square one dynamics

operator manual

KLARK TEKNIK

OPERATOR MANUAL

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Square ONE Dynamics Processor - Operator Manual
DOC02-SQ1DYNAMIC Issue B - August 2006

IMPORTANT SAFETY INSTRUCTIONS

The lightning flash with arrowhead symbol within an equilateral triangle, is intended to alert the user to the presence of uninsulated "Dangerous Voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle, is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Unplug this apparatus during lightning storms or when unused for long periods of time.
13. Refer all servicing to qualified personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
14. Use the mains plug to disconnect the apparatus from the mains.
15. "WARNING - TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE."
16. "DO NOT EXPOSE THIS EQUIPMENT TO DRIPPING OR SPLASHING AND ENSURE THAT NO OBJECTS FILLED WITH LIQUIDS, SUCH AS VASES, ARE PLACED ON THE EQUIPMENT"
17. "THE MAINS PLUG OF THE POWER SUPPLY CORD SHALL REMAIN READILY OPERABLE"

square one

KLARK TEKNIK
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EU DECLARATION OF CONFORMITY

We, **Telex Communications (UK) Limited** of Klark Teknik Building, Walter Nash Road, Kidderminster, Worcestershire, DY11 7HJ, declare that a sample of the following product:

Product Type Number	Product Description	Nominal Voltage(s)	Current	Freq.
Square ONE Dynamics	Analogue Dynamic Processor	115V AC 230V AC	300mA 150mA	50/60Hz

to which this declaration refers, is in conformity with the following directives and/or standards:

Directive(s)	Test Standard(s)
89/336/EEC Electromagnetic Compatibility Directive amended by 92/31/EEC & 93/68/EEC 73/23/EEC, Low Voltage Directive, amended by 93/68/EEC	
Generic Standard Using EN55103 Limits and Methods	EN50081/1
Class B Conducted Emissions PAVI	EN55103
Class B Radiated Emissions PAVI	EN55103
Fast Transient Bursts at 2kV	EN61000-4-4
Static Discharge at 4kV	EN61000-4-2
Electrical Stress Test	EN60204
Electrical Safety	EN60065 7th Edition

Signed: ..... Date: 22nd December 2005
Name: Simon Harrison

Authority: Research and Development Director, Telex Communications (UK) Limited

Attention!
Where applicable, the attention of the specifier, purchaser, installer or user is drawn to special limitations of use which must be observed when these products are taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are available on request and are available in product manuals.

Contents

Welcome!

Thank you for purchasing a Klark Teknik Square ONE Dynamics. The Square ONE Dynamics is a user-friendly, high-performance, eight-channel analogue dynamics processor designed for live sound reinforcement with applications in both front-of-house and monitoring situations. Other possible areas for use include broadcasting, the recording studio and installation.

The Square ONE Dynamics provides a wide variety of easy-to-use controls for precise manipulation of compression parameters. These enable you to, for example, alter the character of an instrument being processed or make sounds seemingly louder but without distortion. Other features include gating for creative and corrective applications and channel linking for stereo or multi-channel operation.

Your Square ONE Dynamics forms an integral part of the Square ONE range, which was conceived by Klark Teknik to offer audio professionals a suite of easily accessible, high-performance audio equipment, designed to provide no-compromise sonic quality with a feature set that offers all essential facilities and functions. It represents the very best of British design and engineering combined with contemporary, efficient manufacturing methods, and will give you many years of reliable service.

All this is backed up, of course, by the standard Klark Teknik three year warranty.

Please take the time to complete and return the registration card or fill in the Warranty Registration Form online by visiting our website at www.ktsquareone.com and, to obtain the best results with a minimum of effort, also read this operators manual.

Finally, enjoy your Klark Teknik Square ONE Dynamics!

Safety precautions

Before installing, setting up or operating this equipment please ensure that you have read and fully understand all of this section and the "IMPORTANT SAFETY INSTRUCTIONS" at the front of this manual.

This equipment is supplied by a mains voltage that can cause electric shock injury!

The following special limitations must be observed in order to maintain safety and electromagnetic compatibility performance.

Safety warnings

This equipment is fitted with a 3-pin power socket. For safety reasons the earth lead must not be disconnected.

Signal 0V is connected internally to the chassis.

To completely disconnect this equipment from the AC mains, unplug the mains lead from the power outlet.

Do not expose this equipment to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the equipment.

To prevent shock or fire hazard, do not expose the equipment to rain or moisture. To avoid electrical shock do not remove covers. Refer servicing to qualified personnel only.

The power supplies - even the DC ones - have a high current!

General precautions

The following information gives basic safety precautions that should be observed to reduce the risk of fire, electric shock and personal injury:

- Only properly trained service personnel familiar with this manual and with the generally applicable safety regulations should service the equipment.
- Safety instructions detailed in the manual should be understood and properly implemented.
- In the event of ground loop problems, disconnect the signal screen at one end of the connecting cables. Note that this can only be done when the equipment is used within a balanced system.
- Never operate damaged equipment and never operate equipment with damaged cables.
- Any part that is damaged should be properly repaired or replaced. This must be done by a fully trained and authorised service engineer.
- Observe all warnings, cautions etc. on any part of the equipment.
- Do not remove, hide or deface any warnings or cautions.

Power

THE POWER SUPPLY SHOULD NEVER BE OPERATED WITH THE MAINS EARTH DISCONNECTED!

This unit should only be operated with the power supply connected to ground via the ground in the mains connector.

The internal power supply is a switch mode type that automatically senses the incoming mains voltage and will work where the nominal voltage is in the range 100VAC to 240VAC.

A single, fused IEC mains inlet is provided on the rear panel. The correct lead for connection in the area to which the unit was shipped is supplied with the unit. The equipment should only be plugged into the mains outlet using the supplied lead.

Please note that the power supply contains LETHAL VOLTAGES greatly in excess of the mains voltage and that its rails can produce extremely large currents that could burn out equipment and wiring if shorted. All testing and servicing must ONLY be carried out by approved service engineers.

We strongly recommend that, for safety and to optimise the life and performance of the equipment, the mains cable plug is removed from the power outlet when the equipment is not to be used for extended periods of time or during electrical storms.

When removing the equipment's electric plug from an outlet, always hold the plug itself and not the cable. Pulling out the plug by the cable can damage it.

Never insert or remove an electric plug with wet hands.

Handling the equipment

Completely isolate the equipment electrically and disconnect all cables from the equipment before moving it.

When lifting or moving the equipment, always take its size and weight into consideration.

Do not insert your fingers or hand in any gaps or openings on the equipment, for example, vents.

Avoid inserting or dropping foreign objects, such as paper, plastic, metal etc., into any gaps or openings on the equipment, for example, vents. If this happens, turn off the power immediately and unplug the power from the AC outlet. Then have the equipment inspected by the manufacturer's qualified service personnel.

Installation

Before installing the equipment:

- Make sure the equipment is correctly connected to the protective earth conductor of the mains voltage supply of the system installation through the mains lead.
- Power to the equipment must be via a fused spur.
- The power plug must be inserted in a socket outlet provided with a protective earth contact. The electrical supply at the socket outlet must provide appropriate over-current protection.
- Both the mains supply and the quality of earthing must be adequate for the equipment.
- Before connecting up the equipment, check that the mains power supply voltage rating corresponds with the local mains power supply and that the mains fuse is of the correct type and rating.

Location

- Ideally a cool area is preferred not in close proximity to power distribution equipment or other potential sources of interference.
- Do not install the equipment in places of poor ventilation.
- Do not install this equipment in a location subjected to excessive heat, dust or mechanical vibration. Allow for adequate ventilation around the equipment, making sure that its vents are not obstructed. To prevent excessive heating of the equipment, avoid mounting it directly above power amplifiers or other devices that radiate significant amounts of heat such as, radiators and heaters. Keep the equipment out of direct sunlight. Where necessary use fan cooled racks.
- Make sure that the mains voltage and fuse rating information of the equipment will be visible after installation.
- Do not use the equipment in the vicinity of electrical devices, such as computer monitors or mobile phones, which may generate electrical noise.

Audio connections

To ensure the correct and reliable operation of your Square ONE Dynamics, only high quality balanced, screened, twisted pair audio cable should be used.

XLR connector shells should be of metal construction so that they provide a screen when connected to the unit and should have Pin 1 connected to the cable screen.

Radio frequency interference

Class B device

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

Electric fields

Caution:
In accordance with Part 15 of the FCC Rules & Regulations, "... changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

Should this product be used in an electromagnetic field that is amplitude modulated by an audio frequency signal (20Hz to 20kHz), the signal to noise ratio may be degraded. Degradation of up to 60dB at a frequency corresponding to the modulation signal may be experienced under extreme conditions (3V/m, 90% modulation).

Operation

To avoid electrical shock, never operate the equipment with the covers removed.

Safety equipment

Never remove, for example, covers, housings or any other safety guards. Do not operate the equipment or any of its parts if safety guards are ineffective or their effectiveness has been reduced.

Optional equipment

Unless advised otherwise, optional equipment must only be installed by service personnel and in accordance with the appropriate assembly and usage regulations.

Special accessories

To comply with part 15 of the FCC Rules, any special accessories (that is, items that cannot be readily obtained from multiple retail outlets) supplied with this equipment must be used with this equipment; do not use any alternatives as they may not fulfil the RF requirement.

Features

The Square ONE Dynamics analogue dynamics processor performs dynamic compressor and gate functions, and has the following features:

- Eight clearly labelled channels, each one comprising:
  - Control knobs for adjusting Threshold, Compressor Gain, Attack, Release, Gate Hold, Ratio/Range and Side Chain Frequency.
  - Hard Knee and Vintage switches used in combination to provide four compressor modes.
  - Swept frequency side chain filter with Filter In and Narrow switches.
  - Solo, External Key, Compressor/Gate and Bypass switches.
  - Input and Attenuation level LED meters in the ranges -40dB to +18dB and -2dB to -20dB, respectively, to show how the outboard processing is performing.
  - LEDs for enabled/disabled status indication on some switches.
- Each channel has a processor that can perform as either a compressor or gate.
- Compressor can operate in RMS or peak sensing type ('vintage') modes. Each mode has hard knee or soft knee options. The vintage mode emulates the performance of old classic valve-type compressors. Other types of compression available are:
  - Lo-Q (wide bandwidth) frequency-conscious compressor.
  - Hi-Q (narrow bandwidth) frequency-conscious compressor; also known as a *de-esser*.
  - Limiter.
- Intelligent threshold shift (i-TS) to reduce 'chattering' within the gate.
- Stereo or multi-channel operation provided by Link switches between channels.
- Variable frequency band pass filter that acts on the side chain signals.
- Solo bus for monitoring the side chain filter during the performance via electrically balanced input and output via female and male XLR connectors.
- Each channel has electrically balanced input and output via female and male XLR connectors and also a 1/4" TRS-balanced jack socket for External Key input.
- Mains supplied via an IEC socket on rear panel.
- Fuse drawer contains easily replaceable mains fuse with a compartment for a spare.

Getting started

Observing the guidelines in "Safety precautions" on page 2, carry out the following to get your Square ONE Dynamics unit fully operational.

Unpacking

Carefully unpack your Square ONE Dynamics equipment package.

Then please inspect the Square ONE Dynamics unit carefully for any signs of damage that may have occurred during transit and notify the courier immediately if you discover any.

Check the contents of your Square ONE Dynamics equipment package. If there are any parts missing, incorrect or faulty, please contact your local distributor or Klark Teknik at the address at the front of this manual.

Please retain the original packing in case you should need to return the equipment to the manufacturer or supplier, or transport or ship the unit later.

Checking the mains fuse

Before installing the equipment you need to make sure that the mains fuse fitted is of the correct type and rating for your unit. To do this refer to "Service information" on page 42.

Installation

This unit is designed for mounting in any 19" EIA standard rack. Four rack-mount holes in the front panel are provided for rack mounting and are designed to fully support the weight of the unit in the rack.

