Test Operation and Panel Display

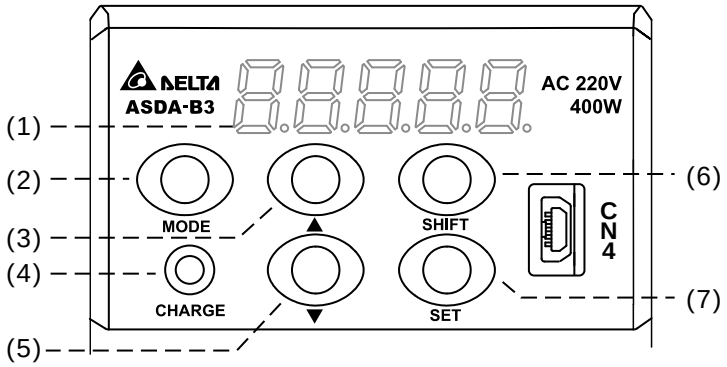
4

This chapter describes the display and operation for the servo drive panel as well as the testing for the servo drive and motor.

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4.1 Panel description



(1) Display: 5-digit, 7-segment LED displays the monitoring codes, parameter numbers, and setting values.

(2) MODE key: switches the display among Monitoring mode, Parameter mode, and Alarm mode. In Editing mode, pressing the MODE key switches back to Parameter mode.

(3) UP (▲) key: changes the monitoring codes, parameter numbers, and setting values.

(4) CHARGE: the LED indicator is on when the power is applied to the main circuit.

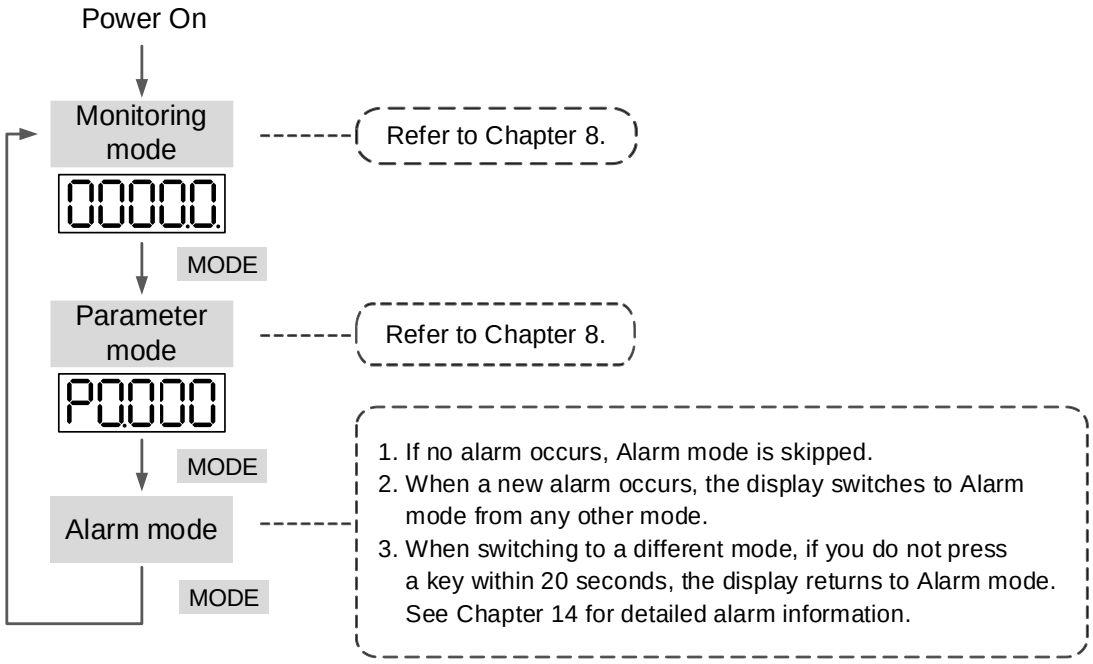
(5) DOWN (▼) key: changes the monitoring codes, parameter numbers, and setting values.

(6) SHIFT key: in Parameter mode, pressing the SHIFT key changes the group number. In Editing mode, pressing the SHIFT key moves the flashing (selected) digit to the left, so you can adjust the higher setting bit. In Monitoring mode, pressing the SHIFT key switches the display of high and low words.

(7) SET key: displays and saves the parameter setting value. In Monitoring mode, pressing the SET key switches between decimal and hexadecimal display. In Parameter mode, pressing the SET key switches to Editing mode.

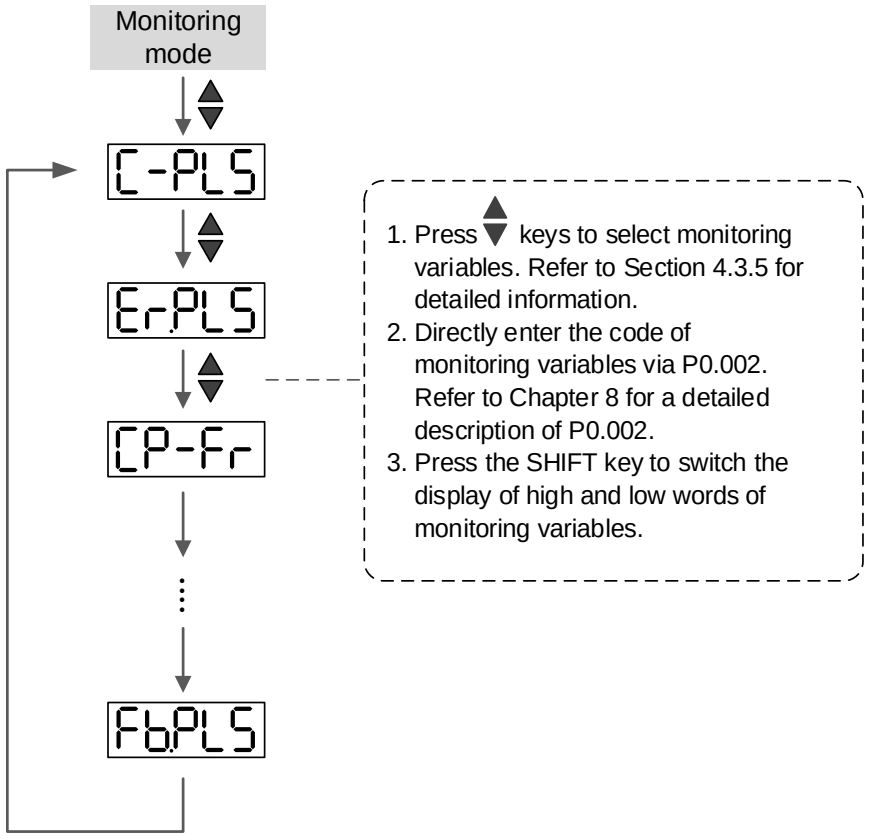
4.2 Parameter setting procedure

Switching modes:



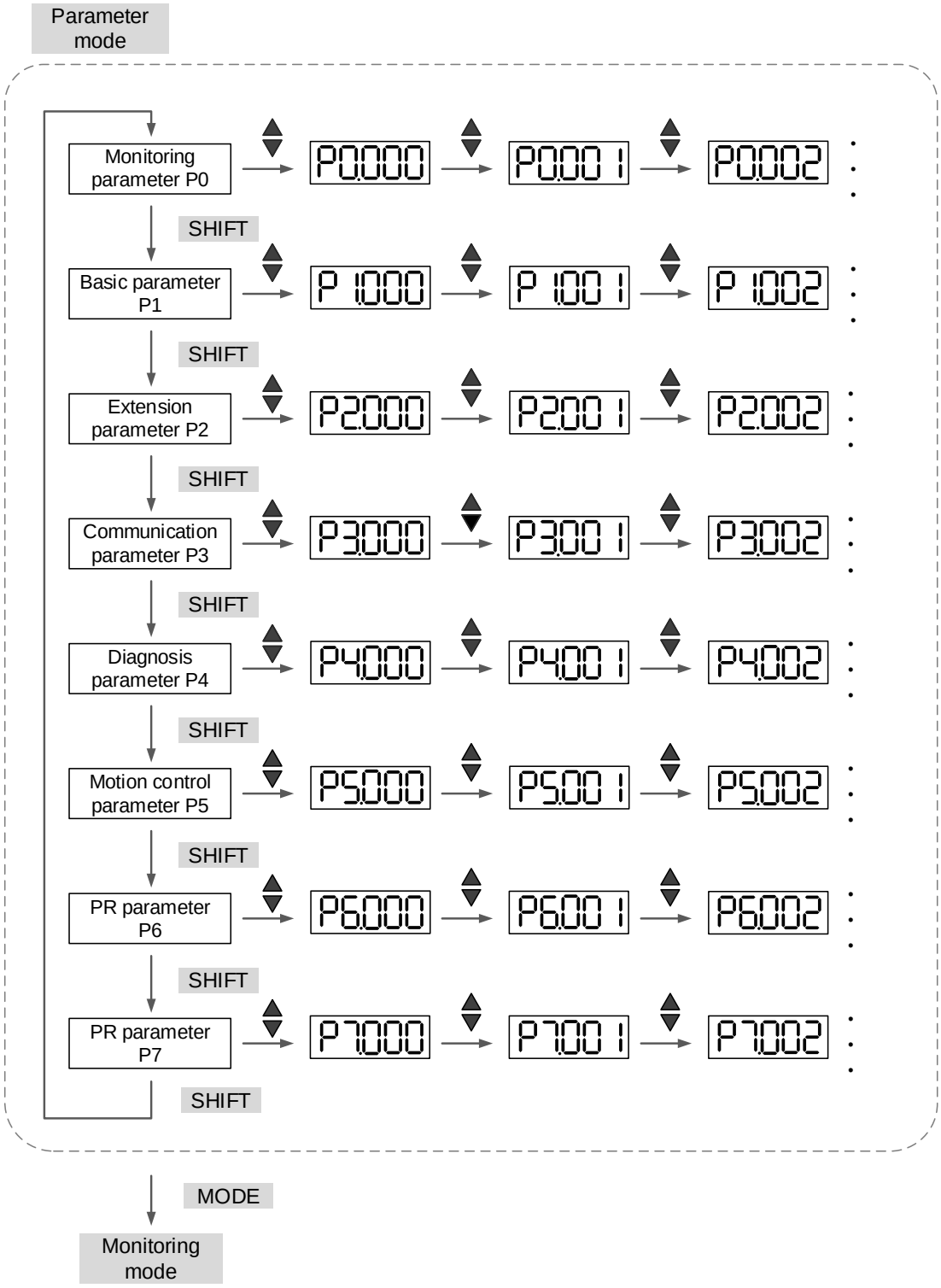
Operating in each mode:

Monitoring mode

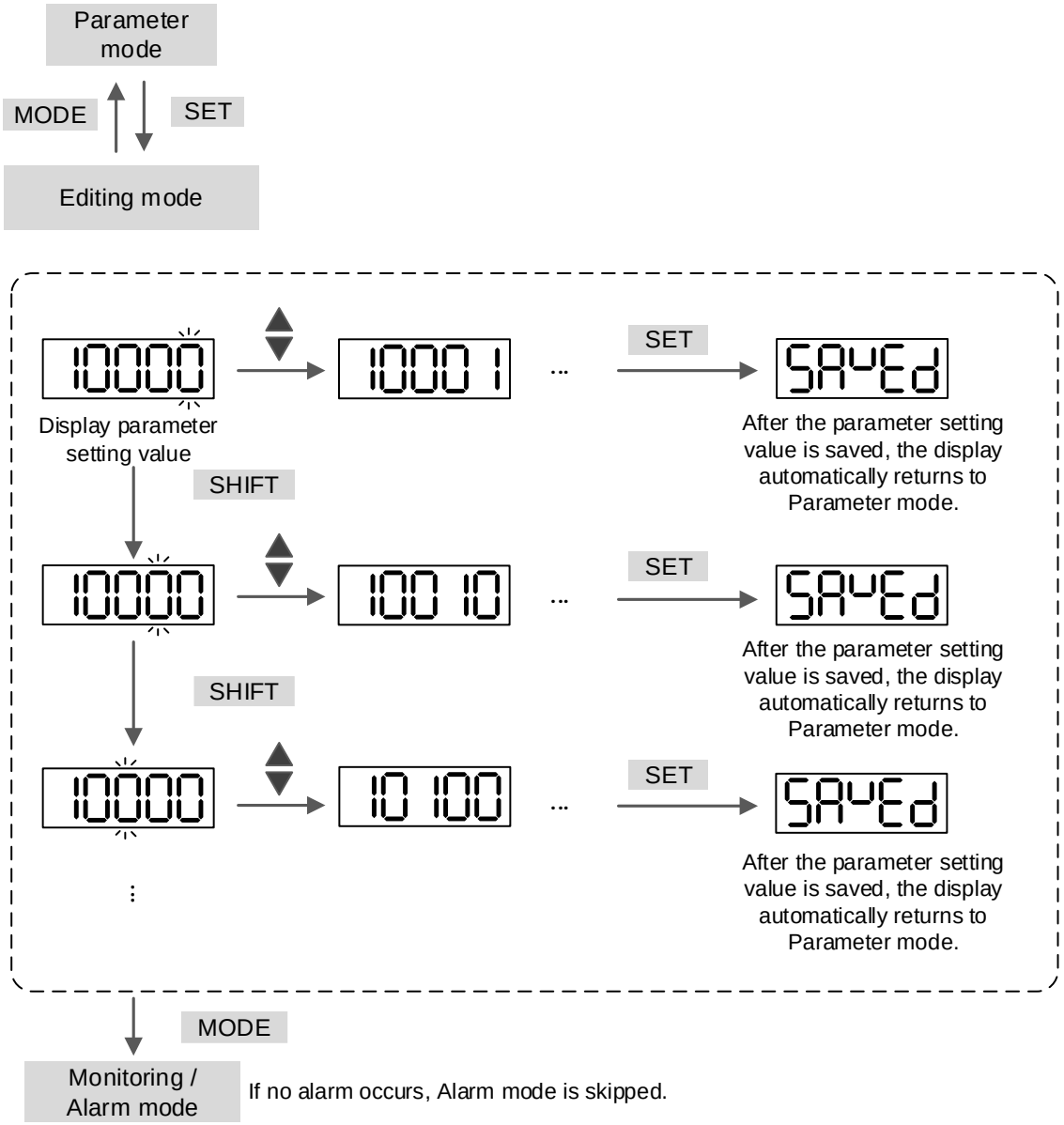


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Parameter mode



Editing mode

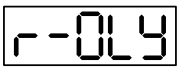
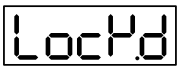
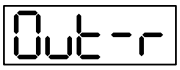
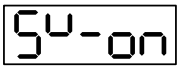
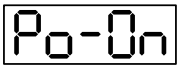


4.3 Status display

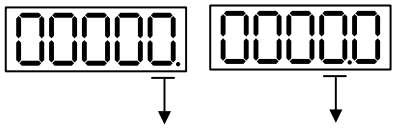
4.3.1 Data save status

4

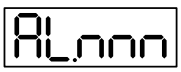
When you complete the parameter setting, press the SET key to save the parameters. The panel displays the symbol of the corresponding status for one second.

Displayed symbol	Description
	Correctly saved the setting value (Saved).
	Read-only and write-protected parameter (Read-only).
	Entered the wrong password or did not enter a password (Locked).
	Entered an incorrect setting value or the reserved setting value (Out of Range).
	You cannot enter a value when the servo is in the Servo On state (Servo On).
	Changes to the parameter take effect after power cycling of the servo drive (Power On).

4.3.2 Decimal points

Displayed symbol	Description
	High word / low word indication: this indicates the current high word or low word when the data is displayed in decimal format (32 bits).
	Negative sign: the two decimal points on the left represent the negative sign when the data is displayed in decimal format (16 or 32 bits). In hexadecimal format, it only shows positive values.

4.3.3 Alarm messages

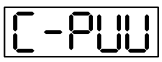
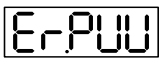
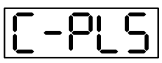
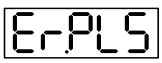
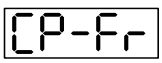
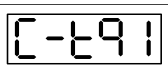
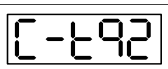
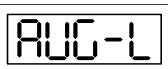
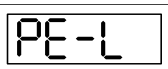
Displayed symbol	Description
	When an alarm occurs, the servo drive panel displays ‘AL’ as the alarm symbol and ‘nnn’ as the alarm code. Refer to Chapter 8 Parameters for a detailed description of P0.001 or Chapter 14 Troubleshooting for alarm details.

4.3.4 Positive and negative value setting

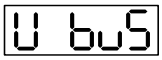
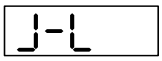
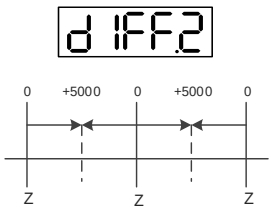
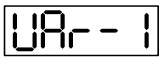
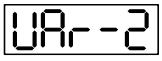
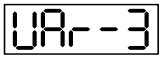
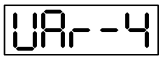
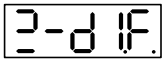
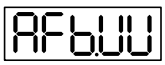
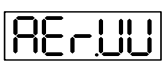
Displayed symbol	Description
	In Editing mode, press the UP (▲) and DOWN (▼) keys to change the displayed value. Press the SHIFT key to change the selected digit (the selected digit is flashing).
	Press the SHIFT key for two seconds to switch between the positive and negative values. If the parameter value is out of range after you switch the positive or negative value, then the servo drive automatically resets it to the original value.

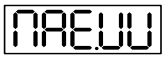
4.3.5 Monitoring display

When you apply power to the drive, the display shows the monitoring displayed symbol for one second and then enters Monitoring mode. In Monitoring mode, press the UP (▲) and DOWN (▼) keys to change the monitoring variables. Or you can directly set P0.002 to specify the monitoring code. When the drive is powered, the default monitoring code is determined by the value of P0.002. For example, if the value of P0.002 is 4, when the drive is powered, the display shows the monitoring symbol C-PLS first and then shows the input number of pulse commands. Refer to the following table for more information. For all monitoring variables, refer to Table 8.3 Monitoring variables descriptions in Section 8.3.

