WELCON
Servo Drive

Hardware Manual

WER-D048/40-FS04A7_V04

2025-07-29

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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.

Copyright Notice

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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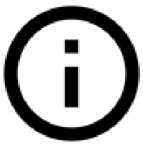
CONTENTS

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.

Warning
Avertissement

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.

Caution
Attention

1.3. Cautions

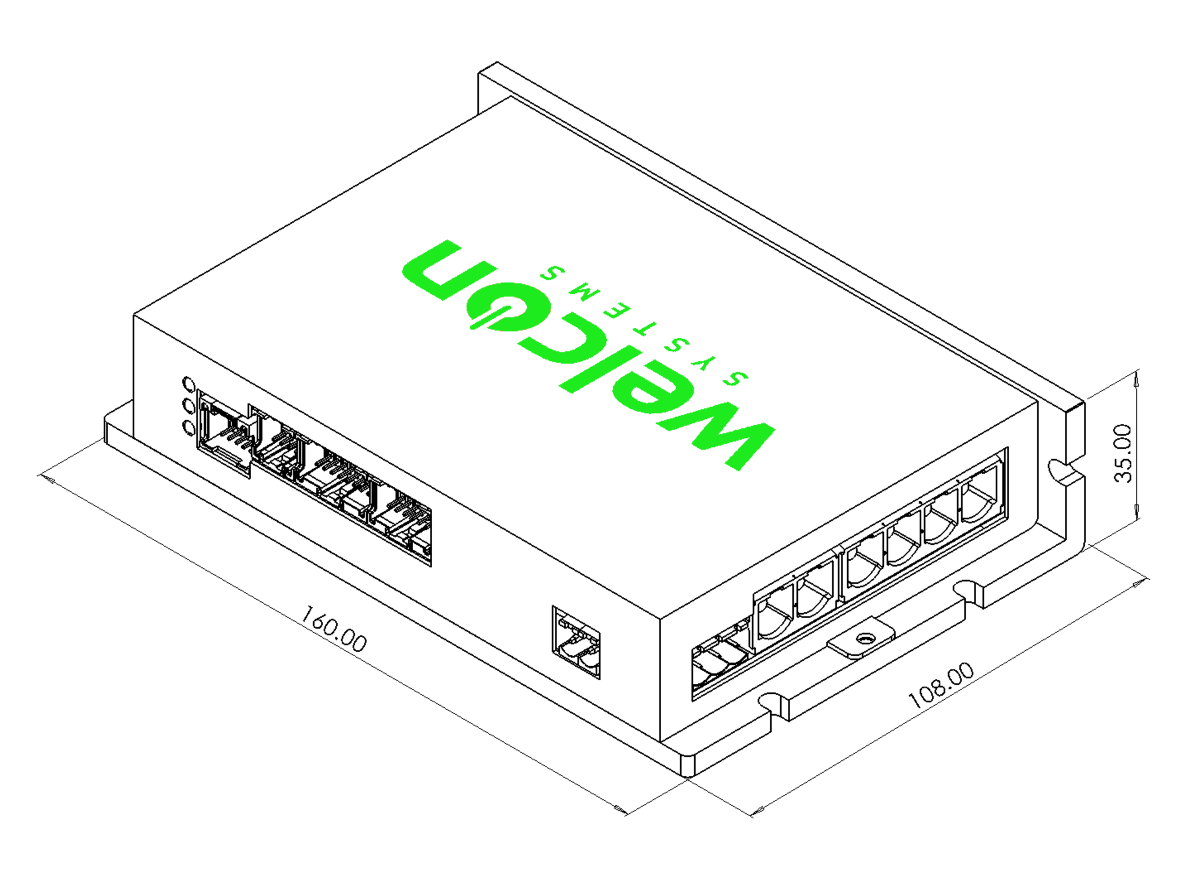
- Be sure to separate U, V, W cables and encoder cables before wiring.
- After turning off the power, proceed with wiring the U, V, W cables and encoder cables.
- Do not drop it or subject it to strong impact.
- Do not install near flammable substances or water.
- Make sure that no sheath or copper wire 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
Operating Place	A place free of iron, flammable gas, dust, etc.

2. Technical Information

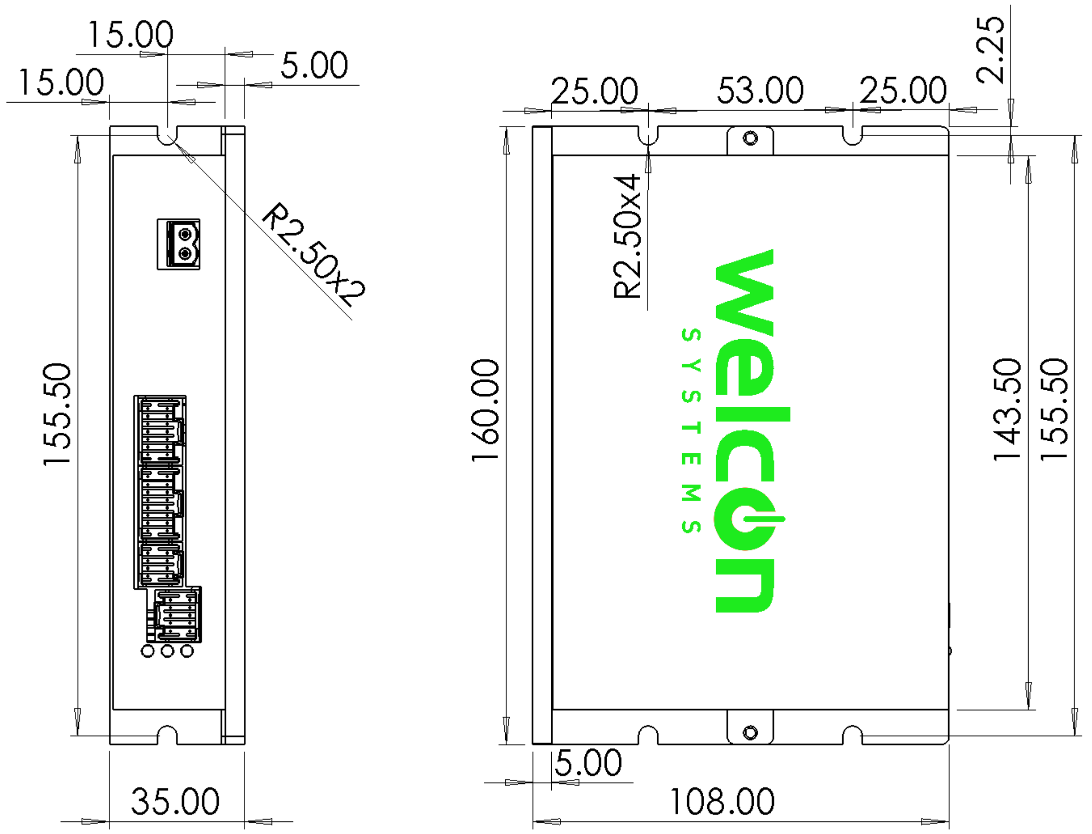
2.1. Mechanical Data

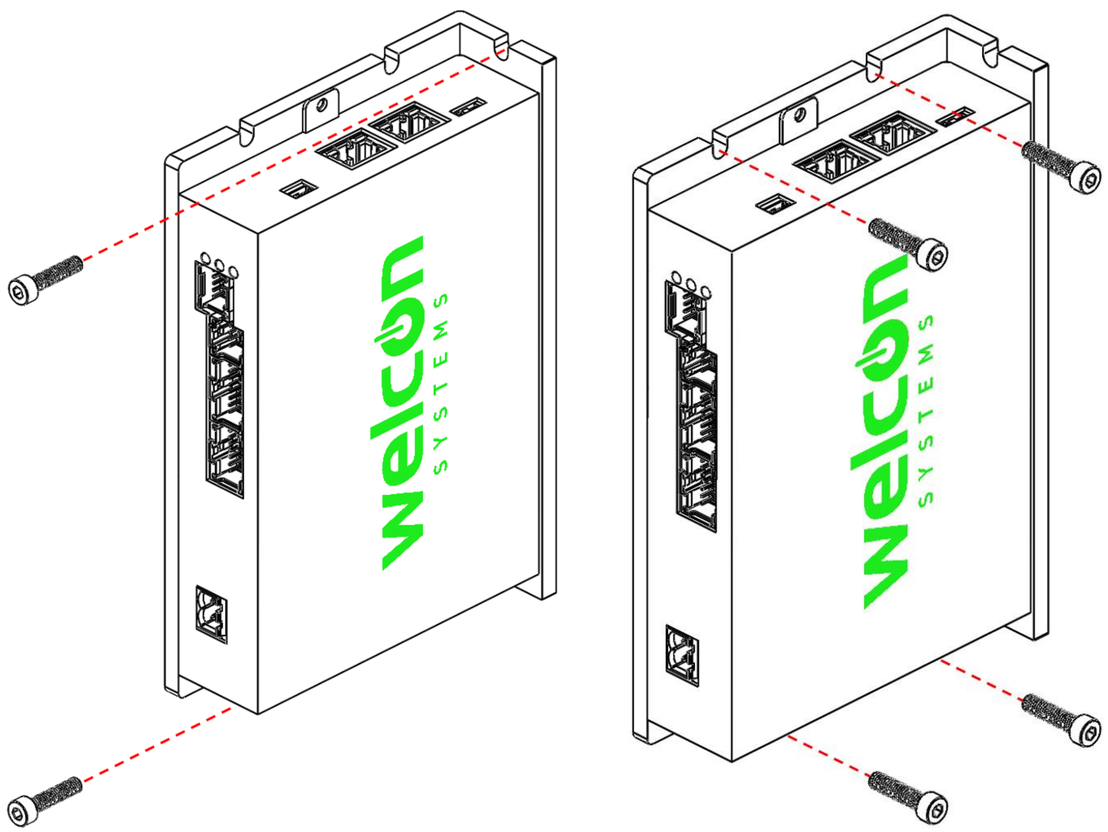


Item	Unit	Description
Weight	g	723
SIZE (L x W x H)	mm	160 * 108 * 35
Fastener	M3	-
Mounting Method	-	Wall Mount / Bookshelf
Mounting Screw	M4	-

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

2.2. Mounting Dimension

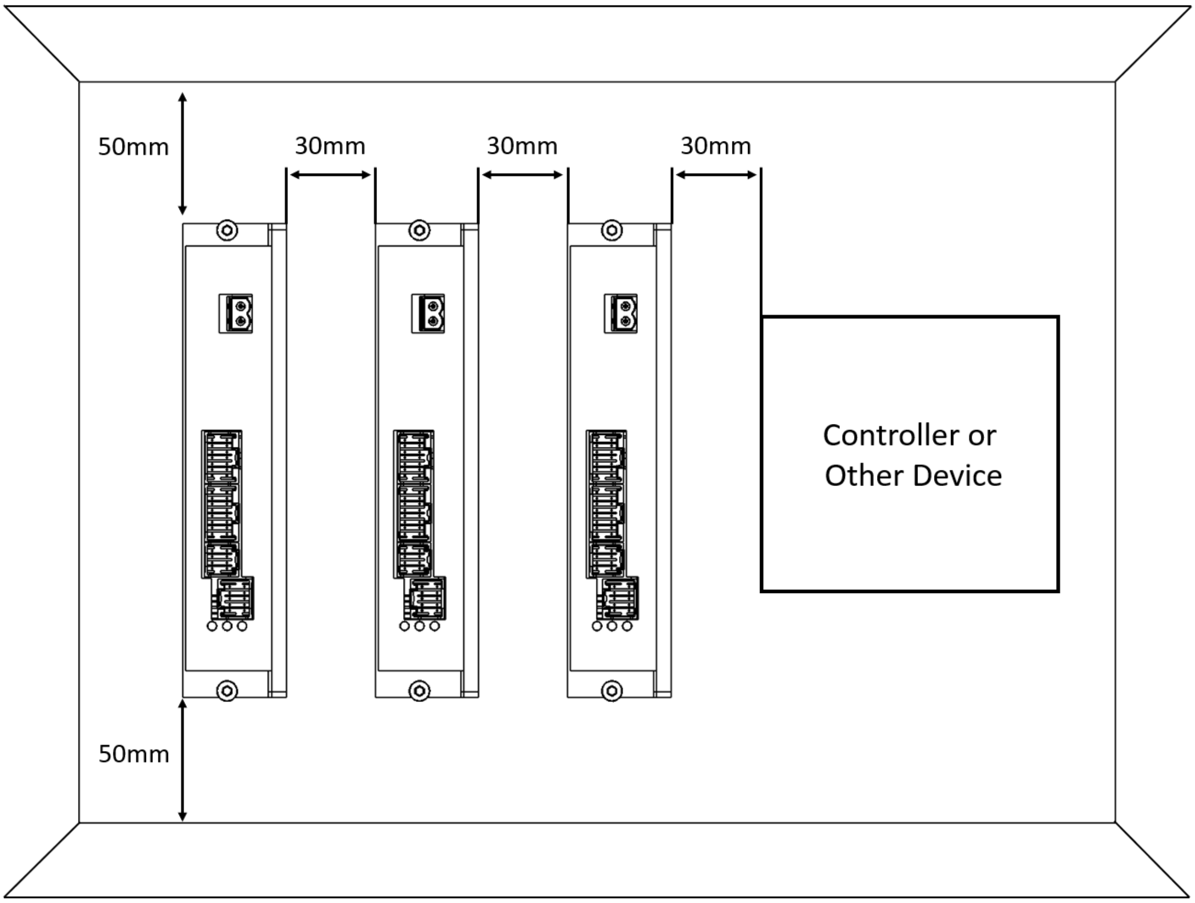




2.3. Mounting Multiple Units

When mounting multiple drives in a row in a cabinet or enclosure, the recommended minimum separation distance is 30mm.

