Operating and service information

DN514

Quad Auto Gate

IMPORTANT:

Product registration
Please check that the product registration card is enclosed with this book. If **NOT**, immediately inform the factory quoting the unit's serial number.

Introduction

Noise gating is a powerful technique for improving the clarity of a mix, whether in music PA work, conference PA, or in the studio. But as the number of channels in multitrack recording increases, and as the microphone arrangement used in live sound becomes more complex, so the noise gate rack increases in size and takes longer to set up.

The Klark Teknik DN514 Quad Auto Gate has been designed to enable the studio or PA engineer greatly to improve the quality of sound achievable, by gating out unwanted background clutter or tape hiss, quickly and simply. The configuration of four gates per nineteen inch rack unit doubles the normal noise gate packing density.

Noise gates have traditionally been difficult to set up correctly to give dependable triggering and to give optimum background noise reduction. The DN514 Quad Auto Gate uses intelligent design to reduce the time spent in setting up:

Two semi-automatic Attack modes, one dedicated to percussion, eliminate the need for a rotary Attack control. Hold time is scaled to the setting of the Release Time control, giving reliable gate closure without the 'jitter' that can often take careful adjustment of controls to remove.

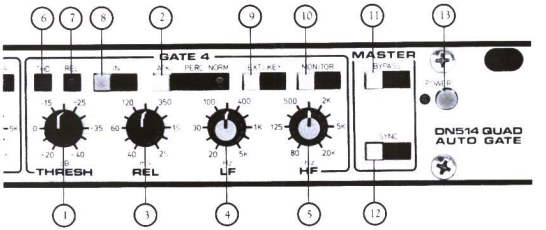
A feature important to the live sound engineer, where microphones may be placed close to each other and pick up instruments other than the one intended, is Frequency Conscious Gating. A low frequency and high frequency rotary control on each channel tune the keying circuitry of the gate to a precise frequency range. The gate only opens for the intended instrument - not when the microphone picks up sounds of other frequencies from neighbouring instruments.

The Sync function is similar to the channel link on conventional stereo noise gates, but here it is possible to interlock the release times of four channels of gating to synchronise harmony vocals or a brass or string section. Key inputs allow gate triggering by sources other than the signal passing through the gate. A Side Chain Monitor switch allows the engineer to monitor the Key signal, whether internal or external, and to monitor the effect of the gate's filters.

LED's provide visual confirmation of gate open/closed status, and also allow monitoring of the Release profile. A gate bypass switch is provided for each channel, and also a master bypass to facilitate setting up.

The DN514 Quad Auto Gate is built to Klark Teknik's high standards of design and construction. A well thought out aesthetic presentation is also an aid to realising clarity of sound in today's complex musical productions.

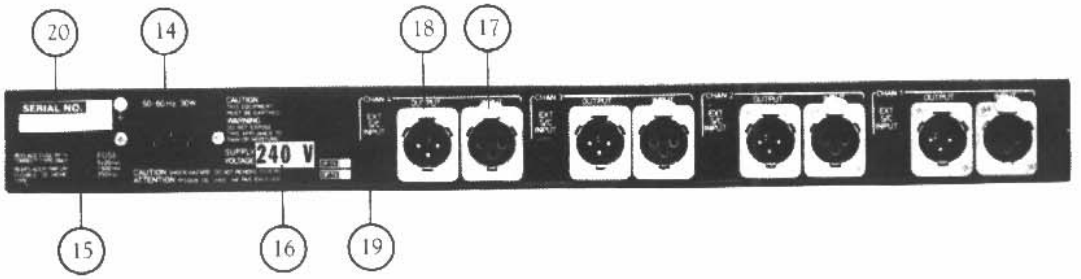
Front panel controls



The DN514 Quad Auto Gate consists of four identical channels and a master control section.

1. **Threshold** determines the level at which the gate will open, variable from -40dBu to +20dBu. An LED indicates when the threshold level has been exceeded and the gate is open.
2. **ATK** (Attack) is semi automatic, with switchable Normal and Percussion modes. Normal mode is intended for use with most instruments and vocals. Percussion is optimised for instruments with a fast attack time.
3. **Release** is adjustable from 40 milliseconds to 2 seconds. Hold time (the time the gate will remain fully open before release) is scaled to the value of release time chosen. An LED indicates via its brightness the release profile.
4. **LF** applies low frequency filtering to the side chain of the gate from 20Hz to 5kHz, with a roll-off rate of 12dB per octave.
5. **HF** applies high frequency filtering to the side chain of the gate from 20kHz down to 80Hz, with a roll-off rate of 12dB per octave.
6. **THD** (Threshold) LED indicates when the gate is open.
7. **REL** shows the release profile of the gate.
8. **In** switches the gate in or out of circuit, working as a true Bypass.
9. **EXT/KEY** switches the Ext Key signal to the S/C input to allow the gate to be triggered by an external signal instead of the main signal.
10. **Monitor** switches the output of the side chain filter to the audio output of the gate, allowing the engineer to assess the effects of the LF and HF filters.
11. **Bypass** forces the VCA's of all four gates to zero attenuation, effectively switching the unit out of circuit.
12. **Sync** links the release times of all four gates. Any one gate entering release mode will cause other open gates to release at an equivalent rate, irrespective of the setting of their Release controls.
13. **Power** switches mains power on or off.

