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p/n YPM08121

ACR8010
Hardware Manual

Effective: October 7, 2002



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CHANGE NOTICE

ACR8010 Hardware Manual P/N PM08121 Version Change:
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1.	Page 12, Jumper List	Corrected JP31 and JP32 descriptions.
2.	Page 18, Digital Output Sink/Source Jumper (JP29 and JP30)	Added output sink driver source.
3.	Page 24, RS-422/RS-485 Configuration Jumpers	Corrected MUX table.
4.	Page 40, ACR8010 Technical Specification	Corrected operating temperature specification.

ACR8010 Hardware Manual P/N PM08121 Version Change:
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To: Version 1.04, Dated 9/30/1999

1.	Page 5, ACR8010 Motherboard Plug and Play	Added note about README file on AMCS CD.
2.	Page 12, ACR8010 Motherboard Jumpers	Added jumper list reference table.
3.	Page 18, ACR8010 Motherboard Jumpers – Digital Output	Added warning about jumper installation with incorrect driver IC's.
4.	Page 23, ACR8010 Motherboard Jumpers – RS-422/RS-485 Configuration	Added additional information about RS-422/RS-485 set-up.
5.	Page 14, ACR8010 Motherboard Hardware Wiring – Encoder Inputs	Corrected signal names on P1C table.
6.	ACRIO Section	Moved ACRIO Module to separate document.

ACR8010 Hardware Manual P/N PM08121 Version Change:
From: Version 1.02, Dated 7/8/1999
To: Version 1.03, Dated 8/16/1999

1.	ACR8010 Motherboard Jumpers – Battery Back-up Select Jumpers (JP4 and JP5)	Added default configuration information.
2.	ACR8010 Motherboard Hardware Wiring – Encoder Inputs (P1A, P1B, and P1C)	Added P1C interface information to standard DB9 connector.

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CHANGE NOTICE, continued

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1.	Chapter 3 Overview	Removed +5VDC reference.
2.	ACRIO Module Jumpers – Digital Input Reference Select Jumpers (J3 and J4)	Removed +5VDC reference.
3.	ACRIO Module Jumpers – Digital Output Sink/Source Select Jumpers (J5 and J6)	Removed +5VDC reference. Added jumper warning.
4.	ACRIO Module Hardware Wiring, Digital I/O Power (PWR1)	Removed +5VDC reference.
5	ACR8010 Motherboard Jumpers – RS-422/RS-485 Configuration Jumpers	Updated and corrected jumper information.

ACR8010 Hardware Manual P/N PM08121 Version Change:
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1.	ACR8010 Motherboard Hardware Setup	Updated and corrected jumper drawing.
2.	ACR8010 Motherboard Jumpers – Digital Input Reference Select Jumpers	Updated and corrected jumper information.
3.	ACR8010 Motherboard Jumpers – RS-422/RS-485 Configuration Jumpers	Updated and corrected jumper information.

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INTRODUCTION

This document provides hardware connection information for the Acroloop ACR8010 motion controller.

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CHAPTER 1

ACR8010 MOTHERBOARD PLUG AND PLAY CAPABILITY

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CHAPTER 1 OVERVIEW

This section contains diagrams of the interrupt, I/O ports, and memory decoding capabilities used in the Plug and Play setup of the ACR8010 motherboard.

NOTE: It is important to read the README file located on the Acroloop CD before attempting any PC installation of the ACR8010 board.

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ACR8010 MOTHERBOARD PLUG AND PLAY CAPABILITY

I/O Port Address Select

The ACR8010 can receive and transmit data through I/O ports on a PC BUS. The port address is automatically configured in Windows 95 using the ACR8010's Plug and Play interface. When using DOS or Windows NT, the port address is selected using the supplied ACROPNP utilities. The data port is used to both transmit and receive. Both transmit and receive channels are connected to 512 byte First In / First Out (FIFO) hardware buffers.

NOTE: It is important to read the README file located on the Acroloop CD before attempting any PC installation of the ACR8010 board.

The status port is used to see if data is waiting to be received from the card and if it is OK to send data to the card. The byte read from the status port is defined as follows:

BIT	Definition	Description
BIT7	Transmit Not Full	Clear to send one byte
BIT6	Transmit Not Half Empty	Clear to send up to 255 bytes
BIT5	Receive Not Empty	Data Available
BIT4	Transmit Not Empty	Still something in the buffer

Table 1.1 ACR8010 PC BUS Status Port Bits

The following table shows the available ACR8010 I/O port addresses.

Port Number	I/0 Block Reserved	Address Function	
		Data	Status
0	0x300-0x303	0x300	0x302
1	0x304-0x307	0x304	0x306
2	0x308-0x30B	0x308	0x30A
3	0x30C-0x30F	0x30C	0x30E
4	0x310-0x313	0x310	0x312
5	0x314-0x317	0x314	0x316
6	0x318-0x31B	0x318	0x31A
7	0x31C-0x31F	0x31C	0x31E

Table 1.2 ACR8010 PC BUS Port Addresses

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ACR8010 MOTHERBOARD PLUG AND PLAY CAPABILITY

Interrupt Select

The ACR8010 can be instructed to interrupt a PC host through the parallel bus by issuing a SET 112 command in immediate mode or from within a program. Interrupt driven software at the host level is an advanced topic and should only be attempted by someone with a thorough knowledge of interrupt driven code.

In order for the PC to see the interrupt, the proper interrupt selection from the following table must be made. The interrupt is automatically configured in Windows 95 using the ACR8010's Plug and Play interface. When using DOS or Windows NT, the interrupt is selected using the supplied ACROPNP utilities.

NOTE: It is important to read the README file located on the Acroloop CD before attempting any PC installation of the ACR8010 board.

Level	Common Function
Disabled	Not Applicable
IRQ3	Secondary Serial (COM2)
IRQ4	Primary Serial (COM1)
IRQ5	Secondary Parallel (LPT2)
IRQ7	Primary Parallel (LPT1)
IRQ10	Reserved (unused)
IRQ11	Reserved (unused)
IRQ12	Reserved (unused)
IRQ15	Reserved (unused)

Table 1.3 ACR8010 PC BUS Interrupt Select

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CHAPTER 2

ACR8010 MOTHERBOARD HARDWARE SETUP

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CHAPTER 2 OVERVIEW

This section contains diagrams of the jumpers and switches on the ACR8010 mother board.