It is recommended to install a cooling fan to prevent the ambient temperature inside the enclosure from increasing. If the drive's temperature rises excessively, it may cause malfunction or damage to parts.



2.4. Electrical Data

WER-D048/40-FS04A7		
Description	**Units**	**Values**
Continuous Output Current	A[rms)	40
Peak Output Current	A[rms]	80
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	1920

Basic Specifications		
Feature	**Specification**	
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), RS-485
Auto Tuning	Method	Automatic self-configuration and optimization of motor phasing, wires, current loop, velocity control loop
GUI	User Interface	WELSS(WelconServoStudio), Setting, Drive, Motor, Feedback, I/O, Motion
Input Voltage	Motor Voltage: 12~48VDC(H/W Limit 10 ~ 90V) Control Voltage: 24VDC(H/W Limit 10 ~ 90V)	
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	
Compliance Standard	CE, TUV	

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	
RS-485*	Baud rate: 9200bps ~ 3Mbps	
I/O		
Feature	**Specification**	
Analog Input	Quantity	2
	Voltage Range	±10 VDC differential, Motor Temperature
	Input Resolution	14 bit
Digital Input	Quantity	6 + 2 STO (H/W)
	Signal	Configurable. Opto-isolated
	Voltage	24V
Digital Output	Quantity	2 + 1 STO (H/W)
	Signal	Configurable. Opto-isolated.
	Voltage	24V
	Max. Output Current	40mA
Brake	Use one of digital outputs (40mA)	
Motor Feedback		
General	Supply Voltage	5VDC
Incremental Encoder	Signal	CH1 : A-quad-B with or without index, RS422, Differential CH2 : A-quad-B with or without index, Single-ended
	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.x
	Bit rate	0.5Mbps, 1Mbps, 2Mbps, 2.5Mbps, 5Mbps

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

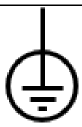
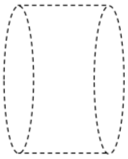
2.5. Protections & Limitations

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	Exceeding H/W Current Limit(80A) or 110% of Maximum Current	-
Over Temperature	100 ℃	95 ℃
Protection		
Motor overload and over-temperature	110% (at rated current)	

- 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 90V or below.

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

3.3. Wiring Precautions

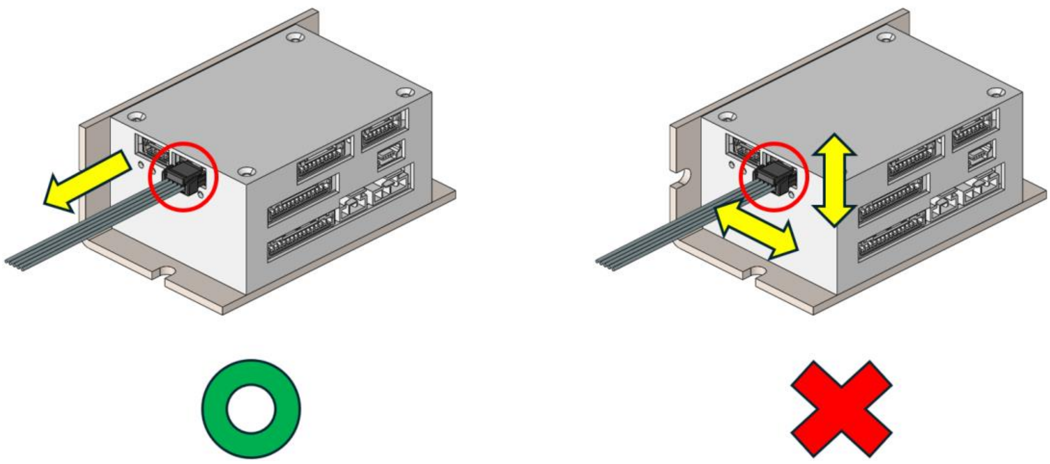
⚠ Cautions

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

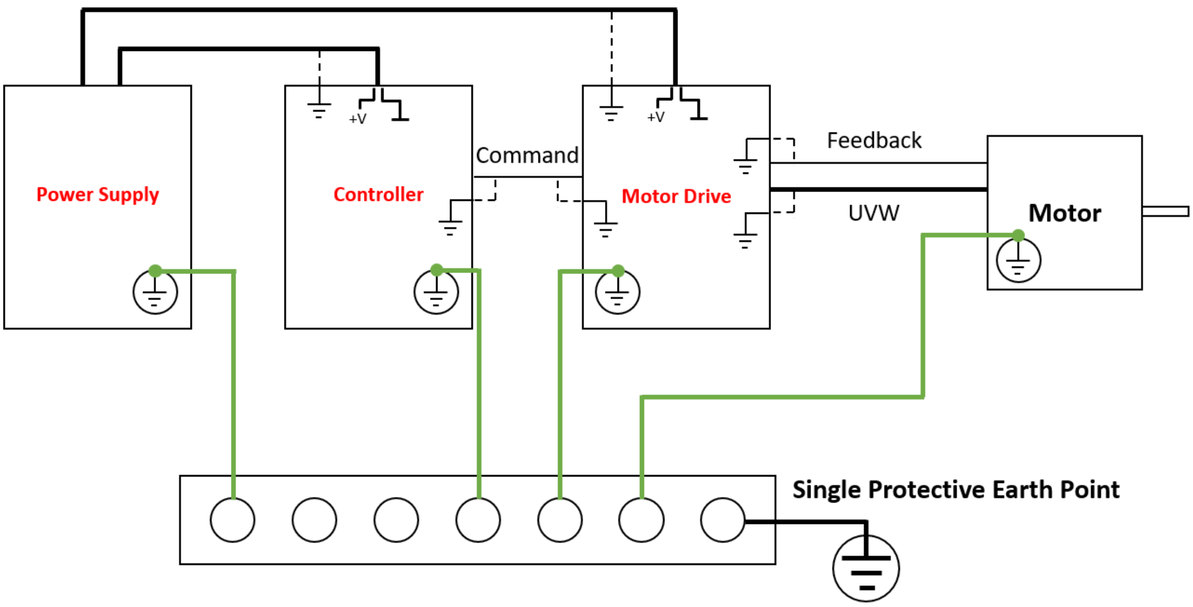
- If there is a locking tab or clip, unlock it by hand and then disconnect the connector.
- Do not forcefully pull on the connector without unlocking it.
- Disconnect the connector by pulling it straight in the designed direction.
- Do not shake it up and down or side to side.
- Separate slowly and gently,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



3.3.1. Grounding

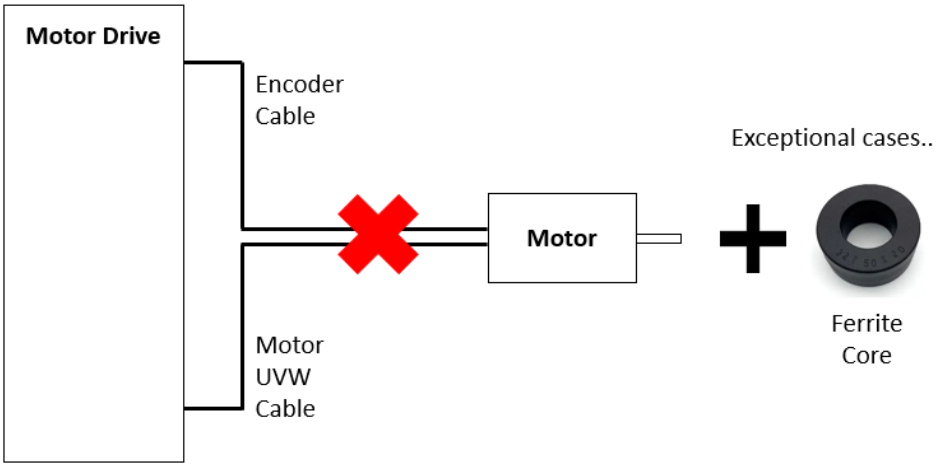
The case grounds of all the system components should be connected to a single Protective Earth (PE) ground point.

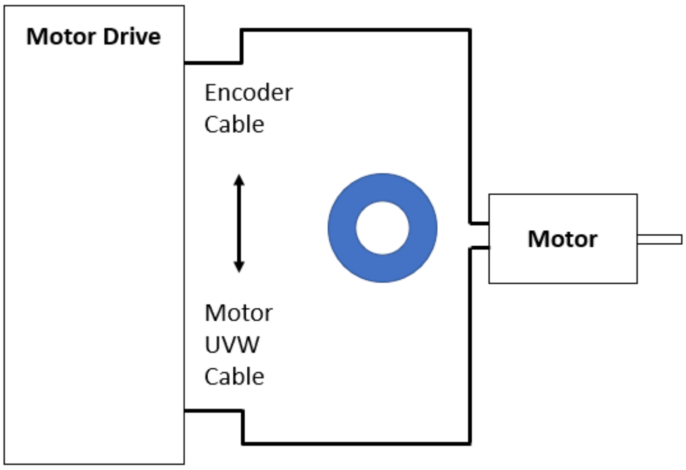
Grounding the case grounds at a central PE ground point through a single low resistance wire reduces the chance for ground loops and helps to minimize high frequency voltage differentials between components. All ground wires must be of a heavy gauge and be as short as possible.



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.





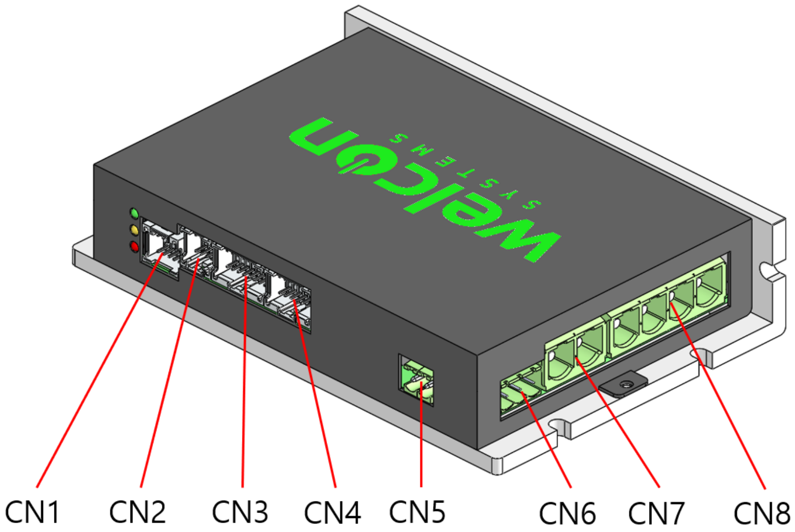
If the two wires cannot be separated from each other, install a ferrite core to attenuate noise. For best results, wind the wire as much as possible, and always in the same direction.
When winding the ferrite core around the motor UVW wire, the ground(FG) wire must not pass through the ferrite core.

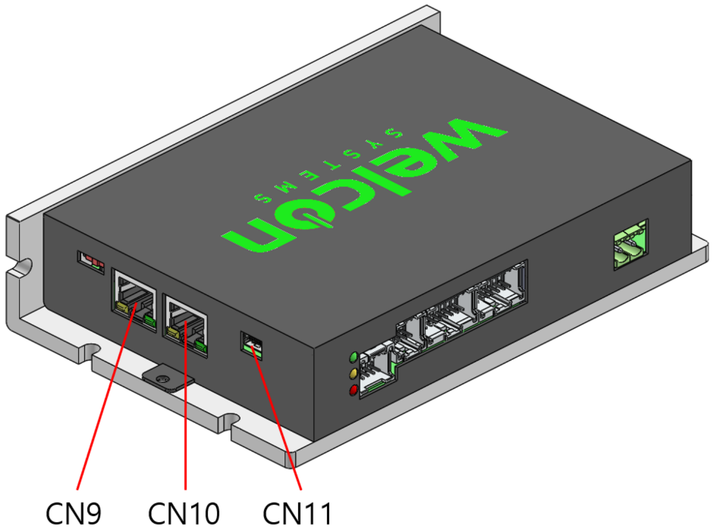
We have experience solving noise problems in systems with a cable length of 4-5m using King Magnetic's KMN-503220 product. The specifications of the ferrite core must be appropriately selected depending on the system.

