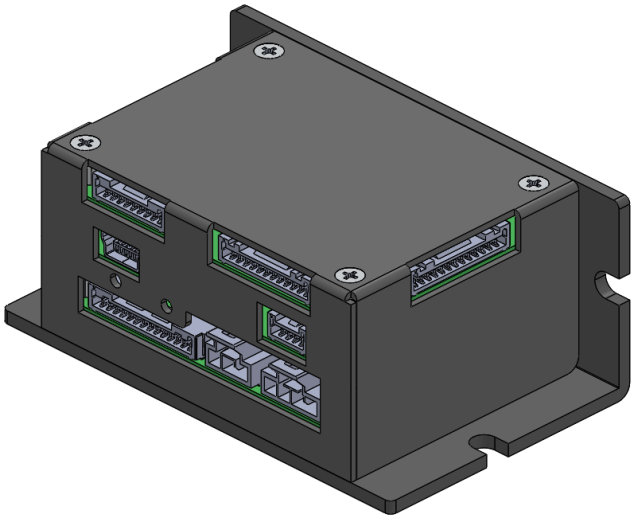
WELCON

Servo Drive

Hardware Manual



WEM-D048/06-FS84E7-V0.1

welcon SYSTEMS

2026-04-01

(15434) Room 812, 555, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea PHONE +82 31 417 6735 FAX +82 417 6736

www.welconsystems.com

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 - FS 0057 - 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

welcon SYSTEMS
www.welconsystems.com
Room 812, 555, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi-do, 15434, Republic of Korea
TEL 031.417.6735 FAX 031.417.6736
ican6070@welconsystems.com

CONTENTS

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

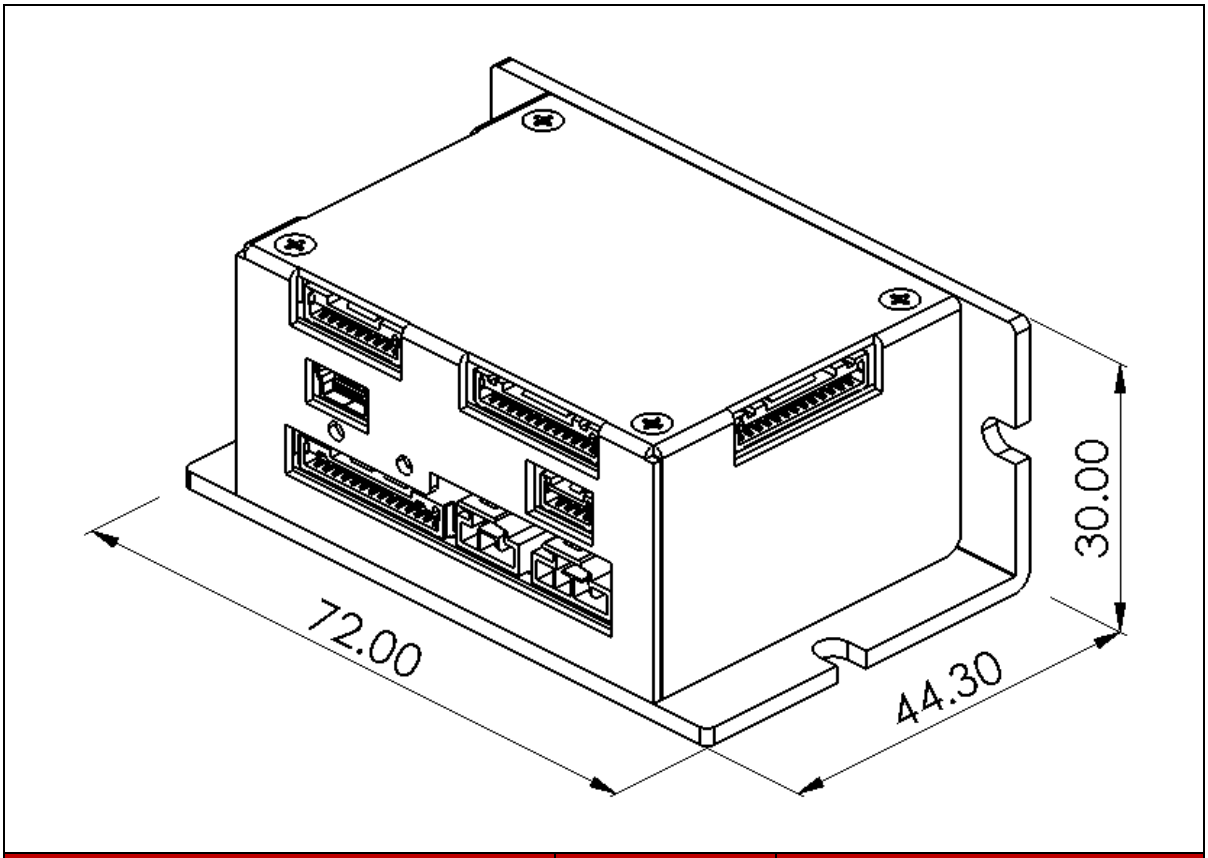
- Be sure to separate U, V, W cables and encoder cables before wiring.
- After turning off the power, proceed with wiring the U, V, W cables and encoder cables.
- Do not drop it or subject it to strong impact.
- Do not install near flammable substances or water.
- Make sure that no sheath or copper wire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

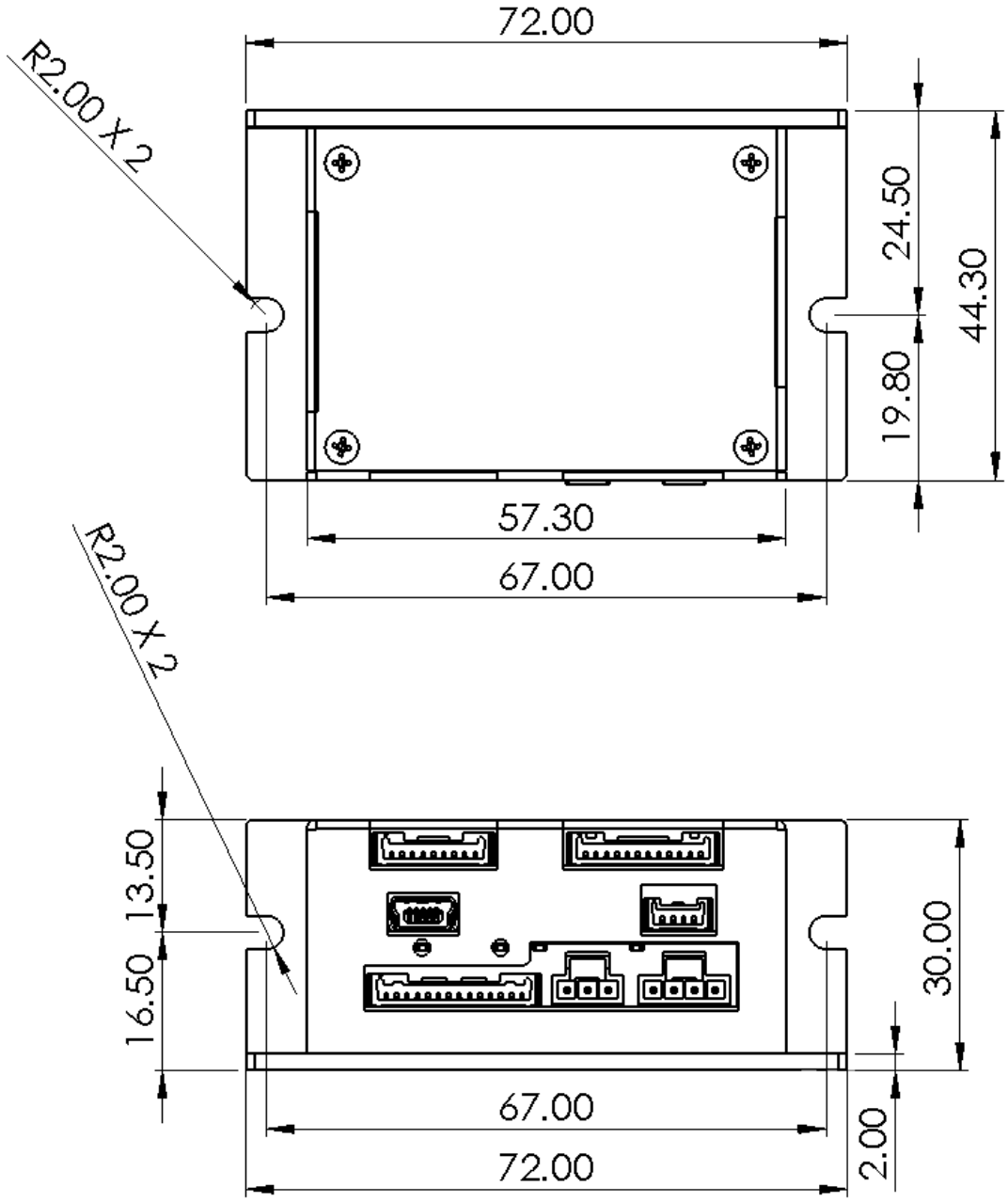
2.1. Mechanical Data



Item	Unit	Description
Weight	g	86.0
SIZE (L x W x H)	mm	72.0 x 44.3 x 30.0
Fastener		Mounting Screw : M3
Mounting Method		Wall Mount / Bookshelf

