Engineering Bulletin

LevelMagicII™ parameter description

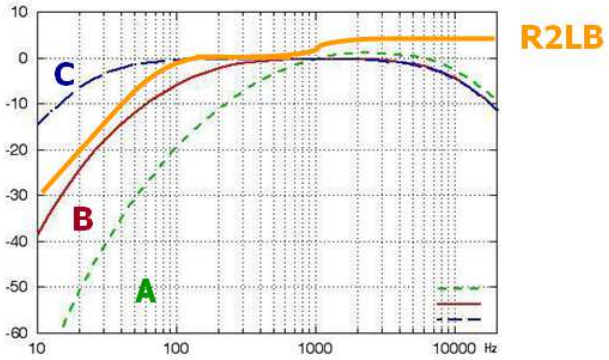
Level Magic Process Control

Level

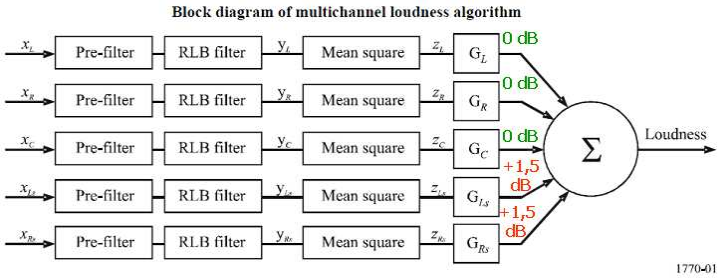
The Jünger Audio proprietary, level based process. The aim is to maintain a desired operating level. Curves and algorithms are the **intellectual property** of Jünger Audio and will not be disclosed.

ITU-BS.1770-1 (A/85:2011)

Loudness based measurement. Several filters and **RMS** weighting are used to get a loudness equivalent result.
Starting from the well known A, B, C weighting curves (DIN-IEC 651), the **ITU** did further research into the relationship of frequencies, their overall levels, their peak levels and the duration of signals to develop the best representation of human loudness perception.
The result was the **RLB** curve [Revised Low frequency B]
The combination of the **RLB-filter** and the Pre-filter is called **R2LB [**Secondly Revised Low frequency **B** curve. AKA **K-Weighting** curve :



E.g. **K-Weighting** filters are used as in the example below for the measurement of loudness of a surround signals (LFE must not be included).



ITU-BS.1770-2

The frequency weighted measurement has been extended by a gating function. The **EBU PLOUD-Group** developed a gating function to exclude quiet sections from the measurement to prevent possible loudness underread. Examples are background noise and atmo which do not add to the loudness perception as much as louder signals do. This gating function consists of an absolute threshold at -70LUFS and a relative threshold 10LU below the absolute-gated level. This involves the necessity to recalculate the whole measurement with every subsequent block. The **ITU** approved the gating function and included it into its recommendation **ITU-R BS. 1770-2** (Revision 2).

Important note! Systems working in **ITU 1770-1** mode **do not** feature a **gating** function. Thus its output readings may vary a bit from meters compliant to **EBU R128** or **ITU 1770-2**. Further keep in mind that the gate is only applicable to the integrated or program loudness measurement (from start to stop) and *not used* for short-term or momentary measurements.

LevelMagicII™ parameter description

EBU R128

This is a **work to rule**, based on ITU-BS.1770-2.
To characterise an audio signal the measures of **Programme Loudness**, **Loudness Range** and **Maximum True Peak Level** are used.

The **Program Loudness Level** is normalized to **-23LUFS**
[Loudness Units referenced to Full Scale]
with a permitted deviation of **+/- 1LU**.
The measurement includes a **gating** method as specified in ITU-BS.1770 (summarized in EBU Tech Doc 3341).

Loudness Range LRA measures the variation of loudness on a macroscopic timescale. It is supplementary to the measure of overall (integrated) loudness. Units are LU. The algorithm for calculating it can be found in EBU Tech Doc 3342.

The **Maximum Permitted True Peak Level** of a program during production is **-1dBTP**, measured with a meter compliant with both ITU-BS.1770 and EBU Tech Doc 3341.

Leveler – **Input Gain** [+20 … -20dB, 0.1dB steps]

The input level can be altered by +/- 20dB to match level diagram needs or for static loudness offset control.

