

WELCON

Servo Drive

Hardware Manual



WER-D048/20-FS04F7_V03



2025-02-21



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

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Product Name for welcon Drive

WE2S-D024 / 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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Question : www.welconsystems.com

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.



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.

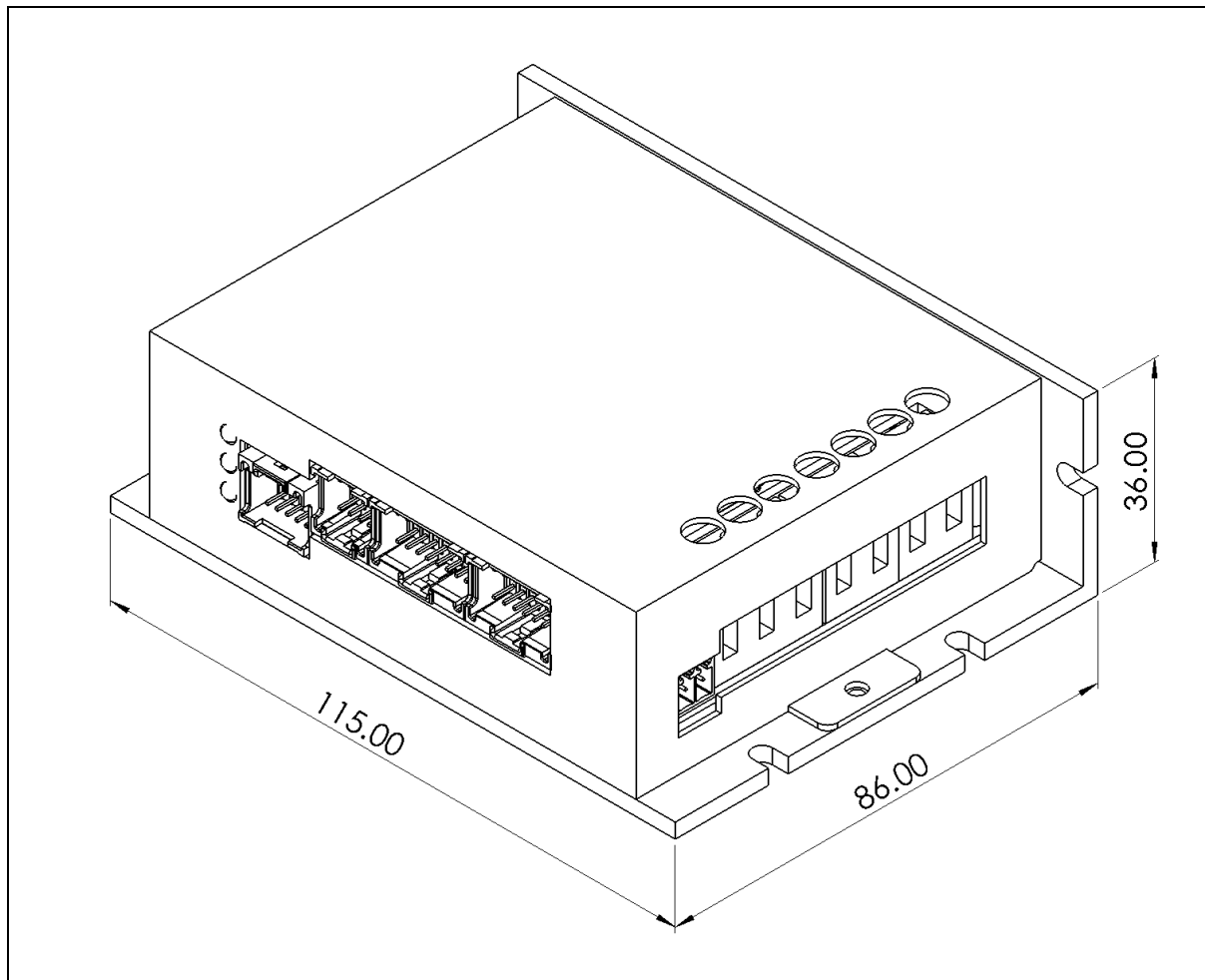
1.4. Use environment

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.

2. Technical Information

2.1. Mechanical Data

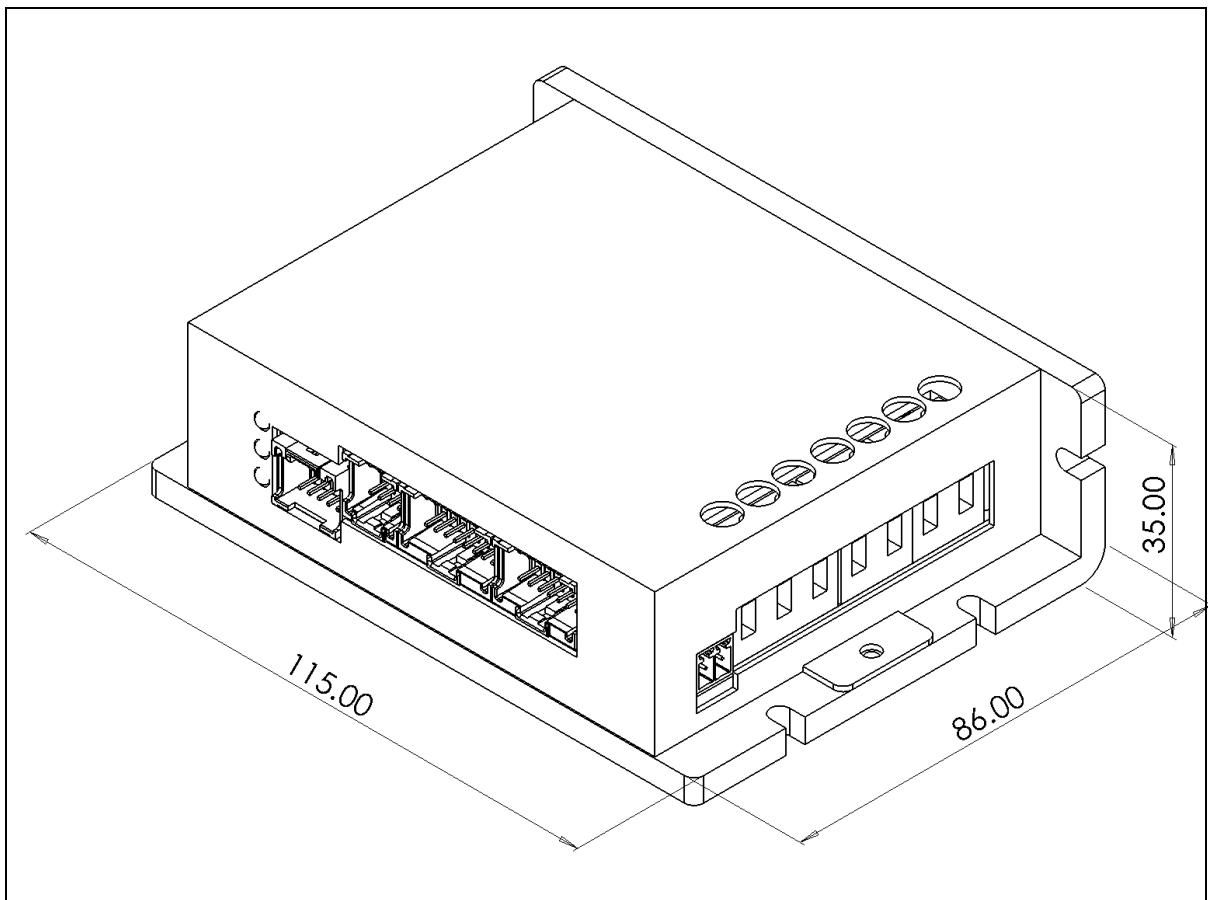
2.1.1. CASE_V0



Item	Unit	Description
Weight	g	430
SIZE (L x W x H)	mm	115 * 86 * 36
Heatsink Thickness	mm	3
Fastener	M3	

[*For details, please refer to the 3D Modelling on the homepage.](#)

2.1.2. CASE_V1

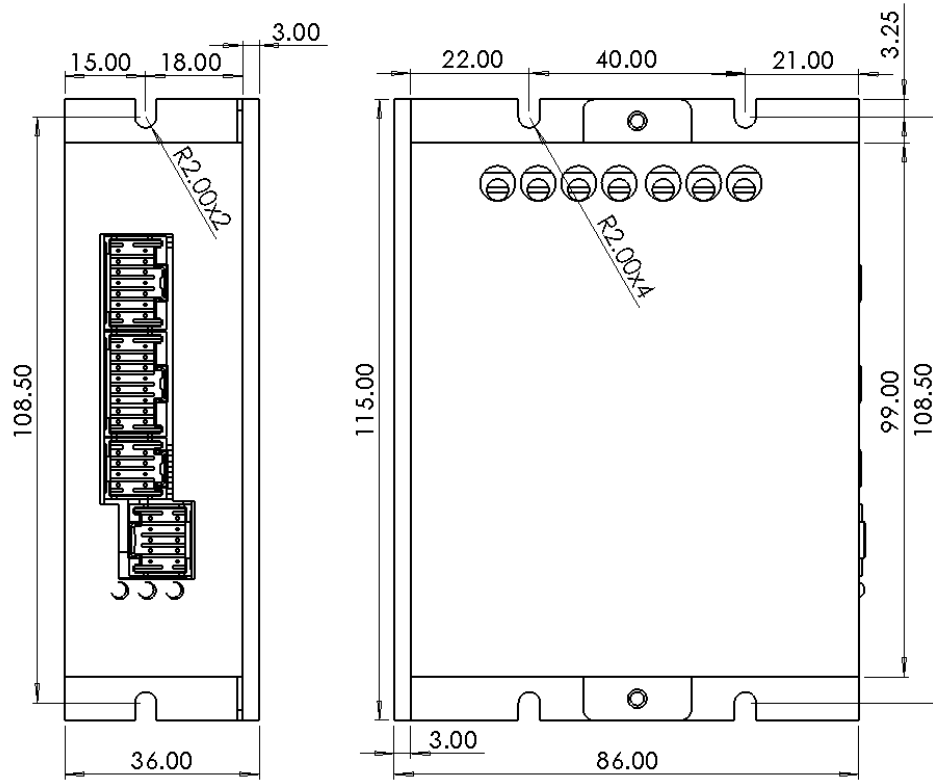


Item	Unit	Description
Weight	g	430
SIZE (L x W x H)	mm	115 * 86.3 * 35
Heatsink Thickness	mm	5
Fastener	M3	

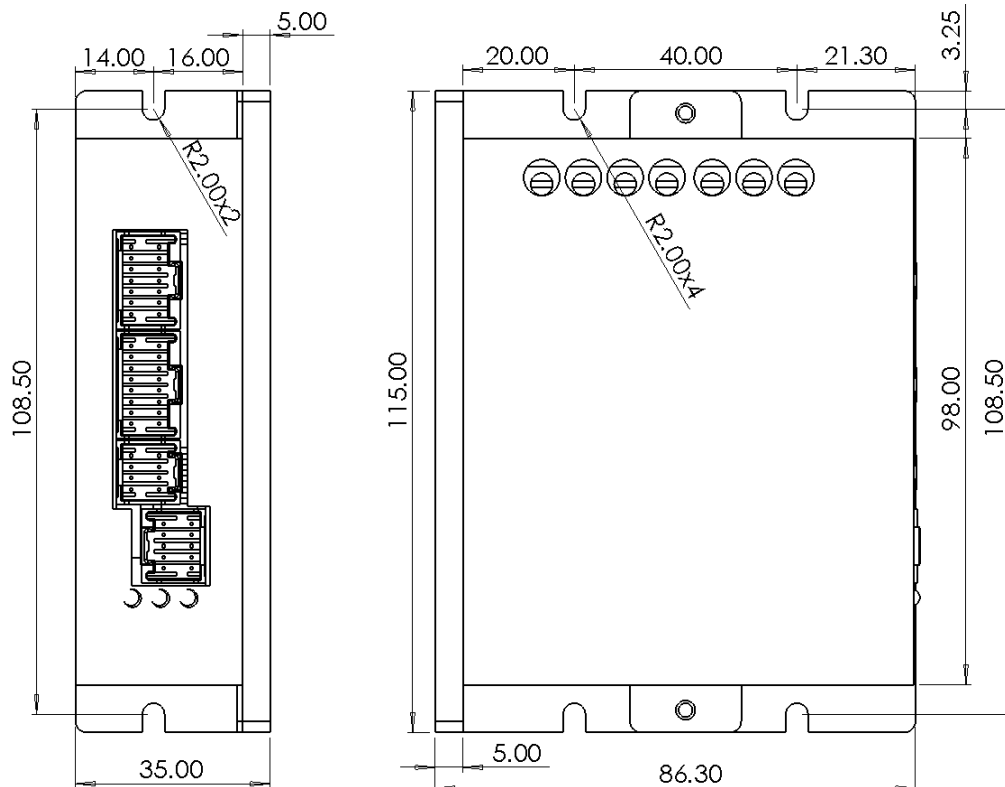
[*For details, please refer to the 3D Modelling on the homepage.](#)

