WELCON

Servo Drive

Hardware Manual





WE2A-D048/05-FS04A5_V04

welcon
SYSTEMS

2025-07-17

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Precautions

- Please read this manual carefully before installing and commissioning.
- WELCON SYSTEMS assumes no responsibility whatsoever for any loss or damage arising out of use for any purpose.

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Product Name for welcon Drive

WE 2S - D 024 / 01 - FS0057 - E

Product Type

WE WELCON Standard
****** User Code (only for customized order)

Drive Shape

R Rectangle Type Board
C Circle Type Board
M Miniature Board
2S 2-Axis Slot Type (Backboard necessary)
2A 2-Axis Stand-Alone Type

Power

D DC
A AC

Voltage

024 12~24V
048 12~48V
310 12~310V

Continuous Current

P3 0.3A rms
P5 0.5A rms
01 1A rms
03 3A rms
10 10A rms
25 25A rms

Feedback Sensor (Hexadecimal)

Bit0	Incremental Encoder	**Bit4**	Sin/Cos Encoder	**Bit8**	Potentiometer
Bit1	Dual Incremental Encoder	**Bit5**	BISS/SSI Interface Encoder	**Bit9**	SPI
Bit2	Separated Digital Hall Sensor	**Bit6**	Analog Hall Sensor	**Bit10**	EnDat
Bit3	Shared Digital Hall Sensor	**Bit7**	Tamagawa/Panasonic Encoder	**Bit11**	PWM

Ex) 0057= 0000 0000 0101 0111
Incremental(Bit0) + Dual Incremental (Bit1) + Separated Digital Hall (Bit2) + Sin/Cos (Bit4) + Analog Hall (Bit6)

Communication

E EtherCAT
C CAN
R RS-485

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CONTENTS

Precautions 2
Copyright Notice 2
CONTENTS 4
1. Safety Information 6
1.1. Attention Symbols 6
1.2. Warnings 7
1.3. Cautions 7
1.4. Use environment 7
2. Technical Information 8
2.1. Mechanical Data 8
2.2. Mounting Dimension 9
2.3. Stacking the drive 10
2.4. Electrical Data 11
2.5. Protections & Limitations 13
3. Wiring 14
3.1. Wiring Legend 14
3.2. Wire Size 14
3.3. Wiring Precautions 15
3.3.1. Grounding 16
3.3.2. Feedback and Motor UVW Wires 17
3.4. Tools 18
3.5. Connections 18
3.6. Regenerative resistance 19
3.7. Main Power 20
3.7.1. Main Power Wiring 21
3.8. Motor UVW 22
3.8.1. Motor UVW Wiring 23
3.9. Digital Encoder 24
3.9.1. Digital Encoder Wiring 25
3.10. Serial Encoder 26

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3.10.1. Serial Encoder Wiring 27
3.11. Digital I/O 28
3.11.1. Digital Inputs(PNP Type) Wiring 29
3.11.2. Digital Inputs(NPN Type) Wiring 30
3.11.3. Digital Outputs(NPN Type) Wiring 31
3.12. Analog Inputs 32
3.12.1. Analog Inputs Wiring 33
3.13. EtherCAT 34
3.13.1. EtherCAT Wiring 35
3.14. CAN 36
3.14.1. Terminating Resistor 36
3.14.2. CAN Wiring 37
3.15. USB 38
3.15.1. USB Wiring 39

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1. Safety Information

- Safety accidents and damage to the product may occur, so be sure to read the safety instructions before use and use it correctly.

1.1. Attention Symbols

In the course of the present document, the following symbols and signs will be used.

Type	Symbol	Description
Safety Alert	 Caution Attention	Indicates a **probable hazardous situation** or calls the attention to unsafe practices. If not avoided, it **may result in injury**.
	 Warning Avertissement	Indicates an **imminent hazardous situation**. If not avoided, it **will result in death or serious injury**.
Information		Indicates an activity you must perform prior continuing, or gives information on a particular item you need to observe.

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1.2. Warnings



- Do not connect/disconnect the main power of the servo drive while the power is on.
- Do not connect/disconnect the servo drive encoder cable and I/O while the power is on. Motor and servo drive may be damaged.
- The power cable can carry high voltage even when the motor is not moving.
- The main power of the servo drive must be accurately input according to the drive specifications. It may cause damage to the drive.
- Do not connect power directly to the servo drive U, V, W output terminals.
- After turning off the servo drive power, disconnect the power after the capacitor is completely discharged.

1.3. Cautions



- Be sure to separate U, V, W cables and encoder cables before wiring.
- After turning off the power, proceed with wiring the U, V, W cables and encoder cables.
- Do not drop it or subject it to strong impact.
- Do not install near flammable substances or water.
- Make sure that no sheath or copper wire gets inside the servo drive.
- It is recommended to use shielded cables for encoder cables.
- For EtherCAT cables, it is recommended to use CAT.6 cables.
- Check the U, V, W and encoder cables of the motor before turning on the power.
- It is recommended to connect the encoder cable and U, V, W and power FG to prevent noise.
- Be careful not to separate the connector from the board when connecting or disconnecting the cable.
- Additional cooling and/or heatsink may be required to achieve rated performance.

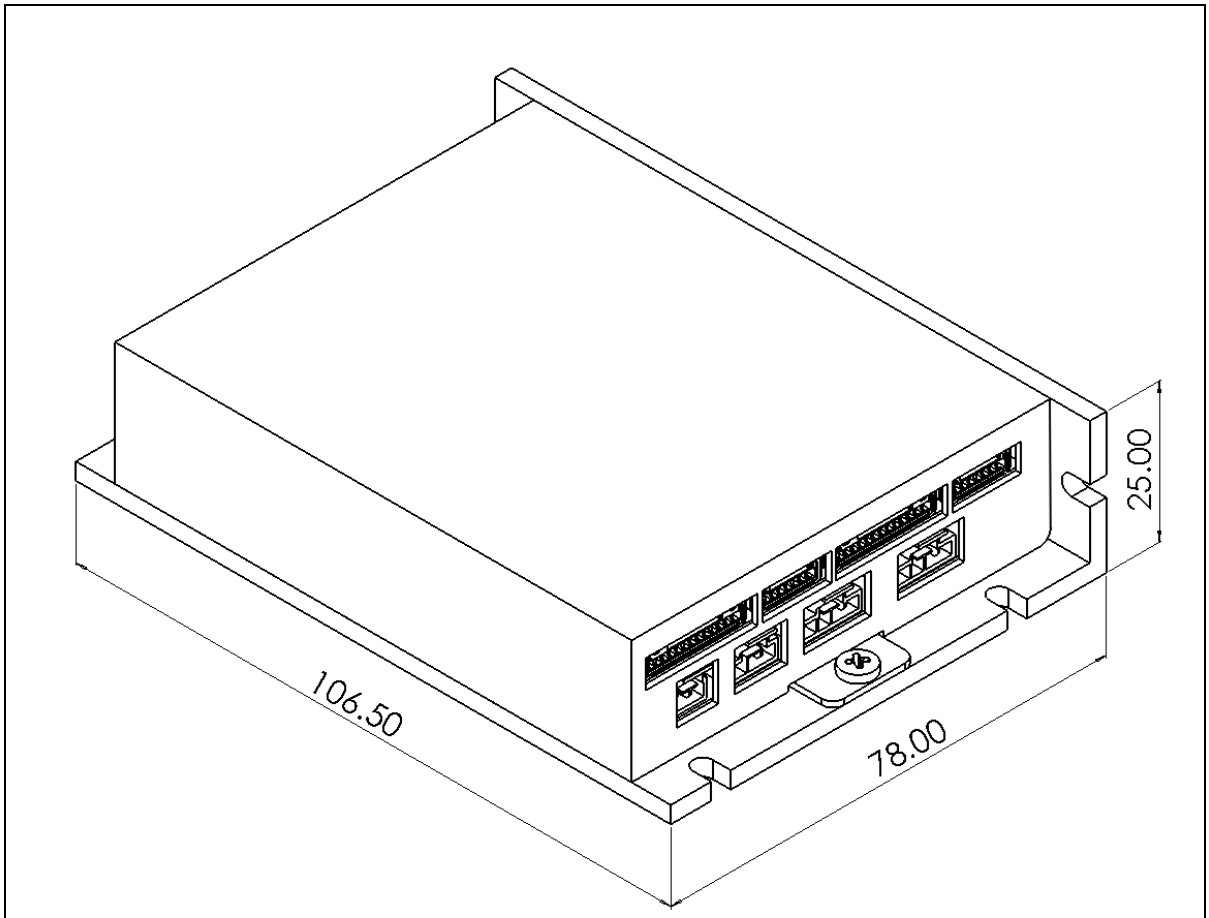
1.4. Use environment

Feature	Details
Operating Temperature	0 °C to 50 °C
Maximum Humidity	90[%] RH
Pollution Degree	2
Operating Place	A place free of iron, flammable gas, dust, etc.

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2. Technical Information

2.1. Mechanical Data

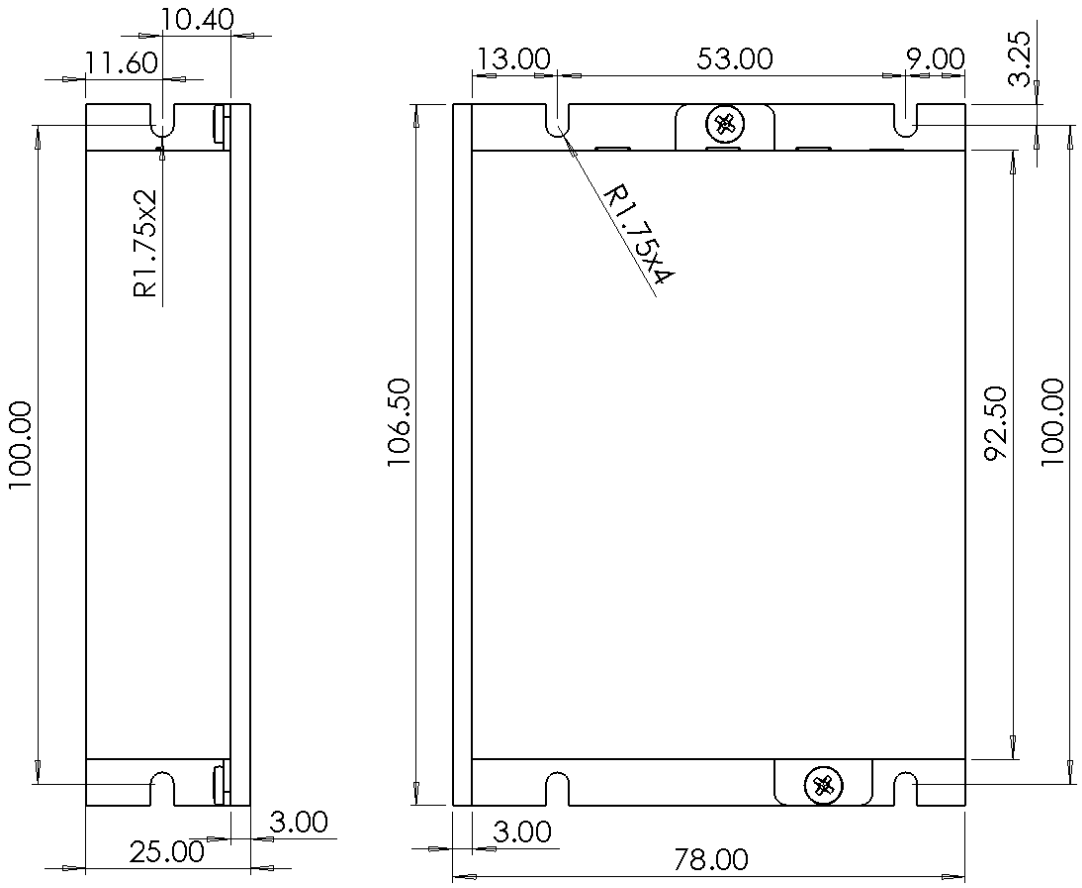


Item	Unit	Description
Weight	g	200
SIZE (L x W x H)	mm	106.5 x 78 x 25
Fastener	M3	

*For details, please refer to the 3D Modelling on the homepage.

