



### Precision 28000 Signal Conditioning System

*The standard for the world's most discriminating test labs*



The **Precision 28000 Signal Conditioning System** provides all the flexibility you need to manage your test measurements.

The Precision 28000 makes it easy to manage a test with hundreds of channels and a mix of programmable transducers. Choose bridge, charge, IEPE w/TEDS, voltage (filter amplifier), strain, thermocouple, RTD/potentiometer, frequency, or other transducers. Customize the 28000 for high-speed transient applications, static applications, or a combination of both.

The 28000 employs a graphical user interface (GUI) and a collection of algorithms to help you manage your measurements. The GUI provides control panels for configuration setup, operation and test. The 28000 can also be controlled as a server on an Ethernet network.

The built-in test hardware and software (optional) provide quick go/no-go measurements which can be run before each test, and rigorous factory acceptance tests to assure you that the 28000 meets your most stringent requirements for critical applications. It won't be long before these tests earn a permanent place in your maintenance routine. And since they are traceable to NIST, they eliminate the need for off-site calibration.

In every phase of your tests—record keeping, installation, design, set-up, operation, maintenance and upgrading—the Precision 28000 offers ways to help you save time and money over the life of the system.

### Applications

#### Aerospace

- Structural Vibration
- Rocket Engine Test
- Aerodynamics - Wind Tunnels

#### Aircraft Engines

- Aircraft Engine and APU Test
- Component Test

#### Energy

- Gas, Wind and Steam Turbines
- Nuclear
- Oil and Gas
- Hydro-electric

#### Transportation

- Automotive
- Trucks and Busses
- Rail

#### Marine

- Underwater Acoustics
- Navy Surface Ships
- Submarines
- Commercial Shipbuilding

#### Shock

- Weapons and Ordnance
- Survivability/Lethality

### System Benefits

- Manage hundreds of channels with a mix of sensors
- Friendly system setup via local or remote GUI and Ethernet network interface
- Assure system integrity before performing measurements
- Reduce life-cycle costs
- Automated factory acceptance and go/no-go tests verify performance
- Upgrade and expand as equipment and requirements change
- Count on unsurpassed performance and reliability

### Transducer Conditioning

- Resistive bridge
- Static and dynamic strain
- RTD/potentiometer
- Thermocouple
- Pressure
- Load cells
- Frequency to Voltage
- Charge
- Voltage
- Integral Electronics Piezoelectric (IEPE) w/TEDS Accelerometers



**PRECISION FILTERS, INC.**  
Phone: 607-277-3550  
Visit our web site [www.pfinc.com](http://www.pfinc.com)

# Salient Features

## Transducer Conditioning

- Up to 256 channels of fully programmable transducer conditioners in a single system.
- Condition charge, bridge, voltage, F-to-V, IEPE w/TEDS, dynamic strain, RTD/potentiometer, and thermocouple.
- Choose from 4, 6, or 8-pole programmable filters—greater than 100 dB/octave and cutoffs from 1 Hz to 204.6 kHz.
- Up to 700 kHz amplifier bandwidth.

## System Control

- Graphical User Interface (GUI) for system control.
- Intelligent gain and system scaling algorithms.
- Ethernet network interface.
- Easily manage hundreds of channels with a mix of sensors in one system.
- Control up to eight systems with one PC controller.

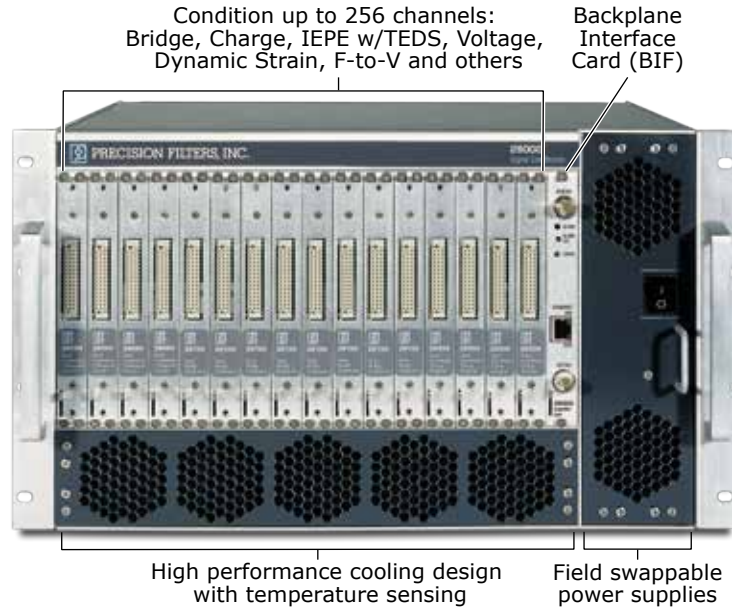
## System Integrity

- Verify system performance with self-tests traceable to NIST while reducing life-cycle costs and eliminating the need for off-site calibration.
- Go/No-Go tests with diagnostics to be used before performing measurements.
- Test input and output monitor busses.
- Check transducer health, cabling and connections with verification techniques tailored to each transducer type.
- Built-in temperature and power supply monitoring with alarms.

