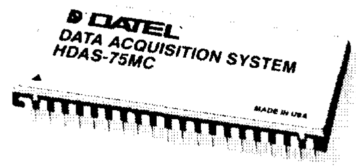
HDAS-75, HDAS-76

12-Bit, 75kHz, Complete Data Acquisition Systems

INNOVATION and EXCELLENCE

FEATURES

- **12-Bit resolution, 75kHz throughput**
- **8 Channels single-ended or 4 channels differential**
- **Miniature 40-pin DDIP**
- **Full-scale input range from 100mV to 10V**
- **High-impedance output state**
- **No missing codes**



GENERAL DESCRIPTION

The HDAS-75 and HDAS-76 are complete data acquisition systems. Each contains an internal multiplexer, instrumentation amplifier, sample-hold, analog-to-digital converter and three-state outputs. Packaged in miniature, 40-pin, double-dip packages and requiring ±15V and +5V supplies, each system dissipates a mere 500 milliwatts.

The HDAS-76 provides 4 differential inputs, and the HDAS-75 provides 8 single-ended inputs. An internal instrumentation amplifier is characterized for gains of 1, 2, 4, 8, 10 and 100. The gain range is selectable through an external resistor.

TECHNICAL NOTES

1. Rated performance requires using good high-frequency circuit board layout techniques. The analog and digital ground pins are connected to each other internally. Avoid ground-related problems by connecting the analog, signal and digital grounds to one point, the ground plane beneath the converter.
2. Double-level multiplexing allows expanding the multiplexer channel capacity of the HDAS-75 from 8 to 128 single-ended channels or the HDAS-76 from 4 to 32 differential channels.

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	CH0/CH0 HI	40	START CONVERT
2	CH1/CH1 HI	39	CA2
3	CH2/CH2 HI	38	CA1
4	CH3/CH3 HI	37	CA0
5	CH7/CH3 LO	36	+5V SUPPLY
6	CH6/CH2 LO	35	DIGITAL GROUND
7	CH5/CH1 LO	34	DIGITAL GROUND
8	CH4/CH0 LO	33	BIT 1 (MSB
9	NO CONNECTION	32	BIT 2
10	RGAIN LO	31	BIT 3
11	RGAIN HI	30	BIT 4
12	INST. AMP OUT	29	BIT 5
13	+10V REFERENCE OUT	28	BIT 6
14	SIGNAL GROUND	27	BIT 7
15	GAIN ADJUST	26	BIT 8
16	OFFSET ADJUST	25	BIT 9
17	BIPOLAR	24	BIT 10
18	−15V SUPPLY	23	BIT 11
19	ANALOG GROUND	22	BIT 12 (LSB)
20	+15V SUPPLY	21	$\overline{EOC}$

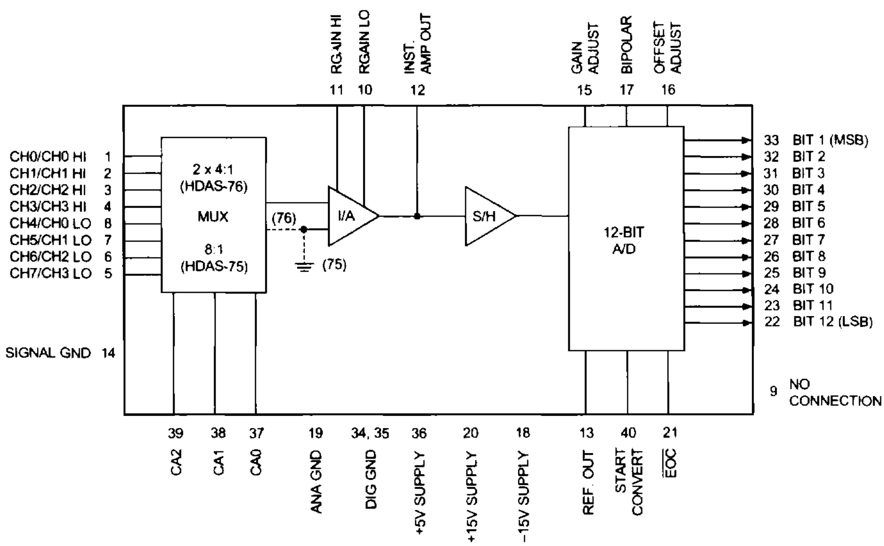


Figure 1. Functional Block Diagram

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ABSOLUTE MAXIMUM RATINGS

PARAMETERS	MIN.	TYP.	MAX.	UNITS
+15V Supply, Pin 20	0	—	+18	Volts
–15V Supply, Pin 18	0	—	–18	Volts
+5V Supply, Pin 36	–0.5	—	+7	Volts
Digital Inputs, Pins 37–40	–0.3	—	+6	Volts
Analog Inputs, Pins 1–8	–25	—	+25	Volts
Lead Temperature (10 seconds)	—	—	300	°C

FUNCTIONAL SPECIFICATIONS

(Apply over the operating temperature range with ±15V and +5V supplies unless otherwise specified.)

