

# Broadcast Control Limiter

Digital Audio Processor

FM MPX Stereo Encoder

FM RDS Encoder

FM Broadcast Analyser

Streaming HD Encoder

All in one powerful system



## BCL406

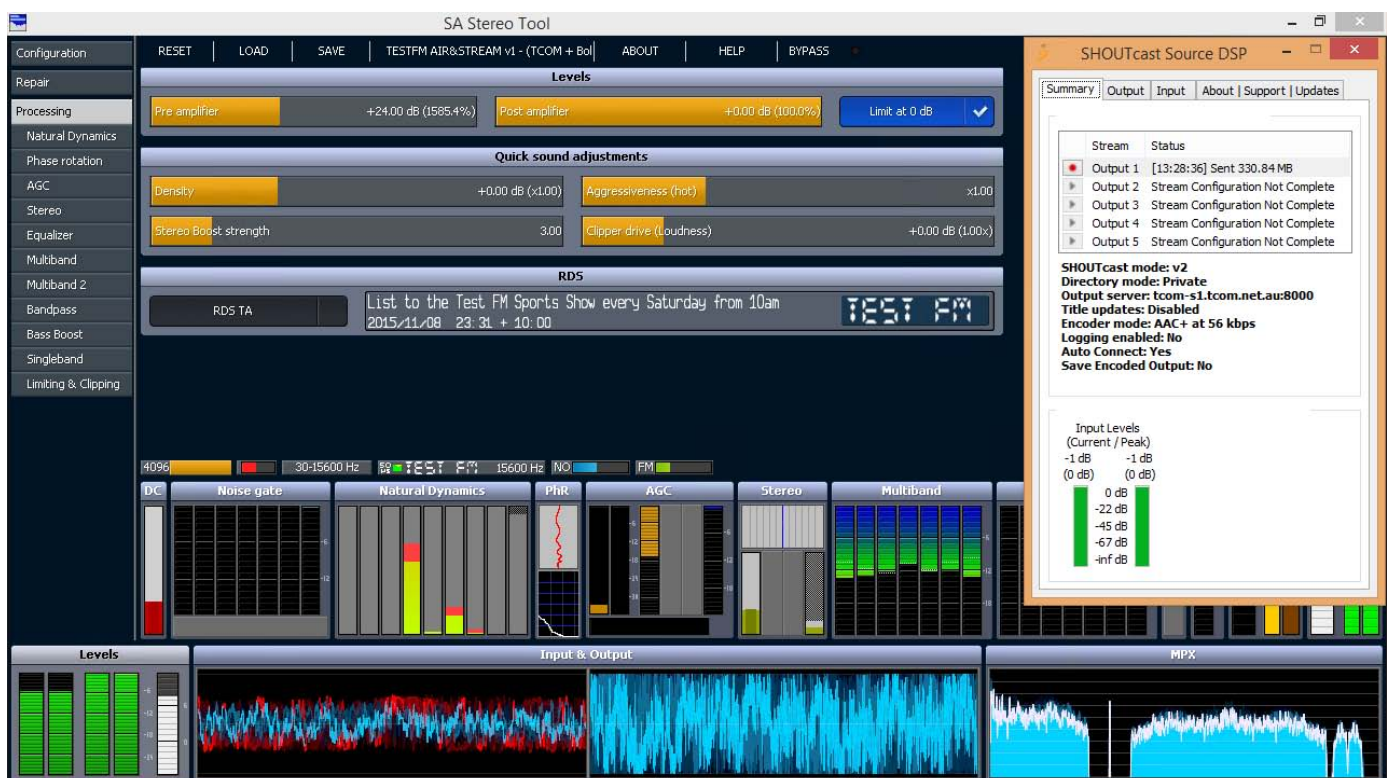
The TCOM Broadcast Control Limiter is an advanced computing system featuring the latest and outstanding European technologies for true wideband digital audio processing, designed specifically for FM and Streaming requirements of radio broadcasters.

FM and Streaming broadcasters need **Punchy, Clear and Bright** audio that is consistent over the varying music types and the ability to enhance the quality from varying sources such as PCM and MP3.

With steady and consistent audio modulation by the TCOM BCL featuring Stereo Tool, your listeners are kept in tune with a professional confident sound that they will enjoy day in and day out, improving your stations reputation.

