MP4U

Installation Guide

April 2019

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MP4U

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PATENTS

ACS MotionControl Ltd. NanoPWM products are protected under the following patents:

IsraelPatent No. 235022

US Patent Application No.14/532,023

Europe Patent application No.15187586.1

JapanPatent Application No.: 2015-193179

Chinese Patent Application No.: 201510639732.X

Taiwan(R.O.C.) Patent Application No.104132118

KoreanPatent Application No.10-2015-0137612

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NOTICE

Revision History

Date	Revision	Description
Decmeber 2018	1.20	Updated with controller documentation
January 2018	1.10	Updated spare parts ordering procedure and part numbers
November 2017	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
`Monospace + grey background`	Code example
Italic	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.

Document	Description
SPiiPlus ACSPL+ Programmer's Guide	Provides practical instruction on how to use ACSPL+ to program your motion controller.
SPiiPlus Command & Variable Reference Guide	Describes all of the variables and commands available in the ACSPL+ programming language.
SPiiPlus MMI Application Studio User Guide	Explains how to use the SPiiPlus MMI Application Studio and associated monitoring tools.

Table of Contents

List Of Figures

List of Tables

1. About this manual

1.1 Scope of document

This document describes how to install the MP4U, including:

> Connectivity

> Mounting

Further information is available from the list of related documents.

2. Product overview

The MP4U system is a 19inch, 6U rack mounted enclosure. It includes the following plug-in modules:

> Optional motion controller

> One to four dual and single drive modules

>> High performance NanoPWM drives (NPM3U)

>> Economical drives (UDM3U)

> Power supplies

> Power management

> Regeneration
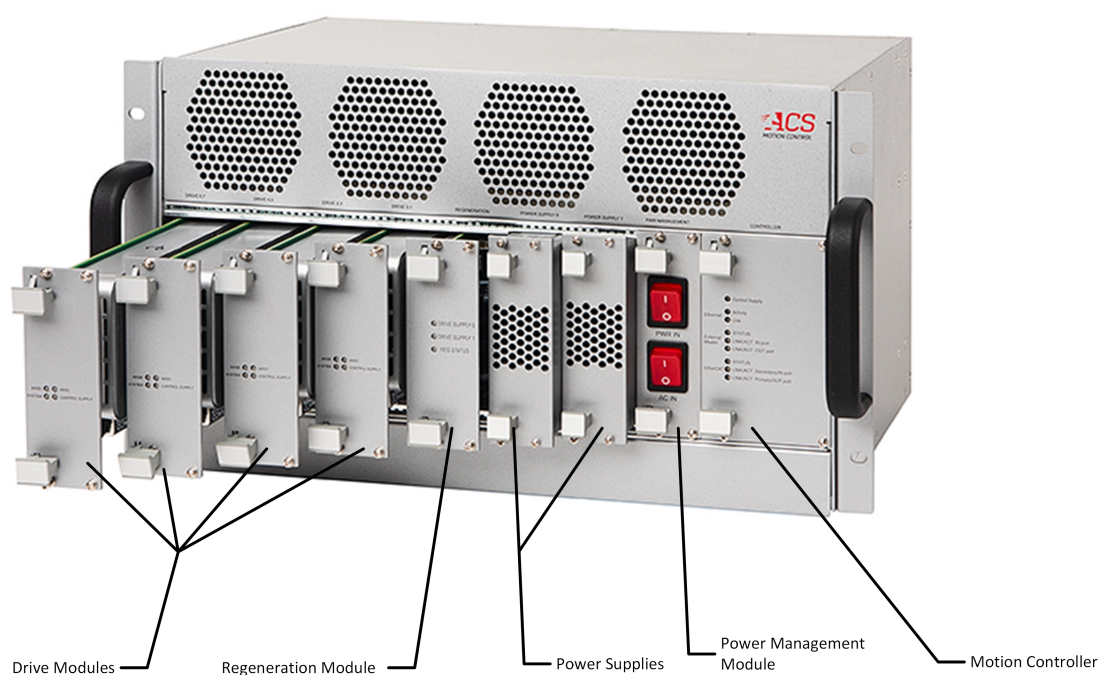
Figure 2-1. MP4U components

2.1 MP4U configuration

> **The MP4U unit is configured at the factory according to the order options. It cannot be changed in the field.**

2.1.1 Basic configuration

The basic configuration consists of (not user selectable)

> 6U enclosure

> Power management plug-in module

> Regeneration plug-in module

Figure 2-2. Basic configuration (front)

2.1.2 User configuration options

The following plug in modules are provided according to the definition made by the user.

> Controller

> Drive

> Power supplies and their configuration

Figure 2-3 is an example of an eight drive MP4U.
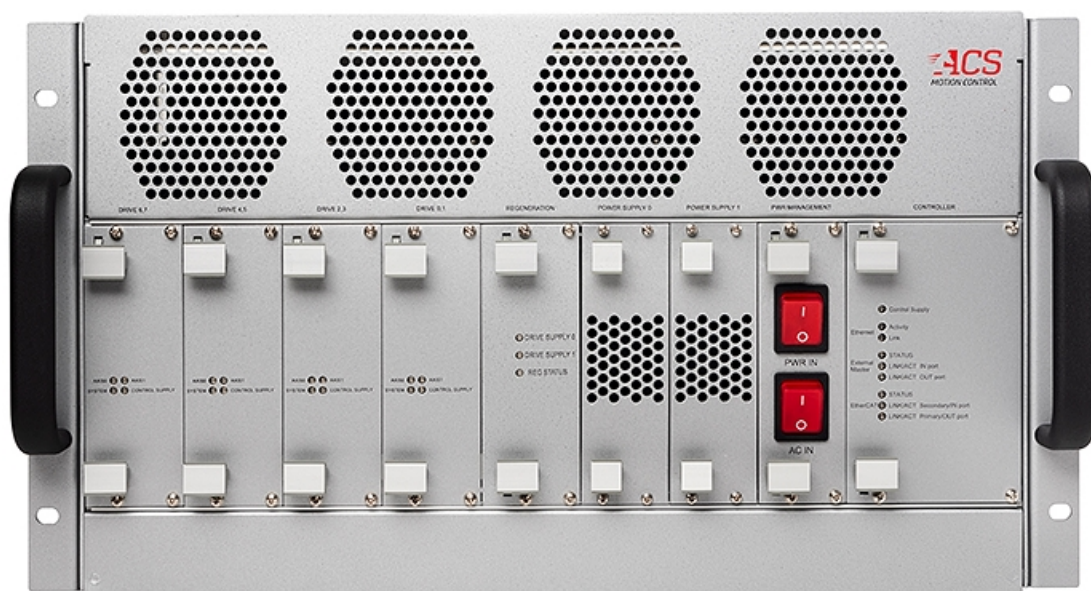
Figure 2-3. Eight drive MP4U

2.1.2.1 Drive controller

The drive controller option has an internal motion controller that operates as an EtherCAT node which is managed by an external ACS EtherCAT master.
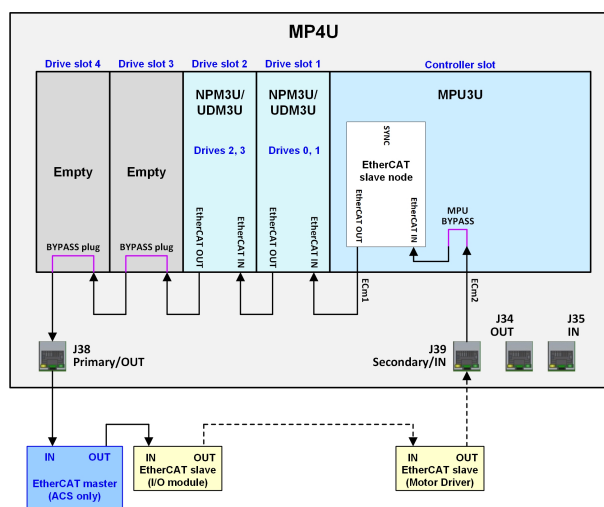
Figure 2-4. Drive controller

2.1.2.2 No internal motion controller

If no motion controller is selected, the slave drive modules are managed by an external EtherCAT master controller.
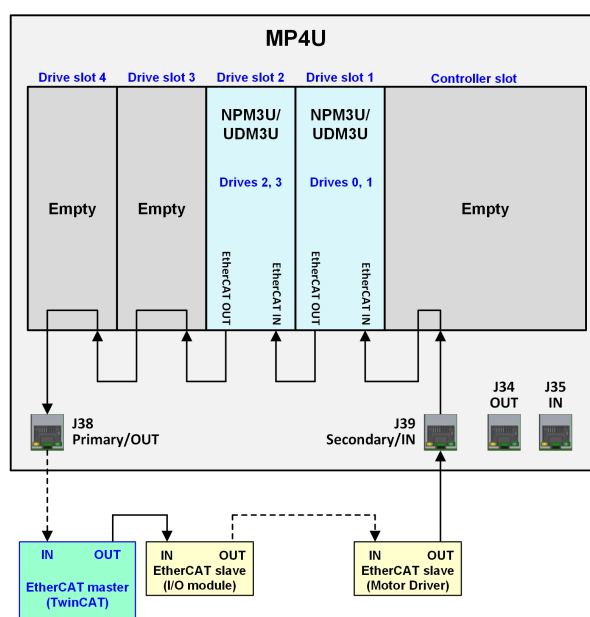
Figure 2-5. MP4U connected to an external EtherCAT master

> The hardware setup identification function is not availalbe for this option.

2.1.2.3 Motion controller and EtherCAT master

> Controller only

> No EtherCAT bridge installed

> This motion controller is similar to the SPiiPlusEC. It operates as a master controller to external EtherCAT slave devices
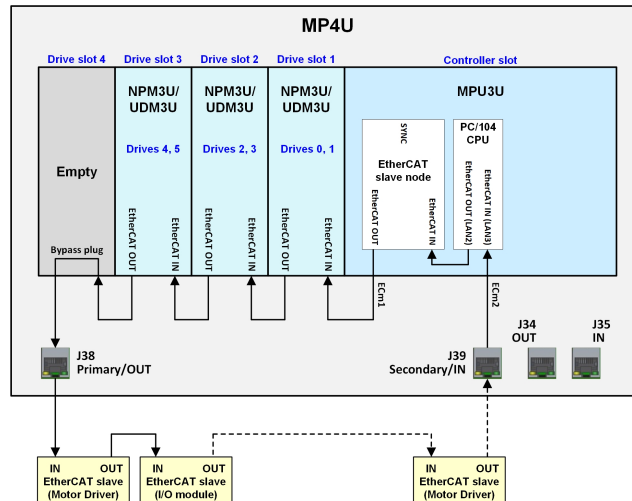
Figure 2-6. Motion controller and EtherCAT master

2.1.2.4 Motion controller and EtherCAT master and node

This motion controller is similar to the SPiiPlusES. It operates as follows:

> As a node can be managed by any EtherCAT automation controller

> As and EtherCAT master is identical to the SPiiPlusEC
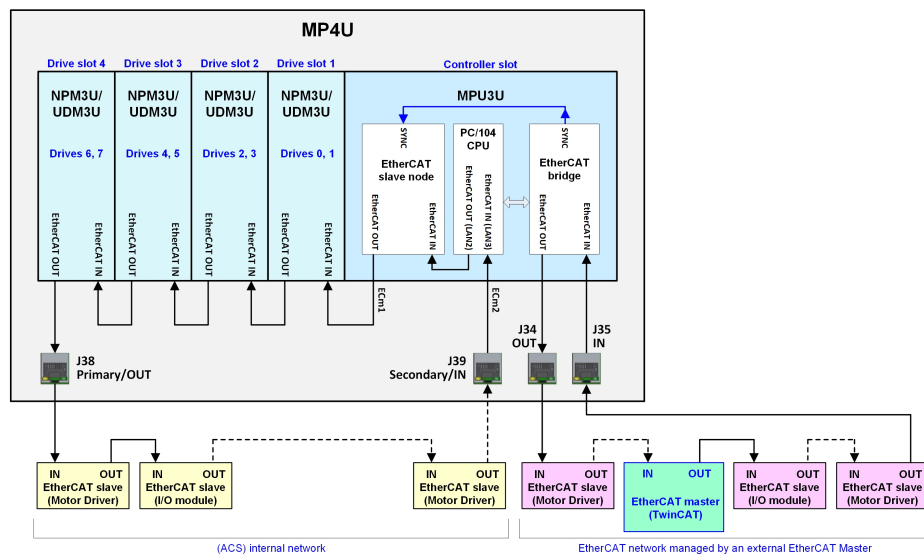
Figure 2-7. Motion controller and EtherCAT master and node

2.2 Interface diagram

An interface block diagram for the MP4U is shown in Figure 2-8.
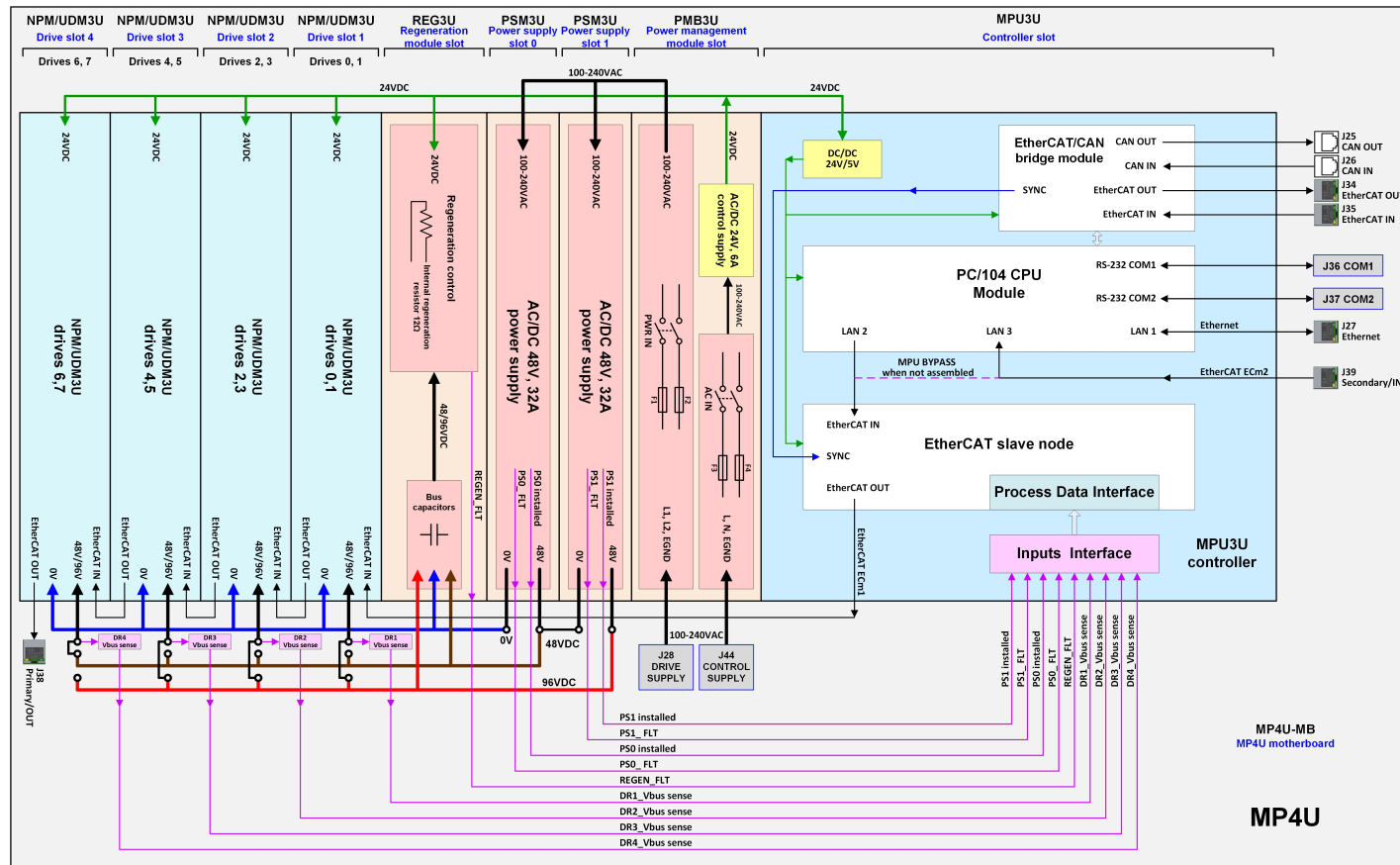
Figure 2-8. Interface block diagram

2.3 Order part number

The order part number (P/N) is a five digit part number assigned by ACS, representing the unique configuration options selected (see example in Figure 2-9). Any new MP4U configuration must be assigned an official 5 digit part number by ACS personnel (ex. MP4U-00495).

MP4U-01234	
Control Supply	24V DC 6.5A max
Number of Drives	4
Drive Supply	110–320V AC 50/60Hz 30A max
Serial Number	MP4U123456
Date	16/08/17
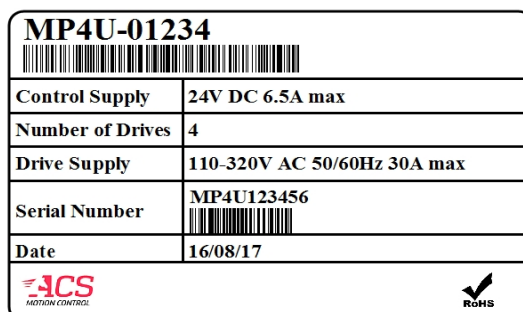
Figure 2-9. Label with ordered P/N example

Table 2-1. Configuration options

Ordering Options	Example User Selection	Available Ordering Option Values
Motion Controller	N	Y - Yes, N - No
Number of axes	A	A - 2, B - 4, C - 8, D - 16, E - 32, F - 64
ServoBoost, number of axis supported	O	N - 0, A - 4, B - 8, C - 12, P - 60, Q - 64
Number of ACSPL+ buffers	A	A - 10, B - 16, C - 32, D - 64
Maximum MPU cycle rate (kHz)	2	1kHz (64 axes) ,2kHz (up to 32 axes), 4kHz (up to 16 axes), 5kHz (up to 8 axes)
NetworkBoost, Flexible configuration	N	N - None, A - NetworkBoost, B - Flexible configuration, C - Both
Input shaping	N	Y - Yes, N - No
EtherCAT master to master bridge	N	Y - Yes, N - No
G-Code	Y	Y - Yes, N - No
STO	Y	Y - Yes, N - No

Ordering Options	Example User Selection	Available Ordering Option Values
Limit switches	A	A - 5V, Source/PNP B - 5V, Sink/NPN C - 24V, Source/PNP D - 24V, Sink/NPN
Digital Inputs	B	A - 5V, Two terminal B - 24V, Two terminal
Digital Outputs	A	A - Source/PNP, 5V & 24V B - Sink/NPN, 5V & 24V
Power supply	D	A - 48V, 32A B - 48V, 64A C - 96V, 32A D - 96V & 48V, 32A

For each drive slot 1, 2, 3, 4,
select from all of the available feature options that follow.

Ordering Options	Example User Selection	Available Ordering Option Values
Drive module	U	N - None U - UDM P - NPM
Number of drives	2	1, 2
Current	A	A - 3.3/10A B - 6.6/20A C - 10/30A D - 13.3/40A
Connected voltage	B	A - 48V B - 96V
500kHz SIN-COS encoder interface	0	For UDM: 0, 1, 2 For NPM: 0, 1, 2, 3, 4
10MHz SIN-COS encoder interface	0	For UDM: 0 For NPM: 0, 1, 2, 3, 4

Ordering Options	Example User Selection	Available Ordering Option Values
Absolute encoders type	N	N - None U - User selectable E - Endat 2.2 & 2.1 digital only S - Smart Abs P - Panasonic B - BISS-A/B/C I - SSI A - Sanyo ABS
Number of absolute encoders inteface	0	0, 1, 2
Motor relays	N	Y - Yes N - No

As an example, P/N MP4U would represent the configuration described in Table 2-2 below.

Table 2-2. P/N example

Field		1	2	3	4	5
P/N	MP4U	0	1	2	3	4

2.3.1 STO

STO is an order option. If STO is ordered, then all ordered drive plug-in modules include the STO option.

2.4 Package content

The MP4U package contains the following items:

> Rack enclosure containing the following plug-in components:

>> Power management plug-in module

>> Regeneration plug-in module

>> Power supply plug-in modules

> Up to two Power supply plug-in modules (according to specific configuration).

>> Up to four drive plug-in modules (according to specific configuration)

>> Control plug-in module (optional)

2.5 Optional accessories

2.5.0.1 Mating connectors kit

2.5.1 Mating connectors kit
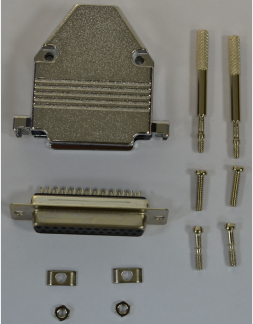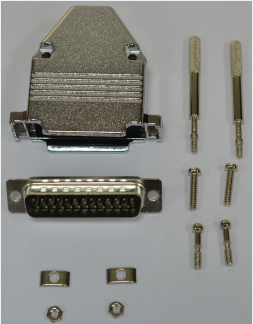
A four-axes and eight-axes mating connector kit are available. The part numbers are in Table 2-3.

