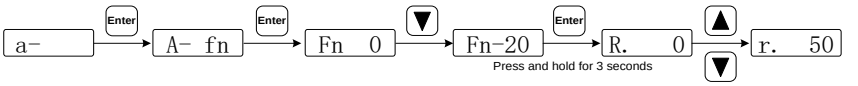
1. Please confirm that the motor has been disconnected from the load before performing the operation.
2. Connect the power supply (AC three-phase 220V or AC single-phase 220V), the driver's display is lit and the POWER indicator is lit.Please check the connection if there is an alarm.
3. If no alarm and abnormal conditions,please confirm the EP3E parameter P304 is 0， then process it based on following photos:



Using 8 and 2 keys to change speed instructions, the motor runs at a given speed. Positive numbers indicate positive rotation (CCW), negative numbers indicate inversion (CW), and the minimum given speed is 0.1r/min.

4.2 Position control

Refer to the "6.4.1 cycle synchronous position control" section.
Position control is applied to systems that require precise positioning, such as CNC machine tools, textile machinery and so on.

4.2.1 Parameter setting of position control

Parameter setting:

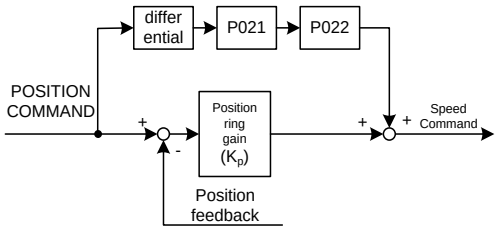
Parameter	Name	Setting value	Default value	Parameter explanation
P097	Neglect inhibition of servo driver	3	3	Use positive turn drive Prohibition (CCWL) and reverse rotation Prohibition (CWL). If set to ignore, CCWL, CWL are not connected.
P304	EtherCAT Mode switch	1	1	0：Common mode； 1： EtherCAT mode。

4.2.2 Position control related gain

Parameter	Name	Range	Default value	Unit	Usage
P009	First position loop gain	1～1000	40	Hz	P
P021	Position loop feedforward gain	0～100	0	%	P
P022	Time constant of position	0.20～50.00	1.00	ms	P

	loop feedforward filter				

The following is the position controller of the system. The gain of position loop Kp increases the bandwidth of the position loop, but is limited by the bandwidth of the speed loop. If want to improve the gain of position loop, we must first increase the bandwidth of the speed loop.



Feedforward can reduce the phase lag of position loop control, and reduce position tracking error and shorter positioning time in position control. With the increase of feedforward, the tracking error of position control decreased, but the system is unstable if the feedforward increased too much. When the electronic gear ratio is greater than 10, it is easy to produce noise. The general application can set the P021 to 0%. When the high response and low tracking error are needed, it can be properly increased, not more than 80%. At the same time, the time constant of the feedforward and filtering of the position loop (parameter P022) may be adjusted.

4.3 Speed control

Refer to the "6.4.2 cycle synchronization speed control" section.

Speed control is applied to situations where precise speed control is needed, such as braiding machine, drilling machine and CNC machine. The position control can also be formed by the upper device.

4.3.1 Parameter setting of speed control

Parameter setting

Para meter	name	Set value	Default value	Parameter description
P025	Speed instruction source	0	0	reserve
P060	Speed instruction acceleration time	appropr iate	0	
P061	Speed instruction deceleration time	appropr iate	0	
P097	Neglect inhibition of servo driver	3	3	Use positive drive inhibit (CCWL) and reverse drive inhibit (CWL). If

				set to ignore, CCWL, CWL are not connected.

4.3.2 Speed instruction source

Speed instructions have several different sources, which is setted by parameter P025:：

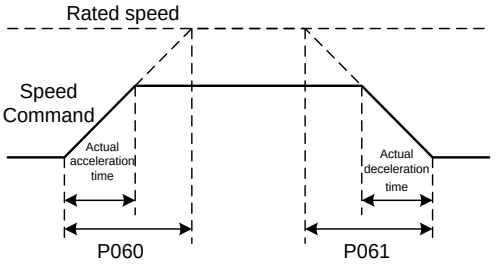
P025	instruction	explaination
3	JOG speed command	set when (JOG) operation
4	Keyboard Speed instruction	Sett when the keyboard speed control (Sr) operation
5	Demo speed instruction	Set when the timing demonstration

4.3.3 Acceleration and deceleration

The acceleration and deceleration are related to the following parameters:

parameter	name	range	Default value	unit	usage
P060	Speed command acceleration time	0～30000	0	ms	S
P061	Speed instruction deceleration time	0～30000	0	ms	S

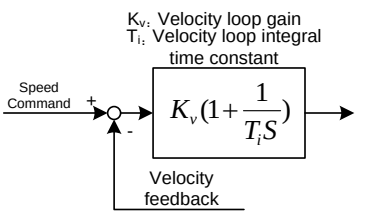
Acceleration and deceleration can slow down the mutation of speed and make the motor run smoothly. As shown below, the parameter P060 sets the acceleration time from zero speed to rated speed, and P061 sets the motor deceleration time from rated speed to zero speed. If the instruction speed is lower than the rated speed, the acceleration and deceleration time needed will be shortened correspondingly. If the driver and upper device constitute position control, the parameter should be set to 0.



4.3.4 Speed control related gain

parameter	name	range	Default value	unit	usage
P005	First speed loop gain	1～3000	40	Hz	P,S
P006	First velocity loop integral time constant	1.0～1000.0	20.0	ms	P,S
P017	Load rotational inertia ratio	0.0～200.0	1.0	times	P,S
P018	Speed loop PDFF control coefficient	0～100	100	%	P,S

First, set up the load moment of inertia ratio,then adjust the speed loop gain and speed loop integration time constant。The following is the speed controller of the system. Increasing the speed loop gain Kv can increase the response frequency of the speed and reduce the speed loop integral time constant Ti, which can increase the rigidity of the system and reduce the steady state error.



P018 can choose speed controller structure, 0 is IP regulator, 100 is PI regulator, 1~99 is PDFF regulator. When the P018 parameter is large, the system has high frequency response, and the system has a high stiffness (resistance to deviation

ability), and the medium value takes into account the frequency response and stiffness.

4.4 Torque control

Refer to the "6.4.3 cycle synchronous torque control" section.

Torque control is used in printing machines, winding machines and injection molding machines. The output torque of motors is directly proportional to the input instructions.

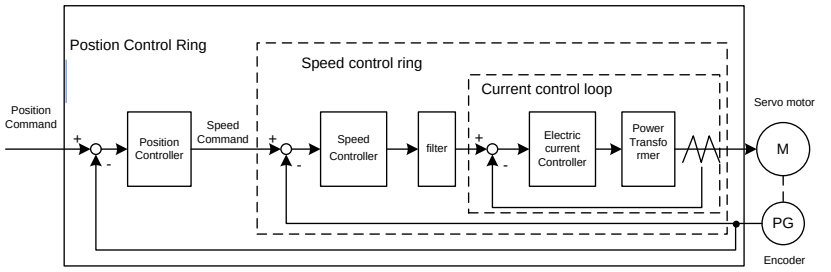
4.4.1 Speed limit of torque control

In torque control, the torque output of the motor is controlled by instruction, but the speed of the motor is not controlled, so overspeed may occur in light load. In order to protect the machinery, the speed must be limited. The parameters of the speed limit are:

parameter	name	range	Default value	unit	usage
P078	Speed limit of torque control	0～5000	3000	r/min	T

4.5 Gain adjustment

The driver includes three control loops: current control loop, speed control loop and position control loop。The diagram as follows:



In theory, the frequency width of the control loop in the inner layer must be higher than the outer layer, otherwise the whole control system will be unstable and cause the vibration or the response is not good, so the relationship between the three control loops is as follows:

Current loop bandwidth > speed loop bandwidth > position loop bandwidth

Because the driver has adjusted the current control loop as the best state, the user only needs to adjust the speed control loop and the position control loop parameters.

4.5.1 Gain parameter

The parameters related to the gain are:

parameter	name	range	Default value	unit	usage
P005	First speed loop gain	1～3000	40	Hz	P,S
P006	First velocity loop integral time constant	1.0～1000.0	20.0	ms	P,S
P009	First position loop gain	1～1000	40	Hz	P
P017	Load rotational inertia ratio	0.0～200.0	1.0	times	P,S

Symbol definition as follows:

Kv: speed loop gain; Ti: speed loop integral time constant; Kp: position loop gain;

G: load moment of inertia ratio (P017); JL: load moment of inertia converted to motor shaft.

JM: the rotational inertia of the rotor of the motor.

