greenMachine®

Reference Manual

greenMachine titan

4K/UHD or 3G/HD/SD Quad (4) Channel SDI Video and Audio Processing Platform

Revision 2.0 – January 2019

LYNXTechnik AG®

Broadcast Television Equipment

THIS MANUAL SUPPORTS:	
titan from Revision	833
greenGUI from Revision	2.4.0

Contents

Warranty

LYNX Technik AG warrants that the product will be free from defects in materials and workmanship for a period of three (3) years from the date of shipment. If this product proves defective during the warranty period, LYNX Technik AG at its option will either repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, customer must notify LYNX Technik of the defect before expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by LYNX Technik, with shipping charges prepaid. LYNX Technik shall pay for the return of the product to the customer if the shipment is within the country which the LYNX Technik service center is located. Customer shall be responsible for payment of all shipping charges, duties, taxes and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure, or damage caused by improper use or improper or inadequate maintenance and care. LYNX Technik shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than LYNX Technik representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-LYNX Technik supplies; or d) to service a product which has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty servicing the product.

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CAUTION:

The LYNX Technik Warranty policy does not cover damages caused by the use of non-LYNX Technik parts and accessories.
Use only LYNX Technik products with LYNX Technik parts delivered with the product or marked as compatible LYNX Technik product accessory.
Installation of parts and accessories not originally intended could result in less than optimal performance and/or injury. For in-depth service information on LYNX Technik products, refer to our website www.lynx-technik.com. Contact your local LYNX Technik partner or dealer for ordering information.

Information contained in this publication is subject to change at any time without prior notice. Your product‘s appearance may vary from the diagrams contained in this catalog.

The greenMachine titan hardware is designed to be used / installed in a horizontal position, either standing on the device feet or mounted in a R FR 6000.

Regulatory information

Europe: Declaration of Conformity

We LYNX Technik AG
Brunnenweg 3
D-64331 Weiterstadt
Germany

Declare under our sole responsibility that the product

TYPE: **greenMachine titan**

To which this declaration relates is in conformity with the following standards:

EN 55103-1:2009+A1:2012 Class A
EN 61000-3-2:2006
EN 61000-3-3:1995

EN 55103-2:2009 Env. E 5

Following the provisions of 2014/30/EU.

i.V. O. R

Weiterstadt, January 2018 Oliver Berisch / QA Manager

USA: FCC 47 Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the users will be required to correct the interference at their own expense.

Product Overview

Product Description

greenMachine adopts a three-prong approach to product definition and function. Rather than being a fixed application specific box, greenMachine is a combination of general-purpose hardware, constellation (pre-defined set of functionalities/features) for re-programmable functionality and powerful control software.

The current greenMachine titan processes four 3G/HD/SD-SDI video streams or a single 4K/UHD video input. It offers up to 12G processing support (3840 x 2160 @60 Hz) and provides the functionality to convert between single-link 4K video (12G) and quad-link 4K video (2SI; 4x3G).

The greenMachine titan hardware is a powerful general-purpose audio and video processing appliance that is custom configured using one of the pre-defined constellations, which can be purchased through the LYNX sales network. You are not limited to one constellation per greenMachine; you can switch between multiple licensed constellations to configure the machine for many different applications in your workflow.

greenMachine hardware devices are standalone processing modules with an intuitive control interface and LCD display for accessing and viewing the graphical menu. The LCD display and menu also allows you to monitor the video inputs and outputs. An entire greenMachine system is fully controlled by the powerful greenGUI® software available for Windows and Mac.

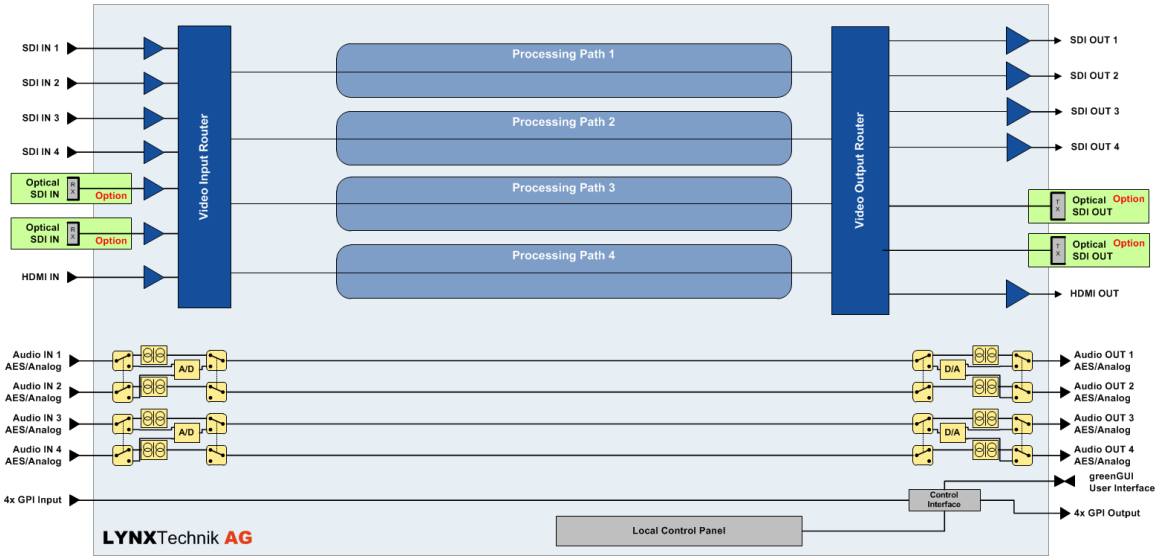
greenMachine hardware devices are extremely powerful and use the very latest high speed programmable Xilinx technology and dual ARM processors. greenMachine and its software, APP based approach and architecture provides a future-proof solution for numerous applications from broadcast all the way to industrial type AV uses.

Functional Diagram

Four electrical 3G/HD/SD SDI inputs and outputs are available on the greenMachine titan. In addition to this it has an HDMI input and output as well as two optional fiber inputs and outputs. Without any APPs installed, the greenMachine titan comes with input and output signal routers as shown in the functional diagram below. Basic conversion functionality from and to HDMI, SDI and Fiber are available.

The greenMachine titan comes with four audio input and output connections that can be configured for either analog or digital audio. Basic conversion functionality from and to analog and digital audio are available without any APPs installed. Monitoring of all inputs and outputs including image previews and audio level meters are also part of the basic functionality as well as the Nova controller providing support for SNMP and custom control.

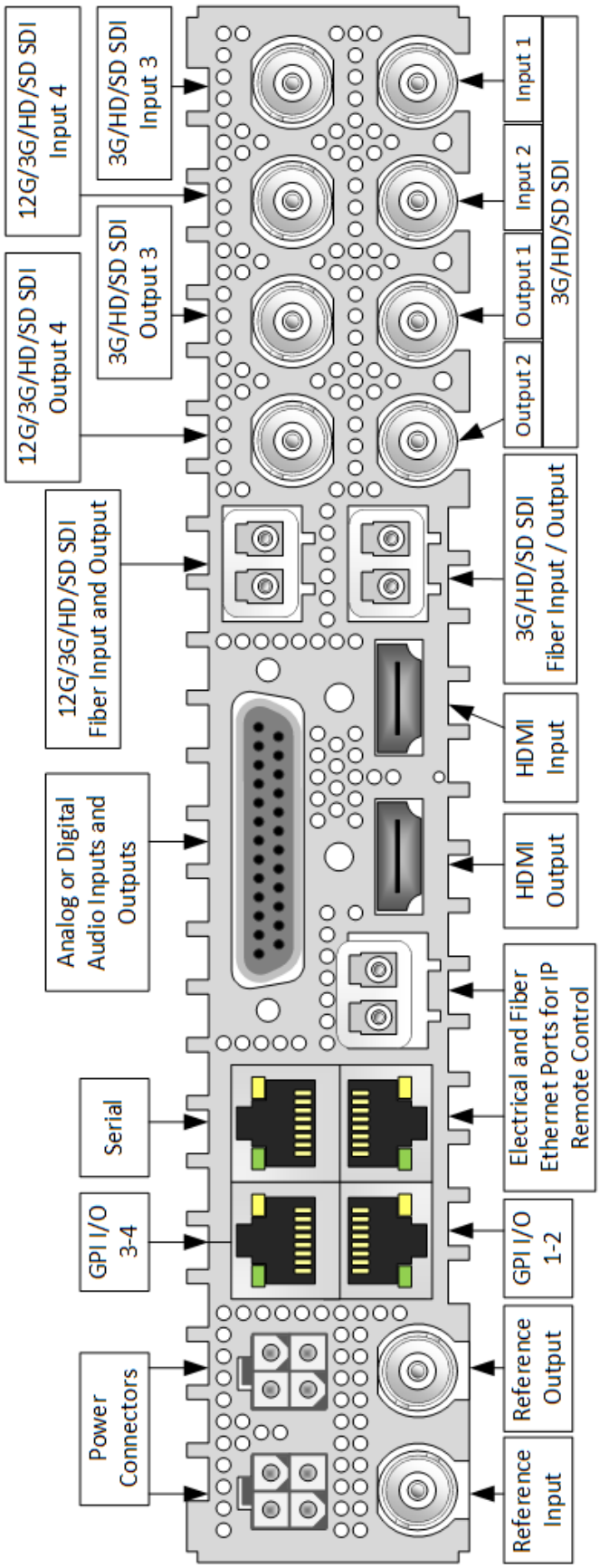
All further video and audio processing functionalities can be defined by deploying the available constealltions.



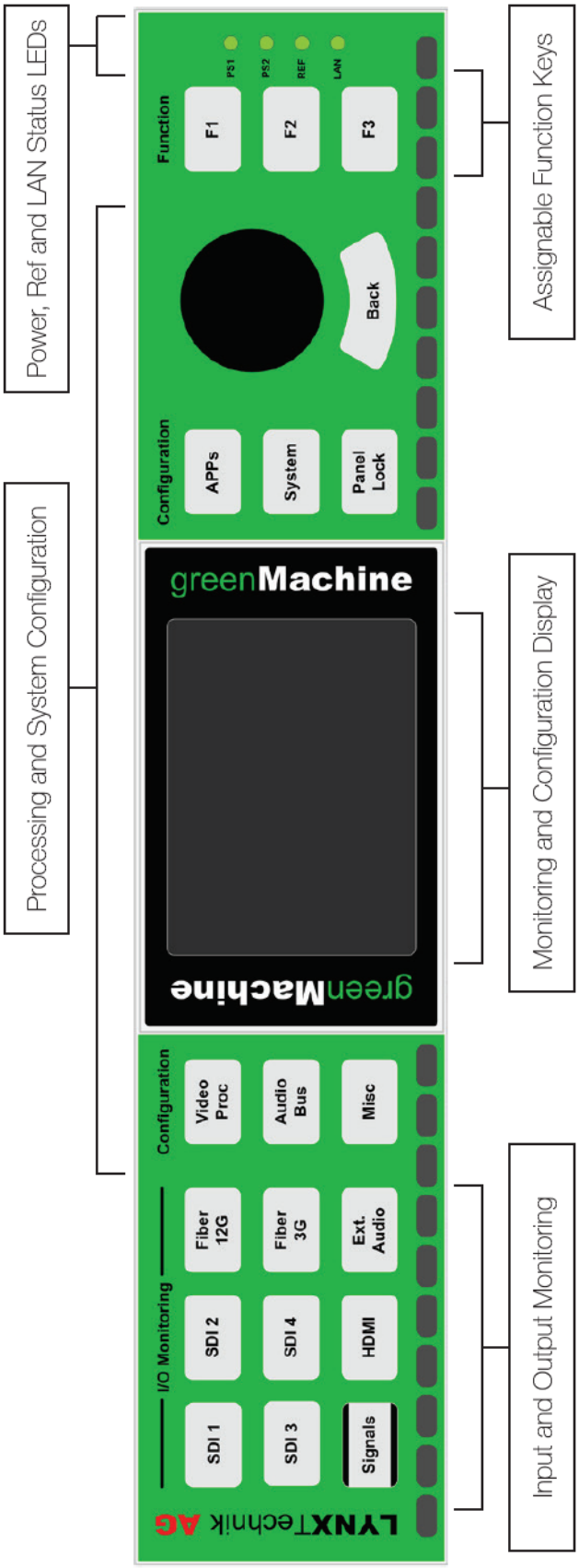
Functional Diagram

Alternatively, the greenMachine titan can be configured with one 12G capable Processing Path.

Rear Connection Panel



Control Panel



Customizing your greenMachine

The greenMachine titan comes standard with basic routing and audio analog to digital conversion functionalities. All further video and audio processing functionalities are defined by the deployed constellation.

Constellation

A constellation is an arrangement of different functionalities. Constellations define what video and/or audio functionality is needed on what processing path. The greenMachine titan has four 3G processing paths or one 12G processing path. When deploying a new constellation, one can choose between constellation types for 3G or 12G 4K/UHD.

There are different processing categories that the functions belong to, which are color coded to help you identify them:

- *Audio I/O* is yellow
- *Sync* is red
- *Video Converter* is turquoise
- *Image Proc* is blue
- *Generate* is green
- *Switching is gray*
- *Monitoring is cadet blue*
- *Global* is magenta

Constellations are pre-defined in the system and are always available, e.g.:

The *Quad FS* Constellation

- This turns your greenMachine titan into a quad channel frame with basic test generator function and video processing, full audio processing including two Dolby E decoders and MADI input and output as well as adjustable user delay.

The *4k UPXD* Constellation

- This constellation provides a broadcast quality 4K/UHD up/down converter with 4x3G Quad Link (2SI) <> 12G Single Link conversion. It also includes powerful scaling capabilities that allow a versatile Region of Interest selection with adjustable user delay Additional functions include the possibility to convert metadata information as well as video / audio processing and a 4K/UHD basic test generator.
- More constellations are available, and we are constantly adding new constellations, please check the LYNX homepage for more information:

www.lynx-technik.com

Deployment

To give your greenMachine titan the functionality you defined in a constellation, you need to deploy this constellation onto your device(s). You can deploy any pre-defined constellation onto your greenMachine titan even if the constellation was not purchased.

