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MODEL D/A-06A

USER MANUAL

FILE: MDA06A.E2b

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Table of Contents

Notice . . . . . **iii**
Warranty . . . . . **ii**

Chapter 1: Introduction **1-1**
Specifications 1-2

Chapter 2: Installation **2-1**
CD Installation 2-1
3.5-Inch Diskette Installation 2-1
Directories Created on the Hard Disk 2-2
Installing the Card 2-4

Chapter 3: Option Selection **3-1**
Analog Output Mode, Voltage or Current 3-1
Analog Output Update Mode 3-3

Chapter 4: Address Selection **4-1**

Chapter 5: Programming **5-1**

Chapter 6: Software **6-1**
Setup Program 6-1
Programming the D/A-06A 6-1

Chapter 7: Calibration **7-1**

Chapter 8: Connector Pin Assignments **8-1**

Appendix A: PPI Data Sheets **A-1**

List of Figures

Figure 1-1: D/A-06A Block Diagram 1-4
Figure 3-2: D/A-06A Option Selection Map 3-4

List of Tables

Table 3-1: Selecting Voltage Range 3-1
Table 3-2: Selecting Current Range 3-2
Table 4-1: Standard Address Assignments for PC and PC/XT Computers 4-1
Table 4-2: Standard Address Assignments for 286/386/486 Computers 4-2
Table 4-3: Example of Address Selection 4-3
Table 5-1: D/A-06A I/O Address Map 5-1
Table 8-1: Connector Pin Assignments 8-1

Chapter 1: Introduction

The D/A-06A is a full-size card that can be installed in long slots of PC/XT/AT class computers. It contains six digital-to-analog converters (DAC) and twenty-four programmable digital I/O channels. Each analog output channel can be independently configured for voltage ranges of:

0V to +5V
0V to +10V
-2.5V to +2.5V
-5V to +5V
-10V to +10V

Or for current ranges of:

1mA to 5mA
4mA to 20mA

With the addition of one resistor per channel the analog outputs can also be configured for a current range of 0mA to 50mA.

All analog output channels have double-buffered inputs for single-step update and each is addressed at its own I/O location. Analog output channels can be user-selected to provide simultaneous updating by either software or external signal. That updating is user-assignable in pairs of channels or all DAC channels can be updated simultaneously.

Digital I/O channels are provided from a type 8255 Programmable Peripheral Interface chip (PPI). The 8255 PPI is a general purpose programmable I/O device. It provides 24 bits of digital I/O and may be programmed for three major modes of operation.

In MODE 0 each group of 24 I/O pins may be programmed to be input or output in sets of eight for ports A and B and in sets of four for port C. In MODE 1, each group may be programmed to have eight lines of input or output. Of the remaining four pins, three are used for handshaking and interrupt control signals. In MODE 2, eight lines are used for bi-directional bus and five lines are used for handshaking. A detailed description of the 8255 PPI is contained in Appendix A.

Specifications

Analog Outputs

- Resolution: 12 bits (0 to 4095 decimal)
- Channels: Six
- Voltage Output Ranges at 5mA max.:

  0.0 to 5.0 VDC
  0.0 to 10.0 VDC
  -2.5 to +2.5 VDC
  -5.0 to +5.0 VDC
  -10.0 to +10.0 VDC
- Current Output Ranges with excitation voltage (8 - 36) VDC:

  1 to 5 mA
  4 to 20 mA
  0 to 50 mA *
  *:Addition of one 167 ohm resistor per
  channel is required. See Chapter 3, Option Selection.

Digital to Analog Converter

- AD-7537 monolithic chip, double buffered, right justified.
- Data Format: Right-justified, two bytes (8LSB's and 4MSB's).
- Relative Accuracy: +/- 1 LSB (includes nonlinearity).
- Monotonicity: Guaranteed over operating temperature range.
- Settling time: 4 usec to 0.01% for full scale step input.
- Offset Temperature Drift:

  +/- 1 ppm/ °C. typ.
  +/- 3 ppm/ °C. max.
- Gain Temperature Drift:

  +/- 1 ppm/ °C. typ.
  +/- 5 ppm/ °C. max.