Note: *Avoid over-tightening the rack-mount screws, as this could damage the front panel.*

The position of the unit will depend upon how it is to be used. However, when positioning the unit, avoid placing it where the control knobs may be damaged by being accidentally knocked or snapped off. Also, try to avoid placing the unit directly near or on any power distribution units or power amplifiers.

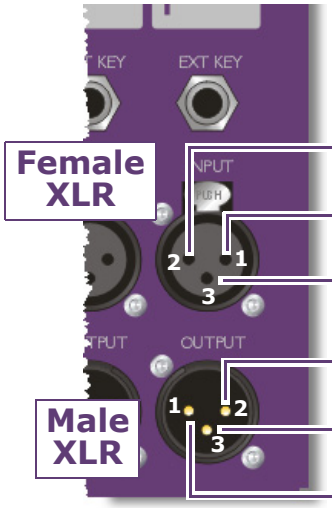
Connecting the power cable

Making sure that the mains power at the power outlet is off, connect the mains cable supplied with your Square ONE Dynamics to the mains power outlet and then to the mains socket at the rear of your unit.

Connecting the audio cables

Making sure that all equipment is switched off, connect your Square ONE Dynamics to the rest of your audio equipment as shown in the following subsections. For more details on balancing, see "Balanced/unbalanced audio" on page 37.

Channel I/O pin-outs



	Balanced I/O	Unbalanced I/O
Female XLR	Pin 2: Hot signal	Pin 2: Hot signal
	Pin 1: Screen/Ground	Pin 1: Screen/Ground (not connected at unbalanced end)
	Pin 3: Cold signal	Pin 3: Ground at unbalanced end
Male XLR	Pin 2: Hot signal	Pin 2: Hot signal
	Pin 3: Cold signal	Pin 3: Ground at unbalanced end
	Pin 1: Screen/Ground	Pin 1: Screen/Ground (not connected at unbalanced end)

Side chain EXT KEY inputs

The electronically balanced side chain inputs are on stereo 1/4" TRS connectors. Inserting a mono jack plug will automatically unbalance the input.

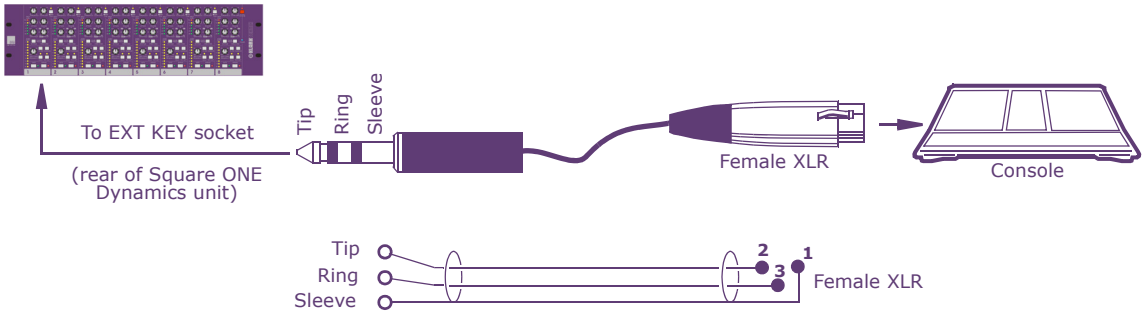


Figure 1: Side chain EXT KEY input connection details

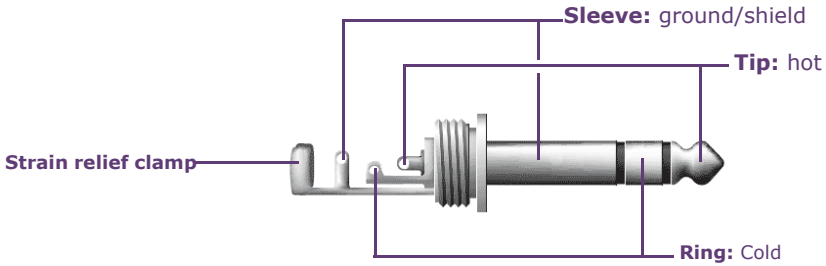


Figure 2: 1/4" TRS connector wiring details

Connecting to unbalanced equipment

Ideally, you will be making the best use of the Square ONE Dynamics's low-noise high-headroom balanced inputs by connecting to similarly balanced equipment. However, if you do have to connect to unbalanced devices, the following wiring is recommended for best results (see Figure 3):

- Connect the +ve (pin 2) of the balanced connection to the +ve terminal on the unbalanced connector.
- Connect the -ve (pin 3) of the balanced connection to the common (ground) terminal on the unbalanced connector.
- Connect the ground (pin 1) of the balanced connection, to the common (ground) terminal on the unbalanced connector.

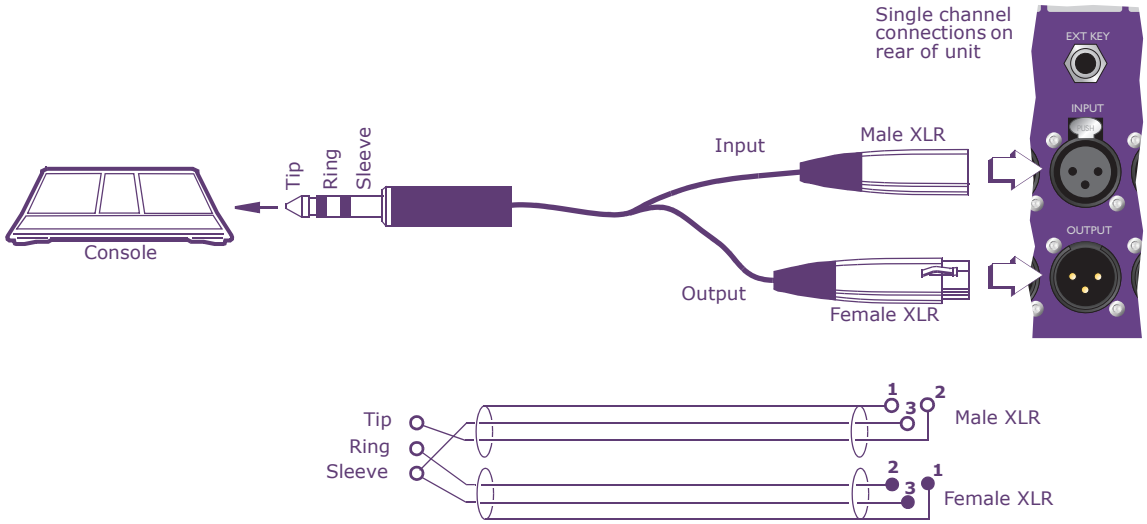


Figure 3: Insert send/return 1/4" TRS connector/XLRs - wiring details

Powering up the unit

To power up the unit, switch on the power at the mains power outlet. The **POWER** LED on the front of the unit will illuminate to indicate that power is on.

Your unit is now ready to operate.

Front panel

The front panel of the Square ONE Dynamics has eight similar channel sections, each with a set of controls comprising control knobs, switches (some with LED on/off indicators) and meters. In addition, there is a master side chain solo in place (**SC SOLO IN PLACE**) switch and **POWER** LED for power on/off indication. Adjacent channels can be linked via intermediate **LINK** switches.

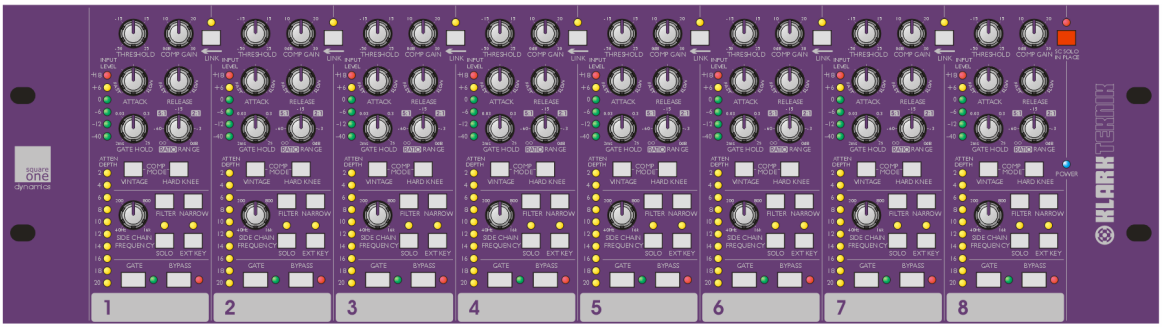
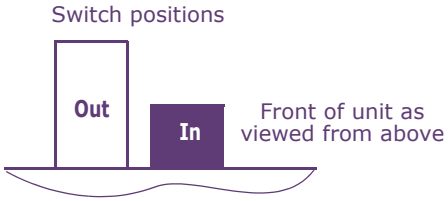
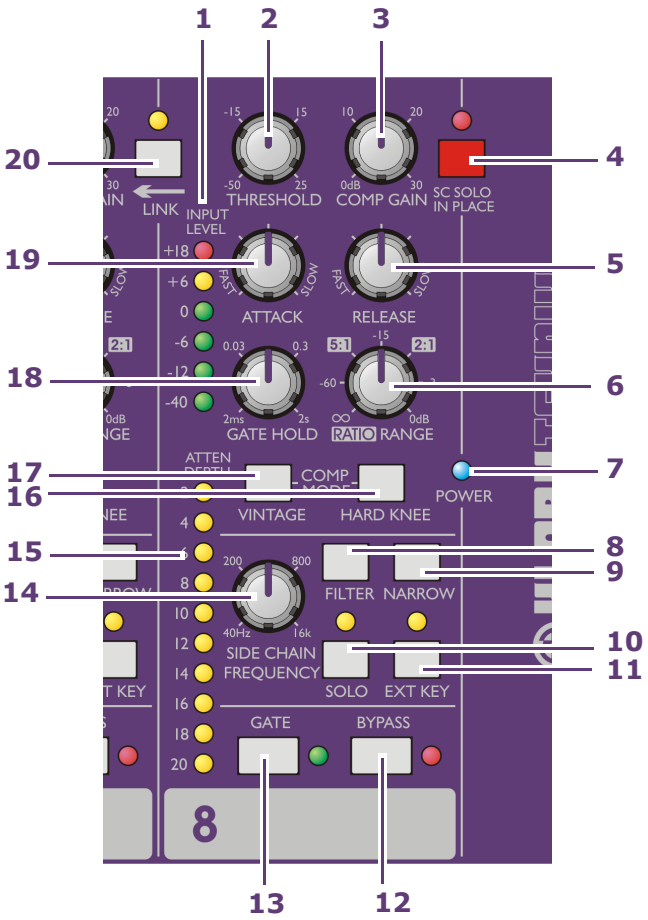


Figure 4: Front panel

For the scale ranges of the control knobs, please refer to "Technical specification" on page 39.

All of the switches on the front panel are of the latching pushbutton type and have two positions, in and out, as shown in the diagram right. To clearly identify switch settings, switches that enable/disable functions (for example, the **GATE** switch) are described as "enabled" when the switch is set to the in position and "disabled" when set to the out position. These switches each have an associated LED that illuminates to show when the switch enabled. Switches that work in combination are described as either "in" or "out", for example, **FILTER** and **NARROW**.





1 **INPUT LEVEL meter (dBu):** Dedicated peak reading, six-segment audio level LED meter that monitors the input XLR level at all times, no matter how the controls are set.

2 **THRESHOLD control knob:** Adjusts the operating point for the compressor or gate, depending on which is selected.

3 **COMP GAIN control knob:** Adjusts compressor gain - also known as the *make up* gain - so that the level of the outgoing compressed signal can be matched to the incoming uncompressed signal.

4 **SC SOLO IN PLACE switch with red LED: Master solo in place (SIP) switch with red enabled/ disabled LED indicator. When enabled, all the SOLO switches change function so that no signal will be sent to the master solo output bus, and the side chain signal will be sent directly to the output XLR on the same channel when the SOLO button is pressed, thus replacing the dynamics output signal.**

5 **RELEASE control knob:** Adjusts the time it takes the compressor to recover or the gate to close after the programme material falls back below threshold, depending on which is selected.

6 **RATIO/RANGE control knob:** Adjusts the amount of compression (ratio) or gain reduction (range) applied to signals below threshold, depending on which is selected.

