



# UDM1c

## Installation Guide

September 2019

Document Revision: 2.70.10

**UDMlc**

Release Date: September 2019

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Date	Revision	Description
May 2020	3.00	Document diagnostics interface in UMD
September 2019	2.70.10	Name Change
April 2019	2.70	Added Real-time Performance Mode
October 2018	2.60.10	Updated programming example for LoadBuffer
May 2018	2.60	First release

## Conventions Used in this Guide

### Text Formats

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

### Flagged Text

	<b>Note</b> - includes additional information or programming tips.
	<b>Caution</b> - describes a condition that may result in damage to equipment.
	<b>Warning</b> - describes a condition that may result in serious bodily injury or death.
	<b>Model</b> - highlights a specification, procedure, condition, or statement that depends on the product model
	<b>Advanced</b> - 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](http://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. Product Overview

The UDMlc-2/4-048 is a 2 or 4 axes universal drive module, part of ACS line of EtherCAT® network drives. The product is small footprint, low price universal PWM network drive module, which functions as a slave of any ACS EtherCAT® master controller. It is panel and DIN rail mounted.

The product supports 12 to 48Vdc bus voltage. It's control is supplied by 15 to 48Vdc. It supports 4 axes of 1.25/2.5A, 2.5/5A (cont./peak Amperes) ratings or, 2 axes of 05/10A rating .

The following types of motors are supported: 2 and 3 phase AC synchronous (DC brushless), DC brush, 2 and 3 phase step motors.

Incremental digital encoder and Hall are provided per axis, and 2 absolute encoders are supported. The product has 4 MARK inputs and 1 PEG output. 2 serial synchronous SPI type high speed receivers are available.

Cross axis synchronization - All drives within the product are highly synchronized, and further synchronization to network-neighboring axes is achieved by a network-wide distributed clock with less than 0.1 microsecond accuracy. The control algorithms are executed at a 20 kHz rate. The EtherCAT cycle update rate is controller dependent. Cycle update rates of up to 5kHz are supported.

## 2. Operation

### 2.1 Operating UDMlc in an ACS network

The product operates as a network element in an ACS EtherCAT network. Minimal network consists of an ACS master and UDMlc-2/4-048. In this configuration a single CAT5E cable is connected from the master's EtherCAT Out port to UDMlc-2/4-048's EtherCAT In port. Host connection for configuration and control purposes connects from the host computer to the network master only, see [Communication](#) for more details.

For any network configuration, a specific setup has to be provided: this is done by using the MMI Application Studio configuration modules EtherCAT Configurator and System Configuration Wizard, see the *SPiiPlus MMI Application Studio User Guide*.

For out of box operation follow the instructions detailed below, referring to the detailed information provided in this manual and to the referred ACS documents. The product's operation depends on ordered features.

### 2.2 Setting up a network master (purchased separately)

1. Establish communication with the master by using the **SPiiPlus MMI Application Studio** and **SPiiPlus User Mode Driver**, using either Ethernet or serial interface. Refer to *SPiiPlus Setup Guide* for details.
2. Setup of EtherCAT network: use the **SPiiPlus MMI Application Studio** and **System Setup** to define the network according to ordered elements and needed network configuration. Refer to the *SPiiPlus MMI Application Studio User Guide* for details.
3. Configure the network elements, axes, and IOs: use the **SPiiPlus MMI Application Studio** and **System Configuration Wizard** module to configure all network elements, numbering and configuration. Refer to the *SPiiPlus MMI Application Studio User Guide* for details.

### 2.3 Setting up UDMlc-2/4-48

UDMLc-2/4-048 set up consists of the following stages:



Please, read the safety instruction in [Personnel Safety Guidelines](#) and closely adhere to them.

1. Prior to applying power, connect supply and control cables (refer to [Product Interfaces](#)) using pre-wired cables. For cables' pin out and connector details refer to [UDMLc-2/4-048 Connectors](#).
2. Using this HW guide, apply control and drive supply power, and setup an ACS network according to the instruction above.
3. SPiiPlusUDMLc-2/4-048 operation and programming: refer to the *ACSPL+ Programmer's Guide*, and the *SPiiPlus Command & Variable Reference Guide*.

### 3. Product Interfaces

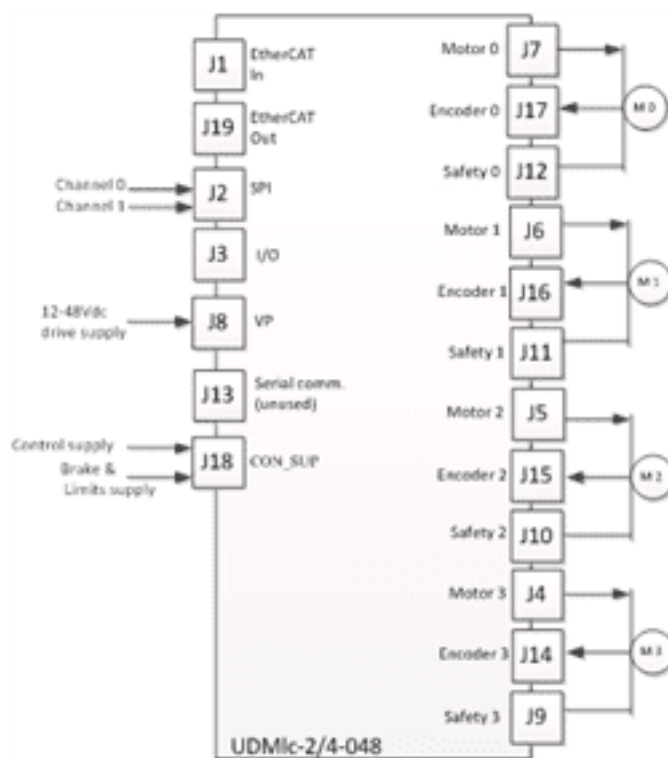


Figure 3-1. UDMlc-2/4-048 Connectors' Schematic

#### 3.1 Motor types and connections

The built-in universal drives support 2 and 3-phase permanent magnet synchronous (DC brushless/AC servo), 2 and 3-phase stepper (micro-stepping open or closed loop), DC brush, and voice coil motors. Selection of motor and parameter setting is done using the **Adjuster Wizard** of the SPiiPlus MMI Application Studio (refer to *SPiiPlus MMI Application Studio User Guide*).

A 3-phase motor connection is depicted in the two following diagrams - (Upper diagram - 1.25/2.5A and 2.5/5A, lower - 5/10A). Note that in the 5/10A version two pins per motor-phase should be connected: for example, phase R is connected to pins 1 and 2 of the corresponding connector.

Motor cable lengths should not exceed 3m. A shielded cable should be used, terminated in the EGND pin of the motor connector, which is internally connected to the chassis (PE). If needed, the shield/GND may be connected to the motor's chassis to provide a seamless common ground reference.

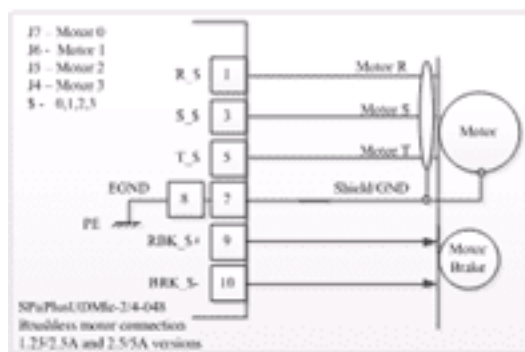


Figure 3-2. 3-Phase BL Motor Connection for 1.25/2.5A and 2.5/5A versions

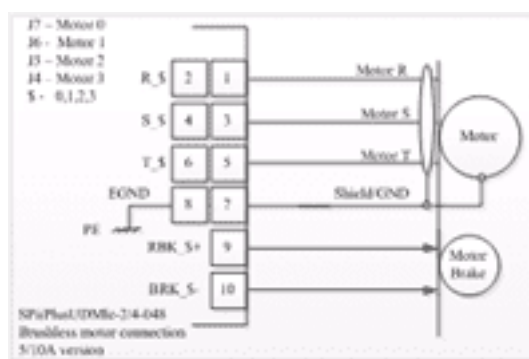


Figure 3-3. 3-Phase BL Motor Connection for 5A/10A version

For DC brush motor or voice coil do not connect phase T as described in the following diagram:

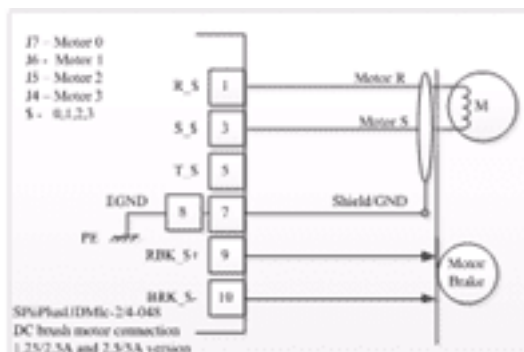


Figure 3-4. DC Brush Motor or Voice Coil Connection



For 2-phase step motors connect the motor phases between S-R and between T-R as shown in the following diagram.

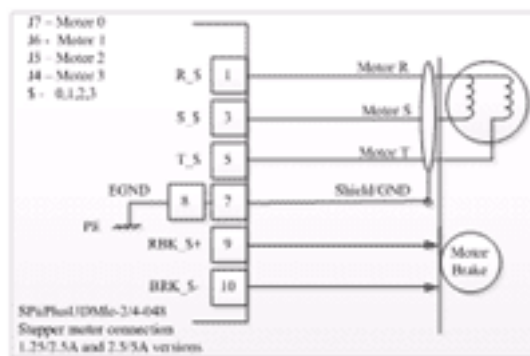


Figure 3-5. 2-Phase Step Motor Connection for 1.25/2.5A and 2.5/5A version

## **4. *Interfacing motors***

For motor cables use shielded (meshwork of tinned copper wire with high optical covering), high voltage withstand and very low capacitance cables. ACS specifies and tests this product using motor cable lengths of 3m. Motor cables should be routed as far as possible from sensitive-signal carrying cables such as encoder cables. Encoder cables should be selected according to manufacturer's recommendation. The motor cables' shield should be connected to specified pin of the motor connector: refer to connectors' pin-out in subsequent paragraphs and to the connection diagrams (see [Motor types and connections](#)).

