ADTECH Robotic Drive System

ADT-RC400

User Manual

(Electrical Wiring)

Information of manual

This manual is edited By ADTECH (SHENZHEN) TECHNOLOGY CO., LTD.

The editors of this manual：

The version of this manual：V2.0

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Range of manual

This is the first manual of QC400 drive robotic control system including full description, drive control for the initial users, to help users select reasonable motor type; followed this specification for drive control electrical wiring between the machine and the robot in detail.

Precautions

※Transport and storage

- ☞ Product package iteration of no more than six;
- ☞ It is not available in the product box on the climb, stand or place heavy objects;
- ☞ Cannot use drag the cables attached to the product or handling products;
- ☞ No collision, scratching the Panel and display screen;
- ☞ Product box should avoid wet, dry and the rain.

※Opening inspection

- ☞ After opening the packaging please confirm whether you purchased the product;
- ☞ Check whether the products in transit damage;
- ☞ Control list identifies whether the part is complete, there is no damage;
- ☞ Product model, lack accessory or transport damage, please contact with me.

※Wiring

- ☞ To participate in connections and inspection personnel must have the appropriate skills for professionals;
- ☞ Products must be reliable earthling, grounding resistance should be less than 4 ohms; you cannot use the neutral (zero line) instead of ground;
- ☞ Wiring must be properly and firmly, so as not to lead to product failure or unexpected consequences;
- ☞ And surge absorption diode must be connected in accordance with the regulations are connected with, otherwise you will damage;
- ☞ Plug or open the front of the chassis, you must cut off the power supply.

※Maintenance

- ☞ Must cut off the power before repair or replacement of components
- ☞ Should check the fault when a short circuit or overload occurs, troubleshooting before they can restart
- ☞ Cannot pass off frequently, if required to re-apply after a power failure, separated by at least 1 minute

※Others

- ☞ Do not open the Cabinet without permission,
- ☞ Long when not in use, please cut off the power.
- ☞ To pay special attention not to let dust, iron powder into the controllers.
- ☞ Output relay if the use of solid state relays shall be freewheeling diode in parallel in the relay coil. Check if the power supply meets the requirements, put an end to the controller is burnt out.
- ☞ Life of the controller temperature has much to do with the environment, if the processing temperature is too high, please install the cooling fan. Controller working ambient temperature range between 0 ℃-60 ℃.
- ☞ To avoid high temperatures, humidity, dust or corrosive gas environments.
- ☞ Shake strongly to add buffer rubber rails.

※Maintenance

Under normal conditions of use (environment conditions: average 30 ℃, load 80%, running 12 hours a day), please press the following items for routine checks and regular checks.

Daily Check	Daily	Recognition of environmental temperature, humidity, dust and foreign bodies ● There are no abnormal vibrations,
Period Check	1 year	● Substantial part is loose or not ● Terminal block damage

Since the robot system is more complex, dangerous. The manual records and security-related precautions, please strictly observe transactions as recorded.

Safety Precautions and mark

Mark		Mark meaning
	Danger	Use wrongly, it will lead to a dangerous situation, causing serious injury or death
	note	Use wrongly， It will lead to a dangerous situation that may cause personal injury or damage to equipment which caused material damage.
	Ban	Absolutely unenforceable
	Forcibly	Must be implemented

■ **Danger** 

Please do not use this system in the flammable and explosive environment.	
	Likely to cause injuries or fire.

Please follow the instructions drawings or wiring.	
	Prone to electrical shock and damage the motor.

In an energized state, do not arbitrarily pull the plug, in the operating state, do not touch the robot operation site.	
	Easy electric shock, causing personal injury.

Energized state, not for wiring, maintenance and other operations, be sure to power at least 5 minutes before proceeding.

	Easy electric shock.

Please be sure to take a reliable grounding between the drive and the robot body.	
	When the fault occurs easily lead to electric shock, fire incident, easy to trigger errors.

■

Non professional personnel, please do not open the drive and control one machine shell, please do not use hand to touch the drive and control of internal components	
	Easy electric shock

■

In the case of power, do not touch the power plug of the integrated machine.	
	Easy electric shock.

■

Please do not damage, the weight of cable or cable suspended load	
	Easy electric shock

■

The energized state, do not plug the drive terminal machine control on	
	Easy electric shock and short circuit

■

Running state, do not pull out the terminal on the one machine	
	Easy electric shock and short circuit

■

■ Attention

Please pay attention to the drive and control of the motor and the heat of the peripheral equipment.	
	Easy to burn.

When a fault occurs, the power supply is cut off, the cause is identified and removed, and the low speed running equipment should be removed.	
	If there are adverse factors, easy to cause false action.

When using the controller and the robot body, it cannot exceed the scope of its specification.	
	Easily cause damage to the product.

When the robot is moved, it needs to be fixed with the attached fixed tool.	
	To prevent the lifting arm, due to accidents.

The installation, operation, maintenance and inspection before, be sure to read the instructions carefully, according to the operating instructions in step.	
	Easy electric shock, fire

Power supply voltage, power capacity must be specified by the company's specifications.	
	Improper use of equipment failure, easy to cause a fire.

Please correct use of the correct control of each other to drive one machine and robot.	
	Prone to failure

Should be regularly on the implementation of the robotics drive system maintenance and inspection operations.	
	Neglect of maintenance and inspection is an important cause of equipment failure and accidents.

Please do not put heavy objects on the product.	
	Easily cause damage

Please correct the wiring in the instruction manual.	
	The wrong wiring way is easy to cause the robot or the drive control one machine damage or cause a fire.

When an exception occurs, please stop.	
	Easy electric shock, personal injury, fire

Need to repair, please contact our company, please do not disassemble.	
	Easy cause trouble.

Do not impact	
	Easy cause trouble

■ **Ban**

In the course of the robot's movement, no person is allowed to stand in the robot action area.	
	There will be a major injury accident.

Equipment to prevent the movement of the robot in the workplace.	
	When the device is abnormal, it is easy to cause damage.

The emergency stop switch on the handheld display device is prohibited.	
	Robots in an accident or is not running properly, you need an emergency stop switch, stop operation of the equipment.

There is no correct operation of the prohibition on the instruction manual.	
	Incorrect operation will bring about the incorrect operation of the equipment.

Other personnel outside the operating personnel to close to the equipment	
	Touching the dangerous area can cause the injury or the major accident.

When an accident, to cut off the power supply, clear reasons.	
	When there are bad reasons, the robot may have a wrong action, causing adverse consequences.

Users are prohibited to carry out parts of the exchange and transformation.

	Will reduce the system performance and may malfunction

Please do not remove the cleaning.	
	Easy to cause fire, easy to get electric shock.
Please don't make the product stored in the leaks, water, and other harmful gases in the environment.	
	Prone to failure

■ Forced

Please keep the sun out of the sun.	
	Easy cause trouble

Please use the specified range.	
	Easily cause burn, failure

Equipment protection cover must be shut off during operation.	
	Open the protective cover will have electric shock, the disabled.

Operator to go through the full training.	
	Incorrect operation will cause the device to malfunction, resulting in disability or major disaster.

If the robot is not in accordance with the specified direction of action, press the emergency stop, stop the equipment operation.	
	Accidents and failures.

Power cord must be used with the specified wire.	
	Prone to fire and failure.

Safety regulations

- Before starting the run, we need to know all the tasks of robot in accordance with the program to be executed;
- Robots run in automatic mode, personnel are not allowed to enter any of its movement reach areas;
- When the need for programming, testing and maintenance work, the robot shall be placed under manual mode;
- When debugging personnel enter the robot work area, he shall carry a teach pendant, to prevent others from malfunction;
- When the robot does not work for a long time, the fixture should not place items; it shall be empty machine;
- After a power outage, the main power on the robot should shut down timely, and remove the clamp on the work piece.

Catalogue

1. System Introduction and Overview of Functions

1.1 System Components

Drive machine control system mainly consists of the following three parts:

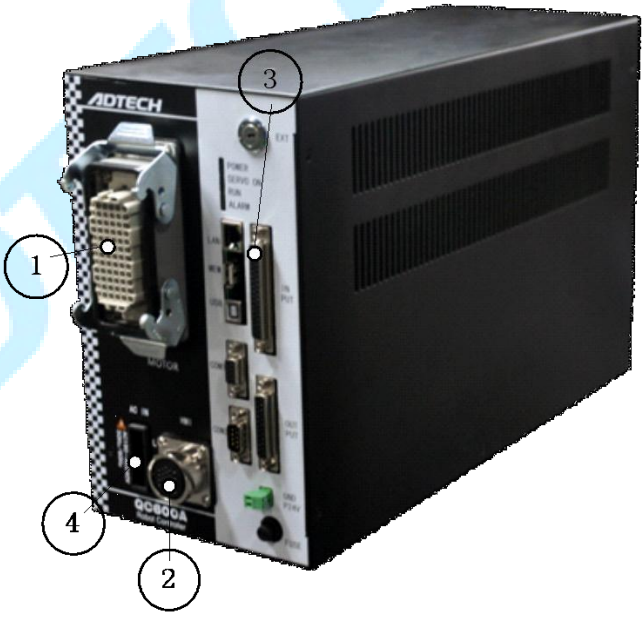
1）QC400 drive control system

2）Handheld FlexPendant

3）Connecting Cables

1.2 Robotics Drive System Instructions

- Figure 1-1 shows the schematic side of robotic drive controller(QC400);
- The system machine integrated several CPUs (ARM9 + DSP + FPGA), which are control module, high-performance servo drive module, I/O module, display module, communication module as a whole;
- Interfaces include motor power cable, encoder cable, IO cable, and power cable and so on.



1. Interface of power , encoder and IO cables;
2. Handheld Flex Pendant connector;
3. External IO board interface;
4. 190~240V Power interface

Figure 1-1 QC400 schematic side

1.3 FlexPendant Introduction

Front view of Flexpedant is shown in Figure 1-2:

Figure 1-2 Front view of FlexPendant

Back view of Flexpedant is shown in Figure 1-3:

Figure 1-3 Back view of FlexPendant

1.4 Feature Overview

1.4.1 Technical Parameters

Table 1-1 Drive control integrated machine technical parameters

model			ADT-QC400
Handheld FlexPendant	screen		color display with a resolution of 800 * 600
	programming language		G-code
	Teach mode		Manual Teach
	Size/weight		355mm*248mm*70mm/2KG
Drive Control System QC400	Drive control function	control axes	4 axis
		support motor type	supports all-digital AC servo motors (for example: Sanyo, Panasonic, Tamagawa, Adtech and other brands)
		position detection method	detection encoder (incremental / absolute)
		power	single-axis power below 1.2KW, four-axis total power below 3KW
	External input	Standard IO	34 road (with opto-coupler isolation)
	External output	Standard IO	27 Road (6 relays, 21 Road NPN open collector)
	Motion control function		circular interpolation, continuous path, the trajectory to follow, all kinds of acceleration and deceleration, etc.
	Coordinate system		joint coordinate system, world coordinate

		system, the tool coordinate system, User Coordinate System
	Cartesian coordinate display mode	Cartesian coordinate display mode, the joint coordinate
	External communication	RS-232：2CH（9 pin）、Ethernet：1CH（100Mbps/10Mbps）USB2.0：2CH
	Dimensions / Weight	length (including aviation head) 517mm * Width 160mm * high 273mm / 20KG
	Power	Single-phase within AC200V~230V，50Hz

1.4.2 Product Configuration

Table 1-2 Product configurations

Name	Descriptions	Qty
QC400	host controller	1 set
Plug	the host power supply plug	1 pcs
USB	USB download cable	1 pcs(optional)
serial line	9 female-female serial line	1 pcs(optional)
Connecting cable	Cable host and motor, encoder cable	1 pcs
Input connecting cable	Input Wiring 37-pin host input port junction	1 pcs
Input board	I/O input board	1 piece
Output connecting cable	Output Wiring 25pin output port junction a host	1 pcs
output board	I/O output board	1 piece
RPB06	handheld FlexPendant	1 set(optional)

1.4.3 Basic Specifications

Table 1-3 Basic specifications

Climatic conditions		
Temperature	Working	-5℃～50℃
	Storage and transportation	-30℃～70℃
Relative humidity	Working	20％～90％（℃）
	Storage and transportation	10％～95％（℃）
Atmospheric pressure		86Kpa～106Kpa

2. External Wiring

2.1 System Configuration

Before using the drive control integrated machine, you need to complete the system wiring, wiring distributed as follows:

Figure 2-1 System Configuration

Four-axis horizontal articulated robot plan as follows:

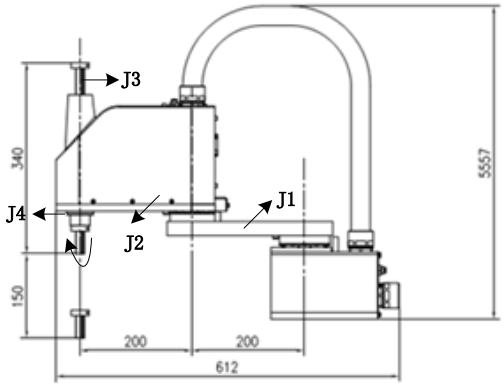


Figure 2-2 horizontal axis robot plan

Industrial robot axes are defined as follows: for the J1 axis arm, the arm of J2 axis, the vertical axis J3 axis, J4 axis rotation axis.

2.2 Product Description of Each Part

- **External Profile of 72Pins Robot Controller**

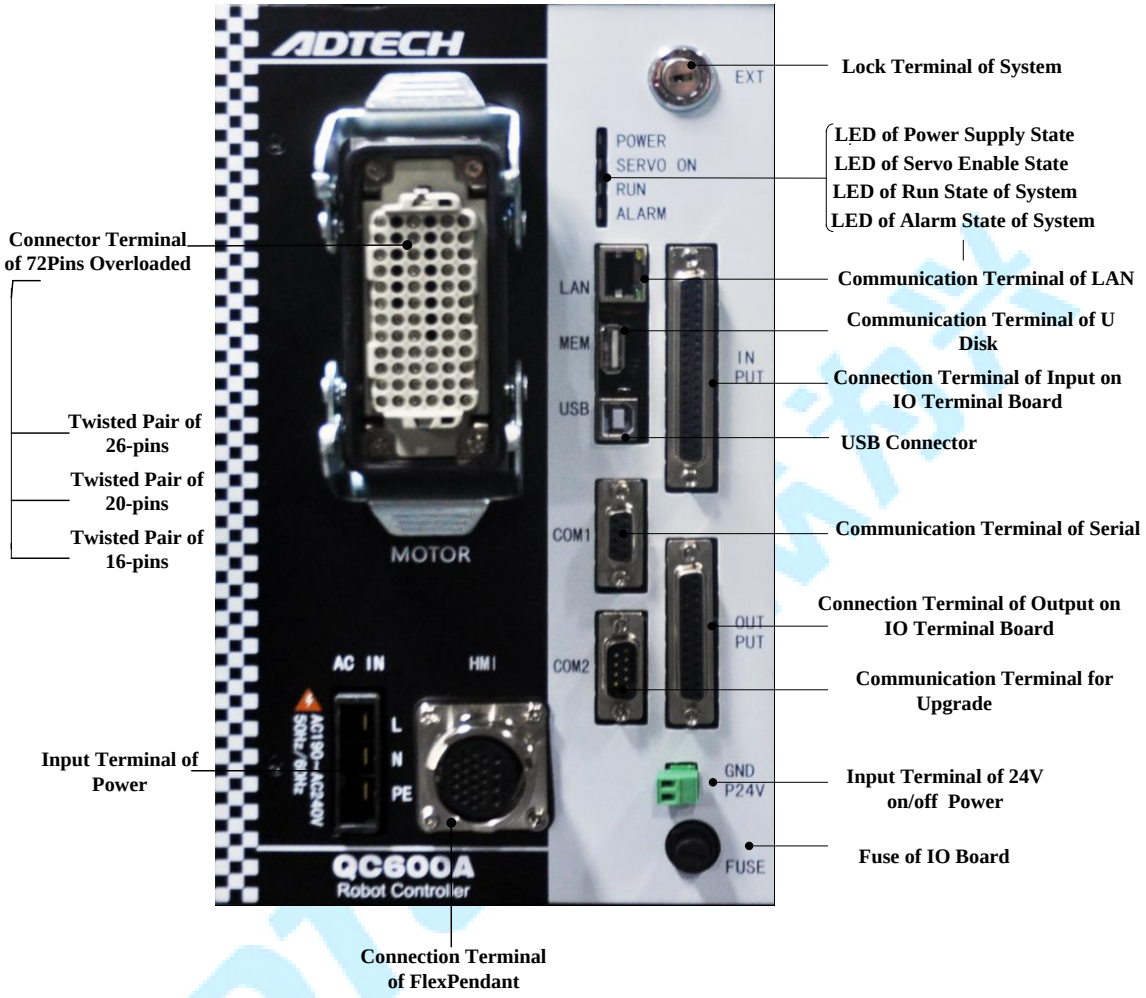


Figure 2-3 Illustration of 72Pins Robot controller

➢ External Profile of 48Pins Robot Controller

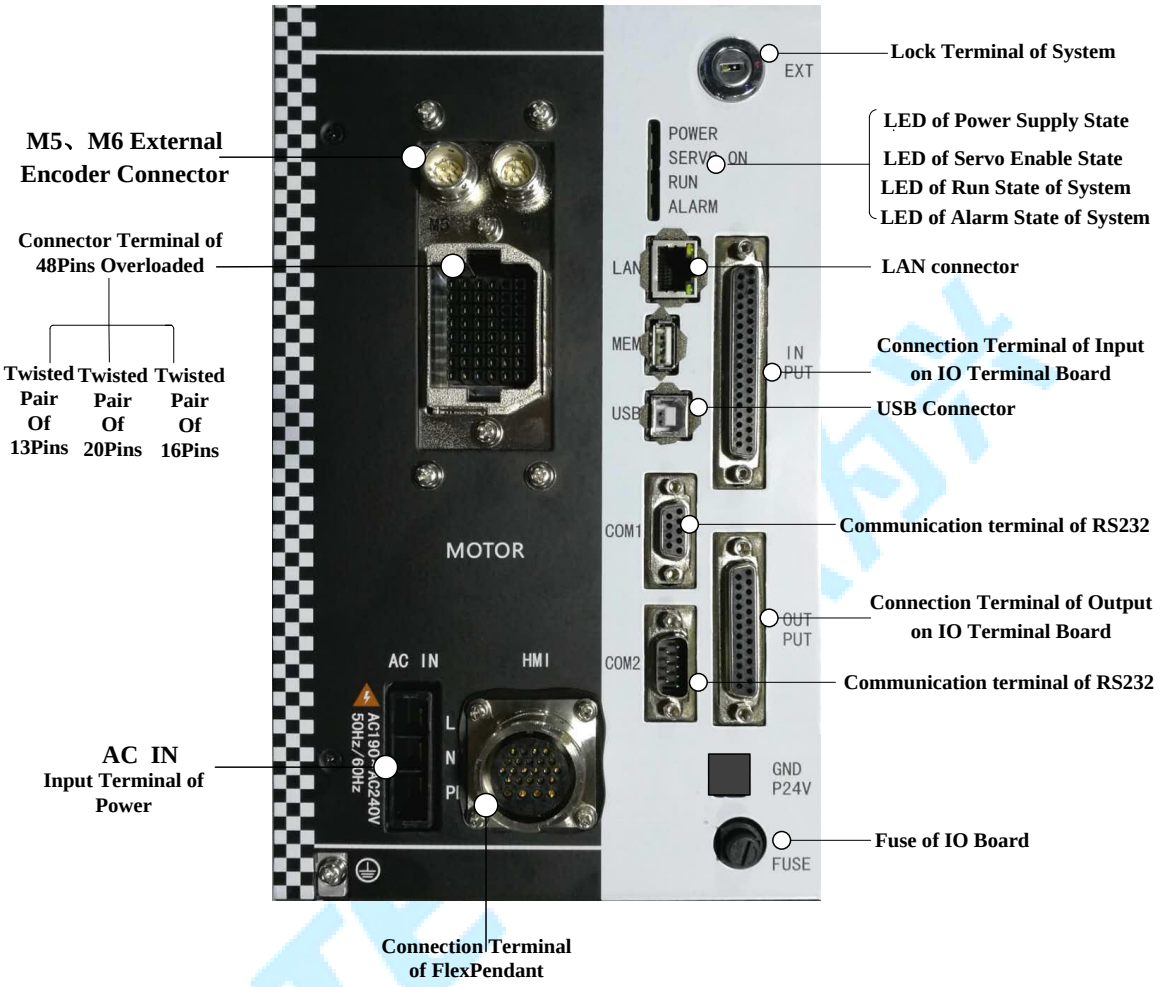


Figure 2-4 Illustration of 48Pins Robot controller

There are many interfaces on QC robot driver system. Name and function of each port is showed in the following table:

Table 2-1 Port list of robot driver system

Port remark	Name	Function description
MOTOR	72Pin or 48Pin heavy load connector	Connect servo and I/O
AC IN	190~240VAC power supply	Power supply terminal
HMI	24 wire aviation plug	Teaching pendent connect terminal
EXT	Double stall switch	System lock terminal

POWER	LED indicator light	Indicate Host power status
SERVO ON	LED indicator light	Indicate servo enable status
RUN	LED indicator light	Indicate system running status
ALARM	LED indicator light	Indicate system alarm status
LAN	Ethernet port	Internet communication
MEM	USB2.0 port	U-disk communication
USB	USB1.1 port	USB communication
COM1	RS232 port	Series ports communication
COM2	RS232 port	Series ports communication
INPUT	Input port	IO wire boards terminal
OUTPUT	Output port	IO wire boards terminal
GND	24V Power ground	Out power supply ground
P24	24V Power positive	Out power supply positive
FUSE	Fuse	IO boards 24V fuse

3. Power Cord Connect

➢ **Main Power Supply**

Robot driver system power cord terminal (AC IN) connect is shown as following figure 3-1:

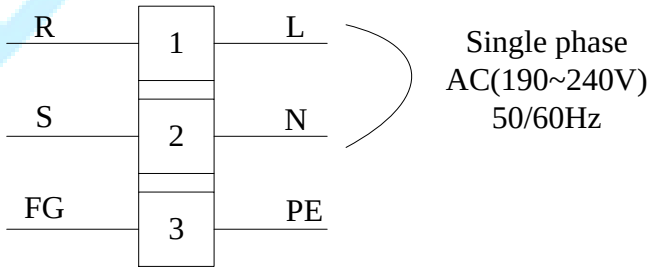


Figure 3-1 Power terminal diagram

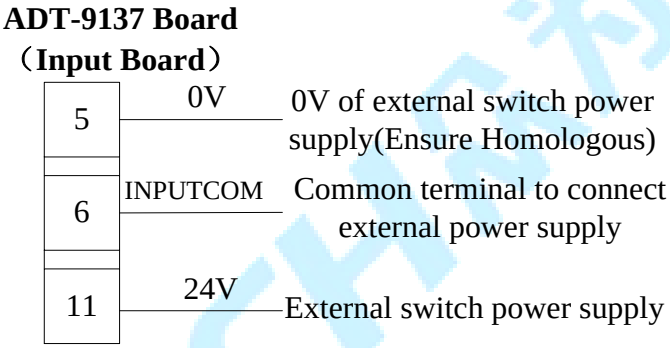
- Terminal spec.: 3 bit, single floor, female, distance of terminal 10.16mm, Black two sides with lock, Total height 29mm, Power cord specification: 3 wire, 200mm, 2.5mm;

- 60W-24V power has been involved within IO board; several internal 24V included in IO board can be used by customers.