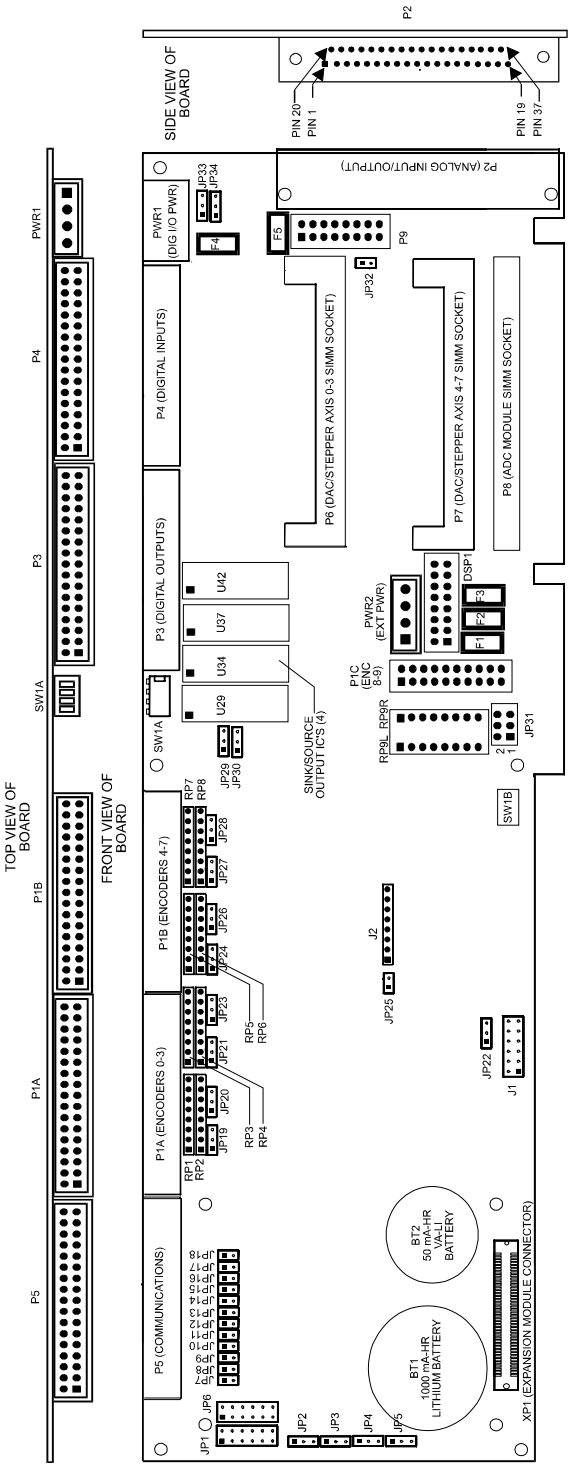
Encoder pull-up jumpers must be set correctly based on the types of encoders being used. Failure to set these jumpers correctly may cause damage to the encoders or to the receivers on the controller card.

There are no analog adjustment “pots” on the board. All analog gain and offset is under software control. The analog outputs must be wired to differential control signal inputs on a servo amplifier. The DAC SIMM module outputs provide an analog control voltage of ±10 volts.

Stepper SIMM module outputs provide open-collector step and direction signals. There are no pull-up resistors provided on the Stepper outputs.

Factory default jumper settings for the ACR8010 motherboard are highlighted within the following jumper tables.

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NOTE: Square pin indicates Pin 1.

Figure 1.. ACR8010 Motherboard Outline

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ACR8010 MOTHERBOARD SWITCHES

Serial Communication Card Selection Switch (SW1A)

Serial communications via the COM1 and COM2 communication ports on the ACR8010 Motherboard are performed with multiple cards using different ACR8010 card numbers. The following table shows how the switch positions relate to the ACR8010 card number.

Note that Switch 4 should be left in the "OFF" position, unless using the Flash Bypass Mode of operation. Flash Bypass Mode is selected when the user does not want to load the program information from flash at power-up or reset. Serial communications via the COM1 and COM2 communication ports on the ACRCOMM module will recognize the card as Card Number 15. However, the card should be placed back to a valid card number during normal operation.

Refer to Figure 1 for switch location.

Card Number	SW1 Settings				
	4	3	2	1	Function
0	OFF	OFF	OFF	OFF	Serial Communications
1	OFF	OFF	OFF	ON	Serial Communications
2	OFF	OFF	ON	OFF	Serial Communications
3	OFF	OFF	ON	ON	Serial Communications
4	OFF	ON	OFF	OFF	Serial Communications
5	OFF	ON	OFF	ON	Serial Communications
6	OFF	ON	ON	OFF	Serial Communications
7	OFF	ON	ON	ON	Serial Communications
8-14	RESERVED				
15	ON	ON	ON	ON	Flash Bypass Mode

Table 2.1 ACR8010 Serial Communication Card Number Select

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ACR8010 MOTHERBOARD SWITCHES

User Switch (SW1B)

This four position dip switch is a dedicated user switch. The switch is available to the user as part of the Miscellaneous Input Flags (bits 68 thru 71). Refer to Appendix B, Flag References.

Refer to Figure 1 for switch location.

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ACR8010 MOTHERBOARD JUMPERS

Jumper Table List

The following is a list of the jumper functions on the ACR8010 motherboard:

JUMPER	JUMPER FUNCTION
JP1	COM1 RS-422/RS-485 Configuration (Page 23)
JP2	Battery BT1 Enable/Disable (Page 22)
JP3	Battery BT2 Enable/Disable (Page 22)
JP4	User Memory Battery Power Select (Page 21)
JP5	User Memory Battery Chip Enable Select (Page 21)
JP6	COM2 RS-422/RS-485 Configuration (Page 23)
JP7	COM1 RS-422 Termination Resistor Select (Page 26)
JP8	COM1 RS-422 Termination Resistor Select (Page 26)
JP9	COM1 Half Duplex Select (Page 23)
JP10	COM1 Half Duplex Select (Page 23)
JP11	COM2 RS-422 Termination Resistor Select (Page 26)
JP12	COM2 RS-422 Termination Resistor Select (Page 26)
JP13	COM2 Half Duplex Select (Page 23)
JP14	COM2 Half Duplex Select (Page 23)
JP15	COM1 and COM2 Autobaud Detect Enable (Page 27)
JP16	Reserved
JP17	Reserved
JP18	Reserved
JP19	ENC0 Pull-up Voltage Select (Page 14)
JP20	ENC1 Pull-up Voltage Select (Page 14)
JP21	ENC2 Pull-up Voltage Select (Page 14)
JP22	Factory Set Firmware Eprom Size Select (Page 20)
JP23	ENC3 Pull-up Voltage Select (Page 14)
JP24	ENC4 Pull-up Voltage Select (Page 14)
JP25	Factory Jumper (U81 Not Installed Select Jumper)
JP26	ENC5 Pull-up to Voltage Select (Page 14)
JP27	ENC6 Pull-up Voltage Select (Page 14)
JP28	ENC7 Pull-up to Voltage Select (Page 14)
JP29	Digital Output Sinking/Sourcing Select (Page 18)
JP30	Digital Output Sinking/Sourcing Select (Page 18)

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Jumper Table List, continued

JUMPER	JUMPER FUNCTION
JP31	ENC8/ENC9 Pull-up Voltage Select (Page 14)
JP32	Reserved
JP33	Digital Input Sinking/Sourcing Select (Page 16)
JP34	Digital Input Sinking/Sourcing Select (Page 16)
J1	Factory Test Header**
J2	Factory Programming Header**

** Connecting external signals to these headers may cause board failure or damage to IC's.

Refer to Figure 1 for locations.

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ACR8010 MOTHERBOARD JUMPERS

Encoder Pull-up Select Jumpers (JP19,20,21,23,24,26,27,28,31)

The ACR8010 is capable of handling various types of incremental open-collector and line driver encoders. Care must be taken to setup each channel to match the encoder type as described below:

The encoder options for the ACR8010 are selectable as follows:

Encoder Options	Encoders Supplied
None	Not Applicable
5	1,2,3,4, and 8
10	1,2,3,4,5,6,7,8, and 9

Open Collector Encoders:

When using open-collector encoders, the encoder channels must be pulled to either +5 or +12 volts, depending upon the application. Pulling up to +12 volts provides higher noise immunity, but causes a slower response time. For high frequency applications (encoder rates higher than 1 megahertz) the +5 volt pull-up section may be necessary.

Line Driver Encoders:

When using line driver (or balanced pair) encoders, the corresponding resistor pack should be removed from it's socket. Leaving the resistor pack in the socket can cause faulty encoder operation and possibly severe encoder damage. Optionally, the resistor pack can be replaced with an 8-pin isolated resistor pack to supply termination resistance for the balanced signal pairs.

Pull-up Selection:

The following table lists the pull-up jumper settings for each encoder:

WARNING

Wiring a line driver encoder with the pull-up selected to +12 volts will permanently damage the encoder.

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Encoder Pull-up Select Jumpers (JP19,20,21,23,24,26,27,28,31), cont'd

Encoder Pull-Up Jumpers				
Encoder	Resistor	Jumper	+5V	+12V
0	RP1	JP19	1-2	2-3
1	RP2	JP20	1-2	2-3
2	RP3	JP21	1-2	2-3
3	RP4	JP23	1-2	2-3
4	RP5	JP24	1-2	2-3
5	RP6	JP26	1-2	2-3
6	RP7	JP27	1-2	2-3
7	RP8	JP28	1-2	2-3
8	RP9L	JP31	1-3	3-5
9	RP9R	JP31	2-4	4-6

Table 2.2 ACR8010 Encoder Pull-Up Jumpers

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD JUMPERS

Digital Input Reference Select (JP33 and JP34)

This jumper selects the reference voltage to be used for the optically-isolated inputs. The reference voltage selected applies to all inputs; there are no combinations available.

Isolated voltage (VEXT) refers to +24VDC

WARNING

Wiring VEXT with the incorrect voltage will permanently damage the Digital I/O circuitry. The isolated voltage (VEXT) is selected as +24VDC.

Refer to Figure 1 for jumper location.

Digital Input Reference Jumper				
Input Type	Reference Voltage	JP33	JP34	User Supplies
Sinking	Reference Inputs to +24VDC Isolated Voltage (VEXT)	1-2	1-2	Path to GEXT
Sourcing	Reference Inputs to Isolated Common (GEXT)	2-3	2-3	Path to VEXT

Table 2.3 ACR8010 Digital Input Reference Jumper

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USER CIRCUIT	JUMPER POSITIONS
Sink Input  	JP33-1 to JP33-2 JP34-1 to JP34-2
Source Input +24VDC Isolated Voltage (VEXT)  	JP33-2 to JP33-3 JP34-2 to JP34-3

Figure 2. ACR8010 Digital Input User Circuit

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ACR8010 MOTHERBOARD JUMPERS

Digital Output Sink/Source Select Jumpers (JP29 and JP30)

These jumpers are set at the factory based on the type of the output drivers, IC's U29, U34, U37, and U42. The selected type of the output driver applies to all outputs; there are no combinations available.

Isolated voltage (VEXT) refers to +24VDC.

WARNING

Wiring VEXT with the incorrect voltage will permanently damage the Digital I/O circuitry. The isolated voltage (VEXT) is +24VDC.

Selecting the wrong jumper settings for the type of output drivers installed on the board will permanently damage the output driver IC's (U29, U34, U37, U42). The output drivers are installed at the factory, based on the Sinking or Sourcing Option selected when ordering the board.

Refer to Figure 1 for jumper location.

