CIO-DAS08/Jr-AO

ComputerBoards, Inc.
Revision 2
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DATA LAB SOLUTION

Congratulations! You have purchased Data Lab Solution, the least expensive complete hardware and software solution for data acquisition and control.

Data Lab Solution is a combination of the CIO-DAS08/Jr and the Labtech Notebook software from Laboratory Technologies.

The CIO-DAS08/Jr comes with software for test and calibration. This software should be installed in addition to the Labtech Notebook software. Instructions for installing each are in this manual.

The complete hardware manual is provided here. The manual for the Labtech Notebook software is provided on disk and you may print it out if you feel you need a printed manual for the software. In most cases, you will find the on-line help to be more than adequate.

Installation instructions for Labtech DataLab Solution Version 8.03

MINIMUM SYSTEM REQUIREMENTS

To install and run DataLab Solution, your computer system must meet the following minimum requirements:

DOS: IBM PC/XT/AT or compatible, 640KB memory (2MB recommended), MS-DOS 2.0 or greater (5.0 recommended), EGA or VGA graphics, 5MB disk space.
Windows: 386 or better, 8MB memory, Windows 3.1, 13MB disk space.

Windows Installation
Your DataLab Solution system consists of three 3.5" high density disks. To install the software (assuming Drive A is your floppy disk drive):

1. Start Windows.
2. Insert the disk labeled Disk 1 in your floppy disk drive, Drive A.
3. Select Run from the Program Manager File menu. Enter
   `A:SETUP`
   in the Command Line field. Choose OK.
4. Install builds a DataLab Solution program group consisting of the following icons:
   - Build-Time icon - used to run the LABTECH build-time.
   - Help icons - provide online Tutotial and the LABTECH User's Guide and LABTECH Block Types Manual.
   - Readme icon - provides recent updates to software information.
5. At the end of the installation:
   Read the readme file (readme.wri) which updates the LABTECH document set. The installation program creates a readme icon in the DataLab Solution program group.

NOTE

If you have any previously-installed LABTECH software, you must exit and restart Windows before running DataLab Solution.

USING ONLINE DOCUMENTATION

The Windows version of DataLab Solution provides four online documents. To read your LABTECH online documentation, you can double-click on the Program Group icons for each document, or you can view the following information from the LABTECH Help system.

1. Double-click on the Build-Time icon in the DataLab Solution Program Group.

2. Select Help from the ICONview menu bar.

The Contents, Blocks, and Tutorial Help commands open online documents that provide information on each of the following topics.

Help Command Topics

Contents	Build-Time
	Block Settings
	Logging Data
	Creating Displays
	Run-Time
	Linking to Other Applications
	Options
	Using Features from Previous Releases
Blocks	Analog Input Blocks
	Digital Input Blocks

Counter Input Blocks
Frequency Input Blocks
Resistance Measurement Blocks
Thermocouple Blocks
RTD Measurement Blocks
Thermistor Blocks
Strain Blocks
Keyboard Entry Blocks
IPC Input Blocks
Analog Output Blocks
Digital Output Blocks
Pulse Output Blocks
Calculated Blocks
Replay Blocks
Time Blocks
C-Icon Blocks
Communications Blocks

Tutorial

Hands-on Experience
Starting NOTEBOOK/CONTROL
ICONview Basics
Creating and Executing a Setup in 4 Easy Steps
Opening a Setup
Building a Setup
Creating a Display
Creating a Run-Time Icon
Handling Multiple Icons
Sending Data from VISION to NOTEBOOK/CONTROL
Time Stampling
Triggering, Staging, and Looping

DOS Installation

Your DataLab Solution DOS system consists of two 3.5" high density disks. To install the software (assuming Drive A is your floppy disk drive):

1. Insert the disk labeled Disk 1 in your floppy disk drive, drive A.

2. To run the install program, change to drive A and type the following command at the A prompt:
   `A:\>INSTALL`

3. At the end of the installation, read or print the following text file, located in your DataLab Solution directory:
   readme.txt is a text file which updates the NOTEBOOK document set

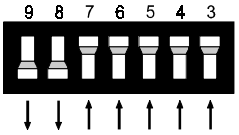
4. Turn off your computer and install your CIO-DAS08/Jr. board. Be sure to read the CIO-DAS08/Jr. Manual (this manual) before you install the board.