## System Flexibility

- Upgrade and expand equipment as requirements change.
- Customizable with field choice of I/O adapters, and output adapter modules to provide multiple buffered outputs per channel, RMS-to-DC converters, and other functions.
- Designed for high speed transient applications, static applications, or a combination of both.
- Stand-alone or remote operation.

# 28000 System Mainframe



**28016-M3** 16-slot chassis uses 10.5 inches of rack space.

Four mainframes are available for the 28000 system. For larger channel count configurations, the 28016 provides sixteen slots for signal conditioner cards. The 28008 8-slot chassis is more suitable for moderate channel count configurations. The 28002 and 28004 2-slot and 4-slot chassis are ideal for small channel count systems where portability is important.

All 28000 mainframes accept field replaceable, low-noise AC power supplies to provide clean power to the signal conditioner cards. Binding posts at the rear panel are provided for connecting circuit and chassis grounds. Internal monitoring and reporting of system power supply levels is supported by the 28000 system architecture. System temperature monitoring is provided and an audible alarm is sounded should the internal chassis temperature exceed factory limits or should a cooling fan operate out of specification.

Cards are inserted/ejected through the front of the 28000 system. Most analog input and output signal interfacing is at the rear panel of the 28000 chassis. The rear panels of the mainframes have cutouts to allow low-level signal input cables to be mated directly to the conditioner cards for optimal signal-to-noise performance. Cables are attached to the rear panel using screw locks.

Cards may be inserted and removed from the system without disconnecting cables at the rear panel.

The 28000 chassis with the M3 output option supports two and four channel card outputs with integrated 50-pin D-shell connectors at the rear panel. The M5 output provides a 26-pin D-shell connector per slot at the rear panel to support all 28000 signal conditioning card outputs including the 28316C 16 channel card.

Precision Filters offers a wide variety of connector and cabling options in order to seamlessly integrate the 28000 into an existing cabling environment. Adapters to convert multi-pin connectors to BNC type are available as well as rugged cable assemblies and connector panels. Auxiliary output modules may be added to several 28000 cards to supply additional buffered outputs per channel with a variety of connector options.

The 28000 mainframes are equipped with TEST and MONITOR analog busses that allow the user to insert test signals to any conditioner input and monitor any signal conditioner output without disconnecting signal cables. Additionally, the TEST and MONITOR busses are used by the 28000 Test Subsystem for Factory Acceptance and Go/No-Go Tests.

# Scale to Your Needs

The 28000 system is available in four mainframe sizes.



## 28016 16-Card Mainframe

- Up to 16 transducer cards per frame
- Daisy-chain up to eight systems for large channel count



## 28002 2-Card Mainframe

- Up to 2 transducer cards per frame
- Laboratory, portable or distributed systems



## 28008 8-Card Mainframe

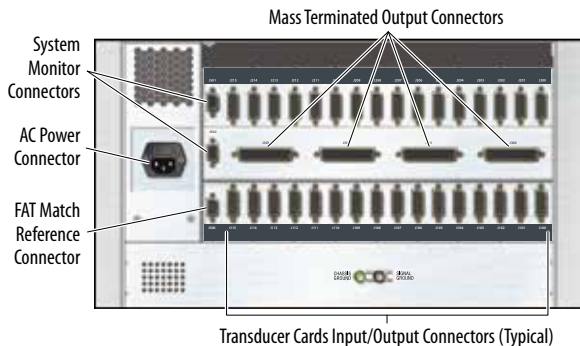
- Up to 8 transducer cards per frame
- Compact chassis requires only 5.25 inches of rack space



