

Firmware Manual - EC Series Drives

Doc Ver 1.01

Firmware ver: _____

EC series drives

For installation details refer to **Hardware Manual**

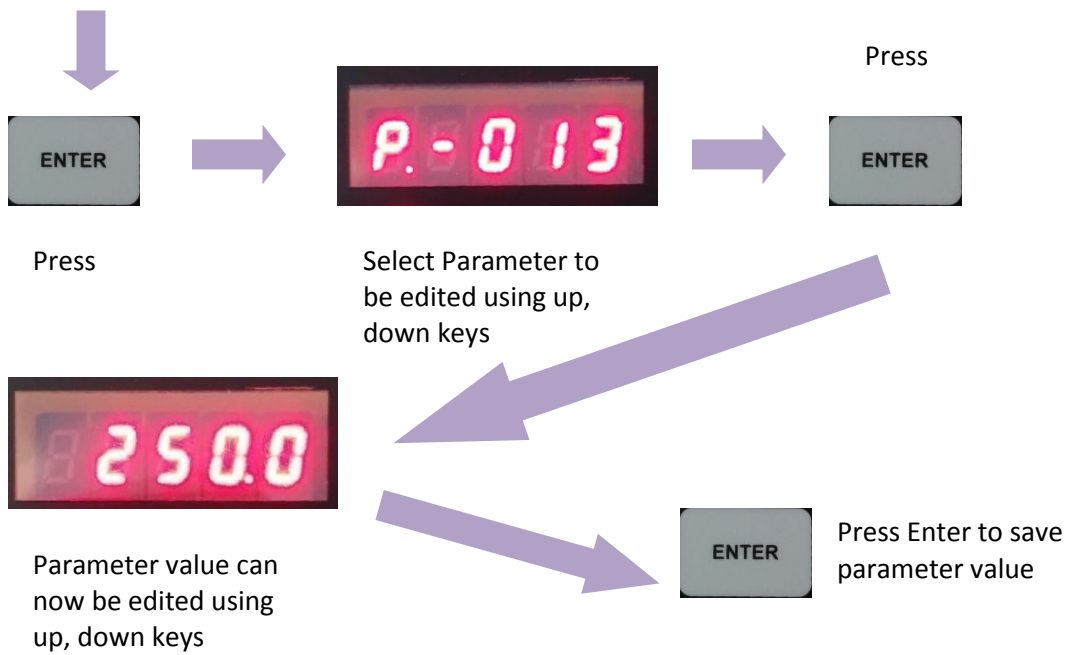
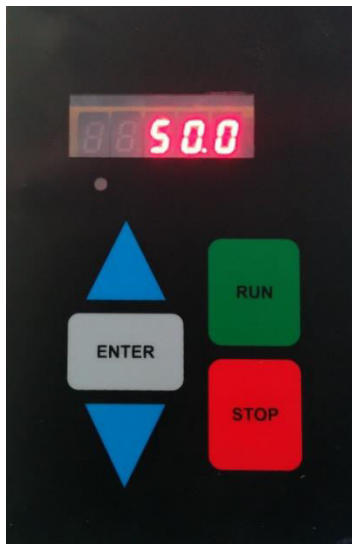
Safety:

- Read safety instruction in hardware manual before installation and commissioning drive.
- Some safety instructions associated with specific parameters should be complied with. These instructions are included in parameter description.

This manual is meant for qualified personnel with knowledge of electrical schematics, basic electrical circuits and wiring.

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1. Display and Parameter editing



2. Quick Start up

Connect drive as per instructions in Hardware manual.

For quick start up of induction motor: 415VAC, 4pole, 50Hz

Set **P -033** = motor rated current.

Drive is now ready for run command.

