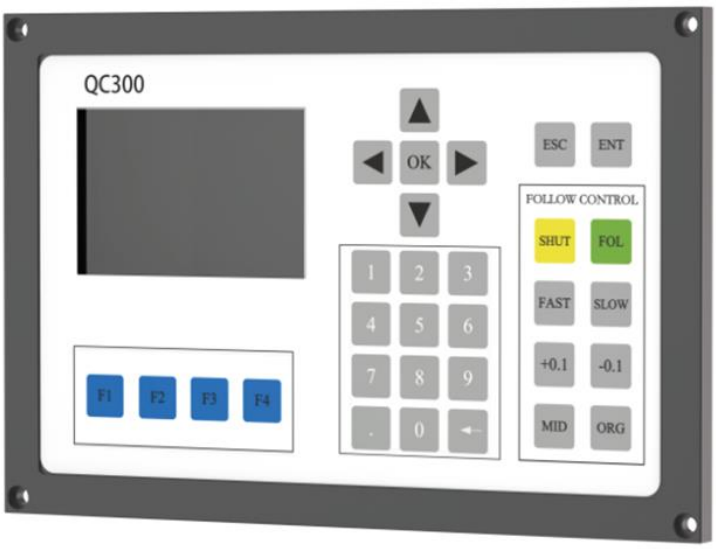
QC300 SERIES

Capacitive Height Sensor Kit (Standalone/EtherCAT/0-10V)- User Manual



Version:	**V 1.3**
Date:	2021/11/23

Content

1 Product Introduction

1.1 Summary

QC300 is a latest capacitive height controller developed by Raytools in 2021. It can realize the rapid response of standalone height adjustment, EtherCAT control and height feedback by 0-10V. It is able to accurately measure the induced capacitance between the laser head and workpiece so as to calculate the corresponding height. With the setting parameters and control signals, the laser head can be controlled to follow the surface curve of workpiece in real time.

- Read and collect the change of induced capacitance between laser head and workpiece in real time and high precision.
- With temperature drift compensation algorithm, it can automatically eliminate the capacitance offset error caused by temperature change.
- It can match various types of laser heads. Different guide rail ranges can be selected by setting parameters such as screw pitch.
- It can run continuously for a long time to meet production demands. Real time monitoring by adopting security mechanism.
- In case of operation errors due to accidents, effective safety measures can be taken in time by QC300 to ensure that the laser head can carry out efficient and safe production activities.

1.2 Technical Data

Model	**QC300**
Digital Input	8 (24V/0V)
Digital Output	8 (24V/0V)
Analog Output	2
Power Supply	Terminal (3-Pin, spacing 5.08mm)
Rated Voltage	24VDC±10%
Rated Current	200mA
DA Resolution	16 bits
Accuracy	0.01mm

Max. Acceleration	20000mm/s^2 (2G)

1.3 Advantages

Feature	Advantage	Result
Application	Applicable to a great variety of laser heads.	To fulfill the demands by using different laser cutting heads considering application difference.
Firmware	Updatable by U drive.	To use the latest function by firmware updating.
EtherCAT	Compatible to EtherCAT protocol.	To realize the fast response of standalone height control and easy control by EtherCAT.
Mechanical Parameter Setting	Able to set mechanical parameters such as lead of screw rod.	Meet the flexible needs of users in a variety of production specifications.
Servo Calibration	Capable of automatic zero drift calibration.	Simplify user setting parameters and improve control accuracy.
Adjustable Follow Performance	Able to manually adjust the follow-up performance level to optimize the follow-up effect	Users can choose different follow-up performances according to the actual follow-up effect so as to achieve the best production efficiency.
Tip Touch Inspection	It can take corresponding safety measurement and display alarm when the nozzle touches the workpiece.	To prevent tip touch crash.
Follow Alarm	It can detect the actual height and target height during the follow-up process. When the difference exceeds the set value, corresponding safety measurement will be taken and alarm is displayed.	Effective protection to prevent errors in the actual production process which could cause head crash.

2 Operating Instructions

QC300 supports 0-10V, EtherCAT and Standalone working features. The parameters or functions identified with * below support only standalone working mode rather than EtherCAT, which are integrated in the upper computer software system in the EtherCAT working mode.

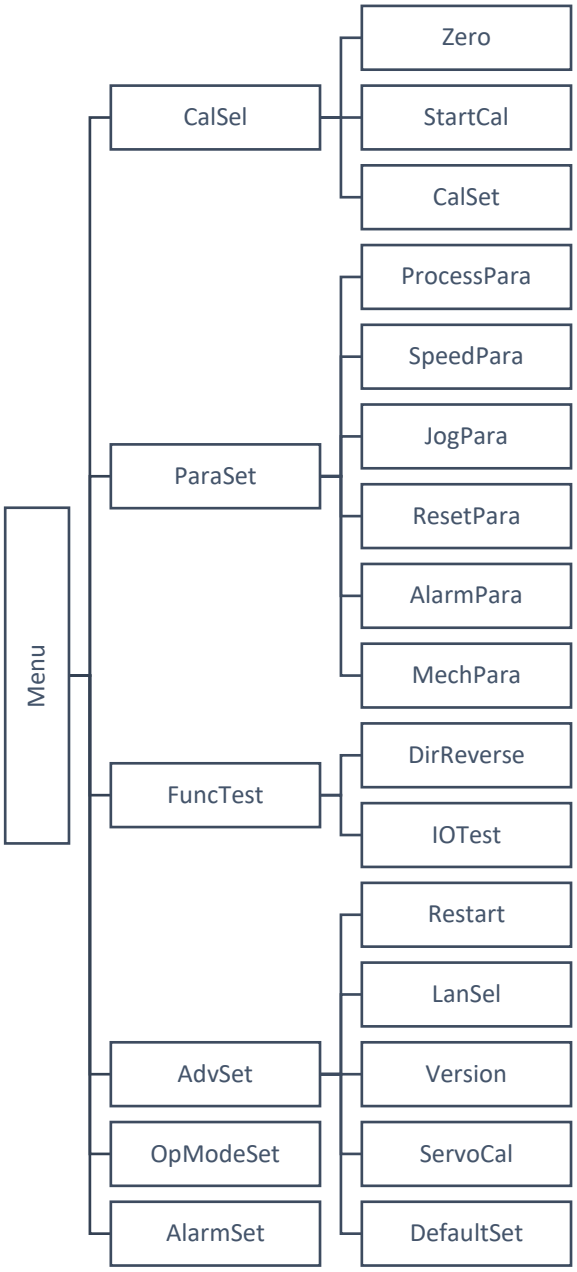
2.1 Keys

Key Category		Function Description
ESC	Return	Exit and return to the previous menu. Stop the motion status.
OK	Confirm	Go to the submenu. Enter settings. Save the parameter settings.
◀ ▶	Left and right direction	Move left and right at the parameter setting interface.
▲ ▼	Up and down direction	Control the laser head movement up and down at the main interface. Menu selection at the menu interface. Change parameter at the parameter setting interface. Press up and down key to increase and decrease number.
ENT	ENT Key	Confirm the operation when you restart or recover the factory settings.
FOL	Follow On	Turn on the follow function of laser head and the laser head moves to the follow height.
SHUT	Follow Off	Turn off the follow function of laser head and the laser head uplifts to the berth point.
FAST	Follow Fast	Speed up the follow responsiveness (reserved)

SLOW	Follow Slow	Slow down the follow responsiveness (reserved)
+0.1	Follow Height +	Increase follow height by 0.1mm
-0.1	Follow Height -	Decrease follow height by 0.1mm
MID	Back to Mid	Return to the middle position of Z axis, where is set in advance.
ORG	Back to Org	Return to the mechanical origin point
F1	F 1 Key	Press to set current position as zero point if without limit sensors (not recommended for regular use but debugging)
F4	F 4 Key	Clear alarm

