

**ANALOGIC**

**MP2321/2322**

**Isolated, Floating  
3½-Digit BCD or 12-Bit  
Binary Integrating A/D  
Converters**

**Description**

Analogic's MP2321 and MP2322 are high performance, low cost extremely versatile integrating analog-to-digital converters that feature well isolated, floating, guarded, bipolar analog inputs. They are designed for use by OEM's in a broad range of recording, analytical and industrial control instrumentation systems. These converters reject high common mode levels of  $\pm 300V$  with respect to system ground, are accurate to 0.05%, exhibit an accuracy tempco that is less than 50 ppm/°C of reading, and require but a single 5V supply. They therefore allow economical, extremely accurate and highly stable 3½ BCD digit or 12-bit (sign and magnitude) data transformation in severe common mode environments, a capability frequently required in process control instrumentation and single current loop remote indicator systems. The DTL/TTL compatible output and control lines provided by these digitizers permit easy automatic examination of the data by local and remote displays and printers, and facilitate control of the data acquisition by computer-oriented hardware.

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The MP2321 and MP2322 are particularly qualified as the nuclei of measurement systems. The isolated floating front end allows digital conversion of remote signals which may not be referred to ground; and the computer-compatible control and status connections permit easy interfacing to ancillary equipment. Additionally, these converters are easily customized for use in a gamut of OEM applications simply by selecting the proper pins for the following operations: Ratiometric A/D conversion, useful for automatic compensation of transducer excitation supply drift, or standard digitization (see Figs. 4 and 6); control of the conversion rate — up to 100 readings per second (see Figs. 3 and 5), or conversion initiation by external command (see Figs. 5 and 7) so that digitizations occur exactly when required, and for the MP2322, a choice of output binary codes (see Fig. 9).

**Features**

- True Floating Isolated Inputs
- 2 Versions  
BCD Outputs — MP2321  
Binary Outputs — MP2322
- 600V p-p Common Mode Voltage
- Automatic Zero  
Negligible Offset
- Ratiometric Conversion Available
- Only Single 5 Vdc Power Supply Required  
Floating Supply Built-In
- Up to 100 Conversions/second
- Low Cost
- Shielded Metal DIP Case  
2" x 4" x 0.49"

ANALOG-TO-DIGITAL CONVERTERS

**Applications**

- Medical Instrumentation Systems
- Industrial Transducer Digitization
- Analytical Instruments
- Industrial Process Control

