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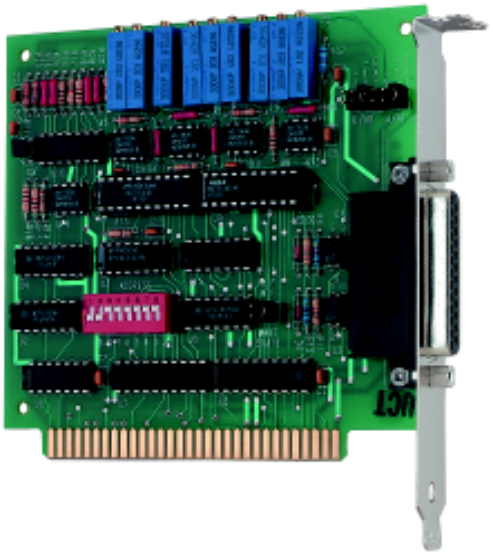
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CIO-DAC02

2 Channel 12 Bit Digital To Analog Voltage or 4-20 mA Output



DESCRIPTION

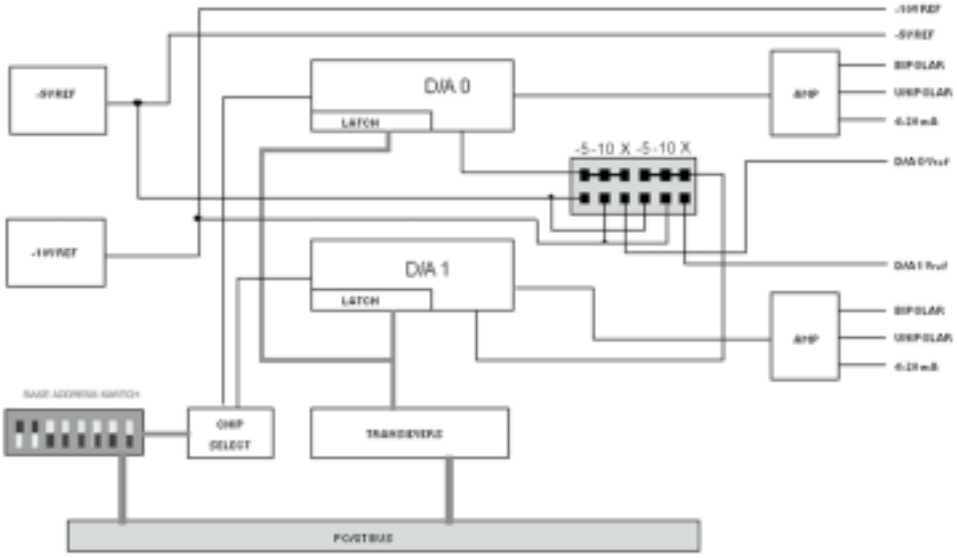
The CIO-DAC02 is a versatile analog output plug in board which may be used to control voltage devices with ranges of 0-5, 0-10, +/-5, and +/-10 volts. In addition, 4-20 mA loops may be controlled directly with no additional circuitry.

Each analog output is controlled by a precision 12 bit digital to analog (D/A) converter. A 12 bit converter provides 1/4096 parts resolution. On a scale of 0-5 volts, output can be controlled to within 1.22mV.

The D/A converter's output range may also be controlled by providing an external DC or AC reference voltage. The D/As are multiplying type and the output range is equal to the reference voltage and of the opposite sign. A -5V Ref = 0 to +5V output. The CIO-DAC02 is easy to program from any language using port output commands. Each D/A occupies two 8 bit addresses for a total of 4 for the board. The output of the D/A is updated whenever the MSB is written, a technique known as double buffering.

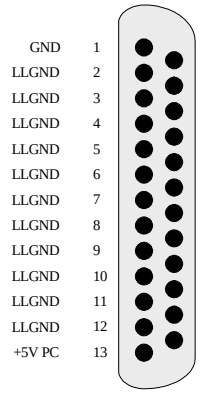
The CIO-DAC02 is provided with software for calibration and test and supported by Universal Library and VI COMponents high level language programming libraries as well as the menu driven Control-CB, Labtech Notebook and other third party software.

CIO-DAC02 BLOCK DIAGRAM



CONNECTOR

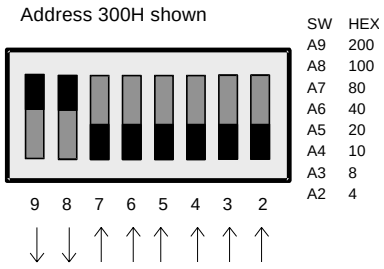
The CIO-DAC02 uses a 25 pin connector (CFM25-2). A mating connector kit, the DFCON25 may be purchases separately.



