Permanent Magnet AC Servo Motor
Instruction Manual

Preface

Thanks for purchasing Physis motor！

Before using the motors, please read this manual carefully to have a thoroughly understanding of product and ensure proper usage.If necessary, please keep in contact with Physis technicians for getting necessary help, so that you can use and maintain the motor correctly and make it work reliable and durable.

This manual includes some very important safety warnings, please comply with them.

⚠️
WARNING

- The motor should be carefully handled to prevent the serious damage by strongly dropping, bumping and shocking. No tapping on the motor extension shaft and the end of motor.
- It is necessary to confirm that the connecting device is fixed before hoisting the motor;
- When installing the motor, please pay attention to prevent foreign matters falling into the motor;
- Before using the motor, the corresponding temperature sensor KTY/PTC must be connected to the corresponding port of the drive;
- Before using the Ultract III series motors, please confirm the carrier frequency is 8kHZ, and it is strictly forbidden to operate below 4KHZ;
- Before using the Express series motors, please confirm the carrier frequency is 4kHZ, and it is strictly forbidden to operate below 4KHZ;

Abbreviation Instructions

Physis	--	Ningbo Physis Technology Co.,Ltd.
U3	--	Ultract III Series Servo Motors
E0	--	Express Series Servo Motors
AxM	--	AxM Series Servo Drive
AxN	--	AxN Series Servo Drive
AxW	--	AxW Series Servo Drive
PH300	--	PH300 Series Servo Drive
Heidenhain	--	Germany Heidenhain
SICK	--	Germany SICK
Tamagawa	--	Japan Tamagawa
LENZE	--	Germany LENZE
KEB	--	Germany KEB
SIEMENS	--	Germany SIEMENS
B&R	--	Germany B&R
CT	--	America Emerson CT

CONTENTS

Chapter 1   Declaration Conformity

Declaration of EC directives: Declaration of conformity to the EC Low Voltage Directive 73/23/CEE.

Permanent magnet AC servo motors of Physis company were designed, manufactured and tested in conformity to the EC Low Voltage Directive 73/23/CEE.

applicable standard: IEC72/1, 34/1, 34//55, 34/11;
EN60034-1+VAR A1 +VAR A2;
EN60529;
EN50262;
CEE73/23.

Chapter 2   Inspection

Before using motor, please check:
- Whether the motor is damaged during transportation;
  Whether motor parameters on nameplate are same as the order, such as rated power, voltage, current, speed and so on;
  Whether all motor accessories are right;
- Whether motor fasteners are looseness or dropped.
- Rotate motor shaft by hand, shaft movement should be smoothly and the motors have no abnormal noise.
- Open the terminal box and use tramegger (500V) to measure winding's insulation resistance. The resistance should be no less than 50 MΩ.

Note: If you get some problem during checking motor, please contact Physis or your supplier immediately.

Chapter 3   Installation

3.1 For installation and commissioning of servo drive, must be qualified personnel which receive professional training. And the environmental conditions need to accord with standard requirements. Motor installation should keep away from other machines to get good ventilation and to make it easy to check, monitor and clean.

3.2 For the motor with baseplate, the mounting surface should be firm, sturdy, and have a certain rigidity. The mounting surface should be flat. If the flatness is poor, the motor will not run smoothly and the bearing will be damaged. If you want to put a shim on the baseplate, it must be ensure that it is not extruded out during the installation of the motor baseplate.

3.3 The motor is allowed to be driven by coupling, toothed belt and metal belt. Professional tools must be used when install or disassemble parts (such as coupling, flange, belt pulley, gear box and etc.) which rotate with the motor. Threaded central holes at the motor shaft can be used. No tapping. When the coupling is used to drive, the center line of the motor shaft should coincide with the center line of the load machine. If the deviation is too large, the motor will generate strong vibration during operation, which will damage the motor and equipment.

3.4 When axial force acting on the motor is inevitable, the part rotating with the motor should lean on the shoulder of extension shaft , and install the spacer sleeve if necessary.

3.5 It should not have axial force for the motor with brake.

3.6 It should not be too loose when the internal spline or rectangular toothed motor is installed with oil pump, and on the shoulder of extension shaft , and install the spacer sleeve if necessary.

3.7 UIII series motors and Express serires motors adopt Physis AxN drive to complete the performance tests. If you want to choose other drives, please connect with Physis.

3.8 Installation Methods

● Motor size, mounting holes size of front flange and screw thread specifications:

UIII Motor Size	U303	U305	U307	U310	U313	U318
Mounting Hole Size of Front Flange	φ6	φ9	φ11	φ14.5	φ19	φ22
Screw Thread Specifications	M5	M8	M10	M12	M16	M20

UIII Motor Size	E010	E012
Mounting Hole Size of Front Flange	φ13.5	φ17.5
Screw Thread Specifications	M12	M16

● Motor size, mounting holes size of baseplate and screw thread specifications :

UIII Motor Size	U310A	U310F	U310C	U313A	U313C	U313C	U318F	U318C
Mounting Hole Size of Baseplate	φ12	φ12	φ12	φ14	φ18	φ18	φ22	φ22
Screw Thread Specifications	M10	M10	M10	M12	M16	M16	M20	M20

UIII Motor Size	E010F	E012F
Mounting Hole Size of Baseplate	φ12	φ18
Screw Thread Specifications	M10	M16

● Motor size, front flange size, front flange joint size and extension shaft diameter specification:

UIII Motor Size	U303	U305	U307	U310	U313	U318
Front Flange Size	□75	□100 (115)	□145	□200	□264	□360
Front Flange Joint Size	φ60j6	φ95j6	φ130j6	φ180j6	φ250j6	φ350h6
Extension Shaft Diameter	φ14j6	φ19j6	φ24j6	φ42j6	φ48/60j6	Check the notes as below

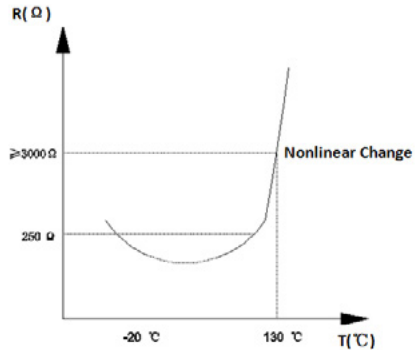| UIII Motor Size	E010	E012
Front Flange Size	□200	□260
Front Flange Joint Size	φ180j6	φ250j6
Extension Shaft Diameter	φ42k6	φ48k6

Notes:

1) U318035: φ60m6;

   U318050/U318060/U318070: φ80m6;

   U318100: φ90m6.

