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LIGHTWARE

Essentials of Proprietary Lightware Technologies

White Paper

Lightware Visual Engineering

Pixel Accurate Reclocking

Signal reclocking is an essential procedure in digital signal transmission. After passing the reclocking circuit, the signal becomes stable, jitter-free, and can be transmitted to processors, event controllers or other sinks. Without reclocking, sparkles, noise, and jaggies would be seen in the images.

Lightware's Pixel Accurate Reclocking technology is more sophisticated than general TMDS reclocking, and it fixes more problems. It removes not only intra-pair skew, but inter-pair skew as well. The Pixel Accurate Reclocking circuit eliminates the following errors:

Intra-pair skew: skew between the + and - wires within a differential wire pair (e.g. Data2- and Data2+). This phenomenon is caused by different wire lengths, or a slightly different wire construction (impedance mismatch) in DVI cables. The result is jitter.
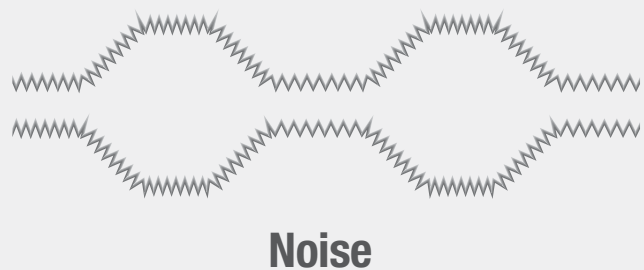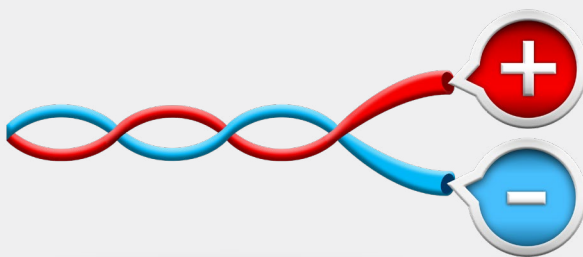

Intra-pair skew
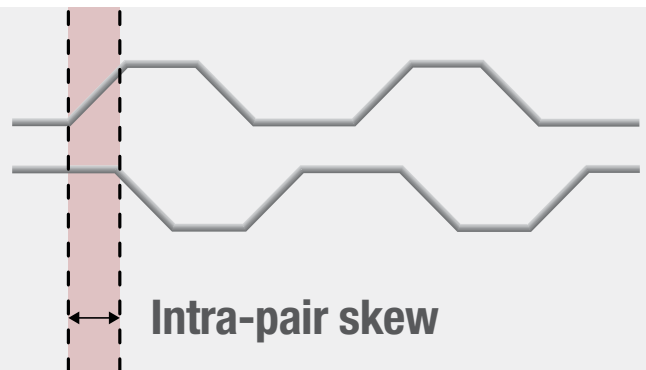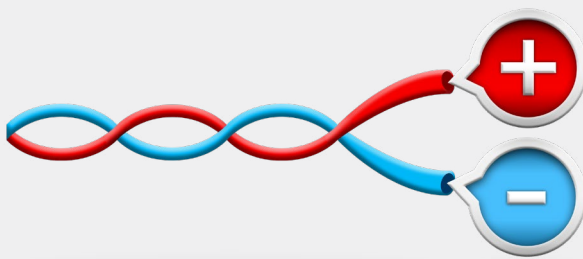
Inter-pair skew: skew between two differential wire pairs in a cable. It is caused by different wire pair lengths or different number of twists in the DVI cable. Too much inter-pair skew results in color shifts in the picture or the loss of sync.