➢ **IO Power Supply**

Inside of IO board has provided DC24V power for IO using. So DC24V is existed between 5Pin and 11pin within ADT9137 input board.

ADT9137 can be also supplied power with external DC24V； Diagram of wiring is shown as follows:



Notes

1、For IO board, inputs and outputs share a same power supply, that is 24V of ADT9137 and 24V of ADT9125 are from the same 24V;

2、The purpose of several P24V、INPUTCOM、GND_24V being existed within IO board is convenient for wiring;

3、For output board (ADT9125), it is not advised to drive electromagnetic valve directly and it is suggested to add a relay switching.

4. Motor Wiring Terminals

- ADTECH has two standard kinds of terminals for load connector, one is 72Pins, another one is 48Pins;
- In order to make the connection more clear, the line numbers are given in actual wiring diagram for each motor. These numbers are corresponding to 72 Pins. If 48Pins are used, please base on actual wiring definition to connect them(for example, descriptions as U/V/W, PS2+);
- Find complete definition of wiring for 48Pins in chapter 4.2 attached.

4.1 Diagrams for Two Kinds of Motor's Terminal <72Pin>/<48Pin>

➢ 72Pin Heavy Load Connector

Motor's terminal is female 72Pin heavy load connector, which definition is as 4-1-1 diagram shown:

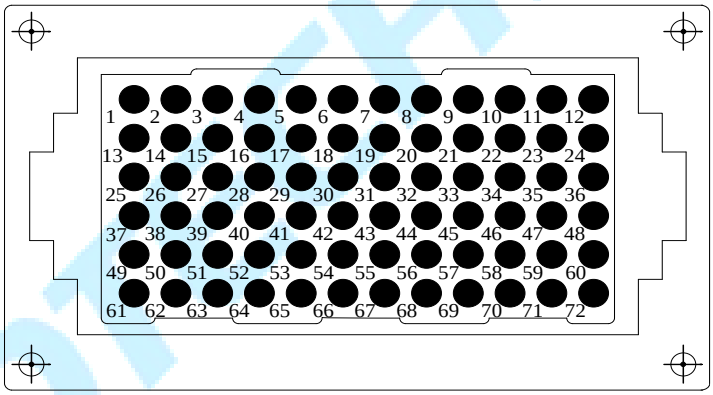


Figure 4-1-1 72Pin Heavy load connector definition

➢ 48Pin Heavy Load Connector

Motor's terminal is female 48Pin heavy load connector, which definition is as 4-1-2 diagram shown:

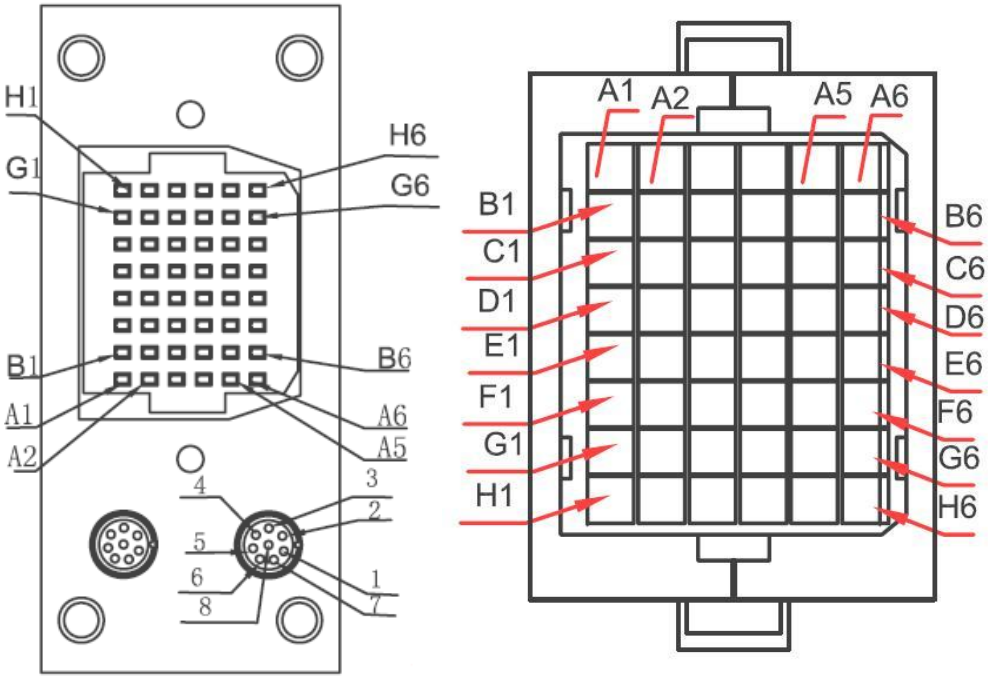


Figure 4-1-2 48Pin Heavy load connector definition

4.2 MOTOR Terminal<72Pin> Signal Description

Table 4-2-1 Heavy load connector instruction

72Pin Heavy load connector pin item	Signal Instructions
1/4/7/10/13/16	Motor 1/2/3/4/5/6 Power terminal U phase input
2/5/8/11/14/17	Motor 1/2/3/4/5/6 Power terminal V phase input
3/6/9/12/15/18	Motor 1/2/3/4/5/6 Power terminal W phase input
19/20/21/22/23/24	Space
25/26/27/28/29/30	IO Signal input
31/32	Relay 1，Relay 2
33/34/35/36	IO Signal output
37/38	Relay 3，Relay 4
39	Inner 24V power
40	24V _GND
41/42/43/44/45/46/47/48	Vacant

49/50/57/58/65/66	Ground pin (GND) of motor 1/2/3/4/5/6 encoders
55/56/63/64/71/72	Power pin (5V) of motor1/2/3/4/5/6 encoders
53/54/61/62/69/70	Signal negative (PS1-/ PS2-/ PS3-/ PS4-/PS5-/PS6-) of motor 1/2/3/4/5/6 encoders
51/52/59/60/67/68	Signal positive (PS1+/ PS2+/ PS3+/ PS4+/PS5+/PS6+) of motor 1/2/3/4/5/6 encoders

For user connect simply, QC400 factory. With 72pin male connector, male connector to cable，User just connect cable terminal to motor's encoder wire, power wire, I/O port. Cable contain 3 pcs including 26 twisted pair, 20 twisted pair, 16 twisted pair

26 Twisted pair——Motor encoder (4 set motor encoder terminal)

20 Twisted pair——Motor U,V,W power (4 pcs motor power terminal)

16Twisted pair——Input and output signal wire (6 channel input+4 channel output+4channel relay)

➢ 26-Pins Encoder Definition

Table 4-2 26 twisted pair definition

PCBA	Definition	72 Pin Heavy load connector item	26 wire shield twisted pair (wire color)
Motor1	GND	49	GrayRed
	5V	55	GrayBlack
	PS1-	53	WhiteRed
	PS1+	51	WhiteBlack
Motor2	GND	50	OrangeRed
	5V	56	OrangeBlack
	PS2-	54	PinkRed
	PS2+	52	PinkBlack
Motor3	GND	57	YellowRed
	5V	63	YellowBlack
	PS3-	61	GrayRedRed
	PS3+	59	GrayBlackBlack
Motor4	GND	58	White red red
	5V	64	WhiteBlackBlack
	PS4-	62	OrangeRedRed
	PS4+	60	OrangeBlackBlack
Motor5	GND	65	PinkRedRed
	5V	71	PinkBlackBlack
	PS5-	69	YellowRedRed
	PS5+	67	YellowBlackBlack
Motor6	GND	66	GrayRedRedRed
	5V	72	GrayBlackBlackBlack
	PS6-	70	WhiteRedRedRed
	PS6+	68	WhiteBlackBlackBlack
Housing			Shield

➢ 20-Pins Power Definition

20 wire twisted pair definition is power cable, Definition is as following:

Table 4-3 20 wire twisted pair definition

PCBA	Definition	72 Pin Heavy load connector item	20 wire shield twisted pair (wire No.)
Motor 1	U	1	1
	V	2	2
	W	3	3
Motor 2	U	4	4
	V	5	5
	W	6	6
Motor 3	U	7	7
	V	8	8
	W	9	9
Motor 4	U	10	10
	V	11	11
	W	12	12
Motor5	U	13	13
	V	14	14
	W	15	15
Motor 6	U	16	16
	V	17	17
	W	18	18
Shield		Housing	Yellow green

➢ 16-Pins IO Line Definition

Driver-controller integration in addition to the digital input/output pin end defines multiple input and output, the overloading jilt terminal also defines a certain number of input and output, while the number of the input and output port enough, users do not need the back of the port：

Chart 4-4 16-Pins twisted-pair definition

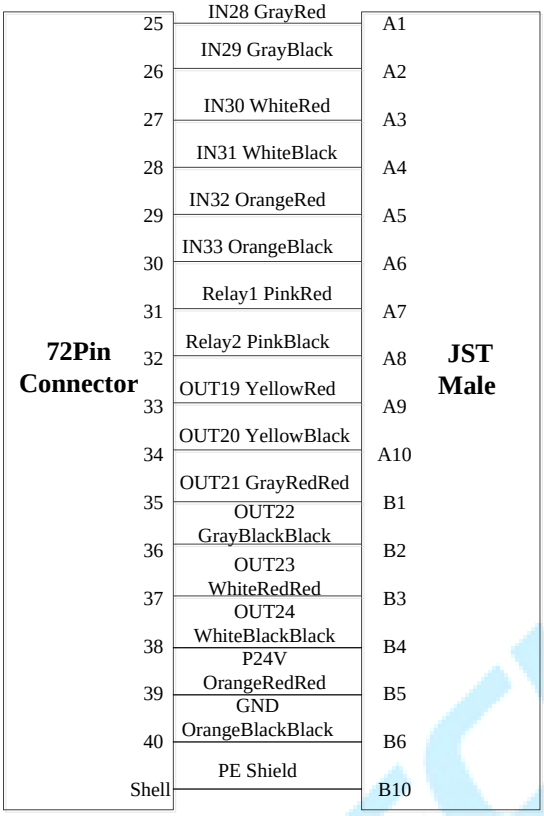
Definition	72PinReloading the connector terminal number	16core shielded twisted-pair (line)
IN28	25	Red gray
IN29	26	gray black
IN30	27	white red
IN31	28	White black
IN32	29	orange red
IN33	30	orange black
Relay1（Relay23）	31	pink
Relay2（Relay24）	32	Powder black
OUT19	33	yellow red
OUT20	34	yellow black
OUT21	35	Gray red red
OUT22	36	Gray black black
Relay3（Relay25）	37	White red red
Relay4（Relay26）	38	White black black
Interior24V Power	39	Orange red red
GND	40	Orange black black

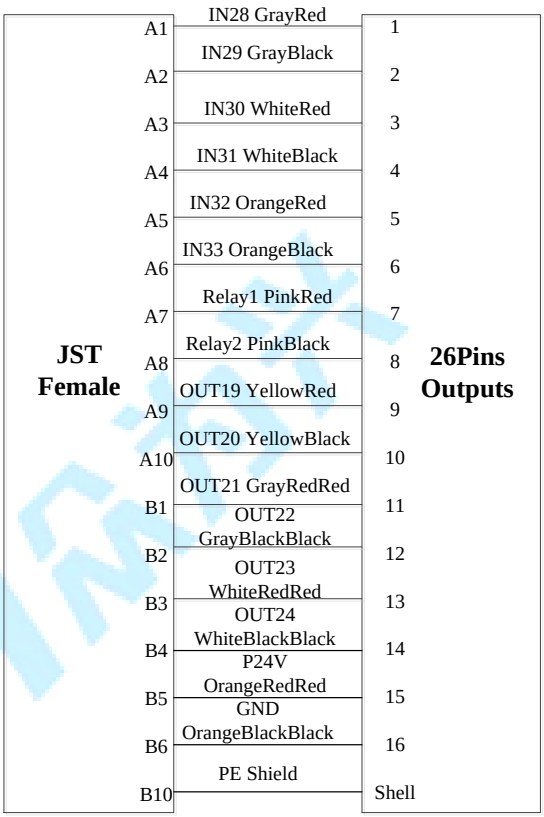
16 core IO cable end four road relay output, in practical use, the robot motor is often used with the brakes, the relay switch state to open or close the motor brake.

The brake specific instance "wiring" connection mode can be reference.

➢ IO Wiring Diagram for 72Pin Robot

Definitions of 26Pin signals (at the back of robot body):





4.3 Connection Instances of Motors for 72Pin

Driver-controller integration support of motor encoder types are: panasonic, sichuan, ADTECH, all the more for such as many motor. Wiring for the convenience of customers, enumerated several motor type and its connection mode, provide the reference for the user.

4.3.1 Panasonic Motor Wiring Instance

➢ Wiring of 17bits Absolute Encoder

17 Bits Absolute Motor of Panasonic

Definition of Encoder Wire

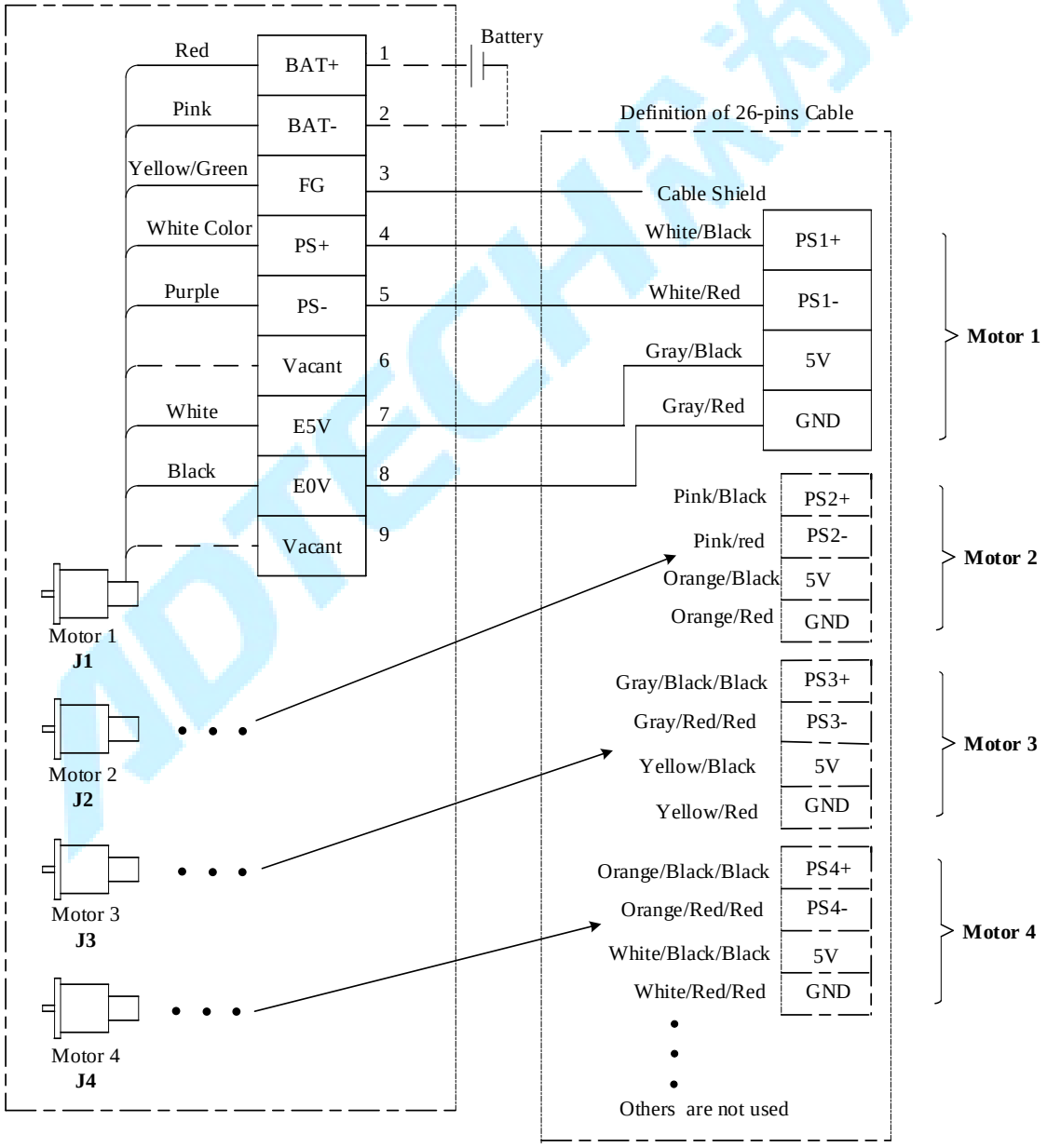


Chart 4-2 Panasonic motor encoder terminal connection

- Wiring of Electrical Power

17 Bits Absolute Motor of Panasonic

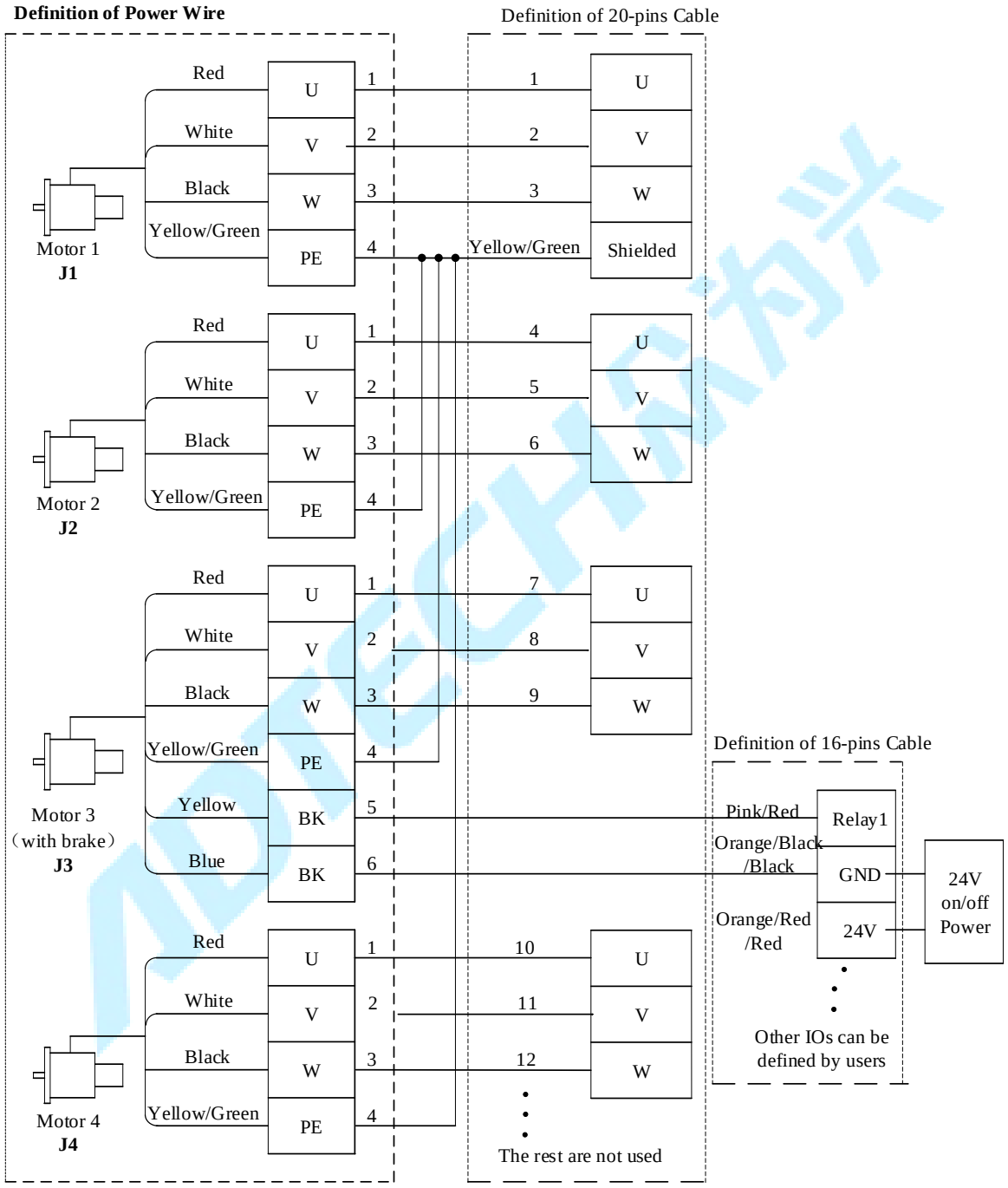


Chart 4-3 Panasonic motor power line side connection

Notes:

Panasonic and QC400 servo motor encoder count procedures defined in the way of counting, UV line number 26 pin cable end connection mode in contrast to the co nventional way.

