UDMNT

EtherCAT Single & Dual Axis Drive Module

Installation Guide

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ACS MOTION CONTROL

UDMnt

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Revision History

Date	Revision	Description
October 2017	2.25.30	Reformatted with new template
August 2016	2.25.20	Updated related documents
July 2016	2.25.10	Reformatted document Replaced connector image for J3, J4 connector Added a table describing the assignment of digital Inputs for MARK inputs Added "U" I/O configuration option to field #8 to the Configuration as Indicated by P/N table Added description of wiring color codes for five-phase motor Added reference to SETCONF for changing digital outputs from mechanical brake to general purpose Various minor updates
July 2014	2.25	First release

Conventions Used in this Guide

Text Formats

Format	Description
Bold	Names of GUI objects or commands.
BOLD+ UPPERCASE	ACSPL+ variables and commandss
Monospace + grey background	Code example.
Italic	Names of other documents.
Blue	Web pages, and e-mail addresses.
[ ]	In GUIs indicates optional item(s)
|	In GUIs indicates either/or items

Flagged Text

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

Related Documents

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

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

Online versions for all ACS software manuals are available to authorized users at ACS Motion Control Knowledge Center.

Document	Description
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.
SPiiPlusMMI Application Studio User Guide	Explains how to use the SPiiPlus MMI Application Studio and associated monitoring tools.
EtherCAT Network Diagnostics	An application note describing how to perform diagnostics of the EtherCAT network.
SPiiPlus Setup Guide	Provides guidance on how to configure and adjust the SPiiPlus systems to work with supported types of motors and feedback devices.
PEG and MARK Operations	Application Note Provides detailed description, specification and operation instructions for PEG capabilities
Motion Control Strategies to Obtain Better Performance	An application note defining best method motion control strategies.
Controlling Gantry Tables with Cross Moving Axis	An application note describing cross moving axis gantry control.
Dual Axis PEG	An application note describing dual axis PEG usage.

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1. Introduction

1.1 Document Scope

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

2. UDMnt Overview

This chapter provides an overview of the UDMnt, the available product options as well as all of the available kits and accessories associated with it.

2.1 Description

The UDMnt is a line of dual and single axis EtherCAT drives, compatible with any of ACS Motion Controller and EtherCAT master.

Figure 2-1 provides an overview of the UDMnt interface.

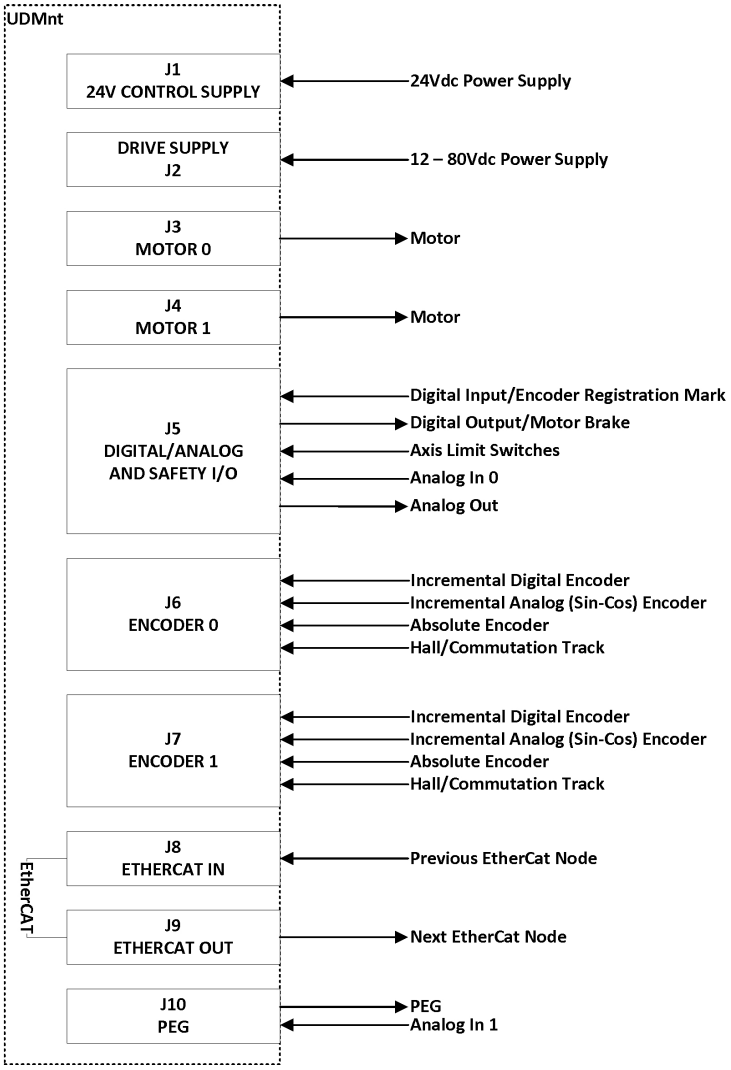

Figure 2-1. UDMnt Interface Block Diagram

2.2 Connectors

The figure and table below show the location and description of the connectors on the UDMnt unit.

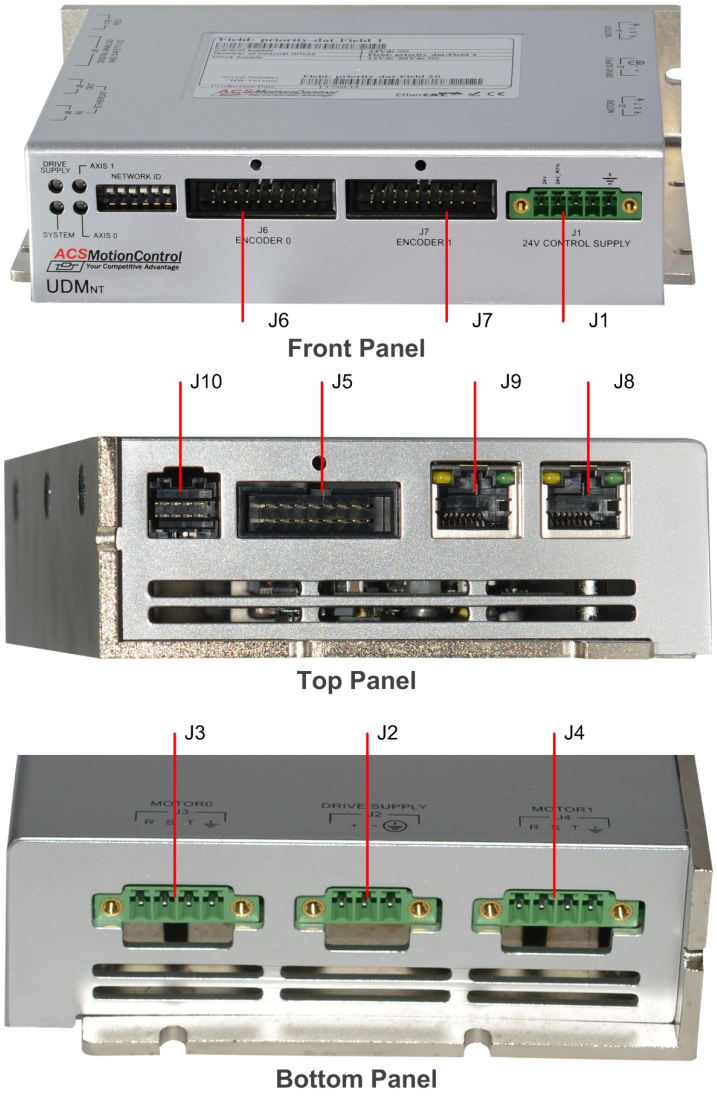

Figure 2-2. UDMnt Connectors - Location

Table 2-1. UDMnt Connectors

Connector	Name	Description
J1	24V CONTROL SUPPLY	Powers all low voltage / logic circuitry
J2	DRIVE SUPPLY	Powers the drives and motors
J3	MOTOR 0	Motor 0

Connector	Name	Description
J4	MOTOR 1	Motor 1
J5	DIGITAL/ANALOG and SAFETY I/O	General purpose inputs / encoder registration mark inputs, analog Input 0, axes' Limit Switch inputs
J6	ENCODER 0	Encoder and Hall inputs for MOTOR 0 (Axis 0)
J7	ENCODER 1	Encoder and Hall inputs for MOTOR 1 (Axis 1)
J8	ETHERCAT IN	EtherCat input
J9	ETHERCAT OUT	EtherCat output
J10	PEG	PEG, analog input 1

The Network ID dip switch is not used and its setting has no effect on the operation of the product.

2.3 Indicators

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

Figure 2-3. UDMnt Indicators - Front Panel

Table 2-2. UDMnt Front Panel Indicators - Description

LED	Description	Notes
Axis 0 Axis 1	Dual color LED: > Green - drive is on > Red - drive is off due to fault > Off - drive is off	
Drive Supply	Green LED: > On - drive supply is on	

LED	Description	Notes
	> Off - drive supply is off	
Systems	Dual color LED: > Red/Off - communication fault > Green/Blinking - normal operation - master communicating with slave	Refer to the *EtherCAT Network Diagnostics* for troubleshooting.

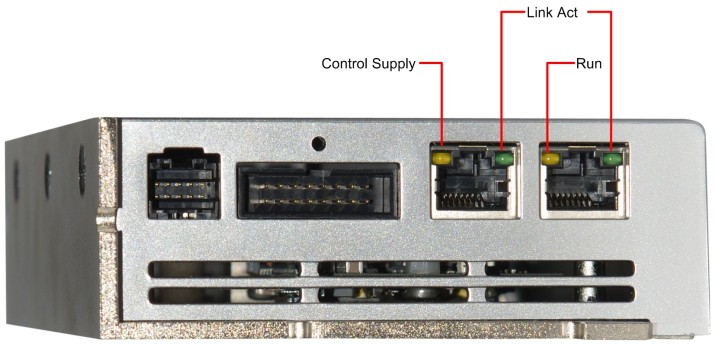

Figure 2-4. UDMnt Indicators - Top Panel

Table 2-3. UDMnt Top Panel Indicators

LED	Description	Notes
Link Act	Green LED: > On - connected but not communicating with master > Blinking - communicating with master > Off - not connected	One on each EtherCAT port.
Run	Yellow LED: > On - network communication is OK > Blinking/Off - network communication error	
Control Supply	Yellow LED: > On - control supply is on > Off - control supply is off	

2.4 Order Part Number

The ordering part number (P/N) contains eight characters (see Figure 2-5) that designate the configuration ordered for the UDMnt module as explained in Table 2-4.

Table 2-4. Configuration as indicated by P/N

Ordering Options	Field	Example User Selection	Available Ordering Option Values
Number of axes	1	2	1, 2
Continuous/Peak Current	2	B	2.5/5A (A), 5/10A (B), 10/20A (C)
Number of encoder channels	3	2	1 (for single axis only), 2
500kHz SIN-COS	4	0	0,1,2
5MHz SIN-COS	5	0	0,1,2
Absolute encoder type	6	N	All - (U), None(N), EnDat 2.2(E), Smart Abs(S), Panasonic(P), Biss-C(B)
# of absolute encoder interfaces	7	0	0,1,2
Special HW option	8	D	(D) or (N) Inputs & Limits: 24V/SOURCE (PNP). Outputs: 24V/SOURCE (PNP) (S) Inputs & Limits: 24V/SINK (NPN). Outputs: 24V/SOURCE (PNP) (R) Inputs & Limits: 5V/SOURCE (PNP). Outputs: 5V/SOURCE (PNP) (T) Inputs & Limits: 5V/SINK (NPN) Outputs: 5V/SOURCE (PNP) (U) Inputs 24V/SOURCE (PNP), Limits 24V/SINK (NPN), Outputs 24V/SOURCE (PNP)

For example, P/N UDMnt2B200N0D, represents the configuration described in Table 2-5.