## KEY BENEFITS:

- **Easy to Use** - Graphical User Windows Display and Control, with local and remote access.
- **Fix the Audio** - with audio Declipper, noise removal and anti-ringing unique algorithms.
- **Process the Audio** - with 12 powerful primary functions of Stereo Tool; from Natural Dynamics, AGC, Bass & Sparkling Highs enhancements, numerous 9 Multiband compressors with digital & analogue algorithms, advanced clipping & limiting.
- **Modulate** - with FM MPX including Stereo Generation, advanced RDS and SCA encoding directly into the TX or STL without clipping and overshoots, and ITU-R SM-1268 Stokkemask clipper & ITU-R BS-412 limiting options.
- **Extend your Coverage** - as much as 30km without increasing TX power through pilot and loudness controls.
- **Analyse your TX** - to ensure regulatory compliance for deviation, RF shoulders, MPX levels and more.
- **Stream your Audio** - of the processed sound directly out to a shoutcast server in high quality AAC+ encoding.
- **Warranty & Support** - with 3 years back to base warranty and remote support ensures on-going confidence with your purchase.







## FEATURES IN DETAIL:

### Operating System

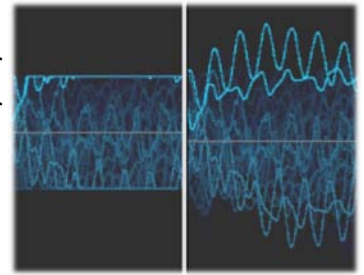
The BCL runs upon the tried, proven and very reliable Microsoft Windows operating system. This operating system was chosen because of its ease maintenance and ability to control patching, as Internet connectivity capabilities existing within the system. No complex knowledge or training is required to handle this operating system as its widely used and accepted globally.

### Digital Audio Processing

Award winning European software Stereo Tool, from Hans van Zutphen provides comprehensive and conclusive digital audio processing using many methods and techniques unique to this software package. With over 15 years of development, Hans continues to develop and improve Stereo Tool with new features and functions, with Stereo Tool now **used by over 1 million home and commercial users** upon personal computers and **powering over 1000 AM & FM radio stations globally**. Don't be fooled by other low power audio processors that claim significant capabilities, Stereo Tool out performs these competitors thanks to the very high CPU power capabilities delivered by the BCL406 system. One needs pure CPU power to provide outstanding and successful digital audio processing —ditto!

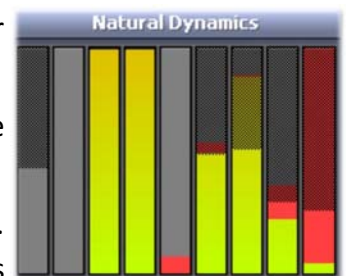
Stereo Tool (ST) started life with a very different path, in that it was being used to display music for the deaf. Subsequently Hans has used this knowledge to further develop the software using similar methods both by listening and visualising sound processed by the software.

So lets go through the features in detail:



### REPAIR

- **PNR Noise and Hum** filter has the ability to 'teach' ST to remove a particular sound, such as hum. Very useful for a studio that has inherit 50 or 60 Hz low level hum.
- **Dedlipper** improves the audio quality of too loud recordings of **most modern CD's** and **MP3's**. A patent pending unique algorithm dynamically learns to calculate the missing information from the audio and repair in real time. No other digital audio processor widely available has this capability. Numerous tuneable functions.
- **Dequantizer** filter increases the bit depth of audio for further downstream analysis. Useful for when low bit-rate audio content is regularly used. A small set of tuneable functions.
- **Delossifier** filter removes compression artefacts by removing the 'ringing' sound heard in some MP3 audio sources. A small set of tuneable functions.
- **Noise removal** filter removes background noise through the use of a 7 band noise gate filter. Also has the ability to remove FM Hiss from translator sources with RF noisy path. Numerous tuneable functions.



### PROCESSING

- **Natural Dynamics** increases the dynamics for music that lacks dynamics. Beside clipping, modern music may also lack dynamics, especially if compressed. With up to 9 bands, Natural Dynamics boosts punchy sounds in music, while attempting to avoid boosting other sounds or to boost punch in already very dynamic music.
- **Phase Rotation** makes peak levels of asymmetrical sounds lower, to protect the compressors, limiters and clippers. This protects the compressors, limiters and clipper against certain types of sounds that can easily distort. Examples are voices (especially female voices) and trumpets.
- **Phase Delay** replicates the sound of older analogue processors, and assists in providing a warmer 'boomy' bass sound.



