PHASE
MOTION CONTROL

AxN

CONFIGURABLE MOTION

CONTROL PLATFORM

Installation Manual

Support Model:

AxN Size3: AxN 22.44.4, AxN 35.70.4, AxN 50.100.4

Version: **V1.0(E)**

Summary

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℃ to 40℃, up to 50℃ with power reduction (2%/℃) 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: 1. oil mist and dust 2. metal shavings, oil, water or other foreign materials 3. radioactive materials 4. combustible materials (e.g., wood) 5. harmful gases and liquids 6. excessive vibration 7. chlorides
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^2 at 9 to 200 Hz
Orientation	Install the drive vertically to maintain maximum cooling effects.

1.3 Overall Dimensions
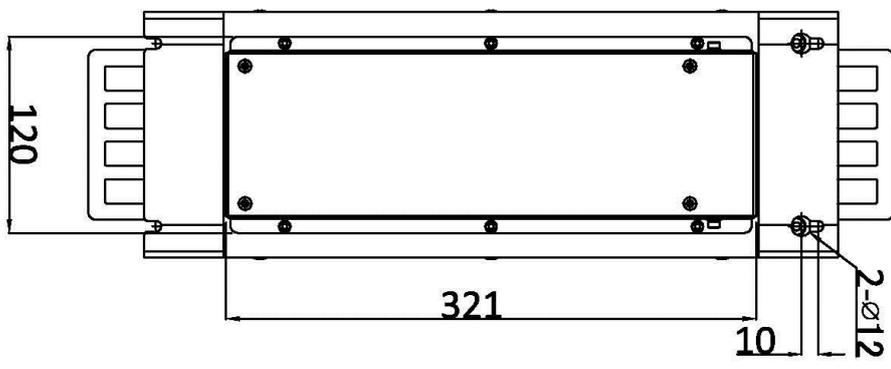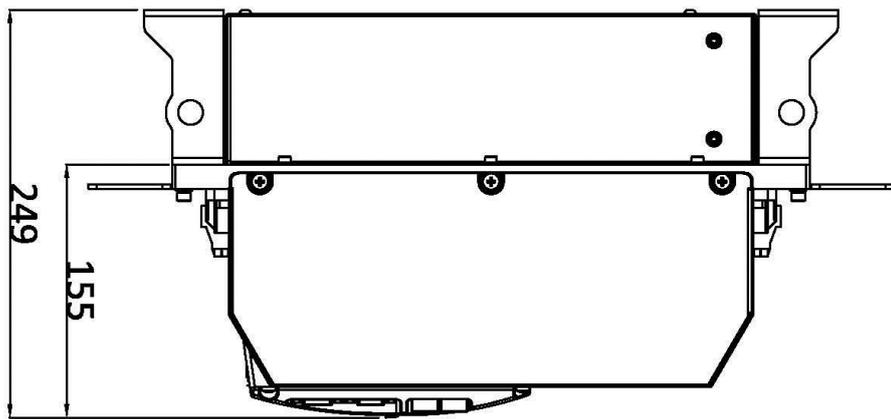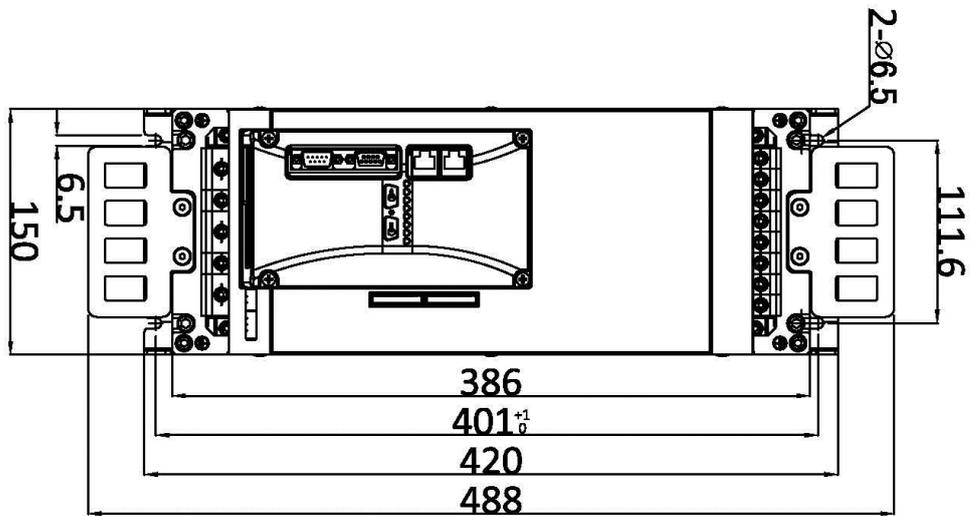
Overall Dimensions of AxN Size3
—— AxN22.44.4、 AxN35.70.4、 AxN50.100.4

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.

Installation Orientation of AxN Size3
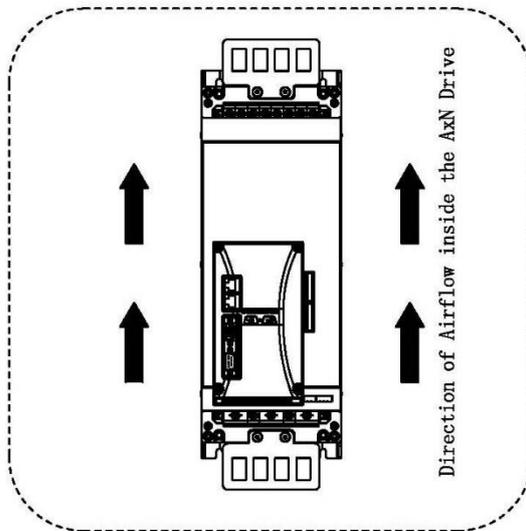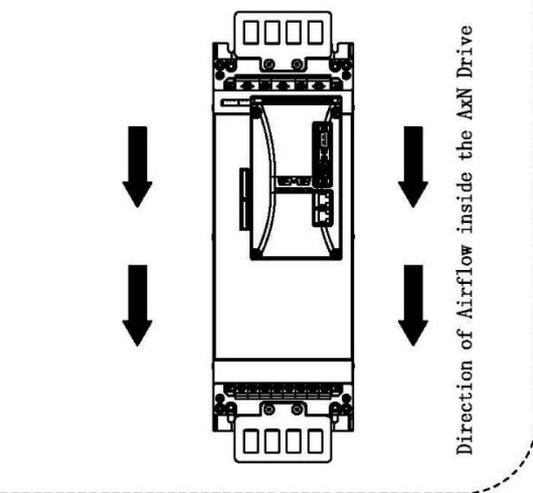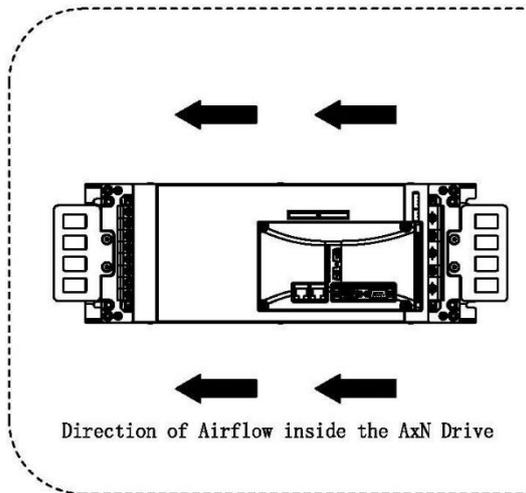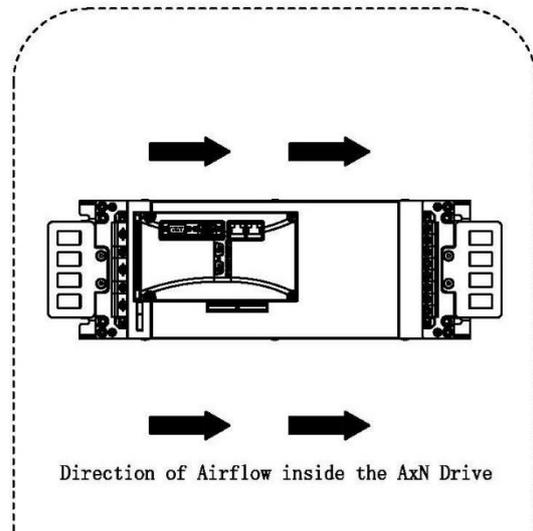
1.5 Installation Spacing

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.

Correct Installation Spacing of AxN Series Drive
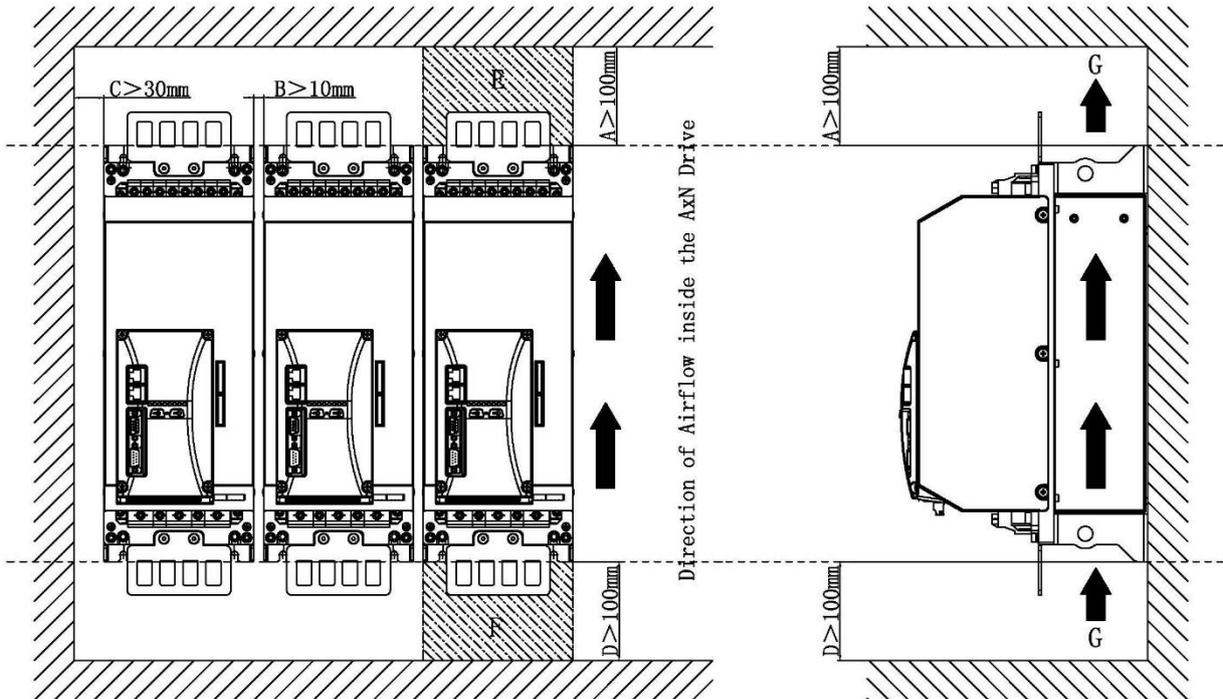
No.	Distance	Description
A	＞100mm	The distance between the top of the switch cabinet, to ensure enough space for air-out.
B	＞10mm	The distance between other device (including other AxN drives and peripheral devices)
C	＞30mm	The distance between the inside wall of the switch cabinet.
D	＞100mm	The distance 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 Series
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 Size3 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 Size3 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 Size3	Current (A rms)	Recommended Gauge (mm²)	Recommended Gauge (AWG)
AxN 22.44.4	27	6.63	9
AxN 35.70.4	43	10.55	7
AxN 50.100.4	61.5	16.77	5
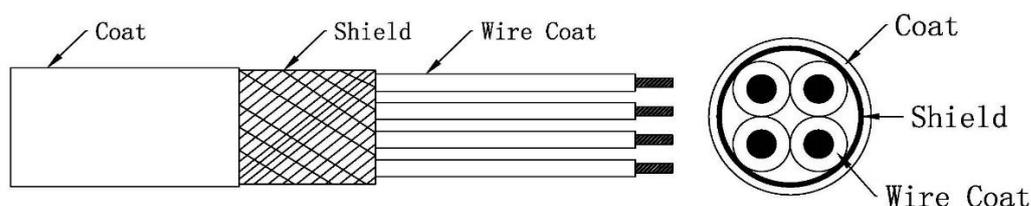
Step 2: Cable Length Measurement
The AC power supply cable is used to connect the output of the filter with the Power Input Port (P1) of AxN Size3 Drive. To minimize the interference, the filter must be installed in close proximity to AxN Size3 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size3 Drive (Refer to 1.5 Installation Spacing).

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

Step 3: Strip the Cable Coat
Strip the outside coat of the AC power supply cable for 160mm and reveal the inside shield.
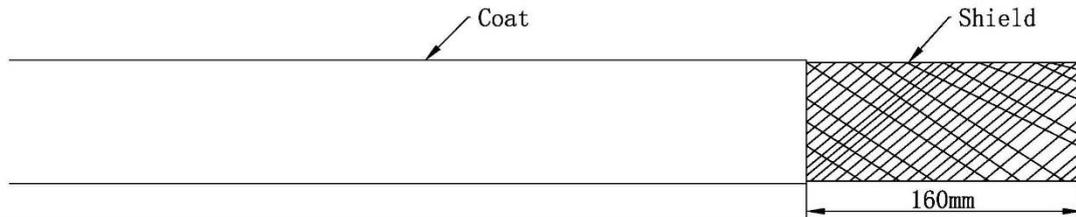
Step 4: Make the Grounding Shield

Leave 65mm Shield as the grounding shield and turn it to the outside of the coat. Then, weld a wire on the shield as the drainage line.
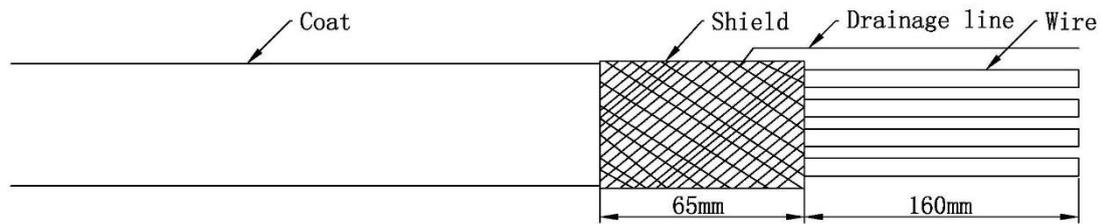
Step 5: Fix the Grounding Shield

Use a 60mm heat-shrink tube to fix the grounding shield and leave 40mm shield outside.
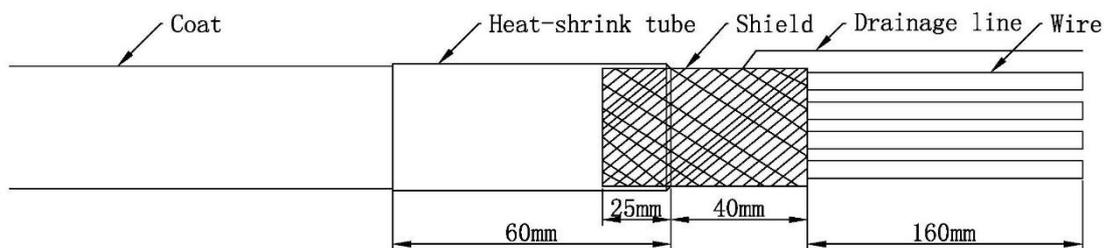
Step 6: Make the Phase Wires

Choose 3 wires of the cable as 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 Size3 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 Size3	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 22.44.4	E6012	12	6.0	8.5	3.9	3.5
AxN 35.70.4	E10-12	12	7.5	8.8	4.9	4.5
AxN 50.100.4	E16-12	12	8.7	10.0	6.2	5.8

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

AxN Size3	Strip Length (mm)	Recommended Strip Length (mm)
AxN 22.44.4	12 ~ 20.5	14
AxN 35.70.4	12 ~ 20.8	14
AxN 50.100.4	12 ~ 22.0	14

Coat Heat-shrink tube Shield Drainage line Core Cord end terminal

T
S
R

60mm 40mm 160mm

L

Detail

D
F
d1
B
W

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 Code End Terminal along with the drainage line.

Coat Heat-shrink tube Shield Drainage line Core Cord end terminal

PE
T
S
R

60mm 40mm 160mm

Step 8: Check and Mark

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

Coat Heat-shrink tube Shield Drainage line Cord end terminal

PE
T
S
R

60mm 40mm 160mm

Heat-shrink label

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 Size3 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size3 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 Size3 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.