7 **Blue POWER LED:** Illuminates to indicate that mains power is being applied to the unit.

8 **FILTER switch:** Used in conjunction with the **NARROW** switch and **SIDE CHAIN FREQUENCY** control knob to provide a variable frequency band pass filter that acts on the side chain signals. This switch enables (switch = in) or bypasses (switch = out) the filter.

9 **NARROW switch:** Changes the bandwidth from wide (switch = out) to narrow (switch = in), see Item 8 above.

10 **SOLO switch with yellow LED:** Enabling the **SOLO** switch with SIP disabled, sends post-filter side chain audio to the solo bus output. If **EXT KEY** switch is enabled, the solo signal will be sourced from the **EXT KEY** input jack instead of the input signal. **Please be aware that if you enable the SOLO switch with SIP *enabled*, the side chain signal is routed directly to the output.**

11 **EXT KEY switch with yellow LED:** Enables the external key signal via the **EXT KEY** input jack, which replaces the incoming compressor signal as the source feed for the side chain. The side chain circuits control the gain reduction.

12 **BYPASS switch with red LED:** Enables a bypass condition whereby the VCA remains in-circuit, fixed at unity gain. The gain reduction meter continues to operate with **BYPASS** enabled.

13 **GATE switch with green LED:** This switch selects channel operation as compressor mode (switch = disabled) or gate mode (switch = enabled).

14 **SIDE CHAIN FREQUENCY control knob:** Selects the frequency at which the band pass filter acts on the side chain signals, see Item 8 above. The filter can be used to make the compression frequency selective. Additionally, there is a solo function (see Item 10 above) that places the filtered side chain onto the compressor's solo bus output or, optionally, the main output (SIP mode).

15 **ATTEN DEPTH meter (dB):** Dedicated attenuation depth (gain reduction) meter that displays the amount of attenuation being applied by the compressor or gate, depending on which mode is selected. The meter comprises 10 LEDs, scaled from -2dB to -20dB in 2dB increments. The compressor gain control will not affect the gain reduction meter reading.

16 **HARD KNEE switch:** Used in combination with the **VINTAGE** switch to provide four compressor operating modes, see "Compressor" on page 19.

17 **VINTAGE switches:** See **HARD KNEE** above.

18 **GATE HOLD control knob:** Minimises chattering in conjunction with internal hysteresis, see "Intelligent threshold shift (i-TS)" on page 29. Once the signal is detected as below threshold, this control defines a waiting period before the gate starts to close.

19 **ATTACK control knob:** Adjusts the time it takes the compressor to respond or the gate to open after an over threshold signal, depending on which is selected.

20 **LINK switch with yellow LED:** Each adjacent pair of channels has an intermediate **LINK** switch that, when enabled links them together, see "Stereo and multiple channel operation - linking" on page 17.

Rear panel

The rear panel provides the power and audio connections for the Square ONE Dynamics. You will also find important information, such as warnings and cautions, power supply and fuse specifications, safety and compliance standards markings etc., printed on this panel.

The correct mains lead for the country to which the unit was shipped is supplied with the unit.

Audio input and output connections for each of the eight channels, which are identical, and the SOLO BUS are electronically balanced and clearly labelled. Audio connections for channel 8 and the SOLO BUS are shown in "Audio connections" on page 15.

Figure 5: Rear panel

Audio connections

Please refer to "Connecting the audio cables" on page 8 for pin assignments.

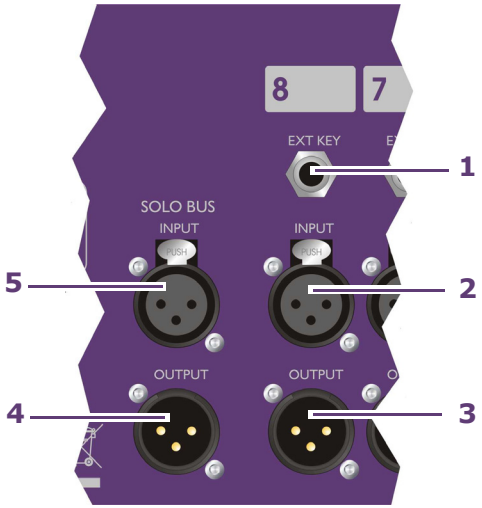
1 **EXT KEY socket:** For 1/4" TRS, balanced jack socket, one per channel.

2 **Channel INPUT socket:** Female XLR connector.

3 **Channel OUTPUT socket:** Male XLR connector.

4 **SOLO BUS OUTPUT socket:** Male XLR connector.

5 **SOLO BUS INPUT socket:** Female XLR connector.



Mains supply

1 **IEC socket:** Auto voltage sensing, switch mode power supply that operates where the nominal mains voltage is in the range 100V AC to 240V AC.

2 **Fuse drawer:** Contains the mains fuse at the rear of a two-compartment drawer. The front compartment provides room for a spare. Always replace the mains fuse with the same type and rating; see "Checking/ replacing the mains fuse" on page 42 for details.

3 **Supply voltage and fuse specifications:** Details of the supply voltage and the mains fuse are printed here.

4 **Fuse warning information:** Details on replacing the mains fuse with the same type is printed here.

Using the Square ONE Dynamics

The Square ONE Dynamics is a dynamics processor that utilises premium quality, high precision components to achieve a high degree of accuracy and control. The Square ONE Dynamics has been designed primarily for creative use as front of house (FOH) or monitor. However, it is just as effective when used in the studio while broadcasting or recording. The Square ONE Dynamics processors offer, in a compact unit, control over the dynamic range for creative and also corrective purposes.

The natural sounds of everyday life, which can be caused by anything from, say, the falling of a leaf to the roar of a jet engine, vary extremely widely in sound level. This variance is known as the 'dynamic range' and is the difference - expressed decibels (dB) - between the loudest and quietest sounds in a piece of audio, such as music or speech, or that can be reproduced by a piece of audio equipment without distortion.

The human ear has an *automatic gain control* that enables it to accommodate all of the sounds ranging from the threshold of hearing to near the threshold of pain, a dynamic range of approximately 120dB. However, a dynamic range of this magnitude, even if it were possible in audio equipment, is not required in practice for comfortable listening. A sound pressure level (SPL) of 96dB would, in a domestic environment, almost certainly annoy the neighbours. While, at the other end of the dynamic scale, a typical ambient noise level of at least 40dB SPL makes it impossible to use very quiet levels in recorded or broadcast sound media. So, it is almost always necessary to compress the dynamic range of natural sounds to fit them into a window (usually about 30dB to 40dB) suitable both for the equipment and for comfortable listening.

Another factor that must be considered is background noise. All of the sounds that we want to listen to, whether natural or electronically processed, are accompanied by a certain amount of unwanted background noise, such as the rustle of musicians turning the pages of the score in the studio. Even if, in the final programme, the noise level is below the ambient noise of the listening area, it may still be heard and is therefore undesirable.

The compressor and gate, both of which are described more fully later, are valuable tools for the control of the dynamic range. By using the compressor artistically, the sounds of instruments and voices can be altered and a mix of instruments can be compressed to give a *tighter* dynamic effect by reducing the dynamic range of any instrument or programme source. Whereas, the gate can remove unwanted background clutter and also has artistic uses.

Stereo and multiple channel operation - linking

Using the intermediate **LINK** switches, adjacent channels can be linked, in all modes, for stereo or multi-channel operation. Linked channels form a group, the lowest numbered channel in the group being the *master* and the other group members are *slaves*. The master channel's settings override those of the slaves with the exception of bypass, solo, ext key and side chain filter, which still act independently. (The slave filters, ext key and solo still function when linked because the slave channel side chain is summed with the master and any other slaves in the group.)

You can have more than one group at any time; Figure 6 "Examples of channel linking" shows some typical group configurations and illustrates that the master is always the lowest numbered channel within the group.

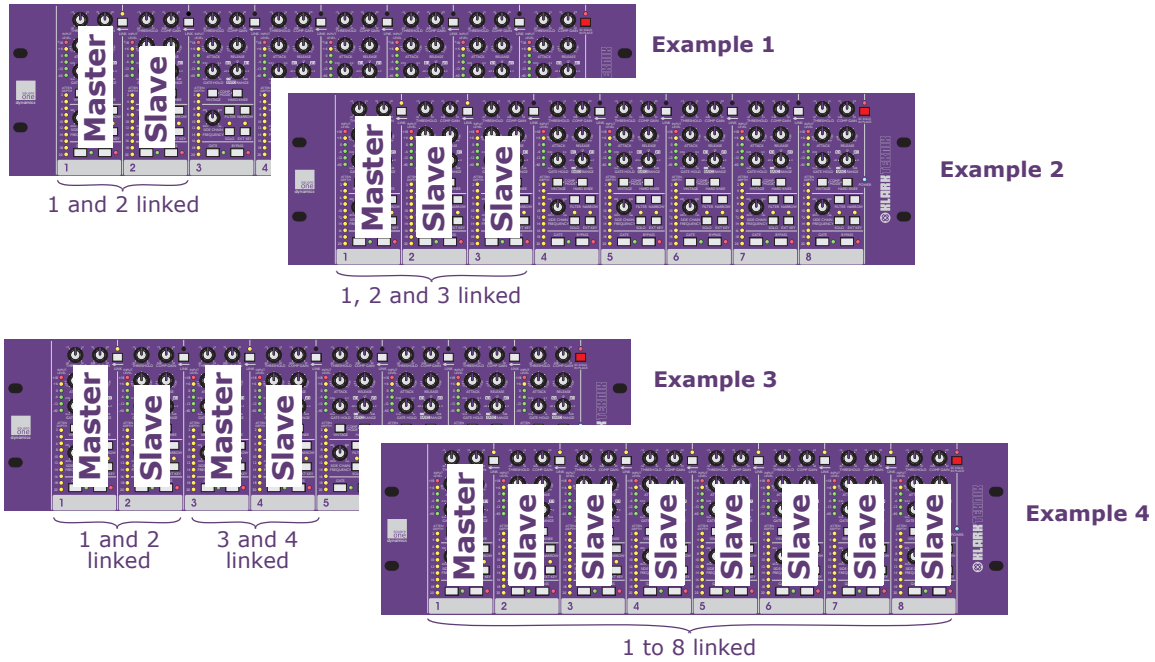


Figure 6: Examples of channel linking

The audio input to the master channel and any slaves in the link are all used to control the action of the dynamic processor. The channel with the highest signal level will have the most effect on the linked group. As all the VCA controls are also linked together, the attenuation or gain applied to the linked channels in the group will always be identical. Each slave's gain reduction meter (**ATTEN DEPTH**) will track its group master channel exactly.

Solo bus

You can monitor the side chain during the performance using the dedicated SOLO OUTPUT. To do this, connect the SOLO OUTPUT to a spare input channel, line return, FX return etc., on your mixing console. Enabling any **SOLO** pushbutton will route that processor's side chain monitor to the SOLO OUTPUT, allowing monitoring of the side chain filter without interrupting the audio output of the processor. If the solo in place (SIP) mode is active, the **SC SOLO IN PLACE** LED will illuminate. In this mode the side chain monitor signal will replace the audio output when **SOLO** is enabled.

The rear panel of the Square ONE Dynamics includes a solo bus with input and output XLRs. This allows multiple units to be linked in series so that a group of units can all apply solo signal to a common solo bus. The final solo bus output will be taken from the last unit in the chain. Units with SIP enabled do not apply signal to the solo bus. The signal from the solo bus input XLR to the solo bus output XLR always operates, even when the unit is in SIP mode.

External key

For most applications, the Square ONE Dynamics is triggered by the level of the incoming signal. Sometimes it can be useful to use a different signal to trigger the gate; this signal is known as an *external key*.

Particularly in the case of drums, a very reliable trigger can be obtained by taping a contact microphone to the shell of the drum, using the clean signal it produces to trigger the gate. An example of this set up is shown in Figure 7 "Typical set up for external key operation".

