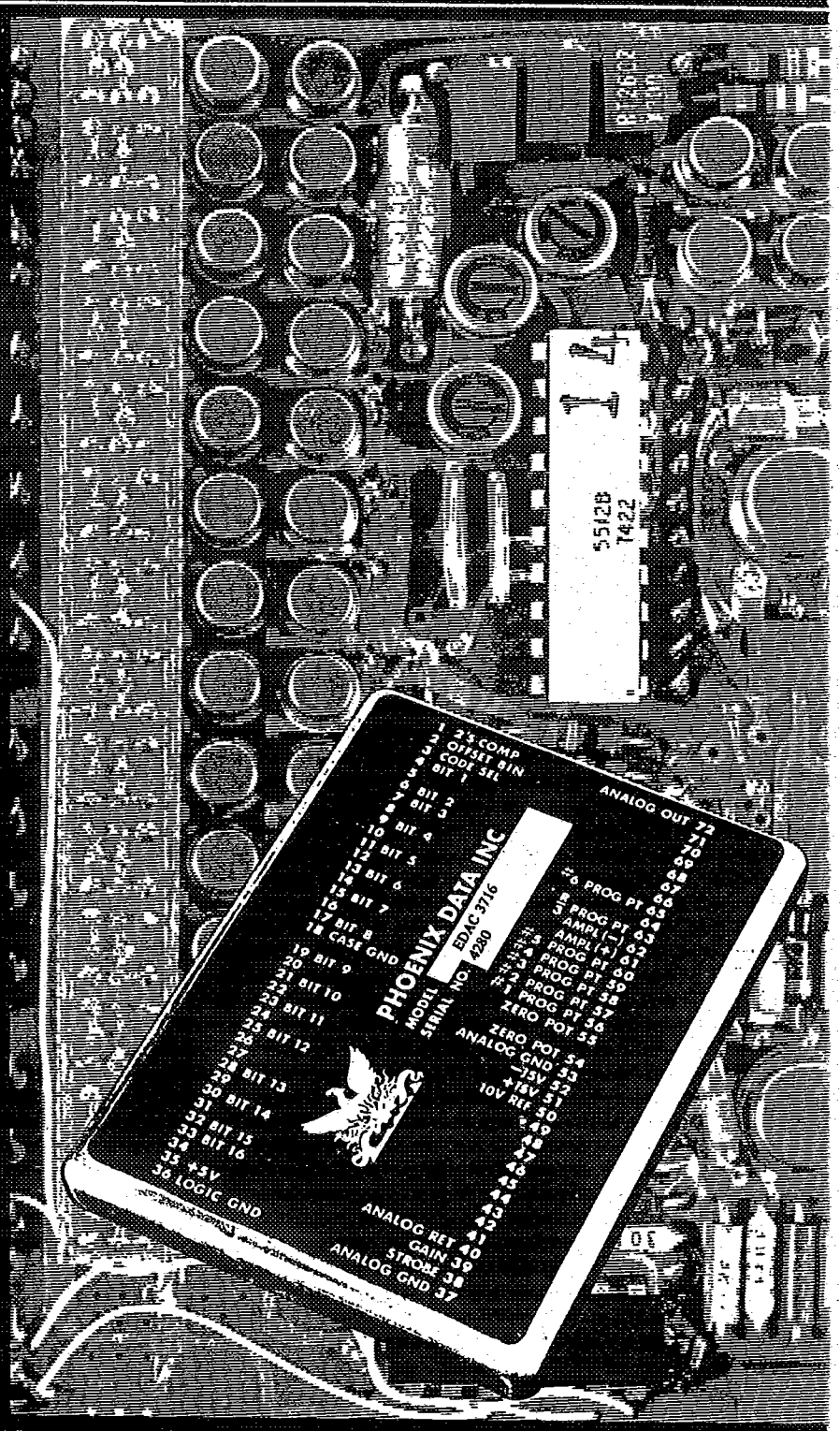
EDAC Series 3000 ENCASED DIGITAL TO ANALOG CONVERTERS

D/A converters for virtually any application.