Inter-pair skew
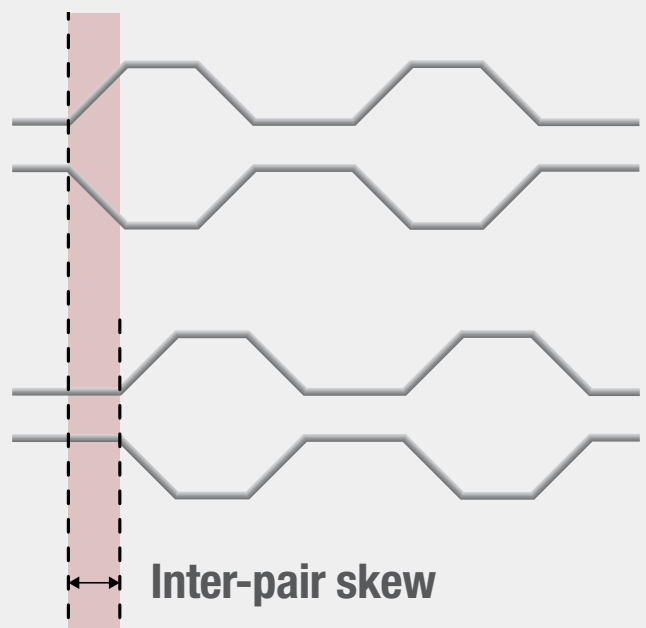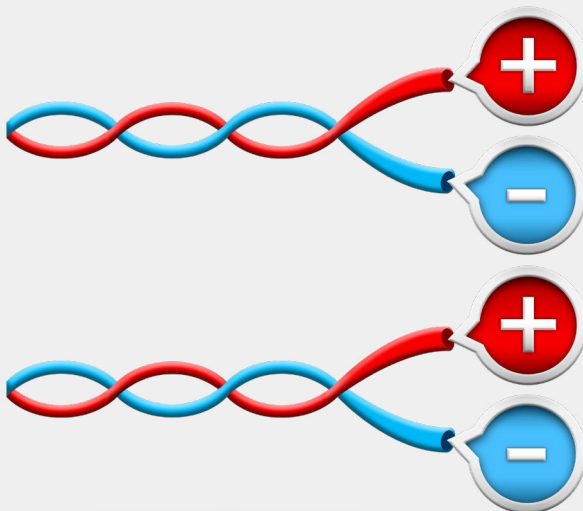
Jitter: signal instability in the time domain. The time difference between two signal transitions should be a fixed value, but noise and other effects cause variations.
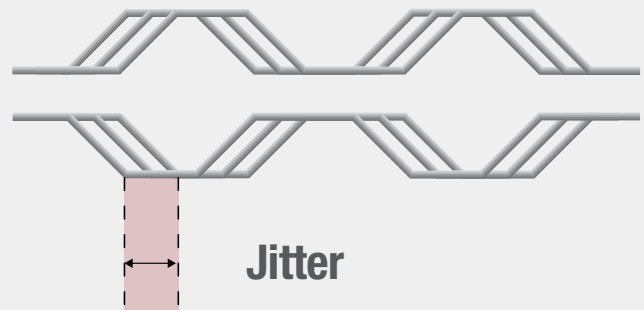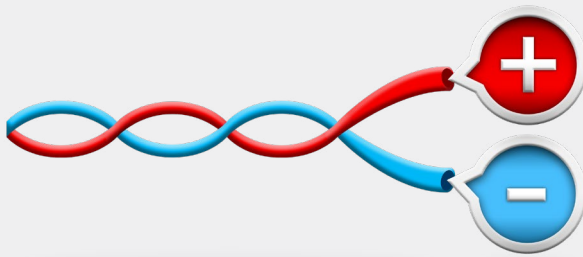
Jitter

Noise: electromagnetic interference between other electronic devices such as mobile phones, motors, etc. and the DVI cable are coupled onto the signal. Too much noise results in increased jitter.

Noise

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EDID Management

EDID stands for Extended Display Identification Data. Simply put, EDID is the passport of display devices (monitors, TV sets, projectors). It contains information about the display's capabilities, such as supported resolutions, refresh rates (these are called Detailed Timings), the type and manufacturer of the display device, etc.

After connecting a DVI source to a DVI display, the source reads out the EDID to determine the resolution and refresh rate of the image to be transmitted.

EDID Communication

Most DVI computer displays have a 128-byte-long EDID structure. However, Digital Televisions and HDMI capable displays may have another 128 bytes, which is called E-EDID and is defined by CEA (Consumer Electronics Association). This extension contains information about additional Detailed Timings, audio capabilities, speaker allocation and HDMI capabilities. It is important to know that all HDMI capable devices must have CEA extension, but not all devices that have the extension are HDMI capable.