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

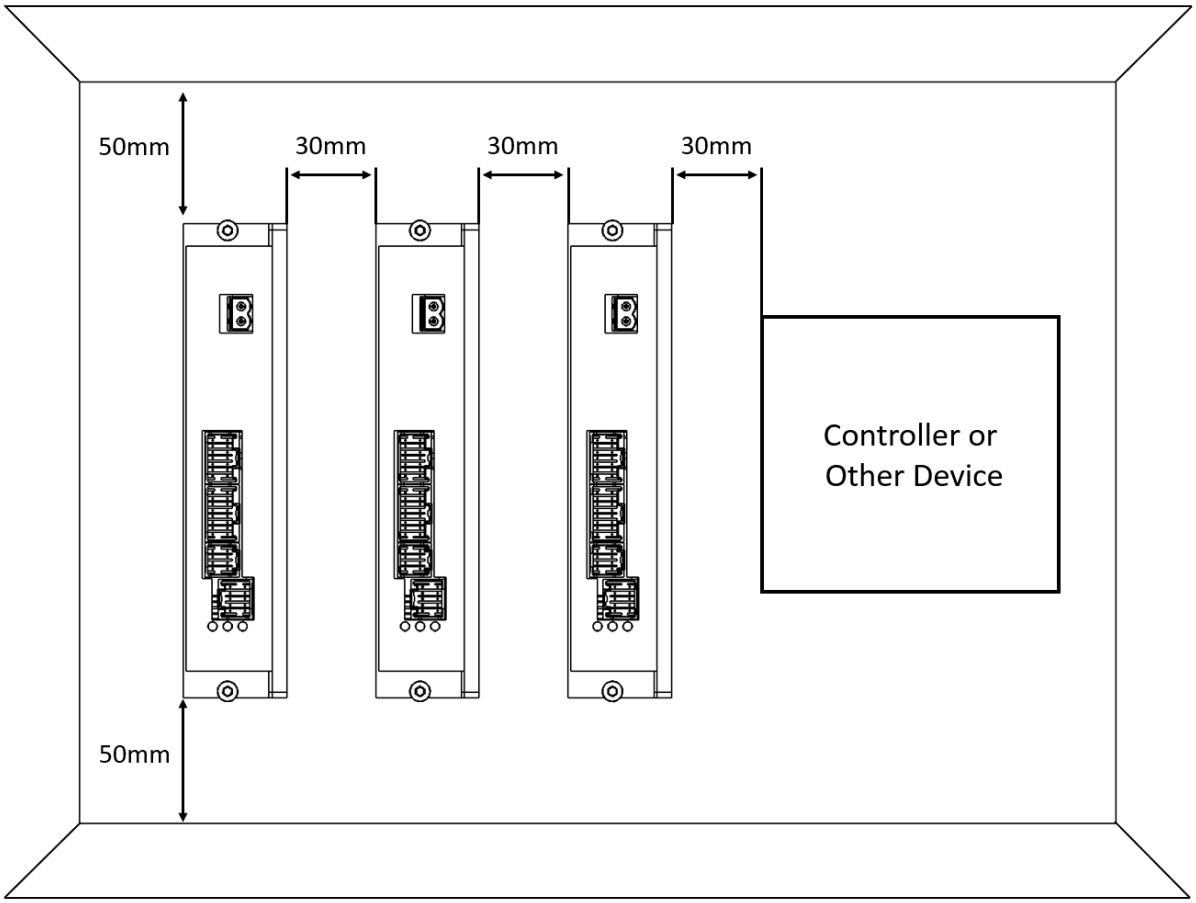
2.2. Mounting Dimension & Ways



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

WEM-D048/06-FS84E7-V0.1		
Description	**Units**	**Values**
Continuous Output Current	A[rms]	6
Peak Output Current	A[rms]	12
Minimum Supply Voltage	VDC	10
Nominal Supply Voltage	VDC	48
Maximum Supply Voltage	VDC	90
Maximum Continuous Output Power	W	288

Basic Specifications		
Feature	**Specification**	
Number of control axes	1	
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, Second Order Fitting Curve, Extended State Observer
Pulse Control	Control Mode	Pulse train input
	Pulse Train Input Type	Count + Direction
	Max. input pulse frequency	10MHz(differential), 200KHz(open collector input)
Reference Command	Current/Velocity/Position	USB
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(H/W Limit 10~90V)	

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℃, Storage 0-70℃ Humidity: 10-90%, Vibration: 1.0g	
Compliance Standard	-	
Communication		
Feature	**Specification**	
USB	Baud rate: up to 3Mbps, Maximum cable length: 3m	
I/O		
Feature	**Specification**	
Analog Input	Quantity	1
	Voltage Range	±10 VDC differential, Motor Temperature
	Input Resolution	14 bit
Digital Input	Quantity	9
	Signal	Configurable. Opto-isolated
	Voltage	24V
Digital Output	Quantity	10
	Signal	Configurable. Opto-isolated
	Voltage	24V
	Max. Output Current	40mA
High Speed Digital Input	Quantity	4
	Signal	Configurable. Opto-isolated
	Voltage	5V
High Speed Digital Output	Quantity	2
	Signal	Configurable. Opto-isolated
	Voltage	5V
	Max. Output Current	7mA
Brake	Use one of digital outputs (40mA)	

Motor Feedback		
General	Supply Voltage	5VDC
Incremental Encoder	Quantity	2
	Signal	CH1 : A-quad-B with or without index, RS422, Differential CH2 : A-quad-B with or without index, RS422, Differential
	A-quad-B Max Input Frequency	10MHz (before quadrature)
Digital Hall Sensor	Quantity	1
	Signal	Single-ended
	Type	Separated Hall sensor
***Serial Encoder**	Quantity	2
	Type	SSI, BiSS-C, Tamagawa, Panasonic, EnDat2.x
	Bit rate	0.5Mbps, 1Mbps, 2Mbps, 2.5Mbps, 5Mbps

*Support for serial encoders is planned for a future update.

* The quantity of Incremental Encoders refers to the maximum number that can be connected when Serial Encoders are not in use. Similarly, the quantity of Serial Encoders refers to the maximum number that can be connected when Incremental Encoders are not used.

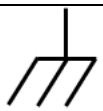
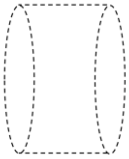
2.5. Protections & Limitations

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 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

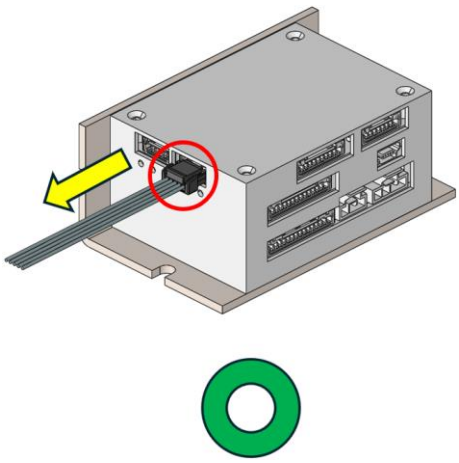
⚠ Cautions

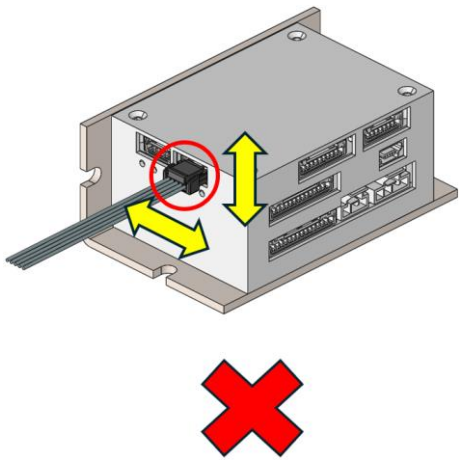
Precautions when connecting connectors

- 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.

