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ORIG

DSI



# DIGITAL-TO-ANALOG CONVERTER

## MODEL DAC-I SERIES

### DESCRIPTION

Datel Systems has achieved a major breakthrough in digital to analog converter design. Specifically designed for when *accuracy, speed, size* and *cost* are of the utmost importance.

Now for the first time, using both proprietary circuit and packaging techniques, ultraminiature (0.8 in<sup>3</sup>) digital to analog converters with resolutions up to 12 binary bits and settling time of 150 nanoseconds are now available for printed circuit board mounting on 0.5" centers. Module size and pin locations conform to standard *Dual In-Line* mounting, which enables both the D/A module and dual in-line packages to be inter-connected efficiently.

DAC-I series converters consist of interfacing logic, a precision resistor ladder network, high speed electronic switches and a temperature compensated precision voltage reference source. When combined, these elements will provide weighted currents at the output with speed and accuracy.

No input strobing signal is required. The analog output changes each time the digital input word changes. Actual conversion delay through the D/A converter is typically 25 nanoseconds.

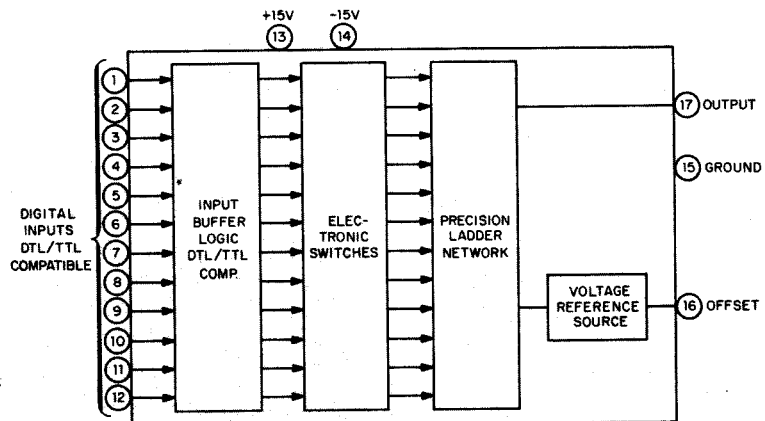
All digital inputs are compatible to DTL or TTL logic.

## FOR FAST SETTLING APPLICATIONS

### FEATURES

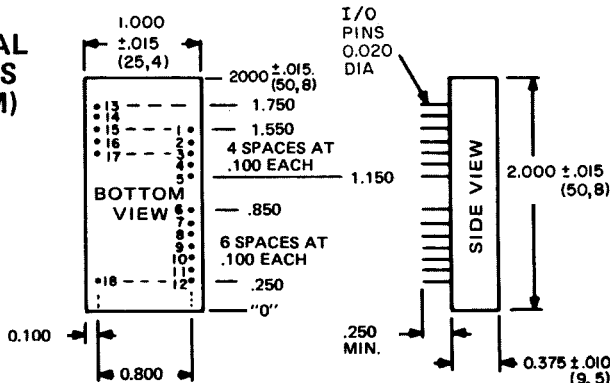
- Accurate Output .....  $\pm 0.05\%$
- Small Size ..... 1" x 2" x 0.375" — Will mount directly on P.C. boards having 0.5" centers.
- Fast Settling Time ..... 150 nanosec's to  $\pm .025\%$  FS.
- Low Temperature Coefficient .....  $\pm 15 \text{ ppm}/^\circ\text{C}$  ( $\pm .0015\%/^\circ\text{C}$ )
- High Resolution ..... Up to 12 binary bits
- Ultra Linear .....  $\pm 1/2 \text{ LSB}$  ( $\pm .0125\%$ )
- Unique Analog Output ..... Can provide either a voltage or current source.
- Adjustment-Free Operation ..... From  $0^\circ\text{C}$  to  $+70^\circ\text{C}$
- Flexible Inputs ..... Will accept a variety of codes.
- Self contained ..... \*Simply apply D.C. power.
- Low Cost ..... See enclosed price list.

\*See Datel Systems' Engineering Power Supply Handbook.



**SIMPLIFIED BLOCK DIAGRAM DAC-I SERIES D/A CONVERTER**

### MECHANICAL DIMENSIONS INCHES (MM)



### INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	Bit 1 (800)	10	Bit 10 (4)
2	Bit 2 (400)	11	Bit 11 (2)
3	Bit 3 (200)	12	Bit 12 (1) LSB
4	Bit 4 (100)	13	+ 15V Power Input
5	Bit 5 ( 80)	14	- 15V Power Input
6	Bit 6 ( 40)	15	Common Ground
7	Bit 7 ( 20)	16	Offset
8	Bit 8 ( 10)	17	Analog Output
9	Bit 9 ( 8)	18	No Connection

# SPECIFICATIONS (typical @ 25°C)

## ELECTRICAL

### Digital Inputs:

Resolution ..... Up to 12 binary bits or 3 digit BCD  
 Coding ..... Parallel data in the following formats:  
 Straight binary (Unipolar output)  
 BCD (Unipolar output)  
 Offset binary or  
 two's complement (Bipolar output)  
 Note: Two's complement bipolar output can be achieved when the MSB is inverted by using an external storage register or inverter.