2) The above standard dimensions are for reference only, subject to physical drawings.

Chapter 4   Temperature Protection

4.1 Motor temperature sensor KTY84/PTC130 (Temperature-Resistance curve)
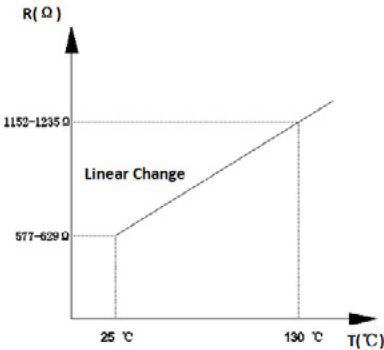
Property curve Of KTY84-130 Thermistor   Property curve Of PTC-130 Thermistor

4.2 Temperature sensor KTY/PTC combined with other drives:

Drive Brand	PHYSIS	INOVANCE	KINWAY	KEB	MODROL	SIEMENS	LENZE	CT	DELTA
KTY84	●	○ +1KΩ	●	—	—	●	—	● +2 KΩ	● +2 KΩ
PTC130	●	●	—	●	●	—	—	—	●
KTY83	○	—	—	—	—	—	●	—	—

● : Support   ○ : Optional   — : Not supported

Notes:

1)   INOVANCE drive (such as ES580 Series) PG card support PTC130 and KTY84-130 together;

2)   INOVANCE drive can support KTY84-130 through the analog interface terminal, but it needs to connect 1K resistance to KTY.

3)   DELTA drive can support KTY84-130 through the analog interface terminal, but it needs to connect 2K resistance to KTY.

4)   When using KTY84-130 temperature sensor, alarm temperature parameters of the drive shall be set at 130°C .

4.3 Characteristics of temperature sensor KTY/PTC:

Temperature sensor	Outgoing line positive/+	Outgoing line negative /-	Rated current	Measuring point
KTY84-130	Brown	White	2mA	Single-point
PTC130	Blue	Blue	2mA	Three-point
KTY83	Green	Green	2mA	Single-point

Note: Temperature sensor KTY84 has positive and negative points, which should correspond to the positive and negative of the drive. No cross use is allowed.

Chapter 5   Encoder Configuration

■ UIII servo motors adopt Sincos encoder as standard feedback. It overcomes the limitation of the resolution of the traditional resolver and the digital encoder. And it can achieve excellent low speed servo performance and uniform rotation characteristics. According to the customer's requestswe, we also can adopt absolute encoder, resolver encoder, incremental, Sick absolute encoder and other brand encoders.

■ E0 series servo motor use resolver encoder as standard, which is mainly used in hydraulic application and it can meets all requirements of this application.

Table1. Encoder Code, Signal Cable Colors and Signal Definition

Resolver (Tamagawa) TS2650N21E78 / TS2640N321E64 (Encoder Code: R3 / R4)		Absolute encoder(Sick) SRS50 / SRM50 / SKS36 / SKM36 (Encoder Code: S5 / S8 / S11 / S12)	
Resex+	Red / White	Sin+	White
Resex-	Yellow / White(Black / White)	Sin-	Brown
Sin+	Blue	Cos+	Pink
Sin-	Yellow	Cos-	Black
Cos+	Red	Data+	Gray
Cos-	Black	Data-	Green
-	-	+Vcc	Red
-	-	0V	Blue

Sincos encoder (Heidenhain) ERN1385 / ERN1387 (Encoder Code: S)		Incremenal encoder (Tamagawa) TS5214N530 / TS5214N566 (Encoder Code: D1 / D2)		Absolute encoder (Heidenhain) ECI1319 / EQI1331 /EQN1325 (Encoder Code: M / N / N3)	
A+	6b	Red	5Vdc	Data-	1a
A-	2a	Black	0V	Vcc	1b
B+	3b	Blue	A+	A+	2a
B-	5a	Blue / Black	A-	Clock+	2b
I+	4b	Green	B+	0V sensor	3a
I-	4a	Green / Black	B-	B-	3b
+Vcc	1b	Yellow	Z+	B+	4a
	5b	Yellow / Black	Z-	0V	4b
Sin+	7b	Brown	U+	Clock-	5a
Sin-	1a	Brown / Black	U-	A-	5b
Cos-	2b	Gray	V+	+Vcc sensor	6a
Cos+	6a	Gray / Black	V-	Data+	6b
0V sensor	3a	White	W+	-	-
+Vcc sensor	7a	White / Black	W-	-	-

Note: When you see from the front of Sincos and Absolute encoder's socket, you can get number 'a' and 'b'.

Note: Absolute encoder without number '7'.
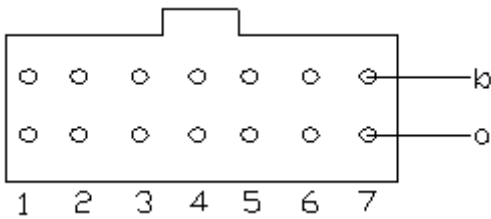
Chapter 6   Preparation

⚠️ **WARNING**

- Wiring according with the instruction manual.
- The shaft sleeve or key should be removed before power on. And operation staff keep away from motor rotation part.
- The motor should be operated without load for a period of time before use, so as to ensure that there is no abnormal condition.

