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M9-Series of VXI Digital Test Instruments

Versatile C-size VXI instruments for high-performance digital testing

- *Highest-performance digital test capabilities available in a fully compliant C-size VXI instrument*
- VXIplug&play driver supports all Windows NT Framework Application Development Environments
- Choice of 25 or 50 MHz channel cards offers solutions for a range of performance requirements
- Programmable logic levels of up to +/- 30 V
- Up to 704 bidirectional, programmable-voltage digital test channels in a single C-size VXI chassis
- Superior timing and voltage level flexibility allows accurate emulation of complex system waveforms
- High-throughput testing of complex digital modules, boards, and boxes
- Fast, accurate fault isolation using guided probe and fault dictionary
- Direct import of SVF and LASAR-generated test vectors for efficient test development
- Rugged, easily maintainable design minimizes support costs



Taking full advantage of VXI interface standards and advanced packaging techniques, the M9-Series offers more digital test capability, with greater cost efficiency and higher reliability, than has ever been available in a C-size VXI instrument.

Teradyne's M9-Series offers industry-leading digital test in C-size VXI instruments. Now VXI system integrators can build test equipment for advanced digital and mixed-signal testing using Teradyne's industry-leading digital test architecture.

The M9-Series of VXI Digital Test Instruments offers Teradyne's high-performance capabilities for digital functional test in a compact C-size format, combining superior performance with all the advantages of a standard, commercial-off-the-shelf (COTS) architecture-configurability, high reliability, and lower acquisition and life-cycle costs.

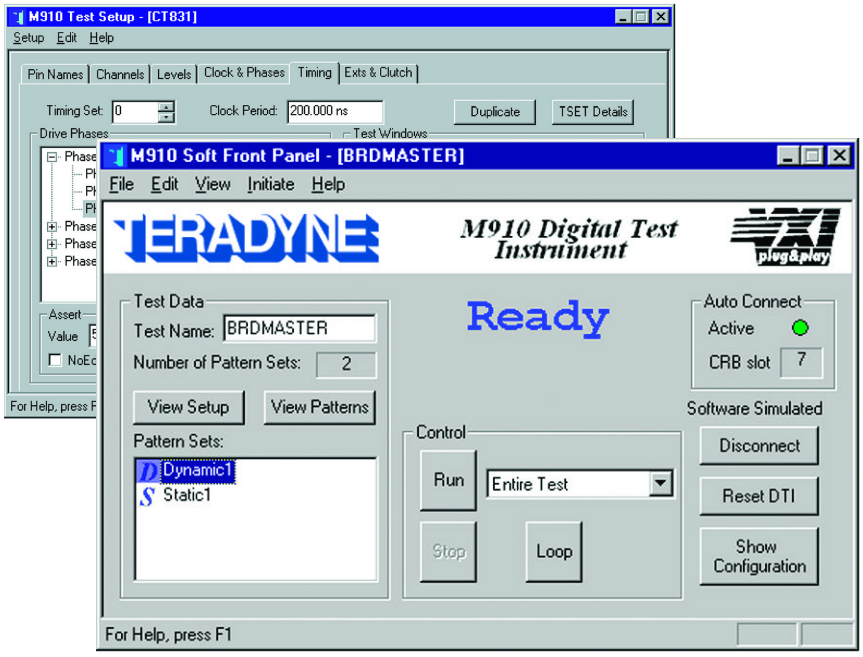
With a VXIplug&play software driver and hardware that is compliant with VXI interface standards, M9-Series instruments are easily integrated with other instruments in VXI-based test systems.

The digital functional test capabilities supplied by the M9-Series represent fifth-generation Teradyne technology and are field-proven in a wide range of commercial and mil/aero applications. M9-Series instruments have been integrated in test equipment supplied to the U.S. Department of Defense, including the U.S. Marine Corps TETS and the U.S. Air Force JSTARS, and are designed into the U.S. Army IFTE. They are also designed into a number of third-party test systems, including the Honeywell H3500, ManTech Aurora, and WesTest 2000 Series.

