The DN8000 is a two input, five output digital crossover. Being a box of DSP, it has the potential to fulfil not only the normal tasks thought of as applicable to a crossover, (i.e. frequency splitting) but many others. This allows it to replace much of, if not all of, the additional outboard processing that has come to be associated with complete multi-driver speaker system alignment and protection.

The unit is completely configurable from the front panel, and included in the signal path for each input to output are the following modules. These modules are fixed in terms of their position in the path - their order has been optimised for the intended application as a crossover.

A delay module -	this allows delays to be set for each output, and master delays to be applied to each input. The units are selectable, and temperature compensation may be added.
A fully configurable routing module -	this allows any output to be fed from either input, both inputs or neither input.
A high pass filter module -	this has fully variable frequency adjustment, and a selection of roll-off (slope) and filter type combinations.
A low pass filter module -	this has fully variable frequency adjustment, and a selection of roll-off (slope) and filter type combinations.
Two parametric equaliser modules -	these both feature fully adjustable frequency, 'Q', and level, and can be placed anywhere on the frequency scale.
A 'Low EQ' filter module -	this has fully variable frequency adjustment, and a selection either parametric mode or shelf mode, and level adjustment.
A 'High EQ' filter module -	this has fully variable frequency adjustment, and a selection either parametric mode or shelf mode, and level adjustment.

A compressor module -   this is fully featured, with adjustment available for threshold, ratio, attack, and release.

An expander module -   this has adjustment for threshold, hold and release.

A limiter module -   this merely has adjustment of threshold. It is a 'zero overshoot' design - and cannot be switched out of circuit. As such, it will not be possible to clip any of the outputs, no matter how much EQ has been added.
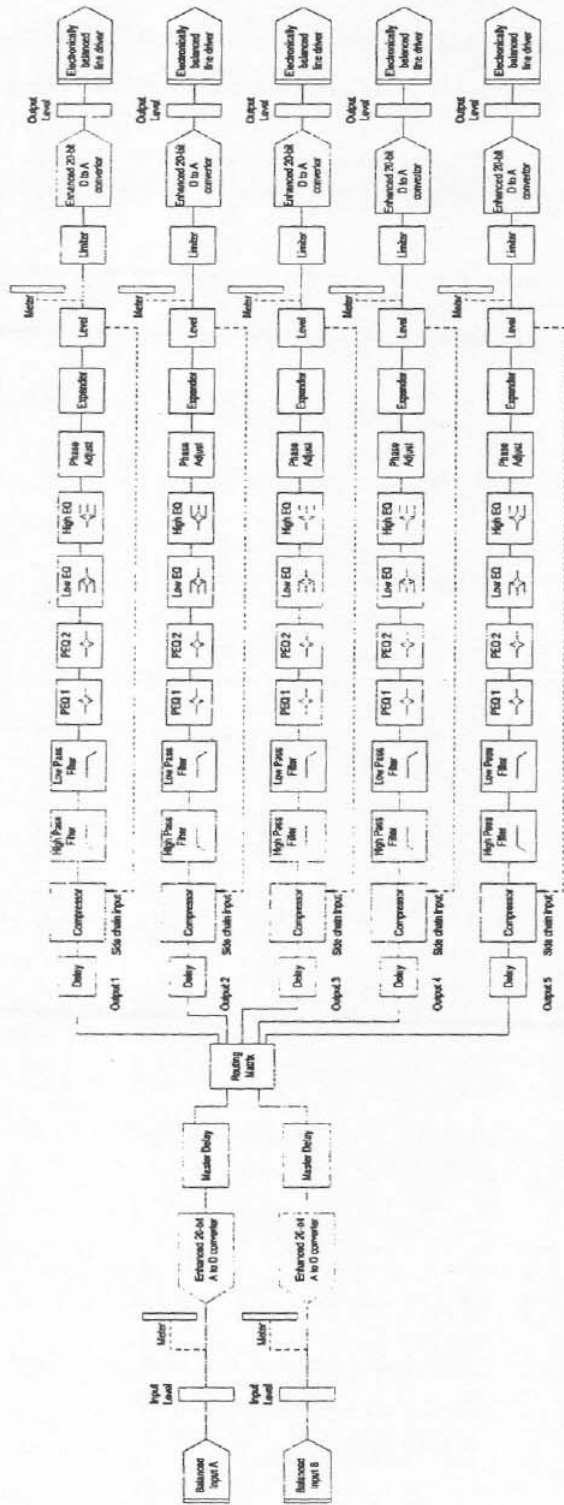
A phase control module -   this allows the phase to be reversed (switch) and also the phase angle to be adjusted in 5° steps.

A level control module -   this allows adjustment of the level of the output over a wide range.

The order of these modules is shown in the signal flow diagram overleaf.

DN8000: MAIN SCREEN DISPLAY.

The default screen will show the memory name and basic crossover construction. This will take the form of routing information - the band designation will be apparent by the labels illuminated over each output section. A typical display would be...

```
ABBA WEMBLEY #01
1A 2A 3B 4B 5Σ
```

From this, it easy to see that outputs one and two are fed from input A, three and four from input B, and five is fed from both ('Σ' or both).
To designate a feed from neither input an '-' will be used.

Names can be up to 12 characters long for user memories, and 16 characters for OEM presets.

Each of the output level controls on the front panel has a press action momentary switch. This is to allow quicker navigation around the edit screens, as the list of parameters available for adjustment is extensive. An additional feature of the output select switches is to give more information regarding each output when the main screen is displayed.

Pressing an output select will show the routing information and the frequency range covered by that output. For example, output 1 for the above set-up might display

```
1:From:A ;-6dB
120Hz-3500Hz
```

and output 5, designated as the mono bass output might display

```
5:From:A+B; 0dB
20Hz-120Hz
```

The order and number of parameters can be adapted to suit the user to some extent through the use of the user parameter list as described elsewhere in this document. However, there will be many cases when this list is not sufficient and all the parameters may need to be accessible.

The structure in full
The editing on the DN800 has been split into three sub-sections - these and their contents are outlined below:

Main-	Delay
	Source (Routing)
	Phase
	Output Level
	Label (Front Panel Icon)
EQ-	High Pass
	Low Pass
	PEQ 1
	PEQ 2
	Low EQ
	High EQ
Dynamics-	Compressor
	Expander
	Limiter

When edit is pressed and the "Which List?" option is set to "All", an initial help screen appears as below for a few seconds. It is worth noting that with any help screen that only appears once when a button is pressed, the user does not have to wait until the help disappears to continue. Once familiar with the user interface, he/she can either disable the extra help or just press/turn what is known to be the next operating step. This action will automatically clear the help and continue.

```
Edit Mode: Press
Again to Exit!
```

followed by....

```
Main eq dyn
Encoder=Choose
```

with the bottom line toggling to show

```
MAIN   eq   dyn
 <SELECT>=Begin
```

every two seconds.

