PRO-SERIES

BCL2

OPERATION MANUAL

CONTENTS

1. INTRODUCTION

The BCL2 Is a stereo compressor-limiter with a de-essing capability which allows the professionnal user to process two different signals of one stereo program.

Applications include : FM transmitter protection, disc mastering, SPL limiting In PA and discotheque applications, tightening of drums and sustain control on guitars and bass.

Main parameters, Including threshold, gain, attack and release times and compression ratio are user controllable.

A unique feature of the BCL2 is the continuously variable detection characteristics. A potentiometer allows mixing of RMS and Peak detectors to tailor the timing parameters to the program being processed. The BCL2 takes advantage of a unique transformer distortion cancelling scheme reducing it an order of magnitude compared to conventional designs.

2 bargraphs control the compression amount and the input/output level. The de-essing functions Involves a slew-rate sensitive network which, keeping operation very simple, allows frequency-conscious compression, In accordance with FM transmission or disc mastering pre-emphasis.

A rear panel jack allows insertion of an external equalizer to achieve more specific frequency-conscious processing.

RFI protection has been a main concern in the design of the BCL2 allowing its use in broadcast installations.

A ground lift switch allows the elimination of hum loops.

2. SPECIFICATIONS

2.1. ELECTRICAL

Frequency Response	
20 Hz to 20 kHz	+0, -0.25 dB
Signal to Noise Ratio	
+ 4 dBu Input, + 4 dBu Output	94 dB
Input Impedance	20 kOhms balanced
Output Source Impedance	20 Ohms
Output Load Impedance	600 Ohms to infinity
Maximum Input Level	+ 20 dBu
Maximum output Level	
600 Ohms Load, 1 kHz	20 dBu
Total Harmonic Distortion (THD)	
+ 4 dBu Output,	
1 kHz, 10 dB compression	0.07 %
1 kHz, by-pass	0.01 %
Intermodulatlon Distortion	0.01 %
Compression Ratio	
Continously variable	from 2 : 1 to 20 : 1
Attack Time (Peak)	
Continously variable	from 0.1 to 70 millisec.
Release Time (Peak)	
Continously variable	from 100 millisec to 3 sec.
Attack Time (RMS)	
Program dependant	Typ. 12 ms for 12 dB Typ. 4 ms for 24 dB.
Release Time (RMS)	
Program dependant	Typ. 120 ms for 12 dB Typ. 240 ms for 24 dB
Mains power	
Consumption	6 Volts-amps
(115/220 VAC, 50-60 Hz)	
Meter Calibration	0 Vu = + 4 dBu
Maximum Gain Reduction	more than 50 dB
DS Action **	12 dB at 8 kHz

2.2. PHYSICAL

Input Connector	XLR/QG 3 pin balanced
Output Connector	XLR/QG 3 Pin balanced
Dimensions	483mm W x 190mm D x 44.5mm H
	19"W x 7.5"D x 1.75”H
Weight	3.9 kg, 8.6 lbs
Shipping Weight	4.8 kg, 10.6 lbs
Temperature Range	
Operating	0°C to +50°C
Storage	-30°C to +75°C
Finish	Light Grey epoxy

Note : In these specifications, 0 dBu is referenced to 0.775 V RMS.
** SMPTE Method : 60 Hz + 7 kHz mixed 4:1, + 20 dBu output.*
*** DS action Is defined as the Increase of compression at the specified frequency, referenced to compression at 1 kHz.*
Product Information and specifications are subject to change without notice.

3. INSTALLATION

IT IS IMPORTANT TO READ THIS SECTION BEFORE USING THE UNIT.

3.1 INSPECTION & UNPACKING

The Model BCL2 is carefully packed at the factory and the container designed to withstand handling in transit.

However, if transit damage Is evident, DO NOT discard any of the packaging material and notify the carrier immediately, as it is he who is responsible for such claims.

The shipment should contain the following :

- The unit BCL2
- Power cable
- Technical Manual (this book)

If any of the above Items are missing, notify your supplier Immediately, and DO NOT discard any of the packaging materials.

The power cable may be supplied without a connector at the supply end. This is because there is no world-wide standard, and therefore the user should supply a mains connector for use with the unit.

3.2. OPERATING ENVIRONMENT

The unit is designed to operate between 0 and +50 degrees Celcius (32 -122 F) and in an atmosphere of relative humidity up to 80%.

Should the unit be installed in an equipment rack, it is important to ensure that the operating temperature inside the rack does not exceed the upper limit. This may often be the case where the rack contains power amplifiers and a cooling fan may be necessary in such installations.

Although designed to withstand hum pick-up, and it is VERY important that the unit is not installed close to any electro-magnetic fields which may be generated from power transformers or motors.

3.3. POWER REQUIREMENTS & LINE VOLTAGE SWITCH

The unit may be operated from either 115-125 Volts AC 60Hz single phase or 200-250 Volts AC 50Hz single phase. (A 100 Volt special unit is available for Japan)

The voltage is normally pre-selected at the factory for the country of destination, and a sticker will indicate the voltage the unit is set for. **IF IN DOUBT CHECK THE VOLTAGE SELECTOR SWITCH INSIDE THE UNIT AND ENSURE THAT THE CORRECT FUSE IS USED.** (0.1 amp for 200-250 & 0.2 amp for 100-125 ; both slow blow).

