CTB technology

Distributor

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Data No.: ZL-14-808-IBCN

CTB technology

GS DRIVER

Operating manual

AC servo spindle driver

Model: BKSC-☐ ☐ ☐ ☐ GSX

Class 400V, 1.5 ~ 315KW (2.5 ~ 460KVA)

Please send the manual to final user, and keep it properly.

BEIJING CTB SERVO CO.,LTD.

Data No.: Z L-14-808-I B C N

Preface

Thank you for purchasing GS series servo driver produced by Beijing CTB Servo Co., Ltd. The GS series AC servo spindle driver is a high-quality, multi-functional and low-noise AC servo driver that was researched, developed and manufactured by Beijing CTB Servo Co., Ltd. The spindle driver is servo driver for AC induction motor (IM) and AC permanent magnet synchronous motor (PM). It can control the position, speed, acceleration and output torque of various AC servo spindle motor appropriately. The wide application of GS series AC servo spindle driver brings infinite vitality to field of machine tool spindle drive control.

In command to achieve control functions of various machine tools, GS series AC servo spindle driver is equipped with dual 32-bit CPU and abundant control function module. It may be conveniently connected with various domestic and foreign CNC systems through standard control interfaces to allow full play to spindle function of CNC system. The characteristics of torque, acceleration and deceleration, precision and efficiency of machine tool spindle which is equipped with GS series AC servo spindle driver are remarkable, and accurate stop, C-axis, rigid tapping, electronic shift, multi-axis synchronization and other spindle functions can be realized easily. GS series AC servo spindle driver is the first choice of electric spindle drive products.

As the first choice of driving product of various machine tool power shaft (spindle), GS series AC servo spindle driver can be widely used for spindle drive of product such as CNC milling machine, vertical machining center, horizontal machining center, CNC boring machine, CNC lathe, vertical lathe, heavy horizontal lathe and gantry machine tool.

For proper application, please read the manual carefully before using the GS series AC servo spindle driver. Abnormal operation, fault or reduction of service life, and even personal injury accident may be caused by inappropriate use. Therefore, the manual shall be read repeatedly before use, and operate in strict accordance with the instructions. The manual is attachment with the equipment. Please keep it properly after using for future repair and maintenance of the driver.

Safety -related symbol description

The following symbols are used for safety-related content in the manual. Sentences marked by the safety symbols describe important content, and must be abided. If the requirements in the safety-related content are not abided, application of the product may lead to abnormal product operation, damage to the product, even danger and personal injury.

	Use the symbol where danger, even personal injury or death when wrong about the described content.
	Use the symbol where danger, even mild or moderate personal injury and equipment damage when wrong about the described content.
	Prohibited matters (matters that cannot do).
	Certain matters do not belong to "danger", and "caution", but they are required to be abided by user. They are marked in the relevant sections.

Safety precautions

◆ Unpacking inspection

 **Caution**
● For risk of injury, please do not install damaged or part missing driver.

◆ Installation

 **Caution**
● For risk of fire, please install the equipment on nonflammable metal plate without combustible materials around. ● Please be sure to tighten the mounting screws of the driver. Falling and damage of the driver or personal injury may be caused by mounting screws loosing. ●Please do not install the equipment in environment with flammable gas where an explosion is caused easily.

◆ Wiring

 **Danger**
● For risk of electric shock and fire, please make sure that the input power supply is in the OFF state before wiring. ●For risk of electric shock, the operation on main circuit terminal of the controller shall be conducted after the power is cut off for five minutes, and the power charge indicator CHARGE in the controller completely extinguished. ●For risk of electric shock and fire, the wiring shall be carried by professional electrical engineering personnel. ●For risk of electric shock and fire, the ground terminal must be grounded reliably. (earth resistance shall be lower than 4Ω) ● It's prohibited to directly connect terminals of P / PB and N, or connect the zero line or the earth wire to the N terminal. Otherwise, the rectifier bridge will be shorted and the main loop will be burned. ●It's prohibited to connect the high-voltage line to control terminal of the driver. Otherwise, the control board will be burned. ●For risk of injury, please set emergency stop and locking circuit at the outside of the controller (user is responsible for the wiring) . ● There is a risk of electric shock and short circuit.

◆ Wiring

 **Caution**
●For risk of injury and fire, please ensure that the voltage of the main circuit AC input power and the rated voltage of the driver are consistent. ● Please do not conduct withstand voltage and insulation test to the controller arbitrarily. Otherwise, the semiconductor and other components in the controller may be damaged. ●For risk of fire, please connect braking resistor and braking unit according to the wiring diagram. ● Please do not connect the AC input power cord to the output U, V, W terminals. Otherwise, damage to inside of the controller may be caused. ●For risk of fire and malfunction of the controller, please tighten the terminals of main loop and control circuit with appropriate torque. ●Please do not connect the phase shifting electrolytic capacitor and LC / RC noise filter to the output circuit. Otherwise, damage to inside of the controller may be caused. ●Please do not connect the electromagnetic switch and electromagnetic contactor to the output circuit to connect or disconnect the load. During loaded operation of the controller, the surge current will cause protection circuit action of the controller.

◆ Trial run

 **Danger**
●For risk of electric shock and short circuit, please do not touch the terminals of the main circuit directly after power-on. ●Please confirm the input and output signals to guarantee safe operation. Malfunction of the system will cause casualties and damage to the work piece and nearby equipment.. ●For risk of injury, alarm reset only can be done after ensuring that the operating signal is cut off. Alarm reset with operating signal will lead to suddenly re-start. ●For risk of driver burning, the inside of long term stored driver shall be checked for water and condensation. ●For risk of electric shock and burning the equipment, it's prohibited to touch the terminals of the driver with hand during operating.

 **Caution**
●For risk of scalding, the running servo driver and motor may have a high temperature

rise, please do not touch.

●For risk of scalding and electric shock as the braking resistor has a high temperature rise for discharging, please do not touch.

●For risk of damage to the equipment and accident, please do not change the settings of the drive arbitrarily.

◆ Maintenance and inspection

Danger

●For risk of electric shock, please do not directly touch terminals of the controller. Some of them have high voltage and very dangerous.

●For risk of electric shock, please do install the housing before power-on; and must disconnect the power firstly before removing the housing.

●For risk of electric shock and fire, please confirm that the power source is in the OFF state or not before wiring.

● Inspection and maintenance only can be carried out after cut off the main circuit input power and confirm that the power charge indicator CHARGE completely extinguished. There is a risk of electric shock as residual power in electrolytic capacitor.

●Please make designated professional electrical engineering personnel to conduct inspection and maintenance. Before work, please take off metal object (watch, rings etc.), and use tools with insulation protection during operation. Otherwise, it may cause electric shock.

●For risk of explosion and fire, used battery, circuit printing plate must not be throw into fire. Otherwise, it may cause explosion.

Caution

●CMOS IC integrated circuit is installed on main control panel. Full attention shall be paid during operating. The electrostatic induction due to direct touching of finger on the main control panel may cause damage to the main control panel.

●For risk of electric shock, please do not conduct wiring and removing terminal when the equipment is energized.

●For risk of damage to the equipment, the appropriate parameter settings must be carried out before running after control panel replacing.

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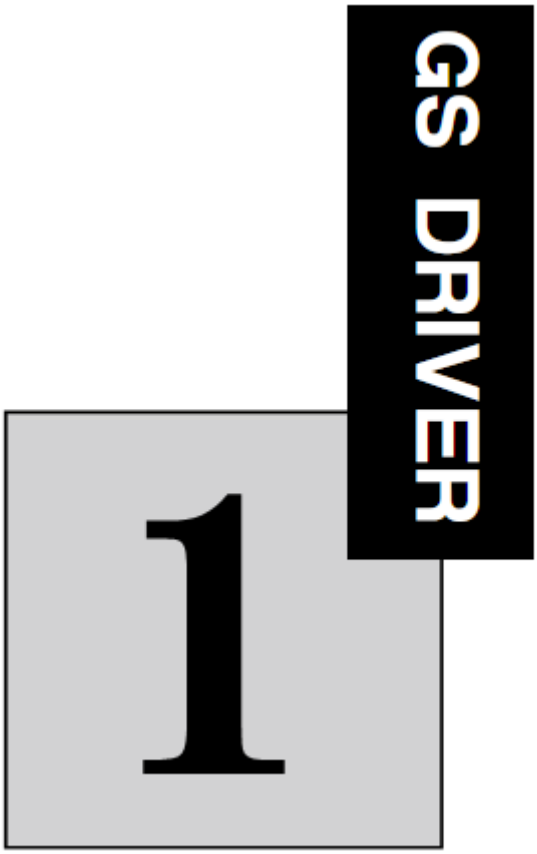


Installation

The chapter describes matters to be confirmed and installation requirements for the user after getting the GS driver.

Introduction to GS DRIVER

GS DRIVER is a type of spindle driver that specifically designed for CNC machine tool. Precise control of position, speed, acceleration and output torque of AC induction servo motor and AC inverter motor is allowed through the driver. It can be used for control of spindle motor of machining center, CNC milling machine, CNC drilling machine, CNC lathe, CNC grinder, and feed motor of large gantry equipment and vertical lathe. To achieve the best operation effect, please complete wiring with CNC system by the " CTB servo application manual ", and carry out installation and commissioning in accordance to the manual.

Model description (taking 7.5kW as example)

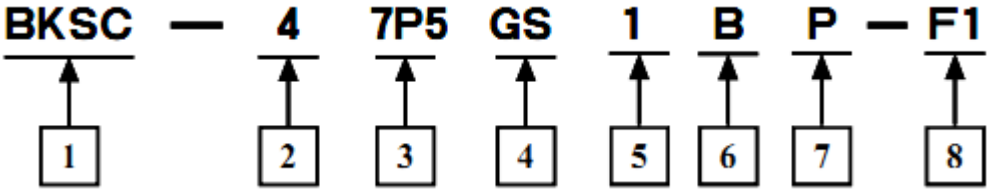


Table 1-1 Detailed description of motor model designation)

Code	Item	Description	Illustrated model meaning
1	Manufacturer code	BKSC: code for driver product of the manufacturer	Manufactured by BEIJING CTB SERVO CO., LTD.
2	Voltage level	1: level 200V 4: level 400V	level 400V
3	Power code	See power code list for detail	7.5kW
4	Product series	GS: GS series driver GH: GH series driver	GS series driver
5	Encoder model	None: incremental 10 driver 0:without encoder 1: incremental encoder 2: rotary transformer 3: Sin-Cos encoder 4: absolute value encoder 5: magnetic encoder	incremental encoder
6	Product model	None: standard type (CP100A1/C1) B: general type(CP100B1/D1) T:special type (CP100AT1/CT1)	general type(CP100B1)
7	Production upgrading identification	None: conventional design P: new energy-saving design	new energy-saving design for main board of the driver
8	Non-standard identification	None: standard product F1: Non-standard requirements to main board F1: Non-standard requirements to driver F1: Non-standard requirements to housing Other: special customer	Non-standard requirements to main board of driver

● GS DRIVER series applies for 21 types with a motor capacity of 1.5kW to 315kW. Please see table 1-2 for detail

Table 1-2 GS driver model (rated voltage: 400v)

Driver model	Rated capacity(KVA)	Rated input current (A)	Rated output current (A)	Adapt motor power (kW)	Built-in brake unit
BKSC-41P5GSX	2.5	4	3	1.5	Yes
BKSC-42P2GSX	3	6	5	2.2	Yes
BKSC-43P7GSX	5.5	9	8	3.7	Yes
BKSC-45P5GSX	8.5	14.2	13	5.5	Yes
BKSC-47P5GSX	11	18	17	7.5	Yes
BKSC-4011GSX	17	26	25	11	Yes
BKSC-4015GSX	21	35	32	15	Yes
BKSC-4018GSX	24	38.5	37	18.5	Yes
BKSC-4022GSX	30	46.5	45	22	Yes
BKSC-4030GSX	40	62	60	30	Yes
BKSC-4037GSX	50	76	75	37	Yes
BKSC-4045GSX	60	92	90	45	Yes
BKSC-4055GSX	72	113	110	55	Yes
BKSC-4075GSX	100	157	152	75	Yes
BKSC-4090GSX	116	190	185	90	Yes
BKSC-4110GSX	138	236	230	110	Yes
BKSC-4132GSX	167	288	280	132	Yes
BKSC-4160GSX	200	345	336	160	Yes
BKSC-4200GSX	250	420	370	200	No
BKSC-4250GSX	300	530	460	250	No
BKSC-4315GSX	360	680	570	315	No

Unpacking inspection

Please confirm the following items when you get the product. Please contact directly with the dealer or manufacturer that purchased from for any adverse situation. Please see Table 1-3 for detail.

Table 1-3 Confirm items

Confirm item	Confirm method
Confirm that the materials listed on the packing list are complete.	Check the materials in the packing against the packing list stuck to the external packing.
Are they in line with the ordered merchandise?	Please confirm the label at the side of the driver.
Is there any damage?	Check the overall appearance for damage during transportation.

Standard specifications and performance parameters

Please see Table 1-4 for standard specifications and performance parameters of 3-phase Class 400V driver

Table 1-4 Standard specifications and performance parameters of GS driver

Model BKSC-××××GSX		41P5	42P2	43P4	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4200	4250	4315
Adapt motor power kW		1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200	250	315
Output	Capacity KVA	2.5	3	5.5	8.5	11	17	21	24	30	40	50	60	72	100	116	138	167	200	250	300	460
	Current A	3	5	8	13	17	25	32	37	45	60	75	90	110	152	185	230	280	336	370	460	570
	Maximum output voltage V	3-phase 380/400/415/440V corresponding input voltage																				
	Maximum output speed rpm	4-pole motor 15000rpm: 500Hz																				
Power	Rated voltage and frequency	3-phase 380/400/415/440V: 50/60Hz±5％																				
	Allowed voltage pulsation	＋10％，－15％																				
Control characteristics	Control mode	Sine wave PWM modulation, entirely closed-loop vector control																				
	Torque feather	200% rated torque output below the fundamental frequency. Accuracy: ±5％																				
	Range of speed regulation	1: 15000																				
	Speed control accuracy	±0.1%																				
	Frequency set resolution	Digital quantity: : 0.01Hz; Analog: Unipolar, maximum output frequency is /4092; bipolar, maximum output frequency is / 2046																				
	Position control accuracy	±1PULSE																				
	Acceleration	0.05～3000Hz/s																				
	Brake mode	dynamic braking. 125％ rated torque: built-in braking unit (external braking resistor)																				
	Overload capacity	200% rated current 30s																				

Input and output interface	Digital quantity input	7-channel isolation photo-coupler input; input mode: PNP, NPN optional
	Digital quantity output	2-channel isolation photo-coupler output; 24V, 10mA
	Analog input	2-channel; －10V～+10V 1 channel, 0～10V 1-channel
	Analog output	2-channel; －10V～+10V
	Relay output	1 channel: a group of N.O/N.C contact: AC250V/DC30V, 1A
	Fault output relay	1 channel: a group of N.O/N.C contact: AC250V/DC30V, 1A
	Encoder input interface	two: maximum receive frequency is 300KHz: cable driven receive mode: RS422 standard
	PULSE input interface	One: direction PULSE or orthotropic PULSE
	Encoder output interface	One: maximum output frequency is 300KHz: cable driven output mode: RS422 standard
	Bus interface	None
Spindle function	Speed control	Range: 0～15000rpm; turning: positive and negative; speed order: Analog, PULSE frequency
	Accurate stop	Accuracy: ±1PULSE; position adjustment: set by user's parameter
	Rigid tapping	May be connected to several domestic and foreign systems. Tapping error: ±2％
	Other function	C-axis control, thread cutting, electronic gear, reaming, swing control
Protection function	Spindle motor over-current	Greater than 200% rated current output
	Motor overload	Specified time of exceeding overload alarm value. Alarm output: set by parameters
	Overvoltage	The voltage of main circuit bus is higher than 800V. Alarm output
	Low voltage	The voltage of main circuit bus is lower than 400V. Alarm output
Service environment	Service site	Free of dust, corrosive gas and inflammable gas
	Temperature	－10～45℃
	Humidity	Lower than 95％RH (no condensation)
	Vibration	vibration frequency≤20Hz: 9.8m/s^2； 20Hz≤vibration frequency≤50Hz: 2m/s^2；

Driver nameplate description

Nameplate which indicates model and rated values of the driver is affixed to the lower right of housing of the driver. The content of the nameplate is shown in Figure 1-1.

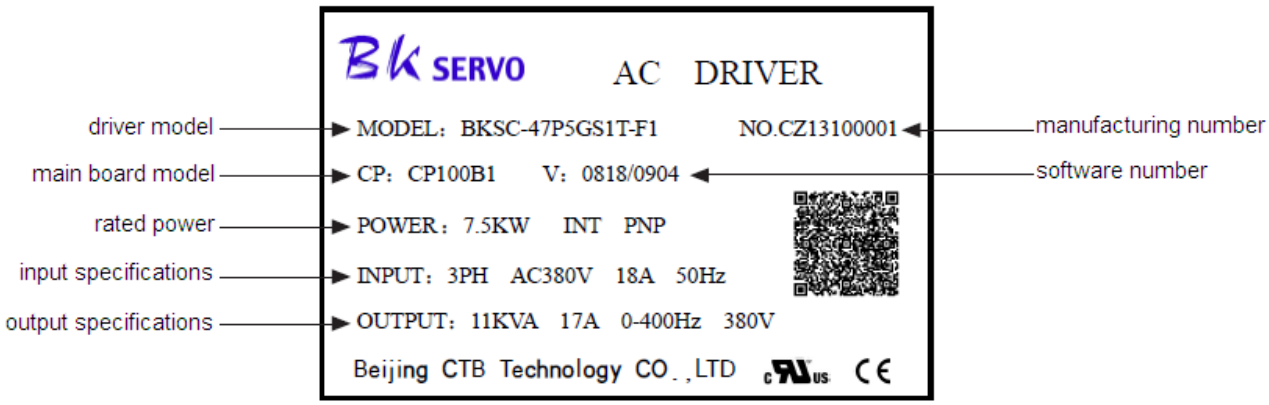


Figure 1-1 AC Servo spindle driver nameplate

Note: the two-dimension code includes manufacturing number of the driver; customer name of the driver (take BEIJING CTB SERVO CO., LTD. as an example); contract number; driver model; main board model; software number; non-standard (take standard as an example) and other description.

External dimensions and installation dimensions

1. 1.5-3.7kw driver

Please see diagram 1-2 for external dimensions and installation dimensions

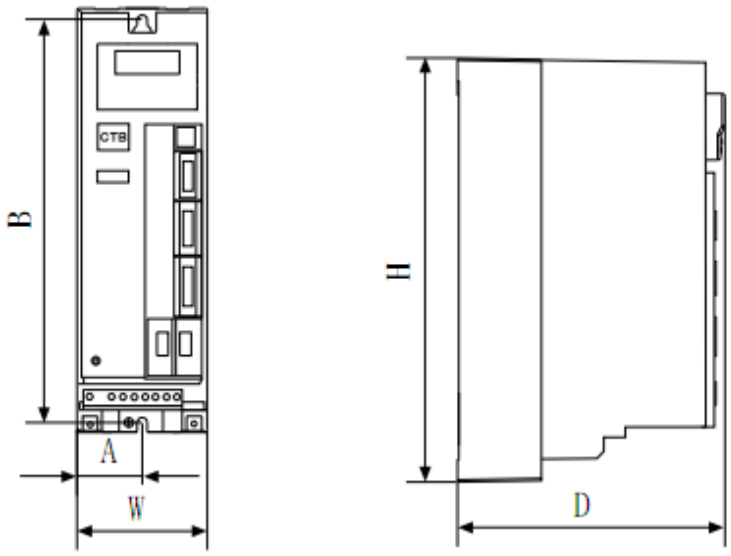


Figure 1-2

Table 1-5 Dimensions (mm) and weight (kg) of GS DRIVER (1.5-3.7kw) driver

Dimension / Model	A	B	W	H	D	Connecting terminal screw	Installation screw	Weight (kg)
BKSC-41P5GSX	45.5	276	91	290	200	Wire nail width 3mm	M6	3
BKSC-42P2GSX								
BKSC-43P7GSX								

2. 5.5～11kw driver

Please see diagram 1-3 for external dimensions and installation dimensions

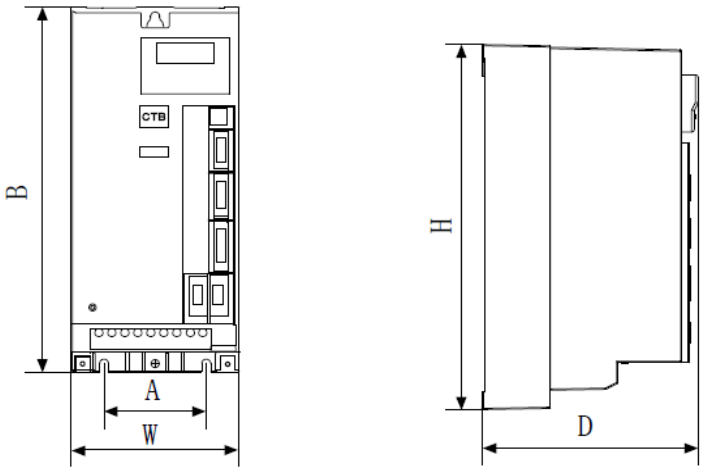


Figure 1-3

Table 1-6 Dimensions (mm) and weight (kg) of GS DRIVER (5.5-11kw) driver

Dimension / Model	A	B	W	H	D	Connecting terminal screw	Installation screw	Weight (kg)
BKSC-45P5GSX	80	276	132	290	200	Wire nail width 3mm	M6	5
BKSC-47P5GSX								
BKSC-4011GSX								

3. 15～45kw driver

Please see diagram 1-4 for external dimensions and installation dimensions.

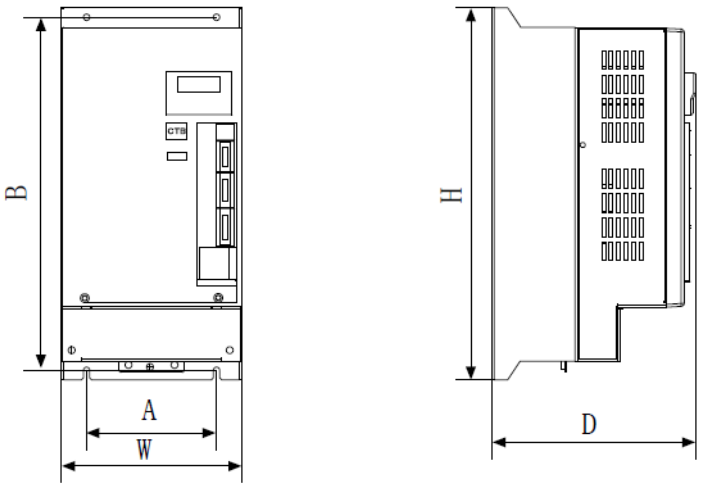


Figure 1-4

Table 1-7 Dimensions (mm) and weight (kg) of GS DRIVER (15-45kw) driver

Dimension / Model	A	B	W	H	D	Connecting terminal screw	Installation screw	Weight (kg)
BKSC-4015GSX	140	376	194	390	228	M6	M6	14

BKSC-4018GSX								
BKSC-4022GSX	236	376	282	390	228	M6	M8	20
BKSC-4030GSX								
BKSC-4037GSX	300	376	380	390	269	M8	M8	26
BKSC-4045GSX								

4. 55～160kw driver

Please see diagram 1-5 for external dimensions and installation dimensions

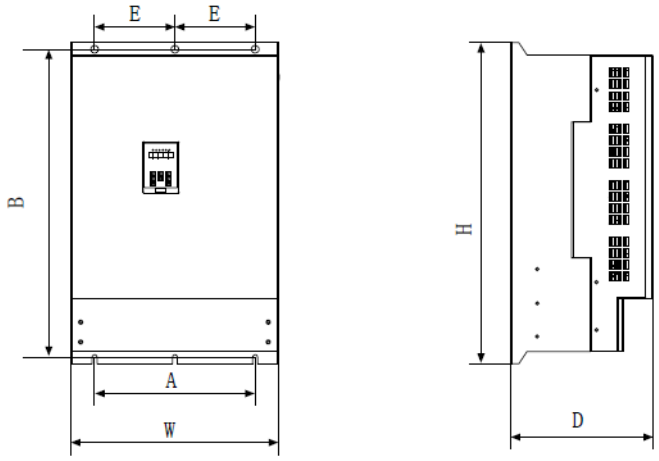


Figure 1-5

Table 1-8 Dimensions (mm) and weight (kg) of GS DRIVER (55-160kw) driver

Dimension / Model	A	B	W	H	D	E	Connecting terminal screw	Installation screw	Weight (kg)
Bksc-4055GSX	392	376	472	390	269	196	M10	M8	33
BKSC-4075GSX									
BKSC-4090GSX	360	690	464	720	320	180	M10	M16	90
BKSC-4110GSX									
BKSC-4132GSX									
BKSC-4160GSX									

5.200 ~ 315kw driver

Please see diagram 1-6 for external dimensions and installation dimensions

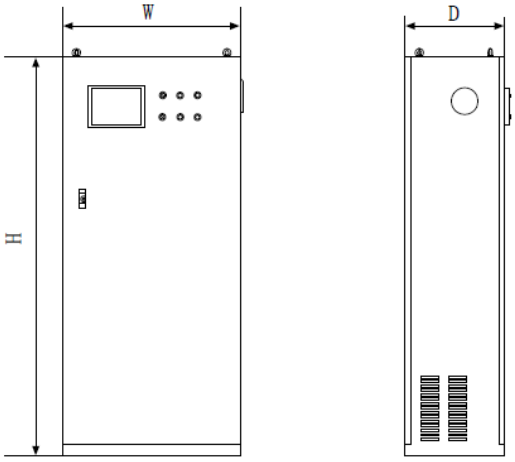


Figure 1-6

Table 1-9 Dimensions (mm) and weight (kg) of GS DRIVER (200-315kw) driver

Dimension / Model	A	B	W	H	D	Connecting terminal screw	Installation screw	Weight (kg)
BKSC-4200GSX	-	-	800	1800	450	-	-	230
BKSC-4250GSX								
BKSC-4315GSX								

Confirmation and requirements of the installation space

Installation environment

The following items shall be noted when selecting the installation environment:

1. Ambient temperature: operate in -10℃ ~ 45℃; if the ambient temperature is higher than 45℃, the equipment shall be used with 30% derating for each 5℃ temperature rise.

★ Note: If the ambient temperature is higher than 45℃, the ventilation shall be strengthened, and use by the specified derating.

2. The humidity of the installation site shall lower than 95%, and free of condensing;

3. Do not install the equipment in place with dust or metal powder;

4. The equipment shall be installed at place without corrosive, explosive gas;

5. The equipment shall be installed at place that meets the requirements of vibration. The vibration frequency ≤ 20Hz: 9.8m/s^2; 20Hz ≤ vibration frequency ≤ 50Hz: 2m/s^2;

6. The equipment shall be installed at place away from direct sunlight.

Installation direction and space

●Installation spacing and distance requirements of single driver are shown in Figure 1-7.

● Generally, abreast installation mode is adopted when multiple drivers are installed in the control cabinet, and air inlet, outlet and dedicated cooling fan shall be equipped; if up and down installation mode is adopted, stream guidance clapboard shall be added between drivers to guarantee good cooling effect as shown in Figure 1-8.

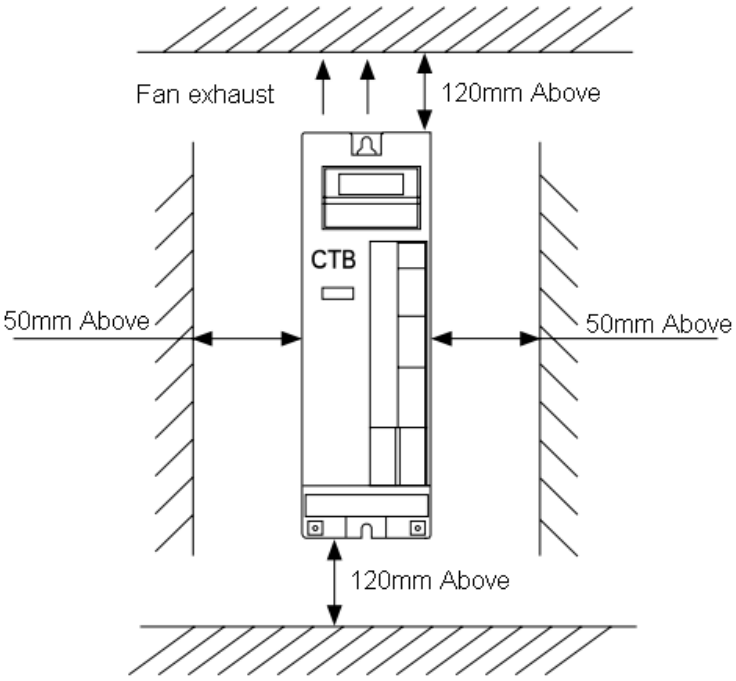


Figure 1-7 Single controller installation

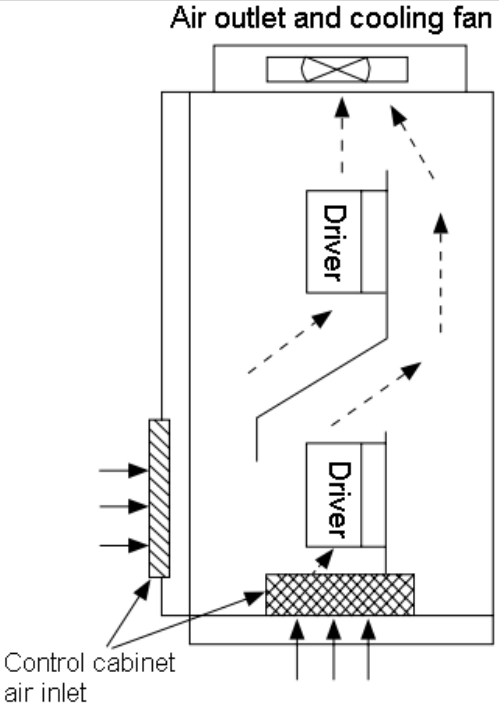


Figure 1-8 Multiple controllers installation

Notes on motor and load

Compared with frequency conversion operation

GS DRIVER is full closed-loop vector servo driver. It adjusts output voltage and current automatically according to the load change. It's more energy-efficient than inverter with higher speed control accuracy and wider speed regulation range. As the controlled motor and driver are closed loop, the control of position, speed and torque can be achieved conveniently.

Constant torque operation

When motor works in constant torque area, the output torque of the motor is required by the mechanical operation instead of the rated torque of the motor. However, the maximum continuous output torque of the motor must not exceed the rated torque.

High-speed operation in constant power area

For high-speed operation in constant power area, the increased vibration and noise shall be considered, and the service speed range of motor bearing and mechanical devices must be confirmed, and consulted in advance. It's strictly prohibited to make the machine operate above the rated speed.

Lubrication of the mechanical device

For reduction box and gear head motor and other mechanical device that requires lubrication, damage may be caused due to deterioration of lubricating effect in long-term low-speed operation. It must be consulted in advance.

Negative torque load

Negative torque load occurs frequently for load such as lifting. The driver will generate over-current and

overvoltage alarm and trip. Equipping of brake components or mechanical safety devices shall be considered.

Reciprocating load

Please pay attention to unstable phenomenon in output current when the driver is driving piston reciprocating load. The phenomenon is more prominent in long-term low-frequency operation. The capacity of driver shall be increased.

Mechanical resonance point of the load device

The driver may encounter the mechanical resonance point of the load device in certain output frequency range. It can be avoided by setting jump frequency.

Notes on the driver

Applications not in rated voltage

The servo driver shall not be used in voltage that not in the working voltage range. Please conduct voltage transformation with appropriate step-up or step-down unit as required.

Note on the drive phase input into 2-phase input

The device shall not be changed into 2-phase input, otherwise, default phase protection will occur.

Capacitor or pressure-sensitive device to improve power factor

As shown in Figure 1-9, the output of the driver is PULSE wave, drive failure tripping or damage to the device will be caused due to capacitor or pressure-sensitive device for lightning to improve power factor installed at the output side. They must be removed.

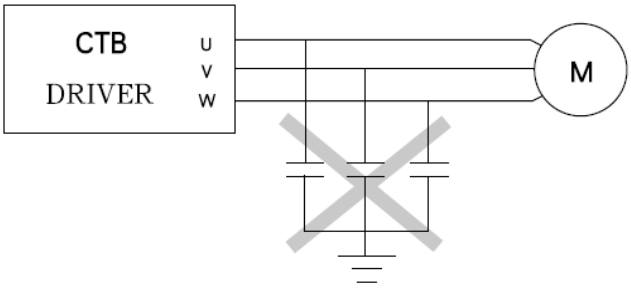


Figure 1-9 Capacitor is prohibited at the output end of controller

Lightning attack protection

lightning over-current device is equipped in the driver for self-protection to induction stroke

Altitude and derating operation

For areas with altitude over 1000 m, derating operation is necessary due to deterioration of cooling effect of the drive caused by thin air. The relationship curve of rated current of driver and altitude is shown in Figure 1-10.

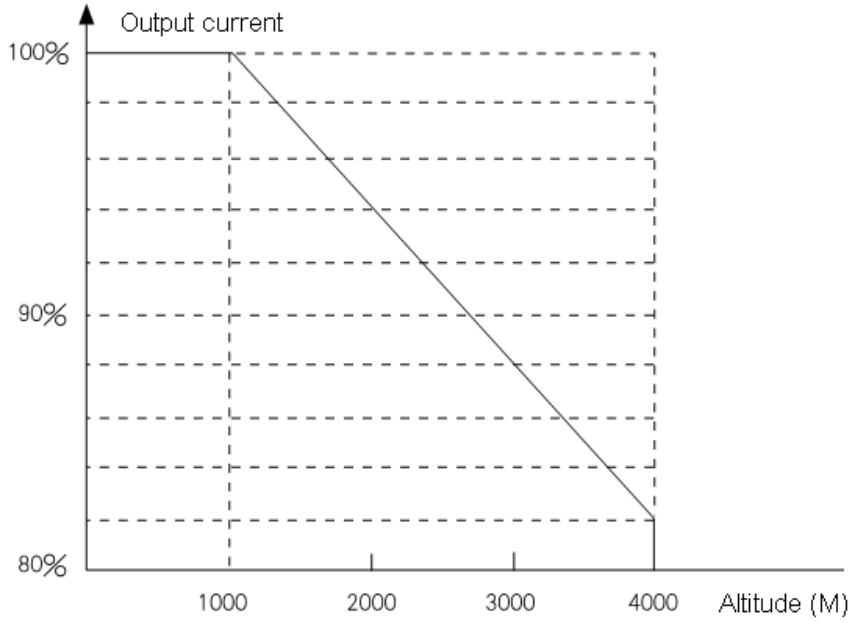


Figure 1-10 Derating curve of rated current of driver and altitude

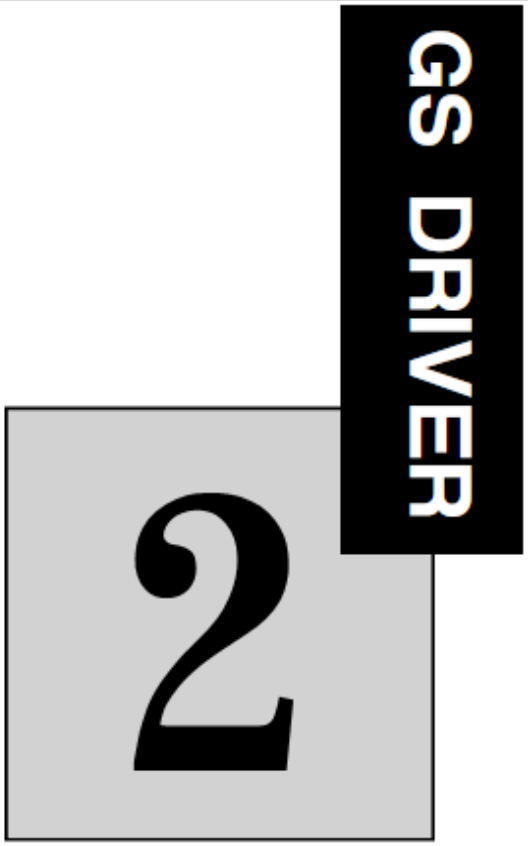
Notes on scrapping:

Explosion of electrolytic capacitor: the electrolytic capacitors on main circuit and printed panel may explode when incinerated.

