

# BENCHMARK MEDIA SYSTEMS, INC.

## RGC-P Revision A Instruction Manual

### 1.0 General Features

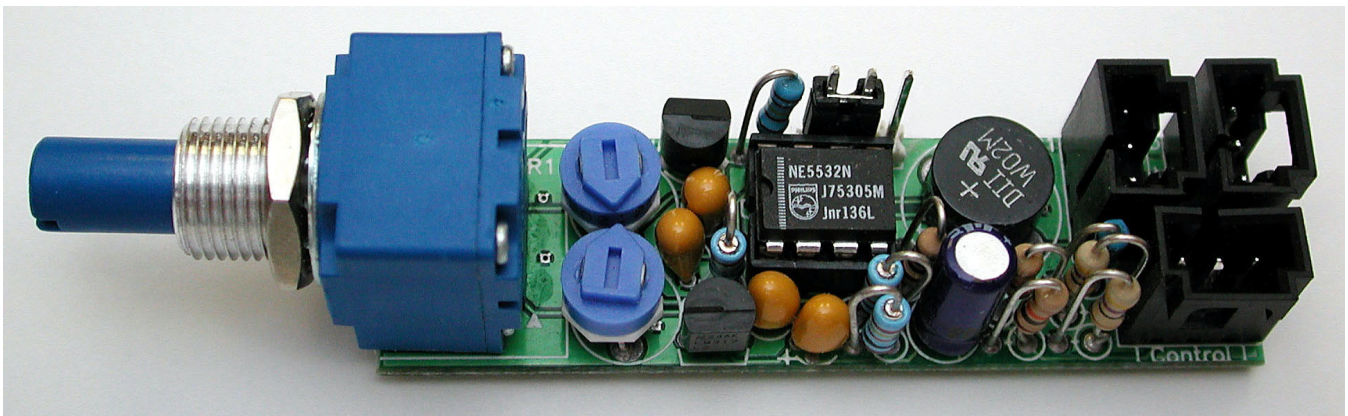
The RGC-P is a controller voltage generator for use with the RGC-06, a System 1000 daughter board, and the VCA-2, a remote gain control stand-alone product. The RGC-P can use the  $\pm 15$  power that is available on the back plane of the MF-300 card frame, or it can use a PS-1 wall mount power supply. The PS-1 will provide sufficient power for up to 10 RGC-P modules. Special ground sensing circuitry allows the use of local (to the RGC-P) power, and still reference the ground potential at the remote VCA location.

The RGC-P is a small printed circuit mounted to a panel potentiometer. The panel potentiometer circuit provides a control voltage range of  $-10$  to  $+2.5$  volts which corresponds to a broad gain range of  $(-100$  to  $+25$  dB). On-board trim resistors allow this control range to be reduced to  $\pm 1$  dB or any where in-between. The output of the RGC-P is a low  $Z$ , impedance-balanced drive of  $144 \Omega$ . The drive capability, from an operational amplifier, allows it to drive almost unlimited lengths of cable. The RGC-P also has a  $0.025''$  sq posts for connection to a SPDT switch. This switch allows instant selection between fixed unity gain and the panel potentiometer determined level.

### 2.0 Unpacking and Physical Installation

As with any delicate electronic equipment, care must be exercised in the handling of this board. Carefully unpack and place the RGC-P on the work table in preparation for installation.

Carefully drill a  $3/8''$  hole in the panel or chassis intended to receive the RGC-P. If the switch option is to be used, it should be wired at this time and the appropriate holes drilled. See section 3.2



### 3.0 Installation and Operational Setup

The electrical installation of the RGC-P consists of three parts. Power installation, control switch wiring - if used - and the signal return. Setup consists of making the electrical connections and adjusting the two trim resistors to the desired overall control range.

### **3.1 Power Connection**

The device can operate with supply voltages from  $\pm 15$  to  $\pm 22$  volts and can even be asymmetrical as noted on the schematic. Connection to the board is made either with the enclosed three position female header or a latching and polarized Molex SL series three pin connector. Those are the same connectors as used with audio connections at a System 1000MLX main frame. If you need latching and polarized connector parts please contract the factory for pricing. A crimp tool will be necessary for connector assembly.

