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Agilent TS-5410 Functional Test Platform

Technical Overview

Accelerate test development and throughput

The right platform for electronic functional testing can help you meet consumer demand for greater functionality and performance at competitive prices—even as designers put more pressure on your schedules, margins and capacity. Versatile measurement suites ensure optimum test coverage, even for the most innovative designs. Rapid test development with a scalable system lets you respond quickly to evolving product specs. Plus, on the manufacturing floor, high-throughput testing increases the capacity of existing lines and enables batch testing of identical devices.

Do more testing with less effort

Every new product shouldn't require a different test system or all new software. Agilent's TS-5410 functional test system gives you the leverage to use one platform across multiple projects and products. The platform approach lets you develop, reuse and update every test configuration, extending the useful life of every system you own. By enabling consistency in test plan development, test strategy, maintenance and support, a platform also helps lower the overall cost of test in your manufacturing environment.

Leverage and customize: To minimize the time and cost required to create a system, we've done most of the development work for you. Of course, if you want to tailor a system to meet specific needs, we provide flexible test hardware and development tools that accelerate your work.

Improve capacity: To help reduce your cost of test, the compact TS-5410 helps improve utilization of floor space. The system's high uptime also makes it a dependable performer on the manufacturing floor.

Refocus your effort: The TS-5410 platform helps you spend less time and effort on system creation—and lets you focus on other essential tasks such as test coverage and optimization, product quality, and manufacturing process improvements.

Explore the TS-5410

This technical overview provides an overview of the TS-5410, describing test system software, hardware, interface, support and more.

Agilent Technologies

Software and development tools

The TS-5410 functional test platform consists of measurement resources and software development tools that can help you deploy a system up to three times faster than if you used individual components. To better accommodate your test strategy and product requirements, both the hardware and software can be easily modified.

Each system includes fully integrated software and documentation. Agilent TestExec SL software is a mature test executive that combines with the TS-5400 application software to provide a development environment and a library of over 400 test routines. Its integrated programming language—Microsoft, Visual Basic for Applications—supports rapid system development and debugging.

TestExec SL

This flexible test executive is ready-to-run, off-the-shelf software. It provides capabilities that can accelerate program development, streamline test execution, increase productivity and integrate test efforts—across systems, processes and time zones. TestExec SL's task-based approach makes it easy to accomplish everyday tasks, helping you create better, tighter tests in less time. You can use the standard TestExec SL interface, or customize it with the look you—or the test operators—prefer.

Within TestExec SL's modular architecture, you can reduce system overhead by choosing the features you need and eliminating the rest. You can optimize your test plans using built-in monitoring devices to study tests in progress, identify problems and evaluate processes.

Key capabilities: TestExec SL links to other test systems and supports multiple applications, creating a cohesive, efficient environment for global manufacturing:

- Supports Microsoft Visual Studio (C, C++, and Visual Basic), Microsoft Visual Basic for Applications, Agilent VEE Pro, Basic for Windows, and National Instrument's LabVIEW.
- Shares test data with other Agilent systems across all manufacturing environments.
- Exports data in spreadsheet, XML or Agilent 3070 formats.
- Makes critical test information available to analysis packages, allowing you to optimize the manufacturing process using actual data from the test floor.
- Provides a standardized framework for interfacing with software applications used in other parts of your enterprise, as well as those used by contractors, suppliers and vendors.

Other tools and features accelerate program development and test integration with TestExec SL:

- **Action Wizard:** A plug-in module for Visual Studio that generates DLL-style code to integrate actions you define.
- **Reuse Library:** Provides a framework for creating reliable code that's already proven, letting you reuse and recycle existing programs.
- **Switch Manager:** Defines logical paths between instruments and the unit under test (UUT), streamlining the configuration of switch topology.
- **Test Profiler:** Monitors and tracks tests, displays key parameters in graphical format, and provides insights to optimize test throughput.
- **Throughput Multiplier:** Enables testing of multiple UUTs at the same time, with the potential to quadruple test throughput.

