

LAB.GRUPPEN

Lake XP Whitepaper

v7.0.0

PLM+/D Series Lake XP Introduction

Introduction

Lake XP (Extended Processing) is available in the PLM+ and D Series Lake product ranges starting with Lake Controller 7.0.0. This document is an introduction to its features, third party Control Plugin API and available prebuilt plugin examples ready to be used out-of-the-box.

Lake XP Highlights

The Lake XP modules offer the following advantages over previous module types in Lake Controller 6.8.x and earlier:

Independent Array Optimization filters

Independent FIR filter and IIR filters (*biquads*) dedicated to Array Optimization. These are never stored with the speaker preset and are always available to the end user and third-party software regardless of the module being locked or not.

There are 4 IIR and 1 FIR filter available for Array Optimization.

NOTE

*The module must be set to **Capable** in the Lake Controller before the Array Optimizer can be used. This option is available even when the module is locked. However — if the module is locked and there are Latency when bypassed values entered, a locked module cannot be set to **Not Capable**.*

Independent and fully visible crossover filters

No sample rate restrictions to consider between outputs when using FIR filters, as is the case with the FIRnway modules. It is possible to have all output filters running at 48 kHz, for instance.

FIR filter management from inside the Lake Controller UI, which also allows importing and exporting coefficients to and from files. Furthermore, visualization of FIR magnitude response in the EQ View is now offered when a Lake XP module is used.

When the crossover is shown in the Lake Controller UI, all output filters are shown simultaneously, making it possible to easily get an overview of the overall frequency bands and cross-splits. The Lake Controller UI is currently visually aiding the user in creating a crossover EQ for non-overlapping frequency bands, but not restricted to such a scheme as bands may overlap due to the independent nature of each output channel — e.g. an XP4way module can easily be configured as a “3-way + 1 aux”. However, please also consider the combination of XP3way alongside with an XP1way in those situations.

The crossover offers 12 IIR filters and 1 FIR filter per output.

Important information about sample rates

The sample rate can be freely set to 12, 24, 48 or 96 kHz. However, both the crossover and array optimization IIR and FIR filters must share the same sample rate. 12 of the IIR filters (depicted BQ) are dedicated to the crossover and speaker preset, and 4 of them are dedicated to array optimization. The first 4 IIR filters are dedicated to the input section (called Pre-Output EQ) and sit before the crossover. They are executed at the products native sample rate of 96 kHz (fixed).

NOTE

When the sample rate is set to 96 kHz, the FIR filters are limited to 192 coefficients only, as opposed to 384 for the other rates available.

Multiband Limiters

Each output features a 3-band multiband limiter with the possibility to fully customize the band filters, with an extra option to use side-chaining or emphasis filters that affect the RMS detectors only.

When filters are set from the Lake Controller (by changing Split Frequencies) — to minimize phase distortion — the resulting filters use Zero Phase Shift filters in the case of a 3-band limiter. For 2-band limiters, the filter pair are of first-order for the same reason.

The multiband limiter can be configured to 2-band and even 1-band processing.

Furthermore, by using the Control Plugin API, side-chaining between bands and more granular control (e.g. make-up gain and maximum gain reduction) is possible apart from setting custom biquad parameters for the band filters.

Independent filters common to all outputs

There are also dedicated IIR filters common to all outputs of the Lake XP module. These so-called Pre-Output EQ filters can be hidden/locked separately from the crossover EQ, and if left unlocked, allow the end user to apply e.g. all-pass filtering for overall phase corrections.

The Pre-Output EQ offers a single set of 4 IIR filters per Lake XP module for this purpose.

Hardware Requirements

All future and existing Lab.gruppen PLM+ and D Series Lake models can load the Lake XP modules after a firmware upgrade to version 4.22 or later.

Each supported device above (also called “frames”) can run the following amount of Lake XP modules:

- Four XP1way modules
- Two XP2way modules
- One XP3way module leaving a single module slot free for e.g. an XP1way module.
- One XP4way module

Furthermore, it is possible to combine the smaller Lake XP modules with any of the previous Contour module types (Classic, Linear-phase and/or FIR) at the same time. E.g. One XP2way module, one LP3way module and one 2Aux classic module.

NOTE

Other product models (including PLM Series, LM Series and Lake MY8) do *not* support Lake XP.

