

28334A QUAD DUAL MODE CHARGE/IEPE CONDITIONER W/LTEDS

200 kHz Filtered/650 kHz Wideband Bandwidth



28000 SIGNAL CONDITIONING SYSTEM

- Graphical User Interface (GUI) and Ethernet network interface for system control
- Intelligent gain and system scaling algorithms
- Test input and output monitor busses
- Go/no-go test with diagnostics
- Rigorous factory acceptance test for maintenance
- Field swappable AC power supplies
- Built-in temperature and power supply monitoring with alarms
- Backward compatible with 27000 signal conditioning modules

28000 SIGNAL CONDITIONING SYSTEM

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 transducers. choose charge, IEPE w/TEDS, voltage (filter amplifier), strain, thermocouple, RTD, potentiometer, current, frequency, or other transducers.

The built-in test hardware and software (optional) provide quick go/no-go performance checks 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.

28334A APPLICATIONS

- Load, torque, dynamic force, dynamic pressure, shock, vibration and acoustic measurements
- Piezoelectric crash tests
- Ballistics shock testing
- Machine health monitoring
- Structural response tests
- Flight tests
- Wind tunnels
- Ultrasonic transducers

28334A FEATURES

- 4 channels per card, 64 channels per chassis
- Dual mode: piezoelectric or IEPE
- Floating or grounded input
- Up to 200 kHz “filtered” bandwidth or 650 kHz “wide-band” bandwidth
- Two ranges for 50,000 or 500,000 pC FS inputs
- Extremely large time constant for quasi-static charge measurements
- Programmable IEPE current to 20 mA
- TEDS compatible
- Programmable amplifier: x1 to x12000
- 6-pole anti-alias filters with filter bypass (wide-band)
- 2° phase matching between any channels, DC to Fc
- Overload detection
- Precise automatic calibration

28334A DESCRIPTION

The 28334A is a member of the precision 28000 family of signal conditioners. The 28334A provides 4 channels of dual mode Charge/IEPE conditioning. Up to sixteen 28334A cards may reside in the 28000 system to provide 64 channels in a single 6U chassis.

In charge mode the 28334A provides two charge conversion ranges with full scale inputs of 50,000 or 500,000 pC. Channel gains of up to 12,000 provide charge sensitivity as high as 2.4 V/pC. Each channel includes a 6-pole Bessel filter with cutoff frequencies programmable to 200 kHz. Filter bypass mode extends the small-signal bandwidth to 650 kHz. A programmable input stage allows operation with both grounded or isolated accelerometers. Extremely large time constants allow measurement of quasi-static charge phenomena. Low noise, low-distortion and high accuracy circuits guarantee accurate high frequency measurements of even low-level signals.

Overall measurement accuracy is assured with built in charge gain adjustment circuits which can be used in-situ to adjust gain under run time conditions. Verification and documentation of actual charge gain can be performed using built in shunt calibration with secondary standard shunt calibration capacitors. The calibrated value of shunt cal capacitors is stored on card EEPROM and can be recalled by host software for exact span verification or data post processing.

28334A DESCRIPTION (Cont.)

In IEPE mode the 28334A accommodates long cable runs with programmable IEPE current up to 20 mA. As with charge mode, accurate measurements of wide band, low level signals is guaranteed by channel gains to 12,000, frequency response to 200 kHz, low noise, and high accuracy circuits.

Input signal visibility is a crucial aspect of IEPE sensors as the sensors bias voltage is a useful indicator of sensor, cable and connector health. The 28334A card IEPE input stage continually monitors the DC bias voltage present on the channel input prior to the AC coupling stage. Not only is this voltage level displayed for each channel but it is also compared to user programmable upper and lower threshold limits to alert the user to a sudden shift of the bias level. A system bias level report can be requested at any time, creating a file useful for pre-test gage health documentation.

Long Distance TEDS

The 28334A provides a mixed mode transducer interface in conformance with IEEE 1451.4 Smart Transducer Interface. The mixed mode interface supports IEPE (Integrated Electronic Piezo-Electric) sensors powered by current source and TEDS (Transducer Electronic Data Sheet) capable sensors. TEDS information such as manufacturer name, serial number, calibration data, etc. are readable by the system for use in system scaling, identification, bookkeeping, troubleshooting and other functions.

