Servo Drive Parameters

Contents of this Chapter...

Parameter Overview and Note Symbols

Parameter Groups

The SureServo® drive has five parameter groups:

- *Group 0: Monitor parameters* *(example: P0-xx)*
- *Group 1: Basic parameters* *(example: P1-xx)*
- *Group 2: Extension parameters* *(example: P2-xx)*
- *Group 3: Communication parameters* *(example: P3-xx)*
- *Group 4: Diagnostic parameters* *(example: P4-xx)*

Reset Parameter Defaults

To reset the parameters to the factory default values, set parameter P2-08 to 10.

The following parameters do not return to factory default values after setting P2-08 to 10: P0-04 ~ P0-08, P0-18, P1-31.

Parameters P2-10 ~ P2-22 may or may not return to factory default values when switching control modes, depending upon the setting of P1-01. Refer to P1-01 for details regarding how these parameters are defaulted.

Parameter Firmware Versions

Some parameters and settings are available or changed only in later firmware versions of SureServo drives. Check P0-00 to determine which firmware version you have. Refer to Appendix C for further information regarding changes in latest firmware.

Parameters/settings available/changed in higher firmware versions

Firmware v2.10 Changes:

- *P0-02: modified*
- *P0-17: new parameter*
- *P1-33: new settings 7 and 8*
- *P1-56: new parameter*
- *P2-10~P2-17: modified*
- *P2-18~P2-22: new setting 10*
- *P2-32: modified*
- *P2-64: new parameter*
- *P2-65: new parameter*
- *P3-08: new parameter*
- *P4-07: modified*

Firmware v2.105 Changes:

- *P0-18: new parameter*

Parameter Summary

Parameter Summary Listings

Parameter values are in decimal format unless otherwise indicated by "h" for hexadecimal.

Abbreviations of Control Modes

- *P: Position control mode*
- *T: Torque control mode*
- *V: Velocity control mode*

Group 0: Monitor Parameters									
Parameter	***Note***	***Description***	***Control Mode***			***Range***	***Units***	***Default***	***Customer Setting***
			P	***V***	***T***				
P0-00	1,5	Firmware Version	Y	Y	Y	(factory setting)	–	varies	
P0-01	1	Drive Fault Code	Y	Y	Y	0~22	–	N/A	
*P0-02	–	Drive Status (Front Panel Display)	Y	Y	Y	0~16	–	0	
P0-03	–	Analog Monitor Outputs	Y	Y	Y	0~55	–	1	
P0-04	5	Status Monitor 1	Y	Y	Y	0~16	–	0	
P0-05	5	Status Monitor 2	Y	Y	Y	0~16	–	0	
P0-06	5	Status Monitor 3	Y	Y	Y	0~16	–	0	
P0-07	5	Status Monitor 4	Y	Y	Y	0~16	–	0	
P0-08	5	Status Monitor 5	Y	Y	Y	0~16	–	0	
P0-09	7	Block Transfer Parameter 1	Y	Y	Y	100~417 [h]	–	407[h]	
P0-10	7	Block Transfer Parameter 2	Y	Y	Y	100~417 [h]	–	10F[h]	
P0-11	7	Block Transfer Parameter 3	Y	Y	Y	100~417 [h]	–	110[h]	
P0-12	7	Block Transfer Parameter 4	Y	Y	Y	100~417 [h]	–	224[h]	
P0-13	7	Block Transfer Parameter 5	Y	Y	Y	100~417 [h]	–	111[h]	
P0-14	7	Block Transfer Parameter 6	Y	Y	Y	100~417 [h]	–	112[h]	
P0-15	7	Block Transfer Parameter 7	Y	Y	Y	100~417 [h]	–	225[h]	
P0-16	7	Block Transfer Parameter 8	Y	Y	Y	100~417 [h]	–	109[h]	
*P0-17	1	Output Functions Status	Y	Y	Y	0~1FF [h]	–	0	
*P0-18	1,5	Servo On Time Record	Y	Y	Y	0~65535	hr	0	
** Some parameters vary by firmware version. Refer to Appendix C for revision details.*									

Notes:
1) Read-only register.
2) Parameter cannot be set when the servo drive is enabled.
3) Parameter is effective only after power to the servo drive has been cycled.
4) Parameter setting not written to drive flash memory; not retained when power is off.
5) Parameter does not return to factory default when P2-08 is set to 10.
6) Parameter may or may not return to factory default when switching control modes, depending upon P1-01 setting.
7) Block Transfer Parameters and Status Monitor Parameters must be entered from the drive keypad.

Group 1: Basic Parameters									
Parameter	*Note*	*Description*	*Control Mode*			*Range*	*Units*	*Default*	*Customer Setting*
			P	*V*	*T*				
P1-00	2	External Pulse Type Input	Y	–	–	0~132	–	2	
P1-01	3	Control Mode and Output Direction	Y	Y	Y	0~1110	–	0	
P1-02	2	Velocity and Torque Limit	Y	Y	Y	0~11	–	0	
P1-03	–	Output Polarity Setting	Y	Y	Y	0~13	–	0	
P1-04	–	Analog Monitor Output Scaling 1 (ch 1)	Y	Y	Y	0~100	%	100	
P1-05	–	Analog Monitor Output Scaling 2 (ch 2)	Y	Y	Y	0~100	%	100	
P1-06	–	Analog Velocity Command Low-pass Filter	–	Y	–	0~1000	ms	0	
P1-07	–	Analog Torque Command Low-pass Filter	–	–	Y	0~1000	ms	0	
P1-08	–	Position Command Low-pass Filter	Y	–	–	0~1000	10 ms	0	
P1-09	–	Velocity Command 1 (V mode)	–	Y	–	±5000	rpm	100	
	–	Velocity Limit 1 (T mode)	–	–	Y				
P1-10	–	Velocity Command 2 (V mode)	–	Y	–			200	
	–	Velocity Limit 2 (T mode)	–	–	Y				
P1-11	–	Velocity Command 3 (V mode)	–	Y	–			300	
	–	Velocity Limit 3 (T mode)	–	–	Y				
P1-12	–	Torque Command 1 (T mode)	–	–	Y	±300	%	100	
	–	Torque Limit 1 (P, V modes)	Y	Y	–				
P1-13	–	Torque Command 2 (T mode)	–	–	Y			100	
	–	Torque Limit 2 (P, V modes)	Y	Y	–				
P1-14	–	Torque Command 3 (T mode)	–	–	Y			100	
	–	Torque Limit 3 (P, V modes)	Y	Y	–				
P1-15	–	Position Command 1 (revolutions)	Y	–	–	±30,000	revs	0	
P1-16	–	Position Command 1 (counts)	Y	–	–	±10,000	counts		
P1-17	–	Position Command 2 (revolutions)	Y	–	–	±30,000	revs	0	
P1-18	–	Position Command 2 (counts)	Y	–	–	±10,000	counts		
P1-19	–	Position Command 3 (revolutions)	Y	–	–	±30,000	revs	0	
P1-20	–	Position Command 3 (counts)	Y	–	–	±10,000	counts		
P1-21	–	Position Command 4 (revolutions)	Y	–	–	±30,000	revs	0	
P1-22	–	Position Command 4 (counts)	Y	–	–	±10,000	counts		
P1-23	–	Position Command 5 (revolutions)	Y	–	–	±30,000	revs	0	
P1-24	–	Position Command 5 (counts)	Y	–	–	±10,000	counts		
P1-25	–	Position Command 6 (revolutions)	Y	–	–	±30,000	revs	0	
P1-26	–	Position Command 6 (counts)	Y	–	–	±10,000	counts		
P1-27	–	Position Command 7 (revolutions)	Y	–	–	±30,000	revs	0	
P1-28	–	Position Command 7 (counts)	Y	–	–	±10,000	counts		
P1-29	–	Position Command 8 (revolutions)	Y	–	–	±30,000	revs	0	
P1-30	–	Position Command 8 (counts)	Y	–	–	±10,000	counts		
P1-31	5	Motor Code: SVA-2040 (100~400W)	Y	Y	Y	10, 11, 12	–	10	
		Motor Code: SVA-2100 (750W~1kW)	Y	Y	Y	20, 21, 22	–	20	
		Motor Code: SVA-2300 (2~3kW)	Y	Y	Y	30, 31	–	30	
P1-32	–	Motor Stop Mode Selection	Y	Y	Y	0~11	–	0	
*P1-33	3	Position Control Mode (when using internal indexer)	Y	–	–	0~8	–	0	
P1-34	–	Acceleration Time (when using internal indexer)	Y	Y	–	1~20,000	ms	200	
P1-35	–	Deceleration Time (when using internal indexer)	Y	Y	–	1~20,000	ms	200	

(table continued next page)

Group 1: Basic Parameters (table continued from previous page)									
Parameter	Note	Description	Control Mode			Range	Units	Default	Customer Setting
			P	V	T				
P1-36	–	Acceleration/Deceleration S-curve	Y	Y	–	0~10,000	ms	0	
P1-37	–	Inertia Mismatch Ratio	Y	Y	Y	0-200.0	–	5.0	
P1-38	–	Zero Velocity Output Threshold	Y	Y	Y	0~200	rpm	10	
P1-39	–	Target Velocity Output Threshold	Y	Y	Y	0~5000	rpm	3000	
P1-40	2	Analog Full Scale Velocity Command/Limit	Y	Y	Y	0~10,000	rpm	rated	
P1-41	2	Analog Full Scale Torque Command/Limit	Y	Y	Y	0~1000	%	100	
P1-42	–	On Delay Time of Electromagnetic Brake	Y	Y	Y	0~1000	ms	20	
P1-43	–	Off Delay Time of Electromagnetic Brake	Y	Y	Y	0~1000	ms	20	
P1-44	–	Electronic Gear Numerator 1	Y	–	–	1~32,767	counts	1	
P1-45	–	Electronic Gear Denominator	Y	–	–	1~32,767	counts	1	
P1-46	2	Encoder Output Scaling Factor	Y	Y	Y	1~125; 10,020~12,500	–	1	
P1-47	–	Homing Mode	Y	–	–	0~1225	–	0	
P1-48	–	Homing Velocity 1 – Fast Search Velocity	Y	–	–	1~2000	rpm	1000	
P1-49	–	Homing Velocity 2 – Creep Velocity	Y	–	–	1~500	rpm	50	
P1-50	–	Home Position Offset (revolutions)	Y	–	–	±30,000	revs	0	
P1-51	–	Home Position Offset (counts)	Y	–	–	±10,000	counts	0	
P1-52	–	Regenerative Resistor Value	Y	Y	Y	10~750	Ohms	20, 40	
P1-53	–	Regenerative Resistor Capacity	Y	Y	Y	30~1000	W	60, 120	
P1-54	–	In Position Window	Y	–	–	0~10,000	counts	100	
P1-55	–	Maximum Velocity Limit	Y	Y	Y	0~max velocity	rpm	rated	
*P1-56	–	Overload Output Warning Threshold	Y	Y	Y	0~120	%	120	
** Some parameters vary by firmware version. Refer to Appendix C for revision details.*									

Notes:
1) Read-only register.
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3) Parameter is effective only after power to the servo drive has been cycled.
4) Parameter setting not written to drive flash memory; not retained when power is off.
5) Parameter does not return to factory default when P2-08 is set to 10.
6) Parameter may or may not return to factory default when switching control modes, depending upon P1-01 setting.
7) Block Transfer Parameters and Status Monitor Parameters must be entered from the drive keypad.

Group 2: Extended Parameters									
Parameter	Note	Description	Control Mode			Range	Units	Default	Customer Setting
			P	V	T				
P2-00	–	Position Loop Proportional Gain (KPP)	Y	–	–	0~1023	rad/s	35	
P2-01	–	Position Loop Gain Boost	Y	–	–	10~500	%	100	
P2-02	–	Position Feed Forward Gain (KFF)	Y	–	–	10~20,000	0.0001	5000	
P2-03	–	Smooth Constant of Position Feed Forward Gain	Y	–	–	2~100	ms	5	
P2-04	–	Velocity Loop Proportional Gain (KVP)	Y	Y	–	0~20,000	rad/s	500	
P2-05	–	Velocity Loop Gain Boost	Y	Y	–	10~500	%	100	
P2-06	–	Velocity Loop Integral Compensation (KVI)	Y	Y	–	0~4095	–	100	
P2-07	–	Velocity Feed Forward Gain (KVF)	–	Y	–	0~20,000	0.0001	0	
P2-08	4	Factory Defaults and Password	Y	Y	Y	0~65,535	–	0	
P2-09	–	Debounce Filter (Contact Suppression)	Y	Y	Y	0~20	2ms	2	
*P2-10	6	Digital Input Terminal 1 (DI1)	Y	Y	Y	0~145	–	101	
*P2-11	6	Digital Input Terminal 2 (DI2)						104	
*P2-12	6	Digital Input Terminal 3 (DI3)						116	
*P2-13	6	Digital Input Terminal 4 (DI4)						117	
*P2-14	6	Digital Input Terminal 5 (DI5)						102	
*P2-15	6	Digital Input Terminal 6 (DI6)						22	
*P2-16	6	Digital Input Terminal 7 (DI7)						23	
*P2-17	6	Digital Input Terminal 8 (DI8)						21	
*P2-18	6	Digital Output Terminal 1 (DO1)	Y	Y	Y	0~110	–	101	
*P2-19	6	Digital Output Terminal 2 (DO2)						103	
*P2-20	6	Digital Output Terminal 3 (DO3)						109	
*P2-21	6	Digital Output Terminal 4 (DO4)						105	
*P2-22	6	Digital Output Terminal 5 (DO5)						7	
P2-23	–	Notch Filter (Resonance Suppression)	Y	Y	Y	50~1000	Hz	1000	
P2-24	–	Notch Filter Attenuation (Resonance Supp.)	Y	Y	Y	0~32	dB	0	
P2-25	–	Low-pass Filter (Resonance Suppression) SVA-2040	Y	Y	Y	0~1000	ms	2	
	–	Low-pass Filter (Resonance Suppression) SVA-2100, 2300	Y	Y	Y			5	
P2-26	–	External Anti-Interference Gain (Resonance Suppression)	Y	Y	Y	0~30,000	–	0	
P2-27	–	Gain Boost Control	Y	Y	–	0~4	–	0	
P2-28	–	Gain Boost Switching Time	Y	Y	–	0~1000	10 ms	10	
P2-29	–	Gain Boost Switching Condition	Y	Y	–	0~30,000	counts; kpps; rpm	10,000	
P2-30	2,4	Auxiliary Function	Y	Y	Y	0~5	–	0	
P2-31	–	Auto and Easy Tuning Mode Response Level	Y	Y	Y	0~FF [h]	–	44[h]	
*P2-32	2	Tuning Mode	Y	Y	Y	0~5	–	0	
P2-33	–	reserved	–	–	–	–	–	–	
P2-34	–	Overspeed Fault Threshold	–	Y	–	1~5000	rpm	5000	
P2-35	–	Position Deviation Fault Window	Y	–	–	1~30,000	pulse	30,000	

(table continued next page)

Group 2: Extended Parameters (table continued from previous page)									
Parameter	Note	Description	Control Mode			Range	Units	Default	Customer Setting
			P	V	T				
P2-36	–	Position 1 Velocity	Y	–	–	1~5000	rpm	1000	
P2-37	–	Position 2 Velocity	Y	–	–			1000	
P2-38	–	Position 3 Velocity	Y	–	–			1000	
P2-39	–	Position 4 Velocity	Y	–	–			1000	
P2-40	–	Position 5 Velocity	Y	–	–			1000	
P2-41	–	Position 6 Velocity	Y	–	–			1000	
P2-42	–	Position 7 Velocity	Y	–	–			1000	
P2-43	–	Position 8 Velocity	Y	–	–			1000	
P2-44	–	Digital Output Mode	Y	–	–	0~1	–	0	
P2-45	–	Index Mode Output Signal Delay Time	Y	–	–	0~250	4 ms	1	
P2-46	–	Index Mode Stations	Y	–	–	2~32	–	6	
P2-47	–	Position Deviation Clear Delay Time	Y	–	–	0~250	20 ms	0	
P2-48	–	Backlash Compensation (Index Mode)	Y	–	–	0~10,312	pulse	0	
P2-49	–	Jitter Suppression	Y	Y	–	0~19	–	0	
P2-50	–	Clear Position Mode	Y	–	–	0~2	–	0	
P2-51	–	Servo Enable Command	Y	Y	Y	0~1	–	0	
P2-52	–	Dwell Time 1 – Auto Index Mode	Y	–	–	0.00~120.00	s	0.00	
P2-53	–	Dwell Time 2 – Auto Index Mode	Y	–	–			0.00	
P2-54	–	Dwell Time 3 – Auto Index Mode	Y	–	–			0.00	
P2-55	–	Dwell Time 4 – Auto Index Mode	Y	–	–			0.00	
P2-56	–	Dwell Time 5 – Auto Index Mode	Y	–	–			0.00	
P2-57	–	Dwell Time 6 – Auto Index Mode	Y	–	–			0.00	
P2-58	–	Dwell Time 7 – Auto Index Mode	Y	–	–			0.00	
P2-59	–	Dwell Time 8 – Auto Index Mode	Y	–	–			0.00	
P2-60	–	Electronic Gear Numerator 2	Y	–	–	1~32,767	pulse	1	
P2-61	–	Electronic Gear Numerator 3	Y	–	–			1	
P2-62	–	Electronic Gear Numerator 4	Y	–	–			1	
P2-63	–	Velocity and Position Deviation Scaling Factor	Y	Y	–	0~11	times	0	
*P2-64	–	Advanced Torque Limit Mode	Y	Y	–	0~3	–	0	
*P2-65	–	Special Input Functions	Y	Y	Y	0~FFFF [h]	bit	0	
* *Some parameters vary by firmware version. Refer to Appendix C for revision details.*									

Notes:
1) Read-only register.
2) Parameter cannot be set when the servo drive is enabled.
3) Parameter is effective only after power to the servo drive has been cycled.
4) Parameter setting not written to drive flash memory; not retained when power is off.
5) Parameter does not return to factory default when P2-08 is set to 10.
6) Parameter may or may not return to factory default when switching control modes, depending upon P1-01 setting.
7) Block Transfer Parameters and Status Monitor Parameters must be entered from the drive keypad.