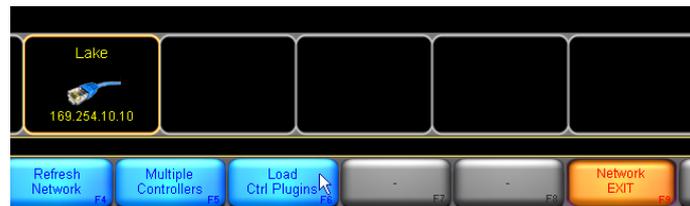
Software Requirements

The Lake XP modules are available in Lake Controller version 7.0.0 and later.

Control Plugin API

To set parameters into a Lake XP module from an external program, the Lake Controller software has a plugin architecture. A third party can write a C++ 32-bit dynamic link library (DLL) plugin compiled with Visual studio 2010 or later. The plugin needs to be placed in a folder named plugins directly below the folder in which the Lake Controller was installed. To load the plugin in Lake controller either add 'startcontrolplugins' to the command line of Lake Controller shortcut target or navigate to the Network menu inside the Lake Controller and press “Load Ctrl Plugins”. The About screen also shows information about currently loaded plugins and can be reached via User Preferences and About. It is possible to have multiple control plugins running side-by-side at the same time.

It is recommended to run the Lake Controller in Window Mode when Control Plugins are used. See the *Lake Controller Operation Manual* for details on how to configure Window Mode.