3.4. Tools

Tool	Manufacturer	Part Number
Hand crimp Tool	MOLEX	63811-6300

3.5. Connections





Connector	Function	Connector	Function
CN1	STO	**CN7**	Motor Power
CN2	Serial Encoder	**CN8**	Motor UVW
CN3	Digital Encoder	**CN9**	CAN / RS-485 / EtherCAT IN
CN4	Digital I/O & Analog Input	**CN10**	CAN / RS-485 / EtherCAT OUT
CN5	Regenerative resistance	**CN11**	USB
CN6	Control Power		

3.6. Regenerative resistance

Dinkle_5ESDV-02P

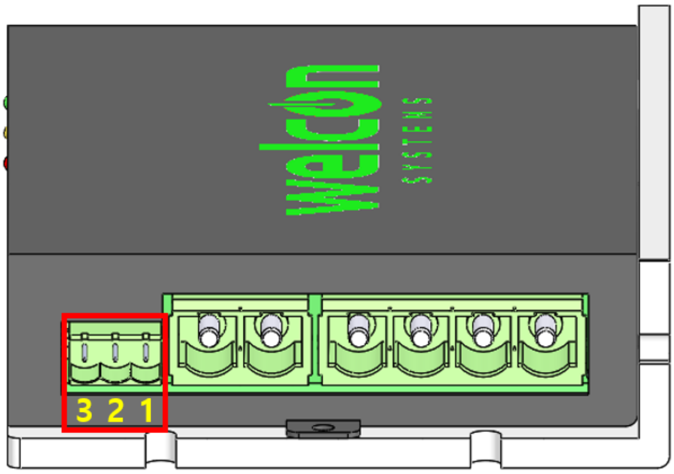
Dinkle_5EHDRC-02P	J103
Pin	**Input Power**
1	R+
2	R-

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 WER-D048/40-FS04A7, we recommend using a regenerative resistor of approximately **1.2 ohm**. 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.

3.7. Control Power



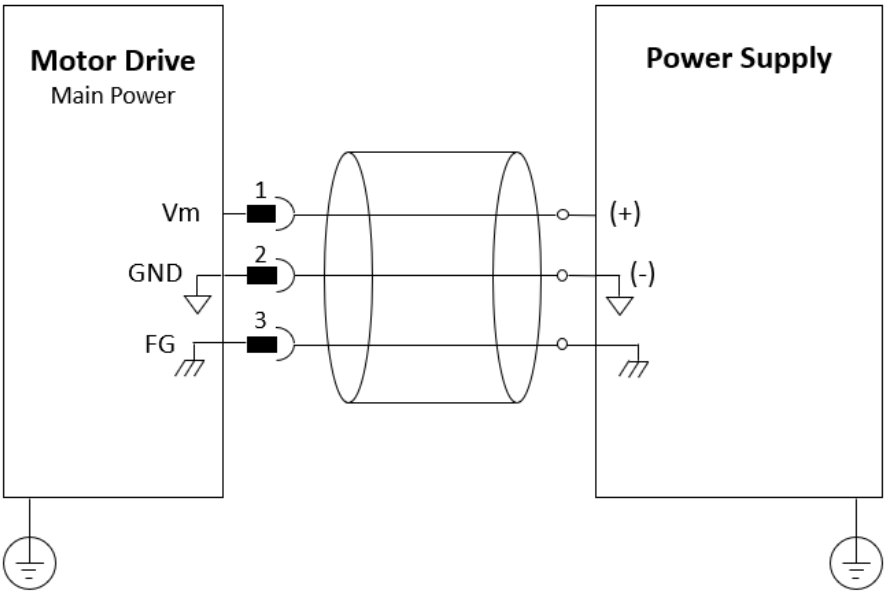
Dinkle_5ESDV-03P

Dinkle_5EHDRC-03P		J101
Pin	**Signal**	**Input Power**
1	Vc	24VDC
2	GND	GND
3	FG	FG

Warning
Avertissement

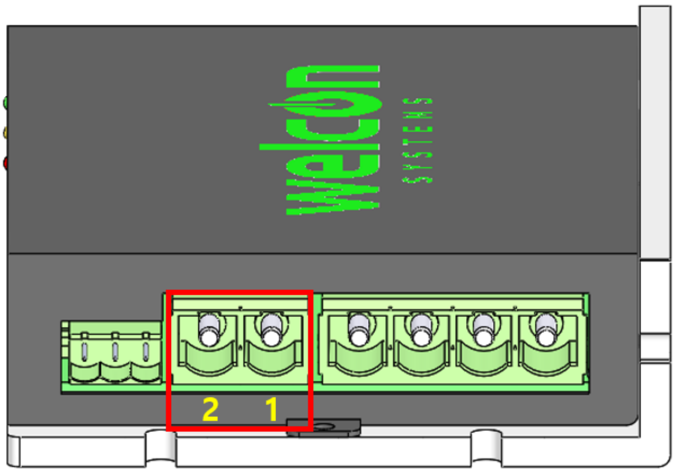
- Do not connect/disconnect the servo drive while the power is on.
- Before applying power, make sure that the DC supply is within the specified range.
- make sure the proper plus and minus connections are in order.

3.7.1. Control Power Wiring



[Control Power(24VDC) Connection Diagram]

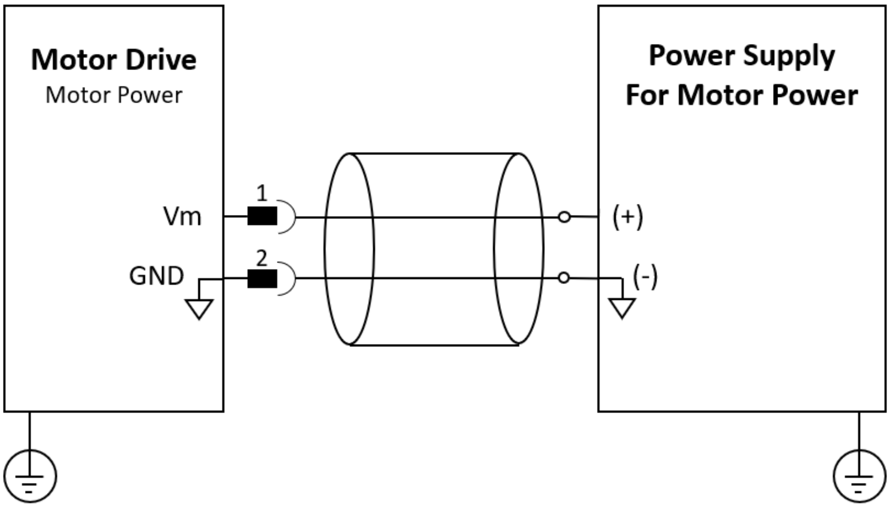
3.8. Motor Power



Phoenix Contact_1913507

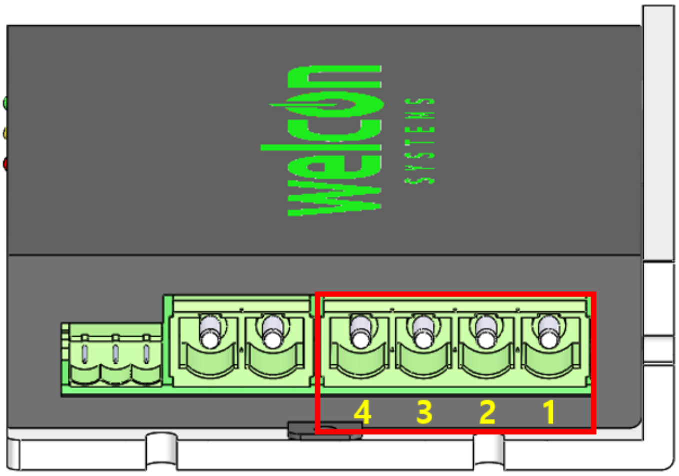
Phoenix Contact_1913646		J102
Pin	**Signal**	**Input Power**
1	Vm	12~48VDC(HW Limit : 10 ~ 90 VDC)
2	GND	GND

3.8.1. Motor Power Wiring



[Motor Power Connection Diagram]

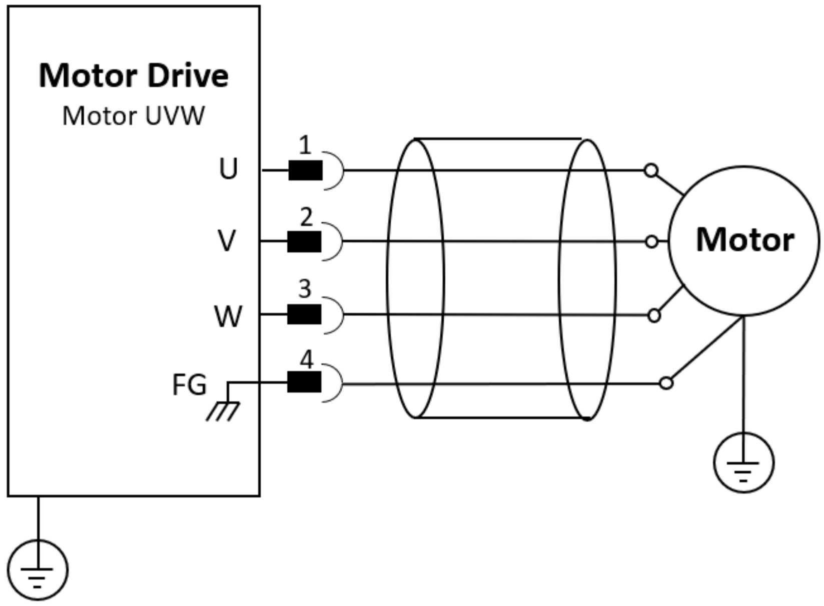
3.9. Motor UVW



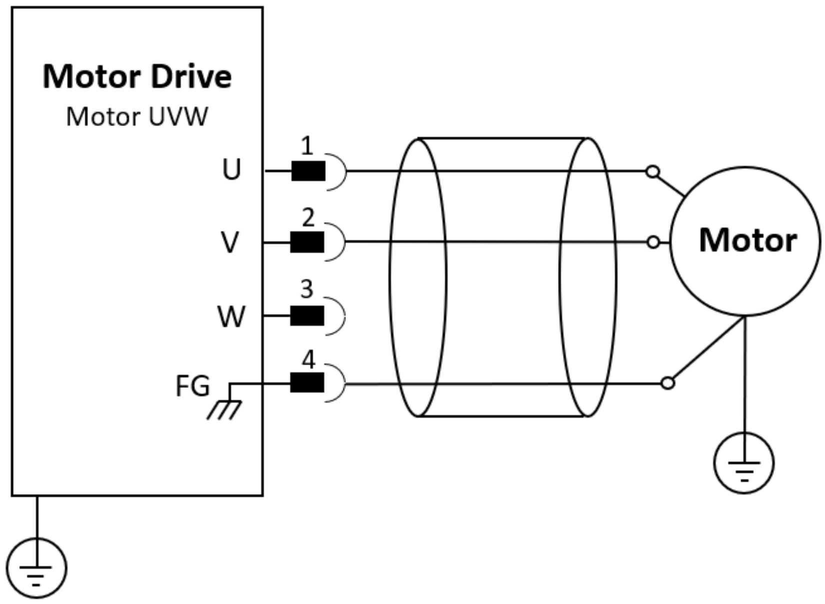
Phoenix Contact_1913523

Phoenix Contact_1913662	J202
Pin	**Signal**
1	U (VCM or DC Motor : +)
2	V (VCM or DC Motor : -)
3	W
4	FG