6.1 Environment Conditions
Ambient Air Pressure: 86-106 kPa Storage
Ambient Temperature: -15℃ ～ 40℃
Ambient Humidity: 0 ～ 80% (No condensation)
Altitude: ≤ 1000m
Protection Degree: should be consistent with motor nameplate.

6.2 Using motor in following environment is forbidden:
The environment contain inflammable gas, chemical corrosive gas or other harmful gas.

6.3 U303, U305, U307, U310, U313, U318, E010, E012 series motors adopt sealed bearing. There is no need to change bearing's grease in it's working life. U316 series motors need to add grease regularly through filler hole.

6.4 To ensure the normal operation of the motor, please add some anti-wear oil in oil seal(The interface to the shaft) regularly and it is better to use high temperature resistant grease. At the same time, please check the motor regularly according to the actual situation.

6.5 To ensure the motor's working life and reduce the noise, please confirm the carrier frequency is 8KHZ. And it is strictly forbidden to operate below 4KHZ.

6.6 To ensure the motor's working life, please confirm that the overload and overspeed range of the drive is required low load at high speed and high load at low speed. The weak magnetic speed of U310 motor does not exceed 400rpm, and the weak magnet speed of U313 motor does not exceed 300rpm. E010 and E012 series motors have strong magnetic weakening and overspeed capability. For specific performance, please refer to "Hydraulic Servo System Selection Manual".

Chapter 7   Connection

- The motor terminal layout shall be subject to the physical objects.
- Power line shouldn't be too thin or too long. And motor's GND must be connected to ground exactly.
- The motor shall be connected strictly according to the power supply and encoder wiring diagram.
- Connect motor with drive and power, and run it without load. The motor's rotary direction is clockwise when you face to motor's shaft extension end(Forward direction).

7.1 Fan Wiring Schematic Diagram

● Fan Connection for U310F and U313F

Temperature control wire (one red and one yellow)

1   7   3   Blue

Fan power cable: single-phase 220Vac

2

Fan

White   White

Capacitance

Brown

Black

● Fan Connection for U318F

Temperature control wire (one red and one yellow)

Fan power cable: single-phase 220Vac

黄

White   White

3   8   7   4

Capacitance

Black

Brown

Blue

Fan
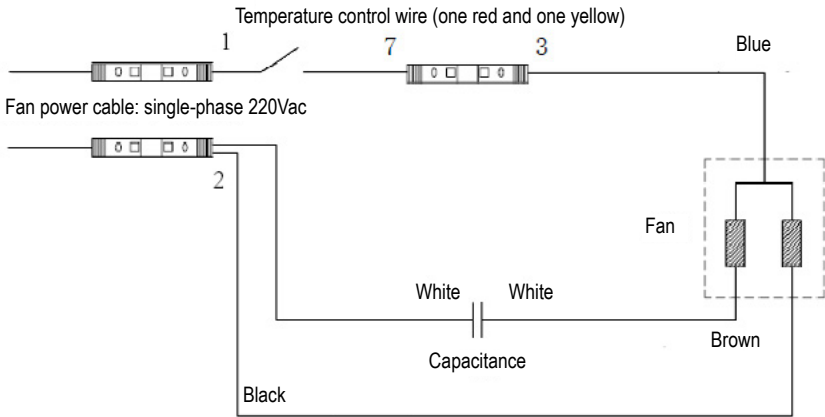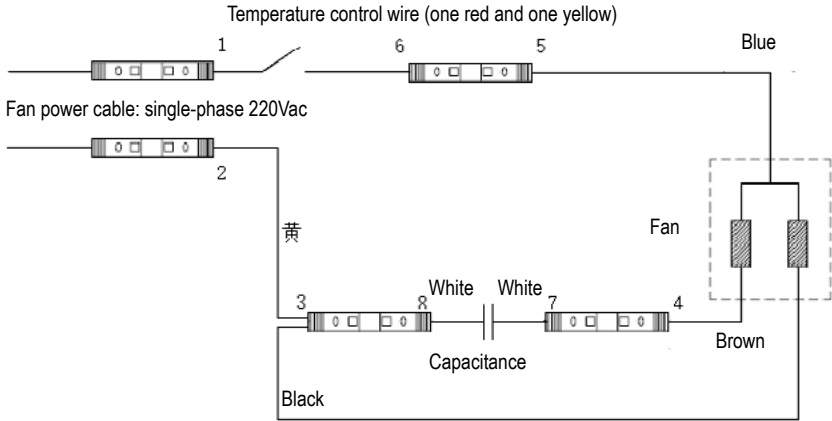
● Fan Connection for E010F and E012F

Fan power cable: single-phase 220Vac

Blue

Fan

White   White

Capacitance

Black
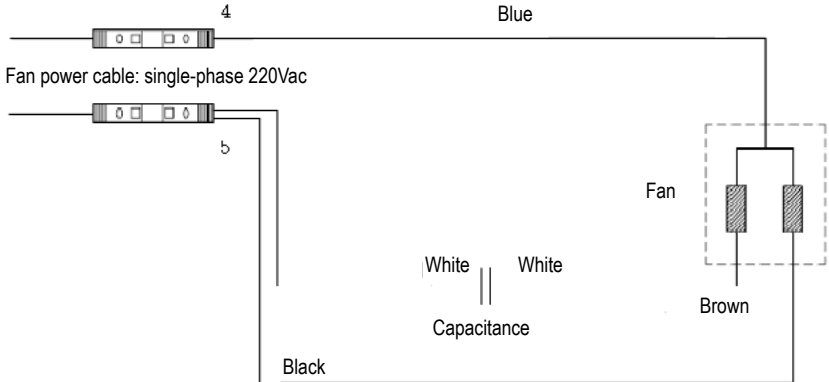
Brown

Press the fan cable (brown) and capacitor cable (white) tightly with a wire pressing cap

Note:

1) Temperature control : when the internal temperature of motor winding reaches 85 °C ± 5 °C , the fan starts to work.