Plastic incineration waste gas: toxic gases will be generated in incineration of front panel and other plastic parts.

Processing method: please process the waste as industrial waste.

★ Description: The contents of the manual are subject to change due to product upgrade or optimize. The new version shall prevail.



Wiring

The chapter describes the wiring specifications of power supply terminals and control circuit terminals, and install wiring specifications of control board jumpers and expansion interface board.

Selection and connection of peripheral devices

Spindle driver and peripheral devices connection diagram taking 15kw drives as an example in Figure 2-1.

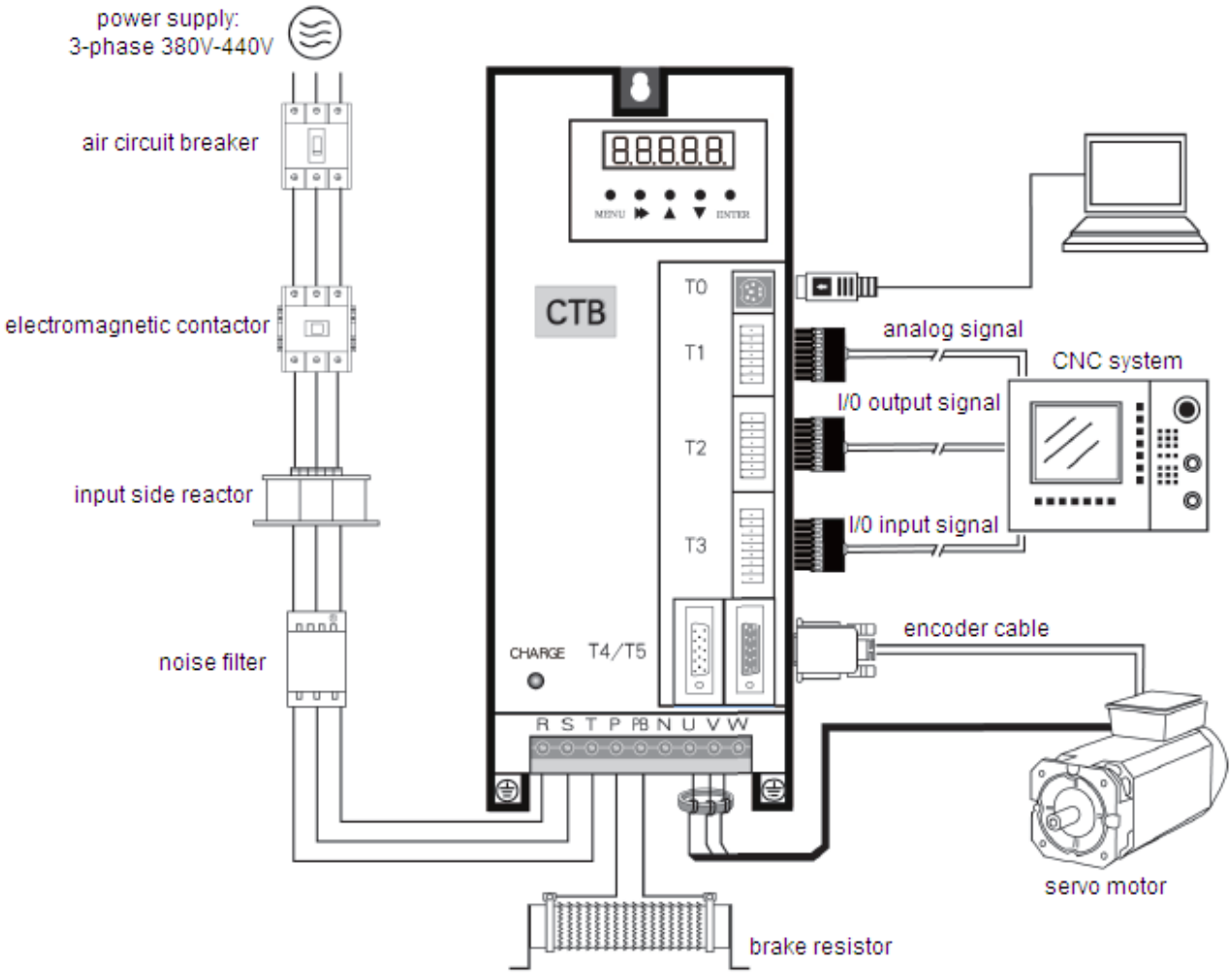


Figure 2-1 Spindle driver and peripheral devices connection diagram

Parts selection description

Item	Usage	Selection note	Remarks
Air circuit breaker	Turn on or off driver power	Select by 150% of rated current of the driver	Refer to Table 2 - 3
Electromagnetic contactor	For automatic power on of driver	Select by 150% of rated current of the driver	Refer to Table 2 - 3
Input side reactor	Improve power factor of power grid	Select by 100% of rated current of the driver	
Input noise filter	Suppress interference of driver to power supply	Select by 150% of rated current of the driver	
Braking resistor	Consume regenerated energy of the driver	Select by standard provided by the factory	Refer to Table 2 - 2
Filtering magnet ring	Suppress wireless interference of the driver to outside	Select by standard provided by the factory	Refer to GS model selection sample

Wiring of the main circuit terminals

The structure of the main circuit

See Figure 2-2A, 2-2B, 2-2C and 2-2D for internal structure diagram of the main circuit.

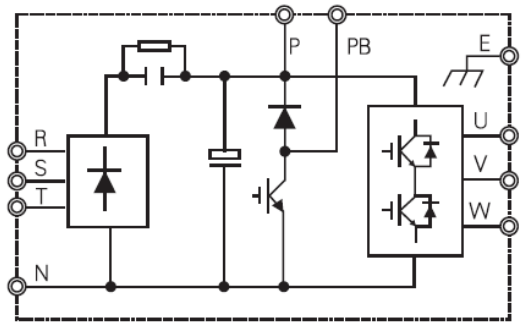


Figure 2-2A 1.5～11kw main circuit composition

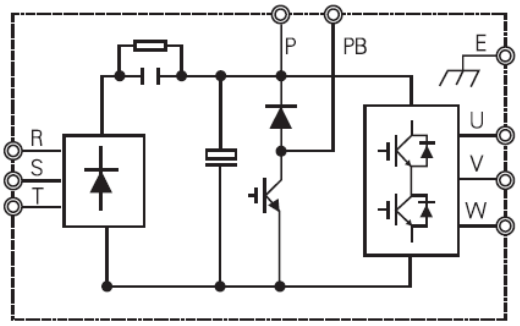


Figure 2－2B 15～30kw main circuit composition

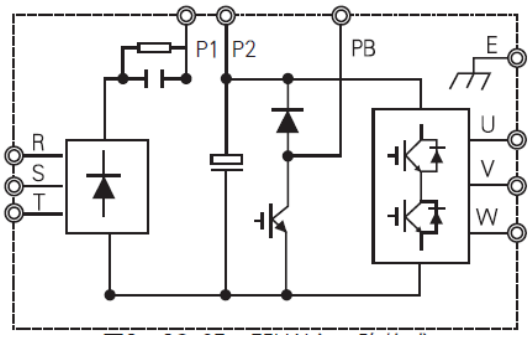


Figure 2－2C 37～75kw main circuit composition

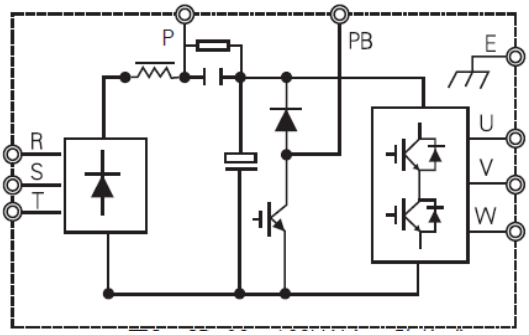
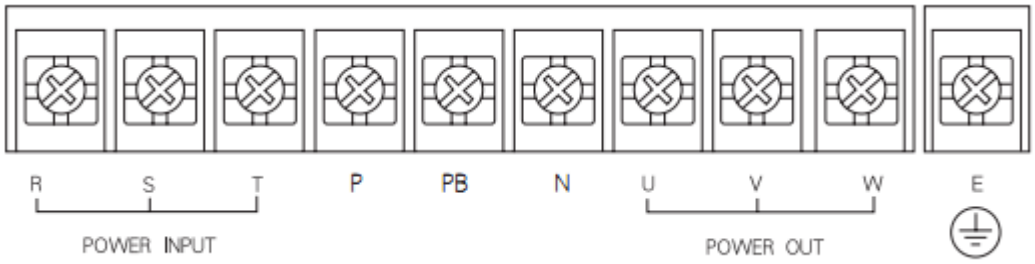


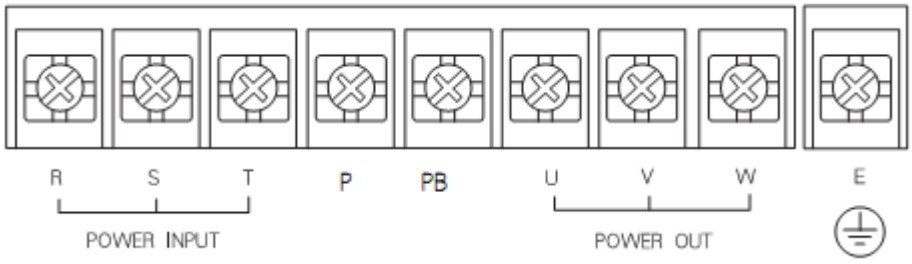
Figure 2－2D 90～160kw main circuit composition

Main circuit terminals composition

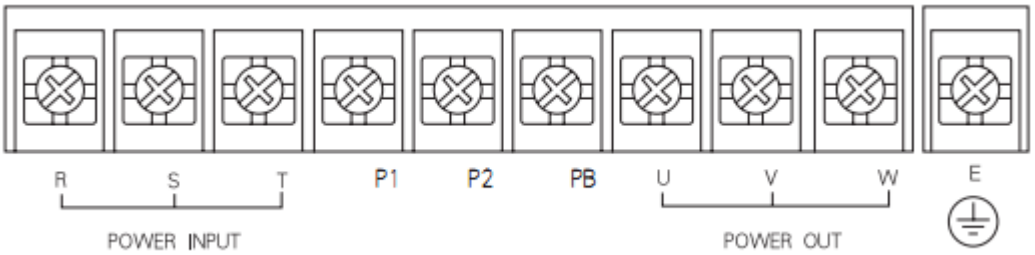
1.5～11kw main circuit terminals composition



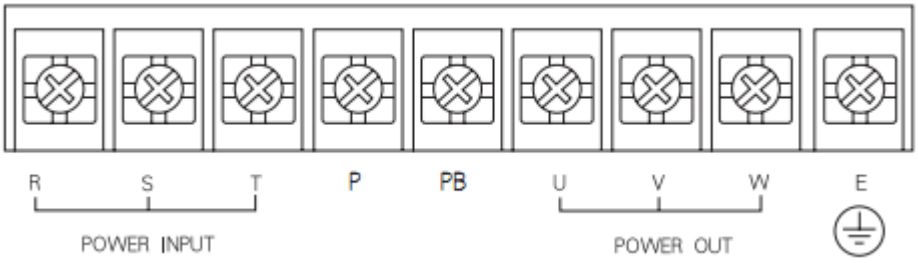
1.5～30kw main circuit terminals composition



37～75kw main circuit terminals composition



90～160kw main circuit terminals composition



Main circuit terminals and functional description

Item	Function	Notes
R S T	3-phase AC supply input terminal. 380~440V, 50/60Hz	Need to install breaker for protection
P P1	DC bus positive pole	P and N are for input of external braking unit or DC power input
P2	DC reactor wiring terminal	P1 and P2 are for external DC reactor
PB	Braking resistor wiring terminal	P, P2 and PB are for external braking resistor
N	DC bus negative pole	N and P are for external braking unit or DC power input
U V W	Driver output terminal	Consistent with the phase sequence of the motor during wiring
E	Earth terminal	C type grounding, the grounding resistance≤ 4Ω

Wiring of input side of the main circuit

Please pay attention to the following items for wiring of input side of the main circuit. See

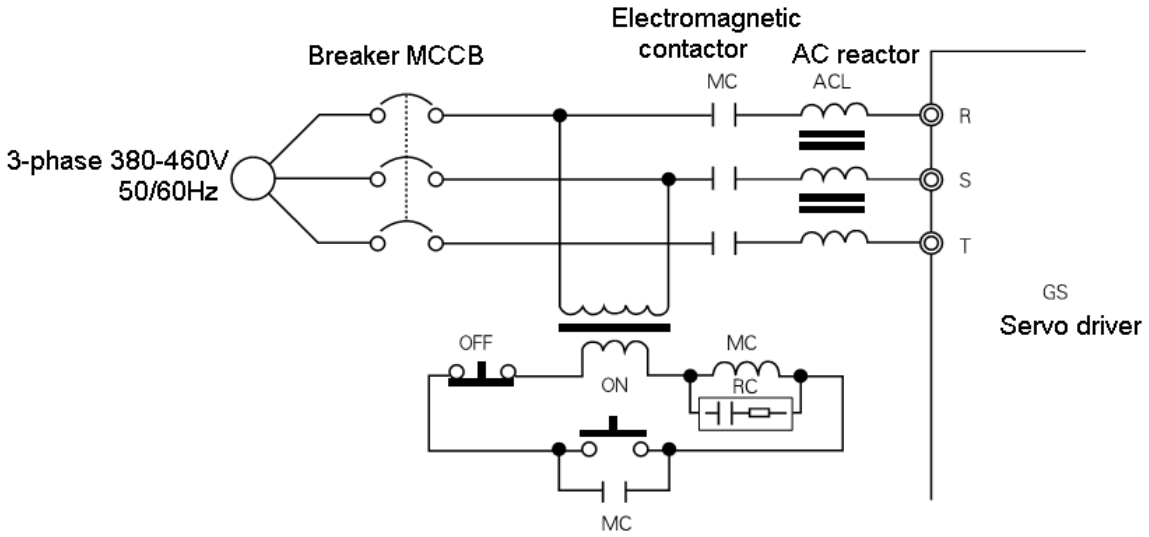


Figure 2-3 Standard wiring diagram for incoming line

Incoming line circuit breaker (MCCB)

The main circuit power input terminals (R, S, T) must be connected to 3-phase AC power through line protection circuit breaker (MCCB).

● The selection of MCCB must be in accordance with requirements in Table 2-3.

● The time characteristics of MCCB must take overload characteristics (rated output current 200%/min) and time characteristics of the servo driver into account.

● Each AC servo driver shall be equipped with independent breaker; when multiple drivers share a circuit breaker, to cut off the power supply and prevent the failure expansion during driver failure, it's recommended to control the incoming line electromagnetic contactor with the fault output relay of the driver to ensure safety.

Installation of the residual current circuit breaker

The output of the servo driver is a high frequency PULSE wave so that there is high-frequency leakage current generated. Residual current circuit breaker can be used at the incoming line side of the driver to remove high-frequency leakage current, and only inspect channel current that dangerous to human body. Please select special residual current circuit breaker for servo (inverter) for wiring.

● When select special residual current circuit breaker, please select model for control of one driver with an induction current over 30ma.

●When select normal residual current circuit breaker, please select model for control of one driver with an induction current over 200ma, and a time over 0.1s.

●Installing isolation transformer between normal residual current circuit breaker and AC servo driver can effectively avoid malfunction of the breaker.

Incoming line electromagnetic contactor

Incoming line electromagnetic contactor may be used to cut off the power in sequential control. It cannot be used as start of AC servo driver. When cut off power of AC servo driver compulsorily with incoming line electromagnetic contactor, AC servo driver is in power-off alarm state, motor only can slide freely and stop.

● Frequent turning on/off incoming line magnetic contactor may cause heating, even burning of charging resistor of the driver (driver interior).

● The time interval of turning on/off incoming line magnetic contactor shall be longer than 10 minutes.

AC reactor

Installing AC reactor at the incoming line side of the servo driver can effectively suppress the surge of power, avoid burning of rectification part of the driver, and also can improve the power factor of the power supply side. Please see Figure 2-3 for connection of AC reactor, see Table 2-1 for selection of AC reactor.

DC reactor

External DC reactor can be connected to GS AC servo driver of 37 to 75KW. It can effectively suppress the surge of power, avoid burning of rectification part of the driver, and also can improve the power factor of the power supply side. Please see Figure 2-4 for connection of DC reactor.

If external DC reactor is not connected, P1, P2 or D C + terminals shall be shorted as shown in Figure

2-5.

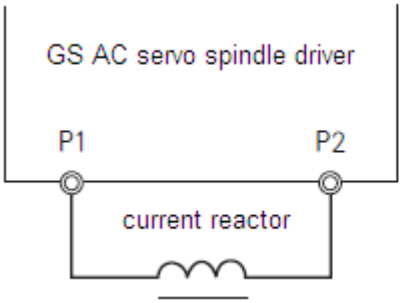


Figure 2-4 DC reactor connection diagram

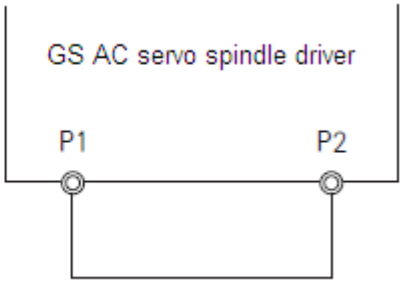


Figure 2-5 Connection diagram without DC reactor

Precautions for wiring of DC reactor

1. Please do not connect DC reactor to any main circuit terminal except P1, P2, otherwise, it may cause internal short circuit of the driver, and burn the driver.
2. Please see Table 2-3 for specifications of DC driver connecting cable, the standard of the main circuit cable.
3. Please see Table 2-1 for selection standard of DC reactor.
4. With external DC reactor, the P2 terminal shall be multiplex terminal, and one end of braking resistor also shall be connected to the terminal.

Table 2-1 Selection of AC reactor, DC reactor and input filter

Driver model		41P5	42P2	43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160
AC reactor	Current (A)	5	7	10	15	20	30	40	50	60	80	90	120	150	200	230	250	290	330
	Model ACL	0005	0007	0010	0015	0020	0030	0040	0050	0060	0080	0090	0120	0150	0200	0230	0250	0290	0490
DC reactor	Current (A)	Without connection to DC reactor										90	110	150	180	Built-in driver			
	Model DCL											090	0110	0150	0180				
Input filter	Current (A)	6	6	6	10	16	25	30	50	50	65	80	100	120	150	200	250	250	320
	Model EMI	06	06	06	010	016	025	030	050	050	065	080	0100	0120	0150	0200	0250	0250	0320

Power side noise filter

In command to reduce high-frequency interference noise from power line coupling to the driver, and suppress the noise feedback to power from the driver, noise filter with appropriate model and specifications at the power input side of the driver.

Set and connect the incoming line filter correctly as shown in Figure 2-6.

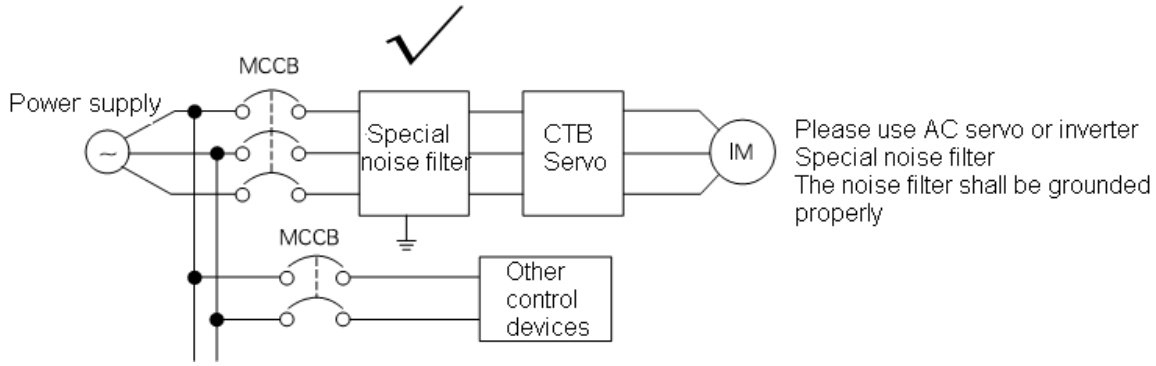


Figure 2-6 Correct installation of noise filter at the input side of the power supply

Please see Figure 2-7 for examples of incorrect settings and connection

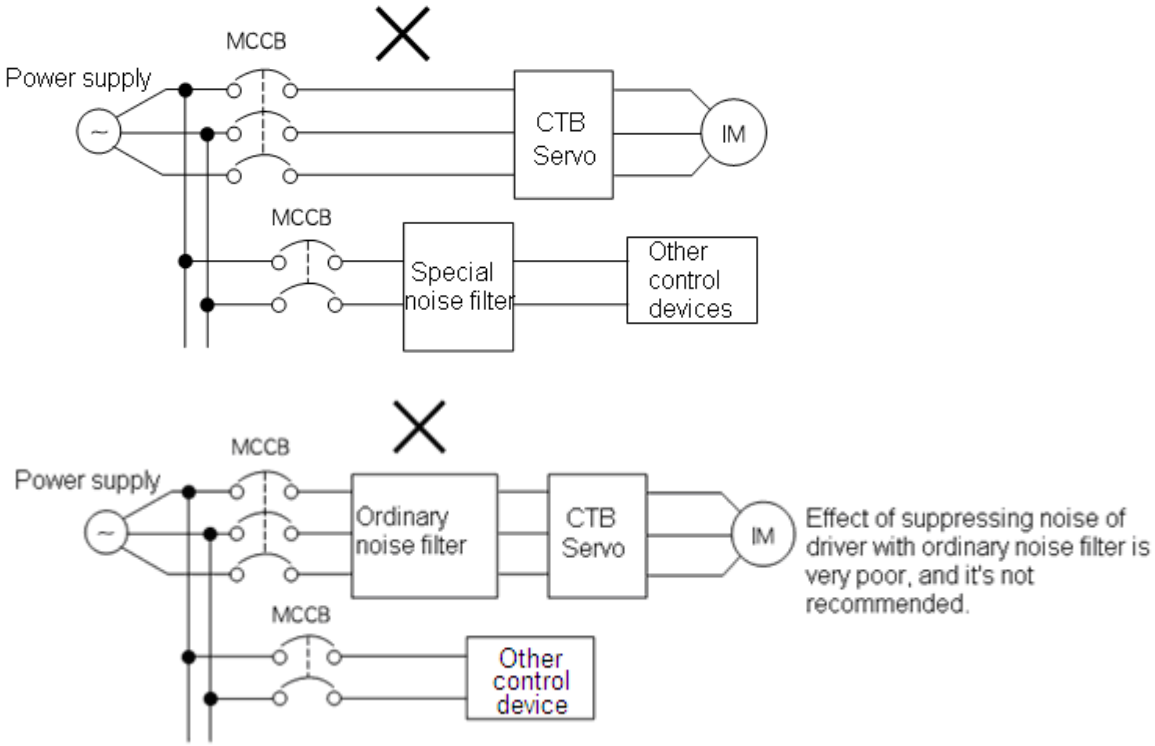


Figure 2-7 Incorrect settings and connection of noise filter at the input side of the power supply

The wiring of output side of main circuit

The output terminals of U, V, and W of the driver shall be connected to the connecting terminals of U, V, and W of three-phase AC motor by correct phase sequence; if the phase sequence is connected wrongly, the driver will raise the wrong phase sequence alarm with an alarm number of E.PV. To solve the problem, exchange phase sequence of any two phases. Please see Figure 2-8 for standard wiring of the output side.

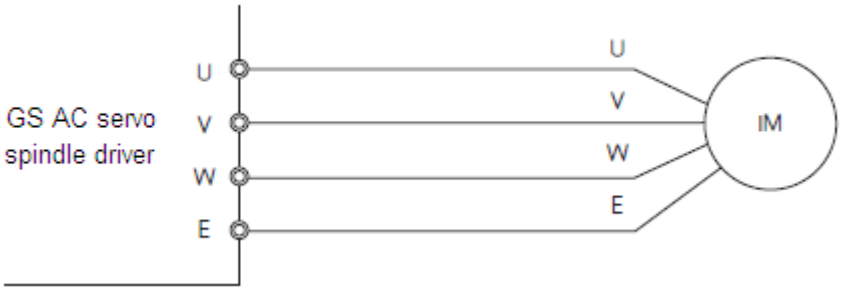


Figure 2-8 Output side wiring

Caution The AC servo spindle driver and motor must be well grounded, otherwise it may make the driver not functioning properly, even burn the driver.

Forbid
● It's strictly prohibited to connect the input power cord to the output terminal. Never connect the input power cord to the output terminal, otherwise, it will lead to damage to internal components of the controller. ● It's strictly prohibited to connect make the output terminal shorted and grounded. Never touch the output terminal directly, or make the output line touch the controller housing for risk of electric shock. In addition, never short the output line. ● It's strictly prohibited to use phase shift electrolytic capacitor, LC / RC noise filter. Never connect phase shift electrolytic capacitor, LC / RC noise filter in output circuit. Damage to internal components of the controller may be caused when use these components. ● It's strictly prohibited to connect or disconnect load with electromagnetic switch. Never connect electromagnetic switch, electromagnetic contactor to connect or disconnect the load in output circuit. During load operation, the protection circuit action of the controller will be acurated by the surge current. surge current will arose ● It's strictly prohibited to connect fan of spindle motor to U / V / W output terminals of the driver. It may burn the fan, and short-circuit the driver.

Wiring distance between the driver and motor

Generally, the wiring distance between the AC servo spindle driver and motor shall be shorter than 50 m. For longer distance, please contact the manufacturer to select wire with smaller resistivity.

Inductive interference countermeasures

Three methods of suppressing radio interference and inductive interference are provided in the information: filter magnetic ring, shielded cable and output filter.

Filter magnetic ring

Installing filter magnetic ring at the output side near to the driver can suppress common code interference at the output side effectively, as shown in Figure 2-9.

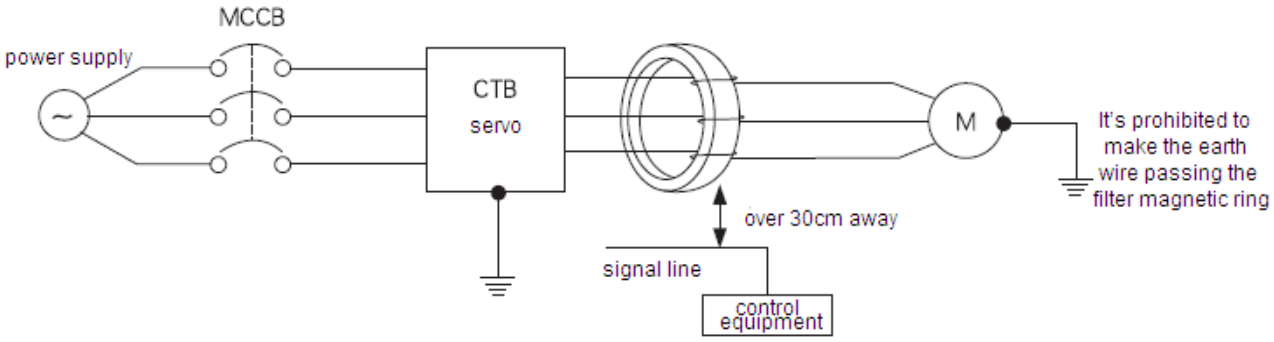


Figure 2-9 Filtering magnetic ring installation diagram

Output shielded cable

Use shielded cable for output line of the AC servo spindle driver can effectively suppress radio interference and inductive interference. The ends of shielding layer of the shielded cable shall be grounded separately as shown in Figure 2-10.

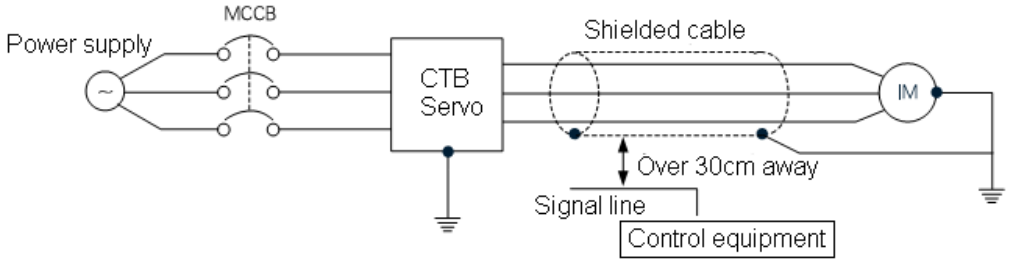


Figure 2-10 Connecting method of shielded cable

For applications of input and output filters in occasions with relatively large radio interference, output filter can be used to suppress interference. The input side and the drive generate radio interference so that the effect is best by using the input, output filter at the same time, as shown in Figure 2-11.

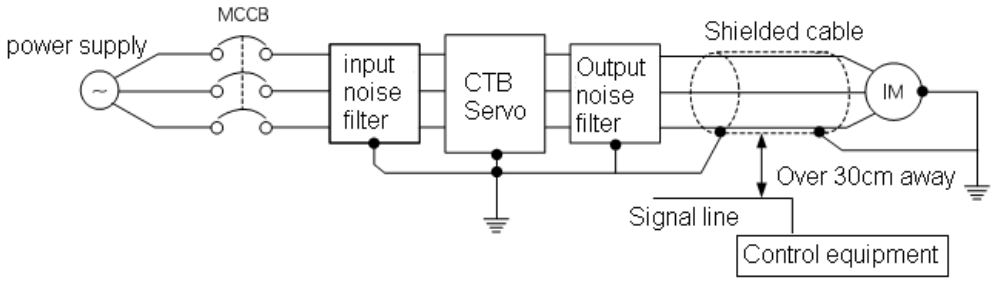


Figure 2-11 Suppress radio interference with output filter

Connection of the grounding wire

● The ground terminal is identified as E or ⏚, please do ground.

● Earth resistance: below 4Ω.

● Do not share grounding wire with welder and other power equipment.

● Please select wire diameter specification for grounding wire as specification in technical standards of electrical equipment, and as short as possible.

● Please make grounding wire forming a loop where more than two drivers are used.

● Example: as shown in Figure 2-12

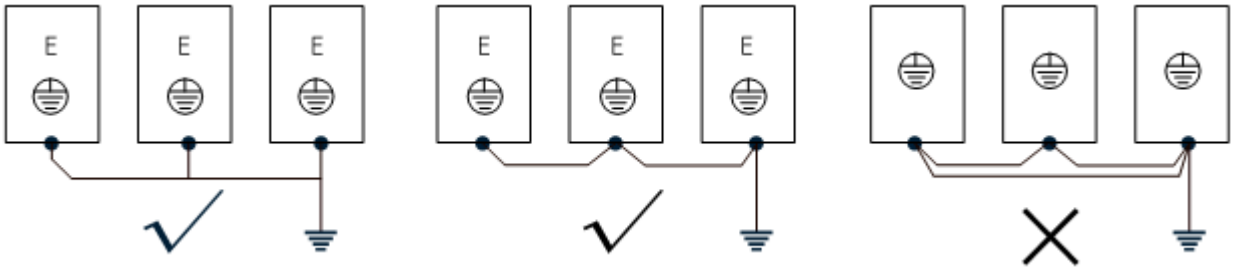


Figure 2-12 Connection of grounding wire

Connection of braking resistor

The P, PB terminals on main circuit block of AC servo spindle driver are for connection with braking resistor. Please do not connect braking resistor to other terminals, otherwise, the braking resistor will heat up and burn out, or cause damage to the driver. Please see Table 2-2 for braking resistor selection.

Table 2-2 Specification of braking resistor

BKSC-XXXX GSX			41P5	42P2	43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4200	4250	4315
Braking resistor	ripple	Power W	-	-	600	800	1000	600	800	1000	1000	1500	2000	2500	2500	2500	2500	2500	2000	2000	2500	2500	2500
		Resistance Ω	-	-	50	40	32	50	40	32	32	32	20	20	20	20	20	20	20	20	20	20	20
		Qty.	-	-	1	1	1	2	2	2	2	2	2	2	2	3	3	3	4	4	6	6	8
	aluminum housing	Power W	200	300	600	800	1000	600	800	1000	1000	Same parameters for ripple resistor											
		Resistance Ω	150	100	50	40	32	50	40	32	32												
		Qty.	1	1	1	1	1	2	2	2	2												
Filtering magnet ring	inside diameter φ(mm)		15	15	15	18	18	23	23	23	27	27	38	38	38	38	38	44	44	44	—	—	—
	Thickness H(mm)		13	13	13	13	13	15	15	15	15	15	24	24	24	24	24	15	15	15	—	—	—

Note: above accessories data is standard data recommended by the manufacturer. For special applications, please contact your supplier.

● The connection of braking resistor shall be in strict accordance with Figure 2-13.

● The length of connecting wire between driver and braking resistor shall be less than 50 m.

● Please pay particular attention to: external braking unit may be connected to p (+) / DC +, N (-) / DC side of the driver, but direct connecting with braking resistor is not allowed, otherwise, damage to driver or fire may be caused.

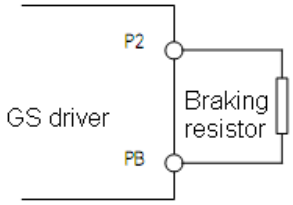


Figure 2-13 Connection of braking resistor

Selection of breaker, contactor and cable

Please see Table 2-3 for selection of breaker, contactor and input and output cable

Table 2-3 Specification of breaker, contactor and cable

Model BKSC	Power (kW)	Breaker (air switch) (A)	Main circuit cable (copper conductor cable) (mm^2)	Contactor Voltage: 380V. Current:(A)
41P5GSX	1.5	10	2.5	9
42P2GSX	2.2	10	2.5	9
43P7GSX	3.7	16	4	16
45P5GSX	5.5	32	4	18
47P5GSX	7.5	40	6	25
4011GSX	11	63	10	32
4015GSX	15	63	16	50
4018GSX	18.5	100	16	63
4022GSX	22	100	25	80
4030GSX	30	125	35	95
4037GSX	37	160	35	115
4045GSX	45	200	50	115
4055GSX	55	200	70	150
4075GSX	75	250	95	185
4090GSX	90	315	95	250
4110GSX	110	400	120	250
4132GSX	132	400	150	315
4160GSX	160	630	185	400
4200GSX	200	630	185	400
4250GSX	250	630	240	500
4315GSX	315	800	300	630

Main circuit wiring precautions

● Please do connect breaker or fuse between power supply and power input terminals (R, S, T) of the driver.

● Please do connect to earth wire at E terminal of the driver. Copper core cable over $4mm^2$ shall be used for earth wire with a grounding resistance lower than 4Ω.

● Please ensure the high reliability of wiring.

● Please check the following items after circuit wiring.

(1) Are all connections correct?

(2) Is there connection missing?

(3) Is there short circuit between terminals and connecting line or shorted to ground?

Control circuit wiring

Input and output signals of GS Series AC servo spindle driver include: switching value input signal, switching value output signal, Analog input signal, PULSE input signal, encoder input / output signal.

Specifications of input and output signal cable

As the control signals are different, the requirements to cable for connector are strict. Specifications of cable for different signal connectors are listed in Table 2-4. User shall follow the standard for wiring.

