AC Drive Parameters

CHAPTER 4

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DURAPULSE GS4 PARAMETER SUMMARY

MOTOR PARAMETERS SUMMARY (P0.XX)

For detailed information about the P0.xx parameter group, please refer to page 4–30.

GS4 Parameters Summary – Motor Parameters (P0.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." 2) Parameters can be restored to their default values using P9.08.							
P0.00	Motor 1 Maximum Output Voltage	230V: 0.0~255.0V 460V: 0.0~510.0V	R/W	0000	40001	GS4-2xxx: 230.0 GS4-4xxx: 460.0	
P0.01	Motor 1 Rated Current	10~120% drive rated Amps	R/W	0001	40002	90% rated I of GS4	
P0.02	Motor 1 Base Frequency	0.00~599.00 Hz	R/W	0002	40003	60.00	
P0.03	Motor 1 Rated RPM	0 to (120 x P0.02/P0.09)-1	♦R/W	0003	40004	1710 (60Hz 4-pole) 1410 (50Hz 4-pole)	
P0.04	Drive Maximum Output Frequency	230V series: 599.00 Hz (75hp & above: 400.00 Hz) 460V series: 599.00 Hz (125hp & above: 400.00 Hz)	R/W	0004	40005	50.00/60.00	
P0.05	Motor Auto Tune	0: Disable 1: Measure motor in dynamic status (motor spinning) 2: Measure motor in static status (motor not spinning)	R/W	0005	40006	0	
P0.06	Motor 1 Resistance	0~65.535Ω	R/W	0006	40007	0	
P0.07	Motor 1 No-Load Current	0~100% motor rated Amps	R/W	0007	40008	40% of Motor1 Rated I	
P0.08	Motor 1 Rated Horsepower (HP)	0.00~655.35hp	♦R/W	0008	40009	Rated hp of GS4	
P0.09	Motor 1 Number of Poles	2 to (120 x P0.02/P0.03)	R/W	0009	40010	4	
P0.10	Motor 1 or 2 Selection	1: Motor 1 2: Motor 2	R/W	000A	40011	1	
P0.11	Motor 2 Maximum Output Voltage	230V: 0.0~255.0V 460V: 0.0~510.0V	R/W	000B	40012	GS4-2xxx: 230.00 GS4-4xxx: 460.00	
P0.12	Motor 2 Rated Current	10~120% drive rated Amps	R/W	000C	40013	90% rated I of GS4	
P0.13	Motor 2 Base Frequency	0.00~599.00 Hz	R/W	000D	40014	60.00	
P0.14	Motor 2 Rated RPM	0 to [(120 x P0.13/P0.18)-1] rpm	♦R/W	000E	40015	1710 (60Hz 4-pole) 1410 (50Hz 4-pole)	
P0.15	Motor 2 Resistance	0~65.535Ω	R/W	000F	40016	0	
P0.16	Motor 2 No-Load Current	0~100% motor rated Amps	R/W	0010	40017	40% of Motor2 Rated I	
P0.17	Motor 2 Rated Horsepower (HP)	0.00~655.35 hp	♦R/W	0011	40018	Rated hp of GS4	
P0.18	Motor 2 Number of Poles	2 to (120 x P0.13/P0.14)	R/W	0012	40019	4	

Ramps Parameters Summary (P1.xx)

For detailed information about the P1.xx parameter group, please refer to page 4–36.

GS4 Parameters Summary – Ramps Parameters (P1.xx)							
Parameter		***Range***	***Run[1] Read/ Write***	***Modbus Address***		***Settings***	
				Hex	***Dec***	***Default[2]***	***User***
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." 2) Parameters can be restored to their default values using P9.08.							
P1.00	Stop Method	0: Ramp to stop 1: Coast to stop	♦R/W	0100	40257	0	
P1.01	Acceleration Time 1	P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.0 sec	♦R/W	0101	40258	10.00	
P1.02	Deceleration Time 1		♦R/W	0102	40259	10.00	
P1.03	Acceleration Time 2		♦R/W	0103	40260	10.00	
P1.04	Deceleration Time 2		♦R/W	0104	40261	10.00	
P1.05	Acceleration Time 3		♦R/W	0105	40262	10.00	
P1.06	Deceleration Time 3		♦R/W	0106	40263	10.00	
P1.07	Acceleration Time 4		♦R/W	0107	40264	10.00	
P1.08	Deceleration Time 4		♦R/W	0108	40265	10.00	
P1.09	S-curve Accel Time 1	P1.15=0: 0.00~25.00 sec P1.15=1: 0.0~250.0 sec	♦R/W	0109	40266	0.20	
P1.10	S-curve Decel Time 1		♦R/W	010A	40267	0.20	
P1.11	S-curve Accel Time 2		♦R/W	010B	40268	0.20	
P1.12	S-curve Decel Time 2		♦R/W	010C	40269	0.20	
P1.13	Jog Acceleration Time	P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.0 sec	♦R/W	010D	40270	10.00	
P1.14	Jog Deceleration Time		♦R/W	010E	40271	10.00	
P1.15	Time Unit for Accel/Decel & S-curve	0: unit 0.01sec 1: unit 0.1sec	R/W	010F	40272	1	
P1.16	Accel/Decel Transition Method	0: rmp2 from terminal 1: transition frequencies P1.17 & P1.18	♦R/W	0110	40273	0	
P1.17	Accel Transition Frequency 1-2	0.00~599.00 Hz	♦R/W	0111	40274	0.00	
P1.18	Decel Transition Frequency 1-2		♦R/W	0112	40275	0.00	
P1.19	Skip Frequency 1 Upper Limit	0.00~599.00 Hz	R/W	0113	40276	0.00	
P1.20	Skip Frequency 1 Lower Limit		R/W	0114	40277	0.00	
P1.21	Skip Frequency 2 Upper Limit		R/W	0115	40278	0.00	
P1.22	Skip Frequency 2 Lower Limit		R/W	0116	40279	0.00	
P1.23	Skip Frequency 3 Upper Limit		R/W	0117	40280	0.00	
P1.24	Skip Frequency 3 Lower Limit		R/W	0118	40281	0.00	
P1.25	DC Injection Current Level	0~100%	♦R/W	0119	40282	0	
P1.26	DC Injection Time During Start-up	0.0~60.0 sec	♦R/W	011A	40283	0.0	
P1.27	DC Injection Time During Stopping		♦R/W	011B	40284	0.0	
P1.28	Start-Point for DC Injection During Stopping	0.00~599.00 Hz	♦R/W	011C	40285	0.00	
P1.29	Deceleration Method	0: Normal Ramp Deceleration 1: Over Fluxing Deceleration 2: Traction Energy Control	R/W	011D	40286	0	

V/Hz Parameters Summary (P2.xx)

For detailed information about the P2.xx parameter group, please refer to page 4–46.

GS4 Parameters Summary – V/Hz Parameters (P2.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only."							
2) Parameters can be restored to their default values using P9.08.							
P2.00	Volts/Hertz Settings	0: General Purpose 1: High Starting Torque (TQR) 2: Fans and Pumps 3: Custom 4: 1.5 Power Curve 5: Square Curve	R/W	0200	40513	0	
P2.01	Slip Compensation Gain	0.00~10.00	♦R/W	0201	40514	0.00 (V/Hz mode) 1.00 (Vector mode)	
P2.02	Torque Compensation Gain	0~10	♦R/W	0202	40515	0	
P2.03	Torque Compensation Filter	0.001~10.000 sec	♦R/W	0203	40516	0.500	
P2.04	Motor 1 Middle Output Frequency 1	0.00~599.00 Hz	R/W	0204	40517	3.00	
P2.05	Motor 1 Middle Output Voltage 1	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	0205	40518	GS4- 21P0~27P5: 15.0V 2010+: 14.0V GS4- 41P0~47P5: 30.0V 4010+: 28.0V	
P2.06	Motor 1 Middle Output Frequency 2	0.00~599.00 Hz	R/W	0206	40519	3.00	
P2.07	Motor 1 Middle Output Voltage 2	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	0207	40520	GS4- 21P0~27P5: 15.0V 2010+: 14.0V GS4- 41P0~47P5: 30.0V 4010+: 28.0V	
P2.08	Motor 1 Minimum Output Frequency	0.00~599.99 Hz	R/W	0208	40521	1.50	
P2.09	Motor 1 Minimum Output Voltage	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	0209	40522	GS4- 21P0~27P5: 9.0V 2010+: 7.0V GS4- 41P0~47P5: 18.0V 4010+: 14.0V	
P2.10	PWM Carrier Frequency *NOTE: THERE ARE INTERDEPENDENCIES BETWEEN P2.10, P6.00/P6.02, P6.33, P6.34. REFER TO PARAMETER DETAILS WHEN SETTING THESE PARAMETERS.*	2~15 kHz	R/W	020A	40523	model specific; refer to param. details	
P2.11	Control Mode	0: V/Hz Open Loop Control 1: SVC Sensorless	♦R/W	020B	40524	0	
P2.12	Motor 2 Middle Output Frequency 1	0.00~599.00 Hz	R/W	020C	40525	3.00	
P2.13	Motor 2 Middle Output Voltage 1	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	020D	40526	GS4- 21P0~27P5: 15.0V 2010+: 14.0V GS4- 41P0~47P5: 30.0V 4010+: 28.0V	
P2.14	Motor 2 Middle Output Frequency 2	0.00~599.00 Hz	R/W	020E	40527	3.00	
(table continued next page)							

GS4 Parameters Summary – V/Hz Parameters (P2.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P2.15	Motor 2 Middle Output Voltage 2	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	020F	40528	GS4- 21P0~27P5: 15.0V 2010+: 14.0V GS4- 41P0~47P5: 30.0V 4010+: 28.0V	
P2.16	Motor 2 Minimum Output Frequency	0.00~599.99 Hz	R/W	0210	40529	1.50	
P2.17	Motor 2 Minimum Output Voltage	230V: 0.0~240.0V 460V: 0.0~480.0V	♦R/W	0211	40530	GS4- 21P0~27P5: 9.0V 2010+: 7.0V GS4- 41P0~47P5: 18.0V 4010+: 14.0V	
P2.18	Zero Speed Select	0: Standby 1: Zero Hold 2: Fmin (Min Hz Output)	R/W	0212	40531	0	
P2.19	Start Frequency	0.00~599.00 Hz	R/W	0213	40532	0.50	
P2.20	Y-D Switching Frequency	0.00~599.00 Hz	♦R/W	0214	40533	60.00	
P2.21	Y-D Switching Enable	0: Disable 1: Enable	R/W	0215	40534	0	
P2.22	Delay Time for Y-D Switching	0.000~600.000 sec	♦R/W	0216	40535	0.200	
P2.23	Automatic Energy-Saving Operation	0: Disable 1: Enable	♦R/W	0217	40536	0	
P2.24	Power Saving Gain	10~1000%	♦R/W	0218	40537	100	
P2.25	Slip Compensation Filter	0.001~10.000 sec	♦R/W	0219	40538	0.100	
P2.26	Slip Deviation Level	0.0~100.0	♦R/W	021A	40539	0.0	
P2.27	Slip Deviation Detection time	0.0~10.0	♦R/W	021B	40540	1.0	
P2.28	Slip Deviation Treatment	0: Warn and continue OP 1: Warn and Ramp to Stop 2: Warn and Coast to stop 3: No Warn	♦R/W	021C	40541	0	
P2.29	Hunting Gain	0~10000	♦R/W	021D	40542	1000	

DIGITAL PARAMETERS SUMMARY (P3.XX)

For detailed information about the P3.xx parameter group, please refer to page 4–60.

GS4 Parameters Summary – Digital Parameters (P3.xx)							
Parameter		***Range***	***Run[1] Read/ Write***	***Modbus Address***		***Settings***	
				Hex	***Dec***	***Default[2]***	***User***
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." *2) Parameters can be restored to their default values using P9.08.*							
P3.00	1st Source of Operation Command [Remote]	0: Digital Keypad 1: External Terminal; Keypad/RS-485 STOP is enabled 2: External Terminal; Keypad/RS-485 STOP is disabled 3: RS485 (Modbus/BACnet); Keypad STOP is enabled 4: RS485 (Modbus/BACnet); Keypad STOP is disabled 5: Comm Card; Keypad STOP is enabled 6: Comm Card; Keypad STOP is disabled	R/W	0300	40769	0	
P3.01	2nd Source of Operation Command [Local]		R/W	0301	40770	0	
P3.02	2/3 Wire Operation Mode	0: 2-wire mode 1 (Fwd, Rev) 1: 2-wire mode 2 (Run, Direction) 2: 3-wire mode	R/W	0302	40771	0	
(table continued next page)							

GS4 Parameters Summary – Digital Parameters (P3.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P3.03	Multi-Function Input (DI1)	0: No function 1: Multi-Speed/PID Multi-Setpoint bit 1 2: Multi-Speed/PID Multi-Setpoint bit 2 3: Multi-Speed/PID Multi-Setpoint bit 3 4: Multi-Speed bit 4 5: Reset 6: JOG 7: Accel/Decel speed inhibit (Speed Hold) 8: 1st~4th Accel/Decel time selection, bit 0 9: 1st~4th Accel/Decel time selection, bit 1 10: External Fault Input by P3.56 (EF error) 11: Base Block Input 12: reserved 13: Disable Auto Accel/Decel Time 14: Switch between drive settings 1 and 2 15: Operation speed command from AI1 16: Operation speed command from AI2 17: Operation speed command from AI3 18: Forced Ramp Stop by P3.56 (no error) 19: Digital Freq Up Command 20: Digital Freq Down Command 21: PID function Disable 22: Clear counter 23: Increment counter value (DI6 only) 24: FWD JOG 25: REV JOG 26: Emergency Stop EF1 (Coast stop)(EF1 error) 27: Signal Confirmation for Y-connection 28: Signal Confirmation for Delta connection 29: Disable EEPROM Write 30: Forced Coast Stop 31: Hand Contact for HOA Control 32: Auto Contact for HOA Control 33: LOCAL/REMOTE Selection 34: Drive Enable 35: Decel Energy Backup (DEB) Enable 36: PLC Mode select bit0 37: PLC Mode select bit1 38: Output MCR Auxiliary Confirmation 39: reserved 40: Fire mode and force drive run 41: Fire mode and maintain operation 42: Disable all motors 43: Disable Motor #1 44: Disable Motor #2 45: Disable Motor #3 46: Disable Motor #4 47: Disable Motor #5 48: Disable Motor #6 49: Disable Motor #7 50: Disable Motor #8	R/W	0303	40772	1	
P3.04	Multi-Function Input (DI2)		R/W	0304	40773	2	
P3.05	Multi-Function Input (DI3)		R/W	0305	40774	3	
P3.06	Multi-Function Input (DI4)		R/W	0306	40775	4	
P3.07	Multi-Function Input (DI5)		R/W	0307	40776	0	
P3.08	Multi-Function Input (DI6)		R/W	0308	40777	0	
P3.09	Multi-Function Input (DI7)		R/W	0309	40778	0	
P3.10	Multi-Function Input (DI8)		R/W	030A	40779	0	
P3.11	Multi-Function Input (option card DI10 or PLC X12)		R/W	030B	40780	0	
P3.12	Multi-Function Input (option card DI11 or PLC X13)		R/W	030C	40781	0	
P3.13	Multi-Function Input (option card DI12 or PLC X14)		R/W	030D	40782	0	
P3.14	Multi-Function Input (option card DI13 or PLC X15)		R/W	030E	40783	0	
P3.15	Multi-Function Input (option card DI14 or PLC X16)		R/W	030F	40784	0	
P3.16	Multi-Function Input (option card DI15 or PLC X17)		R/W	0310	40785	0	

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GS4 Parameters Summary – Digital Parameters (P3.xx) – (continued)								
Parameter		**Range**		**Run Read/ Write**	**Modbus Address**		**Settings**	
					Hex	**Dec**	**Default**	**User**
P3.17	Multi-Function Output Terminal 1 (Relay 1 or PLC Y0)	0: no function 1: AC Drive Running 2: At Frequency Setpoint 3: At Speed 1 (P3.32) 4: At Speed 2 (P3.34) 5: At Zero Speed Including Drive Running 6: At Zero Speed Drive not Running 7: Over Torque Level 1 8: Over Torque Level 2 9: Drive Ready 10: Low Voltage warning (Lv) 11: Error indication (All faults, Except for Lv Stop) 12: Brake Release Function (P3.51) 13: Over-temp Warning 14: Dynamic Braking Output 15: PID deviation error 16: Over Slip (oSL) 17: Middle Count Value Attained (P3.45) 18: Final Count Value Attained (P3.44) 19: Base Block Indication 20: Warning Output 21: Overvoltage Alarm 22: Oc Stall Alarm 23: Ov Stall Alarm 24: External Control Mode 25: Forward Command 26: Reverse Command 27: Above Current Output (≥ P3.52) 28: Below Current Output (< P3.52) 29: Wye Connected Command	30: Delta Connected Command 31: Zero Speed at Drive Running 32: Zero Speed including Drive Stop 33: Fault Option 1 (P11.00) 34: Fault Option 2 (P11.01) 35: Fault Option 3 (P11.02) 36: Fault Option 4 (P11.03) 37: At Speed (Setpoint include 0Hz) 38: reserved 39: Under Ampere (Low Current) 40: UVW Motor Contactor Enable 41: DEB active 42: Brake Released at Stop 43: RS485 Digital Output 44: Comm Card Digital Output 45: Fire Mode Indication 46: Fire Bypass Indication 47: Motor #1 Selected 48: Motor #2 Selected 49: Motor #3 Selected 50: Motor #4 Selected 51: Motor #5 Selected 52: Motor #6 Selected 53: Motor #7 Selected 54: Motor #8 Selected 55: Mtr1/Mtr2 Nameplate Parameters Select 56: Safety N.O. STO A 57: Safety N.C. STO B 58: Above Frequency Output (≥ P3.53) 59: Below Frequency Output (< P3.53)	♦R/W	0311	40786	11	
P3.18	Multi-Function Output Terminal 2 (Relay 2 or PLC Y1)			♦R/W	0312	40787	1	
P3.19	Multi-Function Output Terminal 3 (DO1 or PLC Y3)			♦R/W	0313	40788	0	
P3.20	Multi-Function Output Terminal 4 (DO2 or PLC Y4)			♦R/W	0314	40789	0	
P3.21	Multi-Function Output Terminal 5 (option card DO10 or RO10, or PLC Y5)			♦R/W	0315	40790	0	
P3.22	Multi-Function Output Terminal 6 (option card DO11 or RO11, or PLC Y6)			♦R/W	0316	40791	0	
P3.23	Multi-Function Output Terminal 7 (option card RO12 or PLC Y7)			♦R/W	0317	40792	0	
P3.24	Multi-Function Output Terminal 8 (option card RO13 or PLC Y10)			♦R/W	0318	40793	0	
P3.25	Multi-Function Output Terminal 9 (option card RO14 or PLC Y11)			♦R/W	0319	40794	0	
P3.26	Multi-Function Output Terminal 10 (option card RO15 or PLC Y12)			♦R/W	031A	40795	0	
P3.27	Multi-Function Virtual Output 11 (DO16, PLC Y13)			♦R/W	031B	40796	0	
P3.28	Multi-Function Virtual Output 12 (DO17, PLC Y14)			♦R/W	031C	40797	0	
P3.29	Multi-Function Virtual Output 13 (DO18, PLC Y15)			♦R/W	031D	40798	0	
P3.30	Multi-Function Virtual Output 14 (DO19, PLC Y16)			♦R/W	031E	40799	0	
P3.31	Multi-Function Virtual Output 15 (DO20, PLC Y17)			♦R/W	031F	40800	0	
P3.32	Desired Frequency 1	0.00~599.00 Hz		♦R/W	0320	40801	60.00	
P3.33	Desired Frequency 1 Width	0.00~599.00 Hz		♦R/W	0321	40802	2.00	
P3.34	Desired Frequency 2	0.00~599.00 Hz		♦R/W	0322	40803	60.00	
P3.35	Desired Frequency 2 Width	0.00~599.00 Hz		♦R/W	0323	40804	2.00	
P3.36	PID Deviation Level	1.0~50.0%		♦R/W	0324	40805	10.0	
P3.37	PID Deviation Time	0.1~300.0 sec		♦R/W	0325	40806	5.0	
P3.38	Frequency Output (FO) Scaling Factor	1~166		♦R/W	0326	40807	1	

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GS4 Parameters Summary – Digital Parameters (P3.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P3.39	Increase/Decrease Speed Mode	0.000: Following Accel/Decel Time 0.001~1.000 Hz/ms: Following Constant Speed	♦R/W	0327	40808	0	
P3.40	DI6 Counter Debounce Filter	0.00~30.00 sec	♦R/W	0328	40809	0.02	
P3.41	Digital Input Response Time	0~30.000 sec	♦R/W	0329	40810	0.005	
P3.42	Multi-Function Input Contact Selection (0=N.O. / 1=N.C.)	0~65535	R/W	032A	40811	0	
P3.43	Multi-Function Output Contact Selection (0=N.O. / 1=N.C.)	0~65535	♦R/W	032B	40812	0	
P3.44	Final Counter Value	0~65500	♦R/W	032C	40813	0	
P3.45	Mid-point Counter Value	0~65500	♦R/W	032D	40814	0	
P3.46	Digital Input Active Status	0~65535	Read	032E	40815	0	
P3.47	Digital Output Active Status	0~65535	Read	032F	40816	0	
P3.48	PLC – Digital Input Mask	0~65535	Read	0330	40817	0	
P3.49	PLC – Digital Output Mask	0~65535	Read	0331	40818	0	
P3.50	Increase/Decrease Speed Command Record	0~600.00	Read	0332	40819	60	
P3.51	Brake Delay Time	0.000~65.000 sec	R/W	0333	40820	0	
P3.52	Desired Current	0~150% of GS4 VT current rating	♦R/W	0334	40821	0	
P3.53	Output Frequency Threshold for Multi-Function Output Terminals	0.00~599.00 Hz	♦R/W	0335	40822	0	
P3.54	reserved	n/a	n/a	0336	40823	n/a	
P3.55	reserved	n/a	n/a	0337	40824	n/a	
P3.56	Emergency Stop (EF) & Force Stop Selection	0: Coast Stop 1: Deceleration Time 1 2: Deceleration Time 2 3: Deceleration Time 3 4: Deceleration Time 4 5: System Deceleration 6: Automatic Deceleration	R/W	0338	40825	0	
P3.57	AUTO to HAND Switching Behavior	0~Fh bit 0: Sleep function control bit bit 1: Parameter units displayed on keypad bit 2: PID control bit bit 3: Source of frequency control bit	♦R/W	0339	40826	0	
P3.58	Local/Remote Switch Mode	0: HAND/OFF/AUTO control 1: Always Stop When Switching 2: Follow Remote Mode 3: Follow Local Mode 4: Follow Local and Remote Mode	R/W	033A	40827	4	

Analog Parameters Summary (P4.xx)

For detailed information about the P4.xx parameter group, please refer to page 4–89.

GS4 Parameters Summary – Analog Parameters (P4.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only."							
2) Parameters can be restored to their default values using P9.08.							
P4.00	1st Source of Frequency Command [Remote]	0: Digital Keypad 1: RS485 Communication (Modbus/BACnet) 2: Analog Input 3: External UP/DOWN Terminal 4: Comm Card	♦R/W	0400	41025	0	
P4.01	2nd Source of Frequency Command [Local]		♦R/W	0401	41026	0	
P4.02	Analog Input 1 (AI1) Function	0: no Function 1: Frequency Command/PID Setpoint REMOTE 2: Frequency Command/PID Setpoint LOCAL 3: Frequency Command/PID Setpoint REMOTE & LOCAL 4: reserved 5: PID Feedback Signal 6: PTC Thermistor Input Value 7: PID Setpt Offset 8~10: reserved 11: PT100 RTD Input Value	♦R/W	0402	41027	1	
P4.03	Analog Input 2 (AI2) Function		♦R/W	0403	41028	0	
P4.04	Analog Input 3 (AI3) Function		♦R/W	0404	41029	0	
P4.05	AI1 – I/V Selection	0: AI_v Selection (0~10V) 1: AI_i Selection (4~20mA) 2: AI_i Selection (0~20mA)	♦R/W	0405	41030	0	
P4.06	AI2 – I/V Selection		♦R/W	0406	41031	1	
P4.07	Trim Reference Frequency	0.00~599.00 Hz	R/W	0407	41032	0.0	
P4.08	Trim Selection	0: Disable Trim Function 1: 1st Source Freq + 2nd Source Freq 2: 1st Source Freq - 2nd Source Freq 3: Speed Source + Trim Ref Freq 4: Speed Source - Trim Ref Freq	R/W	0408	41033	0	
P4.09	Analog Frequency Command for Reverse Run	0: Negative Frequency Input is Disabled. Forward and reverse directions are controlled by digital keypad or by external terminal. 1: Negative Frequency Input is Enabled. Forward direction when positive frequency; reverse direction when negative frequency. Forward and reverse directions are NOT controlled by digital keypad or by external terminal.	♦R/W	0409	41034	0	
P4.10	AI1 Input Bias (Offset)	-100.0% to +100.0%	♦R/W	040A	41035	0	
P4.11	AI1 Input Bias (Offset) Polarity	0: NO Offset 1: Positive Offset 2: Negative Offset	♦R/W	040B	41036	0	
P4.12	AI1 Input Gain	-500.0% to +500.0%	♦R/W	040C	41037	100.0	
P4.13	AI1 Filter	0.00~20.00 sec	♦R/W	040D	41038	0.01	
P4.14	reserved	n/a	n/a	040E	41039	n/a	
P4.15	AI2 Input Bias (Offset)	-100.0% to +100.0%	♦R/W	040F	41040	0	
P4.16	AI2 Input Bias (Offset) Polarity	0: NO Offset 1: Positive Offset 2: Negative Offset	R/W	0410	41041	0	

(table continued next page)

GS4 Parameters Summary – Analog Parameters (P4.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P4.17	AI2 Input Gain	-500.0% to +500.0%	♦R/W	0411	41042	100.0	
P4.18	AI2 Filter	0.00~20.00 sec	♦R/W	0412	41043	0.01	
P4.19	AI3 Input Bias (Offset)	-100.0% to +100.0%	♦R/W	0413	41044	0	
P4.20	AI3 Input Bias (Offset) Polarity	0: NO Offset 1: Positive Offset 2: Negative Offset	R/W	0414	41045	0	
P4.21	+AI3 Input Gain	-500.0% to +500.0%	♦R/W	0415	41046	100.0	
P4.22	-AI3 Input Gain	-500.0% to +500.0%	♦R/W	0416	41047	100.0	
P4.23	AI3 Filter	0.00~20.00 sec	♦R/W	0417	41048	0.01	
P4.24	AI V/Hz Calculated Selection	0: All Inputs Use Bias and Gain 1: AI1 Custom V/Hz 2: AI2 Custom V/Hz 3: AI1 and AI2 Custom V/Hz 4: AI3 Custom V/Hz 5: AI1 & AI3 Custom V/Hz 6: AI2 & AI3 Custom V/Hz 7: All Custom V/Hz	R/W	0418	41049	0	
P4.25	AI1 Low V/A	P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA	R/W	0419	41050	P4.05=0: 0.00V P4.05=1: 4.00mA P4.05=2: 0.00mA	
P4.26	AI1 Low Hz Percent	0.00~100.00%	R/W	041A	41051	0	
P4.27	AI1 Mid V/A	P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA	R/W	041B	41052	P4.05=0: 5.00V P4.05=1: 12.00mA P4.05=2: 10.00mA	
P4.28	AI1 Mid Hz Percent	0.00~100.00%	R/W	041C	41053	50.00	
P4.29	AI1 High V/A	P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA	R/W	041D	41054	P4.05=0: 10.00V P4.05=1: 20.00mA P4.05=2: 20.00mA	
P4.30	AI1 High Hz Percent	0.00~100.00%	R/W	041E	41055	100.00	
P4.31	AI2 Low V/A	P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA	R/W	041F	41056	P4.06=0: 0.00V P4.06=1: 4.00mA P4.06=2: 0.00mA	
P4.32	AI2 Low Hz Percent	0.00~100.00%	R/W	0420	41057	0	
P4.33	AI2 Mid V/A	P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA	R/W	0421	41058	P4.06=0: 5.00V P4.06=1: 12.00mA P4.06=2: 10.00mA	
P4.34	AI2 Mid Hz Percent	0.00~100.00%	R/W	0422	41059	50.00	

(table continued next page)

GS4 Parameters Summary – Analog Parameters (P4.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P4.35	AI2 High V/A	P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA	R/W	0423	41060	P4.06=0: 10.00V P4.06=1: 20.00mA P4.06=2: 20.00mA	
P4.36	AI2 High Hz Percent	0.00~100.00%	R/W	0424	41061	100.00	
P4.37	AI3 Low Voltage Unipolar	0.00~10.00V	R/W	0425	41062	0	
P4.38	AI3 Low Hz Percent Unipolar	0.00~100.00%	R/W	0426	41063	0	
P4.39	AI3 Mid Voltage Unipolar	0.00~10.00V	R/W	0427	41064	5.00	
P4.40	AI3 Mid Hz Percent Unipolar	0.00~100.00%	R/W	0428	41065	50.00	
P4.41	AI3 High Voltage Unipolar	0.00~10.00V	R/W	0429	41066	10.00	
P4.42	AI3 High Hz Percent Unipolar	0.00~100.00%	R/W	042A	41067	100.00	
P4.43	-AI3 High Voltage Bipolar	-10.00V to 0.00V	R/W	042B	41068	0.00	
P4.44	-AI3 High Hz Percent Bipolar	-100.00% to +100.00%	R/W	042C	41069	0.00	
P4.45	-AI3 Mid Voltage Bipolar	-10.00V to 0.00V	R/W	042D	41070	–5.00	
P4.46	-AI3 Mid Hz Percent Bipolar	-100.00% to +100.00%	R/W	042E	41071	–50.00	
P4.47	-AI3 Low Voltage Bipolar	-10.00V to 0.00V	R/W	042F	41072	–10.00	
P4.48	-AI3 Low Hz Percent Bipolar	-100.00% to +100.00%	R/W	0430	41073	–100.00	
P4.49	reserved	n/a	n/a	0431	41074	n/a	
P4.50	Analog Output 1 (AO1)	0: Output Frequency (Hz) 1: Frequency Command (Hz) 2: Motor Speed (Hz) 3: Output Current (A_{rms}) 4: Output Voltage (V) 5: DC Bus Voltage (V) 6: Power Factor (%) 7: Power (% Rated) 8: AI1 (%) 9: AI2 (%) 10: AI3 (%) 11: As 485 AO 12: As COMM Card AO 13: Fixed Voltage	♦R/W	0432	41075	0	
P4.51	AO1 Gain	0.0~500.0%	♦R/W	0433	41076	100.0	
P4.52	AO1 Negative Value Handle	0: Absolute Value 1: 0V When Negative 2: Offset 5V = 0 Value	♦R/W	0434	41077	0	
P4.53	AO1 0~20mA/4~20mA Selection	0: 0~20mA 1: 4~20mA	R/W	0435	41078	0	
P4.54	Analog Output 2 (AO2)	0: Output Frequency (Hz) 1: Frequency Command (Hz) 2: Motor Speed (Hz) 3: Output Current (A_{rms}) 4: Output Voltage (V) 5: DC Bus Voltage (V) 6: Power Factor (%) 7: Power (% Rated) 8: AI1 (%) 9: AI2 (%) 10: AI3 (%) 11: As 485 AO 12: As COMM Card AO 13: Fixed Voltage	♦R/W	0436	41079	0	
P4.55	AO2 Gain	0.0~500.0%	♦R/W	0437	41080	100.0	

(table continued next page)

GS4 Parameters Summary – Analog Parameters (P4.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P4.56	AO2 Negative Value Handle	0: Absolute Value 1: 0V When Negative 2: Offset 5V = 0 Value	♦R/W	0438	41081	0	
P4.57	AO2 0~20mA/4~20mA Selection	0: 0~20mA 1: 4~20mA	R/W	0439	41082	0	
P4.58	reserved	n/a	n/a	043A	41083	n/a	
P4.59	AO2 Offset (Bias)	-100.00% to +100.00%	♦R/W	043B	41084	0.00	
P4.60	AO1 Output Constant Level	0.00~100.00%	R/W	043C	41085	0.00	
P4.61	AO2 Output Constant Level	0.00~100.00%	R/W	043D	41086	0.00	
P4.62	PLC Analog Output Mask	0 to 65535	♦R/W	043E	41087	0	
P4.63	Loss of AI1 Signal (4~20mA)	0: Disable 1: Run at Last Freq (ANL Warning) 2: Decelerate to 0Hz (ANL Warning) 3: Stop (ACE Fault)	R/W	043F	41088	0	
P4.64	Loss of AI2 Signal (4~20mA)			0440	41089	0	
P4.65	AI1%	-100% to 100%	Read	0441	41090	0	
P4.66	AI2%	-100% to 100%	Read	0442	41091	0	
P4.67	AI3%	-100% to 100%	Read	0443	41092	0	

PRESETS PARAMETERS SUMMARY (P5.XX)

For detailed information about the P5.xx parameter group, please refer to page 4–119.

GS4 Parameters Summary – Presets Parameters (P5.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only."							
2) Parameters can be restored to their default values using P9.08.							
P5.00	Jog Frequency	0.00~599.00 Hz	♦R/W	0500	41281	6.0	
P5.01	Multi-Speed 1	0.00~599.00 Hz	♦R/W	0501	41282	0.0	
P5.02	Multi-Speed 2	0.00~599.00 Hz	♦R/W	0502	41283	0.0	
P5.03	Multi-Speed 3	0.00~599.00 Hz	♦R/W	0503	41284	0.0	
P5.04	Multi-Speed 4	0.00~599.00 Hz	♦R/W	0504	41285	0.0	
P5.05	Multi-Speed 5	0.00~599.00 Hz	♦R/W	0505	41286	0.0	
P5.06	Multi-Speed 6	0.00~599.00 Hz	♦R/W	0506	41287	0.0	
P5.07	Multi-Speed 7	0.00~599.00 Hz	♦R/W	0507	41288	0.0	
P5.08	Multi-Speed 8	0.00~599.00 Hz	♦R/W	0508	41289	0.0	
P5.09	Multi-Speed 9	0.00~599.00 Hz	♦R/W	0509	41290	0.0	
P5.10	Multi-Speed 10	0.00~599.00 Hz	♦R/W	050A	41291	0.0	
P5.11	Multi-Speed 11	0.00~599.00 Hz	♦R/W	050B	41292	0.0	
P5.12	Multi-Speed 12	0.00~599.00 Hz	♦R/W	050C	41293	0.0	
P5.13	Multi-Speed 13	0.00~599.00 Hz	♦R/W	050D	41294	0.0	
P5.14	Multi-Speed 14	0.00~599.00 Hz	♦R/W	050E	41295	0.0	
P5.15	Multi-Speed 15	0.00~599.00 Hz	♦R/W	050F	41296	0.0	

Protection Parameters Summary (P6.xx)

For detailed information about the P6.xx parameter group, please refer to page 4–121.

GS4 Parameters Summary – Protection Parameters (P6.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only."							
2) Parameters can be restored to their default values using P9.08.							
P6.00	Electronic Thermal Overload Relay (Motor 1) *Note: There are interdependencies between P2.10, P6.00/P6.02, P6.33, P6.34. Refer to Parameter Details when setting these parameters.*	0: Constant Torque 1: Variable Torque 2: Inactive	♦R/W	0600	41537	1	
P6.01	Electronic Thermal Characteristic (Motor 1)	30.0~600.0 sec	♦R/W	0601	41538	60.0	
P6.02	Electronic Thermal Overload Relay (Motor 2) *Note: There are interdependencies between P2.10, P6.00/P6.02, P6.33, P6.34. Refer to Parameter Details when setting these parameters.*	0: Constant Torque 1: Variable Torque 2: Inactive	♦R/W	0602	41539	2	
P6.03	Electronic Thermal Characteristic (Motor 2)	30.0~600.0 sec	♦R/W	0603	41540	60.0	
P6.04	Auto Restart after Fault	0~10	♦R/W	0604	41541	0	
P6.05	Reset Time for Auto Restart after fault	0.0~6000.0 sec	♦R/W	0605	41542	60.0	
P6.06	Base Block Speed Search after Fault (oc,ov,bb)	0: Disable 1: Speed search starts with current speed reference 2: Speed search starts with minimum output frequency	♦R/W	0606	41543	0	
P6.07	Speed Search at Start	0: Disable 1: Speed search from maximum output frequency 2: Speed search from start-up motor frequency 3: Speed search from minimum output frequency	♦R/W	0607	41544	0	
P6.08	Momentary Power Loss	0: Disable 1: Speed search for last frequency command 2: Speed search for the minimum output frequency	♦R/W	0608	41545	0	
P6.09	Fwd/Rev Direction Inhibit	0: Enable Fwd/Rev 1: Disable Reverse Operation 2: Disable Forward Operation	♦R/W	0609	41546	0	
P6.10	Auto Voltage Regulation	0: AVR Enable 1: AVR Disable 2: AVR Disable during Decel	♦R/W	060A	41547	0	
P6.11	Over-Voltage Stall Prevention	0: Enable Over-voltage Stall Prevention 1: Disable Over-voltage Stall Prevention	R/W	060B	41548	0	
P6.12	Selection for Over-voltage Stall Prevention	0: Traditional Over-voltage Stall Prevention 1: Advanced Over-voltage Prevention	♦R/W	060C	41549	0	
(table continued next page)							

GS4 Parameters Summary – Protection Parameters (P6.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P6.13	Auto Adjustable Accel/ Decel	0: Linear Accel/Decel 1: Auto Accel, Linear Decel 2: Linear Accel, Auto Decel 3: Auto Accel, Auto Decel 4: Auto Accel/Decel Stall Prevention (limited by P1.01~P1.08 and P1.13~P1.14)	♦R/W	060D	41550	0	
P6.14	Over-Torque Detection Mode (OT1)	0: Disable 1: Enable during at speed 2: Enable during at speed and Stop 3: Enable during OP 4: Enable during OP and Stop	♦R/W	060E	41551	0	
P6.15	Over-Torque Detection Level (OT1)	10~200%	♦R/W	060F	41552	120	
P6.16	Over-Torque Detection Time (OT1)	0.1~60.0 sec	♦R/W	0610	41553	0.1	
P6.17	Over-Torque Detection Mode (OT2)	0: Disable 1: Enable during at speed 2: Enable during at speed and Stop 3: Enable during OP 4: Enable during OP and Stop	♦R/W	0611	41554	0	
P6.18	Over-Torque Detection Level (OT2)	10~200%	♦R/W	0612	41555	120	
P6.19	Over-Torque Detection Time (OT2)	0.1~60.0 sec	♦R/W	0613	41556	0.1	
P6.20	Over-Current Stall Prevention Level During Accel	0~160% (by P6.34 setup; VT: 0~130%; CT: 0~160%) 0: Disable	♦R/W	0614	41557	VT: 120 CT: 150	
P6.21	Over-Current Stall Prevention Level During Operation	0~160% (by P6.34 setup; VT: 0~130%; CT: 0~160%) 0: Disable	♦R/W	0615	41558	VT: 120 CT: 150	
P6.22	Maximum Allowable Power Loss Time	0.0~20.0 sec	♦R/W	0616	41559	2.0	
P6.23	Base-Block Time for Speed Search	0.1~20.0 sec	♦R/W	0617	41560	0.5	
P6.24	Maximum Speed Search Current Level	20~200%	♦R/W	0618	41561	100	
P6.25	Upper Limit of Output Frequency	0.00~599.00 Hz	♦R/W	0619	41562	599.00	
P6.26	Lower Limit of Output Frequency	0.00~599.00 Hz	♦R/W	061A	41563	0.00	
P6.27	Over-Voltage Stall Prevention Level	230V: 300.0~450.0 VDC 460V: 600.0~900.0 VDC	♦R/W	061B	41564	390.0 780.0	
P6.28	Dynamic Braking Voltage Level	230V: 350.0~450.0 VDC 460V: 700.0~900.0 VDC	♦R/W	061C	41565	390.0 780.0	
P6.29	Line Start Lockout	0: Enable start-up lockout 1: Disable start-up lockout	♦R/W	061D	41566	0	
P6.30	Heat Sink OH Warning Level	0.0~110.0 °C	♦R/W	061E	41567	105.0	
P6.31	Cooling Fan Control	0: Always ON 1: Fan OFF 1 minute after Stop 2: Run fan ON/Stop fan OFF 3: Heat sink temperature 4: Always OFF	♦R/W	061F	41568	0	
P6.32	PWM Fan Speed	0~100%	R/W	0620	41569	60	

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GS4 Parameters Summary – Protection Parameters (P6.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P6.33	Drive Derating Method *NOTE: THERE ARE INTERDEPENDENCIES BETWEEN P2.10, P6.00/P6.02, P6.33, P6.34. REFER TO PARAMETER DETAILS WHEN SETTING THESE PARAMETERS.*	0: Constant rated current 1: Constant carrier frequency 2: Constant rated current (with higher current limit)	R/W	0621	41570	0	
P6.34	Variable/Constant Torque Duty Selection *NOTE: THERE ARE INTERDEPENDENCIES BETWEEN P2.10, P6.00/P6.02, P6.33, P6.34. REFER TO PARAMETER DETAILS WHEN SETTING THESE PARAMETERS.*	0: VT, 3-phase input 1: CT, 3-phase input 2: CT, 230V 1-phase input	♦R/W	0622	41571	0	
P6.35	Low Voltage Level	230V Frame <E: 150.0~220.0 VDC 230V Frame ≥E: 190.0~220.0 VDC 460V Frame <E: 300.0~440.0 VDC 460V Frame ≥E: 380.0~440.0 VDC	♦R/W	0623	41572	180.0 200.0 360.0 400.0	
P6.36	OC Stall Preventation Accel/Decel Time Selection at Normal Speed	0: Follow System Accel/Decel Time 1: Follow the 1st Accel/Decel Time 2: Follow the 2nd Accel/Decel Time 3: Follow the 3rd Accel/Decel Time 4: Follow the 4th Accel/Decel Time 5: Auto Accel/Decel	♦R/W	0624	41573	0	
P6.37	OC Stall Preventation Limit for operation over Rated Speed	0~100%	♦R/W	0625	41574	50	
P6.38	Torque Limit (Current Limit)	0~200%	♦R/W	0626	41575	150	
P6.39	PTC/RTD Detection Selection	0: Warn and Run 1: Warn and Ramp Stop 2: Warn and Coast Stop 3: No Warning	♦R/W	0627	41576	0	
P6.40	PTC Level	0.0~100.0%	♦R/W	0628	41577	50.0	
P6.41	RTD (PT100) Level 1, PTC Level Detection Selection	0.000~10.000V	R/W	0629	41578	5.000	
P6.42	RTD (PT100) Level 2, PTC Level Detection Selection	0.000~10.000V	R/W	062A	41579	7.000	
P6.43	RTD (PT100) Drop Frequency for PT100 Level 1	0.00~599.00 Hz	R/W	062B	41580	0.00	
P6.44	RTD (PT100) Treatment Delay Time	0~6000 sec	R/W	062C	41581	60	
P6.45	Output Phase Loss (OPhL) Detection Selection	0: Warn and continue to operate 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	R/W	062D	41582	3	
P6.46	Output Phase Loss Detection time	0.000~65.535 sec	R/W	062E	41583	0.500	
P6.47	Output Phase Loss Current Detection Level	0.00~100.00% (of max current)	R/W	062F	41584	1.00	
P6.48	Output Phase Loss DCI Time	0.000~65.535 sec	R/W	0630	41585	0.000	
P6.49	Input Phase Loss Treatment	0: Warn and ramp to stop 1: Warn and coast to stop	R/W	0631	41586	0	
P6.50	GFF Detect Current Level (% of INV I-Rated)	0.0~100.0%	R/W	0632	41587	60.0	
P6.51	GFF Low Pass Filter Gain	0.00~655.35	R/W	0633	41588	0.10	

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GS4 Parameters Summary – Protection Parameters (P6.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P6.52	Low Current Level	0.0~100.0%	R/W	0634	41589	0.0	
P6.53	Low Current Detection Time	0.00~360.00 sec	R/W	0635	41590	0.00	
P6.54	Low Current Action	0: Disable, no warning 1: Warn and coast to stop 2: Warn and ramp to stop by 2nd decel time 3: Warn and continue operation	R/W	0636	41591	0	
P6.55	Fire Mode	0: Disable 1: Forward Operation 2: Reverse Operation	R/W	0637	41592	0	
P6.56	Fire Mode Operation Frequency	0.00~599.00 Hz	R/W	0638	41593	60.00	
P6.57	Fire Mode Enable Bypass	0: Disable Bypass 1: Enable Bypass	R/W	0639	41594	0	
P6.58	Fire Mode Bypass Delay Time	0.0~6550.0 sec	R/W	063A	41595	0.0	
P6.59	Fire Mode Auto Restart Counter	0~10	R/W	063B	41596	0	
P6.60	Fire Mode Auto Restart Counter Reset Time	0.0~6000.0 sec	R/W	063C	41597	60.0	
P6.61	Decel Energy Backup (DEB) Decel Selection	0: Disable 1: 1st Decel Time 2: 2nd Decel Time 3: 3rd Decel Time 4: 4th Decel Time 5: Current Decel Time 6: Auto Decel Time	♦R/W	063D	41598	0	
P6.62	DEB Offset Level	230V models: 0.0~100.0 VDC 460V models: 0.0~200.0 VDC	R/W	063E	41599	40.0 80.0	
P6.63	DEB Disable Voltage Level	230V models: 0.0~200.0 VDC 460V models: 0.0~400.0 VDC	R/W	063F	41600	150.0 300.0	
P6.64	DEB Delay Time	0.0~25.0 sec	♦R/W	0640	41601	0.0	
P6.65	Dwell Time at Accel	0.00~600.00 sec	♦R/W	0641	41602	0	
P6.66	Dwell Frequency at Accel	0.00~599.00 Hz	♦R/W	0642	41603	0	
P6.67	Dwell Time at Decel	0.00~600.00 sec	♦R/W	0643	41604	0	
P6.68	Dwell Frequency at Decel	0.00~599.00 Hz	♦R/W	0644	41605	0	
P6.69	Input Phase Loss Detection Time	0.00~600.00 sec	R/W	0645	41606	0.20	
P6.70	Input Phase Loss Ripple Detection	230V models: 0.0~160.0 VDC 460V models: 0.0~320.0 VDC	R/W	0646	41607	30.0 60.0	
P6.71	STO Alarm Latch	0: STO Alarm Latch 1: STO Alarm no Latch	♦R/W	0647	41608	0	
P6.72	IGBT Temperature	-3,276.7 to 3,276.7 ℃	Read	0648	41608	0	
P6.73	Cap Temperature	-3,276.7 to 3,276.7 ℃	Read	0649	41609	0	

PID Parameters Summary (P7.xx)

For detailed information about the P7.xx parameter group, please refer to page 4–160.

GS4 Parameters Summary – PID Parameters (P7.xx)							
Parameter		**Range**	**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only."							
2) Parameters can be restored to their default values using P9.08.							
P7.00	PID Action/Mode	0: PID Disabled 1: PID Reverse Local/Remote 2: PID Forward Local/Remote 3: PID Reverse Remote Only 4: PID Forward Remote Only 5: PID Reverse Local Only 6: PID Forward Local Only	♦R/W	0700	41793	0	
P7.01	reserved	~	~	0701	41794	~	
P7.02	PID Setpoint Source Display (when PID enabled, this parameter data will be mapped from P4.00~P4.01 dependent upon whether in Remote=4.00 or Local=4.01)	00: Keypad 01: RS485 02: AI1 03: AI2 04: AI3 05: Ext Up/Down Key 06: Comm Card 07: Multi-Step Inputs 08: PID off	Read	0702	41795	7	
P7.03	PID Feedback Gain	0.00 to 300.00%	♦R/W	0703	41796	100.00	
P7.04	PID Offset Value	-100.0% to +100.0%	♦R/W	0704	41797	0.0	
P7.05	Keypad PID Setpoint	0.00~100.00%	Read	0705	41798	0.0	
P7.06	PID Multi-Setpoint 1	0.00~100.00%	♦R/W	0706	41799	0.00	
P7.07	PID Multi-Setpoint 2	0.00~100.00%	♦R/W	0707	41800	0.00	
P7.08	PID Multi-Setpoint 3	0.00~100.00%	♦R/W	0708	41801	0.00	
P7.09	PID Multi-Setpoint 4	0.00~100.00%	♦R/W	0709	41802	0.00	
P7.10	PID Multi-Setpoint 5	0.00~100.00%	♦R/W	070A	41803	0.00	
P7.11	PID Multi-Setpoint 6	0.00~100.00%	♦R/W	070B	41804	0.00	
P7.12	PID Multi-Setpoint 7	0.00~100.00%	♦R/W	070C	41805	0.00	
P7.13	Proportional Gain	0.0~100.0	♦R/W	070D	41806	1.0	
P7.14	Integral Time	0.00~100.00 sec	♦R/W	070E	41807	1.00	
P7.15	Derivative Value	0.00~1.00 sec	♦R/W	070F	41808	0.00	
P7.16	Upper Limit for Integral Time	0.0~100.0%	♦R/W	0710	41809	100.0	
P7.17	Derivative Filter Time Constant	0.0~2.5 sec	♦R/W	0711	41810	0.0	
P7.18	PID Output Frequency Limit	0.0~100.0%	♦R/W	0712	41811	100.0	
P7.19	PID Feedback Value	-200.00% to +200.00%	Read	0713	41812	0.00	
P7.20	Feedback Signal Detection Time	0.0~3600.0 sec	♦R/W	0714	41813	0.0	
P7.21	PID Feedback Loss	0: Warn and Continue Operation 1: Warn (fault) and Ramp to Stop 2: Warn (fault) and Coast to Stop 3: Warn and Operate at Last Frequency 4: Warn and Run at P7.22	R/W	0715	41814	0	
P7.22	PID Feedback Loss Speed Level Default	0.00~400.00 Hz	♦R/W	0716	41815	0.00	
P7.23	reserved	~	~	0717	41816	~	
P7.24	PID Offset Selection	0: Set by P7.04 1: Set by an AI Input	♦R/W	0718	41817	0	
P7.25	PID Mode Selection	0: Old PID mode, Kp, Kp*Ki, Kp*Kd 1: New PID mode, Kp, Ki, Kd are independent	R/W	0719	41818	0	

(table continued next page)

GS4 Parameters Summary – PID Parameters (P7.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P7.26	PID Reverse Enable	0: PID can't change command direction 1: PID can change command direction	R/W	071A	41819	0	
P7.27	Source of Sleep	0: Frequency / PID Command Frequency (CV) 1: Feedback	R/W	071B	41820	0	
P7.28	Integral Limit During Sleep	0.0~200.0	R/W	071C	41821	50.0	
P7.29	Sleep Reference	P7.27=0: 0.0~599.00 Hz P7.27=1: 0.0~200.00%	♦R/W	071D	41822	0.00	
P7.30	Wake-up Reference	P7.27=0: 0.0~599.00 Hz P7.27=1: 0.0~200.00%	♦R/W	071E	41823	0.00	
P7.31	Sleep Time	0.0~6000.0 sec	♦R/W	071F	41824	0.0	
P7.32	Wake-up Delay Time	0.00~600.00 sec	R/W	0720	41825	0.00	

Display Parameters Summary (P8.xx)

For detailed information about the P8.xx parameter group, please refer to page 4–171.

GS4 Parameters Summary – Display Parameters (P8.xx)								
Parameter		**Range**		**Run[1] Read/ Write**	**Modbus Address**		**Settings**	
					Hex	**Dec**	**Default[2]**	**User**
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." 2) Parameters can be restored to their default values using P9.08.								
P8.00	User Display	0: Output Amps 1: Counter Value 2: Actual Freq 3: DC Bus Voltage 4: Output Voltage 5: Power Factor 6: Output Power 7: Calculated RPM 8~9: reserved 10: PID Feedback % 11: AI1 % 12: AI2 % 13: AI3 % 14: IGBT Temperature 15: Cap Temperature 16: DI Input Status 17: DO Output Status 18: Multi-Speed Step 19: CPU DI Status 20: CPU DO Status 21~24: reserved 25: Overload %	26: Ground Fault % 27: DC Bus Ripple 28: PLC D1043 Value 29: reserved 30: User-Defined 31: Out Hz x P8.05 32~33: reserved 34: Fan Speed 35: reserved 36: Carrier Frequency 37: reserved 38: Drive Status 39: reserved 40: reserved 41: kWh 42: PID Reference 43: PID Offset 44: PID Output Hz 45: Reserved 46: STO Version 47: STO Chksum High 48: STO Chksum Low	♦ R/W	0800	42049	3	
P8.01	Start-up Display Selection	0: Freq Setpoint 1: Output Hz 2: User Display (P8.00) 3: Output Amps		♦ R/W	0801	42050	0	
(table continued next page)								

GS4 Parameters Summary – Display Parameters (P8.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P8.02	User Defined Format	Bits 0~3: User defined decimal place: 0000b: no decimal place 0001b: one decimal place 0010b: two decimal place 0011b: three decimal place Bits 4~9: User defined unit: 000xh: Hz 001xh: rpm 002xh: % 003xh: kg 004xh: m/s 005xh: kW 006xh: hp 007xh: ppm 008xh: 1/m 009xh: kg/s 00Axh: kg/m 00Bxh: kg/h 00Cxh: lb/s 00Dxh: lb/m 00Exh: lb/h 00Fxh: ft/s 010xh: ft/m 011xh: m 012xh: ft 013xh: °C 014xh: °F 015xh: mbar 016xh: bar 017xh: Pa 018xh: kPa 019xh: mWG 01Axh: inWG 01Bxh: ftWG 01Cxh: psi 01Dxh: atm 01Exh: L/s 01Fxh: L/m 020xh: L/h 021xh: m^3/s 022xh: m^3/h 023xh: gpm 024xh: cfm	R/W	0802	42051	0	
P8.03	User Defined Max	0: Disable 0~65535 (when P8.02 set to no decimal place) 0.0~6553.5 (when P8.02 set to 1 decimal place) 0.00~655.35 (when P8.02 set to 2 decimal place) 0.000~65.535 (when P8.02 set to 3 decimal place)	R/W	0803	42052	0	
P8.04	User Defined Setpoint	0~65535	Read	0804	42053	0	~
P8.05	Output Frequency Gain	0.00~160.00	R/W	0805	42054	1.00	
P8.06	Password Input	0~65535	♦ R/W	0806	42055	0	
P8.07	Password Set Up	0~65535	♦ R/W	0807	42056	0	
P8.08	Power On Counter	0~65535	Read	0808	42057	~	~
P8.09	Power On Day	0~65535	Read	0809	42058	~	~
P8.10	Power On Minute	0~1439	Read	080A	42059	~	~

(table continued next page)

GS4 Parameters Summary – Display Parameters (P8.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P8.11	Accumulative Motor Operation Time (minute)	0~1439	Read	080B	42060	~	~
P8.12	Accumulative Motor Operation Time (day)	0~65535	Read	080C	42061	~	~
P8.13	Keypad Communication Fault Treatment	0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation	R/W	080D	42062	2	
P8.14	Keypad Time Out	0.0~100.0 sec	R/W	080E	42063	1.0	~
P8.15	reserved	~	~	080F	42064	0	~
P8.16	reserved	~	~	0810	42065	0	~
P8.17	reserved	~	~	0811	42066	0	~
P8.18	reserved	~	~	0812	42067	0	~
P8.19	reserved	~	~	0813	42068	0	~
P8.20	PLC Buffer 1	0~65535	R/W	0814	42069	0	
P8.21	PLC Buffer 2	0~65535	R/W	0815	42070	0	
P8.22	PLC Buffer 3	0~65535	R/W	0816	42071	0	
P8.23	PLC Buffer 4	0~65535	R/W	0817	42072	0	
P8.24	PLC Buffer 5	0~65535	R/W	0818	42073	0	
P8.25	PLC Buffer 6	0~65535	R/W	0819	42074	0	
P8.26	PLC Buffer 7	0~65535	R/W	081A	42075	0	
P8.27	PLC Buffer 8	0~65535	R/W	081B	42076	0	
P8.28	PLC Buffer 9	0~65535	R/W	081C	42077	0	
P8.29	PLC Buffer 10	0~65535	R/W	081D	42078	0	
P8.30	PLC Buffer 11	0~65535	R/W	081E	42079	0	
P8.31	PLC Buffer 12	0~65535	R/W	081F	42080	0	
P8.32	PLC Buffer 13	0~65535	R/W	0820	42081	0	
P8.33	PLC Buffer 14	0~65535	R/W	0821	42082	0	
P8.34	PLC Buffer 15	0~65535	R/W	0822	42083	0	
P8.35	PLC Buffer 16	0~65535	R/W	0823	42084	0	
P8.36	PLC Buffer 17	0~65535	R/W	0824	42085	0	
P8.37	PLC Buffer 18	0~65535	R/W	0825	42086	0	
P8.38	PLC Buffer 19	0~65535	R/W	0826	42087	0	
P8.39	PLC Buffer 20	0~65535	R/W	0827	42088	0	

Serial Communication Parameters Summary (P9.xx)

For detailed information about the P9.xx parameter group, please refer to page 4–178.

GS4 Parameters Summary – Serial Communication Parameters (P9.xx)								
Parameter		***Range***		***Run[1] Read/ Write***	***Modbus Address***		***Settings***	
					Hex	***Dec***	***Default[2]***	***User***
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. *R/W indicates "read/write."* *Read indicates "read-only."* *2) Parameters can be restored to their default values using P9.08.*								
P9.00	VFD Comm Address	1 to 254		♦ R/W	0900	42305	1	
P9.01	Modbus Baud Rate	0: 4.8k 1: 9.6k 2: 19.2k	3: 38.4k 4: 57.6k 5: 115.2k	♦ R/W	0901	42306	1	
P9.02	Modbus Protocol	1: 7N2 (ASCII) 2: 7E1 (ASCII) 3: 7O1 (ASCII) 4: 7E2 (ASCII) 5: 7O2 (ASCII) 6: 8N1 (ASCII) 7: 8N2 (ASCII) 8: 8E1 (ASCII) 9: 8O1 (ASCII)	10: 8E2 (ASCII) 11: 8O2 (ASCII) 12: 8N1 (RTU) 13: 8N2 (RTU) 14: 8E1 (RTU) 15: 8O1 (RTU) 16: 8E2 (RTU) 17: 8O2 (RTU)	♦ R/W	0902	42307	12	
P9.03	Modbus Fault Select	0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation		♦ R/W	0903	42308	3	
P9.04	Modbus Time Out Detection	0: Disable 1: Enable		♦ R/W	0904	42309	0	
P9.05	Modbus Time Out Duration	0.1 to 100.0 seconds		♦ R/W	0905	42310	0.5	
P9.06	Parameter Copy	0: Disable Copy Keypad Function 1: Enable Copy Keypad Function		♦ R/W	0906	42311	0	
P9.07	Parameter Lock	0: Normal Operation (allow changes) 1: Prevent any Changes to Parameters		R/W	0907	42312	0	~
P9.08	***Restore to Default***	0: no function 1: Parameter Lock 2: no function 3: no function 4: no function 5: Reset kWh Display to Zero 6: Reset PLC (clear PLC) 7: no function 8: no function 9: Reset 50Hz Default 10: Reset 60Hz Default		R/W	0908	42313	0	
(table continued next page)								

GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P9.09	Block Transfer Data Location 1	0~65535 * P9.09~P9.24 can be set in run mode if the corresponding Block Transfer Address Pointer (P9.69~P9.84) is pointing to a register that allows writes while in run mode.	* R/W	0909	42314	0	
P9.10	Block Transfer Data Location 2			090A	42315		
P9.11	Block Transfer Data Location 3			090B	42316		
P9.12	Block Transfer Data Location 4			090C	42317		
P9.13	Block Transfer Data Location 5			090D	42318		
P9.14	Block Transfer Data Location 6			090E	42319		
P9.15	Block Transfer Data Location 7			090F	42320		
P9.16	Block Transfer Data Location 8			0910	42321		
P9.17	Block Transfer Data Location 9			0911	42322		
P9.18	Block Transfer Data Location 10			0912	42323		
P9.19	Block Transfer Data Location 11			0913	42324		
P9.20	Block Transfer Data Location 12			0914	42325		
P9.21	Block Transfer Data Location 13			0915	42326		
P9.22	Block Transfer Data Location 14			0916	42327		
P9.23	Block Transfer Data Location 15			0917	42328		
P9.24	Block Transfer Data Location 16			0918	42329		
P9.25	reserved	n/a	n/a	0919	42330	n/a	
P9.26	RS485 Speed Reference	0.00~599.00 Hz	Read	091A	42331	60.00	~
P9.27	RS485 RUN Command	0: Stop 1: Run	♦ R/W	091B	42332	0	
P9.28	RS485 Direction Command	0: Forward 1: Reverse	♦ R/W	091C	42333	0	
P9.29	RS485 External Fault	0: No Fault 1: External Fault	♦ R/W	091D	42334	0	
P9.30	RS485 Fault Reset	0: No Action 1: Fault Reset	♦ R/W	091E	42335	0	
P9.31	RS485 JOG Command	0: Stop 1: Jog	♦ R/W	091F	42336	0	
P9.32	reserved	n/a	n/a	0920	42337	n/a	
P9.33	GS4 Drive Rated Amps	0.00~655.34A	Read	0921	42338	#.##	~
P9.34	PLC Command Mask (status only)	0~65535	Read	0922	42339	0	~
P9.35	Response Delay Time	0.0~200.0 ms	♦ R/W	0923	42340	2.0	
P9.36	reserved	n/a	n/a	0924	42341	n/a	
P9.37	PLC Address	1~254	R/W	0925	42342	2	
P9.38	Firmware Date Code	Format: yywwd • yy = year (2017 = 17) • ww = week (01~52) • d = day of week (1~7; Mon=1, Sun=7)	Read	0926	42343	#####	
P9.39	Firmware version	x.xx	Read	0927	42344	#.##	~
P9.40	reserved	n/a	n/a	0928	42345	n/a	
P9.41	GS Series Number	0~9	Read	0929	42346	4	

(table continued next page)

GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)							
Parameter		Range	Run Read/ Write	Modbus Address		Settings	
				Hex	Dec	Default	User
P9.42	GS Model ID	00: GS4-21P0 (230V 1ph/3ph 1.0hp) 01: GS4-22P0 (230V 1ph/3ph 2.0hp) 02: GS4-23P0 (230V 1ph/3ph 3.0hp) 03: GS4-25P0 (230V 3ph 5.0hp) 04: GS4-27P5 (230V 3ph 7.5hp) 05: GS4-2010 (230V 3ph 10hp) 06: GS4-2015 (230V 3ph 15hp) 07: GS4-2020 (230V 3ph 20hp) 08: GS4-2025 (230V 3ph 25hp) 09: GS4-2030 (230V 3ph 30hp) 10: GS4-2040 (230V 3ph 40hp) 11: GS4-2050 (230V 3ph 50hp) 12: GS4-2060 (230V 3ph 60hp) 13: GS4-2075 (230V 3ph 75hp) 14: GS4-2100 (230V 3ph 100hp) 15: GS4-41P0 (460V 3ph 1.0hp) 16: GS4-42P0 (460V 3ph 2.0hp) 17: GS4-43P0 (460V 3ph 3.0hp) 18: GS4-45P0 (460V 3ph 5.0hp) 19: GS4-47P5 (460V 3ph 7.5hp) 20: GS4-4010 (460V 3ph 10hp) 21: GS4-4015 (460V 3ph 15hp) 22: GS4-4020 (460V 3ph 20hp) 23: GS4-4025 (460V 3ph 25hp) 24: GS4-4030 (460V 3ph 30hp) 25: GS4-4040 (460V 3ph 40hp) 26: GS4-4050 (460V 3ph 50hp) 27: GS4-4060 (460V 3ph 60hp) 28: GS4-4075 (460V 3ph 75hp) 29: GS4-4100 (460V 3ph 100hp) 30: GS4-4125 (460V 3ph 125hp) 31: GS4-4150 (460V 3ph 150hp) 32: GS4-4175 (460V 3ph 175hp) 33: GS4-4200 (460V 3ph 200hp) 34: GS4-4250 (460V 3ph 250hp) 35: GS4-4300 (460V 3ph 300hp)	Read	092A	42347	##	
P9.43	Ignore Comm Card Warning	0: Disable function (do NOT ignore) 1: Enable function (ignore warning)	1	092B	42348	1	
P9.44	Comm Card Type	0: No Communication Card 1: reserved 2: reserved 3: reserved 4: MODBUS-TCP Slave 5: EtherNet/IP Slave 6: reserved 7: reserved 8: reserved	Read	092C	42349	0	~
P9.45	Comm Card Version	0~65535	Read	092D	42350	0	~
P9.46	Comm Card Production Code	0~65535	Read	092E	42351	0	~
P9.47	Comm Card Fault Code	0~65535	Read	092F	42352	0	~
P9.48	Comm Card IP Configuration	0: Static IP 1: Dynamic IP (DHCP)	R/W	0930	42353	0	
P9.49	Comm Card IP Address Octet 1	0~255	R/W	0931	42354	0	
P9.50	Comm Card IP Address Octet 2	0~255	R/W	0932	42355	0	
P9.51	Comm Card IP Address Octet 3	0~255	R/W	0933	42356	0	
P9.52	Comm Card IP Address Octet 4	0~255	R/W	0934	42357	0	
P9.53	Comm Card Mask Octet 1	0~255	R/W	0935	42358	0	
P9.54	Comm Card Mask Octet 2	0~255	R/W	0936	42359	0	

(table continued next page)

GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)							
Parameter		Range	Run Read/ Write	Modbus Address		Settings	
				Hex	Dec	Default	User
P9.55	Comm Card Mask Octet 3	0~255	R/W	0937	42360	0	
P9.56	Comm Card Mask Octet 4	0~255	R/W	0938	42361	0	
P9.57	Comm Card Gateway Octet 1	0~255	R/W	0939	42362	0	
P9.58	Comm Card Gateway Octet 2	0~255	R/W	093A	42363	0	
P9.59	Comm Card Gateway Octet 3	0~255	R/W	093B	42364	0	
P9.60	Comm Card Gateway Octet 4	0~255	R/W	093C	42365	0	
P9.61	reserved	~	~	093D	42366	0	~
P9.62	reserved	~	~	093E	42367	0	~
P9.63	Comm Card Factory Reset	0: No Action 1: Reset to the Factory Setting	R/W	093F	42368	0	
P9.64	Comm Card External Set	0, 2 Bit 0 = reserved Bit 1 = Write Ethernet Parameters to Comm Card Bit 2 = reserved	R/W	0940	42369	0	
P9.65	reserved	~	~	0941	42370	0	
P9.66	reserved	~	~	0942	42371	~	~
P9.67	reserved	~	~	0943	42372	~	~
P9.68	reserved	~	~	0944	42373	~	~
P9.69	Block Transfer Address Pointer 1	0~65535	♦ R/W	0945	42374	999	
P9.70	Block Transfer Address Pointer 2			0946	42375		
P9.71	Block Transfer Address Pointer 3			0947	42376		
P9.72	Block Transfer Address Pointer 4			0948	42377		
P9.73	Block Transfer Address Pointer 5			0949	42378		
P9.74	Block Transfer Address Pointer 6			094A	42379		
P9.75	Block Transfer Address Pointer 7			094B	42380		
P9.76	Block Transfer Address Pointer 8			094C	42381		
P9.77	Block Transfer Address Pointer 9			094D	42382		
P9.78	Block Transfer Address Pointer 10			094E	42383		
P9.79	Block Transfer Address Pointer 11			094F	42384		
P9.80	Block Transfer Address Pointer 12			0950	42385		
P9.81	Block Transfer Address Pointer 13			0951	42386		
P9.82	Block Transfer Address Pointer 14			0952	42387		
P9.83	Block Transfer Address Pointer 15			0953	42388		
P9.84	Block Transfer Address Pointer 16			0954	42389		
P9.85	PLC Frequency Command Force to 0	0~1h Bit 0 = 1: Before PLC scan, set up PLC Target Frequency = 0	R/W	0955	42390	0	
P9.86	COMM1 Protocol (via RS-485)	0: Modbus 1: BACnet	Read	0956	42391	0	
P9.87	BACnet Address	0~127	R/W	0957	42392	10	
P9.88	BACnet Baud Rate	9.6~76.8 Kbps	R/W	0958	42393	38.4	
P9.89	BACnet Device Instance Low Word	0~65535	R/W	0959	42394	10	
P9.90	BACnet Device Instance High Byte	0~63	R/W	095A	42395	0	
P9.91	BACnet Max Polling Address	0~127	R/W	095B	42396	127	
P9.92	BACnet Password	0~65535	R/W	095C	42397	0	
P9.93	Ethernet Comm Card Fault Select	0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation	♦ R/W	095D	42398	3	
P9.94	Ethernet Comm Card Time Out Detection	0: Disable 1: Enable	♦ R/W	095E	42399	0	

(table continued next page)

GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)							
Parameter		Range	Run Read/ Write	Modbus Address		Settings	
				Hex	Dec	Default	User
P9.95	Ethernet Comm Card Time Out Duration	0.1 to 100.0 seconds	♦ R/W	095F	42400	0.5	
P9.96	reserved	~	~	095F	42401	~	~
P9.97	reserved	~	~	0960	42402	~	~
P9.98	reserved	~	~	0961	42403	~	~
P9.99	reserved	~	~	0962	42404	~	~

Pump Parameters Summary (P10.xx)

For detailed information about the P10.xx parameter group, please refer to page 4–190.

GS4 Parameters Summary – Pump Parameters (P10.xx)							
Parameter		Range	Run[1] Read/ Write	Modbus Address		Settings	
				Hex	Dec	Default[2]	User
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." 2) Parameters can be restored to their default values using P9.08.							
P10.00	Circulative Control	0: no function 1: Time Circulation 2: Quantity Cycle 3: Quantity Control 4: Time Circulation + Quantity Cycle 5: Time Circulation + Quantity Control	R/W	0A00	42561	0	
P10.01	Number of Connected Motors	1~8	R/W	0A01	42562	1	
P10.02	Desired Run Time of Each Motor in Minutes	0~65500 min	R/W	0A02	42563	0	
P10.03	Motor Switch Delay Time During Increasing Demand	0.0~3600.0 sec	R/W	0A03	42564	1.0	
P10.04	Motor Switch Delay Time During Decreasing Demand	0.0~3600.0 sec	R/W	0A04	42565	1.0	
P10.05	Aux Motor Switch Delay Time During Fix Amount Circulation in Seconds	0.0~3600.0 sec	♦ R/W	0A05	42566	10.0	
P10.06	Aux Motor Switch Frequency During Fix Amount Circulation in Hz	0.00~599.00 Hz	♦ R/W	0A06	42567	60.00	
P10.07	Circulative Control Malfunction Action	0: Turn Off All Aux 1: Keep Aux Running	R/W	0A07	42568	0	
P10.08	AUX Motor Stop Frequency	0.00~599.00 Hz	♦ R/W	0A08	42569	0	

Fault Parameters Summary (P11.xx)

For detailed information about the P11.xx parameter group, please refer to page 4–203.

