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Calrec: Mic Pre/EQ – Compressor Rackmounting Project

Design Details

Calrec Mic Pre/Compressor Quick Start

1. Connect the Power Supply Box to AC power, making sure not to disable the safety ground of the AC Mains connector

2. Connect the 6 Pin XLR cable from the power supply to the audio box. Make sure the proper end is connected to the power supply. This end is labeled “Power Supply”

3. Turn on the power and use the box as you would any other channel strip

Here are some special notes:

1. This Calrec processors use Transformers for microphone inputs and compressor outputs. Transformers are subject to electromagnetic interference such as from AC power transformers. Do not mount the audio box directly above or below a piece of gear with an AC transformer inside. If you hear any unexpected hum from the audio outputs, then you may be having this problem and need to move the offending piece of equipment.

2. Due to mounting of one of the AC power supplies in the Power Supply unit, I was not able to put in one of the screws that supports the bottom panel of the power supply to the side of the box. Please do not mount the power supply in such a way that the metal is bent during operation. IE: Place it only on a solid surface, preferably rack mount it to prevent anything from pressing against the bottom of the power supply

3. The Line Input, Mic Input, and Compressor out are all balanced connections. All other connections are unbalanced. When using a TRS cable with these unbalanced connections, the “ring” connection is grounded instead of left floating.

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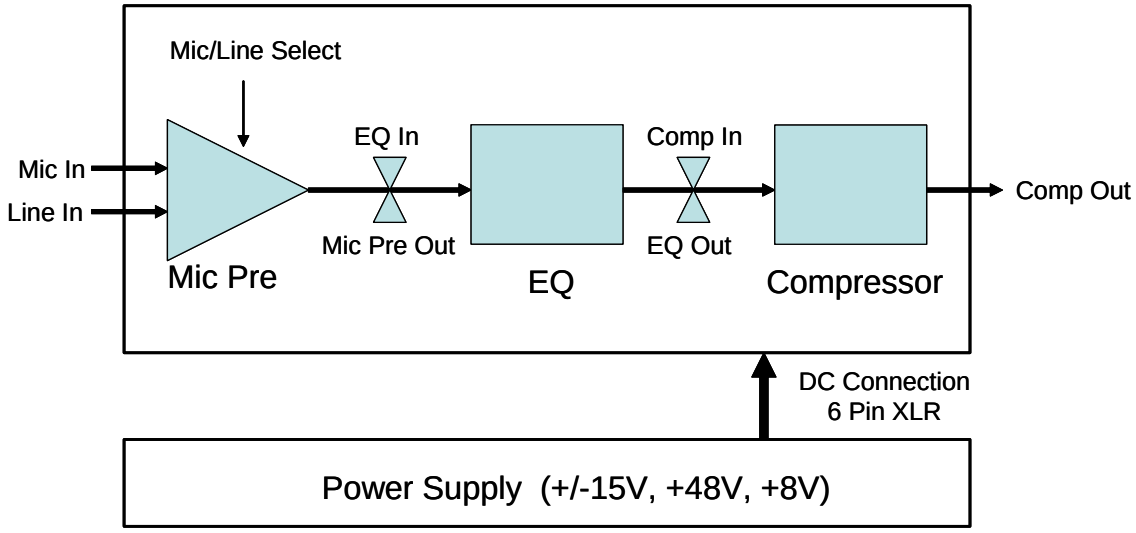
Calrec Mic Pre/EQ – Compressor Rackmounting

INTRODUCTION

The scope of this project was to rackmount two each of the PQ1253 Microphone Preamp/Equalizer modules and two each of the DL1656 Compressor/Limiter modules.

The modules will be placed in a channel strip configuration with the mic pre and the compressor next to each other. The user can plug a microphone into the input of the preamplifier and drive a recording/mixer device from the compressor output without any patch cables due to normalled connections on the rear of the unit. Additionally, connections are supplied for the user to tap into or drive any individual component of the signal chain.

The power supply is a separate mounted box to maintain low noise specifications. Power supplies are chosen as commercially available models to maintain high reliability. Heat dissipation is minimized in all areas – especially the audio rack unit. The power supply will connect to the channel modules using a custom umbilicus cable.



