

# AxN

CONFIURABLE MOTION CONTROL PLATFORM

## Installation Manual

**Support Model:**

**AxN Size2: AxN 15.30.4**

**Version: V1.2**  
**141100000030**

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# 1. MECHANICAL INSTALLATION

## 1.1 Notes for Operation

### Avoid

#### Please be sure to avoid:

1. penetration of damp into the device;
2. aggressive or conductive substances in the immediate vicinity;
3. explosive and flammable substances in the immediate vicinity;
4. drill chippings, screws or foreign bodies dropping into the device;
5. ventilation openings being covered over, as otherwise the device may be damaged

### Note

#### Note the following points:

1. Make sure every part of the drive is anchored before moving the drive. Failure to comply may result in minor or moderate injury from the drive parts falling;
2. Observe proper electrostatic discharge (ESD) procedures when handling the drive. Failure to comply could result in ESD damage to the drive circuitry;
3. Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during installation and project construction. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up, as the cover will reduce ventilation and cause the drive to overheat.

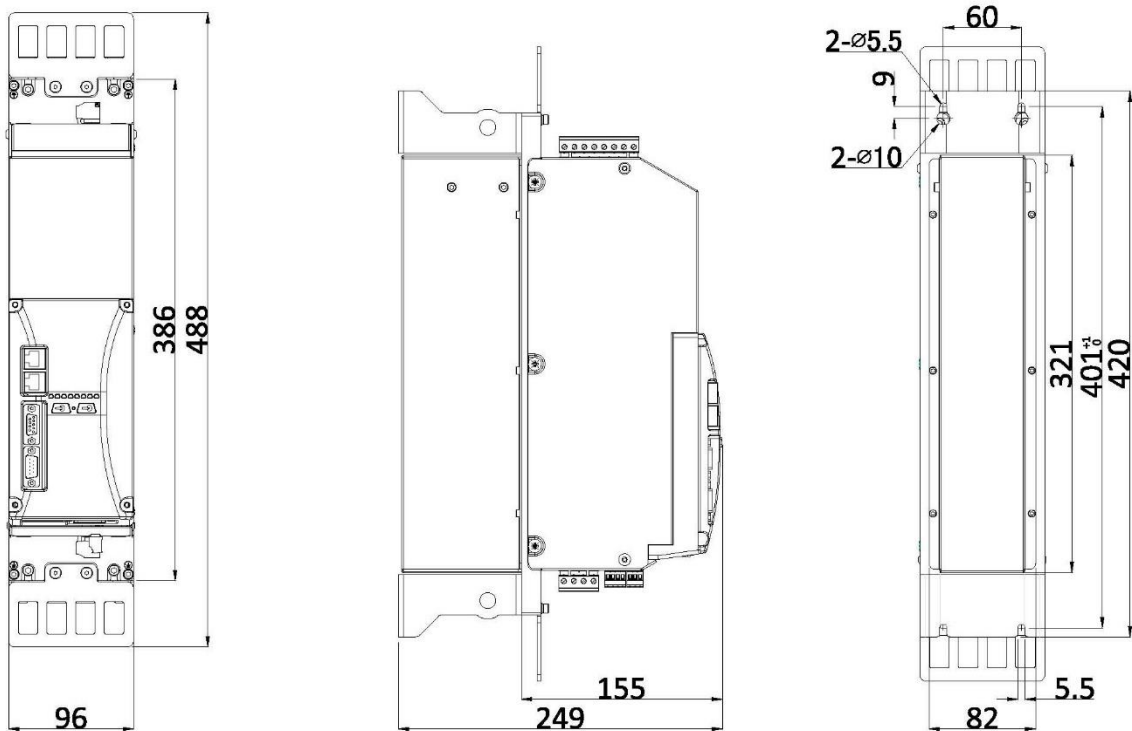
Install proper cooling to ensure the temperature in the enclosure does not exceed 40°C.

## 1.2 Installation Environment

To help prolong the optimum performance life of the drive, install the drive in the proper environment. The table below provides description of the appropriate environment for the drive.

Environment	Condition
Installation Area	Indoor
Ambient Temperature	0°C to 40°C, up to 50°C with power reduction (2%/°C) Drive reliability improves in environments without wide temperature fluctuations. When using an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	5 to 90% without condensation
Surrounding Area	Install the drive in an area free from: <ol style="list-style-type: none"><li>1. oil mist and dust</li><li>2. metal shavings, oil, water or other foreign materials</li><li>3. radioactive materials</li><li>4. combustible materials (e.g., wood)</li><li>5. harmful gases and liquids</li><li>6. excessive vibration</li><li>7. chlorides</li></ol>
Altitude	Up to 1000m above MSL, over 1000 m above MSL with power reduction ( 3% per 100m)
Vibration	Amplitude up to 0.3mm at 2 to 9 Hz Acceleration up to 1m/s <sup>2</sup> at 9 to 200 Hz
Orientation	Install the drive vertically to maintain maximum cooling effects.

### 1.3 Overall Dimensions

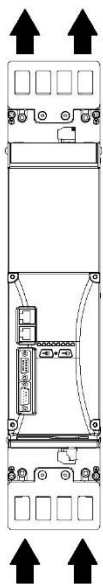


### 1.4 Installation Orientation

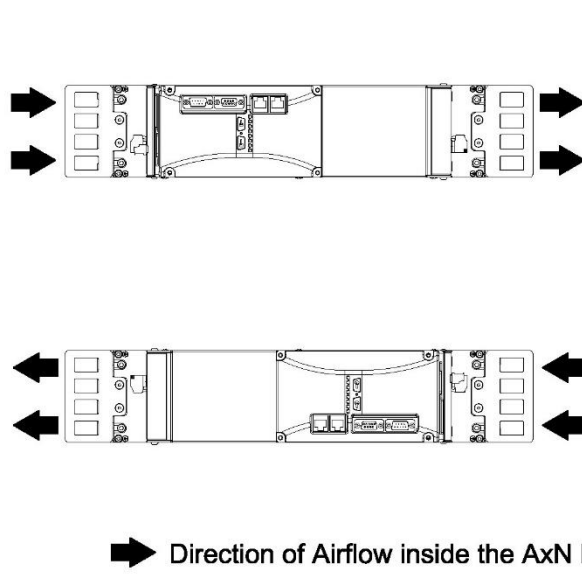
To maintain proper cooling, install the AxN drive upright inside the switch cabinet as illustrated below:

**WARNING:** The airflow inside the drive must be upright after installation as illustrated below. If other form of installation must be taken, **CONNECT PMC ENGINEER BEFORE INSTALLATION.**

**Correct**



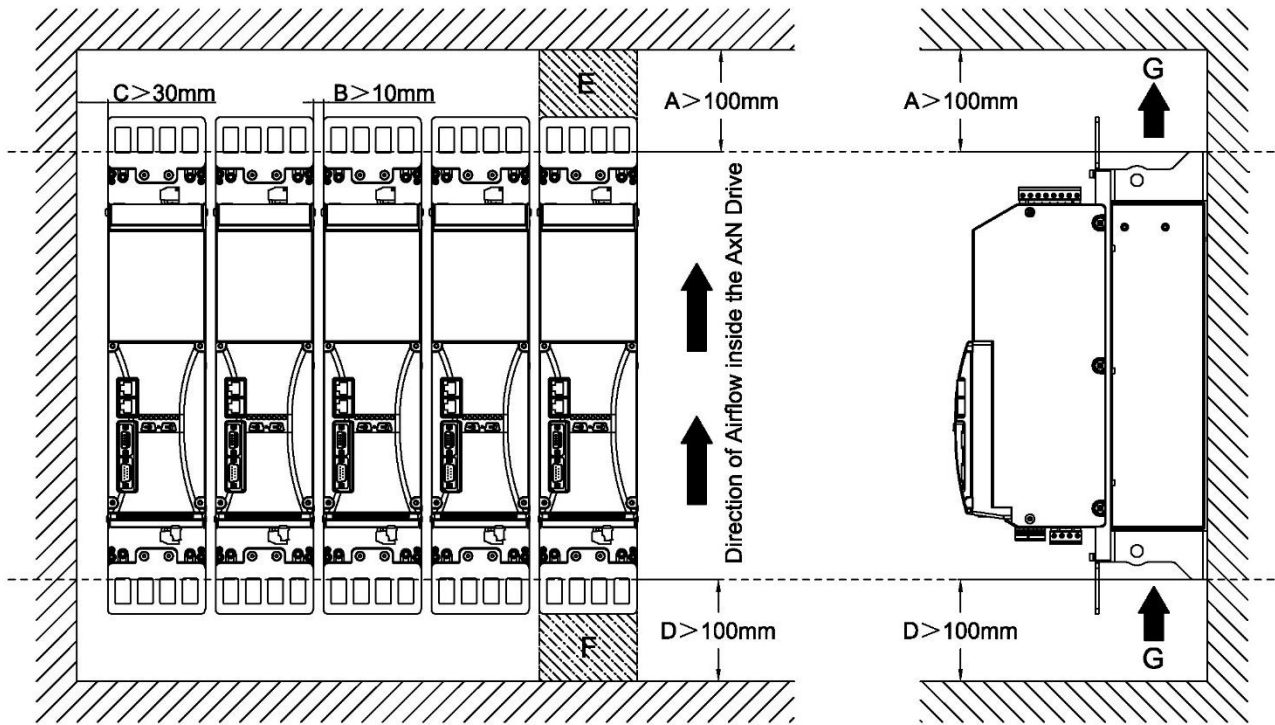
**Incorrect**



Installation Orientation of AxN Size2 Series Drive

## 1.5 Installation Spacing

To maintain sufficient space for airflow and wiring, the space between AxN drive and other device (including other AxN drives) must comply the requirement below.



Installation Spacing of AxN Size2 Series Drive

No.	Distance	Description
A	> 100mm	The distance between the top of the switch cabinet, to ensure enough space for air-out.
B	> 10mm	The distance between other device (including other AxN drives and peripheral devices)
C	> 30mm	The distance between the inside wall of the switch cabinet.
D	> 100mm	The distance between the bottom of the switch cabinet, to ensure enough space for air-in.
E	> 100mm	Air-out area, do not place any other device in this area
F	> 100mm	Air-in area, do not place any other device in this area
G		Airflow Direction

**NOTE:** The switch cabinet must have air outlets and inlets to ensure the thermal exchange between the cold air outside and the hot air inside.

## 2. MAIN CIRCUIT WIRING

### 2.1 AC Power Supply Input

#### 2.1.1 AC Power Supply Requirement

Mains Supply	AxN Size2 Series Drive
Voltage	150 ~ 500Vac
Type	Three-phase AC power
Frequency	50/60Hz
Fluctuation of Frequency	±10% (45 ~ 66Hz)
Asymmetry	±3%

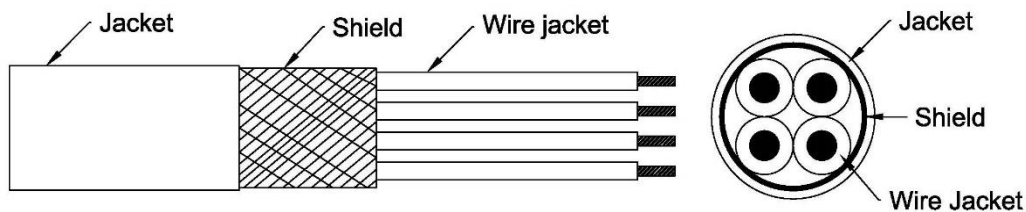
#### 2.1.2 AC Power Supply Cable Fabrication

AC power supply cable is the cable which connect the AxN Size2 Drive with the filter. The connection between AC power supply and the filter is not mentioned in this manual, and should be connected properly based on the real application.

##### Step 1: Cable Selection

AxN Size2 drive must use a 4 wire cable with shield as its AC power supply cable. Refer to the table below to select the appropriate cable:

AxN Size2	Current (A rms)	Recommended Gauge (mm <sup>2</sup> )	Recommended Gauge (AWG)
AxN 15.30.4	15	4.17	11



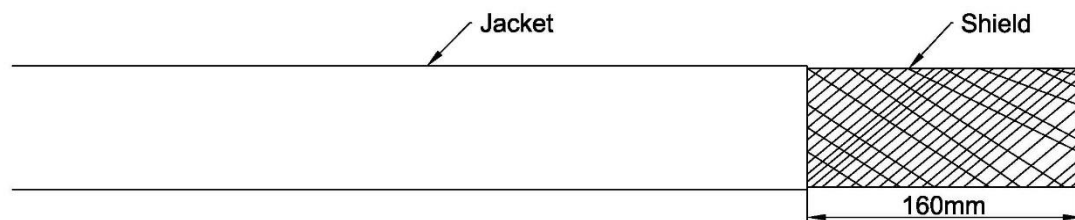
##### Step 2: Cable Length Measurement

The AC power supply cable is used to connect the output of the filter with the Power Input Port (P1) of AxN Size2 Drive. To minimize the interference, the filter must be installed in close proximity to AxN Size2 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size2 Drive (Refer to [1.5 Installation Spacing](#)).

**NOTE:** The length of AC power supply cable should **NOT** exceed **0.5m**.

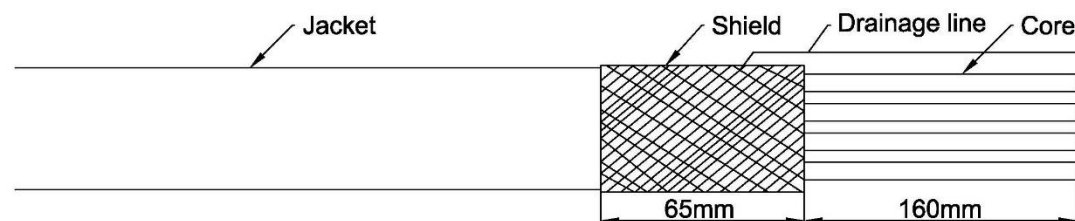
##### Step 3: Strip Cable Outside Jacket

Strip the outside jacket of AC power supply cable for 160mm and reveal the inside shield.



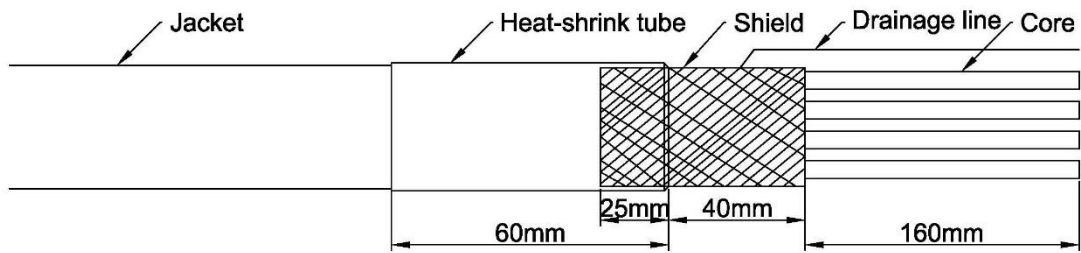
##### Step 4: Make Grounding Shield

Leave shield for 65mm as the grounding shield. Turn it to the outside of the jacket, then weld a wire on the shield as a drainage line.



##### Step 5: Fix Grounding Shield

Use a 60mm heat-shrink tube to fix the grounding shield, in the meaning time leave 40mm shield outside.



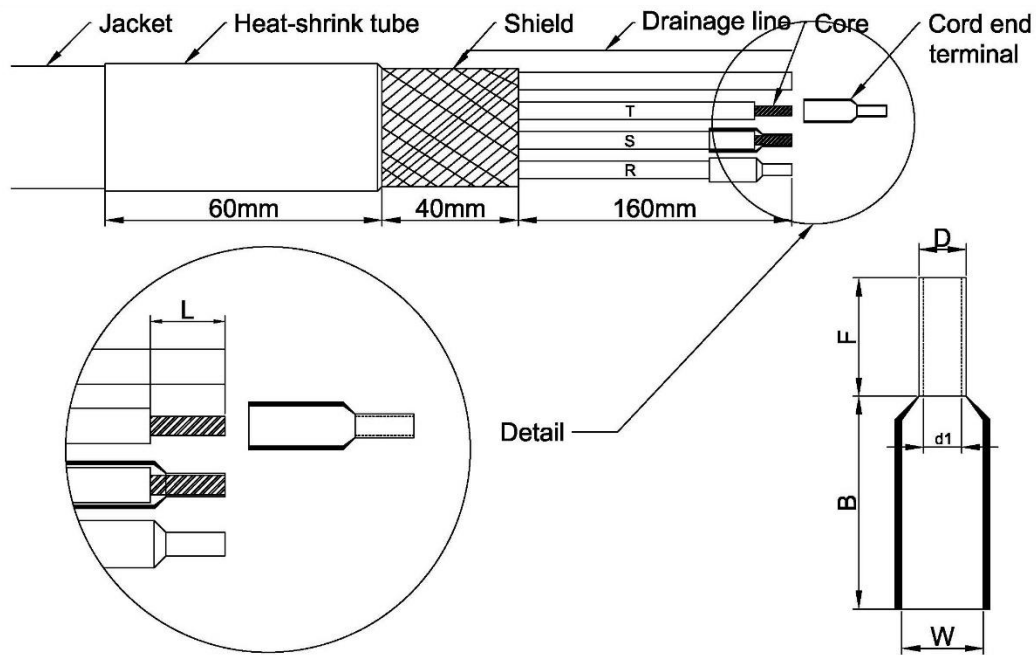
**Step 6: Make Phase Wires**

Choose 3 wires as the phase wires (R, S and T). Crimping pre-insulated Terminals on the wires will enhance the connection stability and simplicity between the cable and drive. AxN Size2 series drives are recommended to use the E Series Cord End Terminals manufactured by KST. Refer to the following table to select the appropriate terminal:

AxN Size2	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 15.30.4	E4012	12	4.5	7.4	3.2	2.8

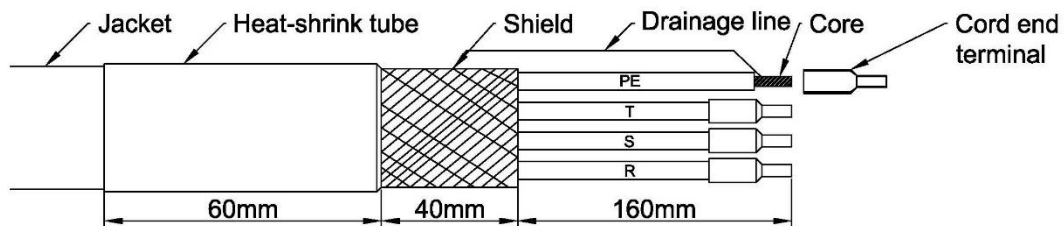
Strip the wires for L mm ( $F \leq L \leq F+B$ ), the recommend strip length is F+2 mm, refer to the following table to select an appropriate length:

AxN Size2	Strip Length (mm)	Recommended Strip Length (mm)
AxN 15.30.4	12 ~ 19.4	14



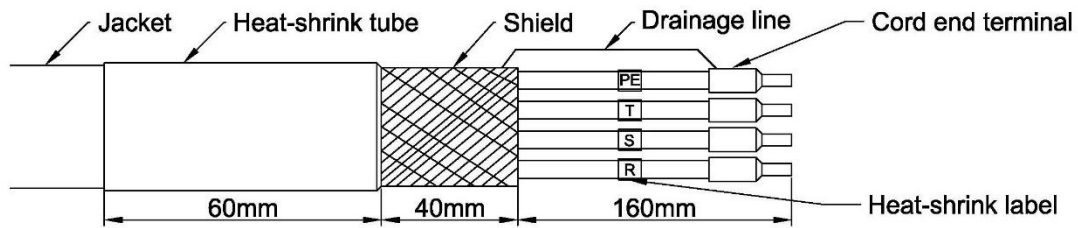
**Step 7: Connect PE wire with Shield**

Use the same method to make the remaining wire as the PE wire. Then crimp the PE wire into the Cord End Terminal along with the drainage line.



**Step 8: Check and Mark**

Check every wire and the connection between shield and PE wire, then label each wire.



### 2.1.3 AC Power Supply Input Installation

#### Step 1: Check the Power Supply Type and Voltage

Make sure that the mains power supply is a 3 phase AC power supply, and its voltage is 150 ~ 500 Vac.