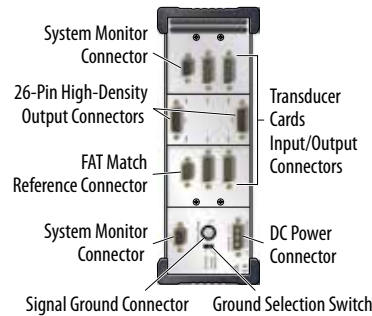
## 28004 4-Card Mainframe

- Up to 4 transducer cards per frame
- Rack mountable or desk top applications

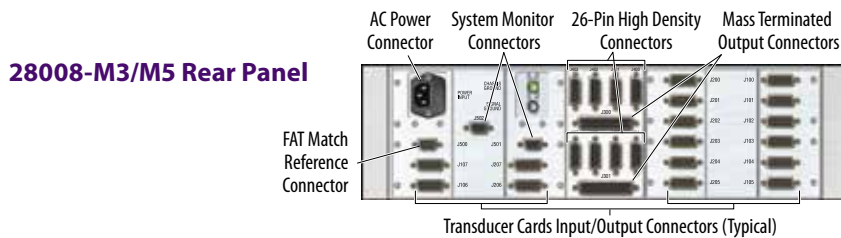
## Mainframe Rear Panels



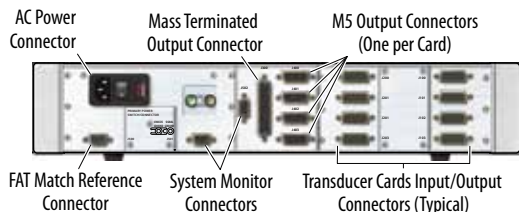
28016-M3 Rear Panel



28002-M5 Rear Panel



28008-M3/M5 Rear Panel

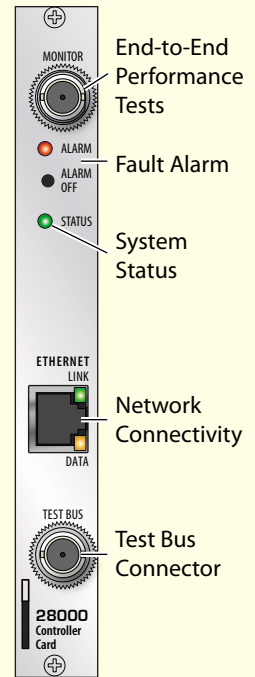


28004-M3/M5 Rear Panel

# Backplane Interface Card (BIF)

The 28000-BIF2-T backplane interface card (BIF) provides communication and control support to the 28000 system. The Graphical User Interface (GUI) control program is included with the BIF controller card. Option F provides Factory Acceptance Test (FAT) and Go/No-Go Test (GNG) hardware and GUI software support for all 28000 transducer conditioning cards.

Control to the 28000 system is by either the supplied GUI program or 28000-LCS Interpreter program using high-level commands. Both programs operate over an Ethernet interface and a Windows compatible PC. Up to eight 28000 systems can be operated from a single controller.



An alarm indicator on the BIF controller card front panel identifies system problems such as an over-temperature condition, a cooling fan failure, or faulty power supply voltages. The BIF controller card front panel TEST BUS connector provides a means to connect an external test signal to the system's test bus. The front panel BNC MONITOR connector may be used with a scope or other measurement device for viewing the output of a selected channel. The rear panel OUTPUT MONITOR connector is intended for use by the 28000-?-TEST test subsystem DMM. System status and communication status LEDs are located on the front panel.



Typical 28000 GUI Screen Display

# 28000 Conditioner and Amplifier Cards

## Dual Mode Current/Voltage Excitation Conditioners

Precision's **281X4 Family of Quad Channel Conditioners** provide the versatility to condition a wide variety of constant voltage excited sensors including full bridges and sensors that require precise bridge completion. Use the Balanced Constant Current (BCC™) excitation technology to perform 2 or 4-wire dynamic or static strain gage, RTD or other resistance measurements. Choose the full-featured high performance 28144 card, the 28124 card for multiple filtered/wideband outputs or the 28114 for the best value. For enhanced DC accuracy, select the 28124-EA or for high common mode measurements (300V) use the 28154. All cards feature real time sensor health monitor of sensor excitation, loop resistance and leakage resistance to ground.

## Bridge Conditioners

**28108 and 28118 Octal Filter/Amplifiers with Constant Voltage Excitation** deliver low-noise and DC stability for either AC or DC bridge-based sensor or low-level voltage measurements. Stable and accurate balanced constant voltage excitation with remote sense is individually regulated and programmable per channel. Low-noise and low-drift amplification is distributed before and after the low-pass filter, providing protection against out-of-band noise. FLAT/PULSE low-pass filter technology with outstanding channel-to-channel matching for correlation measurements.

*Auxiliary output connector on the front panel allows for custom output adapter modules and is standard on many 28000 conditioning cards.*

## Dynamic Strain Conditioner

**28458 Octal Dynamic Strain Conditioner** is equipped with Precision's Balanced Constant Current (BCC™) technology so measurements of dynamic strain are much less susceptible to EMI pickup and lead resistance desensitization that plague single-ended constant current topologies. The 28458 features Precision's "on-the-fly" measurement of transducer resistance, excitation and leakage resistance, alerting the operator immediately to an out-of-tolerance condition. Detection of sensor open or short condition are also monitored and reported. AC dither test current allows evaluation of true sensor plus cable frequency response. Fully programmable PULSE/FLAT filters with distributed gain for out-of-band noise protection.