Calrec PQ1253/DL1656 System Block Diagram

POWER SUPPLY REQUIREMENTS

Current Requirements

The modules were connected and current draw measured to size the power supplies. The table below shows the maximum current draw for each of the modules. Note that making these measurements took into account changes in current requirements as the signal level increased and as LED's turned on. The power supplies will be able to turn on all LED's and maintain that level without any current limit issues. Realistically the user will never run the compressor/limiter at 30dB of attenuation constantly, but the supplies must be sized to handle this current requirement.

Calrec Power Supply Requirements (all values in mA)

	+/-16V	+5V	+8V (BL)	+48V (Phantom)
PQ1253 - A card	20	10	--	30
PQ1253 - B card	50	10	--	--
DL1656	120	--	220	--
Total per channel	190	20	220	30
Total two channels	380	40	440	60
25% Safety Margin	95	10	110	15
Total Current Required	**475**	**50**	**550**	**75**

Design Details

The power supply has been designed as a separate unit. This is so that it can be removed in location from the main audio path components. The power supply is connected to the mic pre/compressor unit using a standard Neutrik 6 pin XLR connector, NC6MX. Both units will have female panel mount connectors with the cable made with two male connectors. The power supply unit will be wired to allow for driving two audio equipment sets for future expandability.

The AC power inlet is fused and filtered using an inline RF filter. The AC travels to the fuse and then to the power switch where both legs of the AC are switched. The AC then runs to the three internal power supplies.

The output of the three internal power supplies is run to separate fuses for each supply and then to a status LED as well as to the output connectors. Please note that at this time all units are fused at ½ amp, any changes in drive requirements such as adding other components will require changing the fuses.

Internally the power supply consists of three commercially available units with the following capabilities and connections:

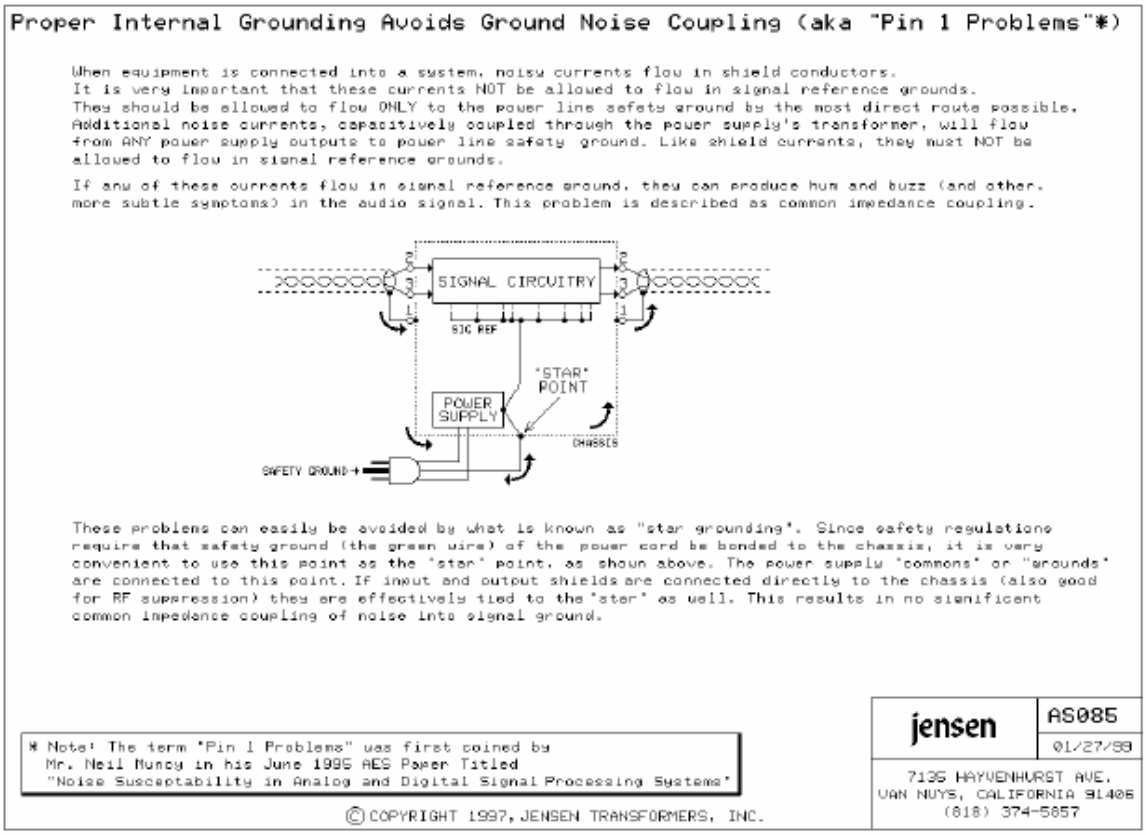
Power Supply Voltage	Current Capability	Connector Pin
+15 V	1.5 A	1
-15V	1.5 A	2
+48V	500mA	3
+8V	4.4A	4
GND	----	5,6