1. Speed loop gain

The speed loop gain Kv directly determines the response bandwidth of the speed loop. When the mechanical system does not generate vibration or noise, increasing the speed loop gain value, the speed response will speed up, and the speed command will follow better. But the excessive setting is easy to cause mechanical resonance.。The speed ring bandwidth is expressed as:

$$速度环频宽(Hz) = \frac{1+G}{1+J_L/J_M} \times K_v(Hz)$$

If the load moment of inertia is set correctly than that of G (G=JL/JM), the width of the speed loop is equal to the speed loop gain Kv.

2. Velocity loop integral time constant

Speed loop integration can effectively eliminate the steady-state error of speed, and react quickly to subtle speed changes. When the mechanical system does not generate vibration or noise, the integral time constant Ti of the speed loop is reduced to increase the rigidity of the system and reduce the steady-state error. If the load inertia ratio is very large or the mechanical system has resonance factors, it is necessary to confirm that the integral time constant of the speed loop is large enough, otherwise the mechanical system will produce resonance easily. If the load moment of inertia is set up correctly than that of G (G=JL/JM), the integral time constant Ti of the speed loop can be obtained by the following formula:

$$T_i(ms) \geq \frac{4000}{2\pi \times K_V(Hz)}$$

3. Position loop gain

The gain of the position loop directly determines the reaction speed of the

position loop. When the mechanical system does not produce vibration or noise, the gain value of the position loop is increased to speed up the reaction speed, reduce the position tracking error and shorten the positioning time. But excessive setting will cause mechanical system jitter or location overshoot. The position ring width should not be higher than the speed loop bandwidth.

$$位置环频宽(Hz) \le \frac{速度环频宽(\mathrm{Hz})}{4}$$

If the load moment of inertia is set correctly than G (G=JL/JM), the position loop gain Kp is calculated as follows:

$$K_p(1/s) \le 2\pi \times \frac{K_v(Hz)}{4}$$

4.5.2 Gain adjustment step

The selection of position and speed bandwidth must be determined by the rigidity and application of the machinery. The conveyor with a belt is low in rigidity and can be set to a lower frequency. The mechanical stiffness of the ball screw driven by the reducer can be medium, and it can be set to a medium width; the direct drive ball screw or linear motor has high stiffness and can be set to high. Bandwidth. If the mechanical characteristics are unknown, step by step gain can be increased to increase the bandwidth until resonance, and then lower the gain.

In servo gain, if one parameter is changed, other parameters need to be readjusted. Please do not make any major changes to a single parameter. As for the steps of changing servo parameters, generally observe the following principles:

Increase response	reduce response, suppress vibration and overshoot
1. increase the speed loop gain Kv 2. reduce the integral time constant Ti of velocity ring 3. improve position loop gain Kp	1. reduction of position loop gain Kp 2. increasing the integral time constant Ti of the velocity ring 3. reduce the speed loop gain Kv

The gain adjustment step of speed control:

1. Set the load moment of inertia ratio.
2. Set integral time constant of the speed loop with a relatively great value.
3. Under no vibration and unusual sound increase the gain of the speed loop, if vibration occurs then decrease the gain a bit.
4. Under no vibration and unusual sound, decrease the integral time constant of speed loop, if vibration occurs then increase the time constant a bit.
5. Because the mechanical system may have resonating factors and is unable to adjust for a bigger gain, then the desired response cannot obtain. Now, use low pass or notch filter for torque to suppress the resonance, and then carry on above steps again enhancing responsiveness. First use the low pass filter of torque, if the effect is not good then use notch filter again. Please refer to 4.6 sections.

Gain adjustment procedure for position control loop：

1. Set the load inertia ratio.
2. Set integral time constant of the speed loop with a relatively great value.
3. Under no vibration and unusual sound increase the gain of the speed loop, if vibration occurs then decrease the gain a bit.

Under no vibration and unusual sound, decrease the integral time constant of speed loop, if vibration occurs then increase the time constant a bit.

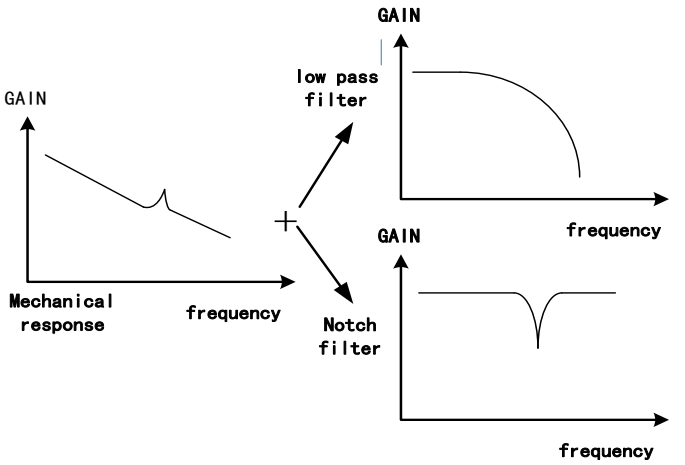
4. Increase the gain of position loop, if vibration occurs then decreases the gain a bit.
5. Because the mechanical system may have resonating factors and is unable to adjust for a bigger gain, then the desired response cannot obtain. Now, use low pass or notch filter for torque to suppress the resonance, and then carry on above steps again enhancing responsiveness. First use the low pass filter of torque, if the effect is not good then use notch filter again. Please refer to 4.6 sections.
6. If need shorter positioning time and smaller position tracking error, can adjust the feed forward of the position loop. Please refer to 4.2.4 section.

4.6 Resonance suppressions

When the mechanical system has the resonance effect, it is possibly created by higher rigidity of the servo system and quicker response. It may improve if reduce the gain. The servo driver provides the low pass filter and the notch filter. Under unchanging the gain by using filters can achieve the effect of resonance suppression.The parameters related to Resonating suppression as follows:

Para meter	Name	Range	Default value	Unit	Usage
P007	Time constant of filter for first torque	0.10～50.00	1.00	ms	ALL
P200	Frequency of first notch filter	50～1500	1500	Hz	ALL
P201	Quality factor of first notch filter	1～100	7		ALL
P202	Depth of first notch filter	0～100	0	%	ALL
P203	Frequency of second notch filter	50～1500	1500	Hz	ALL
P204	Quality factor of second notch filter	1～100	7		ALL
P205	Depth of second notch filter	0～100	0	%	ALL

The principle for suppression resonance is to use filters to suppress the resonance peak that the machinery responds. The schematic drawing is as follows:



Two kinds of filter characteristics are:

Filter type	Suitable case	Advantage	Disadvantage
Low pass filter	High frequency resonance	Do not need to know the exact resonance frequency	Bring phase delay; reduce bandwidth of the system. Do not suitable for the case of medium and low frequency resonance.
Notch filters	medium and low	Do not affect the	It is important to know the exact resonance

	frequency resonance	bandwidth of the system.	frequency. If make mistake of frequency setting, will affect the performance. It is not suitable that if the resonance frequency drifts all the time.

4.6.1 Low pass filters

The low pass filter is active by default, which setted by parameters P007. The low pass filter has the very good weaken effect on high frequency and can suppress high frequency resonance and noise. For example, the machinery with ball bearing screw sometimes can have high frequency resonance if increasing the gain. Using low pass filter can get better effect, but the system response bandwidth and the phase allowance also reduced, the system may become unstable. If the system is low frequency resonating, the low pass filter is unable to suppress it.

When the high frequency vibration caused by the servo driver, adjust the filter time-constant Tf of torque, possibly can eliminate the vibration. The smaller the value, the better control response achieves, but it is limited by mechanical condition. ; The bigger the value, the better suppressing effect achieves on high frequency vibration, but the phase allowance reduces and can cause the oscillation if the value is too big. If the load inertia ratio is set correctly G (G=JL/JM), must satisfy the following condition:

$$T_f(ms) \le \frac{1000}{2\pi \times 2 \times K_v(Hz)}$$

4.6.2 Notch filters

The notch filters are not active by default. By setting the parameter P200~P205, two notch filters can be used at the same time and can suppress two kind of different frequency resonance. If the resonance frequency is known, then by using the notch filter the resonance can be eliminated directly. It has better effect than by using the low pass filter. When resonance frequency is unknown, may gradually reduce the notch frequency from high to low, the notch frequency will be the optimum setting value while the vibration is smallest. If resonance frequency changes with time or other factor and the frequency displacement is too large, therefore it is not suitable to use the notch filter.