The idea here is that the encoder will choose a sub-list to start editing, and pressing a select key will enter that list immediately. The encoder will show which list is going to be entered on a press of a 'select' button by displaying the chosen list title in upper case, i.e.

```
MAIN   eq   dyn
Encoder=Choose
```

or

```
main   EQ   dyn
Encoder=Choose
```

or

```
main   eq   DYN
Encoder=Choose
```

So, with 'MAIN' written in upper case, pressing a select button will enter the main parameter editing list which comprises:

> master delays,
> routing,
> output delay,
> phase,
> output level,
> label.

Similarly, with 'EQ' the list for equalisation editing is entered directly, comprising the sections:

> high pass,
> low pass,
> PEQ 1,
> PEQ 2,
> low EQ,
> high EQ.

Lastly, with 'DYN' the list for dynamics editing is entered directly, comprising the sections:

> compressor,
> expander,
> limiter.

At any of the three stages above, the select buttons will now scroll round the list of parameters in the selected sub-list only. If a different list is to be selected, pressing edit twice (to exit the mode and re-enter at the list choice stage) allows this to be accomplished quickly. Note that the ENTER key can also be used to scroll round the main/EQ/dynamics headings.

The last selected parameter in all three lists will be remembered (as will the last selected parameter in the user list, if chosen in the options menu), so that when a list is re-entered editing can carry on as before. When edit is initially pressed, before selecting a list, the choice of list always defaults to 'MAIN'.

A compare feature is available when editing. Please read the section entitled "Compare Function" in the additional notes towards the back of this manual.

Edit Menu: The Three Parameter Lists.

The structure and operation of the lists has been covered in sufficient detail now to allow the contents of the lists to be examined and detailed at the bottom level. The descriptions will take the form of a screen shot with the range of each parameter given, along with any additional points where necessary.

Worth a mention at this stage is the use of the output level controls 'press to select' action. Their main function is, when editing, to allow selection of each output for adjustment. The idea of scrolling through a parameter with five outputs - e.g. PEQ1 Frequency Output 1, PEQ1 Frequency Output 2 etc. has been avoided. The select switches will select the next parameter, NOT scroll through the five outputs at one parameter.

Selected Output Indication

Although it will be displayed on the screen as an icon during edit mode, when an output is selected, its label in the associated window will begin to flash.

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Warning: Default Parameter Values.

Please note that when the unit leaves the factory, it will have had all its memories, including the working memory loaded upon power-up, set to default values. As user settings cannot be predicted (unless a specific OEM preset has been requested) these settings have been chosen to minimise the risk of damage to loudspeaker systems upon first connection. However, it is strongly recommended that initially no audio connections are made to the unit due to the fact that

NO CROSSOVER FILTERS ARE IN PLACE WHEN POWER IS APPLIED FOR THE VERY FIRST TIME.

The high and low pass filters should be introduced as appropriate prior to adjusting gain, routing, or dynamics parameters. These have all be set to minimise output level regardless of input level.

Main Parameters List.

Master Delay Input A.

```
EDIT A:Master Del
██ ░ ██░░ 1300000 us
```

Range: 2ms to 1300ms
Notes: **Total** delay for each input to output is 1300ms max.

Master Delay Input B.

```
EDIT B:Master Del
██ ░ ██░░ 1100000 us
```

Range: 2ms to 1300ms
Notes: **Total** delay for each input to output is 1300ms max.

Source Selection.

```
EDIT 1:Source
Input A    [A]
```

Range: A, B, A+B, Off.
Notes: These are displayed as 'A', 'B', 'Σ', and '-' respectively on the main
           screen.

Output Delay.

```
EDIT2:Output Del
██▄█▄▀█        4456 uS
```

Range: 2mS to 300mS

Notes: This is dynamically allocated from the 1300mS pool available for use with
          the master delay.

Polarity.

```
EDIT2:Polarity
          Reversed
```

Range: Normal/Reversed

Phase Adjust.

```
EDIT4:Phase Adj
██▄█▄▀█        125°
```
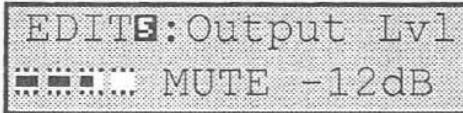
Range: 0 to 180°

Notes: 5° steps

Output Level.

```
EDIT5:Output Lvl
██▄█▄▀█        -12dB
```
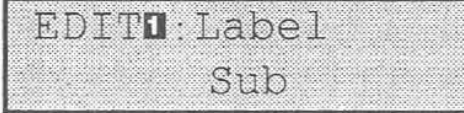
Range: +24dB to -40dB

Notes: The entire range of adjustment is only available using the combination of encoder and trim pot. Turning the trim pot will move the window of control available, and will update the level parameter on the screen in real time. If the output has been muted with, shockingly enough, the mute switch then the display will still allow adjustment of the level but will also show...

```
EDIT5:Output Lvl
▪▪▪     MUTE  -12dB
```

Output Label.

```
EDIT1 : Label
           Sub
```

Range: Sub, Lo, Lo-Mid, Mid, Hi-Mid, Hi, Full-Range, None.

Notes: As the selection is changed, the icon on the front panel will be seen to change in sympathy.

EQ Parameters List.

High Pass Filter Frequency.

```
EDIT5:HPF:Freq.
▀▀▪▫  15000 Hz
```

Range: 20Hz to 15000Hz

High Pass Filter Response.

```
EDIT5:HPF:Resp.
Lnk-Ril 24dB/Oct
```

Range: Exact Text Shown...   Full Range (Off)
                                 6dB/Oct
                                 Bessel 12dB/Oct
                                 Butter 12dB/Oct
                                 Lnk-Ril 12dB/Oct
                                 Peaking 12dB/Oct
                                 Bessel 18dB/Oct
                                 Butter 18dB/Oct
                                 Bessel 24dB/Oct
                                 Butter 24dB/Oct
                                 Lnk-Ril 24dB/Oct
                                 Peaking 24dB/Oct
                                 Bessel 36dB/Oct
                                 Butter 36dB/Oct
                                 Lnk-Ril 36dB/Oct
                                 Bessel 48dB/Oct
                                 Butter 48dB/Oct
                                 Lnk-Ril 48dB/Oct

Notes: To protect individual system components, if the 'Full Range' selection is
          chosen, the selected output will mute. This mute can be turned off manu
          ally,   but will always be automatically enabled.

