UFG Console

User Manual

UFG-06 Nopea
UFG-04 DP
UFG-04 HDMA
UFG-04 LVDS
UFG-04 LVDS Quad

/// UNIGRAF

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CE Mark

The UFG-04 and UFG-06 Series Frame Grabbers meet the essential health and safety requirements, is in conformity with and the CE marking has been applied according to the relevant EU Directives using the relevant section of the corresponding standards and other normative documents.

Warning	This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures

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Table of Contents

QUICK START GUIDE

This is a reduced version of the UFG Console configuration instructions. If you feel quite confident with installing new hardware and software in your PC you can attempt this procedure. The instructions are the same for installing all UFG board types.

► Uninstall any previous version of UFG Software

► Power off your PC

► Insert your UFG board in a vacant PCI Express slot in your PC.

► Boot the Windows system and log in. Administrator's privilege is required for performing the installation.

► Run **UFG Setup** application on the CD. It will install needed software and drivers.

Note   Please note that you must install the UFG board device drivers in the *UFG Setup*.

► Start the **UFG Console** application and select your board. The software will verify that the firmware in your UFG board matches the version of the UFG Console.

► If you need to update the firmware please follow the instructions in the dialog and select the firmware file that matches your UFG board type.

► After that in the dialog select the UFG board and the used video input. For controlling the board and using the advanced function of the tool, please refer to chapter *Using UFG Console* later in this document.

1. ABOUT THIS MANUAL

Purpose

This guide is the User Manual of **UFG Console** user interface for use with **UFG-06 Nopea, UFG-04 DP, UFG-04 HDMA, UFG-04 LVDS** and **UFG-04 LVDS Quad** capture boards in a PC with Windows XP or Windows 7 Operating System.

- Give an overview of the product and its features.

- Give instruction for the user on how to install the board.

- Give instructions for the user on how to install the related software drivers in a PC.

- Assist the user in configuring the capturing process with the user interface.

- Give instructions for the user how to capture images.

Product and Driver Version

This manual explains in the following versions the product and the related software:

	Version	Issued
UFG-04 Setup	3.2	27.03.2012
UFG-06 Setup	1.3	20.09.2012

Notes

On certain sections of the manual, when important information or notification is given, text is formatted as follows. Please read these notes carefully.

Note	This text is an important note

2. INTRODUCTION

UFG Console

UFG Console is a source analysis and debugging utility for use with UFG-04 and UFG-06 Series frame grabber boards. UFG Console API functionality is based on the API included **UFG SDK**. All functions (Except HDCP enabling functions) found in the UFG Console API can be implemented by a custom utility by using the UFG SDK.

Each UFG capture board has their individual device drivers and set of custom functionality. Most of the functions, however, are common to all UFG boards.

UFG-04 and UFG-06 Nopea Test Frame Grabbers

UFG family frame grabbers are PCI Express (PCIe) bus compatible boards. The functionality is based on the combination of the driver SW in the PC and a dedicated hardware with a receiver chip and an advanced FPGA design. The FPGA controls the data stream from the receiver to the on board buffer memory and to the PC over the PCIe bus.

All UFG-04 family boards share the same basic design architecture and performance. The main differences are based on the capabilities of the video interface in question. The common features for all UFG boards are the following:

	UFG-06 Nopea HDDP	UFG-04 DP	UFG-04 HDMA	UFG-04 LVDS	UFG-04 LVDS Quad
Inputs	2 x HDMI 1 x DP	1 x Display Port 1 x RS-232 for CTS tools	1 x HDMI 1 x DVI	2 x LVDS (single or dual channel LVDS)	4 x LVDS (single dual or quad channel LVDS)
Max timing	1920x1080p60 1920x1200p60 RB	2560x1600p60 RB	1920x1080p60 1920x1200p60 RB	1920x1080p60 1920x1200p60 RB	2560x1600p60(RB) 1920x1080p120
Max color depth	HDMI: 12 bits / color DP: 10 bits / color	10 bits / color	12 bits / color	10 bits / color	10 bits / color
HDCP	Yes	Yes	Yes	No	No
3D	Frame packing (p/i), Side-by-Side (h/f), Top-and-Bottom Bottom. L + Depth for UFG-06 Nopea only			No	No
Audio capture	No (TBA)	Yes	Yes	No	No
On-board frame buffer	2 or 4 GBytes	2 or 4 GBytes	2 or 4 GBytes	2 or 4 GBytes	2 x 2 or 2 x 4 GBytes
Programmable EDID	Yes	Yes	Yes	No	No
On board CRC calculation	Yes	Yes	Yes	Yes	Yes
Timing measurement	Yes	Yes	Yes	Yes	Yes
Other	HDMI 1.4	Full featured DP Reference Sink	HDMI 1.3 Deep Color	Programmable LVDS data mapping	Programmable LVDS data mapping

UFG-06 Nopea HDDP
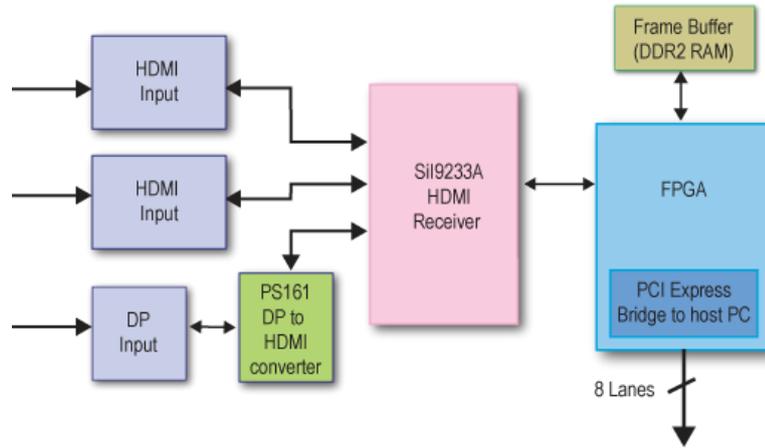
The UFG-06 Nopea HDDP has three connectors in its front panel:

- Two HDMI A Type connectors (top 2)
- One DisplayPort™ connector

One input can be selected at a time. The functionality of the two HDMI inputs is equal.
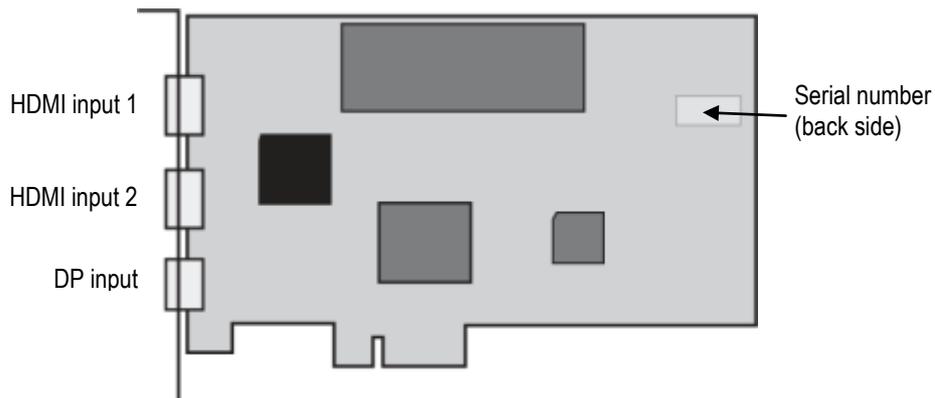
UFG-04 DP
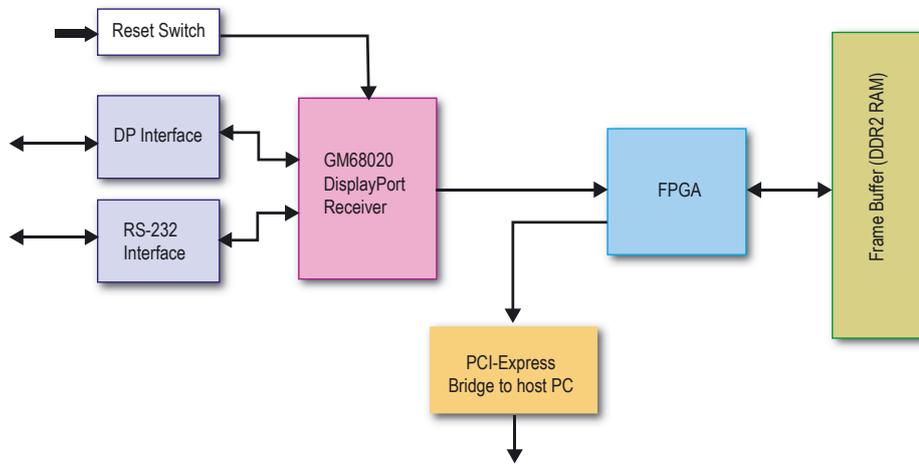
The UFG-04 DP has two connectors in its front panel:

- DisplayPort™ connector (upper)
- D-Sub 9 RS-232 connector used for CTS testing (lower)

Please refer to the illustration below for location of the connectors.
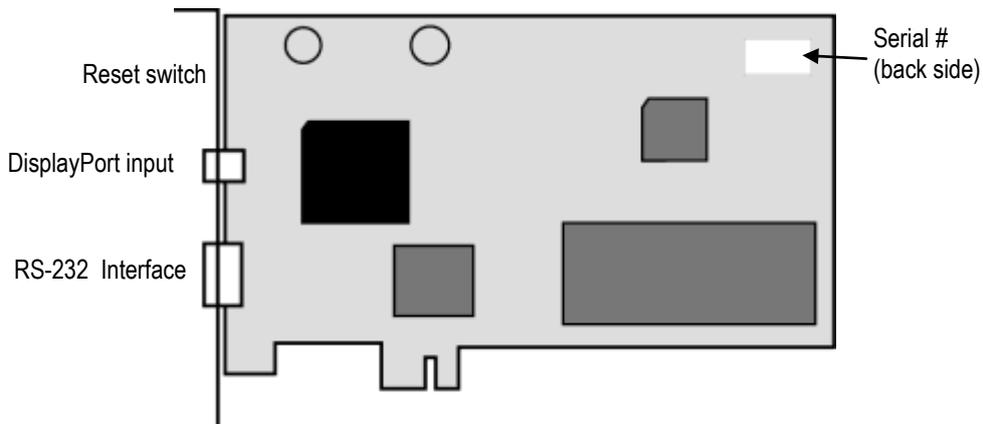
UFG-04 HDMA
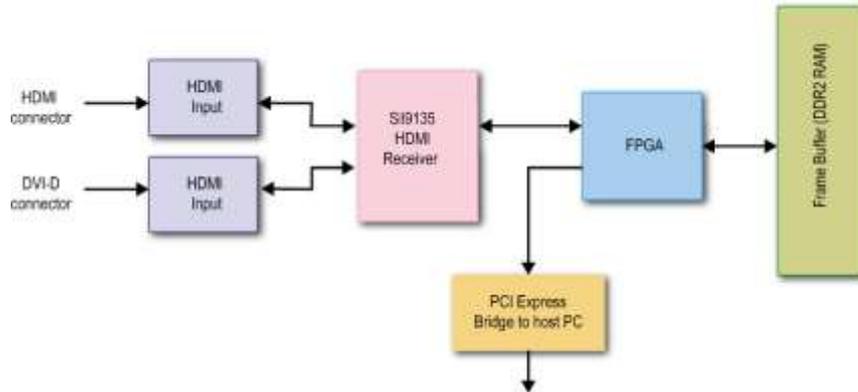
The UFG-04 HDMA has two connectors in its front panel:

- One HDMI A Type connector (top)
- One DVI-D connector

Both connectors input HDMI input stream and their functionality is equal. The DVI-D connector is provided mainly for its better mechanical properties in industrial environment.
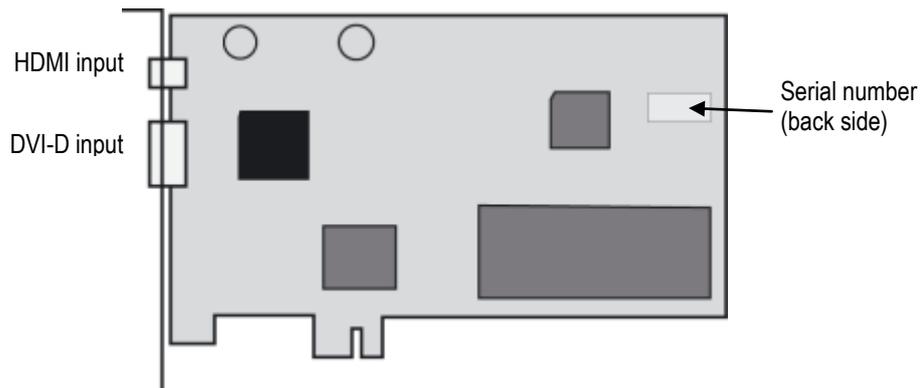
UFG-04 LVDS
UFG-04 LVDS Quad
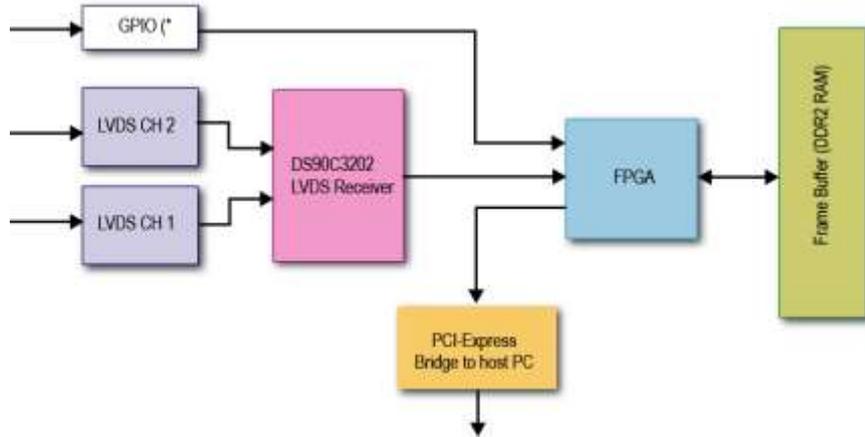
(* GPIO (General purpose I/O lines) is used for synchronizing the master and the slave boards in a multi-board capturing configuration.