GS4 Parameters Summary – Fault Parameters (P11.xx)							
Parameter		***Range***	***Run[1] Read/ Write***	***Modbus Address***		***Settings***	
				Hex	***Dec***	***Default[2]***	***User***
1) ♦ in the Run-Read/Write column indicates that the parameter can be set during RUN mode. R/W indicates "read/write." Read indicates "read-only." 2) Parameters can be restored to their default values using P9.08.							
P11.00	Fault Output Option 1	0: No Error 1~65535: (refer to Fault bit code)	♦R/W	0B00	42817	0	
P11.01	Fault Output Option 2		♦R/W	0B01	42818	0	
P11.02	Fault Output Option 3		♦R/W	0B02	42819	0	
P11.03	Fault Output Option 4		♦R/W	0B03	42820	0	
(table continued next page)							

GS4 Parameters Summary – Fault Parameters (P11.xx) – (continued)								
Parameter		**Range**		**Run Read/ Write**	**Modbus Address**		**Settings**	
					Hex	**Dec**	**Default**	**User**
P11.04	First Fault Record	0: No Error 1: Overcurrent during Accel (ocA) 2: Overcurrent during Decel (ocd) 3: Overcurrent during normal speed (ocn) 4: Ground Fault (GFF) 5: IGBT short circuit (occ) 6: Overcurrent during Stop (ocS) 7: Overvoltage during Accel (ovA) 8: Overvoltage during Decel (ovd) 9: Overvoltage during normal speed (ovn) 10: Overvoltage during Stop (ovS) 11: Low voltage during Accel (LvA) 12: Low voltage during Decel (Lvd) 13: Low voltage during normal speed (Lvn) 14: Low voltage during Stop (LvS) 15: Output ripple / Input phase loss (OrP) 16: IGBT Overheat 1 (oH1) 17: Cap Overheat 2 (oH2) 18: Thermister 1 open (tH1o) 19: Thermister 2 open (tH2o) 20: Power Reset Off (PWR) 21: Overload (oL) (150% 1Min, Inverter) 22: Motor1 Thermal Overload (EoL1) 23: Motor2 Thermal Overload (EoL2) 24: Motor Overheat-PTC (oH3) 25: reserved 26: Over Torque 1 (ot1) 27: Over Torque 2 (ot2) 28: Under current (uc) 29: reserved 30: EEPROM write error (cF1) 31: EEPROM read error (cF2) 32: reserved 33: U phase current sensor detection error (cd1) 34: V phase current sensor detection error (cd2) 35: W phase current sensor detection error (cd3) 36: CC Hardware Logic error 0 (Hd0) 37: OC Hardware Logic error 1 (Hd1) 38: OV Hardware Logic error 2 (Hd2) 39: OCC Hardware Logic error 3 (Hd3) 40: Motor auto tune error (AuE) 41: PID Feedback loss (AFE) 42~47: reserved 48: Analog input signal loss (ACE) 49: External Fault (EF) 50: Emergency Stop (EF1) 51: Base Block (bb) 52: Password Error (Pcod) 53: Software Code lock (ccod) 54: PC Command error (CE1) 55: PC Address error (CE2) 56: PC Data error (CE3) 57: PC Slave error (CE4) 58: PC Communication Time Out (CE10) 59: PC Keypad Time out (CP10) 60: Braking Transistor Fault (bf) 61: Y-Delta connection Error (ydc) 62: Decel Energy Backup Error (dEb) 63: Over Slip Error (oSL) 64: Electromagnet switch error (ryF) 65~71: reserved 72: STO Loss1 (STL1) STO1~SCM1 internal hardware detect error 73: ES1 Emergency Stop (S1) 74: In Fire Mode (Fire) 75: reserved 76: Safety Torque Off function active (STO) 77: STO Loss2 (STL2) STO2~SCM2 internal hardware detect error 78: STO Loss3 (STL3) – STO1~SCM1 and STO2~SCM2 internal hardware detect errors 79: U Phase Short (Uoc) 80: V Phase Short (Voc) 81: W Phase Short (Woc) 82: U Phase Loss (UPHL) 83: V Phase Loss (VPHL) 84: W Phase Loss (WPHL) 85~89: reserved 90: PLC Force Stop (FStp) 91~96: reserved 97: Ethernet Card Timeout (CD10) 98: reserved 99: CPU Command error (TRAP) 100~110: reserved 111: InrCom Time Out (ictE)	Read	0B04	42821	0	
P11.05	Second Most Recent Fault Record			Read	0B05	42822	0	
P11.06	Third Most Recent Fault Record			Read	0B06	42823	0	
P11.07	Fourth Most Recent Fault Record			Read	0B07	42824	0	
P11.08	Fifth Most Recent Fault Record			Read	0B08	42825	0	
P11.09	Sixth Most Recent Fault Record			Read	0B09	42826	0	

(table continued next page)

GS4 Parameters Summary – Fault Parameters (P11.xx) – (continued)							
Parameter		**Range**	**Run Read/ Write**	**Modbus Address**		**Settings**	
				Hex	**Dec**	**Default**	**User**
P11.10	Operating Time of Present Fault Record (Day)	0~65535 day	Read	0B0A	42827	0	
P11.11	Operating Time of Present Fault Record (Minute)	0~1439 min	Read	0B0B	42828	0	
P11.12	Operating Time of Second Most Recent Fault Record (Day)	0~65535 day	Read	0B0C	42829	0	
P11.13	Operating Time of Second Most Recent Fault Record (Minute)	0~1439 min	Read	0B0D	42830	0	
P11.14	Operating Time of Third Most Recent Fault Record (Day)	0~65535 day	Read	0B0E	42831	0	
P11.15	Operating Time of Third Most Recent Fault Record (Minute)	0~1439 min	Read	0B0F	42832	0	
P11.16	Operating Time of Fourth Most Recent Fault Record (Day)	0~65535 day	Read	0B10	42833	0	
P11.17	Operating Time of Fourth Most Recent Fault Record (Minute)	0~1439 min	Read	0B11	42834	0	
P11.18	Frequency Command at Fault	0.00~655.35 Hz	Read	0B12	42835	0	
P11.19	Output Frequency at Fault	0.00~655.35 Hz	Read	0B13	42836	0	
P11.20	Output Voltage at Fault	0.0~6553.5V	Read	0B14	42837	0	
P11.21	DC Bus Voltage at Fault	0.0~6553.5V	Read	0B15	42838	0	
P11.22	Output Current at Fault	0.00~655.35A	Read	0B16	42839	0	
P11.23	IGBT Temperature at Fault	-3276.7 to 3276.7 °C	Read	0B17	42840	0	
P11.24	HeatSink Temperature at Fault	-3276.7 to 3276.7 °C	Read	0B18	42841	0	
P11.25	RPM of Motor at Fault	-32767 to 32767 rpm	Read	0B19	42842	0	
P11.26	Digital Input Status at Fault	0~65535	Read	0B1A	42843	0	
P11.27	Digital Output Status at Fault	0~65535	Read	0B1B	42844	0	
P11.28	Drive Status at Fault	0~65535	Read	0B1C	42845	0	

DURApulse GS4 Parameter Details

Explanation of Parameter Details format

		Type	Hex Addr	Dec Addr
Px.xx	**Descriptive Parameter Name**	♦R/W	xxxx	4xxxx
Range/Units		Default		
xx~xxx.xx		xx		

Where:

- *Px.xx = Parameter number, followed by descriptive parameter name*
- *Type = Parameter type (♦R/W)*
  ♦ = Parameter can be set while drive is in run mode
  R/W = Read/Write parameter
  Read = Read-only; parameter can be read from, but not written to
- *Hex Addr = Hexadecimal parameter address*
- *Dec Addr = Modbus decimal parameter address*
- *Range/Units = Range of parameter settings, including units if applicable*
- *Default = Parameter default setting*
  (Parameters can be restored to their default values using P9.08.)

Group P0.xx Details – Motor Parameters

		Type	Hex Addr	Dec Addr
P0.00	**Motor 1 Maximum Output Voltage**	R/W	0000	40001
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~255.0V 460V: 0.0~510.0V		GS4-2xxx: 230.0 GS4-4xxx: 460.0		

This parameter determines the Maximum Output Voltage of the GS4 drive. The Maximum Output Voltage setting must be less than or equal to the rated voltage of the motor as indicated on the motor nameplate.

		Type	Hex Addr	Dec Addr
P0.01	**Motor 1 Rated Current**	R/W	0001	40002
Range/Units (Format: 16-bit unsigned)		Default		
10~120% drive rated Amps		90% rated current of GS4		

Set the value of this parameter according to the full load amperage rating (FLA) of the motor as indicated on the motor nameplate. The Default setting is 90% of the GS4 drive (Variable Torque) rated current. Motor 1 Rated Current is used in the GS4 drive as the threshold for motor overload calculations, when Motor 1 is the selected motor.

Example:

- *The rated output current for the GS4-47P5 drive is 12A. The default setting will be 10.8A, which is 90% of the GS4 drive VT current rating.*
- *The range of the parameter is 10% to 120% of the GS4 VT current rating. (12 x 10% = 1.2A and 12 x 120% = 14.4A).*

		Type	Hex Addr	Dec Addr
P0.02	**Motor 1 Base Frequency**	R/W	0002	40003
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz (Format: 16-bit unsigned)		60.00		

The value of this parameter should be set according to the base frequency of the motor as indicated on the motor nameplate. The output Volts per Hertz ratio is established by the Motor 1 Maximum Output Voltage (P0.00) divided by the Motor 1 Base Frequency (P0.02).

		Type	Hex Addr	Dec Addr
P0.03	**Motor 1 Rated RPM**	♦R/W	0003	40004
Range/Units (Format: 16-bit unsigned)		Default		
0 to (120 x P0.02/P0.09)-1 (Format: 16-bit unsigned)		1710 (60Hz 4-pole) 1410 (50Hz 4-pole)		

Set the rated speed (rpm) of the motor according to the value indicated on the motor nameplate.

For a given motor pole setting (P0.09), Motor 1 Rated RPM (P0.03) can only be decreased from the motor Base RPM defined by "Base RPM = (120 x Freq/# of Poles)-1."
(Pole setting is P0.09 for Motor 1 or P0.18 for Motor 2)

- *The # of poles must be adjusted down **before** you can increase the value in P0.03.*
- *Rated RPM must be adjusted down **before** you can increase number of poles.*

		Type	Hex Addr	Dec Addr
P0.04	**Drive Maximum Output Frequency**	R/W	0004	40005
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0–599.00 Hz (0–400.00 Hz for models > 75hp) 460V: 0–599.00 Hz (0–400.00 Hz for models > 125hp) (Format: 16-bit unsigned)		50.00/60.00		

This parameter determines the GS4 drive Maximum Output Frequency, which is used to set the desired maximum for the specific application. All of the GS4 drive frequency command sources (analog inputs 0 to +10V, 4 to 20mA, 0 to 20mA, and ±10V) are scaled to correspond to the output frequency range.

WARNING: The Maximum Output Frequency parameter (P0.04) should never exceed the maximum rpm rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

- *This value cannot be set lower than Motor 1 Rated RPM (P0.03).*
- *This parameter, along with P0.02 and P0.03, determines the Maximum Output Frequency of the GS4 Drive. The Maximum Output Frequency can be calculated as follows:*
  Motor1 Max Out Freq [P0.04] =
  (Mtr Max RPM [from motor nameplate]) / (Mtr1 Rated RPM [P0.03]) x (Mtr1 Base Freq [P0.02])
- *If an output limit based on maximum output speed is desired, use the following equation to determine the corresponding value for Motor Maximum RPM:*
  Motor1 Max RPM =
  (Mtr1 Max Out Freq [P0.04]) / (Mtr1 Base Freq [P0.02]) x (Mtr1 Rated RPM [P0.03])

		Type	Hex Addr	Dec Addr
P0.05	***Motor Auto Tune***	R/W	0005	40006
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable		0		
1: Measure motor in dynamic status (motor spinning)				
2: Measure motor in static status (motor not spinning)				

Measured values will be written to (P0.06: Motor 1 Rs and P0.07: Motor 1 No-Load Current for motor #1) or (P0.15: Motor 2 Rs and P0.16: Motor 2 No-Load Current for motor #2) automatically by the GS4 drive.

NOTE: When auto-tuning 2 motors, the user needs to set a multi-function input terminal to setting 14 for motor selection or change P0.10 for motor 1/motor 2 selection.

NOTE: The rated speed (P0.03) can't be larger than or equal to 120xF/P; [where F = rated frequency P0.02 or P0.13; P = number of motor poles P0.09 or P0.18].

Auto-Tuning (Dynamic):

1) *Make sure that the motor wiring is correct.*
2) *Make sure that you can start and stop the drive (e.g. using the Run key if in Local Mode, or with digital inputs if using terminals), and that an E-stop is wired.*
3) *Make sure that the parameter values in the table below are correct:*

Parameter	***Motor 1***	***Motor 2***
Maximum Output Voltage	P0.00	P0.11
Motor Rated Current	P0.01	P0.12
Motor Base Frequency	P0.02	P0.13
Motor Rated RPM	P0.03	P0.14
Motor Rated Horsepower	P0.08	P0.17
Motor Pole Numbers	P0.09	P0.18

4) *Before dynamic auto-tuning, make sure the motor output shaft is not connected to a load. If the motor cannot be separated from the load, static auto-tuning (P0.05=2) is recommended.*
5) *Set P0.05=1 to select dynamic auto-tuning. Trigger the Run command; either keypad <RUN> or external terminals depending on how you have P3.00 and P3.01 configured.*
   WARNING: Within a few seconds, the motor shaft will begin to turn. An "Auto Tuning" warning will begin to flash on the keypad display, and will continue until auto tuning is complete. If the motor has to be stopped during Auto Tuning, an "Auto Tune Error" will be generated. To restart Auto Tuning, clear the error and restart this procedure again.
6) *When auto-tuning is complete, P0.05 will default back to 0, and Motor1 parameters (P0.06 and P0.07) and/or Motor2 parameters (P0.15 and P0.16) will be written to the drive.*

   If the motor is statically auto-tuned (P0.05=2), the GS4 drive will NOT measure no-load current. It is the responsibility of the user to obtain the motor no-load current value and manually enter the value in P0.07 for Motor1 and P0.16 for Motor2. Motor no-load current may be available on the motor nameplate or in the motor manufacturer's performance specifications.

		Type	Hex Addr	Dec Addr
P0.06	***Motor 1 Resistance***	R/W	0006	40007
Range/Units (Format: 16-bit unsigned)		*Default*		
0~65.535Ω		0		

Motor Auto Detection (P0.05) will set this parameter value. Before using Motor Auto Detection, set P0.10 to Motor 1. Motor 1 Rs (P0.06) value may be entered manually. If this information is not on the motor nameplate, consult the manufacturer specifications.
Note: Motor 1 Resistance is stator resistance.

		Type	Hex Addr	Dec Addr
P0.07	**Motor 1 No-Load Current**	R/W	0007	40008
Range/Units (Format: 16-bit unsigned)		Default		
0~100% motor rated Amps		40% of P0.01 Motor 1 Rated Current		

The setting of the Motor No-Load current will affect slip compensation. The value entered must be less than or equal to Motor 1 Rated Current (P0.01). Motor Auto Detection (P0.05) will also set this parameter value. Before using Motor Auto Detection, set P0.10 to Motor 1.

		Type	Hex Addr	Dec Addr
P0.08	**Motor 1 Rated Horsepower (HP)**	♦R/W	0008	40009
Range/Units (Format: 16-bit unsigned)		Default		
0.00~655.35 hp		rated hp of GS4		

Used to set rated horsepower of motor 1.

Set the value of this parameter according to the horsepower rating on the motor nameplate.

		Type	Hex Addr	Dec Addr
P0.09	**Motor 1 Pole No.**	R/W	0009	40010
Range/Units (Format: 16-bit unsigned)		Default		
2 to (120 x P0.02/P0.03)		4		

Used to set the number of motor poles (must be an even number).

For a given Motor 1 Rated RPM (P0.03) value, Motor 1 Pole Number (P0.09) can only be decreased from the # of poles defined by "# of Poles = (120 x Freq/Base RPM)." The Motor 1 Rated RPM (P0.03) value must be adjusted to a lower speed before the pole count can be adjusted up.

- *The # of poles must be adjusted down **before** you can increase the value in P0.03.*
- *Rated RPM must be adjusted down **before** you can increase number of poles.*

Motor Synchronous Speed (RPM)	900	1200	1800	3600
Number of Motor Poles (#)	8	6	4	2

		Type	Hex Addr	Dec Addr
P0.10	**Motor 1 or 2 Selection**	R/W	000A	40011
Range/Units (Format: 16-bit binary)		Default		
1: Motor 1 2: Motor 2		1		

Selects the motor that is driven by the GS4 drive. Selecting Motor 1 will apply parameters P0.00~P0.04, P0.06~P0.09 to the drive. Selecting Motor 2 will apply parameters P0.04, P0.11~P0.18 to the drive.

		Type	Hex Addr	Dec Addr
P0.11	**Motor 2 Maximum Output Voltage**	R/W	000B	40012
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~255.0V 460V: 0.0~510.0V		GS4-2xxx: 230.00 GS4-4xxx: 460.00		

This parameter determines the Maximum Output Voltage of the GS4 drive. The Maximum Output Voltage setting must be less than or equal to the rated voltage of the motor as indicated on the motor nameplate.

		Type	Hex Addr	Dec Addr
P0.12	**Motor 2 Rated Current**	R/W	000C	40013
Range/Units (Format: 16-bit unsigned)		Default		
10~120% drive rated Amps		90% rated current of GS4		

Set the value of this parameter according to the full load amperage rating (FLA) of the motor as indicated on the motor nameplate. The Default setting is 90% of the GS4 drive (Variable Torque) rated current. Motor 2 Rated Current is used in the GS4 drive as the threshold for motor overload calculations, when Motor 2 is the selected motor.

Example:

- *The rated output current for the GS4-47P5 drive is 12A, and the default setting is 10.8A, which is 90% of the GS4 drive VT current rating.*
- *The range of the parameter is 10% to 120% of the GS4 VT current rating. (12 x 10% = 1.2A and 12 x 120% = 14.4A).*

		Type	Hex Addr	Dec Addr
P0.13	**Motor 2 Base Frequency**	R/W	000D	40014
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		60.00/50.00		

The value of this parameter should be set according to the base frequency of the motor as indicated on the motor nameplate. The output Volts per Hertz ratio is established by the Motor 2 Maximum Output Voltage (P0.11) divided by the Motor 2 Base Frequency (P0.13).

		Type	Hex Addr	Dec Addr
P0.14	**Motor 2 Rated RPM**	♦R/W	000E	40015
Range/Units (Format: 16-bit unsigned)		Default		
0 to [(120 x P0.13/P0.18)-1] rpm		1710 (60Hz 4-pole) 1410 (50Hz 4-pole)		

Sets the rated speed (rpm) of the motor according to the value indicated on the motor nameplate. For a given motor pole setting (P0.18), Motor 2 Rated RPM (P0.14) can only be decreased from the motor Base RPM defined by "Base RPM = (120 x Freq/# of Poles)-1."
(Pole setting is P0.09 for Motor 1 or P0.18 for Motor 2)

- *The # of poles must be adjusted down **before** you can increase the value in P0.14.*
- *Rated RPM must be adjusted down **before** you can increase number of poles.*

		Type	Hex Addr	Dec Addr
P0.15	**Motor 2 Resistance**	R/W	000F	40016
Range/Units (Format: 16-bit unsigned)		Default		
0~65.535Ω		0		

Motor Auto Detection (P0.05) will set this parameter value. Before using Motor Auto Detection, set P0.10 to Motor 2. Motor 2 Rs (P0.15) value may be entered manually. If this information is not on the motor nameplate, consult the manufacturer specifications.
Note: Motor 2 Resistance is stator resistance.

		Type	Hex Addr	Dec Addr
P0.16	**Motor 2 No-Load Current**	R/W	0010	40017
Range/Units (Format: 16-bit unsigned)		Default		
0~100% motor rated Amps		40% of P0.12 Motor 2 Rated Current		

The setting of the Motor No-Load current will affect slip compensation. The value entered must be less than or equal to Motor 2 Rated Current (P0.12). Motor Auto Detection (P0.05) will also set this parameter value. Before using Motor Auto Detection, set P0.10 to Motor 2.

		Type	Hex Addr	Dec Addr
P0.17	**Motor 2 Rated Horsepower (HP)**	♦R/W	0011	40018
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~655.35 hp		rated hp of GS4		

Used to set rated horsepower of Motor 2.

Set the value of this parameter according to the horsepower rating on the motor nameplate.

		Type	Hex Addr	Dec Addr
P0.18	**Motor 2 Pole No.**	R/W	0012	40019
Range/Units (Format: 16-bit unsigned)		*Default*		
2 to (120 x P0.13/P0.14)		4		

Used to set the number of motor poles (must be an even number).

For a given Motor 2 Rated RPM (P0.14) value, Motor 2 Pole Number (P0.18) can only be decreased from the # of poles defined by "# of Poles = (120 x Freq/Base RPM)." The Motor 2 Rated RPM (P0.14) value must be adjusted to a lower speed before the pole count can be adjusted up.

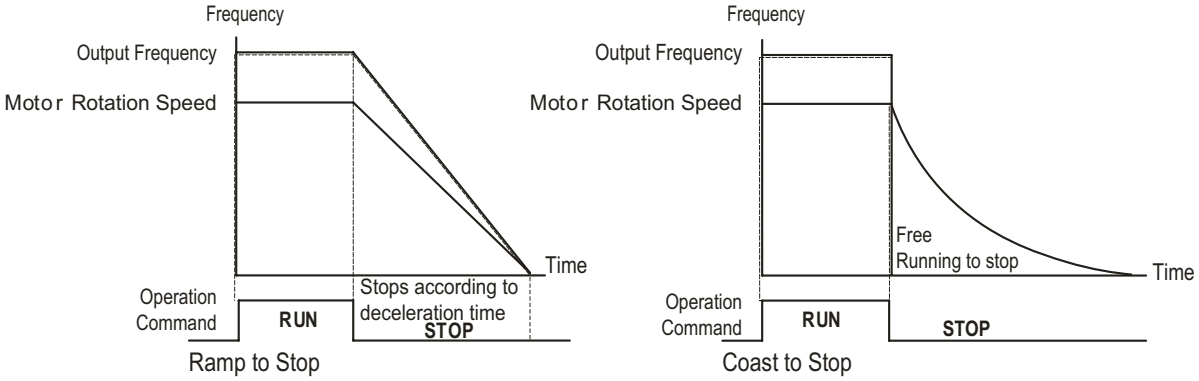
- *The # of poles must be adjusted down **before** you can increase the value in P0.14.*
- *Rated RPM must be adjusted down **before** you can increase number of poles.*

Motor Synchronous Speed (RPM)	900	1200	1800	3600
Number of Motor Poles (#)	8	6	4	2

GROUP P1.XX DETAILS – RAMPS PARAMETERS

		Type	Hex Addr	Dec Addr
P1.00	**Stop Method**	♦R/W	0100	40257
	Range/Units (Format: 16-bit binary)	Default		
	0: Ramp to stop 1: Coast to stop	0		

This parameter determines how the motor is stopped when the GS4 drive receives a valid stop command.



Ramp to stop: The GS4 drive decelerates by the time setting of Deceleration Time to 0 or Minimum Output Frequency (P2.08) and will then stop. The ramp rate is set by Maximum Output Frequency (P0.04) and the currently selected Deceleration Time (P1.02, P1.04, P1.06, or P1.08).

- *Example 1: Maximum Frequency = 60Hz, Motor is running at 60Hz, and Deceleration Time is set for 10s. The motor will ramp to stop in 10s. If the motor is running at 30Hz, the motor will ramp to stop in 5s.*
- *Example 2: Maximum Frequency is set to 120Hz, the motor is running at 60Hz, and the Decel Time is set for 10s. The motor will ramp to stop in 5s.*

When stopping high inertia loads in ramp-to-stop method, it may be necessary to add a braking resistor.

Coast to stop: The GS4 drive stops the output instantly upon a STOP command, and the motor coasts to a complete stop.

- *We recommend using "ramp to stop" for safety of personnel or to prevent material from being wasted in applications where the motor has to stop after the drive is stopped. The deceleration time has to be set accordingly.*
- *If the motor free running is allowed or the load inertia is large, we recommend to selecting "coast to stop." For example: blowers, punching machines, and pumps.*

		Type	Hex Addr	Dec Addr
P1.01	**Acceleration Time 1**	♦R/W	0101	40258
P1.02	**Deceleration Time 1**	♦R/W	0102	40259

Range/Units (Format: 16-bit unsigned)	Default
P1.15=0: 0.00~600.00 sec	10.00
P1.15=1: 0.0~6000.0 sec	

The Acceleration Time determines the length of time required for the GS4 drive to ramp from 0.0Hz to the Drive Maximum Output Frequency (P0.04).

The Deceleration Time determines the length of time required for an GS4 drive to decrease from the Drive Maximum Output Frequency (P0.04) to 0.00Hz.

The Acceleration/Deceleration Time is invalid when P6.13 Auto Adjustable Acceleration/ Deceleration is set to Auto.

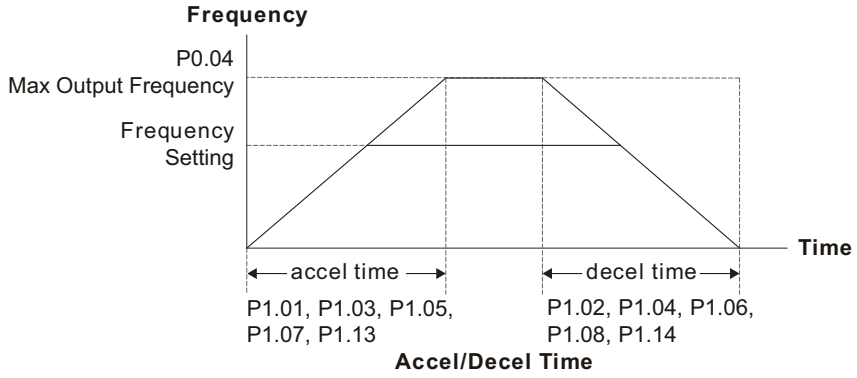
The Acceleration/Deceleration Times 1, 2, 3, 4 are selected according to the Multi-Function Input Terminals settings (P3.03~P3.16 = 8 and 9). The factory settings are Accel/Decel Time 1. These are also used if no Digital Inputs are assigned as Acceleration/Deceleration selection.

When enabling torque limits and stalls prevention function, actual Accel/Decel Times may be longer than the action time set up above.

Please note that the drive may cause motor damage or may trigger protection functions (P6.20 Over-current Stall Prevention during Acceleration or P6.27 Over-voltage Stall Prevention) when the Accel/Decel Times are too short, which can cause higher than desired currents.

When enabling P1.09~P1.12 (S-curve settings), the actual Accel/Decel Times will be longer than the setting of P1.01~P1.08.

Use a suitable brake resistor (see Chapter 06 Accessories) to decelerate in a short time and prevent over-voltage.



SEE ALSO P1.16 ACCEL/DECEL TRANSITION METHOD (page 4–41) TO USE MULTIPLE ACCELS/DECELS IN THE SAME RAMP.

		Type	Hex Addr	Dec Addr
P1.03	**Acceleration Time 2**	♦R/W	0103	40260
P1.04	**Deceleration Time 2**	♦R/W	0104	40261
P1.05	**Acceleration Time 3**	♦R/W	0105	40262
P1.06	**Deceleration Time 3**	♦R/W	0106	40263
P1.07	**Acceleration Time 4**	♦R/W	0107	40264
P1.08	**Deceleration Time 4**	♦R/W	0108	40265

Range/Units (Format: 16-bit unsigned)	Default
P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.0 sec	10.00

Parameters P1.03, P1.05, and P1.07 allow additional Acceleration Time settings which operate the same way as does Acceleration Time 1, P1.01 (page 4–37).

Parameters P1.04, P1.06, and P1.08 allow additional Deceleration Time settings which operate the same way as does Deceleration Time 1, P1.02 (page 4–37).

See also P3.03~P3.16 Multi-Function Input Terminal Function Settings 8 and 9 (page 4–63) to select the different Acceleration and Deceleration Times.

		Type	Hex Addr	Dec Addr
P1.09	**S-Curve Accel Time 1**	♦R/W	0109	40266
P1.10	**S-Curve Decel Time 1**	♦R/W	010A	40267
P1.11	**S-Curve Accel Time 2**	♦R/W	010B	40268
P1.12	**S-Curve Decel Time 2**	♦R/W	010C	40269

Range/Units (Format: 16-bit unsigned)	Default
P1.15=0: 0.00~25.00 sec P1.15=1: 0.0~250.0 sec	0.20

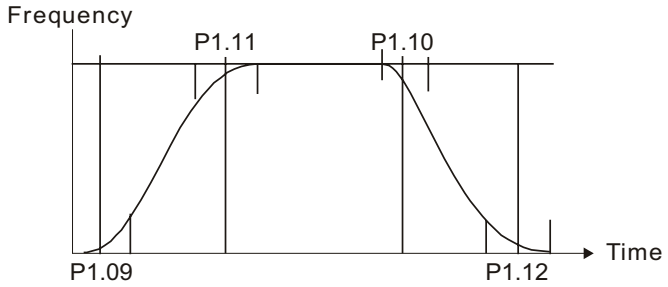
Parameters P1.09 and P1.10 work in conjunction with P1.11 and P1.12 to provide smooth transitions (S-Curve) when accelerating or decelerating. Expressed in seconds; Accel and Decel S-Curves are enabled by entering non-zero values in the s-curve parameters. When enabled, s-curve will lengthen accel and decel times.

Accel and Decel S-Curves are disabled by entering ZERO in the respective parameters. It is recommended to keep a non-zero value in these S-Curve parameters. Frequency transitions (acceleration or deceleration) are much smoother when S-Curve is enabled.

As shown in the illustration P1.09 (S-Curve Accel Time 1) defines the Acceleration S-Curve at the *bottom* of the acceleration ramp, while P1.11 (S-Curve Accel Time 2) defines the Acceleration S-Curve at the *top* of the ramp. The Deceleration S-Curve parameters P1.10 and P1.12 (S-Curve Decel Time 1 and S-Curve Decel Time 2) work the same way for deceleration, with P1.10 defining the Deceleration S-Curve at the *top* of the deceleration ramp and P1.12 at the *bottom* of the ramp.

Acceleration and Deceleration S-Curves defined by these parameters apply to *all* accel and decel times, regardless of selection.

- *Formula for Actual Acceleration Time:*
  Actual Acceleration Time = (Accel Time) + (S-Curve Accel Time)/2
  Actual Acceleration Time = (P1.01 or P1.03 or P1.05 or P1.07) + (P1.09 + P1.11 / 2)
  [This formula is an approximation. Actual motor Accel will vary depending on load.]
- *Formula for Actual Deceleration Time:*
  Actual Deceleration Time = (Decel Time) + (S-Curve Decel Time)/2
  Actual Deceleration Time = (P1.02 or P1.04 or P1.06 or P1.08) + (P1.10 + P1.12 / 2)
  [This formula is an approximation. Actual motor Decel will vary depending on load.]

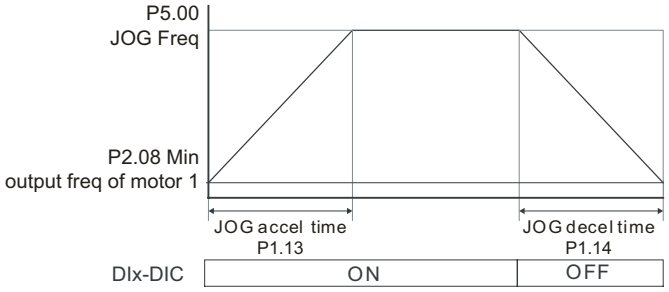


		Type	Hex Addr	Dec Addr
P1.13	**Jog Acceleration Time**	♦R/W	010D	40270
Range/Units (Format: 16-bit unsigned)		Default		
P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.0 sec		10.00		

		Type	Hex Addr	Dec Addr
P1.14	**Jog Deceleration Time**	♦R/W	010E	40271
Range/Units (Format: 16-bit unsigned)		Default		
P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.0 sec		10.00		

Parameters P1.13 and P1.14 set the Acceleration and Deceleration times used for jogging motors.
P1.13 sets the time to accelerate from 0.0Hz to the JOG Frequency (P5.00).
P1.14 sets the time to decelerate from the JOG Frequency (P5.00) to 0.0Hz.

NOTE: Jog Acceleration and Deceleration parameters define the time to accelerate the GS4 drive from zero speed to Jog speed, or to decelerate the GS4 drive from Jog speed to zero speed.
These Jog Acceleration parameters should not be confused with the running Acceleration and Deceleration parameters 1 thru 4.



		Type	Hex Addr	Dec Addr
P1.15	**Time Unit for Accel/Decel & S-curve**	R/W	010F	40272
Range/Units (Format: 16-bit binary)		Default		
0: unit 0.01sec 1: unit 0.1sec		1		

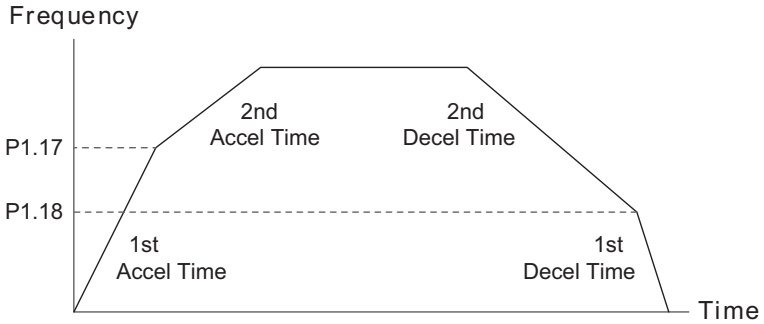
Changing this value does not change the scaling of values previously entered into the various acceleration and times P1.01~P1.14. (If P1.15=0 and P1.01=3.21 seconds, changing P1.15=1 will truncate the last digit; P1.01 will now = 3.2 seconds.)

		Type	Hex Addr	Dec Addr
P1.16	**Accel/Decel Transition Method**	♦R/W	0110	40273
	Range/Units (Format: 16-bit binary)	Default		
	0: Transition according to Digital Input Terminals (Two Multi-Function Inputs (P3.03~P3.16) set to 8 and 9) (Four different accel/decel ramps can be selected using P1.01~P1.08) 1: Transition according to Transition Frequencies P1.17 and P1.18 (Only accel/decel ramps one and two (P1.01~P1.04) are used)	0		

This parameter selects whether the Acceleration/Deceleration will be changed mid-ramp by changing the digital inputs, or if the Acceleration/Deceleration changes at Transition frequencies (P1.17 and P1.18).

If using Transition Frequencies, acceleration starts at Acceleration Time 1 and transitions to Acceleration Time 2; deceleration begins with Deceleration Time 2 and transitions to Deceleration Time 1.

S-Curve Time settings are also in effect and will smooth the transition from one rate to the another.



Auto Accel/Decel Switching when P1.16 = 1

If using P1.16=1 (Transition Frequencies), do not set any Mult-Function Inputs to #8 or #9 (Accel/Decel selection by Input terminals). The inputs can overwrite the Transition Frequencies.

		Type	Hex Addr	Dec Addr
P1.17	**Accel Transition Frequency 1-2**	♦R/W	0111	40274
P1.18	**Decel Transition Frequency 1-2**	♦R/W	0112	40275
P1.17 and P1.18	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~599.00 Hz	0.00		

These parameters set the frequency at which the acceleration ramp transitions automatically from Accel Time 1 (P1.01) to Accel Time 2 (P1.03), and the frequency to transition from Decel Time 2 (P1.04) to Decel Time 1 (P1.02).

- *These parameters are active only if Accel/Decel Transition Method (P1.16) is set to 1.*
- *Acceleration Time 1 (P1.01) is the first Accel Time used. Once the frequency set in P1.17 is reached, Acceleration Time 2 (P1.03) is used until commanded speed is achieved.*
- *Deceleration Time 2 (P1.04) is the first Decel Time used. Once the frequency set in P1.18 is reached, Deceleration Time 1 (P1.02) is used until a full stop is achieved.*

Refer to P1.16 (Accel/Decel Transition Method, page 4–41) for more information for parameters P1.17 and P1.18.

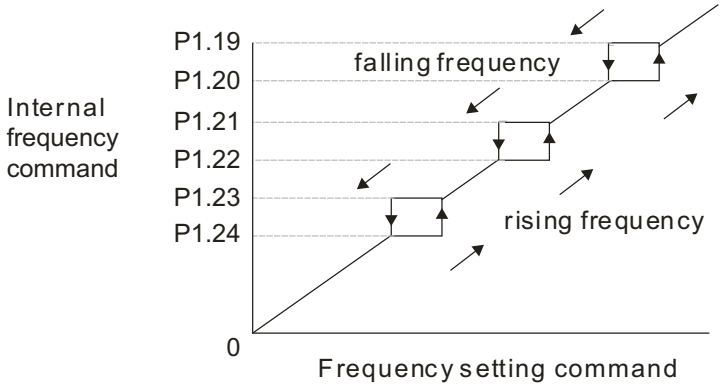
		Type	Hex Addr	Dec Addr
P1.19	**Skip Frequency 1 Upper Limit**	R/W	0113	40276
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0		

		Type	Hex Addr	Dec Addr
P1.20	**Skip Frequency 1 Lower Limit**	R/W	0114	40277
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0		

These parameters (P1.19~P1.24) are used to set skip frequency zones for the GS4 drive, but the frequency output is continuous. These skip frequencies are useful when a motor has vibration at specific frequency bandwidths. The vibration can be avoided by skipping these frequencies, and the GS4 offers three Skip Frequency zones for this purpose.

- *The limits (other than 0.0) of these three zones are parameters P1.19 ≥ P1.20 ≥ P1.21 ≥ P1.22 ≥ P1.23 ≥ P1.24.*
- *Do not overlap Skip Frequencies.*
- *An individual skip frequency will be ignored when both Upper and Lower Limit are set to 0.0 (i.e., Skip Frequencies 1 and 3 can be active, even if Skip Frequency 2 limits are set to 0.0).*
- *The commanded frequency for the drive can be set within the range of these Skip Frequency Upper and Lower Limits. At this moment, the actual output frequency of the drive will be limited by the Skip Frequency Limit settings.*
- *When accelerating/decelerating, the output frequency will still pass through the range of skip frequencies according to Accel and Decel Times.*
- *These values can only be set when the drive is not in RUN.*

Example: Set P1.19 = 10Hz. Set P1.20 = 5Hz. When following an analog input command, the drive's output frequency will not follow the input command between 5Hz and 10Hz. When accelerating, the drive output will remain at 5Hz until the command increases above 10Hz. When decelerating, the drive output will remain at 10Hz until the command signal falls below 5Hz.



		Type	Hex Addr	Dec Addr
P1.21	**Skip Frequency 2 Upper Limit**	R/W	0115	40278

		Type	Hex Addr	Dec Addr
P1.22	**Skip Frequency 2 Lower Limit**	R/W	0116	40279

		Type	Hex Addr	Dec Addr
P1.23	**Skip Frequency 3 Upper Limit**	R/W	0117	40280

		Type	Hex Addr	Dec Addr
P1.24	**Skip Frequency 3 Lower Limit**	R/W	0118	40281

P1.21 thru P1.24	Range/Units (Format: 16-bit unsigned)	Default
	0.00~599.00 Hz	0

These parameters allow additional Skip Frequency Upper Limit and Lower Limit settings.

The Skip Frequency Upper Limit parameters operate the same way as does Skip Frequency Upper Limit 1, P1.19 (page 4–42).

The Skip Frequency Lower Limit parameters operate the same way as does Skip Frequency Lower Limit 1, P1.20 (page 4–42).

		Type	Hex Addr	Dec Addr
P1.25	**DC Injection Current Level**	♦R/W	0119	40282

Range/Units (Format: 16-bit unsigned)	Default
0~100%	0.00

This parameter sets the level of DC Brake Current output to the motor during start-up and stopping. When setting DC Injection Current Level percentage, the drive Rated Current is regarded as 100%. It is recommended to start with a low DC Brake Current Level and then increase until proper holding torque has been attained.

		Type	Hex Addr	Dec Addr
P1.26	**DC Injection Time During Start-up**	♦R/W	011A	40283

Range/Units (Format: 16-bit unsigned)	Default
0.0~60.0 sec	0

DC Brake at Start-up is used for loads that may move before the GS4 drive starts, such as fans and pumps. Under such circumstances, DC Brake can be used to hold the load in position before setting it in motion.

When the drive doesn't have any output, the motor may be in the rotation status due to external force or its inertia. If the drive is used with the motor at this moment, it may cause motor damage or drive protection due to over current. This parameter can be used to output DC current before motor operation to stop the motor and get a stable start. This parameter determines the duration of the DC Brake current after a RUN command. When P1.26 is set to 0.0, DC Injection is not used during start-up.

Example: P1.26 is set to 3 (and there is a non-zero value in P1.25). When the drive is given a RUN command, the DC output (P1.25) will be applied for 3 seconds, then the normal acceleration ramp will begin.

Related parameters: P1.25 DC Injection Current Level; P3.51 Brake Delay Time, Multi-Function Output = #12 or #42.

		Type	Hex Addr	Dec Addr
P1.27	**DC Injection Time During Stopping**	♦R/W	011B	40284
Range/Units (Format: 16-bit unsigned)		Default		
0.0~60.0 sec		0		

DC injection braking at stop is used to shorten stopping time and also to hold a stopped load in position, such as a crane or cutting machine.

Due to external force or motor inertia, the motor may continue to rotate after a drive stop command. The GS4 drive can output DC current to force the motor to stop. When P1.27 is set to 0.0, DC injection braking is not used when stopping.

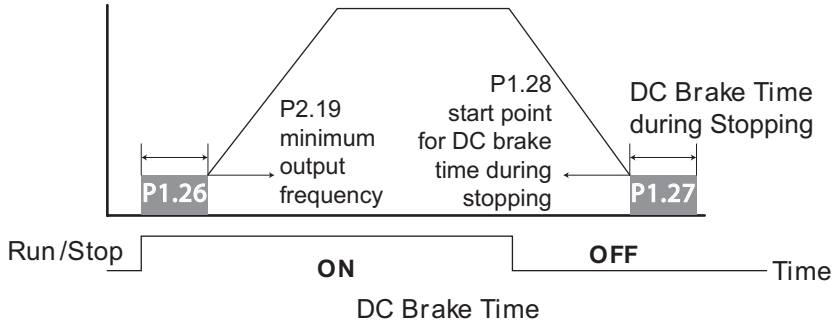
This parameter determines the duration of the DC injection braking current during stopping.

- *The DC Injection function is active when P1.00 (Stop Method) is set to 0 (Ramp to Stop).*
- *The DC Injection function is inactive when P1.00 (Stop Method) is set to 1 (Coast to Stop).*

Related parameters: P1.00 Stop Method; P1.28 Start-point for DC Brake; P3.51 Brake Delay Time, Multi Function Output = #12 or #42.

		Type	Hex Addr	Dec Addr
P1.28	**Start-Point for DC Injection During Stopping**	♦R/W	011C	40285
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0		

This parameter determines the frequency when DC injection braking will begin during deceleration. When this setting is less than Minimum Output Frequency (P2.08 or P2.15), the start-point for DC injection braking will start from the Minimum Output Frequency.



		Type	Hex Addr	Dec Addr
P1.29	**Deceleration Method**	R/W	011D	40286
	Range/Units (Format: 16-bit unsigned)	Default		
	0: Normal Ramp Deceleration	0		
	1: OverFluxing Deceleration			
	2: Traction Energy Control			

Setting 0: Normal Ramp Deceleration

Deceleration or stop will occur according to the deceleration method determined by the settings of P1.00, P1.02, P1.04, P1.06, or P1.08.

Setting 1: OverFluxing Deceleration

The drive will control the deceleration time according to the Over-Voltage Stall Prevention Level (P6.27) setting value and DC BUS voltage.

- *If the DC BUS > 95% of P6.27 Over-Voltage Stall Prevention setting value, the drive will enable Over Fluxing Deceleration method only if P6.11=0 ((Enable Over-Voltage Stall Prevention).*
- *If the Over-Voltage Stall Prevention P6.11=0, the drive will enable Over Fluxing Deceleration method according to the operating voltage and DC BUS regenerative voltage. This method will use the Deceleration Time setting (P 1.02 or P1.04 or P1.06 or P1.08). The actual deceleration time will take longer than the deceleration time setting because of the Over-Voltage Stall Prevention function.*
- *When P1.29=1, use the parameter Over-Voltage Stall Prevention P6.12=1 to get a better over voltage suppression effect during deceleration.*

Setting 2: Traction Energy Control

This function is based on the ability of the drive to auto-adjust output frequency and voltage in order to get faster DC BUS energy consumption, and the actual deceleration time will be as consistent as possible with the deceleration parameter set-up time. If the real deceleration time is longer than the programmed deceleration time (this can cause over-voltage faults), use P1.29=2 to attempt to shorten the deceleration time.

Note – Comparison of Settings 1 & 2:

P1.29=1 (OverFluxing) limits deceleration by monitoring the DC bus level. This method is smoother than Traction Energy Control.

P1.29=2 (TEC) will attempt to prevent an OV (Over-Voltage) fault with faster deceleration and higher current. TEC controls limits decel by monitoring current (limiting output to Rated Current).

Please also see note at P6.12 (Over-Voltage Stall Prevention).

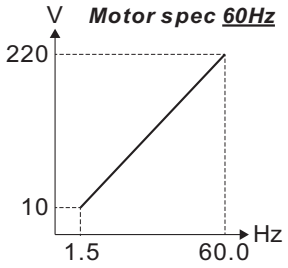
GROUP P2.XX DETAILS – V/HZ PARAMETERS

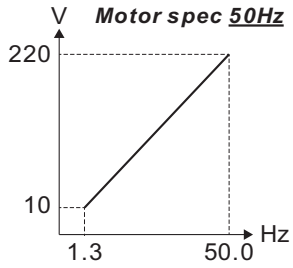
		Type	Hex Addr	Dec Addr
P2.00	**Volts/Hertz Settings**	R/W	0200	40513
	Range/Units (Format: 16-bit binary)	Default		
	0: General Purpose	0		
	1: High Starting Torque (TQR)			
	2: Fans and Pumps			
	3: Custom			
	4: 1.5 Power Curve			
	5: Squared Curve			

Common setting of V/Hz curve.

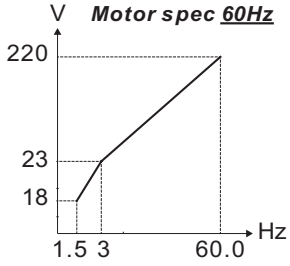
- *When setting to 1 or 2, the 2nd and the 3rd voltage frequency setting are invalid.*
- *If a motor load is a variable torque load (the torque is in direct proportion to the speed, such as the load of a fan or a pump), the drive will decrease input voltage to reduce flux loss and iron loss of the motor at low speed with low load torque to raise the overall efficiency.*
- *When setting the higher power V/Hz curves (selection #4 or #5), low frequency torque will be even lower than General Purpose. Therefore it is not suitable for fast acceleration/deceleration. It is recommended NOT to apply this parameter for any fast acceleration/deceleration.*

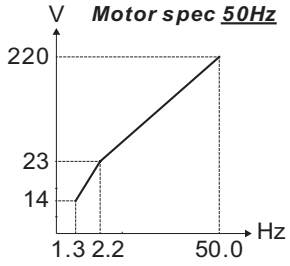
Setting 0: General Pupose Curve



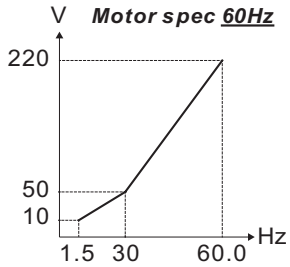


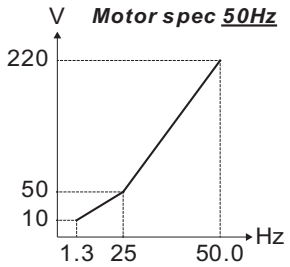
Setting 1: High Starting Torque





Setting 2: Fans and Pumps Curve





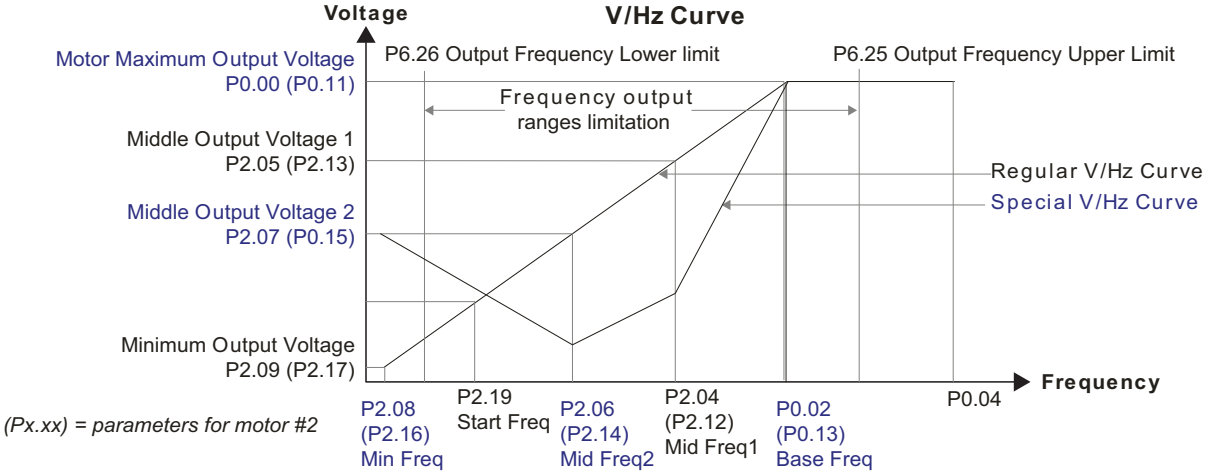
Setting 3: Custom

The setting of a custom V/Hz curve usually follows the load characteristics of a motor. If the workload exceeds a motor's capacity, pay attention to its heat dissipation, dynamic balance, and bearing lubrication.

Custom V/Hz curves are used when "General Purpose," "High Starting Torque," or "Fan and Pump" curves do not deliver the voltage required for the application.

If the voltage setting at low frequency is set to too high a value, it can cause motor insulation or coil damage through motor overheating, cause a motor stall prevention event, and/or contribute to over current protection faults. Care must be given to the determination of this parameter's value to best protect the motor and provide the best application experience.

The V/Hz curve of Motor 1 is shown below. The V/Hz Curve of Motor 2 will be similar, using comparable parameters for Motor 2 as shown in ().



NOTE: P2.04~P2.09 and P2.12~17 are used only when the V/Hz parameter (P2.00) is set to 03.

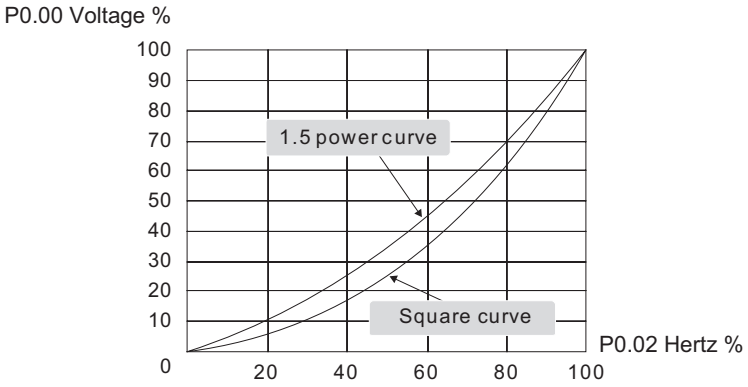
Setting 4: 1.5 Power Curve

- V_{out} = [(P0.00-P2.09) x ([(F_x-P2.08)/(P0.00-P2.09)]^3)$^{0.5}$] + P2.09
- Where: V_{out} is GS4 drive output voltage; F_x is GS4 drive output frequency
- Refer to "Energy Saving Power Curves for Fans & Pumps" V/Hz curve below Setting 05.

Setting 5: Square Curve

- V_{out} = [(P0.00-P2.09) x ([(F_x-P2.08)/(P0.00-P2.09)]^2)] + P2.09
- Where: V_{out} is GS4 drive output voltage; F_x is GS4 drive output frequency
- Refer to "Energy Saving Power Curves for Fans & Pumps" V/Hz curve below.

ENERGY SAVING POWER CURVES FOR FANS & PUMPS (P2.00 SETTINGS 04 & 05)



P2.01	Slip Compensation Gain	Type	Hex Addr	Dec Addr
		♦R/W	0201	40514
Range/Units (Format: 16-bit unsigned)		Default		
0.00 to 10.00		V/Hz mode: 0.00 Vector mode: 1.00		

P2.01 sets the compensation frequency in order to reduce slip and increase drive accuracy when the motor is running at loads approaching the motor's rated current. When drive output current is larger than the motor's No-Load Current (P0.07 or P0.16), drive output frequency will be compensated by this parameter (P2.01).

- *The induction motor needs constant slip to produce torque. It can be ignored at higher motor speeds, such as rated speed or 2-3% slip.*
- *In operation at variable frequency, slip and the synchronous frequency will be in reverse proportion to produce the same torque. That is, slip will increase with the reduction in synchronous frequency. The motor may stop when/if synchronous frequency is decreased to a specific value. Therefore, slip greatly affects the accuracy of the motor speed at low speed.*

When the Control Mode (P2.11) is changed from V/Hz mode to Sensorless Vector mode, this parameter will automatically be set to 1.00. Otherwise, it will be set to 0.00. Please set the compensation of slip after setting overload and acceleration. The compensation value should be increased from small to large gradually. That is to add the output frequency with motor rated slip X P2.01 Slip Compensation Gain when the motor is at rated load. If the actual speed ratio is slower than expectation, please increase the setting. Otherwise, decrease the setting.

P2.02	Torque Compensation Gain	Type	Hex Addr	Dec Addr
		♦R/W	0202	40515
Range/Units (Format: 16-bit unsigned)		Default		
0 to 10		0		

- *When motor load is large, a part of drive output voltage is lost due to the resistance of the stator winding. This causes insufficient voltage and results in increased drive output current and insufficient motor torque. The drive can auto adjust output voltage for the load and keep the air gap magnetic fields stable to get the optimal operation.*
- *In V/Hz control, drive output voltage is decreased in direct proportion to decreasing output frequency, resulting in decreased torque at lower speeds. Therefore, the auto Torque Compensation function will increase drive output voltage at lower output frequencies to achieve higher starting torque.*
- *When P2.02 is set too large, it may cause motor overflux and result in too large output current, motor overheat, or trigger protection functions.*

P2.03	Torque Compensation Filter	Type	Hex Addr	Dec Addr
		♦R/W	0203	40516
Range/Units (Format: 16-bit unsigned)		Default		
0.001 to 10.000 (sec)		0.500		

Longer filter times provide stable control, but with delayed response. Shorter filter times provide for quick response, but control may be unstable.

		Type	Hex Addr	Dec Addr
P2.04	**Motor 1 Middle Output Frequency 1**	R/W	0204	40517
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz • P2.04 value cannot be greater than the value in P0.02, Motor 1 Base Frequency. • P2.04 value cannot be less than the value in P2.08, Motor 1 Minimum Output Frequency.		3.00		

		Type	Hex Addr	Dec Addr
P2.05	**Motor 1 Middle Output Voltage 1**	♦R/W	0205	40518
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 15.0V; GS4-2010+: 14.0V 460V: GS4-41P0~47P5: 30V; GS4-4010+: 28.0V		

		Type	Hex Addr	Dec Addr
P2.06	**Motor 1 Middle Output Frequency 2**	R/W	0206	40519
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz • P2.06 value cannot be greater than the value in P2.04, Motor 1 Middle Output Frequency 1. • P2.06 value cannot be less than the value in P2.08, Motor 1 Minimum Output Frequency.		3.00		

		Type	Hex Addr	Dec Addr
P2.07	**Motor 1 Middle Output Voltage 2**	♦R/W	0207	40520
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 15.0V; GS4-2010+: 14.0V 460V: GS4-41P0~47P5: 30V; GS4-4010+: 28.0V		

		Type	Hex Addr	Dec Addr
P2.08	**Motor 1 Minimum Output Frequency**	R/W	0208	40521
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.99Hz • P2.08 value cannot be greater than or equal to the value in P2.06, Motor 1 Middle Output Frequency 2.		1.50		

		Type	Hex Addr	Dec Addr
P2.09	**Motor 1 Minimum Output Voltage**	♦R/W	0209	40522
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 9.0V; GS4-2010+: 7.0V 460V: GS4-41P0~47P5: 18.0V; GS4-4010+: 14.0V		

Parameters P2.04~P2.09 are used to establish the V/Hz curve of Motor 1, and are used only with "Custom" V/Hz parameter settings; when P2.00 is set to 03.

Refer to P2.00 (Volts/Hertz Settings, page 4–46) for operational information for parameters P2.04~P2.09.

	Type	Hex Addr	Dec Addr
P2.10 PWM Carrier Frequency	R/W	020A	40523

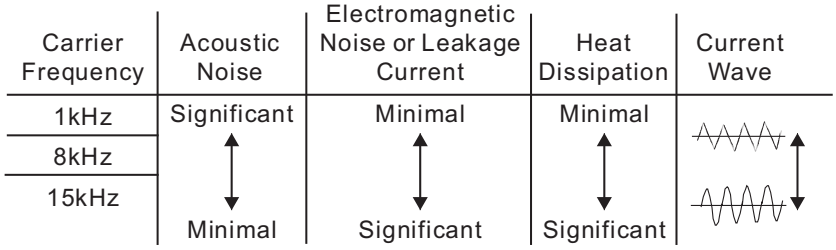
Range/Units (Format: 16-bit unsigned)	Default
2~15 kHz	model specific; refer to table below

Model-Specific PWM Carrier Frequency Defaults				
230V/3Ø Drive		Supplied 3Ø/230V Variable Torque	Supplied 3Ø/230V Constant Torque	Supplied 1Ø/230V Constant Torque
Frame	Model GS4-			
A	21P0, 22P0, 23P0, 25P0	8kHz	2kHz	12 kHz
B	27P5, 2010, 2015			
C	2020, 2025			
	2030	6kHz		
D	2040, 2050			
E	2060, 2075, 2100	4kHz		
460V/3Ø Drive		Supplied 3Ø/460V Variable Torque	Supplied 3Ø/460V Constant Torque	N/A
Frame	Model GS4-			
A	41P0, 42P0, 43P0, 45P0, 47P5	8kHz	2kHz	n/a
B	4010, 4015, 4020			
C	4025, 4030, 4040	6kHz		
D0	4050, 4060			
D	4075			
	4100	4kHz		
E	4125, 4150			
F	4175, 4200			
G	4250, 4300			

This parameter determines the PWM carrier frequency of the GS4 drive.

- *When carrier frequency is higher than the factory setting, reference parameter P6.33 Drive Derating Method for frequency derating of the GS4 drive.*
- *When P6.34 (VT/CT Duty Selection) is set, it can change this parameter (P2.10).*
- *P6.00/P6.02 (Electronic Thermal O/L Relay) must be set independently.*

As shown in the diagram below, the PWM carrier frequency has a significant influence on electromagnetic noise, GS4 drive heat dissipation, and motor acoustic noise. Therefore, if surrounding ambient noise is greater than motor noise, then lowering the carrier frequency will help to reduce temperature rise in the motor. Although motor noise is reduced at the higher carrier frequencies, the entire wiring and interference resistance should be considered before choosing a higher frequency.

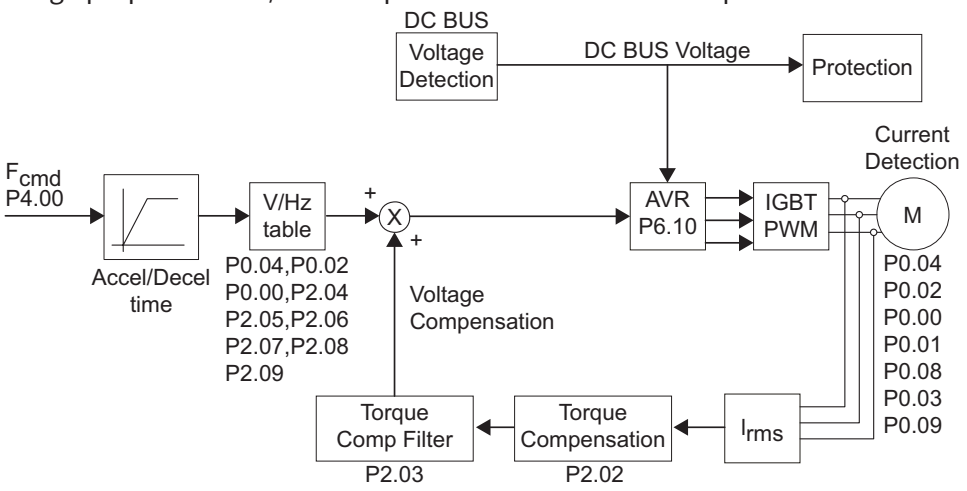


		Type	Hex Addr	Dec Addr
P2.11	**Control Mode**	♦R/W	020B	40524
Range/Units (Format: 16-bit binary)		*Default*		
0: V/Hz Open Loop Control		0		
1: SVC Sensorless Vector				

This parameter determines the control method of the GS4 drive:

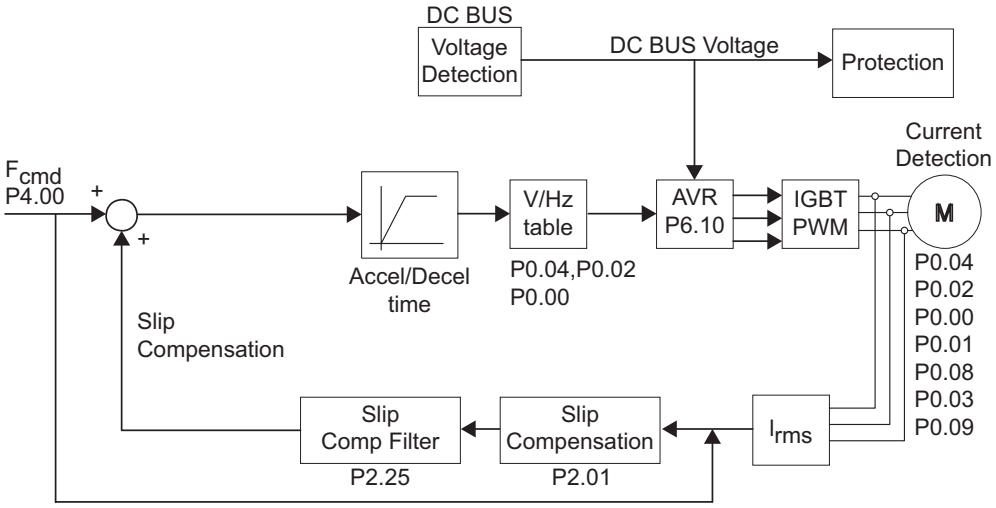
Setting 0: V/Hz open loop control

User can design proportion of V/Hz as required and can control multiple motors simultaneously.



Setting 1: SVC Sensorless Vector

Get the optimal control by the auto-tuning of motor parameters.

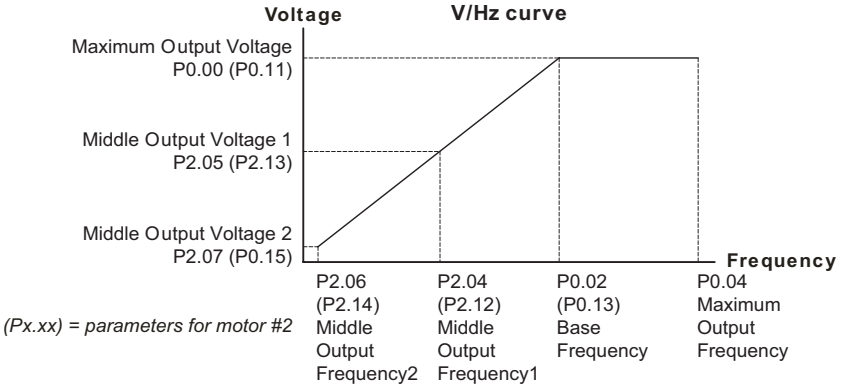


		Type	Hex Addr	Dec Addr
P2.12	**Motor 2 Middle Output Frequency 1**	R/W	020C	40525
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		3.00		
		Type	Hex Addr	Dec Addr
P2.13	**Motor 2 Middle Output Voltage 1**	♦R/W	020D	40526
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 15.0V; GS4-2010+: 14.0V 460V: GS4-41P0~47P5: 30V; GS4-4010+: 28.0V		
		Type	Hex Addr	Dec Addr
P2.14	**Motor 2 Middle Output Frequency 2**	R/W	020E	40527
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		3.00		
		Type	Hex Addr	Dec Addr
P2.15	**Motor 2 Middle Output Voltage 2**	♦R/W	020F	40528
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 15.0V; GS4-2010+: 14.0V 460V: GS4-41P0~47P5: 30V; GS4-4010+: 28.0V		
		Type	Hex Addr	Dec Addr
P2.16	**Motor 2 Minimum Output Frequency**	R/W	0210	40529
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.99 Hz		1.50		
		Type	Hex Addr	Dec Addr
P2.17	**Motor 2 Minimum Output Voltage**	♦R/W	0211	40530
Range/Units (Format: 16-bit unsigned)		Default		
230V: 0.0~240.0V 460V: 0.0~480.0V		230V: GS4-21P0~27P5: 9.0V; GS4-2010+: 7.0V 460V: GS4-41P0~47P5: 18.0V; GS4-4010+: 14.0V		

Parameters P0.11, P0.13, and P2.12~ P2.17 are used to establish the V/Hz curve of Motor 2. When multi-function input terminals P3.04~P3.10 and P3.11~P3.16 (expansion card) are set to 14, and enabled, then the drive will operate by following V/Hz curve of Motor 2.

P2.12~P2.17 are used only with "Custom" V/Hz parameter settings; when P2.00 is set to 03.

- *P2.12 value cannot be > the value in P0.13, Motor 2 Base Frequency.*
- *P2.12 & P2.14 value cannot be < the value in P2.16, Motor 2 Minimum Output Frequency.*
- *P2.14 value cannot be > the value in P0.13, Motor 2 Base Frequency.*
- *P2.16 value cannot be ≥ the value in P2.14, Motor 2 Middle Output Frequency 2.*



REFER TO P2.00 (VOLTS/HERTZ SETTINGS, PAGE 4–46) FOR OPERATIONAL INFORMATION FOR PARAMETERS P2.12~P2.17.

		Type	Hex Addr	Dec Addr
P2.18	***Zero Speed Select***	R/W	0212	40531
Range/Units (Format: 16-bit binary)		*Default*		
0: Standby 1: Zero Hold 2: Min Hz Output		0		

When the output frequency is less than Motor Minimum Output Frequency (P2.08, P2.16), the GS4 drive will operate by this parameter.

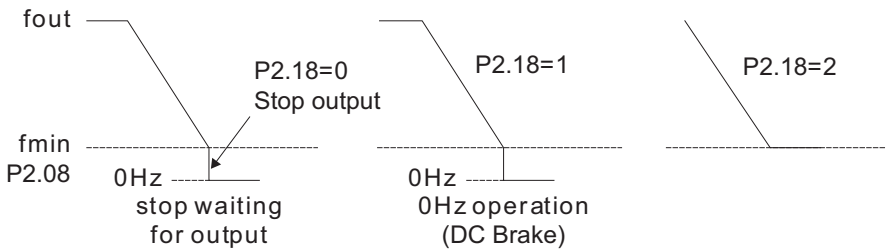
When P2.18 is set to 0, the GS4 drive will be in waiting mode with no voltage output from terminals U/V/W.

When P2.18 is set to 1, the GS4 drive will execute DC brake by Motor Minimum Output Voltage (P2.09, P2.17) in V/Hz and SVC modes.

When P2.18 is set to 2, the GS4 drive will run by Motor Minimum Output Frequency (P2.08, P2.16) and Motor Minimum Output Voltage (P2.09, P2.17) in V/Hz and Sensorless Vector modes.

When P2.18 is set to 2, and if the setting of P6.26 (Output Frequency Lower Limit) is higher than Motor Minimum Output Frequency, then the GS4 drive will run in accordance with the setting of P6.26 in V/Hz and SVC mode.

In V/Hz and SVC modes:



		Type	Hex Addr	Dec Addr
P2.19	**Start Frequency**	R/W	0213	40532
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0.50		

When start frequency is higher than the minimum output frequency, GS4 drive output will be from start frequency to the setting frequency. Please refer to the following diagram for details.

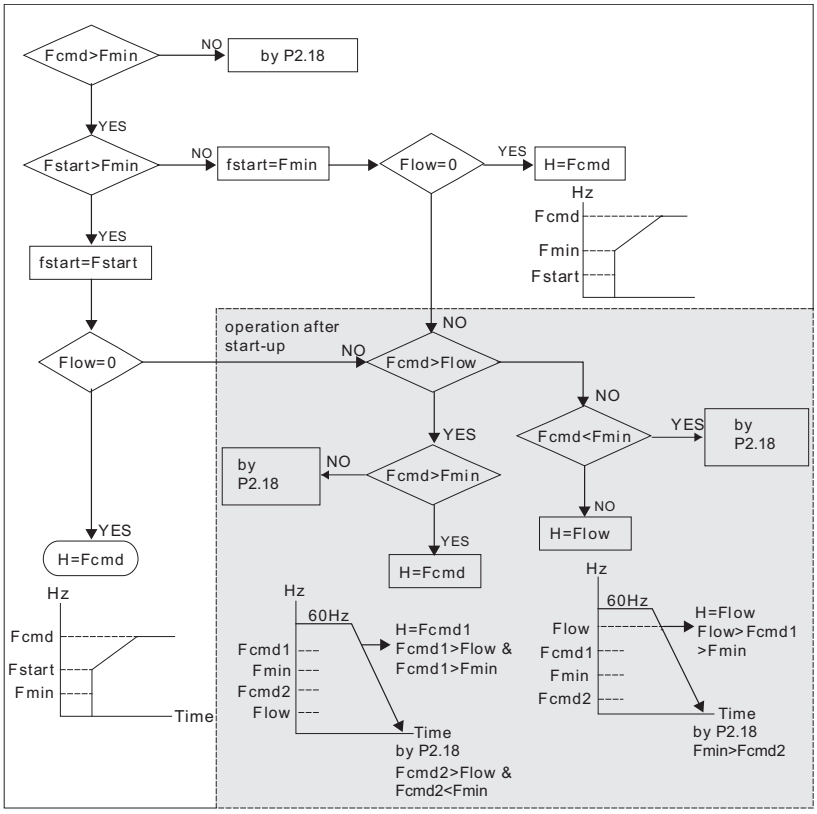
F_{cmd} = frequency command

F_{start} = start frequency (P2.19)

f_{start} = actual start frequency of drive

F_{min} = 4th output frequency setting (P2.08/P2.16)

F_{low} = output frequency lower limit (P6.26)



		Type	Hex Addr	Dec Addr
P2.20	**Y-D Switching Frequency**	♦R/W	0214	40533
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~599.00 Hz	60.00		

		Type	Hex Addr	Dec Addr
P2.21	**Y-D Switching Enable**	R/W	0215	40534
	Range/Units (Format: 16-bit binary)	Default		
	0: Disable 1: Enable	0		

		Type	Hex Addr	Dec Addr
P2.22	**Delay Time for Y-D Switching**	♦R/W	0216	40535
	Range/Units (Format: 16-bit unsigned)	Default		
	0.000~600.000 sec	0.200		

Explanations for parameters P2.20~P2.22:

P2.20~P2.22 are applied with wye-delta (or star-delta) motors where the drive will control the switching of Y-connection/Δ-connection as required. This method reduces voltage by changing the motor phase connections such that the winding is wye-connected for starting. This connection puts less than line voltage on each phase, which softens the start. After starting, the motor phase connections are changed to a delta configuration, which allows for phase voltage equal to line voltage while running. Effectively, the voltage is reduced by a factor of 1.732 during wye starting. The impedance seen by the power system is 3 times the impedance of the delta run connection.

