Another novel feature of the ADC-500 is the provision of a Sample/Hold control pin for applications where a sample-hold is used in conjunction with the ADC-500. This feature allows the sample-and-hold device to go back into the sample mode a minimum of 30 nanoseconds before the conversion is complete, improving the overall conversion rate of the system.

ABSOLUTE MAXIMUM RATINGS			
Parameters	MINIMUM	MAXIMUM	UNITS
+15V Supply (Pin 13)	0	+18	Volts dc
−15V Supply (Pin 14)	0	−18	Volts dc
+5V Supply (Pin 11)	−0.5	+7	Volts dc
−5V Supply (Pin 15)	+0.5	−7	Volts dc
Digital Inputs (Pins 7, 9, 10 & 31)	−0.3	+6	Volts dc
Analog Input (Pin 3)	−15	+15	Volts dc
Lead temp. (10 sec)		300	°C

FUNCTIONAL SPECIFICATIONS

Apply over the operating temperature range and at ±15V dc and ±5V dc unless otherwise specified.

DESCRIPTION	MIN.	TYP.	MAX.	UNITS
INPUTS				
Input Voltage Range	—	0 to +10	—	Volts dc
(See Tech. Note 9)	—	0 to +20	—	Volts dc
	—	±10	—	Volts dc
Logic Levels: Logic 1	2.0	—	—	Volts dc
Logic 0	—	—	0.8	Volts dc
Logic Loading: Logic 1	—	—	2.5	μA
Logic 0	—	—	−100	μA
OUTPUTS				
Output Coding:				
(Pin 7 High)	straight binary/offset binary			
(Pin 7 Low)	complementary binary complementary offset binary			
Logic Levels: Logic 1	2.4	—	—	Volts dc
Logic 0	—	—	0.4	Volts dc
Logic Loading: Logic 1	—	—	−160	μA
Logic 0	—	—	6.4	mA
Internal Reference:				
Voltage, +25°C	9.98	10.0	10.02	Volts dc
Drift	—	±5	±30	ppm/°C
External Current	—	—	1.5	mA
PERFORMANCE				
Integral Nonlinearity:				
+25°C	—	—	±0.0125	%FSR ±½ LSB
0°C to +70°C	—	—	±0.0125	%FSR ±½ LSB
−55°C to +125°C	—	—	±0.0125	%FSR ±3 LSB
Integral Nonlin. Tempco.	—	±3	±8	ppm/°C
Differential Nonlinearity				
+25°C	—	—	±0.0125	%FSR ±½ LSB
0°C to +70°C	—	—	±0.0125	%FSR ±½ LSB
−55°C to +125°C	—	—	±0.0125	%FSR ±1 LSB
Differential Nonlin. Tempco	—	—	±2.5	ppm/°C
Full-Scale Absol. Accuracy:				
+25°C	—	±3	±8	LSB
0°C to +70°C	—	±4	±14	LSB
−55°C to +125°C	—	±8	±29	LSB

PERFORMANCE (cont.)				
DESCRIPTION	MIN.	TYP.	MAX.	UNITS
Unipolar Zero Error, +25°C	—	±1	±3	LSB
Unipolar Zero Tempco	—	±13	±25	ppm/°C
Bipolar Zero Error, +25°C	—	±1	±3	LSB
Bipolar Zero Tempco	—	±13	±25	ppm/°C
Bipolar Offset Error, +25°C	—	±2	±5	LSB
Bipolar Offset Error Tempco	—	±17.5	±35	ppm/°C
Gain Error, +25°C	—	±2	±5	LSB
Gain Tempco	—	±17.5	±35	ppm/°C
Conversion Times:				
ADC-500				
+25°C	—	—	500	nsec.
0°C to +70°C	—	—	540	nsec.
−55°C to +125°C			560	nsec.
ADC-505				
+25°C	—	—	550	nsec.
0°C to +70°C	—	—	590	nsec.
−55°C to +125°C	—	—	620	nsec.
Harm. Distort. (-FS) ①				
+25 °C			-72 dB min.	
0 to +70 °C			-72 dB min.	
-55 to +125 °C			-65 dB min.	
No Missing Codes (12 Bits)	Over the Operating Temp. Range			
POWER SUPPLY REQUIREMENTS				
Power Supply Range:				
+15V dc Supply	+14.25	+15	+15.75	Volts dc
−15V dc Supply	−14.25	−15	−15.75	Volts dc
+5V dc Supply	+4.75	+5	+5.25	Volts dc
−5V dc Supply	−4.75	−5	−5.25	Volts dc
Power Supply Current:				
+15V Supply	—	+23	+30	mA
−15V Supply	—	−11	−15	mA
+5V Supply*	—	+55	+90	mA
−5V Supply	—	−175	−210	mA
Power Dissipation	—	1.6	1.8	Watts
Power Supply Rejection	—	—	0.01	%FSR/%V
PHYSICAL/ENVIRONMENTAL				
Operating Temp. Range:				
−BMC	0	—	+70	°C
−BMM	−55	—	+125	°C
Storage Temperature Range	−65	—	+150	°C
Package Type	32-pin hermetic sealed, ceramic DIP			
Pins	0.010 x 0.018 inch Kovar			
Weight	0.42 ounces (12) grams			

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

① With DATEL sample and hold model number SHM-45.

