



Portico[™] 5043

TWO CHANNEL COMPRESSOR LIMITER

USER GUIDE

Serial No:

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IMPORTANT

For your convenience, write your serial number on the box above and keep this guide in a safe place. The number can be found on the bottom of the product and also on the packaging materials.

This number must be quoted in all communications in order to obtain technical support and spare parts from either the factory or your dealer.

**BUILT ON CORNERSTONES OF TRADITION
SOARING TO TRANSCEND THE CONFINES OF CONVENTION**

Thank you for your purchase of the 5043 Duo Compressor Limiter. Everyone at Rupert Neve Designs hope you enjoy using this tool as much as we have enjoyed designing and building it. Please take note of the following list of safety concerns and power requirements before the use of this or any Portico Series™ product.

Safety

It's usual to provide a list of “do's and dont's” under this heading but mostly these amount to common sense issues. However here are some reminders:

- The Portico 5043 dissipates about 9 watts, which means that it will get warm in use. The heat generated is radiated through the case work and by convection through the ventilation holes. Therefore the holes should not be covered or blocked. Portico modules may be stacked horizontally on a desk top or vertically in a rack without heat problems. The anti-slip feet may be removed while used in a rack, but should be retained for desktop use. Porticos should not be stacked immediately above or adjacent to other equipment that gets hot. Also bear in mind that other equipment may radiate strong hum fields which could spoil the performance of your Portico™ module.
- Don't operate your Portico™ module in or around water! Electronic equipment and liquids are not good friends. If any liquid was spilled such as soda, coffee, alcoholic or other drink, the sugars and acids will have a very detrimental effect. Sugar crystals act like little rectifiers and can produce noise, “crackles” etc. SWITCH OFF IMMEDIATELY because once current starts to flow the mixture hardens, can get very hot (burnt toffee!) and cause permanent and costly damage. If it gets wet and you suspect that good clean water may have gotten in, immediately unplug the unit, and remove it from the source of water. Please contact support as soon as possible at support@rupertneve.com for resolution.
- Rear connecting cables can get very untidy when a number of Portico™ modules are stacked on your bench. It's a good idea to use cable ties to bunch the cords into a tidy form.
- Don't be tempted to operate a Portico™ with the cover removed. The cover provides magnetic screening from hum and R.F. stray fields.

Power Requirements

Each Portico™ 5043 module has a high quality DC to DC converter that provides carefully stabilized and filtered ± 17.5 VDC for the amplifiers. **The meticulous audio quality of your Portico™ is protected by the internal converter and does not depend primarily on the eveternal mains power supply.** The input is protected from reverse polarity. The connector center pin must be positive.

The converters will work from any DC supply from 9 to 18 volts that is reasonably “clean”. The power supply normally provided with the 5043 is a high quality, robust, and very reliable switched mode power supply. There are no special requirements for the Portico™ low voltage units other than that they must be of good quality, reliable, and able to supply enough current for the number of modules in use.

The great advantage of this system is that there are no common D.C. supply rails that are directly shared by other modules.

In a traditional console large, bi-polar regulated supplies were used, necessarily having a shared common 0 "ground" wire. Crosstalk between modules resulted, often accompanied by R.F. interference due to the unbalanced loop "antennas" that were inevitably present. This interference, in some cases, could actually be heard, but even at low levels below audibility there was a potential intermodulation with the desired signal. Of course this represented both a quantitative and subjective intrusion affecting sound quality.

One of the advantages of the Portico™ method of feeding equipment is that external power units will work from almost any of the very wide range of mains supply voltages and frequencies that are found world-wide. While many different types of mains power wall sockets are found in different countries, Portico™ 5043 module power units leave the factory with standard US plugs. If required, any suitable connecting cord may be substituted.

Avoid using a mains power outlet that is on the same circuit as air conditioning of other equipment that regularly switches on and off. Unplug your Portico™ power units during a thunder storm or if it will be unused for a long period.