Table 2-4 Specifications of input and output signal cable

Signal	Signal name	Cable	Cable specification
switching value input /output	I1～I6 Q1～Q2 PV SC	common cable or shielded cable	0.2～2
Relay output	M0A/M0B/M0C M1A/M1B/M1C	common cable or shielded cable	0.2～2
Analog signal	FI FV FS FC FS FT	shielded cable	0.2～1
Encoder signal	PV1 G1 A+ A- B+ B- Z+ Z- PV2 G2 OA+ OA- OB+ OB- OZ+ OZ-	Shielded twisted twin cable	0.2～1
PULSE signal	SA+ SA- PB+ PB- DZ+ DZ-	Shielded twisted twin cable	0.2～1
enable reset signal	ST PV SC	common cable or shielded cable	0.2～1

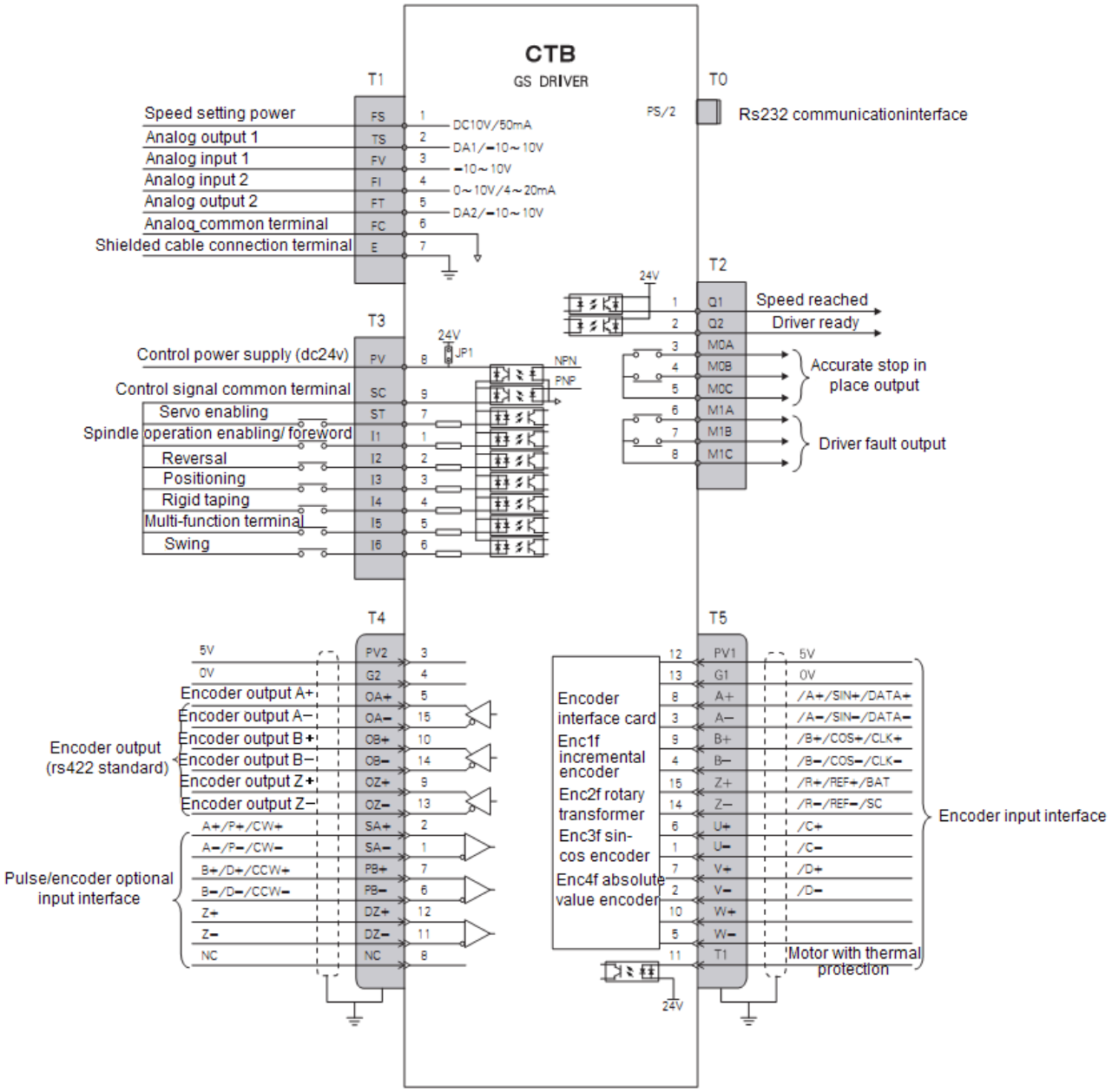
GS driver control panel specifications

GS Series driver provides six kinds of control board according to different power and function of GS Series driver. Please see Table 2-5 for interface characteristics and applicable model.

Table 2-5 GS driver main board specifications

Control panel model	switching value input	switching value output	Analog input	Analog output	PULSE input	Communication interface	Encoder input	Encoder output
CP100A1/ CP100C1	7	4	2	2	○	RS232	○	○
CP100B1/ CP100D1	14	8	2	2	○	RS232 RS485 CAN TCP/IP	○	○
CP100AT1/ CP100CT1	8	4	3	-	○	RS232	○	○

Standard version control wiring diagram (taking 7.5kW GSX driver as an example)



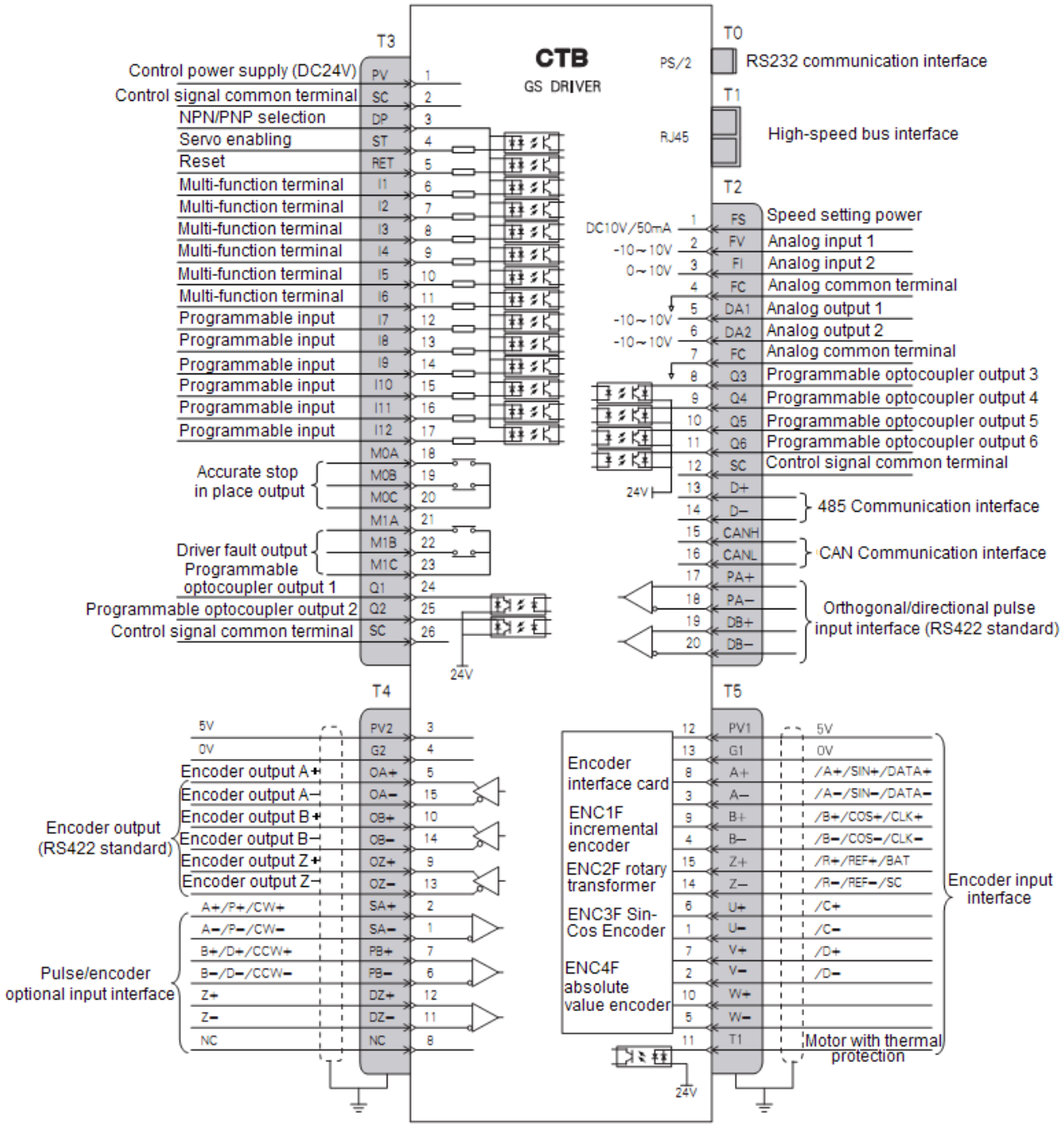
Input and output signals description (GSX Series)

Table 2-6 Input and output signal function description

Port	Type	Pin	Name	Function	Signal standard
T0	Communication			communicate with computer	RS232
T1	Analog input	1	FS	10V power for speed setting is provided inside common port	DC10V 50mA
		6	FC	analog input /output common terminal	0V
		3	FV	-10V ～ +10V analog input, input impedance: 20KΩ	Analog signal
		4	FI	Analog input impedance may be selected for 0 ～ 10V , 4 ～ 20mA impedance: 20K/500Ω	
	Analog output	2	TS	0～10V output	
		5	FT	0～10V output	
T2	Programmable optocoupler output	1	Q1	speed reached	24V optocoupler output 10mA
		2	Q2	driver ready	
	Relay output	3/4/5	MOA/MOb/MOc	output accurate stop end (in place) output	Ac250V 1A Dc30 1A
		6/7/8	MIA/MIB/MIC	driver fault output	
T3	Control signal input	7	ST	control enabling and reset	PNP: 0V input effective NPN:24V input effective Input mode of PNP or NPN Shall be selected by software parameter setting
		1	I1	Foreword/ operation enabling	
		2	I 2	reverse	
		3	I 3	accurate stop, close: start accurate stop and maintain; open: cancel accurate stop	
		4	I 4	rigid tapping signal, close : enter rigid tapping state	
		5	I 5	multifunctional terminal	
		6	I 6	Swing	
	Control power	8	PV	DC24V power terminal, it's 24V output when JP1 is turned on, and 24V input when JP1 is shut down.	DC24V 100mA
		9	SC	D 24V power 0V terminal /control signal common port	
T4	Encoder output	3/4	PV2/G2	Preset power, provided by digital system, system without electrify inspection may go without.	DC5V，200mA
		5/15	OA + /OA—	encoder A phase output	line driver output RS 422 standard
		10/14	OB +/ OB-	encoder B phase output	
		9/13	OZ + /OZ—	encoder Z phase output	
	Encoder	1/2	SA + /SA—	encoder A phase/orthogonal PULSE A phase input /single PULSE train	RS422 standard

	PULSE input			input P	
		7/6	PB + /PB—	encoder B phase/orthogonal PULSE B phase input /single PULSE direction input D	
		12/11	DZ +/ DZ-	encoder Z phase	
T5	Communication encoder input	12/13	PV1/G1	encoder power supply provides terminal /power common port	Dc5V 200mA
		8/3	A +/ A—	encoder A phase input	Corresponding encoder standard
		9/4	b + /b—	encoder B phase input	
		15/14	z +/ z—	encoder Z phase input	
		6/1	U+/U-	U/C increment/ sine and cosine	
		7/2	V+/V-	V/D increment/ sine and cosine	
		10/5	W+/W-	W increment	
	Thermal protection input	11	T1	Motor thermal protection signal input	N.C./ N.O.

General version control wiring diagram (taking 7.5kW GSXB driver as an example)



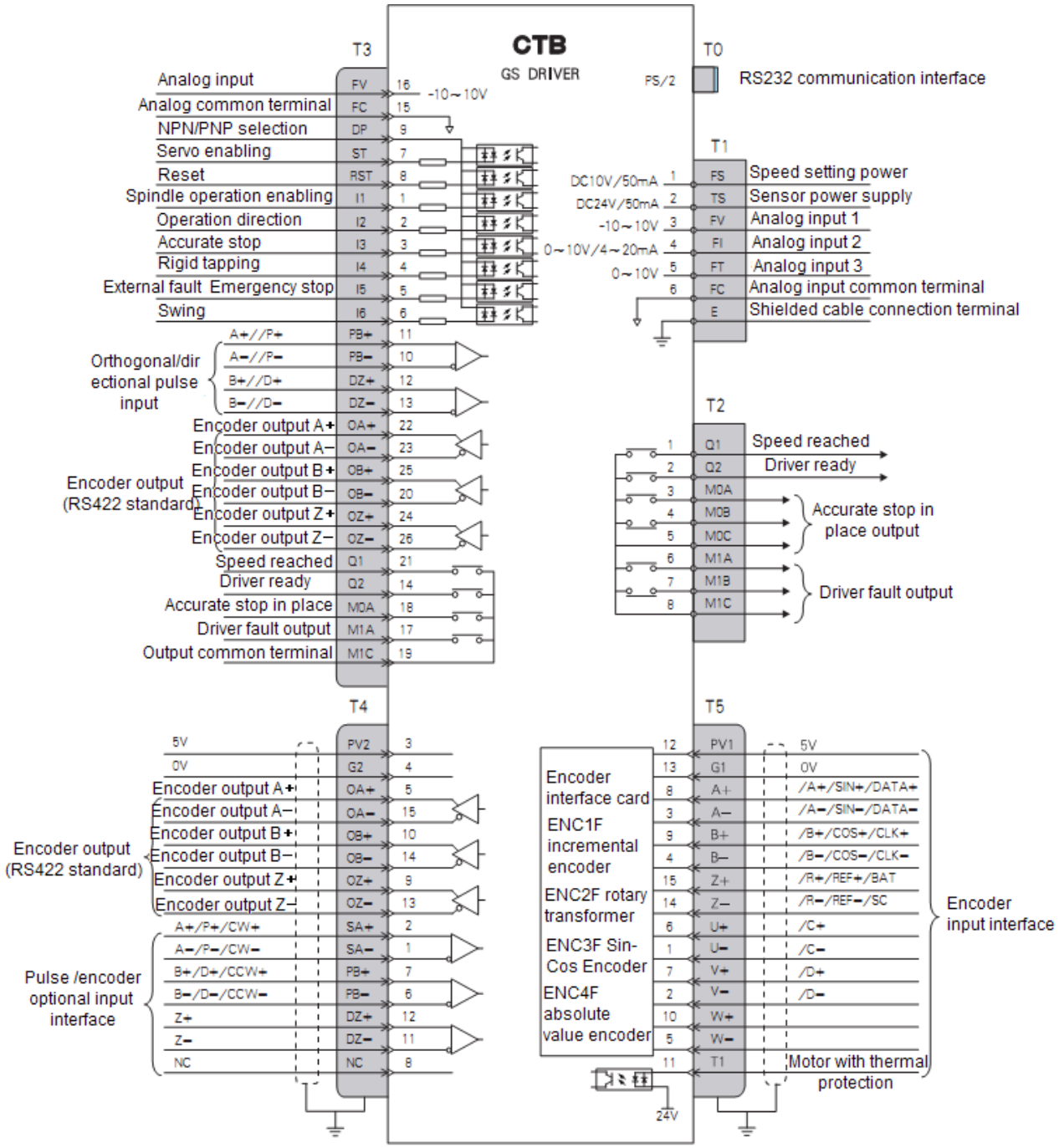
Input and output signals description (GSXB Series)

Table 2-7 Input and output signal function description

Port	Type	Pin	Name	Function	Signal standard
T0	Communication			communicate with computer	RS232
T1	High-speed bus interface				
T2	Analog input	1	FS	10V power for speed setting is provided inside common port	DC10V 50mA
		4/7	FC	analog input /output common terminal	0V
		2	FV	-10V ～ +10V analog input, input impedance: 20KΩ	Analog signal
		3	FI	Analog input impedance may be selected for 0 ～ 10V , 4 ～ 20mA impedance: 20K/500Ω	
	Analog output	5/6	DA1/DA2	0～10V output	
	Programmable optocoupler output	8/9/10/11	Q2/Q4/Q5/Q6	Programmable output	24V optocoupler output 10mA
	Control power	12	SC	Control signal common terminal	DC24V 100mA
	485 communication interface	13/14	D+/D-	485 communication interface	RS485 standard
	CAN communication interface	15/16	CANH/CANL	CAN communication interface	CAN communication standard
	orthogonal/directional pulse input interface	17/18	PA+/PA-	orthogonal/directional pulse input interface	RS422 standard
		19/20	DB+/DB-	orthogonal/directional pulse input interface	
T3	Control signal input	4	ST	Control enabling and reset	PNP: 0V input effective NPN:24V input effective
		5	RET	Reset	
		6	I1	Multi-function terminal	
		7	I 2	Multi-function terminal	
		8	I 3	Multi-function terminal	
		9	I 4	Multi-function terminal	
		10	I 5	Multi-function terminal	
		11	I 6	Multi-function terminal	
		12	I 7	Programmable input	
		13	I 8	Programmable input	
		14	I 9	Programmable input	

		15	I 10	Programmable input	
		16	I 11	Programmable input	
		17	I 12	Programmable input	
	Programmable optocoupler output	24	Q1	Speed reached	24V optocoupler output 10mA
		25	Q2	Driver is ready	
	Relay output	18/19/20	M0A/M0B/M0C	Output accurate stop ends (in place) output	AC 250V 1A DC30 1A
		21/22/23	M1A/M1B/M1C	Driver fault output	
T4	Encoder output	3/4	PV2/G2	Preset power, provided by digital system, system without electrify inspection may go without.	DC5V，200mA
		5/15	OA + /OA—	encoder A phase output	line driver output RS 422 standard
		10/14	OB +/ OB-	encoder B phase output	
		9/13	OZ + /OZ—	encoder Z phase output	
	Encoder PULSE input	1/2	SA + /SA—	encoder A phase/orthogonal PULSE A phase input /single PULSE train input P	RS422 standard
		7/6	PB + /PB—	encoder B phase/orthogonal PULSE B phase input /single PULSE direction input D	
		12/11	DZ +/ DZ-	encoder Z phase	
T5	Communication encoder input	12/13	PV1/G1	encoder power supply provides terminal /power common port	Dc5V 200mA
		8/3	A +/ A—	encoder A phase input	Corresponding encoder standard
		9/4	b + /b—	encoder B phase input	
		15/14	z +/ z—	encoder Z phase input	
		6/1	U+/U-	U/C increment/ sine and cosine	
		7/2	V+/V-	V/D increment/ sine and cosine	
		10/5	W+/W-	W increment	
	Thermal protection input	11	T1	Motor thermal protection signal input	N.C./ N.O.

Special version control wiring diagram (taking 7.5kW GSXT driver as an example)



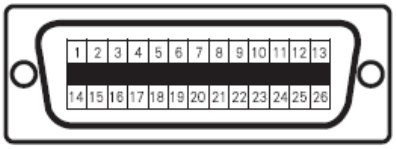
Input and output signals description (GSXT Series)

Table 2-8 Input and output signal function description

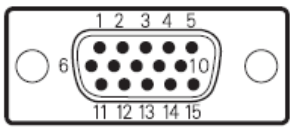
Port	Type	Pin	Name	Function	Signal standard
T0	Communication			communicate with computer	RS232
T1	Analog input	1	FS	10V power for speed setting is provided inside	DC10V 50mA
		6	FC	analog input common terminal	0V
		3	FV	-10V～+10V analog input, input impedance: 20KΩ	Analog signal
		4	FI	Analog input impedance may be selected for 0～10V , 4～20mA impedance: 20K/500Ω	
		2	TS	0～10V analog input	
		5	FT	Sensor power	DC24V 50mA
T2	Relay output	1	Q1	Speed reached	AC 250V 1A DC30 1A
		2	Q2	Driver ready	
		3/4/5	M0A/M0B/M0C	Output accurate stop ends (in place) output	
		6/7/8	M1A/M1B/M1C	Driver fault output	
T3	Analog input	16	FV	0～10V analog input	DC24V 100mA
		15	FC	Analog input common terminal	
	NPN/PNP selection	9	DP	NPN/PNP selection	DP is NPN when connected to PV. DP is PNP when connected to SC.
		7	ST	Control enabling and reset	PNP: 0V input effective NPN:24V input effective
		8	RET	Reset	
		1	I1	Forward/operation enabling	
		2	I2	Reversal	
		3	I 3	Accurate stop, close: start accurate stop and hold; switch off: cancel the accurate stop	
		4	I 4	Rigid tapping signal, close; enter rigid tapping state	
		5	I 5	Multi-function terminal	
		6	I 6	Swing	

	Orthogonal/directional pulse input interface	11/10	PB + /PB—	Orthogonal/directional pulse input interface	RS422 standard
		12/13	DZ +/ DZ-	Orthogonal/directional pulse input interface	
	Encoder output	22/23	OA + /OA—	encoder A phase output	line driver output RS 422 standard
		25/20	OB +/ OB-	encoder B phase output	
		24/26	OZ + /OZ—	encoder Z phase output	
	Relay output	21	Q1	Speed reached	AC 250V 1A DC30 1A
		14	Q2	Driver ready	
		18/17/19	M0A/M1A/M1C	Output accurate stop ends (in place) output	
T4	Encoder output	3/4	PV2/G2	Preset power, provided by digital system, system without electrify inspection may go without.	DC5V，200mA
		5/15	OA + /OA—	encoder A phase output	line driver output RS 422 standard
		10/14	OB +/ OB-	encoder B phase output	
		9/13	OZ + /OZ—	encoder Z phase output	
	Encoder PULSE input	1/2	SA + /SA—	encoder A phase/orthogonal PULSE A phase input /single PULSE train input P	RS422 standard
		7/6	PB + /PB—	encoder B phase/orthogonal PULSE B phase input /single PULSE direction input D	
		12/11	DZ +/ DZ-	encoder Z phase	
T5	Communication encoder input	12/13	PV1/G1	encoder power supply provides terminal /power common port	Dc5V 200mA
		8/3	A +/ A—	encoder A phase input	Corresponding encoder standard
		9/4	b + /b—	encoder B phase input	
		15/14	z +/ z—	encoder Z phase input	
		6/1	U+/U-	U/C increment/ sine and cosine	
		7/2	V+/V-	V/D increment/ sine and cosine	
		10/5	W+/W-	W increment	
	Thermal protection input	11	T1	Motor thermal protection signal input	N.C./ N.O.

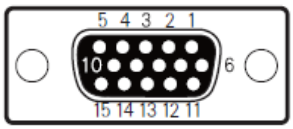
Connector terminal arrangement



T3 26-pin high density plug



T4 D-type 15-pin plug (pin)



T5 D-type 15-pin plug (hole)

Control power supply wiring

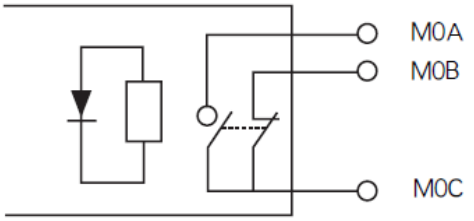
In addition to analog control terminal, all of other control terminals of GS series AC servo spindle driver are equipped with optocoupler isolation. Power of the optocoupler isolation may select from internal of the driver or external power provided by the user according to the actual requirements. To ensure better isolation effect, it is recommended to use external DC24V isolation power provided by user.

The wiring of relay output signal

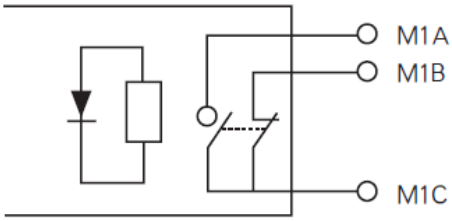
GS AC servo spindle driver provides two relay output points.

Output standard: AC250V 1A DC30V 1A

Accurate stop relay output schematic diagram



Fault relay output schematic diagram



Transistor output wiring precautions

● The maximum oad capacity of output tape of transistor output QI/Q2 is 20 mA, and the output voltage is DC24V.

● If the output terminal needs 0V, intermediate relay may be installed for switching as shown in Figure 2-14.

● If the output terminal drives inductive load (e.g., electromagnetic relay, intermediate relay), surge voltage absorbing circuit shall be added as shown in Figure 2-14.

If follow current diode is installed in surge absorption circuit (for DC electromagnetic circuit), attention must be paid to polarity during installation.

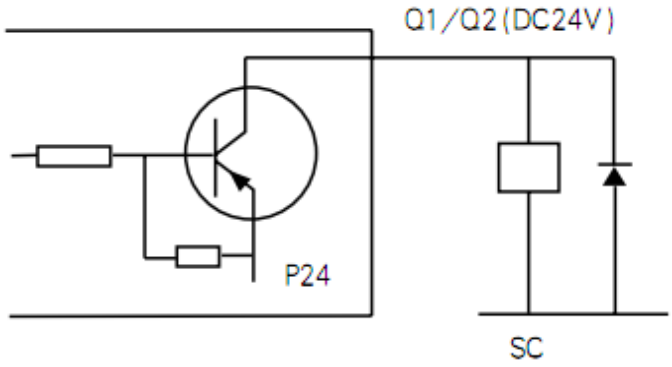


Figure 2-14 Transistor output circuit

Wiring of analog input signal

GS AC servo spindle driver selects two analog input interfaces of FI and FV, as well as a group of power interface FS and FC for analog input. Please see Table 2-9 for signal function description.

Table 2-9 Analog interface signal description

Signal	Function	Signal standard
FI	Unipolarity analog input terminal A2.02=1	0～10V, input impedance: 20KΩ

Signal	Function	Signal standard
FV	Bipolarity analog input terminal A2.02＝0	-10V～+10V analog input, input impedance: 20KΩ
FS	inside provided speed setting power	DC10V，50mA,
Fc	analog common port	0V
E	Shielding layer connecting terminal	

Wiring requirements

● Connect to signal source or control signal with multi-core shielded cable or stranded shielded wire.

● The near-end of shielding layer of the case (end near the driver) shall be connected to the connector housing.

● During wiring, the control cables shall be arranged more than 30cm away from the main circuit and strong power line (including power line, motor line, relay, contactor connecting cable), and avoid parallel layout. Vertical wiring is recommended to prevent malfunction of the driver due to interference.

●Filter magnetic ring provided by the manufacturer shall be used for long distance wiring. It shall be installed at the side near the driver.

FI terminal wiring example

Use internal power for speed setting. The input signal is 0 ~ 10V/4-20mA as shown in Figure 2-15.

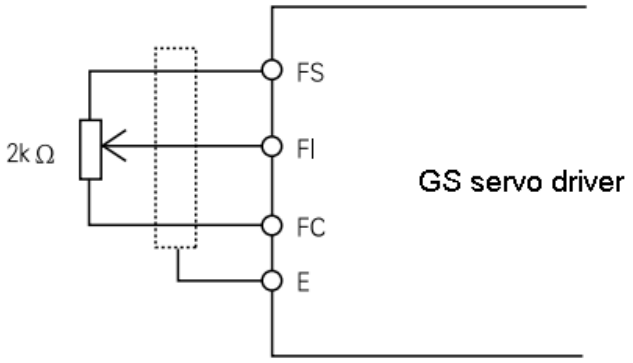


Figure 2-15 Conduct speed setting with internal power

FV terminal wiring example

CNC system uses bipolar (-10V ~ +10 V) analog output. The speed is determined by the value of the analog, the direction of rotation is determined by polarity of the analog as shown in Figure 2-16.

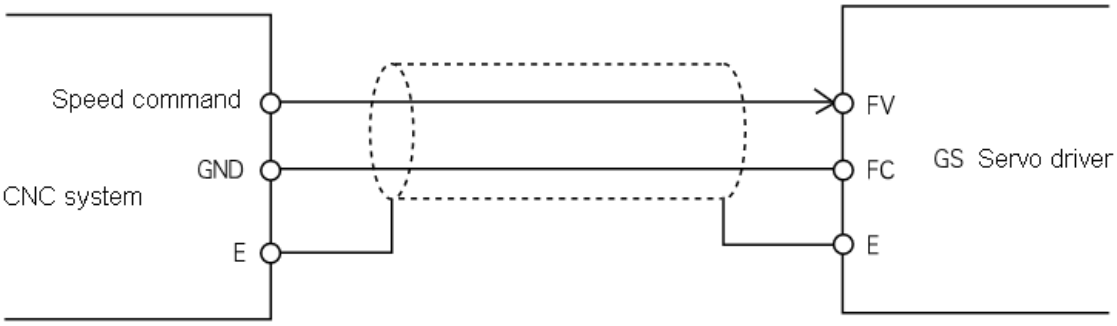


Figure 2-16 Bipolar speed setting is conducted by CNC system

Forbid
● It's prohibited to connect the signal line and OV reversely. The signal line is likely to be burned, and reverse operation may be caused for bipolar. ● It's prohibited to connect high-voltage to analog signal terminal. The driver may be burned.

Connection of the encoder interface

A group of encoder input interface T5 and encoder input interface T4 are provided on main board of GS series AC servo driver. Please see Table 2-10 and Table 2-11 for interface definition.

Table 2-10 Encoder input interface T5

Signal	Description	Signal standard
PV1	Encoder power supply DC5V	DC5V/1200mA
G1	Encoder power ground 0V	
A+	A phase PULSE same-phase input (+)	Line drive mode RS422 standard
A-	A phase PULSE reverse -phase input (-)	
B+	B phase PULSE same-phase input (+)	
B-	B phase PULSE reverse -phase input (-)	

Z+	Z phase PULSE same-phase input (+)	
Z-	Z phase PULSE reverse-phase input (-)	
T1	Motor thermal protection input terminal	NC/NO

Table 2-11 Encoder output interface T4

Signal	Description		Signal standard
PV2	Encoder power supply DC5V	Or external sensor power supply	DC5V/200mA Note: the connection is not required when used as speed/position feedback of the CNC system
G2	Encoder power ground 0V		
OA+	A phase PULSE same-phase input (+)		Line drive mode RS422 standard
OA-	A phase PULSE reverse-phase input (-)		
OB+	B phase PULSE same-phase input (+)		
OB-	B phase PULSE reverse-phase input (-)		
OZ+	Z phase PULSE same-phase input (+)		
OZ-	Z phase PULSE reverse-phase input (-)		
SA+	Pulse/encoder A-phase input (+)		Line drive mode RS422 standard
SA-	Pulse/encoder A-phase input (-)		
PB+	Pulse/encoder B-phase input (+)		
PB-	Pulse/encoder B-phase input (-)		
DZ+	Pulse/encoder Z-phase input (+)		
DZ-	Pulse/encoder Z-phase input (-)		

Encoder wiring precautions

● The encoder cable must be shielded twisted pair cable.

● The shielding layer shall be connected to the connector housing.

Forbid

●It's prohibited to connect the DC5V power reversely. It's likely to burn the DC5V power or encoder of the driver.

●It's prohibited to reverse the A, B phase sequence. Otherwise, the motor will not function properly, or even burn the motor or driver.

Connection of serial communication port

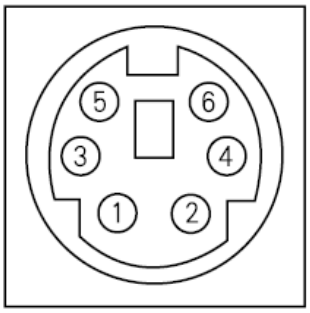
GS driver provides users with a R S232A serial communication interface T0 for connection with computer to realize transmission of program and parameters. The port is connected with computer through RS232-P1 cable.

Please see Table 2-12 for definition of serial communication interface T0

Table 2-12 T0 interface definition

Pin	Name	Description	Pin	Name	Description
1	VCC	DC5V	4	NC	Used by manufacturer
2	GND	0V	5	TX	Send terminal
3	RX	Receive terminal	6	NC	Used by manufacturer

T0 interface diagram



General Purpose cable model: RS 232-p1

Caution

● Please select the standard cable provided by the manufacturer for communication.

Manipulator application

The chapter describes the functions and methods of application of the manipulator.

Digital tube display

0.4 ~ 18.5kw driver:

22 ~ 315kw driver:

LCD display

0.4 ~ 18.5kw driver:

22 ~ 315kw driver:

Configuration and key functions of the 0.4 ~ 18.5kw driver digital tube manipulator

The chapter defines and describes terms and phrases for operation and state of 0.4 ~ 18.5kw driver manipulator, defines the operation methods of driver and manipulator. Please read carefully. It's very helpful for proper use of the 0.4 ~ 15kw driver.

Manipulator

The manipulator is one of the standard equipment of 0.4 ~ 18.5kw driver. User may carry out parameter setting, state monitoring, operation control and other operations to the driver through the manipulator. It's very important to be familiar with function and operation of the manipulator for proper application of 0.4 ~ 18.5kw series driver. Please read the manual carefully before using.

Manipulator appearance diagram

Manipulator of 0.4 ~ 18.5kw driver is mainly composed of two parts of LED digital tube and keys. The appearance and functional zones are shown in Figure 3-1.

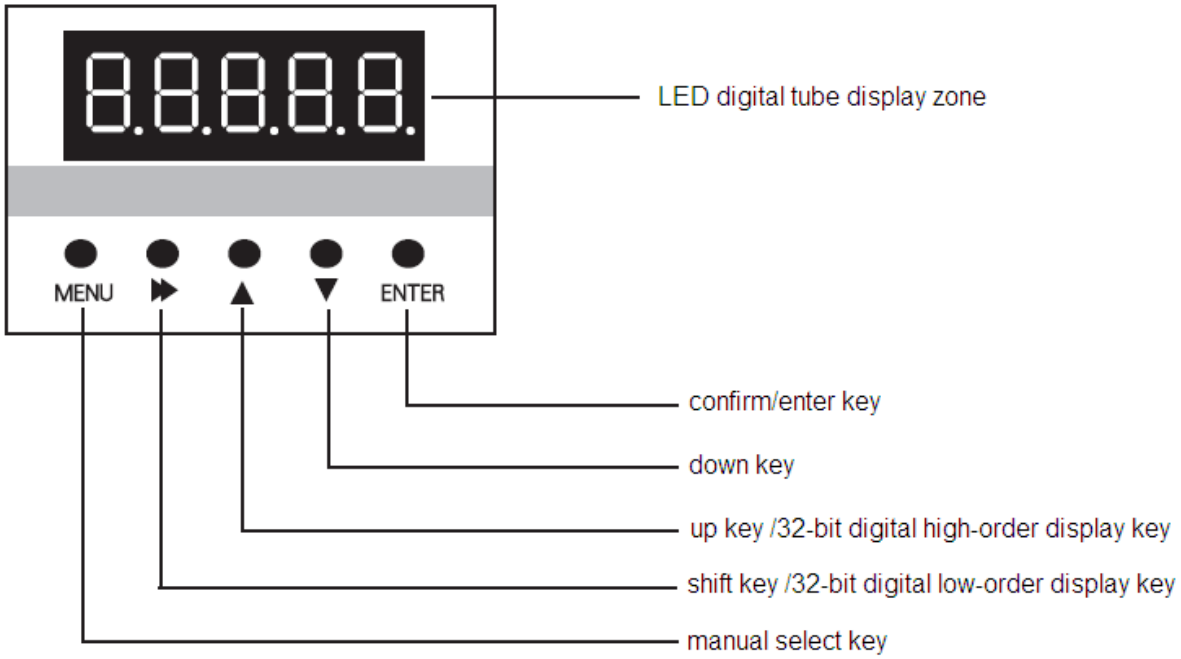


Figure 3-1 Manipulator diagram

Manipulator key function description

Please see Table 3-1 for function description of the manipulator key

Table 3-1 Manipulator key function

Key	Name	Function
Menu	Menu selection switching key	switching key of each menu item;
▶▶	Shift key 32-bit digital low-order display key	It's used to switch data bit of the parameter number when browse parameter items; When displayed by 32-bit digital display, the low-order of the data may be displayed; When modifying data in program state, it can be used to modify the modified bit of the modified data.
▲	up key /32-bit digital high-order display key	Increase menu item, parameter item or modified parameter value progressively. When displayed by 32-bit digital display, the high-order of the data may be displayed;
▼	down key	Decrease menu item, parameter item or modified parameter value progressively.
Enter	Confirm / enter key	Press the key in program state to return to the previous menu. Enter the next level menu; Complete selection of the parameter group in1-level menu; Complete parameter value checking operation in 2-level menu; Complete modification and storage operation of the parameter value in 3-level menu;

The operating state of the driver

0.4 ~ 18.5kw driver has four operating states after power-on: standby, operating, programming and fault alarm. They are described as follows:

Standby state

0.4 ~ 18.5kw driver is in standby state after power-on and before receiving any operating control order. The default standby state display function code of LED digital tube is F.0. User may make LED circling switch display Un monitoring function parameter groups by press MENU key. In Un interface, the monitoring function parameter groups of Un, An may be displayed by circling switching. After press ENTER key, user may make LED circling switch display monitoring parameters defined in function parameter group by pressing ▲, ▼ and ▶▶ key, and then press ENTER key to check /monitor its value.

