



SPiiPlusCMhv

Installation Guide

December 2020

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SPiiPlusCMhv

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Revision History

Date	Revision	Description
November 2020	3.03	CTIME table
September 2020	3.02	Add footnote about inputs support to Ordering Table
May 2020	3.00	CMhv corrected product specification table
September 2019	2.70.10	Name Change
April 2019	2.70	Added Real-time Performance mode
February 2018	1.80	Updated ordering options for flexible configuration
January 2018	1.70	Updated ordering options for built-in shunt resistor
January 2018	1.60	Added reference to Jumper J1 and Recovery Wizard
December 2017	1.50	Reformatted.
August 2016	1.40	Updated related documents.
July 2016	1.30	Corrected connection instructions for "Safety" power supply Removed PLC option
May 2016	1.20	Added note concerning STO
April 2016	1.10	Updated "LED Indicators" table. Updated product label with UL mark. Updated "Configuration as Indicated by P/N" table. Updated content and figures where required for PE connections. Added note that SPiiPlusCMhv is shipped with a cover fan. Added note that SPiiPlusCMhv is shipped with heatsink fan. Added "Max. input continuous current" to product specifications table.
July 2015	1.00	First Release

Conventions Used in this Guide

Text Formats

Format	Description
Bold	Names of GUI objects or commands
BOLD + UPPERCASE	ACSPL+ variables and commands
<code>Monospace + grey background</code>	Code example
<i>Italic</i>	Names of other documents
Blue	Hyperlink
[]	In commands indicates optional item(s)
	In commands indicates either/or items

Flagged Text

	Note - includes additional information or programming tips.
	Caution - describes a condition that may result in damage to equipment.
	Warning - describes a condition that may result in serious bodily injury or death.
	Model - highlights a specification, procedure, condition, or statement that depends on the product model
	Advanced - indicates a topic for advanced users.

Related Documents

Documents listed in the following table provide additional information related to this document.

The most updated version of the documents can be downloaded by authorized users from www.acsmotioncontrol.com/downloads.

Online versions for all ACS software manuals are available to authorized users at [ACS Motion Control Knowledge Center](#).

Document	Description
<i>ACS Components in XL Scan System Application Note</i>	Gives the system setup and calibration procedures for the ACS components included in an XL SCAN scanning solution

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1. Overview

This document describes the installation information for the SPiiPlusCMHV, including electrical interfacing, device compatibility, mounting, and ventilation.

1.1 Description

The SPiiPlusCMhv and are similar products. The SPiiPlusCMhv is actually an with the addition of a motion controller and EtherCAT master. The SPiiPlusCMhv control module contains two built-in drives and a few I/Os, and as an EtherCAT network master can manage additional external drives and I/Os.

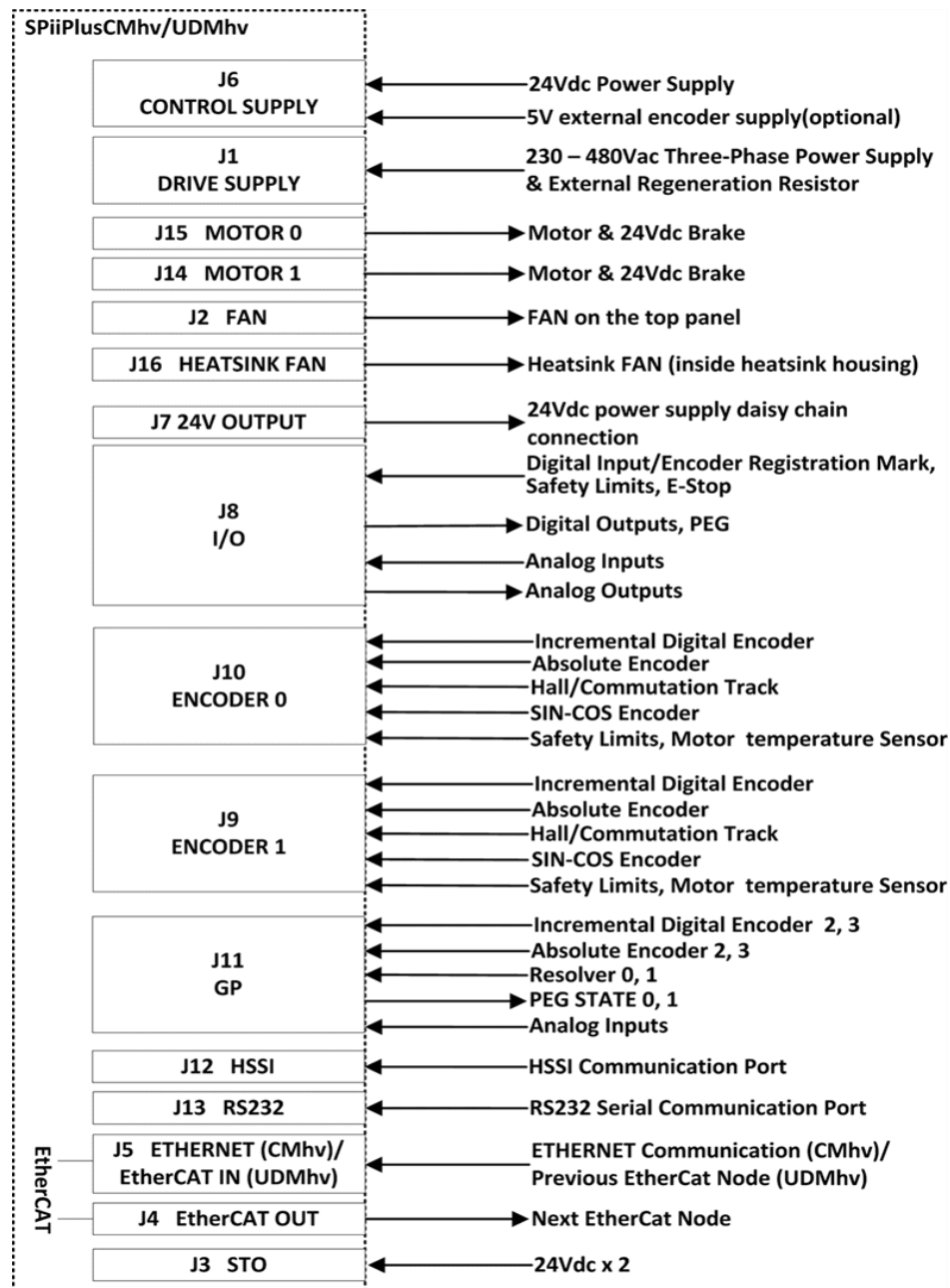
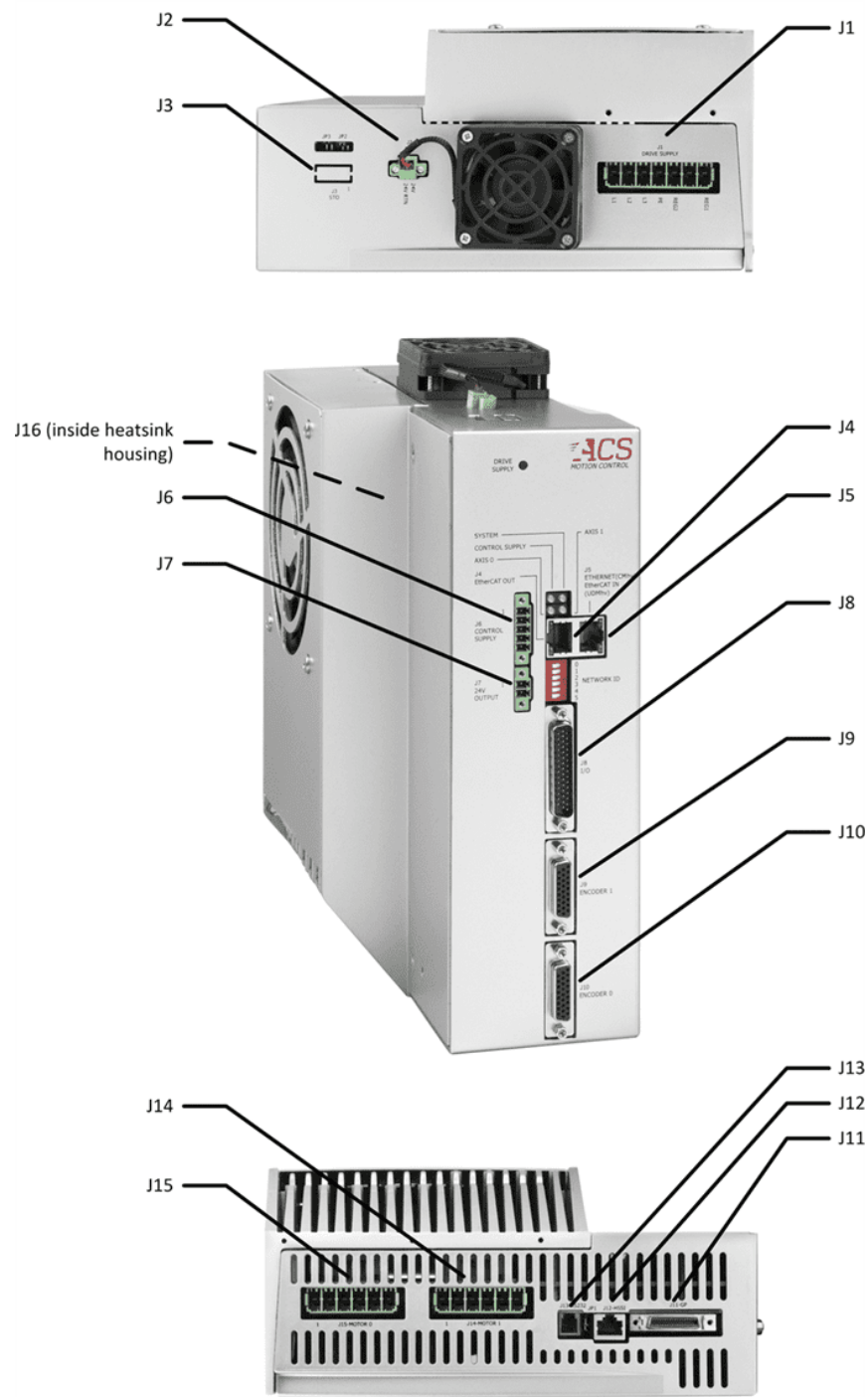


Figure 1-1. Interface SPiiPlusCMHV

1.2 Connectors



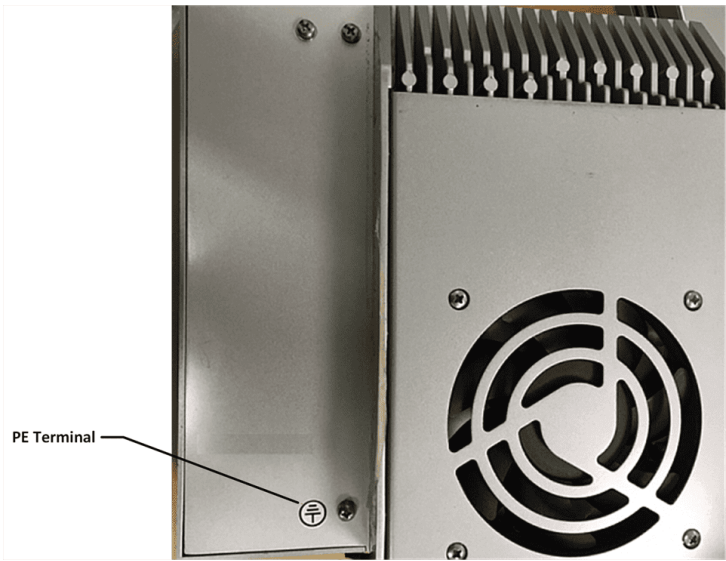


Figure 1-2. Connectors

1.3 Indicators

The following figures and tables show the location and description of the LED indicators.

Indicator	Description	Remarks
Axis 0 Axis 1	One bicolor LED for each Green - Drive is enabled Red - Drive fault Off - Drive is disabled	
System	One bicolor LED Red - System Fault Green - System OK Blinking - Software command	
Drive supply	One red LED On - drive supply is OK. Off - no drive supply is connected	
Control supply	One green LED, Off - Logic supply is not functioning On - Power supply is OK	

Indicator	Description	Remarks
Link Act	Two green LEDs Blinking - Linked and active On - Link without activity Off - No cable is connected	EtherCAT IN, EtherCAT OUT Green LEDs
Run	Yellow LED: On - network communication is OK Blinking/Off - network communication error	EtherCAT IN Yellow LED

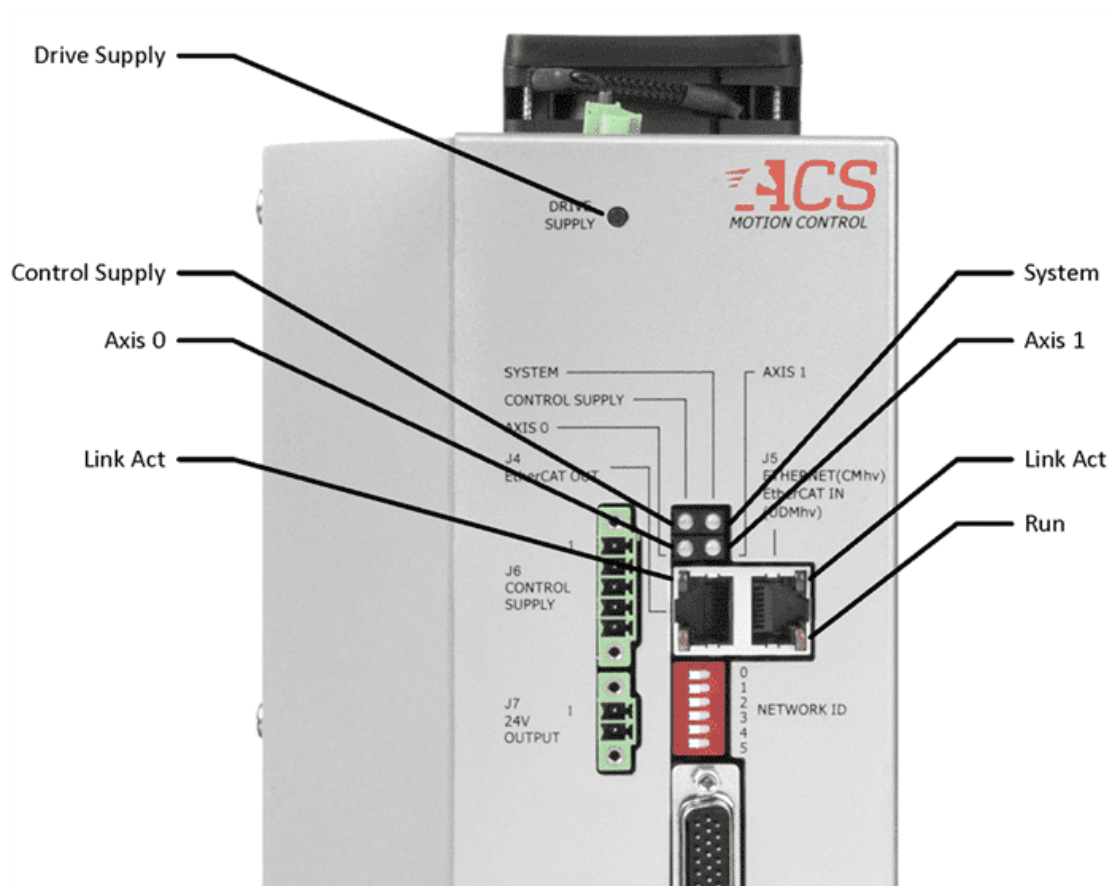


Figure 1-3. SPiiPlusCMhv

1.4 Ordering Part Number

The ordering part number (P/N) contains 18 characters (see [Figure 1-4](#)) each specifying a configuration characteristic ordered for the SPiiPlusCMhv module, as shown in [Table 1-1](#).