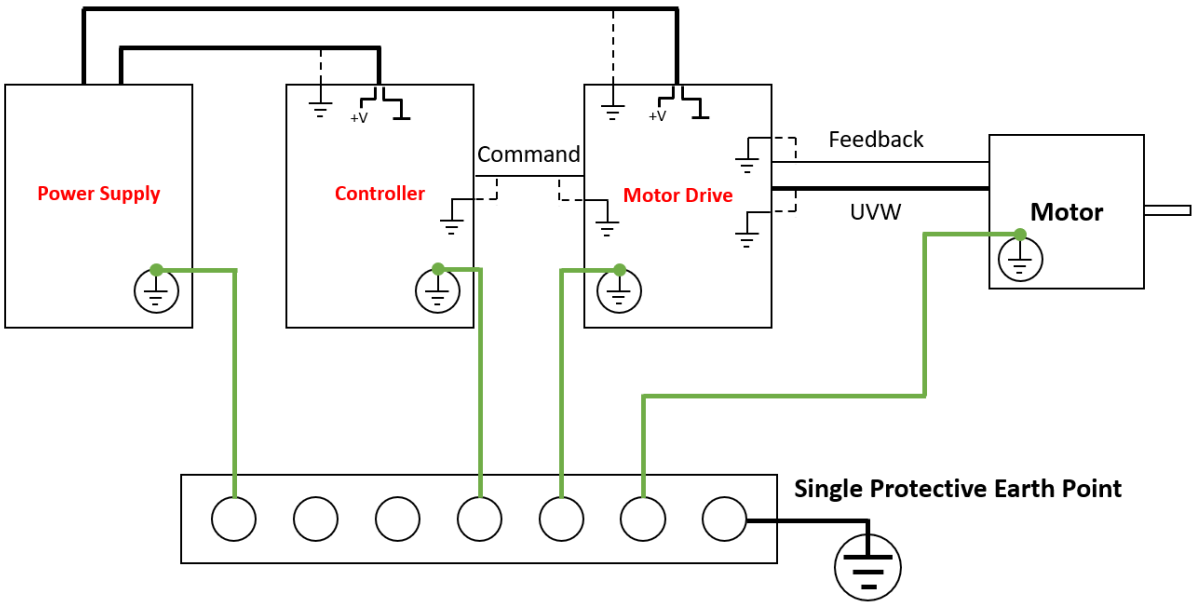




3.3.1. Grounding

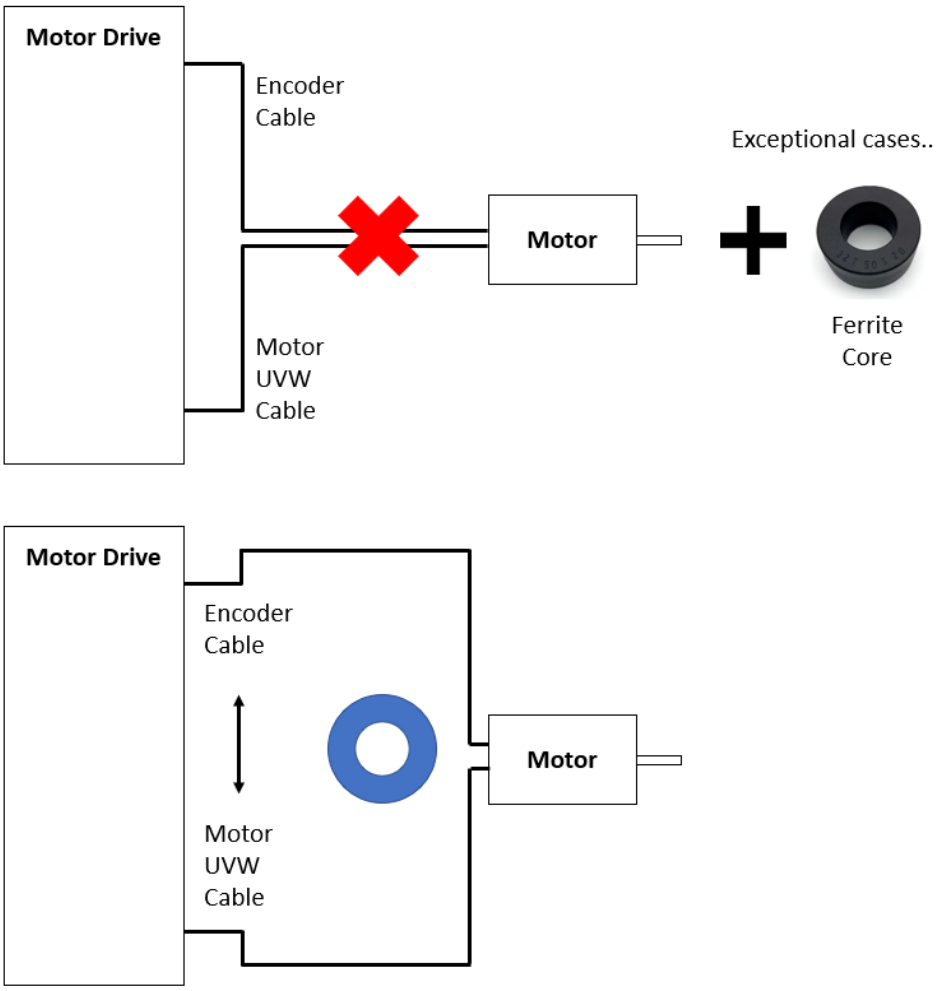
The case grounds of all the system components should be connected to a single Protective Earth (PE) ground point.

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.

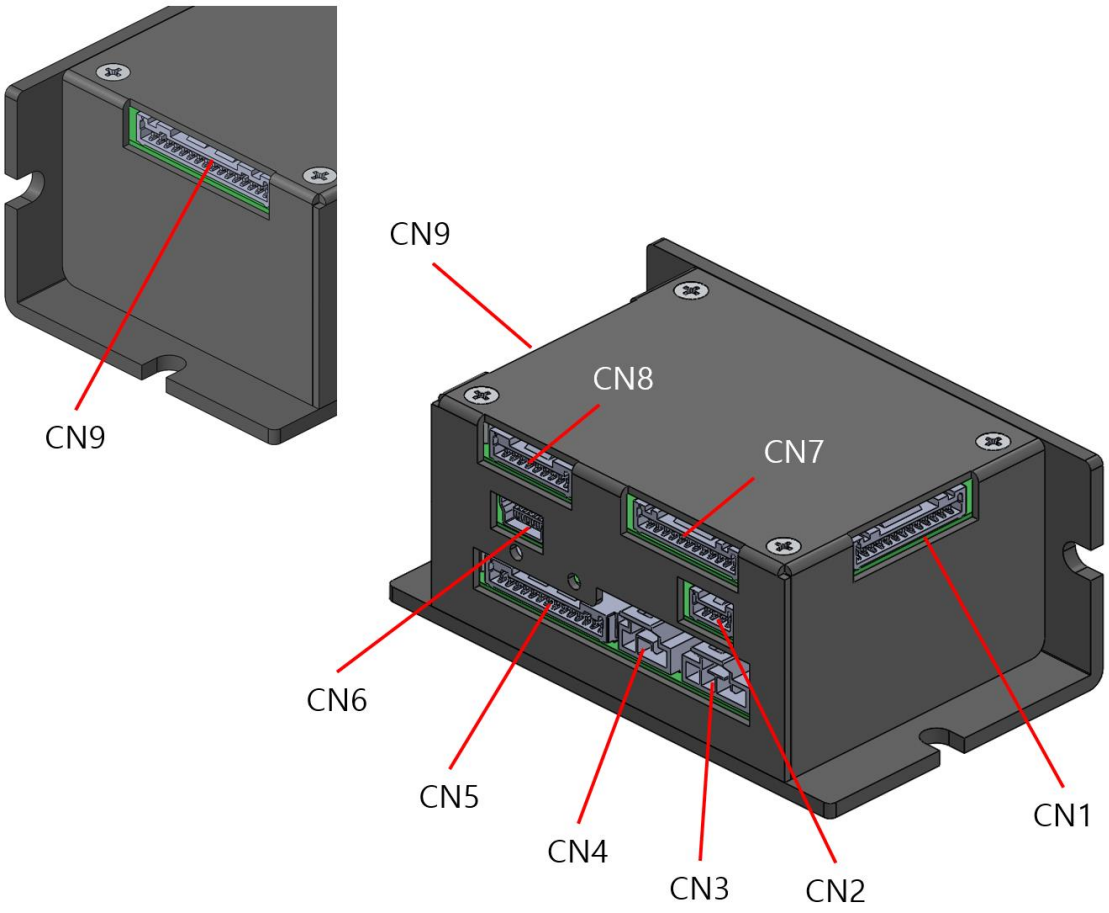
3.4. Tools

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

Warning
Avertissement

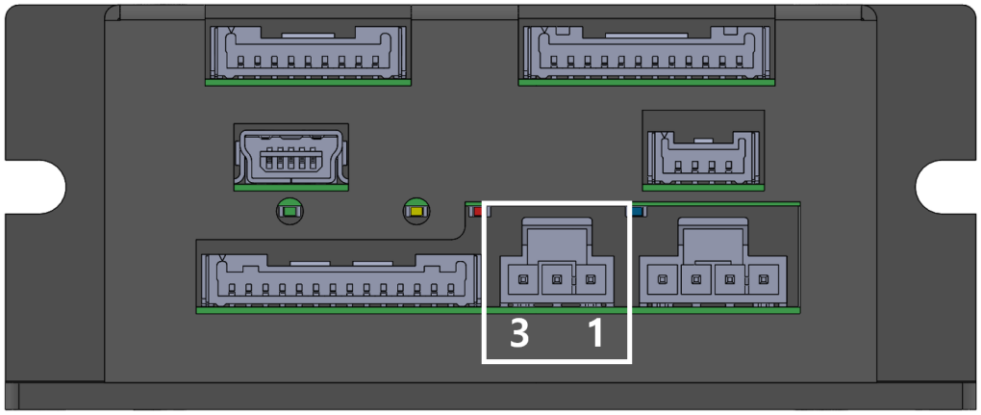
NOTICE: To prevent wiring errors and ensure signal integrity, only use the designated crimping tool and specified connectors. Issues caused by the use of unauthorized tools are not covered under the performance guarantee."