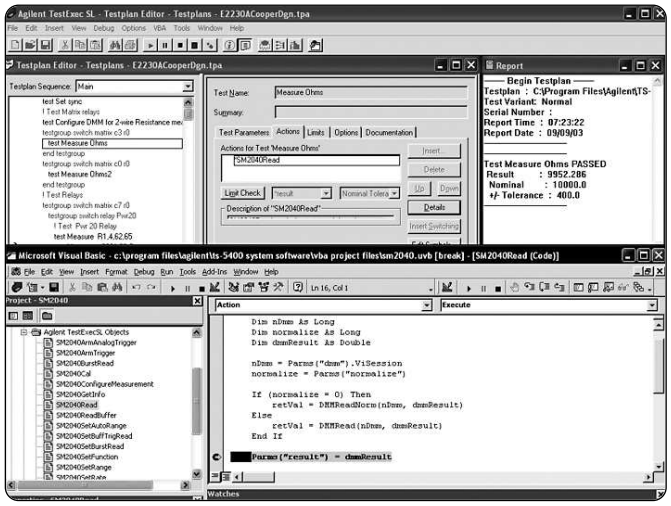

Figure 1: *TestExecSL*

System illustration

The Agilent TS-5410 is packaged in a 0.75-meter rack that can fit under a manufacturing conveyor system. The system is capable of handling 5 to 50 test points through its Express Connect test system interface.

The Express Connect interface is where you make connections between the system and your test fixture. Express Connect is fully documented, speeding and simplifying the process of creating a test fixture. All of the necessary internal cabling is also pre-engineered: internal cabling harnesses are included with the system and are also available off the shelf as spare parts.

As illustrated in **Figure 2**, the system hardware includes measurement instrumentation, modular switching, cabling, a compact rack and optional fixturing. Available instrumentation includes a digital multimeter, a counter, a function generator with arbitrary waveform capability, digital input/output, a programmable power supply and a serial interface.