You will be able to test this constellation with your own signals including all the parameters available. As long as you haven't been purchased the deployed constellation, you will get watermarks on all the outputs of your greenMachine. The video watermark is shown below.

Watermarked video output

The audio channels embedded in the output video as well as the external audio channels will also be watermarked with a 1 kHz test tone every 20 seconds.

greenUniverse

As soon as there are at least two greenMachines in the same network, they will form a virtual cloud, which we refer to as “greenUniverse.” This cloud enables the greenMachines to share and transfer information, such as your licensed Constellations or stored images/patterns in the TESTOR constellation.

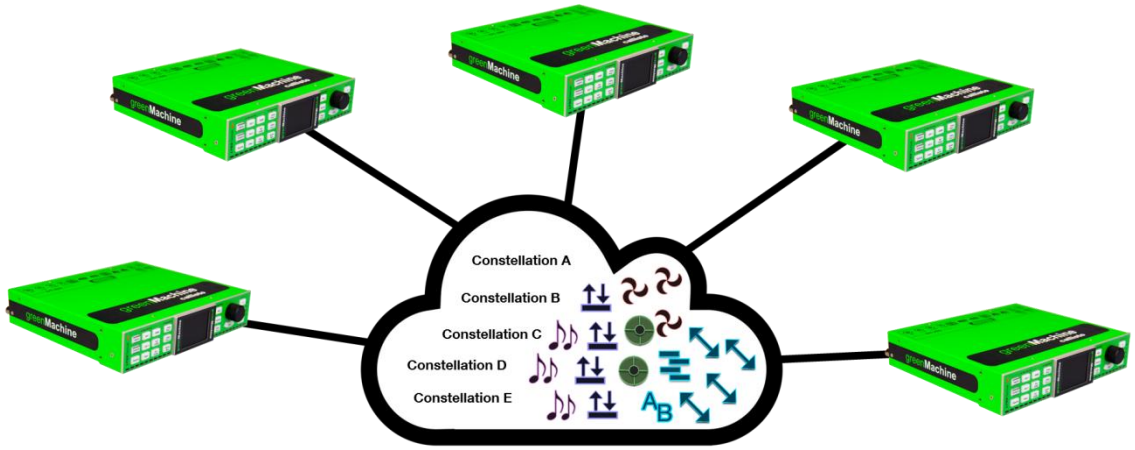


Image 1: the greenUniverse - greenMachine cloud with five greenMachines

When you purchase constellations, they are available for the entire greenUniverse. Purchasing a constellation from LYNX means you have purchased one instance of the constellation that can be used on any of your greenMachines at a given time. If you need to use several instances of the constellation at the same time, you will need to purchase additional constellations. If, on the other hand you want to use a constellation at several different points in your greenUniverse and at different times, you will need only one instance of a constellation.

A simple example of this is the TESTOR constellation. Although you may need to have a generated test pattern at every output of all your greenMachines, it probably will not be necessary at the same point in time. In this case, you can share one, or a few TESTOR constellations throughout your Network, deploying it at will to the greenMachines needing a generated output.

When you deploy a given Constellation to a greenMachine, the system will check if there is an available instance in the greenUniverse. If so, this instance will be assigned to this greenMachine. If not, you will get, as described above, watermarks on your outputs until your purchase the required constellation.

Control Panel Description

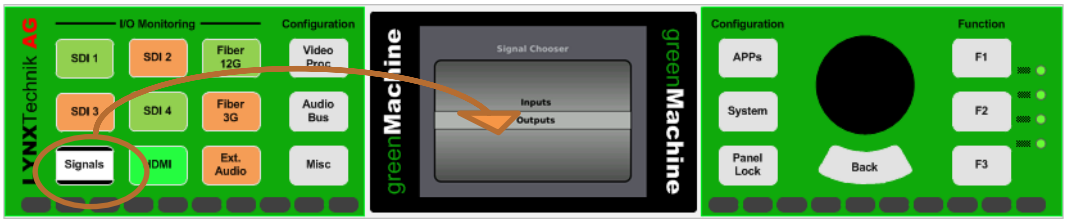
The front control panel allows the complete configuration of the module in addition to detailed monitoring features of the input and output signals. The following chapters will outline the control panel functions.

I/O Monitoring

The nine push buttons located on the left hand side of the control panel used with the local display provide everything that is required for detailed input and/or output signal monitoring.

Signals Button

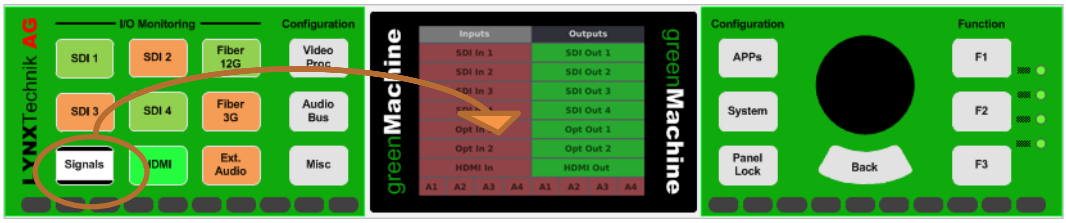
Pressing the *Signals* button located on the bottom left of the control panel will show the I/O Monitoring Signal Chooser to switch between Inputs and Outputs (see Detailed Signal Information as well). The *Signals* button will be illuminated white to indicate that it is selected.



Signals - Chooser

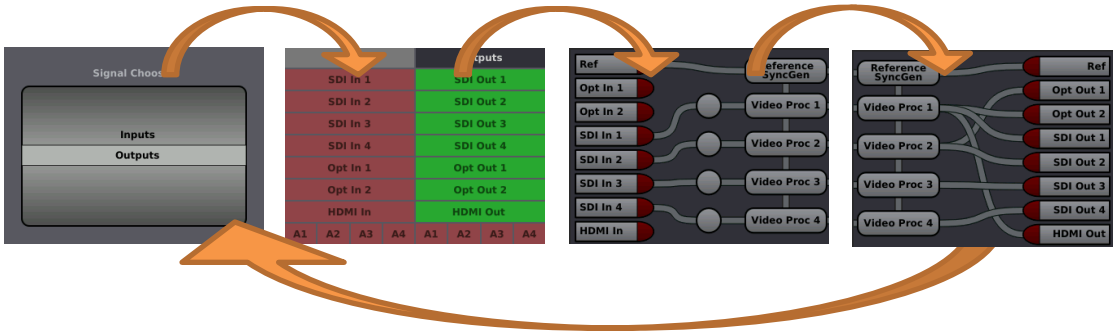
The signal buttons (e.g. SDI 1, SDI 2, SDI 3, SDI 4, 12G Fiber, 3G Fiber HDMI, etc.) now will be illuminated with colors according to the status of the selected signals (e.g. inputs).

Pressing the *Signals* button a second time will show the inputs and outputs overview page.



Signals - Monitoring of all Input and Output Signals

Pressing the *Signals* button a third time will show the left hand side of a signal flow overview of the module including the status indication of the video and reference inputs and outputs. Pressing the *Signals* button a fourth time will pan to the right hand side of this flow diagram.



Signals Display Navigation

When either the left or right hand side of the diagram is shown in the display, the rotary push encoder can be used to pan between the left and right side.

Pressing the *Signals* button when the display shows the right hand side of the diagram page will switch back to the Signal Chooser.

Detailed Signal Information

To get detailed information for a specific input (or output) signal simply press the signal button (e.g. SDI 1) when in *Inputs (or Outputs)* mode (selected with Signal Chooser). The chosen signal button will be illuminated more brightly than the other ones to indicate that it is selected.

Detailed Input Monitoring

The detected input standard of the selected input will be shown at the top of the display. The bottom of the display will list which internal video processor the signal is assigned to (none, Video Proc 1 and/or 2 and/or 3 and/or 4).

Pressing the same signal button repeatedly will toggle between different pages with more information. The following example will show the information pages for the SDI inputs.

Detailed Signal Information Pages

1. **Signal Status Overview**
   Depending on the type of input (i.e. electrical SDI or Fiber) this page will show details about the input format, available audio, optical input budget or similar.
2. **Preview**
   The display will show a preview image of the selected input that is assigned to one of the video processors. This feature is only available for the input signal(s) assigned to one of the processors.
3. **Audio Level Meters**
   The display will show audio level meters of the selected input that is assigned to one of the video processors. This feature is only available for the input signal(s) assigned to one of the processors.
4. **Meta Data Information**
   The display will show the detected metadata information of the selected input that is assigned to one of the video processors. This feature is only available for the input signal(s) assigned to one of the processors.

Processing Configuration

The three buttons to the left of the display access the three processing configuration menus in the panel.

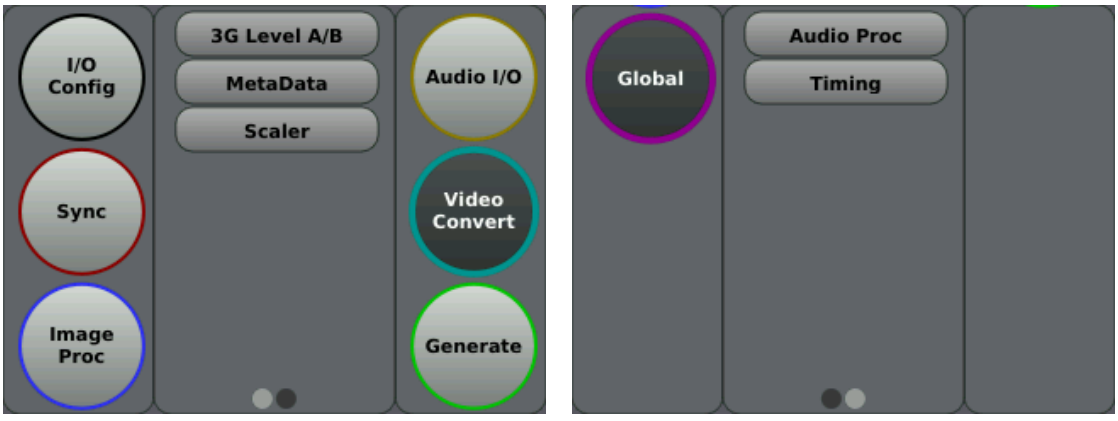
Together with the rotary push encoder and the back button, these three configuration menus are all that is required to configure the processing of the greenMachine titan.

Configuration Controls

Processing Configuration Menus

The processing configuration parameters are generally grouped to the *Video Proc* and the *Audio Bus* menus according to their respective processing function. Settings that cannot be logically associated to any of these categories can be found in the *Misc* menu.

Inside the three processing configuration menus, the parameters are ordered according to the processing category they belong to. These processing categories are the same as described in the Constellation chapter: *Audio I/O*, *Sync*, *Video Convert*, *Image Proc*, *Generate, Monitoring* and *Global*, and are shown with the same color code. The picture below shows the first level of the VideoProc1 menu with all processing categories. The parameters controlling the Routers are grouped under the category *I/O Config*.



First Level of the VideoProc1 Menu - the Processing categories

Inside the processing categories, the parameters are ordered according to their respective APP. Therefore, you will find in the first two levels of the configuration a direct mapping of the deployed constellation.Below picture shows the second menu (the functions) contained in the *Video Convert* processing category of the Video Proc 1 Menu. In this case three functions in that category were contained in the Constellation that was deployed on that greenMachine: 3G Level A/B, MetaData and Scaler.

Second Level of the Video Convert Menu

The structure and usage of the configuration menus works as follows:

Active Menu Items

The areas on the left and right side of the display show the active menu items. Turning the rotary push encoder will navigate between these different menu items. The inverted menu item (i.e. dark gray with white text) is currently selected. It's possible that there are more than six menu items. In this case there will be more pages available. These are indicated by the circles at the bottom of the center part of the menu. The pale gray circle

indicates which page is currently selected. To change pages, simply continue turning the rotary encoder beyond the last icon (next page) or the first icon (previous page).

There are two different shapes for the menu items. The square boxes are menus containing at least one additional menu level. When selected, the middle part of the display will show a preview of what settings and/or menus are available within this menu (see below). Pressing the encoder will enter the selected menu. Pressing the *Back* button below the encoder will return to the higher menu level.

Image 2: Preview of Menu Content

The hexagon shaped items are parameters. When one of these menu items is selected, the middle area of the display will show the type of parameter and the current setting (see picture below).

Image 3: Parameter Preview

To edit the parameter, press the encoder. When in edit mode, turn the encoder. To exit the edit mode, press either the encoder or the *Back* button.

System Settings

The *System* menu contains all setting and monitoring possibilities that are not directly related to the processing.

Deploying Constellations with the local Control Panel

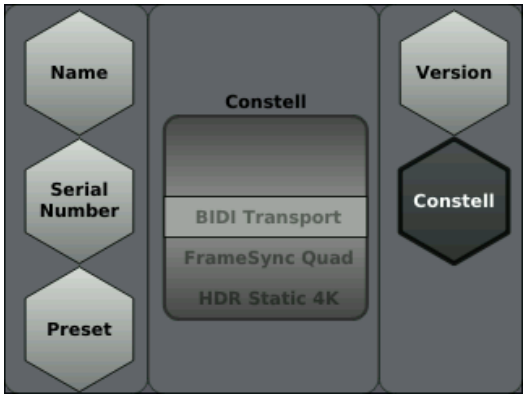
The front control panel allows the complete configuration of the module including the deployment of new constellations.

Deployment of new constellations can be done in the *System* menu. To select the *System* menu, just press the button next right to the display. Then select the *General* menu.