It will be limited by functional parameter A1.00 when user want to check / modify the content of parameter groups other than Un, An during operation. All of the parameters may be checked when A1.00=1.

Operating state

When 0.4 ~ 18.5kw driver in standby and no-fault state, it will enter operating state after receiving operating order.

User may make LED circling switch display Un and monitoring function parameter groups by press MENU

key. In Un interface, Un, An function parameter groups may be displayed through circling switching by pressing ▲, ▼. After press ENTER key, user may make LED circling switch display monitoring parameters defined in function parameter groups by pressing ▲ , ▼.and ▶ key, and then press ENTER key to check /monitor its value.

Setting, modifying or editing state

For 0.4 ~ 18.5kw driver, user may switch to the state in which function code parameters can be modified through MENU, ▶, ▲,▼.and ENTER on the operator panel. The state is programming state.

Function parameter value is displayed in programming state, and the bit to be modified is flashing.

Fault alarm state

In the state, 0.4 ~ 18.5kw driver fails and displays the fault code.

LED displays fault code in fault state, and user may conduct fault reset operation enabled by terminal disconnection.

Operative mode of the manipulator

Standby state:

The state of the manipulator is shown in Figure 3-2 when the driver is in standby state. The LED digital tube default display F. 0. At this point, user may press MENU to enter menu items, and check or modify parameters.

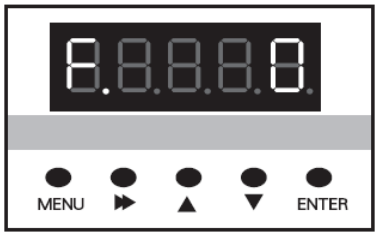


Figure 3-2 Standby state

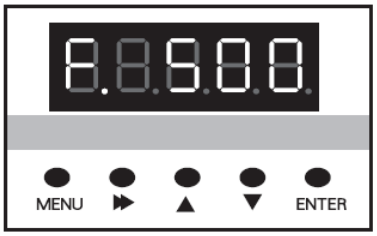


Figure 3-3 Operating state

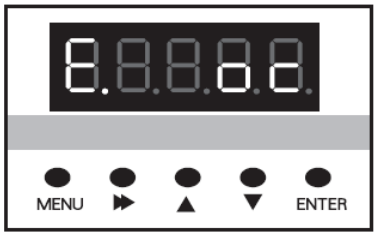


Figure 3-4 Fault alarm state

Operating state:

The driver enters operating state after receiving correct operation command in standby state. As shown in Figure 3-3, the LED digital tube default displays the set speed of the driver, e.g F. 500. In this state, user may press MENU to enter menu items, and check or modify parameters.

Fault alarm state

When fault is detected as the driver is in operating, standby or programming state, the driver will stop and enter fault state immediately as shown in Figure 3-4.

When a fault occurs, user may enable conduct drive reset through terminal disconnection. If the fault has disappeared, it returns to the standby state; if the fault still exists, the fault code will be displayed again.

Use method of the manipulator

The section mainly introduces use of the manipulator, and basic operations of functions.

Parameter setting operation process

Parameter setting method of manipulator of 0.4 ~ 18.5kw driver adopts three-level menu structure.

Parameter value of menu items can be checked and modified conveniently.

The three-level menu: menu item (1-level menu), parameter tem (2-level menu) and parameter setting (3-level menu). The operation process is shown in Figure 3-5.

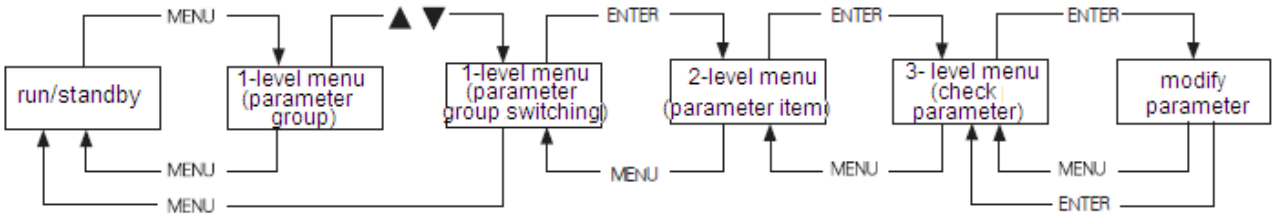
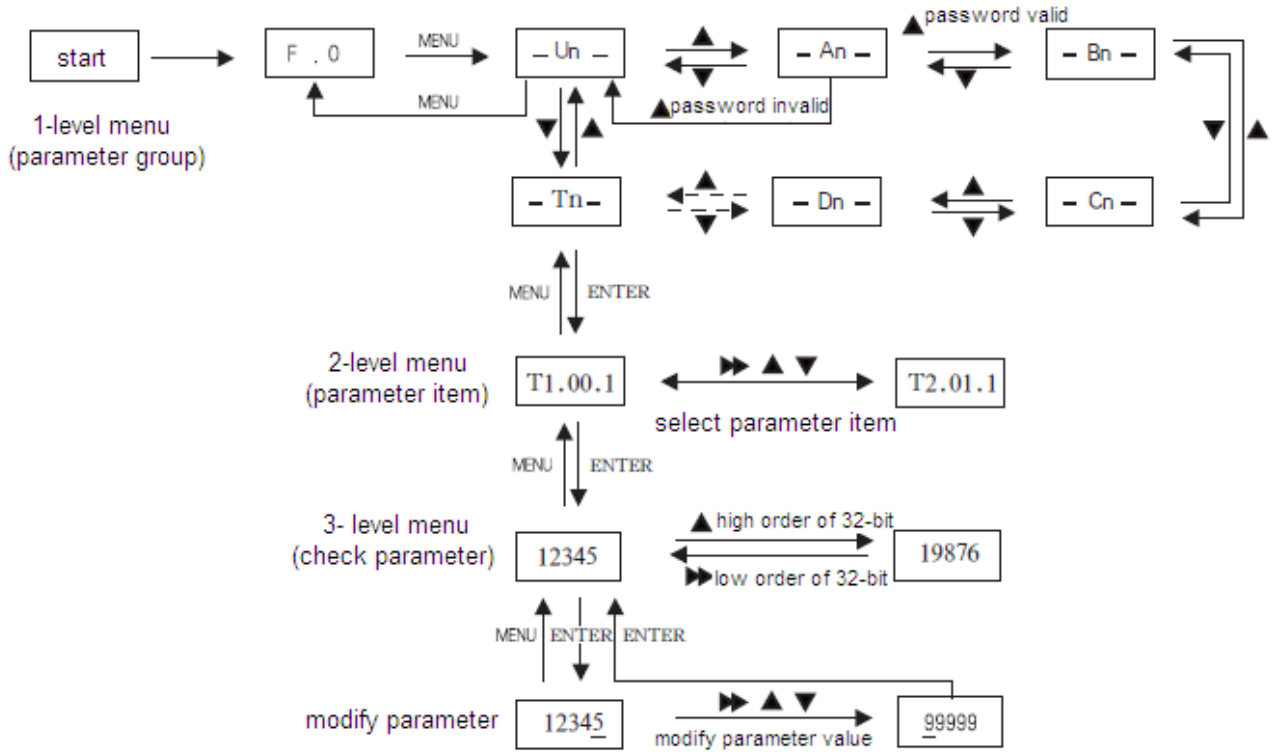


Figure 3-5 3-level menu operation flow chart

During operation in 3-level menu, user may return to 2-level menu by pressing MENU or ENTER (see Figure 3-5 and Figure 3-6). The difference between the two operations: after press ENTER key, the set parameter value will be saved to the controller, and then return to 2-level menu; it will return to 2-level menu directly without saving the parameter value by pressing MENU. The detail operational procedures of 3-level menu are shown in Figure 3-6.

Modify the parameters with the manipulator

The flow chart of modify the parameters with the manipulator is shown in Figure 3-20.



★ Description:

Ten menu items are included in 1-level menu: Un menu, An menu, Bn menu, Cn menu, Dn menu, En menu, Fn menu, Pn menu, Sn menu and Tn menu.

Please see parameter description for specific functions in 2-level menu.

Monitor operating state with the manipulator

Operation state, interface state and fault information of the driver can be monitored respectively through U1, U2 and U3 of the manipulator

Operation state monitoring

Operation state monitoring includes set speed F, output speed O, feedback speed b, output current A, output torque T and DC bus voltage U of the driver. Please see Figure 3-7 for monitoring method.

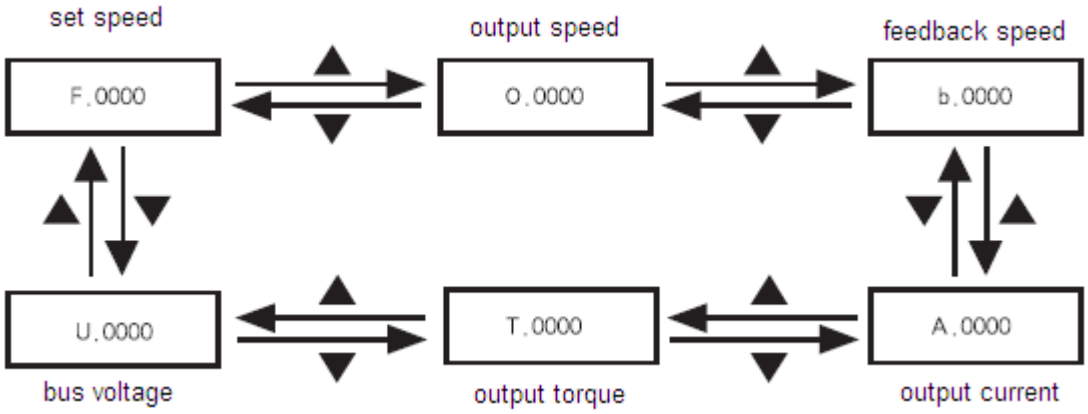


Figure 3-7 Driver operation state monitoring flowchart

Interface state monitoring

Interface state includes driver's encoder input interfaces U2.00, U2.01; switching value input terminals U2.02, U2.03; switching value output terminal U2.04, analog input interfaces U2.05, U2.06; output terminals U2.07, U2.08. The monitoring method is same with monitoring parameter, only needs to select corresponding parameter in U2. Please see U2 parameter monitoring table 2 for parameter number.

Fault information monitoring

The control panel will display the current fault message code when the driver is in fault state. The fault record of the driver can be checked through U3. The check operation is same with monitoring parameter, only needs to select corresponding parameter in U3. Please see fault state recording parameter table U3 for parameter number.

22～315k w driver: Configuration and key functions of the 22～315kw driver digital tube manipulator

The chapter defines and describes terms and phrases for operation and state of 22～315kw driver manipulator, defines the operation methods of the driver and manipulator. Please read carefully. It's very helpful for proper use of the 22～315kw driver.

Manipulator

The manipulator is one of the standard equipment of 22～315kw driver. User may carry out parameter setting, state monitoring, operation control and other operations to the driver through the manipulator. It's very important to be familiar with function and operation of the manipulator for proper application of 22～315kw series driver. Please read the manual carefully before using.

Manipulator appearance diagram

Manipulator of 22～315kw driver is mainly composed of three parts of LED digital tube, LED indicator and key. The appearance and functional zones are shown in Figure 3-8.

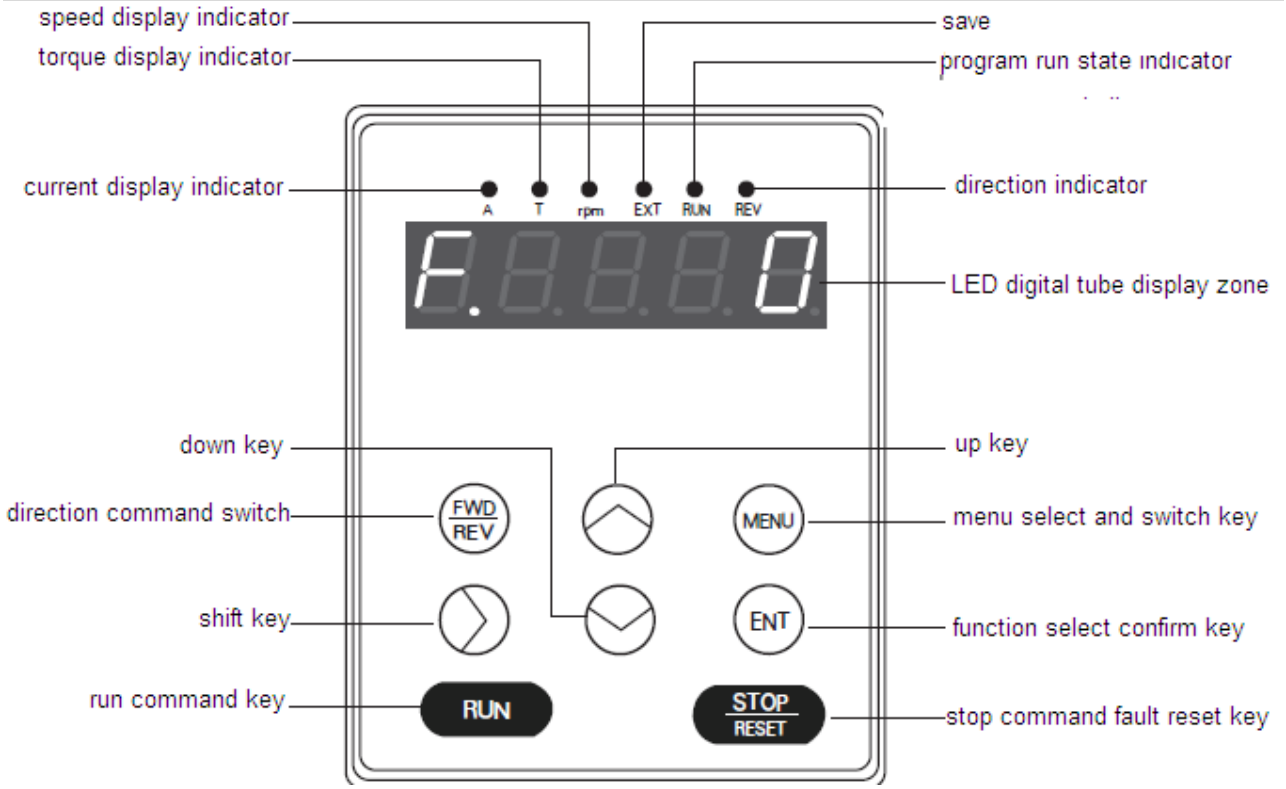


Figure 3-8 Manipulator diagram

Manipulator key function description

Please see Table 3-2 for function description of the manipulator key

Table 3-2 Manipulator key function

Key	Name	Function
MENU	Menu select and switch key	switching key of each menu item;
ENT	Confirm / enter key	Press the key in program state to return to the previous menu. Enter the next level menu; Complete selection of the parameter group in 1-level menu; Complete parameter value checking operation in 2-level menu; Complete modification and storage operation of the parameter value in 3-level menu;
∧	up key 32-bit data high order display key	Increase menu item, parameter item or modified parameter value progressively. The high order of the data may be displayed when displaying 32-bit data
∨	down key	Decrease menu item, parameter item or modified parameter value progressively.
>	Shift key 32-bit data low order display key	It's used to switch data bit of the parameter number when browse parameter items; The low order of the data may be displayed when displaying 32-bit data. When modifying data in program state, it can be used to modify the modified bit of the modified data.
RUN	run command key	It's used to start the driver in driver control mode;
STOP/RESET	fault reset key	It's used to reset driver reset when the driver is in fault alarm state.

FWD/REV	direction command switch key	It's used to select rotation direction of the driver in manipulator command control mode.

Manipulator LED indicator description

There are six LED indicators on the manipulator. They are on or off in various states. The detail description is as follows:

Current display indicator A:

It has two states of on and off which indicates that the data displayed in the current LED digital tube display zone is current parameter or not. On means current parameter is displayed in the LED digital tube display zone; off means that it's not current parameter displayed in the LED digital tube display zone.

Torque display indicator T:

It has two states of on and off which indicates that the data displayed in the current LED digital tube display zone is torque parameter or not. On means torque parameter is displayed in the LED digital tube display zone; off means that it's not torque parameter displayed in the LED digital tube display zone.

Speed display indicator rpm:

It has two states of on and off which indicates that the data displayed in the current LED digital tube display zone is speed parameter or not. On means speed parameter is displayed in the LED digital tube display zone; off means that it's not speed parameter displayed in the LED digital tube display zone.

Indicator EXT

Save;

Run state indicator RUN:

It has two states of on and off which indicates the run state of the system under various operating control orders. On means the driver is in operating state; off means the driver is shutdown.

Operating direction indicator REV:

It has two states of on and off which indicates the current operating direction of the driver. On means reverse operation of the driver; off means forward operation of the driver.

The operating state of the driver

22～315kw driver has four operating states after power-on: standby, operating, programming and fault alarm. They are described as follows:

Standby state

22～315kw driver is in standby state after power-on and before receiving any operating control order. The Run state indicator (RUN) on operation panel is off, and the default tandby state display function code of LED digital tube is F.0. User may make LED circling switch display Un and monitoring function parameter groups by press MENU key. In Un interface, user may make LED circling switch display Un, An and monitoring function parameter groups by pressing ∧,∨ key. Press ∧,∨ and > after pressing ENT to make LED circling switch display monitoring parameters defined in function parameter group, and then press ENT to check /monitor its value.

It will be limited by selection functional parameter A1.00 when user want to check / modify the content of parameter groups other than Un, An during operation. All of the parameters may be checked with A1.00=1.

Operating state

When 22～315kw driver in standby and no-fault state, it will enter operating state after receiving operating order.

In normal operating state, the Run state indicator (RUN) on operation panel is on. User may make LED circling switch display Un, An monitoring function parameter groups by press MENU key. User may make LED circling switch display Un, An and monitoring function parameter groups by pressing ∧,∨ key. Press ∧,∨ and > after pressing ENT to make LED circling switch display monitoring parameters defined in function parameter groups, and then press ENT to check /monitor its value.

Setting, modifying and editing state

For 22～315kw driver, user may switch to the state in which function code parameters can be modified through MENU, ENT, ∧, ∨and > on the operator panel. The state is programming state.

Function parameter value is displayed in programming state, and the bit to be modified is flashing.

Fault alarm state

In the state, 22～315kw driver fails and displays the fault code.

LED displays fault code in fault state, and terminal disconnection may enable user conducting fault reset operation.

Operative mode of the manipulator

Standby state:

The state of the manipulator is shown in Figure 3-9 when the driver is in standby state. The LED digital tube default display F. 0. At this point, user may press MENU to enter menu items, and check or modify parameters.

Figure 3-9 Standby state

Figure 3-10 Operating state

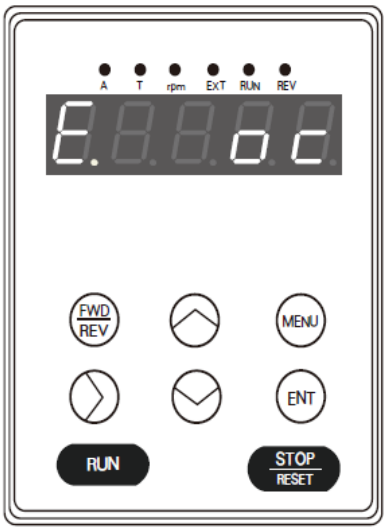


Figure 3-11 Fault alarm state

Operating state:

The driver enters operating state after receiving correct operation command in standby state. As shown in Figure 3-10, the LED digital tube default displays the set speed of the driver, e.g F. 500. In this state, user may press MENU to enter menu items, and check or modify parameters.

Fault alarm state

When fault is detected as the driver is in operating, standby or programming state, the corresponding fault information will be displayed immediately as shown in Figure 3-11.

When a fault occurs, the driver may enable driver reset through disconnection. If the fault has disappeared, it returns to the standby state; if the fault still exists, the fault code will be displayed again.

Use method of the manipulator

The section mainly introduces use of the manipulator, and basic operations of functions.

Parameter setting operation process

Parameter setting method of manipulator of 22～315kw driver adopts three-level menu structure. Parameter value of menu items can be checked and modified conveniently.

The three-level menu: menu item (1-level menu), parameter tem (2-level menu) and parameter setting (3-level menu). The operation process is shown in Figure 3-12.

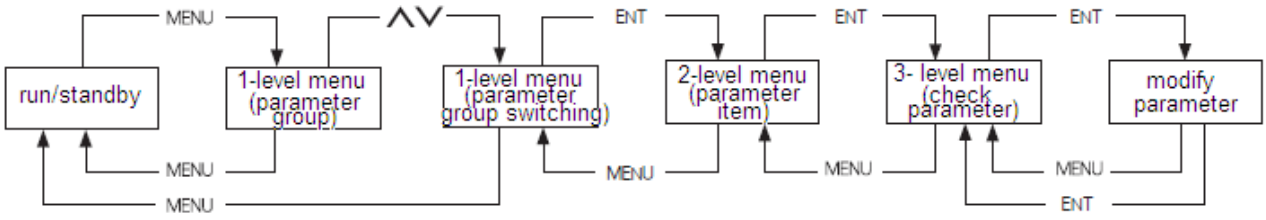


Figure 3-12 3-level menu operation flow chart

During operation in 3-level menu, user may return to 2-level menu by pressing MENU or ENTER (see Figure 3-12 and Figure 3-13). The difference between the two operations: after press ENTER key, the set

parameter value will be saved to the controller, and then return to 2-level menu; it will return to 2-level menu directly without saving the parameter value by pressing MENU. The detail operational procedures of 3-level menu are shown in Figure 3-13.

Modify the parameters with the manipulator

The flow chart of modify the parameters with the manipulator is shown in Figure 3-13.

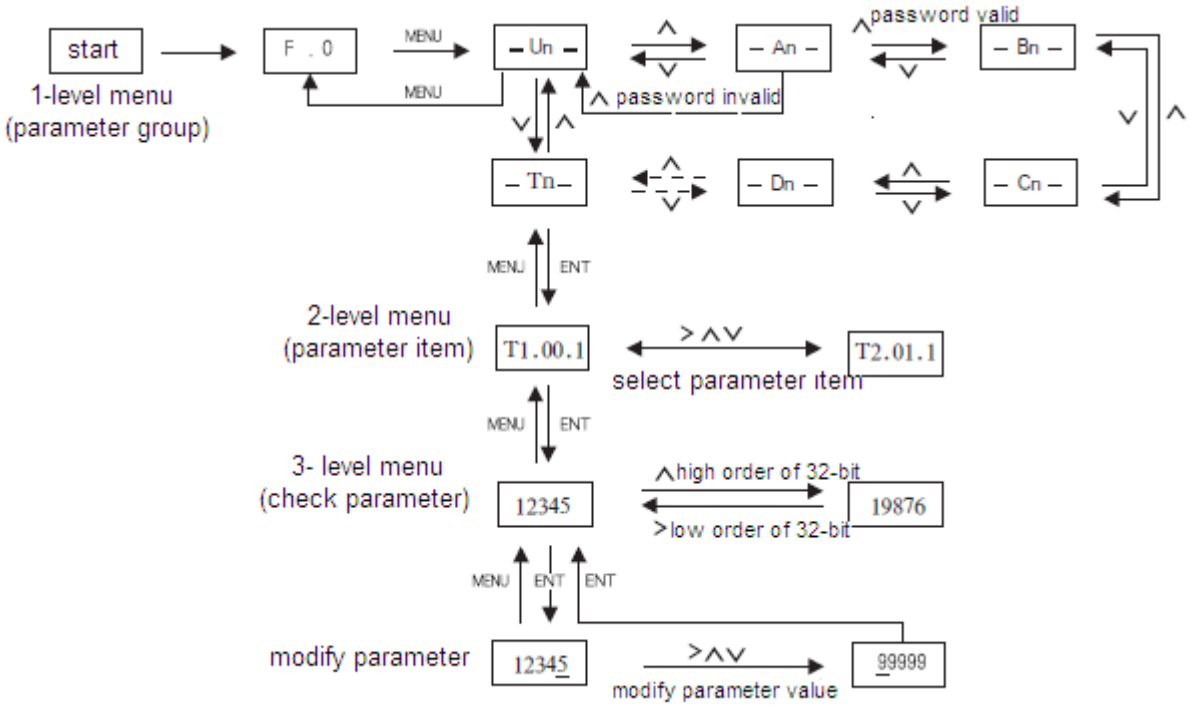


Figure 3-13 3-level menu operation flow chart

★ Description:

10 menu items are included in 1-level menu: Un menu, An menu, Bn menu, Cn menu, Dn menu, En menu, Fn menu, Pn menu, Sn menu and Tn menu. Please see parameter description for detailed function in 2-level menu.

Monitor operating state with the manipulator

Operation state, interface state and fault information of the driver can be monitored respectively through U1, U2 and U3 of the manipulator

Operation state monitoring

Operation state monitoring includes set speed F, output speed O, feedback speed b, output current A, output torque T and DC bus voltage U of the driver. Please see Figure 3-14 for monitoring method.

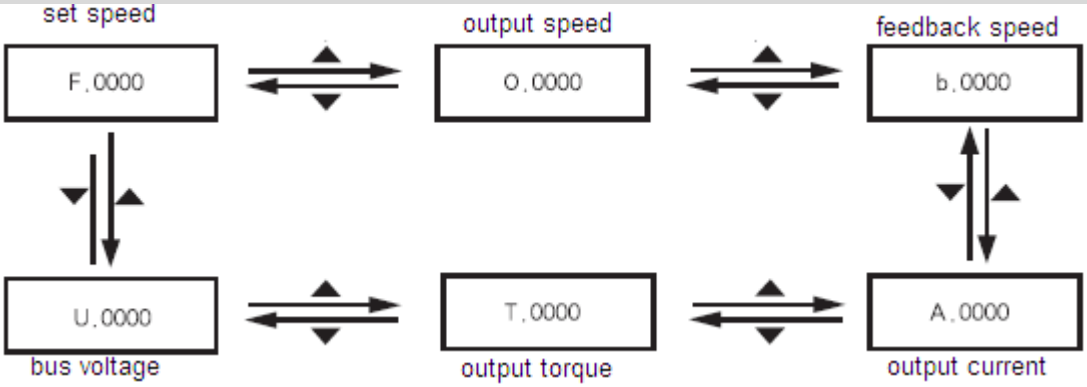


Figure 3-14 Driver operation state monitoring flowchart

Interface state monitoring

Interface state includes driver's encoder input interfaces U2.00, U2.01; switching value input terminals U2.02, U2.03; switching value output terminal U2.04, analog input interfaces U2.05, U2.06; output terminals U2.07, U2.08. The monitoring method is same with monitoring parameter, only needs to select corresponding parameter in U2. Please see U2 parameter monitoring table 2 for parameter number.

Fault information monitoring

The control panel will display the current fault message code when the driver is in fault state. The fault record of the driver can be checked through U3. The check operation is same with monitoring parameter, only needs to select corresponding parameter in U3. Please see parameter table of parameter number.

Configuration and key functions of the 0.4～18.5kw driver LCD manipulator

The chapter defines and describes terms and phrases for operation and state of 0.4～18.5kw driver manipulator, defines the operation methods of the driver and manipulator. Please read carefully. It's very helpful for proper use of the 0.4～18.5kw driver.

Manipulator

The manipulator is one of the standard equipment of 0.4～18.5kw driver. User may carry out parameter setting, state monitoring, operation control and other operations to the driver through the manipulator. It's very important to be familiar with function and operation of the manipulator for proper application of 0.4～18.5kw series driver. Please read the manual carefully before using.

Manipulator appearance diagram

Manipulator of 0.4～18.5kw driver is mainly composed of two parts of LCD display zone and keys. The appearance and functional zones are shown in Figure 3-15.

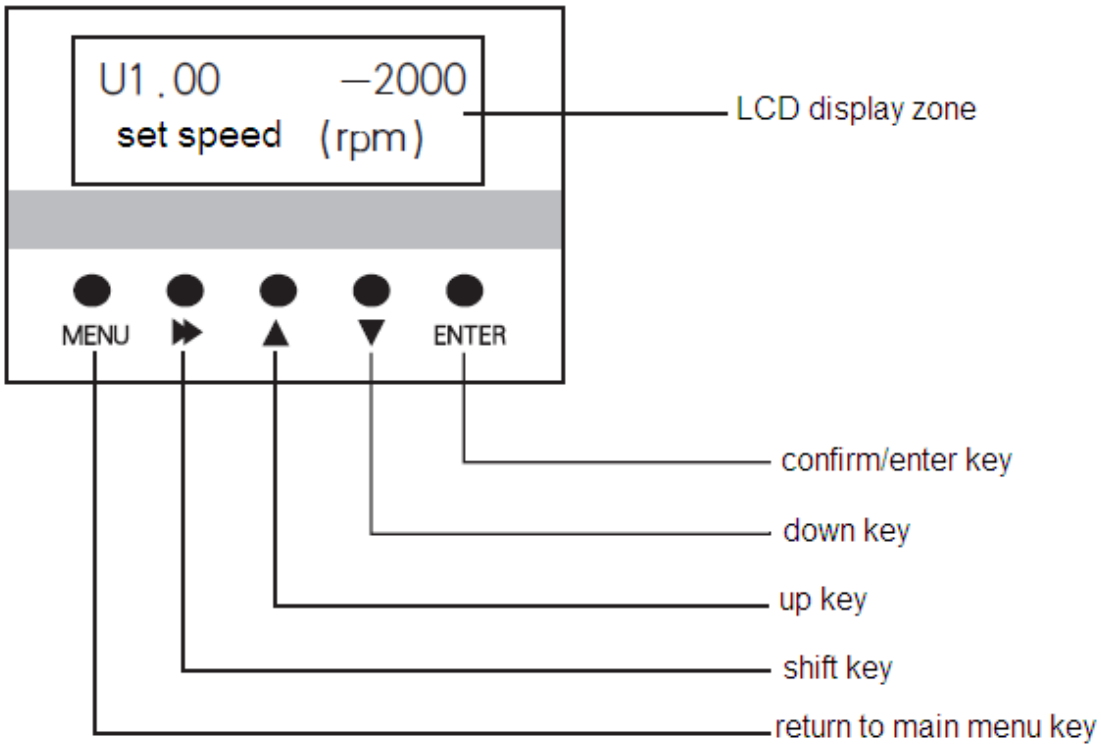


Figure 3-15 PO-S6 Manipulator diagram

Manipulator key function description

Please see Table 3-3 for function description of the manipulator key

Table 3-3 Manipulator key function

Key	Name	Function
MENU	Menu select and switch key	switching key of each menu item;
▶▶	Shift key	It's used to switch data bit of the parameter number when browse parameter items; The low order of the data may be displayed when displaying 32-bit data. When modifying data in program state, it can be used to modify the modified bit of the modified data.
▲	up key	Increase menu item, parameter item or modified parameter value progressively.
▼	down key	Decrease menu item, parameter item or modified parameter value progressively.
ENTER	Confirm / enter key	Press the key in menu state to enter parameter modifying interface; Complete modification and storage operation of the parameter value in the parameter modifying interface.

The operating state of the driver

0.4～18.5kw driver has four operating states after power-on: standby, operating, programming and fault alarm. They are described as follows:

Standby state

0.4～18.5kw driver is in standby state after power-on and before receiving any operating control order.

The default standby state display function code of LCD digital tube is F.0. User may make LCD circling switch display Un and monitoring function parameter groups by pressing MENU key. In Un interface, user may make LCD circling switch display Un, An and monitoring function parameter groups by pressing ▲ , ▼ key. Press ▲ , ▼ and ▶▶ after pressing ENTER to make LCD circling switch display monitoring parameters defined in function parameter group, and may check/monitor the value. Then press ENTER to modify its value.

It will be limited by selection functional parameter A1.00 when user want to check / modify the content of parameter groups other than Un, An during operation. All of the parameters may be checked with A1.00=1.

Operating state

When 0.4～18.5kw driver in standby and no-fault state, it will enter operating state after receiving operating order.

User may make LCD circling switch display Un and monitoring function parameter groups by pressing MENU key. In Un interface, user may make LCD circling switch display Un, An and monitoring function parameter groups by pressing ▲ , ▼ key. Press ▲ , ▼ and ▶▶ after pressing ENTER to make LCD circling switch display monitoring parameters defined in function parameter group, and may check/monitor the value. Then press ENTER to modify its value.

Setting, modifying and editing state

For 0.4～18.5kw driver, user may switch to the state in which function code parameters can be modified through MENU, ▲ , ▼ , ▶▶ and ENTER on the operator panel. The state is programming state.

Function parameter value is displayed in programming state, and the bit to be modified is displayed in inverse color.

Fault alarm state

In the state, 0.4～18.5kw driver fails and displays the fault code.

LCD displays fault code in fault state, and terminal disconnection may enable user conducting fault reset operation.

Operative mode of the manipulator

Standby state:

The state of the manipulator is shown in Figure 3-16 when the driver is in standby state. The LCD digital tube default display F. 0. At this point, user may press MENU to enter menu items, and check or modify parameters.

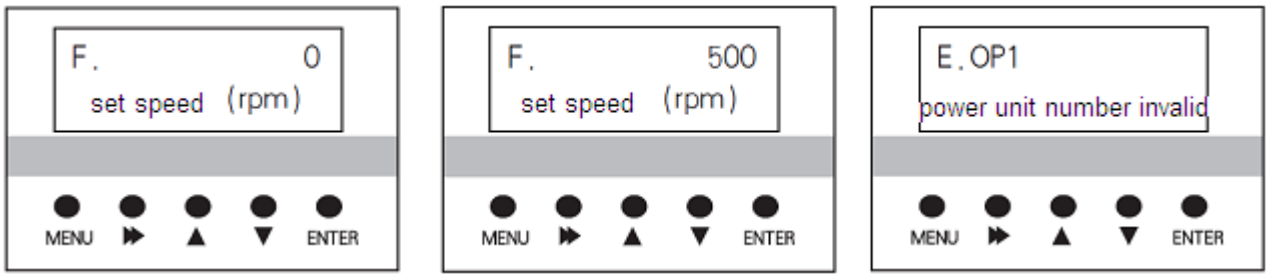


Figure 3-16 Standby state Figure 3-17 Operating state Figure 3-18 Fault alarm state

Operating state:

The driver enters operating state after receiving correct operation command in standby state. As shown in Figure 3-17, the LCD digital tube default displays the set speed of the driver, e.g F. 500. In this state, user may press MENU, ▲ , ▼ , ▶▶ and ENTER to enter menu items, and check or modify parameters.

Fault alarm state

When fault is detected as the driver is in operating, standby or programming state, the corresponding fault information will be displayed immediately as shown in Figure 3-18.

When a fault occurs, the driver may enable driver reset through disconnection. If the fault has disappeared, it returns to the standby state; if the fault still exists, the fault code will be displayed again.

Use method of the manipulator

Parameter setting operation process

Parameter setting method of manipulator adopts three-level menu structure. Parameter value of menu items can be checked and modified conveniently.

The three-level menu: menu item (1-level menu), parameter tem (2-level menu) and parameter setting (3-level menu). The operation process is shown in Figure 3-19.

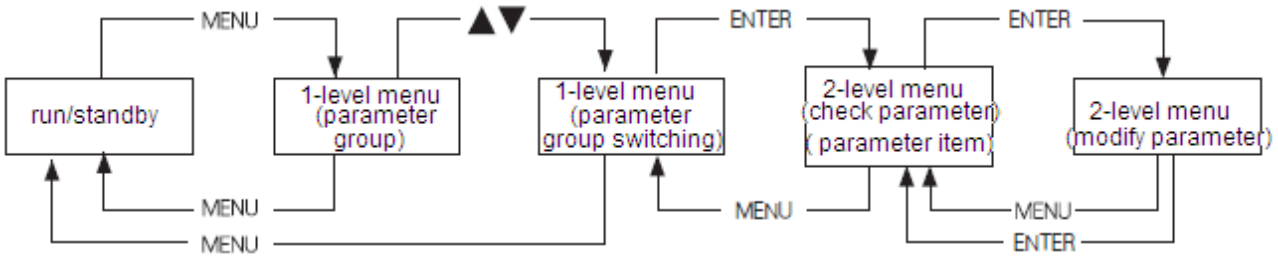


Figure 3-19 2-level menu operation flow chart

During operation in 2-level menu, user may return to 2-level menu by pressing MENU or ENTER. The difference between the two operations: after press ENTER key, the set parameter value will be saved to the controller, and then return to 2-level menu; it will return to 2-level menu directly without saving the parameter value by pressing MENU. The detail operational procedures of 2-level menu are shown in Figure 3-20.

