

WELCON

Servo Drive

Hardware Manual



WER-D048/10-FS04F7_V03

welcon
SYSTEMS

2025-06-10



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

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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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



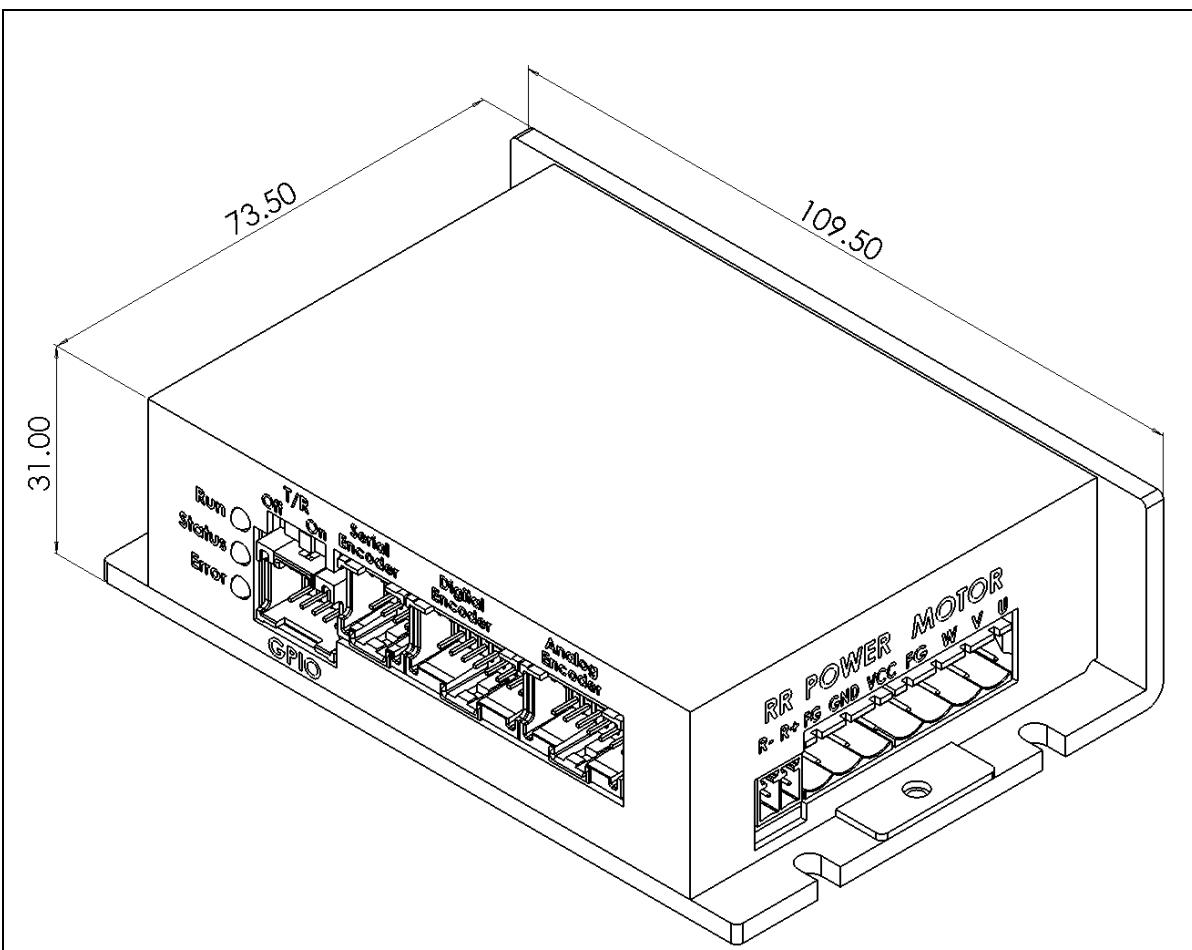
- Be sure to separate U, V, W cables and encoder cables before wiring.
- After turning off the power, proceed with wiring the U, V, W cables and encoder cables.
- Do not drop it or subject it to strong impact.
- Do not install near flammable substances or water.
- Make sure that no sheath or copper wire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

2. Technical Information

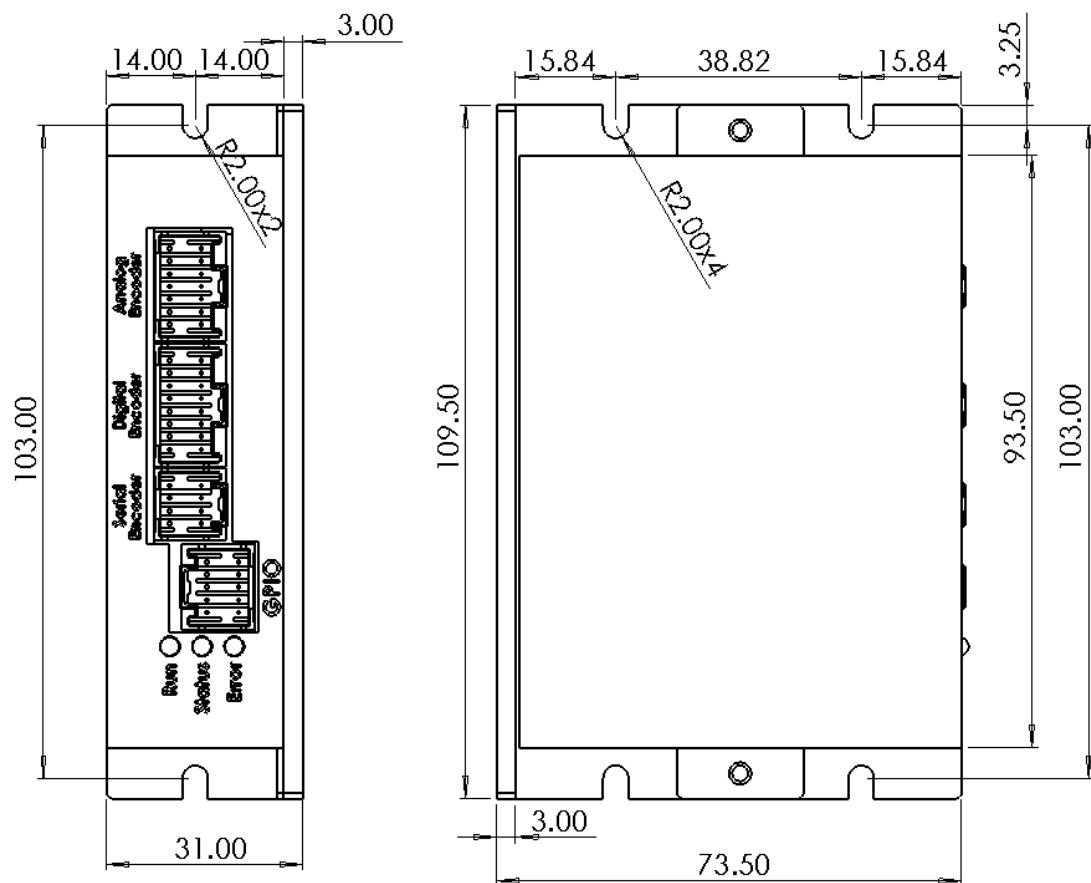
2.1. Mechanical Data



Item	Unit	Description
Weight	g	296
SIZE (L x W x H)	mm	109.5 * 73.5 * 31
Fastener	M3	

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

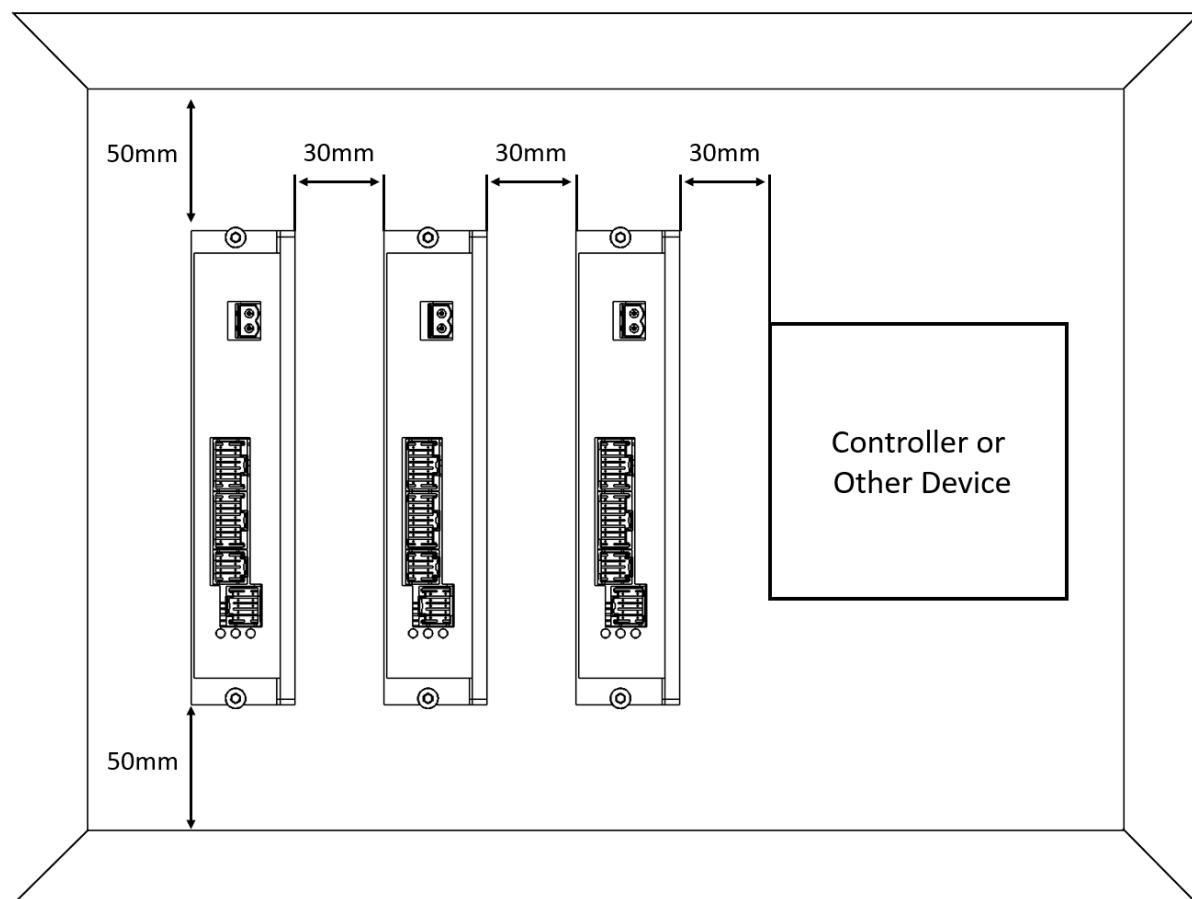
2.2. Mounting Dimension



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-D048/10-FS04F7			
Description	Units	05	10
Continuous Output Current	A[rms]	5	10
Peak Output Current	A[rms]	10	20
Minimum Supply Voltage	VDC	10	
Nominal Supply Voltage	VDC	48	
Maximum Supply Voltage	VDC	60	
Maximum Continuous Output Power	W	240	480

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	≈30mA 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°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	±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-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
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 <u>(5/10A)*</u>	Exceeding H/W Current Limit(10/20A) or 110% of Maximum Current	-
Over Temperature	100 °C	95 °C
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 65V 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

