

LeCroy®, a worldwide leader in serial data test solutions, creates advanced instruments that drive product innovation by quickly measuring, analyzing and verifying complex electronic signals. With systems available for protocol layer testing, LeCroy offers a complete solution to meet the high demands of Fibre Channel technologies.

The Fibre Channel analyzers are built with the CATC™ Protocol Analyzer System as its foundation for stable and reliable measurements. With interchangeable plug-ins, field upgradeable firmware, and the ability to link multiple analyzers together for higher bandwidth applications, the CATC platform can evolve, as your protocol analysis needs change.



The LeCroy Fibre Channel analyzers, built on the CATC 10K platform, include the FC*Tracer* 4G analyzer and the FC*Tracer* 2G analyzer. The FC*Tracer* 4G analyzer supports 4 recording channels- or two full duplex links in a fibre channel fabric. It can record 4, 2, and 1 Gbps transfer rates. And, you can cascade multiple FC*Tracer* systems to provide a synchronized display of captured traffic across up to 16 links. The FC*Tracer* 2G supports 2 and 1 Gbps fibre channel only.

Powerful display views allow for easy analysis of protocol traffic

LeCroy's *Tracer* analysis software gives you a variety of powerful tools for analyzing and displaying bus traffic.

The *Tracer* software makes it easy for you to view all elements of a command, even if they are spread over

several different physical links - helping you understand traffic flow and ensure devices are behaving correctly at the protocol level.

The FC*Tracer* analyzer records all the data on the link. Unfiltered Fibre Channel traffic contains tens of

thousands of idles and link management ordered sets, which can make it extremely difficult for you to understand and analyze events on the bus. Within the CATC Trace™ software display, you can preserve the detail, but also have an easy way to view the traffic hierarchically.

For instance, you can:

- Isolate the view to just the transport layer by clicking first on the Hide Primitives button to remove the redundant ordered sets. Then, by clicking on the SEQ button, it narrows down the display to just the transport layer of the protocol. Each bi-directional exchange of information is represented on a separate line making it easier for you to see the exchange of information between the initiator and target.
- Decode up to the exchange layer by selecting the Xch button. This decodes the user payload of the exchange, including FCP (SCSI) transactions, extended link service commands, FC-Tape and Switch protocols. It shows you all the SCSI operations with the most important SCSI parameters decoded, and shows the addresses of the devices involved, the tag, LUN, type of command, plus performance metrics that the software calculates.

The *Tracer* software actually detects and alerts you to problems at all functional levels of the Fibre Channel layering including:

FC-1: Invalid CRC; running disparity error, invalid 10bit codes

FC-2: frame, sequence and exchange violations

FC-4: FCP mapping and SCSI errors

Although the CATC Trace display is ideal for showing traffic at the logical level, it is often necessary to drill down to the byte level and see traffic across multiple lanes on a common timescale. The Link Tracker™ software display provides this view, and allows you to see the low level

ordered sets and 32-bit data structures in hex, scrambled hex, or decoded with the field names displayed. It also helps you analyze propagation delay or state changes between two points in a fabric by showing a time slice at DWORD level resolution - 9 ns between each cell.

For more advanced analysis, another view available to you is the Frame Tracker™ software display. This view shows each exchange of information in a separate cell while preserving the spatial relationship of traffic that is moving across multiple links.

Within each of these displays, Tooltips pop up to provide you with detailed descriptions of the field, including information about the Fibre Channel specification. At the higher layers, valuable performance metrics are calculated for each operation making it easier to view variances in throughput or latency. This helps you identify possible problems at the lower levels.



The CATC Trace display logically groups all transactions that are part of a SCSI operation

Colors and graphics are used to represent SCSI operations, transactions and frames

The Frame Tracker display gives a high-level view of primitives and frames across multiple links

May be scrolled independently or synchronized with other displays

Displays an absolute time stamp for each event. Where appropriate, a relative time delta is calculated and shown

May be scrolled independently or synchronized with other displays

The Link Tracker display shows all DWORDS on all channels synchronized to a common clock

