PYE 588S Stereo Feed Forward Compressor

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The 500-series format is a standardized format for a modular signal processor system consisting of a combination of 500-series modules installed within a 500-series chassis (or rack), with the chassis providing power and audio connections for the individual modules. Originally invented by Automated Processes, Inc. today numerous companies manufacture 500-series format products.

The modular nature of the 500-series format allows individual modules to be combined to create a customized signal processing chain, with individual modules added or changed as budget allows. Many 500-series chassis also offer portability, allowing a recording engineer to bring their desired signal processing chain to any recording session. (Source: Wikipedia)

Compressor History

A LIMITER is a device which stops the output of a signal path going above a predetermined level.

A COMPRESSOR is a device which controls perceived volume level, it reduces the dynamic range of programme material. A 'perfect' compressor is an amplifier where the input/output ratio is constant: So using a 2:1 compressor, increasing the input by 2dB gives a corresponding 1dB increase in the output.

A LEVELLING AMPLIFIER is a device for controlling the perceived volume level of an audio signal in preparation for transferring the audio to disk or for transmission by radio or streaming.

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Compressor History *continued*

Early compressors like the Altec and the JoeMeek shown here, used variable mu thermionic tubes or photoelectric devices which only approximated true compression over a limited range. Later analogue compressors use complex analogue circuitry to achieve true RMS sensing and voltage-controlled amplifiers to achieve a near perfect compression to closely controlled parameters. Digital compressors go one stage further and are able to reproduce the specified characteristics with considerable accuracy. However, the variations of timings of attack and release on older analogue compressors made them more desirable for record production, they sound lively and retain sparkle.

ALTEC 436C tube compressor (mono)

JoeMeek SC2 photoelectric compressor (stereo)

The PYE 4061S Analogue Limiter/ Compressor levelling amplifier

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Compressor History *continued*

The Pye Compressor 588S

The 588S is a dual channel analogue limiter/compressor designed for stereo effects compression, limiting and mastering level control.

The early PYE compressors, the BBC type 4060, 4061 and others, were mono units using the principle of pulse width modulation. It was a ground breaking design setting a standard for the technology of the time. That technology worked well but had limitations in its noise performance. The new PYE compressor 588S is also a ground breaking design, it is a re-application of Ted Fletcher's earlier work on exciting opto compressors, combined with advantages provided by feed forward technology.

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Feed forward technology

Most analogue compressors work by sensing the audio output of an amplifier and then feeding a proportion back to a gain changing device at the input.

Some later analogue and all digital compressors operate by sensing the audio at the input, and then feeding forward to a gain changing device at the output. Feed***back*** compressors suffer from the problem of over-compression (compression overshoot) leading to an unwanted dip in audio following transient peaks. This problem is eliminated by feed forward compression.

The PYE 588S in detail

Audio is fed to the 588S via the Lunchbox frame to precision balancing transformers working in Ted Fletcher's 'current mode' design which produces extremely linear output with minimal distortion.

An illuminated 'compressor' switch operates the input relays switching the output connectors from direct (or by-pass) to compressed (compressor output). The stereo audio then enters a 'sum and difference' matrix where a width control affects the 'difference' signal and sets the stereo image width.

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The PYE 588S in detail *continued*

A feed from the 'sum' signal feeds filter networks and is converted to a carefully regulated DC current with controls for the speed of attack and decay.

The 'sum and difference' (M and S) audio feeds direct to a pair of current controlled (transconductance) amplifiers which are gain controlled by the DC control current and operate in feedback around a pair of precision low distortion operational amplifiers.

Buffer amplifiers convert the compressed M and S audio back to 'left and right', they are affected by the 'gain make up' control and drive specialist high quality output transformers.

Balanced outputs are available on both XLR and jack connectors.

Audio volume level is shown on a pair of illuminated peak programme meters developed specifically for the PYE 588S project. An illuminated switch selects either a normal mode of left and right outputs, or the left meter showing a mono (sum) signal from a point before the output 'gain make up' control, and a measure of gain reduction on the right meter.

Limiter operation

The operation of the limiter/compressor section is not a simple one. The sidechain (the audio signal that feeds forward to the control elements) has a by-pass filter that gives immediate passage to short transient bursts of audio, this allows the control amplifier (a transconductance amplifier) to react extremely quickly, in the order of microseconds.

Further filters set the normal attack time which can be controlled by the attack switch setting the time it takes for the compressor to operate. A loud signal comes along and if it contains a transient ‘burst’ of sound, then the transient filter controls it. It then takes a small fraction of a second for the compressor to 'catch' the main sound level, 'attack' sets how small the fraction is.

The feed forward system allows for extremely fast and accurate attack times with zero overshoot; so when a transient ‘spike’ appears, this is controlled (limited) separately whichever attack time is selected.The character of the sound of the compressor is affected significantly by the attack control. An engineer-friendly feature is the 'comp off' position, deactivating the compression amplifiers while retaining system gain.