Rear Panel Functions



14. **Mains** is supplied via an IEC standard 3-pin connector. A compatible power cord is supplied with the unit.
15. The **mains fuse** is located next to the mains inlet connector. Always replace with the correct type and rating as indicated on the unit.
16. **Voltage selector switch.** This unit is switchable between two nominal supply voltages, 110V and 220V, via a slide switch. The switch MUST be set before the supply is connected. Any attempt to run the unit from a 220V supply with the switch set to 110V is liable to result in severe damage to the unit.
17. **Signal Input** is made via a female XLR type connector.
18. **Signal Output** is available on a male XLR type connector. For wiring details see page 16 of this manual.
19. **External Side Chain Input** is made via a 1/4 inch type A stereo jack connector.
20. Always quote the **Serial Number** in any correspondence concerning the unit.

Reliability Control

Even with the advanced technology incorporated in this product, each instrument is given the full backing of Klark Teknik's **reliability control** which proves each product against a specification consistent with the highest professional standards. Only top quality components are used, and every unit is bench tested and aligned before a burn-in period and final performance test.

Options

Security cover
Transformer input * /output balancing

*Input transformer balancing is non-retrofittable and has to be specified with order.

Options Ordering Information

	Parts Number
Perspex security cover	SCP..... Model No.
Aluminium security cover	SCA..... Model No.
Output balancing transformer	BU37
Input balancing transformer	BN37

Using the DN514 Quad Auto Gate

The human ear is connected to an extremely sophisticated organ for processing incoming audio information - the brain. Even in situations where there are many interacting 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 many 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.

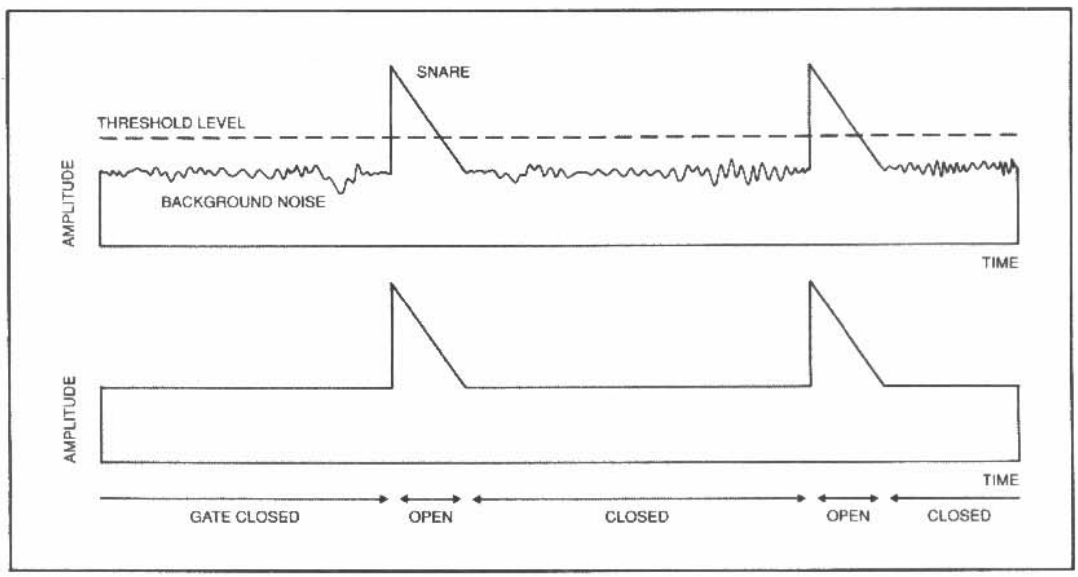


Diagram 1

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.

Interface with the console

The Klark Teknik DN514 Quad Auto Gate is optimised for use at line level, therefore to gate a microphone, the input to the DN514 has to be taken from the console - preferably from the channel insert point send. The output from the DN514 comes back to the channel insert return. By connecting the DN514 at this position in the signal chain, its operation is unaffected by the use of any of the console controls, except Input Gain.

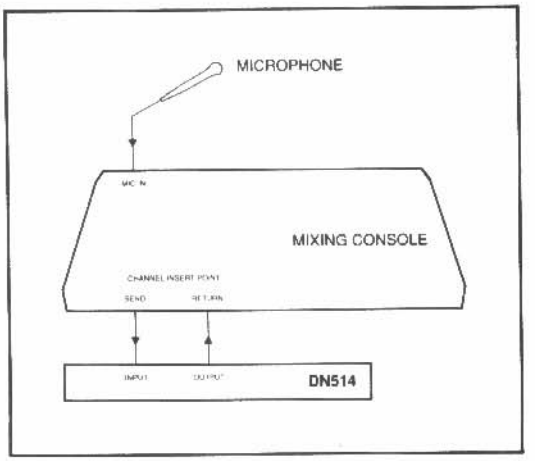


Diagram 2

The DN514 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 DN514 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.