4. DESCRIPTION OF THE CONTROLS

The following controls are the same for both left and right channels, each side containing the following :

GAIN REDUCTION DISPLAY:

This 12 Led bargraph Indicates the amount of compression (In dB). The law Is expanded at low values.

LEVEL DISPLAY :

This 12 Led bargraph indicates either the input level or the output level as selected by the Input/output push-button.

COMP/BYPASS :

This switches the compressor in and out of circuit, so that comparisons may be made between the compressed and un-compressed signal.

INPUT/OUTPUT:

This switches the second bargraph display between input and output level.

DS/FLAT:

This button instantly adds de-essing capability to the BCL2 by adding a filter into the side-chain. This makes the compressor "frequency conscious', which means that it compresses more on the frequency chosen, in this case the frequency where sibilance occurs.

GAIN:

This controls the output gain after compression and is used to match the output with the level of the incoming signal. This may be varied from -20 dB to +20 dB.

RATIO :

This determines the ratio of compression applied. This may be varied from 1:1 to LIMIT (20:1). The ratio of compression may be defined as the ratio which determines how much the output is allowed to increase by in comparison to an increase of the input. For example, with a 10:1 compression ratio, once the input signal is above the threshold level, the output will only rise by 1dB for every 10 dB that the input rises. When the ratio is in excess of 10:1 the action of such large amounts of compression is described as "limiting", because the output is unable to exceed the limit imposed by the compressor.

THRESHOLD :

This adjust the signal level above which compression occurs. The lower it is set, the greater is the compression. The threshold range is from -40 dBu to +20 dBu.

ATTACK :

This determines how fast the compressor will act upon the incoming signal. This time may be varied from between 0.1 milli-seconds and 70 milliseconds. (Caution : Very fast attack times introduce distortion at low frequencies with ANY form of compressor. This is caused by a low frequency signal being longer than the attack time. The low frequency waveform will be distorted by the initial gain reduction because the action is almost certain to occur mid-waveform.)

RELEASE :

This determines how fast the action of the compressor will take to be turned off as the incoming signal falls below the threshold. This time may be varied from between 100 milliseconds and 3 seconds. (Caution: Very fast release times introduce distortion at low frequencies with ANY form of compressor. This is caused by a low frequency signal being longer than the release time. The low frequency waveform will be distorted by the initial release of gain reduction because the action is almost certain to occur mid-waveform

4. DESCRIPTION OF THE CONTROLS

RECTIFIER:

This controls the respective percentage of RMS detection and Peak detection that will be processed by the sloe-chain. In the extreme positions, It uses only one of the rectifiers. In the Intermediate position, It uses a blend of both. A very basic rule-of-thumb would be to use RMS detection on individual tracks and Peak detection on mixed program (see applications). As always this is very much open to experimentation.

The unique continuously-variable detection characteristic of the BCL2 makes experimentation as easy as turning a knob.

NB : The Attack and Release controls relate to the Peak rectifier only. Hence, when the Rectifier control Is in the full ccw position (RMS), these controls are inoperative.

STEREO/DUAL :

The unit may be switched between stereo mode and two separate mono channels.

POWER:

This switches the unit ON or OFF and the adjacent led lights when the unit is ON.

5.1. DEFINITIONS OF TERMS USED

Compressor:

A variable gain amplifier whose gain decreases as the input Increases beyond a threshold point. A compressor uses ratios of up to 8:1

LImIter:

A limiter is a compressor with very high compression ratios, usually above 10:1. A high ratio maintains an almost constant output level despite large changes in the input level above the threshold point.

Compression ratio :

The ratio In dB of input level change to output level change above the threshold point. A 4:1 compression ratio implies that the output level will only change by 1 dB for every 4dB that the input level changes above the threshold point.

Threshold:

This is the point at which compression starts to be applied as the signal rises, or starts to be removed as the signal falls. The Gain Reduction display will indicate when compression commences, and then the threshold can be varied to obtain the desired effect. Reducing the threshold point will give more compression effect than leaving it just below the input level.

Peak detection :

It is closely related to the maximum electric amplitude of the signal. This characteristic is ideal for compressor-llmiters used in protection of transmission lines, amplifiers, broadcast transmitters etc...

RMS Detection :

It is related to the psycho-acoustic perceived "loudness". This characteristic is more suitable for "creative" applications such as drums fattening, bass sustain, vocal processing, etc...

De-essing :

Reducing or removing the sibilance effect produced by some microphones, some people, and certain sound sources. This is achieved by making a compressor "frequency conscious'. This means that a pre-emphasis filter Is placed in the side-chain, which controls the compressor, making it work harder upon those particular frequencies. In true de-ess mode, the compressor ONLY acts upon those frequencies and passes all other ones.

