

PCI-Express™ Serial Protocol Preprocessor **FuturePlus Systems**

For Use With Tektronix Logic Analyzers

Power Tools For Bus Analysis



FS4405 Protocol Preprocessor

- Low-cost PCI Express analysis
- ExpressCard™ support
- Supports most Tektronix logic analysis systems
- Includes protocol-decode software with Transaction Viewer
- Includes automatic logic analyzer configuration software



FS4405 PCI Express Protocol Preprocessor

FuturePlus® FS4405 Key Features

- Support for X1, X2, X4, X8 and ExpressCard
- Data acquisition up to 2.5 GT/s
- 2- and 4-lane lane deskew for PCI-Express in both 8b and 10b data modes.
- Detects packet types and checks packet delimiters
- Packet-aware data filtering and logic analyzer triggering.
- Supports upstream and downstream directions or for two unrelated single direction links.
- Probe Manager software executes on a logic analyzer or PC for real time control

Straightforward, Reliable PCI Express Protocol Analysis

The FS4405 provides a mechanical, electrical and software interface between a PCI-Express bus and a Tektronix logic analyzer. The probe provides quick, reliable connections to the system under test. Internal termination networks minimize loading effects and reflections on the PCI-Express bus. The protocol-decode software decodes and displays incoming data on your logic analyzer.



Helping You Design Tomorrow's Computer Buses, Today

FuturePlus Systems is the technology leader in protocol analysis tools for the computer design industry. Our analysis probes and software help you monitor and verify complex activities on your advanced-technology computer bus design. FuturePlus Systems offerings include bus-analysis solutions for HyperTransport®, PCI-X, DDR Memory, USB2.0, and most other popular computer buses.

Full-featured, Low-cost PCI Express Protocol Analysis

The FS4405 is a low-cost PCI Express protocol preprocessor, capable of non-intrusively probing a PCI-Express bus at a serial data rate of 2.5 Gb/s. It is equipped with a full-sized mid-bus probe that can intercept various combinations of eight channels out of the possible 16. The FS4405 includes protocol decode software that decodes and displays incoming data on a Tektronix logic analyzer. The probe and decode software are designed to handle a single uni-directional link, a pair of uni-directional links, or a bi-directional link on a single TLA module.

The probe hardware and decode software treat the two links individually. For analysis of interactions between two links, the logic analyzer inter-machine triggering function is used.

With the FS4405, the X1, X2, X4 and X8 bi-directional footprints can be probed at all locations. The unidirectional footprint is also supported.

Protocol-decode Software

The probe acquires serial data, converts it to parallel form, recognizes and filters packets, and clocks the information into the

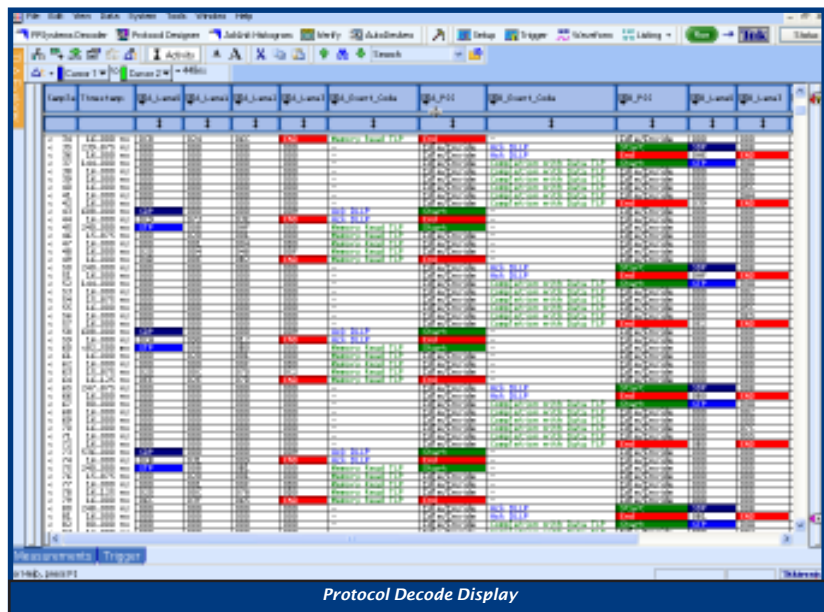
analyzer. The data sent to the analyzer includes:

- Captured data (in 8b or 10b representation)
- Information about packet types
- Packet state information
- Packet recognizers, and error indicators

This data is processed by the protocol decoder for display of packets, transactions and errors. Although the probe hardware has the ability to filter and trigger, the software interface provides bits arranged to support the use of logic-analyzer-based trigger functions, even on packet-based data.

Probe Connections

The FS4405 accommodates a variety of connection methods. Choose from interposer, mid-bus and lead-set cables, as well as connections supporting standard industry connectorless probing technology.