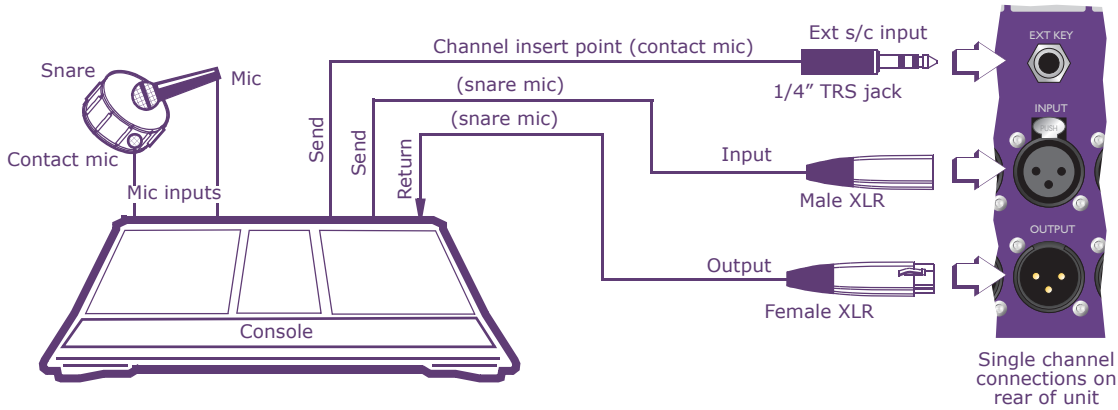


Figure 7: Typical set up for external key operation

Compressor

Principles of compression

One of the principal uses of compression is the control of level in vocals. Many singers train for years to achieve the degree of breath control necessary for an even tone and expressive performance. Whereas, other vocalists rely on an instinctive voice production technique, which may need technological assistance to maintain a consistent level that *sits* correctly in the programme.

The level of a vocal may vary widely. As shown in the typical example in Figure 8 "Compression - signal level graphs", the unprocessed signal has a large dynamic range between the highest and lowest levels. Applying compression reduces the highest levels, thus reducing the dynamic range, while leaving the signal below threshold relatively unaltered. Because the peak level of the signal is now lower, make up gain is added to restore the original peak level. The result is a much more controlled and usable sound.

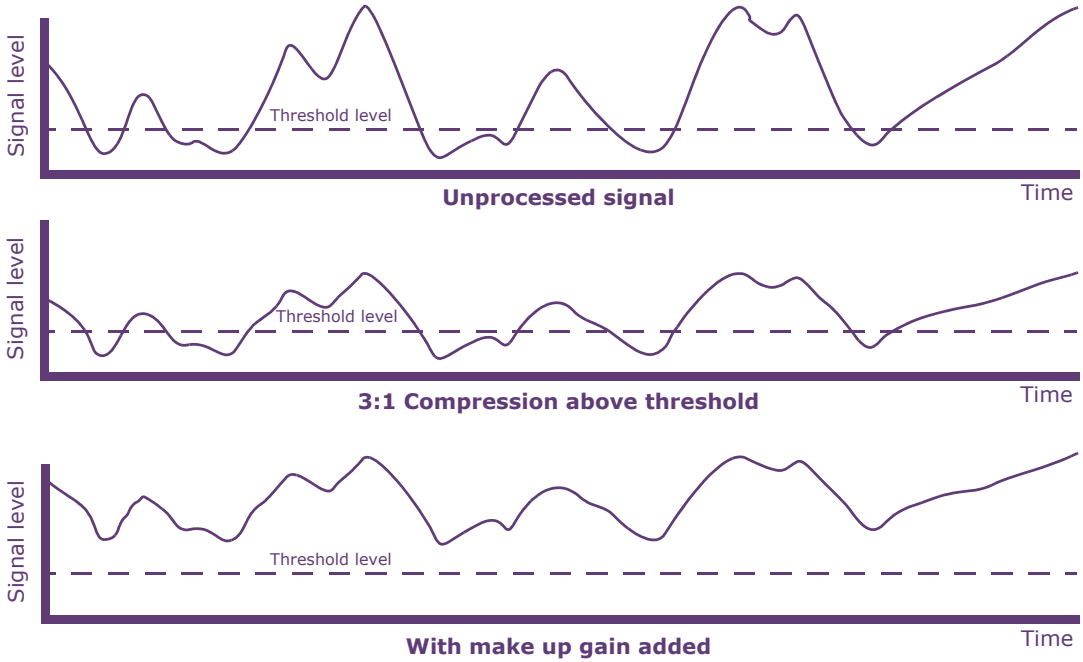
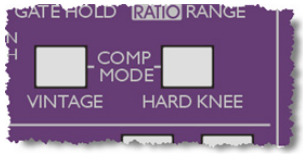


Figure 8: Compression - signal level graphs

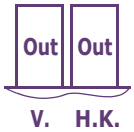
Modes of operation

The compressor has been designed to operate as a root-mean-square (RMS) sensing type or peak sensing type compressor. Basically, this means that the unit's circuitry responds to either the effective average value of the signal's waveform or its peak value. The peak sensing type mode of compression has been designed to emulate the qualities and performance of 'vintage' valve-type compressors.

The two main compressor modes each operate in one of two modes, hard knee or soft knee. Thus giving the four following compressor modes, selectable using the **VINTAGE** and **HARD KNEE** switches (shown right) in combination.



Compressor soft knee and RMS (default setting)



With both the **VINTAGE** and **HARD KNEE** pushbutton switches switched out (see left), the compressor behaves in the default soft knee and RMS mode. This gives the slowest and most subtle feel to the compressor envelopes. The soft knee curvature combines with the adaptive RMS attack and release times to produce gentle envelope curvatures that are ideal for compressing sung vocals, but which can still be aggressive enough to limit transients when needed. The knee curvature also slightly reduces the adaptive nature of the RMS detection, thus providing a little more manual control of the envelope timings than is the case with the compressor set for hard knee and RMS.

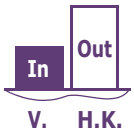
Compressor hard knee and RMS

With only **HARD KNEE** switched in, the compressor operates in a more clinical way with a more defined transition between under threshold and over threshold; this is better suited to limiting style compression. A small amount of soft knee is still retained, keeping the sound reasonably natural but without any modification of the envelope occurring. Thus, attacks are a little more aggressive but the adaptive nature of the RMS detection is still allowed to operate to its fullest extent. This mode is good for natural sounding limiting of speech.

Compressor hard knee and vintage

With the **VINTAGE** and **HARD KNEE** switches both switched in, the compressor operates with more precise envelope control and, again, with a more defined transition between under and over threshold. This mode uses faster peak sensing (not RMS), like many older compressor designs with exponential attack and release. This produces aggressive compression that gives good fast control and/or limiting of extremely dynamic material. It can also be used to add colour to low frequency signals, making it ideal for controlling instruments such as the bass guitar.

Compressor soft knee and vintage



With only **VINTAGE** switched in, the compressor employs a dual time constant, linear attack profile. The soft knee blurring of threshold occurs once more, as in RMS mode, although the effect is greatly accentuated. This produces extremely subtle attack and release curves during the onset of compression that are largely independent of the envelope control settings. As the compressor is driven harder (signals go further over threshold) the soft knee effect reduces, gradually returning manual control of the attack and release times to optimise capture of larger transients etc. Thus, like the RMS modes, this compressor mode is very adaptive, making set-up of the envelope controls relatively easy. However, the peak sensing increases harmonic overtones, adding a *valve-like* brightness and sparkle to the programme, and producing extremely natural and lively sounding compression of acoustic instruments.

Lo-Q frequency-conscious compressor

In the Lo-Q frequency compression mode the compressor operates at a selected frequency over a wide bandwidth rather than over the whole signal.

To set up the compressor for Lo-Q operation, activate the side chain filter for wide bandwidth by enabling the **FILTER** switch and disabling the **NARROW** switch, then select the required frequency using the **SIDE CHAIN FREQUENCY** control knob.

Hi-Q frequency-conscious compressor (de-esser)

In the Hi-Q frequency compression mode the compressor operates at a selected frequency over a narrow bandwidth rather than over the whole signal. Also known as the "de-esser" mode, this method of compression can be used for effects, such as de-essing and de-popping; see "De-essing" on page 26.

To set up the compressor for Hi-Q operation, activate the side chain filter for narrow bandwidth by enabling the **FILTER** and **NARROW** switches, then select the required frequency using the **SIDE CHAIN FREQUENCY** control knob.

Limiter

A limiter is essentially an extreme form of compressor that only affects signals above a selected threshold level (dB). This is particularly useful for limiting only peaks in the signal, while leaving the rest of the signal alone. A limiter acts as a last check on signal level. If the level goes over threshold, fast acting, high ratio compression is applied to bring it back within bounds.

To set up the Square ONE Dynamics as a limiter, select compressor to operate in vintage and hard knee mode with attack set to fastest and the ratio set at infinity to one. Adjust release to suit programme and set threshold as required.

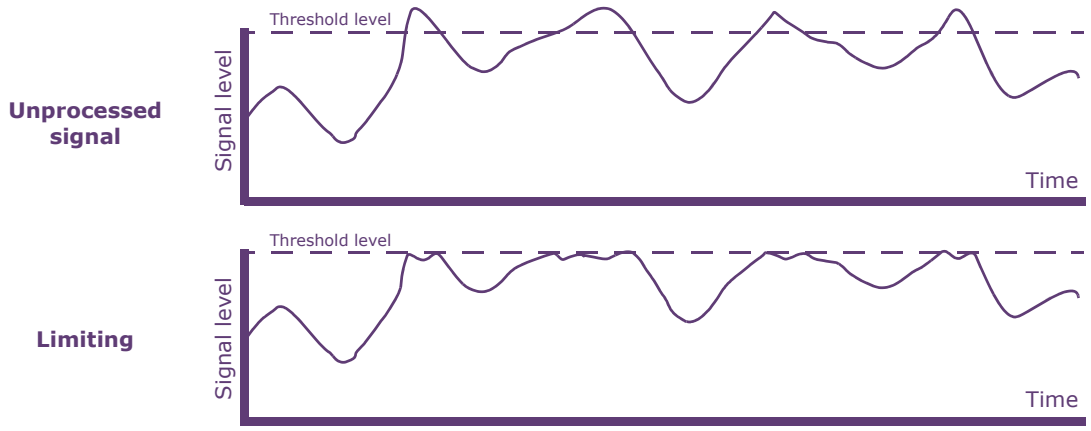


Figure 9: Compression - limiting signal level graphs

If a compression effect is required together with limiting of high level transients, two channels of the Square ONE Dynamics may be cascaded. The output of Channel 1 (compression) is fed to the input of Channel 2 (limiting), which gives powerful two stage control over gain.

Below the compression threshold, the signal is unaltered. In the example shown in Figure 10 "Limiting and compression graph", the first threshold is compressed at a mild 2:1 ratio. Whereas, at the second threshold it is firmly limited at a ratio of 20:1.

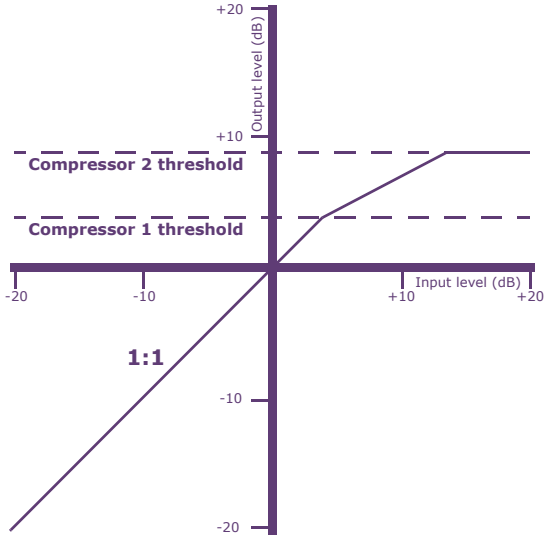


Figure 10: Limiting and compression graph

Threshold

The compression threshold is the point at which the compressor begins to operate. Signals that exceed this point, that is, go *over threshold*, will be affected by compressor actions. However, signals below the threshold do not trigger any compression, but may still be affected by compression releases from previous over threshold signals.