BASE ADDRESS

The base address of the CIO-DAS08/Jr-AO is set by switching a bank of DIP switches on the board. This bank of switches is labeled ADDRESS and numbered 9 to 3.

Ignore the word ON and the numbers printed on the switch

The switch works by adding up the weights of individual switches to make a base address. A 'weight' is active when the switch is down. Shown to the right, switches 9 and 8 are down, all others are up. Weights 200H and 100H are active, equaling 300H base address.



SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10
A3	08

BASE ADDRESS SWITCH - Address 300H shown here.

HEX RANGE	FUNCTION	HEX RANGE	FUNCTION
000-00F	8237 DMA #1	2C0-2CF	EGA
020-021	8259 PIC #1	2D0-2DF	EGA
040-043	8253 TIMER	2E0-2E7	GPIB (AT)
060-063	8255 PPI (XT)	2E8-2EF	SERIAL PORT
060-064	8742 CONTROLLER (AT)	2F8-2FF	SERIAL PORT
070-071	CMOS RAM & NMI MASK (AT)	300-30F	PROTOTYPE CARD
080-08F	DMA PAGE REGISTERS	310-31F	PROTOTTYPE CARD
0A0-0A1	8259 PIC #2 (AT)	320-32F	HARD DISK (XT)
0A0-0AF	NMI MASK (XT)	378-37F	PARALLEL PRINTER
0C0-0DF	8237 #2 (AT)	380-38F	SDLC
0F0-0FF	80287 NUMERIC CO-P (AT)	3A0-3AF	SDLC
1F0-1FF	HARD DISK (AT)	3B0-3BB	MDA
200-20F	GAME CONTROL	3BC-3BF	PARALLEL PRINTER
210-21F	EXPANSION UNIT (XT)	3C0-3CF	EGA
238-23B	BUS MOUSE	3D0-3DF	CGA
23C-23F	ALT BUS MOUSE	3E8-3EF	SERIAL PORT
270-27F	PARALLEL PRINTER	3F0-3F7	FLOPPY DISK
2B0-2BF	EGA	3F8-3FF	SERIAL PORT

TABLE OF I/O ADDRESSES

INSTALLING THE CIO-DAS08/Jr-AO IN THE COMPUTER

Turn the power off.

Remove the cover of your computer. Please be careful not to dislodge any of the cables installed on the boards in your computer as you slide the cover off.

Locate an empty expansion slot in your computer.

Push the board firmly down into the expansion bus connector. If it is not seated fully it may fail to work and could short circuit the PC bus power onto a PC bus signal. This could damage the motherboard in your PC as well as the CIO-DAS08/Jr-AO.

SIGNAL CONNECTION TO TEST THE INSTALLATION

To test the installation of the CIO-DAS08/Jr-AO there must be electrical signals for it to read and display. You can supply the signal with a function generator or other voltage source or you can loop-back the CIO-DAS08/Jr-AO output signals into the CIO-DAS08/Jr-AO inputs.

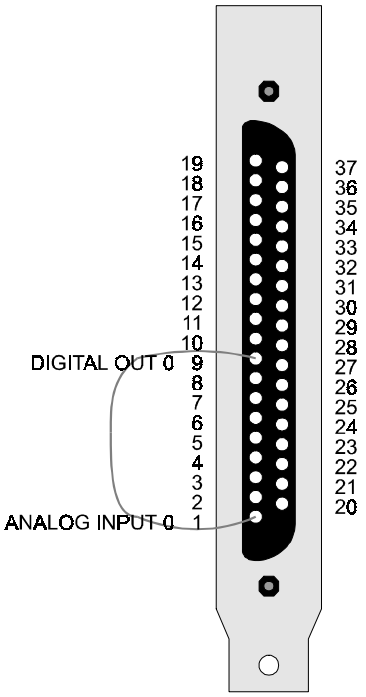
Please, before you connect a voltage from a signal generator or other source, be sure that the signal does not exceed +/-5V, the maximum analog input range of the board, or 0-5V, the maximum digital input range. The analog inputs are protected to 30V but why prove it.

