

# SP 15



## OPERATING AND SERVICE MANUAL

**RANE**  
CORPORATION

## I. WARRANTY EXPLANATION - PLEASE READ CAREFULLY

Rane offers a limited warranty, described in full on the Limited Warranty card included in the packing materials, which covers both parts and labor necessary to repair any defects in the manufacturing of you Rane product.

The warranty period is two (2) years, starting from either (i) the date of retail purchase, as noted on either the sales slip from an authorized Rane dealer or on the warranty registration card sent in to the factory or, (ii) in the event no proof of purchase date is available, from the date of manufacture, which is coded on the rear of the chassis.

If you send in the registration card according to the instructions on the card, or retain your sales slip as proof of purchase, you will receive a full two (2) year warranty period from the date of **purchase**, regardless of the date of manufacture. If you do not send in the registration card ("I forgot."), or you do not have a sales slip from an authorized Rane dealer ("My dog ate it."), the warranty period will only extend two (2) years from the date of **manufacture**.

All registered warranties are tracked by serial number, not by owner. Once your Rane product is registered, it will be covered the full two years, regardless of any change in ownership.

Should you encounter any problems with your Rane product, be sure to contact either your local Rane dealer or the Rane factory before taking it anywhere for repairs. We will help you to identify and locate any specific malfunctions, possibly avoid needless shipment, or instruct you as to the speediest method for authorized repair.

If you must send your Rane product to the factory or a warranty station for repair, BE SURE TO INCLUDE THE FOLLOWING INFORMATION:

1. YOUR COMPLETE NAME AND RETURN SHIPPING ADDRESS (P.O. box numbers are NOT acceptable)
2. THE SERIAL NUMBER OF THE RANE PRODUCT IN FOR REPAIR
3. A COMPLETE DESCRIPTION OF ANY AND ALL PROBLEMS YOU ARE EXPERIENCING WITH THE PRODUCT.

**Never ship the unit in any shipping carton other than the original or a replacement supplied by Rane.** Ship only by a reputable carrier. Be sure to insure the package for the full replacement value. Rane cannot be held responsible for any damage incurred during shipping.

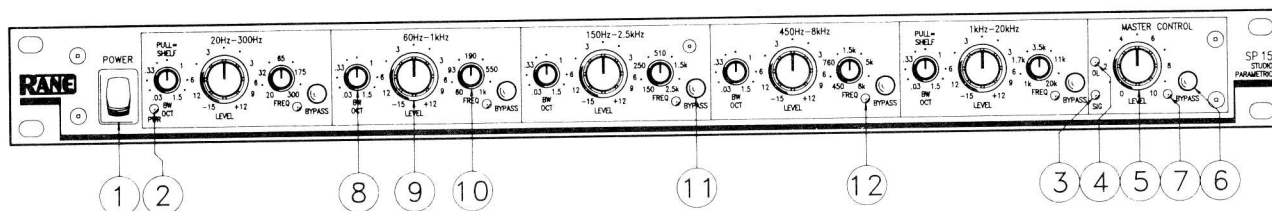
### NOTICE REGARDING DAMAGES

THE RANE LIMITED WARRANTY COVERS ONLY THE COSTS IN LABOR AND MATERIALS TO REPAIR DEFECTS IN MATERIAL OR WORKMANSHIP OR, AT RANE'S OPTION, TO REPLACE DEFECTIVE PRODUCTS. CONSEQUENTIAL AND INCIDENTAL DAMAGES SUCH AS ECONOMIC LOSS OR INJURY TO PERSON OR PROPERTY, WHATEVER THE CAUSE, ARE EXCLUDED FROM COVERAGE. PLEASE REFER TO THE LIMITED WARRANTY CARD FOR A FULL DESCRIPTION OF THE LIMITS ON THE COVERAGE OF THE LIMITED WARRANTY.