## FEATURES IN DETAIL:

### PROCESSING ...

- **Equalizer** filter is a fully GUI driven drag and click interface use to increase or reduce the presence of frequencies on the input.
- **AGC** filter with 1 to 3 bands, with either Digital or Analog algorithms, adjusts the audio level to a constant, without causing noticeable changes to the sound.
- **AZIMUTH** filter corrects phasing errors, especially with older recordings up to the early 1970's.
- **Stereo** boosting, with up to 3 variants provide methods to expand the Left to Right channel separation with minimal impact on FM multipath reception distortion.
- **True Bass** processor restores harmonics that were removed or lost in the original recordings microphones or subsequent processing, resulting in a more natural sound and feel of the music content.
- **Multiband1** reduces the dynamic range of the audio and limits it, using a configurable number of bands from 1 to 9, using either the Digital or Analog algorithms. Includes extensive functions within each sub setting of speeds, level, behaviour, burst protection and detection.
- **Multiband2** reduces the dynamic range of the audio and limits it, using a configurable number of bands from 1 to 9, using the Analog algorithm. Includes extensive functions within each sub setting of attack, release, gating, levels, limiters, sound and spectral balance.
- **Bandpass** filter removes very low or very high frequencies, with its primary function related to broadcast audio bandwidth management.
- **Bass Boost** filter deforms the bass sounds to make them sound louder, without causing large volume spikes of a traditional equalizer.
- **Singleband** filter reduces the dynamic range of the audio and limits the overall processed chain, just prior to final limiting filters. The side chain may include selections for ITU-BS.1770 Bass, ITU-BS.1770 Head and PEQ.
- **Limiting & Clipping** filter clips the output, while removing distortion caused by clipping. With sub filters for pre-limiter, bass, highs, CPU, distortion, and correct implementation of the Stokkemask FM ITU-R SM.1268 reception improvement process.

### CONFIGURATION

- **Scheduler** function allows ST to change its loaded profile when used in conjunction with the OS task scheduler. For example, a more heavier dense profile may be used during daylight hours, and a lighter more wider dynamic range in the evening.
- **Web Interface** function allows remote configuration of ST remotely via a web browser.
- **Sound Cards** function allows for the configuration of system audio IO interfaces that comes preconfigured by TCOM. All types of interfaces; be analog, digital or AoIP when provided with the system, is configured here. Of interest to RF Engineers if the ability to support **Single Frequency Networks**, with ST currently supporting 2 SFN site deployments.
- **FM Transmitter** function multiplexes together to a single output from 30Hz to 96Khz baseband, using sub-functions of Mono FM, 19Khz Pilot, L+R FM, RDS and SCA1; all whilst ensuring compliance with the relevant feature (if enabled by the user) for BS412, Stokkemask and ultimately the Advanced Clipper, to ensure the maximum and compliant Power level (sound) and FM deviation limits.



## FEATURES IN DETAIL:

### CONFIGURATION...

- **RDS** sub-function supports both input file from a playout system or user generated script, or TCP socket (UECP) RadioText allowing both text and binary data (such as album covers) to be send in the RDS text field. A comprehensive set of RDS protocols are included; PI, PS, PTY, TP, TA, Music, Head, Compressed, Clock Time and AF . The last Alternate Frequency is a must for broadcasters with MPX translators along your chain, with most modern RDS receivers now supporting automatic frequency change when RF signal becomes poor. IE, the radio receiver changes to the next best available RF signal with your RDS details contained.
- **SCA** sub-function supports the standard SCA1 with input from the unbalanced line or from an alternative stream. This allows the broadcaster to add an additional mono channel to the transmission without impacting the traditional FM stereo receiver. Real revenue opportunities exist here for broadcasters with additional program content. For receivers, numerous Chinese radio manufactures are now supporting SCA1 within cheap radio receivers. Interested - then discuss this with TCOM to determine the possibilities that are available for you.
- **AM Transmitter** function is designed feeding signal to AM transmitters via bandpass limiting, either mono or C-QUAM stereo, all with asymmetrical limiting of up 200%. Broadcasters wishing to use a combination of AM and FM should discuss this with TCOM as several configuration options are possible which will fit your requirements.