Digital Output Sink/Source Select Jumpers				
Output Type	Output Driver IC Type Installed (U29, U34, U37, U42) (See Warning Above)	JP29	JP30	User Supplies
Sink	Motorola / ST Micro ULN2803A	1-2	1-2	Path to VEXT
Source	Allegro UDN2981A	2-3	2-3	Path to GEXT

Table 2.4 ACR8010 Digital Output Sink/Source Select Jumper

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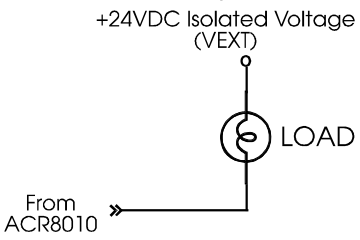
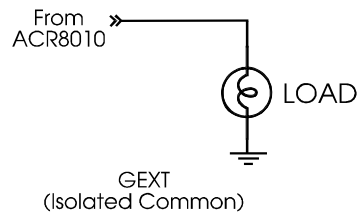
USER CIRCUIT	JUMPER POSITIONS
Sink Output  	JP29-1 to JP29-2 JP30-1 to JP30-2
Source Output  	JP29-2 to JP29-3 JP30-2 to JP30-3

Figure 3. ACR8010 Digital Output User Circuit

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ACR8010 MOTHERBOARD JUMPERS

EPROM Size Select Jumper (JP22)

This jumper is set at the factory to match the EPROM size required for the current firmware version. This jumper should not be set by the user.

EPROM Size Jumper		
Memory	Part No.	JP22
128K x 32	27C2048	1-2
256K x 32	27C4096	2-3

Table 2.5 ACR8010 EPROM Size Select Jumper

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD JUMPERS

Battery Back-Up Select Jumpers (JP4 and JP5)

These two jumpers allow for disabling and enabling of the battery back-up function on the ACR8010 motherboard.

When the jumpers are set to "Battery Function Enabled", user programs on the board are retained when power is removed (and batteries are enabled – see Battery Enable Jumpers). When the jumpers are set to "Battery Function Disabled", user programs on the board are not retained when power is removed.

Battery Back-up Jumpers		
Battery Function	JP4	JP5
Battery Function Disabled	1-2	1-2
Battery Function Enabled	2-3	2-3

Table 2.6 ACR8010 Battery Back-Up Enable Jumpers

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD JUMPERS

Battery Enable Jumpers (JP2 and JP3)

These two jumpers enable or disable the batteries on the ACR8010 Motherboard. A primary 1000mA-Hr Lithium (LI) coin battery is provided on the board (BT1 – User-Replaceable). A 50mA-Hr rechargeable Vanadium-Lithium (VA-LI) battery is also provided as a short-term secondary back-up source (BT2 – Factory Replaceable Only). This allows for continued back-up of the user memory during replacement of the primary battery.

The factory default jumper settings are set to disconnect the batteries from the circuit. This prevents the battery power from draining during shipping. The jumpers must be moved to the Battery Load Enable positions for normal battery back-up operation.

Battery Selection Jumpers		
Battery Type/Function	JP2	JP3
Battery Load Enable (BT1 and BT2 installed)	1-2	1-2
Battery Load Enable (BT1 only installed)	2-3	1-2
Battery Load Disable	2-3	2-3

Table 2.7 ACR8010 Battery Selection Jumpers

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD JUMPERS

RS-422/485 Configuration Jumpers (JP1, JP6, JP9, JP10, JP13, JP14)

The ACR8010 serial communication interface is software configurable. At power-up, the default COM1/COM2 communications mode is RS-232.

ACR8010/SA Boards:

For Standalone ACR8010 boards, reconfiguration of the communications ports to RS-422/RS-485 must be performed via an RS-232 port.

If one of the serial ports is a dedicated RS-232 port, reconfiguration of the second port may be accomplished at power-up (or at any time).

If both ports are to be configured to RS-422/RS-485 mode, the following must be performed:

1. Open serial communication to one of the ports via RS-232.
2. Load a PBOOT program containing the desired communication flags configuration for COM1 and COM2 ports.

This will configure the serial ports to the desired mode of operation at power-up. If a different communication mode is then required, disabling the User-Memory battery-backup batteries via jumpers or a issuing a BRESET command (or issuing a FLASH ERASE command, if the programs are stored in flash memory) will set the communications modes back to default (RS-232) at the next power-up sequence.

ACR8010/PS Boards:

For PC ACR8010 boards with the communications option, the serial ports may be configured as above via a serial port, or at power-up (or any time) via the ISA bus communications port.

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RS-422/485 Configuration Jumpers, continued

The following tables show the configuration schemes for the ACR8010 board with the serial communication option. Refer to the User's Guide manual, COM1/COM2 Stream Flags, Appendix B, for bit flag details. Refer to the following page for hardware jumper details.

MUX Flags, Set-up communication type flags:

MUX1 FLAG	MUX0 FLAG	COMM FUNCTION
CLR (0)	CLR (0)	Not Used
CLR (0)	SET (1)	RS-232 (Default)
SET (1)	CLR (0)	RS-422/RS-485
SET (1)	SET (1)	Not Used

RECEIVE/TRANSMIT Flags, RS-485 flow control flags:

RECEIVE FLAG	TRANSMIT FLAG	COMM FUNCTION
CLR (0)	CLR (0)	Use for RS-485 Operation: (Default) Receiver Enabled Transmitter Disabled
CLR (0)	SET (1)	Not Used: Receiver Enabled Transmitter Enabled
SET (1)	CLR (0)	Not Used: Receiver Disabled Transmitter Disabled
SET (1)	SET (1)	Use for RS-485 Operation Receiver Disabled Transmitter Enabled

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RS-422/485 Configuration Jumpers, continued

These jumpers selections show some of the standard interface configurations for the RS-422/RS-485 output control. Refer to the following figure for a schematic of the RS-422/RS-485 interface.

Standard RS-422/485 Interface Jumpers Examples		
Interface Function	COM1 Jumpers	COM2 Jumpers
RS-422 Full Duplex: Drivers and Receivers are enabled at all times. 4-Wire Interface.	JP1-1 to JP1-2 JP1-3 to JP1-4 JP9 Out JP10 Out	JP6-1 to JP6-2 JP6-3 to JP6-4 JP13 Out JP14 Out
RS-485 Half Duplex: Drivers and Receivers are enabled and disabled by the user via COM1/COM2 RXD/TXD Transmit Enable flags. 2-Wire Interface.	JP1-1 to JP1-2 JP1-3 to JP1-4 JP9 In JP10 In	JP6-1 to JP6-2 JP6-3 to JP6-4 JP13 In JP14 In

Table 2.9 ACR8010 RS-422/485 Interface Jumpers

Refer to Figure 1 for jumper location.