Three-lead motors are not capable of being controlled via wye-start and delta (star)-run. Six-lead, 9-lead, and 12-lead motors can typically be run in wye-delta. Check your motor documentation to be sure.

P2.21 is used to enable/disable Y-connection/Δ-connection switch.

When P2.21 is set to 1, the drive will select by P2.20 setting and current motor frequency to switch motor to Y-connection or Δ-connection. At the same time, it will also affect motor parameters.

P2.22 is used to set the delay time at the start of any Y or Delta transition. Delay time affects the following:

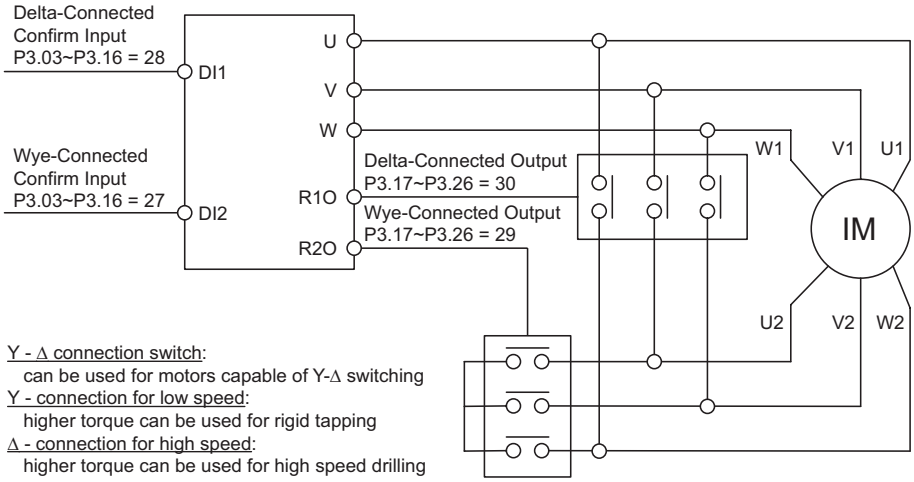
- *Error time between Run command given and Y-connected confirmation.*
- *Coast time and Error time between Δ-connected output on and Δ-connected confirmation on acceleration.*
- *Coast time and Error time between Y-connected output on and Y-connected confirmation on deceleration.*

When the drive's output frequency reaches the P2.20 Y-connection/Δ-connection switch frequency, the drive will delay by P2.22 before multi-function output terminals are active.

The use of Y-Δ will require the use of two Digital Inputs and two Digital Outputs.

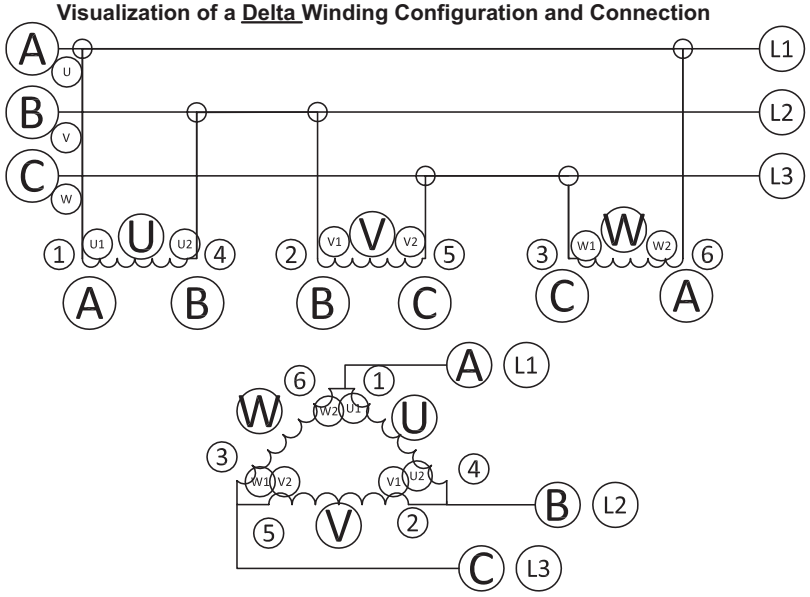
Refer to the following Wiring Diagram and Timing Charts:

Wiring Diagram for Y-Δ Starting:

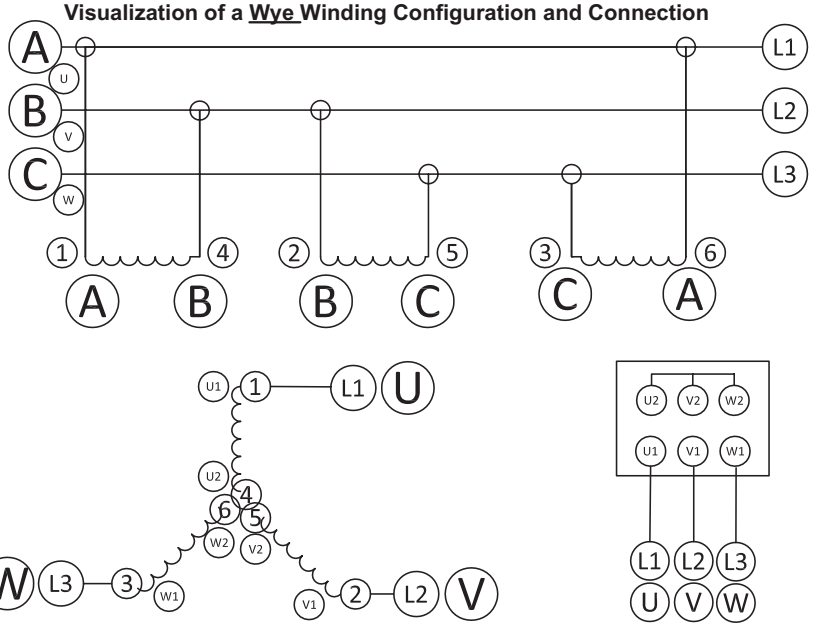


Y - Δ connection switch:
can be used for motors capable of Y-Δ switching
Y - connection for low speed:
higher torque can be used for rigid tapping
Δ - connection for high speed:
higher torque can be used for high speed drilling

Visualization of a Delta Winding Configuration and Connection



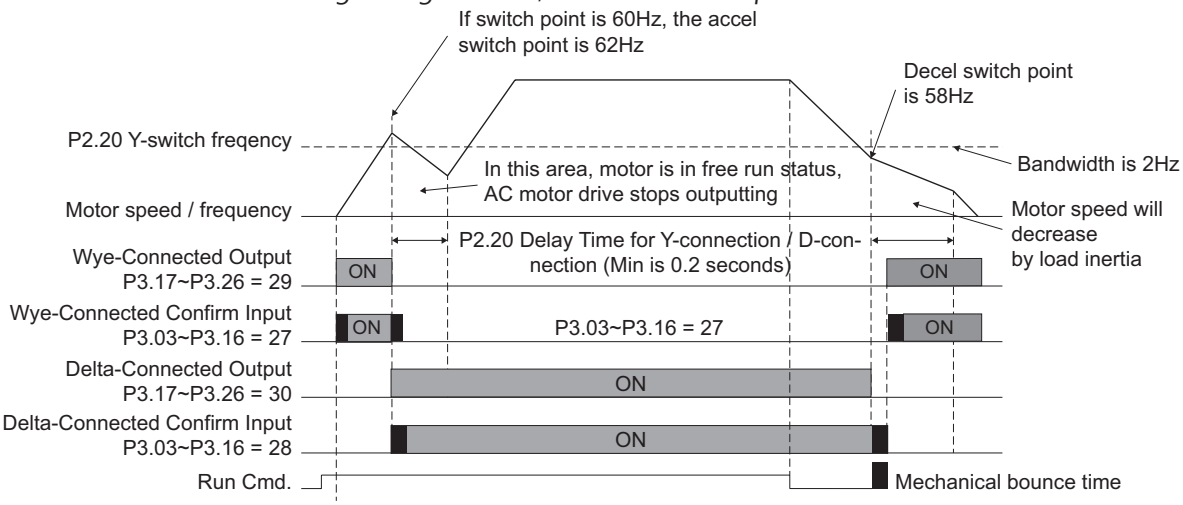
Visualization of a Wye Winding Configuration and Connection



Timing Charts for Y-Δ Starting:

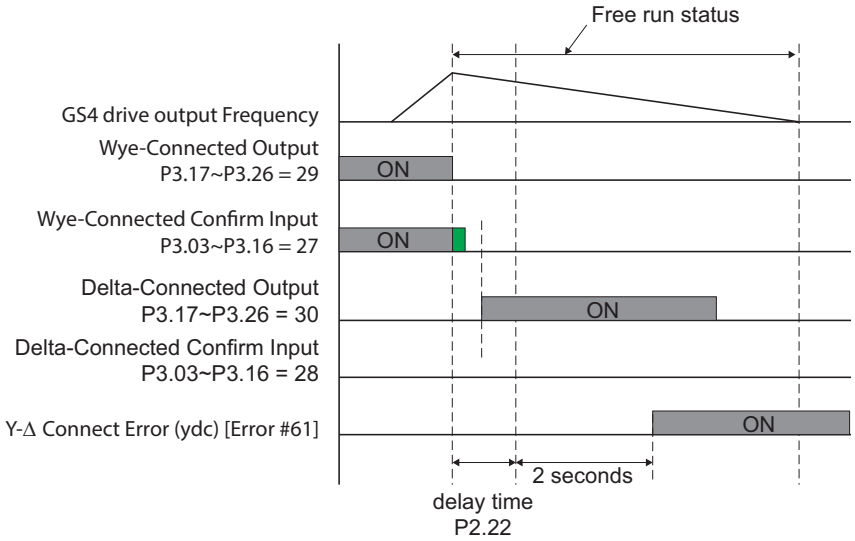
What happens when Y-Δ switching occurs properly:

- *The delta confirmation signal is generated, and the drive output continues*



What happens when Y-Δ switching does not occur properly:

- *In this example, the delta-connection confirmation input does not turn on. Two seconds after Delay Time for Y-D Switching (P2.22) has elapsed, the GS4 drive sets a Y-D Connect Error (61).*



		Type	Hex Addr	Dec Addr
P2.23	**Automatic Energy-Saving Operation**	♦R/W	0217	40536
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable 1: Enable		0		

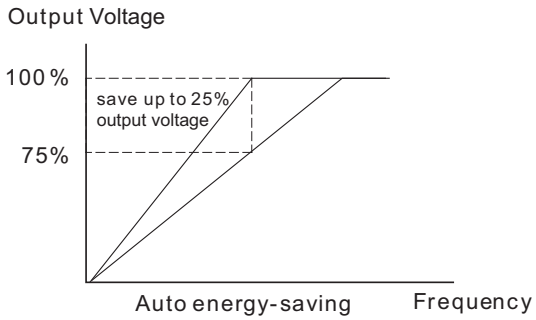
When P2.23 is set to 1, the acceleration and deceleration will operate with full voltage. During constant speed operation, the drive will auto calculate the best voltage value by the load power for the load. This function is not suitable for constantly changing loads or applications where the motor is near full-load (>70~80% of FLA).

When P2.23=1, the frequency command signal (keypad entry, analog input, etc.) must be stable for approximately 30s before Automatic Energy Saving Mode will turn on and reduce the output voltage. If the drive is in Energy Saving Mode and the frequency command signal changes (increases or decreases), Automatic Energy Saving Mode will temporarily stop. After the frequency command has become stable for 30s, the drive will re-enter Automatic Energy Saving Mode and reduce the output voltage to the motor.

When a motor runs at full load, the current flowing in the stator produces enough flux to generate full torque. Unfortunately, when a motor is lightly loaded, the stator current at full voltage stays the same (resulting in a lot of wasted energy). P2.23 automatically reduces the voltage delivered to the motor, which will reduce the unnecessary/excess current in the stator. Because AC motor speed is determined by frequency (and not voltage), the speed will remain the same. Therefore, the drive will operate at the required speed with minimum power (drawing less current).

To see the effect of Automatic Energy Saving Mode, set P2.23=1. Run an unloaded motor from the keypad (P4.00 or P4.01 = Digital Keypad frequency command). On the keypad, set P8.00 User Display setting to VAC (Output Voltage), and allow the unloaded motor to run without changing the frequency command. After 30s, you should see the output voltage (and output current) drop significantly.

If the incoming line voltage is low (at or near the bottom of the allowable input range), Automatic Energy Savings may not be able to reduce the output voltage.



NOTE:

The amount of power savings is highly dependent on the application. A small, very lightly loaded motor (5hp, 40~50% loaded) could see an energy savings approaching 10%.

Since the flux-generating current is a much smaller % of the total current in a larger motor (100hp), the % of savings will be smaller in larger motors (less than 5%). However, the total energy saved (in kWH or $$) could be higher.

Unfortunately, the only true way to determine energy savings is to run the drive with and without Energy-Savings enabled, and measure the difference in energy consumption.

Rough estimates of energy reduction can be seen by monitoring output current and voltage with P2.23=0, then P2.23=1.

The P8.00 User Display setting allows you to view Power (P), AC Output Voltage (E), and output Amps (A).

		Type	Hex Addr	Dec Addr
P2.24	**Power Saving Gain**	♦R/W	0218	40537
Range/Units (Format: 16-bit unsigned)		Default		
10~1000%		100		

When P2.23 is set to 1, this parameter (P2.24) can be used to adjust the gain of energy-saving. Decrease the gain to increase power savings. Increase the gain if the motor oscillates.

		Type	Hex Addr	Dec Addr
P2.25	**Slip Compensation Filter**	♦R/W	0219	40538
Range/Units (Format: 16-bit unsigned)		Default		
0.001~10.000 sec		0.100		

P2.25 and P2.03 can be used to change the response time of slip and torque compensation, respectively.

If P2.25 and P2.03 are set to 10 seconds, the response time of compensation is the slowest. But the system may be unstable when the setting is too short. The higher the value, the longer the time and the slower the response, resulting in increased damping of the signal. The smaller the value, the shorter the time and the faster the response, which can result in instability if the response is too fast.

		Type	Hex Addr	Dec Addr
P2.26	**Slip Deviation Level**	♦R/W	021A	40539
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0%		0.0		

P2.26, Slip Deviation Level; P2.26 = xx.x% of 20.00Hz.

Slip deviation is calculated on motor current. Slip deviation is valid in V/Hz or Sensorless Vector control modes. If P2.01>0, then slip deviation level is active.

		Type	Hex Addr	Dec Addr
P2.27	**Slip Deviation Detection time**	♦R/W	021B	40540
Range/Units (Format: 16-bit unsigned)		Default		
0.0~10.0 seconds		1.0		

		Type	Hex Addr	Dec Addr
P2.28	**Slip Deviation Treatment**	♦R/W	021C	40541
Range/Units (Format: 16-bit unsigned)		Default		
0: Warn and continue operating 1: Warn and Ramp to Stop 2: Warn and Coast to stop 3: No Warning		0		

P2.26 to P2.28 are used to set allowable slip level/time and over slip treatment when the drive is running.

		Type	Hex Addr	Dec Addr
P2.29	**Hunting Gain**	♦R/W	021D	40542
Range/Units (Format: 16-bit unsigned)		Default		
0~10000 (0=disable)		1000		

The motor could develop an oscillating motion around some specific frequency. This situation can be improved by setting this parameter. (If the oscillation occurs at a high frequency, try lowering this value, even to 0 if necessary. If the oscillation occurs at a low frequency, then increase this parameter.)

Group P3.xx Details – Digital Parameters

		Type	Hex Addr	Dec Addr
P3.00	**1st Source of Operation Command [Remote/Auto]**	R/W	0300	40769
	Range/Units (Format: 16-bit binary)	*Default*		
	0: Digital Keypad	0		
	1: External Terminal; Keypad/RS-485 STOP is enabled			
	2: External Terminal; Keypad/RS-485 STOP is disabled			
	3: RS485 (Modbus/BACnet); Keypad STOP is enabled			
	4: RS485 (Modbus/BACnet); Keypad STOP is disabled			
	5: Comm Card; Keypad STOP is enabled			
	6: Comm Card; Keypad STOP is disabled			

Sets the source of run and stop control when in REMOTE mode (AUTO if P3.58=0). When the operation command is controlled by the keypad (GS4-KPD), the keys RUN, STOP, and JOG (F1) are valid.

P4.00 is for setting the frequency source for the REMOTE Source of Operation. The LOCAL/REMOTE mode can be switched by the keypad GS4-KPD or multi-function input terminal (DI =33).

The factory setting of frequency source and operation source is REMOTE mode. **Control will return to REMOTE mode whenever power is cycled to the drive**. If there is a multi-function input terminal used to switch LOCAL/REMOTE modes, then the multi-function input terminal has priority.

When the motor is running and the source of operation is changed from 1st to 2nd source or 2nd to 1st source, the motor will ramp to a stop regardless of the presence of a run command at either source (if P3.58 = default of 0). The drive looks for a rising edge or transition on the start command for each source of operation to allow the drive to start the motor. The drive does not look at the state; only the state change for start operations.

Refer to P3.58 LOCAL/REMOTE Selection to define how the drive handles starting and stopping when transitioning between Local and Remote Modes, and to enable bumpless transfer between the two modes.

NOTE: If the GS4 PLC is running the drive and P3.00 or P3.01 is set to 1, 3, or 5, then the keypad stop button will stop the drive.

NOTE: P8.13 and P8.14 can be configured to stop the drive if the keypad is removed.

Related parameter: P8.13 Keypad Communication Fault Treatment

		Type	Hex Addr	Dec Addr
P3.01	***2nd Source of Operation Command [Local/Hand]***	R/W	0301	40770
Range/Units (Format: 16-bit binary)		*Default*		
same settings as P3.00		0		

Sets the source of run and stop control when in LOCAL mode (HAND if P3.58=0). When the operation command is controlled by the keypad (GS4-KPD), the keys RUN, STOP, and JOG (F1) are valid.

P4.01 is for setting the frequency source for the Local Source of Operation. The LOCAL/REMOTE mode can be switched by the keypad GS4-KPD or multi-function input terminal (DI).

The factory setting of frequency source and operation source is REMOTE mode. **Control will return to REMOTE mode whenever power is cycled to the drive**. If there is a multi-function input terminal used to switch LOCAL/REMOTE modes, then the multi-function input terminal has priority.

When the motor is running and the source of operation is changed from 1st to 2nd source or 2nd to 1st source, the motor will ramp to a stop regardless of the presence of a run command at either source (if P3.58 = default of 0). The drive looks for a rising edge or transition on the start command for each source of operation to allow the drive to start the motor. The drive does not look at the state; only the state change for start operations.

Refer to P3.58 LOCAL/REMOTE Selection to define how the drive handles starting and stopping when transitioning between Local and Remote Modes, and to enable bumpless transfer between the two modes.

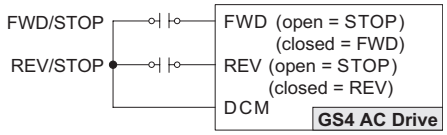
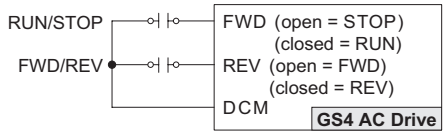
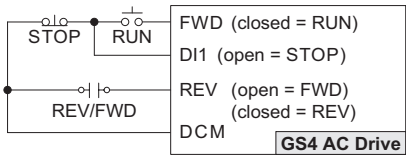
NOTE: If PLC is running the drive and P3.00 or P3.01 is set to 1, 3, or 5, then the keypad stop button will stop the drive.

NOTE: P8.13 and P8.14 can be configured to stop the drive if the keypad is removed.

Related parameter: P8.13 Keypad Communication Fault Treatment

		Type	Hex Addr	Dec Addr
P3.02	**2/3 Wire Operation Mode**	R/W	0302	40771
Range/Units (Format: 16-bit binary)		Default		
0: 2-wire mode 1 (Fwd, Rev) 1: 2-wire mode 2 (Run, Direction) 2: 3-wire mode		0		

Sets the type of control when Remote source (P3.00) or Local source (P3.01) control is set to External Terminal operation method. There are three different control modes, as described below. When P3.02 is set for three-wire operation control (P3.02=2), the terminal DI1 becomes the STOP contact. P3.02 cannot be changed during operation. At any transition of a Run, Stop, FWD, or REV command the drive will re-evaluate the state of the control terminals and apply or stop motion as commanded. The FWD and REV terminals are only configurable through the P3.02 parameter.

P3.02	External Terminal Control Circuit Diagram
Setting 0 2-wire mode 1 FWD/STOP REV/STOP	
Setting 1 2-wire mode 2 RUN/STOP REV/FWD	
Setting 2 3-wire mode	

Setting 0: Two-wire control mode 1 (Fwd, Rev)

- *FWD Terminal: Open = stop. Maintained close = Run forward.*
- *REV Terminal: Open = stop. Maintained close = Run reverse.*
- *If both terminals are open or both closed, the drive will not run. After an External Fault and subsequent Reset the drive will not run until is sees a high or low transistion from either the FWD or REV terminal.*

FWD Input Terminal	open	closed	open	closed
REV Input Terminal	open	open	closed	closed
Drive Action	Stop	Forward	Reverse	Stop

Setting 1: Two-wire control mode 2 (Run, Direction)

- *FWD Terminal: Open = stop. Maintained close = Run. After an External Fault and subsequent Reset, the Run command will have to be cycled off then back on to run.*
- *REV Terminal: Open = FWD. Maintained close = REV.*

Setting 2: Three-wire control mode

- *FWD Terminal: The Run command needs a momentary high in order for the drive to run. If a Run command is high when drive is commanded to stop, the stop will take precedence. Once the Stop command is realeased the drive will start if the Run command is active.*
- *DI1 Terminal: The Stop command is maintained closed in order to allow drive to run. A momentary opening of the Stop command will cause the motor to stop if there is no Run command present. If there is a Run command present at the the time the Stop command opens, the drive will stop but will will restart if the Stop contact is closed while the Run command is high. DI1 is automatically assigned as the STOP contact and cannot be altered while P3.01=2.*
- *REV Terminal: The choice is a maintained selection: Open = FWD. Closed = REV.*
- *After an External Fault and subsequent Reset the drive will not run until is sees a high or low transistion from either the Run, Stop, or FWD/REV command.*

		Type	Hex Addr	Dec Addr
P3.03~P3.16	**Multi-Function Input (MFI) Terminal Functions**	R/W	varies by parameter	
Range/Units (Format: 16-bit unsigned)		Default		
0~50 (see P3.03~P3.16 Input Function Settings table below)		varies by parameter		

These parameters set the functions of the Multi-Function Input terminals.

- *See Appendix C for Digital Input worksheet (page C–3).*
- *Terminals for parameters P3.11 to P3.16 are located on the optional extention cards, if installed. If there is no expansion card installed, these parameters remain virtual terminals. For example, after installing the multiple function expansion card "GS4-06CDD," parameter P3.11 to P3.14 are defined as corresponding parameters for terminals DI10 to DI13, but parameters P3.15 to P3.16 are still virtual terminals.*
- *When terminals are defined as virtual, you need a digital keypad such as GS4-KPD or a communication mode to modify status of bits 8~15 (0=ON, 1=OFF) at Parameter P3.42.*
- *If an MFI will not take a setting, then most likely that setting is already assigned to a different input. MFI inputs also cannot be changed when the drive is running.*
- *When an external input is used in the GS4 PLC and the PLC is in Run or Stop mode, the PLC then owns that input and any Multi-Function Input setting assigned via P3.03~P3.16 is void. To read the status of an input into the PLC while maintaining the MFI setting, use the RPR command on the DI Status Register (P3.46). The ownership of the I/O can be returned to the drive by disabling the PLC either through the keypad or digital inputs when they are assigned values 36 and 37.*

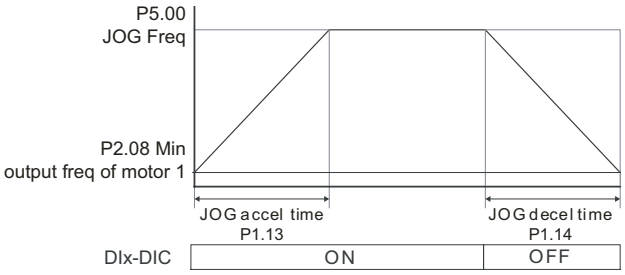
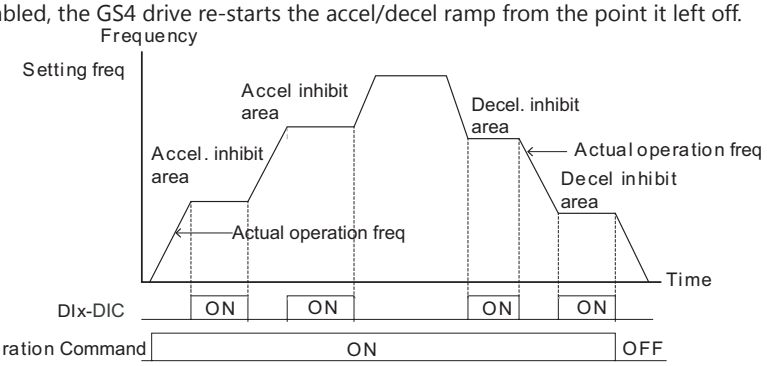
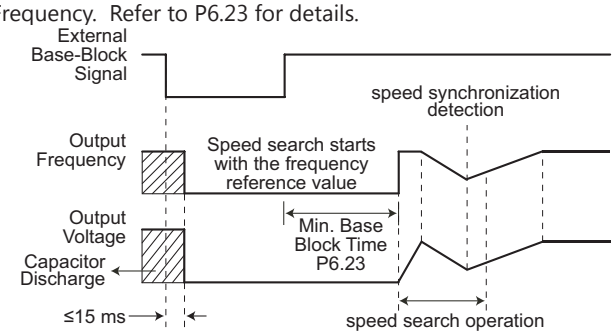
Multi-Function Input Terminal Function Settings (P3.03~P3.16)

Setting: Function	***Function Description***
0: No function	Setting a Multi-Function Input to 0 will disable that input. The purpose of this function is to provide isolation for unused Multi-Function Input Terminals. ***Any unused terminals should be programmed to 0 to make sure they have no effect on drive operation.***
1: Multi-Speed/PID Multi-Setpoint bit 1 2: Multi-Speed/PID Multi-Setpoint bit 2 3: Multi-Speed/PID Multi-Setpoint bit 3 4: Multi-Speed bit 4	15 speeds can be commanded through the digital status of the 4 terminals; total of 16 speeds if the master speed is included. (Refer to parameter group P5 for settings.) When settings 1, 2, & 3 are selected and registers P7.06~P7.12 are populated, the Multi-Function Inputs refer to PID Multi-Setpoints. The SPs are determined by P7.06~P7.12. 1) In order to use the Multi-PID SPs, P7.06~P7.12 must be set, and P7.00≠0. 2) When all PID Multi-Setpoint inputs are off, the GS4 drive reverts to the PID Setpoint Source (P7.02).

Multi-Speed / PID Setpoint				***Selection***	
Bit 4	***Bit 3***	***Bit 2***	***Bit 1***	***Speed***	***PID Setpoint***
OFF	OFF	OFF	OFF	P4.00/P4.01	P7.02: SP Source
OFF	OFF	OFF	ON	P5.01: Speed 1	P7.06: Setpoint 1
OFF	OFF	ON	OFF	P5.02: Speed 2	P7.07: Setpoint 2
OFF	OFF	ON	ON	P5.03: Speed 3	P7.08: Setpoint 3
OFF	ON	OFF	OFF	P5.04: Speed 4	P7.09: Setpoint 4
OFF	ON	OFF	ON	P5.05: Speed 5	P7.10: Setpoint 5
OFF	ON	ON	OFF	P5.06: Speed 6	P7.11: Setpoint 6
OFF	ON	ON	ON	P5.07: Speed 7	P7.12: Setpoint 7
ON	OFF	OFF	OFF	P5.08: Speed 8	–
ON	OFF	OFF	ON	P5.09: Speed 9	–
ON	OFF	ON	OFF	P5.10: Speed 10	–
ON	OFF	ON	ON	P5.11: Speed 11	–
ON	ON	OFF	OFF	P5.12: Speed 12	–
ON	ON	OFF	ON	P5.13: Speed 13	–
ON	ON	ON	OFF	P5.14: Speed 14	–
ON	ON	ON	ON	P5.15: Speed 15	–

5: Reset	After the error of the drive is eliminated, use this terminal to reset the drive.

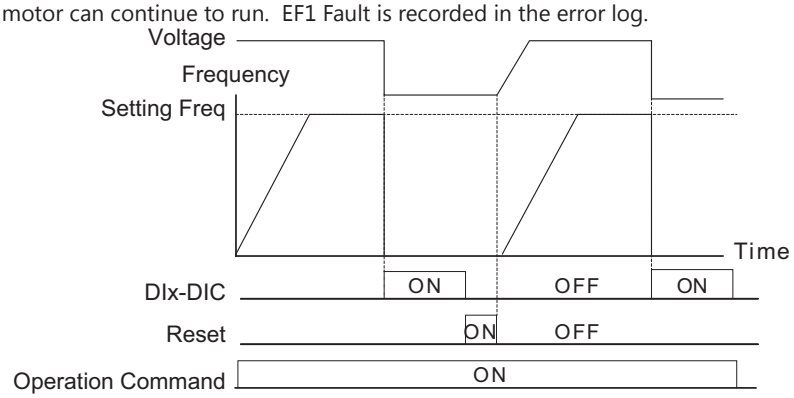
(table continued next page)

Multi-Function Input Terminal Function Settings (P3.03~P3.16) (continued)	
Setting: Function	***Function Description***
6: JOG	Before executing this function, wait for the drive to stop completely. While the drive is running, the operating direction can be modified and the STOP key on the keypad is still valid. Once the external terminal receives OFF command, the motor will stop by the JOG deceleration time. Refer to P1.13, P1.14 and P5.00 for details. 
7: Accel/Decel speed inhibit (Speed Hold)	When this function is enabled, the acceleration and deceleration are stopped right away and the drive maintains a constant speed. After this function is disabled, the GS4 drive re-starts the accel/decel ramp from the point it left off. 
8: 1st~4th Accel/Decel time selection, bit 0 9: 1st~4th Accel/Decel time selection, bit 1	The acceleration/deceleration time of the drive can be selected from the status of these two digital inputs configured to setting 8 and 9. there are 4 acceleration/deceleration speeds in total for selection. *DIx = 9* / *DIx = 8* / *Accel/Decel* OFF / OFF / 1st Accel/Decel OFF / ON / 2nd Accel/Decel ON / OFF / 3rd Accel/Decel ON / ON / 4th Accel/Decel
10: External Fault Input by P3.56 (EF error)	External fault input terminal. The drive decelerates by P3.56 setting. The External Fault will be saved to the error log. Fault must be cleared and the drive reset before drive can run again.
11: Base Block Input	When this contact is ON, output of the drive will be cut off immediately, and the motor will be in coast and display "b.b." When the External Base Block is deactivated, the GS4 drive will start the speed search function and synchronize with the motor speed if P6.06 ≠ 0. The GS4 drive will then accelerate to the Master Frequency. Refer to P6.23 for details. 
12: reserved	n/a

(table continued next page)

Multi-Function Input Terminal Function Settings (P3.03~P3.16) (continued)	
Setting: Function	***Function Description***
13: Disable Auto Accel/Decel Time	Before using this function, P6.13 should be set to mode 01, 02, 03, or 04. When this function is enabled, accel and decel time is linear when input is activated or ON. When input is deactivated or OFF, the accel and decel times are determined by P6.13.
14: Switch between drive settings 1 and 2	When contact is ON: Drive uses parameters of motor 2 (P0.11~P0.18). When contact is OFF: Drive uses parameters of motor 1 (P0.00~P0.04, P0.06~P0.09).
15: Operation speed command from AI1	When contact is ON, the source of the frequency has to be from AI1. Set P4.02=1 (Freq Reference). If multiple DI terminals are set to AI1, AI2, and AI3 operation speed commands at the same time, the priority is AI1>AI2>AI3.
16: Operation speed command from AI2	When contact is ON, the source of the frequency has to be from AI2. Set P4.03=1 (Freq Reference). If multiple DI terminals are set to AI1, AI2, and AI3 operation speed commands at the same time, the priority is AI1>AI2>AI3.
17: Operation speed command from AI3	When contact is ON, the source of the frequency has to be from AI3. Set P4.04=1 (Freq Reference). If multiple DI terminals are set to AI1, AI2, and AI3 operation speed commands at the same time, the priority is AI1>AI2>AI3.
18: Forced Ramp Stop by P3.56 (no error)	When contact is ON, the drive will ramp to a stop by the setting of P3.56. The External Fault will NOT be saved to the error log. The drive will not need to be reset, but the fault will need to be cleared before the drive will run again.
19: Digital Freq Up Command	Before using this function, set 1st or 2nd Source of Frequency Command (P4.00 or P4.01) equal to external up/down input. If this input is constantly ON, the frequency will be increased or decreased by the rate defined in parameter P3.39. After a stop from this speed mode and a subsequent restart, the drive will start again at the last frequency given according ramp selected in P1.01 to P1.08. The increase and decrease speed functions can be adjusted while the motor is stopped. *NOTE: If P3.39 > the actual drive acc/dec (p1.01 and P1.02), the command freq will reach desired speed well before the drive output reaches setpoint.*
20: Digital Freq Down Command	
21: PID function Disable	When the contact is activated, the PID function is disabled.
22: Clear counter	When the contact is activated, it will clear current counter value and display "0". When this function is deactivated the counter will continue to count.
23: Increment counter value (DI6 only)	The counter value will increase 1 count when ON. Count occurs during the rising edge of an input and must be on for at least 1ms. The input is not debounced; user supplied switch debouncing is recommended if needed. P3.44 (Final Count) needs to be set before counter will work. *This setting (23) can be assigned only to DI6.* *P3.40 can be adjusted to vary the debounce time for this setting.* *Adjustments to P3.41 (Digital Input Response Time) will <u>not</u> affect DI6.* *P3.44 (Final Counter Value) must have a value set for counter to count.*
24: FWD JOG	When contact is ON, the drive will execute *forward* Jog command. Jog functions can only be initated from a stop state. Jog Accel/Decel Time: P1.13, P1.14; Jog Frequency: P5.00.
25: REV JOG	When contact is ON, the drive will execute *reverse* Jog command. Jog functions can only be initated from a stop state. Jog Accel/Decel Time: P1.13, P1.14; Jog Frequency: P5.00.

(table continued next page)

<table>
<tr><th colspan="2">Multi-Function Input Terminal Function Settings (P3.03~P3.16) (continued)</th></tr>
<tr><th>Setting: Function</th><th>Function Description</th></tr>
<tr><td>26: Emergency Stop EF1
(Coast stop) (EF1 error)</td><td>When contact is ON, the drive will execute emergency stop and display EF1 on the keypad. The motor stays in the free run until the error is cleared (terminal's status is back to normal). Only after pressing RESET (EF1: Emergency Stop), the motor can continue to run. EF1 Fault is recorded in the error log.
 
</td></tr>
<tr><td>27: Signal Confirmation for
Y-connection</td><td>When the control mode is V/Hz (P2.11=0) and the contact is ON, the drive will operate by following the 1st V/Hz. The following parameters must also be configured P2.20~P2.22, and two digital outputs (P3.17~P3.31) must be set to 29 and 30.</td></tr>
<tr><td>28: Signal Confirmation for Delta
connection</td><td>When the control mode is V/Hz (P2.11=0) and the contact is ON, the drive will operate by following the 2nd V/Hz. The following parameters must also be configured P2.20~P2.22, and two digital outputs (P3.17~P3.31) must be set to 29 and 30.</td></tr>
<tr><td>29: Disable EEPROM Write</td><td>When this contact is ON, write to EEPROM is disabled. The modified values changed while this contact is on will revert back to the old values after restarting the drive. (When input is ON, any values that are modified will not be retained when power is cycled)
The RPR instruction in the PLC will not affect the EEPROM.
The WPR instruction will contribute to the 10^9 maximum life time EEPROM writes to the FRAM memory in the drive.</td></tr>
<tr><td>30: Forced Coast Stop</td><td>When this contact is ON during an operation, the drive will coast to stop.</td></tr>
<tr><td>31: Hand Contact for HOA Control

32: Auto Contact for HOA Control</td><td>When controlling the drive using the standard HOA (Hand/Off/Auto) function, settings 31 & 32 should be used together. When these multi-function input terminals are both on or both off, the drive executes a STOP command. That means when switching Hand to Auto or Auto to Hand the switch configuration must pass through a Stop state causing the drive to always stop when changing modes.
Local/Remote buttons on the keypad and MFI setting 33 will not be operational when digital inputs are configured for 31 & 32.
MFI settings 31 & 32 have priority over P3.58 settings.
The digital keypad will display the drive's status ("HAND," "OFF," "AUTO") in the upper right corner of the keypad, depending on what control mode the drive is in.
P3.57 contains additional behavior settings when switching from Auto to Hand.
<table>
<tr><td rowspan="4"><u>DI1 = 31</u>
<u>DI2 = 32</u></td><td>(DI2, DI1) = 00</td><td>OFF</td><td>Off</td></tr>
<tr><td>(DI2, DI1) = 01</td><td>HAND</td><td>Follows LOCAL source (P3.01 & P4.01)</td></tr>
<tr><td>(DI2, DI1) = 10</td><td>AUTO</td><td>Follows REMOTE source (P3.00 & P4.00)</td></tr>
<tr><td>(DI2, DI1) = 11</td><td>OFF</td><td>Off</td></tr>
</table></td></tr>
<tr><td>33: LOCAL/REMOTE Selection</td><td>DI=0: (Switches to REMOTE source, P3.00 & P4.00)
DI=1: (Switches to LOCAL source, P3.01 & P4.01)
If another MFI is set to 31 or 32, then this input will be ignored.
This function is enabled when P3.58 is <u>not</u> set to 0.
Keypad "LOCAL" and "REMOTE" buttons will be disabled.
The digital keypad will display the drive's states ("LOC","REM") in the upper right corner of the keypad.
MFO setting 24 will indicate the position of this function.</td></tr>
<tr><td colspan="2">(table continued next page)</td></tr>
</table>

<table>
<tr><th colspan="2">Multi-Function Input Terminal Function Settings (P3.03~P3.16) (continued)</th></tr>
<tr><th>Setting: Function</th><th>Function Description</th></tr>
<tr><td>34: Drive Enable</td><td>When drive is Enabled, the drive will run when commanded to do so. When drive is not Enabled, the drive will not run. If the drive is running and the enable switch is deactivated, then the motor will coast to stop.</td></tr>
<tr><td>35: Decel Energy Backup (DEB) Enable</td><td>Decel Energy Backup at momentary power loss. Allows controlled stopping during a power failure or predetermined behavior during a power brown out. See P6.61~P6.64 for related settings.</td></tr>
<tr><td>36: PLC Mode select bit0
37: PLC Mode select bit1</td><td>
<table>
<tr><th><u>PLC status</u></th><th><u>Bit 1</u></th><th><u>Bit 0</u></th><th><u>Note</u></th></tr>
<tr><td>Disable PLC function (PLC 0)</td><td>0</td><td>0</td><td rowspan="4">PLC mode selection through MFI terminals will trump the selection made through the keypad menu. GSLogic will override these settings. On a power cycle these bits will take priority.</td></tr>
<tr><td>Trigger PLC to run (PLC 1)</td><td>0</td><td>1</td></tr>
<tr><td>Trigger PLC to stop (PLC 2)</td><td>1</td><td>0</td></tr>
<tr><td>Maintain last state</td><td>1</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>38: reserved</td><td>n/a</td></tr>
<tr><td>39: reserved</td><td>n/a</td></tr>
<tr><td>40: Fire mode and force drive run</td><td>Enable this function under Fire Mode (P6.55) to force the drive to run.
Other than Safety Torque Off (STO), the drive will run at the Fire Mode frequency regardless of when this function is activated.
When STO is activated, the drive will <u>not</u> output. Fire mode will <u>not</u> override STO while there is an active alarm.
If the drive is stopped or running when this DI turns ON, the drive will run. When the DI goes off, the drive will stop ("In Fire Mode") regardless of the state of the RUN input. To restart the drive, either turn this DI back ON, or clear the fault (using the Reset input) and turn the RUN input on.
Related parameters: P6.55~P6.60.</td></tr>
<tr><td>41: Fire mode and maintain operation</td><td>Enable this function under Fire Mode (P6.55). Current state of operation of the drive will continue.
Other than Safety Torque Off (STO), the drive will run if currently running, but will be limited in frequency by P6.56. If the drive is currently in a stop state, the drive will remain in a stop state.
WARNING: Use #40 if you want the drive to always RUN when in Fire Mode.
When STO is activated, the drive will <u>not</u> output. Fire mode will <u>not</u> override STO while there is an active alarm.
Keypad will display "In Fire Mode." When the Fire Mode DI goes off, the drive will stop ("In Fire Mode") regardless of the state of the RUN input. To restart the drive, clear the fault (using the Reset input) and then turn the RUN input on. (when using Mode 41, the DI will not cause the drive to RUN when in Fire Mode).
Related parameters: P6.55~P6.60.</td></tr>
<tr><td>42: Disable all motors</td><td>When the multi-motor circulative control (P10.00) is enabled, all motors will be disabled when this function is activated.</td></tr>
<tr><td>43: Disable Motor #1</td><td rowspan="8">When the multi-motor circulative control (P10.00) is enabled, motors #1 to #8 can be disabled. If one or more motors (1~8) are out of order or under maintenance, enable this terminal to bypass that motor.</td></tr>
<tr><td>44: Disable Motor #2</td></tr>
<tr><td>45: Disable Motor #3</td></tr>
<tr><td>46: Disable Motor #4</td></tr>
<tr><td>47: Disable Motor #5</td></tr>
<tr><td>48: Disable Motor #6</td></tr>
<tr><td>49: Disable Motor #7</td></tr>
<tr><td>50: Disable Motor #8</td></tr>
</table>

		Type	Hex Addr	Dec Addr
P3.03	**Multi-Function Input (DI1 or PLC X2)**	R/W	0303	40772
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		1		

This parameter sets the function of Multi-Function Input (DI1).
- *Represented by Bit 2 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 2 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.04	**Multi-Function Input (DI2 or PLC X3)**	R/W	0304	40773
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		2		

This parameter sets the function of Multi-Function Input (DI2).
- *Represented by Bit 3 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 3 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.05	**Multi-Function Input (DI3 or PLC X4)**	R/W	0305	40774
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		3		

This parameter sets the function of Multi-Function Input (DI3).
- *Represented by Bit 4 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 4 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.06	**Multi-Function Input (DI4 or PLC X5)**	R/W	0306	40775
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		4		

This parameter sets the function of Multi-Function Input (DI4).
- *Represented by Bit 5 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 5 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.07	**Multi-Function Input (DI5 or PLC X6)**	R/W	0307	40776
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI5).
- *Represented by Bit 6 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 6 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.08	**Multi-Function Input (DI6 or PLC X7)**	R/W	0308	40777
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.03~P3.16 except multi-function setting 23 (Increment Counter Value) can only be used with DI6 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI6).
- *Represented by Bit 7 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 7 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.09	**Multi-Function Input (DI7 or PLC X10)**	R/W	0309	40778
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI7).
- *Represented by Bit 8 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 8 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.10	**Multi-Function Input (DI8 or PLC X11)**	R/W	030A	40779
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI8).
- *Represented by Bit 9 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 9 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.11	**Multi-Function Input (option card DI10 or PLC X12)**	R/W	030B	40780
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI10).
- *DI10 is available only on extension cards GS4-06NA & GS4-06CDD.*
- *Represented by Bit 10 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 10 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.12	**Multi-Function Input (option card DI11 or PLC X13)**	R/W	030C	40781
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI11).
- *DI11 is available only on extension cards GS4-06NA & GS4-06CDD.*
- *Represented by Bit 11 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 11 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.13	**Multi-Function Input (option card DI12 or PLC X14)**	R/W	030D	40782
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI12).
- *DI12 is available only on extension cards GS4-06NA & GS4-06CDD.*
- *Represented by Bit 12 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 12 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.14	**Multi-Function Input (option card DI13 or PLC X15)**	R/W	030E	40783
Range/Units (Format: 16-bit unsigned)		Default		
See P3.03~P3.16 (page 4–63)		0		

This parameter sets the function of Multi-Function Input (DI13).
- *DI13 is available only on extension cards GS4-06NA & GS4-06CDD.*
- *Represented by Bit 13 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 13 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.15	**Multi-Function Input (option card DI14 or PLC X16)**	R/W	030F	40784
	Range/Units (Format: 16-bit unsigned)	Default		
	See P3.03~P3.16 (page 4–63)	0		

This parameter sets the function of Multi-Function Input (DI14).

- *DI14 is available only on extension card GS4-06NA.*
- *Represented by Bit 14 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 14 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.16	**Multi-Function Input (option card DI15 or PLC X17)**	R/W	0310	40785
	Range/Units (Format: 16-bit unsigned)	Default		
	See P3.03~P3.16 (page 4–63)	0		

This parameter sets the function of Multi-Function Input (DI15).

- *DI15 is available only on extension card GS4-06NA.*
- *Represented by Bit 15 on the "DI Status" (P3.46) bit map.*
- *NO/NC behavior is controlled by Bit 15 in P3.42.*

		Type	Hex Addr	Dec Addr
P3.17~P3.31	**Multi-Function Output (MFO) Terminal Functions**	♦R/W	varies by parameter	
	Range/Units (Format: 16-bit unsigned)	Default		
	0~55 (see P3.17~P3.31 Output Function Settings table below)	varies by parameter		

These parameters set the functions of the Multi-Function output terminals.

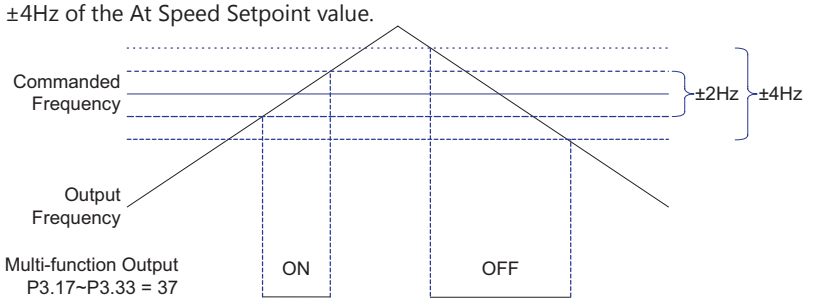
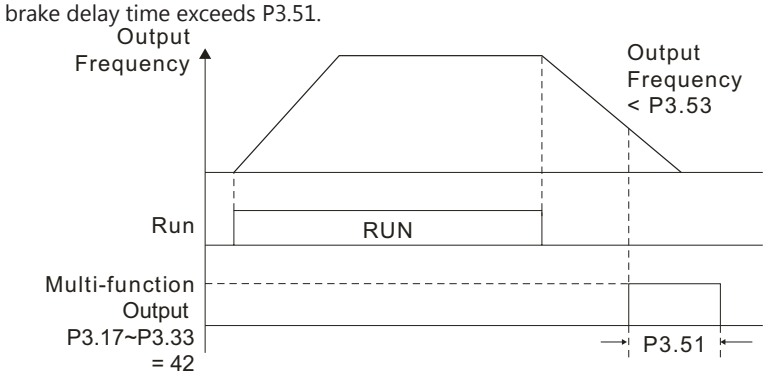
- *If an MFO will not take a setting, then most likely the setting is already assigned to a different output. MFO outputs also cannot be changed when the drive is running.*
- *See Appendix C for digital and analog I/O worksheet.*

Multi-Function Output Terminal Function Settings (P3.17~P3.31)	
Setting: Function	***Function Description***
0: No Function	Output terminal has no function configured.
1: AC Drive Running	Active when the drive is not at STOP.
2: At Frequency Setpoint	Active when the GS4 drive reaches the output frequency setting.
3: At Speed 1 (P3.32)	Active when desired frequency #1 (P3.32) is attained. ON state frequency band determined by P3.33.
4: At Speed 2 (P3.34)	Active when desired frequency #2 (P3.34) is attained. ON state frequency band determined by P3.35.
5: At Zero Speed Including Drive Running	Active when frequency command =0 and the drive is in RUN mode.
6: At Zero Speed Drive not Running	Active when frequency command =0 or stop.
7: Over Torque Level 1	Active when detecting over-torque. Refer to P6.15 (over-torque detection level-OT1) and P6.16 (over-torque detection time-OT1). Refer to P6.14~P6.16.
8: Over Torque Level 2	Active when detecting over-torque. Refer to P6.18 (over-torque detection level-OT2) and P6.19 (over-torque detection time-OT2). Refer to P6.17~P6.19.
9: Drive Ready	Active when the drive is ON and no faults or abnormality detected. Drive is ready for a start.
10: Low Voltage warning (Lv)	Active when the DC Bus voltage is too low. (refer to P6.35 low voltage level)
11: Error indication (All faults, Except for Lv Stop)	Active when fault occurs (except Lv stop). Output will not deactivate until fault is cleared and drive is reset back to ready state.
12: Brake release function	This function should be used with an external DC brake, and it is recommended to use contact "b" (N.C) (P3.43). This output turns ON at the beginning of the accel ramp and turns OFF at the end of the decel ramp. To use the P3.51 Brake Delay Timer, use MFO selection #42. (See P3.51 for more details and timing diagrams.)

(table continued next page)

Multi-Function Output Terminal Function Settings (P3.17~P3.31) (continued)	
Setting: Function	***Function Description***
13: Over-temp warning	Active when IGBT or heat sink overheats. To prevent an OH fault from turning off the output to the drive. (refer to P6.30 for OH warning level)
14: Dymamic braking output	Active when the dynamic brake function is ON. If DC Bus voltage is greater than the braking voltage level set in parameter P6.28 (Dynamic Braking Voltage level), then any output configured for function 14 will change state.
15: PID deviation error	Active when the feedback signal is abnormal. The output will be activated when the GS4 drive exceeds the PID Deviation Level (P3.36) for longer than the PID Deviation Time (P3.37).
16: Over Slip (oSL)	Active when the slip error is detected.
17: Mid-point Counter Value Attained (P3.45)	Active when the counter reaches Middle Counter Value (P3.45). This output will only be active for the count number specified, once the counter input is incremented one more count the output will be deactivated. DI6 must be configured to 23 "Input Counter." This output won't activate if the middle counter value is greater than final counter value.
18: Final Count Value Attained (P3.44)	Active when the counter reaches Final Counter Value (P3.44). This output will only be active for the count number specified, once the counter input is deactivated from the achieved final count the count value will automatically reset to 0. DI6 must be configured to 23 "Input Counter."
19: Base Block Indication	Active when the output of the GS4 Drive is shut off during base block. A mulit-function input must be configured to 11 "Base Block Inhibit."
20: Warning Output	Active when a warning is detected.
21: Overvoltage Alarm	Active when an over-voltage is detected.
22: Oc Stall Alarm	Active when an over-current stall prevention is detected.
23: Ov Stall Alarm	Active when an over-voltage stall prevention is detected.
24: External Control Mode	Active when the operation command (P3.00, P3.01) is controlled by RS-485, External Terminals, or Communication Card. This setting takes into account if the drive is in LOCAL or REMOTE mode. The drive does not need to be running for this output to energize.
25: Forward Command	Active when the commanded drive direction is forward. Does not indicate actual direction of rotation of motor. If motor is running REV and then commanded to run FWD this output will turn on, but the motor will still need time to ramp down in order to change direction.
26: Reverse Command	Active when the commanded drive direction is reverse. Does not indicate actual direction of rotation of motor. If motor is running FWD and then commanded to run REV this output will turn on, but the motor will still need time to ramp down in order to change direction.
27: Above Desired Current (≥ P3.52)	Active when current is ≥P3.52.
28: Below Desired Current (< P3.52)	Active when current is <P3.52.
29: Wye Connected Command	Used to trigger the switching contactors for a Wye-connected motor when switching from Wye to Delta starting of a motor. Use P2.20~P2.22 to enable and set up this feature. Two digital *inputs* must be set to 27 and 28.
30: Delta Connected Command	Used to trigger the switching contactors for a Delta-connected motor when switching from Wye to Delta starting of a motor. Use P2.20~P2.22 to enable and set up this feature. Two digital *inputs* must be set to 27 and 28.
31: Zero Speed at Drive Running	Active when the actual output frequency is 0. (The drive should be in RUN mode.)
32: Zero Speed including Drive Stop	Active when the actual output frequency is 0 or Stop.
33: Fault Option 1 (P11.00)	Active when fault group selected in P11.00 is ON.
34: Fault Option 2 (P11.01)	Active when fault group selected in P11.01 is ON.
35: Fault Option 3 (P11.02)	Active when fault group selected in P11.02 is ON.
36: Fault Option 4 (P11.03)	Active when fault group selected in P11.03 is ON.

(table continued next page)

<table>
<tr><th colspan="2">Multi-Function Output Terminal Function Settings (P3.17~P3.31) (continued)</th></tr>
<tr><th>Setting: Function</th><th>Function Description</th></tr>
<tr><td>37: At Speed (Setpoint include 0Hz)</td><td>Active when the output frequency reaches frequency setting including an output frequency of 0Hz. The output will be activated when the output frequency reaches ±2Hz of the At Speed Setpoint, and go off when the frequency exceeds ±4Hz of the At Speed Setpoint value.
 
</td></tr>
<tr><td>38: reserved</td><td>n/a</td></tr>
<tr><td>39: Under Ampere (Low Current)</td><td>This function needs to be used with P6.52, P6.53, P6.54. If P6.54 is not 0, the corresponding multi-function terminal will be ON if the current is less than P6.52 level and time elapsed is greater than P6.53.</td></tr>
<tr><td>40: UVW Motor Contactor ON</td><td>Set an MFI=34 (drive enable) and MFO=40 (Motor Contactor ON). The magnetic contactor will then follow the drive enable status.</td></tr>
<tr><td>41: DEB Active (Decel Energy Backup)</td><td>Active when DEB activation is on.</td></tr>
<tr><td>42: Brake Released at Stop
(Brake Engaged During Decel)</td><td>This function is typically used in conjunction with a mechanical brake.
When drive stops, the corresponding Multi-Function Output terminal will be ON if the frequency is less than P3.53. After it is ON, the output will turn OFF when brake delay time exceeds P3.51.
 

<u>Note</u>: With a long deceleration and a short brake time, the output could energize (for P3.51) and de-energize before the ramp is complete.</td></tr>
<tr><td>43: RS485 Digital Output</td><td>Enables user control of an output via RS-485. When the MFO is set to 43, writing to the correct bit in address 2640h (Modbus 49793) will turn on the associated output. This address will reset to zero when written to via RS-485 (but the output will stay ON because the bit was set). Digital Output Status should always be read from P3.47 (Modbus decimal address 40816).
<table>
<tr><td>Bit</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>Out</td><td>R1</td><td>R2</td><td>xx</td><td>DO1</td><td>DO2</td><td>DO10</td><td>DO12</td><td>DO13</td><td>DO14</td><td>DO15</td></tr>
</table>
<u>Example</u>:
Set P3.17 = 43 (Sets R1 to RS485 Digital Output)
Write a 1 to Bit 0 of 49793. R1 will turn ON.
Bit 0 of 49793 will read 0 (49793 auto-resets to 0).
Bit 0 of 40816 (P3.47 Digital Output Status) will read 1.
Write a 0 to Bit 0 of 49793 to turn R1 OFF.</td></tr>
<tr><td>44: COMM Card Digital Output</td><td>Allows user to control Digital Outputs via Ethernet Comm Card. Each output has a corresponding bit in 49793 (see option 43 for bit map). Only writes from the Ethernet card will cause the output to turn ON if #44 is selected. The value in 49793 is maintained when written to over Ethernet.</td></tr>
<tr><td colspan="2">(table continued next page)</td></tr>
</table>

Multi-Function Output Terminal Function Settings (P3.17~P3.31) (continued)	
Setting: Function	***Function Description***
45: Fire Mode Indication	An activation of setting 45 indicates fire mode is active. Requires Multi-Function Input P3.03~3.16 configured for 40: Fire Mode with RUN Command, or 41: Fire Mode without RUN Command. Requires Fire Mode P6.55 to be enabled. When the DI for Fire Mode turns ON, the DO associated with this input will also turn ON. The output is not retentive; the output turns ON and OFF with the Fire Mode DI.
46: Fire Bypass Indication	Requires Fire Mode Enable Bypass P6.57 to be enabled. The bypass will activate after the Bypass Delay Time. Once Fire Mode input is turned OFF, the bypass will be turned OFF. *Only certain types of faults are able to be bypassed in Fire Mode.* The list of fault codes, including which ones can and cannot be bypassed in Fire Mode, is shown in the "Fault Codes" table in Chapter 6: Maintenance and Troubleshooting (*page 6–16*).
47: Motor #1 Selected	When setting multi-motor circulative function, the Multi-Function Output terminal will automatically set up P3.17(R1), 3.18(R2), and P3.21(R10)~P3.26(R15) in accordance with P10.01's (Number of Connected Motors) setting (*page 4–192*).
48: Motor #2 Selected	
49: Motor #3 Selected	
50: Motor #4 Selected	
51: Motor #5 Selected	
52: Motor #6 Selected	
53: Motor #7 Selected	
54: Motor #8 Selected	
55: Mtr1/Mtr2 Nameplate Parameters	Indicates which motor is selected from P0.10 or MFI setting 14.
56: Safety STO A	Normally Open Auxiliary output for STO indication. *Not safety rated*.
57: Safety STO B	Normally Closed Auxiliary output for STO indication. *Not safety rated*.
58: Frequency Output Above P3.53	Active when current frequency output is ≥ the value in P3.53.
59: Frequency Output Below P3.53	Active when current frequency output is < the value in P3.53.

		Type	*Hex Addr*	*Dec Addr*
P3.17	***Multi-Function Output Terminal 1 (Relay 1) or (PLC Y0)***	♦R/W	0311	40786
Range/Units (Format: 16-bit unsigned)		*Default*		
Same as P3.17~P3.31 (page 4–70)		11		

This parameter (P3.17) sets the function of Multi-Function Output Terminal 1 (Relay 1).

Relay 1 (R1) has a normally open (R1O) and normally closed (R1C) dry contact located on the drive terminal board.

- *Represented by Bit 0 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 0 in P3.43.*

		Type	*Hex Addr*	*Dec Addr*
P3.18	***Multi-Function Output Terminal 2 (Relay 2) or (PLC Y1)***	♦R/W	0312	40787
Range/Units (Format: 16-bit unsigned)		*Default*		
Same as P3.17~P3.31 (page 4–70)		1		

This parameter sets the function of Multi-Function Output Terminal 2 (Relay 2).

Relay 2 (R2) has a normally open (R2O) and normally closed (R2C) dry contact located on the drive.

- *Represented by Bit 1 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 1 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.19	**Multi-Function Output Terminal 3 (DO1) or (PLC Y3)**	♦R/W	0313	40788
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 3 (DO1).

DO1 can be wired for a sink or source configuration, and is located on the drive.

- *Represented by Bit 3 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 3 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.20	**Multi-Function Output Terminal 4 (DO2) or (PLC Y4)**	♦R/W	0314	40789
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 4 (DO2).

DO2 can be wired for a sink or source configuration, and is located on the drive.

- *Represented by Bit 4 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 4 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.21	**Multi-Function Output Terminal 5 (option card DO10 or RO10) or (PLC Y5)**	♦R/W	0315	40790
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 5 (DO10) or (RO10) (option card), and can be used only after installing the optional card.

DO10 can be wired for a sink or source configuration, and is located on the GS4-06CDD expansion card.

RO10 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 5 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 5 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.22	**Multi-Function Output Terminal 6 (option card DO11 or RO11) or (PLC Y6)**	♦R/W	0316	40791
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 6 (DO11) or (RO11) (option card), and can be used only after installing the optional card.

DO11 can be wired for a sink or source configuration; located on the GS4-06CDD expansion card.

RO11 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 6 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 6 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.23	**Multi-Function Output Terminal 7 (option card RO12) or (PLC Y7)**	♦R/W	0317	40792
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 7 (RO12) (option card), and can be used only after installing the optional card.

RO12 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 7 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 7 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.24	**Multi-Function Output Terminal 8 (option card RO13) or (PLC Y10)**	♦R/W	0318	40793
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 8 (RO13) (option card), and can be used only after installing the optional card.

RO13 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 8 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 8 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.25	**Multi-Function Output Terminal 9 (option card RO14) or (PLC Y11)**	♦R/W	0319	40794
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 9 (RO14) (option card), and can be used only after installing the optional card.

RO14 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 9 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 9 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.26	**Multi-Function Output Terminal 10 (option card RO15) or (PLC Y12)**	♦R/W	031A	40795
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Output Terminal 10 (RO15) (option card), and can be used only after installing the optional card.

RO15 has a normally open dry contact located on the GS4-06TR expansion card.

- *Represented by Bit 10 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 10 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.27	**Multi-Function Virtual Output 11 (DO16) or (PLC Y13)**	♦R/W	031B	40796
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Virtual Output 11 (PLC DO16).
This output is a virtual terminal used by the PLC; there is no physical wiring point.

- *Represented by Bit 11 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 11 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.28	**Multi-Function Virtual Output 12 (DO17) or (PLC Y14)**	♦R/W	031C	40797
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Virtual Output 12 (PLC DO17).
This output is a virtual terminal used by the PLC; there is no physical wiring point.

- *Represented by Bit 12 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 12 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.29	**Multi-Function Virtual Output 13 (DO18) or (PLC Y15)**	♦R/W	031D	40798
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Virtual Output 13 (PLC DO18).
This output is a virtual terminal used by the PLC; there is no physical wiring point.

- *Represented by Bit 13 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 13 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.30	**Multi-Function Virtual Output 14 (DO19) or (PLC Y16)**	♦R/W	031E	40799
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

This parameter sets the function of Multi-Function Virtual Output 14 (PLC DO19).
This output is a virtual terminal used by the PLC; there is no physical wiring point.

- *Represented by Bit 14 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 14 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.31	**Multi-Function Virtual Output 15 (DO20) or (PLC Y20)**	♦R/W	031F	40800
Range/Units (Format: 16-bit unsigned)		Default		
Same as P3.17~P3.31 (page 4–70)		0		

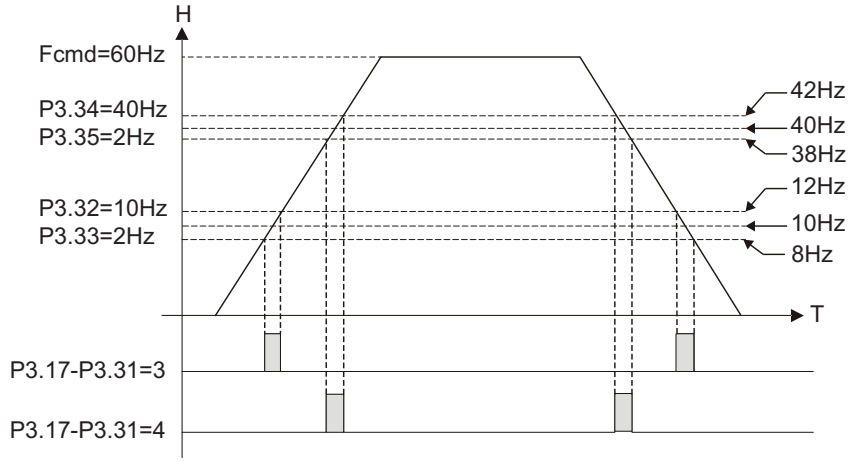
This parameter sets the function of Multi-Function Virtual Output 15 (PLC DO20).
This output is a virtual terminal used by the PLC; there is no physical wiring point.

- *Represented by Bit 15 on the "DO Status" (P3.47) bit map.*
- *NO/NC behavior is controlled by Bit 15 in P3.43.*

		Type	Hex Addr	Dec Addr
P3.32	**Desired Frequency 1**	♦R/W	0320	40801
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		60.00		

If a Multi-Function Output terminal is set to function "At Speed" (P3.17~P3.31 = 03 or 04), then the output will be activated when the programmed frequency is attained and within the window set in P3.33.

- *Once output frequency reaches desired frequency (± width) and the corresponding multi-function output terminal is set to 3 or 4 (P3.17~P3.31), this multi-function output terminal will be ON.*



		Type	Hex Addr	Dec Addr
P3.33	**Desired Frequency 1 Width**	♦R/W	0321	40802
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		2.00		

Sets the window of when the "Desired Frequency 1" (P3.32) will be activated. The value set here represents a plus and minus range surrounding the P3.32 setting. The overall window width will be twice the value set here.

- *Refer to timing chart at P.3.32.*

		Type	Hex Addr	Dec Addr
P3.34	**Desired Frequency 2**	♦R/W	0322	40803
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		60.00		

If a Multi-Function Output terminal is set to function "At Speed" (P3.17~P3.31 = 03 or 04), then the output will be activated when the programmed frequency is attained and within the window set in P3.35.

- *Refer to timing chart at P.3.32.*

		Type	Hex Addr	Dec Addr
P3.35	**Desired Frequency 2 Width**	♦R/W	0323	40804
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		2.00		

Sets the window of when the "Desired Frequency 2" (P3.34) will be activated. The value set here represents a plus and minus range surrounding the P3.34 setting. The overall window width will be twice the value set here.

- *Refer to timing chart at P.3.32.*

		Type	Hex Addr	Dec Addr
P3.36	**PID Deviation Level**	♦R/W	0324	40805
Range/Units (Format: 16-bit unsigned)		Default		
1.0~50.0%		10.0		

If a Multi-Function Output terminal is set to PID Deviation Alarm (setting = 15), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop exceeds the threshold set by this parameter for the period of time set by P3.37.

- *This parameter is used in conjunction with P3.37, PID Deviation Time.*

		Type	Hex Addr	Dec Addr
P3.37	**PID Deviation Time**	♦R/W	0325	40806
Range/Units (Format: 16-bit unsigned)		Default		
0.1~300.0 sec		5.0		

If a Multi-Function Output terminal is set to PID Deviation Alarm (setting = 15), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop exceeds the threshold set by P3.36 for the period of time set by this parameter.

- *This parameter is used in conjunction with P3.36, PID Deviation Level, as seen above.*

		Type	Hex Addr	Dec Addr
P3.38	**Frequency Output (FO) Scaling Factor**	♦R/W	0326	40807
Range/Units (Format: 16-bit unsigned)		Default		
1~166		1		

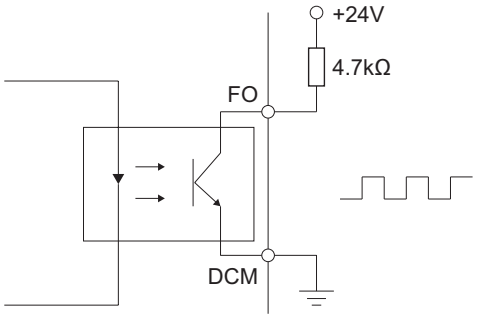
This parameter determines the scaling factor that is used to scale the frequency at the Digital Frequency Output terminals (FO-DCM). The number of output pulses per second at terminal FO is equal to the GS4 drive output frequency multiplied by P3.38.

- *(Pulse per second = actual output frequency x P3.38).*

Example 1: When drive frequency is 60.0Hz and P3.38 = 10; 60.0Hz x 10 = 600.0Hz; Frequency of FO's outputted square wave is 600.0Hz

Example 2: When drive output frequency = 400.0Hz and P3.38 = 20; 400.0Hz x 20 = 8kHz; FO's output frequency is 8kHz.

FO is an open collector circuit. A 50% duty cycle square wave is generated. To use a 24VDC source, insert a 4.7kΩ resistor between the FO and 24V supply. Then read or use the output square wave at the FO terminal for a 24V pulse.

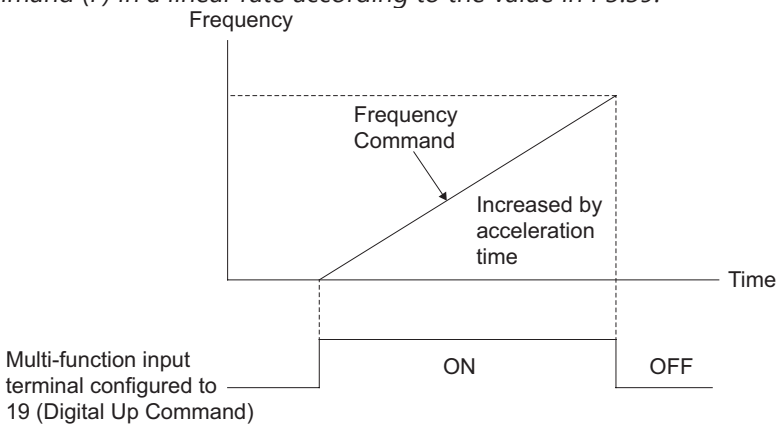


		Type	Hex Addr	Dec Addr
P3.39	**Increase/Decrease Speed Mode**	♦R/W	0327	40808
Range/Units (Format: 16-bit unsigned)		Default		
0.000: External Up/Down Terminal used for frequency change follows Accel/Decel Time (P1.01 & P1.02) 0.001~1.000 Hz/ms: External Up/Down Terminal used for frequency change follows constant speed		0		

P3.39 adjusts the rate for the Frequency Up/Down Commands when Multi-Function Input Terminals are set to 19 or 20 (Digital Freq Up/Down Commands). If P3.39 = 0.000, the Frequency Up/Down Commands follow the Accel/Decel Time (P1.01 & P1.02). Any setting higher than 0.000 would be the constant speed rate value in P3.39.

Before using this function, set 1st or 2nd Source of Frequency Command equal to External Up/Down Terminal (P4.00 or P4.01 = 3).