Portico™ modules can alternatively be powered from a 12 volt battery, in which case the supplied AC power unit is not needed. When using a 12 volt battery, choose one that has enough capacity to power your Portico™ 5043 - or your complete assembly of Portico™ modules - for the expected duration of your session.

THE NEED FOR DYNAMIC CONTROL OF SOUND LEVELS

The dynamic range of sounds we hear around us in normal life greatly exceeds the capability of our best recording and processing equipment - but even if this were not so, the scale of dynamic range must be accommodated to the venue in which it is to be reproduced. For example, actual volume levels of the dance hall would be deafening in a student's bedroom. In the same way, late night listening in a quiet living room demands careful adjustment of dynamic range. In the constantly changing background noise of a car, drama dialog does not work without constant attention to the level control. In the field of communications, it is often necessary to ensure that the best possible signal-to-noise ratio is obtained, in the interest of intelligibility, within the limited performance of, say, a reporter's recording device.

Digital recorders are unforgiving when overloaded. Overload can be avoided with careful use of high ratio compression - on the verge of limiting - with careful choice of time constants. A recording that still sounds "loud" can be produced without non-musical harmonic distortion.

A compressor-limiter is one of the most powerful, yet subjective items in the sound engineer's armory. Compression should never be obvious to the listener and this needs intuitive and effective controls on the part of the designer together with considerable skill on the part of the sound engineer.

A NOTE ON DISTORTION

The human hearing system unconsciously perceives minute signals both within and well beyond the traditional audio frequency spectrum. When such frequencies that are not present in nature, such as high order harmonics produced by amplifier distortion, or by the presence of seemingly inaudible artifacts due to interference, or when those frequencies that are present in nature are missing, the human hearing system "reports" what we might describe as a deviation from faithfulness. It seems that we store a bank of information based on "natural" sound and are able, subconsciously, to compare reproduced sound with "natural" sound.

This deviation from faithfulness gives rise to a feeling of discomfort and frustration that is very hard to describe or to explain. However, amazingly, it can be measured! When subject to non-faithful sound, the brain actually emits electric activity that can be measured. (See "Audible Range Affects Brain Electric Activity and Sound Perception" (Ref: 1).

Inevitably our data bank of "natural" sound is built up on the basis of our personal experience and this must surely emphasize the importance of listening to "natural" sound, and high quality musical instruments within acoustic environments that is subjectively pleasing so as to develop keen awareness that will contribute to a reliable data bank. Humans who have not experienced enough "natural" sound may well have a flawed data bank!

The way in which an analog amplifier handles very small signals is as important as the way it behaves at high levels. For low distortion, an analog amplifier must have a **linear transfer characteristic**, in other words, the output signal must be an exact replica of the input signal, differing only in magnitude. The magnitude can be controlled by a gain control or fader (consisting of a high quality variable resistor that, by definition, has a linear transfer characteristic.)

A dynamics controller - i.e. a compressor, limiter or expander - is a gain control that can adjust gain of the amplifier very rapidly in response to the fluctuating audio signal, ideally without introducing significant distortion, i.e. it must have a linear transfer characteristic. But, by definition, rapidly changing gain means that a signal "starting out" to be linear and, therefore without distortion, gets changed on the way to produce a different amplitude.

In order to control gain, a V.C.A. or Voltage Controlled Amplifier (or Attenuator) is used. There are many types of V.C.A.'s that include the use of tubes, discrete and integrated solid state circuits, or naturally non-linear devices. Each one has its own characteristic behavior that reflects sonically on the final performance, and, inevitably, gives it a character or signature that can be musically attractive or - not! In order to achieve a sonically musical signature, low level signals below the "Threshold" level at which the VCA starts to operate, must be treated linearly, to avoid low level distortion.

1. □Tutomu Oohashi, Emi Nishina, Norie Kawai, Yoshitaka Fuwamoto, and Hishi Imai. National Institute of Multimedia Education, Tokyo. "High Frequency Sound Above the Audible Range, Affects Brain Electric Activity and Sound Perception" Paper read at 91st. Convention of the A.E.S. October 1991. Section 7. (1), Conclusion.