2) U310F fan: Power 51W (50Hz) /53W (60Hz) , Current 0.29A (50Hz) /0.33A (60Hz) , Voltage 220Vac.

3) U313F fan: Power 135W (50Hz) /200W (60Hz) , Current 0.6A (50Hz) /0.88A (60Hz) , Voltage 220Vac.

4）Except for special customization: for example, when power is on or the internal temperature of motor winding reaches 45 °C ± 5 °C , the fan starts to work.

7.2 Connection Box Connection Terminal Drawing

● U310F/U313F Connection Terminal Drawing
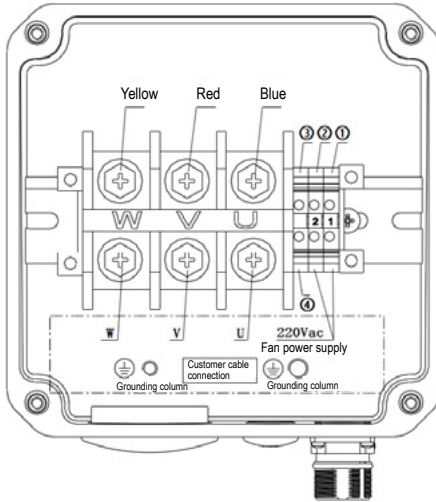
Fan wiring (switch as soon as it is powered on)	
①	Fan (blue)
②	Fan (black) and Capacitance (white)
③	Capacitance (white)
④	Fan (brown)

Fan connection (temperature control)	
①	2 sticks temperature control (red and yellow)
②	Fan (black) and Capacitance (white)
③	Fan (blue)
④	2 sticks temperature control (red and yellow)
Press the fan (brown) and capacitor (white) wires with a pressing cap	

● U310C/U313C Connection Terminal Drawing

● U318F Connection Terminal Drawing

● U318C Connection Terminal Drawing
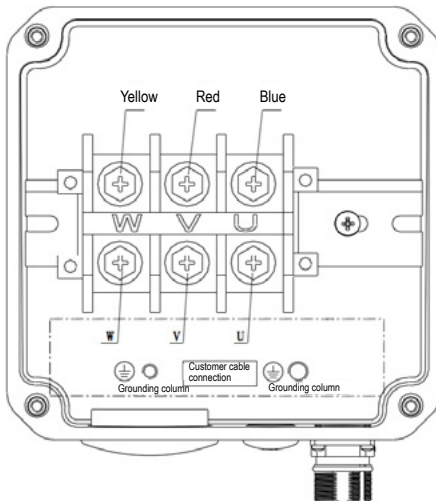
● E010F/E012F Connection Terminal Drawing
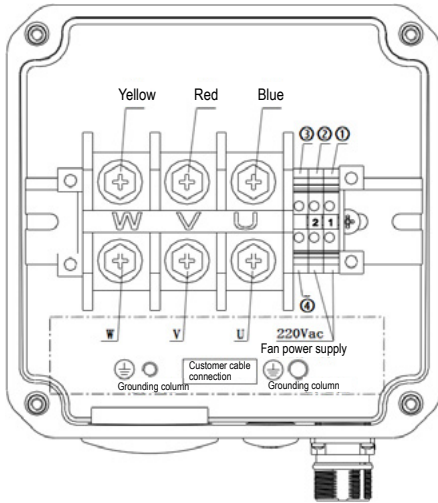
Fan wiring (switch as soon as it is powered on)	
①	Fan (blue)
②	Fan (black) and Capacitance (white)
Press the fan (brown) and capacitor (white) wires with a pressing cap	

● Power Connector Definition
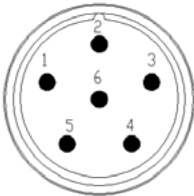
M23 power connector(nominal current ≤30 Arms)
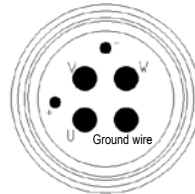
M40 power connector(30Arms < nominal current ≤60 Arms)

Power Connector Pin	Signal Definition
1	U
2	V
6	W
3	GND
4	BR+
5	BR-

Power Connector Pin	Signal Definition
U	U
V	V
W	W
+	BR+
-	BR-
地	GND

Note: Power socket is only applicable to U303A/U305A/U307A and some U310A motor, please consult Firs!

7.3 Signal Terminal(PCB board)
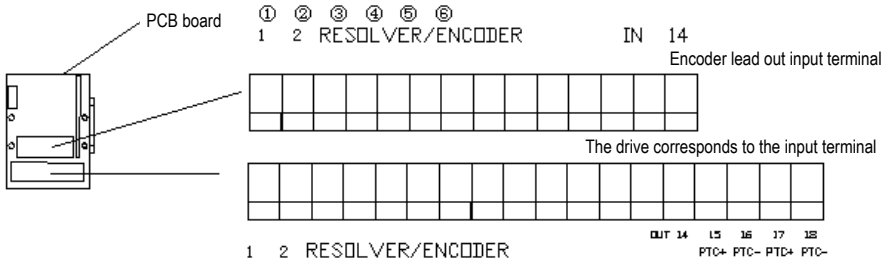
Signal terminal definition (PCB boards are applicable only to U310F/U313F)

(*When the PHYSIS drive is matched with a third party drive, the drive side Cos+ and Cos- should be exchanged with each other.)

