Model 3120

4-20 mA Output Drivers

INSTRUCTION MANUAL

April, 1992

SPECIAL OPTION

Model 3120-S002

12-Bit 0-5 mA Current Loop Driver

March, 1988

SPECIAL OPTION

The module 3120-S002 is the same as module 3120-A1A except it has been modified to drive 0-5 mA.

MLH:rem(3000 HWD Ser 5)
March, 1988

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KineticSystems Corporation

Standardized Data Acquisition and Control Systems

3120,25,26

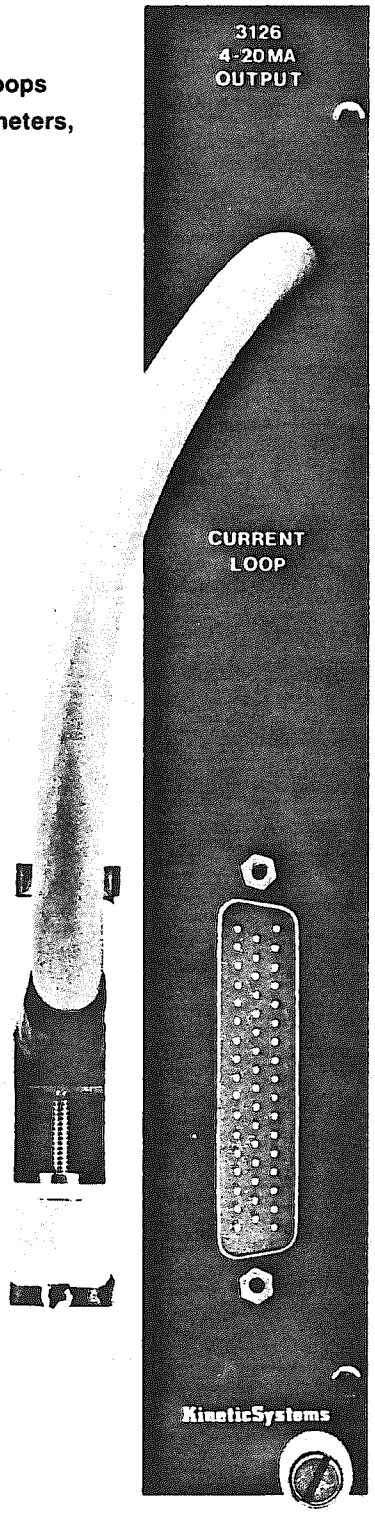
4-20 mA Output Drivers

FEATURES

- **Drive 4-20 milliampere current loops**
- **Ground-connected and isolated source modules available**
- **Eight current-loop channels provided on each module**
- **A 3120 module includes eight D/A converters**
- **The 3125 and 3126 use 3110 or 3112 D/A modules as voltage sources**

APPLICATIONS

- **Driving process current loops**
- **Controlling current-loop meters, valves, etc.**



GENERAL DESCRIPTION

The Model 3120 is a single-width CAMAC module arranged to produce eight separate ground-connected 4-20 milliampere current-loop output signals. Each channel includes a register written from the Dataway, a 12-bit D/A converter, and a voltage-to-current converter for producing the current-loop signal.

The Models 3125 and 3126 are double-width CAMAC modules, each arranged to convert eight voltage signals to 4-20 milliampere current-loop output signals. A cable tail is provided on both modules allowing them to be driven by a Model 3110 or 3112 D/A converter module. The 3125 provides a ground-connected, current-loop source and uses Analog Devices 2B20 voltage-to-current converters. The 3126 provides an isolated, current-loop source and uses 2B22 voltage-to-current converters.

ACCURACY (maximum error)

Model	Nonlinearity	Drift
3120	±0.1%	±0.01%/°C
3125	±0.005%	±0.005%/°C
3126	±0.1%	±0.01%/°C

Note: For the 3125 and 3126, this is the current-to-voltage transfer accuracy only.

