

# INVOTONE

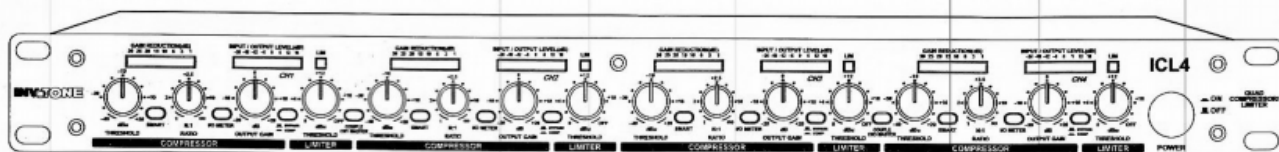
## USER'S MANUAL

### ICL4

### QUAD COMPRESSOR/LIMITER



07130000836



# IMPORTANT SAFETY INSTRUCTION



**TO REDUCE THE RISK OF ELECTRIC SHOCK PLEASE DO NOT REMOVE THE COVER OR THE BACK PANEL OF THIS EQUIPMENT. THERE ARE NO PARTS NEEDED BY USER INSIDE THE EQUIPMENT. FOR SERVICE, PLEASE CONTACT QUALIFIED SERVICE CENTERS.**

This symbol, wherever used, alerts you to the presence of un-insulated and dangerous voltages within the product enclosure. These are voltages that may be sufficient to constitute the risk of electric shock or death.

This symbol, wherever used, alerts you to important operating and maintenance instructions. Please read.

- ⊕ Protective Ground Terminal
- ~ AC mains (Alternating Current)
- ⚡ Hazardous Live Terminal

ON: Denotes the product is turned on.  
OFF: Denotes the product is turned off.

## CAUTION

Describes precautions that should be observed to prevent damage to the product.

1. Read this Manual carefully before operation.
2. Keep this Manual in a safe place.
3. Be aware of all warnings reported with this symbol.
4. Keep this Equipment away from water and moisture.
5. Clean it only with dry cloth. Do not use solvent or other chemicals.
6. Do not damp or cover any cooling opening. Install the equipment only in accordance with the Manufacturer's instructions.
7. Power Cords are designed for your safety. Do not remove Ground connections! If the plug does not fit your AC outlet, seek advice from a qualified electrician. Protect the power cord and plug from any physical stress to avoid risk of electric shock. Do not place heavy objects on the power cord. This could cause electric shock or fire.
8. Unplug this equipment when unused for long periods of time or during a storm.
9. Refer all service to qualified service personnel only. Do not perform any servicing other than those instructions contained within the User's Manual.
10. To prevent fire and damage to the product, use only the recommended fuse type as indicated in this manual. Do not short-circuit the fuse holder. Before replacing the fuse, make sure that the product is OFF and disconnected from the AC outlet.

## WARNING

**To reduce the risk of electric shock and fire, do not expose this equipment to moisture or rain.**



**Dispose of this product should not be placed in municipal waste and should be separate collection.**

11. Move this Equipment only with a cart, stand, tripod, or bracket,

specified by the manufacturer, or sold with the Equipment. When a cart is used, use caution when moving the cart / equipment combination to avoid possible injury from tip-over.



12. Permanent hearing loss may be caused by exposure to extremely high noise levels. The US. Government's Occupational Safety and Health Administration (OSHA) has specified the permissible exposure to noise level.

These are shown in the following chart:

HOURS X DAY	SPL	EXAMPLE
8	90	Small gig
6	92	train
4	95	Subway train
3	97	High level desktop monitors
2	100	Classic music concert
1,5	102	
1	105	
0,5	110	
0,25 or less	115	Rock concert

According to OSHA, an exposure to high SPL in excess of these limits may result in the loss of heat. To avoid the potential damage of heat, it is recommended that Personnel exposed to equipment capable of generating high SPL use hearing protection while such equipment is under operation.

The apparatus shall be connected to a mains socket outlet with a protective earthing connection.