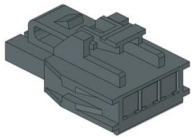
3.5. Connections



Connector	Function	Connector	Function
CN1	Digital Outputs	**CN6**	USB
CN2	Analog Inputs	**CN7**	Pulse Signal
CN3	Motor UVW	**CN8**	Encoder B
CN4	Main Power	**CN9**	Digital Inputs
CN5	Encoder A		

3.6. Main Power





Molex_105307-1203

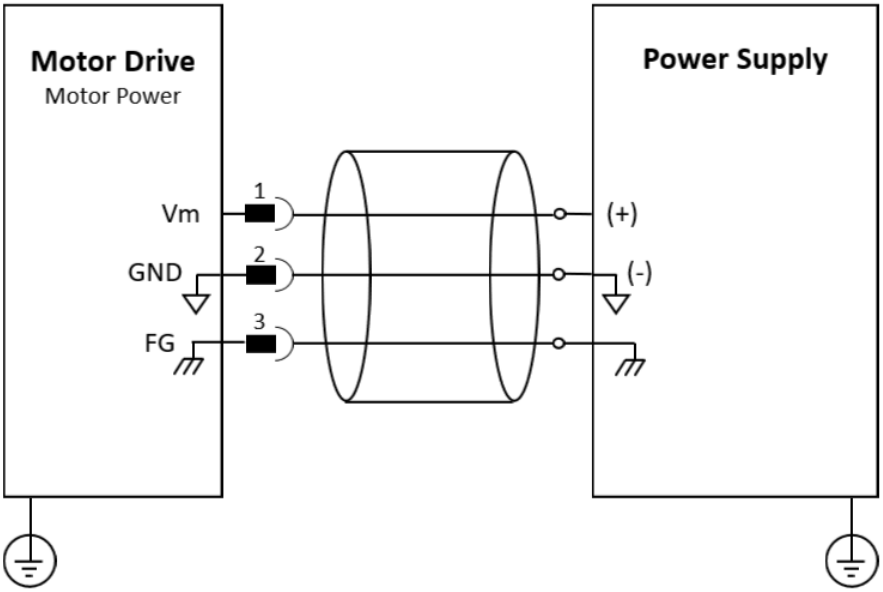
Molex_105300-2100

Molex_105313-1103		J1
Pin	**Signal**	**Input Power**
1	Vm	12~48VDC
2	GND	GND
3	FG	FG

Warning
Avertissement

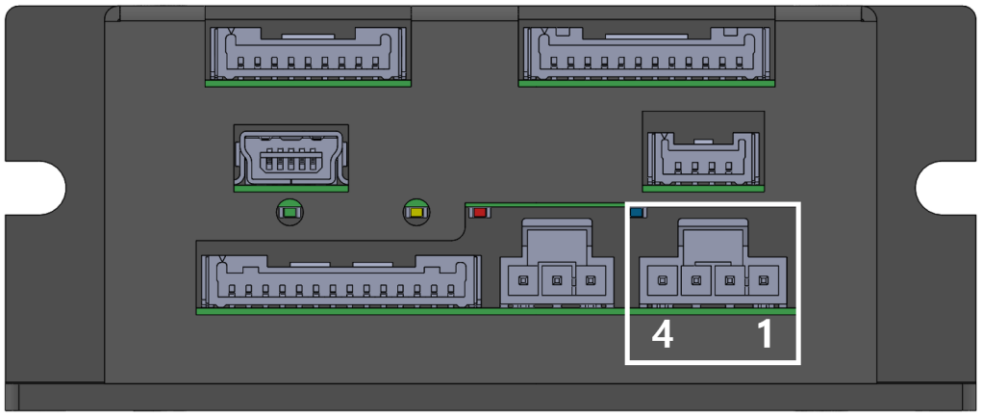
- Do not connect/disconnect the servo drive while the power is on.
- Before applying power, make sure that the DC supply is within the specified range.
- make sure the proper plus and minus connections are in order.

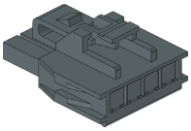
3.6.1. Main Power Wiring



[Motor Power Connection Diagram]

3.7. Motor UVW

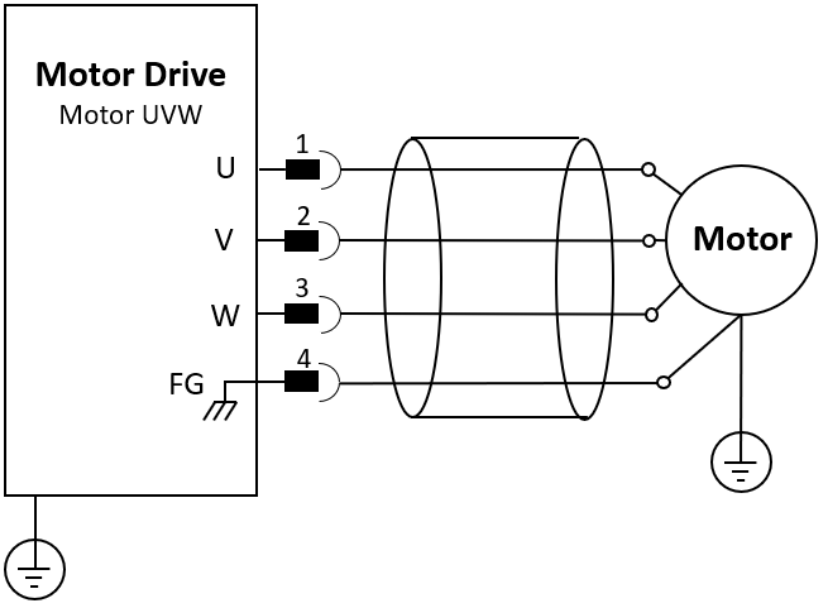




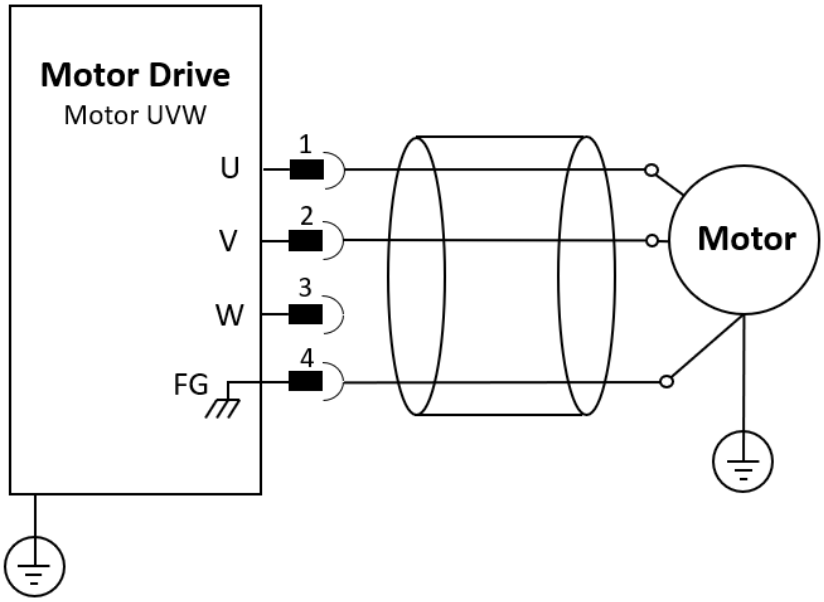
Molex_105307-1204 Molex_105300-2100

Molex 105313-1104	J101
Pin	**Signal**
1	U (VCM or DC Motor : +)
2	V (VCM or DC Motor : -)
3	W
4	FG

3.7.1. Motor UVW Wiring

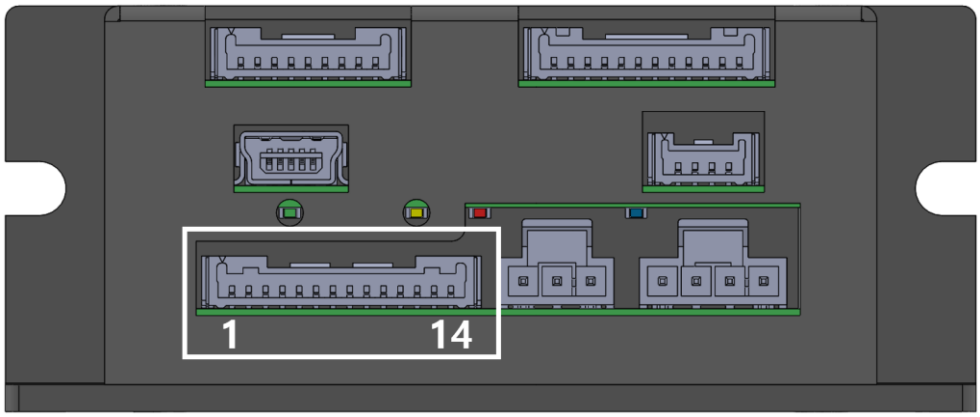


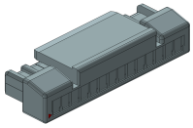
[Brushless / PMSM Motor UVW Connection Diagram]



[Brushed DC / Voice Coil Motor UVW Connection Diagram]