Features

- 20 Different Models
- 12 to 16 Bit Resolution
- Straight Binary, Offset Binary, or 2's Complement Input
- Programmable Output Range Selection
- Bipolar or Unipolar Output
- Precision Internal Voltage Reference
- Pre-Calibrated for Specified Temperature Range
- RFI and EMI Shielded
- Conversion Times to 1μSec for 13 Bits, 3μSec for 16 Bits
- Accuracy to 0.003% of FSR
- Optional Temperature Ranges From -55°C to 90°C
- TTL Compatible Input Holding Register
- Convenient Printed Circuit Board Mounting



General Description

Phoenix Data precision Digital to Analog Converters have long been an accepted industry standard—providing a wide range of cost and performance configurations to meet the needs of virtually any application. Their ease of application and time-proven reliability have made them a first choice with both commercial and industrial equipment designers everywhere.

The EDAC 3000 series consists of general purpose Digital to Analog Converters employing the latest in precision component and design technology. All D/A Converters use the highly reliable voltage switching technique and are totally self-contained except for external power requirements of ±15 and 5 volts DC.

Each converter consists of a TTL compatible input holding register, solid-state analog switches, a precision ladder network, temperature compensated internal voltage reference generator, an operational output amplifier, and a low-impedance complimentary emitter follower output driver circuit. For those applications not requiring the holding register feature, the strobe input line may be connected to +5 VDC through a 1K ohm resistor, thus allowing the converter to continuously follow input data changes.

All converters are factory calibrated to published specifications over the designated temperature range, and are totally repairable. The dual-in-line pinout configuration (0.100 inch grid centers) allows convenient printed circuit board mounting.

PDI

Phoenix Data, Inc.

EDAC Series 3000
ENCASED DIGITAL TO ANALOG CONVERTERS
D/A converters for virtually any application.

Series 3000 Specifications

Model	Input / Resolution (Note 1)	Full Range Slew & Settling Time (Note 2)	Accuracy of FSR (Note 3)	Linearity of FSR	Temperature Coefficient (0°C to 70°C) (Note 4)	Performance
3012	12 Bits	15 µS	±0.02%	±0.010%	10 ppm/°C	Standard
3112	12 Bits	15 µS	±0.01%	±0.006%	5 ppm/°C	Precision
3212	12 Bits	1 µS	±0.02%	±0.010%	10 ppm/°C	High Speed
3312	12 Bits	1 µS	±0.01%	+0.008%	5 ppm/°C	Precision & High Speed
3413 3414 3415 3416	13 Bits 14 Bits 15 Bits 16 Bits	15 µS 17 µS 20 µS 20 µS	±0.015% ±0.0125% ±0.010% ±0.007%	±0.008% ±0.007% ±0.006% ±0.004%	10 ppm/°C	Standard
3513 3514 3515 3516	13 Bits 14 Bits 15 Bits 16 Bits	15 µS 17 µS 20 µS 20 µS	±0.010% ±0.007% ±0.005% ±0.003%	±0.006% ±0.004% ±0.003% ±0.0015%	5 ppm/°C	Precision
3613 3614 3615 3616	13 Bits 14 Bits 15 Bits 16 Bits	1 µS 1.5 µS 2 µS 3 µS	±0.015% ±0.0125% ±0.010% ±0.007%	±0.008% ±0.007% ±0.006% ±0.004%	10 ppm/°C	High Speed
3713 3714 3715 3716	13 Bits 14 Bits 15 Bits 16 Bits	2.0 µS 2.5 µS 3.5 µS 4.5 µS	±0.010% ±0.007% ±0.006% ±0.004%	±0.006% ±0.005% ±0.004% ±0.002%	5 ppm/°C	Precision & High Speed

Notes:

1. Lower resolution units available on request.
2. Conversion time includes settling time to rated accuracy for a full-range step (worse case). See Conversion Timing Diagram.
3. Accuracy figures include all error parameters.
4. Standard operating temperature range is 0°C to 70°C. Extended temperature ranges are available. Also, on special order, units available to 2.5 ppm/°C.
5. For Model Number Coding, see Ordering Information.
6. For special configurations or applications, contact your local Phoenix Data, Inc. representative or the factory.
7. The temperature coefficient includes all gain, offset, reference and differential linearity related temperature effects over 0 to 70°C. For extended operating temperature ranges the T.C. degrades by a factor of 2 from +70°C to +90°C and from 0°C to -55°C.