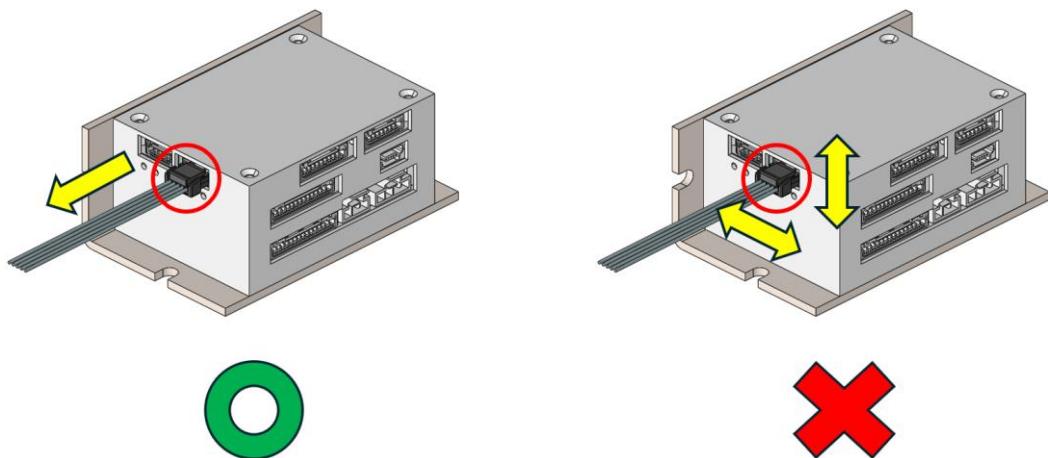
⚠ Cautions

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

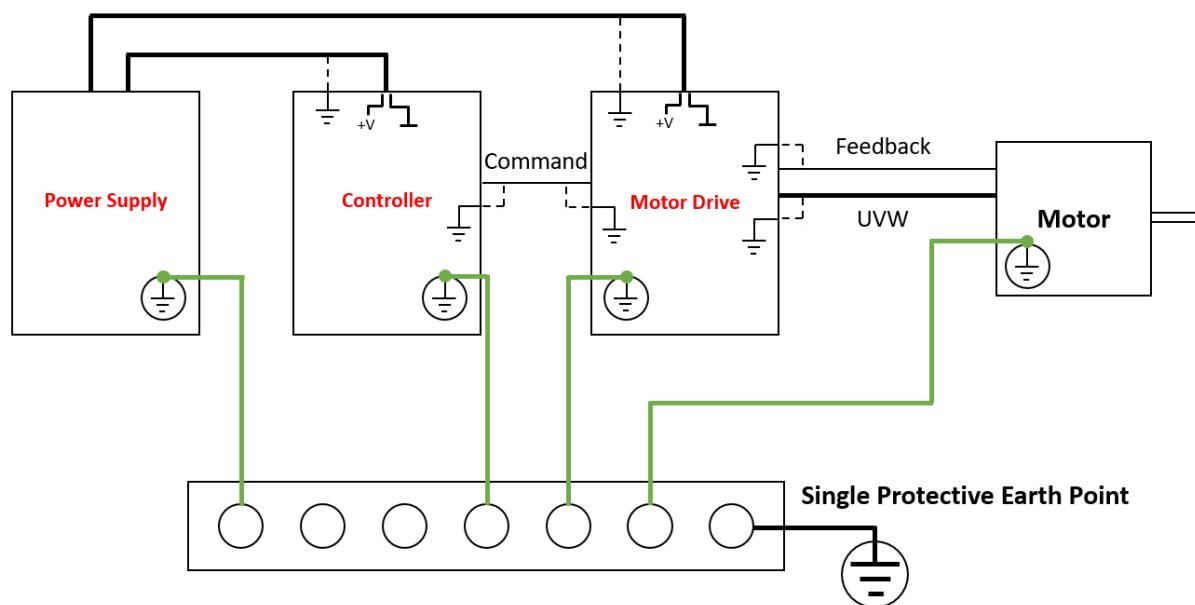
- If there is a locking tab or clip, unlock it by hand and then disconnect the connector.
- Do not forcefully pull on the connector without unlocking it.
- Disconnect the connector by pulling it straight in the designed direction.
- Do not shake it up and down or side to side.
- Separate slowly and gently,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



3.3.1. Grounding

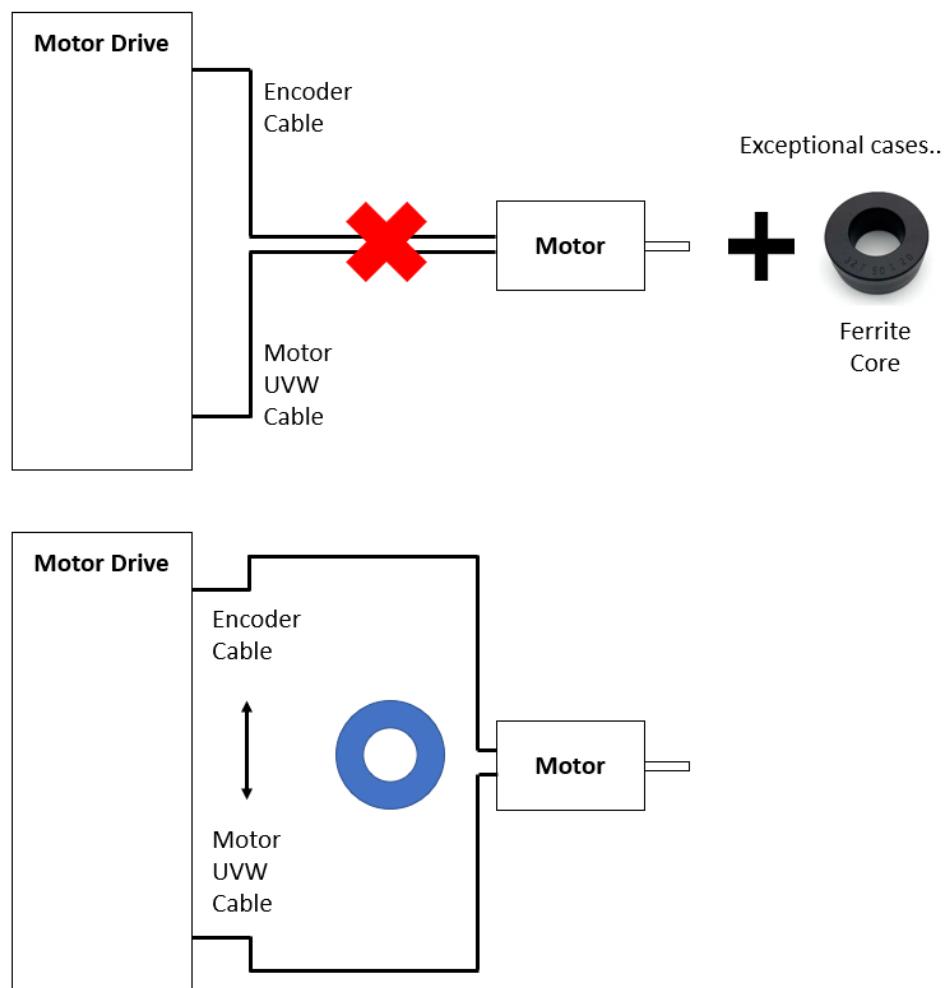
The case grounds of all the system components should be connected to a single Protective Earth (PE) ground point.

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.



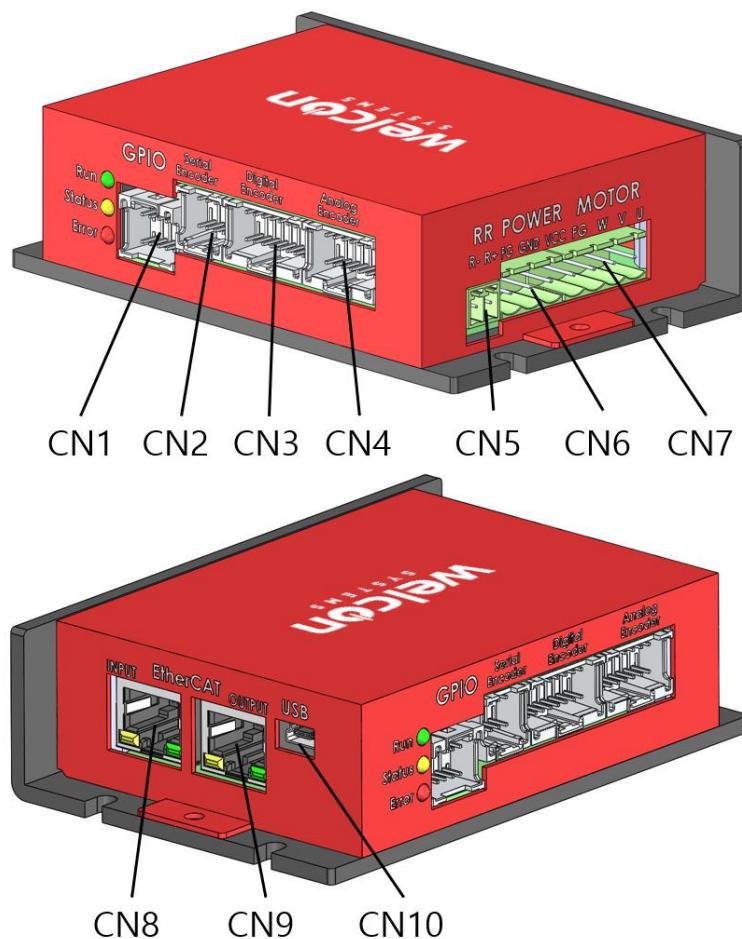
If the two wires cannot be separated from each other, install a ferrite core to attenuate noise. For best results, wind the wire as much as possible, and always in the same direction. When winding the ferrite core around the motor UVW wire, the ground(FG) wire must not pass through the ferrite core.

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

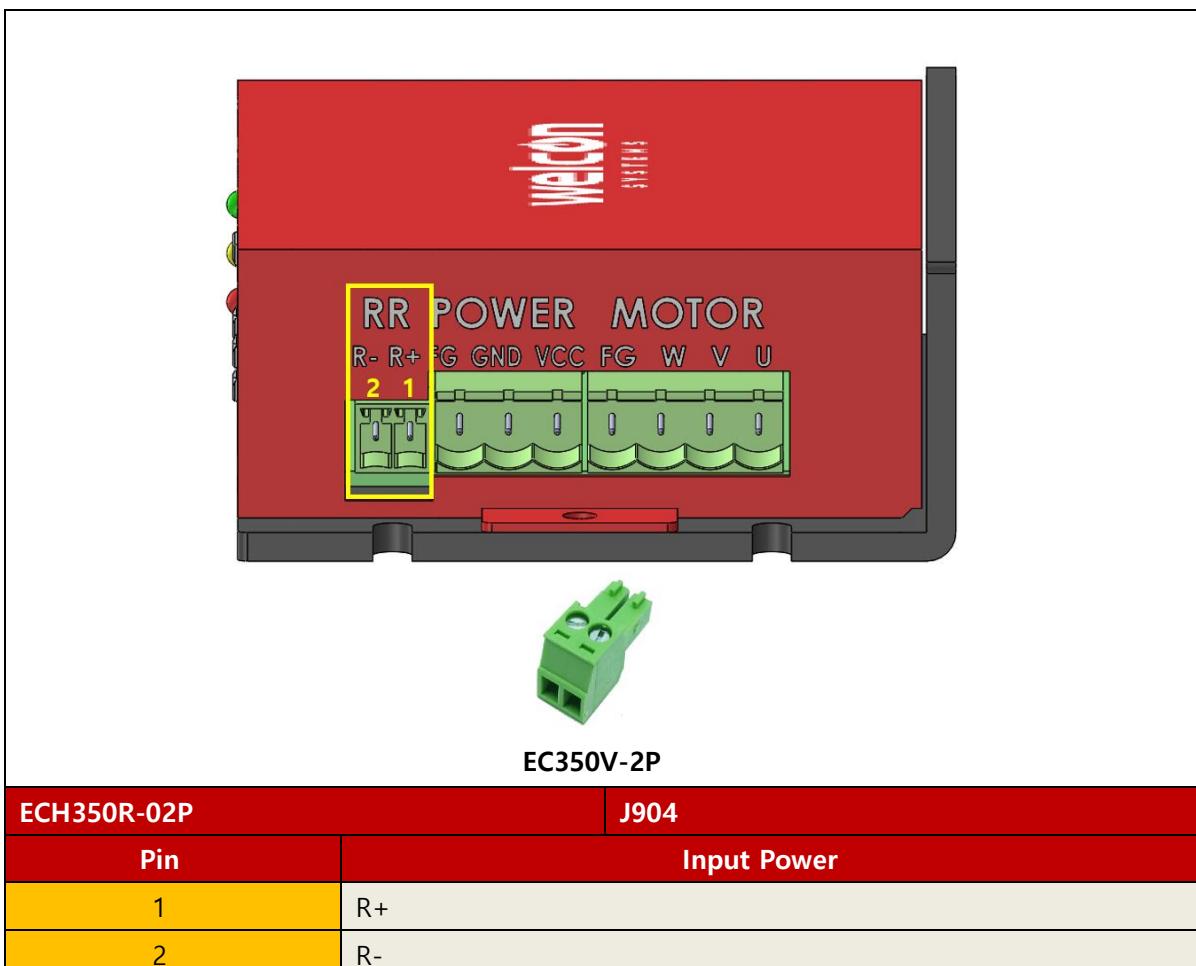
Tool	Manufacturer	Part Number
Hand crimp Tool	MOLEX	63811-6300
Hand crimp Tool	MOLEX	63819-0500