Table 2-5. P/N Example

Field		1	2	3	4	5	6	7	8
P/N	UDMnt	2	B	2	0	0	N	0	D

TheUDMnt is shipped with the configuration set as ordered. The configuration cannot be modified by the user.

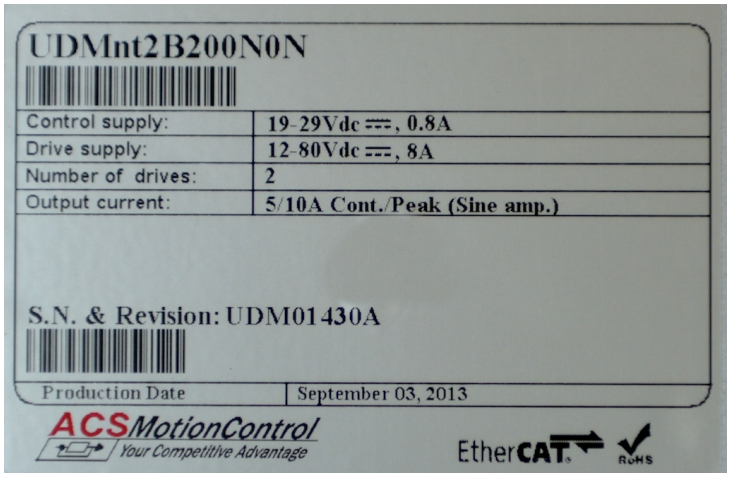

Figure 2-5. UDMnt label with ordering PN

2.5 UDMnt Package Content

The UDMnt package contains the following items:

- UDMnt Module
- Control Supply Mating Connector and Locking Clips Kit

2.5.1 Control Supply Mating Connector and Locking Clips Kit

This kit comes with the UDMnt.

ACS P/N: CK-169000-000/LF.

Table 2-6. Control Supply Mating Connector and Locking Clips Content

Ref.	P/N	Qty	Manufacturer	Description
1	1827732	1	PHOENIX	24V CONTROL SUPPLY mating connector (J1) MC1,5/3-STF-3,81
2	GG-16900-00	2	ACS	Locking clip for encoder mating connectors (J6, J7) (see note below)
3	GG-16900-01	1	ACS	Locking clip for Digital, ANalog and Limit I/O mating connector (J5)
4	SC-10036-120	3	Many	Phillips type screw 4 x 3/8

The two types of clips are similar. Make sure to use the proper one for each connector. The difference between the two types is shown in Figure 2-6 and Figure 2-7.

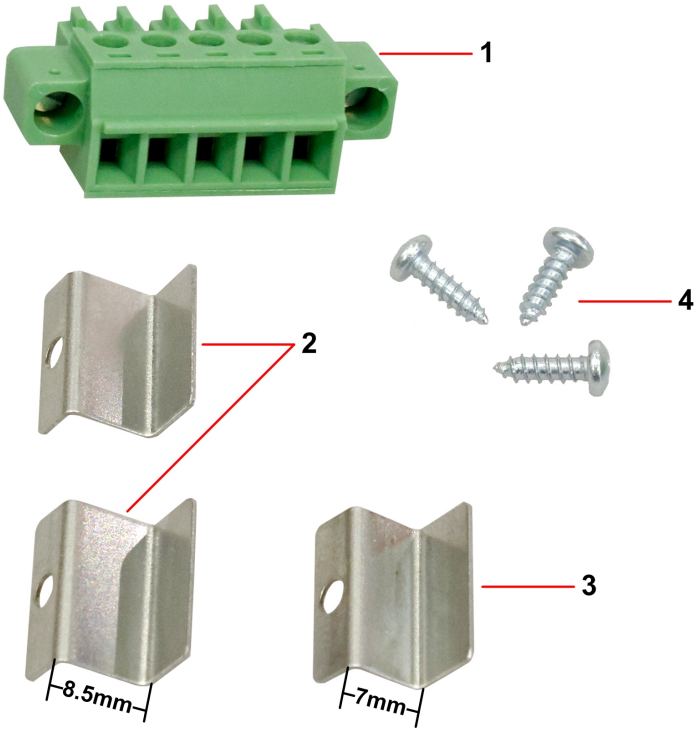

Figure 2-6. Control Supply Mating Connector and Locking Clips Kit

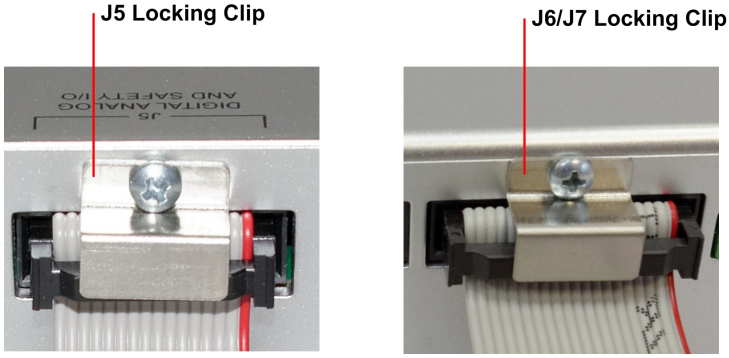

Figure 2-7. Connector Locking Clips

2.6 Optional Kits and Accessories

The following kits are available:

- **UDMNT MATING CONNECTORS AND ACCESSORIES KIT** - A set of mating connectors, excluding the 24V CONTROL SUPPLY (J1) mating connector that is included in the UDMnt package.
- **UDMNT SINGLE AXIS BREAKOUT BOX ACCESSORY KIT** - A set of cables, connectors and breakout modules for the single axis UDMnt. Recommended for fast prototyping.
- **UDMNT DUAL AXIS BREAKOUT BOX ACCESSORY KIT** - A set of cables, connectors and breakout modules for the dual axis UDMnt. Recommended for fast prototyping.

2.6.1 UDMnt Mating Connectors and Accessories Kit

ACS P/N: UDMnt-ACC1.

Table 2-7. UDMnt Mating Connectors and Accessories Kit Content

Ref.	P/N	Qty	Manufacturer	Part Description
1	1827716	1	PHOENIX	DRIVE SUPPLY (J2) mating connector MC 1,5/3-STF-3,81
2	1827729	2	PHOENIX	MOTOR (J3,J4) mating connectors MC 1,5/4-STF-3,81
3	612 020 230 2	2	Wurth Elektronik	Encoder mating connectors (J6,J7) Header 20 pin, female 2.54mm
4	612 016 230 21	1	Wurth Elektronik	Digitak, Analog and Safety I/O (J5) mating connector Header 16 pin, female 2.54mm
5	PADP-10V-1-S	1	JST	PEG mating connector housing (J10)
6	SPND-001T-C0.5	10	JST	Mating Connector pins

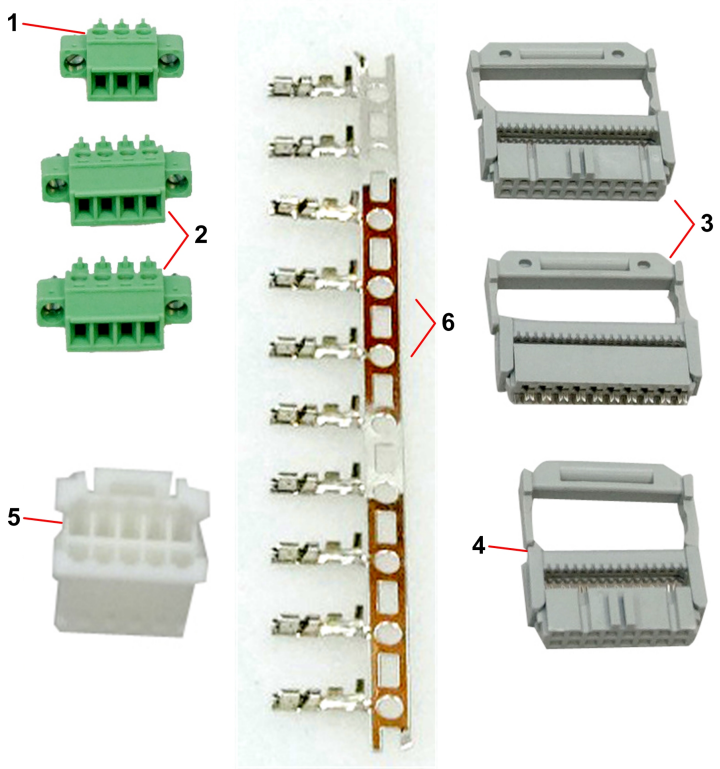

Figure 2-8. UDMnt Mating Connectors and Accessories Kit

2.6.2 UDMnt Single Axis Breakout Box Accessory Kit

ACS P/N: UDMnt-1-BOB.

Table 2-8. UDMnt Single Axis Breakout Box Accessory Kit

Ref.	P/N	Qty.	Manufacturer	Part Description
1	CB-16900-000/LF	1	ACS	0.5m cable with mating connector to PEG (J10)
2	1827716	1	PHEONIX	DRIVE SUPPLY (J2) mating connector MC 1,5/3-STF-3,81
3	1827729	1	PHEONIX	MOTOR (J3,J4) mating conntectors MC 1,5/4-STF-3,81
4	2962641	1	PHEONIX	Digital, Ananlog and Safety I/O (J5) UM45-FLKS16 VARIOFACE module. 16 positions
5	2962654	1	PHEONIX	Encoder(J6, J7) UM45-FLKS20 VARIOFACE module. 20 positions
6	FC-01616-50	1	ACS	0.5m flat ribbon cable, 16 pins
7	FC-02020-050	1	ACS	0.5m flat ribbon cable, 20 pins

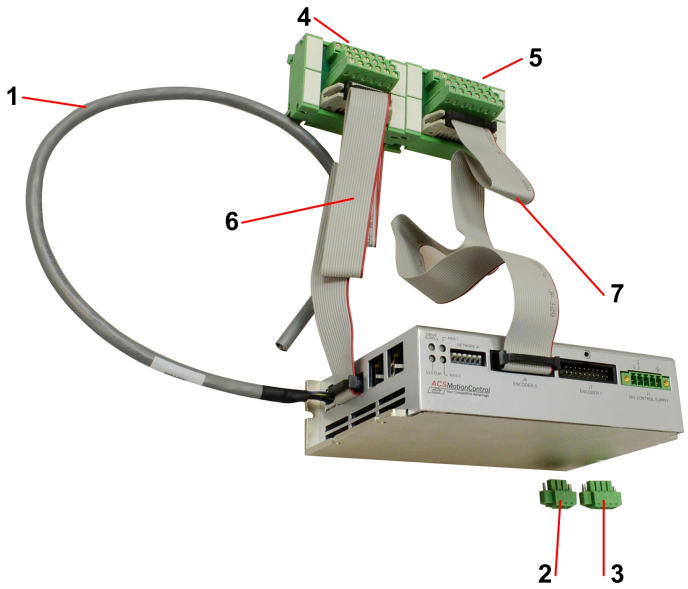

Figure 2-9. UDMnt Single Axis Breakout Box Accessory Kit

2.6.3 UDMnt Dual Axis Breakout Box Accessory Kit

ACS P/N: UDMnt-2-BOB.

