

- Provides synchronization of (1) to (5) “soft-synced” DVI-D video sources to a master video timing
- Master timing is automatically selected from Channel 1 Input or Repeater Input
- Repeater Output for downstream EZsyncs, for installations requiring more than 5 video channels to be synchronized
- Programmable line delay



EZsync™ Video Processor

The EZsync is configured with 1 to 5 channels (referred to as synchronizing channels) of DVI-D video (dual link or single link) to be synchronized to a master video timing. The master video timing is automatically selected to be either Input 1 or the Repeater Input. The first box in a system will use Input 1 as the Master timing, allowing up to 4 additional channels to be synchronized to it. A Repeater Output is provided so that EZsync Video Processors can be daisy-chained to allow more channels to be synced to a master video timing.

The EZsync re-times soft synced inputs into a stable output with a fixed frame time, locked to the master video vertical sync. To avoid video artifacts, the input vertical syncs must be synchronized to within typically +/- 325 usecs of the master video vertical sync. (see section entitled **Soft sync Constraint Analysis**).

The re-timing is performed by using a FIFO rather than a frame memory. The FIFO provides “rubber-banding” to the system, such that periodic, standard video can be “pulled” from FIFO’s that are being filled by a soft sync input with varying timing.

Each channel can be individually configured in Auto Mode or Manual Mode. In Auto Mode, the synchronized output timing is simply a delayed version of the master timing. In Manual Mode, the synchronized output timing may have different timing and resolution than the master timing, while maintaining the same frame time as the master timing, and retaining a “lock” to the master timing. For timings (and resolutions) different than the master timing, the user will define the output timing desired (see section entitled **Output Video Timing**).

The EZsync is designed to require minimal programming. Most key parameters have pre-programmed default values. A configuration utility allows the user to program parameters when the default parameters are not suitable.

Features

- Synchronizes multiple channels to a master sync source
- Each channel individually configured as Auto Mode (same timing as Master) or Manual Mode, which supports different resolutions while maintaining gunlock.
- DVI-D input/output (single link and dual link)
- Up to 2560x1600 resolution
- Remote interface for both initial configuration and, if required, operational control via RS-232, USB, or Ethernet (optional)

Synchronizing Video Outputs

Synchronizing the video timings of multiple graphic cards can sometimes be required for multi-monitor or multi-projector applications. True video genlocked operation is not available with most graphics cards, and those that support genlocking are often expensive or lacking in other features.

To overcome this issue, some specialized software and hardware implementations can be done that will “soft sync” the video frames across otherwise independent computers and graphics cards. “Soft sync” is implemented by closed loop modifications of the video timing (ex: varying the clock frequency, adding or subtracting pixels and lines, etc.) to keep the outgoing Vertical Sync (VS) within an acceptable range of the master timing’s VS. These real-time modifications result in varying frame times, also known as frame jitter.

Downstream devices may not synchronize properly to the soft sync video due to the frame jitter within the video. For these situations, the EZsync can convert the soft sync video into stable video, genlocked to a master timing.

Soft sync Constraint Analysis

The EZsync requires inputs to be synchronized to within certain constraints. Two (2) key EZsync design items dictate constraints on the incoming soft synced channels. These design items are as follows:

1. Each synchronizing channel has 131,000 pixels of FIFO depth (262,000 pixels for Dual DVI channels), and
2. A synchronizing channel's FIFO is "cleared" each frame, at the start of incoming active pixels known as Line 1 Pixel 1 (L1P1).

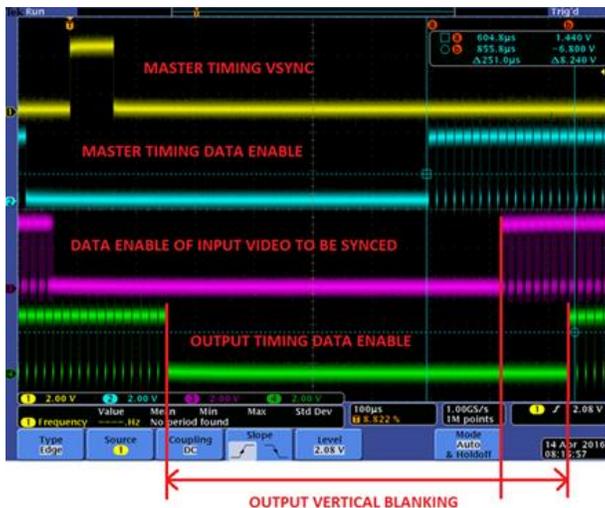
These two items help determine the soft sync constraints. Each specific configuration will require its own analysis, but for this discussion we assume the master timing and soft synced channels are 1080P.

Design item 1 equates to a line buffer size of:
 $131,000 \text{ pixels} / (1920 \text{ pixels/line}) = 68 \text{ lines}$.