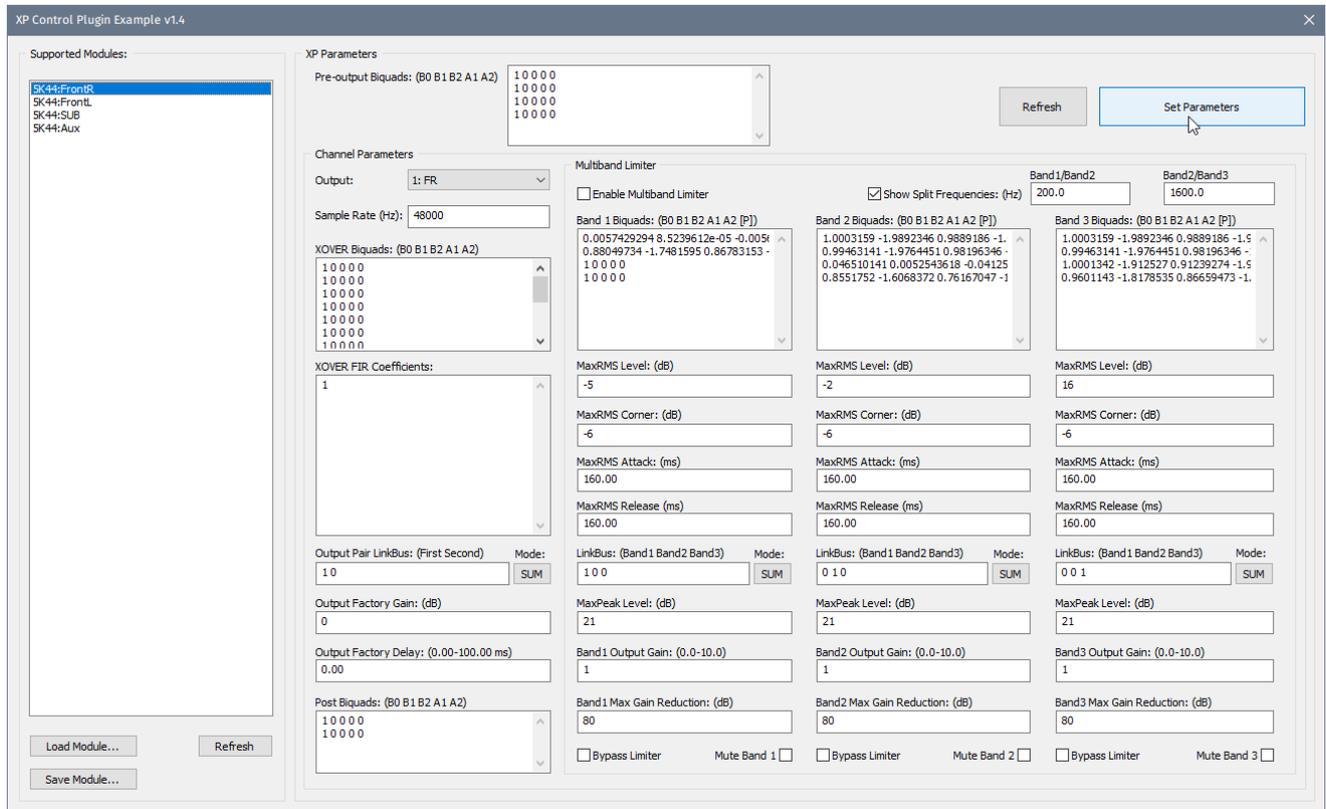


A third party can set and get Lake XP speaker preset parameters and set Array Optimization related parameters through this interface. The plugin API is specified through commented source code header files and are available upon request from Lab.gruppen as a Plugin SDK together with example implementations that can be used as a starting point or for evaluation.

Example plugins and coefficient load tool

The plugin SDK comes with example plugins for Lake XP modules that also works as a tool to load parameters into a Lake frame. The plugins are available as C++ source code (WinAPI) and as built DLLs that can be used out of the box.

XP Control Example



Step by step instructions

1. Have a compatible Lake device powered and connected to the network
2. Configure your computer to connect to the network and only have that network adapter enabled
3. Place the bundled XPControlExample.dll from the Plugin SDK in the plugins folder of your Lake Controller installation
4. Start the Lake Controller and make sure it runs in Window Mode.
5. Hit Modules button and drag the amplifier to the work area
6. Select a Module and hit *Module Store/Recall*
7. Locate and recall e.g. the XP2way.csm
8. Exit the *Modules* menu and go to *Network > Load Ctrl Plugins*.
9. The window above appears where you can select the appropriate module in the pane to the left
10. Enter or paste in coefficients in the respective window
11. Hit *Set Parameters* to transfer all parameters.