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2.2. Mounting Dimension



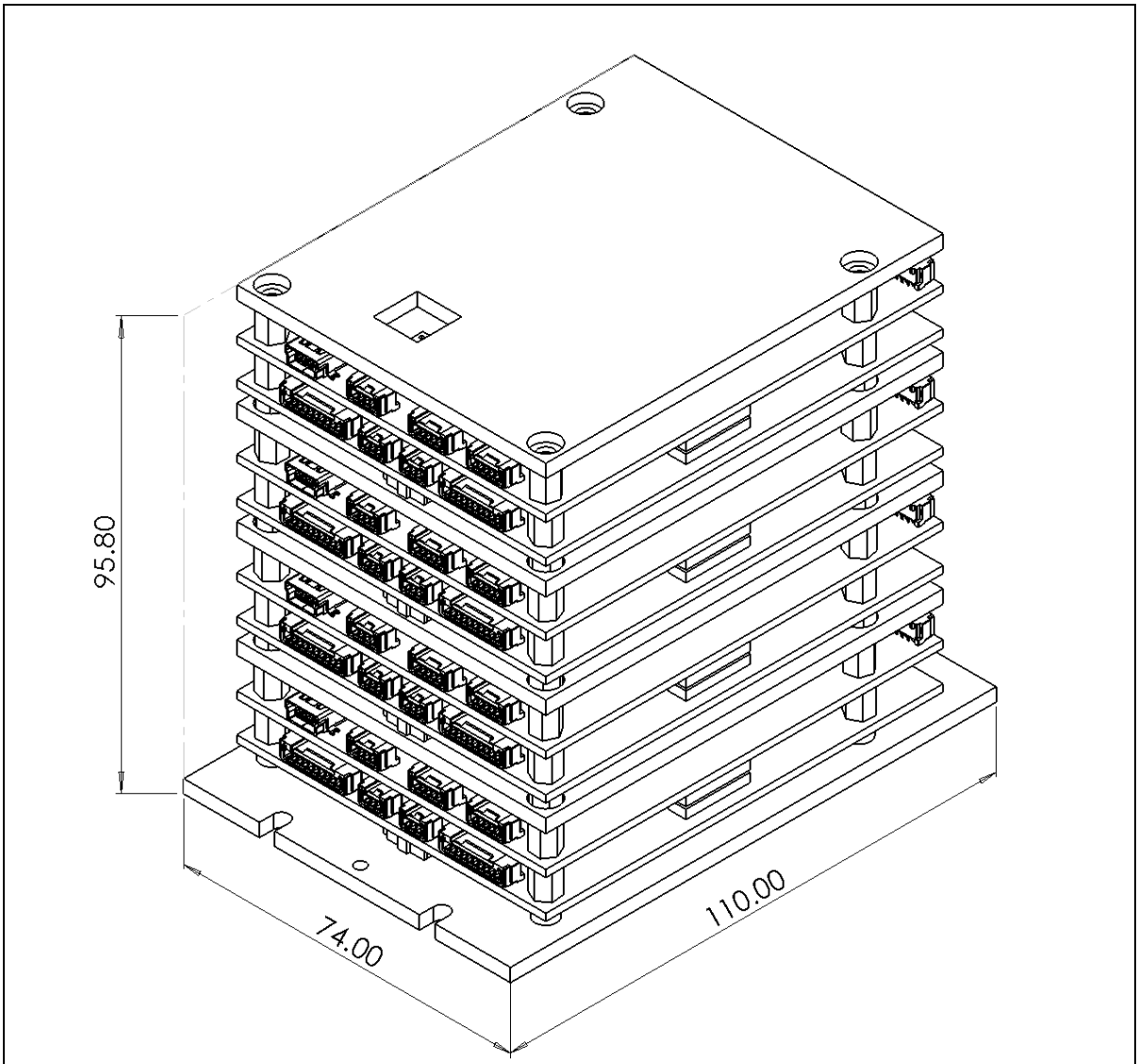
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2.3. Stacking the drive

Multiple drives can be stacked. Since the EtherCAT communication lines of the drives are connected to each other, physical wiring can be much simpler.

When the products are stacked and used in this manner, strong heat dissipation measures, such as using cooling fans, are required.

The picture shown below is an example of stacking 4 drives(8 axes).



Item	Unit	Description
Weight	g	620
SIZE (L x W x H)	mm	110 x 74 x 95.8
Fastener	M3	

*For details, please refer to the 3D Modelling on the homepage.

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2.4. Electrical Data

WE2A-D048/05-FS04A5				
Description	**Units**	**01**	**02**	**05**
Continuous Output Current	A[rms]	1	2	5
Peak Output Current	A[rms]	2	4	10
Minimum Supply Voltage	VDC	10		
Nominal Supply Voltage	VDC	48		
Maximum Supply Voltage	VDC	90		
Control Power Supply	VDC	24		
Maximum Continuous Output Power	W	48	96	240

Basic Specifications		
Feature	**Specification**	
Number of control axes	2	
Motors	DC/BLDC/PMSM/VCM	Rotary servo motors, Linear servo motors
Current(Torque) Control	Control Periodic	20KHz
	Control Loop	PI + Feed-forward
Velocity & Position Control	Control Periodic	4KHz
	Control Loop	Cascade P/PI + Feed-forward
	Filters	First order low pass filter, Four notch filters, First order adaptive windowing filters
Reference Command	Current/Velocity/ Position	USB, CAN(CANopen), EtherCAT(CoE, FoE)
Auto Tuning	Method	Automatic self-configuration and optimization of motor phasing, wires, current control loop, velocity control loop
GUI	User Interface	WELSS(WelconServoStudio), Setting, Drive, Motor, Feedback, I/O, Motion
Input Voltage	12~48VDC	
Current Consumption	≈50mA without encoder or other peripheral	
Protective Functions	Under- and over-voltage, Over-current, Over-load(with I^2T), Drive over-temperature	
Environment	Ambient temperature: Operation 0-50℃, Storage 0-70℃ Humidity: 10-90%, Vibration: 1.0g	

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Communication		
Feature	**Specification**	
USB	Baud rate: up to 3Mbps, Maximum cable length: 3m	
CAN	Bit rate: 125kbps ~ 1Mbps	
EtherCAT	100Mbps Communication cycle time: up to 250μs	
I/O		
Feature	**Specification**	
Analog Input	Quantity	1x2
	Voltage Range	Analog ±10 VDC differential
	Input Resolution	14 bit
Digital Input	Quantity	6x2
	Signal	Configurable. Opto-isolated.
	Voltage	24V
Digital Output	Quantity	2x2
	Signal	Configurable. Opto-isolated.
	Voltage	24V
	Max. Output Current	100mA
Brake	Use one of digital outputs (100mA)	
Motor Feedback		
General	Supply Voltage	5VDC
Incremental Encoder	Signal	A-quad-B with or without index, RS422, Differential
	A-quad-B Max Input Frequency	10MHz (before quadrature)
Digital Hall Sensor	Signal	Single-ended
	Type	Separated hall sensor
Serial Encoder	Type	SSI, BiSS-C, Tamagawa, Panasonic, EnDat2.2
	Bite rate	0.5Mbps, 1Mbps, 2Mbps, 2.5Mbps, 5Mbps

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2.5. Protections & Limitations

Protection Functionality	Switch-off threshold	Recovery threshold
Under Voltage	DC Link Voltage Minimum Limit	DC Link Voltage Minimum Limit + 0.5V
Over Voltage	DC Link Voltage Maximum Limit	DC Link Voltage Maximum Limit – 0.5V
Over Current (1/2/5A)*	Exceeding H/W Current Limit(2/4/10A) or 110% of Maximum Current	-
Over Temperature	100 ℃	95 ℃
Protection		
Motor overload and over-temperature	110% (at rated current)	

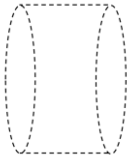
*** Optional (Refer to product code)**

- Under Voltage and Over Voltage are related to the value set in DC Link Voltage Limit (Index: 0x5012).
- DC Link Voltage Minimum Limit (Subindex: 0x01) can only be set to a value of 10V or above.
- DC Link Voltage Maximum Limit (Subindex: 0x02) can only be set to a value of 80V or below.

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3. Wiring

3.1. Wiring Legend

Wiring Symbol	Description
	Ground
	Frame Ground
	Protective Earth Connection
	Twisted-pair wires
	Shielded Cable
	Power Supply

3.2. Wire Size

When selecting the wire gauge for the motor power wires, power supply wires, and ground wires, it is better to err on the side of larger diameter wire rather than too thin. This becomes more critical as the cable length increases. The following table provides recommendations for selecting the appropriate wire size for a specific current. These values should be used as reference only.

Use 24-28AWG for control wires(I/O, Feedback, Communication Wire) excluding main wires such as motor power.