Digital Inputs/Outputs

- 24 programmable digital input/ output lines. (Ports A, B, C lo, and C hi).
- 8255 PPI Controller. All modes supported.
- Inputs TTL, DTL, CMOS compatible:

  Logic Low: -0.5V to +0.8V.
  Logic High: +2.0V to +5.0V.
  Load Current: 10 uA.
- Outputs TTL, DTL, CMOS compatible:

  Logic Low: 0.45V max. at 1.7mA sink current.
  Logic High: 2.4V min. at -200uA source current.
  1.5V min. at -1mA source current (Darlington drive not available from Port A).

Power Requirements

- +5 VDC at 500mA max.
- +12 VDC at 70mA max.
- -12 VDC at 60mA max.

Environmental

- Operating Temperature: 0 °C. to +60 °C.
- Storage Temperature: -20 °C. to +85 °C.
- Humidity: 5% to 95% non condensing.
- Size: 13.375 inches. Install in a full-size slot.

Figure 1-1: D/A-06A Block Diagram

Chapter 2: Installation

The software provided with this card is contained on either one CD or multiple diskettes and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your software format and operating system. Substitute the appropriate drive letter for your CD-ROM or disk drive where you see d: or a: respectively in the examples below.

CD Installation

DOS/WIN3.x

1. Place the CD into your CD-ROM drive.
2. Type d:K to change the active drive to the CD-ROM drive.
3. Type installK to run the install program.
4. Follow the on-screen prompts to install the software for this card.

WIN95/98/NT

a. Place the CD into your CD-ROM drive.
b. The CD should automatically run the install program after 30 seconds. If the install program does not run, click START | RUN and type d:install, click OK or press K.
c. Follow the on-screen prompts to install the software for this card.

3.5-Inch Diskette Installation

As with any software package, you should make backup copies for everyday use and store your original master diskettes in a safe location. The easiest way to make a backup copy is to use the DOS DISKCOPY utility.

In a single-drive system, the command is:

diskcopy a: a:K

You will need to swap disks as requested by the system.
In a two-disk system, the command is:

diskcopy a: b:K

This will copy the contents of the master disk in drive A to the backup disk in drive B.

To copy the files on the master diskette to your hard disk, perform the following steps.

1. Place the master diskette into a floppy drive.
2. Change the active drive to the drive that has the diskette installed. For example, if the diskette is in drive A, type a:K.
3. Type installK and follow the on-screen prompts.

Directories Created on the Hard Disk

The installation process will create several directories on your hard disk. If you accept the installation defaults, the following structure will exist.

[CARDNAME]

Root or base directory containing the SETUP.EXE setup program used to help you configure jumpers and calibrate the card.

DOS\PSAMPLES: A subdirectory of [CARDNAME] that contains Pascal samples.
DOS\CSAMPLES: A subdirectory of [CARDNAME] that contains "C" samples.
Win32\language: Subdirectories containing samples for Win95/98 and NT.

WinRisc.exe

A Windows dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem.

ACCES32

This directory contains the Windows 95/98/NT driver used to provide access to the hardware registers when writing 32-bit Windows software. Several samples are provided in a variety of languages to demonstrate how to use this driver. The DLL provides four functions (InPortB, OutPortB, InPort, and OutPort) to access the hardware.

This directory also contains the device driver for Windows NT, ACCESNT.SYS. This device driver provides register-level hardware access in Windows NT. Two methods of using the driver are available, through ACCES32.DLL (recommended) and through the DeviceIOControl handles provided by ACCESNT.SYS (slightly faster).

SAMPLES

Samples for using ACCES32.DLL are provided in this directory. Using this DLL not only makes the hardware programming easier (MUCH easier), but also one source file can be used for both Windows 95/98 and WindowsNT. One executable can run under both operating systems and still have full access to the hardware registers. The DLL is used exactly like any other DLL, so it is compatible with any language capable of using 32-bit DLLs. Consult the manuals provided with your language's compiler for information on using DLLs in your specific environment.