If the compressor is being used as a limiter, the threshold level is the level at which the limiter begins to operate.

Attack

Attack sets the time it takes for the compressor to respond once the threshold has been exceeded. Attack may be set so that the initial transient of the instrument passes through unaltered or set to a faster value so that the very start of the sound is compressed. Particularly with drum sounds, careful adjustment of attack time can make the sound more 'punchy' and 'driving'.

Adjusts the time taken for the compressor to respond to an over threshold signal. The shape or style of the attack is selected from one of the four modes mentioned in "Compressor" on page 19, making the compressor more adaptable for differing creative and corrective applications.

Release

Adjusts the time the compressor takes to recover after the programme material falls back below threshold. Both attack and release also respond to changes in programme level that remain over threshold. For example, a signal that reduces in level but remains above threshold will still trigger a release. However, in this case it will only be a partial release because the compressor is still required to generate gain reduction, albeit for the new lower signal level.

Release time plays a very important role in compression. During periods of high signal level, gain is reduced. When the signal level falls below the threshold, the gain will increase at a rate determined by the **RELEASE** control knob. If the release time is short, the gain will rise quickly. A long release time will mean that the gain will stay at its reduced level, only recovering gradually, see Figure 11 "Compression fast and slow release signal envelope graphs".

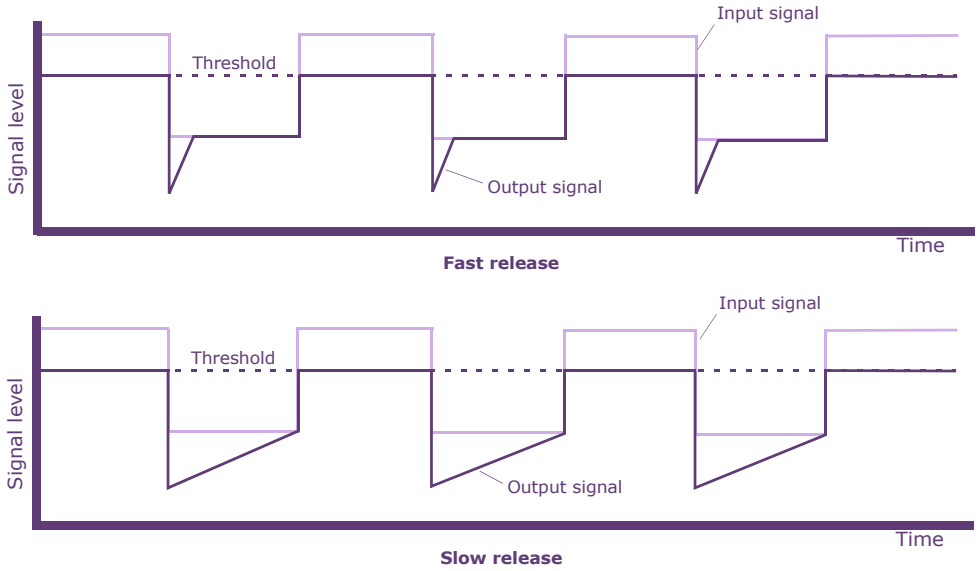


Figure 11: Compression fast and slow release signal envelope graphs

The setting of the correct release time is a compromise. If is too short, background noise can cause effects often known as 'breathing' and 'pumping'. A release time that is too long results in a signal that is not compressed, but merely reduced in level. For effective compression the release time must be set as short as possible before modulation of the background noise becomes too noticeable. The **ATTEN DEPTH** gain reduction meter will show how much actual compression is occurring. If it is steady, there is little active compression, just a steady-state reduction in level. The faster the meter level moves up and down, the harder the compressor is working.

Ratio

Ratio is the *strength* of compression above the threshold level and controls the amount of compression applied to signals that are over threshold. Ratio is expressed as a ratio of signal level changes from input to output, for example, when the compressor is set to 2:1, every 2dB input level change will only generate a 1dB output level change, assuming the signal levels are over threshold. As can be seen from the graphs in Figure 12 "Compression ratio graphs of 2:1 and 12:1", the higher the ratio, the greater the effect.

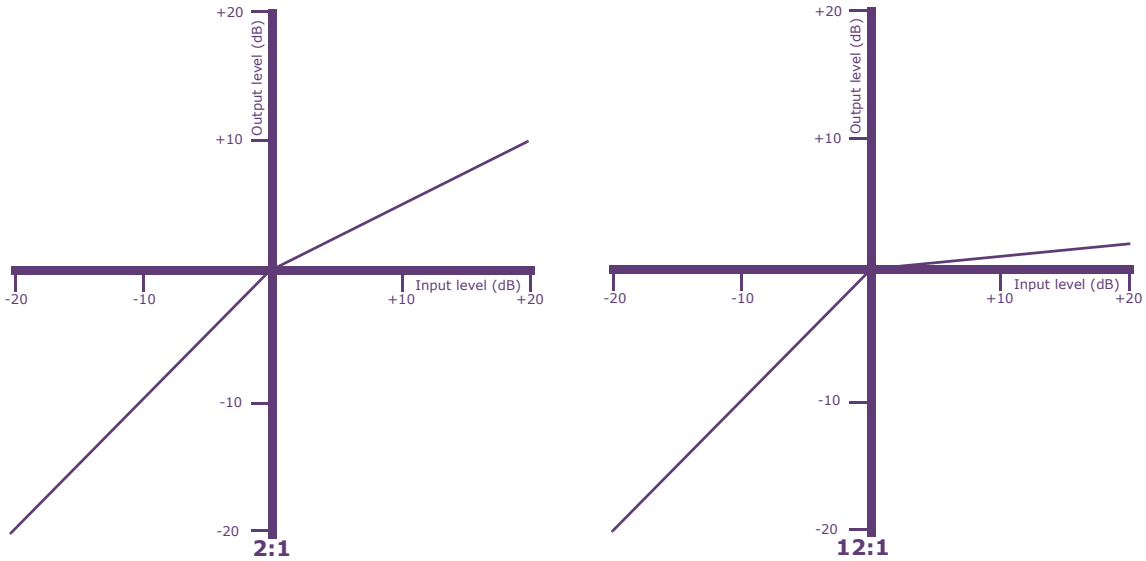


Figure 12: Compression ratio graphs of 2:1 and 12:1

At a compression ratio of up to 2:1, the effect is mild and suitable for the subtle compression of vocals or of a complete mix. At 3:1, compression is becoming stronger and more noticeable. Ratios between 3:1 and 5:1 are suitable for the 'compressor' sound, which is used as an effect in its own right. Higher ratios are used for the control of extremely peaky signals.

Hard knee and soft knee

The point where the slope of the compressor curve changes is knows as the *knee*. The Square ONE Dynamics can be set to operate as either a hard knee or soft knee compressor (each one being either vintage or RMS); the effects of both can be seen in Figure 13 "Hard knee and soft knee graphs".

In hard knee mode the compressor operates as soon as the input signal reaches threshold level, imposing the new ratio - selected via the **RATIO** control knob - on the signal. This mode is useful as a brick wall limiter, which stops transients without affecting the lower level signals. It can also be used at lower ratio levels so that the compression slope is not too narrow and none of the compressive *punch* is lost.

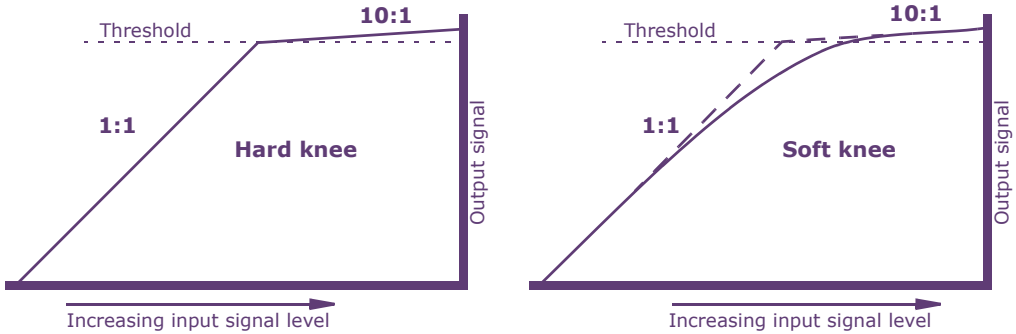


Figure 13: Hard knee and soft knee graphs

Soft knee compression gives a more gradual transition between up to ratio change over at threshold. The ratio value of signals approaching threshold increase exponentially in proportion to the input signal level. At threshold the ratio level becomes that selected via the **RATIO** control knob. Soft knee is useful on high-ratio compression or limiting, as it less obtrusive than hard knee.

The difference in the effect produced by hard knee and soft knee compression is more noticeable at higher ratios.

Side chains

Each channel of the Square ONE Dynamics has a side chain input for the compressor. In normal use, the amount of compression or expansion is related to the dynamics of the input signal. The side chain allows the signal passing through the unit to be controlled by the dynamics of another separate signal.

Connection to the side chain input is made via the rear panel jack sockets, see "Connecting the audio cables" on page 8.

De-essing

De-essing is an important compression technique that uses the side chain for reducing sibilance, de-popping or removing specific resonances from instruments for programmed material.

Many singers have high level sibilants, that is, the "s", "sh" or "ch" sounds in vocals, which detract from their performance. Equalising the signal will reduce the sibilants, but also make the overall vocal sound dull. However, by compressing only when there is an excessive level of high frequencies the sibilants can be removed selectively. A typical set up is shown in Figure 14 “De-essing connections diagram”. In this case the compressor will react whenever there is a sibilant, thereby reducing the gain for the duration of the sibilant and cleaning up the vocal sound.

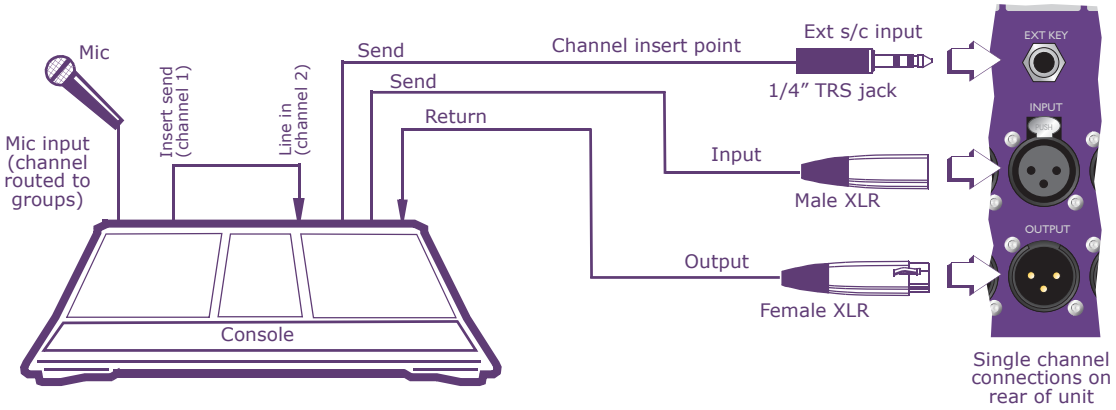


Figure 14: De-essing connections diagram

De-popping is the removal of the burst of sound at the start of vocals when the mic is held too close to the singer’s mouth. The de-essing compression technique can be used to remove these sounds and also to compensate for a *boomy* bass, or other situations where a band of frequencies is occasionally obtrusive.

For de-essing, we recommend that you set the side chain frequency to about 10kHz. While, towards the other end of the frequency range, an initial setting of 100Hz would be a good starting point for de-popping. As the filter operates between 40Hz and 16kHz, there are numerous creative styles of frequency-conscious compression available where the compression threshold has a higher sensitivity to audio in the selected bandwidth. From the initial settings you can use your judgement and experience to adjust the side chain filter frequency to obtain the best results according to the source of audio.

Gate

The gate function on the Square ONE Dynamics not only allows you to minimise or eliminate unwanted low level noises, but also gives you creative possibilities by providing the tools to artistically restructure the dynamics of a signal.