3.9.1. Motor UVW Wiring

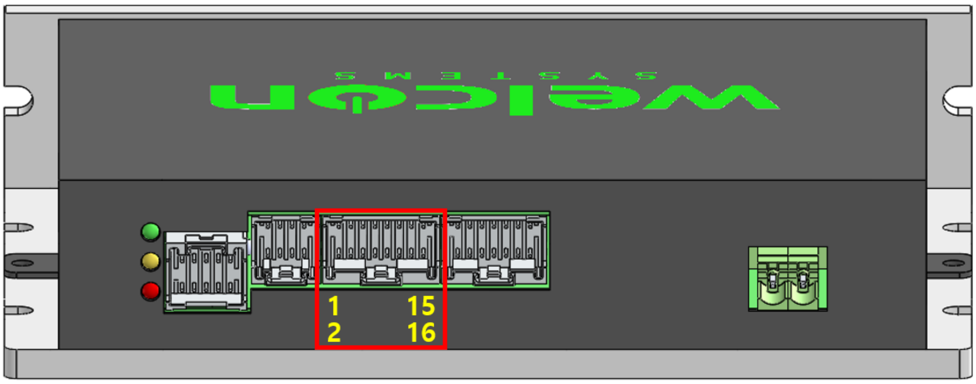


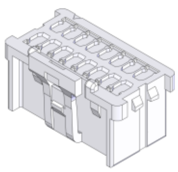
[Brushless / PMSM Motor UVW Connection Diagram]



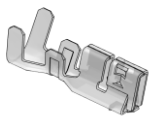
[Brushed DC / Voice Coil Motor UVW Connection Diagram]

3.10. Digital Encoder (Port A)





Molex_51353-1600



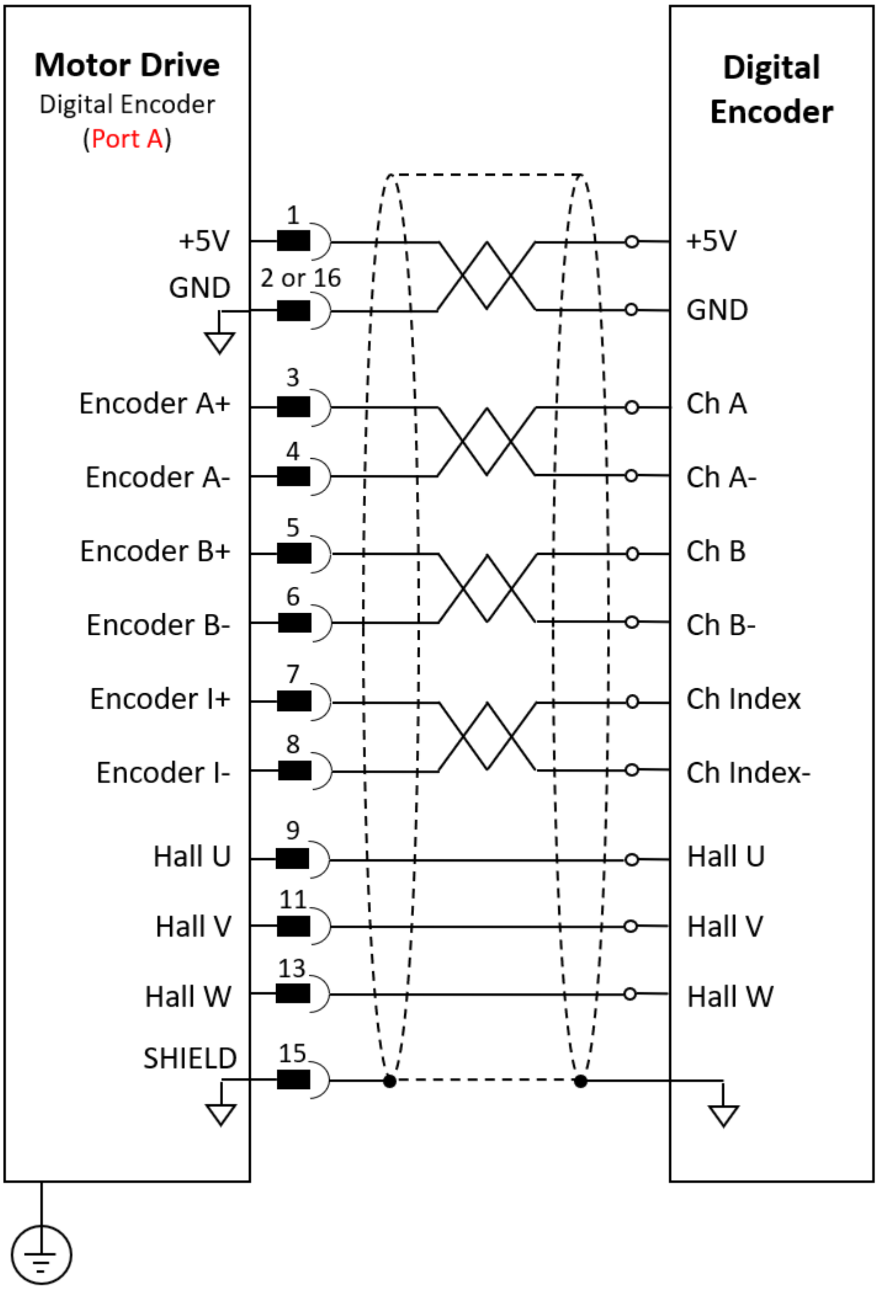
Molex_56134-9000

Molex_55959-1630	J501
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	Not used
11	Hall V
12	Not used
13	Hall W
14	Not used
15	Shield
16	GND

3.10.1. Digital Encoder(Port A) Wiring

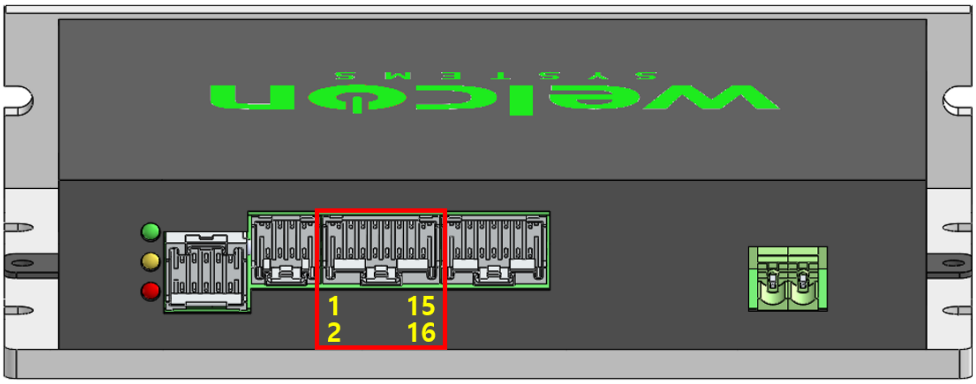
The cable's shield is connected to the shield in the connector.

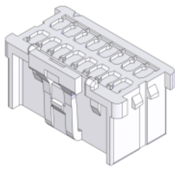
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues.



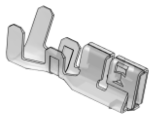
[Digital Encoder(Port A) Connection Diagram]

3.11. Digital Encoder (Port B)





Molex_51353-1600



Molex_56134-9000

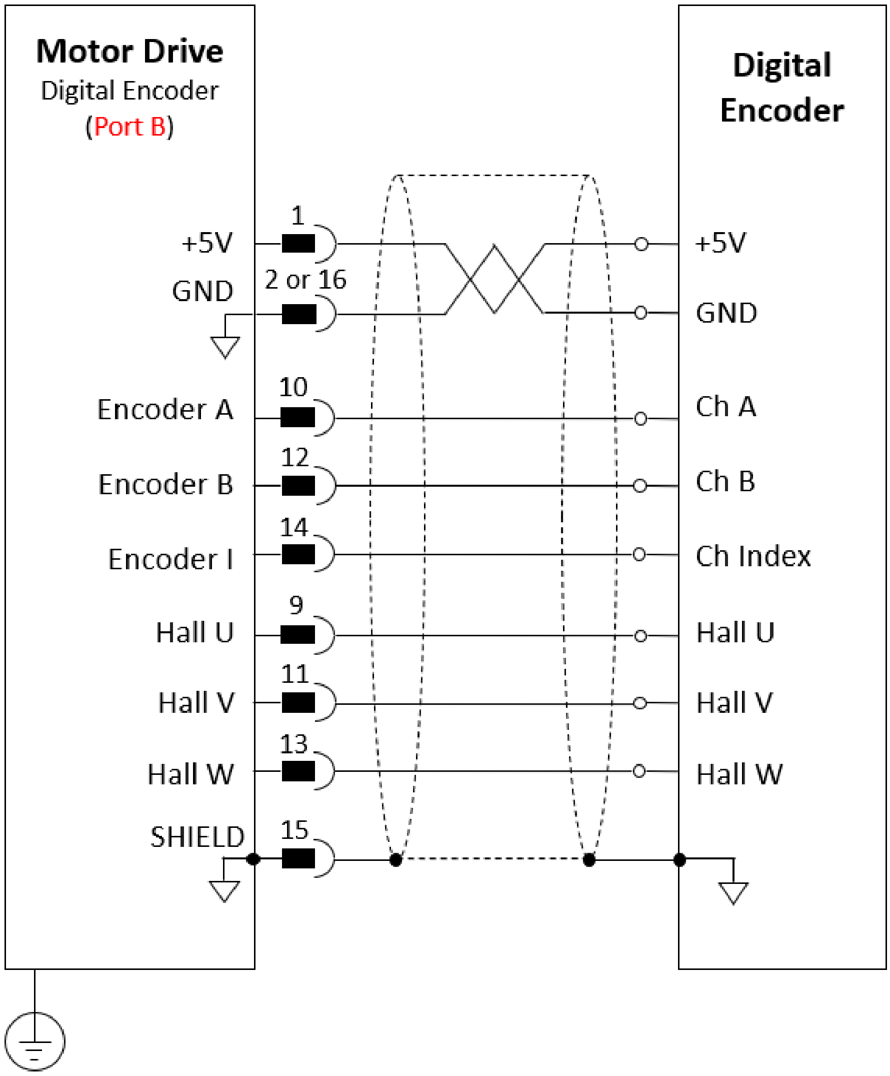
Molex_55959-1630	J501
Pin	**Signal**
1	5V
2	GND
3	Not Used
4	Not Used
5	Not Used
6	Not Used
7	Not Used
8	Not Used
9	Hall U
10	Encoder A
11	Hall V
12	Encoder B
13	Hall W
14	Encoder I
15	Shield
16	GND

* When using Dual Feedback, only Hall Sensor A can be selected in WELSS UI.

3.11.1. Digital Encoder(Port B) Wiring

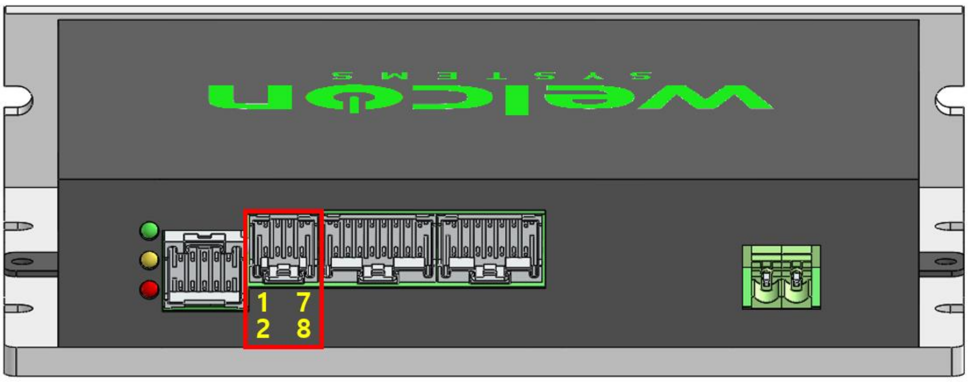
The cable's shield is connected to the shield in the connector.

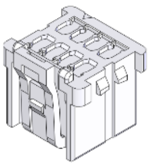
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues.