ANALOG INPUTS	MIN.	TYP.	MAX.	UNITS
Number of Inputs				
HDAS-75	8 single-ended inputs			
HDAS-76	4 differential inputs			
Input Voltage Ranges				
Gain = 1	0 to +10V, ±10V			
Gain = 100	0 to +100mV, ±100mV			
I.A. Gain Ranges	1, 2, 4, 8, 10, 100			
Input Impedance				
CH On, CH Off	10^{11}	10^{12}	—	Ohms
Input Capacitance				
(-75) CH On, CH Off	—	—	25	pF
(-76) CH On, CH Off	—	—	12	pF
Input Bias Current	—	—	±200	pA
Input Offset Current	—	—	±50	pA
Input Offset Voltage	—	—	±10	mV
Common Mode Voltage Range	±11	—	—	V
CMRR, G = 1, @10Hz,				
Vcm = 1Vp-p	75	80	—	dB
Voltage Noise (RMS)				
Gain = 1	—	—	200	µV
Gain = 8	—	—	50	µV
MUX Crosstalk @125kHz	—	—	-72	dB
MUX ON Resistance	—	450	500	Ohms
Bias Current Tempco	Doubles (max.) every 10°C above +70°C			
Offset Current Tempco	Doubles (max.) every 10°C above +70°C			
Offset Voltage Tempco	(±30ppm/°C x gain) ±20ppm/°C (max.)			
Input Gain Equation	$G = \frac{2k\Omega}{Rgain} + 1$			
DIGITAL INPUTS				
Logic Levels				
Logic 1	+2.4	—	—	Volts
Logic 0	—	—	+0.8	Volts
Logic Loading				
Logic 1	—	—	+30	µA
Logic 0	—	—	–30	µA
OUTPUTS				
Logic Levels				
Logic 1	+2.4	—	—	Volts
Logic 0	—	—	+0.4	Volts
Logic Loading				
Logic 1	—	—	-500	µA
Logic 0	—	—	+1.6	mA
Internal Reference				
Voltage, +25°C	+9.9	+10.0	+10.1	Volts
Drift	—	±5	±35	ppm/°C
External Current	—	—	1.5	mA
Output Coding	Straight binary/Offset binary			