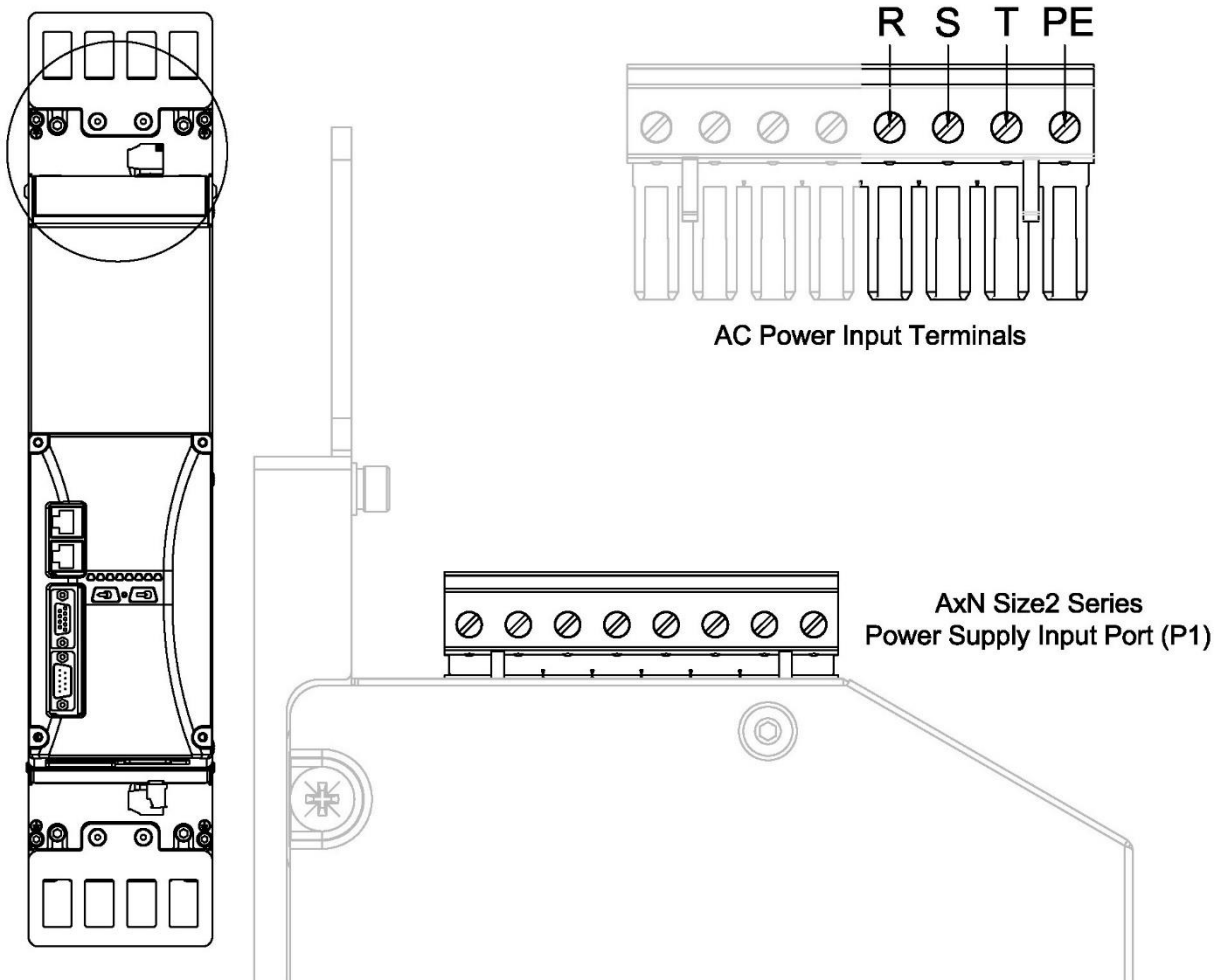
#### Step 2: Install the Filter

Connect the filter to the AC power supply. Then, connect one end of the AC power supply cable to the filter. Fuses or Breaker can be installed before the filter based on the real application.

**NOTE:** To minimize the interference, the filter must be installed in close proximity to AxN Size2 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size2 Drive (Refer to [1.5 Installation Spacing](#)). The length of AC power supply cable should **NOT** exceed **0.5m**.

#### Step 3: Find out the AC Power Input Terminals

PE, T, S and R, these are the four terminals called AC Power Input Terminals. AxN Size2 Drive's AC Power Input Terminals are in the Power Supply Input Port (P1) which is on the top of the drive. Refer to the following figures for exact locations and terminal Assignment.

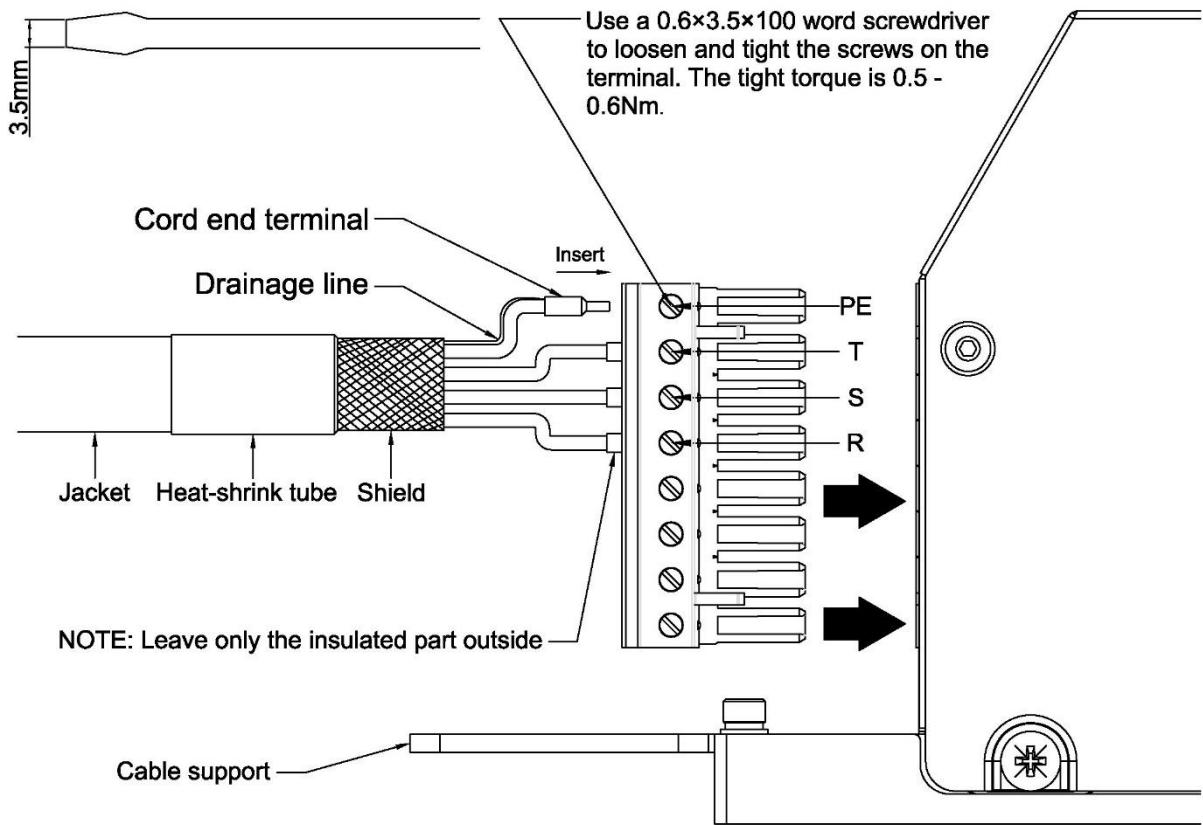


#### Step 4: Insert Wires into Corresponding Terminals

Use a 0.6 × 3.5 × 100mm Word Screwdriver or to loosen the screws on PE, T, S and R Terminals which are in the drive's Power Supply Input Port (P1). Insert the Wires of the AC power supply cable into the corresponding terminals: PE to PE, T to T, S to S and R to R.

**NOTE:** The metal part of the cord end terminal on the wire should be fully inserted into the corresponding terminals. Leave only the insulated part outside.



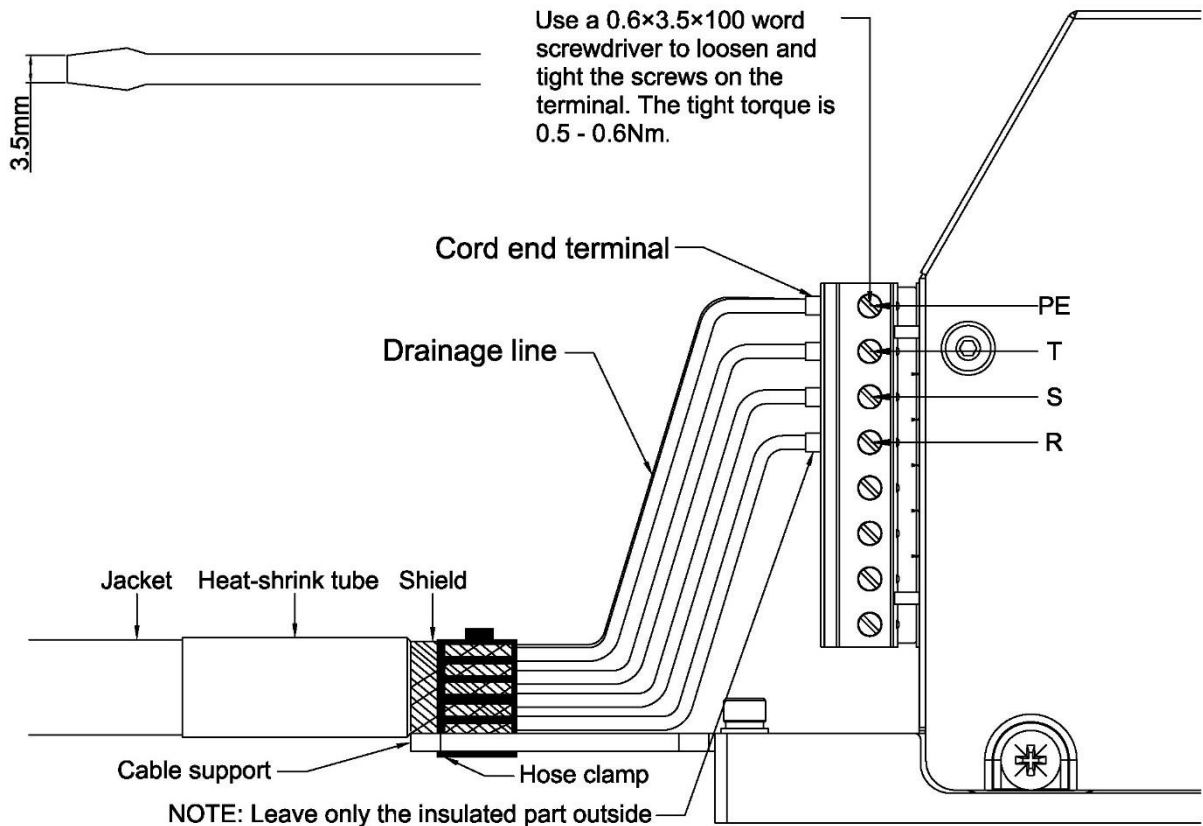


#### Step 5: Tight the Terminals

Use a 0.6 × 3.5 ×100mm Word Screwdriver or a PH2 to tight the screws on PE, T, S and R Terminals which are in the drive's Power Supply Input Port (P1). The nominal torque to tight these terminals is 0.5 ~ 0.6 Nm.

#### Step 6: Cable Fixing

Use a hose clamp to fix the cable on the cable support. Make sure that the cable shield has a large-area contact against the cable support, so that they can together be grounded through drive housing.



## 2.2 DC Power Supply Input

### 2.2.1 DC Power Supply Requirement

Main Supply	AxN 15.30.4
Voltage	565V
Type	DC power
Fluctuation of Voltage	0 ~ 800V
Nominal Power	10.4KW
Peak Power	20.8KW

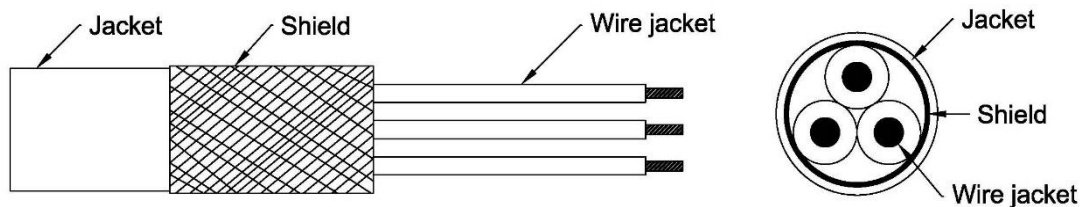
### 2.2.2 DC Power Supply Cable Fabrication

DC power supply cable is the cable which connect the AxN Size2 Drive with the DC power supply. This manual only mention the cable fabrication of AxN drive side. The power supply side should be fabricated based on the requirement of the DC power supply

#### Step 1: Cable Selection

AxN Size2 drive must use a 3 wire cable with shield as its DC power supply cable. Refer to the table below to select the appropriate cable:

AxN Size2	Current (A rms)	Recommended Gauge (mm <sup>2</sup> )	Recommended Gauge (AWG)
AxN 15.30.4	18.4	5.26	10

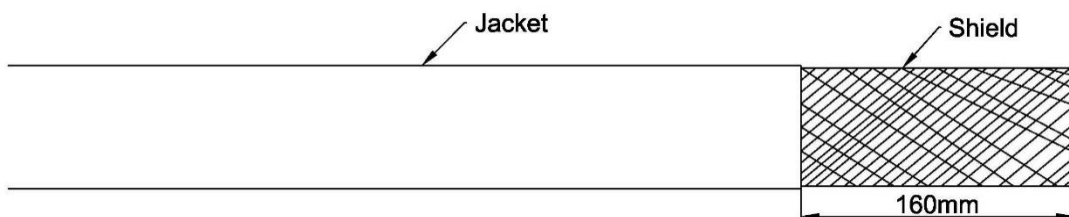


#### Step 2: Cable Length Measurement

The AC power supply cable is used to connect the output of the DC power supply with the Power Input Port (P1) of AxN Size2 Drive. To minimize the interference, the DC power supply must be installed in close proximity to AxN Size2 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size2 Drive (Refer to [1.5 Installation Spacing](#)).

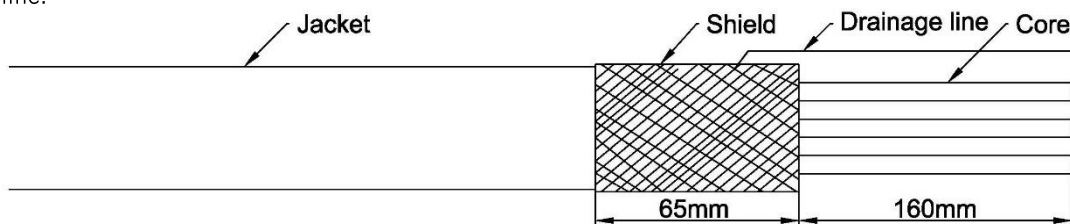
#### Step 3: Strip Cable Outside Jacket

Strip the outside jacket of the DC power supply cable for 160mm and reveal the inside shield.



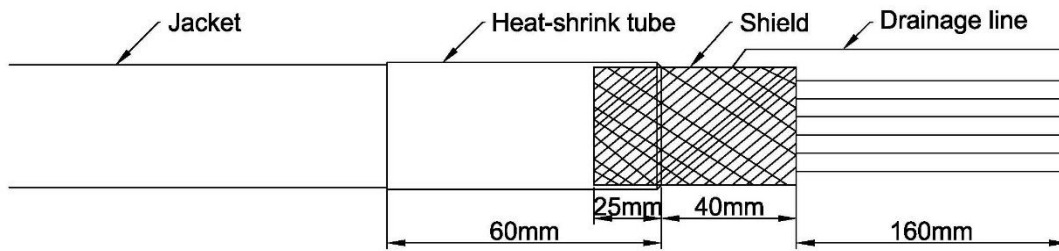
#### Step 4: Make Grounding Shield

Leave 65mm Shield as the grounding shield and turn it to the outside of the jacket. Then, weld a wire on the shield as the drainage line.



#### Step 5: Fix Grounding Shield

Use a 60mm heat-shrink tube to fix the grounding shield and leave 40mm shield outside.



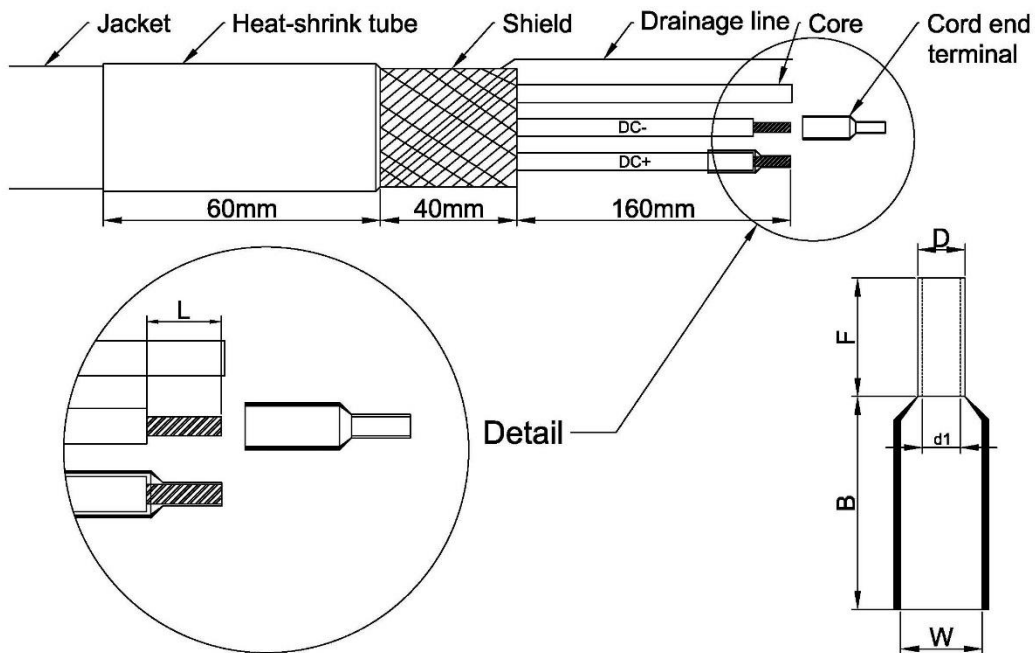
**Step 6: Make Phase Wires**

Choose 2 wires as DC+ and DC-. Crimping pre-insulated Terminals on the wires will enhance the connection stability and simplicity between the cable and drive. AxN Size2 series drives are recommended to use the E Series Cord End Terminals manufactured by KST. Refer to the following table to select the appropriate terminal:

AxN Size2	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 15.30.4	E6012	12	6.0	8.5	3.9	3.5

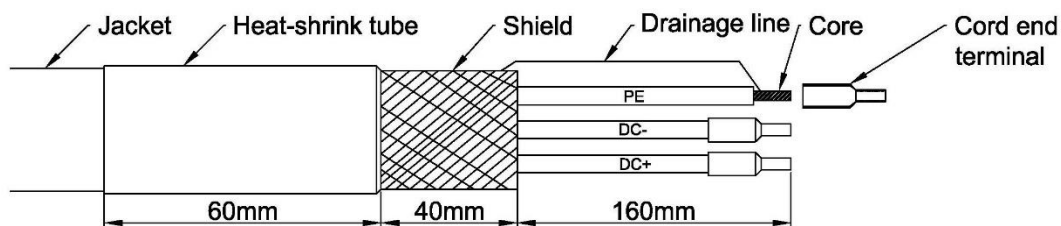
Strip the wires for L mm ( $F \leq L \leq F+B$ ), the recommend strip length is  $F+2$  mm, refer to the following table to select an appropriate length:

AxN Size2	Strip Length (mm)	Recommended Strip Length (mm)
AxN 15.30.4	12 ~ 20.5	14



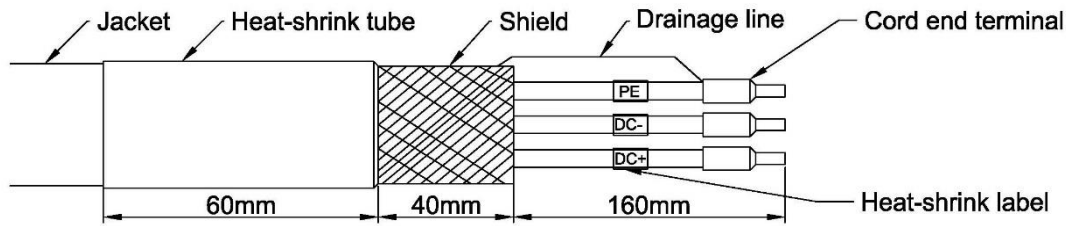
**Step 7: Connect PE wire with Shield**

Use the same method to make the remaining wire as the PE wire. Then crimp the PE wire into the Cord End Terminal along with the drainage line.



**Step 8: Check and Mark**

Check every wire and the connection between shield and PE wire, then label each wire.



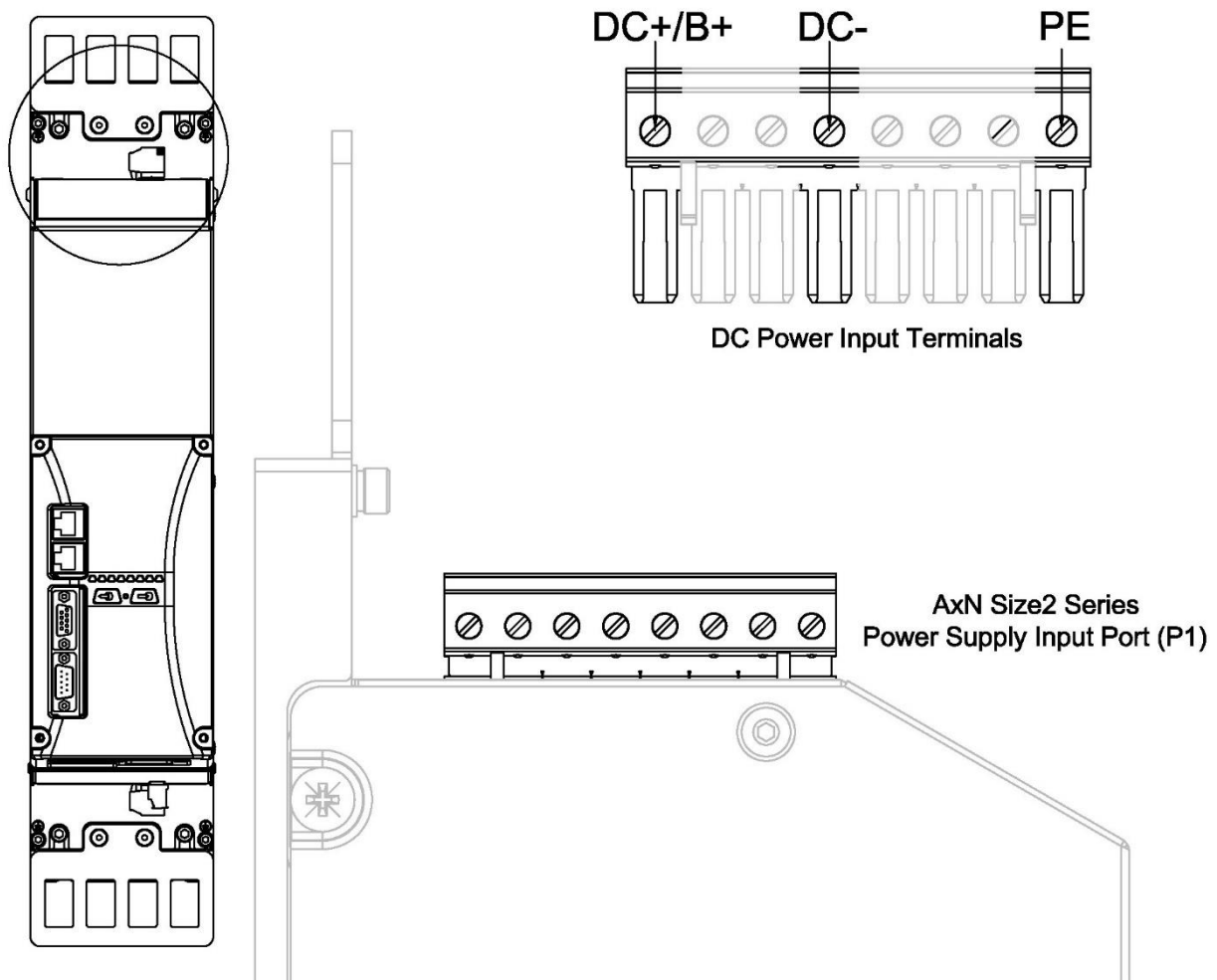
### 2.2.3 DC Power Supply Input Installation

#### Step 1: Check the Power Supply Type and Voltage

Make sure that the mains power supply is a DC power supply, and its voltage is 0 ~ 800 Vdc.

