

# Operating Instructions

TCS 50 / TCS 63B / TCS 80B / TCS 100B / TCS 125 / TCS 160

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# 1. Safety Precautions

This product complies with the latest technical standards and safety specifications; however, dangers may still exist.

## 1.1. Terms of Use

Operate in accordance with the operating specifications under safe conditions.
Operate equipment in good condition and comply with the operating specifications.

## 1.2. Technical Requirements for Operations

Trained professionals are required to operate the turret in accordance with the requirements of the operations manual.



Warning
There is a risk of personal injuries or damage to the machinery.
Electrical installation must be performed only by an electrical engineer! Electrical wiring must be maintained regularly.

## 1.3. Product Features General Notes

24V DC power supply is required for operation.



When initiating, the tool disc may rotate unexpectedly, so care must be taken to avoid personal injuries.
Follow the turret installation steps, the hydraulic must be applied to oil pipe inlet A first.



In the event of mis-operation or collision, the tool disc may rotate unexpectedly, so care must be taken to avoid personal injuries.
Disconnect the turret drive power before repairing, adjusting or manually rotating the turret.



Debris or dirt that enter the turret can cause functional failure.
Appropriate sealing plugs should be used to seal relevant openings of the tool holder and coolant outlets.



When the turret malfunctions, please do not try to rotate the turret to avoid damage to the turret and other parts. Contact the TCSM's after-sales service department promptly.

## 1.4. Scraps Cleaning

When cleaning scraps, national and regional regulations and laws should be followed.

## 1.5. Disclaimer

The information contained in this operation manual is correct at the time of printing, and is subject to change without notice.
The company shall not be liable for the following situations:

- Failure to strictly follow the precautions or instructions in the operations manual
- Failure to use this product according to the specifications
- Failure to operate this product and accessories correctly
- Non-professional repair or maintenance of this product including accessories
- Modification or function transformation of this product without the consent of the manufacturer
- Failure to use suitable tool discs and tool holders
- Failure to use original parts

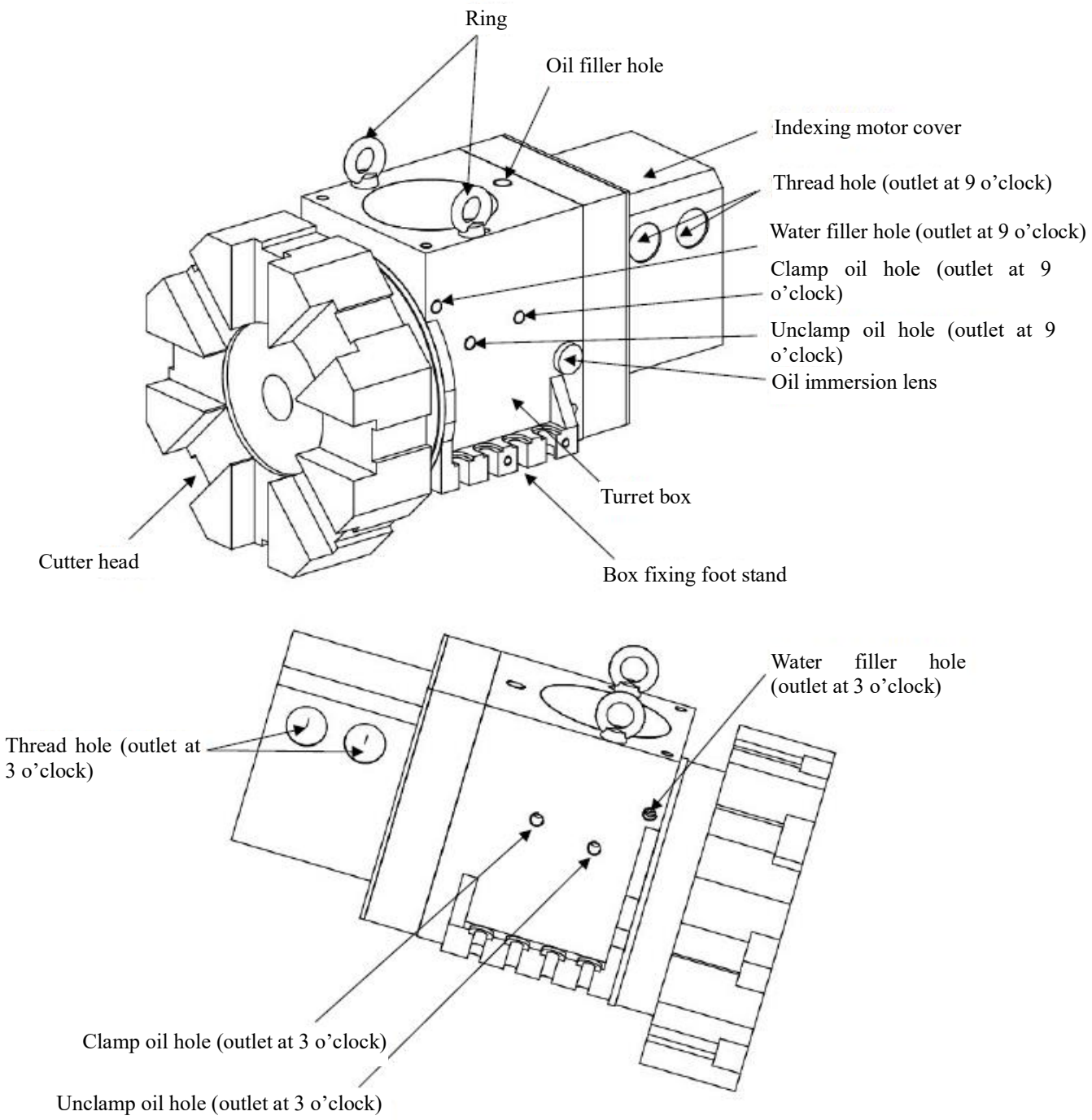
# 2. Product Introduction

## 2.1. Overview

The TCS horizontal servo turret is a high-performance product developed by the Company' s professional personnel with more than 10 years of development and production experiences after millions of tests. It has the following characteristics:

- Motor driven, compact structure, reliable action, rapid tool changeover;
- Dedicated drive suitable for various controllers; both PNP or NPN modes can be used for the I/O signal;
- Multiple control modes which can realize the functions of zeroing tool position, two-way nearest location automatic tool change and one-way jog tool change;
- Tool position is automatically memorized without the need to perform zeroing after switching on and off; connection programming is simple and convenient;
- Large-diameter precision triple ring gear positioning, large-diameter cylinder clamping, high precision, large clamping force, high rigidity, suitable for heavy cutting and precision processing;
- The high-performance seals are sealed. The surfaces are all quenched and finely grounded, which makes it durable;
- It can be transformed into a horizontal indexing head, which can realize any conversion between 2, 3, 4, 6, 8, 12, 24, with a wide range of applications at low cost.

## 2.2. INTRODUCTION



## 2.3. Turret Naming

### 2.3.1. Turret Naming

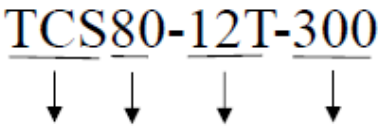
TCS *1 *2 *3 - *4 - *5 *6

| TCS | *1 | | *2 | | *3 | | *4 | | *5 | | *6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Servo turret | Height of center | Code | Type | Code | Outlet direction | Code | Station number | Code | Size across fiats of cutter head | Code | Cutter head type | Code |
| | 50 | 50 | Standards | - | 3 o'clock | - | 8 | 8T | 295 | 295 | Standards | - |
| | 63 | 63 | Upgrade | B | 9 o'clock | L/LZ | 10 | 10T | 330 | 330 | Custom 1 | /1 |
| | 80 | 80 | | | 12 o'clock | T | 12 | 12T | 350 | 350 | Custom 2 | /2 |
| | 100 | 100 | | | | | | | ... | ... | ... | ... |
| | 125 | 125 | | | | | | | | | | |
| | 160 | 160 | | | | | | | | | | |

*3: 9 o'clock (L: 9 o'clock outlet direction standard parts/LZ: 9 o'clock outlet direction positive parts)

*: For special requirements, please contact TCSM's Technical Department for confirmation.

Naming example:




Servo turret *1 *3 *5

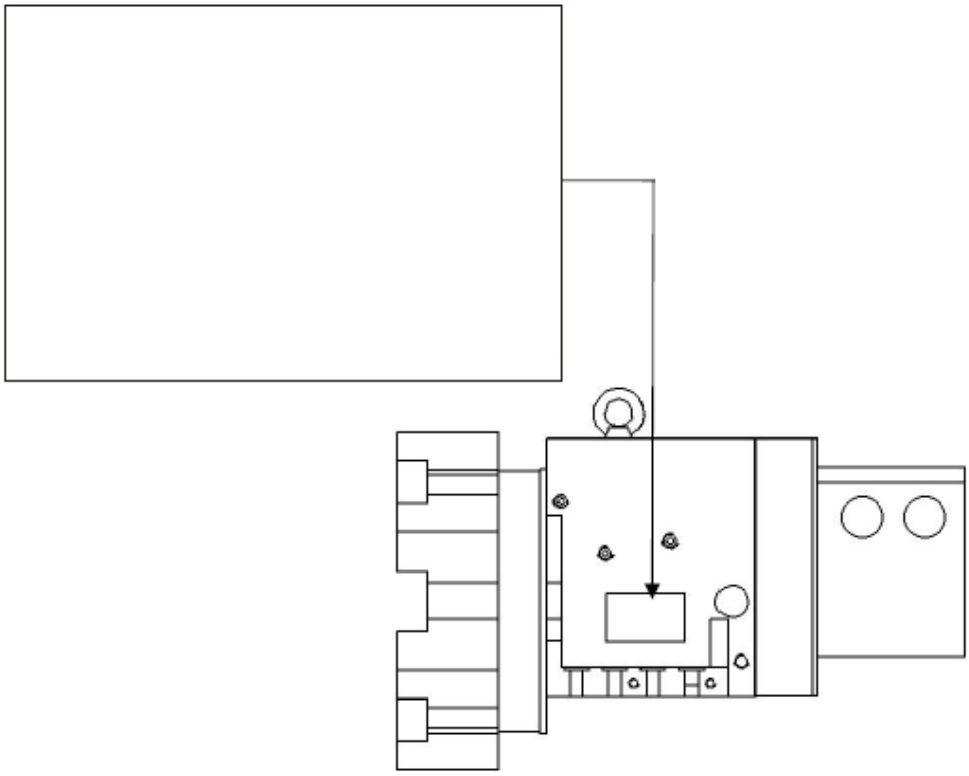
Power 80B outlet at 3 o'clock, 12 stations, 300 across fiats of cutter head

TCS100BL-12T-420

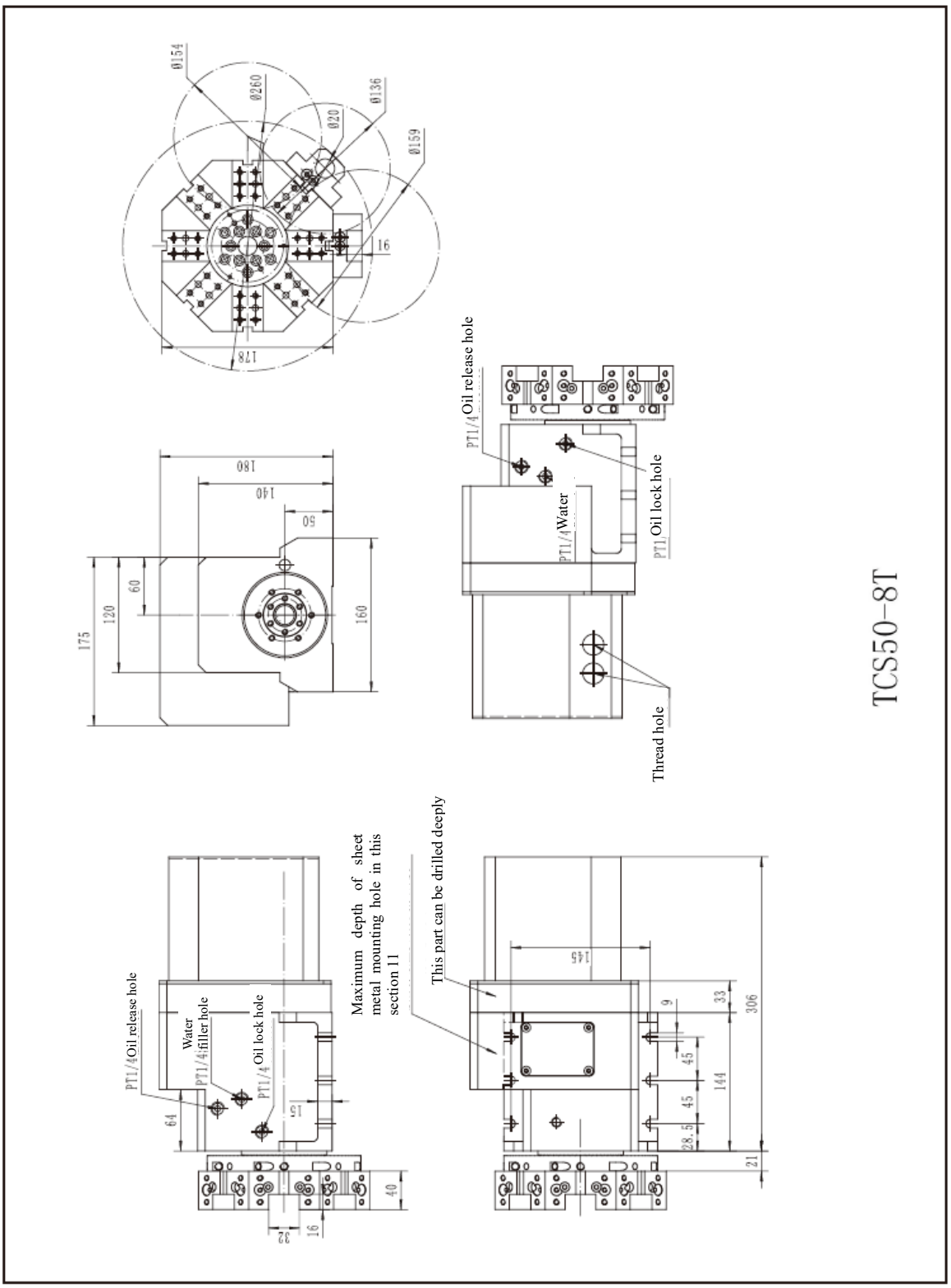
Servo turret $*_1$ $*_3$ $*_5$ $*_4$ $*_5$