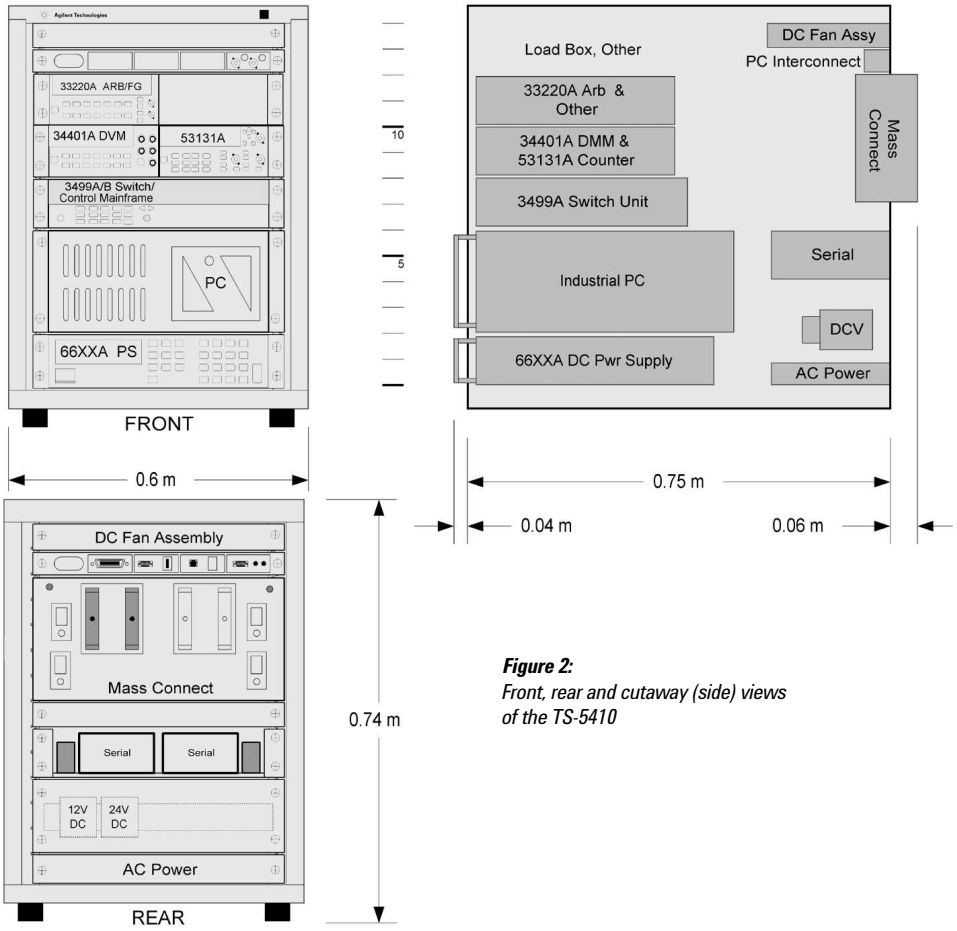

Figure 2:
Front, rear and cutaway (side) views of the TS-5410

System block diagram

The TS-5410 architecture consists of a Windows XP Pro-based controller running TestExec SL software. The controller connects to the Agilent 3499A switch/control mainframe through a GPIB interface. The controller also connects to the instrument set, including power supplies, through a GPIB interface for IEEE-488 instruments, RS-232 for serial communication and USB for peripheral devices.

Figure 3, below, is a simplified block diagram of the TS-5410. The white blocks with dashed outlines represent additional equipment that can be added to the system (but cannot be ordered as part of the system).