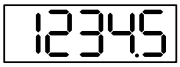
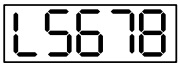
P0.002 setting value	Monitoring displayed symbol	Description	Unit
0		Motor feedback pulse number (after the scaling of E-Gear ratio)	PUU
1		Input number of pulse commands (after the scaling of E-Gear ratio)	PUU
2		The deviation between control command pulse and feedback pulse number	PUU
3		Motor feedback pulse number (encoder unit)	pulse
4		Input number of pulse commands (before the scaling of E-Gear ratio) (encoder unit)	pulse
5		Error pulse number (after the scaling of E-Gear ratio) (encoder unit)	pulse
6		Input frequency of pulse commands	Kpps
7		Motor speed	rpm
8		Speed command	Volt
9		Speed command	rpm
10		Torque command	Volt
11		Torque command	%
12		Average torque	%
13		Peak torque	%

4

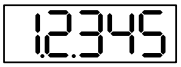
P0.002 setting value	Monitoring displayed symbol	Description	Unit
14		Main circuit voltage	Volt
15		Load / motor inertia ratio Note: if the display shows 13.0, it means the load inertia ratio is 13.	1 times
16		IGBT temperature	°C
17		Resonance frequency (low word is the first resonance point and high word is the second resonance point)	Hz
18		The absolute pulse number counting from the encoder Z phase (origin). It is -4999 to +5000 pulses when the motor rotates in the forward or reverse direction starting from the origin (0).	-
19		Mapping parameter #1: shows the content of parameter P0.025 (P0.035 specifies the mapping target)	-
20		Mapping parameter #2: shows the content of parameter P0.026 (P0.036 specifies the mapping target)	-
21		Mapping parameter #3: shows the content of parameter P0.027 (P0.037 specifies the mapping target)	-
22		Mapping parameter #4: shows the content of parameter P0.028 (P0.038 specifies the mapping target)	-
23		Monitoring variable #1: shows the content of parameter P0.009 (P0.017 specifies the monitoring variable)	-
24		Monitoring variable #2: shows the content of parameter P0.010 (P0.018 specifies the monitoring variable)	-
25		Monitoring variable #3: shows the content of parameter P0.011 (P0.019 specifies the monitoring variable)	-
26		Monitoring variable #4: shows the content of parameter P0.012 (P0.020 specifies the monitoring variable)	-
27		Offset value between motor position and Z phase. (Only available for Delta CNC controllers.)	PUU
28		The alarm code (in decimal). The value being converted to the hexadecimal notation is identical to the alarm code displayed in P0.001 and the error code of communication models.	-
29		Position feedback from the auxiliary encoder. Note: B3 drives do not support this monitoring variable.	PUU
30		Position difference between the position feedback and the command from the auxiliary encoder. Note: B3 drives do not support this monitoring variable.	PUU

P0.002 setting value	Monitoring displayed symbol	Description	Unit
31		Feedback position difference between the main encoder and auxiliary encoder. Note: B3 drives do not support this monitoring variable.	PUU

The following table shows the panel display of 16-bit and 32-bit values.

Example of the displayed value		Description	
	(Dec)	16 bits	If the value is 1234, the panel displays 01234 (in decimal format).
	(Hex)		If the value is 0x1234, the panel displays 1234 (in hexadecimal format; the first digit is not shown).
	(Dec high)	32 bits	If the value is 1234567890, the display of the high word is 1234.5 and the display of the low word is 67890 (in decimal format).
	(Dec low)		
	(Hex high)		If the value is 0x12345678, the display of the high word is h1234 and the display of the low word is L5678 (in hexadecimal format).
	(Hex low)		

The following table shows the panel display for negative values.

Example of the displayed value	Description
	If the value is -12345, it displays as 1.2.345 (only in decimal format; there is no positive or negative sign for hexadecimal format display).

Note:

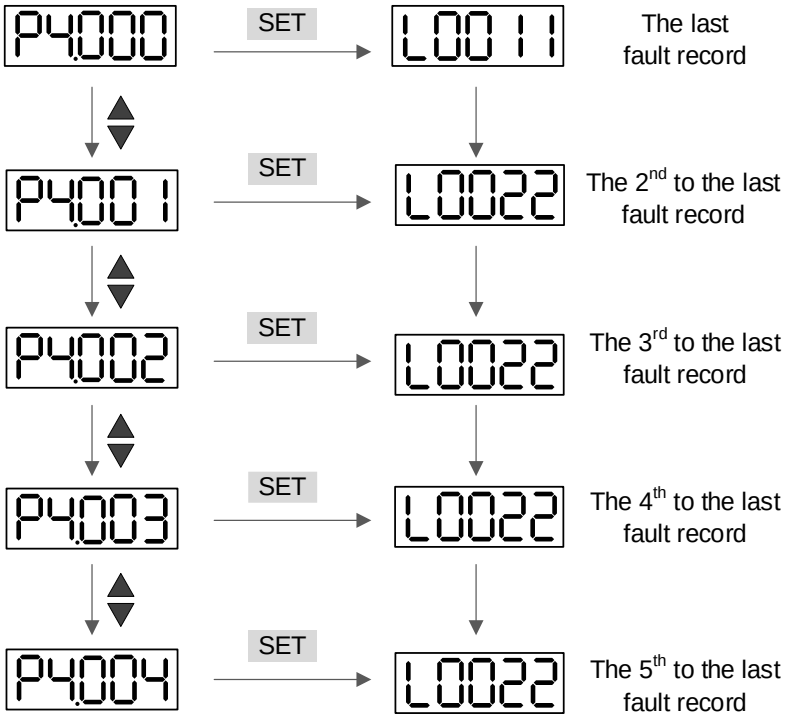
1. Dec means the value is displayed in decimal format; Hex means the value is displayed in hexadecimal format.
2. The display shown in the preceding tables is applicable in both Monitoring mode and Editing mode.
3. All monitoring variables are 32-bit data, and you can switch the high / low word and the display format (Dec / Hex). According to the definition in Chapter 8, each parameter only supports one display format and switching the display format is not allowed.