PCB board pins	Incremental (Tamagawa)	Sincos Encoder (Heidenhain)	Resolver (Tamagawa)	Absolute Encoder (Sick)	Absolute Encoder (Heidenhain)
1	+Vcc(+5V)	I+	Resex+	Data+	-
2	0V	I-	Resex-	Data-	-
3	V-	A+	Sin+	-	A+
4	V+	A-	Sin-	-	A-
5	U+	B+	Cos+	-	B+
6	U-	B-	Cos-	-	B-
7	A+	0V	-	0V	0 V
8	A-	+Vcc(+5V)	-	+Vcc(7-12V)	+Vcc (+5 or +8V)
9	Z-	Cos+	-	Cos+	Clock+
10	Z+	Cos-	-	Cos-	Clock-
11	W+	Sin+	-	Sin+	Data+
12	W-	Sin-	-	Sin-	Data-
13	B-	+Vcc sensor	-	-	+Vcc sensor
14	B+	0V sensor	-	-	0V sensor
15	PTC+(output)	PTC+(output)	PTC+(output)	PTC+(output)	PTC+(output)
16	PTC-(output)	PTC-(output)	PTC-(output)	PTC-(output)	PTC-(output)
17	PTC+(input)	PTC+(input)	PTC+(input)	PTC+(input)	PTC+(input)
18	PTC-(input)	PTC-(input)	PTC-(input)	PTC-(input)	PTC-(input)

7.4 Signal Terminal (Signal Connector)

Signal connector definition

(*When the PHYSIS drive is matched with a third party drive, the drive side Cos+ and Cos- should be exchanged with each other.)

Socket Pin	Incremental (Tamagawa)	Sincos Encoder (Heidenhain)	Resolver (Tamagawa)	Absolute Encoder (Sick)	Absolute Encoder (Heidenhain)
1	+Vcc(+5V)	A+	-	Sin+	A+
2	0V	A-	-	Sin-	A-
3	V-	I+	-	Cos+	Data+
4	V+	Sin-	Sin-	Cos-	PTC+
5	U+	Cos+	Cos+	Data+	Clock+
6	U-	Cos-	Cos-	Data-	-
7	A+	0V	Resex+	-	0 V
8	A-	PTC+	KTY+	KTY+	KTY+
9	Z-	PTC-/KTY-	KTY-	KTY-	KTY-
10	Z+	+Vcc(+5V)	Resex-	-	+Vcc (+5 or +8V)
11	W+	B+	-	+Vcc(7-12V)	B+
12	W-	B-	-	0V	B-
13	B-	I-	-	PTC+	Data-
14	B+	Sin+	Sin+	PTC-	Clock-
15	PTC+	0V sensor	-	-	0V sensor
16	PTC-/KTY-	+Vcc sensor	PTC+	-	+Vcc sensor
17	KTY+	KTY+	PTC-	-	PTC-
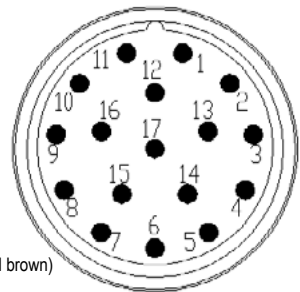
Signal connector schematic diagram (socket inner core is white and brown)

Chapter 8
Motor Match Various Drives Connection Table

8.1 Physis Drive Connection Table(AxM/AxN/AxW)

8.1.1 Sincos Encoder(Heidenhain ERN1385)

Adopt Signal Connector

Signal Connector		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
1	A+	7
2	A-	12
3	I+	14
4	Sin-	5
5	Cos+	3
6	Cos-	4
7	0V	1
8	PTC+	-
9	PTC-/KTY-	1
10	+Vcc(5V)	6
11	B+	15
12	B-	13
13	I-	9
14	Sin+	2
15	0V sensor	-
16	+VCC sensor	-
17	KTY+	8

Adopt PCB Board Pins

PCB Board Pins		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
1	I+	14
2	I-	9
3	A+	7
4	A-	12
5	B+	15
6	B-	13
7	0V	1
8	+Vcc	6
9	Cos+	3
10	Cos-	4
11	Cos+	2
12	Cos-	5
15	PTC+	8
16	PTC-	1

8.1.2 Absolute Encoder(Heidenhain ECI 1319 /EQI 1331)

Adopt Signal Connector

Signal Connector		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
3	Data+	14
5	Clock+	3
7	0V	1
8	KTY+	8
9	KTY-	Shell
10	+Vcc(7-10V)	6
13	Data-	9
14	Clock-	4

Adopt PCB Board Pins

PCB Board Pins		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
11	Data+	14
15	PTC+	8
9	Clock+	3
7	0V	1
8	+Vcc	6
12	Data-	9
10	Clock-	4
14	0V sensor	-
13	+VCC sensor	-
16	PTC-	1
3	A+	-
4	A-	-
5	B+	-
6	B-	-

8.1.3 Resolver Encoder(Tamagawa TS2640N321E64)

Adopt Signal Connector

Signal Connector		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
4	Sin-	5
5	Cos+	3
6	Cos-	4
7	Resex+	10
8	KTY+	-
9	KTY-	-
10	Resex-	11
14	Sin+	2
16	PTC+	8
17	PTC-	1

Adopt PCB Board Pins

PCB Board Pins		Physis Drive AxM/AxN/AxW (15 pins 2 rows male)
Pins	Signal Definition	Pins
1	Resex+	10
2	Resex-	11
3	Sin+	2
4	Sin-	5
5	Cos+	3
6	Cos-	4
15	PTC+	8
16	PTC-	1

8.2 Physis Drive Connection Table (PH300)

8.2.1 Resolver Encoder(Tamagawa TS2640N321E64)

Adopt Signal Connector

Signal Connector		Physis Drive PH300 (9 pins 2 rows male)
Pins	Signal Definition	Pins
14	SIN+	5
4	SIN-	9
5	COS+	3
6	COS-	4
7	REF+	2
10	REF-	1
16	PTC+	7
17(short circuit)	PTC-	8
9(short circuit)	KTY-	8
8	KTY+	6

Adopt PCB Board Pins

PCB Board Pins		Physis Drive PH300 (9 pins 2 rows male)
Pins	Signal Definition	Pins
1	Resex+	2
2	Resex-	1
3	Sin+	5
4	Sin-	9
5	Cos+	3
6	Cos-	4
15	PTC+	7
16	PTC-	8