VBACCES

This directory contains sixteen-bit DLL drivers for use with VisualBASIC 3.0 and Windows 3.1 only. These drivers provide four functions, similar to the ACCES32.DLL. However, this DLL is only compatible with 16-bit executables. Migration from 16-bit to 32-bit is simplified because of the similarity between VBACCES and ACCES32.

PCI

This directory contains PCI-bus specific programs and information. If you are not using a PCI card, this directory will not be installed.

SOURCE

A utility program is provided with source code you can use to determine allocated resources at run-time from your own programs in DOS.

PCIFind.exe

A utility for DOS and Windows to determine what base addresses and IRQs are allocated to installed PCI cards. This program runs two versions, depending on the operating system. Windows 95/98/NT displays a GUI interface, and modifies the registry. When run from DOS or Windows3.x, a text interface is used. For information about the format of the registry key, consult the card-specific samples provided with the hardware. In Windows NT, NTioPCI.SYS runs each time the computer is booted, thereby refreshing the registry as PCI hardware is added or removed. In Windows 95/98/NT PCIFind.EXE places itself in the boot-sequence of the OS to refresh the registry on each power-up.

This program also provides some COM configuration when used with PCI COM ports. Specifically, it will configure compatible COM cards for IRQ sharing and multiple port issues.

WIN32IRQ

This directory provides a generic interface for IRQ handling in Windows 95/98/NT. Source code is provided for the driver, greatly simplifying the creation of custom drivers for specific needs. Samples are provided to demonstrate the use of the generic driver. Note that the use of IRQs in near-real-time data acquisition programs requires multi-threaded application programming techniques and must be considered an intermediate to advanced programming topic. Delphi, C++ Builder, and Visual C++ samples are provided.

Findbase.exe

DOS utility to determine an available base address for ISA bus , non-Plug-n-Play cards. Run this program once, before the hardware is installed in the computer, to determine an available address to give the card. Once the address has been determined, run the setup program provided with the hardware to see instructions on setting the address switch and various option selections.

Poly.exe

A generic utility to convert a table of data into an nth order polynomial. Useful for calculating linearization polynomial coefficients for thermocouples and other non-linear sensors.

Risc.bat

A batch file demonstrating the command line parameters of RISCTerm.exe.

RISCTerm.exe

A dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem. RISCTerm stands for Really Incredibly Simple Communications TERMinal.

Installing the Card

Before carefully read the chapters on Address Selection and Option Selection of this manual and configure the card according to your requirements. Use the FINDBASE program provided with the card to select the base address for the card. Use the program called SETUP to select other options such as ranges, update mode, etc.

Be especially careful with address selection. If the addresses of two installed functions overlap, you will experience unpredictable computer behavior.

To Install the Card

1. Remove power from the computer.
2. Remove the computer cover.
3. Remove blank I/O backplate.
4. Install jumpers for selected options. See Option Selection, Chapter 3.
5. Select the base address on the card. See Address Selection, Chapter 4.
6. Install the card in an I/O expansion slot. Important: Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.
7. Inspect for proper fit of the card and cables and tighten screws.
8. Replace the computer cover.

To ensure that there is minimum susceptibility to EMI and minimum radiation, it is important that there be a positive chassis ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the I/O connector, twisted-pair wiring, and, in extreme cases, ferrite level of EMI protection) must be used for input/output wiring.

CE-marked versions of D/A-06A meet the requirements of EN50081-1:1992 (Emissions), EN50082-1:1992 (Immunity), and EN60950:1992 (Safety).

Chapter 3: Option Selection

Refer to the Block Diagram and Option Selection Map when reading this section. Card operation is determined by jumper installation and switch settings as described in the following paragraphs.

Analog Output Mode, Voltage or Current

Each analog output channel can be configured as a voltage or current output by installation of jumpers in locations marked V0 through V5, or I0 through I5.

