

SWITCH GAINS ACCURATELY WITH THE INA120

Integrated circuit instrumentation amplifiers are used in a wide variety of applications such as medical instruments, data acquisition systems and thermocouple signal conditioners. Many such applications require the gain to be switched to accommodate a variety of input signals and/or wide-ranging signal levels. The INA120 instrumentation amplifier meets this requirement as well as making it simple to switch the gains.

An analog multiplexer can be used to switch gains of an instrumentation amplifier. This allows gains to be digitally selected. Unfortunately, this scheme has poor gain accuracy

because the channel on-resistance of the multiplexer, R_{ON} , is in series with the gain-setting resistors which determine the gain. Multiplexers have R_{ON} values ranging from 50 to 5000 Ω . Even with R_{ON} as low as 50 Ω gain accuracy is severely degraded.

The INA120 precision instrumentation amplifier is ideal for accurate signal acquisition. Gain-sense connections on the INA120 maintain gain accuracy when using multiplexer or gain-switching circuitry. Figure 1 shows that the internal gain-set and feedback resistors are always connected in series. No error-causing parasitic resistance is inserted into

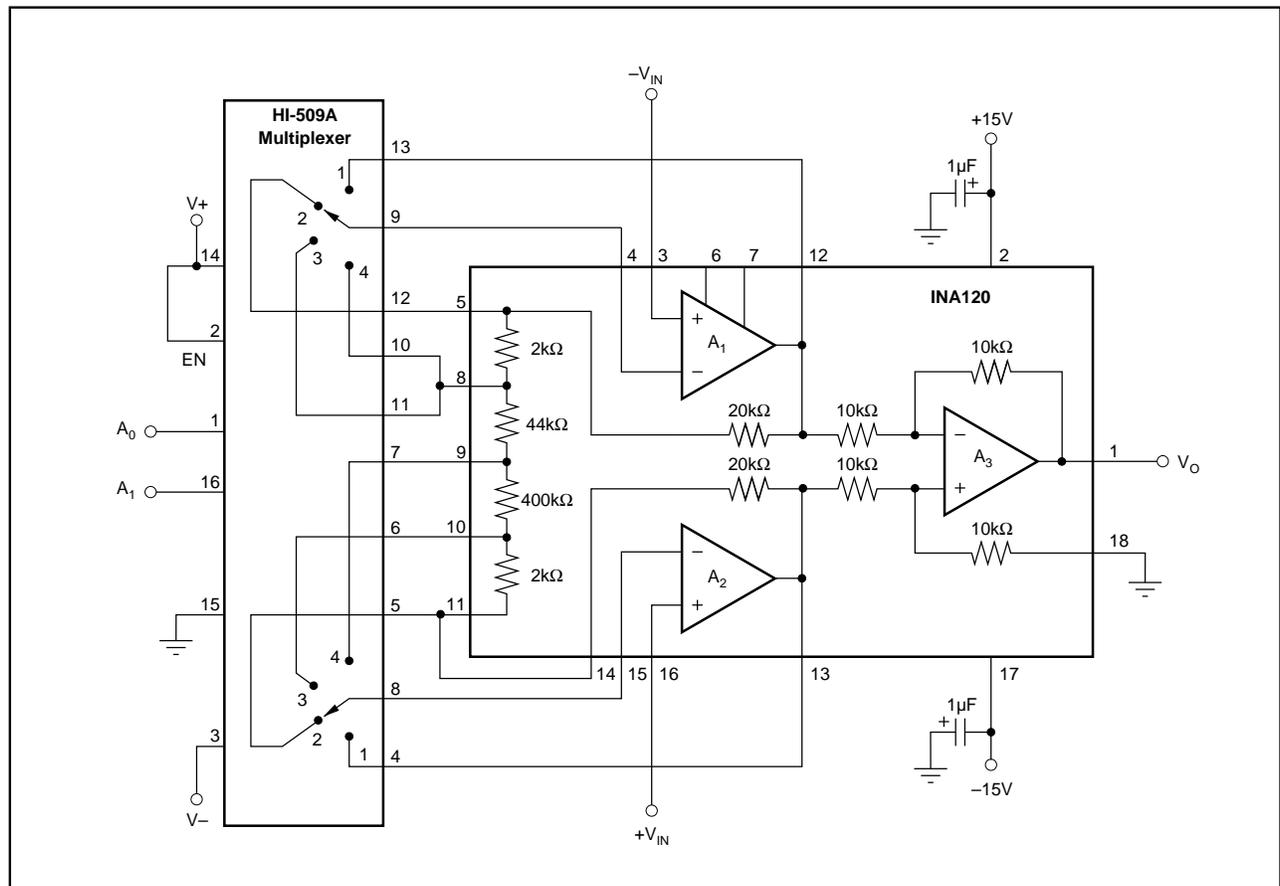


FIGURE 1. The INA120 and a Dual 4-to-1 Analog Multiplexer Form a Programmable Gain Amplifier.

the loop. Multiplexer resistance, R_{ON} , is in series with the INA120's high impedance inputs at pins 4 and 15 where gain is not affected. Table I lists the available gains, the digital selection codes, and the observed gain errors. For all four gains, gain accuracy is maintained to better than 1% over the full operating temperature range, due to the low gain drift of the INA120's internal resistor network.

GAIN	SELECT CODE		MEASURED GAIN ERROR (%)
	A1	A0	
1	0	0	0.05
10	0	1	0.08
100	1	0	0.10
1000	1	1	0.30

TABLE 1. The INA120 and a Dual 4-to-1 Analog Multiplexer. Gain errors are small because parasitic channel resistances are placed in series with the amplifier inputs.

The information provided herein is believed to be reliable; however, BURR-BROWN assumes no responsibility for inaccuracies or omissions. BURR-BROWN assumes no responsibility for the use of this information, and all use of such information shall be entirely at the user's own risk. Prices and specifications are subject to change without notice. No patent rights or licenses to any of the circuits described herein are implied or granted to any third party. BURR-BROWN does not authorize or warrant any BURR-BROWN product for use in life support devices and/or systems.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.