



INDUSTRIAL COMPUTER SOURCE
TM

Model AD12-8 LABTECH Notebook Product Manual

MANUAL NUMBER : 00650-015-1A

ΤφρΑΩωψΤΠυ ΡΧΦχΑωΣψ ΩΧΑψΡΣ

ΜΜΚη πΠψφΣΩ ΡΠφΉΧφ ψΧΠρε ΩΠφ ρΤΣΣΧε ΡΠ γκΘΜΔ κΛΛΖηΛΛ γσΠέΔ κΘΜΖκΛΛΖηΛΜΚ

ΤφρΑΩωψΤΠυ ΡΧΦχΑωΣψ ΩΧΑψΡΣ ΣΑψΧχΣ ωΣυ γΘΔ κΜζΘΛζλιζιη σΠέ γΘΔ κιζκζιηζιθ ά ΤφρΑΩωψΤΠυ ΡΧΦχΑωΣψ ΩΧΑψΡΣ γΑΥΔ υωρ ωΣυ ηθιζΚιιΜηη σΠέ ηθιζΚιθΜΜ

FORWARD

This product manual provides information to install, operate and or program the referenced product(s) manufactured or distributed by Industrial Computer Source. The following pages contain information regarding the warranty and repair policies.

Technical assistance is available at: **1-800-480-0044**.

Manual Errors, Omissions and Bugs: A "Bug Sheet" is included as the last page of this manual. Please use the "Bug Sheet" if you experience any problems with the manual that requires correction.

NOTE

The information in this document is provided for *reference* only. Industrial Computer Source does not assume any liability arising out of the application or use of the information or products described herein. This document may contain or reference information and products protected by copyrights or patents and does not convey any license under the patent rights of Industrial Computer Source, nor the rights of others.

Copyright © 1994 by Industrial Computer Source, a California Corporation, 9950 Barnes Canyon Rd., San Diego, CA 92121. All rights reserved. Printed in the United States of America. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

This page intentionally left blank

Guarantee

A thirty day money-back guarantee is provided on all **standard** products sold. **Special order products** are covered by our Limited Warranty, *however they may not be returned for refund or credit.*

Refunds

In order to receive a full refund on a product purchase price, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, software, cables, etc.) within 30 days of receipt and in as-new and resalable condition. The **Return Procedure** must be followed to assure prompt refund.

Restocking Charges

Product returned *after* 30 days, and *before* 90 days, of the purchase will be subject to a **minimum** 20% restocking charge and any charges for damaged or missing parts.

Products not returned within 90 days of purchase, or products which are not in as-new and resalable condition, are not eligible for credit return and will be returned to the customer.

Limited Warranty

One year limited warranty on all products sold with the exception of the "Performance Series" I/O products, which are warranted to the original purchaser, for as long as they own the product, subject to all other conditions below, including those regarding neglect, misuse and acts of God. Within one year of purchase, Industrial Computer Source will repair or replace, at our option, any defective product. At any time after one year, we will repair or replace, at our option, any defective "Performance Series" I/O product sold. This does not include products damaged in shipment, or damaged through customer neglect or misuse. Industrial Computer Source will service the warranty for all standard catalog products for the first year from the date of shipment. After the first year, for products not manufactured by Industrial Computer Source, the remainder of the manufacturer's warranty, if any, will be serviced by the manufacturer directly.

The **Return Procedure** must be followed to assure repair or replacement. Industrial Computer Source will normally return your replacement or repaired item via UPS Blue. *Overnight delivery or delivery via other carriers is available at additional charge.*

The limited warranty is void if the product has been subjected to alteration, neglect, misuse, or abuse; if any repairs have been attempted by anyone other than Industrial Computer Source or its authorized agent; or if the failure is caused by accident, acts of God, or other causes beyond the control of Industrial Computer Source or the manufacturer. Neglect, misuse, and abuse shall include any installation, operation, or maintenance of the product other than in accordance with the owners' manual.

No agent, dealer, distributor, service company, or other party is authorized to change, modify, or extend the terms of this Limited Warranty in any manner whatsoever. Industrial Computer Source reserves the right to make changes or improvements in any product without incurring any obligation to similarly alter products previously purchased.



Shipments not in compliance with this Guarantee and Limited Warranty Return Policy will not be accepted by Industrial Computer Source.