The mains plug or an appliance coupler is used as the disconnect device, the disconnect device shall remain readily operable.

## **PREFACE**

Dear Customer:

Thanks for choosing INVOTONE ICL4 Compressor/Limiter/Gate and thanks for choosing one of the results of INVOTONE job and researches.

For our INVOTONE , music and sound are more than a job... are first of all passion and let us say... our obsession!

We have been designing professional audio products for a long time in cooperation with some of the major brands in the world in the audio field.

The INVOTONE line presents unparalleled analogue and digital products made by Musicians for Musicians in our R&D Centers in Italy, Netherlands, United Kingdom and Taiwan. The core of our digital audio products is a sophisticated DSP (Digital Sound Processor) and a large range of state of the art algorithms which have been developed by our Software Team for many years.

Because we are convinced you are the most important member of INVOTONE and the one confirming the quality of our job, we like to share our work and our dreams with you, paying attention to your suggestions and your comments. Following this idea we create our products and we will create the new ones! From our side, we guarantee you and we will guarantee you also in future the best quality, the best fruits of our continuous researches and the best prices.

Our INVOTONE ICL4 is the result of many hours of listening and tests involving common people, area experts, musicians and technicians. The results of this effort is that you can acquire an extremely efficient and universal dynamics processor. It contains several new circuits design which make the unit an ultimate dynamic processor: intelligent program recognition, Smart Expander / Gate and super low distortion VCA (Voltage Controlled Amplifier).

Nothing else to add, but that we would like to thank all the people that made the INVOTONE ICL4 a reality available to our customers, and thank our designers and all the INVOTONE staff, people who make possible the realization of products containing our idea of music and sound and are ready to support you, our customers, in the best way, conscious that you are our best richness.

Thank you very much.

INVOTONE

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# 1. INTRODUCTION

You are now the Owner of an INVOTONE ICL4 Quad Compressor/Limiter. The ICL4 is a very powerful dynamic processor. We have included in it with several innovative circuit designs that make the ICL4 a very versatile processor: smart and fast recognition of the program and very low distortion Voltage Control Amplifier (VCA).

## Feature List:

### • **Smart Knee Control Compressor (SKC)**

Soft knee or hard knee? This is the question! SKC combines both: In the "soft knee" mode you can control the program material so that the compression will be the most musical and inaudible. On the other hand, the hard knee function is used for better precision, limiting signal peaks with precision and will allow you to add creativity to the dynamic processing. This function also allows you to protect other equipment in the signal loop against distortion.

### • **The AUTO Function**

Thanks to the AUTO function attack and release times of the program materials are automatically analysed in your ICL4 unit. Then the dynamic range of the program is heavily compressed in a very musical way so that there will not be any audible breathing or pumping effect.

### • **Smart Gain Control peak limiter (SGC)**

This function includes two important functions: Clipper and program limiter. The peak limiter will be activated above a certain threshold that is adjusted by the User and will radically restrict signal peaks. But what about if the threshold of the Limiter is surpassed only for a few milliseconds? SGC will turn on automatically and reduce the output signal so that you will not hear any distortion. Smart, isn't it? The SGC proves to be very efficient in loudspeaker protection and to reduce undesired peaks in digital situations.

## 2. THE CONCEPT BEHIND

### 2.1 Some technical stuff

Good old analog technology: It will allow us to manufacture audio equipment with a very high dynamic range: up to 125 dB. But the dynamic range of digital equipment is more or less 25 dB. A further reduction in dynamic range occurs with the use of tape recorders and/or vinyl records.

#### 2.1.1 It is not just Music

Yes, a piece of electronic will produce some noise. When the current flows through a conductor this will generate a certain movement of the electrons and therefore: noise. And throughout the whole spectrum of audio. Imagine what happens when this inherent noise will be amplified. Yes, today one can use "low-noise" components but still such components will present a certain level of residual noise. For example with tape recorders it will not be possible to get an S/N (signal to noise) ratio better than 70dB. This level would not be accepted today by the increased sensitivity of the listeners. It is possible to improve the performance of a tape recorder: Absolutely no!