TEDS sensors may be effectively applied to test models; however, there is a restriction that the cable run between the signal conditioner and the sensor be limited to 400 feet in order to be able to properly read the TEDS. For applications such as weapons test or vibration test on large structures, safety, environment, test article size and other factors often require cable runs in excess of 1000 feet that have until now precluded the use of TEDS equipped sensors.

To overcome the communications distance limitations of conventional TEDS, the 28334A is equipped with Precision Filters proprietary Long-Distance TEDS (LDTEDS) hardware. The proprietary LDTEDS circuitry uses an analog to digital converter to digitize the TEDS waveforms and utilizes a digital signal processor to process the TEDS data. LDTEDS can communicate with sensors at distances out to 1500 feet.

Input Stage

The 28334A input stage connects to either the charge or the IEPE front end. The input stage has low distortion, low DC drift and ultra-low noise (≤ 163 dBV/ $\sqrt{\text{Hz}}$).

A programmable switch at the input stage is provided to connect the amplifier to the 28000 system test bus. The test bus is used to inject signals for performance verification.

28334A DESCRIPTION (Cont.)

Amplifier and Filter

Programmable pre- and post-filter amplifiers provide an overall gain of 12,000. Gain is distributed both before and after the filter to provide protection from large out-of-band energy or transients that could cause clipping before the filter, distorting the data. Overload detectors alert the user to over-voltage conditions. A fully buffered output having over 20 mA of drive capability may be used to drive long output cable runs.

The 28334A contains a 6-pole Bessel low-pass filter with cut-offs programmable from 1 Hz to 200 kHz.

28334A PROGRAMMABLE FEATURES

Charge Mode Feature

- FS Range (50,000 pC or 500,000 pC)
- Input type (isolated or grounded)
- Time Constant (long or short)
- Charge converter reset (reset or enable)
- Shunt Calibration (on or off)

IEPE Mode Features

- IEPE current (0 to 20 mA, 1 mA steps)
- Bias monitor with programmable fault limits (upper limit and lower limit)
- Input mode (IEPE conditioner or differential input filter/amp)
- AC current dither

IEPE/Charge Common Features

- Gain (1X to 12,000X)
- Cutoff frequency (1 Hz to 200 kHz)
- Wide band (650 kHz) or filtered operation
- Test modes: run (operate), input short, cal voltage substitution (Test Bus)

28334A CARD MODEL NUMBER

The 28334A card model number describes the configuration of the four channels on the card. The model number identifies the options included on the card.

28334A-FX01-BE6-?

Options:
T Differential Output

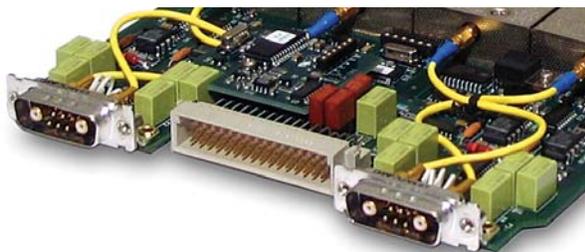
INPUT CHARACTERISTICS

Piezoelectric Inputs (Charge Mode)

Type:	Programmable single-ended (sensor floating) or isolated (sensor grounded)
Connector:	Two isolated coaxial insert Combo-D (two channels per connector)
Maximum Input:	Low range, 50,000 pC ($F \leq 200$ kHz) 50,000 * 200 kHz/F ($F \geq 200$ kHz) High Range, 500,000 pC ($F \leq 20$ kHz) 500,000 pC * 20 kHz/F ($F \geq 20$ kHz)
Charge Sensitivity:	Low range, 0.2 mV/pC to 2.4 V/pC High range, 0.02 mV/pC to 0.24 V/pC
Charge Conversion Accuracy:	0.2% (V_{out}/Q_{in} after auto gain adjustment at 55 Hz, Gain = 1X)
Shunt Calibration Capacitor:	5,000 pF $\pm 0.1\%$ (Calibrated value stored in card EEPROM)
Shunt Cal Frequency Response:	-0.05 dB at 100 kHz, -0.2 dB at 200 kHz
Time Constant:	Low Range: 10 or 5,000 seconds High Range: 100 or 50,000 seconds
Noise (100 kHz BW):	Low Range: 0.08 pC + 0.0033 pC/nF High Range: 0.8 pC + 0.0033 pC/nF
Drift:	2pC/Sec
Ground Signal Rejection:	-60 dB DC to 1 kHz (Isolated Mode)
Source Capacitance:	<0.03 μ F meets all specifications
Source Resistance:	>10 M Ω meets all specifications
Reset:	1 K Ω shunt resets conversion capacitor

