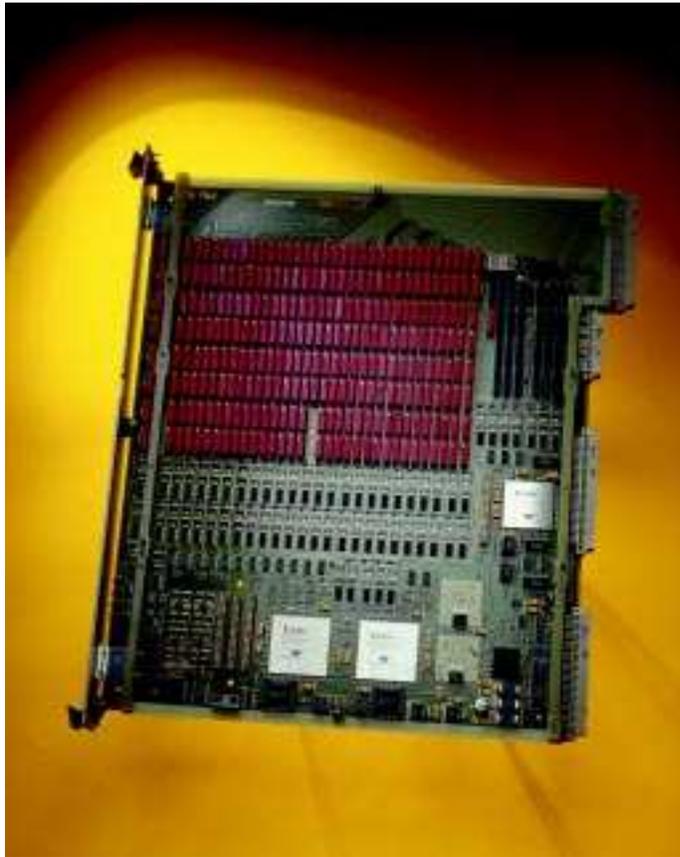


# CC<sup>3</sup> Lightning™ Flash/ISP Programmer

- Minimize cycle time for flash and ISP programming
- Combine in-circuit test and device programming, decreasing manufacturing costs
- Program flash memories at speeds approaching their maximum specified performance
- Configure ISP devices including FPGAs, CPLDs
- Overcome reduced circuit access using JTAG test access port (TAP) techniques
- Perform in-circuit test, program flash memory, and configure ISP devices on multi-function pins



High-speed channel card for flash memory and ISP device programming on Spectrum Manufacturing Test Systems

*CC<sup>3</sup> Lightning's "at speed" flash programming performance and its multi-card parallel processing capability make it the ultimate high-end solution for high-throughput and multi-panel applications.*

**If you could...** program flash memory and configure In-System Programmable (ISP) devices in-line as part of the manufacturing process without sacrificing beat rate...

If you could combine in-house functional test and flash programming onto a single stage test (SST) platform...

If your test system included multi-function channels with in-circuit test, flash programming, and ISP configuration...

*...you'd be dreaming, right?*

Over the past several years, flash memory use has grown tremendously. Many products from MP3 players to PC motherboards have now incorporated large amounts of flash memory. At the same time, smaller and smaller process technologies have driven the density and capacity of flash memory devices much higher. The result is that flash memory programming has become a critical technology for manufacturing systems. In-circuit test times are now fast relative to flash memory programming cycle

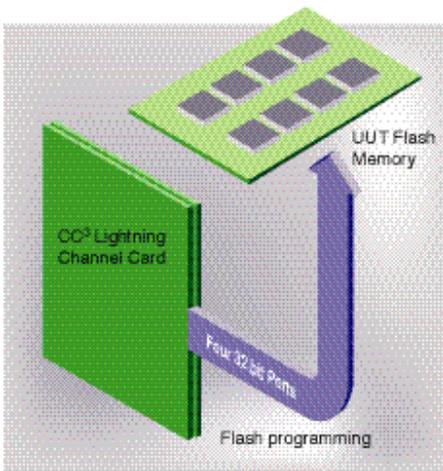
time and flash has become, in many cases, the manufacturing bottleneck. The time required to program flash devices can have a major impact on capital equipment requirements and production line throughput. In addition to flash, the use of ISP devices including FPGAs and CPLDs are also a significant throughput constraint.