## 2.1.2 Introducing Audio Dynamics

The human ear can detect the noise generated by falling leaves as well as the roar generated by the taking off space shuttle. Unfortunately no analog, nor digital device can reproduce such wide spectrum. Please look at Chart. 1 and you will see the difference when dynamic capacity of various devices compare to the human ear. More problems occur when handling high level signals and low level signals. When you reach the high level limit you may incur in distortion because of the dynamic range of the instrument therefore a certain "reserve" must be maintained to avoid distortion. This reserve is known as "headroom" and it is usually set at 10-20 dB. Would not be easier just to reduce the operating level? Yes it would but you would put low level music signals at the same level of the basic noise floor so the overall quality of the signal would be highly deteriorated. Please look at Chart. 2 and note the Usable dynamic range (including headroom) versus high level distortion generated by peaks, and Noise floor level.

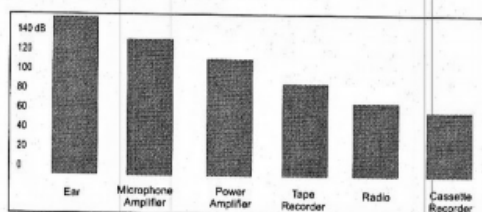


Chart. 1 The dynamic range capabilities of various devices

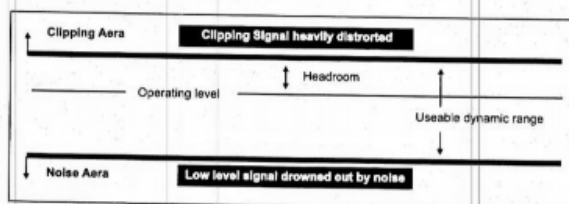


Chart. 2 The interactive relationship between the operating level and the headroom

So the operating level must be as high as possible but not high enough to generate distortion.

There is a very easy way to obtain this. With the volume knob in hand you can increase the volume during low passages and decrease the volume during loud passages. Unfortunately even the Great Houdini would not be fast enough to monitor carefully the speed of the musical signal and it would be impossible to detect signal peaks and consequently levelling them out. Manual control is therefore out of question. The answer is AGC (automatic gain control); a device that will monitor the signal in real time and that will adjust the gain for the best S/N ratio without producing distortion. So, the name of this device is "Compressor/limiter".

## 2.1.3 More technical stuff about Compressor/Limiters

Try to measure the dynamic range of musical instruments. You will find out that your can ear will handle range during which the distortion and overloading will be generated in your audio equipment.

To avoid these, compressor/ Limiters will be used. Both Compressors and Limiters more or less do the same job but Limiters brutally limit the audio signal above a set threshold, while Compressors handle signal in a much more civilised way and over a wide range of levels. If an audio signal exceed the threshold set by the User the limiter will kill any audio signal above that threshold. Period! Also Compressors perform their function when the audio signal exceed a certain threshold but the signal is not killed brutally. The audio signal will be reduced in gain in proportion with the amount above the set threshold.

## 2.2 Voltage Controlled Amplifier (VCA)

The VCA is the soul of the ICL4 and it is one of the best components available today in his category thanks to its excellent performances in terms of distortion, linearity, noise and temperature stability.