3. Parameter Summary

Parameter number	Parameter	Range	Default	Unit	Runtime operability
P-000	Set frequency	Display values		Hz	Read only
P-001	Drive output frequency			Hz	Read only
P-002	Output Current			Amps	Read only
P-003	DC link Voltage			Volts	Read only
P-004	Output Voltage			Volts	Read only
P-005	HS temperature			°C	Read only
P-006	Power			KW	Read only
P-007	Counter value				Read only
P-008	Firmware Version				Read only
P-009	Frequency Reference	0:Zero Speed 1:Keypad ref 2:Analog input ref 3:Motorized pot ref	1		Read-Write
P-010	Minimum Speed	0 - 999.9	0.5	Hz	Read-Write
P-011	Maximum Speed	0 - 999.9	50.0	Hz	Read-Write
P-012	Acceleration Time	0.1 - 999.9	10.0	Sec	Read-Write
P-013	Deceleration Time	0.1 - 999.9	10.0	Sec	Read-Write
P-014	Operator select	0:Keypad 1:Control Terminals	0		Read only
P-015	DI-1	0 : Disable input 1 : RUN 2 : STOP 3 : REV 4 : Jog Start 5 : Fault Reset 6: Emergency Stop 7: Reserved 8: Mot Pot up 9: Mot Pot Down 10: Preset speed 1 11:Preset speed 2 12:Pulse Counter 13-Pulse Counter Reset	1		Read-Write
P-016	DI-2		2		Read-Write
P-017	DI-3		12		Read-Write
P-018	DI-4		13		Read-Write

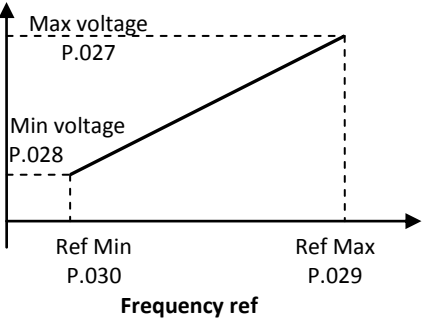
P-019	DI-1 Invert	0: Non inverting 1: Inverting	0		Read-Write
P-020	DI-2 Invert		0		Read-Write
P-021	DI-3 Invert		0		Read-Write
P-022	DI-4 Invert		0		Read-Write
P-023	Reserved				
P-024	Ext Start/Stop Mode	0:3 Wire Mode 1:Fwd Run /Rev Run 2:Run/Fwd	0		Read-Write
P-025	Stop Mode	0:Coast 1:Ramp	0		Read-Write
P-026	Analog inp filter time	0.00 - 25.00	0.30	Sec	Read- Write
P-027	Analog inp max	0.00 - 10.00	9.40	Volts	Read- Write
P-028	Analog inp min	0.00 - 10.00	0.00	Volts	Read- Write
P-029	Analog inp max ref	0.0 - 999.9	50.0	Hz	Read- Write
P-030	Analog inp min ref	0.0 - 999.9	0.00	Hz	Read-Write
P-031	Reserved				
P-032	Motor Rotation	0:Forward 1:Reverse	0		Read only
P-033	Motor Nom Amps	0.00-99.9	4.6	Amps	Read only
P-034	Motor Rated Voltage	0 - 690	415	Volts	Read only
P-035	Motor Rated frequency	0.00 - 500.0	50.0	Hz	Read only
P-036	Motor Rated Speed	0 - 9999	1500	RPM	Read only
P-037	V/f Volt 1	0 - 1000	5	Volts	Read only
P-038	V/f Volt 2	0 - 1000	5	Volts	Read only
P-039	V/f Volt 3	0 - 1000	415	Volts	Read only
P-040	V/f Freq 1	0.0 - 500.0	0.5	Hz	Read only
P-041	V/f Freq 2	0.0 - 500.0	0.5	Hz	Read only
P-042	V/f Freq 3	0.0 - 500.0	50.0	Hz	Read only
P-043	Motor Poles	2 - 15	4		Read only
P-044	IR Compensation	0.0 - 50.0	0.0	%	Read only
P-045	Slip Compensation	0:Disable 1: Enable	0		Read only
P-046	Auto Torque boost	0:Disable 1: Enable	0		Read only
P-047	Current Limit	0 - 300	110	%	Read only
P-048	Reserved				
P-049	Reserved				
P-050	Reserved				
P-051	Reserved				
P-052	Jog reference	0 - 999.9	10.0	Hz	Read-Write
P-053	Jog acceleration time	0.1 - 999.9	10.0	Sec	Read-Write
P-054	Jog deceleration time	0.1 - 999.9	10.0	Sec	Read-Write
P-055	Preset Speed select 1	0 - 999.9	10.0	Hz	Read-Write
P-056	Preset Speed select 2	0 - 999.9	20.0	Hz	Read-Write
P-057	Preset Speed select 3	0 - 999.9	30.0	Hz	Read-Write