Design item 2: Because the FIFO is cleared each frame at the start of active incoming video, it is essential that this "clear" function happens during the output vertical blank period (OVBP), when theoretically the FIFO should be empty and pixels are not being read out yet. Thus, a soft sync input's frame start can vary by OVBP.

Standard 1080P has an OVBP of ~45 lines. This is the maximum allowed variation in a soft sync input. Assuming most soft sync techniques should lead and lag a master timing by equal amounts, the EZsync automatically selects a delay of $50\% * \text{OVBP}$. Thus, the allowable variation of the soft sync channel's L1P1 with respect to the master channel's L1P1 is $\pm 50\% * \text{OVBP}$. In the example above, this is $\pm 22 \text{ lines}$ ($\pm 325 \text{ usecs}$).

In summary, the input channel's L1P1 clears the FIFO. For proper operation, the input channel's L1P1 must occur within the OVBP. If not, then a FIFO overrun or underrun will occur and a black image will be output for that frame.



The user can ensure proper operation by using a soft sync approach that keeps total frame jitter within $\pm 50\%$ of OVBP.

As a check, the # of lines in OVBP must be less than or equal to the FIFO line storage (FLS), where

$$\begin{aligned} \text{FLS} &= 131,000 / \text{active pixels per line} \\ &= 131,000 / 1920 = 68 \text{ lines} \end{aligned}$$

In our example, 45 lines in OVBP \leq 68 lines of FIFO storage, so the constraint is met. In some cases, a user may want to override the automatic delay value with a different value. Please see the Users Guide for more information.

Output Video Timing

The output timing for any synchronizing channel is programmed to be either a) identical to the master timing (Auto Mode), or b) derived from the master timing, but a different timing and/or resolution (Manual Mode) than the master timing. If Auto Mode, then the synchronizing channel will be timed identically as the master video timing, with minimal user programming required.

If Manual Mode, the user will define the desired soft sync channel output timing. The output clock is derived from the repeater (master) timing and desired output timing as follows:

VRtotal = Total lines per frame in Repeater Video
 HRtotal = Total clocks per line in Repeater Video
 PclkR = Frequency of the Repeater Clock

VOtotal = Total lines per frame in Output Video
 HOtotal = Total clocks per line in Output Video
 PclkO = Frequency of the Output Clock

Due to gen-locking,
 Frame Time, Repeater = Frame Time, Output
 $\text{VRtotal} * \text{HRtotal} / \text{PclkR} = \text{VOtotal} * \text{HOtotal} / \text{PclkO}$
 $\text{PclkO} = \text{PclkR} * (\text{VOtotal} * \text{HOtotal}) / (\text{VRtotal} * \text{HRtotal})$

The EZsync implementation allows programming of output timing to ensure genlocked operation. See Users Guide for details.

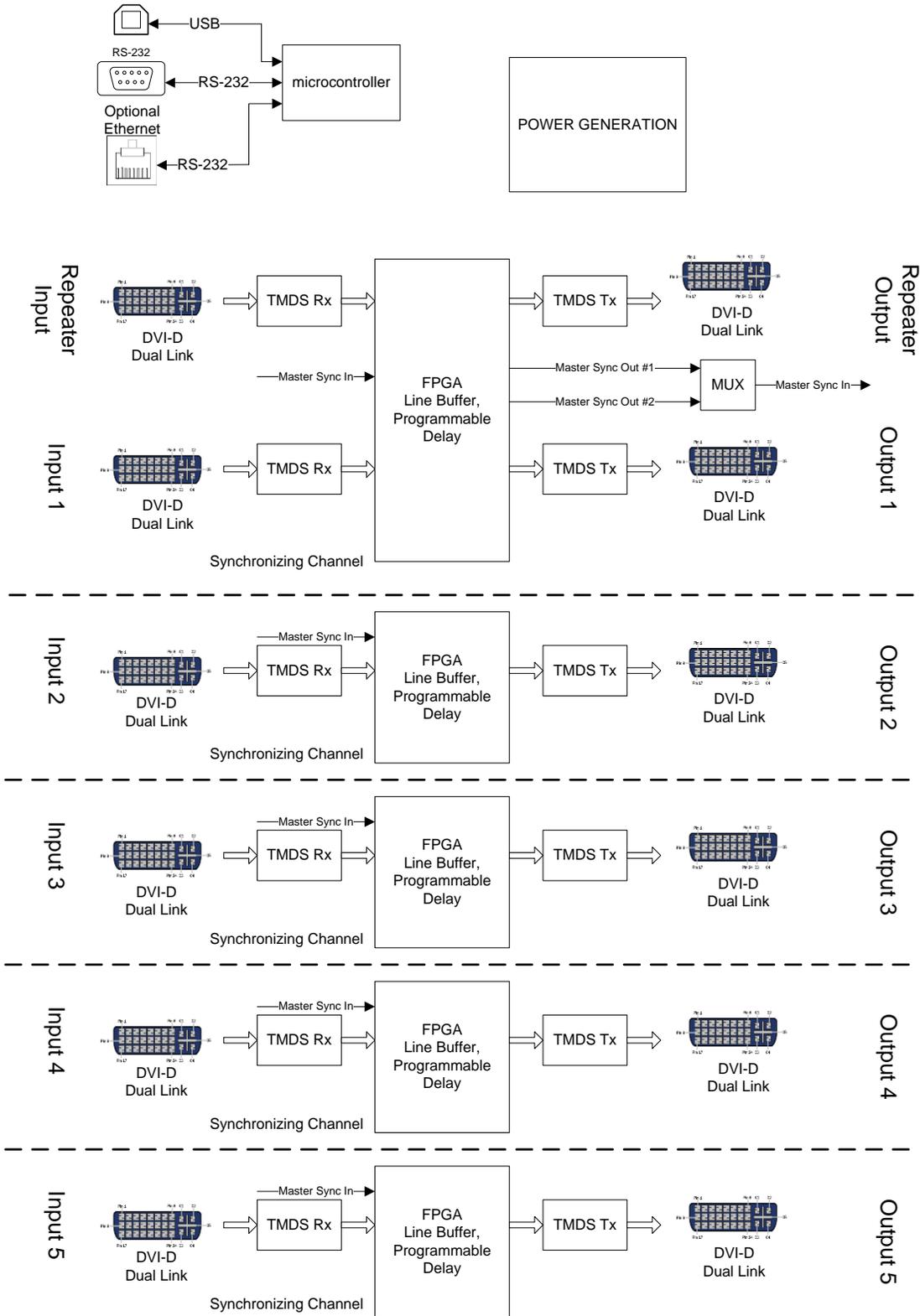
Master Timing, Output Video Timing Modes

