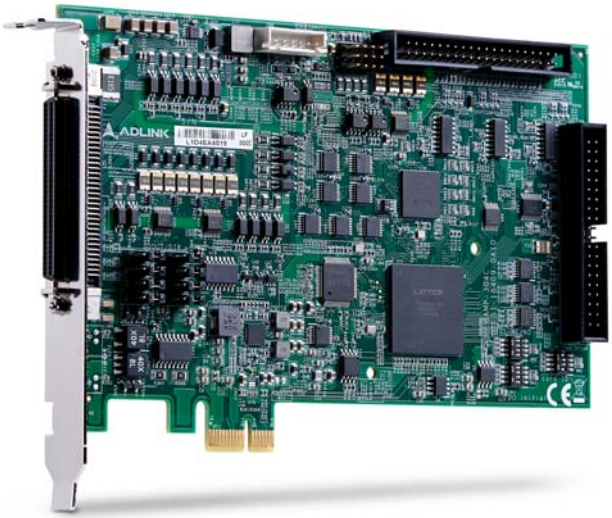
AMP-304C

4-Axis Pulse Motion Controller

User's Manual



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LEADING EDGE COMPUTING

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Revision History

Revision	Release Date	Description of Change(s)
1.0	2021-11-04	Initial release

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Preface

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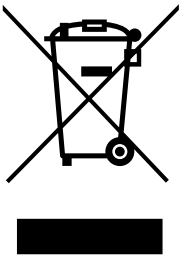
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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.

NOTE: Additional information, aids, and tips that help users perform tasks.

CAUTION: Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.
ATTENTION: Informations destinées à prévenir les blessures corporelles mineures, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche.

WARNING: Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.
AVERTISSEMENT: Informations destinées à prévenir les blessures corporelles graves, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche spécifique.

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1 Introduction

1.1 Overview

AMP-304C is an advanced 4-axis motion controller card with a PCI Express® interface that can generate a pulse train up to 9.99MHz to control a motor. With more general purpose as well as dedicated IOs, functional logic selection switches, 4-channel encoder feedback input, AMP-304C can be used for a multitude of scenarios or applications.

As a motion controller, AMP-304C covers all functions of the AMP-104C, which provides asymmetric speed profile settings in T-curve and S-curve, selection of motion stop method, and changing speed on-the-fly. Also supported are interpolation in linear, circular and helical directions with any 2-4 axes, 13 home return modes, backlash compensator, and vibration suppression.

Highly flexible position comparison trigger, and position latch functions are provided. The trigger function can be implemented by 16-channel output, including 4-channel dedicated output with voltage selection by onboard jumpers, while the position latch function uses a 12-channel input.

All functions and computations are performed internally by the ASIC and FPGA, thus limiting the impact on the PC's CPU, as shown in the figure below.

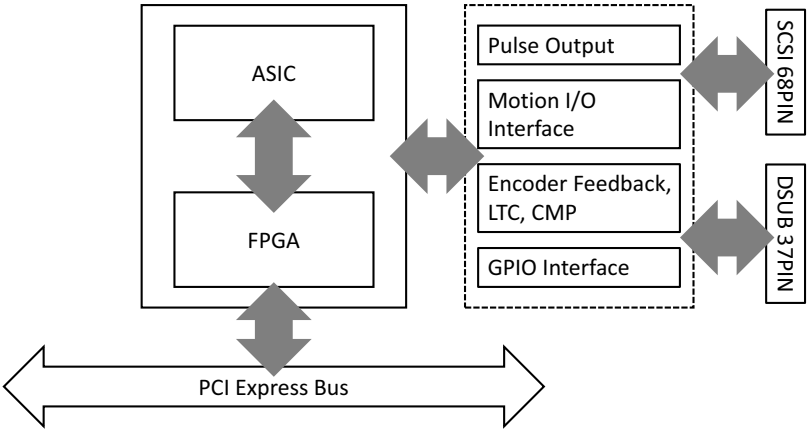


Figure 1-1: Functional Diagram

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1.2 Features

The following lists summarize the main features of the AMP-304C motion control system.

1.2.1 General Features

- 4-axis pulse type motion card
- PCI Express® Gen1 x1
- Supports up to 16 cards in one system
- Pulse output frequency up to 9.99 Mpps
- Pulse output mode: CW / CCW, OUT / DIR, AB Phase
- Encoder feedback input frequency up to 16 MHz
- Configurable emergency stop input
- Mechanical signal input / servo interface IO
- 32-ch onboard isolated GPIO / 32-ch extended TTL GPIO
- 12-ch position latch input
- 16-ch position comparison trigger output
- 4-ch dedicated CMP output with voltage selection
- 1-ch pulsar input
- Selection of card index by switch
- Selection of EL Logic NO / NC mode by switch
- Selection of DO initial state by switch
- Programmable interrupt control
- Security protection for user's program
- DIN-304C to support specific motors by cable selection

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1.2.2 Motion Features

- T-Curve and S-Curve: configurable asymmetric profile
- 13 home return modes
- Speed and position change on-the-fly
- Linear / Circular / Helical interpolation
- Motion stop method selection: EMG / deceleration
- Backlash compensator / vibration suppression
- High speed position latch function with configurable filter
- Flexible position comparison trigger output function

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1.3 Specifications

Pulse Type Motion Control	
Max. Axes	4
Pulse Output Frequency	up to 9.99 Mpps
Pulse Output Mode	CW/CCW, OUT/DIR, AB Phase
Pulse Output Type	Differential / Single-End
Encoder Feedback Input Mode	CW/CCW; 1x/2x/4x AB Phase
Encoder Feedback Input Frequency	4 MHz (up to 16 MHz at 4x AB)
Positon/Encoder Counter Resolution	32-bit
Motion I/O Interface Signals	
Emergency Stop Input	Configurable
Mechanical Signal Input	EL± / ORG / SD
Motion Interface IO	SVON / ERC / ALM / INP / RDY
GPIO Interface Signals	
GPIO Onboard	16-ch Optically Isolated DI
	16-ch Optically Isolated DO
Isolated Voltage	1000 VRMS
Digital Input Type	Source
Digital Input Voltage	24V DC
Digital Input Current	5-10 mA
Digital Output Type	Sink
Digital Output Voltage	5-24V DC
Digital Output Max. Current	100 mA
Response Frequency	up to 1MHz
GPIO Extension	16-ch Non-isolated TTL DI
	16-ch Non-isolated TTL DO

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Other I/O Interface Signals	
Pulsar Input	1-ch
Position Latch Input (Dedicated)	4-ch LTC (up to 1MHz)
Position Comparison Trigger Output (Dedicated)	4-ch CMP (up to 1MHz)
CMP Output Voltage Selection	5, 24 V or Open Collector
Position Latch Input (Configurable)	4-ch Optically Isolated DI (up to 10KHz)
	4-ch Non-isolated TTL DI (up to 1MHz)
Position Comparison Trigger Output (Configurable)	8-ch Optically Isolated DO (up to 1MHz)
	4-ch Non-isolated TTL DO (up to 1MHz)
General	
Main Connector	68-pin SCSI-Type Connector
Extension Connector	40-pin to 37-pin SCSI Box Header
Operating Temperature	0°C to 60°C
Storage Temperature	-20°C to 80°C
Humidity	5% to 95%, non-condensing
Environmental	
Safety Compliance	CE: EN 55032/55035 for Class B FCC: Part 15 B RoHS

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1.4 Supported Software

1.4.1 OS Support / Software Compatibility

- OS Support
  - Windows 7/10 (x86/x64)
- Software Compatibility
  - Visual Studio VB.NET, C#, VC.NET
  - APS Function Library Support

1.4.2 APS Functions

The AMP-304C is fully compliant with the APS (Automation Product Software) function library, independent of programming languages and operating systems (OS). A complete detailed listing of functions can be found in the APS Function Library User Manual.