Table 2-4 and Table 2-6 list the parts in the four-axes mating connectors kit. Table 2-5 and Table 2-6 list the parts in the eight-axes mating connectors kit.

Table 2-3. Part numbers for mating connectors kits

Part Number P/N	Description
MP4U-ACC1	Four-axes mating connectors kit
MP4U-ACC2	Eight-axes mating connectors kit

Table 2-4. MP4U-ACC1: Four-axes mating connectors kit

Connector	Part Description	Manufacturer	P/N
J6 and J12	CON D-T 25p FML STR SOLDER NPB	Industry Standard	NA
	HOOD D-Type 25P STR Metal NPB	Industry Standard	NA
J5 and J11	CON D-type 2row 25pin Male Solder	AMPHENOL	G17S-2510-110-EU
	HOOD D-Type 25P STR Metal NPB	Industry Standard	NA
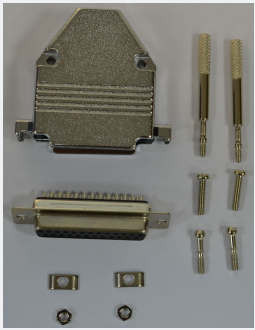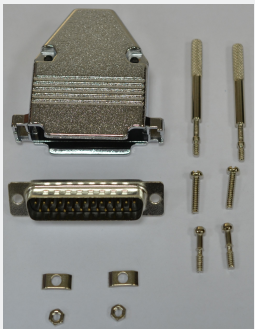
Connector	Part Description	Manufacturer	P/N
J30, J31, J46, and J47	CONN. MIX 9W4 25P MALE	FCT Electronics	FM9W4P-K120
	Hood shield. Size3	FCT Electronics	FKC3GAE
	Rubber bushing	FCT Electronics	FKT 3-4
Total quantity of solder pins = 16.	Solder Pin 20A for PWR D-Sub plug NPB	FCT Electronics	FMP006P103
J1, J2, J3, J4, J7, J8, J9, J10	D-TYPE CUP 26P HI-DNSTY ML NPB	Industry Standard	NA
	HOOD plast+nickl 15P std EMI npb	AMPHENOL	G17Z15014-LF

Table 2-5. MP4U-ACC2: Eight-axes mating connectors kit

	Connector	Part Description	Manufacturer	P/N
	J6, J12, J16, J24	CON D-T 25p FML STR SOLDER NPB	Industry Standard	NA
		HOOD D-Type 25P STR Metal NPB	Industry Standard	NA
	J5, J11, J17, J23	CON D-type 2row 25pin Male Solder	AMPHENOL	G17S-2510-110-EU
		HOOD D-Type 25P STR Metal NPB	Industry Standard	NA
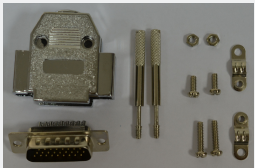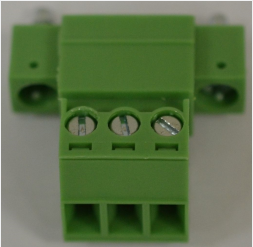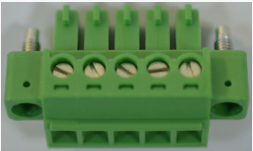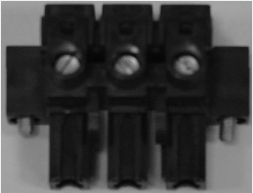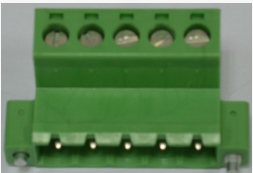
Connector	Part Description	Manufacturer	P/N
J30, J31, J32, J33 J46, J47, J48, J49	CONN. MIX 9W4 25P MALE	FCT Electronics	FM9W4P-K120
	Hood shield. Size3	FCT Electronics	FKC3GAE
	Rubber bushing	FCT Electronics	FKT 3-4
Total quantity of solder pins = 32.	Solder Pin 20A for PWR D-Sub plug NPB	FCT Electronics	FMP006P103
J1, J2, J3, J4, J7, J8, J9, J10 J13, J14, J15, J16, J19, J20, J21, J22	D-TYPE CUP 26P HI-DNSTY ML NPB	Industry Standard	NA
	HOOD plast+nickl 15P std EMI npb	AMPHENOL	G17Z15014-LF

Table 2-6. Additional mating connectors in MP4U-ACC1 (Four-axes) and MP4U-ACC2 (Eight-axis) kit

Additional mating connectors in MP4U-ACC1 (Four-axes) and MP4U-ACC2 (Eight-axis) kit

	Conenctor	Description	Manufacturer	P/N
	J28	Female plug flange 4-pin 7.62mm 20A 300V NPB	Weidmuller	1095700000 (BLZ 7.62HP/04/180F SN BK BX)
	J29	Male plug flange 3-pin 5.08mm 12A 250V NPB	Pheonix Contact	1825323 (IC 2,5/ 3-STF-5,08)
	J36 and J37 (one each)	CON D-T 9p FML STR SOLDER NPB	Industry Standard	NA
		HOOD D-Type 09P STR Metal NPB	Industry Standard	NA

	Conenctor	Description	Manufacturer	P/N
	J40	Male plug flange 3-pin 3.81mm 8A 300V NPB	Wurth Electronic	691349340003
	J43	CON POWER 3.81 mm 2.5Kv 5p NPB	Pheonix Contact	1827732 (MC 1,5/ 5-STF-3,81)
	J44	Female plug flange 3-pin 7.62mm 20A 300V NPB	Weidmuller	1095690000 (BLZ 7.62HP/03/180F SN BK BX)
	J45	Male plug flange 5-pin 5.08mm 12A 250V NPB	Pheonix Contact	1825349 (IC 2,5/ 5-STF-5,08)

2.6 Spare parts / field replacement units (FRU)

All plug-in modules are field replaceable.

Table 2-7. Spare parts list

Item	Part number
Plug-in controller	Future option
Plug-in power management module	PMB3U
48V, 32A power supply	SB-18422-200/LF
Plug-in regeneration module	REG3U
Plug-in NanoPWM driver	*see note
Plug-in non NanoPWM driver	*see note

> *To order a plug-in drive spare part or replacement module, send an image of the plug-in module product sticker located on the front of the module (as shown below) to your contact at ACS for a quote.

Figure 2-10. Plug-in module product sticker

3. Product description

3.1 Drive controller

An optional controller with or without an EtherCAT bridge is available.

The controller does the following hardware setup identification functions:

> > Number of power supply modules
> > Power supply configuration
> > Number and type of NPM/UDM3U drive modules

3.1.1 Motion controller and EtherCAT master

The motion controller and EtherCAT master is similar in functionality and features to SPiiPlusEC and can manage any ACS slave and third party EtherCAT modules that comply with the EtherCAT protocol.

Figure 2-6 shows the connectors for a MP4U with a motion controller and EtherCAT master.

They are:

> > EtherCAT Primary/OUT connector
> > EtherCAT Secondary/IN connector
> > Ethernet connector

3.1.2 Motion controller and EtherCAT master and node

The motion controller and EtherCAT master and node complies with DS402 protocol. It supports up to 8 axes using the standard protocol and up to 64 axes using manufacturer's specific commands and thousands I/Os.

2.1.2.4 shows the connectors for a MP4U with a motion controller with an EtherCAT master and node.

The connectors are:

> > EtherCAT IN (from external master)
> > EtherCAT OUT (to external slave) connectors
> > EtherCAT Primary/OUT (to an internal network salve)
> > EtherCAT Secondary/IN connectors (from internal network slave)
> > Ethernet connector

3.1.3 LED indicators

The are two sets of controller LED indicators. One set is found on the front panel of the MPU3U controller and the second set is found on the MP4U rear panel.

3.1.3.1 MPU3U controller front panel LED indicators

Figure 3-1 shows the location of the LED indicators and Table 3-1 gives a description.
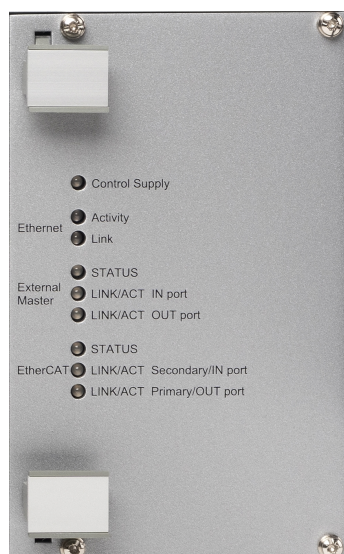
Figure 3-1. Controller LED indicators

Table 3-1. Controller LED indicator description

Communication type	Indicator	Description
	Control Supply	One green LED: > Off- Control supply doesn't function > On- Control supply is ok
Ethernet	Activity	One yellow LED: > Off - no data link activity > Blinking - link is up and transmitting/receiving data
	Link	One bicolor LED: > Off - no data link activity > Green - link is up and operating at 10/100Mbit speed > Yellow - link is up and operating at 1000Mbit speed
External Master	STATUS	One bicolor LED: > Green – behavior in according to "RUN indicator", see ETG.1300 S (R) V1.1.1 > Red - behavior in according to "ERROR" indicator", see ETG.1300 S (R) V1.1.1

Communication type	Indicator	Description
	LINK/ACT IN port	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity
	LINK/ACT OUT port	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity
EtherCAT	STATUS*	One bicolor LED: > Green blinking – during controller power up process or after successful power up, when communication with the host is open > Green – controller power up is finished "OK" (master enters to "OP" state) > Red – master exits from "OP" state or in case of "Network Error" fault > Red blinking - communication with the host is open upon internal network fault condition (master exits from "OP" state or in case of "Network Error" fault)
	LINK/ACT Secondary/IN port	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity
	LINK/ACT Primary/OUT port	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity

*The EtherCAT "STATUS" LEDs do not operate for the following controller modules:
> Drive controller
> Motion controller and EtherCAT master.

3.1.3.2 Controller LED indicators on the MP4U rear panel

Figure 3-2 shows the location of the LED indicators and Table 3-2 gives a description.
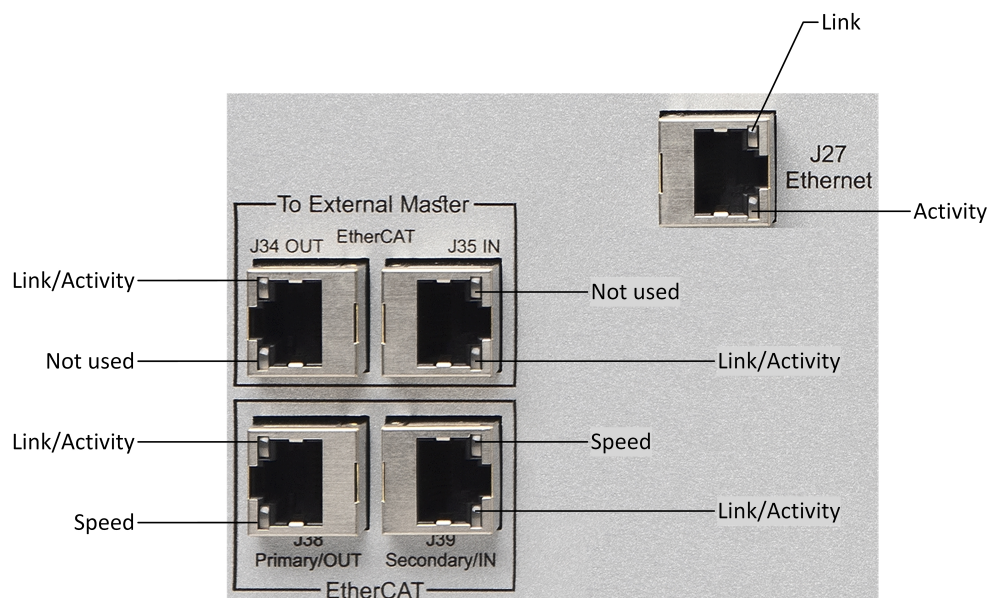
Figure 3-2. Controller LED indicators

Table 3-2. Controller LED indicator description

Communication type	Connector name/number	Inidicator	Description
Ethernet	Ethernet / J27	Link	One bicolor LED: > Off - no data link activity > Green - link is up and operating at 10/100Mbit speed > Yellow - link is up and operating at 1000Mbit speed
		Activity	One yellow LED: > Off - no data link activity > Blinking - link is up and transmitting/receiving data
To Extenal Master EtherCAT	OUT / J34	Link/Activity	One green LED: > Off - no link (not connected)

Communication type	Connector name/number	Inidicator	Description
			> Blinking - link and activity > On - link without activity
	IN / J35	Link/Activity	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity
EtherCAT	Primary/OUT - J38	Link/Activity	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity
		Speed	One green LED: > On - EtherCAT speed 100Mbit
	Secondary/IN - J39	Speed	One green LED: > On - EtherCAT speed 100Mbit
		Link/Activity	One green LED: > Off - no link (not connected) > Blinking - link and activity > On - link without activity

3.2 Drive plug-in module

The drive plug in module includes one or two identical drives.

Either a high performance NanoPWM drive (NPM3U) or an economical drive (UDM3U) are supported. LED indicators provide the status of the drive. The LED indicators are located on the 3U drive front panel.
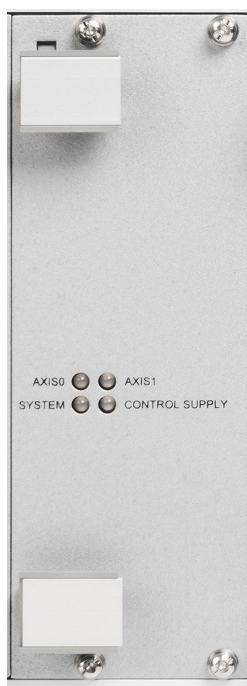
Figure 3-3. Drive plug-in module front view

3.2.1 LED indicators

Each plug-in module has a four LED indicators.

Figure 3-4. LED indicators

The drive index corresponding to AXIS0 and AXIS1 for each plug-in module is shown below.

Table 3-3. Drive (axis) index corresponding to AXIS0 and AXIS1 for each drive slot

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
AXIS0 → 0 AXIS1 → 1	AXIS0 → 2 AXIS1 → 3	AXIS0 → 4 AXIS1 → 5	AXIS0 → 6 AXIS1 → 7

The description for each LED indicator is below.

Table 3-4. LED indicators description table

Indicator	Description
AXIS0	One bicolor LED for each drive:

Indicator	Description
AXIS1	> Green - Drive is enabled > Red - Drive fault > Off - Drive is disabled
System	One bicolor LED: > Red - System Fault > Green - System OK > Blinking - Software command
Control Supply	One green LED: > On - Control supply is On - voltage applied > Off - Control supply is Off - voltage not applied

3.2.2 Motor connections

The connectors for the motors are located on the rear of the MP4U. The following figure and table shows and describes these connectors for an eight driveMP4U.

Figure 3-5. MP4U motor connections

Table 3-5. MP4U motor connections

Connector	Connector label	Description
J30	MOTOR 0	Drive plug-in module 1 - drive 0

Connector	Connector label	Description
J31	MOTOR 2	Drive plug-in module 2 - drive 0
J32	MOTOR 4	Drive plug-in module 3 - drive 0
J33	MOTOR 6	Drive plug-in module 4 - drive 0
J46	MOTOR 1	Drive plug-in module 1 - drive 1
J47	MOTOR 3	Drive plug-in module 2 - drive 1
J48	MOTOR 5	Drive plug-in module 3 - drive 1
J49	MOTOR 7	Drive plug-in module 4 - drive 1

3.3 Power supplies

The MP4U includes one or two power 48V/32A supplies. The number of power supplies and configuration are selected by user the available options are:

> 48V, 32A

> 48V, 64A

> 96V, 32A

> Mixed 48V and 96V, 32A

3.4 Power management plug-in module

The Power management plug-in module routes the two 100-240Vac inputs to the drive supplies (48Vdc, 96Vdc outputs) and to the 24Vdc control supply. The following figure and table shows and describes the power management plug-in module.

Figure 3-6. Power management plug-in module

Table 3-6. Power managemenet plug-in module

Reference	Description	Protection	Switch	Note
PWR-IN	Drive supply AC input	2 fuses`	2-pole	
AC-IN	Control supply AC input	2 fuses	2-pole	Also controls power for 24Vdc supply output (J14 see Power management plug-in module connections.

3.4.1 Switches and fuses

The two AC inputs pass through fuses. To replace the fuses, remove the power management plug-in module from the MP4U enclosure. The fuse specifications are listed in Table 3-7.

Table 3-7. Fuse specifications

Reference	Descriptin	Type	Ampere Rating	Voltage Rating	Size
F1	PWR-IN AC input phase 1	fast acting	20A	500V	6.3 x 32mm
F2	PWR-IN AC input phase 2	fast acting	20A	500V	6.3 x 32mm
F3	AC-IN AC input phase	fast acting	3A	250V	6.3 x 32mm
F4	AC-IN AC input phase	fast acting	3A	250V	6.3 x 32mm

3.4.2 Power management plug-in module connections

All connections to the power management plug-in module are made from the rear. The following figure and table shows the connector locations and lists their assignments.
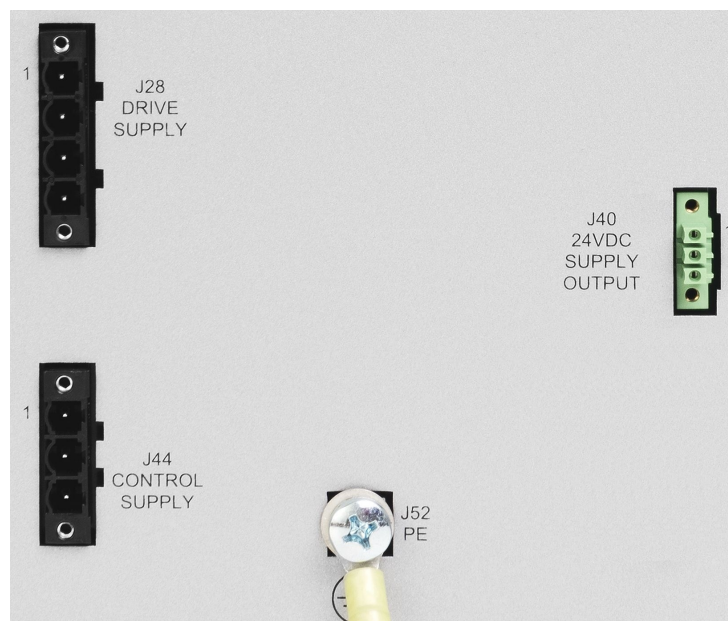
Figure 3-7. Power management plug-in module rear view

Table 3-8. Power management plug-in module connections

Conenctor Assignment	Connector label	Description
J28	DRIVE SUPPLY	48V/96V Drive supply AC input connector Rating: 100/240Vac, single-phase, 50/60Hz
J40	24V SUPPLY OUTPUT	Output connector for an external control device supplying: Rating: 24Vdc, 2A
J44	CONTROL SUPPLY	24V Control supply AC input connector. Rating: 100/240Vac, single-phase, 50/60Hz
J52	PE	Protected earth connection terminal

3.5 Regeneration plug-in module

The MP4U has regeneration control with built-in regeneration resistor. An external regeneration resistor can be also connected via dedicated connector J29 on the back plane, see Figure 3-9.

he Regeneration plug-in module dissipates the energy that the motors produce when they decelerate and thus ensures that the supply voltage does not raise above its allowed maximum value. It can dissipate up to 1.5KW peak and 100W continuously. The shunt resistor value is 12Ω.
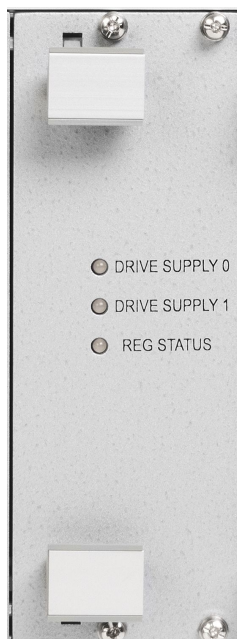
Figure 3-8. Regeneration plug-in module front view

Figure 3-9. Regeneration plug-in module rear view

3.5.1 LED indicators

Status LEDs for the drive supply and regeneration circuit are located on the front of the regeneration plug-in module. The following table describes the LED indicators.

> If the built-in regeneration resistor is insufficient, then use an external regeneration resistor.

Table 3-9. Drive supply power and regeneration circuit LED status indicators

Indicator	Description
DRIVE SUPPLY 0 DRIVE SUPPLY 1	One bicolor LED for each drive supply > Off- 48Vdc power supply is off > Green- 48Vdc power supply is on > Red- 48Vdc power supply fault
REG STATUS	One bicolor LED > Off- regeneration circuit is not activated > Green blinking - regeneration circuit is intermittently activate when drive supply voltage exceeds the limit > Red- regeneration circuit is in the fault condition due to over temperature or short circuit, see below for instructions

4. *Mounting*

The MP4Ucan be mounted in a 19 inch rack. The MP4Ucooling is self-contained.

