Care must be exercised when using ancillary equipment to avoid overloading it.

## THE BUSS OUTPUT

The Buss output is balanced and high impedance, and the BUSS connection is derived pre-mute. It is intended for use with modules in the Portico™ range which are equipped with a matching MIX or BUSS input.

The Portico™ 5016 BUSS output has dual, paralleled, TRS connectors that allow any number of Portico™ modules to be mixed to the BUSS input on any of these appropriate modules using a standard TRS patch cord.

When multiple Portico™ modules are configured in a console assembly, mixing busses will be available at many points (beyond the ones traditionally expected), providing enormous flexibility. More detailed descriptions with suggested block and system diagrams are available in the future on the Rupert Neve Designs website at [www.rupertneve.com](http://www.rupertneve.com).

## DESIGN NOTES

In former years, before the introduction of solid state amplifiers, transformers were necessary to step up to the very high input impedance of tubes, and to provide a balanced input for the microphone line. An input impedance of 1,000 or 1,200 ohms became established for microphones having a source impedance of 150 or 200 ohms, with connection being made on a twisted twin screened cable (This type of cable, while excellent for low impedance work, has high capacitance between its conductors and between each conductor and screen. Resultant high frequency losses are excessive with piezo pickups and may cause resonances with magnetic pickups) Thus microphones were not heavily loaded. Condenser microphones worked off high voltage supplies (300V!) on the studio floor which polarized the diaphragms and powered a built-in pre-amplifier.

More and more microphones were needed as “Pop” music gained ground and this led to the popular and efficient method of 48-volt “Phantom” powering that was built into the multi-channel recording Console – in place of numerous bulky supplies littering the studio, a miniature pre-amplifier now being fitted inside the microphone casing.

The 48-volt supply was fed to the microphone through balancing resistors so it was impossible for this voltage to actually reach the microphone, resulting in low polarizing volts and virtual starvation of the little pre-amp inside the microphone. Nevertheless amazingly good microphones were designed and made, becoming the familiar product we use today.

If a low value resistive load is connected to the output of an amplifier, that amplifier has to produce power in order to maintain a voltage across that load. Obviously if we want more voltage (output from the microphone) we need to provide a larger supply for the amplifier or settle for a lighter load.

A microphone is a voltage generator, not a power amplifier. Most microphones give their most accurate performance when they are not loaded by the input impedance of a traditional preamplifier.

If the microphone uses an electronic circuit (transformerless) output, a low value of load impedance will likely stress the little microphone pre-amplifier, causing slew rate and compression at high levels.

On the other hand, a high value of load impedance allows the microphone to “breathe” and give of its best, this being particularly advantageous with very high level percussive sounds.

If the microphone has an inductive source (such as would be the case if it has a transformer output) a low value of load impedance causes the high frequencies to roll off due to leakage inductance in the transformer in addition to the above amplifier distortion (This can be an advantage with some microphones!).

For this reason I have provided a high value of input impedance that will load microphones to the smallest possible extent and makes the best possible use of that limited “Phantom” 48-volts supply.

MIC PRE CONTROLS

- MIC GAIN   A 12-way precision rotary switch covering from 0 to 66 dB in 6 dB steps.    
  Selecting the right gain optimizes Noise and Headroom.
  
- TRIM   Provides further gain adjustment, continuously over a range of +/- 6 dB.
  
- +48V   Push button makes phantom power available at the microphone input.
  
- Ø   Push button inverts the phase of the signal path.
  
- MUTE   Disconnects the main output.
  
- SILK   Much could be written about this feature, but suffice to say that it gives a subtle option to enhance sound quality in the direction of vintage modules. The SILK button reduces negative feedback and adjusts the frequency spectrum to provide a very sweet and musical performance. We suggest you try it and make your own judgment.
  
- TO BUSS   Provides a resistive feed to the Portico™ Buss mix system.
  
- HPF   A 12 dB/octave high pass filter providing continuously variable Low Frequency   
attenuation between 20 Hz and 250 Hz. The high pass filter is a valuable aid in   
any signal chain but particularly so in a microphone preamplifier. Signals    
within this band can be attenuated, leaving higher frequencies unaffected.    
Helps get rid of building rumble, air handling motor hum etc. (see fig. 1)