2.2. Mounting Dimension

2.2.1. CASE_V0



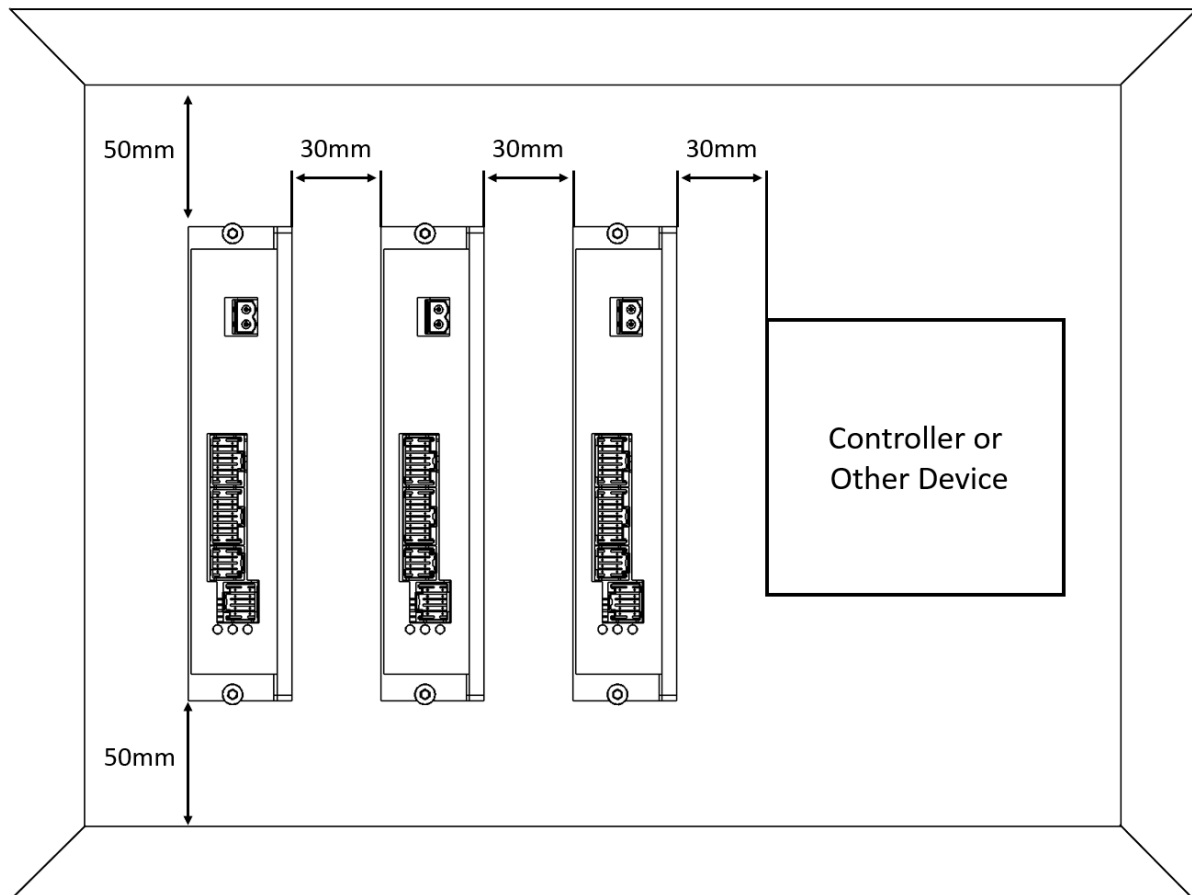
2.2.2. CASE_V1



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-D048/20-FS04F7	
Ratings	20
Continuous Output Current A[rms]	20
Peak Output Current A[rms]	40
Basic Specifications	
Feature	Specification
Motors	DC/BLDC/PMSM/VCM Rotary servo motors, Linear servo motors
Current(Torque) Control	Control Periodic 24KHz
	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	12~48VDC
Current Consumption	≈40mA without encoder or other peripheral
Protective Functions	Under- and over-voltage, Over-current, Over-load(with I ² T), Drive over-temperature
Environment	Ambient temperature: Operation 0~50°C, Storage 0~70°C Humidity: 10~90%, Vibration: 1.0g
Compliance Standard	CE
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	1
	Voltage Range	Analog ± 10 VDC differential
	Input Resolution	14 bit
Digital Input	Quantity	6
	Signal	Configurable. Opto-isolated
	Voltage	24V
Digital Output	Quantity	2
	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-quadr-B with or without index, RS422, Differential CH2 : A-quadr-B with or without index, Single-ended
	A-quadr-B Max Input Frequency	10MHz (before quadrature)
Digital Hall Sensor	Signal	Single-ended
	Type	Separated hall sensor
Analog Hall Sensor*	Signal	0~5V, Single-ended
	Sampling Frequency	24KHz
Sin/Cos Encoder*	Signal	-0.7~+0.7V at 2.5V, Differential
	Sampling Frequency	24KHz
Serial Encoder	Type	SSI, BiSS-C, Tamagawa, Panasonic, EnDat2.2
	Bite rate	0.5Mbps, 1Mbps, 2Mbps, 2.5Mbps, 5Mbps

* Optional (Refer to product code)

2.5. Protections & Limitations






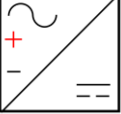
Protection Functionality	Switch-off threshold	Recovery threshold
Under Voltage	DC Link Voltage Minimum Limit	DC Link Voltage Minimum Limit + 0.5V
Over Voltage	DC Link Voltage Maximum Limit	DC Link Voltage Maximum Limit – 0.5V
Over Current	Exceeding H/W Current Limit(40A) or 110% of Maximum Current	-
Over Temperature	100 °C	95 °C
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

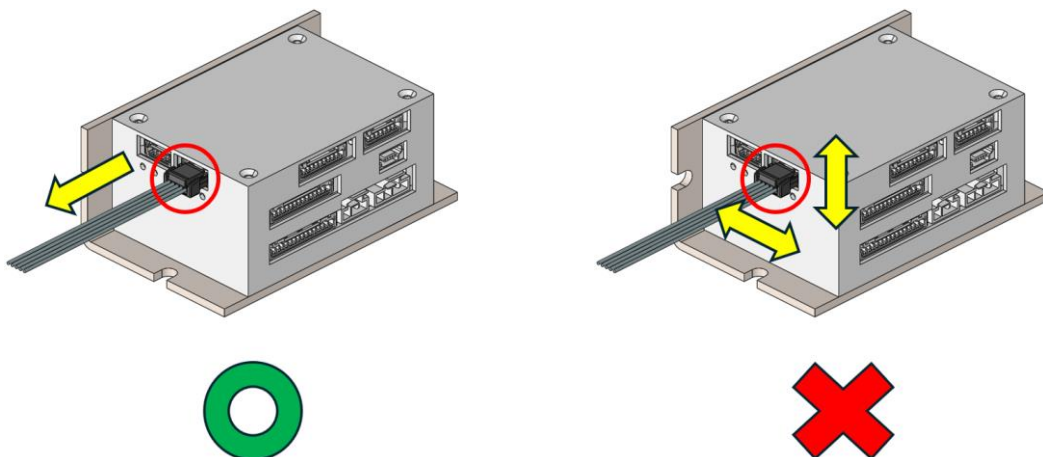
⚠ Cautions

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

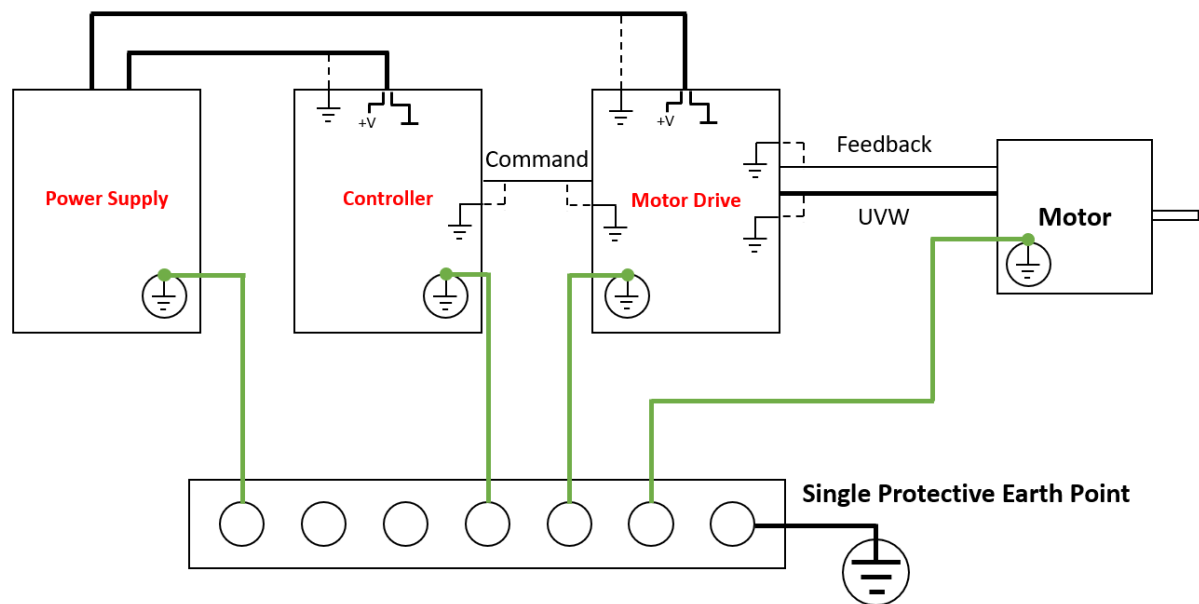
- If there is a locking tab or clip, unlock it by hand and then disconnect the connector.
- Do not forcefully pull on the connector without unlocking it.
- Disconnect the connector by pulling it straight in the designed direction.
- Do not shake it up and down or side to side.
- Separate slowly and gently,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



3.3.1. Grounding

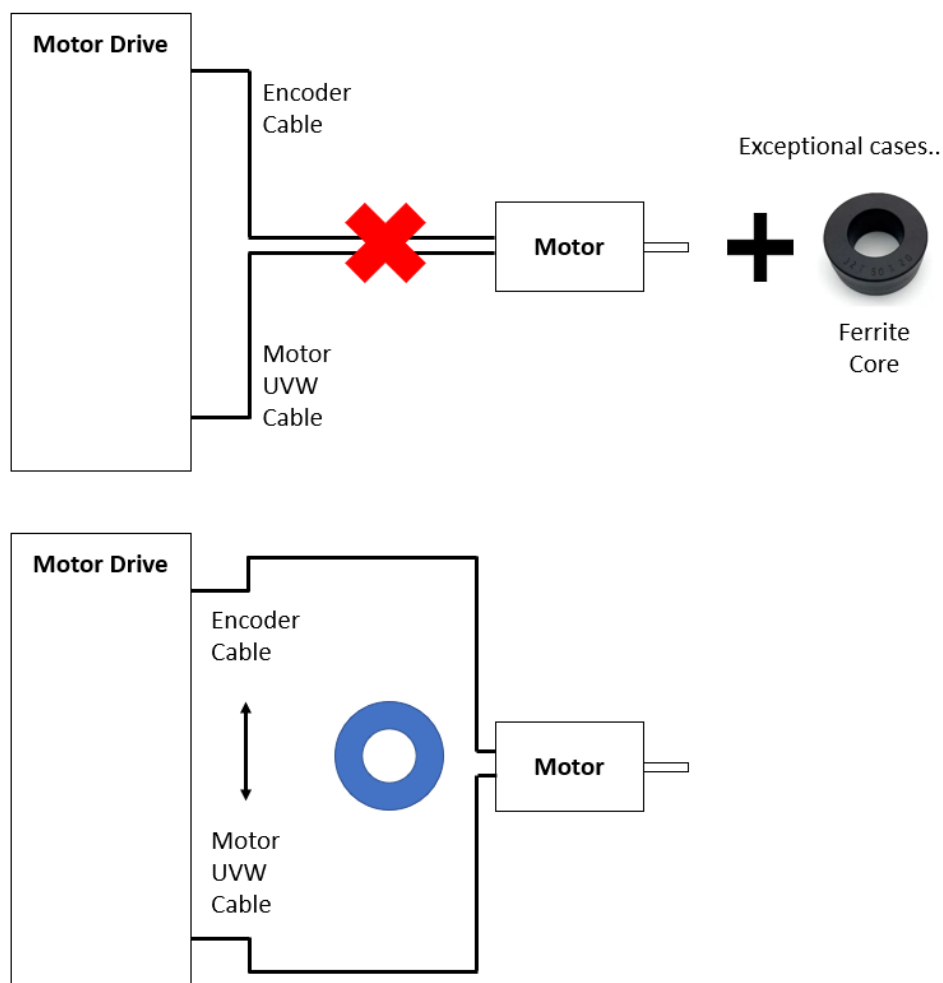
The case grounds of all the system components should be connected to a single Protective Earth (PE) ground point.

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.