## 5. Regeneration and over voltage

The application must ensure that under no conditions does the bus voltage exceed 52Vdc, a conditions which may damage the product's power stage. The nominal bus voltage supported is 12 to 48Vdc.

In order to absorb excess mechanical reverse energy translated into electrical energy during deceleration, and to avoid a voltage rise beyond the drive's damaging overvoltage condition, an external active regeneration device should be used, connected in parallel to the Voltage Bus (VP) inputs, and set to trip at 52Vdc.

### 5.1 Mechanical Motor Braking

One per axis control interface is provided, supplying 0.5A. The interface is fed by external 24V supply applied to J18. The control circuit is opto-isolated, and protected against shorts. Refer to the following diagram for a schematic description.

The outputs can be programmed to be used as General Purpose outputs. For more information, see the **SETCONF** command in the *SPiiPlus Command and Variable Reference Guide*.

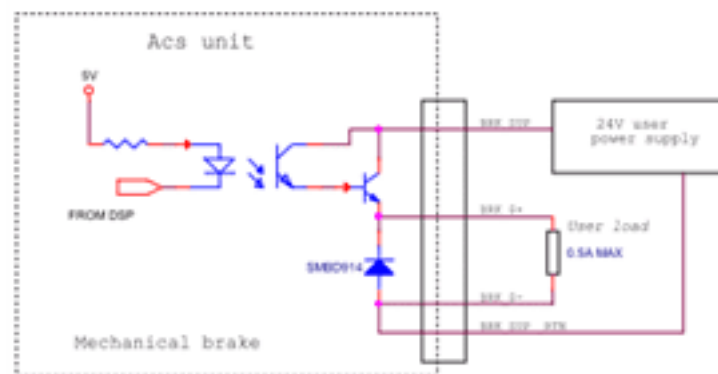


Figure 5-1. Mechanical Brake



## 6. Feedback

The UDMlc-2/4-048 supports multiple feedback types: Incremental digital (1 per axis, either differential or single-ended, software command selectable), Hall sensors (one set per axis) and up to 2 absolute encoders (in the 1.25/2.5A and 2.5/5A versions axes 0(X) and 1(A) are supported, and in the 5/10A version 1 encoder for axis 0(X)) is supported. The absolute encoders are of same type as detailed, see [Absolute Encoder Support](#). The type of absolute encoder has to be specified upon order, and cannot be modified at field level. Up to 1A at 5V is available as encoder power feed.

Certain constraints result from sharing internal resources and connector pins – detailed data for the UDMlc-2/4-048 is provided below.



The axes below have the following number-to-letter translation: 0-X, 1-Y, 2-A, 3-B.

UDMlc-2-048 (2 axes product) of 1.25/2.5A and 2.5/5A: as function of selected configuration, 2 or 4 incremental encoders and 0, 1 or 2 absolute encoders of same type are available.

UDMlc-2-048 of 5/10A is offered as a 2 axes product only, supporting axes 0(X) and 2(A).

### 6.1 Dual feedback (dual loop) scheme

Dual feedback (dual loop) topology per axis is supported at the expense of number of the total network axes. The number of utilized network axes equals the number of digital encoders used. For example, when a dual feedback scheme is implemented for an axis, 2 network axes are consumed out of the total number of network axes supported for the specific master controller.

For 1.25/2.5A and 2.5/5A versions: The secondary encoder for axis 0(X) is that of 2(A), and for axis 1(Y) is that of 3(B). A total of 2 dual-loop setups are supported.

An absolute encoder can be used as the primary axis for axis 0(X) and 1(Y).

For 5/10A version: Axes 0(X) and 2(A) is available. Axis 0(X) can use either the incremental or absolute encoder as its prime, or encoder 1(Y) as a secondary one. Axis 2(A) can use the only the incremental encoder as its prime, and encoder 3(B) as a secondary one. Refer to available configurations for dual loop schemes in the tables below.

## 7. Axis and encoder numbering and assignments

Use the following tables for axes and encoder configurations, for single loop and for dual loop applications.

**Table 7-1. 1.25/2.5A and 2.5/5A encoder configurations**

1.25/2.5A 2.5/5A		Prime encoder		Secondary encoder
Axis	Encoder deployment	Digital Incremental	Absolute	Digital Incremental
0(X)	Single loop	0(X)		
0(X)	Single loop		0(X)	
0(X)	Dual loop	0(X)		2(A)
0(X)	Dual loop		0(X)	2(A)
1(Y)	Single loop	1(Y)		
1(Y)	Single loop		1(Y)	
1(Y)	Dual loop	1(Y)		3(B)
1(Y)	Dual loop		1(Y)	3(B)
2(A)	Single loop	2(A)		
3(B)	Single loop	3(B)		

**Table 7-2. 5/10A encoder configurations**

5/10A		Prime encoder		Secondary encoder
Axis	Encoder deployment	Digital Incremental	Absolute	Digital Incremental
0(X)	Single loop	0(X)		
0(X)	Single loop		0(X)	
0(X)	Dual loop	0(X)		1(Y)
0(X)	Dual loop		0(X)	1(Y)

## 7.1 Incremental Digital AqB Encoder

[illegible]

The interface is a protected RS-422 differential line with 120Ω termination.

- 

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When single-ended encoder is selected and the pull up resistor is greater than 2.5K $\Omega$ , the encoder will not work. In this case, on the encoder connector, add a 1K $\Omega$  resistor between encoder CH\_A and 5V.

Encoders are fed by a 5V $\pm$ 5% 1A supply (the total available current to all encoders) referenced to a digital ground.

A, B, I and Clk/Dir modes of operation are supported.

## 7.2 Absolute Encoder Support

Endat2.2, Tamagawa SmartABS, Panasonic and BiSS-C encoders are supported – check with ACS regarding availability and specific encoder support. The supported encoder type is factory preset according to order.

## 7.3 Position Event Generation (PEG) for axis 0

The UDMlc-2/4-048 supports one advanced position dependent PEG output signal (referred to also as Output Compare) for synchronous random and incremental timing generation. The PEG pulse is assigned to axis 0(X) encoder, and can be programmed for polarity and shape.

The Incremental PEG mode provides the ability to generate a fixed width pulse, starting and ending at pre-programmed points.

The Random PEG mode provides the ability to control a PEG pulse at pre-defined positions, which are stored as a 256 member user-defined array. The signal can be used as a General Purpose output.



PEG does not work with Absolute encoders.

Refer to the *PEG and MARK Operations Application Note* for more details.

## 8. Power Supplies

The UDMlc-2/4-048 is fed by two supply sources: Control Supply (referred as CON\_SUP on front panel) to the logic and control circuitry, and a 12 to 48Vdc supply to the motors (referred as Vp+ and Vp- on front panel or as bus voltage supply or Vbus). In addition, dedicated supply pins are assigned for motor braking and for limit safety inputs.

### Control DC supply (CON\_SUP)

Maximal consumption of 12W (0.5A at 24Vdc), 15 to 48Vdc.

### Mechanical braking supply

Maximum of 0.5A per axis (24V±20%, opto isolated, source) is provided for motor mechanical brake activation. The brake supply is fed through dedicated pins in J18.

### Bus voltage supply

12 to 48Vdc. Maximum current 8A continuous. Peak current for 1 second is 16A.

Maximal continuous/peak input currents as functions of maximal continuous and peak Output power is presented in the following table.

Warning: Plugging the 48V supply cable while the supply is on will damage the unit. The power cord must be connected when the supply is off.

### Single supply operation

Both Control Supply and Bus Supply can be fed from a single power supply (15 to 48Vdc). Note however that this configuration disrupts the isolation of the control section from the power section, and thus impacts safety, regulation and performance of the product. Refer to [Grounding and Shielding](#) for further details.

**Table 8-1. Output Power vs. Input Current and bus voltage**

Product version Cont./Peak Arms	Input cont./peak Arms @ max output power (per axis) function of Vbus (Vdc)			Max Output power [W] cont./peak (per axis)		
Bus supply (Vdc)	12	24	48	12	24	48
1.25/2.5A (4 axes)	1.2/ 2.7	1.1/ 2.4	1.1/ 2.2	12/21	24/46	49/ 97
2.5/5A (4 axes)	2.3/ 4.8	2.2/ 4.5	2.2/ 4.4	23/42	48/92	99/ 193
5/10A (2 axes)	4.4/9	4.3/ 8.7	4.3/ 8.5	46/84	97/185	197/ 386

## 8.1 HALL Sensors

One HALL sensor set per drive is available. Each consists of a set of 3 single ended, opto isolated interfaces, with 7mA maximal current, source input type signals. The connection for a HALL sensor is shown in the following diagram.

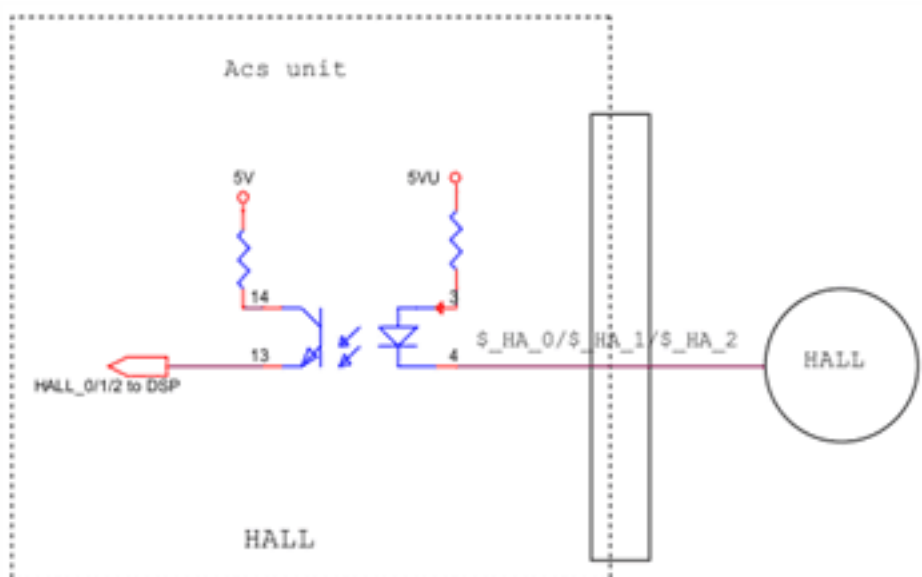


Figure 8-1. HALL Sensor Connection

## 8.2 Registration MARK Inputs

Total of four. Fast, 24V±5%, opto-isolated, two terminals available which can be configured as 'sink' or 'source'.