The UFG-04 LVDS board has two MDR-26 connectors in its front panel. The LVDS channel configurations are explained in the following table.

LVDS Channel	Single Channel	Dual Channel	Quad Channel (Master and Slave board)
CH1	LVDS CH1	LVDS CH1	Master LVDS CH1
CH2		LVDS CH2	Master LVDS CH2
CH3			Slave LVDS CH1
CH4			Slave LVDS CH2

Quad channel mode uses *LVDS Mode 2*.
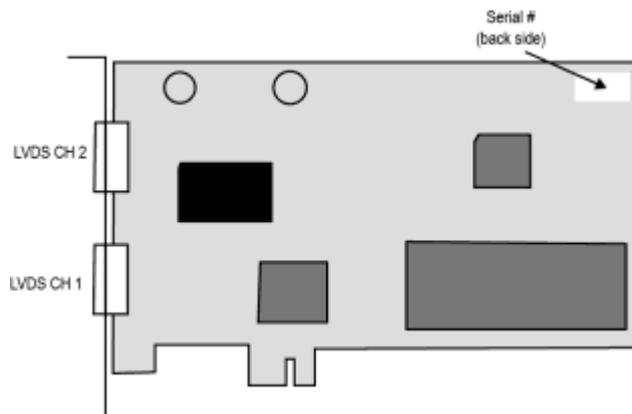
Version Information

The **Serial Number Label** gives information about the assembly version of the unit and the versions of the factory configured programmable devices on the unit.

This information and the version information of the software are available in **Help > About** box of the UFG Console software.

Note	Whenever contacting Unigraf for information or advice; please have this information available along with the version information of the software package used. You can copy & paste this information to e.g. an email.

3. INSTALLATION

Unpacking

The UFG Console product shipment contains

- The UFG board in an anti-static bag

- The *UFG Frame Grabbers Installation CD* containing the Console software, the SDK and the device drivers for Windows operating system. An electronic copy of this User Manual is included.

Warning	The UFG board is a highly dedicated electronic device that contains ESD sensitive components. Before opening the anti-static bag and always before touching the board, please be sure to ground yourself. You can do the grounding by wearing a special grounding strap or simply touching a grounded metal surface.

Contents of the Installation CD

UFG Console SW can be used either with UFG-04 or UFG-06 frame grabber boards. The user interface is the same but the device drivers and the installation package is different.

UFG-04 Installation package contains the following items:

- UFG-04 Setup utility for installing the software
- Windows device drivers for all UFG-04 boards
- UFG SDK for all UFG-04 board types with documentation and example source code
- FPGA firmware files individually for all UFG-04 board types
- User Manuals including this document
- Special *Stress Pattern* bitmaps for testing different features of the source DUT

UFG-06 Installation package contains the following items:

- UFG-06 Setup utility for installing the software
- Windows device drivers
- LVCA SDK with documentation and example source code
- FPGA firmware embedded in the software
- User Manuals including this document

Uninstalling the Previous Version

You can uninstall UFG Console and the device drivers by using the link in the Start Menu.

►   In the *Start Menu* select Unigraf > UFG > Un-install

The uninstall utility will ask you which components you would like to have uninstalled. It will also ask you if you would like the device drivers to be uninstalled.

If you are updating the software to a new version, you do not need to remove the license data. It will be valid for your new version too.

Note   Before installing version 3.X of the UFG Console it highly recommended that you uninstall the 2.X version software and drivers from your computer.

Installation of the UFG Console and API

The software setup utility will install all software needed to use the UFG-04 and UFG-06 series frame grabbers.

- UFG device drivers
- UFG Console Graphical User Interface (GUI)
- UFG SDK in case of UFG-04 setup
- UFG LVCA SDK in case of UFG-06 setup

The UFG Console and the UFG04 SDK are common to all UFG-04 boards, UFG LVCA SDK is used with UFG-06 boards. UFG Console will detect the board and provide the user the features applicable to that board type.

The 3.X series software package supports x32 and x64 editions of Windows 7, Windows Vista and Windows XP. It is recommended to use a PC with at least a dual-core CPU.

Note: Administrator's privilege is required for performing the installation.

For installing the UFG Console software perform the following steps:

►   Run the **UFG Setup** application from a CD or from your hard disk.

Installation with Windows 7

Before UFG04 Installation Wizard will start in Windows Vista or Windows 7 you may see a warning dialog. Click **Yes** to continue.

Previously installed version

UFG Software Package installer will check if there is a previous version installed. It is highly recommended that you uninstall all previously installed UFG Software packages from the PC prior to installing a new version. To do this, click **Yes** to uninstall the old package and to proceed into the installation wizard.

Once the installer has started a welcome page is displayed. The welcome page shows UFG Software package release version. Click **Next** to continue.

In the next dialogs you will able to define which software components are installed.

- *UFG Console* can be used to capture frames and to analyze the input video stream in several ways.

- *UFG SDK* and *UFG LVCA SDK* are used to create software utilizing UFG frame grabbers.

- *UFG Drivers* option will install the latest device drivers for UFG series frame grabbers. If this is the first time a 3.x release is installed on the computer, this option should be checked.

The next two dialogs will allow you to define the Start Menu folder used, the location in your PC where UFG SDK will be installed where the executable software will be installed.

When you are ready with the selections, click **Install** to start the installation.

Note   In previous releases, it has been possible to install the drivers manually. In this release, this is no longer possible.

If Device Driver installation was selected at the component selection page, the driver installation wizard will appear at some point. Otherwise, wait for the installation to complete and click **Finish** to exit the installation wizard.

Driver Installation

The driver installation wizard is started by the Software Package Installation program, if device drivers were selected in the component selection page. Click **Next** to continue.

Click **Continue anyway**, or **Install this driver software anyway** depending on the given warning type.

Once the drivers are successfully installed, the completion page will appear. Click **Finish** to exit driver installation wizard. If the wizard suggests that a reboot is required, select Restart Later to allow the *UFG Software Package* installer to complete the installation.

Once the UFG Software package installation is complete, a finish page is shown. If device drivers were installed, it is necessary to restart the system in order to complete the device driver installation. Click **Finish** to exit installation wizard.

Installation with Windows XP

It is highly recommend that you uninstall all previous versions of the UFG04 Software package without installing a new version.

▶ Click **Next** in the UFG software package Setup Wizard welcome page.
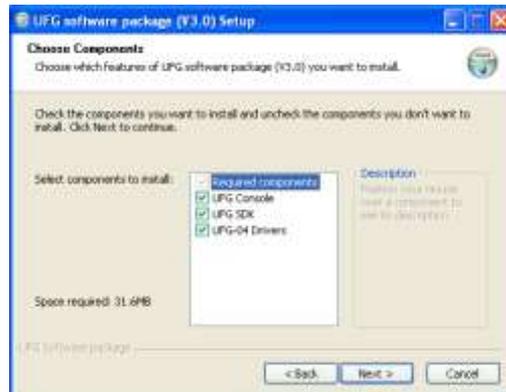
▶ In the *Choose Components* page you can select which software components will be installed.

Note	Please note that the device drivers can installed only with *UFG Setup.*

In the following three pages you can define the locations for the program shortcut, and the destination folder where the SDK and the Console will be installed. You can either type in the folder name or select it by clicking the **Browse…** button.

▶ Click **Install** to install the selected options. Click **Install Anyway** to the *Software Installation* and *Hardware Installation* pop-up windows.

▶ Click **Finish** to exit the Device Driver Installation Wizard.

▶ Reboot your PC to start using the newly installed drivers.

UFG License Manager

Starting from version 3.X of UFG Software Package *UFG License Manager* is now introduced as a separate tool. The purpose is to provide simple means to enter and save license keys for use in all software based on the UFG API. The UFG API users do not have to add a license manager in their applications, and simplifies the licensing on the API level.

The License Manager is automatically installed by the UFG Software Package installer.

Note	The user needs *administrator rights* to use the License Manager. In Windows Vista and Windows 7 this means that UAC dialogs may appear when LCM is started. Click **Yes** to continue.

Note	Please note that in order to the License Manager properly access the UFG board, the board Firmware needs to be updated to match the version of the UFG Software Package. Please refer to *Firmware Update* in *Chapter 5* of this document.

The License manager shortcuts are created in the start-menu at *All programs / Unigraf / UFG / Licensing /*. This folder will contain the following shortcuts:

- **Manage** launches *UFG License Manager* dialog. You can view the currently installed license keys, add new licenses or to remove old licenses.

- **Migrate licenses** allows you to copy license data from installations of older version of UFG Software Package the UFG Console over to the new licensing system.

- **Scan hardware** to scan for newly installed hardware, and request licenses as necessary.

Adding Licenses
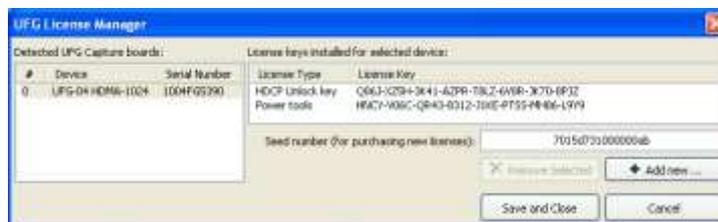
▶ To add a new license for an existing device, first select the device for which to add a license. The License Manager will first open the device for license key verification. This will take a few seconds.

▶ Once the device is open, click the **Add new...** button. This will open the license key entry dialog.

Make sure that the serial number and the seed number in your license sticker matches the information displayed in this dialog.

▶ Enter the license key exactly as printed on the license key sticker. Once the key is entered, click **Accept**.

The license key is verified at this point. If the verification succeeds, the new license key is added into the license list of the selected device. If the verification fails, you will be asked to check spelling and try again.

Note	The older license stickers don't show device serial numbers. In the case the serial number is not shown, please verify that the *Seed number* shown in the sticker matches the Seed number shown in the dialog.

▶ To remove a license, first select the device from which to remove the license. Once the license list appears, select the license key you wish to remove, and click Remove selected.

▶ To save the changes in the license key data click **Save and Close** in License Manager main dialog. **Cancel** will exit the License manager without saving.

Migrating Licenses

Migrate licenses allows you to copy license data from installations of older version of UFG Software Package the UFG Console over to the new licensing system. The tool will migrate all existing license codes saved by previous versions of UFG Software package (UFG Console). The old license data will not be deleted in the process.

Migrating licenses requires that the UFG-04 boards where the licenses are attached are installed in the system. Migration can be repeated after swapping boards if necessary.

Migration is mostly a silent operation. Once the migration is completed, a results dialog is shown.
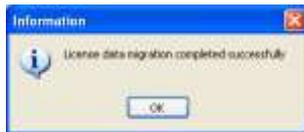
Note	Please note that in order to the License Manager properly access the UFG board, the board Firmware needs to be updated to match the version of the UFG Software Package. Please refer to *Firmware Update* in *Chapter 5* of this document.

Detecting new boards

Scan hardware shortcut of the tool will scan for newly installed UFG-04 or UFG-06 boards and to provide a possibility to enter licenses for any new boards found.

Note	Once a device is once found in scan mode, it will not be found with successive scans.

Note	UFG-04 LVDS boards do not feature licensed features and therefore do not include a Seed number in the license entry dialog.

4. FUNCTIONAL DESCRIPTION

UFG-06 Nopea HDDP Frame Grabber

UFG-06 Nopea HDDP frame grabber board is based on Silicon Image Sil9233A HDMI receiver chip. The board features full HDMI 1.4 functionality with HDCP support. The DisplayPort™ input is converted to HDMI using Parade Technologies PS161 chip. HDMI and DP streams up to VESA 1920x1200@60 (RB) and CEA 1080p60 can be captured. HDCP encrypted streams will be previewed in a HDCP compliant PC. Please refer to the full specifications in Appendix A.