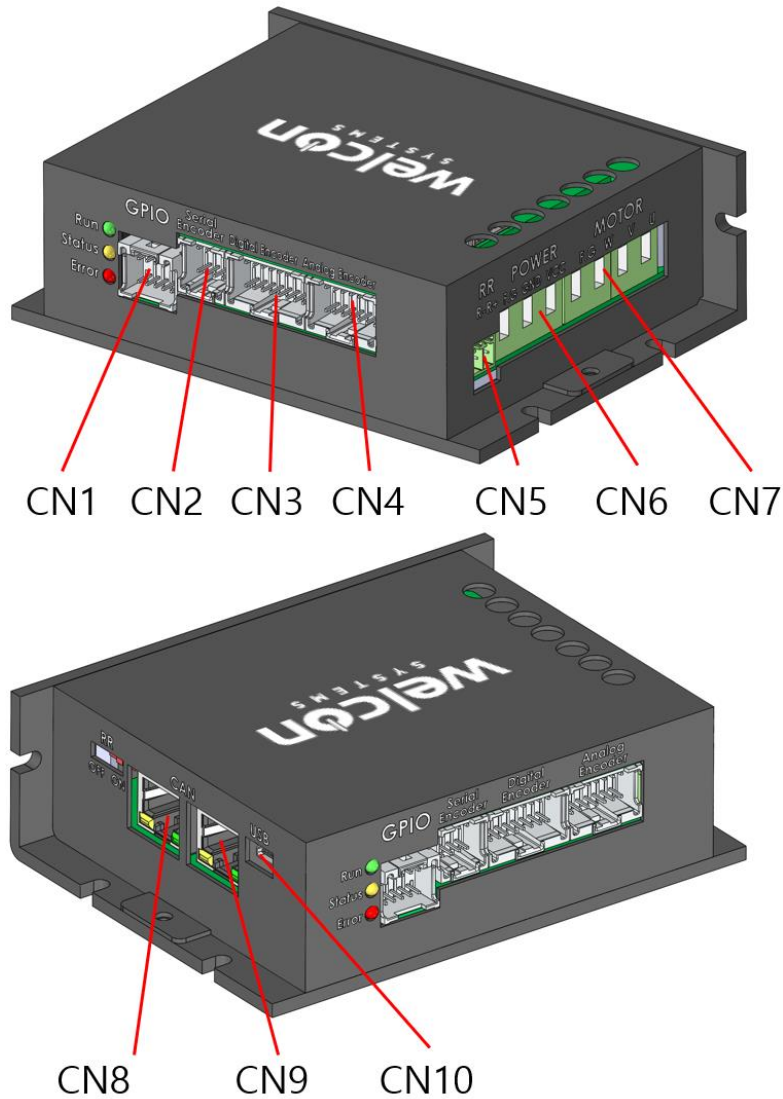
If the two wires cannot be separated from each other, install a ferrite core to attenuate noise. For best results, wind the wire as much as possible, and always in the same direction. When winding the ferrite core around the motor UVW wire, the ground(FG) wire must not pass through the ferrite core.

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	GPIO	CN6	Main Power
CN2	Serial Encoder	CN7	Motor UVW
CN3	Digital Encoder	CN8	CAN / RS-485 / EtherCAT IN
CN4	Analog Encoder	CN9	CAN / RS-485 / EtherCAT OUT
CN5	Regenerative resistance	CN10	USB

3.6. Regenerative resistance

Dinkle_ECH350R-02P		J702
Pin	Input Power	
1	R+	
2	R-	

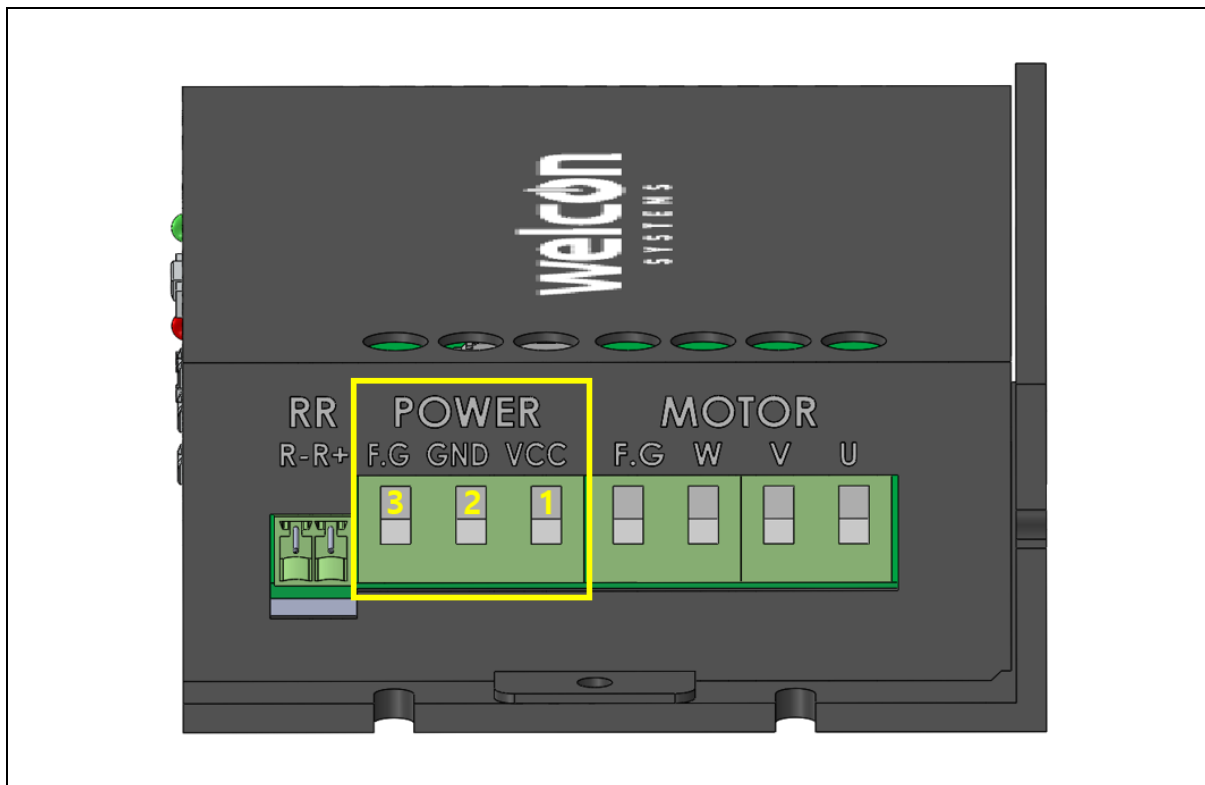


- In a system with a large inertia enough to generate regenerative power, you must connect a regenerative resistor to consume energy as heat. Please note that the drive may be damaged by regenerative power.
- Be sure to connect the regenerative resistor after changing the regen clamp cut-off voltage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



- For WER-D048/20-FS04F7, we recommend using a regenerative resistor of approximately **2.4 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. Main Power



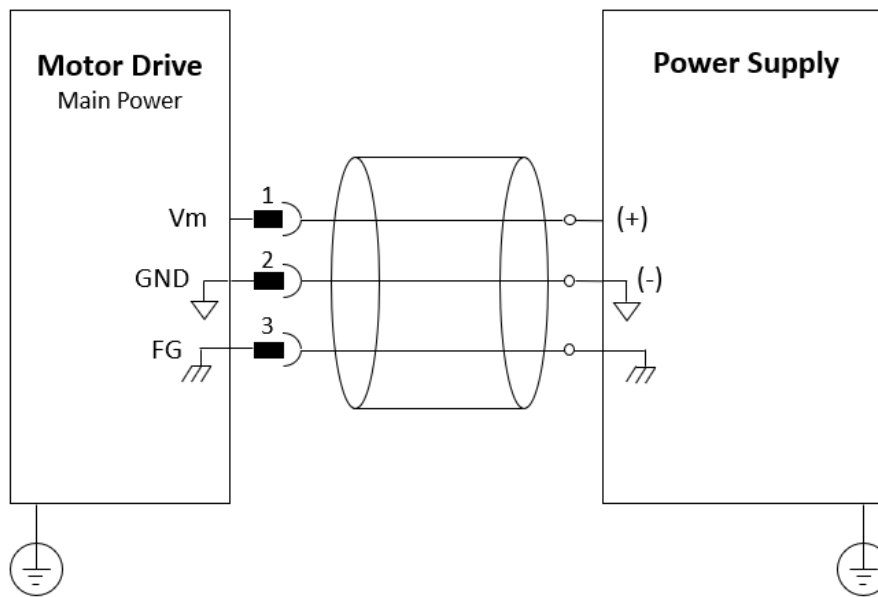
Dinkle_EHK750V-03P		J701
Pin	Signal	Input Power
1	VCC	12~48VDC
2	GND	GND
3	FG	FG



Warning
Avertissement

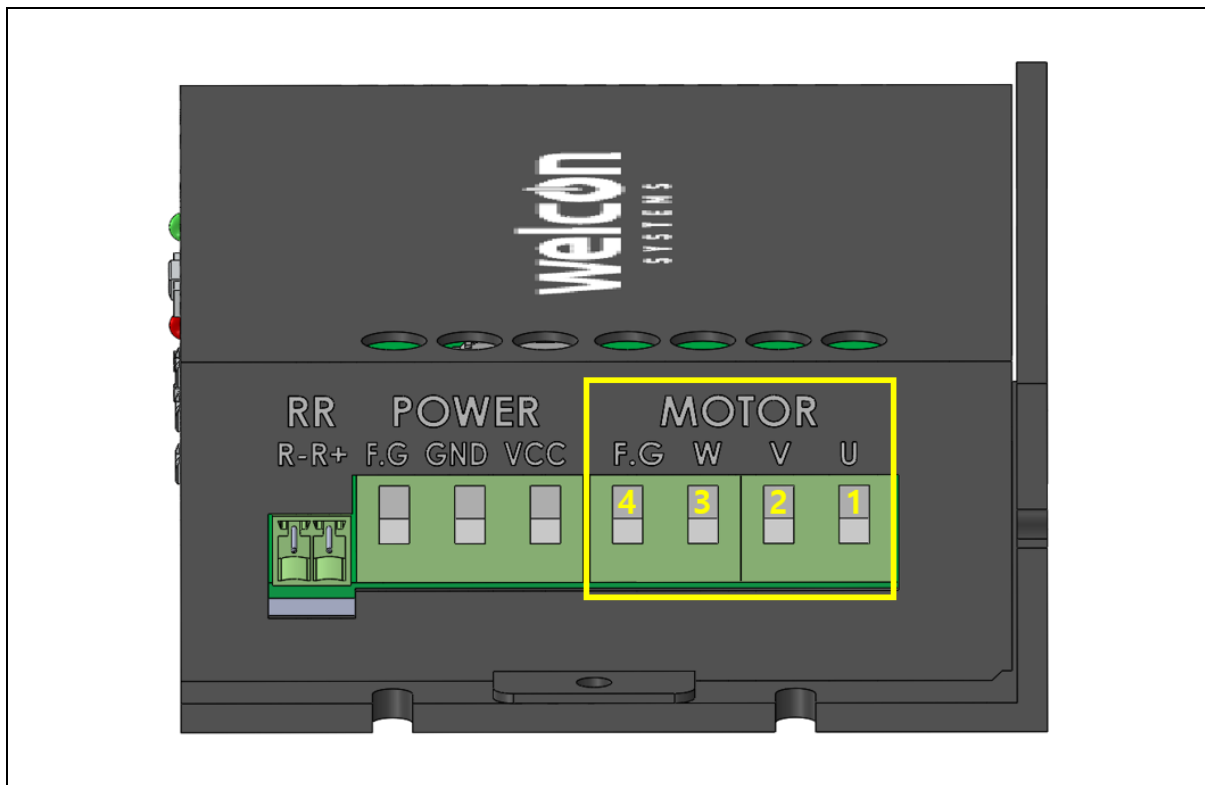
- Do not connect/disconnect the servo drive while the power is on.
- Before applying power, make sure that the DC supply is within the specified range.
- make sure the proper plus and minus connections are in order.

3.7.1. Main Power Wiring



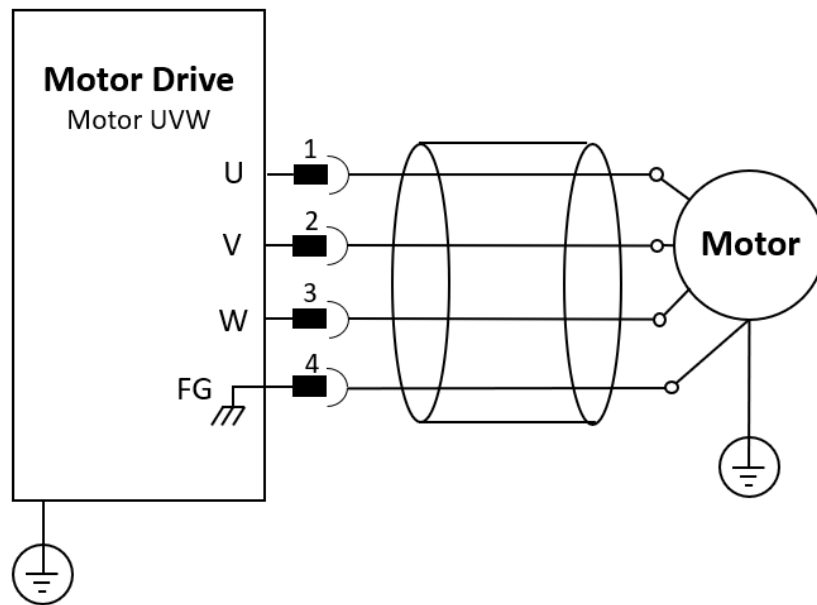
[Main Power Connection Diagram]

3.8. Motor UVW

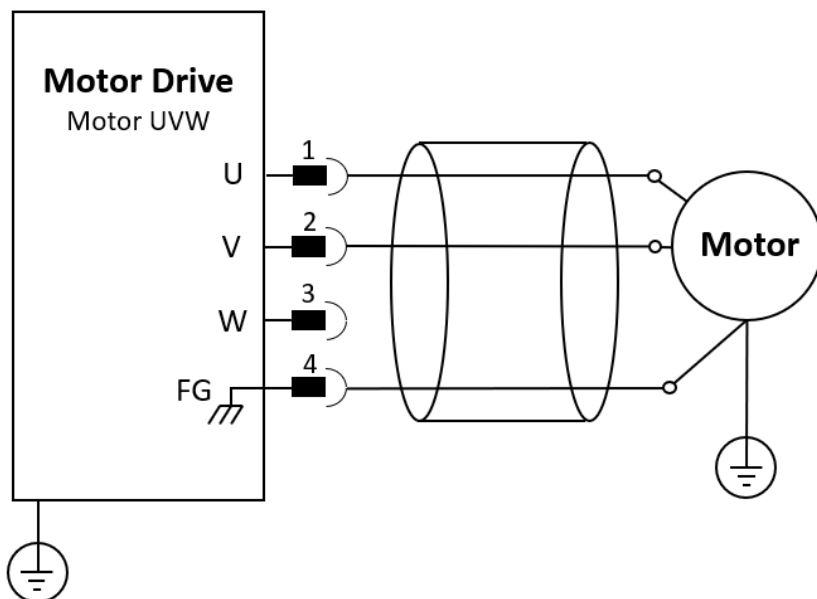


Dinkle_EHK750V-04P		J801
Pin	Signal	
1	U (VCM or DC Motor : +)	
2	V (VCM or DC Motor : -)	
3	W	
4	FG	