The direction of airflow is from the frontside of the rack to the rear side.

> Keep the area in front and in the back of the MP4Ufree of any obstructions.

5. Connections

This section describes how to interface with the MP4U using proper safety, EMC and wiring guidelines. shows the connectors on the rear of a MP4U.
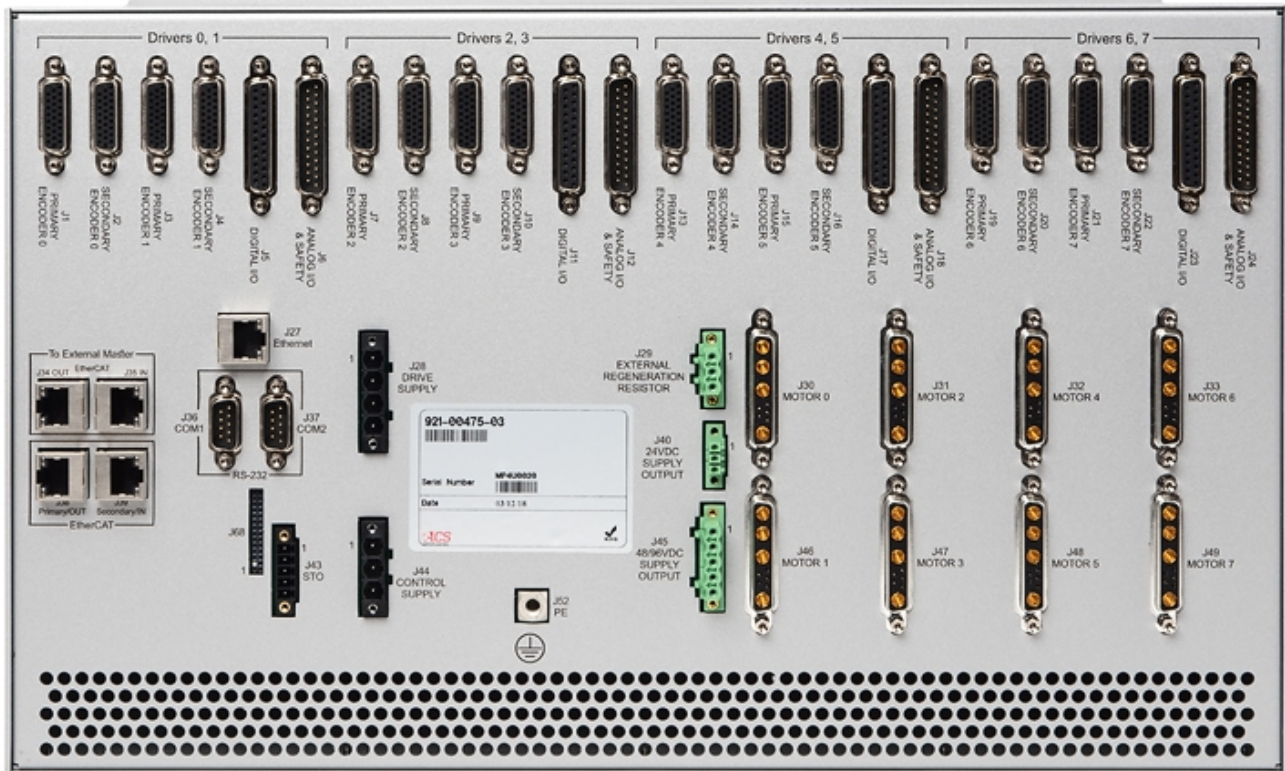
Figure 5-1. Connectors on the rear of a MP4U

5.1 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.

An STO module (Safe Torque Off) is an optional feature of the unit. Additional information can be found in STO.

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.

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 MP4U while the power source is on.

The MP4U is not intended for use in safety-critical applications (such as life supporting devices) where a failure of the MP4U can reasonably be expected to cause severe personal injury or death.

Perform the following instructions to ensure safe and proper wiring:

> No operator accessible parts are hazardous live, provided that motor connectors are covered by mating connectors when the unit is connected to the mains

> Whenever possible, use shielded cables with braided shield of at least 80%-95% coverage.

> 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.

> For drive supply connection instructions, see Drive supply connection instructions.

> For connection instructions for the PE ground terminal, see PE Connection instructions.

> For the motor and control supply AC input, follow the guidance of below, based on the current rating of your MP4U.

Wiring Guidelines

Item	Gauge	Twisted pair
Control supply AC input	16-18AWG	No
Motor	14-16AWG	No

5.2 Encoders

The connector number and label for the primary encoder and secondary encoder for each drive slot on the MP4U is shown in Table 5-1.

Table 5-1. Encoder feedback connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
J1 - PRIMARY ENCODER 0	J7 - PRIMARY ENCODER 2	J13 - PRIMARY ENCODER 4	J19 - PRIMARY ENCODER 6
J2 - SECONDARY ENCODER 0	J8 - SECONDARY ENCODER 2	J14 - SECONDARY ENCODER 4	J20 - SECONDARY ENCODER 6
J3 - PRIMARY ENCODER 1	J9 - PRIMARY ENCODER 3	J15 - PRIMARY ENCODER 5	J21 - PRIMARY ENCODER 7
J4 - SECONDARY ENCODER 1	J10 - SECONDARY ENCODER 3	J16 - SECONDARY ENCODER 5	J22 - SECONDARY ENCODER 7

The encoder connector and mating connector description is shown in Table 5-2.

Table 5-2. Encoder connector and mating connector descirption

Connector	
Manufacturer	Any - industry standard
Type	D-sub HD, female
Version	26-pin with insert UNC 4-40
P/N	NA

Mating Connector	
Manufacturer	Any - industry standard
Type	D-sub HD, male
Version	26-pin with lockers UNC 4-40
P/N	NA

The primary encoder connector pinout is shown in Table 5-3 and the secondary encoder pinout is shown in Table 5-4.

Table 5-3. Primary encoder pinout table

Pin	Signal	Description
1	CHA_PRM$-	Primary AQB Incremental digital encoder $, channel A inverted input, for differential encoder only
		Primary CLK-DIR Incremental digital encoder $, channel CLK inverted input, for differential encoder only
		Primary Absolute encoder $ Data-
		Squared SIN inverted output $
		$ is the drive (axis) number: 0..7

Pin	Signal	Description
2	CHB_PRM$-	Primary AQB Incremental digital encoder $, channel B inverted input, for differential encoder only Primary CLK-DIR Incremental digital encoder $, channel DIR inverted input, for differential encoder only Primary Absolute encoder $ CLK- Squared COS inverted output $ $ is the drive (axis) number: 0..7
3	CHI_PRM$-	Primary AQB Incremental digital encoder $, channel I (index) inverted input, for differential encoder only Primary CLK-DIR Incremental digital encoder $, channel I (index) inverted input, for differential encoder only $ is the drive (axis) number: 0..7
4	HB_$	$ Motor Hall B $ is the drive (axis) number: 0..7
5	V_SUP_SFTY	Supply for limits input
6	RL_$	Right limit $ $ is the drive (axis) number: 0..7
7	SIN_PRM$-	Primary Sin-Cos encoder $, SIN inverted input $ is the drive (axis) number: 0..7
8	COS_PRM$-	Primary Sin-Cos encoder $, COS inverted input $ is the drive (axis) number: 0..7
9	SC_I_PRM$-	Primary Sin-Cos encoder $, Index inverted input $ is the drive (axis) number: 0..7
10	CHA_PRM$+	Primary AQB Incremental digital encoder $, channel A non-inverted input, used for both single-ended and differential encoders Primary CLK-DIR Incremental digital encoder $, channel CLK non-inverted input, used for both single-ended and differential encoders Primary Absolute encoder $ Data+ Squared SIN non-inverted output $ $ is the drive (axis) number: 0..7

Pin	Signal	Description
11	CHB_PRM$+	Primary AQB Incremental digital encoder $, channel B non-inverted input, used for both single-ended and differential encoders Primary CLK-DIR Incremental digital encoder $, channel DIR non-inverted input, used for both single-ended and differential encoders Primary Absolute encoder $ CLK+ Squared COS non-inverted output $ $ is the drive (axis) number: 0..7
12	CHI_PRM$+	Primary AQB Incremental digital encoder $, channel I (index) non-inverted input, used for both single-ended and differential encoders Primary CLK-DIR Incremental digital encoder $, channel I (index) non-inverted input, used for both single-ended and differential encoders $ is the drive (axis) number: 0..7
13	HA_$	$ Motor Hall A $ is the drive (axis) number: 0..7
14	HC_$	$ Motor Hall C $ is the drive (axis) number: 0..7
15	LL_$	Left limit $ $ is the drive (axis) number: 0..7
16	SIN_PRM$+	Primary Sin-Cos encoder $, SIN non-inverted input $ is the drive (axis) number: 0..7
17	COS_PRM$+	Primary Sin-Cos encoder $, COS non-inverted input $ is the drive (axis) number: 0..7
18	SC_I_PRM$+	Primary Sin-Cos encoder $, Index non-inverted input $ is the drive (axis) number: 0..7
19	5U	5V user supply for digital encoder and Hall
20	DGND	5V user supply return for digital encoder and Hall
21	NC	Not connecte

Pin	Signal	Description
22	MTMP_$	$ Motor temperature sensor $ is the drive (axis) number: 0..7
23	DGND	Motor temperature sensor return
24	V_RTN_SFTY	Supply return for limits input
25	5F	5V user supply for Sin-Cos encoder and Hall
26	AGND	5V user supply return for Sin-Cos encoder and Hall
	Connector shell and front screw	SHIELD

Table 5-4. Secondary encoder pinout table

Pin	Signal	Description
1	CHA_SEC$-	Secondary AQB Incremental digital encoder $, channel A inverted input, for differential encoder only $ is the drive (axis) number: 0..7
2	CHB_SEC$-	Secondary AQB Incremental digital encoder $, channel B inverted input, for differential encoder only $ is the drive (axis) number: 0..7
3	CHI_SEC$-	Secondary AQB Incremental digital encoder $, channel I (index) inverted input, for differential encoder only $ is the drive (axis) number: 0..7
4	HB_$	$ Motor Hall B $ is the drive (axis) number: 0..7
5	V_SUP_SFTY	Supply for limits input
6	RL_$	Right limit $ $ is the drive (axis) number: 0..7
7	SIN_SEC$-	Secondary Sin-Cos encoder $, SIN inverted input $ is the drive (axis) number: 0..7
8	COS_SEC$-	Secondary Sin-Cos encoder $, COS inverted input

Pin	Signal	Description
		$ is the drive (axis) number: 0..7
9	SC_I_SEC$-	Secondary Sin-Cos encoder $, Index inverted input $ is the drive (axis) number: 0..7
10	CHA_SEC$+	Secondary AQB Incremental digital encoder $, channel A non-inverted input, used for both single-ended and differential encoders $ is the drive (axis) number: 0..7
11	CHB_SEC$+	Secondary AQB Incremental digital encoder $, channel B non-inverted input, used for both single-ended and differential encoders $ is the drive (axis) number: 0..7
12	CHI_SEC$+	Secondary AQB Incremental digital encoder $, channel I (index) non-inverted input, used for both single-ended and differential encoders $ is the drive (axis) number: 0..7
13	HA_$	$ Motor Hall A $ is the drive (axis) number: 0..7
14	HC_$	$ Motor Hall C $ is the drive (axis) number: 0..7
15	LL_$	Left limit $ $ is the drive (axis) number: 0..7
16	SIN_SEC$+	Secondary Sin-Cos encoder $, SIN non-inverted input $ is the drive (axis) number: 0..7
17	COS_SEC$+	Secondary Sin-Cos encoder $, COS non-inverted input $ is the drive (axis) number: 0..7
18	SC_I_SEC$+	Secondary Sin-Cos encoder $, Index non-inverted input $ is the drive (axis) number: 0..7
19	5U	5V user supply for digital encoder and Hall
20	DGND	5V user supply return for digital encoder and Hall

Pin	Signal	Description
21	NC	Not connecte
22	MTMP_$	$ Motor temperature sensor $ is the drive (axis) number: 0..7
23	DGND	Motor temperature sensor return
24	V_RTN_SFTY	Supply return for limits input
25	5F	5V user supply for Sin-Cos encoder and Hall
26	AGND	5V user supply return for Sin-Cos encoder and Hall
	Connector shell and front screw	SHIELD

5.2.1 AqB encoder connection instructions
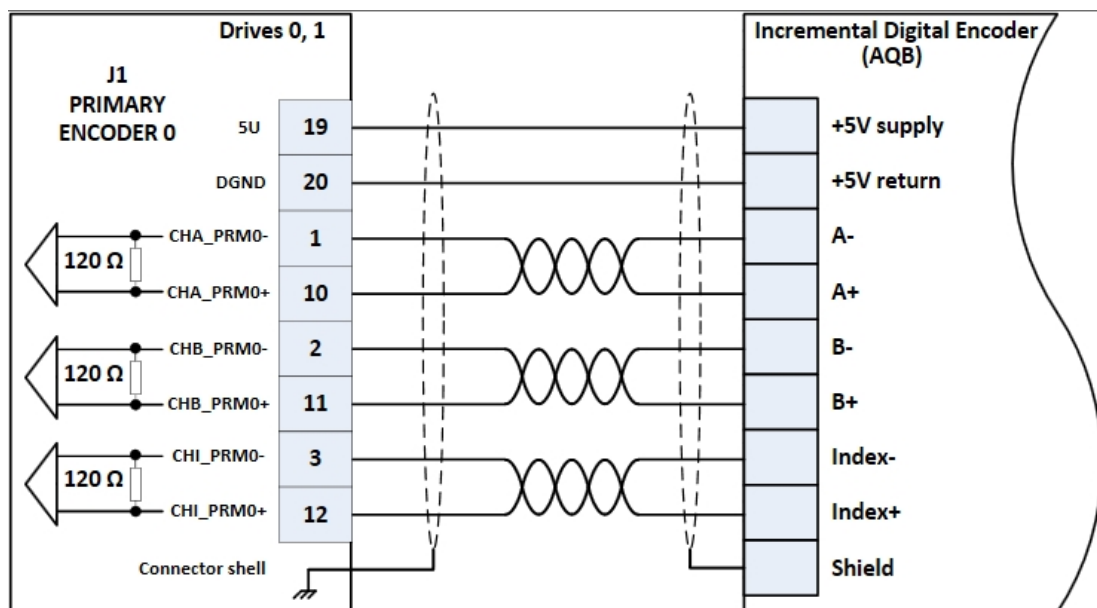
Figure 5-2. AQB encoder connection to "PRIMARY ENCODER 0" connector
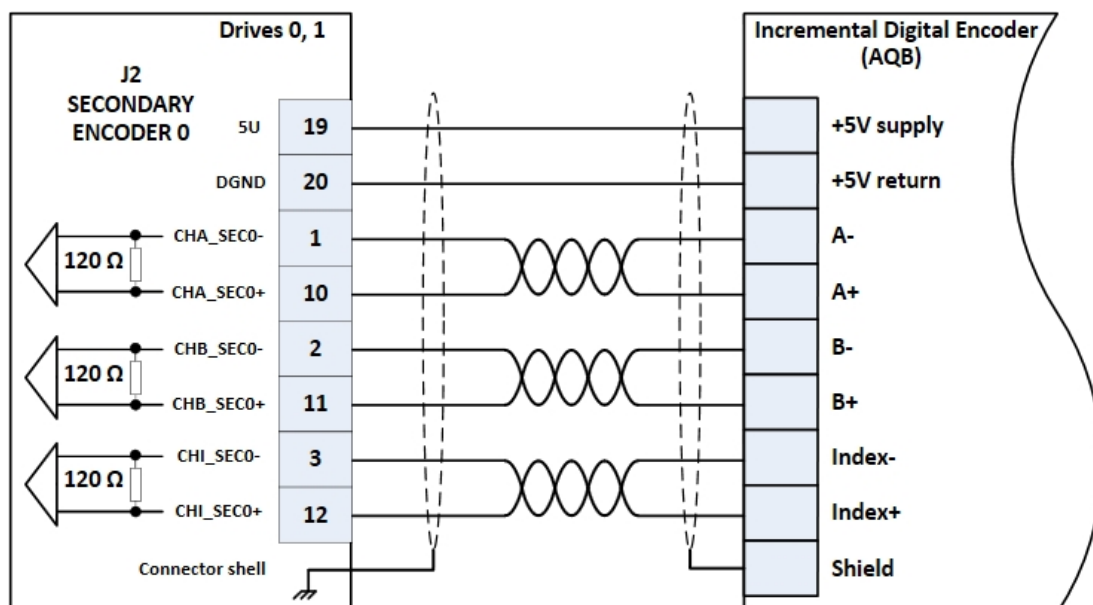
Figure 5-3. AQB encoder connection to "SECONDARY ENCODER 0" connector

5.2.2 SIN-COS encoder connection instructions
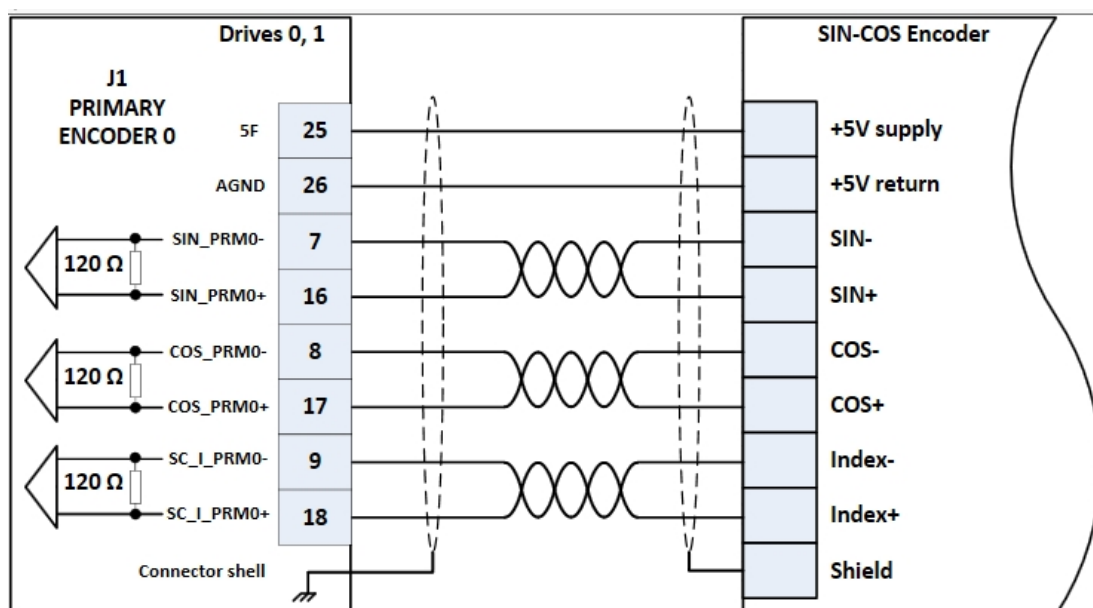
Figure 5-4. SIN-COS encoder connection to "PRIMARY ENCODER 0" connector
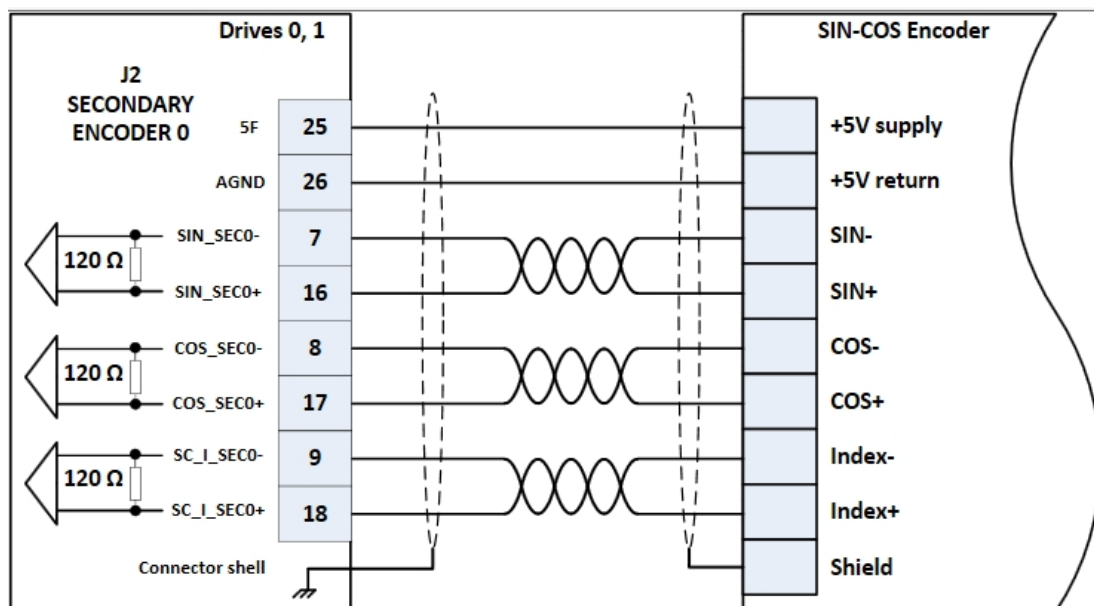
Figure 5-5. SIN-COS encoder connection to "SECONDARY ENCODER 0" connector