#### Step 2: Find out the DC Power Input Terminals

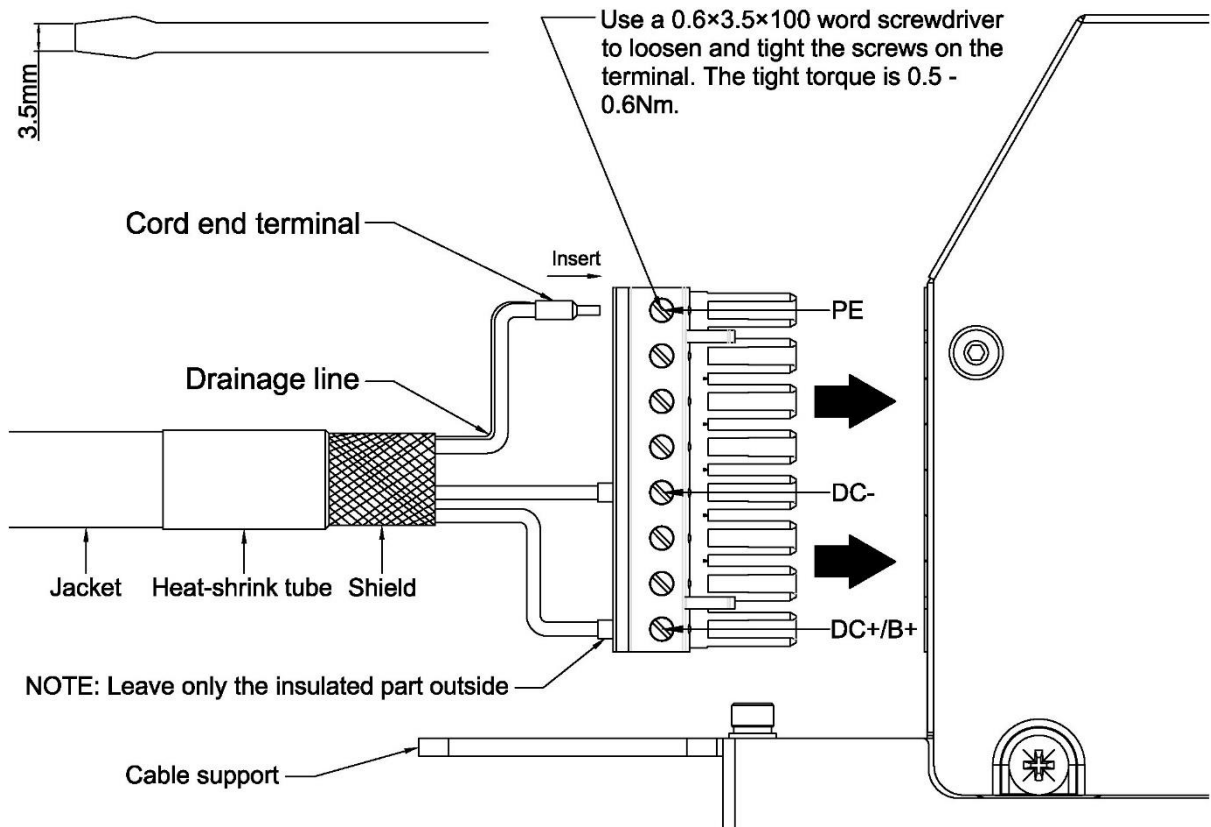
PE, DC+/B+ and DC-, these are the three terminals called DC Power Input Terminals. AxN Size2 Drive's DC Power Input Terminals are in the Power Supply Input Port (P1) which is on the top of the drive. Refer to the following figures for exact locations and terminal Assignment.



#### Step 3: Insert Wires into Corresponding Terminals

Use a 0.6 × 3.5 × 100mm Word Screwdriver to loosen the screws on PE, DC+/B+ and DC- Terminals which are in the drive's Power Supply Input Port (P1). Insert the Wires of the DC power supply cable into the corresponding terminals: PE to PE, DC+ to DC+/B+, and DC- to DC-.

**NOTE:** The metal part of the cord end terminal on the wire should be fully inserted into the corresponding terminals. Leave only the insulated part outside.

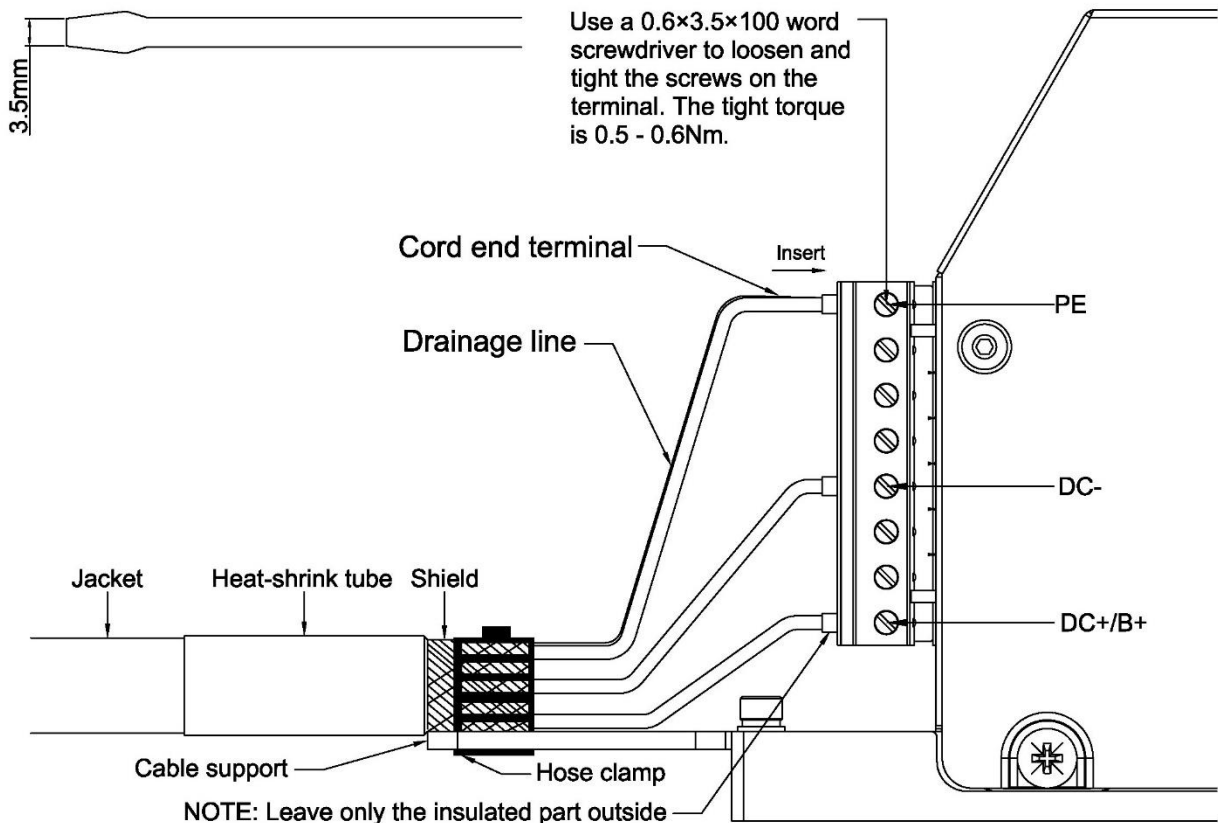


#### Step 4: Tight the Terminals

Use a 0.6 × 3.5 × 100mm Word Screwdriver to tight the screws on PE, DC- and DC+/B+ Terminals which are in the drive's Power Supply Input Port (P1). The nominal torque to tight these terminals is 0.5 ~ 0.6 Nm.

#### Step 5: Cable Fixing

Use a hose clamp to fix the cable on the cable support. Make sure that the cable shield has a large-area contact against the cable support, so that they can together be grounded through drive housing.



## 2.3 Brake Resistor

Dynamic braking (DB) helps bring the motor to a smooth and rapid stop when working with high inertia loads. As the drive lowers the frequency of a motor with high inertia connected, regeneration occurs. This can cause an overvoltage situation when the regenerative energy flows back into the DC bus capacitors. A brake resistor prevents these overvoltage faults.

AxN Series Drive has an internal brake resistor inside the drive. And it can also connect an external brake resistor (Recommended).

**WARNING: Do not operate AxN Drive without any brake resistor. Failure to comply may result in damage to braking circuit or drive.**

### 2.3.1 Internal Brake Resistor

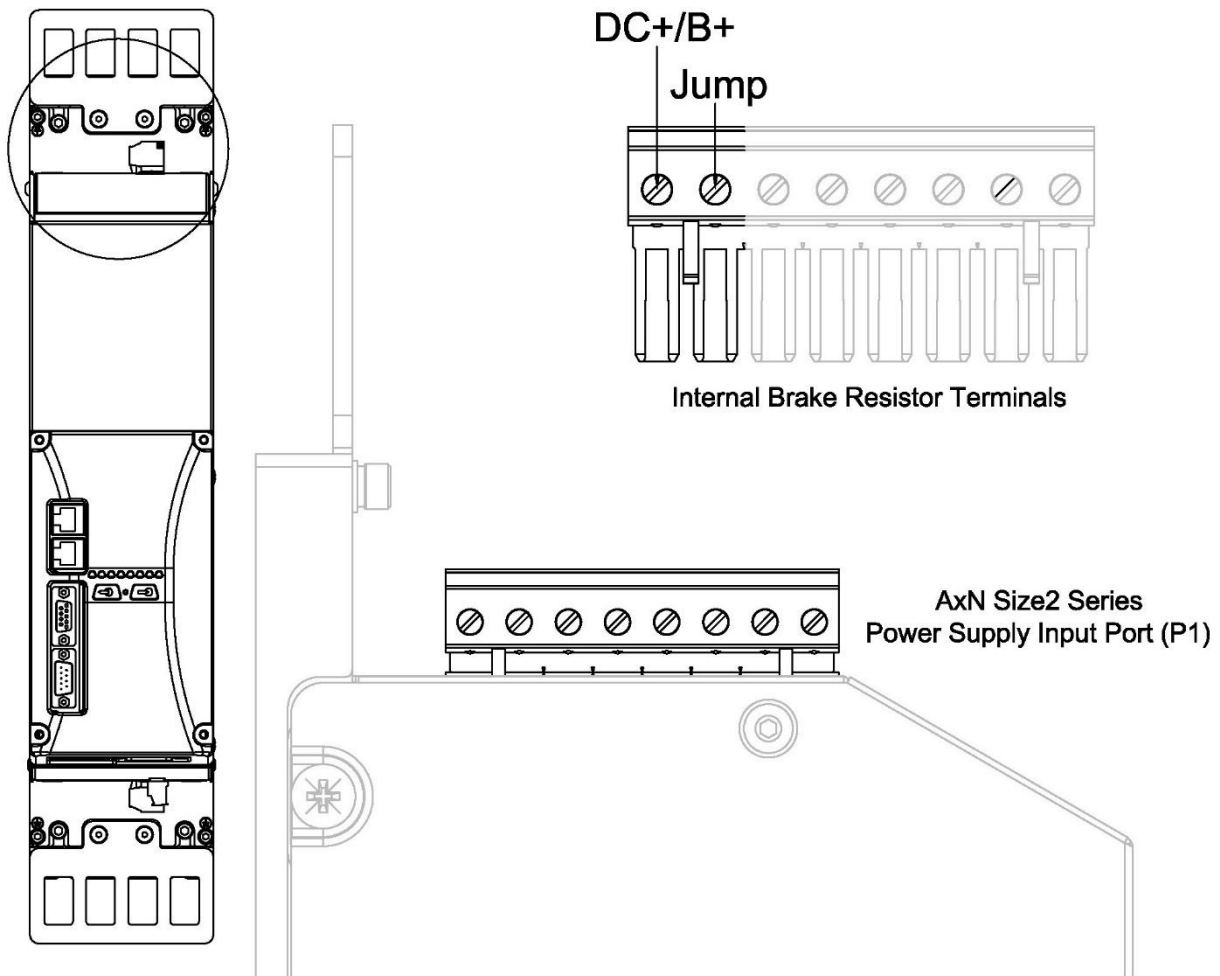
Every AxN Series Drive has an internal brake resistor. Regard to its properties, using internal brake resistor in real applications is **NOT** recommended. Refer to the following table for more details:

AxN Size2	Resistance ( $\Omega$ )	Power (W)
AxN 15.30.4	18	30

### 2.3.2 Internal Brake Resistor Installation

#### Step 1: Find out the Internal Brake Resistor Terminals

DC+/B+ and Jump, these are the two terminals called Internal Brake Resistor Terminals. AxN Size2 Drive's Internal Brake Resistor Terminals are in the Power Supply Input Port (P1) which is on the top of the drive. Refer to the following figures for exact locations and terminal Assignment.



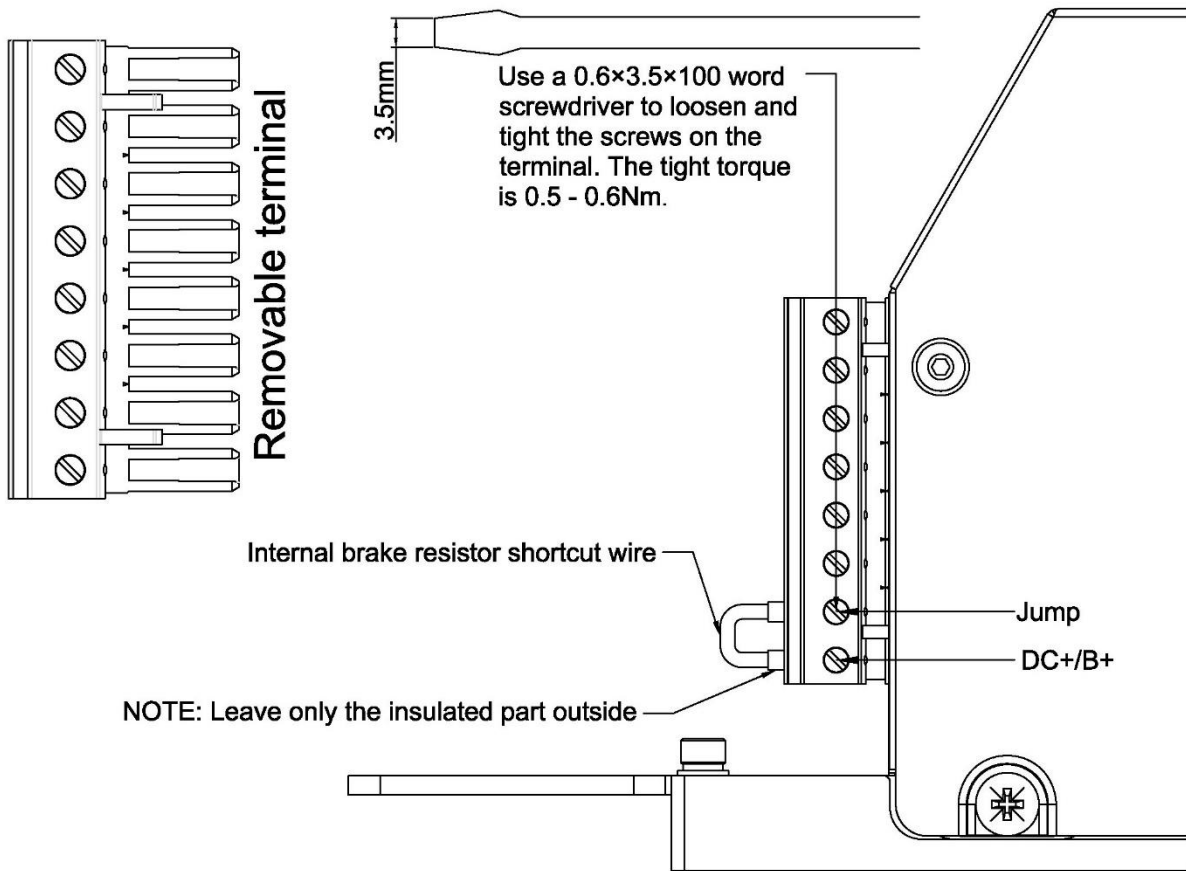
#### Step 2: Shortcut Jump and DC+/B+

Use a  $0.6 \times 3.5 \times 100$ mm Word Screwdriver to loosen the screws on DC+/B+ and Jump Terminals which are in the drive's Power Supply Input Port (P1). Then, use a wire to shortcut DC+/B+ and Jump.

**NOTE:** The metal part of the shortcut wire should be fully inserted into corresponding terminals. Leave only the insulated part outside.

### Step 3: Tight the Terminals

Use a 0.6 × 3.5 × 100mm Word Screwdriver to tight the screws on DC+/B+ and Jump Terminals .The nominal torque to tight these terminals is 0.5 ~ 0.6 Nm.



### 2.3.3 External Brake Resistor

The External Brake Resistor must be sized properly in order to dissipate the required power to decelerate the load in desired time. There are three important factors: **Resistance**, **Maximum Absorb Energy** and **Maximum Power**.

#### Resistance

The selection of the external brake resistor resistance must be proper. If the resistance is smaller than Minimum Resistance, the IGBT might be damaged by the overload brake current. And if the resistance is bigger than Maximum Resistance, the brake procedure might be abort because of the high DC-Bus Voltage (over 900V).

Refer to following table to check the Minimum and Maximum Resistance of external brake resistor which is suitable for a particular drive:

AxN Size2	Minimum Resistance (Ω)	Maximum Resistance (Ω)
AxN 15.30.4	18	18.4

#### Maximum Absorb Energy and Maximum Power

Maximum Absorb Energy and Maximum Power are two important factors to evaluate the energy absorption ability of the brake resistor. The values of these two factors may differ from one application to another, but the basic idea is always the same, to dissipate the required power to decelerate the load in desired time.

**NOTE: Brake resistor wires' insulation grade must be higher than 1000Vac and 3000Vdc.**

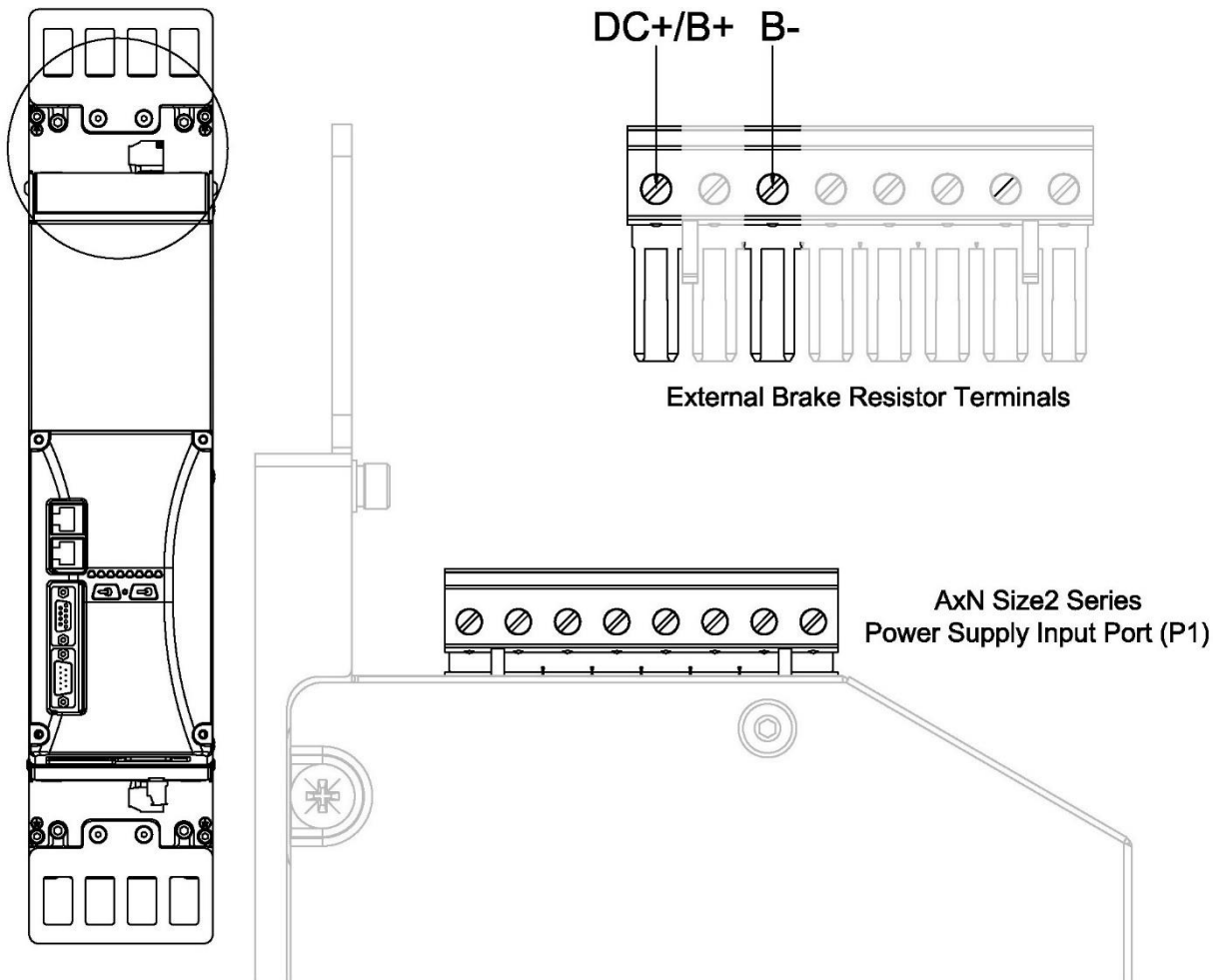
### 2.3.4 External Brake Resistor Installation

#### Step 1: Check the Brake Resistor

Check the external brake resistor's resistance, maximum absorb energy and maximum power. Make sure that the brake resistor is suitable for AxN Size2 Drive and real application.

