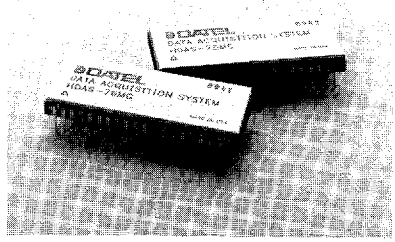
DATEL

HDAS-75,-76
12-Bit, 75 KHz
Data Acquisition Systems

T-51-07-01

FEATURES

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

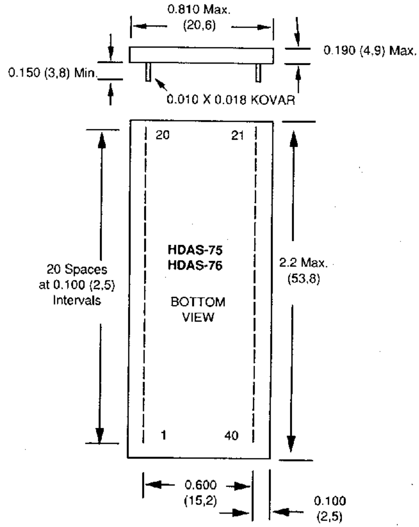


GENERAL DESCRIPTION

The HDAS-75,-76 are complete data acquisition systems containing an internal multiplexer, instrumentation amplifier, sample-hold, analog-to-digital converter and three-state outputs. Packaged in a miniature 40-pin double-dip package, the HDAS-75/76 has a low power dissipation of 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.

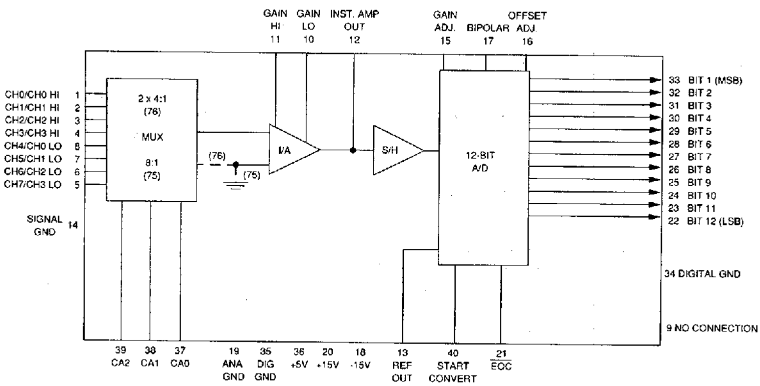
MECHANICAL DIMENSIONS INCHES (MM)



TECHNICAL NOTES

1. 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 analog, signal and digital 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.

2. Double-level multiplexing allows expanding the multiplexer channel capacity of the HDAS-75 from 8 single-ended channels to 128 single-ended channels or the HDAS-76 from 4 differential channels to 32 single-ended channels.



INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	CH 0/CH 0 HI	40	START CNVRT
2	CH 1/CH 1 HI	39	CA2
3	CH 2/CH 2 HI	38	CA1
4	CH 3/CH 3 HI	37	CA0
5	CH 7/CH 3 LO	36	+5V
6	CH 6/CH 2 LO	35	DIGITAL GND
7	CH 5/CH 1 LO	34	DIGITAL GND
8	CH 4/CH 0 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 REF OUT	28	BIT 6
14	SIGNAL GND	27	BIT 7
15	GAIN ADJ	26	BIT 8
16	OFFSET ADJUST	25	BIT 9
17	BIPOLAR	24	BIT 10
18	-15V	23	BIT 11
19	ANALOG GND	22	BIT 12 (LSB)
20	+15V	21	EOC

HDAS-75,-76

ABSOLUTE MAXIMUM RATINGS

PARAMETERS	LIMITS	UNITS
+15V Supply (pin 20)	0 to +18	V dc
-15V Supply (pin 18)	0 to -18	V dc
+5V Supply (pin 36)	-0.5 to +7.0	V dc
Digital Inputs (pins 37-40)	-0.3 to +6.0	V dc
Analog Inputs (pins 1-8)	±25	V
Lead Temp. (10 Sec.)	300	°C