Modify the parameters with the manipulator

The flow chart of modify the parameters with the manipulator is shown in Figure 3-20.

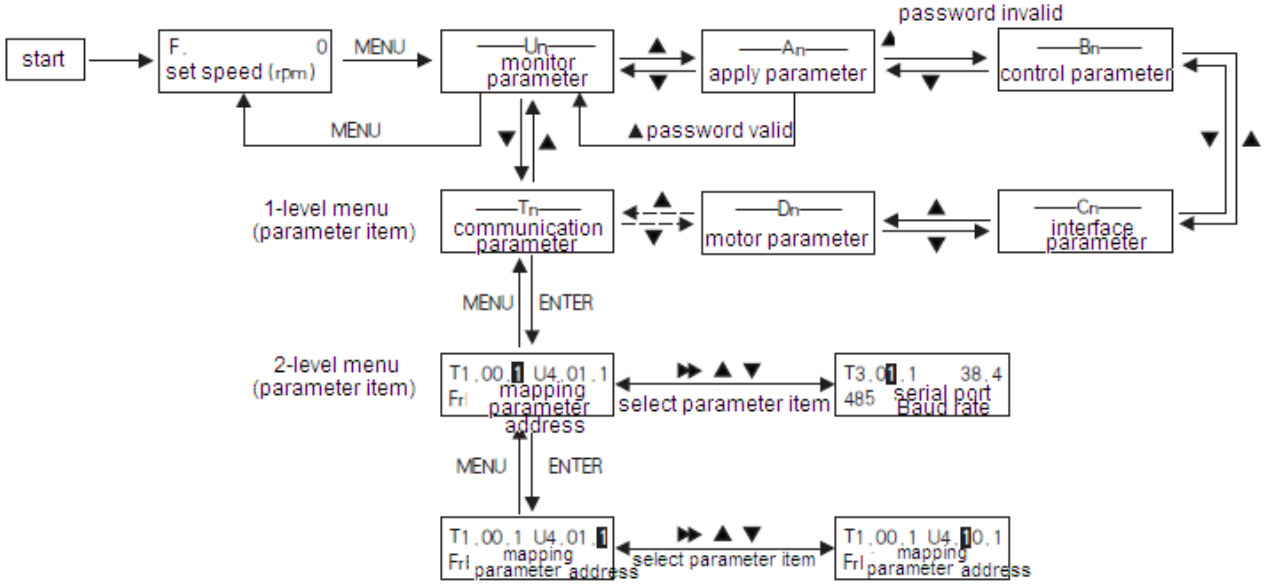


Figure 3-20 2-level menu operation flow chart

★ **Description:**

10 menu items are included in 1-level menu: Un menu, An menu, Bn menu, Cn menu, Dn menu, En menu, Fn menu, Pn menu, Sn menu and Tn menu. Please see parameter description for detailed function in 2-level menu.

Monitor operating state with the manipulator

Operation state, interface state and fault information of the driver can be monitored respectively through U1, U2 and U3 of the manipulator

Operation state monitoring

Operation state monitoring includes set speed F, output speed O, feedback speed b, output current A, output torque T and DC bus voltage U of the driver. Please see Figure 3-21 for monitoring method.

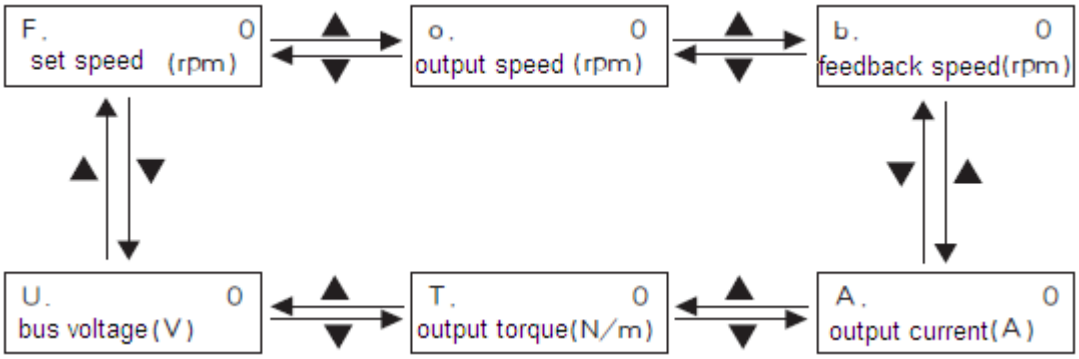


Figure 3-21 Driver operation state monitoring flowchart

Interface state monitoring

Interface state includes driver's encoder input interfaces U2.00, U2.01; switching value input terminals U2.02, U2.03; switching value output terminal U2.04, analog input interfaces U2.05, U2.06; output terminals U2.07, U2.08. The monitoring method is same with monitoring parameter, only needs to select corresponding parameter in U2. Please see U2 parameter monitoring table 2 for parameter number.

Fault information monitoring

The control panel will display the current fault message code when the driver is in fault state. The fault record of the driver can be checked through U3. The check operation is same with monitoring parameter, only needs to select corresponding parameter in U3. Please see fault state recording parameter table U3 for parameter number.

Configuration and key functions of the 22～315kw driver LCD manipulator

The chapter defines and describes terms and phrases for operation and state of 22～315kw driver manipulator, defines the operation methods of the driver and manipulator. Please read carefully. It's very helpful for proper use of the 22～315kw driver.

Manipulator

The manipulator is one of the standard equipment of 22～315kw driver. User may carry out parameter setting, state monitoring, operation control and other operations to the driver through the manipulator. It's very important to be familiar with function and operation of the manipulator for proper application of 22～315kw series driver. Please read the manual carefully before using.

Manipulator appearance diagram

Manipulator of 22～315kw driver is mainly composed of three parts of LED indicator, LCD display zone and keys. The appearance and functional zones are shown in Figure 3-22.

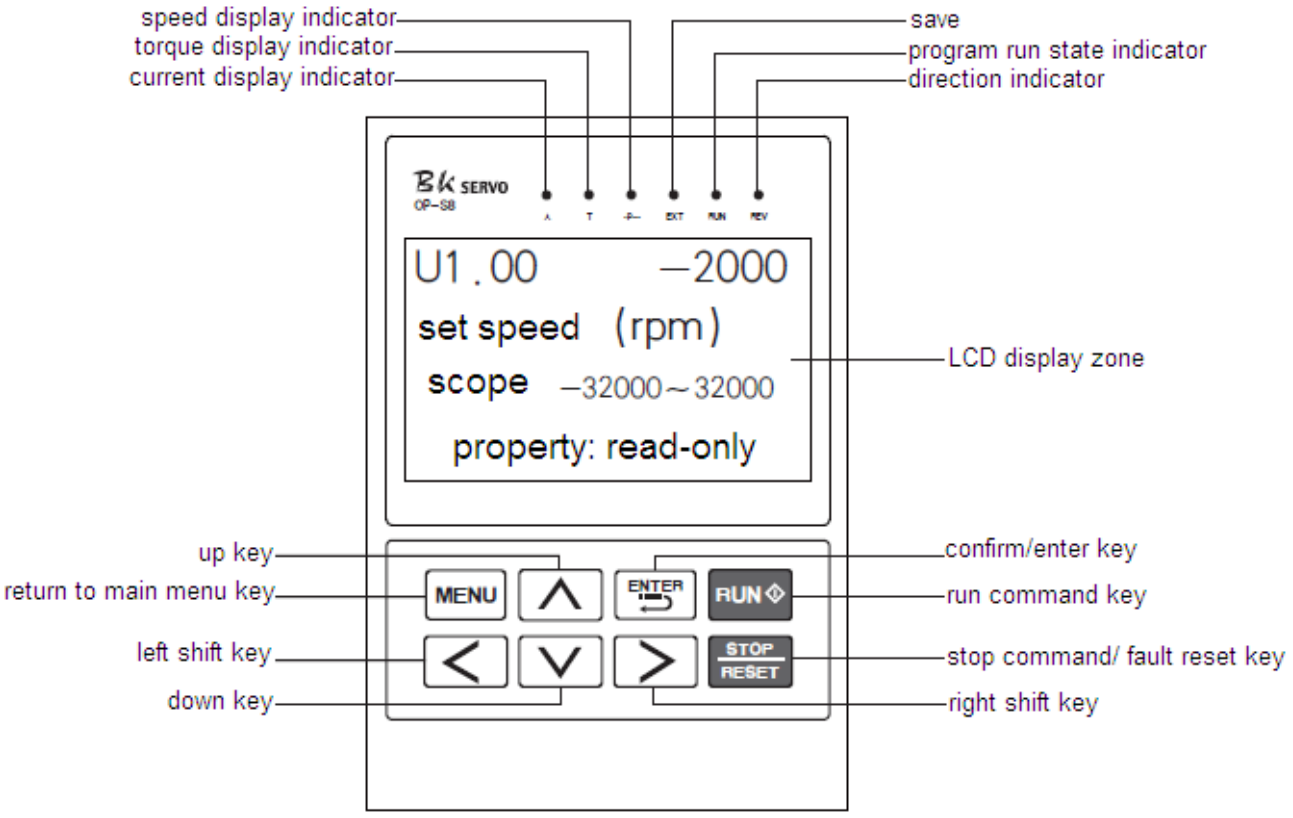


Figure 3-22 PO-S8 Manipulator diagram

Manipulator key function description

Please see Table 3-4 for function description of the manipulator key

Table 3-4 Manipulator key function

Key	Name	Function
MENU	Menu select and switch key	Switching key of each menu item;
>	Right shift key	It's used to switch data bit of the parameter number when browse parameter items; It's used to change the modified bit of the modified data when change parameter.
<	left shift key	It's used to change the modified bit of the modified data when change parameter.
∧	up key	Increase menu item, parameter item or modified parameter value progressively.
∨	down key	Decrease menu item, parameter item or modified parameter value progressively.
ENTER	Confirm / enter key	Press the key in menu state to enter parameter modifying interface; Complete modification and storage operation of the parameter value in the parameter modifying interface.
STOP/RESET	Fault reset key	It's used for reset of driver fault when the driver is in fault alarm state.
FWD/REV	Direction command switch key	It's used to select the run operation of the driver when the driver is in command control mode; the key indicator automatically displays the run direction of the driver during terminal control.

Manipulator LED indicator description

There are six LED indicators on the manipulator. They are on or off in various states. The detail description is as follows:

Current display indicator A:

It has two states of on and off which indicates that the data displayed in the current LCD display zone is current parameter or not. On means current parameter is displayed in the LCD display zone; off means that it's not current parameter displayed in the LCD display zone.

Torque display indicator T:

It has two states of on and off which indicates that the data displayed in the current LCD display zone is torque parameter or not. On means torque parameter is displayed in the LCD display zone; off means that it's not torque parameter displayed in the LCD display zone.

Speed display indicator rpm:

It has two states of on and off which indicates that the data displayed in the current LCD display zone is speed parameter or not. On means speed parameter is displayed in the LCD display zone; off means that it's not speed parameter displayed in the LCD display zone.

Indicator EXT

Save;

Run state indicator RUN:

It has two states of on and off which indicates the run state of the system under various operating control orders. On means the driver is in operating state; off means the driver is shutdown.

Operating direction indicator REV:

It has two states of on and off which indicates the current operating direction of the driver. On means reverse operation of the driver; off means forward operation of the driver.

The operating state of the driver

22～315kw driver has four operating states after power-on: standby, operating, programming and fault alarm. They are described as follows:

Standby state

22～315kw driver is in standby state after power-on and before receiving any operating control order. The default standby state display function code of LCD is F.0. User may make LCD circling switch display Un and monitoring function parameter groups by pressing MENU key. In Un interface, user may make LCD circling switch display Un, An and monitoring function parameter groups by pressing ∧, ∨ key. Press∧, ∨, > and < after pressing ENTER to make LCD circling switch display monitoring parameters defined in function parameter group, and may check/monitor the value. Then press ENTER to modify its value.

It will be limited by selection functional parameter A1.00 when user want to check / modify the content of parameter groups other than Un, An during operation. All of the parameters may be checked with A1.00=1.

Operating state

When 22～315kw driver in standby and no-fault state, it will enter operating state after receiving operating order.

User may make LCD circling switch display Un and monitoring function parameter groups by pressing MENU key. In Un interface, user may make LCD circling switch display Un, An and monitoring function parameter groups by pressing ∧, ∨key. Press ∧, ∨, > and < after pressing ENTER to make LCD circling switch display monitoring parameters defined in function parameter group, and may check/monitor the value. Then press ENTER to modify its value.

Setting, modifying and editing state

For 22～315kw driver, user may switch to the state in which function code parameters can be modified through MENU, ENTER, ∧, ∨, > and < on the operator panel. The state is programming state.

Function parameter value is displayed in programming state, and the bit to be modified is displayed in inverse color.

Fault alarm state

In the state, 22～315kw driver fails and displays the fault code.

LCD displays fault code in fault state, and terminal disconnection may enable user conducting fault reset operation.

Operative mode of the manipulator

Standby state:

The state of the manipulator is shown in Figure 3-23 when the driver is in standby state. The LCD default displays F. 0. At this point, user may press MENU to enter menu items, and check or modify parameters.

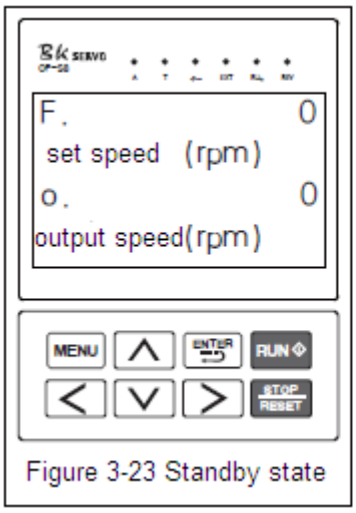


Figure 3-23 Standby state

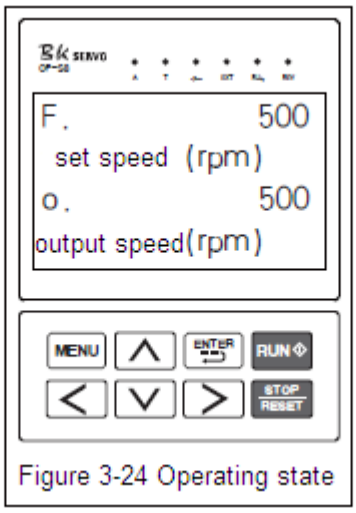


Figure 3-24 Operating state

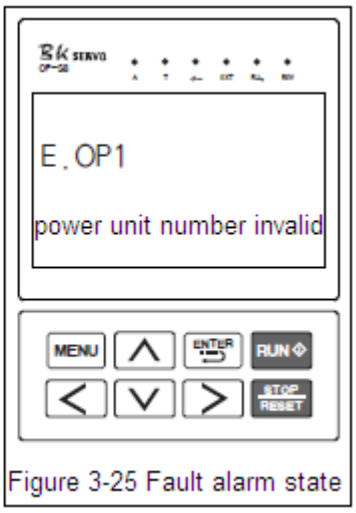


Figure 3-25 Fault alarm state

Operating state:

The driver enters operating state after receiving correct operation command in standby state. As shown in Figure 3-24, the LCD digital tube default displays the set speed of the driver, e.g F. 500. In this state, user may press MENU, ENTER, ∧, ∨, > and < to enter menu items, and check or modify parameters.

Fault alarm state

When fault is detected as the driver is in operating, standby or programming state, the corresponding fault information will be displayed immediately as shown in Figure 3-25.

When a fault occurs, the driver may enable driver reset through disconnection. If the fault has disappeared, it returns to the standby state; if the fault still exists, the fault code will be displayed again.

Use method of the manipulator

Parameter setting operation process

Parameter setting method of manipulator adopts 2-level menu structure. Parameter value of menu items can be checked and modified conveniently.

The 2-level menu: menu item (1-level menu), parameter and parameter setting value tem (2-level menu).

The operation process is shown in Figure 3-26.

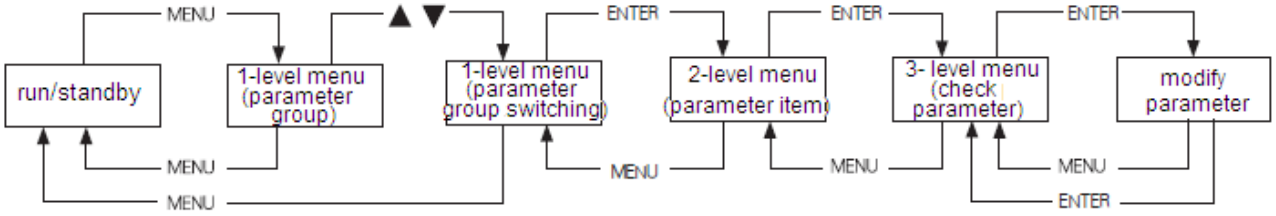


Figure 3-6 2-level menu operation flow chart

During operation in 2-level menu, user may return to 2-level menu by pressing MENU or ENTER. The difference between the two operations: after press ENTER key, the set parameter value will be saved to the controller, and then return to 2-level menu; it will return to 2-level menu directly without saving the parameter value by pressing MENU. The detail operational procedures of 2-level menu are shown in Figure 3-27.

Modify the parameters with the manipulator

The flow chart of modify the parameters with the manipulator is shown in Figure 3-27.

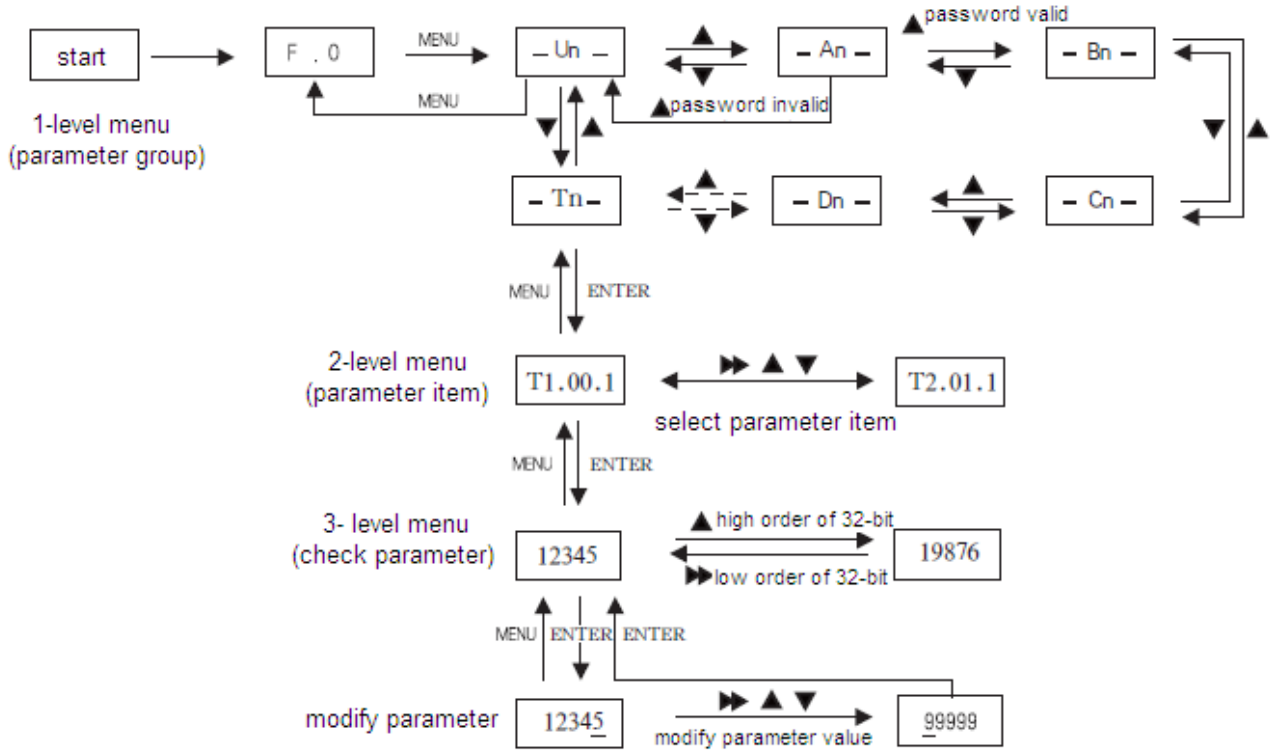


Figure 3-27 2-level menu operation flow chart

★ Description:

10 menu items are included in 1-level menu: Un menu, An menu, Bn menu, Cn menu, Dn menu, En menu, Fn menu, Pn menu, Sn menu and Tn menu. Please see parameter description for detailed function in 2-level menu.

Monitor operating state with the manipulator

Operation state, interface state and fault information of the driver can be monitored respectively through U1, U2 and U3 of the manipulator

Operation state monitoring

Operation state monitoring includes set speed F, output speed O, feedback speed b, output current A, output torque T and DC bus voltage U of the driver. Please see Figure 3-21 for monitoring method.

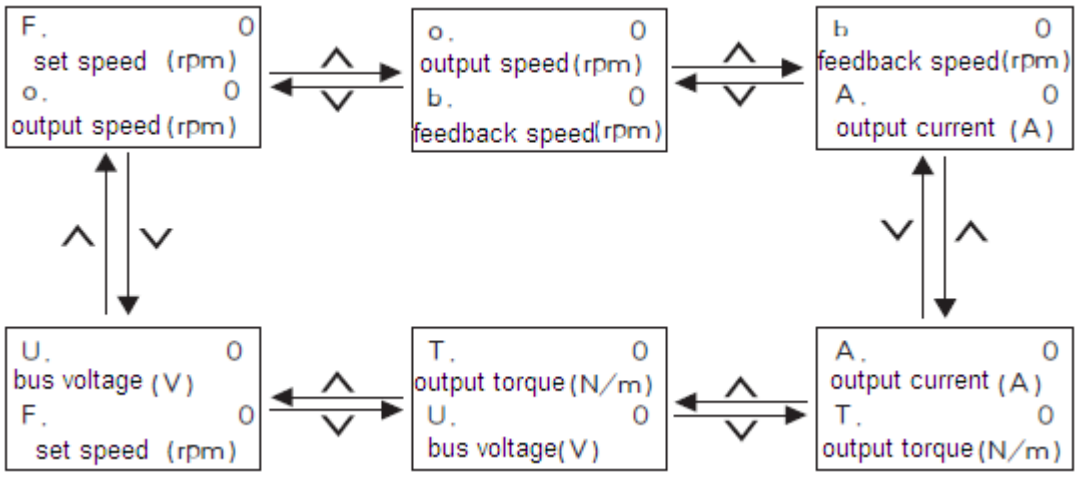


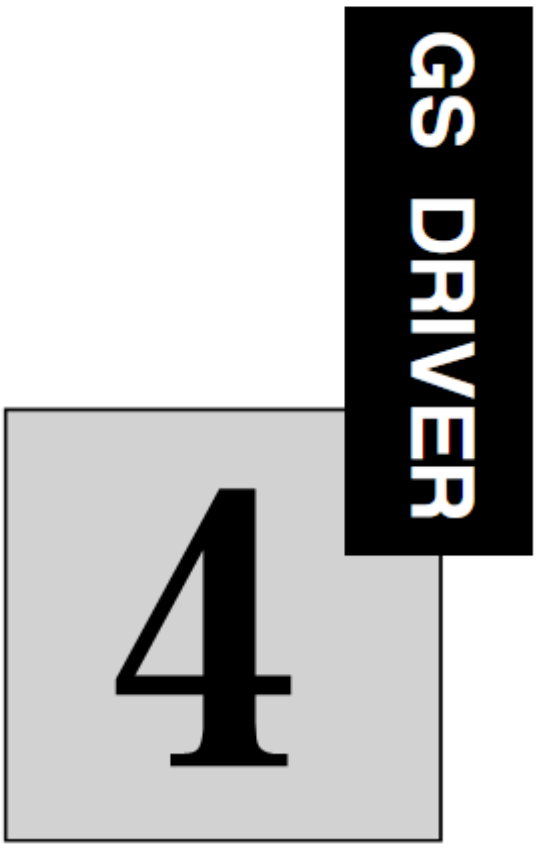
Figure 3-28 Driver operation state monitoring flowchart

Interface state monitoring

Interface state includes driver's encoder input interfaces U2.00, U2.01; switching value input terminals U2.02, U2.03; switching value output terminal U2.04, analog input interfaces U2.05, U2.06; output terminals U2.07, U2.08. The monitoring method is same with monitoring parameter, only needs to select corresponding parameter in U2. Please see U2 parameter monitoring table 2 for parameter number.

Fault information monitoring

The control panel will display the current fault message code when the driver is in fault state. The fault record of the driver can be checked through U3. The check operation is same with monitoring parameter, only needs to select corresponding parameter in U3. Please see fault state recording parameter table U3 for parameter number.

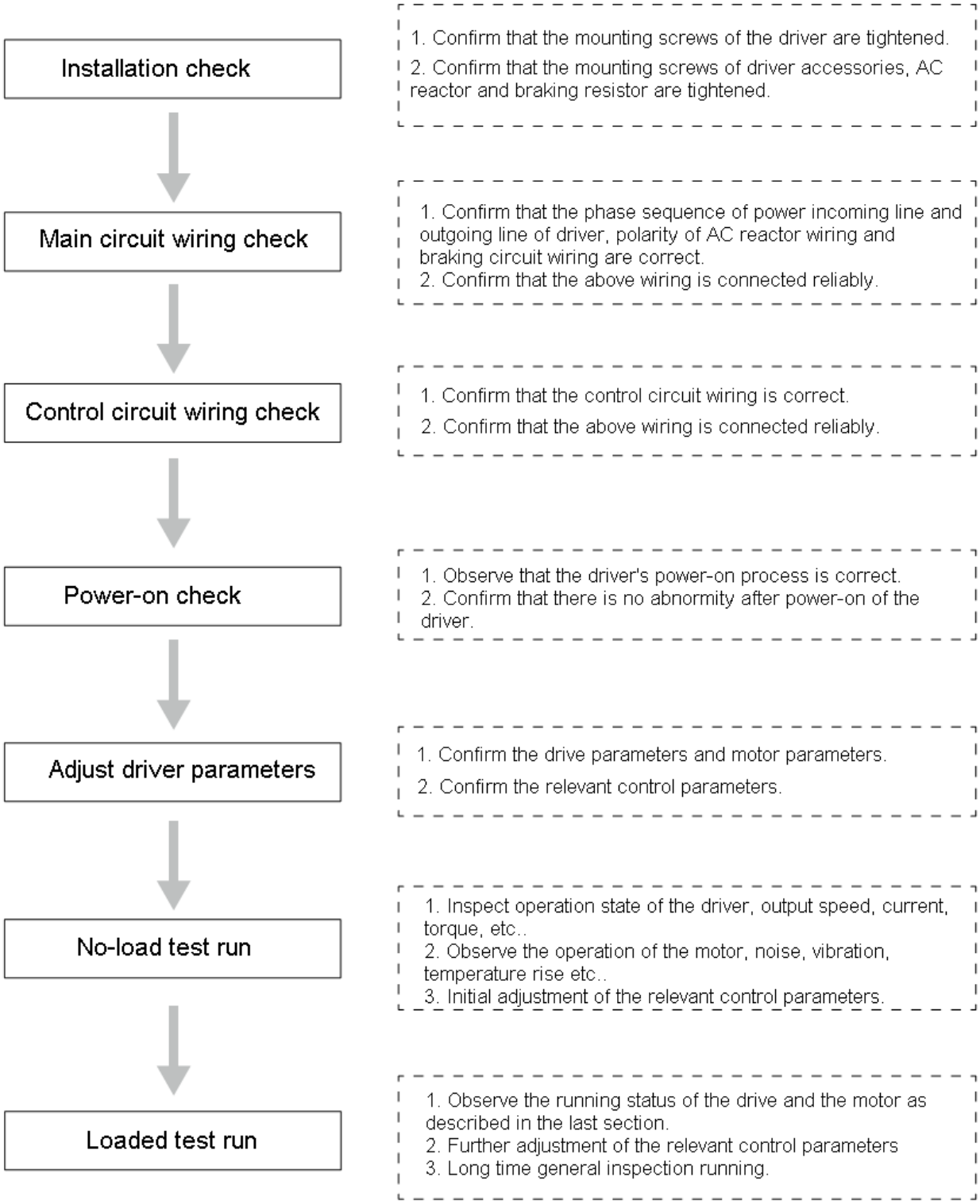


Test run

The chapter describes methods and precautions for initial test run of the driver

Basic procedure of test run

The initial power-on operation of the driver shall be carried out by the following procedures, otherwise, accident, damage to equipment or other hazards are likely to happen.



Confirmation of the connection of the main circuit

Please confirm the following contents in connection of the main circuit

1. Connect the connecting wire on driver R / S / T to 3-phase power frequency power supply. The voltage of the power supply shall meet the requirements of the drive.

2. The driver is equipped with built-in braking unit. The braking resistor is connected to P / PB. Do not connect any connect wire to N terminal.

3. When the output terminal of the driver is connected to the motor, it shall by ensured that their phase sequences are same, otherwise, he motor cannot operate normally, and prone to burn the equipment. If shield cable is used for output cable, the shielding layer at the ends of the cable shall be connected respectively to ground terminal of the drive and motor.

4. When filtering magnet ring is installed on the output line, it shall be close to the driver side as possible. The shielding layer and ground line cannot pass through the magnet ting, and the magnet ting cannot be in contact with the U / V / W terminal.

5.The driver and motor must be well grounded.

6. Confirm all connecting wire are connected reliably.

Control circuit wiring confirmation

Please confirm the following contents for control circuit wiring and jumper

1. Confirm the terminal input state is connected correctly by the design requirements. PNP mode shall be selected when output signal of the CNC system is 24V; NPN mode shall be selected when output signal of the CNC system is 0V (by modifying A2.46).

2. It's prohibited to connect the high-voltage line to the control signal.

3. Analog signal input signal connecting line must use shielded cable. The shielded cable shall be connected to housing of the connector.

4. When use 0 ~ 10V as speed set, confirm that parameter A2.02 is 1 or not.

5. Cable for motor encoder shall use the standard cable provided by the manufacturer.

6. Connecting wire from encoder output to the CNC system must use shielded twisted pair cable.

7. Confirm all control signals are connected firmly.

8. ST terminal is driver enabling. The driver cannot start work without input at ST.

 **Caution**
● The wire connection must be inspected carefully before initial power-on of the driver, otherwise, it's prone to accidents

Motor and driver parameters confirmation

The default parameters of GS series AC servo spindle driver shall be basically in conformity with the practical application. Most of the parameters do not need modification. For initial application, user shall modify or confirm part of the parameters as required.

Parameters need to be confirmed in test run

● Motor and driver parameters: D1, D1.00 ~ D1.05.

● Basic control parameters:A2, A2.00~ A2.35.

● Control relevant parameter:A3, A3.00~ A3.69.

Motor self-learning

Notes for self-learning

1.The parameters of the nameplate of the controlled motor shall be input correctly before self-learning.

2. Before self-learning, ensure that the motor is in stop state, otherwise, the self-learning may not be performed normally.

3. The rated current of the motor is higher, the self-learning time of the motor is longer.

Self-learning method

1. Unplug T3 terminal, ensure that there isn't signal input for ST.

2. Set A1.10=7, and the servo driver will start the self-learning mode, and the LED displays LEAr.

3. The self-learning succeeds when the LED displays F.0.

4. Set A1.11=1 to conduct self-matching of the motor parameters.

No-load test run

Test run is carried out with default parameters: analog-10V ~ +10 V speed setting. The process is as follows:

(1) Apply 1V voltage to FV-Fc, set input enabling signal ST and forward signal I1.

Monitor the following data:

◇ The given speed U1.00 is displayed as 10% of parameter A3.23. A few turns deviation is normal and can be adjusted through parameter A3.

◇ The feedback speed U1.02 is in conformity with the given speed.

◇ Output current U1.03, deviation below 30% of rated current is normal.

◇ Output torque U1.04, deviation below 10% of rated torque is normal..

Observe the following phenomenon:

◇ Is the driver fan running?

◇ Is the motor fan running with correct direction?

◇ Is the motor running smoothly?

◇ Is there abnormal sound during motor operation?

◇ Is surface temperature of the motor normal?

(2) Forward I1 signal

◇Observe the deceleration of the motor is normal or not.

◇Observe heating of braking resistor (braking unit) is serious or not?

(3) Increase speed continuously, and repeat the first and second step, and monitor operation of the driver and motor. The equipment must be shutdown immediately for inspection for any abnormalities, and contact with technical personnel of the manufacturer if necessary.

Loaded test run

Attention shall be paid to the following contents during loaded test run of the driver:

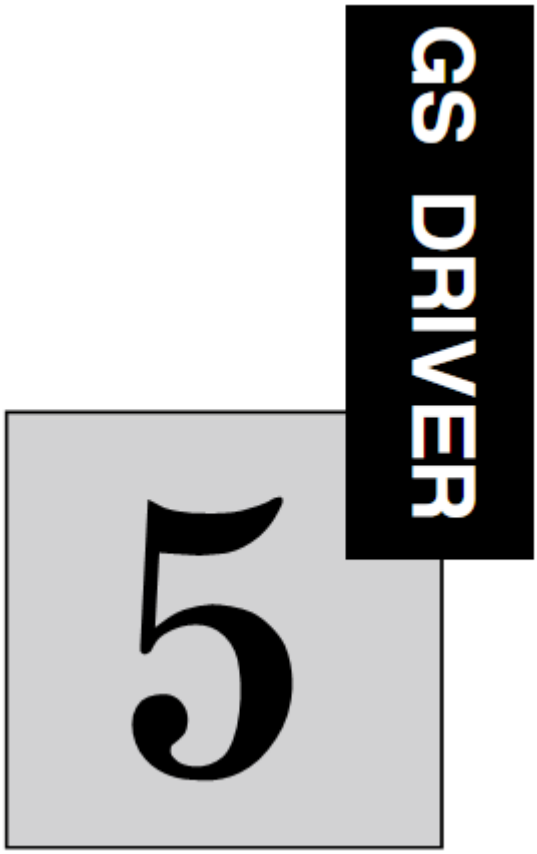
1. Loading gradually from small to large. Please inspect or contact with the manufacturer for over loading.

2. Monitor feedback speed, output current and output torque of the driver constantly during loading; observe motor vibration and noise and temperature rise continuously. The equipment shall be shutdown timely for any abnormalities.

3. To avoid accident, the motor shall be stopped before adjusting motor parameters. The parameter regulating quantity shall not be too big.