Group 3: Communication Parameters									
Parameter	Note	Description	Control Mode			Range	Units	Default	Customer Setting
			P	V	T				
P3-00	–	Communication Address	Y	Y	Y	1~254	–	1	
P3-01	–	Transmission Speed	Y	Y	Y	0~5	bps	2	
P3-02	–	Communication Protocol	Y	Y	Y	0~8	–	8	
P3-03	–	Communication Fault Action	Y	Y	Y	0~1	–	0	
P3-04	–	Communication Watchdog Time Out	Y	Y	Y	0~20	s	0	
P3-05	–	Communication Selection	Y	Y	Y	0~2	–	0	
P3-06	–	reserved	–	–	–	–	–	0[h]	–
P3-07	–	Communication Response Delay Time	Y	Y	Y	0~255	0.5 ms	0	
*P3-08	–	Digital Input Software Control Mask	Y	Y	Y	0~FFFF [h]	bit	0	
** Some parameters vary by firmware version. Refer to Appendix C for revision details.*									

Notes:
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4) Parameter setting not written to drive flash memory; not retained when power is off.
5) Parameter does not return to factory default when P2-08 is set to 10.
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7) Block Transfer Parameters and Status Monitor Parameters must be entered from the drive keypad.

Group 4: Diagnostic Parameters									
Parameter	***Note***	***Description***	***Control Mode***			***Range***	***Units***	***Default***	***Customer Setting***
			P	***V***	***T***				
P4-00	1	Fault Record (N) (most recent)	Y	Y	Y	ALE01~ALE23	–	0	
P4-01	1	Fault Record (N-1)	Y	Y	Y	ALE01~ALE23	–	0	
P4-02	1	Fault Record (N-2)	Y	Y	Y	ALE01~ALE23	–	0	
P4-03	1	Fault Record (N-3)	Y	Y	Y	ALE01~ALE23	–	0	
P4-04	1	Fault Record (N-4)	Y	Y	Y	ALE01~ALE23	–	0	
P4-05	–	Jog Function [Refer to P4-05 in details section for serial comm parameter settings above 3000.]	Y	Y	Y	1~3000	rpm	20	
P4-06	2	Force Outputs Command	Y	Y	Y	00~1F [h]	–	00[h]	
*P4-07	–	Input Status (with external control)	Y	Y	Y	–	–	–	
	–	Force Input Command (with software control)	Y	Y	Y	0~FFFF [h]	bit	0[h]	
P4-08	–	reserved	–	–	–	–	–	–	–
P4-09	–	Output Status	Y	Y	Y	–	–	–	
P4-10	–	reserved	–	–	–	–	–	–	–
P4-11	–	reserved	–	–	–	–	–	–	–
P4-12	–	reserved	–	–	–	–	–	–	–
P4-13	–	reserved	–	–	–	–	–	–	–
P4-14	–	reserved	–	–	–	–	–	–	–
P4-15	–	reserved	–	–	–	–	–	–	–
P4-16	–	reserved	–	–	–	–	–	–	–
P4-17	–	reserved	–	–	–	–	–	–	–
P4-18	–	reserved	–	–	–	–	–	–	–
P4-19	–	reserved	–	–	–	–	–	–	–
P4-20	5	Analog Monitor 1 Offset (ch 1)	Y	Y	Y	±800	mV	0	
P4-21	5	Analog Monitor 2 Offset (ch 2)	Y	Y	Y	±800	mV	0	
P4-22	–	Analog Velocity Input Offset	–	Y	–	±5000	mV	0	
P4-23	–	Analog Torque Input Offset	–	–	Y	±5000	mV	0	
** Some parameters vary by firmware version. Refer to Appendix C for revision details.*									

Notes:
1) Read-only register.
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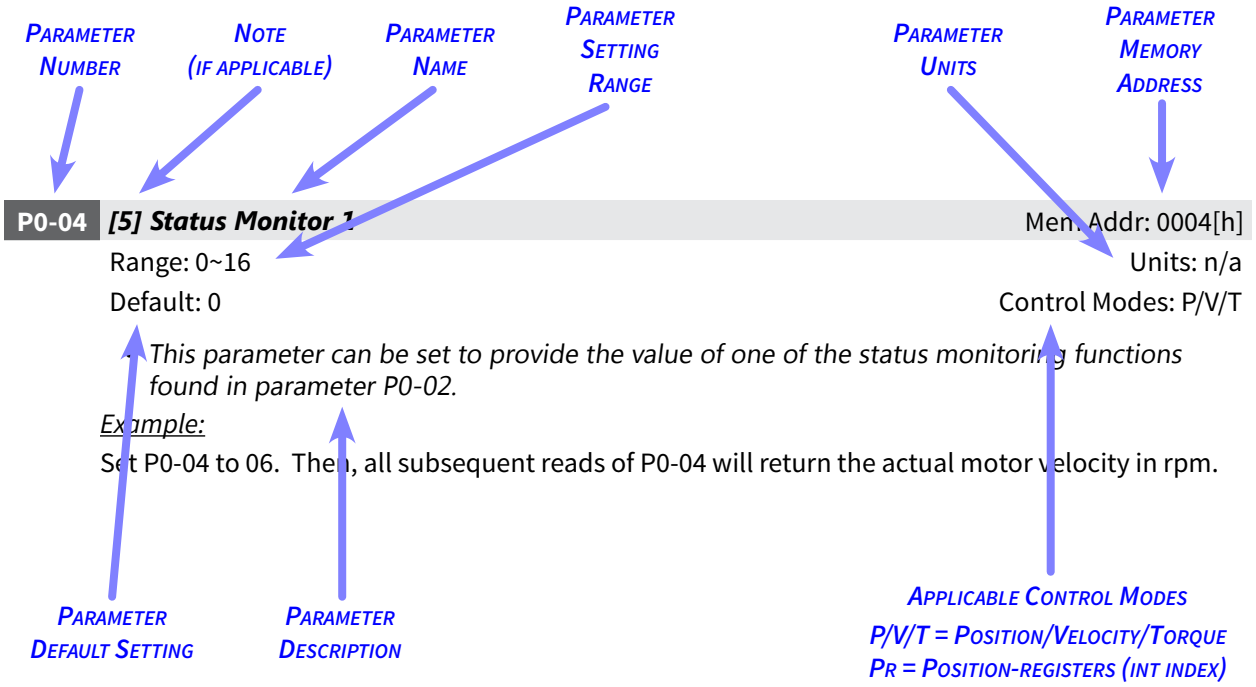
7) Block Transfer Parameters must be entered from the drive keypad.

Detailed Parameter Listings

Sample Parameter Listing



Notes:

1) Read-only register.
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7) Block Transfer Parameters must be entered from the drive keypad.

Parameter values are in decimal format unless otherwise indicated by "h" for hexadecimal.

Monitor Parameters

P0-00 ***[1] Firmware Version*** Mem Addr: 0000[h]

Range: n/a Units: n/a

Default: (factory setting) Control Modes: P/V/T

- *This parameter shows the software version of the servo drive.*

P0-01 ***[1] Drive Fault Code*** Mem Addr: 0001[h]

Range: 0~22 Units: n/a

Default: n/a Control Modes: P/V/T

- *This parameter shows the current servo drive fault, if the drive is currently faulted.*

Settings:

00	No fault occurred
01	Overcurrent
02	Overvoltage
03	Undervoltage
04	Motor overtemperature
05	Regeneration error
06	Overload
07	Overspeed
08	Abnormal pulse control command
09	Excessive deviation
10	Watchdog fault
11	Encoder fault
12	Internal Components Require Calibration
13	Fault stop
14	Reverse limit error (DI setting 22 reverse limit switch activated)
15	Forward limit error (DI setting 23 forward limit switch activated)
16	IGBT temperature error
17	Memory error (internal system error)
18	DSP communication error (internal system error)
19	Serial communication error
20	Serial communication time out
21	DSP to MCU command (internal system error)
22	Input power phase loss
23	Overload warning

P0-02 ***Drive Status (front panel display)*** Mem Addr: 0002[h]

Range: 0~16 Units: various

Default: 0 Control Modes: P/V/T

- *This parameter shows the selected servo drive status on the front display. Reading this parameter will only report the setting number. Read P0.04 ~ P0.08 for actual status values. (See Ch3 >> Display Messages >> Monitor Mode Function Display for more information.)*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

Settings:

00	Motor feedback - absolute position (counts) (10,000 counts = 1 rev)
01	Motor feedback - absolute position (revs)
02	Position command (counts)
03	Position command (revs)
04	Position error (counts)
05	Input frequency of pulse command (0.1kHz)
06	Actual motor velocity (rpm)
07	Velocity input command (V)
08	Velocity input command (rpm)
09	Torque input command (V)
10	Torque input command (%)
11	Current load (% of rated torque)
12	Peak load (% of rated torque since powerup)
13	Bus voltage
14	Ratio of load inertia to motor inertia (J_l/J_m)
15	Motor feedback - captured position (counts) (10,000 counts = 1 rev) (motor position in counts relative to the last incremental position command executed)
16	Motor feedback - captured position (revs) (motor position in revolutions relative to the last incremental position command executed)

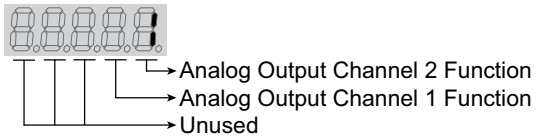
P0-03 ***Analog Monitor Outputs*** Mem Addr: 0003[h]

Range: 0~55 Units: n/a

Default: 1 Control Modes: P/V/T

- *This parameter determines the functions of the analog monitor outputs.*

Settings:



Analog Output Function Settings:

0	Motor velocity (± 8V / maximum velocity)
1	Motor torque (± 8V / maximum torque)
2	Pulse command frequency (8V / 650kpps)
3	Velocity command (± 8V / maximum velocity command)
4	Torque command (± 8V / maximum torque command)
5	DC bus voltage (± 8V / 450V)

P0-03 Example:

P0-03 = 3 (Ch2 monitors Velocity Command; Ch1 monitors Motor Velocity)

- *Ch 2:* V_{cmd} *= (max velocity cmd)(*V_{out}*/8V)(P1-04) / 100*
- *Ch 1:* V_{motor} *= (max velocity)(*V_{out}*/8V)(P1-05) / 100*

Notes:

1) Use P1-04 and P1-05 for analog output scaling.

2) The resolution for both channels is 16V / 1250 counts = 12.8 mV per count.

Status Monitor parameters P0-04 ~ P0-08 must be entered from the drive keypad.

P0-04 ***[5] Status Monitor 1*** Mem Addr: 0004[h]

P0-05 ***[5] Status Monitor 2*** Mem Addr: 0005[h]

P0-06 ***[5] Status Monitor 3*** Mem Addr: 0006[h]

P0-07 ***[5] Status Monitor 4*** Mem Addr: 0007[h]

P0-08 ***[5] Status Monitor 5*** Mem Addr: 0008[h]

Range: 0~16 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter can be set to provide the value of one of the status monitoring functions found in parameter P0-02.*

Example:

Set P0-04 to 06. Then, all subsequent reads of P0-04 will return the actual motor velocity in rpm.

P0-09	***Block Transfer Parameter 1***	Mem Addr: 0009[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 407[h] (address for P4-07)	Control Modes: P/V/T
P0-10	***Block Transfer Parameter 2***	Mem Addr: 000A[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 10F[h] (address for P1-15)	Control Modes: P/V/T
P0-11	***Block Transfer Parameter 3***	Mem Addr: 000B[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 110[h] (address for P1-16)	Control Modes: P/V/T
P0-12	***Block Transfer Parameter 4***	Mem Addr: 000C[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 224[h] (address for P2-36)	Control Modes: P/V/T
P0-13	***Block Transfer Parameter 5***	Mem Addr: 000D[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 111[h] (address for P1-17)	Control Modes: P/V/T
P0-14	***Block Transfer Parameter 6***	Mem Addr: 000E[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 112[h] (address for P1-18)	Control Modes: P/V/T
P0-15	***Block Transfer Parameter 7***	Mem Addr: 000F[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 225[h] (address for P2-37)	Control Modes: P/V/T
P0-16	***Block Transfer Parameter 8***	Mem Addr: 0010[h]
	Range: 100~417 [h] (address for P1-00 ~ P4-23)	Units: n/a
	Default: 109[h] (address for P1-09)	Control Modes: P/V/T

- *The block transfer parameters P0-09 through P0-16 are used to "group" parameters together consecutively for efficient access via block transfers when using Modbus communications. Use the **keypad** to enter the **hexadecimal** memory **address** of the desired parameter number (i.e. enter P1-15 as 10F; P4-07 as 407) into the block transfer parameter. Serial communication (Modbus) reads and writes will affect the block transfer parameter's data; not the address.*

Block Transfer Parameters P0-09 ~ P0-16 must be entered from the drive keypad.

