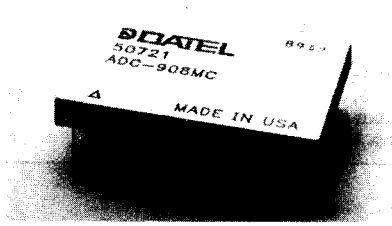
ADC-908
High-Resolution Ultra-Fast A/D Converter

FEATURES

- **14-Bit resolution**
- **1.0 µSec. conversion time**
- **Functionally complete**
- **Small 32-pin DIP**
- **Low-power, 2.9 Watts maximum**
- **Three-state output buffers**
- **No missing codes**



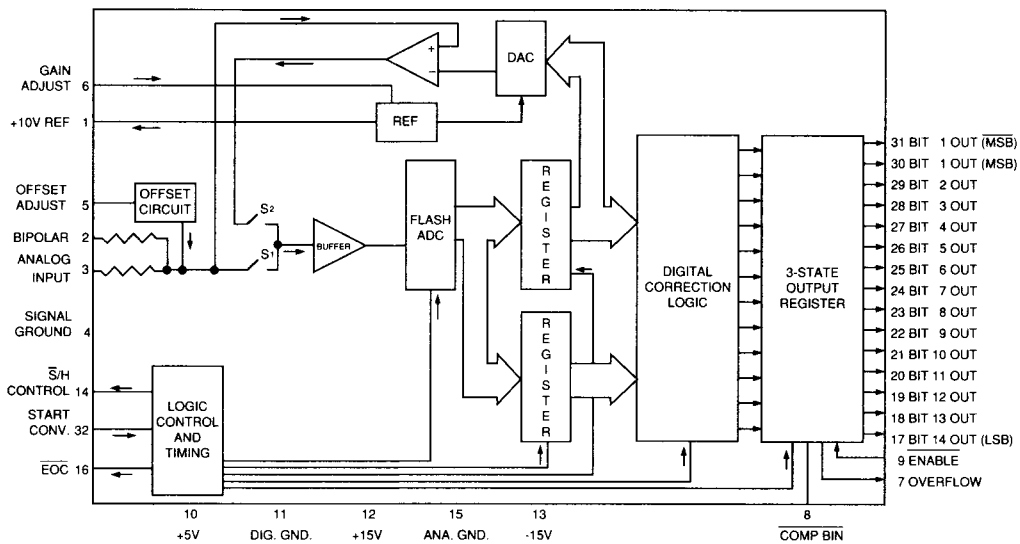
GENERAL DESCRIPTION

DATEL's ADC-908 is a 14-bit, 1.0 microsecond conversion time, functionally complete A/D converter.

Packaged in a small 32-pin DIP, power requirements are ±15 volts and +5 volts with a 2.9 Watts maximum power dissipation.

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	+10V REF. OUT	17	BIT 14 OUT (LSB)
2	BIPOLAR	18	BIT 13 OUT
3	ANALOG INPUT	19	BIT 12 OUT
4	SIGNAL GROUND	20	BIT 11 OUT
5	OFFSET ADJUST	21	BIT 10 OUT
6	GAIN ADJUST	22	BIT 9 OUT
7	OVERFLOW	23	BIT 8 OUT
8	COMP. BIN	24	BIT 7 OUT
9	ENABLE	25	BIT 6 OUT
10	+5V	26	BIT 5 OUT
11	DIGITAL GROUND	27	BIT 4 OUT
12	+15V	28	BIT 3 OUT
13	-15V	29	BIT 2 OUT
14	S/H CONTROL	30	BIT 1 OUT (MSB)
15	ANALOG GROUND	31	BIT 1 OUT (MSB)
16	EOC	32	START CONVERT



ABSOLUTE MAXIMUM RATINGS

PARAMETERS	LIMITS	UNITS
+15V Supply (Pin 12)	-0.3 to +18	Volts dc
-15V Supply (Pin 13)	+0.3 to -18	Volts dc
+5V Supply (Pin 10)	-0.3 to +7.0	Volts dc
Digital Inputs (Pins 8, 9, 32)	-0.3 to +7.0	Volts dc
Analog Input (Pin 3)	±25	Volts
Lead Temp. (10 Sec.)	300 max.	°C

FUNCTIONAL SPECIFICATIONS

Apply over theoperating temperature range and at ±15V dc and +5V dc power supply voltages unless otherwise specified.

