Precision 28000-4A-TEST
Test System for the 28000 Signal Conditioner System

Performance verification is a critical part of insuring data integrity of any measurement system.

The 28000-4A-TEST Test System, the 28000-BIF1-FT interface card and the 28000 GUI support a complete suite of tests that run on the instrument “in-place” without removing the system from the equipment rack. The tests check out all critical system specifications, are NIST traceable and are the same manufacturing tests that are run at the factory.

28000-4A-TEST Description
28000-4A-TEST Test System provides three levels of test. Pre-Test Verify and Diagnostics are used to confirm that all elements of the Test System are functional. The Factory Acceptance Test (FAT) does a complete parametric performance checkout of the signal conditioners. Parameters such as common mode rejection ratio noise, offset, gain, frequency response, amplitude match and phase match are tested to original specifications. For a quick checkout of the equipment prior to a test, run the Go/No-Go test to measure system performance of the current programmed setup.

The Precision 28000-4A-TEST Test System interfaces with the 28000-BIF1-FT card, installed in each 28000 frame, providing self-test capability for the 28000 signal conditioning system. The 28000-BIF1-FT card provides the buffers and multiplexers necessary to interface between the Test System instruments and the 28000 system internal test and monitor busses. The graphical user interface GUI software shipped with the system provides the necessary software modules to perform tests on all supported 28000 conditioner cards. Initiation of tests is via the GUI software running on a Windows-based host computer. The GUI allows viewing and saving test results on the host computer.

In a typical application, the same computer controlling the 28000 system is used to control the Test System instruments. The GUI running on this computer has access to all components necessary to run complete system tests. The 28000 channels are set to a desired test state, appropriate signal sources selected, levels are programmed and the multimeter read—all under computer control. One Test System and a host computer can test multiple 28000 Systems by daisy chaining mainframes together.

System Features
- Built-in factory acceptance (parametric) tests
- Go/No-Go Tests with diagnostics
- Test results saved in text files on the host computer
- Self diagnostic tests of test system components
- System end-to-end calibration
- Programmable calibrated signal sources and meters
- Graphical User Interface (GUI) control
- Local or Remote operation
- Optimized for Ethernet operations

System Benefits
- System Self-Test and Verification assures good data
- Perform Factory Acceptance Test (full parametrics) anytime with the click of a button
- Turn-key—No user development of hardware or software is required

Function Generator
An Agilent 33220A function/arbitrary waveform generator is used as the source of test signals in the 28000-4A-TEST Test System.

Digital Multimeter
An Agilent 34410A High Performance Multimeter provides the measuring device in the 28000 Test System.

Cable Set and Rack Mount Adapters
The 28000 Test System cable set connects to the test and monitor busses of the 28000 chassis. Supplied rack mount hardware provides side-by-side mounting for the function generator and digital multimeter in a 19 inch rack.

CB-BNC-24
Coaxial BNC cable, 2 feet long, connects the Agilent 33220A Synthesizer and the 28000 front panel TEST BUS connector.

CB-DE9P/BAN-MONBUS-4
9-pin D-shell to banana plug cable (with twisted shielded pair cable), 48 inches long, connects the Agilent 34410A Multimeter and the 28000 frame rear panel SYSTEM MONITOR connector.
28000-4A-TEST Description

Test System Control
The Precision 28000-4A-TEST Test System interfaces with the 28000-BIF1-FT card installed in each 28000 chassis to provide self-test capability to the 28000 signal conditioning system. The 28000-BIF1-T backplane interface card (BIF) provides communication and control support to the 28000 system. Option F provides Factory Acceptance Test (FAT), Go/No-Go hardware, and GUI software support for all 28000 transducer conditioning cards. Control of the tests is via the 28000 graphical user interface (GUI) software running on a Windows-based host computer. Multiple 28000 systems may be tested by daisy chaining chassis together with one Test System. For faster test times and GUI performance, it is recommended that a dedicated 28000-4A-TEST system and a control computer is provided per 28000 chassis.

Test Descriptions
The 28000-4A-TEST Test System provides three levels of tests.
- Pre-Test Verify and Diagnostics
- Factory Acceptance Tests
- Go/No-Go Tests

Pre-Test Verify and Diagnostics are used to confirm that all elements of the Test System are functional. The Factory Acceptance Test (FAT) does a complete parametric performance checkout of the 28000 System. Parameters such as Common Mode Rejection Ratio (CMRR), noise, offset, gain frequency response and composite match are tested to factory specifications. For a quick checkout of the equipment prior to a test run, the Go/No-Go test measures the system performance of the current programmed setup.

Pre-Test Verify and Diagnostics
The comprehensive Pre-Test Verify and Diagnostics routine confirms that Test System components are functional. The Pre-Test and Diagnostics routine is typically run before Factory Acceptance Tests and Go/No-Go tests. It can also run independently prior to the other tests.