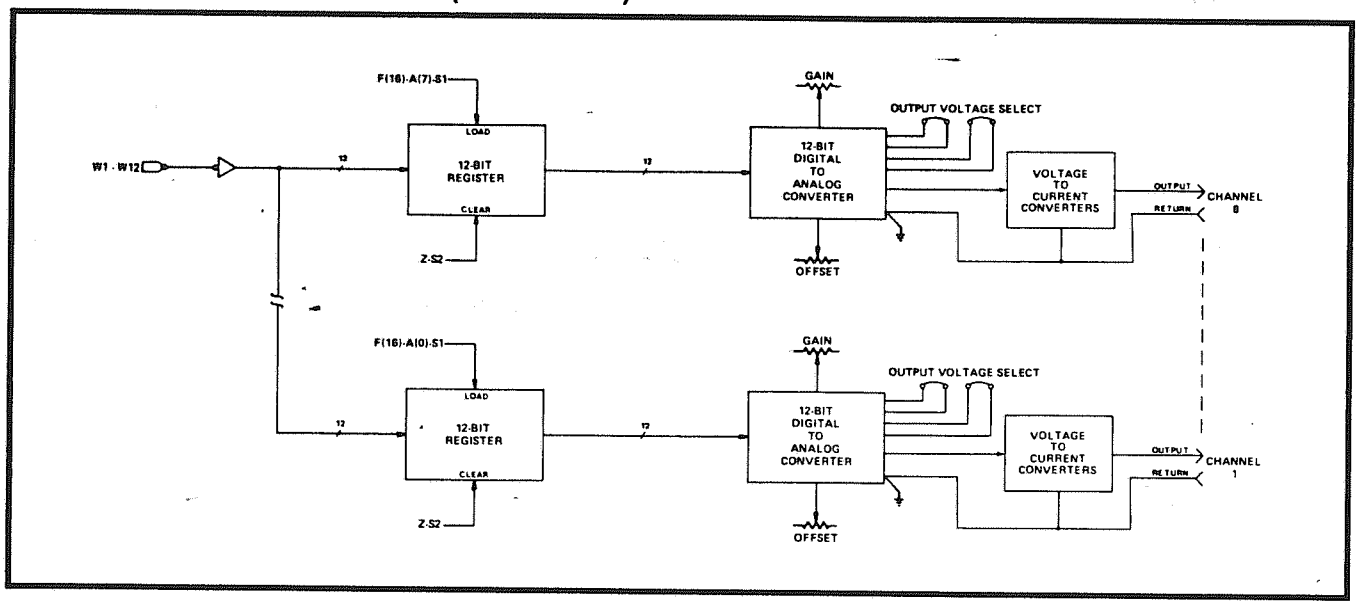
FUNCTION CODES (Model 3120)

Command	Q	Action
F(16)·A(i) WT1	1	Writes the Data register i.
Z · CZ	0	Clears the data registers.

Notes: 1. i can range from 0 to 7.
2. X = 1 for all valid addressed commands.
3. A watchdog timer is provided. When strap-selected, this timer clears all registers if no Dataway activity is detected for a selected period of time.

11 Maryknoll Drive • Lockport, IL 60441 • (815) 838 0005 • TWX 910 638 2831 • FAX (815) 838 4424

SIMPLIFIED BLOCK DIAGRAM (Model 3120)



POWER REQUIREMENTS

Model	+6V	+24	−24
3120	400 mA	300 mA	200 mA
3125	—	500 mA	200 mA
3126	—	800 mA	—

Weight: **Model 3120** - 0.51 kg. (1 lb. 2 oz.).
Model 3125 - 0.62 kg. (1 lb. 6 oz.)
Model 3126 - 1.36 kg. (3 lb)

ORDERING INFORMATION

Model	Connector	Voltage Source	Output Type
3120-A1A	50-contact Ribbon-socket	On-board D/A	Grounded
3120-E1A	50-contact "D" Plug	On-board D/A	Grounded
3125-A2A	50-contact Ribbon-socket	Use 3110/3112	Grounded
3125-P2A	36-contact P.C. Edge	Use 3110/3112	Grounded
3126-A2A	50-contact Ribbon	Use 3110/3112	Isolated
3126-E2A	50-contact "D" Plug	Use 3110/3112	Isolated

Accessories

Module	Mating Connector	Termination Panel
3120-A1A	5950-Z1A	1850-A1D
3120-E1A	5934-Z1A	1850-E1D
3125-A2A	5950-Z1A	1850-A1D
3125-P2A	5960-Z1A or Z1B	1850-P1D
3126-A2A	5950-Z1A	1850-A1D
3126-E2A	5934-Z1A	1850-E1D

The Watchdog Timer

The Watchdog Timer circuit provides a safety mechanism, whereby all channels on the module can be reset to the 4-milliamp output condition if no Dataway activity is detected within a predetermined period of time. The trigger for the timeout circuit can be strap selected as being either any activity on the CAMAC Dataway (the BUSY signal), or any command addressed to the module itself (the N-line signal).