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Flexibility and accuracy to meet advanced digital requirements



Graphical soft front panels provide interactive"benchtop" access to M9-Series instrument functions.

Industry-standard architecture, superior performance

M9-Series instruments consist of one central resource board (CRB) and up to 11 channel cards. The CRB supplies clock generation, central timing, guided probe, and other instrument-wide functions.

The channel cards, configurable with any VXIplug&play slot 0 controller, plug into contiguous backplane slots to provide up to 704 bidirectional, programmable-voltage digital test channels in a single 13-slot C-size VXI chassis. Channel cards can be added in the field, expanding pin count while maintaining TPS compatibility.

M9-Series instruments are self-contained and require no external power or circuitry outside of the VXI backplane-simplifying integration into larger test systems and minimizing cost, size, and weight.

With a distributed-resource architecture and optimized data handling, M9-Series instruments set a new standard for digital functional testing in VXI-based systems.

- The M9-Series is fully compliant with the C-size VXI standard (IEEE Std 1155-1992) interface specifications. The VXI bus supports all internal and external communications, including synchronization and triggering for bus testing, mixed-signal and precision digital testing.
- The VXIplug&play software driver supports a soft front panel and programmatic interface to all Windows NT Applications Development Environments (ADEs):
  - The soft front panel provides interactive, graphical instrument control for "benchtop" access to all instrument functions, plus spreadsheet-based programming and debug.
  - The Applications Programming Interface provides programmatic access to M9-Series hardware and supports popular ADEs, including National Instruments LabVIEW and LabWindows/ CVI, HP VEE, and Microsoft Visual C++. TYX PAWS ATLAS is also supported.
- An intelligent register-based data transfer protocol expedites direct communications between the test system controller and M9-Series instruments, without the delays inherent in message-based systems. The result is a minimum sustained effective test rate of 10,000 test patterns per second for fast execution of long test sequences.

Accurate signal emulation delivers dependable results

M9-Series instruments accurately emulate complex test signals and reliably deliver tests to the UUT, significantly reducing the time required to develop or rehost test programs.

Proven capabilities ensure reliable pass/fail results and high-fault-coverage functional tests:

- 256 timing sets-with four drive phases and four test windows that are fully programmable, selectable per pin, and switchable on-the-fly make it easy to map M9-Series test patterns to simulation results, other ATE timing schemes, or UUT specs. This kind of timing flexibility eliminates manual workarounds in TPS development and saves costly debug time.
- Absolute accuracy is specified across all pins using a proven, time-domain reflectometry technique that actively measures and removes channel-to-channel delay.
- Dual-threshold voltage detection guarantees that the UUT meets voltage level specifications.
- All specifications are maintained over the M9-Series full operating range, ensuring repeatable test results from system to system and eliminating no-fault-found looping on the UUT.
- Up to 256 clocks-per-pattern and five data formats enable complex microprocessor cycles to be modeled with a single pattern, reflecting actual databook operation while using less pattern RAM than other digital test instruments.

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Easy plug&play integration, high-performance software

- Conditional pattern sequencing and looping, along with multiple clocks per pattern, support efficient execution of long initialization sequences.
- Individual timing generators allow maximum flexibility for test program generation. They can also be used to keep dynamic memory alive during pattern reloading.
- High-accuracy triggering required for asynchronous and mixed-signal test is supported using dedicated synchronization ports on the M9-Series CRB in addition to the VXI trigger bus.
- Flexible synchronization resources provide enhanced handshaking capabilities required for bus testing.
- On-the-fly algorithmic pattern generation and signature analysis provide efficient memory testing.
- Disconnect relays isolate digital pins from the UUT for device protection and sensitive analog measurements.

Guided-probe and fault-dictionary diagnostics find faults fast

The M9-Series proven techniques for fault detection and diagnosis offer higher accuracy and better resolution than other implementations, preventing repair loops and minimizing repair time.

