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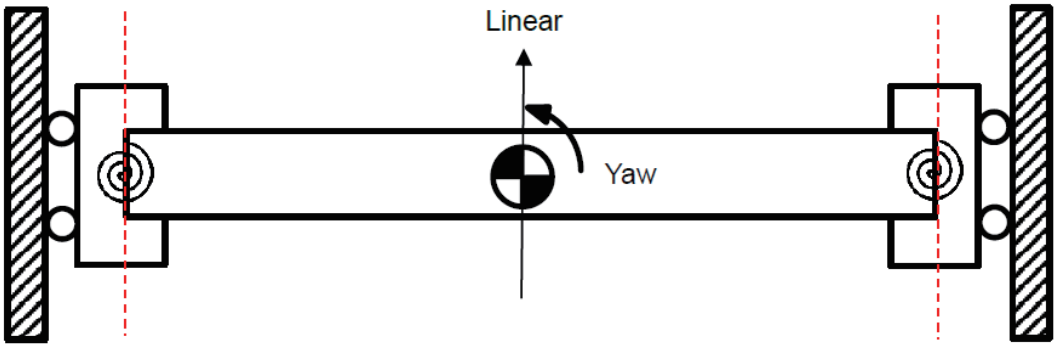


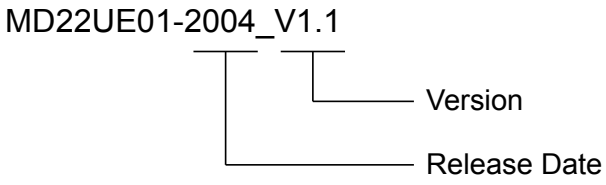
E1 Series Servo Drive

Gantry Control System
User Manual

www.hiwinmikro.tw
MD22UE01-2004_V1.1

Revision History

The version of the manual is also indicated on the bottom of the front cover.



Release Date	Version	Applicable Product	Revision Contents
Apr. 30th, 2020	1.1	E1 series servo drive	1. Update section 3.5: ✓ When using a multi index encoder, users should adopt near home sensor input (DOG) signal on both axes. ✓ Add figures to illustrate the definition of home position. 2. Add section 3.6: ✓ Describe touch probe function and offer the list of the related objects. ✓ Add figures to illustrate the installation limit of near home sensor. 3. Add description tables for Pt parameters in section 3.2, section 3.4, section 3.5, section 4.2, section 4.3 and section 6.1.
Oct. 15th, 2019	1.0	E1 series servo drive	First edition.

Firmware Update History

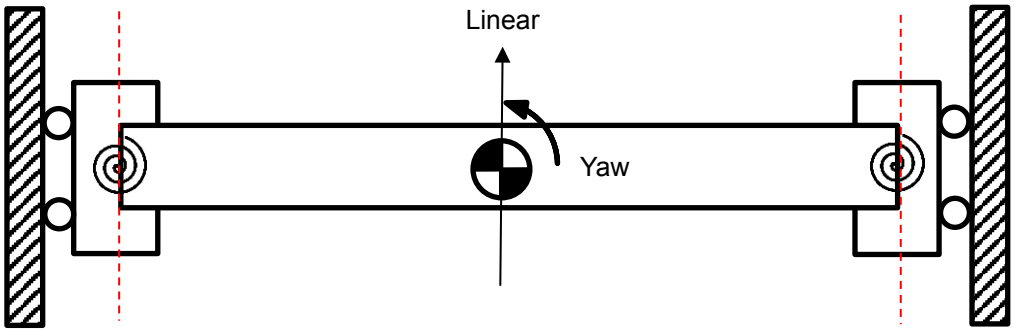
Refer to “E1 Series Servo Drive User Manual” for the information of servo drive firmware version.

Servo Drive Firmware Version	Applicable Product	Revision Contents related to Functions of Gantry Control System
2.4.6	E1 series servo drive	1. Optimize the searching DOG signal procedure in internal homing. Users can detect single axis or both axes with Pt parameters. 2. Fieldbus type servo drive supports Touch Probe function: also for multi index encoders (refer to section 3.6 for the requirements)
2.3.12	E1 series servo drive	1. Change the searching DOG signal procedure in internal homing from detecting single axis to detecting both axes. 2. Fieldbus type servo drive supports Touch Probe function: only for single index encoders
2.2.8	E1 series servo drive	Support functions of gantry control system.

Table of Contents

Preface

Gantry control system: high-performance response gantry control can be achieved by high-speed data exchange technology between two servo drives. Please select ED1□-□G model.



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1. Hardware Configuration

Select the model supporting gantry function and connect two servo drives via CN8 with the communication cable.

Table 1.1

Type	Control Interface	Model
Standard	Voltage command and pulse	ED1S-VG-□□□□-□□
Fieldbus	EtherCAT	ED1S-EG-□□□□-□□
	mega-ulink (For HIMC motion controller)	ED1S-HG-□□□□-□□

Standard Fieldbus

Figure 1.1 CN8 position

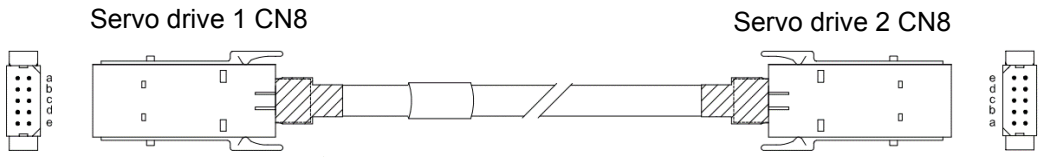

Figure 1.2 Servo drive communication cable (for gantry control system)

Table 1.2 Communication cable for gantry function

Name	HIWIN Part Number	Description
Servo drive communication cable	HE00EJ6DD000	Connect two servo drives which both support gantry function via CN8. (0.5 m)

2. System Architecture

To build a complete gantry control system, two servo drives, two motors and the corresponding encoders must be prepared as two axes. Before activating gantry control system through setting, establish communication system between two servo drives first.