AxN Size3 Series
Power Supply Input Port(P1)

PE T S R

AC Power Input Terminals
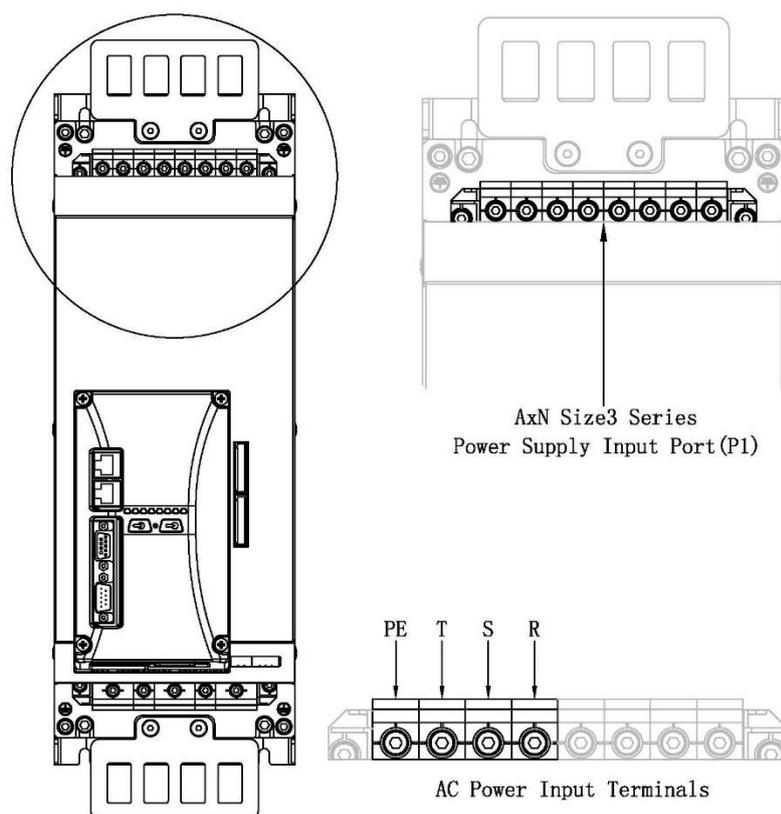
Step 4: Insert Wires into Corresponding Terminals
Use a 3mm hexagonal wrench to loosen the hexagonal screws on PE, T, S and R Terminals which are in the drive's Power Supply Input Port (P1). Insert the Wires of the AC power supply cable into the corresponding terminals: PE to PE, T to T, S to S and R 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.

Labels in figure: Coat, Heat-shrink tube, Drainage line, Shield, Cord end terminal, NOTE: Leave only the insulated part outside, Insert, 120mm, 3mm, PE T S R

Use a 3mm hexagonal wrench to loosen the hexagonal screws. The length of wrench must be longer than 120mm.
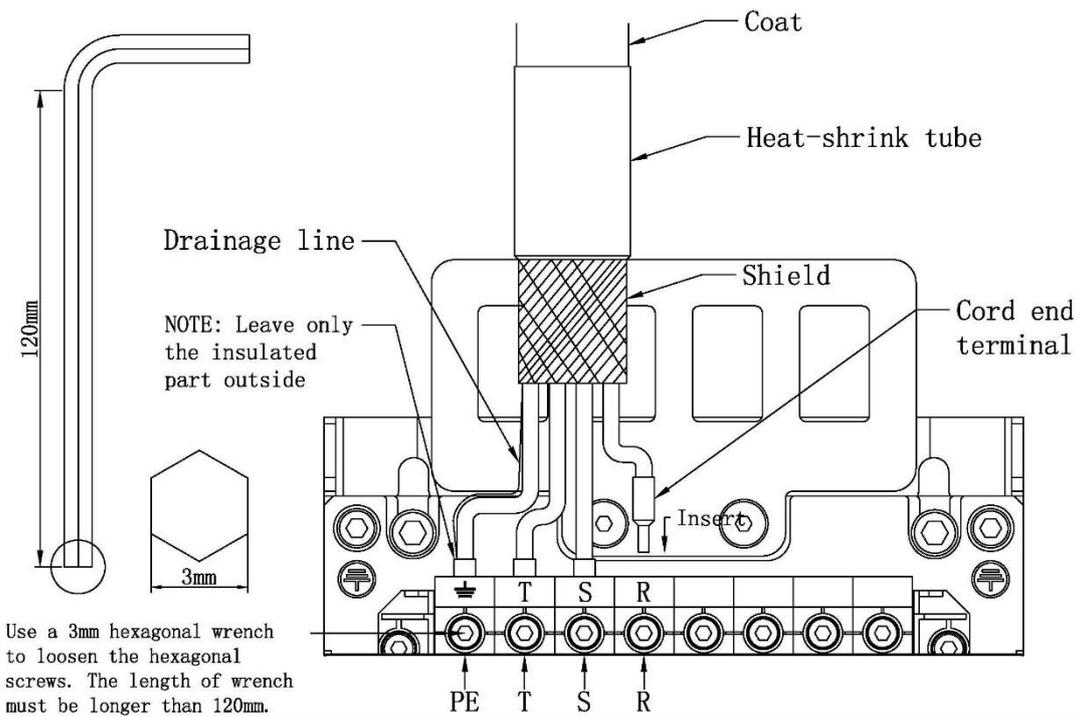
Step 5: Tight the Terminals

Use a 3mm hexagonal torque wrench to tight the hexagonal 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 4.0 ~ 4.5Nm. If the tight torque reaches higher than 8.5Nm, the terminal will be broken.

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.

Labels in figure: Coat, Heat-shrink tube, Hose clamp, Drainage line, Shield, Cord end terminal, NOTE: Leave only the insulated part outside, 120mm, 3mm, PE T S R

Use a 3mm hexagonal torque wrench to tight the hexagonal screws. The nominal torque is 4.0 ~ 4.5Nm

12
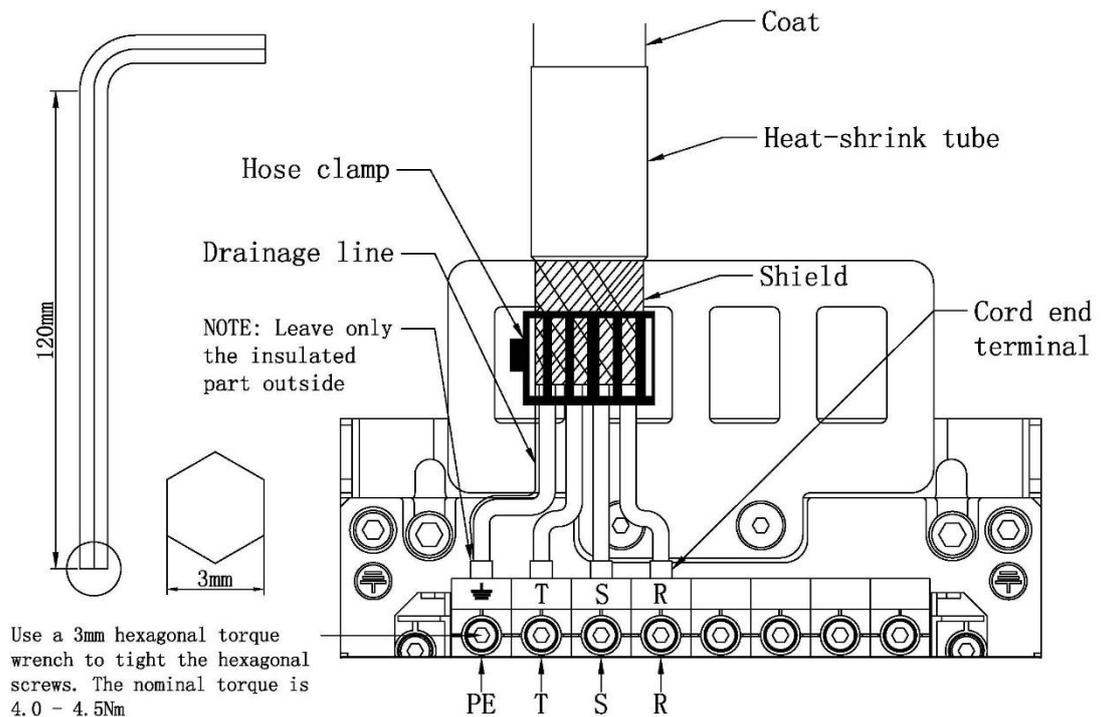
2.2 DC Power Supply Input

2.2.1 DC Power Supply Requirement

Main Supply	AxN Size3
Voltage	565V
Type	DC power
Fluctuation of Voltage	0 ~ 800V
Nominal Power	48.5KW
Peak Power	97KW

2.2.2 DC Power Supply Cable Fabrication

DC power supply cable is the cable which connect the AxN Size3 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 Size3 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 Size3	Current (A rms)	Recommended Gauge (mm²)	Recommended Gauge (AWG)
AxN 22.44.4	27	6.63	9
AxN 35.70.4	43	10.55	7
AxN 50.100.4	61.5	16.77	5
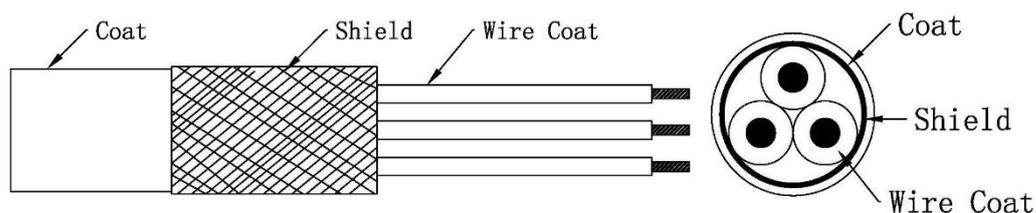
Step 2: Cable Length Measurement
The AC power supply cable is used to connect the output of the DC power supply with the Power Input Port (P1) of AxN Size3 Drive. To minimize the interference, the DC power supply must be installed in close proximity to AxN Size3 Drive as much as possible. But, the distance between two devices should also comply with the Installation Space Regulation of AxN Size3 Drive (Refer to 1.5 Installation Spacing).

Step 3: Strip the Cable Coat
Strip the outside coat of the DC power supply cable for 160mm and reveal the inside shield.
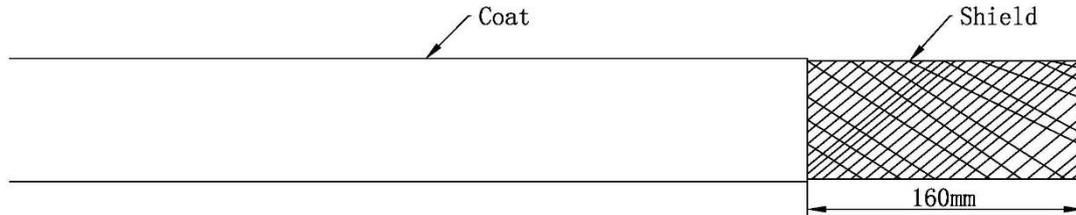
Step 4: Make the Grounding Shield

Leave 65mm Shield as the grounding shield and turn it to the outside of the coat. 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.
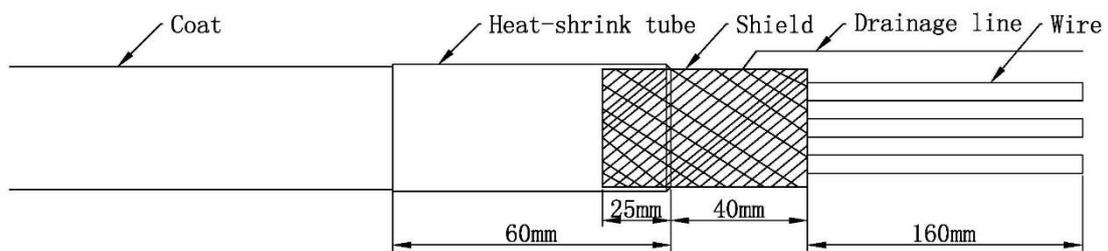
Step 6: Make the Phase Wires

Choose 2 wires of the cable as DC+ and DC-. Crimping pre-insulated Terminals on the wires will enhance the connection stability and simplicity between the cable and drive. AxN Size3 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 Size3	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 22.44.4	E10-12	12	7.5	8.8	4.9	4.5
AxN 35.70.4	E16-12	12	8.7	10.0	6.2	5.8
AxN 50.100.4	E16-12	12	8.7	10.0	6.2	5.8

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

AxN Size3	Strip Length (mm)	Recommended Strip Length (mm)
AxN 22.44.4	12 ~ 20.8	14
AxN 35.70.4	12 ~ 22.0	14
AxN 50.100.4	12 ~ 22.0	14
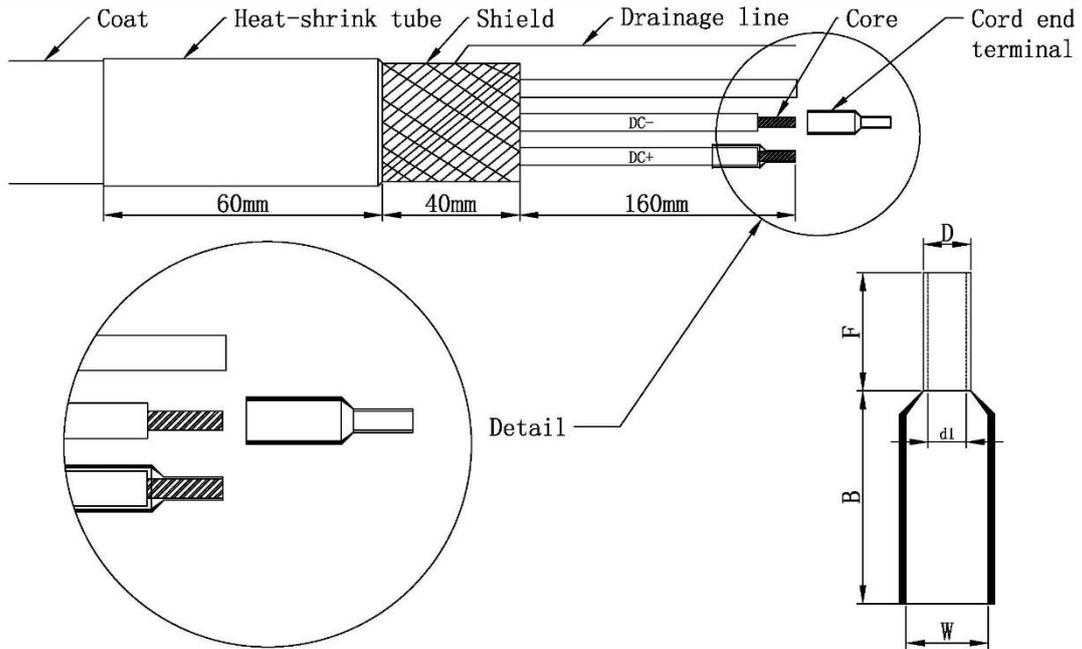
14

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 Code End Terminal along with the drainage line.
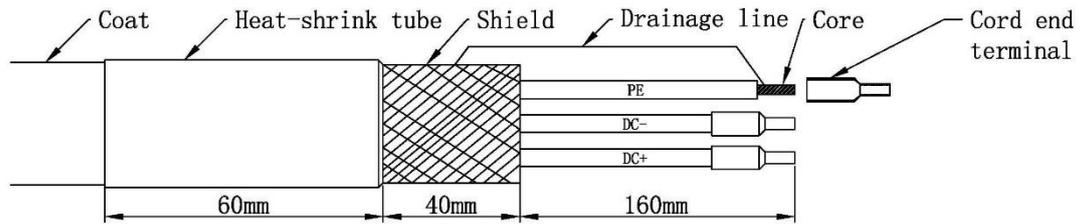
Step 8: Check and Mark

Check every wire and the connection between shield and PE wire, then label each wire.
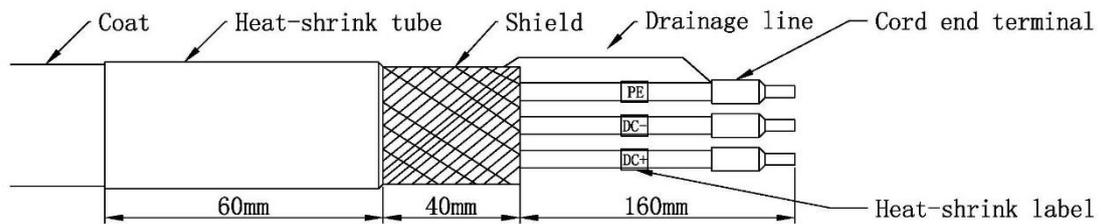
2.2.3 DC Power Supply Input Installation

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+ and DC-, these are the three terminals called DC Power Input Terminals. AxN Size3 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.

AxN Size3 Series
Power Supply Input Port(P1)

PE   DC-   DC+

DC Power Input Terminals
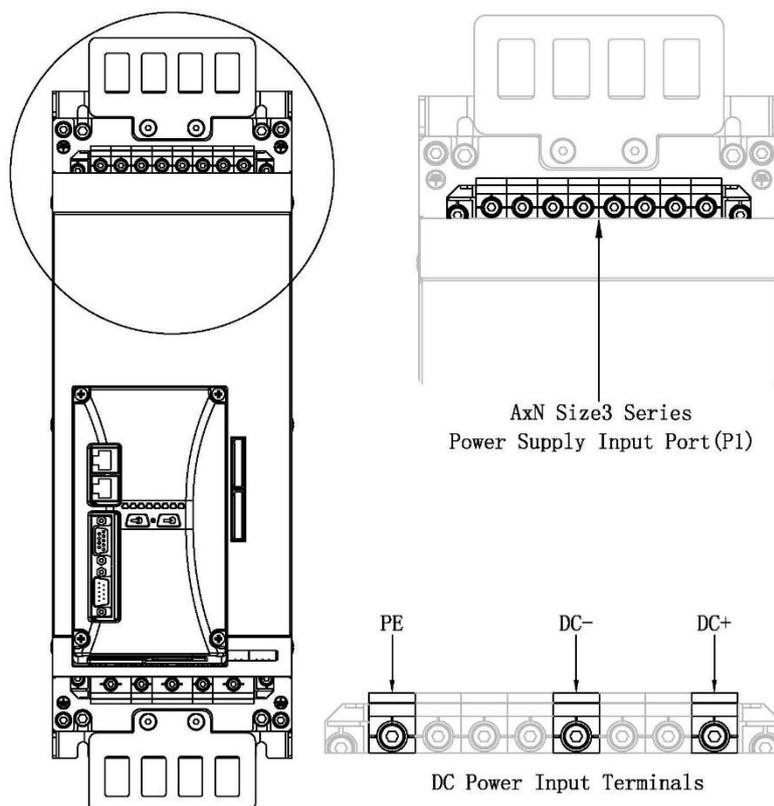
Step 3: Insert Wires into Corresponding Terminals

Use a 3mm hexagonal wrench to loosen the hexagonal screws on PE, DC+ 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+, 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.