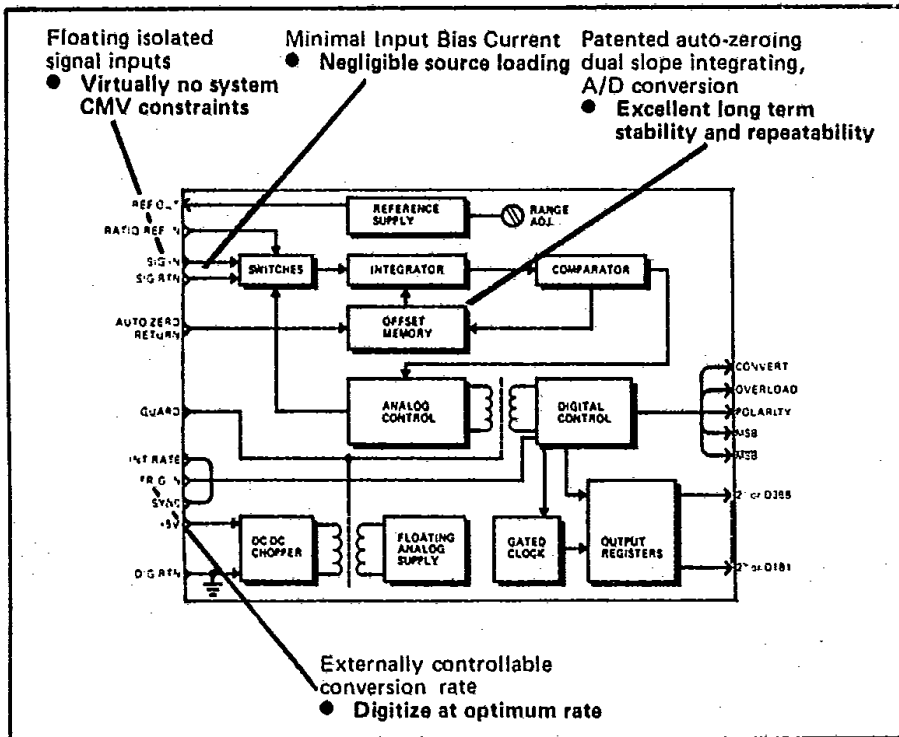


Figure 1. Functional Block Diagram.

(All specifications guaranteed at 25°C unless otherwise noted)

**ANALOG INPUT****Configuration**

Bipolar, floating, isolated, guarded and shielded

**Full Scale Range**

MP2321:  $\pm 1.999V$  or  $\pm 199.9$  mV standard,  $+1V$  or  $+100$  mV Ratiometric  
 MP2322:  $\pm 2V$  or  $\pm 1V$  or  $\pm 200$  mV or  $\pm 100$  mV depending on output code (see Fig. 9) standard;  $+1V$  or  $100$  mV ratiometric

**Input Impedance**500 M $\Omega$  nom.**Bias Current**

1 nA nom.

**Common Mode Voltage (Between SIG RTN and DIG RTN)** $\pm 300$  Vdc, 600 Vac p-p**Common Mode Rejection (With 1 K $\Omega$  Unbalance)**

120 dB min. @ dc, 100 dB min. @ 60 Hz, 60 dB min. @ 1 kHz

**ACCURACY****Resolution**

MP2321: 1 part in 2000 counts, 3½ BCD digits plus sign

MP2322: 1 part in 2048 counts, 11 bits plus sign

**Relative Accuracy (Linearity)**0.05% rdg  $\pm 1$  count**Offset**50  $\mu V$  typ., 75  $\mu V$  max.**Monotonicity**

Guaranteed

**STABILITY****Range Tempco**50 ppm rdg/ $^{\circ}C$  max. for 1V or 2V FSR75 ppm rdg/ $^{\circ}C$  max. for 100 mV or 200 mV FSR**Offset Tempco**1  $\mu V$ / $^{\circ}C$  max.**CONVERSION****Technique**

Dual slope bipolar integration with auto-zero; complete conversion in each cycle

**First Integration Time**

2 ms nom. See timing diagram

**Auto-zero Time**

3 ms min. See timing diagram

**Reading Rate**

Internal trigger: 4/s nom.

External trigger: 100/s max. See Fig. 5

**CONTROL INPUTS****External Trigger**

TTL/DTL compatible

Negative pulse 1.5  $\mu s$  min., 1.8 ms max.

See Fig. 5

**Hold**Conversion held by connecting a 47 k $\Omega$  resistor between INT RATE and DIG RTN. See Fig. 7**Line Frequency Sync**

Connecting 10 Vac p-p max. at power line frequency to sync input will minimize effect of normal mode noise

**DIGITAL OUTPUTS****Compatibility**

TTL/DTL compatibility, sinks 5 mA max. (3 loads)

**Output Data Codes**

MP2321: Bipolar BCD (sign and magnitude)

MP2322: Bipolar binary (sign and magnitude) offset binary, and 2's complement. Pin selectable. See Fig. 9

**Polarity**

High (logic "1") level indicates positive input signal

**Overload**

High (logic "1") level indicates input signal amplitude greater than FSR

**Convert**

High level indicates conversion in process. Negative going transition signifies end of conversion. See timing diagram. Note: Internal clock is available; consult factory.