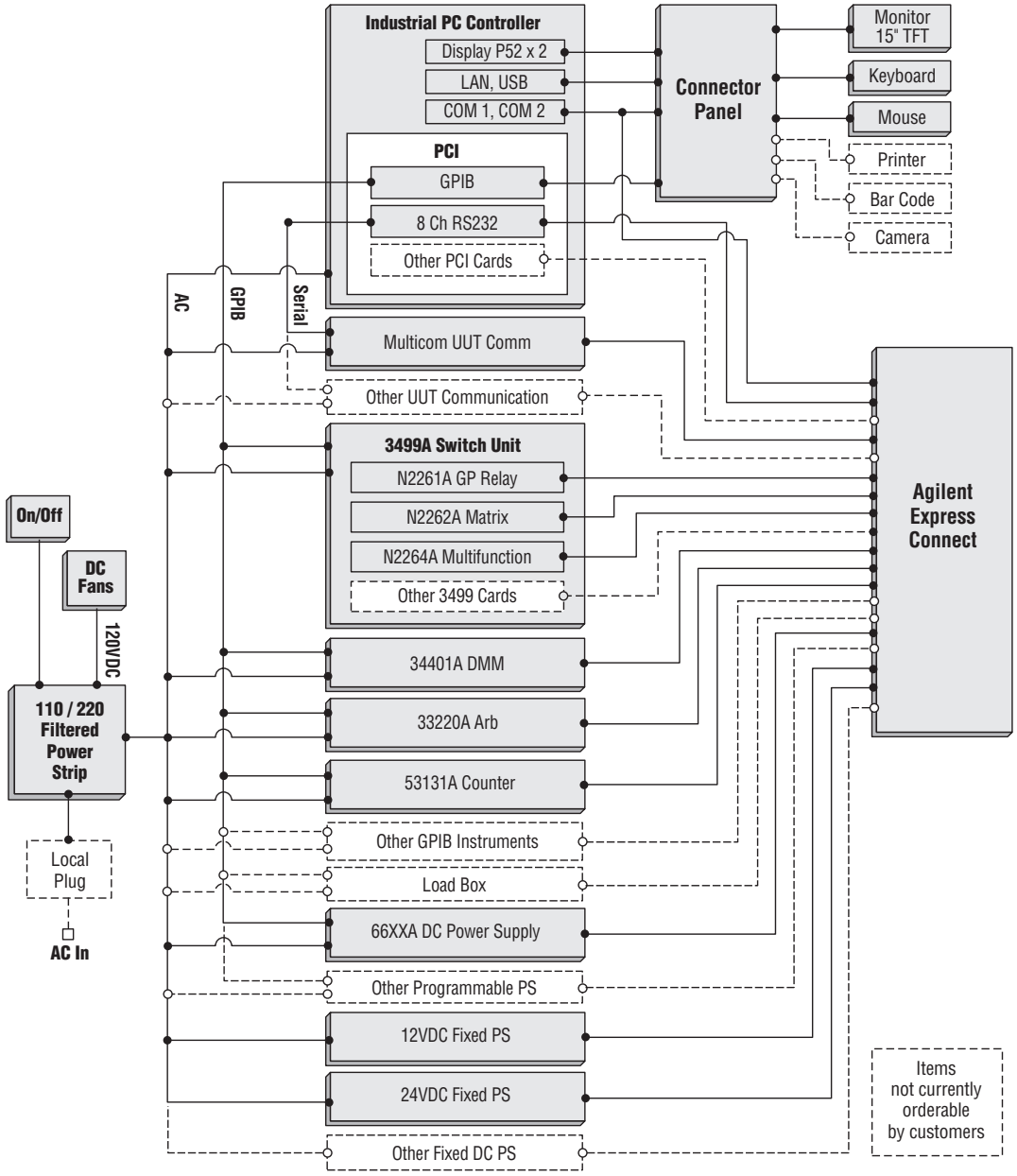

Figure 3:
Simplified system block diagram

Standard and optional system hardware

This section presents a closer look at the equipment shown in the block diagram: switching, instrumentation, power supply and PCI cards.

Standard Switching

The TS-5400 includes a switch/control mainframe loaded with three plug-in modules.

Agilent 3499A Five-slot Switch/Control Mainframe:

The high-speed architecture and high-density switching capabilities of the 3499A help maximize test throughput. The mainframe can accommodate up to five plug-in modules, conserving space and reducing system complexity. In the TS-5410, the 3499A contains one each of the N2261A general-purpose (GP) relay module, the N2262A matrix switch module, and the N2264A multifunction module (see below for details).

Key features and specifications

- Simultaneous opening and closing of switches
- Frequency range of dc to 20 GHz
- Signals up to 60V or 5A

1. Agilent N2261A 40-Channel GP Relay Module:

The N2261A contains 40 independent single-pole/single-throw (SPST, Form A) latching relays. Each channel can switch up to 200V, 1A, and 60w or 62.5VA. An innovative driving circuit enables simultaneous operation of 10 switching channels, contributing to higher test throughput. The module can be operated in one of two modes: single-channel break-before-make (BBM) or multiple channels opened or closed.

Key features and specifications

- 40 independent relays in one module
- High-speed switching in parallel operation
- Built-in relay cycle counters

2. Agilent N2262A 4x8 Two-wire Matrix Switch Module:

The N2262A matrix module connects a group of test instruments to multiple test points on a UUT. It contains 32 two-wire nodes (cross points) organized into four rows and eight columns. Each node in the matrix contains a two-wire latching relay for switching both the high and low terminals of a signal line. Multiple switches can be closed, allowing any combination of row-to-column connections. Up to eight two-wire nodes in the same row can be closed simultaneously (parallel switching).

Key features and specifications

- Multiple inputs connected to multiple outputs
- High-speed switching in parallel operation
- Built-in relay cycle counters

3. Agilent N2264A Multifunction Module:

The N2264A combines 12 GP relays, three high-current relays, and 16-bit digital input/output in one module. The 12 GP channels are non-latching relays which can switch up to 200V, 1A, 60w or 62.5VA. The three high-current channels are non-latching relays, switching up to 5A, 125Vdc or 200Vacrms. Any 10 of the 15 GP relays can be closed simultaneously (parallel switching). The 16-bit digital I/O provides 16 bi-directional data lines plus three lines for control and handshaking.

Key features and specifications

- 12+3 general purpose and 16-bit digital I/O in one module
- High-speed switching in parallel operation
- Built-in relay cycle counters

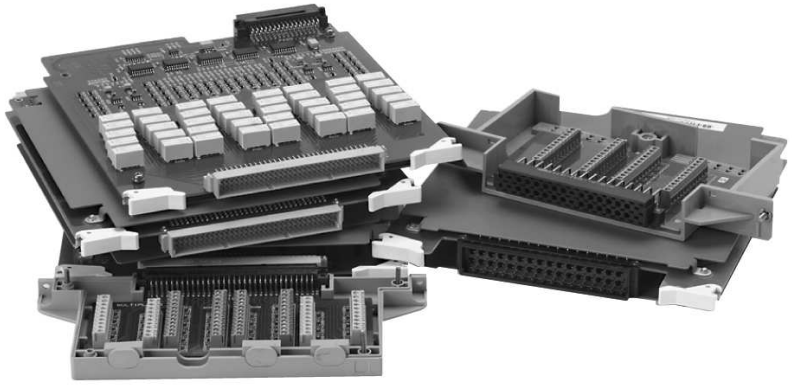

Figure 4:
3499A/B/C switch modules

Standard and optional system hardware, cont.

