

HDBaseT™ Long Reach Mode

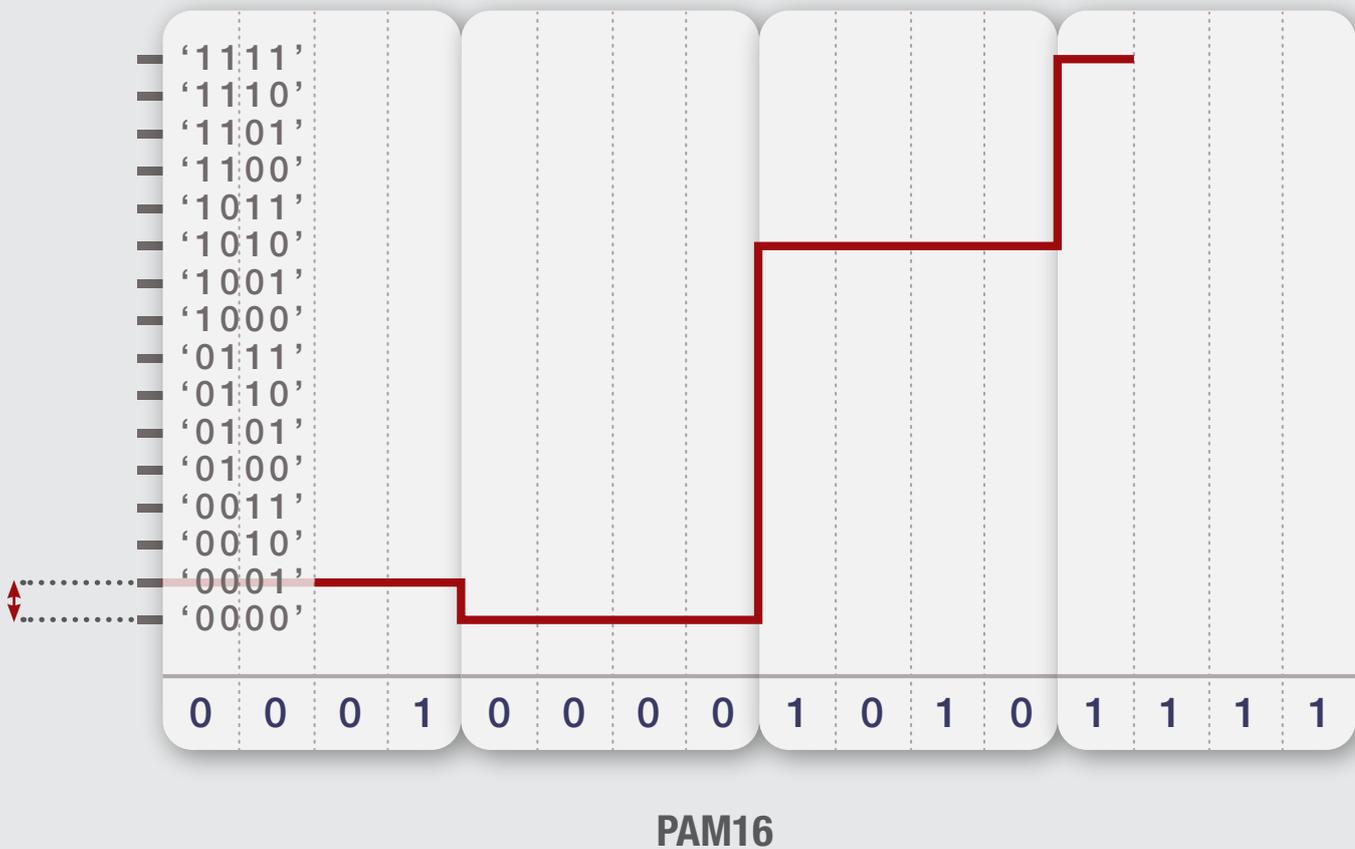
White Paper
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Lightware Visual Engineering

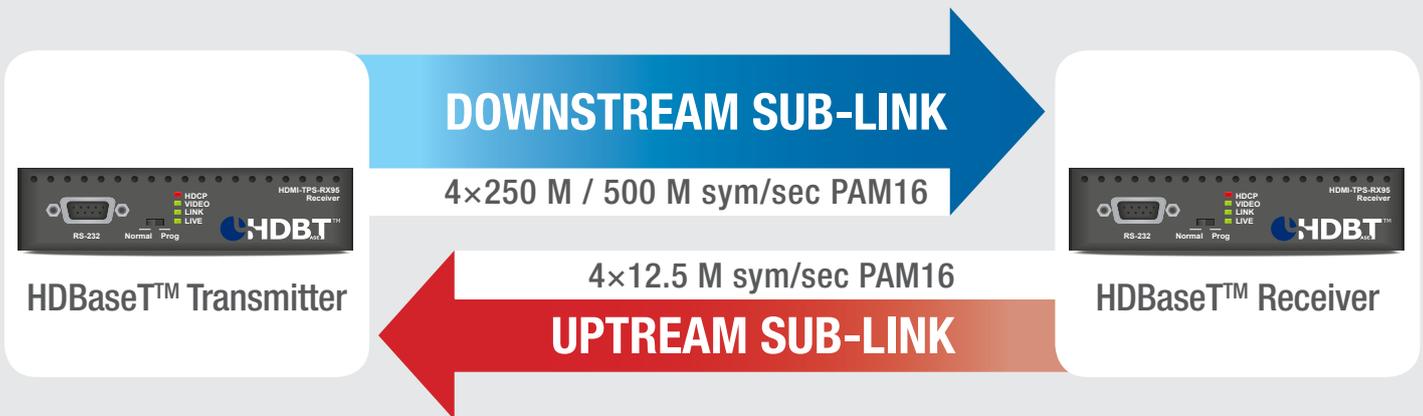
Theory of Operation

HDBaseT uses an asymmetric method to send audio, video, Ethernet, USB, controls and power from source to sink, but only 300 Mb are transferred back (Ethernet, controls, and possibly power).

