

## GQ Series Interpolating Constant-Q Equalizer

### General Description

The Rane GQ Series Interpolating Constant-Q Equalizers consist of the GQ 15, a two-channel, 2/3-octave design and the GQ 30, a one-channel, 1/3-octave version. Housed in a two rack-space unit, these units feature long throw 45mm sliders for excellent resolution of settings, as well as adjustable bandlimiting Low and High Cut Filters.

The active filter sections of these units feature Rane's patented (#4,891,841) constant bandwidth (constant-Q) design. The bandwidth of each individual filter is guaranteed to be narrow enough to prevent unwarranted interaction between filters, yet wide enough to produce the optimum type of correction curve demanded by the the most unusual acoustic surrounding. This differs dramatically from conventional designs of the past. Earlier designs are encumbered with the unfortunate characteristic of changing bandwidth with changing boost/cut amounts.

The GQ's, aside from being constant-Q devices, also

provide what Rane has dubbed "Interpolating" performance. This means that when two adjacent bands are boosted or cut to the same level, the response of the equalizer peaks (or interpolates a response) at a frequency centered between the filters. Interpolating performance allows effective control between ISO centers.

Front panel controls and indicators include an input and output gain control as well as individual overload indicators. The rear of the unit provides balanced 3-pin input and output connectors; a 1/4" balanced Tip-Ring-Sleeve connector for the same, and a barrier strip which provides access to all of the above. This full range of connectors also allows unbalanced operation by using only the positive and signal ground conductors of any of the Inputs or Outputs. Included also are 1/4" Tip-Ring-Sleeve Patch I/O jacks. These allow connecting to conventional tip-send ring-return insert points on mixing consoles using only a single 1/4" TRS cable.

### Features

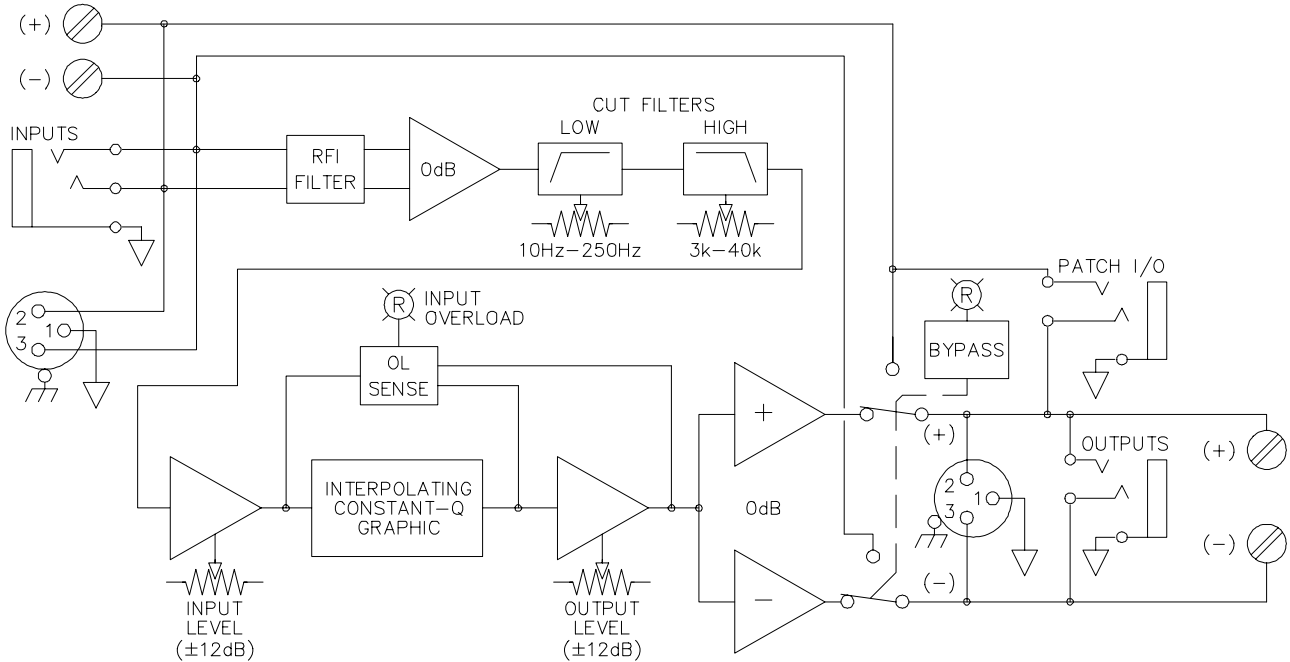
- **INTERPOLATING CONSTANT-Q DESIGN**
- **ADJUSTABLE LOW & HIGH CUT FILTERS**
- **TERMINAL STRIP, 3-PIN, & 1/4" TRS BALANCED INPUTS AND OUTPUTS**
- **GROUNDING CENTER DETENTS**
- **INDEPENDENT INPUT AND OUTPUT LEVEL CONTROLS**
- **INDIVIDUAL BYPASS SWITCHES WITH LED INDICATORS**
- **OVERLOAD INDICATORS**
- **RFI FILTERS**
- **CLASS 2 POWER - AGENCY EXEMPT**
- **UL LISTED POWER SUPPLY**
- **U.S. PATENT 4,891,841**