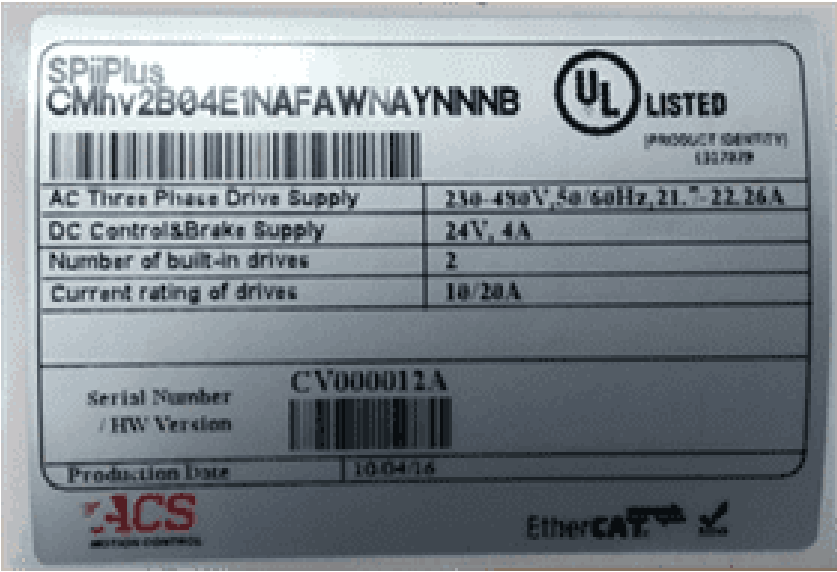


Figure 1-4. Label with Ordering P/N

Table 1-1. Configuration as Indicated by P/N

Ordering Options	Field	Example User Selection	Available Ordering Option Values
Number of built-in drives	1	2	1,2
Voltage & Current rating of built-in drives (cont/peak) ¹	2	B	A - 400-480V,5/10A B - 400-480V,10/20A C - 400-480V,15/30A D - 400-480V, 20/20A+5/10A ² E - 230V, 5/15A F - 230V, 10/30A G - 230V, 15/45A H - 230V, 20/60A
250kHz SIN-COS	3	0	0,1,2
Total number of feedback channels	4	4	2,4

¹When Option A, B, C, or D is selected for this field, Resolver inputs and Hall inputs are not supported.

²Axis 0 = 20/20A; Axis 1 = 5/10A

Ordering Options	Field	Example User Selection	Available Ordering Option Values
Absolute encoders type ¹	5	E	B - BiSS-C E - EnDAT (2.2 & 2.1 digital only) H - Hiperface I - SSI N - None P - Panasonic R - Resolver S - Smart Abs
Number of Absolute encoders interface	6	1	0,1,2
STO	7	N	N - No Y - Yes
Maximum number of axes	8	A	A - 2,4,8, 16 B - 32
ECAT 3rd party Servo Drive	9	F	0 to 16 (0,1,2,3,...9,A,B,C,D,E,F,G)
ECAT 3rd party Step motor Drive (open & closed loop)	10	A	0 to 16 (0,1,2,3,...9,A,B,C,D,E,F,G)
ECAT 3rd party IO EtherCAT node	11	W	W - 32 X - 64
G-Code, Flexible configuration, Both	12	N	N - None G - G-code F - Flexible configuration T - Both

¹All absolute encoder channels must be the same type

Ordering Options	Field	Example User Selection	Available Ordering Option Values
ServoBoost, number of axes supported	13	A	A - 4 B - 8 C - 12 D - 16 E - 20 F - 24 G - 28 H - 32 N - 0
Input shaping	14	Y	N - No Y - Yes
I/O Configuration	15	N	N: > Inputs & limits: 24V/SOURCE (PNP) > Outputs : 24V/SOURCE (PNP) D: Identical to N (for compatability reasons) S: > Inputs & limits: 24V/SINK (NPN) > Outputs: 24V/SOURCE (PNP) U: > Outputs & Inputs 24V/SOURCE (PNP) > Limits 24V/SINK (NPN)

Ordering Options	Field	Example User Selection	Available Ordering Option Values
Built-in Shunt Resistor	16	N	N - None A ¹ - 50R/300W for 230Vac B ² - 150R/300W for 480Vac
NanoPWM	17	N	N - No
Number of ACSPL+ buffers	18	B	D - Default ³ A - 16 B - 32

An example Part Number of SPIIPlusCMhv2B04E1NAFAWYAYNNNB would be set for the configuration described below.

Table 1-2. P/N Example

Field		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
P/N	SPIIPlusCMhv	2	B	0	4	E	1	N	A	F	A	W	N	A	Y	N	N	N	B



The product is shipped with the configuration set as specified. The configuration cannot be modified by the user.



To use a 5Vdc external supply for the encoders, please consult ACS.

¹For "Voltage and Current Rating" (field 2) selction E,F,F,G

²For "Voltage and Current Rating" (field 2) selction A,B,C,D

³Default number of ACSPL+ buffers is a function of the number of axes specified (field 8).
Up to 8 axes - 10 buffers; 16 axes - 16 buffers; 32 axes - 32 buffers.

For more information regarding the various options refer to the following documents:



- > *Motion Control Strategies to Obtain Consistent and Better Performance Application Note*
- > *Gantry Control with Cross Moving Axis Application Note*
- > *Dual axis PEG Application Note*
- > *SPiiPlus ACSPL+ Programmer Guide*



PEG does not work with absolute encoders.

1.5 SPIIPlusCMhv Package Content

The SPIIPlusCMhv package contains:

- > SPIIPlusCMhv Module
- > Control supply mating connector for J6 (Phoenix 1827732, 5 pin, MC-1.5/5 STF 3.81)



Figure 1-5. Control supply mating connector

- > Drive supply mating connector for J1 (Phoenix 1778117, 7 pin, PC 5/ 7-STCL1-7,62)

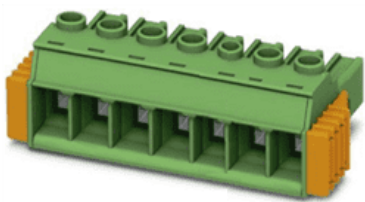


Figure 1-6. Drive supply mating connector

1.6 Optional Accessories

- > Ethernet Cables
- > Mating Connectors Kit
- > J11 mating connector with 2m cable
- > Clamping Yoke
- > Cover Fan Kit
- > Heatsink Fan Kit
- > STO kit, 2 meter cable with flying leads for STO
- > STO kit, Connector Kit for STO card

1.6.1 Ethernet Cables

The following Ethernet CAT5e cables are available:

Table 1-3. Ethernet Cables

Length [m]	Part Number
0.3	SP+ECAT-CA-30CM-00
0.5	SP+ECAT-CA-50CM-00
1	SP+ECAT-CA-1M-00

Length [m]	Part Number
2	SP+ECAT-CA-2M-00
3	SP+ECAT-CA-3M-00
5	SP+ECAT-CA-5M-00
10	SP+ECAT-CA-10M-00
15	SP+ECAT-CA-15M-00
20	SP+ECAT-CA-20M-00

1.6.2 Mating Connectors Kit

P/N: CMhvUDMhv-ACC1

Table 1-4. - Mating Connectors Kit Contents

Ref.	Qty	Description	Connector
1	1	SCSI connector for GP	J11
2	2	D type connectors for ENCODER 0, ENCODER1	J10,J9
3	2	Terminal connectors for MOTOR 0, MOTOR 1	J15,J14
4	1	Terminal connector for 24V output	J7
5	1	D type connector for I/O	J8

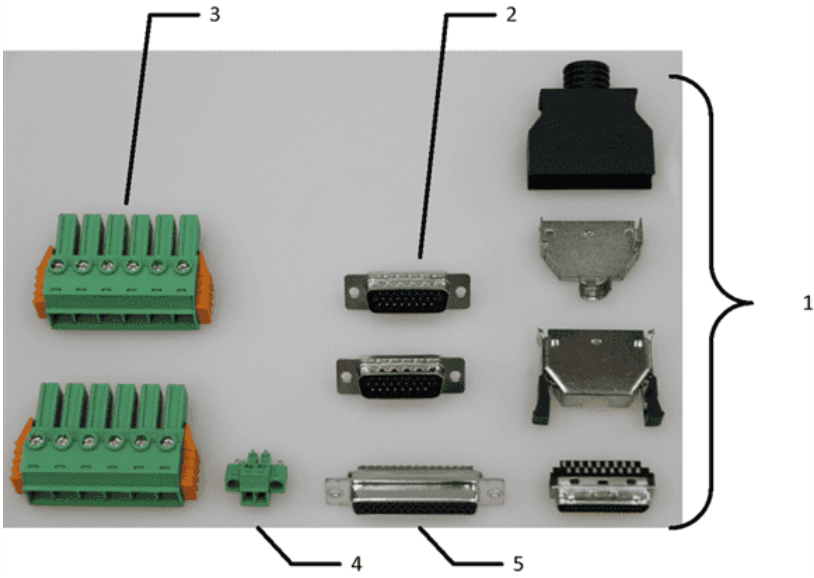


Figure 1-7. Mating Connectors Kit

1.6.3 J11 Mating Connector with 2 Meter Cable

P/N: CMhvUDMhv-ACC2

J11 mating connector with 2m cable with flying leads.



Figure 1-8. J11 Mating Connector

Table 1-5. CMhvUDMhv-ACC2 Pinout

Pin	Wire Color	Signal
1	Red	2_CHA+
2	Black	2_CHA-
3	White	2_CHB+
4	Black	2_CHB-
5	Green	2_CHI+
6	Black	2_CHI-
7	Blue	5U
8	Black	STATE0+/ENC_0+
9	Brown	STATE0-/ENC_0-

Pin	Wire Color	Signal
10	Black	ANGD
11	Yellow	AIN2+
12	Black	AIN2-
13	Orange	0_RSV_SIN+
14	Red	0_RSV_SIN-
15	Green	0_RSV_COS+
16	Red	0_RSV_COS-
17	White	0_RSV_EXT+
18	Red	0_RSV_EXT-
19	Blue	3_CHA+
20	Red	3_CHA-
21	Yellow	3_CHB+
22	Red	3_CHB-
23	Brown	3_CHI+
24	Red	3_CHI-
25	-	DGND
26	Blue	STATE1+/ENC_1+
27	Green	STATE1-/ENC_1-
28	-	EGND
29	White	AIN3+
30	Green	AIN3-
31	Brown	1_RSV_SIN+
32	Green	1_RSV_SIN-
33	Orange	1_RSV_COS+

Pin	Wire Color	Signal
34	Green	1_RSV_COS-
35	Yellow	1_RSV_EXT+
36	Green	1_RSV_EXT-

1.6.4 Clamping Yoke

P/N: CMhvUDMhv-ACC3

1.6.5 Cover Fan Kit

P/N: HV COVER FAN ACC1

Table 1-6. Cover Fan Kit Contents

Ref.	P/N	Quantity	Description
1	GG-09250-000/LF	1	Plastic fan 60x60mm
2	SB-17638-100/LF	1	Fan assembly for CMhv2 plastic cover
3	SC-25305-040	4	Flat self-tapping screw 3x25/BN82427



The SPIIPlusCMhv is shipped with a cover fan. Order HV COVER FAN ACC1 for a replacement fan.

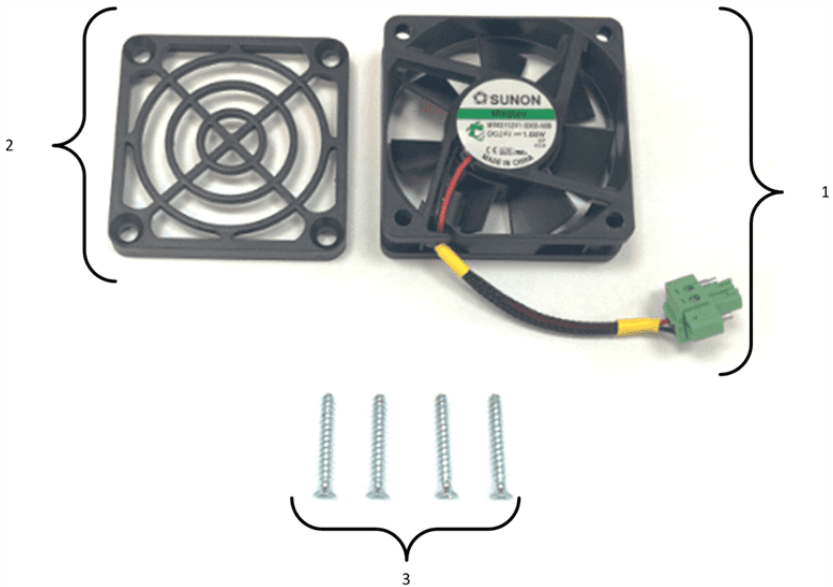


Figure 1-9. Cover Fan Kit

1.6.6 Heatsink Fan Kit

P/N: HV HEATSINK FAN ACC1

Table 1-7. Heatsink Fan Kit Contents

Ref.	P/N	Quantity	Description
1	SB-17638-200/LF	1	Fan assembly for CMhv2 heatsink
2	SC-35048-220	4	M4X35 DIN 7985A-A2 RoHS screws



The SPIIPlusCMhv is shipped with a heatsink fan. Order HV HEATSINK FAN ACC1 for a replacement fan.



- > When the temperature inside the power module for axis 0 or axis 1 is greater than 65°C, the heatsink fan will operate.
- > If the heatsink fan is in operation, when the temperature inside the power module for axis 0 or axis 1 decreases to below 50°C, the heatsink fan will stop.

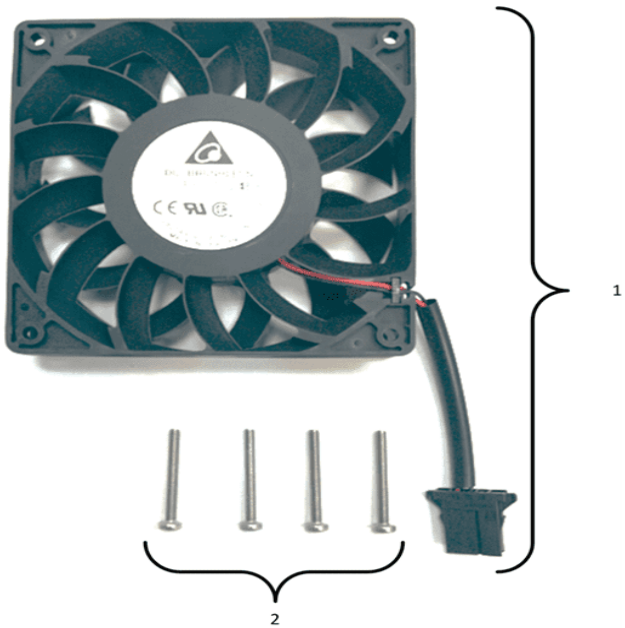


Figure 1-10. Heatsink Fan Kit

1.6.7 ST0 kit, 2 meter cable with flying leads for ST0

2 meter cable with flying leads
P/N: ST0-ACC1



Figure 1-11. ST0-ACC1 Accessory Kit

Table 1-8. ST0-ACC1 Pinout

Pin	Wire Color	Signal
1	Black	ST01-
2	Red	ST01+
3	Yellow	EGND
4	White	ST02+
5	Black	ST02-

1.6.8 ST0 Kit, Connector Kit for ST0 card

P/N: ST0-ACC2

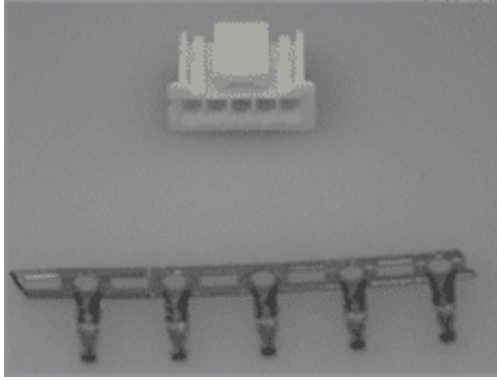


Figure 1-12. ST0 Kit

2. Mounting and Cooling

Unit should be mounted vertically, using M4 type Philips screws. The dimensions (in millimeters) are shown below.