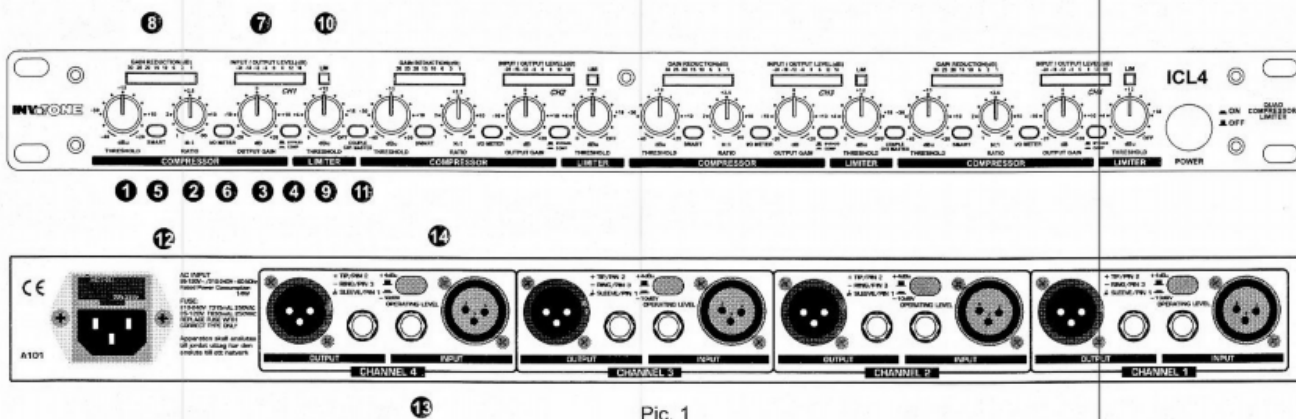
## 2.3 Inputs

### 2.3.1 Take it easy: Balanced Inputs

To make your life easy and clean we have provided ICL4 with electronically balanced inputs. Even if you operate at high signal levels, hum and noise will be reduce automatically. There is also a servo-function that will automatically adjust the internal level when unbalanced connectors are detected. The correction is of 6dB and it will avoid differences in level in between input and output signal.

## 3. CONTROL ELEMENTS

Your ICL4 presents with four channels. Each channel is equipped with the same control elements: 3 push-button switches, 4 rotary controls and 17 LEDs. You can operate in stereo mode via pressing the Couple switch. The details please refer to following content.



Pic. 1

### 1. Threshold Control for Compressor Section

With this control you can adjust the threshold level in the Compressor. The range is varied from -40dBu to +20dBu. When a signal exceed the set threshold by 10dB maximum the SKC will be applied, while above such level signal will be processed with hard knee compression.

### 2. Ratio Control

The ratio in between input and output level signals above the set threshold is determined by this control. When the SKC is applied such ratio is only expressed for the signals exceeding the set threshold more than 10dB. The range of control of the ratio varies from 1:1 to  $\infty$ :1.

### 3. Output Gain Control

You can increase or decrease the output signal by a maximum of 20dB. IN such way you can recover the level lost during the compression process.

### 4. Bypass / Comp Switch

Push this switch and you will deactivate the corresponding channel. You can also use the bypass switch to make an A / B comparison in between processed and unprocessed signal.

### 5. Smart Switch

A hard knee compression is turned into SKC by mean of this switch. If you wish to get a compression that is quite inaudible use the SKC mode through the Smart switch.

## 6. Meter Switch for input / output

When this switch is ON the Meter will read the output level. When the switch is OFF, the Meter will read the input level.

## 7. Level Meter for Input / Output

You can adjust the operating level by mean of the Operating Level Switch and choose -10dBV or +4dBu. Consequently the Meter will be the Input or Output Level with a range from -24dB to +18dB.

## 8. Meter for Gain Reduction

The gain reduction will be shown by this Meter with a range of 1 to 30dB.

## 9. Threshold Control for Limiter

The threshold Level for the Limiter will be adjusted by this control

## 10. Limiter LED

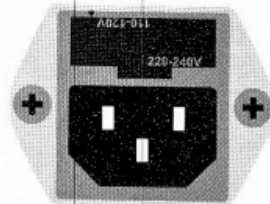
When the Limiter is active, this LED will flash up.

## 11. Couple Switch

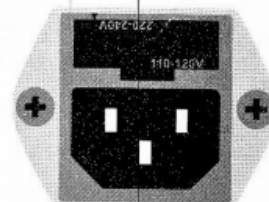
When pressing this button Channel 1 and 3 will operate in stereo mode.