3.8. Encoder A





Molex_505565-1401

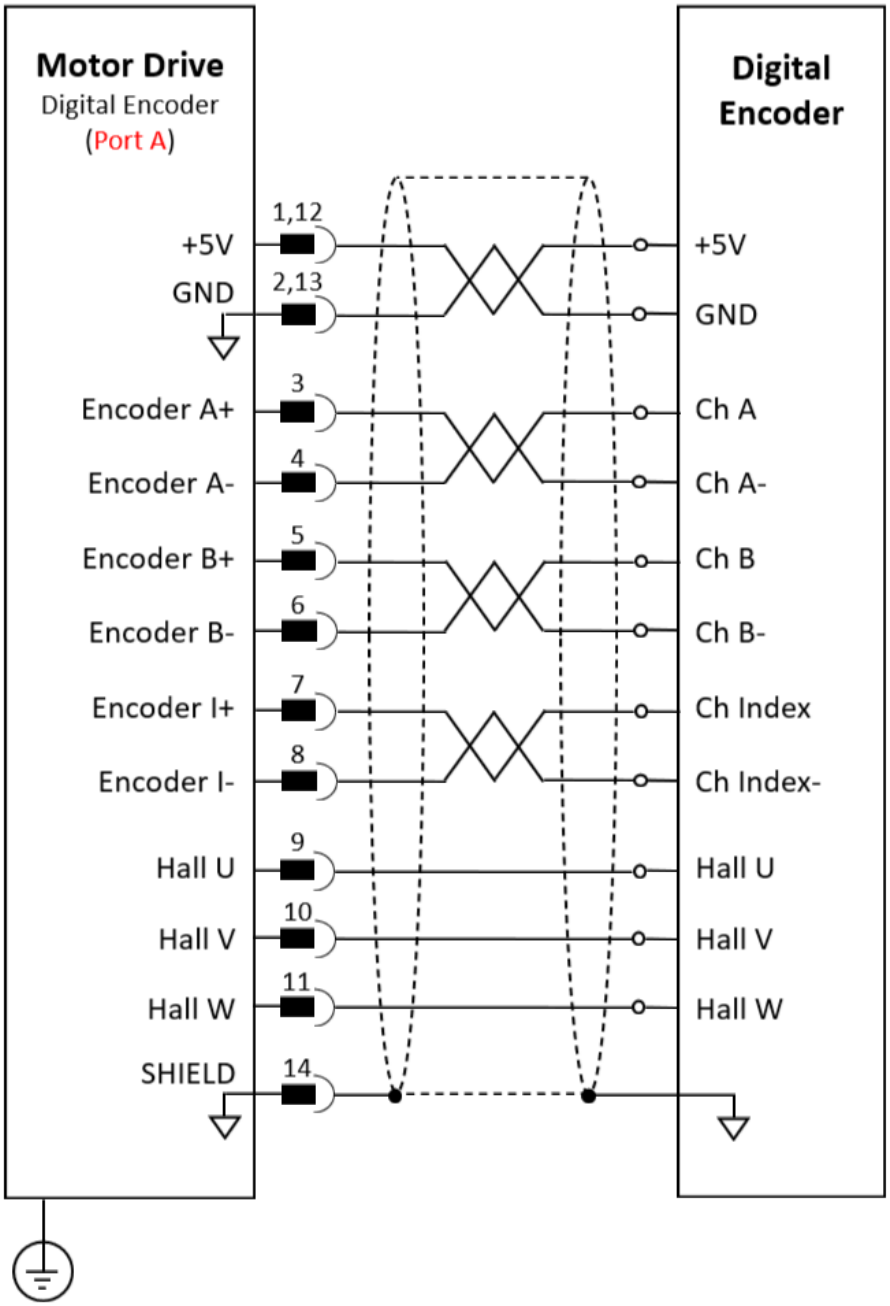
Molex_505431-1100

Molex 505567-1481	J201
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
14	Shield

3.8.1. Encoder A – Digital Encoder(Port A) Wiring

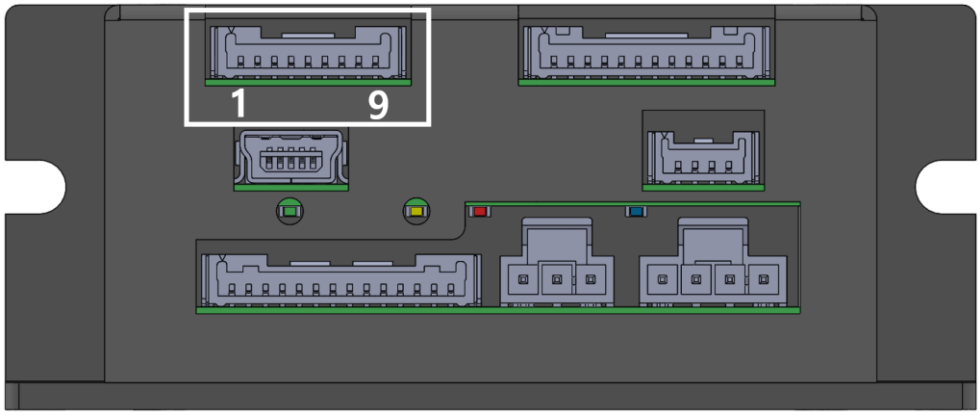
The cable's shield is connected to the shield in the connector.

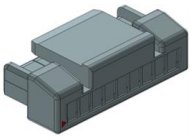
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues



[Encoder A – Digital Encoder(Port A) Connection Diagram]

3.9. Encoder B





Molex_505565-0901

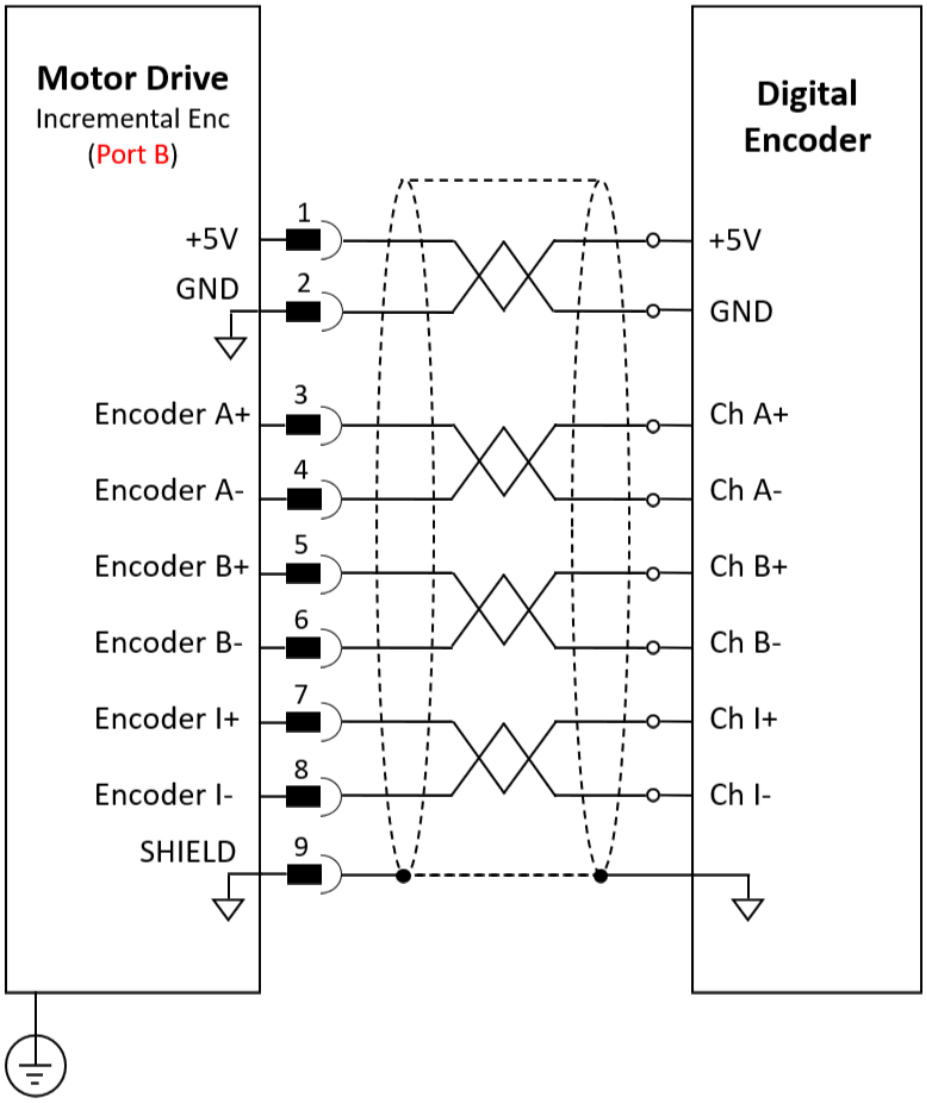
Molex_505431-1100

Molex 505567-0981	J101
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	Shield

3.9.1. Encoder B – Digital Encoder(Port B) Wiring

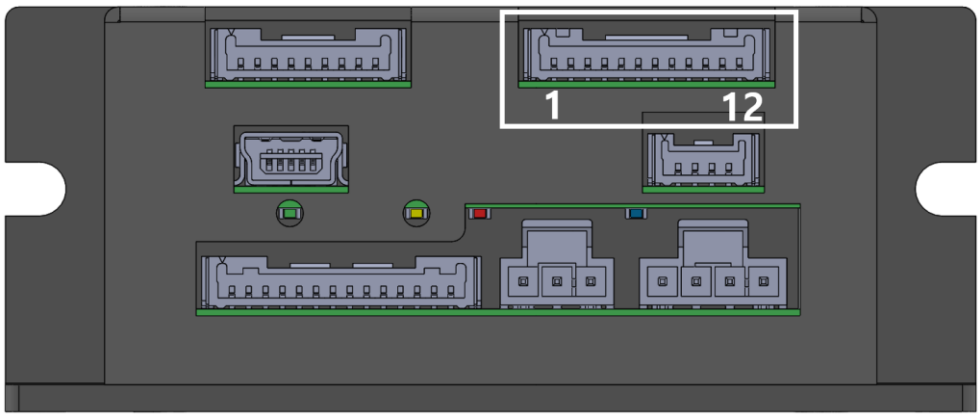
The cable's shield is connected to the shield in the connector.