## Conditioner and Amplifier Card Selection Guide

Card	Type	Chan.	Applicable Transducer	Interface	Excitation
<b>28154</b>	AC/DC Voltage, Bridge, Static or Dynamic Resistance, 300 Vcm	4/card	Static or dynamic strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor, IEPE (opt. HC14)	Prog. Bridge Completion, Shunt Cal, 2/4 Wire Constant Current	Constant V: 0 to 20.475 V; BCC: 0 to 20.475 mA; Opt. HC10 BCC: 0 to 1.023 mA
<b>28144</b>	AC/DC Voltage, Bridge, Static or Dynamic Resistance	4/card	Static or dynamic strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor, IEPE (opt. HC14)	Prog. Bridge Completion, Shunt Cal, 2/4 Wire Constant Current	Constant V: 0 to 20.475 V; BCC: 0 to 20.475 mA; Opt. HC10 BCC: 0 to 1.023 mA
<b>28124</b>	AC/DC Voltage, Bridge, Static or Dynamic Resistance	4/card	Static or dynamic strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor, IEPE (opt. HC14)	Prog. Bridge Completion, Shunt Cal, 2/4 Wire Constant Current	Constant V: 0 to 20.475 V; BCC: 0 to 20.475 mA; Opt. HC10 BCC: 0 to 1.023 mA
<b>28124-EA</b>	AC/DC Voltage, Bridge, EA = 0.01% DC Accuracy	4/card	Static or dynamic strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor	Prog. Bridge Completion, Shunt Cal, 2/4 Wire Constant Current	Constant Voltage: 0 to 20.475 V; Balanced Constant Current: 0 to 20.475 mA
<b>28114</b>	AC/DC Voltage, Bridge, Static or Dynamic Resistance	4/card	Static or dynamic strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor, IEPE (opt. HC14)	Prog. Bridge Completion, Shunt Cal, 2/4 Wire Constant Current	Constant V: 0 to 20.475 V; BCC: 0 to 20.475 mA; Opt. HC10 BCC: 0 to 1.023 mA
<b>28108</b>	AC/DC Voltage, Bridge, Static Resistance	8/card	Static strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor	2 to 6-wire w/ shield	Constant Voltage: 0 to 20.475 V
<b>28118</b>	AC/DC Voltage, Bridge, Static Resistance	8/card	Static strain, pressure, RTD, load, accel, AC/DC filter/amp, any bridge type sensor	2 to 6-wire w/ shield	Constant Voltage: 0 to 20.475 V
<b>28458</b>	AC Voltage, Dynamic Strain	8/card	Dynamic strain, AC/DC filter/amp	2-wire w/ shield	Balanced Constant Current: 0, 5, 10, 15, 20 mA
<b>28608B</b>	AC/DC Voltage	8/card	Low-Level AC or DC amps and LP, HP or BP filtering	2-wire w/ shield	N/A
<b>28618</b>	AC/DC Voltage	8/card	Low-Level AC or DC amps and LP, HP or BP filtering	2-wire w/ shield	N/A
<b>28612</b>	AC/DC Voltage	2/card	Low-Level AC or DC amps and LP, HP or BP filtering	2-wire w/ shield	N/A
<b>28208</b>	DC Voltage with Cold Junction Compensation	8/card	Thermocouple, low-level DC voltage	2-wire w/ shield	N/A
<b>28524</b>	Freq. to Voltage, Pulse Rate Conditioner	4/card	Frequency counter, pulse rate, flow rate, Hall effect sensors	2-Wire w/Shield	N/A
<b>28918A</b>	IEPE (GND or ISO), CVLD, In-Line Preamp	8/card	IEPE Sensor, CVLD current output sensor, External Preamp Power, AC voltage	5-wire (+/- Signal, +/- Preamp Pwr, Sensor Cal) w/ shield	IEPE: 0, 4, 8, 12 mA; CVLD: 10, 15, 20 V; Preamp Power
<b>28304</b>	SE Charge, IEPE (GND or ISO) w/ Long Distance TEDS	4/card	Piezoelectric or IEPE Sensor, Remote Charge Converter, AC Voltage	2-wire coaxial on Combo-D	IEPE Current: 0, 4, 8, 12 mA
<b>28324</b>	SE Charge, IEPE (GND or ISO) w/ Long Distance TEDS	4/card	Piezoelectric or IEPE Sensor, Remote Charge Converter, AC Voltage	2-wire coaxial on Combo-D	IEPE Current: 0, 4, 8, 12 mA
<b>28316C</b>	IEPE (GND or ISO) w/ Long Distance TEDS	16/card	IEPE Sensor with TEDS (optional), AC voltage	2-wire w/ shield	IEPE Current: 0, 2, 4, 8 mA
<b>28302B</b>	SE or Differential Charge, IEPE or Velocity Coil Input	2/card	Piezoelectric or IEPE Sensor, Velocity Coil, AC Voltage	2-wire coaxial or 3-wire LEMO	IEPE Current: 8.5 mA

## Conditioners for Shock and Vibration

### 28304 and 28324 Quad Dual-Mode Charge Amplifier

support either Charge or IEPE type sensors. The 28304 features versatile 4- or 8-pole filtered bandwidth up to 204.6 kHz while the economical 28324 provides 4-pole filtered bandwidth to 30 kHz. Both cards have the T-Insertion that can be used as an "Electronic Tap-Test" to verify all accelerometer channels quickly and easily from the convenience of the control room and LDTEDS™ technology to communicate with TED capable sensors out to a distance of 1500 feet.

**28302B Dual Vibration Amplifier** is designed to condition signals from rotating machinery. The card accepts inputs from single-ended or differential piezoelectric accelerometers, IEPE accelerometers, or remote velocity sensors. AC outputs are provided for acceleration, velocity and displacement. A DC output for acceleration, velocity or displacement is also provided.

### 28316C Isolated IEPE Accelerometer Conditioner with Long Distance TEDS™

provides 16 channels of precision signal conditioning for IEPE (Integrated Electronic Piezoelectric) accelerometers or remote charge converters (RCC's). The 28316C card is equipped with Precision Filters' long-distance TEDS (LDTEDS) technology.