## 12. Voltage Selector and Fuse holder

Please make sure about the voltage available in your Country before connecting the unit to the AC socket. Please consult with a qualified Engineer to change the fuse or to change the AC Voltage operation on the ICL4.



THIS IS SET FOR  
110V AC TO 120V  
AC OPERATION



THIS IS SET FOR  
220V AC TO 240V  
AC OPERATION

Pic. 2

## 13. Audio In and Out

You can input and output the audio signal in the ICL4 via XLR connectors or 1/4" jack.

## 14. Operating Level Control

Choose +4dBu when using ICL4 in professional recording studios or -10dBV when using home recording equipment. The Input / Output Meter will automatically self-adjust to the chosen Operating Level.

## 4. READY TO ROLL?

### 4.1 Compressor Section

Sophisticated Voltage Controlled Amplifiers (VCA) are responsible of the control of dynamics in the ICL4. The operating range of our VCA is more than 60dB. This means that the input level or the output level can be increased or decreased in a range of 60dB. Signals below the set threshold will not be reduced, so the dynamic control will be activated as soon as the signal exceeds the threshold level. Gain reduction will be proportioned to the amount of the signal above the set threshold level.



### 4.1.1 The Threshold Control

The compressor threshold control sets the point where the input level starts to be reduced. Let's say the level is +12dBu and the threshold control is set at +2dBu: In this case up to 10dB can be compressed. If the input level is the same and the control is set at -10dBu the maximum compression will be 22dB, The operating range of the threshold control is -40 to +20dBu. Turn the threshold control fully clockwise and you will get a threshold level of +20dBu.

You must remember that the degree and the type of compression not only depend by the threshold control but also by other controls such as Ratio, Attack and Release.

### 4.1.2 Ratio Control

This control sets the change of input level to output level but only for the signals that exceed the threshold. The scale of the ratio control on the front panel (calibrated in dB) indicates how much input level is required to increase the output level by 1dB. If you have a ratio equal to 1:1 you will get the same level of input and output signal: So, no level change. If you have a ratio of 2:1 this means that for every 2dB increase of the input level (above threshold) you will get an increase of output level of 1dB. ON the same way, a ratio of 10:1 means that for every 10dB increase of the input level (above threshold) you will get an increase in output level equal to 1dB, and so on. You need to be aware that higher ratio settings produce less natural sounds so if you wish a more minute effect on the dynamic range of a program you should use a Ratio of 4:1 or lower.

With the SKC circuit (Smart Knee Control) you can avoid aggressive compression generated by using high ratios. How we achieve this? Introducing a "soft knee" curve in the range of up to 10dB above the threshold level. Hard Knee compression is then used beyond this range.

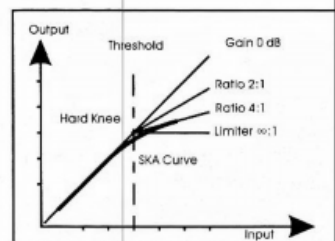


Chart. 3 SKA characteristic of the compressor section

### 4.1.3 Output Gain Control

This Control is indispensable to compensate the loss of level at output level generated by the gain reduction caused by the compression and limiting processing.

### 4.1.4 Bypass Switch

This switch simply turns off the correspondent channel. This is useful to compare quickly the processed and unprocessed signal.

### 4.1.5 Gain Control LED Meter

This consists of 8 LED on the front of the ICL4. Through this LED Meter you can visualise the amount of gain reduction at any given time.