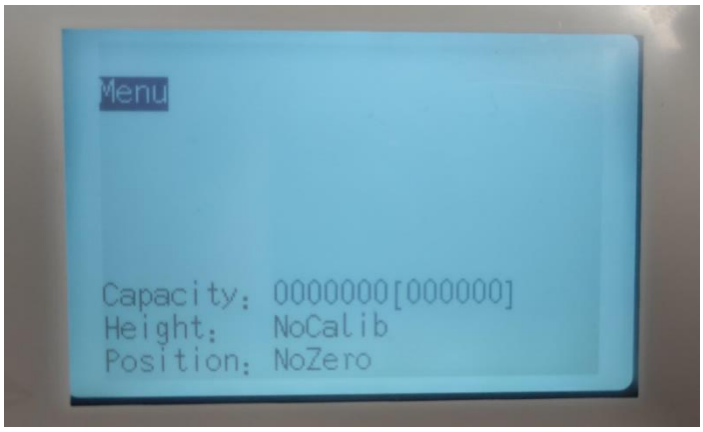
2.2 Level Diagram of System Functions

The level diagram of the system function is as follows:



2.3 Main interface

Enter the main interface automatically after power on.



The display on the main interface includes:

Item	Description
Follow Status	Show if follow function is running.
Cap	Realtime capacitance (max. differential value).
Height	Distance from nozzle tip to workpiece.
Position	Coordinates of laser head.
Alarm status	Show the alarm status of laser head.

2.4 CalSel

2.4.1 Zero

It is the process that the laser head moves upward to return to the upper limit point and determines the z-axis coordinates at the same time. Zero return operation must be carried out before capacitance calibration. After the laser head returns to zero, decide whether to return to the docking point according to the reset parameters.

Ensure the valid limit signal before zero operation and the laser head is between the two limits, otherwise it may cause mechanical failure.

2.4.2 StartCal

The purpose of the capacitance calibration is to determine the relationship between the capacitance and the nozzle height.

Move the laser head near to the work-piece (about 15mm) before calibration and start the capacitance calibration. Capacitance calibration cannot be performed without homing.

The calibration will last approximately 10~20s and the nozzle will perform the following actions:

- Lower slowly to determine the tip touch position.
- Check the capacitance stability by uplifting.
- Determine the tip touch position in the second time.
- Slowly uplift to collect capacitance curve.

After the calibration is completed, the interface will show the calibration result. For the flat cutting head, it will show the capacitance smoothness, stability and calibration value. For the 3D cutting head, it will show the capacitance stability and calibration value.

In general, the calibration value over 3000 for flat cutting and over 1000 for 3D cutting is good.

Before the capacitance calibration, ensure the laser head is properly positioned with enough Z travel range to avoid triggering a limit or exceeding the travel range during calibration. In addition, ground the work-piece and implement capacitance calibration after the tip touch signal is valid.

2.4.3 CalSet

Calibration range:

Set the range of capacitance collection. The follow range is limited within this value after capacitance calibration.

Calibration speed:

The uplifting speed of the nozzle while collecting the capacitance is recommended to set as 2mm/s. Theoretically it obtains more calibration points with higher calibration quality if to lower the calibration speed.

Touch threshold:

When touching the plate, the capacitance value will suddenly change. This value mainly determines the sensitivity to the judgment of the plate. The smaller the value, the higher the sensitivity. Recommended setting is 5000. If the collision plate cannot be detected, the parameter can be adjusted down appropriately.

The capacitance value will jump while touching the plate, which mainly determines to judge the sensitivity by touching plate. The smaller value means higher sensitivity. It is recommended to set this as 5000. If the tip touch cannot be detected, the parameter can be set smaller appropriately.

2.4.4 Capacitance type

The capacitance type is divided into three-dimensional and plane. If the plane type is selected, the

calibration curve will be mathematically analyzed to evaluate the calibration quality.

2.4.5 Calibration points

Display the calibration points of the current calibration data. Generally, the more calibration points, the better the follow-up effect.

2.4.6 Calibration curve

After entering, the calibration curve of the current calibration data is displayed. The horizontal axis is the height from the plate and the vertical axis is the capacitance value.

2.5 ParaSet

The parameter setting mainly includes the six types of parameters as below. When using QC300 for the first time, the user must set these parameters correctly especially the "MechPara", otherwise the system will not work normally.

2.5.1 ProcessPara

- Follow Mode *: it consists of "Follow" and "Pierce". In the follow mode, the height sensor will directly enter the normal follow mode under the follow command. In the piecing mode, the height sensor will enter the piecing mode under the follow command. The relevant parameters of the piecing mode are set in the "piecing parameters".

- Internal Follow Height: in the follow state, the distance from the nozzle tip to workpiece surface which will be shown in the main interface. The internal follow height must be less than the calibration range.

- Stay Coordinate *: After turn off follow, the laser head will move to the berth coordinate in dry run if it is set return to berth point.

- Z Travel *: This value is valid when the soft limit is on.

- Middle Coordinates *: The target position laser head moves to when receives external input signal to return to middle position.

- Back to Stay*: if return to the berth point or not after turn off follow function.

- Height Offset *: Height compensation can be achieved by the IO signal in certain applications.

- Vibration Suppression: If cutting head vibration occurs while following, turn on this function to improve effect.

- Follow Adjusting Parameter: suggest to adjust under instruction from service engineer. See the recommended setting value as below.

  3D/Tube cutting

  Uplift/Lower Coefficient: 25

  2D cutting

  Uplift Coefficient: 60, Lower Coefficient: 30

- Piecing Parameters *: QC300 supports up to 3-stage piecing (from stage 1 to stage 3). Each stage can set piecing height and piecing delay. When the piecing delay is set to 0, this stage and next piecing will not be performed. For example, when 2nd piecing delay is set to 0, the 2nd and 3rd piecing will not be performed. When the piecing height of each stage is reached, it outputs 24V.

Note: When the primary piecing height is greater than 5mm, the piecing process is as follows: move to follow height》uplift to the 1st stage piecing height》gradually move down》follow.

when the primary piecing height is not greater than 5mm, the piecing process is as follows: Gradually move down》follow.

2.5.2 SpeedPara

- DryRun Speed *: max. moving speed of back to middle, origin or berth position. (mm/s)

- DryRun Acceleration *: max. acceleration of back to middle, origin or berth position. (mm/s^2)
- Follow Speed: max. follow speed. (mm/s)
- Follow Acceleration: max. follow acceleration. (mm/s^2)

2.5.3 JogPara *

- Jog Mode: fast or slow jog. It is shifted in main interface by click “ENT”.
- Fast Jog: the corresponding jog speed when enters Fast Jog.
- Slow Jog: the corresponding jog speed when enters Slow Jog.
- Soft Limit: it alarms once it exceeds Z axis travel when this function is turned on.

2.5.4 ResetPara *

- Home: to select whether to activate auto homing when power is on. Set the option to "Yes" after debugging and save the parameters.
- Back to Stay: if to return to berth coordinate after homing.
- Home Speed: Z axis homing speed.

2.5.5 AlarmPara

- Follow Offset: the max. follow offset (up limit) allowed by QC300. After the laser head follows in place, the follow offset caused by the movement beyond the workpiece boundary or the violent shaking of the workpiece exceeds the set alarm value with duration exceeding the follow offset delay, QC300 will generate "follow offset alarm".

- Follow Offset Delay: to set delay duration of follow offset alarm. It allows a longer duration if to set it a bigger value, which means a better capability to filter interruption.