GRAPHIC EQUALIZERS

Parameter	Specification	Limit	Units	Conditions/Comments
Equalizer:				
.....Bands: GQ 15	(15) 2/3-Octave ISO Spacing			From 25Hz to 16kHz
..... GQ 30	(30) 1/3-Octave Iso Spacing			From 25Hz to 20kHz
.....Type	Interpolating Constant-Q			Smooth Combining
.....Accuracy	3		%	Center Frequency
.....Travel	45		mm	Positive Grounded Center Detent
Inputs: Type	Active Balanced/Unbalanced			
.....Connectors	Term, 3-Pin & + 1/4" TRS•••			
.....Impedance	40k	1%	Ohms	Balanced: 20k Ohms/leg
.....Maximum Level	+21	1	dBu	
Outputs: Type	Active Balanced			
.....Connectors	Term, 3-Pin & + 1/4" TRS•••			
.....Impedance	100	1%	Ohms	Each Output
.....Maximum Level	+27 <sup>3</sup> 2k•; +24 <sup>3</sup> 600•	1	dBu	
Overall Input Gain Range	-12 to +12	1	dB	
Overall Output Gain Range	+12 to -12	1	dB	
Adjustable Low Cut Filter	10Hz-250Hz, 12dB/Oct	10%	Hz	
Adjustable High Cut Filter	3.1kHz-40kHz, 12dB/Oct	10%	Hz	
RFI Filters	Yes			
Passive Bypass Switches	Yes			LED Indicated
LED Thresholds: Overload	+18	1	dBu	Output or any Internal Level
Frequency Response	10-40kHz	10	%	-3dB Points
THD+Noise	0.009	.002	%	+4dBu, 20-20kHz
IM Distortion (SMPTE)	0.005	.003	%	60Hz/7kHz, 4:1, +4dBu
Signal-to-Noise Ratio	re +20dBu/+4dBu			20kHz Noise BW; Balanced
	108/92	2	dB	Sliders Flat, Gains Up (Unity)
	91/75	2	dB	Full Boost, Gains Up (Unity)
	106/90	2	dB	Full Cut, Gains Up (Unity)
Channel Separation (GQ 15)	70	5	dB	20-20kHz
Maximum Current	400		mA	RMS Current From Remote Supply
Power Supply Input	18-24VAC w/center tap	10%	Vrms	
Power Supply Connector	6-Pin Mod Plug			
Safety Agency—Unit				
.....Classification	Class 2 Equipment			National Electrical Code
.....Design	Safety Extra-Low Voltage			VDE SELV
.....U.L. Listing	UL 813 Exempt			Class 2
.....C.S.A. Certification	C22.2 No. 1 Exempt			Class 2
.....CENELEC	IEC 65 Exempt			Harmonization Doc. HD 195.S4
Remote Power Supply	Model RS 1			Class 2 Equipment
.....U.L. Listed	E90493			
.....C.S.A. Certified	LR62694			
.....230VAC Export Model	Meets requirements of IEC 380			Double Insulated Design
Unit: Construction	All Steel			
.....Size	3.5"H x 19"W x 8.5"D (2U)			(8.9cm x 48.3cm x 21.6cm)
.....Weight	7 lb			(3.2 kg)
Shipping: Size	7" x 22" x 13"			(18cm x 56cm x 33cm)
.....Weight (GQ 15)	12 lb			(5.4 kg)
.....Weight (GQ 30)	12 lb			(5.4 kg)
Note: 0dBu=0.775Vrms				