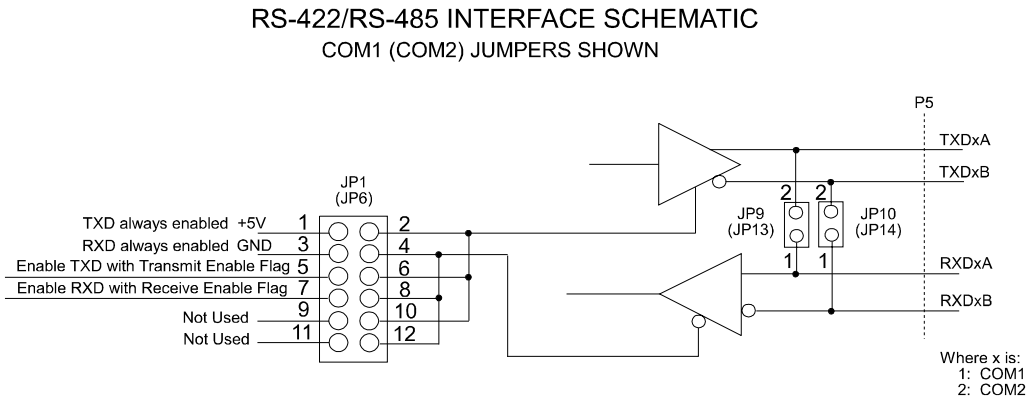


Figure 4. ACR8010 RS-422/RS-485 Interface Schematic

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RS-422 Communication Ports Line Terminator Jumpers (JP7, JP8, JP11, JP12)

These jumpers provide 120 ohm termination resistors for the RS-422 signals.

Communication Ports Termination Jumpers			
Signal	Jumper	Termination	No Termination
RXD1A/RXD1B	JP8	Jumper In	Jumper Out
TXD1A/TXD1B	JP7	Jumper In	Jumper Out
RXD2A/RXD2B	JP12	Jumper In	Jumper Out
TXD2A/TXD2B	JP11	Jumper In	Jumper Out

Table 2.8 ACR8010 RS-422 Termination Jumpers

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD JUMPERS

Autobaud Detect Jumper (JP15)

This jumper enables or disables the autobaud detect feature of the serial communications channels on the ACR8010 Motherboard. This jumper works in conjunction with the COM1 Startup Mode (P7013) and COM2 Startup Mode (P7029) parameters listed in the ACR2000/ACR8000 User's Guide under Miscellaneous Parameters P6912-P7029.

When the Startup Enable bit is not set (0 - default) in the COM1/2 Startup Mode parameters, the jumper is ignored and Autobaud detect is always enabled. The default operation of the COM1 and COM2 ports is Autobaud Detect enabled.

When the Startup Enable bit is set (1) in the COM1/2 Startup Mode parameters, the jumper defines the Autobaud Detect function as listed in the following table.

Autobaud Detect Jumper	
Function	JP15
Autobaud Detect Enabled	ON
Autobaud Detect Disabled	OFF

Table 2.10 ACR8010 Autobaud Detect Jumper

Refer to Figure 1 for jumper location.

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ACR8010 MOTHERBOARD HARDWARE WIRING

This section contains diagrams of the connectors on the ACR8010 motherboard.

Before optically-isolated digital inputs and outputs can be used, the card must be connected to an external +24V DC power supply. This connection is made at the PWR1 connector and is fused on-board at 4 amps to protect the controller card.

☠ WARNING

Wiring VEXT with the incorrect voltage will permanently damage the Digital I/O circuitry. The isolated voltage (VEXT) is +24VDC.

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Encoder Inputs (P1A, P1B, P1C)

There are two 34 pin headers and one 20 pin header provided on the ACR8010 for encoder feedback. The two 34 pin header provide up to eight (8) axes of encoder feedback (Encoders 0 thru 7). The 20 pin header provides 2 axes of encoder feedback (Encoder 8 and 9). Refer to Figure 1 for connector location.

Note: P1A and P1B are 34-pin shrouded male headers.

P1A			
Usage	**Pin**	**Pin**	**Usage**
CHA0	1	2	CHA0'
CHB0	3	4	CHB0'
MRK0	5	6	MRK0'
VCC	7	8	GND
CHA1	9	10	CHA1'
CHB1	11	12	CHB1'
MRK1	13	14	MRK1'
VCC	15	16	GND
CHA2	17	18	CHA2'
CHB2	19	20	CHB2'
MRK2	21	22	MRK2'
VCC	23	24	GND
CHA3	25	26	CHA3'
CHB3	27	28	CHB3'
MRK3	29	30	MRK3'
VCC	31	32	GND
N.C.	33	34	N.C.

P1B			
Usage	**Pin**	**Pin**	**Usage**
CHA4	1	2	CHA4'
CHB4	3	4	CHB4'
MRK4	5	6	MRK4'
VCC	7	8	GND
CHA5	9	10	CHA5'
CHB5	11	12	CHB5'
MRK5	13	14	MRK5'
VCC	15	16	GND
CHA6	17	18	CHA6'
CHB6	19	20	CHB6'
MRK6	21	22	MRK6'
VCC	23	24	GND
CHA7	25	26	CHA7'
CHB7	27	28	CHB7'
MRK7	29	30	MRK7'
VCC	31	32	GND
N.C.	33	34	N.C.

Table 2.11 ACR8010 Encoder Input Connectors P1A and P1B

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Encoder Inputs (P1A, P1B, P1C), cont'd.

Note: P1Cis a 20-pin unshrouded male header.

P1C			
Usage	**Pin**	**Usage**	**Pin**
CHA8	1	MRK8'	2
CHA8'	3	VCC	4
CHB8	5	GND	6
CHB8'	7	N.C.	8
MRK8	9	KEY**	10
CHA9	11	MRK9'	12
CHA9'	13	VCC	14
CHB9	15	GND	16
CHB9'	17	N.C.	18
MRK9	19	N.C.	20

Table 2.12 ACR8010 Encoder Input Connector P1C

NOTE: P1C pin 10 is used as a key pin.

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Encoder Inputs (P1A, P1B, P1C), cont'd.

P1C is designed to work in conjunction with a 20 pin ribbon cable terminated to two (2) standard 9-pin female D-sub type connectors.

This 12 inch cable, AMCS P/N PWH015, is supplied with the Encoder 8/9 Option.