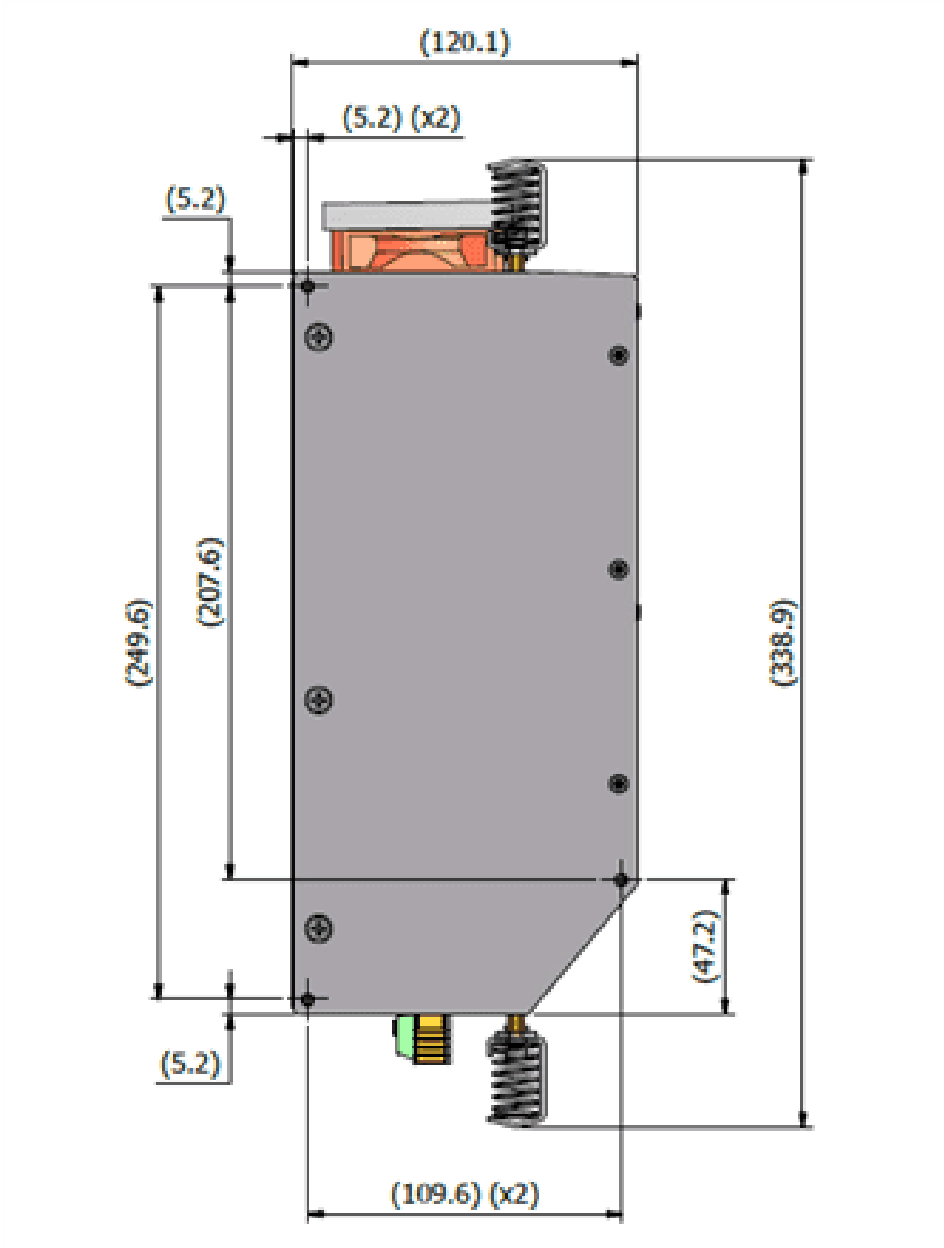


Figure 2-1. Retaining Screw Locations

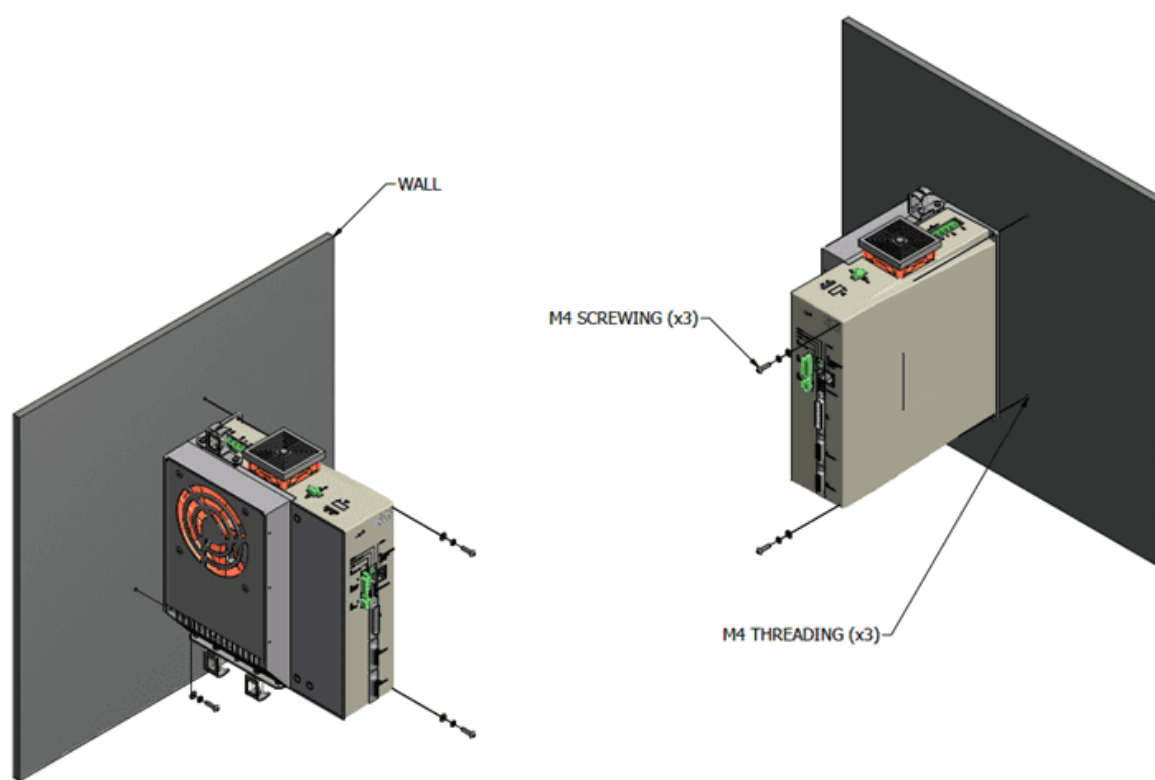


Figure 2-2. Mounting to Wall

- > Unit operates in temperature range of 0 to 40°C.
- > Leave sufficient clearance of 50 millimeters on all open sides for cable routing and free air flow.

3. Connections

This section describes how to interface with the SPiiPlusCMhv using proper safety, EMC and wiring guidelines. The following diagram is a standard representation of connections and grounding, specific settings and configurations are described in the subsections below.

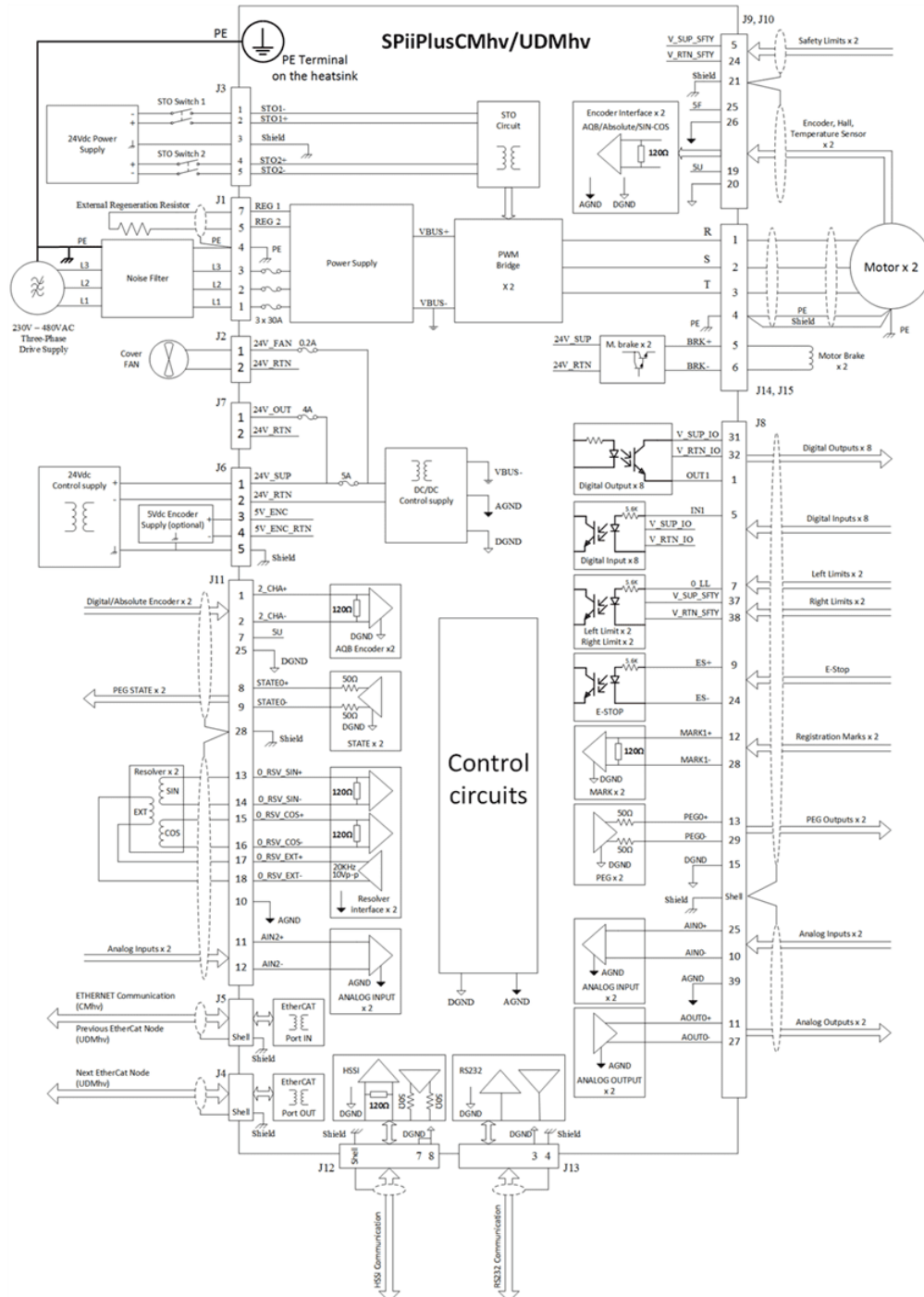
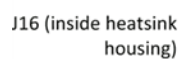


Figure 3-1. Connections and Grounding

Table 3-1. SPIIPlusCMHV Connectors

Connector Assignment	Connector Name
J1	Drive supply
J2	Fan
J3	STO
J4	EtherCAT OUT
J5	Ethernet
J6	Control supply
J7	24V output
J8	I/O
J9	Encoder 1
J10	Encoder 0
J11	GP
J12	HSSI
J13	RS232
J14	MOTOR 1
J15	MOTOR 0
J16	Heatsink fan



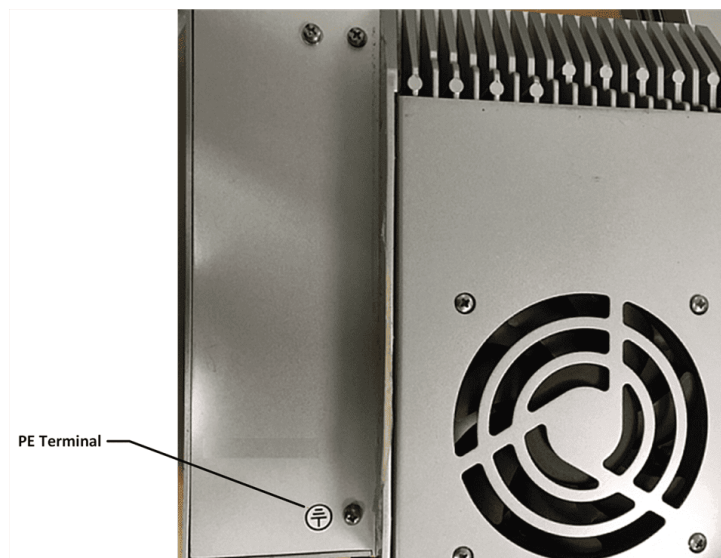


Figure 3-2. SPiiPlusCMhv Connectors

3.1 Safety, EMC and Wiring Guidelines

Read this section carefully before beginning the installation process.

Make sure that the following guidelines and procedures are addressed and observed prior to powering up and while handling any of the EtherCAT network elements.

An STO module (Safe Torque Off) is an optional feature of the Unit additional information can be found in [STO \(Safe Torque Off\)](#).

Installation and maintenance must be performed only by qualified personnel who have been trained and certified to install and maintain high power electrical and electro-mechanical equipment, servo systems, power conversion equipment and distributed networks.

Prior to powering up the system, ensure that all EtherCAT network devices are properly installed and grounded. Further ensure that all of the attached power and signal cables are in good operating condition. Maintenance should be performed only after the relevant network devices have been powered down, and all associated and surrounding moving parts have settled in their safe mode of operation. Certain drives require a longer time to fully discharge.

To avoid electric arcing and hazards to personnel and electrical contacts, avoid connecting and disconnecting the SPiiPlusCMhv while the power source is on.

When connecting the SPiiPlusCMhv to an approved isolated control and drive supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation, in accordance with approved safety standards.



The SPiiPlusCMhv is not intended for use in safety-critical applications (such as life supporting devices) where a failure of the SPiiPlusCMhv can reasonably be expected to cause severe personal injury or death.



J14 and J15 contain hazardous voltages of up to 670V PWM modulated.



All internal fuses are not user replaceable. In case of any of the internal fuses blown, the unit should be sent to ACS for repair.