ANALOG INPUTS	MIN.	TYP.	MAX.	UNITS
Input Voltage Range				
	–	0 to +10	–	Volts
	–	0 to +20	–	Volts
	–	±5	–	Volts
Input Impedance	1	–	–	K Ohms
Input Capacitance	–	7	15	pf
DIGITAL INPUTS				
Logic Levels				
Logic "1"	2.0	–	–	Volts dc
Logic "0"	–	–	0.8	Volts dc
Logic Loading "1"	–	–	5	µA
Logic Loading "0"	–	–	-200	µA
A/D PERFORMANCE				
Integral Non-Linearity				
+25 °C	–	±1/2	±3/4	LSB
0 °C to +70 °C	–	±3/4	±1	LSB
-55 °C to +125 °C	–	±1	±2	LSB
Differential Non-Linearity				
+25 °C	–	±1/4	±1/2	LSB
0 °C to +70 °C	–	±1/2	±3/4	LSB
-55 °C to +125 °C	–	±1	±2	LSB
Full Scale Absolute Accuracy				
+25 °C.	–	±0.08	±0.122	%FSR
0 °C to +70 °C	–	±0.18	±0.36	%FSR
-55 °C to +125 °C	–	±0.61	±0.85	%FSR
Unipolar Zero Error,				
+25 °C	–	±0.04	±0.122	%FSR
0 to +70 °C	–	±0.07	±0.13	%FSR
-55 to +125 °C	–	±0.1	±0.17	%FSR
Bipolar Zero Error,				
+25 °C (Tech Note 1)	–	±0.012	±0.04	%FSR
0 to +70 °C	–	±0.07	±0.18	%FSR
-55 to +125 °C	–	±0.1	±0.3	%FSR
Bipolar Offset Error,				
+25 °C (Tech Note 1)	–	±0.018	±0.061	%FSR
0 to +70 °C	–	±0.12	±0.3	%FSR
-55 to +125 °C	–	±0.53	±0.73	%FSR
Gain Error,				
+25 °C (Tech Note 1)	–	±0.018	±0.12	%FSR
0 to +70 °C	–	±0.12	±0.3	%FSR
-55 to +125 °C	–	±0.53	±0.73	%FSR

A/D PERFORMANCE	MIN.	TYP.	MAX.	UNITS
A/D Conversion Times				
+25 °C	–	–	1.0	µSec.
0 °C to +70 °C	–	–	1.08	µSec.
-55 °C to +125 °C	–	–	1.15	µSec.
No Missing Codes				
(14 Bits)	0 to +70 °C			
(13 Bits)	-55 to +125 °C			
OUTPUTS				
Resolution	14 Bits			
Output Coding				
(Pin 8 Hi)	Straight binary/offset binary			
(Pin 8 Low)	Complementary binary			
Logic Levels				
Logic "1"	2.4	–	–	Volts dc
Logic "0"	–	–	0.4	Volts dc
Logic Loading "1"	–	–	-160	µA
Logic Loading "0"	–	–	6.4	mA
Internal Reference Voltage, +25 °C	+9.98	+10.0	+10.02	Volts dc
Drift	–	±13	±30	ppm/ °C
External Current	–	–	2	mA
POWER REQUIREMENTS				
Power Supply Range				
+15V dc Supply	+14.25	+15.0	+15.75	Volts dc
-15V dc Supply	-14.25	-15.0	-15.75	Volts dc
+5V dc Supply	+4.75	+5.0	+5.25	Volts dc
Power Supply Current				
+15V dc Supply	–	+85	+95	mA
-15V dc Supply	–	-71	-80	mA
+5V dc Supply *	–	+80	+100	mA
Power Dissipation	–	2.7	2.9	Watts
Power Supply Rejection	–	–	0.02	%FSR/%V
PHYSICAL/ENVIRONMENTAL				
Operating Temp. Range				
-MC	0	–	+70	°C
-MM	-55	–	+125	°C
Storage Temperature Range	-65	–	+150	°C
Package Type	32-pin hermetic sealed, ceramic TDIP			
Weight	0.42 ounces (12 grams) max.			

* +5V power usage at 1 TTL logic loading per data output bit.

Specifications subject to change without notice.

TECHNICAL NOTES

1. Use external potentiometers to remove system errors or the small initial errors to zero. Use a 20K trimming potentiometer for gain adjustment with the wiper tied to pin 6 (ground pin 6 for operation without adjustments). Use a 20K trimming potentiometer with the wiper tied to pin 5 for zero/offset adjustment (ground pin 5 for operation without adjustment).

2. Rated performance requires using good high-frequency circuit board layout techniques. The analog and digital grounds are not connected internally. Avoid ground-related problems by connecting the digital and analog grounds to one point, the ground plane beneath the converter. Due to the inductance and resistance of the power supply return paths, return the analog and digital ground separately to the power supplies.

3. Bypass the analog and digital supplies and the +10V reference (pin 1) to ground with a 4.7 µF, 25V tantalum electrolytic capacitor in parallel with a 0.1 µF ceramic capacitor. Bypass the +10V reference (pin 1) to analog ground (pin 15).