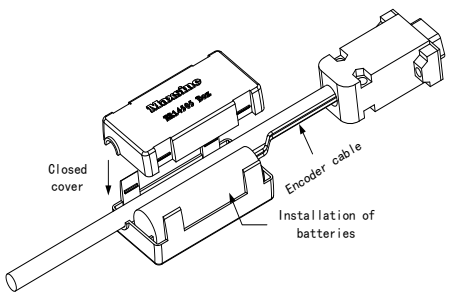
Except frequency, but also may adjust the notch depth and the quality factor and must pay attention to the setting values to be appropriate. If the notch depth is deep, the suppression effect on the mechanical resonance is possibly good, but can create the phase changing in a big way, sometimes can strengthen the vibration instead. The smaller the quality factor, the wider notch width achieves, and the mechanical resonance suppression effect is quite good, but can create the phase changing in big region, sometimes can strengthen the vibration instead.

4.7 Setting of absolute value encoder

4.7.1 The preservation of the multi loop information of the absolute encoder

The absolute value encoder defaults to the single ring absolute value. If the user needs multiple rounds of location values, the parameter P090 needs to be set to 1, save and restart the drive.

In order to preserve the multi loop position data of absolute encoder, battery units are required.



Note: do not install battery units on both sides of the servo drive. Please set the battery unit on any side of the servo drive.

Battery voltage requirements: 3.2VDC ~ 4.8VDC

When the battery voltage is out of range, the servo driver will alarm (Err48) when power is on. Replace the battery at this time. After replacing the battery, to relieve the "encoder battery alarm (Err48)" display, please ensure that the servo driver is in an un activated state. Connect the servo driver to control part of the power supply, and initialize the absolute encoder. After initialization, the multi loop value is 0. The confirmation error is missing and the servo driver can work properly.

4.7.2 The initialization of the absolute encoder

The absolute encoder must be initialized through Fn36 for the following occasions. Please refer to section 3.6.1 for reference.

- Initially starting the machine；
- Set the rotation data of absolute encoder to 0.。

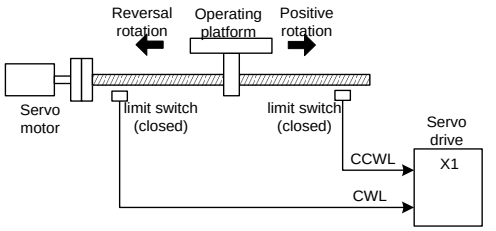
The encoder alarm should be cleared by Fn37 for the following occasions， Please refer to section 3.6.1 for reference.

When "Err48" occurs "encoder battery alarm"；

When the encoder internal fault alarm (Err41) occurs

4.8 overrange protection

The override protection function refers to the safety function when the mechanical part moves beyond the safe movement range of the design, the limit switch action, and the safe function of motor is forced to stop. The schematic diagram of overrange protection is as follows:



Limit switch is recommended to use normally closed contact, closed in safe range and overrun is disconnected. Connected to the positive turn drive prohibited (CCWL) and reverse drive prohibited (CWL), through the parameter P097 can also be set to use and ignore. Set to use, you must access the limit signal; set to ignore, do not need the signal. The default values of the parameters are CCWL and CWL are ignored. If you want to use them, you must modify the parameter P097. Even in the super state, it is still allowed to exit the overrun state by input reverse instruction.

P097	Reverse drive prohibition（CWL）	Forward drive prohibition（CCWL）
0	Use	Use
1	Use	ignore
2	ignore	Use
3（default）	ignore	ignore

4.9 Torque limit

The output torque can be restricted for the purpose of protecting machinery.

4.9.1 Torque limiting parameter

The parameters related to the torque limit are:

Para meter	name	range	default	unit	usage
P065	Internal rotation (CCW) torque limit	0～300	300	%	ALL
P066	Internal reversal (CW) torque limit	-300～0	-300	%	ALL

The 402 parameters related to the torque limit are

Index	Name	Units	Range	Data Type	Access	PDO
6072h	Max torque	0.1%	0-65535	U16	rw	RxPDO
60E0h	PositiveTorque Limit Value	0.1%	0-65535	U16	rw	RxPDO
60E1h	NegativeTorque Limit Value	0.1%	0-65535	U16	rw	RxPDO

4.9.2 Torque restriction mode

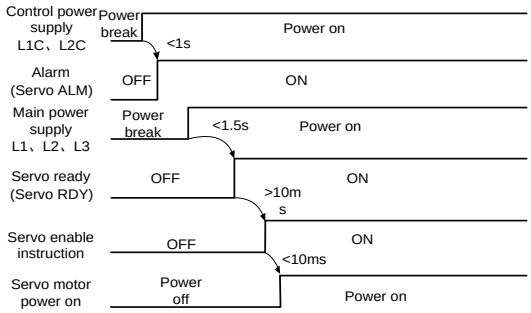
Positive rotation (CCW)	Reverse rotation（CW）
Decided by P065，6072h and 60E0h	Decided by P066，6072h and 60e1h

Note: if there are multiple restrictions, the final limit is a smaller absolute value.

4.10 Working time sequence

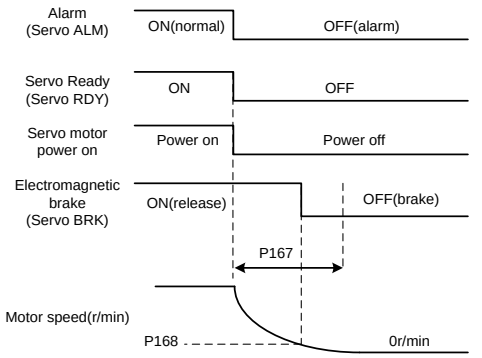
4.10.1 Power switching time sequence

- Control power L1C, L2C and main power L1, L2, L3 are connected at the same time or before the main circuit power supply. If only the power supply of the control circuit is turned on, the servo is ready to signal (RDY) OFF.
- After the main power is switched on, the delay is about 1.5 seconds, and the servo is ready to signal (RDY) ON. At this time, the servo can be accepted, and the servo enables the power circuit to be opened, the motor is excited, and the motor is in the running state. The servo enable is invalid or alarm is detected, the power circuit is turned off, and the motor is in free state.



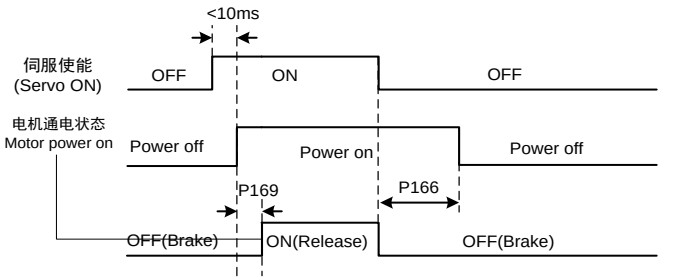
4.10.2 Alarm timing in servo ON

Electromagnetic brake is controlled by servo control:



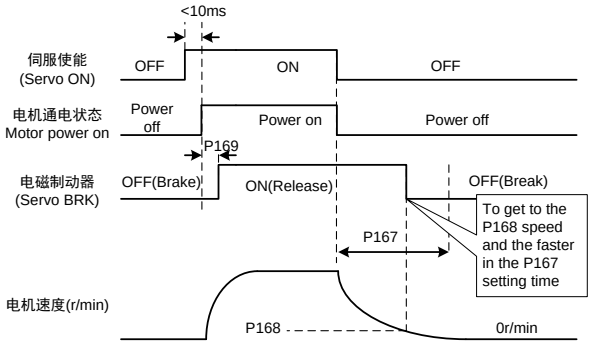
4.10.3 Servo ON/OFF action timing of motor at rest

When the electromagnetic brake is servo controlled and the motor speed is lower than the parameter P165, the action sequence is:



4.10.4 Servo ON/OFF action timing of motor operation

When the motor speed is higher than the parameter P165, the action sequence is:



4.11 Electromagnetic brake

The relevant parameters of the electromagnetic brake:

Para meter	name	range	Default	unit	usage
P165	Motor static speed detection point	0～1000	5	r/min	ALL
P166	Time delay time of electromagnetic brake when motor is still	0～150	150	ms	ALL
P167	The waiting time of the electromagnetic brake when the motor runs	0～2000	500	ms	ALL
P168	The motion speed of the electromagnetic brake when the motor runs	0～3000	100	r/min	ALL
P169	The delay time of the opening of the electromagnetic brake	0～1000	0	ms	ALL

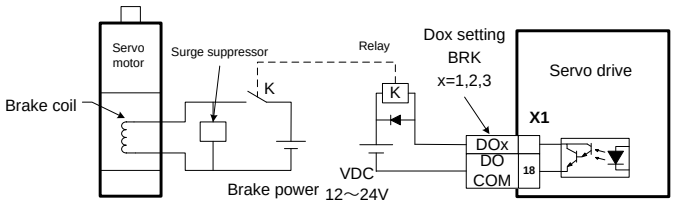
4.13.2 Use of electromagnetic brake

The following is the brake wiring diagram. The brake release signal of the driver is connected to the relay coil by BRK, and the relay contacts are connected to the brake power supply. The power supply of the brake is supplied by the user and has enough capacity. It is recommended to install surge absorber to suppress surge voltage caused by relay on / off operation. The diode can also be used as surge absorber. Attention should be paid to a slight delay in braking.