Leveler – Level mode - **Operating Level** [0 … -50dBFS]

This is the target level of the whole system. All processes within the **LevelMagic™** algorithm are designed to aim for the **target level**. It is crucial to understand that the target level is not a threshold and is not a reference for peak levels of any kind. For easier understanding imagine the target level as the balance point or center of gravity of the signal. Level Magic is balancing the signal around this centre, thus achieving a consistent loudness impression for the listener. Single peaks are not affected by this balancing process so that, as far as possible, the natural dynamics of the program are preserved.

Leveler – ITU mode – **Loudness Target** [0 … -50LKFS]

ITU has defined the unit of measure to **LKFS** (loudness K-Weighted referenced to digital Full Scale)

Leveler – EBU mode – **Loudness Target** [0 … -50LUFS] (Loudness Units referenced to digital Full Scale)

EBU has defined the unit of measure to **LUFS**

Imprtant Note! LKFS and LUFS are different units for the same measure. They are fully compatible.

Leveler – **Time** [10, 20, 40sec. / 1, 2, 5, 10, 20, 40min / 1, 2h]

This controls the speed at which **LevelMagic™** tries to reach target level. This setting should not be confused with the attack time of a conventional sound processor. As the leveling process is a self-adjusting system this time is not an absolute term but rather an initial value that could exceed the numerical value many times. When setting it, it is necessary to take the overall function of the system into account. Production duties may require faster time settings, while ingest or play-out correction systems may need slower settings.

Leveler – **Max Gain** [0 … 40dB]

This parameter controls the **maximum permitted gain change** to reach the target level. It can be useful to limit the maximum amount of gain so as not to overly boost noise and other unwanted signals. The maximum attenuation is not affected by this setting. The system regulates the maximum attenuation adaptively to the signal structure.

Engineering Bulletin

LevelMagicII™ parameter description

Leveler – **Freeze Level** [-20 … -60dBFS]

The Freeze Level function holds the amount of gain or attenuation if the signal level drops below this threshold. It works in a similar way to a Hold function in other sound processors. Although this sounds difficult, it is in fact easy to understand with an example. Assuming the process applies a gain change of 10 dB to achieve target loudness, the input level will suddenly drop below freeze level. The gain change remains in its last state until the signal returns above **Freeze Level**. This behavior is different to the Processing Threshold (see below) where the gain change would return to its neutral state if the level falls below threshold. It is necessary to always set Freeze Level above the Processing Threshold to prevent unwanted release behavior.

Transient Processor – **Max Gain** [0 … 15dB]

The **Transient Processor** can be **limited to a maximum processing gain range**. Sometimes a hard setting with a very limited gain range can sound more natural than a softer response at full gain range. Adjusting the **Transient Processor** according to the designated overall behavior of the Level Magic process will improve its neutral processing character.

Transient Processor – **Response** [soft, mid, hard]

The **response of the Transient Processor** is a highly **self-adjusting process** which reacts adaptively to the incoming signal structure. Its response can be adjusted in three presets from a more vital to a more relaxed setting but it also depends on the **Limiter Processing** setting.
That means that the overall handling of transients and peaks is determined by the parameters of the Transient Processor **and** the Limiter.

Limiter – **Max Peak /** – **Max True Peak Level** [-20.0 … 0dBFS] / [-20.0 … 0.0dBTP]

The **Maximum Peak Level** sets the threshold for the system's true peak limiter. Its fast detection system with a 2ms look-ahead time characterizes its response as a full **brick wall limiter**, not only for the obvious sample peaks but also for the hidden inter-sample peaks.
Its precision fulfills all criteria defined in **ITU 1770**.