High Pass Filter Peak.

```
EDIT2 :HPF:Peak
▪▪=∷    2 dB Lift
```

Range: 0dB to 6dB

Notes: This is the under-damping of the filter to allow extra emphasis at the corner
          frequency without the need for a separate filter. This parameter is only
          adjustable if the high pass filter response type is set to a "Peaking" type.
          Under all other circumstances the lift applied is fixed at 0dB. This is re
          flected in the display by showing...

```
EDIT2 :HPF:Peak
▪▪=∷    0 dB [Set]
```

The setting of the lift, when applied to peaking type filters, however, will be remem-
bered.

Low Pass Filter Frequency.

```
EDIT5 :LPF:Freq.
▪▪▪∷    1250 Hz
```

Range: 50Hz to 20000Hz

Low Pass Filter Response.

```
EDIT5 :LPF:Resp.
Lnk-Ril 24dB/Oct
```

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Range: · Exact Text Shown...   Full Range (Off)
                                               6dB/Oct
                                               Bessel 12dB/Oct
                                               Butter 12dB/Oct
                                               Lnk-Ril 12dB/Oct
                                               Bessel 18dB/Oct
                                               Butter 18dB/Oct
                                               Bessel 24dB/Oct
                                               Butter 24dB/Oct
                                               Lnk-Ril 24dB/Oct
                                               Bessel 36dB/Oct
                                               Butter 36dB/Oct
                                               Lnk-Ril 36dB/Oct
                                               Bessel 48dB/Oct
                                               Butter 48dB/Oct
                                               Lnk-Ril 48dB/Oct

Notes: To protect individual system components, if the 'Full Range' selection is chosen, the selected output will mute. This mute can be turned off manually, but will always be automatically enabled.

Parametric Filter One Frequency.

```
EDIT5:PEQ1:Freq.
▪▪▪▫▫  1250 Hz
```

Range: 20Hz to 20000Hz

Parametric Filter One 'Q'.

```
EDIT5:PEQ1:'Q'
▪▪▪▫▪  2.5 Oct.
```

Range: 0.08; 0.01-1.0 (0.1 steps); 1.2; 1.5; 2.0; 2.5; 3.0

Notes: Called 'Q', but displayed in octave bandwidth.

Parametric Filter One Level.

```
EDIT5:PEQ1:Level
          +3.5dB
```

Range: -12 to +12dB in 0.5dB steps

Parametric Filter Two Frequency.

```
EDIT5:PEQ2:Freq.
▪▪▪▫▫  1250 Hz
```

Range: 20Hz to 20000Hz

Parametric Filter Two 'Q'.

```
EDIT5:PEQ2:'Q'
▰▰▰▱▱  2.5 Oct.
```

Range: 0.08; 0.1-1.0(0.1 steps); 1.2; 1.5; 2.0; 2.5; 3.0

Notes: Called 'Q', but displayed in octave bandwidth.

Parametric Filter Two Level.

```
EDIT5:PEQ2:Level
▰▰▰▱▱  +3.5dB
```

Range: -12 to +12dB in 0.5dB steps

Low EQ Filter Frequency.

```
EDIT3:LEQ:Freq
▰▰▰▱▱     100Hz
```

Range: 6 or 12dB/Octave.

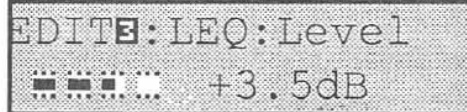**Low EQ Filter Q/Slope.**

```
EDIT3:LEQ:Q/Slpe
12dB/Oct [LoShf]
```

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Range: 'Q' as for parametrics, 6 or 12dB/Octave for shelf.

Notes: This filter is switchable between a parametric and a shelf by turning the
              encoder one step above the widest 'Q' setting. This converts it to a shelving
              response with selectable slope.

Low EQ Filter Level.

```
EDIT3:LEQ:Level
▰▰▰▱  +3.5dB
```

Range: -12dB to +12dB in 0.5dB steps.
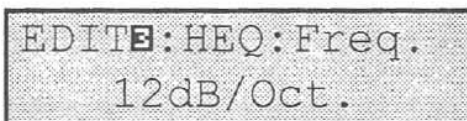
High EQ Filter Frequency.

```
EDIT3:HEQ:Freq.
▰▰▰▱  12500Hz
```

Range: 500Hz to 15kHz.

High EQ Filter Slope.

```
EDIT3:HEQ:Freq.
    12dB/Oct.
```

Range: 'Q' as for parametrics, 6 or 12dB/Octave for shelf.

Notes: This filter is switchable between a parametric and a shelf by turning the
              encoder one step above the widest 'Q' setting. This converts it to a shelving
              response with selectable slope.

High EQ Filter Level.

```
EDIT3:HEQ:Level
■■■■    +3.5dB
```

Range: -12dB to +12dB in 0.5dB steps.

Dynamics Parameter List.

Note: When any parameter relating to the compressor is being edited, the output meters automatically change mode to show the amount of gain reduction being applied. This reads from the top of the meter (red LED) downwards. The front panel scaling is still accurate, so for example if the red LED and both yellow LEDs are illuminated, 9dB of gain reduction is being applied to that output.

Compressor Threshold.

```
EDIT2:Comp:Thr.
■■■■         -10dBu
```

Range: -10dBu to +22dBu

Notes: The units used are adjustable in the options menu, and may be set to abso
          lute (dBu), dB from clipping point, or dB from the limiter threshold.
          Confirmation of the selected units is by additional text as shown. For dB
          from clipping the display shows

```
EDIT2:Comp:Thr.
■■■■[Clp]-10dB
```

and for dB from the limiter threshold,

```
EDIT2:Comp:Thr.
■■■■[Lim] 10dB
```

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Compressor Ratio.

```
EDIT2:Comp:Ratio
██▪▪▫   15:1
```

Range: 1:1 to 15:1.

Compressor Attack.

```
EDIT2:Comp:Atk.
██▪▪▫   100ms
```

Range: Minimum (100us) to 100ms and Auto

Notes: One step above the maximum setting will force the compressor to automati
           cally track the high pass filter frequency setting. This allows the optimal
           attack time to be set when the HPF frequency is adjusted. The display will
           show...

```
EDIT2:Comp:Atk.
██▪▪▫   Track HPF
```

Compressor Release.

```
EDIT2:Comp:Rel.
██▪▪▫   5000ms
```

Range: 10ms to 5000ms

Gate Threshold.

```
EDIT:Gate:Thr.
▪▪▪▫  -80dBu
```

Range: -80dB to -10dB

Gate Range.

```
EDIT:Gate:Range
        25dB
```

Range: 0dB to 70dB

Note: The range sets the level of attenuation when the gate is closed. If this is set
          to 0dB, the gate is effectively turned off, and this is reflected in the display...

```
EDIT:Gate:Range
▪▪▪▫  0dB  [Off]
```

Gate Decay Rate.

```
EDIT:Gate:Decay
▪▪▪▫  0.03dB/ms
```

Range: 0.01dB.ms to 0.1dB/ms in 0.01dB/ms steps, then
          0.1dB/.ms to 2.0dB/ms in 0.1dB/ms steps.