General Specifications

DATA INPUT SIGNALS
(WITH INPUT HOLDING REGISTER, TTL COMPATIBLE)

Logic "1" voltage/current (True Input)	+2.4 VDC to 5.0 VDC @ 80μA max.
Logic "0" voltage/current (False Input)	0 VDC to 0.4 VDC @ -1.6 mA max.
Output Impedance	Less than 0.02 ohm
Output Connection	Single Ended (shielded)
Long Term Stability	0.01% FSR @ 25°C for 12 months

ADJUSTMENTS

Models 3000 thru 3300 (Up to 12 Bits)
Internal Gain and Zero Offset adjustments for the output voltage specified.

Pinout is provided for external Gain and Zero Offset potentiometers should the converter be used for output ranges other than that specified on order, or for additional adjustment due to temperature, etc.

Models 3400 & 3600 (13 thru 16 Bits)
External Gain and Zero Offset potentiometers required (no internal adjustments)

Models 3500 & 3700 (13 thru 16 Bits)
Internal Gain and Zero Offset adjustments (accessible through case). No external potentiometers required, but may be added if desired.

ENCASEMENT SHIELDING

RFI	Protected on six (6) sides.
EMI	Protected on five (5) sides.

MECHANICAL

Case material	Hot tin-dipped steel
Repairability	Completely repairable

ENVIRONMENTAL

Temperature	
Operating	0°C to 70°C Standard
Optional	-25°C to 85°C, or -55°C to 90°C

NOTE: The conversion error includes all error sources, ±1/2 LSB, and all temperature related errors over the temperature range of 10° to 40°C up to 12 bits and 15° to 35°C for 13 and 14 bit resolution with no adjustments. If an input range other than that specified at time of purchase is selected, the gain and offset may have to be adjusted.

Storage	-55°C to 125°C
Humidity	0 to 99% relative, no condensation

STROBE INPUT SIGNAL

Strobe input "enable" (Logic "1", True)	Logic voltage and current levels same as data inputs.
Strobe input "disable" (Logic "0", False)	
Strobe enable pulse width	50 ns min.

NOTE: Data input is transferred to the DAC output when the Strobe input goes "high" (logic 1), and the output will continue to follow the data input as long as the Strobe input remains high.

DIGITAL INPUT CODES
Straight Binary, Offset Binary, 2's Complement
(See Input Code Selection for strapping requirements.)

ANALOG OUTPUT SIGNAL (Standard Full-Range, Selectable)

NOTE: 5.12 or 10.24 volts full-range outputs available on special order.

Output Ranges (Models 3000 thru 3300)

Bipolar	B10	±10 VDC @ 10 mA
	B5	±5 VDC @ 10 mA
Unipolar	U10	0 to +10 VDC @ 10 mA
	N5	0 to -5 VDC @ 10 mA

Output Ranges (Series 3400 thru 3700)

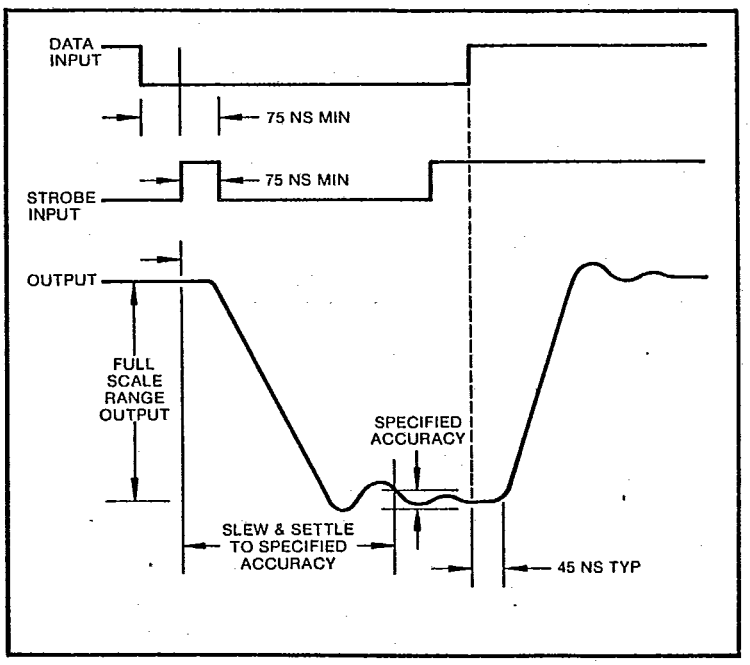
Bipolar	B10	±10 VDC @ 10 mA
	B5	±5 VDC @ 10 mA
Unipolar	U10	0 to +10 VDC @ 10 mA
	N10	0 to -10 VDC @ 10 mA
	N5	0 to -5 VDC @ 10 mA