P0-17 ***[1] Output Function Status*** Mem Addr: 0011[h]

Range: 0~1FF [h] Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter allows you to read the status of the DO Functions via MODBUS communications, regardless of whether or not those functions are assigned to physical digital outputs (DO1~DO5).*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

DO Functions Indications:

bit 0	Servo Ready (no faults)
bit 1	Servo On (enabled)
bit 2	At Zero Velocity
bit 3	At Velocity Reached
bit 4	At Position
bit 5	At Torque Limit
bit 6	Overload Warning
bit 7	Active Fault
bit 8	Electromagnetic Brake Control
bit 9~15	reserved

P0-18 ***[1][5] Servo On Time Record*** Mem Addr: 0012[h]

Range: 0 ~ 65,535 Units: hr

Default: 0 Control Modes: P/V/T

- *This parameter stores and displays the total time that the servo drive is ON. It is written to EEPROM once per hour.*

Basic Parameters

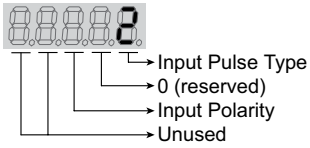
P1-00 ***[2] External Pulse Input Type*** Mem Addr: 0100[h]

Range: 0~132 Units: n/a

Default: 2 Control Modes: P

- *This parameter determines the input pulse type and polarity.*

Settings:



Input Pulse Type Settings:

0 Quadrature Input

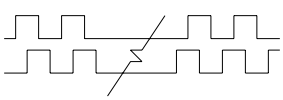
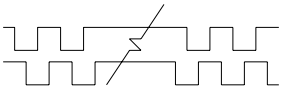
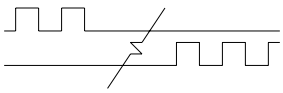
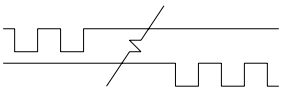
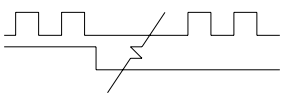
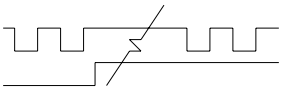
1 Clockwise (CW) and Counterclockwise (CCW) Pulse Inputs

2 Pulse and Direction Inputs

Input Polarity Settings:

0 Positive Logic (Active High)

1 Negative Logic (Active Low)

Pulse Type	***Polarity***			
	0 = Positive Logic		***1 = Negative Logic***	
	Forward	***Reverse***	***Forward***	***Reverse***
Quad				
CW & CCW				
Pulse & Direction				

Input Pulse Interface	***Maximum Input Pulse Frequency***
Line Driver	500 kpps
Open Collector	200 kpps

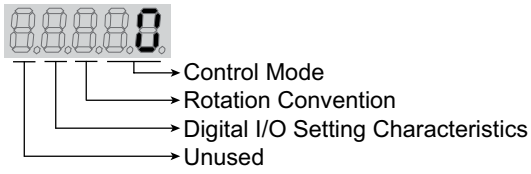
P1-01 ***[3] Control Mode and Output Direction*** Mem Addr: 0101[h]

Range: 0~1110 Units: n/a

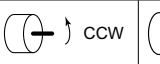
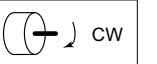
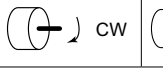
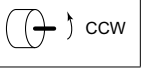
Default: 0 Control Modes: P/V/T

- *This parameter determines the control mode and output direction.*

Settings:



Control Mode											
Mode	***Mode Description***	***Control Mode Settings***										
		00	***01***	***02***	***03***	***04***	***05***	***06***	***07***	***08***	***09***	***10***
Pt	Position Control (external command)	X	-	-	-	-	-	X	X	-	-	-
Pr	Position Control (internal command)	-	X	-	-	-	-	-	-	X	X	-
V	Velocity Control (internal or external command)	-	-	X	-	-	-	X	-	X	-	X
T	Torque Control (internal or external command)	-	-	-	X	-	-	-	X	-	X	X
Vz	Zero Velocity Control (internal command)	-	-	-	-	X	-	-	-	-	-	-
Tz	Zero Torque Control (internal command)	-	-	-	-	-	X	-	-	-	-	-
Note: For detailed mode descriptions, refer to the "SureServo Control Modes of Operation" table in Chapter 5 of this manual.												

Rotation Convention		
Direction	***Rotation Settings***	
	0	***1***
Forward		
Reverse		

Digital I/O Setting Characteristics	
Characteristic Settings	***Settings of P2-10~P2-22 digital I/O functions when switching to new control mode***
0	retain previous settings
1	change to default settings of new mode

P1-02 *[2] Velocity and Torque Limit*

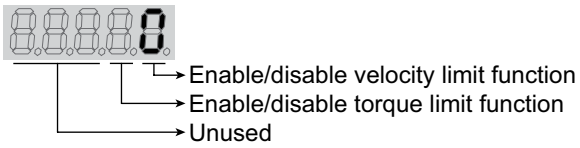
Mem Addr: 0102[h]

Range: 0~11 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter determines whether the Velocity and Torque Limit functions are enabled or disabled. The source of the limit command (analog input or preset parameter) is then selected by the applicable Command Select digital input.*
- *For Torque Limits in modes P and V, analog input and preset parameter limits can be used simultaneously by setting this parameter in conjuntion with P2-64.*

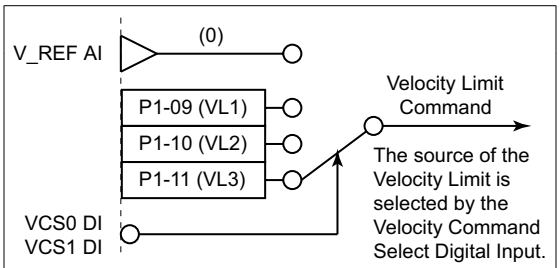
Settings:



Velocity Limit Function Settings:

0 Disable velocity limit function

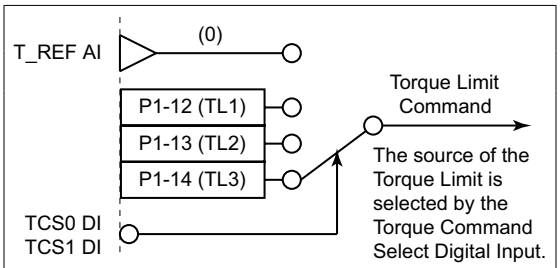
1 Enable velocity limit function (valid only in torque mode)



Torque Limit Function Settings:

0 Disable torque limit function

1 Enable torque limit function (valid only in position and velocity modes)



Velocity Limit Selection (Torque Mode)			
DI Signal		*Velocity Limit Source*	*Range*
VCS1(15)	*VCS0(14)*		
0	0	V_REF AI (T mode)	±10V
		Limit = 0 (Tz mode)	0
0	1	P1-09	±5000rpm
1	0	P1-10	±5000rpm
1	1	P1-11	±5000rpm
VCS = Velocity Command Select DI function; P2-10~P2-17 settings 14 (VCS0) & 15 (VCS1).			

Torque Limit Selection (Position & Velocity Modes)			
DI Signal		*Torque Limit Source*	*Range*
TCS1(17)	*TCS0(16)*		
0	0	T_REF AI (Pt, V modes)	±10V
		Limit = 0 (Pr, Vz modes)	0
0	1	P1-12	±300%
1	0	P1-13	±300%
1	1	P1-14	±300%
TCS = Torque Command Select DI function; P2-10~P2-17 settings 16 (TCS0) & 17 (TCS1).			

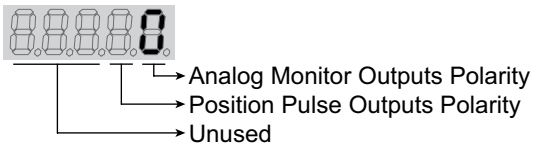
P1-03 ***Output Polarity Setting*** Mem Addr: 0103[h]

Range: 0~13 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter determines the polarity of the Analog Monitor Outputs and Position Pulse Outputs. The Analog Monitor Outputs can be individually configured with different polarities, but the Position Pulse Outputs must each have the same polarity.*

Settings:



Analog Monitor Outputs Polarity Settings:

0 Analog Monitor Output 1 = (+); Analog Monitor Output 2 = (+)

1 Analog Monitor Output 1 = (+); Analog Monitor Output 2 = (-)

2 Analog Monitor Output 1 = (-); Analog Monitor Output 2 = (+)

3 Analog Monitor Output 1 = (-); Analog Monitor Output 2 = (-)

Position Pulse Outputs Polarity Settings:

0 Forward (Output direction is same as motor rotation per P1-01)

1 Reverse (Output direction is opposite of motor rotation per P1-01)

P1-04 ***Analog Monitor Output Scaling 1 (ch 1)*** Mem Addr: 0104[h]

Range: 0~100 Units: %

Default: 100 Control Modes: P/V/T

- *This parameter scales the output monitor voltage with respect to the full scaling of the variable being monitored.*

P1-04 Example: (For P0-03 = 00; motor max velocity = 5000rpm)

1) If P1-04 = 100, then the ±8V AO range represents ±5000rpm
2) If P1-04 = 50, then the ±8V AO range represents ±2500rpm

P1-05 ***Analog Monitor Output Scaling 2 (ch 2)*** Mem Addr: 0105[h]

Range: 0~100 Units: %

Default: 100 Control Modes: P/V/T

- *Refer to P1-04 for explanation of Analog Monitor Output Scaling parameters.*

P1-06 ***Analog Velocity Command Low-Pass Filter*** Mem Addr: 0106[h]

Range: 0~1000 (0 = disable) Units: ms

Default: 0 Control Modes: V

- *This parameter determines the maximum frequency that is allowed to pass into the velocity control loop. Increasing the parameter value lowers the maximum frequency. (The maximum frequency is the reciprocal of this parameter.)*
  $f = 1 / t$
- *Example: Setting P1-06 = 1 allows 1kHz and lower frequencies to pass:*
  $f_{max} = 1 / (P1\text{-}06) = 1 / 0.001s = 1kHz$
- *Setting this parameter value too high may result in sluggish responses to setpoint command changes.*

P1-07 ***Analog Torque Command Low-Pass Filter*** Mem Addr: 0107[h]

Range: 0~1000 (0 = disable) Units: ms

Default: 0 Control Modes: T

- *Refer to P1-06 for explanation of Analog Command Low-Pass Filter parameters.*

P1-08 Position Command Low-Pass Filter Mem Addr: 0108[h]

Range: 0~1000 (0 = disable) Units: 10 ms

Default: 0 Control Modes: P

- *This parameter sets the length of time that changes in Position Commands take to reach the position control loop. By the default setting (0), any Position Command will be instantaneously applied to the control loop.*

Refer to the "Control Modes of Operation..." chapter for further information.

P1-09 ***Velocity Command 1 (Velocity Mode)*** ***Velocity Limit 1 (Torque Mode)*** Mem Addr: 0109[h]

Range: ±5000 Units: rpm

Default: 100 Control Modes: V/T

- *When in Velocity Mode using the Internal Indexer, this parameter sets Velocity Command #1.*
- *When in Torque Mode using the Internal Indexer, this parameter sets Velocity Limit #1.*

Velocity Command/Limit Source Selection:

Velocity Command/Limit Source Selection			
DI Signal		***Velocity Command Source***	***Velocity Limit Source***
VCS1 (15)	***VCS0 (14)***		
Off	Off	V Mode: V_REF analog input Vz Mode: Velocity = 0 (no drift)	T Mode: V_REF analog input Tz Mode: Limit = 0
Off	On	P1-09	
On	Off	P1-10	
On	On	P1-11	
VCS = Velocity Command Select DI function; P2-10~P2-17 settings 14 (VCS0) & 15 (VCS1).			

Note: The Velocity Command/Limit parameters P1-09~P1-11 can be scaled using parameter P2-63.

P1-10 ***Velocity Command 2 (Velocity Mode)*** ***Velocity Limit 2 (Torque Mode)*** Mem Addr: 010A[h]

Range: ±5000 Units: rpm

Default: 200 Control Modes: V/T

- *Velocity Command #2.*
- *Velocity Limit #2.*
- *Refer to P1-09 for further explanation and note.*

P1-11 ***Velocity Command 3 (Velocity Mode)*** ***Velocity Limit 3 (Torque Mode)*** Mem Addr: 010B[h]

Range: ±5000 Units: rpm

Default: 300 Control Modes: V/T

- *Velocity Command #3.*
- *Velocity Limit #3.*
- *Refer to P1-09 for further explanation and note.*

P1-12 ***Torque Command 1 (Torque Mode)***
Torque Limit 1 (Position/Velocity Modes)

Mem Addr: 010C[h]

Range: ±300 Units: %

Default: 100 Control Modes: P/V/T

- *When in Torque Mode using the Internal Indexer, this parameter sets Torque Command #1.*
- *When in Position or Velocity Modes using the Internal Indexer, this parameter sets Torque Limit #1. When used in conjunction with P2-64 Advanced Torque Limit, P1-12 sets the Negative Torque Limit.*
- *Parameters P1-12 through P1-14 set the thresholds that are used to determine when the Torque Limit digital output becomes active. Parameters P2-19 through P2-22 assign the digital output functions.*

Torque Command/Limit Source Selection:

Torque Command/Limit Source Selection			
DI Signal:		***Torque Command Source***	***Torque Limit Source***
TCS1 (17)	***TCS0 (16)***		
Off	Off	T Mode: T_REF analog input Tz Mode: Torque = 0	Pt, V Modes: T_REF analog input Pr, Vz Modes: Limit = 0
Off	On	P1-12	
On	Off	P1-13	
On	On	P1-14	
TCS = Torque Command Select DI function; P2-10~P2-17 settings 16 (TCS0) & 17 (TCS1).			

P1-13 ***Torque Command 2 (Torque Mode)***
Torque Limit 2 (Position/Velocity Modes)

Mem Addr: 010D[h]

Range: ±300 Units: %

Default: 100 Control Modes: P/V/T

- *Torque Command #2.*
- *Torque Limit #2.*
- *Positive Torque Limit in P or V Modes when used in conjunction with P2-64.*
- *Refer to P1-12 for further explanation and note.*

P1-14 ***Torque Command 3 (Torque Mode)***
Torque Limit 3 (Position/Velocity Modes)

Mem Addr: 010E[h]

Range: ±300 Units: %

Default: 100 Control Modes: P/V/T

- *Torque Command #3.*
- *Torque Limit #3.*
- *Refer to P1-12 for further explanation and note.*

Parameters P1-15 ~ P1-30 are associated with Position Register (Pr) mode in the servo. Refer to Chapter 5, Command Source of Pr Position Control Mode (page 6) for further details.

P1-15 Position 1 Command (Revolutions)

Mem Addr: 010F[h]

Range: ± 30,000 — Units: revs

Default: 0 — Control Modes: Pr

- *This parameter sets the number of revolutions for Position 1 Command when using the Internal Indexer. Refer to P1-16 for Position Command (counts).*

Position Command selection:

Position Command Pr Source Selection							
DI Signal			Position Command Parameters	DI Signal			Position Command Parameters
PCS2(13)	PCS1(12)	PCS0(11)		PCS2(13)	PCS1(12)	PCS0(11)	
Off	Off	Off	P1-15, P1-16	On	Off	Off	P1-23, P1-24
Off	Off	On	P1-17, P1-18	On	Off	On	P1-25, P1-26
Off	On	Off	P1-19, P1-20	On	On	Off	P1-27, P1-28
Off	On	On	P1-21, P1-22	On	On	On	P1-29, P1-30

Note: Pt mode accepts pulse inputs.
PCS = Position Command Select DI function; P2-10~P2-17 settings 11 (PCS0), 12 (PCS1), 13 (PCS2).

P1-16 Position 1 Command (Counts)

Mem Addr: 0110[h]

Range: ± 10,000 — Units: encoder counts

Default: 0 — Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 1 Command when using the Internal Indexer. Refer to P1-15 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 1 as follows:

- *Pos 1 Command = [(P1-15) (10,000)] + (P1-16)*

Example: For 1.5 revolutions, set P1-15 = 1, and set P1-16 = 5000.