### Voltage Conditioners

#### 28608B and 28618 Octal Programmable Filter/ Amplifier

cards are ideal for conditioning low-level voltage inputs in front of high-resolution digital data acquisition systems. Low-pass, high-pass and band-pass configurations are available. Programmable pre- and post-filter amplifiers provide an overall gain of x8192.

**28612 Dual 3MHz Filter/Amplifier** provides low noise amplification and precisely controlled 6-pole PULSE/FLAT low-pass filtering with programmable cutoffs as high as 3.15 MHz. Gain is programmable from x1 to x1000.

## Other Conditioners

### 28208 Octal Thermocouple Conditioner

provides eight channels of conditioning for thermocouples or other DC and AC voltage inputs. The 28208 consists of a low-drift programmable differential pre-amplifier, a 3-pole programmable filter and a programmable post-amplifier. A rugged remote isothermal block provides a reference junction for hardware correction.

### 28524 Quad Frequency-to-Voltage Converter Module

provides conditioning for pulse, rate and frequency transducers, giving a voltage output proportional to input frequency or rate. Distorted inputs such as signals with ringing, crossover or harmonic distortion are handled with programmable trigger threshold and trigger hold-off time.

**28918A Octal CVLD/IEPE Filter/Amp** conditions IEPE, CVLD, In-Line Pre-Amps and Voltage signals and is particularly suited for making underwater acoustics noise and vibration measurements, especially in high magnetic field environments.

## Conditioner and Amplifier Card Selection Guide

Card	Bandwidth	Gain	Filter	Cutoff Frequencies	Outputs
<b>28154</b>	250 kHz	x1/16 to x8192 w/ vernier	4-poles; PULSE/FLAT LP	FLAT: 2 Hz to 100 kHz PULSE: 1 Hz to 100 kHz	(3) Buffered Prog WB/Filtered SE Outputs per channel w/ optional Isolated Output (opt. 0)
<b>28144</b>	500 kHz	x1/16 to x8192 w/ vernier	4, 8-poles; PULSE/FLAT LP	FLAT: 2 Hz to 204.6 kHz PULSE: 1 Hz to 102.3 kHz	Single-ended w/ ground reference
<b>28124</b>	250 kHz	x1/16 to x8192 w/ vernier	4-poles; PULSE/FLAT LP	FLAT: 2 Hz to 100 kHz PULSE: 1 Hz to 100 kHz	(3) Buffered Prog WB/Filtered SE outputs per channel w/ ground reference
<b>28124-EA</b>	250 kHz	x1/16 to x8192 w/ vernier	4-poles; PULSE/FLAT LP	FLAT: 2 Hz to 51 kHz PULSE: 1 Hz to 25.5 kHz	(3) Buffered Prog WB/Filtered SE outputs per channel w/ ground reference
<b>28114</b>	190 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	Single-ended w/ ground reference (opt. L)
<b>28108</b>	100 kHz	x1/16 to x8192 w/ vernier	4-poles; PULSE/FLAT LP	FLAT: 2 Hz to 204.6 kHz PULSE: 1 Hz to 102.3 kHz	Single-ended or Differential (Opt. T)
<b>28118</b>	190 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	Single-ended or Differential (Opt. T)
<b>28458</b>	190 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	(2) Buffered Single-ended outputs per channel
<b>28608B</b>	500 kHz	x1/16 to x8192 w/ vernier	4, 8-poles; PULSE/FLAT LP or BP	FLAT: 2 Hz to 204.6 kHz PULSE: 1 Hz to 102.3 kHz	Single-ended w/ ground reference
<b>28618</b>	190 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	Single-ended w/ ground reference
<b>28612</b>	3.15 MHz	x1 to x1000	6-poles; PULSE/FLAT LP	5 kHz to 315 kHz 350 kHz to 3.15 MHz	Single-ended
<b>28208</b>	650 Hz	x1, 10, 100, 1000	3-pole Bessel LP	1, 10, 100 Hz and Wideband	Single-ended or Differential (Opt. T)
<b>28524</b>	1 Hz to 50 kHz	Input Range 10 mV to 100 V	Band-Pass	1 Hz to 50 kHz, Programmable	Single-ended Vout w/ ground reference; Single-ended Pulse output
<b>28918A</b>	1.2 Hz to 190 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	(2) Buffered Single-ended outputs per channel
<b>28304</b>	0.25 Hz to 450 kHz	x1/16 to x8192 w/ 0.05% resolution	4, 8-poles; PULSE/FLAT LP or BP	FLAT: 2 Hz to 204.6 kHz PULSE: 1 Hz to 102.3 kHz	(2) Buffered Single-ended outputs per channel
<b>28324</b>	0.5 Hz to 170 kHz	x1/16 to x1024 w/ vernier	4-poles; PULSE/FLAT LP	FX02: 300, 1k, 3k, 10k, 30 kHz	(2) Buffered Single-ended outputs per channel
<b>28316C</b>	0.25 Hz to 140 kHz	x1 to x512 w/ vernier	4-poles; Time Delay or Butterworth	FX02: 300, 1k, 3k, 10k, 30 kHz	(2) Buffered Single-ended outputs per channel
<b>28302B</b>	0.3 Hz to 20 kHz	PE: 1 to 200 pC/g IEPE: 0.1 to 200 mV/g	6-pole HP, 6-Pole LP	HP: 0.3, 3, 10, 30, 100 Hz LP: 50 Hz to 12.75 kHz in 50 Hz steps	(2) Accel, (2) Velocity, (1) Displacement, (1) DC, (1) Alarm