Principles of gate operation

The gate closes when the input signal falls below threshold (position 1 in Figure 15 "Gate function"). This cuts off the output signal altogether until the gate opens again (position 2 in Figure 15 "Gate function") when the input signal goes over threshold.

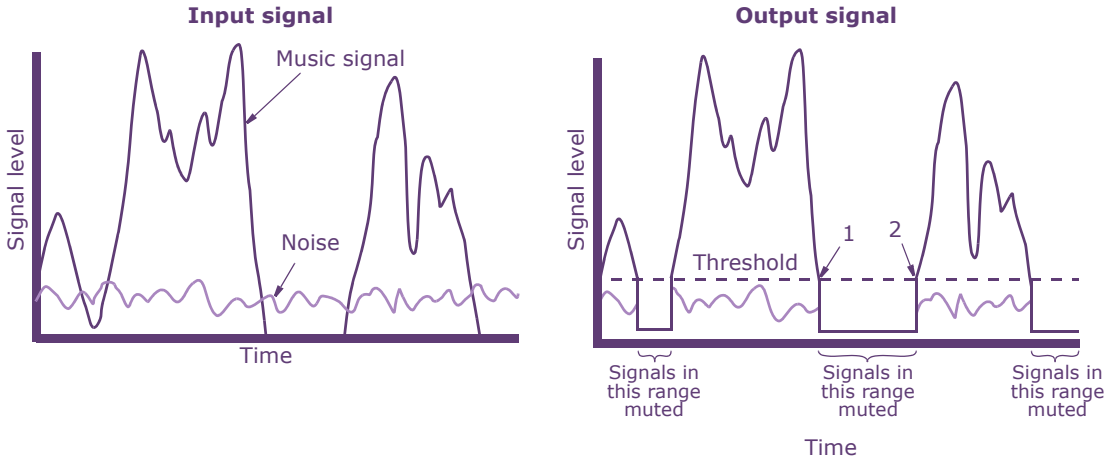


Figure 15: Gate function

You would normally set the gate threshold below the lowest level of the performance so as not to lose any of the performance but eliminating any of the unwanted hum, low level noise etc.

Creative use

The human ear is connected to an extremely sophisticated organ for processing incoming audio information: the brain. Even in situations where there are many sound sources we seem to be able to *tune in* on the sounds we want to hear and reject others. This is sometimes known as the *cocktail party effect*, where it is possible to pick out one person's voice - even at a distance - from may conflicting conversations.

The microphone is less selective in its pick up, being sensitive to all sounds within its range and coverage angle. For example, a microphone set to pick up the snare drum of a drum kit will pick up every other drum and cymbal to some extent, and probably the bass guitarist as well. When several microphones are positioned on the kit, each one giving a good sound on its own particular drum, they will all pick up unwanted instruments as well, making the sound less clear.

One solution to this problem is to use a noise gate on each microphone. The gate will reduce the output from the microphone to almost zero when the drum is silent, yet will open practically instantaneously when the drum is played. As the sound from the drum decays, the gate will close again and reject noise from the rest of the kit.

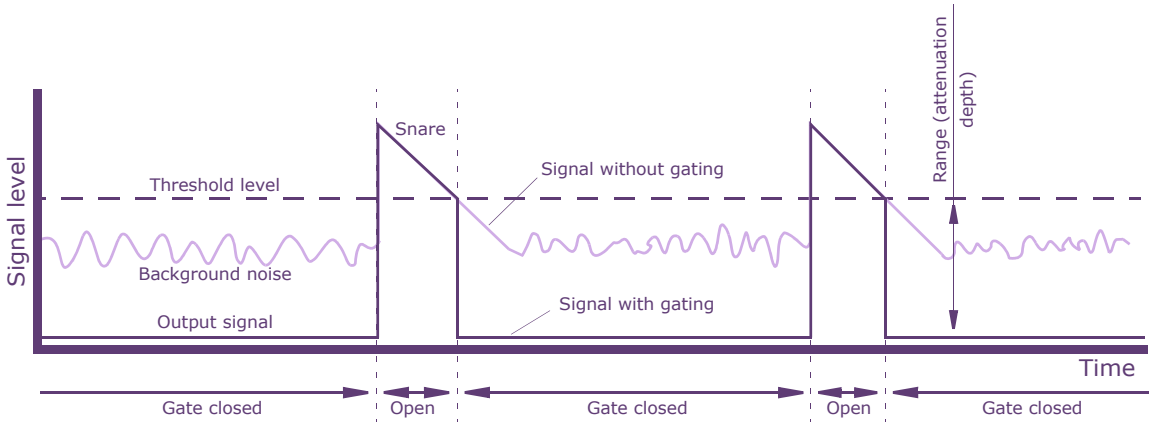


Figure 16: Effects of noise gate on each microphone

The threshold level represents the sound level at which the gate will open. Any sound exceeding the threshold triggers the gate. Sounds at lower levels leave the gate closed and the microphone will be almost completely silent.

Gate operation

To use the Square ONE Dynamics in gate mode, first ensure that the **GATE** switch is enabled and then set the threshold, attack, hold and release times to suit the programme. Set attenuation depth using the **RANGE** control knob and use the side chain filter to *tune* the gate to open at a selected frequency in wide or narrow modes. The attack characteristic of the gate is exponential, which ensures that even at extremely fast attack settings the attack envelope seamlessly blends into the audio waveform. This prevents the creation of any undesirable audio artifacts (clicks).

Threshold

This is the gate operating point. Signals that go over threshold will open the gate, while signals that go below threshold will close the gate. In both cases, gate opening/closing occurs over a period of time, which is dependent on the envelope (attack and release) control settings.

Attack

Attack is the time taken for the gate to open after an over threshold signal. The shape of the attack is fixed and has been carefully tailored to produce a transparent gating action.

Release

Release is the time taken for the gate to close after the programme material falls back below threshold. The shape is crucial to the sound and has been tailored to produce the most transparent possible gating action.

Range

Controls the amount of gain reduction that is applied to signals below threshold. Although the gain reduction can be infinite, it is often better to back it off slightly. With this type of setting the background noise and spill remain relatively constant and become less noticeable because they do not switch in and out with the gate.

Intelligent threshold shift (i-TS)

i-TS operates in conjunction with **GATE HOLD** (see Item 18 on page 13) to reduce *chattering* within the gate. Chattering is the undesirable condition that occurs when signals - especially low frequency ones - are very close to the gate threshold. In this situation the gate can become indecisive and repeatedly open and shut on the programme. i-TS ensures that the gate remains open by automatically adjusting the threshold downwards as the signal goes over threshold. When the signal actually falls below threshold (that is, the temporarily adjusted threshold) the i-TS resets, ready for the next gate opening. This improved decision-making ensures that gating is rock solid and attacks start instantly and consistently, even on signals that go slightly over threshold.

i-TS is particularly useful for low frequency material and instruments with oscillating or unpredictable decay envelopes.

Music PA

The more microphones (mics) there are in a public address (PA) system, the more background noise and stage clutter will be picked up and amplified unless noise gating is used. The most significant improvement in clarity will be obtained by gating those microphones that are used least often, for example the mic used only occasionally by a backing vocalist.

Microphones used at a fairly high gain setting, for example, on a string section, will pick up a lot of background noise. These should be gated too, to improve PA clarity.

Noise gates on the drum mics will also improve the sound of the kit.

Conference PA

In a conference or business presentation PA system, there may be several microphones in use simultaneously. Since each microphone is placed at some distance from the speaker's mouth, the gain setting on the console will be quite high. Background noise, such as outside traffic or air conditioning, will be picked up and amplified, causing a considerable reduction in the signal to noise ratio of the system. The solution is to gate each microphone individually using the Square ONE Dynamics.

Interfacing with the console

The Square ONE Dynamics is optimised for use at line level, therefore to gate a microphone, the input to the Square ONE Dynamics has to be taken from the console, preferably from the channel insert point send. The output from the Square ONE Dynamics comes back to the channel insert return. By connecting the Square ONE Dynamics at this position in the signal chain, its operation is unaffected by the use of any of the console controls, except Input Gain.

The Square ONE Dynamics may, if desired, be connected via an auxiliary send and return, but if the aux send on your console is post-EQ, then operation of the EQ will alter the overall signal level and the Threshold level of the Square ONE Dynamics will probably need adjustment.

Another alternative is connection to the group insert point of the console. This is useful when many inputs are mixed down to a smaller number of outputs. A given number of gates can achieve a greater coverage.

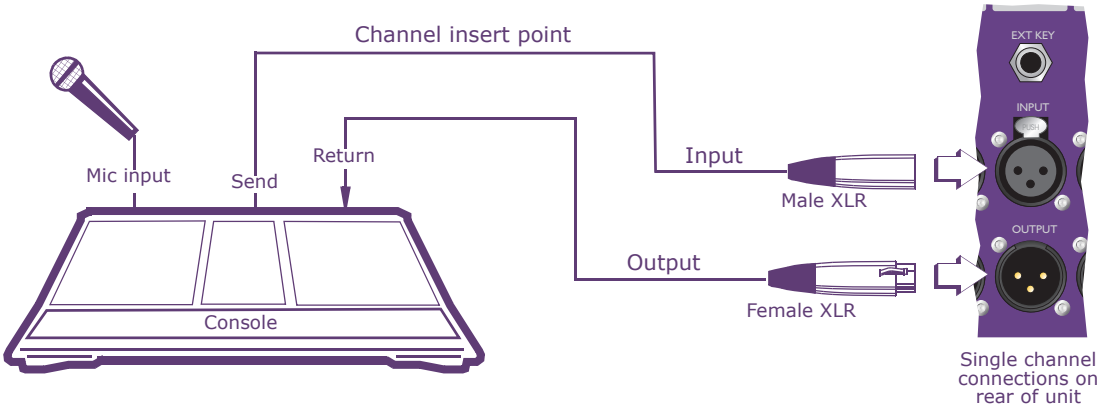


Figure 17: Effects of noise gate on each microphone

Using gates with compressors

One of the most important applications of a noise gate is the reduction of noise emphasised by the action of compressors. When any signal is compressed the highest levels are reduced, but the lowest noise levels remain the same. This effectively decreases the signal to noise ratio.

By gating the signal before it enters the compressor, the noise can be eliminated before it has chance to be exaggerated by the compressor action.

Some engineers prefer to connect the gate after the compressor. This reduces any slight noise produced by the compressor itself, but since the dynamic range of the signal is less when it leaves the compressor, setting the correct threshold level may take a little longer. Alternatively, the uncompressed signal may be parallelled to the external side chain input and this external key used to trigger the gate.

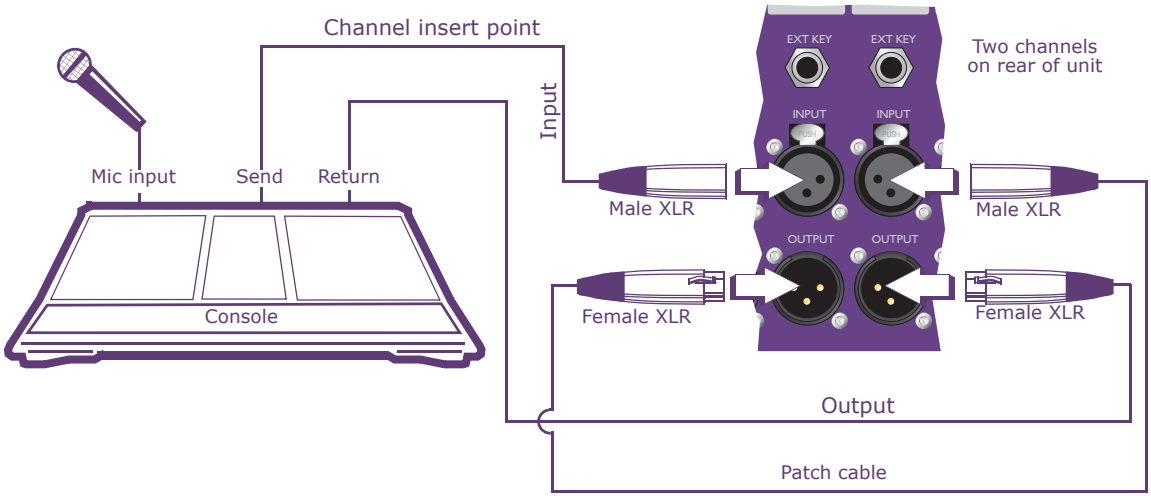


Figure 18: The use of gating with compressors

Instrument synchronisation

Sometimes it is necessary to synchronise the attack of two instruments. Often a bass guitar must be made to synchronise precisely to the regular beat of the bass drum. This can be done by passing the bass guitar through the gate and using the bass drum as the external key.