Note: This parameter sets the speed at which the gate approaches its losed attenu
          ation setting. As such, the rate and the range are interelated.

Limiter Threshold.

```
EDIT4:Limit:Thr.
▬▬▮░        -4dBu
```

Range: -10 to +22dBu

Notes: Set at +22dBu limiter is NOT effectively off.
          The units used are adjustable in the options menu, and may be set to abso
          lute (dBu), or dB from clipping point. Confirmation of the selected units is
          by additional text as shown. For dB from clipping the display shows

```
EDIT4:Limit:Thr.
▬▬▮░ [Clp]-10dB
```

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The options menu contains all the miscellaneous user adjustable parameters not directly related to audio (on an output by output basis), and therefore not stored in individual memories.

Pressing Options will display a brief screen of help text before entering the list of available options. As usual, the list will be re-entered where it was last left. So, the help screen is...

```
Options:Press
Again to Exit!
```

followed by, starting at the beginning of the list...

Limit Threshold Units.

```
Limit Threshold
in dB from Clip
```

Range: dBu; Volts; dB from Clip.

Notes: Range available when readout is in Volts is determined by the "Max Output Level" parameter above.

Compressor Threshold Units.

```
Compressor Thd.
in dB from Limit
```

Range: dBu; dB from Limit; dB from Clip.

Notes: Range available will be related to the limiter threshold when readout is set to "dB from Limit".

Compressor Linkage.

```
Compressor Link
No Linkage!
```

Range: No Linkage!; Input [A] [B] [Σ]; Input: [A/Σ] [B/Σ]; Input: [A/B/Σ]

Notes: Please read the sections under "Additional Notes" entitled "Compressor Linkage" for details about this option.

Output Meter Units.

```
Output Meters
in dB from Clip
```

Range: dB from Limit; dB from Clip.

Notes: To differentiate between the two metering modes, normal (dB from clip) metering is a bar graph type meter, whilst dB from limit thresh old is shown as a moving dot style meter. This only affects the output meters - the input meters always read dB from clip and are always bar graph style.

Meters Peak Hold.

```
Meters Peak Hold
Automatic Clear
```

Range: Automatic Clear, Press to Clear.

Notes: To trap all possible clipping occurrences of the unit, the meters may be disabled from automatically clearing their clip LEDs. They may be manually cleared at any time by pressing the appropriate output pot.

Delay Units.

```
Delay Units Are
    Metric
```

Range: Time(us); Time(ms); Metric; Imperial.

Notes: The minimum increment in microseconds is 21us.

Delay Temperature Compensation.

```
Delay Temp.
Compensate: 32°C
```

Range: 0 to +40°C

Notes: If the previous option has set the units to read out in time rather than dis
           tance, the temperature compensation is fixed at +20°C. This state is re
           flected on the display as...

```
Delay Temp. [Set]
Compensate: 20°C
```

Clip/Limit Log.

The clip log counts how many times the input meters and output meters hit maximum over
time. The time is stored in memory so that it continues from its last value when the unit is
next switched on.

Initially the display shows

```
Clip/Limit Log:
Encoder = Check
```

and turning the encoder will cycle through...

```
Log Time:003 Hrs
Ins [A/B]:0000345
```

Maximum Output Level.

```
Max Output Level
2.45V:Power Amps
```

Range: 2.45V:Power Amps; 9.75V:Line Drive.

Notes: Changing this setting switches a 12dB pad into all the outputs. This pad is
          purely analogue and is switched to match the input sensitivity accurately
          when driving power amplifiers. When the limiter units have been set to read
          out in Volts, this setting will affect the range available.

Modify User List.

As mentioned earlier, the number of parameters available for adjustment on each output is
large (at the last count, 33 in total) and scrolling through this list can be tedious and time
consuming, even given the output select controls.

This option is available for the user to select up to ten of the most used parameters and create
a 'user' parameter list. If this list is selected, under the 'Which List' option, when the edit
mode is enabled, only the user selected parameters will appear in the list. So for example,
once the crossover points and EQ have been selected, the only parameters that need to be in
the user list might be, delay time, phase adjust, level and limiter threshold.

Selecting this option now will display

```
Modify User List
Output Lvl:
```

with the option to add or delete this item being immediately available.
This has been achieved by displaying, as above '___' if the parameter is not in the list, and

```
Modify User List
Output Lvl: USER
```

if the parameter is in the list. The top line of help text will automatically begin toggling when the option if selected using the select keys, but the information will be related as to whether the parameter shown is already in the list or not. Just like this...

```
Modify User List
Output Lvl   :
```

will toggle to

```
ENTER = Add! [04]
Output Lvl :
```

The number in square brackets indicates how many parameters may still be added to the list. For a parameter already in the list, the top line will show

```
ENTER = Delete!
Output Lvl :USER
```

Pressing enter will still toggle the selected parameter to include it or exclude it from the list, with the accompanying text updating to the right of it.

If ten parameters have been selected, and another is chosen to be added to the list, rather than automatically delete one already in the list (which would take some working out by the user as to which end of the list was being attacked) a message is displayed as below on the top line.

```
10 Item Limit!
Output Lvl :USER
```

toggling with

```
Modify User List
Output Lvl :USER
```

if the item currently selected is in the list, or

```
ENTER = Delete!
Output Lvl :___
```

if not.

The user then has to go back through the list and delete some parameters if different ones are to be added.

Which List.

Coupled with the construction of the user parameter list, is the selection of which list to use - the user list or the full list. This is simply selected as below. The display shows...

```
Which List?
All Parameters
```

or

```
Which List?
User Parameters
```

If a preset is currently being used, unless the PIN for the preset has been correctly entered, the choice will not be available. Under these circumstances the display will show

```
Which List?
OEM Parameters
```

Note that if the user list has been emptied, this option automatically switches to "All Parameters", and it will not be possible to select the "User Parameters".

Lockout PIN.

The security lockout allows the user to prevent unwanted tampering with the front panel at two levels. The full lockout leaves only pots active, the partial lockout additionally allows memory recall and preview access and use of the mute switches.