- Wiring of Electrical Brake

Robot has one or more brakes needed in practical use. And realization of brakes' on and off is through opening or closing the relays on IO board. Specific implementations are as follows:

（1）Brake wiring；

（2）IO board 24 v power supply, the specific reference "3 connect the power cord -" connection mode.

17 Bits Absolute Motor of Panasonic

Definition of Brake

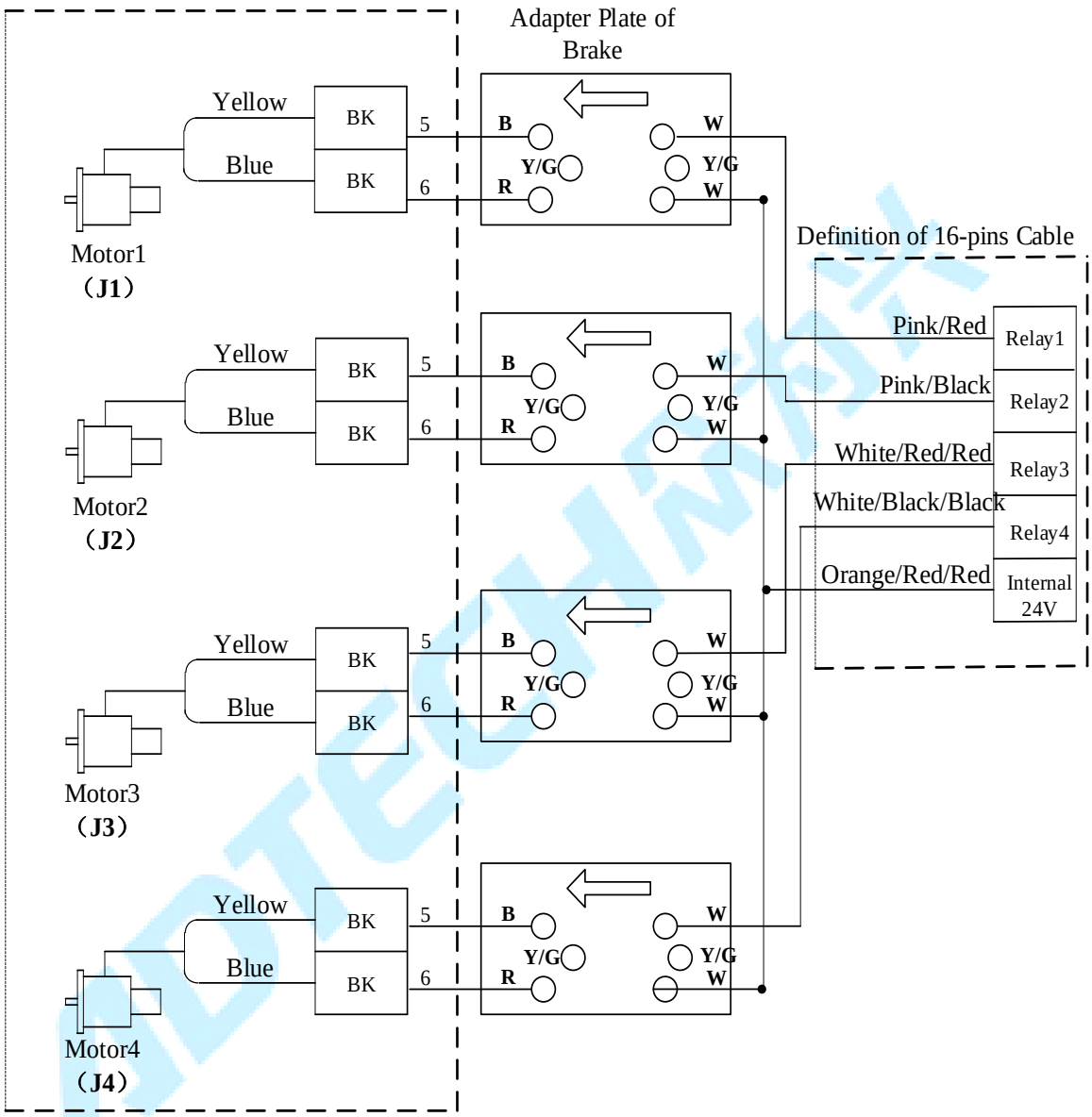


Chart 4-4 Panasonic motor brake end connection

Practice, must be completed according to the main brake end connection, if there is only one axis with the brakes, pick up the shaft brake. Wiring is completed; with the brake port configuration method in teaching device please refer to the "operating manual.

4.3.2 Tamagawa Motor Wiring Instance

➢ Wiring of 17bits Absolute Encoder

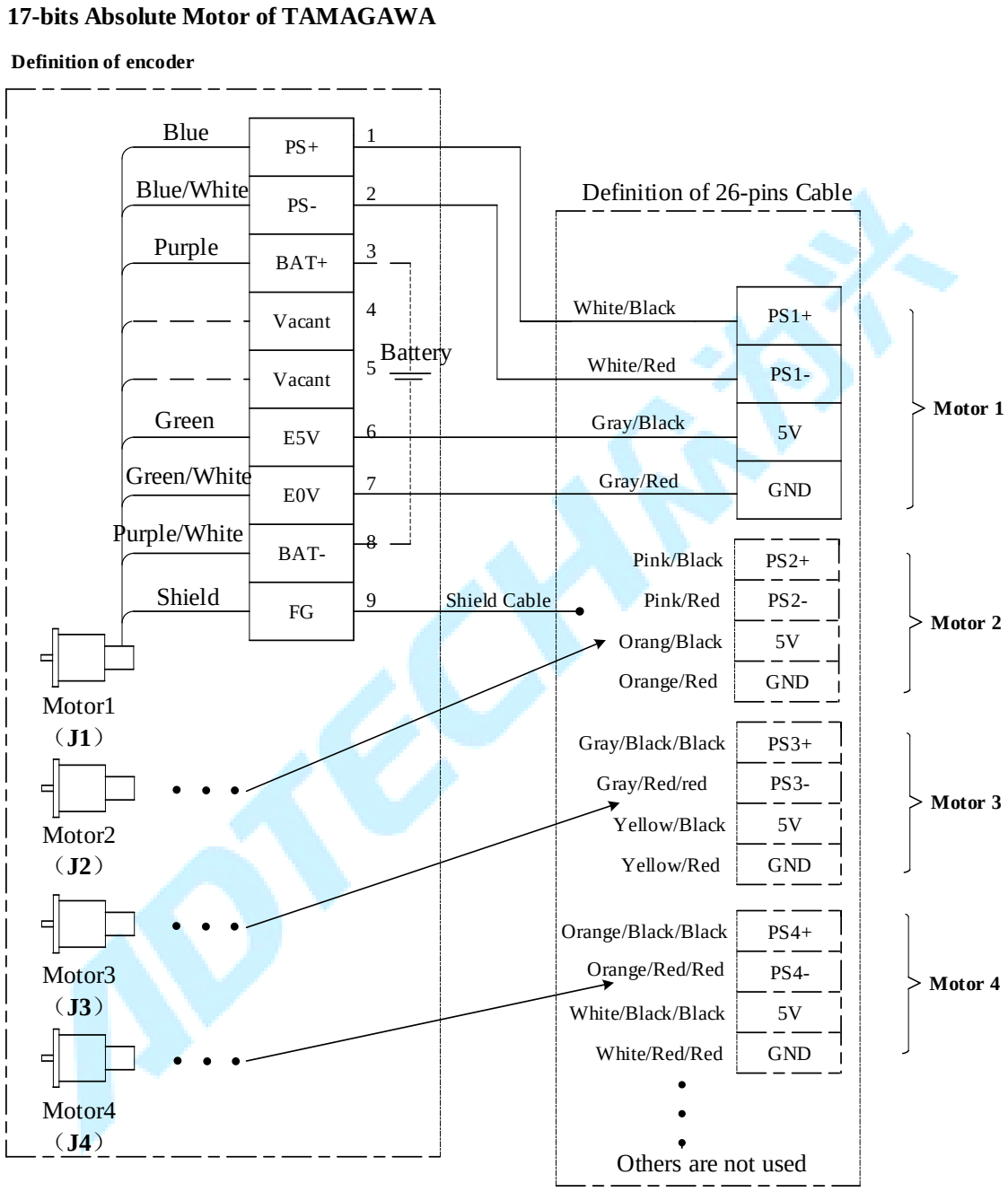


Figure 4-5 Tamagawa motor encoder line wiring

➢ Wiring of Electrical Power

17-bits Absolute Motor of TAMAGAWA

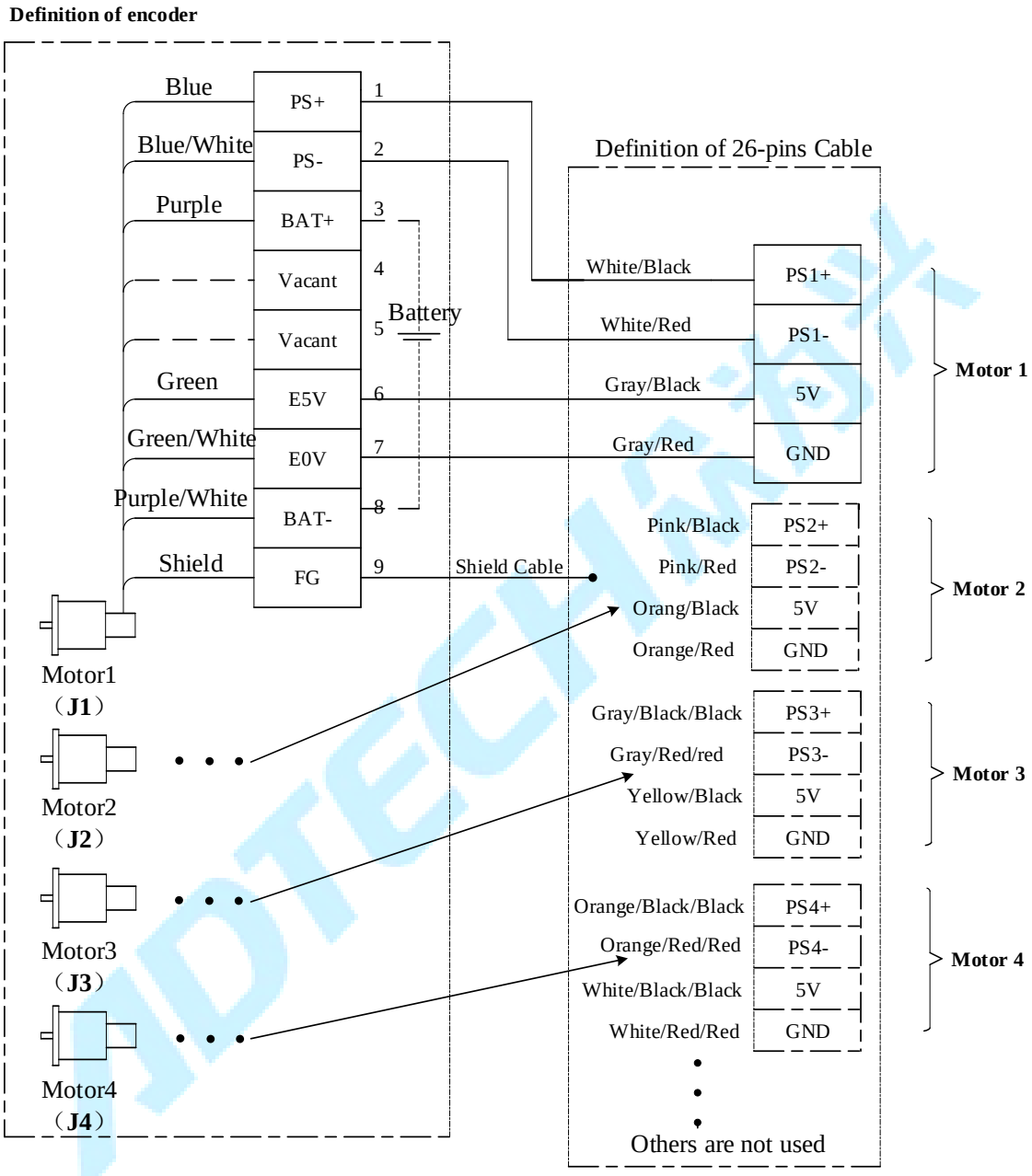


Figure 4-6 Tamagawa motor power line wiring

➢ Wiring of Electrical Brake

Tamagawa motor brake line wiring and Matsushita Electric brake line wiring is similar. Specific implementation is as follows:

(1) Brake wiring;

(2) IO board 24V power supply, specific wiring refer to “3-power cable”.

17-bits Absolute Motor of TAMAGAWA

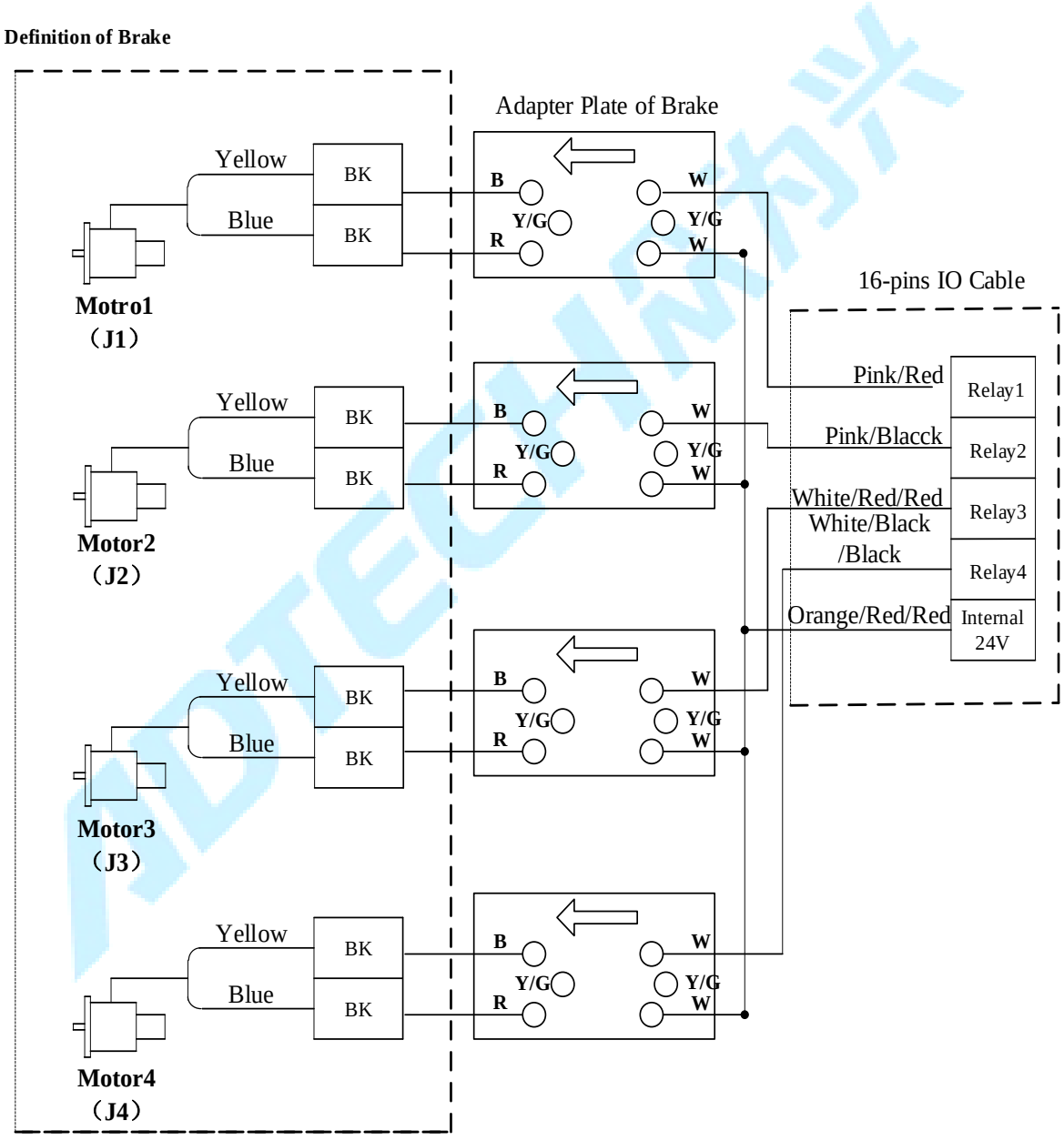


Figure 4-7 Tamagawa motor brake side wiring

Practical application, the need to complete the brakes according to the terminal of the robot body. If only one axis with the brakes, then brake to the shaft. After wiring is complete, the handheld FlexPendant in brake port configuration please refer to "teach Operation Manual."