After the motor is stably stopped (speed less than P165) servo OFF, the motor continues to maintain the position, the brake from release to brake, after a stable period of time (time determined by the parameter P166), remove the motor power supply.

When the motor does not change the energy state to the state of energy, the time delay time of the motor current to the electromagnetic brake (DO output terminal BRK ON) is determined by the parameter P169.

The motor is running OFF (speed greater than P165), when the motor current is cut off, the brake continues to release, and the brake is delayed after a period of delay. This is to slow down the motor from high speed to low speed, and then to make the mechanical brake act, so as to avoid damaging the brake. The delay time is the time required for parameter P167 or motor speed deceleration to the speed of parameter P168.


Servo motor
Surge suppressor
Relay
Dox setting
BRK
x=1,2,3
Servo drive
Brake coil
K
K
X1
DOx
DO
COM
18
VDC
12～24V
Brake power

Chapter 5 Parameters

5.1 Parameter table

The parameters used in this manual, the contents of Data Type are all INT16 .The INT16 range is shown in the following table.

name	description	range
INT16	Signed 16bit	-32768 ~ 32767

The format of the parameters that can be written and read through SDO communication is as follows:

The read and write parameters must be decimal number of parameters in the driver's display panel and manual manual with a small number of parameters.In the process of reading and writing are amplified the corresponding multiplier, making it a decimal number of plastic. Displays binary parameters, which are actually used in the process of reading and writing operations.

Details as follows：

parameter	Manual display value	Communication operating value	Transformation way
P005	40	40	No change
P006	20.0	200	1 decimal points, magnified 10 times
P007	1.00	100	2 decimal points, magnified 100 times
P120	00000 （binary system）	0 （Decimal system）	Binary convert to decimal

5.1.1 Parameters of section 0

Para meter	Name	Range	Default value	Unit	Usage
P000	NO	Password	0～9999	315	
P001	NO	Identity code of servo driver	*	*	
P002	NO	Identity code of servo motor	0～8	0	
P003	2003h	Software edition	*	*	
P004	NO	Control mode	0~5	0	
P005	2005h	First gain of speed loop	1～3000	40	Hz
P006	2006h	First integral time constant of speed loop	1.0～1000.0	20.0	ms

P007	2007h	First filter time constant of torque	0.10～50.00	1.00	ms
P009	2009h	First gain of position loop	1～1000	40	Hz
P010	NO	Second gain of speed loop	1~3000	40	Hz
P011	NO	Second integral time constant of speed loop	1.0~1000.0	10.0	ms
P012	NO	Second filter time constant of torque	0.10~50.00	1.00	ms

Para meter	Index	Range	Default value	Unit	Usage
P013	NO	Second gain of position loop	1~1000	80	1/s
P017	2011h	Inertia ratio of load	0.0～200.0	1.0	times
P018	2012h	Control coefficient PDFF of speed loop	0～100	100	%
P019	2013h	Time constant of filter for speed detection	0.50～50.00	2.00	ms
P021	2015h	Feed forward gain of position loop	0～100	0	%
P022	2016h	Time constant of feed forward filter for position loop	0.20～50.00	1.00	ms
P025	NO	Sources of speed command	0~5	0	
P040	NO	Time-constant of exponential form filter for position command	0~1000	0	ms
P060	203Ch	Acceleration time of speed command	0～30000	0	ms
P061	203Dh	Deceleration time of speed command	0～30000	0	ms
P065	2041h	Internal torque limit in CCW direction	0～500	300	%
P066	2042h	Internal torque limit in CW direction	-500～0	-300	%
P070	2046h	Alarm level of torque overload in CCW direction	0～300	300	%
P071	2047h	Alarm level of torque overload in CW direction	-300～0	-300	%
P072	2048h	Detection time for torque overload alarm	0～10000	0	10ms
P075	204Bh	Maximum speed limit	0～6000	5000	r/min
P076	NO	JOG running speed	0～5000	100	r/min
P078	204Eh	Speed limit in torque control	0～5000	3000	r/min
P080	2050h	Position deviation test	0.00～327.67	4.00	round
P084	2054h	brake resistor option switch	0～1	1	
P085	2055h	The value of external brake resistor	1～750	50	Ω
P086	2056h	The power of external brake resistor	1～10000	60	W
P088	NO	Encoder type	0~31	0	
P090	205Ah	Absolute positon encoder type (only absolute type.)	0～2	0	
P093	205Dh	fan alarm on	0～1	1	
P094	205Eh	The switching temperature point of fan	25~125	50	℃
P096	NO	Items of initial display	0～29	29	
P097	2061h	Neglect inhibition of servo driver	0～3	3	
P098	NO	Forced enable	0~1	0	

5.1.2 Parameters of section 1

Para meter	Index	Range	Default value	Unit	Usage
P100	2100h	Function of digital input DI1	-37～37	4	
P101	2101h	Function of digital input DI2	-37～37	3	
P102	2102h	Function of digital input DI3	-37～37	23	
P103	2103h	Function of digital input DI4	-37～37	0	
P104	2104h	Function of digital input DI5	-37～37	0	
P108	NO	Digital high speed input 1 (HDI1) Filter enabling	0~1	0	
P109	NO	Digital high speed input 2 (HDI2) Filter enabling	0~1	0	
P110	210Ah	Filter of digital input DI1	0.1～100.0	2.0	ms
P111	210Bh	Filter of digital input DI2	0.1～100.0	2.0	ms
P112	210Ch	Filter of digital input DI3	0.1～100.0	2.0	ms
P113	210Dh	Filter of digital input DI4	0.1～100.0	2.0	ms
P114	210Eh	Filter of digital input DI5	0.1～100.0	2.0	ms
P118	NO	Digital high speed input 1 (HDI1) Filter grade	1~8	4	
P119	NO	Digital high speed input 2 (HDI2) Filter grade	1~8	4	
P120	2114h	First group function of DI digital inputs	00000～11111	00000	
P121	2115h	Second group function of DI digital inputs	00000～11111	00000	
P122	2116h	third group function of DI digital inputs	00000～11111	00000	
P123	2117h	Fourth group function of DI digital inputs	00000～11111	00000	
P124	2118h	Fifth group function of DI digital inputs	00000～11111	00000	
P130	211Eh	Function of digital output DO1	-28～28	23	
P131	211Fh	Function of digital output DO2	-28～28	0	
P132	2120h	Function of digital output DO3	-28～28	0	
P133	2121h	Digital output DO4 function	-28～28	0	
P134	2122h	Digital output DO5 function	-28～28	0	
P160	213Ch	Zero speed detection point	0～1000	10	r/min

Para meter	Index	Range	Default value	Unit	Usage
P161	213Dh	Range for zero speed detection	0～1000	5	r/min
P164	2140h	An emergency shutdown mode	0～1	0	
P165	2141h	Motor static speed detection point	0～1000	5	r/min
P166	2142h	Time delay time of electromagnetic brake when motor is still	0～2000	0	ms
P167	2143h	The waiting time of the electromagnetic brake when the motor runs	0～2000	500	ms
P168	2144h	The motion speed of the electromagnetic brake when the motor runs	0～3000	100	r/min
P169	2145h	The delay time of the opening of the electromagnetic brake	0～1000	0	ms

5.1.3 Parameters of section 2

Para meter	Index	Range	Default value	Unit	Usage
P200	2200h	Frequency of first notch filter	50～1500	1500	Hz
P201	2201h	Quality factor of first notch filter	1～100	7	
P202	2202h	Depth of first notch filter	0～100	0	%
P203	2203h	Frequency of second notch filter	50～1500	1500	Hz
P204	2204h	Quality factor of second notch filter	1～100	7	
P205	2205h	Depth of second notch filter	0～100	0	%
P208	NO	Gain switching selection	0~5	0	
P209	NO	Level of gain switching	0~32767	100	
P210	NO	Level hysteresis of gain switching	0~32767	5	
P211	NO	Delay time of gain switching	0~3000	5	ms
P212	NO	Time of gain switching	0~3000	5	ms
P222	2216h	Compensation coefficient of vibration suppression	1.0～100	1.0	
P223	2217h	Vibration suppression mode	0～3	0	
P224	2218h	Manual setting of vibration cycle	0～1000	0	ms
P226	NO	Intermediate frequency vibration frequency	50～1500	100	Hz
P227	NO	Compensation coefficient of moderate frequency suppression	1～1000	100	%

P228	NO	Damping coefficient of medium frequency suppression	0～300	0	%
P229	NO	Medium frequency vibration suppression switch	0～1	0	0