1.4.3 MotionCreatorPro 2 (MCP2)

MotionCreatorPro2™ is a user interface exclusively developed for ADLINK motion control products in a standard Windows environment to easily setup cards and axis parameters. A Setup Wizard guides users through hardware installation and wiring as well as single-axis manipulation in minutes.

MotionCreatorPro2™ not only effectively reduces development time but also enables concurrent validation of overall mechanisms and electric design with all single axis and interpolation motion operation pages.

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1.5 Accessories

ADLINK's exclusive DIN-304C terminal board is designed for all AMP-304C signals and functions using ACL-10569, ACL-10437 and ACL-10137 cables.

Another way to connect is with ADLINK's DIN-68S terminal board and ACL-10569 cable. For extended connectors, Encoder Feedback, LTC, and CMP as well as TTL DIO, use a DIN-37 terminal board with ACL-10437 and ACL-10137 cables (sold separately).

	Main Function	TTL DI/O	Encoder Feedback, LTC, CMP
Terminal Board			
DIN-304C	Yes	Yes	Yes
DIN-68S-01	Yes		
DIN-37D-01		Yes	Yes
Cable			
ACL-10569-X, X = 1, 2, 3 (length in meters)	Yes		
ACL-10137-X, X = 1, 2, 3, 5 (length in meters)		Yes	Yes
ACL-10437		Yes	Yes

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2 Getting Started

This chapter describes how to install and connect to the AMP-304C, its hardware settings, and related signals.

2.1 Package Contents

The package includes the following items:

- 1x AMP-304C Card 4-Axis Pulse Motion Controller
- 1x ACL-10437 (DB37F - IDC40) Cable
- 4x Mini Jumper (2P)
- Product Warranty Card

If any of these items are missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton to ship or store the product in the future.

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2.2 Board Layout

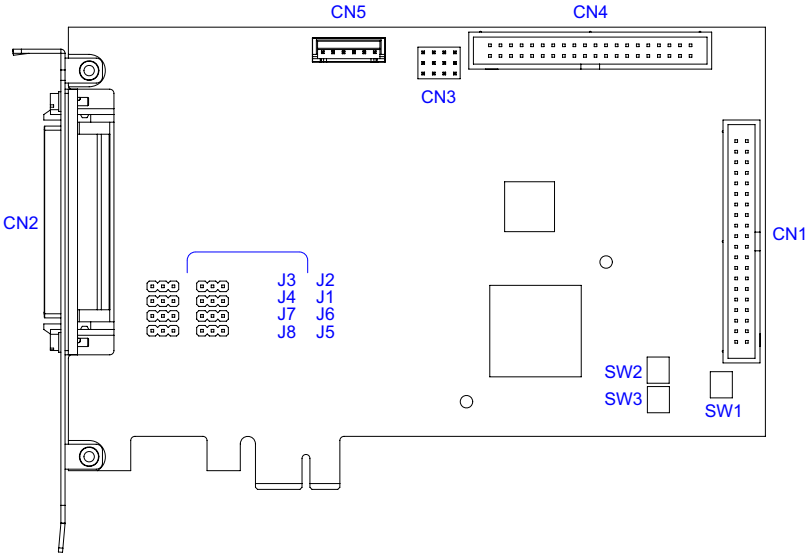


Figure 2-1: AMP-304C Board Layout

Item	Description
SW1	Card ID Selection Switch
SW2	End Limit Type Selection Switch
SW3	DO Initial State Selection Switch
J1-J8	Pulse Output Mode Selection Jumper
CN1	Extended TTL DIO 40-pin box header
CN2	AMP-304C Main Connector 68-pin SCSI
CN3	CMP Output Voltage Selection Jumper
CN4	Encoder Feedback, LTC, and CMP Signal 40-pin box header
CN5	Manual Pulser Input Signal 6-pin box header

Table 2-1: Board Features Legend

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2.3 Hardware and Software Driver Installation

2.3.1 Hardware Configuration

The AMP-304C is fully Plug-and-Play compliant and can be installed in any PCI Express slot. It employs a PCI Express Gen1 x1 bus, and the system BIOS can auto-configure memory and IRQ channels.

ADLINK's exclusive DIN-304C terminal board provides an easy-to-use set to connect to external drivers and to fulfill extra functions.

2.3.2 Installation Procedures

1. Read through this manual and setup the switches, jumper and I/O signals according to your application.

2. Turn off the computer and all relevant terminal boards, and install the AMP-304C in any available PCI Express x1/x4/x8/x16 slot. Make sure you have proper ESD (Electrostatic discharge) protection.

3. Connect the AMP-304C and DIN-304C with the ACL-10569 (68-pin SCSI-II), or 2 sets of ACL-10137 (37-pin D-SUB) and ACL-10437 cables.

4. Set up servo or stepper drive connection as well as mechanical signals, servo interface signals, switches and jumpers settings, GPIO and any essential drive signals.

5. Turn on the system power including computer power, terminal board power, and 24V DC power.

6. Verify all signals and servo operation via MotionCreatorPro2.

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2.3.3 Troubleshooting

If the computer cannot power on normally or the motion control system operates abnormally after system installation, follow the steps described below for troubleshooting. If the problem persists, consult your dealer for technical services.

Problem	Correction
The card does not appear in Windows Device Manager after its driver has been installed	Ensure the card is properly mounted in the PCI Express slot and the driver is properly installed in Windows Control Panel's "Add/remove programs"
MotionCreatorPro2™ does not launch after driver installation	Ensure .NET framework v3.5 or later version has been installed
The NO Signal indicator in MotionCreatorPro2™ appears after the motor is connected and the motor does not work.	Ensure 24 VDC power is provided to the system
When using MotionCreatorPro2™, all the control indicators of the drive light correctly, but there is a drive warning	Ensure correctness of the axis parameter setup, alarm logic (ALM) and the EMG loop configuration
Value of output command differs from the encoder feedback	Ensure encoder feedback signal (CW/CCW, 1xAB, 2xAB, 4xAB) settings comply with that of the drive
During motion control, the motor moves only in one direction rather than both directions	Ensure setting of signal pattern (CW/CCW, OUT/DIR, AB Phase) comply with that of the motor drive

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2.3.4 Software Driver Installation

1. Download the APS SDK file from ADLINK and run it. Installation executes automatically.

2. Select **NEXT** as prompted to complete installation.

3. After installation is complete, select **FINISH**.

4. Ensure the Windows Device Manager lists the AMP-304C.

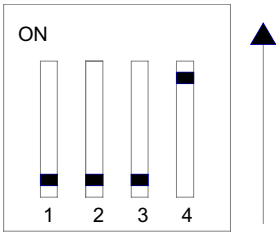
5. Restart the computer.

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2.4 DIP Switch Settings

2.4.1 SW1 – Card ID Selection

The SW1 switch is used to set the card ID. For example, if SW1 Pin 1 is set to ON and the others are OFF, the card index is 1. The index value can be from 0 to 15.



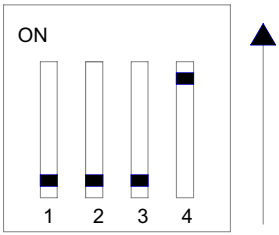
Card ID	Switch Setting (ON=1)
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111 (default)

Table 2-2: SW1 Card ID Selection

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2.4.2 SW2 – End Limit Type Selection

The SW2 switch is used to set the type of end limit logic, which are Normally Open (NO) and Normally Closed (NC). For example, if the switch pin is set to “OFF”, the type of end limit logic is Normally Open.