- *When P3.39 is set to 0.00, activate the external terminal Up/Down input to increase/decrease the frequency command according to the system ramps (P1.01 & P1.02).*
- *When P3.39 is set >0, activate the external terminal Up/Down input to increase/decrease the frequency command (F) in a linear rate according to the value in P3.39.*



NOTE: If P3.39>0 and if the UP/DOWN acc/dec P3.39 is faster than the actual drive acc/dec (P1.01 and P1.02), the command frequency will reach desired speed well before the drive output reaches setpoint.

		Type	Hex Addr	Dec Addr
P3.40	**DI6 Counter Debounce Filter**	♦R/W	0328	40809
Range/Units (Format: 16-bit unsigned)		Default		
00.00~30.00 sec		00.02		

When Digital Input 6 (DI6) is configured for Incremental Counter (P3.08 setting 23), mechanical debounce can be adjusted using P3.40.

- *If the counter is a mechanical switch with a lot of jitter during transitions, the debounce time should be increased.*
- *Debounce time will be applied to both rising and falling edges of the trigger.*

		Type	Hex Addr	Dec Addr
P3.41	**Digital Input Response Time**	♦R/W	0329	40810
Range/Units		Default		
0~30.000 sec		0.005		

This parameter sets the response time of the digital input terminals FWD, REV, and DI1~DI8.
NOTE: *The response time of DI6 will not be affected by P3.41 when DI6=23. Use P3.40 for response time when DI6=23.*

This setting is for digital input terminal signal delay and confirmation. The delay time is confirmation time to prevent some uncertain interference that would cause error in the input of the digital terminals. Under this condition, increasing P3.41 would decrease the likelihood of false triggers. Adjusting this response time effectively acts as a debounced input for some applications.

Use caution when adjusting this Response Time > default. If using Terminals for RUN/STOP or for INC/DEC speed commands, the inputs will respond with the delay set in P3.41 (delay in responding to an input coming ON and going OFF). For most applications, keep this response time as low as possible to reduce unintended consequences.

		Type	Hex Addr	Dec Addr
P3.42	**Multi-Function Input Contact Selection (0=N.O. / 1=N.C.)**	R/W	032A	40811
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

The setting of this parameter is in hexadecimal (0 to FFFFh).

The parameter value entered selects the normally open or normally closed state for each of the drive's digital inputs. The value entered here has no affect on SINK/SOURCE configuration, nor will a change in SINK/SOURCE affect the normally-open/normally-closed settings selected here.

This parameter value can be changed from the keypad or through communications with the GS4 drive.

Changes to the NO/NC state of a given digital input, whether from the keypad or from a communications link, will *not* result in a change of that input's logical True/False state.

Example: You cannot select a multi-speed setpoint merely by changing the state of a digital input configured for that purpose.

Bit#	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input	DI15	DI14	DI13	DI12	DI11	DI10	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1	REV	FWD

NOTE: **Bit #0 = FWD and Bit #1 = REV, normally open contact selection CANNOT be changed!**

		Type	Hex Addr	Dec Addr
P3.43	**Multi-Function Output Contact Selection (0=N.O. / 1=N.C.)**	♦R/W	032B	40812
Range/Units		Default		
0~65535		0		

The setting of this parameter is in hexadecimal (0 to FFFFh).

This parameter sets the normally open or normally closed default state for individual digital outputs. If a bit is 1, the corresponding output acts in the opposite way.

Example: If bit0 =1 and P3.17=1, relay output 1 (normally-open contact) is open when the drive is running and is closed when the drive is stopped.

Bit#	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output*	DO20	DO19	DO18	DO17	DO16	DO15	DO14	DO13	DO12	DO11	DO10	DO2	DO1	reserved	R2*	R1*

**NOTE: Outputs R1 and R2 are SPDT relays with both a normally open and a normally closed output. Be aware of which contact you are wired to in order to correctly anticipate the output state.*

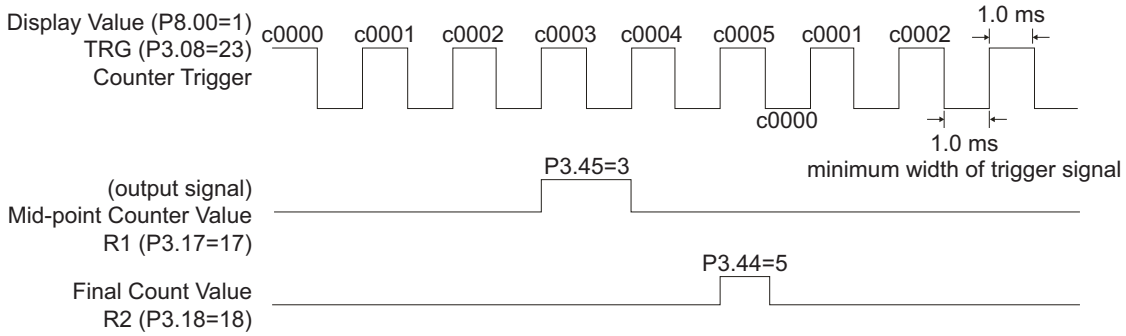
NOTE: This parameter can be used to set digital outputs ON/OFF with remote communications.

		Type	Hex Addr	Dec Addr
P3.44	**Final Counter Value**	♦R/W	032C	40813
Range/Units		Default		
0~65500		0		

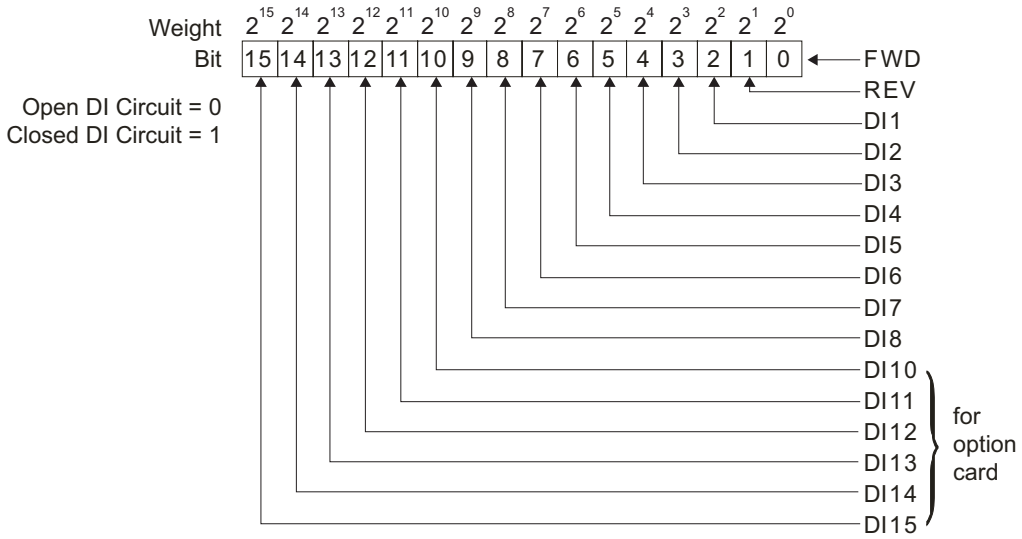
The counter trigger can be incremented by the Multi-Function Input Terminal DI6 (set P3.08 to 23). Once the counter has reached the value in P3.44, the specified output terminal will be activated (any Multi-Function Output = 18). When the final count trigger is deactivated the count automatically returns to 0.

		Type	Hex Addr	Dec Addr
P3.45	**Mid-point Counter Value**	♦R/W	032D	40814
Range/Units (Format: 16-bit unsigned)		Default		
0~65500		0		

When the counter value reaches the value set in this parameter, the corresponding Multi-Function Output Terminal (set to 17) will be activated only for that count. Once DI6 is triggered again to the next count, the associated output terminal will be deactivated, as shown below.

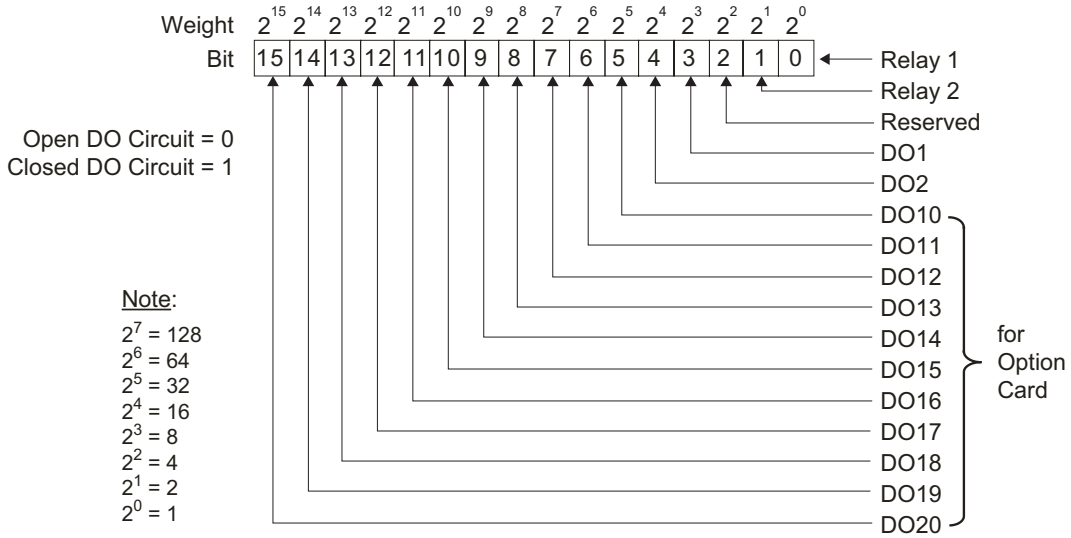


P3.46	Digital Input Active Status	Type	Hex Addr	Dec Addr
		Read	032E	40815
Range/Units		Default		
0~65535		0		



Example: If P3.46 displays 0034h (Hex), 110100 (binary), it means that DI1, DI3, and DI4 are active if these inputs are in an NO configured state according to P3.42.

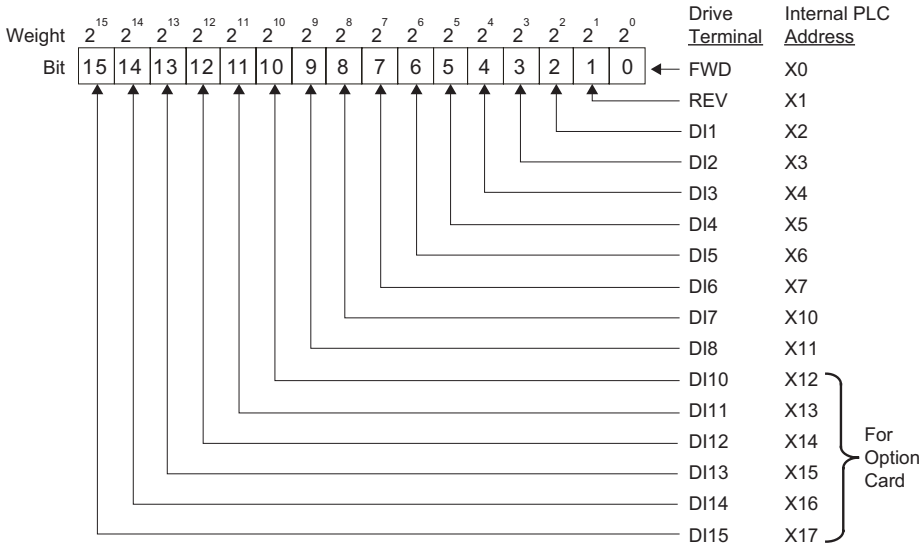
P3.47	Digital Output Active Status	Type	Hex Addr	Dec Addr
		Read	032F	40816
Range/Units (Format: 16-bit binary)		Default		
0~65535		0		



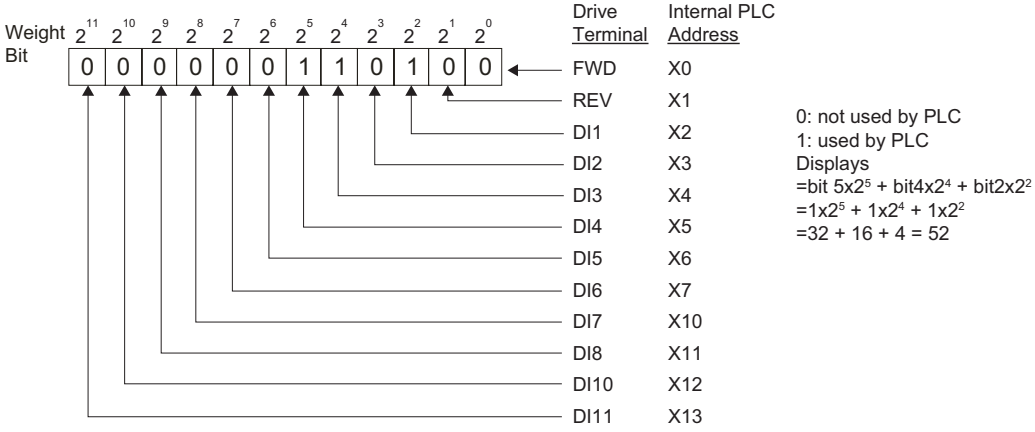
Example: If P3.47 displays 00013h (Hex), 10011 (binary), it means R1, R2, and DO2 are active (or conducting) if these outputs are in an NO configured state according to P3.43.

		Type	Hex Addr	Dec Addr
P3.48	***PLC – Digital Input Mask***	Read	0330	40817
Range/Units (Format: 16-bit binary)		*Default*		
0~65535		0		

P3.48 shows the external Multi-Function Input terminals that are controlled by the PLC.

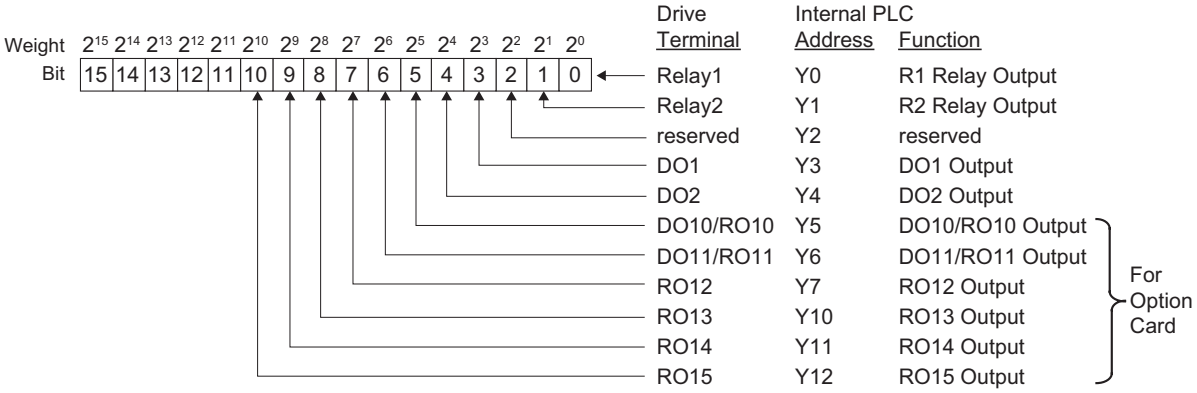


Example: If P3.48 displays 0034h(hex), 110100 (binary), it means DI1, DI3, and DI4 are used by PLC.

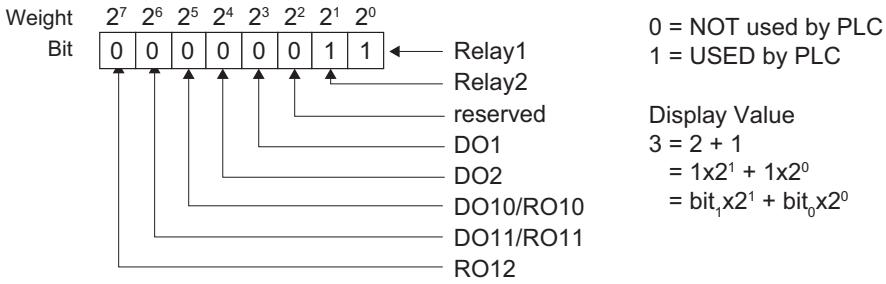


		Type	Hex Addr	Dec Addr
P3.49	**PLC – Digital Output Mask**	Read	0331	40818
Range/Units (Format: 16-bit binary)		Default		
0~65535		0		

P3.49 shows the external Multi-Function Output terminals that are controlled by the PLC.



Example: If the value of P3.49 displays 0003h (Hex), it means R1and R2 are used by PLC.



		Type	Hex Addr	Dec Addr
P3.50	**Increase/Decrease Speed Command Record**	Read	0332	40819
Range/Units (Format: 16-bit unsigned)		Default		
0~599.00		60.00		

When the source of frequency command comes from the external terminal and a fault occurs at this time, the frequency command of the external terminal will be saved in this parameter. (Not the actual current frequency of the drive at time of fault, just the last *commanded* frequency.)

		Type	Hex Addr	Dec Addr
P3.51	**Brake Delay Time**	R/W	0333	40820
Range/Units (Format: 16-bit unsigned)		Default		
0.000~65.000 sec		0		

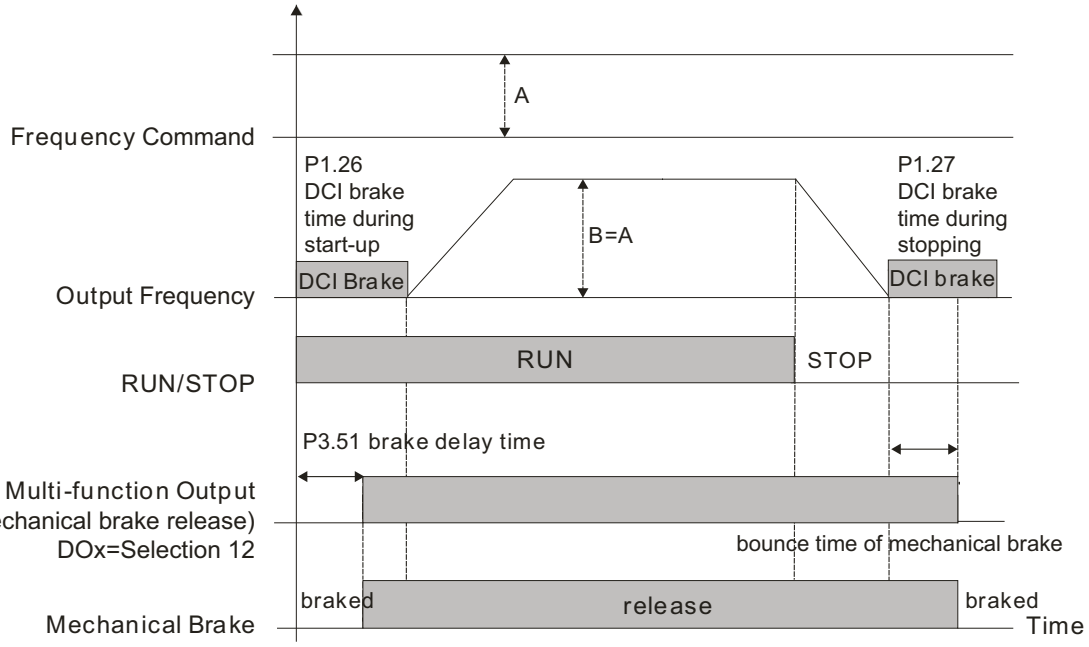
When P3.51 is used with MFO selection #42, see the MFO definition #42 (P3.17) for more details.

When P3.51 is used with MFO selection #12 AND the GS4 drive runs after P3.51 delay time, the corresponding Multi-Function Output terminal (12: brake release function) will be ON when used with DC Injection Braking (P1.25, P1.26, P1.27).

Timing chart for parameter P3.51 used with DC Injection (DCI) braking:

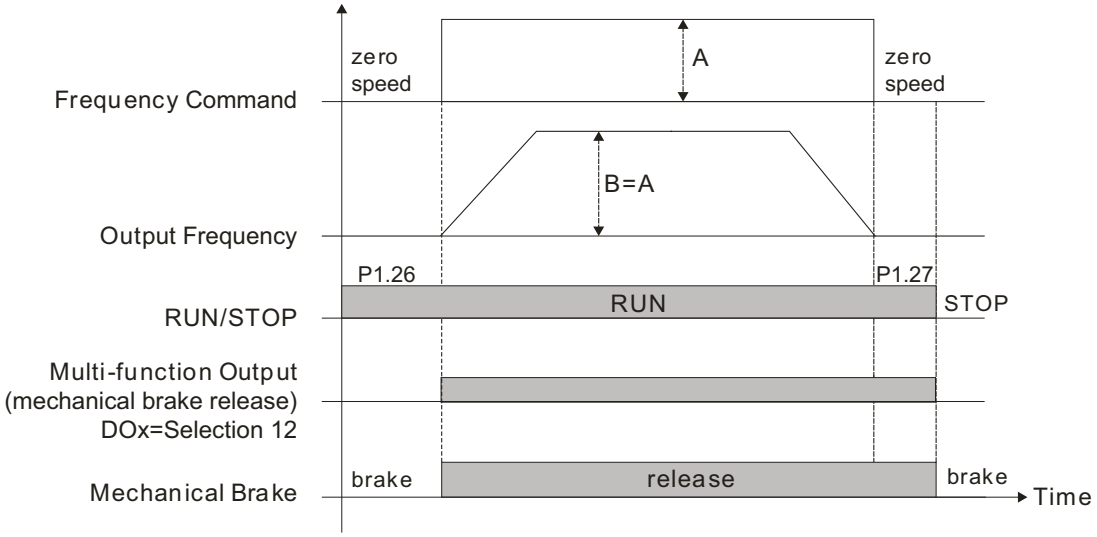
If Brake Delay Time is longer than DCI Start Time, the Brake output will energize at the Start of the Accel ramp (total delay time is never more than DCI Start Time).

If Brake Delay Time is longer than DCI Stop Time, the brake output will energize at the end of DCI Stop Time (the total delay time is never more than DCI Stop Time).



Timing chart for parameter P3.51 used without DC Injection (DCI) braking (P1.25 > 0):

(P3.51 is not used if DC Injection braking is turned off.)



Related parameters: P3.52, P3.53. (Parameters related to P3.51)

		Type	Hex Addr	Dec Addr
P3.52	**Desired Current**	♦R/W	0334	40821
Range/Units		Default		
0~150% of GS4 VT current rating		0		

Output Current Level Setting for Multi-Function Output Terminals.

When output current to the motor is greater than or equal to P3.52, it will activate the Multi-Function Output terminal that is set to 27 (Above Current Output).

When output current to the motor is less than P3.52, it will activate Multi-Function Output terminal that is set to 28 (Below Current Output).

NOTE: *The % of Desired Current P3.52 is based on the Drive's VT Current Rating (not motor current rating).*

Related parameters: P3.51, P3.53 (refer to P3.51, page 4–85).

		Type	Hex Addr	Dec Addr
P3.53	**Output Frequency Limit for Multi-Function Output Terminals**	♦R/W	0335	40822
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0		

When a Multi-Function Output setting = #42 (Brake Released at Stop), the output will activate when the drive is stopped and decels past P3.53. In this mode, the output will only stay on for the time in P3.51 (Brake Delay Time). With a long decel ramp and a short brake time, the output could energize (for P3.51 seconds) and then de-energize before the deceleration ramp is complete.

- *When a Multi-Function Output setting = #58 (Frequency Output Above P3.53), the output will activate when the drive's output frequency is ≥ P3.53.*
- *When a Multi-Function Output setting = #59 (Frequency Output Below P3.53), the output will activate when the drive's output frequency is < P3.53.*

Related parameters: P3.51, P3.52 (refer to P3.51, page 4–85).

		Type	Hex Addr	Dec Addr
P3.54	**reserved**	n/a	0336	40823
Range/Units		Default		
n/a		n/a		

		Type	Hex Addr	Dec Addr
P3.55	**reserved**	n/a	0337	40824
Range/Units		Default		
n/a		n/a		

		Type	Hex Addr	Dec Addr
P3.56	**Emergency Stop (EF) & Force Stop Selection**	R/W	0338	40825
Range/Units (Format: 16-bit binary)				*Default*
0: Coast Stop				0
1: Stop by 1st Deceleration Time (P1.02)				
2: Stop by 2nd Deceleration Time (P1.04)				
3: Stop by 3rd Deceleration Time (P1.06)				
4: Stop by 4th Deceleration Time (P1.08)				
5: System Deceleration (The drive will ramp down according to the current deceleration time selected. This could be 1st~4th decel time.)				
6: Automatic Deceleration (The drive will try to ramp down to a stop within 1 second.)				

P3.56 determines GS4 drive stop method. When the multi-function input terminal is set to 10 or 18 and is activated, the drive will stop according to the setting in P3.56.

		Type	Hex Addr	Dec Addr
P3.57	**AUTO to HAND Switching Behavior**	♦R/W	0339	40826
Range/Units (Format: 16-bit binary)				*Default*
0~Fh				0
bit 0: Sleep function control bit				
0: Cancel sleep function				
1: Sleep function follows setting of Auto mode (P7.27~P7.32)				
bit 1: Parameter (units) displayed on keypad				
0: Change the unit to be Hz in Hand mode and display units in P8.02 in Auto mode.				
1: Change the unit to display units in P8.02 in Auto and Hand modes.				
bit 2: PID control bit				
0: Cancel PID control				
1: PID control follows the setting of Auto mode (P8.02)				
bit 3: Source of frequency control bit				
0: The source of frequency is set by parameters. If the multi-step speed setting is activated then multi-step speed has the priority.				
1: In Auto mode the source of frequency is set by P4.01, no matter whether or not the multi-step speed setting is activated.				

P3.58 does not need to be set to 0 for P3.57 to be valid.

		Type	Hex Addr	Dec Addr
P3.58	**Local/Remote Switch Mode**	R/W	033A	40827

Range/Units (Format: 16-bit binary) — *Default*: 4

0: Used for HAND/OFF/AUTO control from external terminals if MFI settings 31 and 32 are configured. If no multi-function inputs are configured for 31 or 32, then only HAND/AUTO control will be available by using the keypad LOCAL (HAND) and REMOTE (AUTO). The OFF feature of HOA will not be available. MFI setting 33 will not be valid when P3.58= 0.

1: Always Stop When Switching: If the drive is running when switching from Local to Remote or Remote to Local, the drive will stop when switched unless there is an active RUN command applied to the switched-to mode. If the drive is already stopped, it still remains stopped.

2: Follow Remote Mode: The drive still follows the setting at Remote while switching to Local. For example, if the setting at Remote is "running," the drive keeps on "running" even after the drive is switched from Remote to Local. Unless a "stop" command is given, then the drive will be stopped under Local mode.

3: Follow Local Mode: The drive still follows the setting at Local while switching to Remote. For example, if the setting at Local is "stop," the drive keeps "stopping" even after the drive is switched to Remote mode. Unless a "running" command is present or given in Remote mode, then the drive will start to run under Remote mode.

4: Follow Local and Remote Mode: The drive follows the settings of both Local and Remote. When switching from one mode to another, the drive follows the command of the previous mode unless a new command is given on the switched-to mode.

Source of operation must be defined in P3.00, P3.01, P4.00, and P4.01.

Settings 0~4:

When set to 0, upper right corner of screen will display "HAND" or "AUTO". When set to 1, 2, 3, or 4, the upper right corner of the screen will display "LOC" or "REM."

If P3.58 ≠ 0 and a multi-function input is set to 31 or 32, then HOA control has priority and the upper right corner of the screen will display "HAND" or "AUTO."

GROUP P4.XX DETAILS – ANALOG PARAMETERS

		Type	Hex Addr	Dec Addr
P4.00	**1st Source of Frequency Command [Remote]**	♦R/W	0400	41025
P4.01	**2nd Source of Frequency Command [Local]**	♦R/W	0401	41026

Range/Units (Format: 16-bit binary)	Default
0: Digital Keypad [see Note below]*	P4.00: 0
1: RS485 Communication (Modbus/BACnet) [see Warning below]**	P4.01: 0
2: Analog Input [must also configure P4.02, P4.03, or P4.04]	
3: External UP/DOWN Terminal	
4: Comm Card [see Warning below]**	

These parameters, P4.00 & P4.01, set the source of the master Frequency.

- *Parameter P4.00 selects the source of the Frequency Command in REMOTE mode.*
- *Parameter P4.01 selects the source of the Frequency Command in LOCAL mode.*

"Local/Remote Selection." Reference parameter P3.03, setting #33.

The factory setting of Frequency and Operation source is for REMOTE mode. The drive will always power-up in REMOTE mode unless a Multi-Function Input terminal is used to switch LOCAL/REMOTE mode. The highest priority is the Multi-Function Input terminal.

Related parameters: P3.00 & P3.01 set the source of the Operation Command.

- *Parameter P3.00 selects the source of the Operation Command in REMOTE mode.*
- *Parameter P3.01 selects the source of the Operation Command in LOCAL mode.*

Related parameter: P3.58 Local/Remote Switch Mode

- *Parameter P3.58 determines the drive behavior while switching from one mode to another.*

Related parameter: P4.09 sets the Analog Frequency Command for Reverse Run.

- *If P4.09 is set to 0, the command signal will be treated as an absolute value (always positive), and the motor will always turn in the direction commanded by the digital inputs (or FWD/REV buttons).*
- *Set P4.09=1 if you want the analog signal to change the motor's direction. Use this setting with AI3 (which can be +/-10V) to achieve positive and negative frequency commands.*
  Non-bipolar analog signals (0~10V, 4~20ma, etc.) can achieve positive and negative frequency command by applying a -50% bias.
  Example: if a 0~10V signal is used on AI1, entering a bias of -50% in P4.10 (AI1 Input Bias) will allow positive and negative direction command. [0~5V will cause reverse rotation, and 5~10V will cause forward rotation. 5V will be the new zero speed.]

Related Parameters: PID parameters P7.00.

- *When PID is enabled (P7.00>0), data will map from P4.00 or P4.01 to P7.02, depending upon whether in Remote or Local. The Source of Frequency Command selected in P4.00 or P4.01 will be the PID Setpoint.*

NOTE: GS4's output frequency can be affected by the Trim Function. If P4.08 Trim Function is set to a non-zero value, the drive's actual output frequency may not match the Local or Remote Command Frequency. See P4.08 for ways to add or subtract to the command frequency.

**NOTE: there is only one Keypad frequency. If both P4.00 and P4.01 are set for 0: Digital Keypad, the Frequency Command will be the same in both Local and Remote modes.*

WARNING! IF THE GS4 DRIVE 1ST OR 2ND "SOURCE OF FREQUENCY COMMAND" IS "RS-485 COMMUNICATION" OR "COMM CARD" (P4.00 OR P4.01 = 1 OR 4), AND THE FREQUENCY COMMAND IS GREATER THAN THE "DRIVE MAXIMUM OUTPUT FREQUENCY (P0.04), THE GS4 DRIVE WILL ACCELERATE TO THE "DRIVE MAXIMUM OUTPUT FREQUENCY AS DEFINED IN (P0.04).

		Type	Hex Addr	Dec Addr
P4.02	**Analog Input 1 (AI1) Function**	♦R/W	0402	41027
P4.03	**Analog Input 2 (AI2) Function**	♦R/W	0403	41028
P4.04	**Analog Input 3 (AI3) Function**	♦R/W	0404	41029

Range/Units (Format: 16-bit binary)	Default
0: no Function	P4.02: 1
1: Frequency Command/PID Setpoint REMOTE*	P4.03: 0
2: Frequency Command/PID Setpoint LOCAL*	P4.04: 0
3: Frequency Command/PID Setpoint REMOTE & LOCAL*	
4: reserved	
5: PID Feedback Signal*	
6: PTC Thermistor Input Value*	
7: PID Setpoint Offset*	
8~10: reserved	
11: PT100 RTD Input Value*	

*(*1,2,3,5,7) PID functions 1, 2, 3, 5 & 7: Refer to Parameter Group 7 to define the analog inputs for PID Setpoint, Feedback, and PID Setpoint Offset use.*

*(*6) PTC Thermistor Input Value: Refer to P6.39~P6.40. When the input goes above the value set in P6.40, the action in P6.39 will occur. The PTC Warning and/or Fault will be oH3: Motor Over Heat. (For Option 6 to work, P6.43 PT Drop Freq must be > 0.)*

*(*11) RTD (PT100) Thermistor Input Value: Refer to P6.41~P6.44. The PT100 Warning and/or Fault will also be oH3: Motor Over Heat. (For Option 11 to work, P6.43 PT100 Drop Frequency must be > 0.)*

These three parameters, P4.02~P4.04, assign functions for the three analog inputs, AI1~AI3.

Please note that parameter settings 1, 2, and 3 can assign any of the analog inputs to be Frequency Command/PID Setpoint for REMOTE mode only (#1), for LOCAL mode only (#2), or for both REMOTE and LOCAL modes (#3).

Example: An application requires analog input control from a PLC while the process is running, but speed control from a local potentiometer is needed for setup/jogging.

- *Set both P4.00 (REMOTE) AND P4.01 (LOCAL) = 2 (Analog Input).*
- *Wire the PLC signal to AI1, and set P4.02 = 1 (AI1 = Freq Command in REMOTE).*
- *Wire the potentiometer to AI2, and set P4.03 = 2 (AI2 = Freq Command in LOCAL).*

With these settings and control wiring, the system will respond to the PLC signal when the REMOTE button is pressed, and will follow the potentiometer when the LOCAL button is pressed.

Note: If multiple registers are selected for the same function, the priority (which one wins) is AI1>AI2>AI3.
Example: If a "1" is entered into all 3 of these parameters, AI1 will be the active "Frequency Command/PID Setpoint REMOTE".

Note: AI3 is always ±10V.

Related parameters: P0.04 (Drive Max Output Frequency), P4.00~P4.01 (Remote/Local Source of Freq Command), P6.39~P6.44 (for details on setting up RTD or PTC), P7.xx (PID)

		Type	Hex Addr	Dec Addr
P4.05	**AI1 – I/V Selection**	♦R/W	0405	41030
P4.06	**AI2 – I/V Selection**	♦R/W	0406	41031

Range/Units (Format: 16-bit binary)	Default
0: AI1v Selection (0~10V)	P4.05: 0
1: AI1i Selection (4~20mA)	P4.06: 1
2: AI1i Selection (0~20mA)	

P4.05 configures Analog Input 1 (AI1) for either voltage or current input.
(P4.63 determines the drive behavior if the AI1 4~20mA signal is lost.)

P4.06 configures Analog Input 2 for either voltage or current input.
(P4.64 determines the drive behavior if the AI2 4~20mA signal is lost.)

This setting must match the DIP switch setting of switch SW3 (for P4.05) or SW4 (for P4.06). (Switches are located just above the control wiring terminal strip)
If ±10V is needed, use AI3.
See P6.39~P6.44 for RTD/PTC setup.

		Type	Hex Addr	Dec Addr
P4.07	**Trim Reference Frequency**	R/W	0407	41032

Range/Units (Format: 16-bit unsigned)	Default
0.00~599.00 Hz	0.0

The Trim Reference Frequency is used with P4.08 to add or subtract to the drive command frequency. This parameter can also be used as an offset or bias to the command signal. Commonly used with communication control.

		Type	Hex Addr	Dec Addr
P4.08	**Trim Selection**	R/W	0408	41033
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable Trim Function		0		
1: 1st Source Freq + 2nd Source Freq				
2: 1st Source Freq - 2nd Source Freq				
3: Speed Source + Trim Ref Freq				
4: Speed Source - Trim Ref Freq				

Trim Selection is used to combine multiple signals into one speed reference. For Options 1 and 2, P4.07 Trim Reference Frequency does not change the output frequency. For options 3 and 4, the currently selected source of frequency is combined with the Trim Frequency (P4.07).

NOTE: P4.09 determines if the frequency command signal can change motor direction. If P4.09=1, and the frequency command goes negative, the motor will spin in the opposite direction. If P4.09=0, the drive will always treat the frequency command as a positive number (direction will not change). The result of this (P4.09=0)calculation is an Absolute Value (no negatives).

NOTE: The Trim function works as expected with all analog signals and setting speed via communication (RS-485 or Ethernet). Care must be used if the Trim function is used while one of the Sources of Operation = Keypad (P3.00 or P3.01=0). The operation is repeatable, but must be understood: When the frequency command is changed via the keypad, the drive interprets that value as the new command value from the keypad (as expected). However, if the Trim function is active, once that frequency command is entered via the keypad, the Trim function will then act upon that new value according to P4.08 (and may not result in expected behavior, until you understand the process).

Example:

- *P4.08 = 1 (output freq = Source 1 + Source 2)*
- *P4.00 = 2 (1st Source of Freq [Remote] = Analog Input 3).*
  [The incoming analog signal = 1V = 6Hz command.]
- *P4.04 = 1 (AI3 = Frequency Command when in Remote mode)*
- *P4.01 = 0 (2nd Source of Freq [Local] = Keypad)*

If you press “LOCAL”, the source of frequency command will be from the keypad. If you enter 0Hz into the frequency command via the keypad, as soon as you press ESC (to get out of the “value entry” mode), the drive will add the entered value to the 6Hz command coming from AI3 (because you selected P4.08 Trim = 1 to add the two sources). The new frequency command will be 6Hz. Now, press “ENTER” to adjust the frequency command again. Don’t change any value (leave the setting at 6Hz). As soon as you press ESC (to get out of the “value entry” mode), the drive will add the 6Hz you just entered to the AI3 value of 6Hz. The new command frequency will be 12Hz. This is the programmed behavior when using the Trim function and Keypad frequency control.

		Type	Hex Addr	Dec Addr
P4.09	**Analog Frequency Command for Reverse Run**	♦R/W	0409	41034
Range/Units (Format: 16-bit binary)				*Default*
0: Negative Frequency Input is Disabled. Forward and reverse directions are controlled by digital keypad or by external terminal. 1: Negative Frequency Input is Enabled. Forward direction when positive frequency; reverse direction when negative frequency. Forward and reverse directions are NOT controlled by digital keypad or by external terminal. Use this setting with AI3 (which can be up to ±10V), or with bias settings to achieve positive and negative frequency commands. Negative analog signals can be generated by AI3 (which has ability for ±10V signal), or by any of the analog inputs used with bias. (A bias of -50% used with a 0~10V signal will result in 0~5V = reverse rotation, and 5~10V = forward rotation)				0

NOTE: Fwd/Rev Direction Inhibit P6.09 can also eliminate reverse (or forward) motor direction.

NOTE: Refer to the detailed Analog Input Example #4 (page 4–112) at the end of these "Group P4.xx Details – Analog Parameters" listings for more information.

		Type	Hex Addr	Dec Addr
P4.10	**AI1 Input Bias (Offset)**	♦R/W	040A	41035
Range/Units (Format: 16-bit signed)		Default		
–100.0% to +100.0%		0		

		Type	Hex Addr	Dec Addr
P4.11	**AI1 Input Bias (Offset) Polarity**	♦R/W	040B	41036
Range/Units (Format: 16-bit binary)		Default		
0: NO Offset 1: Positive Offset 2: Negative Offset		0		

		Type	Hex Addr	Dec Addr
P4.12	**AI1 Input Gain**	♦R/W	040C	41037
Range/Units (Format: 16-bit signed)		Default		
–500.0% to +500.0%		100.0		

Parameters P4.10 to P4.13 are used when the source of the Frequency Command is an analog voltage signal connected to AI1. The relationship between the external input voltage (current) and setting frequency: 0~10V (4~20mA) corresponds to 0~60Hz.

- *P4.10 adjusts the bias (offset) for Analog Input #1.*
- *P4.11 sets the offset polarity for Analog Input #1.*
  If the application requires a negative offset, but the PLC cannot supply a negative number, choose "Negative Offset" and enter a positive number in P4.10.
- *P4.12 adjusts the gain for Analog Input #1.*
- *P4.13 provides a delay to serve as an electrical noise filter for Analog Input #1.*

	Offset	Polarity	Analog Command Calculation
P4.10 thru P4.12	Positive	P4.11=1	Frequency Output (Hz) = [(Analog In %) x (Gain %) + (Bias %)] x (Max Out Hz)
	Negative	P4.11=2	Frequency Output (Hz) = [(Analog In %) x (Gain %) - (Bias %)] x (Max Out Hz)
	Calculation by Parameter #s		Frequency Output (Hz) = [(AI Volts / 10) x (P4.12) ± (P4.10)] x (P0.04)

NOTE: P4.24 must be set to enable bias and gain calculations for this AI.

NOTE: Refer to the detailed Analog Input Examples (page 4–108) at the end of these "Group P4.xx Details – Analog Parameters" listings for more information.

		Type	Hex Addr	Dec Addr
P4.13	**AI1 Filter**	♦R/W	040D	41038
Range/Units (Format: 16-bit unsigned)		Default		
0.00~20.00 sec		0.01		

This parameter sets a delay for Analog Input #1 to filter a noisy signal.

When the setting of P4.13 is too large, the reading of AI1 will be more stable but the control response will be slower. When the setting of P4.13 is too small, the control response will be faster but the control may be unstable due to a noisy AI1 reading. To find the optimal setting, adjust the setting according to the desired amount of response vs signal accuracy.

		Type	Hex Addr	Dec Addr
P4.14	**reserved**	n/a	040E	41039
Range/Units		Default		
n/a		n/a		

		Type	Hex Addr	Dec Addr
P4.15	**AI2 Input Bias (Offset)**	♦R/W	040F	41040
	Range/Units (Format: 16-bit signed)	Default		
	–100.0% to +100.0%	0		

		Type	Hex Addr	Dec Addr
P4.16	**AI2 Input Bias (Offset) Polarity**	R/W	0410	41041
	Range/Units (Format: 16-bit binary)	Default		
	0: NO Offset 1: Positive Offset 2: Negative Offset	0		

		Type	Hex Addr	Dec Addr
P4.17	**AI2 Input Gain**	♦R/W	0411	41042
	Range/Units (Format: 16-bit signed)	Default		
	–500.0% to +500.0%	100.0		

Parameters P4.15 to P4.18 are used when the source of the Frequency Command is an analog current signal connected to AI2. The relationship between the external input current (voltage) and setting frequency: 4~20mA (0~10V) corresponds to 0~60Hz.

- *P4.15 adjusts the bias (offset) for Analog Input #2.*
- *P4.16 sets the offset polarity for Analog Input #2.*
  If the application requires a negative offset, but the PLC cannot supply a negative number, choose "Negative Offset" and enter a positive number in P4.15.
- *P4.17 adjusts the gain for Analog Input #2.*
- *P4.18 provides a delay to serve as an electrical noise filter for Analog Input #2.*

	Offset	**Polarity**	**Analog Command Calculation**
P4.15 thru P4.17	Positive	P4.16=1	Frequency Output (Hz) = [(Analog In %) x (Gain %) + (Bias %)] x (Max Out Hz)
	Negative	P4.16=2	Frequency Output (Hz) = [(Analog In %) x (Gain %) - (Bias %)] x (Max Out Hz)
	Calculation by Parameter #s		Frequency Output (Hz) = [(AI Volts / 10) x (P4.17) ± (P4.15)] x (P0.04)

NOTE: P4.24 must be set to enable bias and gain calculations for this AI.

NOTE: Refer to the detailed Analog Input Examples (page 4–108) at the end of these "Group P4.xx Details – Analog Parameters" listings for more information.

		Type	Hex Addr	Dec Addr
P4.18	**AI2 Filter**	♦R/W	0412	41043
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~20.00 sec	0.01		

This parameter sets a delay for Analog Input #2 to filter a noisy signal.

When the setting of P4.18 is too large, the reading of AI2 will be more stable but the control response will be slower. When the setting of P4.18 is too small, the control response will be faster but the control may be unstable due to a noisy AI2 reading. To find the optimal setting, adjust the setting according to the desired amount of response vs signal accuracy.

		Type	Hex Addr	Dec Addr
P4.19	**AI3 Input Bias (Offset)**	♦R/W	0413	41044
	Range/Units (Format: 16-bit signed)	Default		
	–100.0% to +100.0%	0		

		Type	Hex Addr	Dec Addr
P4.20	**AI3 Input Bias (Offset) Polarity**	R/W	0414	41045
	Range/Units (Format: 16-bit binary)	Default		
	0: NO Offset 1: Positive Offset 2: Negative Offset	0		

		Type	Hex Addr	Dec Addr
P4.21	**+AI3 Input Gain**	♦R/W	0415	41046
P4.22	**-AI3 Input Gain**	♦R/W	0416	41047
	Range/Units (Format: 16-bit signed)	Default		
	–500.0% to +500.0%	100.0		

Parameters P4.19 to P4.23 are used when the source of the Frequency Command is an analog voltage signal connected to AI3.

- *AI3 is the only input that has ± voltage capability.*
- *Bias is the same regardless of AI3 value, but Gain is different for positive/negative input.*

The relationship between the external input voltage and setting frequency:

- *If P4.09=0: -10V to +10V corresponds to 0~60Hz.*
- *If P4.09=1: 0V to +10V corresponds to 0~60Hz foward direction.*
  0V to -10V corresponds to 0~60Hz reverse direction.
- *P4.19 adjusts the bias (offset) for Analog Input #3.*
- *P4.20 sets the offset polarity for Analog Input #3.*
  If the application requires a negative offset, but the PLC cannot supply a negative number, choose "Negative Offset" and enter a positive number in P4.19.
- *P4.21 adjusts the gain for Analog Input #3 when the input is positive.*
- *P4.22 adjusts the gain for Analog Input #3 when the input is negative.*
- *P4.23 provides a delay to serve as an electrical noise filter for Analog Input #3.*

	Offset	***Polarity***	***Analog Command Calculation***
P4.19 thru P4.22	Positive	P4.20=1	Frequency Output (Hz) = [(Analog In %) x (Gain %) + (Bias %)] x (Max Out Hz)
	Negative	P4.20=2	Frequency Output (Hz) = [(Analog In %) x (Gain %) - (Bias %)] x (Max Out Hz)
	Calculation by Parameter #s		Frequency Output (Hz) = [(AI Volts / 10) x (P4.21 or P4.22) ± (P4.19)] x (P0.04)

NOTE: P4.24 must be set to enable bias and gain calculations for this AI.

NOTE: Gain% is dependent on P4.20 setting. If P4.20=1 use P4.21 for Gain% calculation. If P4.20=2 use P4.22 for Gain% calculation.

NOTE: Refer to the detailed Analog Input Examples (page 4–108) at the end of these "Group P4.xx Details – Analog Parameters" listings for more information.

		Type	Hex Addr	Dec Addr
P4.23	**AI3 Filter**	♦R/W	0417	41048
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~20.00 sec	0.01		

This parameter sets a delay for Analog Input #3 to filter a noisy signal.

When the setting of P4.23 is too large, the reading of AI3 will be more stable but the control response will be slower. When the setting of P4.23 is too small, the control response will be faster but the control may be unstable due to a noisy AI3 reading. To find the optimal setting, adjust the setting according to the desired amount of response vs signal accuracy.

		Type	Hex Addr	Dec Addr
P4.24	**AI V/Hz Calculated Selection**	R/W	0418	41049
Range/Units (Format: 16-bit binary)		*Default*		
0: All Inputs Use Bias and Gain	4: AI3 Custom V/Hz	0		
1: AI1 Custom V/Hz	5: AI1 & AI3 Custom V/Hz			
2: AI2 Custom V/Hz	6: AI2 & AI3 Custom V/Hz			
3: AI1 & AI2 Custom V/Hz	7: All Custom V/Hz			

This parameter selects the type of V/Hz calculation to be used by each Analog Input.

Detailed Descriptions of P4.24 AI V/Hz Calculated Selection Settings	
Setting: Function	***Function Description***
0: All Inputs Use Bias and Gain	All analog input signals are calculated by using bias and gain (P4.10~P4.23).
1: AI1 Custom V/Hz	AI1 is calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.25~P4.48). Other analog input signals are calculated by using bias and gain.
2: AI2 Custom V/Hz	AI2 is calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.31~P4.36). Other analog input signals are calculated by using bias and gain.
3: AI1 & AI2 Custom V/Hz	AI1 & AI2 are calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.25~P4.36). Other analog input signals are calculated by using bias and gain.
4: AI3 Custom V/Hz	AI3 is calculated by using frequency and voltage in Low/Mid/High-Point format (P4.37~P4.48). Other analog input signals are calculated by using bias and gain.
5: AI1 & AI3 Custom V/Hz	AI1 & AI3 are calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.25~P4.30, P4.37~P4.48). Other analog input signals are calculated by using bias and gain.
6: AI2 & AI3 Custom V/Hz	AI2 & AI3 are calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.31~P4.48). Other analog input signals are calculated by using bias and gain.
7: All Custom V/Hz	All analog input signals are calculated by using frequency and voltage/current in Low/Mid/High-Point format (P4.25~P4.48).

NOTE: Refer to the detailed Analog Input Example #9 (page 4–117) at the end of these "Group P4.xx Details – Analog Parameters" listings for more information.

		Type	Hex Addr	Dec Addr
P4.25	**AI1 Low V/A**	R/W	0419	41050
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA		P4.05=0: 0.00V P4.05=1: 4.00mA P4.05=2: 0.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.26	**AI1 Low Hz Percent**	R/W	041A	41051
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		0		
		Type	*Hex Addr*	*Dec Addr*
P4.27	**AI1 Mid V/A**	R/W	041B	41052
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA		P4.05=0: 5.00V P4.05=1: 12.00mA P4.05=2: 10.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.28	**AI1 Mid Hz Percent**	R/W	041C	41053
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		50.00		
		Type	*Hex Addr*	*Dec Addr*
P4.29	**AI1 High V/A**	R/W	041D	41054
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.05=0: 0.00~10.00V P4.05=1: 4.00~20.00mA P4.05=2: 0.00~20.00mA		P4.05=0: 10.00V P4.05=1: 20.00mA P4.05=2: 20.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.30	**AI1 High Hz Percent**	R/W	041E	41055
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		100.00		

Parameters P4.25 to P4.30 are used to configure custom V/Hz settings when the source of the Frequency Command is a current or voltage analog signal at AI1.

		Type	Hex Addr	Dec Addr
P4.31	**AI2 Low V/A**	R/W	041F	41056
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA		P4.06=0: 0.00V P4.06=1: 4.00mA P4.06=2: 0.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.32	**AI2 Low Hz Percent**	R/W	0420	41057
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		0		
		Type	*Hex Addr*	*Dec Addr*
P4.33	**AI2 Mid V/A**	R/W	0421	41058
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA		P4.06=0: 5.00V P4.06=1: 12.00mA P4.06=2: 10.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.34	**AI2 Mid Hz Percent**	R/W	0422	41059
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		50.00		
		Type	*Hex Addr*	*Dec Addr*
P4.35	**AI2 High V/A**	R/W	0423	41060
Range/Units (Format: 16-bit unsigned)		*Default*		
P4.06=0: 0.00~10.00V P4.06=1: 4.00~20.00mA P4.06=2: 0.00~20.00mA		P4.06=0: 10.00V P4.06=1: 20.00mA P4.06=2: 20.00mA		
		Type	*Hex Addr*	*Dec Addr*
P4.36	**AI2 High Hz Percent**	R/W	0424	41061
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~100.00%		100.00		

Parameters P4.31 to P4.36 are used to configure custom V/Hz settings when the source of the Frequency Command is a current or voltage analog signal at AI2.

		Type	Hex Addr	Dec Addr
P4.37	**AI3 Low Voltage Unipolar**	R/W	0425	41062
Range/Units (Format: 16-bit unsigned)		Default		
0.00~10.00V		0		
		Type	Hex Addr	Dec Addr
P4.38	**AI3 Low Hz Percent Unipolar**	R/W	0426	41063
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00%		0		
		Type	Hex Addr	Dec Addr
P4.39	**AI3 Mid Voltage Unipolar**	R/W	0427	41064
Range/Units (Format: 16-bit unsigned)		Default		
0.00~10.00V		5.00		
		Type	Hex Addr	Dec Addr
P4.40	**AI3 Mid Hz Percent Unipolar**	R/W	0428	41065
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00%		50.00		
		Type	Hex Addr	Dec Addr
P4.41	**AI3 High Voltage Unipolar**	R/W	0429	41066
Range/Units (Format: 16-bit unsigned)		Default		
0.00~10.00V		10.00		
		Type	Hex Addr	Dec Addr
P4.42	**AI3 High Hz Percent Unipolar**	R/W	042A	41067
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00%		100.00		

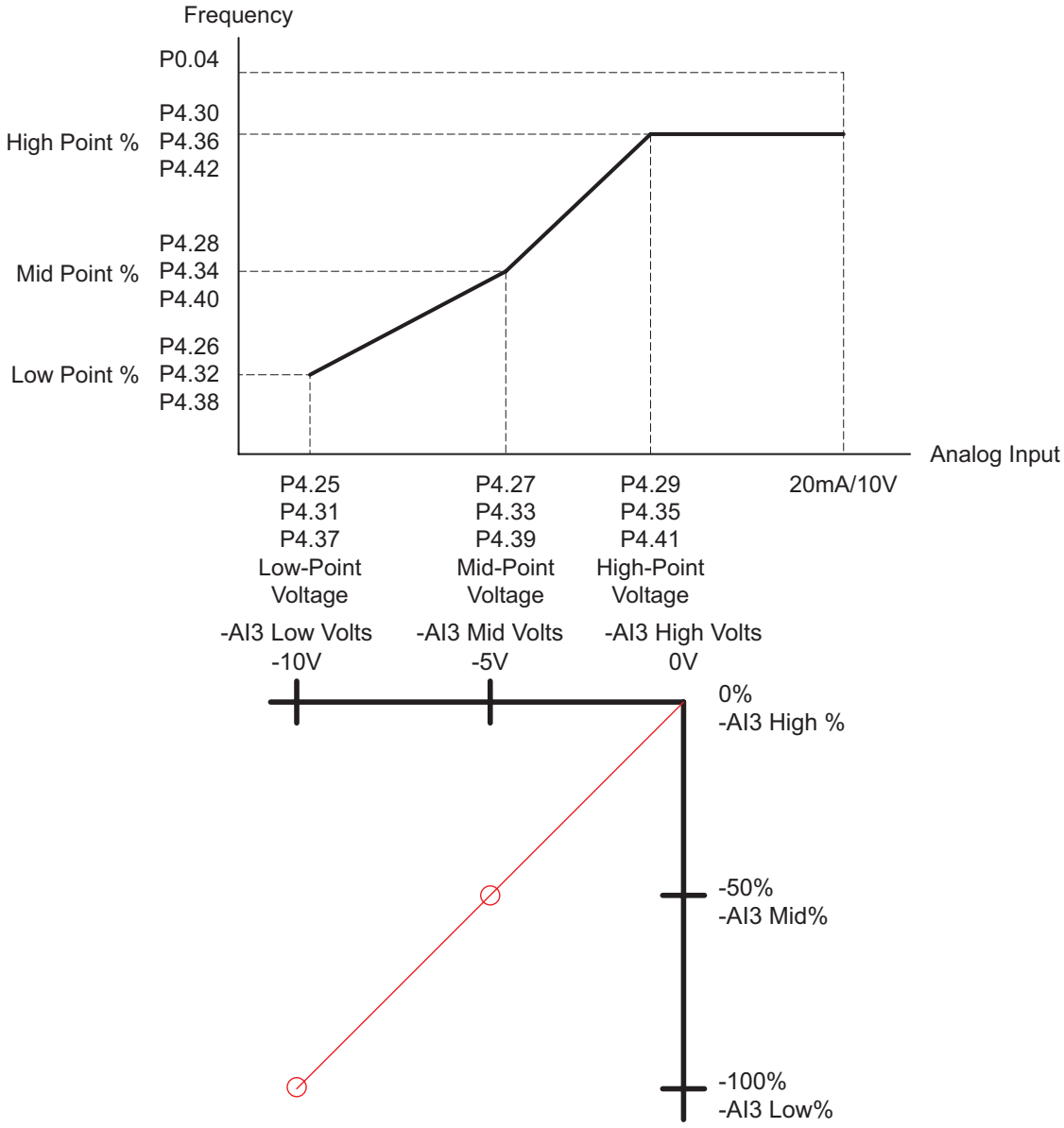
Parameters P4.37 to P4.42 are used to configure custom V/Hz settings when the source of the Frequency Command is a unipolar voltage analog signal at AI3.

		Type	Hex Addr	Dec Addr
P4.43	**-AI3 High Voltage Bipolar**	R/W	042B	41068
Range/Units (Format: 16-bit signed)		Default		
–10.00V to 0.00V		0.00		
		Type	Hex Addr	Dec Addr
P4.44	**-AI3 High Hz Percent Bipolar**	R/W	042C	41069
Range/Units (Format: 16-bit signed)		Default		
–100.00% to +100.00%		0.00		
		Type	Hex Addr	Dec Addr
P4.45	**-AI3 Mid Voltage Bipolar**	R/W	042D	41070
Range/Units (Format: 16-bit signed)		Default		
–10.00V to 0.00V		–5.00		
		Type	Hex Addr	Dec Addr
P4.46	**-AI3 Mid Hz Percent Bipolar**	R/W	042E	41071
Range/Units (Format: 16-bit signed)		Default		
–100.00% to +100.00%		–50.00		
		Type	Hex Addr	Dec Addr
P4.47	**-AI3 Low Voltage Bipolar**	R/W	042F	41072
Range/Units (Format: 16-bit signed)		Default		
–10.00V to 0.00V		–10.00		
		Type	Hex Addr	Dec Addr
P4.48	**-AI3 Low Hz Percent Bipolar**	R/W	0430	41073
Range/Units (Format: 16-bit signed)		Default		
–100.00% to +100.00%		–100.00		

Parameters P4.43 to P4.48 are used to configure custom V/Hz settings when the source of the Frequency Command is a bipolar voltage analog signal at AI3.

P4.24 must be set to use Low/Mid/High Point customization.

The corresponding functions of open-loop control are shown as images below.



		Type	Hex Addr	Dec Addr
P4.49	**reserved**	n/a	0431	41074
	Range/Units			Default
	n/a			n/a

		Type	Hex Addr	Dec Addr
P4.50	**Analog Output 1 (AO1)**	n/a	0432	41075
	Range/Units			Default
	0: Output Frequency (Hz)	7: Power (% rated)		0
	1: Frequency Command (Hz)	8: AI1 (%)		
	2: Motor Speed (Hz)	9: AI2 (%)		
	3: Output Current (A_{rms})	10: AI3 (%)		
	4: Output Voltage (V)	11: RS485 AO		
	5: DC Bus Voltage (V)	12: Comm Card AO		
	6: Power Factor (%)	13: Fixed Voltage		

NOTE: AO1 is a voltage output. To use AO1 as an analog current output, external resistance needs to be supplied. See the detailed information in P4.53.
If only 1 analog current output is needed, consider using AO2. AO2 is capable of supplying a true current output (no external resistors needed between the GS4 analog output and the other device's analog input).

The Parameter memory can only be written to 10^9 (10 to the 9th) times before a memory error will occur. This memory error will not occur if using setting #11 or #12.
• Use setting #11 or #12 if the AO value will be changed frequently.
• Use setting #13 if the value will not be changed frequently.

DIP SW1 (above the terminals) sets AO1 to be either 0~10VDC output or -10 to +10VDC output.

- *For 0~10V switch setting: 0=0V; 5000=5V; 10,000=10V.*
- *For -10 to +10V setting: 0=-10V; 5000=0V; 10,000=10V.*

Setting #11: As 485 AO

- *Write to 26A0 hex (49889 dec) via the RS-485 port to control the output. 0~10,000 ==> 0~100%. The register will not maintain the value, but the analog signal will remain (if you write a value of 5000 to 26A0h, the analog output will produce 5V but the register will read zero). Writing via the Ethernet cards will have no effect.*

Setting #12: As COMM Card AO

- *Write to 26A0 hex (49889 dec) via the Ethernet card to control the output. 0~10,000 ==> 0~100%. The register will not maintain the value, but the analog signal will remain (if you write a value of 5000 to 26A0h, the analog output will produce 5V but the register will read zero). Writing via RS-485 will have no effect.*

Setting #13: Fixed Value

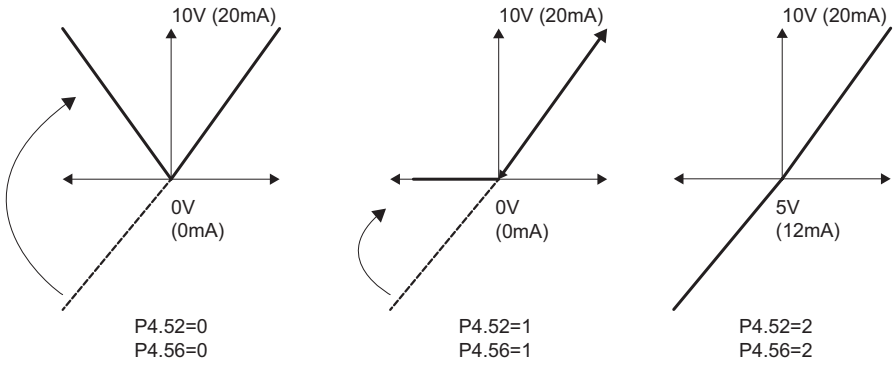
- *Adjust the value of P4.60 via the keypad to increase or decrease the analog output. Writing to P4.60 via RS-485 or Ethernet does change the output value.*

		Type	Hex Addr	Dec Addr
P4.51	**AO1 Gain**	♦R/W	0433	41076
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~500.0%		100.0		

Scaling factor for the analog output AO1. This parameter adjusts the analog voltage level of the output.
NOTE: For 100% of gain via communications, write a value of 1000.

		Type	Hex Addr	Dec Addr
P4.52	**AO1 Negative Value Handle**	♦R/W	0434	41077
Range/Units (Format: 16-bit binary)		*Default*		
0: Absolute Value		0		
1: 0V When Negative				
2: Offset 5V = 0 Value				

This parameter setting can be used for determining AO1 output direction in Forward and Reverse, but the positive and negative output voltages can be used for other types of signals as well.



		Type	Hex Addr	Dec Addr
P4.53	**AO1 0~20mA/4~20mA Selection**	R/W	0435	41078
Range/Units (Format: 16-bit binary)		Default		
0: 0~20mA 1: 4~20mA		0		

This parameter determines the scaling and offset for Analog Output 1 (AO1).

See also DIP switch AO1 located above the control terminal strip.

- *If using AO1 as a 0~20mA output, set P4.53=0.*
- *If using AO1 as a 4~20mA output, set P4.53=1.*
- *If using AO1 as a 0~10V or ±10V output, set P4.53=0.*

Although AO1 is an analog voltage output, it can emulate an analog current output.

If 500Ω* of total resistance is connected across AO1 and ACM, the output will effectively become an analog current output.

Selecting 1: 4~20mA output will adjust the range so that 0~100% will be output as 2~10V (can be used with an external 500Ω resistance to create a 4~20mA output).

This analog output can be set to fixed levels (thru comms, keypad, etc.). P4.50 must be set for 13: Fixed Voltage to use AO1. If writing via comms, the values are 0~10000 for 0~100.00%. (Gains = 100%, 0~20mA selection = 0~20mA, Negative Value Handle (P4.52) ≠2)

P4.60 works with the setting "#13 Fixed Voltage" of P4.50 to set up the constant voltage at AO1.

Example: Set P4.60 to 0~100.00% to correspond to the 0~10V of AO1.

**NOTE: The 500 Ohms across AO1 and ACM must include the other device's analog input circuitry.*

- *Example: GS4's AI2 input circuit resistance is 250Ω. If you want to connect output AO1 to input AI2 (configuring AI2 parameters and DIP switch as a 0~20mA input), you must add a 250Ω resistor between terminals AO1 and AI2 for a total resistance of 500Ω.*

Related parameters: P4.50 (Analog Output 1), P4.60 (AO1 Output Constant Level)

		Type	Hex Addr	Dec Addr
P4.54	**Analog Output 2 (AO2)**	♦R/W	0436	41079
Range/Units (Format: 16-bit binary)		Default		
0: Output Frequency (Hz) 1: Frequency Command (Hz) 2: Motor Speed (Hz) 3: Output Current (A_{rms}) 4: Output Voltage (V) 5: DC Bus Voltage (V) 6: Power Factor (%)	7: Power (% rated) 8: AI1 (%) 9: AI2 (%) 10: AI3 (%) 11: RS485 AO 12: Comm Card AO 13: Fixed Voltage	0		

DIP SW2 (above the terminals) sets AO2 to be either a voltage output (0~10VDC) or a true current output (0~20mA or 4~20mA per P4.57).

The Parameter memory can only be written to 10^9 times before a memory error will occur. This memory error will not occur if using setting #11 or #12.

- *Use setting #11 or #12 if the AO value will be changed frequently.*
- *Use setting #13 if the value will not be changed frequently.*

Setting #11: As 485 AO

- *Write to 26A1 hex (49890dec) via the RS-485 port to control the output. 0~10,000 ==> 0~100%. The register will not maintain the value, but the analog signal will remain (if you write a value of 5000 to 26A0h, the analog output will produce 5V but the register will read zero). Writing via the Ethernet cards will have no effect.*

Setting #12: As COMM Card AO

- *Write to 26A1 hex (49890dec) via the Ethernet card to control the output. 0~10,000 ==> 0~100%. The register will not maintain the value, but the analog signal will remain (if you write a value of 5000 to 26A0h, the analog output will produce 5V but the register will read zero). Writing via RS-485 will have no effect.*

Setting #13: Fixed Value

- *Adjust the value of P4.61 via the keypad to increase or decrease the analog output. Writing to P4.61 via RS-485 or Ethernet does change the output value.*

		Type	Hex Addr	Dec Addr
P4.55	**AO2 Gain**	♦R/W	0437	41080
Range/Units (Format: 16-bit unsigned)		Default		
0.0~500.0%		100.0		

Scaling factor for the analog output AO2. This parameter adjusts the analog voltage level of the output.
NOTE: For 100% of gain via communications, write a value of 1000.

		Type	Hex Addr	Dec Addr
P4.56	**AO2 Negative Value Handle**	♦R/W	0438	41081
Range/Units (Format: 16-bit binary)		Default		
0: Absolute Value		0		
1: 0V When Negative				
2: Offset 5V = 0 Value				

This parameter setting can be used for determining AO2 output direction, the same as described in P4.52 (page 4–102).

		Type	Hex Addr	Dec Addr
P4.57	**AO2 0~20mA/4~20mA Selection**	R/W	0439	41082
Range/Units (Format: 16-bit binary)		Default		
0: 0~20mA		0		
1: 4~20mA				

This parameter determines the scaling and offset for Analog Output 2 (AO2).

See also DIP switch AO2 located above the control terminal strip.

This analog output can be set to fixed levels (thru comms, keypad, etc.). P4.54 must be set for 13: Fixed Voltage to use AO2. If writing via comms, the values are 0~10000 for 0~100.00%. (Gains = 100%, 0~20mA selection = 0~20mA, Negative Value Handle (P4.56) ≠2)

		Type	Hex Addr	Dec Addr
P4.58	**reserved**	♦R/W	043A	41083
Range/Units		Default		

		Type	Hex Addr	Dec Addr
P4.59	**AO2 Offset (Bias)**	♦R/W	043B	41084
Range/Units (Format: 16-bit signed)		*Default*		
–100.00% to +100.00%		0.00		

This parameter is used to add or subtract from the AO2 signal.

Example 1:
If AO2 0~10V is set to Output Frequency (P4.54 = 0: Output Freq), the output equation is:
10V x AO2 Gain x (Output Frequency / Max Output Frequency) + 10V x AO2 Offset (Bias)
10V x P4.55 x (Output Frequency / P0.04) + 10V x P4.59)

Example 2:
If AO2 0~20mA is set to Output Frequency (P4.54 = 0: Output Freq), the output equation is:
20mA x AO2 Gain x (Output Frequency / Max Output Frequency) + 20mA x AO2 Offset (Bias)
20mA x P4.55 x (Output Frequency / P0.04) + 20mA x P4.59)

Example 3:
If AO2 4~20mA is set to Output Frequency (P4.54 = 0: Output Freq), the output equation is:
4mA + (16mA x AO2 Gain) x (Output Frequency / Max Output Frequency) + 16mA x AO2 Offset (Bias)
4mA + (16mA x P4.55) x (Output Frequency / P0.04) + 16mA x P4.59)

		Type	Hex Addr	Dec Addr
P4.60	**AO1 Output Constant Level**	R/W	043C	41085
P4.61	**AO2 Output Constant Level**	R/W	043D	41086
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00%		0.00		

The Parameter memory can only be written to 10^9 times before a memory error will occur. This memory error will not occur if using P4.50/P4.54 setting #11 or #12.

- *Use P4.50/P4.54 setting #11 or #12 if the AO value will be changed frequently.*
- *Use P4.50/P4.54 setting #13 if the value will not be changed frequently.*

The analog outputs can be set to fixed levels through communications, keypad, etc.

- *To use AO1, P4.50 must be set for 13: Fixed Voltage.*
- *To use AO2, P4.54 must be set for 13: Fixed Voltage.*

For P4.50/P4.54 Setting #13: Fixed Value

- *Adjust the value of P4.60 via the keypad to increase or decrease the analog output. Writing to P4.60 via RS-485 or Ethernet does change the output value.*

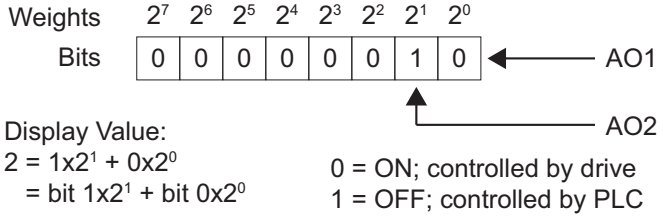
If writing via comms, the values are 0~10000 for 0.00~100.00% gains.

- *P4.51/P4.55 Gain = 100%*
- *P4.52/P4.56 Negative Value Handle ≠ 2*
- *P4.53/P4.57 AOx mA Selection = 0~20mA*

		Type	Hex Addr	Dec Addr
P4.62	**PLC Analog Output Mask**	♦R/W	043E	41087
Range/Units (Format: 16-bit unsigned)		Default		
0 to 65535		0		

P4.62 shows the external Analog Output terminals that are controlled by the PLC.

Example: If the value of P4.62 displays 0002h(Hex), it shows that AO1 is controlled by the drive and AO2 is controlled by the PLC.



		Type	Hex Addr	Dec Addr
P4.63	**Loss of AI1 Signal (4~20mA)**	R/W	043F	41088
P4.64	**Loss of AI2 Signal (4~20mA)**	R/W	0440	41089

Range/Units (Format: 16-bit binary) — *Default*

0: Disable (will decelerate to 0Hz and will not generate an error or fault; will restart when signal returns) — P4.63: 0, P4.64: 0
1: Continue Run at Last Freq and display "AnL" (ANL Warning) (will follow AIx signal if it returns)
2: Decelerate to 0Hz and display "AnL" Warning (will restart if signal returns)
3: Stop immediately and display "ACE" Fault (will not restart)

These parameters determine the behavior of the GS4 drive when AI1 or AI2 signal is lost when set to 4~20mA.