Setting the Controls

The DN514 is a high performance quad noise gate, yet its design makes operation extremely simple. Most important are the Threshold, Attack, and Release controls.

Threshold sets the level at which the gate will open. Turning the control clockwise lowers the threshold level and allows quieter signals through. To set the threshold level, it is best to start off with the control fully clockwise. Then turn it anti-clockwise, cutting out more and more noise, until the gate just starts to affect the signal you want to hear. Backing off around 5dB from this point will give a good threshold level for reliable triggering.

Attack is set semi-automatically. A switch selects between two modes of operation, Normal and Percussion.

Release sets the time it takes for the gate to close - for the VCA to go from zero attenuation to almost infinite attenuation. The release time should be set to correspond with the decay of the signal. For instance, the sound from a drum decays very quickly, a sustained note on a piano takes much longer. The optimum release time is when the gate closes fast enough to prevent any noise from getting through, yet smoothly enough not to cut off the sound of the instrument prematurely.

Two LED's indicate the activity of the gate. **THD** (Threshold) illuminates when the gate is open. **REL** indicates, by its level of brightness, the release profile of the gate. To help in setting up the gate, these LED's illuminate even when the gate is bypassed.

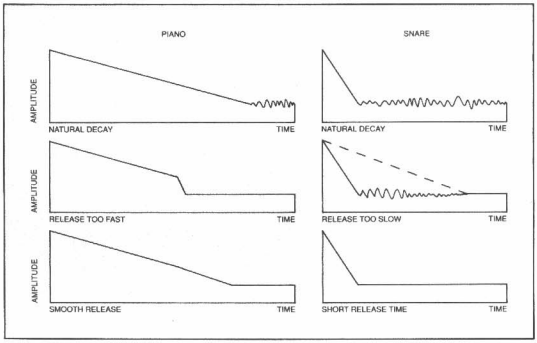


Diagram 3

Side Chain Filter

It is most important for a noise gate to trigger reliably every time the instrument plays or vocalist sings, yet it should not be triggered by the occasional loud sound coming from some other instrument. In a drum kit, for instance, the snare drum and hihat cymbals are usually miked and gated separately, yet they may be so close that an almost equal level of signal from both instruments is being picked up by each microphone. This makes the threshold level very difficult to set correctly.

The solution to this problem is to tune the LF and HF filters of each gate to the principal band of frequencies produced by the respective instruments. The gate on the snare drum is tuned to a band of low frequencies, the gate on the hihat is tuned to the higher frequencies it produces:

Diagram 4

For other instruments, and vocals, a mid-range band of frequencies may be selected:

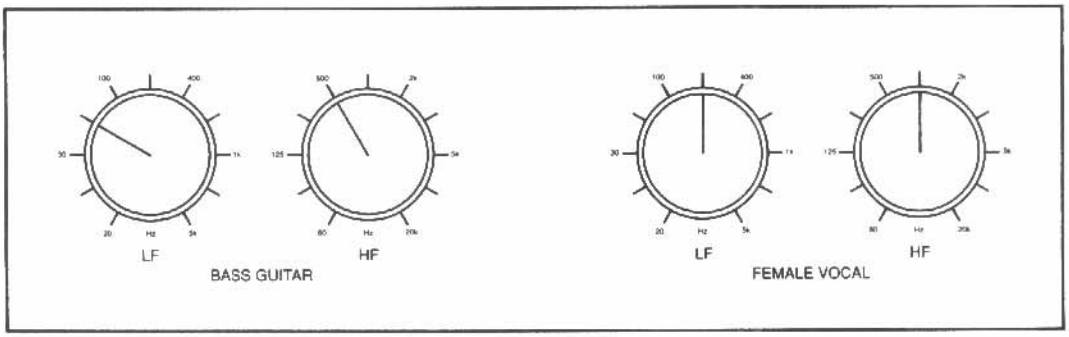


Diagram 5

In normal use, these filters affect only the triggering circuits of the gate, not the audio output. But to assist in tuning the gate to the right band of frequencies, a **Monitor** facility is provided so that the engineer can hear the effect of the filters while setting up.