P-058	Preset Speed select 4	0 - 999.9	40.0	Hz	Read-Write
P-059	E2prom Default	0:Disable 1:Enable	0		Read only
P-060	Reserved				
P-061	Reserved				
P-062	Dynamic brake select	0:Disable 1:Enable			Read only
P-063	Power up Parameter	Power up display selection	0		Read-Write
P-064	Auto Fault Reset enable	0:Disable 1:Enable			Read-Write
P-065	Time between retries	0.5 to 150.0 sec	10.0	Sec	Read-Write
P-066	Analog out config	0:Set frequency 1:Output frequency 2:Output current	0		Read-Write
P-067	Analog op max ref	0.00 - 500.00	50.00		Read-Write
P-068	Analog op min ref	0.00 - 500.00	0.50		Read-Write
P-069	Analog op max	0.00 - 10.00	10.00	Volts	Read-Write
P-070	Analog op min	0.00 - 10.00	0.00	Volts	Read-Write
P-071	DIO o/p config	0:Drive fault condition 1:Run condition 2:Set frequency 3:Desired frequency 4:Drive is ready to Run 5:Direction reversal 6:Under voltage trip 7:Counter match	1		Read-Write
P-072	DIO on time	0.000 - 60.000	0.000	Sec	Read-Write
P-073	DIO off time	0.000 - 60.000	0.000	Sec	Read-Write
P-074	Desired Frequency	0.0 - 500.0	50.0	Hz	Read-Write
P-075	Counter match value	0-9999	1000	Nos	Read-Write
P-076	Motor Stator Resistance	0.00-655.35	2.66	Ohms	Read only
P-077	Reserved				

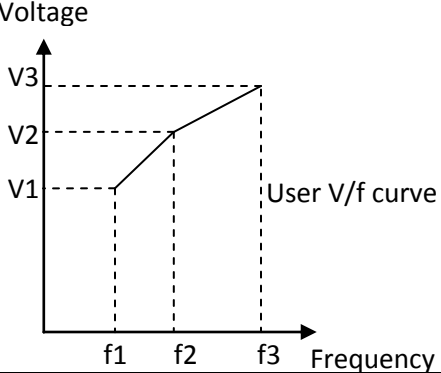
4. Parameter Descriptions

Number	Parameter	Description	Unit								
P-000	Set Frequency	Set frequency before ramp.	Hz								
P-001	Output Frequency	This is the ramp output frequency.	Hz								
P-002	Output Current	Output current of the drive.	Amps								
P-003	DC Link Voltage	DC bus voltage	Volts								
P-004	Output Voltage	Drive output voltage.	Volts								
P-005	HS Temperature	Heatsink temperature of the drive	°C								
P-006	Power	Power output of the drive	KW								
P-007	Counter Value	Input pulses (0-24V) are counted. Maximum counter input frequency = 250Hz.									
P-008	Firmware version	Installed firmware version									
P-009	Frequency reference	<p>Range: 0 – 3 Default: 1 Description: Frequency ref can be selected as follows:</p> <table border="1"> <tr> <td>0</td> <td>Zero Speed</td> </tr> <tr> <td>1</td> <td>Keypad reference</td> </tr> <tr> <td>2</td> <td>Analog input reference</td> </tr> <tr> <td>3</td> <td>Motorized pot ref</td> </tr> </table>	0	Zero Speed	1	Keypad reference	2	Analog input reference	3	Motorized pot ref	
0	Zero Speed										
1	Keypad reference										
2	Analog input reference										
3	Motorized pot ref										
P-010	Minimum Speed	<p>Range: 0 – 999.9Hz Default value: 0.50Hz Description: Set Frequency cannot be set below this value.</p>	Hz								
P-011	Maximum Speed	<p>Range: 0 – 999.9Hz Default value: 50.0Hz Description: Set Frequency cannot be set above this value.</p>	Hz								
P-012	Acceleration Time	<p>Range: 0.1 – 999.9s Default value: 10.0s Description: Final frequency reference ramps up from 0 to rated frequency P-035 in this time.</p>	Sec								
P-013	Deceleration Time	<p>Range: 0.1 – 999.9s Default value: 10.0s Description: Final frequency reference ramps down from rated frequency P-035 to 0 in this time.</p>	Sec								
P-014	Operator Select	<p>Range: 0 – 1 Default value: 0 Description: Operator options:</p> <table border="1"> <tr> <td>0</td> <td>Keypad</td> </tr> <tr> <td>1</td> <td>Control Terminals</td> </tr> </table>	0	Keypad	1	Control Terminals					
0	Keypad										
1	Control Terminals										