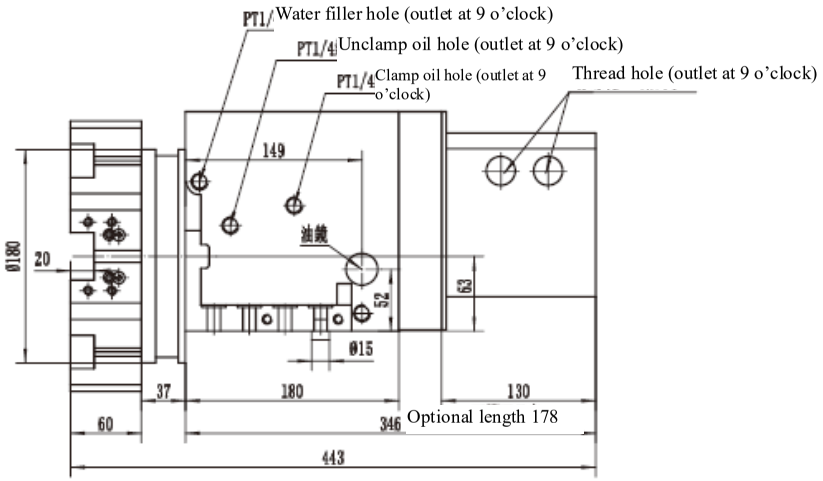
Power 100B outlet at 9 o'clock, 12 stations, 420 across fiats of cutter head

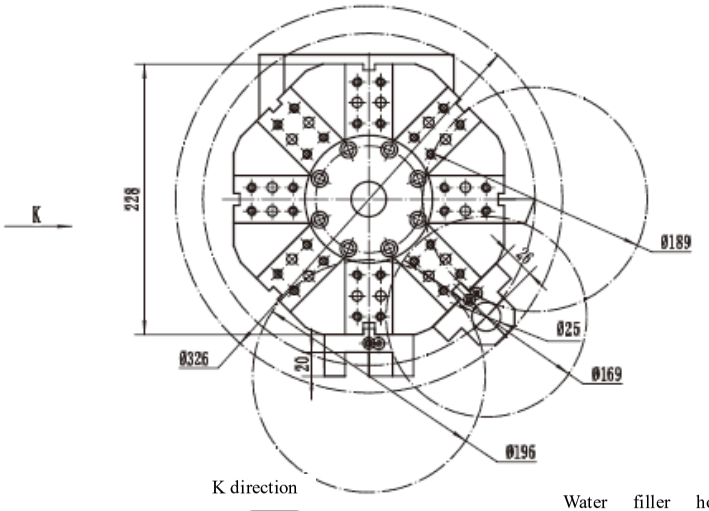
### 2.3.2. Nameplate

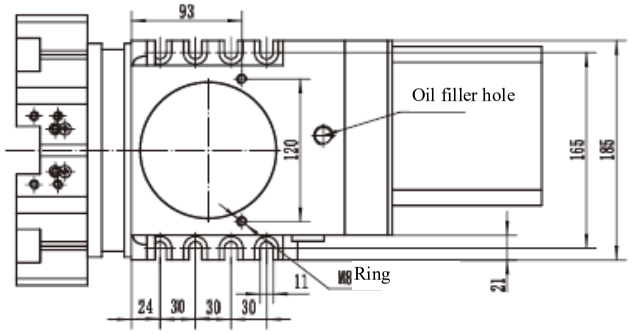


## 2.4. Dimensions

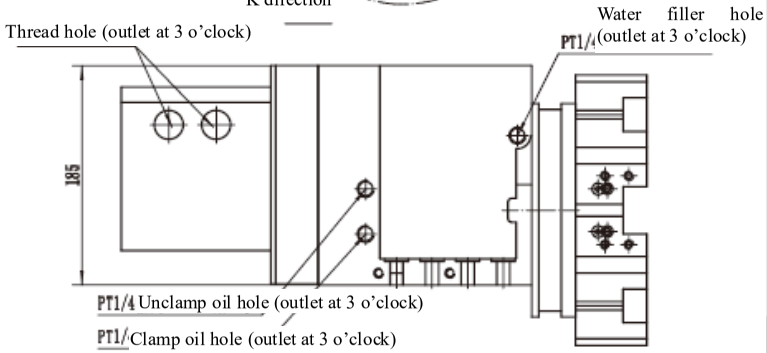




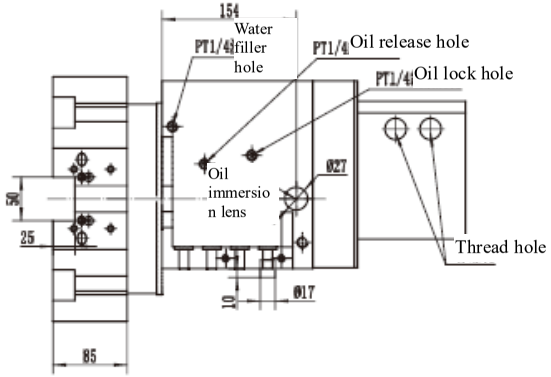



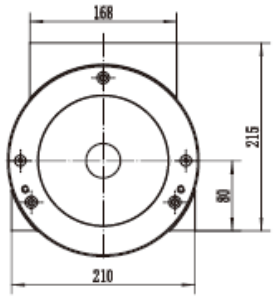



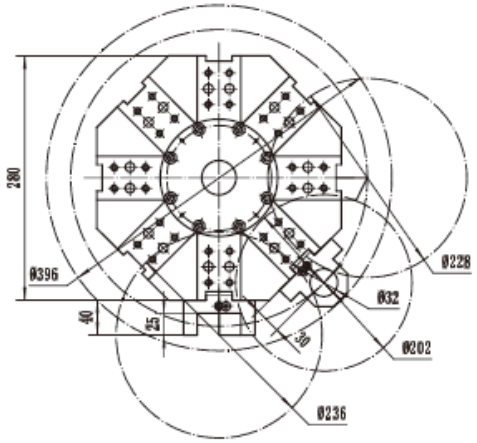

K direction

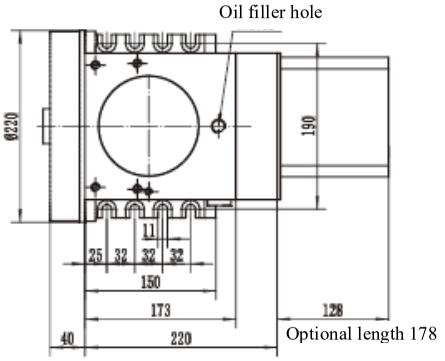


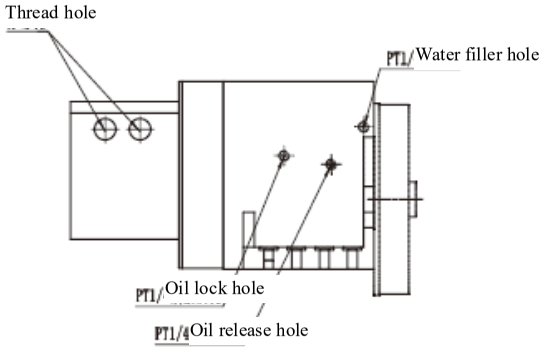

# TCS63B-8T


154
Water filler hole
PT1/4
PT1/4
Oil release hole
PT1/4
Oil lock hole
Oil immersion lens
Ø27
50
25
10
Ø17
85
Thread hole

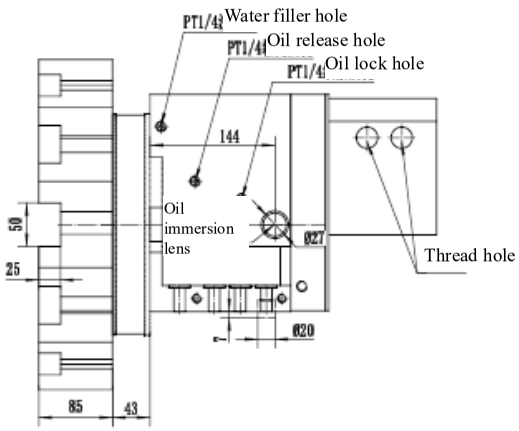

168
215
80
210

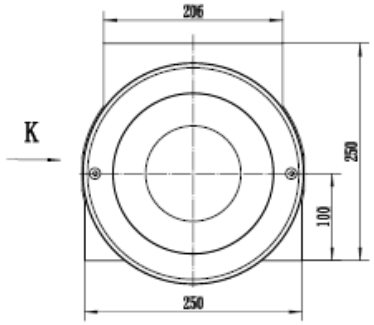

280
Ø396
Ø228
Ø32
Ø202
Ø236
40
25
30

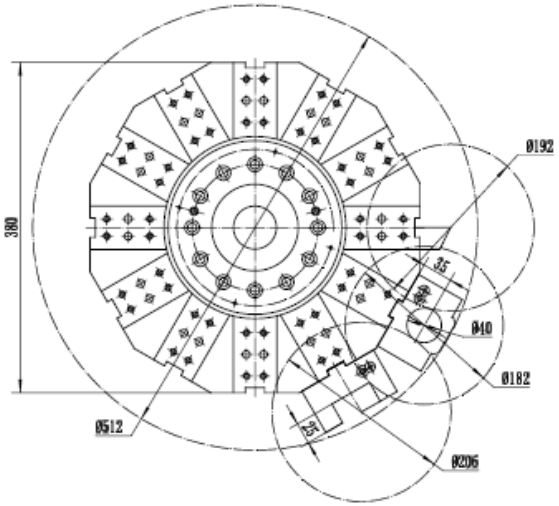

Oil filler hole
Ø220
190
11
25
32
32
32
150
173
128
40
220
Optional length 178

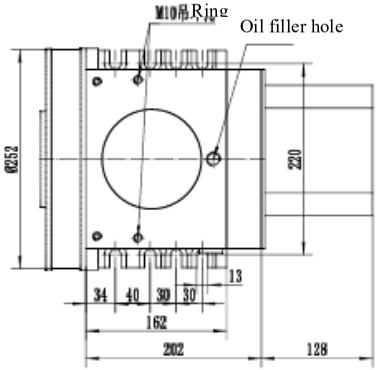

Thread hole
PT1/
Water filler hole
PT1/
Oil lock hole
PT1/4
Oil release hole

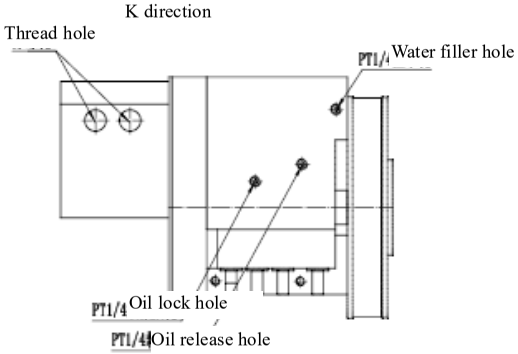
TCS80B-8T


PT1/4
Water filler hole
PT1/4
Oil release hole
PT1/4
Oil lock hole
144
Oil
immersion
lens
Ø27
Thread hole
50
25
Ø20
85
43