- *P4.63 configuration is valid only if AI1 is set for 4-20mA (per P4.05).*
- *P4.64 configuration is valid only if AI2 is set for 4-20mA (per P4.06).*

If P4.63/P4.64 is set to 1 or 2 and AI1/AI2 signal is lost, warning code "AnL" will blink on the keypad display. The keypad will continue to blink "AnL" until the signal is restored.

If P4.63/P4.64 is set to 3 and AI1/AI2 signal is lost, warning code "ACE" will blink on the keypad display. The keypad will continue to blink until the signal is restored, and a reset command is issued (STOP/RESET key, etc.).

NOTE: Both of these faults/warnings (ACE/AnL) are active only if the drive is currently looking for the analog signal. (Can switch to the alternate Local/Remote Mode to temporarily bypass the fault).

		Type	Hex Addr	Dec Addr
P4.65	**AI1%**	Read	0441	41090

Range/Units (Format: 16-bit signed) — *Default*: -100% to 100% — 0

		Type	Hex Addr	Dec Addr
P4.66	**AI2%**	Read	0442	41091

Range/Units (Format: 16-bit signed) — *Default*: -100% to 100% — 0

		Type	Hex Addr	Dec Addr
P4.67	**AI3%**	Read	0443	41092

Range/Units (Format: 16-bit signed) — *Default*: -100% to 100% — 0

Parameters P4.65 - P4.67 allow the user to monitor the actual input signal to the analog inputs. The configured voltage or current signal will display as -100 to 100%. These registers are read only.

When AI1 Voltage/Current Selection (P4.05) is voltage, the setting range of P4.25, P4.27, and P4.29 have to be 0.00~10.00 or 0.00~20.00.

When AI2 Voltage/Current Selection (P4.06) is voltage, the setting range of P4.31, P4.33, and P4.35 have to be 0.00~10.00 or 0.00~20.00. (Ex: If AI2 is set for 0~10V input, do not use 4~20mA settings to calculate Low/Mid/High Points.)

The analog input values can be set at P4.25~P4.42, and the Maximum Operating Frequency can be set at P0.04.

Analog Input Parameter Examples

Refer to the following equations and examples for changing the ratio of the analog input signal relative to the output frequency of the drive.

Use the equations below when calculating the values for the Drive Maximum Output Frequency, Analog Input Offset, Analog Input Gain, and the Mid-point Frequency.

A) **Drive Maximum Output Frequency** = P0.04 = ((Desired Max RPM)/(Base RPM)) x Base Freq

B) **Analog Offset %** = AIx Input Bias
(Input bias determines the offset)

Analog Input (AIx)	*AI1*	*AI2*	*AI3*
AIx Bias (Offset) Parameter	P4.10	P4.15	P4.19
AIx Bias (Offset) Polarity Parameter	P4.11	P4.16	P4.20

Determine your required settings for these parameters as follows:
Analog Offset (Bias) = (DesiredOffsetFreq / MaxFreqOut) x 100

C) **Analog Gain %** = AIx Input Gain

Analog Input	*AI1*	*AI2*	*AI3*	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

[(Max Freq Reference - Min Freq Reference) / P0.04] x 100

D) **Mid-point Frequency** = [(Max Freq Reference - Min Freq Reference) / 2] + Min Freq Reference

The Mid-point Frequency calculation shows the frequency reference of the drive when the potentiometer or other analog input device is at its mid-point.

Equations

AI1	*Offset*	*Polarity*	*Analog Command Calculation*
P4.10 thru P4.12	Positive	P4.11=1	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) + (Bias%)] x Max_Out (Hz)
	Negative	P4.11=2	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) - (Bias%)] x Max_Out (Hz)
Calculation by Parameter #s			Frequency Output (Hz) = [($AI_{(volts)}$ / 10) x (P4.12) ± (P4.10)] x (P0.04)
AI2	*Offset*	*Polarity*	*Analog Command Calculation*
P4.15 thru P4.17	Positive	P4.16=1	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) + (Bias%)] x Max_Out (Hz)
	Negative	P4.16=2	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) - (Bias%)] x Max_Out (Hz)
Calculation by Parameter #s			Frequency Output (Hz) = [($AI_{(volts)}$ / 10) x (P4.17) ± (P4.15)] x (P0.04)
AI3	*Offset*	*Polarity*	*Analog Command Calculation*
P4.19 thru P4.22	Positive	P4.20=1	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) + (Bias%)] x Max_Out (Hz)
	Negative	P4.20=2	Frequency Output (Hz) = [(Analog_In%*) x (Gain%) - (Bias%)] x Max_Out (Hz)
Calculation by Parameter #s			Frequency Output (Hz) = [($AI_{(volts)}$ / 10) x (P4.21 or P4.22) ± (P4.19)] x (P0.04)

** Analog_In% = $Analog\_Signal_{(volts)}$ / 10 → for 0~10V inputs*
$Analog\_Signal_{(mA)}$ / 20 → for 0~20mA or 4~20mA inputs

*For AI1, AI2, and AI3: **P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

For AI3: Gain% is dependent on P4.20 setting. If P4.20=1 use P4.21 for Gain% calculation. If P4.20=2, use P4.22 for Gain% calculation.

Analog Input Parameter Example 1: Standard Operation

This example illustrates the default operation of the drive. The example is given to further illustrate the use of the analog calculations. The full range of the analog input signal corresponds to the full forward frequency range of the AC drive.

- *Minimum Frequency Reference = 0Hz*
- *Maximum Frequency Reference = 60 Hz*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see *page 4–108* for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = (0Hz / 60Hz) x 100 = 0%

Analog Input (AIx)	***AI1***	***AI2***	***AI3***
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(60Hz - 0Hz) / 60Hz] x 100 = 100% = AIx Input Gain

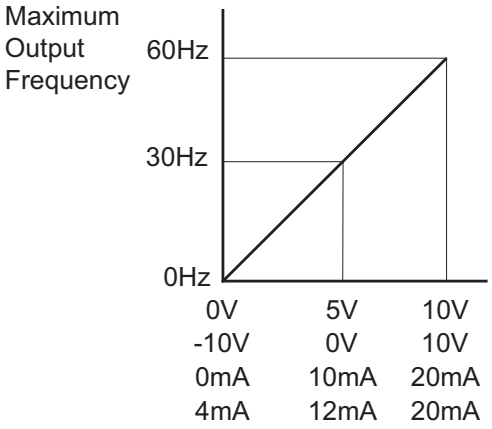
Analog Input	***AI1***	***AI2***	***AI3***	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(60Hz - 0Hz) / 2] + 0Hz = 30Hz

Parameter Settings

Analog Input	***AI1 or***	***AI2 or***	***AI3***		***Parameter Settings***
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		0.0%
AIx Polarity Parameter	P4.11	P4.16	P4.20		0: No Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	100.0%
Reverse Run Parameter	P4.09				0: Digital FWD/REV
Drive Max Output Freq	P0.04				60Hz

Results



Analog Input Parameter Example 2: Standard Operation with Increased Maximum Output Frequency

This example illustrates how to run the motor faster than its base speed. For this purpose, the only required parameter change is P0.04, Drive Maximum Output Frequency. (Motors produce reduced output torque when running above their base speed.)

Warning: The Drive Maximum Output Frequency parameter (P0.04) should never exceed the maximum speed rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

The analog input adjustment parameters can remain defaulted, as determined by the analog input calculations shown below. The increased Drive Maximum Output Frequency can be obtained regardless of whether the Source of Frequency Command (P4.00 of P4.01) is an analog input or one of the other sources, such as the keypad, RS-485 communication interface, jog, or multi-speed settings.

- *Minimum Frequency Reference = 0Hz*
- *Maximum Frequency Reference = 70Hz*
- *Motor Maximum Output Speed = 2042 rpm*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see page 4–108 for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (2042 rpm / 1750 rpm) x 60Hz = 70Hz

B) **Analog Offset %** = [0Hz / (70Hz)] x 100 = 0%

Analog Input (AIx)	*AI1*	*AI2*	*AI3*
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(70Hz – 0Hz) / 70Hz] x 100 = 100% = AIx Input Gain

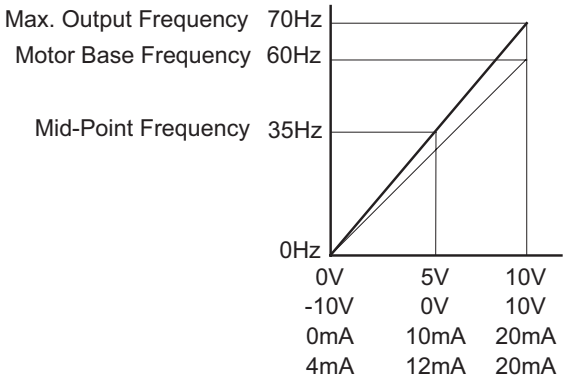
Analog Input	*AI1*	*AI2*	*AI3*	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(70Hz – 0Hz) / 2] + 0Hz = 35Hz

Parameter Settings

Analog Input	*AI1 or*	*AI2 or*	*AI3*		*Parameter Settings*
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		0.0%
AIx Polarity Parameter	P4.11	P4.16	P4.20		0: No Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	100.0%
Reverse Run Parameter	P4.09				0: Digital FWD/REV
Drive Max Output Freq	P0.04				70Hz

Results



Analog Input Parameter Example 3: Positive Offset

In this example, the Analog Input will have a positive offset while still using the full scale of the potentiometer or other analog signal device. When the analog signal is at its lowest value (-10V, 0V, 0mA, or 4mA), the set-point frequency will be at 10Hz. When analog signal is at its maximum value (10V or 20mA), the set-point frequency will be 60Hz.

- *Minimum Frequency Reference = 10Hz*
- *Maximum Frequency Reference = 60Hz*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see *page 4–108* for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = (10Hz / 60Hz) x 100 = 16.7%

Analog Input (AIx)	***AI1***	***AI2***	***AI3***
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(60Hz – 10Hz) / 60Hz] x 100 = 83.3% = AIx Input Gain

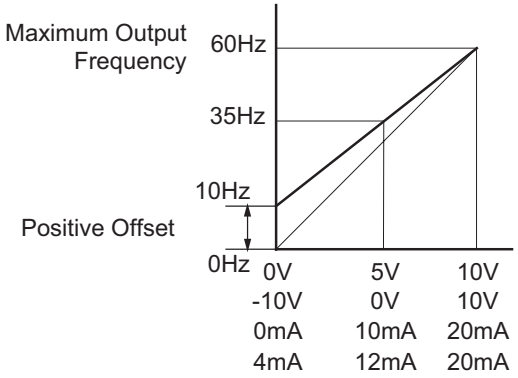
Analog Input	***AI1***	***AI2***	***AI3***	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(60Hz – 10Hz) / 2] + 10Hz = 35Hz

Parameter Settings

Analog Input	***AI1 or***	***AI2 or***	***AI3***		***Parameter Settings***
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		16.7%
AIx Polarity Parameter	P4.11	P4.16	P4.20		1: Positive Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	83.3%
Reverse Run Parameter	P4.09				0: Digital FWD/REV
Drive Max Output Freq	P0.04				60Hz

Results



Examples

- *Output Freq = [(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)*
- *For AI1 set to 0~10V, and an analog input of 1 Volt:*
  Output Freq = [(1/10) x (0.833) + (0.167)] x 60Hz = 15Hz
- *For analog input of 7 Volts:*
  Output Freq = [(7/10) x (0.833) + (0.167)] x 60Hz = 45Hz

Analog Input Parameter Example 4: Forward and Reverse Operation

In this example, the potentiometer (or other analog signal device) is programmed to run a motor full-speed in both forward and reverse directions. The frequency reference will be 0Hz when the potentiometer is positioned at mid-point of its scale. Parameter P4.09 must be set to enable reverse motion.

When calculating the values for the Analog Input using reverse motion, polarity matters in the Bias/Offset Parameter (P4.10, P4.15, or P4.19) AND in the Polarity Parameter (P4.11, P4.16, or P4.20). If both parameters are negative, the resulting offset will be positive (double negatives). If a negative offset is required, either the Bias/Offset value OR the Polarity Parameter needs to be negative (not both). If your PLC does not handle negative values easily, use the Polarity Parameter to create a negative bias/offset.

- *Minimum Frequency Reference = -60Hz (reverse)*
- *Maximum Frequency Reference = 60Hz*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see *page 4–108* for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = [(-60Hz) / (60Hz)] x 100 = -100%

Analog Input (AIx)	***AI1***	***AI2***	***AI3***
AIx Bias Parameter	P4.10	P4.15	P4.19

The negative (-) value for the Analog Offset shows that you can use either a negative value in the Offset/Bias Parameter (P4.10, P4.15, or P4.19) or a negative setting in the Polarity Parameter (P4.12, P4.17, or P4.21). Do not put a negative into both.

C) **Analog Gain %** = [(60Hz – (-60Hz)) / 60Hz] x 100 = 200% = AIx Input Gain

Analog Input	***AI1***	***AI2***	***AI3***	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(60Hz – (-60Hz)) / 2] + (-60Hz) = 0Hz

Parameter Settings

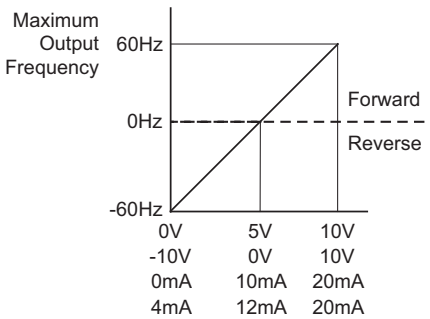
Analog Input	***AI1***	***AI2***	***AI3***		***Parameter Settings***
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		-100.0% *
AIx Polarity Parameter	P4.11	P4.16	P4.20		1: Positive Offset *
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	200.0%
Reverse Run Parameter	P4.09				1: AI Bias FWD/REV
Drive Max Output Freq	P0.04				60Hz

** This example uses Bias = -100% and Positive Bias Polarity.*
The example will work exactly the same with Bias = +100% and a Negative Bias Polarity.

Examples

- *Output Freq = [(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)*
- *For AI1 set to 0~10V, and an analog input of 5 Volts:*
  Output Freq = [(5/10) x (2.00) + (-1.00)] x 60Hz = 0Hz
- *For analog input of 10 Volts:*
  Output Freq = [(10/10) x (2.00) + (-1.00)] x 60Hz = 60Hz

Results



Analog Input Parameter Example 5: Forward Run/Reverse Jog

This example shows an application in which the drive runs full-speed forward and jogs in reverse. The full scale of the potentiometer (or other analog signal device) will be used.

When calculating the values for the Analog Input using reverse motion, the reverse frequency reference should be shown using a negative (-) number. Pay special attention to signs (+/-) for values representing reverse motion.

- *Minimum Frequency Reference = -15Hz (reverse)*
- *Maximum Frequency Reference = 60Hz*

*For AI1, AI2, and AI3: **P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see page 4–108 for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = [(-15Hz) / (60Hz)] x 100 = -25%

Analog Input (AIx)	*AI1*	*AI2*	*AI3*
AIx Bias Parameter	P4.10	P4.15	P4.19

The negative (-) value for the Analog Offset % shows that a negative offset is needed for P4.11, P4.16, or P4.20, or a negative value in P4.10, P4.15, or P4.19. Do not use negatives in both parameters.

C) **Analog Gain %** = [(60Hz – (-15Hz)) / 60Hz] x 100 = 125% = AIx Input Gain

Analog Input	*AI1*	*AI2*	*AI3*	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(60Hz – (-15Hz)) / 2] + (-15Hz) = 22.5Hz

Parameter Settings

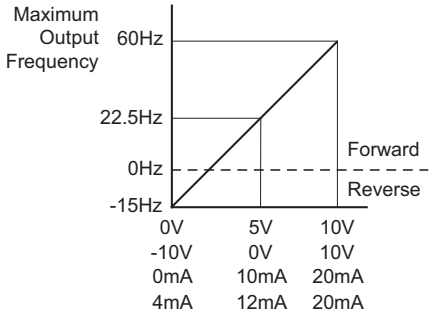
Analog Input	*AI1 or*	*AI2 or*	*AI3*		*Parameter Settings*
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		-25.0% *
AIx Polarity Parameter	P4.11	P4.16	P4.20		1: Positive Offset *
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	125.0%
Reverse Run Parameter	P4.09				1: AI Bias FWD/REV

** This example uses Bias = -20% and Polarity = 1: Positive Offset.*
The example will work exactly the same with Bias = +20% and Polarity = 2: Negative Offset.

Examples

- *Output Freq = [(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)*
- *For AI1 set to 0~10V, and an analog input of 1 Volt:*
  Output Freq = [(1/10) x (1.25) + (-0.25)] x 60Hz = -7.5Hz
- *For analog input of 7 Volts:*
  Output Freq = [(7/10) x (1.25) + (-0.25)] x 60Hz = 37.5Hz

Results



Analog Input Parameter Example 6: Reduced Analog Gain

This example shows how to limit the Maximum Frequency Reference by reducing the Analog Input Gain. When the Analog Input is at its maximum value (10V or 20mA), the set-point frequency will be 50Hz. However, this reduced maximum frequency applies only to an Analog Input Source of Frequncy Command. The Maximum Output Frequency can still can still go to 60Hz if controlled from the Keypad, RS-485 interface, Jog Command, or Multi-Speed settings.

- *Minimum Frequency Reference = 0Hz*
- *Maximum Frequency Reference = 50Hz*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see page 4–108 for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = [(0Hz) / (60Hz)] x 100 = 0%

Analog Input (AIx)	***AI1***	***AI2***	***AI3***
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(50Hz – 0Hz) / 60Hz] x 100 = 83.3% = AIx Input Gain

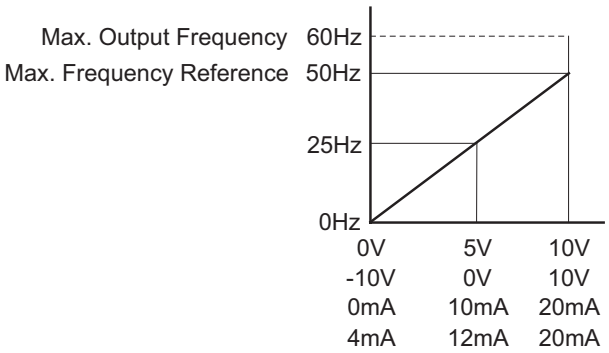
Analog Input	***AI1***	***AI2***	***AI3***	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(50Hz – 0Hz) / 2] + 0Hz = 25Hz

Parameter Settings

Analog Input	***AI1 or***	***AI2 or***	***AI3***		***Parameter Settings***
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		0.0%
AIx Polarity Parameter	P4.11	P4.16	P4.20		0: No Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	83.3%
Reverse Run Parameter	P4.09				0: Digital FWD/REV

Results



Examples

- *Output Freq = [(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)*
- *For AI1 set to 0~10V, and an analog input of 5 Volts:*
  Output Freq = [(5/10) x (0.833) + (0)] x 60Hz = 25Hz
- *For analog input of 10 Volts:*
  Output Freq = [(10/10) x (0.833) + (0)] x 60Hz = 50Hz

Analog Input Parameter Example 7: Positive Offset with Reduced Analog Gain

This example illustrates how to provide a positive offset of the Analog Input, while using the full scale of the potentiometer or other analog device. At the same time, the Maximum Frequency Reference is limited by reducing the Analog Input Gain.

When the analog signal is at its lowest value, the set-point frequency will be at 11.5Hz. When the analog signal is at its maximum value, the set-point frequency will be 39.6Hz.

- *Minimum Frequency Reference = 11.5Hz*
- *Maximum Frequency Reference = 39.6Hz*

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see *page 4–108* for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = (11.5Hz / 60Hz) x 100 = 19.2%

Analog Input (AIx)	***AI1***	***AI2***	***AI3***
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(39.6Hz – 11.5Hz) / 60Hz] x 100 = 46.8% = AIx Input Gain

Analog Input	***AI1***	***AI2***	***AI3***	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(39.6Hz – 11.5Hz) / 2] + 11.5Hz = 25.6Hz

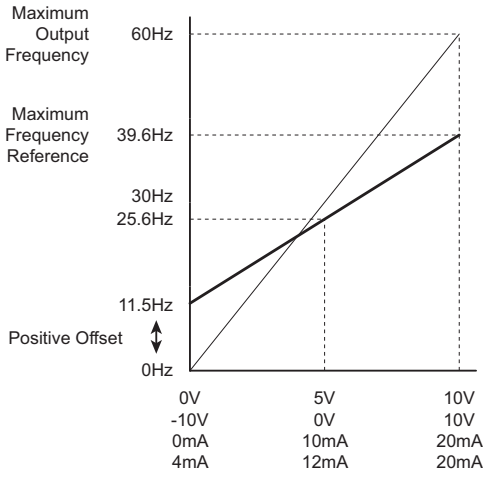
Parameter Settings

Analog Input	***AI1 or***	***AI2 or***	***AI3***		***Parameter Settings***
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		19.2%
AIx Polarity Parameter	P4.11	P4.16	P4.20		1: Positive Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	46.8%
Reverse Run Parameter	P4.09				0: Digital FWD/REV

Examples

- *Output Freq = [(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)*
- *For AI1 set to 0~10V, and an analog input of 5 Volts: Output Freq = [(5/10) x (0.468) + (0.192)] x 60Hz = 25.6Hz*
- *For analog input of 10 Volts: Output Freq = [(10/10) x (0.468) + (0.192)] x 60Hz = 39.6Hz*

Results



Analog Input Parameter Example 8: Trim Mode

This example illustrates using the drive in Trim Mode with a Trim Reference Frequency.

- *Minimum Frequency Reference = 0Hz*
- *Maximum Frequency Reference = 45Hz*
- *Actual Drive Output Frequency (when P4.08 = 4) = Frequency Command - Trim Reference Frequency*
- *Trim Frequency Reference P4.07 = 15Hz*
  (use comms or keypad to adjust this value based on the application needs)

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see *page 4–108* for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = [0Hz / (0Hz)] x 100 = 0%

Analog Input (AIx)	*AI1*	*AI2*	*AI3*
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(60Hz - 0Hz) / 60Hz] x 100 = 100% = AIx Input Gain

Analog Input	*AI1*	*AI2*	*AI3*	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

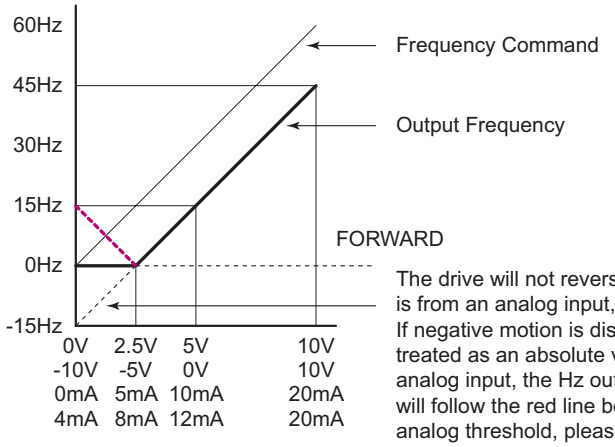
D) **Mid-point Frequency** = [(45Hz – 0Hz) / 2] + 0Hz = 22.5Hz

E) **Actual Output Frequency**$_{\mathbf{P4.08=04}}$ = Freq Command – Trim Ref Freq

Parameter Settings

Analog Input	*AI1 or*	*AI2 or*	*AI3*		*Parameter Settings*
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		0.0%
AIx Polarity Parameter	P4.11	P4.16	P4.20		0: No Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	100.0%
Reverse Run Parameter	P4.09				1: AI Bias FWD/REV
Trim Selection	P4.08				4: Speed Source - Trim Ref Freq
Trim Reference Freq	P4.07				15.00Hz

Results



The drive will not reverse direction unless the Frequency Command is from an analog input, and reverse motion is enabled in P4.09. If negative motion is disabled (P4.09=0), the analog signal will be treated as an absolute value. Instead of 0Hz output below 2.5V analog input, the Hz output will be treated as an absolute value and will follow the red line below 2.5V. To establish 0Hz below a specific analog threshold, please see Analog Input Parameter Example 9.

Examples

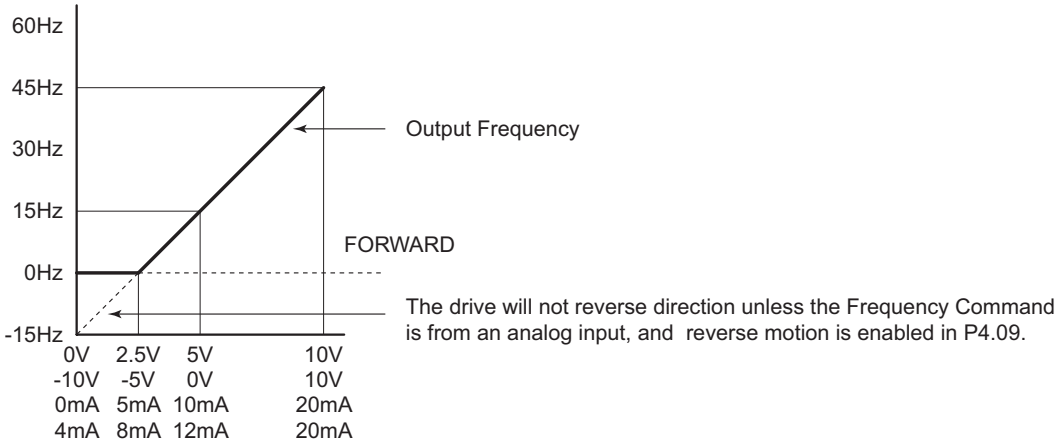
- *Output Freq = [[(Analog_In%) x (Gain%) + (Bias%)] x Max_Out (Hz)] - Trim Freq (when P4.08=4)*
- *For AI1 set to 0~10V, and an analog input of 5 Volts:*
  Output Freq = [[(5/10) x (1.00) + (0)] x 60Hz] - 15 = 15Hz
- *For analog input of 10 Volts:*
  Output Freq = [[(10/10) x (1.00) + (0)] x 60Hz] - 15 = 45Hz

Analog Input Parameter Example 9: Zero Volts Out at Low V_{IN}

This example gives 0Hz output through the first 0V~2.5V of Analog Input. The rest of the 2.5V~10V corresponds to 0~45 Hz

- *Minimum Frequency Reference = 0Hz*
- *Maximum Frequency Reference = 45Hz*

Results



NOTE: Due to the way Bias, Gain, and Reverse works, the graph above cannot be achieved with the Bias and Gain settings: If Reverse is enabled (P4.09), the motor will run reverse when the signal goes below 2.5V. If reverse is disabled, the analog value will be evaluated as an absolute value (what would have been negative motion will now result in positive motion).

Set P4.24 to use Low Point, Mid Point, and High Point settings for analog input conditioning (instead of Bias and Gain). Use the following settings to create a deadband from 0~2.5V analog input:

- *Low Point = 0V input; 0Hz output; chart coordinates 0,0*
- *Mid Point = 2.5V input; 0Hz output; chart coordinates 2.5,0*
- *High Point = 10V input; 45Hz output; chart coordinates 10,45*

NOTE: The Low/Mid/High Point method uses % output, instead of Hz. Therefore, the High Point value in this example = 45Hz / 60Hz Max Output = 75%.

Parameter Settings

Analog Input	**AI1 or**	**AI2 or**	**AI3**		**Parameter Settings**
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AI V/Hz Calculated Selection	P4.24 = 1, 3, 5, or 7	P4.24 = 2, 3, 6, or 7	P4.24 = 4, 5, 6, or 7		as shown to left, or 7: All Custom V/Hz
AIx Low V/A	P4.25	P4.31	P4.37	P4.43	0V
AIx Low Hz Percent	P4.26	P4.32	P4.38	P4.44	0%
AIx Mid V/A	P4.27	P4.33	P4.39	P4.45	2.5V
AIx Mid Hz Percent	P4.28	P4.34	P4.40	P4.46	0%
AIx High V/A	P4.29	P4.35	P4.41	P4.47	10V
AIx High Hz Percent	P4.30	P4.36	P4.42	P4.48	75%
Reverse Run Parameter	P4.09				0: Digital FWD/REV

Analog Input Parameter Example 10: Inverse Analog Speed Reference

This example illustrates the use of an inverse analog speed reference to the drive. The minimum analog reference value corresponds to the full forward output frequency of the drive.

- *Minimum Frequency Reference = 60Hz*
  (drive output frequency at the minimum analog input reference, 0V)
- *Maximum Frequency Reference = 0Hz*
  (drive output frequency at the maximum analog input reference, 10V)

For AI1, AI2, and AI3: ***P4.24 (AI V/Hz Calculated Selection) MUST BE SET TO ZERO (All Inputs Use Bias and Gain) TO ENABLE BIAS AND GAIN CALCULATIONS.***

Calculations (see page 4–108 for formulas)

A) **Drive Maximum Output Frequency** = P0.04 = (1750 rpm / 1750 rpm) x 60Hz = 60Hz

B) **Analog Offset %** = (60Hz / 60Hz) x 100 = 100%

Analog Input (AIx)	*AI1*	*AI2*	*AI3*
AIx Bias Parameter	P4.10	P4.15	P4.19

C) **Analog Gain %** = [(0Hz - 60Hz) / 60Hz] x 100 = -100% = AIx Input Gain

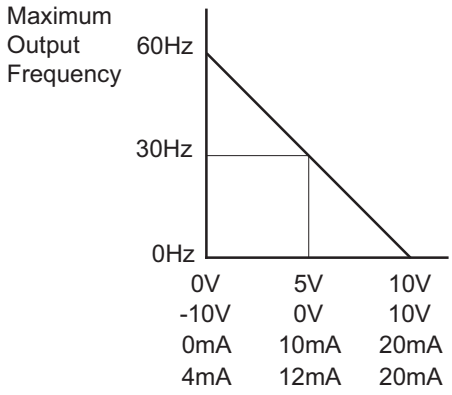
Analog Input	*AI1*	*AI2*	*AI3*	
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22

D) **Mid-point Frequency** = [(60Hz - 0Hz) / 2] + 0Hz = 30Hz

Parameter Settings

Analog Input	*AI1 or*	*AI2 or*	*AI3*		*Parameter Settings*
Polarity	Positive (+)	Positive (+)	Positive (+)	Negative (-)	
AIx Bias Parameter	P4.10	P4.15	P4.19		100.0%
AIx Polarity Parameter	P4.11	P4.16	P4.20		1: Positive Offset
AIx Gain Parameter	P4.12	P4.17	P4.21	P4.22	-100.0%
Reverse Run Parameter	P4.09				0: Digital FWD/REV
Drive Max Output Freq	P0.04				60Hz

Results



Group P5.xx Details – Presets Parameters

		Type	Hex Addr	Dec Addr
P5.00	**Jog Frequency**	♦R/W	0500	41281
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0.00~599.00 Hz	6.0		

Both external terminal JOG and key “F1” on the keypad GS4-KPD can be used. F1 is active when the drive is in LOCAL mode (using the keypad for source of operation). The JOG Terminal is active when the drive is in REMOTE mode (using the terminals for source of operation). When the jog command is ON, the GS4 drive will accelerate from 0Hz to Jog Frequency (P5.00). When the jog command is OFF, the GS4 drive will decelerate from Jog Frequency to zero. The Jog Accel/Decel Time (P1.13,P1.14) is the time that the drive accelerates from 0.0Hz to P5.00 JOG Frequency. (In contrast, all of the Accel/Decels in the P1 parameter group are referenced from 0 to Max Speed.)

The JOG command cannot be executed when the GS4 drive is running (or decelerating to STOP). Similarly, the RUN command is invalid when the JOG command is being executed.

JOG and RUN commands are edge-triggered inputs. Therefore, a RUN input will be ignored if it is initiated before the JOG input turns off. The drive needs to see the RUN input transition from off to on while the JOG input is off, and also would need to see a JOG input transition from off to on after the RUN input turns off.

		Type	Hex Addr	Dec Addr
P5.01	Multi-Speed 1	♦R/W	0501	41282
P5.02	Multi-Speed 2	♦R/W	0502	41283
P5.03	Multi-Speed 3	♦R/W	0503	41284
P5.04	Multi-Speed 4	♦R/W	0504	41285
P5.05	Multi-Speed 5	♦R/W	0505	41286
P5.06	Multi-Speed 6	♦R/W	0506	41287
P5.07	Multi-Speed 7	♦R/W	0507	41288
P5.08	Multi-Speed 8	♦R/W	0508	41289
P5.09	Multi-Speed 9	♦R/W	0509	41290
P5.10	Multi-Speed 10	♦R/W	050A	41291
P5.11	Multi-Speed 11	♦R/W	050B	41292
P5.12	Multi-Speed 12	♦R/W	050C	41293
P5.13	Multi-Speed 13	♦R/W	050D	41294
P5.14	Multi-Speed 14	♦R/W	050E	41295
P5.15	Multi-Speed 15	♦R/W	050F	41296

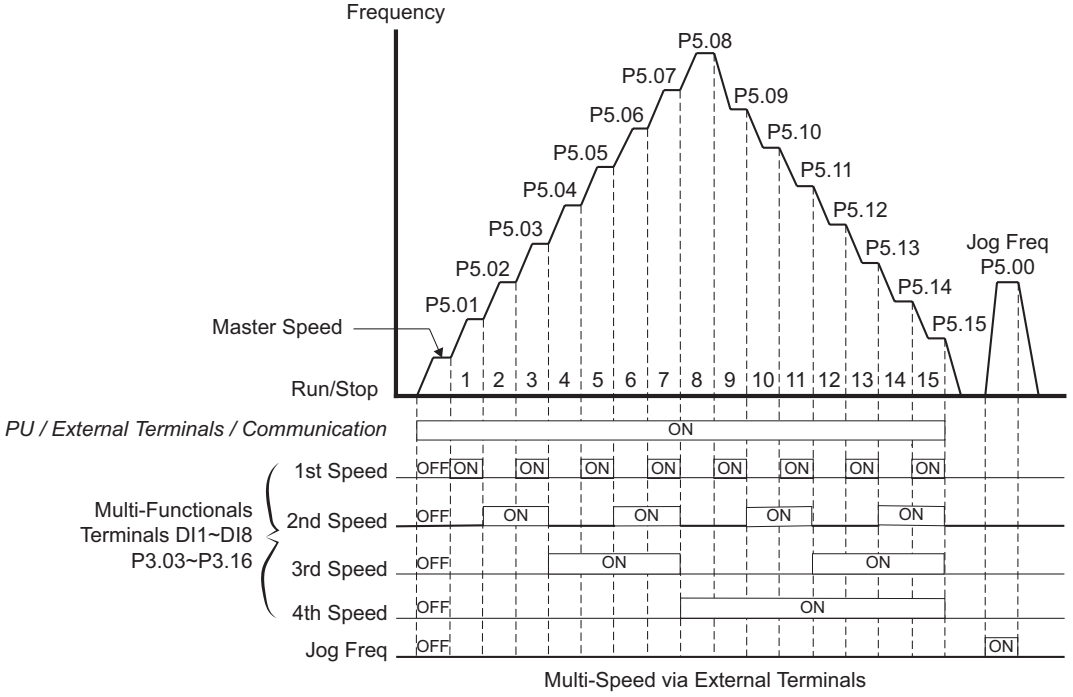
Range/Units (Format: 16-bit unsigned)	Default
0.00~599.00 Hz	0.0

The Multi-Function Input Terminals (DI1~DI15) are used to select individual Multi-Speed frequencies (max. 15). The speeds (frequencies) are determined by the values placed in parameters P5.01 through P5.15.

- *Multi-Function inputs (DI1, DI2, DI3, and DI4) are configured for "Multi-Speed" by default.*
- *Reference P3.03~P3.10 (page 4–63) to configure GS4 local Multi-Function Inputs (DI1~DI8).*
- *Reference P3.11~P3.16 (page 4–63) to configure GS4 optional Multi-Function Inputs (DI10~DI15), if used.*

Timing diagram for multi-step speeds and external terminals:

- *P5.01~15: setting multi-speed frequencies (to set the frequency of each step speed)*
- *P3.03~16: setting multi-function input terminals (multi-step speeds 1~4)*
- *Related parameters: P5.00 JOG Frequency; P3.03 Multi-Function Input (DI1); P3.04 Multi-Function Input (DI2); P3.05 Multi-Function Input (DI3); P3.06 Multi-Function Input (DI4)*



Multi-Speed via External Terminals

GROUP P6.XX DETAILS – PROTECTION PARAMETERS

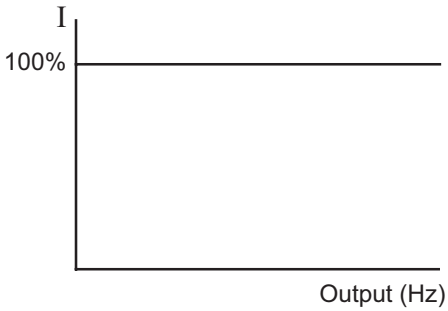
		Type	Hex Addr	Dec Addr
P6.00	**Electronic Thermal Overload Relay (Motor 1)**	♦R/W	0600	41537
Range/Units (Format: 16-bit binary)		Default		
0: Constant Torque 1: Variable Torque 2: Inactive		1		

The Electronic Thermal Relay Selection is used to prevent a self-cooled motor from overheating under low speed. This setting limits the drive's output power.

This parameter determines the drive's motor overload protection characteristic. The Variable Torque setting (01) allows less motor current at lower speeds than does the Constant Torque setting (00).

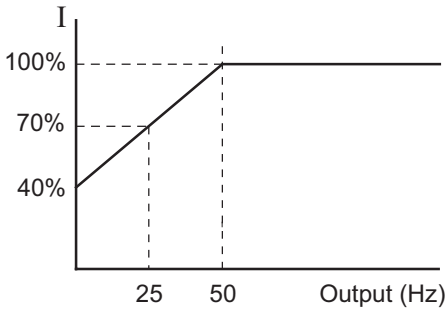
Related parameter: P6.01

*Setting 0: Constant Torque (Recommended for **inverter/vector duty motors**)*



Use this setting when using the GS4 drive with motors designed specifically for AC drive outputs, and for running at low speeds with high currents. Motor currents will be 100% throughout the speed range, and can be up to 150% for one minute.

*Setting 1: Variable Torque (Recommended for **fan-cooled standard motors**)*



Use this setting when using the GS4 drive with motors which are NOT designed specifically for AC drive outputs. Motors with shaft mounted fans offer poor cooling at low speeds, therefore the output can be derated at lower output frequencies. This derated current is for protecting the motor at lower speeds.

The output current is derated as follows:

- I_{output} (%) = [f_{output} (Hz) x 1.2 %/Hz] + 40%

Example: If the rated motor current is 10A, and the output frequency is 25Hz, the derating will be 70%, and the overload will be 10.5A (150%) for one minute:

- I_{output} (%) = [(25Hz) (1.2 %/Hz)] + 40% = 70%
- 10A x 70% = 7A
- 7A x 150% = 10.5A

Setting 2: Inactive

NOTE: P6.00/P6.02 (Electronic Overload Relay) must be set independently, yet in conjunction with P6.33 (Drive Derating Method), and P6.34 (VT/CT Duty Selection).
When P6.34 is set, it can change P2.10 (PWM Carrier Frequency); refer to P2.10.

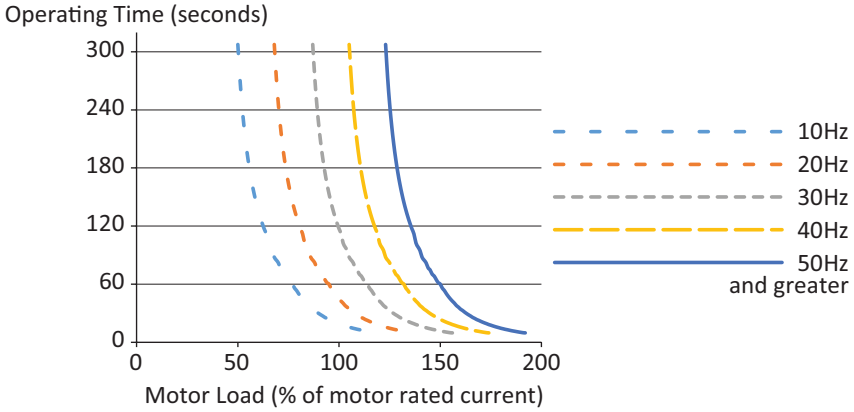
		Type	Hex Addr	Dec Addr
P6.01	**Electronic Thermal Characteristic (Motor 1)**	♦R/W	0601	41538
Range/Units (Format: 16-bit unsigned)		*Default*		
30.0~600.0 sec		60.0		

The parameter uses the default overload of 60 seconds when the motor is running at 150% of the motor rated current. When P6.01 and P6.03 are adjusted to some value other than 60 seconds or a time until trip is needed when operating for a different time period, use the following graph and formula to determine the trip time. The time entered into P6.01 and P6.03 is not necessarily the trip time; refer to examples below. When the trip time has elapsed the keypad will display "EoL1/ EoL2" and the motor will coast to a stop.

P6.01 and P6.03 are EoL1/EoL2 detection time for P6.00 and P6.02.

EOL Fault Time = Operating Time from graph × P6.01/60s

Example 1: Set P6.01 = 100 seconds, and get the operation time from the graph below. Find the time that lines up with the 50Hz curve at 150%. If the output frequency is 50Hz and the output current is 150% of motor rated current, then the operating time is 60 seconds. Plug that time into the formula 60s x 100s/60s = 100 seconds.



Example 2: P6.01 = 250s; output frequency = 40Hz; output current = 120%; operating time = 60s.

- *Detection Time = 125s x 250s/60s = 521 seconds.*

Example 3: P6.01 = 48s; output frequency = 50Hz; output current = 132%; operating time = 60s.

- *Detection Time = 150s x 48s/60s = 120 seconds.*

Example 4: P6.01 = 8s; output frequency = 20Hz; output current = 72%; operating time = 60s.

- *Detection Time = 275s x 8s/60s = 36 seconds.*

Related parameters: P6.00

		Type	Hex Addr	Dec Addr
P6.02	**Electronic Thermal Overload Relay (Motor 2)**	♦R/W	0602	41539
Range/Units (Format: 16-bit binary)		Default		
0: Constant Torque 1: Variable Torque 2: Inactive		2		

This parameter is the same as P6.00, except that it applies to motor #2.

Related parameters: P6.03

		Type	Hex Addr	Dec Addr
P6.03	**Electronic Thermal Characteristic (Motor 2)**	♦R/W	0603	41540
Range/Units (Format: 16-bit unsigned)		Default		
30.0~600.0 sec		60.0		

This parameter is the same as P6.01, except that it applies to motor #2.

Related parameter: P6.02

		Type	Hex Addr	Dec Addr
P6.04	**Auto Restart after Fault**	♦R/W	0604	41541
Range/Units (Format: 16-bit unsigned)		Default		
0~10		0		

The value in this parameter determines the number of reset/restarts following a drive fault. The maximum number of restarts is 10. [Allowable faults: over-current OC (ocA, ocd, ocn, ocS), over-voltage OV (ovA, ovd, ovn, ovS), and short circuit (OCC)].

When this parameter is set to 0, there will be no resets or restarts.

When auto reset/restarts are enabled, the GS4 Drive will follow the setting at P6.06 to do a speed search before the drive is activated again.

When the number of faults occured exceeds P6.04 and is within the time specified in P6.05, the GS4 drive will not restart. Please press the "RESET" key to continue operation.

To set the fault recovery time after a fault, please see P6.23 baseblock time for speed search.

Related parameters: P6.05, P6.06, P6.23

		Type	Hex Addr	Dec Addr
P6.05	**Reset Time for Auto Restart after fault**	♦R/W	0605	41542
Range/Units (Format: 16-bit unsigned)		Default		
0.0~6000.0 sec		60.0		

This parameter defines the time period for accumulating drive faults such as ov, oc, occ. If the number of faults accumulated during this time span exceeds the value in parameter P6.04, then the drive will not reset until the "RESET" key is pressed. If, however, the number of faults accumulated does NOT exceed the number in P6.04, then the accumulated fault count will be reset and begin from zero on the next restart of the drive.

Related parameters: P6.04, P6.06, P6.23

		Type	Hex Addr	Dec Addr
P6.06	**Base Block Speed Search after Fault (oc,ov,bb)**	♦R/W	0606	41543
Range/Units (Format: 16-bit binary)		Default		
0: Disable		0		
1: Speed search starts with current speed reference				
2: Speed search starts with minimum output frequency				

Fault includes: Base Block BB, over-current OC, over-voltage OV, short circuit OCC. To restart after oc, ov, occ, P6.04 cannot be set to 0.

Related parameters: P6.04, P6.05, P6.23

		Type	Hex Addr	Dec Addr
P6.07	**Speed Search at Start**	♦R/W	0607	41544
Range/Units (Format: 16-bit binary)		Default		
0: Disable		0		
1: Speed search from maximum output frequency				
2: Speed search from start-up motor frequency				
3: Speed search from minimum output frequency				

This parameter is used for starting and stopping a motor with a high inertia. A motor with high inertia will take 2–5 minutes or longer to stop completely. By setting this parameter, the user does not need to wait for the motor to come to a complete stop before restarting the GS4 drive.

Related parameters: P6.24 (sets the output current)

		Type	Hex Addr	Dec Addr
P6.08	**Momentary Power Loss**	♦R/W	0608	41545
Range/Units (Format: 16-bit binary)		Default		
0: Disable		0		
1: Speed search from last frequency command				
2: Speed search from the minimum output frequency				

This parameter determines the operation mode when the GS4 drive restarts from a momentary power loss. The power connected to the drive may power off momentarily due to many reasons. This function allows the drive to keep running after power comes back on line; won't cause drive stop.

Setting Explanations:

0: Stop operation after momentary power loss.

1: Operation continues after momentary power loss, speed search starts with the Master Frequency reference value after drive output frequency, and motor rotator speed is synchronous. The motor will have a closer characteristic of a lot of inertia and low resistance. For example, in equipment with a big inertia wheel, the motor will take a long time to stop. The drive does not need to wait for the wheel to stop in order to start again.

2: Operation continues after momentary power loss, speed search starts with the minimum output frequency after drive output frequency, and motor rotational speed is synchronous. The motor will have a closer characteristics of less inertia and more resistance.

Related parameters: P6.04, P6.05

		Type	Hex Addr	Dec Addr
P6.09	**Fwd/Rev Direction Inhibit**	♦R/W	0609	41546
Range/Units (Format: 16-bit binary)		*Default*		
0: Enable Fwd/Rev		0		
1: Disable Reverse Operation				
A forward or reverse command will run the motor forward.				
2: Disable Forward Operation				
A forward or reverse command will run the motor reverse.				

This parameter enables/prohibits the GS4 drive to run in the forward or reverse direction. It may be used to prevent a motor from running in a direction that would consequently injure the user or damage the equipment.

		Type	Hex Addr	Dec Addr
P6.10	**Auto Voltage Regulation (AVR)**	♦R/W	060A	41547
Range/Units (Format: 16-bit binary)		*Default*		
0: AVR Enable		0		
1: AVR Disable				
2: AVR Disable during Decel				

The rated voltage of the motor is usually 220V/200VAC 60Hz/50Hz, and the input voltage of the GS4 drive may vary between 180~264 VAC 50Hz/60Hz. Therefore, when the GS4 drive is used without AVR function, the output voltage will be the same as the input voltage. When the motor runs at voltages exceeding the rated voltage by 12~20%, the lifespan of the motor may be decreased due to damage from higher temperature, failing insulation, and can also result in unstable torque output.

The AVR function automatically regulates the GS4 drive output voltage to the motor rated voltage (P0.00). For instance, if V/Hz curve is set at 200VAC/50Hz and the input voltage is at 200~264 VAC, then the motor Output Voltage will automatically be reduced to a maximum of 200VAC/50Hz. If the input voltage is at 180~200 VAC, output voltage to motor and input power will be in direct proportion.

Setting Explanations:

0: When AVR function is enabled, the drive will calculate the output voltage by actual DC-bus voltage. The output voltage will *not* be changed by DC bus voltage.

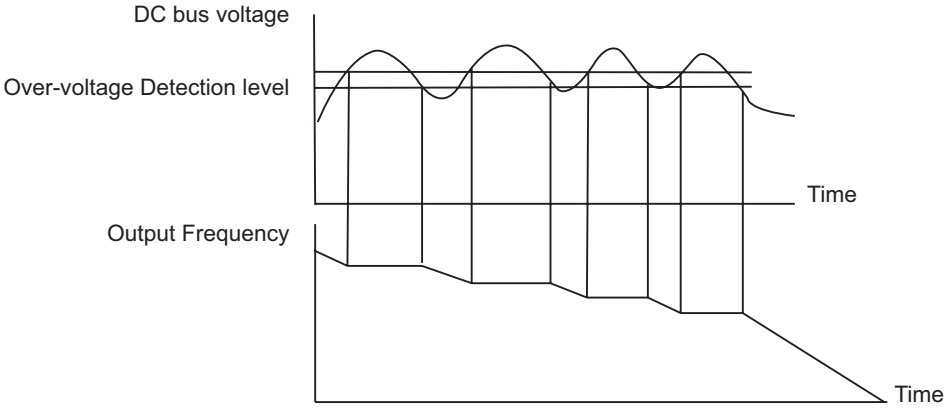
1: When AVR function is disabled, the drive will calculate the output voltage by DC-bus voltage. The output voltage *will* be changed by DC bus voltage. It may cause insufficient/over current.

2: The drive will disable the AVR during deceleration, such as operating from high speed to low speed.

When the motor ramps to a stop with a long deceleration time, set P6.10 to 2 along with auto acceleration/deceleration, and the deceleration will be much quicker.

		Type	Hex Addr	Dec Addr
P6.11	**Over-Voltage Stall Prevention**	R/W	060B	41548
Range/Units (Format: 16-bit binary)		*Default*		
0: Enable Over-voltage Stall Prevention		0		
1: Disable Over-voltage Stall Prevention				

During deceleration, the GS4 drive DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the GS4 drive will stop decelerating, and maintain a constant output frequency. The drive will resume deceleration when the voltage drops below the factory-preset value.



NOTE: With moderate inertial loads, over-voltage during deceleration should not occur. For applications with high inertia loads, the GS4 drive will automatically extend the deceleration time. If deceleration time is critical for the application, a dynamic braking resistor should be used. Set this parameter to 1 (disable) when using a dynamic braking resistor.

Related parameters: P6.11, P6.12, P6.27

		Type	Hex Addr	Dec Addr
P6.12	**Selection for Over-Voltage Stall Prevention**	♦R/W	060C	41549
Range/Units (Format: 16-bit binary)		*Default*		
0: Traditional Over-Voltage Stall Prevention 1: Advanced Over-Voltage Prevention		0		

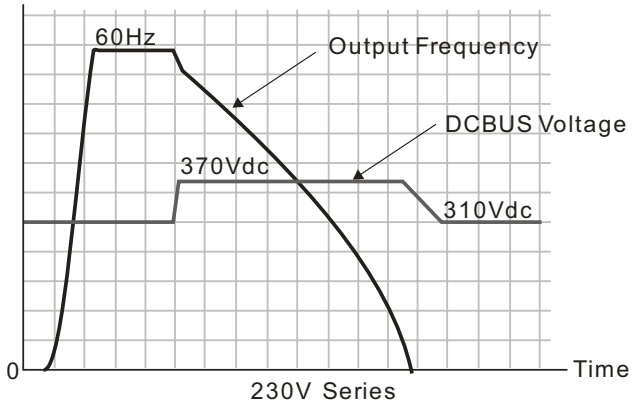
This function is used if there is a potential for high load inertia. When stopping a normal load, an over-voltage won't occur during deceleration, and deceleration time will be followed. If the load has high inertia, the drive may not stop the motor due to over-voltage during deceleration. During this situation the drive will auto adjust the deceleration time until the drive stops.

See P6.11 to enable/disable Over-Voltage Stall Prevention. These settings are not used when a Dynamic Braking Resistor is in use.

Setting Explanations:

0: During deceleration, the DC bus voltage may exceed its maximum allowable value due to motor regeneration in some situations, such as a high inertial load or the decel time set too short. When Traditional Over-Voltage Stall Prevention is enabled, the drive will not decelerate further. It will keep the output frequency constant until the voltage drops below the setting value again (P6.27).

1: The drive will maintain DC bus voltage when decelerating and prevent OV. The Advanced setting will provide a smoother output frequency change than traditional.



Related parameters: P1.29, P6.11, P6.27

Over-Voltage Stall Prevention will try to prevent an OV (Over-Voltage) fault. (P6.12 setting #1: Frequency is decelerated in a smoother way than Traditional OVSP.) (See P1.29) P1.29 setting #2 TEC will attempt to prevent an OV fault with faster deceleration and higher current. (P1.29 setting #1: control using DCbus; P1.29 setting #2: control using RateCurrent) (See P6.12)

		Type	Hex Addr	Dec Addr
P6.13	**Auto Adjustable Accel/Decel**	♦R/W	060D	41550

Range/Units (Format: 16-bit binary) — *Default*: 0

0: Linear Accel/Decel
1: Auto Accel, Linear Decel
2: Linear Accel, Auto Decel
3: Auto Accel, Auto Decel
4: Auto Accel/Decel Stall Prevention (limited by P1.01~P1.08 and P1.13~P1.14)

In regards to auto accel and auto decel ramps, this parameter helps to decrease the mechanical vibration when a motor starts/stops a load, and helps prevent complicated auto-tuning processes. It auto-detects the torque size of a load, and then accelerates to reach the frequency of your setting within the shortest time and the smoothest start-up current. It can also auto-detect the re-generated voltage of a load, and then decelerates to stop the motor within the shortest time and in a smoothest way.

Setting Explanations:

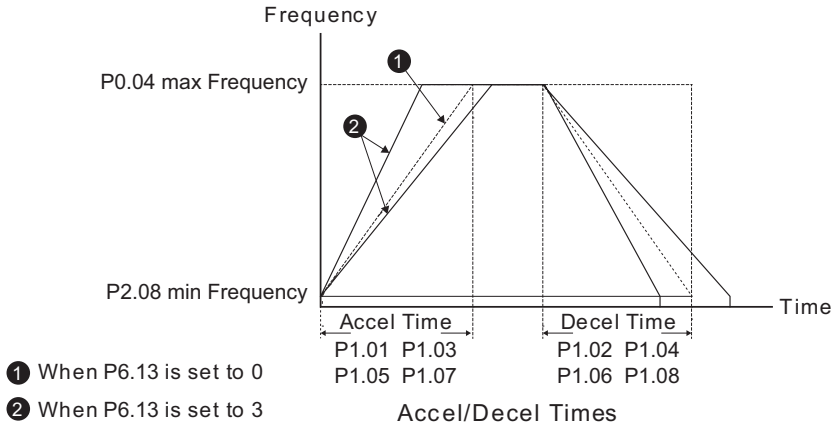
0: Linear acceleration and deceleration operation by P1.01~P1.08 acceleration/deceleration times.

1: Automatic acceleration; linear deceleration (Acceleration by automatic operation; Deceleration by P1.02, P1.04, P1.06, or P1.08 decel time).

2: Linear acceleration; automatic deceleration (Acceleration by P1.01, P1.03, P1.05, or P1.07 accel time; Deceleration by automatic operation).

3: Automatic acceleration and deceleration. (Operation by GS4 drive auto adjustable control). The drive won't stall during acceleration, so a brake resistor is not required. If the acceleration/deceleration is in a reasonable range, the drive will accelerate/decelerate in accordance with the setting of P1.01~P1.08. If the Accel/Decel Time setting is too short, the actual accel/decel time will be greater than the setting of Accel/Decel Time.

4: Auto acceleration; deceleration is for stall protection only. The auto accel/decel will not be quicker than the settings for Accel and Decel Times (P1.02~P1.08 and P1.13~P1.14). The operation is specifically for preventing a stall.

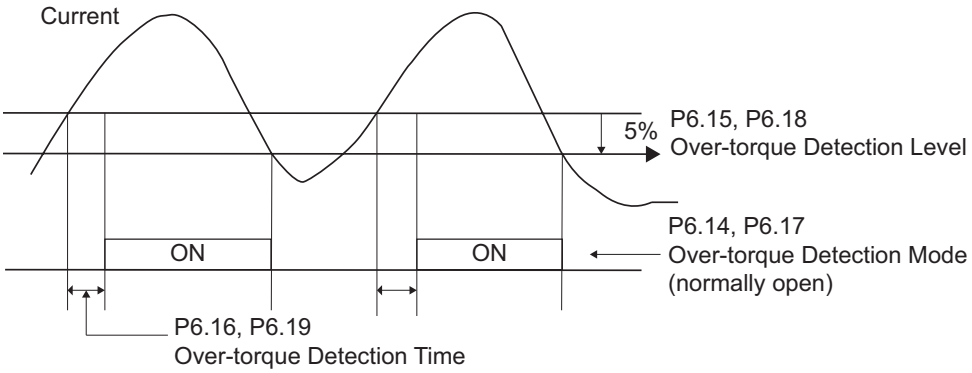


		Type	Hex Addr	Dec Addr
P6.14	**Over-Torque Detection Mode (OT1)**	♦R/W	060E	41551
Range/Units (Format: 16-bit binary)		Default		
0: Disable 1: Enable during at speed 2: Enable during at speed and Stop 3: Enable during operation 4: Enable during operation and Stop		0		

Over-Torque detection is determined by the following method:

If the output current exceeds the Over-Torque Detection Level (P6.15/P6.18) and also exceeds the Over-Torque Detection Time (P6.16/P6.19), the fault code "ot1/ot2" will appear. If a Multi-Functional Output Terminal is set to Over-Torque Detection (setting 7 or 8), the output will come on. When the output frequency decreases and passes under the over-torque detection level, there will be a 5% delay (it decreases to 95% of P6.15/P6.18). Then the over-torque detection stops.

P6.14 reacts to the detection level set in P6.15.



Setting Explanations:

0: Disable.

1: Over-Torque detection during constant speed operation, continue to operate after detection. *Keypad will display a warning message but will not record the event.*

2: Over-Torque detection during constant speed operation, stop operation after detection. *Keypad will display a warning message and will record the event.*

3: Over-Torque detection during operation (acceleration and constant speed), continue to operate after detection. *Keypad will display a warning message but will not record the event.*

4: Over-Torque detection during operation (acceleration and constant speed), stop operation after detection. *Keypad will display a warning message and will record the event.*

		Type	Hex Addr	Dec Addr
P6.15	**Over-Torque Detection Level (OT1)**	♦R/W	060F	41552
Range/Units		Default		
10~200%		120		

This parameter sets the first Over-Torque Detection Level (OT1) in 1% increments. A setting of 100% is proportional to the Rated Output Current of the drive.

Refer to P6.14 for explanation of operation of parameters P6.14~P6.19.

		Type	Hex Addr	Dec Addr
P6.16	**Over-Torque Detection Time (OT1)**	♦R/W	0610	41553
Range/Units (Format: 16-bit unsigned)		Default		
0.1~60.0 sec		0.1		

This parameter sets the first Over-Torque Detection Time (OT1) in units of 0.1 seconds.

Refer to P6.14 for explanation of operation of parameters P6.14~P6.19.

		Type	Hex Addr	Dec Addr
P6.17	**Over-Torque Detection Mode (OT2)**	♦R/W	0611	41554
Range/Units (Format: 16-bit binary)		Default		
0: Disable 1: Enable during at speed 2: Enable during at speed and Stop 3: Enable during operation 4: Enable during operation and Stop		0		

P6.17 reacts to the detection level set in P6.18.

Setting Explanations: Same as P6.14.

Refer to P6.14 for explanation of operation of parameters P6.14~P6.19.

		Type	Hex Addr	Dec Addr
P6.18	**Over-Torque Detection Level (OT2)**	♦R/W	0612	41555
Range/Units (Format: 16-bit unsigned)		Default		
10~200%		120		

This parameter sets the second Over-Torque Detection Level (OT2) in 1% increments. A setting of 100% is proportional to the Rated Output Current of the drive.

Refer to P6.14 for explanation of operation of parameters P6.14~P6.19.

		Type	Hex Addr	Dec Addr
P6.19	**Over-Torque Detection Time (OT2)**	♦R/W	0613	41556
Range/Units (Format: 16-bit unsigned)		Default		
0.1~60.0 sec		0.1		

This parameter sets the second Over-Torque Detection Time (OT2) in units of 0.1 seconds.

Refer to P6.14 for explanation of operation of parameters P6.14~P6.19.

		Type	Hex Addr	Dec Addr
P6.20	**Over-Current Stall Prevention Level During Accel**	♦R/W	0614	41557
Range/Units (Format: 16-bit unsigned)		Default		
If P6.34 = VT (light duty): 0~130% of drive rated current If P6.34 = CT (normal duty): 0~160% of drive rated current 00 = Disable		VT: 120 CT: 150		

Light Duty (Variable Torque) or Normal Duty (Constant Torque) will be automatically selected depending on the setting chosen in P6.34.

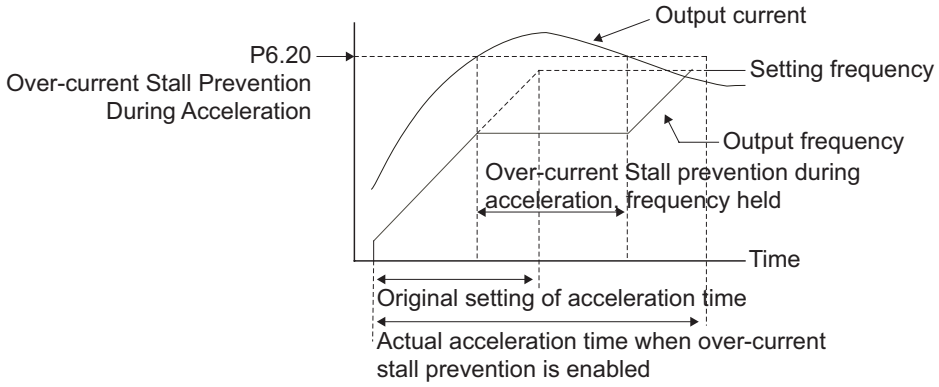
If the motor load is too large or drive acceleration time is too short, GS4 drive output current may increase abruptly during acceleration resulting in possible motor damage or fault protection functions (OL or OC). This parameter is used to prevent this situation.

During acceleration, the GS4 drive output current may increase abruptly and exceed the value specified by P6.20 due to rapid acceleration or excessive load on the motor. When this function is enabled, the GS4 drive will stop accelerating and keep the output frequency constant until the current drops below the maximum value.

When the Over-current Stall Prevention is enabled, drive acceleration time can be greater than the system acceleration time.

If there is any problem with acceleration time, refer to the following items to solve it:

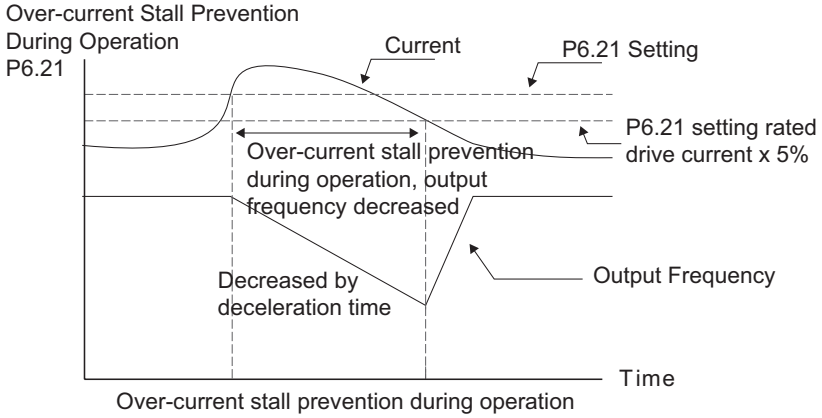
- *1. Increase the acceleration time to a suitable level.*
- *2. Set P6.13 Optimal Acceleration/Deceleration Setting, to 1, 3 or 4.*



Related parameters: P6.34 VT/CT Duty Selection, P1.01 Accel Time 1, P1.03 Accel Time 2, P1.05 Accel Time 3, P1.07 Accel Time 4, P6.13 Optimal Acceleration/Deceleration Setting, any multi-function output.

P6.21	Over-Current Stall Prevention Level During Operation	Type	Hex Addr	Dec Addr
		♦R/W	0615	41558
Range/Units (Format: 16-bit unsigned)		Default		
If P6.34 = VT (light duty): 0~130% of drive rated current		VT: 120		
If P6.34 = CT (normal duty): 0~160% of drive rated current		CT: 120		
00 = Disable				

During steady-state operation with motor load rapidly increasing, the GS4 drive output current may exceed the limit specified in P6.21. If output current exceeds the setting specified in P6.21 when the drive is operating, the drive will decrease its output frequency (according to P6.36) to prevent a motor stall. If the output current is lower than the setting specified in P6.21, the drive will resume acceleration (according to P6.36) to catch up with the set frequency command value.



Over-current stall prevention during operation

Related parameters: P6.34 VT/CT Duty Selection,
P6.36 OC Stall Prevention Accel/Decel Time Selection at Normal Speed

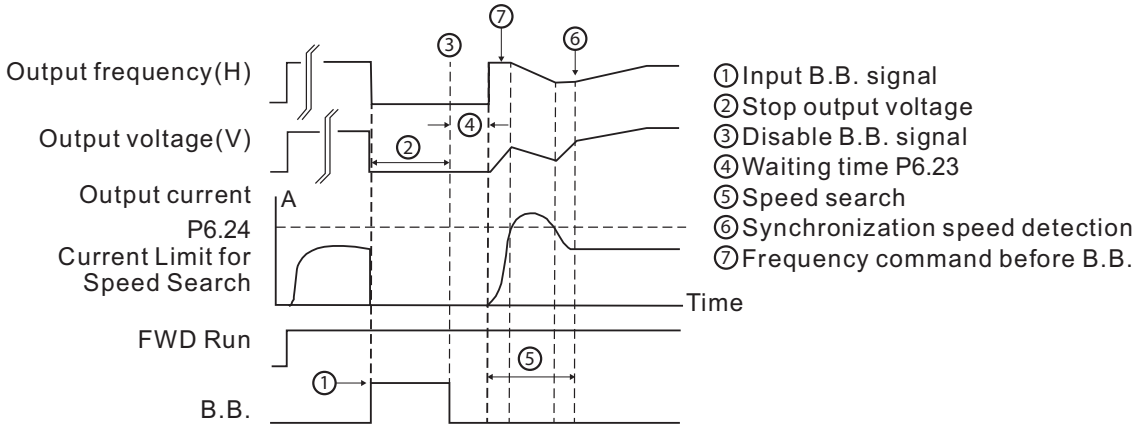
P6.22	Maximum Allowable Power Loss Time	Type	Hex Addr	Dec Addr
		♦R/W	0616	41559
Range/Units (Format: 16-bit unsigned)		Default		
0.0~20.0 sec		2.0		

If the duration of a power loss is less than this parameter setting, the GS4 drive will resume operation. If it exceeds the Maximum Allowable Power Loss Time, the GS4 drive output is then turned off (coast stop).

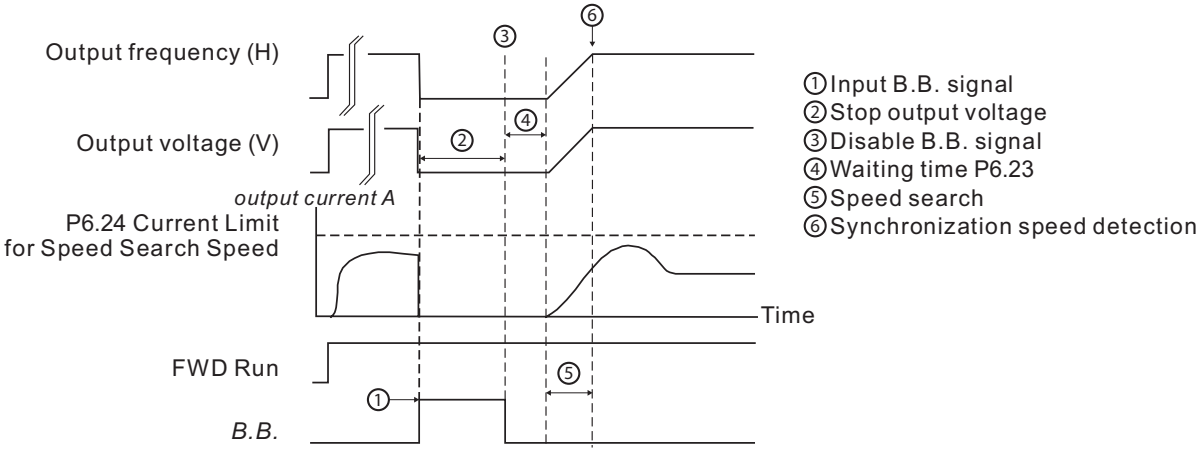
The selected operation after power loss in P6.08 is only executed when the maximum allowable power loss time is ≤ 20 seconds and the GS4 drive displays "LU." But if the GS4 drive is powered off due to overload, even if the maximum allowable power loss time is ≤5 seconds, the operation mode as set in P6.08 is *not* executed. In that case the drive starts up normally.

		Type	Hex Addr	Dec Addr
P6.23	***Base-Block Time for Speed Search***	♦R/W	0617	41560
Range/Units (Format: 16-bit unsigned)		*Default*		
0.1~20.0 sec		0.5		

When momentary power loss is detected, the GS4 drive will block its output and then wait for a specified period of time (determined by P6.23, Base-Block Time) before resuming operation. This parameter should be set at a value to ensure that any residual voltage regenerated from the motor onto the output has disappeared before the drive is activated again.



B.B. Search with last output frequency downward timing chart



B.B. Search with minimum output frequency upward timing chart

Related parameters: P6.03, P6.04, P6.05, P6.06, P6.20, P6.24.

		Type	Hex Addr	Dec Addr
P6.24	***Maximum Speed Search Current Level***	♦R/W	0618	41561
Range/Units (Format: 16-bit unsigned)		*Default*		
20~200%		100		

Following a momentary power loss, the GS4 drive will begin speed search operation only if the output current is greater than the value set by P6.24.

When performing speed search, the V/Hz curve is determined by parameter group 1. The maximum current for the optimum accel/decel and start speed search is set by P6.24.

The speed search current level will affect the synchronization time. The drive and motor will synchronize faster when this parameter is set to a larger value, but a value that is too large may activate overload protection.

		Type	Hex Addr	Dec Addr
P6.25	**Upper Limit of Output Frequency**	♦R/W	0619	41562
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~599.00 Hz	599.00		
		Type	Hex Addr	Dec Addr
P6.26	**Lower Limit of Output Frequency**	♦R/W	061A	41563
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~599.00 Hz	0.00		

The setting of output frequency upper/lower limit is used to prevent mis-operation, machine damage, overheating due to too low operation frequency, and damage due to too high speed.