10mA maximum input current.

The signals can be used as general purpose fast inputs, as function of software configuration.

The opto-isolated MARK inputs have a propagation delay of up to 200 ns. For MARK and GP Input assignment refer to the *SPiPlus Command & Variable Reference Guide*.

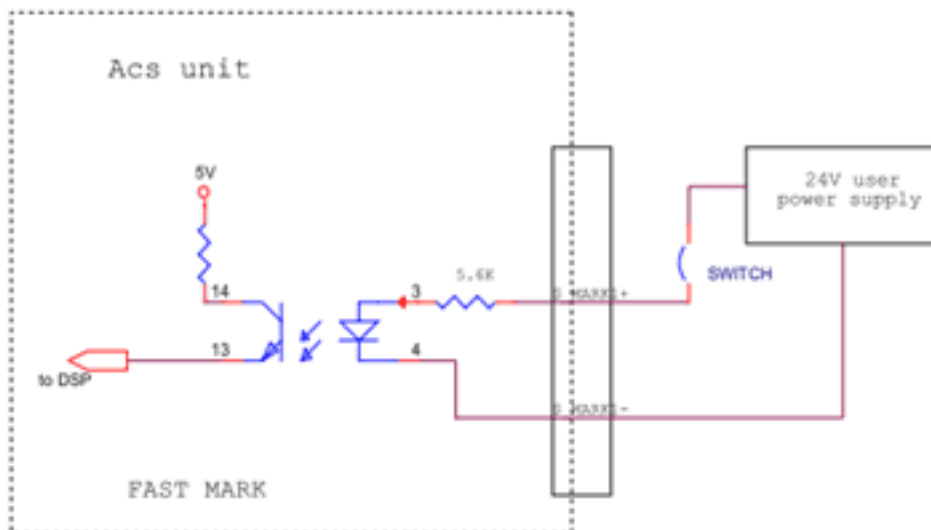


Figure 8-2. MARK inputs

### 8.3 Right and Left Limits

Right Limit and Left Limit inputs per axis are provided. The limit connections are shown in the following diagram.

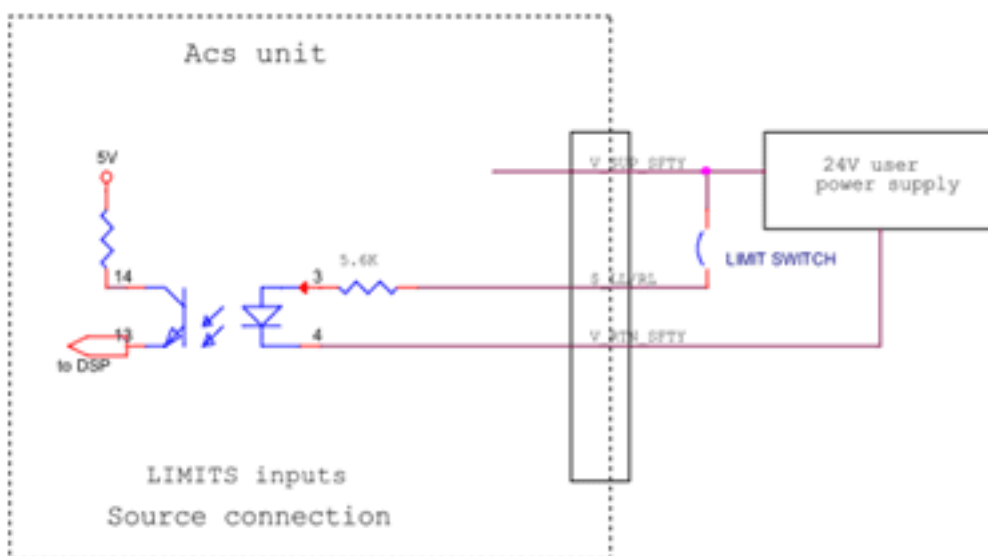


Figure 8-3. R/L Limit Connections

The inputs are single-ended, fed by a 24V  $\pm 20\%$  driving 'source', referenced to a common return signal, and internally opto-isolated. The input current is limited to 14mA, with an internal resistor is 5.6k $\Omega$ . 'No current' is defined as the default inactive state of switch.

Sink configuration available by special factory order.

## 8.4 Emergency Stop

The Emergency Stop input is a two line, opto-isolated signal, fed from a user-provided 24V supply and activated at above 14mA, as depicted in the following diagram. 'No current' is defined as the default inactive state of switch.

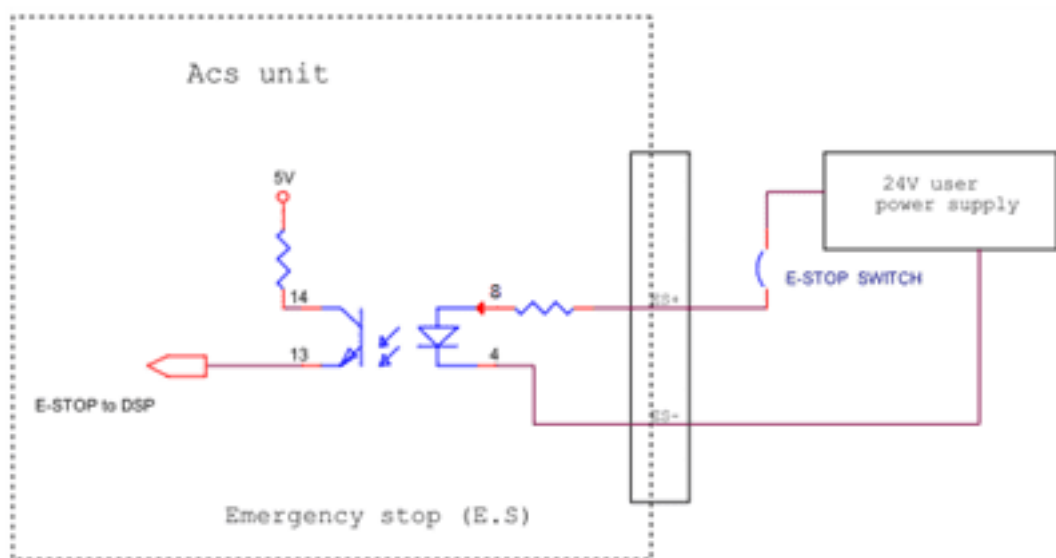


Figure 8-4. Emergency Stop Input



## 9. Fault Indications

The UDMlc-2/4-048 supports hardware – and – software -based fault indications (measured per axis and reported by software) for:

- > Over voltage at 55Vdc  $\pm 3\%$  reported by software
- > Over Temperature at 100deg C, reported by software
- > Motor Phase faults: Phase-to-Phase Short and Short-to-Ground, reported by software
- > Over Current

### 9.1 LED Indicators

The following table summarizes the meaning of the UDMlc-2/4-048 LED indicators:

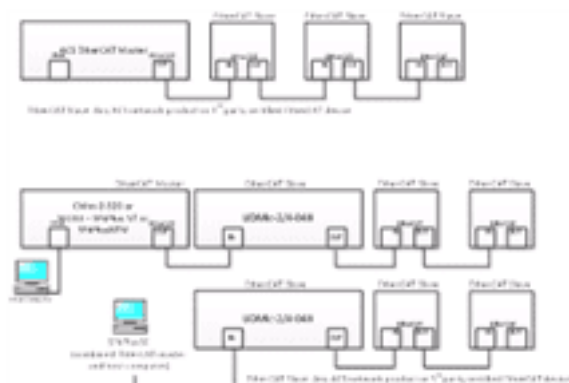
**Table 9-1. UDMlc-2/4-048 LED Indicators**

Indication	Description
Control Supply (on EtherCAT Out connector)	Yellow - when on – power is applied
Link/Activity (on EtherCAT In and Out connector)	Green - <ul style="list-style-type: none"><li>&gt; Off – No link</li><li>&gt; On – Link exists, no data transferred</li><li>&gt; Blinking – Data being transferred</li></ul>
Run (on EtherCAT In connector)	Yellow – software controlled. The LED reflects the state of the EtherCAT link <ul style="list-style-type: none"><li>&gt; Off –INIT state</li><li>&gt; Blinking (slow) –PRE-OPERATIONAL state</li><li>&gt; Single Flash- SAFE-OPERATIONAL state</li><li>&gt; On –OPERATIONAL state</li><li>&gt; Flickering (fast) –BOOTSTRAP state</li></ul>
System (on panel)	Bicolor - <ul style="list-style-type: none"><li>&gt; Red – System Fault (communication lost with master, loss of synchronization etc.)</li><li>&gt; Green – System ok</li><li>&gt; Blinking – transitional state, during command execution</li></ul>

## 10. Communication

### 10.1 Network (EtherCAT®) Communication

Being an EtherCAT network element ("slave"), the UDMlc-2/4-048 has EtherCAT IN and EtherCAT OUT ports, for connection with the product's neighboring network devices. UDMlc-2/4-048 can be positioned anywhere in the network, including being the first device connected to the master. The following schematic connectivity diagrams depict 2 sample configurations: in the upper diagram, UDMlc is connected to an ACS master which in turn is connected to a host computer. In the lower diagram, UDMPM is connected to SPiiPlusSC, which combines an EtherCAT master functionality, host application and ACS motion controller.



**Figure 10-1. EtherCAT Network Connections**

Cable type – use CAT5E or other high quality cables. ACS provides such cables at varying lengths of 30 cm to 50 m.

EtherCAT cable lengths – all ACS products have been tested with 50 m cables between adjacent nodes. At lengths of up to 100 m one should carefully test performance as function of network complexity and operating environment.