5.2. GENERAL

The usual purpose of Limiting and Compression is to increase loudness and to provide overload protection and generally to control level.

Limiting

Limiting is used mainly to provide overload protection ; i.e. to limit the output to some desired output level.
The protection required is usually against transients which exceed the peak Input level required for a tape recorder or a transmitter. These high energy transients are usually of very short duration (micro-seconds) but may wreck a transmitter or ruin a good recording by introducing distortion.
Control of these transients by limiting does not noticeably affect the dynamic range, since the gain reduction, when it does occur, is momentary and of a relatively low order of magnitude. In most cases, a fast release time will be employed so that the transients are controlled quickly without any apparent change in programme content..

This form of compression, using ratios of 10:1 and above allows the engineer to reduce his system headroom, and operate with a higher recording or broadcast level without fear of overload and thus increase the useable dynamic range of a recording or transmission system.

Compression

Compression describes conditions of gain reduction that are more of less continuous, so that the original dynamics are compressed. A low compression ratio Is used when it is desirable to preserve a relationship with the original dynamics, but higher ratios provide useful effects, particularly In "pop" recording and the transmission of speech, where the main sound source needs to be brought out clearly. This is effectively increasing the loudness of the signal, and this enhances its prescence in a recording or over a background.

Attack and Release time

Attack and release times are important when using compression, since they determine the moment to moment gain change in a system, and therefore the apparent loudness. A fast release time combined with a high ratio will bring more of the lower level signal content up towards peak level, and a fast attack time will really bring out the prescence. However, this kind of setting can sometimes be heard to be "breathing" or "pumping". This Is the effect where the main sound source is intermittent and you notice the compressor working. (Suddenly the main voice comes through and sounds veryfull, and then as it pauses, the compressor turns off, allowing the background noise to be heard, and then the voice cuts in again immediately obscuring the background). In these cases it may be necessary to either reduce the times used or reduce the ratio depending upon the effect required.

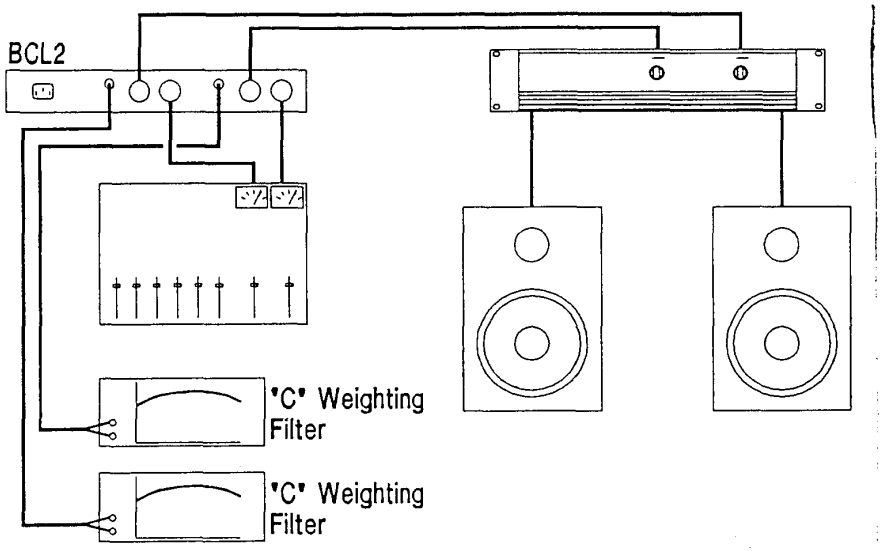
Modulation

If more than about 6db of compression is used, it is desirable to treat individual sound sources or groups of similar sound sources separately in order to avoid modulation effects, when a dominant sound modulates the rest of the signal. It Is particularly difficult to limit low frequency sounds in a final balance, because the effect on the remaining signal and ambience will be most noticeable. Separate compression will increase the overall compression effect.