Standard Instrumentation

Agilent 34401A Digital Multimeter:

This digital multimeter (DMM) delivers superior performance in test system applications. It provides a combination of speed, resolution and accuracy that rivals DMMs costing many times more. In a system, the 34401A can send up to 1000 readings per second via GPIB in ASCII format. Voltmeter Complete and External Trigger signals allow synchronization with other instruments.

Key features and specifications

- 6.5 digit resolution
- 0.0015% DC accuracy, 0.06% AC accuracy
- True RMS AC volts and current

Optional Instrumentation

Agilent 33220A Function/Arbitrary Waveform Generator:

The 33220A uses direct digital synthesis techniques to create stable, low-distortion output signals that ensure accurate results. It provides easy access to standard sine, square, ramp, triangle, and pulse waveforms. You can also create custom waveforms using the 14-bit, 50 MSa/s, 64K-point arbitrary waveform function. The variable-edge pulse function, along with the PWM capability, provides excellent flexibility for test applications.

Key features and specifications

- 20 MHz sine and square waveforms
- Ramp, triangle, pulse, noise and DC waveforms
- AM, FM, PM, FSK and PWM modulation types
- Linear and logarithmic sweeps and burst operation modes
- 10 mVpp to 10 Vpp amplitude range

Agilent 53131A Universal Frequency Counter:

The two-channel 53131A offers 10 digits per second of frequency or period resolution and bandwidth of 225 MHz. Time interval resolution is specified at 500 ps. An optional third channel provides frequency measurements up to 3 GHz, 5 GHz, or 12.4 GHz. With fast signal processing and automated limit tests, the 53131A can make measurements such as frequency, rise/fall time, phase and more—quickly and correctly.

Key features and specifications

- Measures frequency, frequency ratio, time interval, rise/fall time, phase, duty cycle, positive/negative pulse width, totalize, peak voltage, time interval average and time interval delay
- Automated limit tests and one-button measurements
- Built-in statistics feature for simultaneous measurement of average, min/max and standard deviation
- Data transfer rate of up to 200 fully formatted measurements per second

Standard Single-output Power Supply

Agilent 6643A 200 Watt System Power Supply:

The 6643A is a single-output, serial pass-regulated power supply. Throughput is significantly enhanced by an active down programmer that quickly removes any energy from the UUT when the output is programmed to zero. Extended remote sensing capability compensates for voltage drops in load leads of up to 50 percent of the rated output voltage, eliminating inaccuracies caused by resistance in load wiring.

Key features and specifications

- 0 to 35V output voltage, 0 to 6A output current
- Excellent regulation and low output noise
- Programmable over-voltage and over-current protection
- Over-temperature protection

Optional Fixed-voltage Power Supply

Modular supplies:

Small, fixed-voltage power supplies are available that can be used to power the UUT or other system accessories. The 12V and 24V power supply outputs are routed to TC2 of the Express Connect test system interface.

Key features and specifications

- One 12V output at 2A
- One 24V output at 1.5A

Optional Serial Protocol

EnGenius MultiCom III/s:

This multi-purpose interface adapter uses a serial connection to a PC to provide digital and analog input/output. The MultiCom III/s consists of a set of physical interface modules (PIMs) that plug into its base platform. Each PIM (standard or custom) contains the specific interface circuits that allow connection to external devices.

PIMs Available with Adaptor

- SAE J1850 PWM
- SAE J1850 VPW
- CAN PIM
- RS485/RS422
- More

Optional PCI Cards

Advantech PCI-1750 Digital I/O Card:

The PCI-1750 offers 16 isolated digital input channels, 16 isolated digital output channels and one isolated counter/timer for the PCI bus. With isolation protection of 2500Vdc and dry contact support, the PCI-1750 is ideal for applications that require high-voltage protection. Each I/O channel of the PCI-1750 corresponds to a bit in a PC I/O port, making the card easy to program. A counter or timer interrupt and two digital input interrupt lines to a PC are also available with the PCI-1750.

Key features and specifications

- Supports dry contact or 5~48Vdc
- 2500Vdc isolation on all channels
- 200mA sink current on isolated output channels

RocketPort 8-Channel RS-232 Card:

The heart of the RocketPort RS-232 card is the exclusive AIOPIC chip, which is a 36-MHz ASIC that achieves data rates far higher than typical multiport cards based on conventional 16550 UART technology. Along with improved throughput speed and reduced load on the host CPU, the highly integrated AIOPIC chip reduces the number of on-card components by 80%, contributing to increased reliability and long mean time between failures.