- Touch Delay: during the follow-up process, if the duration of the plate collision reaches the set value, the laser head will automatically lift up for protection and output an alarm signal. QC300 will generate "Touch Alarm". **This value cannot be filled as 0.**

2.5.6 MechPara

- Pulse Per Revolution: set the number of pulses fed back by the encoder per revolution of the servo motor. It shall be consistent with the corresponding parameters of the drive.

- Pitch: set the stroke of each revolution of the transmission mechanism. Take the screw pitch of screw rod as an example. Theoretically, the larger the lead of screw rod, the faster the running speed of z-axis.

- Max RPM: set the upper limit of the allowable speed of the servo motor according to the motor and load characteristics.

- Velocity Gains: set the actual speed corresponding to the voltage per volt, which shall be consistent with the parameters in the drive (for example, 375r / min / V, the voltage increases by 1V, the speed increases by 375r / min. The voltage 8V corresponds to the motor speed of 3000r / min).

- Servo Type: it is mainly the difference of servo signal level. The following table lists few used types of servo drives.

Type		**1**	**2**
Servo Signal	Alarm Input	NPN, NC	NPN, NC
	Alarm Clear	NPN	NPN
	ZEROSPD	NPN	PNP
	Enable	NPN	NPN
Drive Brand Reference		Yaskawa	Panasonic
		Schneider 26 series	Fuji
		Delta B2 series	
		HCFA	

- UpLimit Logic: Logic of up limit input port, NO or NC.
- DownLimit Logic: Logic of down limit input port, NO or NC.
- General Logic: Logic of general input port, NO or NC.

2.6 FuncTest

- Direction Reversal: select this option to reverse the direction of the servo motor.
- IO Test: carry out relevant io tests after entering, which can be used by after-sales personnel.

2.7 Advanced Settings

- System Restart: restart the system.
- Language Selection: language switch.
- Version: display the software and hardware version of QC300.
- Servo Calibration:

  The purpose of servo calibration is to compensate the zero drift of servo motor. The whole servo calibration time lasts about 5S.

  Clear Zero Drift Value: select to clear the current zero drift value.

  Zero Drift Value: shown as the current zero drift value.

Note: If the laser head is not moved between the Z axis stroke before the servo calibration, the servo calibration may be abnormally terminated and report the error of "over the Z axis stroke" at the main interface.

The servo zero drift value is generally not large. If the calibration result is abnormally large (above 20m V), please check the electrical wiring and mechanical structure.

- Default Setting: clear the existing parameters settings and restore to factory default values.

2.8 Mode

QC300 supports EtherCAT, standalone and sensor (0-10V feedback) mode which is switchable. In addition, the AX system can be switched in the mode. If AX system is selected, it needs to be used with AX CNC motion control system from Raytools.

Need to restart system after mode switching.

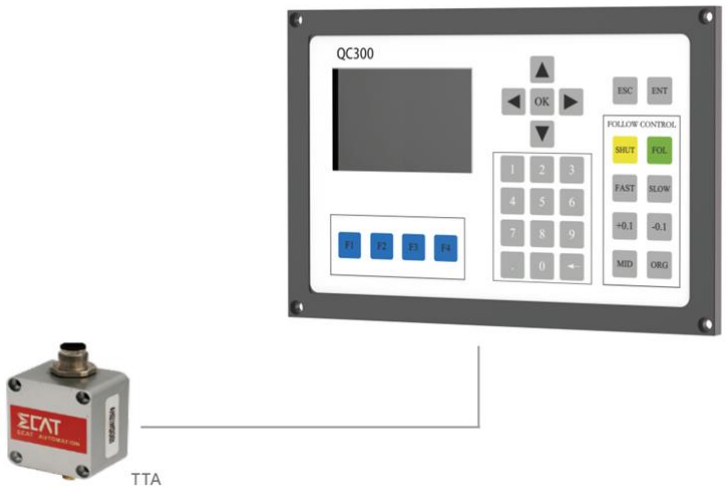
2.9 AlarmSet

QC300 can show the latest 100 alarm records.

3 Wiring and Commissioning

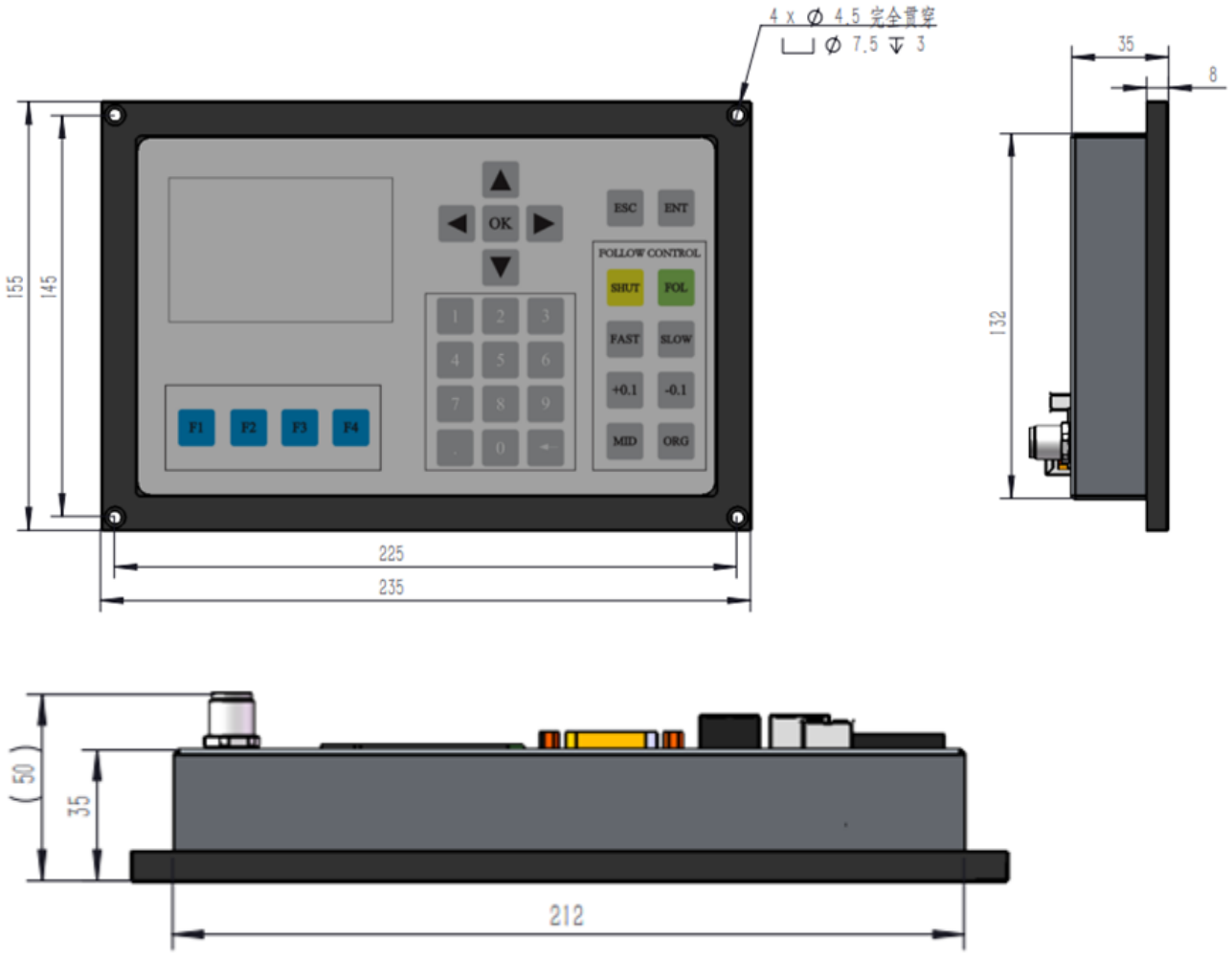
3.1 Accessories

S/N	Item
1	QC300 Master
2	Pre-amplifier (TTA)
3	Servo control cable (optional, only used under EtherCAT or Standalone mode)
4	Sensor cable