HDBaseT employs PAM16 for encoding video content, which allows slower symbol speed than TMDS for the same amount of data. PAM16 is a version of Pulse Amplitude Modulation technology, where the digital data is represented with a coding scheme using 16 levels of voltage.



HDBaseT uses four downstream sub links with 250M symbols/sec or 500M symbols/sec with PAM16 coding, which is the direction of video. It also uses four upstream sub links each at 12.5M symbols/sec with PAM16 coding, which is used for backward communication like for example Ethernet.



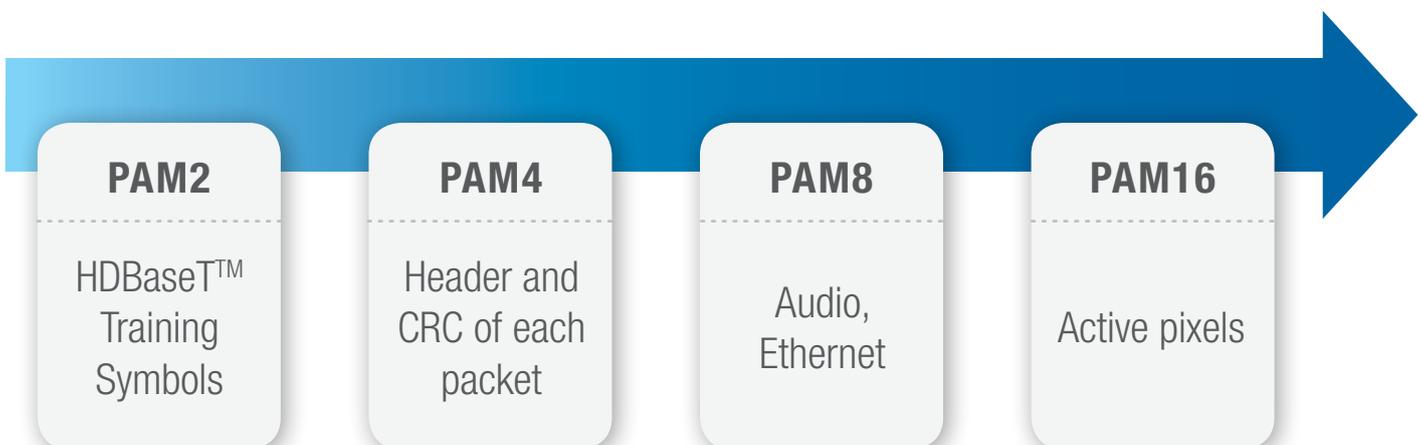
Downstream Sub Links have two modes of operation:

Basic Mode: provides up to 4Gbps throughput using symbol rate of 250MSPS.

Enhanced Mode: provides 8Gbps throughput using symbol rate of 500MSPS.

Both Sub Links utilize all four twisted pairs of the UTP cable transmitting in full duplex, downstream and upstream at the same time.

HDBaseT also provides different transmission quality for various data types using different PAM modulations according to the data type which is being transferred.



Working in Long Reach Mode

The Valens VS100 chip family support long reach mode. When this mode is applied, a more robust modulation technique is used in order to enhance range while compromising on maximum supported rate. If a system is not required to support video rates higher than 4 Gbps (i.e. 1080p, 24 bpp, 60 Hz or video formats not exceeding a pixel clock rate of 148.5 MHz), then we can activate long reach mode and enjoy longer cable reach of 170 meters with a CAT7 SFTP cable. Long reach mode actually means that the downstream sub links are operating with 250M symbols/sec in Basic Mode.

As established by the HDBaseT Specification Version 1.1.0, each HDBaseT Device shall maintain an HDBaseT Configuration Database (HDCD). It contains information regarding device configuration and status.

As per HDBaseT Specification Version 1.1.0 definition, there are database entities which provide information on the supported modes and current operation modes.

Entity ID	Definition	Value lengths (octets)	Read/Write	Remark
0x0405	Max Active Mode Supported:	1	RO	
	<ul style="list-style-type: none"> ▪ 0x01 – 250M PAM16 ▪ 0x02 – 500M PAM16 			
0x0406	Current Operation Mode:	1	RO	
	<ul style="list-style-type: none"> ▪ 0x00 – Partner Detect ▪ 0x01 – 100BaseT Fallback ▪ 0x02 – LPPF #1 ▪ 0x03 – LPPF #2 ▪ 0x04 – 250M PAM16 ▪ 0x05 – 500M PAM16 			

To configure the VS100RX and VS100TX for working in long reach mode, the chip manufacturer provides further necessary information.

Requirements for 170m Extension in Long Reach Mode

Lightware aims to reach a superior quality signal extension with HDBaseT extenders. These are the key prerequisites to achieve successful 170m signal transmission in long reach mode:

- The HDMI video signal must be limited to 148,5MHz pixel clock (practically 1920x1080p@60Hz, 24 bpp) due to the limitation of the downstream basic mode.
- We have a dedicated HDBaseT Testing Lab, testing inter-operability with other brands and products.
(<http://www.lightware.eu/support/lightware-testing-lab>)
- We aim to over-perform the design checklist recommended for standard HDBaseT designs (power supply filtering, noise, layout guidelines etc...)
- We use only quality CAT7 SFTP cables and connectors for this very long distance transmission:

*Cable: TE Connectivity ISO-EN Compliant 487146 CAT7A S/FTP XG SOLID PRO4 **AWG23** LSFRZH*