When employing the UDMlc-2/4-048 in an EtherCAT network, **System Setup** in the SPiiPlus MMI Application Studio is used for setting it up (refer to the *SPiiPlus MMI Application Studio User Guide* for details).

### 10.2 Serial RS232 port

The serial RS232 panel connector is not in use.

## 11. Thermal Considerations

The UDMlc-2/4-048 operates in 0°C to 50°C ambient temperatures. In order to determine whether air flow is needed as function of the output power and ambient temperature, use charts A and B below in the following way:

calculate the total heat dissipation of all axes used, by summing the heat dissipation per axis from chart A. As function of the ambient temperature and the calculated dissipation above, determine whether forced 10CFM air flow is needed.

The air flow should be applied through the ventilation openings of the unit when the RJ45 EtherCAT connectors are facing upwards, vertically upwards.

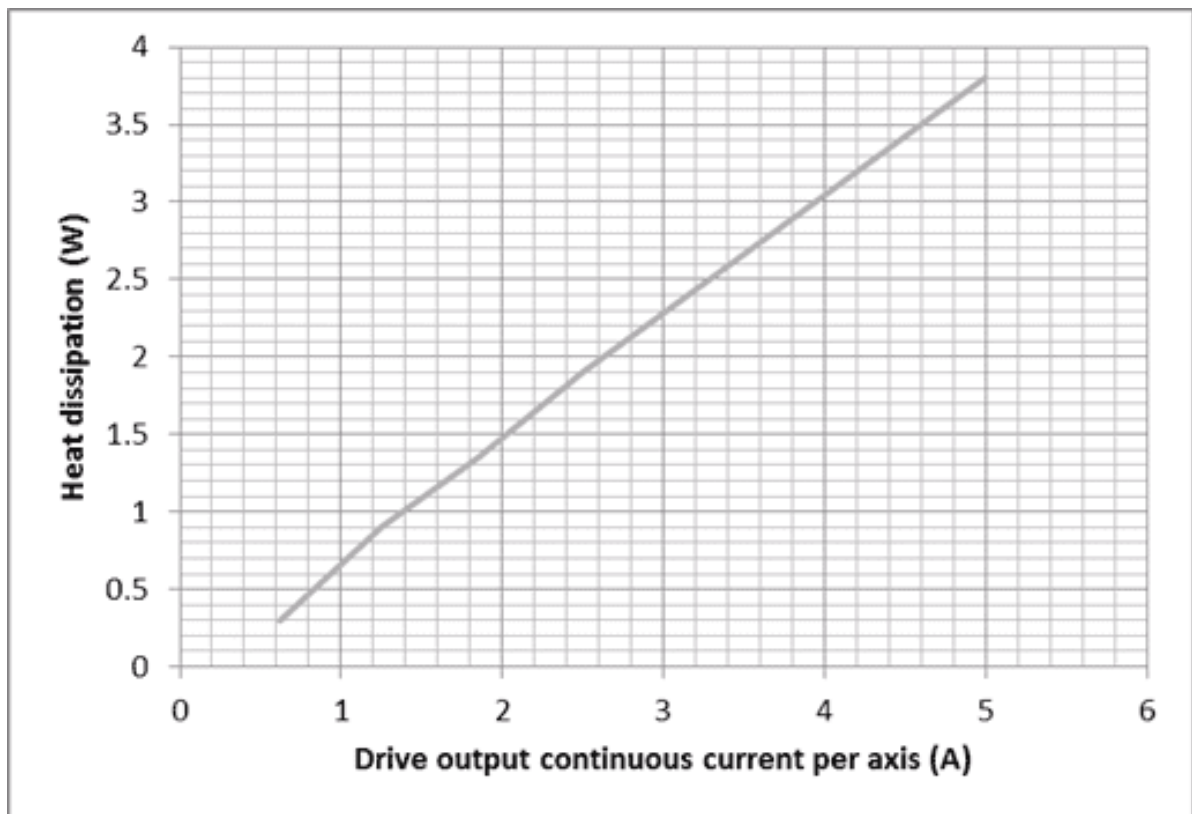


Figure 11-1. Chart A

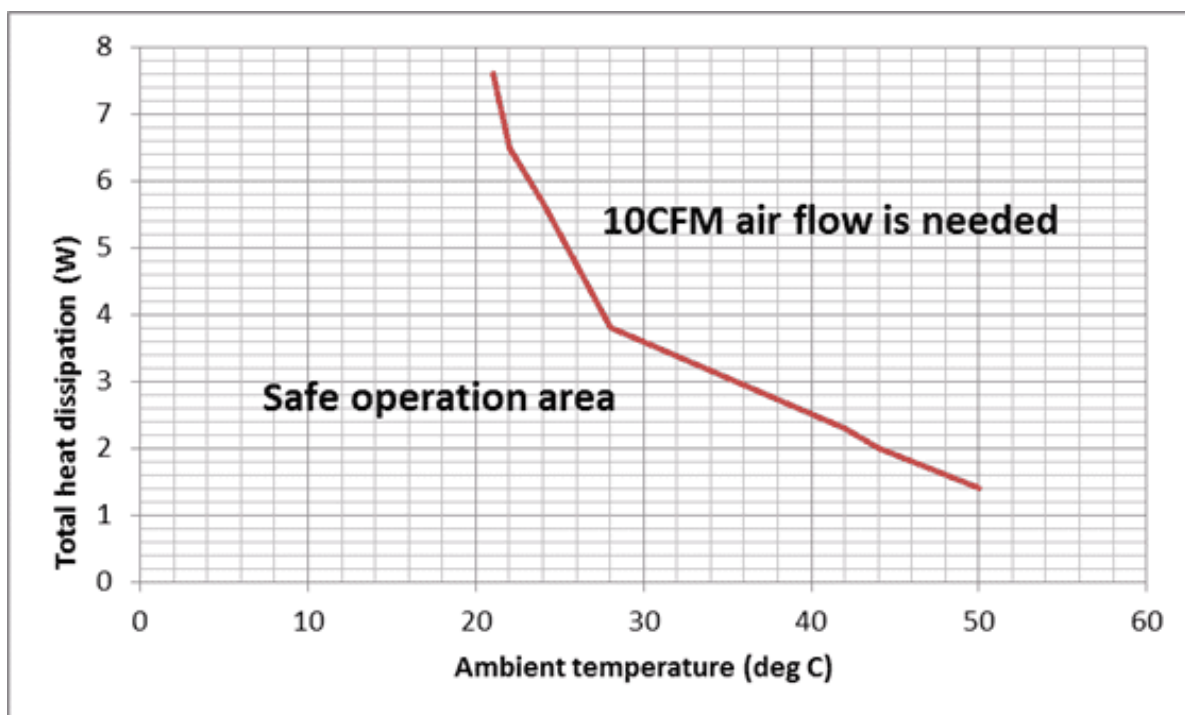


Figure 11-2. Chart B

## 12. Personnel Safety Guidelines

Make sure that the following guidelines and procedures are addressed and observed prior to powering, and while handling any of the network elements. Observing these procedures is crucial in order to achieve safe and optimal operation of ACS networking provisions.

Installation and maintenance must be performed by qualified personnel only. Such a person must be 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 network components are properly installed mechanically, properly grounded and that all attached power and signal cables are in good operating conditions. Maintenance should be performed only after the relevant network element has been powered down, and all associated and surrounding moving parts have settled in their safe mode of operation. Certain drives require longer times in order to fully discharge.

Follow the hardware guide of each element and observe the residual discharge time specified. Avoid contact with electrostatic-sensitive components and take the required precautions.

The UDMlc-2/4-048 is powered up as long as a live power inlet is connected to it. Therefore it is the responsibility of the user to provide an in-series switch or circuit breaker that disconnects all power-carrying signals which is readily and rapidly accessible to the operator. The disconnecting device must meet the requirements of IEC60947-1 or IEC60947-3. A 10A maximal rating of the circuit breaker is recommended.

Power supply should allow the circuit breaker to be activated at the product's short circuit condition.

The disconnecting device must be in close proximity to the equipment and within easy reach of the operator, and be clearly marked as a disconnecting device.

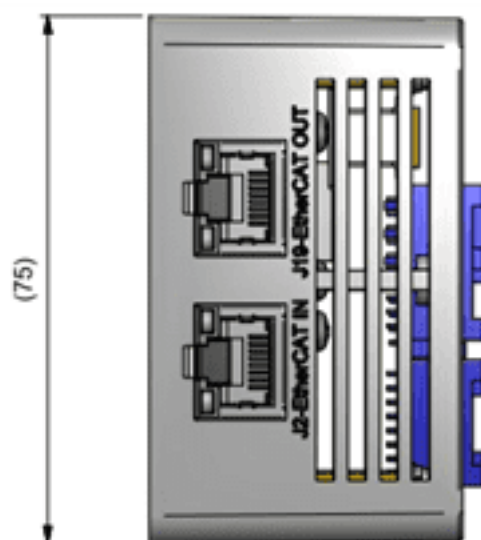
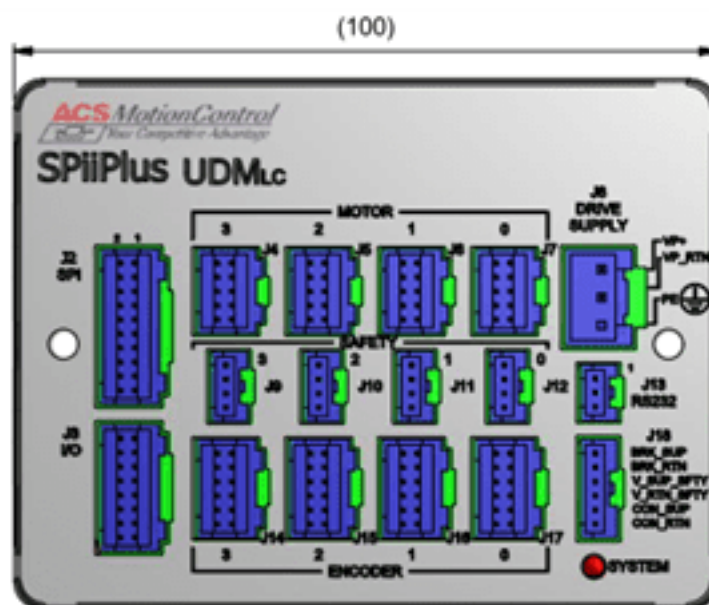
## 13. Dimensions and Installation

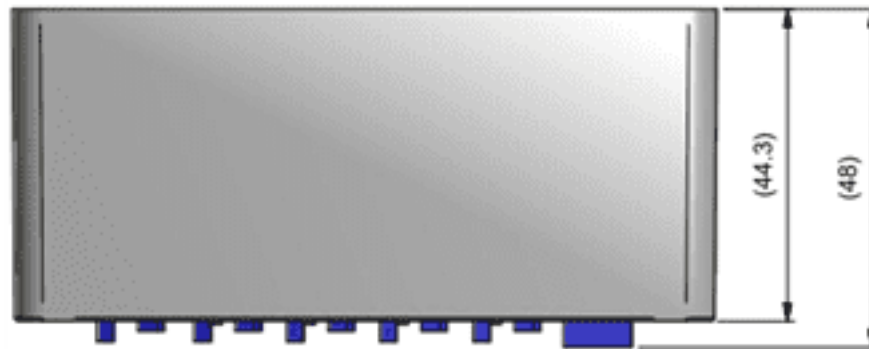
### 13.1 External Dimensions

Length: 100mm

Width: 75mm

Height: 48mm (including panel connectors).