4. Do not make overload test or destructive test to avoid burning of the driver and motor.

 **Caution**
If the following situations occur, please shut down immediately and inspect, or contact the manufacturer. 1. Major fluctuation of feedback speed, output current and output torque of the driver, or reach the limit. 2. The motor operation is abnormal with abnormal vibration and noise. 3. Mechanical equipment abnormalities

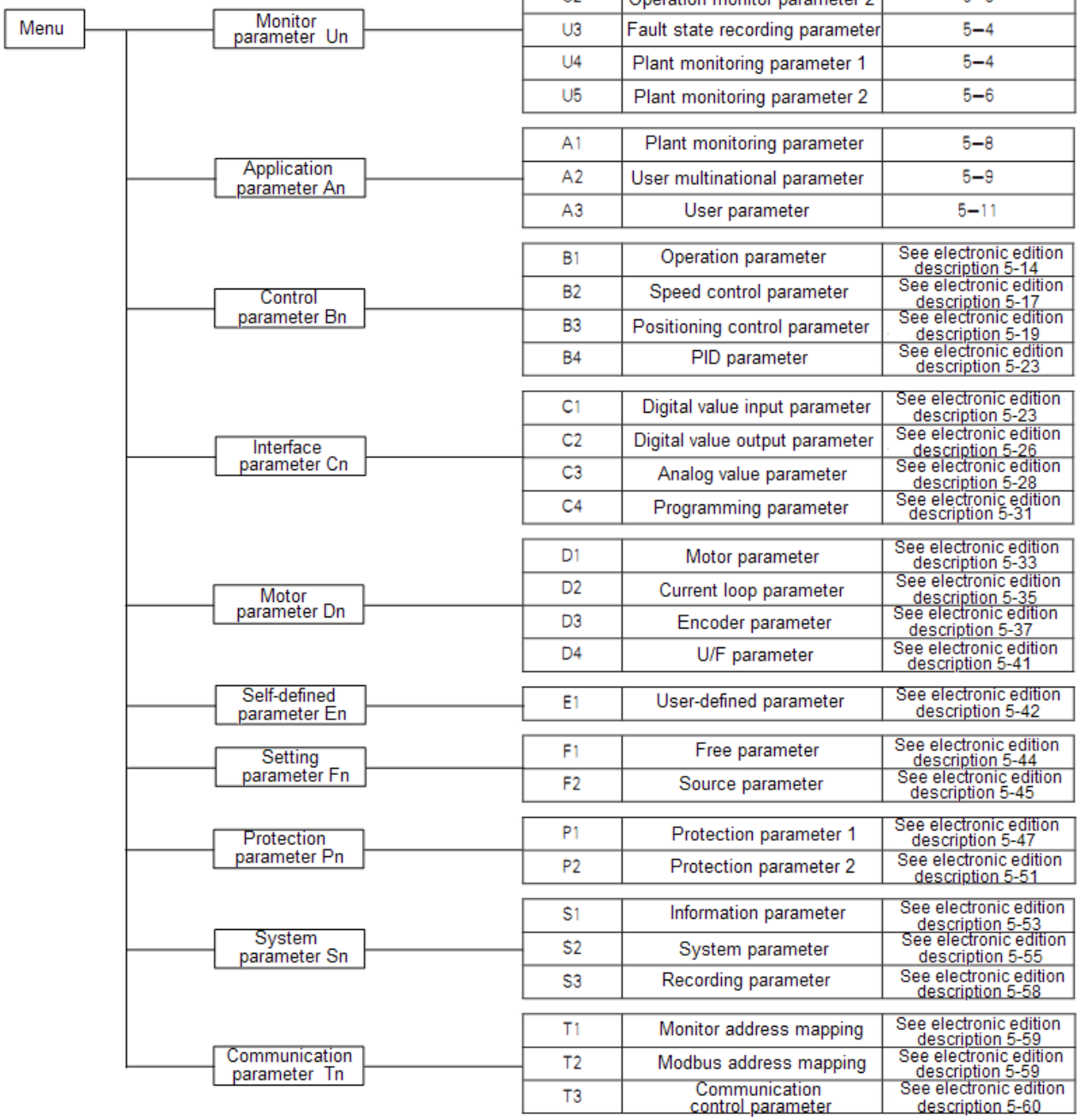


Parameter list

The chapter describes all of parameters of the driver.

Hierarchical structure diagram of display function of the manipulator

The following is hierarchical structure of display function of transducer manipulator.



Function number	Function	Reference page
U1	Operation monitor parameter 1	5–3
U2	Operation monitor parameter 2	5–3
U3	Fault state recording parameter	5–4
U4	Plant monitoring parameter 1	5–4
U5	Plant monitoring parameter 2	5–6
A1	Plant monitoring parameter	5–8
A2	User multinational parameter	5–9
A3	User parameter	5–11
B1	Operation parameter	See electronic edition description 5-14
B2	Speed control parameter	See electronic edition description 5-17
B3	Positioning control parameter	See electronic edition description 5-19
B4	PID parameter	See electronic edition description 5-23
C1	Digital value input parameter	See electronic edition description 5-23
C2	Digital value output parameter	See electronic edition description 5-26
C3	Analog value parameter	See electronic edition description 5-28
C4	Programming parameter	See electronic edition description 5-31
D1	Motor parameter	See electronic edition description 5-33
D2	Current loop parameter	See electronic edition description 5-35
D3	Encoder parameter	See electronic edition description 5-37
D4	U/F parameter	See electronic edition description 5-41
E1	User-defined parameter	See electronic edition description 5-42
F1	Free parameter	See electronic edition description 5-44
F2	Source parameter	See electronic edition description 5-45
P1	Protection parameter 1	See electronic edition description 5-47
P2	Protection parameter 2	See electronic edition description 5-51
S1	Information parameter	See electronic edition description 5-53
S2	System parameter	See electronic edition description 5-55
S3	Recording parameter	See electronic edition description 5-58
T1	Monitor address mapping	See electronic edition description 5-59
T2	Modbus address mapping	See electronic edition description 5-59
T3	Communication control parameter	See electronic edition description 5-60

Parameter list description

1. The contents of the parameter list are described as follows:

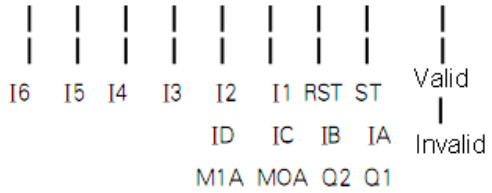
Function code:	Code of parameter group and parameter number;
Name:	Name of the parameter;
Description:	Detailed description about function and effective setting value of the parameter;
Setting range:	The range of effective setting value of parameter;
Unit:	Parameter setting unit;
Factory setting:	Original factory parameter setting;
Change:	Parameter changing properties (ie, allow changing or not and change condition) are as follows: "○": indicates the setting of the parameter may be changed in shutdown, operating state of the driver; "×": indicates the setting of the parameter cannot be changed in operating state of the driver; "-": indicates changing of setting of the parameter by user is prohibited; "*": indicates the value of the parameter actually measured value, and cannot be changed.

Monitoring parameter Un

■ U1: operation monitoring parameter 1

Function code	Name	Description	Unit
U1.00	Set speed/frequency	Speed is displayed with maximum speed＜10000rpm;frequency is displayed with maximum speed≥10000rpm	Speed : rpm Frequency: Hz
U1.01	Output speed/ frequency		
U1.02	Feedback speed/ frequency		
U1.03	Driver output current	—	A
U1.04	Actual feedback torque of the motor	Range: -32767∽32767	n.m
U1.05	Driver DC bus voltage	DC bus voltage =AC power voltage x1.414	V

■ U2: operation monitoring parameter 2

Function code	Name	Description	Setting range	Unit
U2.00	Motor encoder count value	Motor encoder 4 frequency multiplication counting	-	PULSE
U2.01	External encoder input /PULSE input count value	4 frequency multiplication counting as encoder input. 2 frequency multiplication counting as single PULSE input, 4 frequency multiplication counting as double PULSE input.	-	PULSE
U2.02	Switching value I1-I6, ST, RST input state		-	—
U2.03	Internal switching value IA-ID input state		-	—
U2.04	Switching value output state of MIA, MOA, Q2, Q1		-	—
U2.05	Analog input FI digital value	Analog 0～+10V Digital quantity 0～4095	-	-
U2.06	Analog input FV digital value	Analog -10 ～0～+10V Digital quantity -0～2047～4095	-	-
U2.07	Analog input TS digital value	Analog -10 ～0～+10V Digital quantity -0～2047～4095	-	-
U2.08	Analog input FT digital value	Analog -10 ～0～+10V Digital quantity -0～2047～4095	-	-
U2.09	Module temperature	Driver power module temperature display	-	℃
U2.10	Driver temperature	Display temperature of inside of the driver	-	℃
U2.11	Accurate stop deviation monitoring	Adjust stop position of the motor	-	PULSE

■ U3: fault state recording parameter

Function code	Name	Description	Set range	Unit	Factory setting	Modification
U3.00	Current fault code	See fault description for detail (Chapter 7)	—	—	0	*
U3.01	last 1st fault code		—	—	0	*
U3.02	last 2nd fault code		—	—	0	*
U3.03	last 3rd fault code		—	—	0	*
U3.04	last 4th fault code		—	—	0	*
U3.05	last 5th fault code		—	—	0	*
U3.06	last 6th fault code		—	—	0	*
U3.07	last 7th fault code		—	—	0	*
U3.08	last 8th fault code		—	—	0	*

■ U4: plant monitoring parameter 1

Function code	Name	Description	Set range	Unit	Modification
U4.00	Driver state	The driver state displays the present working condition of the transducer (e.g. constant forward, static). If a fault occurs, the present error information will be displayed	—	—	*
U4.01	Set speed	Actual set speed	-32000~32000	rmp	*
U4.02	Slope output speed	Slope output speed	-32000~32000	rmp	*
U4.03	Actual frequency	Actual transducer output frequency	-32000~32000	Hz	*
U4.04	Encoder 1 frequency	Encoder 1 output frequency	-32000~32000	Hz	*
U4.05	Encoder 2 frequency	Encoder 2 output frequency	-32000~32000	Hz	*
U4.06	Calculated actual speed	Actual speed through calculation	-32000~32000	rmp	*
U4.07	Actual speed	Actual speed of encoder	-32000~32000	rmp	*
U4.08	Save	—	—	—	—
U4.09	Encoder 1 speed	Actual speed measured on encoder input 1	-32000~32000	rmp	*
U4.10	Encoder 2 speed	Actual speed measured on encoder input 2	-32000~32000	rmp	*

U4.11	Given torque value display	Present given torque	-32000.00~32000.00	N.m	*
U4.12	Actual torque value display	Present actual speed	-32000.00~32000.00	N.m	*
U4.13	Actual use ratio	The present use ratio of the rated current of the driver	0~65535	%	*
U4.14	Peak value use ratio	Record rated current peak use ratio	0~65535	%	*
U4.15	effective current	Actual effective current	0.0~6553.5	A	*
U4.16	Peak effective current	Record short time peak valid current in an operation circle	0.0~6553.5	A	*
U4.17	Torque current	active current formed by torque	-3276.7~3276.7	A	*
U4.18	AC bus voltage	DC bus voltage =AC power cable voltage x 1.414	0~1500	V	*
U4.19	Peak bus voltage	Record short time bus voltage peak value in an operation circle	0~1500	V	*
U4.20	Output voltage	Present output voltage	0~1167	V	*
U4.21	Input terminal (hardware) state	1:ST 2: RST 4: I5 8:I6 16:I1 32:I2 64:I3 128:I4 256:IA 512:IB 1024:IC 2048:ID	0~4095	—	*
U4.22	Input terminal (software) state		0~4095	—	*
U4.23	Output condition state	The parameter displays the switch condition met through programmable logic connection or before change: 1: switch condition 0 2: switch condition 1 4: switch condition 2 8: switch condition 3 16: switch condition 4 32: switch condition 5 64: switch condition 6 128: switch condition 7	0~255	—	*
U4.24	Output flag bit state	Connect the selected switch condition, and display it here: 1: flag bit 0 2: flag bit 1 4: flag bit 2 8: flag bit 3 16: flag bit 4 32: flag bit 5 64: flag bit 6 128: flag bit 7	0~255	—	*

U4.25	Output terminal state	Present set external output and internal output: 1: Q1(transistor output) 2: Q2(transistor output) 4: M01(relay output) 8: M1A(relay output) 16: OA(internal output A) 32: OB(internal output B) 64: OC(internal output C) 128: OD(internal output D)	0~255	—	*
U4.26	Present parameter set	The driver has 8 parameter sets (0-7). The driver may modify the parameter sets by its own through programming, and thus may start different operation mode.	0~7	—	*
U4.27	Analog value input FI front end display	The corresponding percentage for analog value signal FI voltage input	-100.0~100.0	%	*
U4.28	Analog value input FI rear end display	The percentage of analog value input FI after software processing	-400.0~400.0	%	*
U4.29	Analog value input FV front end display	The corresponding percentage for analog value signal FV voltage input	-100.0~100.0	%	*
U4.30	Analog value input FV rear end display	The percentage of analog value input FV after software processing	-400.0~400.0	%	*
U4.31	save	—	—	—	—
U4.32	Save	—	—	—	—
U4.33	Analog value output TS front end display	The percentage of analog value output TS front end	-400.0~400.0	%	*
U4.34	Analog value output TS rear end display	The percentage of analog value output TS rear end	-115.0~115.0	%	*
U4.35	Analog value output FT front end display	The percentage of analog value output FT front end	-400.0~400.0	%	*
U4.36	Analog value output FT rear end display	The percentage of analog value output FT rear end	-115.0~115.0	%	*

U4.37	Save	—	—	—	—
U4.38	Power module temperature	The present power module temperature of the driver	0~150	℃	*
U4.39	Overloading timer	To prevent “E.OL” fault due to overloading (the load decreases in predetermined time), the internal countering of the OL counter may be displayed through this parameter.	0~100	%	*
U4.40	Accumulated power-on time	Driver start time, the displayed value include all operation time	0~65535	h	*
U4.41	Accumulated operation time	Driver power module modulate time	0	h	*
U4.42	Save	—	—	—	—
U4.43	Timer 1 display	The count value of timer 1 may be programmed freely	0.00~655.35	—	*
U4.44	Timer 2 display	The count value of timer 2 may be programmed freely	0.00~655.35	—	*
U4.45	Actual switching frequency	0: 2kHz 1: 4kHz 2: 8kHz 3: 12kHz 4: 16kHz	0~4	—	*
U4.46	Save	—	—	—	—
U4.47	Motor output torque amplitude limiting	Actual given torque amplitude limiting during motor operation	-32000.00~3200.00	N.m	*

■ U5: plant monitoring parameter 2

Function code	Name	Description	Set range	Unit	Modification
U5.00	Generator operation torque amplitude limiting	Actual given torque amplitude limiting during generator operation	-32000.00~32000.00	N.m	*
U5.01	Save	—	—	—	—
U5.02					
U5.03					

U5.04	PID external output display	A general PID regulator is integrated within the driver which may be used inside and outside separately.	-400.0~400.0	%	*
U5.05	Save	—	—	—	—
U5.06	Actual position	The actual position is displayed in an incremental form	-2147483648~2147483647	Inc	*
U5.07	Save	—	—	—	—
U5.08	Given position	The set position is displayed in an incremental form	-2147483648~2147483647	Inc	*
U5.09	Save	—	—	—	—
U5.10	Position deviation	Actual position deviation between given position and actual position	-2147483648~2147483647	Inc	**
U5.11	Rotor adapt factor	The actual rotor adapt factor	0~200	%	*
U5.12	Actual positioning index	Actual index number of present positioning operation	0~255	—	*
U5.13	Target position	Target position of present positioning operation	-2147483648~2147483647	Inc	*
U5.14	Save	—	—	—	—
U5.15	Positioning speed	Present positioning speed	-32000~32000	rpm	*
U5.16 ~ U5.19	Save	—	—	—	—
U5.20	Rated DC bus voltage	Driver rated DC bus voltage	0~1500	V	*
U5.21	Relative zero point distance	The distance relative to the zero point after leaving the reference switch	-2147483648~2147483647	Inc	*
U5.22 U5.23 U5.24	Save	—	—	—	—
U5.25	Relative given torque display	The percentage of set torque (U4,11) and torque amplitude limiting (B2，19)	-400.0~400.0	%	*

U5.26	Relative actual torque display	The percentage of actual torque (U4,12) and torque amplitude limiting (B2，19)	-400.0~400.0	%	*
U5.27	Save	—	—	—	—
U5.28					
U5.29					
U5.30	Relative speed display	The percentage of actual speed (U4,7) to the maximum set value (B1.10)	-400.0~400.0	%	*
U5.31	Save	—	—	—	—
U5.32	Digital value output state	Present set external output and internal output : 1: Q1(transistor output) 2: Q2(transistor output) 4: M0A(relay output) 8: M1A(relay output) 16: OA(internal output A) 32: OB(internal output B) 64: OC(internal output C) 128: OD(internal output D)	0~255	—	*
U5.33	active power	active power of the driver, a negative value will be displayed during operation of the generator	-1000.00~1000.00	kw	*
U5.34	High definition slope speed display	High definition slope speed display	-2147483648~2147483647	—	*
U5.35	High definition actual speed display	High definition actual speed display	-2147483648~2147483647	—	*
U5.36	Save	—	—	—	—
U5.37	Encoder 1 peak speed	Encoder 1 peak speed	0~32767	rpm	*
U5.38	Encoder 2 peak speed	Encoder 2 peak speed	0~32767	rpm	*
U5.39	Excitation current	Excitation current	-~3276.7~3276.7	Hz	*
U5.40	Actual frequency	Actual frequency	-32000~32000	A	*
U5.41	Actual speed	Actual speed	-32000~32000	rpm	*

U5.42	Maximum torque percentage	Maximum torque percentage display	0.00~400.00	%	*
U5.43	Save	—	—	—	—
U5.44	Input power	Input power	-1000.00~1000.00	kw	*
U5.45	Power consumption	Power consumption	-1000.00~1000.00	kw	*

Application parameter An

■ A1: plant control parameter

Function code	Name	Description	Set range	Unit	Factory setting	Modification
A1.00	parameter display selection	0: user parameter 1: system parameter	0～1	—	0	×
A1.01	control mode selection	select driver motor control mode 0:sensing motor V/Fcontrol 1:sensing motor open loop vector control 2:sensing motor close loop vector control	0～2	—	2	×
A1.02	driver power code	display /set driver power code	0～65535	-	—	×
A1.03	motor code selection	0: non-standard motor Other code : see appendix	0～99999	—	—	×
A1.04	motor model selection	1: motor model 1 2: motor model 2 3: motor model 3 4: motor model 4	1～32767	-	1	×

A1.05	encoder type	0: no encoder 1: incremental encoder 2: rotary transformer 3: sine and cosine encoder 4: absolute value encoder	0～255	—	1	×
A1.06	control parameter call and storage	0: no operation 1: call the factory data stored within the driver. 2: store all of the data within the driver	0～2	-	0	×
A1.07	system program version number	Factory software version number	—	—	C0801	
A1.08	control program version number	factory software version number	—	—	H0430	
A1.09	Application program version number	factory software version number	—	—	J0818	
A1.10	motor self-learning	7: self-learning (static) 8: self-learning (rotary)	7,8	—	0	×
A1.11	control parameter self-matching	0: invalid 1: preset the control parameters of the motor, and take the set stabilivolt value or transducer voltage level as input voltage. 2: preset the control parameters of the motor, and take the measured DC bus voltage 2 during power-on as input voltage	0～3	—	0	×
A1.12	Save	—	—	—	—	

~						
A1.19						
A1.20	FV analog value calibration speed	set FV analog value calibration speed	-30000～30000	rpm	0	×
A1.21	FI analog value calibration speed	set FI analog value calibration speed	-30000～30000	rpm	0	×
A1.22	FT analog value calibration speed	set FT analog value calibration speed	-30000～30000	rpm	0	×
A1.23	analog value channel selection	0: no selection 1: FV 2: FI 3: FV FI FT	1～3	—	3	×
A1.24	analog value communication control filtering times	Set filtering times during analog value communication control	0～100	次	1	×
A1.25	Save	—	—	—	—	×
~						
A1.60						
A1.61	The parameter not stored for internal	Displacement reset flag bit (1 reset)	0～1	—	-	×

A1.62	power-off	Machinery spindle speed	-	rpm	-	×
A1.63		Feed line speed	-	0.01mm/min	-	×
A1.64	The parameter stored for internal power-off	Feed displacement	-	0.1mm	-	×
A1.65		Screw thread pitch	0～65535	-	0	×
A1.66		Numerator of eduction ratio (when no input of I9,I10)	0～65535	-	0	×
A1.67		Denominator of eduction ratio	0～65535	-	0	×
A1.68		Numerator of eduction ratio of gear 1 (when there is input of I9)	0～65535	-	0	×
A1.69		Denominator of eduction ratio of gear 1	0～65535	-	0	×
A1.70		Numerator of eduction ratio of gear 2 (when there is input of I10)	0～65535	-	0	×
A1.71		Denominator of eduction ratio of gear 2	0～65535	-	0	×
A1.72		Numerator of eduction ratio gear 3 (when there is input of I9,I10)	0～65535	-	0	×
A1.73		Denominator of eduction ratio of gear 3	0～65535	-	0	×

■ A2: user multifunction parameter

Function code	Name	Description	Set range	Unit	Factory setting	Modification
A2.00	control mode select	0: terminal operation 1: operation panel operation 2: EtherCAT bus control 3: modbus communication control	0～3	—	0	×
A2.01	Operation order mode select	0: I1 forward /reverse (determined by polarity of analog voltage) 1: I1 forward I2 reverse	0，1	—	0	×
A2.02	analog mode select	0: bipolaritys (-10～+10V) 1: unipolarity (0～10V)	0，1	—	0	×
A2.03	positioning mode select	0: motor built-in coded disc 1: spindle encoder 2: approach switch	0～2	—	0	×
A2.04 ~ A2.07	save	—	—	—	—	—
A2.08	Start speed search function	0: invalid 1: valid	0，1	—	0	×
A2.09 ~ A2.14	save		—	—	—	—
A2.15	I1 terminal function definition	0: analog speed control 1: pulse speed control	0，1	—	0	×

A2.16 ~ A2.18	save	—	—	—	—	—
A2.19	I4 terminal function definition	0: analog position control 1: pulse position control	0～2	—	0	×
A2.20	terminal Q1 output function select	0: no output 5: operating in zero speed 1: always output 6: accurate stop reached 2: driver operating 7: torque alarm output 3: driver ready 8: approach switch reset complete 4: speed reached	0～9	—	5	×
A2.21	terminal Q2 output function select			—	3	×
A2.22	terminal MOA output function select			—	7	×
A2.23	terminal M1Aoutput	Driver fault	-	—	-	×
A2.24	save	—	—	—	—	—
A2.25	save	—	—	—	—	—
A2.26	DA1(TS)analog output select	0: speed 1: voltage 2: current 3: torque 4: active power	0～4	—	0	x
A2.27	DA2(FT)analog output select				2	

A2.28	save	—	—	—	—	—
A2.29	save	—	—	—	—	—
A2.30	I5multifunction function terminal function select	0: invalid 3: zero speed function 1: second accurate stop function 4: external fault input 2: inching function 5: approach switch accurate stop	0～5	—	0	×
A2.31	I6 terminal function select	0: swing 1: inching reversal	0，1	—	0	×
A2.32 ~ A2.44	save	—	—	—	—	—
A2.45	operation panel control motor rotate direction select	0: forward 1: reversal	0，1	—	0	×
A2.46	I/O electrical level select	0: PNP 1: NPN	0，1	—	1	×
A2.47	control enabling	0: terminal control enabling 1: internal control enabling	0，1	—	0	×

■ A3: user parameter

Function	Name	Description	Set range	Unit	Factory setting	Modification

code						
A3.00	motor encoder direction	0: encoder forward counting 1: encoder reverse counting 16: anticlockwise operation is forward 17: clockwise operation is forward	0～17	—	—	×
A3.01	pulse order reverse	0:no reverse 1: reverse	0, 1	—	0	×
A3.02	numerator of encoder gear ratio	set numerator of encoder gear ratio	-32000～32000	—	1000	×
A3.03	denominator of encoder gear ratio	set denominator of encoder gear ratio	1～32000	—	1000	×
A3.04	numerator of electronic gear	set numerator of multiplying power of position order pulse (electronic gear)	-32000～32000	—	1000	×
A3.05	denominator of electronic gear	set denominator of multiplying power of position order pulse (electronic gear)	1～32000	—	1000	×
A3.06	encoder line number	set line number of physical encoder of one circle of motor	1～65535	pulse	—	×
A3.07	Spindle encoder line number	set line number of physical encoder of one circle of spindle	1～65535	pulse	—	×
A3.08	Primary acceleration time	set acceleration time after removing operation I/O	0～300	s	1	×
A3.09	Primary deceleration time	set deceleration time after removing operation I/O	0～300	s	1	×
A3.10	current loop proportional gain	set proportional gain of current loop PI regulator	0～32767	—	—	×
A3.11	current loop integral gain	set integral gain of current loop PI regulator	0～32767	—	—	×
A3.12	maximum output torque	set maximum output torque	-32000～32000	N.m	—	×
A3.13	Speed reach scope	set speed reach scope	0～800	rpm	30	×
A3.14	acceleration and deceleration curve	0: standard acceleration and deceleration curve (oblique line) 153: acceleration and deceleration	0～255	—	0	×

	selection	curve by fixed time (without S curve function) 255: acceleration and deceleration curve by set time (with S curve function)				
A3.15	analog FI gain	set analog FI gain	-20～20	—	1	×
A3.16	analog FV gain	set analog FV gain	-20～20	—	1	×
A3.17	analog FI dead zone	When FI input is zero, the speed order analog bias may be eliminated through changing the parameter to make the motor speed to be zero.	-10～10	—	0	×
A3.18	analog FV dead zone	When FV input is zero, the speed order analog bias may be eliminated through changing the parameter to make the motor speed to be zero.	-10～10	—	0	×
A3.19	DA1(TS) analog gain	set DA1(TS) channel analog output gain	-20～20	—	1	×
A3.20	DA2(FT) analog gain	set DA2(FT) channel analog output gain	-20～20	—	1	×
A3.21	DA1(TS) analog zero offset	set DA1(TS) channel analog output zero offset	-100～100	—	0	×
A3.22	DA2(FT)analog zero offset	set DA2(FT) channel analog output zero offset	-100～100	—	0	×
A3.23	maximum output speed during speed control	input corresponding speed for 10V analog	0～16000	rpm	—	×
A3.24	Acceleration time during speed control	set motor acceleration time during speed control	0～300	s	1	×
A3.25	Deceleration time during speed control	set motor deceleration time during speed control	0～300	s	1	×
A3.26	S curve during speed control	S curve time during speed control	0～5	s	0	×
A3.27	speed ring ratio proportional gain during speed control	set speed ring ratio PI regulator proportional gain, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～32767	—	1500	×

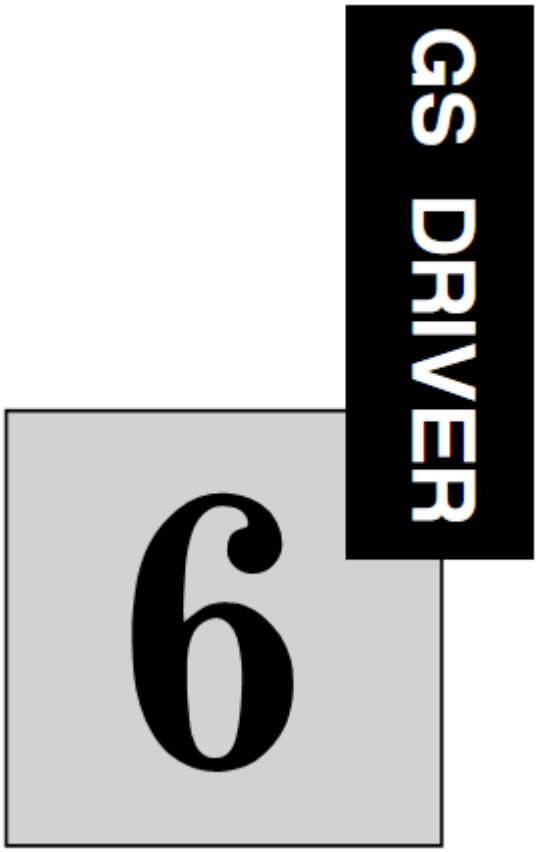
A3.28	Speed integral gain during speed control	set speed ring ratio PI regulator integral gain, the value is higher, the integral speed is higher and the rigidity is greater.	0～32767	—	1000	×
A3.29	Zero speed gain during speed control	set speed ring regulator proportional gain when set zero speed of the speed control, the value is higher, the gain is higher and the rigidity is greater.	0～32767	—	500	×
A3.30	maximum speed during rigid tapping /pulse position	set maximum speed of motor during rigid tapping /pulse position control	0～16000	rpm	1500	×
A3.31	acceleration time during rigid tapping /pulse position	Set acceleration time of motor during rigid tapping /pulse position control	0～300	s	1	×
A3.32	deceleration time during rigid tapping /pulse position	set deceleration time of motor during rigid tapping /pulse position control	0～300	s	1	×
A3.33	S curve time during rigid tapping /pulse position	Set Scurve time during rigid tapping /pulse position control	0～5	s	0	×
A3.34	speed ring proportional gain during rigid tapping /pulse position	set speed ring proportional gain during rigid tapping /pulse position, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～32767	—	1500	×
A3.35	speed ring integral gain during rigid tapping /pulse position	set speed ring integral gain during rigid tapping /pulse position, the value is higher, the integral speed is higher and the rigidity is greater.	0～32767	—	1000	×
A3.36	zero speed gain during rigid tapping /pulse position	set speed ring regulator proportional gain during rigid tapping /pulse position zero speed，the value is higher, the gain is higher and the rigidity is greater.	0～32767	—	500	×
A3.37	position ring proportional gain during rigid tapping /pulse position	set position ring proportional gain during rigid tapping /pulse position. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be	0～32767	—	500	×

		caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.				
A3.38	accurate stop index	When set accurate stop position, change the parameter to 6, and then set accurate stop position.	0～7	—	—	×
A3.39	accurate stop position	set accurate stop point position	-32768～32767	pulse	—	×
A3.40	accurate stop speed	look for speed of Z-phase pulse of encoder during accurate stop	0～1000	rpm	300	×
A3.41	accurate stop reach scope	set position reach scope accuracy during accurate stop	0～32767	pulse	20	×
A3.42	accurate stop acceleration time	set motor acceleration time during accurate stop	0～300	s	1	×
A3.43	accurate stop deceleration time	set motor deceleration time during accurate stop	0～300	s	1	×
A3.44	accurate stop position ring proportional gain	set position ring proportional gain during accurate stop. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.	0～32767	—	500	×
A3.45	accurate stop speed ring proportional gain	set speed ring PI regulator proportional gain during accurate stop. the parameter is higher, the gain is higher, the rigidity is greater.	0～32767	—	1500	×
A3.46	accurate stop speed ring integral gain	set speed ring PI regulator integral gain during accurate stop. the parameter is higher, the integral speed is higher, the rigidity is greater.	0～32767	—	1000	×
A3.47	accurate stop zero speed gain	when set zero speed of accurate stop, for speed ring regulator proportional gain, the parameter is higher, the gain is higher, the rigidity is greater.	0～32767	—	500	×
A3.48	approach switch accurate stop speed	look for the speed of the approach switch during accurate stop of the approach switch	0～1000	rpm	100	×

A3.49	approach switch accurate stop bias speed	set the accurate stop index as 0, and then set accurate stop bias speed of approach switch	0～1000	rpm	50	×
A3.50	acceleration and deceleration time of approach switch accurate stop	Set acceleration and deceleration time of approach switch	0～300	s	2	×
A3.51	swing speed	set speed swing during swing	0～1000	rpm	300	×
A3.52	swing index	when set forward swing amplitude, set the swing index as 2, and then modify the swing amplitude. when set reverse swing amplitude, set the swing index as 3, and then modify the swing amplitude.	0～7	—	—	×
A3.53	swing amplitude	set swing amplitude	-32768～32767	pulse	—	×
A3.54	swing acceleration time	set motor acceleration time during swing	0～300	s	2	×
A3.55	swing deceleration time	set motor deceleration time during swing	0～300	s	2	×
A3.56	swing torque set	set the maximum output torque of the driver during swing	-32000～32000	N.m	—	×
A3.57	swing position ring proportional gain	set position ring proportional gain during swing. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.	0～32767	—	500	×
A3.58	swing speed ring proportional gain	speed ring regulator proportional gain when set swing	0～32767	—	1500	×
A3.59	swing speed ring integral gain	speed ring regulator integral gain when set swing	0～32767	—	1000	×
A3.60	swing zero speed	zero speed proportional gain when set swing	0～32767	—	500	×

	gain					
A3.61	emergency stop mode	When the multi-function terminal is set as emergency stop, set emergency stop mode: 0: free stop 1: emergency stop	0～1	—	0	×
A3.62	emergency stop deceleration time	set deceleration time of emergency stop	0～300	s	2	×
A3.63	emergency stop deceleration torque limit	set deceleration torque limit value of emergency stop	0～32000	N.m	0	×
A3.64	multi-function terminal maximum speed	set maximum speed of multi-function terminal	0～16000	rpm	1000	×
A3.65	multi-function terminal acceleration time	set motor acceleration time of multi-function terminal	0～300	s	1	×
A3.66	multi-function terminal deceleration time	set motor deceleration time of multi-function terminal	0～300	s	1	×
A3.67	multi-function terminal speed ring proportional gain	set speed ring regulator proportional gain of multi-function terminal	0～32767	—	1500	×
A3.68	multi-function terminal speed ring integral gain	set speed ring regulator integral gain of multi-function terminal	0～32767	—	1000	×
A3.69	multi-function terminal speed ring zero speed gain	set zero speed proportional gain of multi-function terminal	0～32767	—	500	×
A3.70	forward manual inching speed	set forward manual inching speed	0～32767	rpm	200	×
A3.71	reverse manual inching speed	set reverse manual inching speed	0～32767	rpm	200	×
A3.72	manual inching acceleration time	set manual inching acceleration time	0～300	s	1	×

A3.73	manual inching deceleration time	set manual inching deceleration time	0～300	s	1	×



Set parameter by function

The chapter helps user for parameter setting and debugging by function of use

6.1 Analog speed control

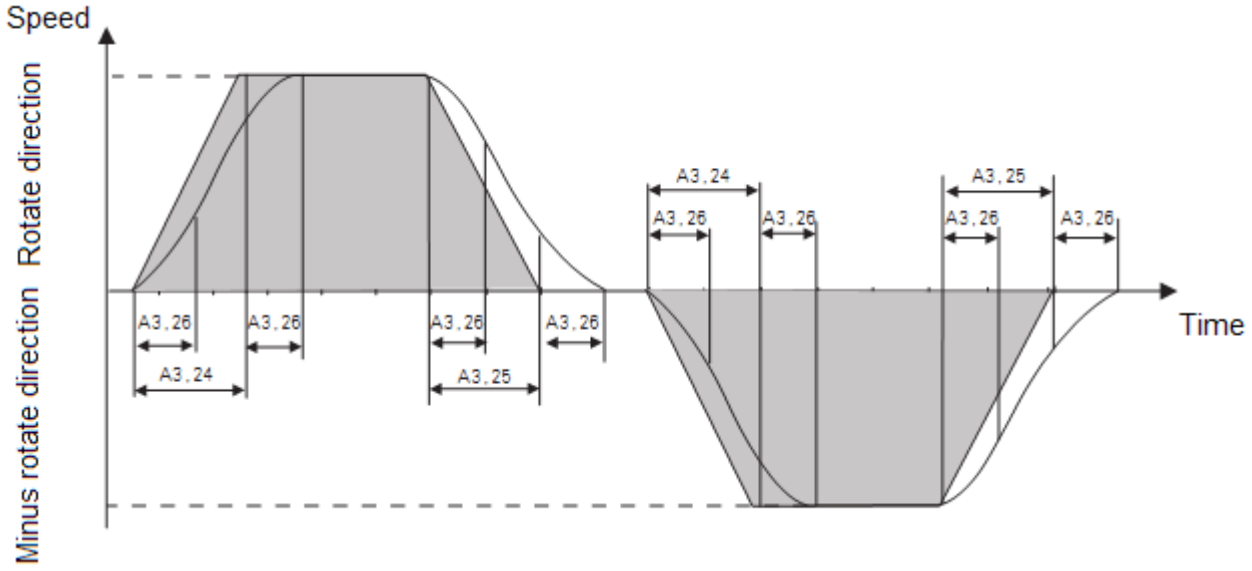
6.1.1 Terminal definition and function parameters

Analog value	Port	Signal	Function	position control parameter needs to be modified
±10V analog voltage	T2	FV	±10V analog voltage input	A2.01=0 A2.02=0 A2.15=0
		FC	Analog voltage input common terminal	
	T3	ST	Servo enabling	
		I1	Operation enabling (forward or reverse is determined by polarity of the analog voltage)	
0~10V analog voltage	T2	FI	0~10V analog voltage input	A2.01=1 A2.02=1 A2.15=0
		FC	Analog voltage input common terminal	
	T3	ST	Servo enabling	
		I1	Forward	
		I2	Reverse	

6.1.2 Relevant parameters of analog speed control

Function parameter	Item	Description	Set range	Unit	Factory setting
A3.23	maximum output speed during speed control	input corresponding speed for 10V analog voltage	0～16000	rpm	—
A3.24	Acceleration time during speed control	set motor acceleration time during speed control	0～300	s	-
A3.25	Deceleration time during speed control	set motor deceleration time during speed control	0～300	s	-
A3.26	S curve during speed control	S curve time during speed control	0～5	s	0
A3.27	speed ring ratio proportional gain during speed control	set speed ring ratio PI regulator proportional gain, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～32767	—	1500
A3.28	Speed integral gain during speed control	set speed ring ratio PI regulator integral gain, the value is higher, the integral speed is higher and the rigidity is greater.	0～32767	—	1000
A3.29	Zero speed gain during speed control	set speed ring regulator proportional gain when set zero speed of the speed control, the value is higher, the gain is higher and the rigidity is greater.	0～32767	—	500

6.1.3 Acceleration and deceleration control curve



6.1.4 Analog calibration and relevant parameter

Function parameter	Item	Description	Set range	Unit	Factory setting
A1.20	FV analog value calibration speed	set FV analog value calibration speed	-30000～30000	rpm	0
A1.21	FI analog value calibration speed	set FI analog value calibration speed	-30000～30000	rpm	0
A1.22	FT analog value calibration speed	set FT analog value calibration speed	-30000～30000	rpm	0
A1.23	analog value channel selection	0: no selection 1: FV 2: FI 3: FV FI FT	1～3	—	3

6.1.5 Analog calibration description

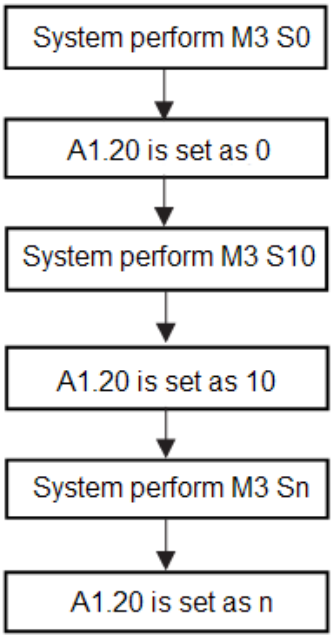
Analog calibration is a function for keeping the speed performed by driver consistent with the speed orders issued by the CNC system, and reduce speed deviation as possible. When deviation occurs between the speed performed by driver and the speed orders issued by the CNC system, analog calibration is required.