The user is expected to select a five digit number to use as the PIN. Initially this will be

displayed as 'None', but once the encoder is used to advance this number, the lockout becomes partially armed and pressing the 'Enter' button will display a question as to whether or not memory recalls are to be allowed in the lockout mode, as below. Help is provided on the way, as below,

```
Lockout PIN ...
Select No.:None
```

and then...

```
Lockout PIN ...
Select No.:24351
```

Pressing Enter will then display...

```
Allow Recalls
When Locked? No
```

The encoder will obviously choose yes or no and at this point in the proceedings pressing Enter will now lock the unit with the chosen PIN. The display will briefly show...

```
Unit is Locked!
Options = Unlock
```

... before reverting to the normal main screen display. Note that it is possible to lock the unit with no PIN, if required. Now, pressing any other button, apart from Options, or turning the encoder will display the "Unit is Locked!" message. If the lockout has been set to allow memory recalls, turning the encoder will still scroll through the memories, and the Enter button will still be active. All other buttons will do nothing.

Unlock.

Pressing Options will show...

```
Lockout PIN ...
Select No.:None
```

and then pressing Enter will either display...

```
PIN Accepted,
Unit Unlocked!
```

... if code was correct, followed by normal main display and operation, or

```
PIN Incorrect,
Unit Locked!
```

... if the code was wrong, followed by the normal main display, and the same scenario as above if anything is pressed or turned.

External Communications Channel.

```
External Comms
Channel : 1
```

    Range: 1 to 32, Global and Off.

    Notes: Please read the section entitled "Memory Dumps..." for a full explanation.

User Memory Protection

It is possible to protect up to the first 30 user memories against being overwritten. This does not affect the ability to recall or edit the memories, it just prevents storing to their location. On entering this option, the screen looks like this:

```
Memory Protect
Is Off!
```

Turning the encoder now selects how many memories to protect, starting with the first up to the 30th. The number of memories chosen are always in a contiguous block:

```
Memory Protect
First Mem Only
```

```
Memory Protect
First 2 Mems
```

up to:

```
Memory Protect
First 30 Mems
```

A protected memory is signified by the addition of exclamation marks around the signal routing information:

```
ROD WEMBLEY #01
!1A 2A 3B 4Σ 5-!
```

The only time that these markings cannot be seen is when the memory is the last recalled memory, then the markings become <>. Attempting to store to a protected memory is not possible as protected memories are not accessible on pressing store.

Memory Dumps...

This option allows memories to be copied from another DN8000 to facilitate cloning of units. Please read the section entitled "Connecting DN8000's for External Comms" before proceeding. Note the protocol in use with this system - the unit being adjusted **requests** settings from the other unit - information is **never** transmitted manually to any unit. The unit to be copied from merely has to be switched on and connected to the destination unit via either RS485 socket on the back panel. Protection against inadvertent over-writing of settings is of paramount importance in a system such as this and, to this end, the operation of this option has been made slightly more complex.

The initial display will show...

```
Memory Dumps ...
None Requested!
```

... and it's worth noting that this will always be the case if the options menu is excited by any means, or the option is re-selected within the menu. Turning the encoder will scroll through the available dump requests. These are...

```
Enter = RX Dump:
User Memory #NN
```

... over the range of available user memories, followed by. .

```
Enter = RX Dump:
All User Mems
```

... which will include the working memory (i.e. the current configuration).

Lastly, the working memory may be requested on its own, like this...

```
Enter = RX Dump:
Working Memory
```

Note that the range of memories that can be requested is related to the setting of the memory protection option. The protected memories cannot be requested (and therefore accidentally over-written). Even when the "All User Mems" option is selected, the requests are confined to the range First unprotected memory → Memory #32 and Working Memory.

Note that the unit must be set to the **global external communication channel** to transmit a request. If it isn't a warning is displayed when ENTER is pressed.

```
Enter = RX Dump:
Comms Not Global
```

Otherwise, pressing ENTER will transmit a **request** for the settings indicated. If the **other unit** is switched on and connected correctly, it **will briefly display** the message

```
Sending Mem Dump
Please Wait ...
```

before reverting to the default (power-up) mode.

The unit receiving the dump will show...

```
Receiving Dump:
            : #NN
```

where NN is the number of the memory it's for, and the colon beside the number denotes it's waiting. This is relevant when a dump of more than one memory is requested. When the working memory has been requested, the display shows

```
Receiving Dump:
            : Wkg
```

In practise, the rest of the bottom line will not be blank for any appreciable time. When a memory has been completely received without error, the bottom line is updated with is name, and the colon disappears to indicate completion. Like this...

```
Receiving Dump:
ALL WEDGES #12
```

Reception of a single memory takes under a second, and it follows that reception of a complete memory dump of all 32 memories and the working memory takes in the order of 30 seconds. Both units are non-interruptible under these circumstances, and although memories are not over written until the replacement settings are checked, **do not disturb either unit during the dump procedure.**

If there is a problem, and the receiving unit hasn't received anything, the following happens: after pressing ENTER to request some settings the display changes to

```
Awaiting Dump...
____
```

The dashed line grows across the bottom line until the unit gives up (after 4 seconds) and shows...

```
Request Expired!
Check Other Unit
```

...and then reverts to the request screen again. ENTER can be pressed immediately if the problem has been fixed, without needing to re-select the request type.

Note that only two units can be connected together in this way - multiple units can be cloned at the same time, due to the protocol being used. But...if multiple units are connected together full Remote Control is possible.

Power On Mute Delay

```
Power On Mute
Delay: 5 Seconds
```

Range: None; 1 to 10 seconds in 1 second steps, and Permanent

Notes: 'None' means audio appearing as soon as the DN8000 has booted the DSPs, and 'Permanent' means that the mutes stay on until turned off manually by the user. In the event of intermittent mains power failure which might result in large noise spikes in the audio, two spikes in quick succession will cause the unit to re-boot permanently muted to protect the subsequent parts of the system (primarily the speakers).

LCD Contrast.

```
LCD Contrast Adj
             +10
```

Range: -10 to +10

LED Brightness.

```
LED Brightness
             14
```

Range: 1 to 14

Notes: This setting adjusts the brightness of all indicators, but not the back light of the LCD which is fixed at maximum.

Help Information.

```
Help Information
Patronisingly
```

Range: Patronisingly, Thoughtfully, Smugly

Notes: Patronisingly is all help messages, Thoughtfully is help only when some
          thing dangerous could happen, and Smugly is after something dangerous
          has happened. The help message level affects many parts of the systems
          operation. Set to its minimum level, no initial messages occur when entering
          store, options or edit modes, and memory access times become unprotected
          in both store and recall modes.