+5V is required for lighting of the LED's and the reed switches in the microphone preamplifier. A standard 7805 regulator is used to generate +5V from the +8V supply. This regulation is done inside of the audio box due to the low current requirements of this voltage.

Additional RC filtering is provided inside the audio box to filter any interference that could accumulate on the DC power cable. This filter is made of electrolytic capacitors as four 2W 1Ω resistors in parallel.

Grounding

This unit follows the grounding scheme recommended in the Jensen Transformers application note AS085 as seen below.



Internally to the power supply all ground connections are tied together at one location with the AC safety ground. The cable connecting the power supply and the audio units provides the same ground (found on pins 5 and 6). Additionally, the shields of the power connecting cable are tied to the chassis ground of the XLR cable at the power supply end of the cable only. This provides shielding for the power cable, but prevents ground loops.

NOTE: The power supply end of the cable is labeled. Please use this end at the power supply only!

Despite other grounding methods, the potential for ground loops was such that this, the most safest method was chosen. Authentic Audio is not responsible for any modifications to the equipment after it is shipped to the user.

PQ1253 MICROPHONE PREAMPLIFIER

Signal Path

The microphone preamplifier has an interesting configuration. For lower gain settings, the system uses a different transformer from the higher gain settings. Additionally, active switching chooses which input transformer is used (high or low gain). Additionally, there is an electronically balanced Line Input.

The user can switch between mic input and line input.

The stepped gain switch sends a signal which, when tied to the mic hi/lo input will automatically "switch in" extra resistance to the microphone level transformer and choose which output path is used (higher gain or lower gain).

To determine how to properly connect this signal, input impedance measurements were made with the gain switch in different positions.

	Gain Switch (+10 to –25dB sensitivity)	Gain Switch (-30 to –70dB sensitivity)
Mic High Level Input	15kΩ	15kΩ
Mic Low Level Input	1500Ω	>100kΩ max measurement (1MΩ per the schematic)

The input impedance of the Line Level input is 22kΩ.

Based on these measurements, it was determined that the two microphone inputs can be hooked together, in parallel, to the same XLR input connector. When the gain switch is moved, the *Low Level Input* impedance is shifted to a high impedance such that there is no loading on the input signal. The relatively