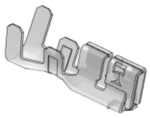
[Digital Encoder(Port B) Connection Diagram]

3.12. Serial Encoder





Molex_51353-0800



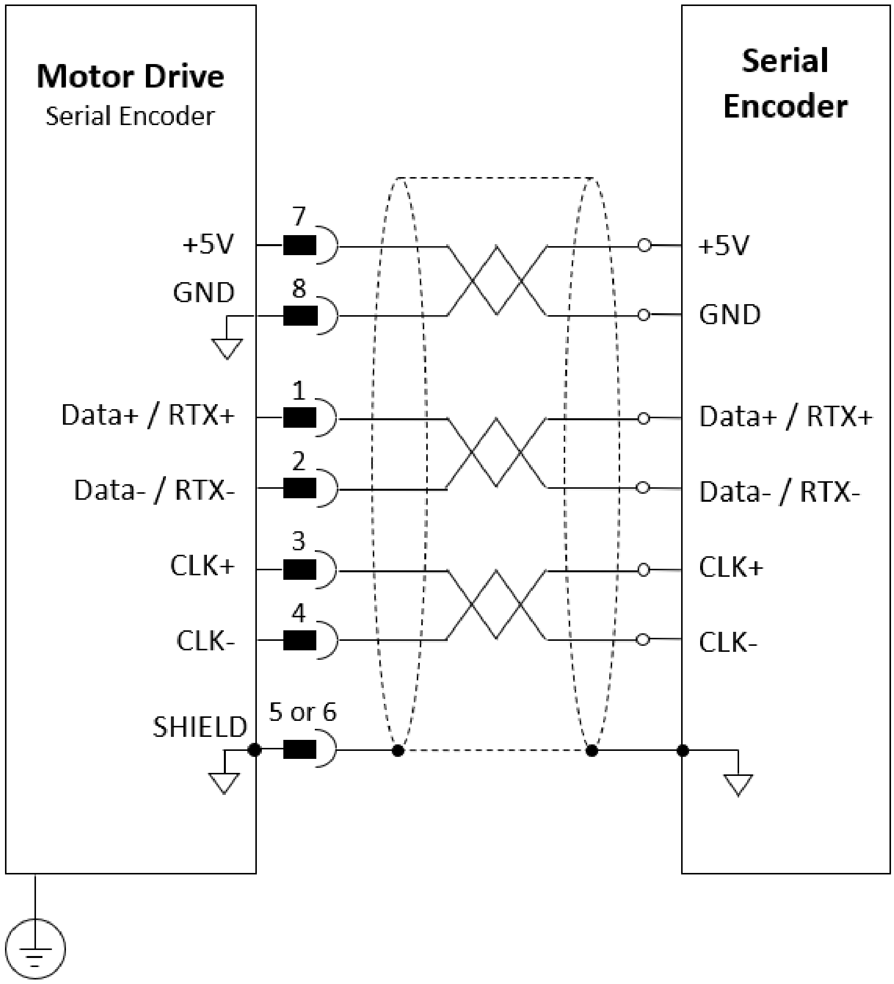
Molex_56134-9000

Molex_55959-0830	J601
Pin	**Signal**
1	Data+ / RS485_RTX+
2	Data- / RS485_RTX-
3	CLK+
4	CLK-
5	Shield
6	Shield
7	5V
8	GND

3.12.1. Serial Encoder Wiring

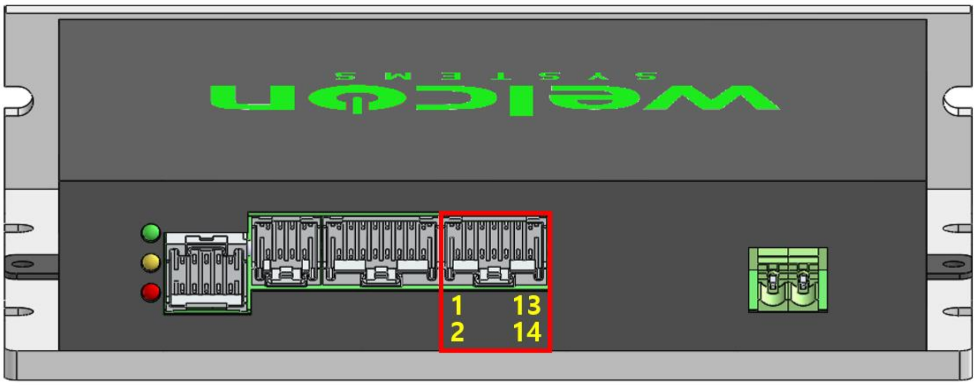
The cable's shield is connected to the shield in the connector.

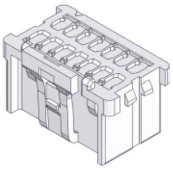
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues.



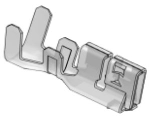
[Serial Encoder Connection Diagram]

3.13. Digital I/O & Analog Input





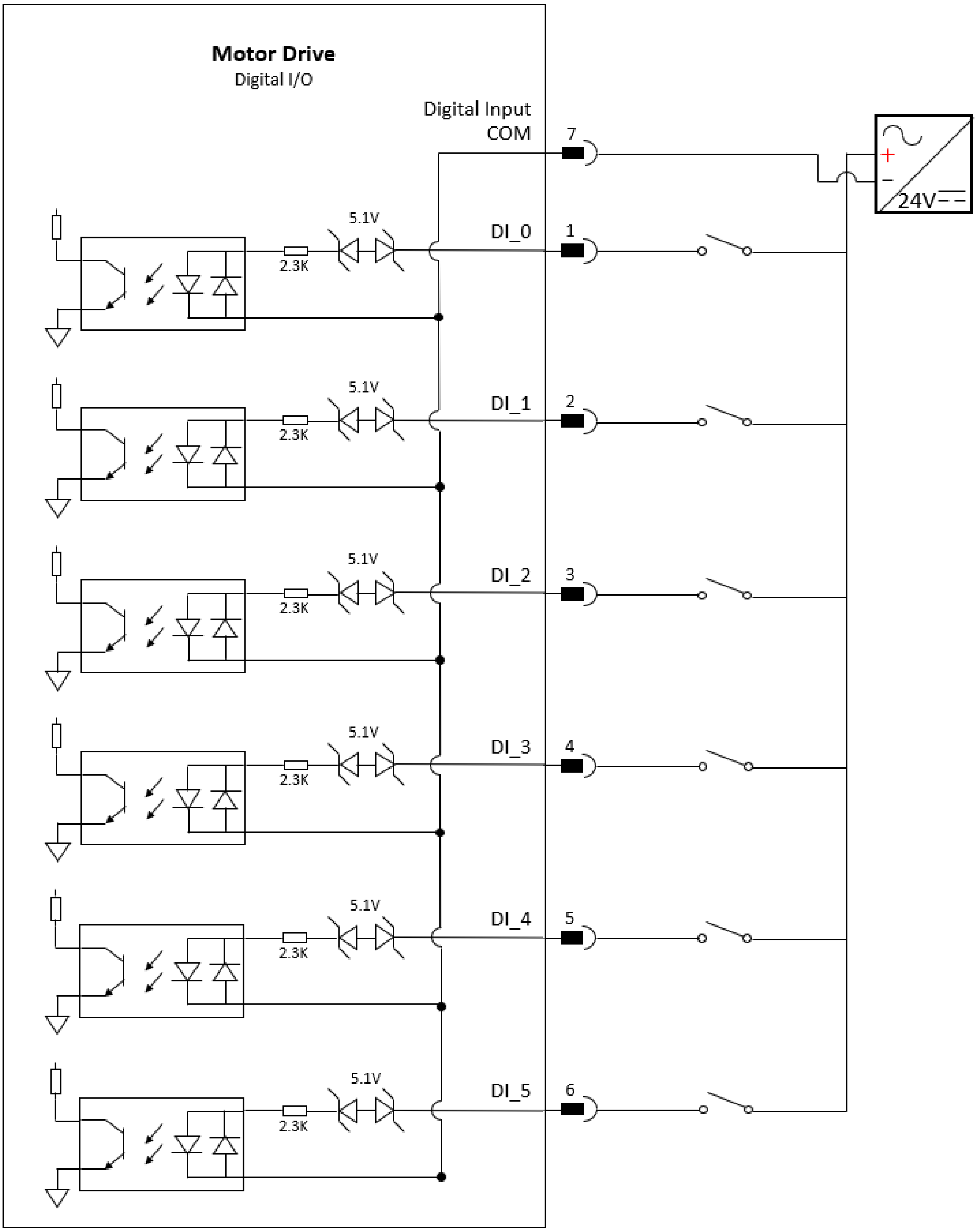
Molex_51353-1400



Molex_56134-9000

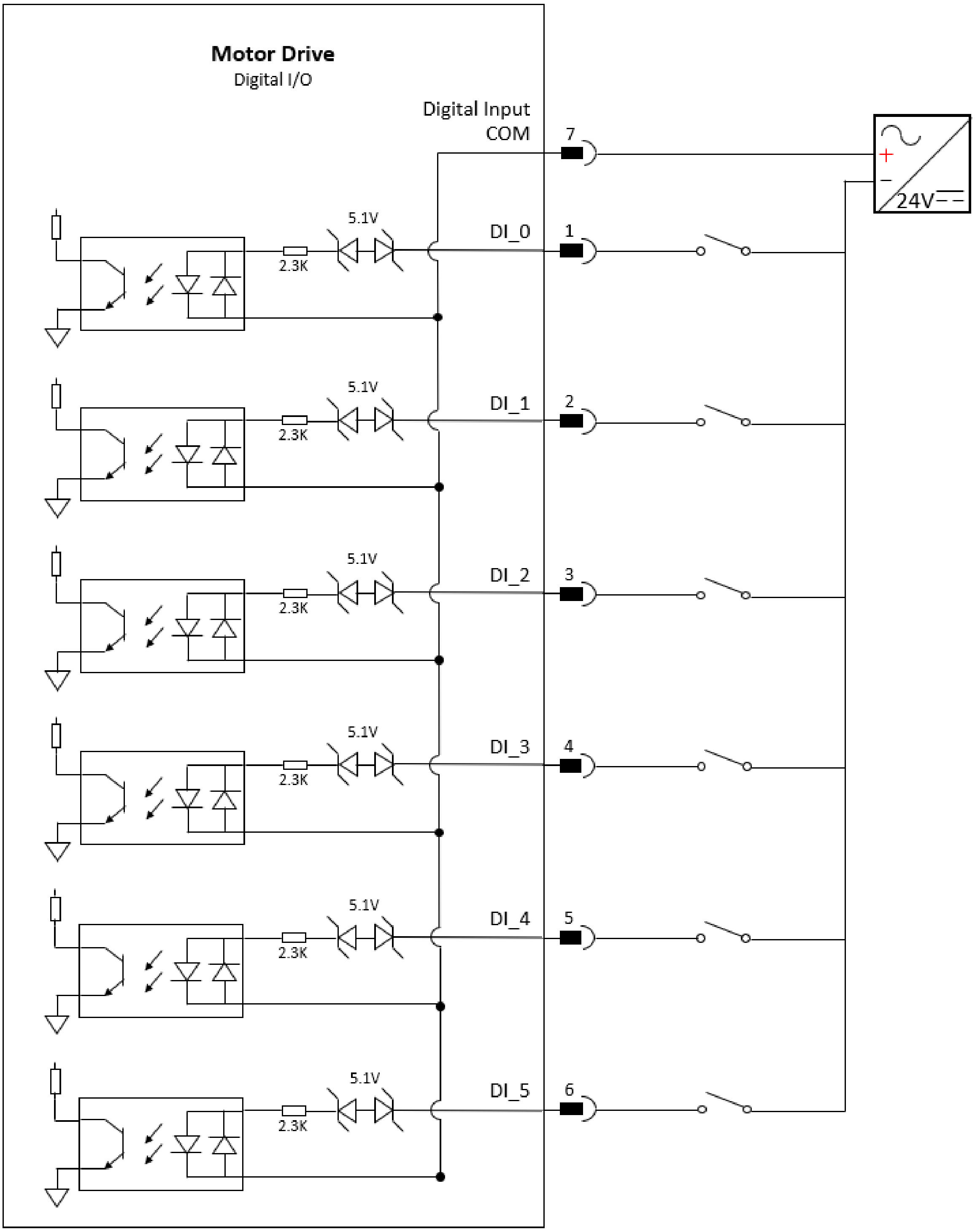
Molex_55959-1430	J701
Pin	**Signal**
1	Digital Input_0
2	Digital Input_1
3	Digital Input_2
4	Digital Input_3
5	Digital Input_4
6	Digital Input_5
7	Digital Input_COM
8	Digital Output_0
9	Digital Output_1
10	Digital Output_COM
11	Analog Input+
12	Analog Input-
13	Motor Temperature+
14	Motor Temperature-