4.3.3 Sanyo Electric Wiring Instance

- Wiring of 17bits Absolute Encoder

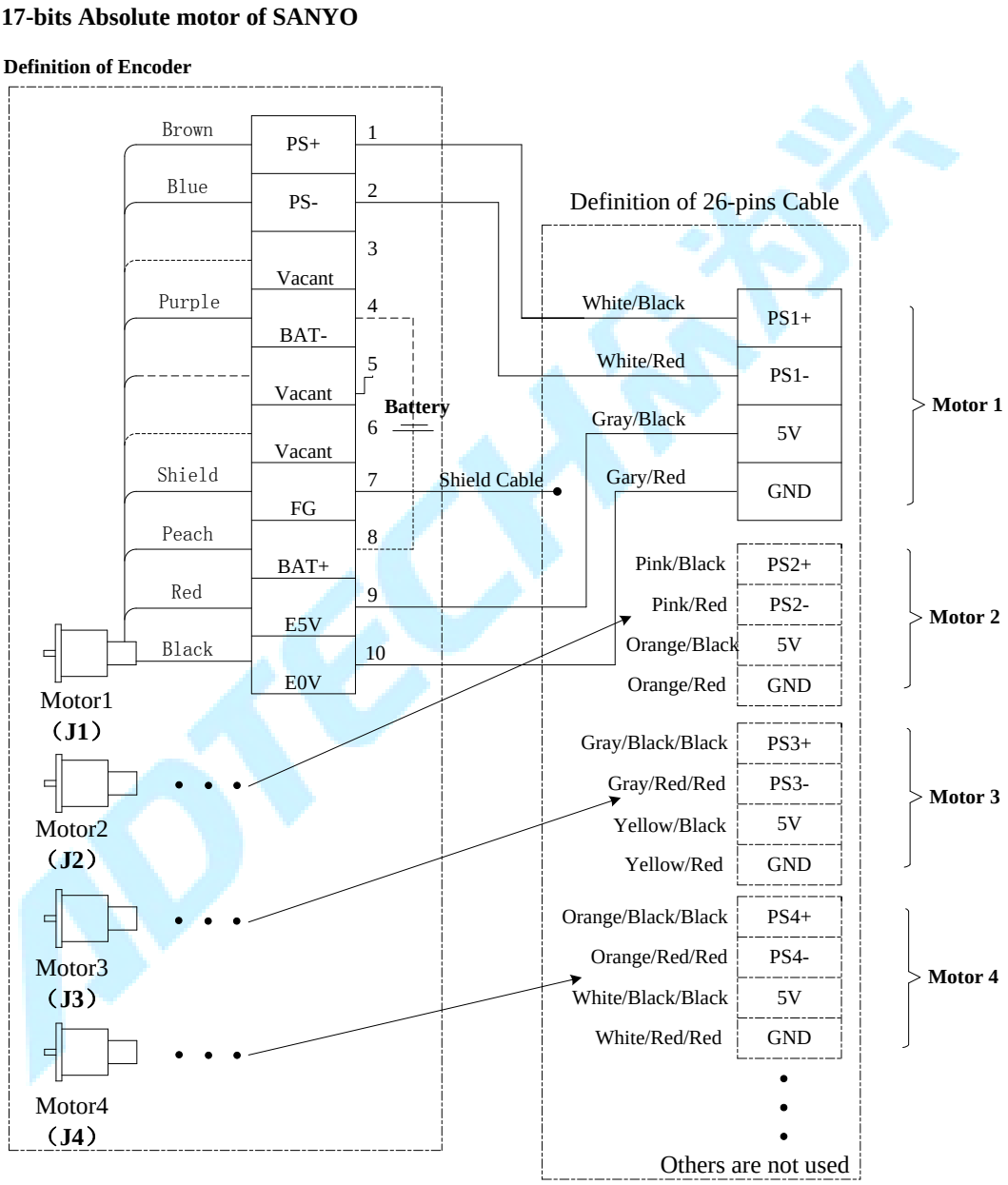


Figure 4-8 Sanyo Electric encoder wiring terminals

➢ Wiring of Electrical Power

17-bits Absolute motor of SANYO

Definition of Encoder

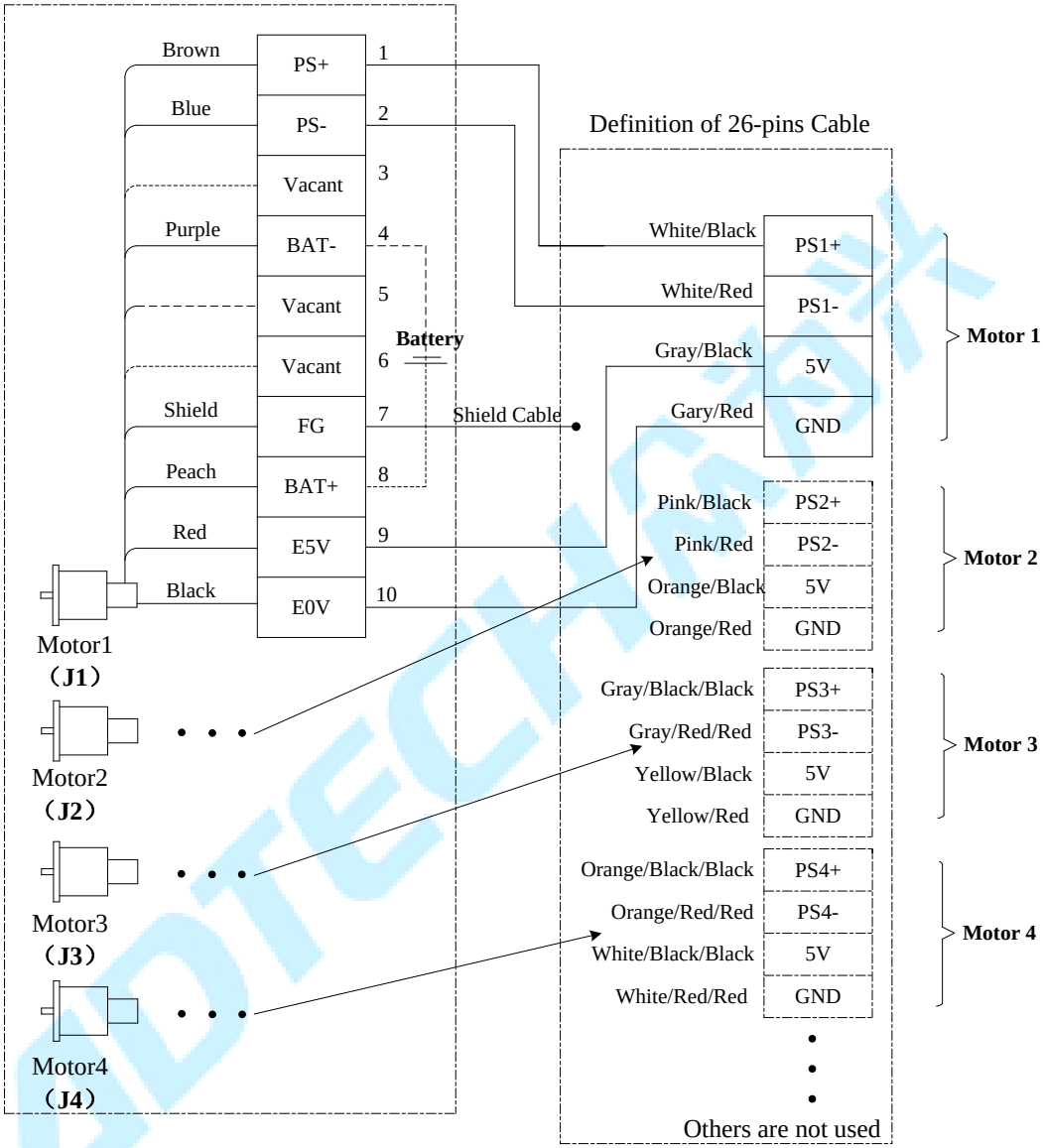


Figure 4-9 Sanyo Electric power line side wiring

Notes:

Motor-side encoder cable, power cable terminal color definitions for reference only, actual colors and line number with manufacturers to provide prevail; power lines cannot be connected to the end of the shielded cable with the encoder shielded wire to wire ends together; the motor brake via 16pin cable Relay terminal control line can also be controlled through the relay output terminal board.

➢ Wiring of Electrical Brake

Sanyo Electric Brake wire connection method similar to Matsushita Electric brake line wiring. Specific implementation is as follows:

(1) brake wiring;

(2) IO board 24V power supply, specific wiring refer to "3- power cable."

17-bits Absolute Motor of SANYO

Definition of Brake

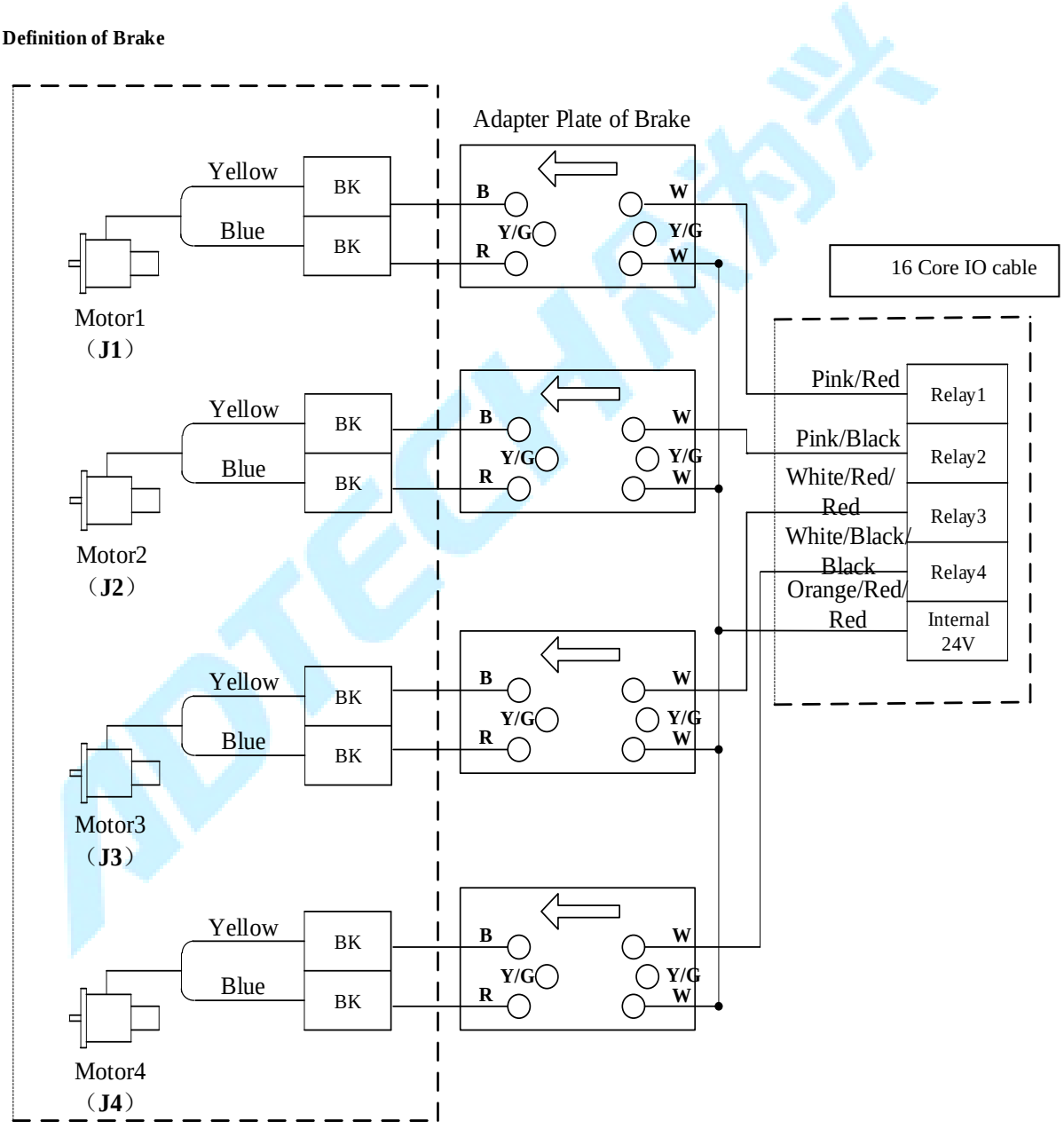


Figure 4-10 Sanyo Electric Brake side wiring

Practical application, the need to complete the brakes according to the terminal of the robot body, if only one axis with the brakes, then brake to the shaft. After wiring is complete, the handheld FlexPendant in brake port configuration please refer to “teach Operation Manual.”

4.3.4 SANKYO Electric Wiring Instance

➢ Wiring of 17bits Absolute Encoder

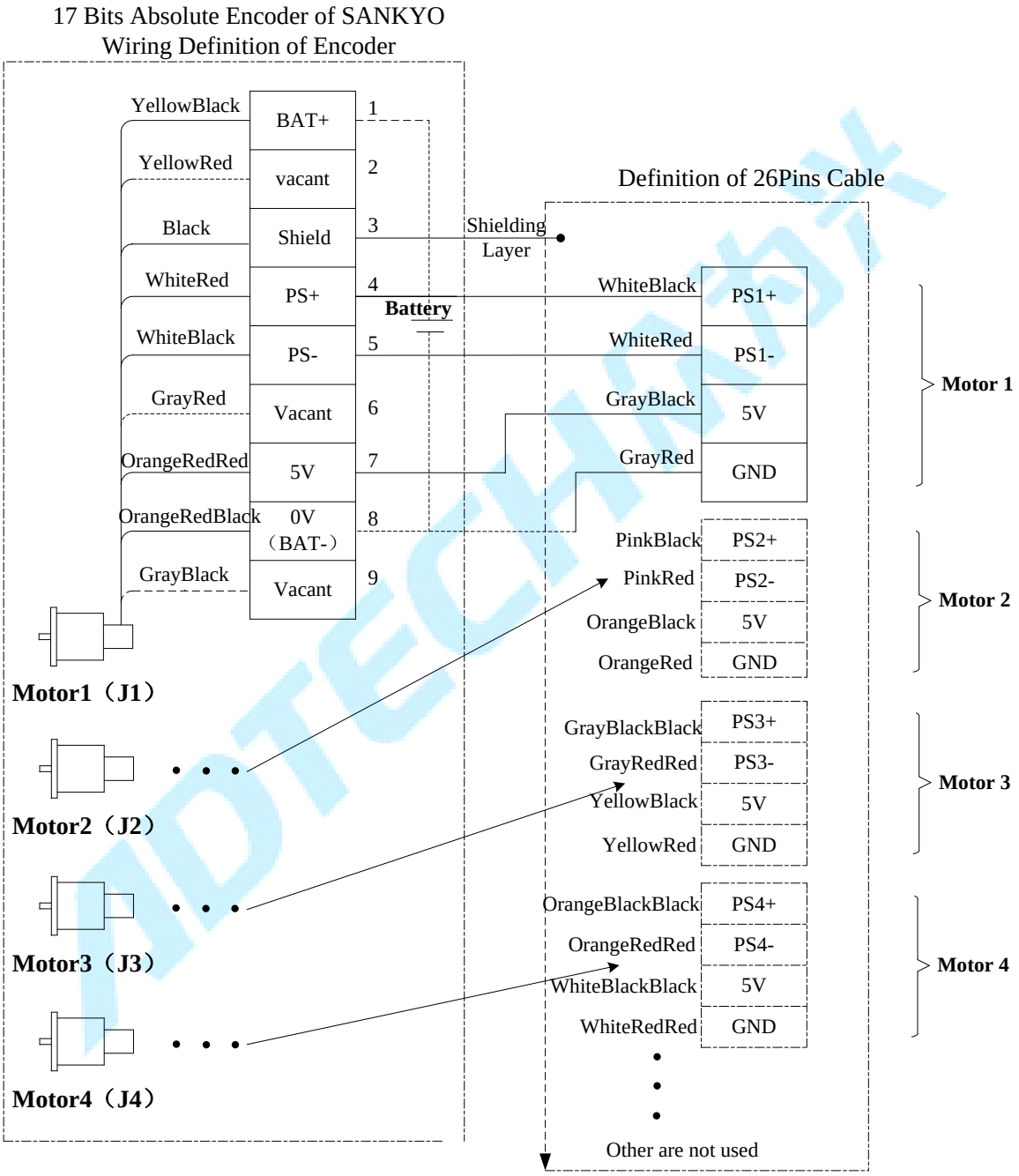


Figure 4-11 Encoder Wiring

Notice:

For SNAKYO motor, the battery's negative and 0V of encoder share the same pin (8 pin).

➢ Wiring of Electrical Power

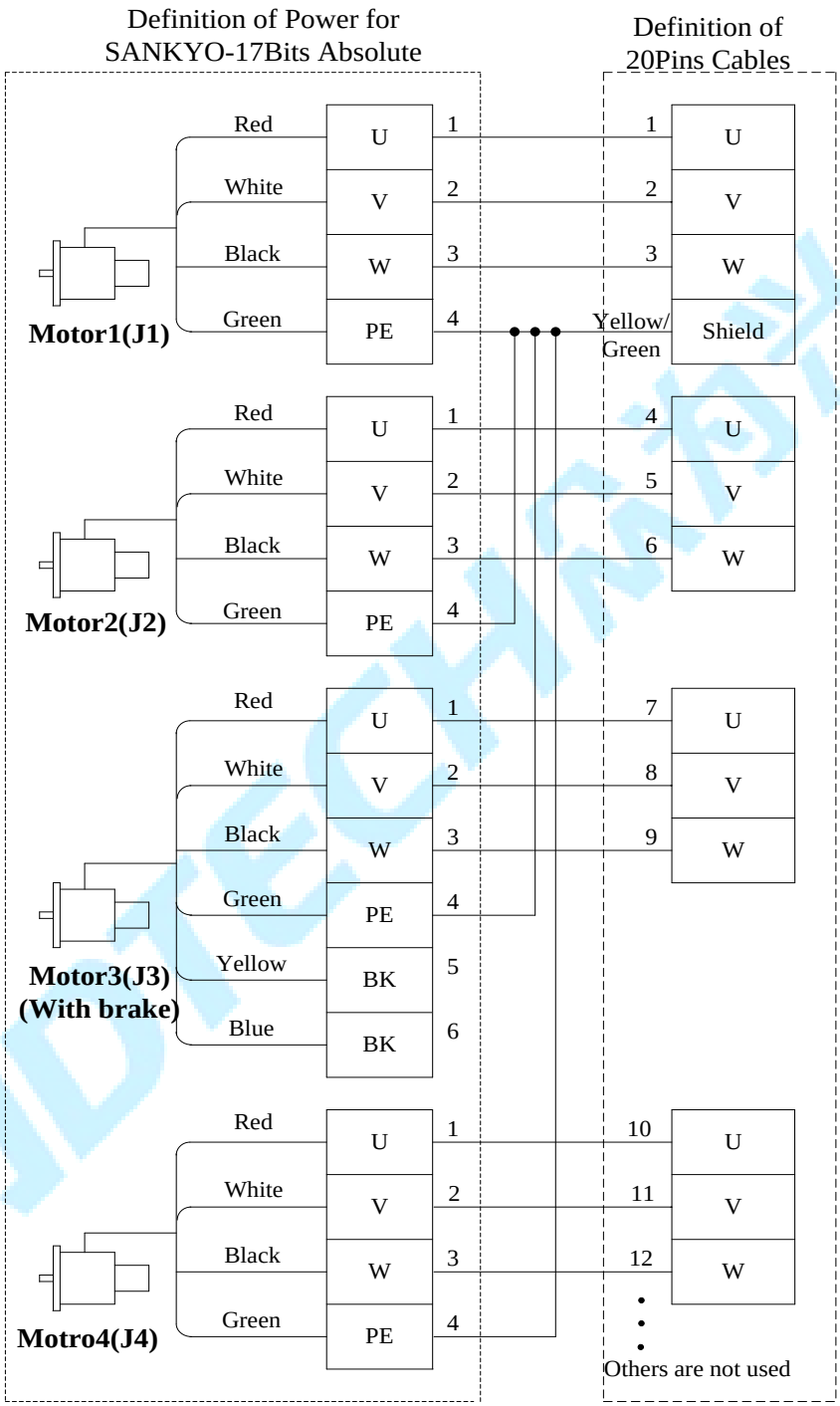


Figure 4-12Wiring of electrical power for SANKYO

Note:

- Colors of motor's encoder and power lines are only as a reference. Actual colors and lines' No provided by manufacture shall prevail;

- Power's shield cannot be connected to the encoder's shield;
- Motor's brake can be controlled by the relay terminal of 16Pins cables or can be controlled by the relay terminal of output board.

➢ Wiring of Electrical Brake

For brake wiring, SANKYO motors have similar mode with Tamagawa. Specific implementations are as follows:

（1）Brake Wiring;

（2）Which is supplied by IO board. Specific wiring can refer to chapter 3。

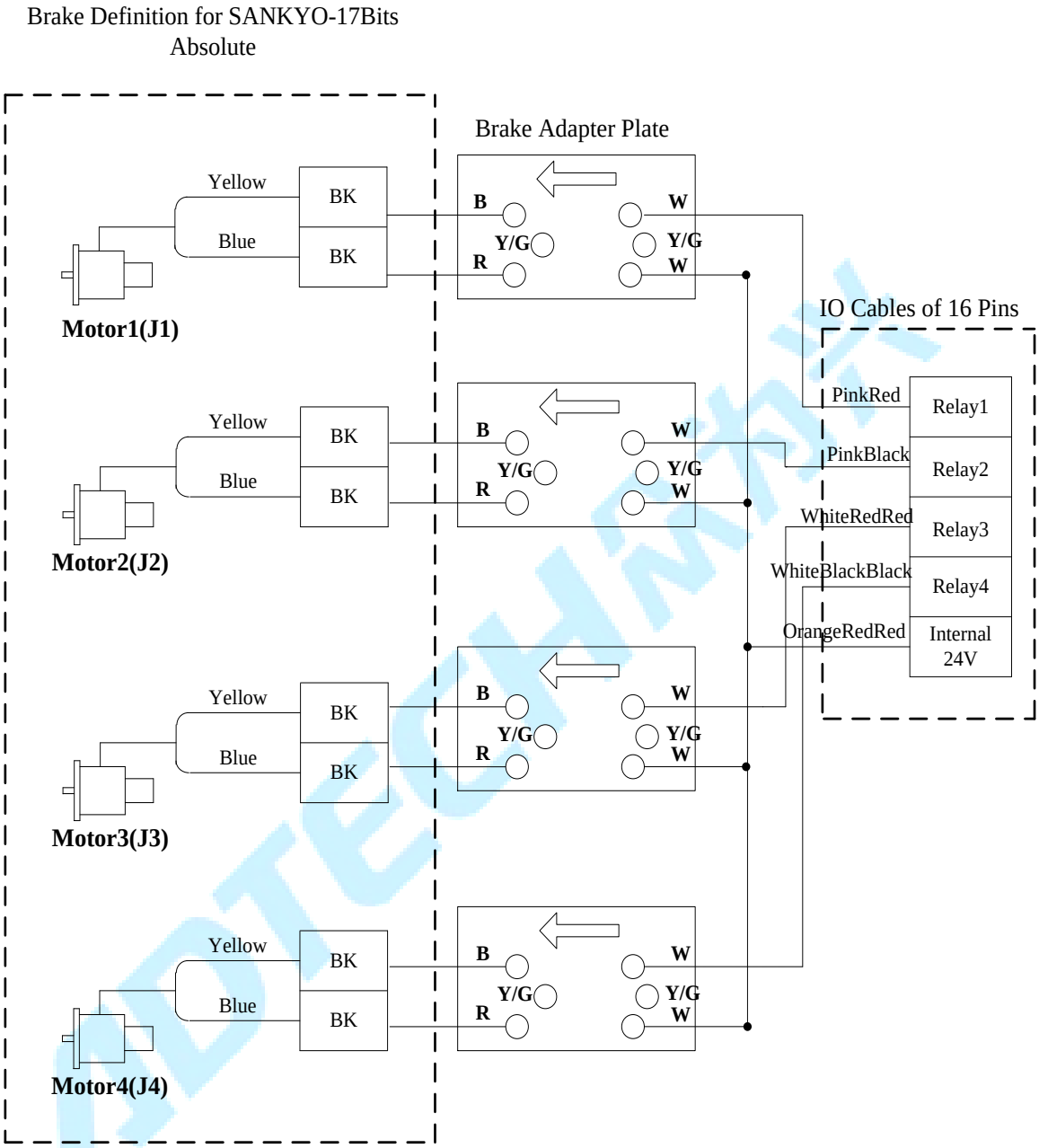


Figure 4-13 Brake Wiring of SANKYO Motor

For practical application, you must finish brake wiring based on the robot used firstly. Then configure brake port, please refer to【Teaching Pendent Operation】.