External Key

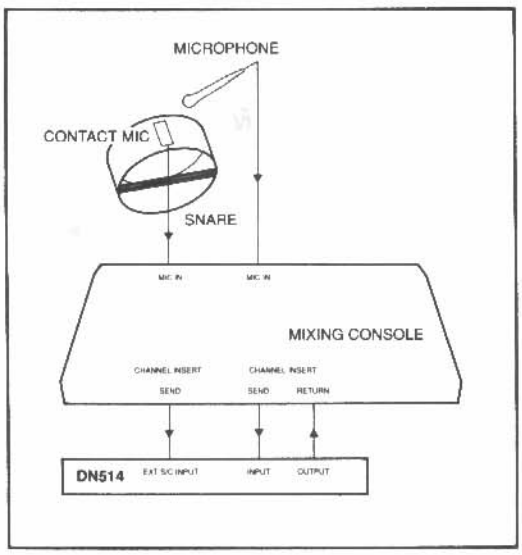


Diagram 6

For most applications, the DN514 is triggered by the level of the incoming signal. Sometimes it can be useful to use a different signal to trigger the gate. This 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 and using the clean signal it produces to trigger the gate:

Synchronisation

In the case of harmony vocalists or a brass section, an improvement to the 'tightness' of the arrangement may be gained by synchronising the release times of the four gates, using the **Sync** function.

With Sync activated, when one gate starts to release, the release times of all the other gates are locked to it:

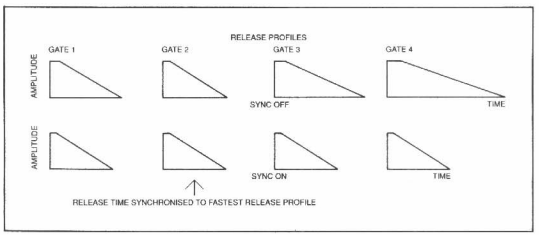


Diagram 7

This means that when one instrument of the section finishes a note, they all do. This is useful for brass 'stabs'. Further improvement to the synchronisation of the instruments may be obtained by linking the external keys of all the channels, as outlined under 'Advanced Applications'.

Basic gating

Music PA

The more microphones there are in a 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 which are used LEAST, 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.

As has already been mentioned, 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 DN514.

Use 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.

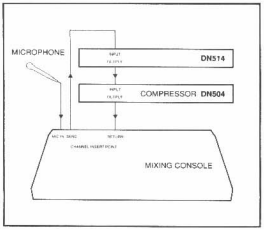


Diagram 8

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 paralleled to the Ext S/C Input and this external key used to trigger the gate.

Tape noise

During mixdown from multitrack tape, noise may become obvious. There are two ways in which this can be reduced using the DN514. The first is to gate the four noisiest tracks, or possibly all twenty-four tracks if you are fortunate enough to have six DN514 units.

Another way is to subgroup all the tracks, minus the reverb returns, and apply a pair of gates to them. Without gating, noise becomes most obvious at the end of the music, as the reverb dies away. If the tracks are subgrouped and gated, then as soon as the instruments and vocals finish, the output from the multitrack tape will be muted, leaving the reverb to die away into a smooth silence:

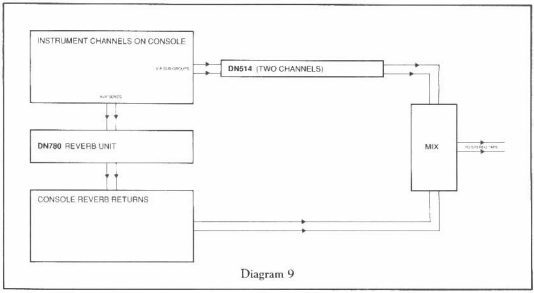


Diagram 9

This technique uses two channels of the DN514. The other two can be usefully employed to gate the output of the reverb unit, which itself may produce some noise, irritatingly noticeable when mixing to digital tape. For the reverb, a longer release time would be used.

MIDI Systems

Because of its compactness, the DN514 will also find application in MIDI keyboard setups where multitrack tape is not used. Many synthesisers - even digital ones - produce a good deal of noise. Effect units do too, especially chorus units and flangers. When synthesisers are recorded on multitrack tape, they can be gated individually as they are recorded. But in a pure MIDI setup, all the sound generators are active simultaneously. It is therefore necessary to use a large number of gates for optimum results. The DN514's packing density of four gates per unit of rack space makes this a practical possibility.

Advanced Applications

Gated Reverb

Gated reverb is a popular effect where a high level of reverb is used on a signal - often a snare drum - and a gate is used to chop off the tail of the reverb, giving a bright punchy sound.

This can be done without artificial reverberation by using two microphones. One mic is positioned close to the drum, another is set further away, to pick up the natural reverberation of the room. The outputs of the close mic and room mic are mixed to give a good sound, and the room mic passed through one channel of the DN514.