Perform the following instructions to ensure safe and proper wiring:

- > Whenever possible, use shielded cables with braided shield of at least 80%-95% coverage.
- > Follow the guidance of below, based on the current rating of your product.
- > Proper wiring, grounding and shielding are essential for ensuring safe, immune and optimal servo performance. After completing the wiring, carefully inspect all wires to ensure tightness, good solder joints and general safety.

Table 3-2. Wiring Guidelines

Item	Gauge	Twisted pair
Control power supply	18AWG	No
Drive power supply	12-16AWG	No
Motor	14-16AWG	No
Motor Brake	18AWG	No
Encoders	28AWG (up to 0.6A), 26AWG (up to 1A)	Yes

3.2 JP1 Jumper

Jumper JP1 is intalled when running the MMI Application Studio Upgrade and Recovery Wizard (see MMI Application Studio User Guide for details).

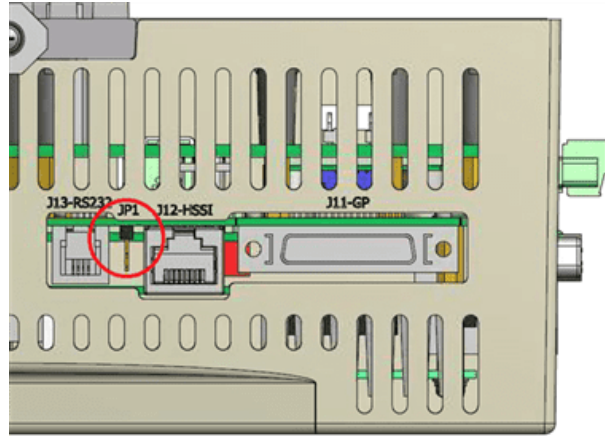


Figure 3-3. Location of jumper JP1



In normal operation, the JP1 jumper setting is to remain in the factory configuration, that is, jumper not installed.

3.3 Connecting the SPiiPlusCMhv

To connect the SPiiPlusCMhv:



In some cases, not all steps listed below apply, for example when connecting to a single axis Unit, only Motor 0 connections are relevant.

1. Ensure that all supplies are off when preparing the unit.
 - > Connect the control supply (see [Power Supplies](#)) to J6.
 - > Connect the drive supply (see [Power Supplies](#)) to J1.
 - > Connect motor 0 to J15.
 - > Connect motor 1 to J14.
 - > Connect IO to J8.
 - > Connect Ethernet J5 to the next slave.
 - > Turn on the control supply and verify communication with the unit.
 - > Turn on the drive supply.



The supplies can be turned on and off in any order.

3.4 Power Supplies

The unit is fed by two power supplies:

- > Control Supply (J1)
- > Drive Supply (J2)

The power supplies must be provided by the customer and must be UL certified. Power supply specifications are detailed in [Product Specifications](#).

The supplies can be switched on and off in any order. Each power supply has a LED indicator on the unit.

During emergency situations, the drive supply can be disconnected while the control supply should remain connected.

3.4.1 Control Supply

An external 24Vdc isolated power supply (not included with the unit) feeds all logic and control low voltage circuitry.

It is recommended to keep this power supply active (on) also during emergency stop situations, thus ensuring the continuing operation of the network, the controller, the feedback sensors and IOs.

3.4.1.1 J6 (CONTROL SUPPLY)

Label: J6 CONTROL SUPPLY

Connector: Phoenix 1827897, 5 pin, MC-1.5/5 GF 3.81

Mating connector: Phoenix 1827732, 5 pin, MC-1.5/5 STF 3.81



Figure 3-4. J6 - Control Supply Connector

Table 3-3. J6 - Control Supply Pinout

Pin	Signal	Description
1	24V_SUP	24V control supply
2	24V_RTN	24V control supply return
3	5V_ENC_EXT	External 5V supply for encoder
4	5V_ENC_EXT_RTN	External 5V supply return for encoder
5	EGND	Shield



If 0.5A is not sufficient for the encoders, an external 5Vdc supply can be used to feed the encoders. This 5Vdc should be connected to J6 pin 3 and 4.

External encoder 5V supply input is not a standard option and requires HW change; please contact ACS about availability and ordering instructions.

3.4.1.2 Connection Instructions

1. Use a shielded cable with a minimum gauge of 18 AWG.

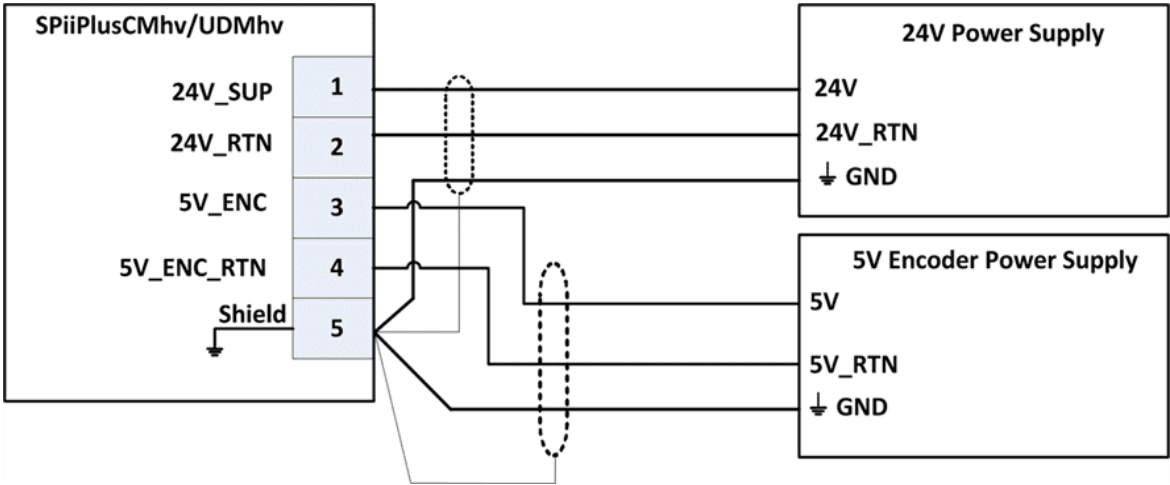


Figure 3-5. Control Supply Connections



J6 pin 3 and 4 can be used to feed the encoders by an external supply if 0.5A is not sufficient.
This feature is optional and must be specified when ordering the product.

3.4.2 Drive Supply

The drive is supplied from the 3 phase mains power supply.

3.4.2.1 J1 (DRIVE SUPPLY)

Label: J1 DRIVE SUPPLY

Connector Phoenix 1720518, 7 pin, PC 5/ 7-G-7,62

Mating connector: Phoenix 1778117, 7 pin, PC 5/ 7-STCL1-7,62

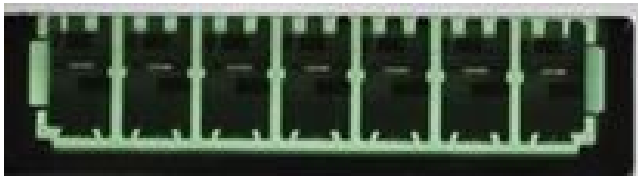


Figure 3-6. J1 - Drive Supply Connector

Table 3-4. J1 - Drive Supply Connector Pinout

Pin	Signal	Description
1	L1	AC input phase 1

Pin	Signal	Description
2	L2	AC input phase 2
3	L3	AC input phase 3
4	PE	EGND, protected earth.
5	REG 2	External regeneration resistor terminal 2
6	NC	Not connected
7	REG 1	External regeneration resistor terminal 1

3.4.2.2 Connection Instructions

1. Use a low inductance cable with a minimum gauge of 12-16 AWG.
2. Route the drive supply and motor cables as far as possible from all other noise sensitive cables (such as encoders and I/O).
3. Connect unit to a 3-phase AC supply. If required, connect the External Regeneration Resistor. Use shielded cable for the External Regeneration Resistor connection.
4. Connect the Unit PE (Protective Earth) to the electrical cabinet PE point.

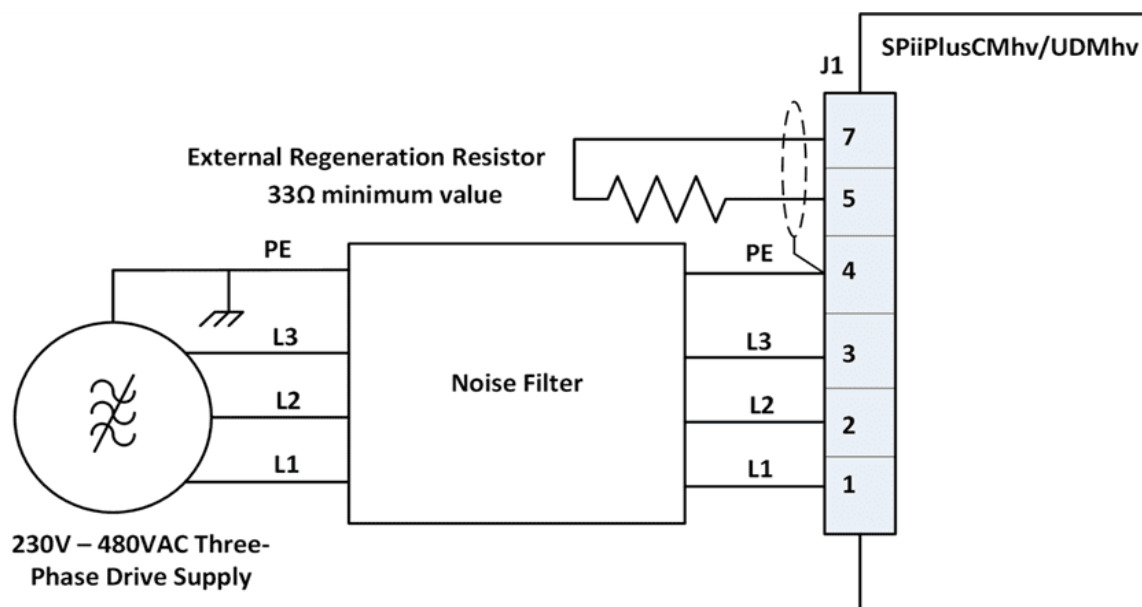


Figure 3-7. Drive Supply Connections

3.4.3 24V Output Supply

This supply is used for daisy-chain supply connection between ACS products.

3.4.3.1 J7 (24V OUTPUT SUPPLY)

Label: J7 24V OUTPUT

Connector: Phoenix 1827868, 2 pin, MC-1.5/2 GF 3.81

Mating connector: Phoenix 1827703, 2 pin, MC-1.5/2 STF 3.81

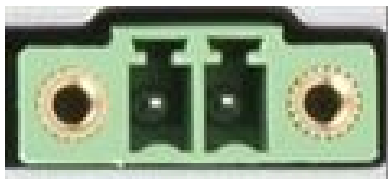


Figure 3-8. J7 - 24V Output Supply Connector

Table 3-5. J7 - 24V Output Supply Pinout

Pin	Signal	Description
1	24V_OUT	24V logic supply output (up to 3.3A)
2	24V_RTN	24V logic supply return

3.5 STO (Safe Torque Off)

3.5.1 J3 (STO)



The STO circuit functionality is designed and tested by ACS to comply with the requirements of EN ISO 13849-1, EN 62061, and IEC 61800-5-2 standards.

A 24V (18Vdc to 33Vdc) must be connected to both STO inputs to enable the drives to generate current and feed the motors. When the 24V is removed from one or both STO inputs, the PWM signals to the power stages are blocked within 50msec to 200msec. In addition, the controller is informed about this event within a few milliseconds. This delay (between informing the controller and blocking of the PWM signals of the drive) provides the controller the ability to bring all axes to a complete stop, or low velocity movement, in an orderly manner. The implementation of the STO guarantees that under any foreseen circumstances, failure or damage, any of following types of motors will not move:

- > AC synchronous (DC brushless)
- > Step motor
- > AC asynchronous (AC induction)

Usually, the STO1 and STO2 are connected to a 24V source via industry standard safety switch. This device disconnects the 24V upon opening a door, a light current tripping or other safety related event. Details for handling STO are provided in the *Safe Torque Off Function Application Notes*.

The STO circuit draws up to 50mA per STO input, with an inrush current of less than 500mA.

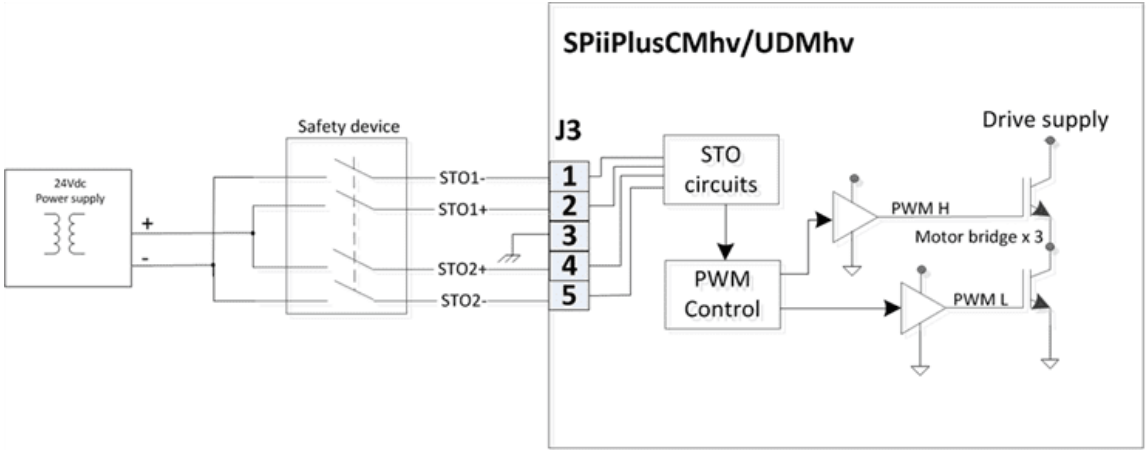


Figure 3-9. J3 - STO Connection

To watch the STO1 and STO2 input status, use the ACSPL+ variable "LOCALST".