3.8.1. Motor UVW Wiring

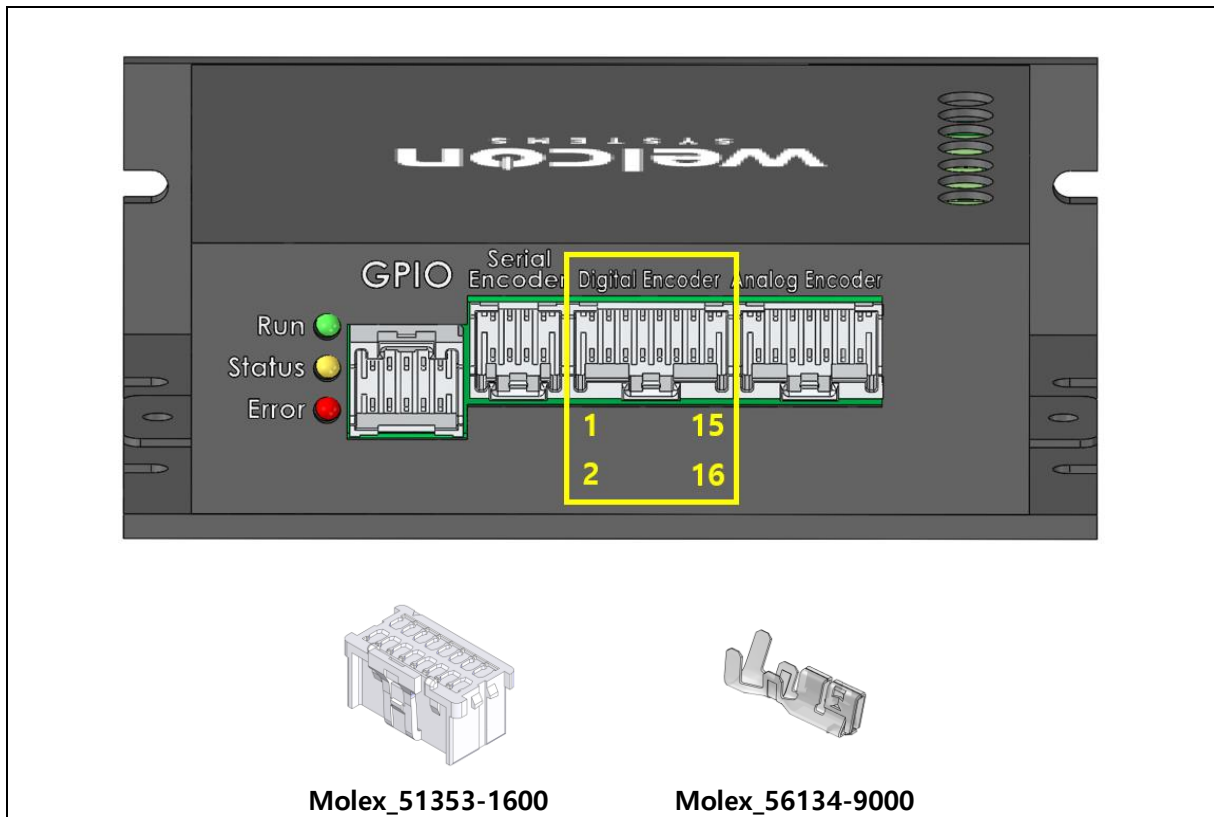


[Brushless / PMSM Motor UVW Connection Diagram]



[Brushed DC / Voice Coil Motor UVW Connection Diagram]

3.9. Digital Encoder (Port A)

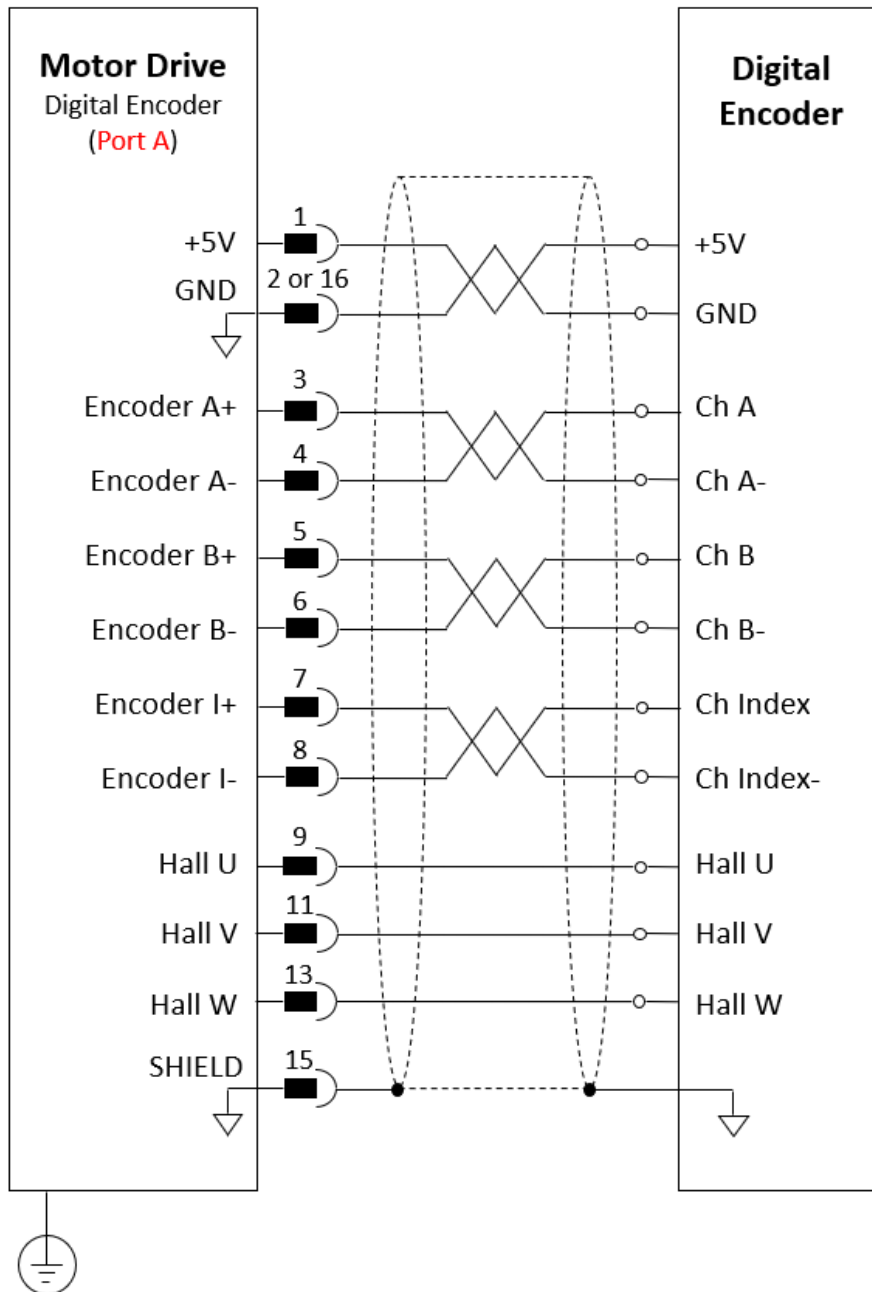


Molex_55959-1630		J501
Pin	Signal	
1	5V	
2	GND	
3	Encoder A+	
4	Encoder A-	
5	Encoder B+	
6	Encoder B-	
7	Encoder I+	
8	Encoder I-	
9	Hall U	
10	Not used	
11	Hall V	
12	Not used	
13	Hall W	
14	Not used	
15	Shield	
16	GND	

3.9.1. Digital Encoder(Port A) Wiring

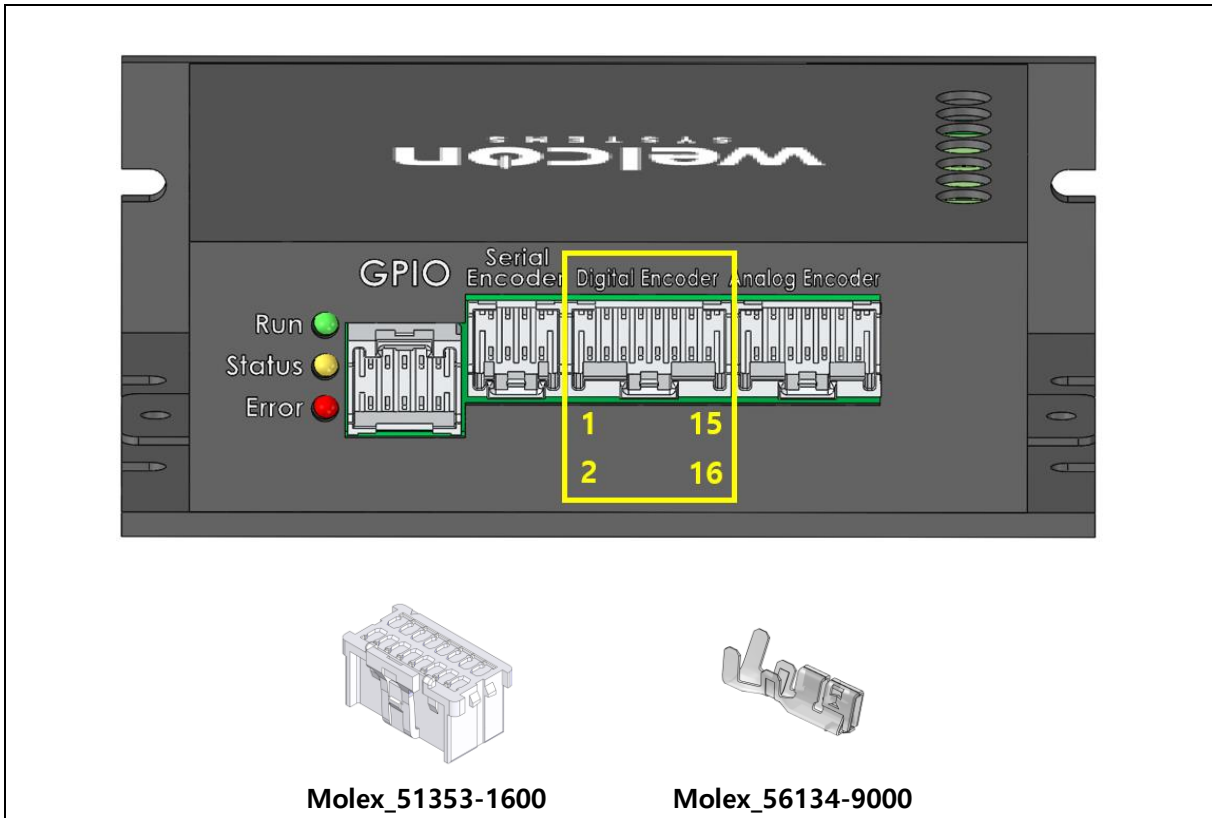
The cable's shield is connected to the shield in the connector.

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]

3.10. Digital Encoder (Port B)



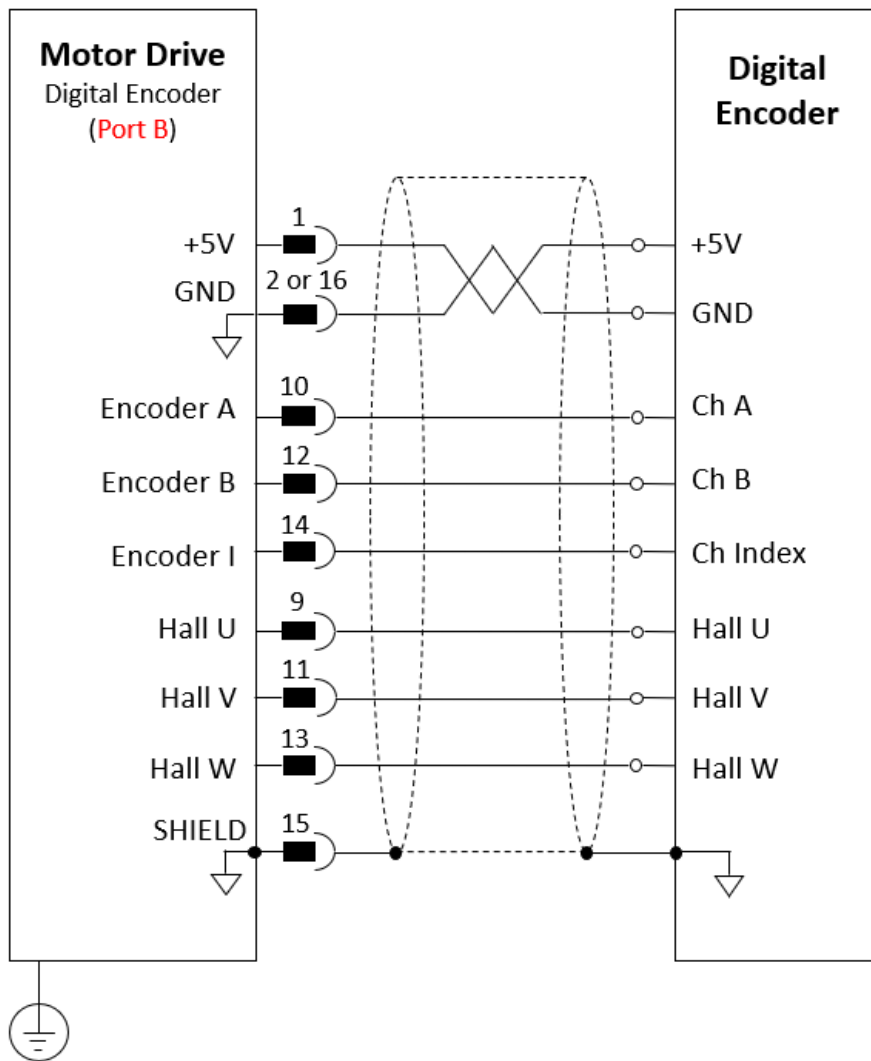
Molex_55959-1630		J501
Pin	Signal	
1	5V	
2	GND	
3	Not Used	
4	Not Used	
5	Not Used	
6	Not Used	
7	Not Used	
8	Not Used	
9	Hall U	
10	Encoder A	
11	Hall V	
12	Encoder B	
13	Hall W	
14	Encoder I	
15	Shield	
16	GND	