Ribbon cable conductors 1 thru 9 connect to D-Sub #1 (conductor 10 is a No Connect). Ribbon cable conductors 11 thru 19 connect to D-Sub #2 (conductor 20 is a No Connect). When used in this manner, the D-sub pinouts are as follows:

Signal	D-Sub #1
CHA8	1
CHA8'	2
CHB8	3
CHB8'	4
MRK8	5
MRK8'	6
VCC	7
GND	8
No Connect	9

Signal	D-Sub #2
CHA9	1
CHA9'	2
CHB9	3
CHB9'	4
MRK9	5
MRK9'	6
VCC	7
GND	8
No Connect	9

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Encoder Inputs (P1), Continued

The ACR8010 can accept any feedback device that supplies either a +5V or +12V differential signal to the ACR8010. The most common type of device is a differential encoder. Refer to the table below for common encoder setups.

Encoder Type	ACR8010 Pull-up/Jumper Setting	Length of Cable/Type
Differential Line Driver (+5 Volt Outputs)	Remove Pull-ups	100 ft. (Beldon 9330 Shielded Twisted Pair)
Open Collector Driver (No Pull-ups on Encoder)	Install Pull-ups and Jumper to +12V	75 ft. (Beldon 9330 Shielded Twisted Pair)
Open Collector Driver (With Pull-ups to +5 V on Encoder)	Install Pull-ups and Jumper to +5V	50 ft. (Beldon 9330 Shielded Twisted Pair)
TTL Driver (+5 Volt Outputs)	Remove Pull-ups	50 ft. (Beldon 9330 Shielded Twisted Pair)

When using a single-ended encoder (an encoder without the A-, B-, or Z- outputs), additional pull-ups and pull-down resistors must be added externally to the ACR8010 board in order for the ACR8010 to read the encoder signals. Warning: This is not a recommended mode of operation. Noise immunity is significantly reduced.

Refer to the ACR8010 Typical Connection Diagram section of this manual for details on wiring a single-sided encoder to the ACR8010.

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Analog Input/Output (P2)

The analog input/output connections are made through a 37-pin D-style connector on the side of the ACR8010 motion controller. Refer to Figure 1 for connector location.

Note: P2 is a standard 37-pin female D-plug.
Pin definitions in parentheses are for stepper modules.

P2				
Definition	**Pin**	**Pin**	**Definition**	**Module**
ASIG-0 (STEP-0)	1	20	AGND-0 (DIR-0)	Module 0
ASIG-1 (STEP-1)	2	21	AGND-1 (DIR-1)	
ASIG-2 (STEP-2)	3	22	AGND-2 (DIR-2)	
ASIG-3 (STEP-3)	4	23	AGND-3 (DIR-3)	
ASIG-4 (STEP-4)	5	24	AGND-4 (DIR-4)	Module 1
ASIG-5 (STEP-5)	6	25	AGND-5 (DIR-5)	
ASIG-6 (STEP-6)	7	26	AGND-6 (DIR-6)	
ASIG-7 (STEP-7)	8	27	AGND-7 (DIR-7)	
AIN-0	9	28	AIN-1	Module 2
AIN-2	10	29	AIN-3	
AIN-4	11	30	AIN-5	
AIN-6	12	31	AIN-7	
(LCUR-0)	13	32	(LCUR-1)	Module0
(LCUR-2)	14	33	(LCUR-3)	
(LCUR-4)	15	34	(LCUR-5)	Module1
(LCUR-6)	16	35	(LCUR-7)	
WD-COM	17	36	WD-NO	None
WD-COM	18	37	WD-NC	
AGND	19			Module 2

Table 2.13 ACR8010 Analog I/O Connector

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Digital Inputs / Outputs (P3 and P4)

There are two 34 pin headers provided on the ACR8010 for digital I/O interface. The 34 pin headers are used for the 32 Digital Inputs and 32 Digital Outputs. Refer to Figure 1 for connector location.

Note: P3 and P4 are 34-pin shrouded male headers.

P3			
Usage	**Pin**	**Pin**	**Usage**
OUT-32	1	2	OUT-33
OUT-34	3	4	OUT-35
OUT-36	5	6	OUT-37
OUT-38	7	8	OUT-39
OUT-40	9	10	OUT-41
OUT-42	11	12	OUT-43
OUT-44	13	14	OUT-45
OUT-46	15	16	OUT-47
OUT-48	17	18	OUT-49
OUT-50	19	20	OUT-51
OUT-52	21	22	OUT-53
OUT-54	23	24	OUT-55
OUT-56	25	26	OUT-57
OUT-58	27	28	OUT-59
OUT-60	29	30	OUT-61
OUT-62	31	32	OUT-63
VISO	33	34	VISO

P4			
Usage	**Pin**	**Pin**	**Usage**
INP-00	1	2	INP-01
INP-02	3	4	INP-03
INP-04	5	6	INP-05
INP-06	7	8	INP-07
INP-08	9	10	INP-09
INP-10	11	12	INP-11
INP-12	13	14	INP-13
INP-14	15	16	INP-15
INP-16	17	18	INP-17
INP-18	19	20	INP-19
INP-20	21	22	INP-21
INP-22	23	24	INP-23
INP-24	25	26	INP-25
INP-26	27	28	INP-27
INP-28	29	30	INP-29
INP-30	31	32	INP-31
GISO	33	34	GISO

Table 2.14 ACR8010 Digital I/O Connector

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Miscellaneous Output (P9)

A fused +5VDC Stepper Output (SVCC) is available on the P9 connector for use with wiring the Stepper SIMM Module outputs. The maximum recommended output rating for SVCC is 250 milliamps.

Note: P9 is a 16 pin unshrouded male header.

P9			
Usage	**Pin**	**Usage**	**Pin**
SVCC	1	SVCC	2
SVCC	3	SVCC	4
GND	5	GND	6
RESERVED	7	RESERVED	8
RESERVED	9	RESERVED	10
GND	8	GND	12
CLOCK	13	N.C.	14
N.C.	15	N.C.	16

Table 2.15 ACR8010 Miscellaneous Output Connector P9

See Figure 1 for fuse F5 location.