5.1.4 Parameters of section 3

Para meter	Index	Range	Default value	Unit	Usage
P300	NO	Site name	0～128	0	
P304	NO	EtherCAT Mode switch	0～1	1	
P306	NO	CSP Pattern spline type	0～2	2	

5.2 DI Functional list

No.	Symbol	DI function	serial	Symbol	DI function
0	NULL	No function	4	CWL	Reverse drive prohibition
2	ARST	Alarm clearance	15	EMG	Emergency shutdown
3	CCWL	Forward drive prohibition	23	HOME SWITCH	Return to the origin point

5.3 DO Functional list

No.	Symbol	DO function	serial	Symbol	DO function
0	OFF	invalid	12	SPL	Speed limit
1	ON	effective	13	HOME	Return to the origin point
2	RDY	Servo ready	23	BRKNET	Electromagnetic brake (EtherCAT object control)
3	ALM	Alarm	24	NETIO0	EtherCATControl word control IO0
4	ZSP	Zero speed	25	NETIO1	EtherCATControl word controlIO1
8	BRK	Electromagnetic brake	26	NETIO2	EtherCATControl word control IO2
9	RUN	Servo running	27	NETIO3	EtherCATControl word control IO3
11	TRQL	Torque limit	28	NETIO4	EtherCATControl word control IO4

5.4 Parameter detailed solution

5.4.1 Parameters of section 0

P000 Index	PASSWORD					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0~9999	315	

- The hierarchical management parameters can ensure that the parameters will not be modified by mistake.
- Setting this parameter as 315 can examine, modify the parameters of the 0, 1, 2, 3 sections. For other setting only can examine, but cannot modify parameters.
- Some special operations need to set the appropriate password.

P001 Index	Identity code of servo driver					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	*	*	

- This is the model of the servo driver in sue now. The manufacturer sets it and the user cannot modify it.

P002 Index	Identity code of servomotor					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0~8	*	

- The current type of motor used is only effective when using Panasonic motor. The factory has been set up before factory
- The parameter will be modified when changing different types of motor . Please refer to "Panasonic motor fitness list" specifically.

P003 Index 2003h	Software version					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	*	*	

- Software version number, which can not be modified

P004 Index	Control mode					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～5	0	

- parameter significance:
  0：Position control； 1：Speed control；2：Torque control； 3，4，5：Reserved。

P005 Index 2005h	First gain of speed loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～3000	40	Hz

- This is the proportion gain of the speed regulator. Increases the parameter value, can make the speed response to speed up. It is easy to cause the vibration and the noise when the value is too large.
- If the P017 (load inertia ratio) is a correct value then the parameter value is equal to the speed response bandwidth.

P006 Index 2006h	First integral time constant of speed loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1.0～1000.0	20.0	ms

- This is the integral time constant of the speed regulator. Reduces the parameter value, can reduce the speed control error, and increase rigidity. It is easy to cause the vibration and the noise when the value is too small.
- If using the maximum value (1000.0) indicates the integral function to be canceled. The speed regulator becomes the P controller.

P007 Index 2007h	First filter time constant of torque					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.10～50.00	1.00	ms

- This is the low pass filter of torque and can suppress the vibration of the machinery.
- The bigger the value, the better effect of suppression achieves. The response will slow down. It is easy to cause oscillation if the value is too large. The smaller the value, the quicker response achieves, but can be limited by mechanical condition.
- When the load inertia is small, can set a small value; the load inertia is big, can set a big value.

P009 Index 2009h	First gain of position loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～1000	40	Hz

- This is the proportional gain of the position regulator. Increases the parameter value, can reduce the position tracking error, and enhance the response. It is easy to cause overshoot or oscillation when the value is too large

P010 Index	Second gain of speed loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit

0	INT16	RO	Yes	1～3000	40	Hz

- Refer to the description of the P005 parameter. It is necessary to set this parameter when begins using the gain switching function

P011 Index	Second integral time constant of speed loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1.0～1000.0	10.0	ms

- Refer to the description of the P006 parameter. It is necessary to set this parameter when begins using the gain switching function.

P012 Index	Second filter time constant of torque					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.10～50.00	1.00	ms

- Refer to the description of the P007 parameter. It is necessary to set this parameter when begins using the gain switching function.

P013 Index	Second gain of position loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～1000	80	1/s

- Refer to the description of the P009 parameter. It is necessary to set this parameter when begins using the gain switching function.

P017 Index 2011h	Inertia ratio of load					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.0～200.0	1.0	倍

- The load inertia ratio is that the inertia of mechanical load (refers to servomotor shaft) divides by the rotor inertia of the servomotor.

P018 Index 2012h	Control coefficient PDFF of speed loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～100	100	%

- Using this PDFF coefficient of speed regulator can choose the structure of the speed controller. “0” and “100” are the IP regulator. 1 to 99 is the PDFF regulator.
- The smaller value of the parameter can get the higher stiffness (anti-deviation ability) of the system. The medium value takes account to both frequency response and stiffness

P019 Index 2013h	Time constant of filter for speed detection					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.50～50.00	2.00	ms

- The bigger value of parameter can get the smoother detected speed signal. The smaller value of parameter can get the quicker responded signal, but it will cause noise if the value is too small. In addition, it will cause oscillation if the value is too big.

P021 Index 2015h	Feed forward gain of position loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～100	0	%

- The feed forward can reduce position-tracking error in the position control mode. Under any frequency command pulse the position-tracking error always becomes zero if the parameter setting value is 100.
- Increasing the parameter value enhance the response of position control. It is easy to cause the system to be unstable, oscillation if the parameter value is too large.

P022 Index 2016h	Time constant of feed forward filter for position loop					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.20～50.00	1.00	ms

- For filtering the feed forward signal in position loop. This function is to increase the stability of feed forward control.

P025 Index 无	Sources of speed command					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～5	0	

- Set the source of the speed command in speed control mode.
- The meanings of this parameter are：

  0，1，2：Reservations

  3：This is the JOG speed command. It needs to set this parameter when begins using the JOG operation.

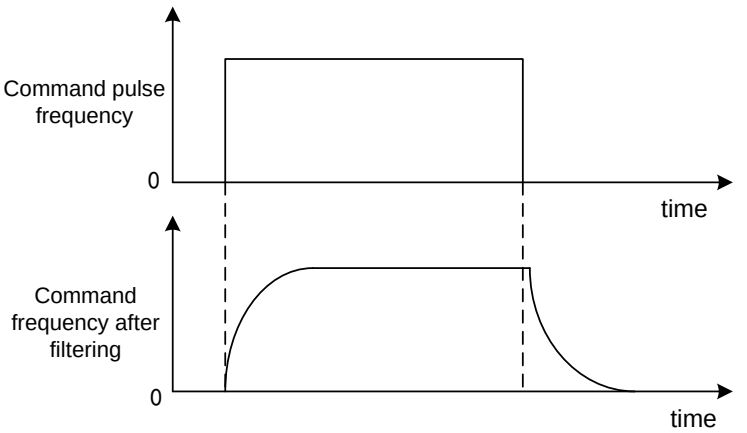
  4： Keyboard speed command, keyboard speed adjustment (Sr) operation need to be setted.

  5：This is the demonstration speed command. It needs to set this parameter when begins using the demonstration operation. The speed command can change automatically.

P040 Index 无	Time-constant of exponential form filter for position command					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	0	ms

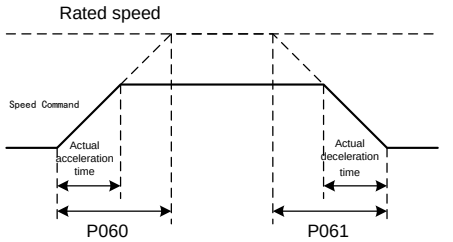
- Carries on the smooth filter to the command pulse and has the exponential form acceleration/deceleration. The filter cannot lose the input pulse, but can delay the command pulse. When the setting value is zero, the filter does not have any effect.
- This filter uses in some cases:

- 1. The host controller has no acceleration/deceleration function;
- 2. The electronic gear ratio is quite big (N/M>10);
- 3. The command frequency is lower;
- 4. When the servomotor is in motion appears step-by-steps or unstable phenomenon.



P060 Index 203Ch	Acceleration time of speed command					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～30000	0	ms

- Set the acceleration time for the servomotor from the zero speed up to rated speed.
- If the command speed is lower than the rated speed, the rise time also correspondingly reduces.
- Only uses in the speed control mode. It is invalid in position control mode.
- If the servo driver constitutes the position control with host controller, this parameter should be set zero, otherwise affects the position control performance.