8.3 LENZE Drive Connection Table

8.3.1 Resolver Encoder(Tamagawa TS2650N21E78)

Adopt Signal Connector

Signal Connector		LENZE Drive 940 (9 pins male)	LENZE Drive 9300/9400/ECS (9 pins male)
Pins	Signal Definition	Pins	
4	SIN-	7	5
5	Cos+	4	6
6	Cos-	5	7
7	Resex+	1	1
8	KTY83+	-	8
9	KTY83-	-	9
10	Resex-	2	2
14	Sin+	6	4
16	PTC+	8	-
17	PTC-	9	-

Adopt PCB Board Pins

PCB Board Pins		LENZE Drive 940 (9 pins male)	LENZE Drive 9300/9400/ECS (9 pins male)
Pins	Signal Definition	Pins	
4	SIN-	7	5
5	Cos+	4	6
6	Cos-	5	7
1	Resex+	1	1
-	KTY83+	-	8
-	KTY83-	-	9
2	Resex-	2	2
-	Sin+	6	4
15	PTC+	8	-
16	PTC-	9	-

Note: The motor side KTY83 is located on the wiring terminal.

8.3.2 Absolute Encoder(Sick SRS50/SRM50/SKS36/SKM36)

Adopt Signal Connector

Signal Connector		LENZE Drive 9300/ECS (9 pins male)	LENZE Drive 9400 (15 pins 2 rows male)
Pins	Signal Definition	Pins	
1	Sin+	1	3
2	Sin-	9	11
3	Cos+	3	1
4	Cos-	2	9
5	Data+	7	5
6	Data-	6	13
8	KTY83+	8	14
9	KTY83-	5	7
11	+Vcc(+8V)	4	4
12	0V	5	2
13	PTC+	-	-
14	PTC-	-	-

Adopt PCB Board Pins

PCB Board Pins		LENZE Drive 9300/ECS (9 pins male)	LENZE Drive 9400 (15 pins 2 rows male)
Pins	Signal Definition	Pins	
1	Data+	7	5
2	Data-	6	13
7	0V	5	2
8	+Vcc(+8V)	4	4
9	Cos+	3	1
10	Cos-	2	9
11	Sin+	1	3
12	Sin-	9	11
-	KTY83+	8	14
-	KTY83-	5	7

Note: The motor side KTY83 is located on the wiring terminal.

8.3.3 Absolute Encoder (Heidenhain EQN1325/EQI1331)

Adopt Signal Connector

Signal Connector		LENZE Drive 9400 (15 pins 2 rows male)
Pins	Signal Definition	Pins
1	A+	1
2	A-	9
3	Data+	5
4	PTC+	-
5	Clock+	8
7	0V	2
8	KTY83+	14
9	KTY83-	7
10	+Vcc(+5V)	4
11	B+	3
12	B-	11
13	Data-	13
14	Clock-	15
17	PTC-	-

8.3.4 Incremental Encoder

Adopt PCB Board Pins/Signal Connector

PCB Board Pins/Signal Connector		LENZE Drive 940 (15 pins 2 rows male)	
Pins	Signal Definition	Pins	Signal Definition
1	+Vcc(5V)	9	PWR
2	0V	7	GND
3	V-	14	HB-
4	V+	12	HB+
5	U+	11	HA+
6	U-	10	HA-
7	A+	1	EA+
8	A-	2	EA-
9	Z-	6	EZ-
10	Z+	5	EZ+
11	W+	13	HC+
12	W-	15	HC-
13	B-	4	EB-
14	B+	3	EB+
15	PTC+	T1(P7□)	PTC+
16	PTC-	T2(P7□)	PTC-

8.4 KEB Drive Connection Table

8.4.1 Sincos Encoder(Heidenhain ERN1385)

Adopt Signal Connector

Signal Connector		KEB Drive (15 pins 3 rows male)	
Pins	Signal Definition	Pins	Signal Definition
1	A+	8	A+
2	A-	3	A-
3	I+	15	R+
4	Sin-	1	C-
5	Cos+	2	D-
6	Cos-	7	D+
7	0V	13	COM
8	PTC+	-	-
9	PTC-/KTY-	-	-
10	+Vcc(+5V)	12	+5V
11	B+	9	B+
12	B-	4	B-
13	I-	14	R-
14	Sin+	6	C+
15	0V sensor	-	-
16	+Vcc sensor	-	-
17	KTY+	-	-

Adopt PCB Board Pins

PCB Board Pins		KEB Drive (15 pins 3 rows male)	
Pins	Signal Definition	Pins	Signal Definition
3	A+	8	A+
4	A-	3	A-
5	B+	9	B+
6	B-	4	B-
1	I+	15	R+
2	I-	14	R-
11	Sin+	6	C+
12	Sin-	1	C-
10	Cos-	7	D+
9	Cos+	2	D-
8	+Vcc(+5V)	12	U1(5V)
7	0V	13	0V
15	PTC+	-	-
16	PTC-	-	-

8.4.2 Resoluver Encoder (Tamagawa TS2640N321E64)

Adopt Signal Connector

Signal Connector		KEB Drive (15 pins 3 rows male)
Pins	Signal Definition	Pins
7	R+	10
10	R-	5
14	Sin+	8
4	Sin-	3
5	Cos+	9
6	Cos-	4
8	KTY+	-
9	KTY-	-
16	PTC+	-
17	PTC-	-

Adopt PCB Board Pins

PCB board pins		KEB Drive (15 pins 3 rows male)
Pins	Signal Definition	Pins
1	R+	10
2	R-	5
3	Sin+	8
4	Sin-	3
5	Cos+	9
6	Cos-	4
15	PTC+	-
16	PTC-	-