#### Step2: Find out the External Brake Resistor Terminals

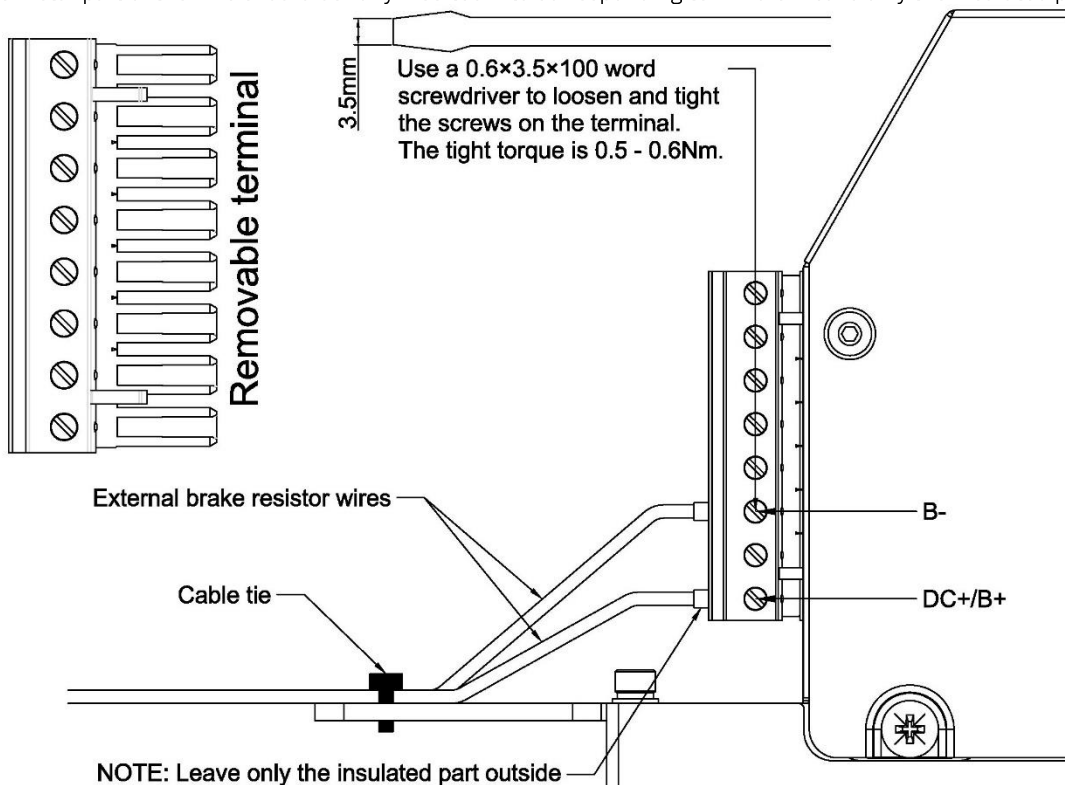
DC+/B+ and B-, these are the two terminals called External Brake Resistor Terminals. AxN Size2 Drive's Internal Brake Resistor Terminals are in the Power Supply Input Port (P1) which is on the top of the drive. Refer to the following figures for exact locations and terminal Assignment.



**Step3: Insert Wires into Corresponding Terminals**

Use a 0.6 × 3.5 ×100mm Word Screwdriver to loosen the screws on DC+/B+ and B- Terminals which are in the drive's Power Supply Input Port (P1). Insert the two wires of the external brake resistor separately into these two terminals.

**NOTE:** The metal part of the wire should be fully inserted into corresponding terminals. Leave only the insulated part outside.





**Step 4: Tight the Terminals**

Use a 0.6 × 3.5 × 100mm Word Screwdriver to tight the screws on DC+/B+ and B- Terminals .The tight torque these terminals is 0.5 ~ 0.6 Nm.

**Step 5: Wire Fixing**

Use a cable tie to fix the wires on the cable support of AxN Size2 drive.

**Step 6: Resistance Measurement**

Use an avometer to measure the resistance between DC+/B+ and B-. Compare it with the resistance of the external resistor, if they are the same, then the external resistor has been correctly installed.

**WARNING: DO NOT BYPASS THIS STEP! This step can prevent malfunctions like wires shortcut, brake resistor fault and so on.**

**2.4 Motor Power Output**

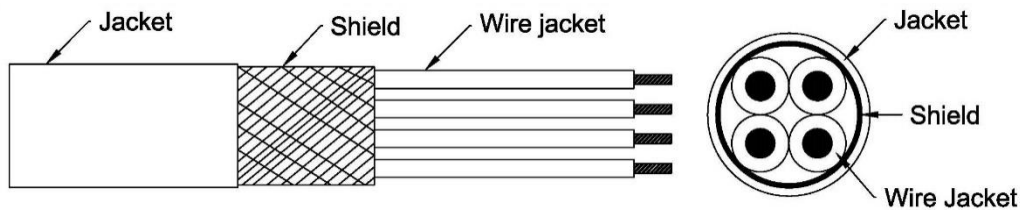
**2.4.1 Motor Power Output Cable Fabrication**

Motor Power Output Cable has two sides: drive side and motor side. This manual only mention the fabrication of drive side. And the motor side fabrication differs from different motors. If the motor is manufactured by Phase Motion Control, our Prefabricated Motor Power Output Cables are recommended. Refer to: [Appendix: Accessories — 5.1 Prefabricated Motor Power Output Cable](#) for more details.

**Step 1: Cable Selection**

AxN Size2 drive must use a 4 wire cable with shield as its motor power output cable. Refer to the table below to select the appropriate cable:

AxN Size2	Current (A rms)	Recommended Gauge (mm <sup>2</sup> )	Recommended Gauge (AWG)
AxN 15.30.4	15	4.17	11

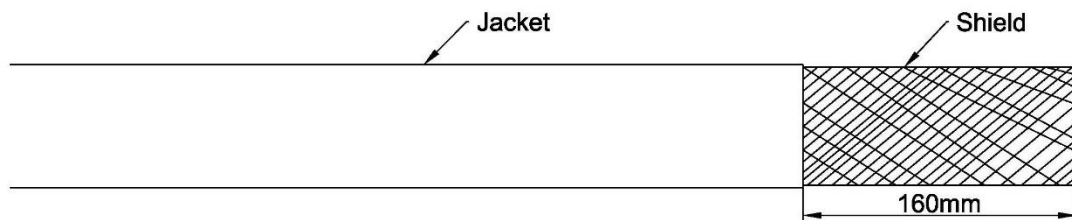


**Step 2: Cable Length Measurement**

Measure the distance between drive and motor then determine the suitable cable length.

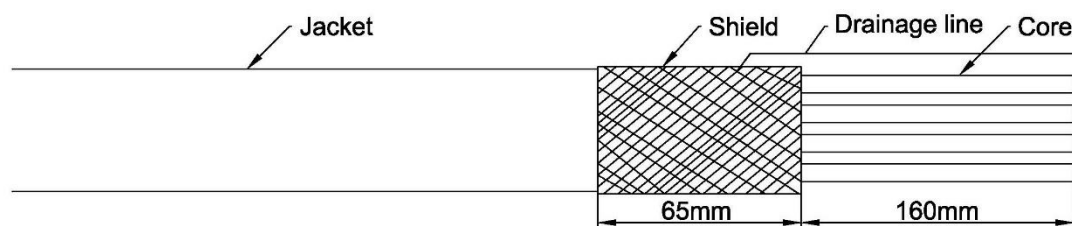
**Step 3: Strip Cable Outside Jacket**

Strip the outside jacket of the DC power supply cable for 160mm and reveal the inside shield.



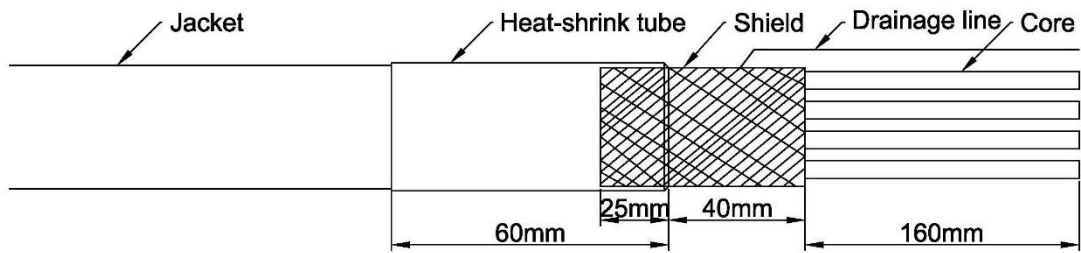
**Step 4: Make Grounding Shield**

Leave 65mm Shield as the grounding shield and turn it to the outside of the jacket. Then, weld a wire on the shield as the drainage line.



**Step 5: Fix the Grounding Shield**

Use a 60mm heat-shrink tube to fix the grounding shield and leave 40mm shield outside.



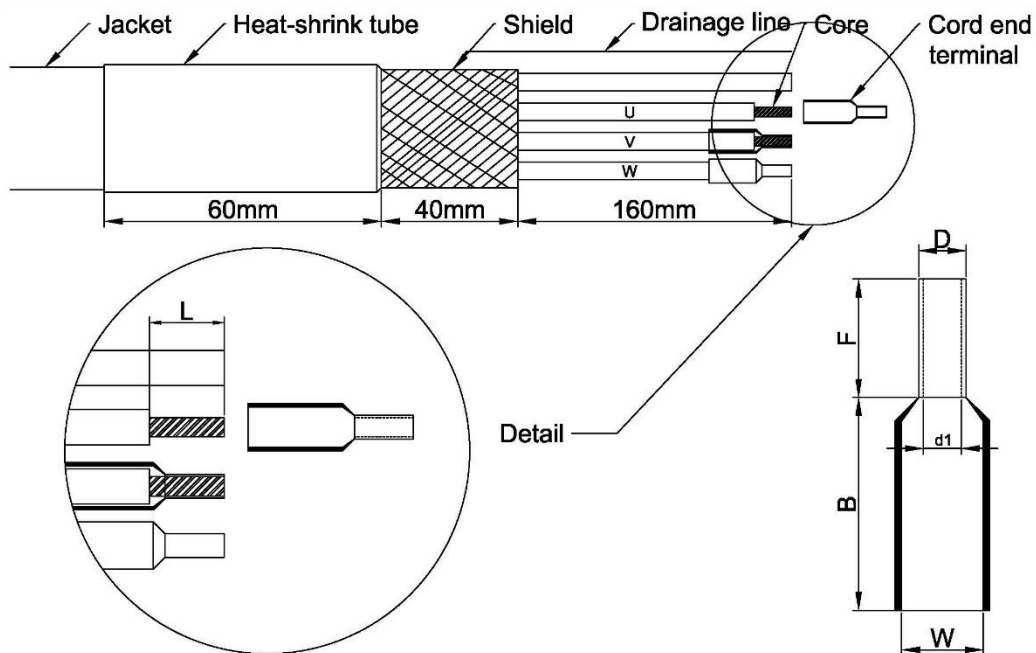
**Step 6: Make the Phase Wires**

Choose 3 wires of the cable as phase wires: U, V, W. Crimping pre-insulated Terminals on the wires will enhance the connection stability and simplicity between the cable and drive. AxN Size2 series drives are recommended to use the E Series Cord End Terminals manufactured by KST. Refer to the following table to select the appropriate terminal:

AxN Size2	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 15.30.4	E4012	12	4.5	7.4	3.2	2.8

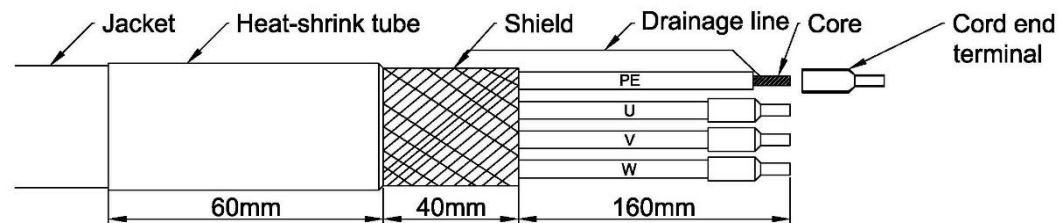
Strip the wires for L mm ( $F \leq L \leq F+B$ ), the recommend strip length is  $F+2$  mm, refer to the following table to select an appropriate length:

AxN Size2	Strip Length (mm)	Recommended Strip Length (mm)
AxN 15.30.4	12 ~ 19.4	14



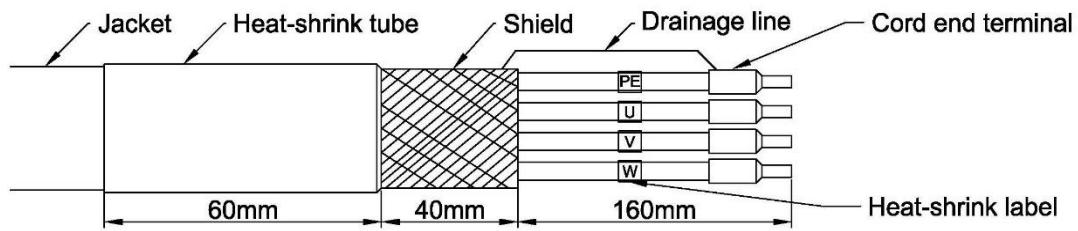
**Step 7: Connect the PE wire with Shield**

Use the same method to make the remaining wire as the PE wire. Then crimp the PE wire into the Cord End Terminal along with the drainage line.



**Step 8: Check and Mark**

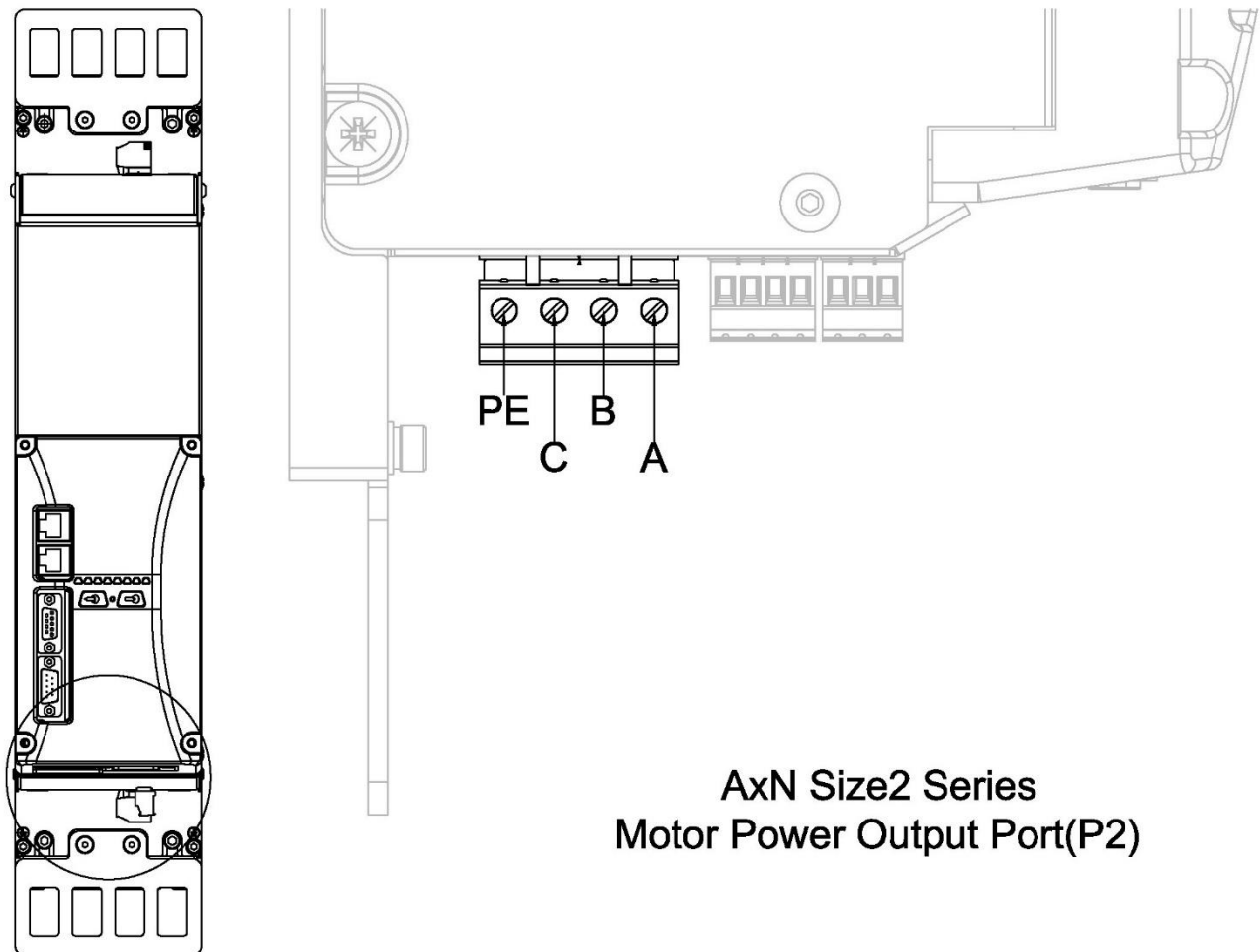
Check every wire and the connection between shield and PE wire, then label each wire.



## 2.4.2 Motor Power Output Installation

### Step 1: Find out the Motor Power Output Terminals

PE, A, B and C, these are the four terminals called Motor Power Output Terminals. AxN Size2 Drive's Motor Power Output Terminals are in the Motor Power Output Port (P2) which is on the bottom of the drive. Refer to the following figures for exact locations and terminal Assignment.



**AxN Size2 Series  
Motor Power Output Port(P2)**

### Step 2: Insert Wires into Corresponding Terminals

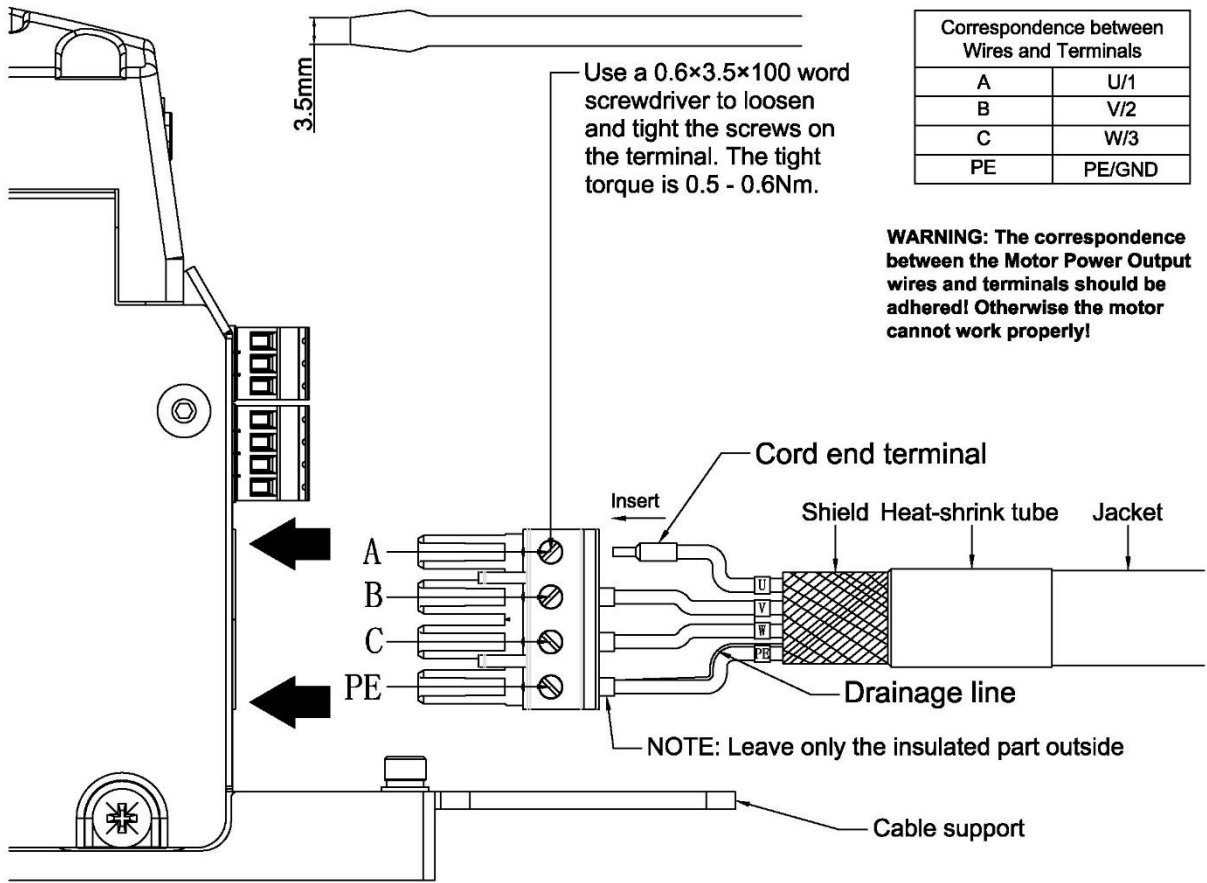
Use a 0.6 × 3.5 × 100mm Word Screwdriver to loosen the screws on A, B, C and either of PE Terminals which are in the drive's Motor Power Output Port (P2). Insert the Wires of the motor power output cable into the corresponding terminals: U to A, V to B, W to C and PE to PE.