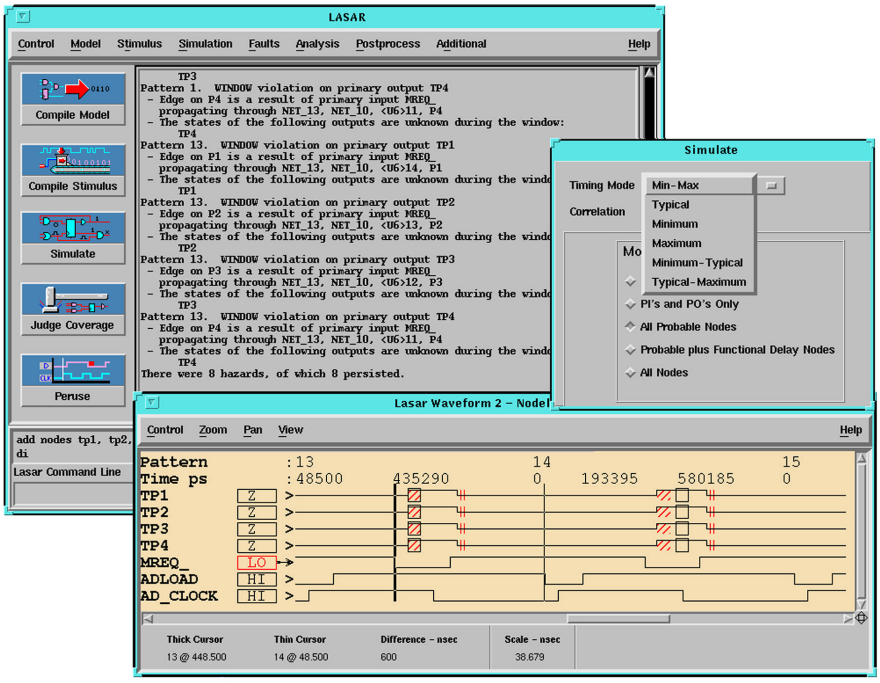
M9-Series instruments are the only VXI digital test instruments with these capabilities:

- Hand-held guided probe, with independent timing control synchronized to the M9-Series system clock, reduces diagnostic time and increases accuracy:
  - Availability of 256 probe timing sets virtually eliminates constraints on probe-window placment and ensures high-accuracy diagnostics.
  - Dual-threshold voltage detection, plus a choice of strobes or test windows, allows the M9-Series to monitor signal stability over time and find bus faults.
  - Detection of 18 different data types, including pulses, rings, and glitches, provides precise detection of failures involving active edges.
  - Data sampling of internal nodes with display of logic states.
  - LED contact indicator minimizes misprobes.
  - Automatic backtrace routines account for intermittent failures, misprobes, and inaccessible nodes to ensure more reliable operation.
- Integrated guided-probe and fault-dictionary diagnostics provide maximum resolution with a minimum number of probe points.

Off-line TPS development using industry-standard LASAR V6

Tight integration with Teradyne's LASAR V6 simulation software enables off-line test development with minimal time required for test program integration:

- LSRTAP (IEEE 1445) import tool enables test patterns and diagnostic databases supplied in standard LSRTAP format to be imported and executed by the M9-Series VXI plug&play driver. LSRTAP, the standard output format used by LASAR V6, is tightly integrated with the M9-Series hardware architecture so that no data mapping is required.
- Guided-probe and fault-dictionary modules quickly execute proven, state-of-the-art diagnostic algorithms when a test fails.
- M9-Series provides full boundary-scan test capabilities. Teradyne's optional VICTORY™ software lets you develop boundary-scan tests. Industry-leading VICTORY tools include Boundary In-Circuit Test (BICT), Virtual Interconnect Test (VIT), Virtual Component/Cluster Test (VCCT), and Boundary Functional Test (BFT).



Teradyne's LASAR V6 simulation software is tightly integrated with the M9-Series hardware archecture. As a result, test programs developed at off-line programming stations are easily integrated, with minimal debug required.