UFG-04 DP Frame Grabber

UFG-04 DP is based on STMicroelectronics GM68020 DisplayPort™ receiver chip. The board features full DisplayPort™ Reference Sink functionality. The receiver chip automatically communicates with the DP Source device and assigns the input resolution and the other parameters of the display data. Please refer to the full specifications in Appendix A.

With proper software and firmware the user can capture individual display frames received from the source device. Additionally by using the DP LL CTS software that communicates directly with the receiver chip, the user can perform Display Port Link Layer Conformance Test steps. The link LL CTS software communicates with the chip with the RS-232 serial interface.

UFG-04 HDMA Frame Grabber

UFG-04 HDMA frame grabber board is based on Silicon Image Sil9135 HDMI receiver chip. The board features full HDMI 1.3 Deep Color functionality with HDCP support. HDMI streams up to VESA 1920x1200@60 (RB) and CEA 1080p60 can be captured. Please refer to the full specifications in Appendix A.
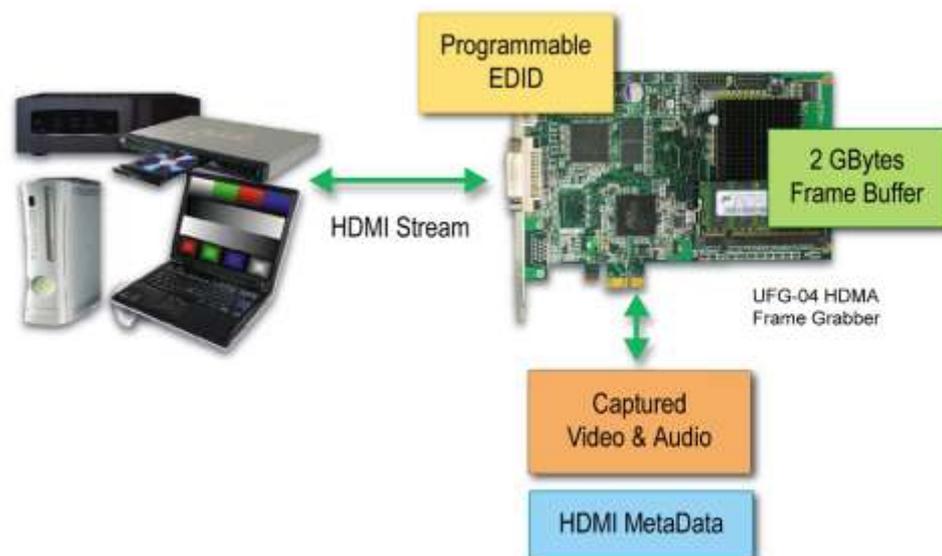
UFG-04 LVDS and UFG-04 LVDS Quad Frame Grabbers

UFG-04 LVDS frame grabber features a 10 bits/color high speed LVDS receiver / de-serializer (DS90C3202) that is capable of receiving 7-bit serialized LVDS data in single or two channel mode. Additionally, a two board combination enables receiving LVDS data in four channel mode. Please refer to the full specifications in Appendix A.

In single pixel mode only LVDS CH 1, the lower input connector is used. In two channel mode even pixels (pixels 0, 2, 4 …) are connected to LVDS CH 1, the lower input connector, and odd pixels (pixels 1,3,5 …) are connected to LVDS CH 2, the upper connector. Please refer to *Introduction* earlier in this document for details.

The LVDS input connectors are 26 pin Mini D Ribbon (MDR-26) compatible. The pin configuration is compliant with DISM 1.0 standard. Please find the description of the pin-out in Appendix C of this document.

The maximum pixel clock of each input channel is 135 MHz. This enables a capturing speed of 135 Mpix/s in single channel mode and 270 Mpix/s in dual channel mode. Please note that the maximum capturing speed of the UFG-04 LV models is 165Mpix/s. The 270 Mpix/s capturing speed enables the capture of e.g. VESA 2560x1600p60 (RB) timing and 165 Mpix/s e.g. VESA 1600x1200p60 timing.

Two specially configured UFG-04 LVDS boards can be coupled together to enable four channel mode capturing. The master and slave boards are connected together with a synchronizing cable. The maximum capturing speed in four channel mode is 540 Mpix/s enabling the capture of 1080p @ 120 Hz.

The Master and Slave boards have to be connected together with a special synchronization cable provided by Unigraf. The synchronization will enable that the two boards are capturing their portions of exactly the same input frame.
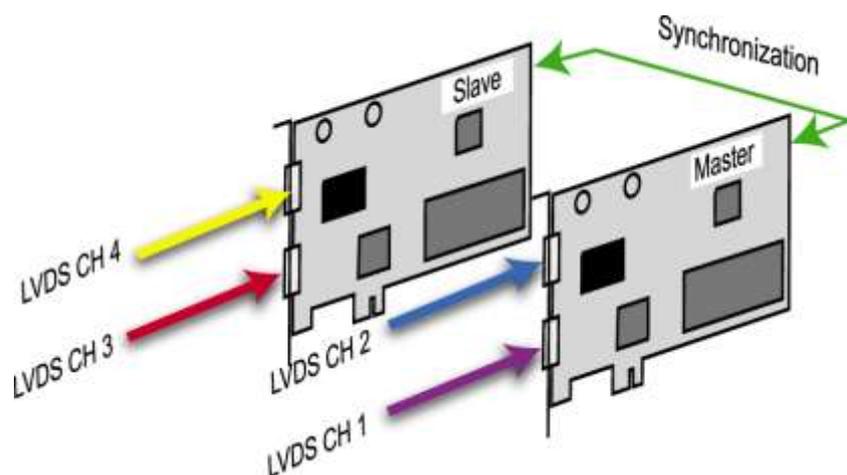
The mapping of the pixel data into LVDS data varies from one data source to another. In order to provide flexibility for the user UFG-04 LVDS features an internal data matrix for multiplexing the LVDS data to the input color bits. The multiplexer enables any pixel data combination to be used. It also enables the use of selectable pixel color depths. The setting of the multiplexer is identical for both input channels.

The UFG Console has pre-set standard mappings based on JEITA and VESA standards. For non standard mappings the user can change the mapping by editing the mapping table. Please refer to chapter LVDS Pin Mapping later in this document.

Extended Frame Buffer

UFG-04 and UFG-06 frame grabber boards include an on-board frame buffer that can store up to 4 Gigabytes of input video data at maximum speed and full 12 bit color depth without any frames lost. The frame buffer is a circular first in – first out memory. Frames can be captured to the PC simultaneously when new input frames are written to the buffer. When the buffer becomes full, the capture will be stopped and the user notified about the buffer overflow.

The storage allocation of the frame buffer is based on the size of the stored frames. The maximum number of frames that can be captured during Sequence Capture feature is dependent on both the capabilities of the PC and the bitmap type used for storing.

Please refer to chapter *Capturing and Storing a Sequence of Frames* later in this manual.
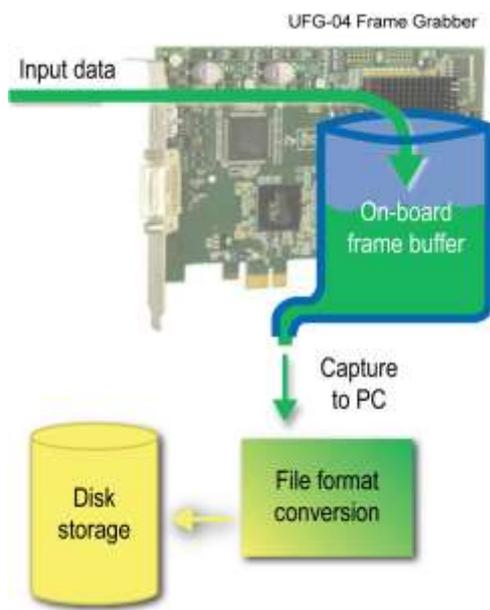
On Board CRC Calculation

The on-board FPGA of the UFG-04 and UFG-06 boards is able to calculate the CRC of the input video frames. The CRC is calculated from the R, G and B 16 bit color components taking into account color depth setting and the compare bit masks set. The CRC calculation is a very effective way of detecting differences in the frames. One color bit error in a single pixel will clearly be seen as a difference in the CRC.

The CRC calculation is used to implement the *CRC Compare* function in Compare utility. The CRC Compare can be used either to compare the current frame to the previous input frame or to a reference frame in the PC.

EDID

The EDID (*Extended Display Identification Data*) content of UFG-04 DP, UFG-04 HDMA and UFG-06 Nopea HDDP boards can be re-programmed by the user for emulation of various monitor types. This is a valuable feature while testing the performance of Source devices. Please refer to chapter *EDID Editor* later in this manual

Status Log

UFG-04 HDMA, UFG-04 DP and UFG-06 Nopea HDDP include a link status log feature. The *Status Log* detects all status, video, audio and InfoFrame related events from the HDMI link. With the time stamped list the user is reliably able to monitor the behavior of the Source device. Each message is parsed to easy to comprehend clear text. Specially combining the EDID and Status Log features provides the user a powerful tool for testing the compatibility of Source devices with different kinds of Sink devices.

For UFG-04 users the Status Log is included in the optional *Power Tools* software package. *Link Status* is an optional feature available in the basic UFG Console software.

HDCP

The UFG-04 DP, UFG-04 HDMA and UFG-06 Nopea HDDP are HDCP (High-bandwidth Digital Content Protection) compliant sink devices. They will enable the preview and analysis of the image content and the corresponding metadata of HDCP protected material in a PC where both the display adapter and monitor are HDCP compliant. The storage of the HDCP protected material is inhibited.

Note   Only applications provided by Unigraf can enable the HDCP protected content.

Licenses

Product licensing is slightly different between UFG-04 and UFG-06 boards. For UFG-06 Nopea HDDP you will need the license key for using all features of the UFG Console and UFG API. For UFG-04 boards only certain features of the UFG Console and UFG04 API require you to provide a *License Key*.

You can enter the key in the *License Manager* utility. For instructions, please refer to chapter License Manager later in this document.

A special license key is used with the UFG-04 DP, UFG-04 HDMA and UFG-06 Nopea HDDP boards for enabling the HDCP encrypted content. The *HDCP Unlock License* key is provided with each board. This key is used for making sure that the application requesting the HDCP encrypted content is provided by Unigraf.

5. USING UFG CONSOLE

UFG Console is a video capture and source analysis application for Unigraf Test and Measurement frame grabber boards. *UFG Console* is based on *UFG API* software application interface which is a powerful tool for users who want to write their own application for test automation. UFG Console uses several techniques in order to offer the full performance of the PC, including multi-threading and MMX Assembler optimization.

When launched, UFG Console will open the *UFG Console – Controls* window that will list all UFG-04 and UFG-06 frame grabbers found in the PC.
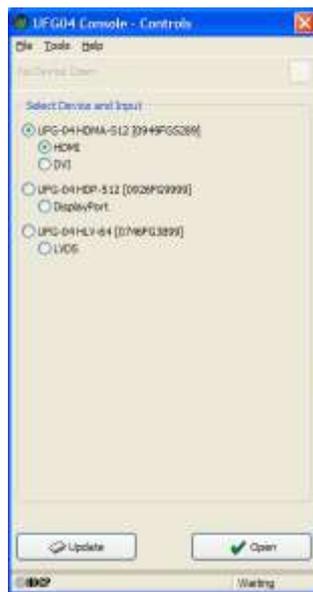
►   Please, select the desired board and input and click **Open**. A *Video preview* window is opened showing the captured data from the selected input.

Note: If the *Open* button is grayed out, it means that the firmware version on the board is not compatible with the version of the UFG Console software. Please refer to *Firmware Update* chapter below.

After a device is opened, UFG Console opens the *UFG Console Main* window. This window is used to show the live preview of the input video captured from the selected input and any snapshot or processed image contents.

The *UFG Console - Controls* is a separate window providing a set of control tabs depending on the type of the frame grabber being accessed. By default Controls window is minimized if the UFG Console window is selected. The full size is returned when the Controls window is selected. Please find the introduction of the UFG Console - Controls window later in this manual.

Firmware Update

When UFG Console software is launched, the compatibility of the firmware on the UFG board to the UFG Console version is verified. In case there is a mismatch, the *Open* button on the Start-Up menu is not enabled. The firmware update procedure for UFG-04 and UFG-06 board is different.

UFG-04 HDMA, UFG-04 DP and UFG-04 LVDS

▶   In the device menu select the board that you want to update and click **Update** button.
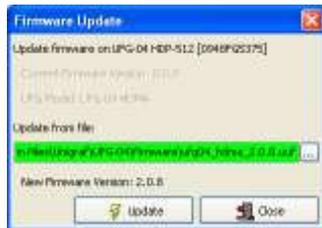
A firmware update dialog is opened. It informs the current firmware version on the board, and suggests the user the firmware file matching the current UFG Console software version. If the firmware file matching the software release is not found, the dialog suggests downloading the file from Unigraf website.

▶   The user can alternatively select the file manually by clicking the ellipsis (**...**) button next to the edit-box to open a file selector and select a firmware file.

▶   When the requested firmware file is selected click the **Update** button and **Yes** to start the update process.