## FEATURES IN DETAIL:

### FM Broadcast Analyser

The FM broadcast analyser provides complete FM modulation and AF spectrum measurements in the FM band 88 to 108MHz. The BCL406 is fitted with a front of system real-time monitoring display and remote control with advanced features with the analyser software FM Scope. An external antenna is required to be installed to the BCL406 with at least 70dBuV of signal to be monitored to achieve the full set of monitoring functions. Ultimately, this allows the BCL406 to be locally or remotely configured whilst ensuring the transmission is being kept within regulatory requirements.

### ANALYSIS

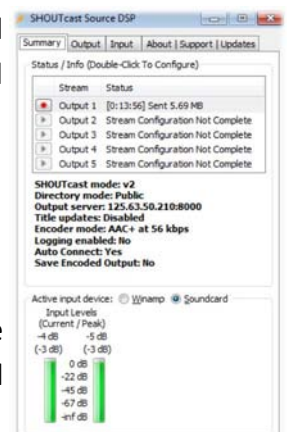
- **Overall Frequency Deviation** function provides the complete analysis of the deviation, including a histogram function.
- **Modulation Power** function provides a report on the overall peak modulated audio, including a histogram function.
- **MPX** function provides a report on the audio, 19KHz Pilot, RDS and Phase shift through the baseband.
- **RF Carrier** function provides RF carrier spectrum and histogram of its instantaneous frequency.
- **Bandscan** function provides the ability to report on your adjacent broadcasters, and their power level (sound), FM deviation and signal quality.



### Streaming HD Encoder

The streaming encoder obtains a separate processed audio feed without FM inclusions from Stereo Tool and passes this into the source digital signal processor for encoding. This ensure the same listener sound and feel of your FM and Stream program feeds.

- **Shoutcast** version 1 and 2 client streams out to 5 different external stream servers.
- **Audio encoding MP3** at 8Kbps mono to 320Kbps stereo.
- **Audio encoding AAC-LC** at 16Kbps to 448Kbps, HE-AAC 16Kbps to 128Kbps.
- **Audio encoding HE-AACv2** at 12Kbps to 56Kbps. Known as AAC+ or the common name High Definition audio, this is now standard now used across a wide range of telecommunication and broadcasting services, with the vast majority of devices supporting HD codec decode capability.







## FEATURES IN DETAIL:

### The BCL406 System

The BCL406 system is housed within a standard 19 inch 4RU computer service rackmount case, with the required depth of just 500mm required to fit with existing racking. The system is mounted to the rack only from the front, with no requirement for a slide kit. This therefore allows inclusion into traditional 19 inch radio racks used across the industry. The BCL406 requires a UPS feed at 120-240VAC 50-60Hz supply source and utilises a typical quiescent power utilisation of 200 watts. The actual demand depends upon Stereo Tool configurations and the amount of computing power required by the configuration, with the supply requiring to deliver up to 650VA of AC supply.

### FEATURES UP FRONT

- **Front 7" LED Colour Monitor** provides local review of Stereo Tool and Streaming operations. With the inclusion of a USB keyboard & mouse, can be used for local configuration when no networking options are available.
- **Front FM Analyser** provides local review of the FM transmission being received via the GUI preconfigured settings. Includes frequency monitored, signal quality, the maximum and average deviation seen in the last few seconds and the power modulation ratio.
- **Local Indicators and Controls** provide traditional computing functions, such as soft switch power on/off, hard reset, power supply on and SSD communication.
- **Front to Back Cooling** with a CPU controlled 120mm front fan pushing air through from the front to the back, and two 80mm fans extracting air from the case directly to the rear. The power supply has a normally dormant fan that only runs under extreme conditions, yet supplying more cooling redundancy. Significant air flow allows for the BCL406 to be installed within environments not typically air-conditioned.





## FEATURES IN DETAIL:

### FEATURES ROUND THE BACK

- **650 Watt Power Supply** provides ample highly reliable power for the internal components of the BCL406 from a 120VAC to 240VAC supply, with minimal moving parts under nominal conditions. Ideally this should be feed from a UPS.
- **Analog XLR Inputs** provide connections for left and right channel analogue audio from the studio, studio delegation controller or telecommunications carrier. Industry standard +8dBm 600  $\Omega$  balanced connectivity applies.
- **MPX XLR Outputs** provide connections for the multiplexed signal for direct connection to Studio-Transmitter Link or main Transmitter. Output level is software adjusted to a peak of +8dBu with a drive capacity for as low as 75  $\Omega$  unbalanced or 600  $\Omega$  balanced.
- **FM Receive Antenna** connection via a F-type female connection from a outside antenna with high signal  $\sim 70\text{dBuV}$  and minimal multipath.
- **Front to Back Cooling** with two 80mm rear fans pulling warm air from inside the case, and pushing out to the rear.