# 28000 System Filter Characteristics

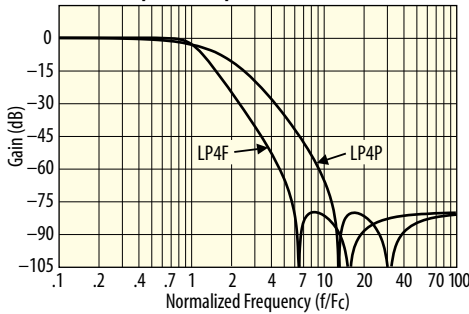
*You want your analog data to come clean before digital conversion.*

The 28000 System has a variety of high performance filter characteristics available for HP, LP or BP Precision filtering.

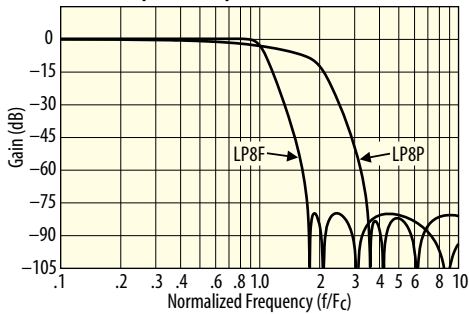
## Flat/Pulse Low-Pass Filters

Our new choice of LP4FP 4-pole or LP8FP 8-pole flat/pulse low-pass filters provide the user with the versatility to address applications in either the time or frequency domain and are available on many 28000 card models. Frequencies can range as high as 204.6 kHz with fixed frequency choices for economy.

LP4F and LP4P Amplitude Response



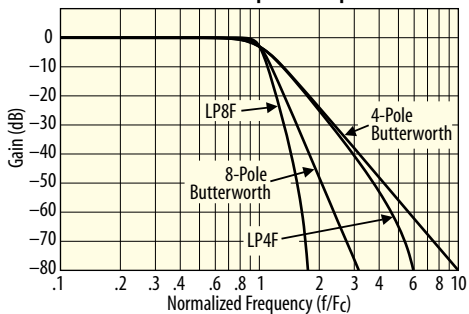
LP8F and LP8P Amplitude Response



## Flat Mode Low-Pass Filters

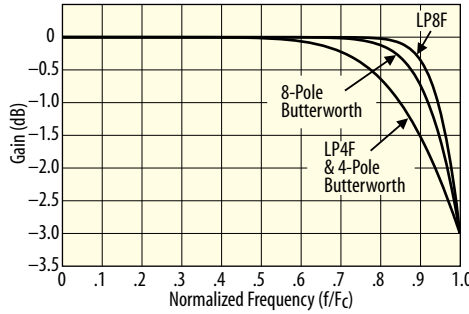
Precision LP4F and LP8F "flat" mode characteristics are specified to have outstanding passband flatness equivalent to the Butterworth yet deliver very sharp roll-off characteristics.

LP4F and LP8F vs Butterworth Amplitude Response



The LP4F and LP8F are a good choice as an anti-aliasing filter and for applications such as spectral analysis. The LP8F has zero passband ripple and over 100 dB/octave attenuation slope.

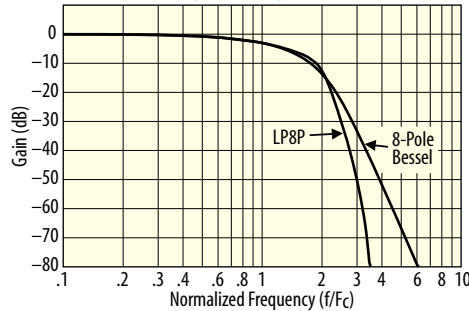
LP4F and LP8F vs Butterworth Passband Response



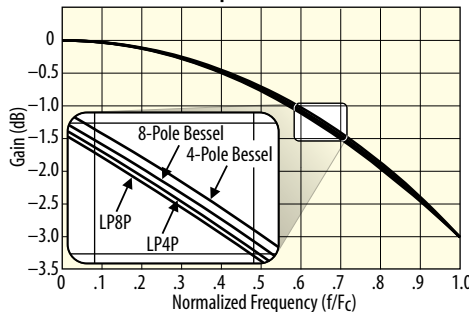
## Pulse Mode Low-Pass Filters

For the time domain, there are the LP4P and LP8P "pulse" mode low-pass filters. These filters have excellent transient response and phase linearity making them ideal filters for time domain applications including transient (shock) measurements and time domain waveform analysis ... all with roll-off characteristics superior to their Bessel filter counterparts.