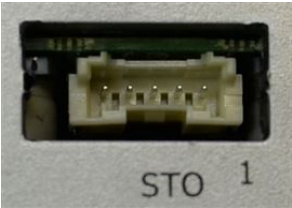


Figure 3-10. J3 - STO Connector

Label: J3 STO

Connector: JST 5 pin, 2mm, male, SM05B-PASS-1

Mating connector: JST 5 pin, 2mm, female, housing: PAP-05V-S, SPHD-001T-P0.5

Table 3-6. J3 - STO Connectors Pin out

Pin	Signal	Description
1	STO1-	STO input 1 inverted input
2	STO1+	STO input 1 non inverted input
3	EGND	Electrical ground
4	STO2+	STO input 2 non inverted input
5	STO2-	STO input 2 inverted input

3.6 GP

3.6.1 J11(GP)

Label: J11 - GP

Connector: SCSI 36 pin 1,27mm, Amtek HPCENR-MF36SAB4A-L

Mating connector: SCSI 36 pin 1,27mm, Amtek HPCENS-MM36SB-L



Figure 3-11. J11 - GP Connectors

Table 3-7. J11 - GP Connectors Pinout

Pin	Wire Color	Signal	Description
1	Red	2_CHA+	Axis 2 Encoder A non inverted input
2	Black	2_CHA-	Axis 2 Encoder A inverted input
3	White	2_CHB+	Axis 2 Encoder B non inverted input
4	Black	2_CHB-	Axis 2 Encoder B inverted input
5	Green	2_CHI+	Axis 2 Encoder non index inverted input
6	Black	2_CHI-	Axis 2 Encoder index inverted input
7	Blue	5U	5V user supply for digital encoder and Hall
8	Black	STATE0+/ENC_0+	PEG STATE 0 non inverted output or encoder 0 output non inverted
9	Brown	STATE0-/ENC_0-	PEG STATE 0 inverted output or encoder 0 output inverted
10	Black	ANGD	Analog ground
11	Yellow	AIN2+	Analog input 2 non inverted
12	Black	AIN2-	Analog input 2 inverted
13	Orange	0_RSV_SIN+	Axis 0 resolver SIN non inverted input
14	Red	0_RSV_SIN-	Axis 0 resolver SIN inverted input
15	Green	0_RSV_COS+	Axis 0 resolver COS non inverted input
16	Red	0_RSV_COS-	Axis 0 resolver COS inverted input
17	White	0_RSV_EXT+	Axis 0 resolver EXT non inverted output
18	Red	0_RSV_EXT-	Axis 0 resolver EXT inverted output

Pin	Wire Color	Signal	Description
19	Blue	3_CHA+	Axis 3 Encoder A non inverted input
20	Red	3_CHA-	Axis 3 Encoder A inverted input
21	Yellow	3_CHB+	Axis 3 Encoder B non inverted input
22	Red	3_CHB-	Axis 3 Encoder B inverted input
23	Brown	3_CHI+	Axis 3 Encoder non index inverted input
24	Red	3_CHI-	Axis 2 Encoder index inverted input
25	-	DGND	Digital ground
26	Blue	STATE1+/ENC_1+	PEG STATE 1 non inverted output or encoder 1 output non inverted
27	Green	STATE1-/ENC_1-	PEG STATE 1 inverted output or encoder 1 output inverted
28	-	EGND	Shield
29	White	AIN3+	Analog input 3 non inverted
30	Green	AIN3-	Analog input 3 inverted
31	Brown	1_RSV_SIN+	Axis 1 resolver SIN non inverted input
32	Green	1_RSV_SIN-	Axis 1 resolver SIN inverted input
33	Orange	1_RSV_COS+	Axis 1 resolver COS non inverted input
34	Green	1_RSV_COS-	Axis 1 resolver COS inverted input
35	Yellow	1_RSV_EXT+	Axis 1 resolver EXT non inverted output
36	Green	1_RSV_EXT-	Axis 1 resolver EXT inverted output

3.7 Motors

SPiiPlusCMhv support the following motors:

- > Two- and three-phase permanent magnet synchronous (DC brushless/AC servo),
- > DC brush motors
- > Voice coil
- > Two- and three-phase stepper (micro-stepping open or closed loop)

> AC Induction*



*Consult ACS.

For more details on each motor type, see www.acsmotioncontrol.com/downloads.

3.7.1 J14 (MOTOR 1), J15 (MOTOR 0)



J14 and J15 contain hazardous voltages of up to 670V PWM modulated..

Label: J15 MOTOR 0, J14 MOTOR 1

Connector: Phoenix 1720505, 6 pin, PC 5/ 6-G-7,62

Mating connector: Phoenix 1778104, 6 pin, PC 5/ 6-STCL1-7,62

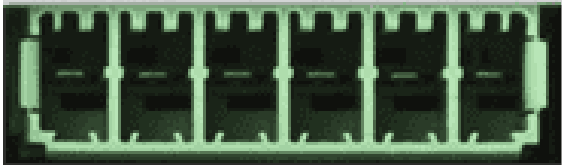


Figure 3-12. Motor Connectors

Table 3-8. Motor Connectors Pinout

Pin	Signal	Description
1	R_	Motor \$ R phase
2	S_	Motor \$ S phase
3	T_	Motor \$ T phase
4	EGND	EGND, protected earth.
5	BRK_+	Mechanical brake non inverted output
6	BRK_-	Mechanical brake inverted output

3.7.2 Connection Instructions

1. Use a shielded cable with a minimum gauge of 16 AWG. It should be less than 20 meters long.
2. Connect the motors according to the figures below.
3. Route the motors' cable (and the drive supply cable) as far as possible from all other noise sensitive cables (such as encoders and I/O).

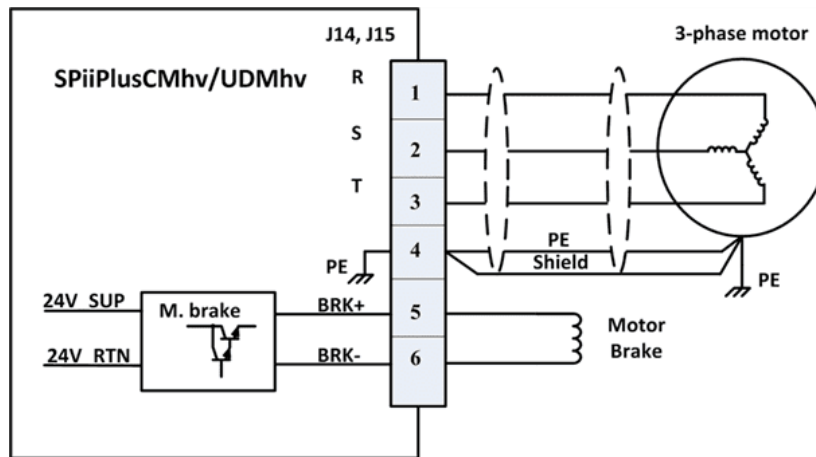


Figure 3-13. 3-Phase Motors (AC Induction, DC Brushless) Connections

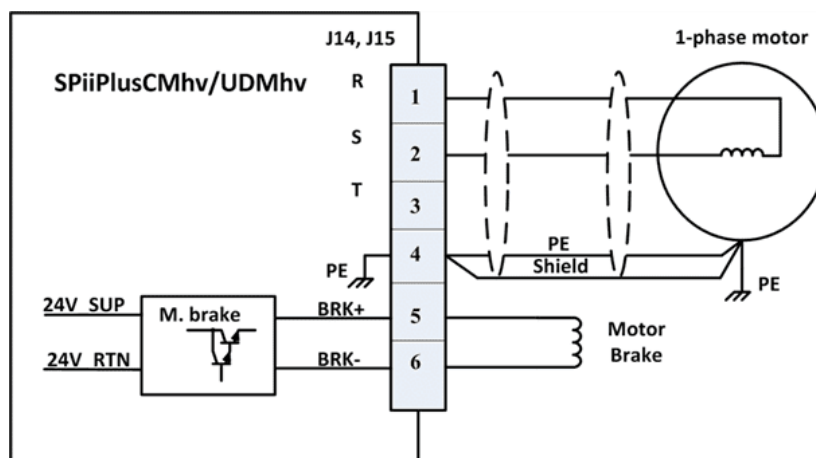


Figure 3-14. 1-Phase Motors (DC Brush, Voice Coil) Connections

3.8 Digital I/Os

The Unit includes the following INPUT/OUTPUT connectors:

- > I/O Connector (J8)
- > Encoder 1 (J9) & Encoder 0 (J10)



With the Unit installed in a network, the user can obtain the exact mapping of the ACSPL+ IN and OUT variables to the connector pins for the device in the system through the MMI Application Studio. For detailed instructions, see the *SPiiPlus MMI Application Studio User Guide* under system configuration.

3.8.1 J8 (I/O)

Label: J8 I/O

Connector: DB44 high density male

Mating connector: DB44 high density female.

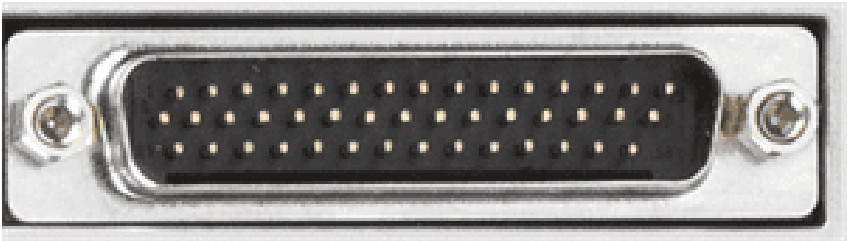


Figure 3-15. J8 - I/O Connector

Table 3-9. J8 - I/O Connectors Pinout

Pin	Signal	Description
1	OUT1	Digital Output 1
2	OUT3	Digital Output 3
3	OUT5	Digital Output 5
4	OUT7	Digital Output 7
5	IN1	Digital Input 1
6	IN3	Digital Input 3
7	0_LL	0 Left Limit
8	1_LL	1 Left Limit
9	ES+	E-STOP non inverted input
10	AIN0-	Analog input 0 inverted
11	AOUT0+	Analog output 0 non inverted
12	MARK1+	MARK 1 non inverted
13	PEG0+	PEG 0 non inverted output
14	PEG1+	PEG 1 non inverted output
15	DGND	Digital ground
16	OUT0	Digital Output 0
17	OUT2	Digital Output 2
18	OUT4	Digital Output 4

Pin	Signal	Description
19	OUT6	Digital Output 6
20	IN0	Digital Input 0
21	IN2	Digital Input 2
22	0_RL	Axis 0 RL
23	1_RL	Axis 1 RL
24	ES-	E-stop inverted input
25	AIN0+	Analog input 0 non inverted
26	AIN1+	Analog input 1 non inverted
27	AOUT0-	Analog output 0 inverted
28	MARK1-	MARK 1 inverted
29	PEG0-	PEG 0 inverted output
30	PEG1-	PEG 1 inverted output
31	V_SUP_IO	IO supply
32	V_RTN_IO	IO supply return
33	IN4	Digital Input 4
34	IN5	Digital Input 5
35	IN6/MARK2	Digital Input 6 or MARK 2
36	IN7/MARK3	Digital Input 7 or MARK 3
37	V_SUP_SFTY	Safety supply
38	V_RTN_SFTY	Safety supply return
39	ANGD	Analog ground
40	AIN1-	Analog input 1 inverted
41	AOUT1+	Analog output 1 non inverted
42	AOUT1-	Analog output 1 inverted

Pin	Signal	Description
43	MARK0+	MARK 0 non inverted
44	MARK0-	MARK 0 inverted



Pin 8 for signal 1_LL on connector J8 and pin 15 for \$_LL on connector J9 are connected on the SPiiPlusCMhv mother board.

3.8.1.1 Connection Instructions

1. Use shielded cables with twisted pairs, a minimum gauge of 24 AWG and up to 10 meters in length.
2. Connect a 24Vdc "Safety" power supply between pins 5 and 10.