P1-17 Position 2 Command (Revolutions)

Mem Addr: 0111[h]

Range: ± 30,000 — Units: revs

Default: 0 — Control Modes: Pr

- *This parameter sets the number of revolutions for Position 2 Command when using the Internal Indexer. Refer to P1-18 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-18 Position 2 Command (Counts)

Mem Addr: 0112[h]

Range: ± 10,000 — Units: encoder counts

Default: 0 — Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 2 Command when using the Internal Indexer. Refer to P1-17 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 2 as follows:

- *Pos 2 Command = [(P1-17) (10,000)] + (P1-18)*

P1-19 ***Position 3 Command (Revolutions)*** Mem Addr: 0113[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 3 Command when using the Internal Indexer. Refer to P1-20 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-20 ***Position 3 Command (Counts)*** Mem Addr: 0114[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 3 Command when using the Internal Indexer. Refer to P1-19 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 3 as follows:

- *Pos 3 Command = [(P1-19) (10,000)] + (P1-20)*

P1-21 ***Position 4 Command (Revolutions)*** Mem Addr: 0115[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 4 Command when using the Internal Indexer. Refer to P1-22 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-22 ***Position 4 Command (Counts)*** Mem Addr: 0116[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 4 Command when using the Internal Indexer. Refer to P1-21 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

• Determine the total number of commanded pulses for Position 4 as follows:

- *Pos 4 Command = [(P1-21) (10,000)] + (P1-22)*

P1-23 ***Position 5 Command (Revolutions)*** Mem Addr: 0117[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 5 Command when using the Internal Indexer. Refer to P1-24 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-24 ***Position 5 Command (Counts)*** Mem Addr: 0118[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 5 Command when using the Internal Indexer. Refer to P1-23 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 5 as follows:

- *Pos 5 Command = [(P1-23) (10,000)] + (P1-24)*

P1-25 ***Position 6 Command (Revolutions)*** Mem Addr: 0119[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 6 Command when using the Internal Indexer. Refer to P1-26 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-26 ***Position 6 Command (Counts)*** Mem Addr: 011A[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 6 Command when using the Internal Indexer. Refer to P1-25 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 6 as follows:

- *Pos 6 Command = [(P1-25) (10,000)] + (P1-26)*

P1-27 ***Position 7 Command (Revolutions)*** Mem Addr: 011B[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 7 Command when using the Internal Indexer. Refer to P1-28 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-28 ***Position 7 Command (Counts)*** Mem Addr: 011C[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 7 Command when using the Internal Indexer. Refer to P1-27 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 7 as follows:

- *Pos 7 Command = [(P1-27) (10,000)] + (P1-28)*

P1-29 ***Position 8 Command (Revolutions)*** Mem Addr: 011D[h]

Range: ± 30,000 Units: revs

Default: 0 Control Modes: Pr

- *This parameter sets the number of revolutions for Position 8 Command when using the Internal Indexer. Refer to P1-30 for Position Command (counts).*
- *Refer to P1-15 for Position Command source selection.*

P1-30 ***Position 8 Command (Counts)*** Mem Addr: 011E[h]

Range: ± 10,000 Units: encoder counts

Default: 0 Control Modes: Pr

- *This parameter sets the number of encoder pulses for Position 8 Command when using the Internal Indexer. Refer to P1-29 for Position Command (revs).*
- *Refer to P1-15 for Position Command source selection.*

Determine the total number of commanded pulses for Position 8 as follows:

- *Pos 8 Command = [(P1-29) (10,000)] + (P1-30)*

P1-31 ***[5] Motor Code*** Mem Addr: 011F[h]

Range: 10, 11, 12, 20, 21, 22, 30, 31 Units: n/a

Default: 10 (SVA-2040)
20 (SVA-2100) Control Modes: P/V/T
30 (SVA-2300)

- *Enter the Motor Code number of the servo motor controlled by the servo drive.*

Settings:

Code:	*Motor:*	*Drive:*
10	SVL-201(B)	SVA-2040
11	SVL-202(B)	SVA-2040
12	SVL-204(B)	SVA-2040
20	SVL-207(B)	SVA-2100
21	SVL-210(B)	SVA-2100
22	SVM-210(B)	SVA-2100
30	SVM-220(B)	SVA-2300
31	SVM-230(B)	SVA-2300

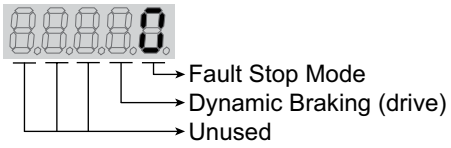
P1-32 ***Motor Stop Mode Selection*** Mem Addr: 0120[h]

Range: 00, 01, 10, 11 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter determines the stop mode when a Forward Inhibit or Reverse Inhibit limit switch stop is triggered. The parameter does not affect the operation of the mechanical spring-load brake mechanism in brake motors (SVx-2xxB types).*

Settings:



Fault Stop Mode Settings:

0 Stop instantly (using dynamic braking)

1 Decelerate to stop (using preset deceleration settings)

Dynamic Braking (drive) settings; behavior when Servo On status signal is inactive (These settings do NOT apply to motor mechanical braking):

0 Use dynamic braking when drive is disabled

1 Allow motor to coast to stop when drive is disabled

P1-33 ***[3] Position Control Mode (Internal Indexer)*** Mem Addr: 0121[h]

Range: 0~8 Units: n/a

Default: 0 Control Modes: Pr

- *This parameter determines the specific type of control when using Pr control mode (P1-01) with the internal indexer. (Refer to Control Modes Chapter 5 for explanation and examples of Index Mode and internal position indexing.)*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

Settings:

0 *Absolute Position Mode (Absolute Positioning):*
The system will move to new positions based on the values set in P1-15 ~ P1-30, which are interpreted as target positions referenced from the home position.

1 *Incremental Position Mode (Incremental Positioning):*
The system will move to new positions based on the values set in P1-15 ~ P1-30, which are interpreted as distances to move from the current position.

2 *Forward Operation Index Mode:*
The system will go to the programmed index position only in the forward direction.

3 *Reverse Operation Index Mode:*
The system will go to the programmed index position only in the reverse direction.

4 *Shortest Path Index Mode:*
The system will go to the programmed index position by determining and using the shortest path and direction.

5 *Absolute Auto Position Mode:*
The system will move to new positions, referenced from the home position, based on the Auto Position Mode internal function.

6 *Incremental Auto Position Mode:*
The system will move to new positions, referenced from the current position, based on the Auto Position Mode internal function.

7 *Absolute One-Cycle Auto-Running Mode:*
This setting operates the same as setting #5, except that the DI acts as an edge trigger, and initiates only one cycle.

8 *Incremental One-Cycle Auto-Running Mode:*
This setting operates the same as setting #6, except that the DI acts as an edge trigger, and initiates only one cycle.

P1-34 ***Acceleration Time (Internal Indexer)*** Mem Addr: 0122[h]

Range: 1 ~ 20,000 Units: ms

Default: 200 Control Modes: Pr/V

- *When parameter settings are used as velocity commands (Internal Indexer), this parameter sets the motor acceleration rate.*
- *When parameter settings are used as position commands (Internal Indexer), this parameter sets both acceleration and deceleration ramps for forward direction.*
- *The value entered into this parameter sets the time required to accelerate from 0 to the Maximum Velocity Limit setting of P1-55. That same rate of acceleration, or slope, is then used for acceleration to any velocity.*

Example:

P1-55 = 3000 rpm & P1-34 = 200 ms

- *P1-34 acceleration rate = 3000rpm / 200ms = 15000 rpm/s*
- *P1-34 acceleration time @ 0~9,000 rpm = 9000rpm / 15000rpm/s = 600ms*

The total acceleration time can be calculated as follows:

- $t_{accel\ total} = t_{P1-34} + t_{P1-36}$

Note: This parameter is valid only when P1-36 ≠ 0.

P1-35 ***Deceleration Time (Internal Indexer)*** Mem Addr: 0123[h]

Range: 1 ~ 20,000 Units: ms

Default: 200 Control Modes: Pr/V

- *When parameter settings are used as velocity commands (Internal Indexer), this parameter sets the motor deceleration rate.*
- *When parameter settings are used as position commands (Internal Indexer), this parameter sets both acceleration and deceleration ramps for reverse direction.*
- *The value entered into this parameter sets the time required to decelerate to 0 rpm from the Maximum Velocity Limit setting of P1-55. That same rate of deceleration, is then used for deceleration from any velocity, as described above in P1-34 for acceleration.*

The total deceleration time can be calculated as follows:

- $t_{decel\ total} = t_{P1-35} + t_{P1-36}$

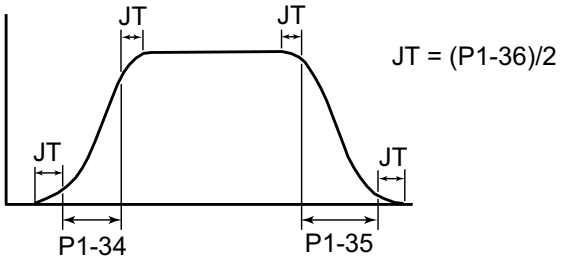
Note: This parameter is valid only when P1-36 ≠ 0.

P1-36 ***Accel/Decel S-Curve*** Mem Addr: 0124[h]

Range: 0 ~ 10,000 Units: ms

Default: 0 Control Modes: Pr/V

- *This parameter allows the motor and load to be accelerated and decelerated more smoothly.*



P1-37 ***Inertia Mismatch Ratio*** Mem Addr: 0125[h]

Range: 0 ~ 200.0 Units: n/a

Default: 5.0 Control Modes: P/V/T

- *This parameter represents the ratio of the load inertia to the servo motor inertia: (J_{load} / J_{motor}).*

P1-38 ***Zero Velocity Output Threshold*** Mem Addr: 0126[h]

Range: 0 ~ 200 Units: rpm

Default: 10 Control Modes: P/V/T

- *This parameter sets the velocity command level below which the Low Velocity Clamp digital input (P2-10~P2.17 = 05) stops and holds the motor, and the At Zero Velocity digital output (P2-18~P2.22 = 03) becomes active.*
  - *IF: 1) Motor velocity command ≤ P1-38 and*
    2) Low Velocity Clamp DI is active
    (both conditions must be met).
  - *THEN: 1) Motor velocity immediately drops to zero,*
    2) Drive holds motor in position (0 rpm with holding torque),
    3) At Zero Velocity DO becomes active.
- *P1-38 has no effect unless the Low Velocity Clamp DI is active.*
- *Low Velocity Clamp DI has no effect unless motor velocity command ≤ P1-38.*

P1-39 ***Target Velocity Output Threshold*** Mem Addr: 0127[h]

Range: 0 ~ 5000 Units: rpm

Default: 3000 Control Modes: P/V/T

- *This parameter sets the threshold used to determine when the At Command Velocity digital output becomes active.*
  For example, the At Command Velocity output will be active by default when the motor velocity is equal to or greater than the current commanded velocity. (The digital output functions are assigned by parameters P2-19 through P2-22.)

P1-40 ***[2] Analog Full Scale Velocity Command (Velocity Mode)***
[2] Analog Full Scale Velocity Limit (P & T Modes) Mem Addr: 0128[h]

Range: 0 ~ 10,000 (for drive models SVL-2040 & SVA-2100)
0 ~ 5,000 (for drive model SVA-2300) Units: rpm

Default: 3000 (for motor models SVL)
2000 (for motor models SVM) Control Modes:P/V/T

- *In Position and Torque Modes, this parameter sets the maximum velocity limit based on the full scale input analog voltage (10V).*
  Velocity Limit Command = (Input V) (P1-40) / 10V
- *In Velocity Mode, this parameter sets the range of the Velocity Command in rpm for a velocity input range from 0V to 10V. (The same range applies in the negative direction from 0V to -10V, if there is no offset.) (P4-22 can be used to provide an offset, such that a non-zero input generates a zero rpm command.)*
  Velocity Command = (Input V) (P1-40) / 10V
- *P1-55 will limit the maximum speed of the motor, but will not limit what can be entered in P1-40.*

P1-41 ***[2] Analog Full Scale Torque Command (Torque Mode)***
[2] Analog Full Scale Torque Limit (P & V Modes)
Mem Addr: 0129[h]

Range: 0 ~ 1000 Units: %

Default: 100 Control Modes:P/V/T

- *In Position and Velocity Modes, this parameter sets the maximum torque limit based on the full scale input analog voltage (10V).*
  Torque Limit Command = (Input Command V) (P1-41) / 10V
- *In Torque Mode, this parameter sets the percent of rated torque which the motor will provide when 10V is applied to the analog input.*
  Torque Command = (Input Command V) (P1-41) / 10V)
- *In Torque Mode, this parameter sets the range of the Torque Command in % for a torque input range from 0V to 10V. (The same range applies in the negative direction from 0V to -10V, if there is no offset.) (P4-23 can be used to provide an offset, such that a non-zero input generates a zero torque command.)*
  Torque Command = (Input V) (P1-41) / 10V
- *The value of the analog torque command/limit can also be affected by P4-23.*

P1-42 ***On Delay Time of Electromagnetic Brake***
Mem Addr: 012A[h]

Range: 0 ~ 1000 Units: ms

Default: 20 Control Modes: P/V/T

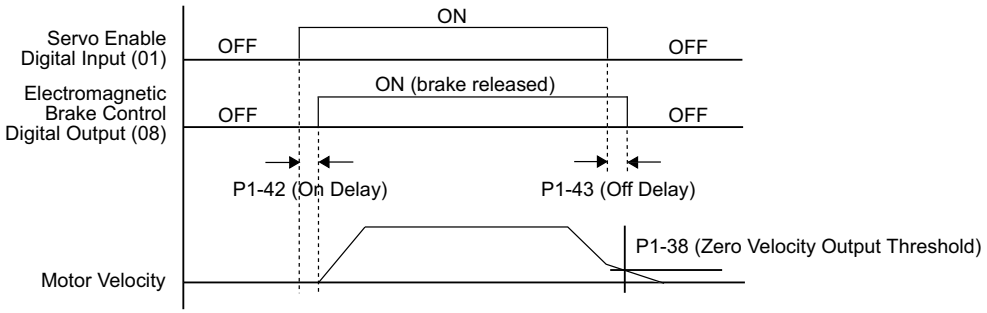
- *This parameter sets the amount of time between when the servo drive is enabled and when the electromagnetic brake is released. (A digital output can be set for Electomagnetic Brake Control in parameters P2-18~2-22.)*

P1-43 ***Off Delay Time of Electromagnetic Brake***
Mem Addr: 012B[h]

Range: 0 ~ 1000 Units: ms

Default: 20 Control Modes: P/V/T

- *This parameter sets the amount of time between when the servo drive is disabled and when the electromagnetic brake is engaged.*



If the motor velocity is below the threshold set by P1-38 (Zero Velocity) when the servo is commanded off, the electromechanical brake will be engaged regardless of the amount of time set in this parameter.

If the motor velocity is above the threshold set by P1-38 (Zero Velocity) when the servo is commanded off and the off delay time has elapsed, the electromechanical brake will be engaged regardless of the current motor velocity.

P1-44 ***Electronic Gear Numerator 1*** Mem Addr: 012C[h]

P1-45 ***Electronic Gear Denominator*** Mem Addr: 012D[h]

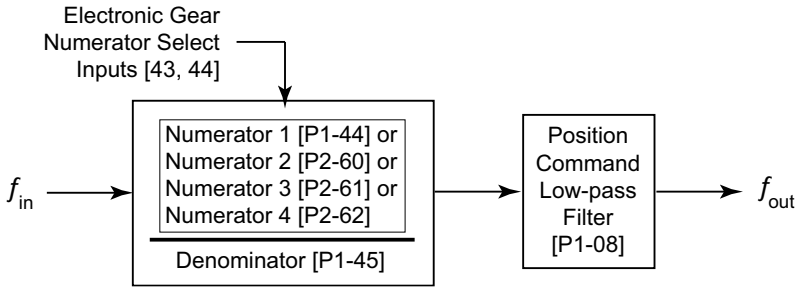
Range: 0 ~ 32,767 Units: counts

Default: 1 Control Modes: P

- *Parameter P1-44 sets the numerator of the Electronic Gear Ratio. Parameters P2-60 through P2-62 set optional additional numerators.*
- *Parameter P1-45 sets the denominator of the Electronic Gear Ratio.*
- *Refer to the "Electronic Gear Ratio" section of Control Modes Chapter 5 for more information regarding this function.*
- *Position Command = (Input Pulses) [(Px-xx EGN) / (P1-45)]*

Select which of the four numerators will be active by using the Electronic Gear Numerator Select digital inputs. For information regarding the setting of the DI functions, refer to P2-10 ~ P2-17 and to the "Electronic Gear Ratio" section of Chapter 5, "Control Modes of Operation and Tuning".