Return Procedure

For any Limited Warranty or Guarantee return, please contact Industrial Computer Source's Customer Service at **1-800-480-0044** and obtain a Return Material Authorization (RMA) Number. All product(s) returned to Industrial Computer Source for service or credit **must** be accompanied by a Return Material Authorization (RMA) Number. Freight on all returned items **must** be prepaid by the customer who is responsible for any loss or damage caused by common carrier in transit. Returns for Warranty **must** include a Failure Report for each unit, by serial number(s), as well as a copy of the original invoice showing date of purchase.

To reduce risk of damage, returns of product must be in an Industrial Computer Source shipping container. If the original container has been lost or damaged, new shipping containers may be obtained from Industrial Computer Source Customer Service at a nominal cost.

Limitation of Liability

In no event shall Industrial Computer Source be liable for any defect in hardware or software or loss or inadequacy of data of any kind, or for any direct, indirect, incidental, or consequential damages in connection with or arising out of the performance or use of any product furnished hereunder. Industrial Computer Source liability shall in no event exceed the purchase price of the product purchased hereunder. The foregoing limitation of liability shall be equally applicable to any service provided by Industrial Computer Source or its authorized agent.

Some *Sales Items* and *Customized Systems* are **not** subject to the guarantee and limited warranty. However in these instances, any deviations will be disclosed prior to sales and noted in the original invoice. ***Industrial Computer Source reserves the right to refuse returns or credits on software or special order items.***

Table of Contents

FORWARD	iii
Guarantee	v
Limited Warranty	v
Return Procedure	vi
Limitation of Liability	vi
Chapter 1: Interface Guide	1-1
Maximum Sampling Rates	1-1
Configuring Cards	1-2
Default Configuration.	1-2
Identifying Devices and Channels in LABTECH	1-2
Devices.	1-2
Channels.	1-2
Using The Drivers	1-3
Installing the Drivers.	1-3
Troubleshooting INSTALL.	1-3
Generic Error Codes	1-4
Chapter 2: AD12-8 Hardware Interface	2-1
Configuring the AD12-8.	2-1
Identifying Channels in LABTECH Software	2-1
Analog Input Blocks.	2-1
Digital I/O Blocks.	2-1
Counter Input.	2-2
Pulse Output Blocks.	2-2
Frequency Input.	2-2
High Speed Data Acquisition.	2-2
Error codes	2-3
Appendix A: Non-Linear Inputs	A-1
Thermocouples.	A-1
Unsupported Thermocouples.	A-1
Other Non-Linear Inputs.	A-1

Current Revision 1A

May 1996

This page intentionally left blank

Chapter 1: Interface Guide

Your LABTECH software is designed to work with the AD12-8 data acquisition and control board. The table shows which LABTECH software I/O types are supported by the card.

LABTECH Block Types							
Models	AD Normal	AD Hi-Speed	DA	DI/DO	TEMP	STRAIN	CONT, FREQ & PULSE
AD12-8	YES	YES	NO	YES	YES(#)	YES(#)	YES

AD=Analog Input, DA=Analog Output, DI=Digital Input DO=Digital Output, TEMP=Temperature Measurement, STRAIN=Strain Measurement, COUNT=Counter Input, FREQ=Frequency Measurement PULSE=Frequency Output

(#) with AT16-P analog-input expansion multiplexer

Each of the cards listed in the table can be plugged directly into an expansion slot of an IBM PC/XT/AT or compatible computer. External screw terminal boards provide connection points for analog and digital signals. A terminal board connects directly to a card by means of a ribbon cable.

LABTECH software also supports the AT16-P analog multiplexer, which allows up to sixteen channels to be read through each of the analog inputs on the AD12-8. By connecting AT16-P's to the analog inputs, you can accommodate up to 128 inputs on an AD12-8 each at an individually programmable voltage range. The AD12-8 card must be connected to one or more AT16-P multiplexer cards for temperature or strain gage measurement. The AD12-8 card takes advantage of the AT16-P's programmable gains.

LABTECH software supports the LVDT8-P signal conditioning card. The LVDT8-P provides signal conditioning and AC excitation for eight LVDTs and/or RVTs, and use of multiple LVDT8-Ps can provide up to 64 input capability with an AD12-8.