3.8.1.2 Connection Examples

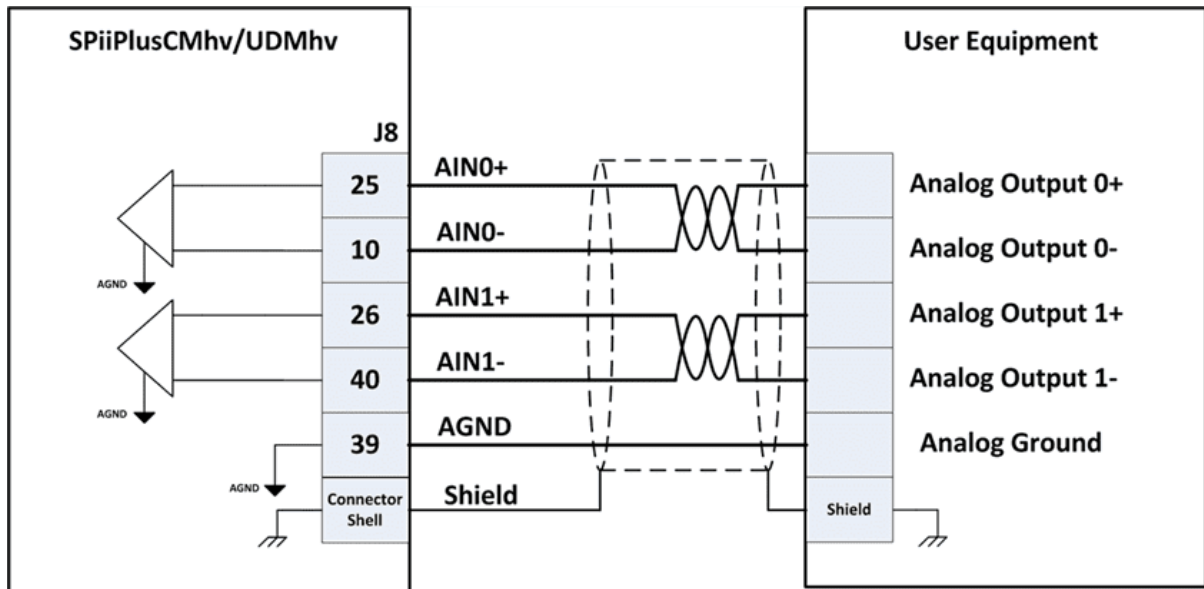


Figure 3-16. AIN0, 1 Differential Analog Inputs Connection

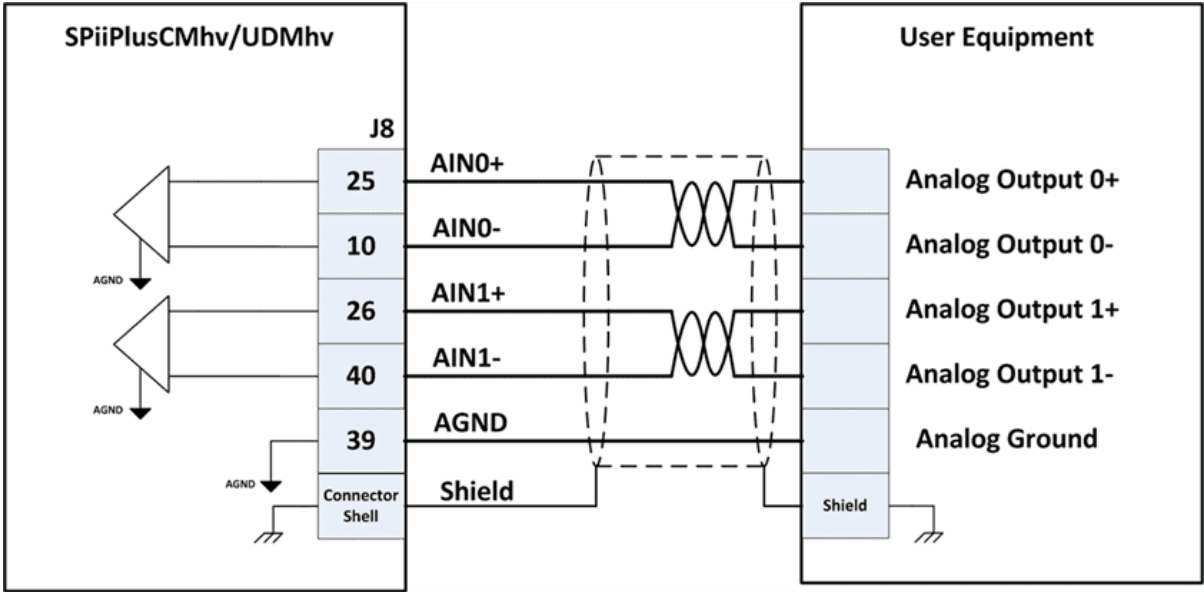


Figure 3-17. AIN2, 3 Differential Analog Inputs Connection

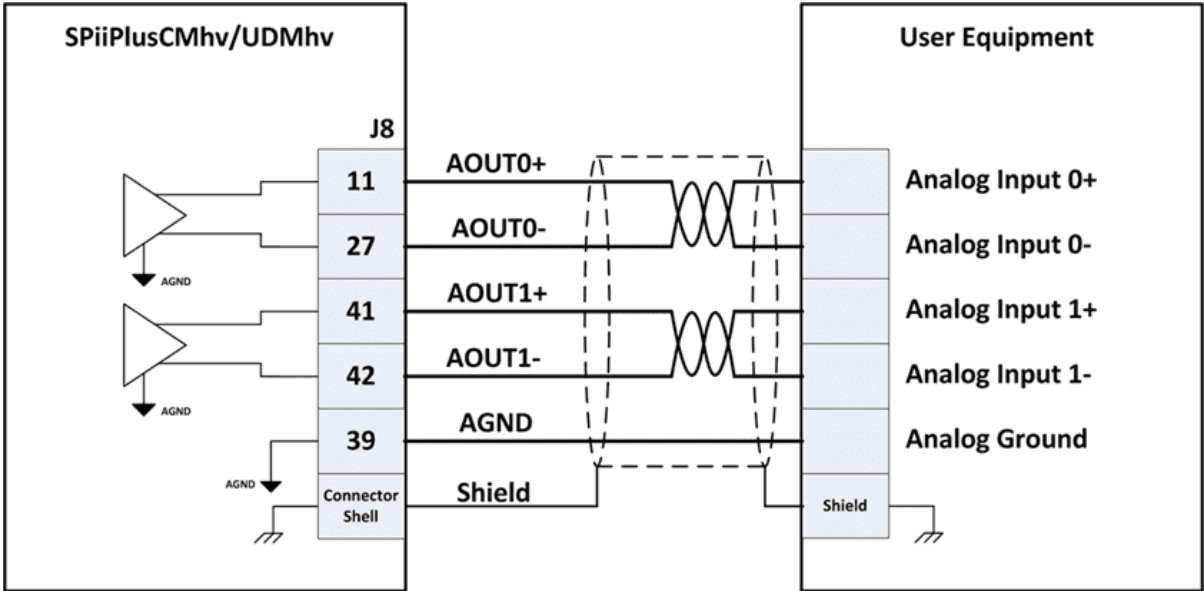


Figure 3-18. AOUT0, 1 Differential Analog Outputs Connection

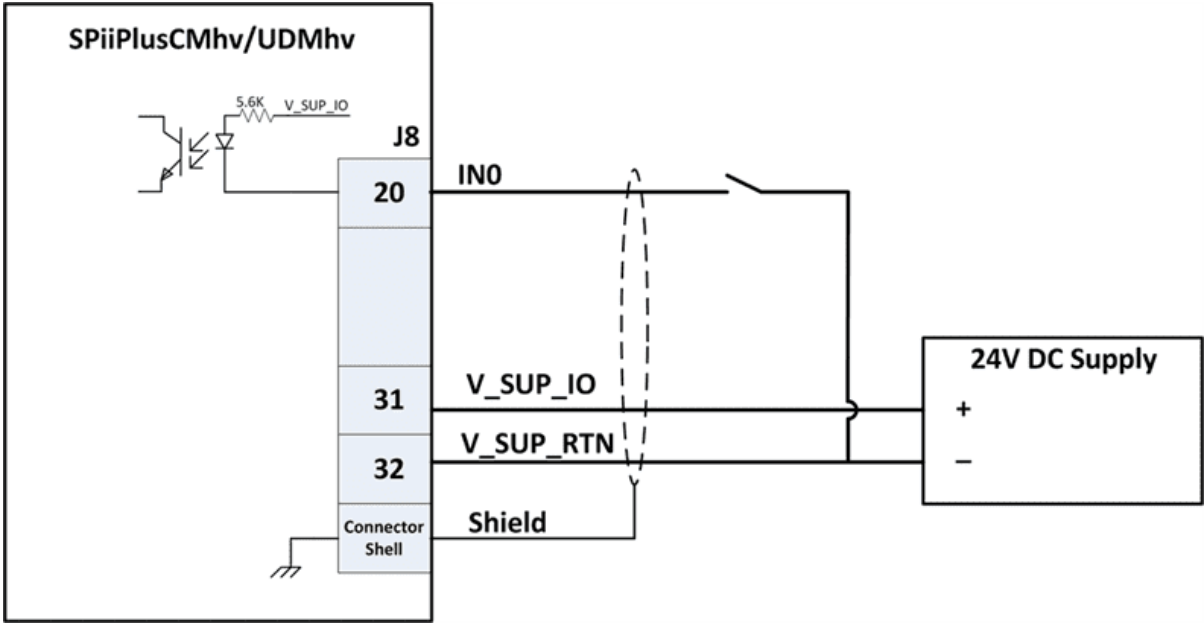


Figure 3-19. Digital Input Sink Connection

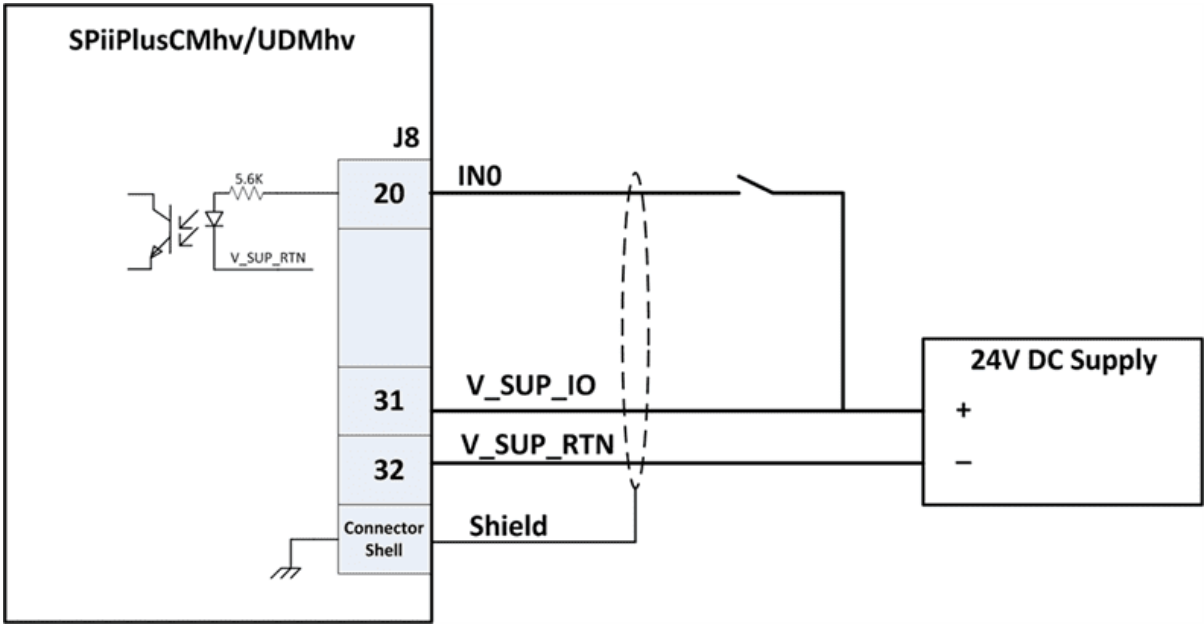


Figure 3-20. Digital Input Source Connection

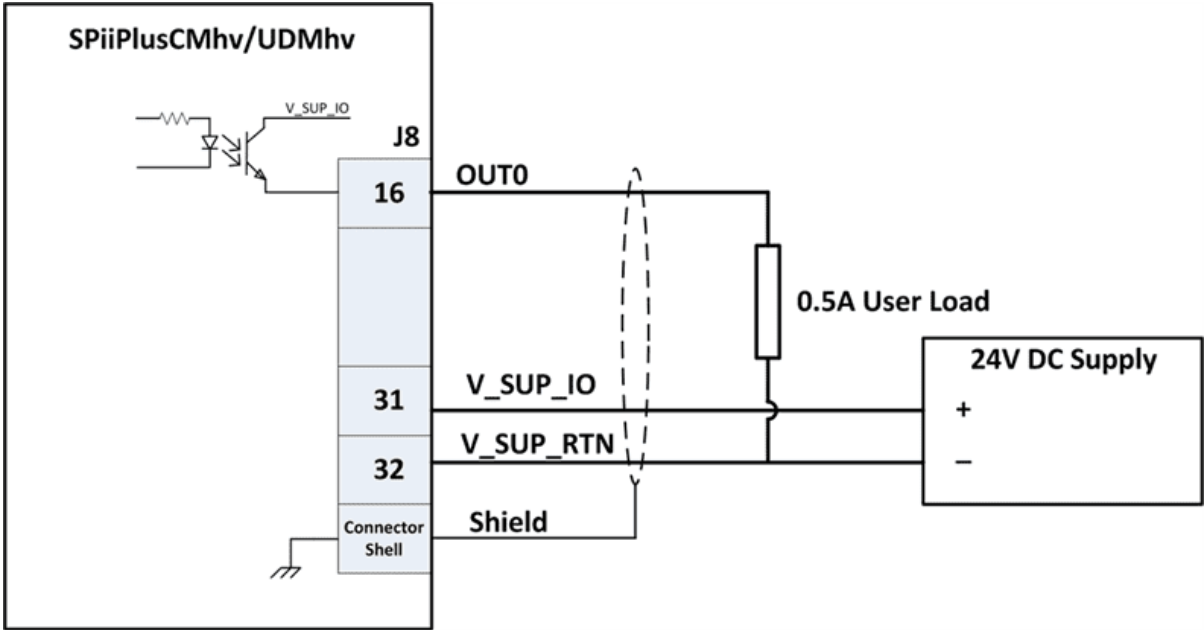


Figure 3-21. Digital Output Source Connection

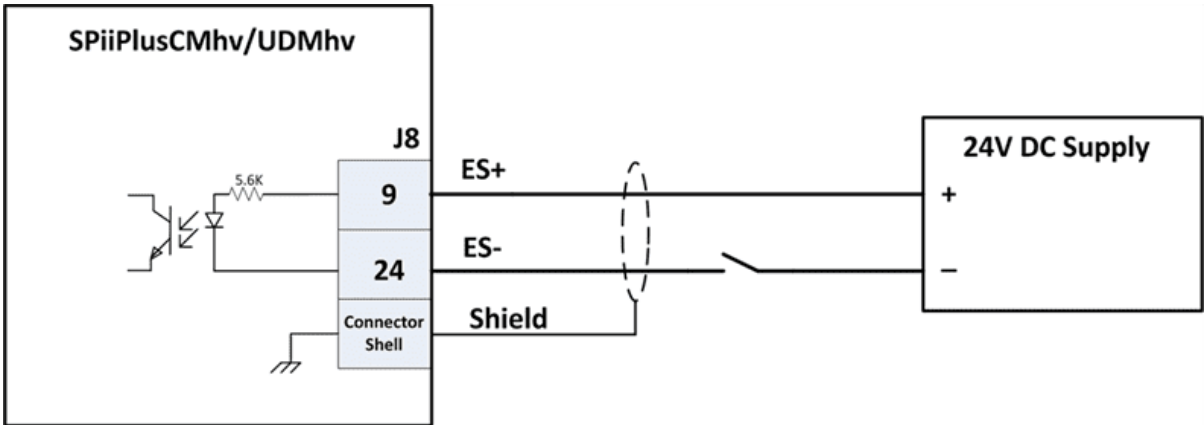


Figure 3-22. E-STOP Input Sink Connection

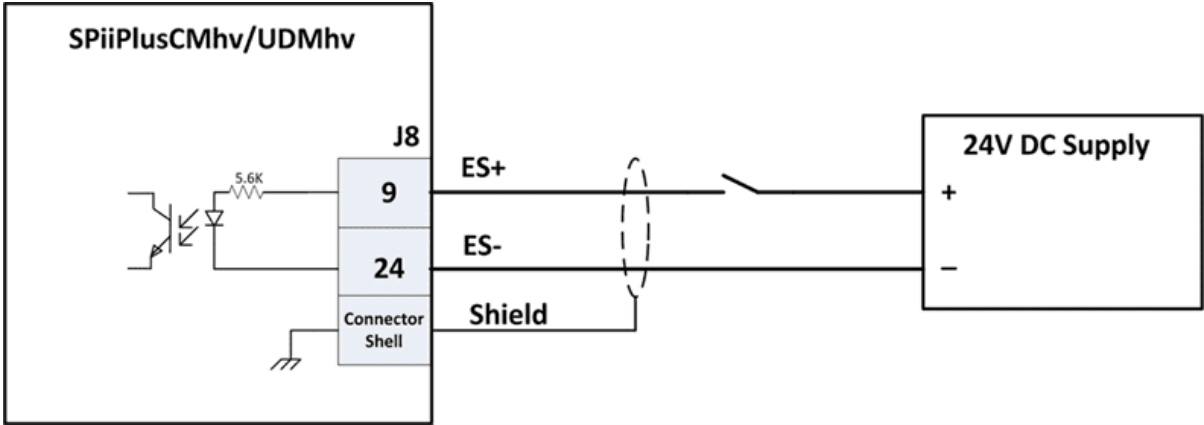


Figure 3-23. E-STOP Input Source Connection

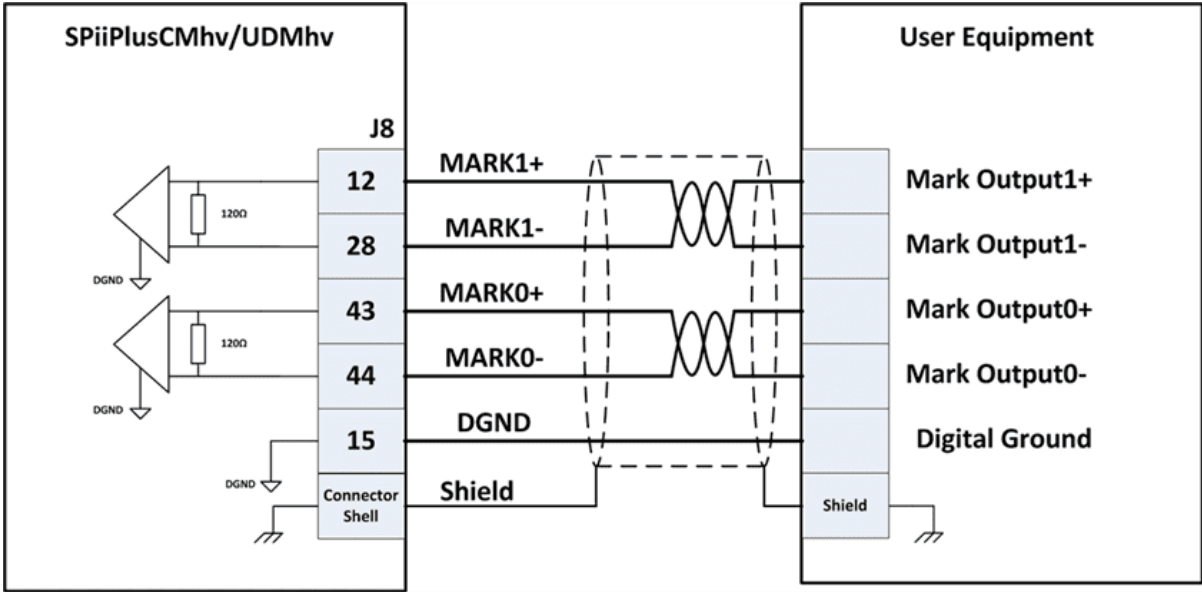


Figure 3-24. MARK 0, 1 Differential Inputs Connection

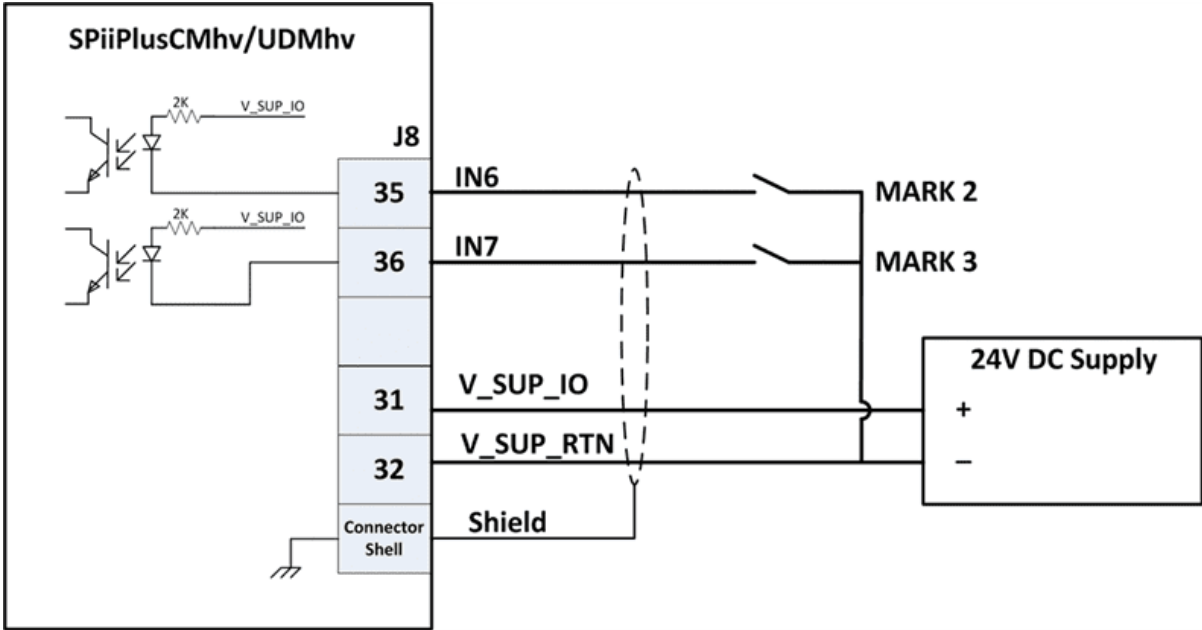


Figure 3-25. MARK 2, 3 Inputs Sink Connection

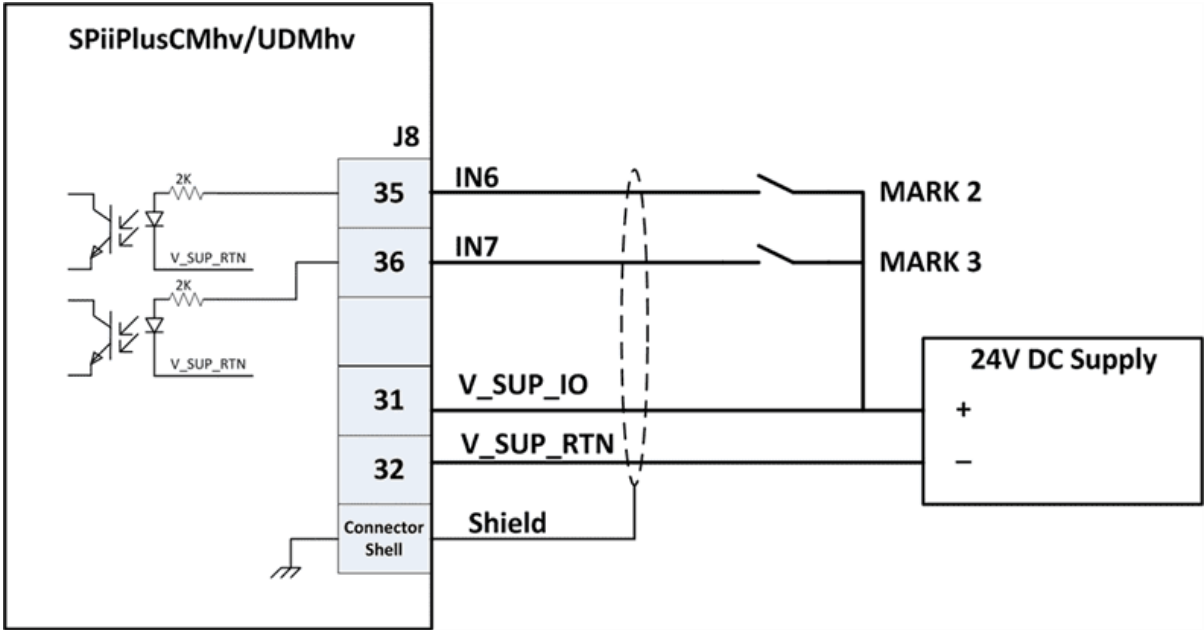


Figure 3-26. MARK 2, 3 Inputs Source Connection

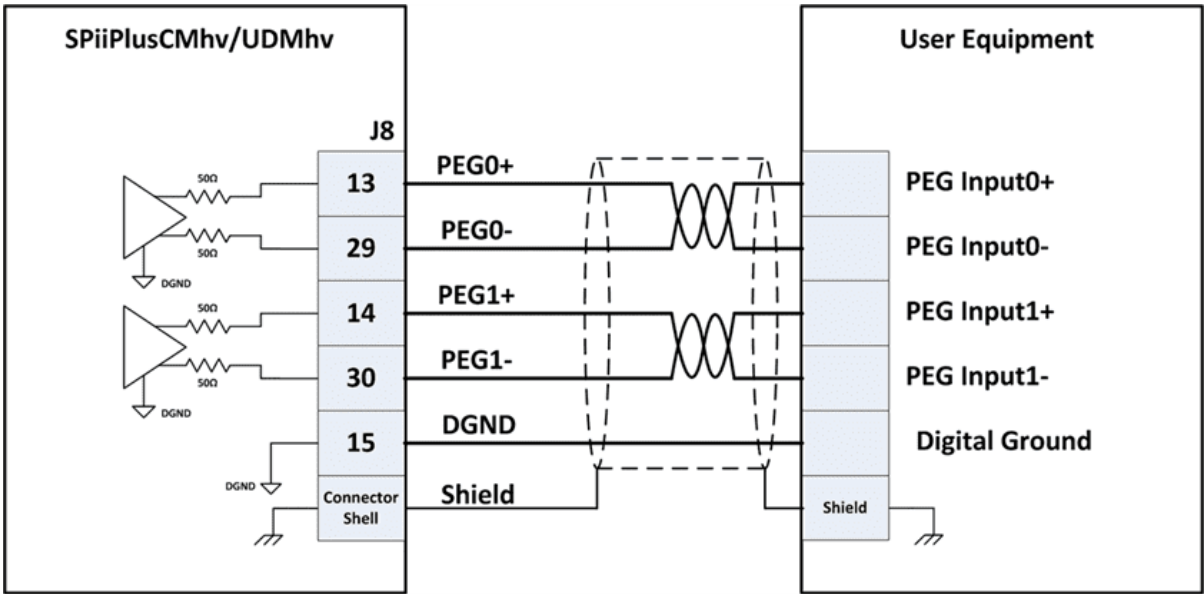


Figure 3-27. PEG 0, 1 Differential Outputs Connection

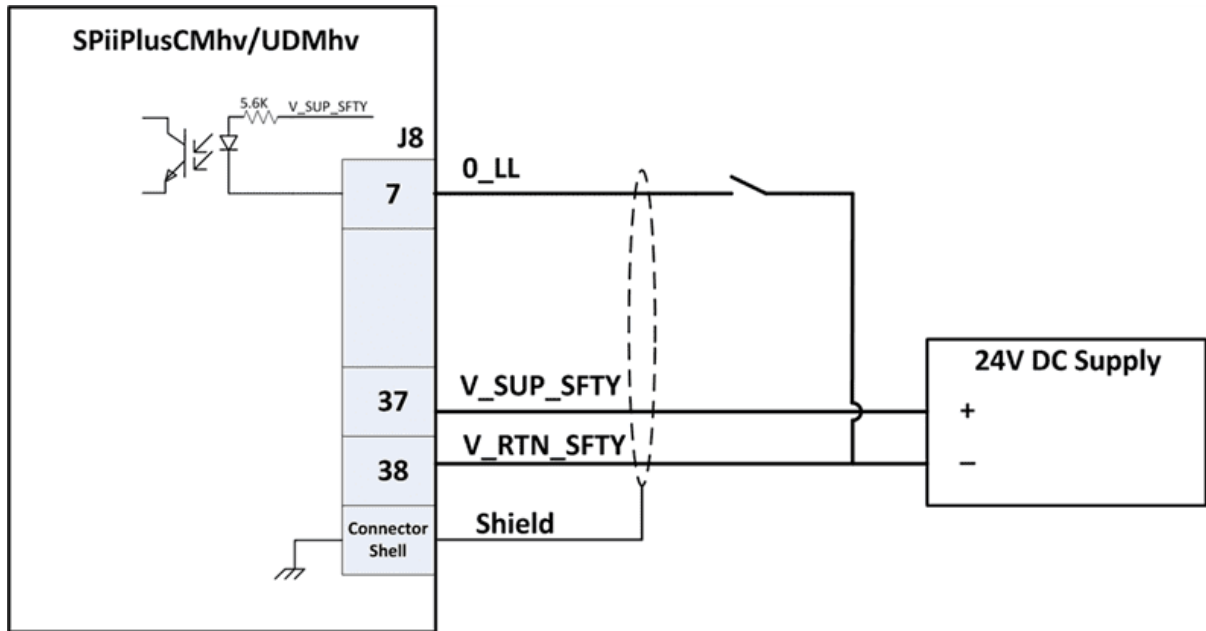


Figure 3-28. Safety Input Sink Connection

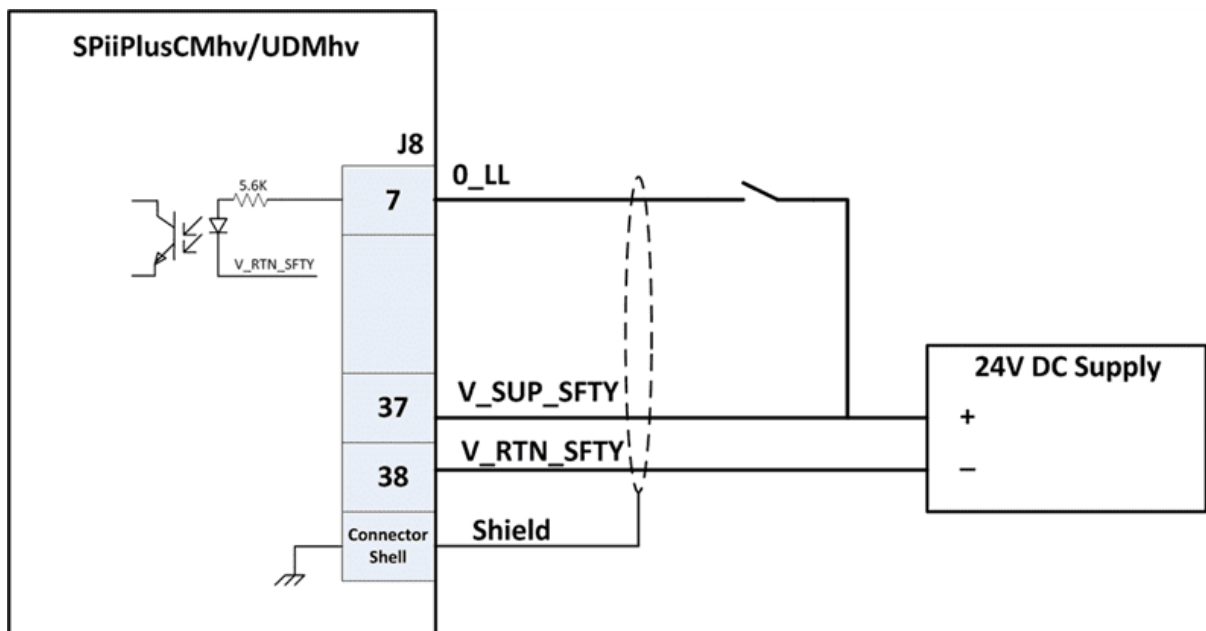


Figure 3-29. Safety Input Source Connection

3.8.2 J9 (Encoder 1), J10 (Encoder 0)

Labels:

J9 Encoder 1

J10 Encoder 0

Connector: DB26 high density female

Mating connector: DB26 high density male.

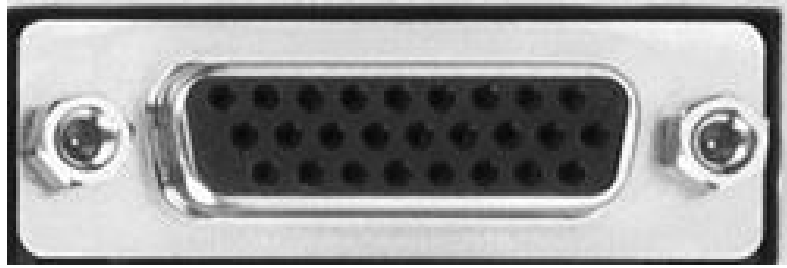