Table 2-9. UDMnt Dual Axis Breakout Box Acessory Kit

Ref.	P/N	Qty.	Manufacturer	Part Description
1	CB-16900-000/LF	1	ACS	0.5m cable with mating connector to PEG (J10)
2	1827716	1	PHEONIX	DRIVE SUPPLY (J2) mating connector MC 1,5/3-STF-3,81
3	1827729	2	PHEONIX	MOTOR (J3,J4) mating conntectors MC 1,5/4-STF-3,81
4	2962641	1	PHEONIX	Digital, Ananlog and Safety I/O (J5) UM45-FLKS16 VARIOFACE module. 16 positions
5	2962654	21	PHEONIX	Encoder(J6, J7) UM45-FLKS20 VARIOFACE module. 20 positions
6	FC-01616-50	1	ACS	0.5m flat ribbon cable, 16 pins
7	FC-02020-050	1	ACS	0.5m flat ribbon cable, 20 pins

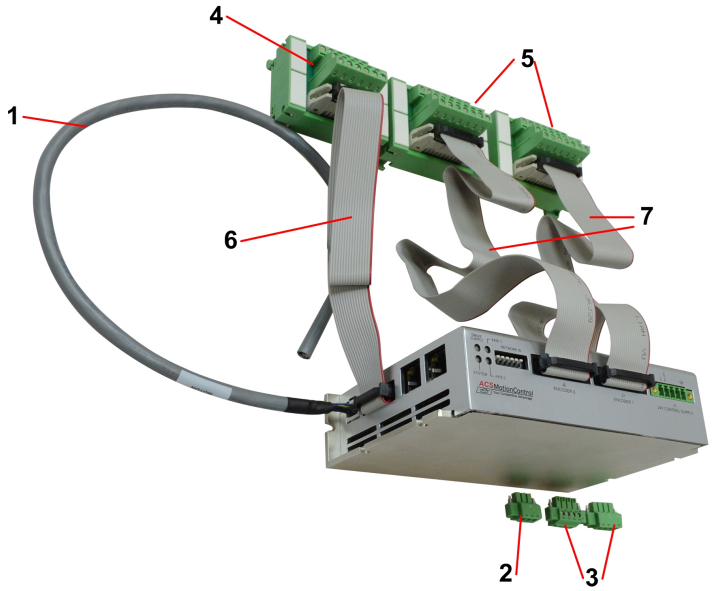

Figure 2-10. UDMnt Dual Axis Breakout Box Accessory Kit

2.6.4 EtherCAT Cables

The following EtherCAT cables are offered by ACS:

Table 2-10. EtherCAT cables offered by ACS

Ethernet Cable, CAT5 Length	
30cm	SP+ECAT-CA-30CM-00
0.5m	SP+ECAT-CA-50CM-00
1.0m	SP+ECAT-CA-1M-00
5.0m	SP+ECAT-CA-5M-00
10.0m	SP+ECAT-CA-10M-00
20.0m	SP+ECAT-CA-20M-00

2.7 Additional Accessories Needed

The UDMnt requires two power supplies to be provided by the user:

- CONTROL SUPPLY – A 24Vdc power supply. Isolated and UL certified. Rated for >1A. This power supply is connected to J1 (24V CONTROL SUPPLY)
- DRIVE SUPPLY – A 12Vdc to 80Vdc power supply. Isolated and UL certified. Its current should be rated so that it can provide the total RMS current of the motors as well as the short time peak current. This power supply is connected to J2 (DRIVE SUPPLY).

The UDMnt has no regeneration circuit. To ensure that the drive voltage does not exceed the 83V maximum voltage during deceleration, a regeneration device, capable of absorbing the motors' regenerating power, might be needed.

The drive will be disabled when the voltage reaches 85V. If the voltage rises above 100V the UDMnt might be damaged.

To comply with European standards (CE), it is recommended to use an AC line filter – such as Shaffner FN-2060-16-06, or similar, on the AC input lines that supply the AC/DC power supply.

3. Mounting and Cooling

The UDMnt should be mounted vertically, using M4 type Philips screws. The exact dimensions (in millimeters) for the UDMnt mounting are shown in Figure 3-1.

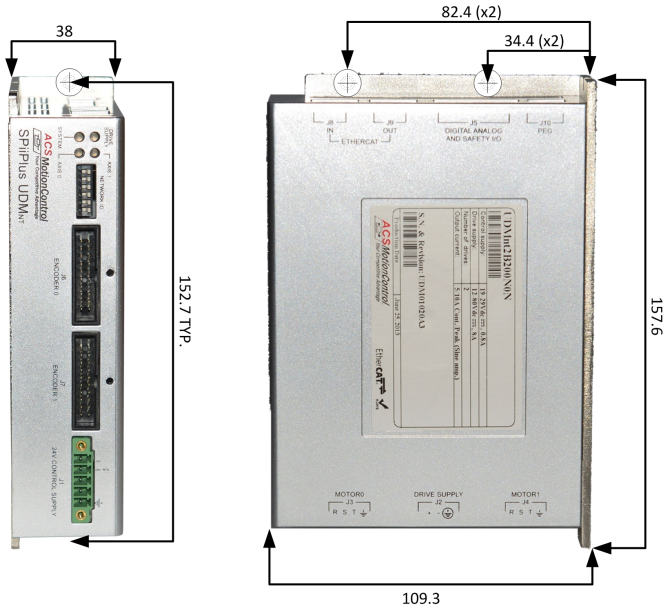

Figure 3-1. UDMnt Vertical Mounting Options

Leave sufficient clearance on all open sides for cable routing and free air flow as shown in Figure 3-2.

The UDMnt is designed to operate at full power with natural air convection, without any forced air for cooling at an ambient temperature (the temperature of its surroundings) of up to 50°C.

The maximum temperature raise of the heatsink under full load, when the product is mounted vertically, is 10°C.

It is not recommended to mount the unit horizontally. However, if the unit is mounted horizontally, then mount it with the metal heatsink on top and provide forced horizontal airflow of at least 10CFM to cool the internal circuits.

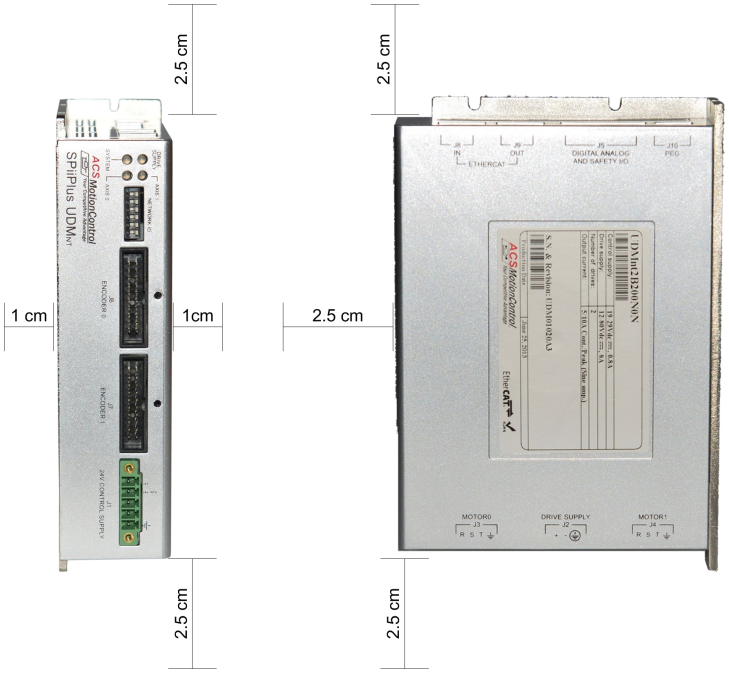

Figure 3-2. UDMnt Vertical Mounting Airflow

4. Connections

This chapter describes in details how to interface with the UDMnt following proper safety, EMC, and wiring guidelines.

4.1 Safety, EMC, and Wiring Guidelines

Read this section carefully before beginning the installation process.

- Make sure that the following guidelines and procedures are addressed and observed prior to powering up and while handling any of the EtherCAT network elements.
- Installation and maintenance must be performed only by qualified personnel who have been trained and certified to install and maintain high power electrical and electro-mechanical equipment, servo systems, power conversion equipment, and distributed networks.
- Prior to powering up the system, ensure that all EtherCAT network devices are properly installed and grounded. Further ensure that all of the attached power and signal cables are in good operating condition. Maintenance should be performed only after the relevant network devices have been powered down, and all associated and surrounding moving parts have settled in their safe mode of operation. Certain drives require a longer time to fully discharge.
- To avoid electric arcing and hazards to personnel and electrical contacts, avoid connecting and disconnecting the UDMnt while the power source is on.
- When connecting the UDMnt to an approved isolated control and drive supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation, in accordance with approved safety standards.

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

J3 and J4 contain hazardous voltages of 80V PWM modulated.

Perform the following instructions to ensure safe and proper wiring:

- Whenever possible, use shielded cables with braided shield of at least 80%-95% coverage.
- Follow the guidance of Table 4-1 below, based on the current rating of your product.
- Proper wiring, grounding, and shielding are essential for ensuring safe, immune and optimal servo performance. After completing the wiring, carefully inspect all wires to ensure tightness, good solder joints, and general safety.

Table 4-1. Wiring Guidelines

	Gauge	Twisted Pair
Control power supply	18AWG	No

	Gauge	Twisted Pair
Drive power supply	16AWG	No
Motor 2.5/5 (sine-peak/max, A)	22AWG or 2X24AWG	No
Motor 5/10 (sine-peak/max, A)	20AWG	No
Motor 10/20 (sine-peak/max, A)	16AWG	No
Motor brake	18AWG	No
Encoders	28AWG (up to 0.6A) 28AWG (up to 1A)	Yes
Digitial I/O	28AWG	According to applications demands
Analog I/O	28AWG	Yes

4.2 Connecting the UDMnt

Connect the UDMnt as described below:

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

1. Ensure that all supplies are off when preparing the unit.
2. Connect 24Vdc control supply to J1.
3. Connect 12 to 80Vdc drive supply to J2.
4. Connect motor 0 to J3.
5. Connect motor 1 to J4.
6. Connect the feedback sensors (ENCODER0 for Motor 0) to J6 and (ENCODER1 for Motor 1) to J7.
7. Connect I/Os to J5 and J10.
8. Connect the EtherCAT IN cable (from the EtherCAT Master or another EtherCAT slave) to J8.
9. Connecting J9 (EtherCAT OUT)
    a. When the UDMnt is not the last network node, connect EtherCAT cable between J9 and EtherCAT IN of the next EtherCAT slave.
    b. When the UDMnt is the last network node and a ring topology is used, connect J9 to the EtherCAT Master secondary port.

c. When the UDMnt is the last network node and a line topology is used, leave J9 unconnected.

10. Once the unit is connected:
    a. Turn on the 24Vdc control supply and verify communication with the UDMnt.
    b. Turn on the 12 to 80Vdc drive supply.