A second option strap is used to select the period of time (after receipt of the trigger) at which the watchdog circuit times out, or it disables the circuit. Figure 1 on Page 4 of this manual shows component placement and the location and settings of the option straps. As shipped from the factory, the Watchdog Timer is strapped to trigger on N and is disabled.

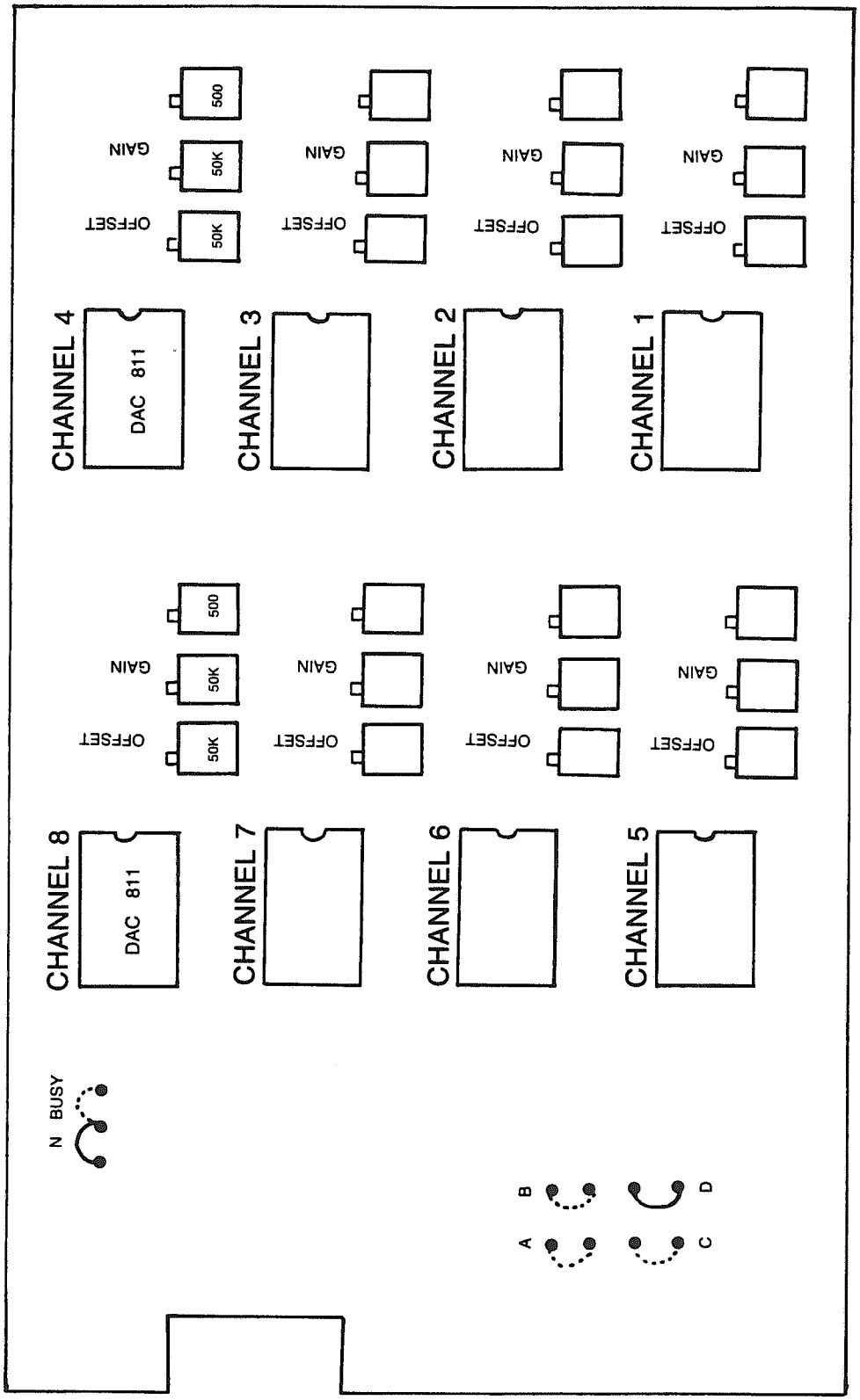
CALIBRATION PROCEDURE

Each output channel of the module is composed of a Digital-to-Analog converter, followed by a voltage-to-current converter circuit. All calibration adjustments are made to the D-to-A devices (Refer to Figure 1 for component locations). If, for any reason, it becomes necessary to recalibrate the module, the following procedures are recommended:

Offset Adjustment: To calibrate the offset, connect a load of 750 ohms and 10 ohms in series at the output of the selected channel. (Precision resistors should be used for the best possible accuracy.) Then perform a CAMAC write to the selected channel with all bits off. Monitor the voltage across the 10 ohm resistor with a quality volt meter and adjust the "Offset" potentiometer of that channel until the voltage is exactly .04000 volts.