5.3. APPLICATION OF BCL2 AS A LOUDNESS LIMITER

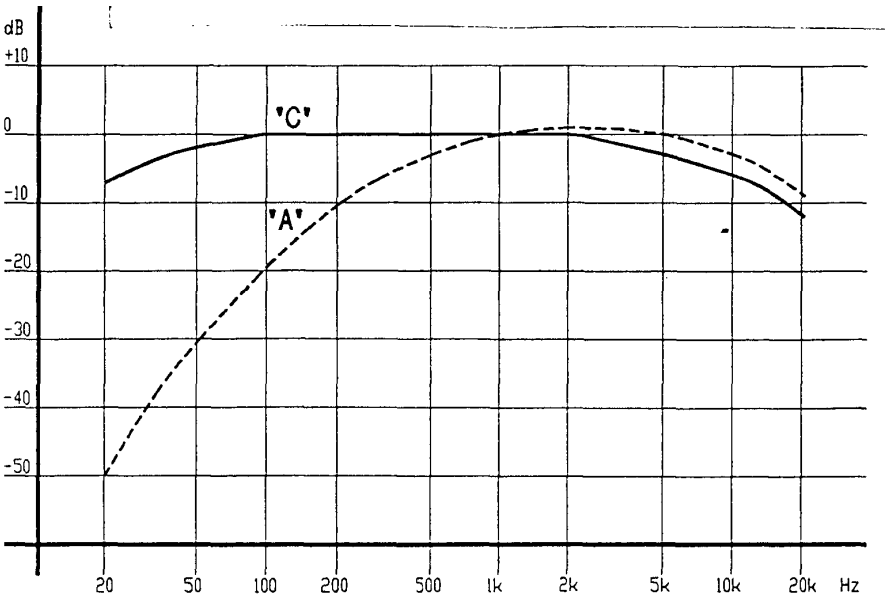
The perceived loudness (SPL) is not linear as a function of frequency. The human ear is more sensitive to the mid-frequencies than to very low or very high frequencies. This phenomenon must be taken into account when using a limiter to control the maximum loudness In certain areas such as discotheques, clubs and concert halls. To emulate the typical loss of high and low frequency sensitivity of the human ear, a weighting filter must be inserted in the sidechain, according to figure 1. This weighting filter is available from a number of companies manufacturing test equipment. It must be set at "C" weighting (high levels).

Fig. 1



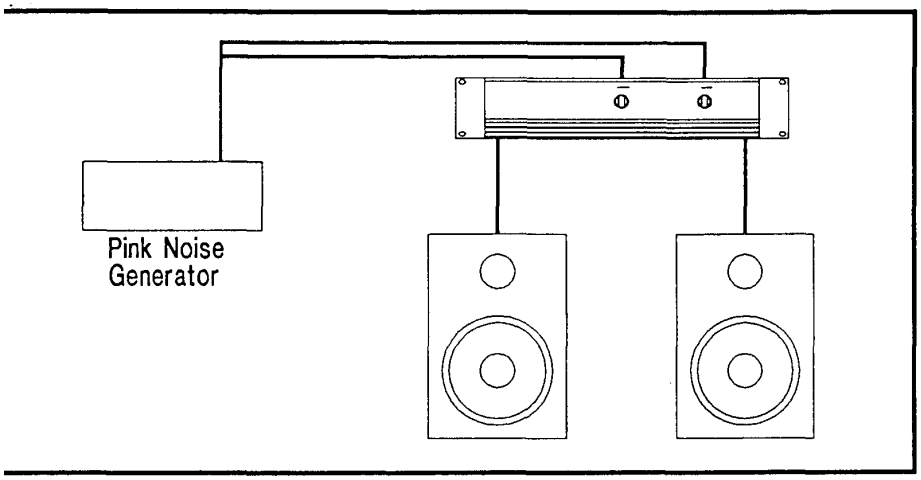
As an alternative, one can emulate such a filter, using a stereo one-octave equalizer set in such a way that the frequency response approximates that of fiqure 2.

Fig. 2

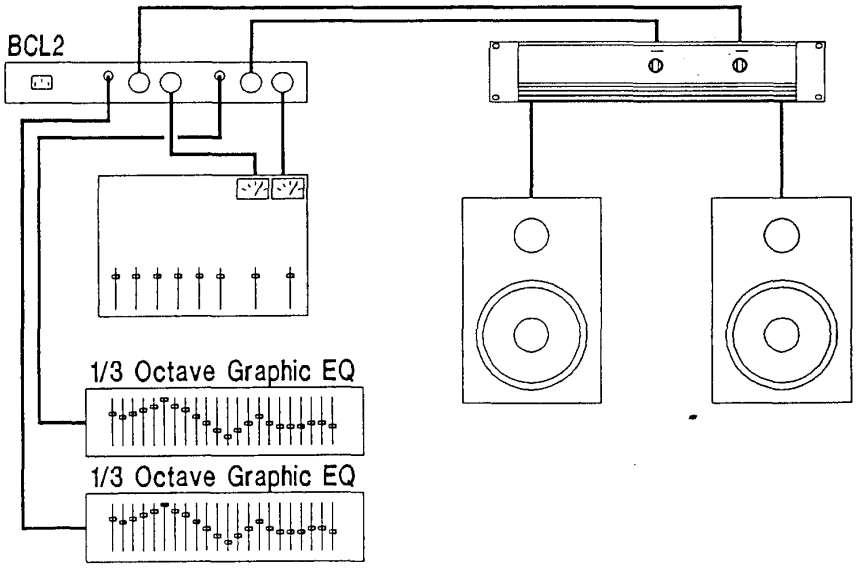


5.4. APPLICATION OF BCL2 AS AN ACOUSTIC NUISANCE LIMITER :

This is a complementary aspect of loudness limiting, but in this instance, the sound pressure level which must be limited is one that remains after attenuation and conduction outside the room or building where the sound is produced. Very often, only certain low frequencies are transmitted, In particular those which excite resonant modes of cavities, walls or structures. To achieve efficient limiting of those frequencies, it is necessary to measure the noise transmission, using a real-time spectrum analyser (preferrably 1/3 octave).



