



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.



Test System Installed with a 28008-M3 Frame

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

28000-4A-TEST Test System Components

The Precision 28000-4A-TEST Test System consists of a high-performance digital multimeter, a function generator, rack mount adapters for the devices, and a cable set. The 28000 test software controls the function of both the digital multimeter and functional generator via an Ethernet or GPIB interface.

Function Generator

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



Agilent 33220A Function Generator

Digital Multimeter

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



Agilent 34410A High Performance Multimeter

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.

The following components are verified:

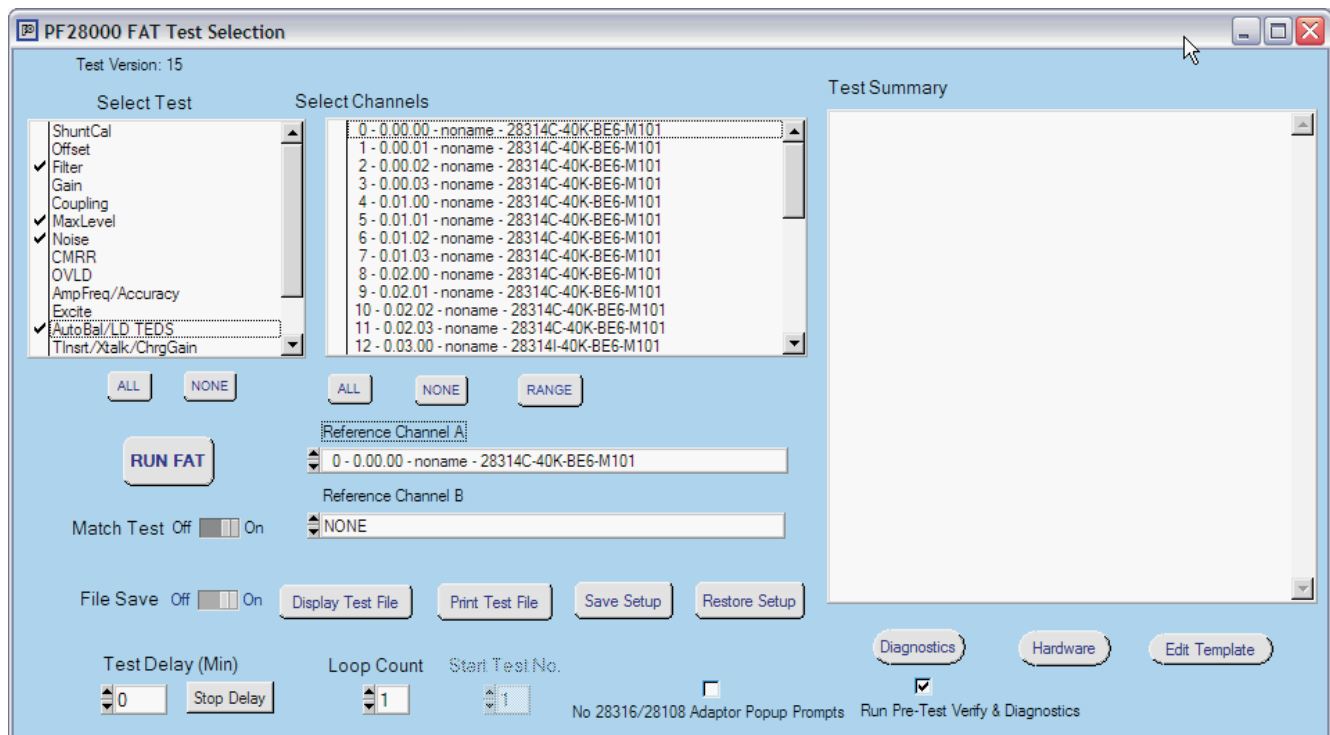
- Equipment verification – all mainframes are responding, the test equipment is connected properly and passes self-test
- Verification of test circuits on the 28000-BIF1-FT card
- Verification of the function generator, digital multimeter and monitor bus
- Verification of the test bus and monitor bus

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 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

The 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.

Excitation

The Excitation test checks the range and accuracy of the excitation circuit for supported cards.

Auto-Balance

The Auto-Balance test checks both the zero suppress and auto-balance for range and accuracy.