2.1 Communication system architecture

Connect CN8 via the cable (refer to “E1 Series Servo Drive User Manual”) and establish communication system (refer to section 3.2). In communication system, the relationship of master and slave exists in the two servo drives.

2.2 Control system architecture

2.2.1 Definition of linear/yaw axis

After establishing communication system, users can enter gantry control system via gantry control interface (refer to chapter 7). After entering gantry control system, two axes’ linear (axis 0 and axis 1) coordinate system will respectively become **linear coordinate system** and **yaw coordinate system**. The relationship between “Master/Slave” and “Linear/Yaw” is described as below.

Master axis → Linear axis
Slave axis → Yaw axis

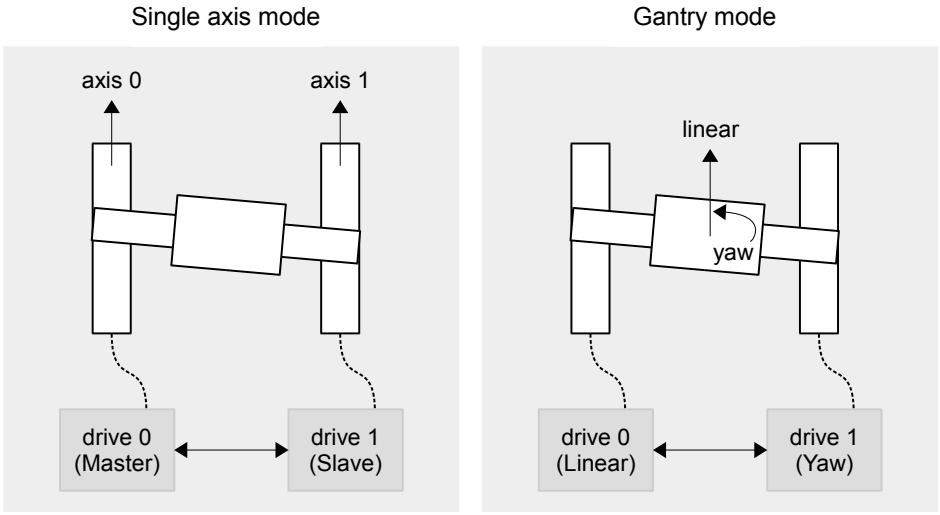

Figure 2.2.1.1

2.2.2 Definition of linear/yaw axis direction

- Definition of linear axis direction
  The linear positive direction of single axis moving part is the positive direction of linear axis.

- Definition of yaw axis direction
  If the positive direction of linear axis and the position of master are already known, the positive direction of yaw axis can be determined by gantry right-hand rule, as the following figure shows.

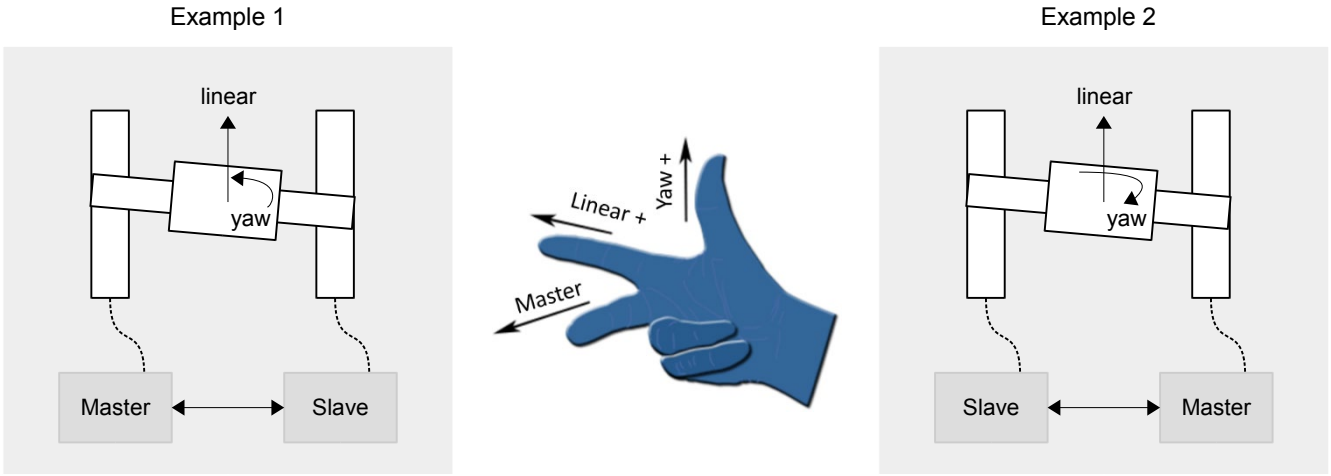

Figure 2.2.2.1

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3. Setting Procedure

To make gantry control system operate normally, some features of the two axes must be the same. Before setting, ensure hardware and software configuration fits the following requirements, or it may cause danger to the stage.

- ✓ Same servo drive model
- ✓ Same firmware version
- ✓ Same positive moving direction (Check it when finishing single axis setting in section 3.1.)
- ✓ Same encoder feedback pulse resolution (Besides hardware specification, check point III in section 3.3.)

Note: Single axis may be driven in the setting process; therefore, ensure the other axis remains freely-operating status, not influenced by the brake.

3.1 Single axis setting

Gantry mode must drive the servo drives and the motors of both axes. Therefore, respectively execute single-axis initialization based on “E1 Series Servo Drive Thunder Software Operation Manual”. The setting procedure is shown as below.

I. Connect to master servo drive and execute single-axis initialization.
II. Set and record the positive moving direction of master motor.
III. Connect to slave servo drive and execute single-axis initialization.
IV. Set and record the positive moving direction of slave motor, which should be the same as that of master motor.