To address these new manufacturing challenges, many approaches have been tried—from bench-top programmers that aren't integrated into the line to in-fixture hardware that is highly customized for each application, and by definition, unreliable.

CC<sup>3</sup> Lightning is the first total solution for flash and ISP programming targeted for high-volume production environments. The CC<sup>3</sup> Lightning hardware and software upgrade package is 100% integrated into the Spectrum Manufacturing Test Platform and combines flash and ISP programming into a single manufacturing stage along with in-circuit test. CC<sup>3</sup> Lightning removes the flash programming bottleneck, because it can program flash devices at speeds approaching maximum specified performance.

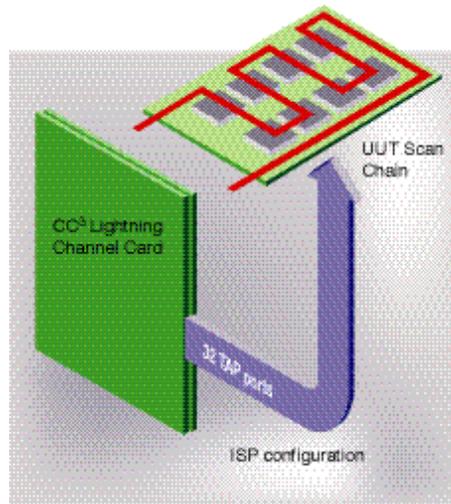
## Programming Flexibility, Standardized Methodology

CC<sup>3</sup> Lightning is a high-technology channel card that targets flash and ISP programming. It incorporates all in-circuit functionality of its predecessor channel card, the CC<sup>2</sup>, *plus* it can program flash memories at speeds approaching maximum specified performance, reducing programming time and maintaining high throughput and a fast beat rate on the line. CC<sup>3</sup> Lightning can also eliminate process steps by combining device programming steps with the ICT step.



CC<sup>3</sup> Lightning flash hardware configuration

CC<sup>3</sup> Lightning supports a wide variety of JTAG scan-chain operations via the industry standard TAP port. This capability provides another tool to address loss-of-access problems in printed circuit assembly designs. Scan chain-based applications include boundary-scan test, "on-board" flash programming, and ISP configuration. On-board flash programming applications deliver data to non-scan-equipped flash devices using adjacent devices that are scan-equipped.



CC<sup>3</sup> Lightning JTAG hardware configuration

With all these capabilities, CC<sup>3</sup> Lightning can become a key strategic piece of your organization's overall manufacturing solution. An excellent investment in manufacturing technology with a low cost of ownership, CC<sup>3</sup> Lightning is the right choice.

## Robust Software Development Environment

CC<sup>3</sup> Lightning product includes a complete package of development tools including a plug and play driver for the CC<sup>3</sup> instrument, a high level API, documentation, model libraries, and an automatic program generator. The APG and device model libraries support all the commonly used flash device types. The APG merges the flash

programming algorithms from the model library together with your data files to produce the target application program. The APG has a graphical user interface and automates the entire process, eliminating the need to manually write C source code, setup developer environments, run compilers, etc.

Programs generated by the APG are documented with full C source code so that, should you desire, you can make any custom additions or modifications. Typical modifications include adding dynamic data such as date code or serial number from a bar code reader or interfaces to data collection systems.

## Industry-standard Architecture

CC<sup>3</sup> Lightning uses the same powerful industry-standard PC engine that drives the Spectrum Manufacturing Test Platform. CC<sup>3</sup> Lightning stores flash and JTAG application data in the workstation PC computer memory rather than in proprietary channel card memory. This provides for virtually unlimited memory depth that is inexpensive and readily available.