## Block Diagram



## Application Information

Constant-Q graphic equalizers arose from the sound professional's need for greater control with less interaction than previously possible with conventional equalizers. Truth in slider position became a requirement. The curve traced out by the slider positions on constant-Q designs indeed represents the actual changes to the frequency response. On conventional designs they do not. Combine this feat with the Rane developed "interpolating" characteristic and you have a tool without peer.

The GQ series of products from Rane goes one step further toward being the best device for any application. It offers choice of all common audio connectors. The inclusion of 3-pin, 1/4" and terminal strip Input and Output terminals ensures the GQ 15 ideally suits all possible situations.

Independent INPUT and OUTPUT GAIN controls allow maximum flexibility in setting up your gain structure. Operating both sliders together always yields unity gain through the equalizer. Always operate the unit with both GAIN controls as far towards the top of the unit as possible without lighting the OL indicators. Only in situations where input overloads become a problem should the GAIN controls be moved downward. This yields the best noise performance.

The HIGH and LOW CUT FILTERS allow bandlimiting of a system. In their full down positions, the bandwidth of the unit is flat from 20Hz to 20kHz. Any upward movement of either slider begins restricting the bandwidth and may aid in preventing accidental overloads in systems not specifically designed to handle audio extremes. This is a useful feature in noise masking and paging systems where full range speakers are not used. Bandlimiting helps prevent low frequencies from overloading the speakers.

While designed primarily for permanently installed systems, this does not mean that its mechanical integrity is inferior to other Rane products. All Rane signal processing gear can withstand the rigors of being thrown into the back of a '68 Pontiac station wagon by their line cords and transported from one bar to another.

### CONSTANT-Q DETAILS

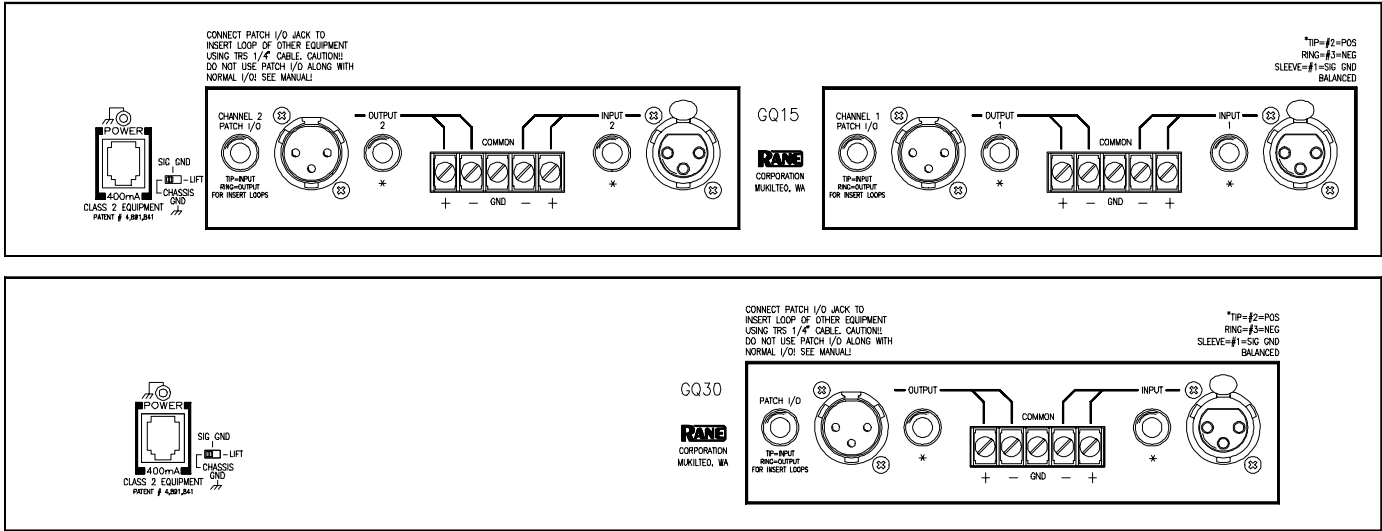
Traditional equalizer designs present a problem in that the filter's level control is actually a part of the filter. Consequently, whenever the slider is moved, the bandwidth changes. The output exhibits the desired bandwidth only at full boost or cut. It degrades to as much as two octaves at moderate slider settings. Responding to this dilemma, Rane developed a topology ensuring constant filter bandwidth ("Q") at all slider positions.