3.2 Establish communication system

All the functions of gantry mode are based on the establishment of communication system. Therefore, communication system must be established first. The setting procedure is shown as below.

I. Build up the relationship of master and slave.
   A. Connect to the left servo drive in figure 3.2.1 and set Pt00D = 0x□□□1 (define it as master).
   B. Reboot the left servo drive to make it become effective.
   C. Connect to the right servo drive in figure 3.2.1 and set Pt00D = 0x□□□0 (define it as slave).
   D. Reboot the right servo drive to make it become effective.

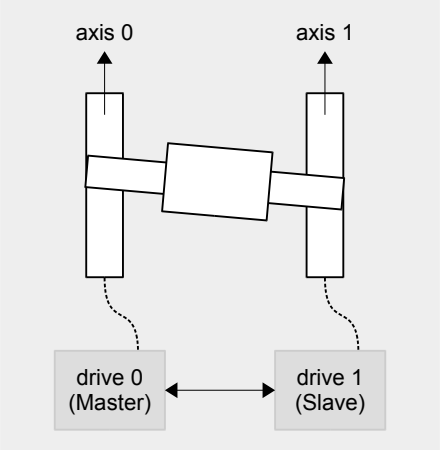

Figure 3.2.1

Table 3.2.1

Parameter		Description	Effective	Category
Pt00D	t.□□□0	Slave axis in group communication.	After power on	Setup
	t.□□□1	Master axis in group communication.		
	t.□□□2 (Default)	No gantry control.		

II. Open **Interface signal monitor** window in Thunder main window to ensure master axis' communication is established, as the red frame in figure 3.2.2 shows.

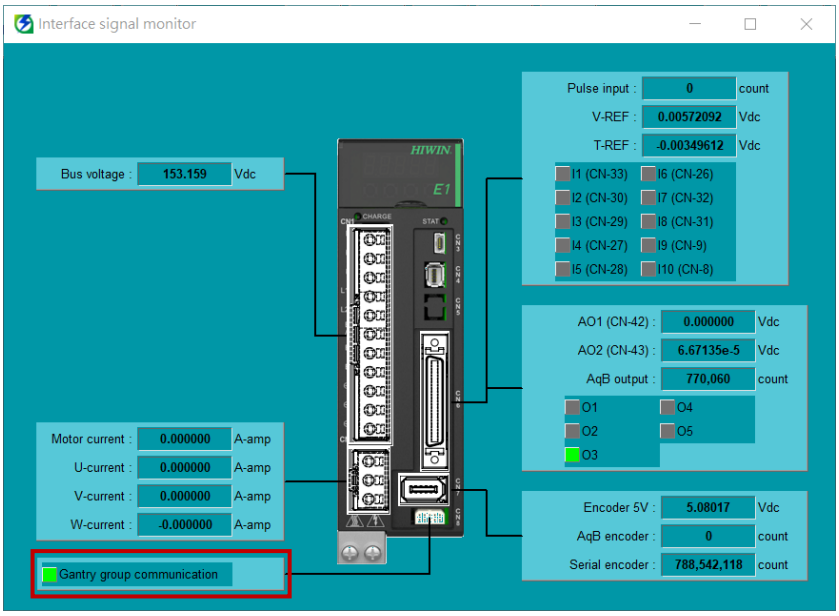

Figure 3.2.2

Note: When communication system is established, alarm AL.FC0 or AL.FC1 may be triggered if users power off any of the axes. Refer to section 5.3 for cause, confirmation method and corrective action.

3.3 Confirmation before activating gantry control system

Before activating gantry control system, double check some parameters and the resolution. The setting procedure is shown as below.

I. Ensure some Pt parameters of both axes are the same.
   A. Connect to master servo drive and record Pt001, Pt20E, Pt210, Pt428, Pt402/Pt483, Pt403/Pt484.
   B. Connect to slave servo drive and ensure the values of the parameters above are the same as those in master axis.

II. Connect to master servo drive to ensure communication is established.

III. Ensure the encoder resolutions of both axes are the same.
   A. Connect to master servo drive.
   B. Make the motor move at least one magnetic pole pair pitch with test run.
   C. Monitor the encoder feedback of both axes via Scope. (Observe position feedback of master axis and slave axis.)
   D. Ensure the incremental direction and the ratio of encoder feedback values are the same.

IV. When this section is completed, the two servo drives can enter gantry mode via gantry control interface.

3.4 Activate gantry control system

There are two ways to activate gantry control system, manual or auto. Manual is for Thunder HMI test run, while auto is for host controller. The setting method is shown as below.

- Manual
  Go to gantry control interface and click **Activate** button (refer to step 4 in chapter 7).
- Auto
  Set Pt00D = 0x□1□□ in master servo drive to activate auto gantry function.

Table 3.4.1

Parameter		Description	Effective	Category
Pt00D	t.□0□□ (Default)	Disable auto switching for gantry control.	Immediately	Setup
	t.□1□□	Enable auto switching for gantry control.		

Note:

1. Before entering gantry mode, ensure things in section 3.1 to 3.3 are completed.
2. After entering gantry mode, both axes are viewed as single linear system. Therefore, master axis test run represents linear axis test run.
3. If auto gantry function is activated, users cannot deactivate gantry mode via gantry control interface.

3.5 Internal homing procedure

After entering gantry mode, both axes are viewed as single linear system. Therefore, homing methods applied in single axis control system (refer to “E1 Series Servo Drive User Manual” for the description) are applicable for gantry control system. The setting procedure is shown as below.

Linear axis homing procedure

I. Ensure both axes have entered gantry mode.
II. Connect to linear servo drive via Thunder HMI or host controller.
III. Set homing method.
IV. Enable the motors. Execute homing via Thunder HMI, or trigger servo drive built-in homing procedure input (HOM) signal via host controller.
V. Wait until homing is completed.

At this time, users only complete “linear axis homing procedure”. Go on to complete “posture regulating setting”.