If you need further assistance concerning the repair, installation or operation of your Rane product, please feel free to contact Rane galactic headquarters at:

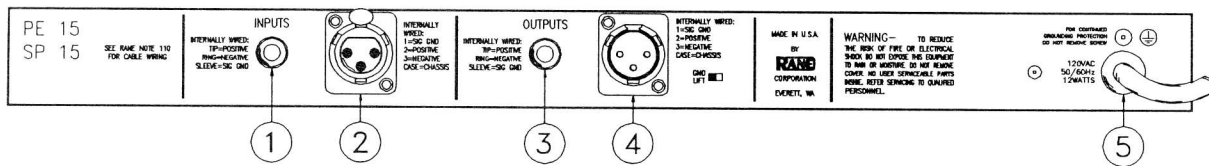
Rane Corporation  
10802 47th Avenue West  
Everett, WA 98204-3400  
Phone: (206) 355-6000  
FAX: (206) 347-7757

## II. FRONT PANEL DESCRIPTION



- 1. POWER SWITCH:** The key to life in any electronic device, this switch allows power to flow from the source to which the line cord is connected into the primary windings of the SP 15's power transformer, thereby powering all of the vital functions and lights of the unit.
- 2. POWER INDICATOR:** When this yellow LED is lit, all output muting circuits are fully on and the unit is ready to operate.
- 3. SIGNAL PRESENT INDICATOR:** This green LED illuminates whenever an input signal greater than -20dBm is applied to the inputs of the unit, even in the bypass mode.
- 4. OVERLOAD INDICATOR:** This red LED illuminates whenever the signal level at the input stage, output stage, or any of the 5 equalizer stages comes within 4dB of clipping.
- 5. MASTER LEVEL CONTROL:** Full counterclockwise rotation of this control provides full input attenuation, full clockwise rotation yields 12dB of gain through the unit. Unity gain will be found at approximately 3:00, (Central Daylight Time).
- 6. OVERALL BYPASS SWITCH:** Pressing this button to the "in" position provides a complete "hard-wire" bypass of the SP 15, including the signal ground. In the out position, the input to the unit will pass through all of the active electronics.
- 7. OVERALL BYPASS INDICATOR:** This red LED will illuminate whenever the overall bypass switch is in the in position.
- 8. BANDWIDTH CONTROL (Q):** Full counterclockwise rotation of this control yields a bandwidth of 1/30 octave in the respective filter. A 1.5 octave bandwidth is realized at full clockwise rotation. (Pulling this control to the out position on bands 1 and 5 will switch the filters to the shelf mode.)
- 9. FILTER LEVEL CONTROL:** The center detent position of this control guarantees flat response through the respective filter, full clockwise rotation yields a +12dB boost, full counterclockwise rotation nets a -15dB cut.
- 10. FREQUENCY SWEEP CONTROL:** Sets the center frequency of the filter band (Turnover frequency when the end bands are in the shelf mode). Available sweep range is approximately four octaves.
- 11. FILTER BYPASS SWITCH:** Each of the five filter bypass switches disable the respective filter bands providing instant comparison between flat response and equalized response.
- 12. FILTER BYPASS LED:** Illuminates when the filter bypass is "on".

### III. REAR PANEL DESCRIPTION



**1. 1/4" RTS INPUT JACK:** A fully differentially balanced, auto unbalanced 1/4" input connector; the tip is the positive input, the ring is the negative input, and the sleeve is signal ground. Should unbalanced operation be required, use a 2 conductor (mono) plug; connect the tip to the signal line and the sleeve to ground. If a 3 conductor plug is used for unbalanced operation, insure that the ring is tied to ground.

**2. 3-PIN INPUT CONNECTOR:** This input is also fully differentially balanced, with pin 1 being ground (shield, screen, etc.), pin 2 is the positive input, and pin 3 is the negative input. Should you wish to use the 3-pin connector in an unbalanced fashion, make sure that pin 3 is tied to ground when wiring the plug. Making this connection will engage the auto unbalanced input mode.

**3. 1/4" RTS OUTPUT JACK:** This jack is an active balanced output. The tip is signal positive, the ring is signal negative and the sleeve is signal ground. Please see Section V, SYSTEM CONNECTION, for complete details on wiring the plug used to interface to this jack.