**WARNING:** The correspondence between the Motor Power Output wires and terminals should be adhered! Otherwise the motor cannot work properly!

**NOTE:** The metal part of the cord end terminal on the wire should be fully inserted into the corresponding terminals. Leave only the insulated part outside.

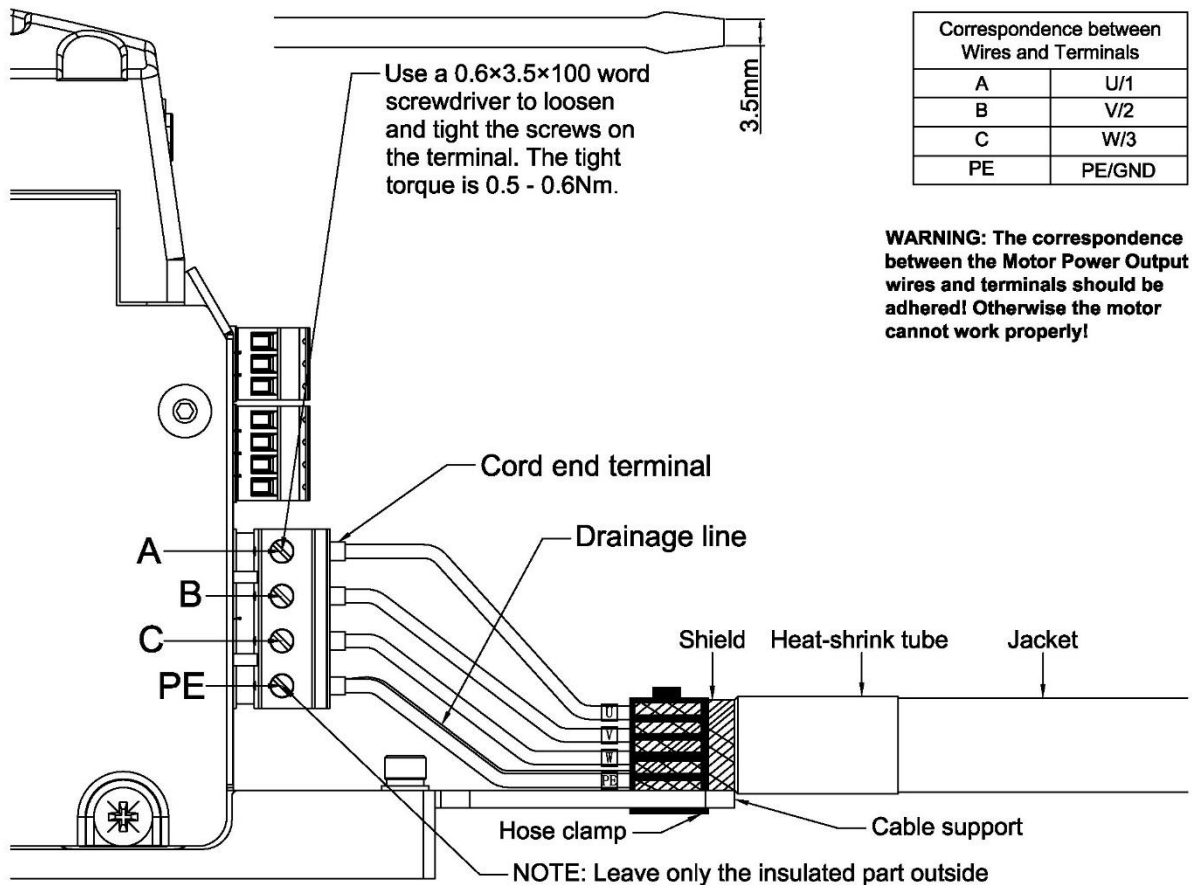
### Step 3: Tight the Terminals

Use a 0.6 × 3.5 × 100mm Word Screwdriver to tight the screws on A, B, C and PE Terminals. The nominal torque to tight these terminals is 0.5 ~ 0.6 Nm.



#### Step 4: Cable Fixing

Use a hose clamp to fix the cable on the cable support. Make sure that the cable shield has a large-area contact against the cable support, so that they can together be grounded through drive housing.



## 3. CONTROL CIRCUIT WIRING

### 3.1 Auxiliary Power Supply (AUX\_Power)

#### 3.1.1 Auxiliary Power Supply Requirement

Main Supply	AxN Size2
Voltage	24V
Type	DC power
Fluctuation of Voltage	±15% (22.8 ~ 25.2V)
Nominal Power	48W
Nominal Current	2A

#### 3.1.2 Auxiliary Power Supply Cable Fabrication

This manual only mention the fabrication of auxiliary power supply port on AxN drive side.

##### Step 1: Cable Selection

Select a 1.6 mm<sup>2</sup> (15 AWG) two wires cable as drive's auxiliary power supply cable.

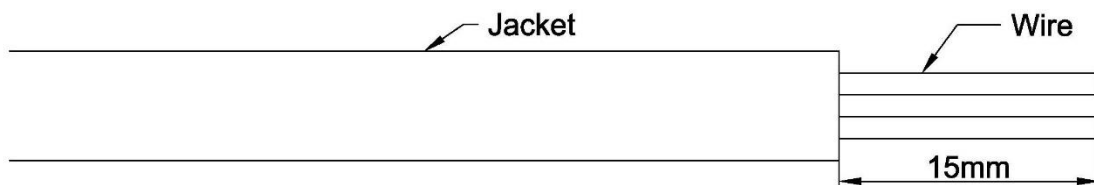
##### Step 2: Cable Length Measurement

Measure the distance between drive and power supply then determine the suitable cable length.

**NOTE:** the distance between two devices should comply with the Installation Space Regulation of AxN Size2 Drive (Refer to [1.5 Installation Spacing](#)).

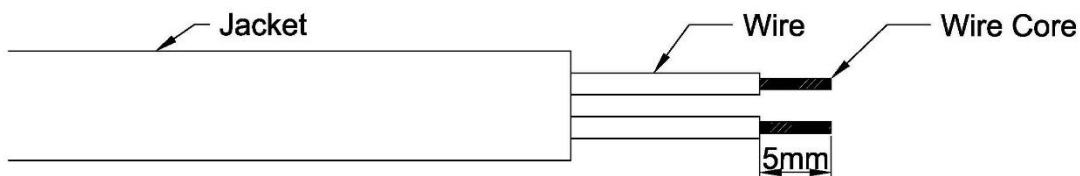
##### Step 3: Strip Cable Outside Jacket

Strip the outside jacket of the auxiliary power supply cable for 15mm and reveal the wires.



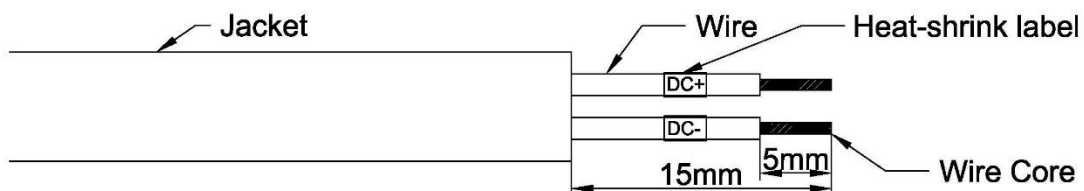
##### Step 4: Make DC+ Wire and DC- Wire

Mark one wire as DC+ and another as DC-, then strip wires' jacket for 5mm.



##### Step 5: Check and Label

Check every wire's conductivity and then label them.



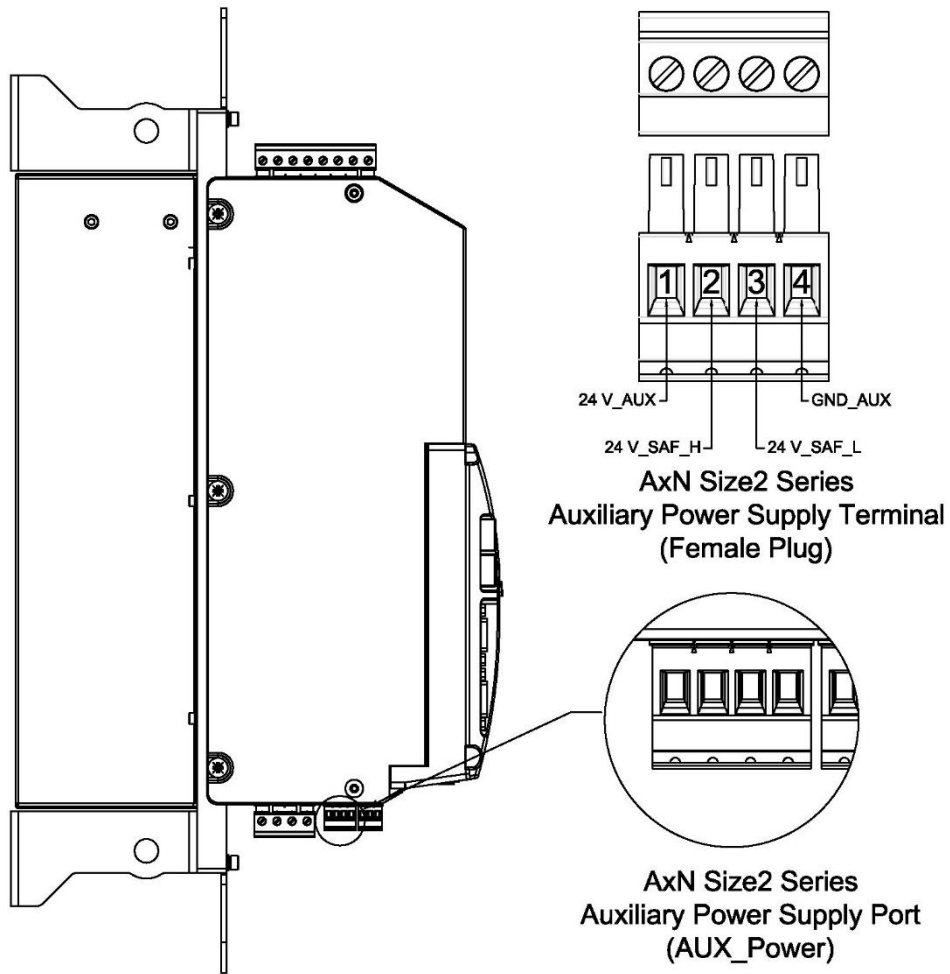
#### 3.1.3 Auxiliary Power Supply Installation

##### Step 1: Check Power Supply Voltage and Power

Make sure that the auxiliary power supply's voltage is 22.8 ~ 25.2Vdc, and also can provide 2A, 48W power.

##### Step 2: Find out the Auxiliary Power Supply Port (AUX\_Power)

AxN Series Drive's Auxiliary Power Supply Port (Male Plug, 4Pin) is on the right bottom of the drive. And a corresponding Auxiliary Power Supply Terminal (Female Plug, 4Pin) is provided in the accessories. Refer to the following figure for exact location.

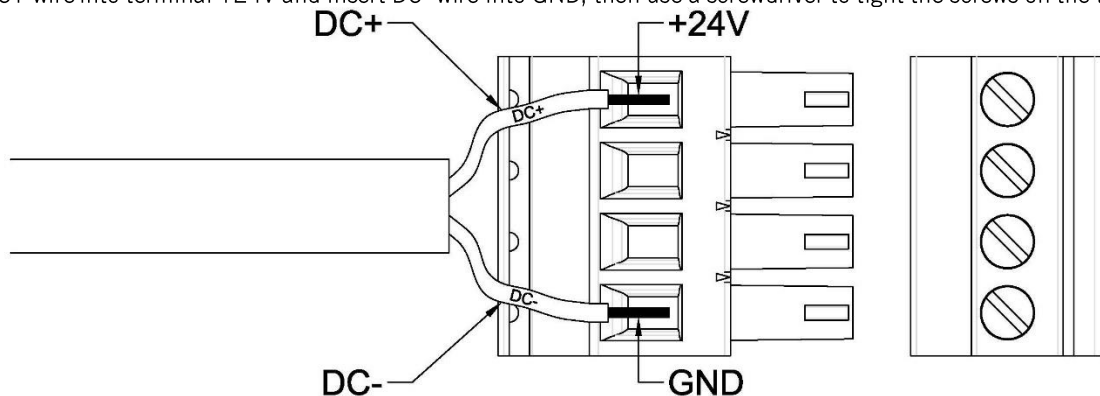


### Terminal Configuration

Pin	Name	Function	Description
1	+24V	Control circuit power supply	24Vdc Positive
2	SH	STO high-side power bridge power supply	24Vdc Positive (3.2 STO Function)
3	SL	STO low-side power bridge power supply	24Vdc Positive (3.2 STO Function)
4	GND	Reference ground	24Vdc Negative

#### Step 3: Connect the Cable to Terminal

Insert DC+ wire into terminal +24V and insert DC- wire into GND, then use a screwdriver to tight the screws on the terminals.



#### Step 4: Insert Terminal into Port

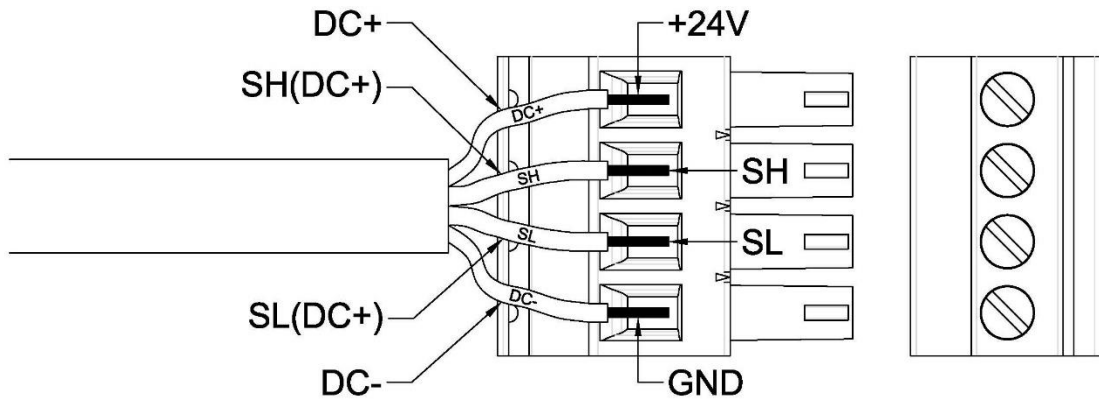
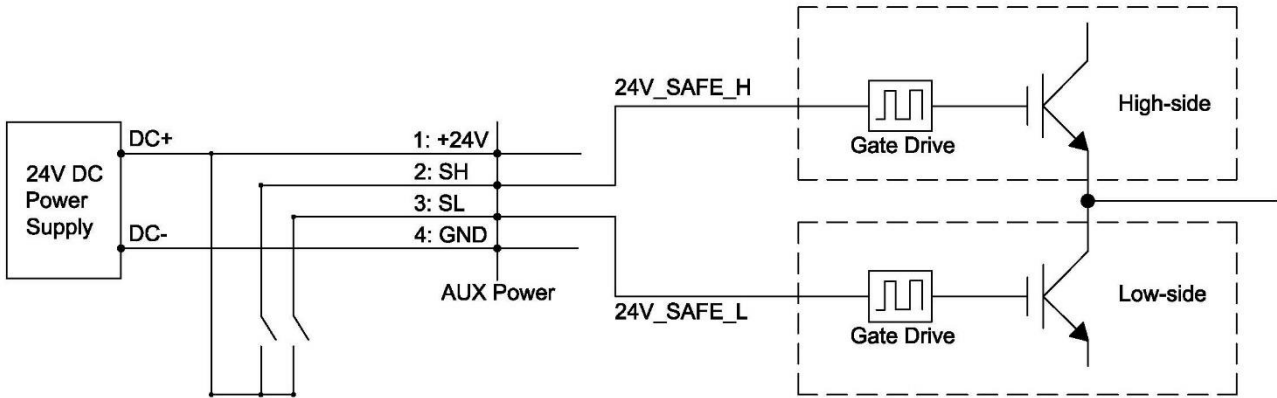
Insert the terminal along with the cable into Auxiliary Power Supply Port (AUX\_Power).

## 3.2 STO Function

All the AxN Series Drives meet the SIL3 requirements for the safety function: Safe Torque Off (STO). There are two corresponding pins on the Auxiliary Power Supply Port: SH and SL. You can enable or disable the STO Function based on different applications with proper connections.

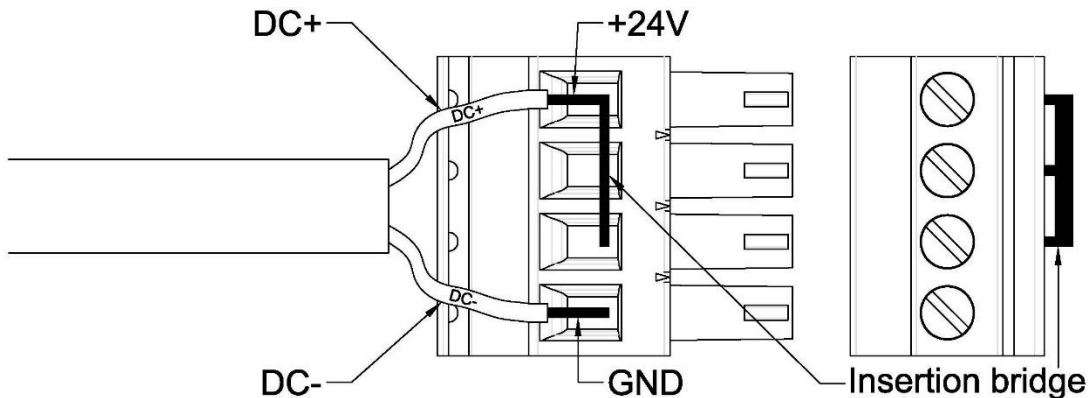
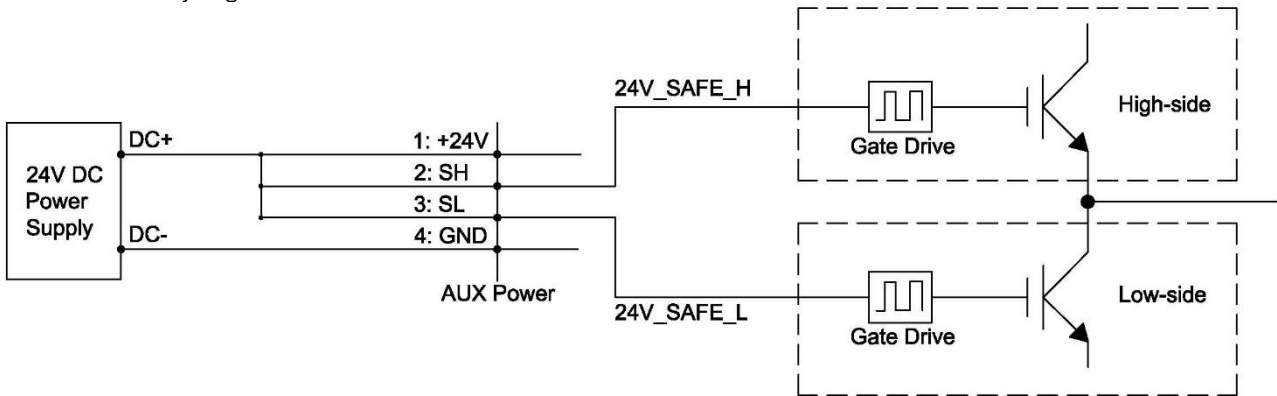
**Enable**

Apply 24 (±15%) Vdc power supply on the Pin 2: SH and Pin 3: SL with proper control system to enable the STO Function.



**Disable**

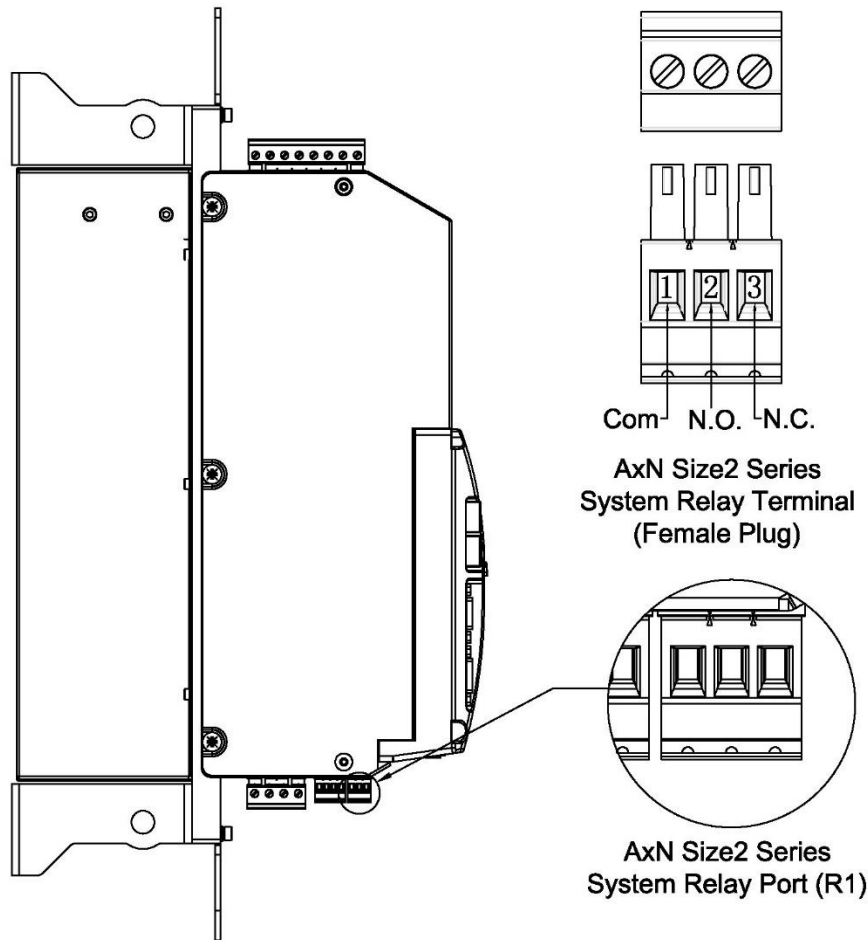
Use an insertion bridge to short cut Pin 1: +24V, Pin2: SH and Pin 3: SL to disable the STO function. The insertion bridge is in the accessory bag.