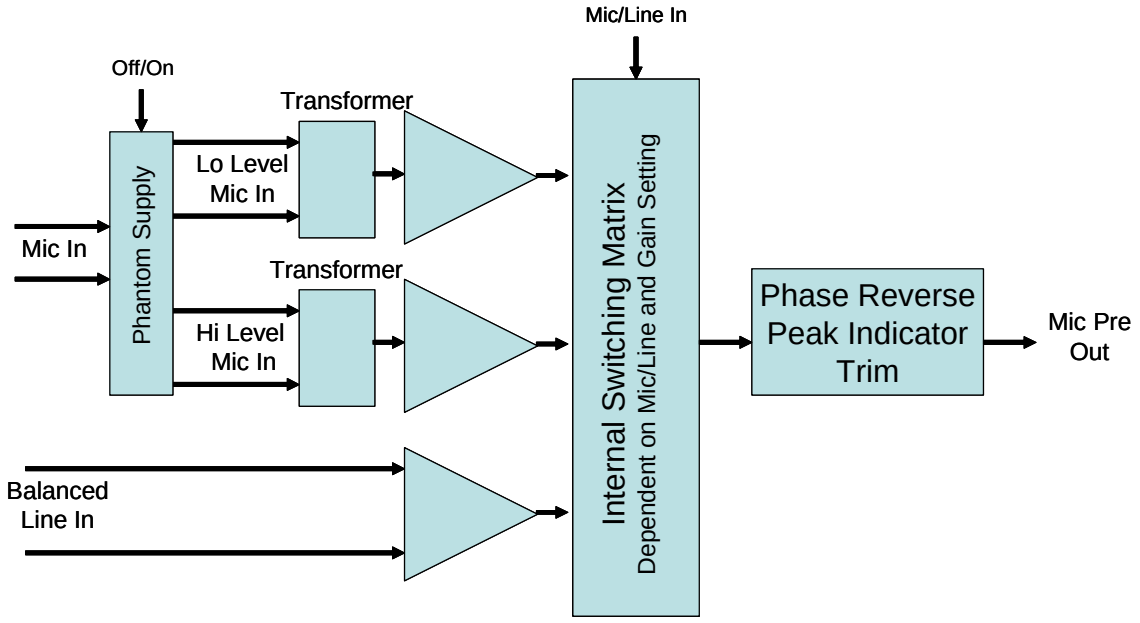
high input impedance of the *High Level Input* does not impact the Low Level input in either gain setting.

To verify this theory the rise time and ringing of a square wave input at 500Hz was measured with individual inputs and with the inputs paralleled. There was no change in the rise time or ringing as a result of the "parallel-ed" transformer inputs.

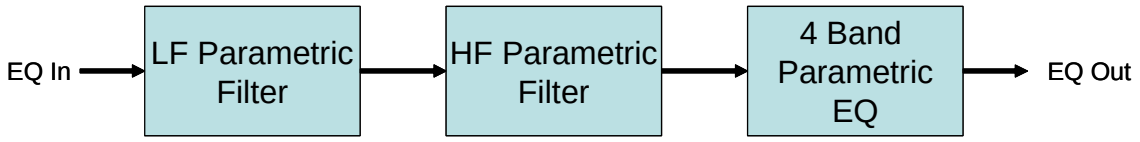
The resulting input impedances for the microphone XLR input are:

	Gain Switch (+10 to –25dB sensitivity)	Gain Switch (-30 to –70dB sensitivity)
Mic Input Impedance	15kΩ	1500Ω

The following is a block diagram for the Microphone Preamplifier Card A/B:



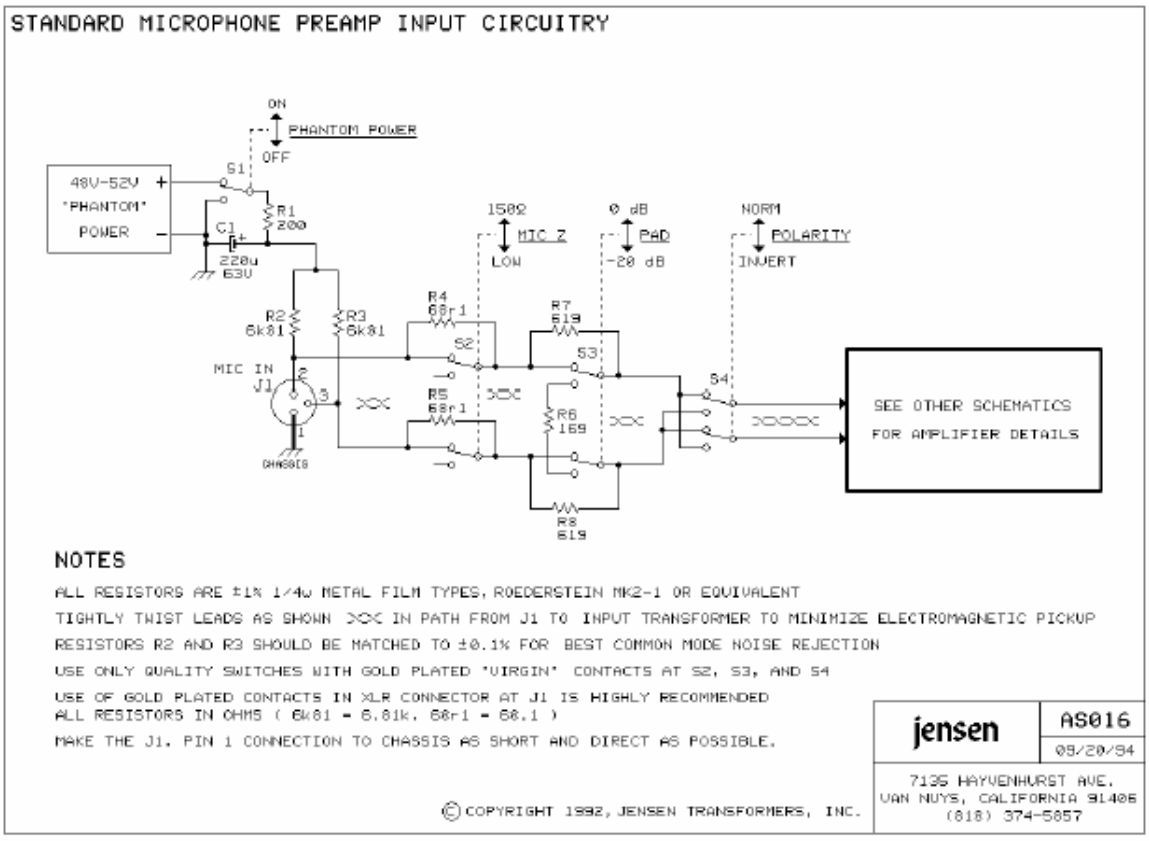
Calrec PQ1253 Microphone Preamplifier Block Diagram



Calrec PQ1253 Equalizer Block Diagram

Connections

To provide Phantom Power for microphones, the two microphone XLR connectors have been wired per the Jensen Transformers application note, AS016



Please note that only the phantom power part of this schematic has been implemented. This is done using a PCB designed to handle the filter capacitor and the two 6.81kΩ resistors as well as an indicator LED. The phantom power is switched at the front panel and connected to the rear mounted XLR connectors using shielded cable.

To allow use of this device connections to the back of the preamplifier are made via DIN standard 41612 size B connector (IEC 60603-2) with 32 connections in the A row only.

The following connections are used for the Mic Preamplifier Card (card B):

Signal Name	**Connection Pin**
Line Input (Balanced)	22 and 23
MIC Low Level Input (Balanced)	30 and 31
MIC High Level Input (Balanced)	28 and 29
Audio Out+	31 (tied to “Audio in” of card A)
Line/MIC Select (Tie to GND for Line Input, Float for MIC)	1
MIC Sensitivity Input	2
MIC Sensitivity Drive (Driven by Gain Setting)	3 (tie to pin 2)
+5V	19
+5V GND	18
+16V	16
-16V	15
+/-16V GND	17
Chassis GND	32

For this application, the Mic Preamplifier output is wired first to the phase/trim/peak detection of card A and then to an unbalanced output, in the case that the user wishes to bypass the EQ circuitry. Additionally, the Mic Pre out of the PQ1253 normalled to the input of the EQ unit to allow a signal path without any additional patch cables.

The following connections are used for the Equalizer Card (card A):

Signal Name	**Connection Pin**
Audio In+	10 (From card B)
Audio Out+	31 (EQ Output)
Trim/Peak Detect Output	14 (Mic Pre Out)
Filters (EQ) Input	21 (EQ Input)
+5V	19
+5V GND	18
+16V	16
-16V	15
+/-16V GND	17
Chassis GND	32

There are a few other switches and pins noted on the schematic but many of these seem to be options that were not needed for the application or were not provided by the manufacturer for this model.