Current(A)	Minimum Wire Size (AWG)	mm^2	Current(A)	Minimum Wire Size (AWG)	mm^2
10	20	0.518	45	12	3.31
15	18	0.823	60	10	5.26
20	16	1.31	80	8	8.37
35	14	2.08	120	6	13.3

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3.3. Wiring Precautions

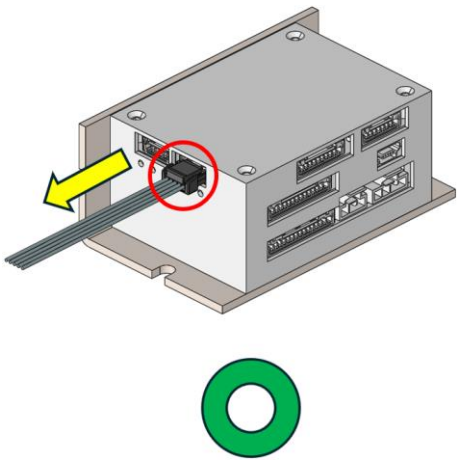
⚠ Cautions

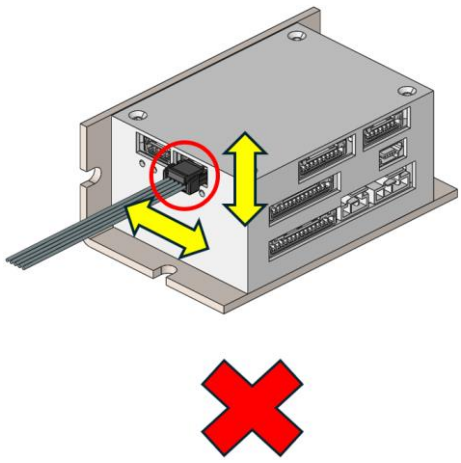
Precautions when connecting connectors

- Before connecting the connector, ensure that the pins and sockets are free of dust, debris, or damage.
- If the pin is bent or damaged, replace or repair it immediately.
- Do not force insertion.
- Make sure the connector is fully inserted and the lock is locked in place.
- When inserting the connector, use even force and be careful not to apply excessive force.

Precautions when disconnecting the connector

- If there is a locking tab or clip, unlock it by hand and then disconnect the connector.
- Do not forcefully pull on the connector without unlocking it.
- Disconnect the connector by pulling it straight in the designed direction.
- Do not shake it up and down or side to side.
- Separate slowly and gently, without applying too much force.
- After disconnection, check that the connector pins and socket are not damaged.



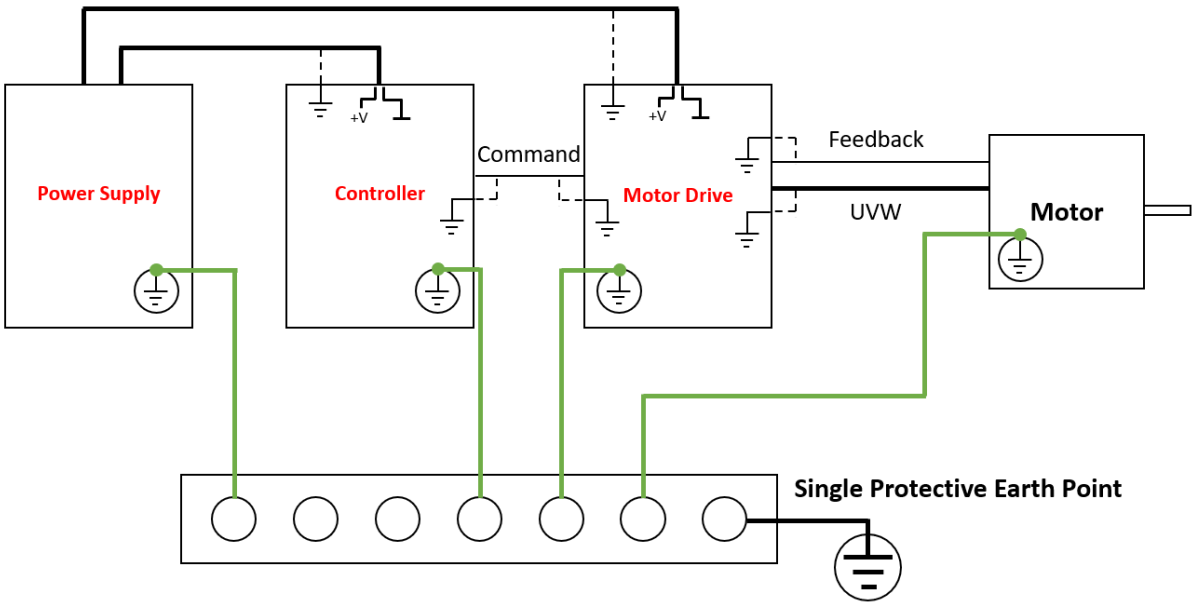


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3.3.1. Grounding

The case grounds of all the system components should be connected to a single Protective Earth (PE) ground point.

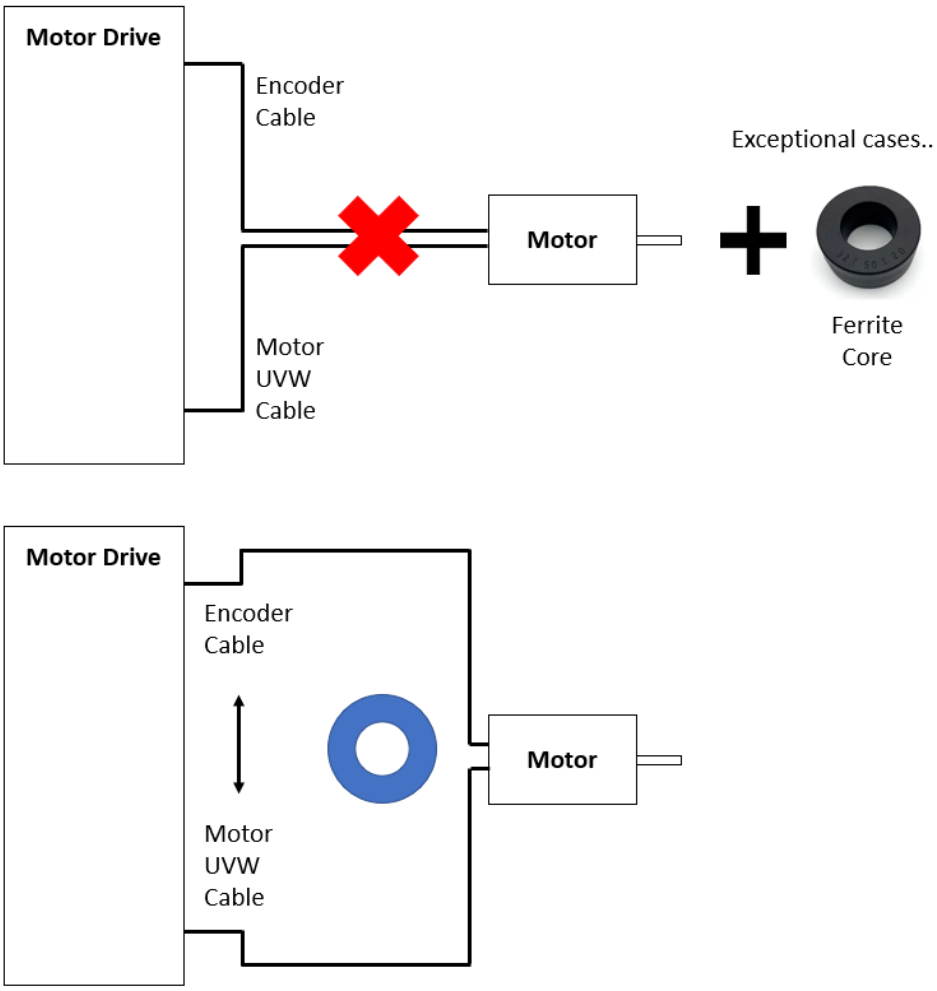
Grounding the case grounds at a central PE ground point through a single low resistance wire reduces the chance for ground loops and helps to minimize high frequency voltage differentials between components. All ground wires must be of a heavy gauge and be as short as possible.



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3.3.2. Feedback and Motor UVW Wires

Use of a twisted, shielded pair for the feedback wires is recommended. Ground the shield at one end only to the drive chassis ground. Also make sure that the feedback connector and D-sub shell preserve the shield continuity. Route cables and/or wires to minimize their length and exposure to noise sources. The Motor UVW wires are a major source of noise, and the Motor Feedback wires are susceptible to receiving noise. This is why it is never a good idea to route the Motor UVW wires with the Motor Feedback wires, even if they are shielded. Although both of these cables originate at the drive and terminate at the motor, try to find separate paths that maintain distance between the two.



If the two wires cannot be separated from each other, install a ferrite core to attenuate noise. For best results, wind the wire as much as possible, and always in the same direction.
When winding the ferrite core around the motor UVW wire, the ground(FG) wire must not pass through the ferrite core.

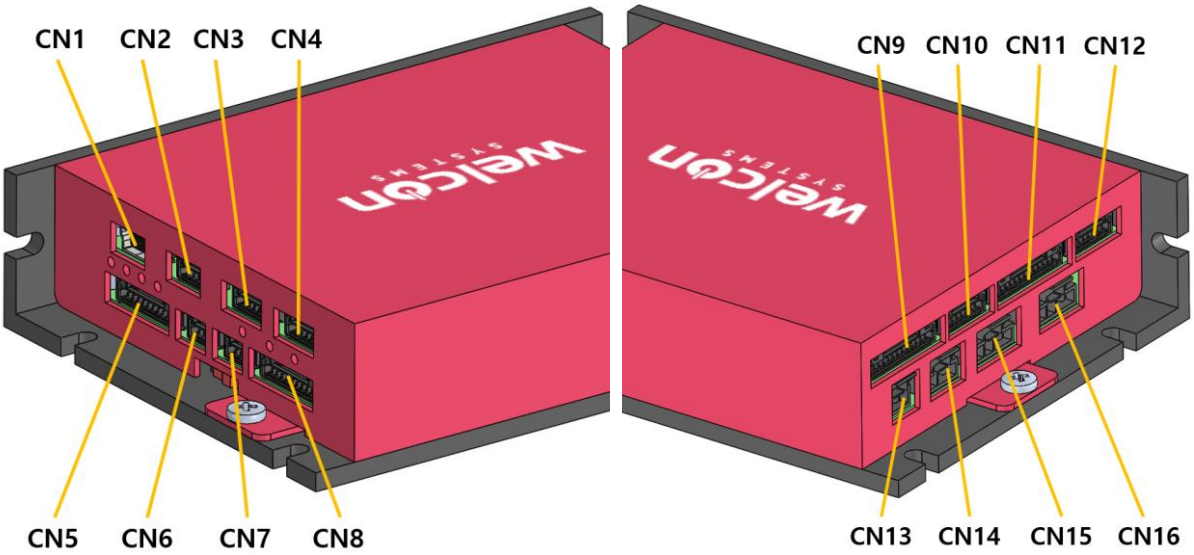
We have experience solving noise problems in systems with a cable length of 4-5m using King Magnetic's KMN-503220 product. The specifications of the ferrite core must be appropriately selected depending on the system.