Another important advantage of constant bandwidth is reduction of adjacent filter overlap. Conventional designs exhibit excessive overlap at moderate slider settings. Adjusting one slider affects the adjacent neighbors, requiring readjustments to each. Filter overlap in Rane equalizers is dramatically less, reducing the need for constant readjustment of adjacent sliders. This means more effective equalization in significantly less time.

### INTERPOLATING DETAILS

Today's sophisticated acoustic measurement tools show exact trouble spots. Often these lie between ISO centers. An interpolating equalizer allows the user to correct for these response errors by producing a smooth peak or dip between (i.e., it interpolates, or inserts between) any two adjacent frequency sliders when they are raised or lowered the same amount. Non-interpolating responses exhibit a slight dip (ripple) under similar conditions.

**Rear Panel**



**Architectural Specifications**

The graphic equalizer shall be of constant-Q design to minimize interactions between adjacent bands, and contain adjustable sliders located on standard ISO center frequencies. Each band shall have a bandwidth of 1/3 or 2/3-octave, as specified elsewhere. Sweepable low and high cut filters shall be provided. A detented and positively grounded 0dB point shall be provided on 45mm linear sliders with dust dams.

An input and output gain control shall be provided, each covering a range of -12dB to +12dB with a center detent at 0dB. These controls shall be of the vertical slide variety.

The inputs shall be active balanced/unbalanced designs terminated with 3-pin, 1/4" TRS (tip-ring-sleeve) and barrier strip connectors. The outputs shall be fully balanced and

terminated with 3-pin, 1/4" and barrier strip connectors. Each unit shall also provide a 1/4" tip-ring-sleeve Patch I/O connector. RFI filters shall be provided. The unit shall provide a passive bypass feature requiring no power to operate. When power is applied to the unit and bypass mode is selected, this shall be indicated via a red LED indicator. LEDs shall be provided to indicate Overload conditions on each channel.

The unit shall be powered from a UL listed external AC power supply. This external supply shall be provided with each unit and be available with either a 120VAC or a 230VAC primary. The unit shall be entirely constructed from cold-rolled steel.

*The unit shall be a Rane Corporation GQ Series Equalizer.*

**Available Accessories**

- SC 3.5 Security Cover

**References**

1. D. Bohn, "Constant-Q Graphic Equalizers," *Rane Note 101*, (1982).
2. D. Bohn, "A New Generation of Filters," *Sound and Video Contractor*, vol. 2, pp. 36-39 (Feb. 1984).
3. T. Pennington, "Constant-Q," *Studio Sound*, vol.27, pp. 82-85 (Oct. 1985).
4. D. Bohn, "Constant-Q Graphic Equalizers," *J. Audio Eng. Soc.*, vol. 34, pp. 611-626 (September 1986).
5. D. Bohn, "Exposing Equalizer Mythology," *Rane Note 115*, (1986).
6. D. Bohn, "RAP - Remote AC Power: An Idea Long Overdue," *Rane Note 121*, (1989).
7. D. Bohn, "Operator Adjustable Equalizers: An Overview," *Rane Note 122*, (1990).