**4. 3-PIN OUTPUT CONNECTOR:** This output is fully differentially balanced. Per IEC 268, pin 1 is ground, pin 2 is positive and pin 3 is negative. The ground in this case is signal ground, with the shell being chassis ground. The SP 15 signal ground should be connected only to the signal ground of the next device in the chain. Chassis ground should be used for all shielding. It is not a good idea to tie the shield to ground at both ends of the cable. Doing so may cause ground loop problems.

**5. POWER CORD:** This handsomely styled vinyl encased lifeline is internally connected to the power switch, a control which is thoroughly described in Section II, item 1 on the preceeding page.

## IV. FUNCTIONAL DESCRIPTION

The SP 15 Studio Parametric Equalizer/Notch Filter incorporates all of the required features of both a parametric equalizer and a notch filter set. With a bandwidth range of 1/30 octave to 1.5 octaves on each of the five bands, this device will serve the needs of any conceivable equalization situation requiring this incredible power.

The switchable shelving/peaking feature of Bands 1 and 5 of the SP 15 are extremely useful due to the nature of audio system rolloffs and the unforgiving problems of feedback and hum. A typical system rolloff correction will require the shelving modes of the switchable bands, while feedback control and hum reduction requires the use of the peaking mode. It should be noted that Bands 2 and 4 will also reach well into the range of Bands 1 and 5 so that the shelving mode of 1 and 5 may be used, as well as some peaking or notching in the same frequency area achieved by setting the center frequency of bands 2 or 4 and dialing in the required boost or cut.

The sense of the SP 15's controls is very straightforward. Rotating the bandwidth control fully counterclockwise delivers the minimum filter bandwidth, (1/30 octave), while full clockwise sets the filter at 1.5 octaves. The filter level controls are standard clockwise boost, counterclockwise cut type controls. The frequency sweep control provides the same type of action, up is up and down is down.

During the EQ set-up process, the individual band bypasses may be used for an instant A/B comparison of the equalization effects. This feature is indispensable due to the complex nature of parametric equalization. Without this capability, it is all too easy for the operator to become lost in the grey area between center frequency, bandwidth and boost/cut. The red LEDs associated with these bypass switches serve as a reminder that the respective band is on holiday, available for recall at any time.

One of the most basic design requirements of any equalizer, whether it be a graphic or parametric, is the immunity from control interaction. This is accomplished in all Rane equalization products through the use of the State Variable Filter. The Rane graphics have built a well respected reputation based on the fact that the bandwidth of the filter sections is not affected by slider position. The SP 15 utilizes the exact same circuit configuration to ensure that the "Q" of the filters will not be affected in any way by the amount of boost or cut selected by the Level controls.

The equalization filters in Rane products perform their filtration tasks totally independently, and their outputs are simply summed via their level controls to either a boost bus or a cut bus. This is the most straightforward and easiest to understand portion of the theoretical stuff. The most difficult to understand is the freedom from interaction provided by the filter with regard to center frequency and bandwidth controls. Most parametric equalizers provide separate adjustment of frequency and Q, but the controls must be set in a certain order to maintain accuracy. The SP 15 incorporates circuitry which allows these controls to be set in any fashion and still provide complete independence, a feature which is very unique.

When Bands 1 and/or 5 are operating in the shelving mode, rotating the bandwidth control will have no effect on the filters. Bandwidth becomes an undefined term in this mode, the mathematical equivalent being dividing by zero. The Level control and the frequency control still operate normally, allowing the user to set the turnover frequency of the shelf and the level independently.



## V. SYSTEM CONNECTION

The proper connection of the SP 15 to a system is a relatively simple matter, the specifics of which vary greatly depending on the specific application. This device may be used anywhere line level frequency contouring is required, such as live sound reinforcement systems, recording studios, dance clubs, etc.

The most common location to insert a device such as the SP 15 is immediately preceding the active crossover or power amplifier, providing the capability to correct loudspeaker deficiencies and to make acoustic corrections which are required in any system for high quality reproduction. Many systems employ both a graphic and parametric equalizer connected in series, the graphic being used to correct for acoustic anomalies and the parametric for source correction, loudspeaker compensation and feedback control. In a situation such as this, the order of placement is not critical, however the SP 15 does feature true actively balanced differential outputs which should be a consideration in installations requiring very long cable runs between the equalizers and the power amplifier or crossover.