Shown to the right, Channel 0 High (pin 1) is connected to the signal source, Digital Out 0 (pin 9).

Run the TEST option in InstaCal to test the installation. Select digital output #0 and analog input channel 0.

You should see a slow moving square wave on the screen.

If you see the square wave, the CIO-DAS08/Jr-AO is installed and running correctly.



37 PIN CONNECTOR

CALIBRATION AND TEST

The CIO-DAS08/Jr-AO is supplied with software for calibration and test. You will find it in the InstaCal program under the CALIBRATE option. Just follow the instructions which guide you through the calibration sequence.

SOFTWARE CALIBRATION

The CIO-DAS08/Jr-AO has a fixed input range and does not have any input amplification or gain/offset compensation electronics. All compensation for gain/offset errors is done in software after the signal is acquired. The gain and offset calibration factors are stored in the CB.CFG file and applied to the analog samples after they are acquired.

The calibration factors may be set as often as you like. Simply run the CALIBRATE option from the InstaCal menu.

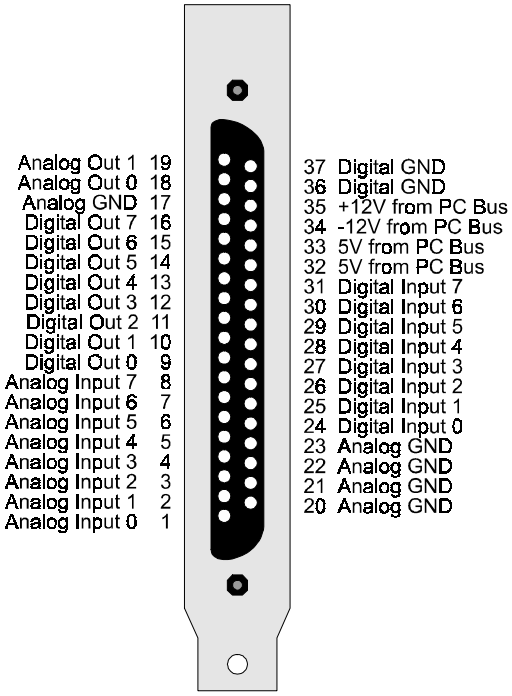
REQUIRED EQUIPMENT

Ideally, you will need a precision voltage source and some pieces of wire. If you do not have a precision voltage source, you will need a non-precision source, a 4 1/2 digit digital volt meter, a calculator and have to make a few calculations.

Signal connection can be one of the most challenging aspects of applying a data acquisition board. Failure to properly connect and ground signals is the most common source of calls to technical support. In most cases, the problem can be located with a few probes of a voltmeter and some crosschecking of your wiring to the connector diagram

CONNECTOR DIAGRAM

The connector pin names reflect the single ended nature of the CIO-DAS08/Jr-AO inputs.



37 PIN CONNECTOR

The CIO-DAS08/Jr-AO analog connector is a 37 pin D type connector accessible from the rear of the PC through the expansion backplate.

The connector accepts female 37 D type connectors, such as those on the C37FF-2, 2 foot cable with connectors.

DIGITAL OUTPUTS & INPUTS

There are 8 inputs and 8 outputs for sensing and controlling digital lines. They are port addressable and are dedicated to either input or output.

The digital outputs and inputs on the CIO-DAS08/Jr-AO are TTL level. TTL is an electronics industry term, short for Transistor Transistor Logic, with describes a standard for digital signals. It is a common misconception that TTL signals are always 0V for low and +5V for high. Although the low signal is reliably close to 0V, the high signal may be anywhere from 2.4V to 5V, and be within the TTL specification. If you must have a solid +5V high signal, use pull-up resistors.

The digital outputs on the CIO-DAS08/Jr-AO are 'high drive'. These digital lines are capable of driving circuits requiring current in excess of 15mA. Please see the specifications at the rear of this manual.