### 3.3 System Relay (R1)

#### Port Location

AxN Size2 Drive's System Relay Port (Male Plug, 3Pin) is on the right bottom of the drive. And a corresponding System Relay Terminal (Female Plug, 3Pin) is provided in the accessories. Refer to the following figures for exact location.



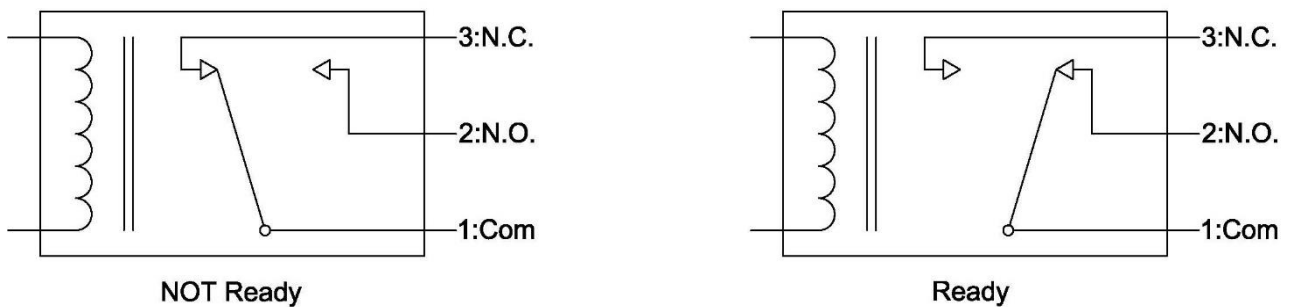
#### Terminal Configuration

Pin	Name	Function	Description
1	Com	Common relay contact	To be used as drive system OK signal
2	N.O.	Relay normally open contact	
3	N.C.	Relay normally closed contact	

#### Diagram

AxN Series Drive use a relay to indicate the status. When Drive is power off or system is not ready, the circuit is connected between N.C. (Normally Closed) and Com. In the meantime, the circuit is disconnect between N.O. (Normally Open) and Com.

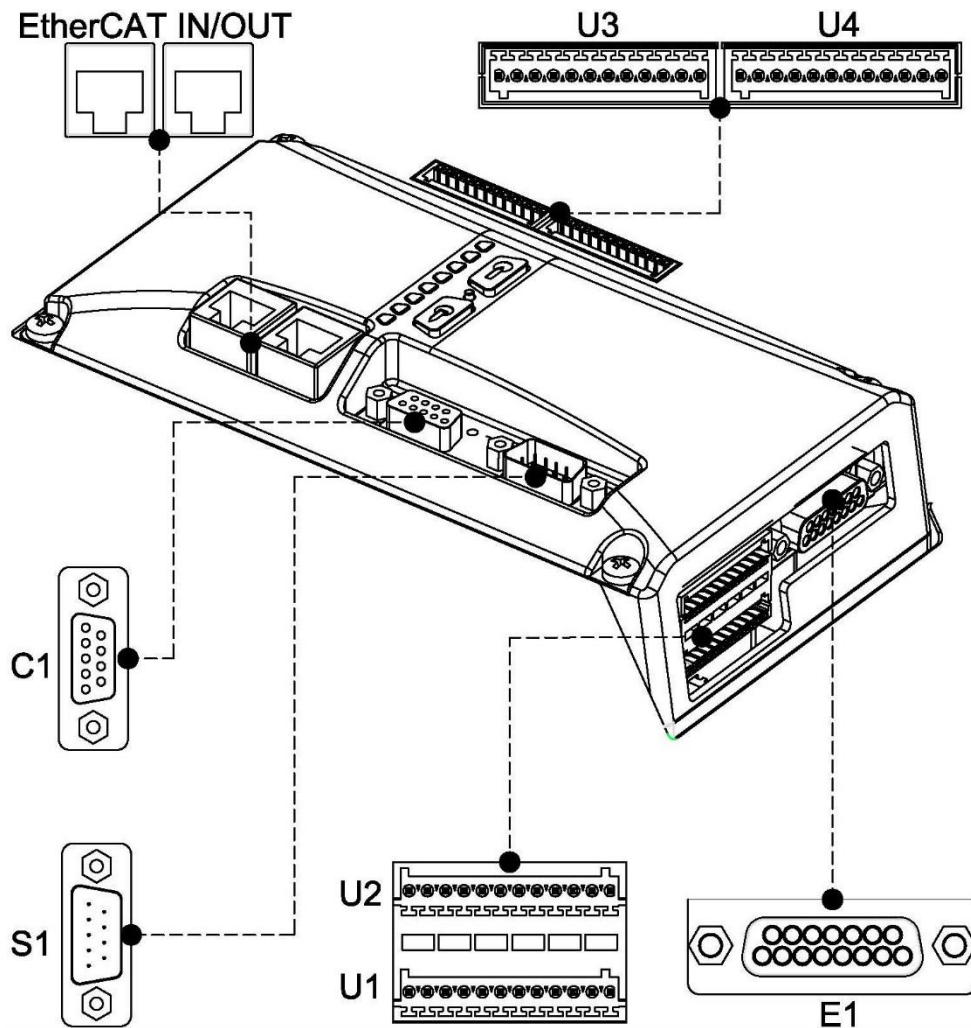
When the drive is ready, N.O. connects Com and N.C. disconnects Com, illustrated as below.





## 4. COMMUNICATION PORT

### 4.1 Overview of Communication Port Panel



Name	Function	Description
E1	Encoder Connector	SinCos, EnDat, Digital Incremental with Hall, Resolver and Hiperface
U1/U2	User Connectors	4 Analog Inputs, 2 Analog Outputs; 8 Digital Inputs, 4 Digital Outputs
S1	Serial Bus Connector	RS232, RS422 and RS485 / Secondary CAN
C1	CAN Connector	Main CAN / Auxiliary Encoder
EtherCAT IN/OUT	EtherCAT Connector	RJ45 100Base-TX
U3/U4	Insolated User Connectors (Optional)	Insolated: 3 Analog Inputs, 2 Analog Outputs; 8 Digital Inputs, 2 Digital Outputs. Optional

### 4.2 Main Encoder Port (E1)

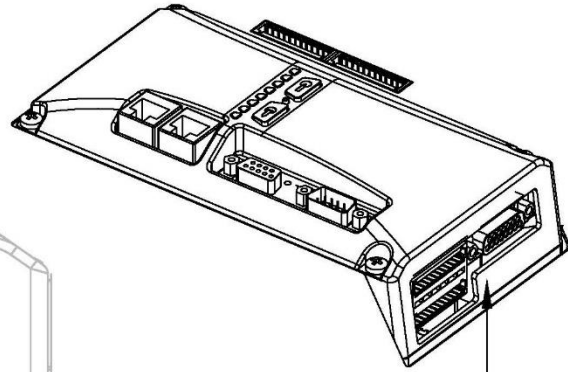
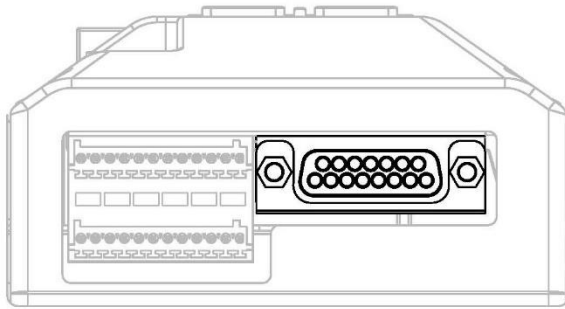
AxN Series Drive's Main Encoder Port is used to connect motor's position sensor (encoder). AxN Series Drive can support 5 different kinds of position sensor: SinCos Encoder, EnDat Encoder, Digital Incremental Encoder with Hall, Resolver and Hiperface Encoder. Different position sensor has different pin assignment, refer to correspond section for more details.

If the motor is manufactured by Phase Motion Control, our Prefabricated Encoder Cables are recommended. Refer to: Appendix: Prefabricated Cable—5.2 Encoder Cable for more details.

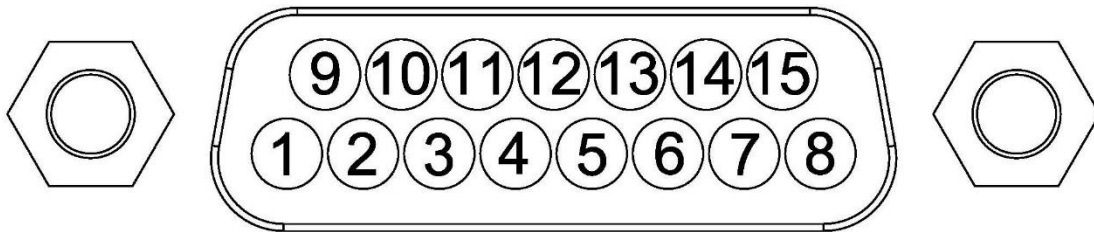
#### Location

AxN Series Drive's Main Encoder Port (Female Plug, 15 Pin D-Sub) is on the right bottom of the Communication Port Panel. Refer to the following figures for exact location.

## AxN Series Drive Main Encoder Port

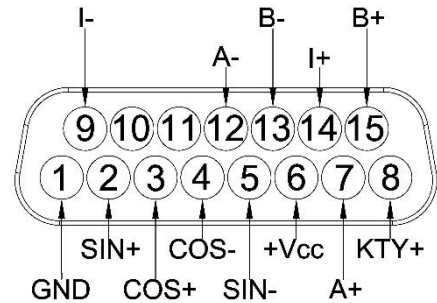


Bottom of Communication Port Panel



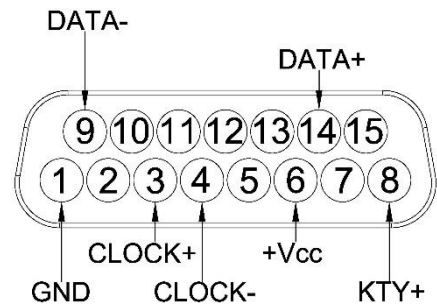
### 4.2.1 SinCos Encoder

Pin	Name	Function	Signal Description
1	GND	Supply ground	Encoder ground
2	SIN+	Encoder absolute channel	1 Vpp differential
3	COS+	Encoder absolute channel	1 Vpp differential
4	COS-	Encoder absolute channel	1 Vpp differential
5	SIN-	Encoder absolute channel	1 Vpp differential
6	+Vcc	Encoder supply, 5Vdc	Positive supply voltage
7	A+	Encoder incremental channel	1 Vpp differential
8	KTY+	Thermal sensor positive	
9	I-	Encoder index	1 Vpp differential
10	--	--	--
11	--	--	--
12	A-	Encoder incremental channel	1 Vpp differential
13	B-	Encoder incremental channel	1 Vpp differential
14	I+	Encoder index	1 Vpp differential
15	B+	Encoder Incremental channel	1 Vpp differential



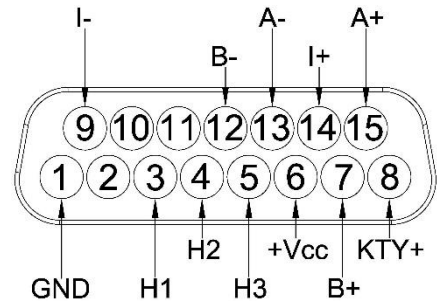
### 4.2.2 EnDat Encoder

Pin	Name	Function	Signal Description
1	GND	Supply ground	Encoder ground
2	--	--	--
3	CLOCK+	EnDat clock	TTL
4	CLOCK-	EnDat clock	TTL
5	--	--	--
6	+Vcc	Encoder supply, 8Vdc	Positive supply voltage
7	--	--	--
8	KTY+	Thermal sensor positive	
9	DATA-	EnDat data	TTL
10	--	--	--
11	--	--	--
12	--	--	--
13	--	--	--
14	DATA+	EnDat data	TTL
15	--	--	--



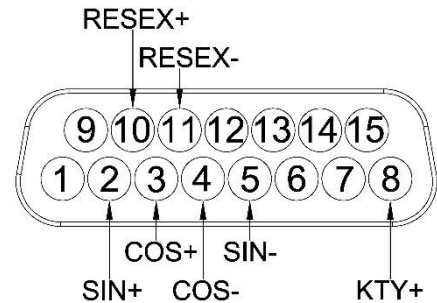
### 4.2.3 Digital Incremental Encoder with Hall

Pin	Name	Function	Signal Description
1	GND	Supply ground	Encoder ground
2	--	--	--
3	H1	Hall sensor	TTL
4	H2	Hall sensor	TTL
5	H3	Hall sensor	TTL
6	+Vcc	Encoder supply, 8Vdc	Positive supply voltage
7	B+	Encoder incremental channel	TTL
8	KTY+	Thermal sensor positive	
9	I-	Encoder index	TTL
10	--	--	--
11	--	--	--
12	B-	Encoder incremental channel	TTL
13	A-	Encoder incremental channel	TTL
14	I+	Encoder index	TTL
15	A+	Encoder incremental channel	TTL



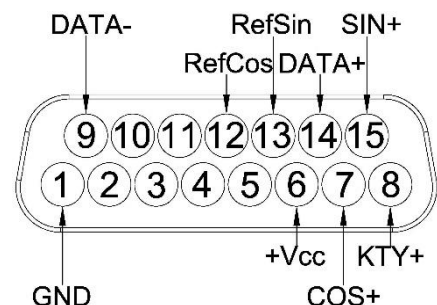
### 4.2.4 Resolver

Pin	Name	Function	Signal Description
1	--	--	--
2	SIN+	Absolute channel	Differential signal
3	COS+	Absolute channel	Differential signal
4	COS-	Absolute channel	Differential signal
5	SIN-	Absolute channel	Differential signal
6	--	--	--
7	--	--	--
8	KTY+	Thermal sensor positive	
9	--	--	--
10	RESEX+	Resolver energising +	8kHz sinusoidal wave
11	RESEX-	Resolver energising -	8kHz sinusoidal wave
12	--	--	--
13	--	--	--
14	--	--	--
15	--	--	--



### 4.2.5 Hiperface Encoder

Pin	Name	Function	Signal Description
1	GND	Supply ground	Encoder ground
2	--	--	--
3	--	--	--
4	--	--	--
5	--	--	--
6	+Vcc	Encoder supply, 8Vdc	Positive supply voltage
7	COS+	Process data channel	TTL
8	KTY+	Thermal sensor positive	
9	DATA-	RS-485 parameter channel	TTL
10	--	--	--
11	--	--	--
12	COS-	Process data channel	TTL
13	SIN-	Process data channel	TTL
14	DATA+	RS-485 parameter channel	TTL
15	SIN+	Process data channel	TTL

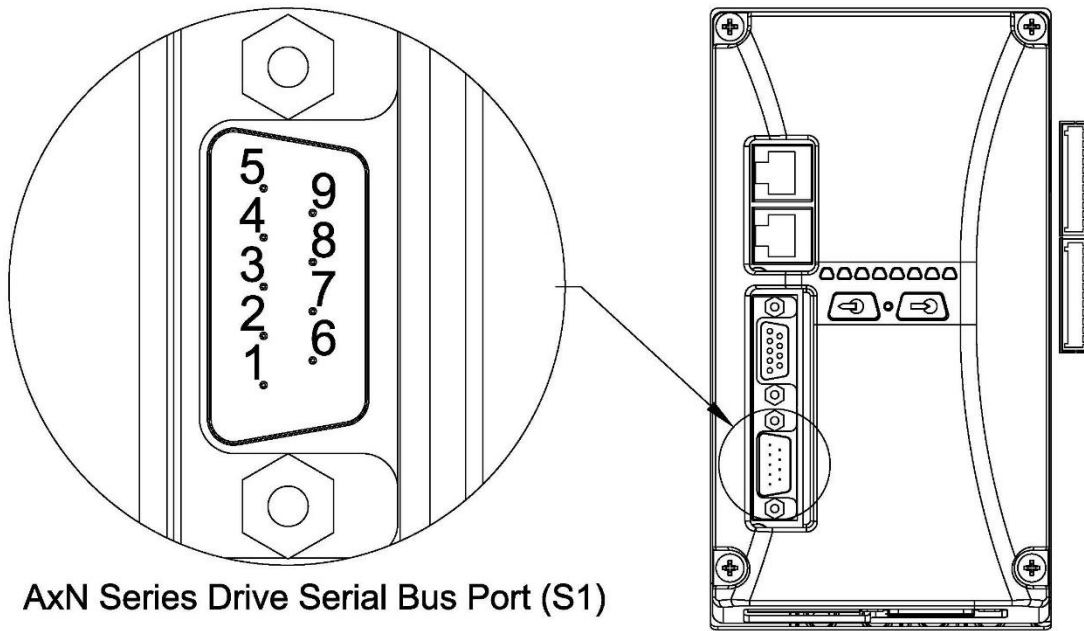


## 4.3 S1 - Serial Bus Port

AxN Series Drive's Serial Bus Port (S1) supports RS-232, RS-422, RS-485 and CAN protocol. But only one communication interface can be used at a time.

### Location

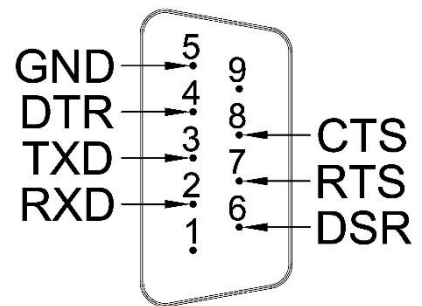
AxN Series Drive's Serial Bus Port (Male Plug, 9 Pin D-Sub) is on the downside of drive's communication port panel. Refer to the following figures for exact location.



### 4.3.1 RS-232

#### Pin Assignment

Pin	Standard RS-232	AxN RS-232	Function
1	DCD	--	Data Carrier Detect
2	RXD	RXD	Received Data
3	TXD	TXD	Transmitted Data
4	DTR	DTR	Data Terminal Ready
5	GND	GND	Common Ground
6	DSR	DSR	Data Set Ready
7	RTS	RTS	Request To Send
8	CTS	CTS	Clear To Send
9	RI	--	Ring Indicator



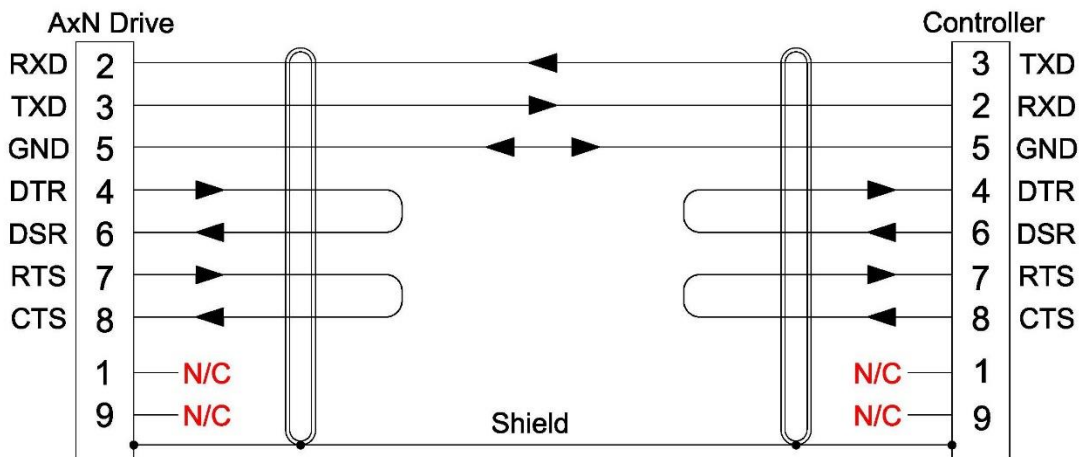
#### Notes:

- RS-232 devices may be classified as Data Terminal Equipment (DTE) or Data Communication Equipment (DCE); this defines at each device which wires will be sending and receiving each signal. AxN Series Drive is a Data Communication Equipment (DCE), and a controller or a computer is a Data Terminal Equipment (DTE).
- The signal voltage is  $\pm 12V$ , and the max current of DTR (Pin4) is 100mA.

#### 4.3.1.1 Minimal "3-wire" Connection

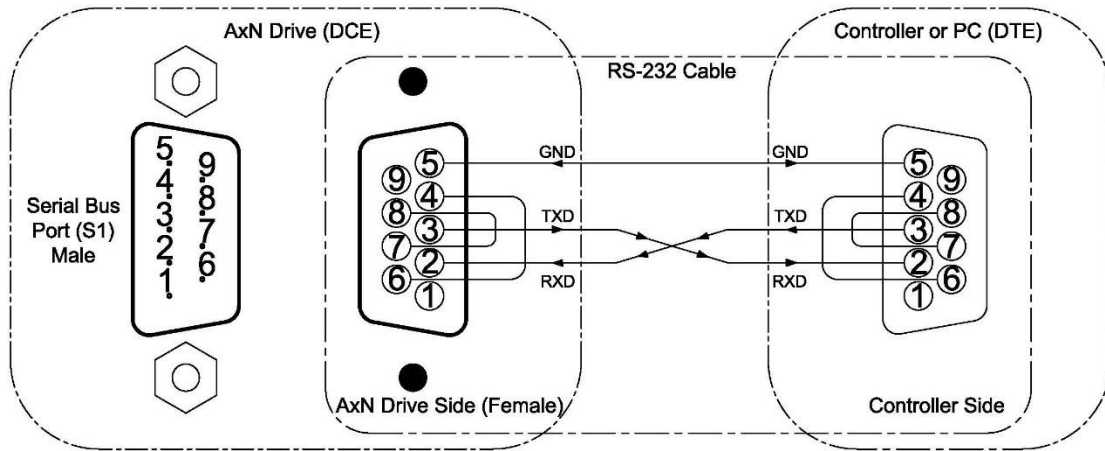
A minimal "3-wire" RS-232 connection consisting only of transmit data, receive data, and ground, is commonly used when the full facilities of RS-232 are not required. And it also the minimal connection requirement of Cockpit communication with AxN Series Drive.