RUPERT NEVE DESIGNS

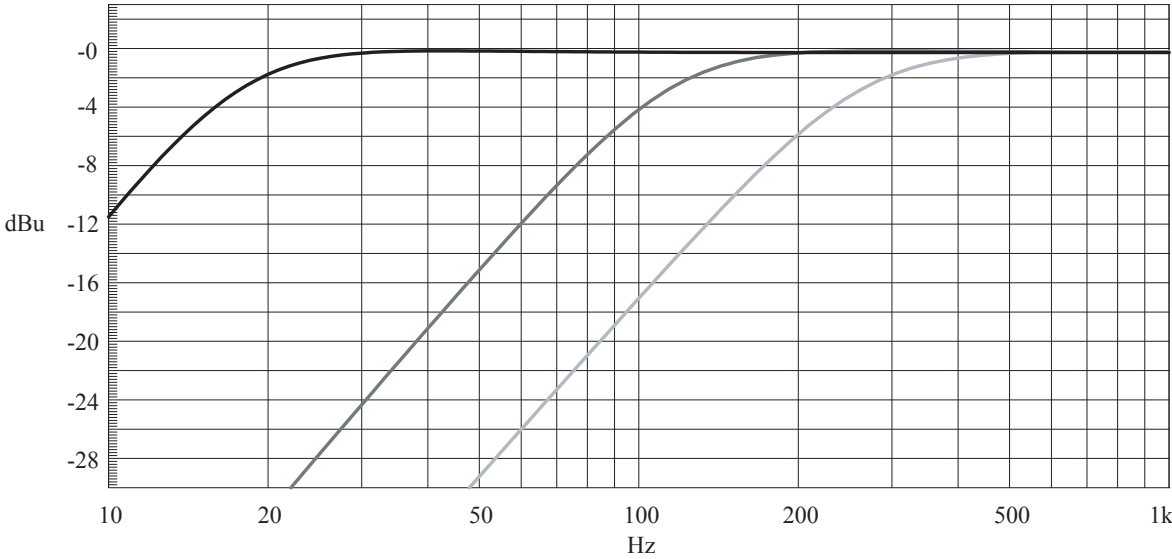


fig. 1: 5016 HPF min, mid, max





## The D.I. and LINE channel of the Rupert Neve Designs Portico™ 5016

The D.I. and Line Preamp Channel is completely separate from the Microphone Preamp Channel housed in this Portico™ 5016 half rack 1U module.

The Channels may be used separately without interaction but the real power of the 5016 lies in the Variable Phase feature incorporated into the D.I. Channel that enables a musical Instrument to be phase-aligned with a voice signal from the microphone input on the Microphone Channel when the microphone and D.I. signals are later mixed.

### The D.I. and LINE channel.

#### The D.I. Input.

With a few notable exceptions, musical instrument pickups, need to work into a very high load impedance. Great care is needed to ensure that the connecting cable and the method of connection does not allow introduction of interference or hum. High quality connecting Plugs should be used (and kept clean!). The cable should be a "low noise", "low capacitance" type and, preferably, not more than about 20' (6 Metres) long.

For these reasons the Portico™ 5016 D.I. is fitted with a T.R.S. (Tip-Ring-Sleeve) "Jack" input on the front panel. The input circuit is a "T.L.A.", amplified transformer configured to provide a very high input impedance; 3 Megohms, between the Tip and Ring legs and an even higher impedance between each leg, (Tip or Ring) and Ground. In this way, although the source (the pickup) is not usually balanced, many of the isolation and grounding benefits of a balanced input are obtained from the Transformer together with the sweet musical character that stems from the elimination of those extremely low level, out-of-band distortion and noise artifacts that cannot be heard but which can intrude subliminally into equipment that is not so uniquely protected.

Either a T.R.S. (Tip-Ring-Sleeve) or a Single Pole "Plug" may be used, depending on the pickup. (see wiring diagram)

For historical reasons unbalanced connections have become the norm with musical instrument pickups. Combining very high impedance with the unbalanced circuit topology constitutes a considerable challenge to the designer who has to ensure the highest possible music signal quality under all conditions.

#### The Line Input

Keyboards, Synthesizers and some low impedance Instrument Pickups generally require a much lower load impedance. However they are often unbalanced and need less gain. Similar care is needed to ensure that the connecting cable and the method of connection does not allow introduction of interference or hum.

The Line Input is on the back panel, with direct connection to the balanced and floating input transformer - no T.L.A. being necessary - the full advantage of the Portico™ Line input Transformer is here used to the full, connection being made via a professional XLR connector.

The Line Input should be used in balanced configuration when possible.

## The D.I. and LINE channel Outputs

The Output stage is identical with that of the Microphone Preamplifier Channel, driving a carefully configured balanced and floating Output Transformer designed to safely feed long lines with up to 25 dBu.

Inter-connection of Professional equipment should always be carried out using balanced lines in order to ensure freedom from interference and hum. A balanced line carries the "Send" and "Return" music signals on two wires that are inside a screening outer lapped or woven "Ground" mesh. So the Ground or Screen connection is not involved with carrying the music signal but is left to do its job of protecting the music from outside garbage or power line currents that may be circulating between modules or floating around a stage with powerful lighting.

## Application Notes

The benefits of Variable Phase cover a number of powerful professional applications and include "fun" effects that can add amazing treatments to the combination of sound sources.