Electronic Gear Numerator Selection		
Digital Inputs		***EGN Selected***
EGN Select 1	***EGN Select 0***	
0	0	P1-44
0	1	P2-60
1	0	P2-61
1	1	P2-62



The electronic gear ratio setting MUST be within the following range:
1/50 < (Px-xx Electronic Gear Numerator) / (P1-45 Electronic Gear Denominator) < 200.

When electronic gearing is used, and no Electronic Gear Numerator Select DI have been configured, the default gear ratio is determined by P1-44 and P-145.

P1-46 ***[2] Encoder Output Scaling Factor*** Mem Addr: 012E[h]

Range: 1 ~ 125 (with B = 0)
10,020 ~ 12,500 (with B = 1)

Units: n/a

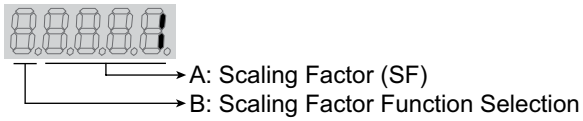
Default: 1

Control Modes: P/V/T

The range of the actual Scaling Factor is less than the full range of P1-46.

- *This parameter sets the Pulse Number or the Pulse Dividing Ratio of the encoder outputs (OA, /OA, OB, /OB). It does not affect the output Z pulse (OZ, /OZ).*

Settings:



Scaling Factor Settings (A):

1~125 or 10,020~12,500	The function and range of the actual SF varies depending upon the setting of part B of this parameter.

Scaling Factor Function Selection Settings (B):

0 Scaling Factor represents Pulse Dividing Ratio (PDR); **Range of SF: 1~125**
- PDR = 2500 / SF

Examples:
- If P1-46 = 1, then PDR = 2500/1 = 2500
  (The encoder will output 2500 pulses per motor revolution)
- If P1-46 = 2, then PDR = 2500/2 = 1250
  (The encoder will output 1250 pulses per motor revolution)

1 Scaling Factor directly represents the number of encoder output pulses for one motor revolution; **Range of SF: 20~2500** (limited to multiples of 20)

Examples:
- If P1-46 = 10020, the encoder will output 20 pulses per motor rev.
- If P1-46 = 10300, the encoder will output 300 pulses per motor rev.

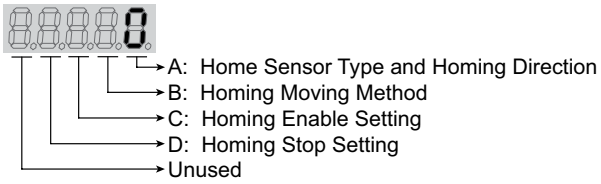
P1-47 ***Homing Mode*** Mem Addr: 012F[h]

Range: 0 ~ 1225 Units: n/a

Default: 0 Control Modes: P

- *This parameter determines the servo motor's homing characteristics.*

Settings:



A: Home Sensor Type and Homing Direction:

0	Move forward to overtravel limit switch used as home position indicator
1	Move reverse to overtravel limit switch used as home position indicator
2	Move forward to dedicated home position sensor
3	Move reverse to dedicated home position sensor
4	Z index mark as position sensor

B: Homing Moving Method:

0	Stop and return to the Z index mark
1	Go forward to the Z index mark
2	Position at home sensor position or Z

C: Homing Enable Setting:

0	Disable homing function
1	Start homing sequence at power-up
2	Start homing sequence by input terminal

D: Homing Stop Setting:

0	After detecting home position, the motor will decelerate and return to home position as determined by P1-50 and P1-52
1	After detecting home position, the motor will decelerate and stop in the forward direction. P1-50 and P1-52 offset settings will be ignored.

Example: P1-47 = 202: (refer to diagram in P1-48)

- *0: when Home Sensor DI is triggered, motor moves reverse off that position*
- *2: motor starts homing when Start Home Move Trigger DI is enabled*
- *0: stops on the next motor Z pulse (after reversing from the Home Sensor position)*
- *2: homes in forward direction until the Home Sensor input is triggered*

1) P1-01 defines the rotation convention.
2) If 0 or 1 is set in the Define Sensor field, the limit sensor inputs must be defined (refer to P2-10~P2-17) and installed. If 2 or 3 is set in the Define Sensor field, a dedicated home sensor input must be defined and installed.
3) The overtravel sensors, when used as the home sensor, will return to overtravel protection after the homing function has completed.

P1-48 ***Homing Velocity 1 - Fast Search Velocity*** Mem Addr: 0130[h]

Range: 1 ~ 2000 Units: rpm

Default: 1000 Control Modes: P

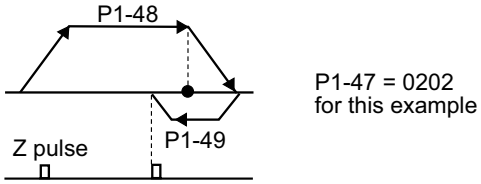
P1-49 ***Homing Velocity 2 - Creep Velocity*** Mem Addr: 0131[h]

Range: 1 ~ 500 Units: rpm

Default: 50 Control Modes: P

- *Parameter P1-48 sets the initial (fast) Homing Velocity.*
- *Parameter P1-49 sets the secondary (creep) Homing Velocity.*

Servo homing may involve two homing velocities. When homing is triggered, the motor proceeds at the Fast velocity until the home sensor is detected. Upon detection of the home sensor, the motor decelerates to the Creep velocity. The direction of the motor from this point is a function of how Homing Mode is configured in parameter P1-47.



P1-50 ***Home Position Offset (revolutions)*** Mem Addr: 0132[h]

Range: ± 30,000 Units: revolutions

Default: 0 Control Modes: P

P1-51 ***Home Position Offset (counts)*** Mem Addr: 0133[h]

Range: ± 10,000 Units: counts

Default: 0 Control Modes: P

- *Set P1-50 and P1-51 to apply an offset from the homing point. These parameters are assigned as the current position at the completion of the homing routine. P1-47 must be set to 0. Determine the total number of offset pulses as follows:*
- *Home Pos_{offset} = [(P1-50]) (10,000)] + (P1-51)*

P1-52 ***Regenerative Resistor Value*** Mem Addr: 0134[h]

Range: 10 ~ 750 Units: Ohms

Default: 40 (1kW and below; SVA-2040, -2100)
20 (above 1kW; SVA-2300)
Control Modes: P/V/T

- *This parameter represents the resistance of the applicable regenerative resistor. If using the servo drive's internal resistor, enter that resistance value here. If using an external resistor, enter the resistance value of that resistor in this parameter. If using the internal resistor only, then leave as default. Refer to the "Regenerative Resistor" section of Chapter 5 for information regarding allowable resistors.*

P1-53 ***Regenerative Resistor Capacity*** Mem Addr: 0135[h]

Range: 30 ~ 1000 Units: Watts

Default: 60 (1kW and below; SVA-2040, -2100)
120 (above 1kW; SVA-2300)
Control Modes: P/V/T

- *This parameter represents the capacity of the applicable regenerative resistor. If using the servo drive's internal resistor, enter that capacity value here. If using an external resistor, enter the capacity value of that resistor in this parameter. If using the internal resistor only, then leave as default. Refer to the "Regenerative Resistor" section of Chapter 5 for information regarding allowable resistors.*

P1-54 ***In Position Window*** Mem Addr: 0136[h]

Range: 0 ~ 10,000 Units: counts

Default: 99 Control Modes: P

- *This parameter sets the width of the window in which the At Position digital output will be active. As an example, the At Position output will be active by default when the current motor position is within ±99 counts of the target position. The total window width is two times the set value. Refer to P2-19 ~ P2-22 to assign the digital output functions.*

P1-55 ***Maximum Velocity Limit*** Mem Addr: 0137[h]

Range: 0 ~ 5000 (SVL-2xxx low inertia motors)
0 ~ 3000 (SVM-2xxx medium inertia motors
Units: rpm

Default: 0 ~ 3000 (SVL-2xxx low inertia motors)
0 ~ 2000 (SVM-2xxx medium inertia motors
Control Modes: P/V/T

- *This parameter sets the maximum motor velocity. The default setting is the rated velocity.*

P1-56 ***Overload Output Warning Threshold*** Mem Addr: 0138[h]

Range: 0 ~ 120 Units: %

Default: 120 Control Modes: P/V/T

- *This parameter sets the level of the overload output warning threshold. When the system reaches threshold time level set by this parameter, it activates the Overload Warning DO signal (P2-18~P2-22 = 10; new setting in this firmware) and displays ALE23 on the LED Display. (ALE23 does not need to be cleared since it is only a warning, rather than a fault.)*
- *The setting of this parameter is a percentage of the continuous overload time required to initiate the Overload Fault ALE06. (The ALE06 Overload Fault times are set by P1-31, and are discussed in Chapter 1 of this manual.)*
- $t_{OL\ warning}$ *= (*$t_{OL\ fault}$*) x (setting value of P1-56)*
- *Example for 100~750W systems operating at 200% OL, and P1-56 = 60%:*
  For 100~750W systems, $t_{OL\ fault}$ *@ 200% OL = 8s per Chapter 1 OL charts.*
  $t_{OL\ warning}$ *= (8s) x (60%) = 4.8s*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

Extended Parameters

P2-00 ***Position Loop Proportional Gain (KPP)*** Mem Addr: 0200[h]

Range: 0 ~ 1023 Units: rad/s

Default: 35 Control Modes: P

- *This parameter adjusts the proportional gain of the position control loop, thereby affecting system stiffness and response. Higher gains reduce position error and increase responsiveness. However, if the setting is too high, it may generate oscillation or noise in the system.*

In Easy Tune mode, this parameter is adjusted by the system.

For information regarding manual tuning of this parameter, refer to "Manual Tuning Mode Details" in the "Control Modes of Operation and Tuning" chapter.

P2-01 ***Position Loop Gain Boost*** Mem Addr: 0201[h]

Range: 10 ~ 500 Units: %

Default: 100 Control Modes: P

- *This parameter sets the amount of KPP boost when the application condition is met. Use P2-27 to set the condition in which this boost will be applied to the system.*

P2-02 ***Position Feed Forward Gain (KFF)*** Mem Addr: 0202[h]

Range: 10 ~ 20,000 Units: 0.0001

Default: 5000 Control Modes: P

- *This parameter sets the Feed Forward Gain when executing the Position Control Command. It is used to reduce position following error and shorten settling time. Increase the gain to reduce the error. However, increasing it too much can lead to mechanical resonance and vibration.*

For information regarding manual tuning of this parameter, refer to "Manual Tuning Mode Details" in the "Control Modes of Operation and Tuning" chapter.

P2-03 ***Smooth Constant of Position Feed Forward Gain*** Mem Addr: 0203[h]

Range: 2 ~ 100 Units: ms

Default: 5 Control Modes: P

- *This parameter is used in conjunction with P2-02. P2-03 sets the length of time that the position error is applied to the velocity loop. Set this value as low as possible for desired system performance.*

Refer to Chapter 5, "Basic Block Diagram of Position Control (Pt and Pr)" (page 3) for further details.

P2-04 ***Velocity Loop Proportional Gain (KVP)*** Mem Addr: 0204[h]

Range: 0 ~ 20,000 Units: rad/s

Default: 500 Control Modes: P/V

- *This parameter sets the proportional gain for the velocity loop. Higher values make the velocity loop more responsive. However, setting it too high will cause excessive vibration or noise.*

In Easy Tune Mode, the value of this parameter is automatically set by the system. For information regarding Manual Tuning of this parameter, refer to "Manual Tuning Mode Details" in the "Control Modes of Operation and Tuning" chapter.

P2-05 ***Velocity Loop Gain Boost*** Mem Addr: 0205[h]

Range: 10 ~ 500 Units: %

Default: 100 Control Modes: P/V

- *This parameter sets the amount of KVP boost when the application condition is met. See P2-27 to set the condition in which this boost will be applied to the system.*

P2-06 ***Velocity Loop Integral Compensation (KVI)*** Mem Addr: 0206[h]

Range: 0 ~ 4095 Units: n/a

Default: 100 Control Modes: P/V

- *This parameter sets the integral time of the velocity loop. When the value of the velocity integral compensation is increased, it can improve the velocity response ability and decrease the velocity control deviation. However, if the setting value is too high, it may generate oscillation or noise.*

In the Easy Tune Mode, the value of this parameter is automatically set by the system. For information regarding Manual Tuning of this parameter, refer to "Manual Tuning Mode Details" in the "Control Modes of Operation and Tuning" chapter.

P2-07 ***Velocity Feed Forward Gain (KVF)*** Mem Addr: 0207[h]

Range: 0 ~ 20,000 Units: 0.0001

Default: 0 Control Modes: V

- *This parameter sets the Feed Forward Gain when executing the velocity control command. When using the velocity smooth command, increased gain can improve velocity track deviation. When not using the velocity smooth command, decreased gain can improve the resonance condition of the mechanical system.*

P2-08 ***[4] Factory Defaults and Password*** Mem Addr: 0208[h]

Range: 0 ~ 65,535 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter can be used to restore factory default parameter settings, and to establish a password.*

Settings:

Restore Default Settings:

10	Reset system to factory default parameters.

Password Settings:

10,000 ~ 65,535	Password which locks the current configuration in the drive. The parameters then cannot be changed unless the correct password is entered first.

Restoring system defaults will reset any active password.

- *To apply a password: Enter a five digit password in the range from 10,000 to 65,535 into P2-08. Then enter the same password again to confirm it.*
- *To change parameters when a password is active: Enter the correct password to unlock the parameters, then change the parameters.*
- *To disable password security: Enter the correct password, and then zero (0) twice in succession.*

P2-09 ***Debounce Filter (Contact Suppression)*** Mem Addr: 0209[h]

Range: 0 ~ 20 Units: 2ms

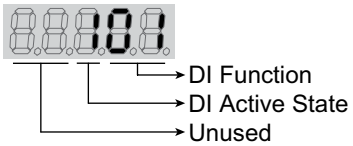
Default: 2 Control Modes: P/V/T

- *This parameter sets a low-pass filter on the general purpose inputs, which helps to prevent false input triggers due to electrical noise and contact bounce. Setting this value too high may result in missed intended triggers.*

P2-10	***[6] Digital Input Terminal 1 (DI1)***	Mem Addr: 020A[h]
	Default: 101	Control Modes: P/V/T
P2-11	***[6] Digital Input Terminal 2 (DI2)***	Mem Addr: 020B[h]
	Default: 104	Control Modes: P/V/T
P2-12	***[6] Digital Input Terminal 3 (DI3)***	Mem Addr: 020C[h]
	Default: 116	Control Modes: P/V/T
P2-13	***[6] Digital Input Terminal 4 (DI4)***	Mem Addr: 020D[h]
	Default: 117	Control Modes: P/V/T
P2-14	***[6] Digital Input Terminal 5 (DI5)***	Mem Addr: 020E[h]
	Default: 102	Control Modes: P/V/T
P2-15	***[6] Digital Input Terminal 6 (DI6)***	Mem Addr: 020F[h]
	Default: 22	Control Modes: P/V/T
P2-16	***[6] Digital Input Terminal 7 (DI7)***	Mem Addr: 0210[h]
	Default: 23	Control Modes: P/V/T
P2-17	***[6] Digital Input Terminal 8 (DI8)***	Mem Addr: 0211[h]
	Range: 0 ~ 145	Units: n/a
	Default: 21	Control Modes: P/V/T

- *P2-10 ~ P2-17 determine the functions and active states of DI1 ~ DI7, respectively.*
- *P2-10 ~ P2-17 vary by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions".*

Settings:



1) When P2-10 ~ P2-17 Function Settings are set to zero (0), the corresponding inputs are disabled.
2) Function Settings 11~17 are for single control modes; 18~20 are for dual control modes.