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

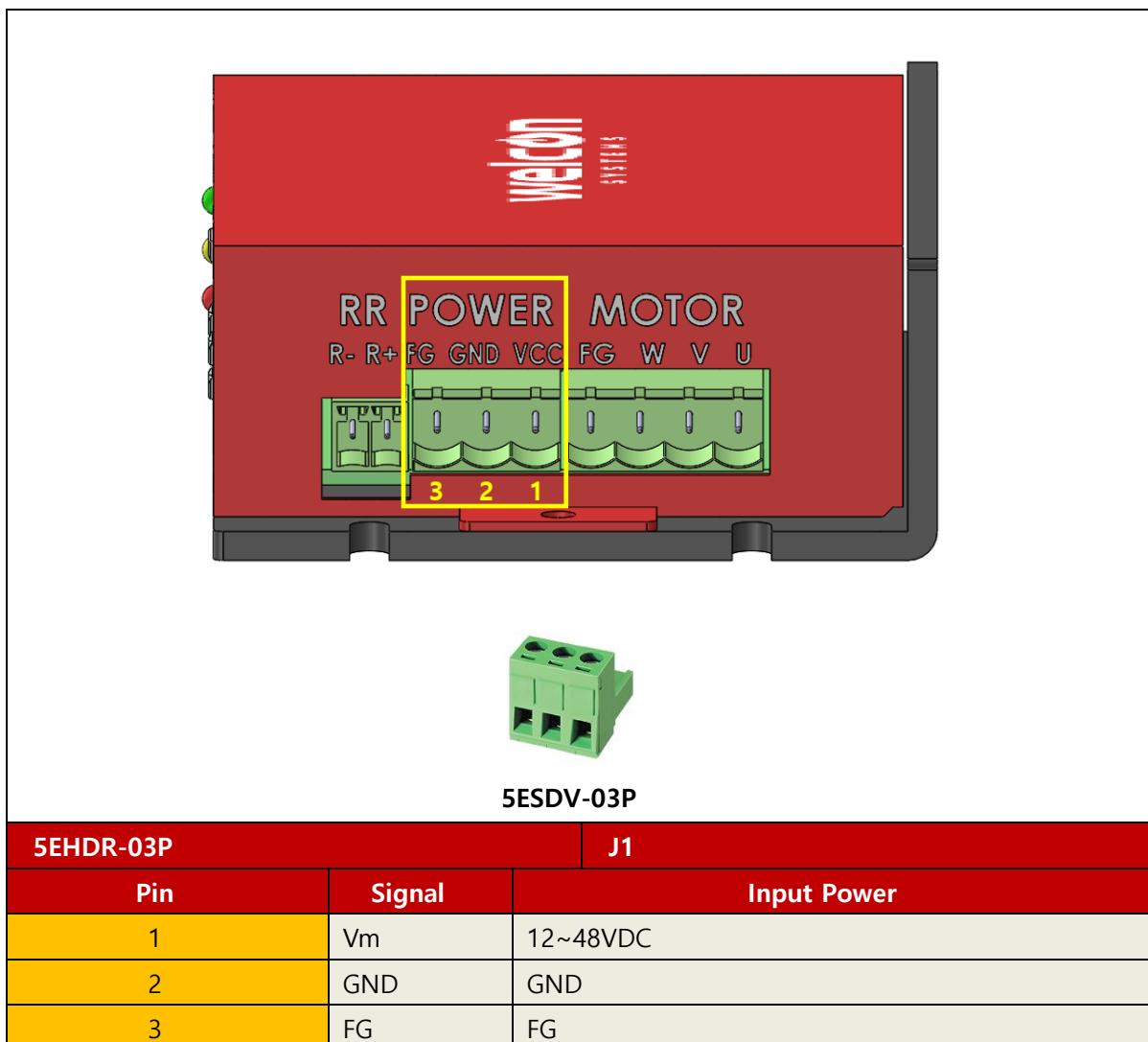


- In a system with a large inertia enough to generate regenerative power, you must connect a regenerative resistor to consume energy as heat. Please note that the drive may be damaged by regenerative power.
- Be sure to connect the regenerative resistor after changing the regen clamp cut-off voltage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



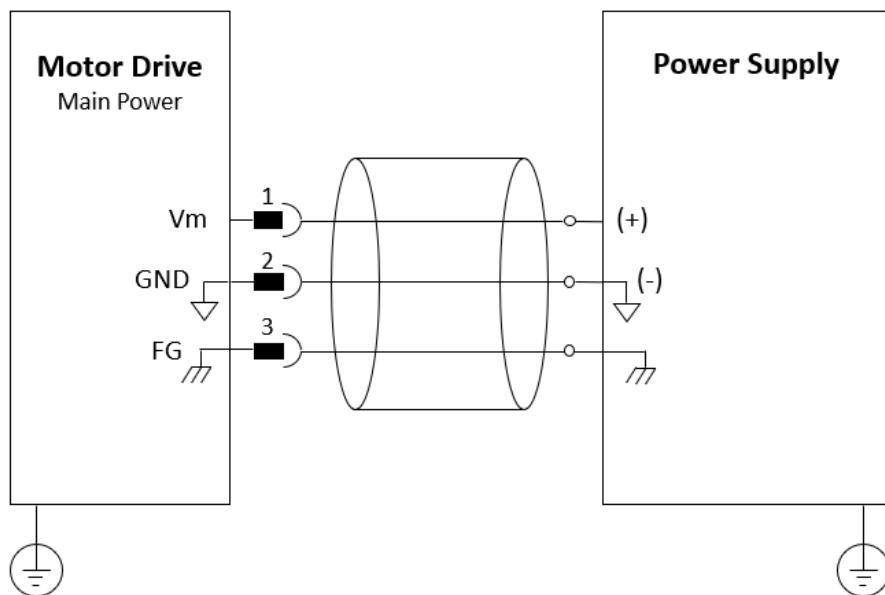
- For WER-D048/10-FS04F7, we recommend using a regenerative resistor of approximately **4.8 ohm**. However, the appropriate resistance value and capacity vary depending on the load and acceleration/deceleration used in the system, so please calculate the capacity appropriate for your system.

3.7. Main Power



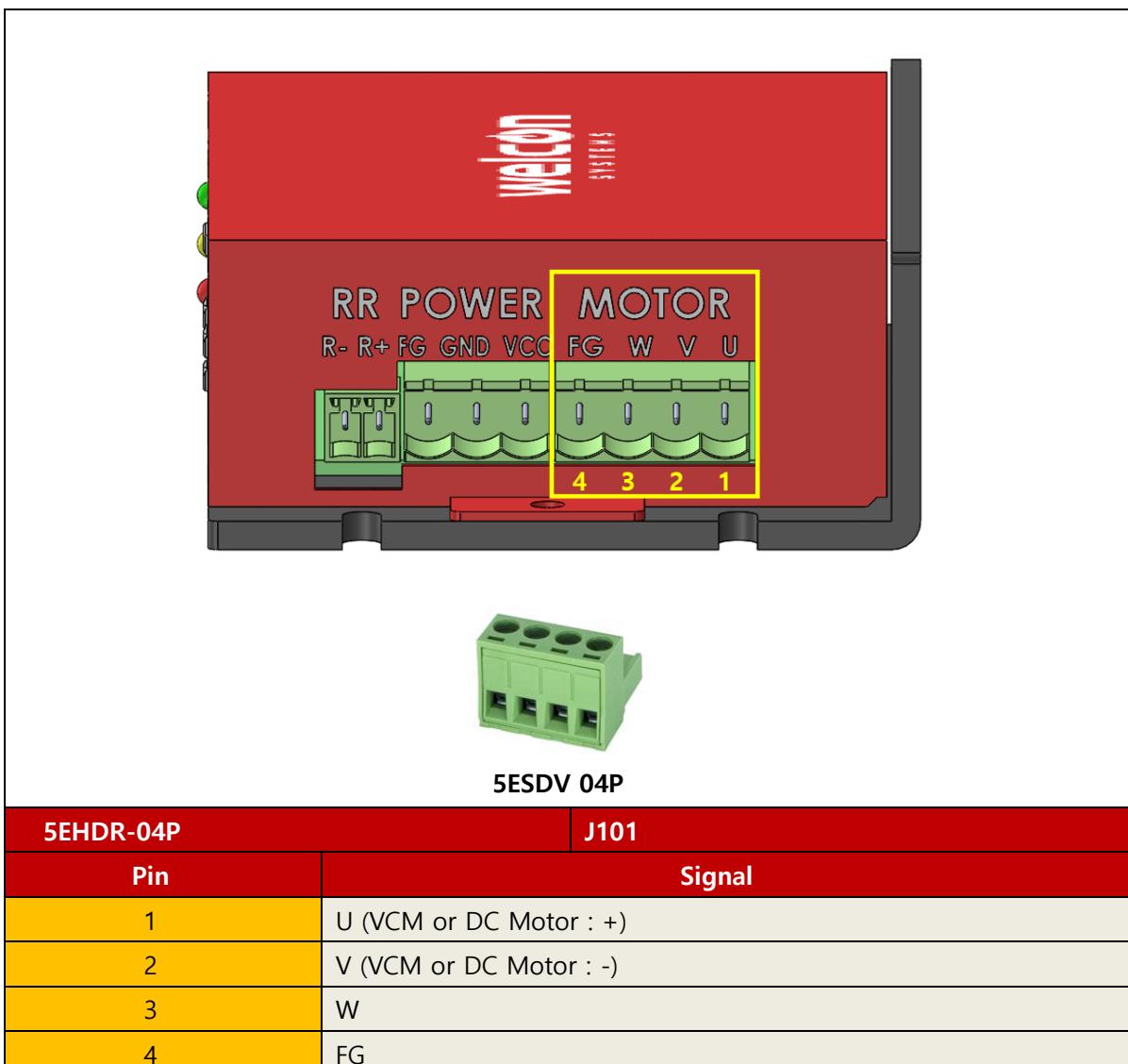
- Do not connect/disconnect the servo drive while the power is on.
- Before applying power, make sure that the DC supply is within the specified range.
- make sure the proper plus and minus connections are in order.

3.7.1. Main Power Wiring

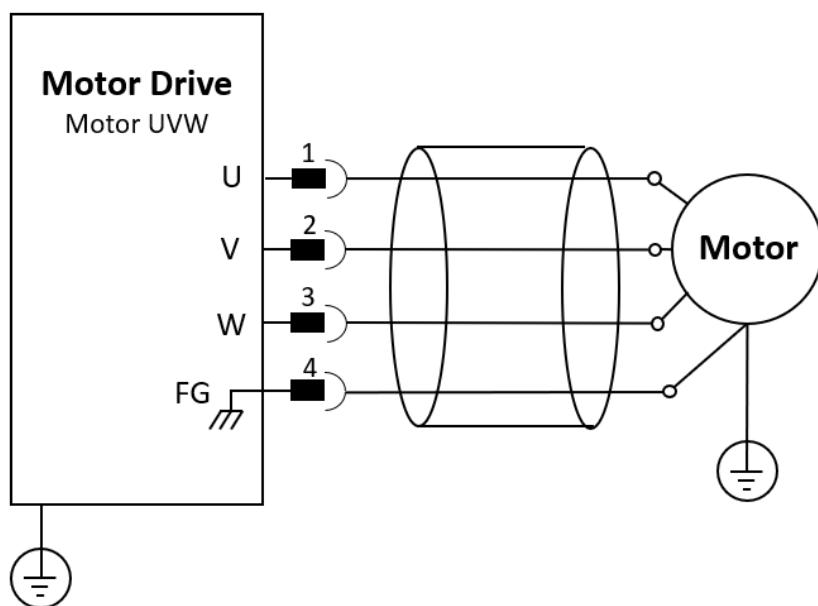


[Main Power(12~48VDC) Connection Diagram]