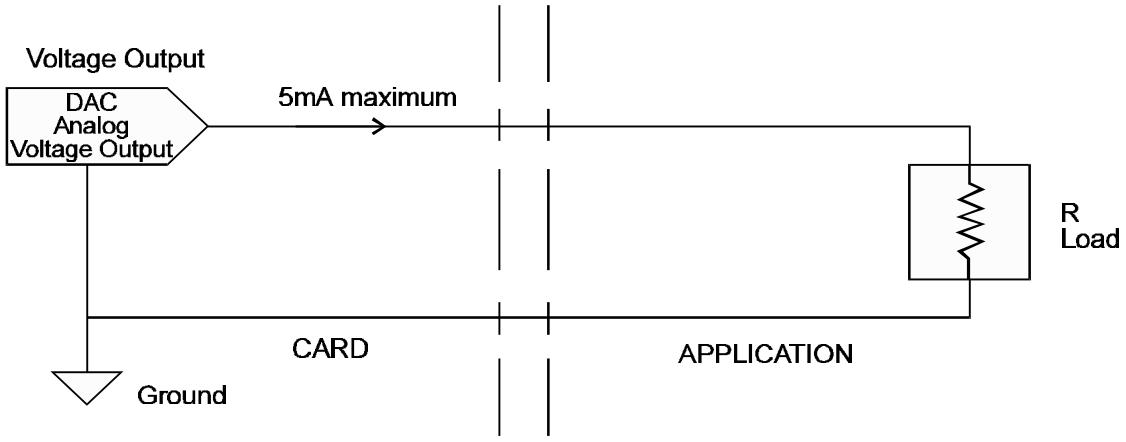
Output Ranges

The output ranges are individually selected for each analog output channel 0 through 5 individually by corresponding switches S0 through S5. The following tables list switch settings for the desired output range.

Analog Output Voltage Range	Switch Position					
	1	2	3	4	5	6
0 to 5V	ON	OFF	OFF	OFF	ON	OFF
0 to 10V	OFF	ON	OFF	OFF	ON	OFF
-2.5 to +2.5V	ON	OFF	OFF	ON	ON	OFF
-5 to +5V	ON	OFF	OFF	ON	OFF	OFF
-10 to +10V	OFF	ON	OFF	ON	OFF	OFF

Table 3-1: Selecting Voltage Range

Jumper in "V" Position



Analog Output Current Range	Switch Position					
	1	2	3	4	5	6
1-5 mA	ON	OFF	ON	OFF	ON	OFF
4-20 mA	ON	OFF	ON	OFF	ON	ON
0-50 mA*	ON	OFF	OFF	OFF	ON	ON

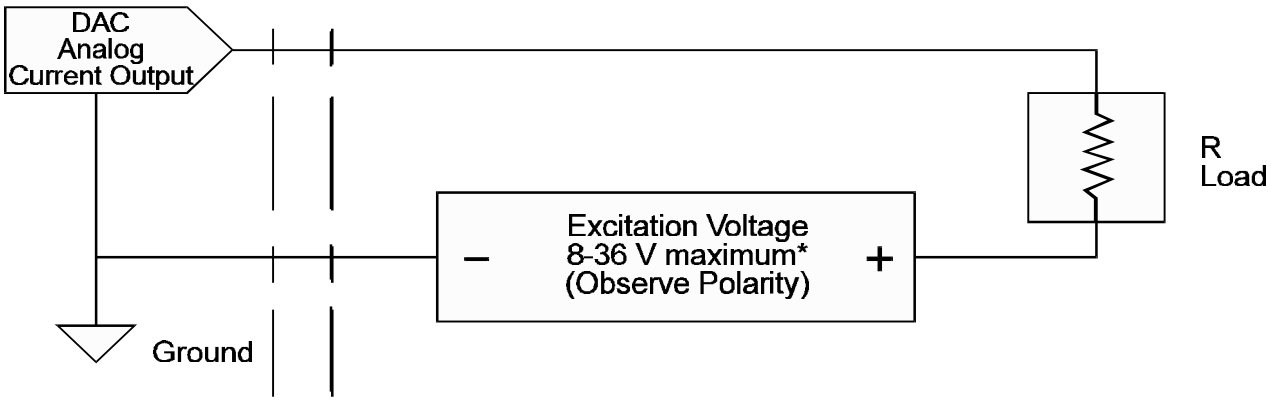
*Signifies option requiring addition of one 118 ohm resistor per channel:

Table 3-2: Selecting Current Range

Add R7a for channel AO0; Add R37a for channel AO3
Add R17a for channel AO1; Add R47a for channel AO4
Add R27a for channel AO2; Add R57a for channel AO5

Jumper in "I" Position

Current Output (Jumpers placed in "5V" Position)



* Excitation Voltage up to 60V is OK on low current ranges. Minimum voltage of 8V must be maintained for correct operation.

Caution

Do not connect current loops to a DAC that is set to voltage mode. The loop supply can cause irreversible damage to the DAC.

Analog Output Update Mode

The analog-output update mode is selected by six-position DIP switch S6. Labels printed alongside the switch facilitate selection. Switches are enabled when placed in the ON position.

Three analog-output update modes are available: (a) Individual update of each channel upon high-byte Write, (b) Simultaneous update of all selected channels upon Read of any digital-to-analog converter address, and (c) Simultaneous update of all selected channels upon receipt of an external signal.

EX1, SM1 Control analog output channels A0 and A1;

EX2, SM2 Control analog output channels A2 and A3;

EX3, SM3 Control analog output channels A4 and A5;

SM Software-directed simultaneous-update mode: update happens on any analog output address read.

EX Update on external pulse or on a low transition. If this update mode is selected, the external signal should be wired to the output connector pins 25, 24, and 23. These pins are allocated to Digital I/O port bits C4,5,6 and will be shared in this mode, which implies that 8255 PPI port C HI should be programmed either as an input or disabled.

The external update can be disabled or enabled by three additional digital I/O lines allocated to port C bits 0,1, and 2. These lines might be controlled externally, or through the 8255 PPI if port C HI is selected as an output.

NONE If switches are de-selected, update will happen automatically on second (high) byte Write to the digital-to-analog converter.

Figure 3-2: D/A-06A Option Selection Map

Chapter 4: Address Selection

Refer to Item 1, "Set Board Address" on the D/A-06A card Setup program provided. The card requires 16 consecutive address locations in I/O space. The starting, or base, address can be selected anywhere within the I/O address range 100-3F0 hex (except 1F0 through 1F8) for AT's and 200 through 3F0 for XT's, providing that the address does not overlap with other functions. If in doubt, refer to the Tables below for a list of standard address assignments. The Base Address Locator program FINDBASE provided on CD will assist you in selecting the base address that will avoid this conflict

Hex Range	Usage
000-00F	DMA Chip 8237A-5
020-021	Interrupt 8259A
040-043	Timer 8253-5
060-063	PPI 8255A-5
080-083	DMA Page Register
0AX	NMI Mask Register
0CX	Reserved
0EX	Reserved
100-1FF	Not Usable
200-20F	Game Control
210-217	Expansion Unit
220-24F	Reserved
278-27F	Reserved
2F0-2F7	Reserved
2F8-2FF	Asynchronous Comm. (Secondary)
300-31F	Prototype Card
320-32F	Fixed Disk
378-37F	Printer
380-38C**	SDLC Communications
380-389**	Binary Synchronous Comm. (Secondary)
3A0-3A9	Binary Synchronous Comm. (Primary)
3B0-3BF	IBM Monochrome Display/Printer
3C0-3CF	Reserved
3D0-3DF	Color/Graphics
3E0-3E7	Reserved
3F0-3F7	Diskette
3F8-3FF	Asynchronous Comm. (Primary)