Note:	Selecting incorrect firmware file for a board type will cause an error message to appear – It is not possible to load by accident a firmware version that is not suitable for the installed board.

UFG-06 Nopea HDDP

▶   Open *UFG-06 Control Center* from *Start > All Programs > Unigraf*.

▶   In the *Configuration Items* under the UFG-06 board that you want to update select **Firmware Update**

▶   The firmware file is embedded in the tool. Click **Update Firmware (to Vx.x.xx)**.

▶   **Restart the PC**

Update of UFG-04 DP Receiver Chip Firmware

The firmware of the DP receiver chip of UFG-04 DP board has to be done separately with the DP specific tools. You can use either *DP RefSink CTS Tool* or *DP Sink Console* for that. Please refer to the documentation in the *DP Tools CD* for details.

UNIGRAF

UFG Console Main Window

The *UFG Console* window shows the captured and processed image contents. The functionality shown on the UFG Console window reflects the tasks performed on the Control window. Several preview dialogs are layered in the Preview window by using tabs and selections. Please refer to the description the functionalities of the UFG Console for explanation of the data found in the UFG Console window.
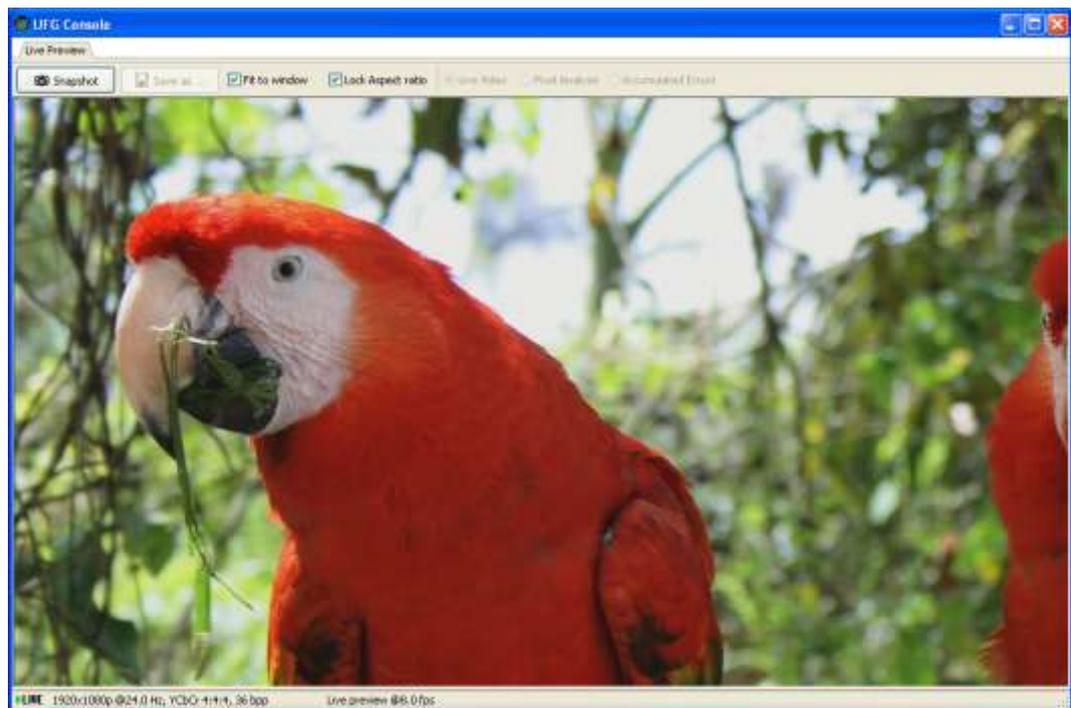
▶ To preview the captured image in whole, select **Fit to window**. To preview the captured bitmap with original pixel size, unselect it.

▶ To keep the aspect ratio of the captured image, select **Lock Aspect ratio**.

Video Status

On the status panel in the bottom of the UFG Console window, the user can see the status of the captured video. The **LIVE** text and the blinking green arrow indicate that a valid live video signal is detected and captured. In case no signal is detected in the selected input, the preview screen turns red with a text **No Signal**. Please see the image on the previous page.

To the right of the live indicator the status panel indicates the *captured video resolution*, *vertical frequency* (frame rate) and *pixel bit depth*. UFG Console preview function supports RGB and YCbCr input color formats. YCbCr 4:2:2 input color format is up-sampled to YCbCr 4:4:4.

The next indicator in the center of the bottom panel indicates the contents of the screen. In the case of the Live Preview it indicates the current *preview rate fps* (frames per second)

HDCP Status

When using UFG-04 DP, UFG-04 HDMA or UFG-06 Nopea HDDP board, UFG Console enables the user to preview and compare HDCP encrypted material in a HDCP compliant PC. UFG Console indicates its HDCP state on the left hand corner of the status bar in the bottom of the *UFG Console - Controls* window.
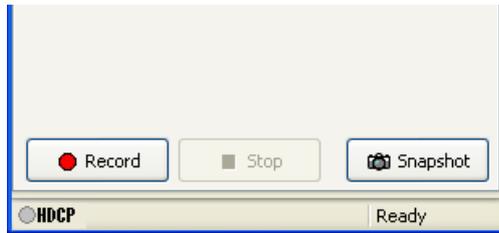
If the **HDCP indicator is gray**, it means that the input video is not HDCP protected
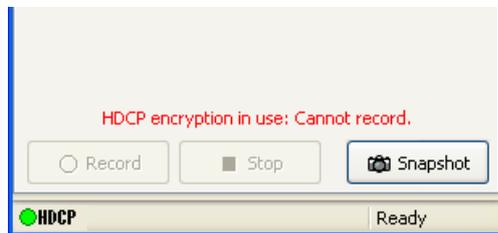
If the **HDCP indicator is green**, it means that the input video is HDCP protected and is displayed on a HDCP protected display
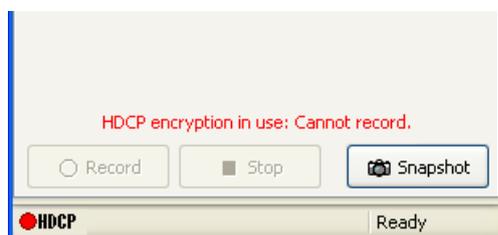
If the **HDCP indicator is red**, it means that the HDCP Unlock License is not set for this board. Please refer to chapter License Manager below for instructions on how to set the license
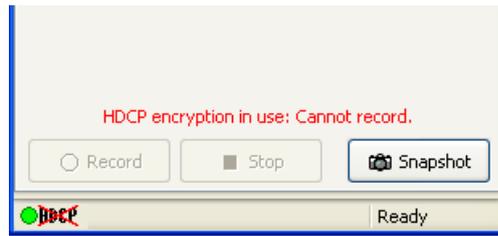
If the **HDCP indicator is green but the HDCP letters are crossed over**, it means that the HDCP protected video can't be displayed. This can happen because one or more components in the PC are not HDCP compliant and HDCP cannot be enabled. The preview window is filled with a warning text
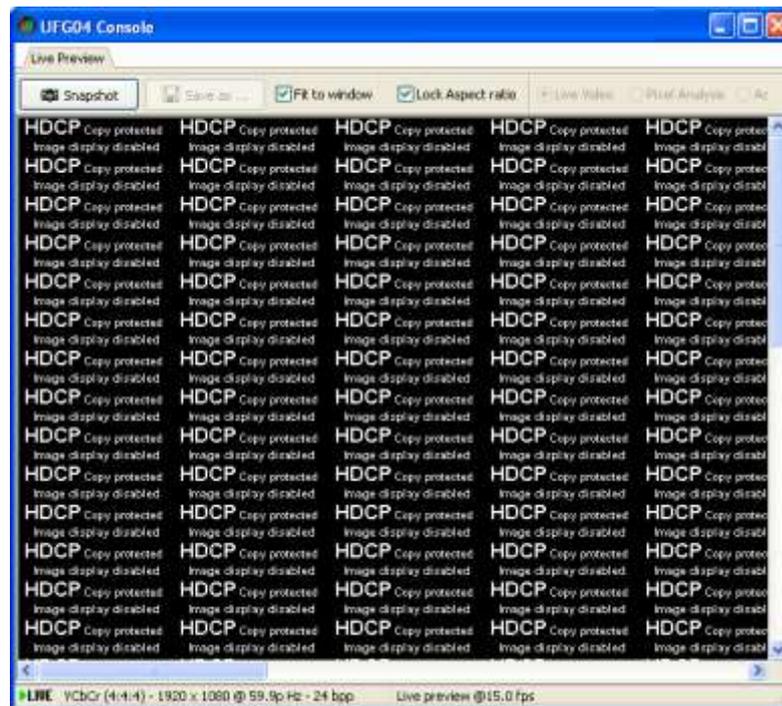
Controls Window – Main Tab

The *UFG Console - Controls* window provides a set of control tabs depending on the type of the UFG frame grabber model being used. Common control tabs for all board types are *Main* and *Frame compare*. The *Main* tab contains a dialog for storing captured frames and the *Frame compare* tab contains a dialog for testing and analyzing the captured frames.

The top of the *Controls* window indicates the current board and interface selected.

▶ In order to change the used board or interface click the **red button on the top right** of the *Controls* window.

The main tab of the Controls window allows the user to save the captured contents.

Capturing and Storing Single Frames

Click **Snapshot** to capture a single frame from the selected input. The captured frame will be shown on a new tab of the *UFG Console* window called Snap_xxx. "xxx" indicates the sequence number of the captured frame since the start of the preview or the latest change in the video mode.

Note:	You can take more snapshots even while viewing other snapshots.

Note:	Snapshots captured from HDCP encrypted content cannot be saved.

Note:	Please note that UFG Console preview and storage converts YCbCr 4:2:2 input color format to YCbCr 4:4:4 with up-sampling.

The bottom status line of the *UFG Console* window shows the color mode, the resolution and the pixel bit depth of the captured frame.

You can save the captured frame as a bitmap file on the disk by clicking the **Save as …** button. When the frame is saved the tab indicates the bitmap file name.
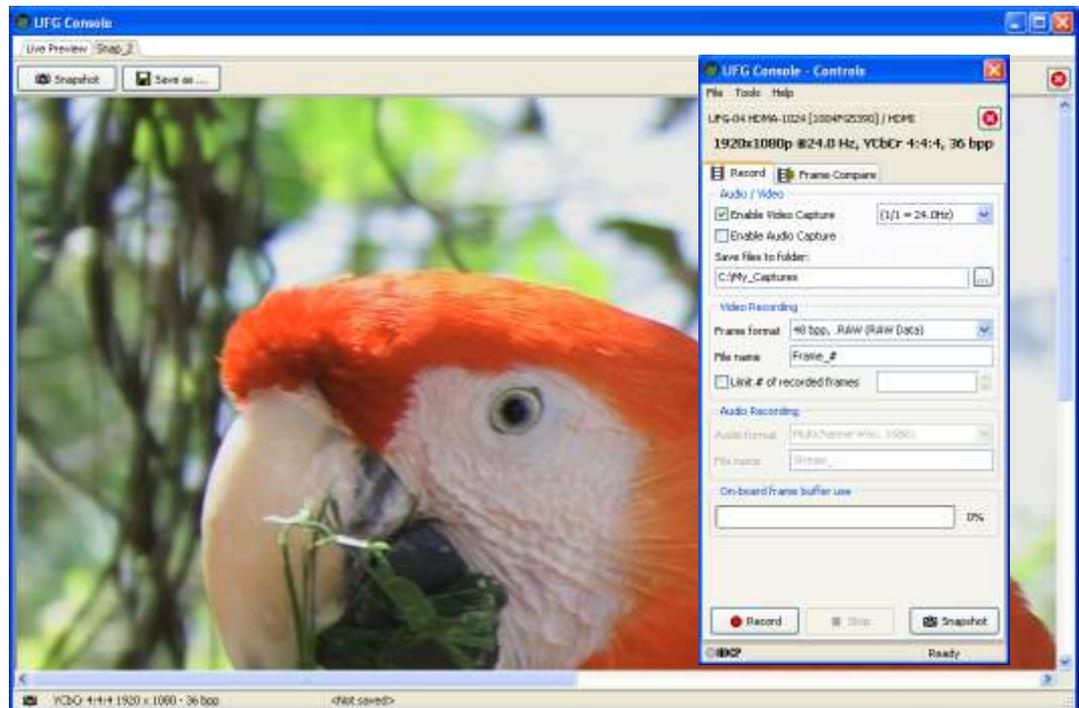
The possible save formats are listed in the table below.

Color format	Bit depth	Possible save formats
RGB	24 bpp	JPEG (.JPG), Portable Pixel map (.PPM), Portable Network Graphics (.PNG), Windows bitmap (.BMP), RAW Data (.RAW), and ASCII (.ASC)
	30 or 36 bpp	(PPM), Portable Network Graphics (PNG), RAW Data (.RAW), and ASCII (.ASC)
YUV	24 bpp	JPEG (.JPG), RAW Data (RAW), and ASCII (ASC) UYVY 4:2:2 (.YUV, decimated), IYU2 4:4:4 (.IYU)
	30 or 36 bpp	RAW Data (.RAW), and ASCII (.ASC)

The possible save formats are listed in the table below. The ASCII format is very practical for reading the actual pixel values in Hex. Please refer to http://www.fourcc.org/ for detailed description of the save formats

► You can close the tabs by clicking the red round button on the top right hand corner of the tab.