DI Function Settings (P2-10 ~ P2-17):

00	Input Disabled
01	Servo Enable
02	Alarm Reset (will not reset all faults; see "Clearing Faults" in Chapter 7)
03	Gain Boost Switch
04	Clear Command (see P2-50)
05	Low Velocity Clamp (see P1-38)
06	Command Input Polarity (Inverts the direction of rotation regardless of control mode. Velocity, torque, and position (incremental and absolute) mode types all get inverted when this input is selected.)
07	Position Command Pause (Internal Indexer only)
08	Command Trigger (available in Pr mode only)
09	Torque Limit Enable (bi-directional) (see DI settings 25, 26; P1-02, P1-12, P2-64)
10	Velocity Limit Enable (see P1-02, P1-09)
11	Position Command Select 0 (PCS0)
12	Position Command Select 1 (PCS1)
13	Position Command Select 2 (PCS2)

[DI Function Settings (P2-10 ~ P2-17) CONTINUED NEXT PAGE*]*

[DI Function Settings (P2-10 ~ P2-17) – (CONTINUED FROM PREVIOUS PAGE)]

14 Velocity Command Select 0 (VCS0)
15 Velocity Command Select 1 (VCS1)
16 Torque Command Select 0 (TCS0)
17 Torque Command Select 1 (TCS1)
18 Position/Velocity Mode Select (0=Vel., 1=Pos.) (dual control)
19 Velocity/Torque Mode Select (0=Vel., 1=Torq.) (dual control)
20 Position/Torque Mode Select (0=Torq., 1=Pos.) (dual control)
21 Fault Stop (Normally Closed)
22 Reverse Inhibit (Overtravel - Normally Closed)
23 Forward Inhibit (Overtravel - Normally Closed)
24 Home Sensor
25 Torque Limit Enable Reverse (reverse direction only) (see DI settings 09, 26; P1-02, P1-12, P2-64)
26 Torque Limit Enable Forward (forward direction only) (see DI settings 09, 25; P1-02, P1-13, P2-64)
27 Start Home Move Trigger
28 Index Mode Select 0 (IMS0)
29 Index Mode Select 1 (IMS1)
30 Index Mode Select 2 (IMS2)
31 Index Mode Select 3 (IMS3)
32 Index Mode Select 4 (IMS4)
33 Index Mode Control 0 (IMC0)
34 Index Mode Control 1 (IMC1)
35 Index Mode - Manual Continuous Operation
36 Index Mode - Manual Single Step Operation
37 Jog Forward
38 Jog Reverse
39 Step Reverse (Pr mode only)
40 Step Forward (Pr mode only)
41 Return to Index 1 (Auto Index Mode only); return motor to 1st position
42 Auto Position mode
43 Electronic Gear Numerator Select 0 (EGNS0) (see P2-60 ~ P2-62)
44 Electronic Gear Numerator Select 1 (EGNS1) (see P2-60 ~ P2-62)
45 Inhibit Pulse Command - Terminal – Causes external pulse input command to be ignored.

DI Active State Settings: (P2-10 ~ P2-17):

0 Normally Closed (use N.C. contact)
1 Normally Open (use N.O. contact)

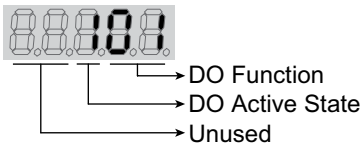
Examples (for P2-10 ~ P2-17):

- *Setting 101 configures this input for Servo Enable command, and requires a normally open contact to be connected to it.*
- *Setting 21 configures this input for Fault Stop circuit monitoring and requires a normally closed contact to be wired to it.*

2-18	***[6] Digital Output Terminal 1 (DO1)***	Mem Addr: 0212[h]
	Default: 101	Control Modes: P/V/T
2-19	***[6] Digital Output Terminal 2 (DO2)***	Mem Addr: 0213[h]
	Default: 103	Control Modes: P/V/T
2-20	***[6] Digital Output Terminal 3 (DO3)***	Mem Addr: 0214[h]
	Default: 109	Control Modes: P/V/T
2-21	***[6] Digital Ouput Terminal 4 (DO4)***	Mem Addr: 0215[h]
	Default: 105	Control Modes: P/V/T
2-22	***[6] Digital Ouput Terminal 5 (DO5)***	Mem Addr: 0216[h]
	Range: 0 ~ 109	Units: n/a
	Default: 7	Control Modes: P/V/T

- *If P2-44 is set to its default value of zero (0), parameters P2-18 ~ P2-22 determine the functions and active states of DO1 ~ DO5, respectively.*
- *P2-18 ~ P2-22 vary by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

Settings:



1) P2-18 ~ P2-22 are effective only if P2-44 is set to zero (0).
2) When P2-18 ~ P2-22 DO Function digits are set to zero (0), the corresponding outputs are disabled.

DO Function Settings (P2-18 ~ P2-22):

00	Output Disabled
01	Servo Ready (no faults)
02	Servo On (enabled)
03	At Zero Velocity (see P1-38)
04	At Velocity Reached
05	At Position
06	At Torque Limit
07	Active Fault
08	Electromagnetic Brake Control
09	Homing Completed (servo position is reset to 0 when this output is set on)
10	At Overload Output Warning Threshold

DO Active State Settings: (P2-18 ~ P2-22):

0	Acts like a Normally Closed contact
1	Acts like a Normally Open contact

Examples (for P2-18 ~ P2-22):

- *Setting 101 configures this output as a Servo Ready indicator, and the output functions like a normally open contact.*
- *Setting 005 configures this output as an At Position Indicator, and the output functions like a normally closed contact.*

P2-23 ***Notch Filter (Resonance Suppression)*** Mem Addr: 0217[h]

Range: 50 ~ 1000 Units: Hz

Default: 1000 Control Modes: P/V/T

- *This parameter is used to reduce mechanical system vibration. Set the value to match the mechanical resonance (vibration) frequency.*
- *Resonance is a condition in a system that happens at certain frequencies, and it is excited with a signal such as a velocity. It is possible to change the velocity (or frequency) to avoid resonance. P2-23 through P2-26 can also be used to suppress resonance.*

If Notch Filter Attenuation (P2-24) is set to 0, then this Notch Filter (P2-23) is disabled.

P2-24 ***Notch Filter Attenuation (Resonance Suppression)*** Mem Addr: 0218[h]

Range: 0 ~ 32 (0 = disable) Unit: dB

Default: 0 Control Modes: P/V/T

- *This parameter sets the magnitude of the resonance suppression set by P2-23. Set P2-24 as low as possible without loss of system control at the resonance frequency (P2-23). (See P2-23 for explanation of resonance.)*

P2-25 ***Low-pass Filter (Resonance Suppression)*** Mem Addr:0219[h]

Range: 0 ~ 1000 (0 = disable) Units: ms

Default: 2 (400W and below; SVA-2040)
5 (750W and above; SVA-2100, -2300) Control Modes: P/V/T

- *This parameter is used to set the Low-pass Filter time constant of resonance suppression, in order to suppress or eliminate noise or resonance. (See P2-23 for explanation of resonance.)*
- *Increasing this parameter will reduce noise or resonance. However, setting the parameter too high will lead to the instability of the velocity loop and overshoot of the machinery system.*
- *The recommended setting value is as follows:*
  P2-25 ≤ 1000 ÷ [(4) (Velocity Loop Bandwidth)]
- *If the value is set to zero, the function is disabled.*

P2-26 ***External Anti-interference Gain (Resonance Suppress)*** Mem Addr: 021A[h]

Range: 0 ~ 30000 (0 = disable) Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter filters out resonance and reduces overshoot in the velocity loop feedback path. (See P2-23 for explanation of resonance.)*
- *It is set automatically in Easy Tune and Fixed Auto Tune (PDFF) modes. It is not recommended for use in Manual Mode unless its value is determined by the adaptive fixed Auto-Tune PDFF mode (P2-32 = 5). Once the value is determined in mode 5, it can be left when the tuning mode is set to Manual (P2-32 = 0).*
- *If the value is set to zero, the function is disabled.*

No manual adjustment of this parameter is usually neccessary. Changing this value may result in exessive overshoot and an unstable system.

P2-27 ***Gain Boost Control*** Mem Addr: 021B[h]

Range: 0 ~ 4 Units: n/a

Default: 0 Control Modes: P/V

- *This parameter sets how or when Gain Boost is applied.*

Settings:

0 Gain Boost is disabled.

1 Gain Boost controlled by input terminal.

2 In Position Mode (Pt or Pr), Gain Boost becomes active when position deviation is outside threshold set by P2-29.

3 Gain Boost becomes active when Position Command frequency is higher than the setting value of P2-29.

4 Gain Boost becomes active when servo motor rotation velocity is higher than the setting value of P2-29.

Gain Boost is used to adjust the position loop gain, the velocity loop gain, or both gains when the control condition determined by this parameter is met. The amount of boost applied is set by P2-01 (position loop) and by P2-05 (velocity loop).

This type of control is used primarily when the motor load changes significantly during normal operation. By applying Gain Boost, the system response and tuning can be altered on-the-fly to produce desirable performance.

P2-28 ***Gain Boost Switching Time*** Mem Addr: 021C[h]

Range: 0 ~ 1000 (0 = disable) Unit: 10 ms

Default: 10 Control Modes: P/V

- *This parameter is used to set the amount of time it takes for the gain boost to be applied. If the value is zero (disabled), then when the Gain Boost Command calls for boost, it will be applied instantaneously. By default, it will take 10 milliseconds.*

P2-29 ***Gain Boost Switching Condition*** Mem Addr: 021D[h]

Range: 0 ~ 30,000 (0 = disable) Unit: count, kpps, rpm

Default: 10,000 Control Modes: P/V

- *This parameter sets the value of the gain switching condition (pulse error, kpps, rpm) selected in P2-27. The setting value will vary depending on the gain switching condition.*

P2-30 *[4] Auxiliary Function*

Mem Addr: 021E[h]

Range: 0 ~ 5 | Unit: n/a

Default: 0 | Control Modes: P/V/T

Refer to chapters 4 and 6 for information and usage of this parameter in Teach Mode and system commissioning.

Settings:

0 Normal operation of Servo Enable and both overtravel limits

1 Force Servo Enable and ignore both overtravel limits

2 Ignore Reverse Inhibit (overtravel limit)

3 Ignore Forward Inhibit (overtravel limit)

4 Set Teach Position Mode

5 Disable flash memory writes. This mode will allow parameters to be changed normally. However, they will NOT be saved to flash memory and will be lost when power is removed. When control power is lost and then restored, this parameter will be set to default 0 and must be set back to 5 to re-enable this mode.

WARNING: THIS PARAMETER WILL DISABLE MACHINE PROTECTION FEATURES, SUCH AS SERVO ENABLE AND OVERTRAVEL LIMITS. USE THIS PARAMETER WITH EXTREME CAUTION.

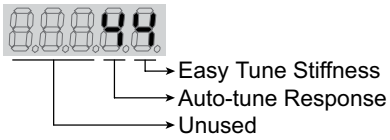
P2-31 *Auto and Easy Tuning Mode Response Level*

Mem Addr: 021F[h]

Range: 0 ~ FF [h] | Unit: n/a

Default: 44[h] | Control Modes: P/V/T

Settings:



Easy Tune Stiffness:

0 ~ F Where 0 equals the lowest stiffness setting, and F equals the highest stiffness setting (16 total settings possible). The higher the setting, the stiffer the control loop.

Auto Tune Response:

0 ~ F Where 0 equals the slowest response setting, and F equals the fastest response setting (16 total settings possible). The higher the setting, the faster the autotune feature will respond to changes.

- *Refer to parameter P2-32 for enabling and disabling this feature.*

P2-32 ***[2] Tuning Mode*** Mem Addr: 0220[h]

Range: 0 ~ 5 Unit: n/a

Default: 0 Control Modes: P/V/T

- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions".*

Settings:

0 Manual Tuning Mode
1 Easy-Tune Mode
2 PI Adaptive Auto-Tune Mode
3 PI Fixed Auto-Tune Mode (ratio is fixed; response levels are adjusted)
4 PDFF Adaptive Auto-Tune Mode
5 PDFF Fixed Auto-Tune Mode (ratio fixed; response levels are adjusted)

- *PI = Proportional - Integral control*
- *PDFF = Pseudo-Derivative Feedback and Feedforward control*

Explanation of Auto-tuning:

1) When switching from mode 2 or 4 to mode 3 or 5 (fixed ratio modes), the system will save the measured load inertia value automatically to P1-37 and then set the other corresponding auto tune parameters accordingly.
2) When switching from mode 2 or 4 to mode 0 (manual mode), load measurements will cease and all parameters will be set to system defaults.
3) When switching from mode 0 to mode 3 or 5 (fixed ratio modes), P1-37 should be set to the proper mismatch ratio.
4) When switching from mode 3 to mode 0 (manual mode), P2-00, P2-04 and P2-06 will retain the values determined by the auto-tune mode.
5) When switching from mode 5 to mode 0 (manual mode), the setting value of P2-00, P2-04, P2-06, P2-25 and P2-26 will retain the values determined by the auto-tune mode.

P2-33 ***reserved***

P2-34 ***Overspeed Fault Threshold*** Mem Addr: 0222[h]

Range: 1 ~ 5000 Units: rpm

Default: 5000 Control Modes: V

- *This parameter is used to set the over-velocity threshold that is used to determine the over-velocity drive fault condition.*

P2-35 ***Position Deviation Fault Window*** Mem Addr: 0223[h]

Range: 1 ~ 30,000 Units: pulse

Default: 30,000 Control Modes: P

- *This parameter is used to set the size of the position deviation window that is used to determine the excessive deviation drive fault condition. Refer to P2-63 for scaling details.*

P2-36	***Position 1 Velocity***	Mem Addr: 0224[h]
P2-37	***Position 2 Velocity***	Mem Addr: 0225[h]
P2-38	***Position 3 Velocity***	Mem Addr: 0226[h]
P2-39	***Position 4 Velocity***	Mem Addr: 0227[h]
P2-40	***Position 5 Velocity***	Mem Addr: 0228[h]
P2-41	***Position 6 Velocity***	Mem Addr: 0229[h]
P2-42	***Position 7 Velocity***	Mem Addr: 022A[h]
P2-43	***Position 8 Velocity***	Mem Addr: 022B[h]

Range: 1 ~ 5,000 Units: rpm

Default: 1000 Control Modes: P

- *P2-36 is the command velocity that is used to move to Position 1. Refer to P1-15 and P1-16 to set the Position 1 command position (absolute mode) or command distance (incremental mode).*
- *P2-37 is the command velocity that is used to move to Position 2. Refer to P1-17 and P1-18 to set the Position 2 command position (absolute mode) or command distance (incremental mode).*
- *P2-38 is the command velocity that is used to move to Position 3. Refer to P1-19 and P1-20 to set the Position 3 command position (absolute mode) or command distance (incremental mode).*
- *P2-39 is the command velocity that is used to move to Position 4. Refer to P1-21 and P1-22 to set the Position 4 command position (absolute mode) or command distance (incremental mode).*
- *P2-40 is the command velocity that is used to move to Position 5. Refer to P1-23 and P1-24 to set the Position 5 command position (absolute mode) or command distance (incremental mode).*
- *P2-41 is the command velocity that is used to move to Position 6. Refer to P1-25 and P1-26 to set the Position 6 command position (absolute mode) or command distance (incremental mode).*
- *P2-42 is the command velocity that is used to move to Position 7. Refer to P1-27 and P1-28 to set the Position 7 command position (absolute mode) or command distance (incremental mode).*
- *P2-43 is the command velocity that is used to move to Position 8. Refer to P1-29 and P1-30 to set the Position 8 command position (absolute mode) or command distance (incremental mode).*

P2-44	***Digital Output Mode***	Mem Addr: 022C[h]

Range: 0 ~ 1 Units: n/a

Default: 0 Control Modes: P

- *This parameter determines whether the digital outputs indicate Pr Auto and Index Modes status, or whether they function according to parameters P2-18 through P2-22.*

Settings:

0 All five outputs function as defined in P2-18 ~ P2-22.

1 Pr Auto and Index Modes output. Outputs indicate current status during indexing operations. (Refer to Chapter 5, “Control Modes of Operation and Tuning”, for explanation of status codes.)