P6.25 Output Frequency Upper Limit:

- *This setting limits the maximum output frequency of the drive. When the drive frequency command or feedback control frequency is higher than this setting, the drive output frequency will be limited by the upper limit of output frequency.*
- *This parameter must be equal to or greater than the Lower Limit of Output Frequency (P6.26).*
- *If the Upper Limit of Output Frequency is 50Hz and the Maximum Output Frequency is 60Hz, then any Command Frequency above 50Hz will generate a 50Hz output from the drive.*
- *If the frequency output upper limit is 60Hz and frequency command is also 60Hz, the drive won't exceed 60Hz even after slip compensation. If the output frequency needs to exceed 60Hz, then increase output frequency upper limit or max operation frequency.*
- *When the drive enters into the function of slip compensation (P2.01) or PID feedback control, the drive output frequency may exceed the frequency command but still be limited by this setting.*
- *The Output Frequency is also limited by the Motor Maximum RPM (P0.04).*

P6.26 Output Frequency Lower Limit:

- *This setting limits the minimum output frequency of the drive. When the drive frequency command or feedback control frequency is lower than this setting, the drive output frequency will be limited by the lower limit of output frequency.*
- *This parameter must be equal to or less than the Upper Limit of Output Frequency (P6.25).*
- *When the drive starts, it will operate from min output frequency (P2.08, 2.12) and accelerate to the setting frequency. The starting ramp won't be limited by this parameter setting; it will only limit the minimum setpoint frequency.*
- *If the Lower Limit of Output Frequency is 10Hz, and the Minimum Output Frequency (P2.08, P2.16) is set at 5.0Hz, then any Command Frequency between 5~10 Hz will generate a 10Hz output from the drive. A Command Frequency of less than 5Hz will not result in an output from the drive.*
- *When the drive enters into the function of slip compensation (P2.01) or PID feedback control, the drive output frequency may exceed the frequency command but still be limited by this setting.*
- *When P2.18 is set to 2, and if the setting of P6.26 (Output Frequency Lower Limit) is higher than Motor Minimum Output Frequency (Mtr1=P2.08; Mtr2=P2.16), then the GS4 drive will run in accordance with the setting of P6.26 in V/Hz and SVC mode (P2.11).*

Related parameters: P0.04, P2.01, P2.08, P2.16, P2.18, P6.25

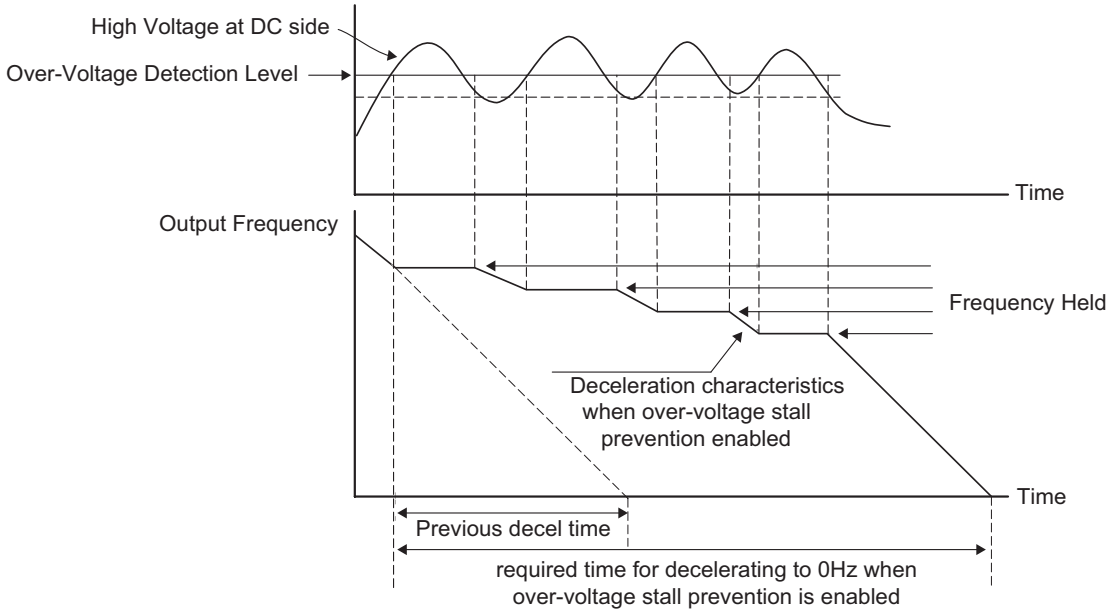
		Type	Hex Addr	Dec Addr
P6.27	**Over-Voltage Stall Prevention Level**	♦R/W	061B	41564
Range/Units (Format: 16-bit unsigned)		Default		
230V: 300.0~450.0 VDC		390.0		
460V: 600.0~900.0 VDC		780.0		

Sets the voltage level of the DC bus when overvoltage stall prevention is activated.

During deceleration, the DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled (Over-Voltage Stall Prevention P6.11=00), the drive will not decelerate further and will keep the output frequency constant until the voltage drops below the preset value again (P6.27).

This function is used if there is a potential for high load inertia. When stopping a normal load, an over-voltage won't occur during deceleration, and deceleration time will be followed. If the load has a high inertia, the GS4 drive may not stop the motor due to over-voltage during deceleration. During this situation drive will auto adjust the deceleration time until drive stops.

When the over-voltage stall prevention is enabled, drive deceleration time could be longer than the decel setting.



Related parameters: P1.29, P6.11, P6.12 (decel times: P1.02, P1.04, P1.06, or P1.08)

		Type	Hex Addr	Dec Addr
P6.28	**Dynamic Braking Voltage Level**	♦R/W	061C	41565
Range/Units (Format: 16-bit unsigned)		Default		
230V: 350.0~450.0 VDC		390.0		
460V: 700.0~900.0 VDC		780.0		

This parameter establishes the Dynamic Braking Voltage Level threshold based on the DC Bus voltage. With the drive running and with DC Bus voltage above the braking level threshold, the braking transistor internal to the drive is gated ON, connecting the external braking resistor across the DC Bus to dissipate the excess voltage as heat.

Refer to Appendix A, Accessories, for detailed information on braking resistors.

Parameter P6.28 is valid only for the models below 40hp for 460 series and 30hp for 230 series (unless a braking resistor is used, in which case larger model drives can be used). Larger GS4 models use external dynamic braking units (DBUs) to determine dynamic braking voltage level.

		Type	Hex Addr	Dec Addr
P6.29	**Line Start Lockout**	♦R/W	061D	41566
Range/Units (Format: 16-bit binary)		*Default*		
0: Enable start-up lockout 1: Disable start-up lockout		0		

Setting Explanations:

0: Enable. When this parameter is enabled, the GS4 drive will not start the motor when powered up with a RUN command already applied. The drive must see the RUN command change from STOP to RUN before it will start.

1: Disable. When this parameter is disabled, the GS4 drive will start the motor when powered up with a RUN command already applied.

When Safe Torque Off (STO) alarms STL1 or STL2 are activated, a power cycle is required to reset the drive. The drive will start on power up while performing this reset condition when P6.29 is set to 1.

		Type	Hex Addr	Dec Addr
P6.30	**Heat Sink OH Warning Level**	♦R/W	061E	41567
Range/Units (Format: 16-bit unsigned)		Default		
0.0~110.0 °C		105.0		

This parameter sets the temperature at which a warning will occur for heat sink monitoring.

If this parameter is set at 110.0°C and the GS4 drive temperature reaches 110.0°C, the drive will trigger an error and stop, instead of just warning. The heat sink FAULT level is 110°C and cannot be changed.

For Frame C and above, when IGBT temperature reaches (P6.30 setting minus 15°C), the heatsink fan will accelerate to the highest speed. When IGBT temperature is lower than (P6.30 setting minus 35°C), and capacitor temperature is lower than (OH2 capacitor warning level minus 10°C), the heatsink fan will return to its setting speed.

If this parameter is set lower than 35°C, the level will remain at 35°C.

IGBT and Capacitor Over-Heat Fault Levels* (°C)

Model # (230V)	***Frame Size***	***OH1 IGBT***	***OH2 Capacitor***		***Model # (460V)***	***Frame Size***	***OH1 IGBT***	***OH2 Capacitor***	
		CT & VT*	***CT****	***VT****			***CT & VT****	***CT****	***VT****
GS4-21P0	A	110	95	90	GS4-41P0	A	110	95	90
GS4-22P0			100	95	GS4-42P0			100	95
GS4-23P0					GS4-43P0			105	100
GS4-25P0					GS4-45P0			100	95
GS4-27P5	B				GS4-47P5				
GS4-2010			80	75	GS4-4010	B	105	80	75
GS4-2015					GS4-4015				
GS4-2020	C				GS4-4020				
GS4-2025		105			GS4-4025	C		85	80
GS4-2030					GS4-4030				
GS4-2040	D		75	70	GS4-4040				
GS4-2050			65	55	GS4-4050	D0	110	65	55
GS4-2060	E	110			GS4-4060		105		
GS4-2075					GS4-4075	D			
GS4-2100					GS4-4100				
					GS4-4125	E	110		
					GS4-4150				
					GS4-4175	F			
					GS4-4200				
					GS4-4250	G			
					GS4-4300			70	60

** The over heating warning levels for OH1 and OH2 are 5°C less than the listed fault temperatures.*
CT = Constant Torque (normal duty).
VT = Variable Torque (light duty).

Related parameters: P6.39 & P6.40 determine the Motor Overheating Level (OH3)

		Type	Hex Addr	Dec Addr
P6.31	**Cooling Fan Control**	♦R/W	061F	41568
Range/Units (Format: 16-bit binary)		*Default*		
0: Always ON (Fan is always ON.) 1: Fan OFF 1 minute after Stop 2: Run fan ON / Stop fan OFF (Fan is ON when drive runs; fan turns OFF when drive stops.) 3: Heat sink temperature (Fan turns ON when preliminary heat sink temperature (around 60°C) is attained.) 4: Always OFF (Fan is always OFF.)		0		

		Type	Hex Addr	Dec Addr
P6.32	**PWM Fan Speed**	R/W	0620	41569
Range/Units (Format: 16-bit unsigned)		*Default*		
0~100%		60		

Adjusts the speed of the internal cooling fan.

Fan speed settings have no effect on smaller-frame GS4 drives with ON/OFF fan control. In these smaller frame sizes, the fan speed setting is ignored and the fan is either ON or OFF.

Fan Control:

230V model GS4-2015 and smaller: ON/OFF switch control
230V model GS4-2020 and larger: PMW control

460V model GS4-4020 and smaller: ON/OFF switch control
460V model GS4-4025 and larger: PMW control.

		Type	Hex Addr	Dec Addr
P6.33	**Drive Derating Method**	R/W	0621	41570
Range/Units (Format: 16-bit binary)				*Default*
0: Constant rated current (reduce carrier frequency)				0
1: Constant carrier frequency (limit load current)				
2: Constant rated current (same as setting 0, but with higher current limit)				

Setting 0: Constant rated current

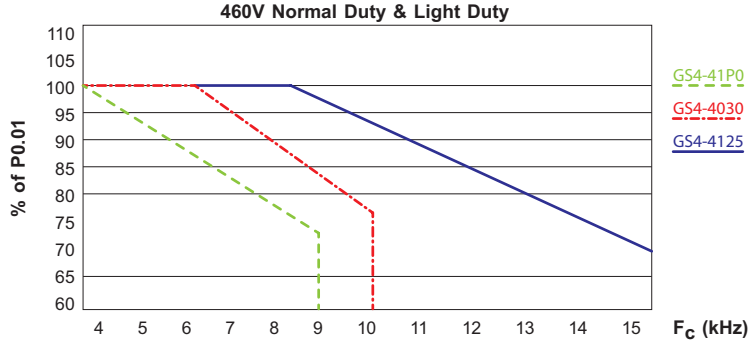
The rated current is constant, the PWM carrier frequency (F_C) output of the GS4 drive will auto decrease according to temperature, overload output current, and time. If an overload situation is not frequent and a constant carrier frequency is not a must, then setting 0 is the best option. The main drawback to reducing the carrier frequency is that you may hear some audible noise in the motor. The carrier frequency will change only during short overload situations in order to try to mitigate the overload current. The OL time at any point along the curve is for 1 minute.

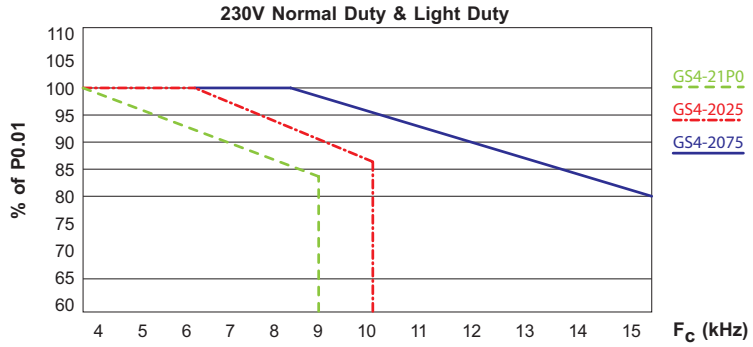
Example 1:

Refer to the following diagram for the auto carrier frequency level at various current levels.

- *GS4-41P0 drive wired 460V set for normal duty, surrounding temperature 50°C with independent installation and UL open-type.*
- *Motor rated current (P0.01) = 100% of drive rated current.*

When the carrier frequency is set to 15kHz, it corresponds to 72% rated output current. When current demand is higher the carrier frequency will automatically decrease to the frequency required in order to supply current demand. If the current demand increases to 83% rated current then the carrier frequency will auto-decrease to 12kHz. This setting will also auto decrease the carrier frequency during an overload condition.





Example 2:

- *Max motor rated current (P0.01) is 120% of the drive's rated current.*
- *Carrier frequency is 15kHz.*

The current is limited to (120%)(72%) = 86% of the drive's rated current for one minute. After one minute the carrier frequency will decrease to the factory setting of 4kHz.

Setting 1: Constant carrier frequency

The carrier frequency is fixed and will not change. The drive will not adjust the PWM carrier frequency; it will only shorten the OL trigger time. The OL time at any point along the curve is for one minute.

Example: Refer to the previous diagram for the current derating percent.

- *GS4-41P0 drive set for normal duty.*

The carrier frequency is a constant 15kHz resulting in the rated current being decreased to 72%. The drive will activate OL protection when the current is (120%)(72%) = 86% for one minute.

Setting 2: Constant rated current

The protection method and current reduction actions are the same as setting 0, except that the drive implements the (% of P0.01)(160% of output current) for normal duty, and the (% of P0.01) (130% of output current) for light duty.

The advantage is that the drive can provide higher output current due to a higher current limit than the factory setting according to the carrier frequency curve. The disadvantage is that the drive decreases the carrier frequency quicker and more often when sensing an overload.

NOTE: Air flow, ventilation, and temperature derating information can be found in Chapter 1: Getting Started and Chapter 2: Installation and Wiring.

NOTE: Additional carrier frequency derating information can be found in Chapter 1: Getting Started.

NOTE: Use this parameter (P6.33) for frequency derating of the GS4 drive when P2.10 (PWM Carrier Frequency) is higher than the factory setting.

NOTE: Refer to P2.10 and P6.34. When setting P6.34 the value in P2.10 changes.

		Type	Hex Addr	Dec Addr
P6.34	***Variable/Constant Torque Duty Selection***	♦R/W	0622	41571
Range/Units (Format: 16-bit binary)		*Default*		
0: VT, 3-phase input (light duty) 1: CT, 3-phase input (normal duty) 2: CT, 230V 1-phase input (normal duty)		0		

- *When working with P6.33 (Drive Derating Method), and P6.34 (VT/CT Duty Selection), refer to P2.10 (PWM Carrier Frequency) for the carrier frequency setting. When P6.34 is set, it will change P2.10. P6.00/P6.02 (Electronic Termal O/L Relay) must be set independently.*
- *Refer to model# specifications (P9.42 & P9.33) for the drive model and rated current.*

Setting 0: VT, 3-phase input (light duty)

When the output current is 110% of the rated output current, the maximum run time is 60 seconds. When the output current is 130% of the rated output current, the maximum run time is 3 seconds.

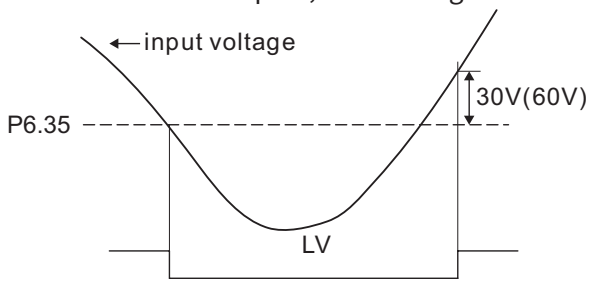
Settings 1 & 2: CT (normal duty)

When the output current is 120% of the rated output current, the maximum run time is 60 seconds. When the output current is 160% of the rated output current, the maximum run time is 3 seconds.

NOTE: When P6.34 is set, it can change P2.10 (PWM Carrier Frequency); refer to P2.10.

P6.35	Low Voltage Level	Type	Hex Addr	Dec Addr
		♦R/W	0623	41572
Range/Units (Format: 16-bit unsigned)		Default		
230V Frame <E: 150.0~220.0 VDC		180.0		
230V Frame ≥E: 190.0~220.0 VDC		200.0		
460V Frame <E: 300.0~440.0 VDC		360.0		
460V Frame ≥E: 380.0~440.0 VDC		400.0		

This parameter is used to set the low voltage level. When the drive is in a low input voltage sag, the drive will coast the motor to a stop. The drive will start the motor again once the input voltage reaches 30 volts higher than P6.35 for 230V inputs, and 60V higher for 460V inputs.



P6.36	OC Stall Prevention Accel/Decel Time Selection at Normal Speed	Type	Hex Addr	Dec Addr
		♦R/W	0624	41573
Range/Units (Format: 16-bit binary)		Default		
0: Follow System Accel/Decel Time (the accel/decel time currently selected for the drive)		0		
1: Follow the 1st Accel/Decel Time				
2: Follow the 2nd Accel/Decel Time				
3: Follow the 3rd Accel/Decel Time				
4: Follow the 4th Accel/Decel Time				
5: Auto Accel/Decel				

Used to follow the Accel/Decel Time Selection (P1.01~1.08) when Over-Current Stall prevention (P6.21) occurs at normal speed.

P6.37	OC Stall Prevention Limit for Operation Over Rated Speed	Type	Hex Addr	Dec Addr
		♦R/W	0625	41574
Range/Units (Format: 16-bit unsigned)		Default		
0~100%		50		

This parameter is used when operation frequency is greater than P0.02 and P0.13 Motor Base Frequency.

Example: When P6.20=150%, P6.21=100%, and P6.37=80%, then:

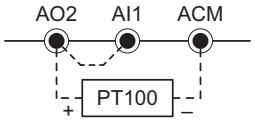
- *Stall Prevention Level during Accel over motor base frequency = P6.20 x P6.37 = 150% x 80% =120%.*
- *Stall Prevention Level at constant speed over motor base frequency = P6.21 x P6.37 = 100% x 80% = 80%.*

P6.38	Torque Limit (Current Limit)	Type	Hex Addr	Dec Addr
		♦R/W	0626	41575
Range/Units (Format: 16-bit unsigned)		Default		
0~200% (of drive's rated current)		150		

This parameter sets the maximum current output of the drive.

P6.39~P6.44 PTC/RTD(PT100) Parameters

Parameters P6.39~P6.44 define how the drive protects the motor when either a PT100 RTD or a PTC is used to monitor motor temperature. An analog output is used to supply current through the temperature detecting device and an analog input is used to measure the voltage generated. From the known excitation current and the measured voltage, the resistance of the device can be calculated.



For an RTD, this resistance can be used to look up the corresponding temperature (PT100 has a standard resistance/degree chart).

A PTC has a very abrupt change to its resistance/degree. PTCs are ordered based on the temperature where this abrupt change occurs. Below the switching threshold, the PTC will have very little resistance (could be ≈100Ω, depending on PTC). At the switching threshold, the resistance increases dramatically (the resistance increases by ≈1MΩ over an ≈20°C increase in temperature).

RTD(PTD100) vs. PTC Characteristics

- *An RTD(PTD100) can give you fairly accurate feedback of the motor temperature.*
- *A PTC can only tell you if the motor temperature has passed the PTC's switching temperature (set during PTC manufacturing).*

Examples of how to set up each type of sensor follow P6.44.

		Type	Hex Addr	Dec Addr
P6.39	**PTC/RTD Detection Selection**	♦R/W	0627	41576
Range/Units (Format: 16-bit binary)		*Default*		
0: Warn and Run		0		
1: Warn and Ramp Stop				
2: Warn and Coast Stop				
3: No Warning				

For PTC (Positive Temperature Coefficient) operation (analog input = #6, PTC Thermistor), this parameter defines the behavior of the drive when the PTC thermistor on the motor gets too hot as defined by P6.40.

For PT100 RTD (P4.02, P4.03, or P4.04 Analog Input = #11 PT100 input), this parameter defines the behavior of the drive when the RTD on the motor gets too hot as defined by P6.41 and P6.42.

Related parameters: P6.39~P6.44; *refer to further information following P6.44*.

		Type	Hex Addr	Dec Addr
P6.40	**PTC Level**	♦R/W	0628	41577
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~100.0%		50.0		

This parameter sets the PTC trip level. The corresponding value for 100% is the maximum analog input value. For most applications, a value of 50% will work.

The PTC will allow current to pass freely until the temperature reaches the PTC's switching point. When the PTC resistance starts to change, it changes rapidly. A 70°C PTC may stay at ≈100Ω until it reaches 70°C. At that point, the resistance will jump up to >1MΩ. (This will cause the analog voltage input to jump well over the 50% default level set in P6.40).

- *For PTC faults to work, PT Drop Freq (P6.43) must be = 0.*
- *One of the analog input functions (P4.02~P4.04) needs to be set to 6 (PTC thermistor input value).*
- *P6.40 must be >0.*

Related parameters: P6.39~P6.44; *refer to further information following P6.44*.

		Type	Hex Addr	Dec Addr
P6.41	**RTD (PT100) Level 1, PTC Level Detection Selection**	R/W	0629	41578
Range/Units (Format: 16-bit unsigned)		Default		
0.000~10.000V*		5.000		

*RTD Level 1 must be set lower than RTD Level 2.

The analog input voltage that triggers Level 1 RTD warning (oH3 Motor Overheat).

- *Works with P6.44 RTD Treatment Delay Time.*

Related parameters: P6.39~P6.44; *refer to further information following P6.44 (page 4–144).*

		Type	Hex Addr	Dec Addr
P6.42	**RTD (PT100) Level 2, PTC Level Detection Selection**	R/W	062A	41579
Range/Units (Format: 16-bit unsigned)		Default		
0.000~10.000V*		7.000		

*RTD Level 2 must be set higher than RTD Level 1.

The analog input voltage that triggers Level 2 RTD Fault (oH3 Motor Overheat-PTC).

- *This fault is instantaneous (does NOT use P6.44 RTD Treatment Delay Time).*

Related parameters: P6.39~P6.44; *refer to further information following P6.44 (page 4–144).*

		Type	Hex Addr	Dec Addr
P6.43	**RTD (PT100) Drop Frequency for PT100 Level 1**	R/W	062B	41580
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		0.00		

The frequency that the drive will "drop" to when P6.41 RTD Level 1 is reached (after P6.44 Delay Time).

When the temperature drops below P6.41, the drive will not return to the original Frequency Command (P4.00, P4.01) until the P6.44 RTD Delay has timed out.

- *When P6.43=0.00Hz, the RTD fault function is disabled.*
- *When P6.43≠0, the PTC faults are disabled.*
- *(Only one temp monitoring type can be active.)*

Related parameters: P6.39~P6.44; *refer to further information following P6.44 (page 4–144).*

		Type	Hex Addr	Dec Addr
P6.44	**RTD (PT100) Treatment Delay Time**	R/W	062C	41581
Range/Units (Format: 16-bit unsigned)		Default		
0~6000 sec		60		

The Delay Time is how long after crossing Level 1 (P6.41) that the Level 1 Frequency Protection (P6.43) is initiated. The delay time is also applicable to when the temperature is cooling and passes Level 1 again. The frequency protection will not turn off until the delay time has passed.

Related parameters: P6.39~P6.44; *refer to further information following P6.44 (page 4–144).*

P6.39~P6.44 Settings Summary for P6.39~P6.44 for PTC and RTD (PT100) Operation

Explanation for P6.39~P6.44:

P6.43 = 0 enables PTC protection and disables both RTD level alarms. If P6.43>0 and the PT100 goes above Level 1, the drive output will drop to P6.43 after the delay time. If the PT100 level goes above Level 2, the drive will fault according to the setting of P6.39.

P6.39 changes behavior for PTC faults and for Level 2 PT100 faults; P6.39 does *not* affect Level 1 PT100 warnings.

P6.44 Delay only affects the Level 1 PT100 fault. Level 2 fault is instant.

PTC and RTD (Resistance Temperature Detector) Operation

The PTC/RTD (voltage) input can come into AI1, AI2, or AI3. Whichever input is selected, it must be switched and selected for 0~10V input. AO2 will provide the fixed excitation current. (See next page for wiring info.)

1) Choose **only one** of the one of the following **analog voltage inputs** to configure for the PTC or RTD (PT100) input:
   a) AI1: Place SW3 on the terminal board to the 0~10V position (sets AI1 = 0~10V input).
      i) P4.02=6 (AI1 Function = PTC input).
         OR
         P4.02=11 (AI1 Function = RTD PT100 input).
      ii) P4.05=0 (AI1 I/V Selection = 0~10V).

      OR

   b) AI2: Place SW4 on the terminal board to the 0~10V position (sets AI2 = 0~10V input).
      i) P4.03=6 (AI2 Function = PTC input).
         OR
         P4.03=11 (AI2 Function = RTD PT100 input).
      ii) P4.06=0 (AI2 I/V Selection = 0~10V).

      OR

   c) AI3: AI3 is 0~10V only, so no hardware switch requires setting.
      i) P4.04=06 (AI3 Function = PT100 input).
         OR
         P4.04=11 (AI3 Function = RTD PT100 input)
2) Set P4.54=13 (AO2 to constant current output). Switch SW2 to 0~20mA/4~20mA on the I/O control terminal block (sets AO2 to 0~20mA/4~20mA).
3) Set P4.57 = 0. This sets AO2 to use 0~20mA output (instead of 4~20mA).
4) P4.61 is for adjusting the constant voltage or constant current of AO2. Set constant current output to 9mA by setting P4.61=45. The AO2 constant output current is 20mA x 45% = 9mA. This is the recommended setting for PTC or RTD(PT100) use. Any effect of RTD self-heating at the 9mA excitation level will be insignificant.

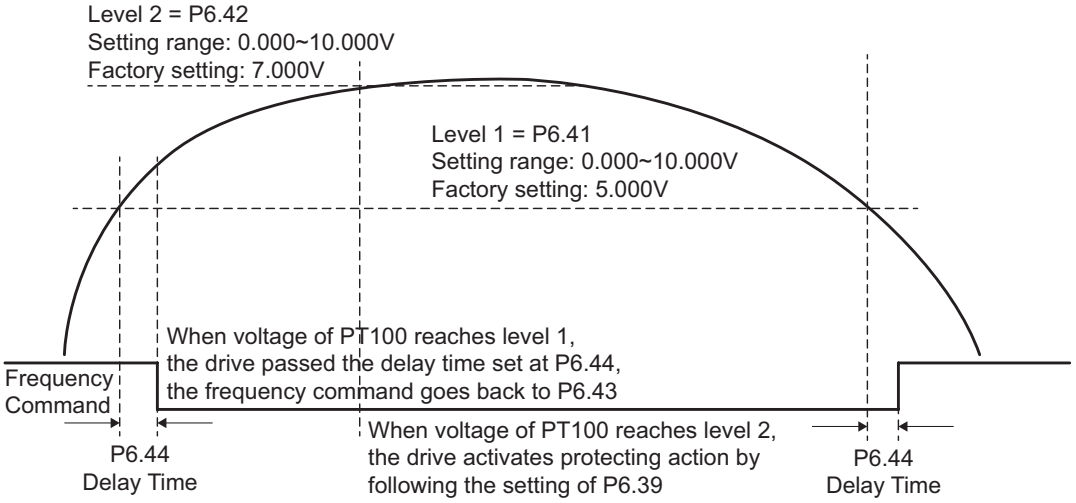
5) Settings for Temperature Sensors:

a) *Settings for **RTD (PT100)** Operation:*

Set The trip levels (P6.41, P6.42), drop frequency P6.43, and delay time P6.44.
P6.41 and P6.42 must be set to appropriate levels (in volts) to protect the motor. NEMA motor insulation is graded by how hot it can get without damage. P6.41 and P6.42 should be set to protect the motor.

NEMA Motor Design	*Max Insulation Temperature (1.0 SF)*	*Typically Protect at Temperature*	*Ohms (from table*)*	*AI Volts (P6.41,42) with AO2=9mA*
A	105°C	90°C	134.71	1.21 V
B	130°C	110°C	142.29	1.28 V
F	155°C	135°C	151.71	1.36 V
H	180°C	155°C	159.19	1.43 V
*Table lookup for PT100 Temperature/Resistance chart (coefficient = 0.00385): http://www.pyromation.com/Downloads/Data/385_c.pdf				

As you can see, P6.41 and P6.42 can be set with values similar to the "AI Volts" column. Please check your motor documentation for maximum allowable temperature. Reduce the trip levels by several degrees to allow for hot spots within the motor and to extend motor insulation life (motor life decreases when subjected to high temperatures).
If using an RTD, P6.42 must be > P6.41. Also, P6.43 must be >0. If you do not want to use a drop frequency, you still must enter a non-zero value into P6.43. To bypass the drop frequency, set P6.42 to 0.001V > P6.41. This setting will ensure that the P6.41 oH3 **fault** occurs instead of the P6.42 oH3 **warning**.
There are two types of action levels for RTD (PT100), as shown below:



b) *Settings for **PTC** Operation:*

Set P6.40 to 50%. This setting will work with most PTCs. When 9mA is pushed through the PTC at low temperature (low resistance), the resulting voltage will be very low (usually around 1V). When the temperature goes above the PTCs switching temperature, the resistance will increase exponentially. AO2 will not be able to push 9mA through the PTC, but it will increase its output voltage to the maximum 10V. That 10V will be read by the Analog input as 100%, triggering the Motor Overheat fault oH3. The only variable when using a PTC is selecting the appropriate temperature (the PTC's switching temperature is defined during manufacturing).

Example for P6.39~P6.44 with RTD (PT100):

An RTD (PT100) is installed to the drive. If motor temperature reaches 135°C (275°F) or higher, the drive will decrease motor frequency to the setting of P6.43 (Level 1 Frequency Protection). Motor will operate at this frequency until the motor temperature decreases to 135°C (275°F) or lower. If the motor temperature exceeds 150°C (302°F), the motor will decelerate to stop and output an 'oH3' fault. (oH3 warning is immediate for Level 2; there is the delay for oH# warning when temp reaches Level 1.)

Set up process:

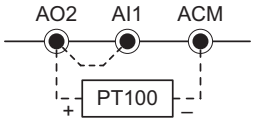
1) Switch AO2 (SW2) to 0/4~20mA on the I/O control terminal block.
   (Control terminal details are shown in Chapter 2, Installation and Wiring.)

   Wiring:

   Connect the RTD (+) wire and sense wire to terminal AO2 (for 3-wire RTDs, connect both positive leads to AO2).

   Connect the RTD (-) wire to terminal ACM.

   Jumper terminals AO2 and AI1 together to form a short-circuit.



2) Referring to manufacturer's applicable RTD temperature and resistance comparison table:
   a) Level 1: Desired Temperature = 135°C
   b) Level 1: Corresponding Resistance = 151.71Ω
   c) Level 1: Voltage at 9mA ≈ 1.37VDC [Volts = (Ohms)(Amps)]
   d) Level 2: Desired Temperature = 150°C
   e) Level 2: Corresponding Resistance = 157.33Ω
   f) Level 2: Voltage at 9mA ≈ 1.42VDC
3) Set the following parameters:
   a) P4.02=11 (Analog Input 1 Function = RTD PT100)
   b) P4.54=13 (Analog output 2. This will be constant current when switch AO2 is set to 0~20mA)
   c) P4.61=45% (AO2 output constant level = 20mA x 0.45 = 9mA)
   d) P4.57 = 0 (AO2 mA Select = 0~20mA)
   e) P6.41=1.37 (RTD Detect Level 1)
   f) P6.43=10Hz (PT100 Drop Frequency)
      Set P6.44 to the desired delay time (for RTD Level 1 activation)
      When the RTD temperature increases to 135°C or higher, the drive will decelerate to the selected frequency and display an oH3 warning.
4) P6.42=1.42 (RTD Detect Level 2)
5) P6.39=1 (warning and ramp to a stop)
   When the RTD temperature increases to 150°C or higher, the drive will ramp to a stop and displays an 'oH3' fault.

If you prefer to not use the drop frequency, set P6.41 to 0.001V less than P6.42. In this example, P6.41 would be set to 1.419V

Example for P6.39~P6.44 with PTC:

A PTC is installed to the drive. If the motor temperature exceeds 150°C (302°F), the motor will decelerate to stop and output an 'oH3' fault.

Set up process:

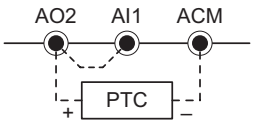
1) Switch AO2 (SW2) to 0/4~20mA on the I/O control terminal block.
   (Control terminal details are shown in Chapter 2, Installation and Wiring.)

   Wiring:

   Connect the PTC (+) wire to terminal AO2 (for 3-wire PTCs, connect both positive leads to AO2).

   Connect the PTC (-) wire to terminal ACM.

   Jumper terminals AO2 and AI1 together to form a short-circuit.



2) Choose a PTC with the appropriate switching temperature (150 deg C in this example).
3) Set the following parameters:
   a) P4.02=6 (Analog Input 1 Function = PTC)
   b) P4.54=13 (Analog output 2. This will be constant current when switch AO2 is set to 0~20mA)
   c) P4.61=45% (AO2 output constant level = 20mA x 0.45 = 9mA)
   d) P4.57=0 (AO2 mA Select = 0~20mA)
   e) P6.41=1.37 (PTC Detect Level)
   f) P6.40=50% (this PTC Level will work for most PTCs)
4) P6.39=1 (warning and ramp to a stop)
   When the RTD temperature increases to 150°C or higher, the drive will ramp to a stop and displays an 'oH3' fault.

		Type	Hex Addr	Dec Addr
P6.45	**Output Phase Loss (OPhL) Detection Selection**	R/W	062D	41582
Range/Units (Format: 16-bit binary)		Default		
0: Warn and continue to operate 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning		3		

This parameter defines the behavior of the drive if there is a phase loss on the output of the drive. P6.45~P6.48 are parameters for output phase loss. When the motor's current is less than the current level in P6.47 and is longer than the time set in P6.46, the result will be seen as output phase loss. An error message OPHL will be shown on the keypad.

- *When P6.45≠3, OPhL Detection is enabled.*
- *When P6.45=3, all OPhL parameters are disabled (P6.45~P6.48).*

Related parameters: P6.45~P6.48; refer to further information following P6.48 (page 4–149).

		Type	Hex Addr	Dec Addr
P6.46	**Output Phase Loss Detection time**	R/W	062E	41583
Range/Units (Format: 16-bit unsigned)		Default		
0.000~65.535 sec		0.500		

This setting will determine the time lapsed from when an output phase loss is detected to when the action selection is initiated in P6.45.

Related parameters: P6.45~P6.48; refer to further information following P6.48 (page 4–149).

		Type	Hex Addr	Dec Addr
P6.47	**Output Phase Loss Current Detection Level**	R/W	062F	41584
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00% (of max current)		1.00		

This parameter sets the Level of Detection for OPhL monitoring.

Related parameters: P6.45~P6.48; refer to further information following P6.48 (page 4–149).

		Type	Hex Addr	Dec Addr
P6.48	**Output Phase Loss DC Injection Brake (DCI) Time**	R/W	0630	41585
Range/Units (Format: 16-bit unsigned)		Default		
0.000~65.535 sec		0.000		

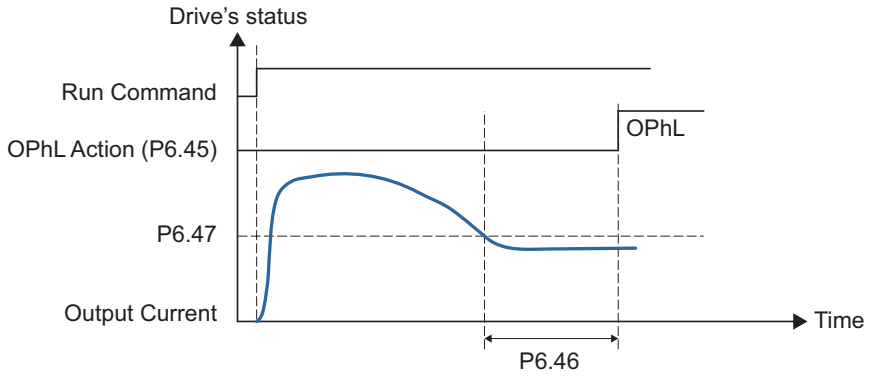
When this parameter is 0, the OPhL DCI Brake function is disabled. When P6.48 >0, the DCI brake current will be monitored against (20)x(P6.47 level). The drive will trigger an OPhL fault If any phase falls below the (20)x(P6.47 level) for a time period of (P6.48)/(2).

Related parameters: P6.45~P6.48; refer to further information following P6.48 (page 4–149).

P6.45~P6.48: Output Phase Loss (OPhL) Summary for P6.45~P6.48

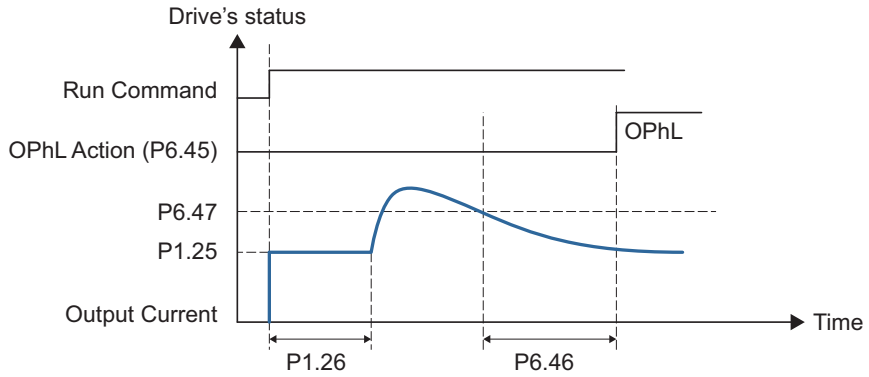
Condition 1: Drive is running; P6.48=0

The drive will perform the action selected in P6.45 if any phase is less than P6.47 (Output Phase Loss Current Detection Level Bandwidth) and exceeds P6.46 (Output Phase Loss Detection Time).



Condition 2: Using standard DC Current Injection Braking; Drive stopped; P6.48=0; P1.26≠0 sec (DCI Time during Start-up)

After drive starts, DC Injection braking will be applied according to P1.25 (DCI Current Level) and P1.26 (DCI Time During Start-up). During this period, OPhL detection will not be monitored. After DCI braking time is complete, the drive will start to run and then monitor the OPhL protection as mentioned in condition 1.

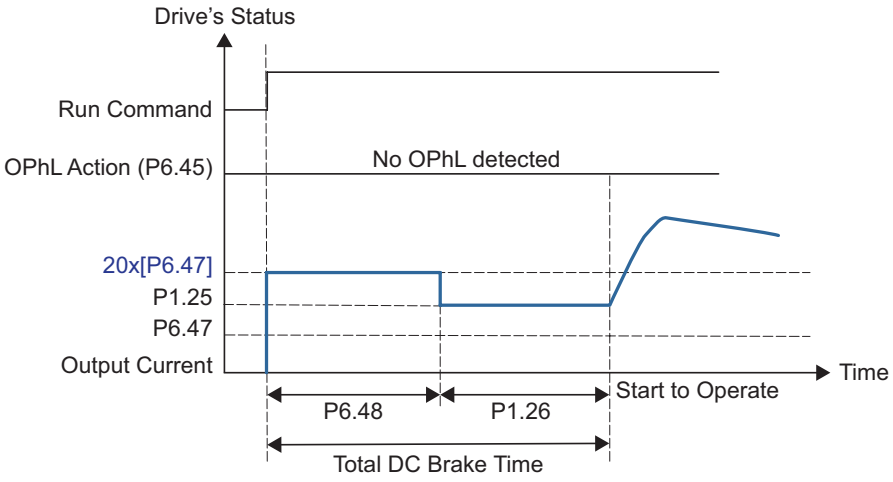


Condition 3: Using OPhL DC Current Injection Braking and Standard DC Current Injection Braking; Drive is stopped; P6.48≠0 ; P1.26≠0 (DCI Time during Start-up)

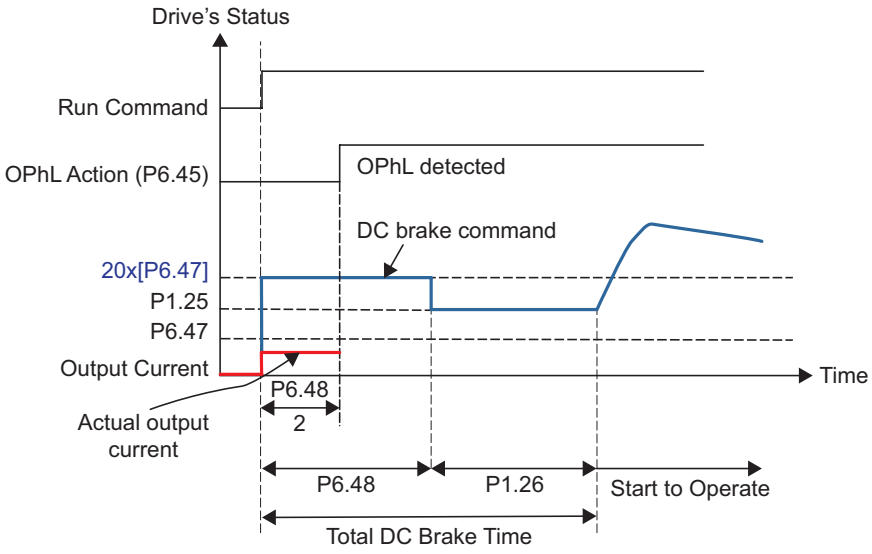
When the drive starts, it will apply DCI injection for time period P6.48 and then P1.26. DC brake current level in this condition includes two parts, one is 20 times the P6.47 setting for the duration of the P6.48 setting time, and the P1.25 setting value for the P1.26 time. Total DC brake time is T=P6.48+P1.26.

In this period, if an OPhL happens, the drive starts to count until P6.48/2 elapses, the drive then performs the actions set in P6.45.

Condition 3-1: P6.48≠0, P1.26≠0 (No OPhL detected before operation)



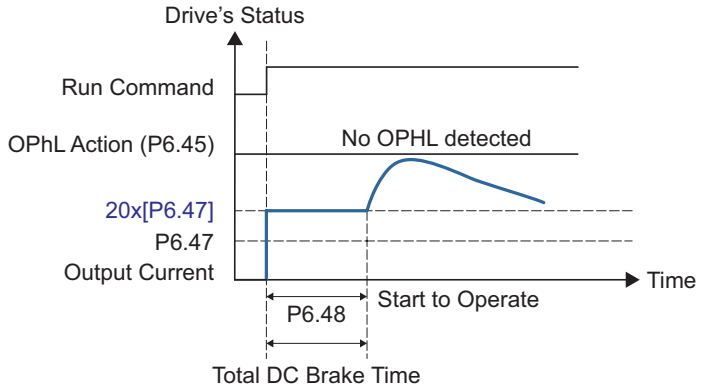
Condition 3-2: P6.48≠0, P1.26 ≠ 0 (OPhL detected before operation)



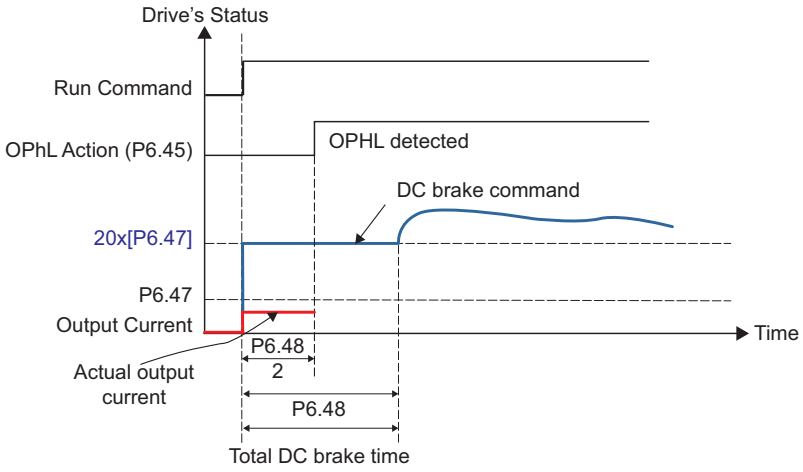
Condition 4: Using OPhL DC Current Injection Braking; Drive stopped; P6.48≠0; P1.26=0

When the drive starts, it will utilize P6.48 as a DC brake. The DC brake current level is 20 times that of the P6.47 value. In this period, if an OPhL happens, the drive starts to count until P6.48/2, the drive will then follow the setting of P6.45.

Condition 4-1: P6.48≠0, P1.26=0 (No OPhL detected before operation)



Condition 4-2: P6.48≠0, P1.26=0 (OPhL detected before operation)



		Type	Hex Addr	Dec Addr
P6.49	**Input Phase Loss Treatment (OrP)**	R/W	0631	41586
Range/Units (Format: 16-bit binary)		Default		
0: Warn and ramp to stop 1: Warn and coast to stop		0		

Over ripple protection.

To prevent damage to the capacitors from overheating due to an input phase loss, the drive will monitor the input phases. This is done by monitoring the DC bus ripple amplitude and frequency. The detection time is related to the output current shown below.

Current (%)	50	75	120	150	200
Time (seconds)	432	225	60	32	15

When the input voltage is greater than the setting in P6.70 for the time determined in the table above, this situation is seen as an input phase loss. An error message OrP will be shown on the keypad.

Related parameters: P6.69, P6.70

		Type	Hex Addr	Dec Addr
P6.50	**GFF Detect Current Level (% of INV I-Rated)**	R/W	0632	41587
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0% (% of drive rated current)		60.0		

The Ground Fault Filter (GFF) level is a user settable level of output current difference between phases that can be tolerated within the time frame specified in P6.51.

		Type	Hex Addr	Dec Addr
P6.51	**GFF Low Pass Filter Gain**	R/W	0633	41588
Range/Units (Format: 16-bit unsigned)		Default		
0.00~655.35 seconds		0.10		

When the drive detects the unbalanced three-phase output current that is higher than the setting of P6.50 for the time specified in P6.51, GFF protection will be activated. The drive will stop at this point.

		Type	Hex Addr	Dec Addr
P6.52	**Low Current Level**	R/W	0634	41589
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0%		0.0		

Percentage of drive's rated current that will trigger the action selected in P6.54 if the current is below P6.52 for the time specified in P6.53. An under-current fault (uC) will occur if enabled.

		Type	Hex Addr	Dec Addr
P6.53	**Low Current Detection Time**	R/W	0635	41590
Range/Units (Format: 16-bit unsigned)		Default		
0.00~360.00 sec		0.00		

The current must be greater than the setting in P6.52 before the time limit specified in P6.53 elapses or else the action selected in P6.54 will be initiated. An under-current (uC) will occur if enabled.

		Type	Hex Addr	Dec Addr
P6.54	**Low Current Action**	R/W	0636	41591
Range/Units (Format: 16-bit binary)		Default		
0: Disable, no warning 1: Warn and coast to stop 2: Warn and ramp to stop by 2nd decel time 3: Warn and continue operation		0		

This parameter selects the action associated with Low Current parameters P6.52~P6.54.

		Type	Hex Addr	Dec Addr
P6.55	**Fire Mode**	R/W	0637	41592
Range/Units (Format: 16-bit binary)		Default		
0: Disable 1: Forward Operation 2: Reverse Operation		0		

This parameter needs to work with multi-input terminal functions #40 or #41 (P3.03~P3.11, page 4–63), and multi-output terminal functions #45 and #46 (P3.17~P3.26, page 4–70). Two digital inputs cannot be set to functions 40 and 41; only one input function can be selected. If there is a machine or building fire, this setting allows the drive to operate as configured in P6.55~P6.60 regardless of most drive faults and safety settings. After Fire Mode has been initiated, the drive must be reset in order for normal control to resume.

Setting Explanations:

0: Fire mode is disabled

1: Motors will operate in the Fwd direction when there is a fire.

2: Motors will operate in the Rev direction when there is a fire.

Related parameters: P6.55~P6.60

		Type	Hex Addr	Dec Addr
P6.56	**Fire Mode Operation Frequency**	R/W	0638	41593
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		60.00		

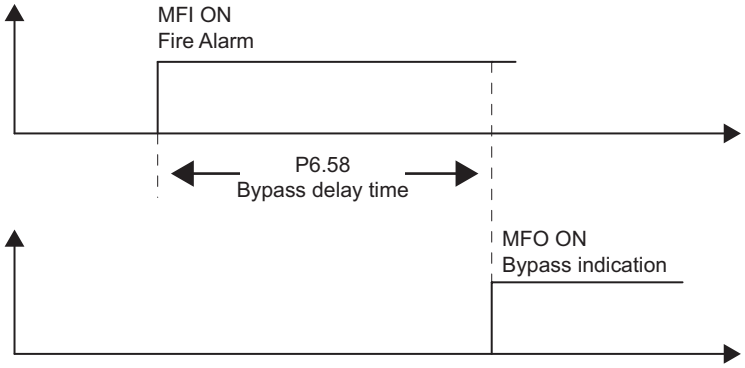
This parameter sets up the drive's output frequency when fire mode is activated by setting a multi-function input to 40 or 41 (P3.03~P3.11, page 4–63).

Related parameters: P6.55~P6.60

		Type	Hex Addr	Dec Addr
P6.57	**Fire Mode Enable Bypass**	R/W	0639	41594
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable Bypass 1: Enable Bypass		0		

The settings of P6.57~P6.60 decide whether to switch motors to operation on line power.

Bypass Function Sequence Diagram:



Conditions required to enable the bypass function:

P6.57 must be set to 1 (enable Bypass), and one of the following two conditions must be met:

1) *During Fire Mode operation if certain faults occur, and the set time elapses according to the time setting of P6.58, then the bypass function will be activated. MFO bypass indication will be ON (one of the outputs P3.17~P3.26 must be set to function #46).*
   Only certain types of faults can be bypassed in Fire Mode; the bypass function cannot bypass every particular fault. The list of fault codes, including which faults can and cannot be automatically bypassed in Fire Mode, is shown in the "Fault Codes Table" in Chapter 6: Maintenance and Troubleshooting.
2) *During Fire Mode operation if there is an fault on auto-reset, and the number of time to auto-reset remains zero or the fire alarm rings according to the time setting of P6.58, then the bypass function will be activated. MFO bypass indication will be ON. If the auto reset is successful before the bypass function is enabled, then the bypass delay counter will return to zero to wait for next trigger.*

Related parameters: P6.55~P6.60

NOTE: The Bypass timer will be reset when the Fire Alarm input turns OFF (or when the fault condition that forces Bypass is cleared - see parameters P6.59 and P6.60).

		Type	Hex Addr	Dec Addr
P6.58	**Fire Mode Bypass Delay Time**	R/W	063A	41595
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~6550.0 sec		0.0		

Delay time from when Fire Mode is triggered to when Fire Mode Bypass is activated.

Related parameters: P6.55~P6.60

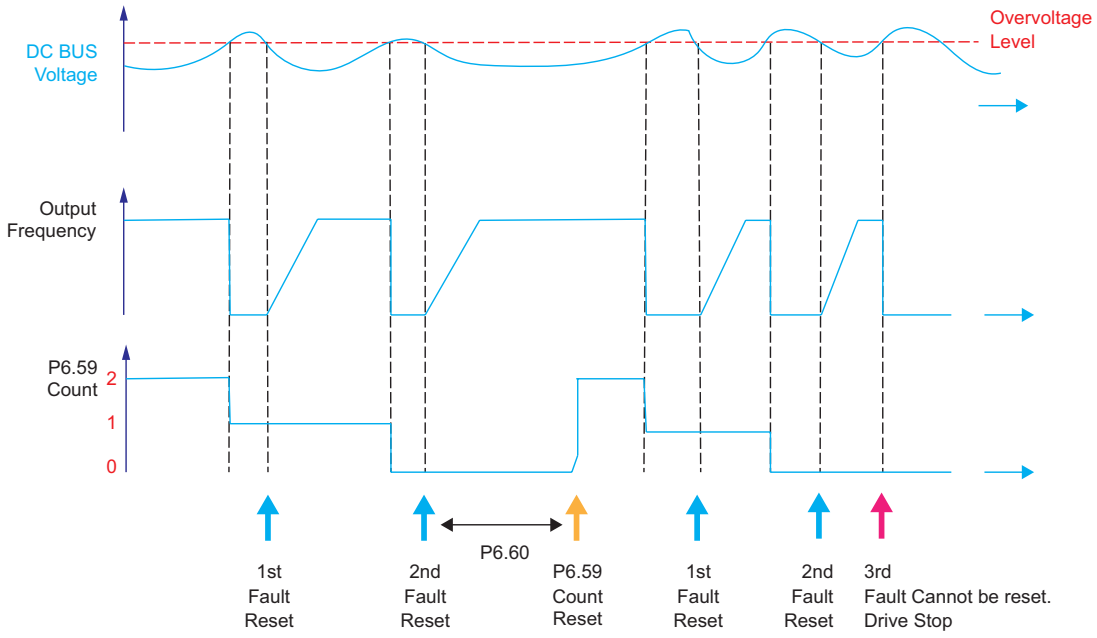
P6.59	Fire Mode Auto Restart Counter	Type	Hex Addr	Dec Addr
		R/W	063B	41596
	Range/Units (Format: 16-bit unsigned)	Default		
	0~10	0		

The number of times that a fault can be automatically reset within the time specified in P6.60. The drive will stop if number of faults exceeds P6.59 within time prescribed in P6.60. Applies only when in Fire Mode.

Related parameters: P6.55~P6.60

P6.60	Fire Mode Auto Restart Counter Reset Time	Type	Hex Addr	Dec Addr
		R/W	063C	41597
	Range/Units (Format: 16-bit unsigned)	Default		
	0.0~6000.0 sec	60.0		

The length of time that the P6.59 count can be reset during this time period. If the fault count exeeds the value set in P6.59, the drive will coast to a stop instead of automatically resetting. Applies only when in Fire Mode.



Related parameters: P6.55~P6.60

		Type	Hex Addr	Dec Addr
P6.61	**Decel Energy Backup (DEB) Decel Selection**	♦R/W	063D	41598
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable 1: 1st Decel Time 2: 2nd Decel Time	3: 3rd Decel Time 4: 4th Decel Time 5: Current Decel Time 6: Auto Decel Time	0		

This parameter is used for the Decel Time Selection for momentary power loss.

Related parameters: P6.61~P6.64; refer to further information following P6.64 (page 4–157).

		Type	Hex Addr	Dec Addr
P6.62	**DEB Offset Level**	R/W	063E	41599
Range/Units (Format: 16-bit unsigned)		*Default*		
230V models: 0.0~100.0 VDC 460V models: 0.0~200.0 VDC		40.0 80.0		

The Decel Energy Backup Offset Level is the bias that is added to the DEB Disable Voltage Level (P6.63) which creates the DEB Activation Level. The DEB Activation Level is the point when the DEB function is initiated.

Related parameters: P6.61~P6.64; refer to further information following P6.64 (page 4–157).

		Type	Hex Addr	Dec Addr
P6.63	**DEB Disable Voltage Level**	R/W	063F	41600
Range/Units (Format: 16-bit unsigned)		*Default*		
230V models: 0.0~200.0 VDC 460V models: 0.0~400.0 VDC		150.0 300.0		

The DEB (Decel Energy Backup) will be disabled when the voltage of the DC Bus is lower than the setting at P6.63. The drive will then coast to a stop.

Related parameters: P6.61~P6.64; refer to further information following P6.64 (page 4–157).

		Type	Hex Addr	Dec Addr
P6.64	**DEB Delay Time**	♦R/W	0640	41601
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~25.0 sec		0.0		

The drive will not ramp up to commanded speed until the DEB Delay Time has elapsed.

Related parameters: P6.61~P6.64; refer to further information following P6.64 (page 4–157).

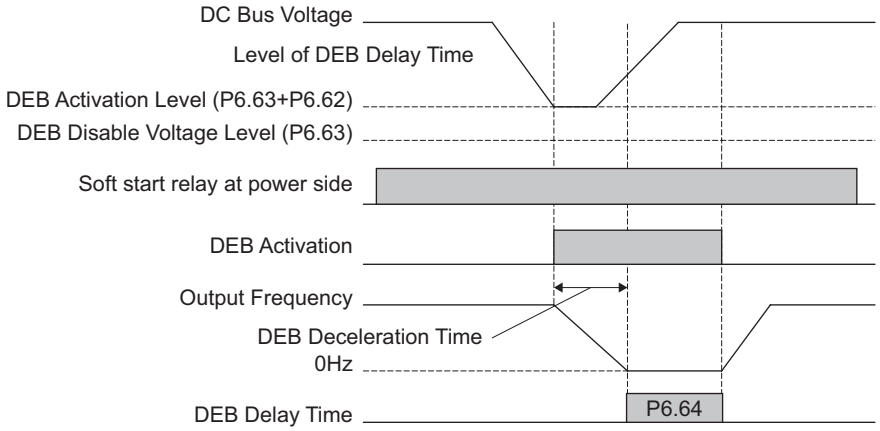
P6.61~P6.64: Decel Energy Backup (DEB) Summary for P6.61~P6.64

The DEB feature allows the drive to decelerate to a stop after a momentary power loss. When a momentary power loss occurs, this function can be used to have the motor decelerate to 0 speed with a predefined deceleration stop method (P6.61). When the supply power comes back on to rated voltage, the motor will run again after the DEB Delay Time (P6.64). The DEB delay time starts after the voltage level has reached the "Level of DEB Delay Time," as defined below.

Level of DEB Delay Time definitions:

- *460V series Frame E and above: "Level of DEB Delay Time" = P6.35 + 180VDC*
- *460V series Frame D and below: "Level of DEB Delay Time" = P6.35 + 160VDC*
- *230V series Frame E and above: "Level of DEB Delay Time" = P6.35 + 90VDC*
- *230V series Frame D and below: "Level of DEB Delay Time" = P6.35 + 80VDC*

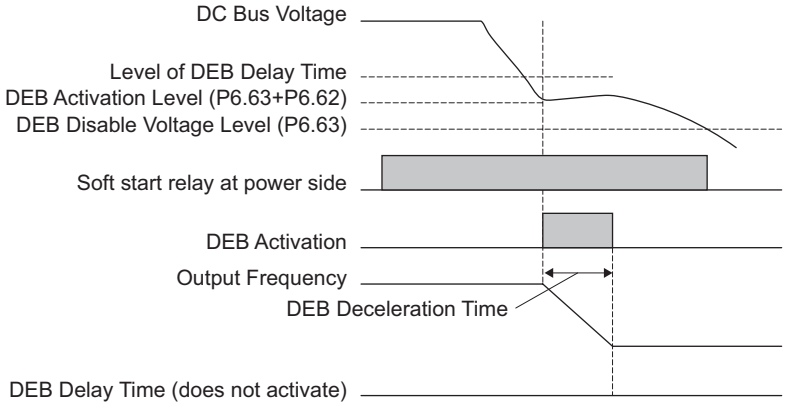
Example 1: *Insufficient power supply due to momentary power loss, or unstable power due to low voltage or sudden loading:*



NOTE: If P6.64 is set to 0, then a STOP command will be given. The drive will not accelerate to reach the commanded frequency before DEB even if the power comes back on. If P6.64 is not set to 0, a command of zero speed will be given and wait for the power on.

NOTE: DEB active level is when the DC BUS voltage level is lower than the DEB Disable Voltage Level (P6.63) plus the DEB Offset Level (P6.62). Defaults are: 230V series: Lv level + 20VDC; 460V series: Lv level + 40VDC.

Example 2: *Unexpected power off, such as momentary power loss:*



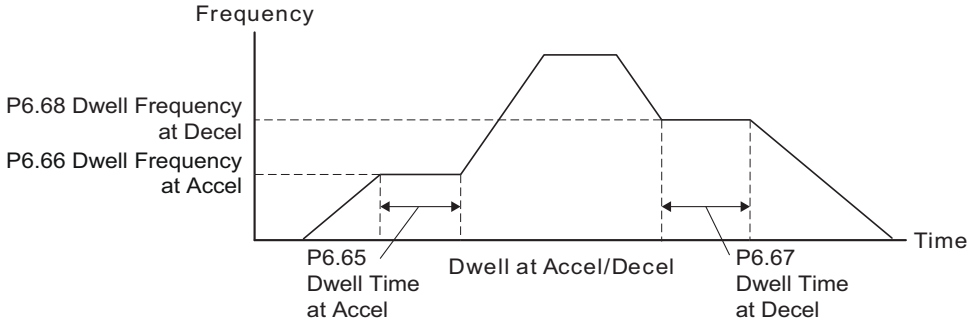
Example Application: There are always several machines running at the same time in a textile factory. To prevent broken stitching when powering down, these machines have to decelerate to a stop in a synchronous manner. So when there is a sudden power loss, the host controller will notify the GS4 Drive to use the DEB function with a deceleration time via EF.

NOTE: DEB active level is when the DC BUS voltage level is lower than the DEB Disable Voltage Level (P6.63) plus the DEB Offset Level (P6.62).

		Type	Hex Addr	Dec Addr
P6.65	**Dwell Time at Accel**	♦R/W	0641	41602
P6.66	**Dwell Frequency at Accel**	♦R/W	0642	41603
P6.67	**Dwell Time at Decel**	♦R/W	0643	41604
P6.68	**Dwell Frequency at Decel**	♦R/W	0644	41605

Range/Units	Default
P6.65, P6.67 Time: 0.00~600.00 sec	0.00
P6.66, P6.68 Frequency: 0.00~599.00 Hz	

P6.65 to P6.68 is for heavy loads in order to prevent OV or OC faults. A heavy load will be accelerated to P6.66 and remain there for the time specified in P6.65, then continue to accelerate to the commanded speed. The same behavior occurs for the Dwell Frequency and Time for the Decel portion.



		Type	Hex Addr	Dec Addr
P6.69	**Input Phase Loss Detection Time**	R/W	0645	41606

Range/Units (Format: 16-bit unsigned)	Default
0.00~600.00 sec	0.20

This parameter sets the monitoring time interval to detect an input phase loss. The factory setting is 0.20 second, which means the drive will check every 0.20 second.

Related parameters: P6.49, P6.70

		Type	Hex Addr	Dec Addr
P6.70	**Input Phase Loss Ripple Detection**	R/W	0646	41607

Range/Units	Default
230V models: 0.0~160.0 VDC	30.0
460V models: 0.0~320.0 VDC	60.0

When the input voltage is greater than the setting in P6.70 for the time determined as shown below, this situation is seen as input phase loss.

Current (%)	50	75	120	150	200
Time (seconds)	432	225	60	32	15

An error message OrP will be shown on the keypad, and the drive will react according to the setting of P6.49.

Related parameters: P6.49, P6.69

		Type	Hex Addr	Dec Addr
P6.71	**STO Alarm Latch**	♦R/W	0647	41608
Range/Units (Format: 16-bit binary)		Default		
0: STO Alarm Latch 1: STO Alarm no Latch		0		

Setting Explanations:

0: STO Alarm Latch: After the reason for an STO Alarm is cleared, a Reset command is needed to clear the STO Alarm unless Fire Mode is turned ON. Once the STO Alarm is cleared, Fire Mode can run the drive without first having received a reset signal. Fire Mode will also run the drive after an STL1 or STL2 alarm is cleared without needing a power cycle.

1: STO Alarm no Latch: After the reason for an STO Alarm is cleared, the STO Alarm will be cleared automatically. Cycling the run command OFF then ON is required, even if P6.29=1 (Line Start Lockout disabled).

All of the STL1~STL3 errors are “Alarm Latch” mode. (In STL1~STL3 mode, the P6.71 function is not effective.)

		Type	Hex Addr	Dec Addr
P6.72	**IGBT Temperature**	Read	0648	41609
Range/Units (Format: 16-bit unsigned)		Default		
-3,276.7 to +3,276.7 °C		0		
		Type	Hex Addr	Dec Addr
P6.73	**Cap Temperature**	Read	0649	41610
Range/Units (Format: 16-bit unsigned)		Default		
-3,276.7 to +3,276.7 °C		0		

Parameters P6.72 and P6.73 allow the user the monitor the IGBT and CAP temperatures in degrees Celcius. These registers are read only.

GROUP P7.XX DETAILS – PID PARAMETERS

NOTE: For detailed information about the PID control process, including applicable parameters from other parameter groups, please refer to Appendix F: PID Control.

		Type	Hex Addr	Dec Addr
P7.00	**PID Action/Mode**	♦R/W	0700	41793
Range/Units (Format: 16-bit binary)		*Default*		
0: PID Disabled 1: PID Reverse Local/Remote 2: PID Forward Local/Remote 3: PID Reverse Remote Only 4: PID Forward Remote Only 5: PID Reverse Local Only 6: PID Forward Local Only		0		

This parameter sets the input terminal to use for the process variable PID feedback.

		Type	Hex Addr	Dec Addr
P7.01	**reserved**	~	0701	41794

		Type	Hex Addr	Dec Addr
P7.02	**PID Setpoint Source Display**	Read	0702	41795
Range/Units (Format: 16-bit binary)		*Default*		
00: Keypad 01: RS485 02: AI1 03: AI2 04: AI3 05: Ext Up/Down Key 06: Comm Card 07: Multi-Step Inputs 08: PID off		7		

This is a Read-Only Parameter which displays the PID Setpoint source.

When PID is enabled (P7.00>0), P7.02 parameter data will be mapped from P4.00~P4.01 dependent upon whether in Remote (P4.00) or Local (P4.01).

This parameter indicates the source for the PID Setpoint, which is determined by setting of the appropriate parameter P4.00 (Remote) or P4.01 (Local).

The user can change the display to show the PID Setpoint by changing parameter P8.00 to 42, PID Reference.

		Type	Hex Addr	Dec Addr
P7.03	**PID Feedback Gain**	♦R/W	0703	41796
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~300.00%		100.00		

This parameter can be used to set a gain for the Process Variable feedback signal.

		Type	Hex Addr	Dec Addr
P7.04	**PID Offset Value**	♦R/W	0704	41797
	Range/Units (Format: 16-bit signed)	Default		
	-100.0% to +100.0%	0.0		

This parameter is for fine tuning a PID setting. The PID Offset Value is added to the PID Output (Frequency Command). See the control diagrams on page 4–165. You can input a PID offset to provide the desired operating condition. It functions similarly to parameters P4.10, P4.15, and P4.19.

		Type	Hex Addr	Dec Addr
P7.05	**Keypad PID Setpoint**	Read	0705	41798
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~100.00%	0.0		

This parameter is used for keypad and serial communication PID Setpoints.

If keypad is the source of Frequency Command when Lv or Fault occurs, the present Frequency Command will be saved in this parameter.

		Type	Hex Addr	Dec Addr
P7.06	**PID Multi-Setpoint 1**	♦R/W	0706	41799
P7.07	**PID Multi-Setpoint 2**	♦R/W	0707	41800
P7.08	**PID Multi-Setpoint 3**	♦R/W	0708	41801
P7.09	**PID Multi-Setpoint 4**	♦R/W	0709	41802
P7.10	**PID Multi-Setpoint 5**	♦R/W	070A	41803
P7.11	**PID Multi-Setpoint 6**	♦R/W	070B	41804
P7.12	**PID Multi-Setpoint 7**	♦R/W	070C	41805
	Range/Units (Format: 16-bit unsigned)	Default		
	0.00~100.00%	0.00		

Parameters P7.06~P7.12 are used to provide seven different PID Setpoints. Multi-Function Input Terminals DI1~DI15 are assigned in parameters P3.03~P3.16 to select which one of the PID Multi-Setpoints is to be used.

Multi-Function Input Terminal Function Settings (P3.03~P3.16) for Input Terminals DI1~DI16
(ABBREVIATED LISTING; INCLUDES ONLY SETTINGS APPLICABLE TO PID)

Setting: Function	***Function Description***
0: No function	Setting a Multi-Function Input to 0 will disable that input. The purpose of this function is to provide isolation for unused Multi-Function Input Terminals. ***Any unused terminals should be programmed to 0 to make sure they have no effect on drive operation.***
1: Multi-Speed/PID Multi-Setpoint bit 1 2: Multi-Speed/PID Multi-Setpoint bit 2 3: Multi-Speed/PID Multi-Setpoint bit 3	When settings 1, 2, & 3 are selected and registers P7.06~P7.12 are populated, the Multi-Function Inputs refer to PID Multi-Setpoints. The SPs are determined by P7.06~P7.12. 1) In order to use the Multi-PID SPs, P7.06~P7.12 must be set, and P7.00≠0. 2) When all PID Multi-Setpoint inputs are off, the GS4 drive reverts to the PID Setpoint Source (P7.02).

PID Setpoint			***Selection***
Bit 3	***Bit 2***	***Bit 1***	***PID Setpoint***
OFF	OFF	OFF	P7.02: SP Source
OFF	OFF	ON	P7.06: Setpoint 1
OFF	ON	OFF	P7.07: Setpoint 2
OFF	ON	ON	P7.08: Setpoint 3
ON	OFF	OFF	P7.09: Setpoint 4
ON	OFF	ON	P7.10: Setpoint 5
ON	ON	OFF	P7.11: Setpoint 6
ON	ON	ON	P7.12: Setpoint 7

		Type	Hex Addr	Dec Addr
P7.13	**Proportional Gain (P)**	♦R/W	070D	41806
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0		1.0		

Proportional Gain is used to eliminate system error. It is most often used to decrease error and increase response speed. But a P7.13 setting value that is too large may cause system oscillation and instability.

If the other two controls (I and D) are set to zero, Proportional Gain is the only one effective in the PID loop.

		Type	Hex Addr	Dec Addr
P7.14	**Integral Time (I)**	♦R/W	070E	41807
Range/Units (Format: 16-bit unsigned)		Default		
0.00~100.00 sec		1.00		

This parameter is used to set the time of the Integral (I) controller. The integral controller is used to eliminate error in a stable system. The integral time of the PID controller is acted upon by the change in integral time. When the integral time is long, it will provide a small gain of integral control, a slower response, and less sloppy external control. When the integral time is short, it will provide a large gain of Integral control, a faster response ,and more rapid external control. The Integral Time doesn't stop working until error is 0. The smaller integral time is set, the stronger integral action will be. This function is helpful to reduce overshoot and oscillation to make a stable system. As it functions the decreasing error will be slowed. The Integral Time is often used with the other two controls to become PI controller or PID controller. Remember when the integral time is too small, it may cause system oscillation.

If the integral time is set as 0.00, P7.14 will be disabled.