5.2.3 Absolute Encoder (CLK-DATA) connection instructions
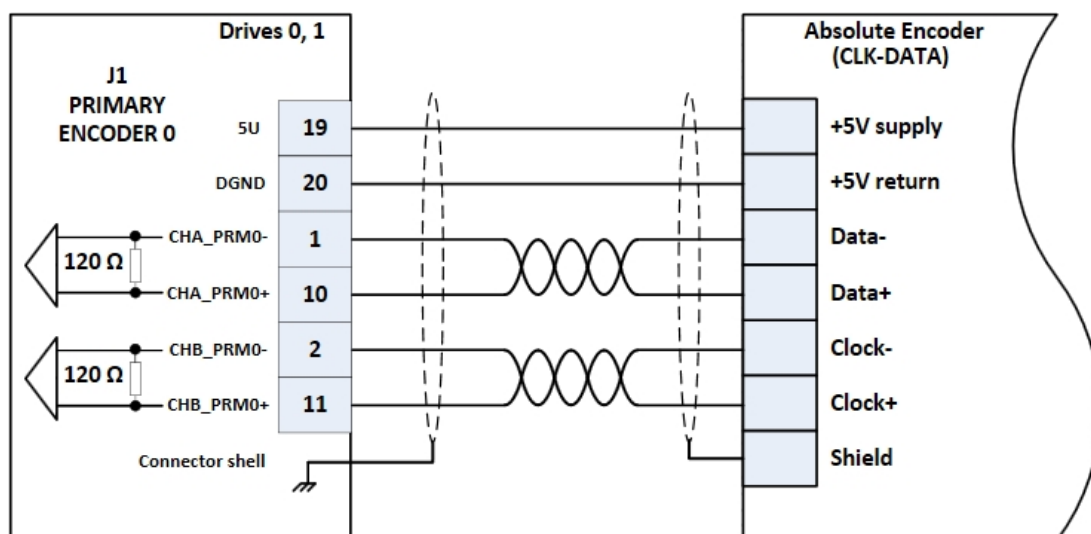
Figure 5-6. Absolute Encoder (CLK-DATA) connection to "PRIMARY ENCODER 0" connector
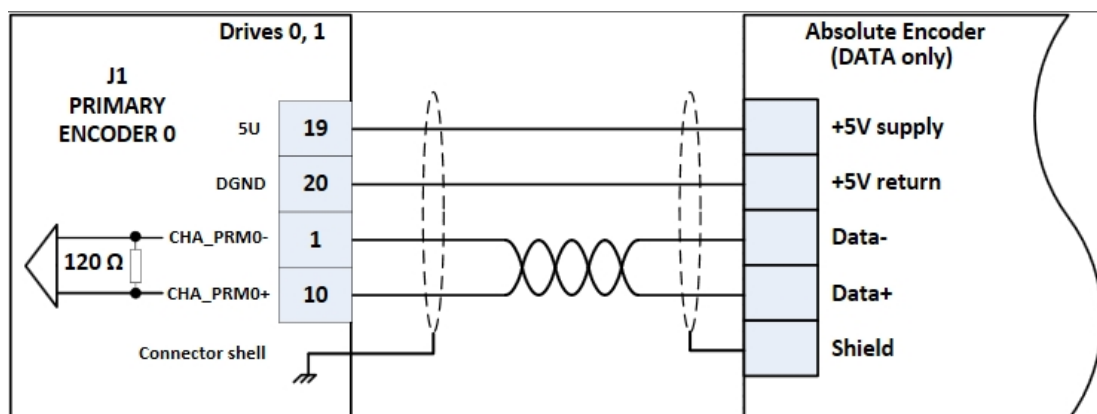
Figure 5-7. Absolute Encoder (DATA only) connection to "PRIMARY ENCODER 0" connector

5.2.4 Incremental digital encoder (CLK-DIR) connection instructions
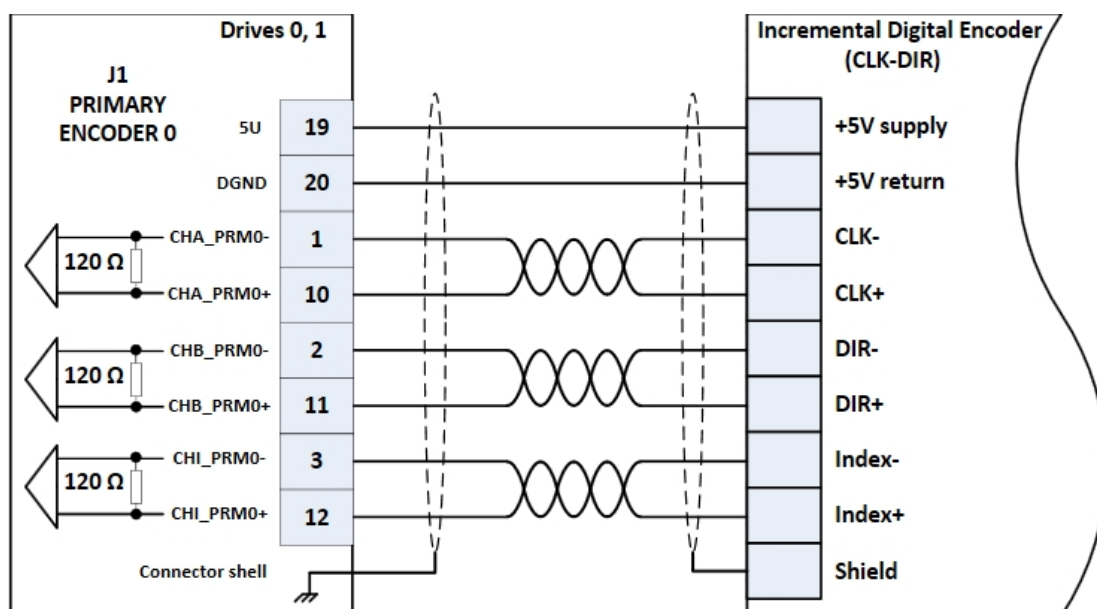
Figure 5-8. CLK-DIR encoder connection to "PRIMARY ENCODER 0" connector
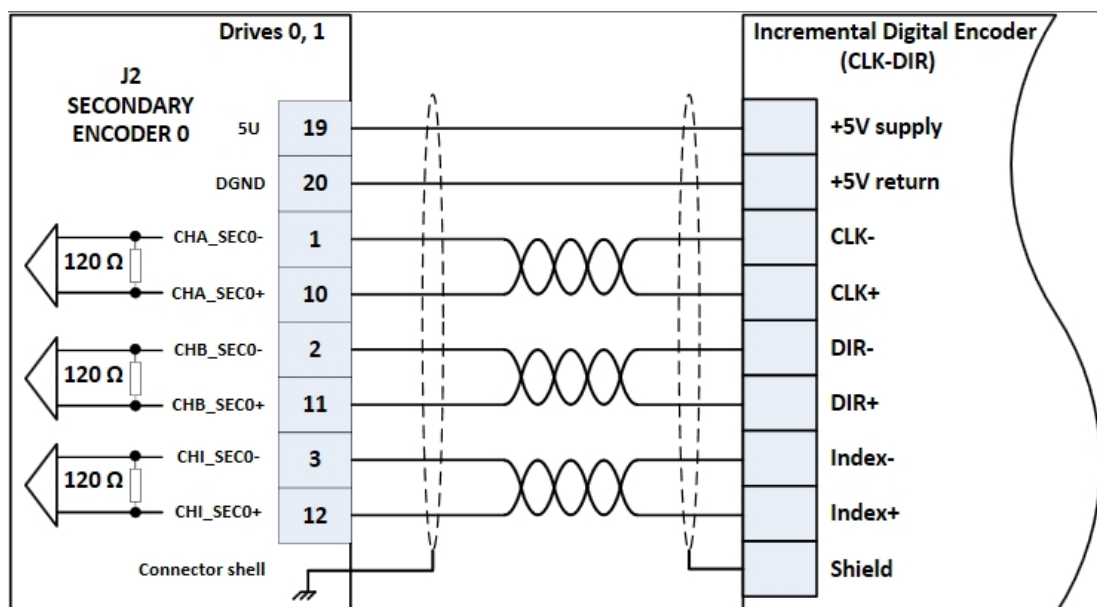
Figure 5-9. CLK-DIR encoder connection to "SECONDARY ENCODER 0" connector

5.2.5 Hall sensor inputs connection instructions

The hall sensors HA_$, HB_$, HC_$ for the specific drive $ can be connected via only one of the connectors are specified for this drive in Table 5-5.

Table 5-5. Hall sensor inputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
HA_0, HB_0, HC_0 J1 - PRIMARY ENCODER 0 J2 - SECONDARY ENCODER 0	**HA_2, HB_2, HC_2** J7 - PRIMARY ENCODER 2 J8 - SECONDARY ENCODER 2	**HA_4, HB_4, HC_4** J13 - PRIMARY ENCODER 4 J14 - SECONDARY ENCODER 4	**HA_6, HB_6, HC_6** J19 - PRIMARY ENCODER 6 J20 - SECONDARY ENCODER 6
HA_1, HB_1, HC_1 J3 - PRIMARY ENCODER 1 J4 - SECONDARY ENCODER 1	**HA_3, HB_3, HC_3** J9 - PRIMARY ENCODER 3 J10 - SECONDARY ENCODER 3	**HA_5, HB_5, HC_5** J15 - PRIMARY ENCODER 5 J16 - SECONDARY ENCODER 5	**HA_7, HB_7, HC_7** J21 - PRIMARY ENCODER 7 J22 - SECONDARY ENCODER 7
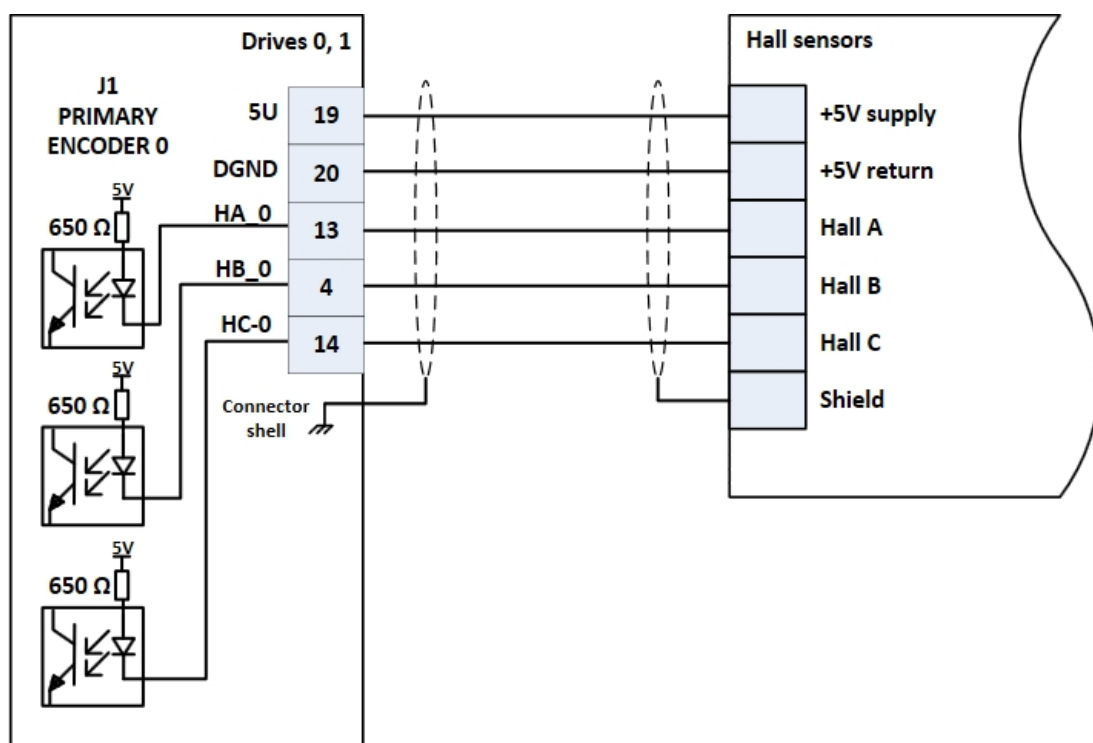
Figure 5-10. Hall sensor inputs connection via "PRIMARY ENCODER 0" connector
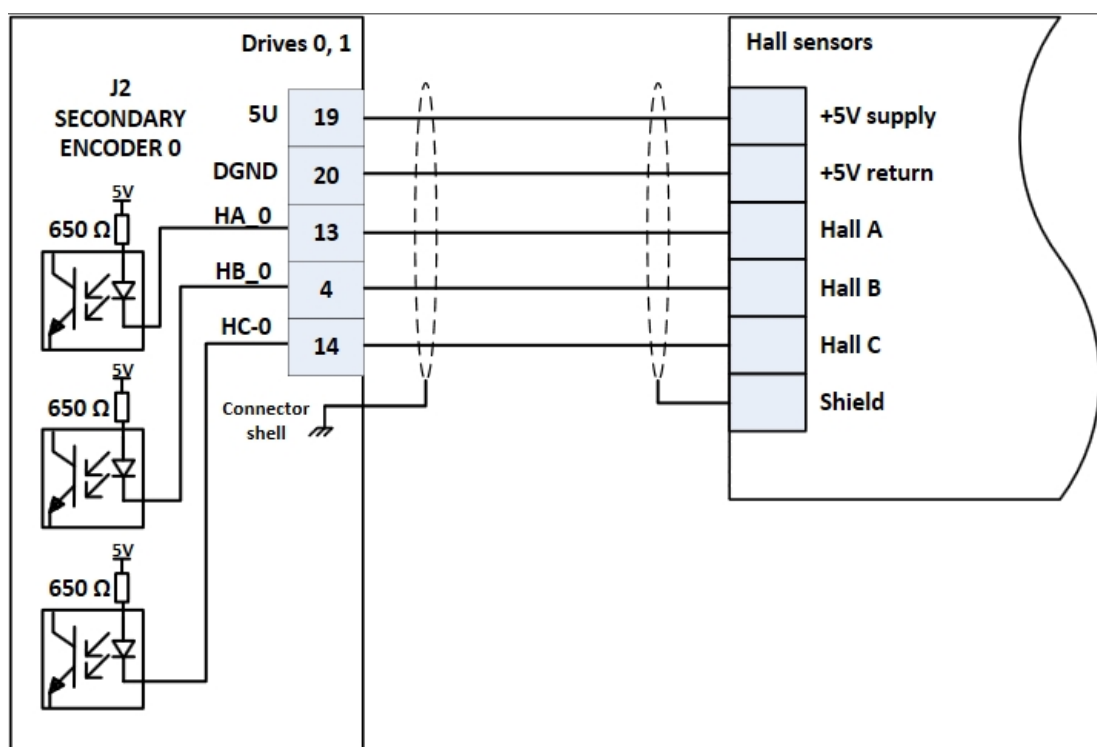
Figure 5-11. Hall sensor inputs connection via "SECONDARY ENCODER 0" connector

5.3 Digital I/O

The connector number and label for the digital I/Os for each drive slot on the MP4U is shown in Table 5-6.

Table 5-6. Digital I/Os connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
J5 - DIGITAL I/O	J11 - DIGITAL I/O	J17 - DIGITAL I/O	J23 - DIGITAL I/O

The digital I/Os connector and mating connector description is shown in Table 5-7.

Table 5-7. Digital I/Os connector and mating connector descirption

Connector	
Manufacturer	Any - industry standard connector
Type	D-sub
Version	DB-25 female, threaded inserts, 4-40 UNC
P/N	NA

Mating Connector	
Manufacturer	Any - industry standard connector
Type	D-sub
Version	DB-25, male, screw locks, 4-40 UNC
P/N	NA

The digital I/Os connector pinout is shown in Table 5-8.

Table 5-8. Digital I/O pinout table

Pin	Signal	Description
1	MARK_PRM$+	Primary mark $ input non-inverted $ is the drive (axis) even number: 0, 2, 4, 6
2	MARK_PRM£+	Primary mark £ input non-inverted £ is the drive (axis) odd number: 1, 3, 5, 7
3	MARK_SEC$+	Secondary mark $ input non-inverted $ is the drive (axis) even number: 0, 2, 4, 6
4	MARK_SEC£+	Secondary mark £ input non-inverted £ is the drive (axis) odd number: 1, 3, 5, 7
5	MTR_RELAY_$	Motor relay $ output $ is the drive (axis) even number: 0, 2, 4, 6
6	OUT$	Mechanical brake $/ Digital output $ $ is the drive (axis) even number: 0, 2, 4, 6
7	V_SUP_IO	I/O supply
8	24V_RELAY_SUP	Motor relay supply output
9	NC	Not connected
10	DGND	Digital ground
11	PEG_$-	PEG $ output inverted $ is the drive (axis) even number: 0, 2, 4, 6
12	PEG_£-	PEG £ output inverted £ is the drive (axis) odd number: 1, 3, 5, 7
13	DRV_£_ON	Drive £ ON status £ is the drive (axis) odd number: 1, 3, 5, 7
14	MARK_PRM$-	Primary mark $ input inverted $ is the drive (axis) even number: 0, 2, 4, 6
15	MARK_PRM£-	Primary mark £ input inverted £ is the drive (axis) odd number: 1, 3, 5, 7

Pin	Signal	Description
16	MARK_SEC$-	Secondary mark $ input inverted $ is the drive (axis) even number: 0, 2, 4, 6
17	MARK_SEC£-	Secondary mark £ input inverted £ is the drive (axis) odd number: 1, 3, 5, 7
18	MTR_RELAY_£	Motor relay £ output £ is the drive (axis) odd number: 1, 3, 5, 7
19	OUT£	Mechanical brake £/ Digital output £ £ is the drive (axis) odd number: 1, 3, 5, 7
20	V_RTN_IO	I/O supply return
21	24V_RTN	Motor relay supply return (output)
22	NC	Not connected
23	PEG_$+	PEG $ output non-inverted $ is the drive (axis) even number: 0, 2, 4, 6
24	PEG_£+	PEG £ output non-inverted £ is the drive (axis) odd number: 1, 3, 5, 7
25	DRV_$_ON	Drive $ ON status $ is the drive (axis) even number: 0, 2, 4, 6
	Connector shett and front screw	SHIELD

5.3.1 MARK inputs connection instructions

Table 5-9. MARK inputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
MARK_PRM0, MARK_PRM1, MARK_SEC0, MARK_SEC1 J5 – DIGITAL I/O	MARK_PRM2, MARK_PRM3, MARK_SEC2, MARK_SEC3 J11 – DIGITAL I/O	MARK_PRM4, MARK_PRM5, MARK_SEC4, MARK_SEC5 J17 – DIGITAL I/O	MARK_PRM6, MARK_PRM7, MARK_SEC6, MARK_SEC7 J23 – DIGITAL I/O
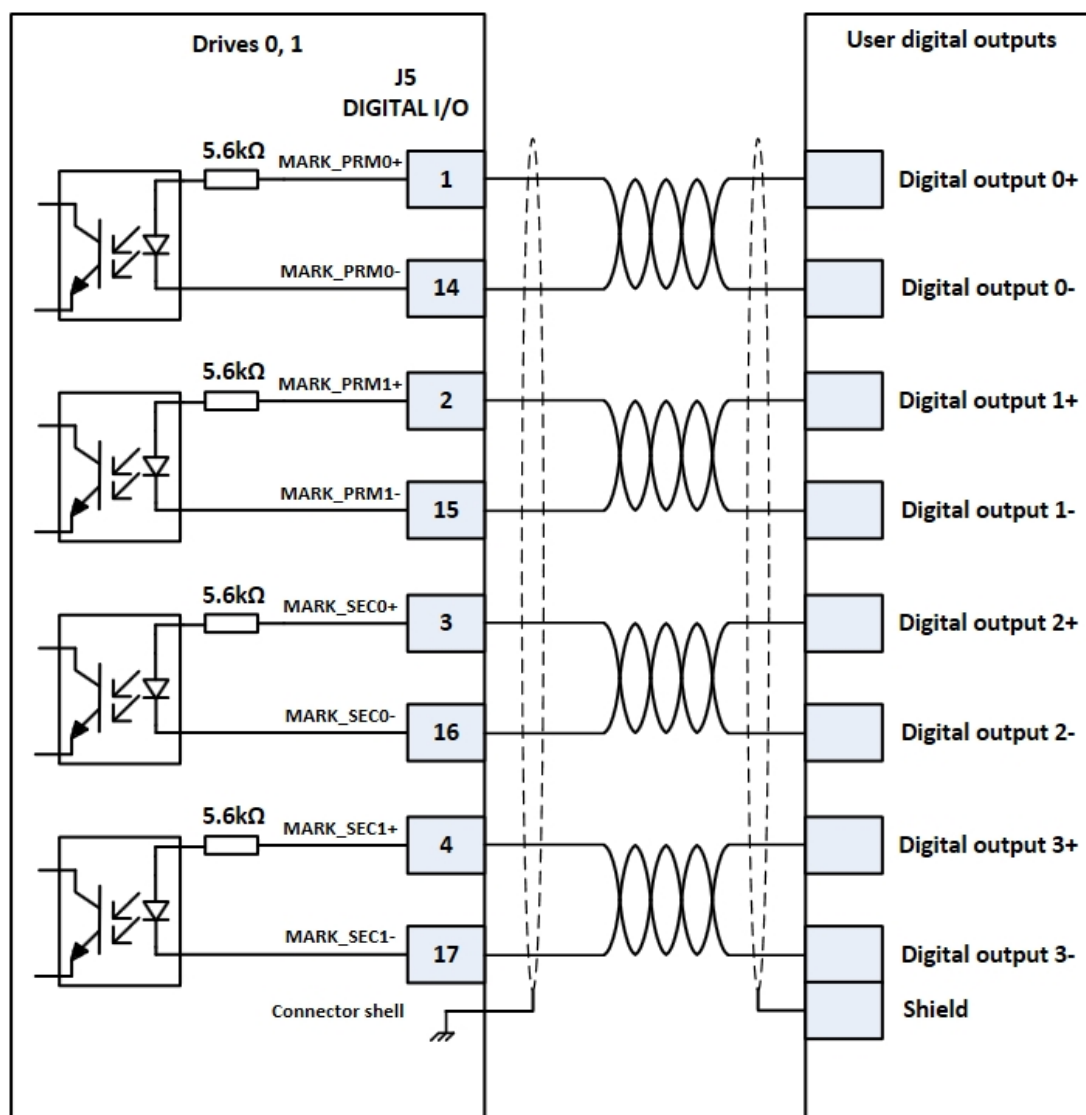
Figure 5-12. Mark inputs connection via "DIGITAL I/O" connector