Power voltage connections have this order in the three pin housing, +V, GND and -V. If a standard foil shielded audio pair is used to bring power from the MF-300 frame, we recommend that the red wire be used for positive voltage, the drain wire be used for ground and the black wire be used for the negative voltage. While the power connection at the RGC-P is specified for polarity, the RGC-P is protected against polarity inversion by a bridge rectifier. Unlike the previous model, you cannot destroy the RGC-P with power polarity reversals. For wiring convenience, this connector pin-out is the same as the audio wire arrangement used in the MF-300MLX card frame.

Refer to the parts placement diagram for the loop-through power connections. The loop-through power connectors are for daisy-chaining power to additional devices.

### **3.2 Switch Wiring**

As noted in the introduction, it may be desirable to mount a switch along side of the RGC-P to expand the control capability of the system. It may be necessary, at times, to quickly return to a known unity gain at the VCA. This is easily accomplished by the addition of a single pole, double throw switch. This switch allows the instant selection of either the panel potentiometer or a ground reference voltage, which is the unity gain position of the VCA.

The switch should be wired with three conductors and a three position 0.025" sq post female connector. See the parts placement diagram for the location of the posts.

### **3.3 Output Signal Wiring**

A female housing at the rear of the board, parallel with the length of the board houses the control output connections. This is an impedance balanced output. The signal drive line comes from the op-amp. The other "signal" line is, in reality, a local ground with a 47  $\Omega$  build out resistance. When using a separate local power supply, we strongly recommend that the signal reference (ground) of the VCA location be brought to the ground pin of the RGC-P output. This will automatically happen if an audio pair is used, with Benchmark Molex standard wiring.

The circuit has been configured to sense the ground at the VCA location, i.e., the System 1000 card frame or the VCA-2 chassis, and force the local ground to follow that reference, thereby reducing signal variations that might occur with normal ground loops. We suggest that a single foil shielded pair be used for each of the RGC-P controllers.

### **3.4 Operational Setup**

The range of the RGC-P can be set to anything the engineer desires. The maximum output voltage range of the RGC-P is from -10 volts to +2.5 volts. Since the RGC-06 daughter board and the VCA-2 have a control sensitivity of +10 dB/Volt, this range represents a theoretical control range of -100 to +25 dB. Actually the range is somewhat less than this, with high frequency feed-through limiting the

amount of attenuation that can be achieved to approximately 70 dB at 20 kHz. Additionally we recommend that no more than a maximum of 20 dB gain be taken from the daughter board in the interest of low distortion.

In practice the RGC-06 daughter board is usually used to achieve a relatively small amount of gain trim. As such it is desirable to limit the range of the RGC-Ps control to those expected limits. This is accomplished using the two end stop or limit trim resistors located at the front of the PC assembly. The bottom trimmer controls the clockwise end stop of the panel potentiometer, while the top trimmer controls the counter-clockwise end stop of the panel potentiometer. Both of these trim resistors have the same voltages at their end stops, that is the range limiting -10 and +2.5 volts. Therefore the action of the panel potentiometer can be setup to be either that of a gain control or an attenuator. You must observe the actual gain of loss at the output of the System 1000 module or VCA-2 to precisely achieve the desired range. A close approximation, however, can be made by measuring the output voltage of the RGC-P at the two limits of the panel potentiometer.

## 4.0 Theory of Operation

Through-out the discussion of the theory of operation, it is well to refer to the electrical schematic of the RGC-P.

Power from the MF-300 frame is brought into the RGC-P where it is de-coupled via two 10  $\mu$ F @ 25 volt capacitors. This power is directly sent to supply the operational amplifier pair. It is also sent to the two voltage regulators, the LM317LZ and the LM337LZ. Here the input voltage is regulated down to the VCA limits of +2.5 volts and -10 volts respectively.

