OPERATION AND USE OF THE ANIMATICS DIO-100 DIGITAL INPUT OUTPUT MODULE



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1. Introduction

1.1 Product Description

The DIO-100 is an eight input/output digital I/O peripheral module for the AniLink bus. This module allows the user to adapt an Animatics controller to control up to eight independent external devices, receive input from up to eight inputs, or communicate in an eight bit parallel scheme. Common examples are controlling electronic relays, or reading data from a A/D converter or other transducer.

The DIO-100 is cable/plug compatible with either the Series 5000 or the SmartMotor control systems. Up to Eight DIO-100 modules can be addressed by a single Series 5000 controller SmartMotor. Powered by the +5 V and ground from the AniLink cable, these units are equipped with a voltage regulator allowing support from an external +6 V to +24 V source. Most applications do not need external support.

The AniLink Network is a proprietary serial based, high speed device network shared by the Series 5000 and SmartMotor lines of motion control products.

1.2 Features

- One eight-bit analog output, ranging from 0 to 5 VDC.
- Latched outputs with high current drive capability for directly driving LEDS
- Read/Write and Date Strobe pins for protocol transfer control
- Two addressing pins
- Simple plug in operation
- Convenient size and mounting, DSUB connector
- Direct firmware support under the Series 5000 and SmartMotor command sets;
- +5 V DC operation
 - Can be drawn directly from AniLink network cable
 - Alternate power supply port available
- AniLink Network Addressable (3-bit)
 - High speed serial communications (100K BPS)
 - Multi-drop addressing,

1.3 Part Numbering

DIO-100 refers specifically to the eight I/O expansion module. Produced as a general purpose peripheral, other similar peripherals have been produced within the DIO-1XX family of peripherals.

Please contact your applications engineer for specifics about our special products.

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1.4 Theory of Operation

The DIO-100 card is equipped with an eight-bit quasi-bidirectional port implemented a single chip silicon gate CMOS I/O chip.

The AIO-100 communicates serially over the AniLink bus with a Animatics controller.

Writing to the DIO-100 is carried out as a three byte string. The first byte of a write command contains a three bit addressing scheme, leading to the eight module limit.

A quasi-bidirectional port can be used as an input or output without the use of a control signal for data direction. At power up the ports are HIGH, and must be set HIGH before being used as input in any mixed I/O application. There is an exception to this default behavior: any DIO-100 addressed as A operated on a Series 5000 controller will default low after a momentary high upon power up. The Series 5000 control issues a command to power down module A as part of its reset cycle (power up or software reset).

The I/O conforms to standard TTL levels. The outputs are not capable of directly driving mechanical relays. They will sink up to 10 ma, but will source only about 2 ma: they are open collector ouputs with 1 K ohm pull up resistors to 5VDC.

The addressing scheme used for the DIO-100 is common to the PW-108, PW-116 and the Animatics LCD peripheral products. While these peripherals may exist on a common AniLink network all must be uniquely addressed for proper operation.

1.5 Simplified Schematic



System Block Diagram

2. Specifications

All listed specifications are correct as of the date of printing. See errata for latest details. Any and all product specifications are subject to change without notice by the manufacturer.

2.1 Electrical

Bus DC line voltage	5V DC
Aux. Power Connector voltage	+6 to 24 V DC
Normal Maximum DC current	100 ma

2.2 Mechanical

Dimensions: See Figure Weight: 1 oz



2.3 Environmental

Operating temperature 0°C to 50°CStorage temperature-20°C to 70°CHumidity0 % to 90 % (non-condensing)

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3. Installation

3.1 Unpacking and Inspection

Upon receipt of the equipment, carefully inspect to ensure that no damage has occurred during shipment. If damage is detected, notify the carrier immediately. Equipment should be stored in its original shipping container until ready for use.

3.2 Mounting

The DIO-100 module should be mounted inside a cabinet or suitable enclosure to protect it from physical and environmental damage. It must be kept free of combustible or flammable materials, oil vapor, steam, excessive moisture, corrosives and general debris.

Mounting holes for standard 4-40 screws are located in eight places on the board. The board can also be secured using the two threaded 4-40 nuts in the 25-pin DSUB connector. Jack screws are suggested for this purpose.