►
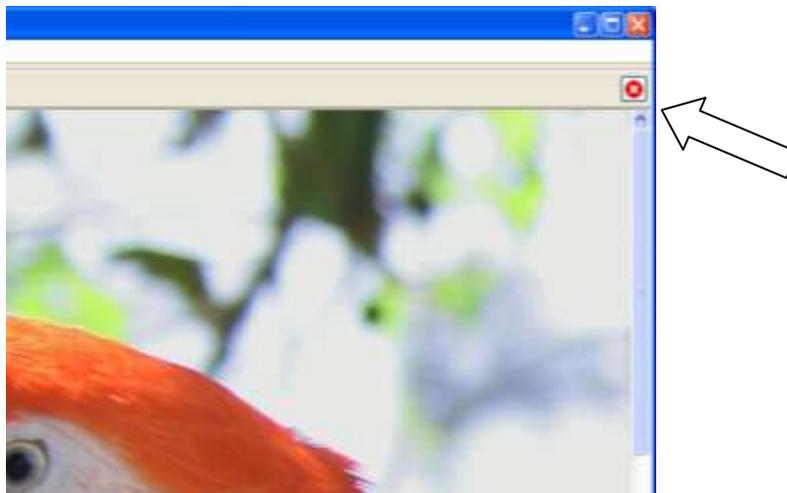
Note: Please note that the snapshots are not automatically saved to the disk. Please use the *Save as ...* button to save the bitmaps.

33.

Capturing and Storing a Sequence of Frames

You can utilize the large on-board frame buffer of the UFG-04 or UFG-06 board and capture a sequence of frames without losing any of them. The frames are buffered locally in the on board frame buffer in real time and the PC stores them at a slower pace to the hard disk. The PC storage speed depends on the capabilities of the PC and the compression method used.
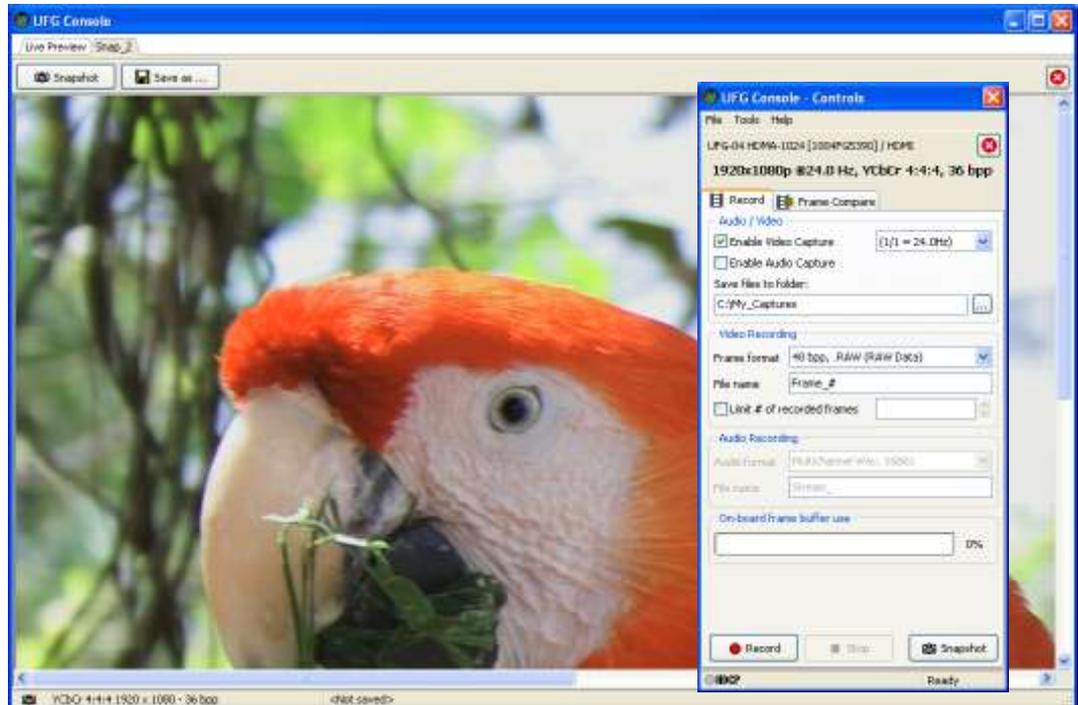
You can select the desired capture frame rate by using the selector. 1/1 means that every frame is stored, ½ means that every 2nd frame is stored, 1/3 that every third frame is stored (2 frames are skipped) etc.

Enter the destination folder in **Save frames to folder** field. By adding the "#" character to the folder name, UFG Console will create a new folder for each recording session and replaces the "#" in the folder name with the session number. E.g. when using name "test_#" will create folders test_1, test_2 etc.

Select the bitmap file type of the stored frames in **Frame format**. The possible save formats are the same ones as when saving snapshots. Please refer to the table on the previous page.

Select the **File name**. You need to include character "#" at least once in the file name. "#" will be replaced by a frame number starting from 0 (zero) for each sequence.

If you want to store only a limited amount of frames, please select **Limit # of recorded frames** check box and specify the number of frames that you would need to capture. Please note that if the number of frames specified here is larger than the amount that the board can capture without losing frames, the capturing is stopped when frames will be lost.

Note   The Record button is not enabled if the file name or the folder names are not valid or if the input content is HDCP encrypted.

In **Tools > Preferences** dialog you can define compression rate for PNG and JPEG images. Higher compression level will enable faster storage time and more frames to be captured. The recorded time span will be dependent on the Frame rate divisor and the file type. For speed, choose JPG – Or for lossless images, choose BMP or RAW.

When the recording ends UFG Console opens by default the folder where the bitmap files have been stored in a file browser window. This feature makes it easy for the user to locate the stored files. You can disable this feature in **Tools > Preferences …** dialog.

When the board starts storing frames into the on-board frame buffer the GUI starts reading frames and emptying the buffer. The effect of this is that you are able to capture more consecutive frames than the board could store in the frame buffer at one time. When the buffer is full, UFG Console stops recording and displays a message *Recording stopped because of buffer overflow on grabber.*
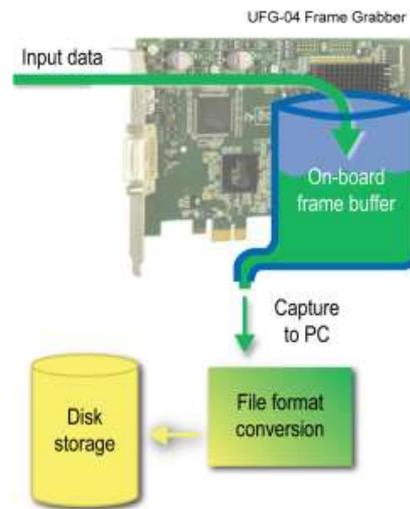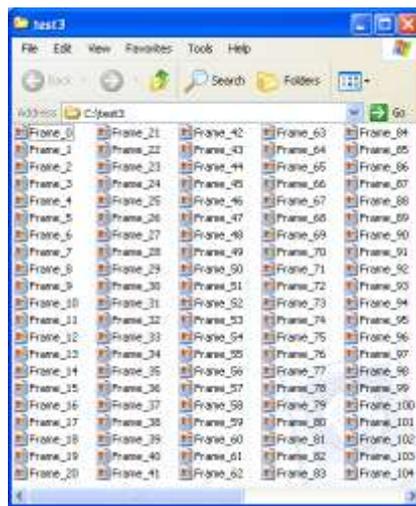
| Note: | The record is interrupted if the frame-buffer located on the frame-grabber becomes full, or if the input video size changes during recording. |

Capturing Audio

When using UFG-04 DP and UFG-04 HDMA boards you can capture audio with the frames by selecting **Enable Audio Capture** in the Main tab of the *UFG Console – Controls*. UFG Console stores the audio data in LPCM audio format with 8 channels. The raw data of the compressed audio formats can also be captured and stored. The user needs to apply third party software for their playback.

Audio can be stored either as a **Multichannel Wav** or **RAW Data** file. Please select the audio file in **File name:** field.

Controls Window – Frame Compare Tab

Frame compare feature of the UFG-04 and UFG-06 frame grabbers is a tool for verifying the fidelity of the output of video source device. There are two compare modes available

- Frame Compare
- Pixel Compare.

When using the *Frame Compare,* the on board firmware hardware calculates a checksum (CRC32) of each R, G and B color component of pixel of the incoming video frames. The calculated CRC values can then be compared to the CRC value of either the previous frame, or reference CRC values calculated from a reference image in the PC. The advantage of the CRC Analysis is that it can verify 100% of the frames.

In *Pixel Compare* the video frames are captured to the PC memory and compared to a reference image. Although Pixel Compare is not able to verify all frames its advantage is that errors in the image can be detected and highlighted on a pixel-by-pixel basis.
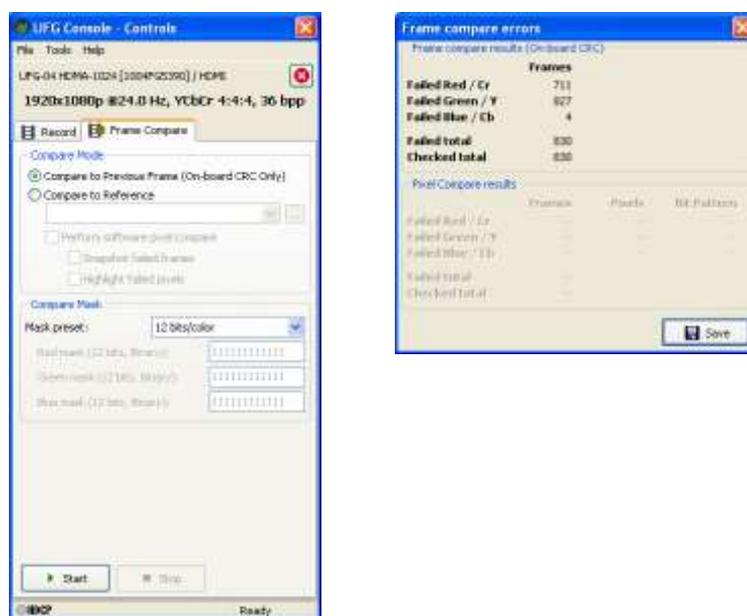
► Click **Start** to start the frame comparison, and **Stop** to stop it.

A new *Frame compare errors* window will open. The data shown on the *Errors* panel reflects the compare mode used.

Note: If the input video timing changes the comparison will be stopped automatically.

Note: For interlaced timings the *Frame Compare* function cannot be used.

Color Mask

Before comparison you can apply a *Color mask*. With the mask you can enable only part of the color bits to be taken into account in the comparison. This enables you to e.g. concentrate to certain color channels or limit the color depth of the comparison.
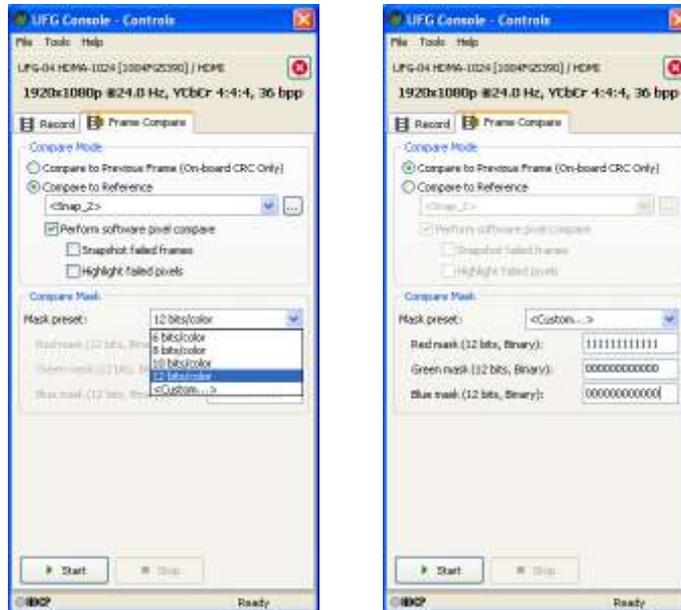
You can either set one of the **Color mask presets** or select **<Custom…>** and define the bit pattern freely. Each bit set to "1" is included in comparison, while "0" bits are not compared. The tool verifies that the entered binary mask is valid before enabling the comparison.

Note   Please note that you should not define a higher color depth in the *Compare Mask* than the color depth your input signal.

Compare to Previous Frame

In this mode the only compare method available is *CRC Compare*. Input video data up to 36 bpp bit depth can be compared.

► This mode is selected by clicking **Compare to Previous Frame** radio button.