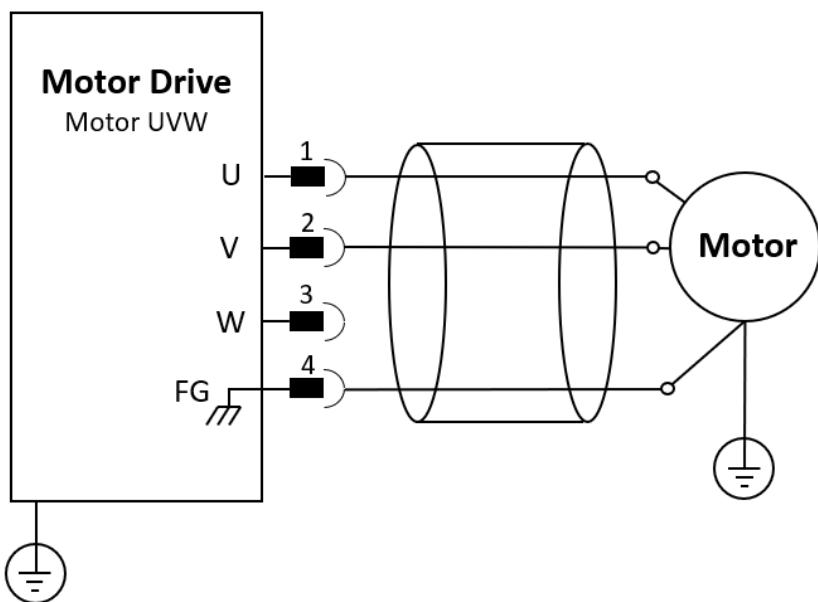
3.8. Motor UVW



3.8.1. Motor UVW Wiring

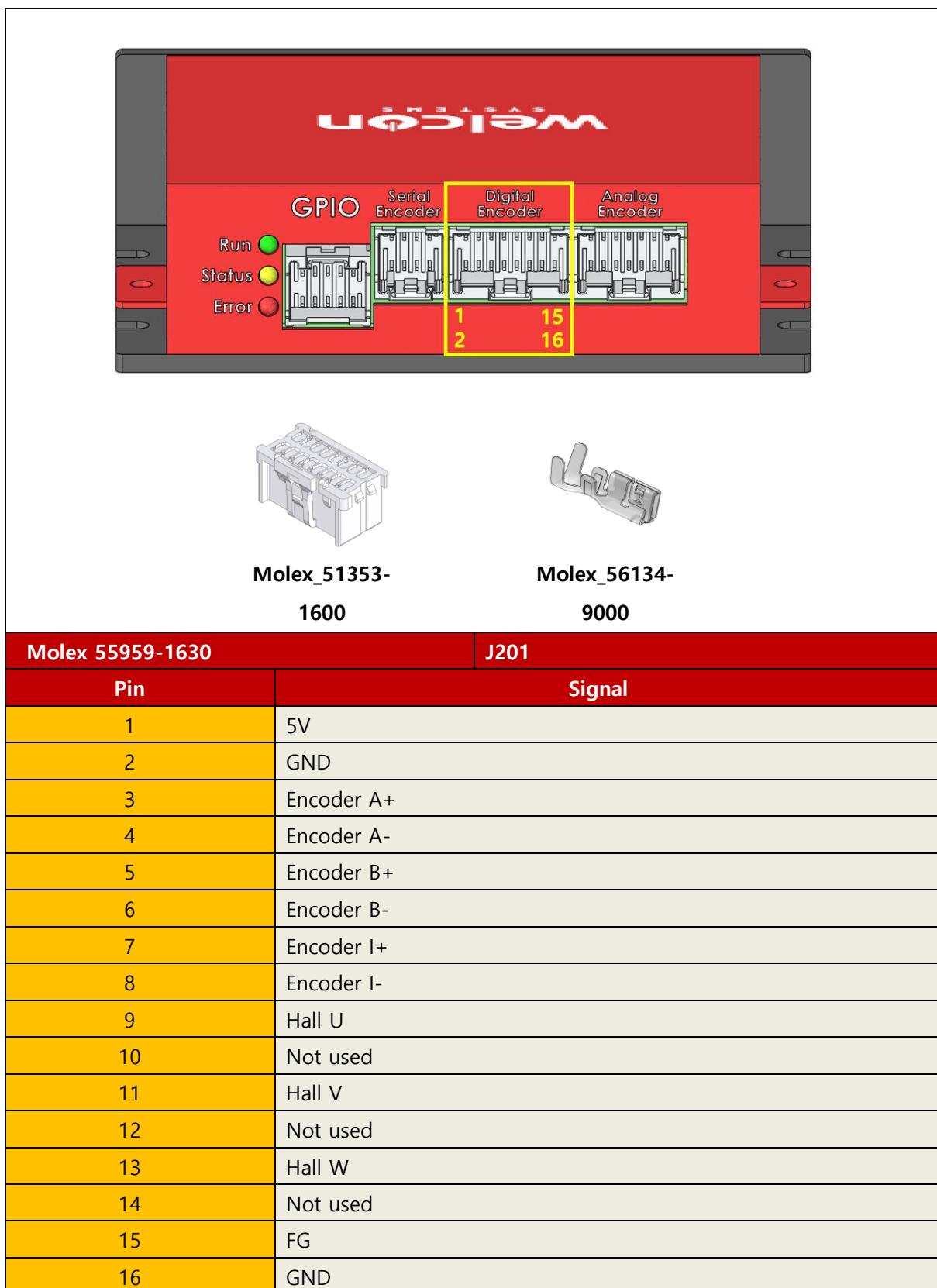


[Brushless / PMSM Motor UVW Connection Diagram]



[Brushed DC / Voice Coil Motor UVW Connection Diagram]

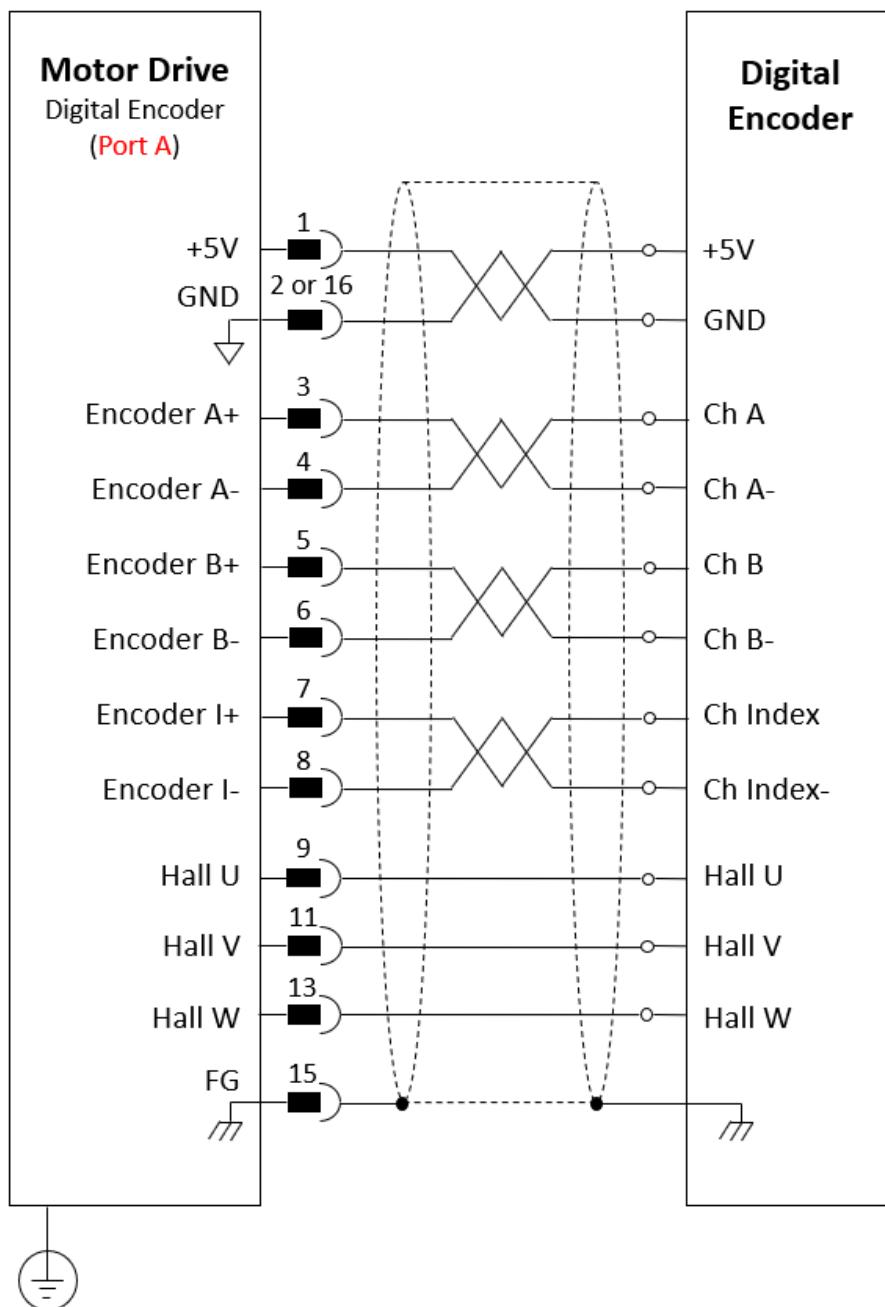
3.9. Digital Encoder (Port A)



3.9.1. Digital Encoder(Port A) Wiring

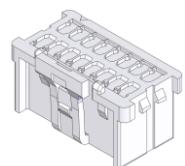
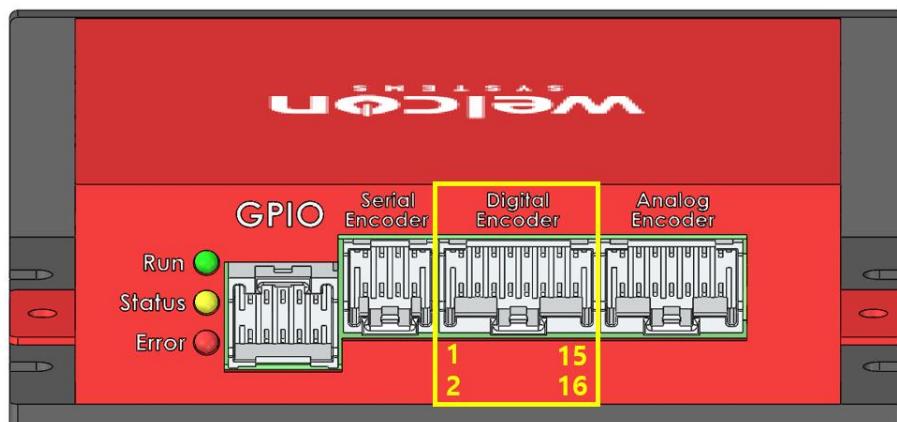
The cable's shield is connected to the chassis(FG) in the connector.

Earthing the Encoder and connecting the Earth(PE) to the drive FG is mandatory to insure reliable operating, high noise immunity and rejection of voltage common mode interferences.



[Digital Encoder(Port A) Connection Diagram]

3.10. Digital Encoder (Port B)



Molex_51353-
1600



Molex_56134-
9000

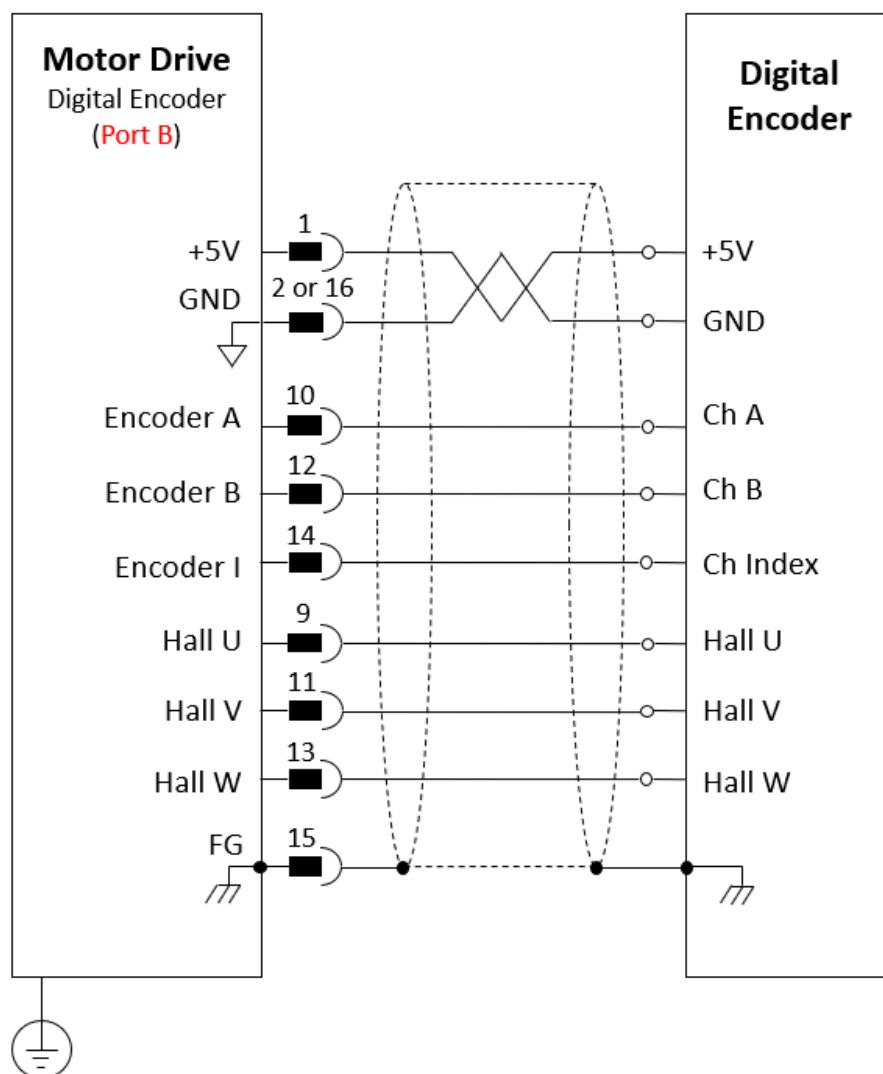
Molex 55959-1630		J201
Pin	Signal	
1	5V	
2	GND	
3	Not Used	
4	Not Used	
5	Not Used	
6	Not Used	
7	Not Used	
8	Not Used	
9	Hall U	
10	Encoder A	
11	Hall V	
12	Encoder B	
13	Hall W	
14	Encoder I	
15	FG	
16	GND	