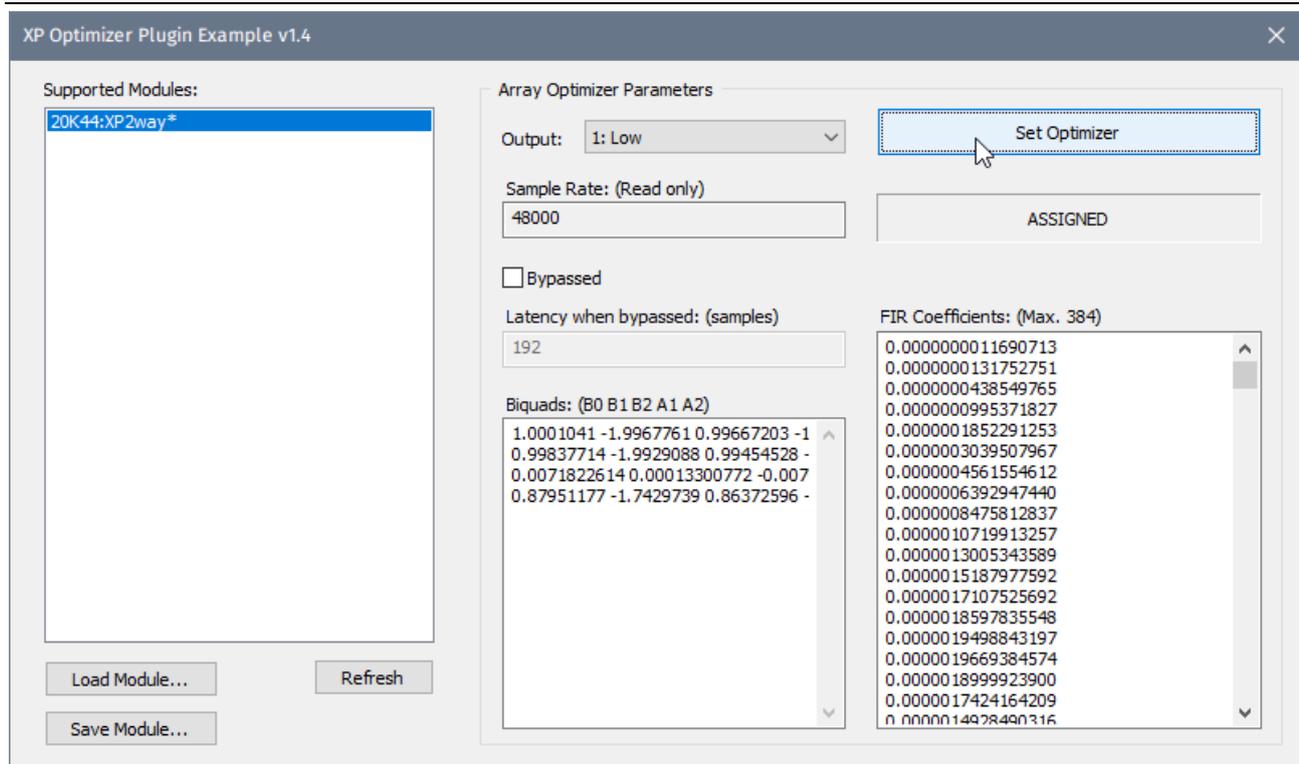
NOTE

Nothing is sent to the Module until *Set Parameters* is pressed.

How to input parameters

- **Biquads** are set by defining one biquad per line, separating the coefficients with a single space. Please refer to the block diagram for information on the maximum number of biquads each section supports. To remove a biquad, just erase its line.
- The biquads inside the **multiband limiter** also support a position parameter. By adding a P as the sixth “coefficient”, the biquad will affect the RMS detector only — thereby acting as a side-chain filter or emphasis of certain frequencies. A total of 18 biquads are available to the multiband limiter and can be freely allocated between the bands within an output.
- **FIR** coefficients are set by defining one coefficient (or “tap”) on each line. A total maximum of 384 taps are supported (or 192 taps in the case of 96 kHz sample rate), but the input field may contain less.
Note: Leaving the entire input blank causes all taps to be zero, which effectively mutes the sound.
- The **sample rates** supported are “12000”, “24000”, “48000” or “96000”. Any sample rate can be chosen for each output. Keep in mind that the Array Optimizer filter runs at the same sample rate as the one specified here.
- The **Link Bus** fields for each band specifies the amount of gain reduction to blend in from the all three bands, separated by a single space character. *Note: Only the gain reduction from the MaxRMS detector is mixed in, and not the MaxPeak.*
There is also an **Output Pair Link Bus** field for the output where it is possible to blend the output limiter with the gain reduction from another output. Blending is however only supported between outputs 1 & 2 and outputs 3 & 4.
- The **Mode** selector selects between *summing* (SUM) and *maximum* (MAX) modes for the Link Bus.
 - **SUM** means the gain reductions from all bands are summed together according to the amounts specified.
 - **MAX** means the maximum gain reduction is chosen after having applied the amounts specified.

XP Optimizer Example



Step by step instructions

1. Have a compatible Lake device powered and connected to the network
2. Configure your computer to connect to the network and only have that network adapter enabled
3. Place the XPOptimizerExample.dll in the plugins folder of your Lake Controller installation
4. Start the Lake controller
5. Hit Modules button and drag the amplifier to the work area
6. Select a Module and hit *Module Store/Recall*
7. Locate and recall e.g. the XP2way.csm
8. Exit the *Modules* menu and go to *Network > Load Ctrl Plugins*.
9. The window above appears where you can select the appropriate module in the pane to the left
10. Select one of the outputs
11. Enter or paste in coefficients in the respective window, adjust bypass latency or toggle the Bypassed state
12. Hit *Set Optimizer* to transfer parameters for this output only
13. The text **ASSIGNED** indicates that there are filter coefficients affecting audio on this output. (**Cleared** means the Array Optimizer section does not contain any audio affecting coefficients.)
14. Repeat from step 10 to target another output

How to input parameters

- **Biquads** are set by defining one biquad per line, separating the coefficients with a single space. The Array Optimizer section has a total of four biquads available.
- **FIR** coefficients are set by defining one coefficient (or “tap”) on each line. A total maximum of 384 taps are supported, but the input field may contain less. *Note: Leaving the entire input blank causes all taps to be zero, which effectively mutes the sound.*