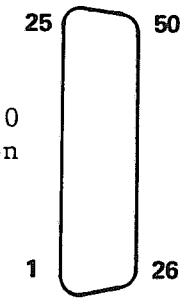
Gain Adjustment: Calibration of the gain adjustment is similar to the offset adjustment. The difference is that the CAMAC write should be with all bits on. Adjust the "Gain" potentiometer of that channel until the voltage across the 10 ohm resistor is exactly .20000 volts.

Bridge Balance: This potentiometer is used to eliminate any possible errors in the voltage to current circuitry due to component tolerances. (This potentiometer is factory adjusted only.)



Watchdog Strap - Selection	
Time	Strap Position
1 Sec	A
10 Sec	B
100 Sec	C
Disable	D

FIGURE 1: COMPONENT LAYOUT



FACE VIEW

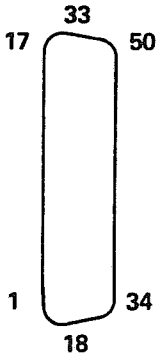
Model 3120
A1A Option

Pin/Wire List

50 PIN RIBBON CONN.

PIN NO.		PIN NO.	
25		50	
24		49	
23		48	
22		47	
21		46	
20		45	
19		44	
18		43	
17		42	
16		41	
15		40	
14		39	
13		38	
12		37	
11		36	
10		35	
9		34	
8	Channel 8 Signal	33	Channel 8 Return
7	Channel 7 Signal	32	Channel 7 Return
6	Channel 6 Signal	31	Channel 6 Return
5	Channel 5 Signal	30	Channel 5 Return
4	Channel 4 Signal	29	Channel 4 Return
3	Channel 3 Signal	28	Channel 3 Return
2	Channel 2 Signal	27	Channel 2 Return
1	Channel 1 Signal	26	Channel 1 Return

Model 3120
EIA Option



FACE VIEW

Pin/Wire List

50 PIN 'D'

PIN NO.		
17	Channel 8	Return
16	Channel 8	Signal
15	Channel 7	Return
14	Channel 7	Signal
13	Channel 6	Return
12	Channel 6	Signal
11	Channel 5	Return
10	Channel 5	Signal
9	Channel 4	Return
8	Channel 4	Signal
7	Channel 3	Return
6	Channel 3	Signal
5	Channel 2	Return
4	Channel 2	Signal
3	Channel 1	Return
2	Channel 1	Signal
1		

PIN NO.	
33	
32	
31	
30	
29	
28	
27	
26	
25	
24	
23	
22	
21	
20	
19	
18	

PIN NO.	
50	
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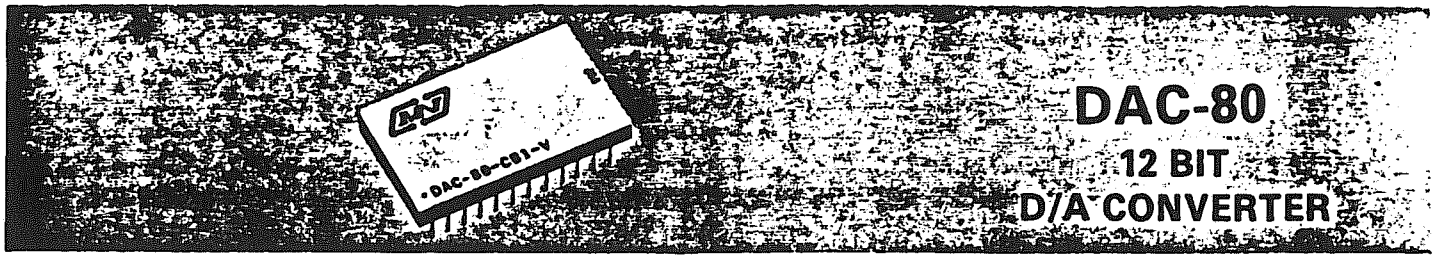


DESCRIPTION

The DAC-80 is a low-cost, 12-bit digital-to-analog converter that combines high performance with the compactness of a 24-pin, dual in-line package. Four versions—two current output and two voltage output are offered.