3.3 Wiring

Wiring the DIO-100 is often as simple as plugging in the supplied "phone cable" into the RJ11-6 type connector, and plugging the opposite end of the cable into the controller. By using the second RJ11-6 (wired in parallel), additional AniLink modules can be plugged in to the network.

Longer runs of AniLink cable are possible. Maximum tested runs for the "phone cable" wiring and RJ11-6 type connectors is about 3 feet. Use of higher efficiency shielded cable and better connectors will allow much longer runs.

Users desiring industrial-type communications connections often remove the RJ11 jack and solder shielded cable directly to the p.c. board. While this is a generally accepted practice, poor user workmanship will void any warranty on this product.

3.3.1 Connector Pin Out

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The I/O connector is a standard female 25 pin DSUB. Peripheral systems can be powered from the AIO-100's + 5 VDC and GND up to the maximum available current on the AniLink network.

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0000	00000000000 0000000000)
25	14	Ļ
PIN 1 2 3 4 5 6 7 8 9 10 11	No. Function I/O 1 I/O 2 I/O 3 I/O 4 I/O 5 I/O 6 I/O 7 I/O 8 Data Strobe Read Write Address 0	
12 13 14 - 1	+ 5 DC 25 GND	



Connector C1 (RJ11-6 connector, x 2 in parallel)

PIN	SIGNAL	DESCRIPTION
1	IN #5	Reserved for other AniLink peripheral devices
2	GND	To Controller
3	+5 V DC	AniLink Power from controller (limited to about 150 Ma)
4	CLOCK	AniLink Clock
5	DATA	AniLink Data
6	IN #6	Reserved for other AniLink peripheral devices

The AniLink connector is a standard RJ-11-6. The two female RJ-11-6 sockets on the DAIO-100 board are wired in parallel. This allows the AniLink network to be extended by plugging one module into the next.

When several AniLink devices are connected to the same network, the available controller power supply may not to maintain operating voltage to the peripherals. In this case, an additional power source can be added to the network at the screw terminals provided at connector C2. If additional power is fed into on module of an AniLink network that power will be distributed to the other modules over the +5V line of the AniLink network. Attention should be paid to the 7805 voltage regulator for any unit receiving external power: if the regulator gets too hot to touch, connect the additional power to the individual screw terminal ports of all the AniLink modules.



Connector C2, External Power Connector

PIN	SIGNAL	Description
1	+5-+24 VDC	
2	GND	
3	+5-+24 VDC	Internally connected to 1

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The power connector is a three socket phoenix type connector.

3.4 Power-up and Checkout

No particular power up procedure is necessary for the DIO-100.

A checkout procedure can be derived from the programming examples found later in this manual.

Be sure to apply common safety practices when working on any motion based system: make sure that their is no possibility of personal injury or machine damage before first time power up.

4. Adjustments

4.1 AniLink Bus Module Address

Peripherals on a AniLink network must have non-conflicting addresses to function properly. This normally means a unique address for each AniLink peripherals. The AniLink peripherals use a three bit address scheme based on the of jumpers 1, 2 and 4.

Module Address	Jumper St	tate	X = jumper in place	O = jumper absent
	1 2	3		
Α	00	0	Bold values only val	id on Series 50000
В	X O	0		
С	O X	0		
D	XX	0		
E	0 0	Х		
F	X O	Х		
G	O X	Х		
Н	X X	Х		

An AIO-100 module must use address A to be addressed by the JOY1ON firmware support.

5. Maintenance and Repair

5.1 Maintenance

There are no user serviceable components on the DIO-100 units. The only periodic maintenance requirement is to keep the board clean.

5.2 Indications

A failure of the DIO-100 module would be indicated by observably incorrect command returns at the host controller, or by invalid signals appearing at the output. These conditions would present themselves as a loss of control in an application.

5.3 Trouble Shooting

As these units have no user serviceable parts, trouble shooting is usually limited to checking for power and ground, and checking for communications signal.

As a part of documenting your application, you should record acceptable test levels for future use during the development process. Should questions arise later about the serviceable condition of an DIO-100 card, comparison levels can be a tremendous asset.

The commands and programming techniques found in the programming section of this document will be useful in the troubleshooting process.

If your unit is not working:

- 0. Check cabling for unplugged connectors or cable cuts
- 1. Check for power using a DMM
 - A. On connector C1: +5 between pins 2 and 3
 - B. On IC 7805: +5 between pins 1 and 2
 - C. External power source (if applicable)

If not receiving power, locate cause.