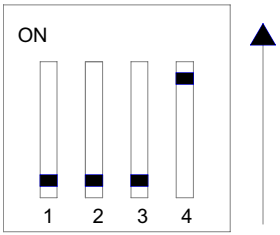


Axis #	SW2 Pin No.	NO (Default)	NC
0	1	OFF	ON
1	2	OFF	ON
2	3	OFF	ON
3	4	OFF	ON

Table 2-3: SW2 End Limit Type Selection

2.4.3 SW3 – DO Initial State Selection

The SW3 switch is used to set the initial DO state group setting. For example, if the SW3 Pin1 is set to “OFF”, the initial states of “DO0 to DO3” are Inactive.



DO #	SW3 Pin No.	Inactive (Default)	Active
DO0 - DO3	1	OFF	ON
DO4 - DO7	2	OFF	ON
DO8 - DO11	3	OFF	ON
DO12 - DO15	4	OFF	ON

Table 2-4: SW3 DO Initial State Selection

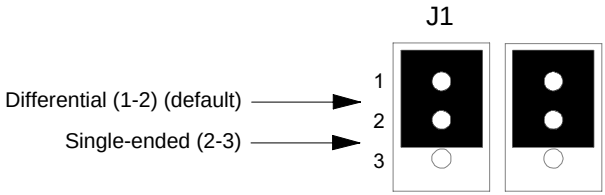
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2.5 Jumper Setting: Pulse Output Mode Selection

2.5.1 J1-J8 – Pulse Output Mode Selection

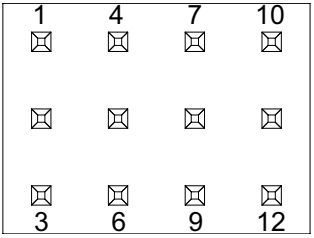
Jumpers J1-J8 are used to set the mode of pulse output signals. The output signal mode can either be differential line driver or single-ended output. Refer to Section 3.1 for detailed jumper settings.

J7 & J8	Axis 0
J3 & J4	Axis 1
J5 & J6	Axis 2
J1 & J2	Axis 3



2.5.2 CN3 – CMP Output Voltage Selection

The CN3 jumper is used to set the CMP output (dedicated) voltage, which are Open Collector Output (default), VDD (5V) and E24V.



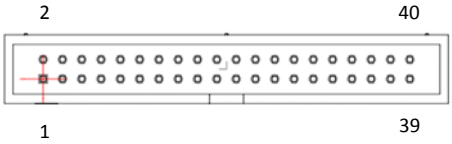
CMP #	Open Collector (Default)	VDD (5V)	E24V
Close Breaks Between			
0	N/A	1 and 2	2 and 3
1	N/A	4 and 5	5 and 6
2	N/A	7 and 8	8 and 9
3	N/A	10 and 11	11 and 12

Table 2-5: CN3 – CMP Output Voltage Selection

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2.6 Connector Pin Assignments

2.6.1 CN1 – Extended TTL DIO



No.	Name	I/O	Function	No.	Name	I/O	Function
1	TDI0/ T-LTC0	I	3.3V/5V TTL Input	2	TDI1/ T-LTC1	I	3.3V/5V TTL Input
3	TDI2/ T-LTC2	I	3.3V/5V TTL Input	4	TDI3/ T-LTC3	I	3.3V/5V TTL Input
5	TDI4	I	3.3V/5V TTL Input	6	TDI5	I	3.3V/5V TTL Input
7	TDI6	I	3.3V/5V TTL Input	8	TDI7	I	3.3V/5V TTL Input
9	TDI8	I	3.3V/5V TTL Input	10	TDI9	I	3.3V/5V TTL Input
11	TDI10	I	3.3V/5V TTL Input	12	TDI11	I	3.3V/5V TTL Input
13	TDI12	I	3.3V/5V TTL Input	14	TDI13	I	3.3V/5V TTL Input
15	TDI14	I	3.3V/5V TTL Input	16	TDI15	I	3.3V/5V TTL Input
17	D5V	O	Digital Power +5V	18	D5V	O	Digital Power +5V
19	GND	--	Digital GND	20	GND	--	Digital GND
21	TDO0	O	5V TTL Output	22	TDO1	O	5V TTL Output
23	TDO2/ T-CMP2	O	5V TTL Output	24	TDO3/ T-CMP3	O	5V TTL Output
25	TDO4	O	5V TTL Output	26	TDO5	O	5V TTL Output
27	TDO6	O	5V TTL Output	28	TDO7	O	5V TTL Output
29	TDO8	O	5V TTL Output	30	TDO9	O	5V TTL Output
31	TDO10	O	5V TTL Output	32	TDO11	O	5V TTL Output
33	TDO12	O	5V TTL Output	34	TDO13	O	5V TTL Output
35	TDO14	O	5V TTL Output	36	----	--	Reserved
37	GND	--	Digital GND	38	----	--	Reserved
39	----	--	Reserved	40	----	--	Reserved

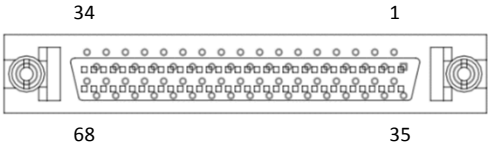
Table 2-6: CN3 Extended TTL DIO

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NOTE:

1. Maximum D5V output current = 0.5A.
2. TDI0-3, configured as TTL LTC Input if not used.
3. TDO0-3, configured as TTL CMP Output if not used.

2.6.2 CN2 – AMP-304C Main Connector



No.	Name	I/O	Function	No.	Name	I/O	Function
1	OUT0+	O	Pulse Signal +	35	OUT2+	O	Pulse Signal +
2	OUT0-	O	Pulse Signal -	36	OUT2-	O	Pulse Signal -
3	DIR0+	O	Direction Signal +	37	DIR2+	O	Direction Signal +
4	DIR0-	O	Direction Signal -	38	DIR2-	O	Direction Signal -
5	OUT1+	O	Pulse Signal +	39	OUT3+	O	Pulse Signal +
6	OUT1-	O	Pulse Signal -	40	OUT3-	O	Pulse Signal -
7	DIR1+	O	Direction Signal +	41	DIR3+	O	Direction Signal +
8	DIR1-	O	Direction Signal -	42	DIR3-	O	Direction Signal -
9	DGND	--	Digital GND	43	ALM2	I	Servo Alarm Signal
10	ALM0	I	Servo Alarm Signal	44	ALM3	I	Servo Alarm Signal
11	ALM1	I	Servo Alarm Signal	45	SVON0 /DO8	O	Servo On Signal / Digital Output
12	CMP4 /DO0	O	Position Comparison Trigger / Digital Output	46	SVON1 /DO9	O	Servo On Signal / Digital Output