**POWER SUPPLY** $+5$  Vdc  $\pm 5\%$ 

300 mA

**ENVIRONMENTAL & PHYSICAL****Operating Temperature** $-10^{\circ}C$  to  $+70^{\circ}C$ **Storage Temperature** $-15^{\circ}C$  to  $+85^{\circ}C$ **Relative Humidity**

0 to 95% non-condensing

**Electrical Shielding**

RFI 6 sides; EMI 5 sides

**Overvoltage Protection (Between SIG IN and SIG RTN)** $\pm 15V$  maximum input without damage**Packaging MP232X**

2" x 4" x 0.49" (50.8 x 101.6 x 12.45 mm) see Fig. 10

## Calibration

The Models MP2321 and MP2322 self-zeroing A/D converters require only a single adjustment for complete calibration to specified accuracy. RANGE is calibrated by applying a voltage level such as +1.9985V or +0.9985V, or +199.85 mV or +99.85 mV (depending on output code and model, see Fig. 9) to the input, and trimming the RANGE control so that the LSB only of the output code alternates equally between "1" and "0".

## Internal Triggering Control

Adjustment of the built-in triggering rate (4 conversions/s) may be implemented by the circuitry described in Fig. 3. The sampling rate is approximately  $1.44/R_T C_T$ , where  $R_T$  is  $R_1$  in parallel with the internal 82 k $\Omega$  and  $C_T$  is  $C_1$  in parallel with the internal 3.3  $\mu$ F.

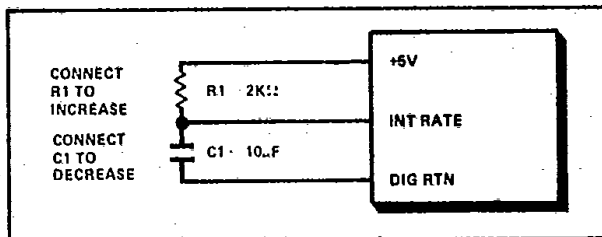


Figure 3. Connections for Adjusting Internal Triggering Rate.

## Hold or Convert on Command

Holding or continuously converting the analog input can be selected by means of the circuitry presented in Figure 7. When the CONVERT/HOLD switch is in the HOLD position, the last conversion will be "held" indefinitely; in the CONVERT position, the analog input will be digitized at the rate selected by the methods shown in Figures 3 and 5.

## External Triggering

Triggering the conversion cycle externally is implemented by means of the external circuitry shown in Figure 5, and applying a negative pulse (logic "1" to logic "0") 1.5  $\mu$ s min. and 1.8 ms max. duration. The negative going transition initiates the conversion cycle. The maximum conversion rate to specified accuracy is 100/s.

## Conversion Operation Selection

The MP2321 and MP2322 can perform standard or ratiometric A/D conversions by implementing the connections described below.

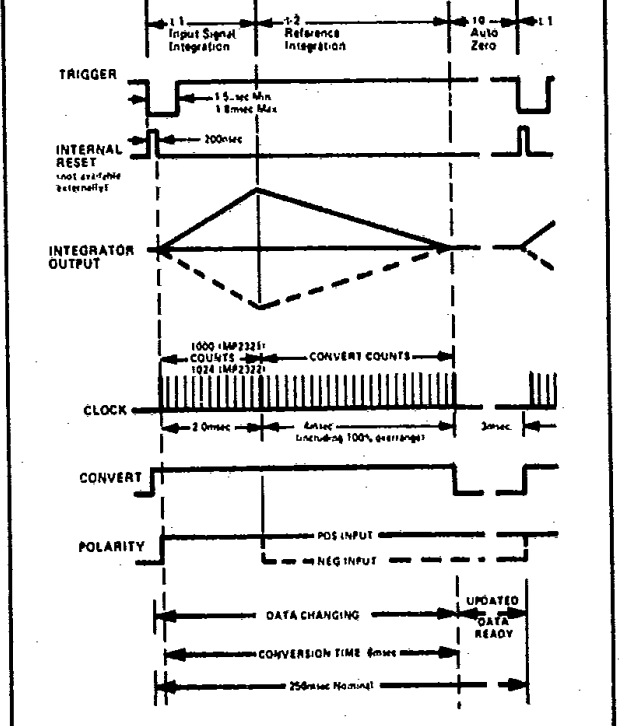


Figure 2. MP2321 and MP2322 Timing Diagram.