4. Obtain straight binary/offset binary or 2's complement output coding by tying $\overline{\text{COMP BIN}}$ (pin 8) to +5V dc or leaving it open. The device has an internal pull-up resistor on this pin. To obtain complementary binary, complementary off set binary, or complementary 2's complement output coding, tie pin 8 to ground. The $\overline{\text{COMP BIN}}$ signal is compatible to CMOS/TTL logic levels for those users desiring logic control of this function.

5. To enable the three-state outputs, connect $\overline{\text{ENABLE}}$ (pin 9) to a logic "0" (low). To disable, connect pin 9 to a logic "1" (high).

6. The $\overline{\text{SAMPLE}}$/HOLD CONTROL, pin 14, is low on power-up. The START CONVERT pulse should be given at a time delay equal to the desired acquisition time minus the 10 nanosecond delay from START CONVERT high to S/H CONTROL high. This assures the sample-hold has the minimum required acquisition time for the particular application mode.

   The $\overline{\text{SAMPLE}}$/HOLD CONTROL pin goes high following the rising edge of a START CONVERT pulse and low 30 nanoseconds minimum before $\overline{\text{EOC}}$ goes low. This indicates the converter can accept a new analog input.

7. Retriggering the START CONVERT pulse before $\overline{\text{EOC}}$ goes low will not initiate a new conversion.

Table 1. Input Connections

INPUT RANGE	INPUT PIN	TIE TOGETHER
0 to +10V	Pin 3	Pins 2 and 4
0 to +20	Pin 2	Pins 3 and 4
±5V	Pin 3	Pins 2 and 1

Table 2. Zero and Gain Adjust

FSR	ZERO ADJUST +1/2 LSB	GAIN ADJUST FS - 1/2 LSB
0 to +10V	+305 µV	+9.999085V
0 to +20V	+610 µV	+19.99817V
±5V	+305 µV	+4.999085V

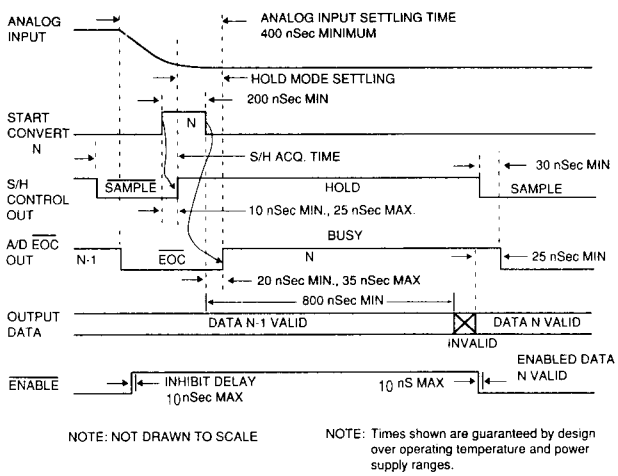


Figure 2. ADC-908 Timing Diagram

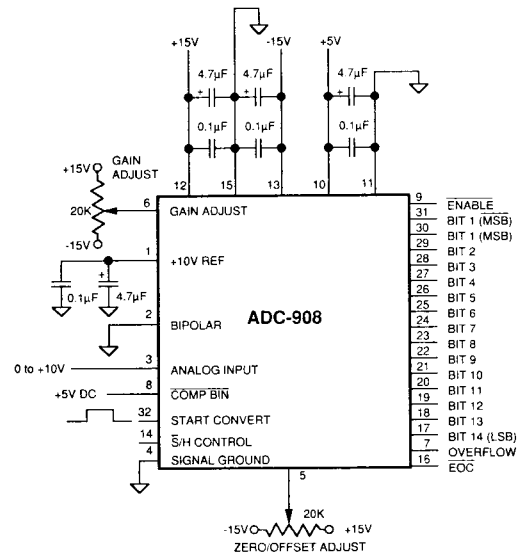


Figure 3. Typical ADC-908 Connection Diagram

CALIBRATION PROCEDURE

1. Connect the converter per Figure 3, and Table 1 for the appropriate full-scale range (FSR). Apply a pulse of 200 nanoseconds minimum to the START CONVERT input (pin 31) at a rate of 250 KHz. This rate is chosen to reduce flicker if LED's are used on the outputs for calibration purposes.

2. Zero Adjustments
   Apply a precision voltage reference source between the analog input (pin 3) and ground (pin 4). Adjust the output of the reference source per Table 2.

   For unipolar, adjust the zero trimming potentiometer so that the output code flickers equally between 00 0000 0000 0000 and 00 0000 0000 0001 with the COMP BIN (pin 8) tied high (straight binary) or between 11 1111 1111 1111 and 11 1111 1111 1110 with pin 8 tied low (complementary binary).