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

3.10.1. Digital Encoder(Port B) Wiring

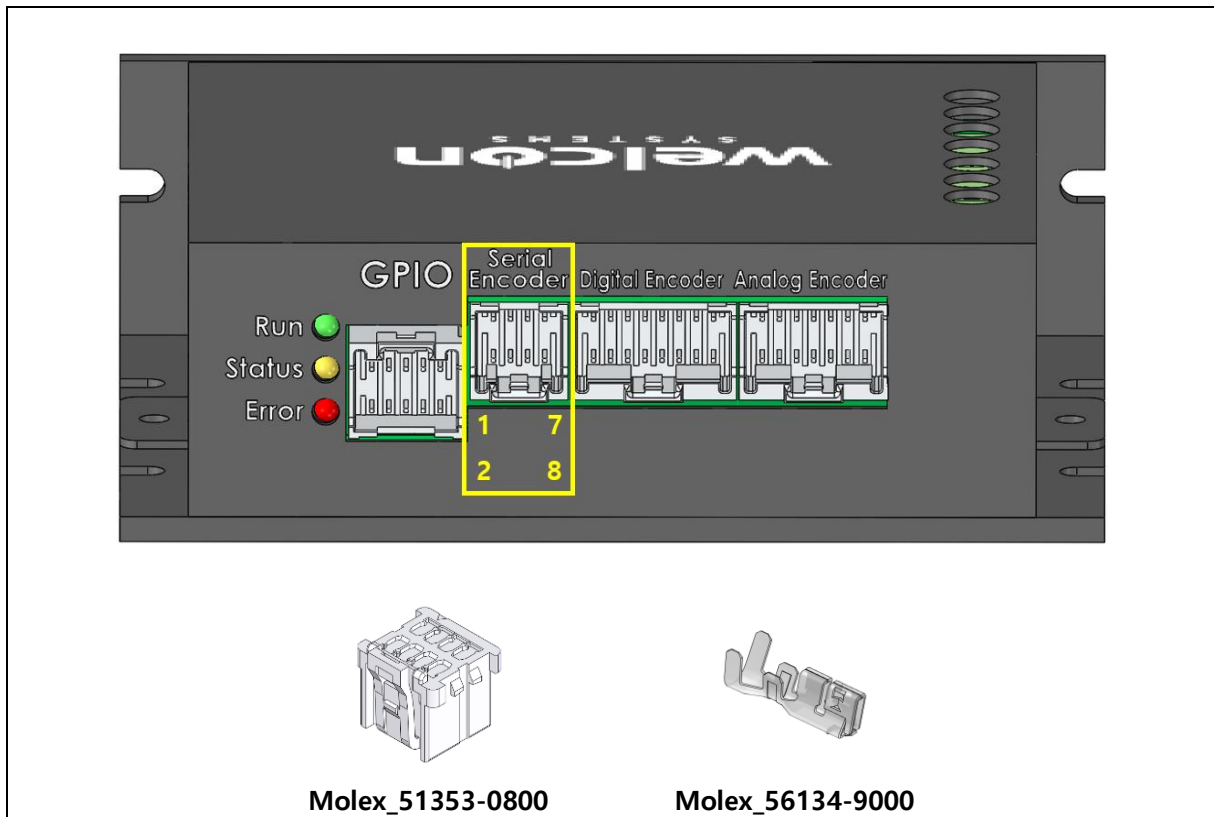
The cable's shield is connected to the shield in the connector.

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]

3.11. Serial Encoder

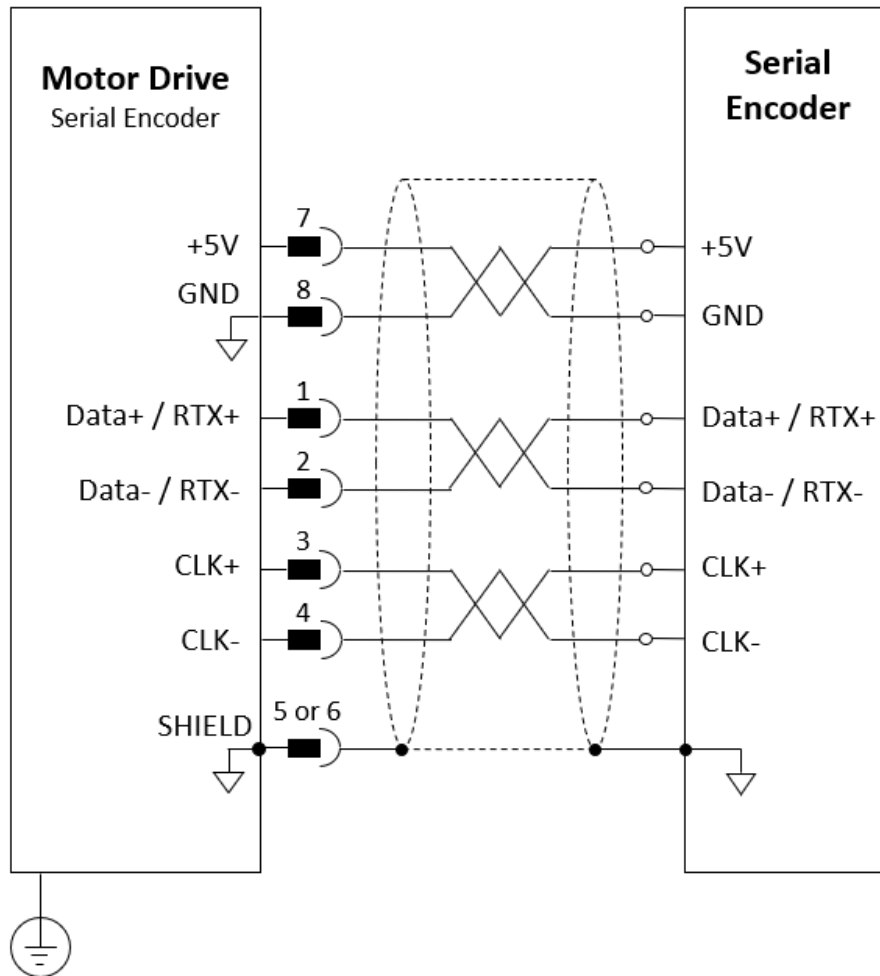


Molex_55959-0830		J601
Pin	Signal	
1	Data+ / RS485_RTX+	
2	Data- / RS485_RTX-	
3	CLK+	
4	CLK-	
5	Shield	
6	Shield	
7	5V	
8	GND	

3.11.1. Serial Encoder Wiring

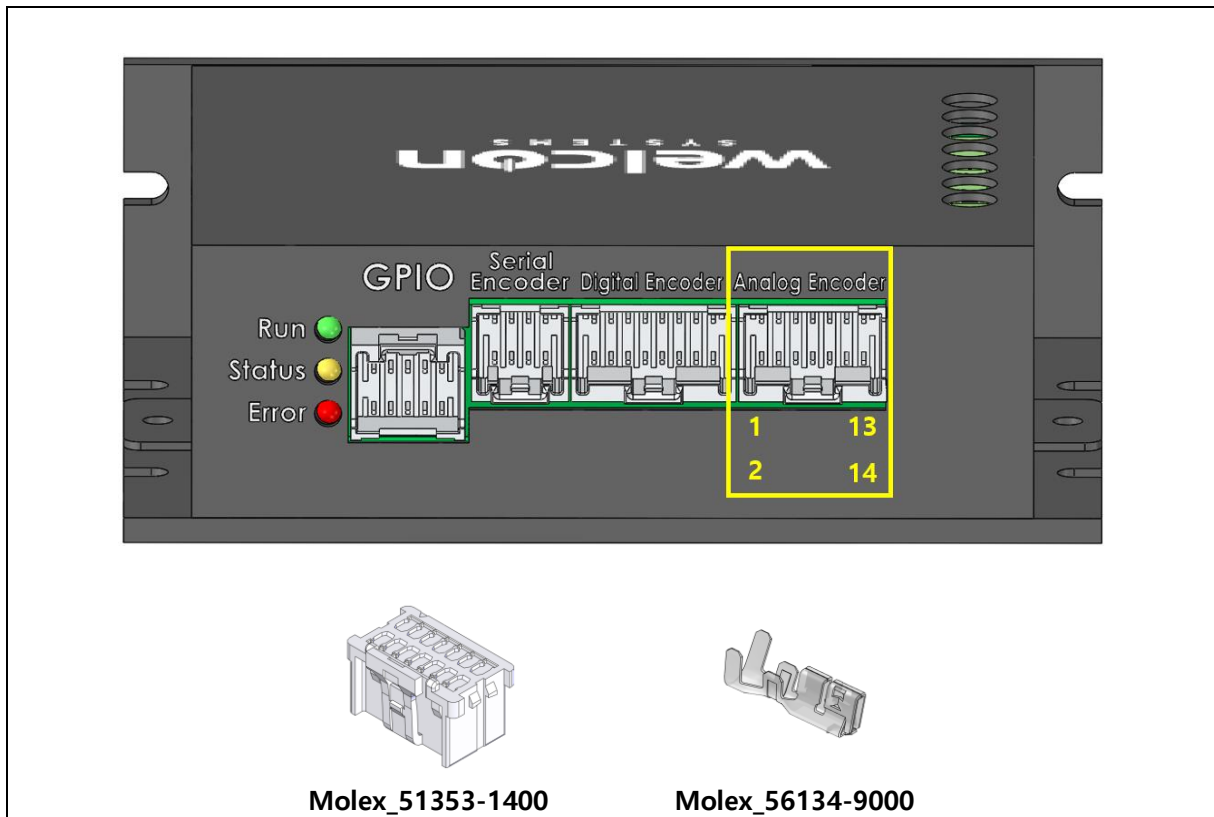
The cable's shield is connected to the shield in the connector.

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.



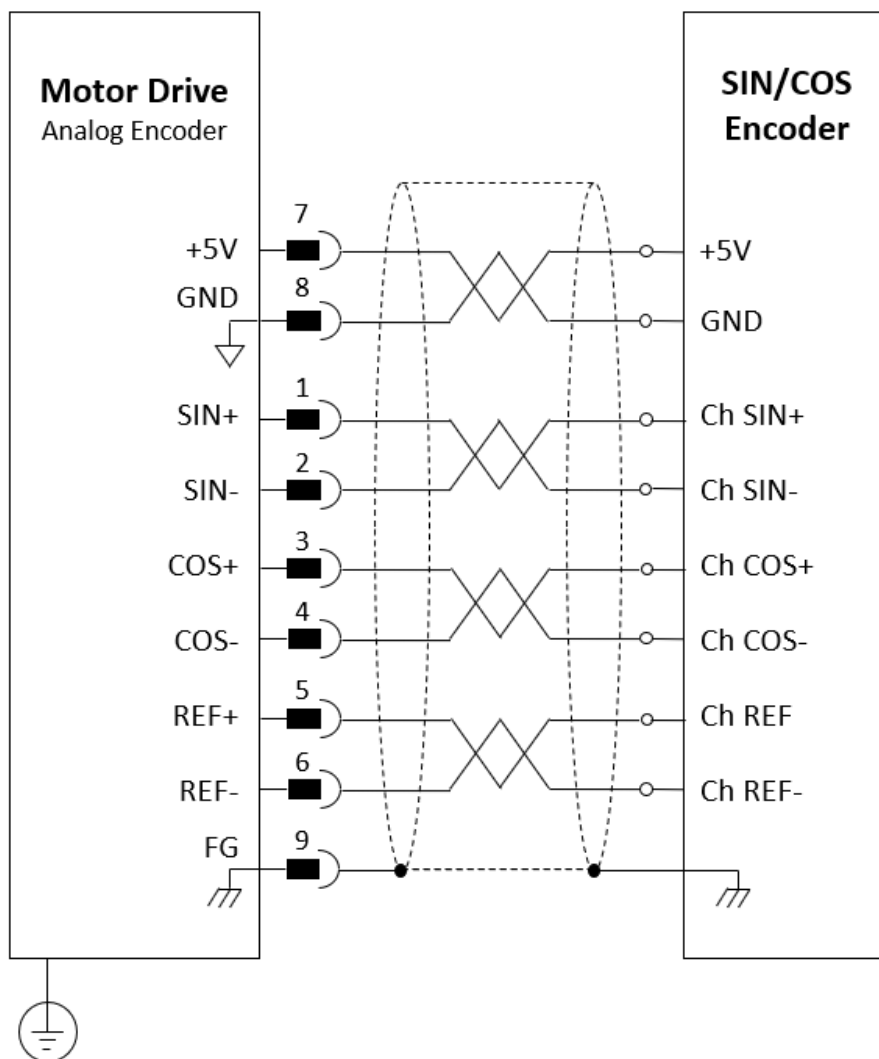
[Serial Encoder Connection Diagram]