Posture regulating setting

VI. Disable the motors at home position.
VII. (Optional) Record the posture position of yaw axis with Scope, add a negative sign to the value, and fill it in **Pt711 - Home offset of yaw axis in gantry control system**. That is, offset the home position of yaw axis. At this time, the posture position of yaw axis will be close to 0.
VIII. Record the posture position of yaw axis with Scope, and set the record value to **Pt712 - Locking position of yaw axis in gantry control system**. (If step VII is done, directly set Pt712 as 0.)
IX. Set Pt710 = 0x□□□1 to activate yaw lock function.
X. Enable the motors. Yaw axis will be locked at the position set by Pt712.

When yaw lock function is activated and the parameters are saved to servo drives, posture regulating setting is done. Even if the stage is rebooted, linear/yaw axis will remain at home posture after users trigger and complete “linear axis homing procedure” via Thunder HMI or host controller.

Note:

1. Overtravel (P-OT or N-OT) signal received by master and slave servo drive can only be triggered in linear servo drive. Therefore, triggering any axis' overtravel signal satisfies the triggering overtravel signal procedure of homing.
2. In gantry control system, before yaw lock function is activated, the posture of yaw axis when the motors are enabled will be taken as the reference position to make the mechanism be at a comfortable state. Therefore, the posture of yaw axis will not be arbitrarily changed.

Table 3.5.1

Parameter		Description	Effective	Category
Pt710	t.□□□0 (Default)	Disable yaw axis locking function for gantry control system.	Immediately	Setup
	t.□□□1	Enable yaw axis locking function for gantry control system.		

The requirements for activating yaw lock function:

(1) Enable yaw axis locking function for gantry control system. (2) Complete "linear axis homing procedure".

Table 3.5.2

Parameter	Pt711	Range	-1073741824 ~ 1073741824	Control mode	Position mode
Default	0	Effective	Immediately	Unit	1 control unit
Description					
Home offset of yaw axis in gantry control system					

Table 3.5.3

Parameter	Pt712	Range	-1073741824 ~ 1073741824	Control mode	Position mode
Default	0	Effective	Immediately	Unit	1 control unit
Description					
Locking position of yaw axis in gantry control system					

- Definition of terms

(1) Home position of linear axis:
the center of two axes' indexes (as figure 3.5.1 shows)

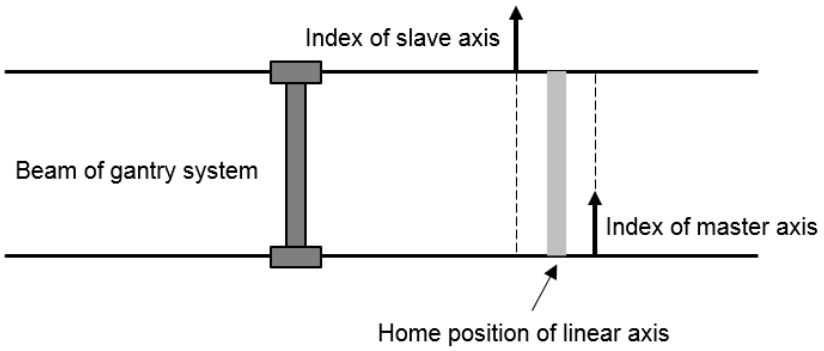

Figure 3.5.1

(2) Home position of yaw axis:
the posture that the two axes' indexes take as the supporting point (as figure 3.5.2 shows)
Before Pt711 is set, a physical installation deviation of mechanism exists in two axes' indexes. Home posture of yaw axis is usually not orthogonal to the linear axis. Therefore, it is reasonable that there is a nonzero value in yaw axis after homing is completed.

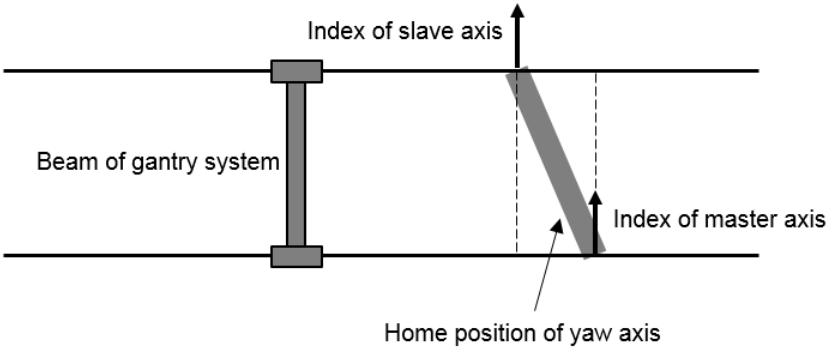

Figure 3.5.2

(3) Home offset of yaw axis in gantry control system (Optional): the offset of yaw axis' home position
Since the physical installation deviation existing in indexes makes the home posture of yaw axis not be orthogonal to the linear axis, users can modify the home position of yaw axis via Pt711. After the modification, the display position of yaw axis will change.

(4) Locking position of yaw axis in gantry control system: After homing is completed and yaw lock function is activated, yaw axis will be locked at the setting position. If there is a value in Pt711, yaw axis will be locked at the offset position.

■ Search DOG signal setting

If searching DOG signal procedure is included in homing procedure, set the searching method based on encoder type. With a multi index encoder, set **Pt710 = 0x□□0□ - Search DOG signal in both axes** to avoid searching different indexes. With a single index encoder, the problem mentioned above will not happen, so users can set **Pt710 = 0x□□1□ - Search DOG signal only in master axis** to lower the cost.

Table 3.5.4

Parameter		Description	Effective	Category
Pt710	t.□□0□ (Default)	Search DOG signal in both axes.	Immediately	Setup
	t.□□1□	Search DOG signal only in master axis.		