Shunt Cal

The Shunt Cal tests cards with bridge completion cards. The test checks for accuracy of the shunt cal resistor value and relay circuitry functions.

Temperature Compensation

The Temperature Compensation test is performed with 28208 cards.

Charge Module Test

Charge mode tests check the accuracy of charge circuits on the 28314 and 28334A cards.

LDTEDS

The 28314, 28334A and 28316B cards provide TEDS support. The LDTEDS test checks the performance of the Long Distance TEDS (LDTEDS) capability.

T-Insert

The T-Insert test measures the gain of a 27304 channel using the complete transducer/charge-amp circuit.

IEPE Operation

The IEPE Operate test measures accuracy of the IEPE current of the 27304 channel.

IEPE Gain

The IEPE Gain test measures the gain of a 27304 channel in IEPE mode.

The screenshot shows the '28000 Tests' software interface. The 'Test Name' is 'Gain' and 'Test Number' is '6'. The 'Test Conditions' section includes: Input Signal (2.500 Vdc), Pre Gain (1.000000), Expected Output (2.000 % +/- 0.100), Input Freq (0.0 Hz), Post Gain (2.0000), Cutoff Freq (127500.0 Hz), Coupling (DC), Bypass (ON), and Measured Output (2.000 %). The 'Channel Under Test' is '00.01.00' and the 'Filter Model' is '28608-HP4F/LP4FP'. The 'Current Status' window shows the following test results:

```

Starting Gain Tests: 28608A-HP4F/LP4FP
GAIN TEST: Reference, PRG=1, POG=1.00000, Fin=0Hz, Fc=Bypass, Cpl=DC
-----
Fr Cd Ch | Vin | Vout | Gain(X) | Spec(X) | Error | Tol | Units | Status
-----
00.01.00 | 5.0000 | 5.0003 | 1.00005 | 1.00000 | 0.0050 | 0.100 | % | P
-----
GAIN TEST: Comparison, PRG=8, POG=1.00000, Fin=0Hz, Fc=Bypass, Cpl=DC
-----
Fr Cd Ch | Vin | Vout | Gain(X) | Spec(X) | Error | Tol | Units | Status
-----
00.01.00 | 0.6250 | 5.0009 | 8.00074 | 8.00000 | 0.0093 | 0.100 | % | P
-----
GAIN TEST: Comparison, PRG=2, POG=1.00000, Fin=0Hz, Fc=Bypass, Cpl=DC
-----
Fr Cd Ch | Vin | Vout | Gain(X) | Spec(X) | Error | Tol | Units | Status
-----
00.01.00 | 2.5001 | 5.0005 | 2.00003 | 2.00000 | 0.0015 | 0.100 | % | P
  
```

The FAT test screen reports the test conditions and provides a tabular listing of the test results during the execution of the test sequence.

28000-4A-TEST Description

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

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 channel, 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

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

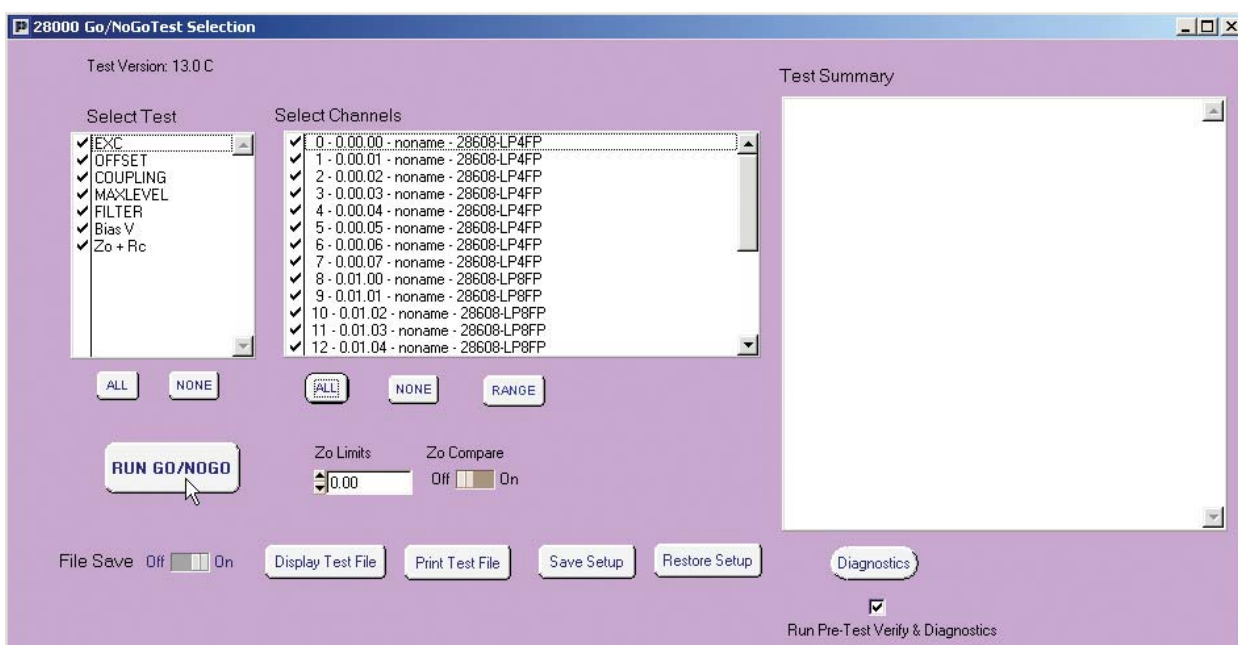
Ethernet to Octal Serial Port Assembly with Cables and Mounting Brackets