Stepper +5VDC Output Fuse			
Fuse	Circuit	Amps	Littelfuse Part No.
F5	SVCC	0.500	154.500

Table 2.16 ACR8010 SVCC Power Fuses

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Communications (P5)

There is one 34 pin header provided on the ACR8010 communications board for the 2 serial and 1 parallel communications ports. The two serial ports, COM1 and COM2, can be individually configured as RS-232 or RS-422/485 interfaces. Configuration of the COM ports is software selectable by the user.

The following diagram shows the connections for the 3 communications ports. Refer to Figure 1 for connector location.

Note: P5 is a 34-pin shrouded male header.

P5			
Usage	**Pin**	**Usage**	**Pin**
RXD1	1	TXD1	2
GND	3	MUX1	4
TXD1A	5	TXD1B	6
RXD1A	7	RXD1B	8
RXD2	9	TXD2	10
GND	11	MUX2	12
TXD2A	13	TXD2B	14
RXD2A	15	RXD2B	16
STB	17	AFD	18
ERR	19	INIT	20
SLIN	21	GND	22
PD0	23	PD1	24
PD2	25	PD3	26
PD4	27	PD5	28
PD6	29	PD7	30
ACK	31	BUSY	32
PE	33	SLCT	34

Table 2.17 ACR8010 Communications Connector

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Digital I/O Power (PWR1)

PWR1 is the connection for the user supplied voltage for the Digital Inputs and Digital Outputs and should be wired to VEXT as shown in the table below. Refer to Figure 1 for connector location.

Isolated voltage (VEXT) refers to +24VDC.

WARNING

Wiring VEXT with the incorrect voltage will permanently damage the Digital I/O circuitry. The isolated voltage (VEXT) is +24VDC.

Note: PWR1 is a 4-pin male Weidmuller plug.

PWR1 Isolated Power Connector	
Usage	**Pin**
Isolated Common (GEXT)	1
Isolated Common (GEXT)	2
Isolated Voltage (VEXT)	3
Isolated Voltage (VEXT)	4

Table 2.18 ACR8010 Isolated Power Connector

Isolated Power Fuse			
Fuse	Circuit	Amps	Littelfuse Part No.
F4	VEXT	4	154.004

Table 2.19 ACR8010 Isolated Power Fuses

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Standalone Power (PWR2)

PWR2 is the connection on the ACR8010 communications board for the main power supply when the card is used as a stand-alone board. Refer to Figure 1 for connector location.

Note: PWR2 is a 4-pin male Weidmuller plug.

PWR2 Stand-alone Power Connector	
Usage	**Pin**
Stand-alone GND	1
Stand-alone +5V	2
Stand-alone -12V	3
Stand-alone +12v	4

Table 2.20 ACR8010 Standalone Power Connector

Stand-alone Power Fuses			
Fuse	Circuit	Amps	Littelfuse Part No.
F1	+5V	4	154.004
F2	-12V	0.25	154.250
F3	+12V	0.25	154.250

Table 2.21 ACR8010 Standalone Power Fuses

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CHAPTER 3
TECHNICAL SPECIFICATIONS

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ACR8010 TECHNICAL SPECIFICATION

ITEM	SPECIFICATION
CPU:	32 Bit Floating Point DSP @ 60 MHz
Processor Type:	Texas Instruments TMS320C32
Board Size:	1 Slot (option modules take up 1 additional slot, each) 13.3" x 4.25" Full-Size PC Form Factor
Axis Configuration:	2, 4, 6, or 8 axes configurations
Weight:	PC Version: 12.5 ounces Stand-alone Version: 13.5 ounces
Operating Temperature:	0°C to 50°C (32°F to 122°F)
Humidity:	0 to 95%, Non-Condensing
Power Consumption:	+5 VDC +/- 0.2VDC @ 2.5 Amps +12 VDC +/- 0.5VDC @ 0.150 Amps -12 VDC +/- 0.5VDC @ 0.150 Amps Note: Power consumption does not include any additional power required for external components (Encoders, Stepper Outputs, etc.).
Encoder Inputs:	Up to 10 per card Differential Quadrature Encoder Open-Collector or Line Driver 0.1 Hz to 8 MHz Frequency Range 100mA maximum power source per channel
DAC/Stepper Outputs:	Up to 8 per card DAC Outputs: +/- 10VDC @ 5mA, maximum Programmable Output (DAC GAIN, DAC OFFSET) 16 Bit Resolution Single Ended input amplifiers can be used if caution is used to avoid ground loops. Stepper Outputs: Open-Collector Step, Direction, and Low Current Outputs (no pull-up resistors on-board); Fused +5VDC Stepper Output available on P9 connector up to 250 mA. Step Output Frequency : 0 to 6 KHz, pulse width 167us 6 KHz to 4 MHz, approx. 50% duty cycle

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ACR8010 TECHNICAL SPECIFICATION, continued

ITEM	SPECIFICATION
Feedback Types:	Any Differential 5VDC or 12VDC including: - Quadrature Encoder - Glass Scales - Analog (Optional)
Watchdog Relay:	+24VDC @ 1.0 A Single Pole - Double Throw (SPDT) Hardwire through P2 analog header
External I/O Power Supply Requirements:	+24 VDC (+3/-6VDC) @ 4A
Digital Inputs:	32 Optically Isolated (standard) @ External Voltage Supplied Sinking or Sourcing Available Activates on 10mA per input
Digital Outputs:	23 Optically Isolated (standard) @ External Voltage Supplied Output Loads: 32 Outputs @ 50 mA continuously, each or Up to 12 Outputs @ 125mA continuously, each, distributed across the four (4) output drivers, as follows: up to 3 between OUT32 and OUT39 up to 3 between OUT40 and OUT47 up to 3 between OUT48 and OUT55 up to 3 between OUT56 and OUT63 Open Collector Sinking or Sourcing Type Available
A/D Inputs (SIMM Board Option):	Up to 8 single-ended or up to 4 differential 12 bit resolution Configurable for various analog inputs 9 microsecond conversion time
Communications:	PC-Bus standard COM1, COM2, and LPT Simultaneous communications on all 4 ports
Serial Communications:	2 ports standard (COM1, COM2) Configurable RS-232 or RS-422/485 Automatic Baud Detect (300 Hz – 38.4 KHz)

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CHAPTER 4

ACR8010 MECHANICAL DRAWINGS

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ACR8010 MECHANICAL DIMENSIONS