#### Connection table



- 1) N/C—No Connection;
- 2) Connector back shell shielded 360° (Both ends);
- 3) ● means that the shield or cable should connect to connectors.

**Connection diagram**

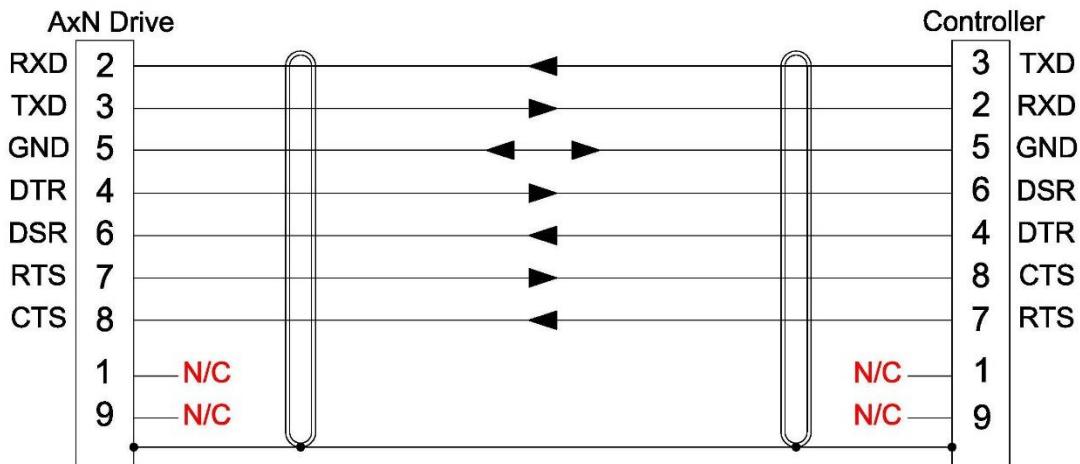


**4.3.1.2 Maximal "7-wire" Connection**

When the controller has a full facilities of RS-232, "7-wire" connection is the maximal connection which AxN series drive can support.

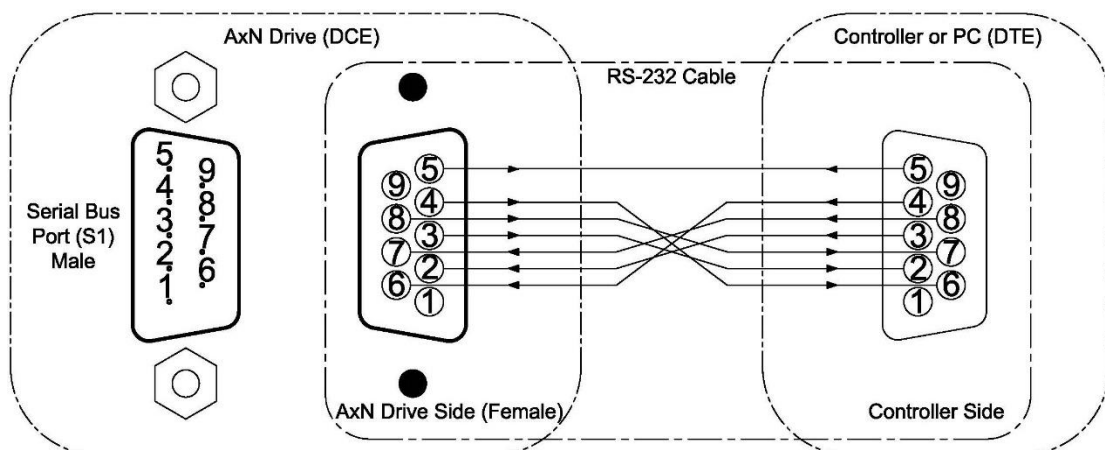
**NOTE:** Do **NOT** use "9-wire" connection, AxN series drive do not support DCD and RI function.

**Connection table**



- 1) N/C—No Connection;
- 2) Connector back shell shielded 360° (Both ends);
- 3) ● means that the shield or cable should connect to connectors.

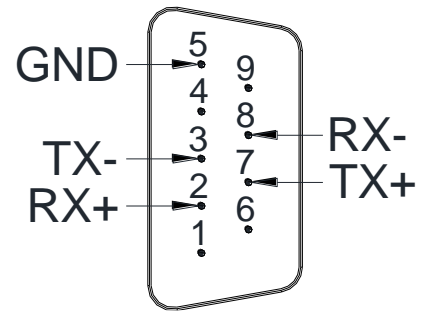
**Connection diagram**



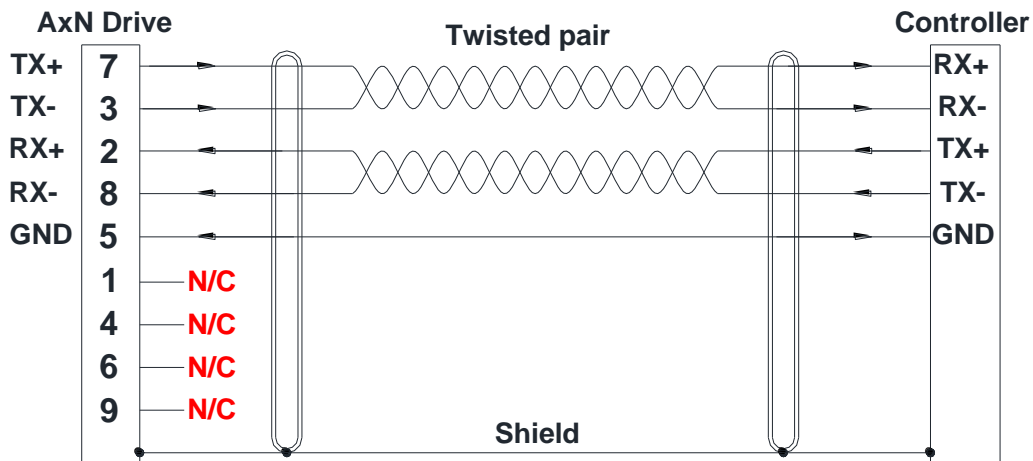
### 4.3.2 RS422/485

#### Pin Assignment

Pin	RS-422	RS-485	Function
1	--	--	--
2	RX+	RX+(LN+)	Receive Data +
3	TX-	TX-(LN-)	Transmit Data -
4	--	--	--
5	GND	GND	Ground connection
6	--	--	--
7	TX+	TX+(LN+)	Transmit Data +
8	RX-	RX-(LN-)	Receive Data -
9	--	--	--

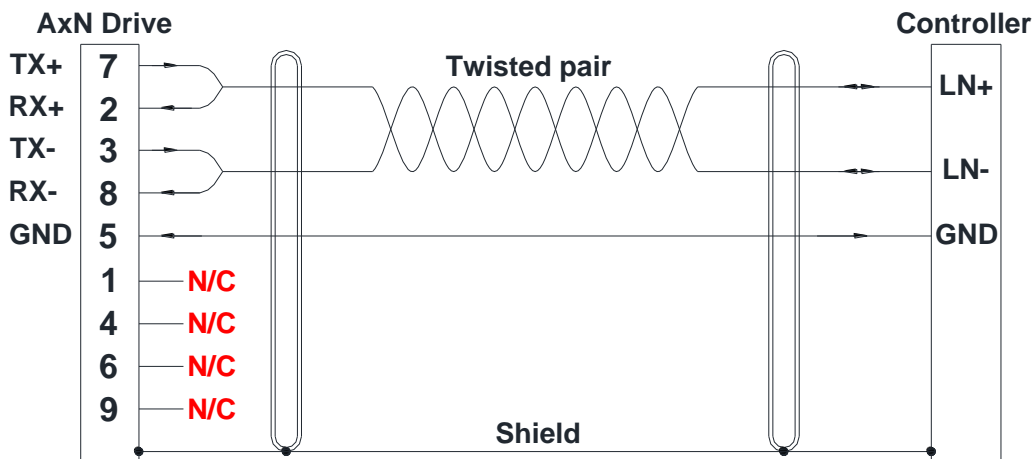


#### RS-422 Connection Table



- 1) N/C—No Connection;
- 2) Connector back shell shielded 360° (Both ends);
- 3) ● means that the shield or cable should connect to connectors.

#### RS-485 Connection Table



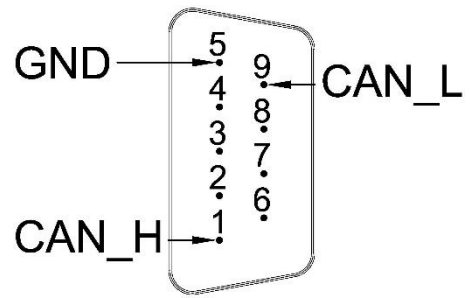
- 4) N/C—No Connection;
- 5) Connector back shell shielded 360° (Both ends);
- 6) ● means that the shield or cable should connect to connectors.

### 4.3.3 Auxiliary CAN

AxN Series Drive supports CANopen protocol and has two independent CAN controller. The auxiliary CAN controller links to the S1 connector.

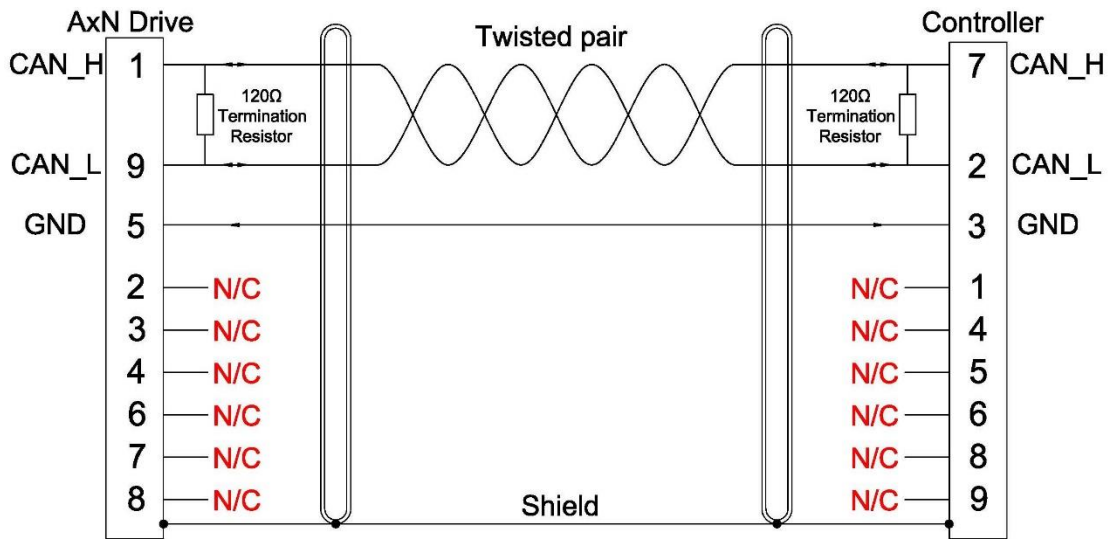
### Pin Assignment

Pin	CANopen	Function
1	CAN_H	CAN_H bus line (dominant high)
2	--	--
3	--	--
4	--	--
5	GND	Ground connection
6	--	--
7	--	--
8	--	--
9	CAN_L	CAN_L bus line (dominant low)



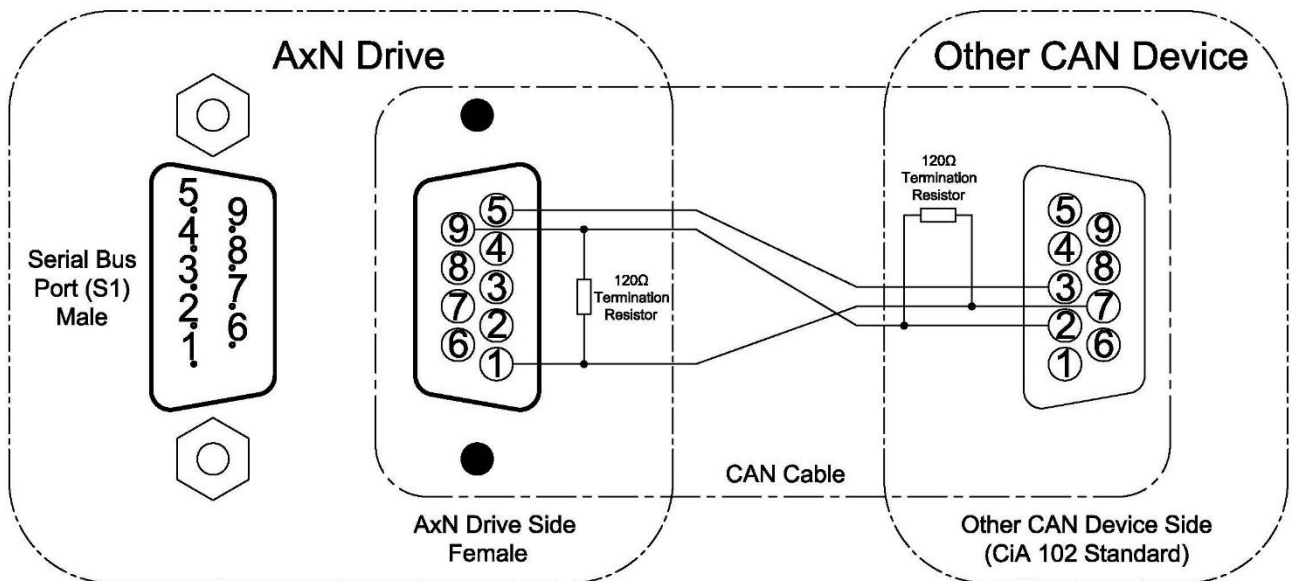
**Note:** CANopen pin assignment on S1 connector does NOT meet CiA 102 Standard.

### Connection Table



- 1) N/C—No Connection;
- 2) Connector back shell shielded 360° (Both ends);
- 3) ● means that the shield or cable should connect to connectors.

### Connection diagram



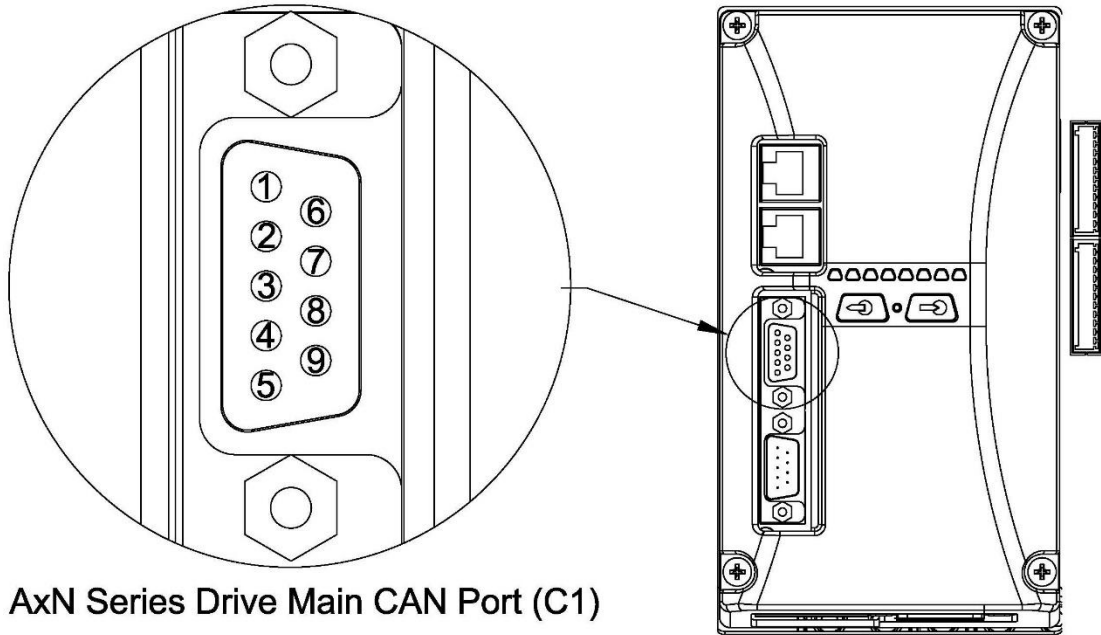
**Note:** Only the first and the last CAN node device should use a 120Ω terminal resistor.

## 4.4 C1 - Main CAN Port

AxN Series Drive's Main CAN Port (C1) connects to the main CAN controller inside the AxN drive. It is the default CAN network port of AxN drive. Moreover, C1 port can also be used as Auxiliary Encoder Port.

**Location**

AxN Series Drive's Main CAN Port (Female Plug, 9 Pin D-Sub) is on the middle side of drive's communication port panel. Refer to the following figures for exact location.



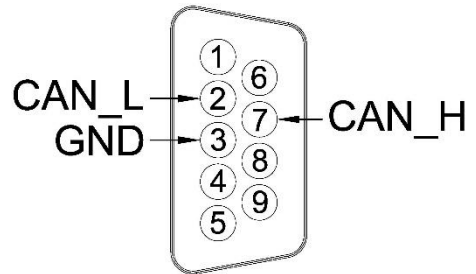
**AxN Series Drive Main CAN Port (C1)**

**4.4.1 Main CAN**

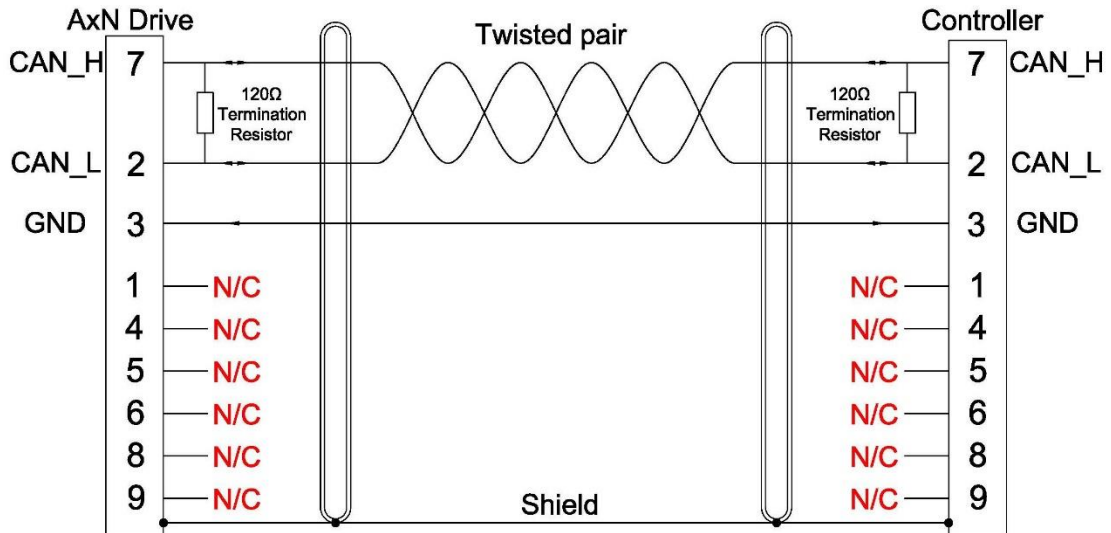
AxN Series Drive supports CANopen protocol and has two independent CAN controller. The main CAN controller links to the C1 connector.

**Pin Assignment**

Pin	CANopen	Function
1	---	---
2	CAN_L	CAN_L bus line (dominant low)
3	GND	Ground connection
4	---	---
5	---	---
6	---	---
7	CAN_H	CAN_H bus line (dominant high)
8	---	---
9	---	---



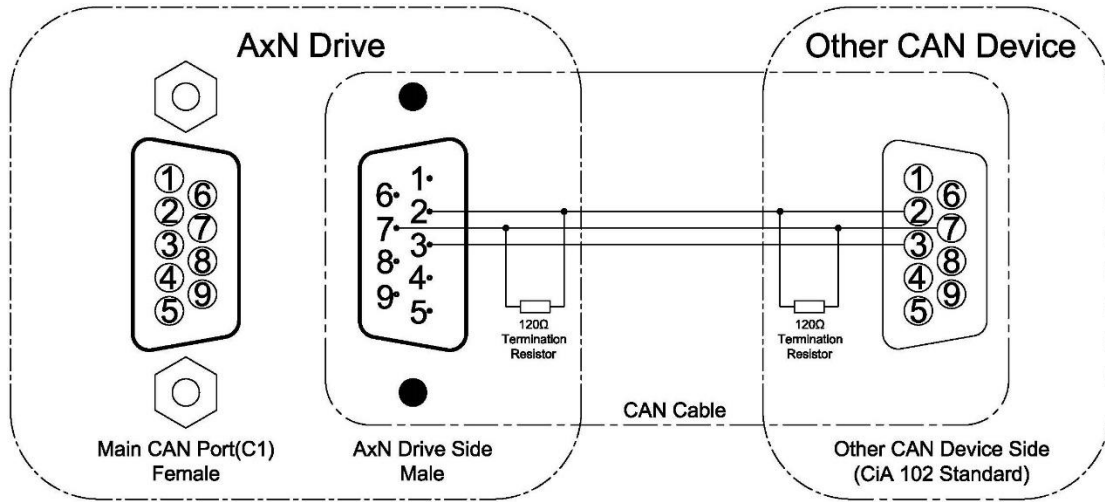
**Connection Table**





- 1) N/C—No Connection;
- 2) Connector back shell shielded 360° (Both ends);
- 3) ● means that the shield or cable should connect to connectors.