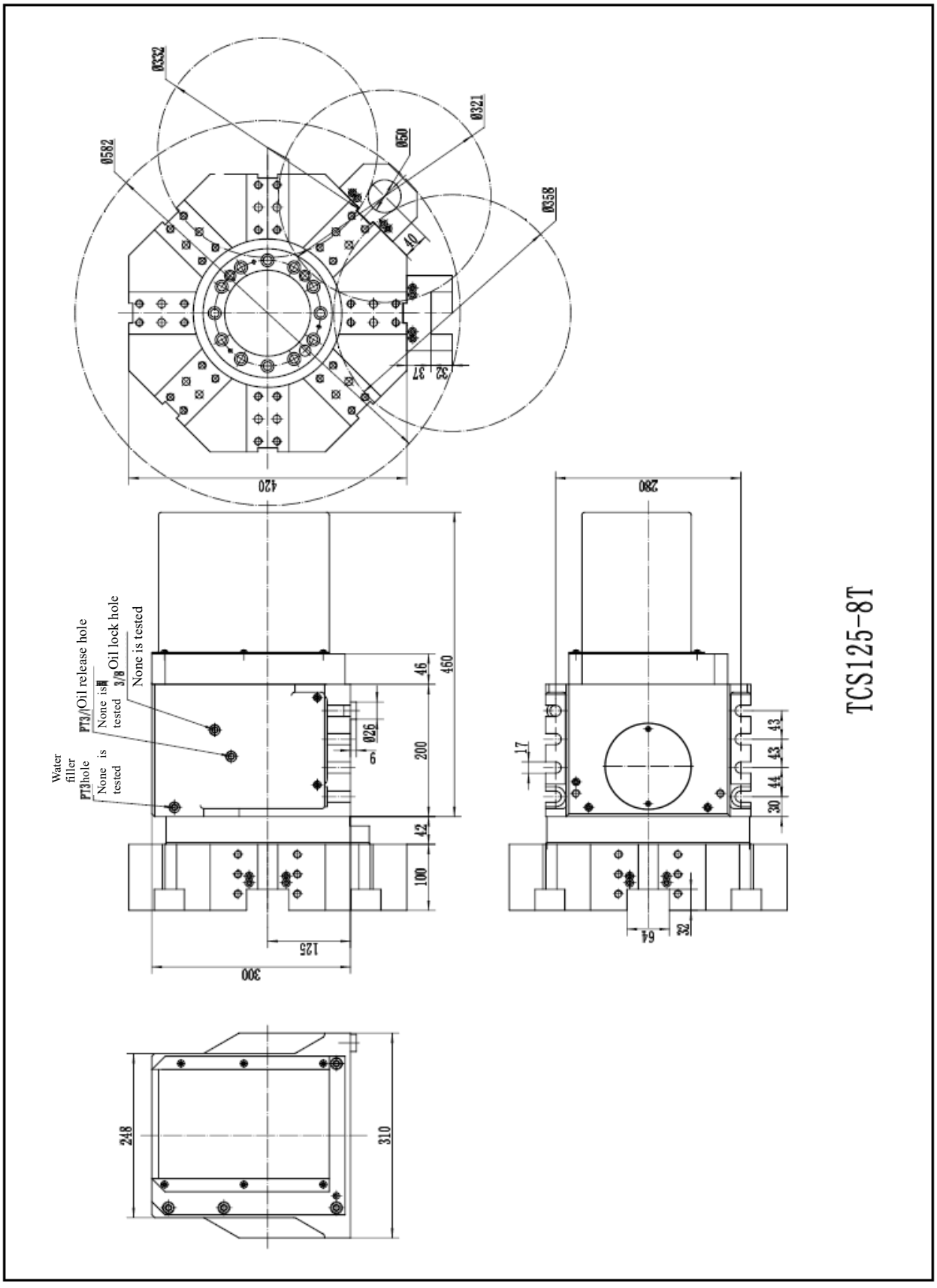

K
206
250
100
250

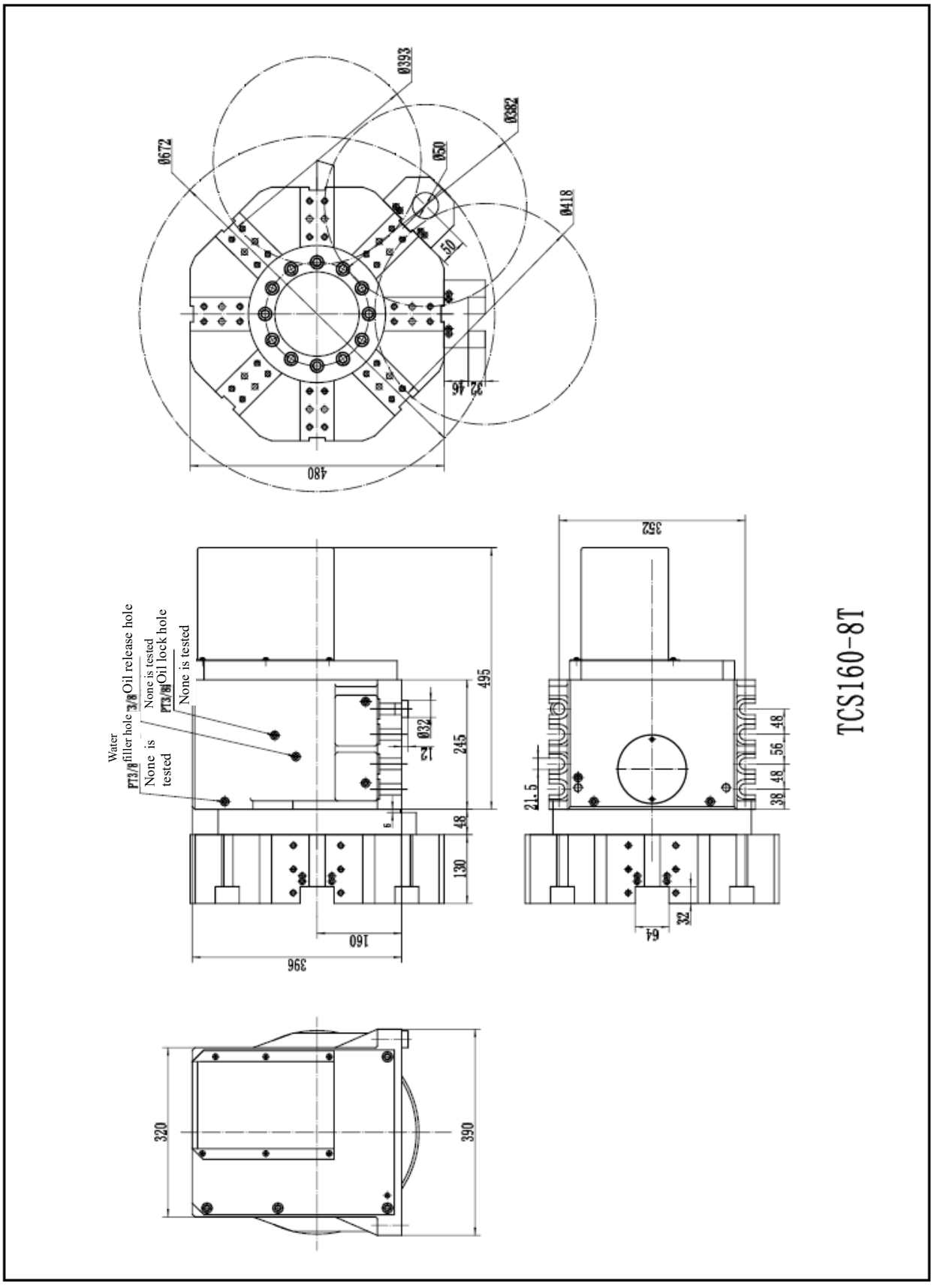

380
Ø192
35
Ø40
Ø182
Ø512
25
Ø206


M10吊环
Oil filler hole
Ø252
220
13
34
40
30
30
162
202
128


K direction
Thread hole
PT1/4
Water filler hole
PT1/4
Oil lock hole
PT1/4
Oil release hole

TCS100B-8T


Ø332
Ø321
Ø50
Ø582
Ø358
40
32
37
420
280
460
46
200
42
100
125
300
Ø26
6
17
43
43
44
30
64
32
Water filler hole PT3/8 None is tested
Oil release hole PT3/8 None is tested
Oil lock hole None is tested
248
310
TCS125-8T


TCS160-8T
Ø393
Ø382
Ø672
Ø50
Ø418
50
32
46
480
352
Water filler hole
3/8
None is tested
Oil release hole
3/8
None is tested
Oil lock hole
3/8
None is tested
495
Ø32
24
245
48
130
160
396
21.5
48
56
48
38
64
32
320
390

# 3. Working Principle

## 3.1. Overview

First, the piston pushes the ring gear to disengage under the action of oil pressure, then through the reduction gear, the tool disc can be driven to be indexed by the servo motor to complete rough positioning. Finally, the piston will engage and clamp under the action of oil pressure to achieve tool disc fine positioning to complete the tool change action.

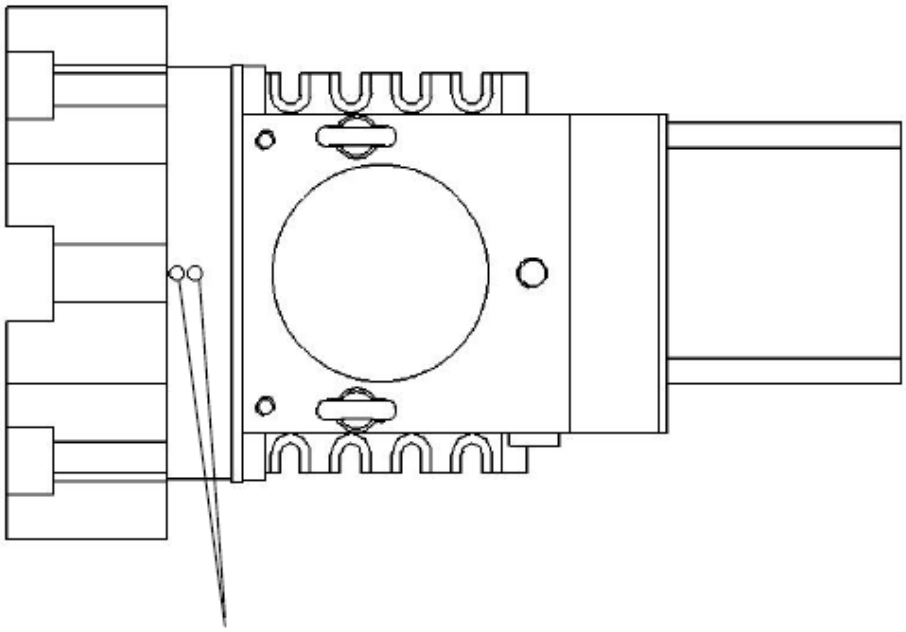
The turret has two working modes, namely, return-to-zero and automatic.

Return-to-zero mode:

It must only be performed once in the following situations, for the drive to determine the position of cutter number 1.

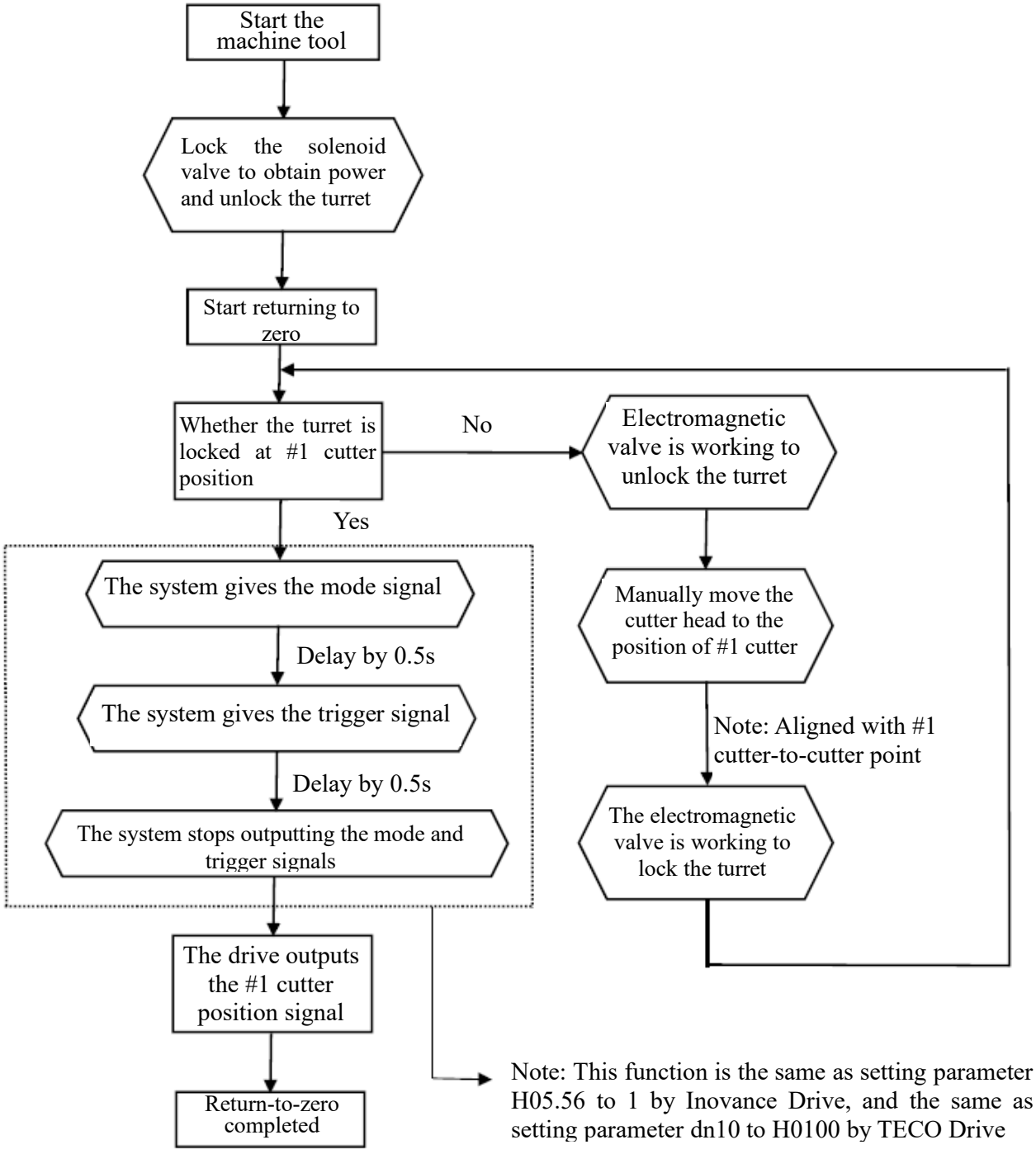
① Power on for the first time to run in after wiring;
② Replace or reinstall the servo motor;
③ Replace the drive;
④ Reinstall or replace any gear;
⑤ During the cutter replacement, it is suddenly powered off and does not turn to the working position;
⑥ During the cutter replacement, a collision occurs, and the cutter head is out of position.

Automatic mode: It is used to realize the function of automatic cutter selection nearby.