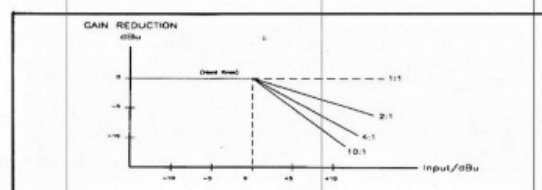


Chart. 4 The effect of a compressor can be expressed as the amount of gain reduction that is taking place for any given input

## 4.2 The Peak Limiter Section

How fast is the compressor to react to a signal which is above the threshold point? This is determined by the attack time. A longer attack time is advisable to process low frequencies while shorter attack time is preferable for high frequencies. IN this way you will avoid undesired dynamic distortion. But what about if you are mixing a program with a wide range of frequencies? IN this case you should choose a setting that would benefit the low frequency better. Well, life is not that easy for conventional compressor/limiters. Ok you handle an audio signal made by a wide range of frequencies and you have chosen a longer attack time. But, if using your ICL4 as a limiter the fast high frequencies will pass through untouched because the attack time is too slow and such transients could cause distortion when the unit is connected to broadcast devices or taper recorders. The solution in ICL4 is represented by our Smart Gain Control (SGC) limiter circuit. The curve in bold is the output signal and the dashed curve above it is the input signal. The area in between the two is the amount of gain reduction.

The unit will activate the limiter when the signal exceeds the threshold for more than 20 microseconds. Then 1 second after that the signal is below threshold again, reduction goes back to 0dB and in this case input and output signals are again identical.

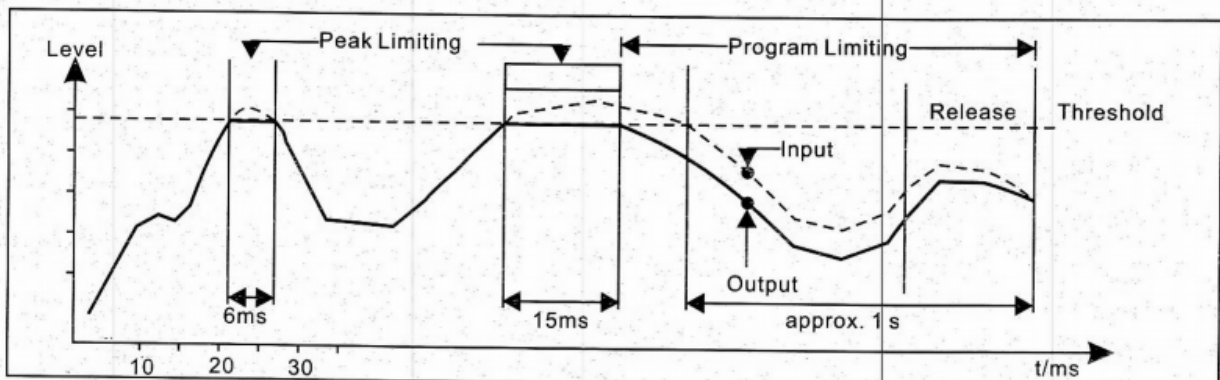


Chart. 5 SGC characteristic of the limiter section

## 5. INSTALLATION AND CONNECTION

### 5.1 Mains Connection

ICL4 is provided with dual voltage plug. You must check the power supply Voltage available in your Country before connecting the power cord in the wall outlet. Please see Page 7, paragraph 12 for further info.

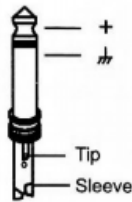
### 5.2 Audio Connection

The ICL4 Compressor/Limiter is equipped with balanced XLR connectors as well as 1/4" phone jack and can be connected with other units in different ways to support a vast range of applications without experiencing a signal loss.

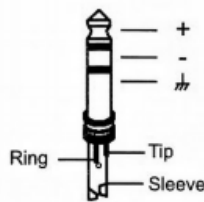
#### a. Wiring Configuration

Both types of connectors available on ICL4 can be wired in balanced and unbalanced modes. Please see following drawing for details:

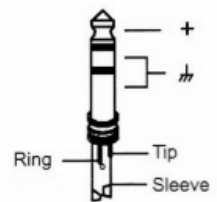
• For 1/4" Phone jack



TS Type Unbalanced



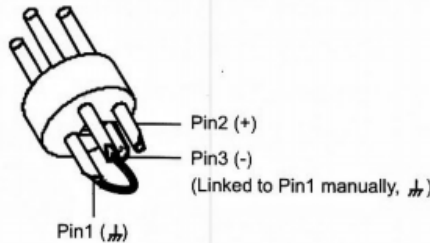
TRS Type Balanced



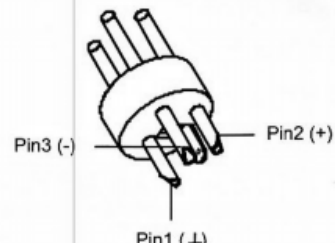
TRS Type Unbalanced

Pic. 3

• For XLR connector



XLR Type Unbalanced



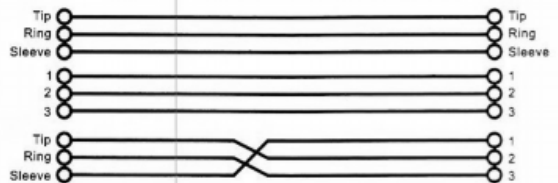
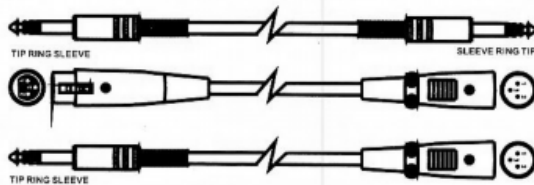
XLR Type Balanced

Pic. 4

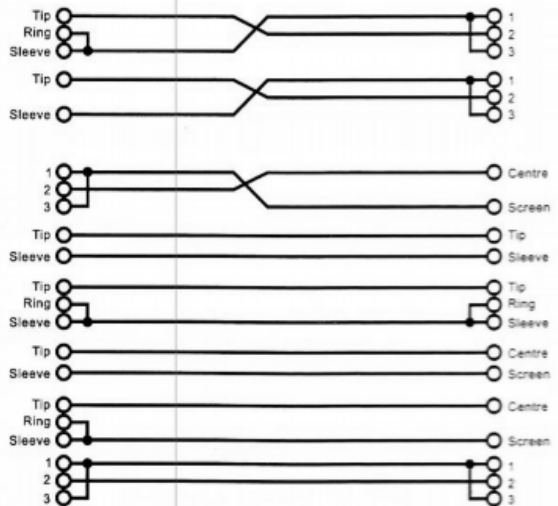
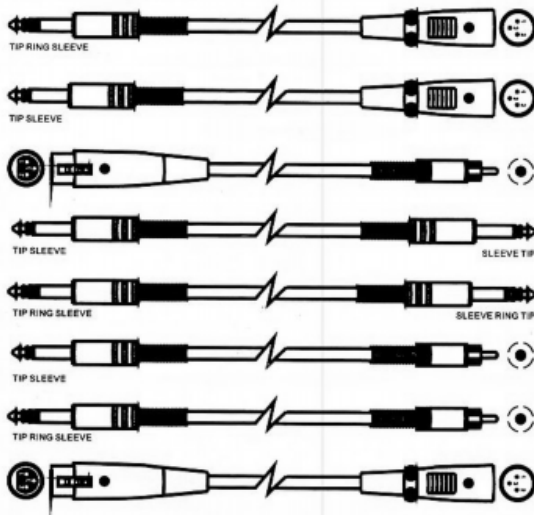
b. In Line Connection

Please see following drawing for details.

• Balanced



• Unbalanced



Pic. 5

### 5.3 Rack Mounting

The most secure mounting is on a universal rack shelf available from various rack manufactures or your music dealer. The ICL4 Quad Compressor/Limiter fits into one standard 19" rack unit of space.

Please allow at least an additional 4" depth for the connectors on the rear panel. Be sure that there is enough air space around the unit for sufficient ventilation and please do not place the ICL4 Quad Compressor / Limiter on high temperature devices such as power amplifiers etc. to avoid overheating.