Note   When using the *Compare to Previous Frame* function first time after changing the input content the compare will find one error in all three color channels. With consecutive tests with the same input no error will be found.

Comparing to Reference:

In this mode you can use both *Frame Compare* and *Pixel Compare*.

► This mode is selected by clicking the **Compare to Reference** radio button

You can select a reference frame either from an existing snapshot, or load a reference image from disk.
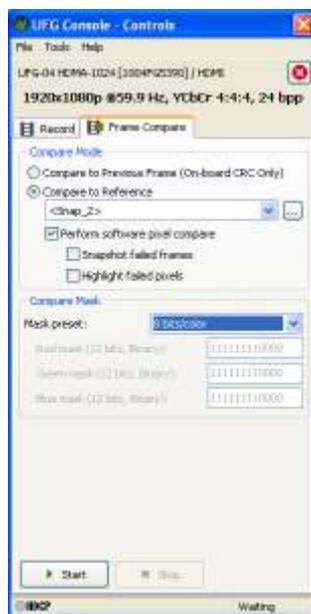
► Click the **Reference** field to select one of the snapshots from the drop-down list or the **Ellipsis** (**…**) button for selecting a bitmap file as reference

Once the reference is selected, you can select what type of compare function you wish to perform. *Frame Compare* is done by default. Select **Perform pixel-by pixel analysis** check-box for the more thorough pixel compare.

Note: Please be careful when using disk files as a reference. You need to make sure that the source device is not modifying the original content with dithering or using CEA limited color range.

Compare Results

The *Frame compare errors* window shows the status during the compare process.

The upper part of the window **Frame compare results** lists the number of frames where the *On-board CRC* has found failures in the Red/Cr, Green/Y Blue/Cb sub-pixels respectively. It also lists the total number of failed frames during the session and the total number of frames compared.

The lower part of the window **Pixel compare results** lists the number of frames and the number of pixels where the *Pixel Compare* by the software in the PC has found failures in the Red/Cr, Green/Y Blue/Cb sub-pixels respectively. The *Bit Pattern* column indicates the color bits failed. The lower part also lists the total number of failed frames during the session and the total number of frames compared.

Note: Please note that values in *Frame compare results (On-board CRC)* fields indicate compare performed to all input frames. The values in *Pixel compare results* fields reflect the *Pixel compare* results performed for the frames captured and analyzed in the PC. The number of frames tested with *Pixel compare* is usually smaller than with *Frame compare.*

You can save the numerical results in a text file, CSV (comma Separated Values) format for later analysis

▶   Click **Save** for saving the numerical results in a file.

Previewing the Pixel Compare Results

During Pixel Compare UFG Console window provides three monitoring modes. You can select between the modes by selecting the corresponding radio button.

Select **Live Video**, for monitoring the captured image

Select **Pixel Analysis**, for monitoring the mismatch found in the latest captured frame.

Select **Accumulated Errors**, showing cumulative mismatches found during the compare session

In the *Pixel* Compare mode each pixel mismatch is shown on a black background. The color of the mismatch pixel indicates the failing colors. Black color indicates a match. By selecting **Highlight Errors** check box in the Controls window, you can enhance the visibility of each pixel mismatch with a small cross sign (+).

At the end of the session UFG Console takes a snapshot of the *Accumulated Errors* and shows it on an **ErrorCumulation_x** tab where x is the number of the test during the session.

By selecting **Snapshot frames with errors** check box in the Controls window, the software takes a snapshot of each frame where errors were found in the pixel by pixel compare. 5 mismatch snapshots are saved to tabs but the Compare function will continue until it is manually stopped.
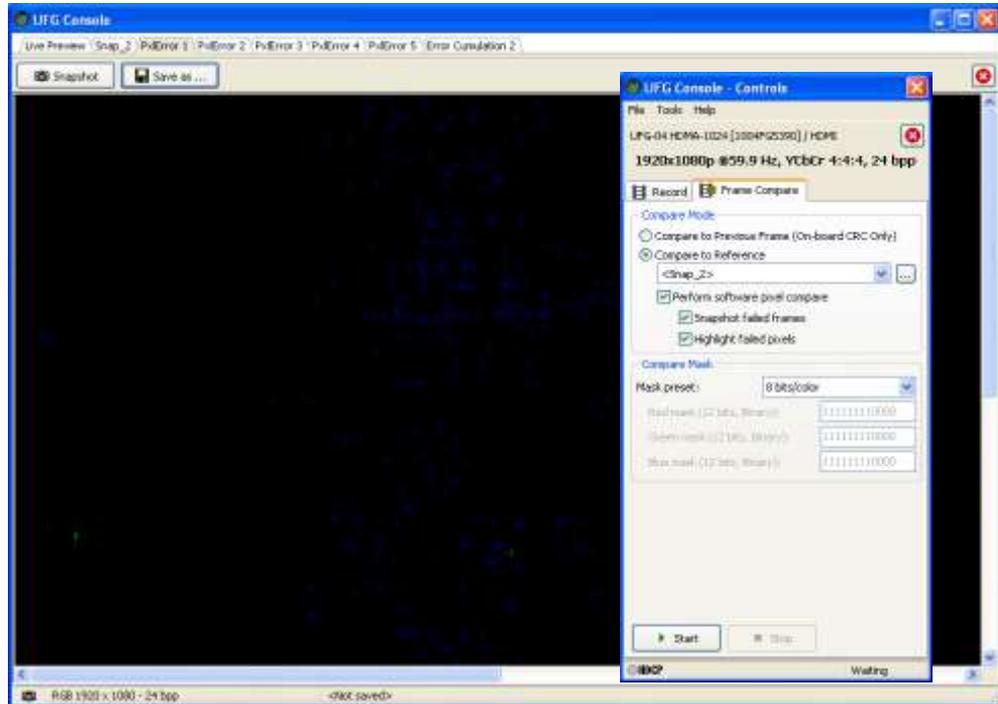
Controls Window – LVDS Tab

When using UFG-04 LVDS or UFG-04 LVDS Quad boards, a third tab appears in the *UFG Console – Controls* window. The LVDS tab allows the user to control the way the LVDS input is interpreted as image data.
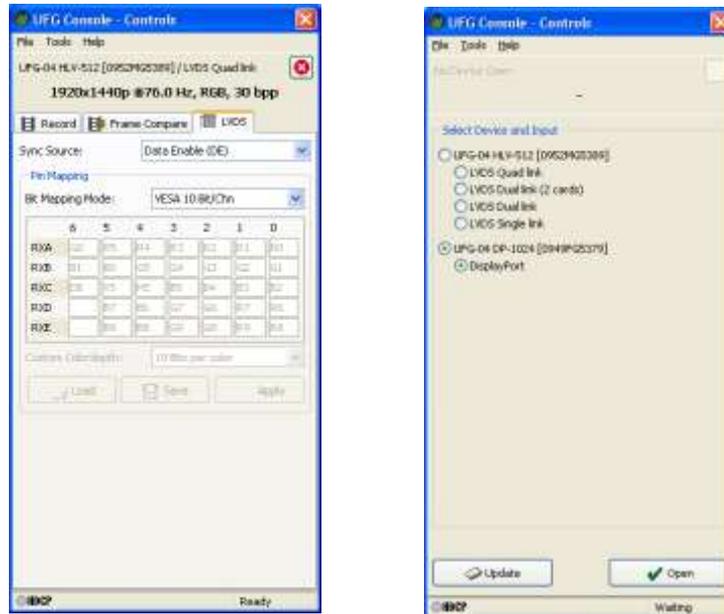
The *LVDS Acquisition Mode* is selected when opening the board. You can select between *Single link* and *Dual link* mode with a single board, and between *Single link, Dual link* and *Quad* link mode with two boards. The special *Dual link (2 boards)* mode uses Dual link mode to speed up the transfer of the captured frames to the PC.

The *Sync Source* defines which synchronizing is used. If *Data Enable (DE)* is selected, **Bit 6** in **Lane C (DE)** is used to indicate the location of the visible frame. If *HSync/VSync (HS/VS)* is selected, **Bit 4 (HS)** and **Bit 5 (VS)** in **Lane C** are used as Horizontal Sync and Vertical Sync.

Pin Mapping

The mapping of the pixel data into LVDS data varies from one data source to another. In order to provide flexibility for the user UFG-04 LVDS board FPGA includes a data matrix for multiplexing the LVDS data to the input color bits.

From Control window's LVDS tab you can select between **5 predefined pin mappings** or a custom mapping. The predefined mappings are 6, 8 and 10 bit JEITA/JEIDA mappings and 8 and 10 bit VESA mappings. Please find the Data / Color mapping table of the preset settings in Appendix D of this manual.

▶   Click **Apply** to use the selected mapping.
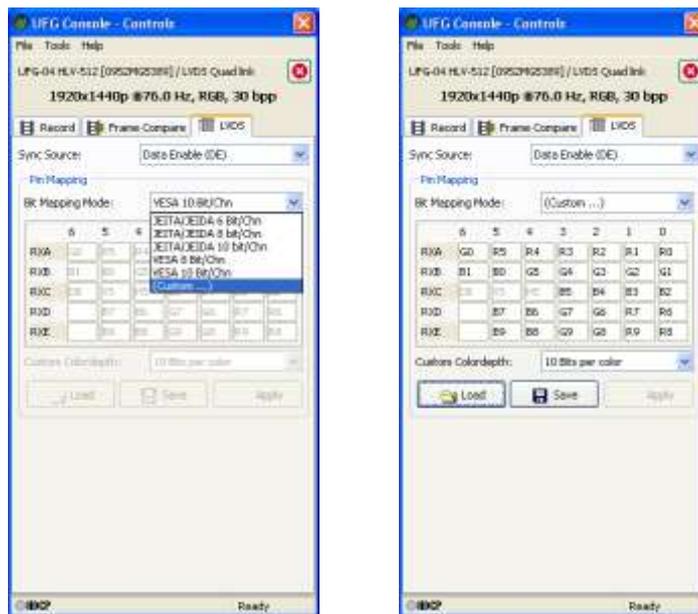
By selecting the **(Custom …)** you can define a custom mapping in the matrix. Please note that the mapping of DE, VS and HS to bits 4 to 6 in lane C (RXC) cannot be changed. *Custom Color depth* field allows you to select between 6, 8 or 10 bit depth of color components.

▶   You can save a custom mapping to a file by clicking **Save** or recall a mapping by clicking **Load.**

▶   Click **Apply** to use the changed mapping.

Note	The setting of the multiplexer is identical for both input channels.

Link Status

UFG Console provides two ways for monitoring the link status and the metadata provided by the Source device. The basic version of the UFG Console features the possibility of monitoring the current *Link Status*.
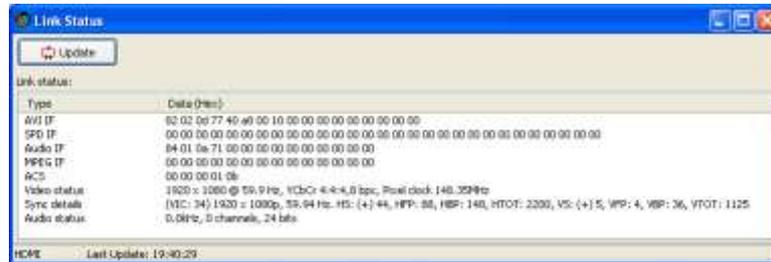
▶   Select **Tools > Link Status …** from the pull down menu of the UFG Console Controls window to open the *Link Status* dialog.

Please click **Update** to re-read the status.

The dialog indicates the current status or latest received metadata of the following items.

AVI IF:	Auxiliary Video InfoFrame
SPD IF:	Source Product Description InfoFrame
Audio IF:	Audio InfoFrame
MPEG IF:	MPEG InfoFrame
ACS:	Audio Control Status
Video status:	Resolution, frame rate, Color format, color component bit depth and pixel clock frequency
Sync details:	Video Identification Code (VIC), Horizontal sync and timing details, Vertical sync and timing details
Audio status:	Sampling frequency, nr of audio channels, audio data bit depth

Event Log

The **Power Tools** software package for UFG-04 DP and UFG-04 HDMA boards and **UFG Console for UFG-06 Nopea** includes an *Event Log* function that collects events, video and audio status, Metadata from input stream.