Maximum Sampling Rates

In Normal mode, the maximum sampling rate for data acquisition is 300Hz if your computer is a 4.77MHz IBM PC (or compatible) and 900 Hz if your computer is a 6MHz IBM PC AT (or compatible). Maximum sampling rates over 2.5KHz are possible on 25MHz 80386-based computers. In High-Speed mode, the maximum sampling rates are shown on the HIGH SPEED setup menu screen. (The Normal and High-Speed modes differ in other ways besides maximum sampling rate; see the LABTECH Software manual for more information.)

Note that these rates are the total maximum available rates. To determine the maximum sampling rate for each channel on your card during a given data acquisition run, these rates must be divided by the number of channels from which you plan to acquire data. Also note that these rates are based on Analog Input blocks, and higher rates may be possible with other block types due to the relatively slow A/D converter speeds as compared to Digital update rates, for example.

Configuring Cards

Before a card can be installed in your system it must be configured. You must choose the card options which suit your particular needs. On the AD12-8, configuration is a matter of setting switches and placing jumpers. For instructions on how to configure your cards, please refer to the appropriate pictorial setup software supplied with the card. These pictorial, menu-driven programs guide you step-by-step through the configuration process, and greatly simplify hardware setup.

For the configuration options required for your card, please consult the appropriate hardware-specific section of this manual.

During the hardware installation procedure in LABTECH Software, you will be asked questions concerning the configuration of the card being installed. For example, you will be asked for the card's base address. It is a good idea, therefore, to keep a list of each card's current configuration to use during installation. Please consult the manual for information on setting the required configuration options.

Default Configuration.

Although we said that the card must be configured before use, this is not strictly true. The card is shipped with a default configuration. If this configuration is appropriate for your use, no additional configuration is required.

Identifying Devices and Channels in LABTECH

Devices.

The Method of identifying devices in LABTECH software menu system is straightforward. Each device has a unique device number. You select the device number during hardware installation in LABTECH (under SETUP/HARDWARE). LABTECH software supports up to 16 devices numbered 0 through 15. (LABTECH software will refer to the cards as interface devices).

Channels.

Each device contains a number of channels. When you set up a LABTECH software data acquisition or control run, you must specify the channel or channels through which you wish to acquire or send data. A channel is identified in the menus by three pieces of information: device number, function (analog input or digital output, for example), and block number. (In the menus, the term "block type" is used in place of the term function; see your LABTECH Manual for details.) The exact relation between Block Type and Block Number vs. Card Channel Number and Channel Type is dependant upon the card in question. Please refer to the appropriate hardware-specific section of this manual for more information.

Using The Drivers

Installing the Drivers.

An installation program has been provided on the master diskette which will copy the drivers to your hard drive, and set up LABTECH software for the drivers. To install the drivers, first make a backup copy of your master driver diskette. Once you have a backup copy of the diskette, log onto the floppy drive and run the INSTALL program, by typing:

```
a: [ENTER]
install [ENTER]
```

NOTE: Substitute the appropriate drive letter if the diskette is in a drive other than A.

The install program will provide you with further instructions. Advanced users can speed the installation process by providing the full path of the LABTECH software on the command line to INSTALL. For example, if you are running LABTECH Notebook installed in C:\NB, and your driver diskette is in drive A, you would type:

```
a: [ENTER]
install c:\nb [ENTER]
```

Troubleshooting INSTALL.

The following information is provided in case there is some difficulty running the installation program.

The drivers are combined into a single file, ACCESSLT.EXE, which is loaded as a Terminate-and-Stay-Resident (TSR) program to interface the hardware with LABTECH software. In order for LABTECH software to locate and use the drivers, you must provide certain information to both LABTECH software and the TSR. Specifically, you need to append a line to LTN.CNF informing LABTECH software of the interrupt you intend to “hook” the TSR into. The line should look something like this: DDK_INTNUM = XXh, where XX is the interrupt vector number in hex that you will pass to the driver at load time. In order to load the driver and hook it to the proper interrupt, you will type the name of the driver file at the DOS prompt, followed by the interrupt-hook command-line option, as follows: accesslt -i xxh. The “-i” indicates to the driver that you are requesting installation to an interrupt. Note that XX refers to the interrupt vector number in hex that you wish to hook the TSR into. This number must be the same as the number passed to LABTECH in LTN.CNF, as described above.