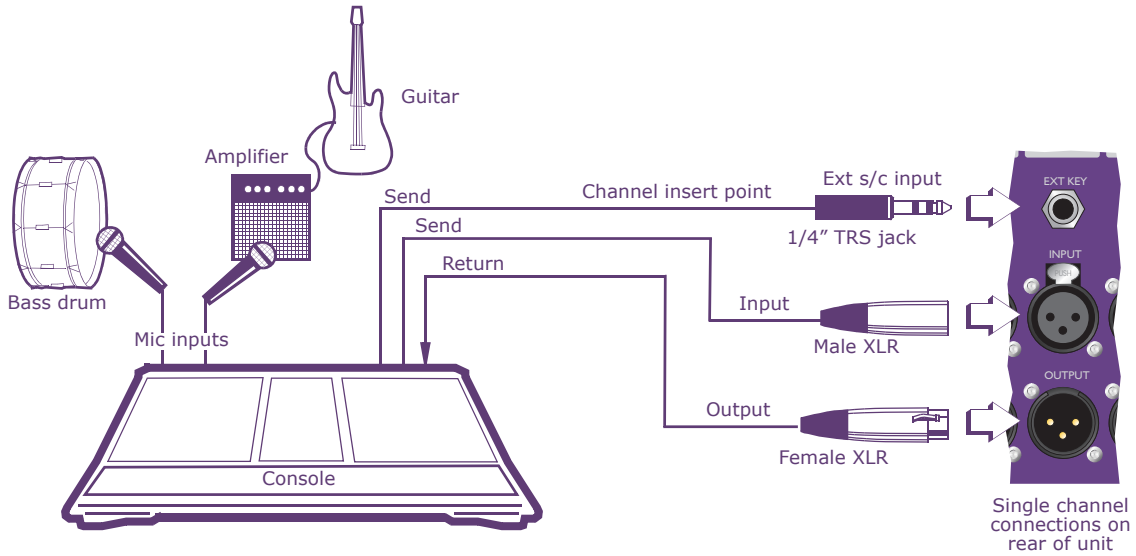


Figure 19: Instrument synchronisation

Envelope shaping

A rhythmic pulse of 8th or 16th notes going all the way through a song is a common musical device. This could be a sequenced synthesiser, but a more interesting method is possible using the Square ONE Dynamics.

The synthesiser is set up to provide continuous sustained notes (changing according to the harmony of the song), perhaps being processed by a chorus unit before passing through the gate. A drum machine, or sequencer, is programmed to produce a regular chain of 8th or 16th notes. This is used as the key input to the Square ONE Dynamics (an alternative source of 8th or 16th note pulses is a live bass drum with added echo, timed to give the appropriate repeats).

By adjusting the release time, the synthesiser will appear to play a perfectly timed sequence of notes which will add interest and rhythm to the arrangement.

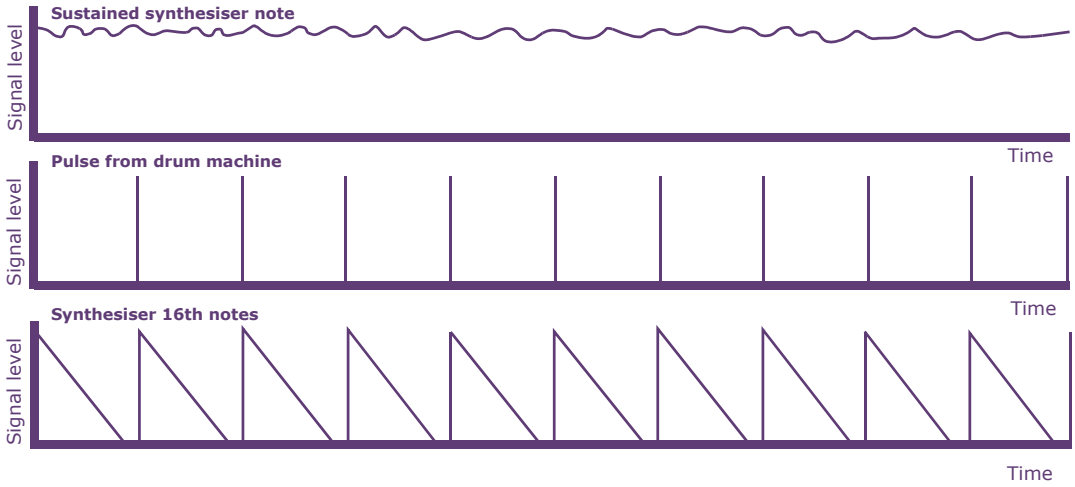


Figure 20: Envelope shaping

In a similar way, a bass drum may be *beefed up* by using it to key a low frequency tone produced by a synthesiser (or even the console oscillator) and mixing this gated tone with the original drum sound. A snare drum may be given added *bite* by keying high frequency noise.

Gating vocals

In a recording studio, vocals usually need to be gated to remove studio ambience, headphone noise, breaths etc. This is best done after the vocal has been committed to the recording medium, otherwise it may be possible to gate out accidentally something which should have been recorded.

If gating is carried out as the vocal is being recorded, it is important not to gate the signal before it is fed to the vocalist's headphones. Many vocalists find a gated headphone feed distracting and it makes it more difficult to find the right note to come in on.

Applications

Your Square ONE Dynamics processor can function as a multi-mode compressor or gate. As most dynamics processing is a matter of personal taste and preference, these application notes are provided as a guide only. Experimenting in unconventional areas can often yield interesting and useful results. Always remember, be creative with your Square ONE Dynamics - and have fun!

Compression

The Square ONE Dynamics's compressor can perform various compression styles for different applications.

Drums and percussive instruments

Drums require consistent slow attack times to *thicken* the sound. Try the compressor in RMS and soft knee (default) mode, using low ratios (between 1.5:1 to 2:1) with threshold set low.

Stringed acoustic instruments

Acoustic instruments benefit from subtle processing. Settings that are too aggressive can sound unnatural. Try the compressor in vintage and soft knee mode, using high compression ratios with a slow attack.

Stringed electric instruments

Here the compression process can become an integral part of the instruments' sound. Try aggressive compression (after ok'ing it with the musicians!) on electric and bass guitars, use RMS and soft knee mode (default) for adaptive compression or try the vintage mode to add *colour*.

Electronic instruments

Electronic keyboards, sound modules and PC audio, typically, have their audio already compressed. If you are using your Square ONE Dynamics's compressor for automatic level control between different patches, try vintage and hard knee mode using fast attack combined with slow release times.

Brass instruments

Compression is useful for *thickening* thin sounding instruments and compensating for less-than-perfect microphone technique. Try RMS and soft knee mode (default) for using high ratios (between 4:1 to 2:1) with medium attack.

Sung vocals

Try the compressor in RMS mode with the ratio at 2:1, making sure the attack is not too fast as you may lose intelligibility. **Be careful not to apply excessive gain reduction when working with live PA, as you may find the compressor *hunting* for level and causing gain problems in the foldback mix.**

De-essing

Setting the compressor to respond to a specific bandwidth of high-frequency audio can reduce excessive sibilance in vocals, see "Hi-Q frequency-conscious compressor (de-esser)" on page 21 and "De-essing" on page 26 for further details.

Spoken word

With the compressor set to RMS and soft knee, use high ratios, for example, 5:1. **Be careful not to compromise intelligibility by using an attack that is too fast, as audio information that helps us identify consonants may be lost.**

Gating

When using noise gates, try experimenting with the attenuation depth for more subtle gating. Bear in mind that 20dB of attenuation is equivalent to switching the pad in on your console's mic amp!

Removal of background noise from electronic sources

Gating can be used, typically, when an electric guitar with noisy effects pedals is set at high gain. On the appropriate channel, insert your Square ONE Dynamics's processor, enable gate mode and, with just the unwanted noise present, turn the threshold up until the gate closes. Set long hold and release times so that the gate does not close on decaying notes, but gates the noise rather that closing abruptly. **Please don't be tempted to set extremely fast attack times; this is an electronic instrument so we want to avoid ultra-fast transients, that is, the high-energy peak at the beginning of waveforms.**

Try setting the side chain filter so that gate is more sensitive to the frequency spectrum of the instrument. Most noise problems will have a predominantly high frequency content.

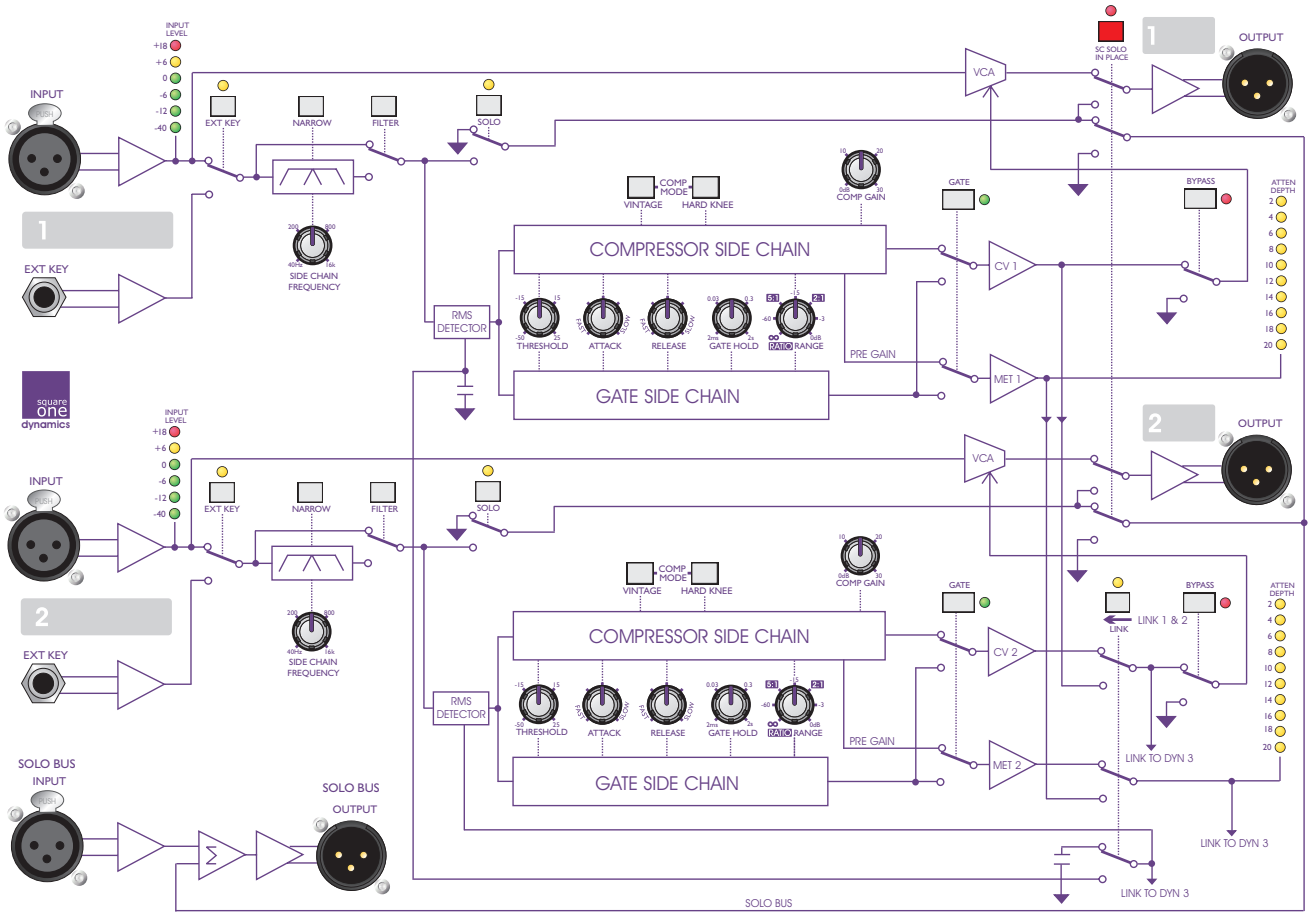
Drums and percussive instruments

Ideally, to obtain the best results you would set the threshold as low as possible to utilise the gate's fastest possible attack. However, in practice the threshold setting is dictated by the noise floor level, that is, adjacent drums, cymbals etc.

