

Description

The 5290 is a four-channel signal conditioner for ICP or other types of transducers requiring constant current excitation. A programmable constant-current source provides power to the integrated circuit in the input sensor, and the return signal (which appears as a varying voltage on the same line) is amplified and processed into a $\pm 10\text{v}$ output signal. Each channel is configured as an AC-coupled amplifier with programmable gain capable of converting sensor signals as low as 50mV (peak) into a $\pm 10\text{v}$ output voltage. Designed for use in the instrumentation systems test environment, it includes many features that simplify the test setup and improve the accuracy of the collected data.

Design Features

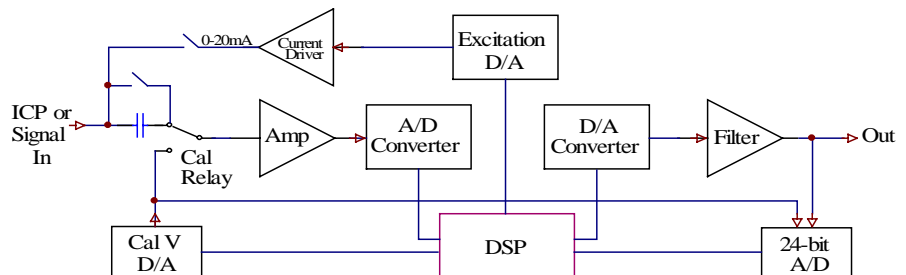
The 5290 provides a gain range of 1 to 5000 with a full 100 kHz bandwidth. A programmable constant-current source provides excitation power to sensors with internal integrated amplifiers, and a programmable calibration voltage source is available for establishing baseline values before and after a test is run. Front-panel LEDs indicate signal presence and warn of overload conditions and module operational problems. Stable low temperature-coefficient components are used to maintain system accuracy over a wide temperature range, and all circuitry is housed in a shielded enclosure for improved reliability and noise reduction.



5290 Four Channel Constant Current (ICP) Conditioner

Stable Amplifier Circuitry

The input signal is first AC-coupled to block the DC excitation current, and then is amplified by a unity-gain precision instrumentation amp. Using this approach ensures high common-mode rejection to reduce noise pickup on the sensor wires, and avoids the use of switched gain resistors in the most noise and temperature sensitive portion of the circuit. A programmable gain amplifier is then used for additional signal magnification as required by subsequent processing stages. Precision op-amps and resistors are used throughout all of the analog circuitry to improve temperature stability.



5290 Technical Diagram

Features

- **Constant Current Source**
Programmable: 2 to 20 mA
Compliance Voltage: 24v
- **Ultra-stable Low Noise Amps**
Output Noise: 1 mV rms
Stability: 50 ppm/°C
- **Wideband Response**
Gain Range: 1 to 5000
0.2 Hz to 100 kHz
- **Programmable Output Filter**
- **LED Status Indicators**
- **Compact Rugged Enclosure**

DSP - Programmable Gain

The variable gain amplifier is controlled by an onboard DSP prior to digitization and subsequent processing. A 16-bit high speed Sigma-Delta converter is then used to convert the amplifier input to a digitized signal for subsequent processing. The Digital Signal Processor uses stored offset and gain calibration factors to correct the digitized data values and generate a digitally filtered output. Digital low-pass filtering is done by the DSP, providing a better response curve and more flexibility than switched analog

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filters. The result is an amplified, error-corrected, and digitally-filtered output that is ready to be converted back to an analog output voltage.

Output Circuit

The processed digital output is converted back to an analog voltage by a high-speed 16-bit Digital-to-Analog Converter. A four-pole low-pass filter/buffer-amp removes the digitizing steps in the reconstructed signal, along with any high-frequency noise. As with the input circuit, temperature-stable components are used to ensure that system calibration holds over a wide temperature range.

Signal and Status Monitor LEDs

Front-panel LED's are used to monitor both the signal level and the operating status of each channel. The DSP compares each digital sample to the level set by the user, and adjusts the intensity and color of the Signal LED accordingly. The DSP also monitors the excitation current level and overall digital operation, and sets the color and flash-rate of the Status LED as needed to warn the user of a problem

Programmable Excitation Current

A programmable constant-current source provides excitation power for the sensor. A Digital-to-Analog Converter creates a programmable control voltage that is used to control the output of current regulator. The current being drawn is sensed and used as a feedback signal to keep the current constant. Each circuit can provide up to 20 mA of excitation current with a maximum output voltage of 24v.

System Calibration

High accuracy is obtained during the conversion process by implementing a unique end-to-end calibration scheme within the 5290 Converter. A precision programmable voltage generator is connected to the input, and two calibration voltages (0v and 80% of full-scale) are fed in, amplified by the input stage, converted by the A/D, processed by the DSP, converted back to analog by the D/A, filtered by the output filter, and then measured by a high-accuracy 24-bit A/D converter. The input and output voltages are compared, and gain and offset correction values are computed and saved in the DSP memory. When data is being collected, these correction factors are applied to each data point in real time, resulting in a system accuracy better than $\pm 0.05\%$ of full-scale.

Specifications

General

Gain Range	1 to 5000, programmable
Frequency response	0.2Hz to 100kHz
Gain accuracy	$\pm 0.05\%$
Linearity	$\pm 0.01\%$
Stability	50 ppm /°C

Input noise	10uV rms
Input Protection	250V max.
AC coupling	0.2 Hz

Output Noise	1 mV rms
Output voltage range	$\pm 10v @ 50 mA$
Output impedance	50 ohms
Short Circuit Protected	Yes

Low Pass Filter

Type	Digital, programmable
Range	1 Hz to 100 kHz
Roll-off	96 dB/octave, programmable

Overload Indicator

Type	Front-panel LED
Trip Level	0.1V to 10V, programmable

Calibration Source

Type	Internal voltage reference
Voltage range	0 to 2.5v, programmable
Accuracy	0.01%
Stability	10 ppm /°C

Excitation

Type	Constant current
Range	1 to 20 mA, programmable
Accuracy	0.5%
Compliance voltage	24v
Stability	10 ppm /°C

Environmental:

Operating temperature	0 to 50 °C
Storage temp	-25 to 85 °C
Humidity	0 to 90% non condensing

Physical Characteristics

Package	Shielded, 6 sides
Dimensions	0.8" x 4.2" x 9.5"
Weight	1.3 lbs