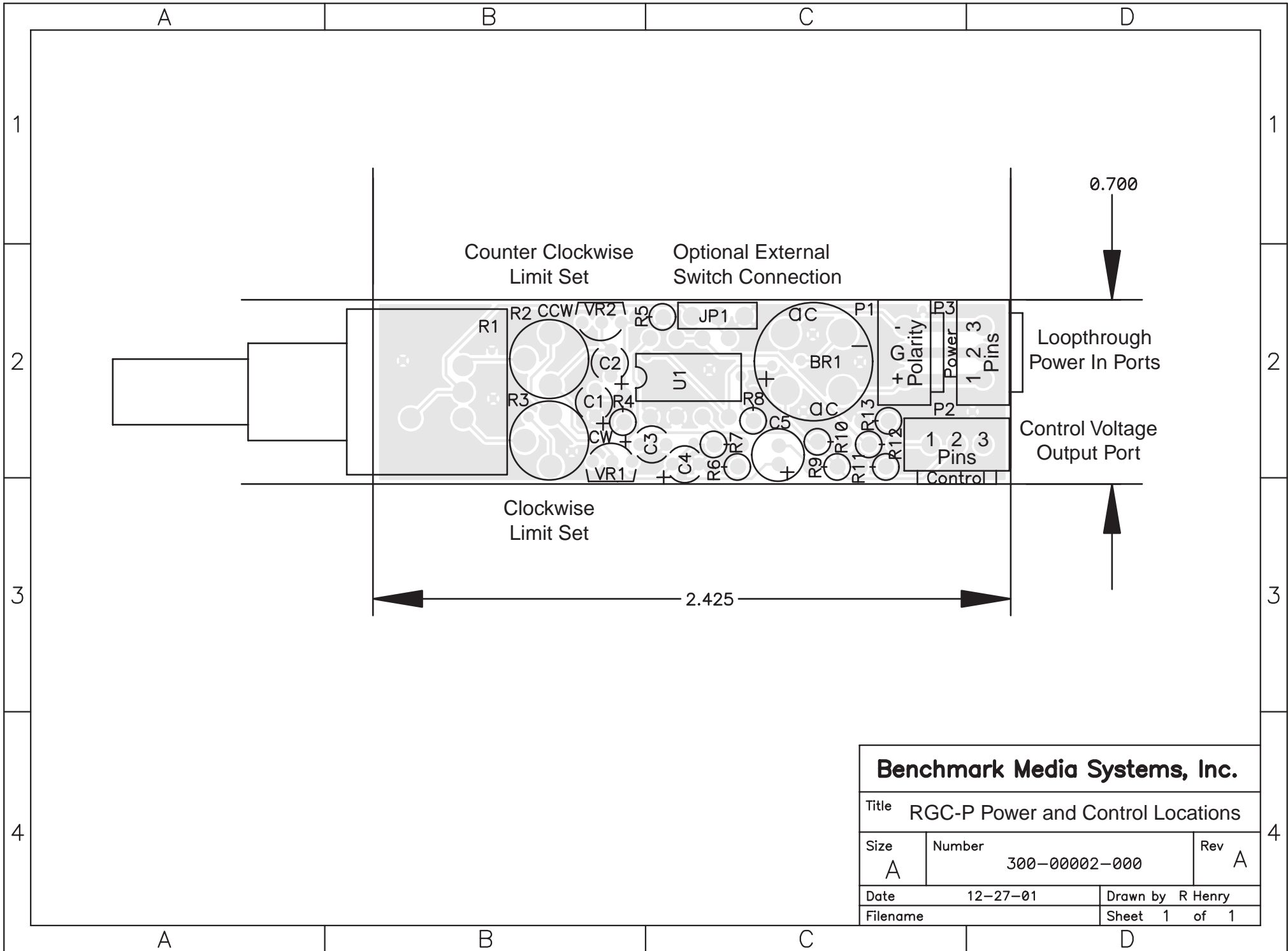
The output of the voltage regulators is fed to the ends of the two trim potentiometers that establish the range limits of the controller. The wipers of the two trim potentiometers are, in turn, connected to the end terminals of the panel potentiometer and become the range limits of the panel pot. The output impedance of the panel pot can be as high as approximately 55 k $\Omega$ . It is important, therefore, that this voltage be "read" by a high input impedance, unity gain buffer op-amp. This is what the first half of the op-amp pair does. The op-amp in turn provides a low impedance to drive the back to the VCA. This is also the insertion point of the control switch mentioned earlier. A 10 Meg  $\Omega$  resistor ties the input of the op-amp to ground to prevent amplifier saturation during switching transitions. The 47  $\Omega$  output resistors are added to isolate the output of the op-amp from the cable, thus protecting the device against a possible shorted cable.

The other half of the op-amp pair is a unity gain follower that senses the ground voltage at the end of the signal transmission pair, the ground at the System 1000 frame, or the VCA-2 chassis. The output of this second buffer then drives the local signal common, forcing the RGC-P to accept the remote "ground" potential as opposed to that of the local power source.

This completes the RGC-P instruction manual.