P061 Index 203Dh	Deceleration time of speed command					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～30000	0	ms

- Set the deceleration time for the servomotor from the rated speed down to zero speed.
- If the command speed is lower than the rated speed, the fall time also correspondingly reduces.
- Only uses in the speed control mode. It is invalid in position control mode.
- If the servo driver constitutes the position control with host controller, this parameter should be set zero, otherwise affects the position control performance.

P065 Index 2041h	Internal torque limit in CCW direction					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～500	300	%

- Set the internal torque limitation value in CCW direction of servomotor.
- This limit is effective all the time.
- If the value surpasses the biggest overload capacity of the servo driver, then the actual limits will be equal to the biggest overload capacity.

P066 Index 2042h	Internal torque limit in CW direction					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-500～0	-300	%

- Set the internal torque limitation value in CW direction of servomotor.
- This limit is effective all the time.
- If the value surpasses the biggest overload capacity of the servo driver, then the actual limits will be equal to the biggest overload capacity.

P070 Index 2046h	Alarm level of torque overload in CCW direction					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～300	300	%

- Set the overload value of torque in (CCW) direction. This value indicates the percentage of rated torque.
- When the torque of the servomotor surpasses P070 and the duration is bigger than P072, then the servo driver alarms, and the servomotor stops. The number of the alarm is Err29.

P071 Index 2047h	Alarm level of torque overload in CW direction					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-300～0	-300	%

- Set the overload value of torque in (CW) direction. This value indicates the percentage of rated torque.
- When the torque of the servomotor surpasses P071 and the duration is bigger than P072, then

the servo driver alarms, and the servomotor stops. The number of the alarm is Err29.

P072 Index 2048h	Detection time for torque overload alarm					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～10000	0	10ms

- Refer to the explanation of parameter P070 and P071.
- The torque overload can be shielded if the setting value is zero.

P075 Index 204Bh	Maximum speed limit					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～6000	5000	r/min

- Set the permission highest speed of servomotor.
- The limit is effective in both CCW and CW direction.
- If the setting value surpasses the system permission the maximum speed, the actual speed also can limit in the maximum speed.

P076 无	JOG running speed					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	No	0～5000	100	r/min

- Set the running speed for JOG operation

P078 Index 204Eh	Speed limit in torque control					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～5000	3000	r/min

- The servomotor running speed limits in this parameter for torque control mode.
- Under light loading can prevent the servomotor from over speed.
- When appears over speed, turns on speed negative feedback to reduce the actual torque, but the actual speed can be higher than the limit value slightly.

P080 Index 2050h	Position deviation limit					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.00～327.67	4.00	circle

- Set the position deviation range for alarm when the deviation exceeds this parameter.
- Under position control mode, when the counting value of position deviation counter exceeds the pulses corresponding to this parameter value, the servo driver gives the position deviation alarm (Err 4).
- The unit is one circle. Multiplying the resolution of encoder with the value of this parameter

can obtain the total pulse number. For example, the encoder has 2500 lines and the resolution of encoder is 10000. If the parameter value is 4.00, then corresponds to 40000 pulses.

P084 Index 2054h	The option switch of brake resistor					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	1	

- The meanings of this parameter:
  0: adopting internal brake resistor.
  1: adopting external brake resistor.

P085 Index 2055h	The value of external brake resistor					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～750	50	Ω

- Set this parameter according to the value of actual external brake resistor.
- This parameter is out of valid when internal brake resistor (P084=0) is adopted.

P086 Index 2056h	The power of external brake resistor					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～10000	60	W

- Set this parameter according to the power of actual external brake resistor
- This parameter is out of valid when internal brake resistor (P084=0) is adopted.

P088 Index 无	Type of encoder					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0~31	0	

- The meanings of this parameter:
  - 0: automatic identification. 1: tamakawa. 2: Panasonic. 3: Nikon.
  - Note: when P088 is 2 (Panasonic), you need to select the motor code through P002.

P090 Index 205Ah	Absolute position encoder type (absolute type only)					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～2	0	

- The meanings of this parameter:
  0: single-ring absolute encoder

1: multi-turn absolute encoder

- The encoder can not reserve multi-turn information, when encoder has no external battery. Please set this parameter to 0.

P093 Index 205Dh	Fan alarm on					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	1	

- The meanings of this parameter:

0: Shield the fan fault alarm (except for special reasons, shield it is not suggested.)

1: allowing fan fault alarm

P094 Index 205Eh	Turn on the fan and start the temperature point					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	25～125	50	℃

- When the module temperature is higher than this temperature, drive cooling fan begins to work.
- When the module temperature is lower than this temperature, drive cooling fan stops working.

P096 Index 无	Items of initial display					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～29	29	

- Set the display status on the front panel after turn on the power supply.
- The meanings of this parameter are:

P096	Display item	P096	Display item	P096	Display item
0	Speed of servomotor	10	Speed command	20	Control mode
1	Original Position command	11	Torque command	21	Number of alarm
2	Position command	12	Analog voltage of speed command	22	Reserved
3	Position of servomotor	13	Analog voltage of torque command	23	Reserved
4	Position deviation	14	DI Digital input DI	24	Bus voltage
5	Torque	15	DO Digital output DO	25	Reserved
6	Peak torque	16	Signals of encoder	26	Internal

					temperature of module
7	Current	17	Absolute position in one turn	27	Position for encoder multi turm encoder
8	Peak current	18	Accumulative load ratio	28	History alarm code display
9	Frequency of input pulse	19	Brake ratio	29	Ether CATstatus display

P097 Index 2061h	Neglect inhibition of servo driver					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～3	3	

- The prohibited positive travel (CCWL) and the prohibited reverse travel (CWL) from DI inputs are used for the limit traveling protection. Use normal closed switch as protecting switch. If the input from DI is ON, then the servomotor can move to this direction, or is OFF, cannot move to this direction. If does not use the limit traveling protection, can neglect it by modifying this parameter and does not need the CCWL and CWL wiring.
- The default value neglects the prohibition, if use this function, please modify this value first.
- The meanings of this parameter are:

P097	Motion inhibition in CW direction(CWL)	Motion inhibition in CCW direction(CCWL)
0	Use	Use
1	Use	Neglect
2	Neglect	Use
3	Neglect	Neglect

Use: When input signal is ON, the servomotor can move to this direction; When OFF the servomotor cannot move to this direction.

Neglect: The servomotor can move to this direction, and the prohibition signal does not have the function, therefore can disconnect this signal.

P098 Index 无	Forced enable					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	0	

- P098 parameter is invalid at P304=1 and valid at P304=0.
- Parameter significance:
- 0: The enable is controlled by SON DI input; 1: software enabling.

5.4.2 Parameters of section 1

P100 Index 2100h	Function of digital input DI1					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-37～37	4	

- The function plan of digital input DI1: the absolute value of the parameter expresses functions; the symbolic expresses the logic. Refer to the 5.5 sections for the functions.
- The symbolic expresses the input logic. Positive number expresses positive logic and the negative number express the negative logic. ON is effective, OFF is invalid:

Parameter	DI input signal	DI Result	parameter values	DI input signal	DI Result
Positive number	**Turn off**	OFF	Negative number	**Turn off**	ON
	Turn on	ON		**Turn on**	OFF

P101 Index 2101h	Function of digital input DI2					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-37～37	3	

- The function plan of digital input DI2. Refer to the explanation of parameter P100.

P102 Index 2102h	Function of digital input DI3					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-37～37	23	

- The function plan of digital input DI3. Refer to the explanation of parameter P100.

P103 Index 2103h	Function of digital input DI4					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-37～37	0	

- The function plan of digital input DI4. Refer to the explanation of parameter P100.

P104 Index 2104h	Function of digital input DI5					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-37～37	0	

- The function plan of digital input DI5. Refer to the explanation of parameter P100.

P108 Index 无	Digital high speed input 1 (HDI1) filter enable					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	0	

- Parameter significance: 0: no enable; 1: enable.

P109 Index 无	Digital high speed input 2 (HDI2) filter enable					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	0	

- Parameter significance: 0: no enable; 1: enable.

P110 Index 210Ah	数字输入 DI1 滤波					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.1～100.0	2.0	ms

- This is the time-constant of DI1 input digital filter.
- The smaller the value, the quicker signal responses; the bigger the value, the slower signal responses, but filtering ability of noise is stronger.

P111 Index 210Bh	Filter of digital input DI2					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.1～100.0	2.0	ms

- This is the time-constant of DI2 input digital filter. Refer to the explanation of parameter P110.

P112 Index 210Ch	Filter of digital input DI3					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.1～100.0	2.0	ms

- This is the time-constant of DI3 input digital filter. Refer to the explanation of parameter P110.

P113 Index 210Dh	Filter of digital input DI4					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.1～100.0	2.0	ms

- This is the time-constant of DI4 input digital filter. Refer to the explanation of parameter P110.