**Connection diagram**



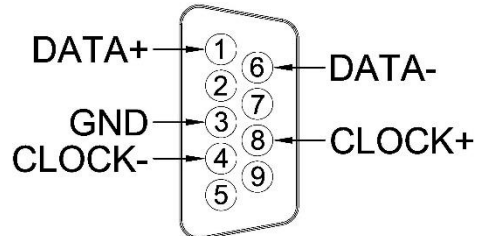
**Note:** Only the first and the last CAN node device should use a 120Ω terminal resistor.

**4.4.2 Auxiliary Encoder**

C1 port is also the Auxiliary Encoder Port. It supports Endat Encoder IN, Incremental Encoder IN and Simulated Incremental Encoder OUT. The output voltage of Simulated Incremental Encoder is 0 ~ 3.3V.

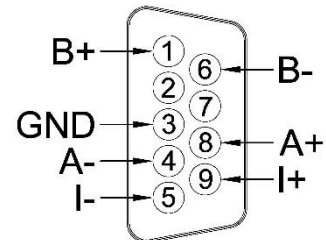
**Endat Encoder (IN)**

Pin	Name	Function
1	DATA+	Endat Data
2	---	---
3	GND	Ground connection
4	CLOCK-	Endat Clock
5	---	---
6	DATA-	Endat Data
7	---	---
8	CLOCK+	Endat Clock
9	---	---



**Incremental Encoder (IN/OUT)**

Pin	Name	Function
1	B+	Encoder incremental channel
2	---	---
3	GND	Ground connection
4	A-	Encoder incremental channel
5	I-	Encoder index
6	B-	Encoder incremental channel
7	---	---
8	A+	Encoder incremental channel
9	I-	Encoder index

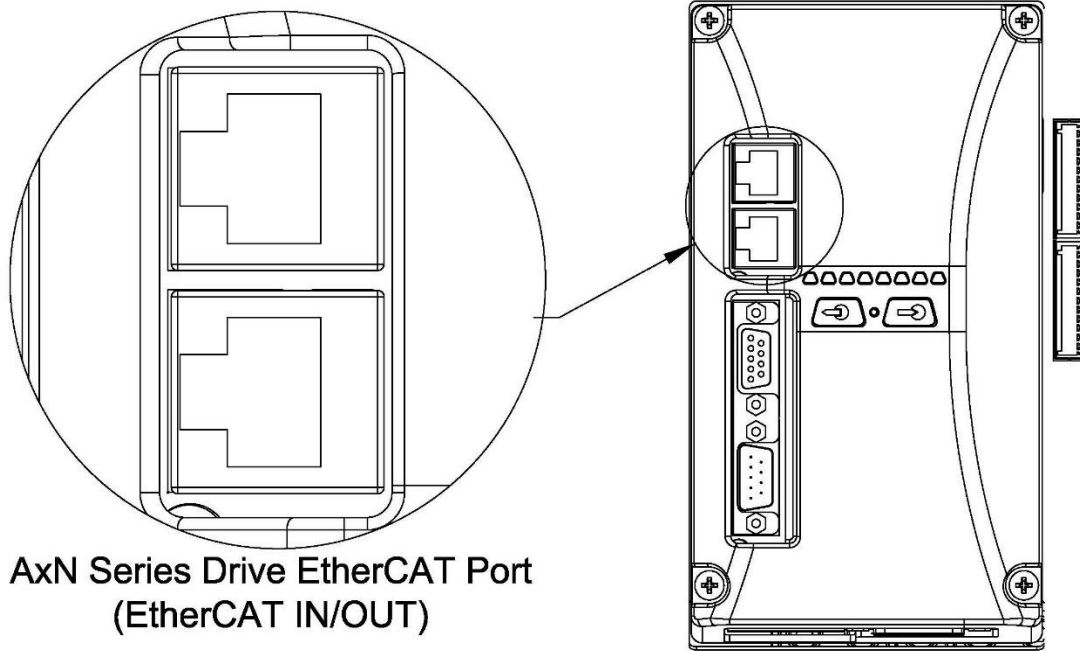


**4.5 EtherCAT IN/OUT - EtherCAT Port**

AxN Series Drive supports EtherCAT fieldbus protocol. And can be connected to an EtherCAT network through two connectors: EtherCAT IN and EtherCAT OUT.

**Port Location**

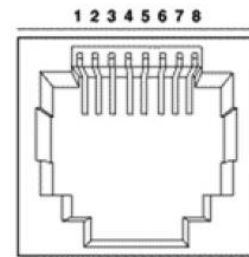
AxN Series Drive's EtherCAT Port is on the upside of drive's communication port panel, formed by two RJ45 100Base-TX female plug. Refer to the following figure for exact location.



**AxN Series Drive EtherCAT Port  
(EtherCAT IN/OUT)**

**Pin Assignment**

Pin	Name	Function
1	TX +	Transmit Data +
2	TX -	Transmit Data -
3	RX +	Receive Data +
4	---	---
5	---	---
6	RX -	Receive Data -
7	---	---
8	---	---

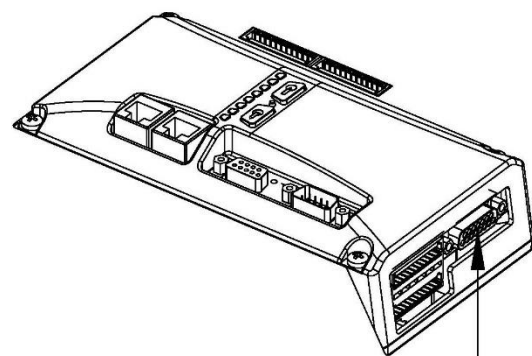
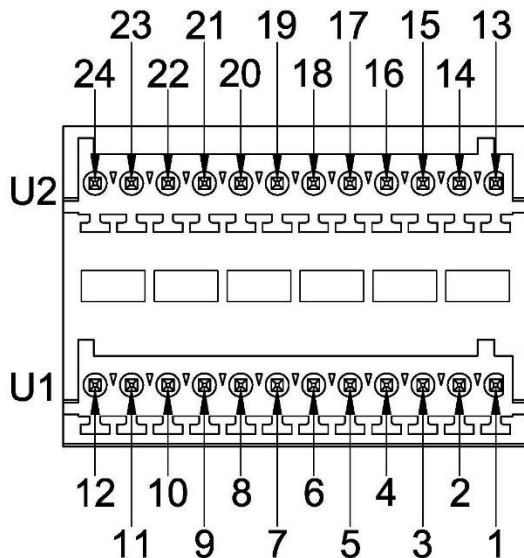


**4.6 U1/U2 - User Connectors**

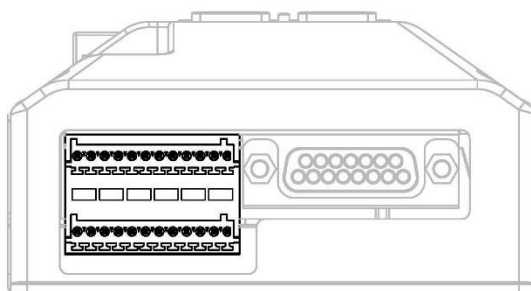
**Port Location**

AxN Series Drive's User Connectors (Male Plug, 2x12 pin) are on the left bottom of the Communication Port Panel. Refer to the following figure for exact location.

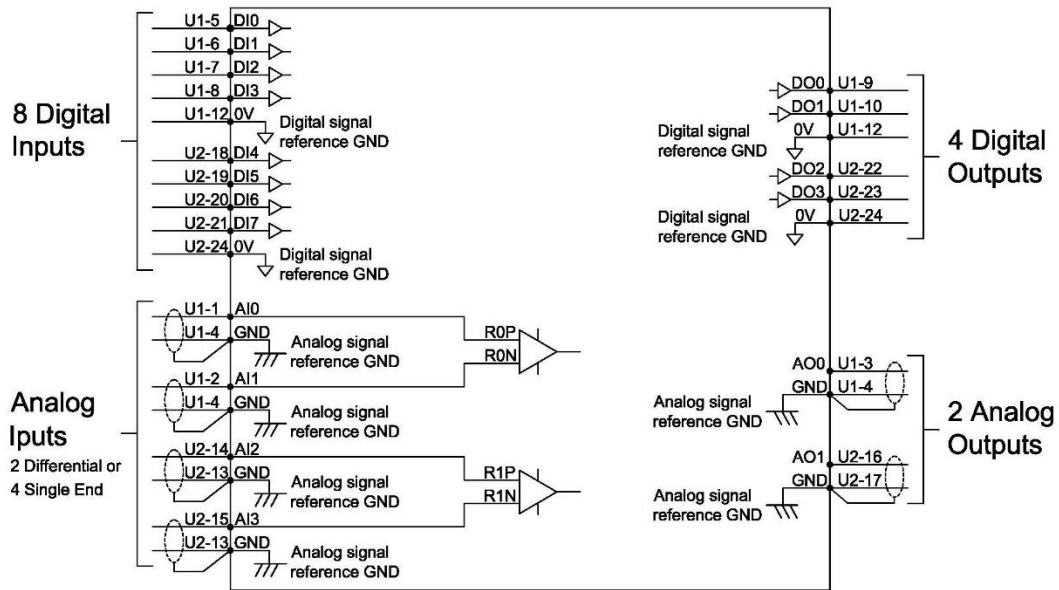
**AxN Series Drive  
User Connectors (U1/U2)**



**Bottom of Communication Port Panel**



## Diagram



**NOTE:** All analog signal reference GND are the same, and all digital signal reference GND are the same.

## Pin Assignment

### User Connector U1

Pin	Name	Function	Signal Description
1	ROP (AI0)	Programmable analog input	$\pm 10V$ , $Z_{in}=10K\Omega$ , able to switch between differential mode and single end mode <sup>(1)</sup>
2	RON (AI1)	Programmable analog input	$\pm 10V$ , $Z_{in}=10K\Omega$ , able to switch between differential mode and single end mode <sup>(1)</sup>
3	AO0	Programmable analog output	0 ~ 10V f.s., 30 mA
4	GND	Analog reference ground	Analog signals reference
5	DI0	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
6	DI1	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
7	DI2	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
8	DI3	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
9	DO0	Programmable digital output	PNP open collector, 24 V, 100mA max
10	DO1	Programmable digital output	PNP open collector, 24 V, 100mA max
11	NC	Undefined	No connection
12	COM	Digital signal reference	Digital signal reference

### User Connector U2

Pin	Name	Function	Signal Description
13	GND	Analog reference ground	Analog signals reference
14	R1P (AI2)	Programmable analog input	$\pm 10V$ , $Z_{in}=10K\Omega$ , able to switch between differential mode and single end mode <sup>(1)</sup>
15	R1N (AI3)	Programmable analog input	$\pm 10V$ , $Z_{in}=10K\Omega$ , able to switch between differential mode and single end mode <sup>(1)</sup>
16	AO1	Programmable analog output	0 ~ 10V f.s., 30 mA
17	GND	Analog reference ground	Analog signals reference
18	DI4	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
19	DI5	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
20	DI6	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
21	DI7	Programmable digital input	6.6 k $\Omega$ to ground, 20-30 V
22	DO2	Programmable digital output	PNP open collector, 24 V, 100mA max
23	DO3	Programmable digital output	PNP open collector, 24 V, 100mA max
24	COM	Digital signal reference	Digital signal reference

## Notes:

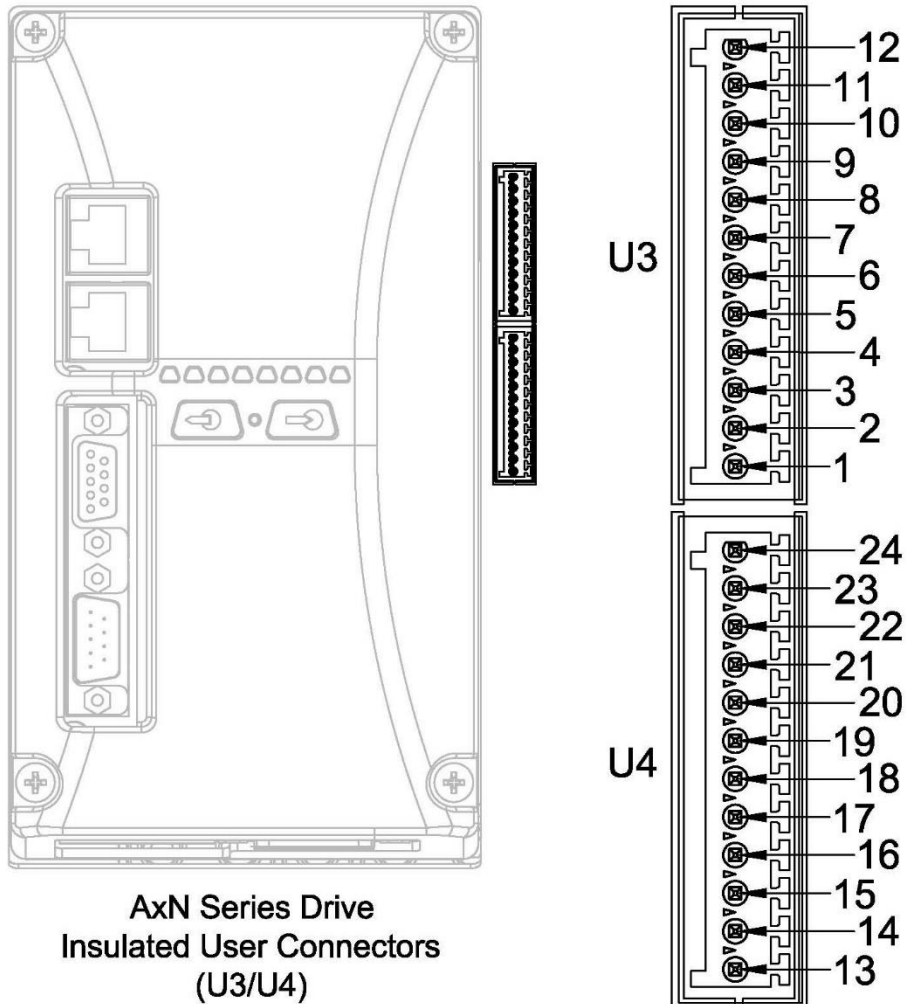
1. AxN Series Drive has 4 single end analog inputs or 2 differential analog inputs, and they can be switched by software. The default mode is differential mode. When analog inputs are in differential mode, pin ROP (U1-1) and pin RON (U1-2) map the RO channel in software, and pin R1P (U2-14) and pin R1N (U2-15) map the R1 channel in software. On

the other hand, when analog inputs are in single end mode, pins: AI0 (U1-1), AI1 (U1-2), AI2 (U2-14) and AI3 (U2-15) respectively map channels AI0, AI1, AI2 and AI3 in software.

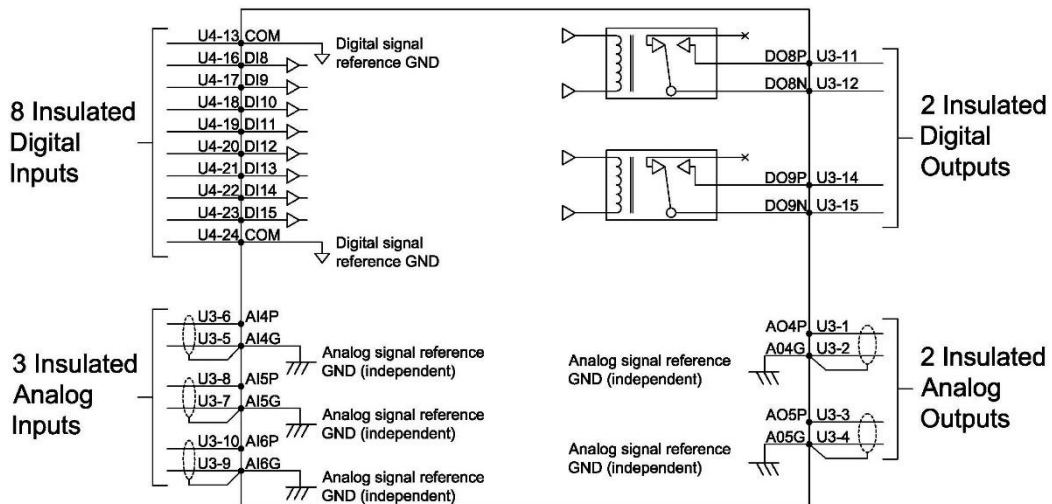
#### 4.7 U3/U4 – Insulated User Connectors

##### Port Location

AxN Series Drive's Insulated User Connectors (Male Plug, 2x12 pin) are on the right of the Communication Port Panel. Refer to the following figure for exact location.



##### Diagram



**NOTE:** All analog signal reference GND are independent, but all digital signal reference GND are the same.

**Pin Assignment**

**Insulated User Connector U3**

Pin	Name	Function	Signal Description
1	AO4P	Programmable analog output	±10V f.s., 30 mA
2	AO4G	Analog reference ground	Insulated reference ground
3	AO5P	Programmable analog output	±10V f.s., 30 mA
4	AO5G	Analog reference ground	Insulated reference ground
5	AI4G	Analog reference ground	Insulated reference ground
6	AI4P	Programmable analog input	±10V
7	AI5G	Analog reference ground	Insulated reference ground
8	AI5P	Programmable analog input	±10V
9	AI6G	Analog reference ground	Insulated reference ground
10	AI6P	Programmable analog input	±10V
11	DO8P	Programmable digital output	On/Off switch, 9V ~ 28Vdc/2A
12	DO8N	Programmable digital output	

**Insulated User Connector U4**

Pin	Name	Function	Signal Description
13	COM	Digital reference ground	Insulated reference ground for digital input
14	DO9P	Programmable digital output	On/Off switch, 9V ~ 28Vdc/2A
15	DO9N	Programmable digital output	
16	DI8	Programmable digital input	5mA, 24Vdc max
17	DI9	Programmable digital input	5mA, 24Vdc max
18	DI10	Programmable digital input	5mA, 24Vdc max
19	DI11	Programmable digital input	5mA, 24Vdc max
20	DI12	Programmable digital input	5mA, 24Vdc max
21	DI13	Programmable digital input	5mA, 24Vdc max
22	DI14	Programmable digital input	5mA, 24Vdc max
23	DI15	Programmable digital input	5mA, 24Vdc max
24	COM	Digital reference ground	Insulated reference ground for digital input

## 5. APPENDIX: ACCESSORIES

### 5.1 Prefabricated Motor Power Output Cable

#### Order Code Definition

The Order Code can provide all the necessary specifications about a Prefabricated Motor Power Output Cable. Choose the specifications and use the corresponding order cable to order.

Order Code	PW	-C	-D16	-5	-GTV
Cable Type	Power Cable				
Terminal Type	Motor Side/Drive Side C = Ring terminal/Cord end terminal F = Ring terminal/Ring terminal S = Stripped wires/Cord end terminal R = Stripped wires/Ring terminal A = Aviation plug/Cord end terminal				
Wire Gauge <sup>(1)</sup>	D1.5=4x1.5mm <sup>2</sup> D2.5=4x2.5mm <sup>2</sup> D04 =4x4mm <sup>2</sup> D06 =4x6mm <sup>2</sup> D10 =4x10mm <sup>2</sup> D16 =4x16mm <sup>2</sup> D25 =4x25mm <sup>2</sup>	B1.5=4x1.5mm <sup>2</sup> +2x__mm <sup>2</sup> B2.5=4x2.5mm <sup>2</sup> +2x__mm <sup>2</sup> B04 =4x4mm <sup>2</sup> +2x__mm <sup>2</sup> B06 =4x6mm <sup>2</sup> +2x__mm <sup>2</sup> B10 =4x10mm <sup>2</sup> +2x__mm <sup>2</sup> B16 =4x16mm <sup>2</sup> +2x__mm <sup>2</sup> B25 =4x25mm <sup>2</sup> +2x__mm <sup>2</sup>			
Length	3=3m 5=5m 7=7m X <sup>(2)</sup> =X m				
Shield Type	G = General shielded	I = General + Internal shielded	N = No shield		
Trace Chain or Not	S = Standard	T = Trace chain			
Coat material	V = PVC	U = PUR <sup>(3)</sup>			

#### Notes:

1. B in the Wire Gauge means power cable for motor with brake, the gauge of brake wires should be provided either;
2. Cable Length are not just 3, 5 and 7m, order whatever cable length you want;
3. Cable Coat made by PUR is oil resistant and wear resistant.

#### Example

##### Order Code: PW-C-D16-7-GTV

Power cable; terminal type of motor side is ring terminal, terminal type of drive side is cord end terminal; wire gauge is 4x16mm<sup>2</sup>; length is 7m; general shielded; trace chain; insulating layer material is PVC.

## 5.2 Prefabricated Encoder Cable (for Phase Motors)

### Order Code Definition

The Order Code can provide all the necessary specifications about a Prefabricated Encoder Cable. Choose the specifications and use the corresponding order cable to order.

Order Code	CE	-X	-A28	-5	-ISU	-XX
Cable Type	CN = Endat Encoder (EQN1325/ECN1313) CE = Endat Encoder (ECI1319/EQI1331) CS = Sincos Encoder CR = Resolver CH = Incremental with Hall sensor					
Terminal Type	X=Aviation plug / DB15(180°outlet) Y=Aviation plug/DB15(45°outlet)					
Wire Gauge	A28=AWG28					
Length	3=3m 5=5m 7=7m X <sup>(1)</sup> =X m					
Shield Type	G = General shielded      I = General + Internal shielded      N = No shield					
Trace Chain or Not	S = Standard      T = Trace chain					
Coat material	V = PVC      U = PUR <sup>(2)</sup>					
Reserve Code	Reserve					

#### Notes:

1. Cable Length are not just 3, 5 and 7m, order whatever cable length you want;
2. Cable Coat made by PUR is oil resistant and wear resistant.

#### Example

##### Order Code: CE-X-A28-5-ISU

Endat cable (ECI1319/EQI1331); terminal type of motor side is aviation plug, terminal type of drive side is DB15 connector(180 °outlet); internal diameter is AWG28; length 5m; general and internal shielded; standard, not trace chain; insulating layer material is PUR.

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