



# 5312 - 5322 - 5332

## Four Channel Instrumentation Amplifiers

### Description

The 53xx series of signal conditioning modules consists of four channel programmable gain instrumentation amplifiers with user-selectable AC or DC input coupling, sensor voltage excitation, input offset compensation and programmable low pass output filtering. Optimizing the front end stage of each product offering for a specified gain range gives cost effective signal conditioning without sacrificing performance. The 5312 utilizes an input attenuator for high common mode voltage applications while the 5322, and 5332, are optimized for higher gain-bandwidth applications. Including a programmable excitation voltage source with the ability to adjust for DC input offsets gives a complete solution for most sensor types not requiring bridge completion.

### Design Features

The 53xx series of general-purpose signal-conditioning amplifiers utilizes onboard DSPs (one per channel) to configure the input circuitry and handle amplifier gain and offset compensation. A mechanical latching relay is used to select AC or DC coupling to ensure that the input signal is not affected by the switching circuitry. High performance front-end analog components are combined with digital signal processing techniques and an ultra-stable calibration reference source to maintain system accuracy. Front-panel LEDs indicate signal presence and activity level, and warn of module operational problems. All circuitry is housed in a shielded enclosure for improved reliability and noise reduction.

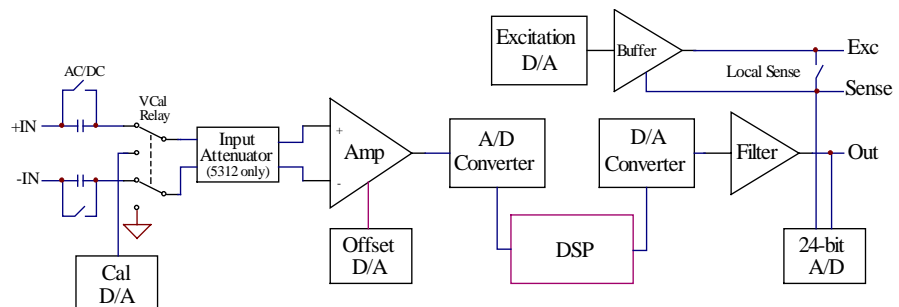


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### Stable Amplifier Circuitry

After AC/DC coupling (and attenuation in Model 5312), the signal is amplified by a fixed-gain precision instrumentation amp (x1 for 5312, 5322 or x10 for 5332). 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. Offset adjustment is done after pre-amplification to isolate the offset voltage generator from the sensor.



5312 - 5322 - 5332 Technical Diagram

### Features

- **Ultra-stable Low Noise Amps**  
Output Noise: 1 mV rms  
Stability: 50 ppm/°C
- **Optimized Gain Ranges**  
M5312: Gain 0.04 to x10  
M5322: Gain x1 to x200  
M5332: Gain x50 to x10,000
- **Programmable Output Filter**  
Range: 1 Hz to 100 kHz
- **Sensor Voltage Excitation**
- **Input Offset Compensation**
- **LED Status Indicators**
- **Compact Rugged Enclosure**

### DSP - Programmable Gain

After offset correction, the signal is fed to a variable gain amplifier controlled by an onboard DSP. A 16-bit high-speed Sigma-Delta converter is then used to convert the amplified signal to a digital value. Digitizing the signal for signal processing allows all gain correction and output filtering to be done digitally, thereby improving system accuracy. The Digital Signal Processor uses stored offset and gain calibration factors to correct the digitized data values and generate a digitally filtered output that is ready for conversion back into an error-corrected 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.

## DSP – AutoZero/AutoGain

Using a programmable offset voltage allows the DSP to automatically servo the amplifier output to zero adjust any input offset voltage imbalance. In a like manner, the DSP can adjust the amplifier gain for a targeted analog output voltage value upon application of a known calibration signal.

## Voltage Excitation with Remote Sense Capability

The 53xx provides four independent programmable excitation voltage sources for use in powering input sensors. Each source is controlled by a 16 bit DAC with an output range from 0 to 10 Volts and 100 mA output buffering. Remote sense can also be selected to provide feedback accounting for IR losses over conductor lines between amplifier and sensor.

## System Calibration

High accuracy is obtained during the conversion process by implementing a unique end-to-end calibration scheme within the 53xx conditioner. A precision programmable voltage source is connected to the input, and two calibration voltages (0v and 80% of full-scale input) are fed in, amplified by the input stages, converted by the A/D, processed by the DSP, converted back to analog and then measured by a high-accuracy 24-bit A/D converter. The input and output voltages are compared with the resulting gain and offset correction values saved in the DSP memory for real time data correction.

## Specifications

### General

Gain Range	0.04 to 10 (Model 5312) 1 to 200 (Model 5322) 50 to 10,000 (Model 5332)
Frequency Response	DC to 100 kHz
Common-Mode Rejection	80 dB @ 100 Hz
Common-Mode Voltage	200v (Model 5312) 10v (Model 5322,5332)
Accuracy	0.05%
Linearity	0.01%
Stability	50 ppm/°C
Input Coupling	AC or DC, programmable
Input Noise	10 uV rms
Input Protection	250V max.
Output Noise	1 mV rms
Output voltage range	±10v@50 mA
Output impedance	50 ohms

### Input Offset Compensation

Programmable	+/- 125v (M5312) +/- 2.5 v (M5322) +/- 250 mV (M5332)
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### Low-Pass Filter

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

### Calibration Source

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

### Excitation

Type	Programmable Voltage
Voltage range	0 to 10v @ 100 mA
Sense	Local or Remote
Accuracy	0.02%
Short protection	Yes

### Signal Overload

Indicator	Front-panel LED
Trip level	0.1v to 10v, Programmable

### 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