IEPE inputs (IEPE Mode)

Type:	Single ended (Low connected to conditioner ground)
Connector:	Two Combo-D pins (two channels per connector)
IEPE Current:	0 to 25 mA in 1 mA steps with disconnect
Current Accuracy:	$\pm 1\%$
Maximum Input:	22 V (DC bias + AC signal)
IEPE sensitivity:	1 mV/mV to 12,000 mV/mV
IEPE Current Noise:	130 pA/ $\sqrt{\text{Hz}}$
Freq. Response:	1 Hz to 200 kHz
Noise:	7 nV/ $\sqrt{\text{Hz}}$ RTI at 1 kHz and pre-gain >x100



28334A Card Input Connectors

FILTER/AMPLIFIER MODE CHARACTERISTICS

Note: Specs at 25°C unless otherwise noted.

Common Mode V:	± 10 V operating
CMRR:	-80 dB DC to 10 kHz
Input Protection:	± 35 V
Input Impedance: (DC Coupled)	10 M Ω //100 pF per side 20 M Ω //50 pF differential 100 M Ω //24 pF common mode
Input Impedance: (AC Coupled)	(0.1 μ F & 10 M Ω)//100 pF per side (0.159 Hz) 0.2 μ F & 20 M Ω common mode
Max Level:	± 10 Vpk for $f \leq 200$ kHz; ± 10 Vpk (200 kHz/f) for $f > 200$ kHz
Offset Drift:	2.5 μ V/ $^{\circ}$ C, max
Noise:	7 nV/ $\sqrt{\text{Hz}}$ RTI at 1 kHz and pre-gain >x100

28334A AMPLIFIER CHARACTERISTICS

Pre-filter Gain:	x1, 1.25, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10, ... , x1500, with overload detection (10.5 Vpk threshold)
Post-filter Gain:	x1, 2, 4, 8
DC Accuracy:	0.12% after auto cal at any gain setting
Stability:	$\pm 0.02\%$ for 6 months
Temp Coef.:	$\pm 0.004\%/^{\circ}$ C
DC Linearity:	$\pm 0.01\%$ re Fullscale, relative to the best straight line
Freq. Response:	DC to 200 kHz, -0.15 dB ± 0.15 dB -3.01 dB BW: 650 kHz, typical

28334A TEST MODES

Shunt Cal: (Charge Mode only) Test Bus signal is applied to charge amp input through a 5000 pF shunt cal capacitor.

Amplifier Short: A switch at the amplifier input is utilized to ground the input stage for measurement of noise and DC offset.

Test Bus: Test input allows for injection of a test signal. An external test signal or the 28000-?-TEST Test Subsystem may be connected at the rear panel. Refer to the 28000-?-TEST Test Subsystem specification for more information.

AC Current: (IEPE Mode only) An AC dither current is summed with the IEPE current to create an AC voltage signal based on the transducer's output impedance. AC current is derived from test bus voltage according to:

$$\text{AC Current} = V (\text{Test Bus})/10000$$

28334A LOW-PASS FILTER CHARACTERISTICS

Type: 6-Pole Bessel Low-Pass
 Cutoff Frequencies
 (FX01 Range): 1, 2, 4, 5, 10, 20, 40, 50, 100, ...
 200K and Bypass (Wideband)
 Cutoff Amplitude: -3.01 dB
 Amplitude Accuracy: ± 0.2 dB max

28334A OUTPUT CHARACTERISTICS

Type: DC-coupled, single-ended output with ground reference.
 Z: $10\ \Omega$ shunted by 100 pF
 Max Output: ± 10 Vpk, ± 20 mApk
 Offset Drift: $2.5\ \mu\text{V}/^\circ\text{C}$, RTI + $150\ \mu\text{V}/^\circ\text{C}$, RTO
 Noise: $5\ \mu\text{Vrms}$ RTI + $300\ \mu\text{Vrms}$ RTO
 0.1 Hz to 200 kHz
 Crosstalk: -80 dB, DC to 100 kHz between adjacent channels with the same configuration and programmed settings.