4.4 Signals' Definition for <48Pin> Motor Terminal

Table 4-4-1 48Pin Heavy load connector instruction

Numbers of 48Pin connector	Signal Instructions
A1/A4/B1/B4	U phase input of motor 1/2/3/4 power terminal
A2/A5/B2/B5	V phase input of motor 1/2/3/4 power terminal
A3/A6/B3/B6	W phase input of motor 1/2/3/4 power terminal
D2/D3/D4	IO signal inputs
C1/C2	Relay 1/Relay 2
C5/C6/D1	IO signal outputs
C3/C4	Relay 3/Relay 4
D5	Internal 24V power
D6	24V _GND
E5/E6/F5/F6/G5/G6/H5/H6	Vacant （***1**）
E1/F1/G1/H1	Ground pin (GND) of motor 1/2/3/4 encoders
E2/F2/G2/H2	Power pin (5V) of motor1/2/3/4 encoders
E3/F3/G3/H3	Signal negative (PS1-/ PS2-/ PS3-/ PS4-) of motor1/2/3/4 encoders
E4/F4/G4/H4	Signal positive (PS1+/ PS2+/ PS3+/ PS4+) of motor 1/2/3/4 encoders
PE	Shell (shielding wire)

In order to connect wiring simply, QC400 is equipped with 48Pin male plug, which is connected with **cable**. For users, they only need to connect cables terminal with encoder/IO/power terminals. **Cable** is divided into three parts, which are 19Pin twisted pair, 16Pin twisted pair and 16Pin twisted pair:

19 Twisted pair——Motor encoders (Encoder terminals of 4 motors)

16 Twisted pair——Motor U,V,W power (Power terminals of 4 motors)

16Twisted pair——Input and output signal wire (3 inputs/3 outputs /4 relays)

***1**：For QC400-D00 version，E5/E6/F5/F6/G5/G6/H5/H6 have their definitions. Details can refer to definitions of 20Pin IO in 4.4 Chapter.

Label1

PCBA	Definition	48pin over load	12Pin Cable
M1	U1	A1	1
	V1	A2	2
	W1	A3	3
M2	U2	A4	4
	V2	A5	5
	W2	A6	6
M3	U3	B1	7
	V3	B2	8
	W3	B3	9
M4	U4	B4	10
	V4	B5	11
	W4	B6	12
PE		shell	YellowGreen

Label2

Definition	48pin over load	16pin twisted-pair shielded wire
Relay1	C1	GrayRed
Relay2	C2	GrayBlack
Relay3	C3	WhiteRed
Relay4	C4	WhiteBlack
OUT1	C5	OrangeRed
OUT2	C6	OrangeBlack
OUT3	D1	Pink
IN1	D2	YellowRed
IN2	D3	YellowBlack
IN3	D4	GrayRedRed
24V	D5	WhiteBlackBlack+ OrangeRedRed
GND	D6	WhiteRedRed+ OrangeBlackBlack
		Shield(cut off)

Label3

PCBA	Definition	48pin over load	16 pin twisted-pair shielded wire
M1	M1 GND	E1	GrayRed
	M1 5V	E2	GrayBlack
	M1 E1-	E3	WhiteRed
	M1 E1+	E4	WhiteBlack
M2	M2 GND	F1	OrangeRed
	M2 5V	F2	OrangeBlack
	M2 E2-	F3	Pink
	M2 E2+	F4	PinkBlack
M3	M3 GND	G1	YellowRed
	M3 5V	G2	YllowBlack
	M3 E3-	G3	GrayRedRed
	M3 E3+	G4	GrayBlackBlack
M4	M4 GND	H1	WhiteRedRed
	M4 5V	H2	WhiteBlackBlack
	M4 E4-	H3	OrangeRedRed
	M4 E4+	H4	OrangeBlackBlack
PE		Shell	Shield

Label2

Definition	48Pin Connector	20Pin twisted-pair shielded wire
Relay1	C1	GrayRed
Relay2	C2	GrayBlack
Relay3	C3	WhiteRed
Relay4	C4	WhiteBlack
OUT19	C5	OrangeRed
OUT20	C6	OrangeBlack
OUT21	D1	PinkRed
OUT22	E5	PinkBlack
IN28	D2	YellowRed
IN29	D3	YellowBlack
IN30	D4	GrayRedRed
IN31	E6	GrayBlackBlack
IN32	F5	WhiteRedRed
IN33	F6	WhiteBlackBlack
24V	D5	OrangeRedRed
GND	D6	OrangeBlackBlack
24V	G5	PinkRedRed
24V	G6	PinkBlackBlack
24V	H5	YellowRedRed
GND	H6	YellowBlackBlack
PE	Shell	Shileded wire

- **Definition of 16Pin Encoder**

Table 4-4-2 Definitions of 16Pin twisted pair

PCBA	Definition	Number of 48Pin connector	Shielding twisted pair of 16Pin（Colors of each wire）
Motor 1	GND	E1	GrayRed
	5V	E2	GrayBlack
	E1-	E3	WhiteRed
	E1+	E4	WhiteBlack
Motor 2	GND	F1	OrangeRed
	5V	F2	OrangeBlack
	E2-	F3	PinkRed
	E2+	F4	PinkBlack
Motor 3	GND	G1	YellowRed
	5V	G2	YellowBlack
	E3-	G3	GrayRedRed
	E3+	G4	GrayBlackBlack
Motor 4	GND	H1	WhiteRedRed
	5V	H2	WhiteBlackBlack
	E4-	H3	OrangeRedRed
	E4+	H4	OrangeBlackBlack
Shell			Shileding wire

➢ **Definition of two-channels External Encoders**

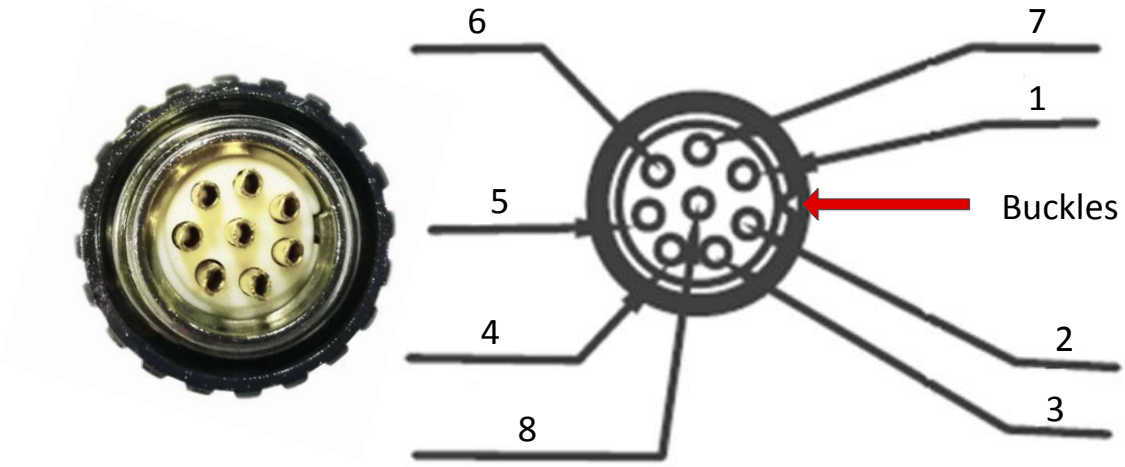


Figure 4-4-1Front view of M5/M6 Encoders

Table 4-4-3 Definition of M5/M6 Encoders

PCBA	**Definition**	**Number of M5/M6 encoders** 10Pin plug wire (2pcs)	**Number of 8-cores aviation plug**
M5/M6	E3+	E1	1
	E3-	E2	2
	E2+	E3	3
	E2-	E4	4
	E1+	F1	5
	E1-	F2	6
	5V	F3	7
	GND	F4	8

Note：

1. For absolute encoder, E1+ and E1- are data signals of serial communication;
2. For incremental encoder(ABZ), E1+ and E1- are corresponding to A+ and A-; E2+ and E2- are corresponding to B+ and B-; E3+ and E3- are corresponding to Z+ and Z-;

- **Definition of 19Pin Power**

19Pin twisted pair is motor power line, and definition of each pin is shown in following table:

Table 4-4-4 Definitions of 19Pin twisted pair

PCBA	Definition	Number of 48Pin connector	Shielding twisted pair of 19Pin（Number of each wire）
Motor 1	U	1	A1
	V	2	A2
	W	3	A3
Motor 2	U	4	A4
	V	5	A5
	W	6	A6
Motor 3	U	7	B1
	V	8	B2
	W	9	B3
Motor 4	U	10	B4
	V	11	B5

	W	12	B6
Shielded wire		Shell	YellowGreen

- **Definition of 16Pin or 20Pin IO**

IOs are not only provided by ADTECH controller, but also provided by over-load connector. For 48Pin over-load connector, it has two types of IO wire; one is 16Pin twisted pair, another is 20Pin twisted pair. Specific definitions of each type are as follows:

Table 4-4-5 Definitions of 16Pin twisted pair

Definition	**Number of 48Pin connector**	**Shielding twisted pair of 16Pin（color of each wire）**
Relay1（OUT23）	C1	GrayRed
Relay2（OUT24）	C2	GrayBlack
Relay3（OUT25）	C3	WhiteRed
Relay4（OUT26）	C4	WhiteBlack
OUT19	C5	OrangeRed
OUT20	C6	OrangeBlack
OUT21	D1	PinkRed
IN28	D2	YellowRed
IN29	D3	YellowBlack
IN30	D4	GrayRedRed
Internal 24V power	D5	WhiteBlackBlack+OrangeRedRed
GND	D6	WhiteRedRed+OrangeBlackBlack

16Pin IO terminal has four relays outputs. In practical application, motors of robot are equipped with brake. On-off state of relay is used to decide whether to open or close motor's brake. Specific wiring of brake can refer to **Chapter 4.5**.

Note: Considering that total load capacity of 16Pin IO wire is 500mA, it is advised to use IO signals of IO board (ADT-9137, ADT-9125).

Table 4-4-6 Definitions of 20Pin twisted pair

Definition	**Number of 48Pin connector**	**Shielding twisted pair of 20Pin（color of each wire）**
Relay1 (OUT23)	C1	GrayRed
Relay2(OUT24)	C2	GrayBlack
Relay3（OUT25）	C3	WhiteRed
Relay4（OUT26）	C4	WhiteBlack
OUT19	C5	OrangeRed
OUT20	C6	OrangeBlack
OUT21	D1	PinkRed
OUT22	E5	PinkBlack
IN28	D2	YellowRed
IN29	D3	YellowBlack
IN30	D4	GrayRedRed
IN31	E6	GrayBlackBlack
IN32	F5	WhiteRedRed
IN33	F6	WhiteBlackBlack
Internal 24V power	D5	OrangeRedRed
GND	D6	OrangeBlackBlack
Internal 24V power	G5	PinkRedRed
Internal 24V power	G6	PinkBlackBlack

Internal 24V power	H5	YellowRedRed
GND	H6	YellowBlackBlack
PE	Shell	Shilded wire

Note: Please use G5/G6/H5 as the power of brake coil when connector has 20Pin IO wire. For example, One terminal of Z-axis brake is connected to C3, another terminal of Z-axis brake is connected to G5 or G6 or H5.

- **IO Wiring Diagram for 48Pin Robot**

Definitions of 26Pin signals (at the back of robot body):

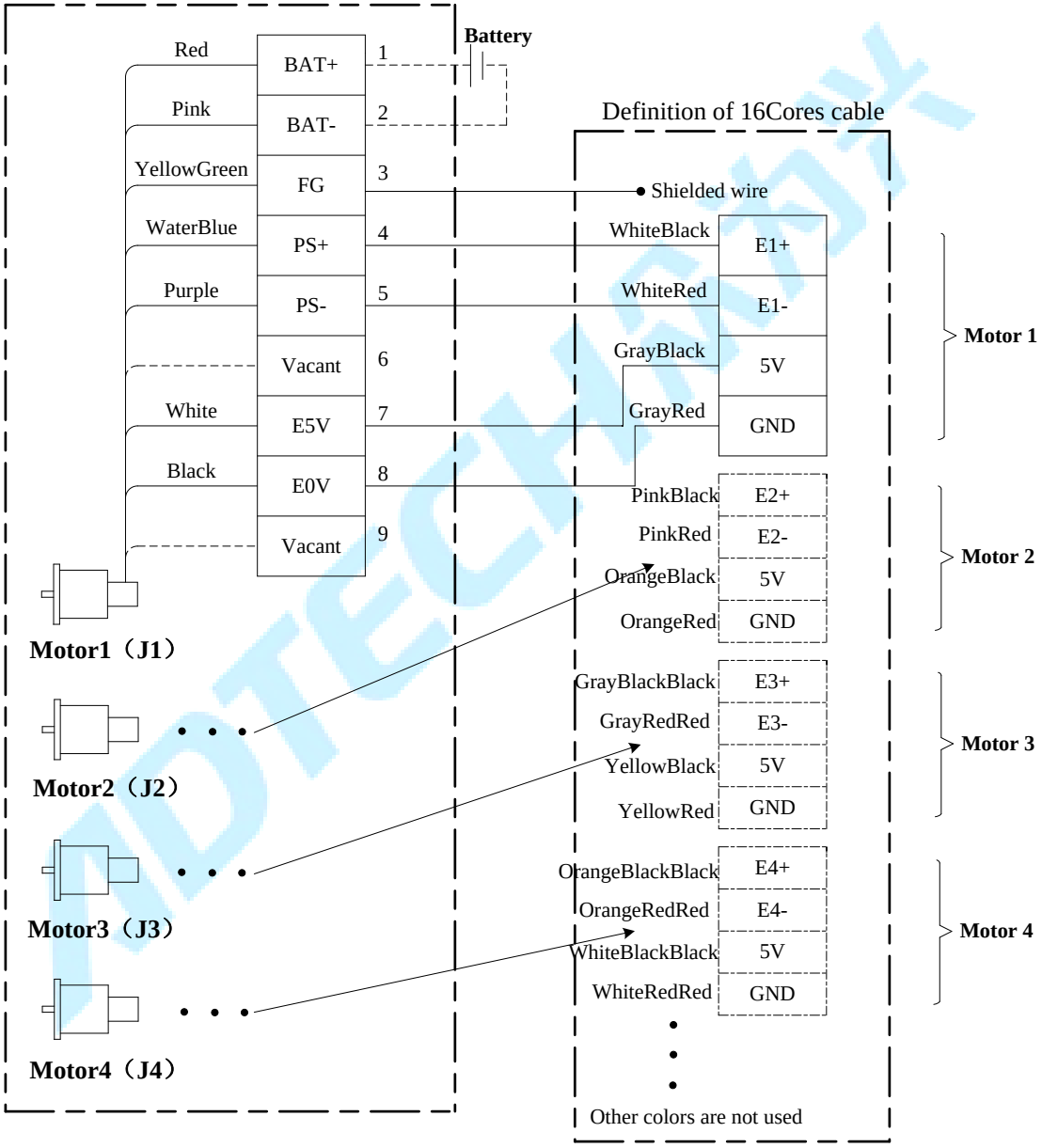
4.5 Connection Instances of Motors for 48Pin

➢ Wiring Instance of Panasonic Motor

✓ Wiring of 17Bits Absolute Encoder (Panasonic)

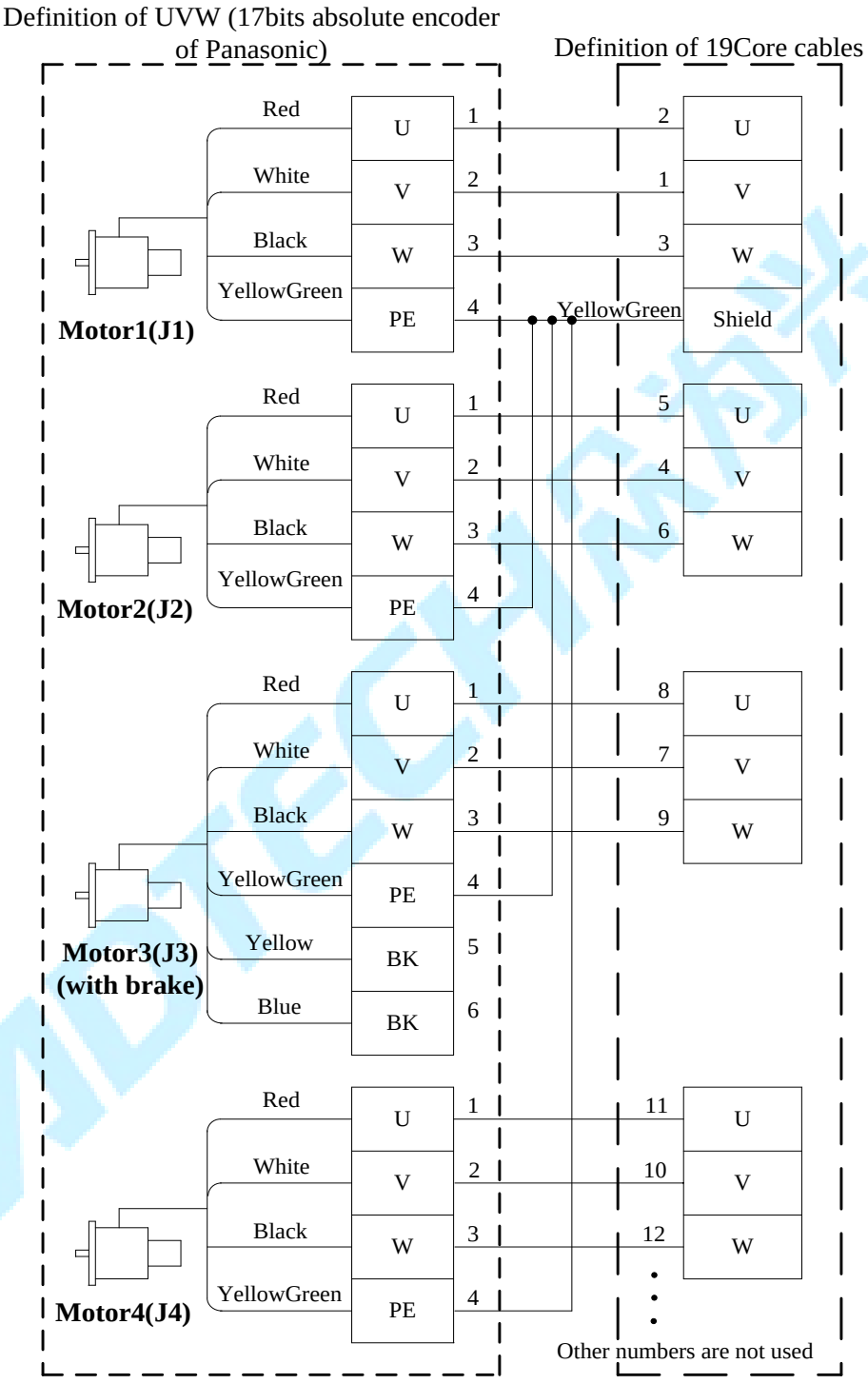
Wiring diagram of encoder for QC400 robot

Definition of encoder(17bits absolute encoder of Panasonic)



✓ Wiring of Power Line (UVW)

Wiring diagram of UVW wiring for QC400 robot:



Notice:

Counting way of encoder (Panasonic motor) is not in accordance with the way used

in program of QC400 servo. Wiring mode of UV phase for 26Pin cable terminal is in contrast to the conventional way.