Software Version

```
Software Version
1.10 - 01/05/96
```
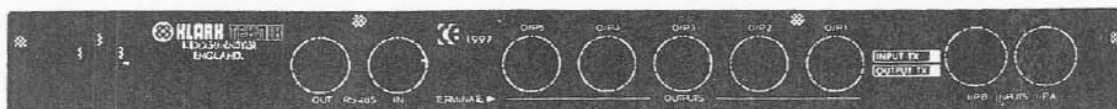
Please note the following points before using the RS485 communications on the DN8000.

1) RS485 is a node based system - that is, no one unit on the line is a permanent master and all units will receive all data as they merely tap off a common wire. This is the same principle as Ethernet - the input and output sockets on the rear panel are linked through in hardware. If a unit fails it will not disturb the communications to units further down the chain.

2) The units must be connected In to Out down the chain to the last unit. It does not need to be looped back to the first unit, if it is the system will not function correctly.

3) The first and last units in the chain must have their "Terminate" switches set to "ON" (i.e. in the direction of the arrow on the rear panel). All other units must have their "Terminate" switches set to "OFF". This follows the same convention as an Ethernet based system. If this is not adhered to, reflections will occur along the transmission cable, causing unpredictable results.

4) When cloning units or dumping memories, only two units can co-exist on the line at the same time - the unit requesting the dump, and the unit transmitting the dump. All other units must be switched off. They do not have to be physically disconnected.

5) When units are connected together and switched on, all units will assume the same parameter value if any unit is adjusted. As mentioned in the remote control section of this manual, this is intentional, as the current protocol is designed for two connected units to operate as a four-input ten-output crossover as transparently as possible.

Remote Control

This remote control extends to all the audio functions available in the EDIT menu, memory recalls, and memory stores, including the transmission of the chosen name. This mode is not really designed for a chain of multiple units to be connected together, more for a pair of units to operate seamlessly as a **four-input ten-output crossover.** Connecting multiple units will work, but adjusting a parameter on any unit will set it to the same value on all connected units. To operate in this mode, both units must have their external communications channel set to "Global". Either unit can assume the job of the master unit - it's best to think of the two units as a single device as they are able to control each other at all times.
In this way it can easily be determined that a change has been made.

If all changes are undone (e.g. mute on/off/on) the memory name reverts back to upper case to indicate that working memory is now the same as the user memory from which it was recalled:

```
ABBA WEMBLEY #01
  1A 2A 3B 4B 5-
```

Memory Access - Overview

The structure of memory management has been implemented in such a way as to maximise flexibility when editing. Edits are not performed direct to user memories - there is a scratch pad referred to as 'working memory'.

Working memory is structured in the same way as a single user memory, and is therefore also battery backed. This has the advantage of retaining edits on power down, and being able to continue with them on power up.

User memory is recalled into working memory where it can then be edited and subsequently stored. However, as soon as working memory is edited (and is therefore different to its original recalled version), the name of the memory changes to lower case:

```
abba wembley #01
  1A 2A 3B 4B 5-
```

Memory Recall.

Typically the main screen will be similar to:

```
ABBA WEMBLEY #01
 1A 2A 3B 4B 5-
```

Turning the encoder on this screen will scroll through the memories, updating the top line of the screen with the memory name and number, and the bottom line with its signal routing details:

```
ROD  WEMBLEY #05
 1A 2A 3B 4- 5-
```

This screen will alternate with the message:

```
Press and hold
ENTER to recall
```

Additional information about the memory may be obtained by pressing the output select buttons on the front panel. This will display the output's routing information, and both its high and low pass frequency settings:

```
1:From:A ; 0dB
20Hz-350Hz
```

Note that if an output is assigned to '-' (nothing) the display is:

```
5:No Input; 0dB
20Hz-350Hz
```

Once the memory to be recalled has been decided, this is confirmed by pressing and holding ENTER, as in the alternating message. This begins a countdown displayed as a decaying bar graph.

```
Ready to recall:
■■:: Hold key!
```

The bar decays as long as the ENTER key is held. The speed of this decay is determined by the help level, and the result of the memory compare algorithm. If the memory to be recalled is sufficiently different to the working memory, the hold time may reach a maximum value. This will result in 'hold' being displayed in upper case letters to indicate this:

```
Ready to recall:
■■:: HOLD key!
```

If ENTER is released without the bar graph decaying to zero, the recall is effectively aborted, and the screen displays:

```
Recall has been
aborted!
```

If ENTER has been held and the bar graph decays to zero, the memory is then recalled:

```
Recalling...
........ Hold key!
```

NOTE:

The last memory to be recalled is indicated by the use of <> to encapsulate the output details as below:

```
ROD  WEMBLEY #05
<1A 2A 3B 4Σ 5->
```

Memory Save.

Pressing store initially displays:

```
Store Mem:Press
Again to Exit!
```

followed by...

```
Store to Memory
ABBA WEMBLEY #01
```

which alternates with

```
Press ENTER to
accept location
```

The list of memory names can be scrolled through to choose the location and then, if ENTER is pressed the message changes to...

```
Store = Confirm!
ABBA WEMBLEY #01
```

with a cursor below the first letter of the name, allowing it to be changed using the encoder to select the character, and the select keys to move the cursor.

Pressing store will display:

```
Ready to store:
▪▪▪▪▪  Hold key!
```

If the memory to be recalled is sufficiently different to the working memory, the hold time may reach a maximum value. This will result in 'hold' being displayed in upper case letters to indicate this:

```
Ready to store:
▪▪▪▫  HOLD key!
```

If STORE is released without the bar graph being fully reduced, the store is effectively aborted, and the screen displays:

```
Store has been
aborted!
```

If STORE has been held and the bar graph decays to zero, the memory is then stored:

```
Storing...
▫▫▫▫  Hold key!
```

NOTE:

The last memory to be stored is indicated by the use of >< to encapsulate the output details as below:

```
ROD  WEMBLEY #05
>1A 2A 3B 4Σ 5-<
```

The only time that these markings do not appear is when the memory is protected, then they become '!!'.