Simplify analysis of state transitions by viewing traffic across multiple links

Tooltips decode SCSI-specific payload information

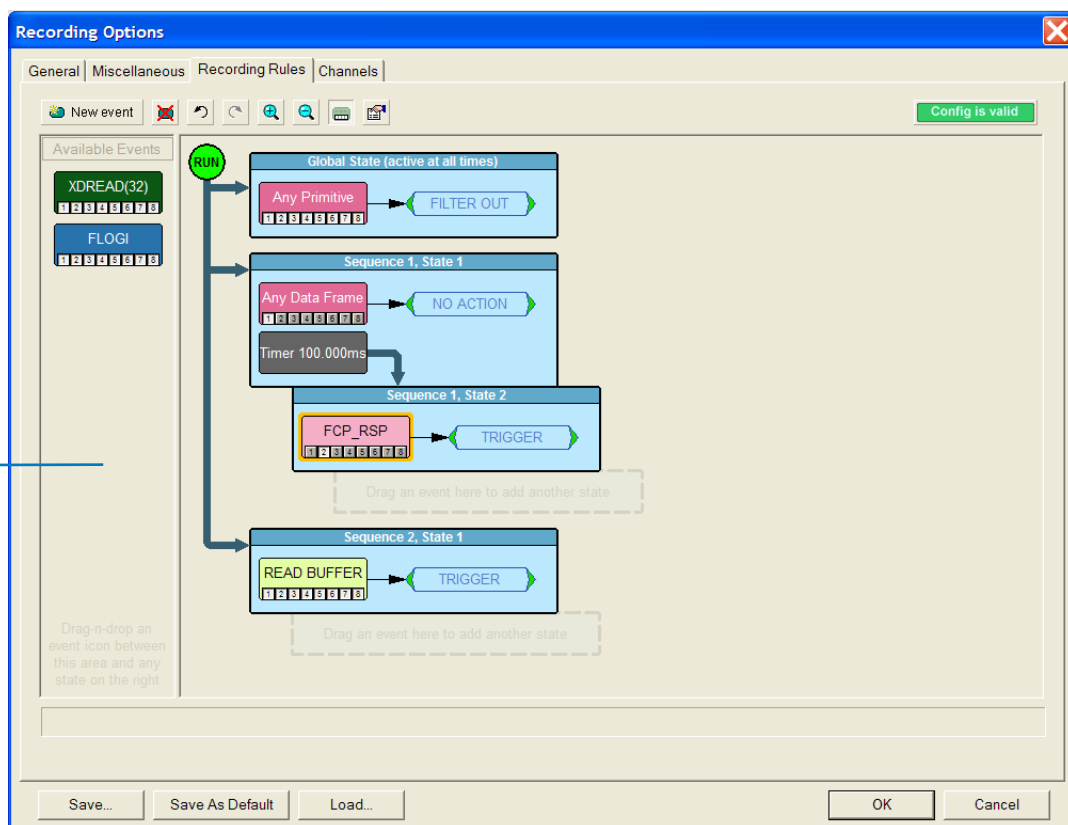
Powerful Triggering and Filtering

As the protocol evolves and moves from prototypes to system level testing, triggering becomes more important since problems from linking devices are more intermittent. The Tracer software provides the ability to select simple triggers on typical events, like Link Services, FCP operations, primitives, specific I_T_L Nexus, Originator Addresses, or SCSI Status. The triggering model features two independent sequencers that can track two unrelated series of events in parallel. Each sequencer can separately monitor up to 256 levels or sequential state machines with up to six "events" per level. The triggering and filtering options are channel independent and can record different fields based on the traffic detected on the individual links.

Sophisticated Triggering includes:

- **FC-2 and FC-4 level events** – allows you to choose from a library of predefined packet types including basic and extended link-services; SCSI operations; or primitives.
- **Custom recording templates** – allows you to predefine and reuse custom trigger/filter settings within a development team.
- **Sequencers** – allows you to create dual sequential trigger scenarios that can each operate independently across multiple channels.
- **Counters** – allows you to further qualify recorded traffic by tracking multiple occurrences of specific events, frames or sequences.
- **Timers** – allows you to employ time-based thresholds to initiate actions including starting subordinate sequences, restarting counters and starting/stopping the recording.

LeCroy's Drag and Drop graphical interface makes sophisticated triggering easy



Intelligent Traffic Reports and Summaries

Our Fibre Channel analyzers are more than just data recorders. The real value is in the analysis of the data. The Tracer software generates detailed reports that provide statistics on the occurrence of errors, primitives, frames, sequences and other protocol events within the trace. You can evaluate these metrics at a glance or use them to navigate through the recording. Metrics on throughput and response time are automatically generated for each SCSI operation to allow easy identification of performance problems. The Bus Usage Calculator can also produce metrics on a user-specified subset of the trace. *FCTracer* also features graphical bus utilization reports, which provide a histogram of bus events dynamically linked to packet level detail.