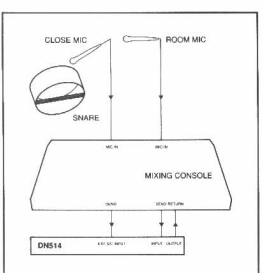


Diagram 10

The External Key input is used, with the close mic giving a sharp attack pulse to trigger the gate. The release time is set to give the best sounding decay on the reverb:

Instrument Synchronisation

Sometimes it is necessary to synchronise the attack of two instruments. Often a bass guitar must be made to sync 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:

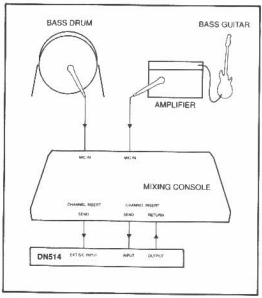


Diagram 11

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 DN514.

The synth 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, and is used as the key input to the DN514 (an alternative source of 8th or 16th notes pulses is a live bass drum with added echo, timed to give the appropriate repeats).

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

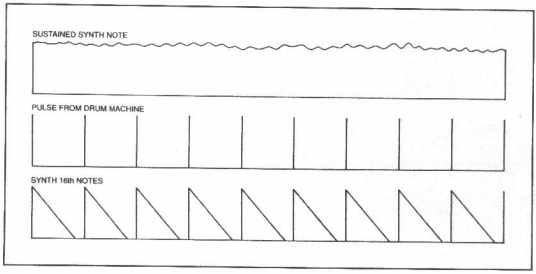


Diagram 12

In a similar way, a bass drum may be 'beefed up' by using it to key a low frequency tone produced by a synth (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 tape, 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.

Although the DN514 Quad Auto Gate is a simple-to-use, high quality noise gate, it has creative potential in abundance too. Engineers will find it a reliable problem solving tool, and also a means towards enhanced musical expression.

Audio Connections

Input

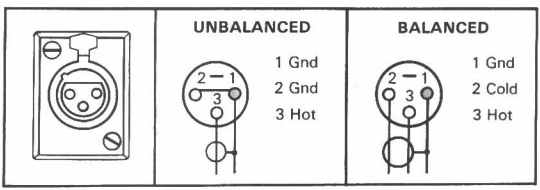
The input circuit is a transformerless, electronically balanced design which achieves a symmetry of better than -50dB from 20Hz to 10kHz.

If transformer balancing of the input is required, this must be specified at the time of order. It is not retrofittable.

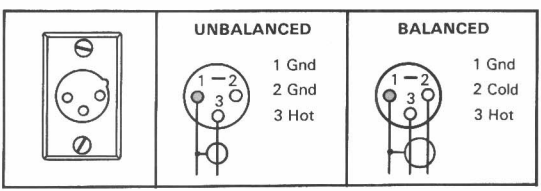
Output

The standard output is unbalanced, but balancing transformers are available and may be retrospectively fitted. The output circuitry is capable of driving a 600 ohm load at a level of +22dBu.

Input

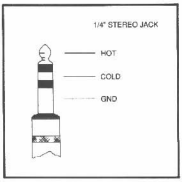


Output



Pin 2/Pin 3 Hot Operation

The unit can be quickly re-configured to accommodate either XLR wiring standard by removing the top cover and changing the orientation of 4 plug-in links per connector, as shown on the adjacent PCB legend. When using a fully balanced system, either pin 2 or pin 3 may be the HOT terminal.



Side Chain/EXT Key Inputs

The electronically balanced Side Chain inputs are on stereo quarter inch type A jack sockets, configured TIP = HOT, RING = COLD, SLEEVE = Earth. Inserting a mono jack plug will automatically unbalance the input.

The sockets are internally normalled so that signal continuity is maintained when there is no jack plug inserted.

Balanced Circuits

Transformer or electronically balanced connections have the benefit of Common Mode Rejection which eliminates externally induced interference, such as mains hum etc. Balancing is especially useful when long cable runs are used between pieces of equipment.

Transformer balanced circuits have the added advantage of being fully floating, with the earth (ground) or screen being totally isolated from the signal. In installations where a difference in earth potential is likely to occur, this isolation prevents earthing problems which can, in some cases, damage the equipment.

DN514 Technical Specifications

Audio Inputs	**Four**
Type	Electronically balanced
Impedance (ohms)	
balanced	20k
unbalanced	10k
Key Inputs	**Four**
Type	Electronically balanced
Impedance (ohms)	
balanced	20k
unbalanced	10k
Audio Outputs	**Four**
Type	Unbalanced
Minimum load impedance	600 ohm
Source impedance	<60 ohm
Maximum level	+21dBu
Performance	
Frequency response	
(20Hz - 20kHz)	±0.5dB
Distortion	
(at +4dBu)	<0.03% at 1kHz
Equivalent input noise	
(20Hz - 20kHz unweighted)	<-103dBu gate closed
	<-94dBu gate open
Attack	
(program related, semi-automatic)	50µS to 200µS 'Perc'
	500µS to 2mS 'Norm'
Hold/Release	Variable 40mS to 2S
Threshold	Variable -40dBu to +20dBu
Attenuation	>84dB gate closed
Key Filters	
High pass filter	20Hz - 5kHz, 12dB/octave
Low pass filter	80Hz - 20kHz, 12dB/octave
Power Requirements	
Voltage	110/120/220/240V, 50/60Hz
Consumption	<30VA
Weight	
Nett	4kg
Shipping	6kg
Dimensions	
Width	482mm (19 inch)
Depth	292mm (11 1/2 inch)
Height	44.5mm (1 3/4 inch)

Terminations	
Audio inputs/outputs	3 pin XLR
Key inputs	1/4 inch stereo jack
Power	3 pin IEC
Options	Security cover
	Transformer input/output balancing*

* Input transformer balancing is non-retrofittable and has to be specified with order.