For ISP configuration applications, CC<sup>3</sup> Lightning accepts SVE, JAM, and STAPL format files. These files are generated by ISP development tools such as those provided by Xilinx and Altera.

CC<sup>3</sup> Lightning code produced by the automatic program generator meets ANSI-C standards. The API libraries can be loaded into any ANSI-C compatible application development environment (ADE) such as Borland or Microsoft products. As a result, you are not dependent on any proprietary or inflexible vendor tools that may not meet your needs.

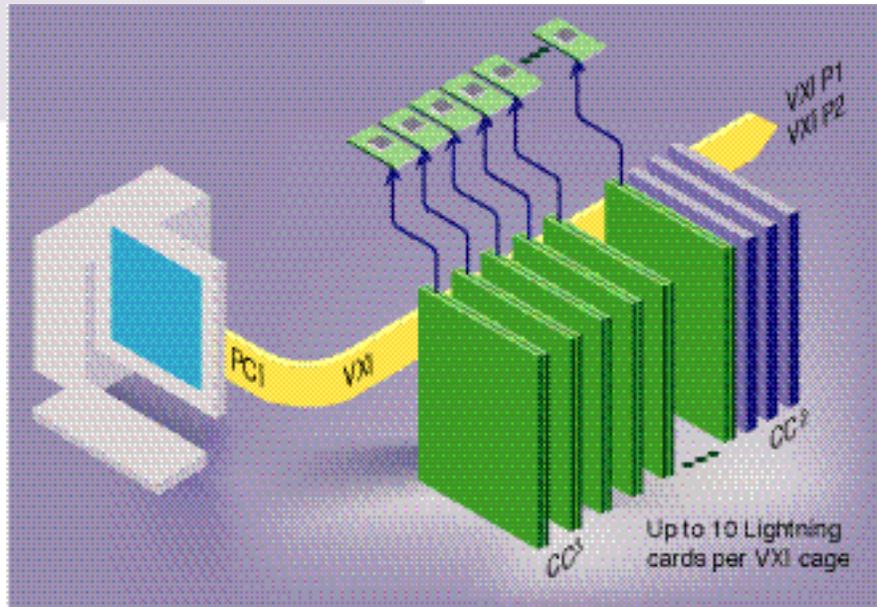
The Spectrum Manufacturing Test Platform, with its Windows NT™ operating system and VXI instrumentation backplane, makes it possible to integrate new tools and processes and to leverage the tools that best fit your flash and ISP programming needs. CC<sup>3</sup> Lightning and Spectrum system software are Microsoft COM™ (Component Object Model) compliant. All popular ADEs are supported such as LabWindows/CVI™, LabVIEW™, C++™, and VBScript™.

### Integration into the Spectrum Manufacturing Test Platform

The CC<sup>3</sup> Lightning VXI-based single slot instrument is compatible with all Spectrum 8800-Series and 8900-Series systems. CC<sup>3</sup> Lightning cards can be installed in any slot in the VXI backplane to add flash/ISP functionality to any pin in the system's fixture interface. This flexibility lets you control your fixture mapping strategy.

Single or multiple CC<sup>3</sup> Lightning cards can be installed in the Spectrum Manufacturing Test Platform's VXI backplane, up to 10 cards per cage. This high degree of configurability allows you to set up the Spectrum Manufacturing Test Platform as a high-speed in-line flash programmer, a multi-board parallel programmer for panelized products, or an ultra-high throughput flash-only programming station such as is used for high-volume SIMMs or flash memory cards.

Flash programming data is transferred from the workstation PC across the 32-bit VXI backplane, making data available to all CC<sup>3</sup> Lightning cards simultaneously. You can plug in as many CC<sup>3</sup> Lightning cards as demanded by your application and throughput requirements.



CC<sup>3</sup> Lightning cards parallel process data from the 32 bit VXI bus.