GENERAL DESCRIPTION

The Rupert Neve Designs 5043 module is a half rack width, 1.75" (1U) module in the now well-known Portico™ style. The 5043 is ideal for both tracking and mixing applications with selectable Mixing Buss or Line inputs. The 5043 is an ideal choice for either standalone operation, or forming the core of a larger mixing system. As with the entire Portico™ range, the construction takes the form of a heavy and robust steel shell providing total magnetic screening and exceptional mechanical stability. The front panel is machined from a solid .2" aluminum plate with a steel sub panel behind it.

Alternative front panel layouts are available providing a choice of vertical or horizontal mounting for the 5043. When the horizontal front panel is chosen, a single 5043 can sit firmly on a bench or desktop on its detachable rubber feet. Two 5043's can be joined with the optional 5221-RM Horizontal Joining Kit, which can be mounted across a standard 19" rack.

When the vertical option is chosen, up to eight 5043's can be mounted in the optional 5285-RM Rack-Mounting Frame that is equipped with guide rails. This leaves a 3" width that can be used to house a power supply or other master modules. The 5285-RM Rack-Mounting Frame also includes basic rear cable management, and optional blank panels are available to fill any unused spaces when the full complement of eight modules is not fitted.

The Portico™ 5043 embodies two independent Compressor-Limiters, "A" and "B". They can be used independently or connected in sequence to provide two separate control slopes. The D.C. control circuits may be linked via a front panel push-button so that the level of each unit, "A" and "B", may be held in a constant relationship for stereo operation. Rear panel connections are provided to enable linking of multiple 5043s. The linking may also be extended to the former AMEK CIB and DMCL units.

THE WAY THE 5043 WORKS

A part of the audio signal is rectified and smoothed to produce a suitable control voltage for the V.C.A. which has to respond very quickly and have low distortion. If the response is too fast, low frequency signals will themselves, be "gain controlled"! If the response is too slow, the signal will overshoot and the first few cycles will not get compressed. The speed and accuracy of the response, known as the "attack", and the time frame that gain remains under the initial control, known as "release" or "recovery", play a large part in the way a compressor sounds.

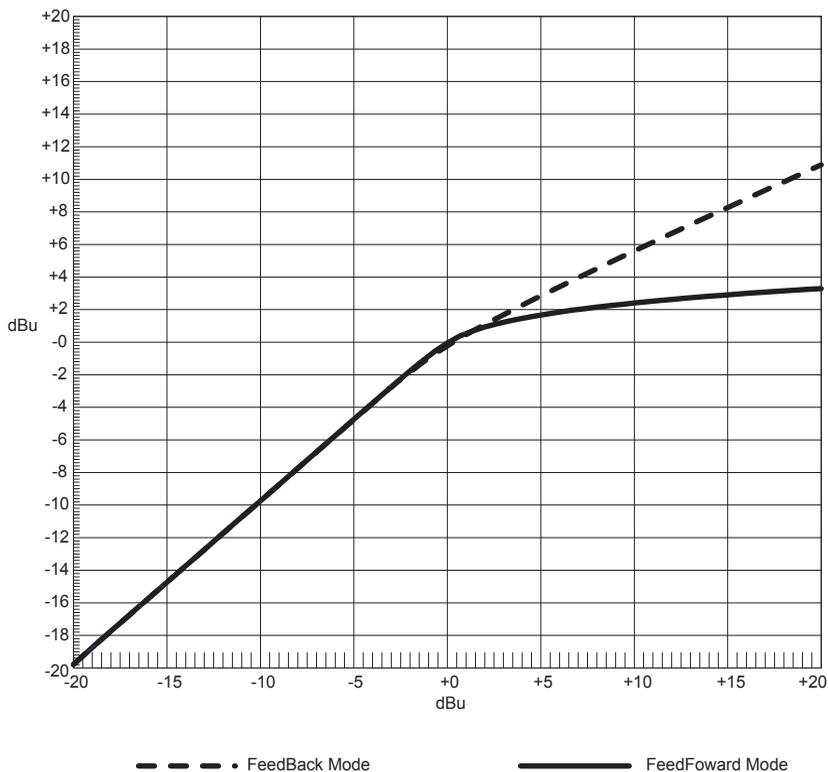
The Portico™ 5043 makes use of a very accurate, low noise, low distortion V.C.A. having, essentially, no "signature" of its own. This leaves the designer free to use amplifier and transformer combinations that are well proven and produce the desired sonic quality.