Unit of analog calibration is rpm. The drive that has not been calibrated is properly wired, and the system input 0 speed order in MDI mode, A1.20 is set as 0, and the calibration begins, and then corresponding speed order shall be issued by the system for the point want to be calibrated, and the A1.20 shall be set as the corresponding data. Each time A1.20 is updated, driver automatically calculates calibration factor again, and the detail practice is as follows (e.g. FV):

For example: the system executes M3 S3000 order, the drive displays F. 2990, the deviation between actual operating speed and order issued by the system is 10 rounds. At this time, set parameter

A1.20=3000 (the method of reverse calibration is same as forward calibration but A1.20=3000.(indicate negative)).

During analog calibration, the speed of a plurarity of points may be calibrated freely. However, the calibration array can only store 50 data. When more than 50 data is calibrated, the last 50 data will be performed. Each time the calibration needs to be performed again, set A1.20 as 0, the software will delete the array data and record data again. The calibration operation flow chart is as follows:



6.2 Pulse speed control

6.2.1 Terminal definition and function parameters

Pulse	Port	Signal	Function	position control parameter needs to be modified
orthogonal pulse	T3	ST	Servo enabling	A2.15=1 T3.13=1
		I1	Pulse speed enabling (forward or reverse is determined by direction of the pulse)	
	T4	SA+	Pulse signal input	
		SA-		
		PB+	Direction signal input	
		PB-		
Direction + pulse	T3	ST	Servo enabling	A2.15=1 T3.13=0
		I1	Pulse speed enabling (forward or reverse is determined by direction of the pulse)	
	T4	SA+	Pulse signal input	
		SA-		
		PB+	Direction signal input	
		PB-		

6.2.2 Relevant parameters of pulse speed control

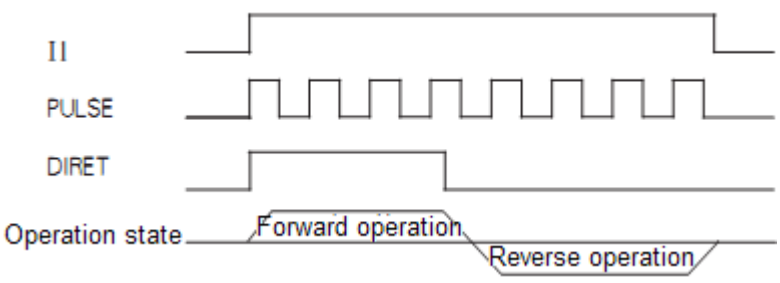
Function parameter	Item	Description	Set range	Unit	Factory setting
A3.01	pulse order reverse	0:no reverse 1: reverse	0, 1	—	0
A3.04	numerator of electronic gear	set numerator of multiplying power of position order pulse (electronic gear)	-32000～32000	—	1000
A3.05	denominator of electronic gear	set denominator of multiplying power of position order pulse (electronic gear)	1～32000	—	1000
A3.23	maximum output speed during speed control	input corresponding speed for 10V analog	0～16000	rpm	—
A3.24	Acceleration time during speed control	set motor acceleration time during speed control	0～300	s	1
A3.25	Deceleration time during speed control	set motor deceleration time during speed control	0～300	s	1
A3.26	S curve during speed control	S curve time during speed control	0～5	s	0
A3.27	speed ring ratio proportional gain during speed control	set speed ring ratio PI regulator proportional gain, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～32767	—	1500
A3.28	Speed integral gain during speed control	set speed ring ratio PI regulator integral gain, the value is higher, the integral speed is higher and the rigidity is greater.	0～32767	—	1000
A3.29	Zero speed gain during speed control	set speed ring regulator proportional gain when set zero speed of the speed control, the value is higher, the gain is higher and the rigidity is greater.	0～32767	—	500

6.2.3 Pulse control sequence chart

Please see the following table for single pulse control interface, and see the right diagram for control sequence.

Control terminal	Function
SA+	PULSE +
SA-	PULSE -
PB+	DIR+
PB-	DIR-

Pulse interface of CNC system and GSX series

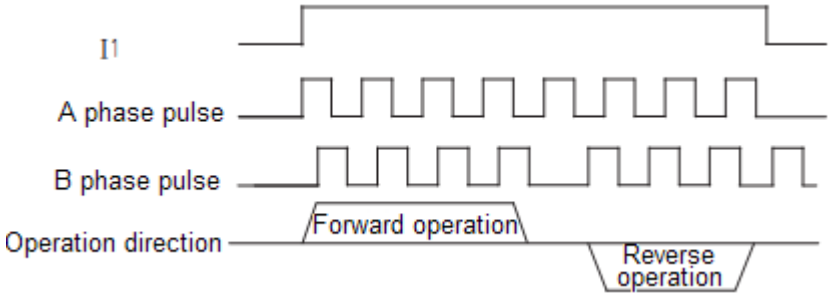


Single pulse input sequence chart

Please see the following table for dual pulse control interface, and see the right diagram for control sequence.

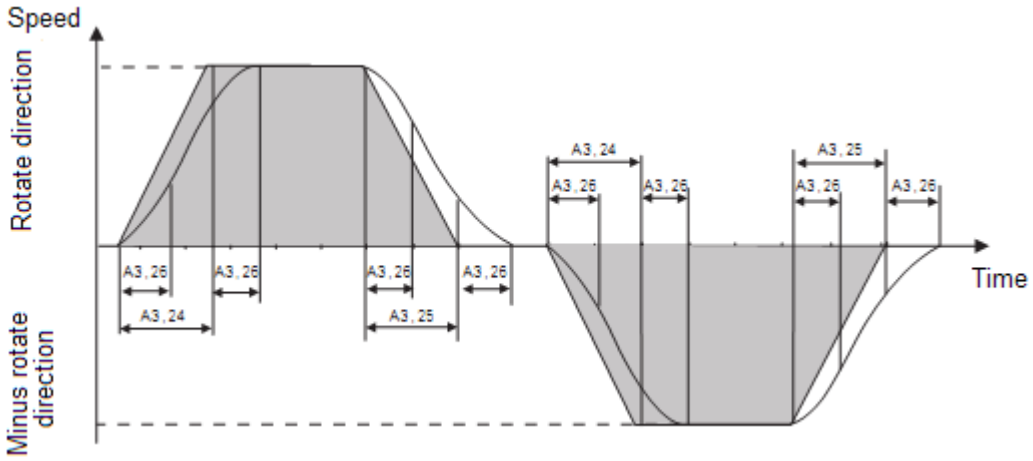
Control terminal	Function
SA+	PA+
SA-	PA -
PB+	PB+
PB-	PB -

Pulse interface of CNC system and GSX series



Dual pulse input sequence chart

6.2.4 Acceleration and deceleration control curve



6.3 Analog rigid tapping

6.3.1 Terminal definition and function parameters

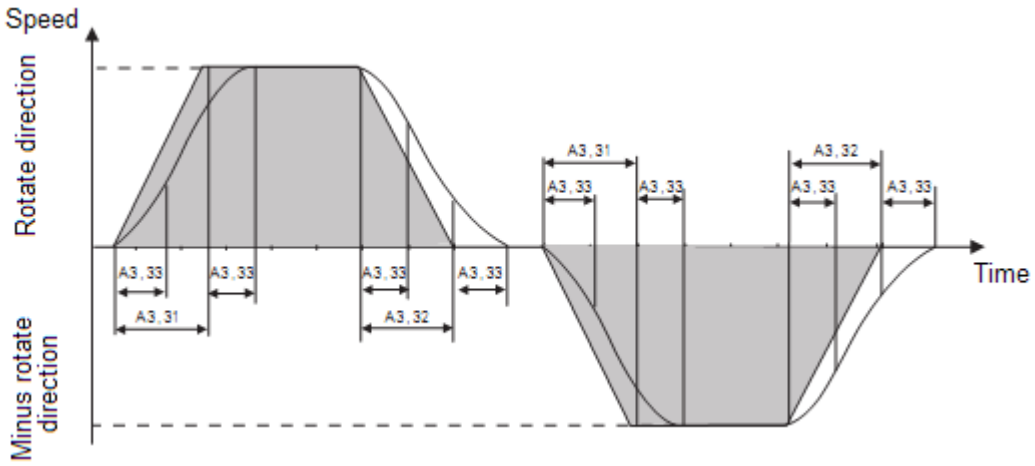
Pulse	Port	Signal	Function	position control parameter needs to be modified
±10V analog voltage	T1	FV	±10V analog voltage input	A2.01=0 A2.02=0 A2.19=0
		FC	Analog voltage input common terminal	
	T3	ST	Servo enabling	
		I4	Rigid tapping (forward or reverse is determined by polarity of the analog voltage)	

6.3.2 Relevant parameters of analog rigid tapping

Function parameter	Item	Description	Set range	Unit	Factory setting
A3.30	maximum speed during rigid tapping /pulse position	set maximum speed of motor during rigid tapping /pulse position control	0～16000	rpm	1500

A3.31	acceleration time during rigid tapping /pulse position	Set acceleration time of motor during rigid tapping /pulse position control	0～300	s	1
A3.32	deceleration time during rigid tapping /pulse position	set deceleration time of motor during rigid tapping /pulse position control	0～300	s	1
A3.33	S curve time during rigid tapping /pulse position	Set Scurve time during rigid tapping /pulse position control	0～5	s	0
A3.34	speed ring proportional gain during rigid tapping /pulse position	set speed ring proportional gain during rigid tapping /pulse position, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～ 32767	—	1500
A3.35	speed ring integral gain during rigid tapping /pulse position	set speed ring integral gain during rigid tapping /pulse position, the value is higher, the integral speed is higher and the rigidity is greater.	0～ 32767	—	1000
A3.36	zero speed gain during rigid tapping /pulse position	set speed ring regulator proportional gain during rigid tapping /pulse position zero speed，the value is higher, the gain is higher and the rigidity is greater.	0～ 32767	—	500

6.3.3 Acceleration and deceleration control curve



6.4 Pulse rigid tapping /pulse position

6.4.1 Terminal definition and function parameters

Pulse	Port	Signal	Function	position control parameter needs to be modified
orthogonal pulse	T3	ST	Servo enabling	A2.19=1 T3.13=1
		I4	Forward and reverse operation enabling (forward or reverse is determined by	

			direction of the pulse)	
	T4	SA+	orthogonal pulse A phase input	
		SA-		
		PB+	orthogonal pulse B phase input	
		PB-		
Direction + pulse	T3	ST	Servo enabling	A2.19=1 T3.13=0
		I4	Forward and reverse operation enabling (forward or reverse is determined by direction of the pulse)	
	T4	SA+	Pulse signal input	
		SA-		
		PB+	Direction signal input	
		PB-		

6.4.2 Relevant parameters of pulse rigid tapping /pulse position

Function parameter	Item	Description	Set range	Unit	Factory setting
A3.01	pulse order reverse	0:no reverse 1: reverse	0, 1	—	0
A3.04	numerator of electronic gear	set numerator of multiplying power of position order pulse (electronic gear)	-32000～32000	—	1000
A3.05	denominator of electronic gear	set denominator of multiplying power of position order pulse (electronic gear)	1～32000	—	1000
A3.30	maximum speed during rigid tapping /pulse position	set maximum speed of motor during rigid tapping /pulse position control	0～16000	rpm	1500
A3.31	acceleration time during rigid tapping /pulse position	Set acceleration time of motor during rigid tapping /pulse position control	0～300	s	1
A3.32	deceleration time during rigid tapping /pulse position	set deceleration time of motor during rigid tapping /pulse position control	0～300	s	1
A3.33	S curve time during rigid tapping /pulse position	Set Scurve time during rigid tapping /pulse position control	0～5	s	0
A3.34	speed ring proportional gain during rigid tapping /pulse position	set speed ring proportional gain during rigid tapping /pulse position, the value is higher, the gain is higher and the rigidity is greater. Set the parameter as high adapt possible without vibration generated by the system.	0～32767	—	1500
A3.35	speed ring integral gain during rigid tapping /pulse position	set speed ring integral gain during rigid tapping /pulse position, the value is higher, the integral speed is higher and the rigidity is greater.	0～32767	—	1000

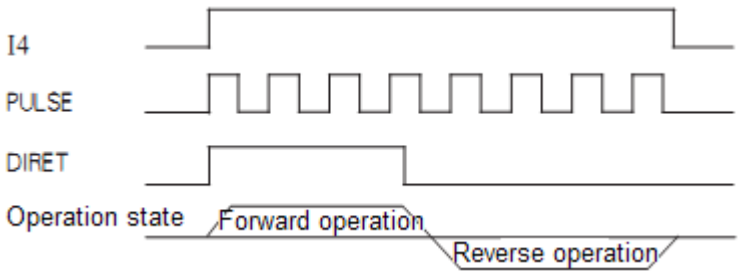
A3.36	zero speed gain during rigid tapping /pulse position	set speed ring regulator proportional gain during rigid tapping /pulse position zero speed, the value is higher, the gain is higher and the rigidity is greater.	0～32767	—	500
A3.37	position ring proportional gain during rigid tapping /pulse position	set position ring proportional gain during rigid tapping /pulse position. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.	0～32767	—	500

6.4.3 Pulse control sequence chart

Please see the following table for single pulse control interface, and see the right diagram for control sequence.

Control terminal	Function
SA+	PULSE +
SA-	PULSE -
PB+	DIR+
PB-	DIR-

Pulse interface of CNC system and GSX series

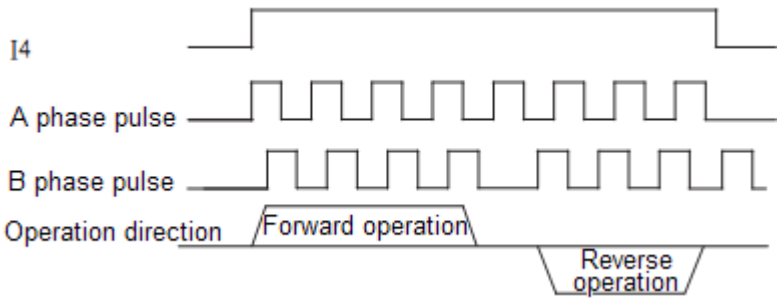


Single pulse input sequence chart

Please see the following table for dual pulse control interface, and see the right diagram for control sequence.

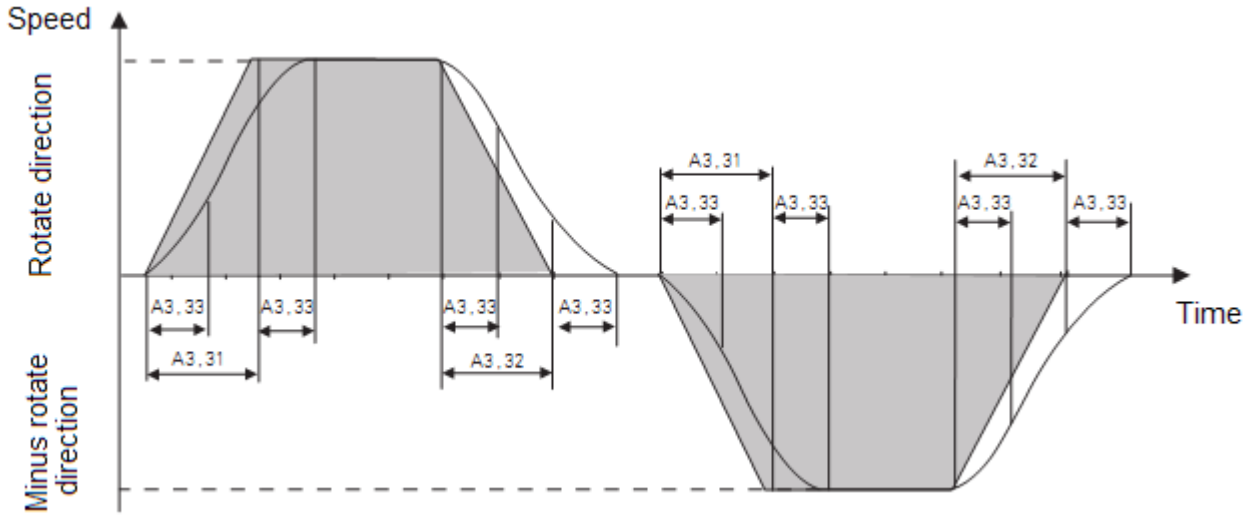
Control terminal	Function
SA+	PA+
SA-	PA -
PB+	PB+
PB-	PB -

Pulse interface of CNC system and GSX series



Dual pulse input sequence chart

6.4.4 Acceleration and deceleration control curve



6.5 Accurate stop

6.5.1 Terminal definition and function parameters

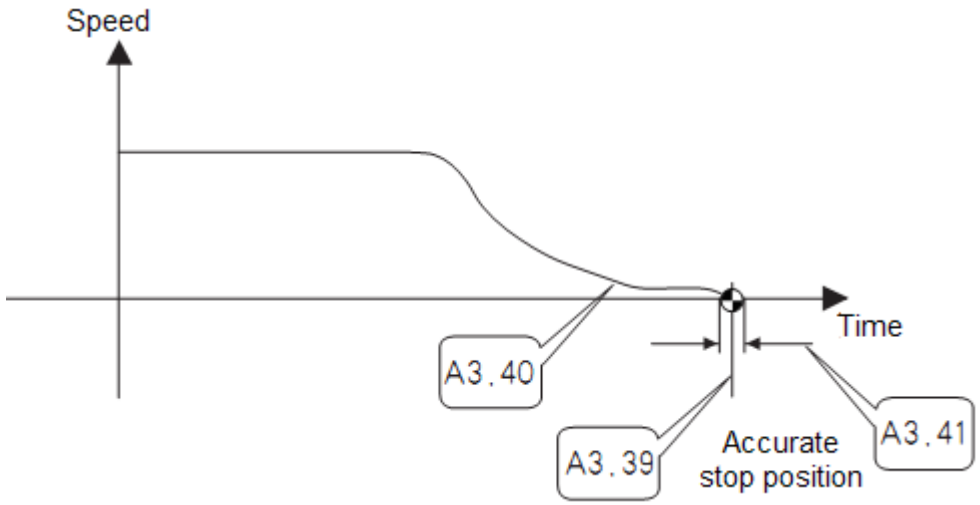
Accurate stop	Port	Signal	Function	position control parameter needs to be modified
Built-in encoder accurate stop	T3	ST	Servo enabling	A2.03=0
		I3	accurate stop	
External encoder accurate stop	T3	ST	Servo enabling	A2.03=1 T3.13=1 A3.07=spindle encoder line number
		I3	accurate stop	
Second accurate stop	T3	ST	Servo enabling	A2.03=0/1 A2.30=1
		I3	accurate stop	
		I5	Second accurate stop symbol	
Approach switch accurate stop	T3	ST	Servo enabling	A2.03=2 A2.30=5
		I3	accurate stop	
		I5	Approach switch input point	

6.5.2 Relevant parameter of accurate stop

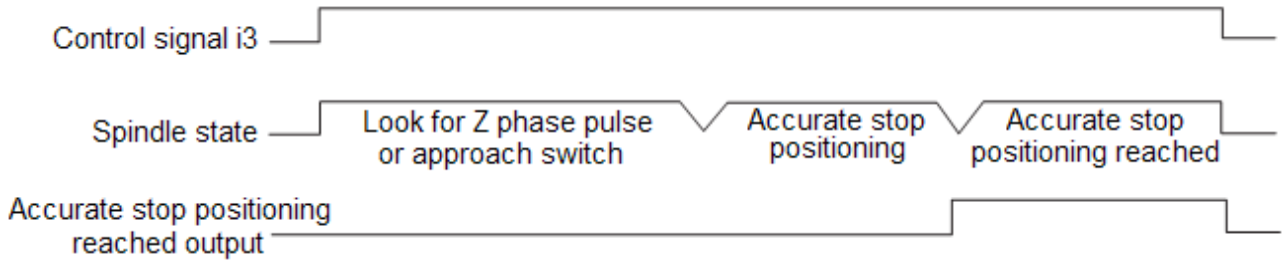
Function parameter	Item	Description	Set range	Unit	Factory setting
A3.06	encoder line number	set line number of physical encoder of one circle of motor	1～65535	pulse	-
A3.07	Spindle encoder line number	set line number of physical encoder of one circle of spindle	1～65535	pulse	-
A3.38	accurate stop index	When set accurate stop position, change the parameter to 6, and then set accurate stop position.	0～7	—	—
A3.39	accurate stop	set accurate stop point position	-32768～	pulse	—

	position		32767		
A3.40	accurate stop speed	look for speed of Z-phase pulse of encoder during accurate stop	0～1000	rpm	300
A3.41	accurate stop reach scope	set position reach scope accuracy during accurate stop	0～32767	pulse	20
A3.42	accurate stop acceleration time	set motor acceleration time during accurate stop	0～300	s	1
A3.43	accurate stop deceleration time	set motor deceleration time during accurate stop	0～300	s	1
A3.44	accurate stop position ring proportional gain	set position ring proportional gain during accurate stop. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.	0～32767	—	500
A3.45	accurate stop speed ring proportional gain	set speed ring PI regulator proportional gain during accurate stop. the parameter is higher, the gain is higher, the rigidity is greater.	0～32767	—	1500
A3.46	accurate stop speed ring integral gain	set speed ring PI regulator integral gain during accurate stop. the parameter is higher, the integral speed is higher, the rigidity is greater.	0～32767	—	1000
A3.47	accurate stop zero speed gain	when set zero speed of accurate stop, for speed ring regulator proportional gain, the parameter is higher, the gain is higher, the rigidity is greater.	0～32767	—	500
A3.48	approach switch accurate stop speed	look for the speed of the approach switch during accurate stop of the approach switch	0～1000	rpm	100
A3.49	approach switch accurate stop bias speed	Touch approach switch accurate stop bias speed during accurate stop of the approach	0～1000	rpm	50
A3.50	approach switch edge selection	33: left edge 41: right edge	33, 41	-	33

6.5.3 Accurate stop curve



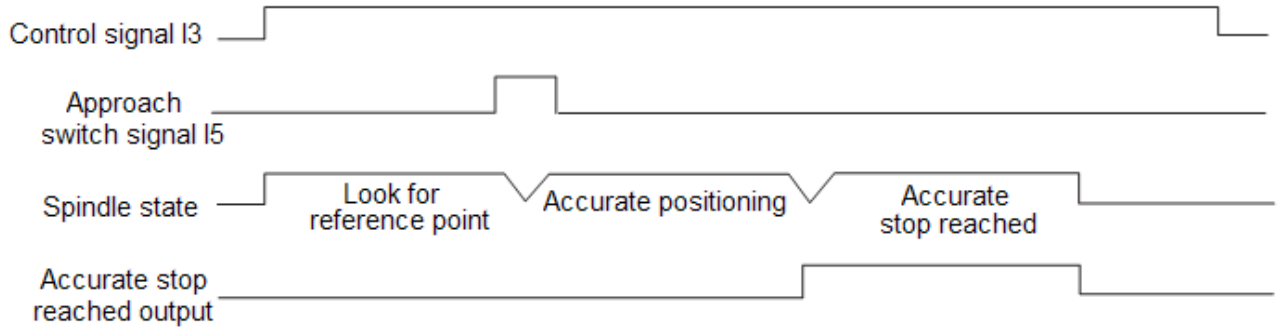
6.5.4 Accurate stop sequence chart



6.5.5 Approach switch accurate stop function

Approach switch accurate stop is a positioning method when spindle motor and spindle are not rotating by 1:1, and external encoder can not be mounted due to mechanical structure. It's suggested to adopt boss sensing mode. Please see the following figure for control sequence of approach switch.

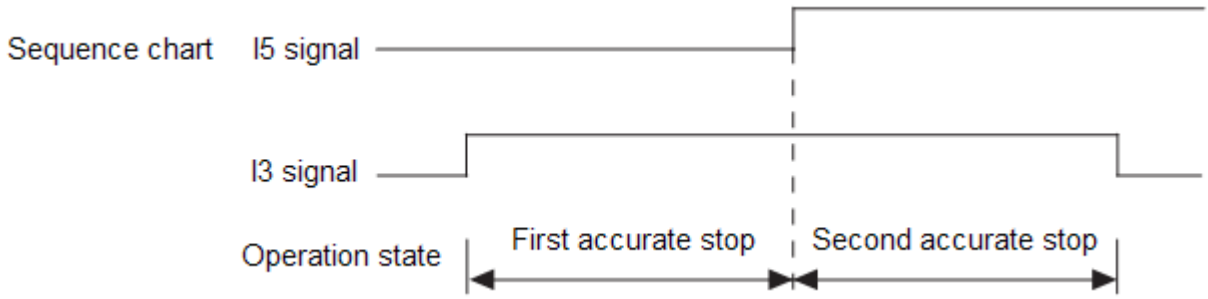
Note: when set accurate stop function of approach switch, set A2.03=2 firstly, and then set A2.30=5



6.5.6 Second accurate stop function

The second accurate stop function is used for the second fixed point positioning as required by the user.

Note: when the second accurate stop is used, the function of I5 will change to first, second accurate stop select signal.

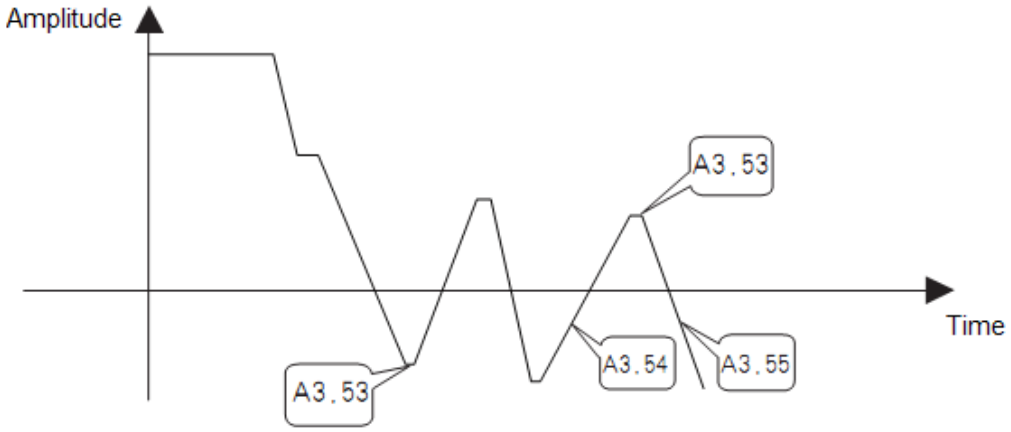


6.6 Swing

6.6.1 Relevant parameter of swing

Function parameter	Item	Description	Set range	Unit	Factory setting
A3.51	swing speed	set speed swing during swing	0～1000	rpm	300
A3.52	swing index	when set forward swing amplitude, set the swing index as 2, and then modify the swing amplitude. when set reverse swing amplitude, set the swing index as 3, and then modify the swing amplitude.	0～7	—	—
A3.53	swing amplitude	set swing amplitude	-32768～32767	pulse	—
A3.54	swing acceleration time	set motor acceleration time during swing	0～300	s	2
A3.55	swing deceleration time	set motor deceleration time during swing	0～300	s	2
A3.56	swing torque set	set the maximum output torque of the driver during swing	-32000～32000	N.m	—
A3.57	swing position ring proportional gain	set position ring proportional gain during swing. The value is higher, the response to position order is faster, and the rigidity is higher. If the value is too great, vibration may be caused due to position overshoot during stop and start. The value is smaller , the effect is slower and the following error increases.	0～32767	—	500
A3.58	swing speed ring proportional gain	speed ring regulator proportional gain when set swing	0～32767	—	1500
A3.59	swing speed ring integral gain	speed ring regulator integral gain when set swing	0～32767	—	1000
A3.60	swing zero speed gain	zero speed proportional gain when set swing	0～32767	—	500

6.6.3 Swing process curve



6.7 Multi-function terminal

6.7.1 Terminal definition and function parameters

Function	Signal	Signal description	Function description	position control parameter needs to be modified
Second accurate stop function	ST	Servo enabling	second accurate stop function is used for the second fixed point positioning as required by the user.	A2.03=1
	I3	accurate stop		
	I5	Second accurate stop symbol		
Low speed function	ST	Servo enabling	The function may be used when the user needs the motor in low speed state during operation	A2.03=2 A3.64 set speed
	I5	Low speed		
Zero speed function	ST	Servo enabling	The function may be used when the user needs the motor in zero speed spindle locking state during operation	A2.30=1 A3.64=0
	I5	Zero speed		
External fault input	ST	Servo enabling	When user needs to take external fault signal (such as emergency stop, motor thermal protection switch, etc.) as input signal and feedback to driver, the function may be used to make the driver alarm and stop quickly. Note: the function has the highest priority in the entire control	A2.03=4
	I5	External fault input		
Approach switch accurate stop	ST	Servo enabling	The function may be used when user needs approach switch accurate stop	A2.03=2 A2.30=5
	I3	Accurate stop		
	I5	Approach switch input point		

Inching forward	ST	Servo enabling	The function may be used when user needs inching function	A2.30=6
	I5	Inching forward		

6.7.2 Multi-function terminal parameter

Function parameter	Item	Description	Set range	Unit	Factory setting
A3.64	multi-function terminal maximum speed	set maximum speed of multi-function terminal	0～16000	rpm	1000
A3.65	multi-function terminal acceleration time	set motor acceleration time of multi-function terminal	0～300	s	1
A3.66	multi-function terminal deceleration time	set motor deceleration time of multi-function terminal	0～300	s	1
A3.67	multi-function terminal speed ring proportional gain	set speed ring regulator proportional gain of multi-function terminal	0～32767	—	1500
A3.68	multi-function terminal speed ring integral gain	set speed ring regulator integral gain of multi-function terminal	0～32767	—	1000
A3.69	multi-function terminal speed ring zero speed gain	set zero speed proportional gain of multi-function terminal	0～32767	—	500

6.8 Operation panel operation

The practice method is as follows:

1. The parameters that need to be modified: A2.00=1，A2.45=1，A2.47=1.

2.In F 0000 menu, press the ENT key on the operation panel and enter digital input state, and then use the ∧ and ＞＞ keys on the panel to input the operating speed, and press ENT key again, and press ＞＞ key to make the motor run.

3. press ＞＞ key again, and the motor decelerates and stop running.

During operation of the motor, step 2 may be repeated at any time to change operation speed of the motor. If the operation direction of the motor needs to be changed, parameter A2.45 may be set to realize.

Caution Operation panel operation is only a simple operation mode which is generally for test. It's suggested that the speed of the motor shall not be set too high during operation of operation panel. The A2.00, A2,45, A2,47 shall recover their original values after test of operation panel.

6.9 Modbus communication settlement

6.9.1 232 communication setting

Function parameter	Item	Description	Set range	Unit	Factory setting
T3.01.1	232 serial port Baud rate	9600:9.6 19200:19.2 38400:38.4 57600:57.6 115200:115.2	0～65535	—	38.4
T3.04.1	232 port communication response time	232 communication response time	0～100	ms	10
T3.06.1	232 port communication protocol selection	0: host100 protocol 1: modbus protocol	0、1	—	1
T3.15.1	Modbus communication station number	Modbus communication station number	0～255	—	1
T3.17.1	Modbus communication 32-bit data high-low bit sequence selection	0: high bit is at front 1: low bit is at front	0、1	—	0
T3.19.1	Modbus communication start address	modbus communication start address	0～65535	—	0

6.9.2 Relevant parameters of 485 communication setting

Function parameter	Item	Description	Set range	Unit	Factory setting
T3.02.1	485 serial port Baud rate	9600:9.6 19200:19.2 38400:38.4 57600:57.6 115200:115.2	0～65535	—	38.4
T3.05.1	485 port communication response time	485 communication response time	0～100	ms	5
T3.07.1	485 port communication protocol selection	0：host100 protocol 1：modbus protocol	0、1	—	1
T3.15.1	Modbus communication station number	Modbus communication station number	0～255	—	1
T3.16.1	485 communication terminal resistance	0：invalid 1：valid	0、1	—	0
T3.17.1	Modbus communication 32-bit data high-low bit sequence selection	0: high bit is at front 1: low bit is at front	0、1	—	0
T3.18.1	Modbus communication verification selection	0：no verification 1：even verification 2：odd verification	0～2	—	0

T3.19.1	Modbus communication start address	T2 start address offset	0～65535	—	0

Note: 1: after modifying modbus 485 communication verification selection, the driver shall be turned off and restarted.

2: when the communication parameter is set as 32-bit data, 2 parameters shall be occupied in the T2 parameter, and only the first parameter needs to be set for parameter address.

As shown in T2 parameter table, the upper computer modbus communication address 5 is 32-bit actual torque. T2.05 is set as U4.12.1, and T2.06 need not to be set.

6.9.3 Communication set speed example

Modbus address	Driver corresponding parameter	Mapping address	Meaning
23 (16-bit without symbolic number)	T2.23	S2.50.1	Direction setting during communication control
24 (16-bit with symbolic number)	T2.24	S2.52.1	Speed setting during communication control
25 (16-bit with symbolic number)	T2.25	B1.10.1	Maximum speed setting during communication control
26 (16-bit without symbolic number)	T2.26	B1.28.1	Acceleration time during communication control
27 (16-bit without symbolic number)	T2.27	B1.30.1	deceleration time during communication control
28 (16-bit with symbolic number)	T2.28	S2.53.1	motor actual speed during communication control

Trouble shooting

The chapter introduces common faults and remedies of the driver.

List of fault alarm and remedies

Protection function is activated, and LED digital tube displays fault information, fault output relay is activated and driver stops the output when fault occurs.

Please see Table 7-1 for faults and remedies of GS driver.

For technical support, please contact the manufacturer.