▶ Select **Tools > Event Log …** from the pull down menu of the UFG Console Controls window to open the *Event Log* dialog.
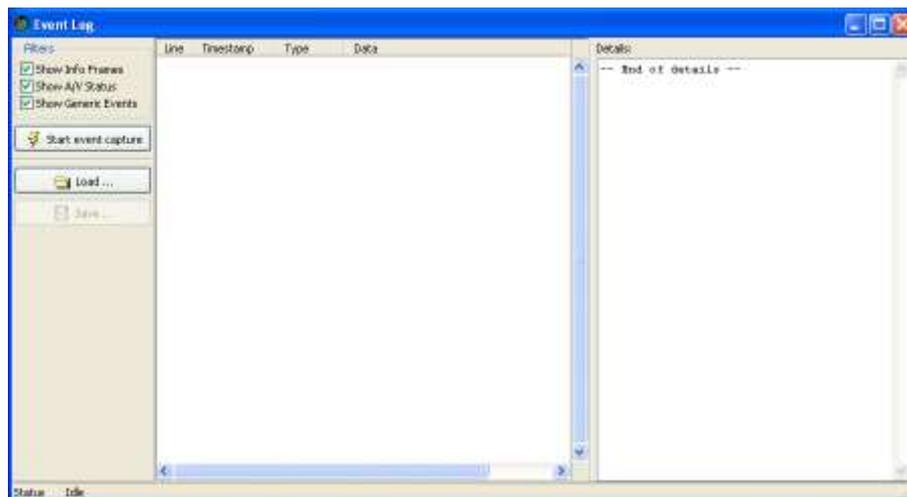
The Event Log dialog is divided into two sections. The leftmost part is the tile log list with time stamp, data type description and actual data received. The rightmost panel shows the parsed clear text description of the information included in the selected log item.

▶ Click **Start event capture** to start collecting data.

While UFG Console is collecting the data you can scroll the list and examine the already collected items. Select the item of interest, the details of that item will be parsed in the *Details* panel.
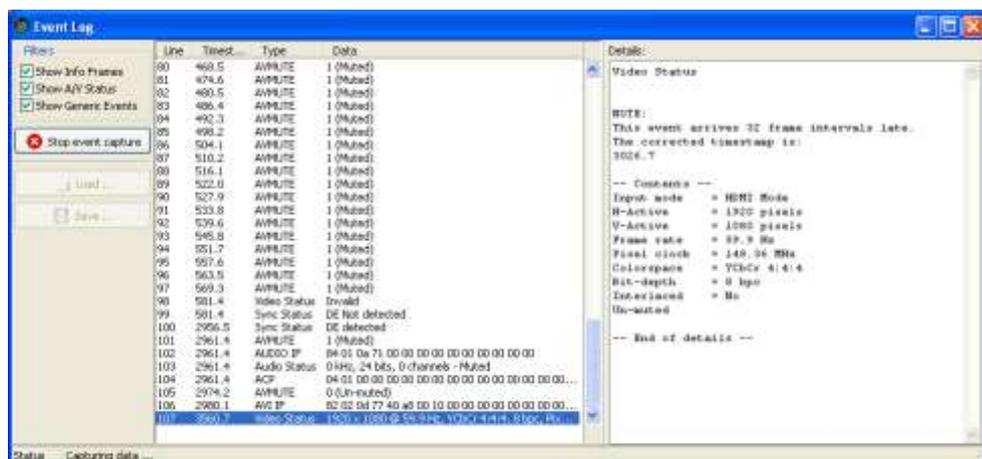
The following table lists the items shown in the log. You can select which items are shown on the log list by selecting or de-selecting the applicable filter check box.

Event Type	Boards	Applicable filter
AVI Info Frame	HDDP, HDMA, DP	Info Frames
SPD Info Frame	HDDP, HDMA, DP	Info Frames
Audio Info Frame	HDDP, HDMA, DP	Info Frames
MPEG Info Frame	HDDP, HDMA, DP	Info Frames
Vendor Specific Info Frame	HDDP, HDMA, DP	Info Frames
Audio Status	HDDP, HDMA, DP	A/V Status
AVMUTE	HDDP, HDMA	A/V Status
Video Status	HDDP, HDMA, DP	A/V Status
ACS (Audio Channel Status)	HDDP, HDMA, DP	A/V Status
ACP (Audio content protection packet)	HDDP, HDMA	Generic
No AVI InfoFrame	HDDP, HDMA	Generic
Sync Status	HDDP, HDMA	Generic
EXT (Extension Packet)	DP	Generic
VB-ID (Vertical Blanking ID)	DP	Generic
MSA (Main Stream Attributes)	DP	Generic
No ACP	HDDP	Generic
Others/Unknown:		Generic

▶ You can select the view options for the log list by **right clicking** on top of it. The options are:

- Timestamp: Enable / disable timestamp
  Show time from start of event capture / from previous event
  Show time as milliseconds / minutes: seconds: micro-seconds
- Type: Enable / Disable display of Type information
- Data: Enable / Disable display of data
  Show RAW data only / Show decoded data when available

▶ Click Stop event capture to end the logging

▶ Click **Save …** to store the events in your PC in three alternative formats

Unigraf Event Log file format	*.EVL	Can be loaded back to UFG Console
Comma separated values	*.CSV	Can be imported to e.g. to spreadsheets
Text file	*.TXT	Universal

▶

UFG Console allows you to select if you would like to apply the used filter to store only part of the data. The image below shows events saved in CSV format.

Note	Please note that when evaluating the input video timing the firmware considers a timing to be *Stable* after there have been no changes in the input timing during 32 consecutive horizontal periods. Therefore the **timestamp of the *Video Status* arrives 32 frame intervals late**. A corrected timestamp is indicated in parsed data on the **Details** panel of the *Video State* event.

EDID Editor

When using UFG-04 DP, UFG-04 HDMA or UFG-06 Nopea boards, you can update the EDID information of the input. This means that you can change the performance information that the connected source device reads from the board.

► To open the EDID dialog select **Settings > EDID Editor …**.
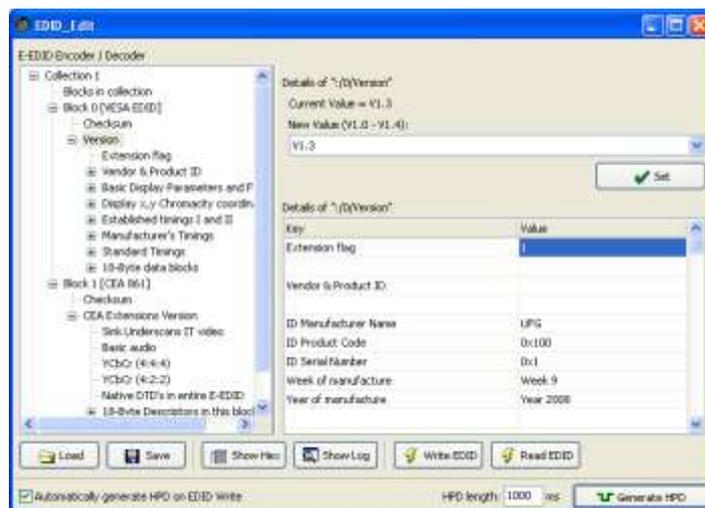
The Main Window

The *EDID Editor* main window is divided into three logical areas. The bottom part of the window contains the command buttons, and the log view. The top-left portion shows the currently edited E-EDID blocks in a tree-form, and the top-right portion shows an edit control for the currently selected item, possibly a list of sub-keys and their names (The list is not shown for all values) and the HEX-view of the block collection.

Notice that there are two moveable splitters to customize the window layout. One is just above the Log-view, and the second is between the top-left and top-right window areas.

Command buttons

Load: Load an EDID block collection file from disk.
Save: Save the current block collection to a disk file.
Show Hex: Show or Hide the HEX view.
Show Log: Show or Hide the Log view.
Write EDID: Program the EDID block collection to the UFG-04 board.
Read EDID: Read the EDID block collection from the UFG-04 board
Generate HPD: Generate a Hot Plug Detect pulse

HPD Pulse

By default UFG-04 HDMA and UFG-06 Nopea HDDP boards generate a Hot Plug Detect pulse when you are reading or writing the EDID contents. By unselecting the **Automatically generate HPD** checkbox you can prevent this. You can also set the length of the pulse.

EDID Editor Features

The EDID Editor currently supports VESA E-EDID block versions 1.3 and 1.4. As the standard defines, the versions 1.0, 1.1 and 1.2 are supposed to be backward compatible, and therefore the VESA E-EDID decoder will also show their contents. However, in these cases it should be noted that the error checking is not compliant with restrictions given in these older versions of the standard. In addition to VESA E-EDID block, the CEA-861 versions 1, 2 and 3 EDID blocks are also fully supported as well as the VESA Block Map Extension blocks.

Practically unlimited number of extension blocks may exist in a single collection. The number of blocks is limited by VESA Specifications and possibly by available system resources. Most EDID blocks contain a structure that is very similar to a tree-structure. The EDID Editor decodes each block into a tree-view of the block. The tree-view then contains all values contained within the EDID block. The contents can then be easily browsed, using only a few mouse clicks. The EDID Editor has a support for automatic variables, such as the block checksum. When the user changes a value in an EDID block, the tool will update the checksum accordingly. The automatic variables appear as read only values for the user. A log print will be made when an automatic variable is updated by the editor.

HEX View: An optional HEX data display of all blocks in the collection. The view also shows the latest changes highlighted.

LOG View: An optional LOG view, which will contain log prints generated by the editor. Mostly it will list values that have been automatically updated due to edits.

Note | The editing feature of EDID Editor is available with *Power Tools License* of the UFG Console only. The Read, Write, Load and Save features are available without the license.

Editing tips

Editing an EDID block is very straightforward, but there are some special cases where the user must know how to accomplish certain types of tasks.

- **Enter** key will apply text-edit values and combo-box selection.
- To apply new setting to *binary* values (ones that show a check-box), please click the **Set** button.
- When you see a **Quick Config** button appear below an editor, you can access a configuration menu that allows you to quickly select one of multiple pre-defined setup options.
- In CEA-861 blocks, you can add and remove 18-byte descriptors and CEA data blocks by setting the values "18-byte Descriptors in this block" and "CEA Data block count". Unfortunately re-arranging the descriptors and CEA data blocks is not supported yet, so you need to be careful when editing these.
- Enter hex values with prefix "**0x**" or "**$**", no prefix means a decimal value.
- You can always enter HEX or DEC, even if the value is presented as HEX, and/or value range is given in HEX.
- Floating point values must be given with period "**.**" as decimal separator, even if your localization setting defines decimal separator as comma (or other).
- Remember to click **Set** after changing a bit-value presented as a single check-box if you want the new value applied.

Note | It is recommended that you backup the un-edited EDID contents to a file before editing and writing it to the board.

Setting User Preferences

The user can control some of the features of the UFG Console to match personal preferences.

▶ On the pull down menu of *UFG Console – Controls* window select
Tools > Preferences …

You can select the visual clues, i.e. the color of the field to indicate if the value entered is valid.

Select **Use Visual clues on input fields** check box to enable the feature and from the buttons select the color you want to use.

Select **Automatically minimize Controls window** if you are using a low resolution display or if you otherwise prefer to be able to see as much of the captured image as possible.

Select **Use Tooltips** to enable the view of tooltips when the mouse cursor is on top of tools. **The current release of UFG Console does not support tooltips.**

Select **Automatically open file browser after recording** if you prefer that after recording a sequence of frames the folder where the frames are stored is opened in Windows file browser.
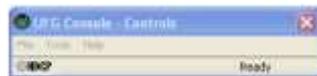
Image saving option allows you to set the desired compression level for the captured and saved bitmap files when using PNG or JPEG file type.

Memory resources enable you to control the amount of *system RAM* used for UFG Console.

The default value 300 Mbytes for snapshot enables you to take about 25 1920x1080 resolution snapshots with 36 bpp color depth and about 50 with 24 bpp color depth.

The memory for the frame queue is used to queue frames with *Record* function. Increasing the value will enable you to store more consecutive frames specially when the storage media is the bottleneck. Please be careful not to increase the value too much. It might have effects in the performance of other tasks in the PC.