When this is done, one has to copy the frequency response to a graphic equalizer which is inserted in the side-chain.



Step 2

In operation, limiting will occure predominantly at those frequencies which create a nuisance.

NB : To improve this scheme, it may be necessary to use a parametric equalizer, tuned precisely at the frequencies which excite resonances.

5.5. APPLICATION AS AN AUTOMATIC VOICE-OVER (DUCKER) :

This application is useful in discotheques and radio where it provides an "automatic fader" which reacts to the voice of the disc-jokeys, reducing the background music accordingly.

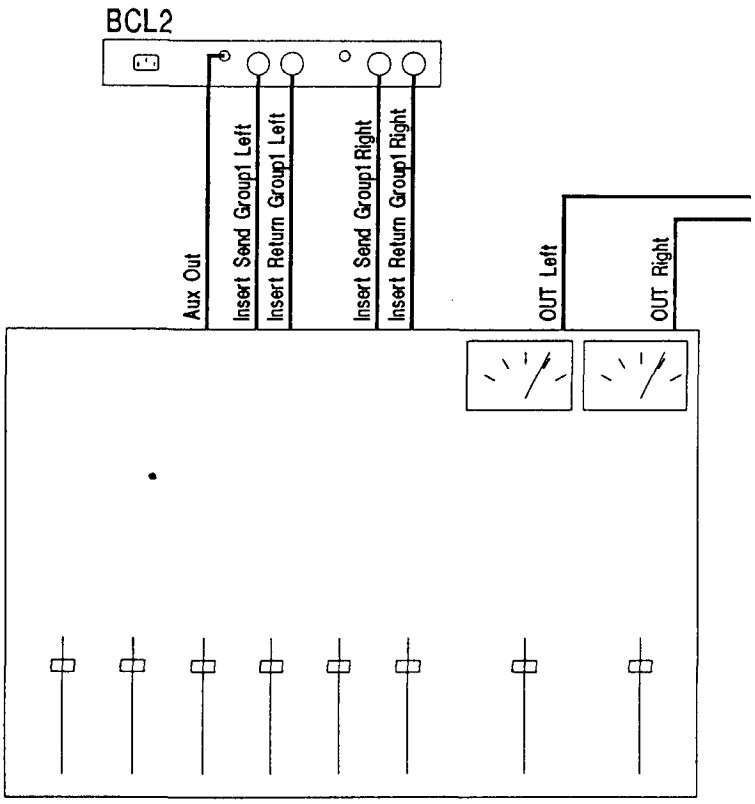
To do this, the music channels must be routed to separate groups which will be processed through the BCL2 and then reinjected to the Mix busses (subgroup).

The voice channels must be routed directly to Mix and to an auxiliary output whichs feeds the Side-Chain insert Return.

The BCL2 must be in the Stereo mode.

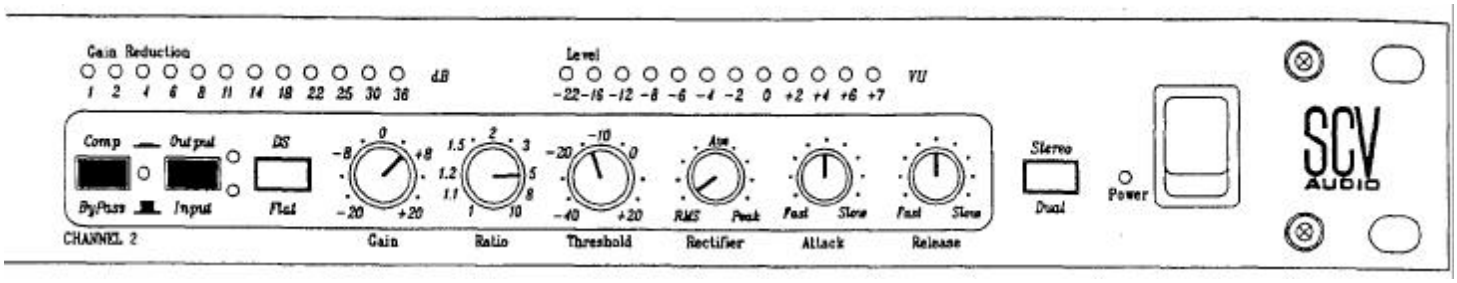
The active front panel controls are those of the channel receiving the auxiliary send.

The other controls must be set as to be inoperative ; it is sufficient to set the Threshold at its maximum value.

