



LXI Overview

Wired Trigger Bus

February 14-16 2006

Wired Trigger Bus Objective

- To provide a uniform physical trigger mechanism between Class A LXI Devices
 - Class A requires the presence of Class B triggers and timing
 - Class C devices may become available with the Wired Trigger Bus
- Alternative to ad hoc trigger exchange between instruments over coaxial cables
- Part of the overall suite of LXI Triggers

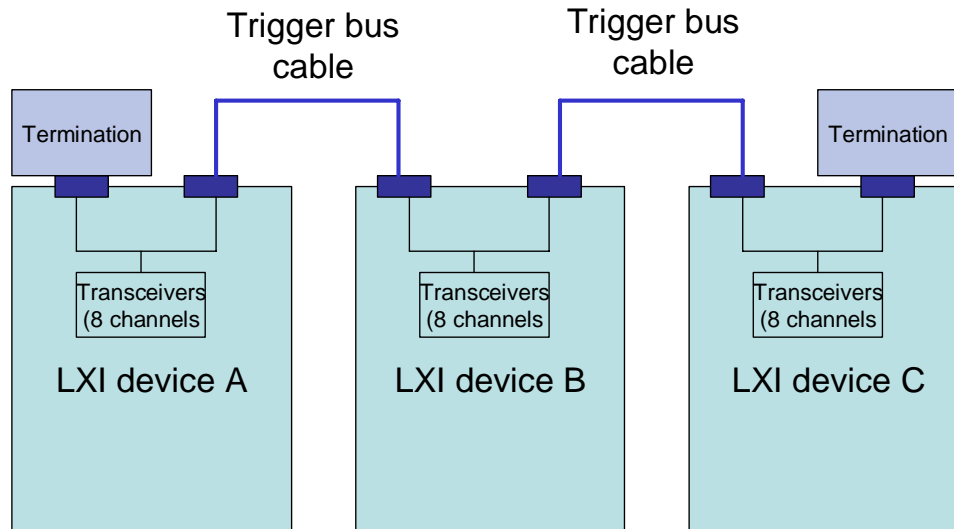
Why a physical wired trigger bus?

- Low latency
 - Connection time is primarily defined by hardware
- Low jitter
 - Delays do not vary significantly
- Can be used to exchange of data over the trigger lines
- Enables the use of clock signals over trigger bus

WTB Capability

- Provides 8 independent channels of connectivity between LXI Class A Devices
 - Matches the channel count in other trigger modes
 - Permits easy exchange of trigger modes
 - Matches trigger bus count of VXI and PXI
- Each LXI Device has two WTB connectors physically wired together

How the system looks



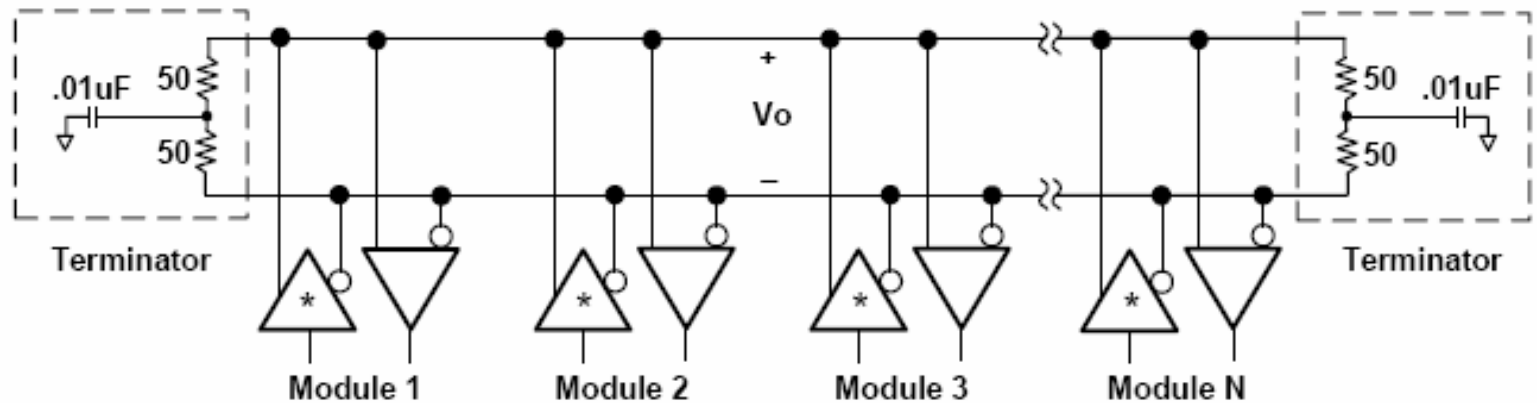
- LXI Devices are connected by LXI Trigger Bus cables
- Trigger bus cable carries 8 channels
- Cable forms a transmission line that is terminated at both ends by the terminator