Table 2-7: CN2 AMP-304C Main Connector

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No.	Name	I/O	Function	No.	Name	I/O	Function
13	CMP5 /DO1	O	Position Comparison Trigger / Digital Output	47	SVON2 /DO10	O	Servo On Signal / Digital Output
14	CMP6 /DO2	O	Position Comparison Trigger / Digital Output	48	SVON3 /DO11	O	Servo On Signal / Digital Output
15	CMP7 /DO3	O	Position Comparison Trigger / Digital Output	49	ERC0 /DO12	O	Servo Deviation Counter Clear Signal / Digital Output
16	CMP8 /DO4	O	Position Comparison Trigger / Digital Output	50	ERC1 /DO13	O	Servo Deviation Counter Clear Signal / Digital Output
17	CMP9 /DO5	O	Position Comparison Trigger / Digital Output	51	ERC2 /DO14	O	Servo Deviation Counter Clear Signal / Digital Output
18	CMP10 /DO6	O	Position Comparison Trigger / Digital Output	52	ERC3 /DO15	O	Servo Deviation Counter Clear Signal / Digital Output
19	CMP11 /DO7	O	Position Comparison Trigger / Digital Output	53	RDY0 /DI8	I	Servo Ready Signal / Digital Input
20	EMG0 /DI0	I	Emergency Stop Signal / Digital Input	54	RDY1 /DI9	I	Servo Ready Signal / Digital Input
21	EMG1 /DI1	I	Emergency Stop Signal / Digital Input	55	RDY2 /DI10	I	Servo Ready Signal / Digital Input
22	EMG2 /DI2	I	Emergency Stop Signal / Digital Input	56	RDY3 /DI11	I	Servo Ready Signal / Digital Input
23	EMG3 /DI3	I	Emergency Stop / Digital Input	57	INP0 /DI12	I	Servo In-Position Signal / Digital Input

Table 2-7: CN2 AMP-304C Main Connector

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No.	Name	I/O	Function	No.	Name	I/O	Function
24	Multi0 /DI4	I	Multi-Function* / Digital Input	58	INP1 /DI13	I	Servo In-Position Signal / Digital Input
25	Multi1 /DI5	I	Multi-Function* / Digital Input	59	EGND	--	External Power GND
26	Multi2 /DI6	I	Multi-Function* / Digital Input	60	INP2 /DI14	I	Servo In-Position Signal / Digital Input
27	Multi3 /DI7	I	Multi-Function* / Digital Input	61	INP3 /DI15	I	Servo In-Position Signal / Digital Input
28	PEL0	I	Positive End Limit Signal	62	PEL2	I	Positive End Limit Signal
29	MEL0	I	Negative End Limit Signal	63	MEL2	I	Negative End Limit Signal
30	ORG0	I	Origin Position Signal	64	ORG2	I	Origin Position Signal
31	PEL1	I	Positive End Limit Signal	65	PEL3	I	Positive End Limit Signal
32	MEL1	I	Negative End Limit Signal	66	MEL3	I	Negative End Limit Signal
33	ORG1	I	Origin Position Signal	67	ORG3	I	Origin Position Signal
34	EGND	--	External Power GND	68	E24V	I	External +24V Power Input

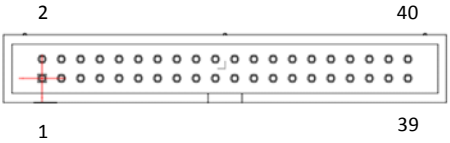
Table 2-7: CN2 AMP-304C Main Connector

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NOTE:

- DGND, used for OUT+/- and DIR+/- signals.
- EGND, used for others IO signals.
- DO0-7, configured as CMP Output if not used.
- DI0-3, configured as EMG Input if not used.
- DI4-7, configured as Multi-function if not used.
  - SD: Direction Ramping-down Point Detection Signal.
  - S-LTC: Position Latch Input Signal (Slow).
  - PCS: Target Position Override Signal.
  - CLR: Reset Counter Signal.
- SVON/ERC, configured as DO if not used.
- RDY/INP, configured as DI if not used.

2.6.3 CN4 – Encoder Feedback, LTC, and CMP Signals



No.	Name	I/O	Function	No.	Name	I/O	Function
1	CMP3	O	Position Comparison Trigger	2	LTC3	I	Position Latch
3	CMP2	O	Position Comparison Trigger	4	LTC2	I	Position Latch
5	CMP1	O	Position Comparison Trigger	6	LTC1	I	Position Latch
7	CMP0	O	Position Comparison Trigger	8	LTC0	I	Position Latch

Table 2-8: CN4 Encoder Feedback, LTC, and CMP Signals

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No.	Name	I/O	Function	No.	Name	I/O	Function
9	EGND	--	External Power GND	10	VDD	O	+5V Power Output
11	EZ3-	I	Encoder Z-phase-	12	EZ3+	I	Encoder Z-phase+
13	EB3-	I	Encoder B-phase-	14	EB3+	I	Encoder B-phase+
15	EA3-	I	Encoder A-phase-	16	EA3+	I	Encoder A-phase+
17	EZ2-	I	Encoder Z-phase-	18	EZ2+	I	Encoder Z-phase+
19	EB2-	I	Encoder B-phase-	20	EB2+	I	Encoder B-phase+
21	EA2-	I	Encoder A-phase-	22	EA2+	I	Encoder A-phase+
23	DGND	--	Digital GND	24	DGND	--	Digital GND
25	EZ1-	I	Encoder Z-phase-	26	EZ1+	I	Encoder Z-phase+
27	EB1-	I	Encoder B-phase-	28	EB1+	I	Encoder B-phase+
29	EA1-	I	Encoder A-phase-	30	EA1+	I	Encoder A-phase+
31	EZ0-	I	Encoder Z-phase-	32	EZ0+	I	Encoder Z-phase+
33	EB0-	I	Encoder B-phase-	34	EB0+	I	Encoder B-phase+
35	EA0-	I	Encoder A-phase-	36	EA0+	I	Encoder A-phase+
37	DGND	--	Digital GND	38	----	--	Reserved
39	----	--	Reserved	40	----	--	Reserved

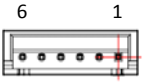
Table 2-8: CN4 Encoder Feedback, LTC, and CMP Signals

NOTE:

1. VDD: Generated from E24V in CN2.
2. VDD/EGND: for CMP and LTC signals.
3. Digital GND: for Encoder signals.

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2.6.4 CN5 – Manual Pulser Input Signals



No.	Name	I/O	Function
1	VDD	O	+5V Power Output
2	PA+	I	Pulser A-phase+ Input
3	PA-	I	Pulser A-phase- Input
4	PB+	I	Pulser B-phase+ Input
5	PB-	I	Pulser B-phase- Input
6	EGND	-	External Power GND

Table 2-9: CN5 Manual Pulser Input Signals

NOTE:

VDD: Generated from E24V in CN2.

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3 Signal Connections

Signal connections of all I/O's are described in this chapter. Refer to the contents of this chapter before wiring any cables between the AMP-304C and any motor drivers.

This chapter contains the following sections:

Section 3.1: Pulse Output Signals

Section 3.2: Encoder Feedback Input Signal

Section 3.3: Motion I/O Interface Signal

Section 3.4: GPIO Interface Signal

Section 3.5: Other I/O Interface Signals

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3.1 Pulse Output Signals

There are 4 axis pulse output signals on the AMP-304C, each supporting up to 9.99 MHz output frequency. For each axis, two pairs of OUT and DIR signals are used to transmit the pulse train and to indicate the direction. In this section, the electrical characteristics of the OUT and DIR signals are detailed. Each signal consists of a pair of differential signals. For example, OUT2 consists of OUT2+ and OUT2- signals. The following table shows all pulse output signals on CN2.