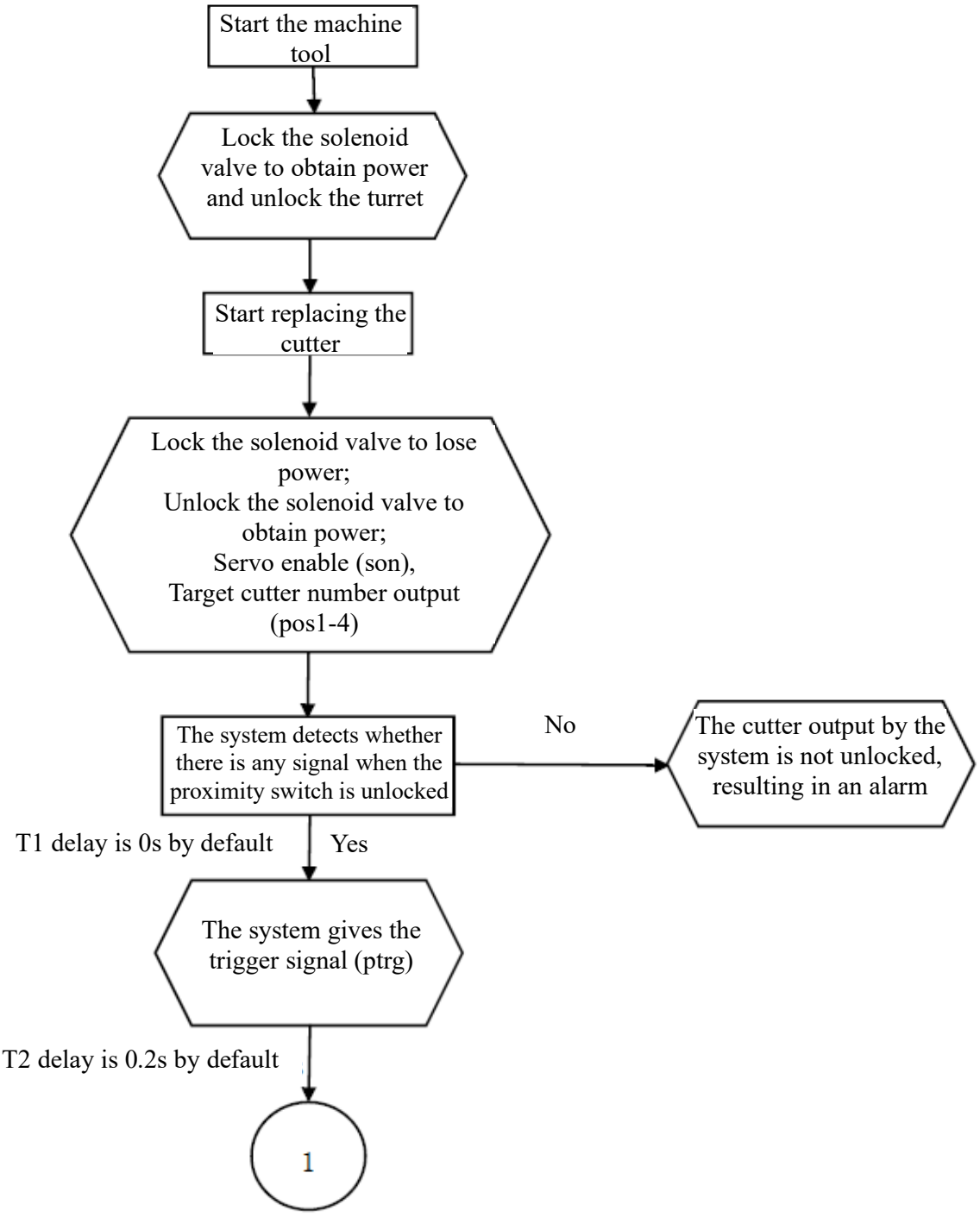


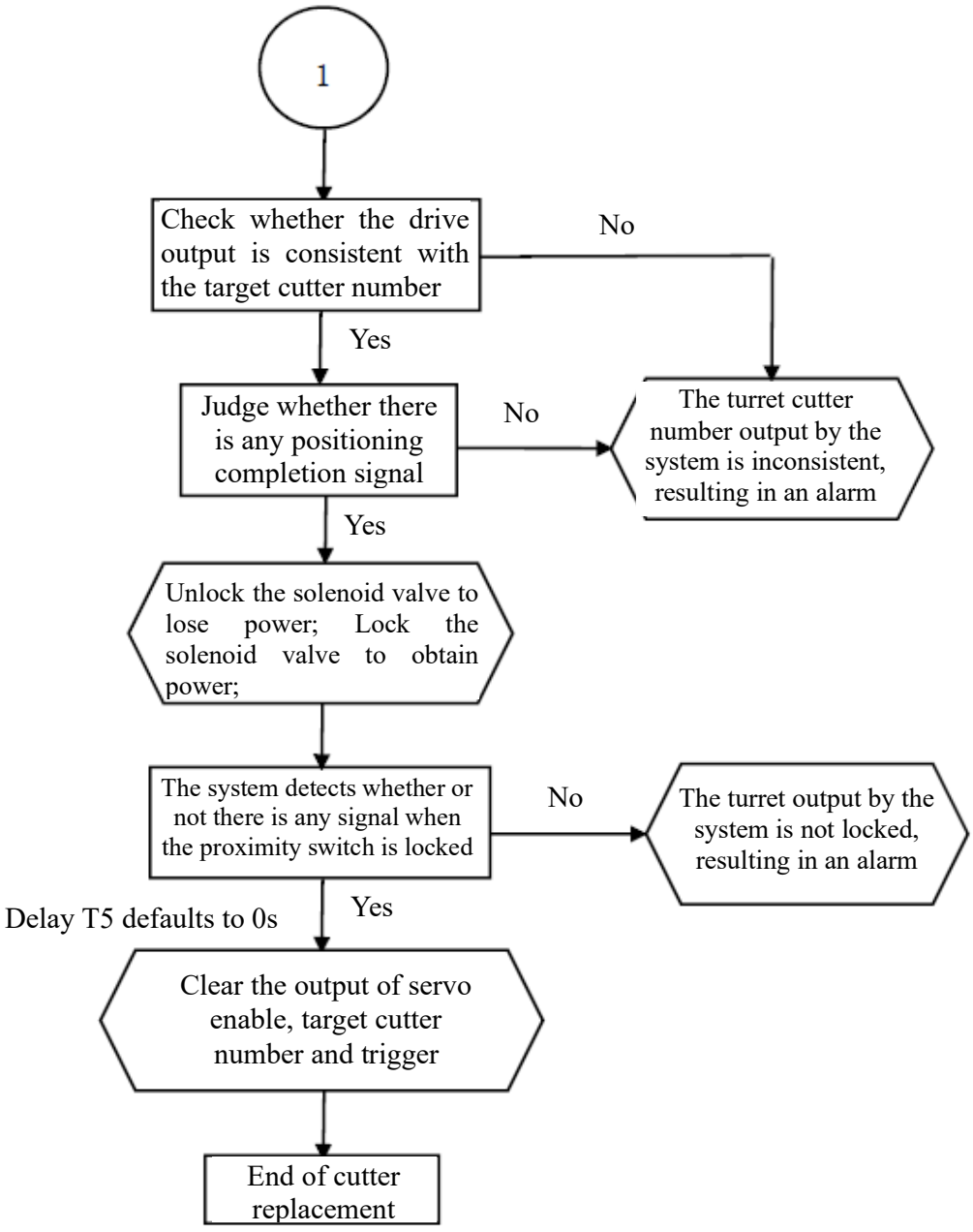
Cutter head #1 cutter-to-cutter point

## 3.2. Zeroing Flowchart



## 3.3. Automatic Tool Change Flowchart






Note: T1 is the indexing delay after unclamp, which is 0s by default and 0.1s if hydraulic unclamp is slow.

T2 is the anti-interference delay of tool change signal during indexing, which is 0.2s by default and can be set to 0.3s.

T5 is the delay for clearing enable, cutter number and trigger after the clamp signal arrives, which is 0s by default and it is set to 0.1s if the cutter head shakes due to slow clamp.

In general, it is recommended to use the default value, and change it if there is an occasional abnormal tool change due to interference.

## 3.4. Tool Change/Zero Procedure

### 3.4.1. System Tool Change Function

1. After power-on, the system needs to output a clamp signal to lock the turret under non-tool changeover conditions (including after the tool change error alarm and after the system re-set button is pressed).
2. After the tool changeover begins, the system outputs an unclamp signal to energize the unclamp solenoid valve, at the same time, outputs the servo on (enable son) and target tool number (4 digits). Note: All 3 signals must be output at the same time.
3. When the unclamp solenoid valve energizes, the turret begins to unclamp. After the turret unclamps and the proximity switch takes action, it will feedback an unclamp signal to the system. After the system receives the unclamp signal, delay T1 (default 0s) and send a trigger/zero (PTRG) signal. Then signal must be maintained until the turret is clamped, and then disconnect.
4. The turret starts to index automatically. When the target tool number is reached, the positioning completion and corresponding tool number will be output. After the system sends the trigger/zero (PTRG) signal, delay T2(default 0.2s), compare the tool number (4 digits), and compare the positioning completion. After it is correct, begin to output a clamp signal so that the clamp solenoid valve is energized.
5. After the clamp solenoid valve is energized, the turret begins to clamp. After the turret clamps and the proximity switch takes action, it will feed back a clamp signal to the system. After the system receives the clamp signal, delay T5 (default 0s) and clear the servo on (enable son), trigger/zero (PTRG) signals and target tool number. Keep only the clamp signal.

CAUTION:
After the tool changeover error alarm, if system re-set button is pressed in manual mode, the clamp signal must be output, while other outputs must be cleared. Before pressing the re-set button, keep the original output (if the turret malfunctions, the problem can be diagnosed based on the signal).
After the re-set button is pressed after the turret alarm, the tool needs to be changed in manual mode (for easy troubleshooting)

### 3.4.2. System Zero Return Function

Method 1: When returning to zero, the turret needs to be unclamped and clamped. The “zeroing mode + long press (number 0) for 1 second” to activate the switch between unclamp and clamp.
Use “zeroing mode + long press (tool change) for 5 seconds” to activate the output; send signal to mode (MDC) pin for 0.5 seconds, at the same time, send signals to trigger/zero (PTRG) and mode (MDC) pins for 0.5 second. Mis-operation needs to be prevented for the zeroing function. After the turret zeroing is initiated, a warning message “Note that the current tool position has been set to no. 1 tool” needs to be given.
Method 2: After “zeroing mode + long press (tool change) for 5 seconds," the system outputs unclamp signal to unclamp the turret, at the same time, deliver a message “Turret is unclamped, please move tool disc manually to No.1 tool position, then press tool change button to complete returning to zero." After the user completes the operation, system outputs clamp signal to clamp the turret, delay 1s, send signal to mode (MDC) pin for 0.5 seconds, at the same time, send signal to trigger/zero (PTRG) and mode (MDC) pins for 0.5 second. After the drive outputs the No. 1 tool signal, the system will show a prompt “Note that the current tool position has been set to no. 1 tool."

### 3.4.3. System Emergency Stop Function

When the emergency stop button is pressed, the system needs to disconnect from servo on (enable son) to terminate the tool change. If reset button is pressed during operation, the tool change will not terminate.
Precautions for system alarms:

① When the turret drive alarms, it needs to alarm the “Turret drive alarm.”

② During the tool change process, if the tool cannot be changed normally due to the failure to receive the unclamp signal, the system needs to give an alarm “Turret is not unclamped.”

③ During the tool change process, if tool number does not match the target tool number after the tool change is unclamped, and the tool change cannot be completed, and the system needs to give an alarm “Turret tool number does not match.”

④ During the tool change process, if the tool change cannot be completed because the clamp signal is not received, the system needs to give an alarm “Turret is not locked.”

⑤ When the system produces a turret alarm, even if required input signal is received, the output signal of the next step of the tool change process still needs to be stopped, especially the (PTRG) signal, to prevent sudden tool change after the alarm.

Special note: the ladder diagram must be written strictly according to the process.

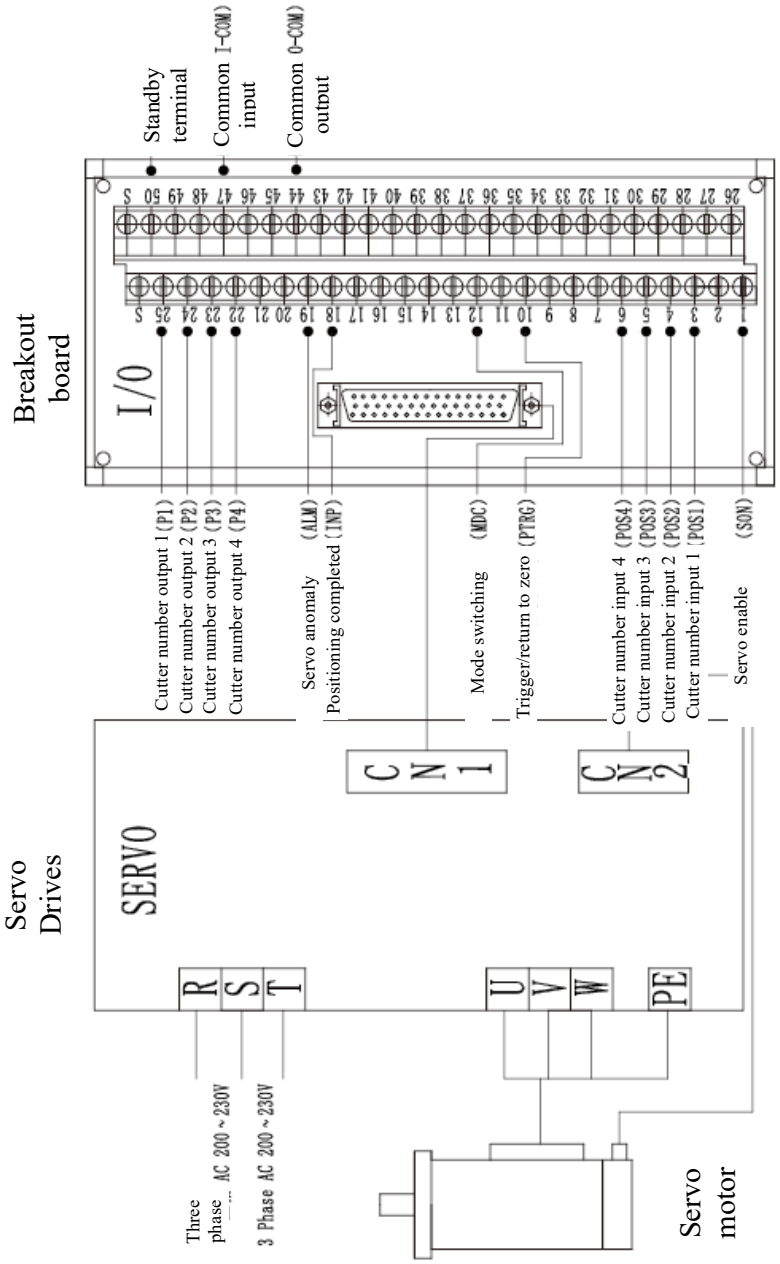
## 3.5. Connection Precautions

1. The drive has a 50-core breakout board
   Wire size to be used:

Input: 1 (son), 3 (pos1), 4 (pos2), 5 (pos3), 6 (pos4), 10 (ptrg), 12 (mdc).
Output: 18 (inp), 19 (alm), 22 (p4), 23 (p3), 24 (p2), 25 (p1).
Note: 18 (inp) is an auxiliary signal used in series with the tool position number and cannot be used as a locking condition alone.
The common terminals of input and output signals are 47 and 44.

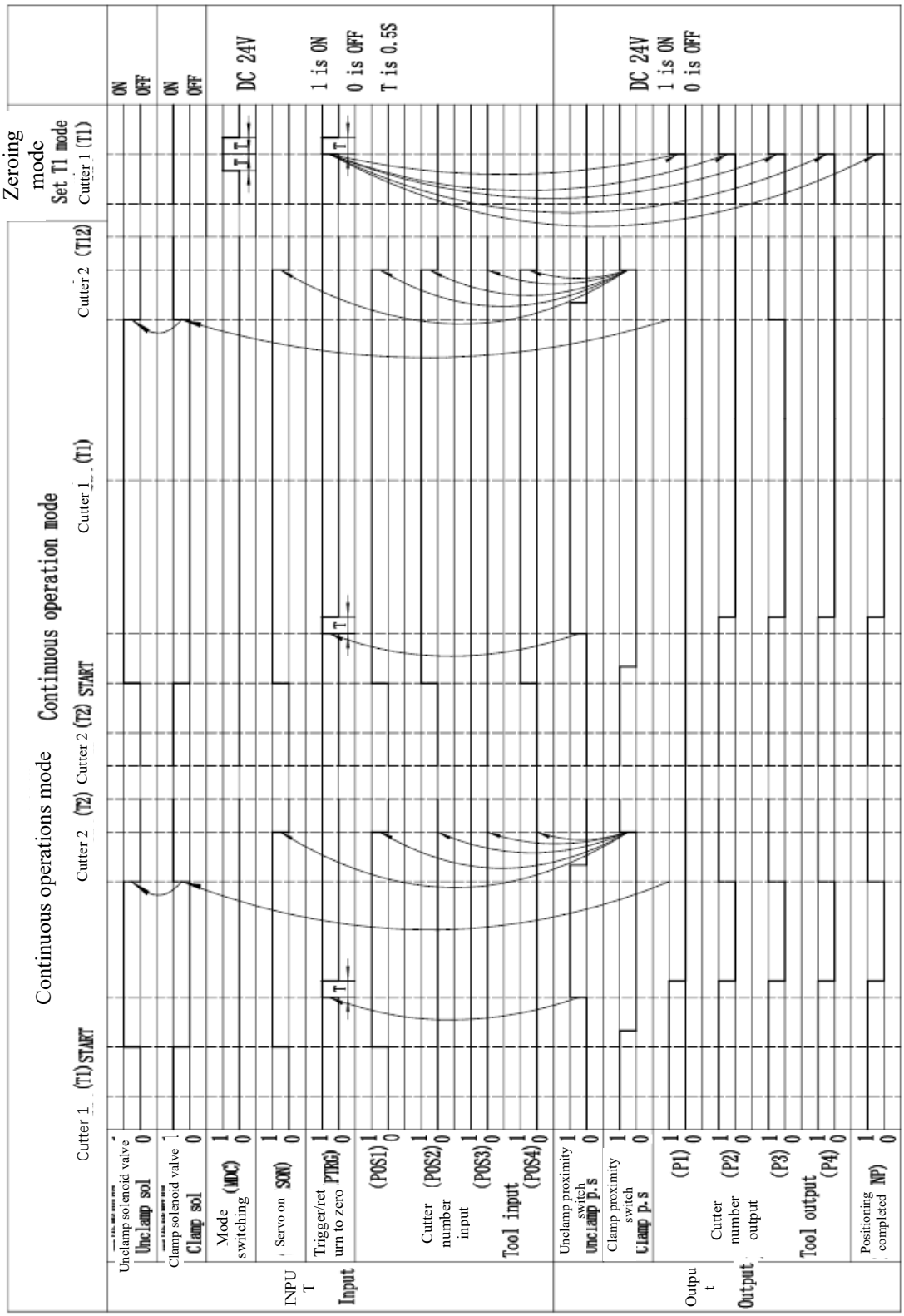
2. Both high and low levels of servo motor input and output are available
   ① The output of the system is at low level and the input is effective at high level, such as GSK and KND. The common termination method is 44 (24V), 47 (24V) and 50 (0V).
   ② The system outputs high levels and the input is valid for high levels, such as Siemens. The common termination method is 44 (24V), 47 (0V).
   ③ The system outputs low levels and the input is valid for low levels. The common termination method is 44 (0V), 47 (24V).
   ④ Unclamp proximity switch is effective for high levels.
3. The proximity switch is blue (0V), brown (24V), and black (output 24V). To judge the unclamp signal, the black cover on top of the turret can be opened. When released, the sensor piece moves rearward (away from the tool disc) and the proximity switch turns on. The proximity switch for the lift-type turret is located inside the rear cover.
4. The solenoid valve can generally use two-position or three-position four-way valves, and it is recommended to use 3C2. Note: after the main power of the machine tool is turned off, the pressure must be maintained to prevent the deflection of the cutter head after the machine tool is powered off. If the pressure is not maintained, it is necessary to replace the solenoid valve with holding pressure function, and the hydraulic pressure of the turret needs to be around 3.5MP.
5. When installing for the first time, it is necessary to set the origin (the TECO Drive will alarm AL16 after the first connection, and the alarm can be cleared by power-off and restart after the origin is set).
6. If the tool position deviates after the collision when the user changes the tool, the origin needs to be reset once. As collisions are sometimes difficult to avoid, it is recommended that the machine tool manufacturer provide users with a training session on setting the origin after the machine tool leaves the factory.