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3.4. Tools

Tool	Manufacturer	Part Number
Hand crimp Tool	MOLEX	638275600
Hand crimp Tool	MOLEX	2002180300

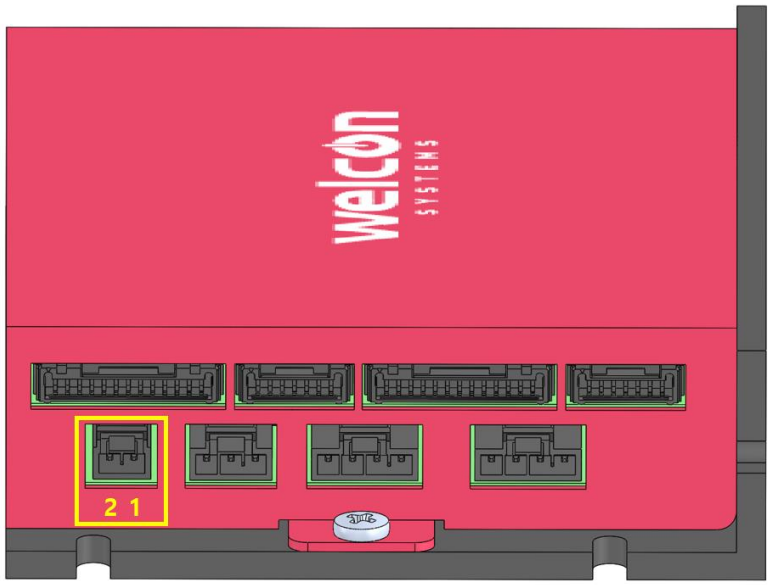
3.5. Connections



Connector	Function	Connector	Function
CN1	USB	**CN9**	Motor #2 Digital Encoder
CN2	Analog Input	**CN10**	Motor #2 Serial Encoder
CN3	EtherCAT OUT	**CN11**	Motor #1 Digital Encoder
CN4	EtherCAT IN	**CN12**	Motor #1 Serial Encoder
CN5	Motor #1 GPIO	**CN13**	Regenerative resistance
CN6	CAN #1	**CN14**	Main Power
CN7	CAN #2	**CN15**	Motor #2 UVW
CN8	Motor #2 GPIO	**CN16**	Motor #1 UVW

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3.6. Regenerative resistance





MOLEX_105307-1202



MOLEX_105300-2100

MOLEX_105313-1102	J102
Pin	**Signal**
1	R+
2	R-

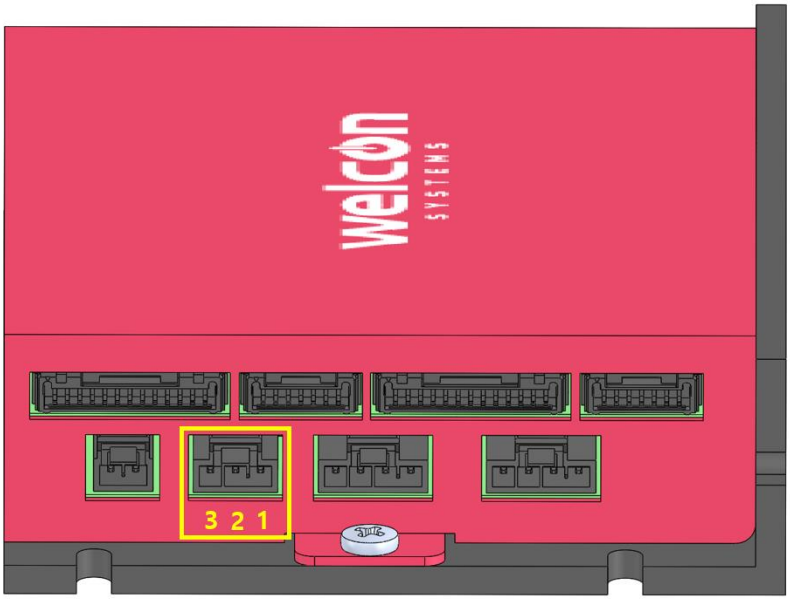
Warning
Avertissement

- In a system with a large inertia enough to generate regenerative power, you must connect a regenerative resistor to consume energy as heat. Please note that the drive may be damaged by regenerative power.
- Be sure to connect the regenerative resistor after changing the regen clamp cut-off voltage value(Object Index : 0x5013).

- For WE2A-D048/05-FS04A5, we recommend using a regenerative resistor of approximately **4.8 ohm**. (In case both axes regenerate at the same time) However, the appropriate resistance value and capacity vary depending on the load and acceleration/deceleration used in the system, so please calculate the capacity appropriate for your system.

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3.7. Main Power





MOLEX_105307-1203



MOLEX_105300-2100

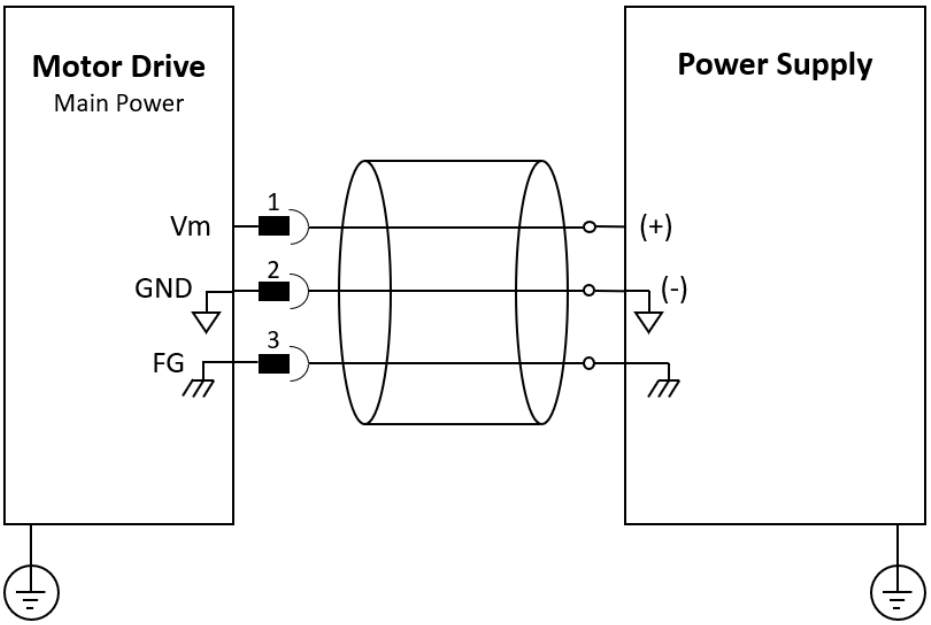
MOLEX_105313-1103		J101
Pin	**Signal**	**Input Power**
1	Vm	12V~48VDC
2	GND	GND
3	FG	FG

Warning
Avertissement

- Do not connect/disconnect the servo drive while the power is on.
- Before applying power, make sure that the DC supply is within the specified range.
- make sure the proper plus and minus connections are in order.

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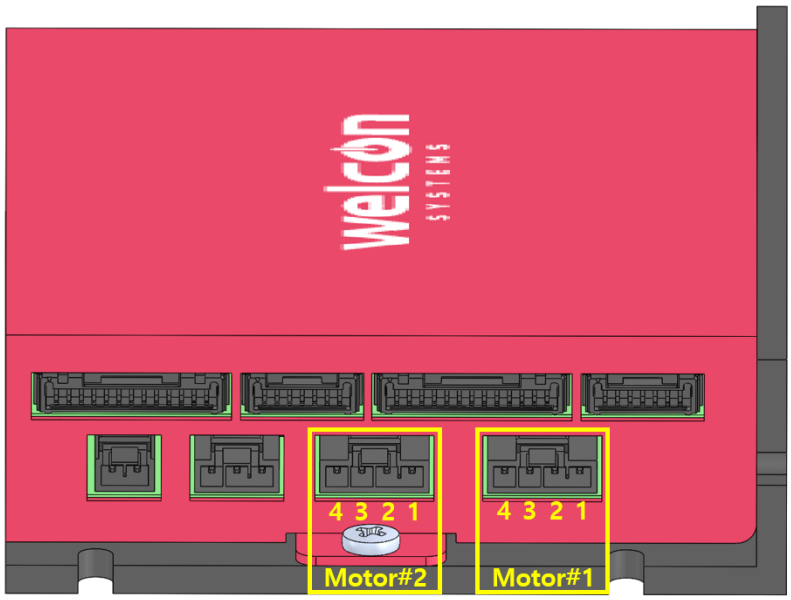
3.7.1. Main Power Wiring



[Main Power(12~48VDC) Connection Diagram]

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3.8. Motor UVW





MOLEX_105307-1204

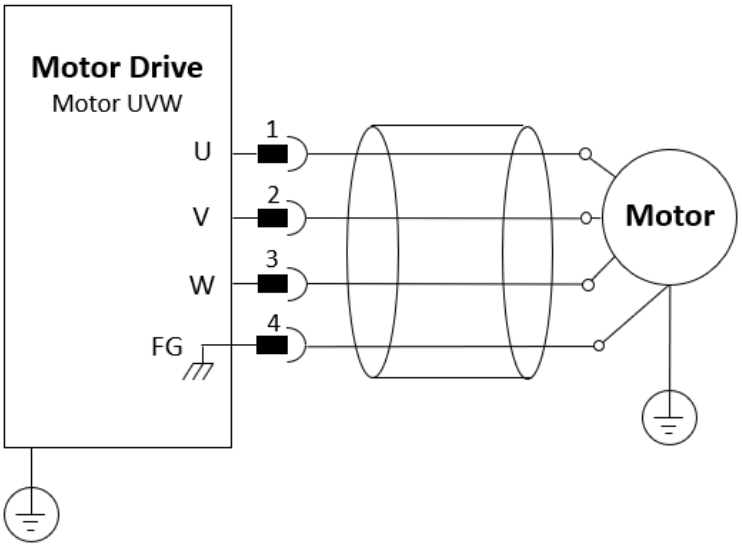


MOLEX_105300-2100

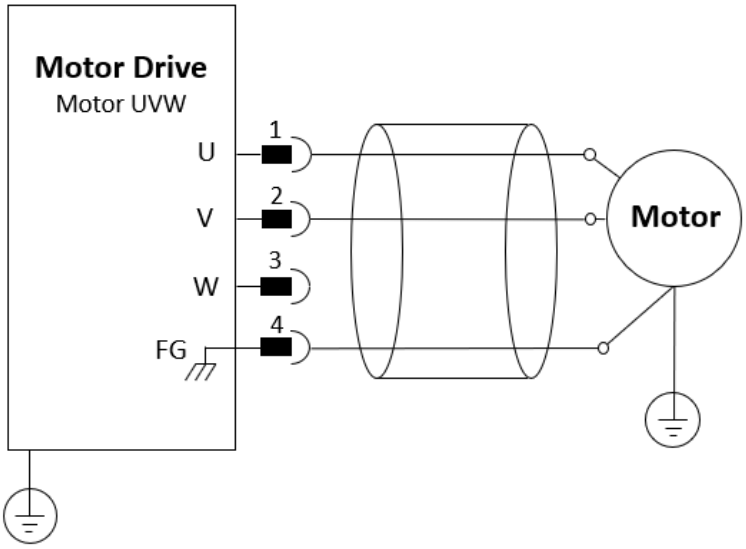
MOLEX_105313-1104	J201, J301
Pin	**Signal**
1	U (VCM or DC Motor : +)
2	V (VCM or DC Motor : -)
3	W
4	FG