5.3.2 PEG outputs connection instructions

Table 5-10. PEG outputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
PEG_0, PEG_1	PEG_2, PEG_3	PEG_4, PEG_5	PEG_6, PEG_7
J5 – DIGITAL I/O	J11 – DIGITAL I/O	J17 – DIGITAL I/O	J23 – DIGITAL I/O
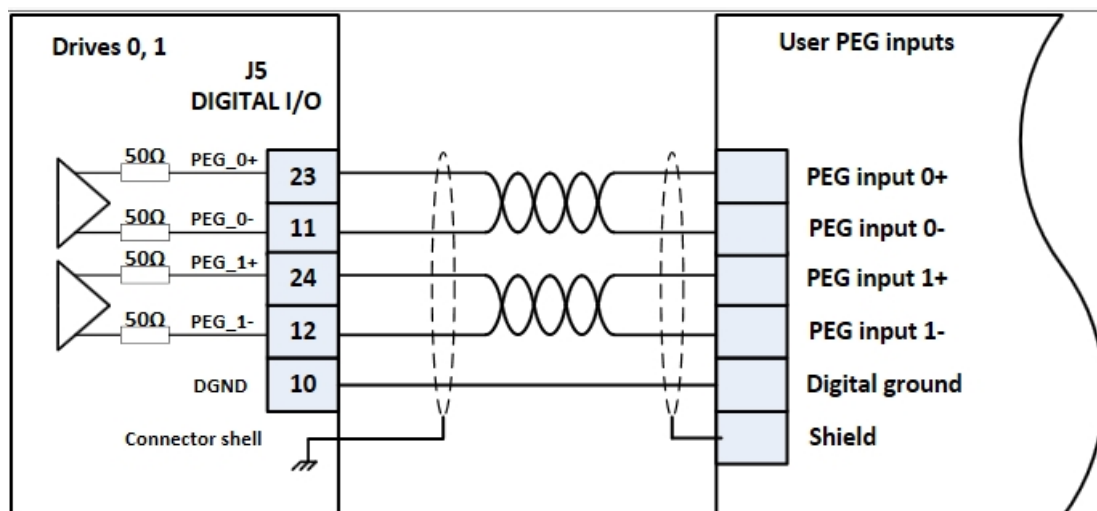
Figure 5-13. PEG outputs connection via "DIGITAL I/O" connector

5.3.3 Digital/mechanical brake outputs connection instructions

Table 5-11. Digital/mechanical brake outputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
OUT0, OUT1 J5 – DIGITAL I/O	OUT2, OUT3 J11 – DIGITAL I/O	OUT4, OUT5 J17 – DIGITAL I/O	OUT6, OUT7 J23 – DIGITAL I/O
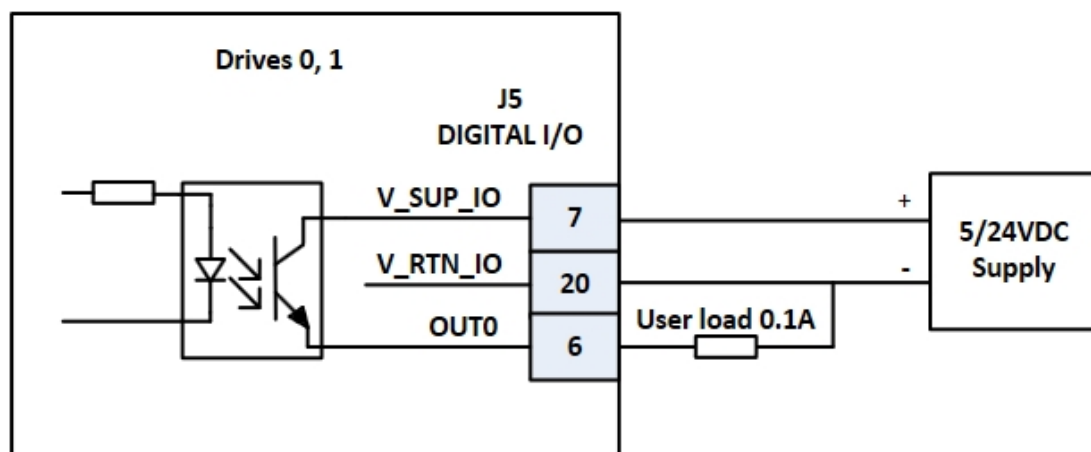
Figure 5-14. Digital/ mechanical brake output source connection via " DIGITAL I/O" connector
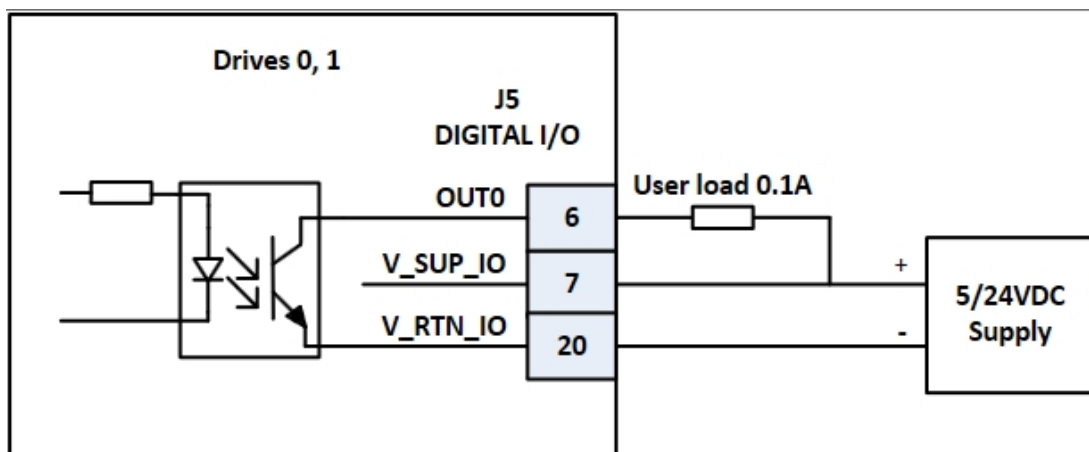
Figure 5-15. Digital/ mechanical brake output sink connection via " DIGITAL I/O" connector

5.3.4 Motor relay outputs connection instructions

Table 5-12. Motor relay outputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
MTR_RELAY_0, MTR_RELAY_1 J5 – DIGITAL I/O	MTR_RELAY_2, MTR_RELAY_3 J11 – DIGITAL I/O	MTR_RELAY_4, MTR_RELAY_5 J17 – DIGITAL I/O	MTR_RELAY_6,,br/>MTR_RELAY_7 J23 – DIGITAL I/O

Figure 5-16. Motor relay output connection via " DIGITAL I/O" connector

5.4 Analog I/O and safety

The connector number and label for the analog I/O & safety inputs for each drive slot on the MP4U is shown in Table 5-13.

Table 5-13. Analog I/O & safety inputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
J6 - ANALOG I/O & SAFETY	J12 - ANALOG I/O & SAFETY	J18 - ANALOG I/O & SAFETY	J24 - ANALOG I/O & SAFETY

The analog I/O & safety connector and mating connector description is shown in Table 5-14.

Table 5-14. Analog I/O & safety inputs connector and mating connector description

Connector	
Manufacturer	Any - Industry standard connector
Type	D-sub
Version	DB-25 male, threaded inserts, 4-40 UNC
P/N	NA

Mating Connector	
Manufacturer	Any - Industry standard connector
Type	D-sub
Version	DB-25, screw locks, 4-40 UNC
P/N	NA

The analog I/O & safety connector pinout is shown in Table 5-15.

Table 5-15. Analog I/O & safety inputs pinout table

Pin	Signal	Description
1	FGND	Analog ground for AIN and AOUT circuits
2	AOUT$+	Analog output $ non-inverted $ is the analog output even number: 2, 6, 10, 14 > AOUT0 - J6 connector, Drives 0, 1 > AOUT4 – J12 connector, Drives 2, 3 > AOUT8 - J18 connector, Drives 4, 5 > AOUT12 – J24 connector, Drives 6, 7
3	AOUT£+	Analog output £ non-inverted £ is the analog output odd number: 1, 5, 9, 13 > AOUT1 - J6 connector, Drives 0, 1 > AOUT5 – J12 connector, Drives 2, 3 > AOUT9 - J18 connector, Drives 4, 5 > AOUT13 – J24 connector, Drives 6, 7
4	AOUT€+	Analog output € non-inverted € is the analog output even number: 2, 6, 10, 14 > AOUT2 - J6 connector, Drives 0, 1 > AOUT6 – J12 connector, Drives 2, 3 > AOUT10 - J18 connector, Drives 4, 5 > AOUT14 – J24 connector, Drives 6, 7
5	AOUT¥+	Analog output ¥ non-inverted ¥ is the analog output odd number: 3, 7, 11, 15 > AOUT3 - J6 connector, Drives 0, 1 > AOUT7 – J12 connector, Drives 2, 3 > AOUT11 - J18 connector, Drives 4, 5 > AOUT15 – J24 connector, Drives 6, 7
6	AIN$+	Analog input $ non-inverted $ is the analog input even number: 2, 6, 10, 14 > AIN0 - J6 connector, Drives 0, 1 > AIN4 – J12 connector, Drives 2, 3 > AIN8 - J18 connector, Drives 4, 5

Pin	Signal	Description
		> AIN12 – J24 connector, Drives 6, 7

7	AIN£+	Analog input £ non-inverted
		£ is the analog input odd number: 1, 5, 9, 13
		   > AIN1 - J6 connector, Drives 0, 1
		   > AIN5 – J12 connector, Drives 2, 3
		   > AIN9 - J18 connector, Drives 4, 5
		   > AIN13 – J24 connector, Drives 6, 7

8	AIN€+	Analog input € non-inverted
		€ is the analog input even number: 2, 6, 10, 14
		   > AIN2 - J6 connector, Drives 0, 1
		   > AIN6 – J12 connector, Drives 2, 3
		   > AIN10 - J18 connector, Drives 4, 5
		   > AIN14 – J24 connector, Drives 6, 7

9	AIN¥+	Analog input ¥ non-inverted
		¥ is the analog input odd number: 3, 7, 11, 15
		   > AIN3 - J6 connector, Drives 0, 1
		   > AIN7 – J12 connector, Drives 2, 3
		   > AIN11 - J18 connector, Drives 4, 5
		   > AIN15 – J24 connector, Drives 6, 7

10	NC	Not connected
11	RL_£	Right limit £ £ is the drive (axis) odd number: 1, 3, 5, 7
12	RL_$	Right limit $ $ is the drive (axis) even number: 0, 2, 4, 6
13	V_SUP_SFTY	Safety supply

14	AOUT$-	Analog output
		$ inverted $ is the analog output even number: 2, 6, 10, 14
		   > AOUT0 - J6 connector, Drives 0, 1
		   > AOUT4 – J12 connector, Drives 2, 3

Pin	Signal	Description
		> AOUT8 - J18 connector, Drives 4, 5 > AOUT12 – J24 connector, Drives 6, 7
15	AOUT£-	Analog output £ inverted £ is the analog output odd number: 1, 5, 9, 13 > AOUT1 - J6 connector, Drives 0, 1 > AOUT5 – J12 connector, Drives 2, 3 > AOUT9 - J18 connector, Drives 4, 5 > AOUT13 – J24 connector, Drives 6, 7
16	AOUT€-	Analog output € inverted € is the analog output even number: 2, 6, 10, 14 > AOUT2 - J6 connector, Drives 0, 1 > AOUT6 – J12 connector, Drives 2, 3 > AOUT10 - J18 connector, Drives 4, 5 > AOUT14 – J24 connector, Drives 6, 7
17	AOUT¥-	Analog output ¥ inverted ¥ is the analog output odd number: 3, 7, 11, 15 > AOUT3 - J6 connector, Drives 0, 1 > AOUT7 – J12 connector, Drives 2, 3 > AOUT11 - J18 connector, Drives 4, 5 > AOUT15 – J24 connector, Drives 6, 7
18	AIN$-	Analog input $ inverted $ is the analog input even number: 2, 6, 10, 14 > AIN0 - J6 connector, Drives 0, 1 > AIN4 – J12 connector, Drives 2, 3 > AIN8 - J18 connector, Drives 4, 5 > AIN12 – J24 connector, Drives 6, 7
19	AIN£-	Analog input £ inverted £ is the analog input odd number: 1, 5, 9, 13 > AIN1 - J6 connector, Drives 0, 1 > AIN5 – J12 connector, Drives 2, 3

Pin	Signal	Description
		> AIN9 - J18 connector, Drives 4, 5 > AIN13 – J24 connector, Drives 6, 7
20	AIN€-	Analog input € inverted € is the analog input even number: 2, 6, 10, 14 > AIN2 - J6 connector, Drives 0, 1 > AIN6 – J12 connector, Drives 2, 3 > AIN10 - J18 connector, Drives 4, 5 > AIN14 – J24 connector, Drives 6, 7
21	AIN¥-	Analog input ¥ inverted ¥ is the analog input odd number: 3, 7, 11, 15 > AIN3 - J6 connector, Drives 0, 1 > AIN7 – J12 connector, Drives 2, 3 > AIN11 - J18 connector, Drives 4, 5 > AIN15 – J24 connector, Drives 6, 7
22	NC	Not connected
23	LL_£	Left limit £ £ is the drive (axis) odd number: 1, 3, 5, 7
24	LL_$	Left limit $ $ is the drive (axis) even number: 0, 2, 4, 6
25	V_RTN_SFTY	Safety supply return
	Connector shell and front screw	SHIELD

5.4.1 Limit inputs connection instructions

The Right and Left limits RL_$, LL_$ for the specific drive $ can be connected via only one of the connectors are specified for this drive in Table 5-16.

Table 5-16. Limit inputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
RL_0, LL_0	RL_2, LL_2	RL_4, LL_4	RL_6, LL_6

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
J1 - PRIMARY ENCODER 0	J7 - PRIMARY ENCODER 2	J13 - PRIMARY ENCODER 4	J19 - PRIMARY ENCODER 6
J2 - SECONDARY ENCODER 0	J8 - SECONDARY ENCODER 2	J14 - SECONDARY ENCODER 4	J20 - SECONDARY ENCODER 6
J6 – ANALOG I/O & SAFETY	J12 – ANALOG I/O & SAFETY	J18 – ANALOG I/O & SAFETY	J24 – ANALOG I/O & SAFETY
RL_1, LL_1	**RL_3, LL_3**	**RL_5, LL_5**	**RL_7, LL_7**
J3 - PRIMARY ENCODER 1	J9 - PRIMARY ENCODER 3	J15 - PRIMARY ENCODER 5	J21 - PRIMARY ENCODER 7
J4 - SECONDARY ENCODER 1	J10 - SECONDARY ENCODER 3	J16 - SECONDARY ENCODER 5	J22 - SECONDARY ENCODER 7
J6 – ANALOG I/O & SAFETY	J12 – ANALOG I/O & SAFETY	J18 – ANALOG I/O & SAFETY	J24 – ANALOG I/O & SAFETY
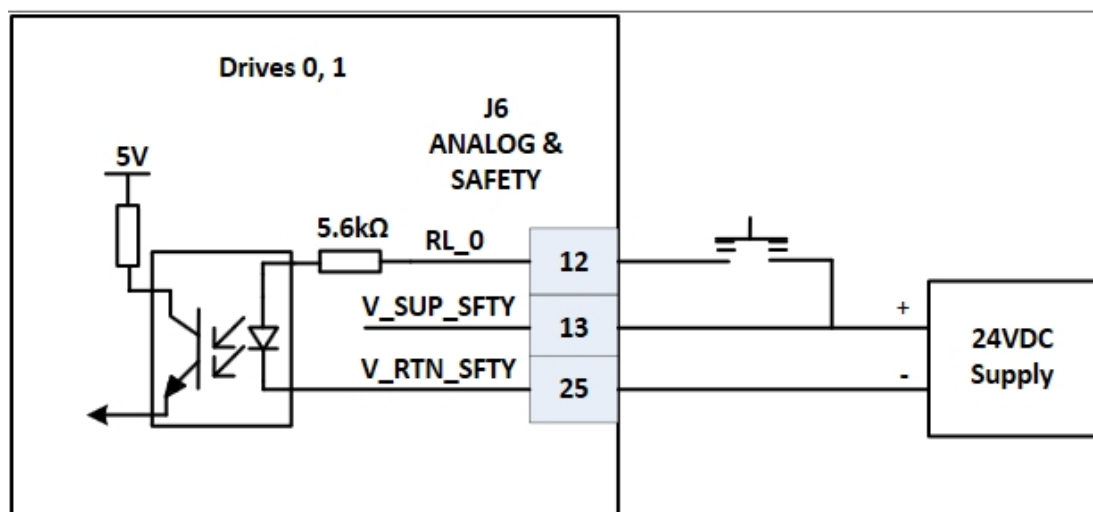
Figure 5-17. Right limit source connection via "ANALOG I/O & SAFETY " connector
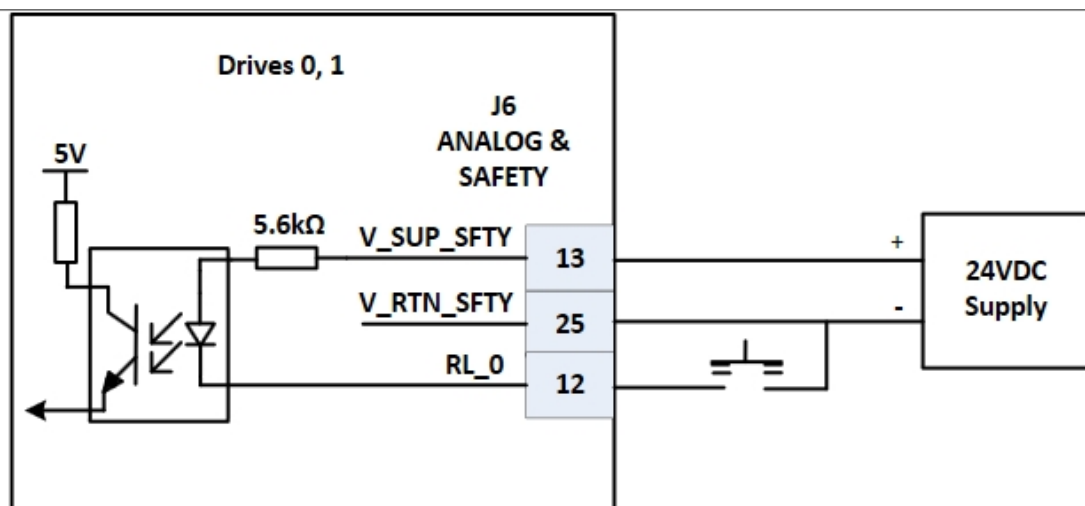
Figure 5-18. Right limit sink connection via "ANALOG I/O & SAFETY " connector
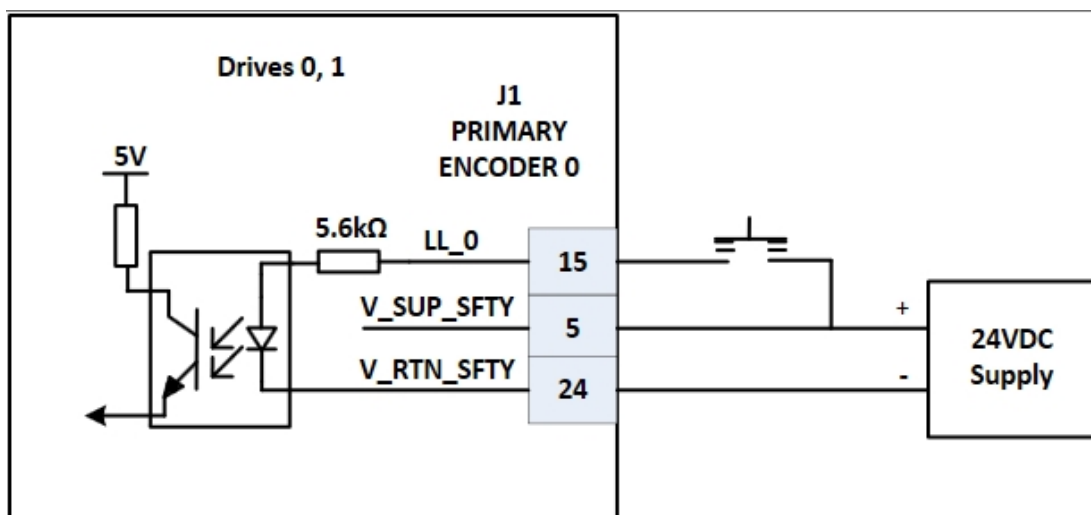
Figure 5-19. Left limit source connection via "PRIMARY ENCODER 0" connector
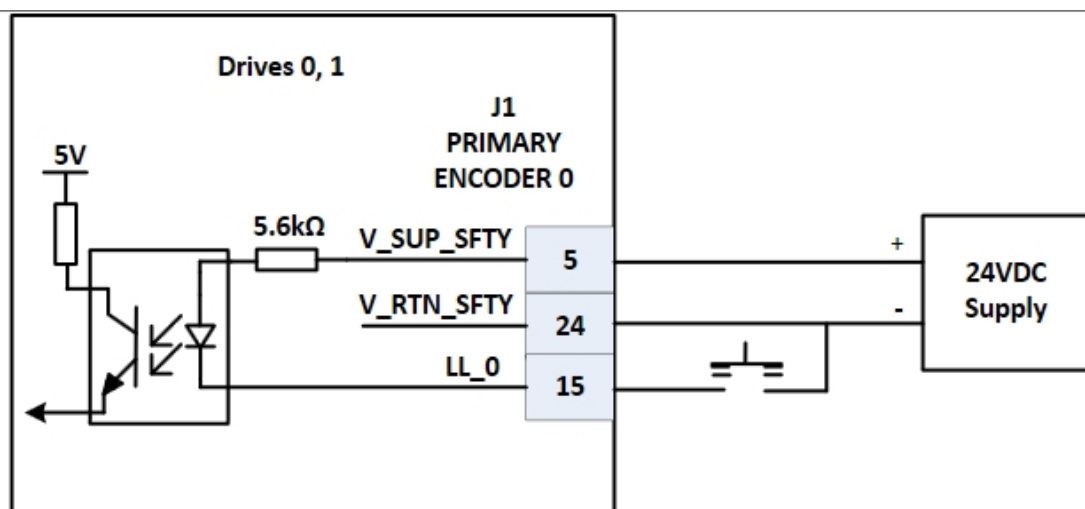
Figure 5-20. Left limit sink connection via "PRIMARY ENCODER 0" connector