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 32 (ground pin 32 for operation without adjustments). Use a 20K trimming potentiometer with the wiper tied to pin 5 for zero/offset adjustment (leave pin 5 open 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.

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3. Bypass all 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 16). The -5V dc supply is treated as an analog supply and analog ground (pin 16) should be treated as its return path for decoupling purposes.

4. Obtain straight binary/offset binary output coding by tying $\overline{\text{COMP BIN}}$ (pin 7) to +5V dc or leaving it open. The device has an internal pull-up resistor on this pin. To obtain complementary binary or complementary offset binary output coding, tie the $\overline{\text{COMP BIN}}$ pin 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. An overflow signal, pin 8, indicates when analog input signals are below or above the desired full-scale range. To overflow pin also has a three-state output and is enabled by pin 10 (Enable bits 1-5 & O.F.).

6. The Sample/$\overline{\text{Hold}}$ control signal, pin 17, goes low following the rising edge of START CONVERT pulse and high 30 nanoseconds minimum before EOC goes low. This indicates that the converter can accept a new analog input.

7. The drive requirements of the ADC-500/505 may be satisfied with a wide-bandwidth, low output impeance input source. Applications of these converters that require the use of a sample-hold may be satisfied by using DATEL's model SHM-45. Using this device with multiplexers or for test purposes will require an input buffer.

8. Over temperature, input capacitance is 50 pF maximum and input impedance is 1.75K minimum (2.5K typical) for unipolar and 3.75K minimum (5K typical) for bipolar. These values are guaranteed by design.

9. Requirements for ±2.5V inputs can be satisfied using DATEL's AM-1435 amplifier in front of the SHM-45/ADC-500 configuration, shown in Figure 3, at the appropriate gain. The SHM-45's gain of 2 mode allows 0 to +5V or ±5V input ranges.

TIMING

Figure 2 shows the relationship between the various input signals. The timing cited applies over the operating temperature range and over the operating power supply range. These times are guaranteed by design.

TABLE 2. INPUT CONNECTIONS

INPUT VOLTAGE RANGE	INPUT PIN	CONNECT PIN 2 (RANGE) TO PIN:
0 to +10V dc	3	3
0 to +20V dc	3	16
±10V dc	3	1

TABLE 3. ZERO AND GAIN ADJUST

FSR	ZERO ADJUST +1/2 LSB	GAIN ADJUST +FS -1 1/2 LSB
0 to +10V dc	+1.22 mV	+9.9963V dc
0 to +20V dc	+2.44 mV	+19.9927V dc
±10V dc	+2.44 mV	+9.9927V dc

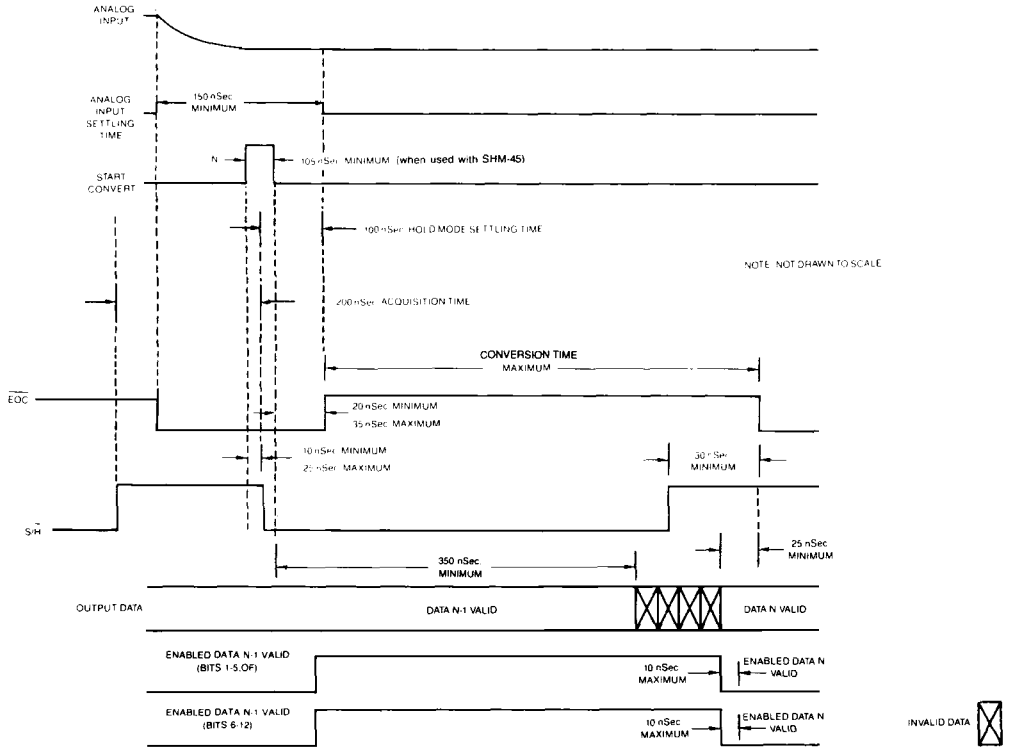

Figure 2. ADC-500/505 and SHM-45 Timing Diagram

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CALIBRATION PROCEDURE

Removal of system errors or the small initial errors is accomplished as follows:

1. Connect the converter per Figure 3 and Table 2 for the appropriate full-scale range (FSR). Apply a pulse of 50 nanoseconds minimum to the START CONVERT input (pin 31) at a rate of 500 KHz. This rate 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 16). Adjust the output of the reference source per Table 3. For unipolar, adjust the zero trimming potentiometer so that the output code flickers equally between 0000 0000 0000 and 0000 0000 0001 with the COMP BIN (pin 7) tied high or between 1111 1111 1111 and 1111 1111 1110 with the COMP BIN tied low.

3. Full-Scale Adjustment - Set the output of the voltage reference used in step 2 to the value shown in Table 3. Adjust the gain trimming potentiometer so that the output code flickers equally between 1111 1111 1110 and 1111 1111 1111 for COMP BIN (pin 7) tied high or between 0000 0000 0001 and 0000 0000 0000 for COMP BIN tied low.

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

TABLE 4. OUTPUT CODING

			STRAIGHT BIN. COMP. BINARY				
UNIPOLAR	INPUT RANGES, V dc		OUTPUT CODING			INPUT RANGE	BIPOLAR
SCALE	0 to +10V	0 to +20V	MSB	LSB	MSB LSB	±10V dc	SCALE
+FS -1 LSB	+9.9976V	+19.9951V	1111 1111 1111		0000 0000 0000	+9.9951V	+FS -1 LSB
7/8 FS	+8.7500V	+17.500V	1110 0000 0000		0001 1111 1111	+7.5000V	+3/4 FS
3/4 FS	+7.5000V	+15.000V	1100 0000 0000		0011 1111 1111	+5.0000V	+1/2 FS
1/2 FS	+5.0000V	+10.000V	1000 0000 0000		0111 1111 1111	0.0000V	0
1/4 FS	2.5000V	+5.0000V	0100 0000 0000		1011 1111 1111	-5.0000V	-1/2 FS
1/8 FS	1.2500V	+2.5000V	0010 0000 0000		1101 1111 1111	-7.5000V	-3/4 FS
1 LSB	0.0024V	+0.0049V	0000 0000 0001		1111 1111 1110	-9.9951V	-FS +1 LSB
0	0.0000V	0.0000V	0000 0000 0000		1111 1111 1111	-10.000V	-FS
			OFF. BINARY		COMP. OFF. BIN		

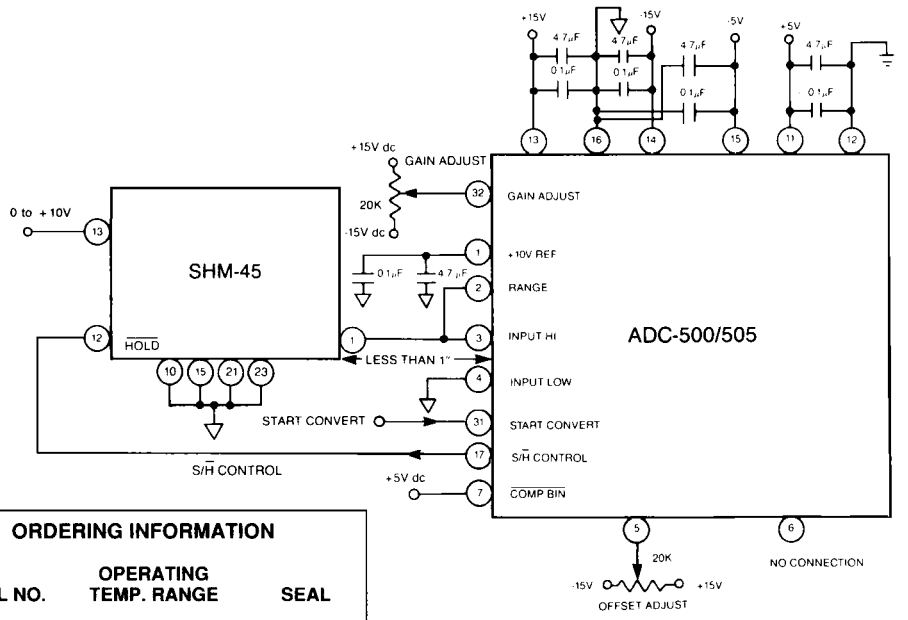

Figure 3. ADC-SHM Connection Diagram

ORDERING INFORMATION

MODEL NO.	OPERATING TEMP. RANGE	SEAL
ADC-500BMC	0 to +70 °C	Hermetic
ADC-500BMM	-55 to +125 °C	Hermetic
ADC-500BMC	0 to +70 °C	Hermetic
ADC-500 BMM	-55 to +125 °C	Hermetic

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

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