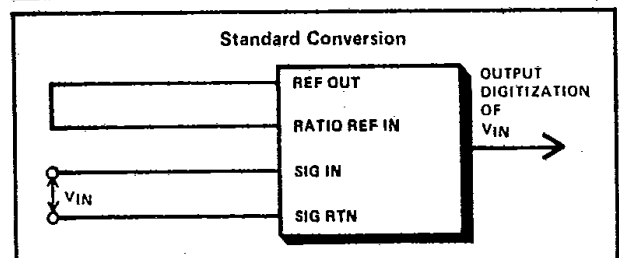


Figure 4. Connections for Standard A/D Conversions.

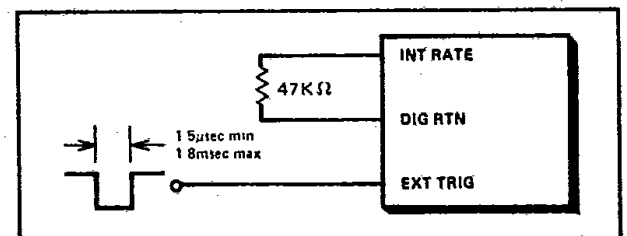


Figure 5. Connections for External Triggering.

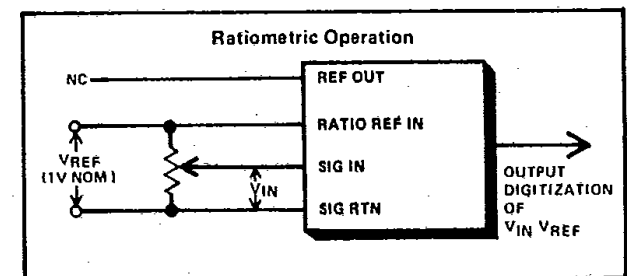


Figure 6. Connections for Ratiometric A/D Conversion.

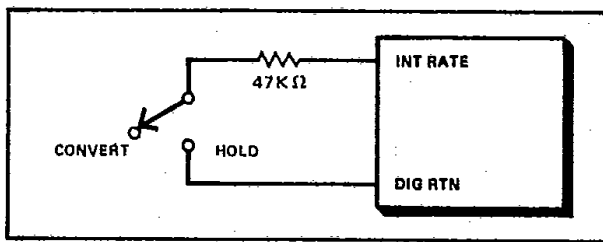


Figure 7. Connections for Commanding Hold or Continuous Conversion.

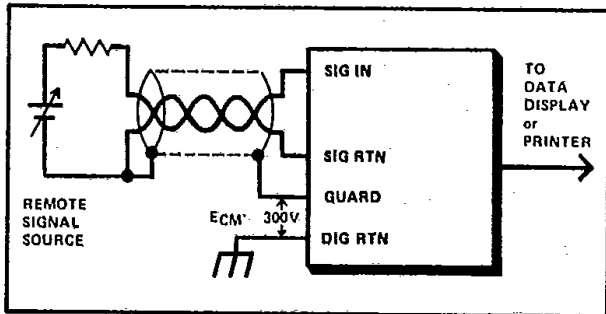


Figure 8. Typical Connections Showing Use of MP2321 GUARD to Minimize Pick-Up Noise.

### Typical Hook-Up Connections

In a typical application the GUARD may be used to minimize stray pick-up noise and enhance common mode rejection by wiring it to the shield of the signal source leads.

## Output Code Selection T-51-07-01

The output code for Model MP2321 is 3½ digits BCD plus sign. The output code for Model MP2322 is pin selectable. Figure 9 presents the appropriate connections and full scale values for the available codes.