For this application, the EQ input is wired to take an unbalanced input if connected, however, the output from the unbalanced Mic Pre out of the PQ1253 card B is normalled to the input of the EQ unit to allow a signal path without any additional patch cables. The output is wired as an unbalanced signal that is normalled with the balanced input of the DL1656 compressor/limiter.

All ground connections are tied together at a single location inside the rack chassis for the unit. A single wire provides ground connection to the power supply (pin 5/6). This is in-line with the Jensen Transformers application note AS085.

DL1656 COMPRESSOR/LIMITER

Signal Path

The DL1656 uses the industry standard dBx2150 VCA (Voltage Controlled Attenuator) to accomplish dynamic range compression. The side chain signal is generated from a limiter detect circuit and a compression circuit, with parameters controllable by the user.

The audio path has an electronically balanced input and transformer balanced output.

The input impedance of this device is 22kΩ.

Connections

To allow use of this device connections are made via DIN standard 41612 size B connector (IEC 60603-2) with 32 connections in the A row only. The following connections are used:

Signal Name	Connection Pin
Audio In+	9
Audio In-	10
Audio Out+	29
Audio Out-	30
+BL (8 Volts)	20
+BL Ground	18
+16V	16
-16V	15
+/-16V GND	17, 31, 7
Chassis GND	32

For this application, the device is wired to take a balanced input if connected, however, the output from the unbalanced EQ out of the PQ1253 unit is normalled to the input of the DL1656 unit to allow a signal path without any additional patch cables. The output is wired as a balanced signal.

All ground connections are tied together at a single location inside the rack chassis. A single wire provides ground connection to the power supply (pin 5/6). This is in-line with the Jensen Transformers application note AS085.

Calrec Rackmounting Piece Part Requirements							
Description	**QTY**	**Supplier**	**Part Number**	**Cost Each**	**Total Cost**	**Notes**	**Ordered**
Fuse holder	5	Mouser	441-FH001	$1.39	$6.95	+15, -15, +8, +48, 120VAC	
1/2 amp fuses	10	Mouser	5760-12500	$0.40	$4.00	3AG Fast Blow	
Power Switch	1	Mouser	611-7201-005	$6.14	$6.14	DPDT	
Filtered AC inlet	1	Mouser	562-857-03/17	$4.34	$4.34		
48V filter caps	1	Mouser	647-UPW2A471MHH	$3.03	$3.03		
.1uF caps	10	Mouser	80-CK06BX104K	$0.44	$4.40		
8V heatsink	1	Mouser	532-531302B25	$1.26	$1.26		
6 pin XLR panel F	3	Mouser	568-NC6MP	$8.04	$24.12		
6 pin XLR cable M	2	Mouser	568-NC6MX	$4.90	$9.80		
5 cable wire	10ft		-----	-----	$0.00	No Charge	
1 Watt Resistors	16	Mouser	282-1.0	$0.19	$3.04		
Phantom Switches	2	Mouser	611-T101-001	$4.62	$9.24	SPDT	
Mic/Line Switches	2	Mouser	611-T101-002	$4.73	$9.46	SPDT	
Phantom Caps	2		-----	-----	$0.00	No Charge	
Phantom Resistors	4		-----	-----	$0.00	No Charge	
1/4" Female	2	Mouser	568-NYS215	$0.68	$1.36		
48V Supply	1	Mouser	675-HB48-0.5A	$42.37	$42.37		
9V Supply	1	Mouser	418-CFM1009S	$18.00	$18.00		
Shipping					$10.00		
Enclosure	2	Sescom	2RU10	$51.75	$103.50		**X**
Shipping					$10.95		
XLR's	2	Mouser	NC3FD-L-1-B	$3.85	$7.70		**X**
1/4" Female	10	Mouser	568-NYS215	$0.68	$6.80		**X**
Elco Connectors	6	Mouser	064-001-025	$3.86	$23.16		**X**
Shipping					$4.00		
TOTAL					$313.62		
+/-15V Power Suply					N/C	Worth $60	
Misc PCB					N/C		
Misc Wiring					N/C		