FUNCTIONAL SPECIFICATIONS

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

ANALOG INPUTS	MIN.	TYP.	MAX.	UNITS
Number of Inputs				
HDAS-76	4 differential inputs			
HDAS--75	8 single-ended inputs			
Input Voltage Ranges				
Gain = 1	0 to +10V , ±10V			
Gain = 100	0 to 100 mV , ±100 mV			
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 Volt. Range	±11	–	–	V
CMMR, G=1,@10Hz, Vcm=1V p-p	-75	-80	–	dB
Voltage Noise (RMS)				
Gain = 1	–	–	200	µV
Gain = 8	–	–	50	µV
MUX Crosstalk @ 125 KHz	-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	(±30 ppm/ °C x gain) ±20 ppm/ °C (max.)			
Input Gain Equation	Rg = 1/[(gain -1)/2K]			
DIGITAL INPUTS				
Logic Levels				
Logic 1	2.4	–	–	V dc
Logic 0	–	–	0.8	V dc
Logic Loading				
Logic 1	–	–	+30	µA
Logic 0	–	–	-30	µA
OUTPUTS				
Logic Levels				
Logic 1	2.4	–	–	V dc
Logic 0	–	–	0.4	V dc
Logic Loading				
Logic 1	–	–	-500	µA
Logic 0	–	–	1.6	mA
Internal Reference				
Voltage, +25 °C	+9.9	+10.0	+10.1	V dc
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	–	–	±3/4	LSB
0 to +70 °C	–	–	±3/4	LSB
-55 to +125 °C	–	–	±1.5	LSB
Differential Nonlinearity				
+25 °C	–	–	±3/4	LSB
0 to +70 °C	–	–	±3/4	LSB
-55 to +125 °C	–	–	±1	LSB
F.S. Abs. Accuracy +25 °C	–	±0.13	±0.30	%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	%FSR
Gain Tempco	–	±20	±40	ppm/ °C
Harmonic Distortion (- FS) (DC to 5KHz,10V pk-pk) ①	-65	-73	–	dB
No Missing Codes	Over operating temperature range			
SIGNAL TIMING				
MUX Address Set-up Time	400	–	–	nS
Start Convert Pulse Width	0.050	1	–	µS
Data Valid Before $\overline{EOC}$ 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				
Gain= 1, ①	75	80	–	KHz
Gain = 2, ①	60	70	–	KHz
Gain = 4, ①	50	60	–	KHz
Gain = 8, ①	45	50	–	KHz
Gain = 10, ①	40	45	–	KHz
Gain = 100, ①	10	20	–	KHz
S/H PERFORMANCE				
Acquistion 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,				
10V to ±0.01%FS	–	200	400	nS
10V to ±0.1%FS	–	150	300	nS
Feedthrough Rejection	-80	-88	–	dB
Droop Rate, ①	–	–	100	µV/µS
POWER SUPPLY				
Range +15V	+14.25	+15.0	+15.75	V dc
-15V	-14.25	-15.0	-15.75	V dc
+5V	+4.75	+5.0	+5.25	V dc
Current +15V	–	+15	+20	mA
-15V	–	-10	-15	mA
+5V	–	+25	+35	mA
Power Dissipation	–	0.500	0.700	Watts
Power Supply Rejection	–	–	0.01%	%FSR/ %V
ENVIRONMENTAL				
Oper. Temp. Range, -MC, -PC	0	–	+70	°C
-MM	-55	–	+125	°C
Storage Temp. Range	-65	–	+150	°C
Package Type	40-pin DDIP			
Weight	0.32 oz./(9 grams) max.			

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

DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1194/TEL (508) 339-3000/TLX 174388/FAX (508) 339-6356

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 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 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.

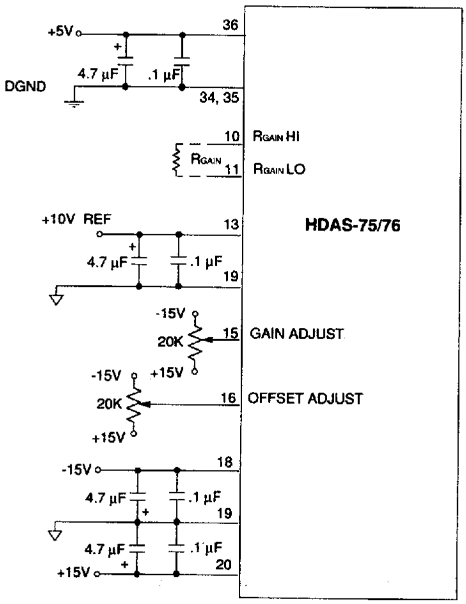


Figure 2. Typical Connection Diagram

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.