All of the programmable functions of the CIO-DAS08/Jr-AO are accessible through the control and data registers, which are explained here. You should program with Universal Library and not via direct register programming.

REGISTER LAYOUT

The CIO-DAS08/Jr-AO is controlled and monitored by writing to and reading from 8 consecutive 8 bit I/O addresses. The first address, or BASE ADDRESS, is determined by setting a bank of switches on the board.

A register is easy to read and write to. Most often, register manipulation is best left to ASSEMBLY language programs as most of the CIO-DAS08/Jr-AO possible functions are implemented in easy to use Universal Library routines.

The register descriptions follow the format:

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	X	X	X	X

Where the numbers along the top row are the bit positions within the 8 bit byte and the numbers and symbols in the bottom row are the functions associated with that bit.

Note that an X is an unspecified bit. There is no function associated with that bit position. All X bits should be masked out of reads.

To write to or read from a register in decimal or HEX, the following weights apply:

BIT POSITION	DECIMAL VALUE	HEX VALUE
0	1	1
1	2	2
2	4	4
3	8	8
4	16	10
5	32	20
6	64	40
7	128	80

To write control words or data to a register, the individual bits must be set to 0 or 1 then combined to form a Byte. Data read from registers must be analyzed to determine which bits are on or off.

The method of programming required to set/read bits from bytes is beyond the scope of this manual. It will be covered in most Introduction To Programming books, available from a bookstore.

In summary form, the registers and their function are listed on the following table. Within each register are 8 bits which may constitute a byte of data or 8 individual bit set/read functions.

ADDRESS	READ FUNCTION	WRITE FUNCTION
BASE	A/D Bits 9-12 (LSB)	None
BASE + 1	A/D Bits 1 (MSB) - 8	Start 12 bit A/D conversion
BASE + 2	A/D status & MUX Address	Set A/D channel
BASE + 3	Digital input, 8 bits	Digital output, 8 bits
BASE + 4		D/A 0 LSB
BASE + 5		D/A 0 MSB
BASE + 6		D/A 1 LSB
BASE + 7		D/A 1 MSB

BASE ADDRESS, Example, 300 HEX

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	X	X	X	X

A read only register.

READ

On read, it contains the least significant 4 digits of the Analog input data.

These 4 bits of analog input data must be combined with the 8 bits of analog input data in BASE + 1, forming a complete 12 bit number. The data is in the format 0 = minus full scale. 4095 = +FS.

BASE ADDRESS + 1, 301 HEX

7	6	5	4	3	2	1	0
A/D1 MSB	A/D2	A/D3	A/D4	A/D5	A/D6	A/D7	A/D8

READ: The most significant A/D byte is read.

WRITE: Any write to this register causes an immediate A/D conversion.

A note of caution: Place several NO-OP instructions between consecutive 12 bit A/D conversions to avoid over-running the A/D converter.

STATUS AND CONTROL REGISTER

BASE ADDRESS + 2

This register address is two registers, one is read active and one is write active.

READ = STATUS

7	6	5	4	3	2	1	0
EOC	X	X	X	X	ChAdd2	ChAdd1	ChAdd0

EOC = 1 the A/D is busy converting and data should not be read.

EOC = 0 the A/D is not busy and data may be read.

ChAdd 2 to ChAdd 0 is the current analog input multiplexor channel. The current channel is a binary coded number between 0 and 7 .

WRITE = CONTROL

7	6	5	4	3	2	1	0
X	X	X	X	X	ChAdd2	ChAdd1	ChAdd2

ChAdd 2 to ChAdd 0. Set the current channel address by writing a binary coded number between 0 and 7 to these three bits.

DIGITAL I/O CONTROL REGISTER

BASE ADDRESS + 3

This address contins two registers, one for output and one for input. The output register is latched and holds the last value written to it. The input register is not latched. Each time the register is read the current state of the inputs is passed through this port into the computer.

WRITE = Set digital output port, all bits.

READ = Read digital input port, all bits.
AND update both D/A simultaneously with last values written to D/A output registers.