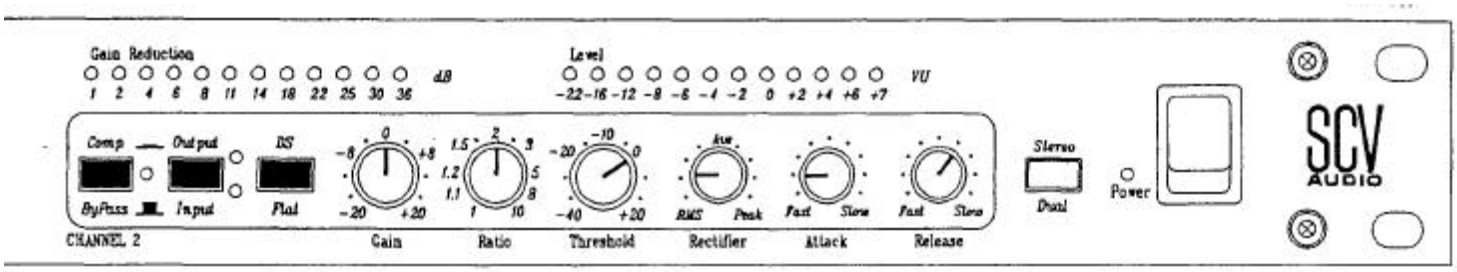


'Master' inputs are routed to MIX and Aux 'Slave' inputs are routed to Group1 Group1 is routed to MIX

In those applications, the BCL2 is inserted in an individual channel. After processing, the signal Is mixed with the other channels. This is done that way because the BCL2 is used to modify a sound, not to control its amplitude.

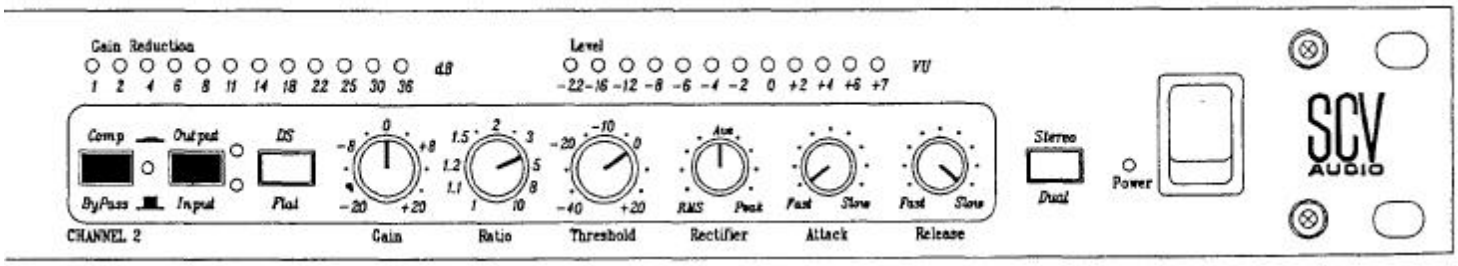


Bass Drum

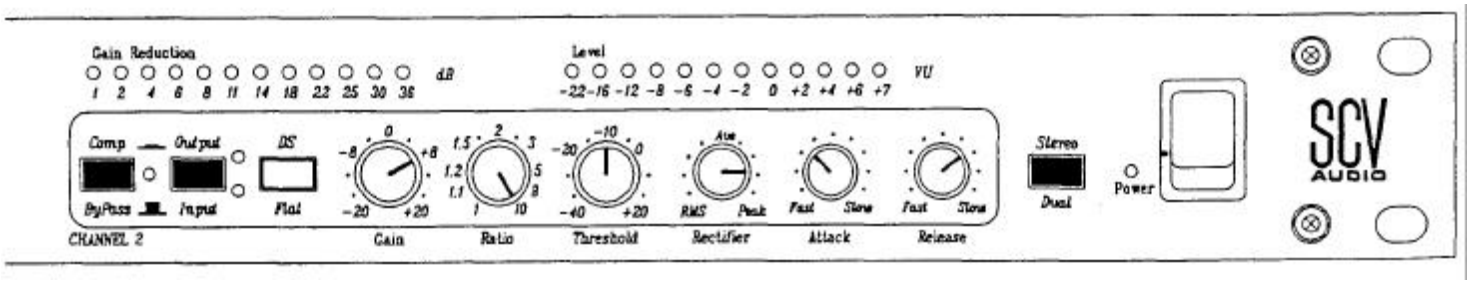


Vocal

In the following applications, the BCL2 is connected at the output of the mixer. This is necessary because, if the BCL2 was inserted in the Mix inserts, the level would vary with the setting of the Master Fader.



Cassette Mastering



FM Transmission

INPUT:

The input stage is based around an op-amp connected as a differential unitygain (U1b). RF protection is provided by capacitors C1 and C2.

VCA:

It is based on the dbx chip which is a current-in current-out device. Op-amp U1a is used as VCA output buffer. U2a is the control voltage buffer driving pin 3 of the VCA. A positive voltage at this pin decreases the gain at a rate of 1 dB per 6mV D.C.

SIDE-CHAIN SIGNAL CONDITIONING:

Normally the signal used for detection is the same as the Input voltage but it is often useful to apply some frequency-conscious conditioning to this signal. So it is possible to connect an equalizer at the insert point. In the absence of connection, the signal flows though the normalling contacts.

Very often it is necessary to lift only the high frequencies to compensate for highly sibillant signals.

Switch SW3 introduces a pre-emphasis of 6 dB at 3,5 kHz, 12dB at 8 kHz with a maximum of 18dB at 18 kHz.