All Portico™ modules use input and output transformers and almost entirely discrete component amplifiers to produce the musical "signature" for which they are known. These are factors that enable the Portico™ 5043 to work unobtrusively within the context of a very high quality audio chain.

THE CONTROL CHAIN:**FEED FORWARD or FEED BACK**

If the V.C.A. Control voltage is taken from the 5043 input, (i.e. before the V.C.A.) the V.C.A. "knows" right away that a gain change is required and there is almost immediate response. This is known, logically, as a "Feed-Forward" compressor.

If the V.C.A. control voltage is taken from the 5043 output, (i.e. after the V.C.A.) it cannot act immediately on the V.C.A. because it has already been modified by settings of the V.C.A. and circuits through which it has passed. This is known as a "Feed-Back" compressor. The two compression characteristics are quite different, there is more "overshoot" and both the attack and recovery ramps are changed, providing the user with powerful choices.



A choice between "Feed-Forward" and "Feed-Back" circuitry is provided. Almost all Mr. Rupert Neve's earlier designs were "Feed-Back". They were more musical and sweeter than with "Feed-Forward" designs.

The way in which these modes change the dynamic performance can be seen in the above graph - but the more interesting effects are noted by listening - "Feed-Back" produces a sweeter, warmer sound but is not as accurate if you need to protect a transmitter, for example.

THE 5043 LINE AMPLIFIER

The Portico™ 5043 consists of two identical Line Driving amplifiers having transformer balanced inputs and outputs. The sonic quality of these amplifiers is such that, by providing galvanic isolation, simple single-sided circuit topology, and freedom from grounding problems, they are capable of enhancing the sonic quality of many signal sources, especially those of digital origin.

The sonic "signature" is one of extreme purity and the image is consistent with that of Mr. Rupert Neve's original designs of 35 - 40 years ago. More detailed discussion on the sonic image and the way in which an analog designer's approach can sweeten and "warm" some of the cold, storage and editing processes may be found on www.rupertneve.com.

PRINCIPAL FEATURES

There are two identical channels, A and B, in the Portico™ 5043 Compressor- Limiter. The controls of each channel can be adjusted independently. A "LINK" Push-Button is provided on each channel that, when operated, connects the DC control lines together and enables the gains to work together.

COMPRESSION

For signals below the "threshold" level that has been set, a compressor provides a linear path allowing signals to be amplified without the gain being adjusted in any way. When signals exceed the "threshold" level, the gain is reduced in a controlled manner that depends on the Ratio setting.

RATIO

Range 1:1 to LIMIT (i.e. 40:1)

Above a given THRESHOLD signals are reduced by an adjustable amount ranging from 1:1, (which is linear, or no reduction at all), to more than 40:1 which is a very high ratio, equivalent to that of a limiter.

RATIO is sometimes referred to as "Slope" because when depicted on a graph, the "slope" of the graph representing Output versus Input, is what changes. RATIO is measured in dB (Decibels). The 40:1 figure mentioned above, means that a change in input signal level of 40 dB only results in 1 dB change in output level!

RATIO and THRESHOLD are closely inter-dependent. If a RATIO as high as 40:1 has been set, and if the THRESHOLD is set at 0 dBu, then even when a massive signal of +40 dBu (unlikely!) is presented to the input, the output signal will only be +1 dBu. RATIOS as high as this would normally be set somewhere above 0 dBu - say at +14 dBu, in order to prevent the output signal level exceeding just over +14 dBu to protect, for example, a digital recorder. Similarly, if a RATIO of 5:1 has been set, an input signal which is 10dB above THRESHOLD will only rise by 2dB above that THRESHOLD at the output.

THRESHOLD

THRESHOLD control covers the range from below -30dB to +22dBu.