The install program performs the above steps for you, loading the TSR onto interrupt 60 hex. If LABTECH reports error 163, or something unusual, and the normal steps (outlined under Generic Error Codes, below) do not solve the problem, there may be a conflict on the interrupt, requiring you to install the driver onto a different interrupt. For example, if you found 60h to be used, you might try 63h, as follows:

Add the line: DDK_INTNUM = 63h to the file LTN.CNF using an ASCII text editor.

Enter: accesslt -i 63h [ENTER] at the DOS prompt to load the driver.

Run your LABTECH software as usual.

Generic Error Codes

The drivers will report any errors they encounter during an acquisition run. These errors are reported by two number codes. The first number is an error code, and second number is a status code, used to provide further insight into the cause of the error. Note that our error codes will always be negative. (please refer to the LABTECH software manual for any non-negative error codes you receive which are not contained in the following table.) All card-specific error codes reported by ICS drivers are documented in the appropriate card-specific Hardware Interface section of this manual. Those error codes pertinent to all cards are listed in the following table.

The following is a list of generic error codes, and possible solutions, for the LABTECH software driver.

Error Code	Status Code	Possible Solution / Explanation	Severity
160		Unrecognized command. This typically results from an attempt to access a block type which the board does not support. Verify that none of your blocks show "NOT AVAILABLE FOR THIS DEVICE".	Fatal
161		Unrecognized driver. This error will result if the .TPL files installed in LABTECH are not associated with the TSR that is loaded.	Fatal
162		INTNUM is not set. Be sure LTN.CNF contains the line DDK_INTNUM=XXh, where XX is the hex interrupt number.	Fatal
163		An attempt was made to run LABTECH without the TSR loaded, or with the TSR hooked to an interrupt other than that entered in LTN.CNF (see above).	Fatal

Chapter 2: AD12-8 Hardware Interface

This section of the manual deals with issues specific to the AD12-8 card.

Configuring the AD12-8.

The following options must be configured on the AD12-8 before it can be used with LABTECH software:

- Base Address
- A/D Range Polarity (Must be Bipolar if using AT16-P)
- A/D Range (Must be 5 volt if using AT16-P)
- AUTO Jumper (Must be in place for high-speed mode acquisition form Labtech)
- CLK0 Jumper (Must be removed to use count input block type)
- Digital I/O Jumpers

Please refer to the Manual and Setup Software provided with the card for instructions on setting the above options.

Identifying Channels in LABTECH Software

Analog Input Blocks.

Analog input channels to the A/D converter cards are assigned software channel numbers. For example, AD12-8 input channels 0 through 7 are assigned software interface channel numbers 0, 16, 32, 48, 64, 80, 96, and 112, respectively. (Also, for compatibility with the High-Speed mode of acquisition, note that the eight analog inputs on the AD12-8 can also be referenced via the channel numbers 128 through 135.) When the AD12-8 card is used with AT16-P multiplexer expanders, these channel numbers refer to the first hardware channel on each AT16-P. The rest of the channels in each AT16-P are referenced by adding the AT16-P channel number to the appropriate software number. For example, the third input channel of an AT16-P (IN2) connected to input channel 0 of an AD12-8 would be LABTECH software channel number 2, the first input channel of an AT16-P (IN0) connected to input channel 1 of an AD12-8 would be channel number 16, etc.

The same is true when using an LVDT8-P. To determine the software channel number, add the hardware channel number of the LVDT8-P to the appropriate AD12-8 base value of 0, 16, 32, 48, etc. Thus, the fourth input of an LVDT8-P connected to input channel 2 of an AD12-8 would be software channel number 35.

Digital I/O Blocks.

The eight digital I/O bits on the AD12-8 are jumper selectable bit-by-bit for input or output. Both input and output block types in LABTECH software refer to the eight I/O bits as channel number 0. It is up to you to keep track of which bits have been selected as input or output. Note that taking input from bits which have been selected as output will result in reading the last value output to those bits. Also note that outputting to bits selected as input will have no effect. Please consult LABTECH software documentation for information about masking off unwanted digital input bits.

Counter Input.

Counter number 0 is used on the AD12-8 to provide a count input block in LABTECH software. This counter is assigned a channel number of 0, and can be used for event counting.

Pulse Output Blocks.