		Type	Hex Addr	Dec Addr
P7.15	**Derivative Value (D)**	♦R/W	070F	41808
Range/Units (Format: 16-bit unsigned)		Default		
0.00~1.00 sec		0.00		

This parameter is used to set the value of the Derivative (or Differential) (D) controller to decide the response of error change. A suitable differential time can reduce the overshoot of a P and I controller to decrease oscillation for a more stable system. The differential controller is used to show the change of system error, is helpful to preview the change of error, and is used to eliminate error to improve a systems operating state. With a suitable differential time, it can reduce overshoot and shorten adjustment time. However, the differential operation does increase (because of its effect) noise interference. Please note that too large of a differential can cause a large amount of noise interference. The differential shows the change and the output of the differential will be 0 when there is no change. Therefore, the differential control can't be used independently. It needs to be used with the other two controllers to make a PD controller or PID controller. Too long a differential time may cause system oscillation. The differential controller acts to minimize the change of error and can't filter noise. It is not recommended to use this function in noisy or noise-prone applications.

NOTE: Differential Control cannot be used independently. It needs to be used with the other PID controls to make a PD controller or PID controller.

		Type	Hex Addr	Dec Addr
P7.16	**Upper Limit for Integral Time**	♦R/W	0710	41809
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0%		100.0		

This parameter defines an upper limit for the Integral Time (I), and therefore limits the Master Frequency.

- *Integral upper limit = Maximum Output Frequency (P0.04) x Upper Limit for Integral Time (P7.16).*

An integral value that is too high will slow the system response due to sudden load changes, and therefore may cause motor stall or machine damage. Therefore, use caution when setting this parameter.

		Type	Hex Addr	Dec Addr
P7.17	**Derivative Filter Time Constant**	♦R/W	0711	41810
Range/Units (Format: 16-bit unsigned)		Default		
0.0~2.5 sec		0.0		

To avoid amplification of measured noise in the controller output, a digital filter is inserted. This filter helps smooth oscillations. Larger values for P7.17 provide more smoothing.

		Type	Hex Addr	Dec Addr
P7.18	**PID Output Frequency Limit**	♦R/W	0712	41811
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0%		100.0		

This parameter defines the percentage of output frequency limit during PID control.

- *Output frequency limit = Maximum Output Frequency (P0.04) x PID Output Frequency Limit (P7.18).*

		Type	Hex Addr	Dec Addr
P7.19	**PID Feedback Value**	Read	0713	41812
Range/Units (Format: 16-bit signed)		Default		
-200.00% to +200.00%		0.00		

This parameter shows the value of feedback signal under PID control.

		Type	Hex Addr	Dec Addr
P7.20	**Feedback Signal Detection Time**	♦R/W	0714	41813
Range/Units (Format: 16-bit unsigned)		Default		
0.0~3600.0 sec		0.0		

This parameter is valid only when the feedback signal is AI2 4~20mA.

This parameter defines the time during which the PID feedback must be abnormal before a warning is given. It also can be modified according to the system feedback signal time.

If this parameter is set to 0.0, the system would not detect any signal abnormality.

		Type	Hex Addr	Dec Addr
P7.21	**PID Feedback Loss**	R/W	0715	41814
Range/Units (Format: 16-bit binary)		*Default*		
0: Warn and Continue Operation 1: Warn (fault) and Ramp to Stop 2: Warn (fault) and Coast to Stop 3: Warn and Operate at Last Frequency 4: Warn and Run at P7.22		0		

Loss detected only if P7.20 (Loss Detect Time) > 0.

This parameter is valid only when the feedback signal is AI2 4~20mA.

GS4 AC drive acts when the feedback signals (analog PID feedback) are abnormal.

If the command frequency falls below the Sleep Reference frequency (P7.29), for the specified Sleep Time (P7.31), then the drive will shut off the output and wait until the command frequency rises above Wake-up Reference (P7.30).

Setting Explanations:

0: Drive goes to 0Hz, but does not fault (warning only). Drive will restart if signal returns.

1 & 2: AFE Fault (PID Feedback AI2 Loss). Requires reset.

3: Drive warns and runs at the last PID Feedback Frequency.

4: Drive warns and runs at setting of P7.22.

If P7.21 = 0 or 3 (KEEP RUNNING ON 4-20mA LOSS) and P7.00 PID Feedback is set for "Forward Operation" (P7.00 = 2, 4, or 6), the drive will accelerate to P7.18 PID Output Limit if the analog signal is lost.

		Type	Hex Addr	Dec Addr
P7.22	**PID Feedback Loss Speed Level Default Value**	♦R/W	0716	41815
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~400.00 Hz		0.00		

This parameter sets the speed of operation of the GS4 drive when there is a loss of the PID feedback signal, if P7.21 is set to 4.

Loss is detected only if P7.20 (Feedback Signal Detection Time) > 0.

		Type	Hex Addr	Dec Addr
P7.23	**reserved**	~	0717	41816

		Type	Hex Addr	Dec Addr
P7.24	**PID Offset Selection**	♦R/W	0718	41817
Range/Units (Format: 16-bit binary)				*Default*
0: Set by P7.04 1: Set by an Analog Input [AI1 (P4.02), AI2 (P4.03), or AI3 (P4.04) must be set to 7: PID Offset (Input)]				0

This parameter sets the source of the PID Offset.

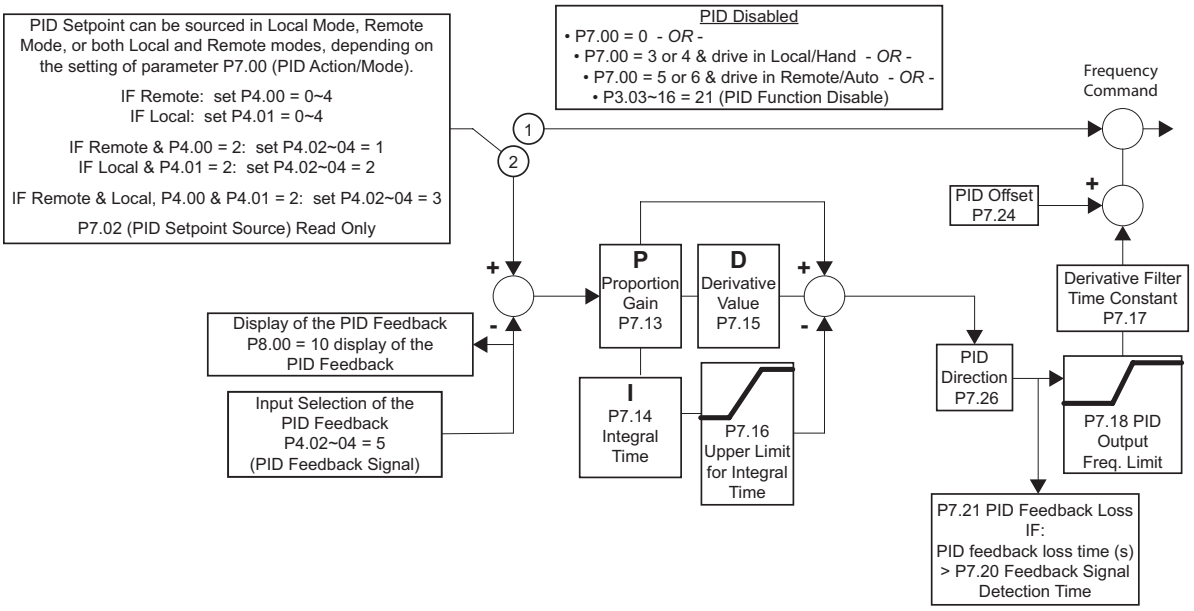
		Type	Hex Addr	Dec Addr
P7.25	**PID Mode Selection**	R/W	0719	41818
Range/Units (Format: 16-bit binary)		Default		
0: Old PID mode, Kp, Kp•Ki, Kp•Kd are dependent/serial		0		
1: New PID mode, Kp, Ki, Kd are independent/parallel				

NOTE: Refer to diagrams below for P7.25=0 and P7.25=1

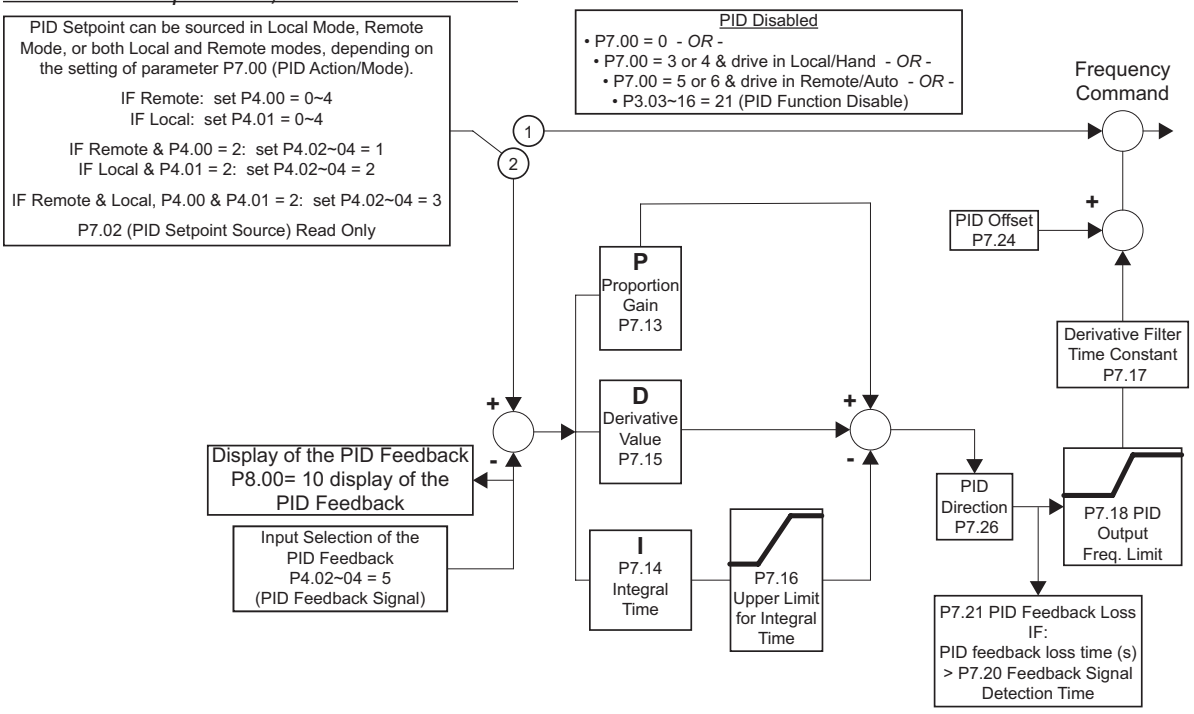
- *Kp = Proportional Gain/Control (P7.13)*
- *Ki = Integral Time/Control (P7.14)*
- *Kd = Derivative Value/Time (P7.15)*

The Serial or parallel connection PID mode selections are explained in the 2 graphics found in the detailed information found below.

P7.25 = 0: Dependent/Serial Connection



P7.25 = 1: Independent/Parallel Connection



		Type	Hex Addr	Dec Addr
P7.26	**PID Reverse Enable**	R/W	071A	41819
Range/Units (Format: 16-bit binary)		Default		
0: PID can't change command direction 1: PID can change command direction		0		

This parameter when engaged changes the ability of PID to change the direction of the drive.

- *When set to 0 it prevents PID from changing the direction of the output.*
- *When set to a 1 it enables the changing of direction by the level of PID.*

		Type	Hex Addr	Dec Addr
P7.27	**Source of Sleep**	R/W	071B	41820
Range/Units (Format: 16-bit binary)		Default		
0: Frequency/PID Command Frequency (CV) 1: Feedback		0		

This parameter selects how the Sleep Mode function will be actuated; either by the *Command Frequency (speed reference)* if the drive is operating with *PID disabled*, or by the *PID Command Frequency (CV)* if the *PID is enabled*.

In application, the trigger for sleep mode is the commanded frequency, (speed reference or PID, CV) and *NOT* the actual drive output frequency.

		Type	Hex Addr	Dec Addr
P7.28	**Integral Limit During Sleep**	R/W	071C	41821
Range/Units (Format: 16-bit unsigned)		Default		
0.0~200.0		50.0		

This upper integral limit of the drive is to avoid running at high speed right after the drive has been awakened.

		Type	Hex Addr	Dec Addr
P7.29	**Sleep Reference**	♦R/W	071D	41822
Range/Units (Format: 16-bit unsigned)		Default		
P7.27=0: 0.0~599.00 Hz P7.27=1: 0.0~200.00%		0.00		

		Type	Hex Addr	Dec Addr
P7.30	**Wake-up Reference**	♦R/W	071E	41823
Range/Units (Format: 16-bit unsigned)		Default		
P7.27=0: 0.0~599.00 Hz P7.27=1: 0.0~200.00%		0.00		

		Type	Hex Addr	Dec Addr
P7.31	**Sleep Time**	♦R/W	071F	41824
Range/Units (Format: 16-bit unsigned)		Default		
0.0~6000.0 sec		0.0		

		Type	Hex Addr	Dec Addr
P7.32	**Wake-up Delay Time**	R/W	0720	41825
Range/Units (Format: 16-bit unsigned)		Default		
0.00~600.00 sec		0.00		

Parameters P7.29, P7.30, P7.31, P7.32:

The Sleep Reference point (P7.29) provides the setpoint at which, should the drive reach or go below, causes the drive to go to sleep. When asleep the drive does nothing (its output being off) besides monitoring its operating point.

In order to Wake-up and again operate, it should reach the Wake-up Reference point (P7.30). If the Command Frequency falls below the Sleep Reference point (P7.29) for the Sleep Time specified in P7.31, then the drive will shut off the output and wait until the Command Frequency rises above what is set in Wake-Up Reference point (P7.30).

The Wake-up Delay Time (P7.32) delays the drive from Waking-Up once the Wake-Up Level has been exceeded by the amount of time set in this parameter.

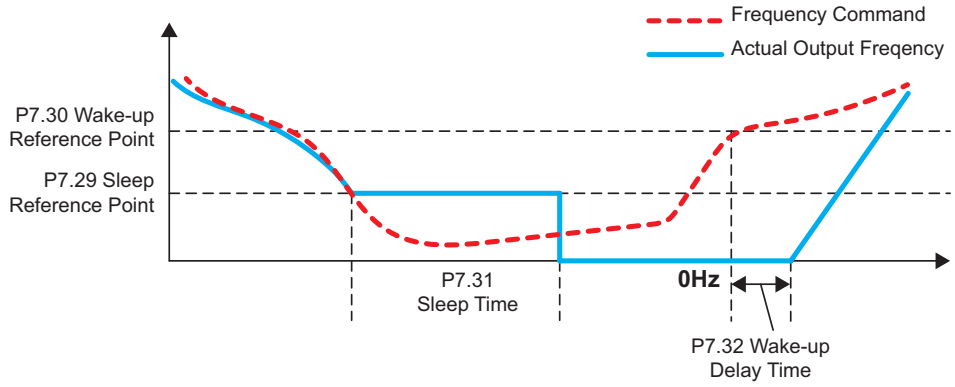
The Wake-up Timer is not cumulative: the reference needs to stay above Wake-up Reference for the entire length of Wake-up Delay, otherwise the Delay timer will reset.

There are three types of Sleep mode and Wakeup mode.

SLEEP/WAKE-UP MODE #01: FREQUENCY COMMAND (NOT USING PID; P7.00=0)

- *When the GS4 frequency command falls below the setting in P7.29 (Sleep Reference), the GS4 output frequency will remain at the "Sleep Reference" frequency.*
- *When sleep time equals the setting in P7.31 (Sleep Time)and the frequency command remains below the "Wake-up Reference" value in P7.30, the GS4 drive will sleep at 0Hz.*
- *When the frequency command exceeds the "Wake-up Reference" value in P7.30, the "Wake-up Delay" timer will increment until elapsed time equals the setting in P7.32. With "wake-up" time elapsed, the GS4 drive will accelerate to the commanded output frequency.*
- *For Sleep Function to be active in LOCAL and REMOTE modes, P3.57 bit 0 must be set to 1. For Sleep Mode to be active in REMOTE mode only, P3.57 bit 0 = 0.*

Sleep Mode Diagram

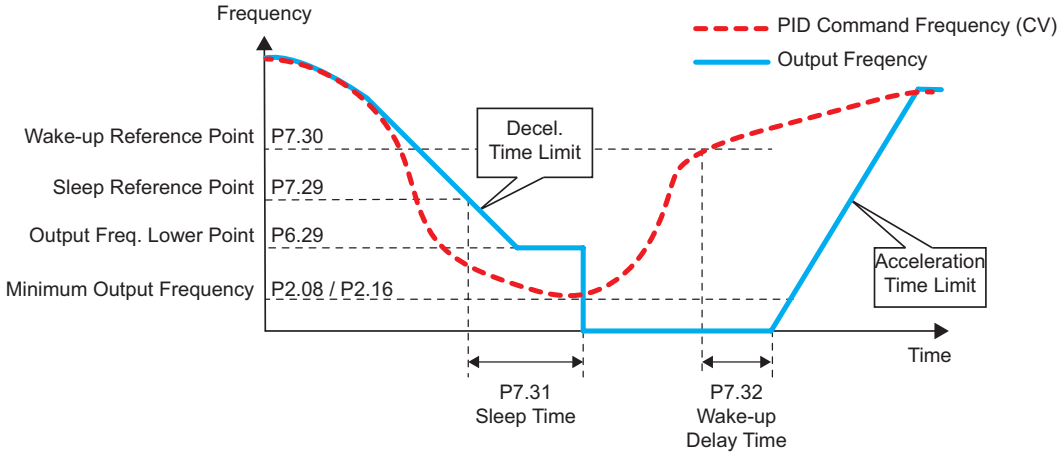


SLEEP/WAKE-UP MODE #02:

INTERNAL PID FREQUENCY CALCULATION COMMAND (USING PID; P7.00 = 1 OR 2, OR P7.00 = 3 OR 4 AND IN REMOTE/AUTO MODE, OR P7.00 = 5 OR 6 AND IN LOCAL/HAND MODE)

- *As the command frequency falls, the output frequency follows at a rate determined by the active deceleration parameter (P1.02, 04, 06, or 08). As output frequency falls below the "Sleep Reference" setting (P7.29), "Sleep Time" (P7.31) begins to increment.*
- *Depending on the rate of deceleration and the "Sleep Time" setting, the output frequency may plateau at the "Lower Limit of Output Frequency" set in P6.26 if "Sleep Time" is not complete, or continue deceleration to zero output frequency if "Sleep Time" had elapsed.*
- *When command frequency rises above the "Wake-up Reference" value set in P7.30, the "Wake-up Delay Time" (P7.32) begins to increment. When elapsed, the output frequency begins to increase at a rate determined by the selected acceleration parameter (P1.01, 03, 05, or 07).*
- *For Sleep Function to be active in LOCAL and REMOTE modes, P3.57 bit 0 must be set to 1. For Sleep Mode to be active in REMOTE mode only, P3.57 bit 0 = 0.*

Internal PID Calculation Frequency Command Diagram



Refer to Appendix F: PID Control for more information about PID control.

Sleep/Wake-up Mode #03:

Internal PID Frequency Calculation Command (Using PID; P7.00 = 1 or 2, OR P7.00 = 3 or 4 and in Remote/Auto Mode, OR P7.00 = 5 or 6 and in Local/Hand Mode)

- *As the PID Feedback Value (PV) rises above the "Sleep Reference" value set in P7.29, the output frequency decreases at a rate determined by the active deceleration parameter (P1.02, 04, 06, or 08). At the same time, "Sleep Time" (P7.31) begins to accumulate.*
- *Depending on the rate of deceleration and the "Sleep Time" setting, the output frequency may plateau at the "Lower Limit of Output Frequency" (P6.26) if "Sleep Time" is not complete, or continue deceleration to zero output frequency if "Sleep Time" had elapsed.*
- *When the PID Feedback Value (PV) falls below the "Wake-up Reference" value set in P7.30, then "Wake-up Delay Time" (P7.32) begins to increment. When elapsed, the output frequency will begin to increase. If "Lower Limit of Output Frequency" P6.26 > 0Hz, then the output frequency will step to that frequency and then ramp at a rate determined by the selected acceleration parameter P1.01, 03, 05, or 07.*
- *For Sleep Function to be active in LOCAL and REMOTE modes, P3.57 bit 0 must be set to 1. For Sleep Mode to be active in REMOTE mode only, P3.57 bit 0 = 0.*

Mode #03 Example #1: Forward-Acting PID

PID controlling tank level. Drive output frequency varies fill pump flow rate to fill the tank. The tank is emptied using a variable position drain valve controlled separately. Pump capacity is sized to fill the tank at a rate suitable to maintain tank level with drain valve at full open position.

Zone	PID Feedback (PV)
Sleep	PV > P7.29 (1,800gal)
Transition	P7.30 < PV < P7.29 (1,500 to 1,800 gal)
Wake-up	PV < P7.30 (1,500gal)

- *Tank volume = 10,000 gallons*
- *PV Range = 0 to 10,000 gallons*
- *Setpoint = 60% = 6,000 gallons*

Set the following parameters:

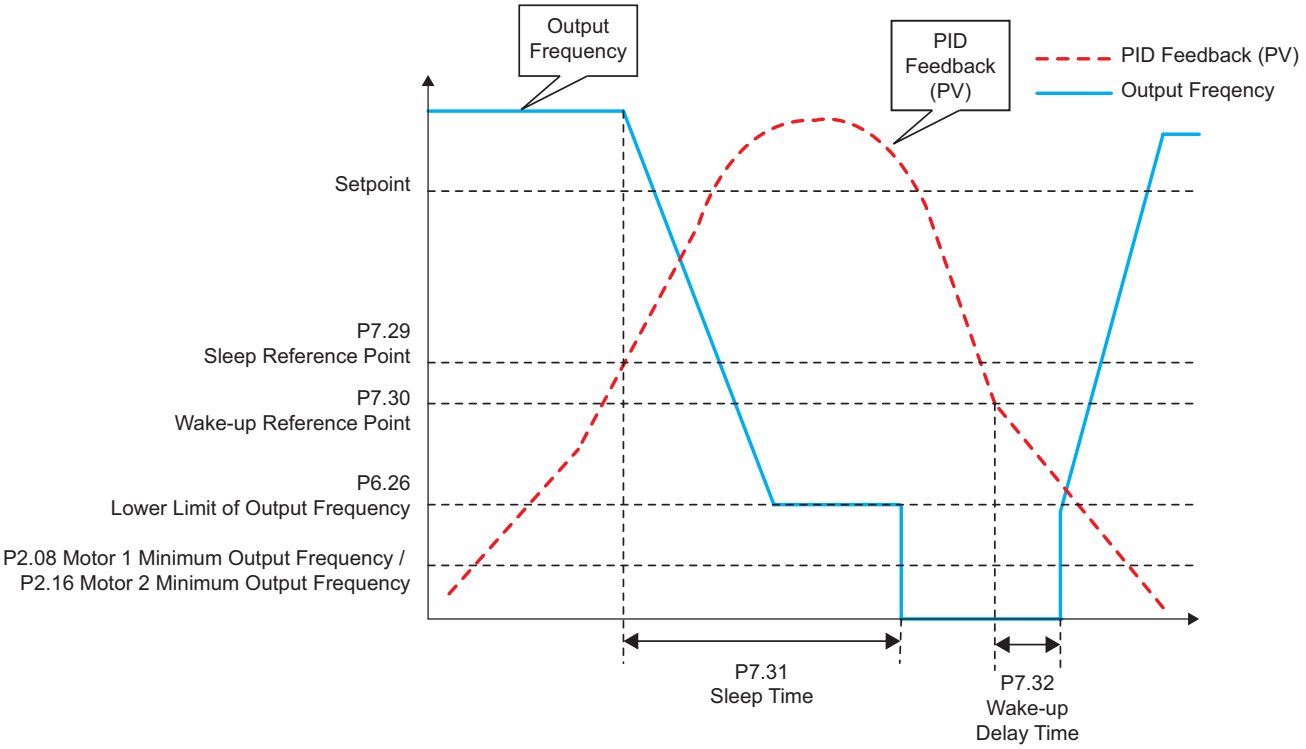
- *Analog Input 1 (AI1) Function P4.02 = 5: PID Feedback Signal*
- *PID Action Mode P7.00 = 2: PID Forward Local/Remote, or 4: PID Forward Remote Only, or 6: PID Forward Local Only*
- *Sleep Reference P7.29 = 30% = (30% of 6,000 = 1,800 gallons)*
- *Note: P7.29 value must be greater than P7.30 value*
- *Wake-up Reference P7.30 = 25% = (25% of 6,000 = 1,500 gallons)*
- *Sleep Time P7.31 = 20.0 seconds (for this example)*
- *Wake-up Delay Time P7.32 = 10.00 seconds (for this example)*
- *Lower Limit of Output Frequency P6.26 = 10Hz (for this example)*

• Case #1:

- *PID Feedback (PV) > Sleep Reference P7.29 = 30% (1,800 gal) – then drive output frequency decreases*

• Case #2:

- *PID Feedback (PV) < Wake-up Reference P7.30 = 25% (1,500gal) – then drive output frequency increases*



Refer to Appendix F: PID Control for more information about PID control.

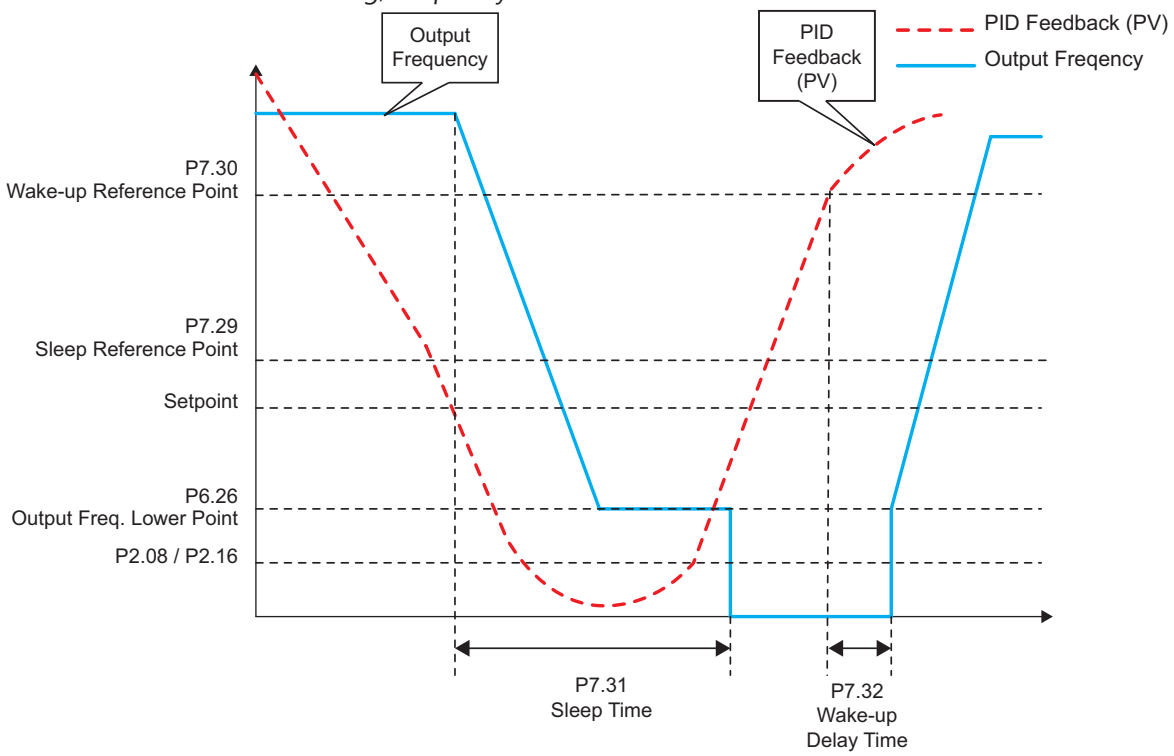
Mode #03 Example #2: Reverse-Acting PID

- *P7.29 must be less than P7.30.*
- *30kg is the setpoint (same as example #1).*

Set the following parameters:

- *P4.03 = 5 (AI1 as PID Feedback Signal)*
- *P7.00 = 1: (PID Reverse Local/Remote), 3: (PID Reverse Remote Only), or 5: (PID Reverse Local Only)*
- *P7.29 = 110% [Sleep Reference 33kg = (110%)·(30kg)]*
- *P7.30 = 120% [Wake-up Reference 36kg = (120%)·(30kg)]*
- *Case #1: If Feedback < 33kg, frequency decreases*
- *Case #2: If Feedback > 36kg, frequency increases*

Zone	*PID Physical Quantity*
Sleep Zone	When greater that 36kg, the GS4 drive goes to sleep
Transition Zone	When between 33kg~36kg, the GS4 drive remains in its previous status
Wake-up Zone	When less than 33kg; in this case 30kg is the setpoint.



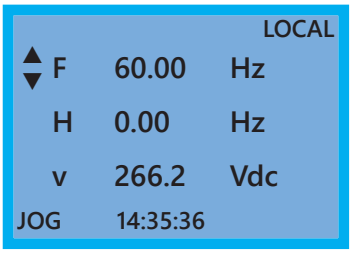
Refer to Appendix F: PID Control for more information about PID control.

GROUP P8.XX DETAILS – DISPLAY PARAMETERS

		Type	Hex Addr	Dec Addr
P8.00	**User Display**	♦ R/W	0800	42049

Range/Units (Format: 16-bit binary) — *Default*: 3

As Seen During Setup	As Displayed During Operation
0: Output Amps	A displayed value Amps
1: Counter Value	c displayed value CNT
2: Actual Freq	H. displayed value Hz
3: DC Bus Voltage	v displayed value Vdc
4: Output Voltage	E displayed value Vac
5: Power Factor	n displayed value deg
6: Output Power	P displayed value kW
7: Calculated RPM	r displayed value rpm
8: reserved	n/a
9: reserved	n/a
10: PID Feedback %	B displayed value %
11: AI1 %	1. (note 1) %
12: AI2 %	2. (note 1) %
13: AI3 %	3.- (note 1) %
14: IGBT Temperature	i. displayed value oC
15: Cap Temperature	c. displayed value oC
16: DI Input Status	i displayed value h
17: DO Output Status	o displayed value h
18: Multi-Speed Step	S displayed value
19: CPU DI Status	d (note 2) h
20: CPU DO Status	0. (note 3) h
21: reserved	n/a
22: reserved	n/a
23: reserved	n/a
24: reserved	n/a
25: Overload %	L (note 4) %
26: Ground Fault %	G. displayed value %
27: DC Bus Ripple	r. displayed value Vdc
28: PLC D1043 Value	C displayed value h
29: reserved	n/a
30: User-Defined	U displayed value
31: Out Hz x P8.05	K displayed value
32: reserved	n/a
33: reserved	n/a
34: Fan Speed	f displayed value %
35: reserved	n/a
36: Carrier Frequency	J. displayed value
37: reserved	n/a
38: Drive Status	6. (note 5) h
39: reserved	n/a
40: reserved	n/a
41: kWh	J displayed value kWh
42: PID Reference	h. displayed value %
43: PID Offset	o. displayed value %
44: PID Output Hz	b. displayed value Hz
45: Reserved	
46: STO Version	d displayed value decimal
47: STO Chksum High	d displayed value h hex
48: STO Chksum Low	d displayed value h hex



Explanation of display shown:

F = Commanded Frequency (setpoint)
H = Frequency the drive is actually outputting (0 means this drive is stopped)
v = DC Bus Voltage
(This is the User Display line resulting from setting P8.00 = 3. The User Display appears in the 3rd row by default, but it can be moved to the top row per the setting of P8.01.)

Note 1 (For P8.00 = 11: AI1, 12: AI2, 13: AI3): The value can display negative values when setting analog input bias (P4.09, P4.10, P4.15, P4.19, P4.11, P4.16, & P4.20).

Note 2 (For P8.00 = 19: CPU DI Status): Example: If REV, DI1 and DI6 are ON, the following table shows the status of the terminals (0 means OFF; 1 means ON).

Terminal	DI15	DI14	DI13	DI12	DI11	DI10	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1	REV	FWD
Status	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0

DI10~DI15 are the terminals for extension cards (P3.11~P3.16).
If REV, DI1 and DI6 are ON, the value is 0000 0000 1000 0110 in binary, and 0086h in HEX. When P8.00 is set to "16" or "19," it will display "0086h." The setting 16 is the status of Digital Inputs in parameter P3.46, and the setting 19 is the corresponding CPU pin status of Digital Input. User can set to 16 to monitor Digital Input status and then set to 19 to check if the internal connections of the drive have failed. The DI status follows the behavior of the NO/NC contact selection in P3.42.

Note 3 (For P8.00 = 20: CPU DO Status): Assume that Multi-Function Output Terminal 1 (R1: P3.17) is set to 9 (Drive Ready). After applying power to the GS4 drive, if there is no other abnormal status, the contact will be OFF. The display status will be shown as follows (0 = OFF; 1 = ON)

Terminal	DO20~DO18				DO17~DO14				DO13~DO10				DO2	DO1	reserved	R2	R1
Status	~	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

If P8.00 is set to 17 (Digital Output Status) or 20 (CPU Digital Output Status), the keypad will display status in hexadecimal "0001h" with LED U is ON on the keypad. The setting 17 is the status of Digital Output by P3.43 setting and the setting 20 is the corresponding CPU pin status of Digital Output. User can set 17 to monitor the Digital Output status and then set to 20 to check if the wire is normal. The DO status follows the behavior of the NO/NC contact selection in P3.43.

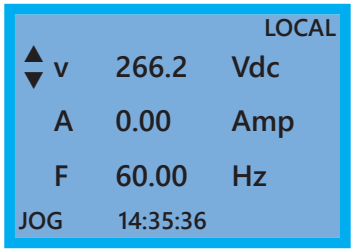
Note 4 (For P8.00 = 25: Overload %): When display value reaches 100.00%, the drive will show "oL" as an overload warning.

Note 5 (For P8.00 = 38: Drive Status): Bit 0: The drive is running forward. Bit 1: The drive is running backward. Bit 2: The drive is ready. Bit 3: Errors occurred on the drive. Bit 4: The drive is running. Bit 5: Warnings on the drive.

		Type	Hex Addr	Dec Addr
P8.01	**Start-up Display Selection**	♦ R/W	0801	42050
Range/Units (Format: 16-bit binary)		Default		
0: Freq Setpoint (F) 1: Output Hz (H) 2: User Display (U) 3: Output Amps (A)		0		

This parameter determines the start-up display page after power is applied to the drive. The sequence does not change; the order of appearance is always (F), (H), (U), then (A). Only three parameters can be displayed on the keypad screen at a time. P8.01 specifies only which parameter appears on the top row when the drive is powered up. All four parameters can always be scrolled to using the keypad up and down arrows. User defined choice (U) displays values and units according to the setting in P8.00.

Example: If P8.00 = 3, the User Display shows DC Bus Voltage.
If P8.01 = 2, the User Display appears in the top row at power up.



		Type	Hex Addr	Dec Addr
P8.02	**User Defined Format**	R/W	0802	42051

Range/Units (Format: 16-bit binary) — *Default*: 0

Bits 0~3:
- User defined decimal place
  - 0000b: no decimal place
  - 0001b: one decimal place
  - 0010b: two decimal place
  - 0011b: three decimal place

Bits 4~9: User defined unit

000xh: Hz	00Fxh: ft/s	015xh: mbar
001xh: rpm	010xh: ft/m	016xh: bar
002xh: %	011xh: m	017xh: Pa
003xh: kg	012xh: ft	018xh: kPa
004xh: m/s	013xh: °C	019xh: mWG
005xh: kW	014xh: °F	01Axh: inWG
006xh: hp		01Bxh: ftWG
007xh: ppm		01Cxh: psi
008xh: 1/m		01Dxh: atm
009xh: kg/s		01Exh: L/s
00Axh: kg/m		01Fxh: L/m
00Bxh: kg/h		020xh: L/h
00Cxh: lb/s		021xh: m^3/s
00Dxh: lb/m		022xh: m^3/h
00Exh: lb/h		023xh: gpm
		024xh: cfm

The user defined format sets the attributes (or units) that are enabled when P8.03 > 0. These settings allow the user to define a display field according to specific system processes. The frequency command signal will be scaled according to P0.04 (Max Output Freq) and P8.03 (User Coefficient Max)

Example:

- *P0.04 Max Output Freq = 60 Hz*
- *P8.00 User Display = 30 (User Defined)*
- *P8.02 User Defined Format = 0072h (unit = ppm, two decimal places)*
- *P8.03 User Defined Max = 115.00*

An analog frequency setting of 50% will result a 30Hz setting, but the keypad will display the user format 57.50ppm (50% x 115.00ppm). Likewise a commanded frequency input value of 100.00ppm will result in an output frequency of 52.17Hz = (100ppm/115ppm) x 60Hz.
Note: Running in forward or reverse will display a positive value.

		Type	Hex Addr	Dec Addr
P8.03	**User Defined Max**	R/W	0803	42052

Range/Units (Format: 16-bit unsigned) — *Default*: 0

0: Disable
0~65535 (when P8.02 set to no decimal place)
0.0~6553.5 (when P8.02 set to 1 decimal place)
0.00~655.35 (when P8.02 set to 2 decimal place)
0.000~65.535 (when P8.02 set to 3 decimal place)

User defined is enabled when P8.03 is not 0. The setting of P8.03 is linearly scaled to P0.04 (Max Output Frequency).

See example in P8.02 for further information.

		Type	Hex Addr	Dec Addr
P8.04	**User Defined Setpoint**	Read	0804	42053
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

This parameter shows commanded frequency or user defined value when P8.03 is not set to 0.

		Type	Hex Addr	Dec Addr
P8.05	**Output Frequency Gain**	R/W	0805	42054
Range/Units (Format: 16-bit unsigned)		Default		
0.00~160.00		1.00		

This parameter sets coefficient gain in actual output frequency. Set P8.00 = 31 to display the calculation result on the screen (calculation = Output Frequency [Hz] x P8.05).

		Type	Hex Addr	Dec Addr
P8.06	**Password Input**	♦ R/W	0806	42055
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

This parameter allows user to enter the password (*which is created in P8.07*) to unlock the parameter protection for the drive and to make changes to the parameters.

After you set up this parameter (in P8.07), make sure that you note its value for any future use.

Enter into P8.06 the password that you previously created by entering it into *P8.07*. The value displayed here in P8.06 (after you enter the password) is the number of times the password was entered incorrectly; it will *not* show you the password you have entered.

NOTE: Once four attempts have been made to unlock the drive, the ability to run the drive is locked. (The number of password attempts 0~4 will show on the display.)

The purpose of having P8.06 and P8.07 is to prevent unauthorized changes to the GS4 drive configuration. *The result of a lost password or a change of password will be a resetting of the parameters within the drive*.

To recover from a lost password or to reset the password because of a change in operating/ engineering personnel, reset the password by inputing 9999 and pressing the Enter key. Then input 9999 again and press Enter again within 10 seconds. ***All drive settings will return to factory default settings***.

NOTE: When password protection is on, all parameter values show a value of 0, except parameter P8.07.

P8.07 Procedure for setting password:

1) Go to P8.07 and value should be 0, indicating password is not set or is unlocked.
2) Enter a password of your choosing and press Enter. (Password can be from 1~65535. Use arrows to move the cursor and increase/decrease the value.)
3) After the password has been entered, the value of P8.07 is now 1, which indicates the parameters are locked from editing or viewing. All other parameters will display a value of 0 when locked. Any attempt to change parameters will result in "ERR" being displayed.
4) To unlock the drive, go to P8.06 and enter the password you set up in P8.07 and press Enter.

		Type	Hex Addr	Dec Addr
P8.07	***Password Set Up***	♦ R/W	0807	42056
Range/Units (Format: 16-bit unsigned)		*Default*		
0~65535		0		

This parameter sets up a password to protect parameter settings from unauthorized modifications. For the first set up, enter a password of your choice. When finished entering the password, the setting of parameter P8.07 will be 1. Then password protection is activated. All parameters will display a value of 0 when locked. If you want to modify any parameter, go to parameter P8.06, enter the password that you set up here. Then you can modify the parameter. If all parameters are locked and P8.07 reads a 0, then P9.08 is most likely set to 1.

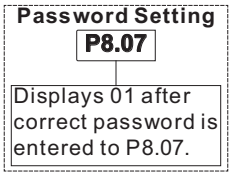
Password setting is permanently effective. If you need to modify any parameter, decode the parameter protection at Parameter P8.06.

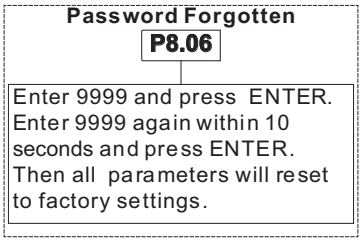
To disable the password lock set first enter the currect password in P8.06, then set P8.07 = 0. Password protection will remain off even during power cycles until a new password is set up.

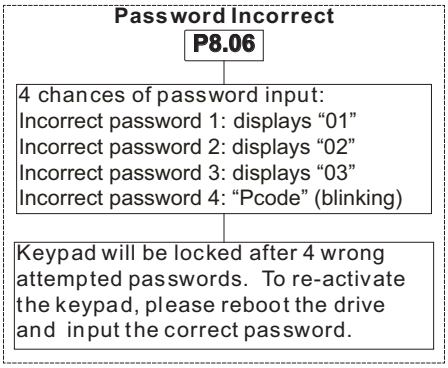
If you would like a new password you must first enter your old password to unlock the drive, then enter a new password in P8.07 and press enter. The drive parameter protection is now locked with the new password in effect.

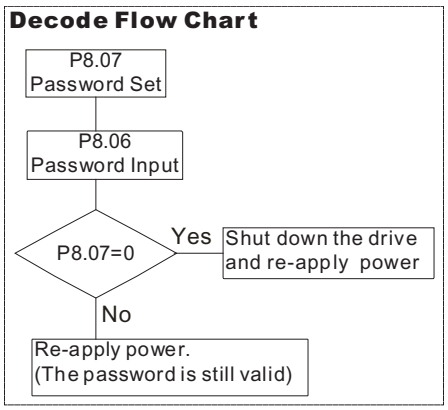
How to re-start the parameter protection after the password is decoded:

- *Method 01: Cycle power to the GS4 drive to restore the password protection if set.*
- *Method 02: Input any value into P8.06 (Do not enter the correct password).*









		Type	Hex Addr	Dec Addr
P8.08	**Power On Counter**	Read	0808	42057
P8.09	**Power On Day**	Read	0809	42058
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		~		

P8.08 records the number of power cycles.

P8.09 records the number of days the drive has been powered on.

		Type	Hex Addr	Dec Addr
P8.10	**Power On Minute**	Read	080A	42059
Range/Units (Format: 16-bit unsigned)		Default		
0~1439		~		

Records the number of minutes the drive has been powered on.

After this parameter reaches 1,439 minutes it will roll over to 0, and P8.09 will increment by 1 day.

		Type	Hex Addr	Dec Addr
P8.11	**Accumulative Motor Operation Time (minute)**	Read	080B	42060
Range/Units (Format: 16-bit unsigned)		Default		
0~1439		~		
		Type	Hex Addr	Dec Addr
P8.12	**Accumulative Motor Operation Time (day)**	Read	080C	42061
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		~		

P8.11 and P8.12 record motor operation time. Both parameters can be cleared by setting to 00. Operation time less than 60 seconds will not be recorded.

Motor operation time will accumulate as long as a Run command is present; *even if the speed reference is zero Hz*.

		Type	Hex Addr	Dec Addr
P8.13	**Keypad Communication Fault Treatment**	R/W	080D	42062
Range/Units (Format: 16-bit binary)		Default		
0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation		2		

This parameter sets the response to a keypad communication fault.

NOTE: Use this parameter with P8.14 to enable Keypad Loss Detection. This is especially useful when the drive is being controlled from the keypad or from External Terminals (with Keypad Stop Enabled).

NOTE: P8.14 must be > 0 for this Parameter to enable Keypad Timeout (disconnected keypad).

		Type	Hex Addr	Dec Addr
P8.14	**Keypad Time Out**	R/W	080E	42063
Range/Units (Format: 16-bit unsigned)		Default		
0.0~100.0 sec		1.0		

This parameter sets the keypad time out. After the time-out period ends with no communications, the keypad will display "Keypad time out" "CP10," and the drive will respond according to the setting of P8.13 (Keypad Communication Fault Treatment).

NOTE: If P8.13 = 3 (No Warning), the drive will not respond to a loss of keypad communication.

		Type	Hex Addr	Dec Addr
P8.15	**reserved**	~	080F	42064
P8.16	**reserved**	~	0810	42065
P8.17	**reserved**	~	0811	42066
P8.18	**reserved**	~	0812	42067
P8.19	**reserved**	~	0813	42068

		Type	Hex Addr	Dec Addr
P8.20	**PLC Buffer 1**	R/W	0814	42069
P8.21	**PLC Buffer 2**	R/W	0815	42070
P8.23	**PLC Buffer 4**	R/W	0817	42072
P8.24	**PLC Buffer 5**	R/W	0818	42073
P8.25	**PLC Buffer 6**	R/W	0819	42074
P8.26	**PLC Buffer 7**	R/W	081A	42075
P8.27	**PLC Buffer 8**	R/W	081B	42076
P8.28	**PLC Buffer 9**	R/W	081C	42077
P8.29	**PLC Buffer 10**	R/W	081D	42078
P8.30	**PLC Buffer 11**	R/W	081E	42079
P8.31	**PLC Buffer 12**	R/W	081F	42080
P8.32	**PLC Buffer 13**	R/W	0820	42081
P8.33	**PLC Buffer 14**	R/W	0821	42082
P8.34	**PLC Buffer 15**	R/W	0822	42083
P8.35	**PLC Buffer 16**	R/W	0823	42084
P8.36	**PLC Buffer 17**	R/W	0824	42085
P8.37	**PLC Buffer 18**	R/W	0825	42086
P8.38	**PLC Buffer 19**	R/W	0826	42087
P8.39	**PLC Buffer 20**	R/W	0827	42088

Range/Units (Format: 16-bit unsigned)	*Default*
0~65535	0

Parameters P8.20~P8.29 can be used for conveniently transferring data to third party devices.

These buffers are used as a data memory storage location so that other devices can access them from those parameter addresses. Users can change these parameter value by keypad or communication. This data will be retained on a power cycle.

The internal GS4 PLC can read and write to these Parameters (as well as all GS4 Parameters) using the RPR (Read Parameter) and WPR (Write Parameter) functions. So, these buffers can be used to transfer information from the internal PLC to external devices without having to program the external device to read data separately from the internal PLC and the Drive.

GROUP P9.XX DETAILS – SERIAL COMMUNICATION PARAMETERS

		Type	Hex Addr	Dec Addr
P9.00	**VFD Comm Address**	♦ R/W	0900	42305
Range/Units (Format: 16-bit unsigned)		Default		
1 to 254		1		

If the GS4 drive is controlled by a communication protocol (MODBUS RTU, MODTCP, EtherNetIP, or BACnet) the communication address for this drive must be set via this parameter. The communication address for each AC motor drive on the same network must be different and unique.

		Type	Hex Addr	Dec Addr
P9.01	**Modbus Baud Rate**	♦ R/W	0901	42306
Range/Units (Format: 16-bit unsigned)			Default	
0: 4.8k	2: 19.2k	4: 57.6k	1	
1: 9.6k	3: 38.4k	5: 115.2k		

This parameter is used to set the transmission speed between the RS-485 master (PLC, PC, etc.) and the drive.

		Type	Hex Addr	Dec Addr
P9.02	**Modbus Protocol**	♦ R/W	0902	42307
Range/Units (Format: 16-bit binary)			Default	
1: 7N2 (ASCII)	7: 8N2 (ASCII)	13: 8N2 (RTU)	12	
2: 7E1 (ASCII)	8: 8E1 (ASCII)	14: 8E1 (RTU)		
3: 7O1 (ASCII)	9: 8O1 (ASCII)	15: 8O1 (RTU)		
4: 7E2 (ASCII)	10: 8E2 (ASCII)	16: 8E2 (RTU)		
5: 7O2 (ASCII)	11: 8O2 (ASCII)	17: 8O2 (RTU)		
6: 8N1 (ASCII)	12: 8N1 (RTU)			

Computer Link Control by PC or PLC (Computer Link).

A GS4 drive can be set up to communicate on Modbus networks using one of the following modes:

- *ASCII (American Standard Code for Information Interchange).*
  Uses 10-bit protocol string for 7 data bits, plus start, stop, and parity bits.
  Example: 7N2 = (1 start + 7 data + 0 parity + 2 stop) bits
- *RTU (Remote Terminal Unit).*
  Uses 11-bit protocol string for 8 data bits, plus start, stop, and parity bits.
  Example: 8E1 = (1 start + 8 data + 1 parity + 1 stop) bits

Modbus RTU is the prevalent protocol for serial Modbus communication. It is more efficient and has better error-checking than Modbus ASCII. We recommend using RTU over ASCII if the external device supports both modes.

Refer to "Chapter 5: Serial Communications" for detailed Modbus serial communication information.

		Type	Hex Addr	Dec Addr
P9.03	**Modbus Fault Select**	♦ R/W	0903	42308
Range/Units (Format: 16-bit binary)			Default	
0: Warn & Continue Operation			3	
1: Warn & Ramp to Stop				
2: Warn & Coast to Stop				
3: No Warning & Continue Operation				

This parameter is used to detect a serial communication error and take appropriate action.
NOTE: P9.03 applies only to serial communications.
Related Parameters: P9.04, P9.05

		Type	Hex Addr	Dec Addr
P9.04	**Modbus Time Out Detection**	♦ R/W	0904	42309
Range/Units (Format: 16-bit binary)		Default		
0: Disable 1: Enable		0		

This parameter Enables or Disables time-out detection for serial communications.
NOTE: P9.04 applies only to serial communications.
Related Parameters: P9.03, P9.05

		Type	Hex Addr	Dec Addr
P9.05	**Modbus Time Out Duration**	♦ R/W	0905	42310
Range/Units (Format: 16-bit unsigned)		Default		
0.1 to 100.0 seconds		0.5		

When parameter P9.04 is set to 1, the communications Time Out Detection is Enabled. If a delay in communications for more than the Time Out Duration (P9.05) is detected, the action selected by the Transmission Fault Treatment (P9.03) will be used.
NOTE: P9.05 applies only to serial communications.
Related Parameters: P9.03, P9.04

		Type	Hex Addr	Dec Addr
P9.06	**Parameter Copy**	♦ R/W	0906	42311
Range/Units (Format: 16-bit binary)		Default		
0: Disable Copy Keypad function 1: Enable Copy Keypad function		0		

The "Copy Param" function in the keypad can always copy parameter values from the drive to the keypad. If you want to copy parameters from the keypad to the drive, P9.06 must be set to 1 first; or else an SE1 error will appear on the keypad. This parameter is used to upload or download parameters from the keypad to the drive. After a power cycle P9.06 will default to 0.
NOTE: This parameter can be changed only by keypad entry. Writing to this parameter (Modbus, etc.) will result in a communications failure.

		Type	Hex Addr	Dec Addr
P9.07	**Parameter Lock**	R/W	0907	42312
Range/Units (Format: 16-bit binary)		Default		
0: Normal Operation (allow changes) 1: Prevent any Changes to Parameters		0		

This parameter lock is global; it *affects all parameters in the GS4 drive*.

P9.08 is also capable of "parameter lock," and it should be checked if the drive parameter settings cannot be changed.

		Type	Hex Addr	Dec Addr
P9.08	**Restore to Default**	R/W	0908	42313

Range/Units (Format: 16-bit binary) — Default

0: no function	6: Reset PLC (clear PLC)	0
1: Parameter Lock	7: no function	
2: no function	8: no function	
3: no function	9: Reset 50Hz Default	
4: no function	10: Reset 60Hz Default	
5: Reset kWh Display to Zero		

When this parameter is set to 1, all parameters except P9.08, P8.06, and P8.07 (Password Set Up) become read only. (P9.07 is capable of locking all of the drive parameters, and it should be checked if the drive parameter settings cannot be changed.)

Set P9.08 to 0 before changing other parameter settings.

- *When set to 5, kWh display value can be reset to 0, even when the drive is operating.*
- *When set to 6, the internal PLC program will be cleared.*
- *When set to 9 or 10, all parameters will be reset to factory settings. If the password is set in P8.07, input the password set in P8.06 to reset to factory settings.*
- *When set to 6, 9, or 10, power must be cycled on the drive for setting to take effect.*
- *Resets cannot be performed while PLC is running or in stop mode; PLC must be in Disable mode.*
- *If an "Err" appears on the keypad after performing a default action, then the default action did not take affect. The keypad will report back "End" if the default was performed correctly.*

This parameter does not reset the communication settings inside the Ethernet communication card. (Any new communication card parameter values must be "pushed" from the P9 parameters to the card. See P9.64)

		Type	Hex Addr	Dec Addr
P9.09	**Block Transfer Data Location 1**	* R/W	0909	42314
P9.10	**Block Transfer Data Location 2**	* R/W	090A	42315
P9.11	**Block Transfer Data Location 3**	* R/W	090B	42316
P9.12	**Block Transfer Data Location 4**	* R/W	090C	42317
P9.13	**Block Transfer Data Location 5**	* R/W	090D	42318
P9.14	**Block Transfer Data Location 6**	* R/W	090E	42319
P9.15	**Block Transfer Data Location 7**	* R/W	090F	42320
P9.16	**Block Transfer Data Location 8**	* R/W	0910	42321
P9.17	**Block Transfer Data Location 9**	* R/W	0911	42322
P9.18	**Block Transfer Data Location 10**	* R/W	0912	42323
P9.19	**Block Transfer Data Location 11**	* R/W	0913	42324
P9.20	**Block Transfer Data Location 12**	* R/W	0914	42325
P9.21	**Block Transfer Data Location 13**	* R/W	0915	42326
P9.22	**Block Transfer Data Location 14**	* R/W	0916	42327
P9.23	**Block Transfer Data Location 15**	* R/W	0917	42328
P9.24	**Block Transfer Data Location 16**	* R/W	0918	42329

Range/Units (Format: 16-bit unsigned) — Default

0~65535 — 0

*P9.09~P9.24 can be set in run mode if the corresponding Block Transfer Address Pointer (P9.69~P9.84) is pointing to a register that allows writes while in run mode.

This block of parameters (P9.09 to P9.24) contains parameter data values. The pointer addresses for these data are defined in parameters P9.69 to P9.84.

Refer to "Block Transfer Explanation" (page 4–189) for details about transferring blocks of data.

		Type	Hex Addr	Dec Addr
P9.25	**reserved**	~	0919	42330

		Type	Hex Addr	Dec Addr
P9.26	**RS485 Speed Reference**	Read	091A	42331
Range/Units (Format: 16-bit unsigned)		Default		
0.00~599.00 Hz		60.00		

When the Source of Frequency Command parameters P4.00 or P4.01 are set to 1 (RS-485 Communication), write the desired command frequency to this register. This parameter is used if the command frequency will not change constantly (more than ≈once per second). The physical memory used for Parameters has a finite number of times each location can be written to (usually in the millions of cycles).

If the GS4 will be sent new frequency commands millions of times over its life span, please write the frequency value to register 2001h (normally identified as Command Frequency for ModTCP Ethernet communication). The 2001h memory location does not have this limitation.

An *example* of this high number of writes: a dancer arm connected to an external PLC determines the drive's command frequency. The command frequency could change every PLC scan (≈10ms) and be sent via RS-485 to the drive. This frequency should be written to 2001h. See "GS4-CM-MODTCP Control Words" in Appendix B: "Optional I/O and Communication Cards" for more details on 2001h.

- *If both P9.26 and 2001h are written to, the last value written will determine the output frequency.*
- *Sending a value of 6000 to P9.26 or 2001h will represent 60.00Hz.*

When using RS-485, use the following parameters (P9.27, P9.29, P9.30, P9.31) for Run/Stop, Jog, Direction, and Fault Reset (instead of 2000h).

When the GS4 drive is set up with reference as RS-485, ModbusTCP, or EtherNet I/P (P4.00 = 1 or 4 & drive in Remote/Auto) – OR – (P4.01 = 1 or 4 & drive in Local/Hand) – AND – Reference > (is greater than) P0.04, Max Hz Output – Drive goes up to Max Frequency where it remains until Max Freq modified or Lower Frequency Reference is sent or stop is sent to the drive.

Writing to and Reading from the RS-485 Run and Direction Commands work as expected with RS-485 communication.
If you are also simultaneously writing to Address 2000h via Ethernet (the Control word for Ethernet control - see Ch5, page 5-6), these RS-485 Run and Direction words may not read back correctly with the current status. (Please use RS-485 OR Ethernet for exact feedback, but not both.)

When controlling the drive via RS-485, do not send a Jog Command while the drive is running. Also, do not send a Run Command while the drive is jogging. When the second command is sent, the drive will respond with "Illegal Data Value."

		Type	Hex Addr	Dec Addr
P9.27	**RS485 RUN Command**	♦ R/W	091B	42332
Range/Units (Format: 16-bit binary)		Default		
0: Stop		0		
1: Run				

In order for this parameter to function, the Source of Operation Command (P3.00 or P3.01) must be set to 03 or 04.

NOTE: Do not write both RUN (P9.27) and JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

Writing to and Reading from the RS-485 Run and Direction Commands work as expected with RS-485 communication.
If you are also simultaneously writing to Status Address 2000h via Ethernet (the Control word for Ethernet control - see Ch5, page 5-6), these RS-485 Run and Direction words may not read back correctly with the current status. (Please use RS-485 OR Ethernet for exact feedback, but not both.)

		Type	Hex Addr	Dec Addr
P9.28	**RS485 Direction Command**	♦ R/W	091C	42333
Range/Units (Format: 16-bit binary)		*Default*		
0: Forward 1: Reverse		0		

This parameter sets the direction for the Run Command.

		Type	Hex Addr	Dec Addr
P9.29	**RS485 External Fault**	♦ R/W	091D	42334
Range/Units (Format: 16-bit binary)		*Default*		
0: No Fault 1: External Fault		0		

Use this parameter to initiate an external fault via RS-485.

		Type	Hex Addr	Dec Addr
P9.30	**RS485 Fault Reset**	♦ R/W	091E	42335
Range/Units (Format: 16-bit binary)		*Default*		
0: No Action 1: Fault Reset		0		

Use this parameter to reset a fault via RS-485.

		Type	Hex Addr	Dec Addr
P9.31	**RS485 JOG Command**	♦ R/W	091F	42336
Range/Units (Format: 16-bit binary)		*Default*		
0: Stop 1: Jog		0		

Use this parameter to issue a Jog Command via RS-485.
NOTE: Do not write both RUN (P9.27) and JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

When controlling the drive via RS-485, do not send a Jog Command while the drive is running. Also, do not send a Run Command while the drive is jogging. When the second command is sent, the drive will respond with "Illegal Data Value."

		Type	Hex Addr	Dec Addr
P9.32	**reserved**	~	0920	42337

		Type	Hex Addr	Dec Addr
P9.33	**GS4 Drive Rated Amps**	Read	0921	42338
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~655.34A		#.##		

This parameter shows the rated currents of the GS4 AC Drives. The rated currents are listed according to the ID codes shown in P9.42.

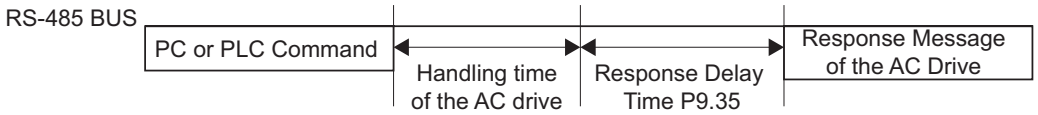
- *By default, the current ratings shown are for light duty (variable torque).*
- *To display normal duty (constant torque) current ratings, set P6.34 (Variable/Constant Torque Duty Selection) to 1.*

		Type	Hex Addr	Dec Addr
P9.34	**PLC Command Mask (status only)**	Read	0922	42339
Range/Units (Format: 16-bit binary)		Default		
0~65535 Bit 0: Control Commands Controlled by PLC Bit 1: Frequency Commands Controlled by PLC Bit 2: reserved Bit 3: reserved		0		

This parameter shows if the Source Of Operation Command (SOOC) or the Source of Operation Frequency (SOOF) is controlled by the internal PLC or controlled by the drive.

		Type	Hex Addr	Dec Addr
P9.35	**Response Delay Time**	♦ R/W	0923	42340
Range/Units (Format: 16-bit unsigned)		Default		
0.0~200.0 ms		2.0		

This parameter is the response delay time after the AC drive receives a serial Modbus or BACnet communication command as shown below.



		Type	Hex Addr	Dec Addr
P9.36	**reserved**	~	0924	42341

		Type	Hex Addr	Dec Addr
P9.37	**PLC Address**	R/W	0925	42342
Range/Units (Format: 16-bit unsigned)		Default		
1~254		2		

Modbus node address of the PLC. Cannot be same as the communication address of drive (P9.00).

		Type	Hex Addr	Dec Addr
P9.38	**Firmware Date Code**	~	0926	42343
Range/Units		Default		
Format: yywwd • yy = year (2017 = 17) • ww = week (01~52) • d = day of week (1~7; Mon=1, Sun = 7)		#####		

		Type	Hex Addr	Dec Addr
P9.39	**Firmware version**	Read	0927	42344
Range/Units (Format: 16-bit unsigned)		Default		
x.xx		#.##		

This parameter shows the firmware version of the GS4 AC Drive.
To see firmware version of the Keypad instead of the drive, hold the UP key during boot up.
Updating firmware will not change the values of the parameters.

		Type	Hex Addr	Dec Addr
P9.40	**reserved**	~	0928	42345

		Type	Hex Addr	Dec Addr
P9.41	**GS Series Number**	Read	0929	42346
Range/Units		Default		
0~9		4		

		Type	Hex Addr	Dec Addr
P9.42	**Manufacturer Model**	Read	092A	42347

Range/Units (Format: 16-bit unsigned) — *Default*: ##

00: GS4-21P0 (230V 1ph/3ph 1.0hp)	18: GS4-45P0 (460V 3ph 5.0hp)
01: GS4-22P0 (230V 1ph/3ph 2.0hp)	19: GS4-47P5 (460V 3ph 7.5hp)
02: GS4-23P0 (230V 1ph/3ph 3.0hp)	20: GS4-4010 (460V 3ph 10hp)
03: GS4-25P0 (230V 3ph 5.0hp)	21: GS4-4015 (460V 3ph 15hp)
04: GS4-27P5 (230V 3ph 7.5hp)	22: GS4-4020 (460V 3ph 20hp)
05: GS4-2010 (230V 3ph 10hp)	23: GS4-4025 (460V 3ph 25hp)
06: GS4-2015 (230V 3ph 15hp)	24: GS4-4030 (460V 3ph 30hp)
07: GS4-2020 (230V 3ph 20hp)	25: GS4-4040 (460V 3ph 40hp)
08: GS4-2025 (230V 3ph 25hp)	26: GS4-4050 (460V 3ph 50hp)
09: GS4-2030 (230V 3ph 30hp)	27: GS4-4060 (460V 3ph 60hp)
10: GS4-2040 (230V 3ph 40hp)	28: GS4-4075 (460V 3ph 75hp)
11: GS4-2050 (230V 3ph 50hp)	29: GS4-4100 (460V 3ph 100hp)
12: GS4-2060 (230V 3ph 60hp)	30: GS4-4125 (460V 3ph 125hp)
13: GS4-2075 (230V 3ph 75hp)	31: GS4-4150 (460V 3ph 150hp)
14: GS4-2100 (230V 3ph 100hp)	32: GS4-4175 (460V 3ph 175hp)
15: GS4-41P0 (460V 3ph 1.0hp)	33: GS4-4200 (460V 3ph 200hp)
16: GS4-42P0 (460V 3ph 2.0hp)	34: GS4-4250 (460V 3ph 250hp)
17: GS4-43P0 (460V 3ph 3.0hp)	35: GS4-4300 (460V 3ph 300hp)

This parameter shows the model number and ID code of the GS4 AC Drive. Use this P9.42 ID code to find the drive rated current in P9.33.

		Type	Hex Addr	Dec Addr
P9.43	**Ignore Comm Card Warning**	R/W	092B	42348

Range/Units — *Default*: 1

0: Disable Ignore function (do NOT ignore warning)
1: Enable Ignore function (ignore warning)

Enabling P9.43 will cause the drive to ignore Comm Card warnings.

		Type	Hex Addr	Dec Addr
P9.44	**Comm Card Type**	Read	092C	42349

Range/Units (Format: 16-bit binary) — *Default*: 0

0: No Communication Card	5: EtherNet/IP Slave
1: reserved	6: reserved
2: reserved	7: reserved
3: reserved	8: reserved
4: MODBUS-TCP Slave	

This parameter displays the type of the currently installed communications card.

		Type	Hex Addr	Dec Addr
P9.45	**Comm Card Version**	Read	092D	42350

Range/Units (Format: 16-bit unsigned) — *Default*: 0

0~65535

This parameter displays the firmware version of the currently installed communications card.

		Type	Hex Addr	Dec Addr
P9.46	**Comm Card Production Code**	Read	092E	42351

Range/Units (Format: 16-bit unsigned) — *Default*: 0

0~65535

This parameter displays the production code of the currently installed communications card.

		Type	Hex Addr	Dec Addr
P9.47	**Comm Card Fault Code**	Read	092F	42352
	Range/Units (Format: 16-bit unsigned)	Default		
	0~65535	0		

This parameter displays applicable Fault Codes for the currently installed communications card. NOTE: *Fault Parameters are explained in Parameter Group P11.xx (page 4–203), and the Fault Code error messages are show in Chapter 6: Maintenance and Troubleshooting (page 6–16).*

		Type	Hex Addr	Dec Addr
P9.48	**Comm Card IP Configuration**	R/W	0930	42353
	Range/Units (Format: 16-bit binary)	Default		
	0: Static IP – User needs to set the IP address manually. 1: Dynamic IP (DHCP) – IP address will be automatically set by the host controller.	0		

This parameter displays the configuration of the currently installed communications card.

We strongly recommend using the Static IP setting. If using Dynamic IP, the DHCP server may unexpectedly change the GS4 IP address. This could cause any external PLCs, HMIs, etc., to lose communication to the drive.

		Type	Hex Addr	Dec Addr
P9.49	**Comm Card IP Address Octet 1**	♦ R/W	0931	42354
P9.50	**Comm Card IP Address Octet 2**	♦ R/W	0932	42355
P9.51	**Comm Card IP Address Octet 3**	♦ R/W	0933	42356
P9.52	**Comm Card IP Address Octet 4**	♦ R/W	0934	42357
P9.53	**Comm Card Mask Octet 1**	♦ R/W	0935	42358
P9.54	**Comm Card Mask Octet 2**	♦ R/W	0936	42359
P9.55	**Comm Card Mask Octet 3**	♦ R/W	0937	42360
P9.56	**Comm Card Mask Octet 4**	♦ R/W	0938	42361
P9.57	**Comm Card Gateway Octet 1**	♦ R/W	0939	42362
P9.58	**Comm Card Gateway Octet 2**	♦ R/W	093A	42363
P9.59	**Comm Card Gateway Octet 3**	♦ R/W	093B	42364
P9.60	**Comm Card Gateway Octet 4**	♦ R/W	093C	42365
	Range/Units (Format: 16-bit unsigned)	Default		
	0~255	0		

The octet addresses 1 through 4 are from left to right.

For more detailed Ethernet information, refer to Appendix B: Optional I/O and Communication Cards.

When P9.xx parameters are changed, the new communication card parameter values must be "pushed" from the P9 parameters to the card. See P9.64.

		Type	Hex Addr	Dec Addr
P9.61	**reserved**	~	093D	42366
P9.62	**reserved**	~	093E	42367

		Type	Hex Addr	Dec Addr
P9.63	**Comm Card Factory Reset**	R/W	093F	42368
	Range/Units (Format: 16-bit binary)	Default		
	0: No Action 1: Reset to the Factory Setting	0		

When the card is reset to Factory Defaults, the P9 parameters still retain their values (IP addresses, Masks, etc.) in the GS4 AC drive. To re-write the drive parameters back into the card, use P9.64.

		Type	Hex Addr	Dec Addr
P9.64	**Comm Card External Set**	R/W	0940	42369
Range/Units (Format: 16-bit binary)		*Default*		
0, 2 Bit 0 = reserved Bit 1 = Write Ethernet Parameters to the Comm Card Bit 2 = reserved		0		

The Ethernet communication cards have their own internal set of configuration registers. The P9.xx parameters must be "pushed" into the Ethernet comm cards before they take effect.

Bit 1: Internet parameters enable

Set Bit 1 (enter a decimal value of 2) to write Ethernet-related parameter values into the comm card after the comm card parameters have been set up in the GS4 drive. This bit will change to 0 when it finishes saving the update of internet parameters. If the value does not automatically reset to 0 after entering "2" and pressing Enter, then the parameters did not get pushed down to the comm card.

When comm card is reset to factory defaults, the P9 parameters still reside in the drive. Bit 1 must be set high to write the Drive Parameters to the comm card.

For more detailed information, refer to Appendix B: Optional I/O and Communication Cards.

		Type	Hex Addr	Dec Addr
P9.65	**reserved**	~	0941	42370
P9.66	**reserved**	~	0942	42371
P9.67	**reserved**	~	0943	42372
P9.68	**reserved**	~	0944	42373

		Type	Hex Addr	Dec Addr
P9.69	**Block Transfer Address Pointer 1**	R/W	0945	42374
P9.70	**Block Transfer Address Pointer 2**	R/W	0946	42375
P9.71	**Block Transfer Address Pointer 3**	R/W	0947	42376
P9.72	**Block Transfer Address Pointer 4**	R/W	0948	42377
P9.73	**Block Transfer Address Pointer 5**	R/W	0949	42378
P9.74	**Block Transfer Address Pointer 6**	R/W	094A	42379
P9.75	**Block Transfer Address Pointer 7**	R/W	094B	42380
P9.76	**Block Transfer Address Pointer 8**	R/W	094C	42381
P9.77	**Block Transfer Address Pointer 9**	R/W	094D	42382
P9.78	**Block Transfer Address Pointer 10**	R/W	094E	42383
P9.79	**Block Transfer Address Pointer 11**	R/W	094F	42384
P9.80	**Block Transfer Address Pointer 12**	R/W	0950	42385
P9.81	**Block Transfer Address Pointer 13**	R/W	0951	42386
P9.82	**Block Transfer Address Pointer 14**	R/W	0952	42387
P9.83	**Block Transfer Address Pointer 15**	R/W	0953	42388
P9.84	**Block Transfer Address Pointer 16**	R/W	0954	42389
Range/Units (Format: 16-bit unsigned)		*Default*		
0~65535		999		

This block of parameters (P9.69~P9.84) define the pointer addresses for Block Transfer. The actual parameter data is read from and written into parameters P9.09~P9.24.

Refer to "Block Transfer Explanation" (page 4–189) for details about transferring blocks of data.