Coat

Heat-shrink tube

Drainage line

Shield

NOTE: Leave only
the insulated
part outside

Cord end
terminal

Insert

DC−

DC+

PE   DC−   DC+

3mm

Use a 3mm hexagonal wrench
to loosen the hexagonal
screws. The length of wrench
must be longer than 120mm.
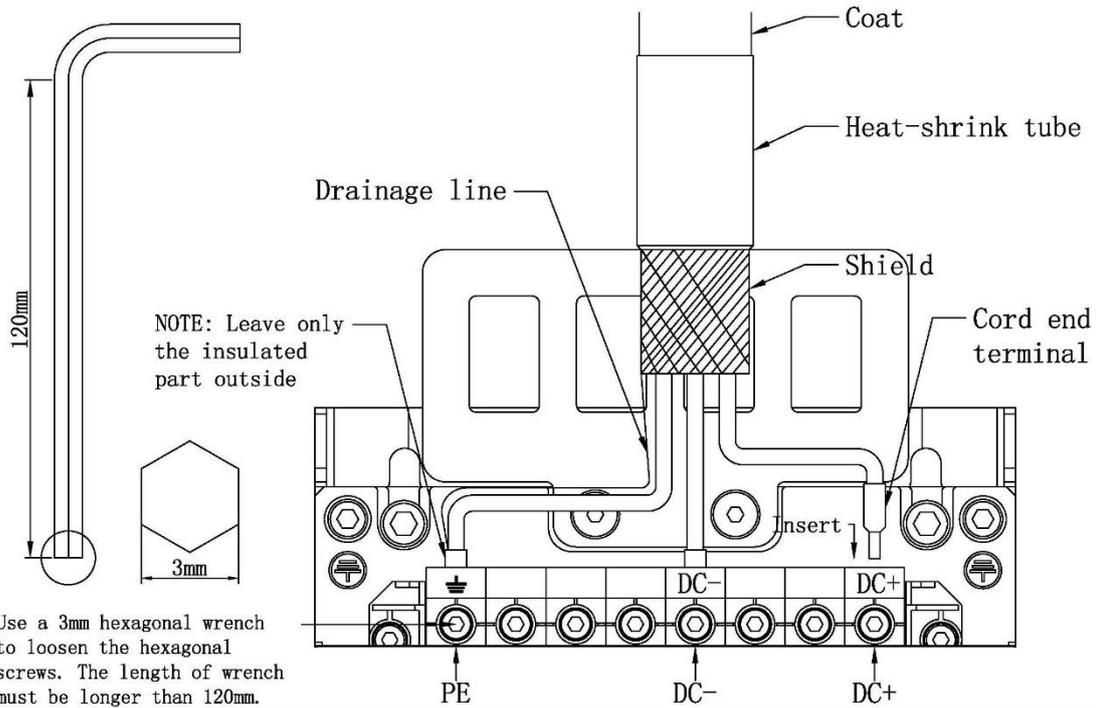
Step 4: Tight the Terminals

Use a 3mm hexagonal torque wrench to tight the hexagonal screws on PE, DC+ and DC- Terminals which are in the drive's Power Supply Input Port (P1). The nominal torque to tight these terminals is 4.0 ~ 4.5Nm. If the tight torque reaches higher than 8.5Nm, the terminal will be broken.

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.

Coat

Heat-shrink tube

Hose clamp

Drainage line

Shield

NOTE: Leave only
the insulated
part outside

Cord end
terminal

3mm

DC−

DC+

PE   DC−   DC+

Use a 3mm hexagonal torque
wrench to tight the hexagonal
screws. The nominal torque is
4.0 ~ 4.5Nm
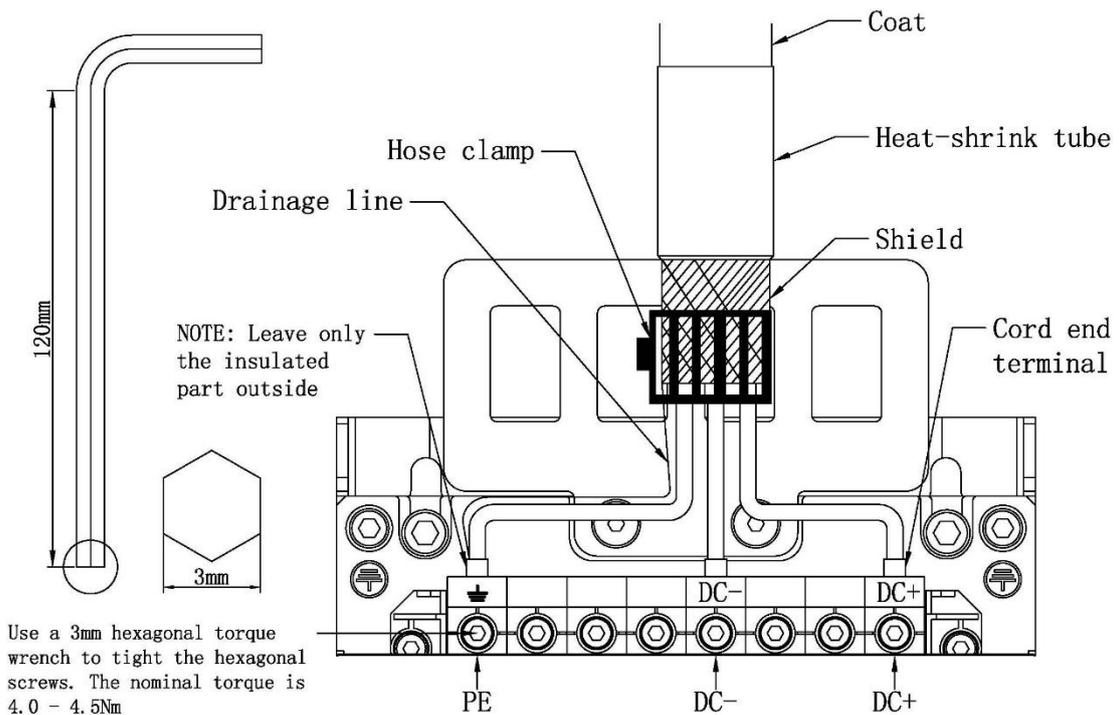
2.3 Brake Resistor

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 Size3	Resistance (Ω)	Power (W)
AxN 22.44.4	12	60
AxN 35.70.4	7	60
AxN 50.100.4	5	60

2.3.2 Internal Brake Resistor Installation

Step 1: Find out the Internal Brake Resistor Terminals

DC+ and Brk+, these are the two terminals called Internal Brake Resistor Terminals. AxN Size3 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.

AxN Size3 Series
Power Supply Input Port(P1)

Brk+ DC+

Internal Brake Resistor Terminals
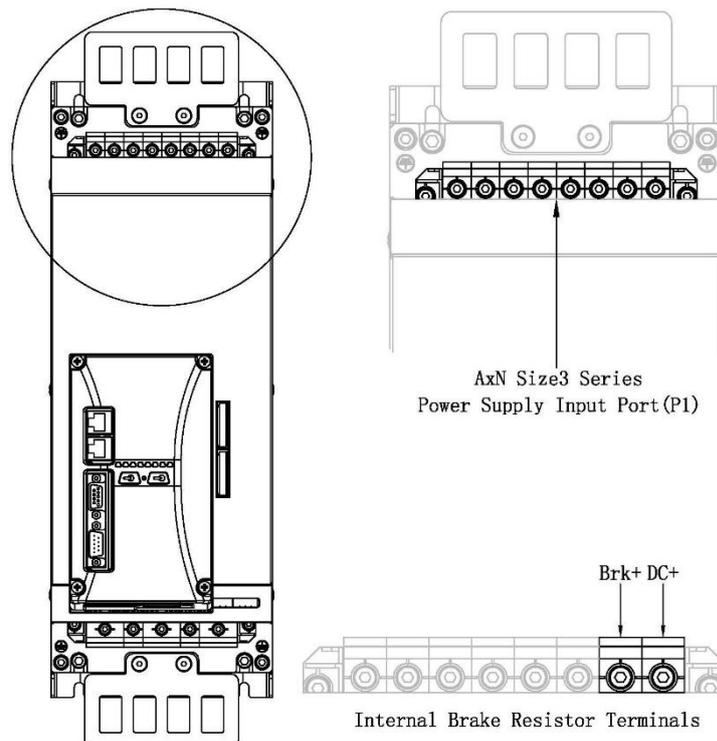
Step 2: Shortcut DC+ and Brk+

Use a 3mm hexagonal wrench to loosen the hexagonal screws on DC+ and Brk+ Terminals which are in the drive's Power Supply Input Port (P1). Then, use a wire to shortcut DC+ and Brk+.

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 3mm hexagonal torque wrench to tight the hexagonal screws on DC+ and Brk+ Terminals .The nominal torque to tight these terminals is 4.0 ~ 4.5Nm. If the tight torque reaches higher than 8.5Nm, the terminal will be broken.
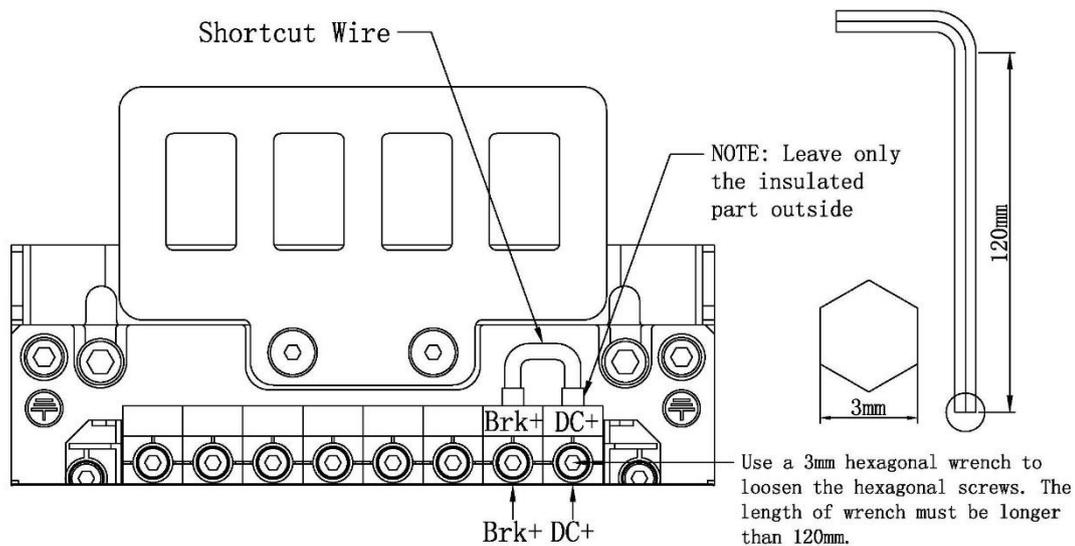
2.3.3 External Brake Resistor

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 Size3	Minimum Resistance (Ω)	Maximum Resistance (Ω)
AxN 22.44.4	9	13.8
AxN 35.70.4	6	7.9
AxN 50.100.4	4.5	5.5

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 Size3 Drive and real application.

Step2: Find out the External Brake Resistor Terminals
DC+ and Brk-, these are the two terminals called External Brake Resistor Terminals. AxN Size3 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.

AxN Size3 Series
Power Supply Input Port(P1)

Internal Brake Resistor Terminals
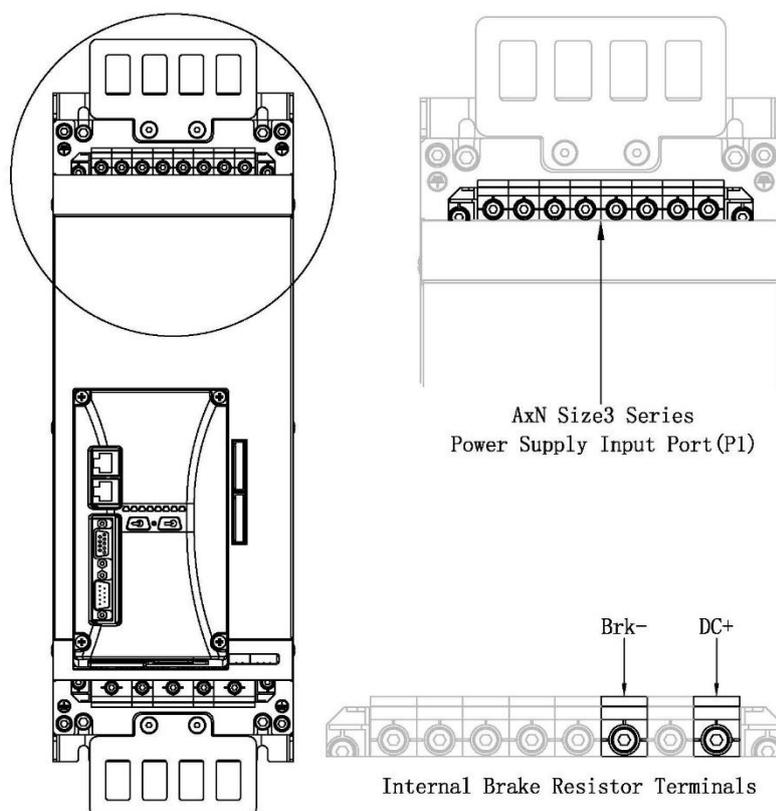
Step3: Insert Wires into Corresponding Terminals
Use a 3mm hexagonal wrench to loosen the hexagonal screws on DC+ and Brk- Terminals which are in the drive's Power Supply Input Port (P1). Insert the two wires of the external brake resistor separately into these two terminals.

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 3mm hexagonal torque wrench to tight the hexagonal screws on DC+ and Brk- Terminals .The nominal torque to tight these terminals is 4.0 ~ 4.5Nm. If the tight torque reaches higher than

8.5Nm, the terminal will be broken.
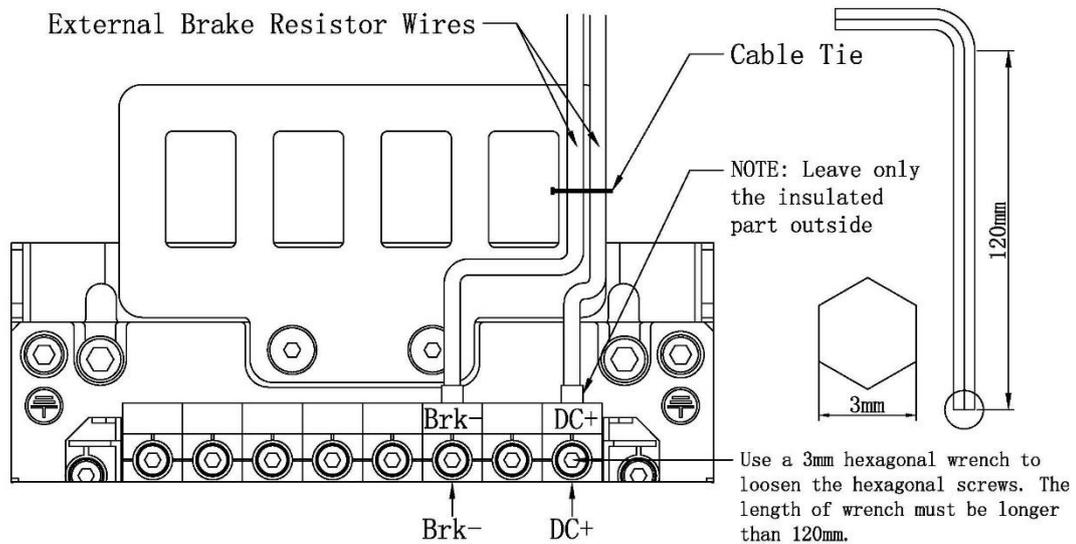
Step 5：Wire Fixing

Use a cable tie to fix the wires on the cable support of AxN Size3 drive.

Step 6: Resistance Measurement

Use an avometer to measure the resistance between DC+ and Brk-. 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: Prefabricated Cable——5.1 Motor Power Output cable for more details.