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

3.10.1. Digital Encoder(Port B) Wiring

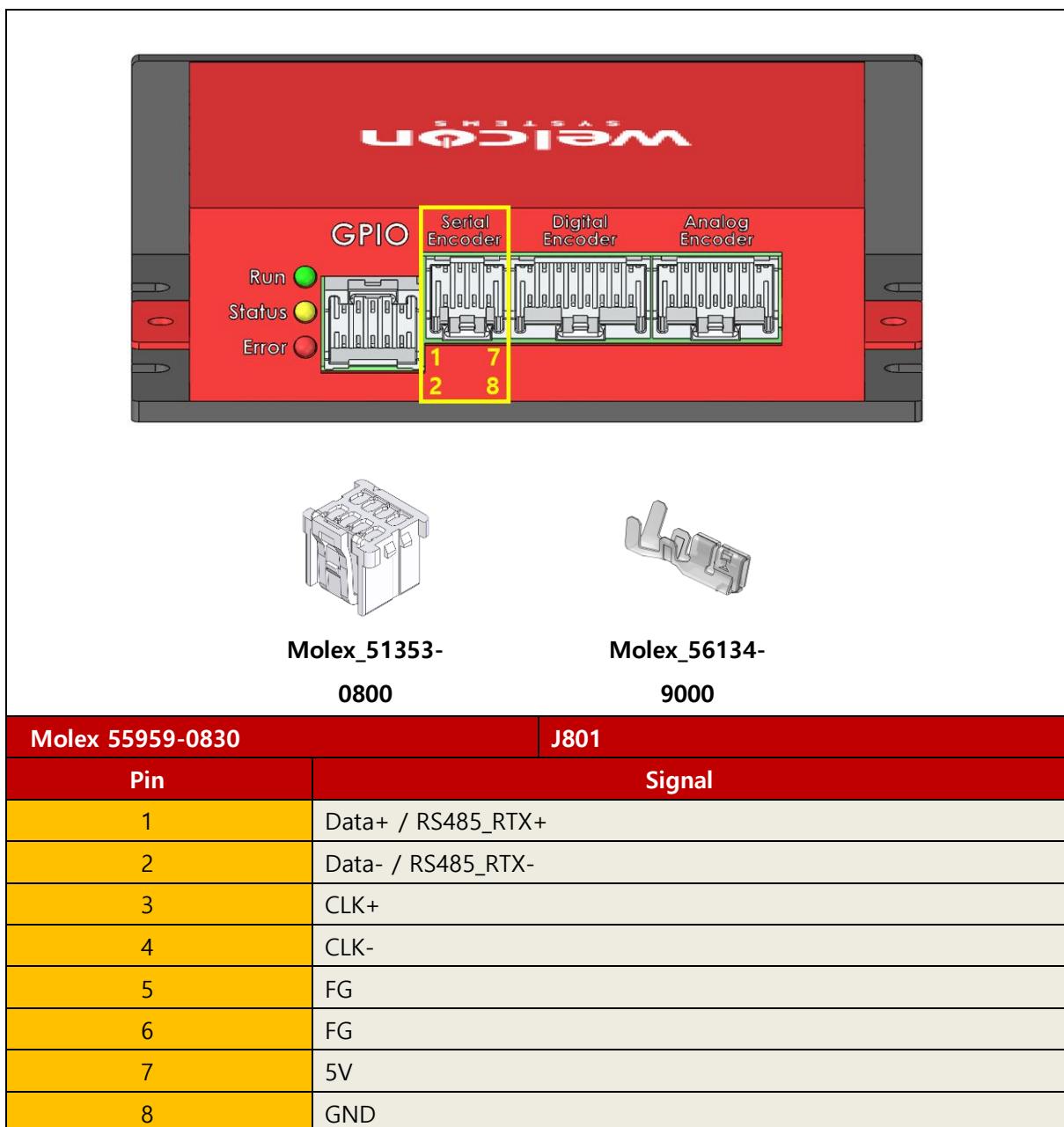
The cable's shield is connected to the chassis(FG) in the connector.

Earthing the Encoder and connecting the Earth to the drive FG is mandatory to insure reliable operating, high noise immunity and rejection of voltage common mode interferences.



[Digital Encoder(Port B) Connection Diagram]

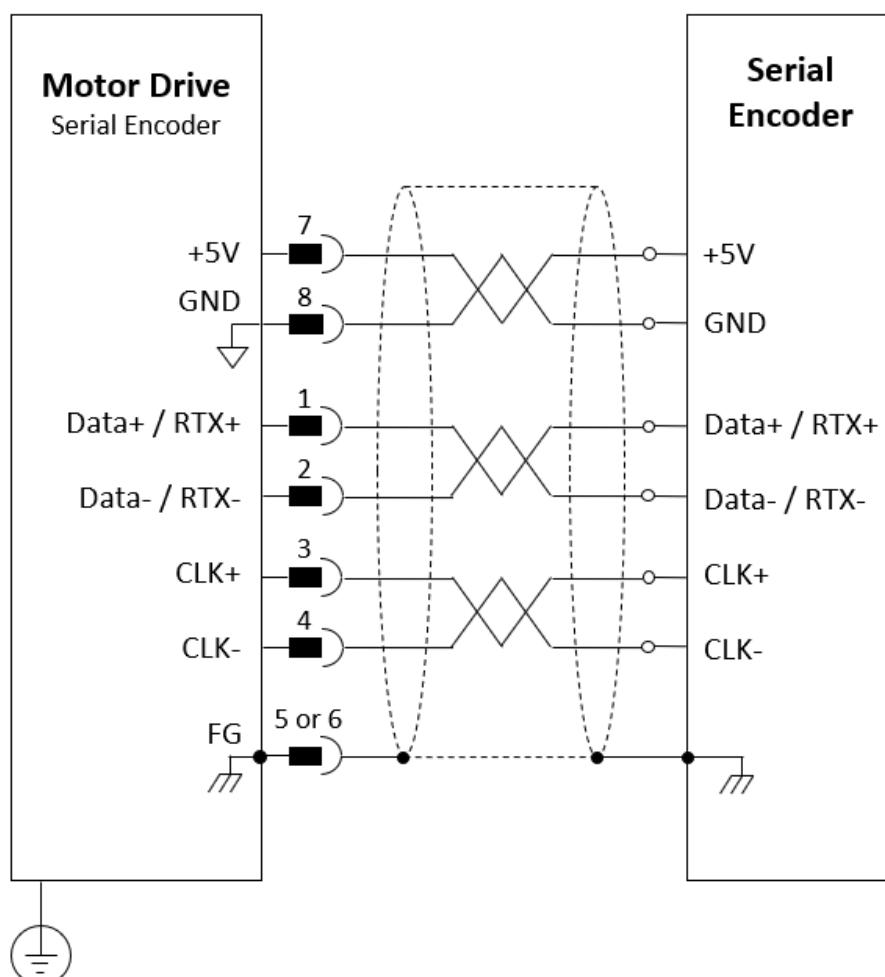
3.11. Serial Encoder



3.11.1. Serial Encoder Wiring

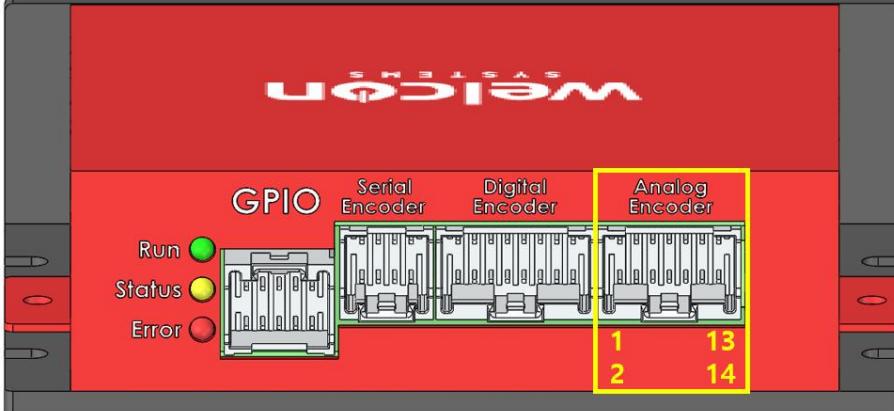
The cable's shield is connected to the chassis(FG) in the connector.

Earthing the Encoder and connecting the Earth to the drive FG is mandatory to insure reliable operating, high noise immunity and rejection of voltage common mode interferences.



[Serial Encoder Connection Diagram]

3.12. Analog Encoder

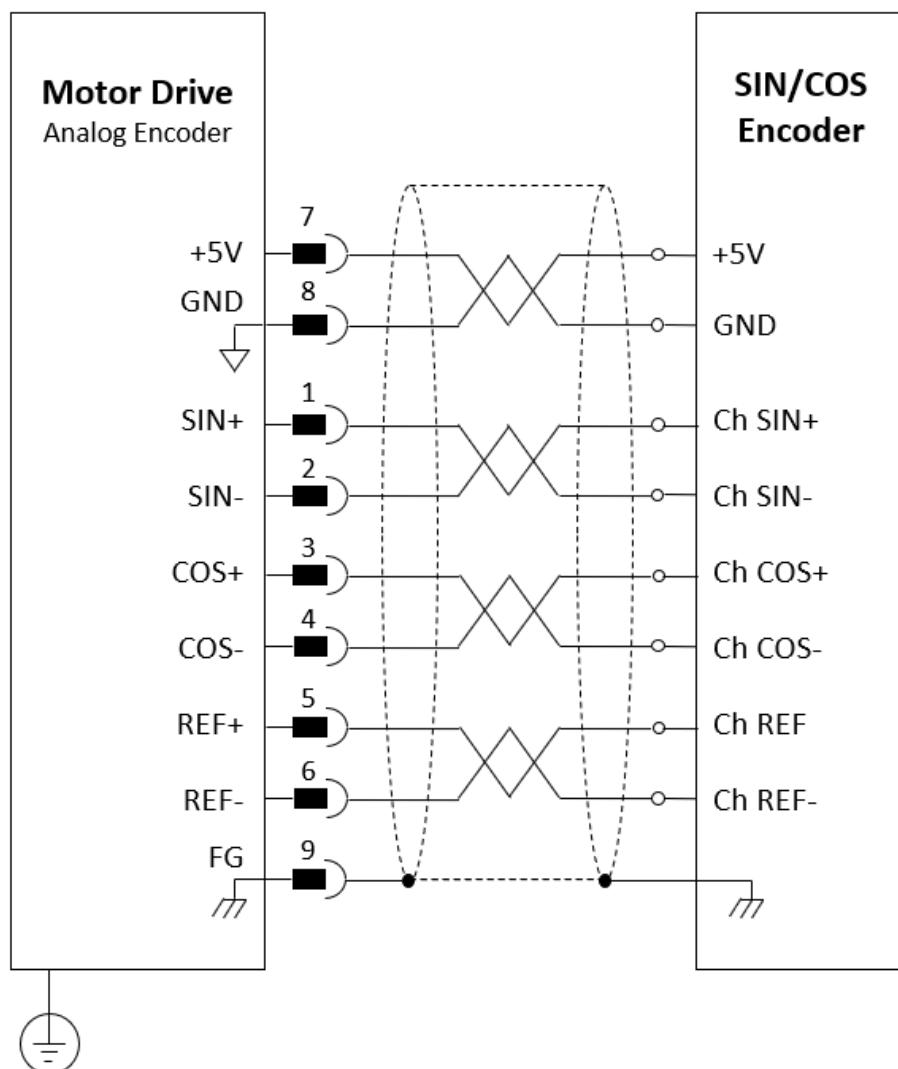


The diagram shows the rear panel of a WELCON servo drive. On the left, there are three status LEDs: Run (green), Status (yellow), and Error (red). To the right of the LEDs are four connector slots: GPIO, Serial Encoder, Digital Encoder, and Analog Encoder. The Analog Encoder slot is highlighted with a yellow box and has its pin numbers (1, 2, 13, 14) labeled below it.

Molex 55959-1430		J901
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-	

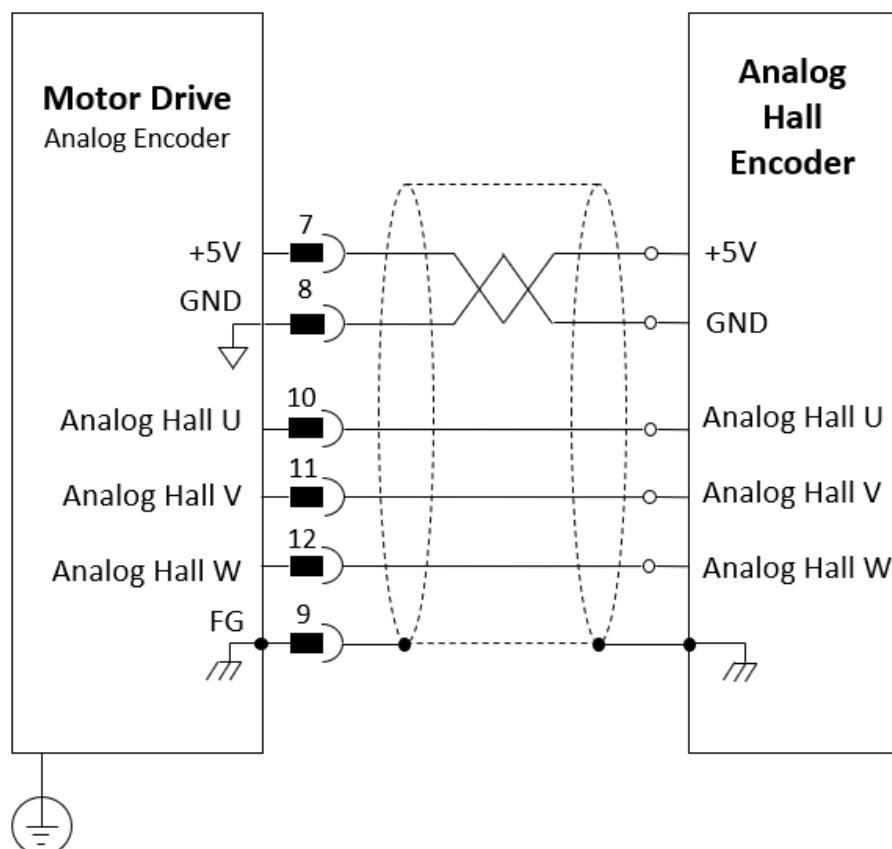
Below the table, two connector models are shown: Molex_51353-1400 on the left and Molex_56134-9000 on the right.