NOTE: See Range Selection Tables for strapping requirements.

POWER REQUIREMENTS

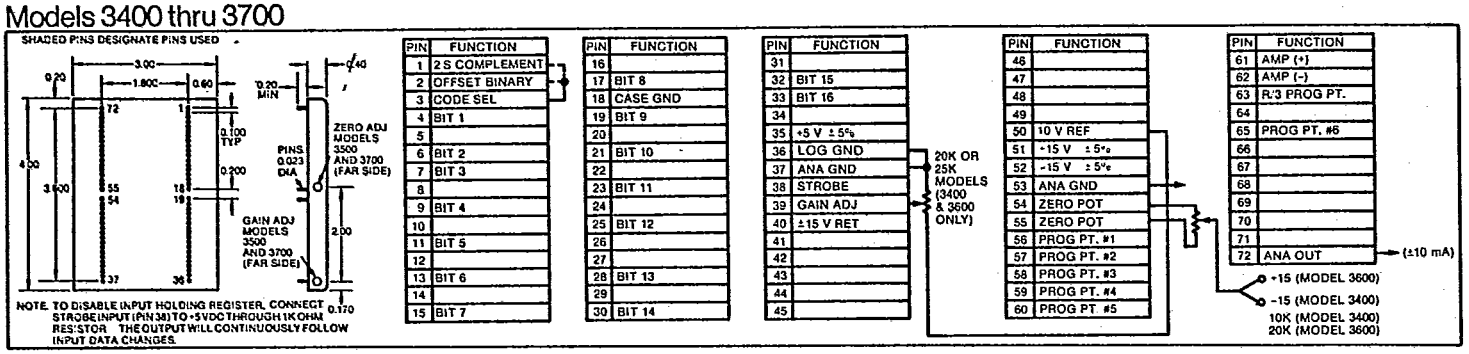
Voltage and current	+15 VDC ±5% @ 100 mA -15 VDC ±5% @ 50 mA + 5 VDC ±5% @ 200 mA + 5 VDC ±0.5% @ 200 mA (on precision models)
Voltage Reference	Internal (Regulated +10 VDC)
Package Configuration	See Physical Dimensions & Pin Connections

Conversion Timing Diagram



Physical Dimensions & Pin Connections

Models 3400 thru 3700



PIN	FUNCTION
1	2 S COMPLEMENT
2	OFFSET BINARY
3	CODE SEL
4	BIT 1
5	
6	BIT 2
7	BIT 3
8	
9	BIT 4
10	
11	BIT 5
12	
13	BIT 6
14	
15	BIT 7

PIN	FUNCTION
16	
17	BIT 8
18	CASE GND
19	BIT 9
20	
21	BIT 10
22	
23	BIT 11
24	
25	BIT 12
26	
27	
28	BIT 13
29	
30	BIT 14

PIN	FUNCTION
31	
32	BIT 15
33	BIT 16
34	
35	+5 V ±5%
36	LOG GND
37	ANA GND
38	STROBE
39	GAIN ADJ
40	±15 V RET
41	
42	
43	
44	
45	