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Loudness

The 588S is uniquely suited for controlling perceived loudness, essential for transferring program material to streaming services like Spotify or YouTube.

It excels in ensuring clear audibility without distortion. By increasing the input control, the audio level approaches a limiter peak, concurrently elevating the compression ratio and perceived loudness.

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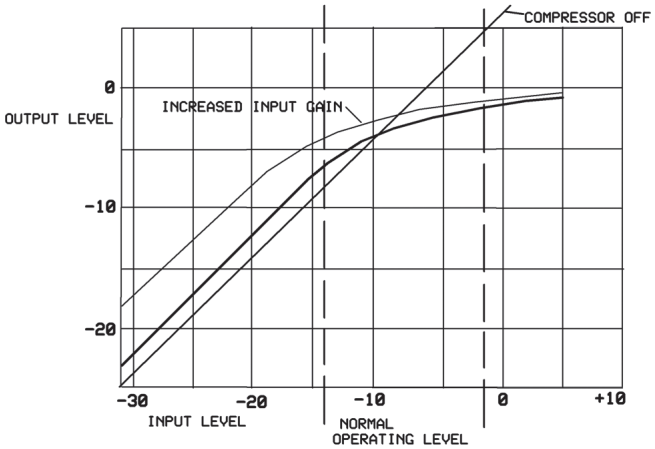
Compression operation

Notably, the 588S lacks a dedicated 'ratio' control; instead, the compression ratio adjusts dynamically with the audio level.

Below - 20dB, the ratio is nearly 1:1, representing minimal compression. As the signal approaches 0dB, the ratio rapidly increases, approaching 20:1, indicating true limiting.



Release

The release control sets the time that the compressor takes to recover after it has applied compression. Short release times generally add 'urgency' to the sound, but the creation of good compression effect is always a careful combination of attack and release settings.

Width and Balance

The width control sets the stereo width of the output, from mono to 150%. When set vertically upwards, the stereo image is the same as the program material entering the unit.

The balance control allows variation in gain between left and right, and allows for fine left/right balance adjustment.

The make-up gain controls the level of signal from the main outputs. This recovers volume lost in the compression process as well as setting the output level.

More about Transformers

The input transformers are unconventional in that they operate in current mode: The audio is transferred as a small AC current with effectively no voltage generated.

This mode means that there can be no power loss in the transformer and therefore no 'overload' condition, audio distortion is eliminated.

Output transformers are special high power low distortion types manufactured in the UK by Stephens and Billington especially for the 588S.

Using the PYE 588S

It's worth pointing out at the beginning, the audio output level can be very high and it's easy to overload any following equipment.

The input gain control is marked with approximate system gains from 0dB to +20dB, this is for convenience of engineers to recognise that a high-volume gain might be in the system when it is not necessarily audible at the output because of the 588S limiting the output.

Keep the 'make up gain' control turned down at first.

When starting it's advisable to have the meter switch engaged, this gives instant indication of what's happening to the audio just before the make up gain control and at the same time gives an indication of volume compression. When the meter switch is pressed in (illuminated), the LH meter reads the sum of the L and R audio.

Both the attack and release controls have a very wide range.
Take the settings in the table on the next page as a starting basis.

Using the PYE 588S *continued*

Audio source	Attack	Release	Compression
Close speech	1mS	100mS	Up to 12dB
Distant speech	2mS	100mS	Up to 6dB
Percussive music	1mS – 4mS	100 – 2000mS	Up to 8dB
General music	4mS – 25mS	100 – 4000mS	Up to 8dB

Set the amount of compression by increasing the input level during level tests, but use caution as it is extremely easy to increase the level too far without realising, this will not produce distortion but will cause the 588S to work as a limiter.

Because of automatic compression ratio it is almost impossible to overload the compressor.

Release the ‘compressor’ button to hear a comparison to the original audio, this bypasses the compressor.

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Technical specifications

- **AMPLITUDE FREQUENCY RESPONSE** +0 -0.2dB 20Hz to 20KHz (40Hz to 10KHz within 0.06dB)
- **HARMONIC DISTORTION** at 1KHz at normal operating level 0.01% 2nd order 0.03% 3rd order. LF distortion dependent on release settings
- **NOISE approx.** 110dB below peak operating level
- **SYSTEM GAIN** max 30dB.
- **MAX LEVELS, INPUT** +30dBu, OUTPUT +28dBu
- **NORMAL OPERATING LEVEL** limited to +8dB peak

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Regulations and safety

The 588S has been designed and built to conform with all current safety requirements.

Within the European Union the Compressor easily meets the requirements for electrostatic and electromagnetic emissions, and conforms to all safety requirements of the European Common Market. the 'CE' symbol on the rear of the unit indicates compliance. In the United States of America the compressor complies with UL requirements and uses UL approved components in all power supply functions.