Audio Circuits

Input Section

The input signal enters via XLR type connector XL1 and may be balanced or unbalanced (see audio connector wiring details).The input is then fed through the Hot-Pin jumper block which allows for either Pin 2 or 3 being selected as the in phase or active pin on the input.
The signal is then connected via the first order filter network R2/C1 and R7/C2 to the differential input amplifier IC1. Common mode rejection is factory set with RV1 to give maximum rejection at 100Hz; typically 85dB.

VCA Section

The output from IC1 passes through the first order LF and HF filter networks C33/R59 and C34/R58 to the VCA input buffer IC8a. From there it is AC coupled to the DBX VCA IC9 via C36 and to the Ext/Key input switch SW4 via C35.
Preset RV2 is factory set to give minimum distortion at 1kHz and +10dBm, (typically 0.003%), this adjustment also reduces control feed-through to a minimum.

Output Section

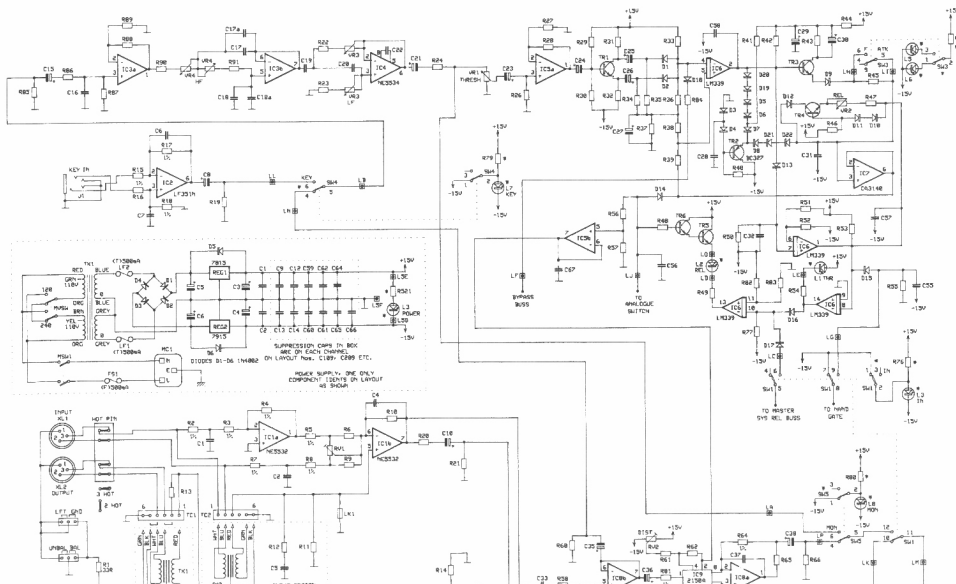
The VCA output is fed to the current to voltage converter IC8b which has a high current drive capability. High frequency stability is optimised with capacitor C37.
The output of IC8b is AC coupled by C38 to the Monitor Switch SW5 and from there via the In/Out Switch to C11.
From C11 the signal is connected to the output transformer socket TC1.
On the standard unit two plug-in links on TC1 connect signal and ground to pins 2 and 3 of the output XLR connector XL2 via the Hot-Pin jumper block.
On units with transformer balanced output the two links are removed and the transformer is connected to TC1.

EXT/KEY Input

The Side Chain input signal enters via stereo jack connector J1 and may be balanced or unbalanced (see audio connector wiring details).
The signal then passes to the differential input amplifier IC2 which has first order R.F. filter networks formed by R17/C6 and R18/C7.
From IC2 the signal is AC coupled to the EXT/KEY selector switch by C8.

HF and LF Filter Section

The output from the EXT/KEY selector switch is AC coupled to the positive filter input buffer IC3a which has a first order R.F. filter formed by R86/C16. This buffer is needed due to the variable impedance offered by the following filter circuits.
The HF and LF filters are 12dB/octave second order butterworth filters arranged around IC3b and IC4 respectively.
The turnover frequency for each filter is continuously variable; between 20Hz and 5kHz using VR4 for the LF and 80Hz and 20kHz using VR3 for the HF.
Both filters are unity gain positive circuits.
Filter output amplifier IC4 has a high current drive capability and is AC coupled by C21 to the Monitor switch and the Threshold control VR1.