Note: The areas on the left and right side of the display show the active menu items. Turning the rotary push encoder will navigate between these different menu items. The inverted menu item (i.e. dark gray with white text) is currently selected.

There are two different shapes for the menu items. The square boxes are menus containing at least one additional menu level. When selected, the middle part of the display will show a preview of what settings and/or menus are available within this menu. Pressing the encoder will enter the selected menu. Pressing the Back *button below the encoder will return to the higher menu level.*

Please select the constellation you would like to deploy form the parameter list in the display and press the rotary button.



Note: The hexagon shaped items are parameters. When one of these menu items is selected, the middle area of the display will show the type of parameter and the current setting.

To edit the parameter, press the encoder. When in edit mode, turn the encoder. To exit the edit mode, press either the encoder or the Back *button.*

IP Settings

This menu provides all settings required for the IP configuration of the greenMachine.

- **Set IP Mode**
  Choose between *Static* IP settings or *DHCP*. If the greenMachine is installed in a network environment where the IP addresses are allocated automatically (DHCP) the greenMachine titan can be set to DHCP mode. The default value is DHCP.

- **Set IP Address**
  This menu allows the reading (in DHCP mode) and setting of the IP address if the *IP Mode* is set to *Static*. To adjust the IP address, press the encoder and the first block of three digits can be set by turning the encoder. Press the encoder to confirm the first block and to edit the second. Repeat this procedure until you have set all four 3-digit blocks of the IP address (Image 4).

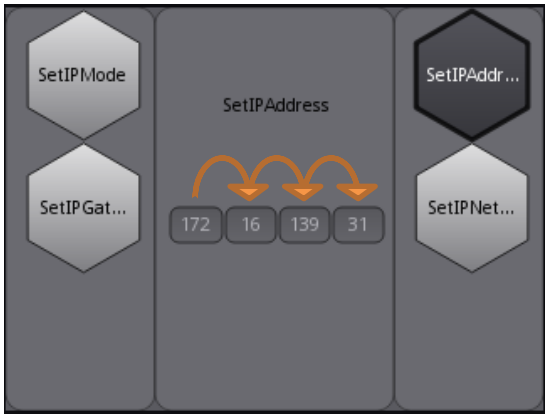


Image 4: IP Setting Adjustment

After entering the four IP address blocks, you will be asked to confirm the new IP address. Press *OK* to finalize the IP address settings. If you press *Cancel* the IP address will not be adjusted. Pressing the *Back* button on the panel at any time while editing the IP address will exit the edit mode and the IP address will not be adjusted.

- **Set Gateway**
  This menu allows the adjustment of the IP Gateway if the *IP Mode* is set to *Static*. This works in the same way as the setting of the IP Address.

- **Set Network Mask**
  This menu allows the adjustment of the IP Network Mask if the *IP Mode* is set to *Static*. This works in the same way as the setting of the IP Address.

NOTE: When in DHCP mode the greenMachine will wait approximately 30 seconds for a DHCP capable server to get allocation of an IP address. If no address is allocated by a DHCP server, the device will configure itself to a zero-conf configuration:

IP address:	169.254.x.x (x.x is arbitrary)
Netmask:	255.255.0.0
Gateway:	0.0.0.0

Panel Configuration

- **Brightness**
  This menu allows the adjustment of the brightness of the display and button illumination.

- **Timeout**
  When turned on, the panel will go into snooze mode after the selected timeout. The panel will turn on again if any button is pressed.

- **Audio Level Meters**
  The Audio Level Meters menu contains all the parameters to configure the Audio Level Meters shown on the panel and in the greenGUI. These parameters include the PGM Level (red) in dB, the Test Level (yellow) in dB and the DropOff wait time in seconds. Image 5 shows the effect of the PGM Level (red) and the Test Level (yellow) on the Audio Level Meters.

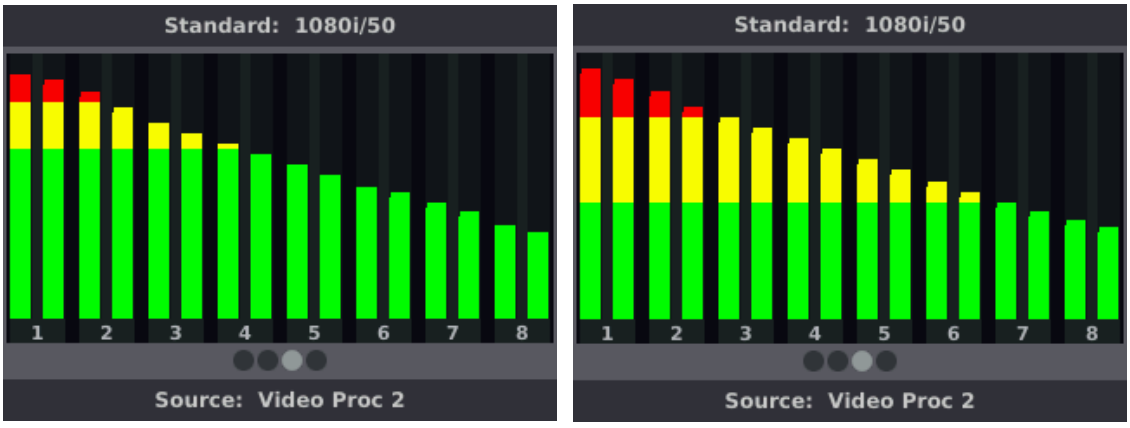


Image 5: Audio Level Meters with different PGM and Test levels

F-Key Assign

This menu provides the possibility to assign stored specific functions to the three F-Keys on the far right of the control panel (Image 6).

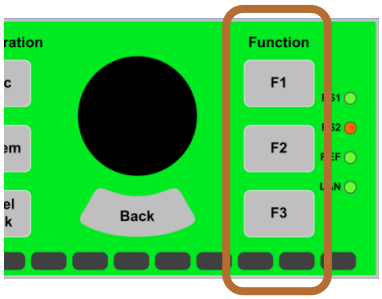


Image 6: Function Keys

Once a function has been assigned to an F-Key, pressing this function button will activate this function. The available functions are:

- **Show IP Settings**
  This will show a screen with the detailed IP Settings of the greenMachine with the IP Mode, the IP Address, the Netmask, the Gateway as well as the MAC Address.
- **Show Constellation**
  This will show a screen with the name of the Constellation which is currently deployed on the greenMachine.
- **Show Demo State**
  This will show whether the greenMachine is working in “demo state”, i.e. with watermarks or not. If the greenMachine produces video or audio watermarks, the missing APPs responsible for the watermarks are also summarized here.

Reset

There are two types of reset available:

- **Reset Proc**
  Using this reset will only set the processing relevant parameters back to factory default. In other words, all parameters that can be configured via the *Video Proc*, *Audio Bus* and *Misc* menus.
- **Reset Panel**
  This reset will set all panel settings (brightness, timeout, F-Key Assignments and Audio Level Meter settings) back to factory default.

There is also a hard reset available between the two HDMI connectors in the back panel. Pressing this with a pin will trigger both resets, resetting all parameters of your greenMachine titan. Only the Network Settings parameter will stay unchanged.

Health Parameters

This menu provides health monitoring parameters for the greenMachine. If one of these parameters should be within a warning or critical level, the System menu button will be illuminated according to the alarm state and in addition the parameter in question on the display menu will have a colored frame.

Image 7: Health Parameters

Panel Lock

The *Panel Lock* button at the bottom right of the display activates or de-activated the panel lock. To lock or to unlock, press and hold the button for 3 seconds.

When in lock mode, the *Panel Lock* button will be illuminated red and the configuration buttons will be dimmed. However, the I/O Monitoring functionality will still be available.

Power Supply Unit, LAN and Ref LEDs

The four LEDs located on the far right of the control panel provide a simple status monitoring of the power supplies, LED activity and reference input.

- **PS 1/2**
  If a power supply is connected the LED will be green. If not, the LED will be off.
- **LAN**
  This LED will indicate if a LAN connection is established.
- **REF**
  This LED is a simple monitoring of the reference input.
  - Green: Valid reference detected
  - Yellow: Reference to video mismatch
  - Red: No valid reference detected

IP Remote Control

The greenMachine can be used as a stand-alone module but at the same time it can be fully controlled by the greenGUI Windows and Mac desktop application. In addition, the greenMachine titan can be remote controlled and/or monitored via SNMP or the LYNX IP remote control protocol through the NOVA controller function.

greenGUI

The greenGUI software is supplied as part of the greenMachine package. This can be downloaded from the LYNX website. greenGUI control software is a comprehensive, centralized application which provides remote control and status monitoring and event (error) reporting for all modules installed in a greenMachine system.

System Requirements

The control software is designed to run on a Windows compatible PC or a Mac. The supported Windows platforms are Windows 7, Windows 8 and Windows 10 (recommended). The supported Mac versions are Mavericks, Yosemite Mac OS X 10.10 or higher, El Capitan and Sierra. In the table below, you will find the minimum and the recommended system requirements.

System Requirements	Minimum	Recommended
CPU	Core-2 CPU 1.6GHz	Quad Core CPU 2.5GHz
RAM	4 GB	8 GB
Free HDD space	1 GB	1 GB
Graphics	1280x960	1920x1080

Passive Operation

The control system software application and hardware are completely passive in nature. All settings for the modules are stored in the individual greenMachine's Flash RAM. Nothing is stored in the PC/MAC. The greenGUI software application and the local control on the greenMachine merely provide a mechanism to view and change the settings stored within the individual modules' Flash RAM.

Should a PC running the control system be shut down or a network error be encountered there will be no impact on the modules' normal operation and settings.

This passive design philosophy was deliberate as terminal equipment is typically used in critical applications where continuity of use and reliability is paramount. The passive nature essentially isolates the control system from normal operations as critical a point of failure.

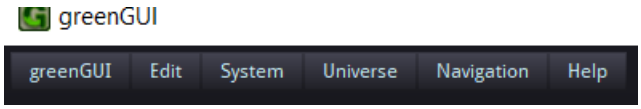
Getting Started

To connect the greenMachine titan to the greenGUI, make sure that the module and the computer running the greenGUI control software are in the same IP range (see IP Settings for more details).

Start the greenGUI. The software will automatically detect all greenMachines present in your network and show them in the Rolodex (see below, item 1) on the left side of the screen. Selecting a machine in the rolodex will cause the UI on the right to update its data and parameters.

General Menu Bar

On left top corner of the GUI is a general menu bar, where you can find some gernal settings and information.



greenGUI: Version Info

Edit: Undo/Redo

System: Enable Simulation and Enable Pathworkflow; Pathworkflow changes the Rolodex on the right side to a scroll down list showing the available processing paths.

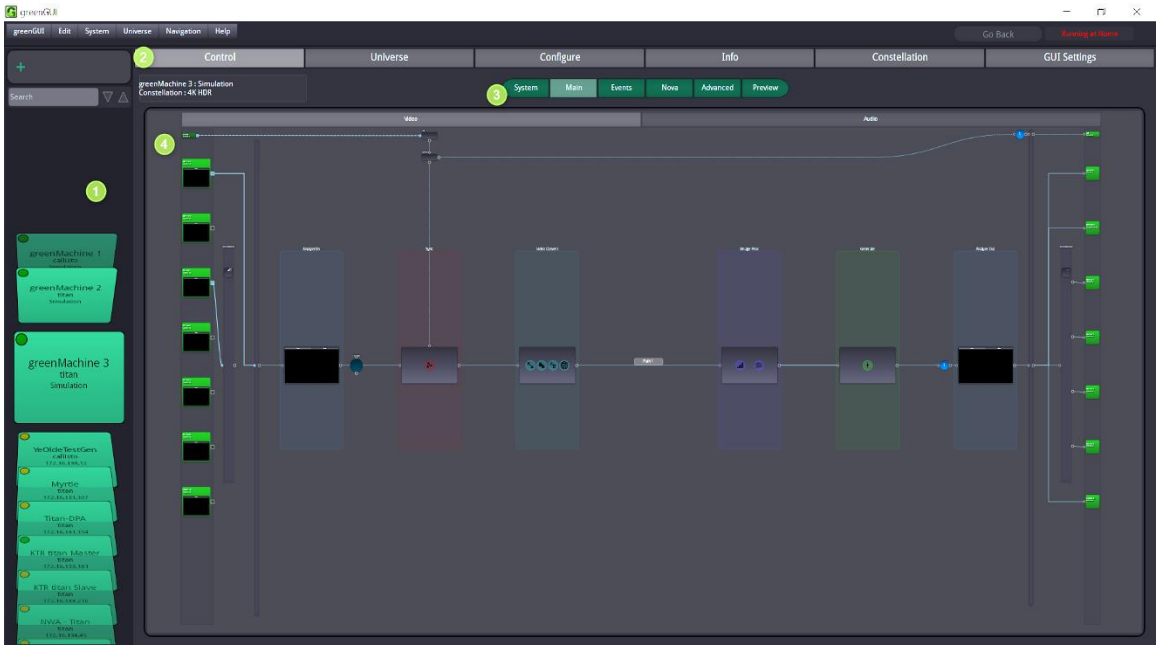
Universe: Export/Import Layouts of the greenUniverse

Navigation: Some shortcuts to navigate to different pages in the greenGUI

Help: Here you can collect additional service information in case you discover any issue

greenGUI Layout

The rest of the GUI is divided into three categories: at the top of your screen you will find the main Pages (item 2) with Control, Universe, Configure, Info, Constellation and GUI Settings. Some of the Pages are further divided into Subpages (item 3). The control, settings and monitoring functions corresponding to the selected greenMachine, Page and Subpage are found in the main area, switchable between Audio and Video Processing (item 4).