P114 Index 210Eh	Filter of digital input DI5					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0.1～100.0	2.0	ms

- This is the time-constant of DI5 input digital filter. Refer to the explanation of parameter P110.

P118 Index 无	Digital high speed input 1 (HDI1) filter level					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1~8	4	

- Parameter significance: 1~8: from low to high, the filtering ability is strengthened.

P119 Index 无	Digital high speed input 2 (HDI2) filter level					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1~8	4	

- Parameter significance: 1~8: from low to high, the filtering ability is strengthened.

P120 Index 2114h	Forced effect in DI digital inputs (group 1)					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	00000～11111	00000	

- The function corresponding to 5 binary bit is as following:

Bit number	bit4	Bit3	Bit2	Bit1	bit0
Function	CWL	CCWL	ARST	SON	NULL

- Use in forcing the DI input function to be effective. If the corresponding bit of function is set to 1, then this function forces ON (effectively).
- The meaning of DI symbol string refers to 5.2 sections.
- The meanings of this parameter are:

Certain bit of this parameter	Function[note]	Function result
0	Not yet planned	OFF
	Has planned	Determine by input signal
1	Not yet planned or has planned	ON

Note: 'Has planned' indicates the function which is selected by parameter P100~P104.

'Not yet planned' indicates the function which is not selected by parameter P100~P104.

P121 Index 2115h	Forced effect in DI digital inputs (group 2)					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	00000～11111	00000	

- The function corresponding to 5 binary bit is as following:

●

Bit number	bit4	bit3	bit2	bit1	bit0
Function	CINV	CZERO	ZCLAMP	TCW	TCCW

- Refer to the explanation of parameter P120 for others.

P122	Index 2116h	Forced effect in DI digital inputs (group 3)				
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	00000～11111	00000	

- The function corresponding to 5 binary bit is as following:

Bit number	bit4	bit3	bit2	bit1	bit0
Function	TRQ2	TRQ1	SP3	SP2	SP1

- Refer to the explanation of parameter P120 for others.

P123	Index 2117h	● Refer to the explanation of parameter P120 for others.				
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	00000～11111	00000	

- The function corresponding to 5 binary bit is as following:

Bit number	bit4	bit3	bit2	bit1	bit0
Function	GEAR2	GEAR1	GAIN	CMODE	EMG

- Refer to the explanation of parameter P120 for others.

P124	Index 2118h	Forced effect in DI digital inputs (group 5)				
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	00000～11111	00000	

- The function corresponding to 5 binary bit is as following:
- Refer to the explanation of parameter P120 for others.

Bit number	bit4	bit3	bit2	bit1	bit0
Function	REF	GOH	PC	INH	CLR

- Refer to the explanation of parameter P120 for others.

P130	Index 211Eh	Function of digital output DO1				
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-28～28	23	

- The function plan of digital output DO1: The absolute value of the parameter expresses functions; the symbol expresses the logic, Refer to the 5.3 sections for the functions.
- '0' is forcing OFF, '1' is forcing ON.
- The symbol indicates the output logic; the positive number expresses the positive logic and the negative number expresses the negative logic:

Parameter value	Function	DO output signal
Positive number	ON	Turn on
	OFF	Turn off
Negative number	ON	Turn off
	OFF	Turn on

P131 Index 211Fh	Function of digital output DO2					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-28～28	0	

- This is the function plan of digital output DO2. Refer to the explanation of parameter P130.
-

P132 Index 2120h	Function of digital output DO3					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-28～28	0	

- This is the function plan of digital output DO3. Refer to the explanation of parameter P130.

P133 Index 2121h	Function of digital output DO4					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-28～28	0	

- This is the function plan of digital output DO4. Refer to the explanation of parameter P130.

P134 Index 2122h	Function of digital output DO5					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	-28～28	0	

- This is the function plan of digital output DO5. Refer to the explanation of parameter P130.

P160 Index 213Ch	Zero speed detection point					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	10	r/min

- When the motor speed is lower than this parameter, the digital output DO ZSP (zero speed) is ON, otherwise OFF.
- The comparator has the function of backlash and is set by parameter P161.

P161 Index 213Dh	Zero speed detection point					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	5	r/min

- Refer to the explanation of parameter P160.

●

P164 Index 2140h	An emergency shutdown mode					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1	0	

When the EMG (emergency shutdown) ON in DI is used, the meaning of this parameter is:

0: The drive cut off the motor current directly, motor will be stopped;

1: The driver maintains the enabling status, and the control motor is stopped by the acceleration and deceleration defined by 6085h (Quick stop deceleration).

P165 Index 2141h	Range for static check of the servomotor.					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	5	r/min

- Use this parameter to check the servomotor to be static. If the speed of the servomotor is lower than the parameter value and will consider the servomotor static.
- Only uses in the timing chart judgment of the electromagnetic brake.

P166 Index 2142h	Delay time for electromagnetic brake when servomotor is in standstill					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～2000	0	ms

- Use the electromagnetic brake when the SON is from ON go to OFF or alarm occurs in the servo driver. This parameter defines the delay time from the action (the BRK is OFF from DO terminals) of the electromagnetic brake until excitation removal of the servomotor during the servomotor to be in static.
- The parameter should not be smaller than the delay time in which the machinery applies the brake. This parameter will make the brake reliable and then turns off the servomotor excitation to guarantee against the small displacement of the servomotor or depreciation of the work piece.
- The timing chart refers to 4.10.3 section.

P167 Index 2143h	Waiting time for electromagnetic brake when servomotor is in motion					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～2000	500	ms

- Use the electromagnetic brake when the SON is from ON go to OFF or alarm occurs in the servo driver. This parameter defines the delay time from excitation removal of the servomotor until the action (the BRK is OFF from DO terminals) of the electromagnetic brake during the servomotor to be in motion.
- This parameter will make the servomotor deceleration from high speed down to low speed

and then applies the brake to avoid damaging the brake.

- The actual action time will take the minimum value in both the parameter P167 and the time in which the servomotor decelerates to the P168 value.
- The timing chart refers to 4.13.4 section.

P168 Index 2144h	Action speed for electromagnetic brake when servomotor is in motion					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～3000	100	r/min

- Refer to the explanation of parameter P167.

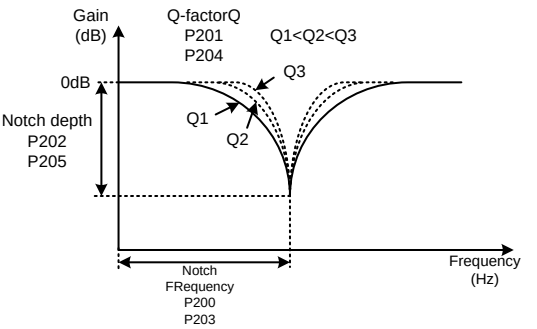
P169 Index 2145h	The delay time of the opening for the electromagnetic brake					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	0	ms

- Refer to the explanation of chapter 4.10

5.4.3 Parameters of section 2

P200 Index 2200h	Frequency of first notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	50～1500	1500	Hz

- Notch filter is the filter for eliminating the specific frequency resonance caused by machinery.
- If the parameter P202 sets zero, then closes the notch filter.



P201 Index 2201h	Quality factor of first notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～100	7	

- The quality factor Q indicates the shape of notch filter. The bigger the quality factor Q, the more incisive of the north shape and the narrower of bandwidth (-3dB) obtain.
-

$$\text{Quality factor } Q = \frac{\text{North frequency}}{\text{North Width}}$$

P202 Index 2202h	Depth of first notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～100	0	%

- Set the depth of the notch filter. The bigger the value, the more depth of the north obtains, namely the bigger attenuating of filter gain obtains. If the parameter P202 sets zero, then closes the north.
- Using dB unit the north depth D is:

$$D = -20\log(1-\frac{P202}{100})(dB)$$

P203 Index 2203h	Frequency of second notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	50～1500	1500	Hz

- Notch filter is the filter for eliminating specific frequency resonance caused by mechanical system.
- If the parameter P205 sets zero the north closes.

P204 Index 2204h	Quality factor of second notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1～100	7	

- Refer to the explanation of parameter P201.

P205 Index 2205h	Depth of second notch filter					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～100	0	%

- Set the depth of the notch filter. If the parameter P205 sets zero the north closes. Refer to the explanation of parameter P202 for others.

P208 Index 无	Gain switching selection					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～5	0	

- The meanings of this parameter are:

0：Fixed first gain group

1：Fixed second gain group

2：Input GAIN terminal for gain switching from DI. 'OFF' is the first gain group; 'ON' is the second gain group

3：The gain group switching depends on the command pulse frequency. If the frequency of input command pulse surpasses the P209, and then switches to the second gain group

4：The gain group switching depends on the pulse deviation. If the position pulse deviation surpasses the P209, and then switches to the second gain group

5：The gain group switching depends on the speed of the servomotor. If the speed of the servomotor surpasses the P209, then switches to the second gain group

- Each group of the gain has four parameters and switches at the same time.