The *Tracer* software provides two powerful post processing capabilities to automate your analysis tasks. Custom decoding provides a script based API that allows you to display vendor-unique content or call out special payload elements to suit a specific development need. The Verification Script Engine (VSE) API is capable of opening and parsing actual trace files. It may be used to automate analysis tasks by performing complex calculations on large trace recordings such as flagging boundary conditions or possible timing violations.

The screenshot displays the FCTracer software interface. The top section shows a detailed view of a SCSI Mode Sense (6) command. Below this, a 'Traffic Summary' window is open, showing a table of SCSI commands and their occurrence counts across six sequences.

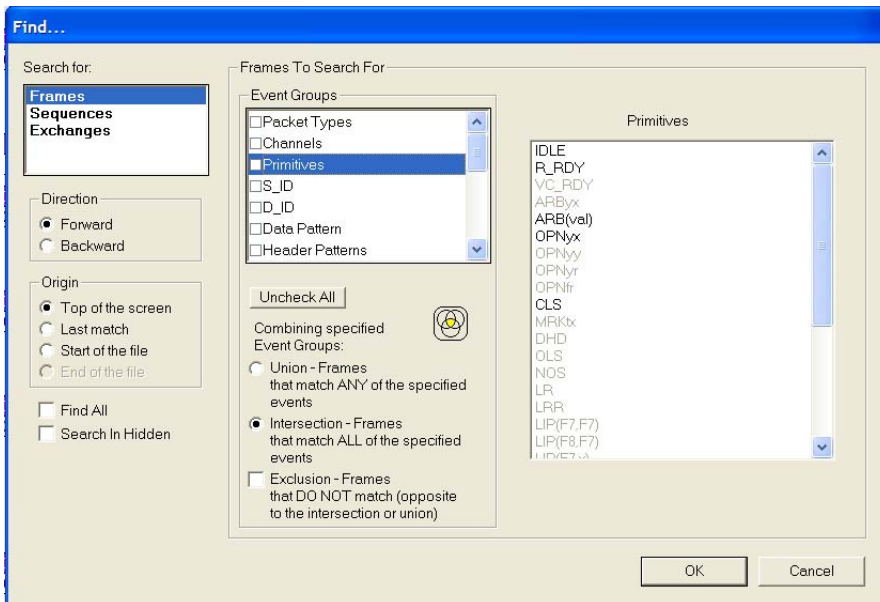
Command	1	2	3	4	5	6	Total
TEST UNIT READY (0x00)	0	0	0	0	0	1	1
INQUIRY (0x12)	106	0	0	0	1	253	360
MODE SENSE(6) (0x1A)	96	0	0	0	0	221	317
READ CAPACITY(10) (0x25)	128	0	0	0	0	29168	41830
READ(10) (0x28)	13009	0	0	0	0	30025	43034
WRITE(10) (0x2A)	48	0	0	0	0	92	140
MODE SENSE(10) (0x5A)	0	0	0	0	0	102	102
REPORT LUNS (0xA0)	3	0	0	0	0	7	10
							85794

Click on Mode Sense (6) Command to automatically jump through each occurrence within the trace

Search Results Quickly

The advanced search features in the Tracer software helps you quickly find what you want. By using the Quick Search, you can select fields right from the drop down menu, such as Go To Trigger or Event, or directly to a specific marker or time stamp in the trace. The Go To feature provides a simple way to search for Fibre Channel protocol events within the trace, such as individual FC primitives or packets.

The advanced Find lets you search on specific SCSI parameters and extended link services commands like the Initiator Address or Tag Value of a SCSI operation. Using the Find dialog, you can choose your selection criteria and create a new trace file that represents only the data you seek.



Intelligent search saves you time by only presenting selections that actually occur in the trace

A Comprehensive Solution

LeCroy's Fibre Channel analyzers provide you with advanced features necessary to ease the development and deployment of Fibre Channel devices. The ability to "cascade" up to four FC Tracer systems together to display traffic synchronized to a single clock reference (from up to 16 links) addresses higher port count applications. The FC Tracer system includes remote control of the analyzer over the LAN to allow

improved workflow. The Tracer software makes it easy to understand what occurred on the link. At every level, you have the ability to drill deeper into the data, to get additional information about the traffic or even the protocol itself.