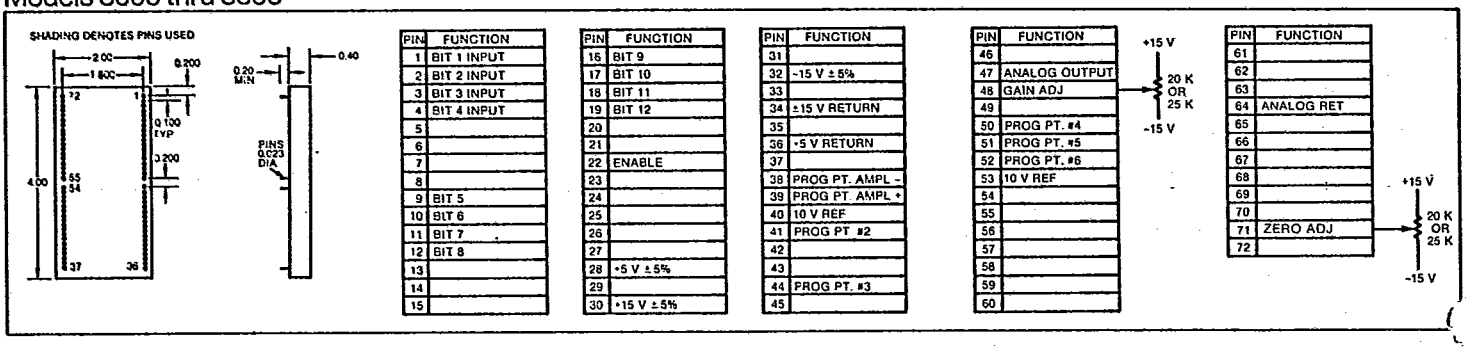
20K OR 25K MODELS (3400 & 3600 ONLY)

PIN	FUNCTION
46	
47	
48	
49	
50	10 V REF
51	+15 V ±5%
52	-15 V ±5%
53	ANA GND
54	ZERO POT
55	ZERO POT
56	PROG PT. #1
57	PROG PT. #2
58	PROG PT. #3
59	PROG PT. #4
60	PROG PT. #5

PIN	FUNCTION
61	AMP (+)
62	AMP (-)
63	R/3 PROG PT.
64	
65	PROG PT. #6
66	
67	
68	
69	
70	
71	
72	ANA OUT (±10 mA)

+15 (MODEL 3600)
-15 (MODEL 3400)
10K (MODEL 3400)
20K (MODEL 3600)

Models 3000 thru 3300



PIN	FUNCTION
1	BIT 1 INPUT
2	BIT 2 INPUT
3	BIT 3 INPUT
4	BIT 4 INPUT
5	
6	
7	
8	
9	BIT 5
10	BIT 6
11	BIT 7
12	BIT 8
13	
14	
15	

PIN	FUNCTION
16	BIT 9
17	BIT 10
18	BIT 11
19	BIT 12
20	
21	
22	ENABLE
23	
24	
25	
26	
27	
28	+5 V ±5%
29	
30	+15 V ±5%

PIN	FUNCTION
31	
32	-15 V ±5%
33	
34	±15 V RETURN
35	
36	+5 V RETURN
37	
38	PROG PT. AMPL -
39	PROG PT. AMPL +
40	10 V REF
41	PROG PT #2
42	
43	
44	PROG PT. #3
45	

PIN	FUNCTION
46	
47	ANALOG OUTPUT
48	GAIN ADJ
49	
50	PROG PT. #4
51	PROG PT. #5
52	PROG PT. #6
53	10 V REF
54	
55	
56	
57	
58	
59	
60	

+15 V
20 K OR 25 K
-15 V

PIN	FUNCTION
61	
62	
63	
64	ANALOG RET
65	
66	
67	
68	
69	
70	
71	ZERO ADJ
72	

+15 V
20 K OR 25 K
-15 V

Ordering Information

EDAC XXXX X XX XX XX

Model Number

B = Bipolar Output
U = Unipolar Output (Positive)
N = Unipolar Output (Negative)

05 = 0 to -5, ±5 V
10 = 0 to +10, 0 to -10, ±10 V

ST = Std. T.C.
25 = 2.5 ppm/°C

ST = Std. Temp Range
MT = -25°C to 85°C
HT = -55°C to 90°C

Warranty

Phoenix Data, Inc. warrants its products to be free from defects in material and workmanship, under normal use and service, for a period of 90 days from date of original shipment. Warranty obligations shall be limited to replacing or repairing, at our option, any product returned, transportation charges prepaid, and found to be defective within the warranty period.