Step 1: Cable Selection

AxN Size3 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 Size3	Current (A rms)	Recommended Gauge (mm²)	Recommended Gauge (AWG)
AxN 22.44.4	22	5.26	10
AxN 35.70.4	35	8.37	8
AxN 50.100.4	50	13.3	6
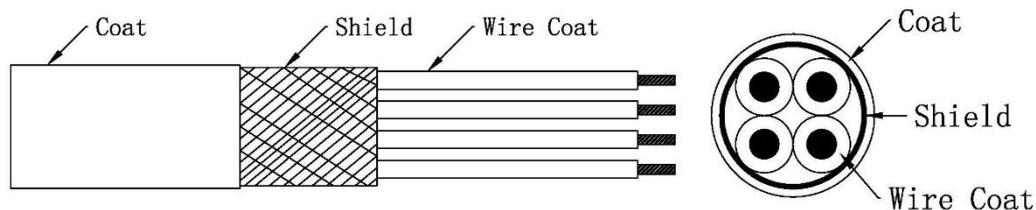
Step 2: Cable Length Measurement

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

Step 3: Strip the Cable Coat

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


Step 4: Make the Grounding Shield

Leave 65mm Shield as the grounding shield and turn it to the outside of the coat. Then, weld a wire on the shield as the drainage line.
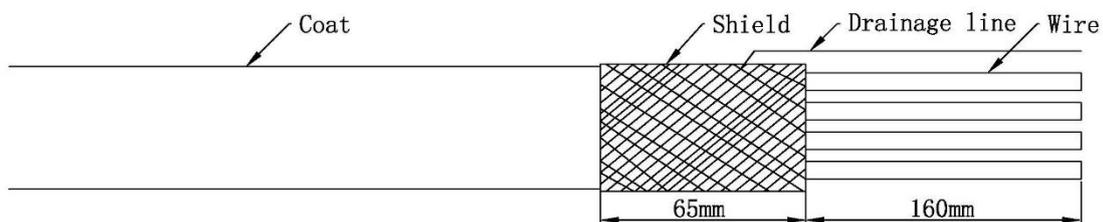
Step 5: Fix the Grounding Shield

Use a 60mm heat-shrink tube to fix the grounding shield and leave 40mm shield outside.
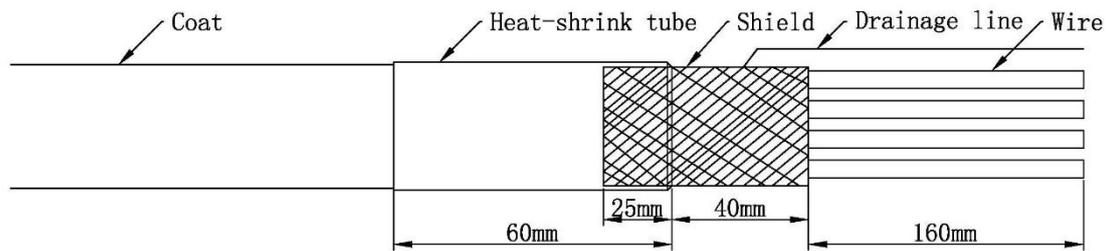
Step 6: Make the Phase Wires

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 Size3 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 Size3	Cord End Terminals	F (mm)	W (mm)	B (mm)	D (mm)	d1 (mm)
AxN 22.44.4	E6012	12	6.0	8.5	3.9	3.5
AxN 35.70.4	E10-12	12	7.5	8.8	4.9	4.5
AxN 50.100.4	E16-12	12	8.7	10.0	6.2	5.8

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

AxN Size3	Strip Length (mm)	Recommended Strip Length (mm)
AxN 22.44.4	12 ~ 20.5	14
AxN 35.70.4	12 ~ 20.8	14
AxN 50.100.4	12 ~ 22.0	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

Code End Terminal along with the drainage line.
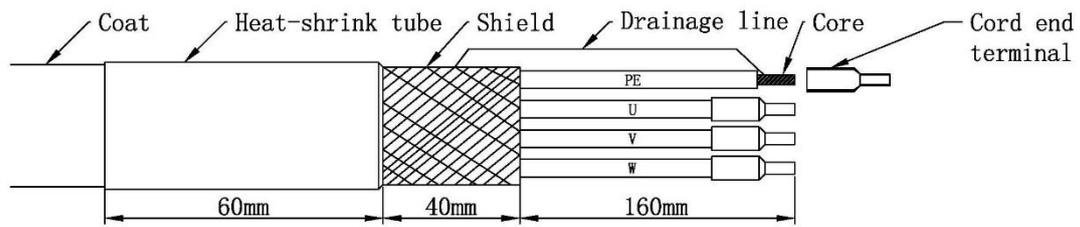
Step 8: Check and Mark

Check every wire and the connection between shield and PE wire, then label each wire.
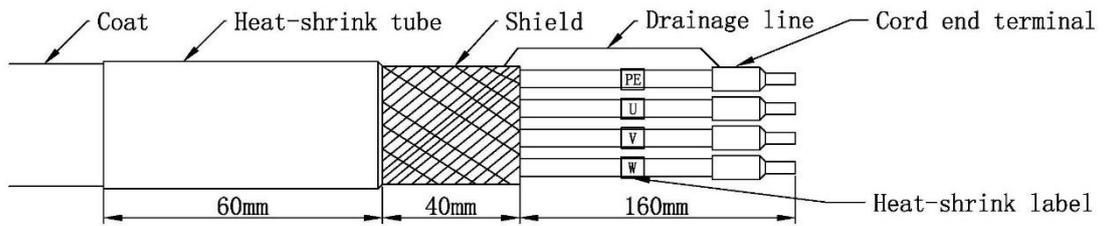
2.4.2 Motor Power Output Installation

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 Size3 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.
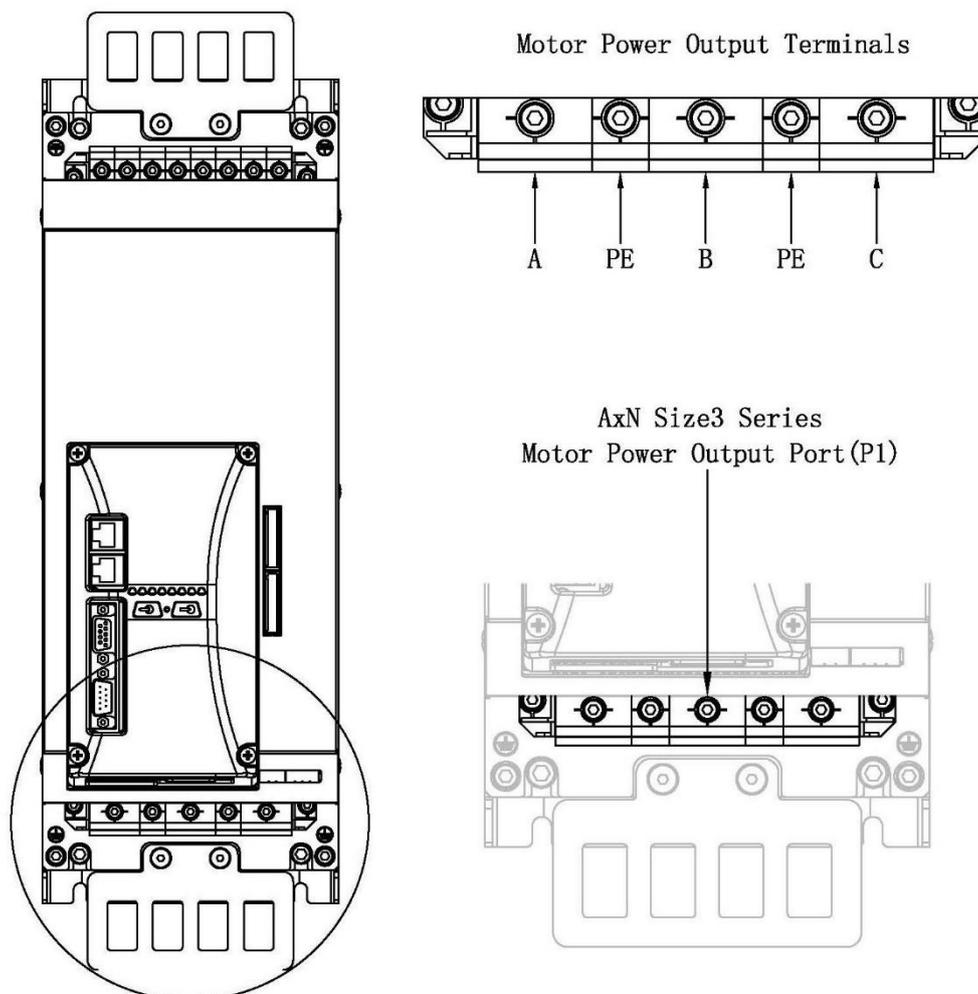


Step 2：Insert Wires into Corresponding Terminals

Use a 3mm hexagonal wrench to loosen the hexagonal 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.

3mm

┌ A   ┌ PE   ┌ B   ┌ PE   ┌ C

A   ⏚   B   ⏚   C

Use a 3mm hexagonal wrench to loosen the hexagonal screws. The length of wrench must be longer than 120mm.

120mm

NOTE: Leave only the insulated part outside

Shield

U V PE W

Cord end terminal

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

Drainage line

Heat-shrink tube

Correspondence between Wires and Terminals	
A	U/1
B	V/2
C	W/3
PE	PE/GND
PE	

Coat
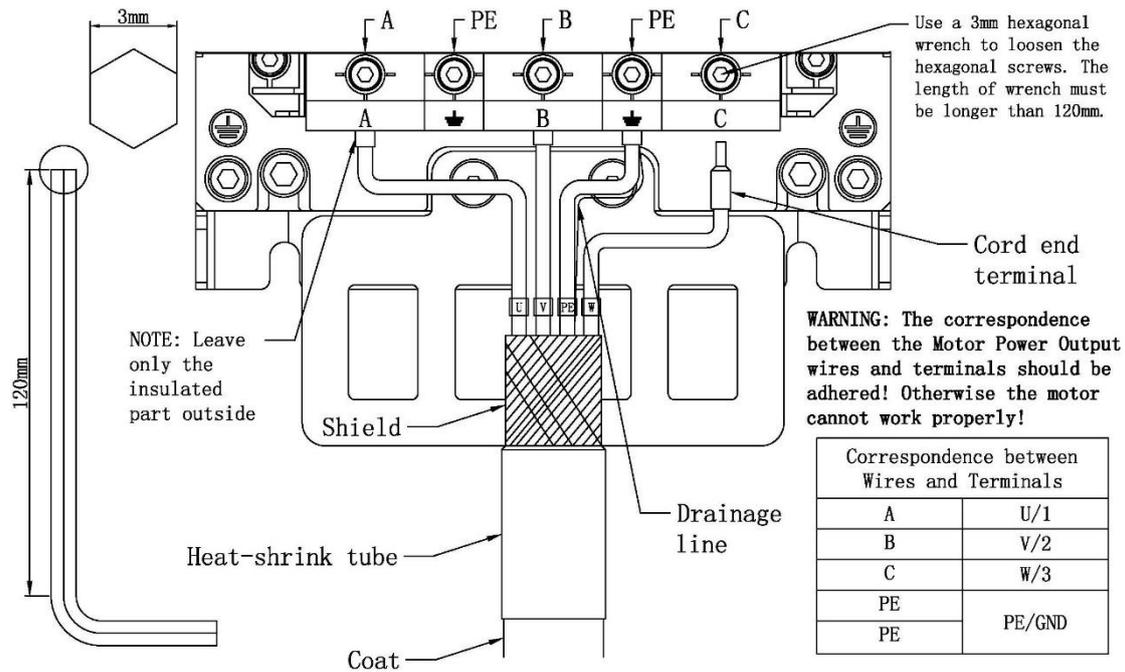
## Step 3: Tight the Terminals

Use a 3mm hexagonal torque wrench to tight the hexagonal screws on A, B, C and PE Terminals .The nominal torque to tight these terminals is 4.0 ~ 4.5Nm. If the tight torque reaches higher than 8.5Nm, the terminal will be broken.

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.

3mm

┌ A   ┌ PE   ┌ B   ┌ PE   ┌ C

A   ⏚   B   ⏚   C

Use a 3mm hexagonal torque wrench to tight the hexagonal screws. The nominal torque is 4.0 – 4.5Nm

120mm

NOTE: Leave only the insulated part outside

Shield

U V PE W

Cord end terminal

Drainage line

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

Hose Clamp

Heat-shrink tube

Correspondence between Wires and Terminals	
A	U/1
B	V/2
C	W/3
PE	PE/GND
PE	

Coat
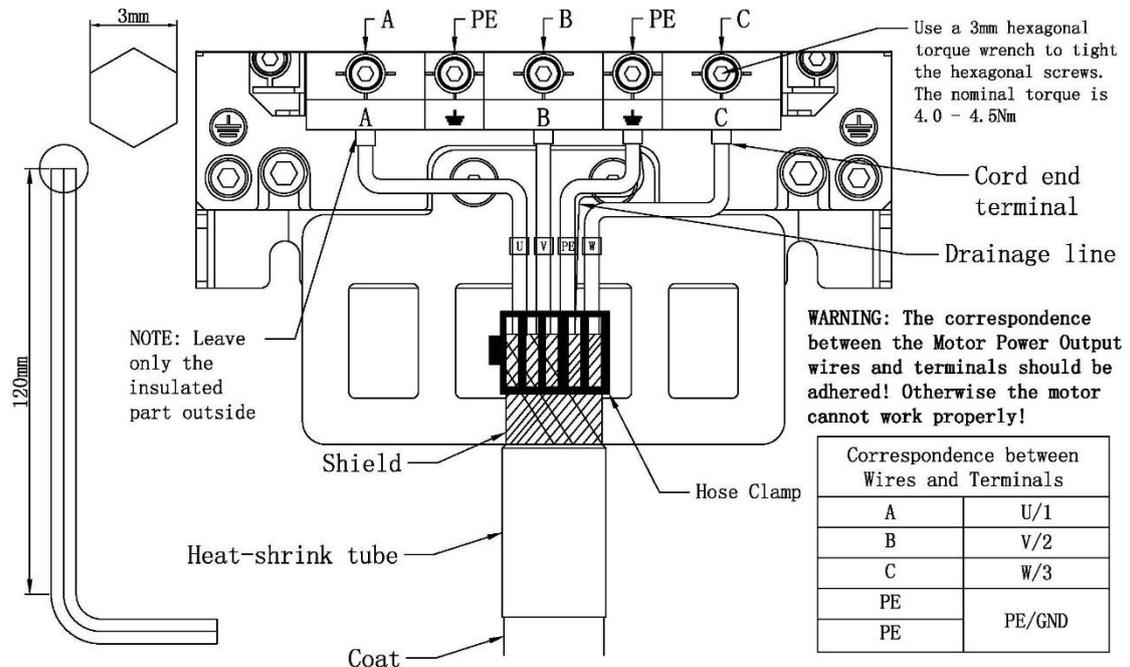
3 Control Circuit Wiring

3.1 Auxiliary Power Supply (AUX_Power)

3.1.1 Auxiliary Power Supply Requirement

Main Supply	AxN Size3
Voltage	24V
Type	DC power
Fluctuation of Voltage	±15% (22.8 ~ 25.2V)
Nominal Power	144W
Nominal Current	3A

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^2 (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 Size3 Drive (Refer to 1.5 Installation Spacing).

Step 3: Strip the Cable Coat

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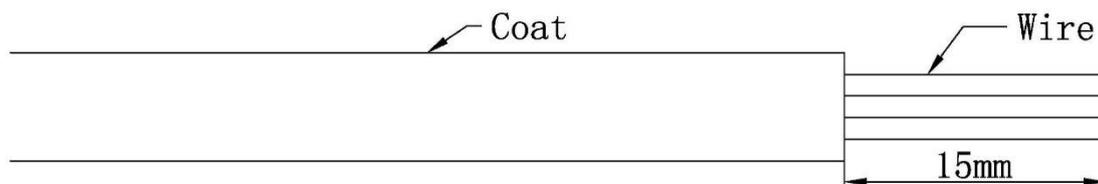

Step 4: Make DC+ Wire and DC- Wire

Mark one wire as DC+ and another as DC-, then strip wires' coat for 5mm.
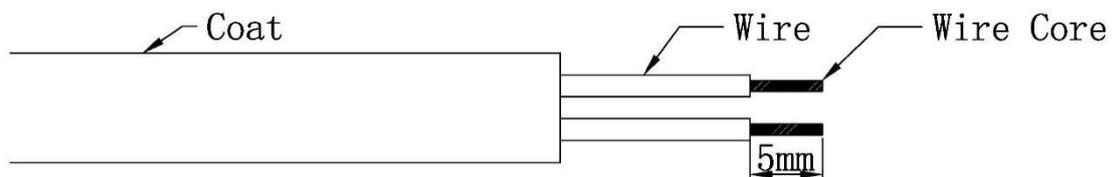
Step 5: Check and Label

Check every wire's conductivity and then label them.
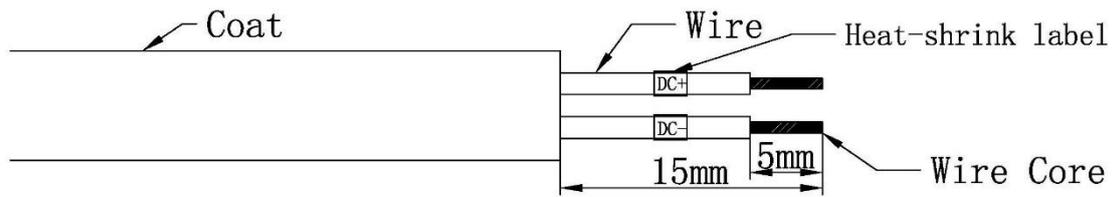
3.1.3 Auxiliary Power Supply Installation

Step 1: Check Power Supply Voltage and Power
Make sure that the auxiliary power supply's voltage is 22.8 ~ 25.2Vdc, and it can provide 6A, 140W power.