3.12. Analog Encoder



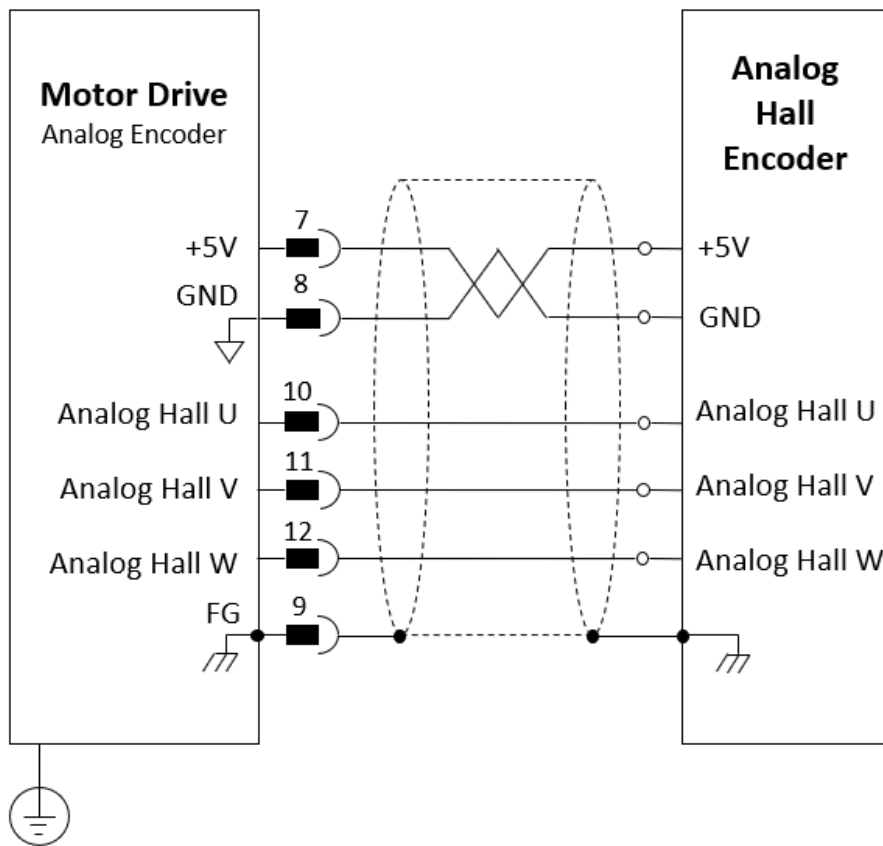
Molex_55959-1430		J701
Pin	Signal	
1	SIN+	
2	SIN-	
3	COS+	
4	COS-	
5	REF+	
6	REF-	
7	5V	
8	GND	
9	FG	
10	Analog Hall U	
11	Analog Hall V	
12	Analog Hall W	
13	Analog Input+	
14	Analog Input-	

3.12.1. Sin/Cos Encoder Wiring



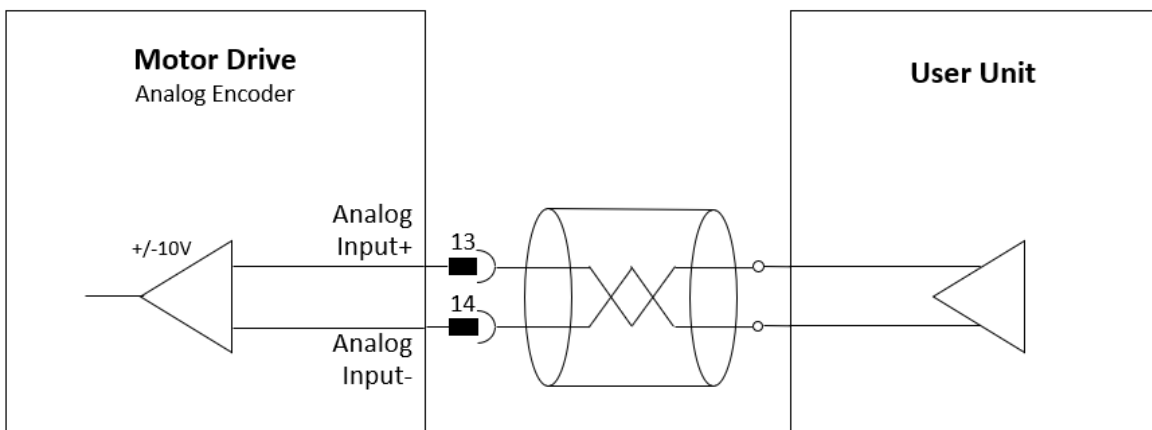
[Sin/Cos Encoder Connection Diagram]

3.12.2. Analog Hall Encoder Wiring



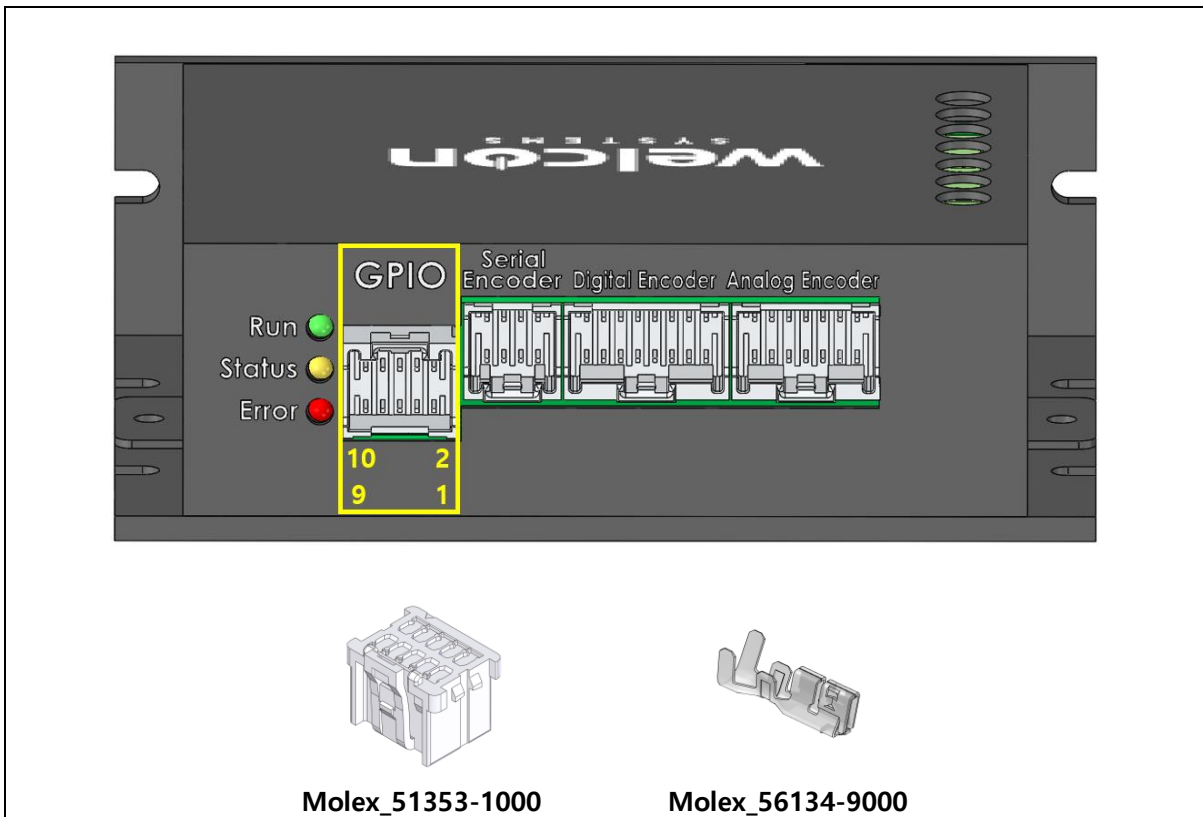
[Analog Hall Encoder Connection Diagram]

3.12.3. Analog Hall Encoder Wiring



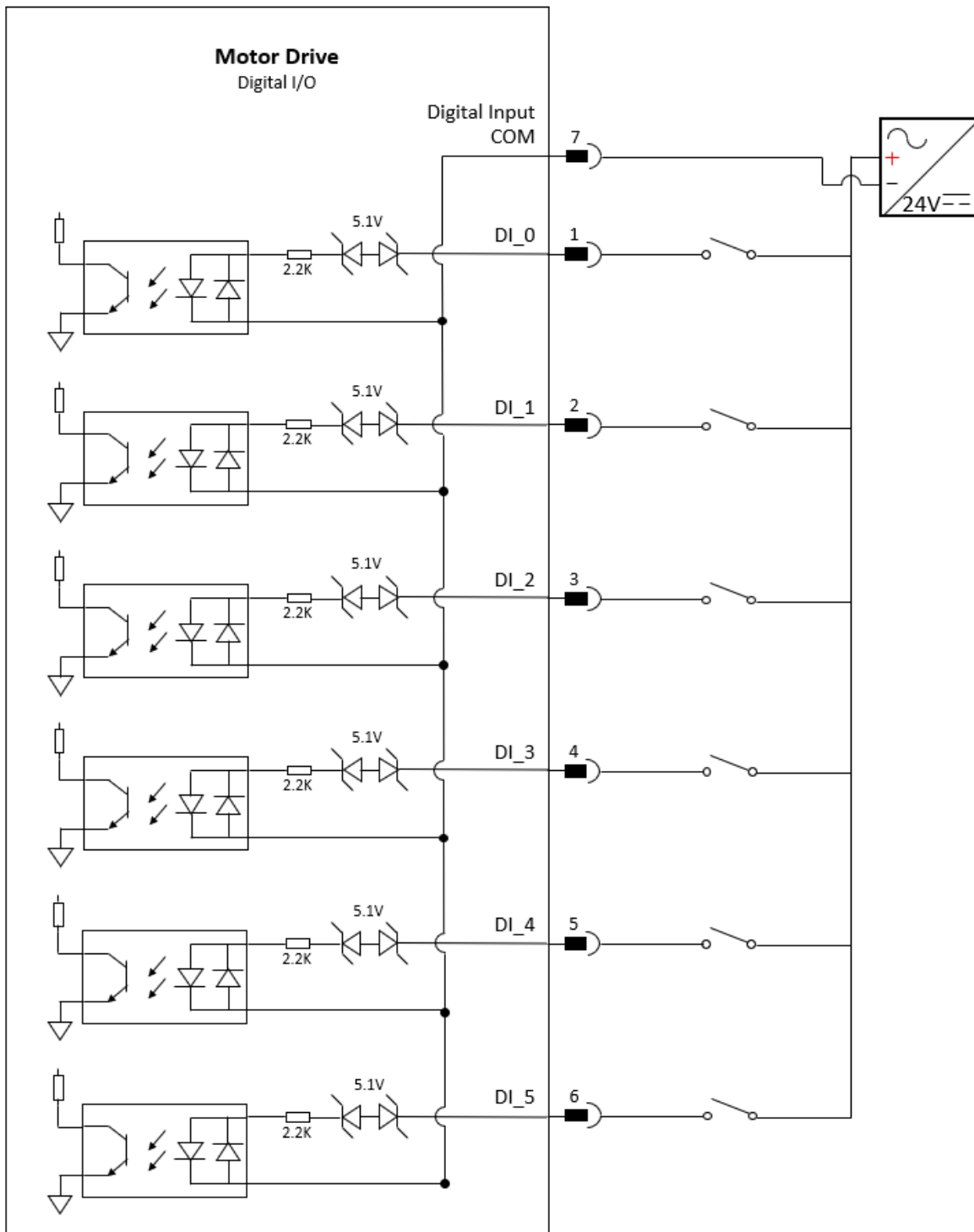
[Analog Input Connection Diagram]

