



Precision 28524 Quad-Channel Frequency to Voltage Converter Modules

The 28524 4-Channel Frequency-to-Voltage Converter Module provides conditioning for pulse, rate and frequency transducers. This card gives precise DC output voltage proportional to input frequency or pulse rate for frequencies from 1 Hz to 50 kHz with amplitude levels from 10 mV to 100 V. A second output is a clean 5 V square wave representation of the input frequency.

Distorted inputs such as signals with ringing, crossover or harmonic distortion are accurately detected with programmable analog filtering, as well as, programmable trigger threshold, slope and trigger hold-off time. Programmable pre-scaler allows once per rev measurements on sensors detecting multiple gear teeth or flow meter vanes.



Transducers:

- Speed Sensors
- Tachometers
- Vane Anemometers
- Flow Meters
- Position Encoder

Programmable Features

- Input frequency range: Low Frequency (F_L), High Frequency (F_H)
- Output voltage range: Low Voltage (V_L), High Voltage (V_H)
- Low frequency roll-off
- Trigger threshold
- Positive or negative trigger
- Hold-off trigger time
- Prescaler
- Input range

Precision 28524 Features:

- Four channels per card, 64 channels per 28016 chassis.
- DC output representative of input frequency
- 5 V square wave representative of input frequency
- GUI readout of input frequency
- Programmable scaling of DC output (F_{min} , F_{max} , V_{min} , V_{max})
- Programmable trigger threshold, slope and hold-off
- Programmable pre-scaling
- Programmable low-pass filter
- 1 Hz to 50 kHz frequency range
- 10 mV to 100 V input
- 16-bit output voltage resolution
- Test input for frequency input simulation

Overview

28000 Analog Signal Conditioning System

The new 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 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 tests, 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, setup, operation, maintenance, and upgrading—the Precision 28000 offers ways to help you save time and money over the life of the system.

28000 System Features

- 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 to be used before tests
- Rigorous Factory Acceptance Test for maintenance
- Field-swappable AC power supplies
- Built-in temperature and power supply monitoring with alarms

Precision 28524 Description

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The 28524 is a member of the 28000 family of signal conditioners. It provides conditioning for pulse rate and frequency transducers, giving a voltage output proportional to input frequency or rate. A programmable attenuator allows linear operation with 100 V input levels.

The user may select a limited band of frequencies within the 50 kHz range by programming a low frequency, F_L , and a high frequency, F_H , for each channel. The user may also specify the output voltages corresponding to these frequencies by selecting a low voltage, V_L , and a high voltage, V_H . The same voltage settings are applied to all channels on a card.

The measured frequency is displayed in the GUI and is updated approximately every ten seconds. This read-back feature can be disabled.

To accommodate distorted inputs such as signals with ringing, crossover or harmonic distortion, the 28524 has programmable trigger threshold and trigger hold-off time.

Test inputs, along with the system test bus and monitor bus make the card ready to work with the 28000 Test Subsystem hardware and software to support Go/No-Go and factory acceptance tests.

Programmable Trigger Controls

Selectable Trigger Type

Positive or negative edge trigger; user selectable.

The selectable edge trigger allows the user to choose the positive (leading) or negative (trailing) signal edge. Selecting the edge with the sharper transition produces a more stable output. See Figure 1.

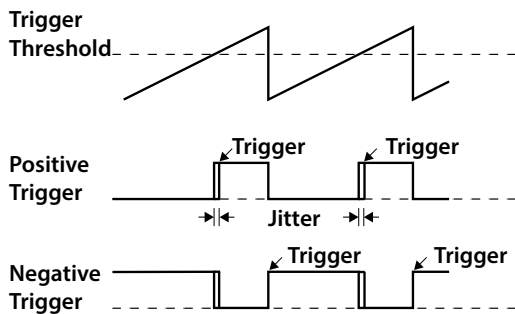


Figure 1 Selectable Trigger

Prescaler

The programmable prescaler divides the input signal by 2 to 255 by counting the specified number of input edges before passing a trigger pulse to the converter circuitry.

In a system where the signal is generated by a transducer sensing gear teeth or flow meter vanes, the signal can be scaled to volts/revolution by dividing the input by the number of teeth or vanes.

Programmable Trigger Hold Off Period

The programmable trigger hold-off time prevents false triggering on signal edges which cross the trigger threshold voltage but are not representative of the actual input frequency. On each valid edge, the trigger circuit is disabled for a period of time to ignore the false edges. An input signal with ringing could cause false triggering. See Figure 2.