8.4.3 Absolute Encoder (Heidenhain EQN1325)

Adopt Signal Connector

Signal Connector		KEB Drive (15 pins 3 rows male)
Pins	Signal Definition	Pins
1	A+	8
2	A-	3
3	Data+	15
4	PTC+	-
5	Clock+	6
7	0V	13
8	KTY+	-
9	KTY-	-
10	+Vcc(5V)	12
11	B+	9
12	B-	4
13	Data-	14
14	Clock-	7
15	0V sensor	-
16	+Vcc sensor	–
17	PTC-	-

Adopt PCB Board Pins

PCB board Pins		KEB Drive (15 pins 3 rows male)
Pins	Signal Definition	Pins
3	A+	8
4	A-	3
5	B+	9
6	B-	4
7	0V	13
8	+Vcc(+5V)	12
9	Clock+	6
10	Clock-	7
11	Data+	15
12	Data-	14
15	PTC+	-
16	PTC-	-

8.5 SIEMENS Drive Connection Table

8.5.1 Sincos Encoder (Heidenhain ERN1385)

Adopt Signal Connector

Signal Connector		SIEMENS Drive (25 holes male)	
Pins	Signal Definition	Pins	Signal Definition
1	A+	3	A+
2	A-	4	A-
3	I+	17	I+
4	Sin-	20	Sin-
5	Cos+	22	D+
6	Cos-	21	D-
7	0V	2	0V
8	PTC+	-	-
9	PTC-/KTY-	25	KTY-
10	+Vcc (+5V)	1	+Vcc (+5V)
11	B+	6	B+
12	B-	7	B-
13	I-	18	I-
14	Sin+	19	Sin+
15	0V sensor	16	0V sensor
16	+Vcc sensor	14	+Vcc sensor
17	KTY+	13	KTY+

8.5.2   Resolver Encoder (Tamagawa TS2640N321E64)

Adopt Signal Connector

Signal Connector		SIEMENS Drive (9 holes male)	SIEMENS Drive (25 holes male)
Pins	Signal Definition	Pins	
4	Sin-	8	7
5	Cos+	1	3
6	Cos-	2	4
7	Resex+	6	9
8	KTY+	9	25
9	KTY-	5	13
10	Resex-	7	11
14	Sin+	3	6
16	PTC+	-	-
17	PTC-	-	-

8.6 B&R Drive Connection Table

8.6.1 Absolute Encoder (Heidenhain EQN1325)

Adopt Signal Connector

Signal Connector		B&R Drive (15pins 2 rows male)
Pins	Signal Definition	Pins
1	A+	1
2	A-	9
3	Data+	5
4	PTC+	-
5	Clock+	8
7	0V	2
10	+Vcc (+5V)	4
11	B+	3
12	B-	11
13	Data-	13
14	Clock-	15
15	0V sensor	10
16	+Vcc sensor	12
17	PTC-	-

8.7 CT Drive Connection Table

8.7.1 Absolute Encoder (Sick SRS/SRM)

Adopt Signal Connector

Signal Connector		CT Drive (15 pins 3 rows male)
Pins	Signal Definition	Pins
1	Sin +	3
2	Sin -	4
3	Cos+	1
4	Cos-	2
11	+Vcc (+5V)	13
12	0V	14
5	Data+	5
6	Data-	6
13	PTC+	15
14	PTC-	11
8	KTY+	-
9	KTY-	-

Chapter 10   Maintenance

WARNING

- Phase lack operation is forbidden.
- Continuous overload is forbidden which will result motor over temperature and will decrease motor's insulation life and reliability.
- Operation without temperature sensor LTY/PTC is forbidden.

9.1 Environment Conditions
   Working environment temperature:-15 ～ 40°C ;
   Height: ≤1000m;
   Working environment air pressure: 86 ~ 106KPa ;
   Storage environment temperature: -10 ~ 35°C ;
   Relative air humidity: Humidity for storage: ≤85% ;
   Humidity for working: 40 ～ 80%(No condensation).
   Motor's protection degree should suitable to requirements for waterproof and dustproof.

9.2 Using motor in following environment is forbidden:
   The environment contain inflammable gas, chemical corrosive gas or other harmful gas.

9.3 Motor surfaces should be cleaned regularly and kept clean to ensure that the inlet, outlet and air ducts are not blocked.

9.4 Keep the motor inside clean. It is forbidden that Water, Oil, Debris fall into motor's internal.

9.5 If you find motor's running is abnormal (For example: abnormal noise, over temperature, burning smell and so on.), please stop the machine and check instantly until the fault is removed.

9.6 U303,U305,U307,U310,U313,U318,E010,E012 series motors adopt sealed bearing. There is no need to change bearing's grease in it's working life. U16 series motors need to add grease regularly through filler hole.

9.7 To ensure the normal operation of the motor, please add some anti-wear oil in oil seal (The interface to the shaft.) regularly and it is better to use high temperature resistant grease. At the same time, please check the motor regularly according to the actual situation.

9.8 If the motor is in the warehouse and not in use, please properly packaging, storage and keep ventilated and dry to prevent the motor from being corroded by moisture. If condensation occurs in the stored environment, it should be drained regularly.

9.9 If you choose water cooling motor, followings are maintenance instructions:

9.9.1 Technical condition for water cooling system working well

Cooling water requirements

Medium Condition	Unit	Numerical value
pH (20°C)	-	6.5 ~ 9
Water hardness	mmol/l	1.43 ~ 2.5
Cl^-	mg/l	<200
SO_4^{-2}	mg/l	<200
Oil	mg/l	<1
Maximum allowable solid particle	mm	<0.1

Coolant: You can choose any one of them

- Use mixture of water and ethylene glycol as coolant and the mixture ratio is 1:1;
- Use mixture of water and ion neutralizer (Such as ELF Chip Supra，Total 60L，Eurotherm Eurocold 131 and etc.) as coolant;
- Use special coolant (Such as Vehicle Coolant, 3M Coolant PN3003 and etc.);

Technical requirements for water cooling systems

Cooling Conditions	Unit	Numerical Value
Maximum Allowable Pipe Pressure	bar	5
Motor cooling water temperature	°C	30°C

Note

- Water used as coolant must be pure water without dirt and suspended solids.(No tap water)
- Do not cool the motor below room temperature to prevent condensation in motor.
- Equipped with independent water cooling machine for fan or water cooling system.
- Pressure gauge and flowmeter must be equipped at the water inlet of motor.
- Shut off the water cooling machine when the motor stops.
- Glycol can dissolve most of the sealing materials except VITON rubber. So, customers must choose the sealing material made of VITON material when choosing sealing materials.