Electrical interface (1)

- Electrical specification is based on a variation of TIA/EIA-889 Multipoint LVDS
- Each channel set to operate in one of two modes
 - Driven mode. Point to multipoint connection
 - Wired OR Mode. Multipoint to multipoint connection

Electrical Interface (2)

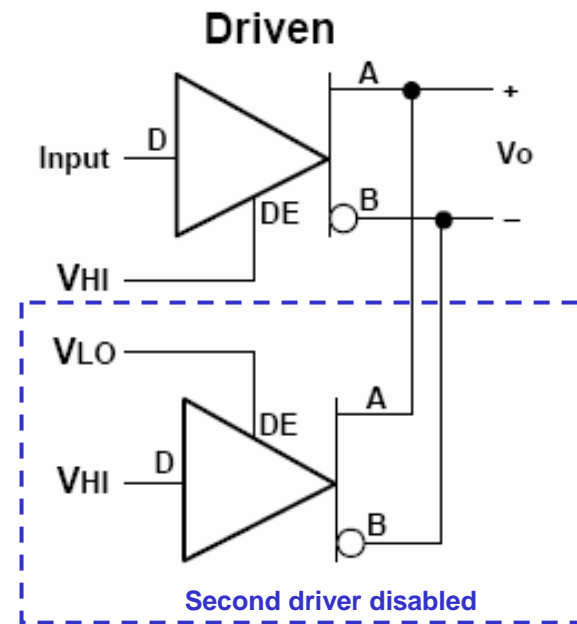
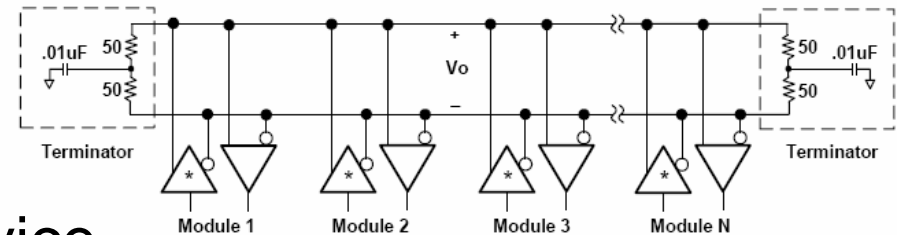
- LVDS signalling allows a long transmission range, high signal immunity and low signal emissions
- M-LVDS is a variation of LVDS
 - Greater current capacity from the drivers
 - Driver sends current in both directions down a transmission line
 - Has two terminations for the transmission line instead of one
 - The LXI implementation uses two drivers on each line



★ Driver uses two devices connected in parallel

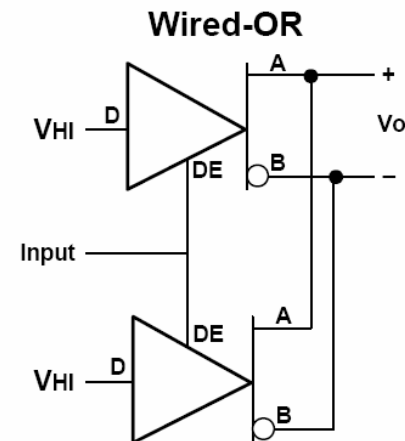
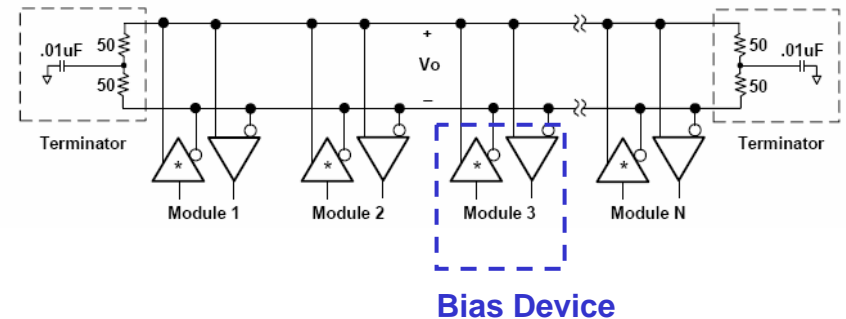
Driven Mode

- For driven mode one LXI Device controls the transmission line condition and many receive
 - One drive only is used to drive the transmission line
 - Similar principal to PXI backplane triggers but with differential signalling over a cable and PCB interconnect



Wired OR Mode

- Designed to allow the first device ready to set the interface high
- A Bias device forces the interface low with one unit of current, others are tri-state
- The first device to trigger forces the interface high with two units of current
- Reverse operation (last device ready) is the same but all devices are set to be on with two units of current
 - Last to go tri-state allows the bias device to force the transmission line low
- Very similar characteristics to VXI Trigger Bus
 - But much faster