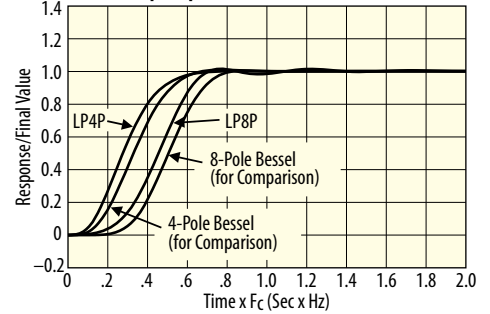
LP8P vs 8-Pole Bessel Amplitude Response



LP8P and LP4P Passband Response



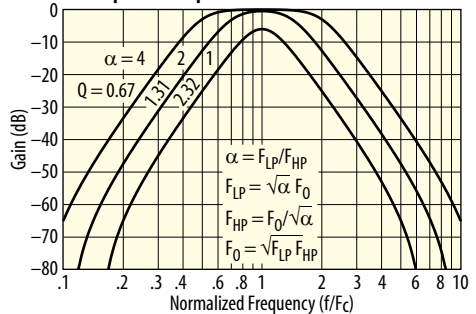
LP8P and LP4P Step Response



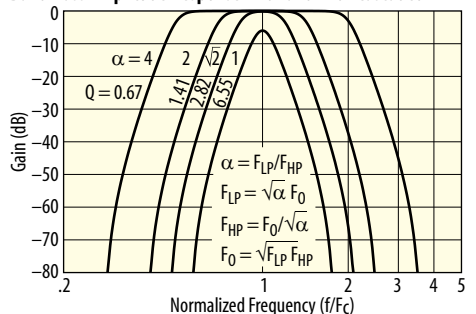
## High-Pass and Band-Pass Filters

For high-pass filtering, we offer the HP4F 4-pole and HP8F 8-pole characteristics. For band-pass filtering, choose the HP4F/LP4FP band-pass characteristic to provide programmable bandwidth and center frequency filters. For more selective band-pass filtering, cascade an HP8F with an LP8F.

Band-Pass Amplitude Response HP4F and LP4F Cascaded



Band-Pass Amplitude Response HP8F and LP8F Cascaded



## Traditional Filters

Of course, we offer the traditional filter types such as Butterworth and Bessel characteristics ... just ask!

In any case, we deliver to you a tightly controlled filter with phase match better than 1 degree and usually better than 0.5 degrees.

# Test Subsystem & Accessories

## Test Subsystem

The performance verification of test instruments is a critical part of insuring data integrity of any measurement system. The 28000-?-TEST test subsystem and the 28000-BIF2-FT controller card provide a complete suite of tests that may be 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.

Three levels of test are provided. Pre-Test Verify and Diagnostics tests 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 conditioner. 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 may be run to measure system performance of the current programmed setup.

## Accessories

### Output Adapter Modules



Several 28000 conditioner cards incorporate an auxiliary output connector at the front panel to support the use of output modules. A variety of output modules are available to provide additional buffered outputs per channel, different connector types, filtering, RMS-to-DC conversion, or other functions.

### Input and Output Connector Adapters

Connector adapters are available for several conditioner cards to provide either coaxial BNC or twinaxial BNC I/O connections or high-density wire terminal adapters to supplement the multipin connectors that are standard on the cards.



### Mating Connectors

Mating connectors are available for all system I/O connections, including the input and output connectors for conditioner cards, for the frames' 50-pin output connectors, and for the backplane interface card connector. Mating connectors include high quality gold plated machined contacts for long life and are available in both crimp-pin and solder-cup styles.

### Rack Mount Slide Kits

Rack mount kits with slides are available for the 28004, 28008 and 28016 chassis. A rack mount adapter kit is also available for the 28002 chassis.

### Cables and Connector Panels



Precision Filters offers a wide range of cables to meet application requirements. A comprehensive set of input and output signal cables is available. Also, custom interconnection systems can be designed using bulkhead mounted BNC panels such as the PNL-32BNCBH-1U together with a wide selection of bulkhead cables. System cables available include RS-232 cables for control of the 28000 system and cables for the 28000-?-TEST test subsystem.

### Extender Cards

Extender cards provide access to the signal conditioner cards for routine maintenance.

### Transit Case

Transit cases are available from Precision Filters for the 28000. This family of transit cases assures safe transport of your valuable equipment.



# System Control

The 28000 system is controlled by the PF Graphical User Interface (GUI) operating on a Windows compatible PC controller or over the network using the built-in 28000-LCS interactive command line interpreter. The PC controller communicates with the 28000 frames via the backplane interface card. A single PC controller can support up to eight 28000 systems. Both the GUI control software and the 28000-LCS interpreter are included with each 28000 system.

## PF Graphical User Interface

The PF Graphical User Interface (GUI) control software provides an easy-to-use spreadsheet-style environment with well-organized menus and point and click ease of use. All system functions are controlled by the GUI, from configuration, set-up and operations through pre-test verify and diagnostics, FAT and Go/No-Go tests. The GUI's display and control panels are customizable to the application or user preference. Selectable security settings control access to the system and movement between various system functions protecting critical programmed system parameters.