Layout of the greenGUI

Control Page

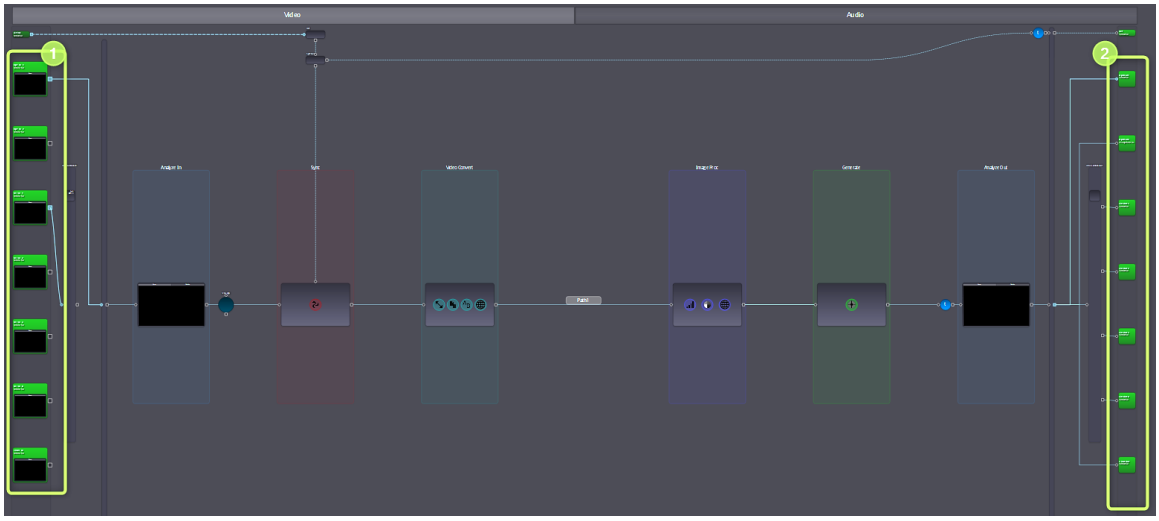
The Control Page contains elements which allow you to manipulate the processing parameters of the greenMachine. The Control Page is further divided into 4 Subpages: System, Main, Events, Nova, Advanced and Preview Page.

System Subpage

If you select the System Subpage of the Control Page you will access the system information of the greenMachine. This will give you general information on the greenGUI regarding network information, general status information (temperature etc.) as well as an overview of the video signal flow set in the machine.

Main Subpage

Selecting the Main Subpage of the Control Page will show the processing flexGUI of the greenMachine (picture below). Considering the possible complexity of the greenMachine, we have decided to graphically represent the modules internal signal processing and indicate the signal flow. To avoid too much information on one page it is split into a video and an audio section. This provides an intuitive and logical method to access specific areas of the device.



flexGUI with the 4K UPXDPXD Constellation deployed

For example, the picture above represents the graphical user interface of the 4KUPXD Constellation (titan). The user interface of this device uses the flexGUI with its 3D navigation. The idea is based on the concept of showing the functionality of a module as a signal flow diagram. Parts of this signal flow diagram are the processing blocks.

The user can navigate around the module by double-clicking on a specific processing box in the diagram. The software will then zoom into the selected processing block. From a certain zoom level onwards, the surface of the processing block will dissolve and reveal the controls. Double clicking anywhere outside of the processing block will zoom out again to the next highest level showing for example the overview.

It is possible to freely navigate as well as zoom in and out within this module / system flow diagram. There are two possibilities to do this.

1. **Mouse**
   Using the mouse wheel will seamlessly zoom in and out. Rolling the mouse wheel forward will zoom in to the position of the mouse curser and rolling it backwards will zoom out. To navigate, simply click and hold anywhere outside of a processing block and move the mouse.

2. **Keyboard**
   Using + and – on the keyboard will zoom in and out. The home button provides the “Fit” functionality and the up, down, left and right keys can be used to move up, down, left and right.

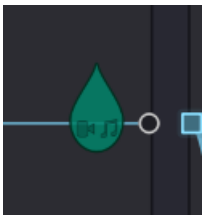
You will also note that the signal inputs (1) are highlighted with colors; this indicates the condition of the input. Green is OK, yellow indicates a possible conflict or problem, and red means not present.

The input (1) as well as the output (2) names can be customized to fit your installation. Simply right click onto the designated input or output entry and select *Rename*.

For an introduction video of the flexGUI, please visit the LYNX Technik website at http://www.lynx-technik.com/en/products/appolo-control/.

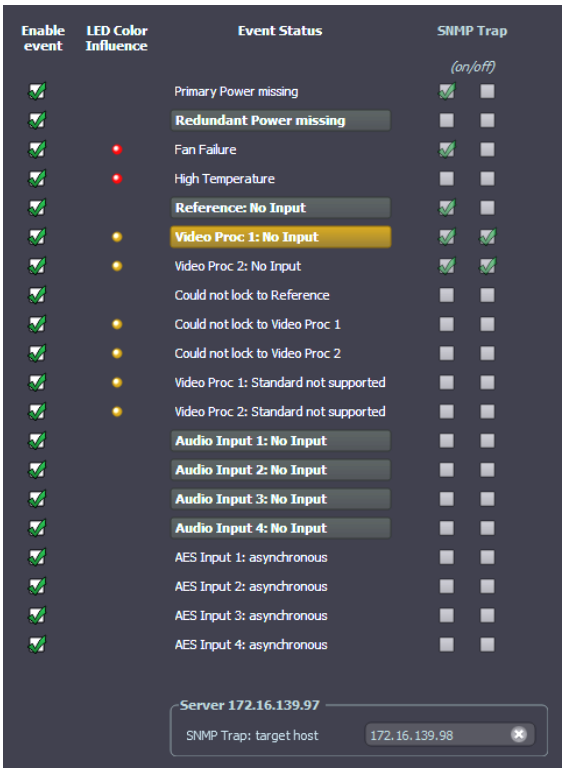
You will find all the monitoring information available on the local panel of the greenMachine also in the Main Subpage in the small monitoring windows respectively right and left of the inputs and outputs. There you can toggle between the preview images, the Audio Level Meters and the MetaData information.

If the deployed Constellation is not licensed in the greenUniverse, you will get watermarks on all the video (as text overlay) and audio outputs (as audio beeps). This is indicated in the flexGUI with the symbol of a drop of water in the video and audio outputs.



Events Subpage

Every module can be configured for the events the user wishes to log. This is to prevent the log being filled with unnecessary clutter. There will be circumstances where for example an input video signal will routinely go missing as the input sources are frequently changed – and for the given application this behavior is considered normal. In this case you can disable the logging of the event on the module.



Likewise, you may only want to log when a specific event happens, and not when it's corrected. For example; you want to log when a signal goes missing but are not interested in logging when the signal returns.

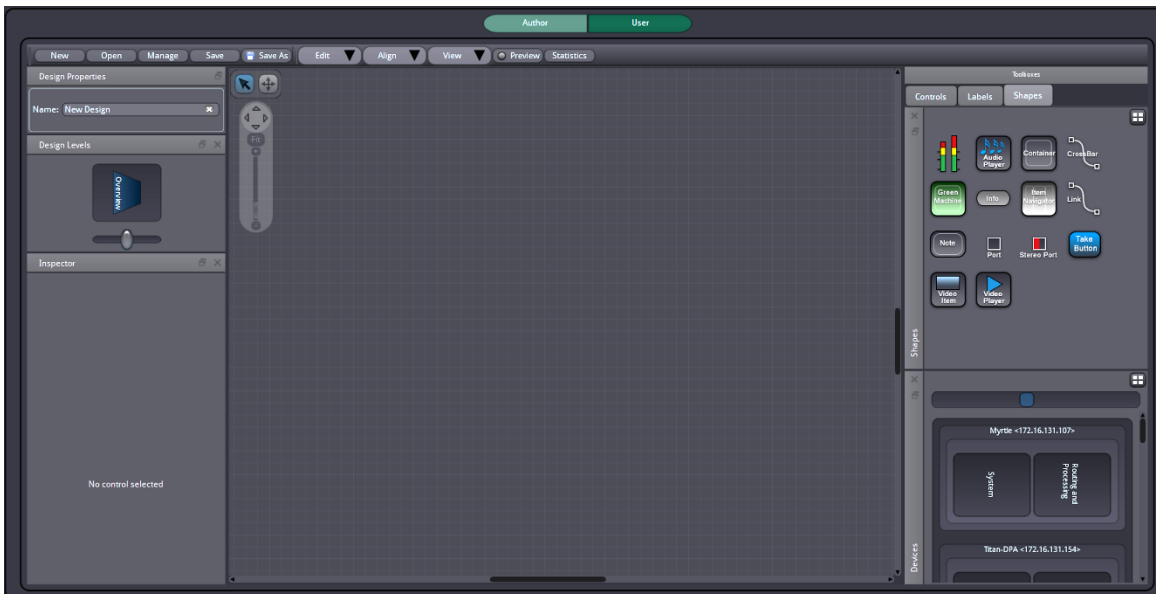
Every module has an Events Page where the error reporting can be configured

The logs are saved on the greenMachine and can be read via the greenGUI in the Device Log Subpage of the Info Page.

It is also possible to configure the SNMP traps sent to an external monitoring or logging device.

Nova Subpage

The full-functional greenGUI is just perfect for the maintenance engineers or expert operator personnel, i.e. for all situations where direct and unlimited access to all functions is desirable. But there are other applications and use-cases, where the opposite is required. As a simple example, a particular application might require a simple control panel, where only the audio gain levels of a few selected channels can be adjusted – but nothing else. These few controls should be accessible directly (no need to open sub-pages or select tabs). And no other controls should be visible, because those other possibilities could potentially confuse the operator or (even worse) lead them to make inappropriate modifications to parts of the system that should not be touched. This demand for freely definable Control Panels (i.e. which are not pre-defined by LYNX) is satisfied by the LYNX CustomControl feature. CustomControl provides a powerful, interactive and intuitive way for setup and deployment of one or more CustomControl Designs. Any number of custom-made Designs (dedicated GUI pages) can be prepared for all those different applications and operating situations in a system where only a subset of the full power of the LYNX greenGUI shall be exposed. Individual such designs can then be loaded and displayed from various workstations and mobile tablet computers.

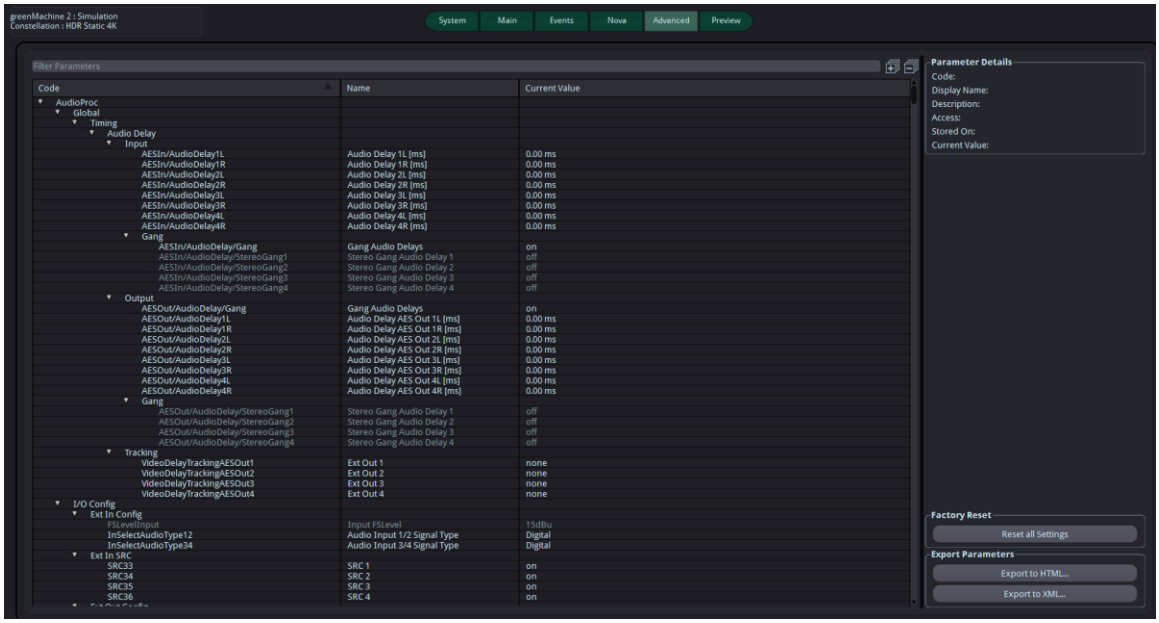


Under the link below you can find a document describing in detail, how you can make the best use of the various capabilities of CustomControl.

https://www.lynx-technik.com/fileadmin/user_upload/LYNX_APPolo_UserGuide_CustomControl_V3.0.pdf

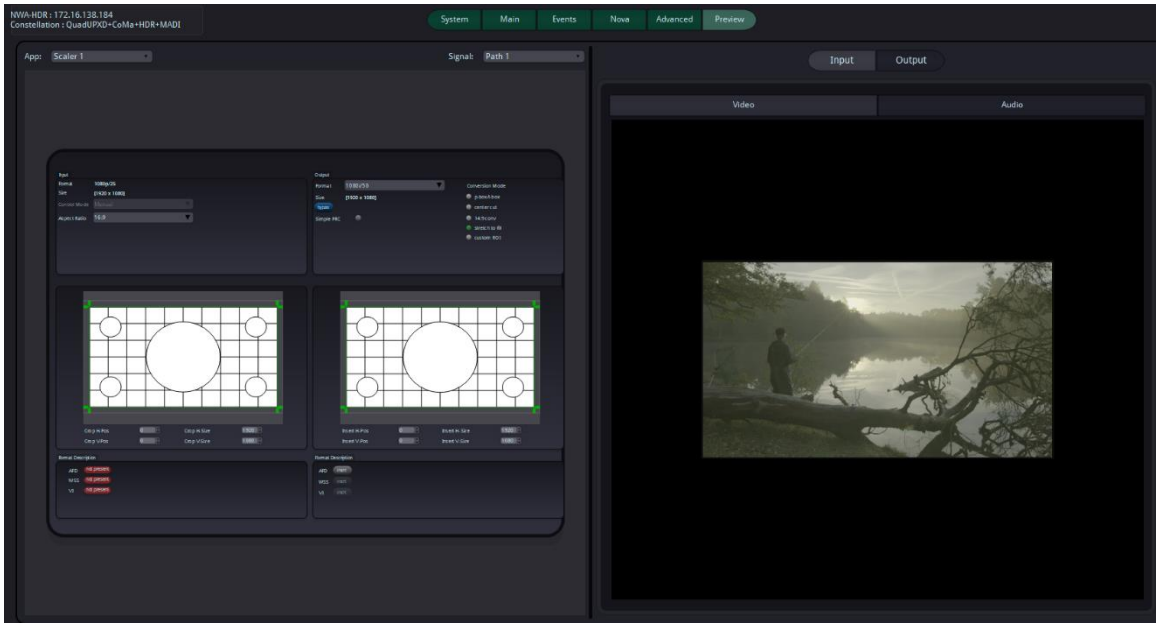
Advanced Subpage

All parameters of the current constellation can also be accessed and set in the Advanced subpage in form of a parameter list. This way of controlling the greenMachine should be used by advanced users only. Those parameter names will also be used in the LYNX Remote protocol.