When THRESHOLD is set at a low level with a fairly high RATIO, the amount of gain reduction will be considerable and it may be necessary to use some GAIN after the compressor to restore the apparent signal level.

RELEASE (or RECOVERY) and ATTACK TIME

Range of RELEASE time is 100 mS to 2.5 Seconds.

Range of ATTACK time is 20 mS to 75 mS.

The notes above explain how the 5043 handles signals of constant amplitude such as pure tones. Real program signals, however, are continually changing in level. The way in which a compressor deals with actual program material depends upon the magnitude and duration of peaks in the program level.

If the RELEASE TIME is set to be very short, a short duration signal will be compressed but the gain will return to normal very quickly, giving a fluctuating and un-natural sound known as "Pumping" when the background, or other signals, are forced up and down. The gain will also tend to follow the wave form of low frequency signals. RELEASE TIME should be set long enough for the gain to remain reasonably constant between each bass note or between speech syllables.

The ATTACK time is the time taken for the compression circuits to start compressing. A long ATTACK time allows short duration peaks to "escape" and go through uncompressed. This may cause overload on subsequent digital circuits. A very short attack time sounds un-natural and robs the signal of "life" by removing transients. Some transients are extremely fast and have little effect on the sound quality. Setting a long attack time often means that almost no gain reduction occurs because the transient is history (!) before compression has had time to operate.

However, even the fastest circuits take time to operate which means that there is always some "Overshoot". Small amounts of "Overshoot" are musically desirable - there are exceptions, of course.

Setting the right values of RELEASE and ATTACK is what compression is all about! Once the principles are understood a Compressor-Limiter such as the 5043 provides a powerful tool that actually appears to enhance the dynamic range of a recording and so provide greater musical enjoyment.

GAIN

GAIN range provided is from -6dB to +20 dB.

As already noted, when compression has taken place, it may be necessary to increase the overall gain to restore the apparent program level

FB BUTTON

Switches from "Feed-Forward" compression mode to "Feed-Back" compression mode as described earlier in this user guide.

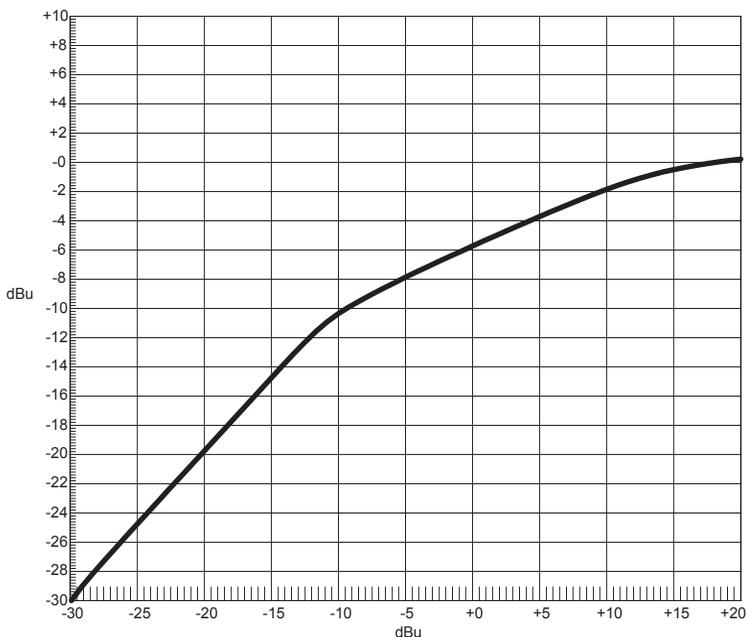
BUSS INPUT BUTTON

Routes the BUSS inputs to the compressor. Each of the "A" and "B" units has a choice of LINE or BUSS input. The LINE inputs are transformer-balanced bridging inputs. The BUSS inputs are configured as balanced and floating inputs that, when fed from a source impedance of 10,000 ohms, will produce unity gain, (Compressor-Limiter switched out) overall.