3.6 With Touch Probe procedure

Linear axis Touch Probe procedure

I. Ensure both axes have entered gantry mode.
II. Connect to linear servo drive via host controller.
III. Enable the motors via host controller and activate Touch Probe procedure.
(Refer to table 3.6.1 and table 3.6.2 for the related objects.)
IV. After the index positions of both axes are triggered and reported to host controller, Touch Probe procedure is completed.

At this time, users only complete “linear axis Touch Probe procedure”. Go on to complete “posture regulating procedure” and “posture regulating setting”.

Posture regulating procedure

V. Set object 3057h as 11 to execute yaw axis regulating procedure.
VI. After it is completed, users will find out that bit11 of object 3056h is 1.
(Yaw axis regulating is completed.)

Posture regulating setting the same as that in section 3.5

VII. Disable the motors at the position.
VIII. (Optional) Record the posture position of yaw axis with Scope, add a negative sign to the value, and fill it in **Pt711 - Home offset of yaw axis in gantry control system**. That is, offset the home position of yaw axis. At this time, the posture position of yaw axis will be close to 0.
IX. Record the posture position of yaw axis with Scope, and set the record value to **Pt712 - Locking position of yaw axis in gantry control system**. (If step VIII is done, directly set Pt712 as 0.)
X. Set Pt710 = 0x□□□1 to activate yaw lock function.
XI. Enable the motors. Yaw axis will be locked at the position set by Pt712.

When yaw lock function is activated and the parameters are saved to servo drives, posture regulating setting is done. Even if the stage is rebooted, linear/yaw axis will remain at home posture after users execute “linear axis Touch Probe procedure” and “posture regulating procedure” via host controller.

Note:

1. The dictionary list and the introduction of the related objects are shown as below.

Table 3.6.1

Index	Sub-index	Name	Data type	Access	PDO	Operation mode	Valid value	Unit
3056h	00h	Software state	U16	ro	-	All	0 ~ 65536	-
3057h	00h	Apply mode of gantry system	U16	rw	-	All	0 ~ 65536	-
3058h	00h	Yaw target position	I32	rw	Y	All	-2147483648 ~ 2147483647	inc
3059h	00h	Yaw feedback position	I32	ro	Y	All	-2147483648 ~ 2147483647	inc

Table 3.6.2

#	Index		Definition
(1)	3056h	bit8	0: Gantry is not activated. 1: Gantry is activated.
		bit11	0: Yaw axis regulating is not completed. 1: Yaw axis regulating is completed.
		bit12	0: Yaw axis is not in-position. 1: Yaw axis is in-position.
(2)	3057h		1: Activate gantry. 2: Deactivate gantry. 11: Execute yaw axis regulating.

2. On gantry mode, Touch Probe value is not the index position of any single axis. Instead, it is the center point of both axes' index positions.

- With a single index encoder

  When a single index encoder is used with near home sensors, install the near home sensor on master axis side and before both axes' indexes, as figure 3.6.1 shows.

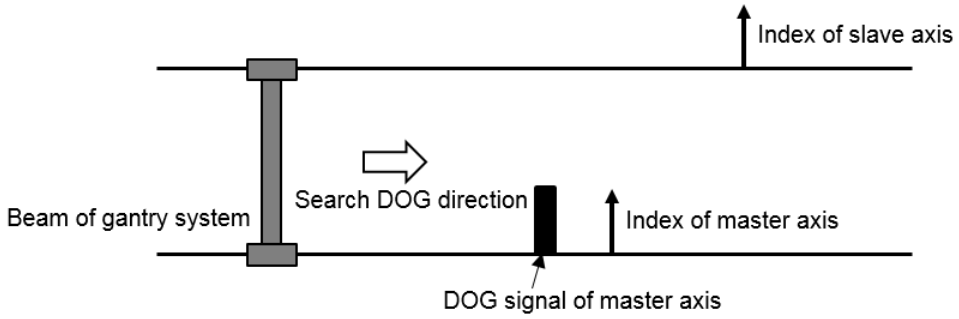

Figure 3.6.1

- With a multi index encoder

  When a multi index encoder is used with near home sensors, please note the following:

  (1) Use Pt parameter

  In gantry control system, Touch Probe procedure with a multi index encoder must adopt the detection of near home sensors. However, the near home sensor read by host controller only represents master axis' signal. With **Pt710 = t.□X□□ - Option of searching index signal for slave axis**, slave axis' servo drive can detect near home sensor and index signal based on the setting.

Table 3.6.3

Parameter		Description	Effective	Category
Pt710	t.□0□□ (Default)	Search index signal only.	Immediately	Setup
	t.□1□□	Search index signal after rising edge of DOG signal is found.		
	t.□2□□	Search index signal after falling edge of DOG signal is found.		

(2) Detection timing

In gantry control system, the detection timing of near home sensor for slave axis is later than that for master axis. The first step of Touch Probe procedure is reading master axis' near home sensor, and the second step is detecting both axes' index signal. (The way to detect slave axis' index signal is determined by Pt710 = t.□X□□.) Therefore, to normally read the position of slave axis' near home sensor, it cannot be in front of the position of master axis' near home sensor, as figure 3.6.2 shows.

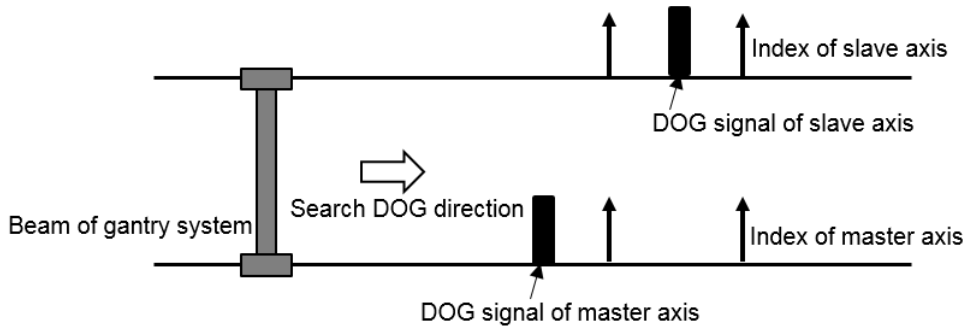

Figure 3.6.2

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4. Gain Tuning

4.1 Single axis gain tuning

When to use: Before entering gantry mode, users want to move the motor by driving single axis.
In this case, the target is to make it stable. Refer to “E1 Series Servo Drive User Manual” for the setting method.