The effect is to make the compressor more conscious of high-frequencies, for improved protection of loudspeakers, tape recorders and transmitters.

RMS DETECTOR:

It is based on the dbx chip, which delivers a DC voltage representing the logarithmic value of the input signal, with a rate of 6 mV per dB. The timeconstants are fixed by capacitor C19 and resistor R44.

PEAK DETECTOR:

The signal is passed through a full-wave rectifier using U6b as phase inverter and U5a and U5b as rectifiers. Time-constants are provided by potentiometers P4 (attack) and P5 (release) in conjunction with capacitor C16. The resulting DC voltage is buffered by U7a then is injected to U10, which is again an RMS chip, used here only to convert absolute DC into logarithmic D.C.

THRESHOLD:

The DC voltages issued from U9 and U10 are connected to both ends of P6, which allows mixing of both RMS and Peak characteristics. The resulting voltage is then compared to the indicated threshold by op-amp U4. The threshold is adjusted by potentiometer P3.

RATIO:

The output signal U4a is transmitted to the Ratio potentiometer P2, through a diode D2. The function of D2 is twofold :

- avoiding negative voltages reaching the VCA which would cause an increase in gain,
- the non-linear characteristic of the junction makes the transition smoother (soft-knee).

STEREO-COUPLING:

In stereo applications, it is generally required to interlock both-channels, in order to have the same instantaneous gain, to avoid lateral shifting of the stereo image. This is done by forcing the less compressing channel to follow the most compressing.

U3a is used as a positive absolute rectifier. The voltage at TP1 cannot be less than the input voltage of U3, but it can be higher, which can happen if SW203 is closed and the other channel delivers a higher voltage.

GAIN:

Potentiometer P1 allows adding of subtracting an offset to the control voltage, thus providing gain control.

It is often necessary to add some gain to a compressed signal, because the higher levels are decreased. However, this is at the expense of increasing the output noise.

OUTPUT STAGE:

It uses a circuitry in which the output transformer is integrated in the feedback loop. The advantages are a dramatic reduction of low frequency distortion and a great improvement in transient response, while retaining a desirable isolation of the secondary.

The signal Is applied to the non-inverting input of U2b. Feedback to the inverting input is applied from 3 sources.

- DC stabilization is done via primary of transformer and R24. Any A.C. content Is snorted to ground by C11.
- High frequencies above 100kHz are fed back directly through capacitor C10.
- Audio frequencies are fed back from ternary winding.

LEVEL INDICATOR DETECTOR:

It consists of an inverting single-wave rectifier based around U4b, charging a capacitor followed by a voltage-follower using U7b.

G.R. INDICATOR BUFFER:

The DC voltage at TP1 is amplified and buffered by U3b.

LEVEL INDICATOR :

D.C. voltage from U7 is applied to variable resistor VR1, then to the input of the led driver (UAA180). A fraction of the input voltage is fed through R2 to the reference input. The result is a non-linear deviation which optimizes resolution at higher levels.

G.R. INDICATOR :

It is identical to the level indicator. The resolution is maximized at low values of gain reduction.

PSU :

Center tap secondary of T201 in conjunction with bridge rectifier CR201 and capacitors C201, 202, 203 and 204 provide two unregulated voltages which are regulated by 3 pin fixed regulators U201 and U202.

RELAY DRIVER:

Diodes D201 and D202 in conjunction with capacitor C210 provide an unregulated positive supply of approx. 22V. The turn-on delay is introduced by R203 and C211.

DISPLAY PSU:

Rectified voltage at C205 is regulated at 15V by 3 pin regulator U203 with local decouple by capacitor C213.

7. MAINTENANCE

7.1. GENERAL

The Model BCL2 is a ruggedly constructed solid state unit which requires NO PREVENTIVE OR ROUTINE MAINTENANCE.

It is constructed from the highest quality components, which are selected so as to be conservatively rated for maximum life. Each unit Is soak-tested before despatch to reduce the possiblity of component failure In the field.

In normal service, the unit should provide years of trouble-free operation.

7.2. REPAIRS & WARRANTY

A warranty against defects in materials and/or workmanship Is extended to the user for a period of one year after initial purchase. This limited warranty must be activated by returning the Warranty Registration card to the factory at the time of purchase.

Because there are specially selected components in this product, unauthorised field repairs are not permitted during the warranty period, and attempts to do so may invalidate the warranty.

This warranty does NOT extend to any subsequent purchaser or user and terminates upon your sale or disposition of our product.

Exclusions from the warranty :

1. Failure caused by misuse, accident or neglect.

2. Products whose serial number has been defaced, altered or removed.

3. Damage to any other equipment caused by our product's failure.

4. Products which have unauthorised modification, accessories, parts or service.

Should a malfunction occur, the dealer from whom the unit was purchased will be glad to handle return to the factory for repair. A RETURN AUTHORISATION NUMBER MUST ACCOMPANY ALL RETURNS, and this may be either obtained directly from us or from your dealer. For prompt service, ship the unit, pro-paid to the factory with the RA number clearly visible on the shipping label.