Common Problems Related to the EDID

Problem: My system consists of the following: a computer, a Lightware matrix, a WUXGA (1920x1200) LCD monitor, and an SXGA (1280x1024) projector. I would like to see the same image on the monitor and the projector. What EDID should I chose on the router?"

Solution: If you want to see the image on both displays, you need to select the resolution of the smaller display (in this case SXGA), otherwise the smaller display may not show the higher resolution image.

Problem: „I have changed to a different EDID on an input port of the matrix to have a different resolution, but nothing happens."

Solution: Some graphics cards and video sources read out the EDID only after power-up and later they do not sense that the EDID has been changed. You need to restart your source to make it read out the EDID again.

Lightware's Advanced EDID Management

Each DVI sink (e.g. monitors, projectors, plasma displays, etc...) must support the EDID data structure. Source BIOS and operating systems are likely to query the sink using DDC2B protocol to determine what pixel formats and interfaces are supported. The DVI standard makes use of EDID data structure for the identification of the monitor type and capabilities. Most DVI sources (VGA cards, set top boxes, etc.) will output DVI signal after accepting the connected sink's EDID information. In case of EDID readout failure or a missing EDID, the source will not output DVI video signal.

All of our modular matrix routers have Lightware's Advanced EDID Management function that helps system integration. The built-in EDID Router stores and emulates 100 EDID data plus all monitor's EDID that are connected to the output connectors.The first 50 EDIDs are factory presets, while memories from 51 to 100 are user programmable. The router stores the EDID of all attached monitors or projectors for each output in a non-volatile memory. This way the EDID from a monitor remains available when the monitor is unplugged or switched off.

Any EDID can be emulated on any input. An emulated EDID can be copied from the EDID router's memory (static EDID emulation), or from the monitor's memory that was last attached (dynamic EDID emulation). For example, the router can be set up to emulate a device that is connected to one of the outputs. In this case, the EDID automatically changes if the monitor is replaced with another display device (as long as it has a valid EDID).

The EDID is independently programmable for all inputs without affecting each other. All inputs have their own EDID circuits. An EDID Router can be controlled via serial port or Ethernet.

The user is not required to disconnect the DVI cable to change an EDID as opposed to other manufacturer's products. The EDID can be changed even if a source is connected to the input and powered ON.

When the EDID has been changed, the router toggles the HOTPLUG signal for 2 seconds. Some sources do not observe this signal, and in such cases the source device must be restarted or powered OFF and ON again.

HDCP Management

Lightware Visual Engineering is a legal HDCP adopter. Several functions have been developed to solve HDCP related problems. Complex AV systems often have both HDCP and non-HDCP components. The matrix allows transmitting both HDCP encrypted and unencrypted signals. The devices will still remain HDCP compliant, as they will never output an encrypted signal to a non-HDCP compliant display device. If an encrypted signal is switched to a non-compliant output, a red screen alert or muted screen will be shown.

Protected and Unprotected Content

Many video sources send HDCP protected signal if they detect that the sink is HDCP capable – even if the content is not copyrighted. This can cause trouble if an HDCP capable device is connected between the source and the display. In this case, the content cannot be viewed on non-HDCP capable displays and interfaces like event controllers. Rental and staging technicians often complain about certain laptops, which always send HDCP encrypted signals if the receiver device (display, matrix router, etc.) reports HDCP compliancy. Even though HDCP encryption is not required all the time (e.g. computer desktop image), certain laptops still do that.

To avoid unnecessary HDCP encryption, Lightware introduced the HDCP enabling/disabling function: the HDCP capability can be disabled in the matrix. If HDCP is disabled, the connected source will detect that the sink is not HDCP capable, and turn off authentication.

Lightware Device Controller (LDC) Software

Below is a short description of basic functions and fundamental steps with examples of how to manage the EDID in Lightware's LDC, the free software tool to setup and control Lightware matrices and other devices.

EDID Menu

Advanced EDID Management can be accessed by selecting the EDID menu. There are two panels: the left one contains the Source EDIDs, and the right one contains the Destinations where the EDIDs can be emulated or copied.