4.4 General functions

4.4.1 Operation of fault record display

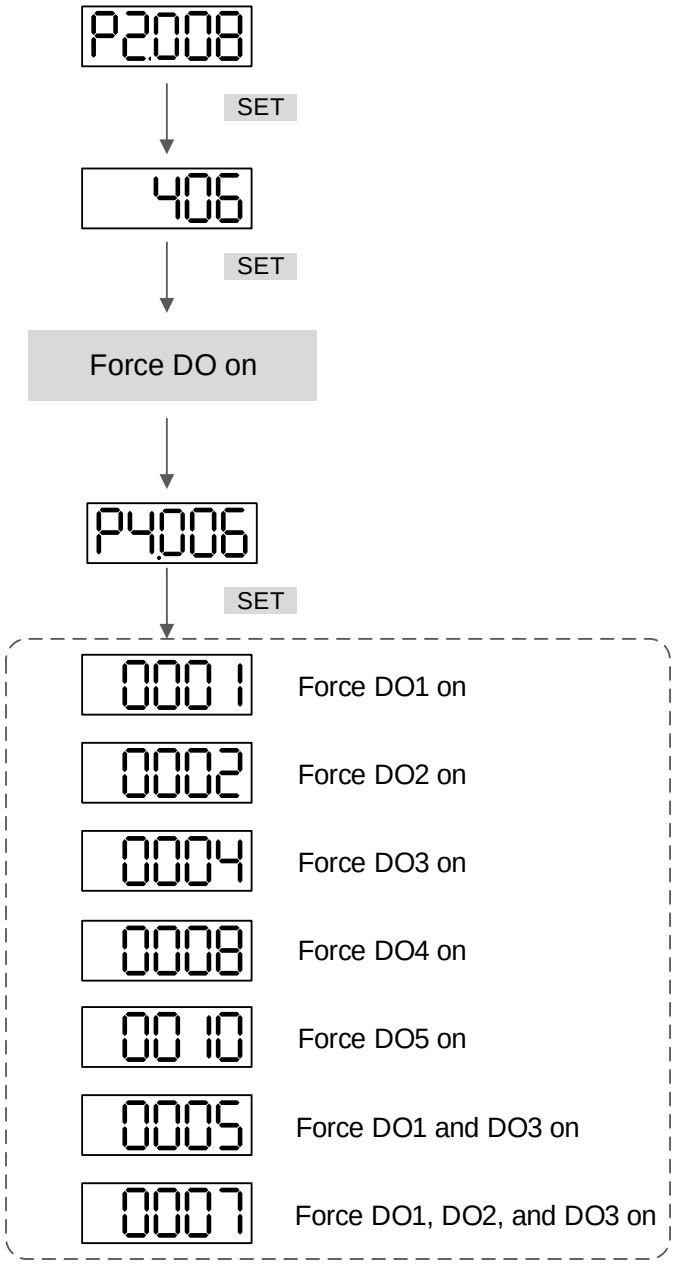
4

In Parameter mode, select P4.000 - P4.004 and press the SET key to show the corresponding fault record.



4.4.2 Force DO on

You can switch to the Diagnosis mode by the following steps. Set P2.008 to 406 to enable the function of forcing DO on. Then, set the DO by binary method with P4.006. When the value of P4.006 is 0x0002, it forces DO2 on. When the value is 0x0005, it forces DO1 and DO3 on. These settings are volatile, so the servo drive returns to the normal DO mode after power cycling. You can also set P2.008 to 400 to switch to the normal DO mode.

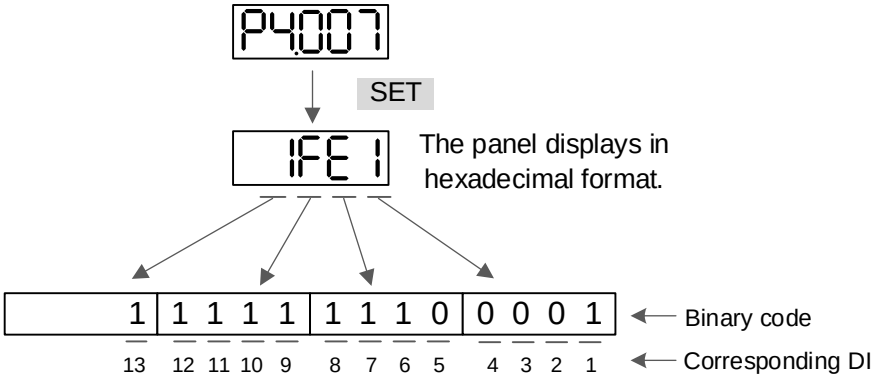


4

4.4.3 Digital input diagnosis

You can switch to the Diagnosis mode by the following steps. When DI1 - DI9 are triggered by the external signal, the panel shows the corresponding signal. In binary format, when the bit shows 1, it means the DI is on.

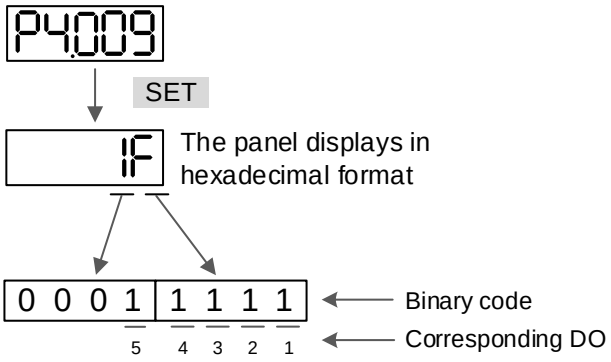
For example, if the panel shows “1FE1”, the hexadecimal E is 1110 in binary format, indicating that DI6 - DI8 are on.



4.4.4 Digital output diagnosis

You can switch to the Diagnosis mode by the following steps. When DO1 - DO6 are triggered by the output signal, the panel shows the corresponding signal. In binary format, when the bit shows 1, it means the DO is on.

For example, if the panel shows “1F”, the hexadecimal F is 1111 in binary format, indicating that DO1 - DO4 are on.



4.5 Testing

This section introduces the testing operations without load. To avoid danger, make sure to operate the servo motor without load first.

4.5.1 Initial testing

Remove the load from the servo motor, including coupling on the shaft and accessories, to avoid any damage to the servo drive or machine. This prevents the parts on the motor shaft from falling off and possibly causing personnel injury or equipment damage during operation.