The supplies can be turned on and off in any order

4.3 Power Supplies

The UDMnt is fed by two power supplies:

> Control Supply - 24Vdc (J1)
> Drive Supply – 12 to 80Vdc (J2)

The power supplies must be provided by the customer and be UL certified. The supplies can be switched on in any order.

During emergency situations, the Drive Supply can be disconnected while the Control Supply should remain connected.

Each power supply has a LED indicator on the UDMnt.

4.3.1 24V Control Supply

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

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

4.3.1.1 24Vdc Power Supply Specifications

The 24Vdc power supply should comply with the specifications shown in Table 4-2.

Table 4-2. 24Vdc Power Supply Requirements

	Description
Type	Isolated Low noise UL certified
Output voltage range	24Vdc±20%
Output current	Minimum 1A

Example: Lambda, P/N LS100-24

4.3.1.2 J1 - 24Vdc Control Supply Connector

> Label: J1 24V CONTROL SUPPLY

- Connector: MC 1,5/ 5-GF-3,81, by PHOENIX, PN 1827897
- Mating connector: MC 1,5/ 5-STF-3,81, by PHOENIX, PN 1827732

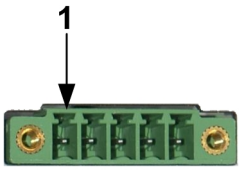

Figure 4-1. J1 -24V Control Supply Connector

Table 4-3. 24 V Control Supply Pinout

Pin	Signal	Description
1	24VDC	+24 Vdc
2	24VRTN	+24V dc return
3	NC	Not connected
4	NC	Not connected
5	Shield	Electrical ground

4.3.1.3 Connection Instructions

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

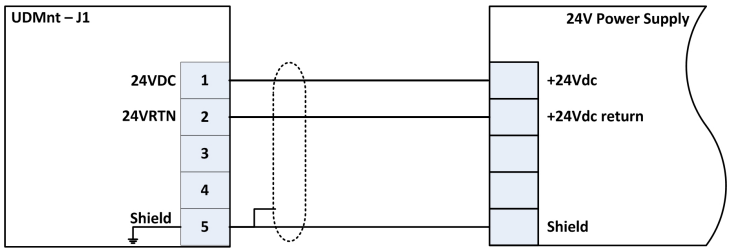

Figure 4-2. 24V Control Supply Connections

4.3.2 Drive Supply

An external isolated 12Vdc to 80Vdc power supply (not included with the UDMnt) feeds the drives and the motors. The maximum drive supply is not to exceed 80Vdc.

4.3.2.1 12V to 80V Drive Supply Requirements

This power supply should comply with the following specifications.

Table 4-4. 12V to 80V Drive Supply Requirements

	Description	Remarks
Type	Isolated	

	Description	Remarks
Output voltage range	12Vdc to 80Vdc	Output voltage not to exceed 83Vdc
Output current, maximum	8A	The total input current of the UDMnt is limited to 8A

European standards (CE) require the use of an AC line filter on the AC input lines that supply the 24VDC control supply.

4.3.2.2 J2 - Drive Supply Connector

- Label: J2 DRIVE SUPPLY
- Connector: MC 1,5/ 3-GF-3,81, by PHOENIX, PN 1827871
- Mating connector: MC 1,5/ 3-STF-3,81, by PHOENIX, PN 1827716

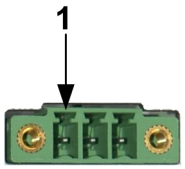

Figure 4-3. J2 - Drive Supply Connector

Table 4-5. J2 - Drive Supply Connector Pinout

Pin	Signal	Description
1	VP+	Drive Supply +
2	VP-	Drive Supply -
3	PE	Protective Earth

4.3.2.3 Connection Instructions

Use a cable with a minimum gauge of 16 AWG.

Route the drive supply and motor cables as far as possible from all other noise sensitive cables (such as encoders and I/O).

1. Connect a 10A fuse between the UDMnt and the external drive supply.

The recommended fuse is a Fast acting Rated current 10A. Example: Cooper Bussmann MNF P/N KTK-R-10.

2. The UDMnt has no regeneration circuit.

a. If the drive voltage raises due to regeneration, then it is recommended to us a drive supply with a maximum of 75Vdc.

b. To keep the drive supply in range, use an active regeneration device. A shunt regulator (regeneration circuit) set to 80V±3% is recommended.

The drive supply must not exceed 83Vdc. It can be disconnected during E-Stop safety situations to prevent any motion of the axes.

3. Connect the UDMnt PE (Protective Earth) to the drive supply PE.
4. In noisy environments, for better noise immunity, the user may consider connecting an external PE (Protective Earth) to the VP-point (J2 pin 2) as well as to J2 pin 3. Connect a short-cable between J2 pin 3 and J2 pin 2.

Connecting the J2 pin 3 to J2 pin 2 disrupts the isolation between the motor circuits and the PE (Protective Earth), and thus impacts adherence to safety standards and regulation.

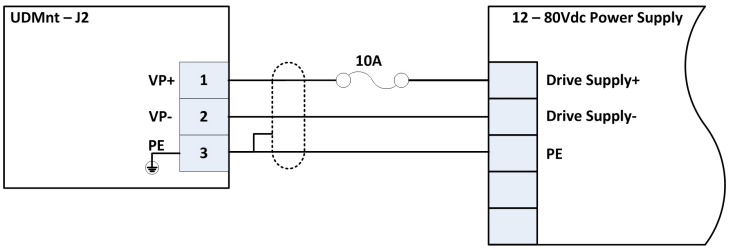

Figure 4-4. Drive Supply Connections

4.4 Motors

The UDMnt supports the following rotary and linear motors:

> Single-phase (DC brush, moving coil), see Figure 4-6.
> Two-phase (AC synchronous, step motor), see Figure 4-7.
> Three-phase (AC synchronous, step motor), see Figure 4-8
> Five-phase (step motor. Consult company), see Figure 4-9.

For more details on each motor type, see *SPiiPlus MMI Application Studio User Guide* and applicable application notes.

Five-phase step motor is an order option and is not supported by the standard unit.

4.4.1 J3 (MOTOR0), J4 (MOTOR1) Connectors

J3 and J4 contain hazardous voltages of 80V PWM modulated.

- Label: J3 MOTOR0 , J4 MOTOR1
- Connector: MC 1,5/ 4-GF-3,81, by PHOENIX, PN 1827884
- Mating connector: MC 1,5/ 4-STF-3,81, by PHOENIX, PN 1827729

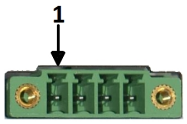

Figure 4-5. J3, J4 - Motor Connectors

Table 4-6. J3, J4 - Motor Connectors Pinout

Pin	Signal	Description
1	R	Drive Phase R
2	S	Drive Phase S
3	T	Drive Phase T
4	Shield	Electrical ground / Protective earth

4.4.2 Connection Instructions

Use a shielded cable with a minimum gauge of 16 AWG. It should be less than 10 meters long.

1. Connect the motors to J3 J4 according to Figure 4-6 through Figure 4-9.

Only one 5 phase step motor can be used, connected to both J3 and J4 connectors.

2. Route the motors' cable (and the drive supply cable) as far as possible from all other noise sensitive cables (such as encoders and I/O).

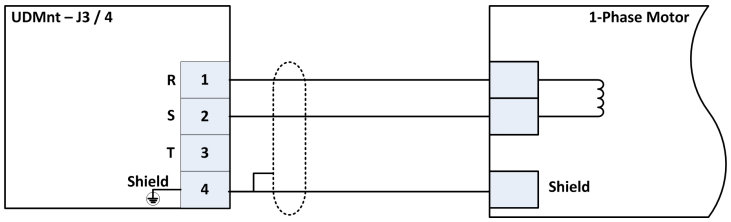

Figure 4-6. Single-Phase Motors (DC brush, Voice coil) Connections

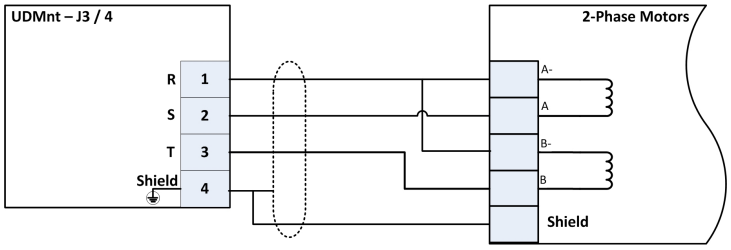

Figure 4-7. Two-Phase Motors (AC synchronous, Step Motor)

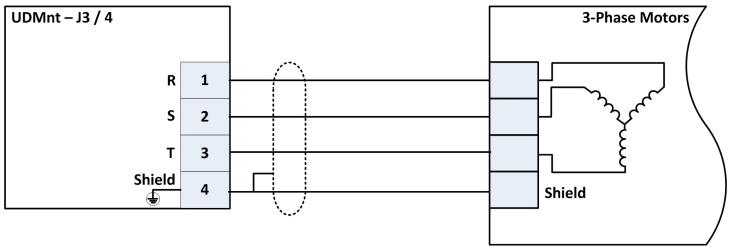

Figure 4-8. Three-Phase Motors (AC synchronous, Step Motor)

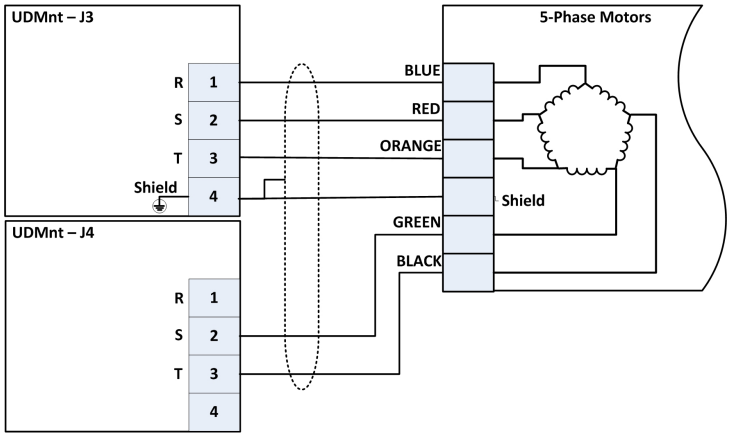

Figure 4-9. Five-Phase Step Motor Connections (example of an Oriental Motor)

Table 4-7. Five-Phase Motor Wiring Color Codes (example of Oriental Motor)

Motor Phase	Color
Phase R of AXIS 0	Blue
Phase S of axis 0	Red
Phase T of axis 0	Orange
Phase S of axis 1	Green
Phase T of axis 1	Black

4.5 Feedback Sensors

There are two position feedback sensors interfaces, supporting the following types of sensors:

- AqB,I and Clk/Dir (=Pulse/Dir) incremental digital encoders, with or without Hall sensors or commutation tracks.
- AqB,I incremental analog encoder (Sin-Cos) with or without Hall sensors or commutation tracks. There are two types of interfaces:
  - 500kHz Sin-Cos. The speed is limited to 500kHz frequency. This interface should be used with optical Sin-Cos encoders.
  - 5MHz Sin-Cos. The speed is limited to 5MHz frequency. This interface should be used with Laser Encoders for higher resolution while moving at high speeds.
- Absolute serial encoders of the following types:
  - Data/Clock
    - EnDAT 2.2
    - BiSS-A/B/C (SSI)
  - Data Line Only (non-return-to-zero NRZ)
    - Tamagawa Smart-Abs
    - Panasonic

Encoder and Hall signals share the same connector.