4.2 Gantry control gain tuning

When to use: After entering gantry mode. Pay attention to the following reminders before tuning.

1. The appropriate gains for gantry control system are different from those for single axis control system. To avoid the inconvenience of switching, in single axis control system, velocity loop gain, velocity loop integral time constant, position loop gain and moment of inertia ratio are respectively Pt100, Pt101, Pt102 and Pt103. In gantry control system, they are changed to Pt190, Pt191, Pt192 and Pt193. Pt190 ~ Pt193 in master servo drive represent linear system gains, while those in slave servo drive represent yaw system gains. Gain parameters (Pt1□□) and torque filter parameters (Pt4□□) are shared by both gantry control system and single axis control system.

Table 4.2.1

Parameter	Pt190	Range	10 ~ 20000	Control mode	Position mode and velocity mode
Default	400	Effective	Immediately	Unit	0.1 Hz
Description					
Velocity loop gain in gantry control system					

Table 4.2.2

Parameter	Pt191	Range	15 ~ 51200	Control mode	Position mode and velocity mode
Default	2000	Effective	Immediately	Unit	0.01 ms
Description					
Velocity loop integral time constant in gantry control system					

Table 4.2.3

Parameter	Pt192	Range	10 ~ 40000	Control mode	Position mode
Default	400	Effective	Immediately	Unit	0.1/s
Description					
Position loop gain in gantry control system					

Table 4.2.4

Parameter	Pt193	Range	0 ~ 50000	Control mode	Position mode and velocity mode
Default	100	Effective	Immediately	Unit	1%
Description					
Moment of inertia ratio in gantry control system					

2. The servo drive's control system is no longer single axis control. Instead, it turns into linear coordinate system and yaw coordinate system of gantry mode.
3. The position information displayed by master axis is no longer encoder position feedback of single axis; it becomes position feedback of linear coordinate system, the average value of two axes' position feedback. The position information displayed by slave axis becomes position feedback of yaw coordinate system, the deviation of two axes' position feedback.
4. Giving commands to master axis represents giving commands to linear axis direction of both axes. Besides, users can give commands to yaw axis via master axis window in gantry control interface if yaw lock function is not activated.
5. Gain parameters and protection parameters in master axis correspond to linear coordinate system; gain parameters and protection parameters in slave axis correspond to yaw coordinate system.
6. In gantry control system, tuneless function is still available. Before operating manual gain tuning, remember to close the function.
7. In gantry control system, auto tuning is still available.
8. In gantry control system, linear axis' moment of inertia ratio is approximately equal to that of single axis, while yaw axis' moment of inertia ratio is approximately equal to 1/3 times that of single axis.
9. Gantry control system only supports frequency analyzer for closed loop control. To avoid the resonance caused by poor initial gain, fill Pt103 - single axis' moment of inertia ratio in Pt193 according to the above ratio before measuring.

4.3 Current ratio parameter

In gantry control system, a connection relationship exists in the structure of the two axes. Excessive force from yaw axis may cause damage to the stage. To ensure yaw axis' force limit, users can set linear axis' and yaw axis' distribution ratio of current limit via Pt428.

For example, without considering force limit, if servo drive's peak limit is 10 A and the Pt428 parameter value is set as 80, linear axis' current limit will be set as 8 A, and yaw axis' current limit will be set as 2 A. In general, the stronger the stiffness, the bigger the Pt428 parameter value should be set.

Table 4.3.1

Parameter	Pt428	Range	0 ~ 100	Control mode	Position mode, velocity mode and torque mode
Default	80	Effective	Immediately	Unit	1%
Description					
Current ratio of linear axis in gantry control system					

Note: In gantry control system, distribution ratio of current limit must be synchronously modified in both axes, and the value should be the same. Therefore, when users modify the Pt428 parameter value of one axis, do not forget to synchronously modify that of the other axis.

4.4 Velocity ripple compensation

In gantry control system, servo drive does not support velocity ripple compensation.

5. Safety Protection Function

Incorrectly operating gantry control system may cause damage to the stage. For safety, pay attention to the following features before entering gantry mode.

5.1 Enable/Disable axes in gantry control system

1. After entering gantry mode, both axes are viewed as single linear system, and master axis is in the position of control. Therefore, enabling master axis equals enabling both axes; disabling master axis equals disabling both axes.
2. When gantry control system is activated, both axes will be disabled if any axis triggers an error.

5.2 Motor stopping method for alarm

In gantry control system, the setting of Pt00A = 0x□□□1 in slave servo drive will be ignored; only Pt001 = 0x□□□1 will be used.

5.3 Relevant alarms

- AL.FC0 Gantry control system communication error

Table 4.3.1

Cause	Confirmation Method	Corrective Action
Communication is interrupted. It could be disconnection of the communication cable or poor connection.	Check if the communication cable is correctly connected.	Check if the communication cable is correctly connected.
Communication is interfered.	Check if there is interference source or the communication cable is not correctly connected.	Add ferrite ring or replace the communication cable.
Power off or reset one of the axes.	N/A	Perform alarm reset on master axis via Thunder or external signal, or reset both axes.
Communication cannot be established (only detected when auto gantry is activated).	Check if the communication cable is correctly connected.	Check if the communication cable is correctly connected.

Note:

1. After the relationship of master and slave is built up, users should power off and reset the servo drives to make some Pt parameters become effective. Therefore, it is normal if alarm AL.FC0 occurs.

2. In gantry control interface, clearing the error or entering alarm reset input (ALM-RST) signal in master axis window represents clearing the error of both axes.