** These options can not be used together - addresses overlap

Table 4-1: Standard Address Assignments for PC and PC/XT Computers

Hex Range	Usage
000-01F	DMA Controller 1
020-03F	INT Controller 1, Master
040-05F	Timer
060-06F	8042 (Keyboard)
070-07F	Real Time Clock, NMI Mask
080-09F	DMA Page Register
0A0-0BF	INT Controller 2
0C0-0DF	DMA Controller 2
0F0	Clear Math Coprocessor Busy
0F1	Reset Coprocessor
0F8-0FF	Arithmetic Processor
1F0-1F8	Fixed Disk
200-207	Game I/O
278-27F	Parallel Printer Port 2
2F8-2FF	Asynchronous Comm'n (Secondary)
300-31F	Prototype Card
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC or Binary Synchronous Comm'n 2
3A0-3AF	Binary Synchronous Comm'n 1
3B0-3BF	Monochrome Display/Printer
3C0-3CE	Local Area Network
3D0-3DF	Color/Graphic Monitor
3F0-3F7	Floppy Diskette Controller
3F8-3FF	Asynchronous Comm'n (Primary)

Table 4-2: Standard Address Assignments for 286/386/486 Computers

The base address is set by a DIP switch which controls address bits A4 through A9. In order to select the base address, convert the desired address to binary. Then for each "1" of the binary address, set the corresponding DIP switch to OFF, and for each "0" of the binary address set the corresponding switch to ON.

For example, to program a base address of hex 300, DIP switches A9 and A8 are set to the "OFF" position, while switches A7 through A4 are set to the "ON" position.

The following example illustrates this process in detail: In this case, switch selection corresponds to binary 10 1101 xxxx (or hex 2D0). The "xxxx" represents address lines A3, A2, A1, and A0 used on the card to select individual registers. See Chapter 5, Programming.

Address Line Controlled	A9	A8	A7	A6	A5	A4
Switch Label	A9	A8	A7	A6	A5	A4
Setup	OFF	ON	OFF	OFF	ON	OFF
Binary Representation	1	0	1	1	0	1
Conversion Factors	2	1	8	4	2	1
Hex Representation	2		D			

Table 4-3: Example of Address Selection

Review the Address Selection Reference Table carefully before selecting card address. If the addresses of two installed functions overlap, you will experience unpredictable computer behavior.

Chapter 5: Programming

The D/A-06A card uses 16 consecutive I/O addresses. The I/O address map is as follows:

Address	Write	Read
Base Address	AO #0 Low Byte**	Simultaneous Update*
Base Address +1	AO #0 High Byte**	Simultaneous Update*
Base Address +2	AO #1 Low Byte**	Simultaneous Update*
Base Address +3	AO #1 High Byte**	Simultaneous Update*
Base Address +4	AO #2 Low Byte**	Simultaneous Update*
Base Address +5	AO #2 High Byte**	Simultaneous Update*
Base Address +6	AO #3 Low Byte**	Simultaneous Update*
Base Address +7	AO #3 High Byte**	Simultaneous Update*
Base Address +8	AO #4 Low Byte**	Simultaneous Update*
Base Address +9	AO #4 High Byte**	Simultaneous Update*
Base Address +10	AO #5 Low Byte **	Simultaneous Update*
Base Address +11	AO #5 High Byte**	Simultaneous Update*
Base Address +12	Dig. I/O Port A	Dig. I/O Port A
Base Address +13	Dig. I/O Port B	Dig. I/O Port B
Base Address +14	Dig. I/O Port C	Dig. I/O Port C
Base Address +15	Dig. I/O Control***	Illegal

Table 5-1: D/A-06A I/O Address Map

* Analog output pairs selected by Analog Output Update switch will be simultaneously updated. See Chapter 3, Option Selection - Analog Outputs Update.

** Data are written to the digital to analog converter in right-justified format; i.e.,

*** The Digital I/O Control Register is used to select the MODE of operation and to configure the 8255 PPI ports A, B, C HI and C LO.