Caution: to prevent danger, it is strongly recommended that you first check if the motor runs normally without load during normal operation. Then, try operating the motor with load.

Check the following items carefully to avoid damages during motor operation.

Inspection before operation (without power)	■ Check for any obvious visible damage on the servo drive. ■ The wires at the wiring terminal should be isolated. ■ Make sure the wiring is correct to avoid damage or any abnormal operation. ■ Check for and remove any electrically conductive objects, including sheet metal and screws, or inflammable objects inside or near the servo drive. ■ Check that the control switch is in the Off state. ■ Do not place the servo drive or external regenerative resistor on inflammable objects. ■ To ensure the electromagnetic brake works, check if the stop and circuit breaker functions are working normally. ■ Reduce the electromagnetic interference if there is electromagnetic interference with the peripheral devices. ■ Make sure the external voltage level of the servo drive is correct.
Inspection during operation (power is applied)	■ Protect the encoder cable from excessive stress. When the motor is running, make sure the cable is not worn or stretched. ■ Contact Delta if the servo motor vibrates or makes unusual noise during operation. ■ Make sure the settings for the parameters are correct. Different machinery has different characteristics. Adjust the parameters according to the characteristics of each machine. ■ Reset the parameters when the servo drive is in the Servo Off state, or it may cause malfunction. ■ If the relay makes abnormal noise or does not make any contact noise when operating, please contact Delta. ■ Check if the power indicator and LED display work properly.

4.5.2 Apply power to the servo drive

Follow these instructions.

1. Make sure the wiring between the motor and servo drive is correct:
   (1) Connect the red, white, black, and yellow/green wires to the U, V, W, and FG terminals respectively. If the wiring is incorrect, the motor cannot work properly. The motor ground wire FG must connect to the drive's ground terminal. Refer to Chapter 3 for wiring.
   (2) The encoder cable for the motor is correctly connected to CN2: if you only want to use the JOG function, connecting CN1 and CN3 is not necessary. Refer to Chapter 3 for the wiring for CN2.

   Caution: do not connect the main circuit power (R, S, T) to the output terminal (U, V, W) of the servo drive, or it may damage the servo drive.

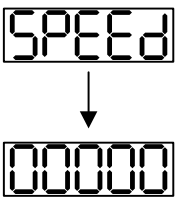
2. Connect the power circuit for the servo drive:
   Servo drive: connect the power to the servo drive. Refer to Chapter 3 for the wiring for power supply.
3. Turn on the power:
   Servo drive power supply: apply power to the control circuit (L_{1C}, L_{2C}) and main circuit (R, S, T).

■ When the power is on, the display of the servo drive shows:



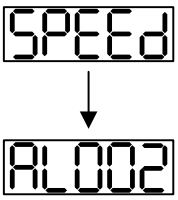
The default signal settings for DI6 - DI8 are negative limit (NL), positive limit (PL), and emergency stop (EMGS). If DI6 - DI8 are not used, you must set the values of P2.015 - P2.017 to 0 (disable the DI function) or some other value for a different function.

■ When P0.002 is set to 07 (motor speed), the display of the servo drive shows:



When the display shows no text, check if the control circuit power is undervoltage.

- When the display shows:



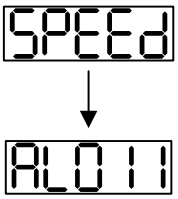
Overvoltage warning:

This means the input voltage of the main circuit is higher than the allowable rated value or an incorrect power input is applied (incorrect power system).

Corrective action:

1. Use a voltmeter to check if the input voltage of the main circuit is within the allowable rated value.
2. Use a voltmeter to check if the power system complies with the specifications.

- When the display shows:



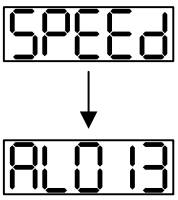
CN2 communication failure warning:

Check if the CN2 connector is securely connected and the wiring is correct.

Corrective action:

1. Make sure the wiring complies with the instructions in the user manual.
2. Check the CN2 connector.
3. Check for loose wiring.
4. Check if the encoder is damaged.

- When the display shows:



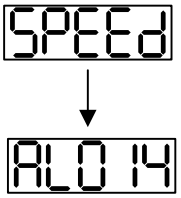
Emergency stop warning:

Check if any of the digital inputs DI1 - DI9 are set to emergency stop (EMGS).

Corrective action:

1. If you do not want to set the emergency stop (EMGS) as one of the digital inputs, make sure none of the digital inputs DI1 - DI9 are set to emergency stop (EMGS) (make sure that none of the parameters, P2.010 - P2.017 and P2.036, are set to 21).
2. If the emergency stop (EMGS) function is needed, make sure the corresponding DI is on when it is preset as normally closed (function code: 0x0021), and then set this DI as normally open (function code: 0x0121).

- When the display shows:



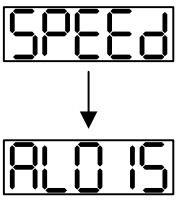
Negative limit error warning:

Check if any of the digital inputs DI1 - DI9 are set to negative limit (NL) and that DI is off.

Corrective action:

1. If you do not want to set the negative limit (NL) as one of the digital inputs, make sure none of the digital inputs DI1 - DI9 are set to negative limit (NL) (make sure that none of the parameters, P2.010 - P2.017 and P2.036, are set to 22).
2. If the negative limit (NL) function is needed, make sure the corresponding DI is on when it is preset as normally closed (function code: 0x0022), and then set this DI as normally open (function code: 0x0122).

- When the display shows:



Positive limit error warning:

Check if any of the digital inputs DI1 - DI9 are set to positive limit (PL) and make sure that DI is off.

Corrective action:

1. If you do not want to set the positive limit (PL) as one of the digital inputs, make sure none of the digital inputs DI1 - DI9 are set to positive limit (PL) (make sure that none of the parameters, P2.010 - P2.017 and P2.036, are set to 23).
2. If the positive limit (PL) function is needed, make sure the corresponding DI is on when it is preset as normally closed (function code: 0x0023), and then set this DI as normally open (function code: 0x0123).

- When the display shows:



Overcurrent warning:

Corrective action:

1. Check the connection between the motor and servo drive.
2. Check if the conducting wire is short-circuited. Fix the short circuit and make sure the metal part of the wiring is not exposed.