3.13.1. Digital Inputs(PNP Type) Wiring



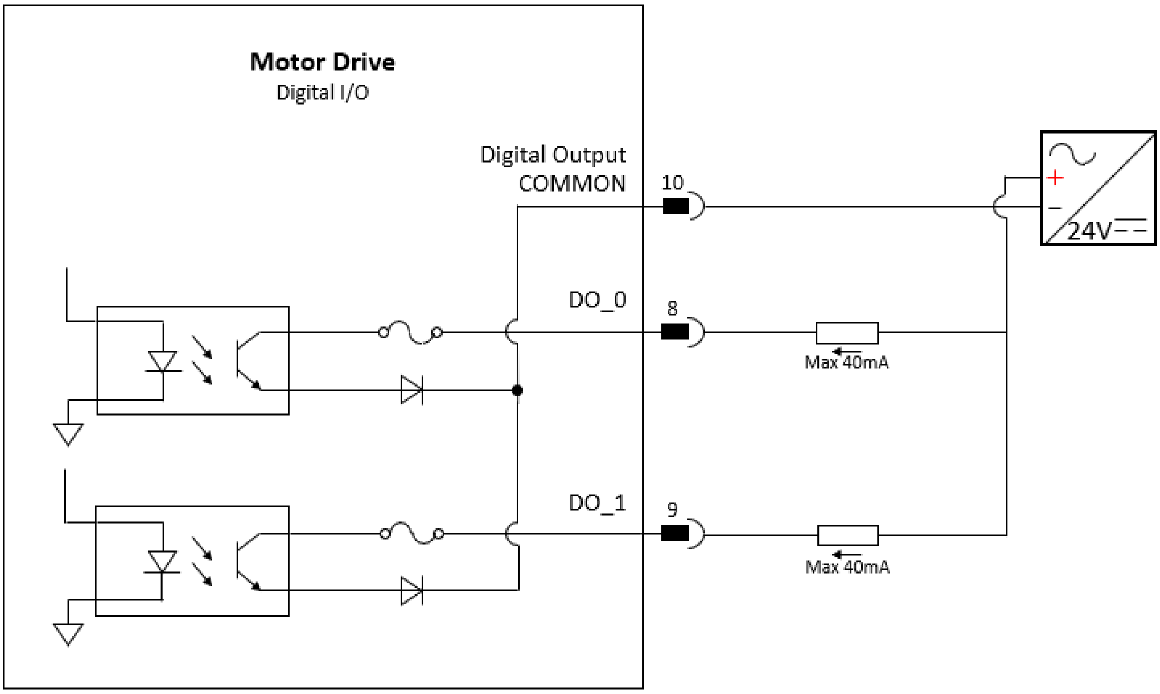
[Digital Inputs(PNP Type) Connection Diagram]

3.13.2. Digital Inputs(NPN Type) Wiring



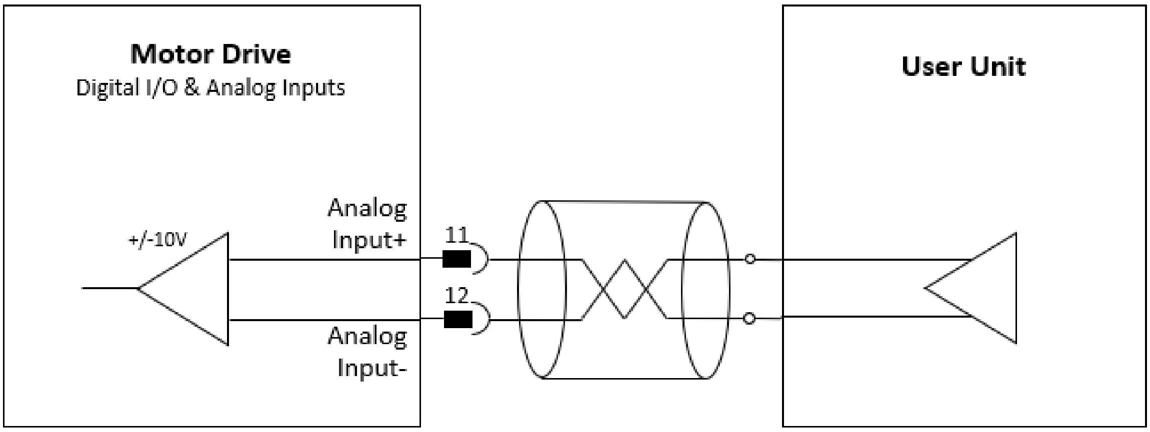
[Digital Inputs(NPN Type) Connection Diagram]

3.13.3. Digital Outputs(NPN Type) Wiring



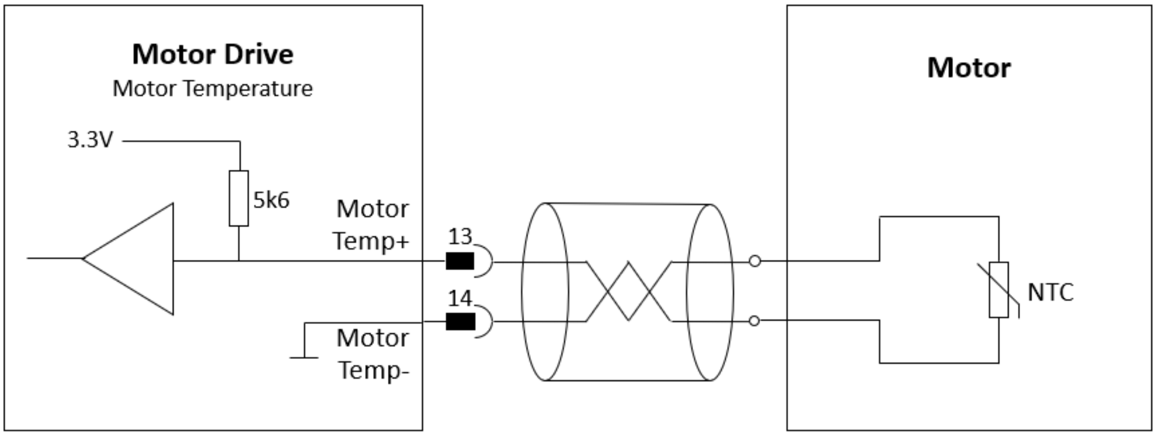
[Digital Outputs(NPN Type) Connection Diagram]

3.13.4. Analog Input Wiring



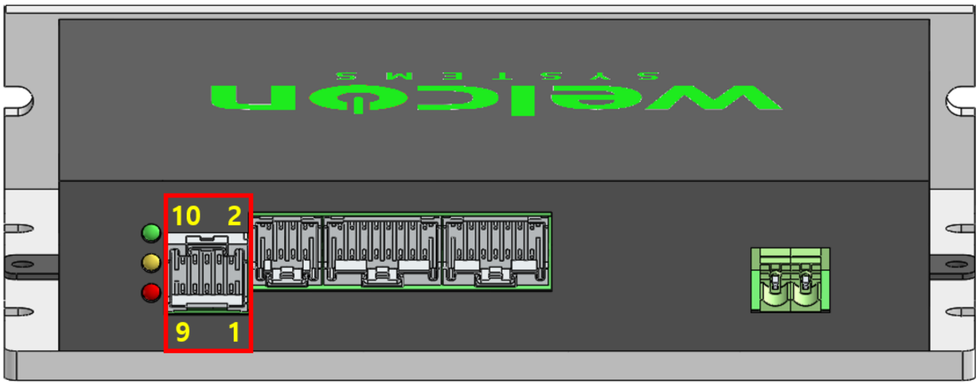
[Analog Input Connection Diagram]

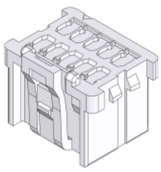
3.13.5. Motor Temperature Wiring



[Motor Temperature Connection Diagram]

3.14. STO



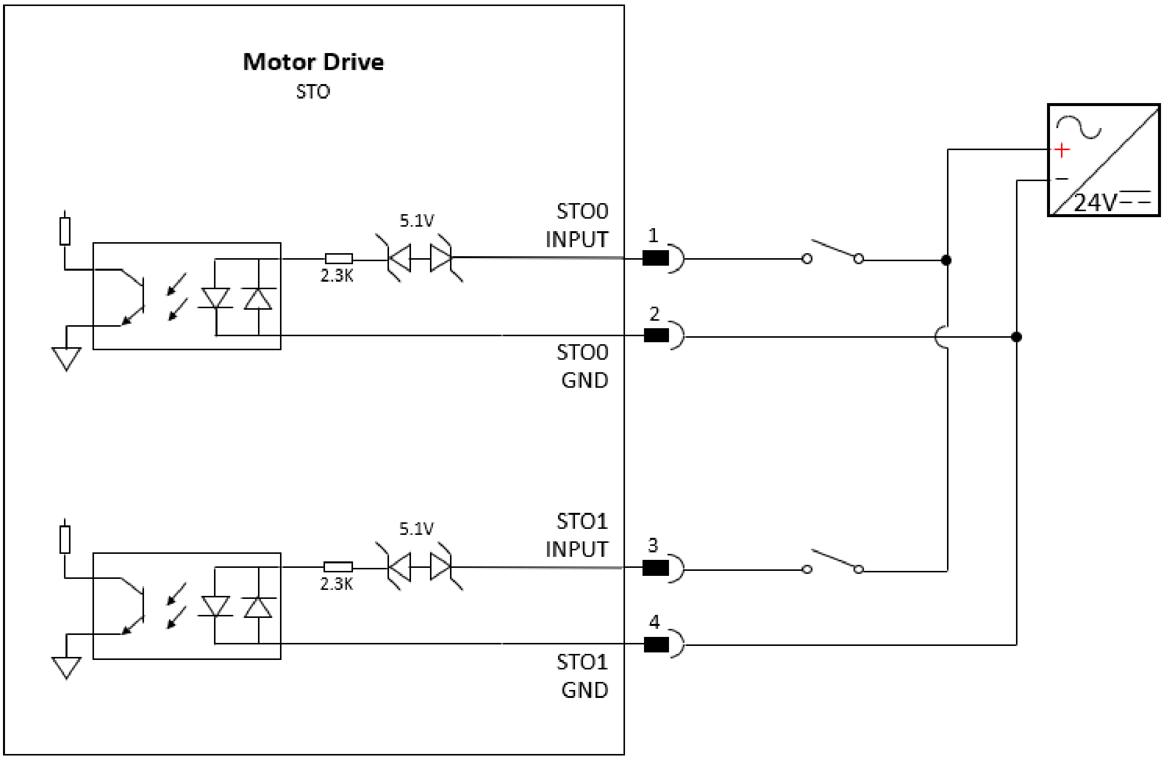


Molex_51353-1000

Molex_56134-9000

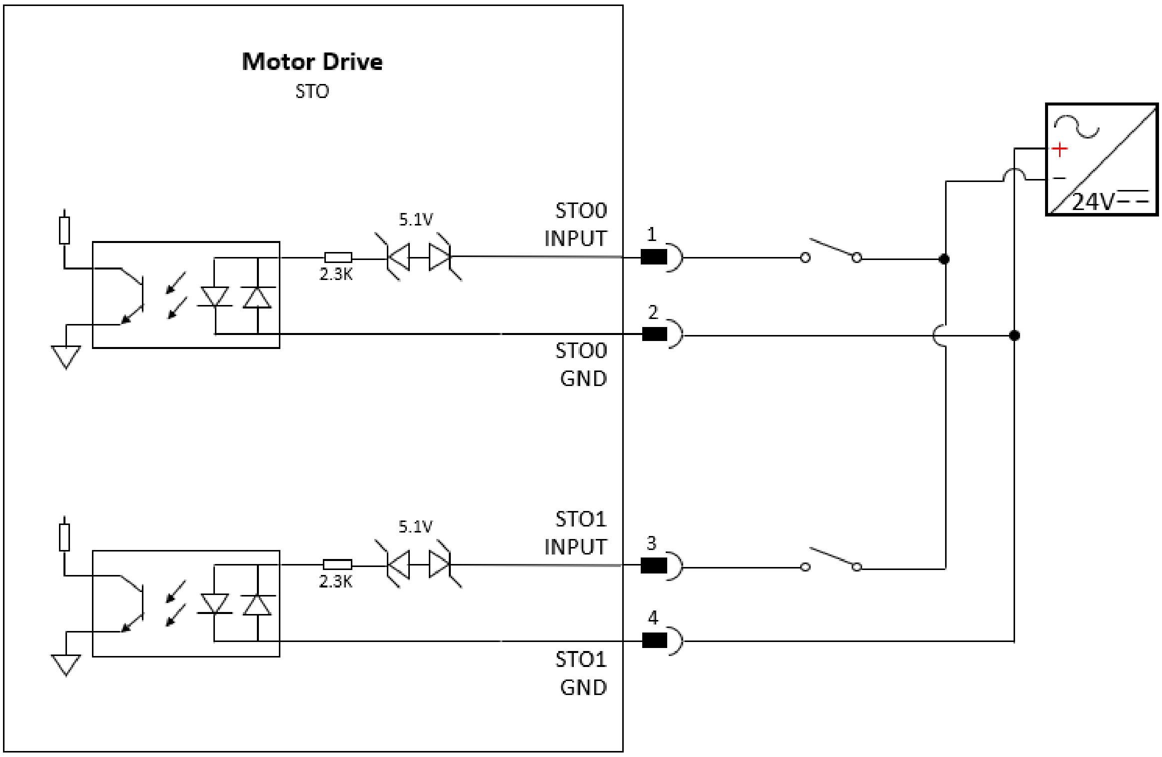
Molex_55959-1030	J1
Pin	**Signal**
1	STO0_INPUT
2	STO0_GND
3	STO1_INPUT
4	STO1_GND
5	STO_OUTPUT
6	STO_GND
7	GND
8	STO0_Disable
9	GND
10	STO1_Disable