7	6	5	4	3	2	1	0
D7	D6	D5	D4	D3	D2	D1	D0

D/A 0 CONTROL REGISTERS

Each D/A is controled by a pair of 8 bit write only registers. These registers contain the high byte and the low byte of the D/A 12 bit control word. The value written to these two registers controls the output of the D/A chip.

To update the D/A outputs with the values in the D/A output registers, read the register at BASE + 3.

The D/A output range can generally be calculated as [(#/4095) * 10V] - 5V.

The #/4095 is a proportion of the Full Scale Range, which is ñ5V.

BASE ADDRESS + 4, DAC 0 LOW BYTE

7	6	5	4	3	2	1	0
DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0 LSb

BASE ADDRESS + 5, DAC 0 HIGH BYTE

7	6	5	4	3	2	1	0
X	X	X	X	DA11 MSb	DA10	DA9	DA8

D/A 1 CONTROL REGISTERS

BASE ADDRESS + 6, DAC 1 LOW BYTE

7	6	5	4	3	2	1	0
DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0 LSb

BASE ADDRESS + 7, DAC 1 HIGH BYTE

7	6	5	4	3	2	1	0
X	X	X	X	DA11 MSb	DA10	DA9	DA8

ANALOG INPUTS

# Channels	8 Single ended.
Resolution	12 bits, 4095 divisions of full scale.
Linearity	+/-1 bit.
Type	Successive approximation
Speed	25 uSec
Monotonicity	Guaranteed over operating temp.
Range	+/-5V
Overvoltage	+/- 30 Volts Continuous
Input Leakage Current	100 nA max @ 25 deg. C.
On Channel Impedence	10 Meg Ohms
Gain Temp. Coef.	50 ppm/deg C
Offset Temp. Coef.	10 ppm/deg C
Offset error	5LSB max (2LSB typical)
Gain error	5LSB max (2LSB typical)

DIGITAL TO ANALOG SPECIFICATIONS

Channels	2
Resolution	12 Bits (1/4096)
Range	+/-5V Bipolar Only
Latches	Double Buffered
Linearity	+/-0.9 LS Bit
Monotonicity	12 Bits guarantied over temp range
Offset TEMPCO	25ppm/deg C max
Gain TEMPCO	25ppm/deg C max
Offset error	5LSB max (2LSB typical)
Gain error	5LSB max (2LSB typical)
Output Resistance	<0.1 ohm
Settling Time +/-FS	10uS max

DIGITAL I/O

Digital Out	74LS273
Digital In	74LS244
Out 0-7 low	0.5 V max @ 24 mA current sink
Out 0-7 high	2.4 V Min @ -3.0 mA current source
Input Type	74LS373
IP1 - IP3 low	0.8 V Max
IP1 - IP3 high	2 V max

ENVIRONMENTAL

Operating Temperature	0 - 50 deg C
Storage Temperature	-20 to 70 deg C
Humidity	0 to 90% non-condensing
Weight	5 oz

POWER CONSUMPTION NO DACS

+5V Supply	200 mA typical / 240 mA max.
+12V Supply	16.5 mA typical / 19.5 mA max.
-12V Supply	19.5 mA typical / 23.5 mA max.

POWER CONSUMPTION WITH DACS

+5V Supply	200 mA typical / 240 mA max.
+12V Supply	26.5 mA typical / 32.0 mA max.
-12V Supply	19.5 mA typical / 26.5 mA max.

NOTE

Additional power will be drawn by user's connections to the power pins accessible on CIO-DAS08/Jr-AO connectors.

EC Declaration of Conformity

We, ComputerBoards, Inc., declare under sole responsibility that the product:

CIO-DAS08/Jr-AO	
Part Number	Description

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other normative documents:

EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.

EU 55022 Class B: Limits and methods of measurements of radio interference characteristics of information technology equipment.

EN 50082-1: EC generic immunity requirements.

IEC 801-2: Electrostatic discharge requirements for industrial process measurement and control equipment.

IEC 801-3: Radiated electromagnetic field requirements for industrial process measurements and control equipment.

IEC 801-4: Electrically fast transients for industrial process measurement and control equipment.

Carl Haapaoja, Director of Quality Assurance