Preview Subpage

Here all modifications in the selected processing channel can be monitored in a larger preview window.



Universe Page

The greenMachine can be used as a stand-alone module or it can be fully controlled by the greenGUI Windows and Mac desktop application. When part of a Universe, each greenMachine can also be configured locally.

The greenUniverse encompasses everything. It graphically depicts all greenMachines in the designated control network. The universe is a zoomable and pannable view.

Each greenMachine in the universe contains a flexGUI to control all the processing parameters within the constellations.

The universe has access to all machines and all their parameters. Selecting a greenMachine in the Rolodex (scrolling menu) will cause the universe to zoom into that machine. Double clicking on a machine in the universe graphic will bring focus in the Rolodex.

Constellation Subpage
On the right hand side of the Constellation Editor you will find a Rolodex with all the Constellations available in the greenUniverse (see picture below). These are the templates that you can use to reconfigure your machine. The constellation rolodex does not display or contain any machine specific information. To deploy a Constellation onto any greenMachine, just select it from the Constellations Rolodex, and drag and drop it on to the greenMachine.

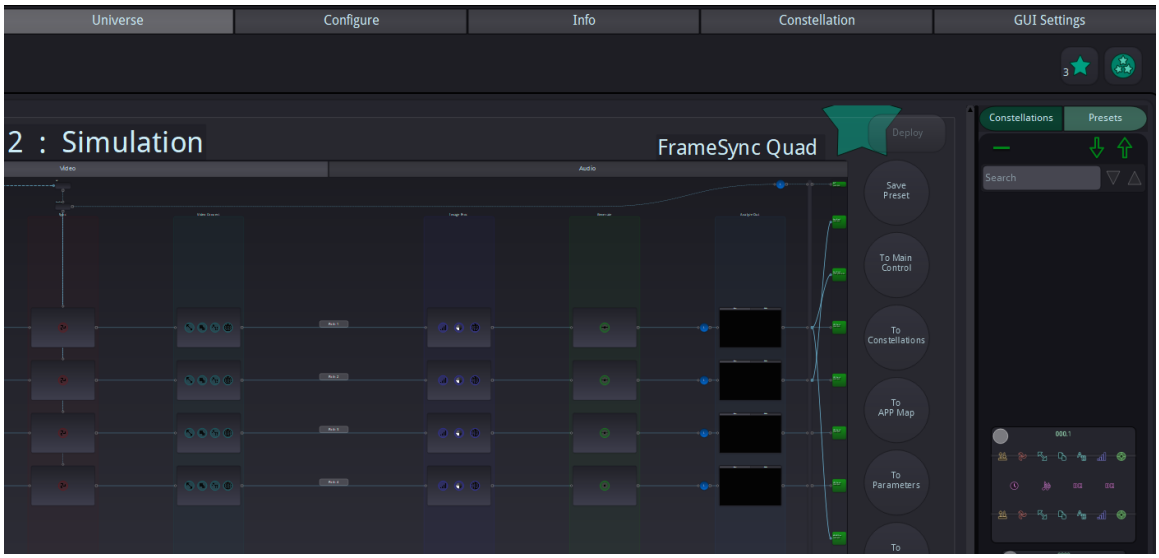
The greenMachine will then have a thick blinking colored border and the Deploy button on the top right of the Universe canvas will also be colored (see image below). If the required license has been purchased, the border and the Deploy button will be green and the Deploy button can be clicked to finalize the license installation. If a constellation licensed is not available in the greenUniverse, the border and the Deploy button will be

red. This red color warns you that on deployment, the outputs of this greenMachine will be watermarked, and/or that a license needs to be released or purchased.

Deployment confirmation of a Constellation

Presets

A Preset is a snapshot of all the parameters available on a greenMachine. The collection of parameters will vary, depending on the currently deployed constellation. A preset does not contain any machine specific information, it only knows parameters.

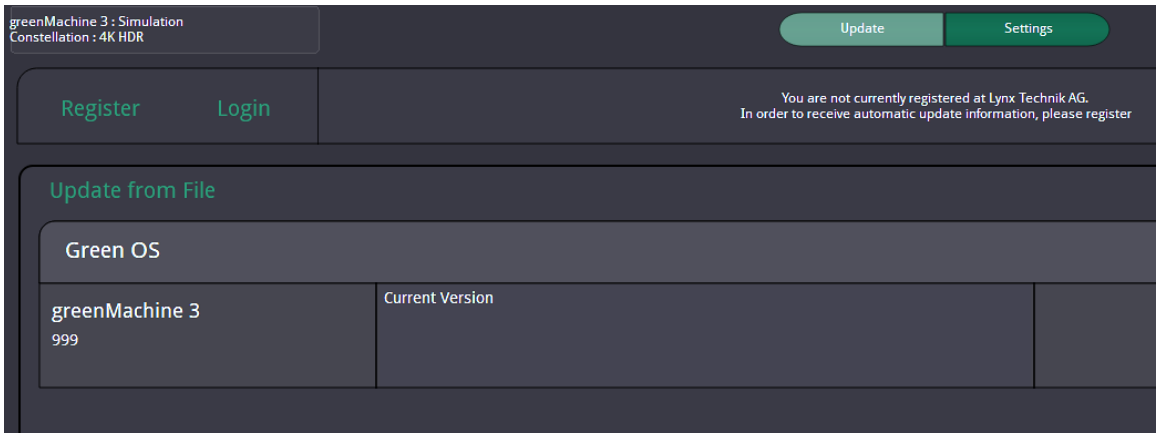


Configure Page

The Configure Page gives you access to all general configuration parameters of your greenMachine and enables you to update your module.

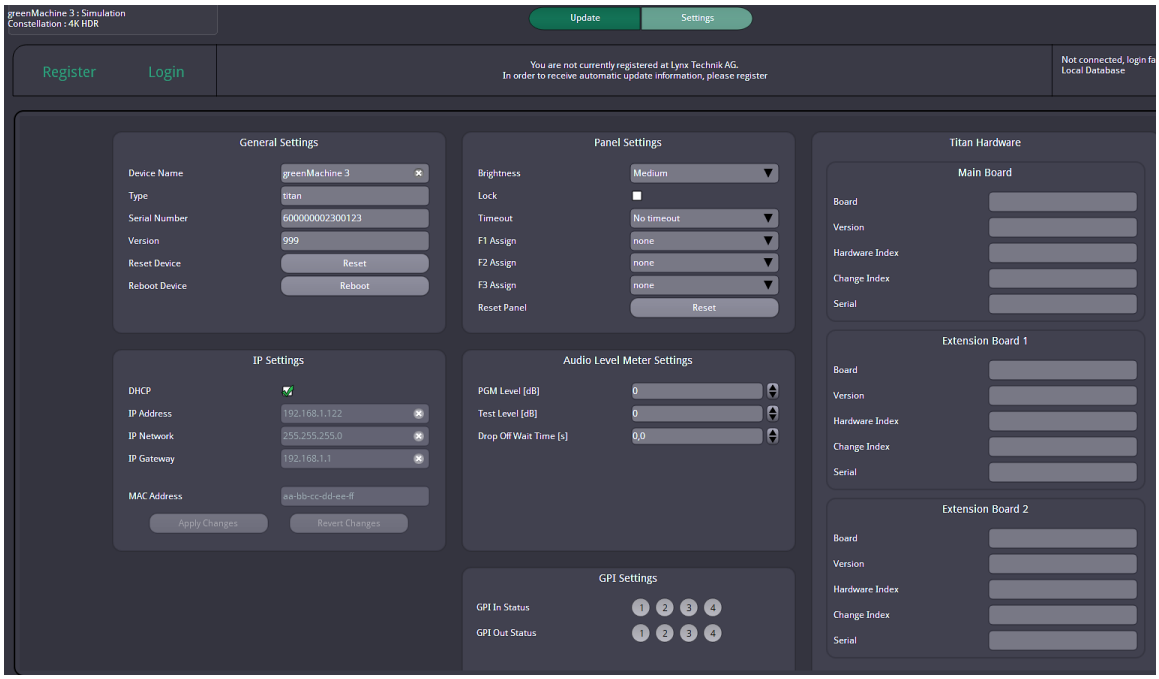
Update Subpage

The Update Subpage provides the possibility to mirror our complete database of programming files onto your local PC and keeping it up-to-date by synchronizing it via Internet. The intuitive user interface makes it straightforward to overview the current release versions of your modules and see if new ones are available.



Settings Subpage

The Settings Subpage gives you access to general configuration parameters and information. You will be able to check and change your network settings, your panel settings as well as GPI settings. Furthermore, you can change your SNMP settings on this page.



You can reset all processing parameters and/or all panel parameters. You can also rename your greenMachines at will in the Settings subpage. The new name will show up wherever your greenMachine is being shown: in the Rolodex, in the greenUniverse and on the local Interface of your greenMachine.

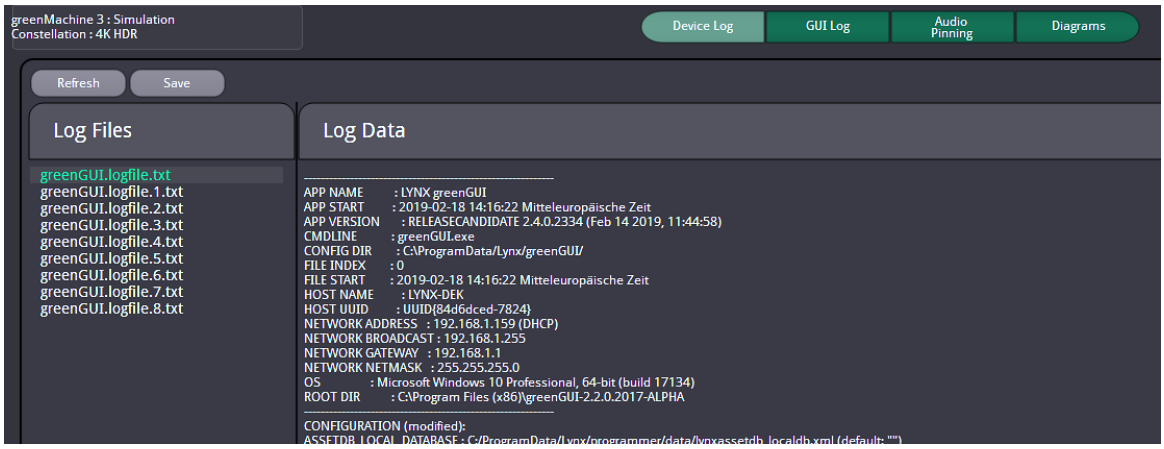
Info Page

The Info Page enables access to different types of general information about the selected greenMachine. The available Subpages are Device Log, GUI Log, Audio Pinning and Diagrams.

Device Log Subpage

On this page you can access the last 9 log files of the selected greenMachine. Older logfiles will be overwritten. You can search for desired key words in one or several log files at once. You can also save the desired files onto your computer.

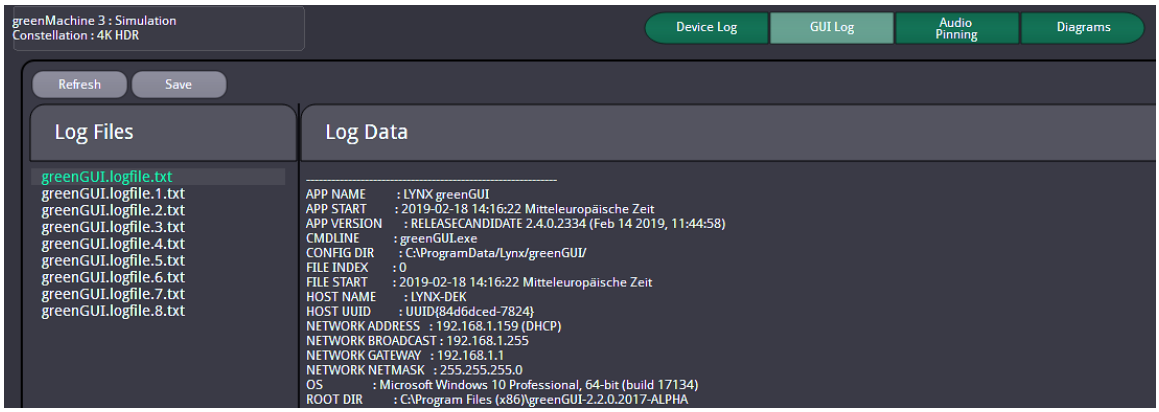
The current log file is called “gmGUI.logfile.txt.”