- When the display shows:



Undervoltage warning:

Corrective action:

1. Check if the wiring of input voltage for the main circuit is correct.
2. Use a voltmeter to check the main circuit voltage.
3. Use a voltmeter to check if the power system complies with the specifications.

Note: during power on or in the Servo On state (without any commands issued), if an alarm occurs or any abnormal display appears, contact the distributor.

4.5.3 JOG trial run without load

It is easy to test the motor and servo drive using a JOG trial run without load since no extra wiring is needed. For safety reasons, it is recommended that you set JOG at low speed. Follow these steps:

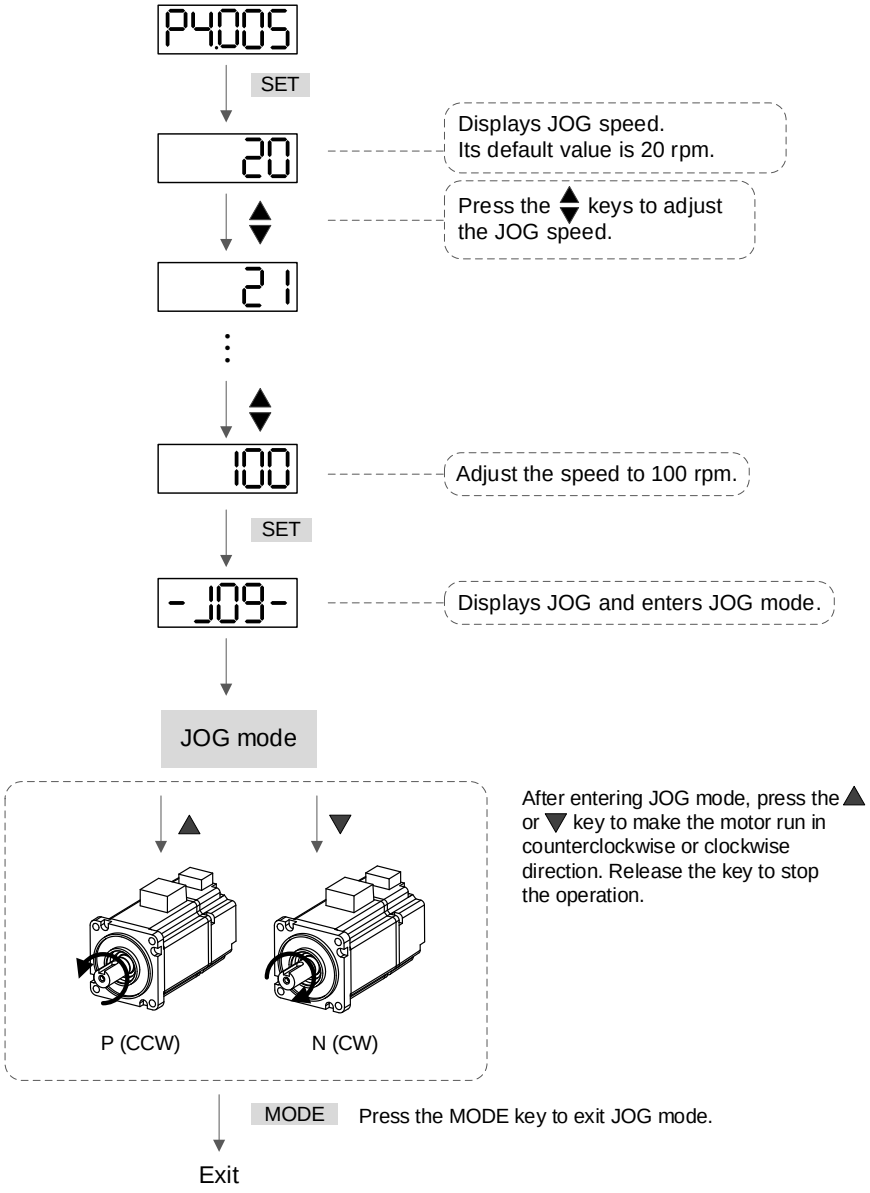
Step 1: JOG trial run is available only when the servo drive is in the Servo On state. The drive can be forced into the Servo On state by setting P2.030 to 1 or with the controller. JOG trial run with panel operation is not available in the Communication mode (P1.001.X = B or C).

Step 2: set the JOG speed (unit: rpm) with P4.005. Press the SET key to display the JOG speed. The default is 20 rpm.

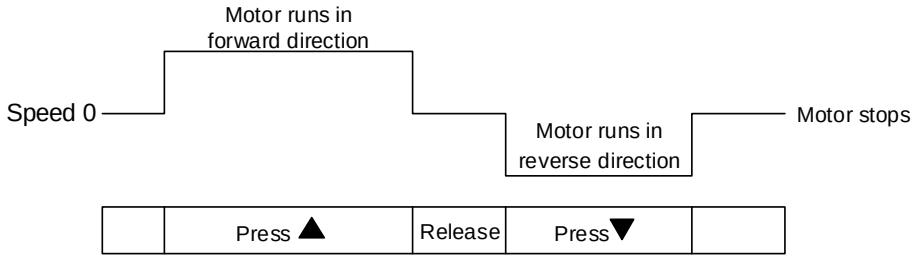
Step 3: press the ▲ or ▼ key to adjust the JOG speed. In the following example, the speed is set to 100 rpm.

Step 4: press the SET key to save the setting value, and then the panel displays “JOG” and enters JOG mode.

Step 5: press the MODE key to exit JOG mode after completing the trial run.



The following shows the JOG timing diagram:



If the motor does not run, check if the UVW and encoder cables are correctly wired.

If the motor runs abnormally, check if the U, V, W phase sequence is correct.

4.5.4 Trial run without load (Speed mode)

Before starting the trial run without load, firmly secure the motor base to avoid any danger caused by force generated by the motor during speed changes.

Step 1: set P1.001 to 2 to set the control mode of the servo drive to Speed mode. Then cycle the power to the servo drive.

Step 2: in Speed mode, set the digital input settings as shown in the following table for the trial run.