P2-45 ***Index Mode Output Signal Delay Time*** Mem Addr: 022D[h]

Range: 0 ~ 250 Units: 4 ms

Default: 1 Control Modes: P

- *This parameter sets the ON time delay after the index move is complete (when Index Mode is enabled).*

Note: Used only when P2-44 is set to 1.

Refer to P1-33 and to the "Position Control Modes" section of chapter 5 for more details.

P2-46 ***Index Mode Stations*** Mem Addr: 022E[h]

Range: 2 ~ 32 Units: n/a

Default: 6 Control Modes: P

- *This parameter sets the number of positions used during index mode operation.*

Note: Used only when P1-33 is set to 2, 3, or 4.

Refer to P1-33 and to the "Position Control Modes" section of chapter 5 for more details.

P2-47 ***Position Deviation Clear Delay Time*** Mem Addr: 022F[h]

Range: 0 ~ 250 Units: 20 ms

Default: 0 Control Modes: P

- *This parameter sets the delay time after the deviation subsides during index mode operation.*

Note: Used only when P1-33 is set to 2, 3, or 4.

P2-48 ***Backlash Compensation (Index Mode)*** Mem Addr: 0230[h]

Range: 0 ~ 10,312 (0~312 counts + direction) Units: counts

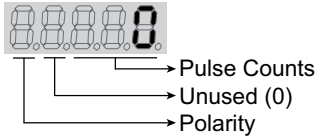
Default: 0 Control Modes: Pr

- *This parameter sets the amount of position compensation (in counts) used in Index Mode.*
- *Used only when P1-33 is set to 2, 3, or 4.*

There is a slight amount of backlash inherent in all mechanical systems. Set the magnitude of the compensation, and the direction in which it should be applied.

Note: The electronic gear ratio has to be considered when setting the magnitude:
Compensation Counts = (P2-48) (Electronic Gear Ratio)

Settings:



Pulse Counts Settings:

0~312	Number of pulse counts

Polarity Settings:

0	Forward compensation
1	Reverse compensation

System must be re-homed after making any changes to this parameter.

P2-49 ***Jitter Suppression*** Mem Addr: 0231[h]

Range: 0 ~ 19 (enable/disable + 0~9) Units: n/a

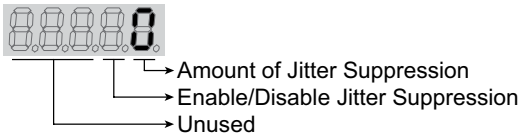
Default: 0 Control Modes: P/V

- *This parameter adjusts the cut-off frequency of the velocity feedback into the velocity control loop.*

It is typically used in applications where low speed performance is needed but fast response is not required. As an example, when the motor stops at a position, the servo control loops are going to force the motor to stay where it is to within +/- 1 encoder count. In some cases (based on tuning), a rapid swing between +/- 1 pulse may cause an intermittent or mechanical noise. Use the parameter to suppress this type of noise problem.

When using this parameter, set the value to the smallest possible value (highest frequency) for desired performance. The higher the value (lower frequency cutoff) the worse the "at position" accuracy will be (not guaranteed to be +/- 1 encoder count).

Settings:



Jitter Suppression Settings:

0	600Hz cutoff frequency
1	500Hz cutoff frequency
2	400Hz cutoff frequency
3	350Hz cutoff frequency
4	300Hz cutoff frequency
5	250Hz cutoff frequency
6	200Hz cutoff frequency
7	150Hz cutoff frequency
8	100Hz cutoff frequency
9	80Hz cutoff frequency

Enable/Disable Settings:

0	Disable Jitter Suppression
1	Enable Jitter Suppression

This cut-off frequency must be higher than the velocity loop bandwidth (P2-04) in order to assure loop stability.

P2-50 ***Clear Position Mode*** Mem Addr: 0232[h]

Range: 0 ~ 2 Units: n/a

Default: 0 Control Modes: P

- *This parameter is used when a digital input is configured as a Clear Pulse function (DIx set to 4). (Refer to P2-10 ~ P2-17 to assign the DI functions.)*

Settings:

0 Triggering this input will clear any remaining active command pulses from memory (Pt and Pr modes only).

1 Triggering this input will clear the current system position in memory to zero (Pt and Pr modes only).

2 Triggering this input will clear any remaining command pulses in memory and will execute a stop command (Pr mode only).

P2-51 ***Servo Enable Command*** Mem Addr: 0233[h]

Range: 0 ~ 1 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter determines how the servo system is enabled.*

Settings:

0 Servo Enable is controlled by the assigned digital input. (Refer to P2-10 ~ P2-17 to assign the DI functions.)

1 Servo Enable is activated when control power is applied the servo drive regardless of the state of the digital input.

When set to 1, if faults exist when power is applied, the servo will enable after the faults are cleared.

P2-52 ***Dwell Time 1 - Auto Position Mode*** Mem Addr: 0234[h]
P2-53 ***Dwell Time 2 - Auto Position Mode*** Mem Addr: 0235[h]
P2-54 ***Dwell Time 3 - Auto Position Mode*** Mem Addr: 0236[h]
P2-55 ***Dwell Time 4 - Auto Position Mode*** Mem Addr: 0237[h]
P2-56 ***Dwell Time 5 - Auto Position Mode*** Mem Addr: 0238[h]
P2-57 ***Dwell Time 6 - Auto Position Mode*** Mem Addr: 0239[h]
P2-58 ***Dwell Time 7 - Auto Position Mode*** Mem Addr: 023A[h]
P2-59 ***Dwell Time 8 - Auto Position Mode*** Mem Addr: 023B[h]

Range: 0.00 ~ 120.00 Units: s

Default: 0 Control Modes: P

- *Parameter P2-52 sets the dwell time at Index Position 1 during Auto Position operation.*
- *Parameter P2-53 sets the dwell time at Index Position 2 during Auto Position operation.*
- *Parameter P2-54 sets the dwell time at Index Position 3 during Auto Position operation.*
- *Parameter P2-55 sets the dwell time at Index Position 4 during Auto Position operation.*
- *Parameter P2-56 sets the dwell time at Index Position 5 during Auto Position operation.*
- *Parameter P2-57 sets the dwell time at Index Position 6 during Auto Position operation.*
- *Parameter P2-58 sets the dwell time at Index Position 7 during Auto Position operation.*
- *Parameter P2-59 sets the dwell time at Index Position 8 during Auto Position operation.*

NOTE: If these parameters are set to zero, Auto Position Mode will not index to the corresponding Index Position. (Refer to P1-33 and Chapter 5, "Control Modes of Operation and Tuning," for more information regarding Auto Position Mode.)

P2-60	***Electronic Gear Numerator 2***	Mem Addr: 023C[h]
P2-61	***Electronic Gear Numerator 3***	Mem Addr: 023D[h]
P2-62	***Electronic Gear Numerator 4***	Mem Addr: 023E[h]

Range: 1 ~ 32,767 Units: pulse

Default: 1 Control Modes: P

- *These parameters set a numerator of the Electronic Gear Ratio. P1-44, P2-60, P2-61, P2-62 set selectable numerators.*
- *P1-45 sets the denominator.*

Refer to P1-44 for information regarding "Electronic Gear Ratio" and Electronic Gear Numerator selection.

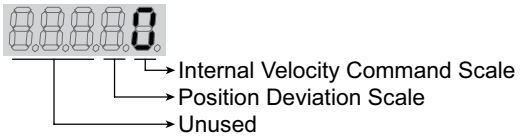
P2-63	***Velocity and Position Deviation Scaling Factor***	Mem Addr: 023F[h]

Range: 0 ~ 11 Units: times

Default: 0 Control Modes: P/V

- *This parameter sets the scaling factor for both the Position Deviation Fault Window (P2-35) and internal Velocity (P1-09 ~ P1-11) commands.*

Settings:



Internal Velocity Command Scale Settings:
(NOTE: This scaling applies to internal velocity commands only, and does NOT apply to velocity limit thresholds)

0 No scaling. The internal Velocity Command values (P1-09 ~ P1-11) are used as raw values.

1 The internal Velocity Command values (P1-09 ~ P1-11) are multiplied by 0.1 before being used by the system.
Example: A P1-09 velocity of 1234 rpm is used by the system as 123.4 rpm.

Position Deviation Scale Settings:

0 No scaling. The Position Deviation value (P2-35) is used as a raw value.

1 The Position Deviation value (P2-35) is multiplied by 100 before being used by the system.
Example: A P2-35 Position Deviation Fault Window of 100 counts is used by the system as 10,000 encoder counts. The Position Deviation fault monitor output will not become active until position error is equal to or greater than 10,000 encoder counts.
(Refer to P2-18 ~ P2-22 for explanation of DO settings, and to P0-01 for list of Drive Fault Codes.)

P2-64 *Advanced Torque Limit*

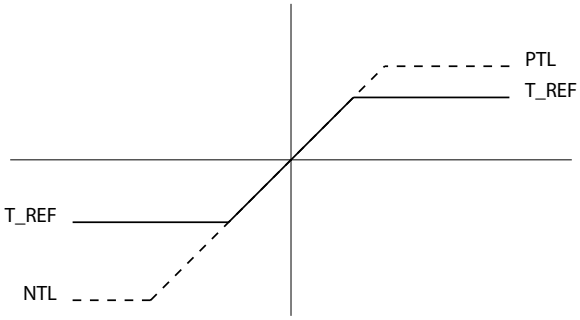
Mem Addr: 0240[h]

Range: 0 ~ 3 | Units: n/a

Default: 0 | Control Modes: P/V

- *This parameter allows you to use a variable analog input Torque Limit whose range is clamped by one or more separate fixed Torque Limits. The drive applies whichever applicable limit is more restrictive; variable or fixed.*
- *The Torque Limit function must be enabled by P1-02 = 1x, or by a DI with setting P2-10~P2-17 = 9, 25, or 26. Different clamping characteristics are available depending upon which enabling method you use. Use only one of the methods to enable the Torque Limit function.*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

» NTL = Negative Torque Limit
» PTL = Positive Torque Limit
» T_REF = Analog Torque Input = CN1 #18
» TL_N = Applied Negative Torque Limit
» TL_P = Applied Positive Torque Limit



Settings:

0 Disable Advanced Torque Limit function

1 Bi-directional Torque Limit (Torque Limit applies in both forward and reverse directions)
If |T_REF| < PTL TL_P = T_REF
If |T_REF| > PTL TL_P = PTL
If |T_REF| < |NTL| TL_N = T_REF
If |T_REF| > |NTL| TL_N = NTL

Torque Limit Clamp Selection for P2-64 = 1				
Torque Enable Method	***Motor Direction***	***Torque Comand Select DI***		***Active Torque Clamp***
		TCS1 (17)	***TCS0 (16)***	
P1-02 = 1x or DI: P2-10~P2-17 = 09	forward (+) or reverse (-)	0	0	Pt, V Modes: T_REF AI Pr, Vz Modes: 0 torque
		0	1	NTL = PTL from P1-12
		1	0	NTL = PTL from P1-13
		1	1	NTL = PTL from P1-14
DI: P2-10~P2-17 = 25	forward (+)	N/A		NTL = PTL from T_REF
	reverse (-)			NTL = PTL from P1-12
DI: P2-10~P2-17 = 26	forward (+)	N/A		NTL = PTL from P1-13
	reverse (-)			NTL = PTL from T_REF
TCS = Torque Command Select DI function; P2-10~P2-17 = 16 (TCS0) & 17 (TCS1).				

(P2-64 settings continued next page)

P2-64 Settings: (continued from previous page)

2 Forward Torque Limit (Torque Limit applies only in forward direction)

If T_REF < 0 $TL_P = 0$

If 0 < T_REF < |PTL| $TL_P = T\_REF$

If T_REF > |PTL| $TL_P = PTL$

Torque Limit Clamp Selection for P2-64 = 2				
Torque Enable Method	***Motor Direction***	***Torque Comand Select DI***		***Active Torque Clamp***
		TCS1 (17)	***TCS0 (16)***	
P1-02 = 1x or DI: P2-10~P2-17 = 09	forward (+) or reverse (-)	0	0	NTL = 0 torque PTL = T_REF AI
		0	1	NTL = 0 torque PTL = P1-12
		1	0	NTL = 0 torque PTL from P1-13
		1	1	NTL = 0 torque PTL from P1-14
DI: P2-10~P2-17 = 25	forward (+)	N/A		NTL = 0 torque PTL = T_REF AI
	reverse (-)			NTL = 0 torque PTL = P1-12
DI: P2-10~P2-17 = 26	forward (+)	N/A		NTL = 0 torque PTL = P1-13
	reverse (-)			NTL = 0 torque PTL = T_REF AI
TCS = Torque Command Select DI function; P2-10~P2-17 = 16 (TCS0) & 17 (TCS1).				

3 Reverse Torque Limit (Torque Limit applies only in reverse direction)

If T_REF > 0 $TL_N = 0$

If -|NTL| < T_REF < 0 $TL_N = -T\_REF$

If T_REF < -|NTL| $TL_N = NTL$

Torque Limit Clamp Selection for P2-64 = 3				
Torque Enable Method	***Motor Direction***	***Torque Comand Select DI***		***Active Torque Clamp***
		TCS1 (17)	***TCS0 (16)***	
P1-02 = 1x or DI: P2-10~P2-17 = 09	forward (+) or reverse (-)	0	0	NTL = T_REF AI PTL = 0 torque
		0	1	NTL = P1-12 PTL = 0 torque
		1	0	NTL from P1-13 PTL = 0 torque
		1	1	NTL from P1-14 PTL = 0 torque
DI: P2-10~P2-17 = 25	forward (+)	N/A		NTL = T_REF AI PTL = 0 torque
	reverse (-)			NTL = P1-12 PTL = 0 torque
DI: P2-10~P2-17 = 26	forward (+)	N/A		NTL = P1-13 PTL = 0 torque
	reverse (-)			NTL = T_REF AI PTL = 0 torque
TCS = Torque Command Select DI function; P2-10~P2-17 = 16 (TCS0) & 17 (TCS1).				

P2-65 *Special Input Functions*

Mem Addr: 0241[h]

Range: 0 ~ FFFF [h]

Units: bit

Default: 0

Control Modes: P/V/T

- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions".*
- *This is a multi-function parameter that controls the behavior of several different DI and DO/alarm functions. For most applications this parameter does not need to be changed. However, if you require some different behavior from some of the inputs or Alarm 08, you can modify certain behaviors by turning the parameter bits ON or OFF as described. Set these parameter bits directly through software, or manually set the parameter to the hexadecimal number that forms the binary bit pattern required for your application.*

P2-65 Bit Number	***15***	***14***	***13***	***12***	***11***	***10***	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***0***
Applicable DI or DO	n/a					DI 1~8	n/a			DO 1~5	n/a	DI8			DI 1~8	
DI or DO Function Setting						05				07; ALE08		new function			16, 17	14, 15

Settings:

Bit 0 Contact type for DI assigned as VCS0 or VCS1 (P2-10~P2-17 codes 14 or 15).
- 0: level sensing
- 1: rising edge sensing

Bit 1 Contact type for DI assigned as TCS0 or TCS1 (P2-10~P2-17 codes 16 or 17).
- 0: level sensing
- 1: rising edge sensing

Bit 2 Contact type for DI8 when assigned as Fast DI per bits 3~4 of this parameter (P2-65).
- 0: rising edge trigger or normally open contact
- 1: falling edge trigger or normally closed contact

Bits 3~4

B4	***B3***	***DI8 Function***
0	0	Disable Fast DI function for DI8
0	1	Enable Fast Position Latch for DI8: This is a new DI function that works in conjunction with P0-04~P0-05 Status Monitor setting 15 or 16. DI8 serves as a fast trigger to latch Position Counts (15) or Position Revs (16) into a Status Monitor.
1	0	Enable Fast DI Inhibit for DI8: Works in conjunction with P2-17 = 07 (Position Command Pause) or 45 (Inhibit Pulse Command - Terminal). Initiates quicker stop; Fast DI response time is 0.0~0.1 ms (vs. 0.4~0.6 ms for normal DI).