Table 7-1 Faults and remedies

Fault code	Fault	Possible reason	Remedies
E. ou	Overvoltage	Power supply voltage is higher than the allowable input voltage range. The voltage variation of the input power is too large. Regeneration discharge resistor is not connected. The external regeneration discharge resistor does not match. Speed of the motor is too high, and cannot absorb energy in preset time. Load inertia increases and cannot absorb energy during deceleration of the motor. Voltage inspection parameters are set inappropriately. Driver (internal circuit) failure.	• Measure line voltage between R, S and T. • Add power voltage regulator. • Inspect connection of regeneration discharge resistor. • Replace resistance and power to be in accordance with the specified regeneration discharge resistor. • Reduce the motor speed, and check parameter A3.25 and A3.09. • Increase the capacity of the drive, extend the acceleration and deceleration time, and add regeneration discharge resistor. • Please replace it with a new driver.
E. uul	Under voltage	The power supply voltage is lower than the allowable input voltage range. The voltage variation of the input power is too large. Power capacity is too low. Voltage inspection parameters are set inappropriately. Driver (internal circuit) failure.	• Measure the line voltage between R, S and T to check it lower than 330V or not. • Add power voltage regulator. • Increase power capacity. • Please replace it with a new driver.
E. PL	phase loss	phase loss in driver input power supply R, S, T	• Check incoming cable
E. oc3	Main circuit over current	Motor cable (U,V,W) short circuit. Motor cable (U,V,W) grounded. Motor winding burned. Motor cable poor contact. Motor does not match with driver.	• Check motor cable to ensure that there is no short-circuit in U,V and W, and the cable is connected properly • checking insulation resistance of U,V and W and PE line. Replace it with a new driver if damaged. • Check resistance between motor cable U,V and W. Replace it with

		Motor operating parameters are set incorrectly. Drive (internal IGBT or other components) failure.	a new driver if the resistance is unbalance. • Check U,V and W terminal of motor for loosing or missing to ensure reliable electrical connection. • Check nameplate of the driver, use matching motor or as required or reduce load. • Check driver's relevant motor control parameters. • Test driver power components referring CTB product maintenance manual, and replace it with new drive.
E. oL	Overload	Motor cable connection error. Electromagnetic brake is not released. Motor cable is connected incorrectly in wiring of multiple motors. The load torque increases suddenly. The motor operates with a heavy load for a long time with torque exceeding the set value. Improper current gain set. Unreasonable driver motor parameters set Encoder feedback signal interference	• Check connection between the motor power cable U,V,W and the driver. • Check the electromagnetic brake, measure brake voltage. • Connect motor cable and encoder cable to the corresponding driver correctly. • Check the mechanical rotating components, reduce the load. • Increase capacity of driver and motor. Reduce the load. • Re-adjust gain. • Check drive motor control parameters. • Check encoder cable. Make cable shielding treatment to reduce interference. • It may only be reset in E.noL state after overload counter is reset
E. noL	Overload fault eliminated	Overload fault eliminated	• No longer overloaded. The overload counter is reset: there must be a cooling time after removing E.oL fault. The information is displayed after the cooling time. At this time, the fault may be reset. The transducer must be powered on in the cooling time.

E. oL2	Overload 2	Motor cable connection error. Electromagnetic brake is not released. Motor cable is connected incorrectly in wiring of multiple motors. The load torque increases suddenly. The motor operates with a heavy load for a long time with torque exceeding the set value. Improper current gain set. Unreasonable driver motor parameters set Encoder feedback signal interference	• Check connection between the motor power cable U,V,W and the driver. • Check the electromagnetic brake, measure brake voltage. • Connect motor cable and encoder cable to the corresponding driver correctly. • Check the mechanical rotating components, reduce the load. • Increase capacity of driver and motor. Reduce the load. • Re-adjust gain. • Check drive motor control parameters. • Check encoder cable. Make cable shielding treatment to reduce interference. • It may only be reset in E.noL state after overload counter is reset. • The E.noL, E.noL2 state may only be reset after cooling time.
E. noL2	Overload fault 2 eliminated	Overload fault 2 eliminated	• The cooling time has been passed and the fault may be reset.
E. oH1	Power module overheating	Ambient temperature of the driver exceeds the specified value. Cooling duct of the driver is blocked and the fan is damaged. Driver works for a long time in the state of overload. Driver (internal temperature detection circuit) failure	• Reduce ambient temperature, and improve the cooling condition. • Check and clean cooling duct and replace fan. • Check the mechanical rotating components, reduce the load. • Please replace it with a new driver.
E. noH1	Power module overheating fault eliminated	Power module overheating fault eliminated	• the fault may be reset when the temperature is lowered to permitted operation scope
E. oH2	Driver internal overheating	Ambient temperature of the driver exceeds the specified value. Cooling duct of the driver is blocked and the fan is damaged. Driver works for a long time in the state of overload. Driver (internal temperature detection circuit) failure	• Reduce ambient temperature, and improve the cooling condition. • Check and clean cooling duct and replace fan. • Check the mechanical rotating components, reduce the load. • Please replace it with a new driver.

E. noH2	Driver internal overheating fault eliminated	Driver internal overheating fault eliminated	• the fault may be reset when the inside of the driver is not overheating ant more and the inside temperature is lowered to 3℃.
E. oH3	Motor overheating	Driver works for a long time in the state of overload. Motor thermal protection connection error or thermal protection parameter setting error. Cooling duct of the driver is blocked or wrong fan direction or the fan is damaged. Driver (internal detection circuit) failure	• Increase capacity of driver and motor or reduce the load. • Check thermal protection wiring connection. • Clean motor cooling duct, modify fan direction, and replace fan. • Please replace it with a new driver.
E. noH3	Motor overheating fault eliminated	Motor overheating fault eliminated	• the fault may be reset when the Motor overheating has been eliminated.
E. oS	Motor over speed	Encoder parameters sett error. Command PULSE sub-frequency multiplication ratio is set improperly.	• Check encoder parameter A3.06, A3.23.
E. Jc	Driver contactor failure	Contactor damaged	• Please replace it with a new driver.
E. EA1	Encoder 1 feedback failure	Encoder connection cable is cut off. Encoder installation failure. failed Encoder failure. Driver encoder parameter set incorrect Driver (internal encoder feedback circuit) error	• Check encoder connection cables and wiring. • Check encoder installation. • Replace the encoder. • Check the driver encoder control parameters . • Please replace it with a new driver.
E. EA2	Encoder 2 feedback failure		
E. PU	Wrong motor cable phase sequence	The sequence of power cable of the motor is connected wrongly.	• Check connection sequence of power cables U, V, W of motor
E. br	Braking circuit failure	Braking switch damaged	• Please replace it with a new driver.
E. Eo	External	Terminal function is defined as external fault input	• Check terminal defined function.

	failure	function. Terminal receives external fault signal.	• Check terminal wiring • Replace the main board.
E. Po	The driver power unit is replaced	The driver power code is changed	• Contact the manufacturer and replace the driver
E. Po1	The driver power code is illegal	The driver power unit is identified wrongly	• Contact the manufacturer and replace the driver
E. Po2	Power unit communicatio n wrong	The parameter value can not be written into the power unit	• Contact the manufacturer and replace the driver
E. Po3	Power unit fail	The version of the software of power unit and control crd are different, and the fault cannot be reset	• Contact the manufacturer and replace the driver
E. Enc	Encoder conversion	Encoder conversion card has problem	• Check that the encoder card is connected and the installation direction of the encoder card is correct, if not, replace the encoder card • The fault may be reset through confirming D3.00 after the encoder is replaced
.LEAr	Self-learning	Indicates the driver is in self-learning state.	•
E. cdd	Self-learning is not successful	The parameters of the motor are not set appropriately The motor has its own problem	• Check the parameters of the motor and contact the manufacturer

Common fault analysis

The drive and the motor may fail to operate to the design requirements due to parameter setting or wiring error during system startup. As no alarm code output from the driver, please make appropriate treatment referring to the section.

■ No display on drive after power-on

Trouble: the manipulator has no display after power-on of the driver. The trouble may be caused by several reasons, and shall be checked carefully. please remove all control lines before inspection.

Reason: drive rectifier bridge failure, inverter bridge failure, switching power supply failure or starting resistance failure.

◆ Main circuit indicator inspection

For situation which indicator is on, rectifier bridge is normal, charging resistor is normal and switching power supply failure, please contact manufacturer for repair or professional maintenance;

Please make further inspection when the indicator is off.

◆ Check the driver input power is normal or not.

Measure three-phase AC voltage of R / S / T terminal of the driv er with multimeter and check for normality. Normal power supply: 330V <power <440V.

No voltage indicates power failure;

Please make further inspection when it's normal.

◆ Rectifier bridge inspection

Measure the rectifier bridge with multimeter by the method specified in " CTB product maintenance manual ".

If the rectifier bridge is normal and the charging resistor is burned, please contact manufacturer for repair or professional maintenance;

If the rectifier bridge is damaged, please replace the rectifier bridge. Manufacturer repair is recommended.

■ Spindle cannot run

Trouble: spindle does not rotate when driver power-on and displays f. 0 and CNC system sends operation order.

Reason: CNC system fails to send frequency command or operation order, control logic error and improper parameter setting may make the spindle do not rotate. It shall be inspected carefully.

◆ Inspect the speed setting value on the driver, namely the displayed value of F.

Make the CNC system execute S1000 M3, and observe the display on driver is F. 1000 or not.

If it is F. 1000, check driver's output frequency U1.01, feedback frequency U1.02;

If it is not F. 1000, please inspect that the CNC system sent frequency command and operation command correctly or not.

◆ Test driver's output frequency O and feedback frequency b

If U1.01 is same with U1.00, the U1.02 is 0, please inspect motor and wiring, and contact manufacturer

for repair or professional maintenance;

If U1.01 is not same with U1.00, or equals to 0, please inspect acceleration parameter A3.24, or contact with the manufacturer.

◆ Inspect that has the CNC system sent frequency command and operation command correctly

Monitor analog input value U2.05 or U2.06, as well as switching value input state U2.02 with monitoring parameter of U2. As normal, the analog value is about 100% (the maximum speed of spindle is 8000rpm), and other switching value input signals are 0.

Step 1: check the corresponding analog values on the driver terminals with multimeter. If they are not correct, check the system and connection cable; if they are correct, proceed to the next step.

Step 2: check A1.35, if it's wrong, correct it and power on again, monitor analog input value U2.05 or U2.06 (select the channel of the analog to be monitored according to the specific plan), if it displays 100%: check analog input terminal select relevant parameters (A1.35, A2.01, A2.02). If the problem cannot be solved, please contact the manufacturer; if it's not 100%, proceed to the next step.

Step 3: calibrate the analog again, please refer to chapter 6 for detailed operation. check U2.05 or U2.06 again (select the channel of the analog to be monitored according to the specific plan). If it displays 100%: please contact the manufacturer if the problem cannot be solved; if it doesn't display 100%, please contact the manufacturer.

◆ Measure command signal sent by CNC system

If it's normal, the driver control panel receive signal falsely, please replace control panel or contact manufacturer for repair.

If it's not normal, check the CNC system interface and driver wiring as well as valid electrical level of driver signal.

◆ Check motor and wiring

Remove motor connection wire from driver, and measure insulation against ground of U, V, W of the motor by tramegger. Measure with the minimum ohms range of a multimeter to check the resistance among the 3-phase is balance or not. Judge the motor and wiring is normal or not.

If it's normal, the driver module is burned;

If it's not normal, replace the motor or wiring.

■ Spindle runs in low speed

Trouble: adjust set speed (frequency), the U1.00 set speed (frequency) on the manipulator is shown normal. However, the spindle speed is very low (about dozens rpm), and does not change with the set speed.

Reason: spindle motor encoder feedback abnormal or motor sequence error.

◆ Check the motor and encoder wiring

Normal wiring: U / V / W of motor and driver are connected correspondingly, and the wiring of encoder is correct.

Abnormal: adjust wiring;

Normal: inspect that the encoder line and physical line number of encoder are in conformity with A3.06.

◆ Inspect encoder signal

Method: driver power-on, respectively measure A + and A-, B + and B-, Z +and the Z- on control panel of the driver in standby state with DC 20V gear of multimeter.

The normal value is about +3 V or-3V.

Normal: inspect encoder cable, and monitor the countering of U2.00.

Abnormal: encoder failure, replace the encoder.

◆ Inspect encoder cable

Method: Remove both ends of the encoder cable respectively from the motor and driver, measure the core cables respectively with ohm gear of multimeter to check conduction.

Abnormal: encoder cable failure, replace the cable;

Normal: encoder failure, replace the encoder.

■ Spindle speed setting error

Trouble: great deviation between the set speed (frequency) of U1.00 on driver and set speed of S command on CNC system.

Reason: the parameter setting on driver or CNC system does not match, or analog interface failure.

◆ Adjust parameter setting of driver and CNC system

Check the drive parameters: A2.02 analog type A3.23 maximum output speed

Check the CNC system parameter setting:

If the settings are normal, measure voltage of analog port with multimeter.

◆Check analog port voltage

Normal port voltage = set speed / maximum speed× 10 (V)

Take the maximum speed 8000 rpm of spindle for example, it shall be inspected by the following table, and error within 0.1% is normal.

CNC system set speed rpm		400	800	1000	2000	4000	8000
analog port	Unipolar	0.50	1.00	1.25	2.50	5.00	10.00
Voltage	Bipolar	0.50	1.00	1.25	2.50	5.00	10.00
Driver displays set speed		400	800	1000	2000	4000	8000

Correct detection value: driver analog port failure, replace driver control panel;

Wrong detection value: CNC system analog output port failure, replace interface boardof the CNC system.

■ Spindle accurate stop position is not accurate

Common phenomenon of inaccurate accurate stop:

The spindle accurate stop angle has deviation with tool magazine in initial use or after replacement of spindle, motor and synchronous belt;

Change of accurate stop position after a certain time operation;

Occasional inaccurate accurate stop position during operation.

◆ Initial use or replacement of spindle

Re-adjust accurate stop angle and adjust parameter: A3.39. accurate stop offset

◆ Change of accurate stop position after a certain time operation

Phenomenon: deviation is stable after change of accurate stop position, and does not recover.

Inspect: the synchronous belt is loose or not; the synchronous belt wheel of spindle motor is loose or not; the encoder of spindle motor is loose or not.

Treatment: please make corresponding repair if the above phenomenon occurs, or contact with the manufacturer to replace encoder.

◆Occasional inaccurate accurate stop position during operation

Please contact with the manufacturer to replace encoder after confirming the following situation.

○ The cables of encoder are connected reliably, and the shielding layer are well grounded.

○ The logic of accurate stop program of the CNC system is correct.

○ The fault still occasionally occurs after carrying out manual accurate stop in MDI mode several times.

■ Over voltage alarm during deceleration

Driver displays E.ou or E.ouH alarm.

Reason: deceleration parameter of driver is set inappropriately and driver brake circuit fails or braking resistor burned.

◆ Check acceleration and deceleration parameters of the driver

Stop the driver, and increase setting value of A3.25. Increase 0.5 each time, and restart again to observe. Make further inspection if the alarm still exists.

◆ Inspect braking resistor

When the display is power off, measure resistance at both ends of the braking resistor with ohm gear of multimeter. If the resistance is infinite, the braking resistor is burned. If it's same with nominal resistor, the braking resistor is normal.

◆ Confirm driver fault

Make the driver run, and then measure DC bus (between P (+) and N) voltage during deceleration of the driver with DC 1000V gear of multimeter. Measured value greater than 750V indicates fault in brake circuit of the driver, or external brake unit, please contact with the manufacturer for repair.

■ Trouble due to encoder failure

○ Spindle rotates in low speed smaller than 100 rpm, the operating current exceeds the rated current, and torque reaches 1000, the speed setting dose not work.

○ During high-speed operation (greater than 3000 rpm), the speed cannot reach the set speed, and the torque reaches 100%.

○ During low-speed operation, it has obvious mechanical noise, the speed is non-uniform, the operation is not stable, and not in control of operating signal.

○ E.oc3, E.oL, E.EA1, E.EA2, E.Enc alarm appear.

○ The spindle rotates in high speed and not in control of operation signal.

■E. PL、E. UuI faults occur frequently

Fault cause: instable power voltage or power supply line failure

Check contents:

○ Instantaneous under voltage may be caused by thunderstorm weather, or time section with large power supply voltage fluctuation or start of large equipment.

○ Poor contact in power supply circuit. Please check contact of breaker, contactors, fuses in power supply circuit carefully for poor contact (shall be judged only by measurement of multimeter).

Treatment method:

○ Add regulated power supply for region with grid with unstable voltage.

○ Solve line fault.

○ Replace faulty low voltage electrical appliances

■ Leakage protection switch is actuated

Phenomenon: when the servo spindle starts, the leakage protection switch trips.

Reason: the leakage protection switch is not the special type for servo (or transducer), the leakage protection value is set too small.

Remedies:

○ for common leakage protection switch, the recommended leakage protection value is 200mA, or cancel the leakage protection switch.

○ for special leakage protection switch for servo (or transducer), the leakage protection value is 30mA.

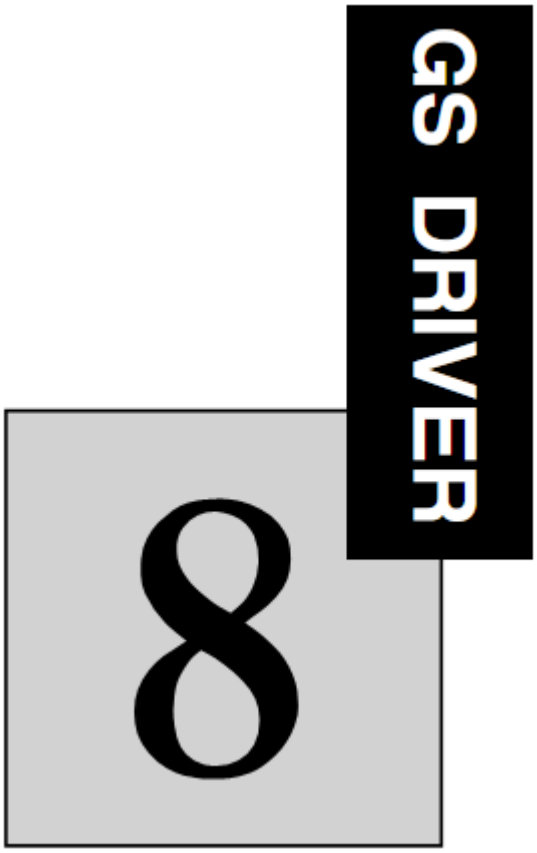
○ add isolation transformer between common leakage protection switch and servo driver.

Alarm reset method

Alarm reset includes the following methods:

○ Enable signal again.

○ Turn off the driver, and power on again after driver power indicator is off



Maintenance

The chapeter introduces the basic requirements and methods of routine maintenance of the driver.

Prompt

Hidden fault of the driver may be caused by effect of temperature, humidity, pH, dust, vibration and other factors of the service environment, as well as aging, wear of internal components of the driver and many other reasons. Therefore, routine inspection must be conducted to the driver and driving system during storage and application, and make maintenance regularly.

Caution

★Dangerous high voltage exists during operation of the driver. Inappropriate operation may result in serious personal injury. Dangerous high voltage still exists for a period of time after the power is turned off.

★Only trained and authorized qualified professionals can conduct driver maintenance.

★Watch, ring and other metal objects of maintenance personnel must be removed before operation. Clothing and tools that meet insulation requirements must be applied during operation. Fail to observe the above requirements may lead to electric shock.

Danger

When inspect or maintain the driver, never touch the main circuit terminals or other components in the driver directly or through metal tools before confirm the following four items completely; otherwise there is a risk of electric shock.

Shut off the drive power supply reliably, and wait at least 5 minutes;

● Open cover plate of the driver after all LED indicators on the operating panel are off;

●Charging indicator (CHARGE light) at the right lower of internal of the driver is off;

●Measure voltage between main circuit terminal P (+), n (-) and confirm that the voltage is lower than 36VDC

Danger

● Don't leave screw, wire, tools and other metal items in the driver. Otherwise, the driver may be damaged.

●Never make unauthorized modification to the internal of the driver. Otherwise, the normal operation of the driver will be affected.

● There is electrostatic sensitive IC elements on the control panel in the driver. Do not touch IC elements on the control panel directly.

● Maintenance to main board of the driver shall be conducted only by manufacturer.

Routine maintenance

Routine maintenance shall be carried out during regular operation of the driver to guarantee excellent

operating environment; and record daily operation data, parameter setting data, parameter changing and so on, establish and improve equipment application file.

Through routine maintenance and inspection, various abnormal situations may be found timely and find out causes, and eliminate hidden fault, ensure normal operation of equipment, and prolong service life of the driver.

List of routing maintenance item

Inspect object	Inspection main point and judge standard			Judge standard
	Inspection content	Cycle	Inspection method	
Service environment	(1) temperature, humidity (2) dust, moisture and dribbling (3) gas	Any time	(1)digimite, hygrometer (2) observation (3)observation and nasil	(1) Ambient temperature is lower 45℃, otherwise, derating operation. Humidity meets application requirements. (2) no accumulated dust, water leakage mark and condensation. (3) no abnormal color and foreign odor. Ambient temperature is lower 45℃, otherwise, derating operation. Humidity meets application requirements.
Driver	(1)vibration (2)radiating and heating (3) noise	Any time	(1) comprehensive observation (2) digimite and comprehensive observation (3) hearing	(1) stable operation without vibration. (2) fan works normally, wind speed and quantity are normal; no abnormal heating. (3)no abnormal noise.
Motor	(1)vibration (2)heating (3) noise	Any time	(1) comprehensive observation and hearing (2) digimite (3) hearing	(1) no abnormal vibration and abnormal sound. (2)no abnormal heating. (3) no abnormal noise.
Operating state parameter	(1)power supply input voltage (2)driving output voltage (3) driving output current (4) internal temperature	Any time	(1) voltmeter (2) rectifier type voltmeter (3)ammeter (4)digimite	(1) meet requirement of specifications. (2) meet requirement of specifications. (3) meet requirement of specifications. (4) temperature rise lower than 40℃.

Regular maintenance

To eliminate hidden fault, and guarantee long term table operation of high performance, user shall carry out a regular inspection to the driver every 3～ 6 months or shorter interval according to the service environment.

Regular inspection content

1. The connector is loose or not;
2. Check main circuit terminals for poor contact, and copper row connection for mark of overheat;
3. Check power cable, control cable for damage, especially cutting mark on skin which in contact with

metal surface;

4. Check insulation binder of power cable nose for falling off;

5. Clean dust on printed circuit board and air passage completely. It is best to use the cleaner;

6. Before insulation test to the driver, all connections between driver, power supply and motor, and short all of main circuit input and output terminals with wire reliably, and then test against ground.

---------- Insulation precautions ----------

Please use qualified 500V Meg-ohmmeter (or corresponding gear of insulation tester). Do not use defective instrument.

■ It's strictly prohibited to conduct insulation test against ground with only single main circuit terminal connected, or there will be a risk of damage to driver.

■ Never make insulation test to control terminals, otherwise driver will be damaged.

■ Do remove all of wires which short main circuit terminals after test.

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7. For insulation test to motor, the connections between the motor and driver must be disconnected completely, and then test the motor separately.

Wearing parts of the driver

Wearing parts of the driver mainly includes cooling fan and electrolytic capacitor for filtering. Their service life are closely related with operating environment and maintenance status. In most cases, service life of fan is 30-40 thousand hours; service life of electrolytic capacitor is 40-50 thousand hours. The normal replacement age limit shall be determined referring to service life of wearing parts and on the basis of working time of the driver. Component shall be replaced when abnormalities is found during inspection. When replace wearing part, it's shall be ensured that the model and electrical parameter of the components are identical or very close to each other.

Routine inspection of common wearing parts

1. Fan

Damage cause: bearing wear, blade aging.

Criteria: check fan blades and other parts for cracks or other abnormalities when the driver is turned off; check operation of the fan for abnormal vibration, noise and so on when the driver is started.

2. Electrolytic capacitor

Damage cause: high ambient temperature, large PULSE power, electrolyte aging.

Criteria: frequent over-current, over-voltage in load operation of the driver; liquid leakage and safety valve protruding; the measured insulation resistance of static capacitance is abnormal or not.

Driver storage

1. Storage environment

Drive storage environment requirement

Environment characteristics	Requirement	Remarks

Ambient temperature	- 40∽+70	The driver shall be stored in long term in environment with temperature lower than 30℃ to avoid condensation and freezing due to temperature variation
Ambient humidity	5∽95% rh	Plastic film enclosure and desiccant and other measures may be applied
Other conditions	No direct sunlight, dust, corrosive or combustible gas, oil mist, steam, gas, dropping water, vibration and little salt.	

2. For long-term idle, it's recommended to turn the driver on for more than half an hour every 6 months during storage to prevent failure of electronic components, or conduct no-load operation to the driver.

Drive warranty

1. For fault or damage of the driver under normal application conditions, the warranty is valid within 12 months from the date of delivery. A reasonable repair cost shall be paid for fault or damage after 12 months;

2. A certain of repair cost shall be paid for the following situations even within the 12 months.

(1). Machine damage due to wiring and operation that not in accordance with the user manual;

(2). Damage caused by fire, floods and abnormal voltage;

(3). Damage caused when use the driver in abnormal function application;

Appendix

List of spindle motor code

Motor Model	Code	Motor Model	Code	Motor Model	Code
CTB-41P8ZXB07-15XXXP	22132	CTB-49P5ZXC15-30XXX	13162	CTB-4011ZXC15-60XXXP	23164
CTB-42P2ZXB10-20XXXP	22142	CTB-49P5ZXC15-45XXX	13163	CTB-4015ZXC20-40XXXP	23172
CTB-42P2ZXB10-30XXXP	22143	CTB-49P5ZXC15-60XXX	13164	CTB-4015ZXC20-60XXXP	23173
CTB-42P2ZXB10-40XXXP	22144	CTB-4013ZXC20-40XXX	13172	CTB-4015ZXC20-60XXXP	23174
CTB-43P7ZXB15-30XXXP	22162	CTB-4013ZXC20-60XXX	13173	CTB-47P5ZXC07-15XXXP	23232
CTB-43P7ZXB15-45XXXP	22163	CTB-4013ZXC20-80XXX	13174	CTB-47P5ZXC07-20XXXP	23233
CTB-43P7ZXB15-60XXXP	22164	CTB-4018ZXC30-60XXX	13192	CTB-47P5ZXC07-30XXXP	23234
CTB-45P5ZXB20-40XXXP	22172	CTB-45P5ZXC07-15XXX	13232	CTB-4011ZXC10-20XXXP	23242
CTB-45P5ZXB20-60XXXP	22173	CTB-45P5ZXC07-20XXX	13233	CTB-4011ZXC10-30XXXP	23243
CTB-45P5ZXB20-80XXXP	22174	CTB-45P5ZXC07-30XXX	13234	CTB-4011ZXC10-40XXXP	23244
CTB-47P5ZXB30-60XXXP	22192	CTB-47P5ZXC10-20XXX	13242	CTB-4015ZXC15-30XXXP	23262
CTB-47P5ZXB30-90XXXP	22193	CTB-47P5ZXC10-30XXX	13243	CTB-4015ZXC15-45XXXP	23263
CTB-42P8ZXB07-15XXXP	22232	CTB-47P5ZXC10-40XXX	13244	CTB-4015ZXC15-60XXXP	23264
CTB-43P7ZXB10-20XXXP	22242	CTB-4011ZXC15-30XXX	13262	CTB-4022ZXC20-40XXXP	23272
CTB-43P7ZXB10-30XXXP	22243	CTB-4011ZXC15-45XXX	13263	CTB-4022ZXC20-60XXXP	23273
CTB-43P7ZXB10-40XXXP	22244	CTB-4011ZXC15-60XXX	13264	CTB-4022ZXC20-80XXXP	23274
CTB-45P5ZXB15-30XXXP	22262	CTB-4015ZXC20-40XXX	13272	CTB-49P0ZXC07-15XXXP	23332
CTB-45P5ZXB15-45XXXP	22263	CTB-4015ZXC20-60XXX	13273	CTB-49P0ZXC07-20XXXP	23333
CTB-45P5ZXB15-60XXXP	22264	CTB-4015ZXC20-80XXX	13274	CTB-49P0ZXC07-30XXXP	23334
CTB-47P5ZXB20-40XXXP	22272	CTB-4022ZXC30-60XXX	13292	CTB-4013ZXC10-20XXXP	23342
CTB-47P5ZXB20-60XXXP	22273	CTB-47P5ZXC07-15XXX	13332	CTB-4013ZXC10-30XXXP	23343
CTB-47P5ZXB20-80XXXP	22274	CTB-47P5ZXC07-20XXX	13333	CTB-4013ZXC10-40XXXP	23344
CTB-4011ZXB30-60XXXP	22292	CTB-47P5ZXC07-30XXX	13334	CTB-4018ZXC15-30XXXP	23362
CTB-4011ZXB30-90XXXP	22293	CTB-4011ZXC10-20XXX	13342	CTB-4018ZXC15-45XXXP	23363
CTB-43P8ZXB07-15XXXP	22332	CTB-4011ZXC10-30XXX	13343	CTB-4018ZXC15-60XXXP	23364
CTB-45P5ZXB10-20XXXP	22342	CTB-4011ZXC10-40XXX	13344	CTB-4026ZXC20-40XXXP	23372
CTB-45P5ZXB10-30XXXP	22343	CTB-4015ZXC15-30XXX	13362	CTB-4026ZXC20-60XXXP	23373
CTB-45P5ZXB10-40XXXP	22344	CTB-4015ZXC15-45XXX	13363	CTB-4026ZXC20-80XXXP	23374
CTB-47P5ZXB15-30XXXP	22362	CTB-4015ZXC15-60XXX	13364	CTB-4011ZXC07-15XXXP	23432
CTB-47P5ZXB15-45XXXP	22363	CTB-4022ZXC20-40XXX	13372	CTB-4011ZXC07-20XXXP	23433
CTB-47P5ZXB15-60XXXP	22364	CTB-4022ZXC20-60XXX	13373	CTB-4011ZXC07-30XXXP	23434
CTB-4011ZXB20-40XXXP	22372	CTB-4022ZXC20-80XXX	13374	CTB-4015ZXC10-20XXXP	23442
CTB-4011ZXB20-60XXXP	22373	CTB-4030ZXC30-60XXX	13392	CTB-4015ZXC10-30XXXP	23443
CTB-4011ZXB20-80XXXP	22374	CTB-49P0ZXC07-15XXX	13432	CTB-4015ZXC10-40XXXP	23444
CTB-4015ZXB30-60XXXP	22392	CTB-49P0ZXC07-20XXX	13433	CTB-4022ZXC15-30XXXP	23462
CTB-4015ZXB30-90XXXP	22393	CTB-49P0ZXC07-30XXX	13434	CTB-4022ZXC15-45XXXP	23463
CTB-44P8ZXB07-15XXXP	22432	CTB-4013ZXC10-20XXX	13442	CTB-4022ZXC15-60XXXP	23464
CTB-47P0ZXB10-20XXXP	22442	CTB-4013ZXC10-30XXX	13443	CTB-47P5ZXC05-10XXXP	23422
CTB-47P0ZXB10-30XXXP	22443	CTB-4013ZXC10-40XXX	13444	CTB-47P5ZXC05-15XXXP	23423
CTB-47P0ZXB10-40XXXP	22444	CTB-4018ZXC15-30XXX	13462	CTB-47P5ZXC05-20XXXP	23424

CTB-49P5ZXB15-30XXXP	22462	CTB-4018ZXC15-45XXX	13463	CTB-47P5ZXD05-10XXX	14122
CTB-49P5ZXB15-45XXXP	22463	CTB-4018ZXC15-60XXX	13464	CTB-47P5ZXD05-15XXX	14123
CTB-49P5ZXB15-60XXXP	22464	CTB-4026ZXC20-40XXX	13472	CTB-47P5ZXD05-20XXX	14124
CTB-4013ZXB20-40XXXP	22472	CTB-4026ZXC20-60XXX	13473	CTB-4011ZXD07-15XXX	14132
CTB-4013ZXB20-60XXXP	22473	CTB-4026ZXC20-80XXX	13474	CTB-4011ZXD07-20XXX	14133
CTB-4013ZXB20-80XXXP	22474	CTB-4037ZXC30-60XXX	13492	CTB-4011ZXD07-30XXX	14134
CTB-4018ZXB30-60XXXP	22492	CTB-45P5ZXC07-15XXXP	23132	CTB-4015ZXD10-20XXX	14142
CTB-4018ZXB30-90XXXP	22493	CTB-45P5ZXC07-20XXXP	23133	CTB-4015ZXD10-30XXX	14143
CTB-45P0ZXC07-15XXX	13132	CTB-45P5ZXC07-30XXXP	23134	CTB-4015ZXD10-40XXX	14144
CTB-45P0ZXC07-20XXX	13133	CTB-47P5ZXC10-20XXXP	23142	CTB-4022ZXD15-30XXX	14162
CTB-45P0ZXC07-30XXX	13134	CTB-47P5ZXC10-30XXXP	23143	CTB-4022ZXD15-45XXX	14163
CTB-47P0ZXC10-20XXX	13142	CTB-47P5ZXC10-40XXXP	23144	CTB-4022ZXD15-60XXX	14164
CTB-47P0ZXC10-30XXX	13143	CTB-4011ZXC15-30XXXP	23162	CTB-49P0ZXD05-10XXX	14222
CTB-47P0ZXC10-40XXX	13144	CTB-4011ZXC15-45XXXP	23163	CTB-49P0ZXD05-15XXX	14223
CTB-49P0ZXD05-20XXX	14224	CTB-4030ZXE10-40XXX	15244	CTB-4090ZXF10-20XXX	16342
CTB-4013ZXD07-15XXX	14232	CTB-4045ZXE15-30XXX	15262	CTB-4090ZXF10-30XXX	16343
CTB-4013ZXD07-20XXX	14233	CTB-4045ZXE15-45XXX	15263	CTB-4090ZXF10-40XXX	16344
CTB-4013ZXD07-30XXX	14234	CTB-4022ZXE05-10XXX	15322	CTB-4132ZXF15-30XXX	16362
CTB-4018ZXD10-20XXX	14242	CTB-4022ZXE05-15XXX	15323	CTB-4132ZXF15-45XXX	16363
CTB-4018ZXD10-30XXX	14243	CTB-4022ZXE05-20XXX	15324	CTB-4055ZXF05-10XXX	16422
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CTB-4026ZXD15-30XXX	14262	CTB-4030ZXE07-20XXX	15333	CTB-4055ZXF05-20XXX	16424
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CTB-4015ZXD07-15XXX	14332	CTB-4060ZXE15-45XXX	15363	CTB-4110ZXF10-40XXX	16444
CTB-4015ZXD07-20XXX	14333	CTB-4026ZXE05-10XXX	15422	CTB-4160ZXF15-30XXX	16462
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CTB-4022ZXD10-40XXX	14344	CTB-4037ZXE07-20XXX	15433	CTB-4062ZXG05-20XXX	17124
CTB-4030ZXD15-30XXX	14362	CTB-4037ZXE07-30XXX	15434	CTB-4093ZXG07-15XXX	17132
CTB-4030ZXD15-45XXX	14363	CTB-4050ZXE10-20XXX	15442	CTB-4093ZXG07-20XXX	17133
CTB-4030ZXD15-60XXX	14364	CTB-4050ZXE10-30XXX	15443	CTB-4093ZXG07-30XXX	17134
CTB-4013ZXD05-10XXX	14422	CTB-4050ZXE10-40XXX	15444	CTB-4123ZXG10-20XXX	17142
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CTB-4018ZXD07-30XXX	14434	CTB-4030ZXF05-20XXX	16124	CTB-4065ZXG05-20XXX	17224
CTB-4026ZXD10-20XXX	14442	CTB-4045ZXF07-15XXX	16132	CTB-4100ZXG07-15XXX	17232
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CTB-4022ZXE07-30XXX	15234	CTB-4065ZXF07-15XXX	16332	CTB-4200ZXG10-30XXX	17443
CTB-4030ZXE10-20XXX	15242	CTB-4065ZXF07-20XXX	16333	CTB-4315ZXG15-30XXX	17462
CTB-4030ZXE10-30XXX	15243	CTB-4065ZXF07-30XXX	16334		