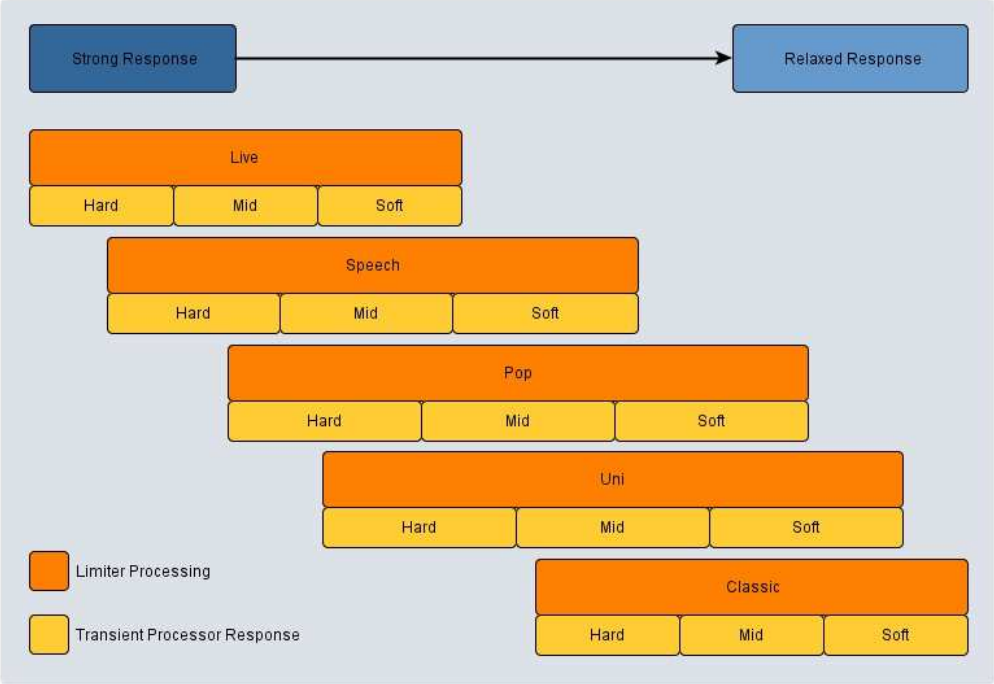
Limiter – **Processing /** Profile – **Processing (Leveler, Limiter)** [live, speech, pop, uni, classic]

Although generally speaking the limiting process will never sound bad it is possible to further improve its neutrality by selecting one of the five given presets to match the actual content of the processed audio signal. The limiter setting has some impact on the **Transient Processor**. Please see above for details.

live	fastest response
speech	fast response
pop	medium response
uni	slow response
classic	slowest response

LevelMagicII™ parameter description

The following picture illustrates this interaction between transient processor and Limiter depending on the parameter settings :



Expert [on / off]

Under normal conditions Level Magic is runs as a 'set up and forget' process with astonishing leveling results and crystal clear sound quality. To improve it further, it is necessary to integrate the system into an automation environment and to adapt some of the settings to the given program material. For systems providing these technical requirements the 'Expert mode' was introduced with our latest firmware. To change Expert mode parameters via web interface, simply tick the 'Expert' box under 'Level Magic'.

Expert **– Clear Processing History**

This is a triggered action that resets the dynamic processing without any release time. Imagine it as a short circuit to the timing circuits of an analog dynamic processor which discharges the whole system and immediately returns the dynamic gain to its neutral state. See picture X for further clarification. This function is useful to reset the process when switching programs (e.g. from movie to commercial breaks). The same function is available to the compressor section (without the 'Initial Dynamic Gain' option).

LevelMagicII™ parameter description

Expert **– Initial Dynamic Gain** [-40 … 15dB]

This parameter directly depends on the 'Clear Processing History' trigger. Instead of resetting the dynamic gain, it can be preloaded to a desired value the moment 'Clear Processing History' is triggered. The preload value is specified by the 'Initial Dynamic Gain' parameter. This helps reduce attack time artifacts, if switching programs incorporates a known and undesired level jump. It is not necessary to exactly predict the level difference between the programs but already helps to set up a few dB in the right direction. It is easy to understand with an example: The level jump from a movie to a commercial break is usually around 6 dB. Resetting Level Magic at the transition point helps to even out the difference. Nevertheless Level Magic needs some attack time to build up damping of 6 dB, which can be audible depending on the program structure. If the process is reset to a damping value between -4 to -6 dB instead, the attack time is much shorter and artifacts fall below the perception threshold. In many cases an Initial Dynamic Gain value of +/-3 dB is sufficient to create transitions with seamless loudness.

Expert **– AGC Recovery** [normal / fast]

All gain changes are processed adaptively to the incoming audio signal. Under normal conditions this adaptive reaction is working fine. However in special configurations it can be necessary to have a faster recovery or release time. Again, an example helps to explain the effect. If Level Magic is configured to work without gain or just a very small amount of positive gain, returning to unity from heavy attenuation can take quite some time. If a very loud part (above target) is followed by a quiet section (right at or below target) the recovery from damping leads to an unnatural 'fade in' effect for the quieter part. To decrease this effect 'AGC Recovery' can be set to 'fast' to accelerate this 'fade in time'. It is accelerated up to fifteen times its normal speed. The result sounds almost the same as if an audio engineer is riding the fader to correct unwanted level jumps and thus is very natural and well accepted by the listener. Please note that this setting is most helpful for setups where no positive gain (AGC amplification) is allowed. The effect works relative to the 'Leveler Time' setting and hence is more obvious for short 'Leveler Time' values.