		Type	Hex Addr	Dec Addr
P9.85	**PLC Frequency Command Force to 0**	R/W	0955	42390
Range/Units (Format: 16-bit binary)		Default		
0, 1 Bit 0 = 1: Before PLC scan, set up PLC Target Frequency = 0		0		

If Bit 0 is set to one (1), the GS4 drive Frequency Command will be reset to zero before the GS4 PLC next scan.

		Type	Hex Addr	Dec Addr
9.86	**COM1 Protocol (via RS-485)**	R/W	0956	42391
Range/Units (Format: 16-bit binary)		Default		
0: Modbus 1: BACnet		0		

		Type	Hex Addr	Dec Addr
P9.87	**BACnet Address**	R/W	0957	42392
Range/Units (Format: 16-bit unsigned)		Default		
0~127		10		

		Type	Hex Addr	Dec Addr
P9.88	**BACnet Baud Rate**	R/W	0958	42393
Range/Units (Format: 16-bit unsigned)		Default		
9.6~76.8 Kbps		38.4		

		Type	Hex Addr	Dec Addr
P9.89	**BACnet Device Instance Low Word**	R/W	0959	42394
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		10		

		Type	Hex Addr	Dec Addr
P9.90	**BACnet Device Instance High Byte**	R/W	095A	42395
Range/Units (Format: 16-bit unsigned)		Default		
0~63		0		

		Type	Hex Addr	Dec Addr
P9.91	**BACnet Max Polling Address**	R/W	095B	42396
Range/Units (Format: 16-bit unsigned)		Default		
0~127		127		

		Type	Hex Addr	Dec Addr
P9.92	**BACnet Password**	R/W	095C	42397
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

Parameters P9.86~P9.92 are applicable for BACnet serial communications.

		Type	Hex Addr	Dec Addr
P9.93	**Ethernet Communication Card Fault Select**	♦ R/W	095D	42398
Range/Units (Format: 16-bit binary)		Default		
0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation		3		

This parameter is used to detect an Ethernet communication error and take appropriate action.
Related Parameters: P9.94, P9.95

		Type	Hex Addr	Dec Addr
P9.94	**Ethernet Communication Card Time Out Detection**	♦ R/W	095E	42399
Range/Units (Format: 16-bit binary)		*Default*		
0: Disable 1: Enable		0		

This parameter Enables or Disables time-out detection for Ethernet communications.
Related Parameters: P9.93, P9.95

		Type	Hex Addr	Dec Addr
P9.95	**Ethernet Communication Card Time Out Duration**	♦ R/W	095F	42400
Range/Units (Format: 16-bit unsigned)		*Default*		
0.1 to 100.0 seconds		0.5		

When parameter P9.94 is set to 1, the communications Time Out Detection is Enabled. If a delay in communications for more than the Time Out Duration (P9.95) is detected, the action selected by the Transmission Fault Treatment (P9.93) will be used.
Related Parameters: P9.93, P9.94

Block Transfer Explanation

Parameters P9.09~P9.24 and P9.69~P9.84

Block Transfer allows parameters from many different Parameter Groups to be consolidated into one Modbus communication message. This can greatly simplify PLC programming and reduce network traffic. Unlike previous GS drives*, the GS4 has two sets of Block Transfer Parameters:

A) New Pointer Parameters P9.69~P9.84 (where you enter the addresses that you want to consolidate)

B) Data Location Parameters P9.09~P9.24 (where you push data into, or pull data out of)

GS4 Parameters Summary – Serial Communication Parameters – Block Transfer Parameter Map											
Parameter / Address Description	*Block Transfer Address Pointers*					*Block Transfer Data*					*Default Setting*
	Parameter	*Description (Range)*	*Modbus Address*			*Parameter*	*Description (Range)*	*Modbus Address*			
			Hex	*Dec*	*Octal*			*Hex*	*Dec*	*Octal*	
Block Transfer 1	***P9.69***	0~65535 Format as xxyy, where: xx = target parameter group # yy = target parameter #	0945	42374	4505	***P9.09***	Dependent upon the target address. Example: If Block Transfer points to a digital parameter, range = 0,1. If it points to analog parameter, the range could be 0–65535.	0909	42314	4411	0
Block Transfer 2	***P9.70***		0946	42375	4506	***P9.10***		090A	42315	4412	0
Block Transfer 3	***P9.71***		0947	42376	4507	***P9.11***		090B	42316	4413	0
Block Transfer 4	***P9.72***		0948	42377	4510	***P9.12***		090C	42317	4414	0
Block Transfer 5	***P9.73***		0949	42378	4511	***P9.13***		090D	42318	4415	0
Block Transfer 6	***P9.74***		094A	42379	4512	***P9.14***		090E	42319	4416	0
Block Transfer 7	***P9.75***		094B	42380	4513	***P9.15***		090F	42320	4417	0
Block Transfer 8	***P9.76***		094C	42381	4514	***P9.16***		0910	42321	4420	0
Block Transfer 9	***P9.77***		094D	42382	4515	***P9.17***		0911	42322	4421	0
Block Transfer 10	***P9.78***		094E	42383	4516	***P9.18***		0912	42323	4422	0
Block Transfer 11	***P9.79***		094F	42384	4517	***P9.19***		0913	42324	4423	0
Block Transfer 12	***P9.80***		0950	42385	4520	***P9.20***		0914	42325	4424	0
Block Transfer 13	***P9.81***		0951	42386	4521	***P9.21***		0915	42326	4425	0
Block Transfer 14	***P9.82***		0952	42387	4522	***P9.22***		0916	42327	4426	0
Block Transfer 15	***P9.83***		0953	42388	4523	***P9.23***		0917	42328	4427	0
Block Transfer 16	***P9.84***		0954	42389	4524	***P9.24***		0918	42329	4430	0

Example:
You want to consolidate the parameters Multi-Speed 15 (P5.15), Skip Frequency 3 Lower Limit (P1.24), and Circulation Time (P10.02). Enter the following values into P9.69, P9.70, and P9.71:

	Address Pointers	Data Locations (to Push Data to, or Pull Data from)
Block Transfer 1	P9.69 = 515 (points to P5.15)	P9.09
Block Transfer 2	P9.70 = 124 (points to P1.24)	P9.10
Block Transfer 3	P9.71 = 1002 (points to P10.02)	P9.11
The Address Pointers use xxyy format, where:	• *xx = Parameter Group# and* • *yy = Parameter# in that group.*	

All of the data is now in consecutive order so that you can write one Modbus message to P9.09 with a length of three registers, and it will change P5.15, P1.24, and P10.02. Or you can use one Modbus Read message that will collect all three parameters at once. Without Block Transfer, reading or writing these three parameters would require three separate communication commands from an external PLC.

***** *Previous GS Drives had only one set of parameters for Block Transfer, and the Pointer Addresses had to be manually entered into the keypad. Only then would any read or write into that Block Transfer address actually be linked to the desired data. Unfortunately, this meant that you would have to manually enter Block Transfer addresses via the keypad for any new drive. With the GS4 method, the Pointer Addresses are in separate parameters. Thus, the complete configuration can be downloaded via software (no keypad entry necessary).*

Group P10.xx Details – Pump Parameters

Pump Parameters Overview

Parameter Group 10 has three basic control modes of operation. Each control mode can use PID feedback as a reference signal. The entire P10 group was developed to allow one GS4 to control multiple pumps. The control modes can be selected individually, or some of them can be combined (see P10.00).

In the explanations below, "Drive-powered" means that the pump gets its power from the drive's IGBTs. "Line-powered" means that the pump is connected to mains power (50 or 60 Hz) through a contactor. The contactors are turned ON and OFF by relays on the GS4.

Time Circulation: This control mode typically has up to 8 similar-sized pumps that can be drive-powered, but only one pump can be ON at a time. The drive will sequentially cycle through the pumps to keep the run-time of all pumps equal. This prevents one pump from accumulating many hours of run time, while other pumps may never get used. When Time Circulation is selected (P10.00 = 1), only one pump is ON at a time.

This mode can be used with PID control, or it can be used with any other input control signal (analog input, serial communication, etc.).

The following two P10.00 control modes allow for multiple pumps to be ON at the same time. These "Quantity" Modes are for use with PID control (an analog input control signal is used for PID feedback; not a frequency reference).

If the "Quantity" modes are used with a frequency reference signal (e.g. Analog Input 1 = a speed reference), pump switching will only occur when the frequency setpoint goes above P10.06 (increasing demand) or when the frequency setpoint goes below P10.08 (decreasing demand).

Quantity Control: This control mode typically has one large pump (Motor 0) that is drive powered. There can also be up to 8 Auxiliary pumps that are line powered. The Auxiliary pumps are switched ON and OFF by contactors controlled by the GS4 relay outputs (R1, R2, R10~R15). The contactors feed the Auxiliary pumps with line power only. In Quantity Control, the Auxiliary pumps are never fed with drive power.

Quantity Cycle: This control mode typically has up to 4 similar-sized pumps. Each pump can be drive-powered (one at a time) or switched to line power (multiple pumps running at the same time). Each pump requires two contactors (and two GS4 relay outputs) per pump: one contactor connects the pump to line power, and the other contactor connects the pump to drive power. The contactors must be electrically interlocked so that both cannot be on at the same time (see the wiring diagrams). The drive will try to satisfy the system demand with one pump connected to drive power. If the system demand is not met with one pump, the drive will switch the first pump over to line power, then start up the second pump on drive power. This continues until all pumps are running line power except for the last pump (it remains on drive power).

Each of the above modes can be selected individually (P10.00 = 1, 2, or 3). The Quantity modes can also be combined with Time Circulation to get the best of both worlds: multiple pump control with the ability to even out the run times of each pump (P10.00 = 4 or 5).

NOTE: For circulative control applications requiring more than two outputs, the GS4-06TR relay output card is required.

Pump Parameters Details

Parameters P10.00~P10.08 provide five different methods for cyclical control of pumps, consisting of the three previously described control modes plus two combined modes.

		Type	Hex Addr	Dec Addr
P10.00	***Circulative Control***	R/W	0A00	42561

Range/Units (Format: 16-bit binary) — *Default*: 0

0: no function
1: Time Circulation
2: Quantity Cycle
3: Quantity Control
4: Time Circulation + Quantity Cycle
5: Time Circulation + Quantity Control

Parameter P10.00 selects one of five Circulative Control modes. The table below associates the P10 parameters with each of the five modes. Only in mode 4, Quantity Cycle + Time Circulation, are all nine parameters used.

Descriptions and timing charts for of each of these five circulative control modes can be found in the subsequent pages of this section following the P10 parameter descriptions.

P10.00~P10.08 – Circulative Control Modes – Related Parameters

Param#	Description	No Fn.	T.Circ.	Q.Cycle	Q.Cont.	Q.Cy.+T.C.	Q.Co.+T.C.
P10.00	Circulative Control	0	1	2	3	4	5
P10.01	Number of Connected Motors	~	√	√	√	√	√
P10.02	Desired Run Time of Each Motor	~	√	~	~	√	√
P10.03	Motor Switch Delay Time During Increasing Demand	~	√	√	√	√	√
P10.04	Motor Switch Delay Time During Decreasing Demand	~	~	√	√	√	√
P10.05	Motor Switch Delay Time During Fix Amount Circulation	~	~	√	√	√	√
P10.06	Motor Switch Frequency During Fix Amount Circulation	~	~	√	√	√	√
P10.07	Circulative Control Malfunction Action	~	~	√	~	√	~
P10.08	AUX Motor Stop Frequency	~	~	√	√	√	√

Disable Motor Outputs

GS4 drive Multi-Function Inputs can be configured to disable all motor outputs, or individual motor outputs. The settings are:

Multi-Function Input Settings to Disable Motor Outputs

P3.03~P3.16 =	42	43	44	45	46	47	48	49	50
Disable Motor Output	all	1	2	3	4	5	6	7	8

When a motor output is disabled, the motor will be de-energized and will coast stop.

		Type	Hex Addr	Dec Addr
P10.01	**Number of Connected Motors**	R/W	0A01	42562
Range/Units (Format: 16-bit binary)		Default		
1~8		1		

Parameter P10.01 sets the Number of Motors (maximum 8). The number of motors defined in this parameter will automatically configure multi-function output terminals to the following settings:

Multi-Function Output Terminals on Circulating Motors*											
Circulative Control	***P10.01***	***01***	***02***	***03***	***04***	***05***	***06***	***07***	***08***	***Modes 1,3,5***	***Modes 2,4***
Multi-Function Output (R1)	P3.17	47	47	47	47	47	47	47	47	Motor 1	Motor 1 on Drive
Multi-Function Output (R2)	P3.18		48	48	48	48	48	48	48	Motor 2	Motor 1 on AC Line
Multi-Function Output (R10)	P3.21			49	49	49	49	49	49	Motor 3	Motor 2 on Drive
Multi-Function Output (R11)	P3.22				50	50	50	50	50	Motor 4	Motor 2 on AC Line
Multi-Function Output (R12)	P3.23					51	51	51	51	Motor 5	Motor 3 on Drive
Multi-Function Output (R13)	P3.24						52	52	52	Motor 6	Motor 3 on AC Line
Multi-Function Output (R14)	P3.25							53	53	Motor 7	Motor 4 on Drive
Multi-Function Output (R15)	P3.26								54	Motor 8	Motor 4 on AC Line
NOTE: The order of motors (1~8 or 1~4) is fixed in GS4 firmware, and cannot be changed.											

Reducing the number of motors in P10.01 will remove settings associated with outputs R1, R2, & RO10~RO15 depending on the current number of motors selected in P10.01.

Example: changing P10.01 from 8 motors to 6 motors will automatically change P3.25 from "54: Mtr 8 On" to "0: No Function," and P3.24 from "53: Mtr 7 On" to "0: No Function."

		Type	Hex Addr	Dec Addr
P10.02	**Desired Run Time of Each Motor in Minutes**	R/W	0A02	42563
Range/Units (Format: 16-bit unsigned)		Default		
0~65500 min		0		

This parameter sets the Desired Run Time of Each Motor in minutes for each of the connected motors defined in parameter P10.01.

Stopping and then restarting the drive will reset the timer. (If the desired run time is 60 minutes, and the drive is stopped and restarted at 59 minutes, the active pump will continue to run for another 60 minutes.)

A value of zero in P10.02 stops timing. *In that event, a connected motor that is currently running will continue to run until a stop command is received by the GS4 drive*.

		Type	Hex Addr	Dec Addr
P10.03	**Motor Switch Delay Time During Increasing Demand**	R/W	0A03	42564
Range/Units (Format: 16-bit unsigned)		Default		
0.0~3600.0 sec		1.0		

As demand increases, this parameter defines the Delay Time in seconds from turn-off of the connected motor to turn-on of the next motor in the sequence.

When the connected motor elapsed Run Time equals the value in P10.02, the GS4 drive turns off that motor, and Delay Time begins to increment.

When the Delay Time in parameter P10.03 has elapsed, the GS4 drive will turn on the next connected motor in the sequence.

		Type	Hex Addr	Dec Addr
P10.04	***Motor Switch Delay Time During Decreasing Demand***	R/W	0A04	42565
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~3600.0 sec		1.0		

As demand decreases, this parameter defines the Delay Time in seconds from turn-off of the connected motor to turn-off of the next motor in the sequence.

When the connected motor elapsed Run Time equals the value in P10.02, the GS4 drive turns off that motor, and Delay Time begins to increment.

When the Delay Time in parameter P10.04 has elapsed and the demand is still decreasing, the GS4 drive will turn off the next connected motor in the sequence. Refer to the Decreasing Demand timing charts beginning on page 4–195.

		Type	Hex Addr	Dec Addr
P10.05	***Aux Motor Switch Delay Time During Fix Amount Circulation in Seconds***	♦ R/W	0A05	42566
Range/Units (Format: 16-bit unsigned)		*Default*		
0.0~3600.0 sec		10.0		

This parameter defines the Switch Delay Time in seconds for the connected motor. The delay time in P10.05 begins to increment when the GS4 output frequency equals the value in P10.06 or P10.08, depending on the control mode. When elapsed, the connected motor is switched off.
Refer to Timing Chart P10.00 = 1 (page 4–194) for details.

		Type	Hex Addr	Dec Addr
P10.06	***Aux Motor Switch Frequency During Fix Amount Circulation in Hz***	♦ R/W	0A06	42567
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~599.00 Hz		60.00		

When the GS4 drive output frequency equals the value in P10.06, the system will start preparing to switch motors.

		Type	Hex Addr	Dec Addr
P10.07	***Circulative Control Malfunction Action***	R/W	0A07	42568
Range/Units (Format: 16-bit binary)		*Default*		
0: Turn Off All Aux 1: Keep Aux Running		0		

This parameter determines which of two actions the GS4 drive will take in the event that the circulative control malfunctions.

- *Setting 0: Turn off all AUX*
- *Setting 1: Keep AUX running*

		Type	Hex Addr	Dec Addr
P10.08	***AUX Motor Stop Frequency***	♦ R/W	0A08	42569
Range/Units (Format: 16-bit unsigned)		*Default*		
0.00~599.00 Hz		0		

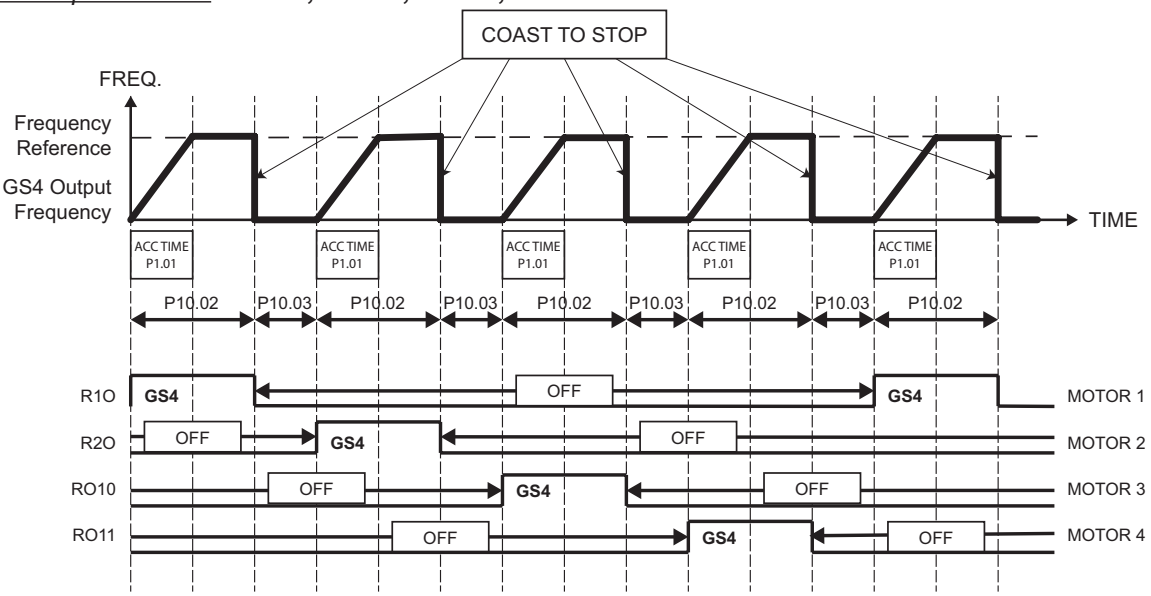
When the GS4 drive output frequency is below the value in P10.08 and remains below that value until the time set in P10.04 has elapsed, the GS4 drive will begin turning off motors one after another, in sequence.

Timing Charts for Circulative Control Modes P10.01 through P10.08

Timing Chart P10.00 = 1: Time Circulation

Up to 8 pumps can be drive-powered (only one is powered at a time). This mode ensures that each pump gets the same amount of run time.

Related parameters: P10.00, P10.01, P10.02, P10.03



P10.00 = 1 – Time Circulation Control

In this mode, the GS4 drive can individually control up to 8 motors.

- *The total number of motors controlled is set in parameter P10.01.*
- *The run time (in minutes) of each motor is set in parameter P10.02.*
- *The delay time (in seconds) between motors is set in parameter P10.03.*

When the motor run time equals the time set in P10.02, the GS4 drive will stop that motor. After the delay time set in parameter P10.03, has elapsed, the next motor in the sequence will start.

Stopping and then restarting the drive will reset the timer. (If the desired run time is 60 minutes, and the drive is stopped and restarted at 59 minutes, the active pump will continue to run for another 60 minutes.)

Timing Chart P10.00 = 2: Quantity Cycle

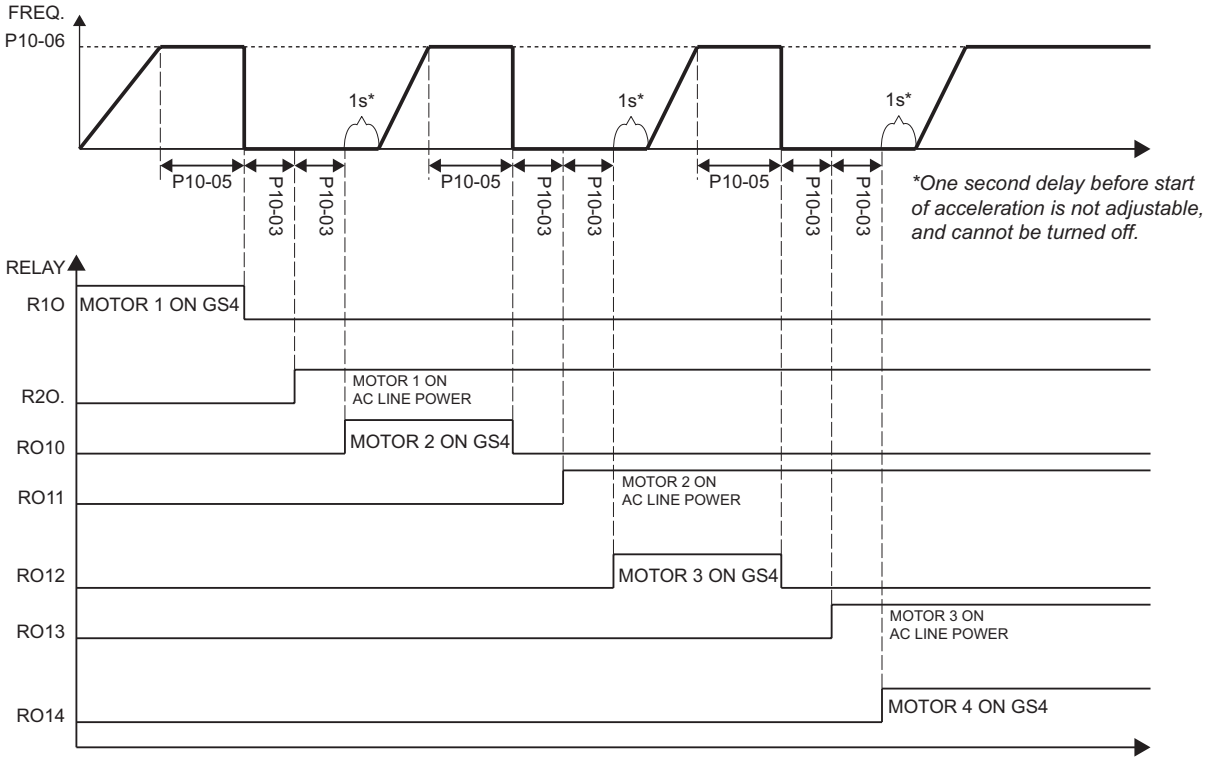
The drive powers one pump at a time. When demand increases, the drive-powered pump is switched to line power, and the next pump is started up on drive power. Up to 4 motors can be ON at the same time (only one will be powered by drive power at a time).

In *decreasing demand*, the last pump that is on drive power stays on drive power. When demand increases, the active pump will be switched to line power and the next pump will start up with drive power.

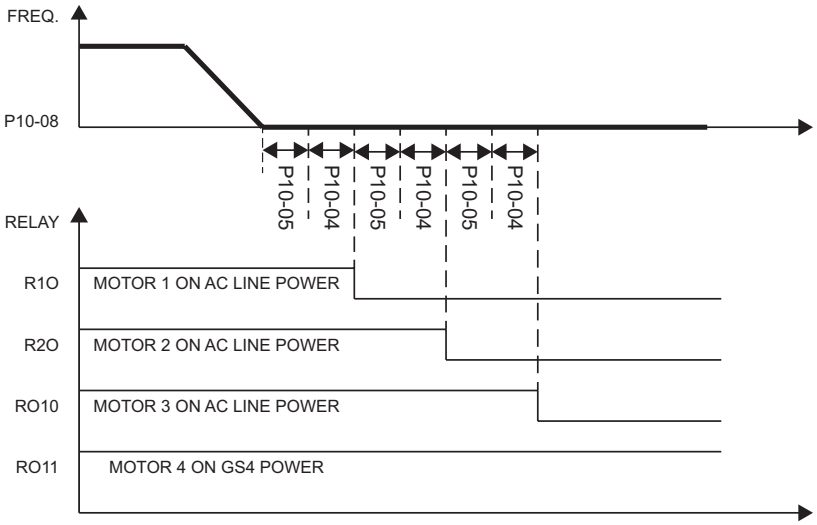
Example: Assume Pumps 1, 2, and then 3 were required to satisfy the load and then demand decreased to zero. Pump 1 and 2 (were on line power) would turn OFF, and Pump 3 would go to 0Hz (on drive power). When demand increased, Pump 3 would ramp to max frequency and then get switched to line power. Pump 4 would then get drive power (then Pump 1, then Pump 2, etc.).

Related parameters: P10.00, P10.01, P10.03, P10.04, P10.05, P10.06, P10.07, P10.08

Increasing Demand



Decreasing Demand

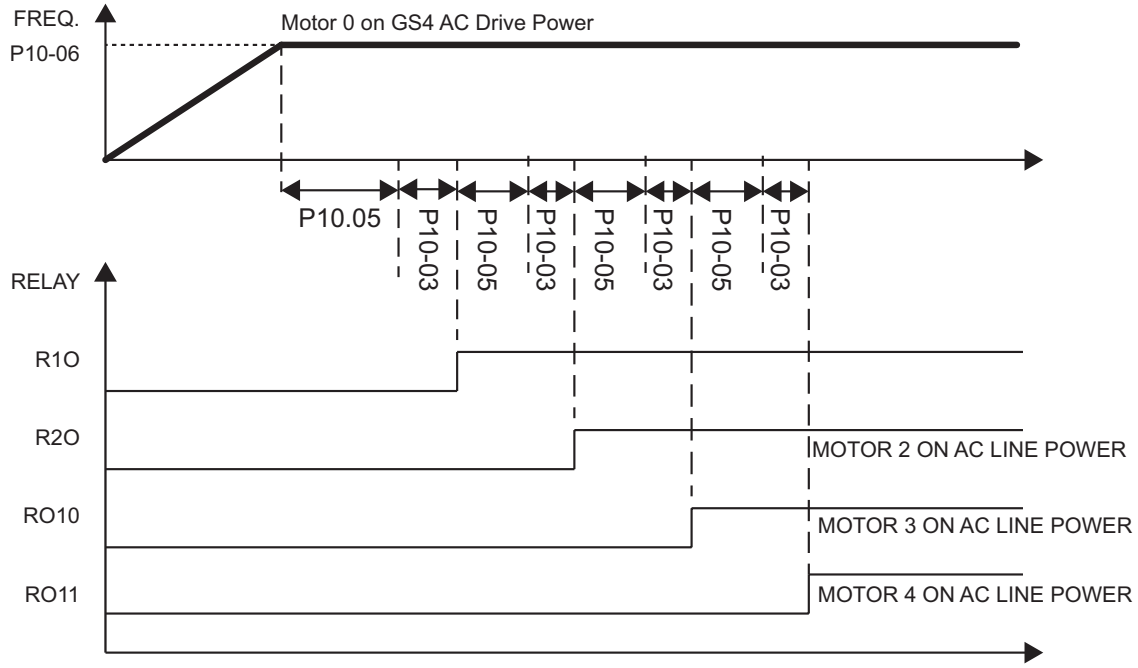


Timing Chart P10.00 = 3: Quantity Control

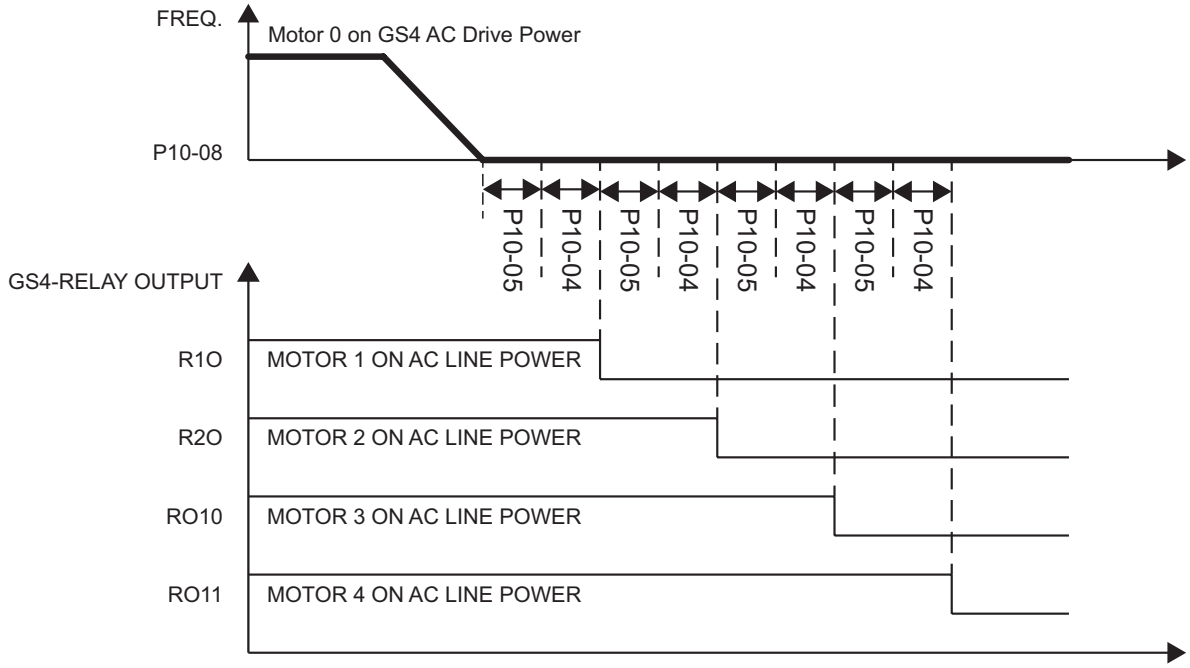
Only one motor will ever be drive-powered. Up to 8 auxiliary motors can be switched ON and OFF to satisfy demand. *The auxiliary motors are line-powered only*.

Related parameters: P10.00, P10.01, P10.03, P10.04, P10.05, P10.06, P10.08

Increasing Demand



Decreasing Demand

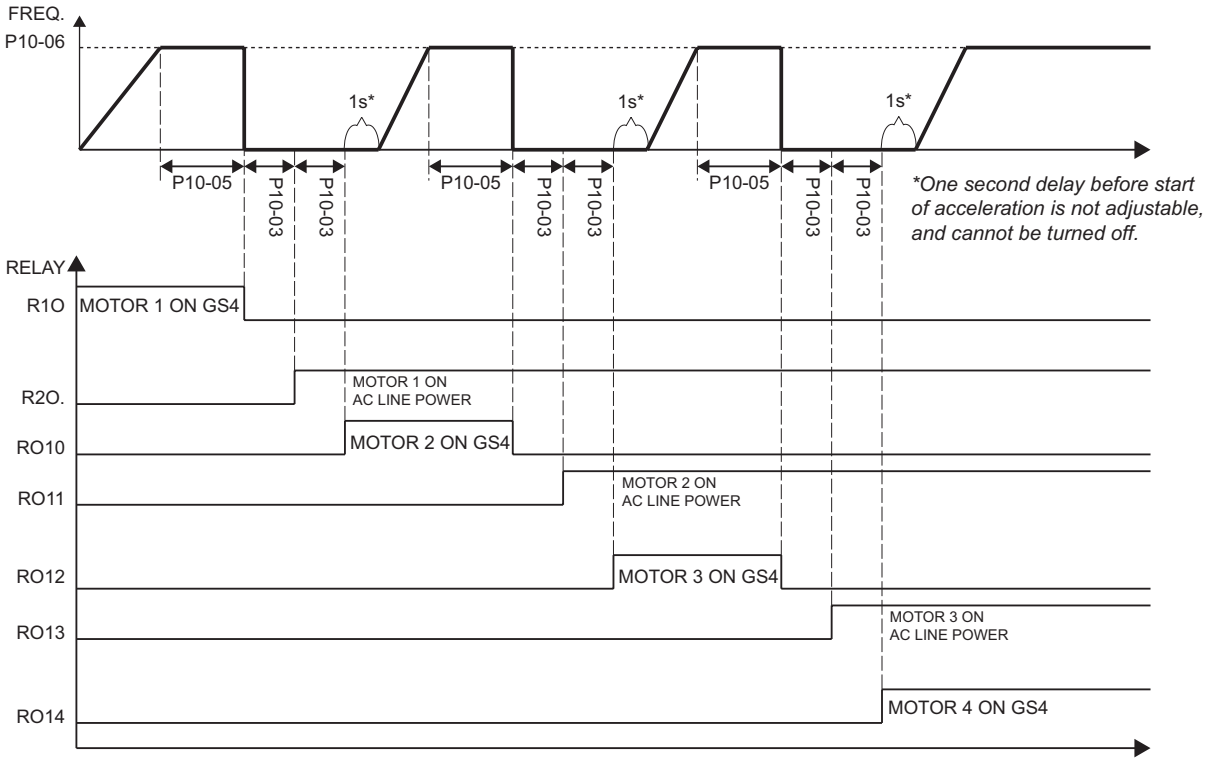


Timing Chart P10.00 = 4: Time Circulation + Quantity Cycle

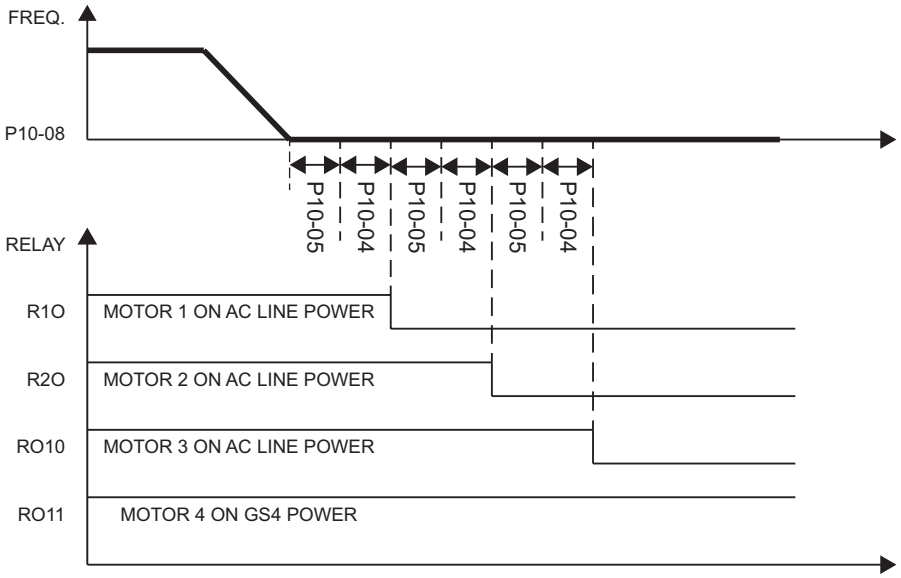
Incorporates the logic of Mode 2 (Quantity Cycle) and Mode 1 (Time Circulation): Up to 4 similar-size pumps with equal run time.

Related parameters: P10.00, P10.01, P10.02, P10.03, P10.04, P10.05, P10.06, P10.07, P10.08

Increasing Demand

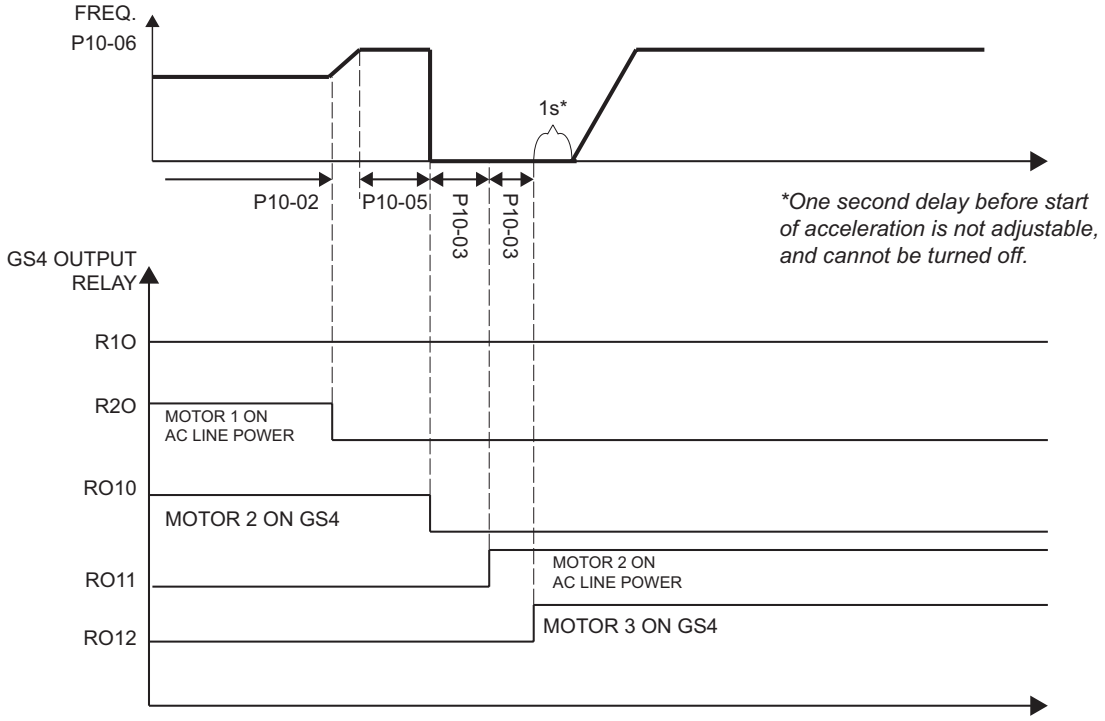


Decreasing Demand



(TIMING CHART P10.00 = 4: TIME CIRCULATION + QUANTITY CYCLE (CONTINUED))

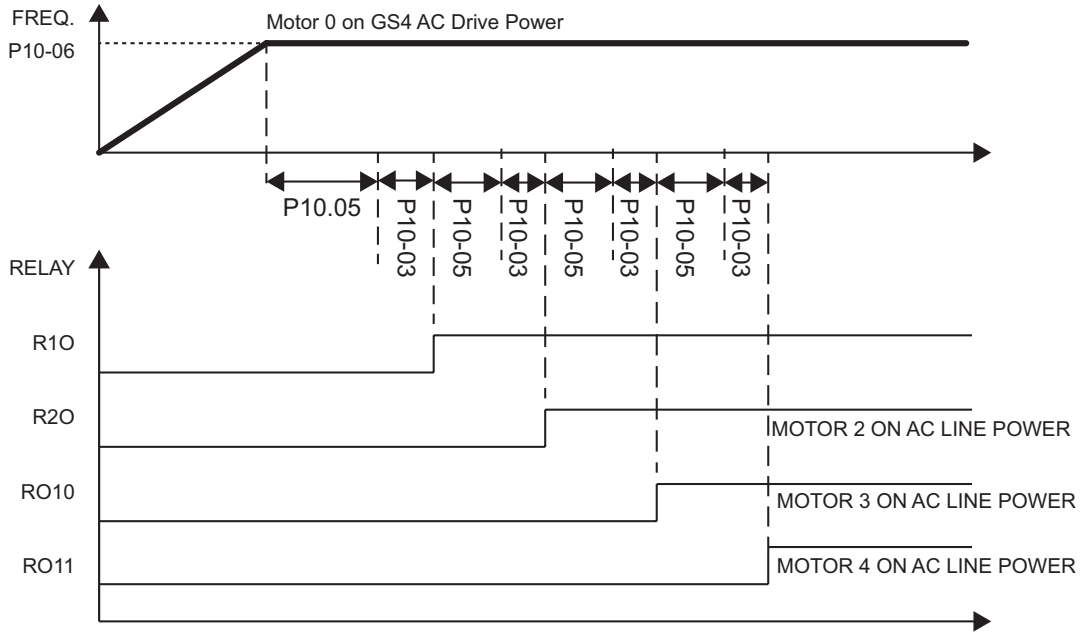
TIME CIRCULATION + QUANTITY CYCLE



TIMING CHART P10.00 = 5: TIME CIRCULATION + QUANTITY CONTROL

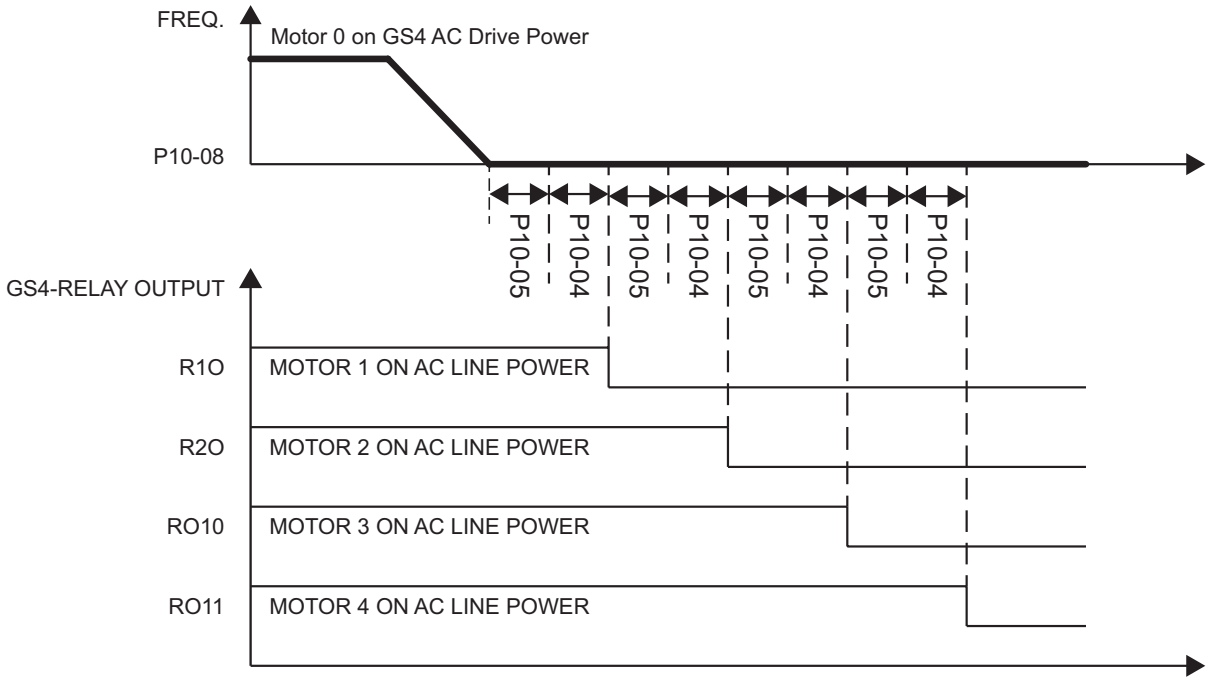
Incorporates the logic of Mode 3 (Quantity Control) with Mode 1 (Time Circulation): one drive-powered motor plus up to 8 auxiliary motors that have equal run time.

INCREASING DEMAND

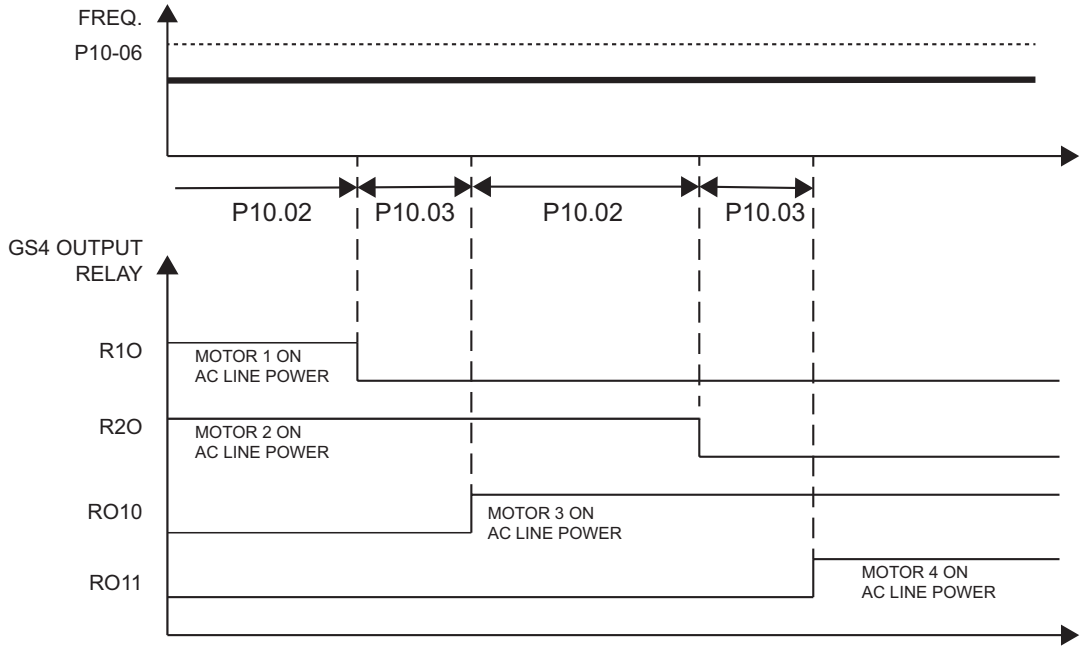


(TIMING CHART P10.00 = 5: TIME CIRCULATION + QUANTITY CONTROL (CONTINUED))

DECREASING DEMAND



TIME CIRCULATION + QUANTITY CONTROL



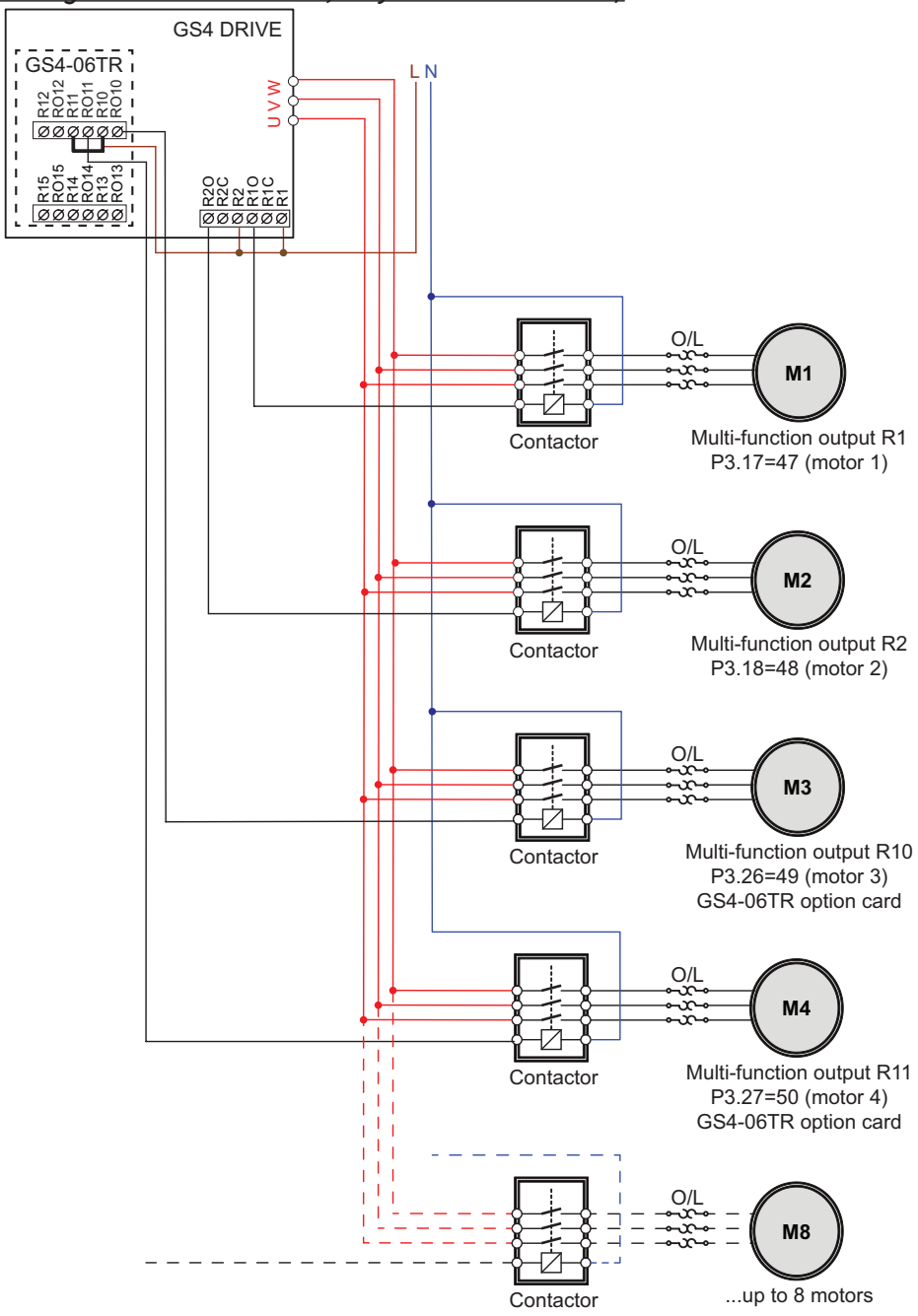
Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)

Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)		
Part #	**Terminals**	**Description**
GS4-06TR	R10~R15 RO10~RO15	Refer to P3.21~P3.26 for Multi-function Output selection Resistive Load: 5A(NO) @ 250VAC 5A(NO) @ 30VDC Inductive Load (COSØ 0.4): 2A(NO) @ 250VAC Six SPST relay outputs Rxx = separate common for each relay ROxx = normally open output

Wiring Diagrams for Cyclical Pump Control

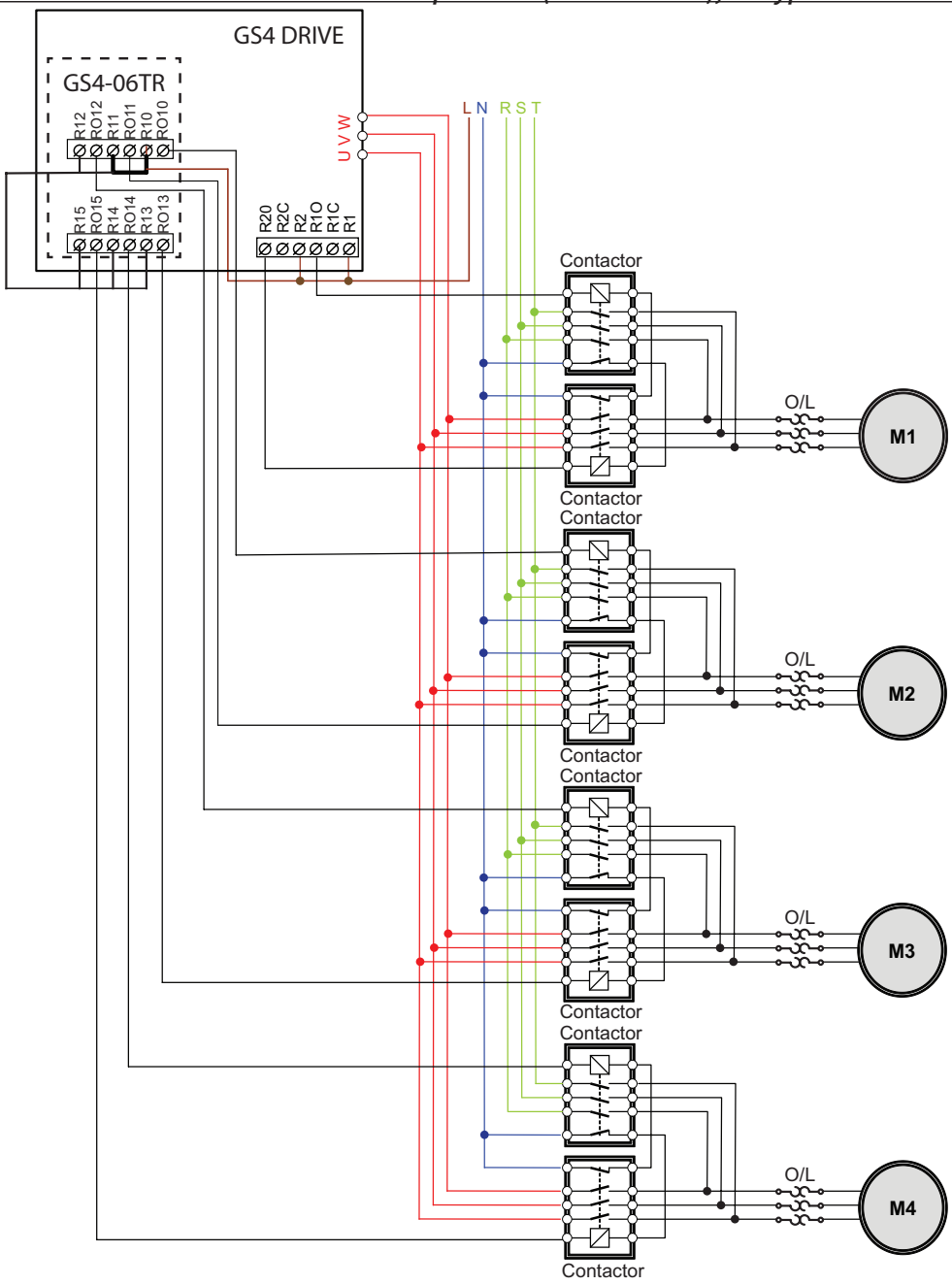
Time Circulation Control (P10.00=1) – Wiring

(Maximum of eight motors connected; only one runs at a time)



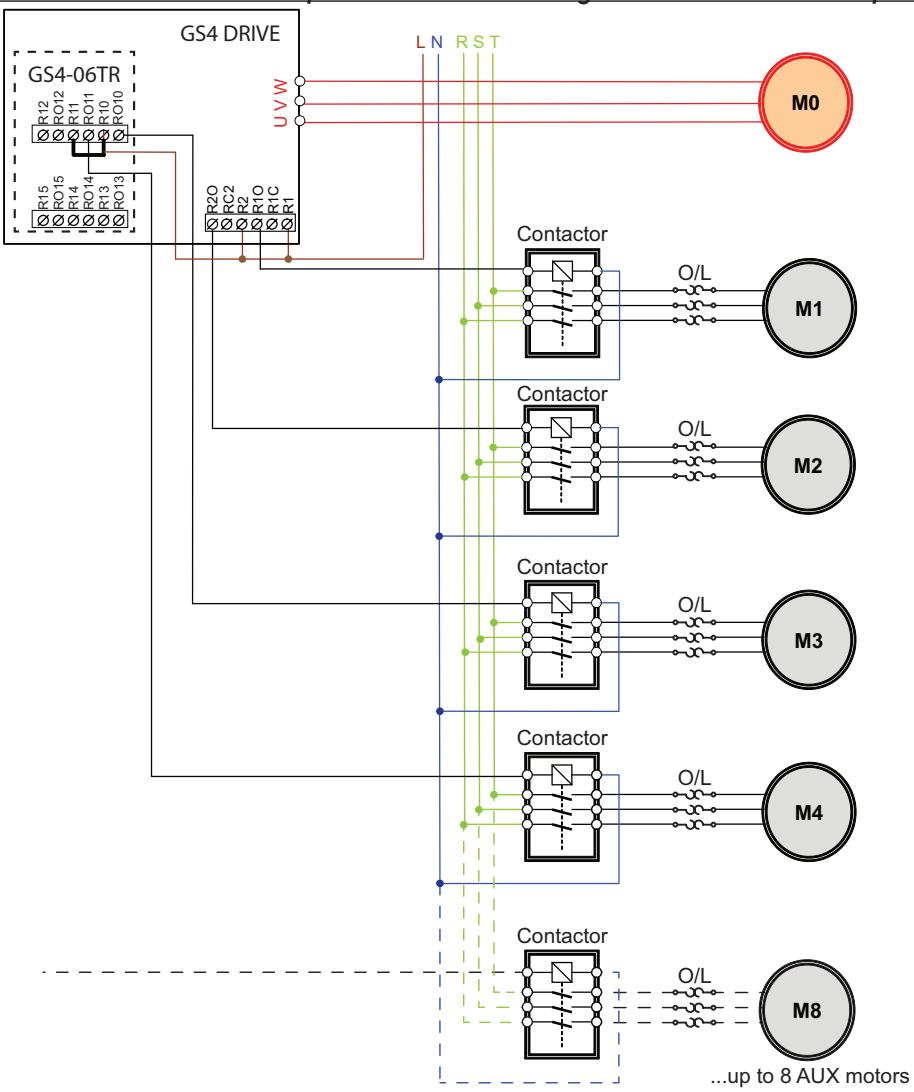
Quantity Cycle (P10.00 = 2 or 4) – Wiring

(Maximum four motors. M1~M4 can be drive powered (one at a time), or bypassed to line power.)



Quantity Control (P10.00 = 3 or 5) – Wiring

(Maximum nine motors. M0 is drive-powered. The other eight AUX motors are line-powered only.)



GROUP P11.XX DETAILS – FAULT PARAMETERS

		Type	Hex Addr	Dec Addr
P11.00	**Fault Output Option 1**	♦R/W	0B00	42817
P11.01	**Fault Output Option 2**	♦R/W	0B01	42818
P11.02	**Fault Output Option 3**	♦R/W	0B02	42819
P11.03	**Fault Output Option 4**	♦R/W	0B03	42820

Range/Units (Format: 16-bit unsigned)	Default
0: No Error 1~65535: (refer to Fault Bit Codes table)	0

These parameters can be used with a Multi-Function Output set to 33~36 for a specific monitoring requirement. When a fault occurs, the corresponding MFO terminals will be activated. Each Fault option parameter can contain multiple monitord bits. Parameter can contain up to 127decimal (7F hex or 1111111 binary). Values are entered in decimal.

Related parameters: P3.17~P3.31 (page 4–70)

Example: If DO1=36 (FO1) and P11.00 (FO1) = 34 (22 hex, 0100010 bin), then when an external fault (EF, EF1, bb..) or a voltage related fault occurs DO1 will be activated.

Representation of bits:

- *Bit0: Current-related fault*
- *Bit1: Voltage-related fault*
- *Bit2: Overload-related fault*
- *Bit3: System-related fault*
- *Bit4: Feedback-related fault*
- *Bit5: External Fault-related fault*
- *Bit6: Communication-related fault*

Table of Fault Bit Codes

Fault Code	Bit6 CE	Bit5 EXI	Bit4 FBK	Bit3 SYS	Bit2 OL	Bit1 Volt	Bit0 Current
0: No Error							
1: Overcurrent during Accel (ocA)							•
2: Overcurrent during Decel (ocd)							•
3: Overcurrent during normal speed (ocn)							•
4: Ground Fault (GFF)							•
5: IGBT short circuit (occ)							•
6: Overcurrent during Stop (ocS)							•
7: Overvoltage during Accel (ovA)						•	
8: Overvoltage during Decel (ovd)						•	
9: Overvoltage during normal speed (ovn)						•	
10: Overvoltage during Stop (ovS)						•	
11: Low voltage during Accel (LvA)						•	
12: Low voltage during Decel (Lvd)						•	
13: Low voltage during normal speed (Lvn)						•	
14: Low voltage during Stop (LvS)						•	
15: Outout ripple / Input phase loss (OrP)						•	
16: IGBT Overheat 1 (oH1)					•		
17: Cap Overheat 2 (oH2)					•		
18: Thermister 1 open (tH1o)					•		
19: Thermister 2 open (tH2o)					•		
20: Power Reset Off (PWR)					•		
21: Overload (oL) (150% 1Min, Inverter)					•		
22: Motor1 Thermal Overload (EoL1)					•		
23: Motor2 Thermal Overload (EoL2)					•		
24: Motor Overheat-PTC (oH3)					•		
25: reserved	–						
26: Over Torque 1 (ot1)					•		
27: Over Torque 2 (ot2)					•		
28: Under current (uc)							•
29: reserved	–						
30: EEPROM write error (cF1)				•			

(table continued next page)

Table of Fault Bit Codes (continued)							
Fault Codes	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
	CE	**EXI**	**FBK**	**SYS**	**OL**	**Volt**	**Current**
31: EEPROM read error (cF2)				•			
32: reserved				•			
33: U phase current sensor detection error (cd1)				•			
34: V phase current sensor detection error (cd2)				•			
35: W phase current sensor detection error (cd3)				•			
36: CC Hardware Logic error 0 (Hd0)				•			
37: OC Hardware Logic error 1 (Hd1)				•			
38: OV Hardware Logic error 2 (Hd2)				•			
39: OCC Hardware Logic error 3 (Hd3)				•			
40: Motor auto tune error (AuE)				•			
41: PID Feedback loss (AFE)			•				
42~47: reserved	–						
48: Analog input signal loss (ACE)			•				
49: External Fault (EF)		•					
50: Emergency Stop (EF1)		•					
51: Base Block (bb)		•					
52: Password Error (Pcod)				•			
53: Software Code lock (ccod)				•			
54: PC Command error (CE1)	•						
55: PC Address error (CE2)	•						
56: PC Data error (CE3)	•						
57: PC Slave error (CE4)	•						
58: PC Communication Time Out (CE10)	•						
59: PC Keypad Time out (CP10)	•						
60: Braking Transistor Fault (bf)		•					
61: Y-Delta connection Error (ydc)		•					
62: Decel Energy Backup Error (dEb)						•	
63: Over Slip Error (oSL)		•					
64: Electromagnet switch error (ryF)		•					
65~71: reserved	–						
72: STO Loss1 (STL1) STO1~SCM1 internal hardware detect error		•					
73: ES1 Emergency Stop (S1)				•			
74: In Fire Mode (Fire)		•					
75: reserved	–						
76: Safety Torque Off function active (STO)		•					
77: STO Loss2 (STL2) STO2~SCM2 internal hardware detect error		•					
78: STO Loss3 (STL3) – STO1~SCM1 and STO2~SCM2 internal hardware detect errors		•					
79: U Phase Short (Uoc)							•
80: V Phase Short (Voc)							•
81: W Phase Short (Woc)							•
82: U Phase Loss (UPHL)							•
83: V Phase Loss (VPHL)							•
84: W Phase Loss (WPHL)							•
85~89: reserved	–						
90: PLC Force Stop (FStp)				•			
91~96: reserved	–						
97: Ethernet Card Timeout (CD10)	•						
98: reserved	–						
99: CPU Command error (TRAP)				•			
100~111: reserved	–						

For detailed fault descriptions, please refer to "Fault Codes" in Chapter 6: Maintenance and Troubleshooting.

		Type	Hex Addr	Dec Addr
P11.04	***First Fault Record***	Read	0B04	42821
P11.05	***Second Most Recent Fault Record***	Read	0B05	42822
P11.06	***Third Most Recent Fault Record***	Read	0B06	42823
P11.07	***Fourth Most Recent Fault Record***	Read	0B07	42824
P11.08	***Fifth Most Recent Fault Record***	Read	0B08	42825
P11.09	***Sixth Most Recent Fault Record***	Read	0B09	42826
	Range/Units (Format: 16-bit unsigned)			*Default*
	Range is comprised of the full list of fault codes in "Table of Fault Bit Codes" (page 4–203)			0

When a fault occurs and forces stopping, it will be recorded in this parameter.

- *At stop with low voltage Lv (LvS warn, no record). During operation with mid-low voltage Lv (LvA, Lvd, Lvn error, will record).*
- *For setting 62: Decel Energy Backup Error (dEb). When dEb function is enabled, the drive will execute dEb and record the fault in P11.04 to P11.09.*

		Type	Hex Addr	Dec Addr
P11.10	***Operating Time of Present Fault Record (Day)***	Read	0B0A	42827
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~65535 day	0		
		Type	Hex Addr	Dec Addr
P11.11	***Operating Time of Present Fault Record (Minute)***	Read	0B0B	42828
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~1439 min	0		
		Type	Hex Addr	Dec Addr
P11.12	***Operating Time of Second Most Recent Fault Record (Day)***	Read	0B0C	42829
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~65535 day	0		
		Type	Hex Addr	Dec Addr
P11.13	***Operating Time of Second Most Recent Fault Record (Minute)***	Read	0B0D	42830
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~1439 min	0		
		Type	Hex Addr	Dec Addr
P11.14	***Operating Time of Third Most Recent Fault Record (Day)***	Read	0B0E	42831
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~65535 day	0		
		Type	Hex Addr	Dec Addr
P11.15	***Operating Time of Third Most Recent Fault Record (Minute)***	Read	0B0F	42832
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~1439 min	0		
		Type	Hex Addr	Dec Addr
P11.16	***Operating Time of Fourth Most Recent Fault Record (Day)***	Read	0B10	42833
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~65535 day	0		
		Type	Hex Addr	Dec Addr
P11.17	***Operating Time of Fourth Most Recent Fault Record (Minute)***	Read	0B11	42834
	Range/Units (Format: 16-bit unsigned)	*Default*		
	0~1439 min	0		

Parameters P11.10~P11.17 are used to record the operation times by day and minute for the four most recent malfunctions. It can also check if there is anything wrong with the drive according to the internal time.

When malfunctions occur during operation, P11.04~11.09 record the six most recent faults, and P11.10~P11.17 record the operation times of the four most recent faults.
These parameter relationships are shown in the following example:

Example of Drive Fault Records

If the first fault ovA occurs after operation 3000 minute, second fault ovd occurs at 3482 min, third fault ovA occurs at 4051 min, fourth fault ocA at 5003 min, fifth fault ocA at 5824 min, sixth fault ocd occurs at 6402 min, and seventh fault ocS at 6951 min, they are recorded as follows:

Drive Fault	Fault Record Parameter	Fault Type	Fault Day Parameter	Fault Minutes Parameter	Fault Time
1st Fault	P11.04	ovA	P11.10	P11.11	3000
2nd Fault	P11.04	ovd	P11.10	P11.11	3482
	P11.05	ovA	P11.12	P11.13	3000
3rd Fault	P11.04	ovA	P11.10	P11.11	4051
	P11.05	ovd	P11.12	P11.13	3482
	P11.06	ovA	P11.14	P11.15	3000
5th Fault	P11.04	ocA	P11.10	P11.11	5824
	P11.05	ovA	P11.12	P11.13	5003
	P11.06	ovA	P11.14	P11.15	4051
	P11.07	ovd	P11.16	P11.17	3482
	P11.08	ovA	n/a	n/a	n/a
6th Fault	P11.04	ocS	P11.10	P11.11	6951
	P11.05	ocA	P11.12	P11.13	6402
	P11.06	ocA	P11.14	P11.15	5824
	P11.07	ovA	P11.16	P11.17	5003
	P11.08	ovd	n/a	n/a	n/a
	P11.09	ovA	n/a	n/a	n/a

	Type	Hex Addr	Dec Addr
P11.18 **Frequency Command at Fault**	Read	0B12	42835
Range/Units (Format: 16-bit unsigned)	Default		
0.00~655.35 Hz	0		

P11.18 shows the Frequency Command at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

	Type	Hex Addr	Dec Addr
P11.19 **Output Frequency at Fault**	Read	0B13	42836
Range/Units (Format: 16-bit unsigned)	Default		
0.00~655.35 Hz	0		

P11.19 shows the Output Frequency at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

	Type	Hex Addr	Dec Addr
P11.20 **Output Voltage at Fault**	Read	0B14	42837
Range/Units (Format: 16-bit unsigned)	Default		
0.0~6553.5V	0		

P11.20 shows the Output Voltage at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

	Type	Hex Addr	Dec Addr
P11.21 **DC Bus Voltage at Fault**	Read	0B15	42838
Range/Units (Format: 16-bit unsigned)	Default		
0.0~6553.5V	0		

P11.21 shows the DC Bus Voltage at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.22	**Output Current at Fault**	Read	0B16	42839
Range/Units (Format: 16-bit unsigned)		Default		
0.00~655.35A		0		

P11.22 shows the Output Current at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.23	**IGBT Temperature at Fault**	Read	0B17	42840
Range/Units (Format: 16-bit signed)		Default		
-3276.7 to 3276.7 °C		0		

P11.23 shows the IGBT Temperature at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.24	**HeatSink Temperature at Fault**	Read	0B18	42841
Range/Units (Format: 16-bit signed)		Default		
-3276.7 to 3276.7 °C		0		

P11.24 shows the HeatSink Temperature at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.25	**RPM of Motor at Fault**	Read	0B19	42842
Range/Units (Format: 16-bit signed)		Default		
-32767 to 32767 rpm		0		

P11.25 shows the Motor Speed in rpm at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.26	**Digital Input Status at Fault**	Read	0B1A	42843
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

P11.26 captures the value of P3.46, Digital Input Active Status, at the instant of last drive fault. If another fault occurs, the previous record will be overwritten.

		Type	Hex Addr	Dec Addr
P11.27	**Digital Output Status at Fault**	Read	0B1B	42844
Range/Units (Format: 16-bit binary)		Default		
0~65535		0		

P11.27 captures the value of P3.47, Digital Output Active Status, at the instant of last drive fault. If another fault occurs, the previous record will be overwritten.

Representation of bits:

- *Bit1~Bit0:* *00: RUN LED light off; STOP LED light on (Drive Stop)*
  01: RUN LED blink; STOP LED light on (Drive Decelerating during stopping)
  10: RUN LED light on; STOP LED blink (Drive Standby)
  11: RUN LED light on; STOP LED light off (Drive Run)
- *Bit2:* *1: JOG active*
- *Bit4~Bit3:* *00: REV LED light off; FWD LED light on (Forward)*
  01: REV LED blink; FWD LED light on (Reverse to Forward)
  10: REV LED light on; FWD LED blink (Forward to Reverse)
  11: REV LED light on; FWD LED light off (Reverse)
- *Bit5:* *1: Factory parameters group opened state*
- *Bit6:* *1: Advance parameter group opened state*
- *Bit7:* *1: Operation command controlled by external terminal*
- *Bit8:* *1: Main frequency controlled by communication*
- *Bit9:* *1: Main frequency controlled by external terminal (AI)*
- *Bit10:* *1: Operation command controlled by communication (PU)*
- *Bit11:* *1: Parameters have been locked*
- *Bit12:* *1: Copy command enable*
- *Bit15~Bit13:* *0: HOA mode OFF*
  1: HOA mode HAND-ON
  2: HOA mode AUTO-ON
  3: LOC/REM mode LOC-ON
  4: LOC/REM mode REM-ON

		Type	Hex Addr	Dec Addr
P11.28	**Drive Status at Fault**	Read	0B1C	42845
Range/Units (Format: 16-bit unsigned)		Default		
0~65535		0		

P11.28 shows the Drive Status from "Status Monitor 2" (2101H) at the time of last drive fault. If another fault occurs, the previous record will be overwritten.

Refer to the Status Addresses table in chapter 5 (page 5–6) for bit-level descriptions of Status Monitor 2.