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

For UNIPOLAR ranges: 0000 0000 0000 = ZERO
1000 0000 0000 = 1/2 SCALE
1111 1111 1111 = FULL SCALE
| |
MSB (or B1) <---- | |----> LSB (or B12)

For BIPOLAR ranges: 0000 0000 0000 = - FULL SCALE
1000 0000 0000 = ZERO
1111 1111 1111 = + FULL SCALE
| |
MSB (or B1) <---- | |----> LSB (or B12)

D7 - Mode set flag
D6, D5 - Mode selection: 00 = Mode 0, 01 = Mode 1, 1X = Mode 2
D4- Port A: 1 = input, 0 = output
D3- Port C upper: 1 = input, 0 = output
D2- Mode selection: 1 = Mode 1, 0 = Mode 0
D1- Port B: 1 = input, 0 = output
D0- Port C lower: 1 = input, 0 = output

For details of 8255 PPI operation, see Appendix A.

Chapter 6: Software

The CD provided with D/A-06A contains a setup and calibration program, sample programs and 16- and 32-bit utility drivers. The first sample program demonstrates how to generate a desired analog voltage output. The second program is more complex. It demonstrates how to generate sine, triangular, and sawtooth waveforms.

Setup Program

The file name of the setup program is SETUP. This program is supplied as a tool for you to use in configuring switches and jumpers on the card. It is menu-driven and provides a picture of the card on the computer monitor to help you locate the switch or jumper locations. You make simple keystrokes to select the functions. The picture on the computer monitor changes to show how the switches or jumpers should be placed to effect your choices.

Programming the D/A-06A

The D/A-06A card is straightforward to program. For example, the following C procedure could be used:

To output an analog value with 12-bit resolution, a corresponding decimal number N between 0 and 4095 is calculated (2^12=4095).

N/4095= V(out)/V(full scale)

Then the number is split between high and low bytes as follows:

```
H= (int)(N/256);
L = N - (H * 256);
```

Next the data are written to the selected analog output channel. (See I/O Address Map.) In this example, we will assume analog output 0 (AO 0) :

```
OUTPORTB (BASE + 0, L);
OUTPORTB (BASE + 1, H);
```

For simplicity it was assumed that the Simultaneous Address Update switch is de-selected. Analog output 0 will change upon Write of high byte to (BASE + 1).

If the Simultaneous Address Update switch is used to select simultaneous software update (SM1,2,3 switches selected), then a Read from any address between BASE and BASE + 11 will cause the output to be updated.

```
A = INPORTB (BASE + 0);
```

If External update is selected by the Simultaneous Address Update switch (EX1,2,3 switches selected), then update will wait for an external low-going transition on I/O connector pin 25 (AO 0 and AO 1), pin 24 (AO 2 and AO 3), and pin 23 (AO 4 and AO 5).

Mixing all update modes is allowed.

Chapter 7: Calibration

Quick and easy calibration of the D/A-06A card can be done by using a menu-driven program on the Board Setup and Calibration CD provided. Calibration is required whenever an analog output range is changed. In addition, periodic calibration of the card is recommended if it is used in extreme environmental conditions. The D/A-06A card uses very stable components but vibration or high/low temperature cycles might result in slight analog output errors.

Factory calibration and periodic calibration of the card includes adjustment of reference voltages +10V, +5V, and -2.5V. However, there is no need to perform that part of the calibration procedure if only changing ranges.

To calibrate the D/A-06A card, run the Setup program and follow the screen prompts.