Expert **– Low Level Behavior**

the 'Low Level Behavior' parameters define what happens if the level drops below the 'Processing Threshold'.

Expert – Low Level Behavior **– Processing Threshold** [-80 … -20dB]

Expert – Low Level Behavior **– Below Threshold Mode** [release, hold]

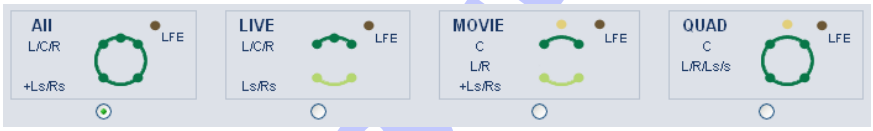
In continuous operation the 'Below Threshold Mode' should remain in 'release'. In this case the dynamic gain slowly returns to its neutral state in case of signal absence. In this mode a returning signal would start a new processing period with its lead in attack time. This can be undesired, especially in production applications where transport operations introduce unnatural gaps. In those cases setting the 'Below Threshold Mode' to 'hold' will pause the dynamic processing at the last value until the signal returns. Returning signals are treated just like continuous signals. This function has some similarities to the 'Freeze Level' but works with a different designation as it is meant to keep processing fluent over signal loss.

Engineering Bulletin

LevelMagicII™ parameter description

General parameters – **Link**

The link function connects all parameters of two channels in a stereo pair. In situations where mono or mid-side transmission is utilized, it is recommended to unlink channels. More importantly it links the control circuits of the processing blocks in order to maintain the sound balance of these channels.
Several **link options** are available depending on the operating and process control modes.
While **4 x 2 mode** is straight forward (linked or unlink), the **5.1 + 2 mode** offers different modes for the surround channels, depending on the device. For **EBU** mode we have two options:
ALL (LFE is not linked) and **ALL+LFE** (LFE is linked).
Below is an example showing the link modes from a **T*AP**, which was set to **EBU** mode, and from a **C8086+,** which was set to **Level** process control.
Dots joined by a line or having the same colour are linked together:



General parameters – **Bit Transparent** [On/Off]

Bit transparency is necessary in cases where non-audio signals are present at the input. A non-audio stream can be any kind of coded transmission, like **Dolby Digital** or **Dolby E**. In Auto mode the process is detecting whether audio or non-audio is present and automatically switches the unit to bit transparency.

General parameters – **Processing Status Monitor** [On/Off]

It is possible to monitor the gain change of the control process. An error status will be provided if the average of the gain change is equal to, or **above**, the **Leveler Range** setting for **more than 10s**.
If this option is turned on, a soft LED for GUI applications will turn from red to green. This status information is combined for all processed channels/programs and is presented as a module (c8k) or device (T*AP, LMx) status to an external monitoring system by sending a **SNMP** trap and/or by firing a **GPO**. The parameter itself is also available for polling.

General parameters – **Processing Threshold** [-40 …. -80dB]

The **Processing Threshold** determines the lowest level to activate **LevelMagic™** processing.
If the signal drops below this threshold all **LevelMagic™** parameters return to their neutral or initial states. It is recommended to set this threshold slightly above the lower dynamic range limit of the whole audio system you are using or the dynamic range you are intended to broadcast. In many cases it makes sense to just leave it at its lowest value.

General parameters – **Loudness measurement**

Jünger Audio equipment and software based applications offer several loudness metering displays. The following items are found on these displays with their abbreviation in square brackets:

M**omentary [M]**	[LUFS]	sliding time window of 0.4sec. length
Short Term [S]	[LUFS]	sliding time window of 3sec. length, not gated
Integrated [I]	[LUFS]	start/pause/continue/reset measurement, gated, of Momentary values (see EBU-Tech 3341)
Loudness Range [LRA]	[LU]	of the program (integrated measurement)
Maximum True Peak Level Max [TPL]	[dBTP]	during the measurement period