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C.S.G. INSTRUCTIONS

INTRODUCTION

The HAECO Compatible Stereo Generator (C.S.G.) is a low noise, low distortion stereo/mono matrixing amplifier. This device is used for creating compatible stereo/mono programs. The principles and methods used (patents pending) are accurate wide band phase shifting. While it is impossible to completely explain all the principles involved without lengthy dissertation, it can be explained briefly by understanding that identical signals of equal phase and amplitude electrically combine by an addition factor of 2 or 6 db. By controlling the phase relationship of common information between two signals which are identical in character, these same signals may later be combined; their addition factor being controlled by the degree they are phase shifted. It is easy to see that at 0 degrees they add 6 db and at 180 degrees they cancel. At any given point between 0 and 180 degrees, the total amplitude of the combined signals is directly proportional to their phase relationship. Besides having a stereo output, the HAECO C.S.G. also has a monophonic output which may be utilized to produce monophonic tapes, discs, etc., or as a monitoring means of knowing what the stereo program will sound like when mixed equally together. It should be thoroughly understood that the C.S.G. will have no effect upon any other information than the common information, i. e., true left and right channels will not have any change in their amplitude or character when combined.

PLACING C.S.G. IN YOUR SYSTEM

The C.S.G. unit is a device which has unity gain. Its two inputs are bridging. It

C S G - 2



C  
S  
G  
= 2

can be placed at the output of a two-track reproducing machine, which has stereophonic program and requires compatibilization. It may be used in the stereo outputs of a console prior to feeding a stereo or mono tape machine. Since the output impedance of the C.S.G. is essentially 16 ohms, it requires no termination and may feed as many bridging tape machine inputs as needed by the engineer. It is important that no pre or post equalization, filtering, limiting, etc., be done unless such adjustments to both channels are equal. Since filtering and equalization change the phasing characteristics of a signal, it can easily be seen that unless both channels containing common information are acted upon with the same amount of adjustments, the phase relationships between the left and right channel common information would be changed and the effect of C.S.G. lessened or negated. C.S.G. is most beneficial when used with signals which have been or are intended to be panned somewhere between the left and right channels. It performs its greatest function by shifting the phases of the common information which must have 0 phase relationships prior to going through C.S.G. See Illustration No. 1.

#### HOW TO USE C.S.G.

THE MOST IMPORTANT THING TO REMEMBER AT ALL TIMES IS THE AZIMUTH OF THE TAPE REPRODUCER OR RECORDER IS ABSOLUTELY PERFECT. As the change from mono to multi-track recorders demanded more critical azimuth alignment, the use of C.S.G. makes it mandatory to have azimuth alignment perfect. If azimuth is not RIGHT ON, phase characteristics between the two channels will be shifting in a frequency-discriminating fashion and the mono mix of C.S.G. processed program might change its entire character and sound.

C. S. G. affords the engineer with the means of obtaining perfect azimuth adjustment.

Please read and understand the following instructions very closely.

If the programmed material to be played through C. S. G. has already been recorded and it is desirous to create a compatible stereo/mono from the original stereo, the azimuth of the playback head may be adjusted thusly:

Place the C. S. G. IN-OUT switch in the IN position, the phase control in the NORMA position, the center channel build-up control in the +3 position. While playing your stereo program material through the C. S. G., monitor the mono output and place the phase switch in the REVERSE position. Listen very carefully for any change in the character or sound especially in the high frequency spectrum. Continue switching the phase switch between normal and reverse while making any azimuth adjustments. When the azimuth is DEAD-ON, there will be absolutely no difference in the quality or character of the program, whether the phase is normal or reverse. When you have achieved this "easy-to-accomplish" adjustment, the azimuth on your tape reproducer is more accurate than any other possible means of azimuth alignment. You will note if the azimuth is far off, there will be a vast difference in the quality of the sound between phase normal and phase reverse conditions. If you have means to monitor the C. S. G. stereo outputs in comparison with its mono output, you will further note when the azimuth is dead-on there will be absolutely no difference in quality or character of the program between the stereo and the mono regardless of the phase switch position.

If you are using the C. S. G. in the output of your dub-down console, it is equally important to be sure that the record head azimuth of your tape recorder is as close

as perfect as you can possibly make it by utilizing standard alignment procedures, i. e., aligning your playback system with a standard alignment tape and then aligning your record head and record circuits so as to match the characteristics of your alignment tape when played back through the playback heads and amplifiers of the same tape machine. It should then be remembered if a stereo program has been recorded through C. S. G., this recorded tape can be combined any time in the future with the amount of center channel buildup equal to that which was originally programmed on the C. S. G. unit when the tape was recorded. When mixing a C. S. G. processed stereo signal for monophonic listening, it is again important to have some means of reversing the phase of the output of one channel of your tape reproducer so that the azimuth of that tape reproducer can be absolutely matched to that of the original tape recorder, thereby eliminating the possibility of any quality or character change of the program. Once a C. S. G. processed tape has been transferred to disc, there is no danger of any quality change by phase normal or reverse conditions in the disc playback system as a disc has no azimuth or other critical electro-mechanical phase shifting qualities.

NEVER USE THE CENTER CHANNEL BUILDUP SWITCH IN THE 0 OR -3 POSITION FOR MAKING AZIMUTH ADJUSTMENTS, ONLY THE +3 POSITION MUST BE USED.