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Teradyne has applied 35 years of experience in the test business to ensuring the reliability of the M9-Series and minimizing support costs:

- Shake and vibration testing and electrical stress testing ensure that the M9-Series is rugged enough for shipboard or mobile environments.
- Rigorous reliability testing maximizes Mean Time Between Failures (MTBF), and high-density packaging reduces the number of components and interconnections.
- To minimize Mean Time To Repair (MTTR), complete board assemblies are replaced, not submodules. With only two assembly types to stock (CRB and channel card), spares provisioning is simplified.
- Three levels of self-test software efficiently verify hardware performance using only internal resources:
  - Confidence testing verifies functionality automatically to confirm basic instrument capabilities.
  - Full self-test software isolates instrument failures to a single line-replaceable unit more than 97% of the time, a process that takes ten minutes or less.
  - Diagnostic self-test software verifies parametric operation of the instrument using the internal meter, counters, and an internal self-test

Worldwide support for M9-Series

A leading supplier commercial-off- the-shelf (COTS) test equipment for mil/aero applications, Teradyne has extensive experience in providing integrated hardware and software support to customers worldwide. These include:

- 24-hour repair-and-return of defective parts.
- Hotline telephone assistance.
- Comprehensive training and documentation.
- Instrument calibration verification can be performed semi-automatically in the field by connecting NIST-traceable instrument standards to the M9-Series front-panel connectors.

Specifications

Edge placement resolution	1 ns
Dead time	None
Timing sets	256 switchable on-the-fly, per pin and per pattern
Stored-pattern capabilities	Loops, branches, conditionals
Algorithmic capabilities	Keep-and-toggle; CRC signature analysis per pin
External clock	DC to 50 MHz, ECL or TTL levels
User clock	Two sets of differential outputs, 100 Hz to 50 MHz clock rate, programmable from -2 to +5 V
Dynamic sync/trigger resources	Four front panel bidirectional pins, 100 Hz to 50 MHz, ECL or TTL levels; 8 VXI TTL trigger bus lines, 100 Hz to 50 MHz
High-voltage utility pins	32, external pull-up to 28 V, 125 mA sink to ground
Guided probe	DC to 50 MHz, 256 timing sets, 1 ns edge placement resolution, detection of 18 data types, LED contact indicator
Operating range	-0º to +35º C ambient
Phases/windows	4/4 (8/8 edges), independently programmable, selectable per pin

	M910 Channel Card	M920 Channel Card	M960 Channel Card
Pattern memory	32K	128K	128K
Data rate	100 Hz to 25 MHz	100 Hz to 50 MHz	100 Hz to 25 MHz
Absolute accuracy	±5 ns	±3 ns	±5 ns
Minimum pulse width	40 ns	20 ns	40 ns
Digital pins (channel cards can be mixed)	64 per channel card, up to 11 cards/704 pins per instrument	48 per channel card, up to 11 cards/528 pins per instrument	16 per channel card, up to 11 cards/176 pins per instrument
Drive current	±50 mA per pin, ±1.2 A per channel card	±50 mA per pin, ±1.2 A per channel card	±50 mA per pin, ±0.8 A per channel card
Drive/detect levels	Programmable -2 to +5 V, selectable per pin from two sets 10 mV resolution	Programmable -2 to +5 V, -5 to +15 V, or -10 to +10 V per pin from two sets 10 mV resolution	Programmable ±30V, max 30V swing, selectable per card, selectable per pin from two sets 10 mV resolution
Overvoltage protection	5.7 V to +9.5 V with auto recovery, disconnect relay	-5.7 V to +9.5 V, -8 to +19 V, -13 V to +13 V depending on drive levels with auto recovery, disconnect relay	±4V past programmed thresholds depending on drive levels with auto recovery, disconnect relay
Data formats	Five (NR, R0, R1, RZ, RC)	Five (NR, R0, R1, RZ, RC)	Five (NR, R0, R1, RZ, RC)

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