## 13.2 Installation

The UDMlc-2/4-048 can be panel or DIN rail mounted.

### Panel mounting

Use 2 long screws of M4X50 mm type, as shown in the following figure.

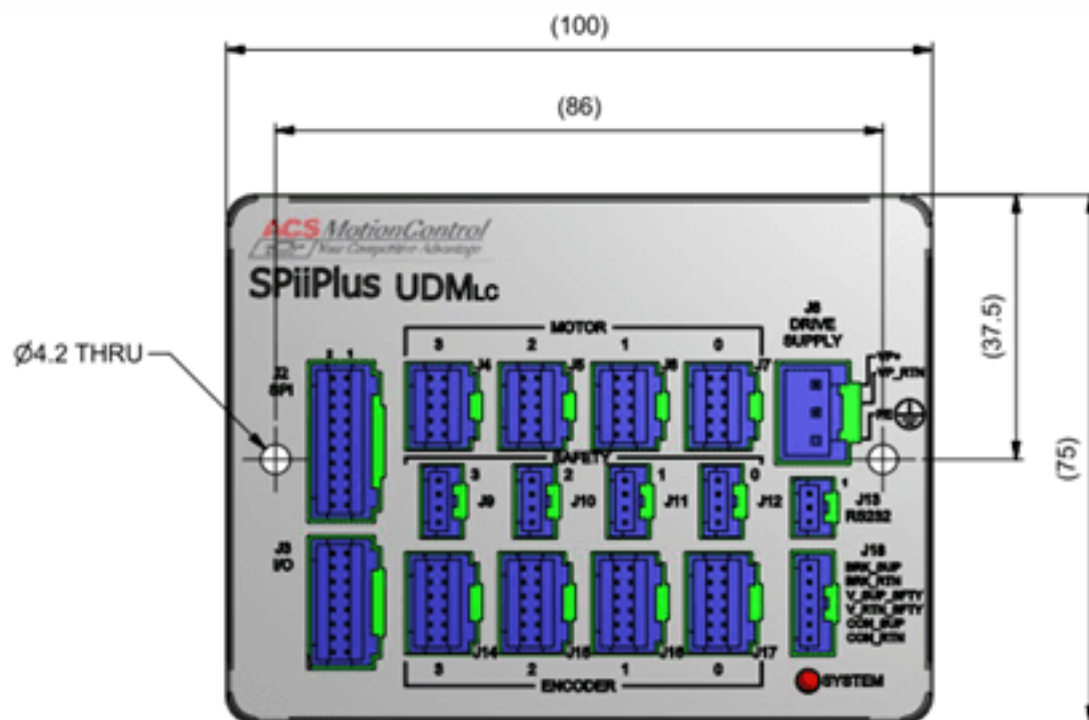
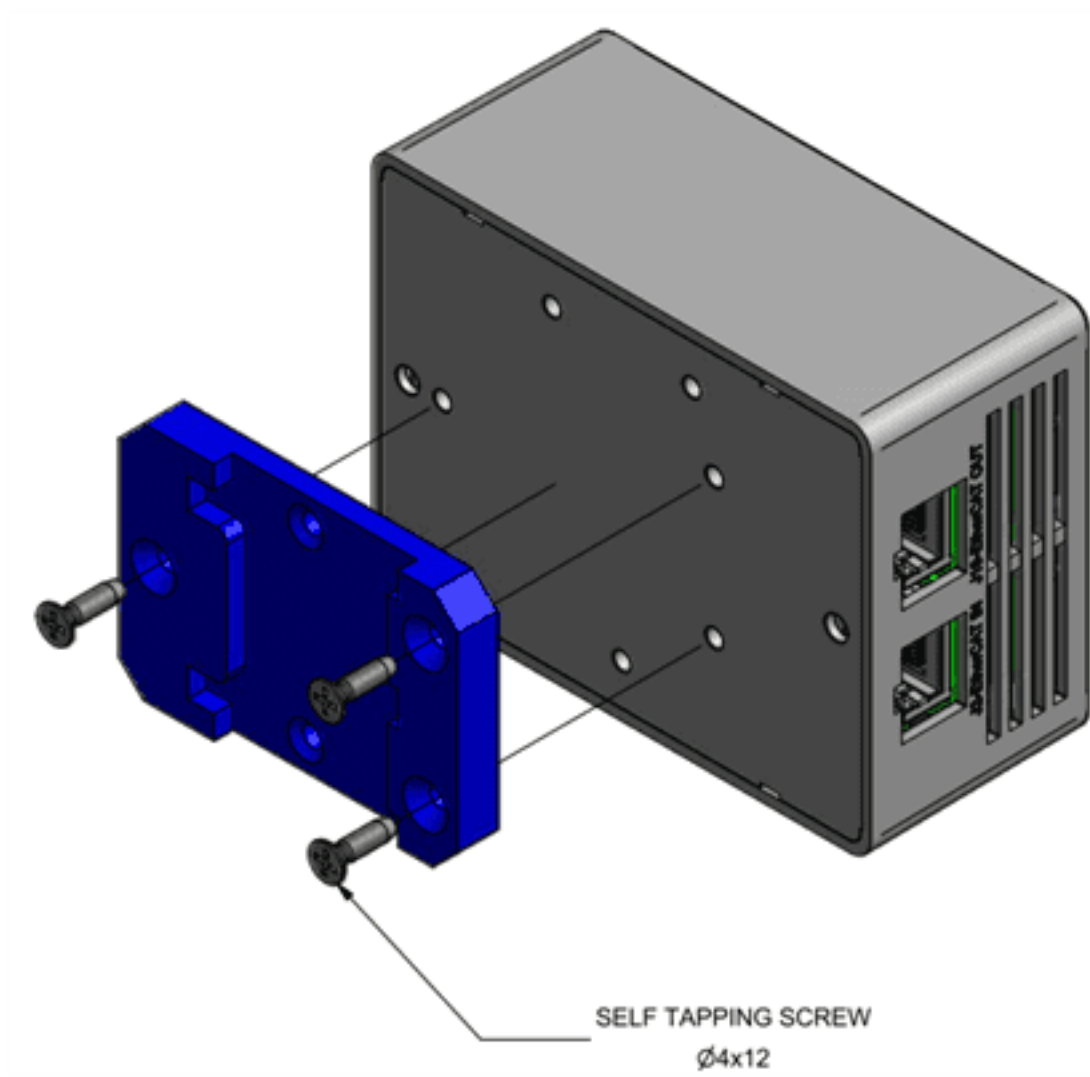


Figure 13-1. Retaining Screw Locations

### DIN rail mounting

A DIN rail adaptor is part of the ordered UDMlc-ACC accessory kit. See the following figure for mounting details and dimension.