For additional information, contact your Phoenix Data representative, or:

Phoenix Data, Inc.
3384 WEST OSBORN ROAD PHOENIX, ARIZONA 85017 PHONE 602/278-8528 TWX 910-951-1364

REPRESENTATIVE:

Installation

POWER CONNECTIONS

If the DAC is to be remotely located three (3) feet or more from its external power source, each power supply voltage lead should be twisted with its respective ground return. Also, should the DAC be located in a rack or chassis with other equipment, all operating from a common power supply, then careful attention to system grounding and power distribution rules should be considered to prevent ground loops and cross-talk between system components.

DIGITAL INPUT SIGNALS

All digital input data and control signals drive TTL compatible integrated circuits, with each input representing one TTL unit load. All normal precautions associated with TTL input logic should apply.

ANALOG OUTPUT

To minimize noise, it is recommended that a twisted-pair, shielded cable be used to connect the *analog output* and *analog return* of the DAC to its terminating device. The shield should be connected to the analog return line at one end only—preferably at the DAC (source) end.

GROUND CONNECTIONS

The common (ground) return for the ±15 VDC supplies and the +5 VDC supply are not connected externally. This connection must be made at the DAC pinout or elsewhere in the system. If the connection is not made at the DAC, caution should be taken to limit the voltage difference between the DAC power supply ground return pins to ±0.25 VDC maximum, including DC offset and peak noise.

Warning Notes

POWER SUPPLY OVERVOLTAGE

Externally supplied power voltages must not exceed specified limits for proper DAC operation. Power supply turn-on/turn-off surging must be suppressed to prevent damage to the DAC circuit. Permanent damage may occur if transients greater than ±18 VDC or +7 VDC are present on the ±15 VDC and +5 VDC supply lines respectively.

SHORT CIRCUITS

A short circuit of any input/output connection to any power supply voltage can cause permanent damage to the DAC.

A short circuit of any input/output connection to ground will *not* damage the DAC, except for the reference output.

Gain and Zero Adjustment

ZERO ADJUST

Adjust zero potentiometer for 0.0 VDC output with all-zero code input.

GAIN ADJUST

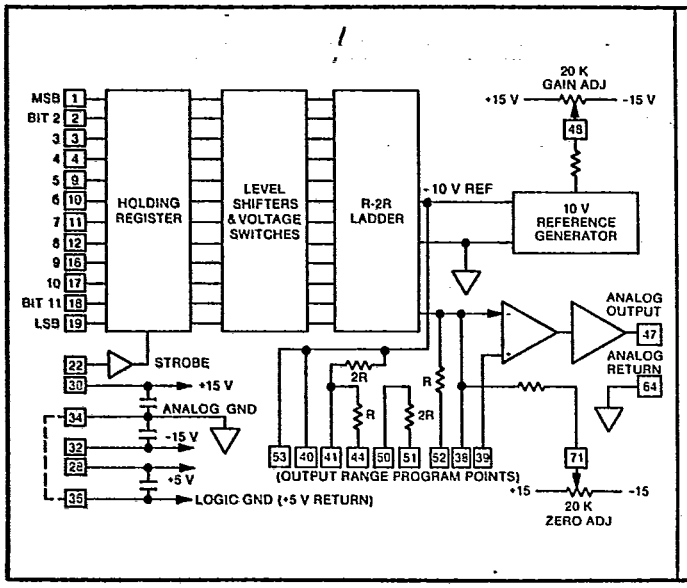
Adjust the gain potentiometer such that the output swing from -F.S. to +F.S. is equal to the specified full-scale range, less *one* LSB. For bipolar units, the positive F.S. magnitude should be equal to $\left(\frac{2^{(\text{NO. OF BITS})}}{2}-1\right)$ bit weight or (1/2 full range -one LSB); and, the negative F.S. magnitude should be equal to $\left(\frac{2^{(\text{NO. OF BITS})}}{2}\right)$ bit weight or (1/2 full range).