Connectors

- Specified as 25 way Micro D Type, commercial grade used
 - Small and robust connector with 1 Amp current rating
- Connector carries 8 M-LVDS pairs, shields, 3.3 V power and power return
- The 3.3 V power is limited to 100 mA and cannot be extended into the cable
 - Ensures no voltage conflict between LXI Devices
- Each LXI Device has two connectors
 - Can be side by side or stacked on top of each other (dual connector)
 - Connectors are wired together with transmission lines and minimized stubs to preserve the transmission line parameters
 - Defects will compromise the whole trigger bus

Cable Assembly

- Mating connectors at each end
- Cable carries 8 twisted pairs with a screen for each
- Wire is specified to have a high conductivity finish to avoid signal degradation at high frequency on longer cable runs
 - Classic problem of skin effect losses

Terminator

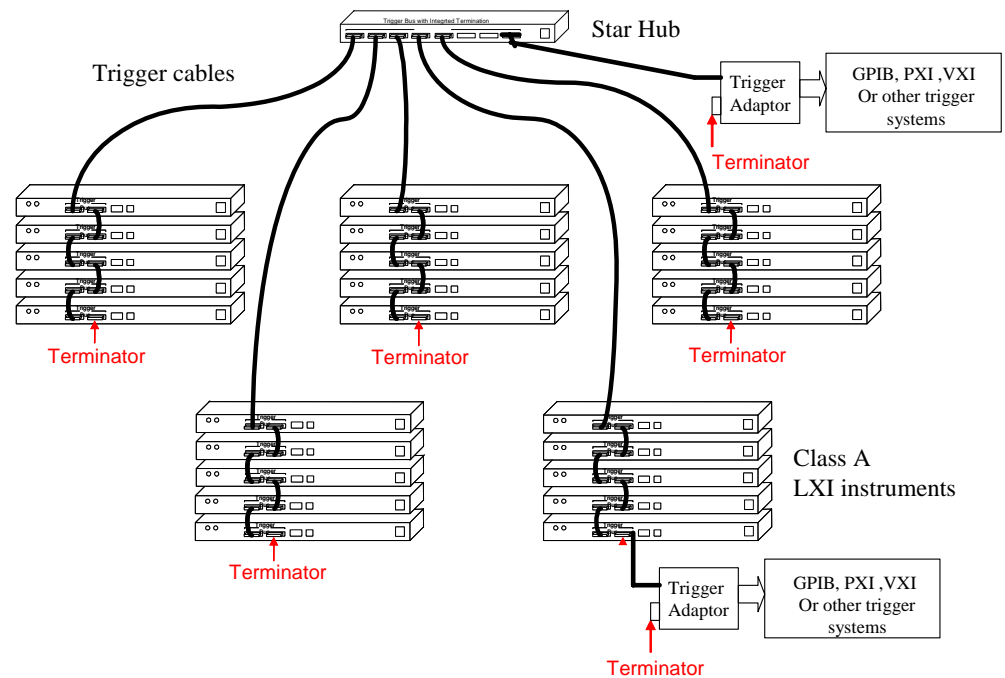
- Simply a block including differential terminations for each differential pair
 - Two 50 ohm resistors in series across the pair with 0.01 uF to ground at centre tap for each channel
 - Terminates differential line in 100 ohms at each end
 - Centre tap provides common mode termination of any current imbalance
 - Some imbalance is always present
 - Driver mismatch
 - Difference in operating times coming out of tri-state mode for drivers

Overall performance

- Can have 16 LXI devices daisy chained together
- Can propagate a 10 ns pulse over 10 m of cable in Driven Mode
- Can propagate a 20 ns pulse over 10 m in Wired OR mode
 - Performance difference resulting from use of tri-state mode for drivers
- Connection length can be extended but at the expense of need for wider pulses
- Flexibility of both driven and Wired OR mode
- Remember that it can also be timed by Class B devices

Expanding with a Star Hub

- Star Hub can be used to connect segments together
 - Extends the number of LXI Devices
 - Electrically separates the segments
 - Terminates one end of the segment
- Star Hub can provide a logical mapping between the segments
 - How much is vendor dependent
- Star Hub acts a directional barrier
 - Has an impact on Wired OR mode



Compliance Procedure

- Requires access to high speed scope
 - Preferably with a differential probe
- There is a procedure for testing the LXI Device
 - Part by vendor declaration
 - Part by physical testing
- Separate procedure will be generated for cable assemblies and terminators
 - Entirely based on the rules already in the standard
 - Will provide user assurance about the performance of the cables and terminators