5.4.2 Analog I/O connection instructions

Table 5-17. General purpose (GP) analog I/O connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
AIN0, AIN1, AIN2, AIN3	AIN4, AIN5, AIN6, AIN7	AIN8, AIN9, AIN10, AIN11	AIN12, AIN13, AIN14, AIN15
AOUT0, AOUT1, AOUT2, AOUT0	AOUT4, AOUT5, AOUT6, AOUT7	AOUT8, AOUT9, AOUT10, AOUT11	AOUT12, AOUT13, AOUT14, AOUT15
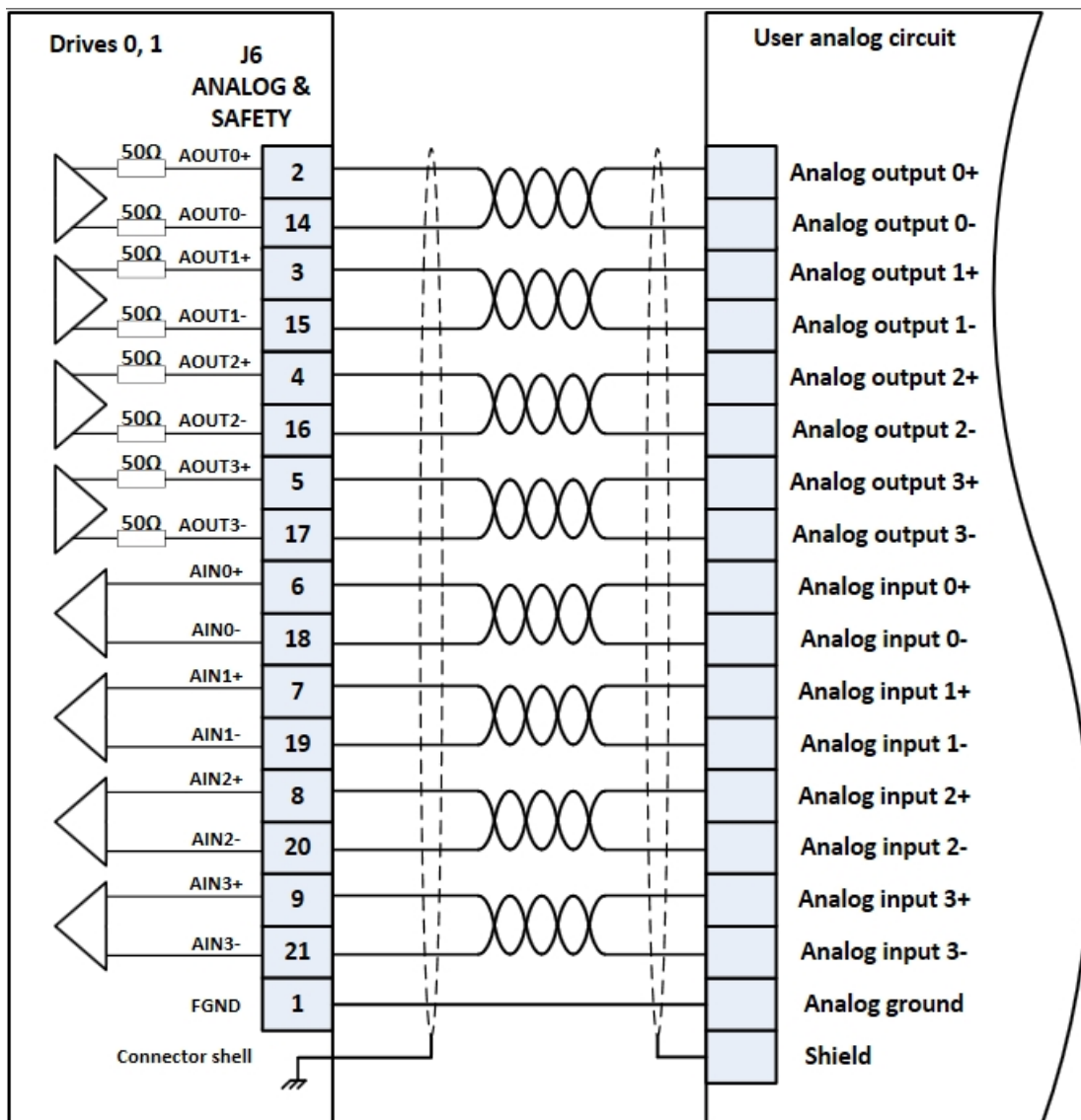
Figure 5-21. Analog I/O connection via "ANALOG I/O & SAFETY " connector

5.4.3 Digital/mechanical brake outputs connection instructions

Table 5-18. Digital/mechanical brake outputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
OUT0, OUT1 J5 – DIGITAL I/O	OUT2, OUT3 J11 – DIGITAL I/O	OUT4, OUT5 J17 – DIGITAL I/O	OUT6, OUT7 J23 – DIGITAL I/O
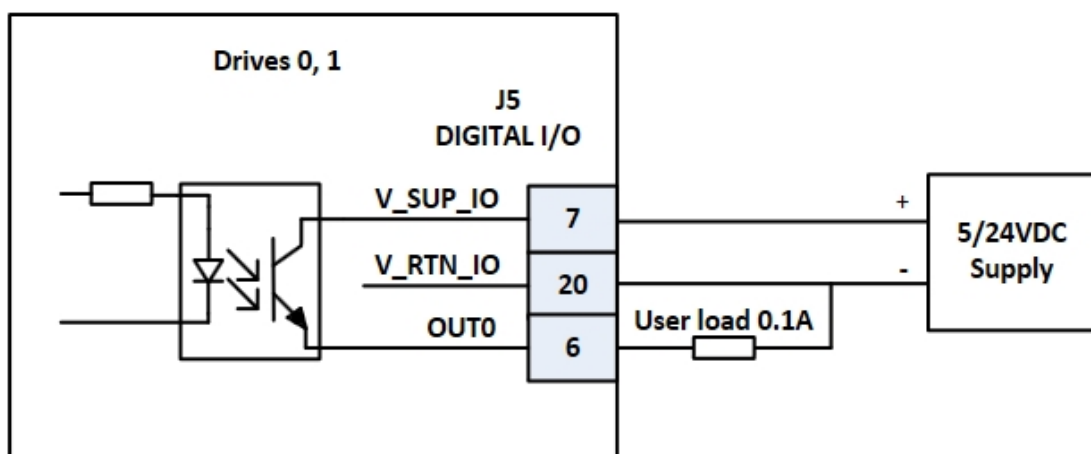
Figure 5-22. Digital/ mechanical brake output source connection via " DIGITAL I/O" connector
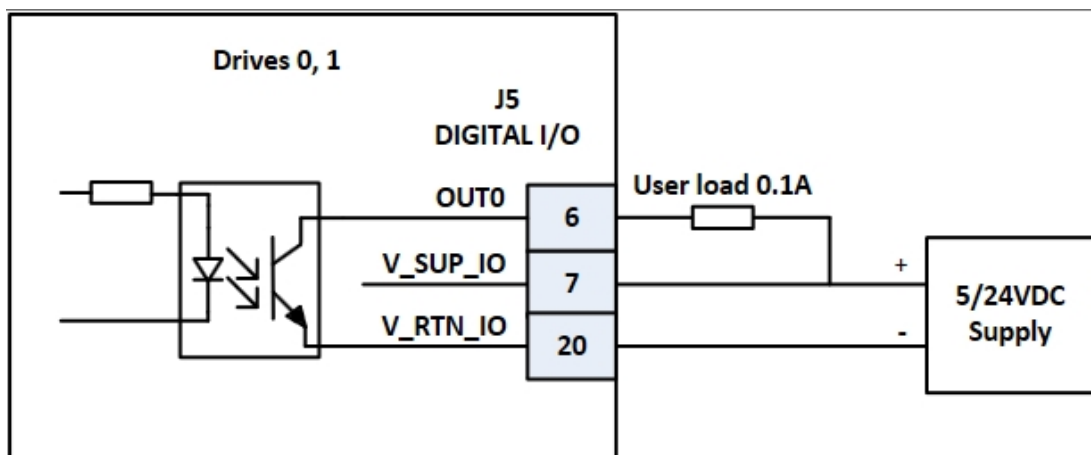
Figure 5-23. Digital/ mechanical brake output sink connection via " DIGITAL I/O" connector

5.4.4 Motor relay outputs connection instructions

Table 5-19. Motor relay outputs connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
MTR_RELAY_0, MTR_RELAY_1 J5 – DIGITAL I/O	MTR_RELAY_2, MTR_RELAY_3 J11 – DIGITAL I/O	MTR_RELAY_4, MTR_RELAY_5 J17 – DIGITAL I/O	MTR_RELAY_6,,br/>MTR_RELAY_7 J23 – DIGITAL I/O

Figure 5-24. Motor relay output connection via " DIGITAL I/O" connector

5.5 Ethernet

Label:

J27 - Ethernet

Available when controller card is installed.

The Ethernet connector and mating connector description is shown in Table 5-20.

Table 5-20. Ethernet connector and mating connector description

Connector	
Manufacturer	Unbranded - industry standard connector
Type	Vertical jack with bi-color Green/Yellow - Green/Yellow LEDs, shielded
Version	RJ-45, 8 pin
P/N	NA

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	Plug
Version	RJ-45, 8 pin
P/N	NA

The Ethernet connector pinout is shown in Table 5-21.

Table 5-21. Digital I/O pinout table

Pin	Signal	Description
1	TXD_1+	Transmit data 1 +
2	TXD_1-	Transmit data 1 -
3	RXD_2+	Receive data 2 +
4	BID_3+	Bi-directional 3 +
5	BID_3-	Bi-directional 3 -
6	RXD_2-	Receive data 2 -

Pin	Signal	Description
7	BID_4+	Bi-directional 4 +
8	BID_4-	Bi-directional 4 -
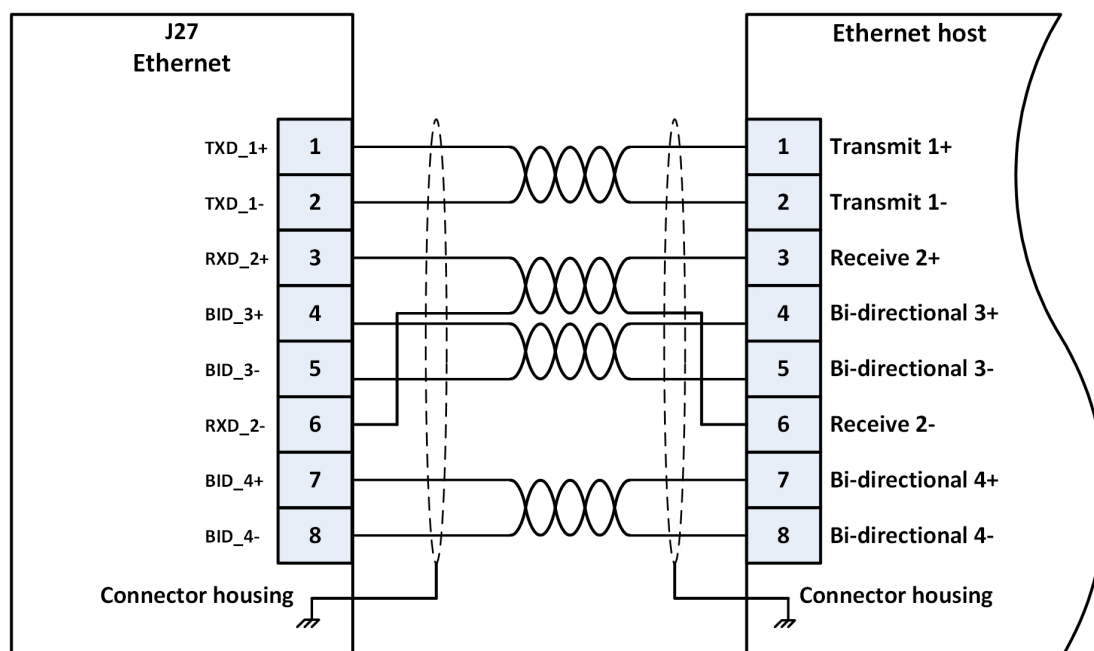
Figure 5-25. Ethernet connection to Ethernet host

5.6 Drive supply

Label:

J28 DRIVE SUPPLY

Connector	
Manufacturer	Weidmüller
Type	SL 7.62HP/04/180F 3.2 SN BK BX
Version	male header, 7.62 mm, 4 pin flange
P/N	1140890000

Mating Connector	
Manufacturer	Weidmüller
Type	BLZ 7.62HP/04/180F SN BK BX
Version	female plug, 7.62 mm, 4 pin
P/N	1095700000

Table 5-22. Drive supply connector pinout table

Pin	Signal	Description
1	L1	AC input Line (for 100 -240Vac single phase supply) or AC input phase 1 (for 120V 3-phase supply)
2	L2(N)	AC input Neutral (for 100 -240Vac single phase supply) or AC input phase 2 (for 120V 3-phase supply)
3	NC	Not connected
4	PE	EGND, protected earth

5.6.1 Drive supply connection instructions

> The 3 wires main supply cord should be rated to 16A current. The conductor size is 14 – 12AWG

> The main supply cord should be connected to the mains via the circuit-breaker

>> Voltage rating: 240Vac min

>> Current rating: 20A max when used with 14AWG main supply cord
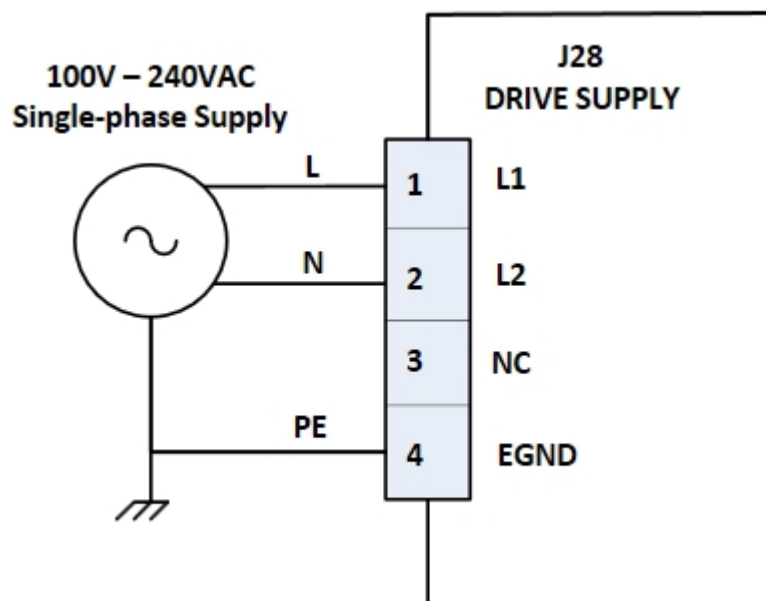
Figure 5-26. 100V – 240VAC single-phase supply connection
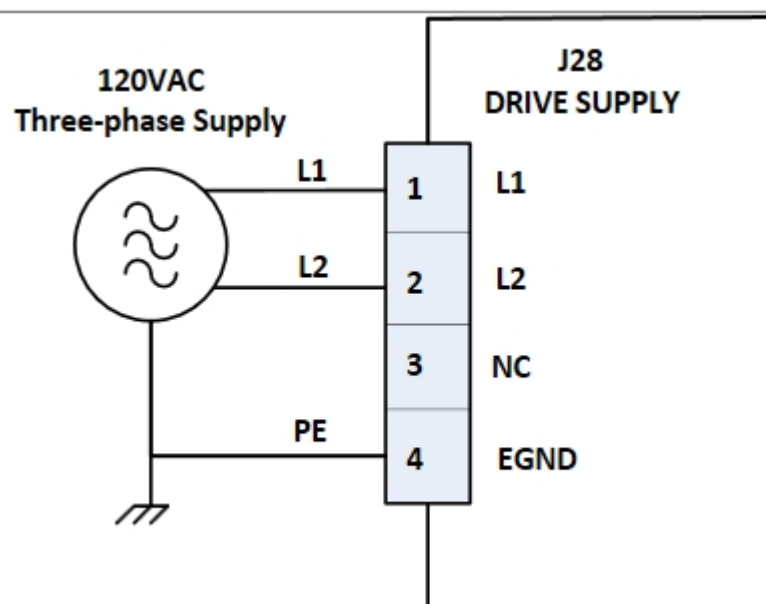
Figure 5-27. 120VAC three-phase supply connection

5.7 External regeneration resistor

Label:

J29 EXTERNAL REGENERATION RESISTOR

Connector	
Manufacturer	Phoenix Contact

Connector	
Type	ICV 2,5/ 3-GF-5,08
Version	Female header flange, 3-pin, pitch 5.08mm, vertical
P/N	1825705

Mating Connector	
Manufacturer	Phoenix Contact
Type	IC 2,5/ 3-STF-5,08
Version	Male plug, pitch 5.08 mm, 3 pin
P/N	1825323

Table 5-23. 24V supply output connector pinout table

Pin	Signal	Description
1	REG1	Terminal "1" of the external regeneration resistor
2	REG2	Terminal "2" of the external regeneration resistor
3	EGND	SHIELD of the external regeneratin resistor cable

5.7.1 External regeneration resistor connection instructions
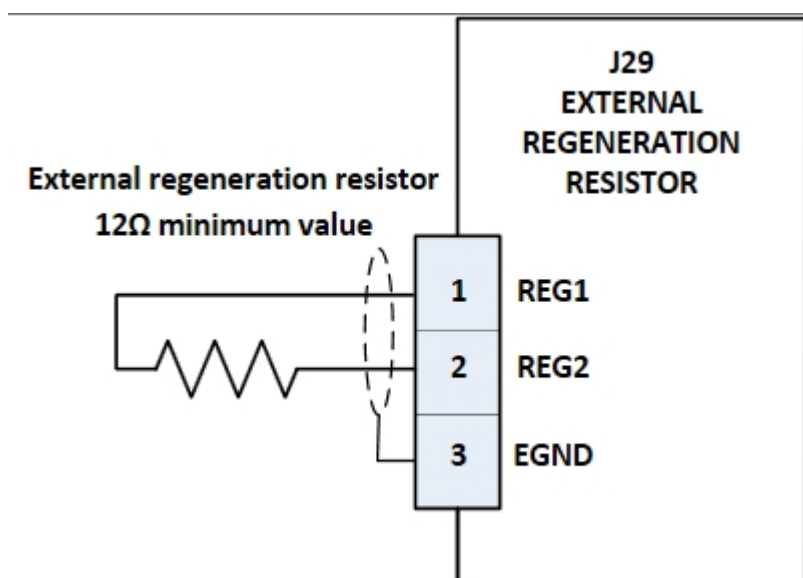
Figure 5-28. External regeneration resistor connection

5.8 Motors

The connector number and label for the motors for each drive slot on the MP4U is shown in Table 5-24.