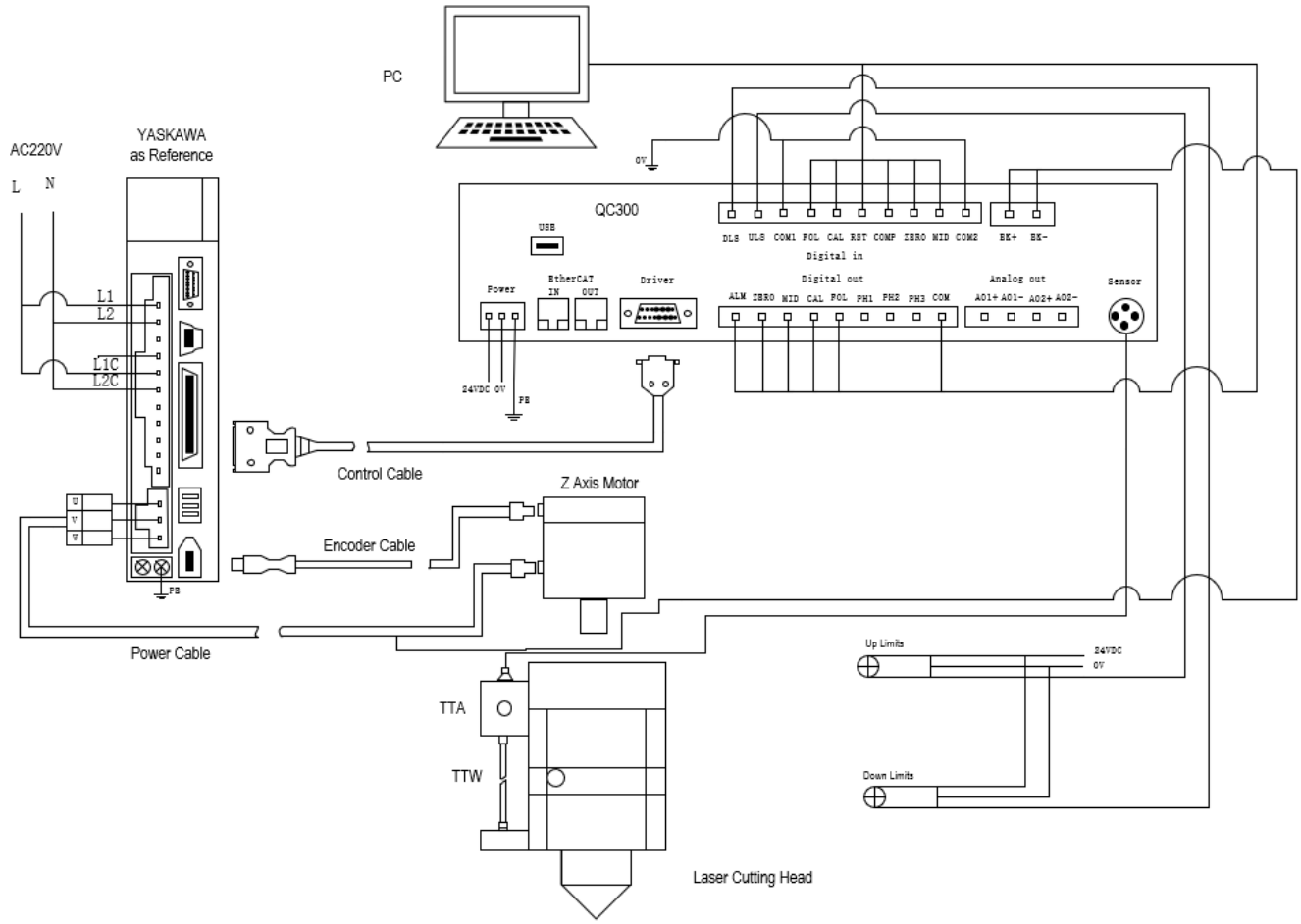


3.2 Overall Size

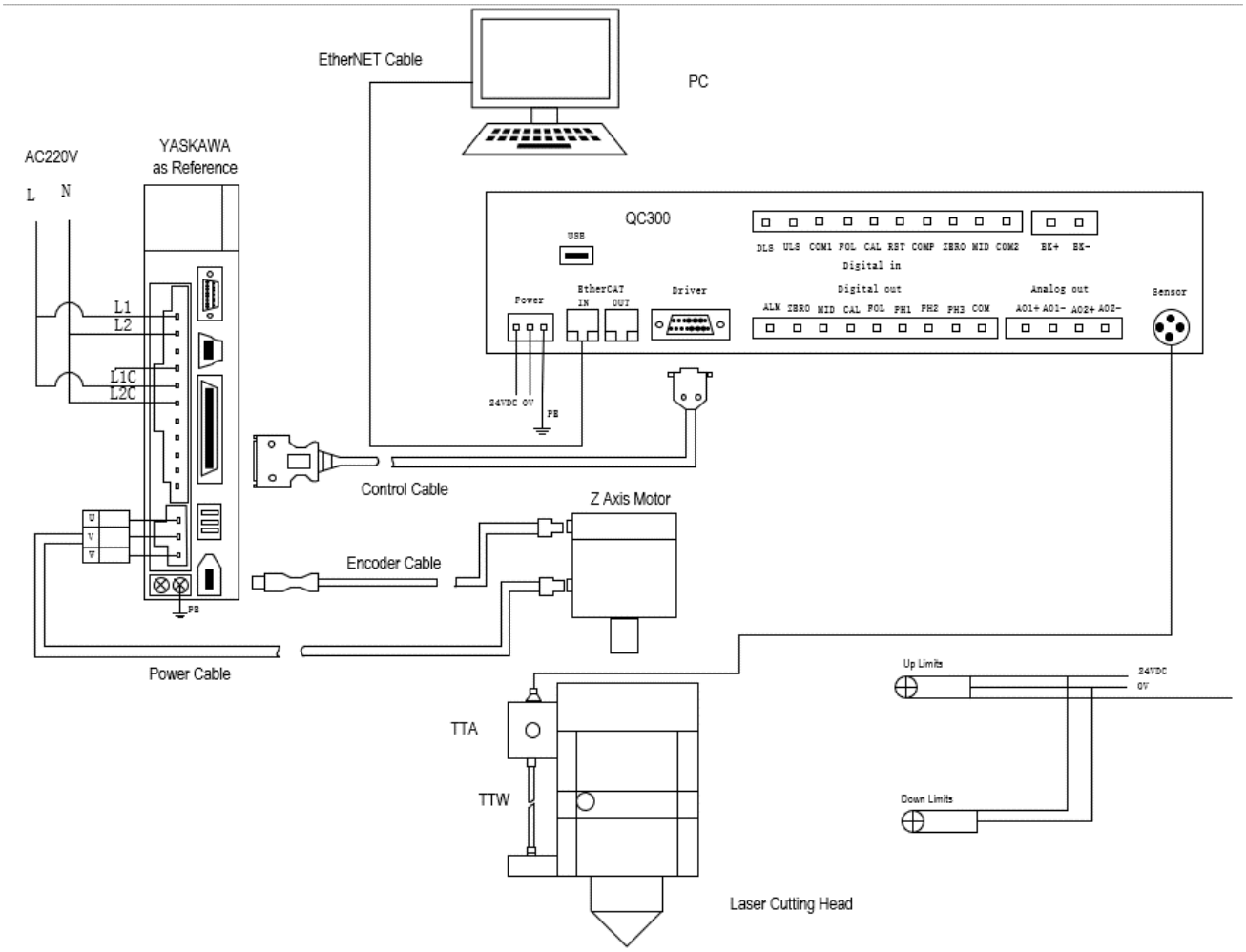
The overall size of the QC300 master is shown as below (unit: mm):