Connect the feedback sensors for Motor 0 to J6 and for Motor 1 to J7.

When using dual feedback (for Motor 0 only), connect the primary feedback sensors to J6 and the secondary feedback sensors to J7.

Interfaces for Sin-Cos and for absolute encoders is optional and must be specified when ordering the product.

UDMnt does not support single ended encoders.

All feedback sensors are powered by the UDMnt internal 5.1Vdc power supply. The total consumptions of all sensors (encoders and Hall) should not exceed 0.5A.

Make sure that the actual voltage measured on the sensors contacts is above its minimum specification (typically >4.75Vdc).

4.5.1 J6, J7 (Encoder 0, Encoder 1) Feedback Sensor Connectors

stands for either 0 (J6) or 1 (J7).

- Labels: J6 ENCODER 0, J7 ENCODER 1
- Connector: Header, male, 20 pin 2.54mm by Wurth Elektronik PN 612 020 217 21
- Mating connector: Header 20 pin, female 2.54mm. for example: by Wurth Elektronik, PN 612 020 230 21

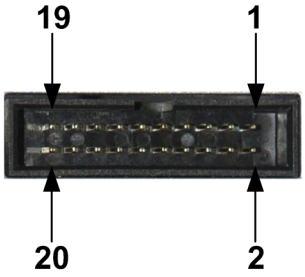

Figure 4-10. J6, J7 - Feedback Sensors Connectors

Pin	Signal	Incremental Digital Encoder AqB,I	Incremental Digital Encoder Clk/Dir,I	Incremental Analog Encoder	Absolute Encoder DATA/CLOCK	Absolute Encoder DATA Only
1	5U	+5V supply	+5V supply	Not used	+5V supply	+5V supply
2	5U_RTN	+5V return	+5V return	Not used	+5V return	+5V return
3	CHA#-	Channel A-	Clk-	Not used	Data-	Data-
4	CHA#+	Channel A+	Clk+	Not used	Data+	Data+
5	CHB#-	Channel B-	Dir-	Not used	Clock-	Not used
6	CHB#+	Channel B+	Dir+	Not used	Clock+	Not used
7	CHI#-	Index -	Index -	Not used	Not used	Not used
8	CHI#+	Index+	Index+	Not used	Not used	Not used
9	HA#	Hall sensor A	Hall sensor A	Hall sensor A	Hall sensor A	Hall sensor A
10	HB#	Hall sensor B	Hall sensor B	Hall sensor B	Hall sensor B	Hall sensor B
11	HC#	Hall sensor C	Hall sensor C	Hall sensor C	Hall sensor C	Hall sensor C
12	Shield	Shield	Shield	Shield	Shield	Shield
13	5F	Not used	Not used	+5V analog supply	Not used	Not used
14	5F_RTN	Not used	Not used	+5V analog return	Not used	Not used

Pin	Signal	Incremental Digital Encoder AqB,I	Incremental Digital Encoder Clk/Dir,I	Incremental Analog Encoder	Absolute Encoder DATA/CLOCK	Absolute Encoder DATA Only
15	SIN#-	Not used	Not used	Channel SIN-	Not used	Not used
16	SIN#+	Not used	Not used	Channel SIN+	Not used	Not used
17	COS#-	Not used	Not used	Channel COS-	Not used	Not used
18	COS#+	Not used	Not used	Channel COS+	Not used	Not used
19	SC_I#-	Not used	Not used	Index- (analog encoder)	Not used	Not used
20	SC_I#+ N	Not used	Not used	Index+ (analog encoder)	Not used	Not used

Hall sensors / commutation tracks are used for initial AC Synchronous motor commutation upon power up. Use of Hall sensors / commutation tracks for commutation purposes is optional. The controller can perform sinusoidal commutation also without Hall sensors / commutation tracks.

4.5.2 J6, J7 Connection Instructions

Use shielded cables with twisted pairs, a minimum gauge of 24 AWG and up to 20 meters in length.

1. Connect the motors to J3 J4 according to Figure 4-11 through Figure 4-15.
2. The mating connector can be locked using the provided connector clip and screw, see Control Supply Mating Connector and Locking Clips Kit.

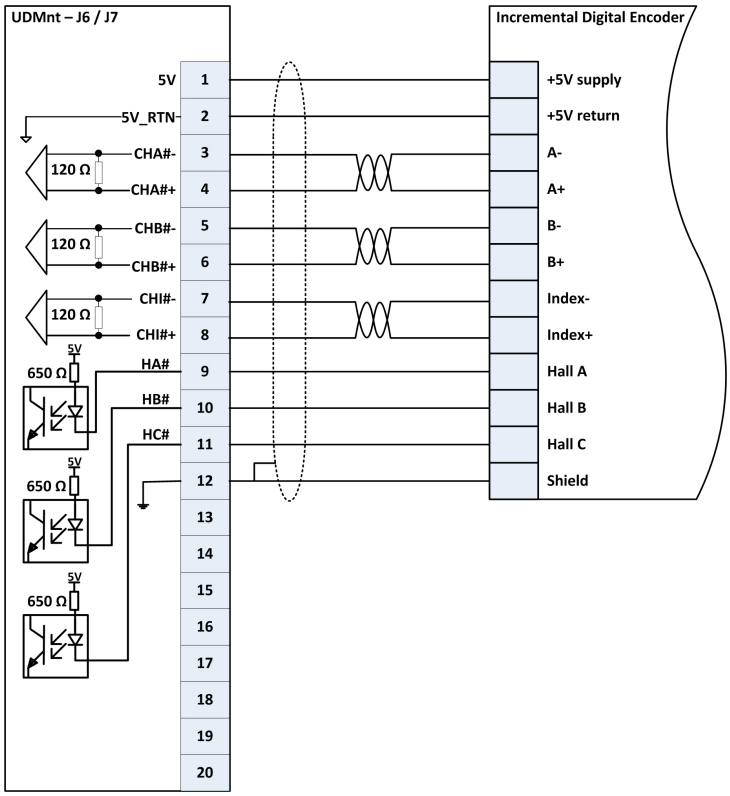

Figure 4-11. Incremental Digital Encoder with Hall / Commutation Tracks AqB,I Connections

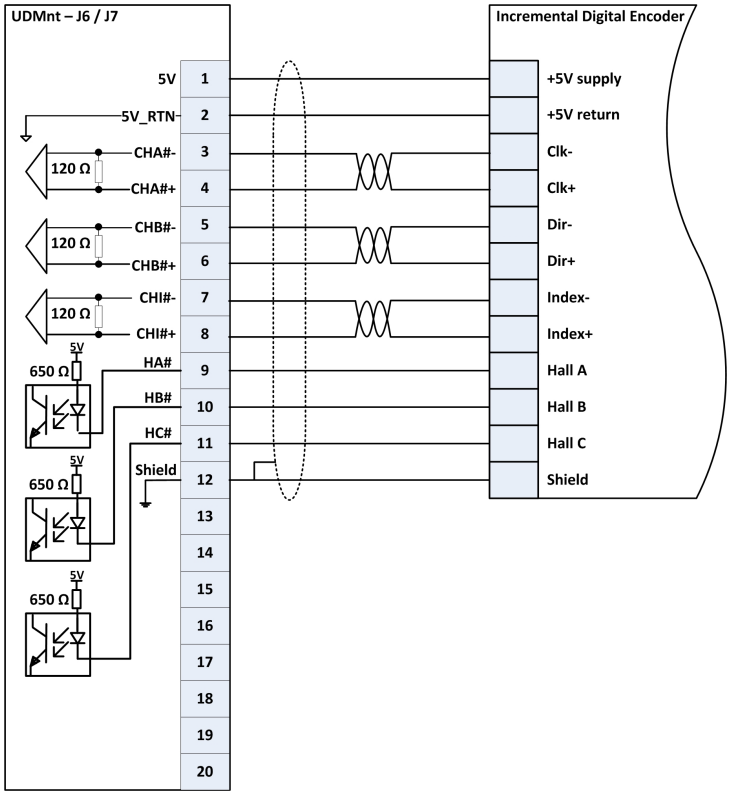

Figure 4-12. Incremental Digital Encoder with Hall / Commutation Tracks Clk/Dir, I Connections

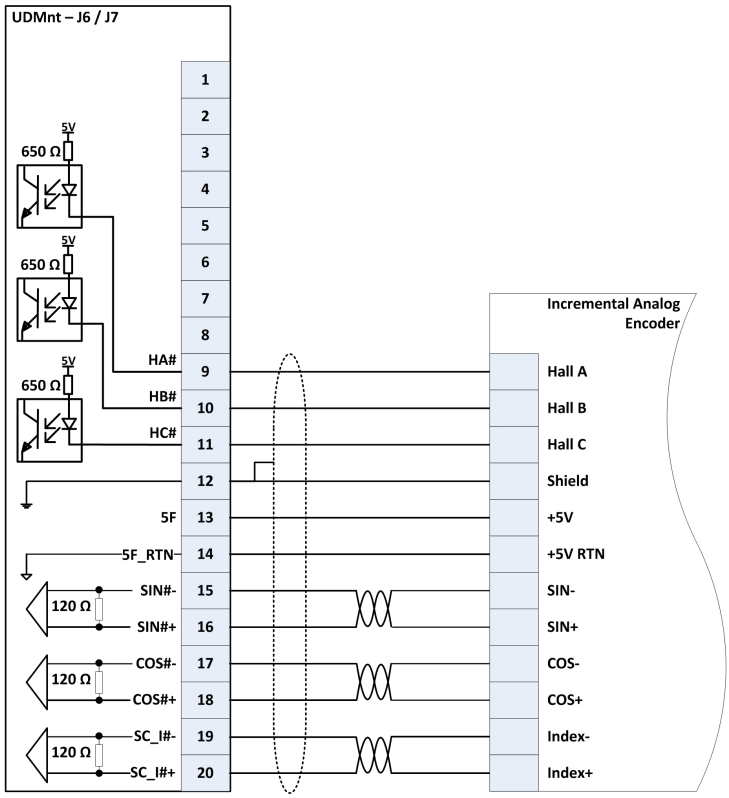

Figure 4-13. Incremental Analog Encoder (Sin-Cos) with Hall / Commutation Tracks AqB,I Connections

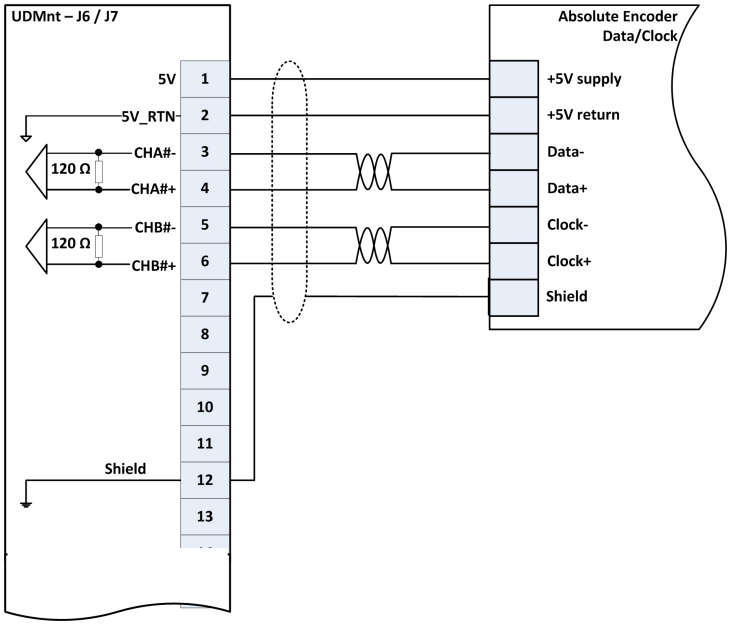

Figure 4-14. Absolute Serial Encoders with Data/Clock Connections (EnDAT 2.2, BISS-A/B/C(SSI))