■ AL.FC1 Slave axis error in gantry control system

Table 4.3.2

Cause	Confirmation Method	Corrective Action
An error occurs in the slave axis of gantry control system.	Check the cause of the error.	After the cause of the error is cleared, perform alarm reset on master axis via Thunder or external signal, or reset both axes.

Note:

1. If any error occurs in slave axis, alarm AL.FC1 will pop up in master axis window to inform users and host controller.
2. In gantry control interface, clearing the error or entering alarm reset input (ALM-RST) signal in master axis window represents clearing the error of both axes.

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6. Advanced Setting

6.1 Error map

- **Linear axis**

  In gantry control system, the requirements for activating linear axis' error map:
  (1) Complete "linear axis homing procedure".
  (2) Set Pt009 = 0x□□□1 in master servo drive.
  (3) Check "Activate error map" in master servo drive.

  The usage is similar to that of single axis. The differences are that the sources are from linear axis' original positions and that the positions of linear axis will be compensated, not the positions of single axis. The setting procedure is shown as below.

  I. Set up linear axis' error map and save it to master servo drive (refer to "E1 Series Servo Drive Thunder Software Operation Manual").
  II. Set Pt009 = 0x□□□1 in master servo drive.
  III. Activate gantry control system.
  IV. Execute homing procedure.
  V. Check "Activate error map" to make it become effective immediately.

- **Yaw axis**

  In gantry control system, the requirements for activating yaw axis' error map:
  (1) Complete "linear axis homing procedure".
  (2) Set Pt009 = 0x□□□1 in slave servo drive.
  (3) Check "Activate error map" in slave servo drive.

  The sources are also from linear axis' original positions, but the positions of yaw axis will be compensated. The setting procedure is shown as below.

  I. Set up yaw axis' error map and save it to slave servo drive (refer to "E1 Series Servo Drive Thunder Software Operation Manual").
  II. Set Pt009 = 0x□□□1 in slave servo drive.
  III. Check "Activate error map".
  IV. Connect to master servo drive and activate gantry control system.
  V. Execute homing procedure.
  VI. After homing is completed, it becomes effective.

Table 6.1.1

Parameter		Description	Effective	Category
Pt009	t.□□□0 (Default)	Enable error map function for single axis.	After power on	Setup
	t.□□□1	Enable error map function for gantry axes.		
	t.□□□2	Enable error map function for specific motor.		

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7. Gantry Control Interface Setting

Here takes linear motor as an example to show the setting of gantry control interface.

Step 1. Presetting of gantry control (refer to section 3.1 to 3.3)

Step 2. Open **Gantry control system** window

(1) Select **Gantry control system** in **Tools**.

(2) Ensure the status light of **Group communication** lights up in green (which means the communication between Master and Slave is fine).

Note: When the setting of Master and Slave is done, operate Master to start gantry control.

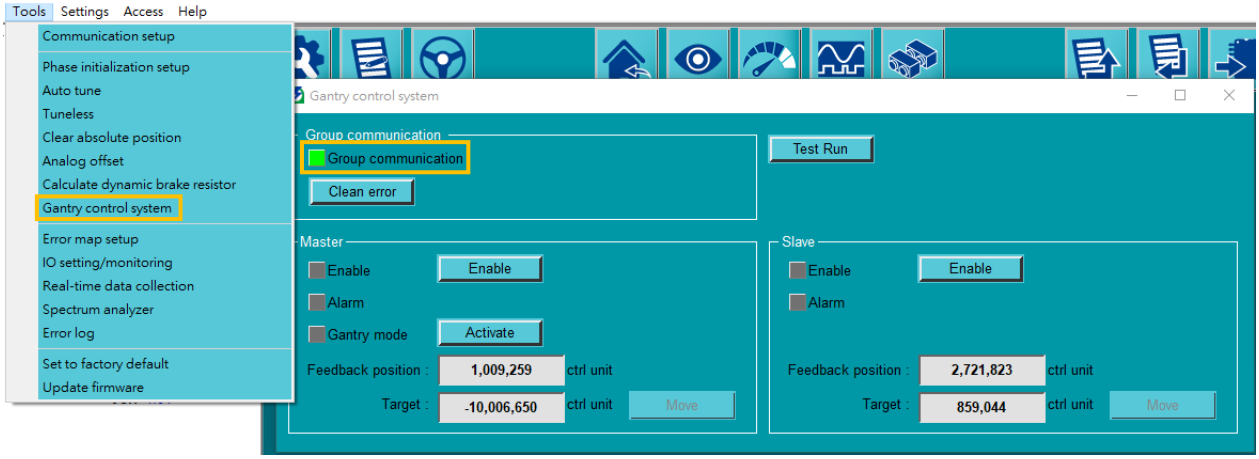

Figure 7.1 Open **Gantry control system** window

Step 3. Respectively enable Master and Slave

(1) Click **Enable** button of Master. When the motor is enabled, the status light of **Enable** in Master will light up in green, as figure 7.2 shows. Click **Disable** button of Master.

(2) Click **Enable** button of Slave. When the motor is enabled, the status light of **Enable** in Slave will light up in green, as figure 7.3 shows. Click **Disable** button of Slave.

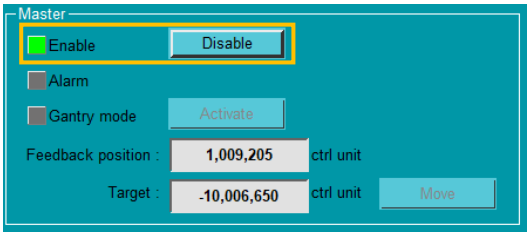

Figure 7.2 Enable Master

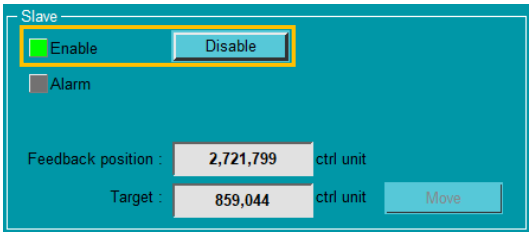

Figure 7.3 Enable Slave

Step 4. Start gantry control

(1) Click **Activate** button, and wait for the status light of **Gantry mode** to light up in green.