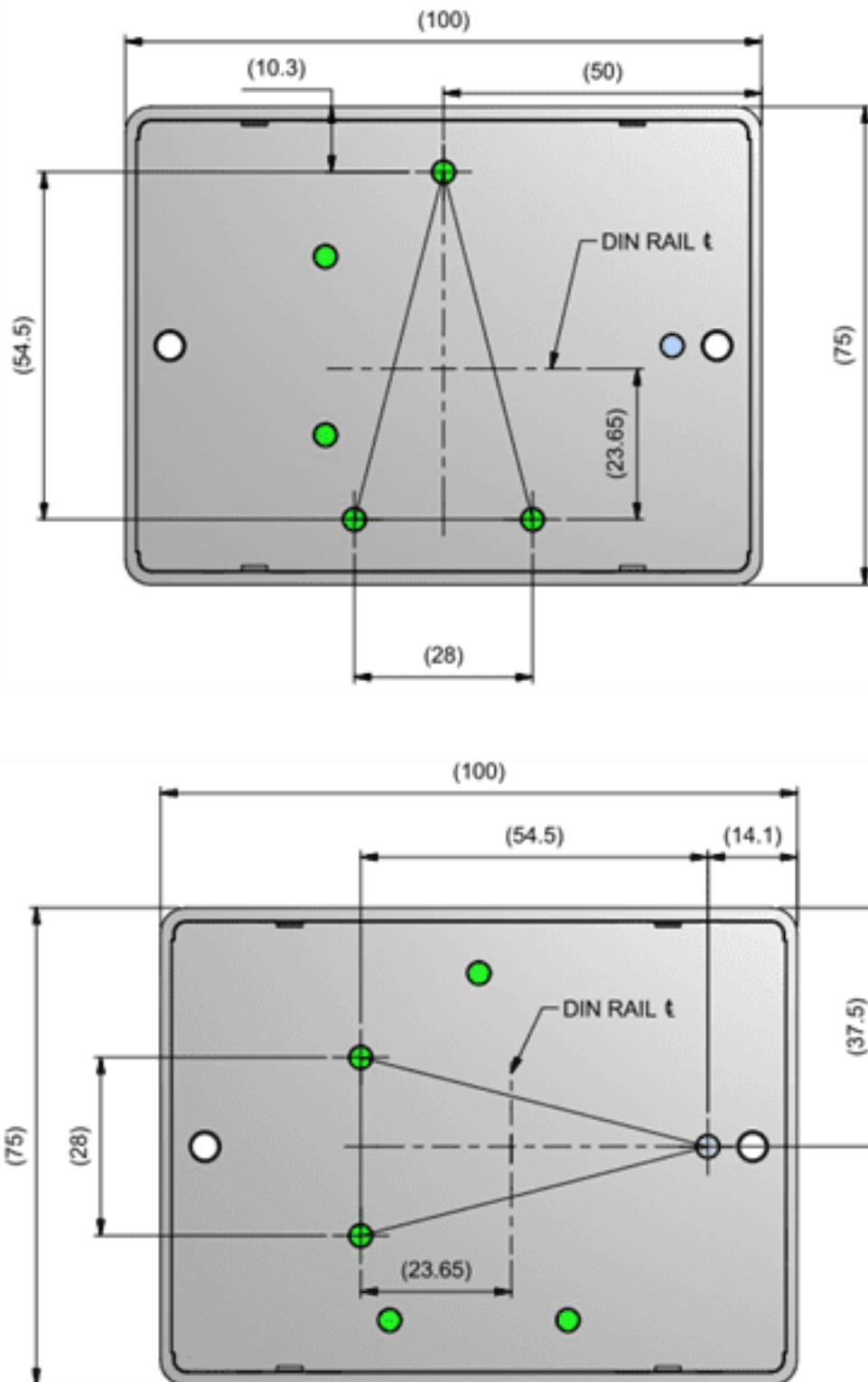


Figure 13-2. DIN rail mounting

Grounding screw: When installing the UDMlc-2/4-048, an Earth ground must be connected to PE pin in connector J8.

### 13.3 Accessory kits

Ordering options for accessories:

UDMlc-ACC1	Mating connectors' set
UDMlc-ACC2	Mating cable set with open flying leads (UDMlc side: mating connector with cable of 50cm. Application side: open flying leads).
UDMlc-ACC3	DIN rail adaptor and screws

## 14. Grounding and Shielding

The following diagram depicts the recommended scheme for shielding and motor cable connections.



The motors' and encoder's shield is connected to the EGND (PE) internal line.

The digital ground (DGND) is shortened internally to Vp[-] line. In order to reduce system noise, the user may elect to connect this common signal of Vp[-] and DGND to the EGND(PE) externally, by shortening pins 2 and 3 in the J8 connector, as depicted in figure 24 by the dotted line. It should be noted that for safety standardization testing mandate to have a separation between these signals.

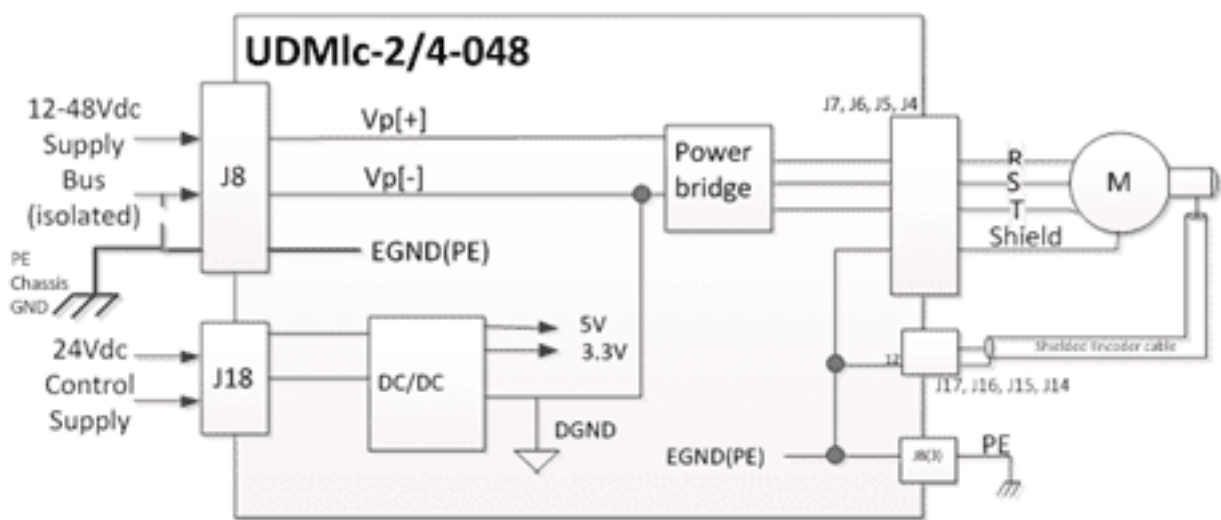


Figure 14-1. Grounding and Shielding

## 15. UDMlc-2/4-048 Specifications

This section presents the specifications for the UDMlc-2/4-48 product line.

### 15.1 General

Part Number X – number of axes YY – special options	UDMlc
Number of internal axes	2, 4
Supported control schemes	Single and Dual loop control schemes. Gantry.
Available options and configurations	Ordering options: number of axes, current rating, number of digital encoders, number of absolute encoders.
Weight	250 grams

### 15.2 Input Power

Control DC supply (CON_SUP)	15 to 48Vdc, 12Watt. Maximum input current 0.5A at 24Vdc. No need to remove the control supply during emergency conditions.
Bus voltage supply	12-48Vdc. Maximum current 8A continuous. Peak current for 1 second is 16A.
Mechanical brake supply	24Vdc 2A to support 0.5A per axis.

### 15.3 Drives

Control	Type: digital current control with field-oriented control and space vector modulation. Current ripple frequency: 40 kHz Current loop sampling rate: 20 kHz Programmable Current loop bandwidth 3 kHz. Commutation type: sinusoidal. Initiation with and without hall sensors. Switching method: advanced unipolar PWM.  Maximal drive output voltage (phase to phase) @ nominal current, sine amplitude:  $V_{bus} \times 94\% (V_{dc})$
Protection	Software fault reporting on: Over voltage, Motor Phase-to-phase short circuit, motor phase to ground short circuit, Over-current, Over-temperature
Motor types	2- and 3-phase permanent magnet synchronous. 2- and 3-phase step (micro-stepping or servo). DC brush. Voice coil.
Motor cable lengths	3m

### 15.4 Communication

EtherCAT	2 ports for Node-to-node connectivity w/o redundancy.  One port for connection in the direction of the master (IN), one port for connecting the next slave away from the master (Out).  100 Mbit/sec.  Up to 100m between adjacent nodes using standard CAT5E cables. Testing performed at 50m using ACS CAT5E cables.
RS-232 port	Unused, front panel connector only.
SPI	Receiver only, synchronous serial communication of up to 12.5Mhz.  Interface signals: data input, Clock input and chip select.
HSSI port	None

## 15.5 Encoders

Incremental digital AqB	<p>Total of 4, one per axis.</p> <p>Supports A&amp;B, I and Clk/Dir modes of operation.</p> <p>Differential or single-ended RS-422 with 120Ω termination interface.</p> <p>Max. Rate: 12.5MHz for A and B, equivalent to 50 million encoder counts/sec.</p> <p>Fault detection: Encoder error, and encoder not connected.</p> <p>Encoders are fed by a 5V±5% supply (total available current to all encoders – 1A).</p>
HALL	<p>Total of 4, a set of three per axis. Single-ended, 5V, source, opto-isolated.</p> <p>Input current: &lt;7mA.</p> <p>Consists of HA, HB and HC lines per axis</p>
Absolute position	<p>Total of 2. <b>Certain assignment constraints</b>, as function of axes and production configuration, apply. Supported types: Endat 2.2, Panasonic, SmartABS (version 2.15) and BiSS (version 2.2)</p>

## 15.6 Registration MARK input

Registration MARK Inputs	<p>Four. Fast, 24V±5%, opto-isolated, two terminals available which can be configured as 'sink' or 'source'.</p> <p>10mA maximum input current.</p> <p>The signals can be used as general purpose fast inputs, as function of software configuration.</p>
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## 15.7 Mechanical brake

Mechanical Brake	<p>One output per axis.</p> <p>24V ±20%, opto-isolated current driving signals, source type, 0.5A each.</p> <p>Protection against short circuit is provided.</p> <p>Power is provided internally from the 24V logic supply without additional protection.</p> <p>The signal can be programmed to be used as General Purpose output.</p>
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## 15.8 PEG Outputs

Dedicated PEG Signal	<p>One (assigned to axis 0(X)) pulse for incremental or random mode, differential RS-422 output. The signal can be used as general purpose output, as function of software configuration.</p> <p>For further information on PEG operation, see the <i>SPiiPlusNT PEG and MARK Operations Application Note</i>.</p>
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## 15.9 Safety and Faults

Limits	<p>Right Limit and Left Limit per axis.</p> <p>Opto-isolated, single-ended 24V± 20%, source type, referenced to a common return signal. Input current: 4-14mA.</p> <p>Software indication to user's application is provided.</p>
Emergency Stop	<p>One opto-isolated, 24V, 2-terminal signal.</p> <p>Input current: 4-14mA.</p> <p>'No current' is defined as the default inactive state of switch.</p> <p>Software indication to user's application is provided.</p>
Over temperature	<p>~100°C (on the product's PCB).</p> <p>All of product's drives are disabled upon the event.</p> <p>Software indication to user's application is provided.</p>
Over current	<p>Short and Over current - Fault error generated by software:</p> <p>7.4±5% A (per axis) for 1.25A and for 2.5/5A version</p> <p>14.8±5% A (per axis) for 5/10A version.</p> <p>The specific drive's is disabled upon the event. Software indication to user's application is provided.</p>
Bus over voltage	<p>55V±3%.</p> <p>Fault error generated by software.</p> <p>All of product's drives are disabled upon the event.</p> <p>Software indication to user's application is provided.</p>

## 15.10 Environment

Temperature during operation	0 to + 50°C. See <a href="#">Thermal Considerations</a> .
Storage	-25 to +70°C
Humidity	5% to 90% non-condensing