A solution is to use the side chain filter so that the gate is more sensitive to the bandwidth you want to hear. Do this by adjusting the narrow filter setting to *tune* the gate to a specific frequency. Then, use the side chain solo facility to help set the filter; you can do this without interrupting the audio by monitoring from the solo bus output via a spare input on your mixing console.

Audio signal path

The following diagram shows the path of the audio signal for channels 1 and 2; all eight channels are identical.



Balanced/unbalanced audio

The electronically balanced input and output connections of the Square ONE Dynamics have the benefit of high common mode rejection (CMR), which eliminates externally induced interference such as mains hum etc. Balancing is especially useful when long cable runs are used between pieces of equipment.

CMR is the ability of a balanced input to reject the part of the incoming signal that has the same amplitude and opposite phase on both input terminals, referenced to ground. As a specification, CMR is usually stated as a dB ratio at a given frequency.

Balanced audio

Balancing refers to the type of input or output signal connection. An unbalanced connection has two signal carrying conductors; one of these is the cable shield or ground, which is used for signal return. A balanced connection has three conductors, two for signals and a shield that is connected to earth. Neither of the signal wires is grounded and each is driven with equal voltage but of opposite polarity; it is important that each of these wires has the same source impedance. Because the signal conductors on the balanced connection are at the same impedance and of opposite polarity they are better able to cancel, and therefore reject, interference and noise pick-up. It is standard practice to use balanced connections for long cable runs, for example, to amplifiers, or for cables carrying sensitive or low level signals, for example, microphones.

A balanced line requires electronics and typically employs connectors of the XLR and 1/4” TRS jack plug types.

No actual circuit can ever be perfectly balanced due to inherent differences in the signal paths caused by the fact that no two resistors or transistors are identical and the signal paths cannot exactly mirror one another. So, each circuit can only be balanced to a certain degree. However, the difference between a balanced and an unbalanced circuit is that the unbalanced circuit can never be balanced whereas, the circuit designed to be balanced can be improved by careful component selection and layout.

In conclusion, unbalanced lines are more susceptible to noise so that cable runs should be short. Whereas, balanced circuits offer good rejection of noise induced equally on both wires, that is, they offer high common mode rejection, and allow long cable runs.

Principles of balanced audio

A balanced audio signal comprises three components:

- **Hot wire:** contains positive voltages.
- **Cold wire:** contains negative voltages.
- **Ground wire:** at zero volts and surrounds hot and cold wires.

A single-ended (unbalanced) signal must be converted into a balanced one. This is done by splitting the signal in two, passing one half through the hot wire while the other is phase reversed into a negative mirror image before being sent through the cold wire. After passing through the balanced cable, the balanced signal is converted back using a CMR circuit. This reverses the phase of the cold (-ve) signal back to normal (+ve) before being mixed with the hot (+ve) signal. Since any noise picked up by the cable will have the same polarity in both the hot and cold signal wires, it will cancel itself out when the cold signal is phase reversed back and mixed with the hot.

Connecting balanced and unbalanced equipment

For a balanced cable to work as required it must be connected between a 'sender' circuit that splits and phase reverses a single ended audio signal, and a 'receiver' circuit that first switches the phase of the negative signal back to normal and then mixes it with the positive. If the signal entering a balanced cable is not balanced, the cable itself can still be used - if you don't use a CMR circuit afterwards - but it will take up noise just like any ordinary cable. An unbalanced audio signal entering a CMR circuit, for example, a mixer input, will be cancelled out.

To turn a balanced signal into an unbalanced one without using a CMR circuit, short the cold (-ve) signal to ground. However, the resulting audio signal will be a little weaker than normal as it is only made up of the positive signal half.

Note: *On balanced circuits, the 'hot' signal is also known as "+ve" and "in phase", while the 'cold' signal is also known as "-ve" and "out of phase".*

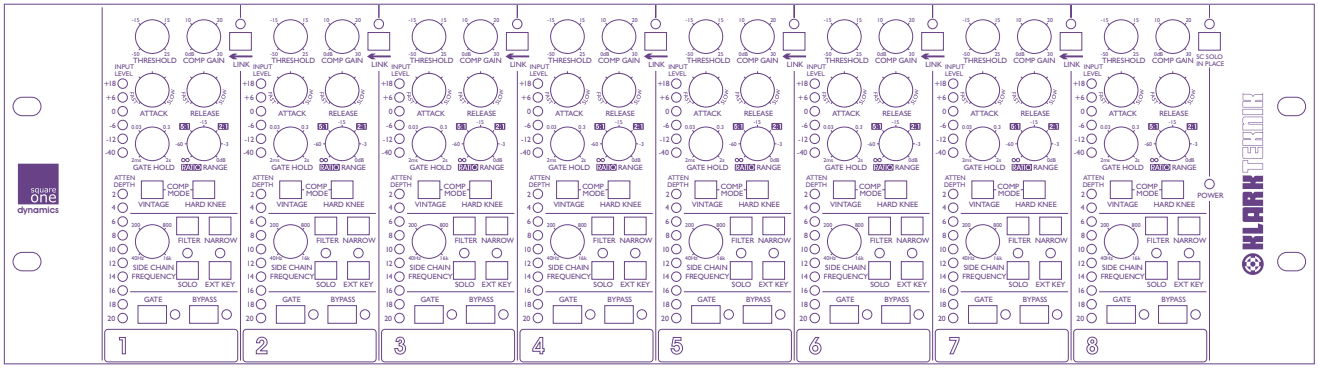
Technical specification

Inputs	**Eight**	
	Type	Analogue, electronically balanced female XLRs (Pin 2 hot)
	Impedance	10k Ohms
	Maximum input level	+22dBu
	Common mode rejection	Typically, -80dB at 1kHz
Outputs	**Eight**	
	Type	Analogue, electronically balanced male XLRs (Pin 2 hot)
	Minimum load impedance	2k Ohms
	Source impedance	<60 Ohms
	Maximum output level	+22dBu
EXT KEY Inputs	**Eight**	
	Type	Analogue, electronically balanced jack sockets
	Impedance	20k Ohms
	Maximum input level	+22dBu
	Common mode rejection	Typically -60dB at 1kHz
SOLO BUS Input	**One**	
	Type	Analogue, electronically balanced female XLR
	Input impedance	20k Ohms
	Maximum input level	+22dBu
	Common mode rejection	Typically -60dB at 1kHz
SOLO BUS Output	**One**	
	Type	Analogue, electronically balanced male XLR
	Output impedance	<60 Ohms
	Maximum input level	+22dBu
	Signal drive capability	<600 Ohms
	Output balancing	Typically -40dB at 1kHz
Performance	Frequency response	±0.5dBu (input to output), 20Hz to 20kHz
	Dynamic range	>117dB (22Hz to 22kHz unweighted)
	Noise floor	<-95dBu (22Hz to 22kHz unweighted)
Compressor	Threshold	-50dBu to +25dBu
	Ratio	Scale infinity to 1:1 with scale markings 5:1 and 2:1
	Attack	Scale = fast to slow (100µs to 20ms)
	Release	Scale = fast to slow (50ms to 2.5s)
	Gain	Scale = 0dB to +30dB
	Operating modes	Four
Gate	Threshold	Scale = -50dB to +25dB
	Range	Scale = -infinity to 0dB
	Attack	Scale = fast to slow (10µs to 10ms)
	Release	Scale = fast to slow (2ms to 2s)
	Hold	Scale = 2ms to 2s
Filter	Side chain filter	Scale = 40Hz to 16kHz
Terminations	Audio	3-pin XLRs (male and female) and 1/4” TRS balanced jack sockets
	Power	3-pin IEC

Power Requirements	Voltage Frequency Consumption	100VAC to 240VAC ±10% 50Hz to 60Hz <35W
Dimensions	Height Width Depth	133 mm (5.25”), 3U high 483 mm (19”) 200 mm (7 $^{7}/_{8}$”)
Weight	Net Shipping	4.4 kg 5.5 kg

Due to a policy of continual improvement, Klark Teknik reserves the right to alter the function or specification at any time without notice.

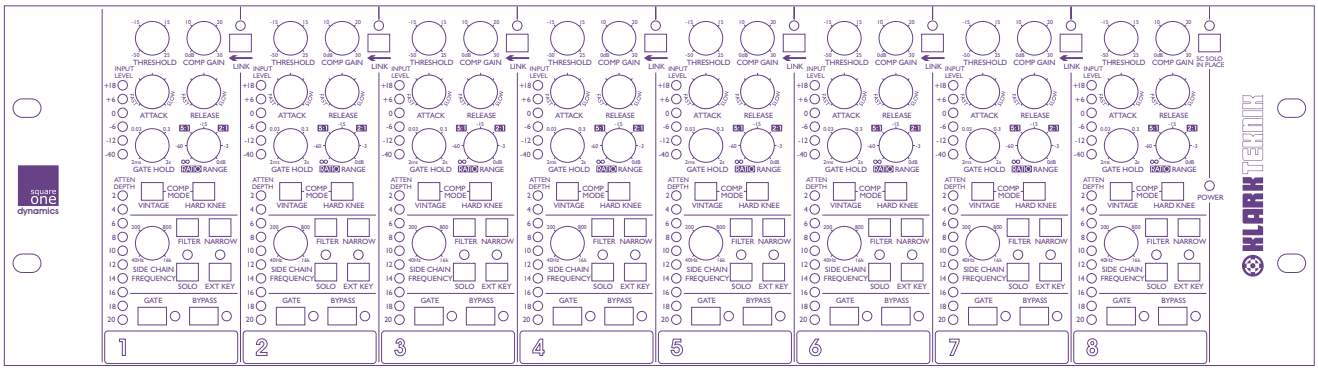
Crib sheet



KLARK TEKNIK
SIGNAL PROCESSING BY DEFINITION

Location: _____ **Date:** _____

Application: _____



KLARK TEKNIK
SIGNAL PROCESSING BY DEFINITION

Location: _____ **Date:** _____

Application: _____

Service information

The service manual for this equipment is available for purchase. Please contact your local distributor for details.

Routine maintenance

To help keep your Square ONE Dynamics unit in good working order and to make sure it gives you optimum performance, we recommend that you carry out the following about once every month:

- Clean the unit, as detailed in "Cleaning the unit" on page 42.
- Check controls for freedom of operation. As the controls are 'self-cleaning', this operation will help to prevent them from sticking.
- Check functionality of all controls, that is, pushbuttons, LEDs etc.
- Check functionality of equipment.

Cleaning the unit

Switch off the unit and electrically isolate it from the mains before cleaning.

Clean the unit using a dry, lint-free cloth. Do not use harsh abrasives or solvents. When cleaning the unit, take great care not to damage control knobs, pushbuttons etc.

Checking/replacing the mains fuse

The equipment must be independently isolated from the mains voltage supply before any attempt is made to change or check the protective fuse. The fuse and its cover must always be replaced before the equipment is reconnected to the mains voltage supply.

Only use the correct replacement type when changing the fuse. Fuse specification is printed on the rear cover.

To remove the fuse, pull out the fuse drawer (see "Mains supply" on page 15). Then, prise out the fuse from the furthest compartment (the nearest compartment is for a spare fuse); a small, flat-bladed screwdriver may be useful for this.

Insert new or existing fuse in the furthest fuse compartment and close drawer.

After replacing a fuse, check that the unit is working properly.

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