#### EXPLANATION OF THE CONTROLS

IN-OUT Switch: The IN-OUT control permits the engineer (monitoring the stereo or mono output of the C. S. G.) to have a direct A. B. comparison of the C. S. G. processed program against the same program without C. S. G. process. In other

words, in the IN position, the programmed material is going through the C. S. G. wide-band phase shifting networks and in the OUT position the program material by-passes the phase shifting networks and merely goes through the line-amplifier sections of the C. S. G.

PHASE NORMAL REVERSE Switch: The phase normal reverse switch is in the left channel only and gives the engineer the facility of reversing the phase of that channel. For example, if C. S. G. is in the OUT position, all common information would add up in the mono output of the C. S. G. (provided that the phase switch is in the normal position). With the same conditions prevailing and the phase switch placed in the reverse position, all center channel or common information will disappear.

CENTER CHANNEL BUILDUP Control: When the IN-OUT switch is in the IN position, the common information addition is controlled by the center channel buildup switch. In this instance, if the center channel switch is in the +3 position, the mono output of the C. S. G. will show only a 3 db addition of the common information. For example, if the common information going through C. S. G. were 0 VU on the left channel and also 0 VU on the right channel, in the mono output the common information would read +3. No matter which position the phase switch were to be placed, the common information would still appear in the mono output reading +3. In the 0 position, the center buildup switch permits the common information to appear in the mono output without any addition. In other words, if the common information were to read 0 VU on the left channel and 0 VU on the right channel, the common information would appear

in the monophonic of the C.S.G., still only reading 0 VU. The aforementioned conditions are true only if the phase switch is in the NORMAL position. If the phase switch were to be reversed, the common information (instead of disappearing as it would normally do in the OUT position with phase reversed) would reappear with a summing factor of +4.5 db center channel buildup.

In the -3 position of the center channel buildup switch, all common information in the stereo program will add up to -3 in the mono output of the C.S.G. For example, any common information which would read 0 VU on the left channel and 0 VU on the right channel of the stereo program would appear as -3 in the mono output of the C.S.G. As with the 0 buildup position, this only holds true when the phase switch is in the normal position. If the phase were to be reversed, all that would occur is the center channel information would become additive in the amount of 5 db, or it would almost restore itself equal to stereo information which was not C.S.G. processed and mixed together.

From the previous instructions, it is easy to realize that no matter which center channel buildup position is used, common information is impossible to lose.

It is highly recommended for all compatible tape and disc mastering that the +3 position be utilized. Common information played back stereophonically through two speakers has an acoustic buildup of 3 db. Playing back a C.S.G. processed program monophonically through one loud speaker (as on an AM radio) would necessitate a 3 db electrical buildup to match the character and quality of the stereo. The 0 or -3 buildup positions are included in the C.S.G. unit for producing monophonic discs or tapes from stereophonic program where the common information was applied in

too great an amplitude so as to make the mix unusable because of an excess of center channel buildup. In any event, when making stereophonic discs, if it is necessary to use the 0 buildup position, please be aware you will be adding to the vertical component of the stereo disc and generally, it would be most desirable to use slightly deeper grooves to accept the added vertical component. Please remember if there is a phase reversal at the broadcast station or any place where it is combined and reproduced monophonically, the 0 buildup C. S. G. processed program will have a center channel buildup of 4.5 db. This, of course, is better than losing the center channel.

It must again be stated that the optimum position for maximum compatibility is the +3 position. C. S. G. stereo processed in this position will have proper center channel buildup, make the disc easiest to cut mechanically, and make it impossible to have any change in center channel loss or buildup regardless of the phase condition. Lastly, as phase normal/reverse conditions have no effect upon the monophonic output of C. S. G. (in the +3 position) they will also have no effect upon the stereo output. Center or common information in the stereo spectrum will maintain its true directional qualities over a broader arc without necessitating the listener to be directly centered between the loud speakers.

### MAINTENANCE

All circuits in C. S. G. utilize prime components with ratings much higher than those required for the given application. Integrated circuit amplifiers are used for the line amplifiers and can be replaced externally. These integrated amplifiers are HAECO Model 614N. If one is found to be defective (by substitution) replacement

units can be purchased directly from HAECCE. It is strongly suggested that no attempt be made to adjust or repair the very critical phase shifting networks within the C. S. G. unit. If the C. S. G. fails to perform as indicated in the "how-to-use" section of this manual, it is recommended that the unit be sent back to HAECO for calibration.

Should it become necessary to calibrate C. S. G. for unity gain, there are four screw driver adjusted gain pots on the front panel. They are labeled INPUT and OUTPUT CALIBRATE. To calibrate the OUTPUT controls, place the switches on the C. S. G. in the following positions: Phase switch NORMAL and IN-OUT switch in the OUT position, (center channel buildup switch is not important). Feed 1 khz tone 0 VU to the input of the left channel and adjust the left OUTPUT control so as to have 0 VU at the left output of the C. S. G. unit. Move the generator input to the right channel and perform the same adjustment so as to obtain unity gain in the right channel.

To adjust the INPUT calibrate controls, merely switch the IN-OUT switch to the IN position and repeat the same process, only in this case adjust the proper INPUT calibrate controls to give unity gain for the corresponding channel.

In any event, your C. S. G. unit is unconditionally guaranteed for a period of six(6) months (180 days) provided no tampering or misuse has been done to the instrument.