3.13. Digital I/O



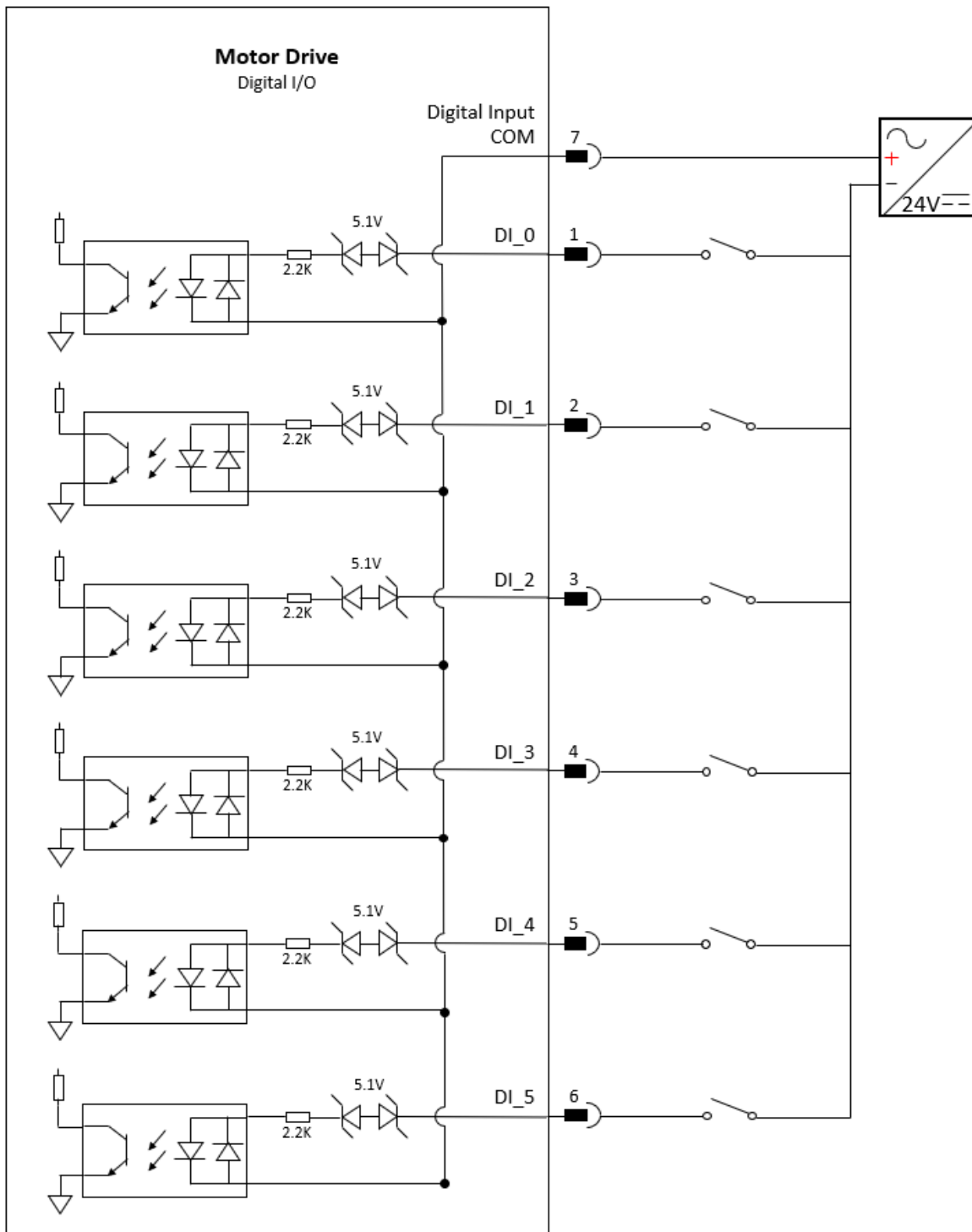
Molex_55959-1030		J901
Pin	Signal	
1	Digital Input_0	
2	Digital Input_1	
3	Digital Input_2	
4	Digital Input_3	
5	Digital Input_4	
6	Digital Input_5	
7	Digital Input_COM	
8	Digital Output_0	
9	Digital Output_1	
10	Digital Output_COM	

3.13.1. Digital Inputs(PNP Type) Wiring



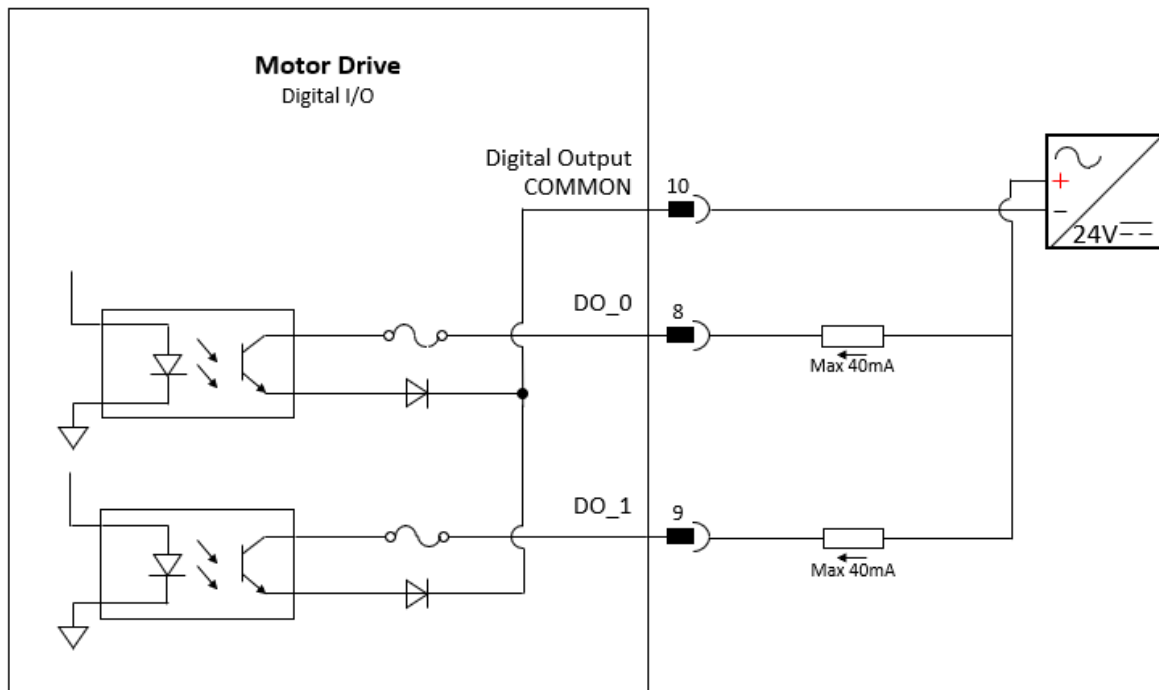
[Digital Inputs(PNP Type) Connection Diagram]

3.13.2. Digital Inputs(NPN Type) Wiring



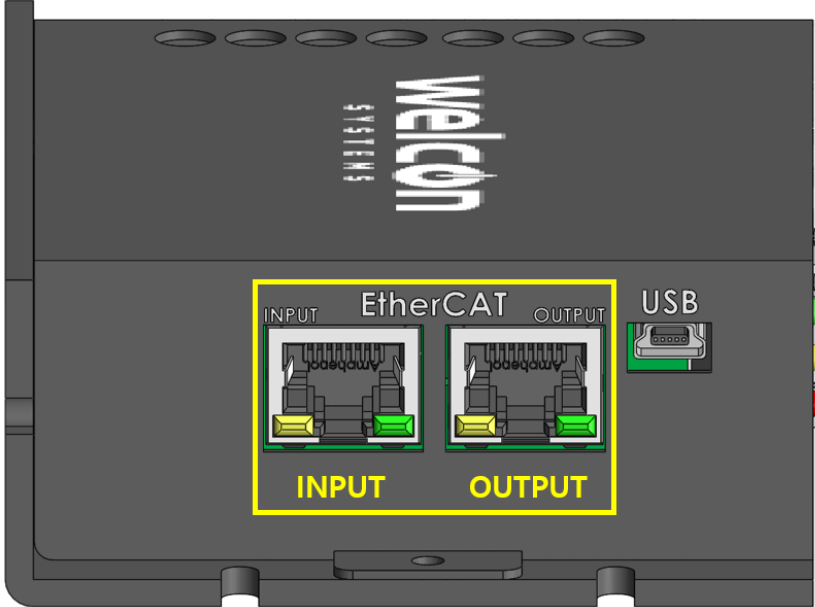
[Digital Inputs(NPN Type) Connection Diagram]

3.13.3. Digital Outputs(NPN Type) Wiring

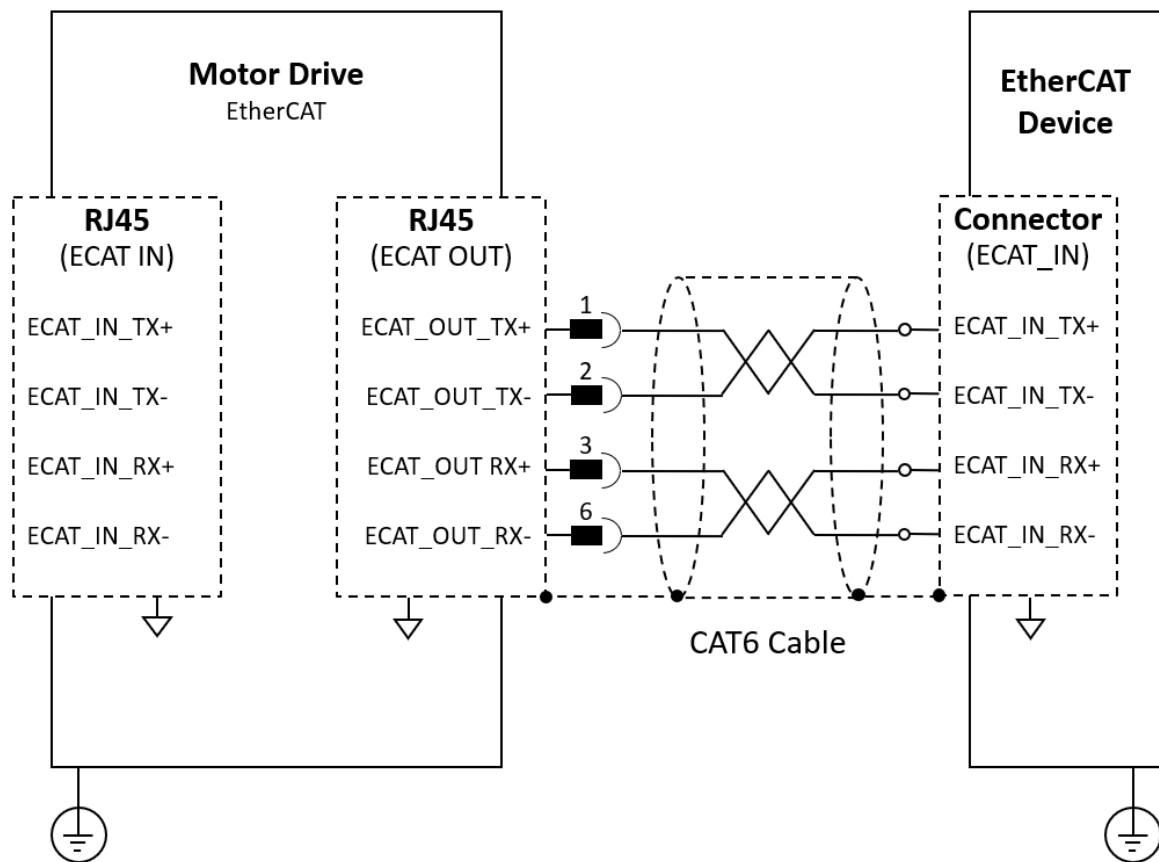


[Digital Outputs(NPN Type) Connection Diagram]

3.14. EtherCAT

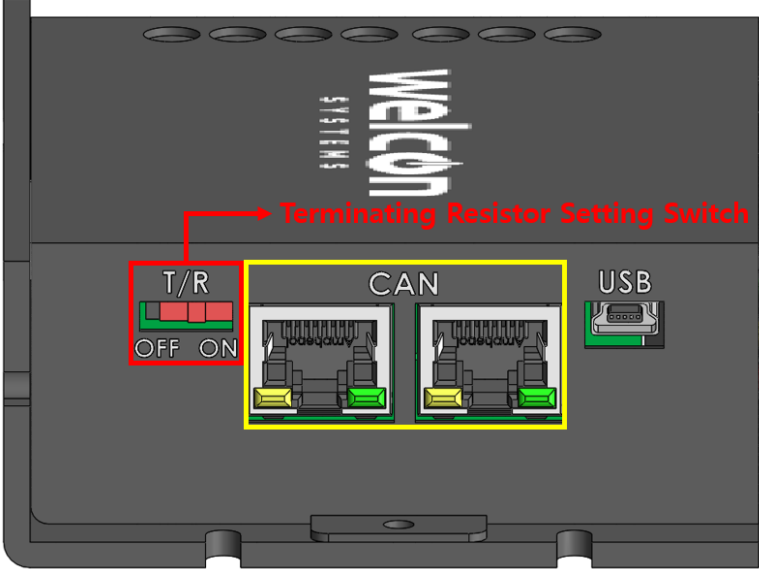
Fieldbus Type	Product Number
EtherCAT	WER-D048/20-FS04F7-E
	
Meritec_N3J11-017-02	J801, J802
Pin	Signal
1	EtherCAT Tx+
2	EtherCAT Tx-
3	EtherCAT Rx+
4	NC
5	NC
6	EtherCAT RX-
7	NC
8	NC

3.14.1. EtherCAT Wiring



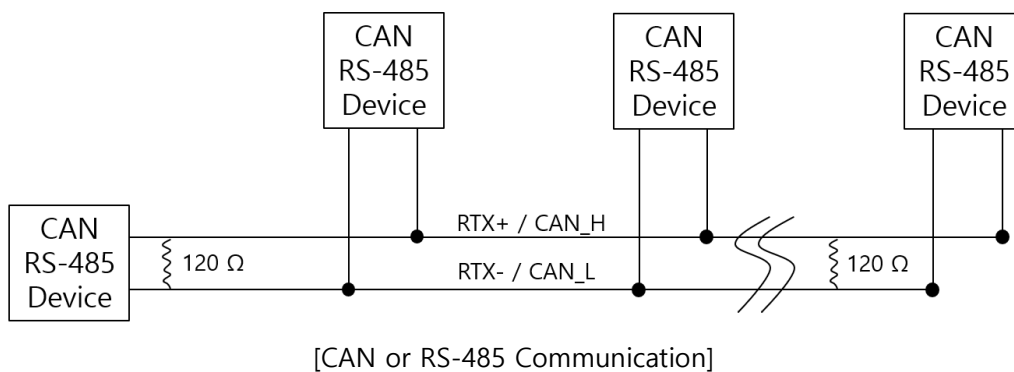
[EtherCAT Connection Diagram]