9.9.2 Check the state of operation (Before runing the motor, customer should start water cooling system first, and check whether it works normally.)

Right connection for pipe.
Water cooling machine works well.
Valve has been opened.
No leakage.
Returning water unobstructed and continuous.
Maintain proper water level in the water cooling machine tank.

9.9.3 Please notice the followings when motors work.

Water temperature of the tank≤50°C .
Water level is higher at least 100mm than inlet of the pump.
Returning water unobstructed and no bubble.
Motor inlet water pressure is not higher than 5bar.

9.9.4 Daily maintenance

Please maintain the pump regularly according to pump's maintenance operation manual.
Usually, customer need to change cooling water per 60 days for closed water cooling system.

9.9.5 Common fan cooling machine specifications (Just reference)

Standard Flow(L/min)	20	25	30
Power(kW)	2.5	4.4	6.2
Range of temperature(°C)	5〜45		

9.9.6 Common water cooling machine specifications

(Please refer to Physis product catalogue or contact with Physis for details of cooling water flow)

Base	Motor Model	Flow(L/min)	Maximum Allowable Pipe Pressure(bar)
U307	U30720C	2	5
	U30730C	3	
	U30740C	5	
U310	U31004C	2.5	
	U31007C	4	
	U31010C	5	
	U31013C	7	
U313	U31310C	5	
	U31320C	8	
	U31330C	11	
	U31340C	14	
U318	U318035C	8	
	U318070C	12	
	U318100C	14	

9.9.7 Fault cheking and troubleshooting

Faults	Possible Causes	Solutions
Outlet no water	Cooling water flow obstructed because of pipe bending	Fix the pipe and prevent bending.
	Outlet of pump no water	Check if the water level of tank was 100mm than pump's inlet.
		If the pump which you chose is vacuum priming pump, please check the enclosing of pump.
		The valves for inlet and outlet were not opened.
Flow of the outlet is small	Valve for inlet and outlet are not opened enough.	Open the valve bigger.
	Serious fouling of motor cooling chamber and pipe wall.	Return to PHYSIS
	Pump's filter screen is obstructed	Clean out the trash in the tank and change cooling water.
Bubble	Cooling water shortage and high temperature.	Open the valve bigger and improve the flow.

Chapter 11
Fault Cheking and Troubleshooting

Faults	Diagnosis and Solution
Abnormal noise of motor	Add a small amount of anti-wear oil at the front end of the motor oil seal (the joint surface with the shaft);
	Check whether the drive carrier frequency setting is within the allowable range (≥ 4kHz);
	Check whether the gain parameters such as speed loop and current loop are set correctly;
	If you still cannot solve the problem after completing the above inspection, please contact Physis after-sales service
Motor fan not working	Check whether the fan connection is correct and whether the external power supply is 220Vac 50/60Hz;
	Check the internal temperature of the motor and the fan can not start until the temperature reaches 85±5°C ;
	Check the fan start capacitor is properly plugged in; Replace the starting capacitor and confirm whether the fan can be started normally;
	Check the reason why the fan is jammed;
	If you still cannot solve the problem after completing the above inspection, please contact Physis after-sales service
Encoder failure indicated on drive	Check whether the encoder has feedback signal through the drive;
	Check whether the encoder wire shielding layer is well grounded; Check whether the encoder line signal is abnormal; Check whether the encoder wire on the motor side is broken;
	When using the rotary transformer, please measure the R+/R-, SIN +/ SIN -, COS +/ COS - signal resistance with the ohmic of the multimeter respectively. For other encoders, please consult Physis.
	Check whether the drive PG card (encoder decoding card) is abnormal;
	If you still cannot solve the problem after completing the above inspection, please contact Physis after-sales service

Faults	Diagnosis and Solution
Motor burned	Check whether the load becomes larger, resulting in time overload operation of the electric pilot; Check whether the load or the motor is blocked, resulting in the overload operation of the electric pilot for a long time;
	Check whether KTY/PTC is well connected to the drive;
	Check whether KTY/PTC is abnormal. Use a multimeter to detect the resistance value of the sensor at room temperature. KTY resistance value is 577-629 Ω/PTC resistance value is 200-300 Ω.
	Check whether the temperature protection function of the drive is turned on or invalid; Check whether the temperature protection parameters of the drive are set correctly;
	Check whether the drive overcurrent protection is invalid; Check whether the drive overcurrent protection parameters are set correctly;
	Check whether the drive carrier frequency setting is within the allowable range (≥ 4kHz)
	If you still c annot solve the problem after completing the above inspection, please contact Physis after-sales service
Motor overheating/ Excessive current	Check whether the load has increased; Check whether the load or the motor is blocked;
	Check whether the drive motor parameters are set correctly;
	Check whether the no-load current of the motor is normal;
	Check whether the encoder and its zero position are normal. Please consult Physis for the inspection method;
	Use the oscilloscope to test whether the motor torque constant is correct. Please consult Physis for the detection method.
	The motor current is normal, indicating that the motor temperature is too high, check whether KTY/PTC is well connected to the drive, check whether KTY/PTC is abnormal; Check whether the temperature protection parameters of the drive are set correctly; Check whether the temperature protection module of the drive is abnormal;
	If you still cannot solve the problem after completing the above inspection, please contact Physis after-sales service

Note: Please consult the drive manufacturer for detailed parameter settings.

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PERPETUAL MOTION