3.14.1. STO Inputs(PNP Type) Wiring



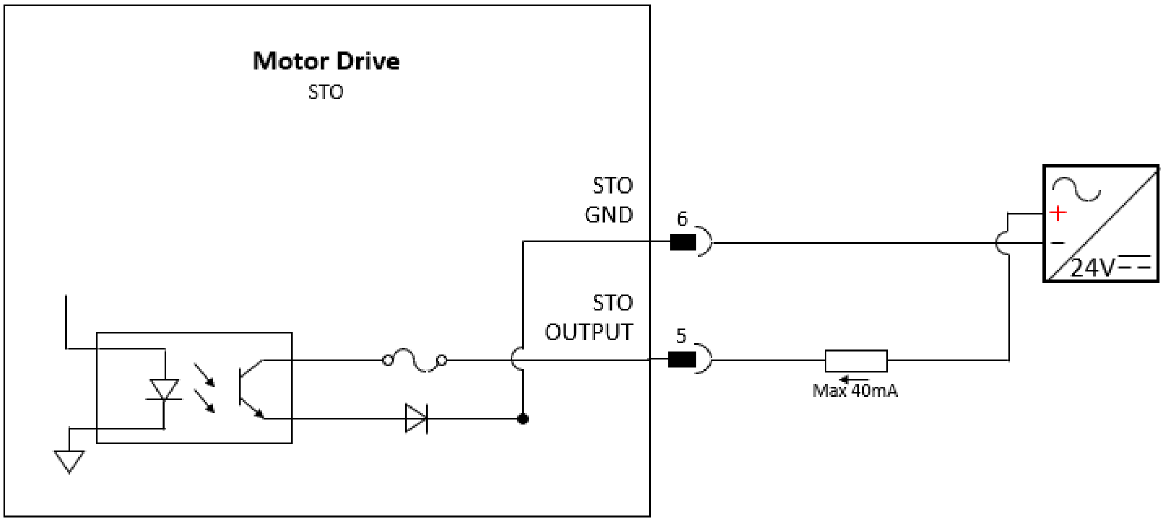
[STO(PNP Type) Connection Diagram]

3.14.2. STO Inputs(NPN Type) Wiring



[STO(NPN Type) Connection Diagram]

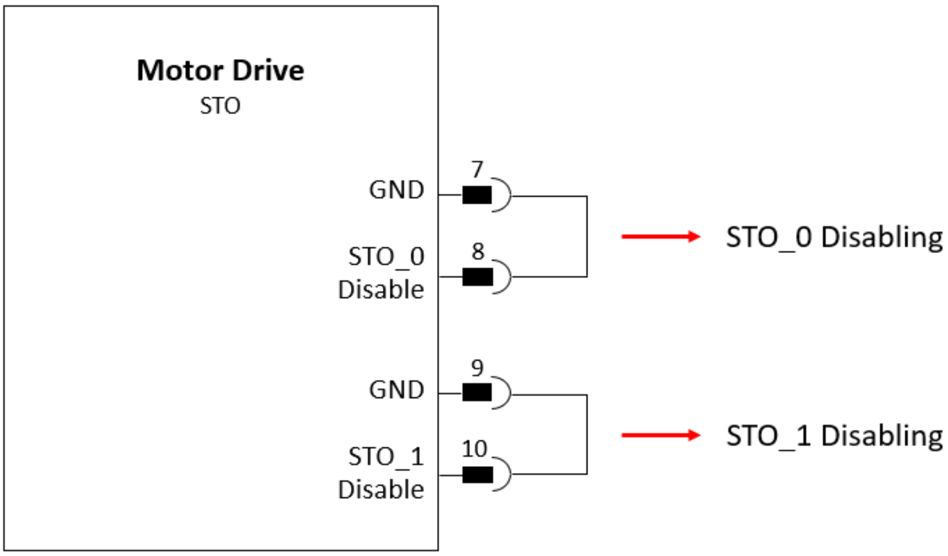
3.14.3. STO Output(NPN Type) Wiring



[STO Output(NPN Type) Connection Diagram]

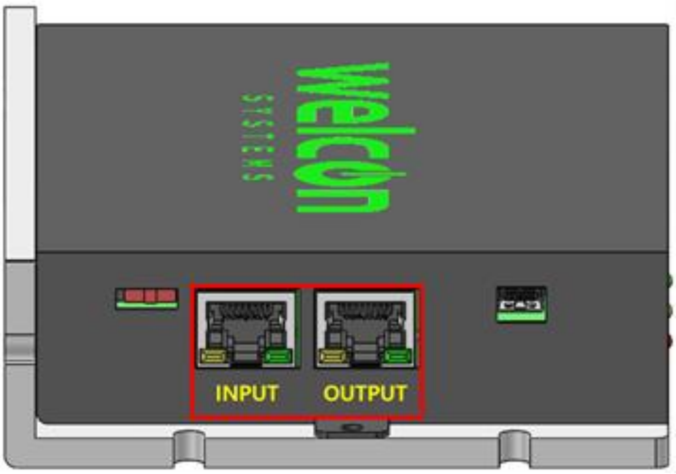
3.14.4. STO Disabling

For applications not using STO functionality, STO may be disabled by wiring the designated pins together as given below in figure.



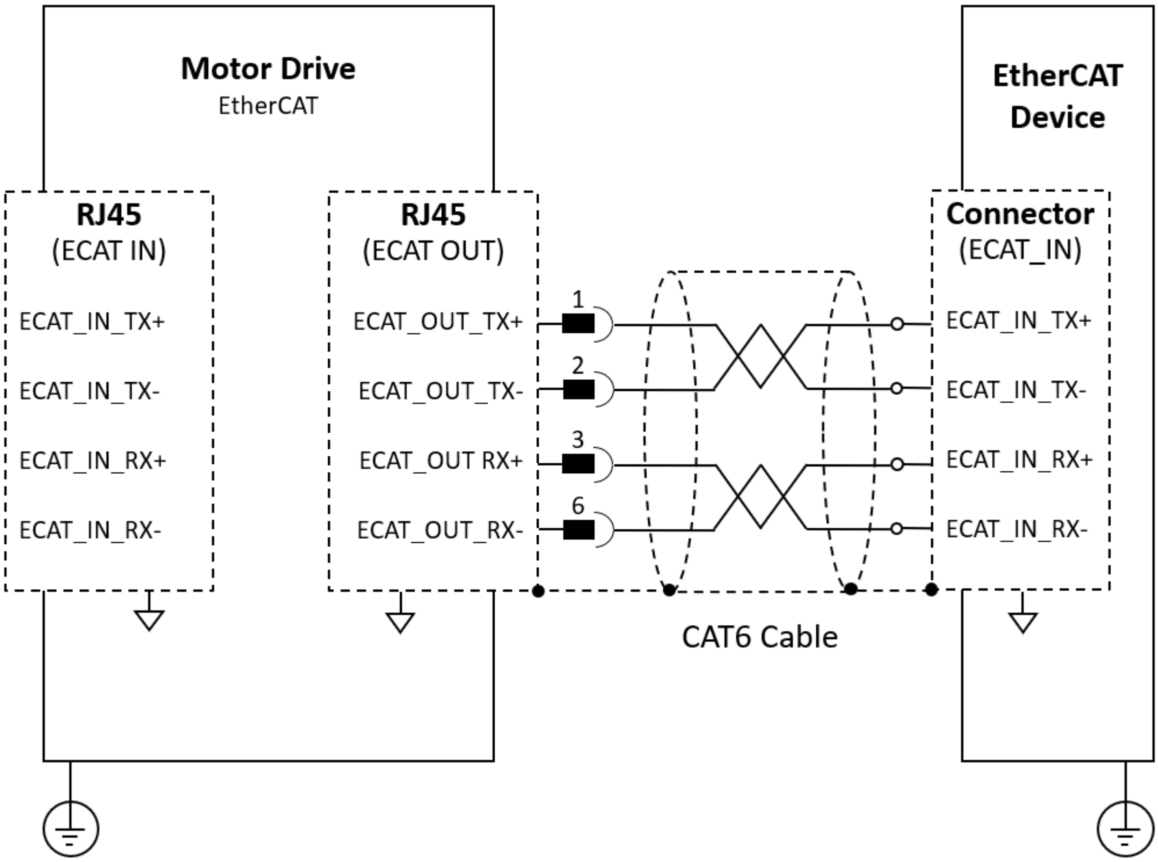
3.15. EtherCAT

Fieldbus Type	Product Number
EtherCAT	WER-D048/40-FS04A7-E



Meritec_N3J11-017-02	J801, J802
Pin	**Signal**
1	EtherCAT Tx+
2	EtherCAT Tx-
3	EtherCAT Rx+
4	NC
5	NC
6	EtherCAT RX-
7	NC
8	NC

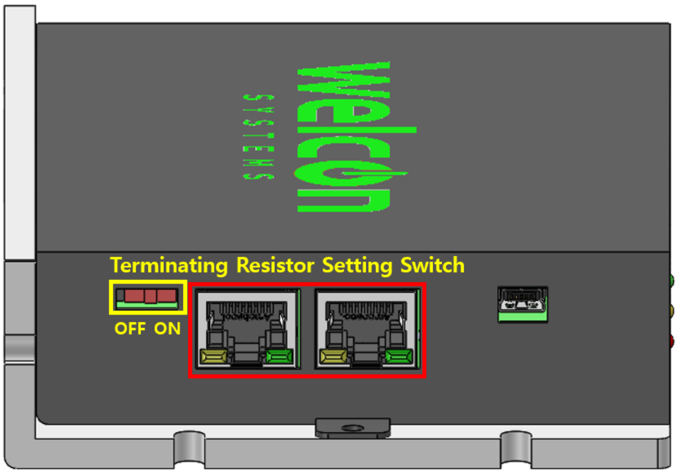
3.15.1. EtherCAT Wiring



[EtherCAT Connection Diagram]

3.16. CAN

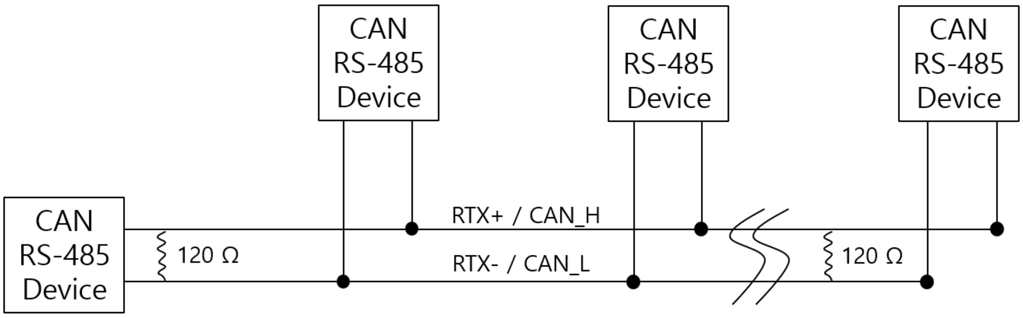
Fieldbus Type	Product Number
CAN	WER-D048/40-FS04A7-C



Meritec_N3J11-017-02	J801, J802
Pin	**Signal**
1	HIGH
2	LOW
3	GND
4	NC
5	NC
6	NC
7	NC
8	NC