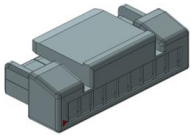
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues



[Encoder B – Digital Encoder(Port B) Connection Diagram]

3.10. Pulse Signal





Molex_505565-1201

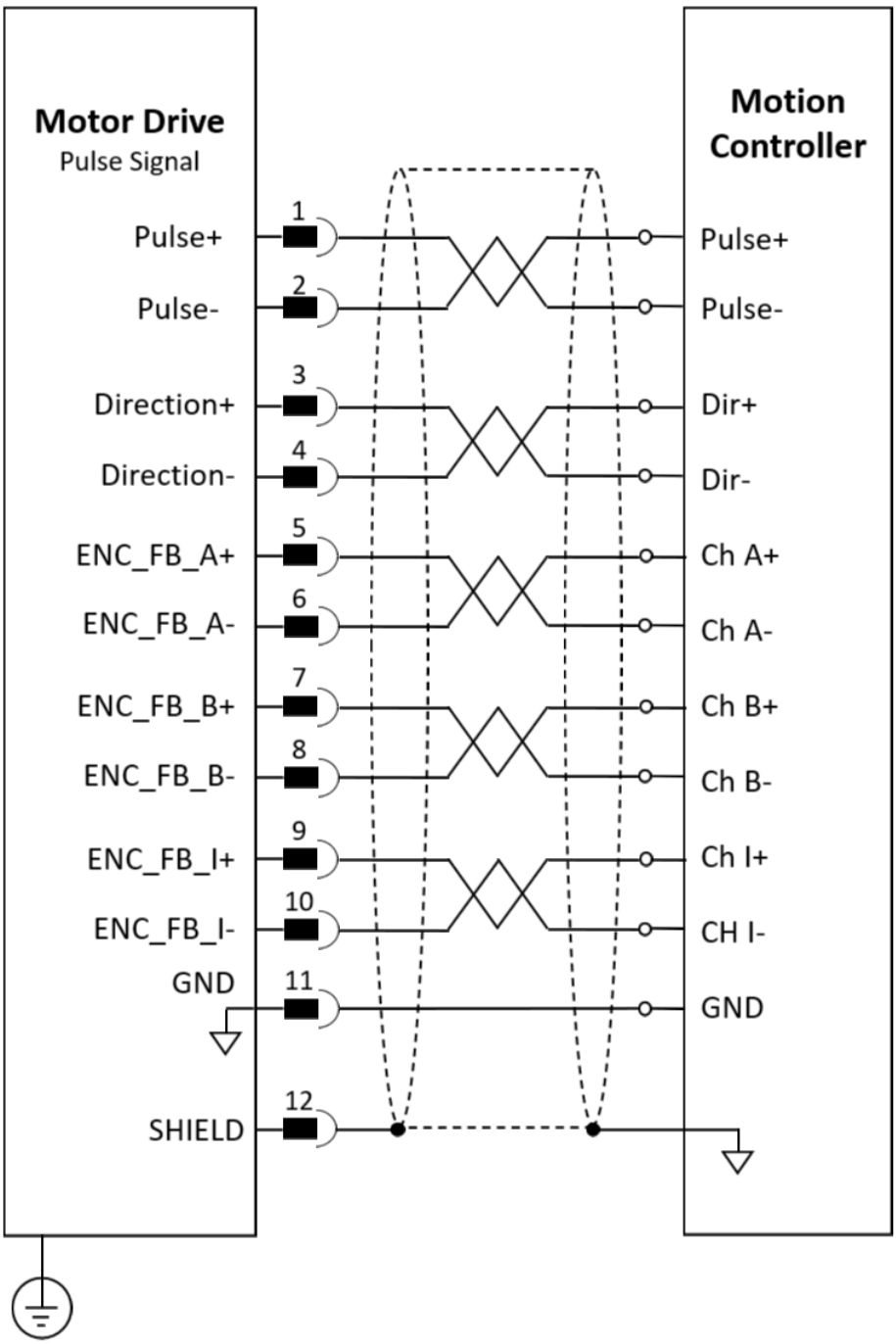
Molex_505431-1100

Molex 505567-1281	J202
Pin	**Signal**
1	Pulse+
2	Pulse-
3	Direction+
4	Direction-
5	ENC_FB_A_+
6	ENC_FB_A_-
7	ENC_FB_B_+
8	ENC_FB_B_-
9	ENC_FB_I_+
10	ENC_FB_I_-
11	GND
12	Shield

3.10.1. Pulse Type Encoder Wiring

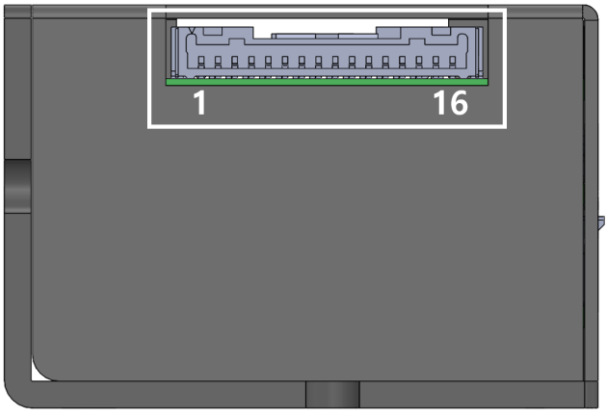
The cable's shield is connected to the shield in the connector.

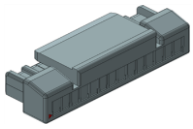
The reason for connecting the encoder's shield wire to the servo drive's GND is to block electrical interference, ensure accurate signal transmission, and prevent ground loop issues



[Pulse Singal Connection Diagram]

3.11. Digital Input & High Speed Digital Input





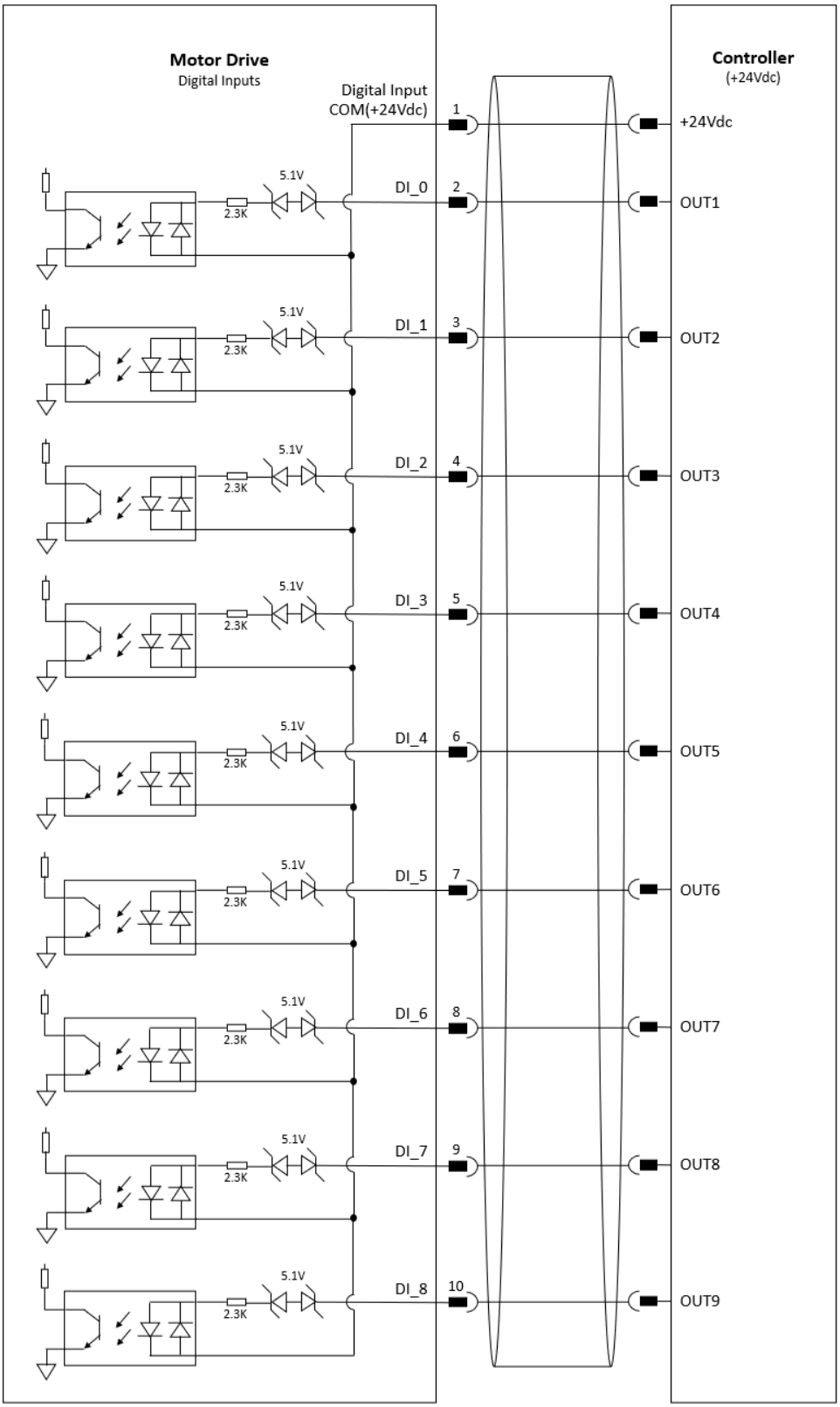
Molex_505565-1601

Molex_505431-1100

Molex 505567-1681	J301
Pin	**Signal**
1	Digital Input_COM(+24Vdc)
2	Digital Input_0
3	Digital Input_1
4	Digital Input_2
5	Digital Input_3
6	Digital Input_4
7	Digital Input_5
8	Digital Input_6
9	Digital Input_7
10	Digital Input_8
11	High Speed Digital GND
12	High Speed Digital Input_9
13	High Speed Digital Input_10
14	High Speed Digital Input_11
15	High Speed Digital Input_12
16	GND