Several modules within the Portico™ Range are fitted with a "TO BUSS" switch. The output from this circuit is intended to provide an input to Portico™ modules with Buss inputs. Any number of modules may be fed to the Buss Input to provide high performance mixing that is intended to provide sub group mixing in a console configuration.

COMPOSITE OPERATION

Cascading the two sections, A and B, of the Portico™ 5043 Compressor Limiter provides extremely powerful and comprehensive control of dynamic range. When an external audio connection is made from the output of one channel to the input of the other, the overall compression characteristics become a composite of the two. For example, channel A may be set up as a low ratio compressor and channel B may be set up as a high ratio compressor or limiter, to produce a powerful composite characteristic (as shown in the graph below)

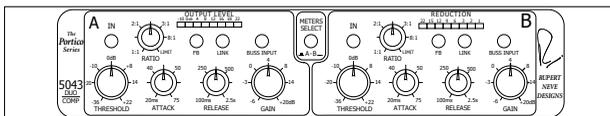


STEREO

When the LINK push-button is engaged and the two channels, A and B, set to approximately the same values, GAIN control on both channels will be the same to preserve stereo balance, levels normally being controlled by the channel with the higher signal level.

DUCKING

When the LINK push-button is engaged, the signal passing through channel A, may be used to control the amplitude of channel B. For example, the level of music through channel A can be controlled by speech on channel B, i.e. reducing the music level to make a "speech-over" announcement.



METERS

Two LED METERS are provided, OUTPUT LEVEL and GAIN REDUCTION. These are switched between channel A and channel B on the central METER SELECT push-button.

OUTPUT LEVEL indicates the actual output level in dBu. The GREEN segments cover the range from -10 to +10 dBu. The YELLOW segments cover the range from +10 to +20 dBu and the RED segment, +22 dBu and above which is regarded as overload.

REDUCTION is calibrated in dB covering the range 1 to 22 dB, reading backwards. This meter indicates the amount of actual reduction taking place and therefore is a valuable point of reference indicating the operation point of the 5043.

5043 Duo Compressor Limiter Specifications

Gain Range:

- Continuously variable from -6 dB to +20 dB.

Threshold Range:

Continuously variable from -36 dB to +22 dB.

Ratio Range:

Continuously variable from 1.1:1 to "Limit" (40:1).

Attack Range:

Continuously variable from 20mS to 75mS

Release Range:

- Continuously variable from 100mS to 2.5 Seconds.

FF/FB:

- Feed-Forward or Feed-Back VCA control.

LINK:

Multiple 5043's may be daisy-chained via the rear panel jacks. When an individual channel is engaged, it's control voltage appears at the rear panel LINK jack. When both channels are engaged they are linked together internally and their control voltage also appears at the rear panel LINK jack.

LINE or BUSS input select:

- Selects rear XLR input or 1/4" Buss Input jacks to accept Portico series Buss Outputs.

Maximum Output Level:

- Balanced and Floating Transformer Output +25 dBu.

Total Harmonic Distortion and Noise:

- @ 2kHz, +20 dBu output level, no load.
 Main Output, compressor bypassed: Better than 0.001%
 Main Output, compressor engaged: Better than 0.06%

Noise: *Mostly 2nd Harmonic*

Measured at Main Output, un-weighted, 22Hz-22kHz, terminated 40 Ohms.

With Gain at Unity, Compressor disengaged Better than -103 dBu

With Gain at Unity, Compressor engaged: Better than -92 dBu

Frequency Response:

Main Output, Unity Gain @ 18 Hz -3 dB
 @ 150 kHz -3 dB

Crosstalk

Measured Channel to Channel: Better than -80 dB @ 16kHz

METERS A/B:

- Monitors INPUT LEVEL and GAIN REDUCTION of either channel A or channel B.

5043 Power:

Voltage Range 9 to 18 Volts DC, 9Watts

- Connector: 5.5mm X 2.5mm DC jack, Center Positive

Current consumption: @ 9VDC = 1.0 A typical

- @12VDC = 730 mA typical

@15VDC = 570 mA typical

@18VDC = 480 mA typical