Factory Acceptance Tests
The Factory Acceptance Test (FAT) is a full parametric test and is normally run at regular maintenance intervals. All programmable settings of the channel are measured and compared to original factory specifications. The system operator is able to specify which channels are tested and which individual tests to perform. Test results are saved as text report files on the host computer.

Test report files include:
- Composite test data of all cards in the system
- Test data of each card
- Pass/Fail summary for each test performed on each card
- Error summary showing only failed test data for each card

The following components are verified:
- Equipment verification – all mainframes are responding, the test equipment is connected properly and passes self-test
- Verification of test circuits on the 28000-BIF1-FT card
- Verification of the function generator, digital multimeter and monitor bus
- Verification of the test bus and monitor bus

The FAT test selection panel allows the user to select any tests to run on any set of channels. The test results can be saved to a file for later retrieval. A test summary is listed for quick diagnosis.
28000-4A-TEST Description

Card FAT Tests
The Card FAT is a comprehensive set of Factory Acceptance Tests for signal conditioner cards. The channels to be tested and each test performed are user selectable.

Filter Frequency Response (Amplitude and Match)
The Filter test consists of two elements: a test of filter frequency response and a composite match test. The filter frequency response test checks DC gain, and passband amplitude response. The composite match test compares the performance of the channel under test to the performance of a designated reference channel.

Gain Accuracy
The Gain test checks the performance of the amplifier circuit related to gain. Gain is measured at multiple settings to verify accuracy of all hardware settings.

Offset Voltage
The Offset test checks DC offset at each amplifier and that settings are within specifications.

AC/DC Coupling
The Coupling test checks the amplifier AC/DC coupling circuit.

Max Level
The Max Level test checks the linearity of the amplifier circuit at the maximum output level of a channel.

Noise
The Noise test is a check of the amplifier circuit's broadband noise (100 kHz) characteristics. Output noise, filter noise and noise referred to the input are measured.

CMRR (Common Mode Rejection Ratio) test verifies the performance of the amplifier with regard to CMRR performance.

Overload
The Overload test checks the operation of the overload detection circuits.

Amplifier Frequency Response
The Amplifier Frequency Response test consists of two elements: a test of the amplifier high frequency response (not related to the filter circuit) and a composite match test. The composite match test compares the performance of the channel under test to the performance of a designated reference channel. Where appropriate, amplifier frequency response is measured at different gain settings to confirm gain independent of frequency response.

The FAT test screen reports the test conditions and provides a tabular listing of the test results during the execution of the test sequence.
Go/No-Go Test
The Go/No-Go test provides a quick check of the system prior to taking data. Failed channels/cards are quickly identified so spares can be plugged in, minimizing system down-time. The flexible Go/No-Go test routines allow you to select one or more tests (several tests are defined, including Filter test, Gain test, Offset test, etc.), on one or more channels. The test confirms that the set of channels, or selected channels, is performing within specification of the selected test, with the current channel set up.

The Go/No-Go tests include:
- Excitation
- Cutoff accuracy
- Gain accuracy
- Offset voltage
- Coupling
- Maximum level

BIF FAT Tests
The BIF FAT test, for the 28000-BIF1-FT card, tests all critical functions and programmable settings of the backplane interface card and the functions of the test circuitry.

Selectable BIF FAT tests include:
- Test bus offset and DAC
- Monitor offset and DAC
- Reference monitor bus offset and DAC
- Monitor filter, gain offset and DAC
- Test bus gain
- Monitor bus gain
- Reference monitor bus gain
- 55 Hz oscillator accuracy
- 5 VDC reference accuracy
- Attenuator Cal
- Test bus frequency response
- Full scale
- Monitor CMRR
- Reference monitor CMRR
- Sync detector
- 100 kHz filter
- Programmable monitor gain
- Monitor reference match
- A/D converter
- Scope monitor gain
- Power supply voltages
- Temperature sensors
- Overload DAC

Test Accessories
Control I/O Adapters
Signal conditioning systems with multiple 28000 chassis require one RS-232 port per chassis. When a 28000-4A-TEST Test System is installed, the local controller PC must provide either an Ethernet or GPIB interface for the Agilent 33220A function generator and Agilent 34410A multimeter.

Precision Filters offers a line of Ethernet and USB I/O port adapters to provide multiple RS-232 serial interface ports and GPIB interface capability.

- **ENET-4SI**
  - Ethernet to Quad Serial Port Assembly with Cables and Mounting Brackets
- **ENET-8SI**
  - Ethernet to Octal Serial Port Assembly with Cables and Mounting Brackets
- **USB-4SI**
  - USB to Quad Serial I/O Port Adapter
- **USB-GPIB**
  - USB to GPIB I/O Adapter

Similar to the FAT test panel, the Go/No-Go test selection panel provides the controls to define, initiate, review and save Go/No-Go tests.
Reference Cables and Test Adapters

Individual card types may require the use of special cables or adapters to support specific Factory Acceptance Tests.