PERFORMANCE	MIN.	TYP.	MAX.	UNITS
Resolution	12	—	—	Bits
Integral Nonlinearity, +25°C	—	—	±1	LSB
0 to +70°C	—	—	±1	LSB
–55 to +125°C	—	—	±1.5	LSB
Differential Nonlinearity, +25°C	—	—	±1	LSB
0 to +70°C	—	—	±1	LSB
–55 to +125°C	—	—	±1	LSB
F.S. Abs. Accuracy, +25°C	—	±0.13	±0.3	%FSR
0 to +70°C	—	±0.15	±0.5	%FSR
–55 to +125°C	—	±0.25	±0.78	%FSR
Unipolar Zero Error, +25°C	—	±0.074	±0.15	%FSR
Unipolar Zero Tempco	—	±15	±30	ppm/°C
Bipolar Zero Error, +25°C	—	±0.074	±0.15	%FSR
Bipolar Zero Tempco	—	±5	±10	ppm/°C
Bipolar Offset Error, +25°C	—	±0.1	±0.25	%FSR
Bipolar Offset Tempco	—	±20	±40	ppm/°C
Gain Error, +25°C	—	±0.1	±0.25	%
Gain Tempco	—	±20	±40	ppm/°C
Harmonic Distortion (–FS)				
(DC to 5kHz, 10Vp-p) ①	—	-73	-65	dB
No Missing Codes	Over operating temperature range			
SIGNAL TIMING				
MUX Address Set-up Time	400	—	—	ns
Start Convert Pulse Width	0.05	1	—	µs
Data Valid Before				
EOC Signal Goes Low	300	—	—	ns
Conversion Time, +25°C	—	—	12	µs
0 to +70°C	—	—	13	µs
–55 to +125°C	—	—	13	µs
Throughput Rates ①				
Gain = 1	75	80	—	kHz
Gain = 2	60	70	—	kHz
Gain = 4	50	60	—	kHz
Gain = 8	45	50	—	kHz
Gain = 10	40	45	—	kHz
Gain = 100	10	20	—	kHz
S/H PERFORMANCE				
Acquisition Time				
Full-Scale Step to ±0.01%	—	1.4	1.8	µs
Full-Scale Step to ±0.1%	—	0.8	1.4	µs
Aperture Delay	-50	-20	0	ns
Aperture Uncertainty	—	—	±200	ps
Slew Rate	±70	±90	—	V/µs
Hold Mode Settling Time				
To ±1mV	—	200	400	ns
To ±10mV	—	150	300	ns
Feedthrough Rejection	80	88	—	dB
Droop Rate ①	—	—	±100	µV/µs
POWER SUPPLIES				
Range, +15V Supply	+14.25	+15.0	+15.75	Volts
–15V Supply	–14.25	–15.0	–15.75	Volts
+5V Supply	+4.75	+5.0	+5.25	Volts
Current, +15V Supply	—	+15	+20	mA
–15V Supply	—	-10	-15	mA
+5V Supply	—	+25	+35	mA
Power Dissipation	—	500	700	mW
Power Supply Rejection	—	—	±0.01	%FSR/%V
PHYSICAL/ENVIRONMENTAL				
Oper. Temp. Range, Case, -MC	0	—	+70	°C
-MM, 883	-55	—	+125	°C
Storage Temp. Range	-65	—	+150	°C
Package Type	40-pin ceramic DDIP			
Weight	0.32 ounces (9 grams)			

Footnotes:

① Specifications valid at +25°C and over the temperature ranges of 0 to +70°C or –55 to +125°C.

DATEL, Inc., 11 Cabot Boulevard, Mansfield, MA 02048-1194 (U.S.A.) Tel: 508-339-3000 Fax: 508-339-6356 • For immediate assistance 800-233-2765

HDAS-75/76 OPERATION

The HDAS devices accept either 8 single-ended or 4 differential input signals. Tie unused channels to SIGNAL GROUND, pin 14.

Channel selection is accomplished using the multiplexer address pins as shown in Table 1. Obtain additional channels by connecting external multiplexers.

The acquisition time is the amount of time the multiplexer, instrumentation amplifier and sample-hold require to settle within a specified range of accuracy after the start convert goes high. The acquisition time can be measured by how long $\overline{EOC}$ is low before the rising edge of the START CONVERT pulse for continuous operation. Higher gains require the use of the RGAIN resistor to increase the acquisition time. The gain is equal to 1 without an RGAIN resistor. Table 2 refers to the appropriate RGAIN resistors for various throughputs.

Table 1. MUX Channel Addressing

MUX ADDRESS PINS 39 CA2	38 CA1	37 CA0	CHANNEL	
0	0	0	0	
0	0	1	1	HDAS-76
0	1	0	2	(2-BIT ADDRESS)
0	1	1	3	
1	0	0	4	
1	0	1	5	HDAS-75
1	1	0	6	(3-BIT ADDRESS)
1	1	1	7	

Table 2. Input Range Parameters

INPUT RANGE	GAIN	RGAIN	THROUGHPUT
0 to +10V	1	OPEN	75kHz
0 to +5V	2	2kΩ	60kHz
0 to +2.5V	4	665Ω	50kHz
0 to +1.25V	8	287Ω	45kHz
0 to +1V	10	221Ω	40kHz
0 to +100mV	100	20Ω	10kHz
±10V	1	OPEN	75kHz
±5V	2	2kΩ	60kHz
±2.5V	4	665Ω	50kHz
±1.25V	8	287Ω	45kHz
±1V	10	221Ω	40kHz
±100mV	100	20Ω	10kHz

$$R_{GAIN} = \frac{2k\Omega}{(GAIN - 1)} \qquad GAIN = \frac{2k\Omega}{R_{GAIN}} + 1$$

Table 3. Zero and Gain Adjust

INPUT RANGE	ZERO ADJUST +1/2LSB	GAIN ADJUST +FS – 1 1/2LSB
0 to +10V	+1.22mV	+9.9963V
±10V	+2.44mV	+9.9927V

CALIBRATION PROCEDURE

1. Connect the converter per Figure 2 and Tables 2 and 3 for the appropriate input range. Apply a pulse of 1µs (typical) to the START CONVERT input (pin 40) at a rate of 75kHz. This rate is chosen to reduce flicker if LEDs are used on the outputs for calibration purposes.
2. Zero Adjustments

   Apply a precision voltage reference source between the analog input and SIGNAL GROUND (pin 14). 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.