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3.8.1. Motor UVW Wiring



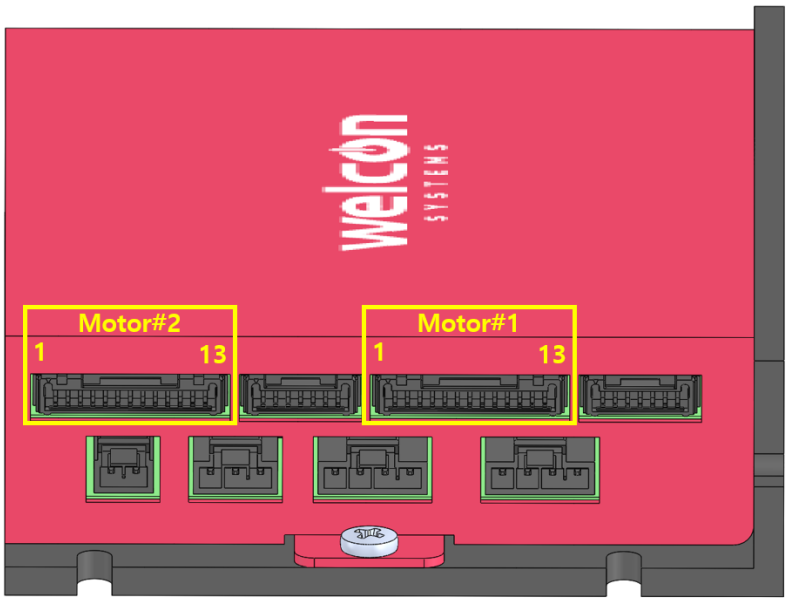
[Brushless / PMSM Motor UVW Connection Diagram]



[Brushed DC / Voice Coil Motor UVW Connection Diagram]

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3.9. Digital Encoder





MOLEX_505565-1301

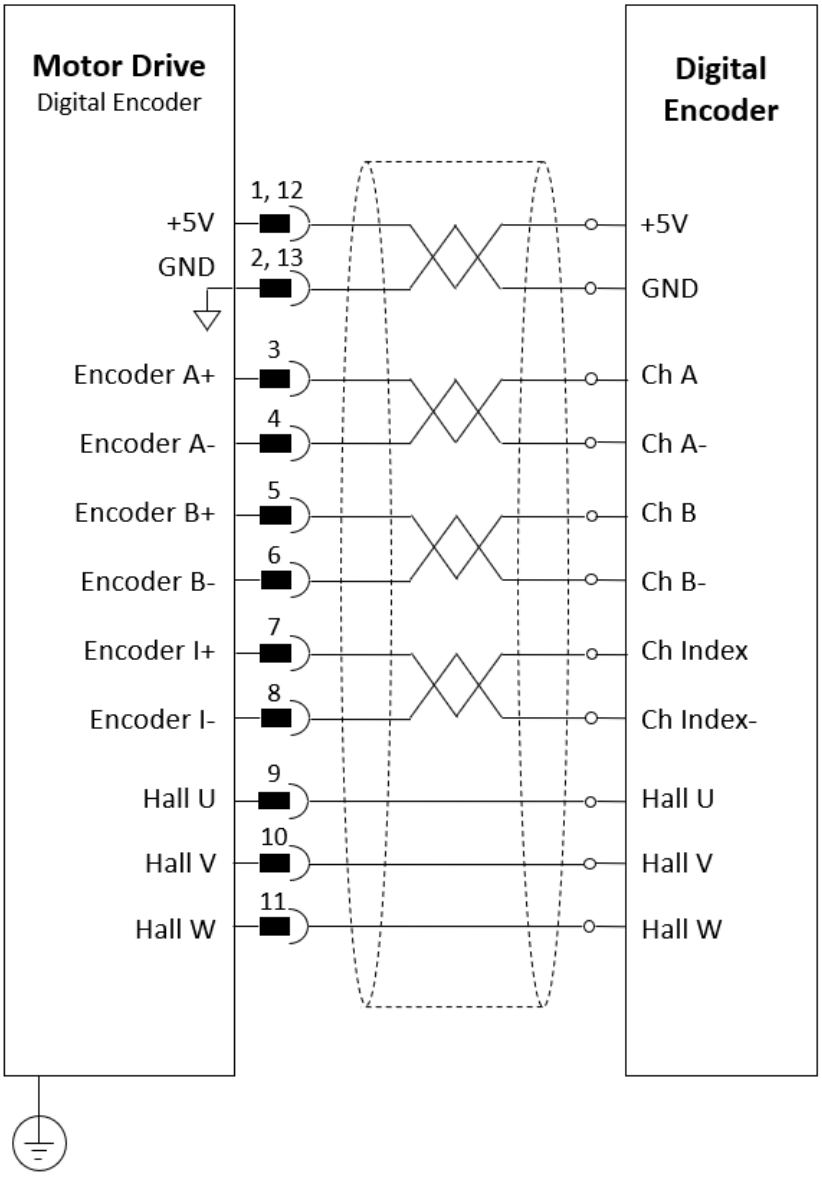


MOLEX_505431-1100

MOLEX_505567-1381	J501, J502
Pin	**Signal**
1	5V
2	GND
3	Encoder A+
4	Encoder A-
5	Encoder B+
6	Encoder B-
7	Encoder I+
8	Encoder I-
9	Hall U
10	Hall V
11	Hall W
12	5V
13	GND

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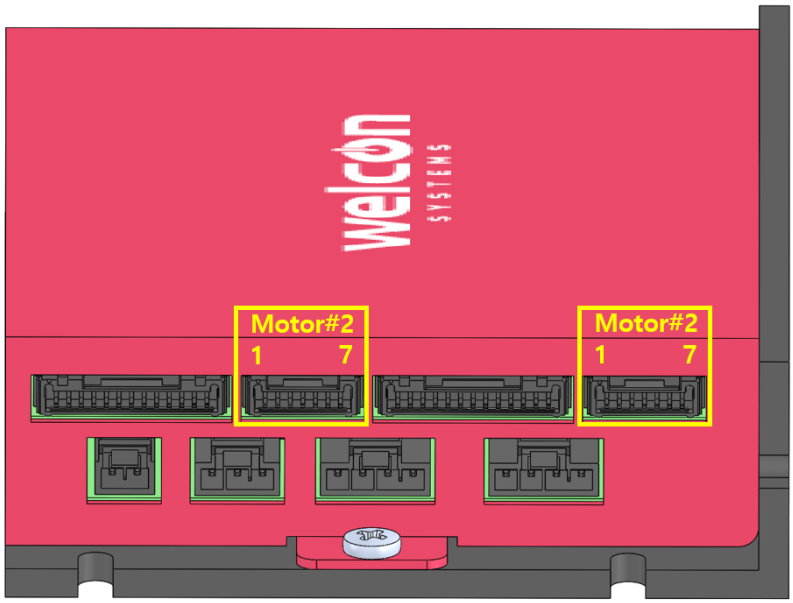
3.9.1. Digital Encoder Wiring



[Digital Encoder Connection Diagram]

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3.10. Serial Encoder





MOLEX_505565-0701



MOLEX_505431-1100

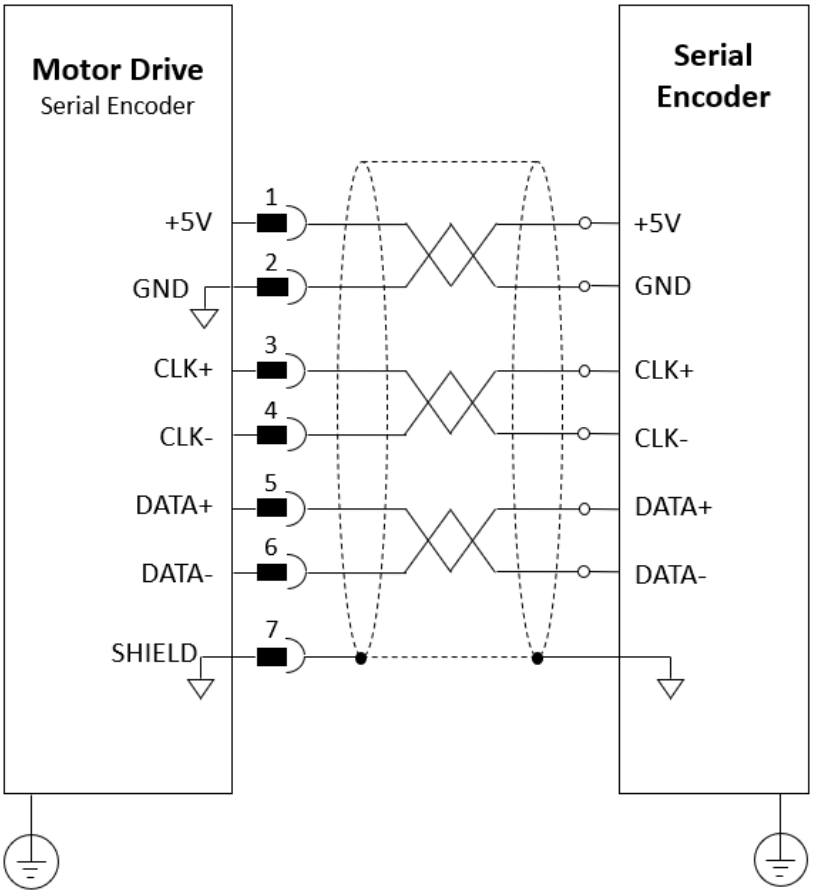
MOLEX_505567-0781	J701, J702	
Pin	**Signal**	
1	5V	
2	GND	
3	CLK+	
4	CLK-	
5	Data+	RS485_RTX+
6	Data-	RS485_RTX-
7	Shield	

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3.10.1. Serial Encoder Wiring

The cable's shield is connected to the shield in the connector.