## 3.6. Wiring Diagram




- CN1 is the control signal connection terminal, which is connected to the I/O port the system via a breakout board;
- The shielding wires of control signal cable and encoder cable shall be connected with the metal shell of the plug;
- Do not connect unused pins and do not use them as relay terminals.

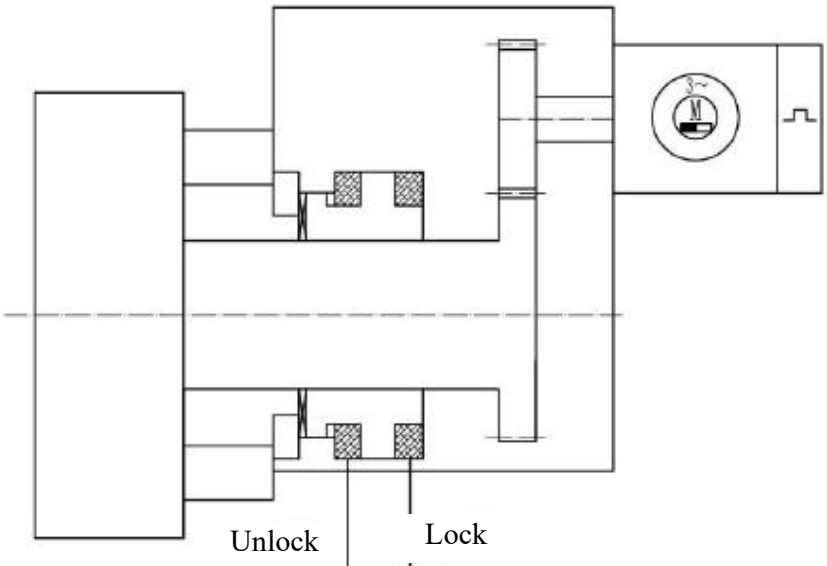
## 3.7. Control Sequence Diagram



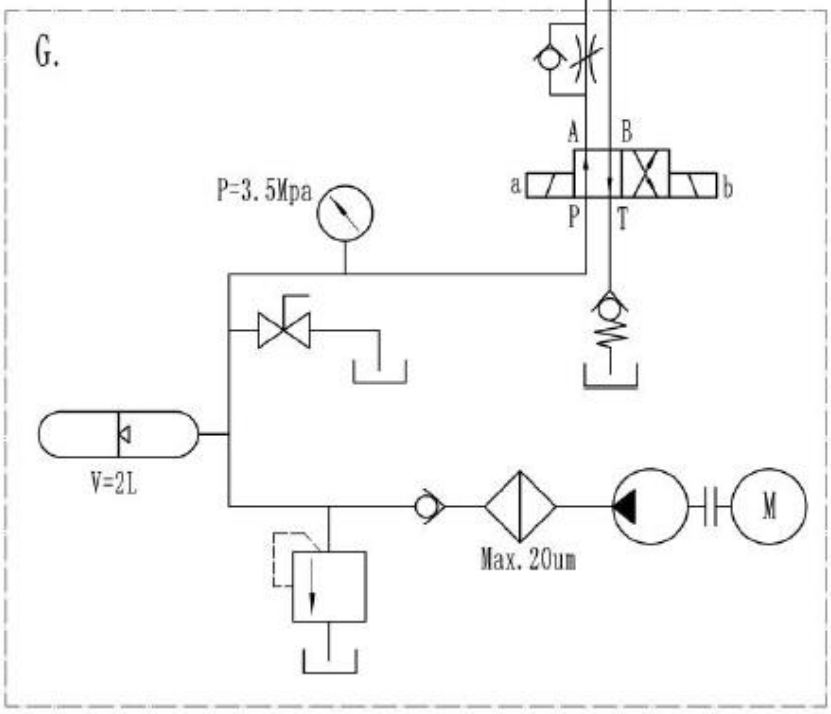
| Tool input signal | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| POS1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| POS2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| POS3 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| POS4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |

| Tool output signal | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | |

## 3.8. Hydraulic Schematics




G: not included in the shipping standards

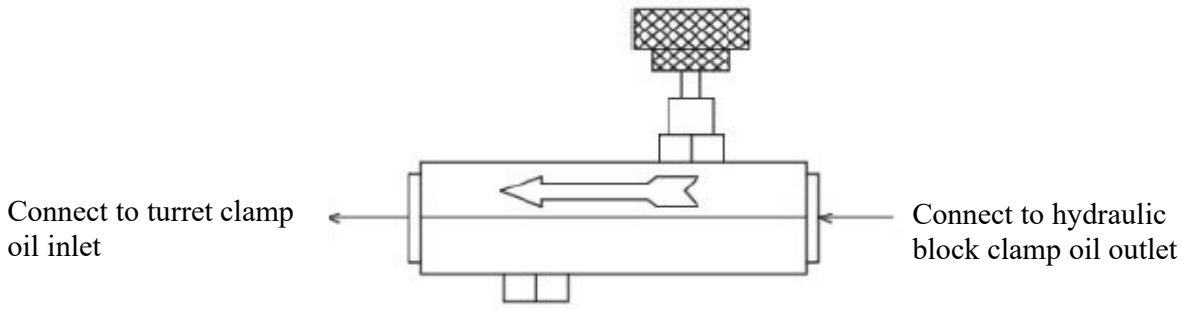



Note:
When the clamping sound of the turret is loud due to the fast clamping speed, the clamping speed can be controlled by adjusting the flow of the throttle valve to reduce the clamping sound.

| Recommended selection of tubing length and tubing diameter | | | | | | | |
|---|---|---|---|---|---|---|---|
| Turret model | | TCS50 | TCS63B | TCS80B | TCS100B | TCS125 | TCS160 |
| Length | ≤6m | 6 | 8 | 8 | 10 | 12 | 12 |
| | >6m | 8 | 10 | 10 | 12 | 14 | 14 |

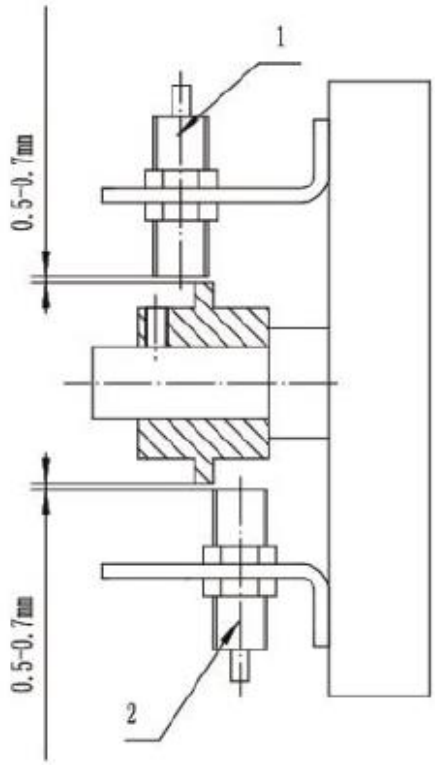
| Specifications of hydraulic oil | |
|---|---|
| Working pressure of hydraulic oil (MPa) | 3.5±0.2 |
| Grade of filter paper (μm) | 20 |
| Viscosity of hydraulic oil (mm2/s) | 32~46 |
| Recommended operating temperature of hydraulic oil (℃) | 25~55 |

| Function list | Electromagnet a | Electromagnet b |
|---|---|---|
| Turret lock | 1 | 0 |
| Turret unlock | 0 | 1 |

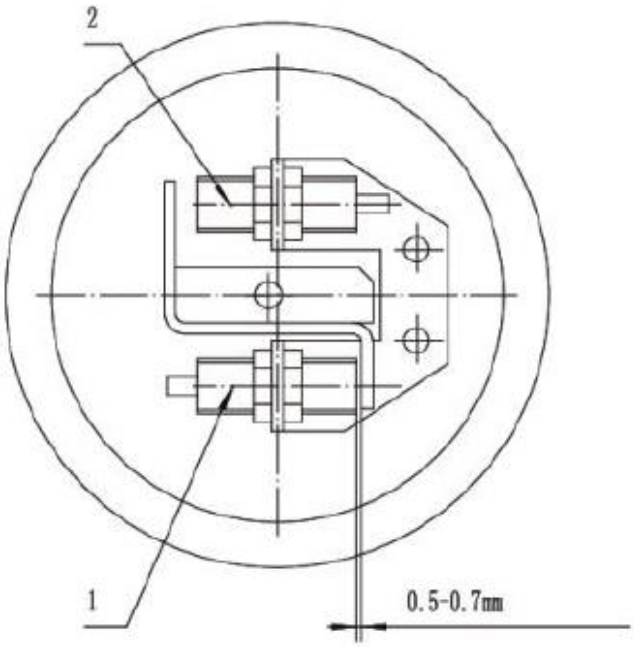



Installation for one-way throttle valve

## 3.9. Proximity Switch




2-piece type (cutter lifting)
2-piece type



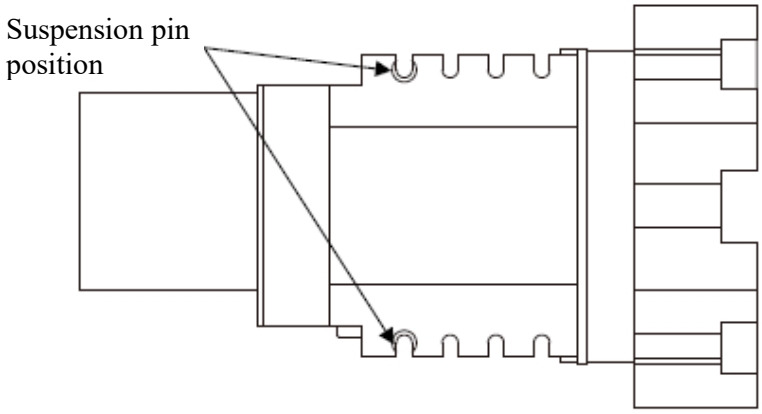

3-piece type (cutter lifting)
3-piece type

1. Clamp proximity switch
2. Unclamp proximity switch

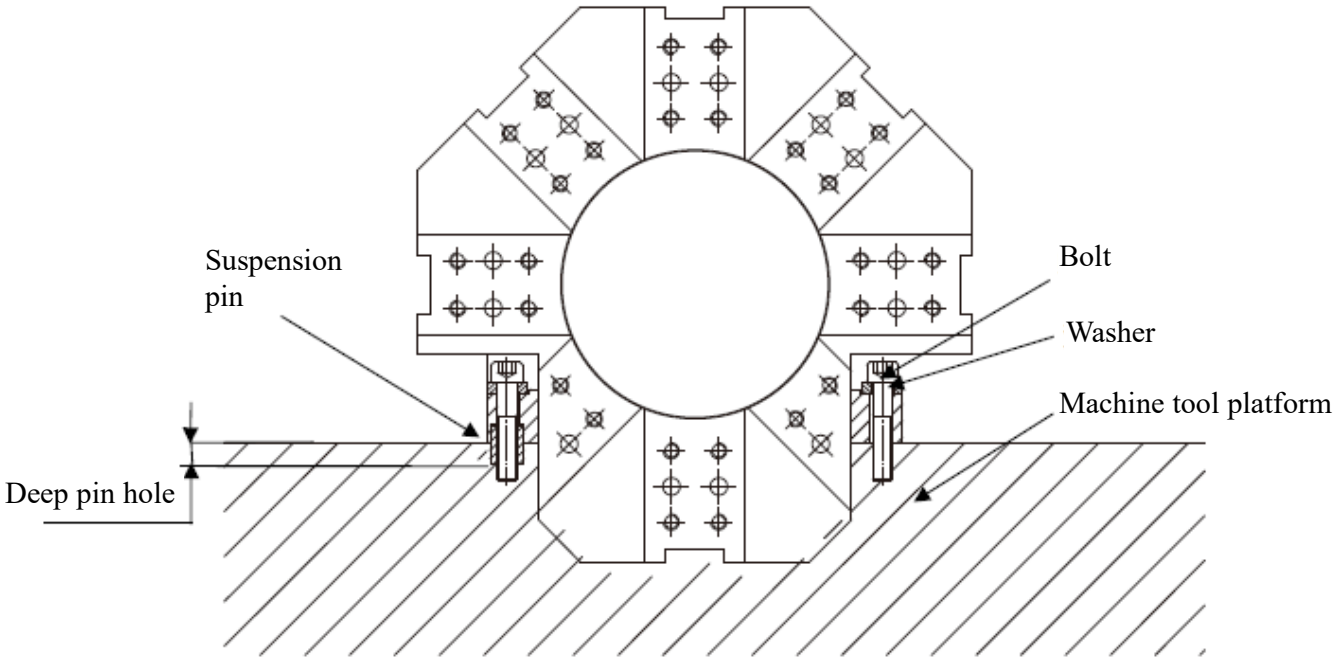
The 2-piece proximity switch is located inside the rear cover of the turret
The 3-piece proximity switch is under the black cover on top of the turret