(2) When it succeeds, the label of **Master** and **Slave** will become **Linear** and **Yaw**.

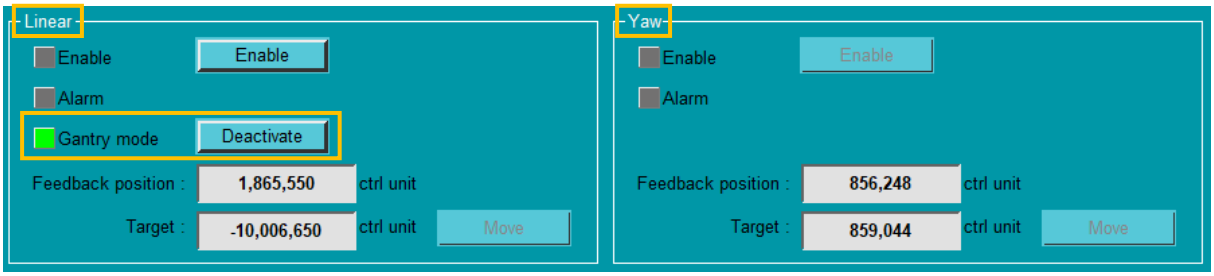

Figure 7.4 Start gantry control

Step 5. Enable axes on gantry mode

(1) Click **Enable** button of Linear. At this time, both axes are enabled, and both the status lights of **Enable** in Linear and Yaw light up in green.

(2) After ensuring the axes can be normally enabled, click **Disable** button of Linear to disable the motors.

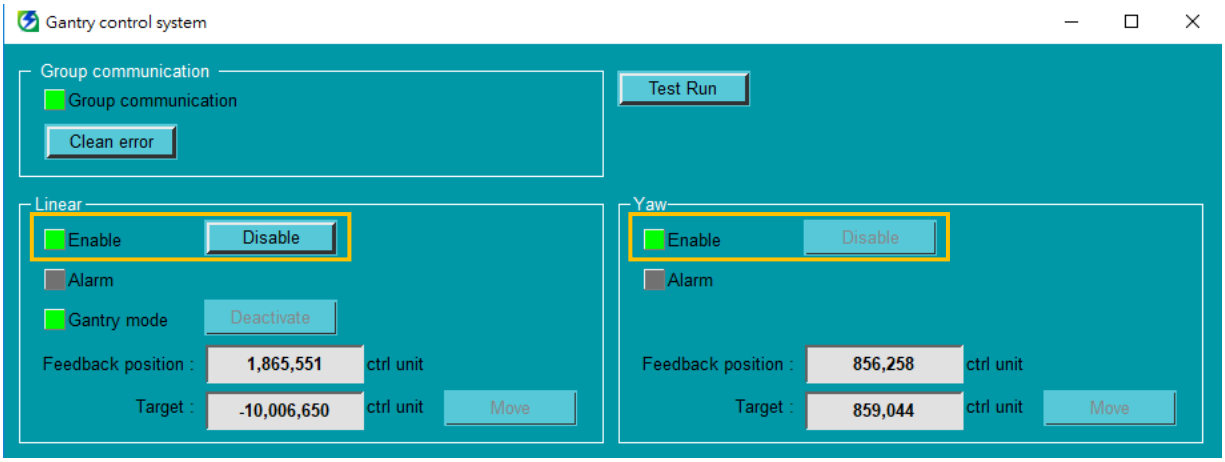

Figure 7.5 Enable status on gantry mode

Step 6. Test run on gantry mode

Close **Gantry control system** window. Click to open **Test Run** window and observe the synchronous effect on gantry mode with low velocity jog (e.g., 50 mm/s).

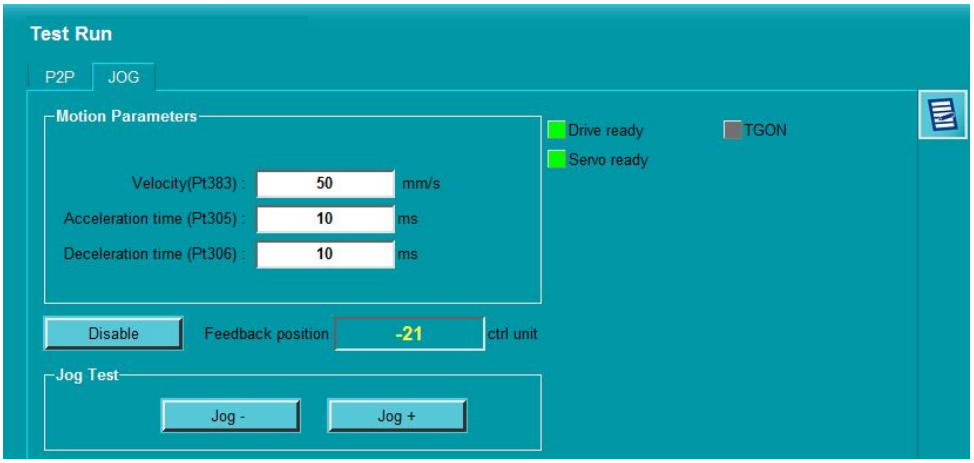

Figure 7.6 Low velocity jog on gantry mode

Step 7. Observe the position of linear axis / yaw axis / single axis

Click to open **Real-time Scope** window and select the items to be monitored. The relevant physical quantities for gantry control system include “2 - Feedback position”, “19 - Yaw position”, “17 - Master feedback position” and “18 - Slave feedback position”.

Figure 7.7 Monitor the relevant physical quantities for gantry control system via Real-time Scope