3.12.1. Sin/Cos Encoder Wiring



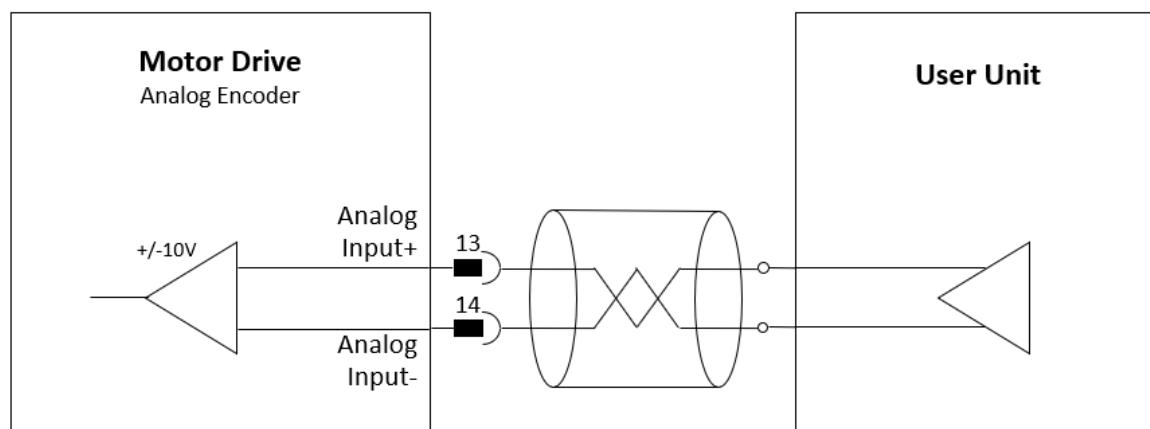
[Sin/Cos Encoder Connection Diagram]

3.12.2. Analog Hall Encoder Wiring



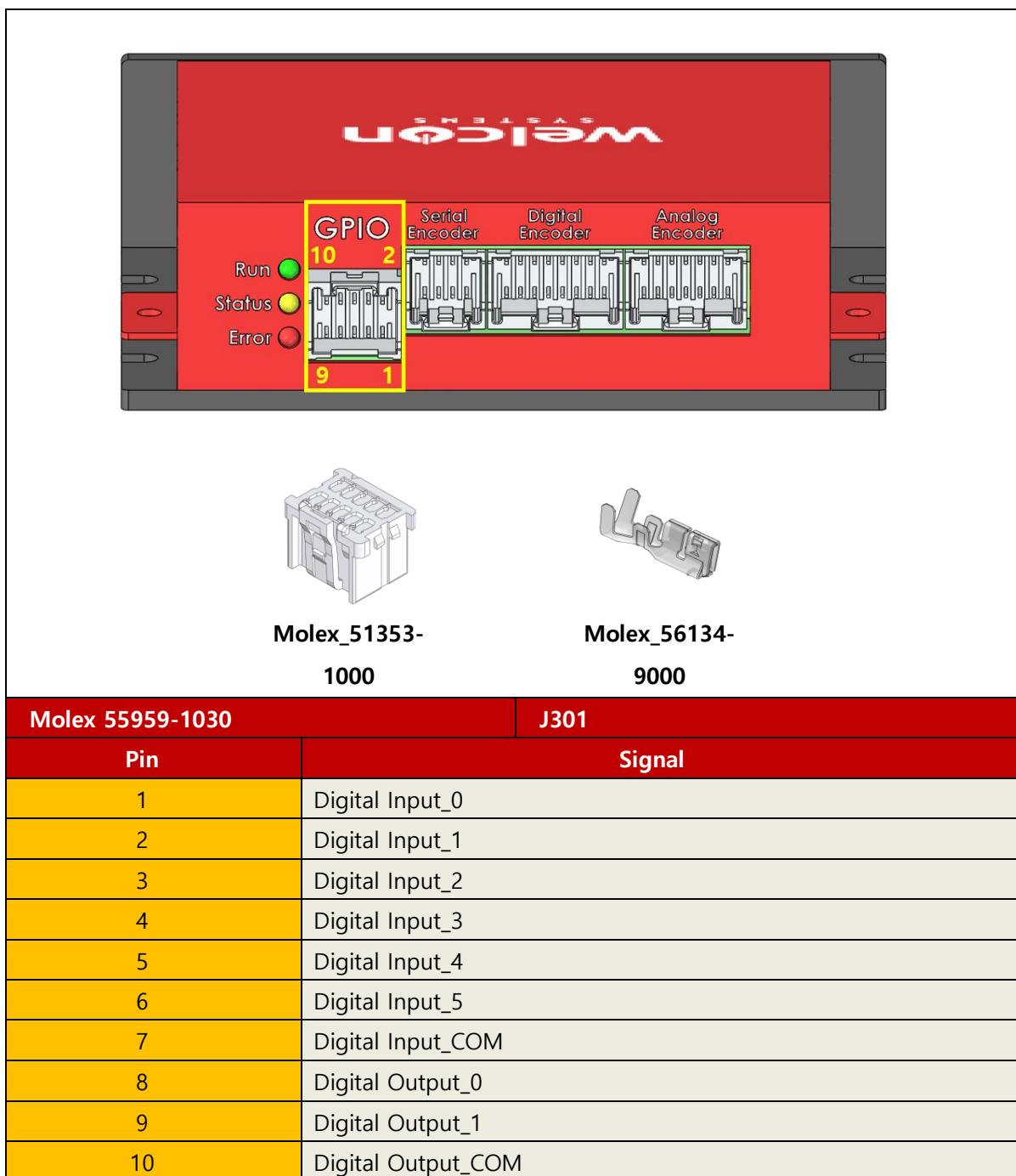
[Analog Hall Encoder Connection Diagram]

3.12.3. Analog Input Wiring

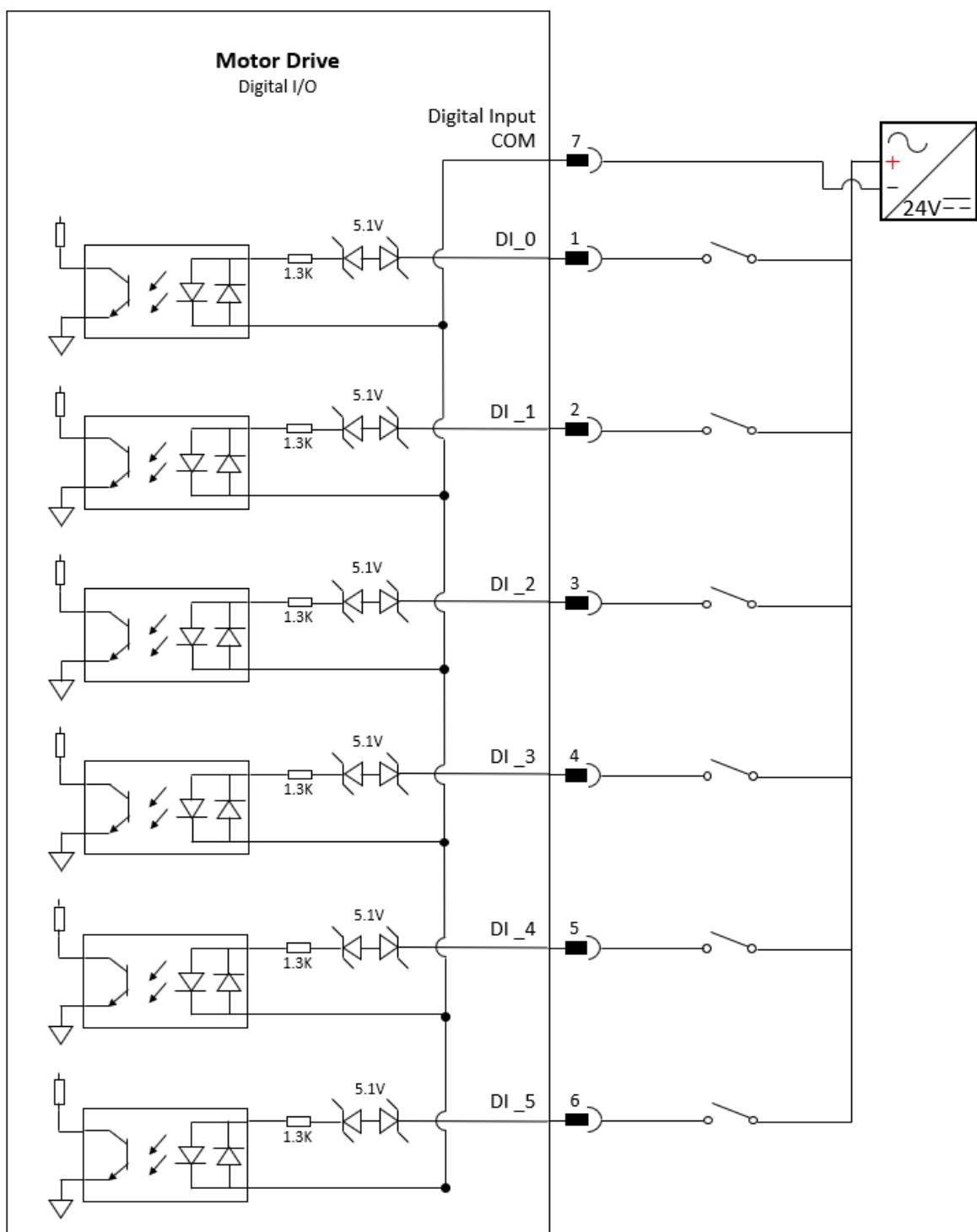


[Analog Input Connection Diagram]