# 4. Installation and Commissioning

## 4.1. Installation of Body




① The mounting hole of the suspension pin is set at the last foot stand of the turret and only one suspension pin is required when in use;




② As shown in the following Table, drill the depth of the suspension pin mounting hole and use the suspension pin provided by TCSM;

③ Put the suspension pin into the mounting hole, and then install the turret on the suspension pin;

④ Install the washer and lock the bolt according to the rated locking torque

Note: confirm the position and depth of the mounting hole of the suspension pin and ensure the flatness and cleanliness of all contact surfaces.

| Specifications\model of turret | TCS50 | TCS63B | TCS80B | TCS100B | TCS125 | TCS160 |
|---|---|---|---|---|---|---|
| Size of suspension pin (mm) | - | 15 | 17 | 20 | 26 | 32 |
| Depth of locating hole (mm) | - | 11 | 11 | 9 | 10 | 13 |
| Specifications of fixing bolt | M8x35 | M10x40 | M10x45 | M12x55 | M16x70 | M20x85 |
| Washer thickness (mm) | 6 | 6 | 6 | 8 | 10 | 12 |
| Locking torque of turret bolt (Nm) | 41 | 80 | 80 | 139 | 343 | 645 |

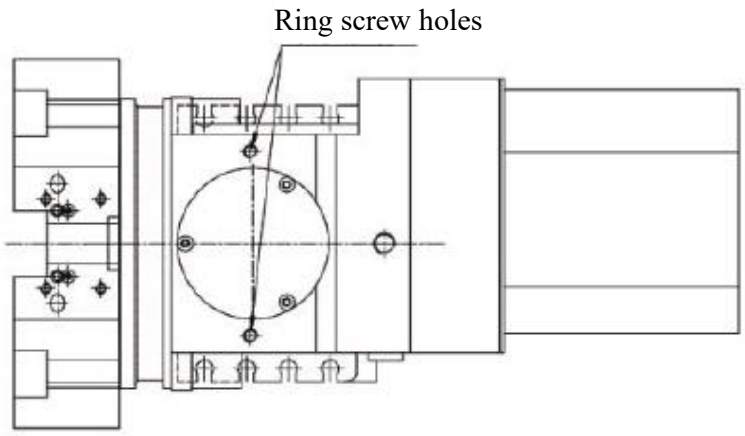
### 4.1.1. Permitted Installation Forms

For installation forms, please contact your company's technical department.

### 4.1.2. Lifting



Warning
There is a potential risk of turret falling during lifting!




Make sure that the ring screws are tightened before lifting and the rope is fixed properly with necessary load-bearing capacity (generally the weight of this type of turret does not exceed 400KG); do not stand under the turret during lifting.

### 4.1.3. Initial Turret Fixation

Clean up each joint surface to ensure that it is clean. Place the backing plate and the turret in specified positions of the carriage accordingly: using screws (12.9 grade) with washers, fix the turret initially.



Warning
There is a potential risk of slipping if the turret is not fixed!

### 4.1.4. Final Turret Fixation

Connect the hydraulic station, and ensure the turret is clamped. Loosen each fixing screw of the turret and tighten them appropriately. The grooved or radial VDI tool disc is the side of the tool disc, and the axial VDI tool disc is the front of the tool disc. After calibration, tighten each fixing screw (12.9 grade).

| Specifications | Locking torque (Nm) |
|---|---|
| M3 x 0.5 | 2.1 |
| M4 x 0.7 | 4.9 |
| M5 x 0.8 | 9.8 |
| M6 x 1 | 17 |
| M8 x 1.25 | 41 |
| M10 x 1.5 | 80 |
| M12 x 1.75 | 139 |
| M14 x 2 | 223 |
| M16 x 2 | 343 |
| M20 x 2.5 | 645 |

### 4.1.5. Cooling Water Connection

Please configure the cooling pump and piping as required and refer to the outline drawing for the location of the interface. The filtration rating cannot be less than 150μm.
Note: Unfiltered coolant will damage the cooling spool and block the cooling channel!

## 4.2. Drive Installation



CAUTION:
Improper installation environment or improper installation may cause damage to the drive or affect its normal function and service life!

### 4.2.1. ENVIRONMENTAL CONDITIONS

The drive installation environment must meet the following conditions:

- Ambient temperature: 0 ~+55℃ (the ambient temperature is 40℃~55℃, and the average load rate shall not exceed 80%) (non-freezing);
- Ambient humidity: below 90%RH (non-condensate);
- Storage temperature: -20℃ ~ 85℃ (non-freezing);
- Storage humidity: below 90%RH (non-condensate);
- Vibration: less than 4.9m/s2, impact: less than 19.6m/s2;
- Protection level 1: IP10;
- Elevation: below 1000m;
- Please install it in an installation cabinet free from sunlight and rain;
- Do not use this product near environments with corrosive and flammable gas such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gas, acid, alkali and salt and combustible materials;
- Please do not install it in an environment with high temperature, humidity, dust and metal dust;
- Place with no vibration.

### 4.2.2. Installation Requirements and Precautions

Installation requirements are as follows:

- Install vertically, with the front facing outwards and the top facing upwards, to ensure firm fixation (M4 screw: tightening torque of 0.6-1.2Nm);
- The connection distance from the upper computer is no more than 3m;
- Avoid drilling cuttings or other foreign bodies from falling into the drive;
- Ensure that the drive is installed on non-combustible materials;
- The ground terminal of the drive must be well grounded.

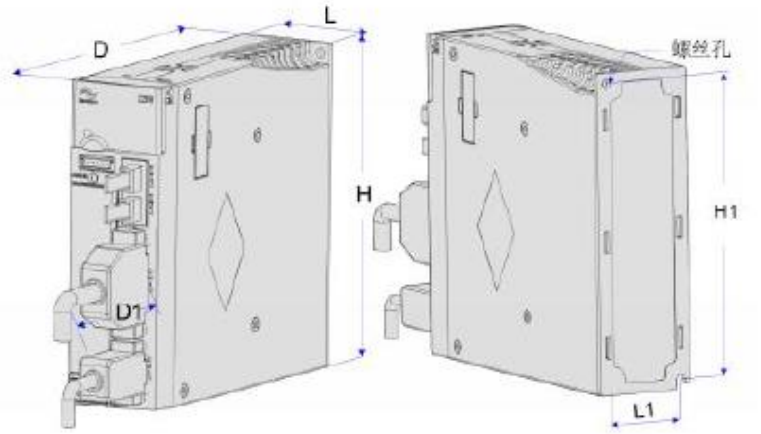
Precautions in installation:

- To ensure cooling by fans and natural convection, sufficient space should be reserved around the servo drive. Please install a cooling fan at the upper part of the servo drive. In order not to cause local over-high ambient temperature of the servo drive, the temperature in the electric cabinet shall be kept uniform.

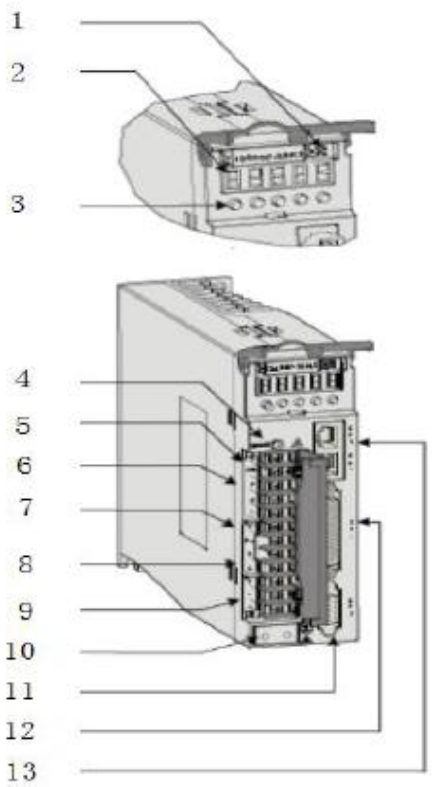
- When installing side by side, it is recommended to reserve a spacing of more than 10mm on both lateral sides (if limited by installation space, no spacing is allowed), and a spacing of more than 50mm on both longitudinal sides.

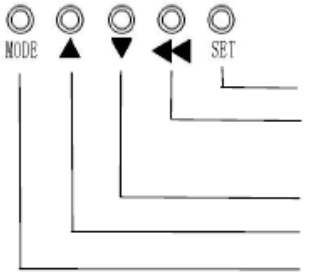
## 4.2.3. Inovance Drive

### 4.2.3.1. Dimensions

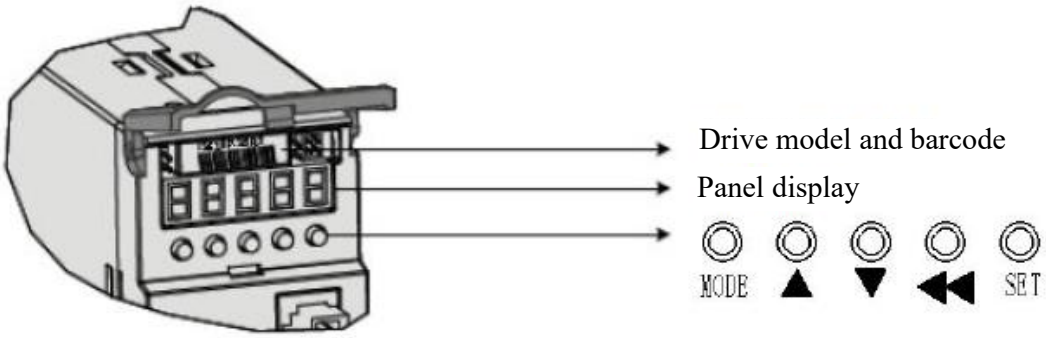



| Structure | L(mm) | H(mm) | D(mm) | L1(mm) | H1(mm) | D1(mm) | Screw hole | Locking torque (Nm) |
|---|---|---|---|---|---|---|---|---|
| SIZE A | 50 | 160 | 173 | 40 | 150 | 75 | 2-M4 | 0.6~1.2 |



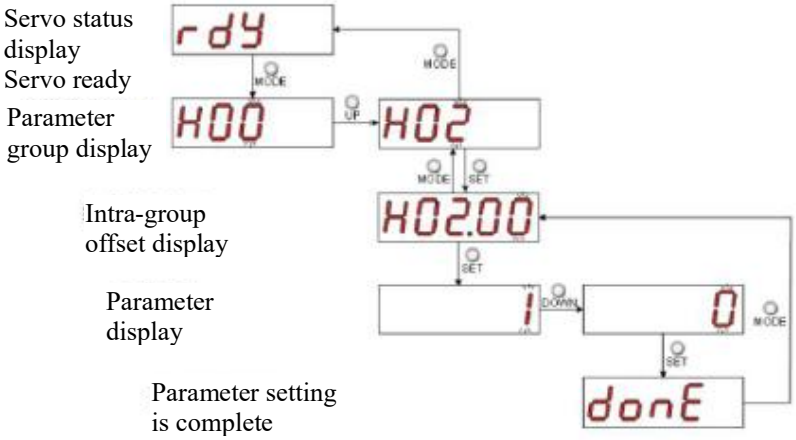
| S/N | Name | Uses |
|---|---|---|
| 1 | CN5<br>Analog monitoring signal terminal | When adjusting the gain, it is convenient to observe the signal state<br>Measuring instruments such as oscillograph can be connected through this terminal |
| 2 | Nixie tube display | 5-digit 7-segment LED nixie tube is used to display the running state and parameter setting of servo |
| 3 | Key operator | <br>Save the modification and enter the next menu<br>Shift to the left from the current flash digit<br>Long press: page turning when more than 5 digits are displayed<br>Reduce the current flash digit setting<br>Increase the current flash digit setting<br>Switch function codes in turn |
| 4 | CHARGE<br>Bus voltage indicator light | Used to indicate that the bus capacitor is in a charged state. When the indicator light is on, even if the main loop power supply is OFF, the internal capacitor of the servo unit may still be charged; Therefore, do not touch the power terminal when the light is on to avoid electric shock. |
| 5 | L1C, L2C<br>Control loop power input terminals | Refer to the rated voltage level of nameplate to input power supply of control loop |
| 6 | R, S, T<br>Main circuit power input terminal | Refer to rated voltage level of nameplate to input power supply of main loop |
| 7 | P ⊕, ⊖<br>Servo bus terminal | DC bus terminal, used for multiple servo common DC buses |
| 8 | P⊕, D, C<br>External braking resistor connection terminal | By default, connect short wires between P⊕-D. When external braking resistor is connected, remove the short wires to make open circuit between P⊕-D, and connect the external braking resistor between P⊕-C. |
| 9 | U, V, W<br>Servo motor connection terminal | Connect servo motor U, V and W boxes |
| 10 | ⏚<br>PEL grounding terminal | Connect with power supply and motor grounding terminal for grounding treatment |
| 11 | CN2<br>Encoder connection terminal | Connect with motor encoder terminal |
| 12 | CN1<br>Control terminal | Ports for command input signals and other input and output signals |
| 13 | CN3, CN4<br>Communication terminals | They are connected in parallel, and connected with RS-232 and RS-458 communication instructions devices |

#### 4.2.3.2. Operations Panel Instructions




| Name | General function |
|---|---|
| MODE key | Switch between various modes and return to the previous menu |
| UP key | Increase the flash digit value of LED nixie tube |
| DOWN key | Reduce the flash digit value of LED nixie tube |
| SHIFT key | Change the flash digit of LED nixie tube<br>View the high-order values of data with a length greater than 5 digits |
| SET key | Enter the next menu<br>Execute the commands such as storing parameter settings |