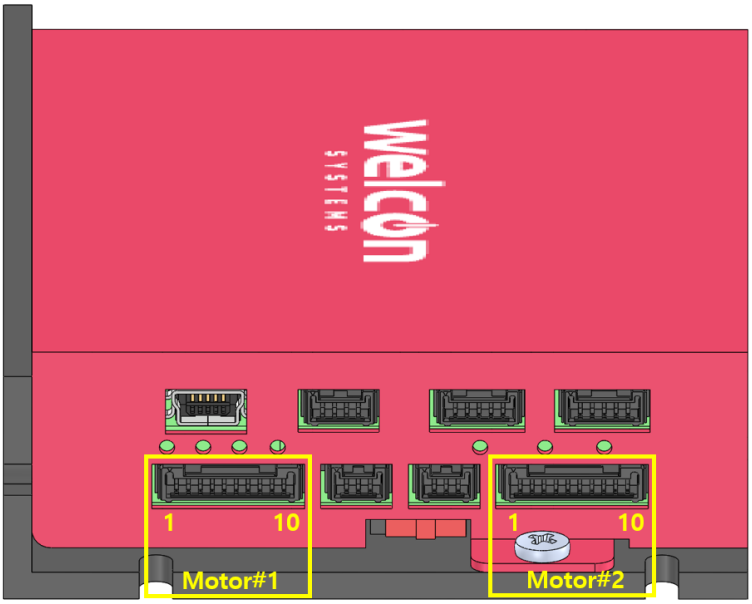
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues.



[Serial Encoder Connection Diagram]

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3.11. Digital I/O





MOLEX_505565-1001

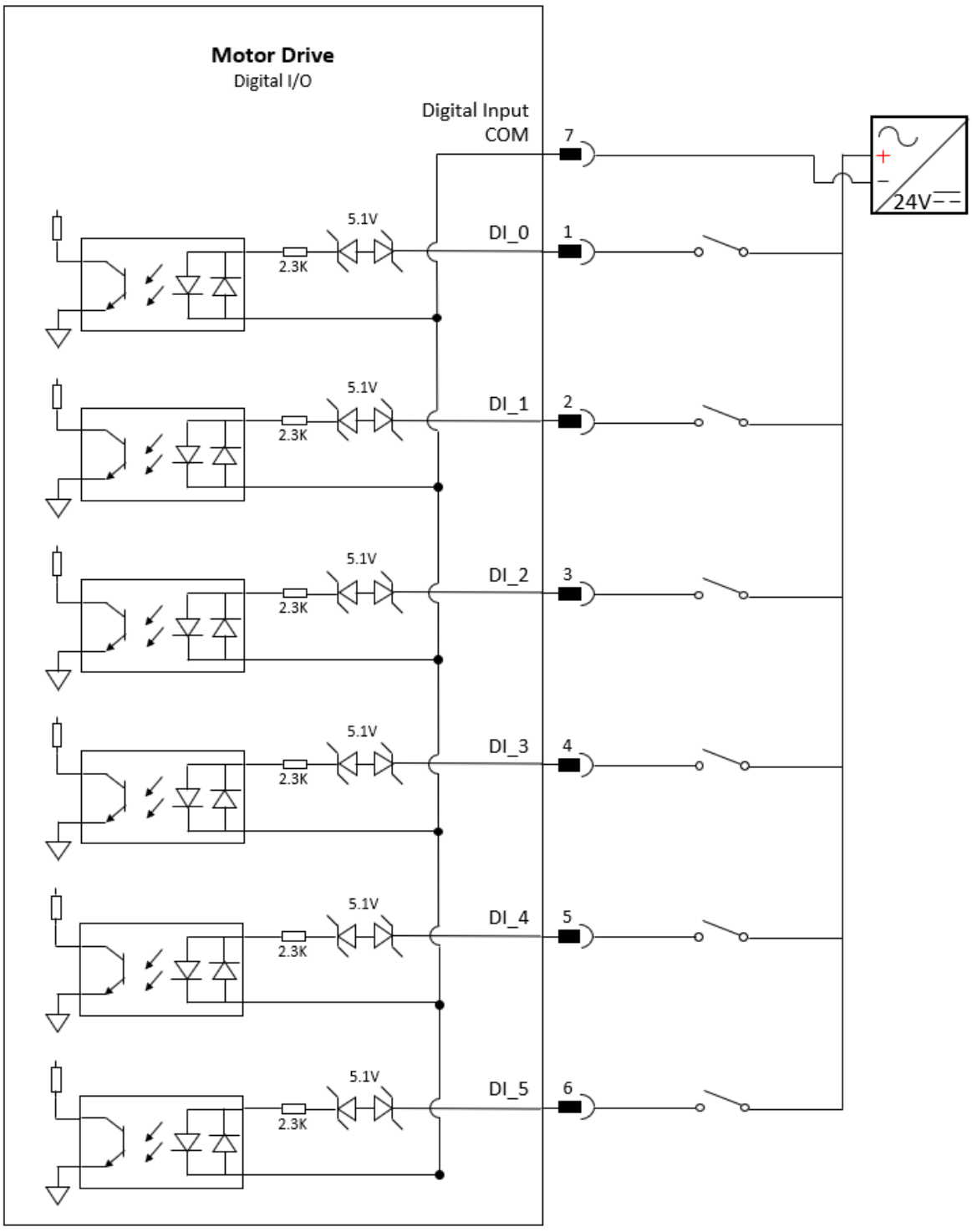


MOLEX_505431-1100

Molex 505567-1081	J401, J402
Pin	**Signal**
1	Digital Input_0
2	Digital Input_1
3	Digital Input_2
4	Digital Input_3
5	Digital Input_4
6	Digital Input_5
7	Digital Input_COM
8	Digital Output_0
9	Digital Output_1
10	Digital Output_COM

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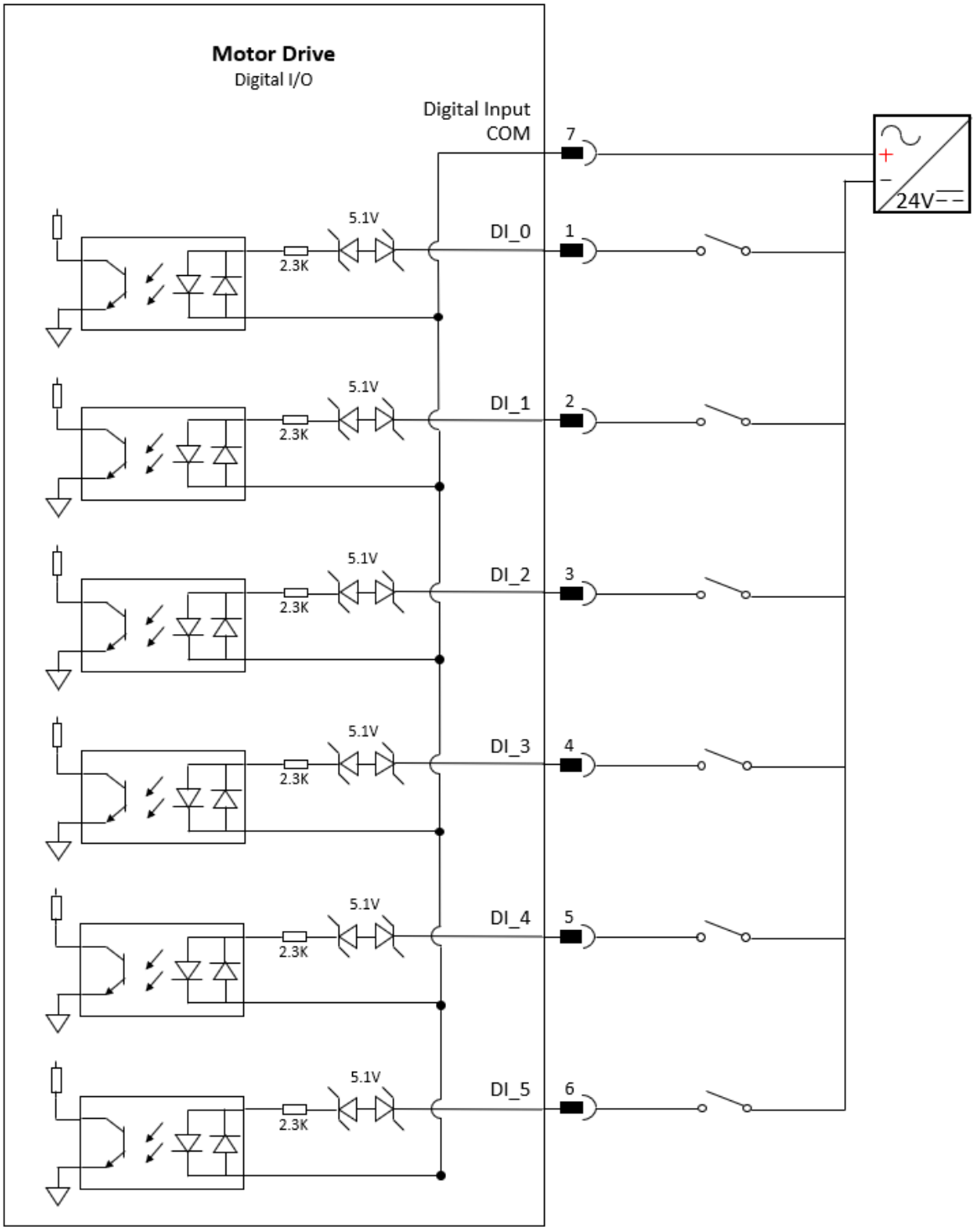
3.11.1. Digital Inputs(PNP Type) Wiring



[Digital Inputs(PNP Type) Connection Diagram]

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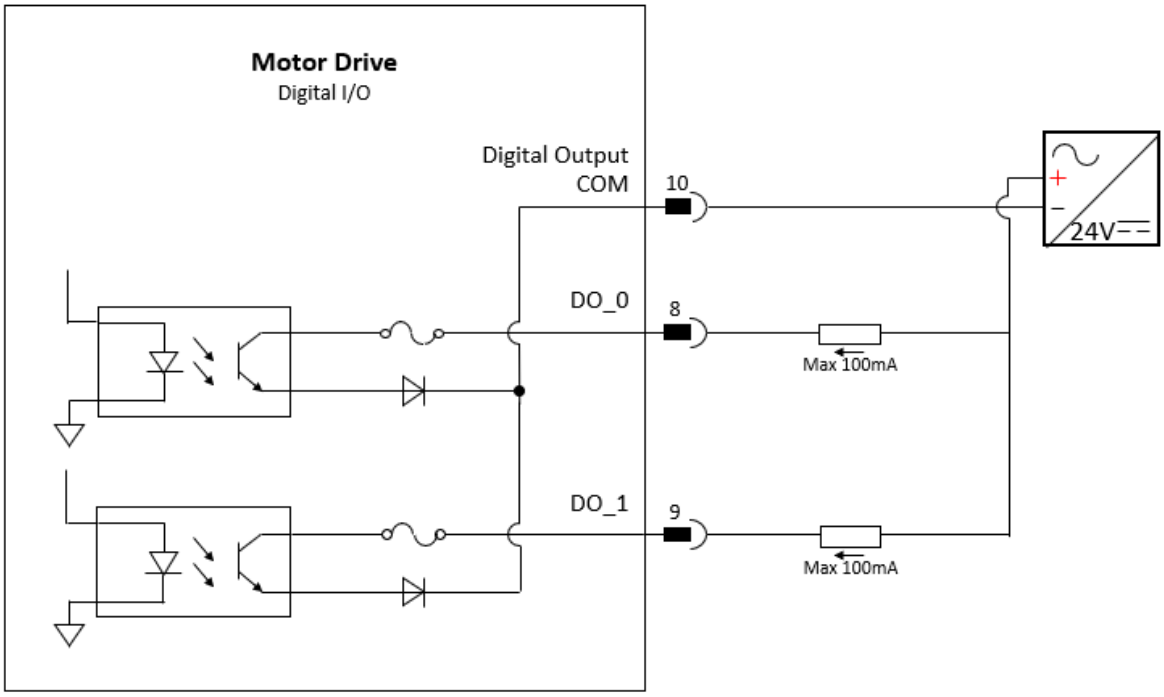
3.11.2. Digital Inputs(NPN Type) Wiring