Step 2: Find out the Auxiliary Power Supply Port (AUX_Power)
AxN Series Drive's Auxiliary Power Supply Port (Female Plug, 4Pin) is on the right bottom of the drive. And a corresponding Auxiliary Power Supply Terminal (Male Plug, 4Pin) is provided in the accessories. Refer to the following figure for exact location.
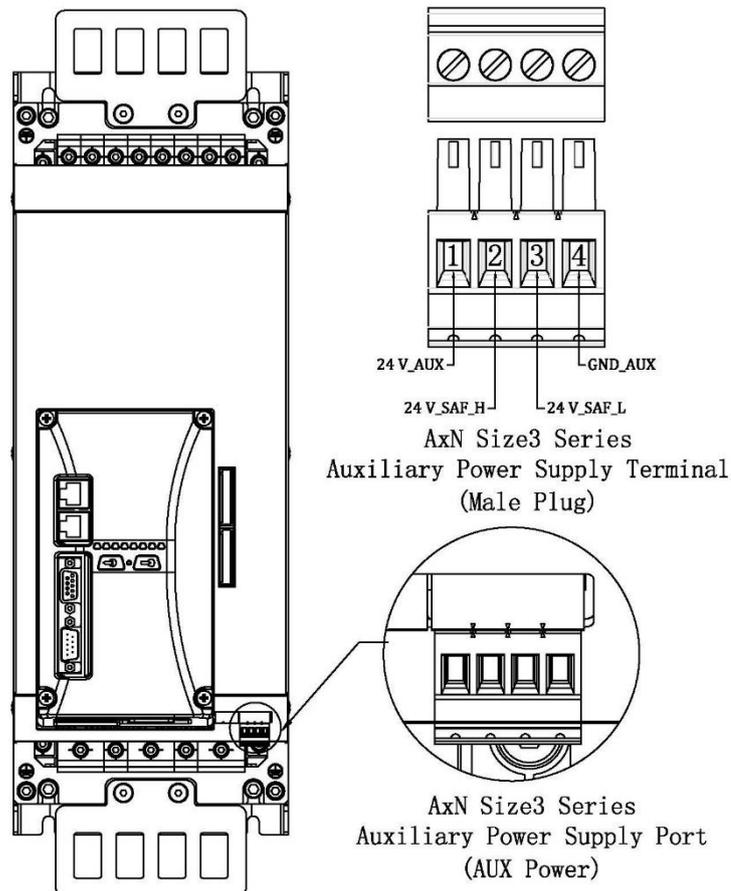

Terminal Configuration

Pin	Name	Function	Description
1	24V_AUX	Control circuit power supply	24Vdc Positive
2	24V_SAF_H	STO high-side power bridge power supply	24Vdc Positive
3	24V_SAF_L	STO low-side power bridge power supply	24Vdc Positive
4	GND_AUX	Reference ground	24Vdc Negative

STO Function

Normal version AxN Series Drive does not have the STO function. If you want to use the STO function, you must order a STO version AxN Series Drive. There are 2 pins which are related to the STO function, 24V_SAF_H and 24V_SAF_L. If you cut either of these pins' power, STO will be activated and the motor will stop. Normal version AxN Series Drive has already internally short cut Pin 24V_AUX, 24_SAF_H and 24V_SAF_L, so that STO function is disabled.

Step 3: Connect the Cable to Terminal

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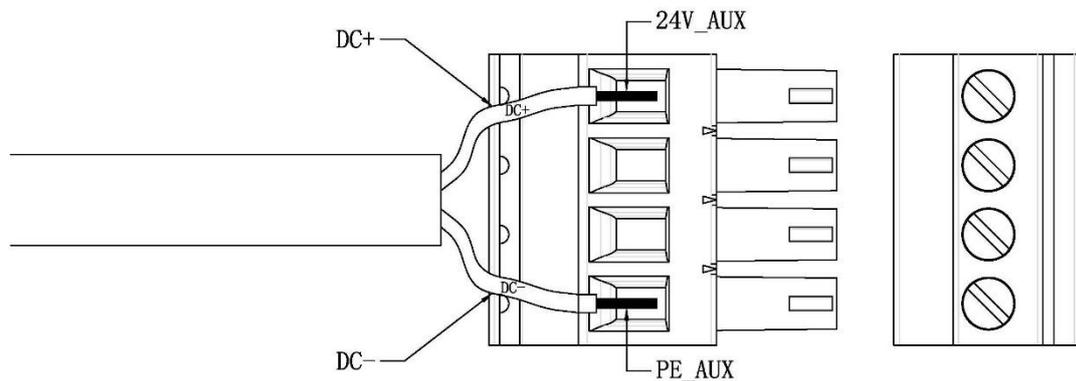

Step 4: Insert Terminal into Port

Insert the terminal along with the cable into Auxiliary Power Supply Port (AUX_Power).

3.2 System Relay (R1)

Port Location

AxN Size3 Drive's System Relay Port (Female Plug, 3Pin) is on the right bottom of the drive. And a corresponding System Relay Terminal (Male Plug, 3Pin) is provided in the accessories. Refer to the following figures for exact location.


Com ─ N.O. ─ N.C.

AxN Size3 Series
System Relay Terminal
(Male Plug)

AxN Size3 Series
System Relay Port (R1)
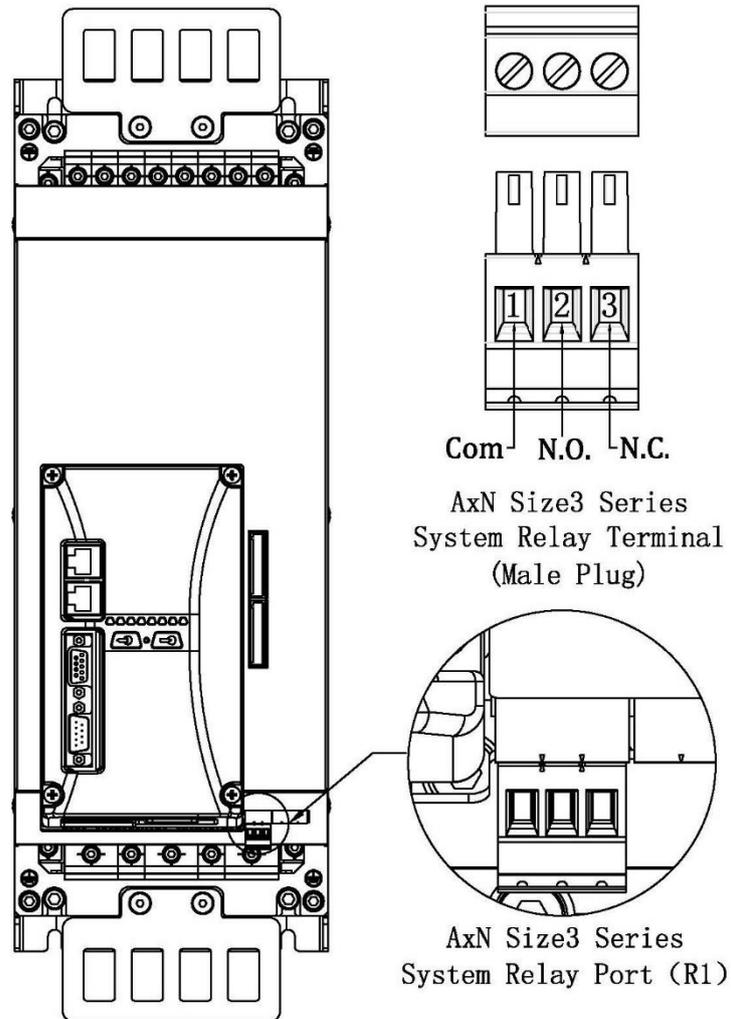
Terminal Configuration

Pin	Name	Function	Description
1	Com	Common relay contact	
2	N.O.	Relay normally open contact	To be used as drive system OK signal
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, illustrated as below.
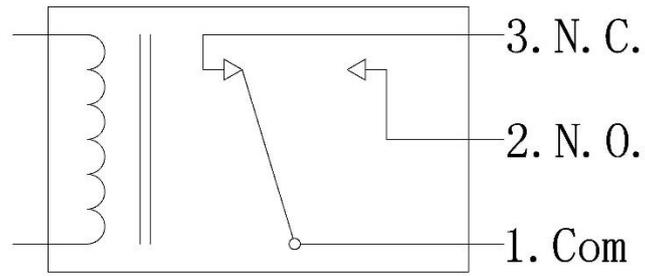
When the drive is ready, N.O. connects Com and N.C. disconnects Com, illustrated as below.
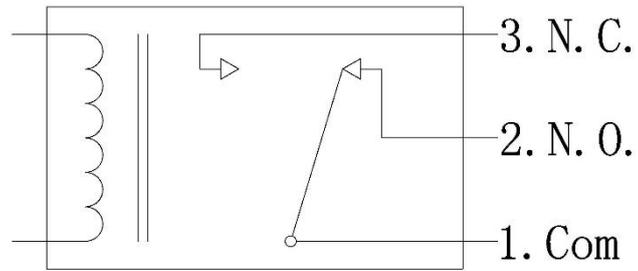
4 Communication Port

4.1 Overview of Communication Port Panel
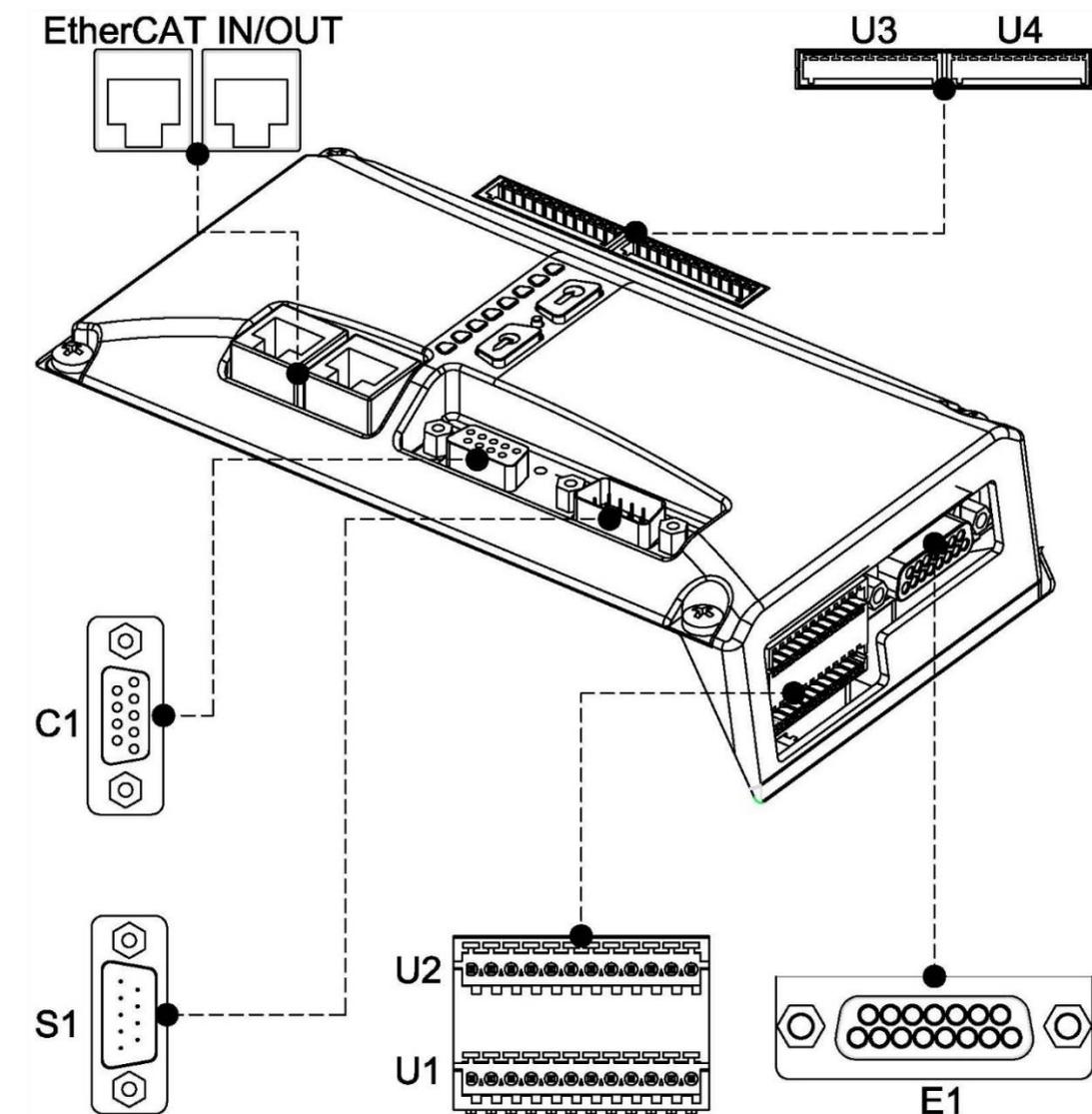
| Name	Function	Description
E1	Encoder Connector	SinCos, Endat, Digital Incremental with Hall, Resolver and Hiperface
U1/U2	User Connectors	4 Analog Inputs, 2 Analog Outputs; 8 Digital Inputs, 4 Digital Outputs
S1	Serial Bus Connector	RS232, RS422 and RS485 / Secondary CAN
C1	CAN Connector	Main CAN / 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 E1 —— Main Encoder Port

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.
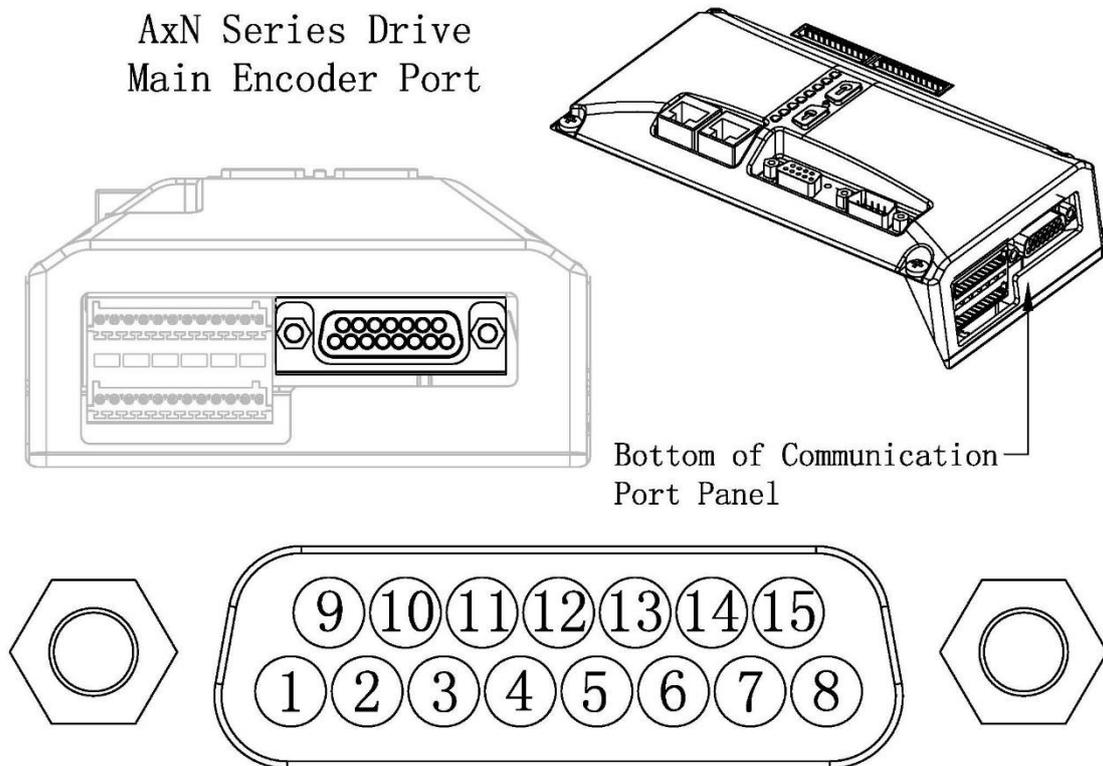
4.2.1 Sincos Encoder

Pin Assignment

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

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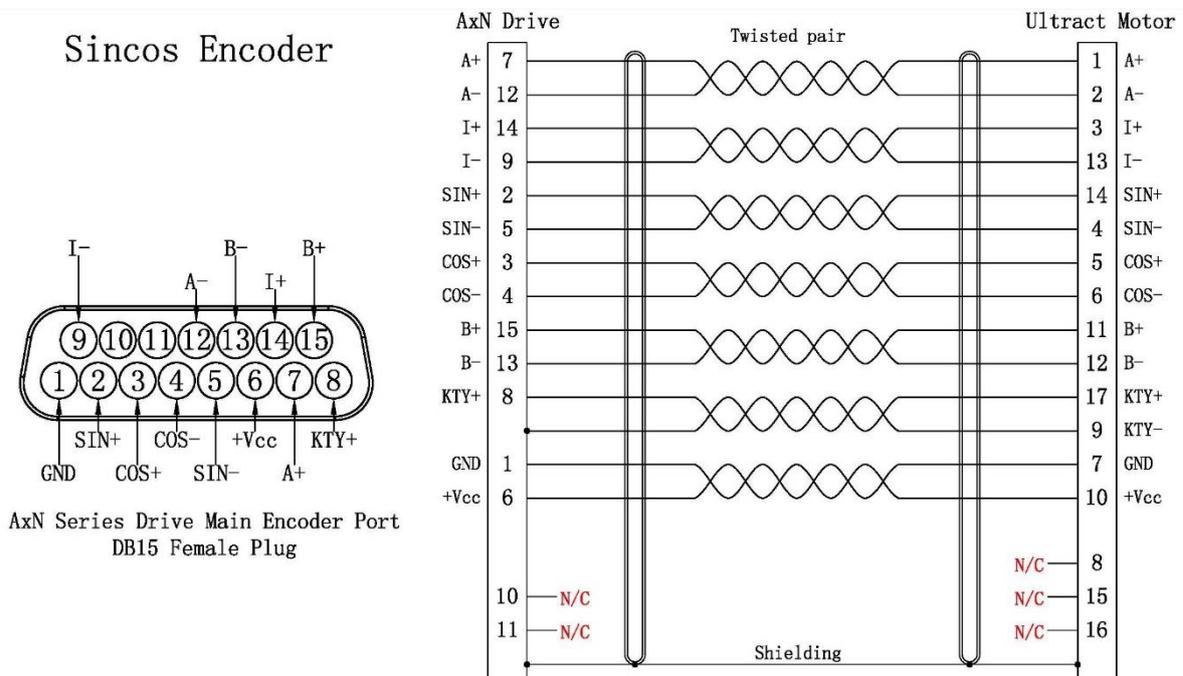
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