GND	1	14	-10 REF OUT
LLGND	2	15	-5V REF OUT
LLGND	3	16	D/A 1 VREF
LLGND	4	17	D/A 1 BIPOLAR
LLGND	5	18	D/A 1 UNIPOLAR
LLGND	6	19	D/A 1 4-20 mA
LLGND	7	20	-10 V REF OUT
LLGND	8	21	-5V REF OUT
LLGND	9	22	D/A 0 VREF
LLGND	10	23	D/A 0 BIPOLAR
LLGND	11	24	D/A 0 UNIPOLAR
LLGND	12	25	D/A 0 4-20 mA
+5V PC	13		

BASE ADDRESS SWITCH

The CIO-DAC02 address is set by an 8 position dip switch located on the board. The dip switch allows the CIO-DAC02 to be located at any address on a 4 bit boundary.



I/O PORT MAP

The CIO-DAC02 occupies four consecutive I/O ports in the PC's I/O address space, beginning with the board's base address.

Base Address	+0	D/A0	Low Byte
	+1	D/A0	High Byte
	+2	D/A1	Low Byte
	+3	D/A1	High Byte

D/A PORT DATA FORMAT

Each D/A is controlled by data written to two I/O ports. The format of the data is the same for each D/A.

LSB	D7	D6	D5	D4	D3	D2	D1	D0
	B9	B10	B11	B12	X	X	X	X
MSB	D7	D6	D5	D4	D3	D2	D1	D0
	B1	B2	B3	B4	B5	B6	B7	B8

PROGRAMMING THE CIO-DAC02

The CIO-DAC02 is easily programmed from any language which supports output to I/O ports. Each D/A occupies two 8 bit addresses, for example , D/A0 occupies the addresses at the board's base address (LSB), and base + 1 (MSB). To output a voltage with the CIO-DAC02, the desired voltage output must first be split into the LSB and MSB then written to the ports.

```
VOLTAGE = 2.25                      'Desired output voltage is 2.25V
CODE = VOLTAGE / 0.00122            'Convert volts to bits, 0-5V FS
MSB = INT(CODE / 16)                'Find MSB
LSB = INT(CODE - MSB * 16)          'Find LSB
LSB = LSB * 16                      'Shift LSB 4 places left
60 OUT &H300, LSB%                  'Output LSB, D/A unchanged.
70 OUT &H301, MSB%                  'Output MSB, D/A now = 2.25V
```

This simple BASIC example can be directly translated to any other language, such as C or TURBO PASCAL.

SOFTWARE

The CIO-DAC02 is supported by:

Universal Library
Control CB
LabTech Notebook

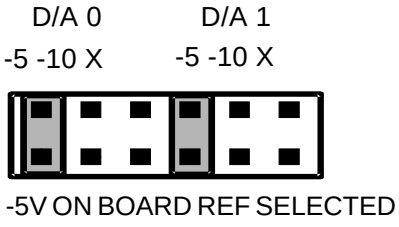
Any Language with Port Output

Any software which supports the MetraByte DAC-02 automatically supports the CIO-DAC02.

SETTING OUTPUT RANGES

The output range of the CIO-DAC02 may be set by placing shorting blocks on the jumpers provided on board or by connecting the several reference voltage outputs to the D/A Vref input at the 25 pin D connector.

The output range jumper block is shown here. One of the ranges provided may be selected or the jumper may be placed in the X position if an external reference will be provided.



Once the reference voltage is chosen, the output of the D/A is available on three of the 25 pin connector's output pins. The three outputs are Unipolar, Bipolar and Current.

V Ref	Unipolar	Bipolar	Current
-5	0 to 5V	+/-5V	4-20mA
-10	0 to 10V	+/-10V	
Ext.	2 Quadrant	4 Quadrant	

Once the output range is chosen the voltage or current output is controlled by writing a value between 0 and 4095 to the D/A converter. The relationship of the D/A digital data to the voltage output is different for unipolar and bipolar ranges.

A 0 D/A value corresponds to 0 volts unipolar and +full scale (+FS) bipolar. A 4095 D/A value corresponds to +FS unipolar and -FS bipolar. The following table applies for Vref = -5V

D/A Value	Unipolar	Bipolar
0	0.0V	+5.0V
2048	2.5V	0.0V
4095	5.0V	-5.0V

ORDERING GUIDE

2 channel, 12 bit analog output plug in board	CIO-DAC02
Connector kit for constructing a cable	DMCON-25
25 Conductor or cable	CFM25-2
Screw Terminal	CIO-MINI25

SPECIFICATIONS

CHANNELS	2
Resolution	12 bits, 1 part in 4096
Relative accuracy	1/2 LSB 0.01% Max.
Differential Linearity	1/2 LSB Max.
On-board reference ranges	0 to 5V, 0 to 10V +/-5V, +/-10V 4-20mA current loop
External reference voltage	+/-10 Max
Voltage output impedance	< 0.1 ohm Max.
V output drive current	+/-5 mA Min.
4-20 mA compliance	8-36 V
Settling time, full scale step	150 uS to 0.001% typ.
Power Consumption	5V @ 300 mA Max. +/-12V @ 25/35mA Max.

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