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.

Test Accessories

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.)

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-IEPE-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.

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

Test System Monitor Cables for Multi Chassis Tests

Test system monitor cable for multi chassis tests are 9-pin D-shell to 9-pin D-shell cables for daisy chaining 28000 chassis using the additional SYSTEM MONITOR connectors on the rear of the chassis.

CB-DE9D/DE9D-2XMONBUS-1.7

20 inches

CB-DE9D/DE9D-2XMONBUS-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



28316B-TEST ADAPTER-A



TEDS TEST Adapter installed on a 28314 Card



28334A/28314-CHARGE-ADAPTOR Components

28000-4A-TEST

Test system for the 28000 Signal Conditioner

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 test 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.

- 28000-4A-TEST** Test System
- 28000?-BIF1-FT** Backplane Interface Card
 - Option T:** Test hardware support for 28000-4A-TEST
 - Option F:** GUI software with imbedded test software modules

Card Selection Chart

Card Type	Reference Cable (one cable per system)	Test Adapter/Cable	Notes
27304	CB-REF-C	27304-TEST-ADAPTER	See Note 2
28104	CB-REF-C		
28104A	CB-REF-C		
28108	CB-REF-C	28108-TEST-ADAPTER	See Note 2
28134	CB-REF-A		
28208	CB-REF-C		
28302B	CB-REF-C	CB-28302B-SE-SHUNTCAL Cable	
28314	CB-REF-C	28334A/28314-TEDS-ADAPTER-A 28334A/28314-CHARGE-ADAPTER	See Note 2 See Note 1
28316B	CB-REF-C	28316B-TEST-ADAPTER-A 28316B-IEPE-ADAPTER	See Note 2
28334A	CB-REF-C	28334A/28314-TEDS-ADAPTER-A 28334A/28314-CHARGE-ADAPTER	See Note 2 See Note 1
28454	CB-REF-C		
28454A	CB-REF-C		
28524			
28608B			
28708			

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

Precision Product Solutions

For over 30 years Precision Filters has been a global provider of instrumentation for test measurements. You can rely on a single source for signal conditioning and switching—a *complete range of instrumentation*—products optimized to work together to provide high performance at reasonable cost.

Precision Products

Precision PF-1U-FA Multi-Channel Programmable Filter/Amplifier System



Exceptional desktop performance at low cost.

Ideal for conditioning low-level voltage inputs in front of high-resolution digital data acquisition systems. Fully programmable 8-channel and 16-channel configurations are available, both offering a choice of either 4- or 8-pole low-pass filters with programmable gain.

464kB High Density Programmable Switch Matrix



Computer controlled analog signal switching replaces tedious manual patch panels.

The 464kB is a reliable solid-state switch matrix system that provides computer-controlled connection between 256 inputs and 256 outputs, all in a single mainframe. Save time and reduce errors on test system setup. Download switch configurations from the host computer over the network. Built-in self-test with fault diagnostics.