The 1/4" RTS and 3-pin input connectors are wired in parallel and are actively balanced. These two inputs are provided primarily to give the user a choice between the two types of connectors. **They will not function as a summing type of input for two different sources and using them as such will result in a great deal of distortion and signal loss in almost all cases.** For further information on this subject, please consult Rane Note 109 titled WHY NOT WYE?. The two inputs may be used in a daisy chain application where the input to the SP 15 also must feed another piece of equipment.

The outputs of the SP 15 also provide the choice between 1/4" RTS connectors and the 3-pin variety. They also are wired in parallel and are actively balanced. However, use of a mono 1/4" plug will not degrade the audio.

All 3-pin connectors used by Rane are wired per the IEC 268 standard as follows:

- Pin 1: GROUND (Shield, Screen, etc.)
- Pin 2: POSITIVE (Signal, Hot, etc.)
- Pin 3: NEGATIVE (Return, Common, etc.)

All 1/4" RTS connectors used by Rane are wired as follows:

- Tip: POSITIVE
- Ring: NEGATIVE
- Sleeve: GROUND

If you are using a TS (tip/sleeve, 2 conductor, mono, etc.) plug, the sleeve will connect to the ring and therefore signal ground in the SP 15. Do not use the sleeve as shield ground in this case, since this will not give you optimum noise immunity. The shield should only be connected at the receiving end of the line to minimize system noise.

## VI. OPERATING INSTRUCTIONS

Once the SP 15 has been properly installed in your system in accordance with the system connection instructions found in the previous section, it is then time to twist some knobs. Power up the system in the normal fashion, always turning on the power amplifiers last. It is good practice to start at the head of the system, turning on any sound sources and mixers first, equalization devices next, and finally power amplifiers. Following this power-up sequence minimizes the chance of turn-on transients in high gain stages from finding their way all the way out to the loudspeakers. (Of course this is never a problem in all Rane systems!) It is a very wise idea to start with the master level control all the way counterclockwise and the 5 boost/cut level controls on the SP 15 set to their center detents. This eliminates the possibility of any surprises that can be encountered by having 12dB of boost centered at a feedback frequency with the bandwidth control set to minimum! With either a canned or live source applied to the system, advance the master level control on the SP 15 until normal system gain is achieved. Once you reach the point where everything appears normal, (minus, of course, the dramatic improvements available through the use of this equalizer), you are ready to make some adjustments.

The use of a Rane (or similar) realtime analyzer makes the job of equalization easier, and we will start out with the premise that you have one available. If you don't have access to one, read this anyway so that you can appreciate how much easier your life would be if you did.

Set up the RTA and microphone as instructed by the operating manual for the device in use. You will most likely see a gradual steady rolloff at the high end and the low end of the analyzer. If this is the case, chances are good that the cause is the natural rolloff of the loudspeaker along with the contribution of the acoustics of the surroundings. To correct this rolloff, pull out the bandwidth control on Band 1 for the low end or Band 5 for the high end to select the shelving mode. Then set the frequency sweep control(s) for roughly .5 to 1 octave into the rolloff area and gradually apply some boost via the band's level control. If the applied boost raises the level of the signal beyond the corner of the rolloff point, simply move the frequency control further into the rolloff area. This procedure will not yield a perfectly flat response in most cases. When that is the case, the use of a 1/3 or 2/3 octave graphic, or possibly the adjacent bands of the parametric may do the trick. As mentioned in Section V, graphics and parametrics are complementary, and are often used together.

When using a realtime analyzer, you will usually notice broad peaks and dips in the response curve. These can be removed effectively using the SP 15 with its bandwidth controls set for relatively wide BWs and proper amounts of boost or cut depending on the direction of the measured deviation. It is difficult to specify precisely the types of correction required for a given indication on the realtime, since no two situations are the same. As inexact as it may sound, experimentation is usually the best way to become familiar with the capabilities of a product of this sort. Study the readout of the analyzer and GENTLY make corrections based on what you see on the display. It takes only a short time to get the feel of it.