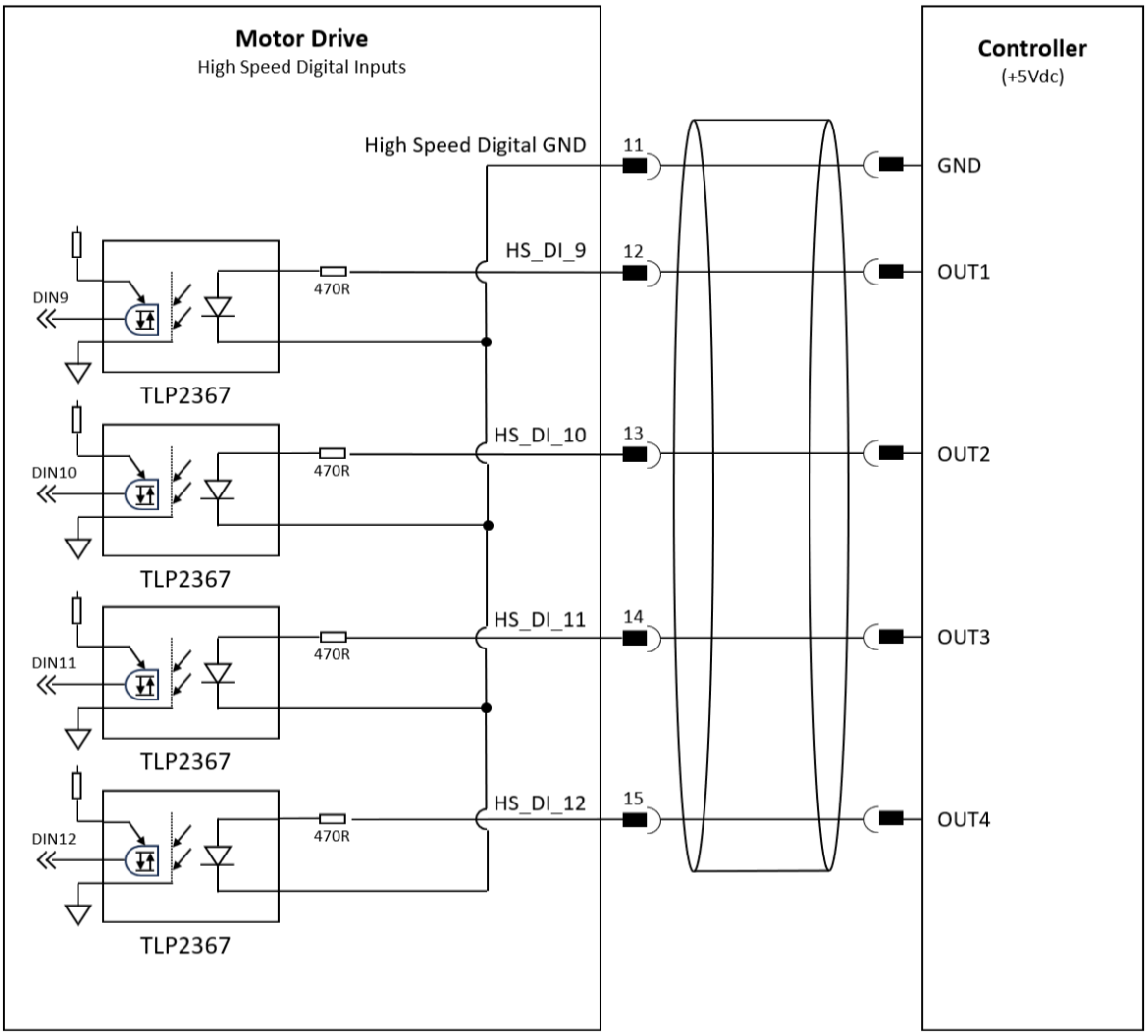
- **High Speed Digital GND (Pin 11):** Must be connected to the 5V ground.
- **High Speed Digital Inputs 9~12 (Pins 12-15):** Require a 5Vdc input signal.

3.11.1. Digital Inputs (NPN Type) Wiring



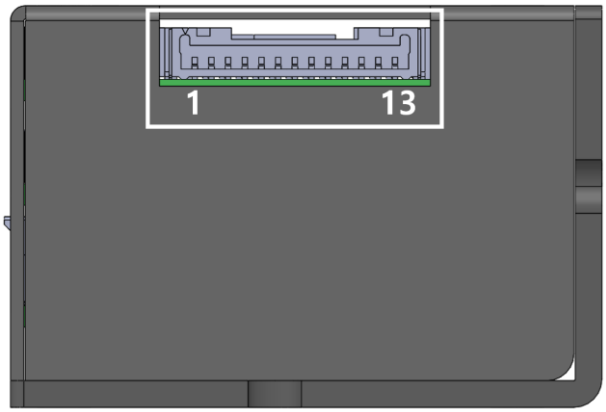
[Digital Inputs(NPN Type) Connection Diagram]

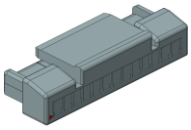
3.11.2. High Speed Digital Inputs (PNP Type) Wiring



[High Speed Digital Inputs(PNP Type) Connection Diagram]

3.12. Digital Output & High Speed Digital Output





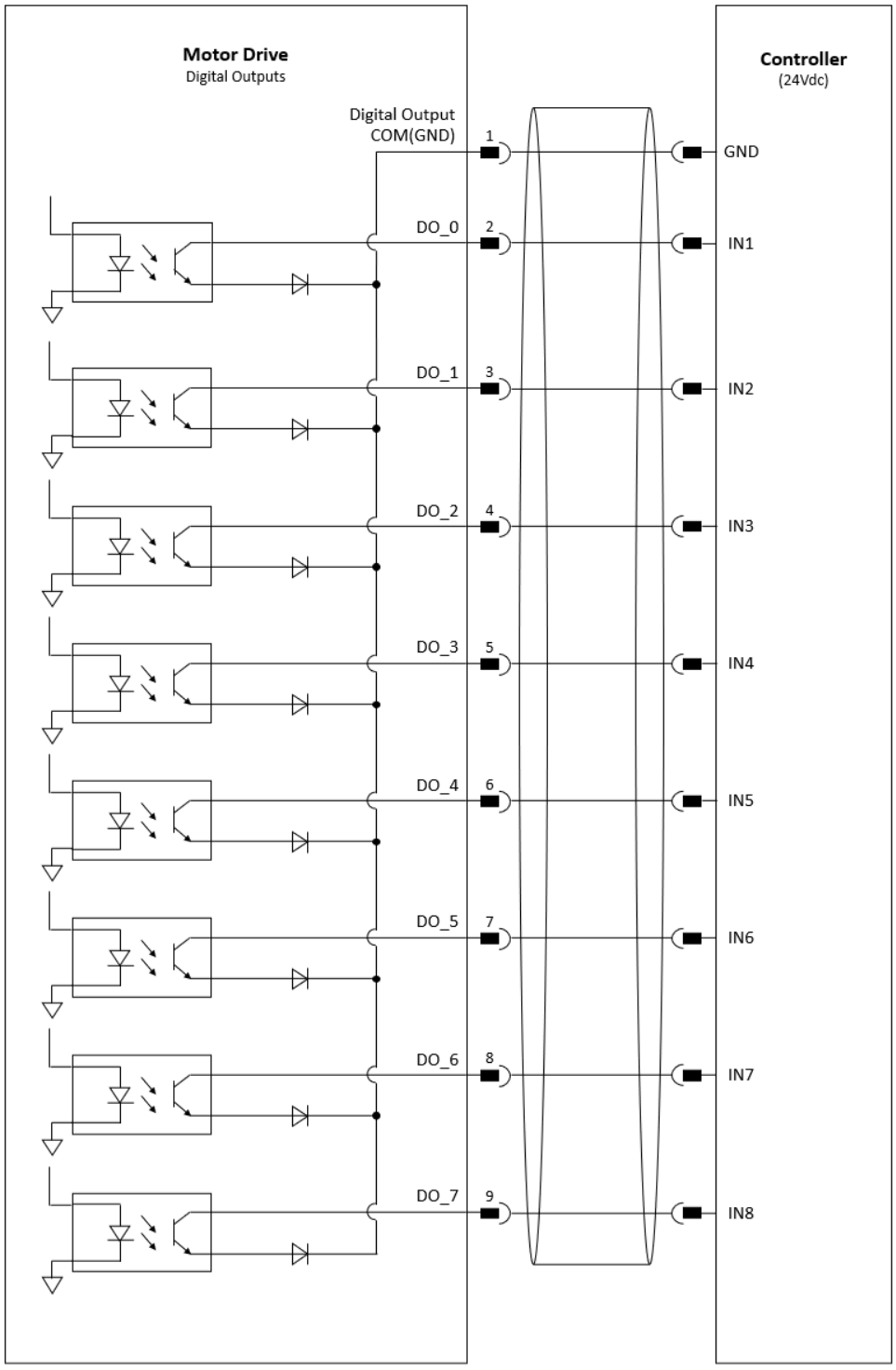
Molex_505565-1301

Molex_505431-1100

Molex 505567-1381	J401
Pin	**Signal**
1	Digital Output COM(GND)
2	Digital Output_0
3	Digital Output_1
4	Digital Output_2
5	Digital Output_3
6	Digital Output_4
7	Digital Output_5
8	Digital Output_6
9	Digital Output_7
10	High Speed Digital Output VDD
11	High Speed Digital Output GND
12	High Speed Digital Output_8
13	High Speed Digital Output_9