Let LeCroy's Serial Data Solutions peel back the layers of Fibre Channel to solve your test and verification challenges.

SPECIFICATIONS

CATC 10K PLATFORM

FCTracer 4G

FCTracer 2G

Host Requirements	Windows 2000, or greater; Intel Pentium II processor or greater; USB port
Recording Memory Size	2 GB for trace capture, timing, and control information
Power Requirements	90-254 VAC, 47-63 Hz (universal input), 150W maximum
Connectors	AC power connection, External trigger connection (TRIG IN/OUT, BNC), USB type B host computer connection, Breakout Board Data Output Connection (RS232)
Power (PWR)	Lights when power is on
Status (STATUS)	Lights during power up of platform; Blinks if self-test fails
Manual Trigger Switch	Forces a trigger event when pressed
Dimensions	311 mm x 311 mm x 89 mm (12.2" x 12.2" x 3.5")
Net Weight	3.4 kg (7.5 lbs.)
Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

FCTracer 4G Plug In Module

Basic Trigger Events	Primitives, Data Frames, Disconnect or connect Link, Frame Header, SOF Primitive, EOF Primitive, Basic Link Services, SCSI Operations, Switch Interlink Service Commands
Traffic Summary Reports	Data Frames, Primitives, Connects/Disconnects, Errors, Read/Write Response
Bus Utilization Reports	Pending SCSI, SCSI Response, Latency, Throughput, Frame Length, Data Throughput, Link Utilization, Frame Count
Connectors	Fibre Channel Connection (4)
REC (green)	Lights when actively recording
TRG (orange)	Lights when triggering an event, or power-on testing
UPLD (green)	Lights when uploading recording memory to the host
Dimensions	236 mm x 170 mm x 32 mm (9.3" x 6.7" x 1.3")
Net Weight	.82 kg (1.8 lbs.)

FCTracer 2G Plug In Module

Basic Trigger Events	Primitives, Data Frames, Disconnect or connect Link, Frame Header, SOF Primitive, EOF Primitive, Basic Link Services, SCSI Operations, Switch Interlink Service Commands
Traffic Summary Reports	Data Frames, Primitives, Connects/Disconnects, Errors, Read/Write Response
Bus Utilization Reports	Pending SCSI, SCSI Response, Latency, Throughput, Frame Length, Data Throughput, Link Utilization, Frame Count
Connectors	Fibre Channel Connection (4)
REC (green)	Lights when actively recording
TRG (orange)	Lights when triggering an event, or power-on testing
UPLD (green)	Lights when uploading recording memory to the host
Dimensions	113 mm x 170 mm x 89 mm (4.5" x 6.7" x 1.3")
Net Weight	.77 kg (1.69 lbs.)

Ordering Information

FCTracer 4G Products

FCTracer 4G 2CH Analyzer System	FC006AAA-X
FCTracer 4G 4CH Analyzer System	FC007AAA-X
FCTracer 4G 8CH Analyzer System	FC008AAA-X
FCTracer 4G 16CH Analyzer System	FC009AAA-X
FCTracer 4G 2 CH Analyzer Module	FC003MAA-X
FCTracer 4G 4CH Analyzer Module	FC004MAA-X

FCTracer 2G Products

FCTracer 2G 2CH Analyzer System	FC001AAA-X
FCTracer 2G 4CH Analyzer System	FC002AAA-X
FCTracer 2G 8CH Analyzer System	FC003AAA-X
FCTracer 2G 16CH Analyzer System	FC004AAA-X
FCTracer 2G 32CH Analyzer System	FC005AAA-X
FCTracer 2G 2CH Module	FC001MAA-X
FCTracer 2G 8CH Module	FC002MAA-X

Fibre Channel Analyzer Accessories

Multimode Fiber 4Gbps SFP Connector Kit	FC005ACA-X
Copper 1-2 Gbps SFP Connector Kit	FC001ACA-X
Multimode Fiber 2Gbps (LC) Transceiver Connector Kit	FC002ACA-X
Multimode Fiber 2Gbps (SC) Transceiver Connector Kit	FC004ACA-X
Singlemode Optical 1-2 Gbps SFP Connector Kit	FC003ACA-X



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