3.13. Digital I/O

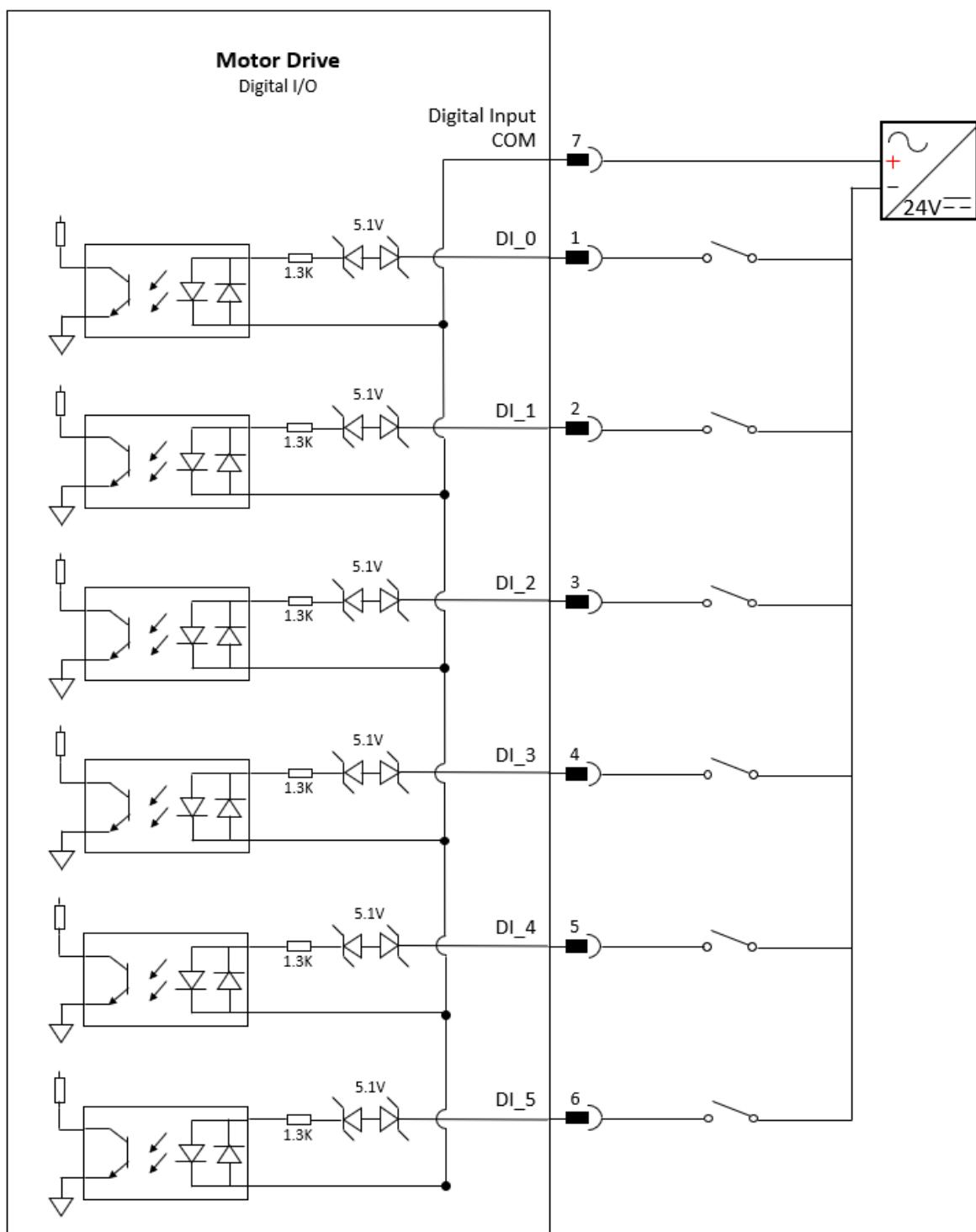


3.13.1. Digital Inputs(PNP Type) Wiring



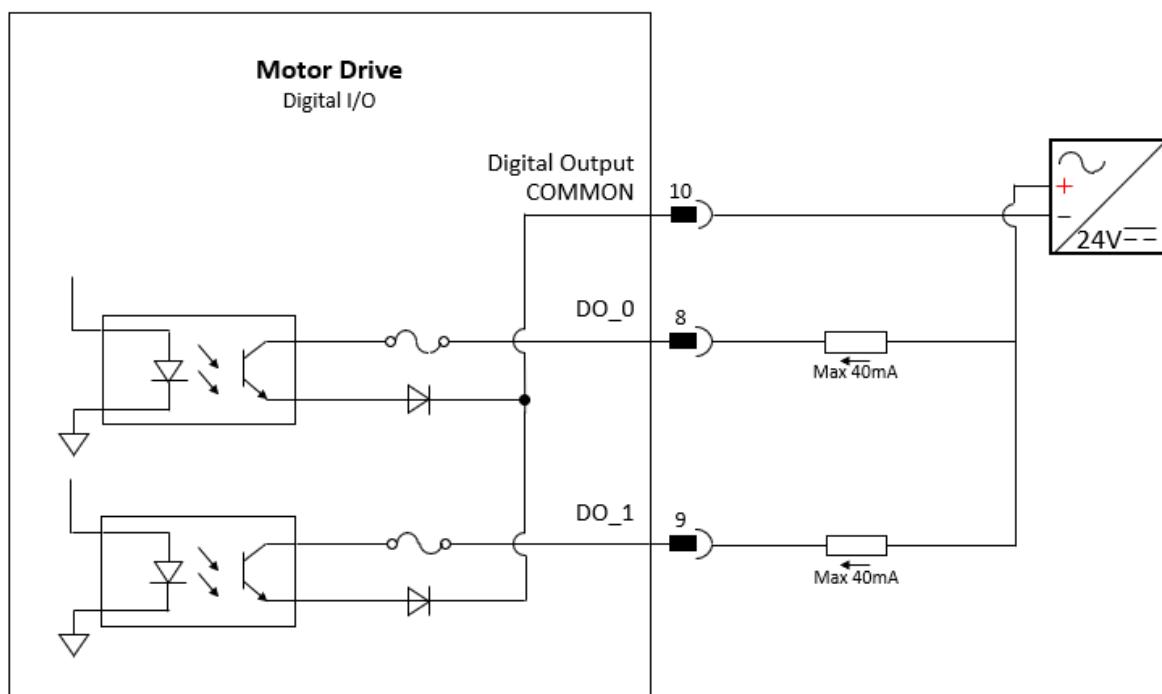
[Digital Inputs(PNP Type) Connection Diagram]

3.13.2. Digital Inputs(NPN Type) Wiring



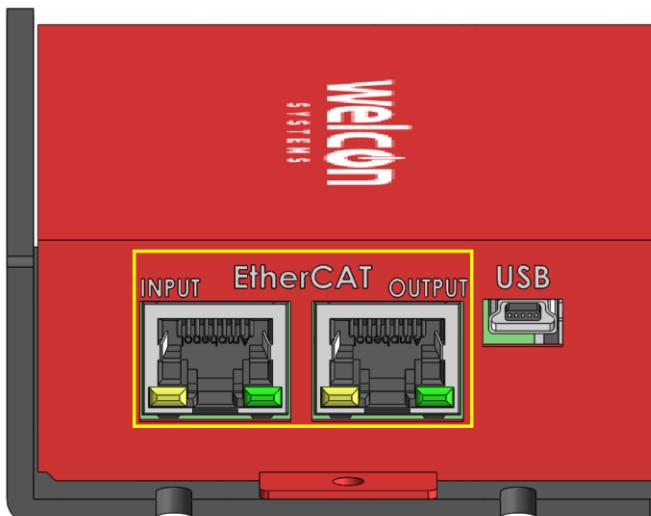
[Digital Inputs(NPN Type) Connection Diagram]

3.13.3. Digital Outputs(NPN Type) Wiring

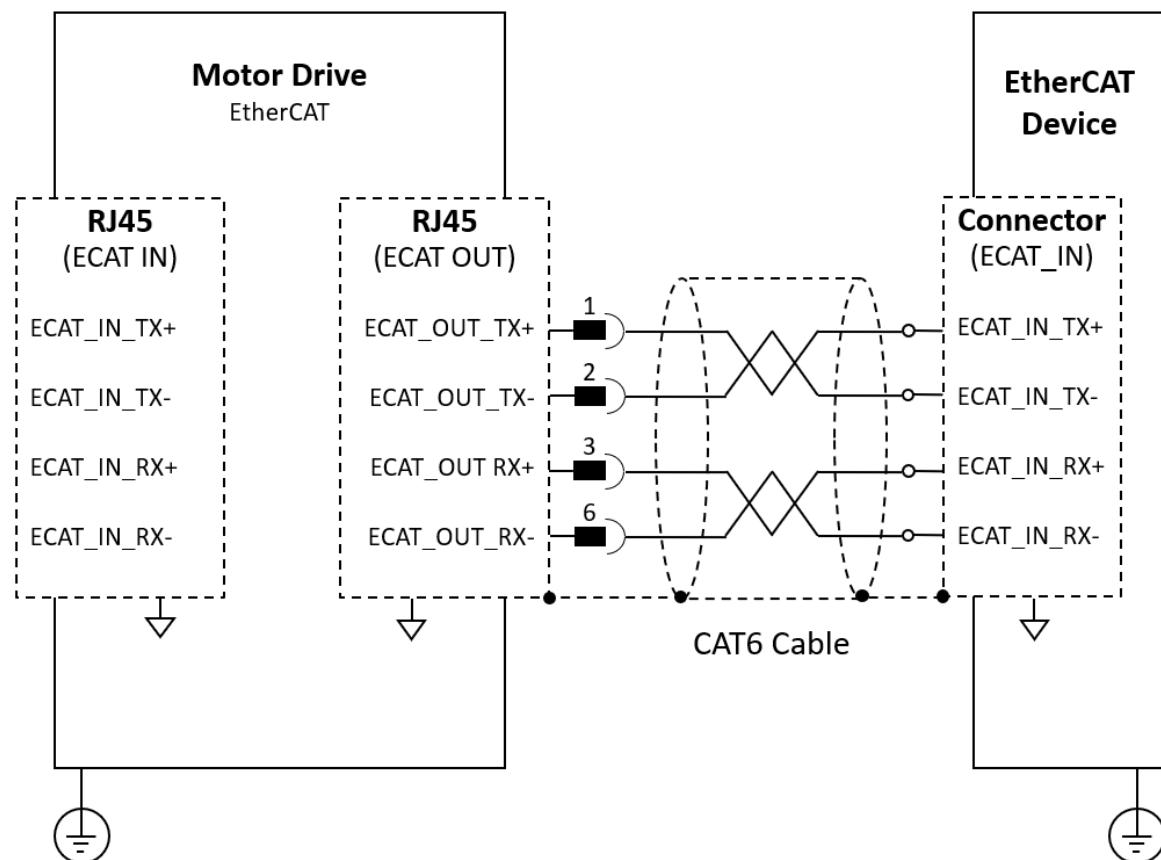


[Digital Outputs(NPN Type) Connection Diagram]

3.14. EtherCAT

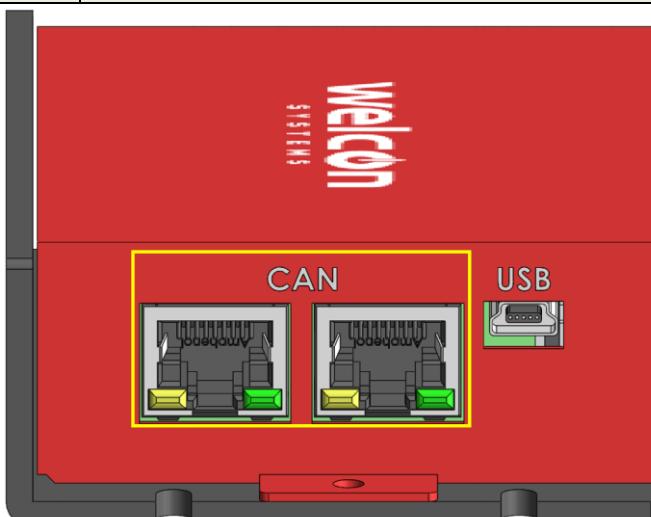
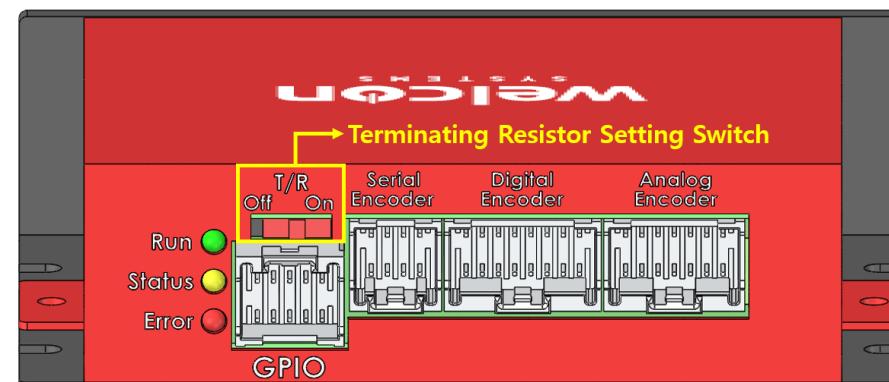
Fieldbus Type	Product Number
EtherCAT	WER-D048/10-FS04F7-E
	
Meritec_N3J11-017-02	J102, J103
Pin	Signal
1	EtherCAT Tx+
2	EtherCAT Tx-
3	EtherCAT Rx+
4	NC
5	NC
6	EtherCAT RX-
7	NC
8	NC

3.14.1. EtherCAT Wiring



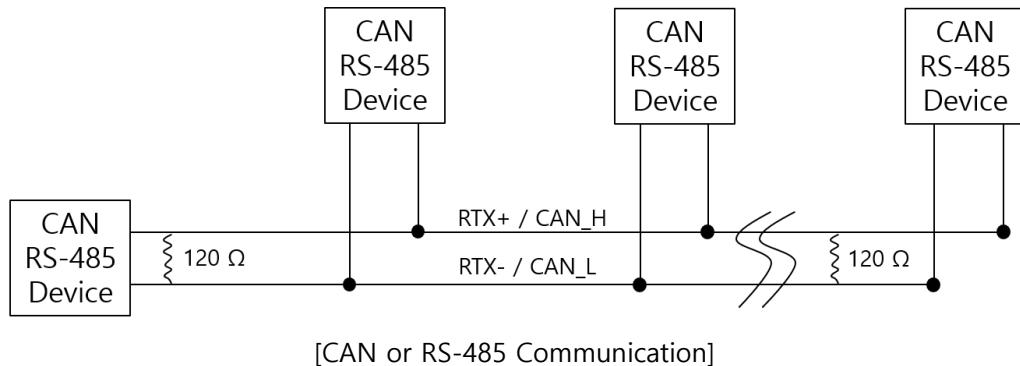
[EtherCAT Connection Diagram]