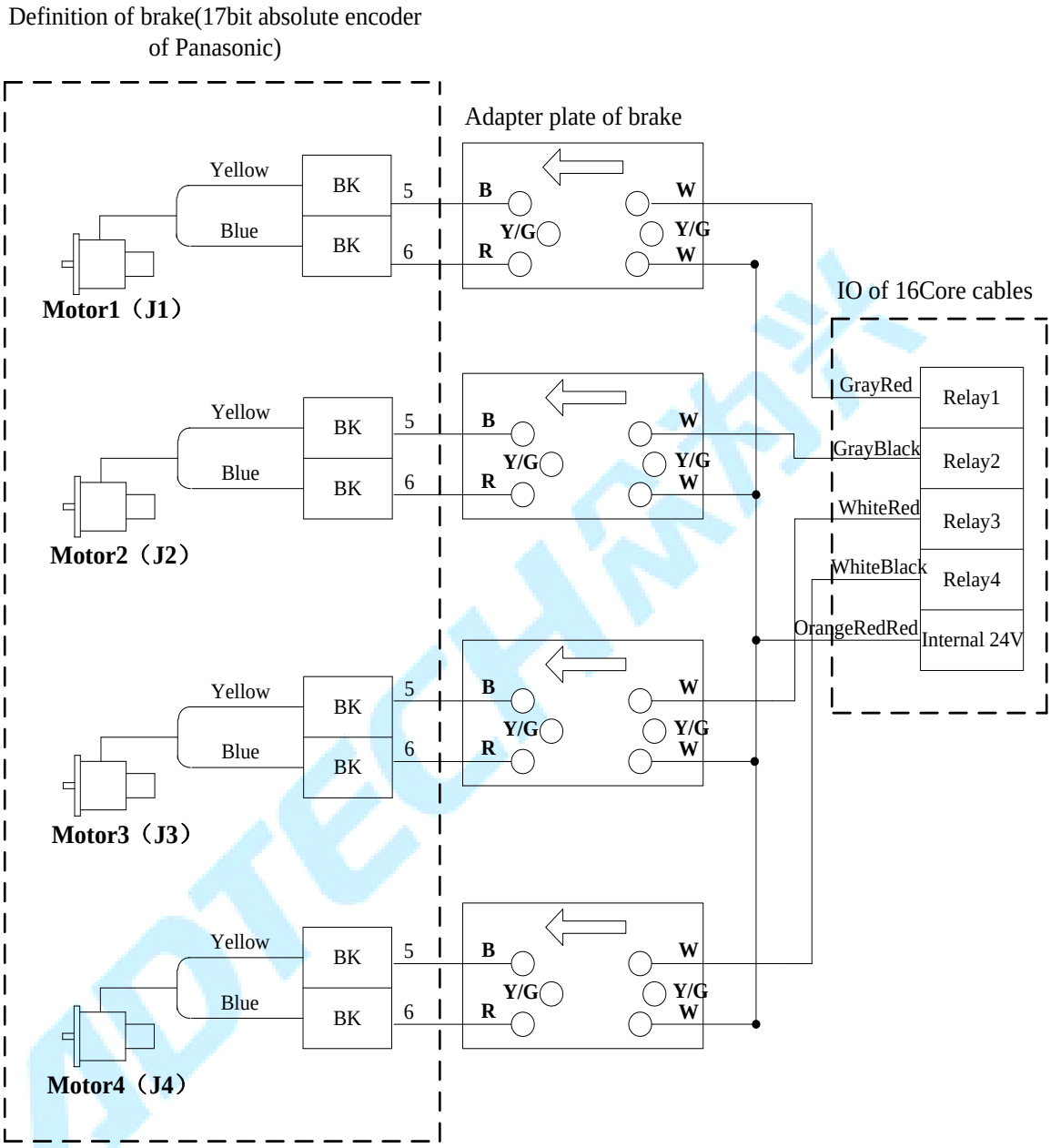
✓ Wiring of Motor Brake (Panasonic)

Robot has one or more brakes needed in practical use. And realization of brakes' on and off is through opening or closing the relays on IO board. Specific implementations are as follows:

（1）Brake Wiring;

（2）Which is supplied by IO board(24V). Specific wiring can refer to chapter 3.

Wiring diagram of brake wiring for ADTECH robot



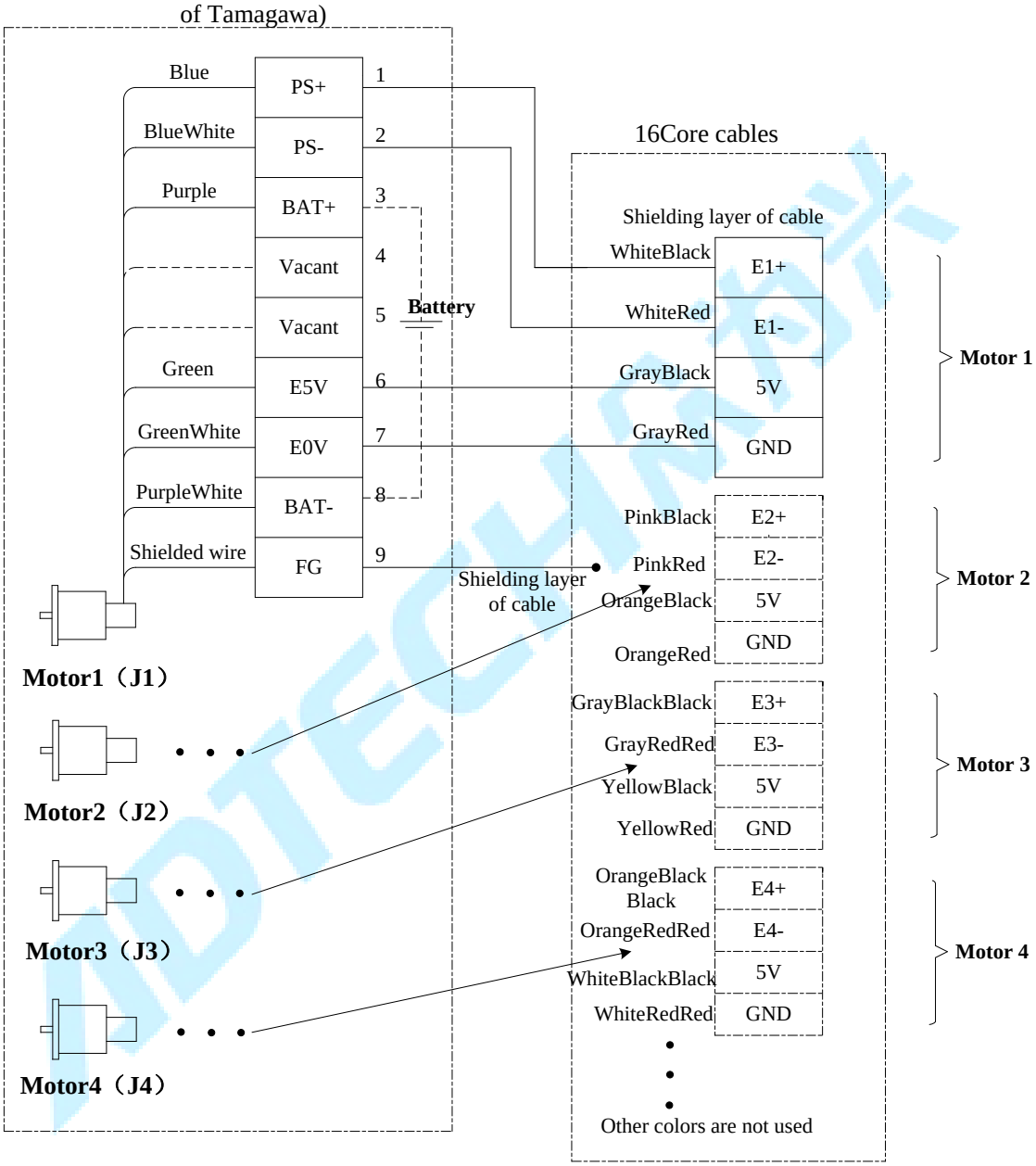
For practical application, you must finish brake wiring based on the robot used firstly. Then configure brake port, please refer to【Teaching Pendent Operation】.

➢ Wiring Instance of Tamagawa Motor

✓ Wiring of 17Bits Absolute Encoder (Tamagawa)

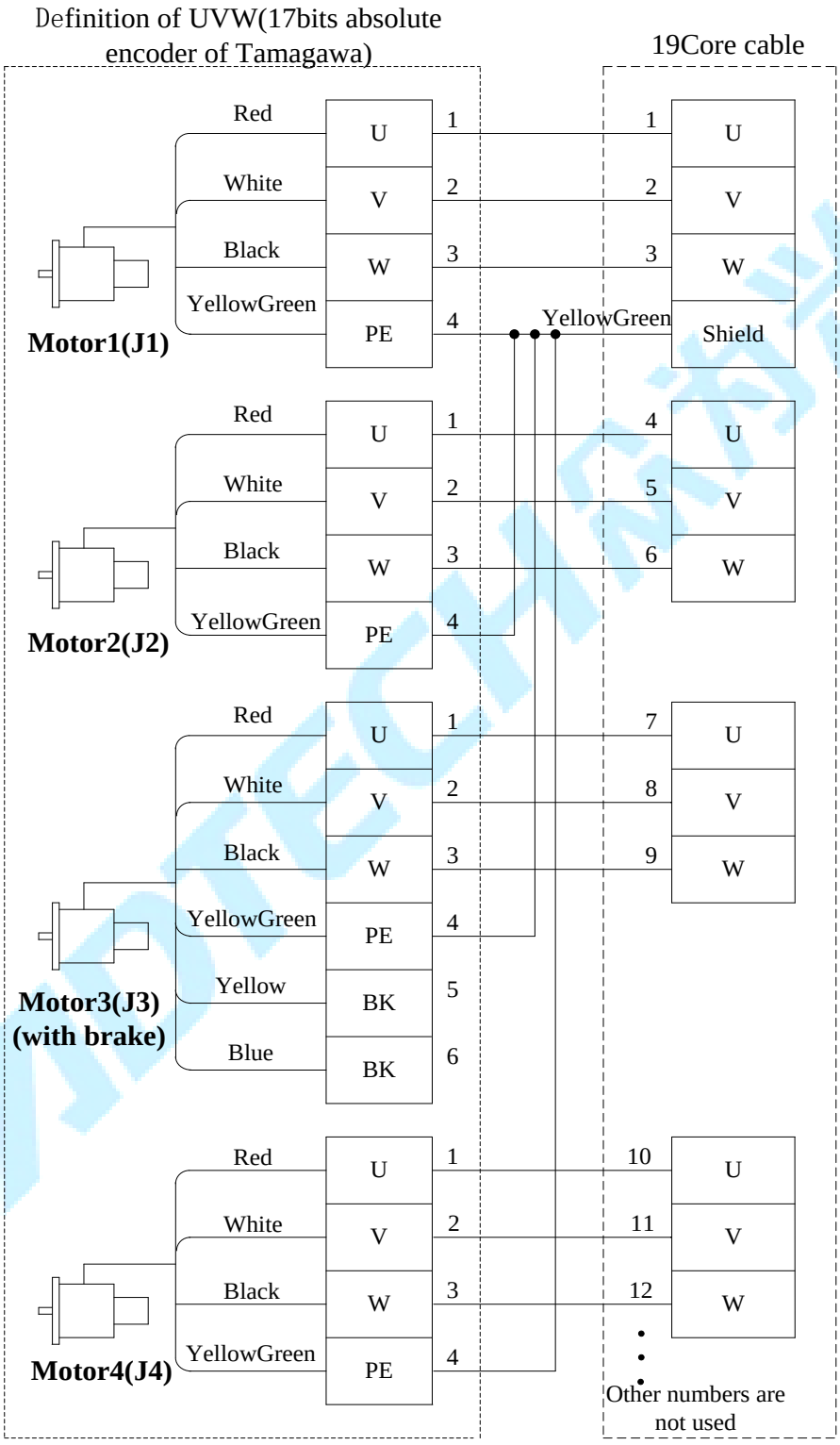
Wiring diagram of encoder for ADTECH robot

Definition of encoder(17bits absolute encoder of Tamagawa)



✓ Wiring of Power Line (UVW)

Wiring diagram of UVW for ADTECH robot:



✓ Wiring Instance of Motor (Tamagawa) Brake

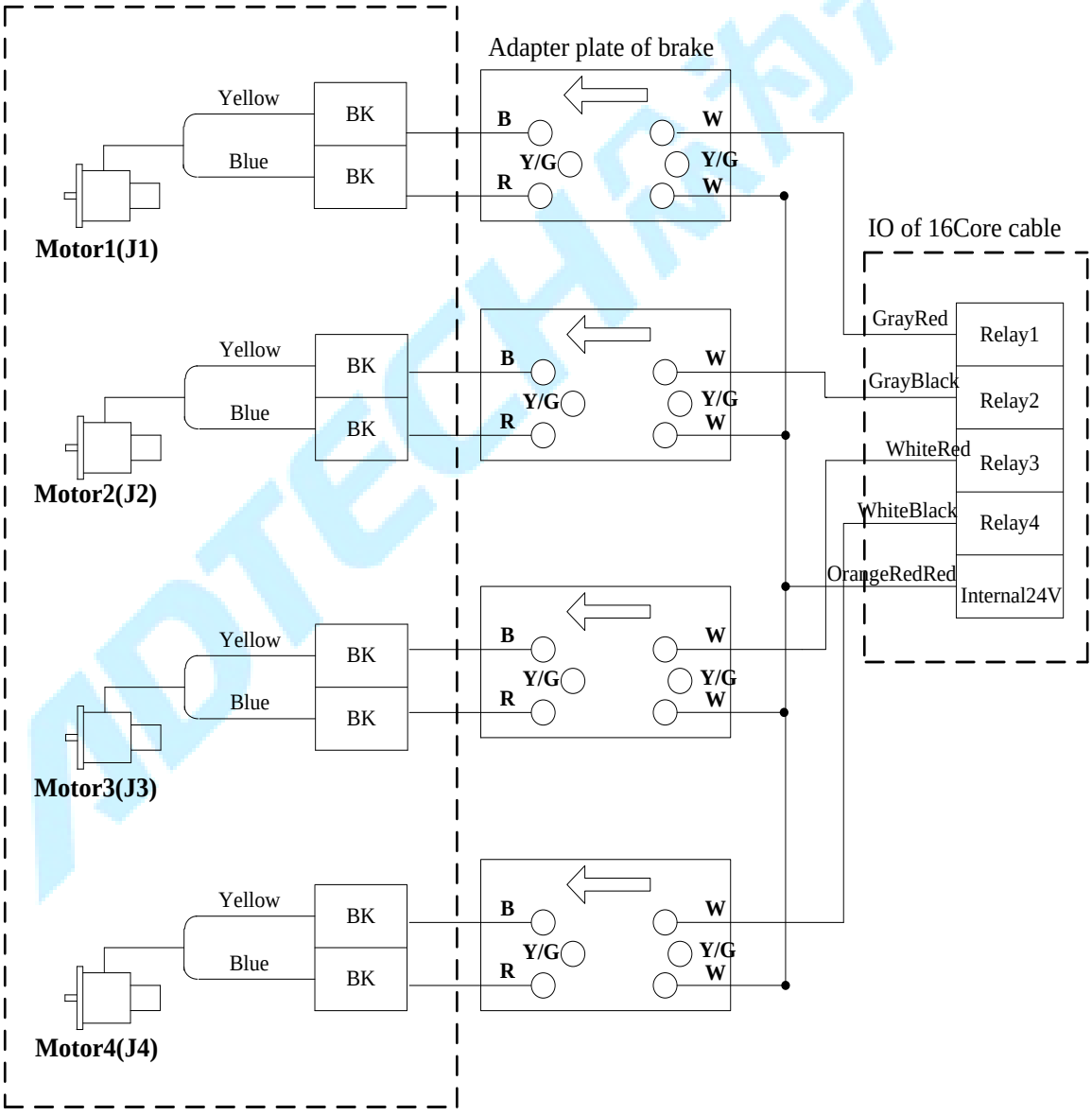
For brake wiring, Sanyo motors have similar mode with Panasonic. Specific implementations are as follows:

（1）Brake Wiring;

（2）Which is supplied by IO board(24V). Specific wiring can refer to chapter 3.

Wiring diagram of brake for ADTECH robot：

Definition of brake(17bit absolute encoder of Tamagawa)



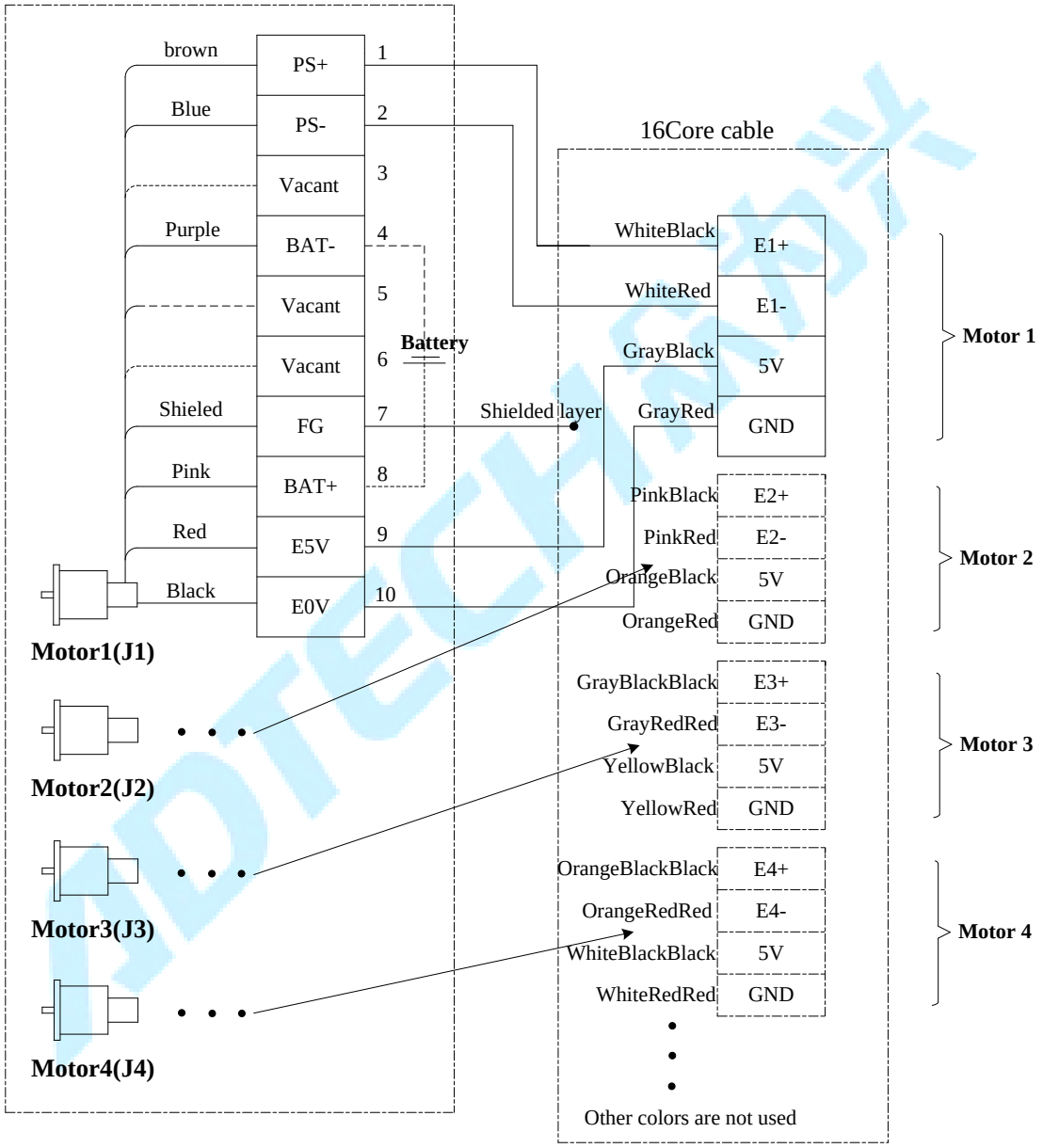
For practical application, you must finish brake wiring based on the robot used firstly. Then configure brake port, please refer to【Teaching Pendent Operation】.

➢ Wiring Instance of Sanyo Motor

✓ Wiring Instance of 17Bits Absolute Encoder (Sanyo)

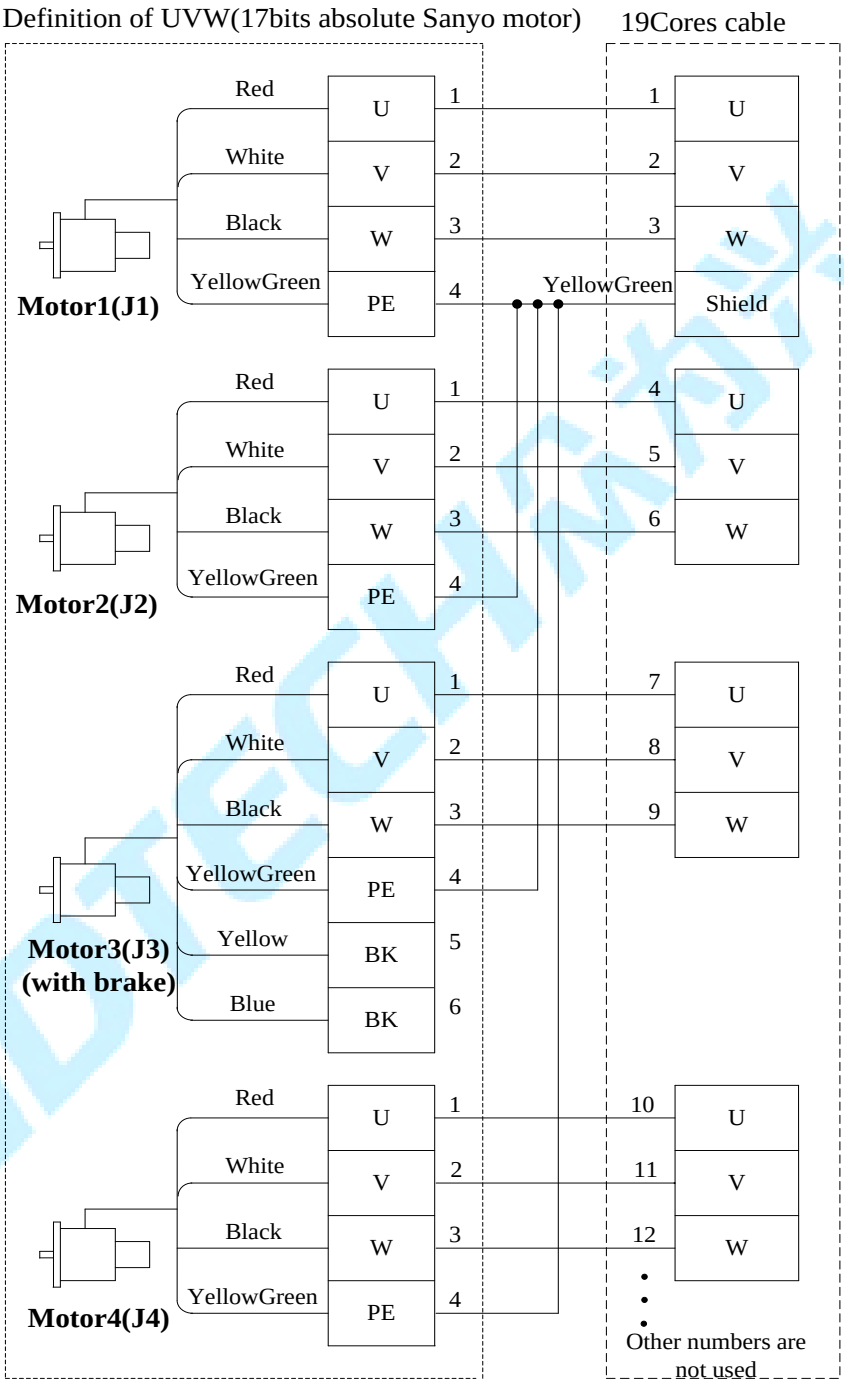
Wiring diagram of encoder for ADTECH robot：

Definition of Encoder(17Bits absolute Sanyo motor)



✓ Wiring of Power Line (UVW)

Wiring diagram of UVW for ADTECH robot：



Note:

- Colors of motor's encoder and power lines are only as a reference. Actual colors and lines' No provided by manufacture shall prevail;

- Power's shield cannot be connected to the encoder's shield;
- Motor's brake can be controlled by the relay terminal of 16Pins cables or can be controlled by the relay terminal of output board.