F.S. = Full Scale

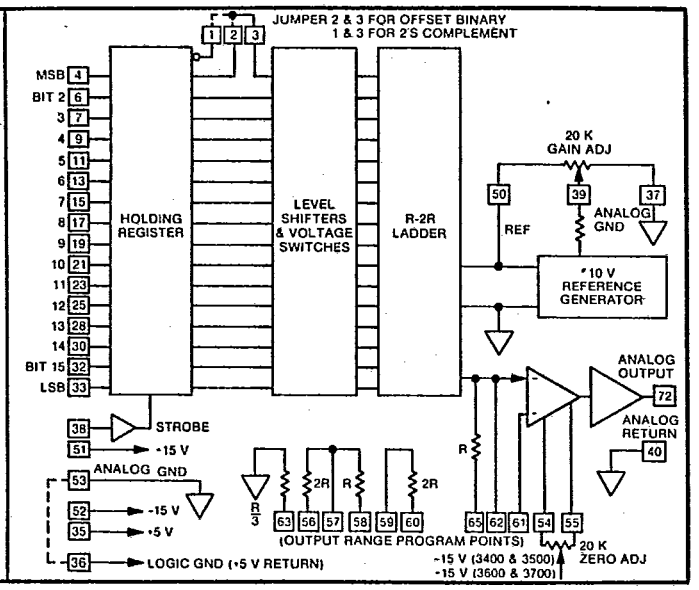
Phoenix Data, Inc.

Application Information

Block Diagram (Models 3000 thru 3300)



Block Diagram (Models 3400 thru 3700)



Programmable Output Range Selection (Pinout jumper connections)

Models 3000 thru 3300

BIPOLAR		UNIPOLAR	
B10(±10VDC)	B5(±5VDC)	U10(0 TO +10VDC)	N5(0 TO -5VDC)
51 to 47	51 to 64	51 to 53	39 to 64
50 to 38	44 to 64	44 to 64	44 to 38
44 to 64	52 to 47	52 to 47	52 to 47
41 to 39	41 to 39	41 to 39	41 to 47
	50 to 39	50 to 39	

Models 3400 thru 3700

BIPOLAR		UNIPOLAR		
B10(±10VDC)	B5(±5VDC)	U10(0 TO +10VDC)	N5(0 TO -5VDC)	N10(0 TO -10VDC)
50 to 56	50 to 56	50 to 56	53 to 56	53 to 56
57 to 61	57 to 61	57 to 61	57 to 72	57 to 62
53 to 58	53 to 58	53 to 58	58 to 62	53 to 58
59 to 72	59 to 61	59 to 61	53 to 59	59 to 61
60 to 62	53 to 60	50 to 60	53 to 60	53 to 60
53 to 63	65 to 72	65 to 72	65 to 72	65 to 72
	53 to 63	53 to 63	61 to 63	53 to 63

Input Code Selection

(Models 3400 thru 3700 only)

BIPOLAR

- Two's Complement: connect pin 1 to pin 3. With this arrangement, the MSB is a logic "1" for all negative value outputs.
- Offset Binary: connect pin 2 to pin 3. With this connection, the MSB is a logic "0" for negative value outputs.

UNIPOLAR

- Straight Binary: connect pin 2 to pin 3

Binary Weights for D/A Converters

(Fraction or full-scale range)

MSB 2^{-0}	.5
2^{-1}	.25
2^{-2}	.125
2^{-3}	.0625
2^{-4}	.03125
2^{-5}	.015625
2^{-6}	.0078125
2^{-7}	.00390625
2^{-8}	.001953125
2^{-9}	.0009765625
2^{-10}	.00048828125
2^{-11}	.000244140625
2^{-12}	.0001220703125
2^{-13}	.00006103515625
2^{-14}	.000030517578125
2^{-15}	.0000152587890625
2^{-16}	.00000762939453125