- 2. Check for signal on AniLink Clock and Data lines using a logic probe or oscilloscope. Logic and Data lines are normally high between data transmissions.
- 3. If power, data and clock all show correct signals, and your unit is still not working, return your module to Animatics for inspection and repair.

6. Programming

The languages and programming techniques for the Series 5000 and the SmartMotor are radically different. Consistent between these languages is the direct command support and module addressing scheme. Each DIO-100 card on an AniLink network can be addressed by a letter address, A- H, and each module has 64 channels, 0 through 64.

Communication with the I/O pins is accomplished using a "Binary Coded Number" from 0 to 255. There are 256 different possible combinations for the I/O states. Each pin has its own contribution to the number read or written. Their contributions are as follows:

Pin:	Value:	Example:	State	Value
1)	1	ON	1	1
2)	2	OFF	0	0
3)	4	OFF	0	0
4)	8	ON	1	8
5)	16	OFF	0	0
6)	32	OFF	0	0
7)	64	OFF	0	0
8)	128	OFF	0	0
		TOT	AL	9

Once a byte of information is written to a module, it will remain at the outputs until another byte is written, or until a byte is read.

If you are not simply using the module for its eight inputs or outputs, but rather using it to communicate to another peripheral that has some more intelligence, like an LCD display module, then you could use the other signals to help transfer data back and forth. The Strobe signal is asserted with a low pulse whenever new data is read or written. The Read/Write is set to 1 when the module is reading external data, and 0 when the module is writing data to an external device. The number "0" in the following example sets the address pins.

IOA0,35 for Series 5000, DOUTA0,35 for the SmartMotor

The number 0 in the above example causes both address outputs to be off. If the number in this field were 1, then address 0 would be ON and address 1 OFF. If the number were 2 then addresses 1 would be ON, and address 0 OFF. If the number in this field were 3 then both address outputs would be ON. These outputs along with the R/W output and the Strobe output are used to transfer data to and from peripherals that use this protocol. Otherwise they may be ignored. The relative sequence of events is as follows:

Writing a byte:

Data

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Address	
Read/Write	
Strobe	
Reading a by	rte:
Data	
Address	
Read/Write	
Strobe	

The exact timing is of the sequence has not yet been measured, but it is very slow compared to typical read and write cycles for electronic components such as memory, latches, LCD modules, etc.

Additional information about the command sets and languages demonstrated in this section can be found in the Series 5000 and SmartMotor User's Manuals.

6.1 Series 5000 Command Set

The AniLink bus on a Series 5000 controller runs throughout the controller, and is ported to the outside in two locations.

Command	Comments
IO(let)#,#	Set the bit pattern on DIO module address (let), channel #.
	(let) valid from A through H – module address
	# first, valid from 0 to $64 -$ channel number
	# second, valid from 0 to 255 - eight bits of output
IO(let)#?	Set the level of the analog output for the corresponding module
	(let) valid from A through D – module address
	# valid from 0 though 255 – input bit pattern

For example:

VARA[IOA0] reads the bit pattern value of module A into controller variable VARA.

IOA0,35 sets the eight outputs to bit pattern 35, (0010 0011).

This programs demonstrates use of these commands

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IOA0,0 **IOB0,0** VARY0 VARX0 50 IF[(IOC0]=1 GOTO60 IF([IOC0&34]=34) GOTO60 GOTO50 60 FOR256 VARX? IOA0,[VARX] VARY[IOB0] IF([VARX]!=[VARY]) GOTO(100) VARX[VARX+1] NEXT PRN1("MADE IT OUT OF LOOP OKAY") END 100 PRN1("X - Y AGREEMENT ERROR") PRN1("X = ") VARX? PRN1("Y = ") VARY? END

6.2 SmartMotor Command Set

The SmartMotor has command software support for the DIO-100 module.

Command	Comments
	Port is valid from A through H
	Input is valid from 0 to 64
	Exp. expressions must evaluate to an integer
DIN{port}{channel}	Fetch input byte from port, input channel
DOUT{port}{channel}, exp.	Output an analog byte on channel port
RDIN{port}input	Fetch input byte from port: report ASCII integer value on RS-232

This program demonstrates the use of these commands.

a=0 a=DINA0 a=a/2 DOUTB,a*3 END