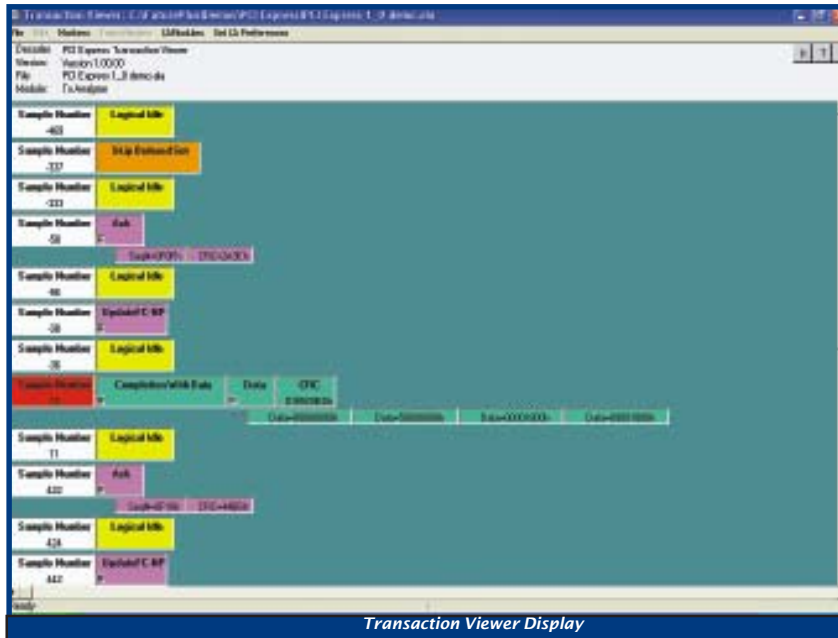
Probe Manager Software

Probe Manager software runs on a logic analyzer or a Windows PC and interfaces to the probe via a USB interface. The software provides an interface to setup and monitor probe pattern recognizers and filters.

Auto Configuration files Get You Up and Running Fast

The FS4405 includes configuration files that set up the Tektronix logic analyzer labels, symbols, and clock assignments necessary for correct capture and decode of the PCI Express data.

These files provide rapid setup, letting you begin analyzing data in just a few minutes.



Transaction Viewer A graphical View of Bus Transactions.

The FS4405 includes Transaction Viewer software that runs on your Tektronix logic analyzer to graphically display bus transactions. Start with a high-level summary view for quick scanning of transactions. Then use the drill-down feature to expose lower-level details of transactions of interest.

Key Features of the FS4405 PCI Express Protocol Preprocessor

- Data acquisition up to 2.5 Gb/s
- Two-way monitoring of X1, X2, X4 and X8 links
- Spread spectrum clocking support
- Packet-level decode
- Support for Ordered Sets, TLP, DLLP and Electrical Idle
- Fast Training Sequence (without extension bit) synchronization in 14-16 FTS
- Six Separate 24-byte pattern recognizers sufficient for the maximum PCIe header size in 8-bit decoding mode
- Software controlled polarity inversion and lane reversal
- Filtering by traffic class or virtual channel (8-bit decoding only)
- Jitter specification (valid data eye) - 140 ps (0.65 unit interval)
- Two Link Processors
- Performs 2- and 4-lane word align (lane deskew) for PCI-Express in both 8b and 10b data modes.
- Power - +5V DC external supply, included
- Detects packet types and checks packet delimiters (minimal protocol checking).
- Provides means for user to enable or disable de-scrambling.
- Packet-aware data filtering and logic analyzer triggering.
- Supports up to two machines for upstream and downstream directions or for two unrelated single direction links.
- User-selectable lane inversion and lane-numbering reversal as needed to probe the target system
- Probe Manager software executes on a logic analyzer or a PC to control probe over a USB interface in real time
- Built-in logic analyzer connectors
- Several different adapter cables are available

Supported Tektronix Logic Analyzers

Logic Analyzer	X1 Bi-directional	X2 and X4 Bi-directional	X8 Uni-directional	X8 Bi-directional
TLA7AAx	2 ea TLA7AA3 or 1 ea TLA7AA4, 235 MHz	2 ea TLA7AA3 or 1 ea TLA7AA4 450 MHz	1 ea TLA7AA3 or 1 ea TLA7AA4 450 MHz	2 ea TLA7AA3 or 2 ea TLA7AA4 450 MHz
TLA7NAx	2 ea TLA7NA3 or 1 ea TLA7NA4, 235 MHz	2 ea TLA7NA3 or 1 ea TLA7NA4 450 MHz	1 ea TLA7NA3 or 1 ea TLA7NA4 450 MHz	2 ea TLA7NA3 or 2 ea TLA7NA4 450 MHz

Logic Analyzer Channel Requirements: The FS4405 requires from eight to 12 logic analyzer channel groups depending on modules used and number of directions to be monitored. Please visit the [FS4405 System Requirements page at www.futureplus.com](http://www.futureplus.com) for the most up-to-date system configuration details.

Ordering Information

FS4405 PCI Express protocol preprocessor 2.5 Gb/s (includes hardware, configuration software, protocol disassembly software and a single user Tektronix logic analyzer license)

Note: for X8 single direction support, one FS4405 is required. For X8 bi-directional support, two FS4405's are required. Choose one of the FS1037, FS1038 or FS1039 adapter cables listed below.

FS4416 PCI Express and Serial Rapid IO Protocol Preprocessor

FS1055 TLA7Axx Probe Cable (for X1-X4, 4 ea required; for X8, 6 ea required for use with Tektronix logic analyzers)

Choose at least one of the following adapter cables:

FS1031 Full size footprint for X1, X2, X4

FS1032 Half size footprint for X1, X2 or X4

FS1033 ExpressCard Interposer

FS1034 Interposer for X1

FS1035 Interposer for X4

FS1036 Flying Lead cable adapter

FS1037 Interposer for X8

FS1038 Full size footprint for X8

FS1039 PCIe X8 Uni-shaped

Additional Software License

FS1160 - PCI Express Software license for TLA7000-series (One FS1160 is included in each FS4405)

**We offer excellent technical support and quick delivery.
Ask about our free newsletter, *The Bus Analyzer***

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