Figure 3-30. J9 - Encoder 1 & J10 - Encoder 0 Connectors

Table 3-10. J9 - Encoder 1 & J10 - Encoder 0 Connectors Pinout

Pin	Signal	Description
1	\$_CHA-	\$ Encoder A inverted input
2	\$_CHB-	\$ Encoder B inverted input
3	\$_CHI-	\$ Encoder index inverted input
4	\$_HB	\$ Motor Hall B
5	V_SUP_ SFTY	Supply for limits input.
6	\$_RL	Right limit
7	\$_SIN-	\$ Encoder SIN inverted input
8	\$_COS-	\$ Encoder COS inverted input
9	\$_SC_I-	\$ Encoder SIN-COS Index inverted input
10	\$_CHA+	\$ Encoder A non inverted input
11	\$_CHB+	\$ Encoder B non inverted input
12	\$_CHI+	\$ Encoder Index non inverted input
13	X_HA	\$ Motor Hall A
14	X_HC	\$ Motor Hall C
15	\$_LL	Left limit
16	\$_SIN+	\$ SIN non inverted input
17	\$_COS+	\$ Encoder COS non inverted input

Pin	Signal	Description
18	\$_SC_I+	\$ Encoder SIN-COS Index non inverted input
19	5U	5V user supply for digital encoder and Hall
20	5U_RTN	5V return user supply for digital encoder, A return for \$ Motor temperature sensor and Hall
21	Shield	Shield
22	\$_Motor_OVER	Motor over temperature (reference to 5U_RTN)
23	V_RTN_IO	Return supply IO (Not used)
24	V_RTN_SFTY	A return for limits input.
25	5F	5V user supply for analog encoder and Hall
26	5F_RTN	5V return user supply for analog encoder and Hall



Pin 15 for \$_LL on connector J9 and pin 8 for signal 1_LL on connector J8 are connected on the SPiiPlusCMhv mother board.

3.8.2.1 Connection Instructions

1. Use shielded cables with twisted pairs, a minimum gauge of 24 AWG and up to 10 meters in length.
2. Connect a 24Vdc "Safety" power supply between pins 5 and 24.