NOTE

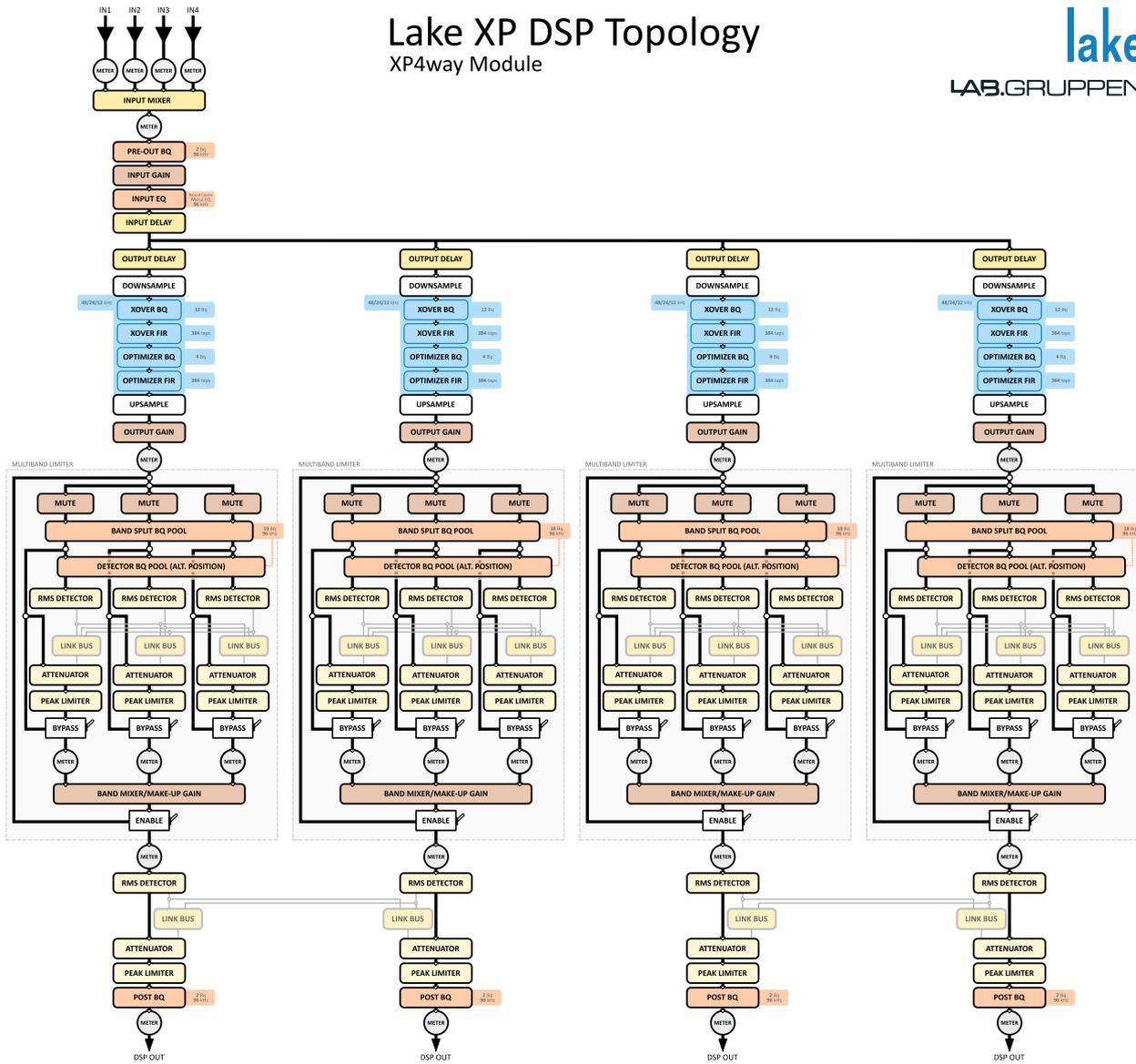
The sample rate can only be changed via the XP Control Example, and only if the Module is unlocked. By changing the sample rate, all FIR and IIR filters using the former sample rate will be cleared.

Locked modules do not allow the *Latency when bypassed* value to be changed via the API. This is why the input control is set read-only in the example DLL in these circumstances.

Storage of module parameters

Once the plugin has pushed parameters to the online XP modules The Lake Controller can be used to store and manage this using module and system files. As the Control Plugin API does not expose all parameters within a module (e.g. Input settings, ISVPL limiter, BEL), further configuration needs to take place from within the Lake Controller UI before the module can be stored and considered a complete speaker preset.

Reference XP4way DSP Block Diagram



Lake XP DSP Topology XP4way Module



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