Highly stable, thin-film resistors ensure maximum accuracy and minimum drifts. Worst case linearity errors are guaranteed to be less than ±0.012% (±1/2 LSB) and gain drift is less than 30 ppm/°C.

Fast settling current switches provide settling times, to ±0.01% (±1/2LSB), of 300 nanoseconds for the current output models and three microseconds for the voltage output models.

Both current and voltage output models of the DAC-80 are available with either complementary binary or three-digit complementary binary coded decimal (BCD) input. Each device contains laser trimmed, precision nichrome resistors matched for low drift that provide user selectable bipolar output ranges of ±2.5, ±5, and ±10 volts and unipolar ranges of 0 to +5 and 0 to +10 volts for voltage models. Output current ranges are either ±1 mA or 0 to −2 mA.

The DAC-80 is supplied fully trimmed, including zero and gain. Although all models are ready to use without further adjustments, gain and zero adjustment points are accessible.

Designed to be a low-cost, physically small alternative to current digital-to-analog converters, the DAC-80 is ideally suited for use in small instruments, medical equipment, industrial and process control systems, computer I/O equipment, and general mini/microcomputer interface applications.

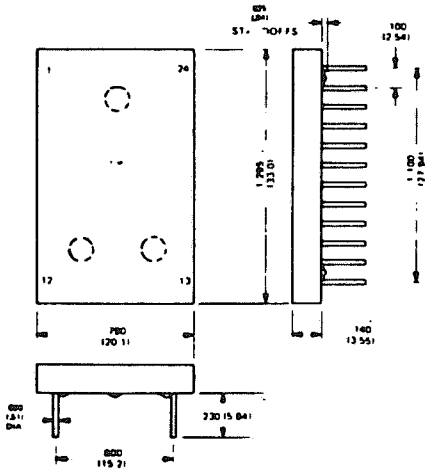
The Micro Networks DAC-80 is now dual sourced, meeting requirements for multiple source procurement.

FEATURES

- Low Cost
- ±½LSB linearity, worst case
- Complete
  - Internal Reference Supply
  - Internal Output Operational Amplifier (Voltage Models)
- Small
  - 24 Pin Hermetically Sealed, Dual-In-Line Package
- Fast Settling
  - 300 nsec to ±0.01% (Current Model)
  - 3 μsec to ±0.01% (Voltage Model)
- Versatile
  - 5 User Selectable Output Ranges (Voltage Models)

APPLICATIONS

- Medical Instrumentation
- Computer I/O Equipment
- Machine Control



Outline dimensions in inches (and millimeters).

Micro Networks Corporation
324 Clark Street, Worcester, Massachusetts 01606 Telephone 617 852-5400 TWX 710-340-0067

SPECIFICATIONS (TYPICAL AT T_A = 25°C, SUPPLY VOLTAGES ±15V, +5V UNLESS OTHERWISE NOTED)

	CBI (Binary)	CCD (Decimal)	UNITS
ACCURACY			
Linearity Error	±½ Max	±¼ Max	LSB
Differential Linearity Error	±½	±½	LSB
Gain Error (Note 1)	±0.1	±0.1	% of FSR (Note 2)
Offset Error (Note 1)	±0.05	±0.05	% of FSR
Minimum Temperature Range for Guaranteed Monotonicity	0 to +70	0 to +70	°C
DRIFT (0°C to +70°C) (Note 4)			
Gain	±30 Max	±30 Max	ppm/°C
Gain, External Reference	±15 Max	±15 Max	ppm/°C
Offset, Unipolar	±1	±1	ppm of FSR/°C
Offset, Bipolar	±15 Max	±15 Max	ppm of FSR/°C
Differential Linearity	±2	±2	ppm/°C
Linearity Error	±½ Max	±½ Max	LSB
SETTLING TIME			
Voltage Models			
Settling Time to ±0.01% of FSR			
For FSR change with 10kΩ Feedback	5	5	μsec
For FSR change with 5kΩ Feedback	3	3	μsec
For 1 LSB change	1.5	1.5	μsec
Slew Rate	20	20	V/μsec
Current Models			
Settling Time to ±0.01%			
For FSR change 10 to 100Ω Load	300	300	nsec
For FSR change 1kΩ Load	1	1	μsec
ANALOG OUTPUT			
Voltage Models			
Output Current, Min. (Note 3)	±5	+5	mA
Output Impedance (DC)	0.05	0.05	Ω
Current Models (Note 4)			
Output Impedance, Bipolar	4.4		kΩ
Output Impedance, Unipolar	15	15	kΩ
Compliance	±2.5	±2.5	Volts
INTERNAL REFERENCE			
Output Voltage	6.3	6.3	Volts
Maximum Current Loading	200	200	μA
Tempco of Drift	±20 Max	±20 Max	ppm/°C
LOGIC INPUT			
"1" Input Voltage	+2 Min	+2 Min	Volts
"0" Input Voltage	+.8 Max	+.8 Max	Volts
"0" Input Current	−1	−1	mA
"1" Input Current	+40	+40	μA
POWER SUPPLY REQUIREMENTS			
Power Supply Rejection (+15V Supply)	±0.02	±0.02	% of FSR/% Supply
Power Supply Rejection (−15V and +5V Supply)	±0.002	±0.002	% of FSR/% Supply
Range of Power Supplies (Note 5)	±14 to ±16 and +4.75 to +16	±14 to ±16 and +4.75 to +16	Volts
Current Drains +15V Supply	25	25	mA
−15V Supply	25	25	mA
+5V Supply	20	20	mA
Power Consumption	850	850	mW