Panel display

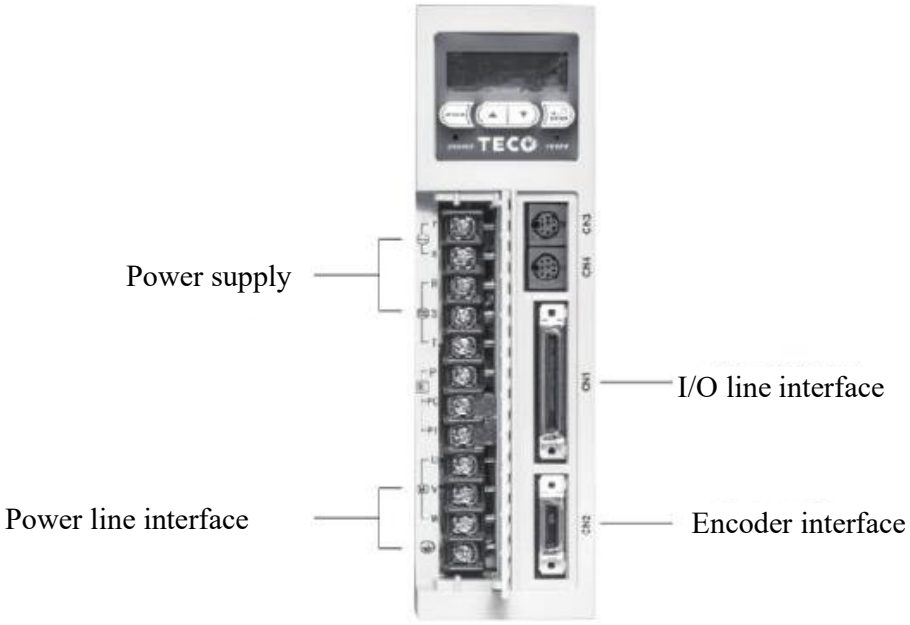


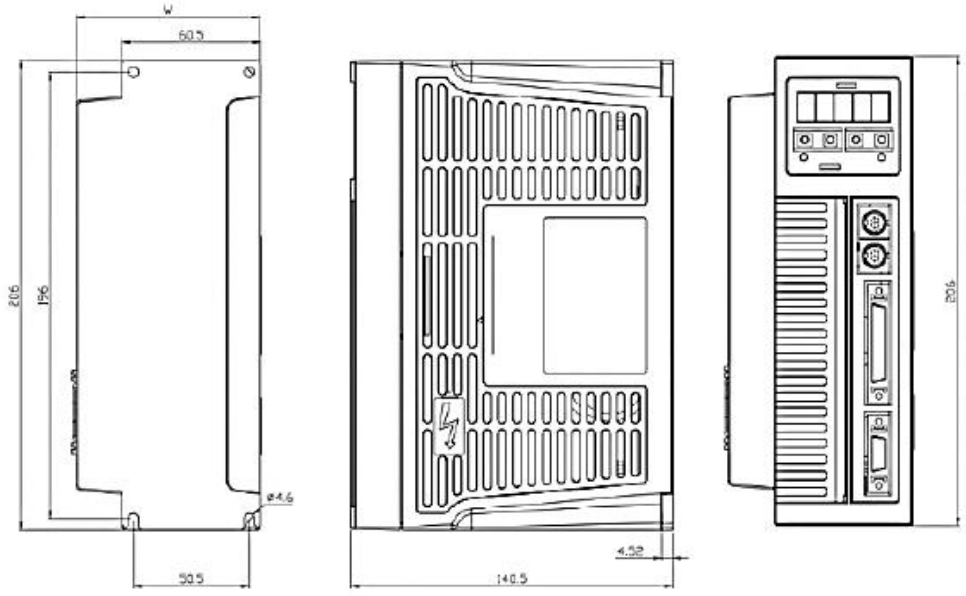
#### 4.2.3.3. Function Code List

| Function code | Name | Setting range | Unit | Factory value | Setting mode |
|---|---|---|---|---|---|
| H0d.20 | 731 alarm clear | 0~1 | 1 | 0 | Shutdown setting |
| H02.02 | Rotation forward direction selection | 0~1 | 1 | 0 | Shutdown setting |
| H05.56 | Enable cutter reset | 0- Not enable<br>1- Enable the cutter reset | - | 0 | Operations setting |
| H05.57 | Total cutter value setting | 2~12 | 1 | 12 | Energize again |
| H05.65 | Forward running clearance compensation | -9000~9000 | 0.0001 turn of motor | 0 | Operations setting |
| H05.66 | Reverse running clearance compensation | -9000~9000 | 0.0001 turn of motor | 0 | Operations setting |
| H05.80 | Transmission ratio of mechanical structure | 1~65535 | 1 | 45 | Energize again |
| Setting of running speed and acceleration and deceleration time | | | | | |
| H11.14 | Running speed of adjacent cutter positions | 1~6000 | 1rpm | 3000 | Operation setting |
| H11.15 | Acceleration and deceleration time of adjacent cutter positions | 0~65535 | 1ms | 50 | Operation setting |
| H11.24 | Changing speed of non-adjacent cutter positions | 1~6000 | 1rpm | 3000 | Operation setting |
| H11.25 | Acceleration and deceleration of non-adjacent cutter positions | 0~65535 | 1ms | 50 | Operation setting |
| Display function code part | | | | | |
| H0B.03 | Input signal monitoring | 1~512 | 1 | | Display |
| H0B.05 | Output signal monitoring | 1~256 | 1 | | Display |

### 4.2.4. TECO Drive

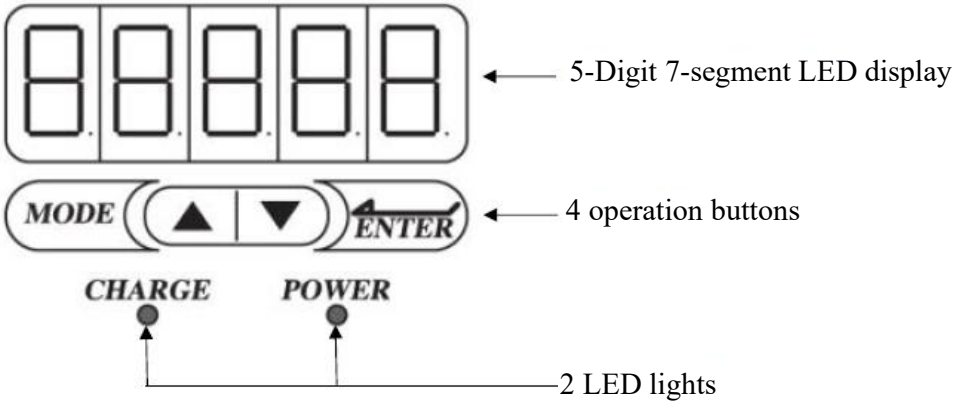
#### 4.2.4.1. Dimensions




| | W (mm) |
|---|---|
| JSDA-10A/15A | 69 |
| JSDA-20A/30A | 80 |

#### 4.2.4.2. Panel Operation Instructions




| Button symbol | Button name | Button functions |
|---|---|---|
| MODE | Mode selection button (MODE button) | 1. Select the 10 parameters provided by this device, each press will change the parameters in cyclic sequence.<br>2. In the data setting screen, press once to jump back to the parameter selection screen. |
| ▲ | Number increase button (UP button) | 1. Select the items within various parameters.<br>2. Change numerical data.<br>3. Press UP button and DOWN button at the same time will eliminate abnormal alarm status. |
| ▼ | Number decrease button (DOWN button) | |
| ENTER | Data setting button (ENTER button) | 1. Data confirmation; parameter item confirmation.<br>2. Shift the adjustable digits to the left.<br>3. End data setting. |

#### 4.2.4.3. Common parameters table

| Parameter | Function | Default |
|---|---|---|
| dn-10 | Zeroing | H0100 |
| Pn324 | No. of stations | 8 |
| Pn326 | Decelerate | 36 |
| Pn327 | Rotation speed | 2000 |
| Pn331 | Turret forward compensation | 1000 |
| Pn336 | Turret reverse compensation | -1000 |

## 4.3. Electrical connection

### 4.3.1. Anti-interference countermeasures of electrical connection

To suppress interference, please take the following measures:

①. Use the shortest connecting cable for command input and encoder wiring.

②. Use thick wires for grounding as much as possible. (More than 2 mm2)

- It is recommended to use D type or above for grounding (the grounding resistance value is below 100Ω).
- It must be grounded at one point.

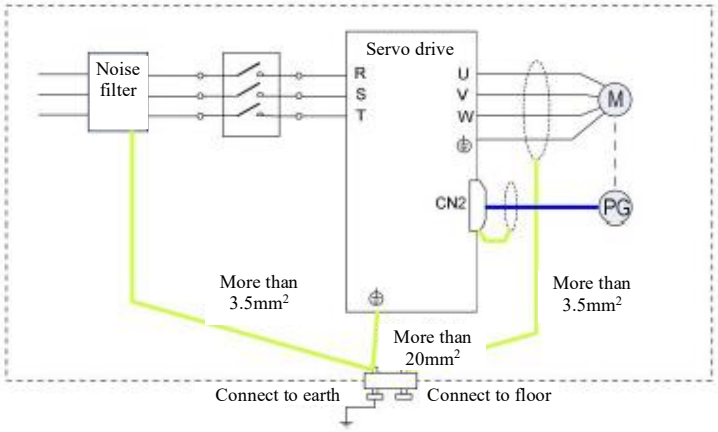
③. Please use a noise filter to prevent radio frequency interference. Please install a noise filter at the input side of the power cord when it is used in a civil environment or in an environment with strong power interference noise.

④. To prevent mis-operation caused by electromagnetic interference, the following treatment methods can be adopted:

- Install the superior device and noise filter near the servo drive as much as possible;
- Install surge suppressor on the coils of relay, screw tube and electromagnetic contactor;
- When wiring, please separate the strong current line from the weak current line, and keep an interval of more than 30cm. Do not put them in the same pipe or bundle them together;
- Do not share power supply with electric welding machine, electric discharge machining equipment, etc. When there is a high frequency generator nearby, please install a noise filter on the input side of the power cord.

Examples of anti-interference wiring:

The main circuit of the servo drive uses "high-speed switching elements," which may cause switching noise to affect the normal operation of the system, depending on the difference between the peripheral wiring and grounding treatment of servo drive. Therefore, correct grounding method and wiring treatment must be adopted and noise filters must be added when necessary.




Examples of anti-interference wiring

Note:

- Please use a thick wire of more than 3.5mm2 as far as possible for the outer box connection wires used for grounding. (braided copper wire is recommended)

Grounding treatment:

①. Grounding of servo motor housing

Please connect the grounding terminal of servo motor with the grounding terminal PE of servo drive, and reliably ground the PE terminal to reduce the potential electromagnetic interference.

②. Grounding of power shielding layer

Please ground the shielding layer or metal conduit in the main circuit of the motor at both ends. It is recommended to adopt crimping method to ensure good lap joint.

③. Grounding of servo drive

The grounding terminal PE of the servo drive shall be reliably grounded, and the fixing screws shall be tightened to keep good contact.

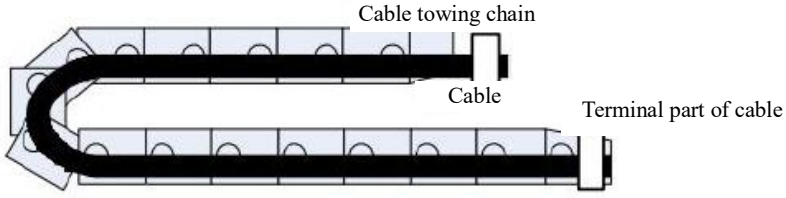
### 4.3.2. Precautions in cable use

①. Do not bend or strain the cable. As the diameter of the core wire of the signal cable is only 0.2mm or 0.3mm and it is easy to break it, please pay attention when using it.

②. When the cables need to be moved, please use flexible cables, since ordinary cables are prone to damage after long-term bending. The low-power motor's cable cannot be used for cable movement.

③. When using the cable protection chain, please ensure that:

- The bending radius of the cable is more than 10 times of the outer diameter of the cable;
- Do not fix or bundle the wiring in the cable protection chain, only bundle the two immovable ends of the cable protection chain;
- Do not wind or twist the cable;
- The duty factor in the cable protection chain shall be below 60%;
- Do not mix cables with different shapes during wiring, to prevent thin wires being pressed and broken by thick wires. If it is required to mix cables, please set a partition device among the cables.




Schematic Diagram of Cable Protection Chain

# 5. Maintenance and Care

CAUTION:
The working life of this turret is about 2 million cycles. If you continue to use it, a comprehensive overhaul is required! Using an air gun to clean the tool disc will cause debris to enter the cooling spool, causing blockage to the coolant channel and premature wear of the spool! Waste oil must be treated or recycled in accordance with local environmental protection requirements, or it will cause damage to the environment!

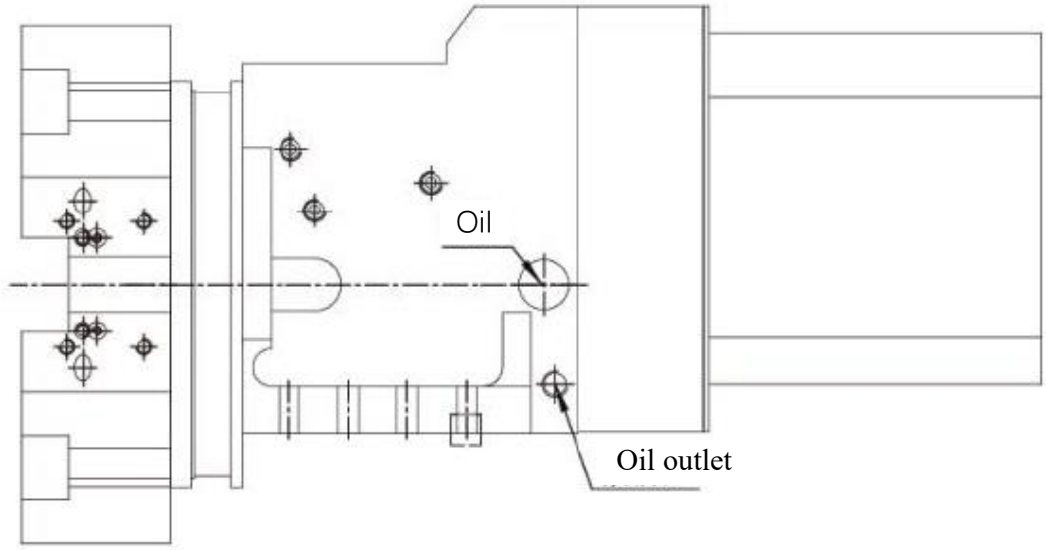
## 5.1. Routine Maintenance

Every day after work is done, the debris and coolant on the turret should be cleaned up, and anti-rust oil should be applied to the tool disc.