Enclose a note, preferably taped to the unit of the malfunction, and instructions for return. We will pay one-way return shipping costs on any warranty repair.

MAKE SURE THE UNIT IS SAFELY PACKED, otherwise it may arrive at the factory in an even worse state. Transit damage IS NOT covered by warranty.

7.3. SERVICE ADJUSTMENTS

THE FOLLOWING PROCEDURES HAVE BEEN CARRIED OUT AT THE FACTORY AND ARE NOT REQUIRED UNLESS EITHER THE UNIT HAS MALFUNCTIONED, OR RECEIVED SERVICE WORK.

PRELIMINARY

All front panel potentiometers fully CCW except Release fully CW and GAIN at mid-position. COMP and OUTPUT depressed. DS released.

A) GAIN

- Inject a 1 kHz sine-wave at 0 dBu.

- Check the output level to be 0 dBu ±0.5 dB.

- Turn the gain potentiometer and check a variation of -20 to +20 dB.

B) VCA TRIM

- Measure the distortion.

- Adjust VR1 and VR101 for minimum distortion (0,015%).

C) BARGRAPH CALIBRATION

- Adjust the gain potentiometers to obtain +4dBu at the outputs.

- Adjust VR1 on each bargraph card to light 8 Led's on each level bargraph.

- Turn the gain potentiometer and check that the last LED goes on for an output level of 11 dBu (± 1 dB).

D) LOG CONVERTER OFFSET

- Turn off the oscillator.

- Check that the Rectifier potentiometer is on the Peak position.

- Measure TP2 with a D.C. millivoltmeter (or an oscilloscope with D.C. input).

- Adjust VR2 and VR102 to obtain the most negative reading (~ 400 mV).

E) CONTROL VOLTAGE CHECK

-Inject a 1 kHz sine-wave at +2dBu.

- Set the Gain potentiometer at +4dBu.

- Set the Ratio potentiometer at maximum (LIMIT).

- Set the Threshold potentiometer at minimum (-40).

- Check that the output levels falls to -34 dBu (±1 dB).

- Rotate the Rectifier potentiometer and check that the output level does not change more than 1 dB.

- Adjust VR2 on each bargraph card to light the complete bargraph.

F) DETECTOR BALANCE CHECK

- Set the threshold potentiometer at mid-position

- Check the output signal goes to -7dBu {± 1 dB).

- Rotate the Rectifier potentiometer and check that the output level does not change more than 1 dB

- Check that only 5 LED's stay lit on the Gain Reduction bargraph.

G) GS CHECK

- Depress the DS push-button
- Check that the level goes down by 2 dB (± 0.5 dB) I.e. -9dBu.
- Change the frequency of the oscillator to 10 kHz.
- Check that the level goes down by another 14 dB (± 1 dB) I.e. -23 dBu.

H) RATIO CHECK

- Set the Ratio potentiometer at mid-position (2:1).
- Check that the level goes up to -15dBu.

I) RMS TRIM

- Inject a 100 Hz sine-wave at +2dBu.
- Set Threshold at mid-position (-10).
- Set Recfifier to RMS.
- Set Ratio at maximum (Limit).
- Check that the output is -6dBu.
- Measure distortion.
- Adjust VR3 and VR103 for minimum distortion (less than 0.5 %).
- Set Rectifier at Peak.
- Set Release at minimum (Fast)
- Check distortion lower than 1 %.
- Set Release at maximum (slow)
- Check distortion lower than 0.1 %.
- Set Attack at maximum (Slow).
- Check distortion lower than 0,06 %.

J) STEREO COUPLING CHECK

- Disconnect the oscillator from channel 2
- Depress the Stereo push-button.
- Check that both Gain Reduction bargraphs display the same value.
- Disconnect channel 1 and Reconnect Channel 2.
- Check same.

K) NOISE

- Turn off the oscillator.
- Check that the output noise is lower than -96 dBu (20 Hz - 20 kHz, RMS rectifier).

L) PK/RMS CHECK

- Release the DS push-button.
- Release the stereo push-button.
- Set Threshold art mid-position.
- Set Ratio at maximum.
- Set Rectifier at RMS.
- Inject a 1 kHz sine-wave at +2 dBu
- Check that the output Is -7 dBu (± 0.5 dB).
- Inject a 1 kHz square-wave at +2 dBu.
- Check that the output level does not change.
- Set Rectifier at Peak.
- Inject a 1 kHz sine-wave at 2 dBu.
- Check that the output level does not change.
- Inject a 1 kHz sqare-wave at +2 dBu.
- Check that the output level increases by 3 dB (-4dBu).

M) SIDE-CHAIN INSERT CHECK

- Insert aTRS jack plug in the rear-panel Insert jack socket.
- Check that the Gain reduction LED's go off and the output level goes up.
- Inject a signal at « OdBu on the tip of the jack.
- Check that the led's go on again.

N) BY-PASS RELAY CHECK

- Disconnect the mains plug.
- Check the signal continuity between input and output.