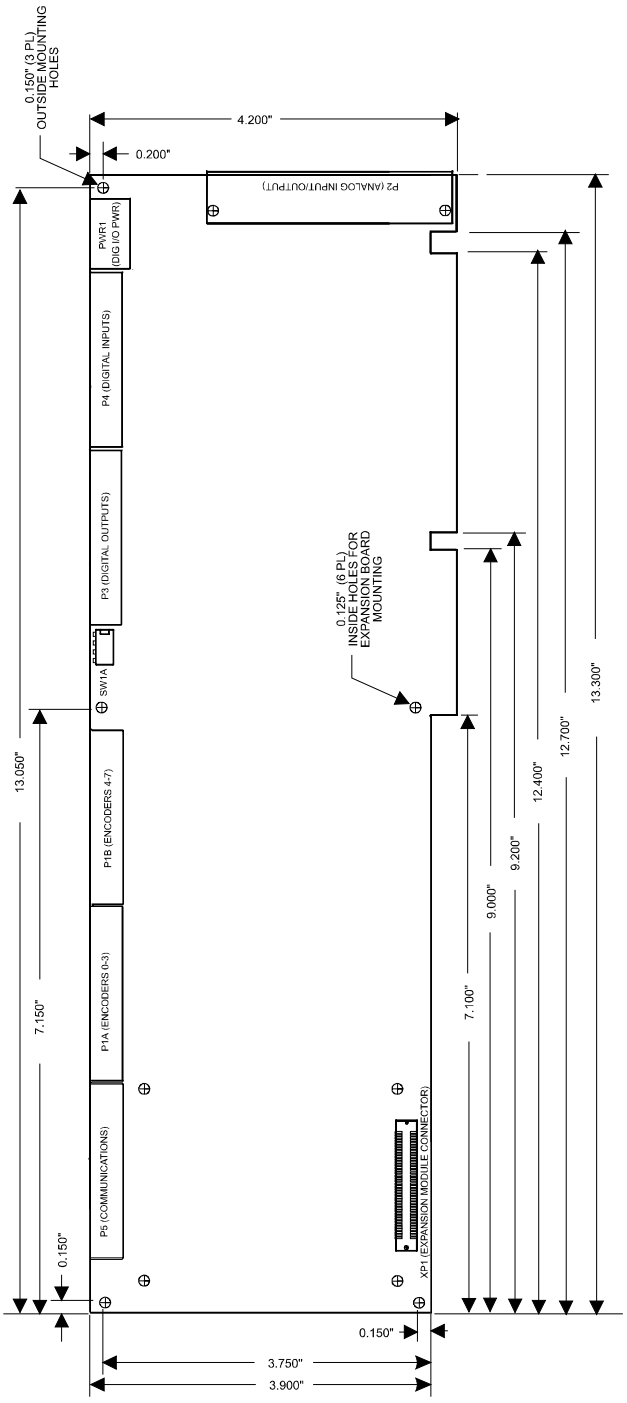


Figure 5. ACR8010 Mechanical Dimensions

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ACRIO/ACR8010 BOARD STACKING EXAMPLES

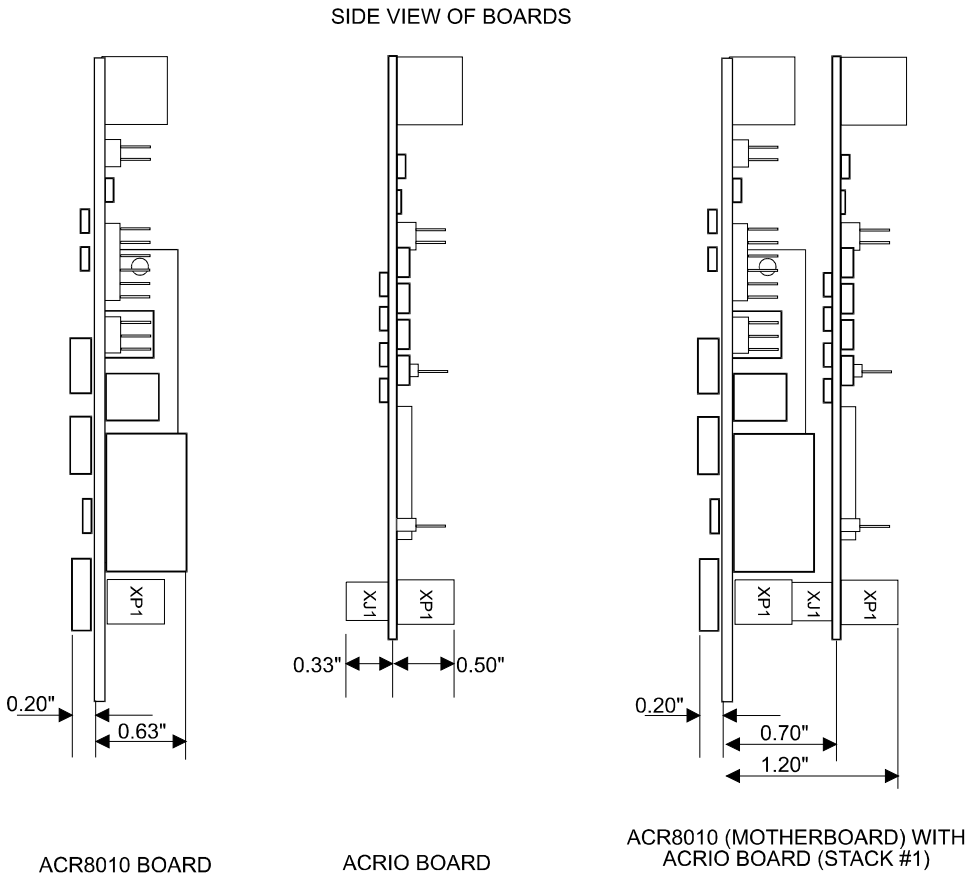


Figure 6. ACR8010 Board Stacking Mechanical Dimensions Examples

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ACR8010 TYPICAL CONNECTION DIAGRAMS

The following schematic sheets represent some typical connection and wiring diagrams for the ACR8010 Motherboard and associated plug-in modules:

For electronic media, refer to the typical connection drawing file, ACR8010 TYPICAL CONNECTIONS.PDF, supplied separately on the AMCS CD P/N CD2000 under the \DOCS directory.

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