First gain group		Second gain group	
Parameter	Name	Parameter	Name
P005	First gain of speed loop	P010	Second gain of speed loop
P006	First integral time constant of speed loop	P011	Second integral time constant of speed loop
P007	First filter time constant of torque	P012	Second filter time constant of torque
P009	First gain of position loop	P013	Second gain of position loop

P209 Index 无	Level of gain switching					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～32767	100	

- Set this parameter according to the parameter P208, there are different unit for different switching condition.
- The comparator has hysteretic function set by parameter P210.

P208	Gain switching condition	unit
3	Frequency of command pulse	0.1kHz(kpps)
4	Pulse deviation	pulse
5	Servomotor speed	r/min

P210 Index 无	Level hysteresis of gain switching					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～32767	5	

- This parameter has the same unit with P209; refers to the explanation of parameter P209.

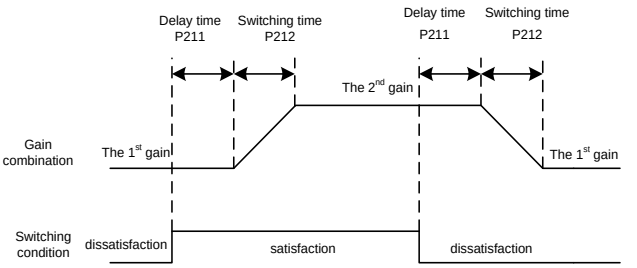
P211 Index 无	Delay time of gain switching					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～3000	5	ms

- The switching condition of gain group must maintain a period set by parameter P211.

- During the delay time, if checks the switching condition unsatisfied, then cancels the switching.
-

P212 Index 无	Time of gain switching					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～3000	5	ms

- During switching of the gain group, the current gain group will make linearity change to the goal gain group according to the setting time by parameter P212. Each parameter of the gain group also changes at the same time.
- The machinery impact caused by changing the parameter suddenly can avoid.



P222 Index 2216h	Compensation factor of vibration suppression					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	1.0～100.0	1.0	

- Vibration suppression switch is valid when it is open.
- The greater the numerical value, the more obvious the inhibition effect, but the numerical value is too large to bring mechanical noise easily.

P223 Index 2217h	Vibration suppression mode					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～3	0	

Parameter significance:

0: the function of vibration suppression is ineffective.

1: vibration suppression mode 1: automatic detection of vibration frequency, suitable for occasions where inertia changes little.

2: vibration suppression mode 2: automatic detection of vibration frequency, suitable for inertia always changing occasions.

3: vibration suppression mode 3: set the vibration frequency manually, suitable for vibration frequency familiar occasions.

P224 Index 2218h	Set the vibration cycle manually					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT16	RO	Yes	0～1000	0	ms

- When the vibration suppression mode (P223) is set to 3, this parameter is used to set the vibration period that needs to be suppressed.

P226 Index 无	Intermediate frequency vibration frequency					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT	RO	Yes	50～1500	100	Hz

- The intermediate frequency vibration suppression switch is effective when opening (P229 is not 0).
- The frequency point manual setting mode (P229=1) needs to find the intermediate frequency vibration point through the servo host computer software FFT function. This parameter is valid for software version V12.22/V13.22 above.

P227 Index 无	Compensation factor of intermediate frequency suppression					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT	RO	Yes	1～1000	100	%

- It is recommended to first use the Fn1 function to determine the load inertia.
- If the servo inertia (P017) set appropriately, this parameter is recommended to set to 100.
- If the inertia can not be deduced, the value is inversely proportional to the actual load inertia.
- This parameter is valid for software version V12.22/V13.22 above.

P228 Index 无	Damping coefficient of intermediate frequency suppression					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT	RO	Yes	0～300	0	%

- Increasing damping coefficient can improve the anti vibration effect, but the damping coefficient will increase the vibration.
- This parameter is valid for software version V12.22/V13.22 above.

P229 Index 无	Medium frequency vibration suppression switch					
Sub Index	Data Type	Access	PDO Mapping	Setting Range	Initial Value	Unit
0	INT	RO	Yes	0～1	0	

- Parameter significance:
- 0: null and void
- 1: manual settings
- 2: automatic setting
- This parameter is valid for software version V12.22/V13.22 above.

5.4.4 Parameters of section 3

P300	Drive ID number	Range	Default value	Unit	Usage
		0～128	0		ALL

- Setting the site name by this parameter, after the parameter changes, you must save the parameters into the EEPROM and turn off the drive power.Then reconnect to the power, which is effective.
- The use of EtherCAT sites depends on the EtherCAT master station. When using sequential addressing, the station number of the slave station is allocated in sequence by the EtherCAT master station. The name of the site is setted invalid. When setting the address, the EtherCAT master station reads the slave station address from the station site name, and the site name needs to be setted to non zero values. In the same network, each drive needs to be setted to a different site alias.

P304	EtherCAT mode switch	Range	Default value	Unit	Usage
		0～1	1		ALL

- Select EtherCAT mode or common mode by this parameter, select ordinary mode when the value is 0, users can test the machine operation in this mode to detect the hardware problem; when the value is 1, select the EtherCAT mode and operate with the EtherCAT master station in this mode.
- Parameter significance: 0: general mode; 1:EtherCAT mode.

P306	CSP CSP pattern type	Range	Default value	Unit	Usage
		0～2	2		ALL

- Through this parameter, the connection mode between the lower line segment of the CSP mode is selected. When the value is 0, the connection between the two displacement lines is selected and the acceleration is continuous. The acceleration mutation is avoided. When the value is 1, the speed continuity is completed between the two displacement lines, and the speed change is avoided; the value is 2 when the value is 2. Considering whether the acceleration and speed between two segments are continuous, each line segment can be interpolated by means of linear equating.
- Parameter significance:
  0: the continuous acceleration of acceleration;
  1: the speed continuous mode transition;
  2: direct transition, linear division between line segments.

5.5 DI function explanation in details

Please refer to the "6.5.3 digital input / digital output" for details. The following table is a functional description of IO.

<table>
<tr><th>No</th><th>Symbol</th><th>Function</th><th>Function explanation</th></tr>
<tr><td>0</td><td>NULL</td><td>No function</td><td>The input condition does not have any influence to the system.</td></tr>
<tr><td>2</td><td>ARST</td><td>Clear alarm</td><td>When an alarm occurs and the alarm has permission to clear, then the rising edge (from OFF becomes ON) of input signal ARST will clear the alarm. Attention: only a part of alarm can have the permission to clear.</td></tr>
<tr><td>3</td><td>CCWL</td><td>CCW drive inhibition</td><td>OFF： Inhibit CCW running;
ON： Enable CCW running
Uses this function for protection of the mechanical traveling limit, the function is controlled by the parameter P097. Pays attention to that the P097 default value neglects this function, therefore needs to modify P097 if needs to use this function:
<table>
<tr><th>P097</th><th>Explanation</th></tr>
<tr><td>0</td><td rowspan="2">Use CCW prohibition function and must connect the normally closed contact of the limit switch.</td></tr>
<tr><td>2</td></tr>
<tr><td>1</td><td rowspan="2">Neglect CCW prohibition function, this signal does not have any influence to CCW movement of the servomotor, and therefore does not need the CCWL wiring.</td></tr>
<tr><td>3(Default)</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No</th><th>Symbol</th><th>Function</th><th>Function explanation</th></tr>
<tr><td>4</td><td>CWL</td><td>CW drive inhibition</td><td>OFF：Inhibit CW running;
ON ： Enable CW running.
Uses this function for protection of the mechanical traveling limit, the function is controlled by the parameter P097. Pays attention to that the P097 default value neglects this function, therefore needs to modify P097 if needs to use this function:
<table>
<tr><th>P097</th><th>Explanation</th></tr>
<tr><td>0</td><td rowspan="2">Use CW prohibition function and must connect the normally closed contact of the limit switch.</td></tr>
<tr><td>1</td></tr>
<tr><td>2</td><td rowspan="2">Neglect CW prohibition function, this signal does not have any influence to CW movement of the servomotor, and therefore does not need the CWL wiring.</td></tr>
<tr><td>3(default)</td></tr>
</table></td></tr>
<tr><td>15</td><td>EMG</td><td>Emergency shutdown</td><td>OFF: allow the servo driver to work;
ON: the motor is stopped according to the P164 parameters.</td></tr>
<tr><td>23</td><td>HOME SWITCH</td><td>Origin return Reference test</td><td>Source point regression external reference point</td></tr>
</table>