Master video timing is automatically selected from the Repeater Input or Input 1. The Repeater input can only be connected to a repeater output from an upstream EZsync device.

If a channel is in Auto Mode, its output timing is the same as the master timing, but delayed by an integer number of lines. This mode is fully automated.

If a channel is in Manual Mode, the output resolution is the same as the input resolution, with a stable clock generated from the master timing. The channel's resolution can be different than the master resolution, but the frames are locked to the master timing. This mode requires additional programming.

EZsync Block Diagram



Spec Summary

Input / Output	Specification	Functional	Specification
Video Type	Standard: TMDS (single link, dual link)	Features	DVI-D video syncing, more
Pixel Rate	Up to 330 MHz (165 MHz single link)	Output Sync	All outputs genlocked to master channel vertical sync with programmable delay
Active Clocks per Line	Up to 4096	Color Processing Depth	8 bits per color
Active Lines per frame	Up to 4096	Re-sizing	No scaling/resizing is supported
EDID	Programmable via EZsync Configuration software	Video Latency	user programmable as x lines. Default value is 50% of master timing output vertical blank time
Volatility	Programmed values are stored in non-volatile memory.	Video Buffering	Up to 131,000 active pixels for single link DVI, 262,000 pixels for dual DVI
Connectors	DVI-I connector	Soft sync Constraints	Worst case frame jitter cannot exceed output blanking time, and line delay must be selected such that the incoming video's L1P1 stays within the vertical blank period of the channel's output timing.
Warranty & Certification	Specification	Electro Mechanical	Specification
Warranty	1 Year Limited	Control	RS-232, USB, Optional Ethernet
Certifications	RoHS	Input Power	IEC Connector, 100-240 VAC, 47-63 Hz, less than 60 Watts
		Dimensions	1U: 19"(W) x 11.5" (D) x 1.75" (H)
		Weight	Less than 5 lbs.

Ordering Configuration

All EZsync units include a repeater input and repeater output. In addition, the EZsync may be ordered with 1 to 5 synchronizing channels. The ordering part number is EZsync-n, where n is the number of synchronizing channels. Valid part numbers are:

EZsync-1, EZsync-2, EZsync-3, EZsync-4, EZsync-5

For optional Ethernet interface, please add :E to the part number, such as EZsync-5 :E.

EZsync Operation

Typically, the EZsync operates as follows:

1. Upon power up, the EZsync configures itself based on its previously saved configuration.
2. When valid video is detected, the EZsync synchronizes the incoming video to the master channel, per the programmed line delay.

What's Included

- EZsync Video Processor (with 1 – 5 synchronizing channels)
- EZsync Configuration software
- USB Cable
- Power Cable
- Rackmount Ears

Additional Resources

To view our full line of Video Processors or other products, visit our website at: www.westardisplaytechnologies.com

Call us for more information and pricing.

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