Note 1. Adjustable to zero with external trim.
Note 2. FSR means "Full Scale Range" and is 20V for ±10V range, 10V for ±5V Range, etc.
Note 3. Short circuit protected to ground or either power supply.
Note 4. To maintain drift specifications, internal feedback resistors must be used for current models.
Note 5. +5V supply input may be connected to +15V. This will increase power consumption by 200 MW.

ABSOLUTE MAXIMUM RATINGS

Storage Temperature Range	−55 to +125°C
Operating Temperature	−25 to +85°C
Output Load Current (Note 3) (Voltage Models)	5 mA
Supply Voltage	
Pin 22 ($+V_{cc}$)	+18V
Pin 14 ($-V_{cc}$)	−18V
Pin 13 (Logic)	+18V
Logic Inputs	+5.5V

MODEL SELECTION

Part Number	Output Code (See Notes Below)
DAC-80-CBI-V	Binary Coded, Voltage Output
DAC-80-CCD-V	Binary Coded Decimal, Voltage Output
DAC-80-CBI-I	Binary Coded, Current Output
DAC-80-CCD-I	Binary Coded Decimal, Current Output

NOTES:

Binary codes are Complementary Binary and Complementary Offset Binary.
BCD codes are Complementary Binary Coded Decimal.

MODEL SELECTION — **OUTPUT MODE AND RANGE**

Input Coding	Input Data	Voltage Output (Volts)					Current Output (mA)	
Model CBI	000000000000	4.9988	9.9976	2.4988	4.9976	9.9951	−1.9995	−0.9995
Complementary/	011111111111	2.5000	5.0000	0.0000	0.0000	0.0000	−1.0000	0.0000
Complementary	100000000000	2.4988	4.9976	−0.0012	−0.0024	0.0049	−0.9995	0.0005
Offset Binary	111111111111	0.0000	0.0000	−2.5000	−5.0000	−10.0000	0.0000	1.0000
Model CCD	011001100110	N/A	9.990	N/A	N/A	N/A	−1.2488	N/A
Complementary	011001101111	N/A	9.900	N/A	N/A	N/A	−1.2375	N/A
3 Digit Binary	011011111111	N/A	9.000	N/A	N/A	N/A	−1.1250	N/A
Coded Decimal	111111111111	N/A	0.000	N/A	N/A	N/A	0.0000	N/A
	000000000000	N/A	N/A	N/A	N/A	N/A	−2.2000	N/A

EXTERNAL OFFSET AND GAIN ADJUSTMENTS

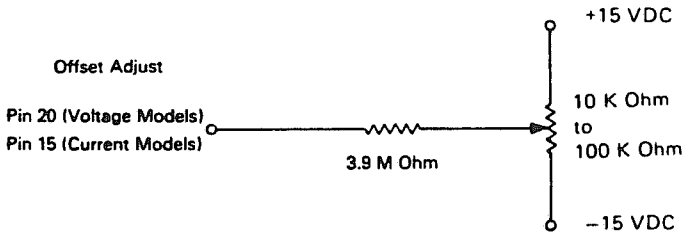
Although both the offset and gain are internally trimmed at the factory, the user has the option of adjusting both offset and gain. The 3.9 megohm and 33 megohm resistors shown below for these adjustments should be located close to the converter input in order to minimize noise pickup.