CB-REF-A Cable
Supports the FAT match test for the 28134 card.

CB-REF-C Cable
Supports the FAT match tests of the 27304, 28104, 28104A, 28108, 28208, 28302B, 28314, 28316B, 28334A, 28454 and 28454A cards.

CB-28302B-SE-SHUNTCAL Cable
Supports shunt capacitor calibration.

27304-TEST-ADAPTER
Supports FAT tests on the 27304 card. (Only required for 27304 cards with Option I.)

CB-28108-TEST-ADAPTER
Supports FAT test of the excitation supply on the 28108 card. The adapter is used to test excitation accuracy under full load, linearity, sense, current limit and offset.

28316B-TEST-ADAPTER-A
Supports FAT tests of the IEPE Mode operation of the 28316B card. This adapter incorporates TEDS memory and a load capacitor and is used to emulate Long Distance TEDS (LDTEDS) capability of the 28316B cards.

28316B-IPE-ADAPTER
Supports FAT tests of the IEPE Mode operation of the 28316B card without the TEDS Option.

28334A/28314-CHARGE-ADAPTER
Supports FAT tests of the Charge Mode operation of the 28334A and 28314 cards. The dual-channel, dual-range FAT test adapter incorporates NIST traceable calibration capacitors.

28334A/28314-TEDS-ADAPTER-A
Supports FAT tests of the IEPE Mode operation of the 28334A and 28314 cards. This dual channel adapter incorporates TEDS memory and a load capacitor and is used to emulate Long Distance TEDS (LDTEDS) capability of the 28334A and the 28214 cards.

Test Accessories

Monitor Bus and Test Bus Cables
Optional Monitor Bus and Test Bus cables are available to support additional cable length requirements and testing multi chassis configurations.

Test Bus System Cables
Test bus system cables are coaxial BNC to BNC cables for connecting between the 28000 front panel TEST BUS connector and the Agilent 33220A Synthesizer.

CB-BNC-24
24 inches

CB-BNC-48
48 inches

Test System Monitor Cables
Test system monitor cables are 9-pin D-shell to banana plug cables, with twisted shielded pair cable, for connecting between the 28000 rear panel SYSTEM MONITOR connector and the Agilent 34410A Multimeter.

CB-DE9D/BAN-MONBUS-1.7
20 inches

CB-DE9D/BAN-MONBUS-4
48 inches

Mating Connectors
Mating connectors are 9-pin D-shell metal backshell connectors that accommodate wire gauges 20 through 24.

CONN-IN-9D
Input connector with crimped machine sockets

CONN-IN-9-SC
Input connector with soldered cup machine sockets

CONN-OUT-9D
Output connector with crimped machine sockets

CONN-OUT-9-SC
Output connector with soldered cup machine sockets
### Selection Guide

The Precision 28000-4A-TEST Test System interfaces with the 28000-BIF1-FT interface card installed in the 28000 Signal Conditioner System. Each 28000 card type has a unique set of FAT tests depending on the type and options of the card. Cards that support match test require a reference cable and some card FAT tests, for example IEPE, require special adapters. The Card Selection Chart below lists each card and its associated cable and adapters if required.

#### Card Selection Chart

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<tr>
<th>Card Type</th>
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<td>28104</td>
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<tr>
<td>28104A</td>
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<td>28134</td>
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<td>28208</td>
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<tr>
<td>28302B</td>
<td>CB-REF-C</td>
<td>CB-28302B-SE-SHUNTCAL Cable</td>
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</tr>
<tr>
<td>28314</td>
<td>CB-REF-C</td>
<td>28334A/28314-TEDS-ADAPTER-A 28334A/28314-CHARGE-ADAPTER</td>
<td>See Note 2 See Note 1</td>
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<tr>
<td>28316B</td>
<td>CB-REF-C</td>
<td>28316B-TEST-ADAPTER-A 28316B-IEPE-ADAPTER</td>
<td>See Note 2</td>
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<tr>
<td>28334A</td>
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<td>28334A/28314-TEDS-ADAPTER-A 28334A/28314-CHARGE-ADAPTER</td>
<td>See Note 2 See Note 1</td>
</tr>
<tr>
<td>28454</td>
<td>CB-REF-C</td>
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<td>28608B</td>
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<tr>
<td>28708</td>
<td>CB-REF-C</td>
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</table>

**Notes:**
1. One adapter required per system.
2. One adapter required, Precision Filters recommends using two adapters per card to speed up tests.