OEM Pre-sets

These are memories that have been pre-set by speaker manufactures to optimise settings for
their own systems. OEM pre-sets are located at the end of the memories i.e., they start at
memory 32 and work up. The pre-sets are easily identified from their name because they do
not have memory numbers - their names can be up to 16 characters long instead. In addition
to this, when recalling a pre-set, the following message appears:

```
Recalling...
===OEM Preset===
```

then, the pre-set:

```
EV DS 4183
<1A 2A 3B 4Σ 5->
```

A further degree of protection is added to pre-sets by the OEMs. Instead of being able to edit
all parameters as with user memories, editing is only from a list of parameters made available
by the OEM (similar to a user parameter list). This can be seen in the options menu, and
cannot be readily changed:

```
Which List?
OEM Parameters
```

This is the only option for which list. Modification of this list is protected with a pass code
supplied by the OEM:

```
Modify User List
Access No.:None!
```

alternating with:

```
Access Denied!
Access No.:None!
```

Turning the encoder increments a number to select the code. When the correct code has been reached, press ENTER to accept it. The list will then be editable.

ADDITIONAL NOTES.

Compressor Linkage.

To prevent dynamic shifts in either the stereo image or the frequency response of the system, it is possible to link the side-chains of the compressors together. This is accomplished through the oprions menu - see the earlier operational description for details. There are four modes available and setting a particular mode will affect all five outputs at the same time. These implement various types of intelligent linkage and may be thought of as follows.

Mode 1 -   "No Linkage!". This is self explanatory - all five compressors are completely independent in their operation.

Mode 2 -   "Input:[A] [B] [Σ]". This mode links the side-chains of all outputs that are fed **exclusively** from an input. So if, for example, outputs 1 to 2 were fed from input A, outputs 4 and 5 from B and 5 from the sum of A and B (Σ), any exceeded threshold on outputs 1 to 2 may cause compression on both outputs. Similarly if either 4 or 5 compress, both may be affected. Compression on output 5 will not affect any other output.

Mode 3 -   "Input: [A/Σ] [B/Σ]". This mode links the side-chains of all outputs that are fed **inclusively** from an input. So if, for example , the same routing existed as in the above example, the difference in operation would be at any compression on outputs 1 to 4 may now affect output 5 as well, as it receives an input from both A and B.

Mode 4 -   "Input: [A/B/Σ]". This mode links all the compressors together, regardless of input. The effect this has on the operation is that compression on any output may affect all the others.

Please note the fact that in all three linked modes, compression **may** be applied to all linked outputs, but the amount of "linked" gain reduction is dependant not only on the various thresholds set, but also on the attack and release times of whichever compressor has exceeded the threshold the most. This intelligent linkage strives to make the action of the linked compressors as transparent as possible, provided the ratio used is not excessive. A recommended maximum ratio for transparent operation is 5:1.

Compare Function.

During editing it is possible to swap between two complete unit configurations, to allow comparisons to be made. The compare function is only active whilst in Edit mode and a compare is performed by pressing and holding the ENTER key. This will swap the current

settings with the ones stored in the 'compare' buffer. The settings stored in the 'compare' buffer will initially be identical to the working memory immediately after a recall has been performed. This is to protect against accidental re-configuration due to the last memory being radically (and possibly dangerously) different to the current one.

The display will show one of several messages to alert the user that a compare has been performed. These detail the changes between the current configuration and the configuration being compared. If there are no changes at all - for instance after post a memory recall, the display will show...

```
No Changes Made
To Compare With!
```

....before reverting back to the parameter that was being edited.

If the compare memory is audibly identical to the working memory, the display will show....

```
Swapping-But No
Audible Changes!
```

This will be the case for the following where these changes will not affect the audible signal path:
   ♦ Labels;
   ♦ HPF/LPF frequency changes if the response is set to OFF;
   ♦ PEQ frequency/'Q' changes if the filter level is set to 0dB;
   ♦ Low/High EQ filter frequency/slope changes if the level is 0dB;
   ♦ Compressor attack/release/threshold changes if the ratio is set to 1:1;
   ♦ Gate threshold/decay changes if the range is set to 0dB

If there are audible changes, the menus that these changes are in will be shown. For instance, if there are changes in output levels only, the display will show....

```
Swapping-Changes
   In Main Only!
```

....or if changes have been made to parametric filter settings and limiter thresholds have been adjusted....

```
Swapping-Changes
In EQ, & Dyn!
```

For safety, the 'compare' buffer is initialised to be the same as the working memory upon power-up.

Single Memory Reset

A single memory may be reset to default values. To do this, press STORE once to get the flashing display:

```
Store to Memory
ROD   WEMBLEY #05
```

alternating with

```
Press ENTER to
accept location
```

At this point, pressing and holding both SELECT keys resets the memory:

```
Resetting #05 to
Default Settings
```

Editing Memory Names

When editing a memory name prior to storing, the last stored memory name may be pasted in by pressing and holding ENTER. Alternatively, this may be undone by pressing and holding both SELECT keys. In addition to this, the cursor may be placed at either end of the memory name by pressing and holding the appropriate SELECT key.

Mute Switches.

All output channels may be muted by pressing and holding only one mute button. This will be useful for soloing an output.

Analogue to Digital Converter Card & Input Level Control.

When the unit starts up, its checks to see if an ADC card is present (as opposed to a fully digital I/O card), and what type of card it is. If no card is present, then a warning is displayed:

```
Input Card Not
Present/Faulty!
```

If the card is of unrecognised type, the actual type number is displayed:

```
Unrecognised ADC
Card Type:
```

If the card uses a standard or enhanced 20 bit ADC, then when the input level control is turned, increases in gain steps are reported to the screen due to the inclusion of a digitally controlled attenuator:

```
Input A:-11.7dB
Input B:-10.9dB
```

As the two halves of the input pot are not friction-locked they operate independently. However, they may be "locked" via software by setting them to the same position and turning them together several times. The unit will recognise this and change the display to show

```
Inputs Ganged!
A and B:-10.9dB
```

From this point on, it is only necessary to turn the front half of the pot (Channel A) to set the gain for both channels. They may be immediately un-ganged by turning the back half of the pot separately. This software "friction - lock" is remembered on power down.

Battery Low Warning.

If the memory backup battery starts to run low, then this is reported to the screen during start-up. In addition to this, the number of times that this warning has been given is also displayed:

```
Back-up Battery
Voltage Low !
```

alternating with:

```
Service Required
Warning No.:NN
```

It is recommended that the DN8000 be referred to qualified personnel only.

If the battery is not changed, and the RAM becomes corrupted, it will be re-initialised with default values. This will be made apparent by a message of the form

```
Resetting #NN to
Default Settings
```

and the mute LEDs flashing. The RAM is checked on a memory by memory basis so as to preserve as many user memories as possible - only those that are corrupted will be reset.

Three Dimensional Metering[1]

Accurate level metering is especially important on a crossover, being the last signal processing in the audio chain, with no further protection for individual drivers before the power amplifiers if clipping occurs. Traditional bar graph level metering is only useful for clipping detection when the meters are being monitored all the time by the engineer. Occurrence of clipping conditions may be missed if the over range signal was transient and the meter was not being directly viewed at the time.