   For bipolar operation, adjust the potentiometer such that the code flickers equally between 1000 0000 0000 and 1000 0000 0001.
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.
4. To confirm proper operation of the device, vary the precision reference voltage source to obtain the output coding listed in Table 4.

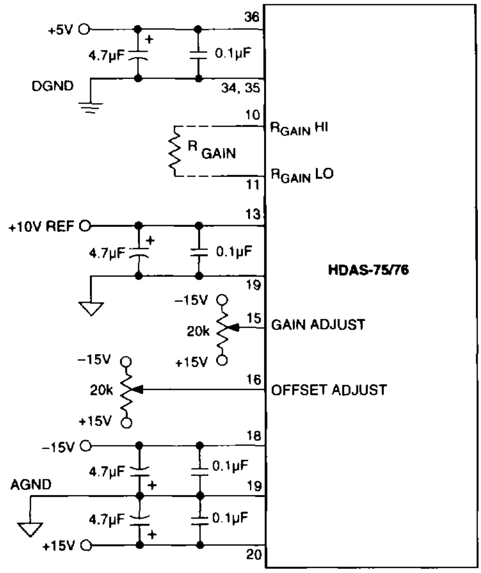

Figure 2. Typical Connection Diagram

Notes:

1. For unipolar operation, connect pin 12 to pin 17.
2. For bipolar operation, connect pin 13 to pin 17.
3. Ground pin 15 if gain adjust is not used.
4. Leave pin 16 open if offset adjust is not used.
5. Position RGAIN as close as possible to pins 10 and 11. Use RN55C, 1% resistors.

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TIMING

The $\overline{EOC}$ output signal, when high, indicates that a conversion is in process. During a conversion, the digital output buffers are in a high-impedance state, preventing data from being read. A START CONVERT input received during a conversion has no effect on the existing conversion. As shown in Figure 3, data can be read while START CONVERT is high and $\overline{EOC}$ is low.

The A/D conversion begins on the falling edge of a start convert command. If START CONVERT stays low after $\overline{EOC}$ becomes low, the output buffers stay in a high-impedance state. Valid data can be read 150ns maximum after START CONVERT goes high. Figure 4 shows how to use the START CONVERT pulse to control when the output data becomes valid.

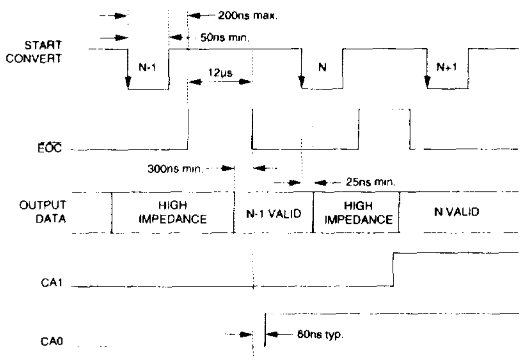


Figure 3. Data Valid with START CONVERT Immediately Returned High

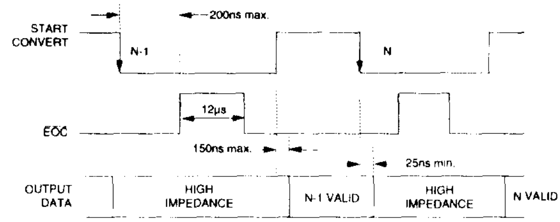


Figure 4. Data Valid with START CONVERT Returned High Later

Notes:

1. A START CONVERT pulse greater than 5µs will slow the overall throughput.
2. Retriggering START CONVERT before $\overline{EOC}$ goes low will not initiate a new conversion.
3. Timing specifications apply over the full operating temperature range.