Digital input	Parameter setting value	DI name	Function description	CN1 Pin No.
DI1	P2.010 = 0x0101	SON	Servo On	DI1- = 9
DI2	P2.011 = 0x0109	TRQLM	Torque limit	DI2- = 10
DI3	P2.012 = 0x0114	SPD0	Speed selection 0	DI3- = 34
DI4	P2.013 = 0x0115	SPD1	Speed selection 1	DI4- = 8
DI5	P2.014 = 0x0102	ARST	Alarm reset	DI5- = 33
DI6	P2.015 = 0x0000	-	DI disabled	-
DI7	P2.016 = 0x0000	-	DI disabled	-
DI8	P2.017 = 0x0000	-	DI disabled	-
DI9	P2.036 = 0x0000	-	DI disabled	-
DI10	P2.037 = 0x0000	-	DI disabled	-
DI11	P2.038 = 0x0000	-	DI disabled	-
DI12	P2.039 = 0x0000	-	DI disabled	-
DI13	P2.040 = 0x0000	-	DI disabled	-

The preceding settings take the -L model for example. This table shows the settings that disable the negative limit (DI6), positive limit (DI7), and emergency stop (DI8) functions. Thus, parameters P2.015 - P2.017 and P2.036 - P2.040 are set to 0x0000 (disabled). You can program the digital inputs of Delta's servo drive by referring to Table 8.1 Digital input (DI) descriptions in Chapter 8.

The default setting includes the negative limit, positive limit, and emergency stop functions. Therefore, if any alarm occurs after you complete the preceding settings, cycle the power to the servo drive or set DI5 to On to clear the alarm. Refer to Section 4.5.2.

The Speed command selection is determined by SPD0 and SPD1. See the following table.

Speed command number	DI signal of CN1		Command source			Content	Range
	SPD1	SPD0					
S1	0	0	Mode	S	External analog signal	Voltage difference between V-REF and GND	-10V to +10V
				Sz	N/A	Speed command is 0	0
S2	0	1	Internal register parameter			P1.009	-75000 to +75000
S3	1	0				P1.010	-75000 to +75000
S4	1	1				P1.011	-75000 to +75000

0: means that DI is off (the circuit is open).

1: means that DI is on (the circuit is closed).

The parameter setting range of the internal register is from -75000 to +75000.

Rotation speed = setting value x unit (0.1 rpm).

For example, P1.009 = +30000, and the rotation speed = +30000 x 0.1 rpm = +3000 rpm.

Command setting for the speed register:

Set P1.009 to +30000.

Set P1.010 to +1000.

Set P1.011 to -30000.

Motor's running direction:

Input command	Rotation direction
+	CCW (forward direction)
-	CW (reverse direction)

Step 3:

(a) Switch on DI1 to have the drive be in the Servo On state.

(b) When both DI3 (SPD0) and DI4 (SPD1) are off, that means the drive executes the S1 command. The motor rotates according to the analog voltage command.

(c) When DI3 (SPD0) is on, that means the drive executes the S2 command. The rotation speed is +3000 rpm.

(d) When DI4 (SPD1) is on, that means the drive executes the S3 command. The rotation speed is +100 rpm.

(e) When both DI3 (SPD0) and DI4 (SPD1) are on, that means the drive executes the S4 command. The rotation speed is -3000 rpm.

(f) You can repeatedly execute steps (c), (d), and (e).

(g) If you want to stop the motor, switch off DI1 (Servo Off).

4.5.5 Trial run without load (Position mode)

Before starting the trial run without load, firmly secure the motor base to avoid any danger caused by the force generated by the motor during speed changes.

4

Step 1: set P1.001 to 1 to set the control mode of the servo drive to Position (PR) mode. Then cycle the power to the servo drive.

Step 2: in Position (PR) mode, set the digital input settings as shown in the following table for the trial run.

Digital input	Parameter setting value	DI name	Function description	CN1 Pin No.
DI1	P2.010 = 0x0101	SON	Servo On	DI1- = 9
DI2	P2.011 = 0x0108	CTRG	Command triggered	DI2- = 10
DI3	P2.012 = 0x0111	POS0	Position selection 0	DI3- = 34
DI4	P2.013 = 0x0112	POS1	Position selection 1	DI4- = 8
DI5	P2.014 = 0x0102	ARST	Alarm reset	DI5- = 33
DI6	P2.015 = 0x0000	-	DI disabled	-
DI7	P2.016 = 0x0000	-	DI disabled	-
DI8	P2.017 = 0x0000	-	DI disabled	-
DI9	P2.036 = 0x0000	-	DI disabled	-
DI10	P2.037 = 0x0000	-	DI disabled	-
DI11	P2.038 = 0x0000	-	DI disabled	-
DI12	P2.039 = 0x0000	-	DI disabled	-
DI13	P2.040 = 0x0000	-	DI disabled	-

The preceding settings take the -L model for example. This table shows the settings that disable the negative limit (DI6), positive limit (DI7), and emergency stop (DI8) functions. Thus, parameters P2.015 - P2.017 and P2.036 - P2.040 are set to 0x0000 (disabled). You can program the digital inputs of Delta's servo drive by referring to Table 8.1 Digital input (DI) descriptions in Chapter 8.

The default setting includes the negative limit, positive limit, and emergency stop functions. Therefore, if any alarm occurs after you complete the preceding settings, cycle the power to the servo drive or set DI5 to On to clear the alarm. Refer to Section 4.5.2.

Refer to Section 3.10.3 for the wiring for Position (PR) control mode. See the following table for the 100 sets of PR and the corresponding Position commands (POS0 - POS6) and parameters.

Position command	POS6	POS5	POS4	POS3	POS2	POS1	POS0	CTRG	Corresponding parameter
Homing	0	0	0	0	0	0	0	↑	P6.000
									P6.001
PR#1	0	0	0	0	0	0	1	↑	P6.002
									P6.003
~									~
PR#50	0	1	1	0	0	1	0	↑	P6.098
									P6.099
PR#51	0	1	1	0	0	1	1	↑	P7.000
									P7.001
~									~
PR#99	1	1	0	0	0	1	1	↑	P7.098
									P7.099

0: means that DI is off (the circuit is open).

1: means that DI is on (the circuit is closed).

You can set the 100 sets of PR (P6.000 - P7.099), which you can also set for absolute position commands.