✓ Wiring of Motor(Sanyo) Brake

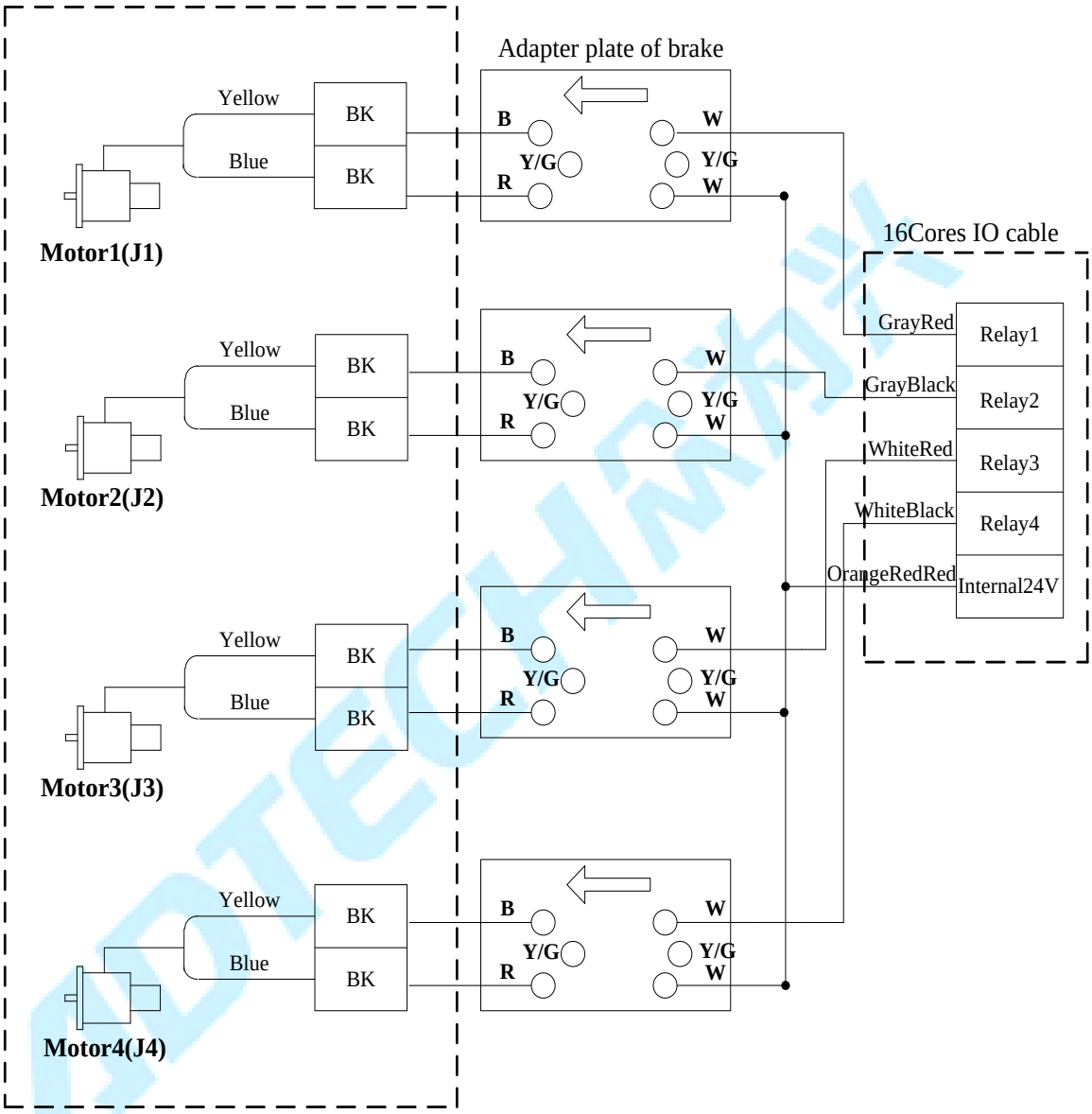
For brake wiring, Sanyo motors have similar mode with Panasonic. Specific implementations are as follows:

（1）Brake Wiring;

（2）Which is supplied by IO board(24V). Specific wiring can refer to chapter 3。

Wiring diagram of brake for ADTECH robot

Definition of brake(17bits absolute Sanyo motor)



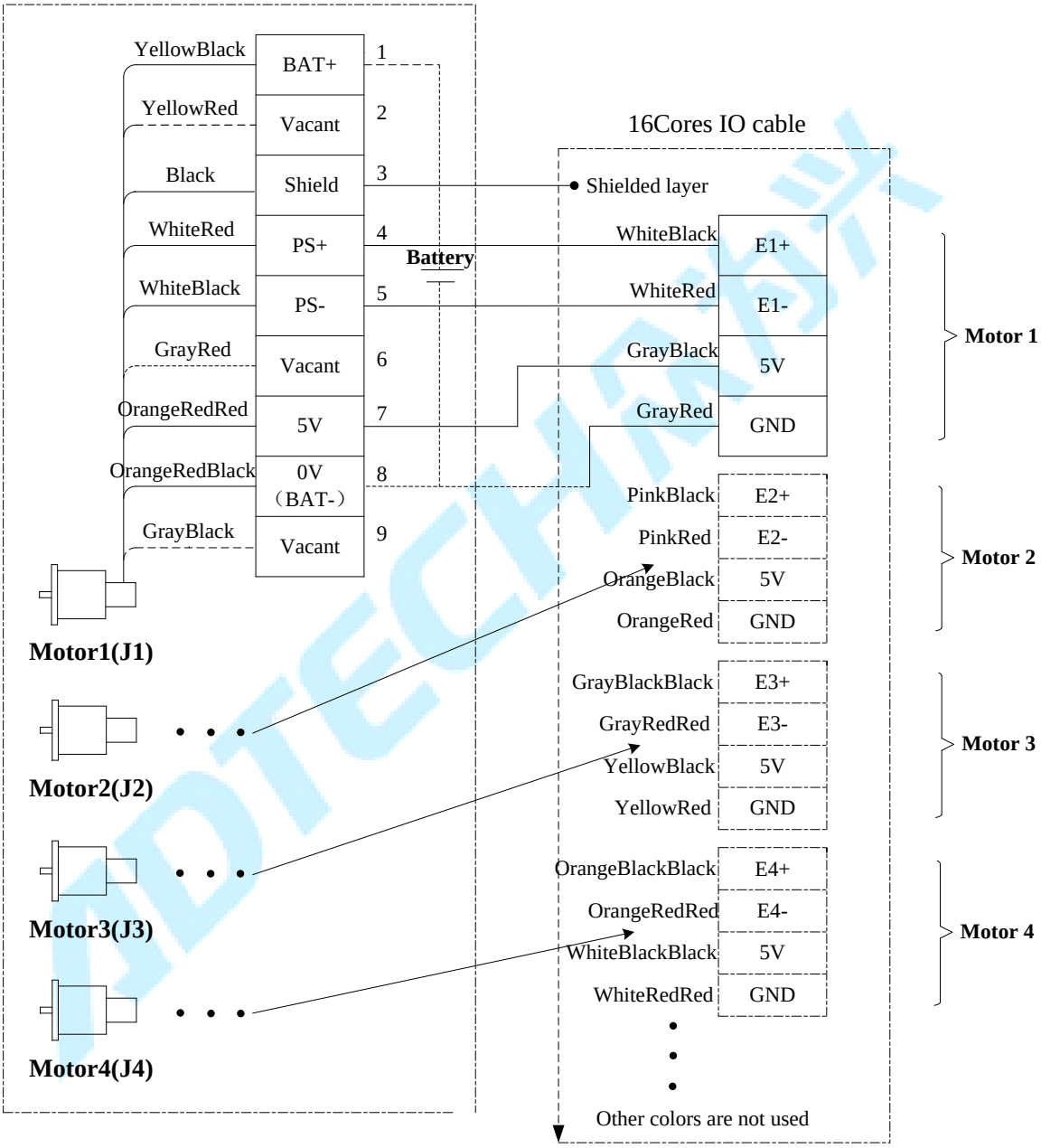
For practical application, you must finish brake wiring based on the robot used firstly. Then configure brake port, please refer to【Teaching Pendent Operation】.

➢ Wiring Instance of SANKYO Motor

✓ Wiring of 17Bits Absolute Encoder (SANKYO)

Wiring diagram of encoder for ADTECH robot

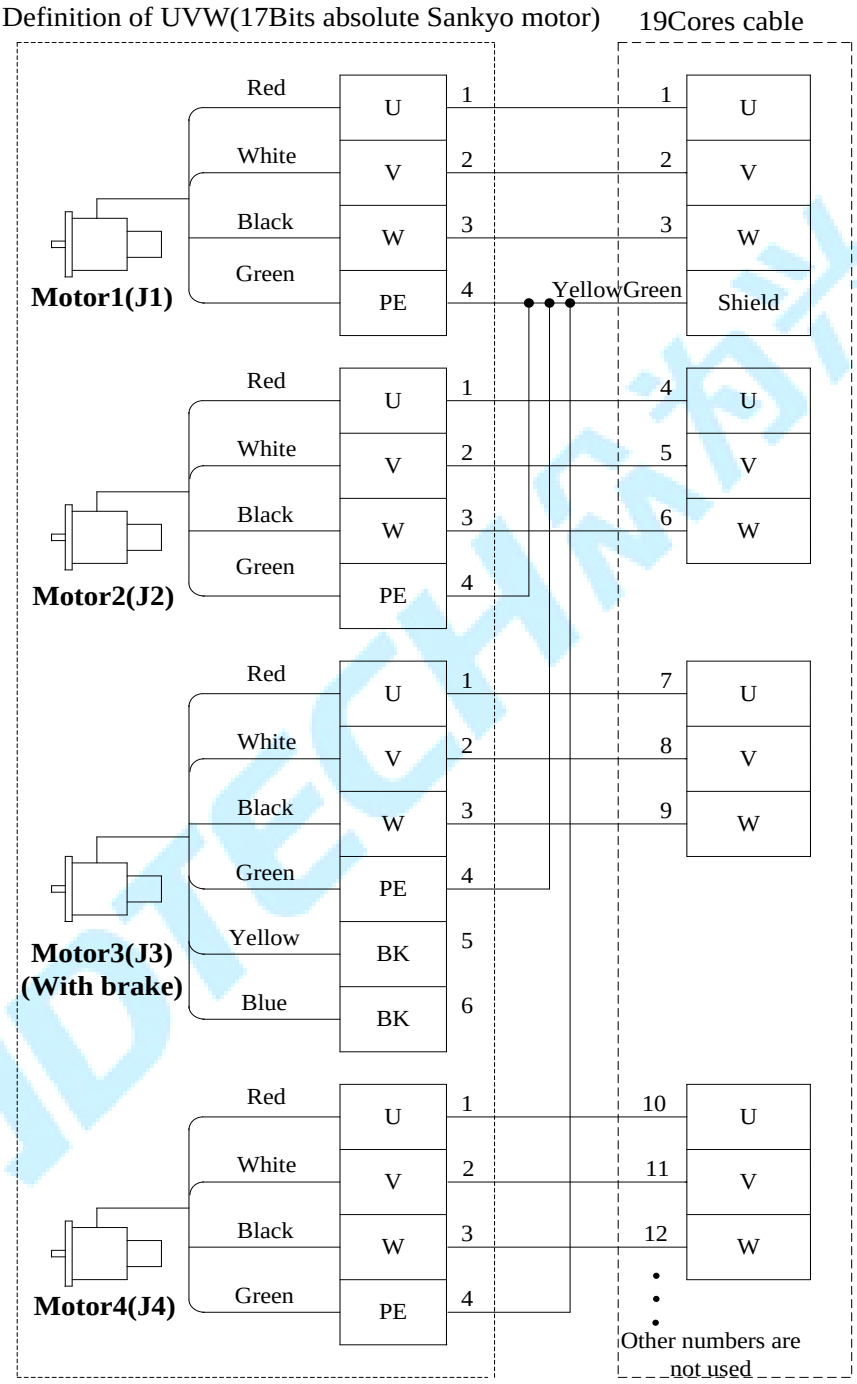
Definition of encoder(17bits absolute Sankyo motor)



Note: For SNAKYO motor, the negative pole and 0V of encoder's battery share the same pin (8 pin).

✓ Wiring of Power Line (UVW)

Wiring diagram of UVW for ADTECH robot



Note：

- Colors of motor's encoder and power lines are only as a reference. Actual colors and lines' No provided by manufacture shall prevail;
- Power's shield cannot be connected to the encoder's shield;

- Motor's brake can be controlled by the relay terminal of 16Pins cables or can be controlled by the relay terminal of output board.

✓ Wiring of Motor (SANKYO) Brake

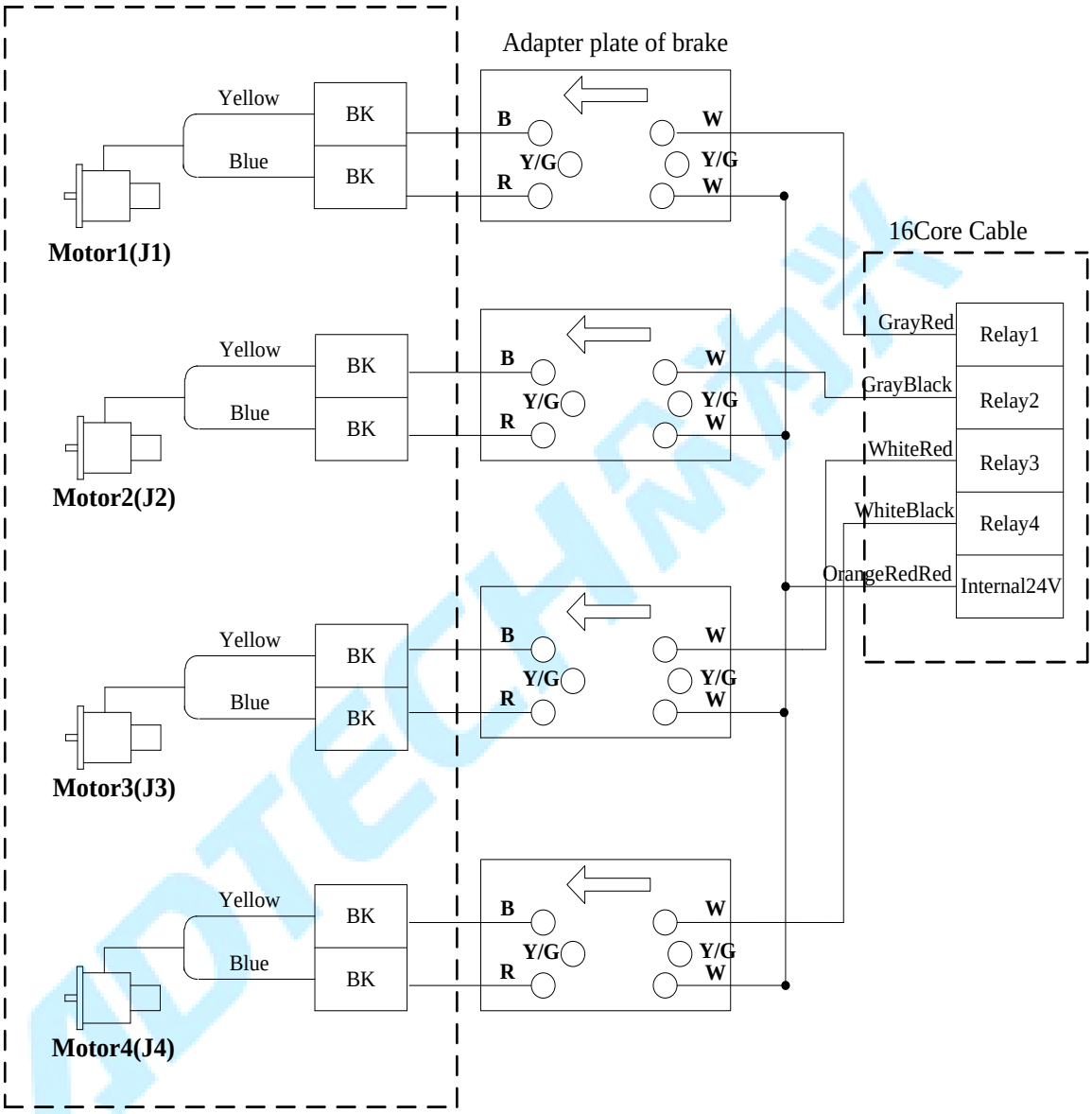
For brake wiring, SANKYO motors have similar mode with Tamagawa. Specific implementations are as follows:

（1）Brake Wiring;

（2）Which is supplied by IO board. Specific wiring can refer to chapter 3。

Wiring diagram of brake for ADTECH robot

Definition of brake(17Bits absolute Sankyo motor)



For practical application, you must finish brake wiring based on the robot used firstly. Then configure brake port, please refer to【Teaching Pendent Operation】.

5. Digital Input and Output Interfaces

5.1 Digital Inputs

QC400 contains an extended wiring IO board, which is powered by an independent external 24V power supply. It has 34 ordinary inputs and 27 ordinary outputs (6 relays are included). Effective input level can be determined to high or low according to the level configuration of common terminal.

5.1.1 Input Interface Definition and Pin Functions

- INPUTCOM(input common terminal): an external 24V or 12V power supplied.
- Digital input interface uses a 37-pin DB terminal and 20-pin socket, which contains the power and common wiring ports.

Pins' arrangement of digital input port is shown as following:

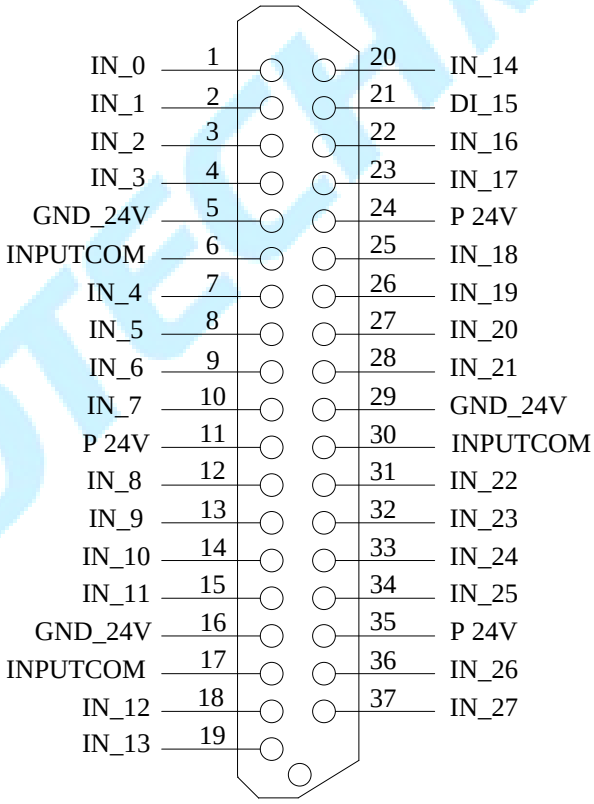


Figure 5-1 Digital input ports

Note:

Input board contains three INPUTCOM ports. All input ports can be used if only one of INPUTCOMs is supplied with 24V.