Range: 1 μ S to 1 S in 1 μ S steps

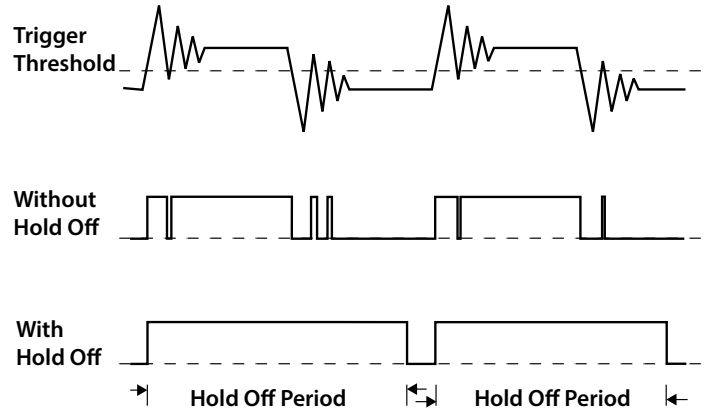


Figure 2 Programmable Trigger Hold Off

Programmable Trigger Threshold

The programmable trigger threshold allows the user to adjust the trigger voltage up or down to avoid distorted portions of the input signal. A signal with crossover distortion could cause false triggering. See Figure 3.

100 V range: \pm 100 V in 50 mV steps

10 V range: \pm 10 V in 5 mV steps

1 V range: \pm 1 V in 500 μ V steps

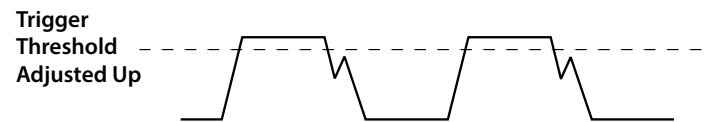
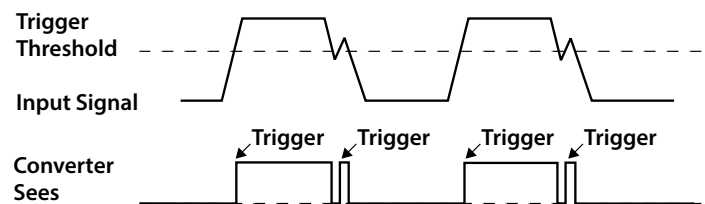


Figure 3 Programmable Trigger Threshold

Auto Trigger

When initiated, the system automatically determines a trigger threshold for a stable input waveform.

28524 Details and Specifications

Input Characteristics

Input Type:

DC-coupled, differential

Input Ranges:

1 V, 10 V, 100 V

Maximum Input:

100 V, differential + common mode

Amplitude Range:

10 mV to 100 V for sine wave and square wave

40 mV pk to 100 Vpk for pulse amplitude, 5 μ S min pulse width

Maximum Frequency In:

50 kHz

Minimum Frequency In:

1 Hz

F_H Settings:

10 Hz to 50 kHz in 1 Hz Steps

F_L Settings:

0 Hz to (F_H - 10 Hz) in 1 Hz Steps

Note: minimum separation between F_H and F_L setting is 10 Hz

Input Z:

400 k Ω , 1 V and 10 V, differential
210 k Ω , 100 V range, differential
110 k Ω , common mode

Common Mode In:

100 V maximum

CMRR:

70 dB, DC to 50 Hz; 40 dB to 5 kHz

Input Noise:

300 μ V rms in 600 kHz BW

Input Connector:

15-pin subminiature D-shell

Input Wires:

HIGH, LOW, SHIELD per channel

28524 Input Filters

The 28524 provides programmable cascaded high-pass and low-pass filters at the input.

High-Pass Filters:

1-pole; 10 Hz, 100 Hz, or Bypass

Low-Pass Filters:

4-pole Bessel Precision Filters,
Range: 5 Hz to 1.275 kHz in 5 Hz steps (low), 1.5 kHz to 127.5 kHz in 500 Hz steps (high)

F_c is slaved to the upper input frequency setting such that:

F_c = 5*F_H for F_H \leq 25.5 kHz and
F_c = 127.5 kHz for F_H > 25.5 kHz.

The low-pass filter can be bypassed.

28524 Output Characteristics

Maximum Voltage Out:

\pm 10 VDC

V_H Settings:

-9 V to 10 V in 0.1 V steps

V_L Settings:

-10 V to (V_H - 1 V) in 0.1 V steps

Type:

DC coupled, single-ended output with ground sense

Output Filter Type:

2-pole Bessel

Output Filter F_c's:

1 Hz, 10 Hz, 100 Hz, Bypass

Z: 50 Ω || 100 pF

Voltage Output Resolution:

(F_H - F_L)/65535 Hz

Initial Accuracy:

\pm 2 mV \pm 0.01% (V_H - V_L) \pm 0.015%* ϵ
accuracy typical

\pm 5 mV \pm 0.05% (V_H - V_L) \pm 0.015%* ϵ
accuracy, maximum

Where ϵ = F_H / (F_H - F_L)