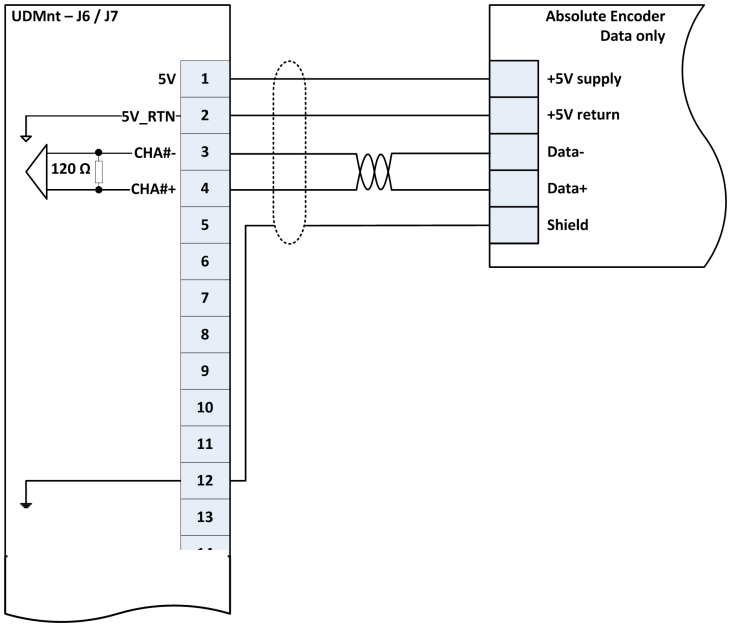

Figure 4-15. Absolute Serial Encoders with Data Line Only Connections (Tamagawa Smart-Abs, Panasonic)

4.6 Digital & Analog I/O

The UDMnt includes the following inputs/outputs:

Table 4-8. Digital & Analog I/O

I/O	Signal	Connector
Limit switch inputs	RL0, LL0, RL1, LL1	J5
Digital inputs / Encoder registration mark	IN0 – IN3	J5
Digital outputs	OUT0, OUT1	J5
Analog inputs	AIN0 AIN1	J5 J10
Analog output	AOUT	J5
PEG outputs	PEG0, PEG1	J10

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

4.6.1 J5 - Digital, Analog and Safety I/O Connector

- Label: J5 DIGITAL/ANALOG AND SAFETY I/O
- Connector: Header, male, 16 pin, 2.54mm, by: Wurth Elektronik , PN 612 016 217 21
- Mating connector: Header 16 pin, female, 2.54mm. For example: by: Wurth Elektronik , PN 612 016 230 21

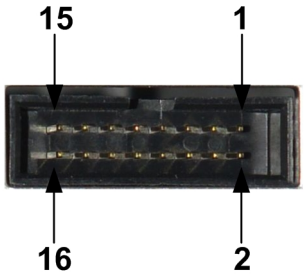

Figure 4-16. Digital/Analog and Safety I/O Connector

Table 4-9. Digital/Analog and Safety I/O Connector

Pin	Signal	Description
1	IN0	Digital input 0
2	IN1	Digital input 1
3	IN2	Digital input 2

Pin	Signal	Description
4	IN3	Digital input 3
5	OUT0	Digital output 0
6	OUT1	Digital output 1
7	RL0	Right limit switch Axis 0 / MOTOR 0
8	LL0	Left limit switch Axis 0 / MOTOR 0
9	RL1	Right limit switch Axis 1 / MOTOR 1
10	LL1	Left limit switch Axis 1 / MOTOR 1
11	IO_SUP	24Vdc I/O Supply input
12	IO_RTN	24Vdc I/O Supply Return
13	AIN0+	Analog input 0 +
14	AIN0-	Analog input 0 -
15	AOUT+	Analog output +
16	AOUT-	Analog output -

4.6.1.1 J5 Connection Instructions

Use shielded cables with twisted pairs, a minimum gauge of 24 AWG and up to 100 meters in length.

1. The mating connector can be locked using the provided locking clip and screw, see Control Supply Mating Connector and Locking Clips Kit .
2. Ensure that the analog input's signal range does not exceed the range of ±10V. Exceeding the range may cause abnormal behavior of the drive and affect its performance.
3. Connect a 24Vdc power supply between pins 11 and 12.

4.6.2 24Vdc I/O Power Supply Specifications

The 24Vdc power supply should comply with the following specifications:

Table 4-10. 24Vdc I/O Power Supply Specifications

	Description
Type	Isolated Low noise UL certified

	Description
Output voltage range	24Vdc±20%
Output current	>1A

Example: Lambda, P/N LS100-24

4.6.3 J10 - PEG & Analog Input

4.6.3.1 Connector

- Label: J10 PEG
- Connector: 10 pin 2mm right-angle, by JST, PN S10B-PADKS-1
- Mating Connector: by JST, PN PADP-10V-1-S
- Pins: by JST, PN SPND-001T-C0.5

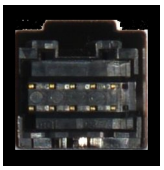

Figure 4-17. PEG Connector

Table 4-11. PEG Connector

Pin	Signal	Description
1	AIN1+	Analog input 1 +
2	AIN1-	Analog input 1 -
3	AGND	Analog ground
4	NC	Not connected
5	DGND	Digital ground
6	Shield	Shield
7	PEG0+	PEG 0 Output +
8	PEG0-	PEG 0 Output -
9	PEG1+	PEG 1 Output +
10	PEG1-	PEG 1 Output -

Pin ID on connector

4.6.4 Connection Instructions

Use shielded cables with twisted pairs, a minimum gauge of 24 AWG and up to 100 meters in length.

1. Ensure that the analog input's signal range does not exceed the range of ±10V. Exceeding the range may cause abnormal behavior of the drive and affect its performance.

4.6.4.1 Digital Inputs

All digital inputs (limit switch inputs, general purpose digital inputs, encoder registration mark inputs) are identical in structure and are factory configured to one of the following:

- (D) or (N) Inputs & limits (and outputs) are 24V/SOURCE (PNP)
- (S) Inputs & limits: 24V/SINK (NPN). (Outputs: 24V/SOURCE (PNP))
- (R) Inputs & limits: 5V/SOURCE (PNP). (Outputs: 5V/SOURCE (PNP))
- (T) Inputs & limits: 5V/SINK (NPN). (Outputs: 5V/SOURCE (PNP))
- (U) Inputs: 24V/SOURCE (PNP). Limits: 24V/SINK (NPN). (Outputs: 24V/SOURCE (PNP))

The 4 digital inputs (IN0 to IN3) can be used as encoder registration mark inputs as well as general purpose inputs for any other need. For more details see the *PEG and MARK Operations Application Notes*.

Table 4-12. Digital / MARK Inputs

Signal	Description
IN0	MARK0_1
IN1	MARK0_2
IN2	MARK1_1
IN3	MARK1_2

Unused limit switch inputs can also be used as general purpose inputs.

To use limits as general purpose inputs, clear the default response to the fault, using the following command:

```
FDEF(<axis number>).#RL = 0
```

or

```
FDEF(<axis number>).#LL = 0
```

To monitor the status of such inputs use the following command:
FAULT(<axis_number>).#RL or FAULT(<axis_number>).#LL

Example of an automatic routine that disables the motor when such an input is activated:

```
ON FAULT(0).#RL;
   Disable (0);
RET;
```

For more information, see the *SPiiPlus ACSPL+ Commands & Variables Guide*.

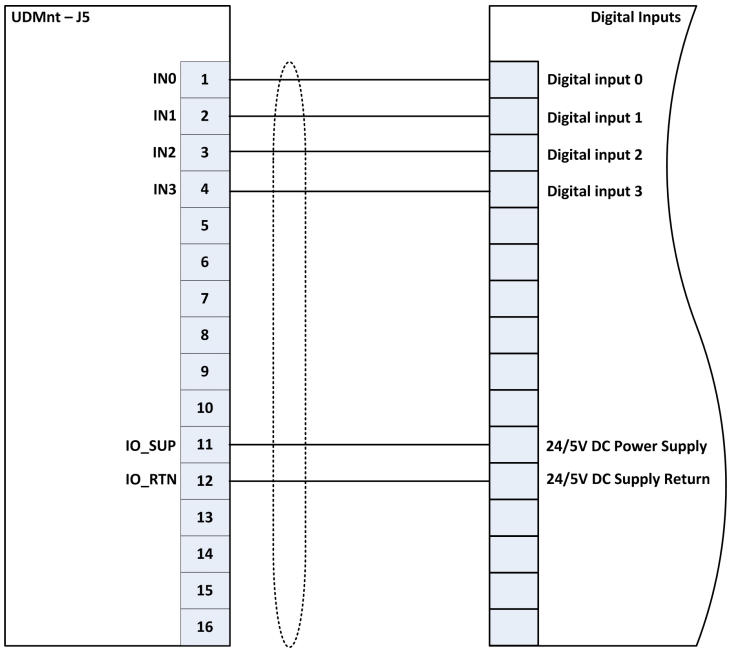

Figure 4-18. Digital Inputs Connection Diagram

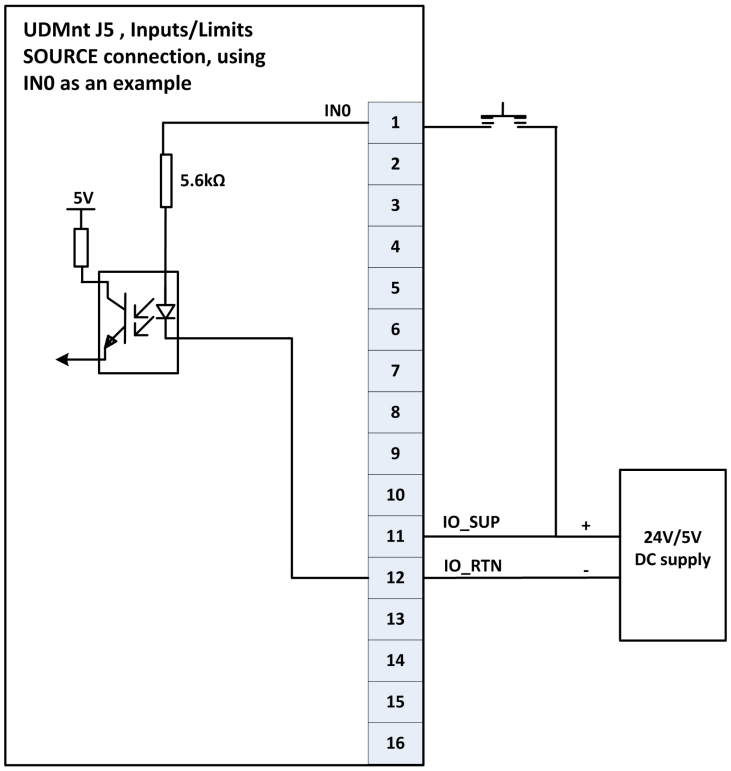

Figure 4-19. Example of Digital Inputs Source (PNP) Type Connection Diagram (Default)