## 6. TECHNICAL SPECIFICATIONS

AUDIO INPUT	Type	Active balanced XLR and 1/4"JACK
	Impedance	Balanced: 50K Ohm Unbalanced: 25K Ohm
	Operating Level	+4dBu /-10dBV
	Maximum input level	Balanced and Unbalanced: +21 dBu
	CMRR	>55dB @1KHz
AUDIO OUTPUT	Type	XLR and 1/4" JACK
	Impedance	Balanced: 60Ohm Unbalanced: 30Ohm
	Maximum output level	+21 dBu
	Bandwidth	20Hz to 20KHz at +0,-0.5dB
	THD +N%	0.01% typ,1KHz ,@+4dBu 0.04% typ,1KHz ,@+20dBu
	IMD	0.01% typ
	Noise	>-90dBu
	Crosstalk	<-100dB
COMPRESSOR SECTION	Type	Smart knee control Compressor
	Threshold	Variable: from -40dB to +20dB
	Ratio	Variable: from 1:1 to ∞:1
	Output	Variable: from -20 to +20dB
PEAK LIMITER SECTION	Type	Smart Gain Control Peak Limiter
	Threshold	Variable: from 0dB to OFF
	Ratio	∞:1
FUNCTION SWITCHES	COUPLE	Linking CH1 (master) and Ch2, CH3 (master) and CH4; stereo operation
	OPERATING LEVEL	Internal reference level: from +4dBu to -10dBV
	BYPASS	Bypass switch
	I/O METER	Switches input and output for the level meter
	SMART	Enables the ` Smart Knee Control ` characteristics
INDICATORS	GAIN REDUCTION: 8 element LED	
	INPUT / OUTPUT LEVEL: 8 element LED	
	PEAK LIMITER THRESHOLD: 1 element LED (Limiter Function )	
	Function switch: LED indicator for each	
POWER SUPPLY	95-120V~/210-240V~, 60-50Hz FUSE: 210-240V: T315mAL 250VAC 95-120V: 630mAL 250VAC	
POWER CONSUMPTION	14 Watts	
DIMENSIONS	483 (W) x194.5 (D) x44 (H)mm (19"x7.7" x1.7")	
WEIGHT	3.1kg (6.83lb)	

## **7. WARRANTY**

### **1. WARRANTY REGISTRATION CARD**

To obtain Warranty Service, the buyer should first fill out and return the enclosed Warranty Registration Card within 10 days of the Purchase Date.

All the information presented in this Warranty Registration Card gives the manufacturer a better understanding of the sales status, so as to purport a more effective and efficient after-sales warranty service.

Please fill out all the information carefully and genuinely, miswriting or absence of this card will void your warranty service.

### **2. RETURN NOTICE**

2.1 In case of return for any warranty service, please make sure that the product is well packed in its original shipping carton, and it can protect your unit from any other extra damage.

2.2 Please provide a copy of your sales receipt or other proof of purchase with the returned machine, and give detail information about your return address and contact telephone number.

2.3 A brief description of the defect will be appreciated.

2.4 Please prepay all the costs involved in the return shipping, handling and insurance.

### **3. TERMS AND CONDITIONS**

3.1 INVOTONE warrants that this product will be free from any defects in materials and/or workmanship for a period of 1 year from the purchase date if you have completed the Warranty Registration Card in time.

3.2 The warranty service is only available to the original consumer, who purchased this product directly from the retail dealer, and it can not be transferred.

3.3 During the warranty service, INVOTONE may repair or replace this product at its own option at no charge to you for parts or for labor in accordance with the right side of this limited warranty.

3.4 This warranty does not apply to the damages to this product that occurred as the following conditions:

- Instead of operating in accordance with the user's manual thoroughly, any abuse or misuse of this product.
- Normal tear and wear.
- The product has been altered or modified in any way.
- Damage which may have been caused either directly or indirectly by another product / force / etc
- Abnormal service or repairing by anyone other than the qualified personnel or technician. And in such cases, all the expenses will be charged to the buyer.

3.5 In no event shall INVOTONE be liable for any incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you.

3.6 This warranty gives you the specific rights, and these rights are compatible with the state laws, you may also have other statutory rights that may vary from state to state.