P-015	DI-1	<p>Range : 0 – 13 Default value: DI1: 1,DI1: 2,DI3: 12,DI4: 13 Description: Digital inputs(0-24V) can be set up as follows:</p> <table border="1"> <thead> <tr> <th></th> <th>Selection</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Disable input</td> <td>Disable input terminal</td> </tr> <tr> <td>1</td> <td>RUN</td> <td>Run command</td> </tr> <tr> <td>2</td> <td>STOP</td> <td>Stop command</td> </tr> <tr> <td>3</td> <td>REV</td> <td>Rev command</td> </tr> <tr> <td>4</td> <td>Jog</td> <td>Jog command</td> </tr> <tr> <td>5</td> <td>Fault Reset</td> <td>External fault reset</td> </tr> <tr> <td>6</td> <td>Emergency Stop</td> <td>Emergency stop when this command is selected.</td> </tr> <tr> <td>7</td> <td>Reserved</td> <td></td> </tr> <tr> <td>8</td> <td>Mot Pot up</td> <td>Set frequency increase.</td> </tr> <tr> <td>9</td> <td>Mot Pot Down</td> <td>Set frequency decrease.</td> </tr> <tr> <td>10</td> <td>Preset speed sp1</td> <td rowspan="2">See preset speeds.</td> </tr> <tr> <td>11</td> <td>Preset speed sp2</td> </tr> <tr> <td>12</td> <td>Pulse Counter</td> <td>Pulse counter input (max 250Hz).</td> </tr> <tr> <td>13</td> <td>Pulse Counter Reset</td> <td>Reset pulse counter</td> </tr> </tbody> </table>		Selection	Description	0	Disable input	Disable input terminal	1	RUN	Run command	2	STOP	Stop command	3	REV	Rev command	4	Jog	Jog command	5	Fault Reset	External fault reset	6	Emergency Stop	Emergency stop when this command is selected.	7	Reserved		8	Mot Pot up	Set frequency increase.	9	Mot Pot Down	Set frequency decrease.	10	Preset speed sp1	See preset speeds .	11	Preset speed sp2	12	Pulse Counter	Pulse counter input (max 250Hz).	13	Pulse Counter Reset	Reset pulse counter	
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P-018	DI-4																																														
P-019	DI-1 invert DI-2 invert DI-3 invert DI-4 invert	<p>Range: 0 – 1 Default Value: 0 Description: Actuation of digital input occurs on 0V if inverted.</p> <table border="1"> <tbody> <tr> <td>0</td> <td>Non Invert</td> <td>Actuation on 24V input</td> </tr> <tr> <td>1</td> <td>Invert</td> <td>Actuation on 0V input</td> </tr> </tbody> </table>	0	Non Invert	Actuation on 24V input	1	Invert	Actuation on 0V input																																							
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P-020																																															
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P-023	Reserved	Reserved																																													