Drift:

(100 ppm of setting + 20 μ V)/ $^{\circ}$ C

Noise:

100 μ V, 1 MHz BW

Pulse Output:

5 V CMOS, F_{OUT} = F_{IN}

Frequency Measurement Accuracy:

\pm 0.03% typical

Frequency Display Resolution:

1.00 to 999.99 in 0.01 Hz steps

1,000.0 to 9,999.9 in 0.1 Hz steps

10,000 to 50,000 in 1 Hz steps

Rear Output Connector:

26-pin D-shell for VDC and pulse out

50-pin D-Shell for VDC

Front Output Connector:

48-pin DIN for pulse outputs

Transfer Characteristics

VDC Output Update Rate:

F_{in} > 1 kHz: 1 to 2 mS

F_{in} < 1 kHz: 1/F_{in} S + 1 mS

Settling time to 0.05% of final value:

Output Filter Bypassed: \approx 125 μ S

Output Filter F_c = 1 Hz: 1.2 S

Output Filter F_c = 10 Hz: 120 mS

Output Filter F_c = 100 Hz: 12 mS

Pulse output:

5 V square wave, F_{OUT} = F_{IN}

Test Bus

A switch at the input of each channel allows the application of a signal for test and calibration. The test bus is used by the Test Subsystem module.

Also, an input can be simulated via GUI control. The user enters a frequency and the 28524 loads the output DAC with the appropriate value taking into account the F_H, F_L, V_H, and V_L set points.

Frequency Entry Resolution:

1.00 to 999.99 in 0.01 Hz steps

1,000.0 to 9,999.9 in 0.1 Hz steps

10,000 to 50,000 in 1 Hz steps

Monitor Bus

Switches at the trigger level input circuit, conversion output and pulse output allow for connection to the output monitor bus. The output monitor bus is available via BNC at the mainframe front panel. The monitor bus is used by the Test Subsystem module.

Characteristics

28524 Card Size:

6.63 x 17.5 x 0.75 inches

Card Weight:

1.3 lbs net, 3 lbs shipping

Temperature:

0 $^{\circ}$ to 40 $^{\circ}$ C (operating)

-20 $^{\circ}$ to 70 $^{\circ}$ C (storage)

Accessories

Mating Connectors

Precision Filters mating connectors accommodate up to 22-AWG wire and are supplied with high-quality metal backshells and gold plated screw machined contacts for high reliability connections and long service life.

CONN-IN-15D: Multipin 15-pin D-shell mating input connector with crimp sockets and metal backshell with strain relief.

CONN-IN-15D-SC: Multipin 15-pin D-shell mating input connector with solder cup sockets and metal backshell with strain relief.

CONN-OUT-26D: High-density 26-pin D-shell mating output connector with machined crimp pins and metal backshell with strain relief.

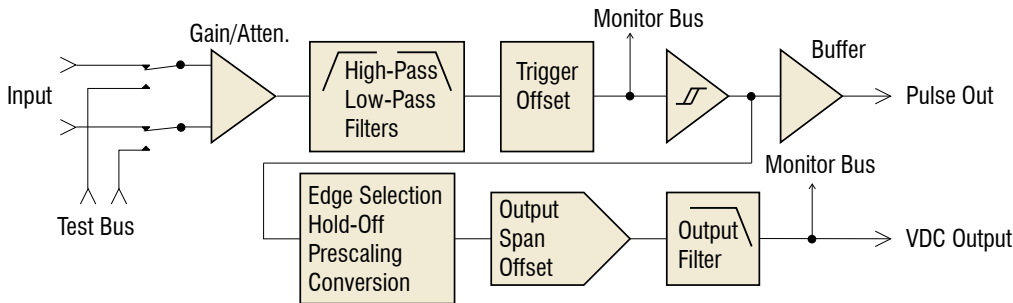
CONN-OUT-26D-SC: High-density 26-pin D-shell mating output connector with machined solder cup pins and metal backshell with strain relief.

Output Adapters

28524 cards are fitted with front panel connectors that accept the output adapter modules in order to provide multiple buffered "pulse" outputs. Adapters plug on to the front of the signal conditioner card and are secured to the card by two screws. The adapters provide four additional fully buffered BNC outputs per channel and one 15-pin D-shell output connector.

BUFF-4BNC/15D: Quad output buffer module provides one buffered output per channel on 4 BNC connectors or one 15-pin multipin connector.

BUFF-4CH/(2)15D: Quad output buffer with dual outputs per channel on two 15-pin connectors.



Block Diagram of Typical 28524 Channel

Precision Product Solutions

For over 40 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.