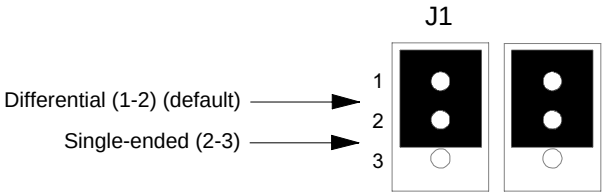
Max. Axes	4
Pulse Output Frequency	Up to 9.99 MHz
Pulse Output Mode	CW/CCW, OUT/DIR, AB phases
Pulse Output Type	Differential / Single-End

Axis #	CN2 Pin No.	Signal Name	Description
0	1	OUT0+	Pulse Signal +
	2	OUT0-	Pulse Signal -
	3	DIR0+	Direction Signal +
	4	DIR0-	Direction Signal -
1	5	OUT1+	Pulse Signal +
	6	OUT1-	Pulse Signal -
	7	DIR1+	Direction Signal +
	8	DIR1-	Direction Signal -
2	35	OUT2+	Pulse Signal +
	36	OUT2-	Pulse Signal -
	37	DIR2+	Direction Signal +
	38	DIR2-	Direction Signal -
3	39	OUT3+	Pulse Signal +
	40	OUT3-	Pulse Signal -
	41	DIR3+	Direction Signal +
	42	DIR3-	Direction Signal -

Table 3-1: Pulse Output Signals

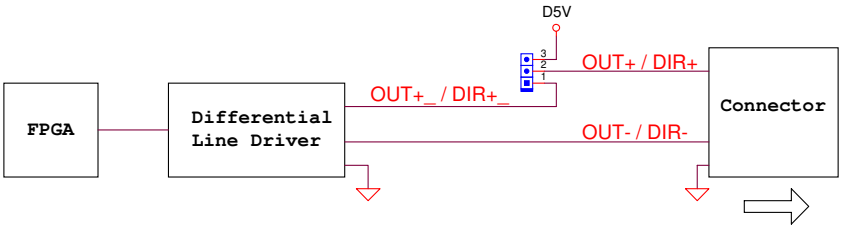
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The output of the signals can be configured by jumpers as either Single-Ended or Differential Line Driver output. Users can select the output mode either by closing breaks between 1 and 2, or 2 and 3 of jumpers J1-J8 as follows:



Axis #	Signal Name	Jumper	Differential Line Driver Output	Single-Ended Output
0	OUT0	J8	Close breaks between 1 and 2	Close breaks between 2 and 3
	DIR0	J7		
1	OUT1	J4		
	DIR1	J3		
2	OUT2	J5		
	DIR2	J6		
3	OUT3	J1		
	DIR3	J2		

The default setting of OUT and DIR is set to differential line driver mode. The following wiring diagram is for OUT and DIR signals on the 4 axes.



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NOTE:

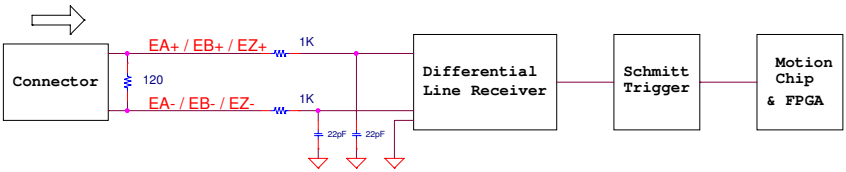
If the pulse output is set to Single-Ended output mode, OUT- and DIR- are used to transmit CW and CCW signals. The sink current must not exceed 20mA on the OUT- and DIR- pins.

3.2 Encoder Feedback Input Signal

The AMP-304C provides 4 encoder feedback input channels each with up to 4MHz and EA, EB, and EZ signals. Each group of EA, EB, and EZ signals contains a pair of differential signals (e.g. the EA signal contains EA+ and EA-).

A 32-bit counter for each encoder feedback input axis and two kinds of decoder modes (CW/CCW, 1x/2x/4x AB Phase) are available. For more information, see the APS Function Library User Manual.

Axis #	CN4 Pin No.	Signal Name	CN4 Pin No.	Signal Name
0	36	EA0+	35	EA0-
	34	EB0+	33	EB0-
	32	EZ0+	31	EZ0-
1	30	EA1+	29	EA1-
	28	EB1+	27	EB1-
	26	EZ1+	25	EZ1-
2	22	EA2+	21	EA2-
	20	EB2+	19	EB2-
	18	EZ2+	17	EZ2-
3	16	EA3+	15	EA3-
	14	EB3+	13	EB3-
	12	EZ3+	11	EZ3-



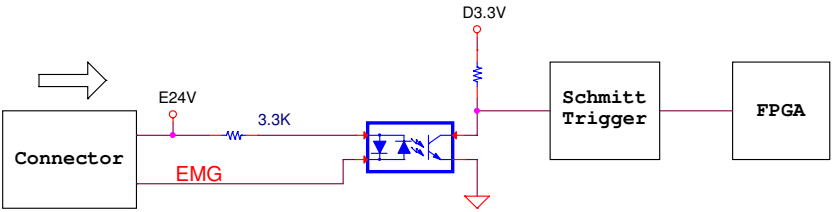
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3.3 Motion I/O Interface Signal

3.3.1 Emergency Stop Input (EMG)

The AMP-304C provides an EMG signal, common with DI. If one of the EMG signals is triggered, all motion control commands will be stopped immediately. Another way to stop operation of each motor immediately is by transmitting an external EMG signal via the DIN-304C to a servo or stepper motor driver. Refer to the DIN-304C User's Manual for more details.

Axis #	CN2 Pin No.	Signal Name
0	20	EMG0
1	21	EMG1
2	22	EMG2
3	23	EMG3



3.3.2 Mechanical Signal Input

The AMP-304C provides some dedicated input pins for mechanical signals such as original position signal (ORG), direction end limit signals (PEL/MEL), and direction ramping-down point detection signals (SD).

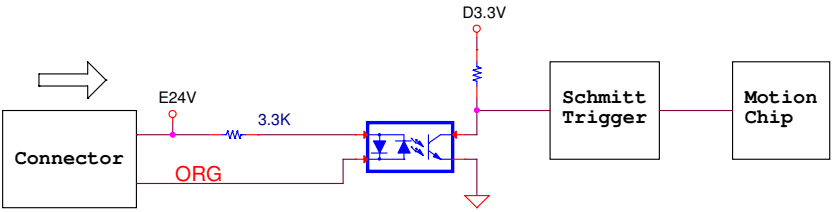
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3.3.2.1 Origin Position Signal (ORG)

The AMP-304C provides one original or home signal for each axis. This signal is used for defining the zero position of this axis. The logic of this signal must be set properly before performing the home procedure.

Axis #	CN2 Pin No.	Signal Name
0	30	ORG0
1	33	ORG1
2	64	ORG2
3	67	ORG3

The input circuit of the ORG signals is shown below. Usually, a limit switch is used to indicate the origin on one axis. The specifications of the limit switch should have a contact capacity of +24V at 10mA minimum. An internal filter circuit is used to filter out any high frequency spikes, which may cause errors in the operation.



When the motion controller is operated in the home return mode, the ORG signal is used to inhibit the Pulse Output Signals.

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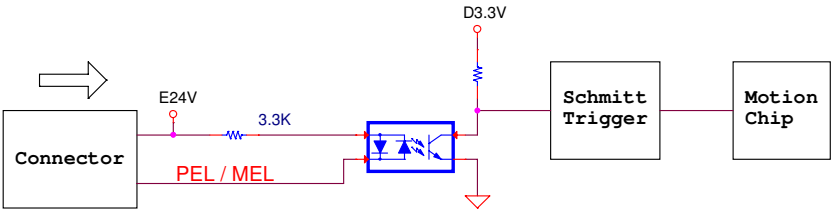
3.3.2.2 Direction End Limit Signal (PEL / MEL)

The end-limit switches are usually installed on both ends of an axis. The positive EL must be installed at the positive position of the axis. If they are installed reversely, the protection will be invalid. These two signals are for safety, which can prevent a machine from crashing when missing an operation.

The AMP-304C provides two direction end limit signals, PEL and MEL, for each axis. PEL indicates the end limit signal is in the positive direction and MEL indicates the end limit signal is in the negative direction.