4.2.2 Endat Encoder

Pin Assignment

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	——	——	——

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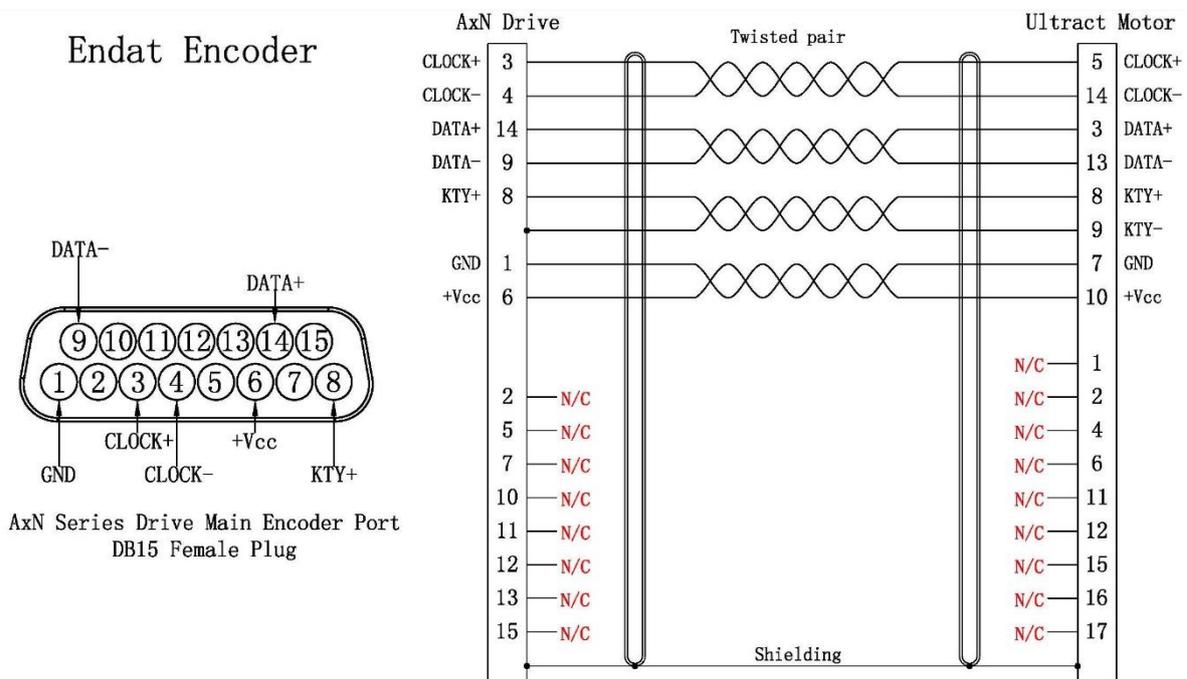
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

4.2.3 Digital Incremental Encoder with Hall

Pin Assignment

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

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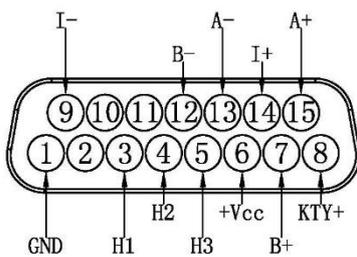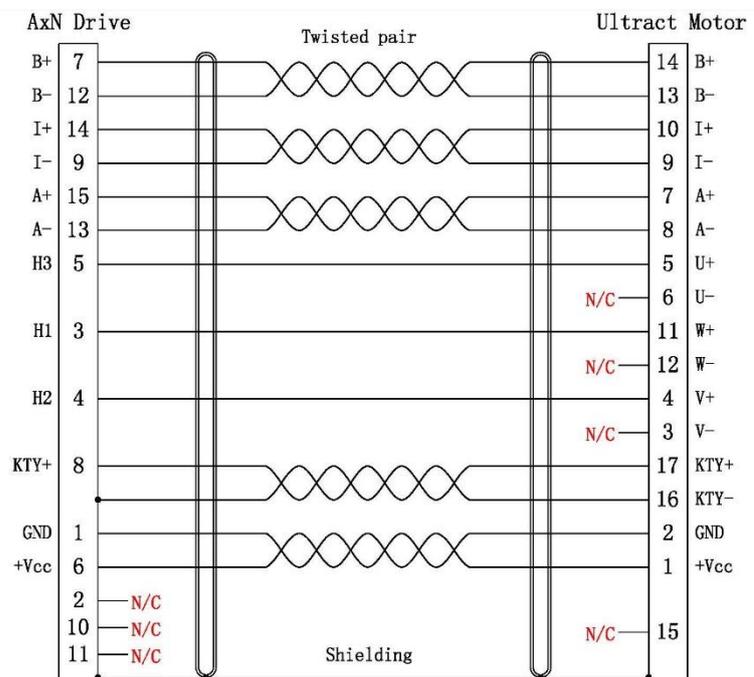
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

4.2.4 Resolver

Pin Assignment

| 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	——	——	——

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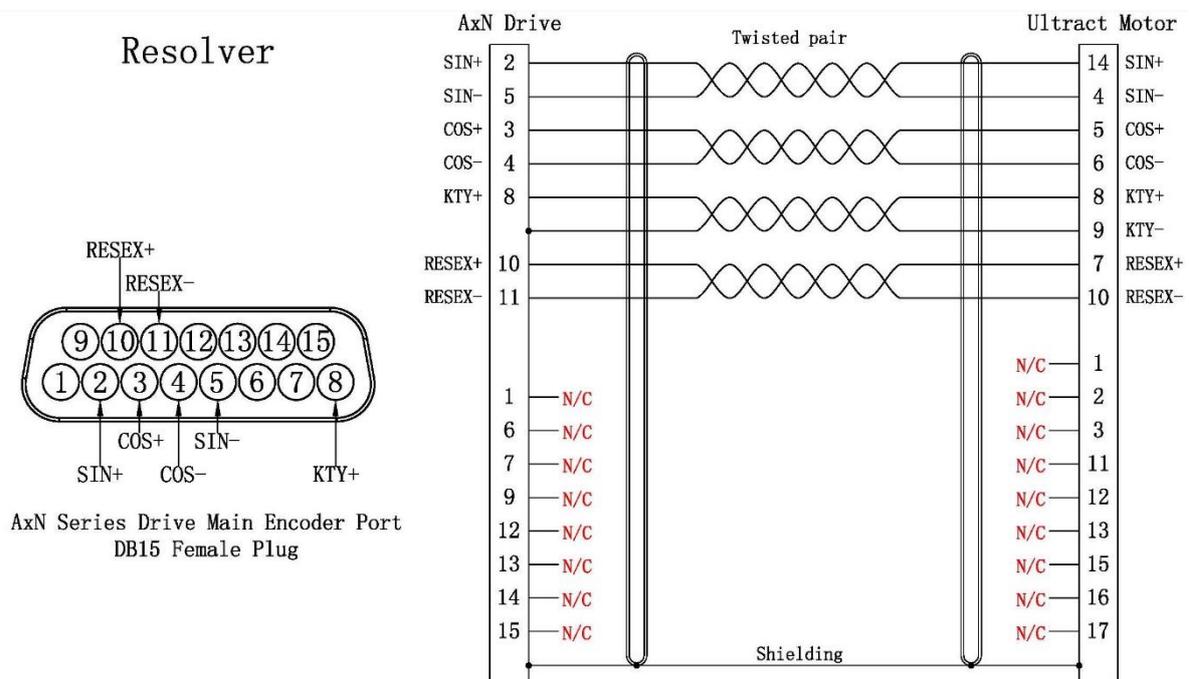
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

4.2.5 Hiperface Encoder

Pin Assignment

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

Connection Table (with Ultract Series Motors)
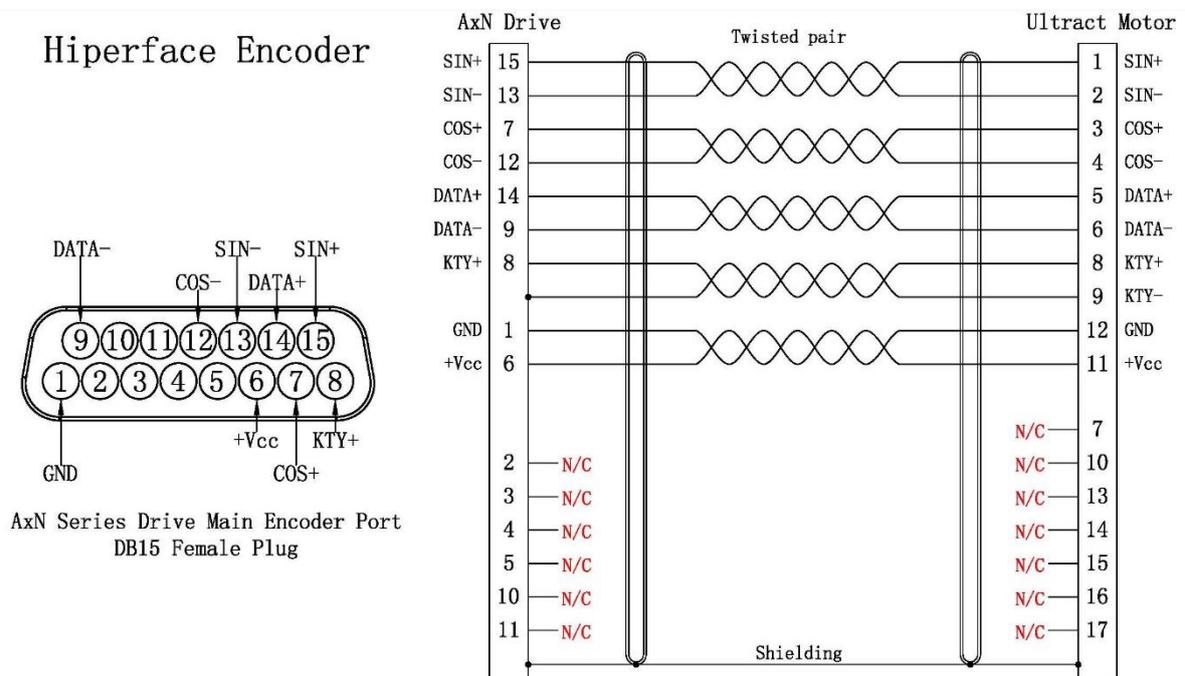

1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

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.
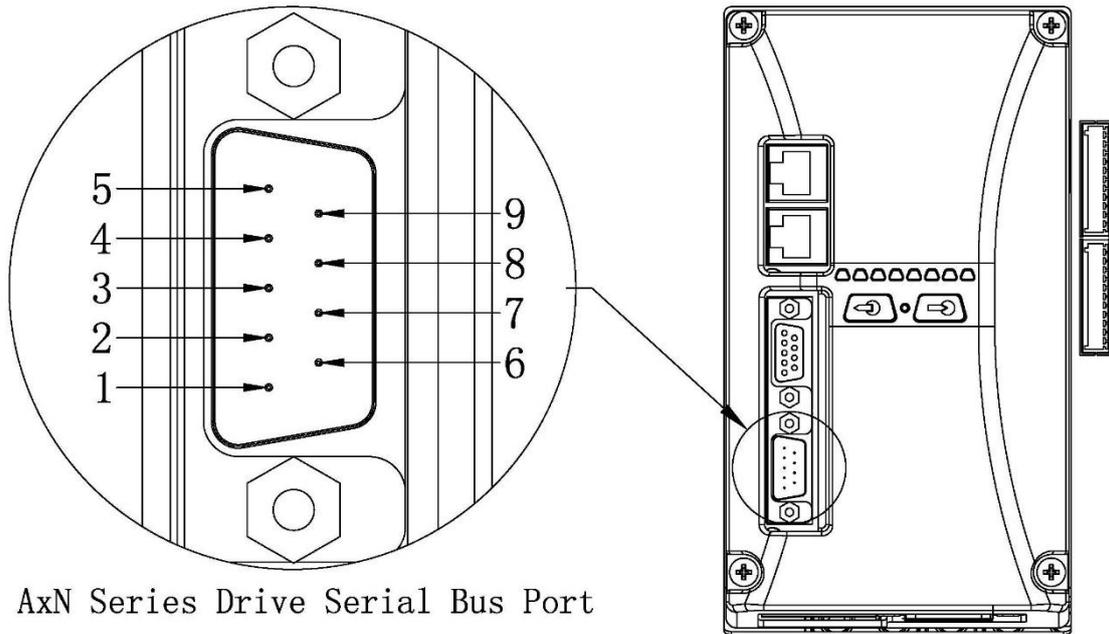
AxN Series Drive Serial Bus Port

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
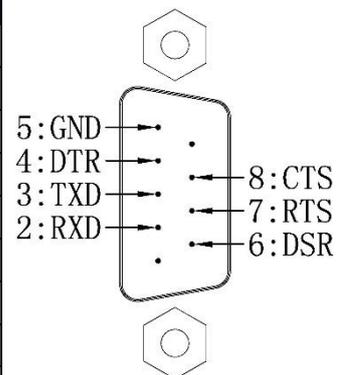
Notes:

1. 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).

2. The signal voltage is ±12V, and the max current of DTR (Pin4) is 100mA.

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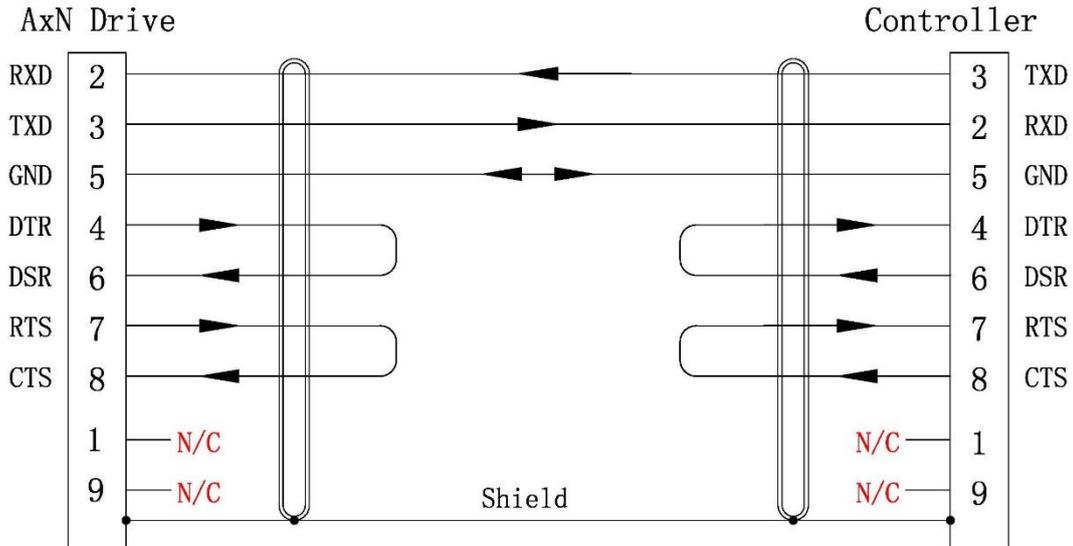
1) N/C———No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

Connection diagram
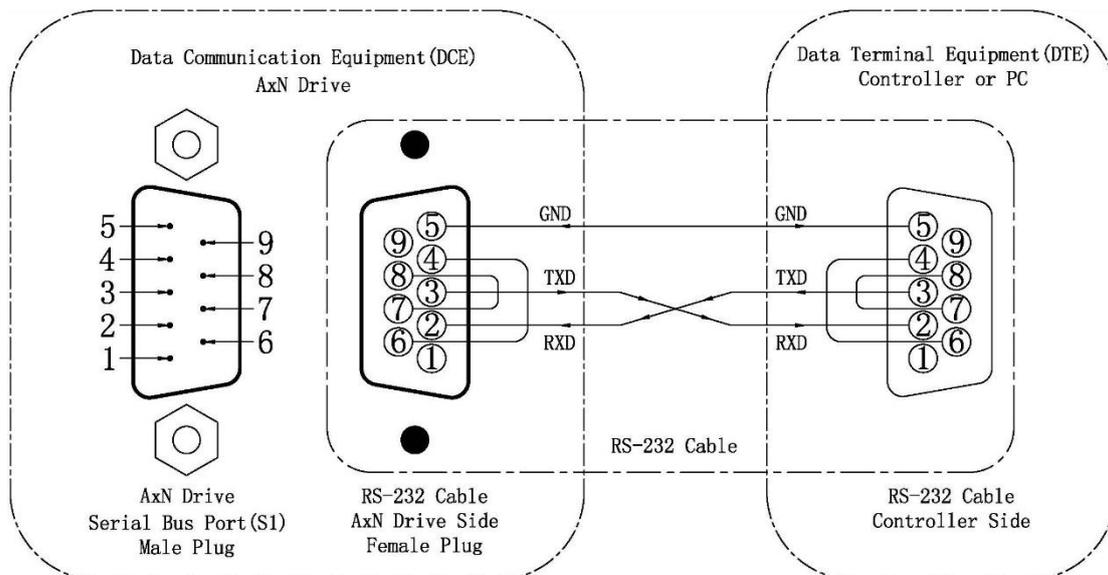
Maximal "7-wire" Connection