Counter number 1 is dedicated to provide a frequency output, called a Pulse Block in LABTECH software. This output channel is assigned a block number of 0. NOTE: The frequency is derived by using counter 1 in mode three (square wave generator), with the counter loaded with $CLOCK_SPEED / \text{Desired_frequency}$. The value of $CLOCK_SPEED$ is the 1/32 multiple of the OSC bus clock from the host computer (14.31818 / 32 Mhz). The actual frequency that will be output for a given desired frequency can be calculated according to the following equation:

$$\text{Actual output frequency} = \frac{\text{CLOCK SPEED}}{\text{INT}(\text{CLOCK SPEED} / \text{desired_frequency})}$$

where $CLOCK\ SPEED$ is 14.31818 / 32, and $INT()$ is the least integer function.

Frequency Input.

Counter number 0 is used to provide a frequency input channel in LABTECH software. Frequency is derived by multiplying the number of counts received between acquisition scans by the length of the scan. This produces frequency with a maximum resolution of your sample rate, as set in LABTECH software. Note that Frequency input can not be run concurrently with other counter operations.

High Speed Data Acquisition.

LABTECH software only supports the Analog Input block type for high-speed data acquisition. Please refer to the Analog Input Block discussion, above, for information on channel numbers. Note that LABTECH Software High Speed modes only support acquisition across a sequential range of points. To support High Speed acquisition from an AD12-8, the AD12-8 driver configures channel numbers 128 through 135 to echo the card's eight analog inputs. These eight channel numbers will return the same data as channel numbers 0, 16, 32, 48, etc., and can be used to perform high-speed acquisition from an AD12-8 without any multiplexing expansion boards. (Also note that these eight channels can be used in normal mode acquisition.)

Error codes

The following is a list of error codes, and possible solutions, for the AD12-8 LABTECH software driver.

Error Code	Status Code	Possible Solution / Explanation	Severity
-99	Base Address	No End - of - Conversion was received at initialization. Confirm that the base address switches on the card match the status code.	Fatal
-98	Base Address	No End - of - Conversion was received during a run. Check all external clock connections (if any).	Fatal
-91		An attempt was made to output an invalid frequency during Pulse Output. Please make sure the frequencies selected for output are supported by the device. See Pulse Output Blocks.	Warning

This page intentionally blank

APPENDIX A: Non-Linear Inputs

Thermocouples.

Thermocouple measurement can be accomplished with the AD12-8 when using an AT16-P multiplexing expansion card. Subsequent linearization of the acquired voltage requires several Blocks per thermocouple. In general, one block will input the voltage from the card. Another block will measure the thermocouple reference junction temperature. The third block will call the CAL.E(X) function (as described in the LABTECH Software Reference Manual) to convert the Reference Junction temperature to thermocouple temperature in volts, using the same thermocouple type as your first block. The fourth block is a calculated block, type TCPL(1,3). This procedure works for those thermocouple types directly supported by LABTECH Software (J,K,S,T,B,R, and E). When using other thermocouple types, please refer to the next section.

Unsupported Thermocouples.

Blocks one through three, outlined above, remain the same when dealing with unsupported thermocouple types. Block four is replaced with a calculated block, type X+Y, to add block three to block one, effectively performing reference junction compensation. A fifth block is added to call the POLY(X) function which converts the compensated thermocouple voltage to thermocouple temperature. Please refer to LABTECH Reference Manual for more information on using the POLY(X) Calculated channel block type.

Other Non-Linear Inputs.

Any non-linear input whose function can be approximated with an nth order polynomial can be linearized in LABTECH Software by judicious application of the techniques presented under Thermocouples, and Unsupported Thermocouples, above. For further information please refer to the LABTECH Reference manual under the POLY(X), CAL.E(X), CAL(X) functions, and under Thermocouple Measurement.

This page intentionally left blank

BUG REPORT

While we have tried to assure this manual is error free, it is a fact of life that works of man have errors. We request you to detail any errors you find on this BUG REPORT and return it to us. We will correct the errors/problems and send you a new manual as soon as available. Please return to:



Attn: Documentation Department
P. O. Box 910557
San Diego, CA 92121-0557

Your Name: _____

Company Name: _____

Address 1: _____

Address 2: _____

Mail Stop: _____

City: _____ State: _____ Zip: _____

Phone: (____) _____

Product: **AD12-8 LABTECH Notebook**

Manual Revision: **00650-015-1A**

Please list the page numbers and errors found. Thank you!