Logic levels ..... DTL or TTL compatible, positive logic

Input Code	Vinput		Bit Status
	Min.	Max.	
"0"	0V	+0.8V	Off
"1"	+2.0V	+5.5V	On

Loading ..... One standard TTL load i.e.,  
 $I_L$  max. = 1.6 ma at  $V_{in} = +0.4V$

### Analog Output (@ 25°C)

Accuracy ..... .05% of FS  $\pm$  1/2 LSB

Zero Offset ..... 15 na

Resolution ..... 1 LSB (0.5  $\mu$ a for 12 Binary Bits)

Linearity .....  $\pm$  1/2 LSB  
 Temperature Coefficient .....  $\pm$  15 ppm/°C of FS  
 Output Voltage Swing Limit .  $\pm$  1.2 V  
 Full Scale Output Current ... 2 ma (Unipolar),  $\pm$  1 ma (Bipolar), 1.25 ma (BCD)  
 Output Impedance ..... 5 K ohms,  $\pm$  0.1%  
 Settling time ..... 150 nSec to 0.025% of FS  
 Reference source ..... Internal  
 (Optional external  $\pm$ 6.2 V  $\pm$  5%)  
 Input Power Requirements ..  $\pm$  15 V DC,  $\pm$  .5V @ 20 ma max.  
 Power Supply Rejection Ratio 0.05%/V

## PHYSICAL – ENVIRONMENTAL

Operating Temperature Range 0°C to + 70°C  
 Storage Temperature Range .. -55°C to +85°C  
 Relative Humidity ..... Up to 100% non-condensing  
 Size ..... 2" L x 1" W x 0.375" H, plug-in module.

Pins ..... 0.020" round gold plated, 0.250" long minimum.

Case Material ..... Black Diallyl Phthalate, per MIL-M-14. Converters are repairable

Weight ..... Less than 1 oz.

Model DAC-I Series D/A converter modules are fully encapsulated and feature dual in-line pinning compatibility (i.e., 0.100" grid pin spacing and 0.800" between rows of pins).

Mating Socket ..... DILS-2, 2 Req'd per Module, \$5/pr.

## APPLICATIONS

Higher output voltages and currents are obtainable by connecting an external operational amplifier and feedback networks, as shown in Figure 2.

A voltage output may also be developed by connecting a load resistor from the summing junction to ground (2 ma max. for Unipolar or  $\pm$  1 ma for Bipolar units), Figure 3.

DAC-I series voltage output configuration with an output load  $R_L$ .

Roffset is for Bipolar Units only.

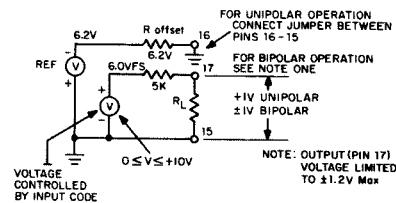


FIGURE 1

DAC-I series current output configuration with an externally connected output amplifier.

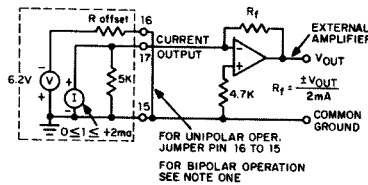


FIGURE 2

Typical DAC-I series applications without external amplifier.

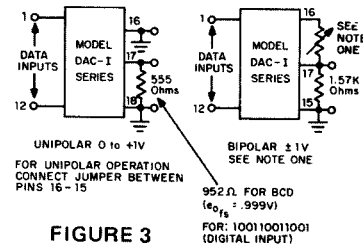


FIGURE 3

Note 1 — For bipolar operation connect trim resistor or small potentiometer (approx. 250 ohms) between pins 16-17 and with input code of 100000000000 adjust for zero voltage output.

## INPUT CODING

### ANALOG OUTPUT

### DIGITAL INPUT

	ANALOG OUTPUT			DIGITAL INPUT		
	8 Bits	10 Bits	12 Bits	8	10	12
Straight Binary (0 to +2mA)	+1.9922mA	+1.9980mA	+1.9995mA	11111111	11	11
	+1.0000mA	+1.0000mA	+1.0000mA	10000000	00	00
	0.0000	0.0000	0.0000	00000000	00	00
Offset Binary (-1mA to +1mA)	+0.9922mA	+0.9980mA	+0.9995mA	11111111	11	11
	0.0000	0.0000	0.0000	10000000	00	00
	-1.0000mA	-1.0000mA	-1.0000mA	00000000	00	00
BCD (0 to +1.25mA)	+1.2375mA	—	+1.24875mA	10011001	—	1001
	+0.625mA	—	+0.625mA	01010000	—	0000
	0.000	—	0.000	00000000	—	0000

## ORDERING INFORMATION

DAC-I		PRICES (1-9)
No of Bits & Coding		
8 B	Binary	DAC-I8B ... \$69
10 B		DAC-I10B ... \$79
12 B		DAC-I12B ... \$89
8 D	BCD	DAC-I8D ... \$69
12 D		DAC-I12D ... \$89

Trimpot (200 $\Omega$ ), Datel No. TP200 \$3ea.



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