3.15. CAN

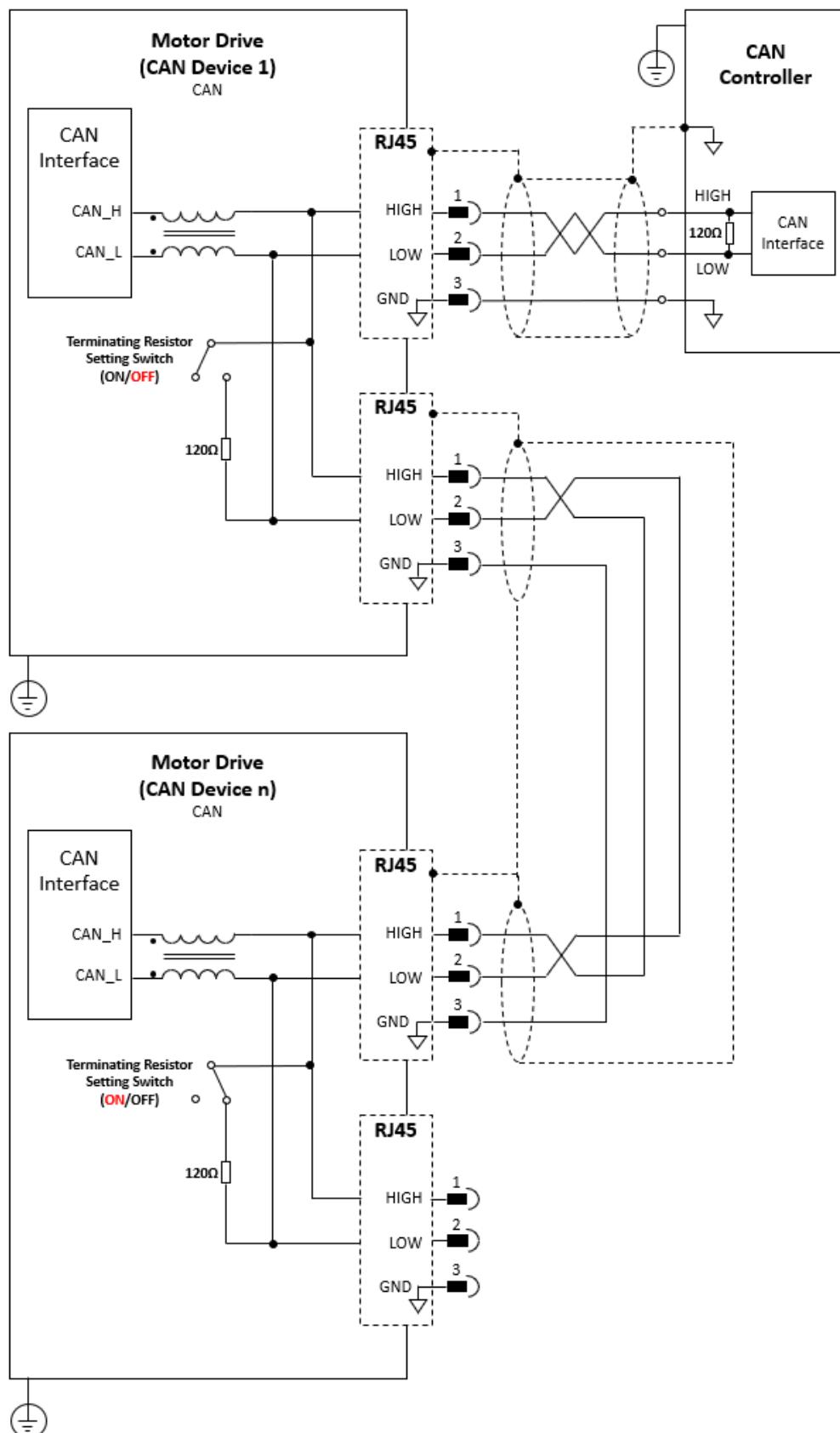
Fieldbus Type	Product Number
CAN	WER-D048/10-FS04F7-C
	
	
Meritec_N3J11-017-02	J102, J103
Pin	Signal
1	HIGH
2	LOW
3	GND
4	NC
5	NC
6	NC
7	NC
8	NC

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.

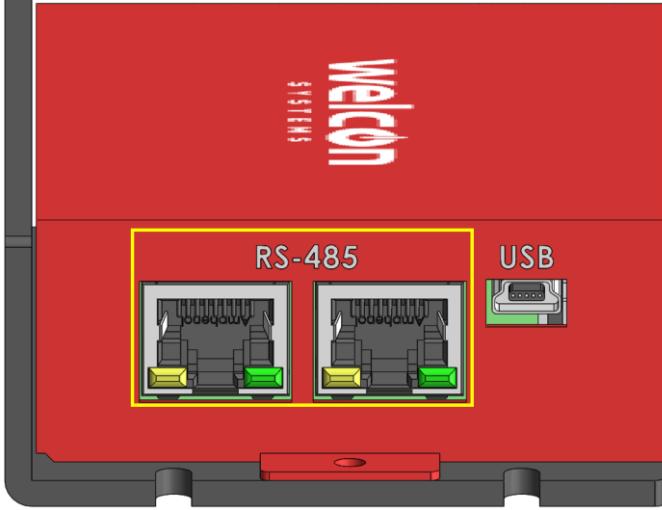
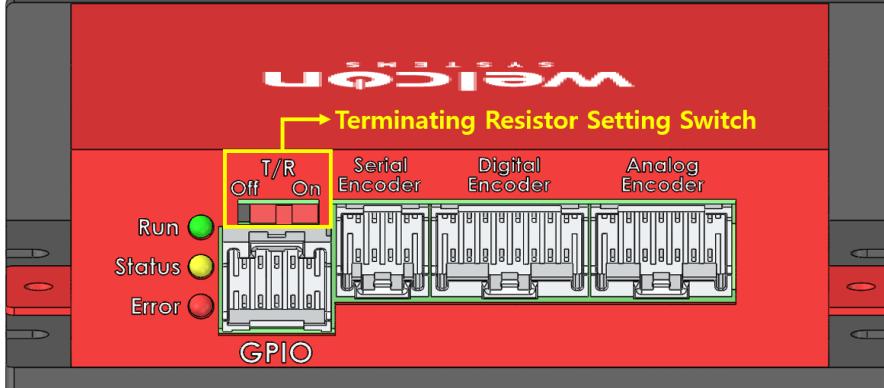


3.15.2. CAN Wiring



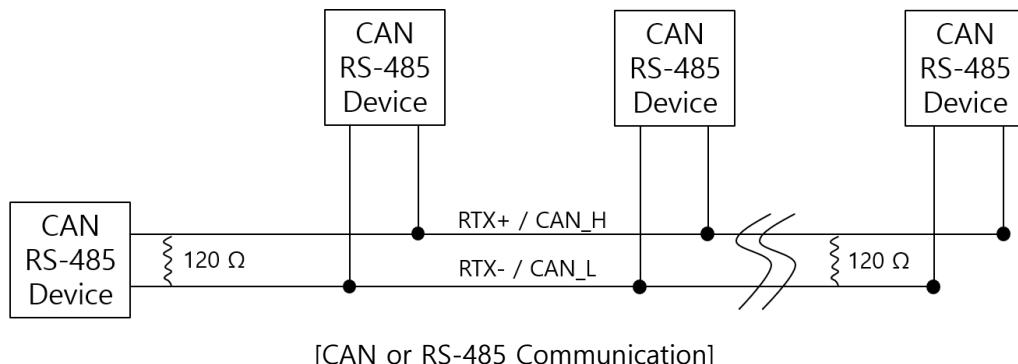
[CAN Connection Diagram]

3.16. RS-485

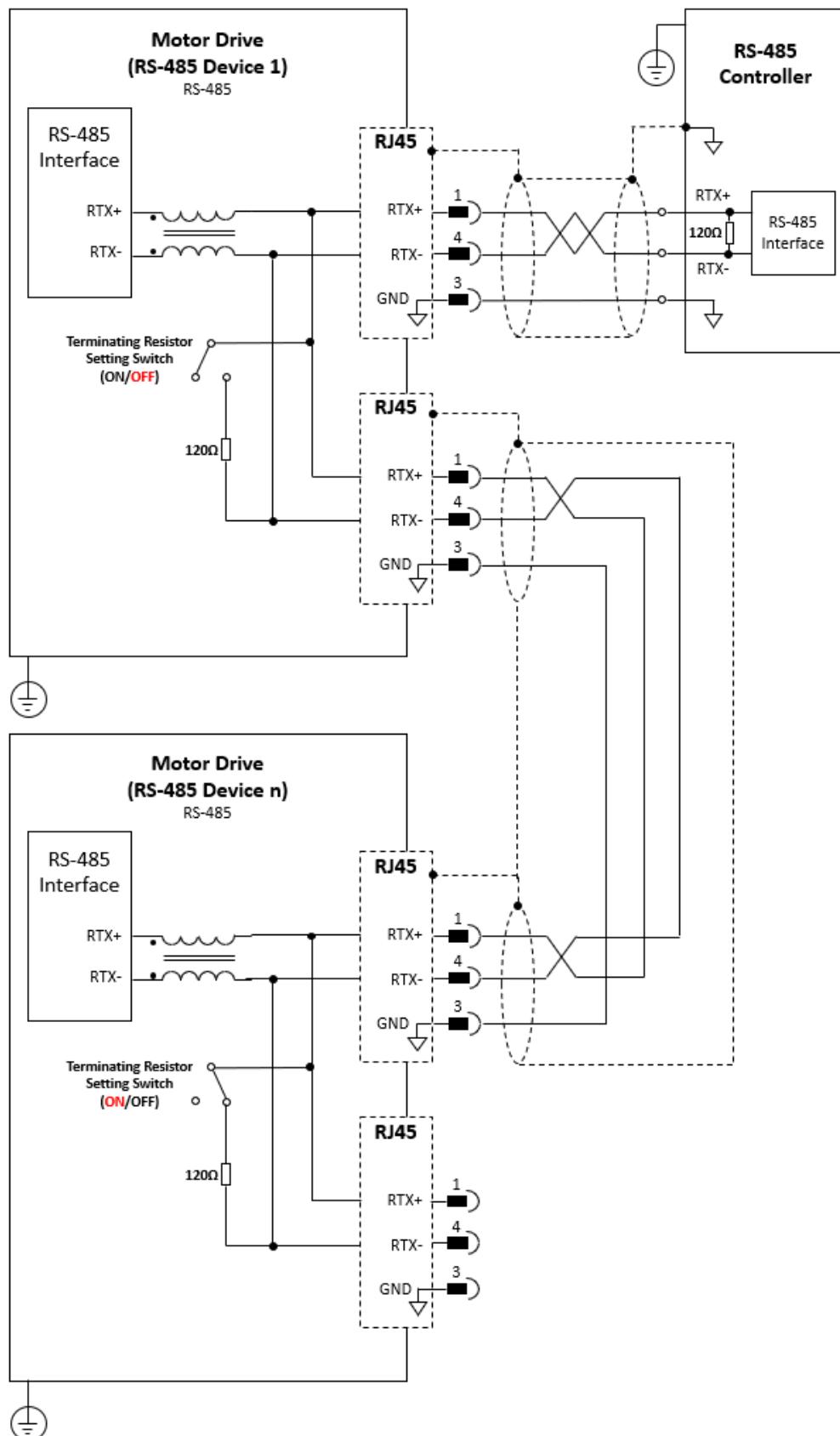
Fieldbus Type	Product Number
RS-485	WER-D048/10-FS04F7-R
	
	
Meritec_N3J11-017-02	J102, J103
Pin	Signal
1	RTX+
2	NC
3	GND
4	RTX-
5	NC
6	NC
7	NC
8	NC

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.

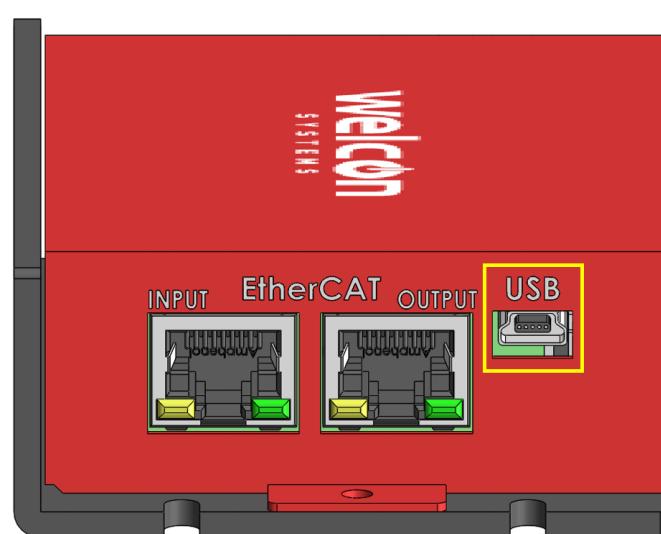


3.16.2. RS-485 Wiring



[RS-485 Connection Diagram]

3.17. USB

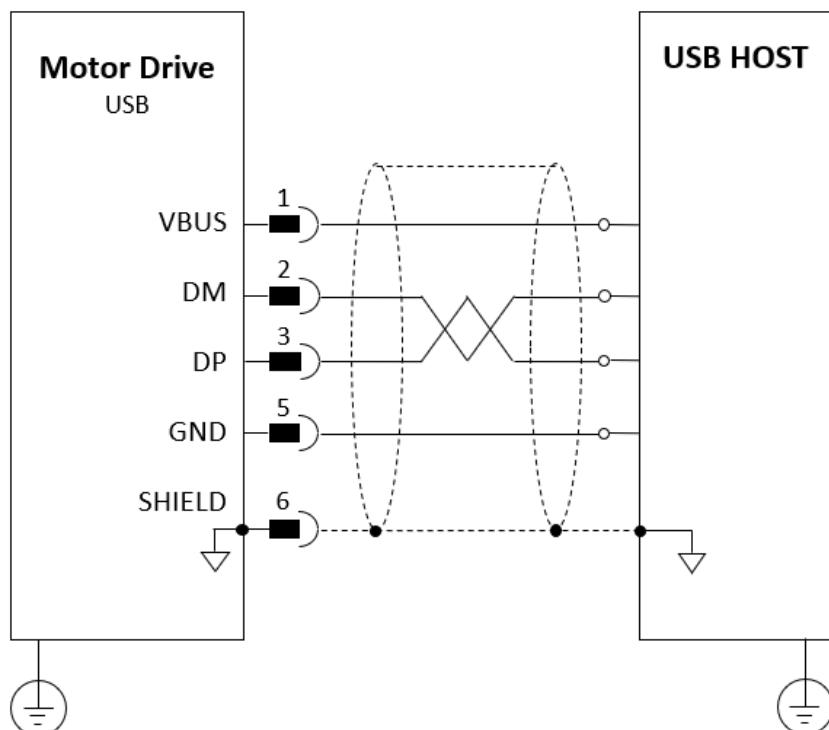


USB-Mini Type B (Keystone Model:934)

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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