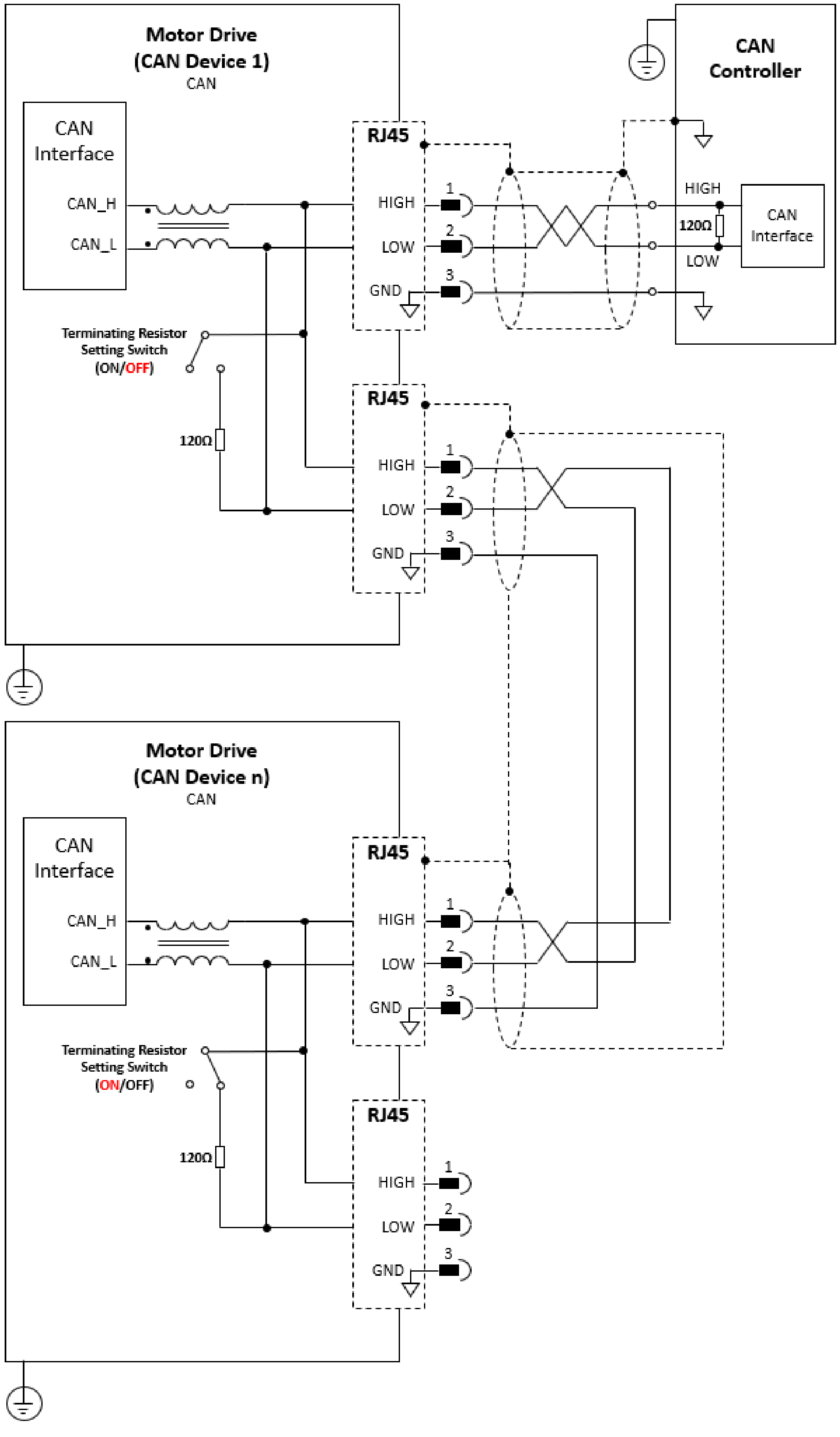
3.16.1. Terminating Resistor

- 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]

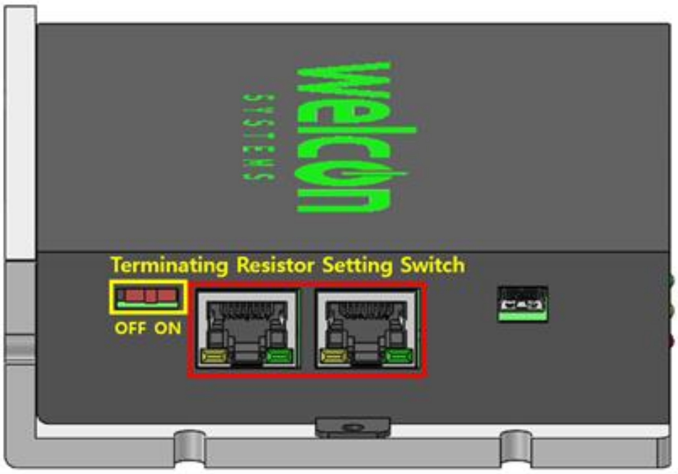
3.16.2. CAN Wiring



[CAN Connection Diagram]

3.17. RS-485

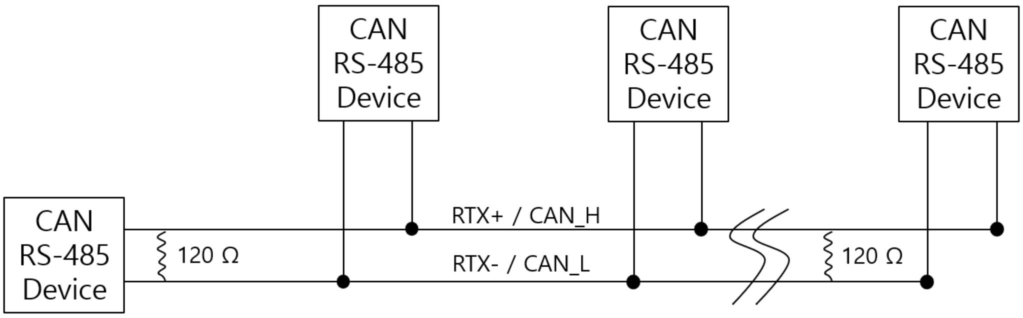
Fieldbus Type	Product Number
RS-485	WER-D048/40-FS04A7-R



Meritec_N3J11-017-02	J801, J802
Pin	**Signal**
1	RTX+
2	NC
3	GND
4	RTX-
5	NC
6	NC
7	NC
8	NC

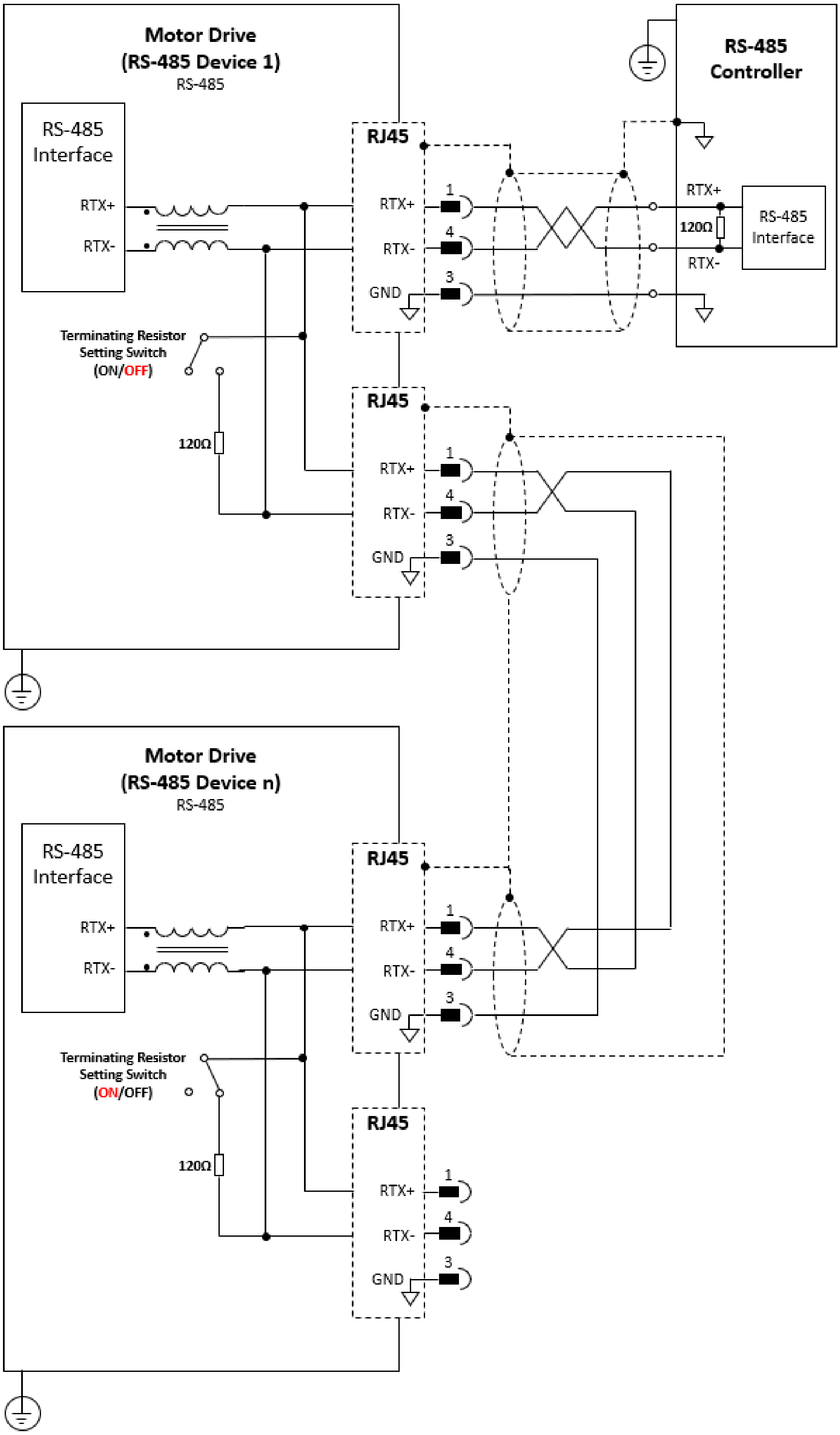
3.17.1. Terminating Resistor

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



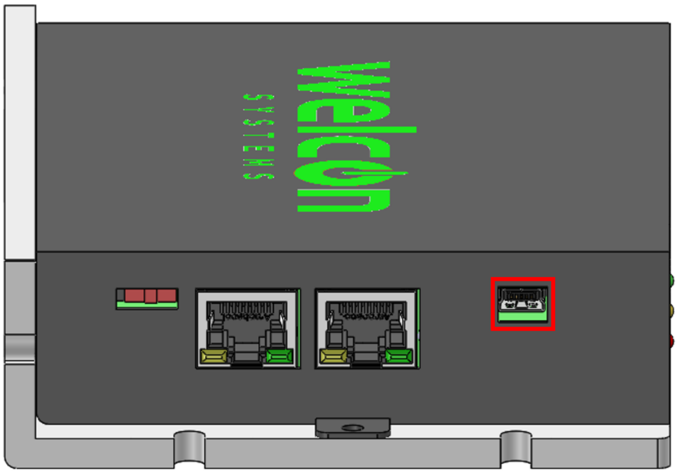
[CAN or RS-485 Communication]

3.17.2. RS-485 Wiring



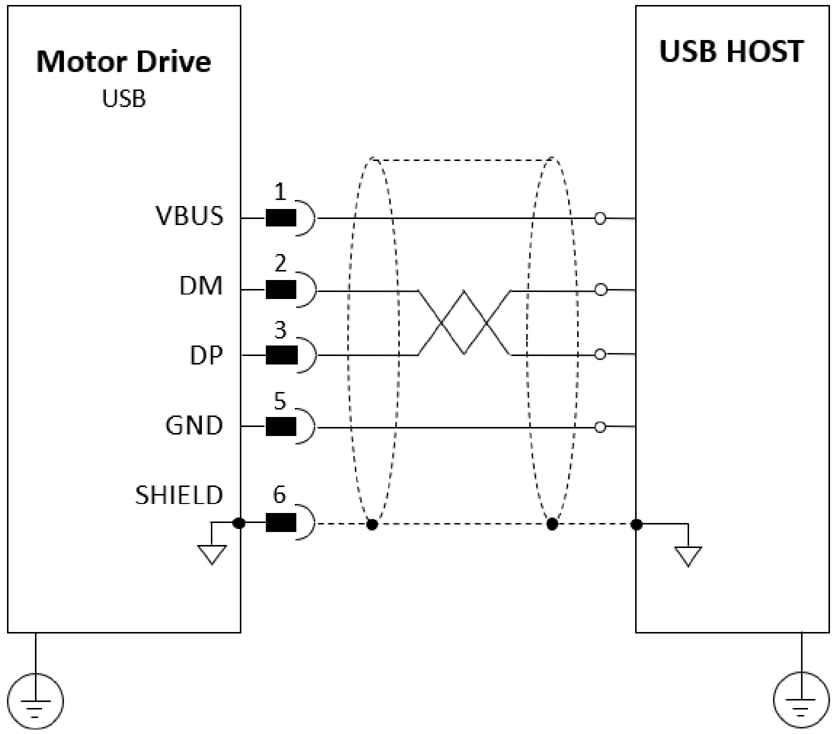
[RS-485 Connection Diagram]

3.18. USB



USB-Mini Type B (Keystone Model:934)	J101
Pin	**Signal**
1	VBUS
2	DM
3	DP
4	Not Used
5	GND
6	Shield

3.18.1. USB Wiring



[USB Connection Diagram]

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