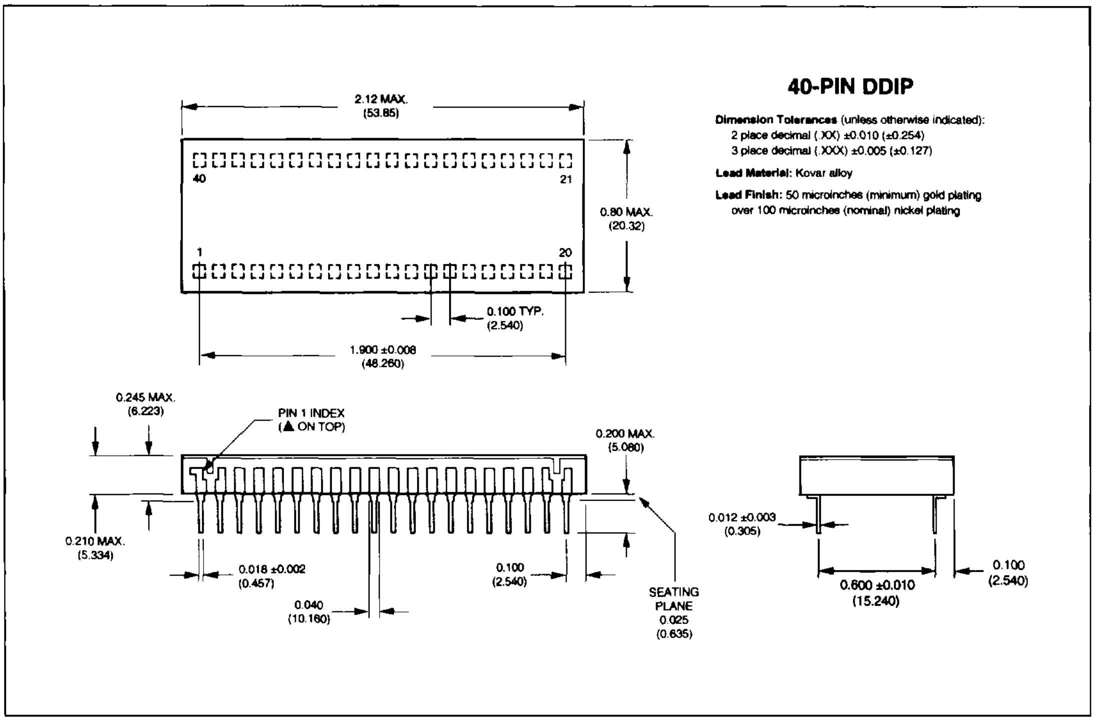
Table 4. Output Coding

STRAIGHT BINARY

UNIPOLAR SCALE	INPUT RANGE 0 to +10V	OUTPUT CODING MSB LSB	INPUT RANGE ±10V	BIPOLAR SCALE
+FS – 1LSB	+9.9976V	1111 1111 1111	+9.9951V	+FS – 1LSB
+7/8FS	+8.7500V	1110 0000 0000	+7.5000V	+3/4FS
+3/4FS	+7.5000V	1100 0000 0000	+5.0000V	+1/2FS
+1/2FS	+5.0000V	1000 0000 0000	0.0000V	0
+1/4FS	+2.5000V	0100 0000 0000	–5.0000V	–1/2FS
+1/8FS	+1.2500V	0010 0000 0000	–7.5000V	–3/4FS
+1LSB	+0.0024V	0000 0000 0001	–9.9951V	–FS + 1LSB
0	0.0000V	0000 0000 0000	–10.000V	–FS

OFFSET BINARY

MECHNICAL DIMENSIONS
INCHES (mm)



40-PIN DDIP

Dimension Tolerances (unless otherwise indicated):
2 place decimal (.XX) ±0.010 (±0.254)
3 place decimal (.XXX) ±0.005 (±0.127)

Lead Material: Kovar alloy

Lead Finish: 50 microinches (minimum) gold plating over 100 microinches (nominal) nickel plating

ORDERING INFORMATION

MODEL NO.	INPUT	OPERATING TEMP. RANGE
HDAS-75MC	8SE Channels	0 to +70°C
HDAS-75MM	8SE Channels	–55 to +125°C
HDAS-75/883	8SE Channels	–55 to +125°C
HDAS-76MC	4D Channels	0 to +70°C
HDAS-76MM	4D Channels	–55 to +125°C
HDAS-76/883	4D Channels	–55 to +125°C

Receptacles for PC board mounting can be ordered through AMP Inc., Part #3-331272-8 (Component Lead Socket), 40 required.

Contact DATEL, Inc. for MIL-STD-883 product specifications.

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