Table 5-24. 17.1.1 Motor connection availability per drives slots

Drivers slots			
Drives 0, 1	Drives 2, 3	Drives 4, 5	Drives 6, 7
J30 → MOTOR 0 J46 → MOTOR 1	J31 → MOTOR 2 J47 → MOTOR 3	J32 → MOTOR 4 J48 → MOTOR 5	J33 → MOTOR 6 J49 → MOTOR 7

The motor connector and mating connector description is shown in Table 5-25.

Table 5-25. Motor connector and mating connector description

Connector	
Manufacturer	Any - industry standard connector
Type	D sub connector with power pins
Version	9W4 mixed with threaded insert UNC 4-40, female
P/N	NA

Connector

Mating Connector	
Manufacturer	Any - industry standard connector
Type	
Version	9W4 mixed with UNC 4-40 lockers, male
P/N	NA

The motor connector pinout is shown in Table 5-26.

Table 5-26. Analog I/O & safety inputs pinout table

Pin	Signal	Description
A1	R_$	Motor $ R phase $ is the drive (axis) number: 0..7
A2	S_$	Motor $ S phase $ is the drive (axis) number: 0..7
A3	T_$	Motor $ T phase $ is the drive (axis) number: 0..7
A4	EGND	Motor shield/ protected earth
1	MTMP_$	$ Motor temperature sensor $ is the drive (axis) number: 0..7
2	NC	Not connected
3	DGND	Motor temperature sensor return

Pin	Signal	Description
4	NC	Not connected
5	EGND	Temperature sensor shield
	Connector shell and front screw	SHIELD

5.8.1 Motor connection instructions
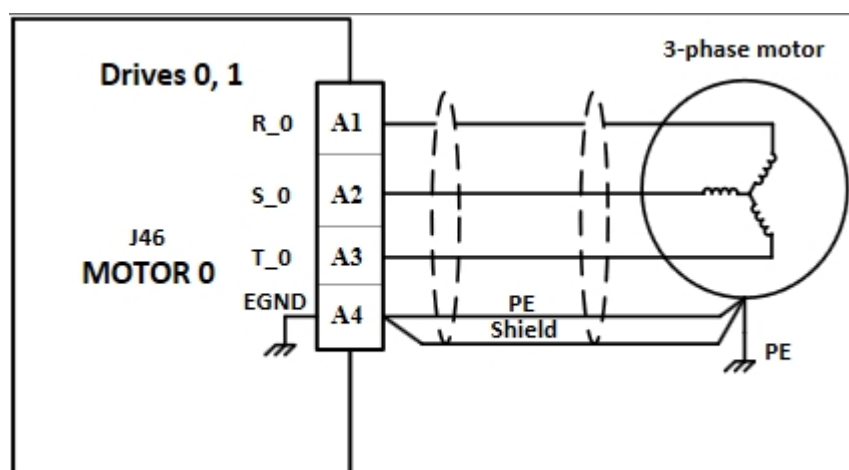
Figure 5-29. Three-phase motor connection

5.9 EtherCAT Out (to external master)

Label

J34 EtherCAT OUT

> When controller with an EtherCAT to EtherCAt bridge is installed, used for connection as a master control module to the external ACS EtherCAT slave devices.

The Ethernet connector and mating connector description is shown in Table 5-27.

Table 5-27. Ethernet connector and mating connector description

Connector	
Manufacturer	Unbranded - industry standard connector
Type	Vertical jack with bi-color Green/Yellow - Green/Yellow LEDs, shielded
Version	RJ-45, 8 pin
P/N	NA

Connector

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	Plug
Version	RJ-45, 8 pin
P/N	NA

The Ethernet connector pinout is shown in Table 5-28.

Table 5-28. Digital I/O pinout table

Pin	Signal	Description
1	TD_OUT+	Transmit data +
2	TD_OUT-	Transmit data -
3	RD_OUT+	Receive data +
4	Termination	Common mode termination
5	Termination-	Common mode termination
6	RD_OUT-	Receive data -
7	Termination	Common mode termination
8	Termination	Common mode termination
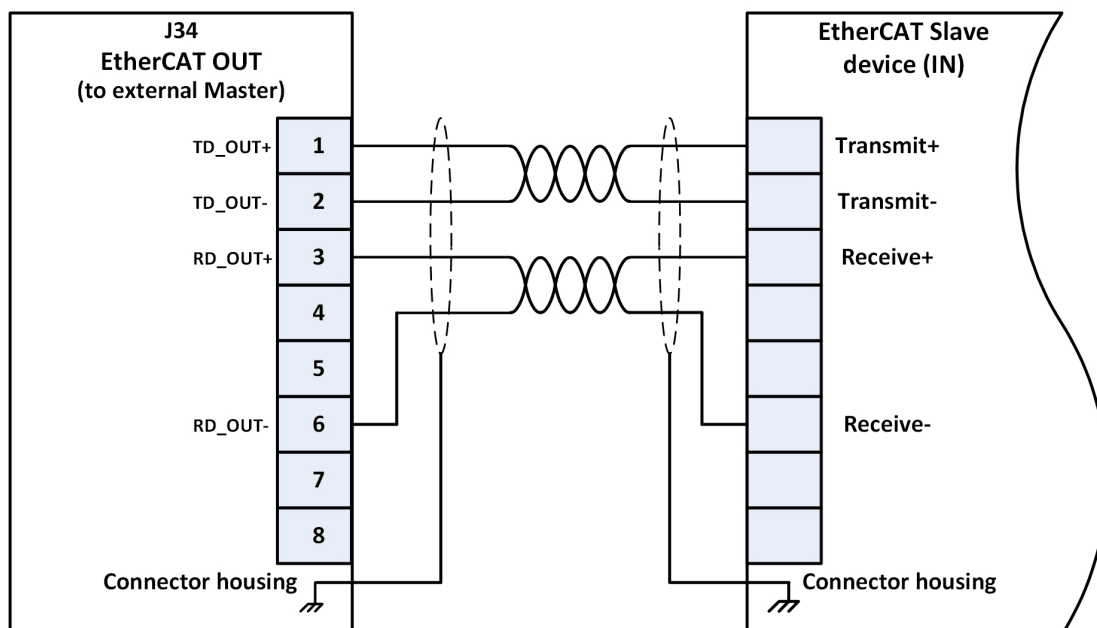
Figure 5-30. Ethernet connection to Ethernet host

5.10 EtherCAT In (to external master)

Label

J35 EtherCAT IN

> When controller with an EtherCAT to EtherCAt bridge is installed, used for connection as a master control module to the external ACS EtherCAT slave devices.

The Ethernet connector and mating connector description is shown in Table 5-29.

Table 5-29. Ethernet connector and mating connector description

Connector	
Manufacturer	Unbranded - industry standard connector
Type	Vertical jack with bi-color Green/Yellow - Green/Yellow LEDs, shielded
Version	RJ-45, 8 pin
P/N	NA

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	Plug
Version	RJ-45, 8 pin
P/N	NA

The Ethernet connector pinout is shown in Table 5-30.

Table 5-30. Digital I/O pinout table

Pin	Signal	Description
1	TD_IN+	Transmit data +
2	TD_IN1-	Transmit data -
3	RD_IN+	Receive data +
4	Termination	Common mode termination
5	Termination	Common mode termination
6	RD_IN-	Receive data -
7	Termination	Common mode termination
8	Termination	Common mode termination
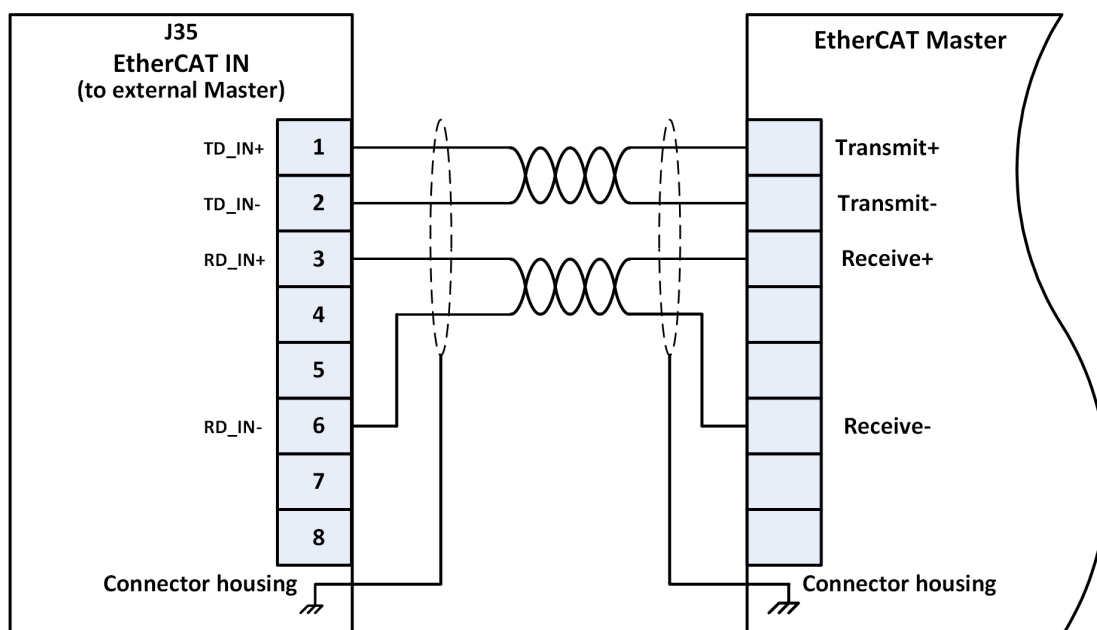
Figure 5-31. Ethernet connection to Ethernet host

5.11 COM

Label:

J36 COM1

J37 COM2

> Available when controller card is installed.

The Ethernet connector and mating connector description is shown in 5.11.

Table 5-31. Ethernet connector and mating connector description

Connector	
Manufacturer	Unbranded - industry standard connector
Type	D-Sub, 9 pin
Version	Male with threaded insert UNC 4-40
P/N	NA

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	D-sub, 9-Pin
Version	Female with threaded insert UNC 4-40
P/N	NA

The Ethernet connector pinout is shown in Table 5-32.

Table 5-32. Digital I/O pinout table

Pin	Signal	Description
1	DCD_$	Carrier detect input
2	RXD_$	Receive data input
3	TXD_$	Transmit signal output
4	DTR_$	Data terminal ready output
5	DGND	Digital ground
6	DSR_$	Data set ready input
7	RTS_$	Request to send output
8	CTS_$	Clear to send input
9	RI_$	Ring indicator input
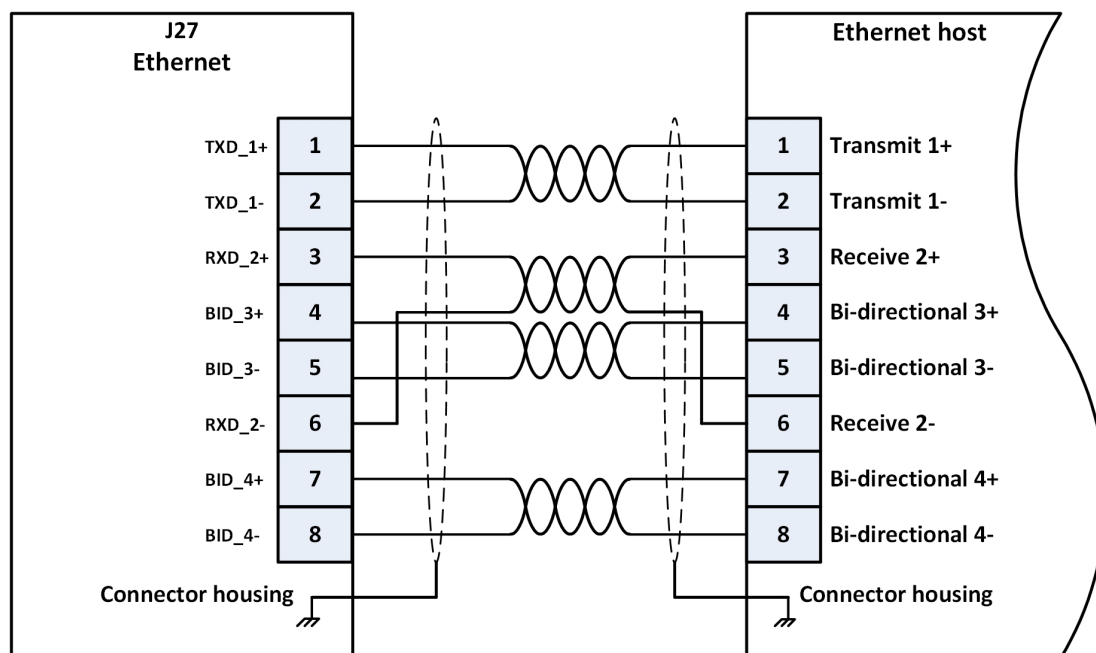
Figure 5-32. Ethernet connection to Ethernet host

5.12 EtherCAT

Label:

J38 - Primary/OUT

J39 - Secondary/IN

5.12.1 EtherCAT Primary/OUT connection instructions

The Primary/OUT connector and mating connector description is shown in Table 5-33.

Table 5-33. Primary/OUT connector and mating connector descirption

Connector	
Manufacturer	Unbranded - industry standard connector
Type	Vertical jack with bi-color Green/Yellow - Green/Yellow LEDs, shielded
Version	RJ-45, 8 pin
P/N	NA

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	Plug
Version	RJ-45, 8 pin
P/N	NA

The Primary/OUT connector pinout is shown in Table 5-34.

Table 5-34. Digital I/O pinout table

Pin	Signal	Description
1	TD_PRM_OUT+	Transmit data +
2	TD_PRM_OUT-	Transmit data-
3	RD_PRM_OUT+	Receive data+
4	Termination	Common Mode Termination
5	Termination	Common Mode Termination
6	RD_PRM_OUT-	Receive data-
7	Termination	Common Mode Termination
8	Termination	Common Mode Termination
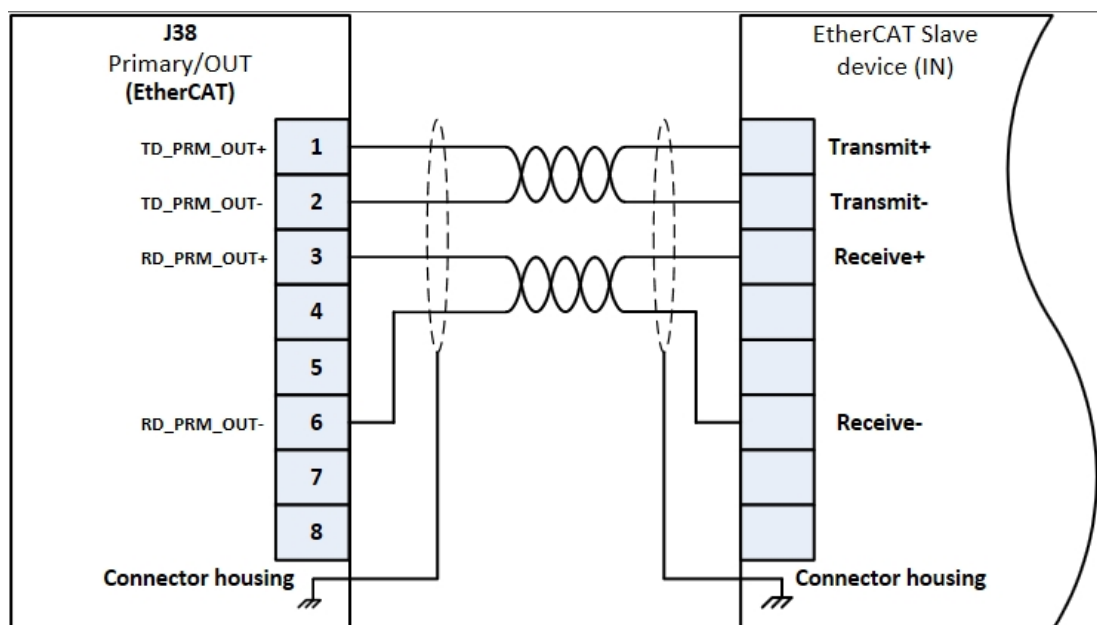
Figure 5-33. EtherCAT Primary/OUT connection to external EtherCAT Slave device

5.12.2 EtherCAT Secondary/IN connection instructions

The Primary/OUT connector and mating connector description is shown in Table 5-35.

Table 5-35. Primary/OUT connector and mating connector descirption

Connector	
Manufacturer	Unbranded - industry standard connector
Type	Vertical jack with bi-color Green/Yellow - Green/Yellow LEDs, shielded
Version	RJ-45, 8 pin
P/N	NA

Mating Connector	
Manufacturer	Unbranded - industry standard connector
Type	Plug
Version	RJ-45, 8 pin

Mating Connector	
P/N	NA

The Primary/OUT connector pinout is shown in Table 5-36.

Table 5-36. Digital I/O pinout table

Pin	Signal	Description
1	TD_SEC_OUT+	Transmit data +
2	TD_SEC_OUT-	Transmit data-
3	RD_SEC_OUT+	Receive data+
4	Termination	Common Mode Termination
5	Termination	Common Mode Termination
6	RD_SEC_OUT-	Receive data-
7	Termination	Common Mode Termination
8	Termination	Common Mode Termination

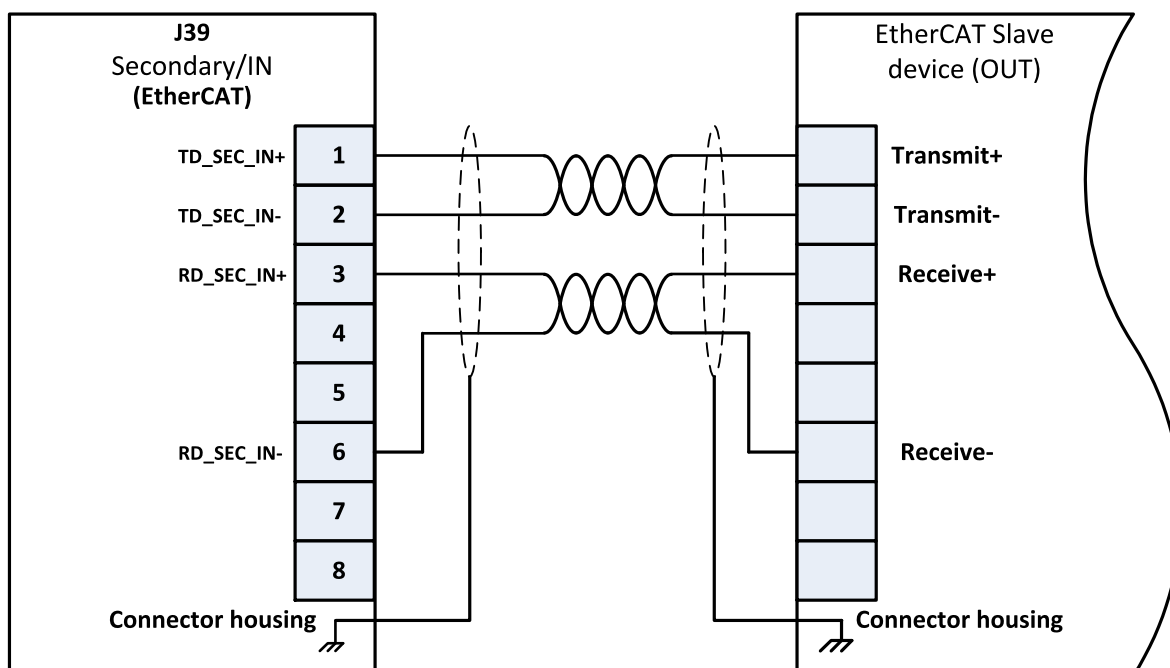**Figure 5-34. EtherCAT Secondary/IN connection to external EtherCAT Slave device**

5.13 24Vdc supply output

Label:

J40 24VDC SUPPLY OUTPUT

To supply control power to external drivers, such as UDMnt, etc.