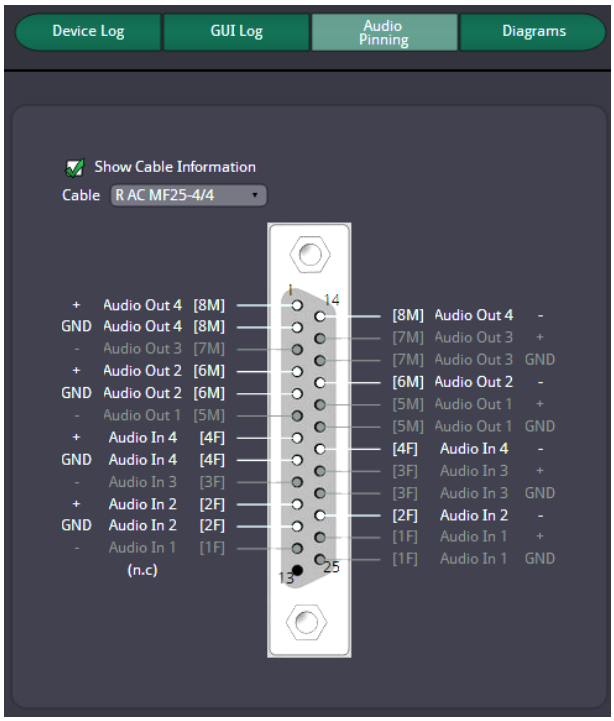
GUI Log Subpage

On this page you can access the last 9 log files of the greenGUI. You can search for desired key words in one or several log files at once. You can also save the desired files onto your computer.

The current log file is called “greenGUI.logfile.txt”.



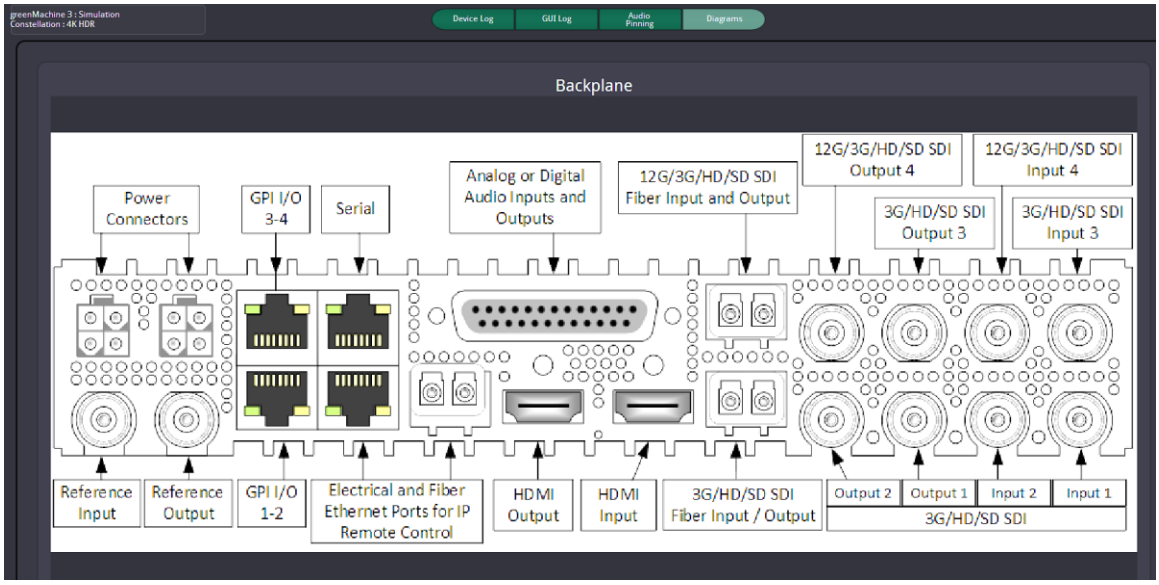
Audio Pinning Subpage



On this page you can see in detail the audio pinning information for the external audio inputs and outputs.

Diagrams Subpage

This page shows the rear connection panel information of the greenMachine.



Constellation Page - Constellation Licensing

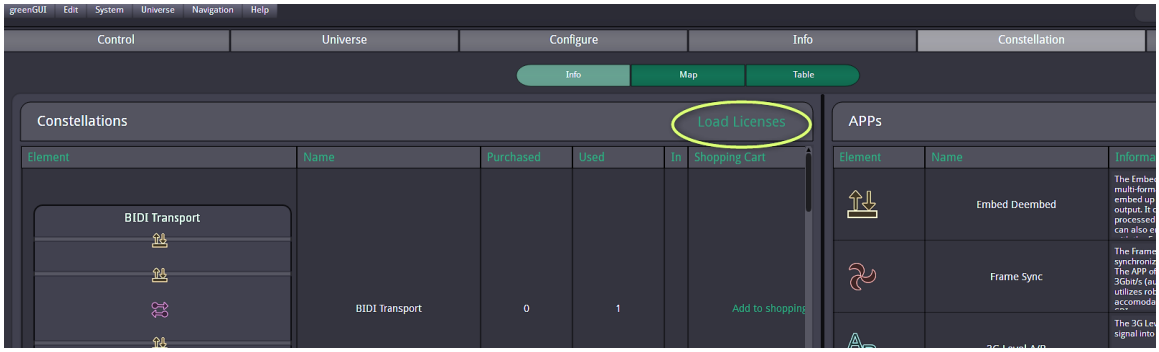
A greenMachine serial number is necessary to buy a constellation license. The license is loaded into the greenMachine with this specific serial number. This machine is now the “owner” of the license.

Licenses are shared in the universe. If the original owner of license A for Constellation A, gets Constellation B deployed, license A is now available for a different machine to use. If a different machine deploys Constellation A, it will take license A away from the original machine. When license A is no longer needed on the other machine, for instance, Constellation C with license C is deployed, license A moves back to the original owner. If the original machine is not currently in the network at that time, the license will remain with the other machine. When the original machine comes back into the network the license will automatically move back to the original owner.

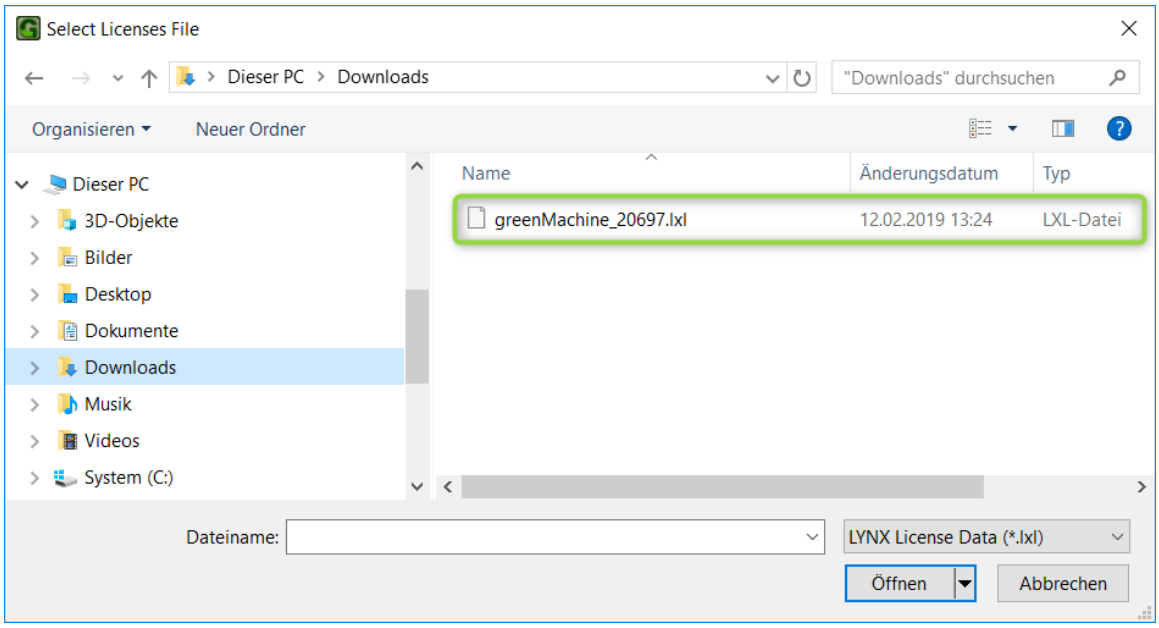
When a greenMachine, which has licenses is powered down or removed from the network, its licenses are not available anymore. You can export the licenses to another greenMachine before doing this, using the export dialog in the Constellation-Map page. A new serial number must be provided, so the owner of the license can be changed.

Load Additional Purchased Licenses

When an additional constellation license is required it must be purchased from the local LYNX representative. The license will be sent via e-mail as an attached .lxl file and can be stored in a folder of your choice on the greenMachine control-network computer running greenGUI. Then simply open greenGUI and click on the “Load Licenses” button in the Constellation-Info tab (see below) and it will be added to the ‘Purchased’ and ‘Unused’ Licenses columns, ready to deploy to the greenMachine of choice.



A window will pop up where you can select available license files (filename.lxl).



Select the required license file (filename.lxl) and “open” it.

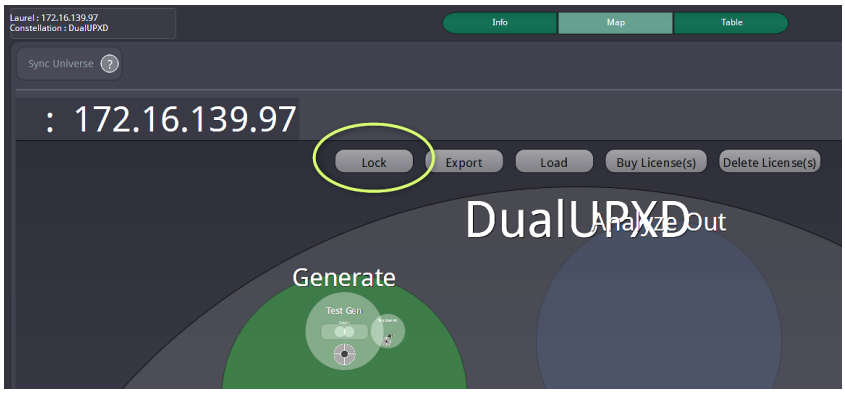
Note: *The serial number of the connected greenMachine must match with the serial number in the license file*

Locking

There are two types of locking in the greenGUI

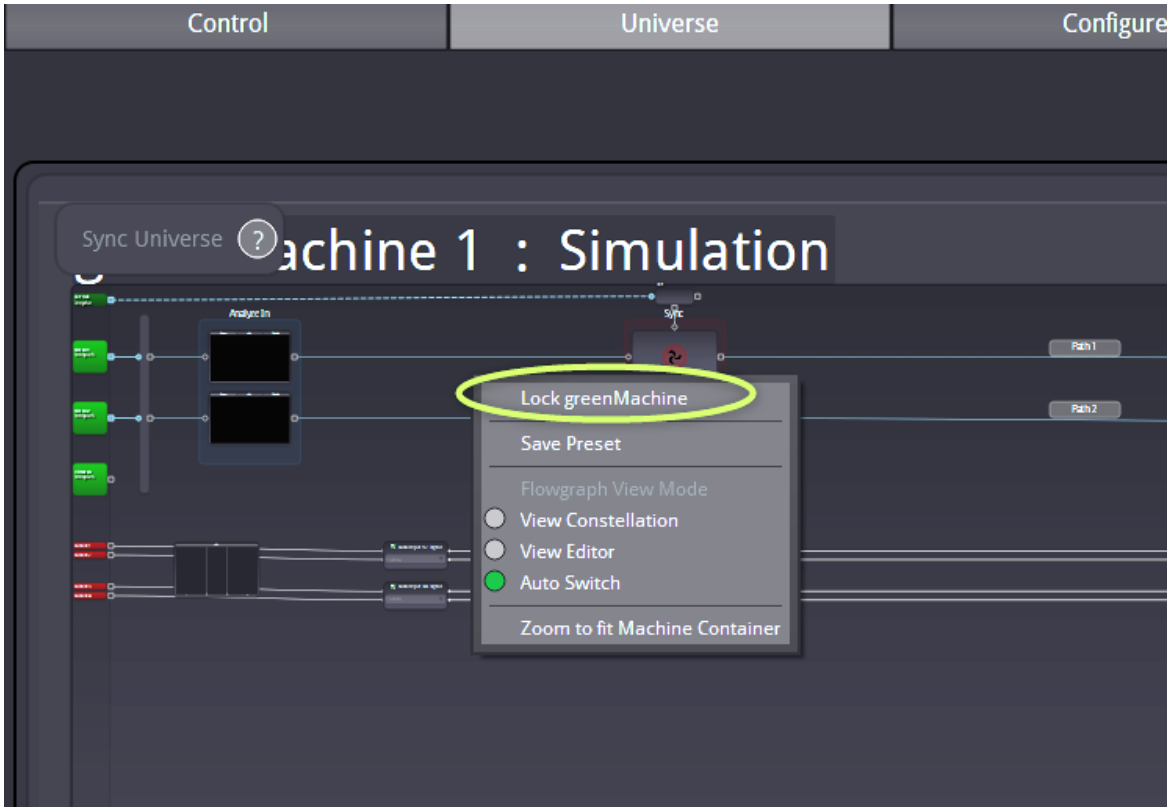
License Lock

This form of locking is performed in the Constellation Map subpage. When the lock is on, it takes the machine out of license sharing, meaning it will not give up a license even if it is not using it.