[Digital Inputs(NPN Type) Connection Diagram]

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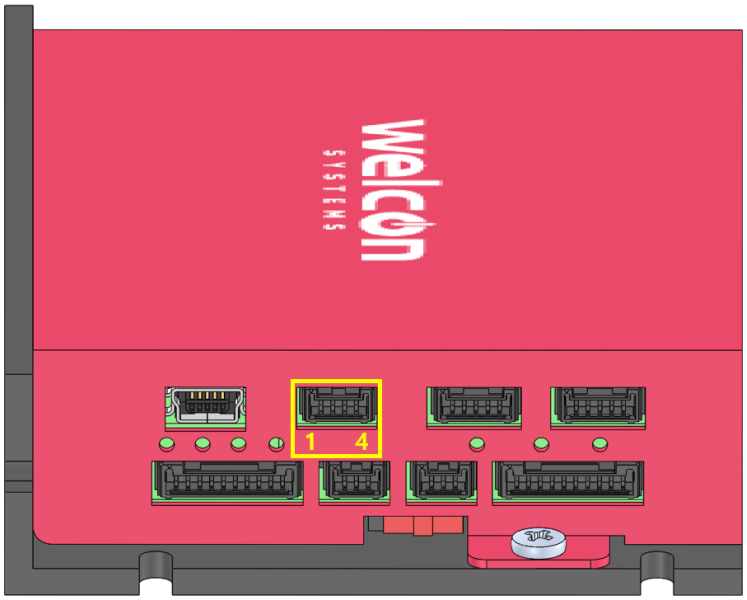
3.11.3. Digital Outputs(NPN Type) Wiring



[Digital Outputs(NPN Type) Connection Diagram]

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3.12. Analog Inputs





MOLEX_505565-0401

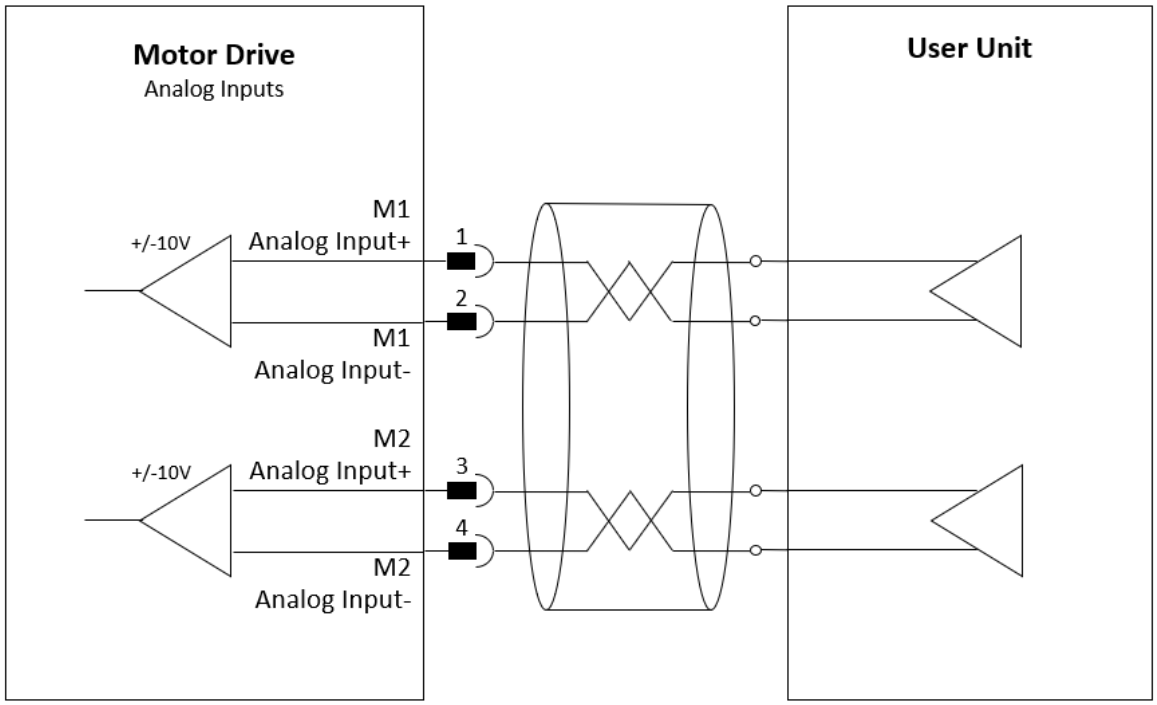


MOLEX_505431-1100

MOLEX_505567-0481	J601
Pin	**Signal**
1	M1_Analog Input1+
2	M1_Analog Input1-
3	M2_Analog Input2+
4	M2_Analog Input2-

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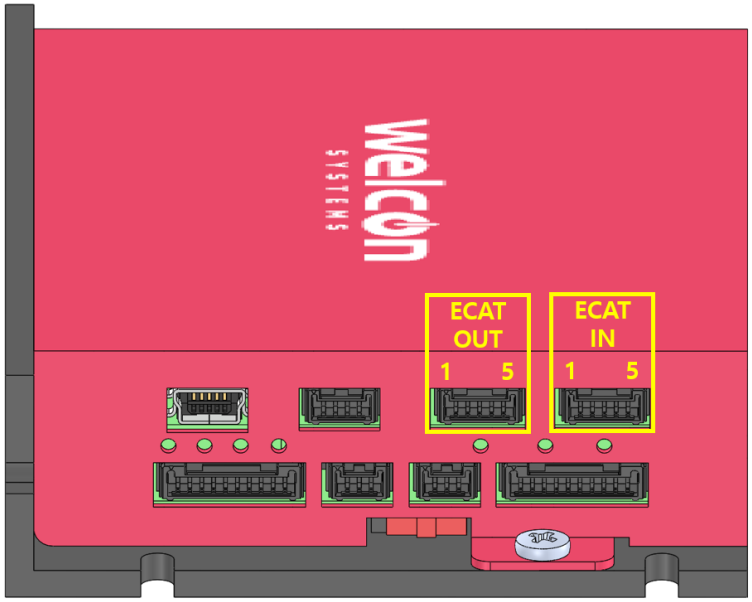
3.12.1. Analog Inputs Wiring



[Analog Input Connection Diagram]

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3.13. EtherCAT





MOLEX_505565-0501

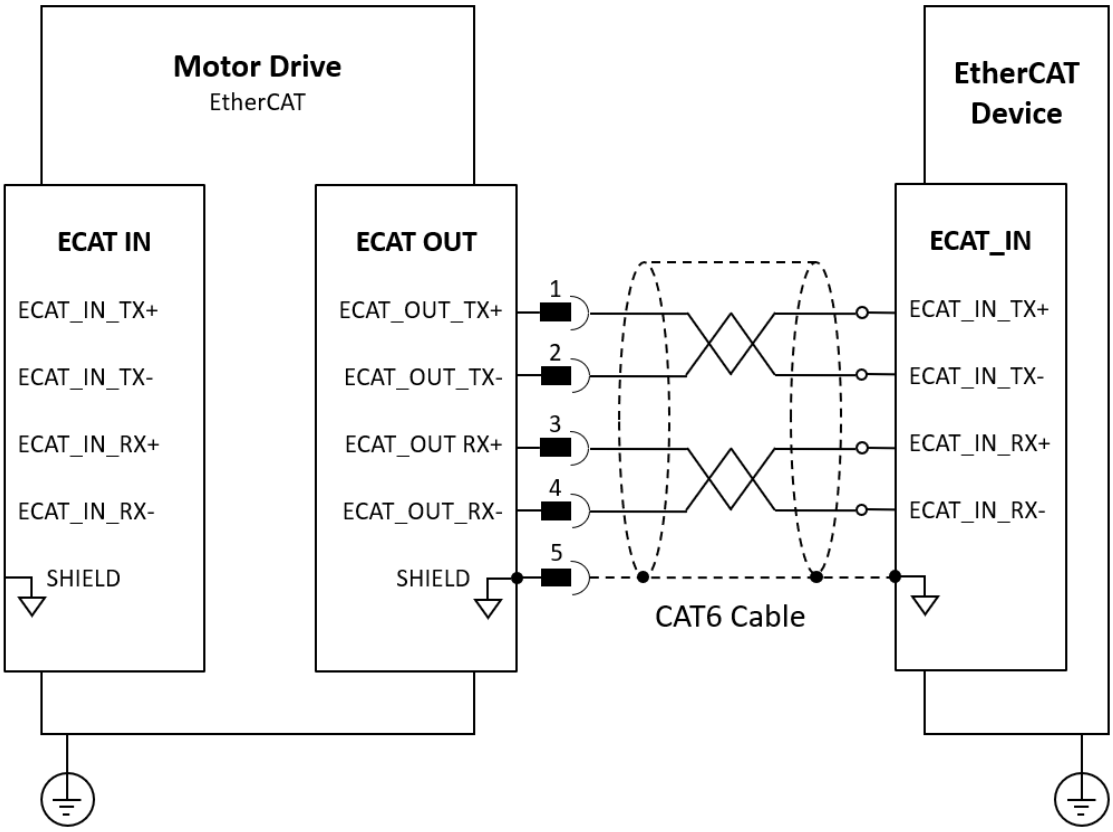


MOLEX_505431-1100

MOLEX_505567-0581	J301, J401
Pin	**Signal**
1	EtherCAT Tx+
2	EtherCAT Tx-
3	EtherCAT Rx+
4	EtherCAT Rx-
5	Shield