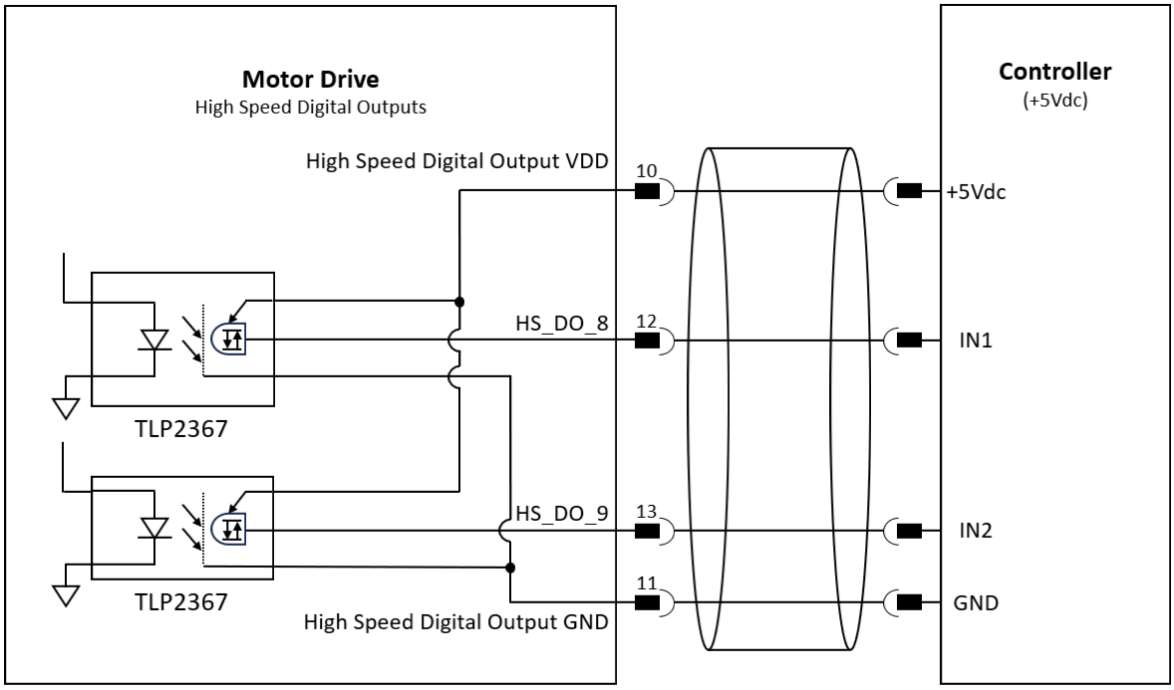
- **High Speed Digital Output VDD (Pin 10):** Connect to **+5Vdc.**
- **High Speed Digital Output GND (Pin 11):** Connect to the **5V ground (0V)**.

3.12.1. Digital Outputs(Sinking Type) Wiring



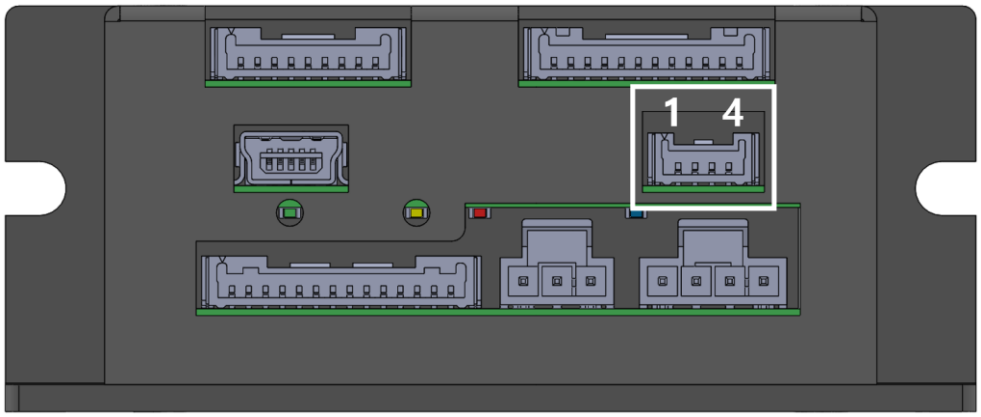
[Digital Outputs(Sinking Type) Connection Diagram]

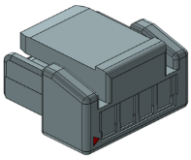
3.12.2. High Speed Digital Outputs (Sourcing Type) Wiring



[High Speed Digital Outputs(Sourcing Type) Connection Diagram]

3.13. Analog Inputs



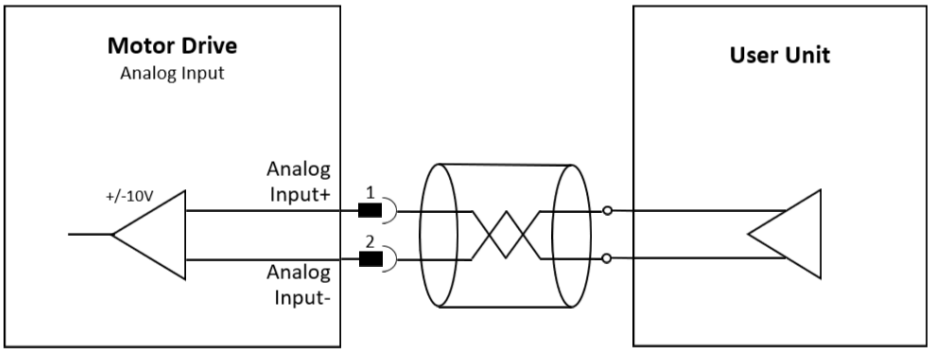


Molex_505565-0401

Molex_505431-1100

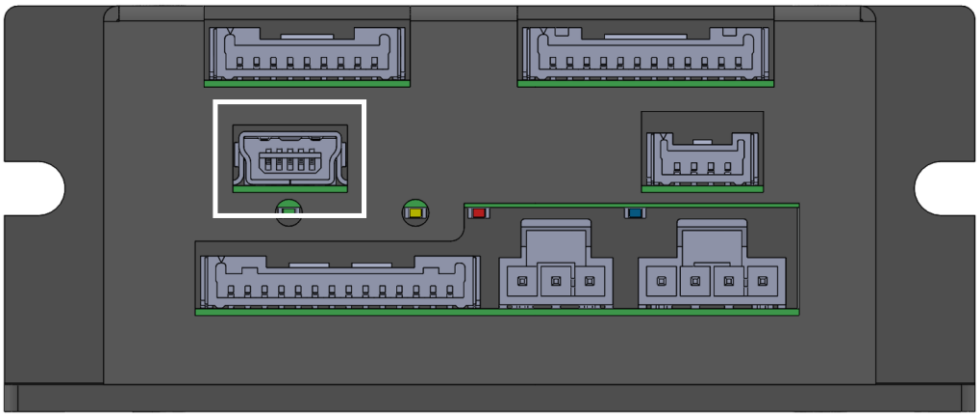
Molex_505567-0481	J401
Pin	**Signal**
1	Analog Input+
2	Analog Input-
3	Motor Temperature+
4	Motor Temperature-

3.13.1. Analog Inputs Wiring



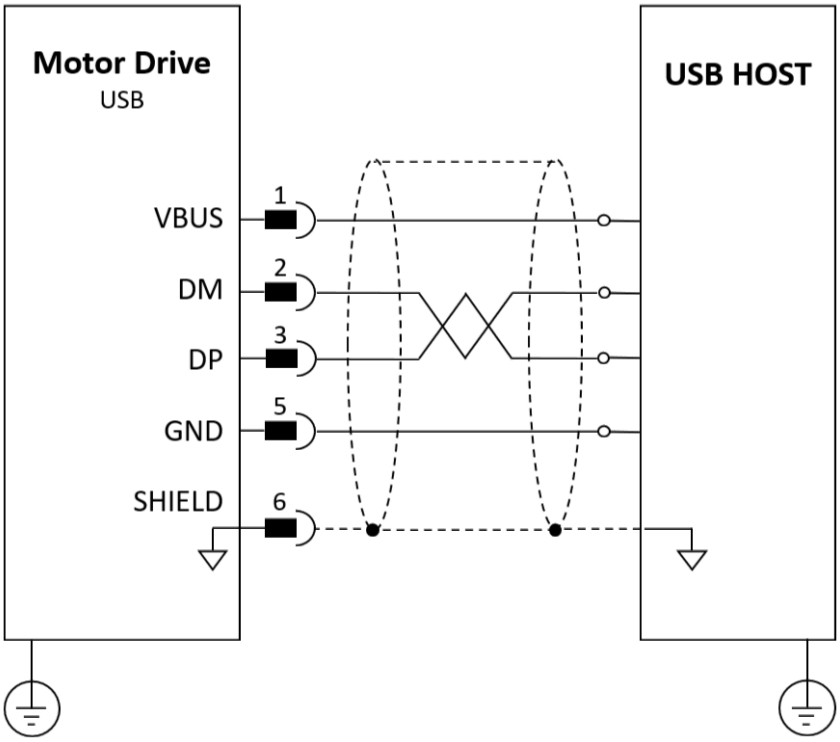
[Analog Input Connection Diagram]

3.14. USB



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

3.14.1. USB Wiring



[USB Connection Diagram]

WELCON SYSTEMS
(15434) Room 812, 555, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea

PHONE +82 31 417 6735
FAX +82 31 417 6736
www.welconsystems.com