CIRCUIT FOR ONE CHANNEL ONLY
OTHER THREE IDENTICAL

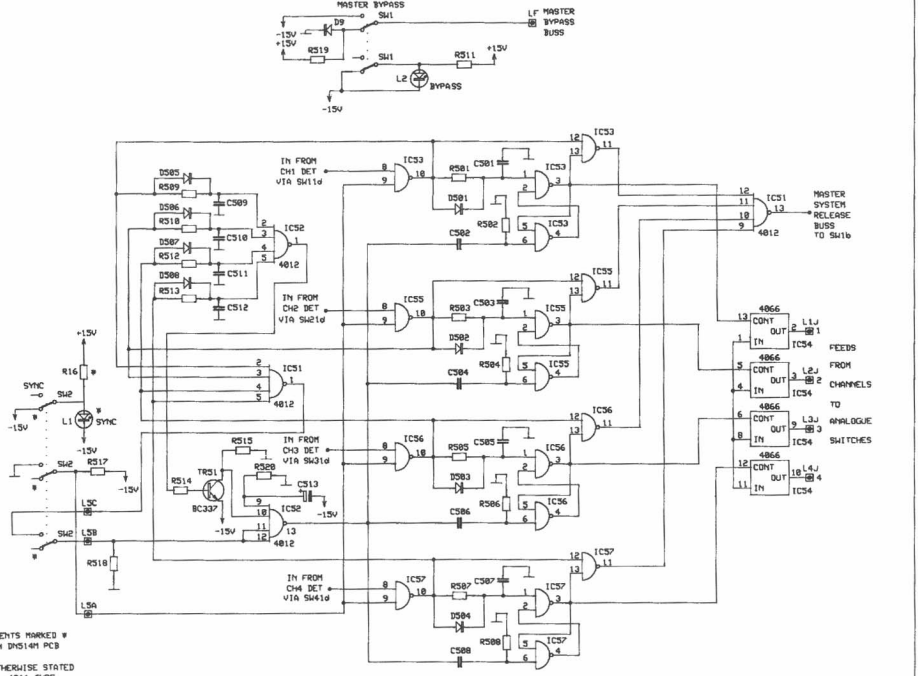
COMPONENT IDENTS ON LAYOUT ARE PREFIXED BY CHANNEL No. EXCEPT RESISTORS, CAPACITORS AND DIODES WHICH ARE NUMBERED FROM 1.000 FOR CHANNEL 1, 2000 FOR CHANNEL 2, ETC

COMPONENTS MARKED * ARE ON DN514S PCB

UNLESS OTHERWISE STATED
ALL ICs LF353N
ALL DIODES 1N4148
ALL TRANSISTORS BC337

TRANSFORMER BALANCED INPUT OPTION	TRANSFORMER BALANCED OUTPUT OPTION
FACTORY OPTION TO SPECIAL ORDER ONLY COMPONENTS REMOVED: LK1, RV1 R2 - R18, C1, C2 REPLACED WITH LINKS: R4, R18 COMPONENTS ADDED: R11, R12, C5	REMOVE THE TWO LINKS ON TC1 PLUG TRANSFORMER INTO TC1 SECURE TRANSFORMER WITH THE SCREW AND WASHER PROVIDED CHANGE THE LINK ON SELECTOR TO "BAL" POSITION

DN514	IN/OUT, VCA, GATE, FILTERS AND PSU	BRD: DN514M	31.1.89



DN514	SYNC LOGIC	BRD: DN514S	31.1.89

Side Chain Control Circuits

Threshold Control Amplifier

The output from the wiper of the Threshold control VR1 is AC coupled via C23 to the positive 40dB amplifier IC5a.
This stage allows continuously variable selection of threshold level down to -40dBm.

AC to DC Convertor Section

The output of IC5a is AC coupled to the base of transistor TR1 which is arranged as a unity gain phase splitter biased for maximum voltage swing on its collector and emitter.
The two out of phase outputs from TR1 are AC coupled by C25 and C26 to rectifier diodes D1 and D2.
These diodes are biased to 0 Volts by R34, R35 and R37 at their anodes and to a voltage slightly higher by R33 and R36 on their cathodes. This voltage difference sets the point at which they start to conduct and hence the level needed at TR1 to open the gate, the threshold point.

Threshold Detector

The junction of the cathodes of D1 and D2 are also joined to the negative input of IC6b, a comparator, the positive input of which is biased to approximately 0 Volts. When the input signal to TR1 is above the threshold level the output of IC6b will switch high on every half cycle of the input waveform. The output is pulled up by R42 but limited to +2.8V by the voltage clamp circuit of TR2, R40, D3 to D7, D19 and D20.