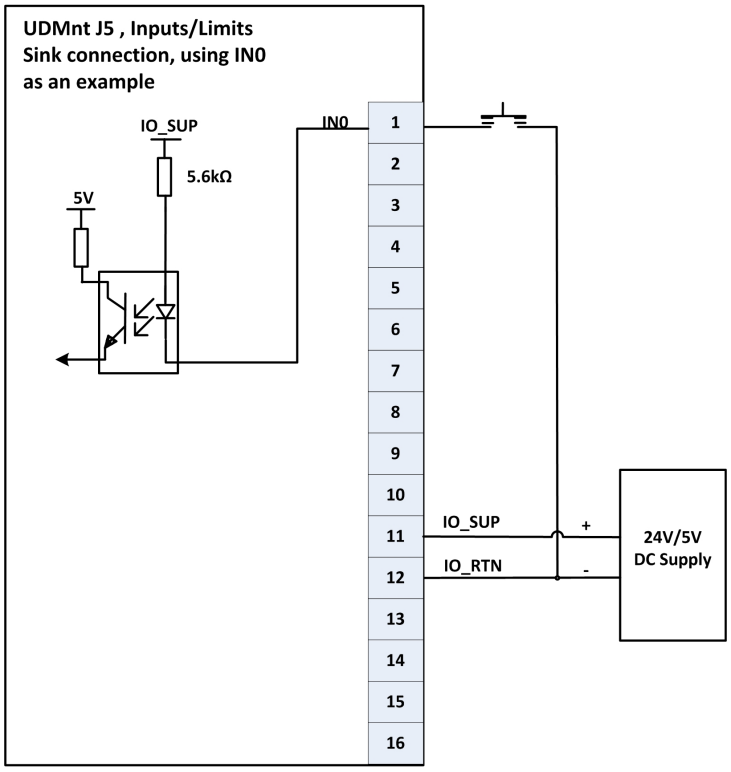

Figure 4-20. Example of Digital Inputs Sink (NPN) Type Connection Diagram

4.6.4.2 Digital Outputs

The 2 opto-isolated, 24Vdc, 0.1A digital outputs are factory configured as A Source (PNP) type.

The outputs can be used as motor brake drivers or as general purpose outputs. The default configuration is set as mechanical brake drivers.

Unused brake outputs can be used as general purpose outputs. Use the ACSPL+ command **SETCONF(29,<>,0)** as part of the application startup program to reconfigure the output. For more information see the *SPiiPlus Commands & Variables Guide*.

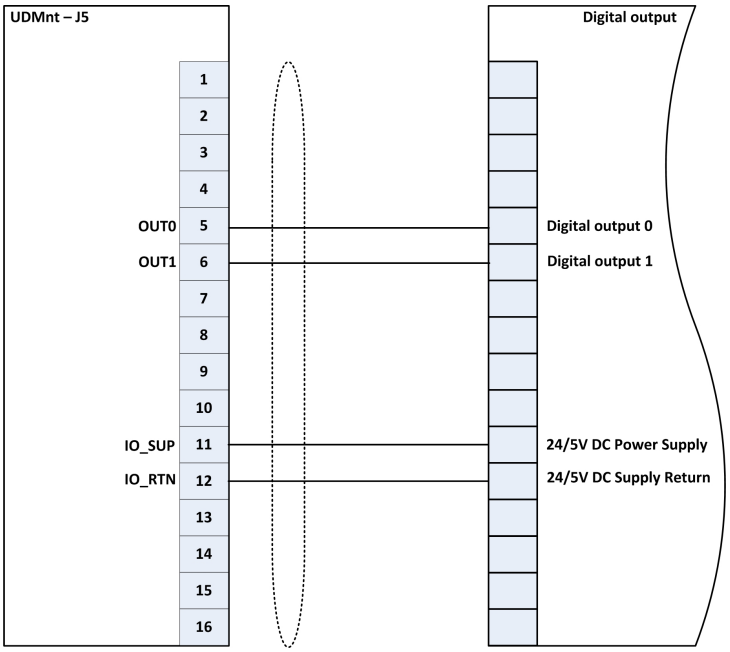

Figure 4-21. Digital Outputs Connection Diagram

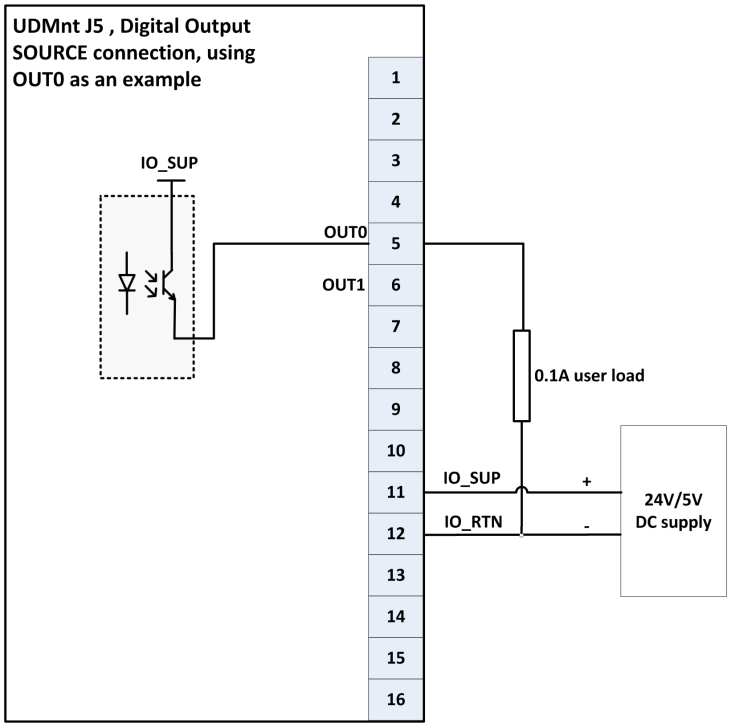

Figure 4-22. Example of Digital Outputs Source (PNP) Type Connection Diagram

4.6.4.3 Analog Inputs

The UDMnt has two (2) analog differential inputs, AIN0 and AIN1 with a range of +/-10V. The inputs are sampled by a 12-bit resolution A to D converter (ADC). AIN1 uses connector J10.

These inputs can also be used for feedback control purposes, which requires special software customized for the specific use.

Signal to Noise Ratio (SNR) = 56db AIN0 uses connector J5.

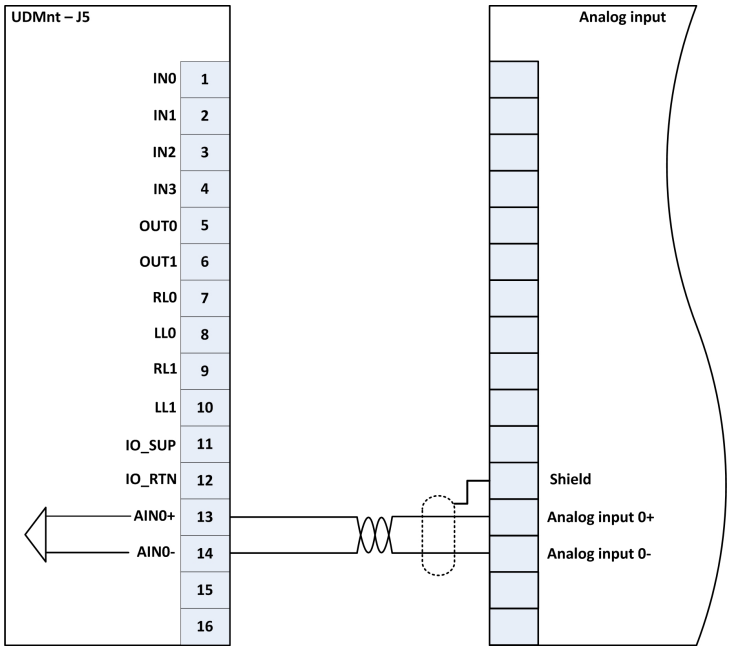

Figure 4-23. Analog Inputs Connection Diagram

4.6.4.4 Analog Output

The UDMnt has one analog differential output, AOUT +/-10V, with a range of +/-10V and with 10-bit resolution.

The user may choose to connect only one edge of the analog output, for single ended connection, in such a case the negative edge (AOUT0-) should be left unconnected and the amplitude will be +/- 5V.

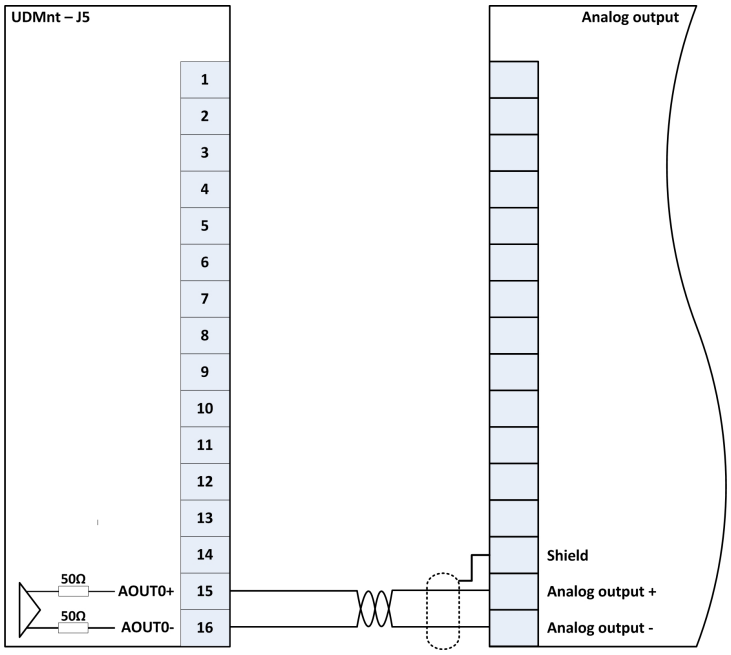

Figure 4-24. Analog Output Connection Diagram

4.6.4.5 Position Event Generation (PEG) Outputs

The UDMnt has two PEG_Pulse outputs. The user can program the controller to generate pulses at the exact location(s) of an axis, see *PEG and MARK Operations Application Note*.

The PEG operates only with incremental encoders.

PEG does not operate with absolute encoders.

With Sin-Cos encoder, PEG the resolution is limited to four counts per encoder sine signal period (=encoder quadrature).