## 5.2. Lubricating Oil Inspection

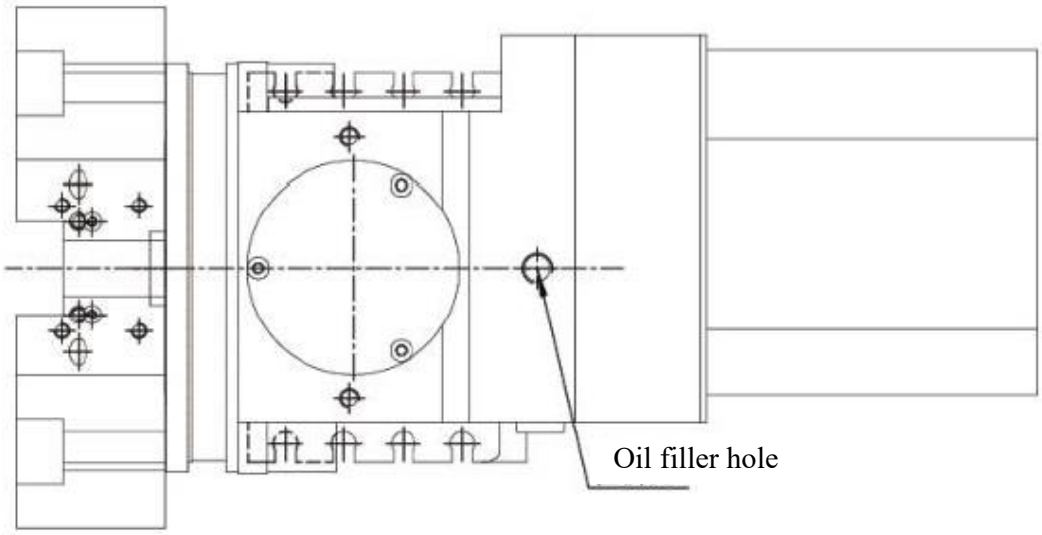
### 5.2.1. Oil Drain and Inspection

Every 4000 working hours or two years, the lubricating oil inside the turret should be drained through the oil drain plug as shown in the diagram below, and conduct inspections.




- If the lubricating oil changes color, no treatment is needed, refill with oil again.
- If there are a lot of metallic chips in the lubricating oil, please contact the supplier or our company for inspection and maintenance.
- If the lubricating oil is mixed with coolant, or has no or only small amounts of lubricating oil, it means that the turret seal has failed, please contact the supplier or our company for inspection and maintenance.

### 5.2.2. Oil Refuel




Screw back the oil drain plug, and unscrew the oil fill plug. Add the specified amount of lubricating oil according to the following requirements. The viscosity of the lubricating oil is ISO VG46 (not containing components that corrode metals, rubber, and PTFE).

## 5.3. Cooling Spool Inspection

Every 4000 working hours or no more than 2 years, the cooling spool should be inspected to check whether or not there is coolant leakage between the tool disc and the cooling disc.

## 5.4. Connection Inspection



Damage to the cables or flooding of terminals may cause electric shock or equipment damage! There is a danger of high-voltage electric shock. Please conduct work after the main power supply of the machine tool is disconnected and that the status indicator light of the drive is off, and only operate by an authorized professional who has received electrical safety training!

Every 8000 working hours or no more than 4 years, the protective pipes and cables of the turret should be inspected.

- Coolant has penetrated inside the back cover. Normally, it is caused by damage to the protective pipes or joints, or connection failure. Please replace the damaged parts or reconnect.
- Damaged protective pipes, joints and cables. Please replace promptly.
- If the wiring of the terminal block is loose and the wire cannot be pressed tightly, it could be caused by failure of the spring piece of the terminal block. Please replace promptly.

# 6. Problems and Troubleshooting



There is danger of personal injury. Unexpected rotation of the tool disc or other accidents may cause injuries to hands or other parts of the body! Make sure to check or observe within the safe area!



There is danger of high-voltage electric shock. Generally, the operation must be performed only by authorized professionals who have received electrical safety training after disconnecting the main power supply! Please ensure safety if power needs to be turned on!

Inappropriate maintenance may cause damage to parts or equipment.

## 6.1. Inovance Drive

### 6.1.1. Anomaly alarm description

When ER is displayed on the two leftmost LEDs of the drive, it indicates that the drive cannot work properly at present. Users can continue to operate the drive according to the normal procedure after troubleshooting according to the countermeasures in the following section. If the anomaly alarm still cannot be cleared, please contact the dealer or manufacturer for further treatment.
When an anomaly alarm occurs, the LED displays as shown in the figure below:

| Display | Name | Description |
|---|---|---|
|  | Current warning code | Er: There is a fault or warning in the servo drive<br>941: Warning code |

### 6.1.2. Anomaly Elimination Countermeasure

| Anomaly alarm number | Anomaly alarm description | Elimination countermeasure | Alarm clearing mode |
|---|---|---|---|
| Er.136 | Failure to connect encoder | 1. Plug and unplug both sides of encoder cable (motor side and drive side) and then power on again;<br>2. If countermeasure 1 fails, replace the motor or encoder cable. | Power on again |
| Er.200 | Overcurrent | 1. Disconnect the UVW cable, and replace the drive if the drive still gives an alarm after power-on again;<br>2. If the drive does not give an alarm after power-on again on the basis of countermeasure 1, first reduce the cutter replacement speed and the acceleration and deceleration, and if there is no effect, change the motor or power cable. | Power on again |

| Anomaly alarm number | Anomaly alarm description | Elimination countermeasure | Alarm clearing mode |
|---|---|---|---|
| Er.234 | Runaway | 1 Reduce cutter replacement speed and acceleration;<br>2. If countermeasure 1 fails, replace the motor or encoder cable. | Power on again |
| Er.258 | Cutter deviates from the correct position | 1. Change H05.56 to 1, wait for 3 seconds and restart the drive;<br>2. Manually run to the first cutter position to reset the cutter;<br>3. Manually run to the next cutter position. | Power on again |
| Er.630 | Motor running fault | 1. Check whether the mechanical part is stuck;<br>2. Check whether the forward and reverse clearance compensation is set reasonably;<br>3. Check whether or not the UVW line of the motor is connected in sequence;<br>4. Check whether or not the motor power cable is broken and change the cable for verification;<br>5. Replace the motor. | Power on again |
| Er.731 | Power supply failure of encoder battery | 1. Make sure that the encoder battery is connected;<br>2. Set H0D.20 to 1 and then restart the drive;<br>3. Please unplug the cable again;<br>4. Test whether or not the battery is lower than 3V; if so, replace the encoder battery;<br>5. Replace the encoder cable;<br>6. Replace the motor or drive. | Power on again |
| Er.740 | Encoder interference fault | 1. Plug and unplug both sides of encoder cable (motor side and drive side);<br>2. Replace the motor or encoder cable. | Power on again |
| Er.941 | The change parameters shall take effect after power on again | 1. Power on again | Power on again |
| Er.A14 | DI cutter number combination input exceeds the total cutter number set for H05-57 | 1. Check whether the cutter number command given by the system exceeds the value of H05-57; | No need to power on again |
| Er.A15 | Cutter replacement timeout fault | Check whether or not the hydraulic valve is locked and whether or not the machinery is locked | Power on again |
| Er.b00 | The motor position is out of tolerance | 1. Check whether the mechanical part is stuck;<br>2. Check whether or not the UVW line of the motor is connected in sequence;<br>3. Check whether or not the motor power cable is broken and change the cable for verification;<br>4. Replace the motor or encoder cable. | Power on again |

## 6.2. TECO Drive

### 6.2.1. Abnormal Alarm Explanation

When the 2 leftmost LEDs of the device display RL, it means the device is currently unable to operate normally. The user can follow the countermeasures in the following section to eliminate the situation, then continue to operate the device according to the standard procedure. If the abnormal alarm still cannot be eliminated, please consult the dealer or manufacturer for further problem solving.

When an abnormal alarm occurs, the LED display status is as follows:




Abnormal alarm history parameter

Abnormal alarm number

Please refer to the next section for alarms that correspond to the abnormal alarm number:

For example: abnormal alarm number 01 indicates that a low power voltage alarm is currently occurring.

Instructions for clearing abnormal alarms:

1. Switch re-set: the following two methods may be used to clear the abnormal alarm:

(a) Input contact reset: when the abnormality is eliminated, release the input contact SON action first (meaning, release the motor from excitation state) then enable the input contact ALRS action to clear the abnormal alarm in order to restore normal operation of the drive. For whether or not the input contact is high-potential action or low-potential action, please refer to Hn parameter setting.

(b) Button re-set: when the abnormality is eliminated, release the input contact SON action first (meaning, release the motor from excitation state), then press UP and DOWN buttons at the same time to clear the abnormal alarm in order to restore normal operation of the drive.

2. Power re-set: when the abnormality is eliminated, the power needs to be turned back on (power off and then re-input power) to clear the abnormal alarm in order to restore normal operation of the drive. It is strongly recommended that when using power re-set to clear normal alarms, it is best to de-active the input contact SON action (meaning, release the motor from excitation state).

Note: before the abnormal alarm is cleared, it is necessary to confirm that the controller has not sent a command to the drive to avoid burst acceleration of the motor.

### 6.2.2. Anomaly Elimination Countermeasure

| Abnormal alarm number | Abnormal Alarm Explanation | Elimination countermeasure | Alarm clearing mode |
|---|---|---|---|
| 00 | No alarms | | |
| 01 | Low voltage to power supply<br>External power supply voltage is lower than rated value | Use an ammeter to measure the external power supply voltage to confirm whether or not the input voltage meets the specifications. If the situation cannot be resolved, the internal components of the drive could be faulty. (This message usually occurs when power is supplied to the drive) | Switch reset |
| 02 | Power supply voltage is too high (abnormal echo)<br>1. External power supply voltage is higher than rated value<br>2. Echo voltage is too high | 1. Use an ammeter to measure the external power supply voltage to confirm whether the input voltage meets the specifications.<br>2. Make sure that parameter Cn012 is set according to regulations.<br>3. Message is generated during operation: Extend the acceleration and deceleration time or reduce the load inertia within the allowable range. Or else, an external echo resistor is needed. (Please consult with the dealer or manufacturer) | Switch reset |
| 03 | Overload of motor<br>When the drive is continuously used more than double the rated load, this abnormal alarm will be generated within about 10 seconds. | 1. Check whether or not the motor terminal wiring (U, V, W) and the encoder wiring are normal.<br>2. Adjust the drive gain, improper adjustment of gain will cause motor resonance, resulting in excessive current and overload of the motor. 3. Extend the acceleration and deceleration time or reduce the load inertia within the permissible range. (This message usually occurs during action. If an abnormal alarm occurs soon after action, please check item 1 first) | Switch reset |
| 04 | Overcurrent of drive Abnormal power transistor<br>The main circuit current of the drive exceeds the protection range and the power transistor directly generates an abnormal alarm. | 1. Check whether or not the motor terminal wiring (U, V, W) and the encoder wiring are normal, and connect the external power supply according to the standard wiring diagram for motor and power supply in Chapter 2. Please turn off the power supply first and then reconnect to the power supply after 30 minutes. If the abnormal alarm still exists, it may be caused by the malfunction or noise interference of the internal power transistor components of the drive. | POWER SOURCE RE-SET |
| 05 | Encoder ABZ phase signal is abnormal<br>The motor encoder is faulty or the wires connecting the encoder are defective. | 1. Check that the motor wiring is connected to the drive.<br>2. Check whether or not the encoder connector is short-circuited, cold-welded or has dropped off.<br>3. Check whether or not the encoder signal terminals CN2-4 and CN2-5 (encoder power supply 5V) are normal. | POWER SOURCE RE-SET |

| Abnormal alarm number | Abnormal Alarm Explanation | Elimination countermeasure | Alarm clearing mode |
|---|---|---|---|
| 06 | Abnormal communication timeout<br>The communication timeout parameter is set improperly or communication is not conducted within the set | 1. Check if the set values of communication timeout parameter are correct<br>2. Check if the communication line connection is loose or disconnected | POWER SOURCE RE-SET |
| 07 | Abnormal multi-function contact planning<br>I/O contact function planning error | 1. Check whether the parameters Hn601~Hn606 input contact function planning is consistent: DI-1~DI-6 pins functions can be repeated, but the action potential of the pins of the repeated functions must be the same.<br>2. Check whether the parameters Hn613~Hn615 output contact function planning is consistent: DO-1~DO-3 pins functions cannot be repeated. | POWER SOURCE RE-SET |
| 08 | Abnormal memory<br>Error occurred while writing parameters | Remove all connectors, if the alarm still occurs when the power is on, then the drive needs to be replaced. | POWER SOURCE RE-SET |
| 09 | Emergency stop action<br>This abnormal alarm is generated when the input contact EMC actions | 1. Release the input contact EMC action.<br>2. The drive is internally interfered by noise, please follow the standard wiring diagram for motor and power supply and the standard wiring diagram for control signals in Chapter 2 to connect to the external power supply and signal lines. | Switch reset |
| 10 | Low battery voltage<br>The battery voltage is lower than normal | 1. Check whether or not the battery voltage is normal.<br>2. Replace the battery. | Switch reset |
| 11 | Excessive position error<br>Pulse command and encoder pulse transmission<br>The wave difference exceeds the set value of Pn308 or Pn309. | 1. Increase the set value of position gain (Pn310 and Pn311).<br>2. Increase the set value of position feedforward gain (Pn312) to speed up the motor response.<br>3. Extend the acceleration and deceleration time or reduce the load inertia within the allowable range.<br>4. Check whether or not the motor wires (U, V, W) are properly connected. | Switch reset |
| 12 | Overspeed of motor<br>The detected motor speed is abnormally high | 1. Reduce the input command speed.<br>2. The electronic gear ratio is set improperly, please confirm the relevant set value of the electronic gear ratio.<br>3. Properly adjust the speed loop gain (Sn211 and Sn213) to speed up the motor response. | Switch reset |

| Abnormal alarm number | Abnormal Alarm Explanation | Elimination countermeasure | Alarm clearing mode |
|---|---|---|---|
| 13 | CPU abnormality<br>The control system is not working properly | Please turn off the power supply first and reconnect it to the power supply after 30 minutes. If the abnormal alarm still exists, it may be caused by noise interference inside the drive. Please connect the external power supply according to the standard wiring diagram for motor and power supply in Chapter 2. | POWER SOURCE RE-SET |
| 14 | Drive is prohibited abnormally<br>This abnormal alarm is generated when the input contacts CCWL and CWL action. | 1. Release the input contact CCWL or CWL action.<br>2. The drive is internally interfered by noise, please follow the standard wiring diagram for motor and power supply and the standard wiring diagram for control signals in Chapter 2 to connect to the external power supply and signal lines. | Switch reset |
| 15 | Heated drive<br>The detected temperature of power transistor exceeds 90℃. | Repeated overload will cause the drive to overheat, please correct the operation mode. | Switch reset |
| 16 | Absolute encoder battery is abnormal<br>1. The absolute encoder battery is poorly connected or not connected.<br>2. The battery voltage of the absolute encoder is lower than specifications.<br>3. After the battery is disconnected, the encoder revolution number needs to be re-set. | 1. Install the battery<br>2. Check whether or not the battery is connected properly<br>3. Replace the battery<br>4. After the battery is reconnected, the encoder revolution number needs to be cleared through Cn041 before use. | Switch reset |

# 7. Turret Structure Diagram