OFFSET ADJUSTMENT

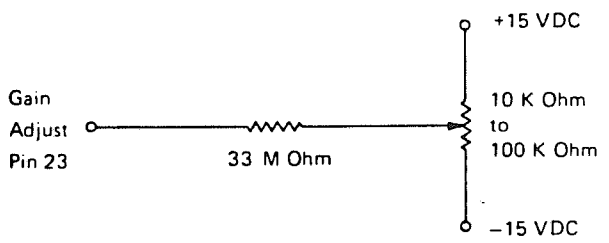
Set all input bits at logic "1." Adjust the offset potentiometer for 0 Volts output if operation is unipolar, or negative full scale voltage if operation is bipolar.

GAIN ADJUSTMENT

Set all input bits to logic "0." Adjust the gain potentiometer for positive full scale voltage.

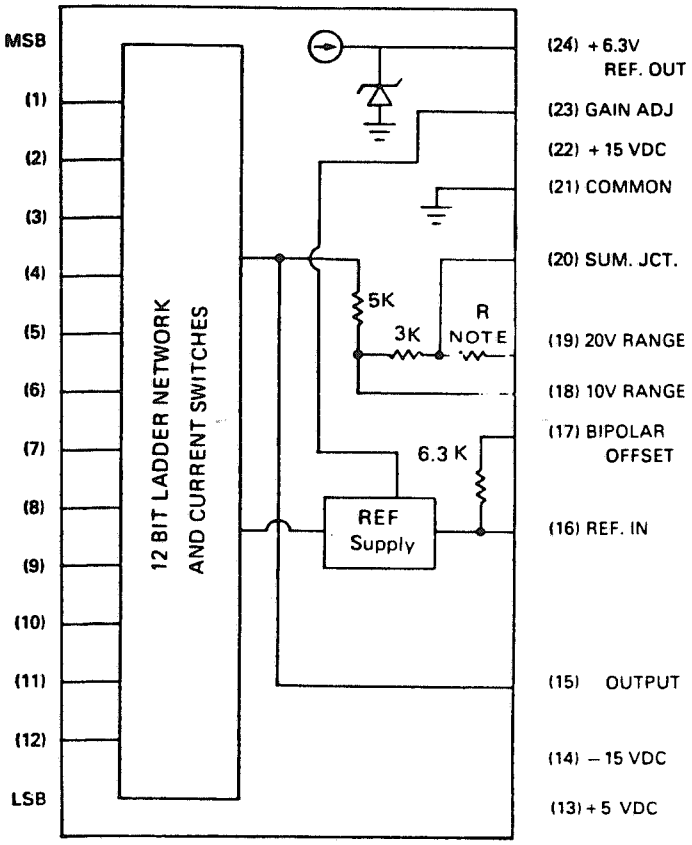


RANGE OF ADJUSTMENT ±.2%



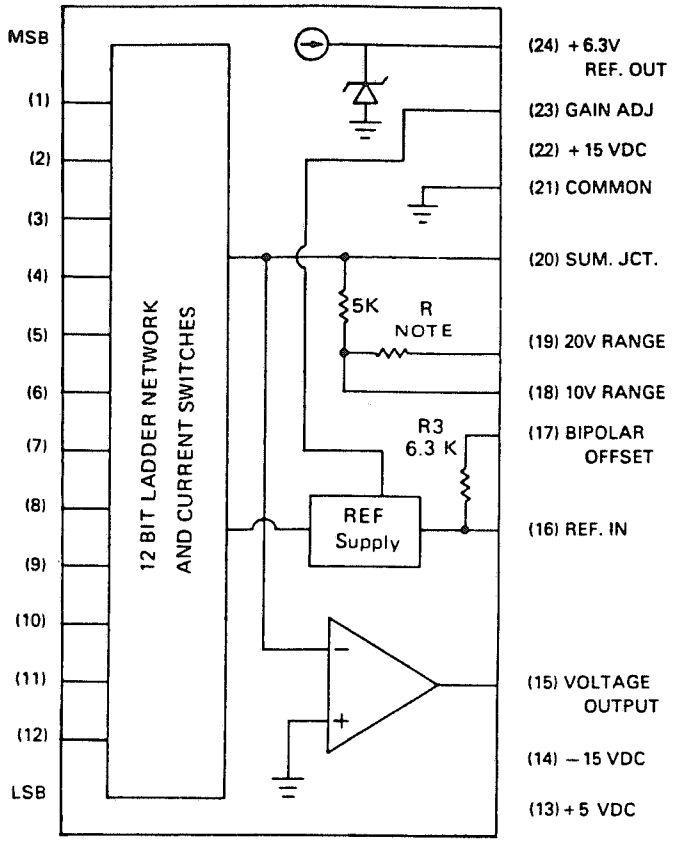
RANGE OF ADJUSTMENT ±.3%

CURRENT OUTPUT



Note: For CBI version R is 2K. For CCD version R is 0 and pins 17 and 20 are not connected.