On power-up, the GUI automatically configures the system to control the exact set of signal conditioner cards installed in the 28000 frames. The GUI incorporates a collection of algorithms to automate tedious setup tasks. Based on user input, the GUI apportions gain in each channel to provide best signal-to-noise ratio while minimizing the chance of an overload occurring on out-of-band signals. Databases allow the user to import TEDS capable transducer information including type, sensitivity, last calibration date and serial number.

## 28000-LCS Interpreter

The resident 28000-LCS program is an interactive command line interpreter that allows the 28000 system to be controlled on an Ethernet network. During operation, the system status and commands pass between the host computer and the 28000 system via a TCP/IP connection. The 28000-LCS is a straightforward method for controlling the 28000 system since status messages and commands are readable sequences of ASCII characters.

# 28000 General Specifications

## General Characteristics

### 28002-M5 2-Slot Mainframe

**Size:** 10.7 H x 3.9 W x 18 D inches

**Weight:** 12 lbs. (net)

### 28004-M3/M5 4-Slot Mainframe

**Size:**

3.5 H (2U) x 19 W x 20 D inches for standard RETMA rack installation

**Weight:** 17 lb. (net)

### 28008-M3/M5 8-Slot Mainframe

**Size:**

5.25 H (3U) x 19 W x 19 D inches for standard RETMA rack installation

**Weight:** 17 lb. (net)

### 28016-M3 and 28000-M5 16-Slot Mainframes

**Size:**

10.5 H (6U) x 19 W x 20 D inches for standard RETMA rack installation

**Weight:** 30 lb. (net)

### Backplane Interface Module (BIF)

#### 28000-BIF2-T and 28000-BIF2-FT

**Size:** 6.6 x 17.5 x 0.75 inches

**Weight:** 1.5 lb. (net)

### 28000 Conditioner Cards

**Size:** 6.6 x 17.5 x 0.75 inches

**Weight:** 1.5 lb. (net) typical

### Temperature and Humidity

**Operating Temperature:**

0° C to 40° C

**Storage Temperature:**

-20° C to 70° C

**Relative Humidity:**

Less than 90% non-condensing

## Power Supplies

Field replaceable, low-noise AC power supplies provide clean power to the signal conditioning cards. The 28000 system supports internal monitoring and reporting of power supply levels. Internal temperature and fan operations are also monitored, sounding an alarm if conditions are out of specified limits.

All 28000 systems are configured with the proper power supply input voltage and fuse(s) for your country when shipped from the factory, unless other requirements are specified.

### External Power Supply for the 28002-M5 Mainframe

#### PF-1U-ACDC2-120 W

(operating range of 100 to 240 VAC)

**Weight:** 2.5 lb.

### Power Supplies for 28004-M3/M5 4-Slot Mainframes

#### 28004-ACPS-1: 115 VAC

(operating range of 104 to 126 VAC)

#### 28004-ACPS-2: 230 VAC

(operating range of 207 to 253 VAC)

**Weight:** 11 lb. (net)

### Power Supplies for 28008-M3/M5 8-Slot Mainframes

#### 28008-ACPS-1: 120 VAC    28008-ACPS-2: 220 VAC

#### 28008-ACPS-3: 240 VAC    28008-ACPS-4: 100 VAC

**Weight:** 15 lb. (net)

### Power Supplies for 28016-M3 and 28000-M5 16-Slot Mainframes

#### 28016-ACPS-1: 115 VAC

(operating range of 104 to 126 VAC)

#### 28016-ACPS-2: 230 VAC

(operating range of 207 to 253 VAC)

#### 28016-ACPS-4: 100 VAC

**Weight:** 18 lb. (net)

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



### Exceptional desktop performance.

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.

## High Density Programmable Switch Systems

Computer controlled analog signal switching replaces tedious manual patch panels.



### Precision 4164 64x64 Switch Matrix System



### Precision 464kB Switch Matrix System

Precision switch systems are reliable solid-state switch matrix systems, providing computer-controlled connection between inputs and outputs signals. Configure the 464kB with up to 256 inputs and 256 outputs, all in a single mainframe, or choose the compact 4164 system with 64 inputs and 64 outputs. 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.

## Configuring a 28000 System

**28000 Mainframe:** Choose either a 28002-M5 (includes power supply), 28004-M3/M5, 28008-M3/M5, 28016-M3 or 28016-M5 mainframe.

**Power Supply:** Choose one power supply per system with correct voltage for your country.

**Note:** A power supply is included with the 28002-M5 chassis.

**Signal Conditioning Cards:** Mix and match any 28000 signal conditioning cards in your system.

**Backplane Interface Card:** Include one 28000-BIF2-FT per 28000 chassis for system control.

**Note:** Option F is part of the 28000 Test Subsystem and is required for the automated Factory Acceptance (FAT) and Go/No-Go (GNG) tests.

**28000-?-TEST:** Optional Test Subsystem instruments and cables required for FAT and GNG tests.