Bit 5 reserved; must remain set = 0

Bit 6 Disable ALE08 Abnormal Pulse Control Command alarm
- 0: Enable ALE08 for Pulse Control Command > 570 kpps
- 1: Disable ALE08 for Pulse Control Command > 570 kpps

Bits 7~9 reserved; must remain set = 0

Bit 10 System behavior when zero velocity clamp conditions are met; when Low Velocity Clamp DI (P2-10~P2-17 code 05) is active and the velocity of the motor is less than P1.38 setting; valid only in velocity modes.
- 0: Motor halts at present position; ramp settings disregarded
- 1: Velocity command is forced to 0rpm using ramp settings

Bit 11~15 reserved; must remain set = 0

Communication Parameters

P3-00 ***Communication Address*** Mem Addr: 0300[h]

Range: 1 ~ 254 Units: n/a

Default: 1 Control Modes: P/V/T

- *This parameter sets the Modbus slave address for this system. The address must be unique with regard to other drives on a 422/485 network, and must be within the range from 1 through 254.*

P3-01 ***Transmission Speed*** Mem Addr: 0301[h]

Range: 0 ~ 5 Units: bps

Default: 2 Control Modes: P/V/T

- *This parameter sets the baud rate of the serial communications.*

Settings:

0	4800 bps Baud rate
1	9600 bps Baud rate
2	19200 bps Baud rate
3	38400 bps Baud rate
4	57600 bps Baud rate
5	115200 bps Baud rate

P3-02 ***Communication Protocol*** Mem Addr: 0302[h]

Range: 0 ~ 8 Units: n/a

Default: 8 Control Modes: P/V/T

- *This parameter sets the communication protocol for serial communications.*

Settings – Modbus ASCII Mode:

0	7 data bits, no parity, 2 stop bits (7,N,2)
1	7 data bits, even parity, 1 stop bit (7,E,1)
2	7 data bits, odd parity, 1 stop bit (7,O,1)
3	8 data bits, no parity, 2 stop bits (8,N,2)
4	8 data bits, even parity, 1 stop bit (8,E,1)
5	8 data bits, odd parity, 1 stop bit (8,O,1)

Settings – Modbus RTU Mode:

6	8 data bits, no parity, 2 stop bits (8,N,2)
7	8 data bits, even parity, 1 stop bit (8,E,1)
8	8 data bits, odd parity, 1 stop bit (8,O,1)

P3-03 ***Communication Fault Action*** Mem Addr: 0303[h]

Range: 0 ~ 1 Units: n/a

Default: 0 Control Modes: P/V/T

- *This parameter determines how the system will behave if a communication error occurs.*

Settings:

0	Display fault and continue operating
1	Display fault and stop operating; [P1-32 determines how the drive will stop (i.e. coast to stop, or stop with dynamic braking)].

P3-04 Communication Watchdog Time Out Mem Addr: 0304[h]

Range: 0 ~ 20 (0 = disable) Units: s

Default: 0 Control Modes: P/V/T

- *This parameter sets the maximum amount of time allowed before faulting due to communication inactivity (watchdog routine). If this is set to a non-zero value, the servo drive must receive a valid request before the allotted time. Otherwise, the servo assumes the controller has failed and shuts down accordingly.*

P3-05 ***Communication Selection*** Mem Addr: 0305[h]

Range: 0 ~ 2 Units: n/a

Default: 0 Control Modes: P/V/T

Settings:

0	RS-232 (must be a point-to-point connection)
1	RS-422 (multidrop connection)
2	RS-485 (multidrop connection)

P3-06 ***reserved***

- *Do NOT modify this parameter.*

P3-07 ***Communication Response Delay Time*** Mem Addr: 0307[h]

Range: 0 ~ 255 Units: 0.5 ms

Default: 0 Control Modes: P/V/T

- *This parameter sets a time used to internally delay the response to a master controller. Some Modbus masters may require that the response to their request not be returned too quickly, so that they can setup to properly receive it. This is generally found in older controllers.*
- *Setting of 0 (default) disables this function.*

P3-08 *Digital Input Software Control Mask*

Mem Addr: 0308[h]

Range: 0 ~ FFFF [h]

Units: bit

Default: 0

Control Modes*: P/V/T

*** The upper eight bits of this parameter are effective only in Pr Mode.**

- *The lower byte of this parameter allows some or all of the drive's Digital Inputs to be controlled via Modbus communications instead of via external hardware. The DIs are controlled by external hardware by default. Control of any or all of the DIs can be changed to Modbus communication by setting the corresponding bit of the P3-08 lower byte to a logic one.*
- *The upper byte of this parameter provides an additional eight Virtual Digital Inputs for use only in Pr control mode. These Virtual DI have factory assigned functions, and are controlled only via Modbus communications.*
- *When DI1~DI8 are controlled via Modbus, the control mode is not limited to Pr mode; any mode will allow control of DI1~DI8. DI1~DI8 can only be controlled in an NO configuration. If one of the digital inputs is configured as an NC, then the requested logic will be ignored and the DI will behave as a NO configuration.*
- *Use P4-07 to write to the actual and virtual DI that are enabled and configured for Modbus control using this parameter (P3-08).*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions."*

P3-08 Bit #	***15***	***14***	***13***	***12***	***11***	***10***	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***0***
Actual CN1 DI	-	-	-	-	-	-	-	-	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
Pr Mode Virtual DI	DI16	DI15	DI14	DI13	DI12	DI11	DI10	DI9	-	-	-	-	-	-	-	-

P3-08 Virtual DI Factory Assigned Functions			
Bit #	***DI #***	***DI Active State & Function Code***	***DI Function Description***
8	9	108	Command Trigger (Pr mode only)
9	10	111	Position Command Select 0 (PCS0)
10	11	112	Position Command Select 1 (PCS1)
11	12	113	Position Command Select 2 (PCS2)
12	13	102	Alarm Reset
13	14	127	Start Home Move Trigger
14	15	137	Jog Forward
15	16	138	Jog Reverse

Settings:

Bit 0~7; DI1~DI8: 0: DI controlled by external hardware

1: DI controlled by Modbus communications

Bit 8~15; DI9~DI16: 0: Disable Virtual DI

1: Enable Virtual DI control via Modbus communications

Diagnostic Parameters

P4-00	***[1] Fault Record - Most recent (N)***	Mem Addr: 0400[h]
P4-01	***[1] Fault Record (N-1)***	Mem Addr: 0401[h]
P4-02	***[1] Fault Record (N-2)***	Mem Addr: 0402[h]
P4-03	***[1] Fault Record (N-3)***	Mem Addr: 0403[h]
P4-04	***[1] Fault Record (N-4)***	Mem Addr: 0404[h]

Range: ALE01 ~ ALE23 Units: n/a

Default: 0 Control Modes: P/V/T

Parameters P4-01 through P4-04 store previous fault code records in order of occurrence.

- *P4-00 stores the most recent fault code on record.*
- *P4-01 stores the second most recent fault code on record.*
- *P4-02 stores the third most recent fault code on record.*
- *P4-03 stores the fourth most recent fault code on record.*
- *P4-04 stores the fifth most recent fault code on record.*

P4-05 ***JOG Function*** Mem Addr: 0405[h]

Range: 1 ~ 3000 Units: rpm

Default: 20 Control Modes: P/V/T

- *This parameter is a function that applies a command to move the system. The operation instructions are as follows:*

Operation from the Keypad:

Note: When jogging from the keypad, any transition of either Fwd or Rev Overtravel switch will cause the motor to stop. If moving Fwd and a Rev OT is activated, you can simply release the Fwd button on the keypad and depress it again to resume operation; same with the Rev direction. Using the Digital Inputs is recommended for production purposes. Jogging from the keypad should only be done for testing, maintenance, or commissioning a machine.

1) Press the Enter key to set the JOG velocity (the default value is 20 rpm). The jog can be set from 1 rpm to the maximum allowable rpm (see P1-55).
2) Press the Enter key again to activate JOG mode and the display will show JOG. Note: The servo system must be enabled without any active faults in order for the motor to turn.
3) Press and hold the UP or DOWN arrow keys to move the motor CW or CCW (depends upon the direction setting; see P1-01).
4) To change the JOG velocity again, press the MODE key, then repeat operation sequence above.

Operation using Digital Inputs:

In order to control the jog function from the digital inputs, they must first be configured (see P2-10 through P2-17):

- *Jog Forward is code 37,*
- *Jog Reverse is code 38.*

Once they are configured, they can be used to initiate the jog function.

Communication Control:

Write the following values to the parameter via serial communications:

- *First enter 1 ~ 3000 to set the velocity in rpm.*
- *Then use:*

4998	*Move CCW command*
4999	*Move CW command*
5000	*Stop Command.*

Please note:

1) When using communication control, P2-30 should be set to 5 in order to prevent excessive writes to the system flash memory.
2) It is necessary in all above cases that the servo is enabled in order to produce movement in the system.

WARNING: UNEXPECTED AND POTENTIALLY DANGEROUS RESULTS CAN OCCUR IF THE JOG FUNCTION IS USED WHEN THE SERVO DRIVE IS CONFIGURED TO RUN A VELOCITY PROFILE. FOR EXAMPLE, IF YOU PUT THE DRIVE IN JOG MODE WHEN IT IS CONFIGURED TO RUN A VELOCITY PROFILE, THE VELOCITY PROFILE SETTING WILL TAKE CONTROL AND RUN THE SERVO AT THE PROFILE SETTING VELOCITY. PRESSING AN ARROW KEY WILL JOG THE MOTOR AT THE JOG SPEED WHILE THE KEY IS DEPRESSED, BUT THE MOTOR WILL RETURN TO THE VELOCITY PROFILE SETTING AS SOON AS THE ARROW KEY IS RELEASED.

P4-06 ***[2] Force Outputs Command*** Mem Addr: 0406[h]

Range: 00 ~ 1F [h] Units: n/a

Default: 00 Control Modes: P/V/T

- *Use this parameter to independently force the state of the digital outputs (Refer to P2-18 ~ P2-22 to assign the DO functions).*

Operation Instructions:

Select P4-06 and press the ENTER key. The display will then show "OP xx", where xx represents the parameter range from 00 to 1F in hex numbers. The two hex digits represent five binary bits which correspond to the five DO. The least significant bit represents DO1, and the most significant bit represents DO5. When the bit = 1 the corresponding DO is active, and when the bit = 0 the corresponding DO is inactive.

WARNING: P4-06 TAKES EFFECT IMMEDIATELY. THE OUTPUTS CHANGE STATE IMMEDIATELY AS THE VALUE IN P4-06 IS INCREMENTED OR DECREMENTED.

1) The outputs revert to normal operation when you exit P4-06.
2) The force outputs function is intended for test purposes only. It will not function if the servo drive is enabled.

P4-07 ***Input Status*** Mem Addr: 0407[h]

Range: 0 ~ FFFF [h] Units: n/a

Default: 0[h] Control Modes: P/V/T

- *Use this parameter to read the status of the digital inputs (Refer to P2-10 ~ P2-17 to assign DI functions). The least significant bit (bit 0) shows DI1 status, and bit 7 shows DI8 status.*
- *Use this parameter in conjuction with P3-08 to change the status of actual and virtual Digital Inputs via Modbus communications.*
- *This parameter varies by firmware version. For revision details, refer to "Appendix C: Latest SureServo Firmware Revisions".*

P4-08 ***reserved***

P4-09 ***Output Status*** Mem Addr: 0409[h]

Range: 00 ~ 1F [h] (0 = disable) Units: n/a

Default: 00 Control Modes: P/V/T

- *Use this parameter to independently read the status of the digital outputs.*

Operation instructions:

Select P4-09 on the keypad, and press Enter. The corresponding display LEDs will be on for each DO that is active. The least significant display digit represents DO1, and the third least significant digit represent DO5. (The two most significant digits are inactive for this parameter function.)

P4-10	***reserved***
P4-11	***reserved***
P4-12	***reserved***
P4-13	***reserved***
P4-14	***reserved***
P4-15	***reserved***
P4-16	***reserved***
P4-17	***reserved***
P4-18	***reserved***
P4-19	***reserved***

P4-20 ***[5] Analog Monitor 1 Offset (Ch1)*** Mem Addr: 0414[h]

Range: ±800 Units: mV

Default: 0 Control Modes: P/V/T

- *Use this parameter to add an offset value (in mV) to the actual Analog Monitor Output 1 (in V).*

P4-21 ***[5] Analog Monitor 2 Offset (Ch2)*** Mem Addr: 0415[h]

Range: ±800 Units: mV

Default: 0 Control Modes: P/V/T

- *Use this parameter to add an offset value (in mV) to the actual Analog Monitor Output 2 (in V).*

P4-22 ***Analog Velocity Input Offset*** Mem Addr: 0416[h]

Range: ±5000 Units: mV

Default: 0 Control Modes: V

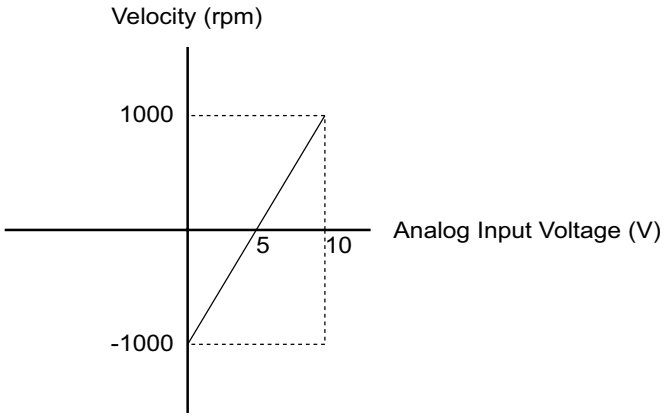
- *Use this parameter to add an offset value to the Analog Velocity Input. Set the parameter value such that (P4-22)/1000 is the input voltage at which you need zero velocity.*
  Velocity Command = ((P1-40)/10) [(Input V) - ((P4-22)/1000)]; Limit ±(P1-40)

Example 1:

Adjust P4-22 in small increments to trim a signal so that a 0V command results in no rotation of the motor.

Example 2:

To allow a 0 to 10V signal to control positive and negative motion, set this parameter value to 5000 (5V). This will offset the input signal (potentiometer, etc.) so that the midpoint of the range provides a command of zero speed to the drive.



P4-22 = 5000 mV; [5000 mV = 5V]
P1-40 = 2000 rpm; [velocity range = -1000 to +1000 = 2000 rpm]

For velocity range of -2000 to 2000 rpm from 0 to10V AI,
set P1-40 Maximum Analog Velocity Command (gain) to 4000 rpm.

P4-23 ***Analog Torque Input Offset*** Mem Addr: 0417[h]

Range: ±5000 Units: mV

Default: 0 Control Modes: T

- *Use this parameter to add an offset value to the Analog Torque Input. Set the parameter value such that (P4-23)/1000 is the input voltage at which you need zero torque.*
  Velocity Command = ((P1-41)/10) [(Input V) - ((P4-23)/1000)]; Limit ±(P1-41)

Refer to P4-22 for examples. (P4-23 affects torque instead of velocity, but otherwise operates the same as P4-22. P1-41, Max Analog Torque Command, is the parameter that determines the gain, or slope, for the Analog Torque Input.)

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