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
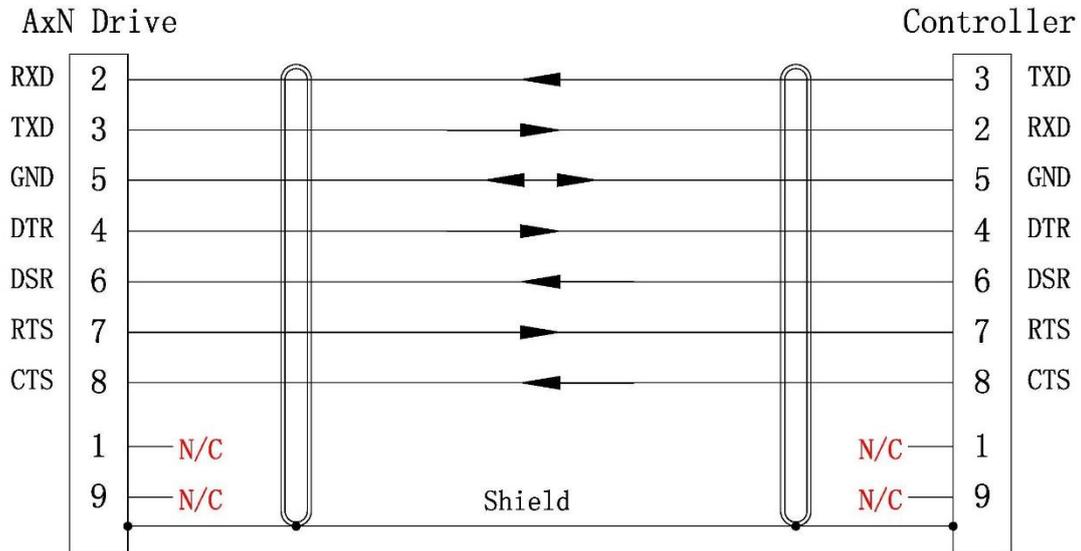
AxN Drive			Controller
RXD	2	←	3 TXD
TXD	3	→	2 RXD
GND	5	←→	5 GND
DTR	4	→	4 DTR
DSR	6	←	6 DSR
RTS	7	→	7 RTS
CTS	8	←	8 CTS
	1	N/C N/C	1
	9	N/C Shield N/C	9

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
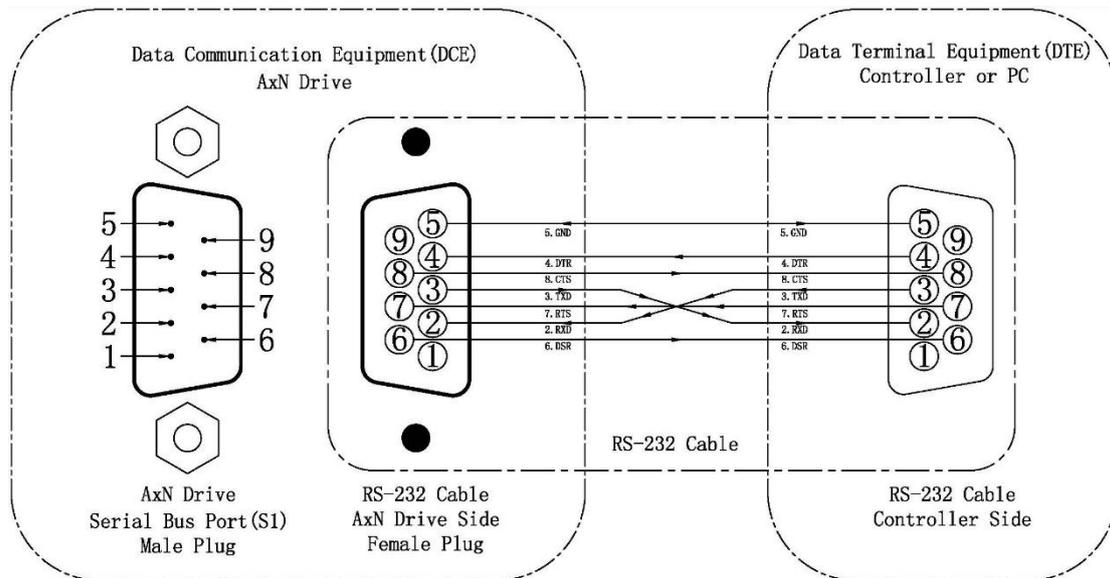
4.3.2 RS422/485

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	---	---	---

5:GND
3:TX+
2:RX−
8:RX+
7:TX−
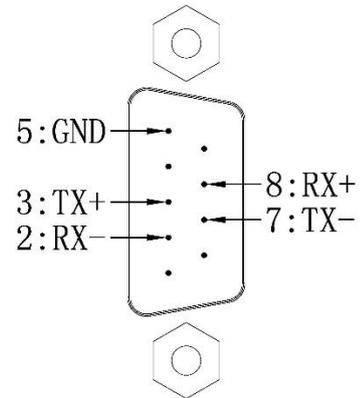
RS-422 Connection Table
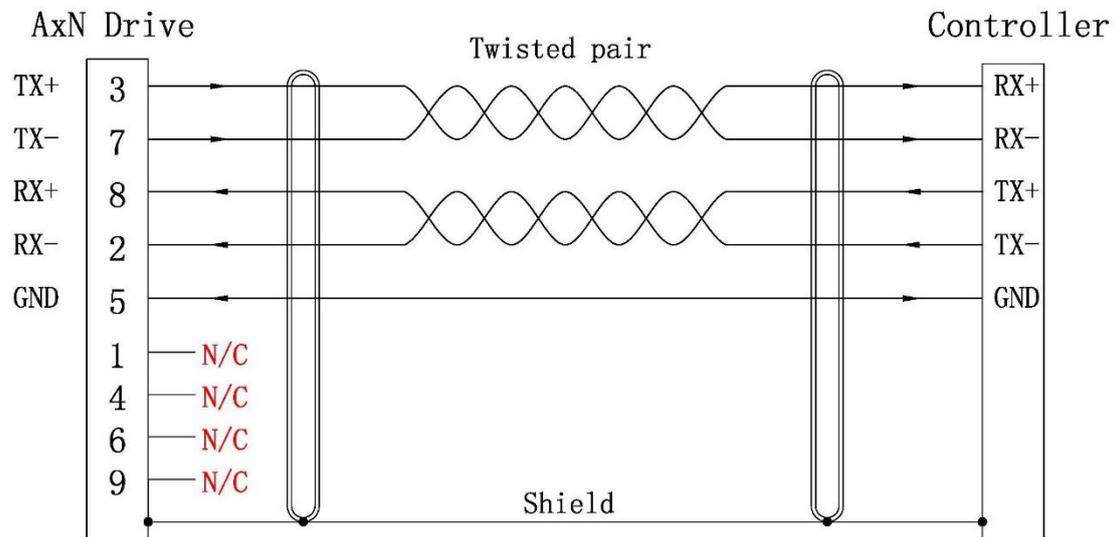
RS-485 Connection Table
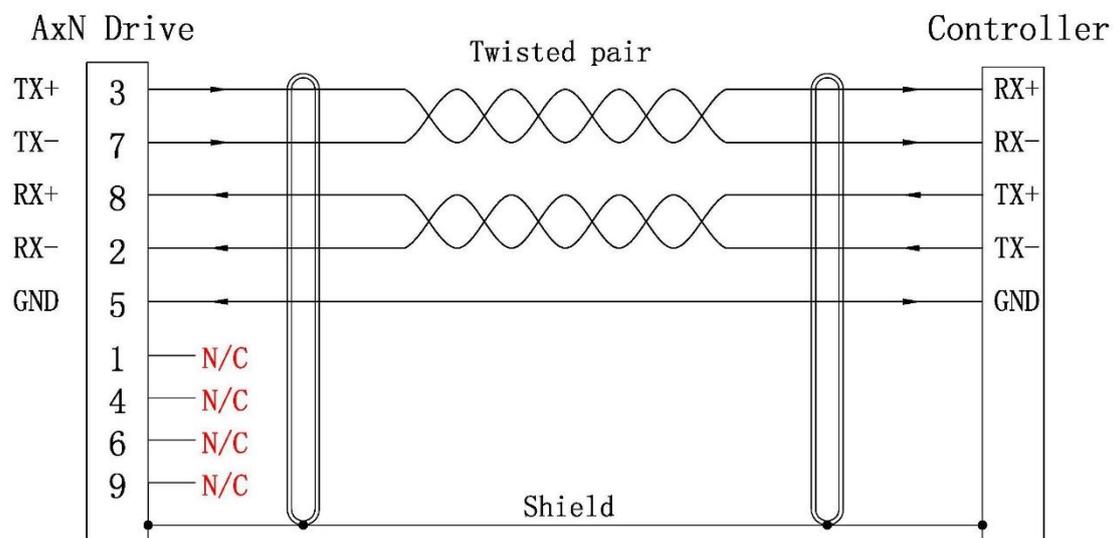
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

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)
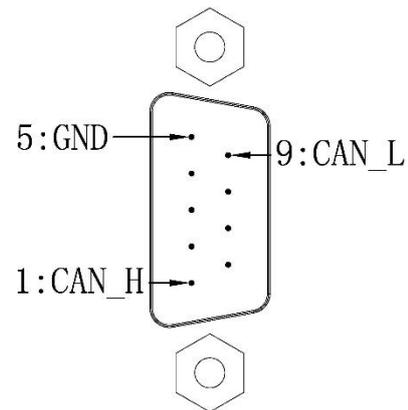
Note: CANOpen pin assignment on S1 connector does NOT meet CiA 102 Standard.

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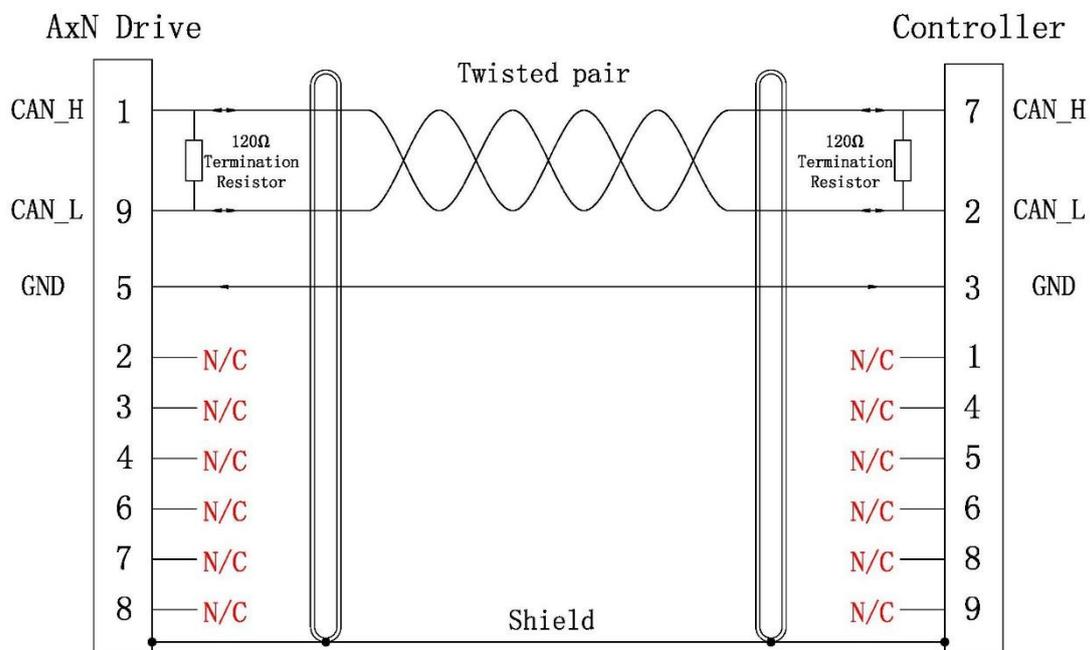
1) N/C——No Connection;
2) Connector back shell shielded 360° (Both ends);
3) ● means that the shield or cable should connect to connectors.

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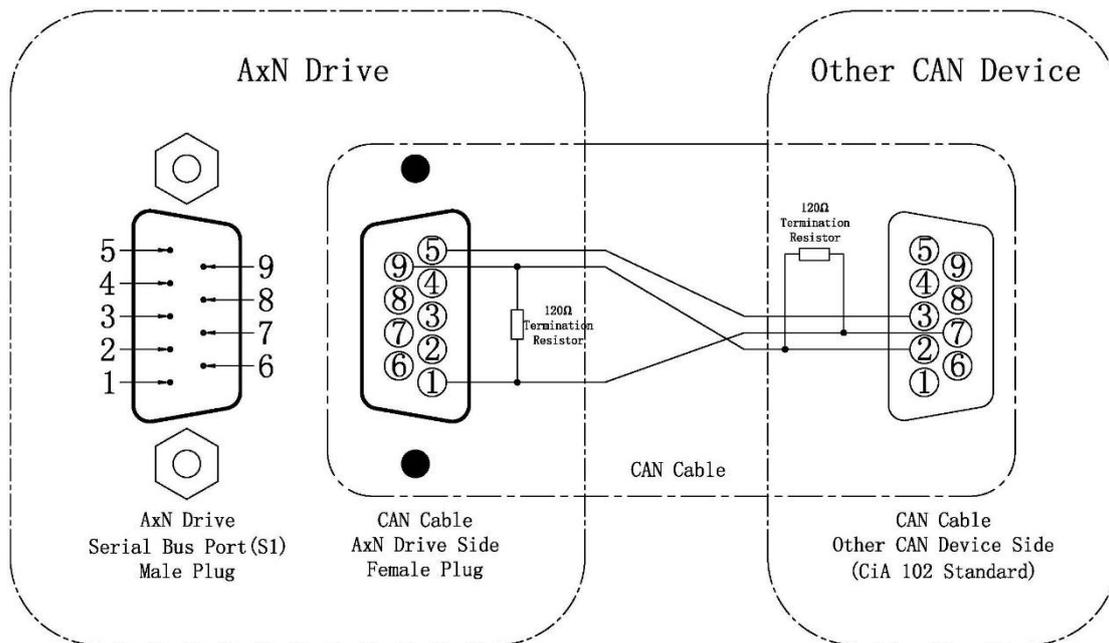
Note: Only the first and the last CAN node device should use a 120Ω terminal resistor.

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 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.
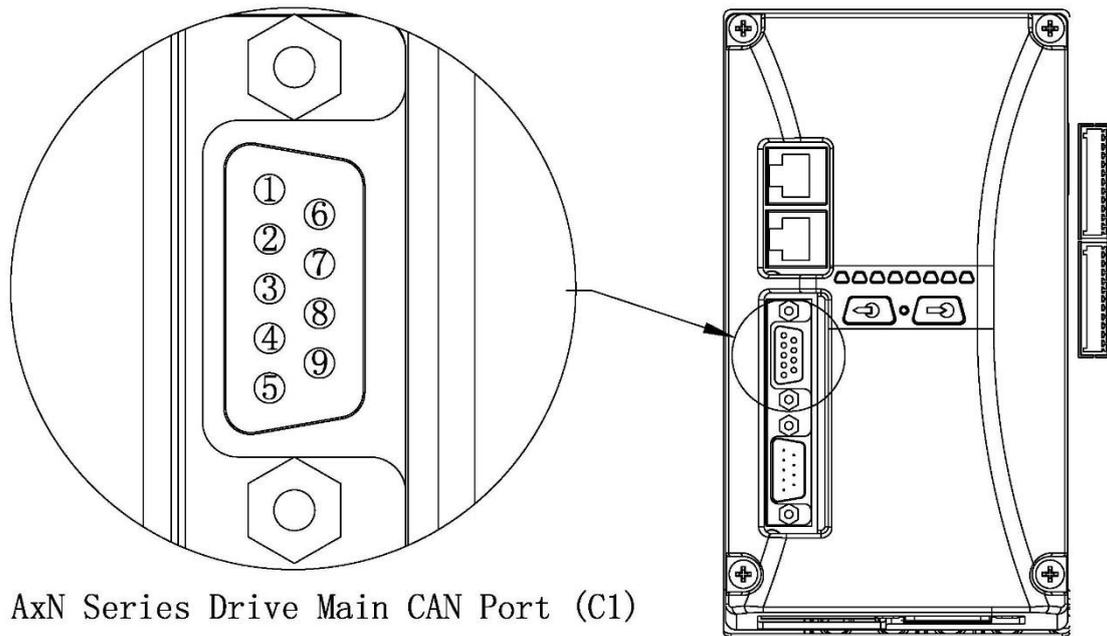
AxN Series Drive Main CAN Port (C1)

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

AxN Drive — Twisted pair — Controller

AxN Drive			Controller
CAN_H	7	7	CAN_H
CAN_L	2	2	CAN_L
GND	3	3	GND
	1 — N/C	N/C — 1	
	4 — N/C	N/C — 4	
	5 — N/C	N/C — 5	
	6 — N/C	N/C — 6	
	8 — N/C	N/C — 8	
	9 — N/C	N/C — 9	

120Ω Termination Resistor

Shield

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

AxN Drive — Other CAN Device

AxN Drive
Main CAN Port(C1)
Female Plug

CAN Cable
AxN Drive Side
Male Plug

120Ω Termination Resistor

CAN Cable

CAN Cable
Other CAN Device Side
(CiA 102 Standard)
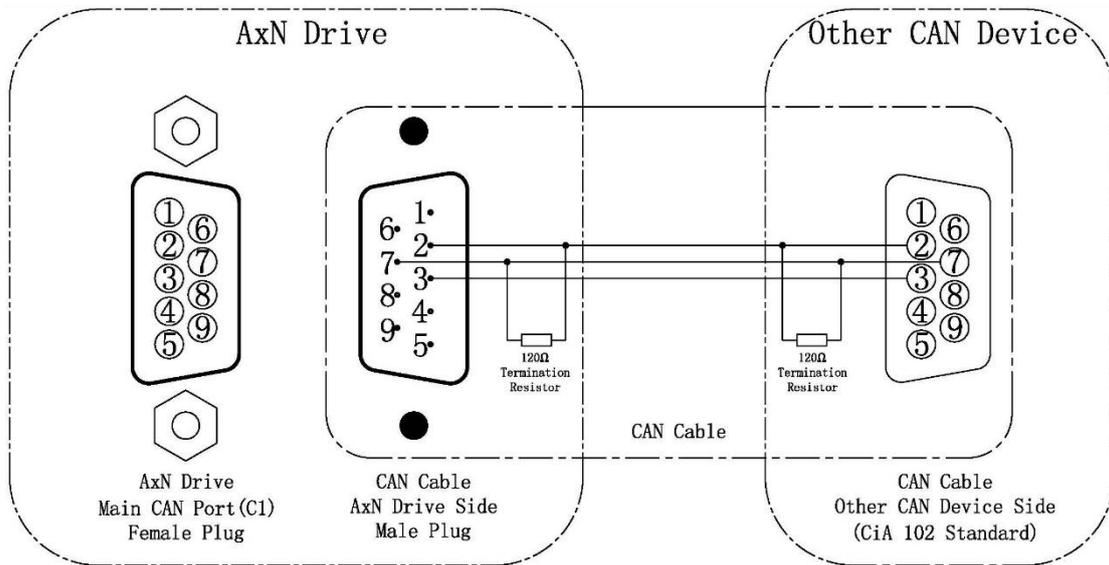
Note: Only the first and the last CAN node device should use a 120Ω terminal resistor.