CALIBRATION PROCEDURE

1. Connect the converter per Figure 2 and Tables 2 and 3 for the appropriate full-scale range (FSR). Apply a pulse of 1.0 µsec (typical) to the START CONVERT input (pin 40) at a rate of 75 KHz. This rate is chosen to reduce flicker if LED's are used on the outputs for calibration purposes.

Table 2. Input Range Parameters

INPUT RANGE	GAIN	RGAIN	THROUGHPUT
0 to +10V	1	OPEN	75 KHz
0 to +5V	2	2K Ω	60 KHz
0 to +2.5V	4	665 Ω	50 KHz
0 to +1.25V	8	287 Ω	45 KHz
0 to +1.0V	10	221 Ω	40 KHz
0 to +100mV	100	20 Ω	10 KHz
±10V	1	OPEN	75 KHz
±5V	2	2K Ω	60 KHz
±2.5V	4	665 Ω	50 KHz
±1.25V	8	287 Ω	45 KHz
±1.0V	10	221 Ω	40 KHz
±100mV	100	20 Ω	10 KHz

$$\text{Rgain} = \frac{1}{\left[\frac{(\text{gain} - 1)}{2K}\right]}$$

Table 1. MUX Channel Addressing

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

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.

Table 3. Zero and Gain Adjust

FSR	Zero Adjust +1/2 LSB	Gain Adjust +FS - 1 1/2 LSB
0 to +10V dc	+1.22mV	+9.9963V dc
±10V dc	+2.44 mV dc	+9.9927V dc

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 Figure1a, 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 150 nanseconds maximum after START CONVERT goes high. Figure 1b shows how to use the START CONVERT pulse to control when the output data becomes valid.

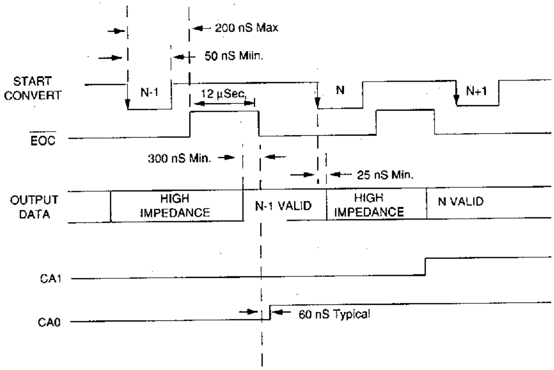


Figure 1a. Data Valid with START CONVERT Immediately Returned High

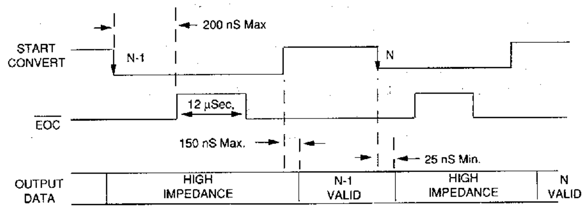


Figure 1b. Data Valid with START CONVERT Returned High Later

NOTES:

1. A START CONVERT pulse greater than 5 µS 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 BIN.		
UNIPOLAR SCALE	**INPUT RANGES, V dc 0 to +10V**	**OUTPUT CODING MSB LSB**	**INPUT RANGE ±10V dc**	**BIPOLAR SCALE**
+FS -1 LSB	+9.9976V	1111 1111 1111	+9.9951V	+FS -1 LSB
7/8 FS	+8.7500V	1110 0000 0000	+7.5000V	+3/4 FS
3/4 FS	+7.5000V	1100 0000 0000	+5.0000V	+1/2 FS
1/2 FS	+5.0000V	1000 0000 0000	0.0000V	0
1/4 FS	+2.5000V	0100 0000 0000	-5.0000V	-1/2 FS
1/8 FS	+1.2500V	0010 0000 0000	-7.5000V	-3/4 FS
1 LSB	+0.0024V	0000 0000 0001	-9.9951V	-FS +1 LSB
0	0.0000V	0000 0000 0000	-10.000V	-FS
		OFF. BINARY		

ORDERING INFORMATION

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

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

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