Key features and specifications

- Up to 32 COM ports without using any IRQs
- Up to 460Kbps transmit and receive across all ports simultaneously
- Large FIFOs (64 times larger than 16550 UART) maximize speed and minimize data loss while optimizing host efficiency and data integrity

Express Connect test system interface

The Agilent TS-5410 test system interface provides a consolidated set of connections between the test stand and your test fixture or UUT. To help ensure rapid test deployment, the test system interface (also called Express Connect) provides tremendous flexibility for specific test requirements and is pre-wired and integrated to test-stand equipment.

Test connectors

The TS-5410 can be configured with either two or four test connectors. These test connectors use 156-pin, ITT Cannon zero-insertion-force (ZIF) plugs and receptacles. As shown in **Figure 5**, the ZIF connectors use an actuator handle to provide precise mating and unmating of multiple-wire signal connections, which can typically be done in less than two seconds. Connectors are also keyed to prevent improper connections. This type of connector costs less per mated line than singular, high-density rack and panel connectors.

High-power connectors

Two high-power (HP) connectors are available as part of the TS-5410 test interface (**Figure 6**). The 16-pin HP connector can route higher current lines to the UUT, carrying up to 20A per pin. This is ideal for powering high-current devices or for customizing the TS-5410 system for test applications that require higher power.

BNC connectors

The test system interface also provides knockouts for mounting BNC connectors (**Figure 7**). Typical applications include connection to an RF signal generator, the voltmeter complete or external trigger signals in the Agilent 34401A DMM, and trigger or external modulation inputs on the Agilent 33220A function/arbitrary waveform generator.

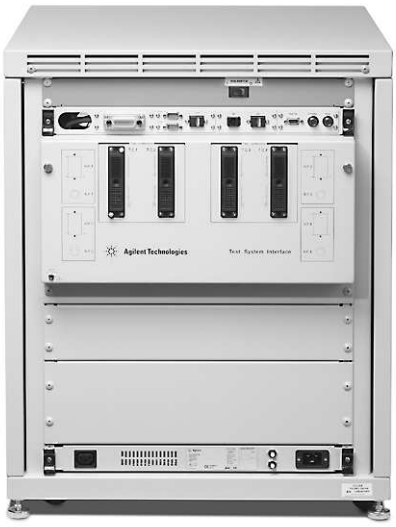

Figure 5:
Rear panel of the TS-5410

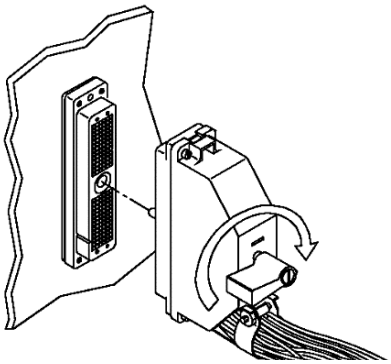

Figure 6:
ITT Cannon zero-insertion-force connector

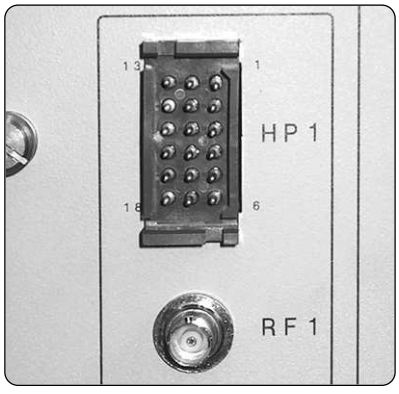

Figure 7:
Close-up of high-power connectors and BNC knock-outs

UUT connectors

The TS-5410 test system interface can contain up to four ITT Cannon test connectors—TC1 through TC4—that provide the majority of the connections to the UUT. Test connectors TC1 and TC2 provide the main connections to the UUT:

- GP relay card
- Matrix card
- Multifunction card
- DMM
- RS-232
- Digital I/O
- DAC channels
- Spare equipment connections
- Safety grounds and system grounds
- Power supply
- Serial interface