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	---	---
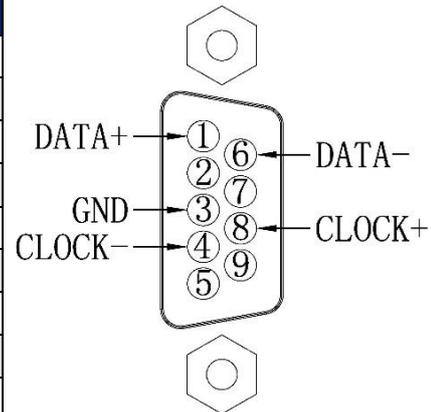
Incremental Encoder (IN/OUT)

| 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
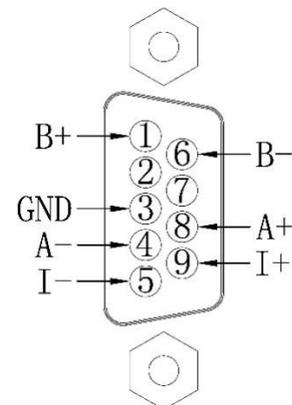
4.5 EtherCAT IN/OUT——EtherCAT Port

AxN Series Drive supports EtherCAT fieldbus protocol. And can be connected to a 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)
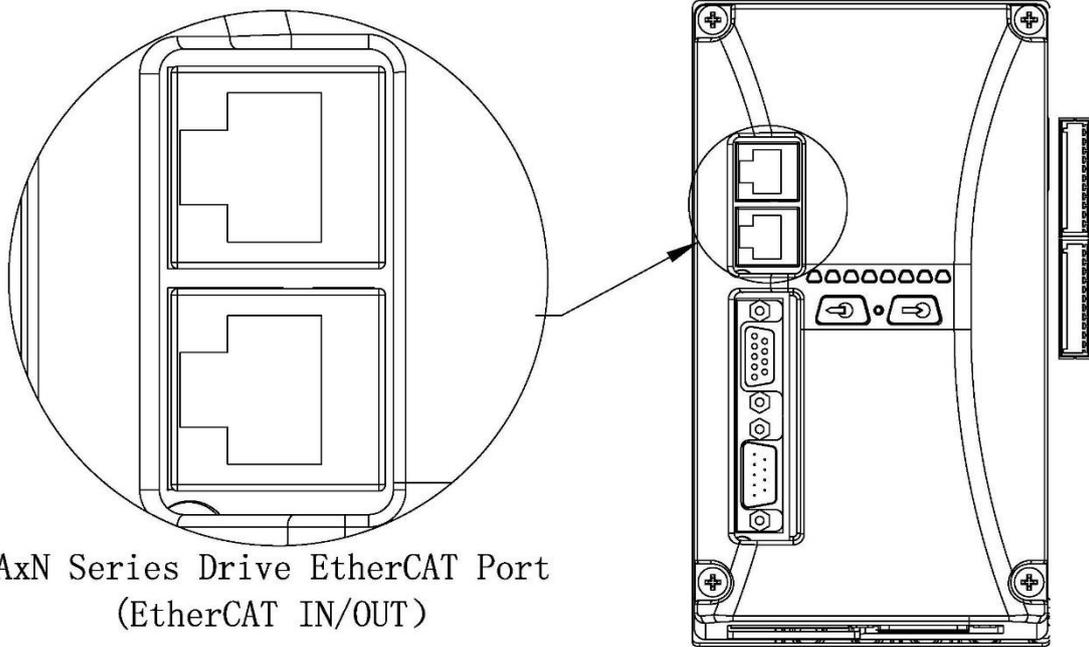
Pin Assignment

Pin	Name	Function
1	TX +	Transmit Data +
2	TX -	Transmit Data -
3	RX +	Receive Data +
4	---	---
5	---	---
6	RX -	Receive Data -
7	---	---
8	---	---
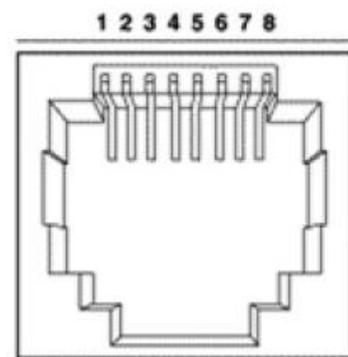
4.6 U1/U2 —— User Connectors

Port Location

AxN Series Drive's User Connectors (Male Plug, 2×12 pin) are on the left bottom of the Communication Port Panel. Refer to the following figure for exact location.
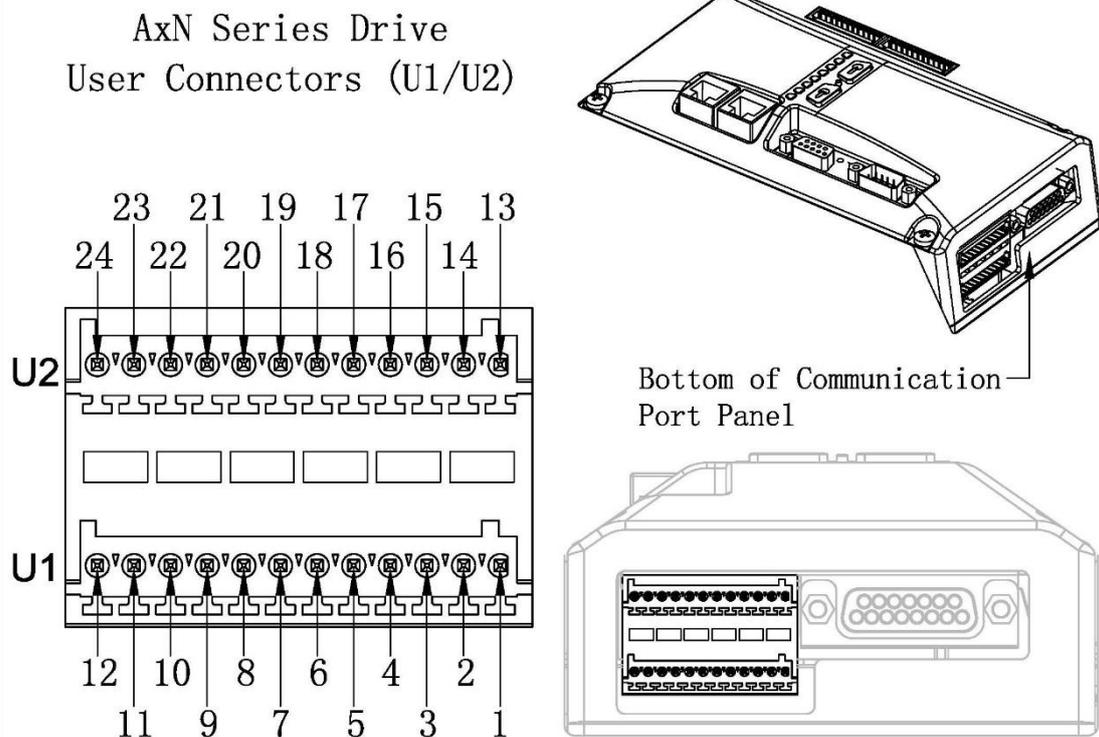
Pin Assignment

User Connector U1

Pin	Name	Function	Signal Description
1	R0P	Differential analog input	+/-10V, Zin=10KΩ
2	R0N	Differential analog input	+/-10V, Zin=10KΩ
3	AO0	Programmable analog output	+/-10V f.s., 30 mA
4	GND	Analog reference ground	Analog signals reference
5	DI0	Programmable digital input	6.6 kΩ to ground, 20-30 V
6	DI1	Programmable digital input	6.6 kΩ to ground, 20-30 V
7	DI2	Programmable digital input	6.6 kΩ to ground, 20-30 V
8	DI3	Programmable digital input	6.6 kΩ 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	24V	Auxiliary supply of control circuits	22 ~ 30Vdc to Pin 12 (0V), 500mA
12	0V	Auxiliary supply negative	Digital signal reference

User Connector U2

Pin	Name	Function	Signal Description
13	GND	Analog reference ground	Analog signals reference
14	R1P	Differential analog input	+/-10V, Zin=10KΩ
15	R1N	Differential analog input	+/-10V, Zin=10KΩ
16	AO1	Programmable analog output	+/-10V f.s., 30 mA
17	GND	Analog reference ground	Analog signals reference
18	DI4	Programmable digital input	6.6 kΩ to ground, 20-30 V
19	DI5	Programmable digital input	6.6 kΩ to ground, 20-30 V
20	DI6	Programmable digital input	6.6 kΩ to ground, 20-30 V
21	DI7	Programmable digital input	6.6 kΩ 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	0V	Auxiliary supply negative	Digital signal reference

**Notes:**

1. Pin 4, 13 and 17 are the same analog reference ground;
2. Pin 1 and 2, 14 and 15 are two pairs of differential analog input. If not using differential signal, connect pin 1, 2, 4 and 15 separately to analog reference ground (pin 4, 13 and 17), you will have 4 channels of programmable analog input;
3. Pin 12 and 24 are the same digital signal reference.

4.7 U3/U4 —— Insulated User Connectors

Port Location

AxN Series Drive's Insulated User Connectors (Male Plug, 2×12 pin) are on the right of the Communication Port Panel. Refer to the following figure for exact location.

AxN Series Drive
Insulated User Connectors
(U3/U4)
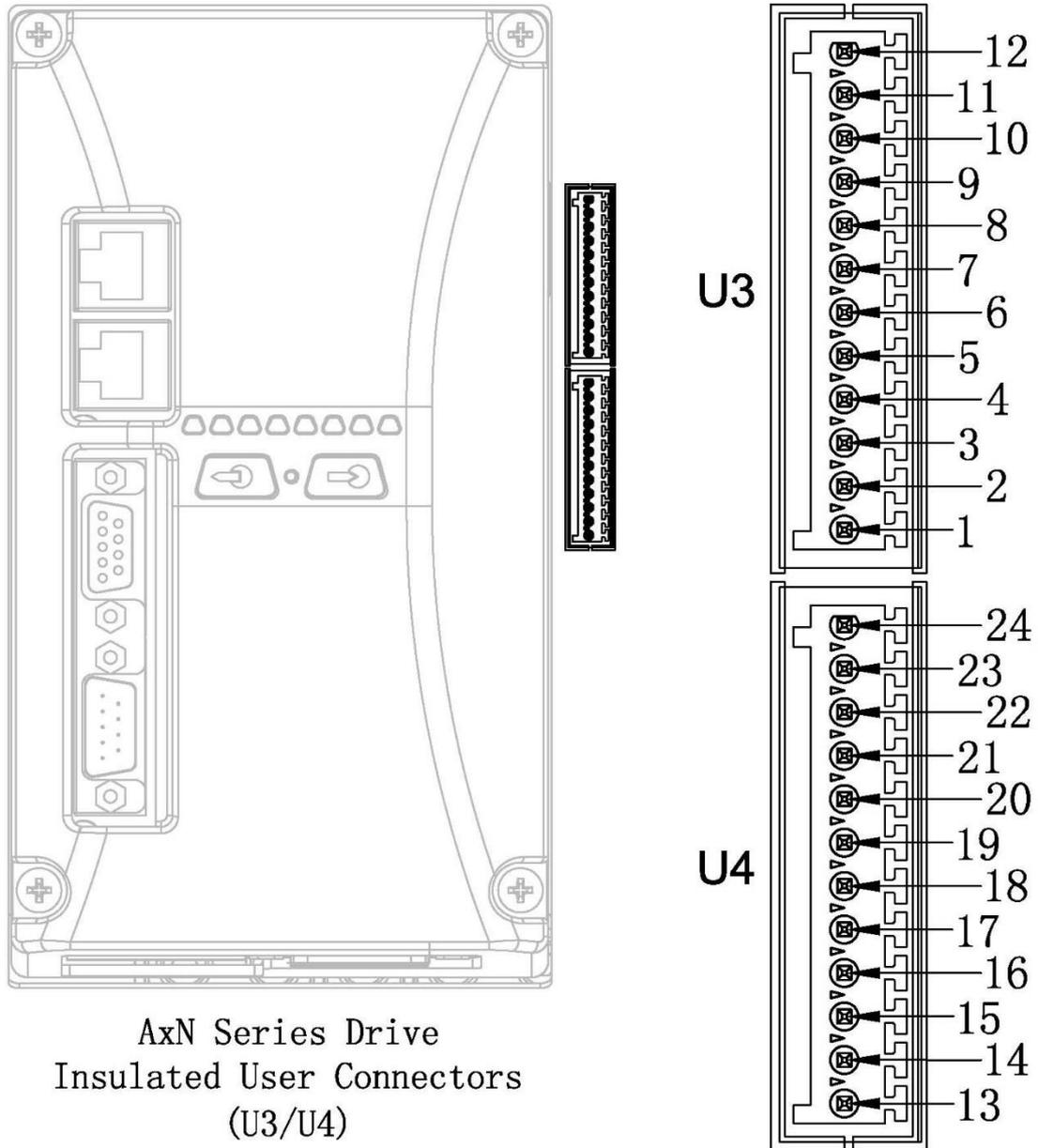
Pin Assignment

Insulated User Connector U3

Pin	Name	Function	Signal Description
1	IS_AO0P	Programmable analog output	Insulated analog output channel No.0: ±10V f.s., 30 mA
2	IS_AO0G	Analog reference ground	Insulated analog output channel No.0: Insulated reference ground
3	IS_AO1P	Programmable analog output	Insulated analog output channel No.1: ±10V f.s., 30 mA
4	IS_AO1G	Analog reference ground	Insulated analog output channel No.1: Insulated reference ground
5	IS_AI0G	Analog reference ground	Insulated analog input channel No.0: Insulated reference ground
6	IS_AI0P	Programmable analog input	Insulated analog input channel No.0: ±10V
7	IS_AI1G	Analog reference ground	Insulated analog input channel No.1: Insulated reference ground
8	IS_AI1P	Programmable analog input	Insulated analog input channel No.1: ±10V
9	IS_AI2G	Analog reference ground	Insulated analog input channel No.2: Insulated reference ground
10	IS_AI2P	Programmable analog input	Insulated analog input channel No.2: ±10V
11	IS_DO0P	Programmable digital output	Insulated digital output channel No.0:
12	IS_DO0N	Programmable digital output	On/Off switch, 9V ~ 28Vdc/2A

Insulated User Connector U4

Pin	Name	Function	Signal Description
13	DI_COM	Digital reference ground	Insulated reference ground for digital input
14	IS_DO1P	Programmable digital output	Insulated digital output channel No.1:
15	IS_DO1N	Programmable digital output	On/Off switch, 9V ~ 28Vdc/2A
16	IS_DI0	Programmable digital input	5mA, 24Vdc max
17	IS_DI1	Programmable digital input	5mA, 24Vdc max
18	IS_DI2	Programmable digital input	5mA, 24Vdc max
19	IS_DI3	Programmable digital input	5mA, 24Vdc max
20	IS_DI4	Programmable digital input	5mA, 24Vdc max
21	IS_DI5	Programmable digital input	5mA, 24Vdc max
22	IS_DI6	Programmable digital input	5mA, 24Vdc max
23	IS_DI7	Programmable digital input	5mA, 24Vdc max
24	DI_COM	Digital reference ground	Insulated reference ground for digital input

Notes: Pin 13 and 24 are the same digital reference ground.