Research in how to alleviate this situation has resulted in a dramatic improvement in performance and presentation of information with regards to the metering incorporated into the DN8000. By modulating the intensity of the meters as well as the traditional method of illuminating more indicators to represent increased signal level, over range conditions can be registered well off the central viewing axis.

In practise, any output which clips (or limits if the metering option is changed) will cause a large step in the intensity of the entire output meter group. Whether this is an increase or decrease in intensity depends on the setting of the LED brightness under the options menu. Similarly, clipping an input will cause both input meters to change intensity. The actual meter (or meters) that caused the over range condition will have their peak (red) LED's held for about 1.5 seconds. However this intensity change only lasts for the duration of the over range condition, giving yet more feedback as to the severity of the over-range condition - occasional flickering of the meter group indicates clipping point has been reached; frequent flickering indicates clipping point is being exceeded regularly; permanent high or low intensity or the meter group indicates severe clipping, and most likely would be clearly audible.

Note that, in the normal (bargraph) mode when the meters are monitoring dB from clip, if clipping occurs somewhere in the signal path, but not at the output (for example, a parametric filter has too much boost) the clip LED for that channel will light independently of the rest of the meter and cause the usual intensity change. This monitoring carries on even if the channel is muted, so if a red LED lights on a muted channel it means distortion is likely to be audible if the channel is un-muted.

---

[1]Patent has been applied for the three dimensional metering invention and is currently pending.

Quick Lock.

This is a fast method for making the unit tamper proof without assigning a lockout PIN. When in the main screen, if ENTER is pressed and held, quick lock is switched on. To leave quick lock, ENTER is pressed and held again.

Generic Presets and Settings Tables.

A selection of templates are included in the unit to aid the setting up of the required system. These are the nine presets that immediately follow the user memories. They all have OEM parameter lists, and only the most important parameters are available for editing. If, however, access is required to modify this list, all nine of the generic presets may be unlocked by entering 00001 for the PIN. The details of the generic presets follow.

2&2-WAY, MONO FR

Master Delay A: minimum
Master Delay B: minimum

	OUT 1	OUT 2	OUT 3	OUT 4	OUT 5
SOURCE	A	A	B	B	A+B
DELAY	min	min	min	min	min
POLARITY	normal	normal	normal	normal	normal
PHASE ADJUST	none	none	none	none	none
MUTE	on	on	on	on	on
LEVEL (dB)	0	0	0	0	0
NAME	Lo	Hi	Lo	Hi	Sub
HPF FREQUENCY	20	4000	20	4000	20
HPF RESPONSE (dB/Oct)	Butter 12	Butter 12	Full Range	Butter 12	Butter 12
HPF PEAK (dB)	0	0	0	0	0
LPF FREQUENCY (Hz)	4000	20000	4000	20000	20000
LPF RESPONSE (dB/Oct)	Butter 12	Butter 12	Butter 12	Butter 12	Butter 12
PEQ1 FREQUENCY (Hz)	20	20	20	20	20
PEQ1 Q	1	1	1	1	1
PEQ1 LEVEL (dB)	0	0	0	0	0
PEQ2 FREQUENCY (Hz)	20	20	20	20	20
PEQ2 Q	1	1	1	1	1
PEQ2 LEVEL (dB)	0	0	0	0	0
LEQ FREQUENCY (Hz)	20	20	20	20	20
LEQ SLOPE (dB/Oct)	6	6	6	6	6
LEQ LEVEL (dB)	0	0	0	0	0
HEQ FREQUENCY (Hz)	500	500	500	500	500
HEQ SLOPE (dB/Oct)	6	6	6	6	6
HEQ LEVEL (dB)	0	0	0	0	0
COMPRESSOR THRESHOLD (dB)	22	22	22	22	22
COMPRESSOR RATIO	1:1	1:1	1:1	1:1	1:1
COMPRESSOR ATTACK (ms)	0	0	0	0	0
COMPRESSOR RELEASE (ms)	10	10	10	10	10
GATE THRESHOLD (dB)	-80	-80	-80	-80	-80
GATE RANGE (dB)	0	0	0	0	0
GATE DECAY TIME (dB/ms)	0.01	0.01	0.01	0.01	0.01
LIMITER THRESHOLD (dB)	22	22	22	22	22

2&2-WAY, MONO SUB

Master Delay A: minimum
Master Delay B: minimum

	OUT 1	OUT 2	OUT 3	OUT 4	OUT 5
SOURCE	A	A	B	B	A+B
DELAY	min	min	min	min	min
POLARITY	normal	normal	normal	normal	normal
PHASE ADJUST	none	none	none	none	none
MUTE	on	on	on	on	on
LEVEL (dB)	0	0	0	0	0
NAME	Lo	Hi	Lo	Hi	Sub
HPF FREQUENCY	121	4000	121	4000	20
HPF RESPONSE (dB/Oct)	Butter 12	Butter 12	Butter 12	Butter 12	Butter 12
HPF PEAK (dB)	0	0	0	0	0
LPF FREQUENCY (Hz)	4000	20000	4000	20000	121
LPF RESPONSE (dB/Oct)	Butter 12	Butter 12	Butter 12	Butter 12	Butter 12
PEQ1 FREQUENCY (Hz)	20	20	20	20	20
PEQ1 Q	1	1	1	1	1
PEQ1 LEVEL (dB)	0	0	0	0	0
PEQ2 FREQUENCY (Hz)	20	20	20	20	20
PEQ2 Q	1	1	1	1	1
PEQ2 LEVEL (dB)	0	0	0	0	0
LEQ FREQUENCY (Hz)	20	20	20	20	20
LEQ SLOPE (dB/Oct)	6	6	6	6	6
LEQ LEVEL (dB)	0	0	0	0	0
HEQ FREQUENCY (Hz)	500	500	500	500	20
HEQ SLOPE (dB/Oct)	6	6	6	6	6
HEQ LEVEL (dB)	0	0	0	0	0
COMPRESSOR THRESHOLD (dB)	22	22	22	22	22
COMPRESSOR RATIO	1:1	1:1	1:1	1:1	1:1
COMPRESSOR ATTACK (ms)	0	0	0	0	0
COMPRESSOR RELEASE (ms)	10	10	10	10	10
GATE THRESHOLD (dB)	-80	-80	-80	-80	-80
GATE RANGE (dB)	0	0	0	0	0
GATE DECAY TIME (dB/ms)	0.01	0.01	0.01	0.01	0.01
LIMITER THRESHOLD (dB)	22	22	22	22	22