CC<sup>3</sup> Lightning cards "parallel process" data simultaneously. For N-up applications such as in multi-board panelized products, up to 10 flash programming sessions have the same high performance, programming flash devices at speeds approaching maximum specified performance.

As a fully-integrated resource in the Spectrum Manufacturing Test Platform, CC<sup>3</sup> Lightning's multi-function channels support all modes of test and programming, including in-circuit test, flash programming, boundary-scan test, and ISP configuration with universal multi-function channels.

### ADE and Runtime Options

Flash and ISP applications produced by the automatic program generator can be hosted in a variety of run-time environments. The base application is a Windows NT executable which can be seamlessly merged into an existing Spectrum or TestStudio™ sequence, a third party test executive, or even run in a standalone mode.

This modular software approach maximizes your flexibility to incorporate flash programming and/or ISP configuration operations at any point in the manufacturing process, using the runtime environment and tools that are optimum for your situation.

- Innovative pipeline architecture simplifies programming of flash parts. UUT flash parts program as if they were locally connected to the workstation PC's internal PCI bus. Test system hardware is transparent to the programmer.
- Data multiplier™ doubles or quadruples data transfer rates (for 16 or 8 bit parts respectively) by putting multiple data words into a 32 bit VXI transfer (e.g. four 8 bit words in a single transfer).
- High-speed block mode data transfers for flash programming operations
- High-speed flash data verify mode
- 900 nS basic VXI bus transfer speed
- Automatic flash memory program generation
- Multiple runtime and user environments supported
- Flash/ISP data storage:
  - Data is resident in workstation PC main memory, eliminating the need to preload channel card memory.
  - Pattern memory user extensible with inexpensive commercially available workstation PC memory
- Parallel flash programming:
  - CC<sup>3</sup> Lightning cards are memory mapped into A32 and A16 space of system PC
  - Global addressing mode of multiple CC<sup>3</sup> Lightning channel cards up to 40 cards per system
  - True parallel "10-up" operation at full speed
- Flash hardware configuration:
  - Four 32 bit ports
  - Any port can be mapped as address or data and/or control pins
  - Address or data assigned as one 8, 16 or 32 bit DUT port per 32 bit lightning port
  - Remaining unused data or address pins on a port can be allocated for control pins for most efficient channel mapping
- CC<sup>3</sup> control pin memory:
  - Stores patterns in hardware (read and write) cycles
  - Control pattern memory depth 256 states
  - Eliminates multiple writes, enhances speed by 4-6 times
- JTAG port operations:
  - Each of the four 32 bit ports on the CC<sup>3</sup> Lightning card handles one of the four major JTAG port pins: TDI, TDO, TMS, TCK
  - CC<sup>3</sup> Lightning channel card supports wiring for up to 32 individual TAP ports
  - Supports all major ISP vendor file formats including SVF, JAM, and JEDEC STAPL standard files
- CC<sup>3</sup> Lightning base channel card features:
  - 128 fully-hybrid multi-function channels: analog & digital in-circuit, flash programming, ISP configuration
  - Single slot T-size VXI instrument
  - Lightning incorporates all pre-existing CC<sup>2</sup> functionality

## Worldwide service and support

From best-in-class hardware and software components to complete turnkey systems, Teradyne delivers and supports proven solutions for the world's most rigorous in-circuit and functional test requirements. Teradyne is the largest manufacturer of automatic test equipment (ATE) for the electronics industry.

The Assembly Test Division serves circuit-board test customers with comprehensive capabilities in test and inspection. The test instruments and systems provided by the division are used in commercial and military/aerospace environments where reliability, time-to-market, and in-line process test are key to success.

Other Teradyne products include systems to test semiconductor devices, printed circuit assemblies, telephone lines, computerized telephone systems, internet and intranet networks, and software. The company is also a leading supplier of high-performance connection systems used in the manufacture of electronics.

Teradyne supports customers through a worldwide service and application engineering network, with technical centers located throughout Asia, Europe, and North America.

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