3.15. CAN

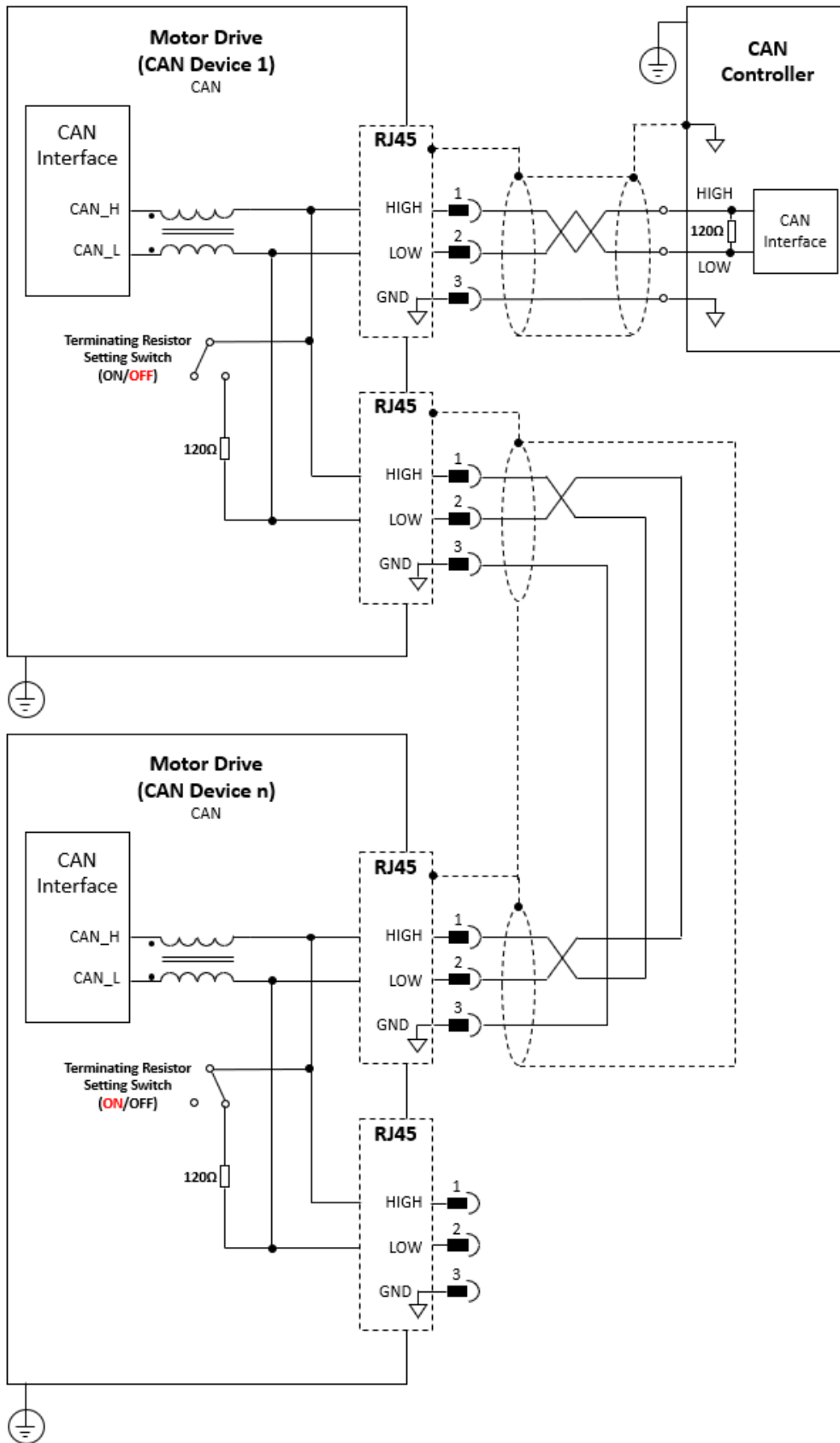
Fieldbus Type	Product Number
CAN	WER-D048/20-FS04F7-C
	
Meritec_N3J11-017-02	J801, J802
Pin	Signal
1	HIGH
2	LOW
3	GND
4	NC
5	NC
6	NC
7	NC
8	NC

3.15.1. Terminating Resistor

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



3.15.2. CAN Wiring



[CAN Connection Diagram]

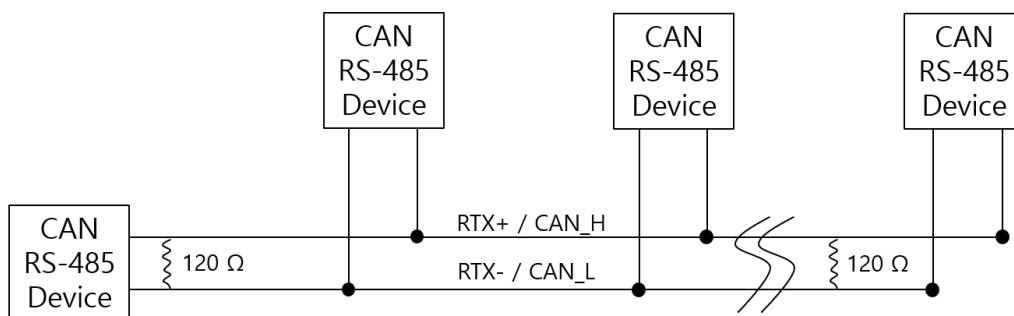
3.16. RS-485

Fieldbus Type	Product Number
RS-485	WER-D048/20-FS04F7-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

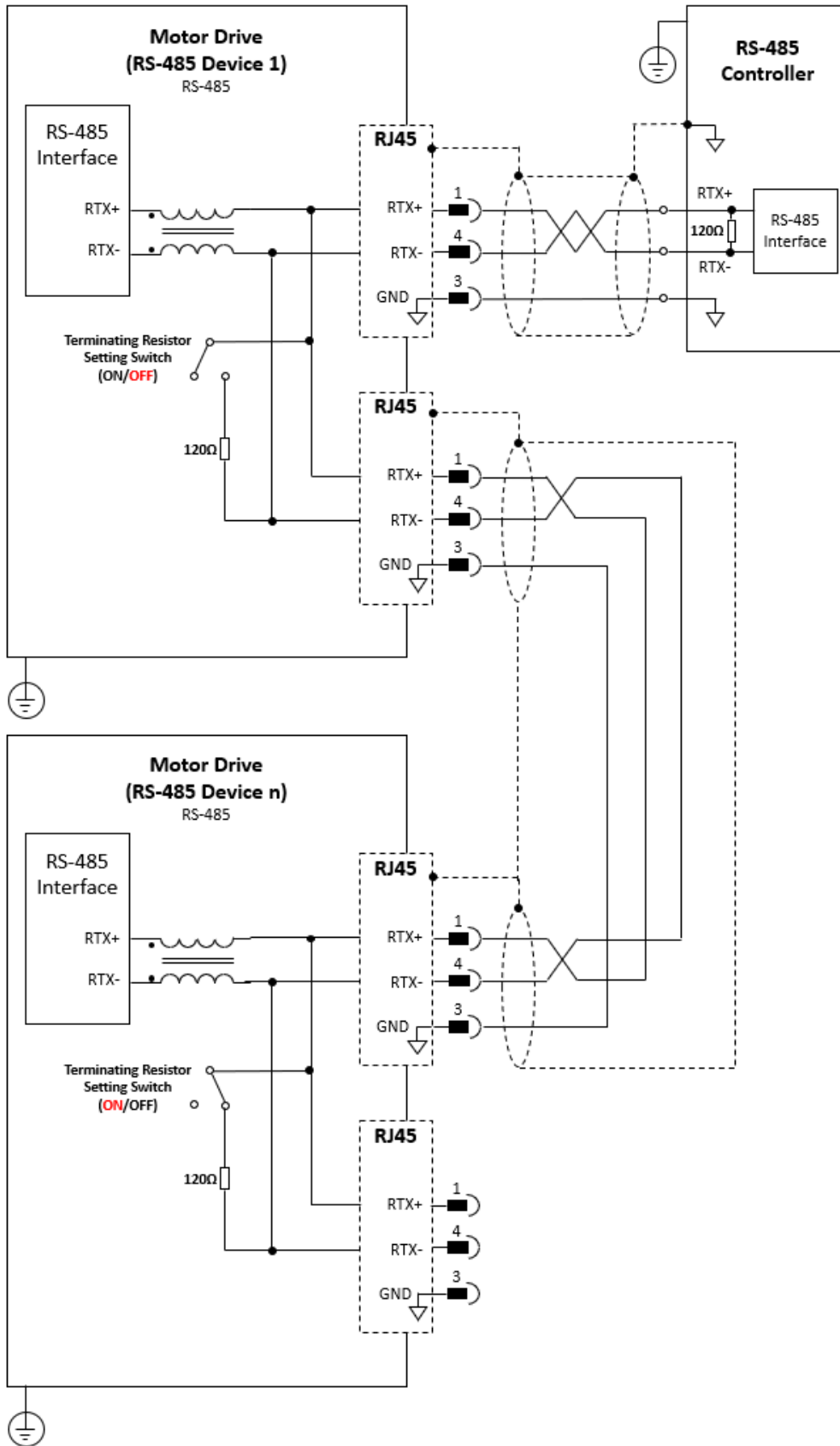
3.16.1. Terminating Resistor

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



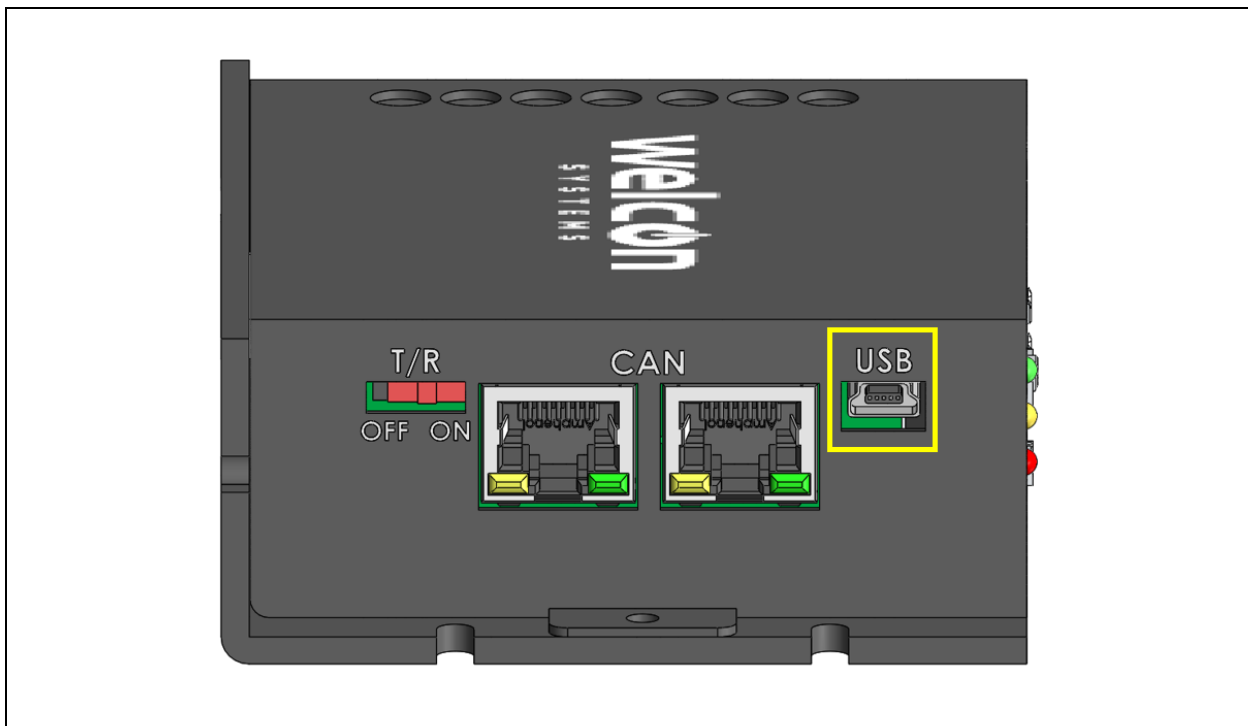
[CAN or RS-485 Communication]

3.16.2. RS-485 Wiring



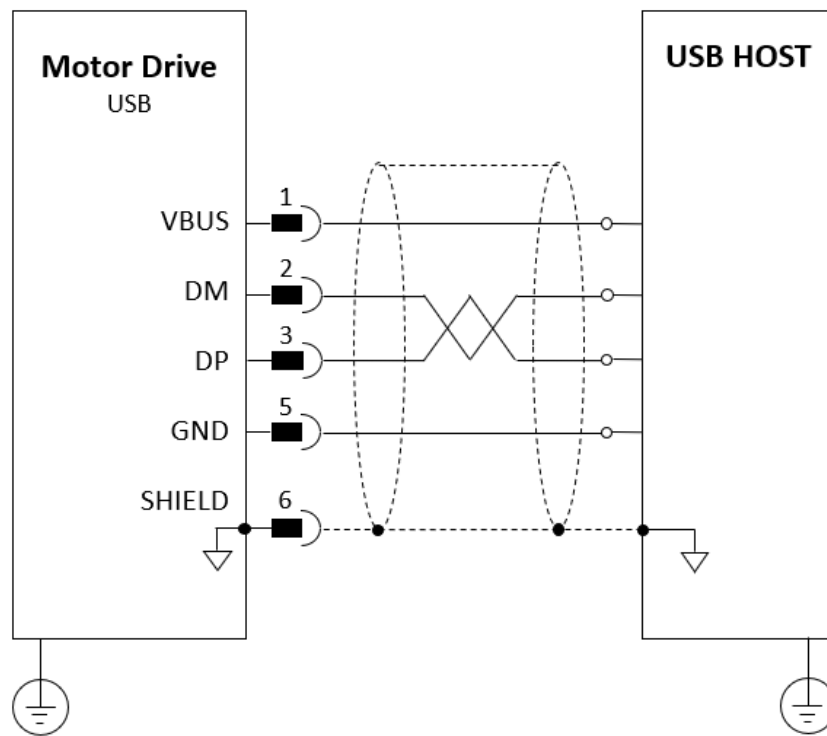
[RS-485 Connection Diagram]

3.17. USB



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

3.17.1. USB Wiring



[USB Connection Diagram]



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