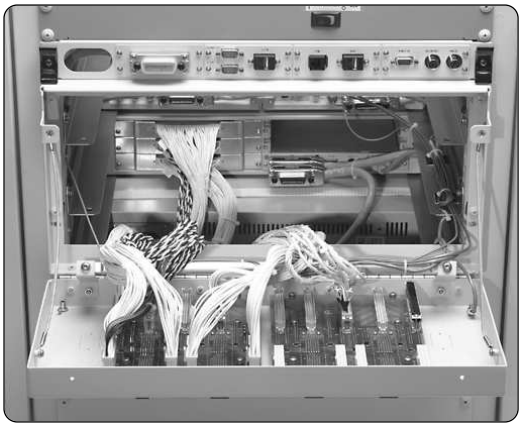

Figure 8:
UUT connections are simplified by pre-engineered internal cabling

Concentrating everything in one convenient location further enhances your ability to achieve rapid deployment of the test system. All of these connections are fully documented in the TS-5410 Test System Interface manual.

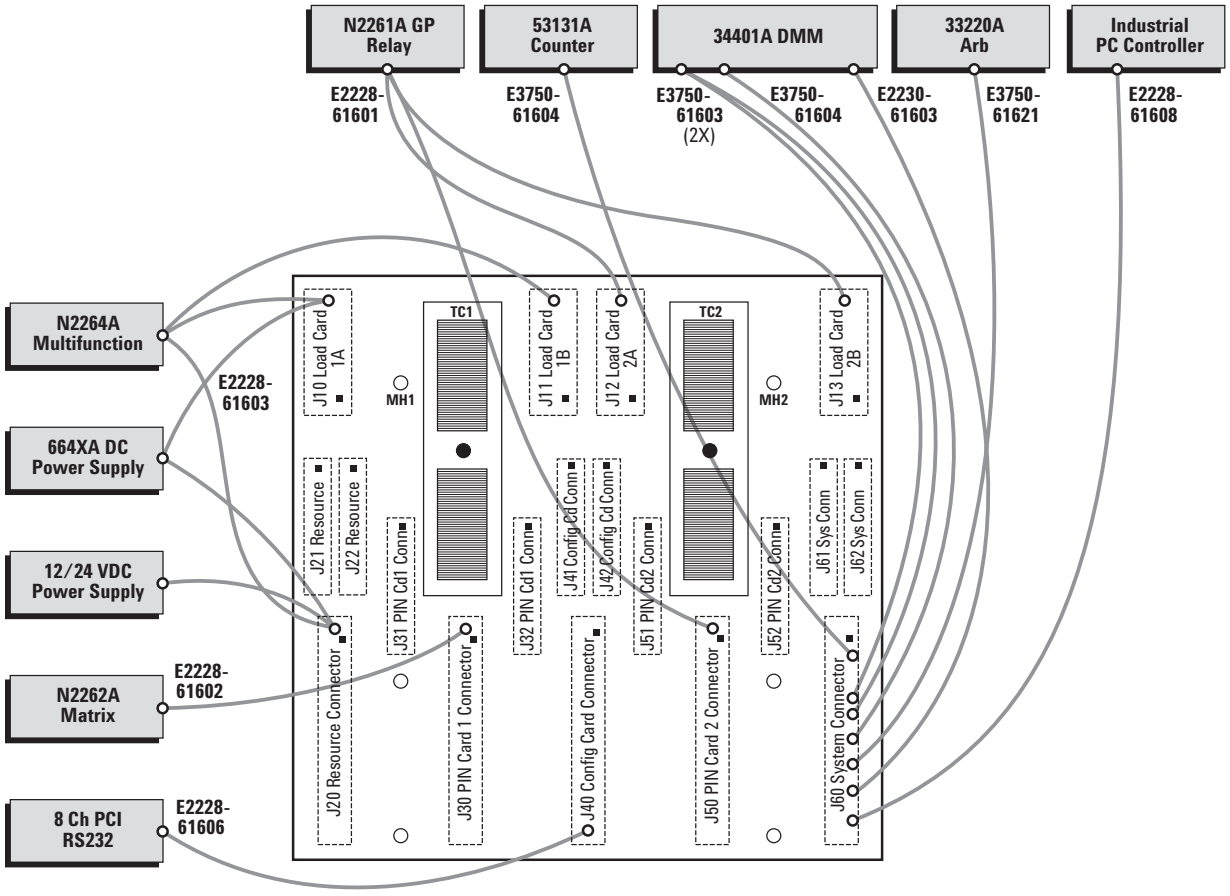

Figure 9:
Cable locator for TC1 and TC2

Troubleshooting and support

To help ensure greater uptime of your manufacturing line, the TS-5410 includes built-in diagnostic capabilities and a special diagnostic fixture that will help you quickly assess many common problems. If those functions don't resolve the issue, the TS-5410 is backed by Agilent's System Uptime Solution support packages. 3-Star remote support is standard with the TS-5410 and includes five key features:

- 8x5 support coverage
- Basic maintenance training
- Four-hour response time
- 3-5 escalation priority
- Cooperative support via system remote access

System remote access

The TS-5410 is factory-configured for secure remote access and support. Remote access and support allows system troubleshooting and diagnosis to begin almost immediately after you contact Agilent.

Using Web-based software and the optional Logitech® Web camera, an Agilent system engineer can check the system's software configuration, run diagnostics, and view system interconnections remotely from any Agilent location. The camera is connected to the system using the computer's USB port. A USB extender cable and feed-through connector are included if additional cable length is required.

Contacting Agilent for support

For application and hardware support of your system, you simply contact the nearest Agilent Service Center. When contacted, an Agilent service support engineer will review the problem with you. If necessary, the engineer will set up a remote access session and provide you with a meeting ID, password, and procedures for connecting to the session.

Once connected, the Agilent engineer will explain how to share your application, which enables remote control of the system and lets the engineer assist you with troubleshooting. If the engineer thinks it will be helpful to view system interconnections or DUT connections, you will be asked to connect the web camera and start the camera software. (A walk-through of this process is included in the basic maintenance training that is provided with the system.)

Global service

To minimize system downtime, Agilent has a worldwide network of support engineers and regional distribution centers to ensure the expertise and parts are there when you need them.

Boost innovation and customer responsiveness

The TS-5400 platform is more than just hardware and software: it's a fully designed and architected solution for electronics functional test. When viewed from a business perspective, the TS-5410 offers three advantages that help your company stay ahead of the competition.

Investment protection: The platform gives your development effort more leverage by enabling future migration of measurement hardware and software as well as the integrated PC. As needs change, you can upgrade your systems with the capabilities needed to test next-generation devices with today's platform.

Rapid test development: Each system includes fully integrated software and documentation. Agilent TestExec SL software is a mature test executive that combines with the TS-5410 application software to provide a development environment and a library of over 400 test routines. Its integrated programming language supports rapid system development and debugging.

High-throughput testing: To increase throughput, the system can perform batch testing of identical devices. To accelerate execution time, the test library is provided as compiled C-language routines. From top to bottom, the platform is designed to enable rapid changeovers from one device to another.

With the TS-5410 platform, you'll be well equipped to test your most innovative device designs, and to respond more quickly to evolving specs, technologies and customer needs.

Leverage our experience

Agilent provides education and consulting to help address your technology challenges and strengthen your competitive advantage. Our roster of on-site services includes four noteworthy examples:

- Start-up Assistance helps you get systems up and running quickly
- Education & Training builds product expertise and awareness of emerging technologies
- Productivity Assistance service provides continued engineering support aimed at fully optimizing your Agilent systems
- Customization services can deliver turnkey systems designed just for you

By leveraging our experience, you can deploy new technologies more rapidly, reduce labor costs and increase return on assets.

Accelerate test development and throughput

The compact TS-5410 platform is ready to evolve as your test needs change and device complexity increases—now and in the future. Its versatile measurement capabilities ensure optimum test coverage, even for the most innovative designs. Rapid test development across a family of code-compatible systems enhances your responsiveness. On the manufacturing floor, high-throughput testing increases the capacity of existing lines and enables batch testing of identical devices. If you need to deploy systems around the world, Agilent will be there with worldwide support, services and assistance.

Find the right solution for your needs

To discuss your requirements in detail, please call your local Agilent office to arrange a consultation. To learn more about the TS-5410 family, visit us on the Web at **www.agilent.com/find/ts-5400**. The web site also contains information about the full range of Agilent products and services that can help your engineering teams simulate and diagnose system performance in the design stage.

Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

"Our Promise" means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you're choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

"Your Advantage" means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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