Attack Circuit

The output of IC6b is current buffered by the emitter follower transistor TR3 and fed through D9 and R45 into the main storage capacitor C31.
D9 is included to stop the reverse biased zener effect of the base-emitter junction of TR3 discharging C31 when the output of IC6b switches low.
R45 is the 'Norm' attack setting resistor and is shorted out by SW3 when in the 'Perc' mode.
To save excessive currents flowing in TR3 under continuous attack conditions its collector current is supplied by R43 which is bypassed by C30 in order to cope with attack transients.
The voltage on C31 is limited to a maximum of +1.4V by D8, D21, D22 and the voltage clamp TR2.

Hold and Release Circuit

The output of IC6b is fed via D13 to the storage/pulse stretching circuit formed by C32/R50 and from there to the input of IC6a. This causes the output of IC6a to remain high continuously if the input pulses are closer together than 25mS, allowing a 20Hz waveform to pass without the gate starting to close on every half cycle.
The output of IC6a which is connected to the Release circuit components is pulled up to the positive rail by R53 to stop the release circuit acting during the attack period.
When the input pulses cease the output of IC6a goes low and the constant current release circuit consisting of TR4, VR2, R46, R47 and D10 to D12 is brought into action.
The Release slope is continuously variable with VR2 from 40mS to 2 Secs per 20dB of attenuation.

THR and REL LEDs

The Threshold LED is driven via R54 by the output of IC6d which gets its input from the output of IC6a.
The Release LED is switched on and off by IC6c and is faded up and down by the darlington pair formed by TR5 and TR6.
TR6 base is driven via R48 from the top of the voltage attenuator feeding the VCA and so the brightness of the Release LED is directly related to the amount of audio attenuation.
The Release Led is activated by IC6c whenever IC6d output or the Master System Release Buss goes high.

Sync Control Circuits

Channel Sections

Each channel has its own quad AND gate in the Sync control section, these being IC53, IC55, IC56 and IC57 for the four channels respectively.
The output of IC6a in channel one side chain control circuit is coupled by D15 and the channels In switch to one input of IC53c.
The other input to IC53c comes from one pole of the Master Sync switch SW2 and inhibits this gate when the switch output voltage is low.
When enabled the output of IC53c is fed via a 100mS R/C delay consisting of R501/C501 to one input of IC53a which is wired with IC53b as an R/S latch.
The output of this latch is high whenever channel one is locked into the system and feeds to the control input of the quad analogue switch IC54a.
The latch is reset via C502 whenever the output of IC52b goes low. C502 ensures that the latch is not held closed by IC52b output remaining low.

Master System Release Buss

The outputs from IC53c and IC53a are both fed to IC53d inputs and the output of this section feeds IC51b which is the Master System Release Buss control gate.
The output of IC51b goes high whenever IC53d (or any other channels 'd' section output) goes low, this in turn only occurs when both IC53a and IC53c outputs are high.
This condition indicates that channel one is locked in but the signal on this channel has fallen below threshold.
Until the voltage on C31 reaches -0.7V the gate stays fully open, therefore the Hold time is a combination of the 25mS storage delay on C32 and a proportion of the Release time set with VR2.

Buffer Circuits

The voltage on C31 is buffered by the high impedance voltage follower IC7 the output of which is fed through D14 to the VCA control port buffer IC5b via the voltage attenuator R56/R57.
This voltage attenuator serves to reduce the 15V output swing of IC7 down to the 0.54V swing required by the VCA for 90dB audio attenuation.
The output of IC7 is also fed to the hysteresis resistor R39 which feeds a DC bias into the positive input of IC6b to reduce the threshold level when the gate is open.

Reset System

The output of IC53c is connected directly to one input of IC51a and via a 2.2mS delay consisting of R509/C509 to one input of IC52a.
The output of IC51a, which goes high if any channel is above threshold, is connected via one section of the Master Sync switch SW2 to two inputs of IC52b, the reset buss control gate. The output of IC52a, which also goes high if any channel is above threshold but 2.2mS late, is fed via TR51 wired as an inverter to another input of IC52b.
The result of this is that the first channel to open causes IC52b to give out a 2.2mS long negative pulse which resets all the channel latch circuits.
The final input to IC52b comes from a power up reset delay circuit consisting of R520 and C513 which holds the output of IC52b high for one second after switch on and then resets all the channel latches.

Linking Section

The quad analogue switch IC54 which is controlled by the outputs of each channels latch circuit has one connection to each analogue switch joined together and the other comes from the top of the voltage attenuator which feeds each channels VCA. This has the effect that all channels that are locked into the Sync system are controlled by the most attenuated channel.

Power Supply

The power supply is a ±15V design using a low noise toroidal transformer with split primary and secondary windings.
The two primaries are connected in series or in parallel by MVSW to give 220 or 110 Volt nominal operation.
The secondaries drive a full wave bridge rectifier, D1 to D4, 2 smoothing capacitors, C5 and C6, and integrated circuit positive and negative regulators REG1 and REG2. Decoupling capacitors C1 to C4 at the power supply and C9, C12 to C14, C59 to C62 in each channel ensure low noise supply rails. Power 'on' is indicated by LED L3 which is connected between the +15V and -15V rails via R521.