APPENDIX A. PRODUCT SPECIFICATIONS

Operating Conditions

Operating temperature	0 – 40 °C
Storage temperature	0 – 40 °C
Humidity	0 – 95%, Non condensing

UFG-04 DP

DisplayPort™ input	DisplayPort™ connector
	STMicroelectronics GM 68020 receiver
Link bandwidth	Up to 10.8 Gbps over 4 lanes
Pixel Depth	18, 24 or 30 or bits per pixel
Image size	Up to 2560 x 1600 pixels
Audio	Capture LPCM data in RAW or WAV format

UFG-04 HDMA

HDMI input	HDMI Type A connector
	Silicon Image Sil9135 HDMI receiver
	HDMI 1.3, HDCP 1.1, and DVI 1.0 compliant Receiver, Integrated TMDS core running at 25 – 225 MHz
Maximum video clock	165 MHz
Color modes	36-bit RGB / YCbCr 4:4:4
	16 / 20 / 24-bit YCbCr 4:2:2 (supported only in the SDK)
	Captured images can be stored in RGB 4:4:4
3D formats	Frame packing (Progressive, Interlaced), Side-by-Side (Half), Top-and-Bottom
Audio	PCM 2/8 audio, Dolby Digital, Dolby Digital +, DTS, DTS96/24, DTS HD, Dolby TrueHD
	Sampling is max 192 kHz and audio bit resolution is 24 bits

UFG-04 LVDS and UFG-04 LVDS Quad

Connectors	2 x MDR-26 DISM 1.0 compliant		
LVDS Input	Dual FPD-Link Receiver (DS90C3202)		
Pixel Frequency	1-channel	135 Mpix/s max	
	2-channel	UFG-04 HLV	270 Mpix/s max
		UFG-04 LV	165 Mpix/s max
	4-channel	540 Mpix/s max	
Input Pixel Depth	8 or 10 bits per color		
Color Mapping	JEITA/JEIDA, VESA or custom		
Output Color Depth	8, 10 or 16 bits per color		

UFG-04 Common

Video Frame Buffer	2 or 4 GBytes.
Image size	8 Mpixels max
Data Interface	PCI Express 1 lane (1.0) Bus master. Sustained transfer rate up to 125 MBytes/s.
EDID	User programmable
HDCP	HDCP decryption engine for receiving protected audio and video content. Built in HDCP BIST. Preview of HDCP encrypted contents in a compatible PC.
Module Size	107 x 168 mm
Power Consumption	+12 Vdc 620 mA, 7.5 W maximum +3.3 Vdc 520 mA 1.7 W maximum

UFG-06 Nopea HDDP

Inputs	Selectable between 2 HDMI and 1 DP
HDMI inputs	Input 2 x HDMI Type A connectors Silicon Image SiI9233A receiver 225 MHz max TMDS clock
DisplayPort	Input 1 x DP connector Parade Technologies PS161 DisplayPort™ to HDMI converter up to 165 Mpps
Maximum video clock	165 MHz
Color modes	RGB, YCbCr and xvYCC
Capture pixel depth	18, 24 and 30 bpp. 36 bpp, Deep Color with HDMI
3D formats	Frame packing (p/i), Side-by-Side (h/f), Top-and-Bottom, L + Depth
Audio	Available through UFG LVCA API
Module Size	107 x 190 mm
Power Consumption	10.0 W

Software

Operating Systems	Windows 7, XP or Vista (32/64 bit)
SW Interface	UFG API for UFG-04 boards, UFG LVCA API for UFG-06 board. C/C++ library with functions for accessing the configuration parameters and capturing the image. Multi-board Support
Software properties	Preview, preview HDCP contents Store video frames. Store audio Compare input frame to previous, Compare captured frame to a reference, highlight difference, save difference Firmware update via software

APPENDIX B. UFG-04 DIAGNOSTIC LED INDICATORS

The UFG-04 frame grabber boards include a set of LED indicators. They are reflecting status of various hardware functions of the board. They are serving a helpful debugging tool. The functions of the LEDs are listed in the table below.
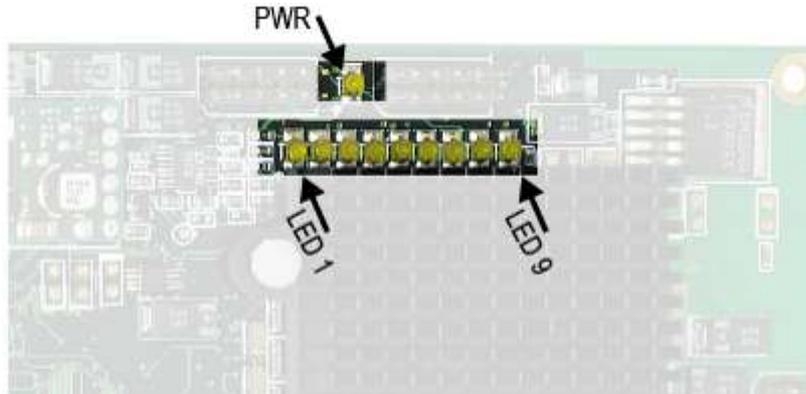
	Name	Preferred State
PWR	Power OK (Board)	Should be on
LED 1	Power OK (PCI Express)	Should be on
LED 2	FPGA operational	Should be flashing
LED 3	Pixel clock detected	Should be on
LED 4	Video syncs detected	Should be on
LED 5	Input signal stable	Should be on
LED 6	Reserved	
LED 7	Reserved	
LED 8	PCI Express link is on	Should be on
LED 9	Reserved	

APPENDIX C. UFG-06 NOPEA HDDP DIAGNOSTIC LED INDICATORS

The UFG-06 Nopea HDDP frame grabber boards include a set of LED indicators. They are reflecting status of various hardware functions of the board. They are serving a helpful debugging tool. The functions of the LEDs are listed in the table below.

	Name	Preferred State
PWR	Power OK (Board)	Should be on
LED 1	FPGA operational	Should be flashing
LED 2	Video clock detected	Should be on
LED 3	Video syncs detected	Should be on
LED 4	Input signal stable	Should be on
LED 5	Reserved	
LED 6	Reserved	
LED 7	Reserved	

APPENDIX D: CONNECTOR PIN DESCRIPTIONS

Pin-out of DP Input Connector

Pin	Signal Type	Signal Name
1	Input	ML_Lane 3 (n)
2		GND
3	Input	ML_Lane 3 (p)
4	Input	ML_Lane 2 (n)
5		GND
6	Input	ML_Lane 2 (p)
7	Input	ML_Lane 1 (n)
8		GND
9	Input	ML_Lane 1 (p)
10	Input	ML_Lane 0 (n)
11		GND
12	Input	ML_Lane 0 (p)
13		GND
14		GND
15	Input / Output	AUX CH (p)
16		GND
17	Input / Output	AUX CH (n)
18	Output	Hot Plug Detect
19		Power Return
20	Power Output	DP_PWR (not connected)

Pin-out of RS-232 connector of UFG-04 DP

Pin	Signal Name
1	n/c
2	TXD
3	RXD
4	n/c
5	GND
6	n/c
7	n/c
8	n/c
9	n/c

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Pin-out of the HDMI Input Connector Type A
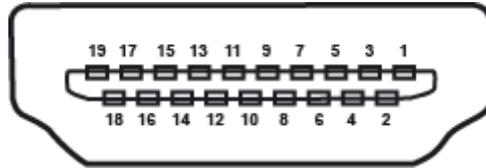
Pin	Signal Name	Description
1	TMDS Data2+	T.M.D.S Diff lane 2+
2	TMDS Data2 Shield	Lane 2 shield
3	TMDS Data2–	T.M.D.S Diff lane 2-
4	TMDS Data1+	T.M.D.S Diff lane 1+
5	TMDS Data1 Shield	Lane 1 shield
6	TMDS Data1–	T.M.D.S Diff lane 1-
7	TMDS Data0+	T.M.D.S Diff lane 0+
8	TMDS Data0 Shield	Lane 0 shield
9	TMDS Data0–	T.M.D.S Diff lane 0-
10	TMDS Clock+	T.M.D.S Diff lane clock+
11	TMDS Clock Shield	Clock shield
12	TMDS Clock–	T.M.D.S Diff lane clock-
13	CEC	Consumer Electronics Control, a control method developed from the European Scart standard.
14	Reserved (N.C. on device)	
15	SCL	DDC I2C Clock
16	SDA	DDC I2C data
17	DDC/CEC Ground	DDC ground
18	+5 V Power (max 50 mA)	DDC +5V
19	Hot Plug Detect	Hot plug detect

Pin-out of LVDS Input Connector CH 1 in UFG-04 LVDS

Signal	Pin n.	Pin n.	Signal
GND	1	14	RXD+
RXD_GND	2	15	RXD-
SENS(**	3	16	N.C.
RXCLK+	4	17	RXCLK_GND
RXCLK-	5	18	Reserved
RXE+	6	19	RXE_GND
RXE-	7	20	RXC+
RXC_GND	8	21	RXC-
Reserved	9	22	RXB+
RXB_GND	10	23	RXB-
GND	11	24	Reserved
RXA+	12	25	RXA_GND
RXA-	13	26	GND

Pin-out of LVDS Input Connector CH 2 in UFG-04 LVDS

Signal	Pin n.	Pin n.	Signal
GND	1	14	RXD+
RXD_GND	2	15	RXD-
SENS(**	3	16	N.C.
N.C	4	17	RXCLK_GND
N.C	5	18	Reserved
RXE+	6	19	RXE_GND
RXE-	7	20	RXC+
RXC_GND	8	21	RXC-
Reserved	9	22	RXB+
RXB_GND	10	23	RXB-
GND	11	24	Reserved
RXA+	12	25	RXA_GND
RXA-	13	26	GND

** SENS = +5V input. Can be left unconnected

Reserved = please leave unconnected

N.C. = not connected on the UFG-04 board

APPENDIX E. LVDS INPUT DATA MAPPING

UFG Console allows you to modify the LVDS input data mapping. The selection includes five predefined mappings: JEIDA 6, 8 and 10 bit, VESA 8 and 10 bit. Other data mappings can be created and saved by using the UFG Console. By default the VESA 10 bit mapping is used.

Please find below a table describing the five predefined mappings.

Predefined LVDS data mappings in UFG-04 LVDS

LVDS data	JEIDA			VESA	
	6 bit/color	8 bit/color	10 bit/color	8 bit/color	10 bit/color
RXA0	R0	R2	R4	R0	R0
RXA1	R1	R3	R5	R1	R1
RXA2	R2	R4	R6	R2	R2
RXA3	R3	R5	R7	R3	R3
RXA4	R4	R6	R8	R4	R4
RXA5	R5	R7	R9	R5	R5
RXA6	G0	G2	G4	G0	G0
RXB0	G1	G3	G5	G1	G1
RXB1	G2	G4	G6	G2	G2
RXB2	G3	G5	G7	G3	G3
RXB3	G4	G6	G8	G4	G4
RXB4	G5	G7	G9	G5	G5
RXB5	B0	B2	B4	B0	B0
RXB6	B1	B3	B5	B1	B1
RXC0	B2	B4	B6	B2	B2
RXC1	B3	B5	B7	B3	B3
RXC2	B4	B6	B8	B4	B4
RXC3	B5	B7	B9	B5	B5
RXC4	HSYNC	HSYNC	HSYNC	HSYNC	HSYNC
RXC5	VSYNC	VSYNC	VSYNC	VSYNC	VSYNC
RXC6	DE	DE	DE	DE	DE
RXD0		R0	R2	R6	R6
RXD1		R1	R3	R7	R7
RXD2		G0	G2	G6	G6
RXD3		G1	G3	G7	G7
RXD4		B0	B2	B6	B6
RXD5		B1	B3	B7	B7
RXD6		N/A	N/A	N/A	N/A
RXE0			R0		R8
RXE1			R1		R9
RXE2			G0		G8
RXE3			G1		G9
RXE4			B0		B8
RXE5			B1		B9
RXE6			N/A		N/A

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	D6	D5	D4	D3	D2	D1	D0
RXA	G4	R9	R8	R7	R6	R5	R4
RXB	B5	B4	G9	G8	G7	G6	G5
RXC	DE	VS	HS	B9	B8	B7	B6
RXD	N/A	B3	B2	G3	G2	R3	R2
RXE	N/A	B1	B0	G1	G0	R1	R0

JEIDA 10 bit

	D6	D5	D4	D3	D2	D1	D0
RXA	G2	R7	R6	R5	R4	R3	R2
RXB	B3	B2	G7	G6	G5	G4	G3
RXC	DE	VS	HS	B7	B6	B5	B4
RXD	N/A	B1	B0	G1	G0	R1	R0
RXE							

JEIDA 8 bit

	D6	D5	D4	D3	D2	D1	D0
RXA	G0	R5	R4	R3	R2	R1	R0
RXB	B1	B0	G5	G4	G3	G2	G1
RXC	DE	VS	HS	B5	B4	B3	B2
RXD							
RXE							

JEIDA & VESA 6 bit

	D6	D5	D4	D3	D2	D1	D0
RXA	G0	R5	R4	R3	R2	R1	R0
RXB	B1	B0	G5	G4	G3	G2	G1
RXC	DE	VS	HS	B5	B4	B3	B2
RXD	N/A	B7	B6	G7	G6	R7	R6
RXE	N/A	B9	B8	G9	G8	R9	R8

VESA 10 bit

	D6	D5	D4	D3	D2	D1	D0
RXA	G0	R5	R4	R3	R2	R1	R0
RXB	B1	B0	G5	G4	G3	G2	G1
RXC	DE	VS	HS	B5	B4	B3	B2
RXD	N/A	B7	B6	G7	G6	R7	R6
RXE							

VESA 8 bit

APPENDIX F: UNIGRAF RAW FILE FORMAT

This is the description of the RAW file format that UFG Console uses when saving snapshots or captured frames. The first 12 bytes of the file form the file header. The tables below describe the header and the image data. All fields that have more than 1 byte are stored in little-endian order.

Description of the header:

Offset	Size	Description
0	1	Color depth per channel. Either 8 or 16
1	1	Color space identifier. See below
2	2	Reserved, must be zero
4	4	Image width, in pixels
8	4	Image height, in lines

Description of color space identifiers, channel counts and data order:

Identifier	Color mode	Nr. of channels	Channel data order
0	RGB 4:4:4	3	Red, Green, Blue
1	YCbCr 4:4:4	3	Cr, Y, Cb
2	YCbCr 4:2:2	4	Cb, Y(Even), Cr, Y(Odd)

UFG Console (Release 2.5) supports RGB 4:4:4 (18, 24, 30 and 36 bpp) and YCbCr 4:4:4 (18, 24, 30 and 36 bpp)