Converter Model	** Full Scale Input Voltage	Output Code	Jumper Connections
Bipolar BCD 3½ BCD Digits + Sign (MP2321)	+1.999 0.000 -1.999	1 1 1001 1001 1001 1 0 0000 0000 0000 0 0 0000 0000 0000 0 1 1001 1001 1001 *P, D4B1, Q3B5, ... D1B1	None
Bipolar Binary 11 Bits + Sign (MP2322)	+1.999 0.000 -1.999	1 1 111 111 1111 1 0 000 000 0000 0 0 000 000 0000 0 1 111 111 1111 *P, MSB, 2 <sup>n</sup> , ... 2 <sup>1</sup>	Connect AUTO ZERO RET to SIG RTN
† Offset Binary - 11 bits (MP2322)	-0.999 0.000 +1.000	1 111 111 1111 1 000 000 0000 0 000 000 0000 *MSB, 2 <sup>n</sup> , ... 2 <sup>1</sup>	Connect AUTO ZERO RET to RATIO REF IN
† Two's Complement - 11 bits (MP2322)	-0.999 0.000 +1.000	0 111 111 1111 0 000 000 0000 1 000 000 0000 *MSB, 2 <sup>n</sup> , ... 2 <sup>1</sup>	Connect AUTO ZERO RET to RATIO REF IN

Figure 9. Table Showing Available Full Scale Value and Jumper Connection Required for Selected Output Code.

- \*\* For 100 mV or 200 mV units divide input voltage by 10
- \* P: polarity (or sign) bit; D4B1: first bit of the fourth digit; NSB: most significant bit
- † Reverse signal input leads to obtain true 2's complement or offset binary output

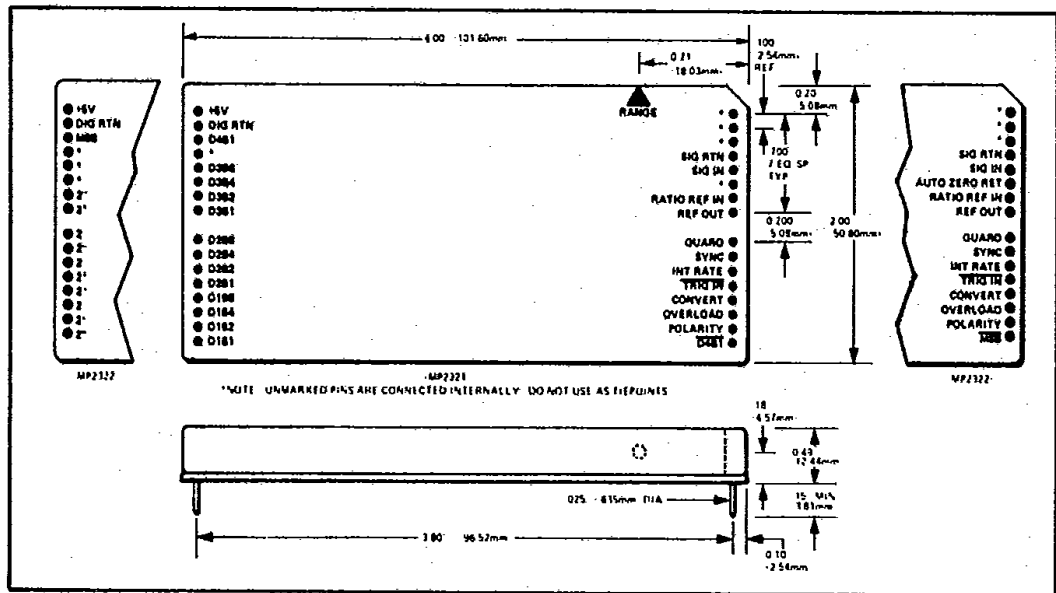


Figure 10. MP2321 and MP2322 Outline Drawing.

## ORDERING GUIDE

For  
3½ Digit BCD Output  
Sign11 Bit Binary + Output

Specify  
MP2321\*  
MP2322\*

\*For 1V and 2V units. To specify 100 mV and 199.9 mV FSR, add "-01" to ordering code. For example a "MP2321-01" converts 199.9 mV FSR to BCD.