Machine Lock

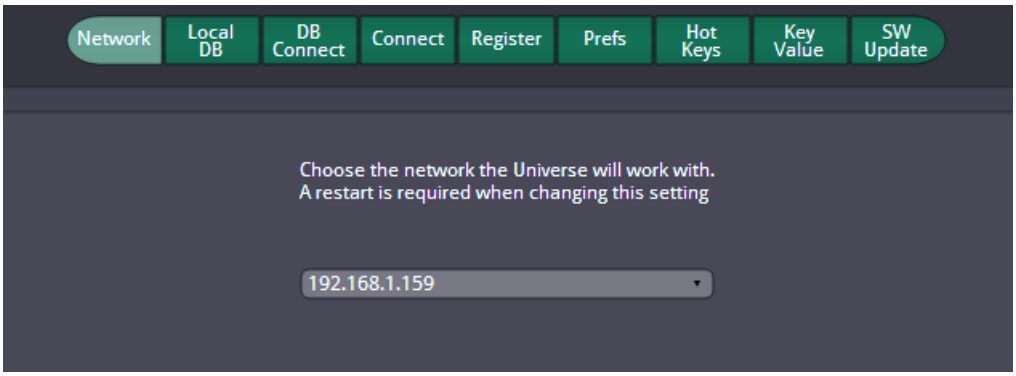
This form of locking can be activated from the context menu of a selected greenMachine in the Universe View. To open the context menu just right click into the view of the respective greenMachine. It locks the current constellation configuration in the machine, meaning it is not possible to deploy a different constellation



GUI Settings Page

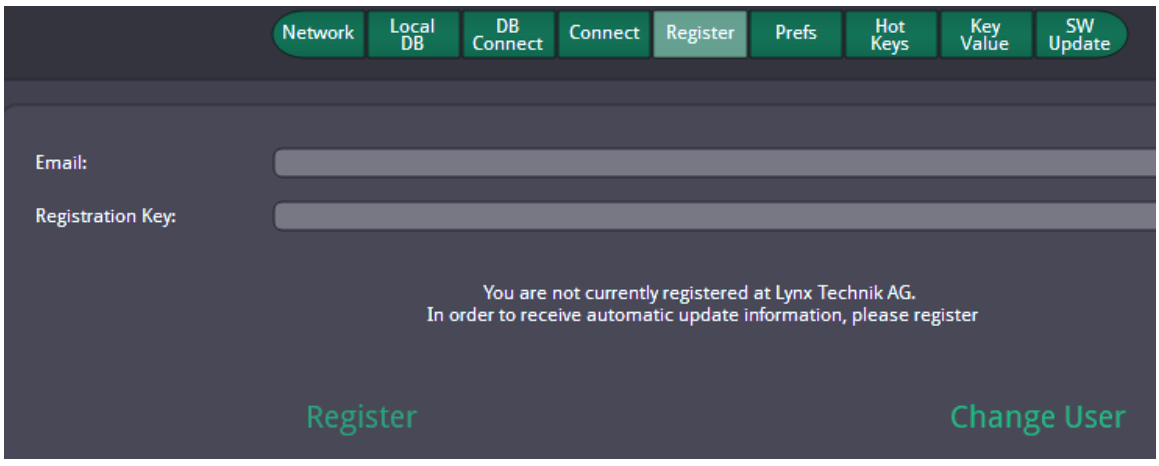
Network Subpage

If the computer, where the greenGUI is running, has the possibility to connect to several Networks, the ***Network* Subpage** will enable you to select in which of these Networks the greenMachines are located.



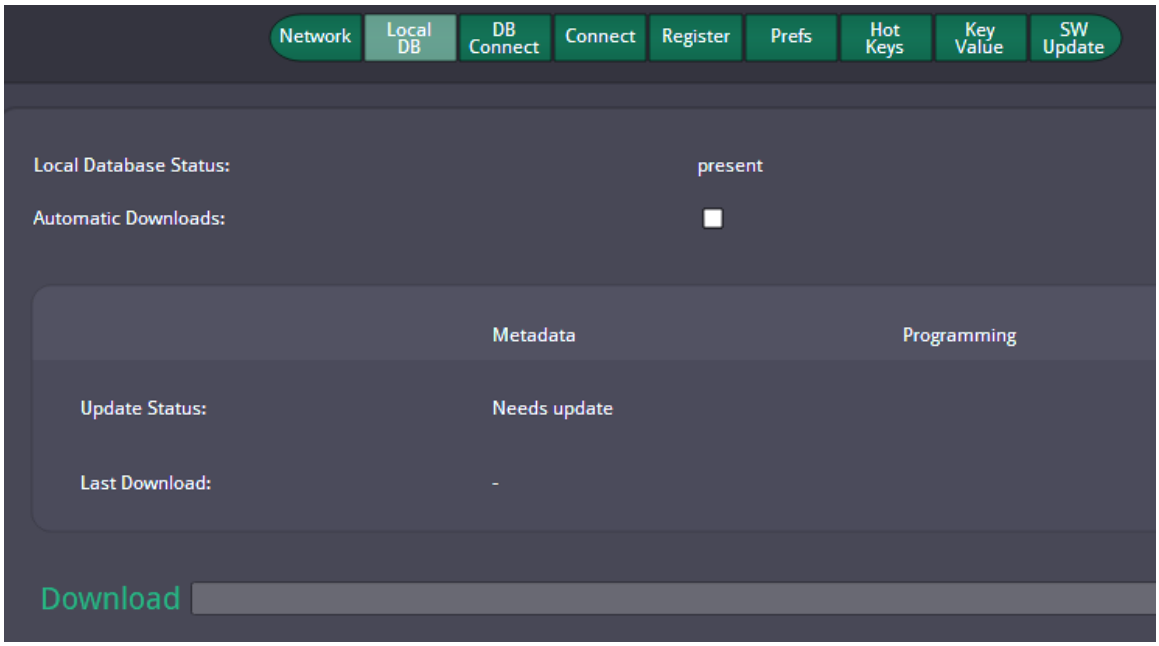
Registration Subpage

To receive automatic update information for your greenMachine modules, a Registration is necessary. This can be done on the ***Registration* Subpage**.



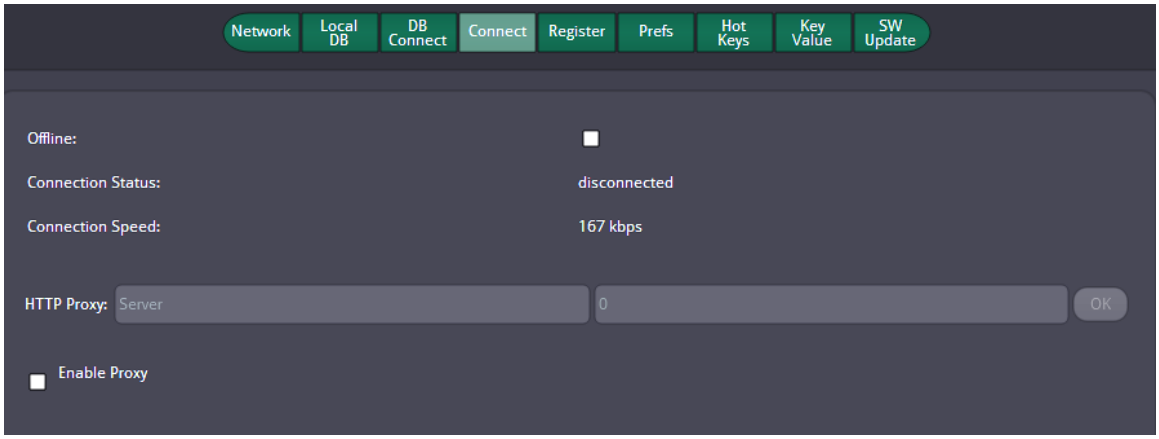
Local DB Subpage

In the ***Local DB* Subpage** you can define the synchronization of update data with the LYNX Server to receive this automatic update information for your greenMachine modules. You can either activate this synchronization manually by clicking the *Download* button or let the system automatically download available updates by checking the *Automatic Downloads* checkbox.



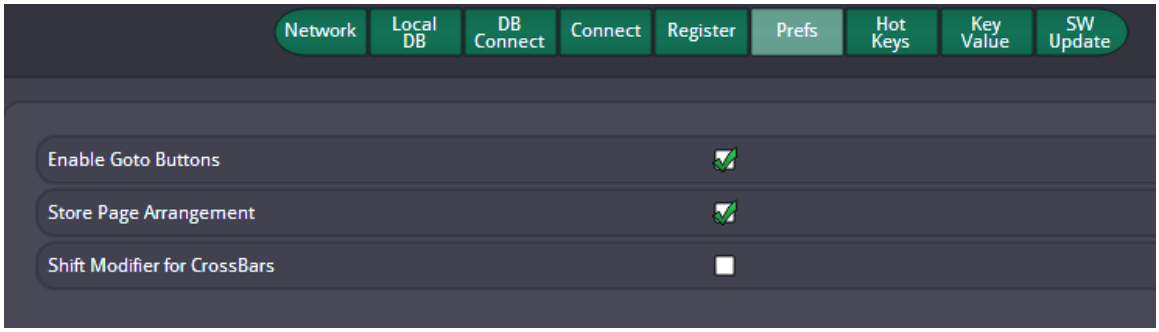
DB Connect and Connection Subpage

In the *DB Connect* and *Connection* Subpages you can check the state of your connection to the LYNX Server as well as define a proxy for this connection.



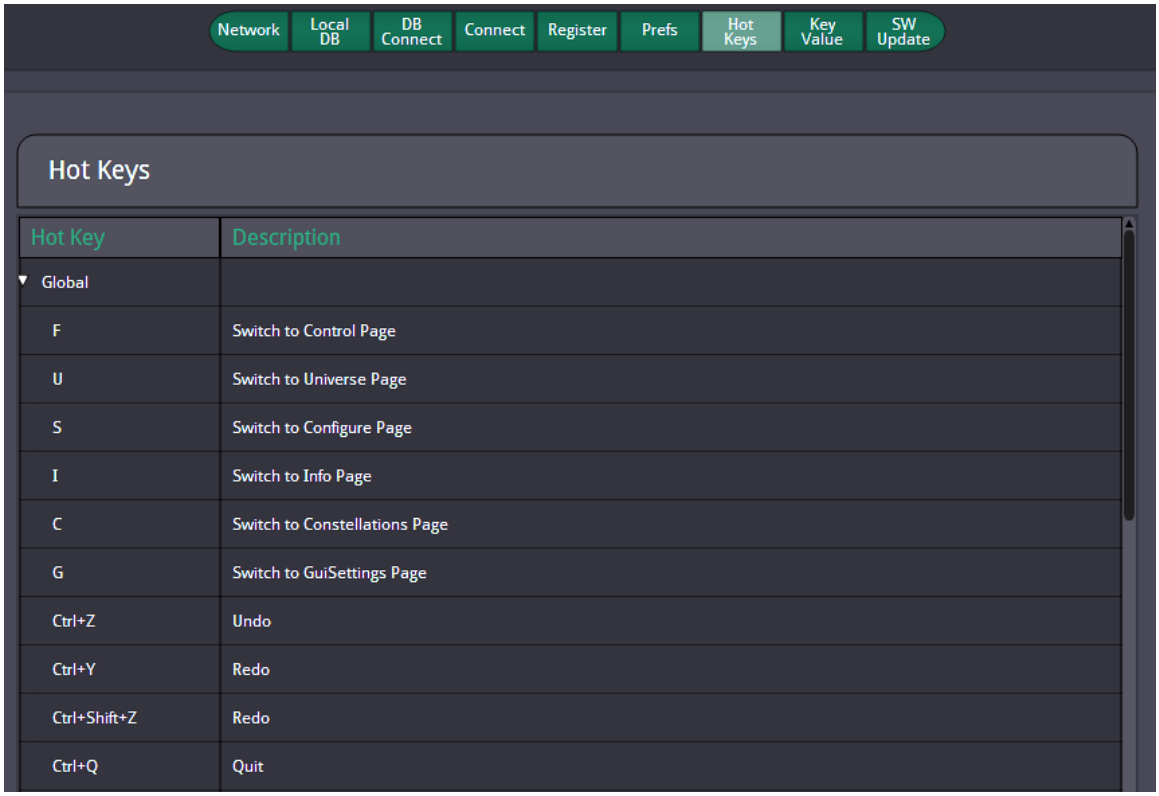
Pref(erences Subpage)

In the ***Pref(****erences)* **Subpage** you can choose to Store the Arrangements of the pages (Default). The *Software* Subpage leads you to connect to the LYNX Technik greenGUI download page on the website to get the newest version of the Software:
http://www.lynx-technik.com/support/download-area/greengui-software/



Hotkeys Subpage

In the ***Hot Keys*** **Subpage** you will find a list of keyboard short cuts for quick access to the most common GUI functions.



SNMP

With the Nova Controller (included in the basic framework) the greenMachine supports a standard SNMPv2 control interface which allows read and write access to all parameters of the system as well as generating SNMPv2 Traps.

Nova Controller Function

The MIB files (SNMP interface description) are available for download from:

http://www.lynx-technik.com/en/support/download-area/greengui/.

You will find detailed information about the SNMP support in greenMachine in the corresponding Quick Reference Guide available for download in our Knowledge Base at:

https://support.lynx-technik.com/.

GET/SET

Full GET/SET/WALK access is provided to all the parameters of the greenMachine. Regular SNMPv2 authentication is implemented.

SNMP Traps

In addition to the get & set access (explained above), all Events that a greenMachine generates can be sent as SNMPv2 Traps.

Every greenMachine provides an individual set of Events. Such Events will be set to ACTIVE state by the greenMachine to signalize an unusual state (such as e.g. “Video Proc 1: No Input” or similar). The individual set of Events per machine can be seen in the greenGUI on the *Events* subtab of the *Control* tab.

Whenever an Event of an individual greenMachine changes its state (from passive to active and vice-versa), an appropriate entry is added to the machine’s Logfile.

An optional SNMPv2 Trap can be sent to the network when the event status changes. This can be controlled from the greenMachine’s “Events” Tab in the greenGUI in the relevant SNMP Trap column (item 1, picture below).