Option T: Balanced differential output
 Z: $10\ \Omega$ shunted by 100 pF per side
 Max Output: ± 5 Vpk per side (20 mApk)
 ± 10 Vpk differential

28334A OUTPUT CHARACTERISTICS (Cont.)

Auto-Offset Adjust (Standard)

Auto-Offset: Auto-offset automatically zeroes offset at the channel output to less than 5 mV at any gain setting. The auto-offset cycle is initiated in the GUI. The offset DAC settings are stored in non-volatile memory on the card for every gain setting. Changes in gain result in minimal disruption of the channel.

Output Monitor (Standard)

Output Monitor: A switch located at the output of each channel allows for multiplexed connection to the mainframe output monitor bus. The output monitor bus is available at a connector located in the 17th slot at the rear of the mainframe. The monitor function is used by the Test Subsystem or is available to the user for viewing channel outputs.

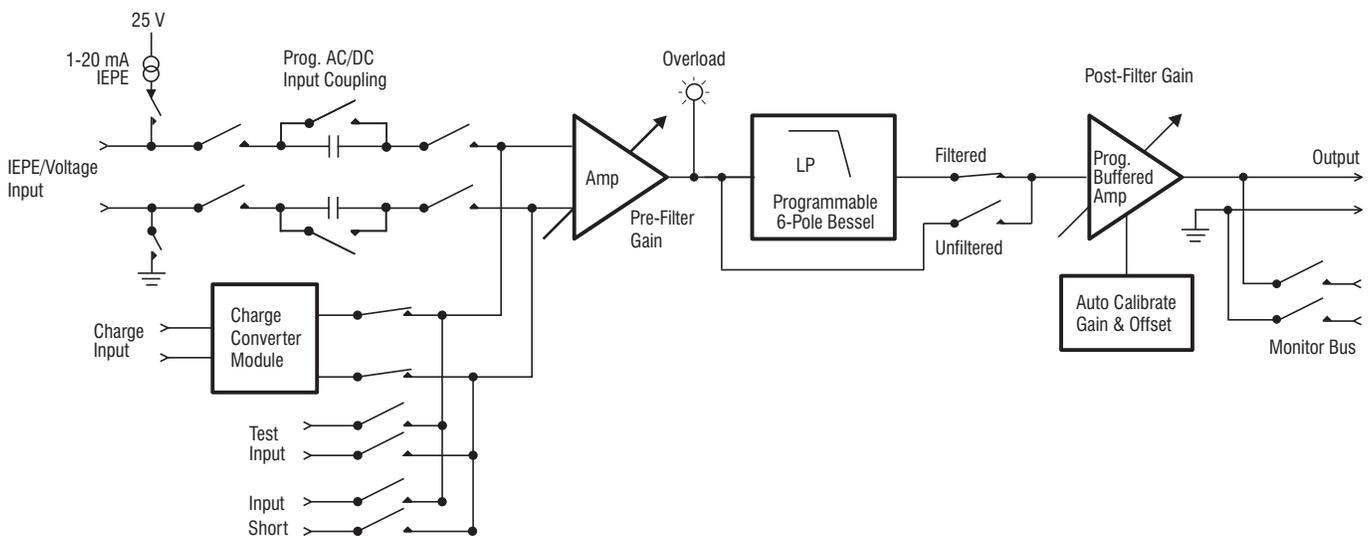
28334A CARD GENERAL CHARACTERISTICS

28334A Card Size: 6.6 x 17.5 x 0.75 inches
 Card Weight: 1.4 lb. net
 Temperature: 0° to 40° C (operating)
 -20° to 70° C (storage)

ORDERING INFORMATION

28334A-FX01-BE6-?

Options: T (Differential Output)



28334A Channel Simplified Block Diagram