Axis #	CN2 Pin No.	Signal Name	CN2 Pin No.	Signal Name
0	28	PEL0	29	MEL0
1	31	PEL1	32	MEL1
2	62	PEL2	63	MEL2
3	65	PEL3	66	MEL3

The external limit switch should have a contact capacity of +24V at 10mA minimum. The EL logical can be configured via switch.

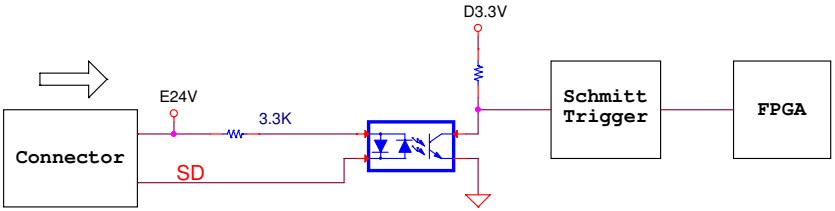


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3.3.2.3 Direction Ramping-down Point Detection Signal (SD)

The AMP-304C provides one slow-down function through SD signal input for each axis. SD indicates both positive and negative directions. For more information and settings, see the APS Function Library User's Manual.

Axis #	CN2 Pin No.	Signal Name
0	24	SD0
1	25	SD1
2	26	SD2
3	27	SD3



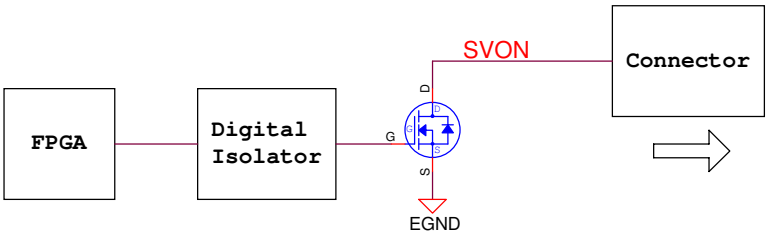
3.3.3 Servo Interface IO

3.3.3.1 Servo-ON Output Signal (SVON)

The AMP-304C provides one servo on output signal, SVON, to enable servo drivers for each axis. For more information and settings, see the APS Function Library User's Manual.

SVON output signals can be configured as General-Purpose Digital Output signals if not used.

Axis #	CN2 Pin No.	Signal Name
0	45	SVON0
1	46	SVON1
2	47	SVON2
3	48	SVON3



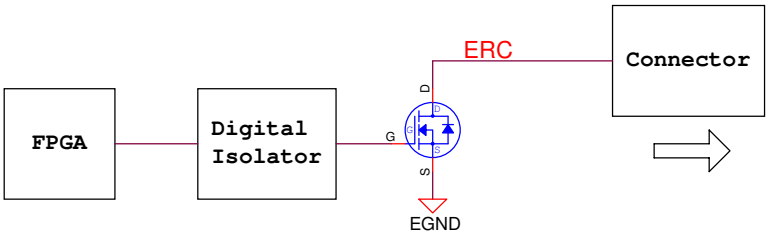
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3.3.3.2 Servo Deviation Counter Clear Output Signal (ERC)

The AMP-304C provides one deviation counter clear function through ERC for each axis, which can be a pulse or a LEVEL signal output. The output logic and pulse width can be changed using software. For more information and settings, see the APS Function Library User's Manual.

ERC output signals can be configured as General-Purpose Digital Output signals if not used.

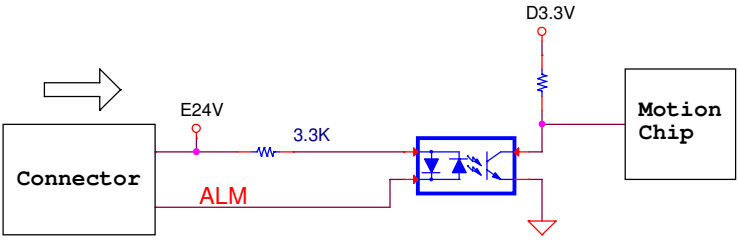
Axis #	CN2 Pin No.	Signal Name
0	49	ERC0
1	50	ERC1
2	51	ERC2
3	52	ERC3



3.3.3.3 Servo Alarm Input Signal (ALM)

The AMP-304C provides one servo alarm input signal, ALM, for each axis. The alarm signal is sent by servo drivers. If the ALM signal is triggered, motion of an axis stops immediately, or will decelerate and stop. The input logic can be selected using software. For more information and settings, see the APS Function Library User's Manual..

Axis #	CN2 Pin No.	Signal Name
0	10	ALM0
1	11	ALM1
2	43	ALM2
3	44	ALM3



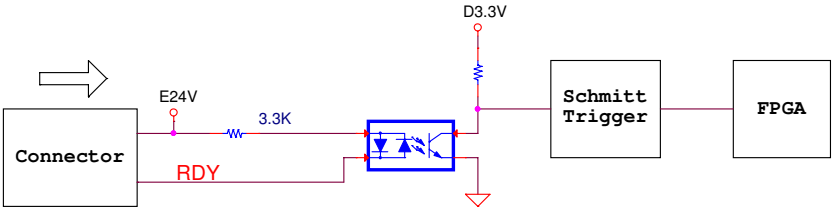
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3.3.3.4 Servo Ready Input Signal (RDY)

The AMP-304C provides one servo ready input signal, RDY, for each axis, which is used to receive the ready signal from a servo driver. If RDY is enabled, the servo driver is ready to receive the pulse command from the AMP-304C. The input logic can be changed using software. For more information and settings, see the APS Function Library User's Manual.

RDY input signals can be configured as General-Purpose Digital Intput signals if not used

Axis #	CN2 Pin No.	Signal Name
0	53	RDY0
1	54	RDY1
2	55	RDY2
3	56	RDY3



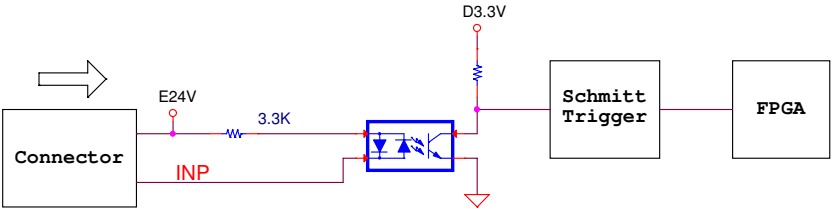
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3.3.3.5 Servo In-Position Input Signal (INP)

The AMP-304C provides one in-position input signal, INP, for each axis. It is used to check the position complete signal, which is from the servo driver if the position mode is set. The input logic can be changed using software. For more information and settings, see the APS Function Library User's Manual.

INP input signals can be configured as General-Purpose Digital Intput signals if not used.

Axis #	CN2 Pin No.	Signal Name
0	57	INP0
1	58	INP1
2	60	INP2
3	61	INP3



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3.4 GPIO Interface Signal

The AMP-304C provides a 32-channel onboard optically isolated GPIO (DI/DO) and a 32-channel extended TTL GPIO (TDI/TDO).