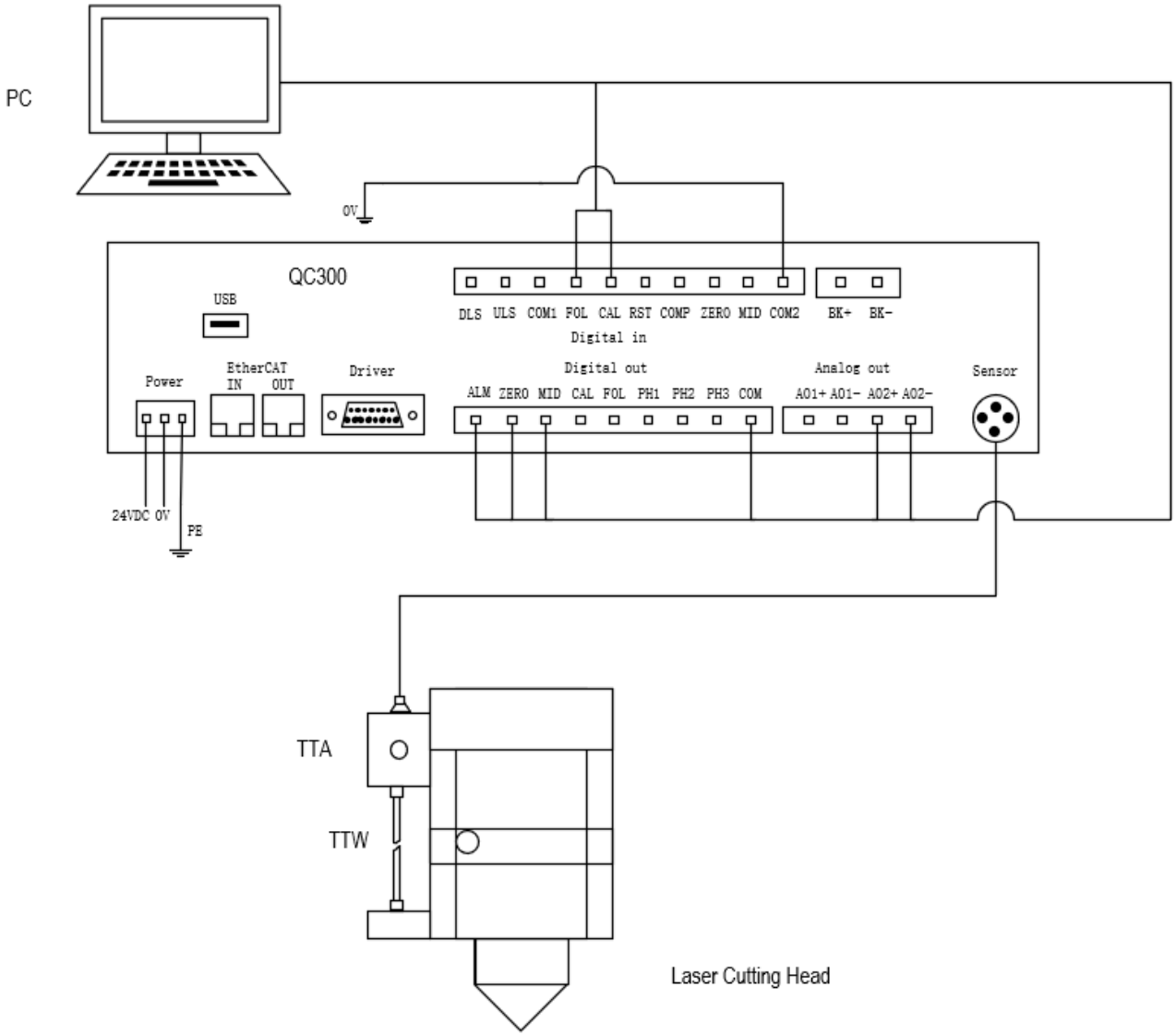
3.3 System Wiring (Standalone Mode)



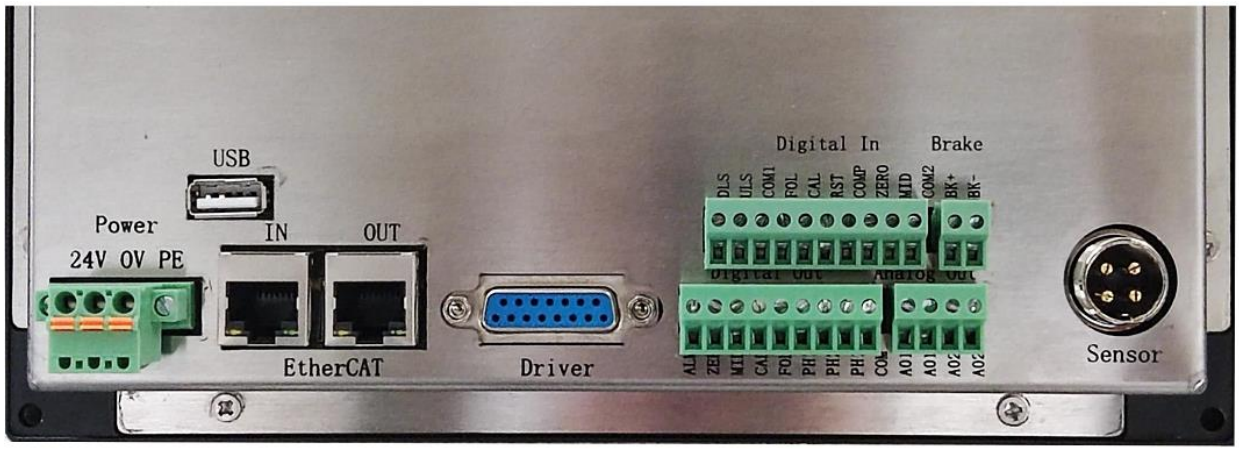
3.4 System Wiring (EtherCAT Mode)



3.5 System Wiring (Sensor Mode, 0-10V Feedback)



3.6 Interface Description



Interface	Description
Power	24VDC power supply
USB	The U disk plug-in for upgrading of firmware
Driver	Interface to servo drive.
Digital Out	8 digital outputs, to share one COM.
Digital In	8 inputs (2 inputs to share COM1 and 6 inputs to share COM2)
Sensor	Interface to pre-amplifier (TTA).
Ether CAT	EtherCAT slave interface. (IN and OUT)
Brake	Used for brake of servo.
Analog Out	0-10V feedback of height from nozzle tip to workpiece. (only used for sensor mode)

Driver Interface (Interface of QC300 to servo drive)

Pin	Description
1	OUT_Servo_DA（drive speed command）
2	Servo_OS（Zero speed position of drive is used to control the shaft locking of motor）
3	E1_A_P（Encoder A Phase Positive）
4	E1_B_P（Encoder B Phase Positive）
5	E1_C_P（Encoder C Phase Positive）
6	Servo_SON（drive enable）
7	Servo_CLR（drive alarm clear）
8	VDD_24V（power supply）
9	AGND (analog grounding)
10	PGND (power grounding)
11	E1_A_N（Encoder A Phase Negative）

12	E1_B_N（Encoder B Phase Negative）
13	E1_C_N（Encoder C Phase Negative）
14	Servo_ALM（drive alarm）
15	PGND（power grounding）

Digital Out Interface (PNP-24V and NPN-0V):

Point	Definition	Description
ALM	Alarm output	Output 24V when alarm occurs. Normally 0V.
ZERO	Homed	Output 24V when it is homed.
MID	Back to middle position	DO3 outputs 24V when it is at middle position.
CAL	Calibrated	It outputs 24V from 0V after calibration is triggered and finished.
FOL	Follow ready	It outputs 24V from 0V after Follow is triggered and ready.
NC1	1st stage pierce ready	It outputs 24V when the piercing height is reached under piercing mode.
NC2	2nd stage pierce ready	It outputs 24V when the piercing height is reached under piercing mode.
NC3	3rd stage pierce ready	It outputs 24V when the piercing height is reached under piercing mode.