## 15.11 Applicable Standards

The UDMlc-2/4-048 Dual Axis Control Module meets the requirements of the following standards:

EN 61326-1:2006	Industrial locations equipment, class A standard, under article 6(2) of EMC Directive 2004/108/EC (ACSEMC_EN.22513C)
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IEC 61010-1:2001	Safety conformance, 2nd edition.
IEC 60068-2-6 Class 4M4 IEC 60068-2-29 Class 4M4 IEC 60068-2-56 Class 4K3	Sine vibration during operation (5-150 Hz, 3 axes, 10 m/s <sup>2</sup> ) 600 shocks, 150m/s <sup>2</sup> , 6ms 93%, 30C
UL 508C	Standard for Power Conversion Equipment



## 16. UDMlc-2/4-048 Connectors

### 16.1 J1 – Ethernet Input Connector



- > Label: J1 ETHERNET
- > Connector Type: RJ45
- > Mating Type: Ethernet plug

**Table 16-1. J1 Connector Pinout**

Pin	Name	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	N/C	Not connected
5	N/C	Not connected
6	RD-	Negative receive signal
7	N/C	Not connected
8	N/C	Not connected

### 16.2 J19 – Ethernet Output Connector



- > Label: J19 ETHERNET
- > Connector Type: RJ45
- > Mating Type: Ethernet plug

**Table 16-2. J19 Connector Pinout**

Pin	Name	Description
1	TD+	Positive transmit signal

Pin	Name	Description
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	N/C	Not connected
5	N/C	Not connected
6	RD-	Negative receive signal
7	N/C	Not connected
8	N/C	Not connected

### 16.3 J2 – SPI connector

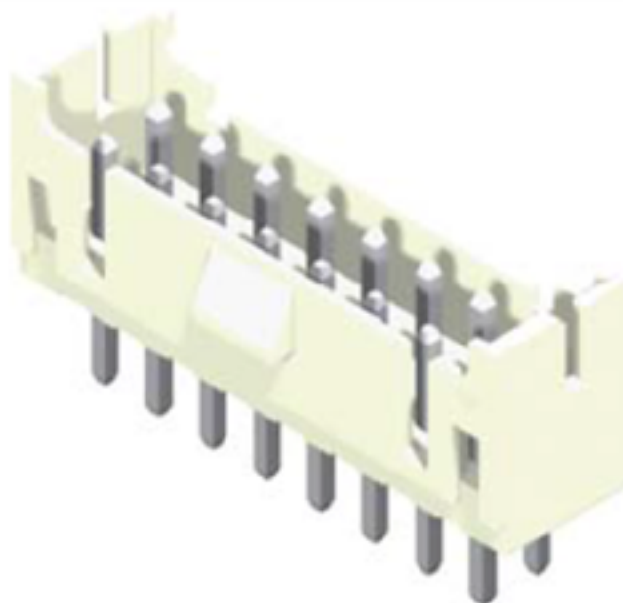
- > Label: SPI
- > Type: 20 pin 2mm pitch header. JST p/n B20B-PADSS-1F.
- > Mating type: 20 pin 2mm pitch plug. JST p/n PADP-20V-1-S.
- > Pin: SPND-001T-C0.5.

**Table 16-3. J2 Connector Pinout**

Pin	Name	Description
1	DATA_IN_0+	Data in of SPI 0 non inverter signal
2	DATA_IN_0-	Data in of SPI 0 inverter signal
3	DATA_OUT_0+	Data out of SPI 0 non inverter signal
4	DATA_OUT_0-	Data out of SPI 0 inverter signal
5	SPI_CLK_0+	Clock out of SPI 0 non inverted signal
6	SPI_CLK_0-	Clock out of SPI 0 inverted signal
7	SPI_CS_0+	Chip select of axis 0 non inverted signal
8	SPI_CS_0-	Chip select of axis 0 inverted signal
9	DATA_IN_1+	Data In of SPI 1 non inverter signal
10	DATA_IN_1-	Data In of SPI 1 inverter signal
11	DATA_OUT_1+	Data Out of SPI 1 non inverter signal

Pin	Name	Description
12	DATA_OUT_1-	Data Out of SPI 1 inverter signal
13	SPI_CLK_1+	Clock Out of SPI 1 non inverted signal
14	SPI_CLK_1-	Clock Out of SPI 1 inverted signal
15	SPI_CS_1+	Chip select of axis 1 non inverted signal
16	SPI_CS_1-	Chip select of axis 1 inverted signal
17	DGND	Digital ground
18	DGND	Digital ground
19	Shield	Shield
20	Shield	Shield

### 16.4 J3 – Input/Output Connector

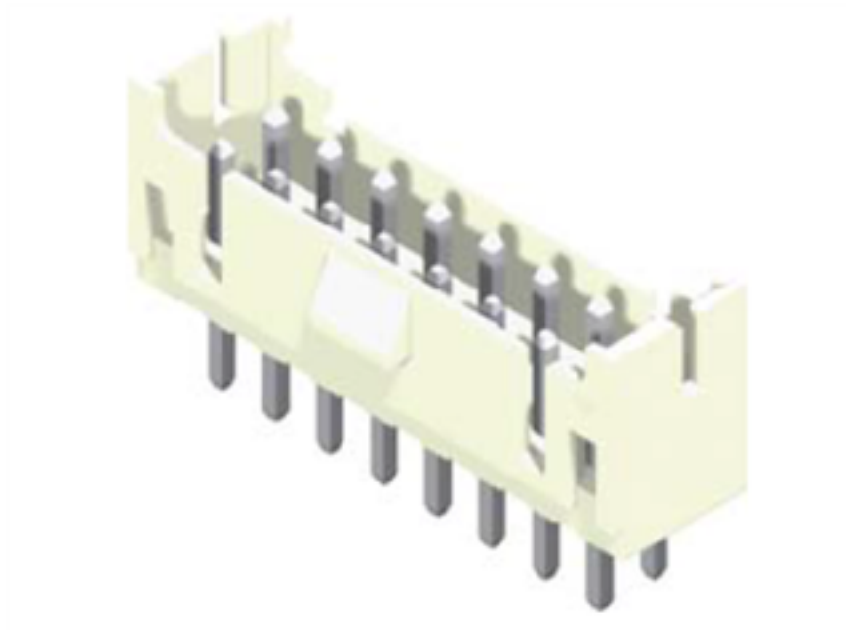


- > Label: I/O connector.
- > Type: 16 pin 2mm pitch header. JST p/n B16B-PADSS-1F.
- > Mating type: 16 pin 2mm pitch plug. JST p/n PADP-16V-1-S.
- > Pin: SPND-001T-C0.5.

**Table 16-4. J3 Connector Pinout**

Pin	Name	Description
1	MARK0+	MARK 0 non inverted
2	MARK0-	MARK 0 inverted
3	MARK1+	MARK 1 non inverted
4	MARK1-	MARK 1 inverted
5	MARK2+	MARK 2 non inverted
6	MARK2-	MARK 2 inverted
7	MARK3+	MARK 3 non inverted
8	MARK3-	MARK 3 inverted
9	PEG0+	PEG 0 non inverted output
10	PEG0-	PEG 0 inverted output
11	DGND	Digital ground
12	Shield	Shield
13	V_SUP_SFTY	Safety supply (output)
14	V_RTN_SFTY	Safety supply return (output)
15	ES+	E-STOP non inverted input
16	ES-	E-STOP inverted input

### 16.5 J4, J5, J6, J7 – Motor Connectors

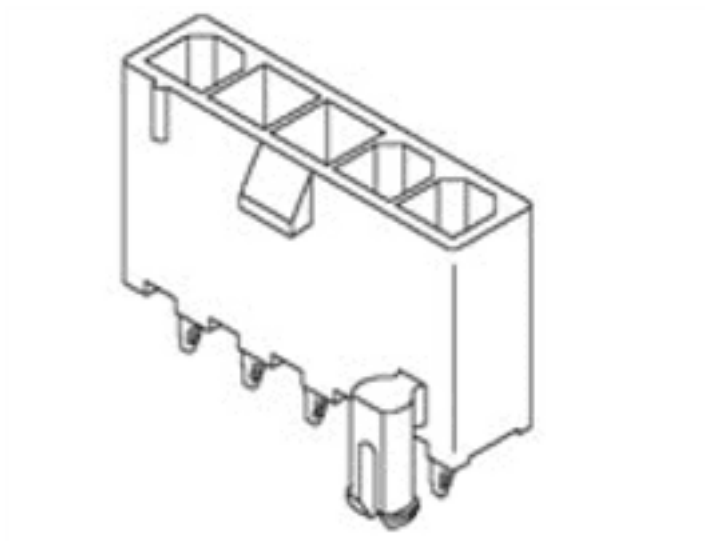


- > Label: J4 –MOTOR3, J5- MOTOR2, J6 –MOTOR1, J7- MOTOR0
- > Type: 10 pin 2mm pitch header. JST p/n. B10B-PAD55-1F.
- > Mating type: 10 pin 2mm pitch plug. JST p/n PADP-10V-1-S.
- > Pin: SPND-001T-C0.5.