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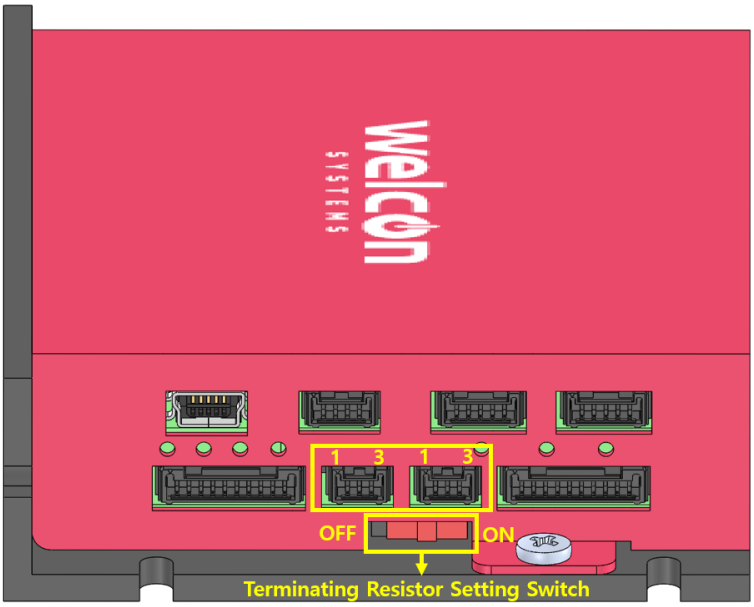
3.13.1. EtherCAT Wiring



[EtherCAT Connection Diagram]

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3.14. CAN





MOLEX_505565-0301

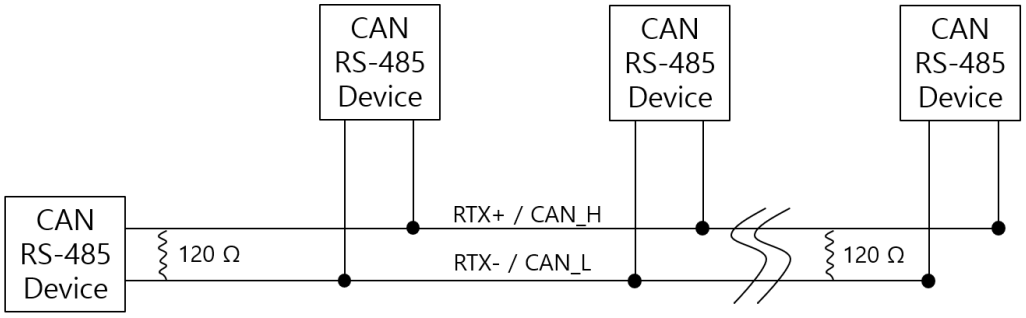


MOLEX_505431-1100

MOLEX_505567-0381	J1, J2
Pin	**Signal**
1	HIGH
2	LOW
3	GND

3.14.1. Terminating Resistor

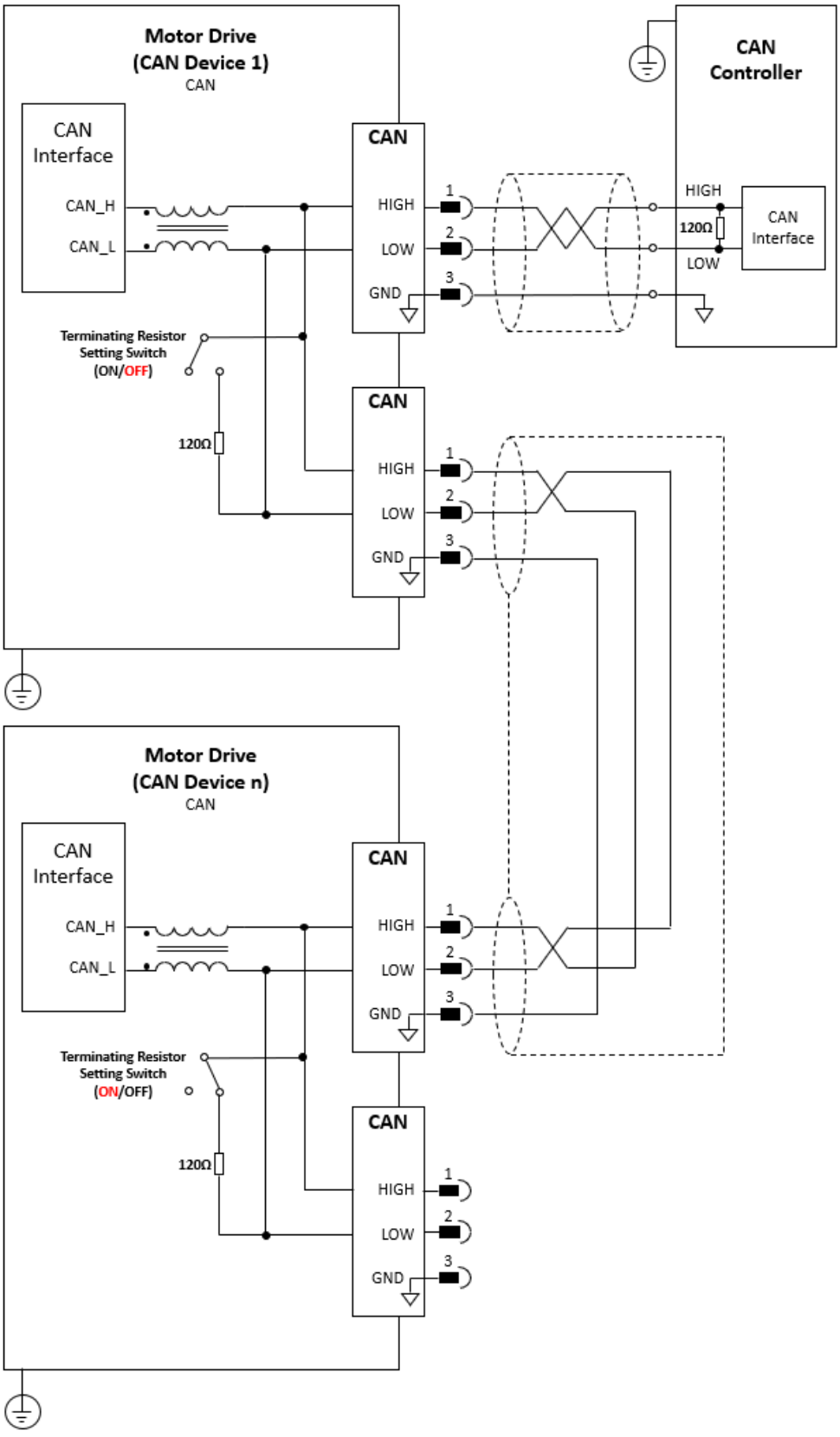
- Connect the terminating resistor to both ends of the CAN or RS 485 signal line using the terminating resistor setting switch.



[CAN or RS-485 Communication]

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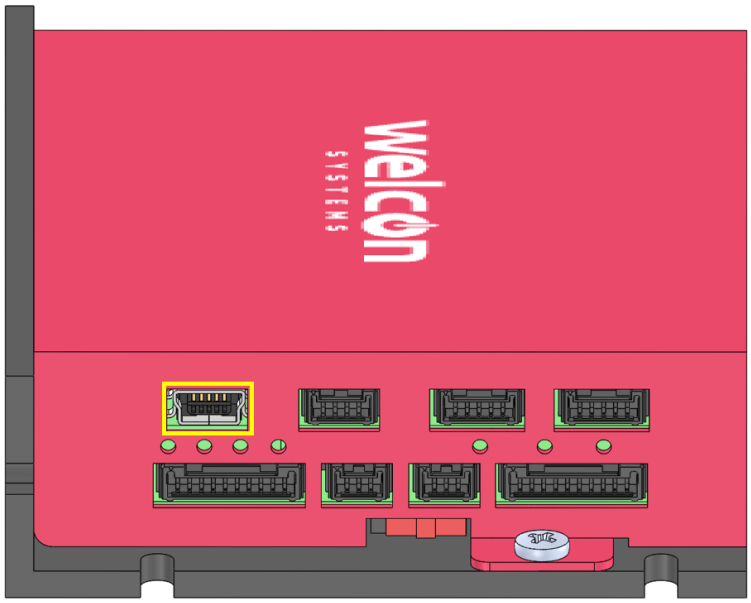
3.14.2. CAN Wiring



[CAN Connection Diagram]

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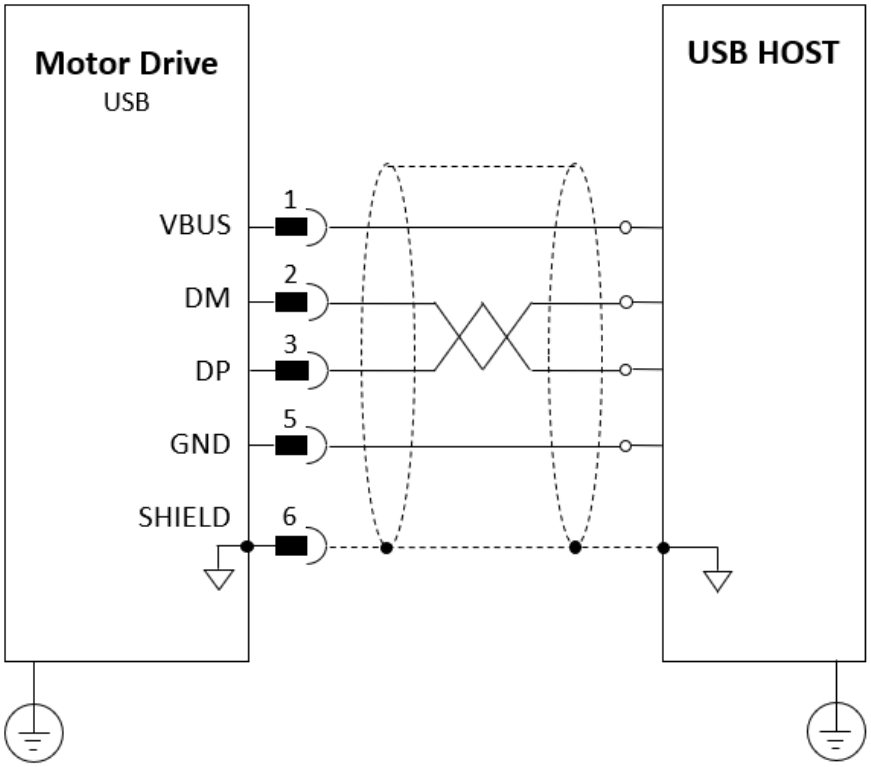
3.15. USB



USB-Mini Type B (Keystone Model:937)	J101
Pin	**Signal**
1	VBUS
2	DM
3	DP
4	Not Used
5	GND
6	Shield

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3.15.1. USB Wiring



[USB Connection Diagram]

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