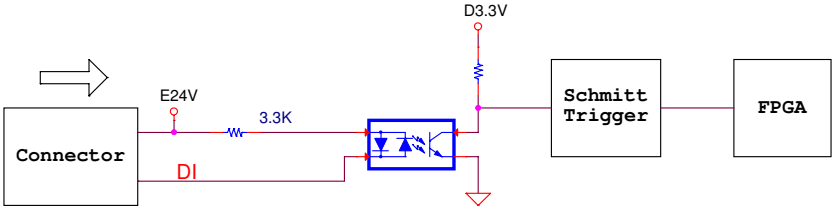
GPIO Onboard	Main Connector CN2	16-ch Optically Isolated DI
		16-ch Optically Isolated DO
GPIO Extended	Extend Connector CN1	16-ch Non-isolated TTL DI
		16-ch Non-isolated TTL DO

3.4.1 32-Channel Onboard Isolated GPIO (DI/DO)

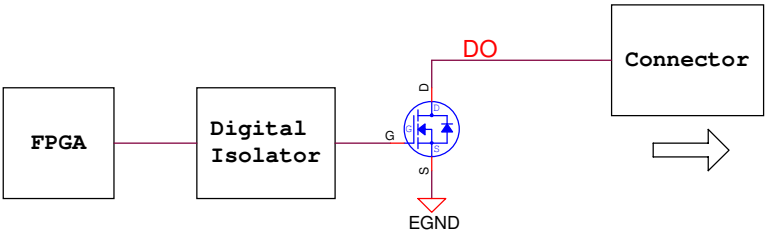
CN2 Pin No.	Signal Name	CN2 Pin No.	Signal Name
20	DI0 / EMG0	12	DO0 / CMP4
21	DI1 / EMG1	13	DO1 / CMP5
22	DI2 / EMG2	14	DO2 / CMP6
23	DI3 / EMG3	15	DO3 / CMP7
24	DI4 / Multi0	16	DO4 / CMP8
25	DI5 / Multi1	17	DO5 / CMP9
26	DI6 / Multi2	18	DO6 / CMP10
27	DI7 / Multi3	19	DO7 / CMP11
53	DI8 / RDY0	45	DO8 / SVON0
54	DI9 / RDY1	46	DO9 / SVON1
55	DI10 / RDY2	47	DO10 / SVON2
56	DI11 / RDY3	48	DO11 / SVON3
57	DI12 / INP0	49	DO12 / ERC0
58	DI13 / INP1	50	DO13 / ERC1
60	DI14 / INP2	51	DO14 / ERC2
61	DI15 / INP3	52	DO15 / ERC3

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Optically Isolated Digital Input:



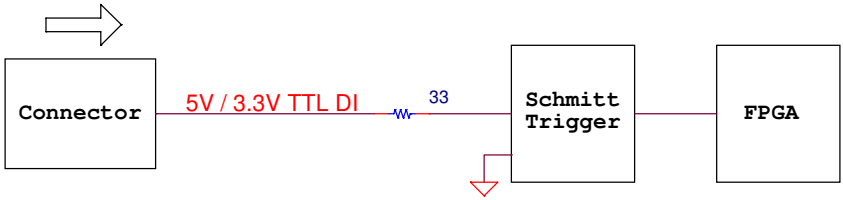
Optically Isolated Digital Output:



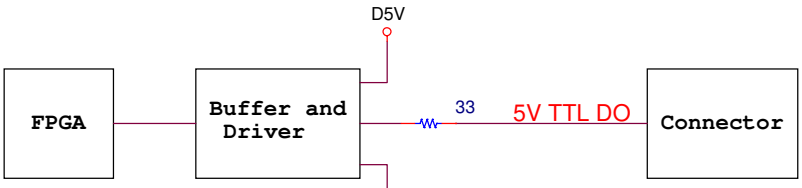
3.4.2 32-Channel Extended TTL GPIO (TDI/TDO)

CN1 Pin No.	Signal Name	CN1 Pin No.	Signal Name
1	TDI0	21	TDO0
2	TDI1	22	TDO1
3	TDI2	23	TDO2
4	TDI3	24	TDO3
5	TDI4	25	TDO4
6	TDI5	26	TDO5
7	TDI6	27	TDO6
8	TDI7	28	TDO7
9	TDI8	29	TDO8
10	TDI9	30	TDO9
11	TDI10	31	TDO10
12	TDI11	32	TDO11
13	TDI12	33	TDO12
14	TDI13	34	TDO13
15	TDI14	35	TDO14
16	TDI15	36	TDO15

Non-isolated TTL Digital Input:



Non-isolated TTL Digital Output:



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3.5 Other I/O Interface Signals

3.5.1 Position Latch Input (LTC)

The AMP-304C provides 12-channel position latch trigger inputs.

- LTC: 4-channel dedicated and isolated input, up to 1MHz
- S-LTC: 4-channel isolated and common with DI, up to 10KHz (slower)
- T-LTC: 4-channel TTL and common with TDI, up to 1MHz

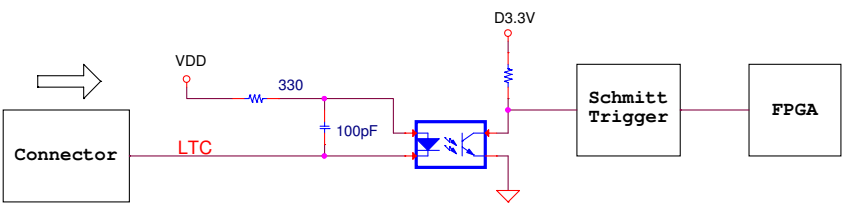
With encoder feedback input signals, a position latch function is available for each axis. Any 12-channel position latch input can be assigned to a latch source to trigger any axis by software. The AMP-304C provides 256 position latch buffer points for each axis. For more information, see the APS Function Library User's Manual.

CN4 Pin No.	Signal Name
8	LTC0
6	LTC1
4	LTC2
2	LTC3

CN2 Pin No.	Signal Name	CN3 Pin No.	Signal Name
24	S-LTC0	1	T-LTC0
25	S-LTC1	2	T-LTC1
26	S-LTC2	3	T-LTC2
27	S-LTC3	4	T-LTC3

NOTE:

- For S-LTC circuit diagram, see Section 3.4.1: 32-Channel Onboard Isolated GPIO (DI/DO).
- For T-LTC circuit diagram, see Section 3.4.2: 32-Channel Extended TTL GPIO (TDI/TDO).



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3.5.2 Position Comparison Trigger Output (CMP)

The AMP-304C provides 16-channel position comparison trigger outputs.

- CMP 0-3: 4-channal dedicated and isolated output, up to 1MHz
- CMP 4-11: 8-channel isolated, common with DO, up to 1MHz
- T-CMP 0-3: 4-channel TTL, common with TDO, up to 1MHz

Voltage output selection is controlled by jumper in dedicated CMP outputs; see Section 2.5.2: CN3 – CMP Output Voltage Selection.

CN4 Pin No.	Signal Name
7	CMP0
5	CMP1
3	CMP2
1	CMP3

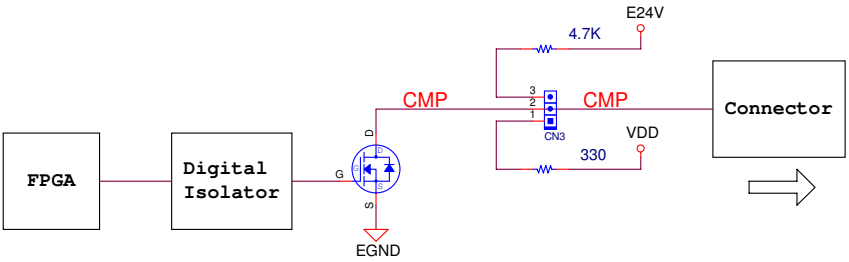
CN2 Pin No.	Signal Name	CN1 Pin No.	Signal Name
12	CMP4	21	T-CMP0
13	CMP5	22	T-CMP1
14	CMP6	23	T- CMP2
15	CMP7	24	T- CMP3
16	CMP8		
17	CMP9		
18	CMP10		


NOTE:

- For CMP 4-11 circuit diagram, see Section 3.4.1: 32-Channel Onboard Isolated GPIO (DI/DO).
- For T-CMP 0-3 circuit diagram, see Section 3.4.2: 32-Channel Extended TTL GPIO (TDI/TDO).