120 - 240VAC  
Supply Input

Station  
Reference Earth  
Connection

2 x 80mm Fans

Gigabit  
Ethernet

Low Latency  
Studio Monitor  
Feed

Input Left  
Analog Bal.

Input Right  
Analog Bal.

Digital Input  
SPDIF  
(AES3  
Optional)

Outputs  
MPX1, MPX2

FM Analyser  
Antenna  
70 - 110dBuV



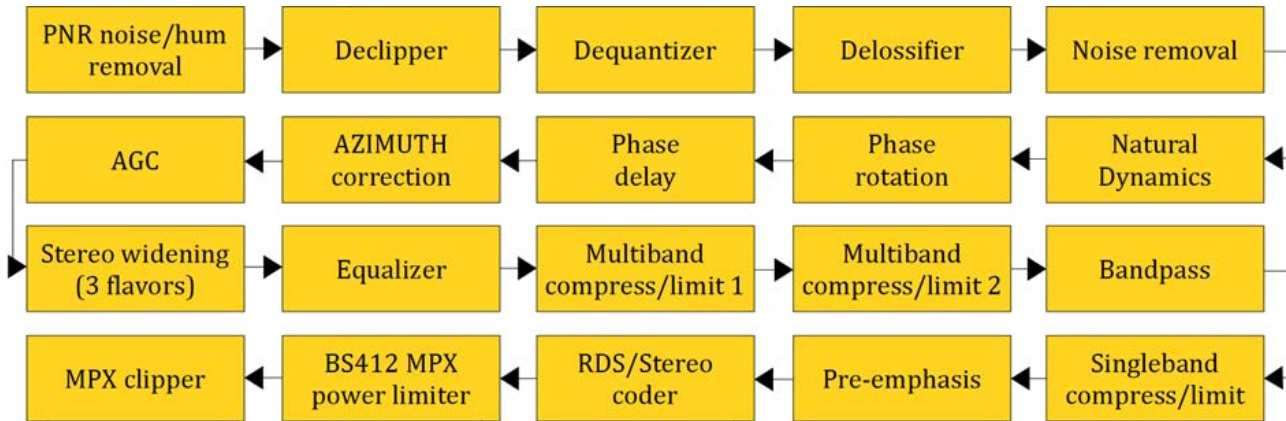




## FEATURES IN DETAIL:

### STEREO TOOL PROCESSING CHAIN

Processing chain subject to change as new features, functions & filters become available within Stereo Tool.





## STEREO TOOL GUI SAMPLES







## STEREO TOOL GUI SAMPLES







## STEREO TOOL GUI SAMPLES





## SPECIFICATIONS

### Primary Analogue Audio Input

Configuration	Stereo or Mono
Connectors	XLR Female Balanced
Impedance	10K Ohm
Nominal Input Level	+8dBu (switchable to +18dBu)
Maximum Input Level	+20dBu
A/D Sampling Rate	192Khz
Frequency Response	20Hz to 20Khz
SNR AD	> 100dB
Crosstalk	> 100dB
Filtering	None. DC and up ensures zero bass loss

### Primary Digital Audio Input

Configuration	<ol style="list-style-type: none"> <li>1. Stereo S/PDIF standard at 24 bits</li> <li>2. Stereo IP Stream via Shoutcast supplied URL Stream</li> <li>3. Optional –Stereo AES3 supported with external AES3 to S/PDIF passive converter</li> </ol>
Connector	RCA
Input Voltage	0.2V
Sampling Rate	S/PDIF & AES3 at 192Khz only. IP Stream at source codec rate

### Auxiliary Analogue Audio Input

Configuration	Mono (SCA1 Left, SCA2 Right)
Connectors	3.5mm 3 Pin Jack Unbalanced
Impedance	10K Ohm
Nominal Input Level	+0dBu
Maximum Input Level	+8dBu
A/D Sampling Rate	192Khz
Frequency Response	20Hz to 20Khz (typically only 3Khz audio bandwidth used)
SNR AD	> 80dB
Crosstalk	> 80dB
Filtering	< 20Hz