3.9 Ethernet

Labels: J5 Ethernet

Connectors: RJ45 female

Mating connector: RJ45 male

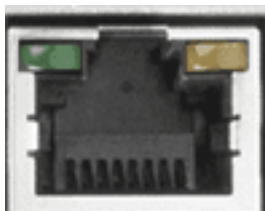


Figure 3-31. J5 - Ethernet Connector

Table 3-11. J5 - Ethernet Pinout

Pin	Signal	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	NC	Not connected
5	NC	Not connected
6	RD-	Negative receive signal
7	NC	Not connected
8	NC	Not connected

3.9.1 Connection Instructions

1.

Use Ethernet cables CAT 5e or better. ACS offers standard cables in different lengths (see [Ethernet Cables](#)).
2.

Connect an EtherCAT cable from the Ethernet network to J5 (Ethernet).

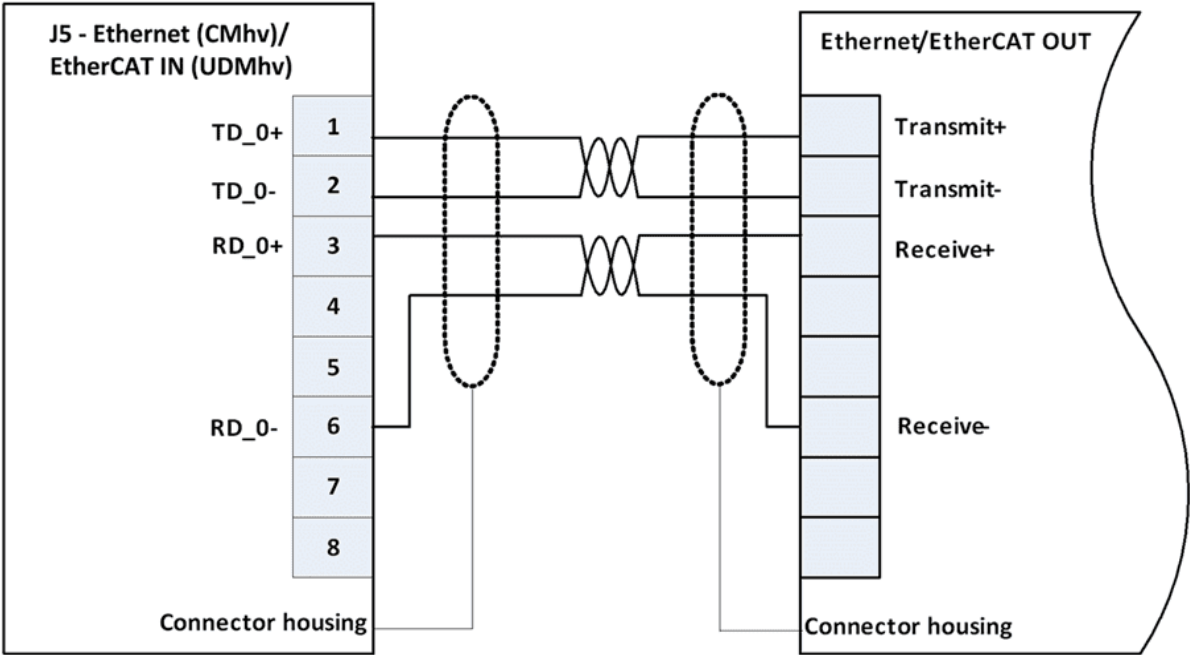


Figure 3-32. Ethernet Connections

3.10 HSSI

3.10.1 J12 (HSSI)

Labels: J12 - HSSI

Connectors: RJ45 female

Mating connector: Ethernet male



Figure 3-33. J12 - HSSI Connector

Table 3-12. J12 - HSSI Connector Pinout

Pin	Signal	Description
1	CONTROL_#+	Control signal non-inverted output for channel 0
2	CONTROL_#-	Control signal inverted output for channel 0
3	SER_DI_#+	Serial data non-inverted input for channel 0
4	SER_DI_#-	Serial data inverted input for channel 0
5	SER_DO_#+	Serial data non-inverted output for channel 0
6	SER_DO_#-	Serial data inverted output for channel 0
7	DGND	Digital ground
8	DGND	Digital ground

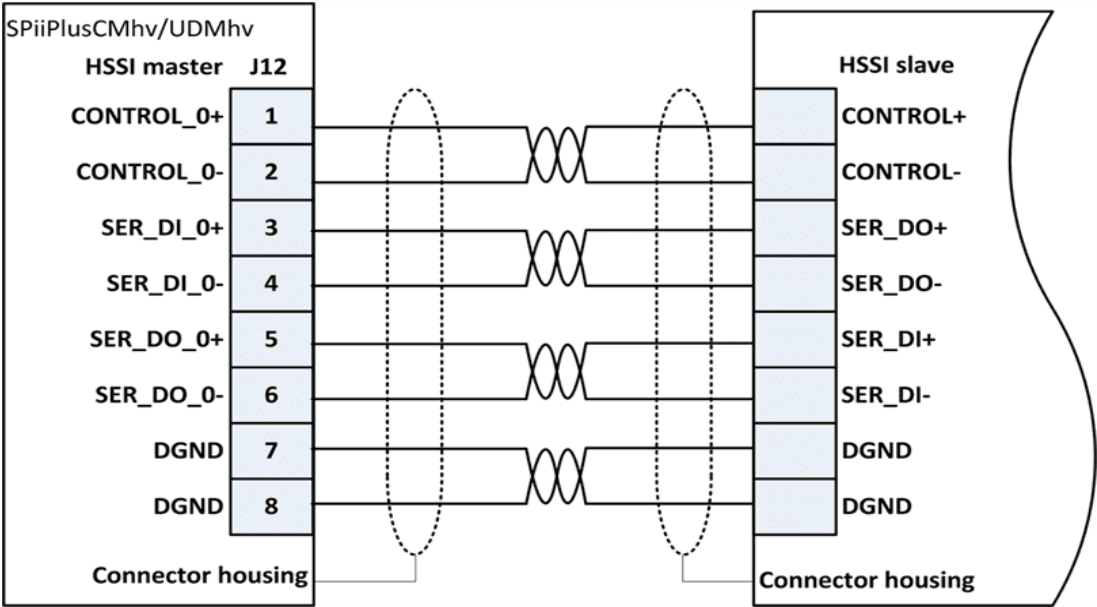


Figure 3-34. HSSI Connections

3.11 RS232 Serial Communications Port

3.11.1 J13 (RS232)

Labels: J13-RS232

Connectors: RJ11 female

Mating connector: RJ11 male



Figure 3-35. J13-RS232 Connector

Table 3-13. J13-RS232 Pinout

Pin	Signal	Description
1	RX232	RS-232 receive signal for communication port 1 (COM1)
2	TX232	RS-232 transmit signal for communication port 1 (COM1)
3	DGND	Digital ground.
4	SHIELD	Cable shield connection

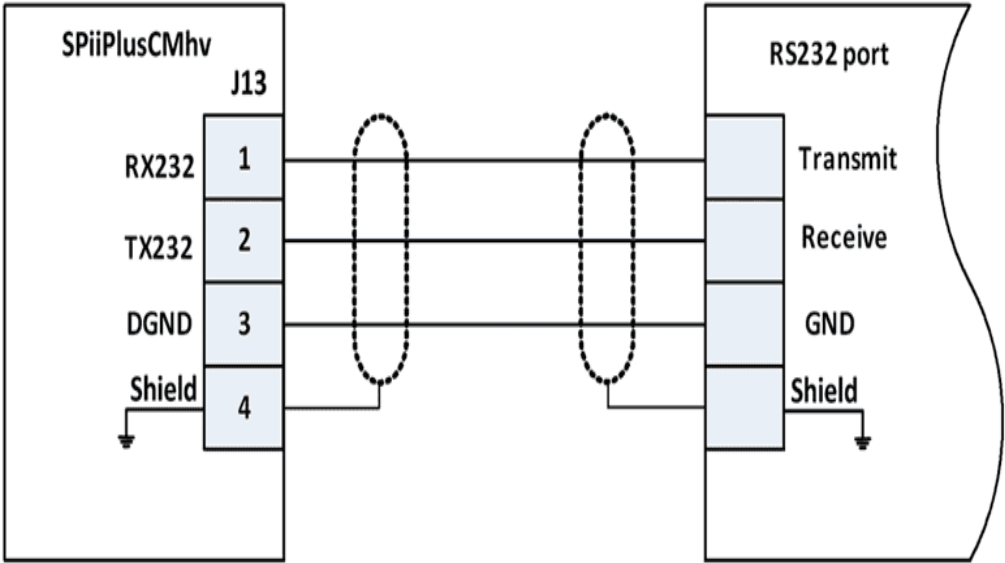


Figure 3-36. J13-RS232 Connection

3.12 Fans

3.12.1 J2 (Fan)

Labels: J2-Fan

Connectors: Phoenix 1827868, 2 pin, MC 1,5/ 2-GF-3,81

Mating connector: Phoenix 1827703, 2 pin, MC 1,5/ 2-STF-3,81



Figure 3-37. J2 - Fan Connector

Table 3-14. J2 - Fan Pinout

Pin	Signal	Description
1	24 V	
2	24 V RTN	

3.12.2 J16 (Heatsink Fan)

Connectors: Tyco vertical header 3-pin, pitch 3.81mm, 2-178313-5

Mating connector: Tyco housing 3-pin, pitch 3.81mm, 2-178288-3



Figure 3-38. J16 - Heatsink Fan Connector

Table 3-15. J16 - Heatsink Fan Pinout

Pin	Signal	Description
1	24V_FAN2	24V fan supply
2	24V_RTN_FAN	24V fan supply return
3	NC	Not connected

3.12.2.1 Connection Instructions

1. To access the heatsink fan, remove the heatsink fan cover by removing the four flat self-tapping screws.
2. Connectors: Tyco vertical header 3-pin, pitch 3.81mm, 2-178313-5
3. Mating connector: Tyco housing 3-pin, pitch 3.81mm, 2-178288-3

4. Product Specifications

Feature	X-A-YY	X-B-YY	X-C-YY	X-D-YY	X-E-YY	X-F-YY	X-G-YY	X-H-YY
	(X - number of axes, YY - other configuration options)							
Number of axes	1 or 2							
Control voltage input [Vdc]	24 ± 10%							
Motor voltage input range [Vac-3 phase, 50-60Hz]	400-525 (480 nominal)				185-250 (230 nominal)			
PWM frequency [KHz]	10				20			
Phase Current per axis Cont./Peak at Vmax 480V [A]	5/10	10/20	15/30	20/20 + 5/10	-	-	-	-
Phase Current per axis (Cont./Peak) at Vmax 230V [A]	6.25/ 12.5	12.5/ 25	18.75/ 37.5	25/25 + 6.25/12.5	5/ 15	10/ 30	15/ 45	20/ 60
Peak current time [sec]	1							
Max. output voltage to motor phase-to-phase [Vrms]	(Vac in) x 88%				(Vac in) x 88%			
Max. input continuous current @ 480 Vac [A rms]	8.5	16.9	25.4	21.3	-	-	-	-
Max. input continuous current @ 230 Vac [A rms]	10.1	20.2	27.8	25.5	8.6	16.9	25.7	33.7
Max. input continuous power @ 480 Vac [KVA]	7.0	14.1	21.1	17.7	-	-	-	-

Feature	X-A-YY	X-B-YY	X-C-YY	X-D-YY	X-E-YY	X-F-YY	X-G-YY	X-H-YY
	(X - number of axes, YY - other configuration options)							
Max. input continues power @ 230 Vac [KVA]	4.0	8.1	11.1*	10.1	3.4	6.7	10.2	13.4
Min. load Inductance, at maximum motor voltage [mH]	1							
Max. output power (cont./peak) per axis @ 480 Vac [KW]	2.4/ 4.6	4.8/ 9.2	7.2/ 13.8	9.6+2.4/ 9.6+4.8	-	-	-	-
Max. output power (cont./peak) per axis @ 230 Vac [KW]	-	-	-	-	1.1/ 3.2	2.2/ 6.3	3.5/ 9.7	4.5/ 12.7
Max. Heat dissipation per axis @ 480 Vac [W]	50	102	156	211+50	-	-	-	-
Max. Heat dissipation per axis @ 230 Vac [W]	36	75	117	162+36	48	98	84	114

*Phase input current is limited to 27.8Arms



Up to 25% higher current is possible with customization when operating at 400Vac. Please contact ACS for more information.

4.1 EtherCAT Cycle Rate

Table 4-1. CTIME Values for SPIIPlusCMHV (Rev. D1 and later) Controller

Controller	Number of Built-in Drives	Maximum Number of Axes	Default Number of Available ACSPL+ Buffers**	Maximum Number of Simultaneously Running		Controller Cycle Time					ServoBoost Supported
				Motors	ACSPL+ Buffers	1 (msec) 2 (msec)	0.50 (msec)	0.25 (msec)	0.20 (msec)	Default Value (msec)	
SPIIPlus CMhv-1-x-x-x-x-x-02-...	1	2	10	2	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-1-x-x-x-x-x-04-...	1	4	10	4	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-1-x-x-x-x-x-08-...	1	8	10	8	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-1-x-x-x-x-x-A-...	1	16	16	16	16	√ ⁽²⁾	√ ^(2,4)	--	--	1	√
SPIIPlus CMhv-1-x-x-x-x-x-B-...	1	32	32	32	32	√ ⁽²⁾	√ ^(2,4)	--	--	1	√
SPIIPlus CMhv-2-x-x-x-x-x-02-...	2	2	10	2	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-2-x-x-x-x-x-04-...	2	4	10	4	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-2-x-x-x-x-x-08-...	2	8	10	8	10	√ ⁽²⁾	√ ^(2,4)	--	--	0.5	√
SPIIPlus CMhv-2-x-x-x-x-x-A-...	2	16	16	16	16	√ ⁽²⁾	√ ^(2,4)	--	--	1	√
SPIIPlus CMhv-2-x-x-x-x-x-B-...	2	32	32	32	32	√ ⁽²⁾	√ ^(2,4)	--	--	1	√

⁽¹⁾ 2-axes Extended Segmented Motion (XSEG) with limitations: a. Segment length > 5 ms, b. IMM VEL = ... command shouldn't be used

⁽²⁾ 6-axes Extended Segmented Motion (XSEG) with limitation: Segment length > 1 ms. The user's responsibility is to ensure that the USAGE doesn't exceed 80%.

⁽³⁾ NetworkBoost (Ring Topology) with limitations: a. CTIME = 1 msec - up to 64 axes b. CTIME = 0.50 msec - up to 24 axes c. CTIME = 0.25 msec - up to 8 axes d. CTIME = 0.20 msec - up to 4 axes

⁽⁴⁾ BPTP/Z command limited to 4 axes or less

**Up to 32 buffers supported with ordering option.

4.2 Dimensions

260 x 246 x 120 mm³

4.3 Weight

5.3 Kg

4.4 Compliance with Standards

4.4.1 Environment

Complies with the following standard:

- > Storage: IEC 60721-3-1 (class 1K3 and 1M3)
- > Transportation: IEC 60721-3-2 (class 2K4 and 2M3)
- > Operating: IEC 60721-3-3 (class 3K3 and 3M4)
 - > Operating ambient temperature: 0 - 40°C

The design complies with ROHS requirements.

4.4.2 CE

- > Safety: IEC 61010-1:01
- > EMC: EN 61326:2002 (pending)



To comply with the above standard, the following filters must be used:

- > AC line filter - EPCOS P/N: B84143B0036R110
- > Motor filter - contact ACS Customer Support.

4.4.3 UL

UL-508C.

Smarter



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