   For bipolar operation, adjust the potentiometer such that the code flickers equally between 10 0000 0000 0000 and 10 0000 0000 0001 with pin 8 tied high (offset binary) or between 01 1111 1111 1111 and 01 1111 1111 1110 with pin 8 tied low (complementary offset binary).

   Two's complement coding requires use of the MSB (pin 31) with pin 8 tied high, adjusting the potentiometer such that the code flickers between 00 0000 0000 0000 and 00 0000 0000 0001.

3. Full-Scale Adjustment
   Set the output of the voltage reference used in step 2 to the value shown in Table 2.

   Adjust the gain trimming potentiometer so that the output code flickers equally between 11 1111 1111 1110 and 11 1111 1111 1111 with pin 8 tied high (straight binary) or between 00 0000 0000 0000 and 00 0000 0000 0001 pin 8 tied low (complementary binary).

   Two's complement coding requires use of the MSB (pin 31) with the pin 8 tied high, adjusting the gain trimming potentiometer so that the output code flickers equally between 01 1111 1111 1110 and 01 1111 1111 1111.

4. To confirm proper operation of the device, vary the precision reference voltage source to obtain the output coding listed in Tables 3 and 4.

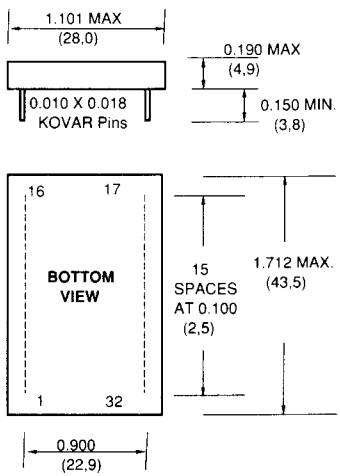
Table 3. Output Coding for Unipolar Operation

UNIPOLAR SCALE	INPUT RANGE (Volts) 0 to +10V	INPUT RANGE (Volts) 0 to +20V	OUTPUT CODING STRAIGHT BIN. MSB LSB	OUTPUT CODING COMP. BINARY MSB LSB
+FS-1LSB	+9.99939	+19.99878	11 1111 1111 1111	00 0000 0000 0000
7/8 FS	+8.7500	+17.500	11 1000 0000 0000	00 0111 1111 1111
3/4 FS	+7.5000	+15.00	11 0000 0000 0000	00 1111 1111 1111
1/2 FS	+5.0000	+10.00	10 0000 0000 0000	01 1111 1111 1111
1/4 FS	+2.5000	+5.000	01 0000 0000 0000	10 1111 1111 1111
1/8 FS	+1.2500	+2.500	00 1000 0000 0000	11 0111 1111 1111
1 LSB	+0.00061	+0.00122	00 0000 0000 0001	11 1111 1111 1110
0	0.0000	0.000	00 0000 0000 0000	11 1111 1111 1111

Table 4. Output Coding for Bipolar Operation

BIPOLAR SCALE	INPUT RANGE (Volts) ±5V	OUTPUT CODING OFFSET BIN. MSB LSB	OUTPUT CODING COMP OFF. BIN. MSB LSB	OUTPUT CODING TWO'S COMP. MSB LSB
+FS -1 LSB	+4.99939	11 1111 1111 1111	00 0000 0000 0000	01 1111 1111 1111
+3/4 FS	+3.7500	11 1000 0000 0000	00 0111 1111 1111	01 1000 0000 0000
+1/2 FS	+2.5000	11 0000 0000 0000	00 1111 1111 1111	01 0000 0000 0000
0	0.0000	10 0000 0000 0000	01 1111 1111 1111	00 0000 0000 0000
-1/2 FS	-2.5000	01 0000 0000 0000	10 1111 1111 1111	11 0000 0000 0000
-3/4 FS	-3.7500	00 1000 0000 0000	11 0111 1111 1111	10 1000 0000 0000
-FS +1 LSB	-4.99939	00 0000 0000 0001	11 1111 1111 1110	10 0000 0000 0001
-FS	-5.0000	00 0000 0000 0000	11 1111 1111 1111	10 0000 0000 0000

MECHANICAL DIMENSIONS INCHES (MM)



NOTE: Pins have a 0.025 inch, ±0.01 stand-off from case.

ORDERING INFORMATION

MODEL NUMBER	OPERATING TEMP. RANGE	SEAL
ADC-908MC	0 °C to +70 °C	Hermetic
ADC-908MM	-55 °C to +125 °C	Hermetic

Receptacle for PC board mounting can be ordered through AMP Inc., Part # 3-331272-8 (Component Lead Socket), 32 required.

For availability of MIL-STD-883 versions, contact DATEL.