VOLTAGE OUTPUT



Note: R equals 5K for CBI, 3K for CCD.

Two models of the DAC-80 are available with current output. The binary model (CBI) has an output current of 0 to −2 mA or ±1 mA shunted by 15kΩ. The decimal model (CCD) has an output current of 0 to −1.25 mA shunted by 15.6kΩ. Both models have internal feedback resistors to provide the same output voltage ranges as the voltage models when used with an external operational amplifier. If desired, the current output models can be terminated directly with a resistive load (R_L) to provide a voltage output over a range of ±2.5 V. For both models, the full scale outputs will be as follows:

$$Vo(CBI) = -2mA\frac{(15k\Omega \times R_L)}{15k\Omega + R_L}$$

$$Vo(CCD) = \pm 1.25mA\frac{(15.6k\Omega \times R_L)}{(15.6k\Omega + R_L)}$$

In order to obtain the best temperature tracking characteristics, it is suggested that the bulk of the load resistor be made up by paralleling the internal feedback resistors. For example, paralleling the 5k, 3k and 2k resistors gives an equivalent impedance of 968. This impedance in series with an external 105Ω resistor yields a voltage range of 0 to −2 V. External resistors should be good quality metal-film types with a maximum of 100 ppm/°C temperature coefficient.

OUTPUT RANGE CONNECTIONS

	Output Range	Connect Pin 15 to	Connect Pin 17 to	Connect Pin 19 to	Connect Pin 16 to
CBI	±10V	19	20	15	24
	±5V	18	20	N.C.	24
	±2.5V	18	20	20	24
	0 to +10V	18	21	N.C.	24
	0 to +5V	18	21	20	24
	±1mA	17	15	N.C.	24
	0 to −2mA	N.C.	GND	N.C.	24
CCD	0 to +10V	19	21	15	24
	0 to −1.25mA	N.C.	21	N.C.	24

WARRANTY

KineticSystems Company, LLC warrants its standard hardware products to be free of defects in workmanship and materials for a period of one year from the date of shipment to the original end user. Software products manufactured by KineticSystems are warranted to conform to the Software Product Description (SPD) applicable at the time of purchase for a period of ninety days from the date of shipment to the original end user. Products purchased for resale by KineticSystems carry the original equipment manufacturer's warranty.

KineticSystems will, at its option, either repair or replace products that prove to be defective in materials or workmanship during the warranty period.

Transportation charges for shipping products to KineticSystems shall be prepaid by the purchaser, while charges for returning the repaired warranty product to the purchaser, if located in the United States, shall be paid by KineticSystems. Return shipment will be made by UPS, where available, unless the purchaser requests a premium method of shipment at their expense. The selected carrier shall not be construed to be the agent of KineticSystems, nor will KineticSystems assume any liability in connection with the services provided by the carrier.

The product warranty may vary outside the United States and does not include shipping, customs clearance, or any other charges. Consult your local authorized representative or reseller for more information regarding specific warranty coverage and shipping details.

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Products will not be accepted for credit or exchange without the prior written approval of KineticSystems. If it is necessary to return a product for repair, replacement or exchange, a Return Authorization (RA) Number must first be obtained from the Repair Service Center prior to shipping the product to KineticSystems. The following steps should be taken before returning any product:

1. Contact KineticSystems and discuss the problem with a Technical Service Engineer.
2. Obtain a Return Authorization (RA) Number.
3. Initiate a purchase order for the estimated repair charge if the product is out of warranty.
4. Include a description of the problem and your technical contact person with the product.
5. Ship the product prepaid with the RA Number marked on the outside of the package to:

KineticSystems Company, LLC
Repair Service Center
900 North State Street
Lockport, IL 60441

Telephone: (815) 838-0005
Facsimile: (815) 838-4424
Email: tech-serv@kscorp.com