The SNMP trap will be generated and sent from the greenMachine to the host that has been specified in the Server's SNMP target host (item 2). You can enter a list of multiple IP addresses, separated by a colon ':'.

Setting up SNMP Traps

LYNX Remote Control Interface

The LYNX Remote Control Interface is a technical alternative to the SNMP Remote Control Interface discussed in the previous section. The LYNX Remote Control Interface is available on port 2306 (TCP and UDP) and provides access to all readable and writeable parameters of the attached system.

There are certain advantages of the LYNX Remote Control Protocol over the SNMP Remote Protocol:

- It provides a very effective subscribe / callback mechanism. A remote controller does not have to send repeated read-commands (polling) to monitor an individual parameter
- It provides a dynamic query functionality which makes any kind of static interface description (like SNMP MIBs) obsolete. Instead the complete capabilities of the current system can be queried at runtime.
- It is very easy to develop / script / program since it is based on clear-text ASCII messages
- The LYNX Control system provides integrated debugging support which also makes it very simple to make yourself familiar with the simple scripting syntax

The technical documentation of the LYNX Remote Control Interface (one HTML page) is available free of charge from LYNX Technik. Please contact your local representative.

Supported Formats

Supported SDI I/O Formats

The module has two multi-format serial digital inputs with automatic input detection. The module will detect the following input standards and configure the input stage automatically for operation in the connected format. The supported SDI output standards are identical to the input standards.

SDTV Formats	HDTV Formats
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
3GBit/s Formats Level A	1080psf / 24Hz
1080p / 50Hz	1080psf / 25Hz
1080p / 59.94Hz	720p / 23.98Hz
1080p / 60Hz	720p / 24Hz
	720p / 25Hz
	720p / 29.97Hz
3GBit/s Formats Level B Dual Link	720p / 30Hz
1080p / 50Hz	720p / 50Hz
1080p / 59.94Hz	720p / 59.94Hz
1080p / 60Hz	720p / 60Hz
12GBit/s Formats - Single Link	
3840 x 2160p / 50Hz	
3840 x 2160p / 59.94Hz	
3840 x 2160p / 60Hz	
12GBit/s Formats – Quad Link 2SI A / B (4 x 3GBits/s)	
3840 x 2160p / 50Hz	
3840 x 2160p / 59.94Hz	
3840 x 2160p / 60Hz	

As the synchronizer uses a single studio reference input both processing paths should be in the same input frequency range (odd or even frame rate) as the reference for normal operation.

The output format frequency (or frame rate) is determined by the connected reference signal and the output will remain fixed to this reference regardless of the connected input signals.

Supported HDMI Input Formats

The module has an HDMI input with automatic input detection. The module will detect the following input standards and configure the input stage automatically for operation in the connected format.

Scaler Function

The supported HDMI output standards are identical to the input standards. If you are using the Scaler Function four further PC Formats are supported as listed below.

SDTV Formats	HDTV Formats
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
3GBit/s Formats	1080p / 23.98Hz
1080p / 50Hz	1080p / 24Hz
1080p / 59.94Hz	1080p / 25Hz
1080p / 60Hz	1080p / 29.97Hz
	1080p / 30Hz
PC Formats (with Scaler Function)	720p / 25Hz
VGA (640x480)	720p / 29.97Hz
SVGA (800x600)	720p / 30Hz
XGA (1024x768)	720p / 50Hz
WXGA (1280x768)	720p / 59.94Hz
	720p / 60Hz
4k Formats (HDMI 1.4b)	
3840 x 2160p / 50Hz 4:2:0 8bit	
3840 x 2160p / 59Hz 4:2:0 8bit	
3840 x 2160p / 60Hz 4:2:0 8bit	

As the synchronizer uses a single studio reference input both input signals should be the same input frequency range (odd or even frame rate) as the reference for normal operation.

The output format frequency (or frame rate) is determined by the connected reference signal and the output will remain fixed to this reference regardless of the connected input signals.

Supported Reference Input Formats

The module has a very flexible input reference stage which facilitates the use of either SDTV analog bi-phase sync (i.e. black burst) or HDTV analog tri-level sync.

The reference input is “cross lock” compatible so an SDTV reference can be used to frequency lock HDTV signals (and vice versa). The connected reference is auto detected and the synchronizer automatically configures the outputs to the frame rate of the connected reference signal.

SDTV Analog Bi-Level Sync	**HDTV Analog Tri-Level Sync**
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
HDTV Analog Tri-Level Sync	1080p / 23.98Hz
720p / 23.98Hz	1080p / 24Hz
720p / 24Hz	1080p / 25Hz
720p / 25Hz	1080p / 29.97Hz
720p / 29.97Hz	1080p / 30Hz
720p / 30Hz	1080psf / 23.98Hz
720p / 50Hz	1080psf / 24Hz
720p / 59.94Hz	1080psf / 25Hz
720p / 60Hz	

Connections

Video SDI

The greenMachine titan uses standard 75 Ohm BNC connectors for SDI connectivity. We recommend the use of high quality video cable for digital video connections to reduce the risk of errors due to excessive cable attenuation. The maximum cable lengths the module will support are shown below.

SDTV	420m Belden 1694A (270Mbits/s)
HDTV	240m Belden 1694A (1.4Gbits/s)
3GBit/s	150m Belden 1694A
12Gbit/s	85m Belden 4794R

NOTE: Due to the compact design of the connection plate it will be necessary to use a connection tool to secure the BNC video connectors.

Video HDMI

The greenMachine titan uses type A connectors with flange for its HDMI 1.4b video input and output.

LAN

The greenMachine titan uses a standard RJ45 connection for LAN connectivity. The RJ45 connection is used to provide TCP/IP network control connectivity into a control system.

Optical Fiber

The greenMachine titan provides LC connectors for single mode fiber cables. This can be used for Video and LAN connectivity. The required SFPs have to be ordered separately.

Multimode fiber cables can be used also, but this will limit the maximum fiber length to approximately 1km.

NOTE: Please take care that surfaces of fiber cables and LC connectors are always protected against scratching and dust if no fiber cables are connected. Dust and/or scratches will lead to high attenuation of the optical power transmitted.

Audio

The greenMachine titan has a female Sub-D 25 connector for external audio interfacing. It has four input connections and four output connections. The connections can be configured for digital or analog audio.

Pinning

The pin layout of the connector is given in the table below.

Pin Number	Connection	Pin Number	Connection
1	Audio Output 4 +	14	Audio Output 4 -
2	Audio Output 4 GND	15	Audio Output 3 +
3	Audio Output 3 -	16	Audio Output 3 GND
4	Audio Output 2 +	17	Audio Output 2 -
5	Audio Output 2 GND	18	Audio Output 1 +
6	Audio Output 1 -	19	Audio Output 1 GND
7	Audio Input 4 +	20	Audio Input 4 -
8	Audio Input 4 GND	21	Audio Input 3 +
9	Audio Input 3 -	22	Audio Input 3 GND
10	Audio Input 2 +	23	Audio Input 2 -
11	Audio Input 2 GND	24	Audio Input 1 +
12	Audio Input 1 -	25	Audio Input 1 GND
13	n.c.		

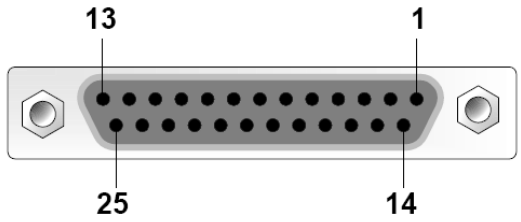


Image 8: Sub-D 25 Female Connector

It is recommended to use high quality screened (twisted pair) cable for the balanced audio connections. LYNX Technik provides optional audio breakout cables which will bring out all audio connections to in line XLR connectors: model number R AC MF 25-4/4, R AC M 25-8 or R AC F 25-8.

Analog - Digital Configuration

The audio inputs and outputs can be configured as analog or digital interfaces. When configured as analog interfaces, a maximum of four analog audio inputs/channels and four analog audio outputs/channels are available.

When configured as digital interfaces, a maximum of four AES inputs (eight audio channels) and four AES outputs (eight audio channels) are available.

When set to analog, the full-scale level adjustments are added to the inputs and outputs.

General Purpose Interface (GPI)

The greenMachine titan provides four inputs and four outputs General Purpose Interfaces (GPI) via an RJ45 connector. The pinning of the RJ45 connector is according to TIA/EIA 568-B. The pin layout is given in the table below:

Pin Number	Connection
1	GND
2	GPI IN 2
3	GPI OUT 2
4	GPI OUT 1
5	GPI OUT 1
6	GPI OUT 2
7	GND
8	GPI IN 1

Pin Number	Connection
1	GND
2	GPI IN 4
3	GPI OUT 4
4	GPI OUT 3
5	GPI OUT 3
6	GPI OUT 4
7	GND
8	GPI IN 3

No GPI functions are implemented yet. Will be added in future versions.

Power Supply Connectors DC1 and DC2 (PSU)

The greenMachine titan is equipped with two power supply connectors (DC1 and DC2) for primary and secondary power supply. Loop connecting two greenMachines is to be avoided. Do not connect and disconnect DC plugs under load. Disconnect AC power first. Refrain from high mating cycle counts.

Timing

The greenMachine titan will automatically add processing compensation delay for the video and audio to be aligned at the output.

In addition to this, when the Timing function (depending on licensed constellation) is activated, up to 30 frames of manual delay can be added to each video processing output (15 frames for Level B Dual Link) as well as AES based audio delay (up to 1.3s).

Timing function

The external audio outputs can also be manually delayed on an AES base and/or tracked to any of the video processing outputs (i.e. adding the automatic processing compensation of the respective video proc output to the audio output).

Specifications

SDI Input	3x SDI video on 75 Ohm BNC connector SMPTE, 292M, 424M, 259M with automatic video format and standard detection Electrical Return Loss: >15dB from 5MHz to 1.5GHz, >10dB from 1.5GHz to 3GHz Automatic cable EQ (Belden 1694A cable) 420m @ 270Mbit/s, 240m @ 1.5Gbit/s, 150m @ 2.97Gbit/s
12G SDI Input	1x 12G SDI video on 75 Ohm BNC connector - SMPTE 292M, 424M, 259M, 2081, 2082 with automatic video format and standard detection Return Loss: same as 3G SDI; >7dB to 6GHz; >4dB to 12GHz/ Automatic cable EQ (Belden 4794R cable): 85m @ 12Gbit/s
HDMI Input / Output	1x 10bit HDMI 4k/UHD 1.4b
Optical I/O (Optional)	1x 3G SDI SFP Transceiver (SMPTE 297M - 2006) 1x 12G SDI SFP Transceiver (SMPTE 292M, 424M, 2081 2082) - no SD SDI (270MBit)
Ethernet (LAN)	1x 10/100/1000 BaseT RJ45 Connector
Reference Input	1x analog video reference on 75 Ohm BNC connector Analog bi-level (SDTV) or tri-level (HDTV) auto detect and cross lock capability
Optical Ethernet (Optional)	IEEE 802.3z 1000Base-X Gbit/s Ethernet over Fiber at 1 Gbit/s (125 MB/s)
GPI I/O	4x general purpose inputs + 4x general purpose outputs - RJ45 Connectors
SDI Output	3x SDI video on 75 Ohm BNC connector (SMPTE, 292M, 424M, 259M)
	Timing jitter: < 0.2 UI @ 270Mbit/s, < 1.0 UI @ 1.5Gbit/s, < 2.0 UI @ 2.97Gbit/s Alignment jitter: < 0.2 UI @ 270Mbit/s, < 0.2 UI @ 1.5Gbit/s, < 0.3 UI @ 2.97Gbit/s Electrical Return Loss: >15dB from 5MHz to 1.5GHz, >10dB from 1.5GHz to 3GHz
12G SDI Output	1x 12G SDI video on 75 Ohm BNC connector - SMPTE 292M, 424M, 259M, 2081, 2082 Return Loss: same as 3G SDI; >7dB to 6GBit/s; >4dB to 12GBit/s
Serial Data	EIA/ETA RS232C / RS422 /RS 485 (selectable through greenGUI) - RJ45 connector ESD protection for up to 16kV
Reference Output	1x analog video reference on 75 Ohm BNC connector Analog bi-level (SDTV) or tri-level (HDTV), cross lock capability
Audio I/O	4x input and 4x output on Sub-D 25 female connector Analog: input impedance >10k Ohm, Output Impedance 150 Ohm Analog I/O full scale level: selectable 12, 15, 18, 20, 22, 24 dBu Digital: AES3 balanced transformer isolated Digital output level: 4V peak to peak nominal
Power	Max. 12VDC @ 45W nominal (supports 7 - 24VDC input range) 2x power connections for redundant power supply
Mechanical	W: 218mm (1/2 19”), H: 44mm (1.75”), D: 225mm (8.86”) - including connectors Weight: 1,1kg (2.43lb)
Ambient	Temperature: 5°C to 40°C (41 F to 104 F) maintaining specification Humidity: 90% maximum, non-condensing
Model #	GM 6840-1 EU - (EAN# 4250479325470)
	GM 6840-1 UK - (EAN# 4250479325487)
	GM 6840-1 US - (EAN# 4250479325494)
Includes	greenMachine, primary power supply and AC power cord, SubD 25 audio adapter PCB and quick reference guide (Constellation license not included - purchased separately)

Technical Support

If you have any questions or require support please contact your local distributor for further assistance.

Technical support is also available from our website:

http://support.lynx-technik.com/

Please do not return products to LYNX without an RMA. Please contact your authorized dealer or reseller for more details.

More detailed product information and product updates may be available on our web site:

www.lynx-technik.com

Contact Information

Please contact your local distributor; this is your local and fastest method for obtaining support and sales information.

LYNX Technik can be contacted directly using the information below.

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LYNX Technik manufactures a complete range of high quality modular interface solutions for broadcast and Professional markets, please contact your local representative or visit our web site for more product information.

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Broadcast Television Equipment