Digital In Interface (PNP-24V and NPN-0V):

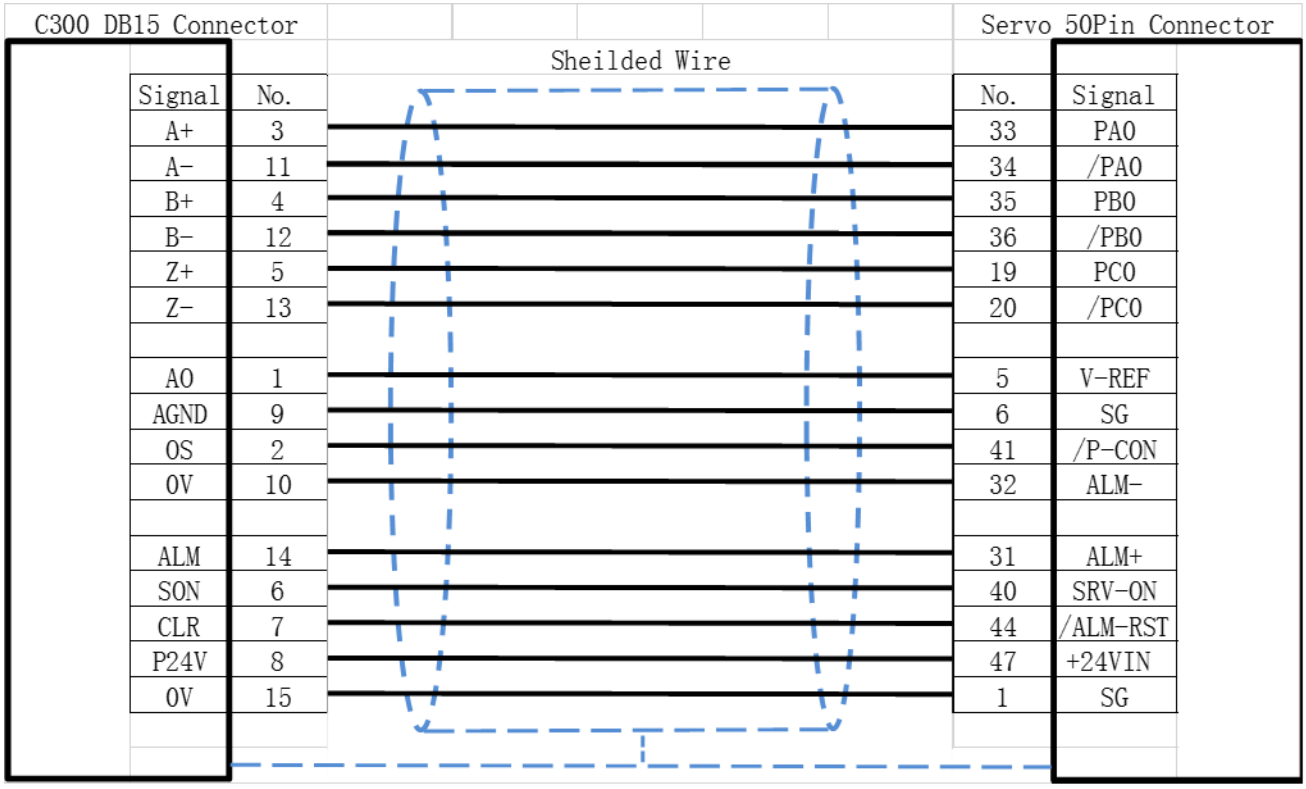
Point	Definition	Description
FOL	Follow On/Off	Follow On by 24V input. Follow Off by 0V input or unwired.
DLS	Down limit	Lower limit switch
ULS	Upper limit	Upper limit switch
CAL	Calibration	Calibration is started when the input changes from 0V to 24V.
RST	Reset	System is reset when the input changes from 0V to 24V.
COMP	Compensation	Run as compensated height when 24V is input after the height offset is on.
ZERO	Home	Homing is started when the input changes from 0V to 24V.
MID	Back to middle	Laser head returns to middle position in dry run speed when the input changes from 0V to 24V.

Note: Digital input contains two groups. DI1 and DI2 are to share COM1. DI3-DI8 are to share COM2. The input is valid when a 24V voltage exists between DI x and COM x.

DI1	DI2	COM1	DI3	DI4	DI5	DI6	DI7	DI8	COM2

3.7 Drive Wiring diagram (for Standalone or EtherCAT Mode)

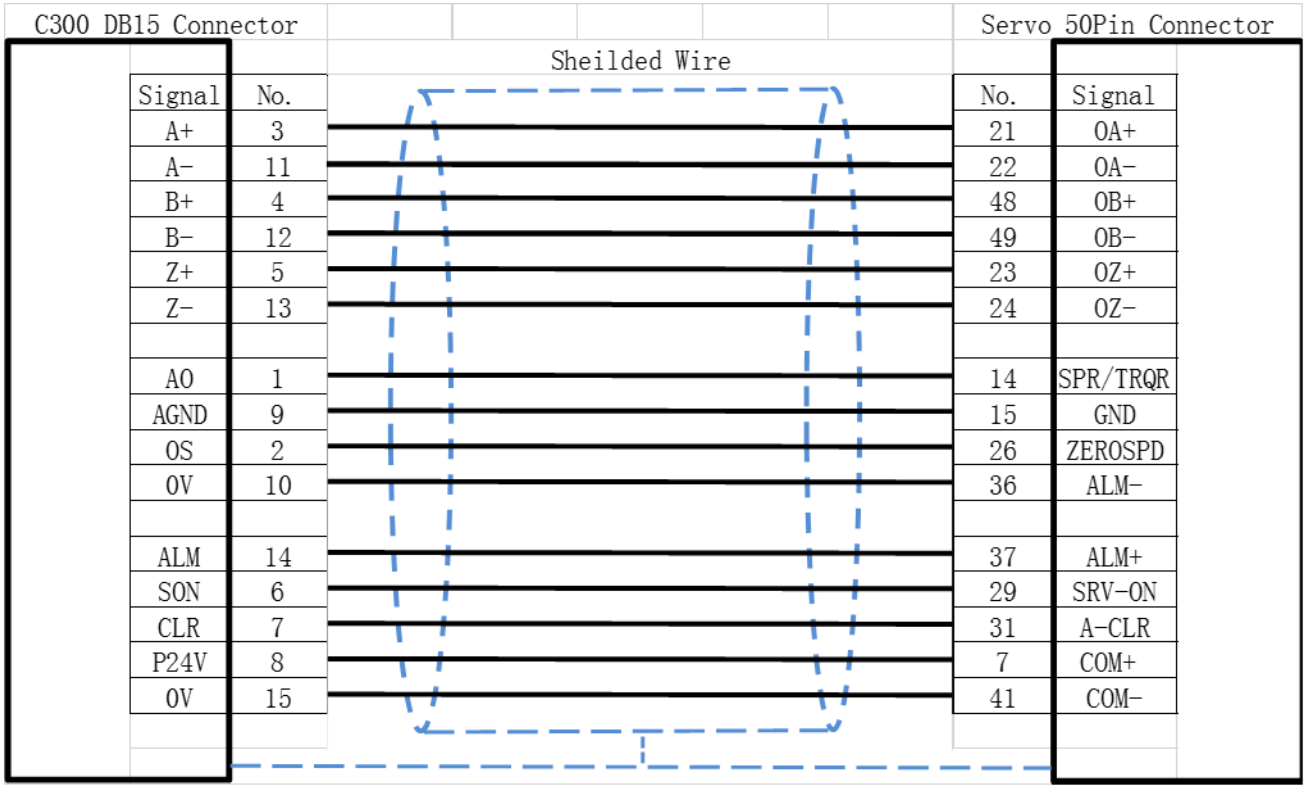
3.7.1 Yaskawa drive wiring diagram



Servo parameters setting of Yaskawa∑ -V series refers to the following table:

Type	Recommended Value	Description
Pn000	00A0	Speed control with zero fixed function
Pn00B	N/A	Set 0100 for single-phase power supply
Pn212	2500	The number of pulses output by the encoder per revolution corresponds to 10000 pulses per revolution of QC300
Pn300	6.00	The velocity gain parameter corresponding to QC300 is 500r/min/V
Pn50A	8100	CW, Forward
Pn50B	6548	CCW, Reverse

3.7.2 Panasonic drive wiring diagram



Servo parameter setting of Panasonic A5/A6 series refers to the following table:

Type	Recommended Value	Description
Pr001	1	Control mode which must be set to the speed/velocity mode
Pr002	3	Real-time automatic adjustment. Recommended to set to vertical axis mode.
Pr302	375	The input speed gain shall be consistent with the speed gain of QC300.
Pr315	1	Turn on the zero-speed function.
Pr504	1	Set forbidden input (POT, NOT) of drive.

3.8 QC300 Commissioning (for Standalone or EtherCAT Mode)

Please follow the below commissioning instructions for 1st operation after the installation and servo drive parameters are set.

QC300 parameter setting

- Power on QC300 to start initialization.
- Set mechanical parameter, jog parameter, process parameter and operation mode. Refer to Chapter 2 Operating Instructions for specific details.
- It is required to switch to “Standalone Mode” for commissioning. Then switch to “EtherCAT Mode” after commissioning.

Motor debugging

- Press the up and down key at the main interface for motor jogging to observe if there is any encoder fault. If there is an encoder failure, it is required to modify the servo drive parameters.

- Press the up and down key at the main interface for motor jogging to observe the moving direction of laser head. If the jogging direction is inconsistent with the movement direction of the laser head, it is necessary to reverse the motor direction in the "FuncTest".

- Switch to servo calibration to wait for completement of servo drive.

- Trigger the upper and lower limit sensors with an iron sheet to observe whether the upper and lower limit alarms flash.

Capacitance calibration

Jog the laser head down to touch plate. If the screen flashes "touch alarm", the capacitance calibration can be started.

Follow test

On the front panel, press FOL and SHUT to control Follow On/Off.

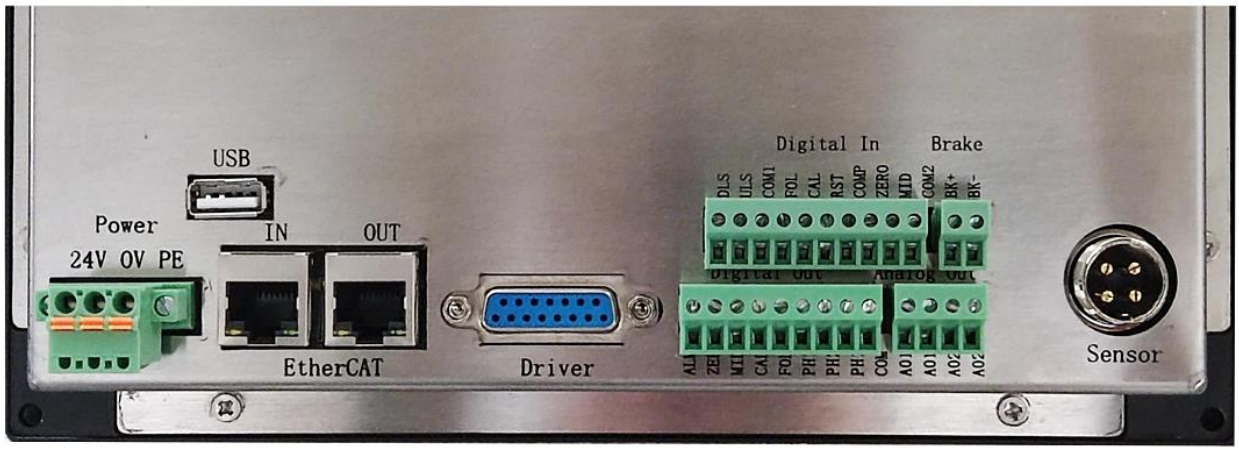
Input the IO signal of follow to observe whether the follow function is normal.

The cutting operation can be performed after the above commissioning steps are completed and correct.

4 Operation of Sensor Mode (0-10V Feedback of Height)

The Sensor Mode is used to detect the height from workpiece to nozzle tip and outputs corresponding voltage to CNC.

4.1 Signal Definition

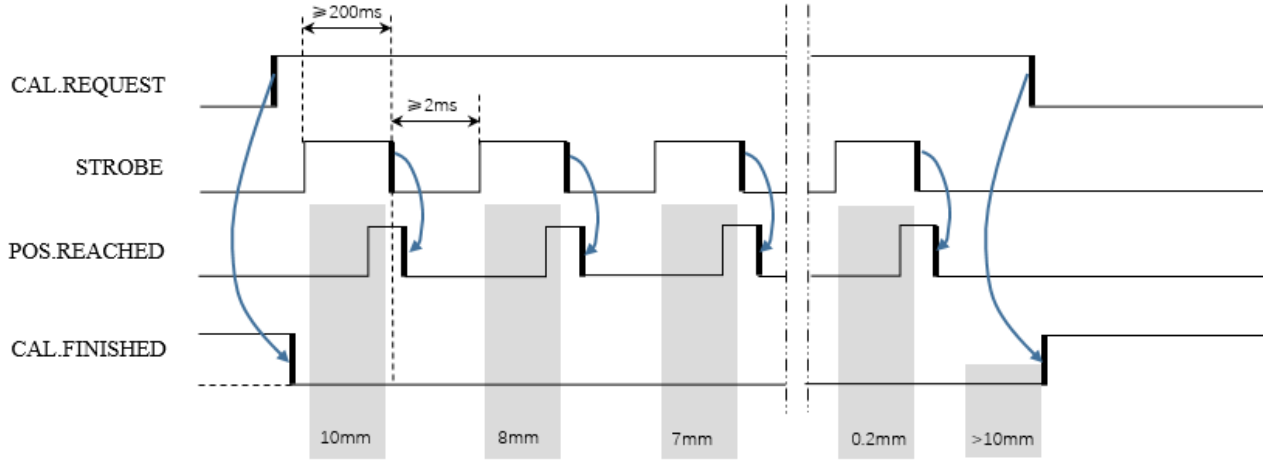


Signal	I/O Type	Interface	Voltage	Definition
CAL.REQUEST	Input	CAL	24V	Continuous input until whole calibration procedure is completed
STROBE	Input	FOL	24V	Reach calibration point input signal with 16 calibration points in total. When specific calibration point is reached, the axis movement shall be stopped and output this signal. Once the “Pos. Reached” is output, to