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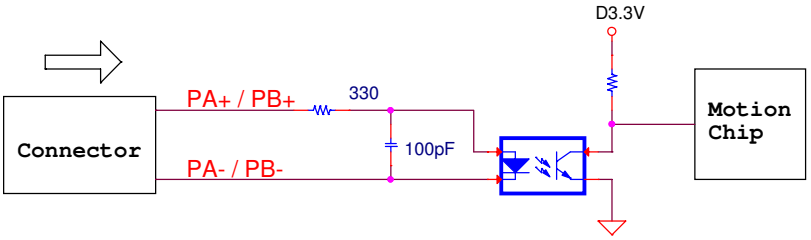
With encoder feedback input signals, a position comparison trigger function is available for each axis. Any 16-channel position comparison trigger output can be assigned as a pulse output mode with width configurable or a toggle output mode. The AMP-304C provides 256 position comparison buffer points for each axis, including Linear and Table comparison modes. Position-reusable is also available in Table comparison modes. For more information, see the APS Function Library User's Manual.



3.5.3 Manual Pulser Input Signal (PA/PB)

The AMP-304C provides one set of manual pusler functions through PA/PB for all axes. CW/CCW and 1x/2x/4x AB Phase modes are supported for receiving external drive pulses. For more information, see the APS Function Library User's Manual.

CN5 Pin No.	Signal Name
2	PA+
3	PA-
4	PB+
5	PB-



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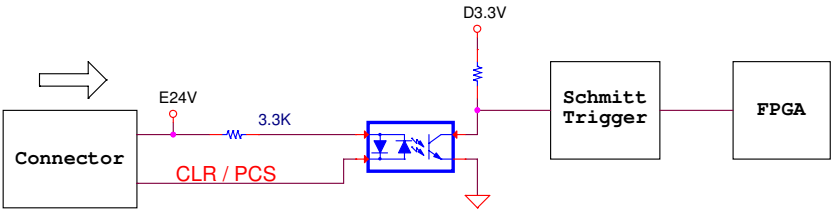
3.5.4 Multi-function Input Signals (DI/SD/S-LTC/PCS/CLR)

Multi-function input signals (DI/SD/S-LTC/PCS/CLR) are allocated through DI4-7.

- For DI, see Section 3.4.1: 32-Channel Onboard Isolated GPIO (DI/DO).
- For SD, see Section 3.3.2.3: Direction Ramping-down Point Detection Signal (SD).
- For S-LTC, see Section 3.5.1: Position Latch Input (LTC).
- PCS is used to override a target position.
- CLR is used to reset a specified counter.

For more information, see the APS Function Library User's Manual.

Axis #	CN2 Pin No.	Signal Name
0	24	DI4 / SD0 / S-LTC0 / PCS0 / CLR0
1	25	DI5 / SD1 / S-LTC1 / PCS1 / CLR1
2	26	DI6 / SD2 / S-LTC2 / PCS2 / CLR2
3	27	DI7 / SD3 / S-LTC3 / PCS3 / CLR3



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Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

- Read these safety instructions carefully.
- Keep the User's Manual for future reference.
- Read the Specifications section of this manual for detailed information on the recommended operating environment.
- The device can be operated at an ambient temperature of 45ºC with DC input, and 35ºC with adapter input.
- It is recommended that the device be installed in Information Technology Rooms that are in accordance with Article 645 of the National Electrical Code and NFPA 75.
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources.
  - Keep device away from high heat or humidity.
  - Keep device properly ventilated (do not block or cover ventilation openings).
  - Always use recommended voltage and power source settings.
  - Always install and operate device near an easily accessible electrical outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate device on stable surfaces and/or recommended mountings.
  - The power cord must be connected to a socket or outlet with a ground connection.
- If the device will not be used for long periods of time, turn off and unplug from its power source.
- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools.

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- A Lithium-type battery may be provided for uninterrupted backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.

- This equipment is not suitable for use in locations where children are likely to be present.
- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location



BURN HAZARD

Hot surface! Do not touch! Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching.

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Consignes de Sécurité Importante

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil, pour éviter des blessures ou des dommages.

- *Lisez attentivement ces consignes de sécurité.*
- *Conservez le manuel de l'utilisateur pour pouvoir le consulter ultérieurement.*
- *Lisez la section Spécifications de ce manuel pour des informations détaillées sur l'environnement d'exploitation recommandé.*
- *L'appareil peut être utilisé à une température ambiante de 45°C avec entrée CC pour les série MVP-61; 35ºC avec entrée adaptateur pour la série MVP-61.*
- *Il est recommandé d'installer l'appareil dans des salles de technologie de l'information conformes à l'article 645 du National Electrical Code et à la NFPA 75.*
- *Pour éviter les chocs électriques et/ou d'endommager l'appareil:*
  - *Tenez l'appareil à l'écart de toute source d'eau ou de liquide.*
  - *Tenez l'appareil à l'écart d'une forte chaleur ou d'une humidité élevée.*
  - *Maintenez l'appareil correctement ventilé (n'obstruer ou ne couvrez pas les ouvertures de ventilation).*
  - *Utilisez toujours les réglages de tension et de source d'alimentation recommandés.*
  - *Installez et utilisez toujours l'appareil près d'une prise de courant facilement accessible.*
  - *Fixez le cordon d'alimentation (ne placez aucun objet sur le cordon d'alimentation).*
  - *Installez/fixez et utilisez l'appareil uniquement sur des surfaces stables et/ou sur les fixations recommandées.*
  - *Le cordon d'alimentation doit être connecté à une prise ou à une prise de courant avec mise à la terre.*

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- Si l'appareil ne doit pas être utilisé pendant de longues périodes, éteignez-le et débranchez-le de sa source d'alimentation
- *N'essayez jamais de réparer l'appareil, qui ne doit être réparé que par un personnel technique qualifié à l'aide d'outils appropriés*
- *Une batterie de type Lithium peut être fournie pour une alimentation de secours ininterrompue ou d'urgence.*



ATTENTION: Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- *Cet équipement ne convient pas à une utilisation dans des lieux pouvant accueillir des enfants.*
- *L'appareil doit être entretenu par des techniciens agrees lorsque:*
- *Le cordon d'alimentation ou la prise est endommagé(e)*
- *Un liquide a pénétré à l'intérieur de l'appareil.*
- *L'appareil a été exposé à une forte humidité et/ou de la buée.*
- *L'appareil ne fonctionne pas ou ne fonctionne pas selon le manuel de l'utilisateur.*
- *L'appareil est tombé et/ou a été endommagé et/ou présente des signes évidents de dommage.*
- *Débranchez le cordon d'alimentation avant de desserrer les vis à oreilles et serrez toujours les vis à oreilles avec un tournevis avant de mettre le système en marche.*
- *Il est recommandé d'installer l'appareil uniquement dans une salle de serveurs ou une salle informatique où l'accès est:*
  - *Réservé au personnel de service qualifié ou aux utilisateurs familiarisés avec les restrictions appliquées à l'emplacement, aux raisons de ces restrictions et toutes les précautions requises*
  - *Uniquement autorisé par l'utilisation d'un outil, d'une serrure et d'une clé, ou d'un autre moyen de sécurité, et contrôlé par l'autorité responsable de l'emplacement.*

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	***RISQUE DE BRÛLURES*** ***Partie chaude!*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures. Pour éviter tout danger, laissez la surface refroidir avant de la toucher.*

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Getting Service

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