## SPECIFICATIONS

<b>Core Functions</b>	
Digital Signal Processor	Thimeo Stereo Tool 7.84 with FM Broadcast Pro Pack Licence Multi-core, Multi-threaded, GUI Display and Interactive HCI
FM Stereo Encoder	Mono, 19Khz Pilot, Stereo L-R, ITU-R SM.1268 Stokkemask selectable, ITU-R BS.412 Head & Bass selectable, fully software driven
FM RDS Encoder	RDS 58Khz with file or RT+, fully software driven RadioText via text file (via Auth. SMB) or TCP via UECP
FM SCA	SCA1 capable. May require professional services for separate Stereo Tool instance for DSP functionality for correct modulation if not pre-processed.
Stream HD Stereo Encoder	Shoutcast 2.3.5 version 1 & 2 support client
Stream Input	Stereo Tool processed audio, less Transmitter enhancements
Stream Codecs	HE-AACv2 at 12Kbs to 56Kbs AAC –LC at 16Kbs to 448Kbs, HE-AAC 16Kbs to 128Kbs MP3 at 8Kbs mono to 320Kbs stereo
FM Receiver	88-108Mhz FM, 75Ω, 70dBuV nominal, 110dBuV maximum, no ESP.
FM Analyser Interface	GUI driven
FM Analyser Freq. Dev.	Graphical display of spectrum frequency deviation of the selected carrier, with long term accumulated distribution plotting
FM Analyser Mod. Pwr.	Graphical display of MPX power modulation and frequency deviation, with time duration plotting
FM Analyser RF	Graphical display of RF carrier with near real time shoulder display, with time duration plotting
FM Analyser MPX	Graphical display of decoded MPX baseband, including left & right channel decode & levels, 19KHz Stereo Pilot level, 58Khz RDS sub-carrier level and Phase shift across the MPX baseband (nice STL check)
FM Analyser RDS	Graphical display of decoded RDS signal, very useful for comparing other broadcaster inclusions
FM Analyser Bandscan	Graphical display of results found from bandscan, displaying results in a single display. Useful for comparing other broadcasters and FM transmission specification compliance
FM Analyser Advanced	Ability to write and run advanced automated scripts, for example, email notification of transmitter off-air.





## SPECIFICATIONS

### Primary Analogue Audio Output

Configuration	MPX1 and MPX2. Separated for SFN capability
Connectors	XLR Female Balanced
Impedance	75 Ohm (Balanced or Unbalanced acceptable)
Nominal Output Level	+8dBu (switchable to +18dBu)
Maximum Output Level	+15dBu
D/A Sampling Rate	192Khz
Frequency Response	20Hz to 96Khz
SNR DA	> 100dB
Crosstalk	> 100dB
Filtering	None. DC and up ensures zero bass loss

### Mains Power

Voltage	1 x 110-120VAC or 220-240VAC 50Hz / 60Hz. UPS Recommended.
Input Connector	IEC C13
Grounding	AC Common Chassis and Electrical Grounding
Safety Standard	CE

### Computing

Processing	4GHz+ quad core
Storage	60GB Solid State Disk. Separate volumes for OS & RDS only. RDS supporting UNC sharing with local auth for remote input from playout systems, etc.
Operating System	Microsoft Windows 8.1 Professional, hardened implementation
Networking	Ethernet 10/100/1000Mbps Internet Protocol IPv4 and/or IPv6
Local/Remote Security	Transparent Screen Saver auto locking with password control
Local Display	7" TFT 1280x720 pixel wide screen
Remote Control	Secure Encrypted UDP/TCP TeamViewer Host. Others available upon request
Typical Availability	99.995% per year

### Environmental

Equipment Dimensions	445 x 430 x 176 (mm), 17.5" x 16.9" x 6.9". 4RU High
Equipment Weight	16KG
Equipment Mounting	Front rackmount only, 4 points
Operating Humidity	0-95%, non-condensing
Operating Temperature	0° to 55 °C supply voltage independent
Shipping Dimensions	600 x 570 x 300 (mm)
Shipping Weight	17KG

### Warranty & Support

Warranty	3 years from shipping date
Support	3 years from shipping date



## Broadcast Control Limiter

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