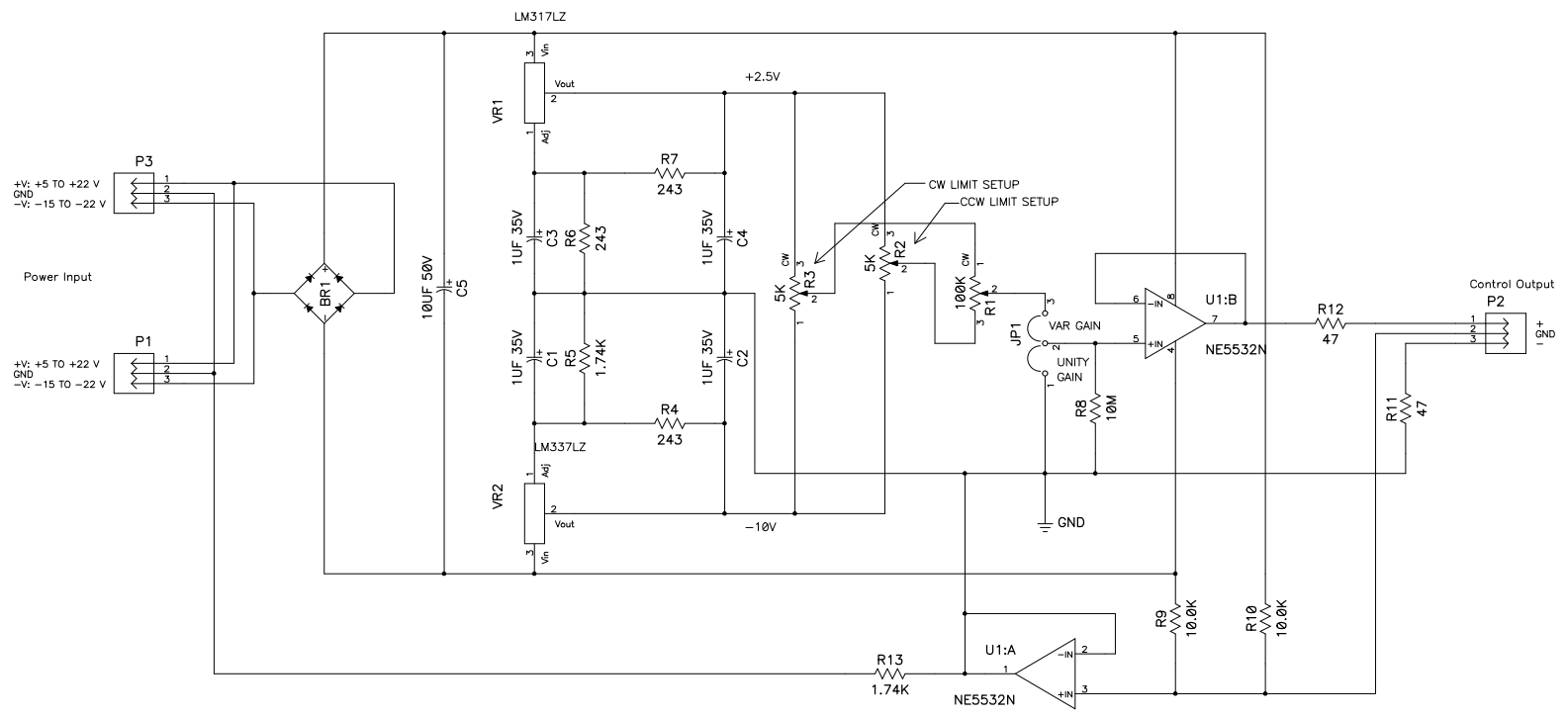
ED February 15, 2003

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<b>Benchmark Media Systems, Inc.</b>			
Title RGC-P Power and Control Locations			
Size A	Number 300-00002-000	Rev A	
Date 12-27-01	Drawn by R Henry		
Filename	Sheet 1 of 1		

REVISIONS			
A	CORRECTED VALUES FOR R1 AND R2.	11/02/95	AHB
B	REDESIGNED CIRCUIT AND MOVED TO ACCEL FORMAT	12/28/01	RAH



Note:  
1. Jumper option allows return to unit gain.

<b>Benchmark Media Systems, Inc</b>			
Title		RGC-P	
Scale	Checked By	AHB	Drawn by
Date	9/10/87	Sheet	1 of 1
Size	C	Assy Number	500-05500-000
Rev	B		