**Table 16-5. J4, J5, J6, J7 Connectors' Pinout**

Pin	Name	Description
1	R_	Motor \$ R phase
2	R_	Motor \$ R phase (used for 5/10A output current version only)
3	S_	Motor \$ S phase
4	S_	Motor \$ S phase (used for 5/10A output current version only)
5	T_	Motor \$ T phase
6	T_	Motor \$ T phase (used for 5/10A output current version only)
7	EGND	EGND, protected earth.
8	EGND	EGND, protected earth.
9	BRK_+	Mechanical brake non inverted output
10	BRK_-	Mechanical brake return

## 16.6 J8 – Drive Supply

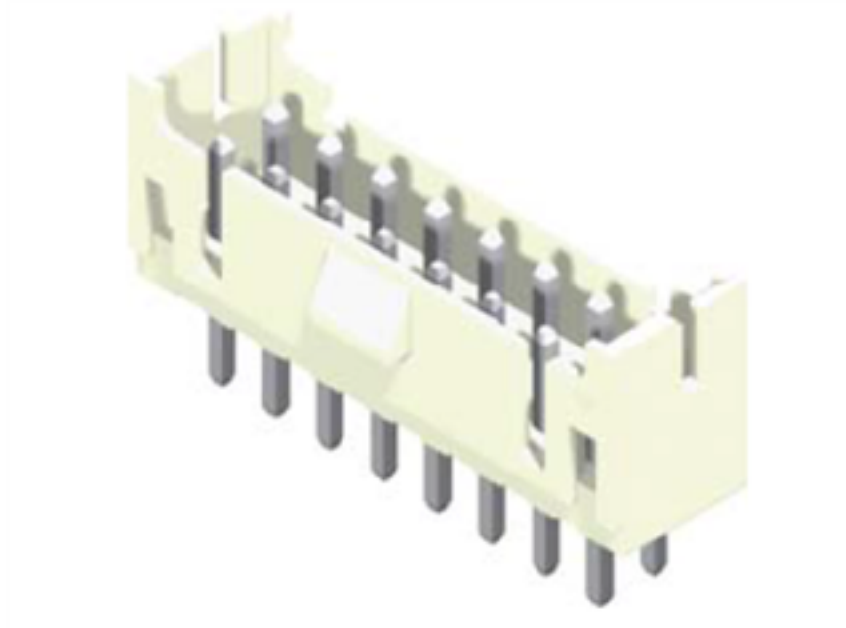


- > Label: J8
- > Type: 3 pin 3.96mm, JST p/n B3P-VH-FB-B.
- > Mating type: 3 pin JST p/n VHR-3N.
- > Pin: SVH-41T-P1.1

**Table 16-6. J8 Connector Pinout**

Pin	Name	Description
1	VP+	12-48Vdc drive supply
2	VP_RTN	Drive supply return
3	EGND (PE)	Protected earth (shield)

## 16.7 J9, J10, J11, J12 – Safety inputs Connectors



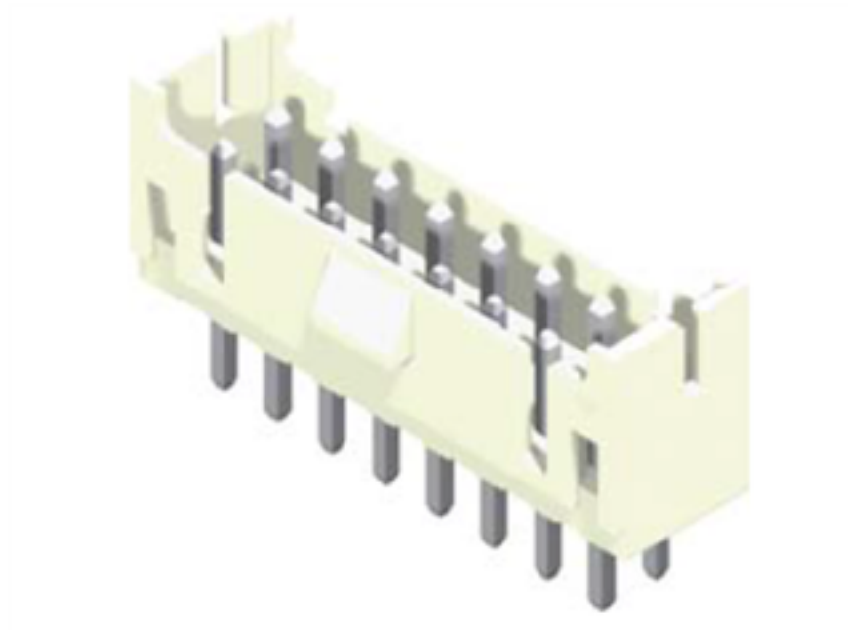
- > Label: J12 for axis 0  
J11 for axis 1  
J10 for axis 2  
J9 for axis 3
- > Type: 4 pin 2mm pitch JST p/n B04B-PASK-1.
- > Mating type: 4 pin 2mm pitch plug. JST p/n PAP-04V-S.
- > Pin: SPHD-001T-P0.5.

**Table 16-7. J9, J10, J11, J12 Connector Pinout**

Pin	Name	Description
1	\$_RL	Right limit
2	\$_LL	Left limit
3	V_SUP_SFTY	Supply for limits input.
4	V_RTN_SFTY	A return for limits input.

Note: The dollar sign (\$) in the table refers to the axis designations.

## 16.8 J13 – RS-232 (unused) connector



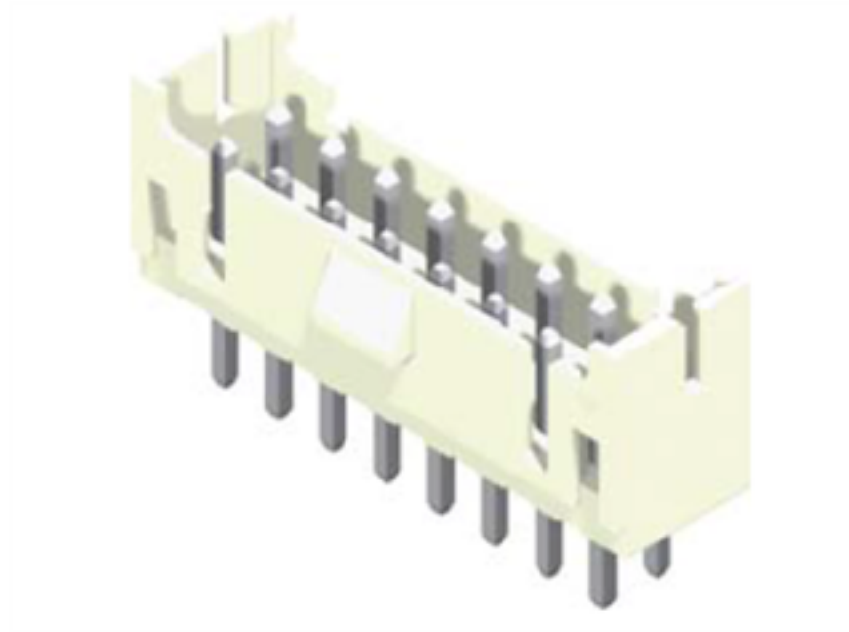
- > Label: RS232 (optional)
- > Type: J13
- > Mating type: 3 pin 2mm pitch JST p/n B03B-PASK-1.

**Table 16-8. J13 Connectors Pinout**

Pin	Name	Description
1	RX	RS232 receive signal
2	TX	RS232 transmit signal
3	DGND	Digital ground



## 16.9 J14, J15, J16, J17 – Encoder connectors



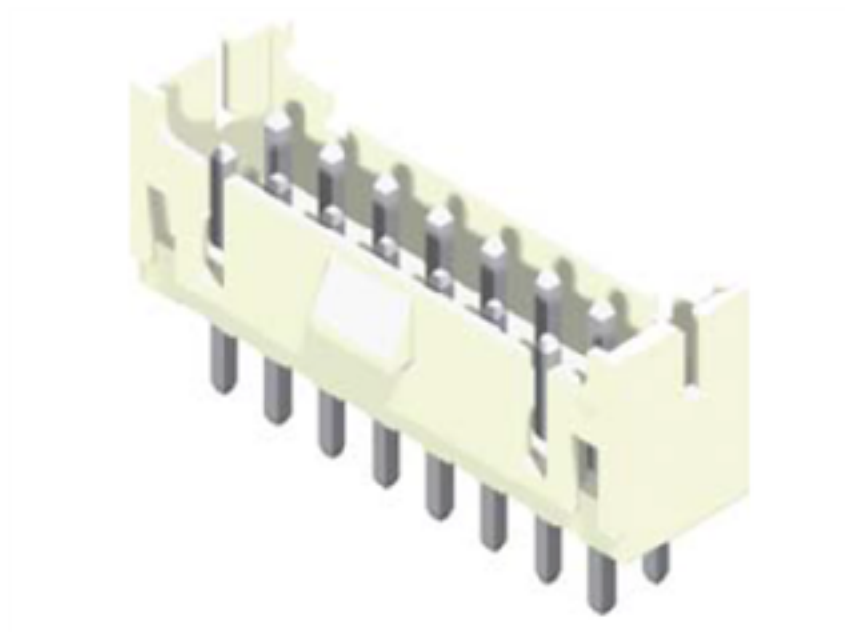
- > Label: J17 for axis 0, J16 for axis 1, J15 for axis 2, J14 for axis 3.
- > Type: 12 pin 2mm pitch header. JST p/n: B12B-PADSS-1F.
- > Mating type: 12 pin 2mm pitch plug. JST p/n PADP-12V-1-S.
- > Pin: SPND-001T-C0.5.

**Table 16-9. J14, J15, J16, J17 Connector Pinout**

Pin	Name	Description
1	\$_CHA+	\$ Encoder A non-inverted input
2	\$_CHA-	\$ Encoder A inverted input
3	\$_CHB+	\$ Encoder B non-inverted input
4	\$_CHB-	\$ Encoder B inverted input
5	\$_CHI+	\$ Encoder Index non-inverted input
6	\$_CHI-	\$ Encoder index inverted input
7	\$_HA	\$ Motor Hall A
8	\$_HB	\$ Motor Hall B
9	\$_HC	\$ Motor Hall C

Pin	Name	Description
10	5U	5V user supply for digital encoder and Hall
11	5U_RTN	5V return user supply for digital encoder.
12	Shield	Shield

### 16.10 J18 – Control, Brake and Safety Supplies



- > Label: Control, Brake and Safety supplies.
- > Type: J18, 6 pin 2mm pitch JST p/n B06B-PASK-1.
- > Mating type: 6 pin 2mm pitch plug. JST p/n PAP-06V-S.
- > Pin: SPHD-001T-P0.5.

**Table 16-10. J18 Connector Pinout**

Pin	Name	Description
1	BRK_SUP	24V brake supply positive
2	BRK_SUP RTN	Brake supply return
3	V_SUP_SFTY	24V Supply for limits input.
4	V_RTN_SFTY	A return for limits input.
5	CON_SUP	12-48V control supply
6	CON_RTN	control supply return

*Smarter*



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