Equalizing a system without a realtime analyzer requires a bit more talent, and it is hard for a technical writer to convey all of the nuances of such a talent. It becomes a bit like playing the piano by ear. It is not something that can be taught, it just happens. When equalizing by ear, the operator somehow knows what he wants to hear and makes it happen using whatever means is available. The SP 15 makes it as easy as possible through straightforward control layout and solid engineering. Rane provides the piano, you provide the music.

As a notch filter, the SP 15 will work very well to increase system headroom by attenuating the system peaks in very narrow bands at the feedback frequencies which are always present in a live sound environment. The obvious goal in notching is to remove only the problem areas and nothing else. With this in mind, it is always a good idea to first try to notch out feedback with the bandwidth controls set to their full counterclockwise position. The acoustic resonances that cause feedback are generally so narrow that a filter bandwidth set at 1/30 octave will easily cure the problem. To chase down the feedback frequency, start with the filter level control set to its full -15dB position. With the bandwidth still set to minimum, tune the frequency sweep control until the feedback goes away. It shouldn't take too much fine tuning to settle the filter into the center of the resonance. Once you have achieved stability, advance the level control until the feedback starts to reappear, then back it down slightly. If a -15dB cut won't cure the problem, the problem is much more severe than it should be. Move the speakers or the mics, move some walls, burn down the building or unplug the system. Something must give.

## VII. FEATURES AND SPECIFICATIONS

### FIVE FULL PARAMETRIC EQUALIZATION BANDS, EACH FEATURING:

A bandwidth range continuously variable between .03 and 1.5 octaves

Frequency sweep ranges of four full octaves

+12dB boost capability

-15dB cut range

Minimum phase design utilized throughout

BANDS 1 AND 5 SWITCHABLE TO SHELF MODE

FULLY DIFFERENTIALLY BALANCED INPUTS

FULLY DIFFERENTIALLY BALANCED OUTPUTS

CHOICE OF 1/4" OR 3-PIN INPUTS AND OUTPUTS

AUTOMATIC ON/OFF TRANSIENT SUPPRESSION MUTING ON ALL OUTPUTS

POWER SWITCH WITH LED INDICATOR

FREQUENCY RESPONSE: 20Hz TO 20kHz  $\pm$  0.25dB

TOTAL HARMONIC DISTORTION: LESS THAN .006%, 20-20kHz, +4dBu

INTERMODULATION DISTORTION (SMPTE): LESS THAN .003% AT +4dBu OUTPUT

SIGNAL-TO-NOISE RATIO: UNWEIGHTED, 20kHz BANDWIDTH

BOOST/CUTS CENTERED, UNITY GAIN ..... 118dB BELOW +20 dBu

..... 102dB BELOW +4 dBu

BOOST/CUTS CENTERED, MAXIMUM GAIN... 118dB BELOW +20 dBu

.... 102dB BELOW +4 dBu

BOOST/CUTS MAXIMUM, MAXIMUM GAIN.... 98dB BELOW +20 dBu



GAIN: OFF TO +12dB

MAXIMUM INPUT LEVEL: +23dBu

INPUT IMPEDANCE: 2,000 Ohms

MAXIMUM OUTPUT LEVEL: +28dBu into 600 Ohms

OUTPUT IMPEDANCE: 600 Ohms Balanced

FREQUENCY RANGES:

BAND 1: 20Hz TO 300Hz

BAND 2: 60Hz TO 1,000Hz

BAND 3: 150Hz TO 2,500Hz

BAND 5: 1,000Hz TO 20,000Hz

SUBSONIC FILTER: FIXED AT 15Hz; -18dB/octave

ULTRASONIC FILTER: FIXED AT 70kHz; -12dB/octave

DIMENSIONS: 1.75"H x 19"W x 5.25" RACK DEPTH, ALL STEEL CHASSIS

WEIGHT: 5lbs. NET

0dBu = 0.775Vrms

## VII. SCHEMATICS