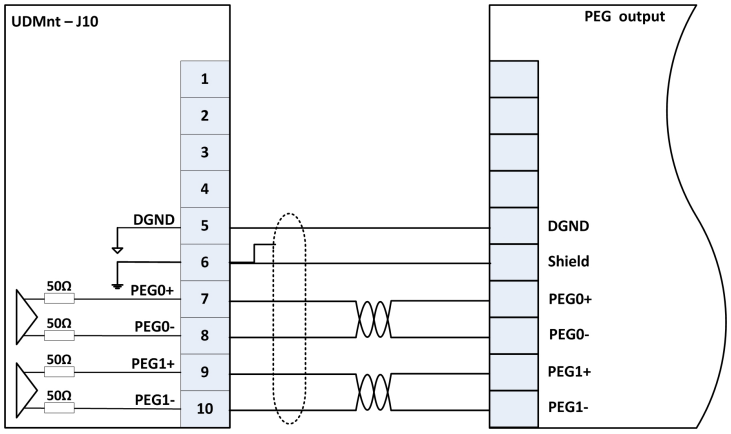

Figure 4-25. PEG Outputs Connection Diagram

5. EtherCAT

5.1 Connection Instructions

Use Ethernet cables CAT 5 or better. ACS offers standard cables in different lengths, see "EtherCAT Cables" on page 21.

Connect the EtherCAT cable between J8 (ETHERCAT IN) and the EtherCAT output of the preceding EtherCAT master or slave.

1. Connecting J9 (ETHERCAT OUT)
   a. When the UDMnt is not the last network node, connect EtherCAT cable between J9 and EtherCAT IN of the next EtherCAT slave.
   b. When the UDMnt is the last network node and a ring topology is used, connect J9 to the EtherCAT Master secondary port.
   c. When the UDMnt is the last network node and a line topology is used, leave J9 unconnected.

5.2 J8 - ETHERCAT IN, J9 - ETHERCAT OUT

> Labels: J8 ETHERCAT IN, J9 ETHERCAT OUT
> Connectors: RJ45, 8P8C MJ Tab Up, by Wurth Elektronik, PN 615008137421
> Mating cable with connectors: Standard Ethernet cables CAT5, see"EtherCAT Cables" on page 21.

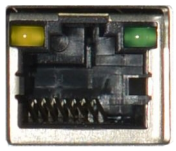

Figure 5-1. EtherCAT Connector

Table 5-1. EtherCAT Connector

Pin	Signal	Description
1	TD_0+	Transmit +
2	TD_0-	Transmit -
3	RD_0+	Receive +
4	NC	Not connected
5	NC	Not connected
6	RD_0-	Receive -
7	NC	Not connected

Pin	Signal	Description
8	NC	Not connected

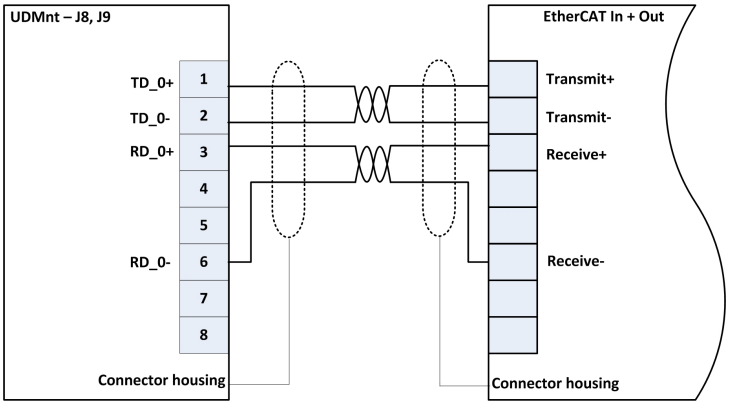

Figure 5-2. EtherCAT Connections

6. Product Specifications

This section provides detailed technical specifications of the UDMnt, including drive power ratings, interfaces, dimensions, environmental conditions, and standards.

6.1 Control

A standard comprehensive set of powerful algorithms to enhance accuracy, move & settle time, smooth velocity, stability and robustness.

- Advanced PIV cascaded structure
- Loop shaping filters
- Gain Scheduling
- Gantry MIMO control
- Dual feedback / loop control
- Disturbance rejection control

Optional ServoBoost algorithm (ordered with the controller) that provides better, more consistent servo performance, insensitive to noise and large changes in the system, please contact ACS Support if you wish to apply the ServoBoost option.

Refer to the following documents for more information regarding the various options:

- *Motion Control Strategies to Obtain Better Performance*
- *Controlling Gantry Tables with Cross Moving Axis*
- *Application Note: Dual axis PEG*
- *ACSPL+ Programmer's Guide*

6.2 External Power Supplies Requirements

Control Supply, isolated

- Input voltage[Vdc] 24Vdc±20%
- Input current [A] <1A

Drive Supply, isolated

- Input voltage[Vdc] 12 to 80Vdc
- Not to exceed [Vdc] 83Vdc
- Input current <8A

6.3 Motor Drive

- PWM, three- phase bridge
- Switching method: advanced unipolar PWM
- Digital current control with field oriented control and space vector modulation.
- PWM switching frequency on the motor: 40 kHz
- Current loop sampling rate: 20kHz
- Programmable current loop bandwidth: up to 2kHz

- Commutation: sinusoidal. Initiation with and without hall sensors or commutation tracks
- Protection: Over voltage, motor phase-to-phase short circuit, motor phase to ground short circuit, over-current, over-temperature and under voltage of the following values:

Table 6-1. Motor Drive Specifications

Protection	Value
Motor phase short circuit	30A ±5%
Over temperature	100°C ±3%
Over voltage	85V ±3
Under voltage	9.5V ±5%

Table 6-2. Motor Drive Specifications

Product	UDMnt...A...	UDMnt...B...	UDMnt...C...
Number or drives	1 or 2		
Motor types	Supports any of the following linear or rotary motors selected by the software settings: - Single-phase (DC brush, moving coil) - Two-phase (AC synchronous, step motor - Three-phase (AC synchronous, step motor) - Five-phase (step motor		
Input current [A]	<4.3	<8.6	<8.6
Motor phase current - Cont/Peak [A sine-amp] - Cont/Peak [A RMS] - Peak current time [S]	2.5/5 1.8/3.6 1	5/10 3.6/7.2 1	10/20 7.2/14.4 1
Output power per drive @ full load, 80Vdc, Cont/Peak [W] Total	160/320 320/640	320/640 640/1280	640/1280 640/2560
Max. output voltage on motor [Vdc]	(Vin motor) x 92%		
Minimum Motor phase Inductance [µH]			

Product	UDMnt...A...	UDMnt...B...	UDMnt...C...
@ 80Vdc @ 48Vdc @24Vdc @12Vdc		50 30 15 8	
Max. Heat dissipation per drive [W]	0.6	1.4	3.4

The two-phase motor has approximately a 30% de-rating factor on the Motor phase current and output voltage

6.4 Feedback Sensors Intefaces

There are two position feedback sensors interfaces, supporting the following types of sensors:

- AqB,I and Clk/Dir (=Pulse/Dir) digital incremental encoders, with or without Hall sensors or commutation tracks.
  - AqB,I Maximum input frequency: 12.5/50 million lines/ quad-counts/sec.
  - Clk/Dir,I Maximum input frequency: 12.5 million clocks/sec.
  - RS422
- AqB,I Sin-Cos (analog) incremental encoder (with or without Hall sensors or commutation tracks). There are two types of Sin-Cos encoder interfaces:
  - 500kHz Sin-Cos. This interface should be used with optical Sin-Cos encoders.
    - Maximum input frequency: 500kHz frequency.
    - Maximum acceleration: 108 sine periods/second^2
  - 5MHz Sin-Cos. This interface should be used with laser encoders for higher resolution while moving at high speeds.
    - Maximum input frequency: 5MHz frequency
    - Maximum acceleration: 108 sine periods/second^2
  - 1Vptp, differential
  - Programmable multiplication factor: x4 to x16,384
- Absolute serial encoders of the following types:
  - Data/Clock
    - EnDAT 2.2
    - BiSS-A/B/C (SSI)
  - Data Line Only (non-return-to-zero NRZ)
    - Tamagawa Smart-Abs
    - Panasonic
- Hall inputs:

- Two sets of three per axis.Type: single-ended, 5V, source, opto-isolated.
- Input current: <7mA.
- Maximum speed: 2kHz.

6.5 Digital Inputs / Outputs

> Safety Inputs: Left and right limit inputs per axis:
  - Single-ended, opto isolated, Source (PNP, default) or Sink (NPN)
  - On: connected to 24V or 5V
  - Off: not connected
  - Input current<4mA
  - Unused safety inputs can be used as general purpose inputs
> Digital Inputs / Registration Mark:
  - Quantity: Four
  - Single-ended, Fast Opto-isolated, Source (PNP, default) or Sink (NPN)
  - On: connected to 24V or 5V
  - Off – not connected
  - Input current <5mA
> Digital Outputs / Motor Brake Outputs:
  - Quantity: Two
  - Single-ended, Opto-isolated source (PNP, default) or Sink (NPN)
  - 24V or 5V
  - Output current: 100mA.
> Position Compare Outputs (PEG):
  - Quantity: Two
  - RS422
  - Can be used as general purpose output
  - Pulse width 26nSec to 1.75mSec
  - Maximum rate: 10MHz

6.6 Analog Inputs

> Quantity: Two
> Differential, ±10V ±5%,
> Input impedance: >160 kΩ
> ADC:12 bit resolution. SNR = 56db

6.7 Analog Output

> Quantity: One
> Differential: ±10V ±5%. Maximum output current: 1mA

- DAC: 10bit resolution

6.8 Communication

Two EtherCAT ports, In and Out.

6.9 Dimensions

144 x 38.5 x 112.5 mm

(5.669 x 1.516 x 4.429 inch)

6.10 Environmental specification

- Operational temperature: 0-50°C (32-122°F)
- Storage and transportation range: -25 to +60°C (-13 to 140°F)
- Humidity (operating range): 5% to 90% non-condensing

6.11 Compliance with Standards

6.11.1 Environment

RoHS

6.11.2 CE

- Safety: IEC 61010-1:01
- EMC: EN 61326:2002

HERMON LABORATORIES

CERTIFICATE OF CONFORMITY

CERTIFICATE

With EN 61326-1: 2006, industrial locations equipment, Class A standard, harmonized under article 6(2) of EMC Directive 2004/108/EC

Certificate Number ACSEMC_EN.24782C

This certificate of conformity has been granted to the applicant based on the results of tests and evaluations, performed by Hermon Laboratories from August 12 to 14, 2013 on representative sample of the specified product.

Products description

Product family:	UDMnt universal drive modules family
Tested item:	Two axes universal drive module
Models:	UDMnt2AXXXXXX UDMnt2BXXXXXX UDMnt2CXXXXXX
Tested item:	One axes universal drive module
Models:	UDMnt1AXXXXXX UDMnt1BXXXXXX UDMnt1CXXXXXX

Applicant/Manufacturer details

Name:	ACS Motion Control Ltd.
Address:	P.O.Box 5668, Ramat Gabriel Industrial Park, Migdal Ha'Emek 10500, Israel
Telephone number:	+972 4654 6440
Fax number:	+972 4654 6443

This is to certify that the tested product sample satisfies the requirements of the above listed standard/s.

Measurement/test results are contained in the test report: ACSEMC_EN.24782.

The comments in the associated (if applicable) test report/s shall be taken into account and used in conjunction with this certificate

Michael Nikishin,
EMC & Radio Group Manager
Hermon Laboratories Ltd.

September 1, 2013 **Page 1 of 1**

EXPERTS IN GLOBAL COMPLIANCE SOLUTIONS

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6.11.3 UL

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