1. Select the card options and base address and install the card in the computer.
2. Measure the 10V reference voltage at the test point labeled +10V and adjust RP15, the 10-turn potentiometer marked +10V, until the voltage is 10.000 V. You will find a convenient GND test point immediately above U25. (There is no need to perform this step of the calibration procedure when changing ranges.)
3. Measure the +5V reference voltage at the test point labeled +5V and adjust RP14, the potentiometer marked +5V until the voltage is +5.0000 V. (There is no need to perform this step of the calibration procedure when changing ranges.)
4. Measure the -2.5V reference voltage at the test point labeled -2.5V and adjust RP13, the potentiometer marked -2.5V, until the voltage is -2.5000 V. (There is no need to perform this step of the calibration procedure when changing ranges.)
5. Select the DAC channel that you wish to calibrate or change range. Set the appropriate Output Range DIP Switch to the positions indicated by the computer display for the range that you desire. Measure the analog output voltage between the appropriate pin of the I/O Connector and Analog Ground I/O Connector Pin 13.

Channel	I/O Pin
AO 0	18
AO 1	16
AO 2	14
AO 3	12
AO 4	2
AO 5	1

6. Select the "Set Offset" menu item in the computer display. Measure the DAC output voltage and adjust the 15-turn potentiometer marked OFFSET (for that DAC channel) until the output value is at minus full scale (or zero volts if a unipolar range was selected).
7. Select the "Set Gain" menu item in the computer display. Measure the DAC output voltage, and adjust the 15-turn potentiometer marked GAIN (for that DAC channel) until the output value is at plus full scale.
8. Repeat the steps 6 and 7 above to verify calibration.
9. Select the "Check Mid Scale" menu item in the computer, display. Measure the output voltage, and verify that the output value is correct.

Calibration should be done on the range that will be used. No attempt at calibration should be made in noisy locations or with a noisy calibration setup.

Chapter 8: Connector Pin Assignments

The analog and digital I/O signals are connected via a 37 pin D-type connector that extends through the back of the computer case. The mating connector is AMP type 747304-1 or equivalent.

Pin	Name	Function
1	AO5	Analog Output Channel 5
2	AO4	Analog Output Channel 4
3	PB7	Digital I/O Port B Bit 7
4	PB6	Digital I/O Port B Bit 6
5	PB5	Digital I/O Port B Bit 5
6	PB4	Digital I/O Port B Bit 4
7	PB3	Digital I/O Port B Bit 3
8	PB2	Digital I/O Port B Bit 2
9	PB1	Digital I/O Port B Bit 1
10	PB0	Digital I/O Port B Bit 0
11	DIG COM	Digital Common (Ground)
12	AO3	Analog Output Channel 3
13	RTN3	Ground for Analog Channel 3
14	AO2	Analog Output Channel 2
15	RTN2	Ground for Analog Channel 2
16	AO1	Analog Output Channel 1
17	RTN1	Ground for Analog Channel 1
18	AO0	Analog Output Channel 0
19	RTN0	Ground for Analog Channel 0
20	RTN5	Ground for Analog Channel 5
21	RTN4	Ground for Analog Channel 4
22	PC7	Digital I/O Port C Bit 7
23	PC6	Digital I/O Port C Bit 6 (Ext. Update 3)
24	PC5	Digital I/O Port C Bit 5 (Ext. Update 2)
25	PC4	Digital I/O Port C Bit 4 (Ext. Update 1)
26	PC3	Digital I/O Port C Bit 3
27	PC2	Digital I/O Port C Bit 2 (Ext. Update 3)
28	PC1	Digital I/O Port C Bit 1 (Ext. Update 2)
29	PC0	Digital I/O Port C Bit 0 (Ext. Update 1)
30	PA7	Digital I/O Port A Bit 7
31	PA6	Digital I/O Port A Bit 6
32	PA5	Digital I/O Port A bit 5
33	PA4	Digital I/O Port A Bit 4
34	PA3	Digital I/O Port A Bit 3
35	PA2	Digital I/O Port A Bit 2
36	PA1	Digital I/O Port A Bit 1
37	PA0	Digital I/O Port A Bit 0

Table 8-1: Connector Pin Assignments

Appendix A: PPI Data Sheets

The data sheet in this Appendix is provided to help your understanding of the 8255-5 PPI which is made by a number of companies. These sheets are reprinted with permission of Mitsubishi Electric Corp. (Copyright 1987).

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