EDID Menu

Control Buttons

Save	Exporting an EDID (save to a file)	>	Executing EDID emulation or copying (Transfer button)
Upload	Exporting an EDID (save to a file)	Deselect	Deleting EDID (from User memory)
Info	Display EDID Summary window	Select All	Selecting all memory places in the right panel
Edit	Opening Advanced EDID Editor with the selected EDID	Deselect All	Selecting none of the memory places in the right panel
Create	Opening Easy EDID Creator		

EDID Operations

Changing the Emulated EDID

Step 1. Choose the desired **EDID list** on the source panel and select an **EDID**.

Step 2. Press the **Emulated** button on top of the Destination panel.

Step 3. Select the desired port on the right panel (one or more ports can be selected); the EDID(s) will be highlighted in yellow.

Step 4. Press the **Transfer** button to change the emulated EDID.

Learning an EDID

The process is the same as changing the emulated EDID; the only difference is the Destination panel: press the User button. Thus, one or more EDIDs can be copied into the user memory either from the factory memory or from a connected sink (Dynamic).

Exporting an EDID

⚠️ *This function works on Windows and Mac OS X operating systems and under Firefox or Chrome web browsers only.*

Source EDIDs can be downloaded as a file (*.bin, *.dat or *.edid) to the computer.

Step 1. Select the desired **EDID** from the Source panel (the line will be highlighted in yellow).

Step 2. Press the **Save** button to open the dialog box and save the file to the computer.

Importing an EDID

Previously saved EDIDs (*.bin, *.dat or *.edid file) can be uploaded to the user memory.

Step 1. Press the **User** button on top of the Source panel and select a **memory** slot.

Step 2. Press the **Upload** button below the Source panel.

Step 2. Browse the file in the opening window, then press the Open button. The browsed EDID is imported into the selected User memory.

⚠️ *This function works on Windows and Mac OS X operating systems and under Firefox or Chrome web browsers only.*

Deleting EDID(s)

The EDID(s) from User memory can be deleted as follows:

Step 1. Press the **User** button on top of the Destination panel.

Step 2. Select the desired **memory** slot(s); one or more can be selected (**Select All** and **Deselect All** buttons can be used). The EDID(s) will be highlighted in yellow.

Step 3. Press the **Delete** selected button to delete the EDID(s).

EDID Summary Window

Select an EDID from the Source panel and press the Info button to display the EDID summary.

General	**General**
Power Management	
Gamma / Colors	EDID version: 1
Established Timings	EDID revision: 3
Standard Timings	Manufacturer ID: SAM (Samsung Electric Company)
Preferred Timing Mode	Product ID: 8E09
2nd Descriptor Field	Monitor serial number: Not present
3rd Descriptor Field	Year of manufacture: 2012
4th Descriptor Field	Week of manufacture: 9
	Signal interface: Digital
CEA General	Separate Sync H&V: -
CEA Video	Composite sync on H: -
CEA Audio	Sync on green: -
CEA Speaker Allocation	Serration on VS: -
CEA HDMI	Color depth: Undefined
CEA Colorimetry	Interface standard: Not defined
CEA Detailed Timing Descriptors	Color spaces: RGB 4:4:4 & YCrCb 4:4:4
	Aspect ratio: 0.56
	Display size: 52 cm X 29 cm

Editing an EDID

Select an EDID from the Source panel and press the Edit button to display the Advanced EDID Editor window. The editor can read and write all descriptors that are defined in the standards, including the additional CEA extension. Any EDID from the device's memory or a saved EDID file can be loaded into the editor. The software resolves the raw EDID and displays it as readable information to the user. All descriptors can be edited, saved in an EDID file, or uploaded to the User memory.

Creating an EDID

Since the Advanced EDID Editor mentioned above needs more complex knowledge about EDID, Lightware introduced a wizard-like interface for fast and easy EDID creation. With Easy EDID Creator it is possible to create custom EDIDs in four simple steps. By clicking on the **Create** button below the Source panel, **Easy EDID Creator** is opened in a new window.

Please visit www.lightware.com or contact Lightware for more information on available proprietary Lightware technologies.