D.I. (Direct) and a microphone signal are often combined to best capture the essence of the instrument signal, together with that of the selected amplifier and room. However, acoustically derived signals from a microphone can never be exactly phase-coherent when combined with signals from a stringed instrument pickup or electronic keyboard, and these issues are only exacerbated when the microphone is recording an amplified loudspeaker. These phase cancellations and additions can be especially detrimental to the low end response.

### Suggested Applications:

1. When using a traditional DI in combination with a microphone signal, the only option to alter phase is to reverse the DI phase or to move the microphone to find the best possible combination point. These methods force the engineer to take the microphone away from the "sweet spot" of the speaker or instrument, and inches of difference in microphone position can greatly change how the two sources combine in phase.

The Variable Phase control on the 5016 allows the direct signal to be rotated across a wide range, enabling the microphone to be placed where it sounds best. When, in addition, Variable Phase is combined with the Phase Reverse switch on the microphone preamp, very powerful control over musical instrument recording is available.

2. When using Variable Phase on already recorded sources such as a snare drum mixed with overheads, follow the same process. Patch the snare track into the XLR Line Level Input, and select Line Input. To find the most phase coherent combination, sum the 3 signals to mono and reverse the phase on both of the overhead channels. Adjust the Variable Phase control to rotate the phase of the snare track until the sound of the snare drum is at it's minimum. Correct the phase on the overhead tracks and listen to make sure the combination sounds as intended.

**Mic Channel****Frequency Response:** 

- Main Output, no load,
- 3 dB @ 18 Hz
- 3 dB @ 160 kHz

**Noise:**

Measured at Main Output, unweighted, 22Hz-22kHz,  
Terminated 150 Ohms.

- With gain at unity   better than -100 dBu
- With gain at 66 dB   better than -62 dBu
- Equivalent Input Noise  better than -128 dBu

**High Pass Filters:**

Continuously variable swept frequency from 20 Hz to 250 Hz.  
Slope:    12 dB/Octave

**Gain:**

- Unity to +66dB in 6 dB steps,
- Trim continuously adjustable from -6dB to +6dB

**Buss Output:**

Output is designed to feed a Buss-mix Amplifier (ie. Buss inputs on 5043) at the internal system level of -2.5 dBu.

**Maximum Output Level:**

- Maximum output from 20 Hz to 40 kHz is +24 dBu.

**Mute:**

- Mutes Main Output only.

**Phantom Power:**

- + 48 Volts DC +/- 1%

**Total Harmonic Distortion and Noise:**

- @ 1kHz, +20 dBu output:
- Main Output:   Better than 0.002%
- @ 20Hz, +20 dBu output:
- Main Output:   Better than 0.020%
- Silk Engaged:   Better than 0.2% Second Harmonic

**Meter:**

Eight segment LED.

**Power requirements:**

- Voltage range:   9 to 18 Volts DC
- Current consumption:
  - @ 9VDC Current is 1000 mA typical: Power = 9W
  - @ 12VDC Current is 800 mA typical: Power = 9.6 watts
  - @ 15VDC Current is 610 mA typical: Power = 9.15 watts
  - @ 18VDC Current is 520 mA typical: Power = 9.36 watts
- Connector:  5.5mm X 2.1mm DC jack, Center Positive

**Instrument / Line Channel:****DI/Line:**

"DI" Selects front panel TRS, "LINE" activates rear panel XLR input.

**Frequency Response:**

Line input / Main Output, no load,

-3.00 dB @ 160 kHz

DI input / Thru Output: +/- 0.50 dB 10 Hz - 200 kHz

**Gain:**

DI selected: Continuously variable +10 dB to +30 dB (THRU out is always unity)

Line selected: Continuously variable 0 dB (unity) to +20 dB.

**Maximum input level:**

DI: +14 dBu

Line: +24 dBu

**Input Impedance:**

DI: 3 Meg Ohm

LINE: 10,000 Ohm

**Total Harmonic Distortion + Noise:**

Main Output, unity gain:

@ 1 kHz, +20 dBu output: Better than 0.001%

@ 40 Hz, +20 dBu output: Better than 0.020%

**Variable Phase:**

Rotates the phase of the DI input (or line if selected) 0 to 180 out (frequency dependant)   
at the rear XLR and Buss outputs. "THRU" jack is not affected.

**DI Output (XLR):**

Maximum Output from 20 Hz to 40 kHz is +24 dBu, Transformer isolated and floating.

**Buss Output:**

Output is designed to feed a Buss-mix amplifier (i.e. Buss inputs on the 5043 or 5014) at   
the internal system level of -2.5 dBu.

**Ground Lift:**

Isolates analog ground from chassis ground.

BLOCK DIAGRAM