Definitions and **functions** of each input pin are described as follows:

Table **5-1 digital input ports are defined**

Pin No	Interface Definition	Features	Pin No	Interface Definition	Features
1	IN0	input port	2	IN1	ordinary general input port
3	IN2	input port	4	IN3	ordinary general input port
5	GND_24V	24V power supply	6	INPUTCOM	input common, then supplied external or internal power supply (24V+)
7	IN4	common input port	8	IN5	general input port
9	IN6	general input port	10	IN7	common input port
11	P24V	internal 24V power supply	12	IN8	general input port
13	IN9	general input port	14	IN10	general input port
15	IN11	general input port	16	GND_24V	24V power ground
17	INPUTCOM	input common terminal, connected to an external or internal power supply provided (24V +)	18	IN12	general input port
19	IN13	general input port	20	IN14	general input port
21	IN15	general input port	22	IN16	general input port
23	IN17	general input port	24	P24V	internal 24V power supply
25	IN18	general input port	26	IN19	general input port
27	IN20	general input port	28	IN21	general input port
29	GND_24V	24V power supply	30	INPUTCOM	input common, then supplied external or internal power supply (24V +)
31	IN22	general input port	32	IN23	general input port
33	IN24	general input port	34	IN25	general input port
35	P24V	internal 24V power supply	36	IN26	general input port
37	IN27	general input port			

5.1.2 Digital Input Schematic Diagram

Digital input brief internal circuit:

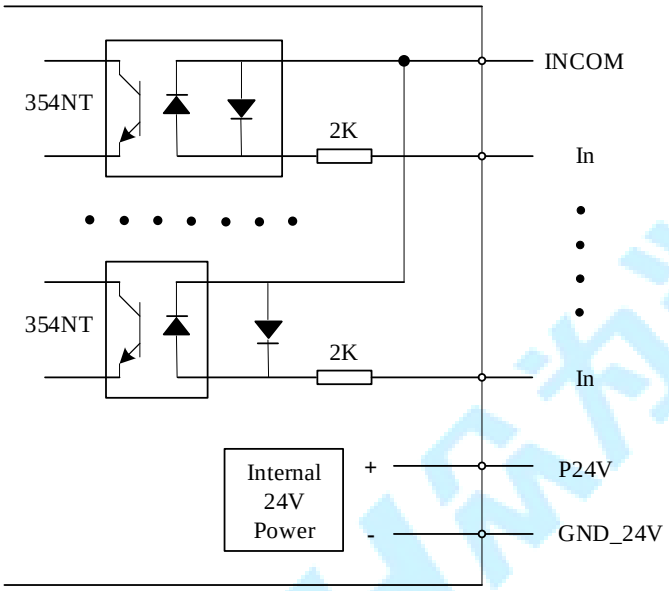


Figure 5-2 Digital Input Internal Circuit

Proximity switches, photoelectric switch wiring diagram is as follows:

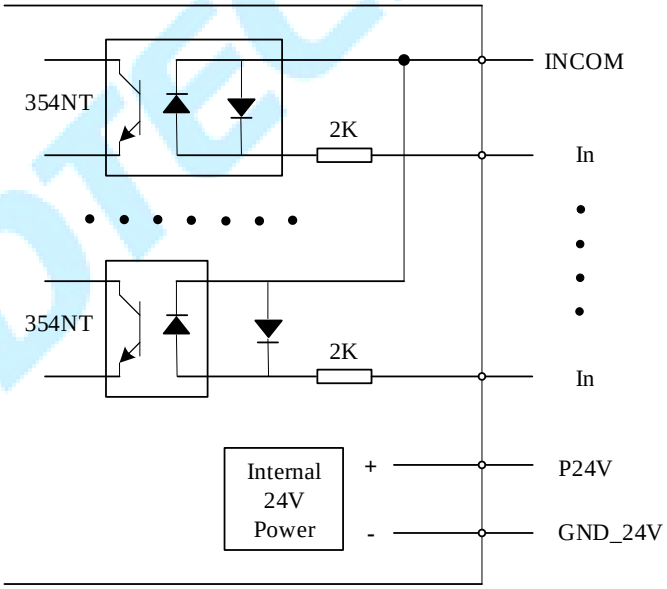


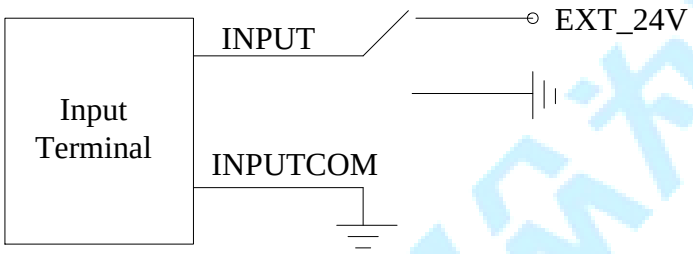
Figure 5-3 Digital input associated wiring diagram

External module "+" side of the power supply for the proximity switch positive, "-" side of the ground proximity switch.

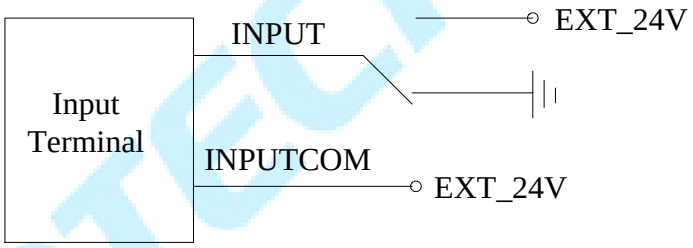
Note:

OUT terminal for the output signal, the general proximity switch selected working power 10-30V, and the NPN output, photoelectric switches is similar.

Common input interface, based on the level of public input conditions corresponding to the input active level is different.



（a）Public grounded, input active high



（b）Public termination high, input active low

Figure 5-4 Input terminal INPUTCOM side wiring

5.2 Digital Output Interface

5.2.1 Output Interface Definition and Pin Functions

Output port use a 25-pin and 20-pin socket DB head, including the power supply wiring port. Digital output port pin arrangement as shown:

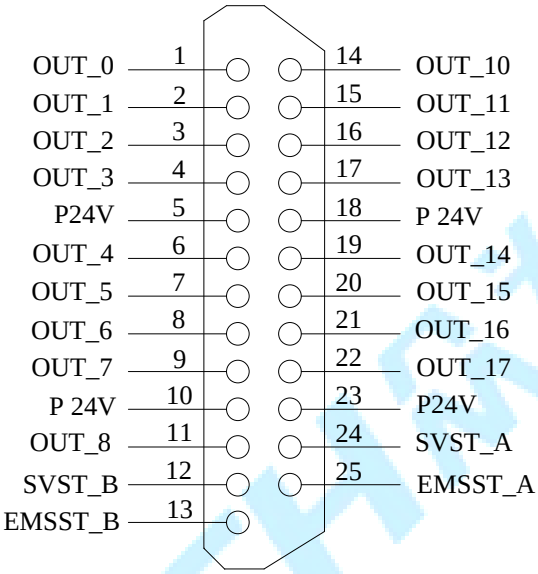


Figure 5-5 Digital output port

After using the external power supply DC24V IO board power supply, the output pin 5,10,18,23 voltages is 24V, it can be supplied to the external use.

System output signal includes two-way relay contact output, which "SVST_A" and "SVST_B" as one relay; "EMSST_A" and "EMSST_B" as another relay.

Output port and pin function definitions as follows:

Table 5-2Digital Output port definition

Pin	Port Definition	Function DES	PIN	Port Definition	Function DES
1	OUT0	Common output port	2	OUT1	Common output port
3	OUT2	Common output port	4	OUT3	Common output port
5	P24V	internal 24V power supply	6	OUT4	Common output port
7	OUT5	Common output port	8	OUT6	Common output port
9	OUT7	Common output port	10	P24V	internal 24V power supply
11	OUT8	Common output port	12	SVST_B	A Relay interface
13	EMSST_B	Relay B interface	14	OUT10	Common output port
15	OUT11	Common output port	16	OUT12	Common output port
17	OUT13	Common output port	18	P24V	internal 24V power supply
19	OUT14	Common output port	20	OUT15	Common output port
21	OUT16	Common output port	22	OUT17	Common output port
23	P24V	internal 24V power supply	24	SVST_A	A Relay interface
25	EMSST_A	B Relay interface			

5.2.2 Schematic Diagram of a Digital Output

Digital output brief internal circuit is shown follows:

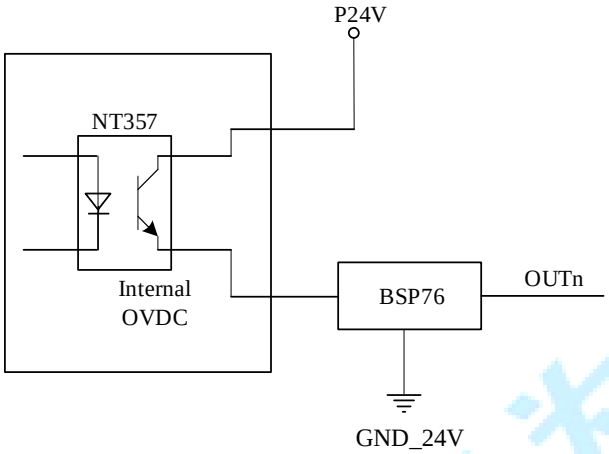


Figure 5-5Digital output internal circuit

And the machine wiring diagram (spindle forward as an example):

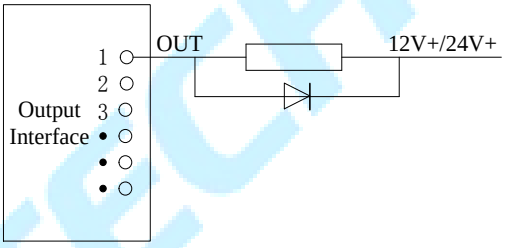


Figure 5-6 the digital output associated wiring diagram

Relay internal circuit:

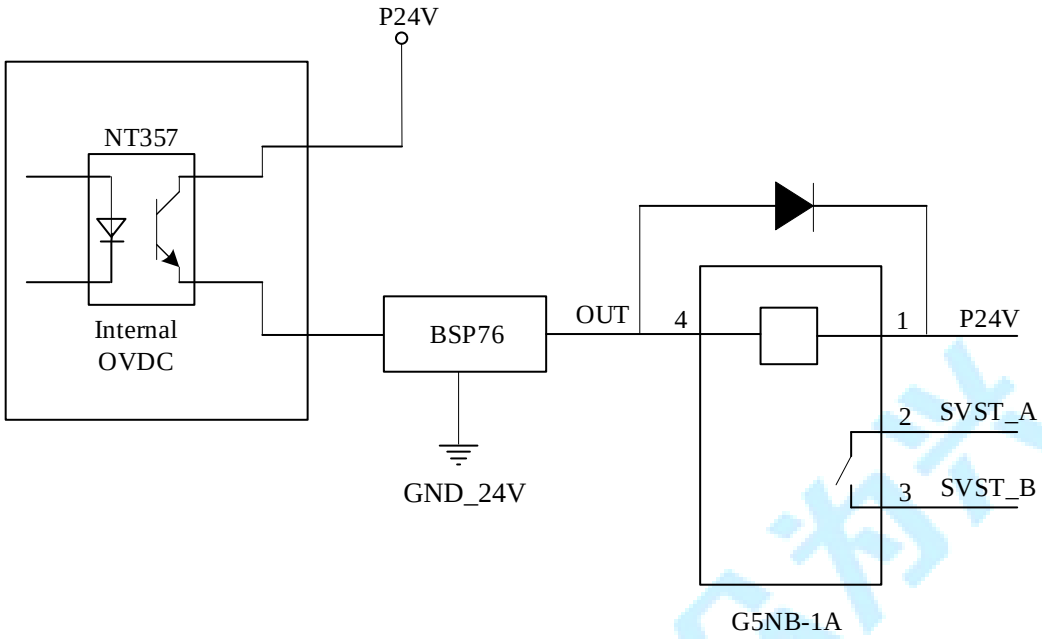
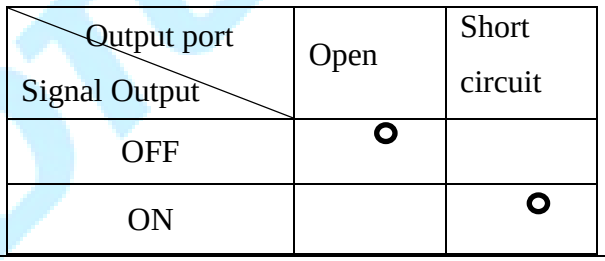
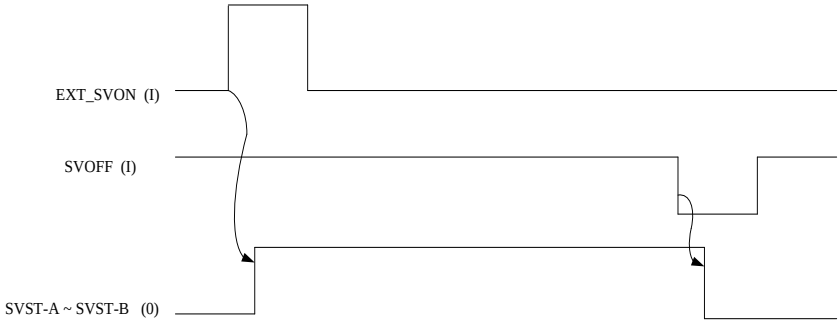


Figure 5-7 Relay Internal Connection diagram

Table 5-3 Relay interface functions

Signal Name	SVST_A ~ SVST_B
Output port	OUTPUT-12 ~ OUTPUT-24
Signal logic	
Function	Servo status :on , output ports short circuit
Signal timing	

Relay output port control panel opening and closing motor brake wiring diagram:

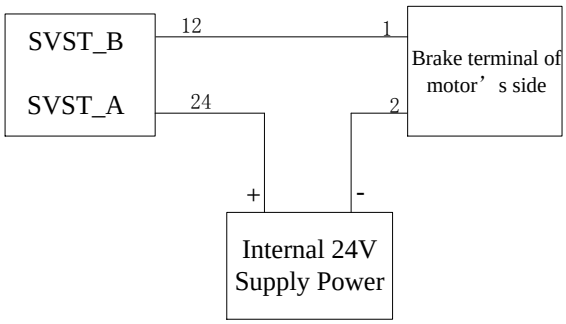


Figure 5-8 Brake-port junctions

Note:

Flexible wiring diagram above, the port number 12 and 24 positions are interchangeable, the motor-side brake line terminals are also used interchangeably.

6. Communication Port

6.1 COM1 Port Wire Drawing

In order to facilitate integrated servo drive control program upgrade and maintenance，QC400 and PC via COM1 port to communication, COM1 port using a standard DB9 female terminal, using RS-232 interface, without the level of the adapter plate. Ports defined below:

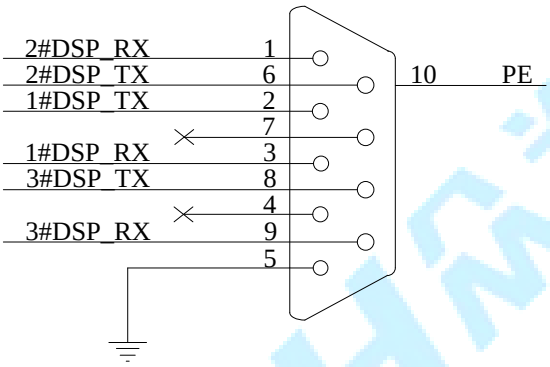


Figure 6-1 COM1Port schematic

Description of each pin function as shown in Table：

Table 6-1 COM1Terminal Signal Description

Pin Number	Signal Name	Explanation
1	2#DSP_RX	Signal receiving terminal of 2#DSP
2	1#DSP_TX	Signal transmitting terminal of 1#DSP
3	1#DSP_RX	Signal receiving terminal of 1#DSP
4	Suspended	Suspended
5	GND	Ground
6	2#DSP_TX	Signal transmitting terminal of 2#DSP
7	Suspended	Suspended
8	3#DSP_TX	Signal transmitting terminal of 3#DSP
9	3#DSP_RX	Signal receiving terminal of 3#DSP

10	PE	Shielded wire

When QC400 robot drive system servo debugging, via COM1 terminal and PC connection, connection Schematic diagram as below:

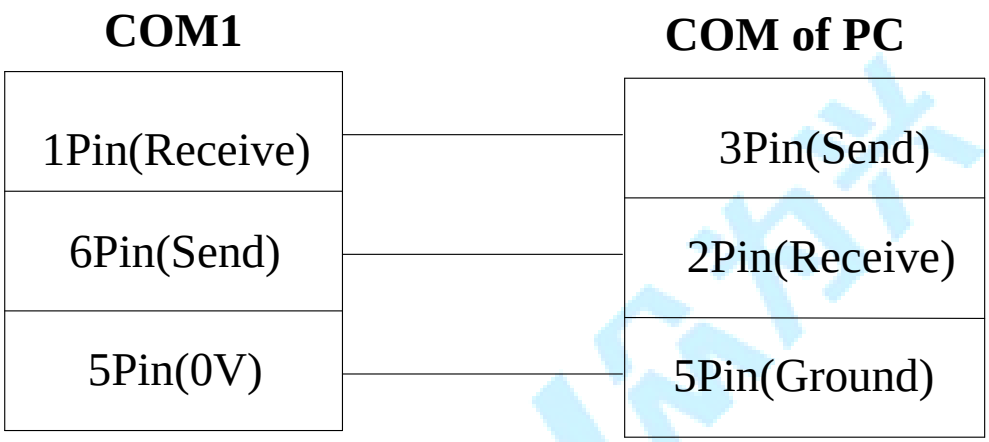


Figure 6-2 COM1 port with PCCOM port connection diagram

6.2 COM2 Port Connection

In order to facilitate the maintenance of robot drive system, a COM2 communication port is provided by QC400. COM2 port is provided with a standard DB9 head terminal, which is no need to connect a voltage switch board. Each pin of COM2 is defined as follows:

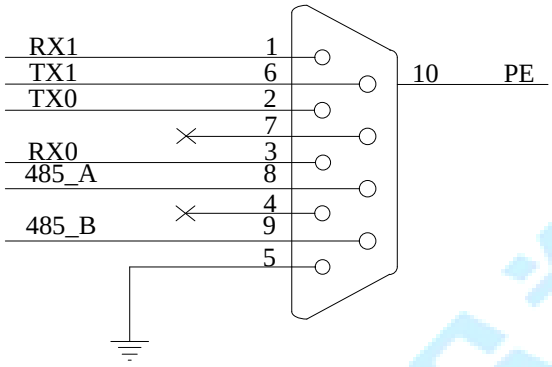


Figure 6-3 Schematic diagram of COM2

Each pin functions and **instructions** as shown in the table：

Table 6-2 COM2 terminal signal description

Pin number	Signal name	Explain
1	RX1	First signal receiving end
2	TX0	The 0 signal sending end
3	RX0	The 0 signal receiving end
4	Suspended	Suspended
5	GND	Ground
6	TX1	First signal sending end
7	Suspended	Suspended
8	485_A	Communication interface when using 485
9	485_B	
10	PE	Shielding wire

6.3 LAN Port

QC400 robot drive system provide Ethernet interface, support TCP/UDP protocol. Network interface definition is as follows:

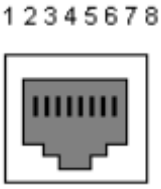


Figure 6-4 LANNet export

Each pin functions and instructions as shown in the table：

Table 6-3 LAN Network port terminal signal description

Pin number	Signal name	Explain
1	TX+	Send data+
2	TX-	Send data-
3	RX+	Receive data+
4	N/C	Bidirectional data
5	N/C	Bidirectional data
6	RX-	Receive data-
7	N/C	Bidirectional data
8	N/C	Bidirectional data

6.4 USB Interface

- RC400 controller provides standard USB(master/slave) communication interface; they cannot be used at same time;
- For USB-slave communication, one D-type USB cable is used to connect controller and PC;
- For USB-master communication, MEM interface is used to read data from USB diak.

6.5 Product Installation Size Chart

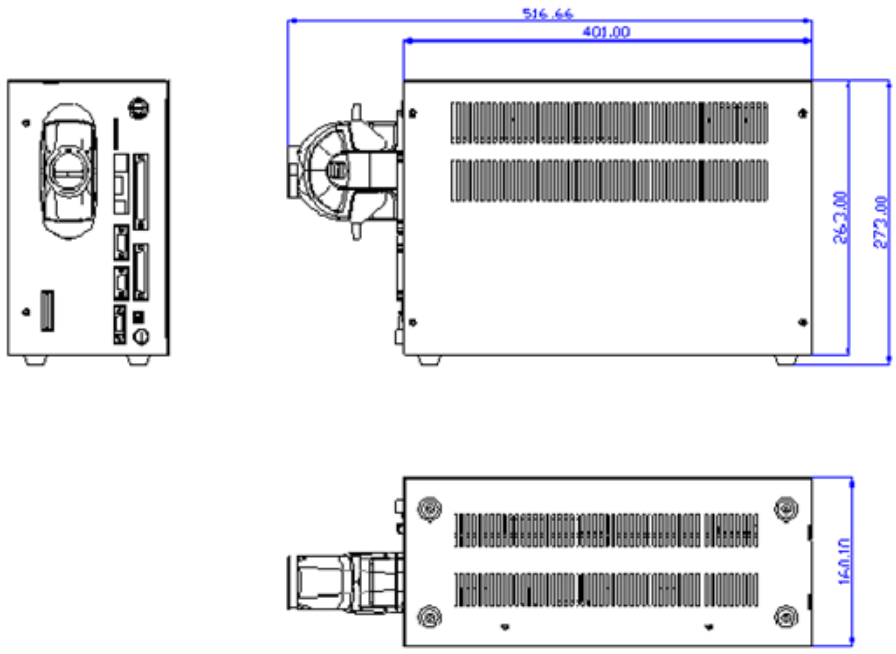


Figure 6-6 Robot drive system dimension chart

Power must be cut off when connect power line, encoder line and IO line to RC400 controller.