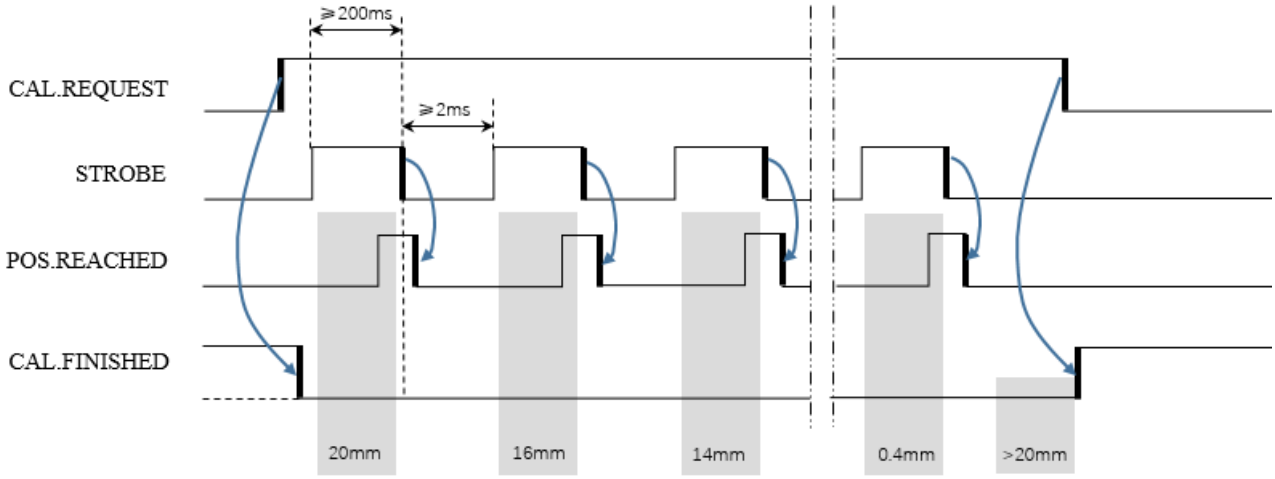
				clear this signal and move to next calibration point.
CAPACITANCE	Input	Sensor	--	Capacitance of TTA. No need to interact with system signal but maintain continuous and stable input.
TIP TOUCH	Output	ALM	24V	It is triggered when the nozzle touches sheet and cleared when the nozzle goes away from sheet.
POS. REACHED	Output	ZERO	24V	System will record the point capacitance and output this signal to clear “Strobe” signal. The “Pos. Reached” signal will be automatically cleared when the “Strobe” signal is cleared.
CAL. FINISHED	Output	MID	0V	This signal is output when the calibration is finished after system is ready.
OUTPUT HEIGHT	Output	AO2+, AO2-	0V-10V	To output analog voltage. It outputs 1V in case of tip touch when alarms occur or system is unready. When the system is ready, it is follow height

4.2 Height Follow Process

10mm Calibration:



20mm Calibration:



- "Cal Request" signal is activated.
- Move nozzle tip to workpiece until "Tip Touch" signal is activated. (Input capacitance is recorded as touch capacitance)
- Move nozzle tip to 1st calibration point. (measure the top range limit)
- Activate "Strobe" signal >200ms when axis remains static and await "Pos. Reached" signal triggered and "Strobe" signal cleared.
- Move to remaining 15 calibration points and repeat the recording.
- Lift above 1st calibration point when all positions are reached and recorded.
- "Cal. Finished" signal is triggered.

In accordance with selected measure range, the following calibration points must be reached one by one.

10mm Calibration	
Cal Point	Distance
1	10mm
2	8mm
3	7mm
4	6mm
5	5mm
6	4mm
7	3mm
8	2.5mm
9	2.0mm
10	1.8mm
11	1.5mm
12	1.2mm
13	1.0mm
14	0.7mm
15	0.5mm
16	0.2mm

20mm Calibration	
Cal Point	Distance
1	20mm
2	16mm
3	14mm
4	12mm
5	10mm
6	8mm
7	6mm
8	5mm
9	4mm
10	3.6mm
11	3.0mm
12	2.4mm
13	2.0mm
14	1.4mm
15	1.0mm
16	0.4mm

5 Troubleshooting

5.1 Alarm Information

5.1.1 Touch alarm

When the metal object contacts with the nozzle or the amplifier back-end circuit is short circuited, a tip touch alarm will be generated. In case of this alarm, please check as below:

- Check if the nozzle is blocked by metal objects or other objects.
- Check if the touch alarm delay is reasonable.

- Confirm whether the nozzle and TTA amplifier housing are conducted when the plate is not actually touched. If it is conducted, check whether there is a short circuit at the back end of the amplifier.

5.1.2 Up/Down limit alarm

This alarm will be generated when the system detects the sensor signal of z-axis upper limit or lower limit. If it does not meet the requirements, please reset the position of the sensor. If this alarm is always displayed, please check as below:

- Check if the limit sensor is blocked by unknown objects.
- Improper installation of limit sensor.
- Check if “Limit Logic” is correctly set in “MechPara”.

5.1.3 Servo alarm

Under normal circumstances, when the driver gives an alarm, the servo alarm will be displayed. If the driver is normal but an alarm is displayed, it may be caused by the following conditions:

- Incorrect selection of servo type.
- Incorrect wiring of servo drive.
- External interference.

If the driver gives an alarm, please check whether the driver parameters and wiring are correct. Restart the drive after troubleshooting.

5.1.4 Follow alarm

If the nozzle cannot follow the workpiece in time and follow height is over follow offset with duration more than offset delay during follow process after follow is ready, a follow offset alarm will be displayed. It is suggested to increase the follow offset value or follow offset delay.

5.1.5 The encoder failed

The drive control mode of QC300 is speed loop mode. The running direction of motor corresponding

to speed command must be consistent with the incremental feedback direction of encoder, otherwise encoder fault will be reported. In case of encoder failure, it is necessary to modify the encoder direction of the servo driver.

5.2 Common Problem Analysis

5.2.1 Slow response of follow process

- Low setting of follow gain level

Observe whether the follow gain in the main interface is set too low, which will lead to slow follow-up response.

- Oversetting of acceleration and deceleration time of driver while soft starting.

If the acceleration and deceleration time of soft start is set too long, the speed response will not be timely. This value can be reduced appropriately.

- Low-setting of speed parameter.

Low follow speed and acceleration will lead to low response, which can be increased appropriately.

- Untimely lifting.

Increase the proportional parameter 1 to enable faster response.

5.2.2 Big difference of actual follow height from set height.

- Incorrect parameter setting.

The lead of the screw rod does not match the actual lead.

- Calibration

Capacitance recalibration is not done after replacement of nozzle or TTA amplifier.

5.2.3 Calibration failure

- Improper location of laser head.

The limit cannot be triggered at any time from the first tip touch to reaching calibration range by uplifting while calibration otherwise it may cause abnormal termination.

- Interruption as below while calibrating.

Workpiece movement.

Nozzle tip touch with other objects.

Drive alarm.

5.2.4 Shaking in follow process

- Excessive follow gain

Excessive follow gain will lead to system vibration, which may cause the motor to drive the robot arm to shake together.

- Improper servo rigidity

Insufficient servo rigidity may lead to inaccurate positioning and jitter. Too high servo rigidity will cause vibration of robot arm.

- Loose or replacement of nozzle

This abnormality may be caused by replacing the nozzle without capacitance calibration or loose of nozzle.

- Insufficient payload of robot arm

If the load of the robot itself is insufficient, it will vibrate during its operation no matter if follow function is on/off.

5.2.5 Abnormal screen or key

Check the system grounding to exempt from external interference.

5.2.6 Tip collision during calibrating

Absence of tip touch signal will cause tip collision during calibrating.

- Properly decrease touch threshold.
- Grounding the workpiece and ensure workpiece is conductive.
- Check whether the TTW wiring (tip transformer wire from cutting head to TTA amplifier) is normal. If the wiring is poor or the internal wire core is damaged, there will be no tip touch signal. In this case, the capacitance will remain still and tip touch signal will not come up while nozzle approaches or touch workpiece.