Up to 2Amp

A resettable fuse will be activated upon short or overload (the fuse automatically resets a few seconds after the short ends)

Connector	
Manufacturer	Wurth Electronics
Type	
Version	Female header, pitch 3.81 mm, flange 3 pin
P/N	691308330003

Mating Connector	
Manufacturer	Wurth Electronics
Type	
Version	Male plug, pitch 3.81 mm, 3 pin
P/N	691349340003

Table 5-37. 24V supply output connector pinout table

Pin	Signal	Description
1	24VU	24V suppy output
2	24V_RTN	24V supply return
3	EGND	EGND, protected earth

5.13.1 24Vdc supply output connection instructions
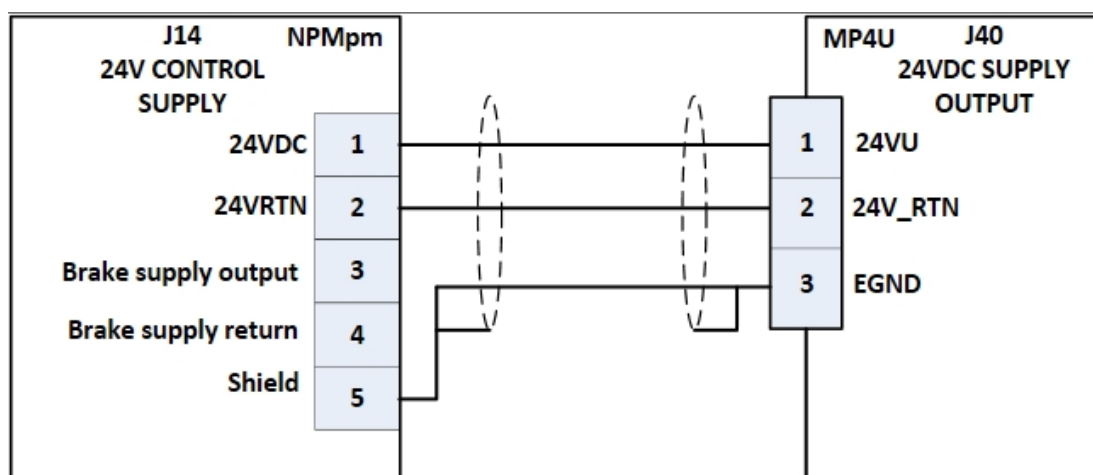
Figure 5-35. 24VDC supply output connection to NPMpm 24V control supply

5.14 STO

Label:

J43 STO

Connector	
Manufacturer	Phoenix
Type	MCV 1,5/5-GF-3,81
Version	Male header flange, 5-pin header, pitch 3.81mm, vertical
P/N	1763232

Mating Connector	
Manufacturer	Phoenix
Type	MC 1,5/ 5-STF-3,81
Version	Female flange, 5-pin plug, pitch 3.81mm
P/N	1827732

Table 5-38. STO connector pinout table

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

5.14.1 STO connection notes

1. If STO is not ordered, then J43 is left open with no mating connector.
2. If STO is included, then connect an external safety circuit and 24Vdc. Use an external 24Vdc supply or connector J40 on the MP4U for a 24Vdc source.
3. If STO is included and not connected, then the drive will not operate.

5.15 Control supply

Label:

J44 CONTROL SUPPLY

Connector	
Manufacturer	Weidmüller
Type	SL 7.62HP/03/180F 3.2 SN BK BX
Version	male header, 7.62 mm, flange 3 pin

Connector	
P/N	1140880000

Mating Connector	
Manufacturer	Weidmüller
Type	BLZ 7.62HP/03/180F SN BK BX
Version	female plug, 7.62 mm, 3 pin
P/N	1095690000

Table 5-39. Control supply connector pinout table

Pin	Signal	Description
1	L	AC input line
2	N	AC input neutral
3	PE	EGND, protected earth

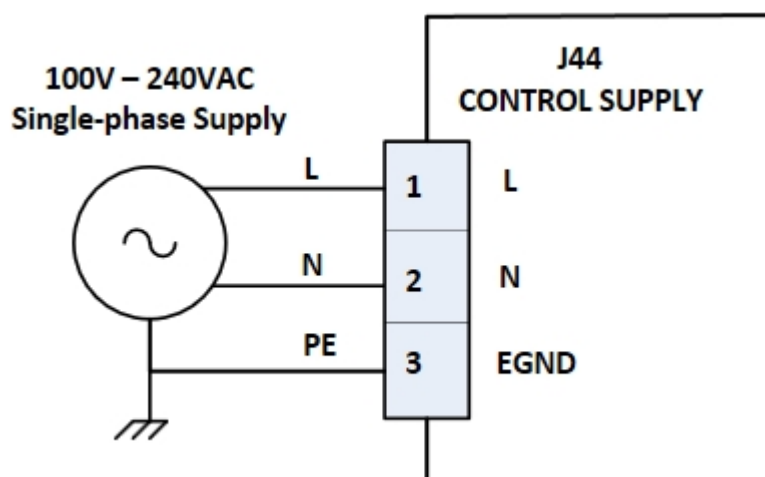### 5.15.1 Control supply connection instructions

Figure 5-36. Control supply connection

5.16 48/96Vdc supply output

Label:

J45 48/96VDC SUPPLY OUTPUT

To supply drive / motor power to external drivers, such as UDMnt, etc.

Up to 10Amp

> User is required to protect and utilize a fuse to limits the current to 10amp.

> If the current is not limited to 10Amp, then an over current may occur which will cause unrepairable damage to the entire unit.

> In the case of an overload, the internal power supply shuts down. After the resolving the problem, in order to restore power, it is required to turn the rocker switch Off and On.

Connector	
Manufacturer	Phoenix
Type	ICV 2,5/ 5-GF-5,08
Version	Female header flange, 5-pin, pitch 5.08mm, vertical

Connector	
P/N	1825721

Mating Connector	
Manufacturer	Phoenix
Type	IC 2,5/ 5-STF-5,08
Version	Male plug flange, 5-pin, pitch 5.08mm
P/N	1825349

Table 5-40. STO connector pinout table

Pin	Signal	Description
1	48_96VU	48V or 96V supply output
2	48_96VU_TRN	48V or 96V supply return
3	48VU_RTN	48 supply return
4	48VU	48V supply output
5	EGND	EGND, protected earth

Pin #1 and pin #2 will supply either 48V or 96V depending on the slected power supply.

5.16.1 48/96Vdc supply output connection instructions

5.16.1.1 96VDC supply output connection

1. The 96V is available on pin 1 of the J45 "48/96VDC SUPPLY OUTPUT" connector for 96V, 32A or mixed (48Vdc and 96Vdc, 32A) drive supply configurations

2. The external fuse should be used:

   a. Current rating: 12A
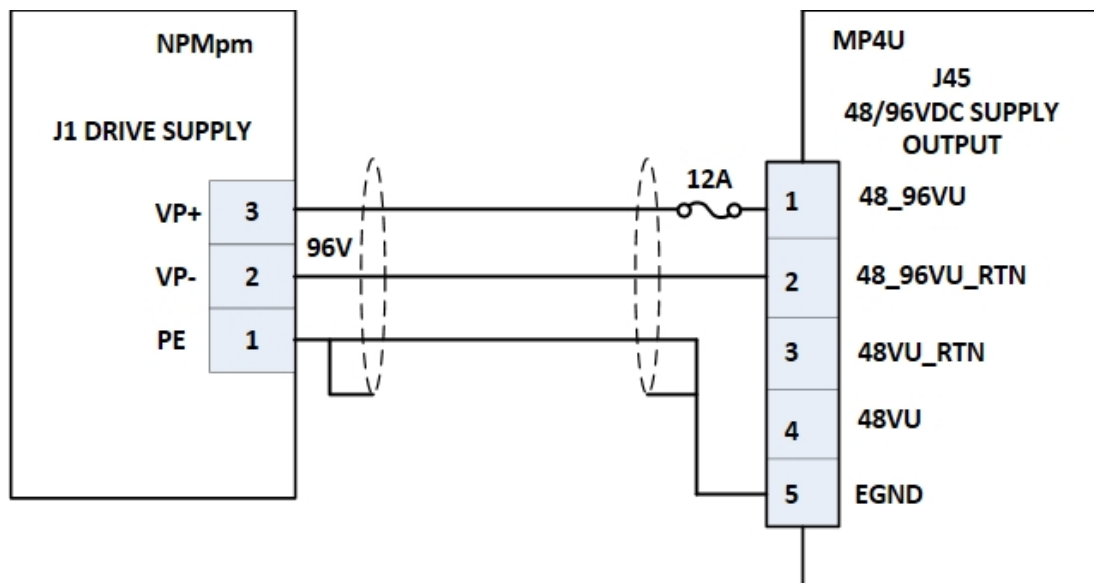
   b. Voltage rating: 125Vdc

   c. Type: fast-acting

Figure 5-37. 96VDC supply output connection to NPMpm drive supply input

5.16.1.2 Mixed (48/96VDC) supply output connection

1. The 96V is available on pin 1 of the J45 "48/96VDC SUPPLY OUTPUT" connector for 96V, 32A or mixed (48Vdc and 96Vdc, 32A) drive supply configurations

2. The 48V is available on pin 3 of the J45 "48/96VDC SUPPLY OUTPUT" connector for all drive supply configurations

3. The external fuses should be used for each of the supply outputs 48VDC and 96VDC:

   a. Current rating: 12A

   b. Voltage rating:

      i. 125Vdc for 96VDC output

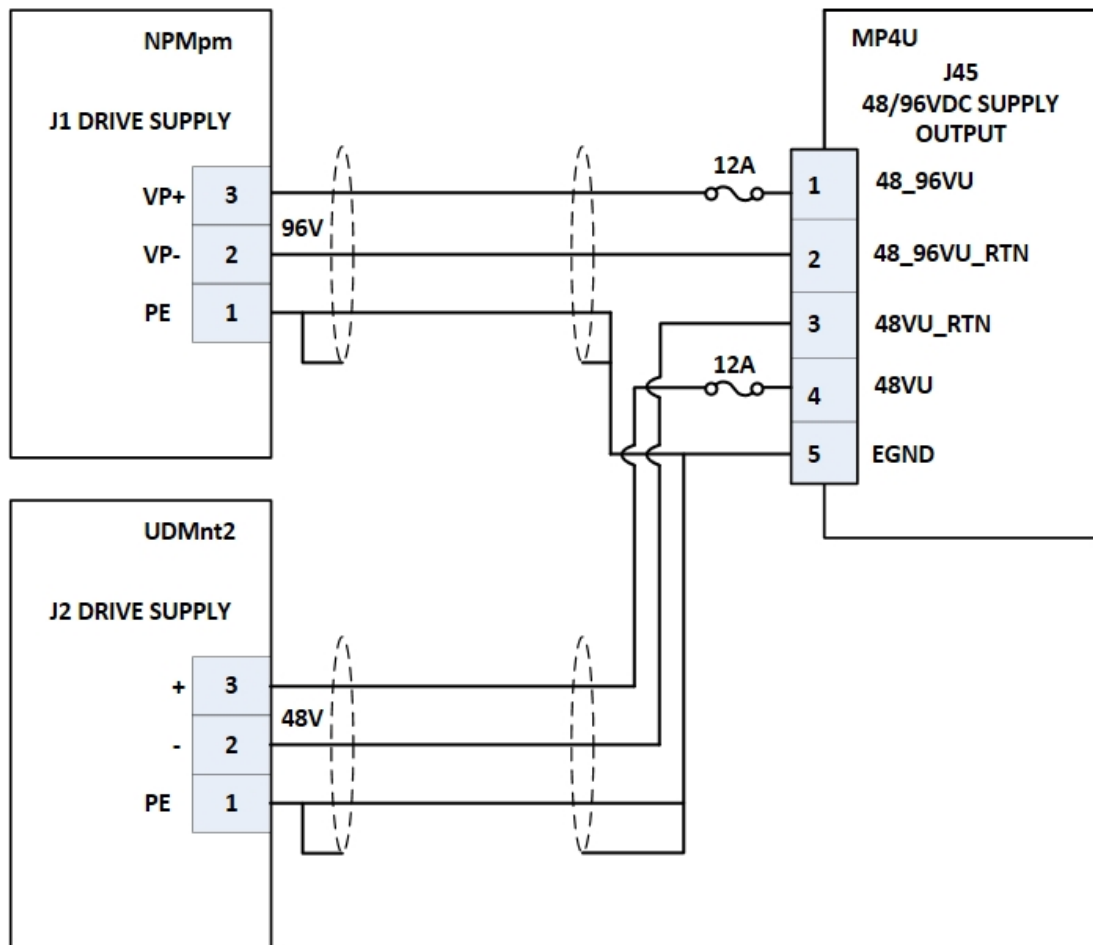   ii. 60..65Vdc for 48VDC output

   c. Type: fast-acting

Figure 5-38. Mixed (48/96VDC) supply output connection to UDMnt2 and NPMpm drive supply inputs

5.16.1.3 48VDC supply output connection diagram

1. The 48V is available on pin 1 of the J45 "48/96VDC SUPPLY OUTPUT" connector for 48V, 64A drive supply configuration

2. The 48V is available on pin 3 of the J45 "48/96VDC SUPPLY OUTPUT" connector for all drive supply configurations

3. The external fuses should be used for each of the 48V supply outputs:

   a. Current rating: 12A

   b. Voltage rating: 60...65Vdc
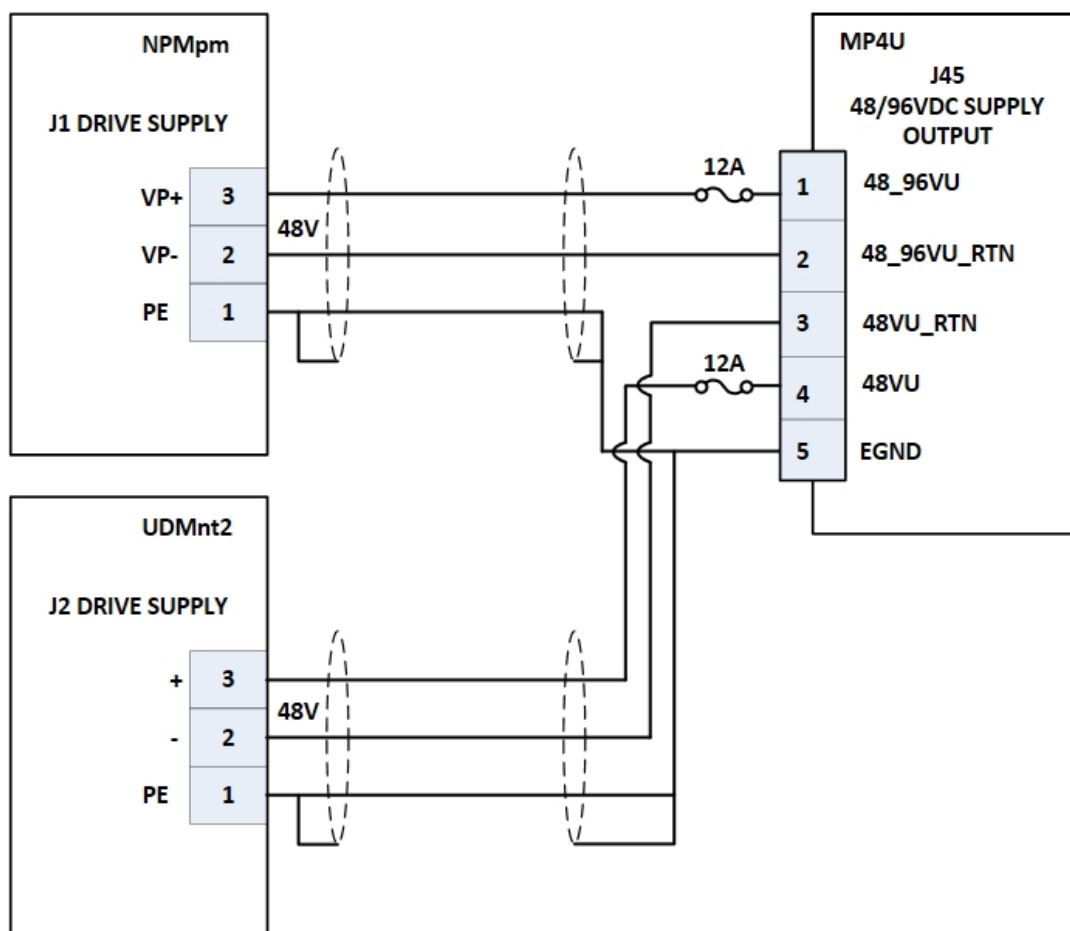
   c. Type: fast-acting

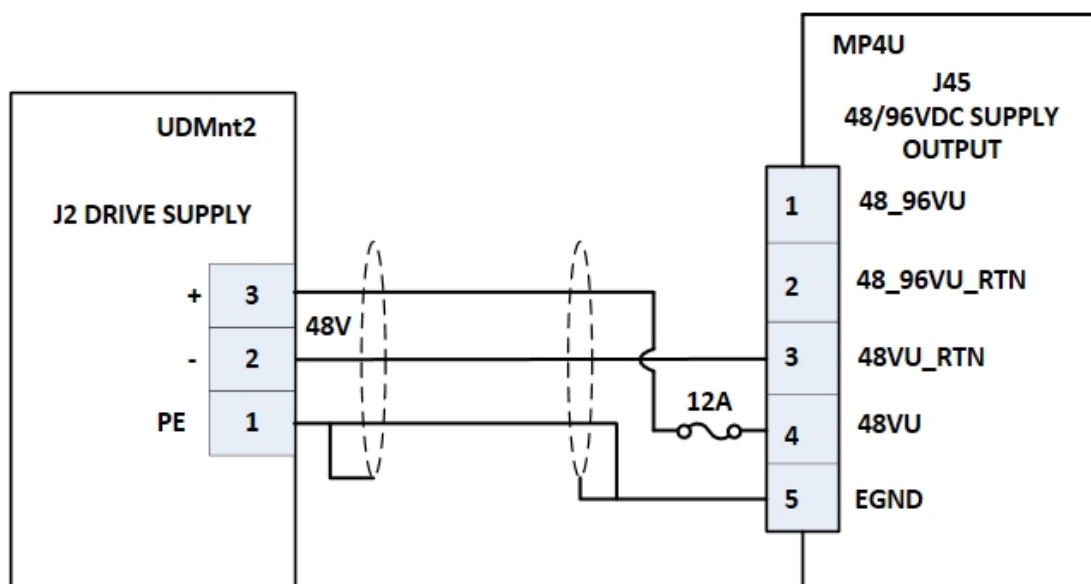Figure 5-39. 48V supply output connection for 48V, 64A drive supply configuration

Figure 5-40. 48V supply output connection for 48V, 32A drive supply configuration

5.17 PE

Label:

J52 PE

Connector	
Manufacturer	Erni
Type	PE ground terminal
Version	PCB bush with threaded hole M6
P/N	225684

Mating Connector	
Manufacturer	Molex
Type	Ring terminal
Version	Insulated ring terminal for M6 screw
P/N	193240014

For wire assembly use Molex Hand Crimp Tool: 64001-0100.

5.17.1 PE Connection instructions

The equipment grounding conductor should be connected to PE (J52) ground terminal located on the rear panel of product

> Equipment grounding conductor size: 12 - 10AWG .

> The conductor should be crimped with insulated ring terminal for M6 screw supplied with the product (type: 193240014, Molex).

> Hand Crimp Tool: 64001-0100, Molex.

> The conductor, crimped with insulated ring terminal, should be fastened to PE (J26) ground terminal by MACHINE SCREW PAN PHILLIPS M6 and WASHER SPLIT LOCK M6 STEEL supplied with the product .

5.18 Internal ACS use

Label: J68

6. Product specifications

6.1 Dimensions

> Standard 19-inch rack mount enclosure

> Length: 435.8mm (482.6mm with front brackets)

> Depth: 261.36mm (306.36mm with handles)

> Height: 265.9mm (6U)

6.2 Weight

> 12Kg for 4 drives (axes)

> 13.5Kg for 8 drives (axes)

6.3 Compliance with standards

6.3.1 Environment

> Operating range: 0 to + 45°C

> Storage and transportation range: -25 to +60°C

> Humidity (operating range): 5% to 90% non-condensing

6.3.2 CE - pending

Complies with the following standards:

> IEC 61326-3-1:2008 under 2014/30/EU directive (STO)

> EN61800-3

6.3.3 Safety - pending

Complies with the following standards:

> IEC 61800-5-1

> UL 61800-5-1

6.3.3.1 Functional safety

Complies with the following standards:

> EN61800-5-2 (defines STO)

> ISO13849 (defines PLe and CAT3)

> EN61508 (defines SIL3)

6.3.4 RoHS

Design complies with RoHS requirements.

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