P-024	Ext Start/Stop mode	<p>Range: 0 - 2 Default value: 0 Description: Start/Stop configurations:</p> <table border="1" data-bbox="516 300 1049 411"> <tr> <td>0</td> <td>3 wire mode</td> </tr> <tr> <td>1</td> <td>FWD RUN/ REV RUN</td> </tr> <tr> <td>2</td> <td>RUN/FWD</td> </tr> </table> <p>3 wire mode:</p> <table border="1" data-bbox="618 491 1297 640"> <thead> <tr> <th>RUN(ext)</th> <th>STOP(ext)</th> <th>Drive status</th> </tr> </thead> <tbody> <tr> <td>0 ----> 1(transition)</td> <td>1</td> <td>Start</td> </tr> <tr> <td>Any</td> <td>1 ---->0 (transition)</td> <td>Stop</td> </tr> <tr> <td>Any</td> <td>0</td> <td>Stop</td> </tr> </tbody> </table> <p>FWD RUN/REV RUN:</p> <table border="1" data-bbox="610 699 1304 884"> <thead> <tr> <th>RUN</th> <th>REV</th> <th>Drive status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>FWD Start</td> </tr> <tr> <td>1</td> <td>0</td> <td>REV Start</td> </tr> <tr> <td>0</td> <td>0</td> <td>Stop</td> </tr> <tr> <td>1</td> <td>1</td> <td>Stop</td> </tr> </tbody> </table> <p>RUN/FWD: Start command is given when RUN is actuated (non-latching). Direction is selected by REV terminal.</p>	0	3 wire mode	1	FWD RUN/ REV RUN	2	RUN/FWD	RUN(ext)	STOP(ext)	Drive status	0 ----> 1(transition)	1	Start	Any	1 ---->0 (transition)	Stop	Any	0	Stop	RUN	REV	Drive status	0	1	FWD Start	1	0	REV Start	0	0	Stop	1	1	Stop	
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Any	1 ---->0 (transition)	Stop																																		
Any	0	Stop																																		
RUN	REV	Drive status																																		
0	1	FWD Start																																		
1	0	REV Start																																		
0	0	Stop																																		
1	1	Stop																																		
P-025	Stop mode	<p>Range: 0 – 1 Default value: 0 Description:</p> <table border="1" data-bbox="516 1161 1396 1236"> <tr> <td>0</td> <td>Coast Stop</td> <td rowspan="2">Range: 0 - 1 Default value: 0</td> </tr> <tr> <td>1</td> <td>Ramp Stop</td> </tr> </table>	0	Coast Stop	Range: 0 - 1 Default value: 0	1	Ramp Stop																													
0	Coast Stop	Range: 0 - 1 Default value: 0																																		
1	Ramp Stop																																			
P-026	Analog inp filter time (Analog Input filter time)	<p>Range: 0.00 – 25.00s Default value: 0.30s Description: This is the time constant of the moving average analog input filter. Increase this value for a noisy input line.</p>	Sec																																	
P-027 P-028	Analog inp max (Maximum Voltage at Analog Input) Analog inp min (Minimum Voltage at Analog Input)	<p>Range: 0 – 10.00V Default value: Max analog inp = 9.40V Min analog inp = 0V</p> <p style="text-align: center;">Analog voltage input</p> 	Volts																																	

P-029	Analog inp max ref (Reference at Max Analog input)	Range: 0 – 999.9Hz Default value: Analog inp max ref = 50.0Hz Analog inp min ref = 0.0Hz Description: This is the frequency ref at maximum input voltage and frequency ref at minimum input voltage.	Hz				
P-030	Analog inp min ref (Reference at Min Analog input)	Frequency ref = $\frac{P.029 - P.030}{\text{abs}(P.027 - P.028)} \times \text{Analog input}(V) + P0.30$					
P-031		Reserved.					
P-032	Motor Rotation	Range: 0 – 1 Default value: 0 Description: This parameter is used to set the direction of rotation of motor. <table border="1" style="margin-left: 20px;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Forward</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Reverse</td> </tr> </table>	0	Forward	1	Reverse	
0	Forward						
1	Reverse						
P-033	Motor Nom Amps (Motor rated current)	Range: 0 – 99.9A Default value: 4.6A Description: This is the rated current as shown on the name plate of the motor. If this current exceeds the rated current of the drive, the rated current of the drive takes precedence. In that case over current trip and current limits would be set as per drive rated current.	Amps				
P-034	Motor Rated Voltage	Range: 0- 690V Default value: 415V Description: This is the rated voltage as shown on the name plate of the motor.	Volts				
P-035	Motor Rated Frequency	Range: 0 – 500.0Hz Default value: 50.0Hz Description: The rated frequency of the motor should be entered here. Motor voltage P-034 along with motor rated frequency is used to determine V/f curve applied to the motor.	Hz				
P-036	Motor Rated Speed in RPM	Range: 0-9999 Default value: 1500 Description: Motor rated speed on name plate is used to determine rated slip of motor. Rated slip(Hz) = rated motor frequency - $\frac{\text{no of poles} \times \text{motor full load rpm}}{120}$ = $P.035 - \frac{P.043 \times P.036}{120}$	RPM				

P-037 P-038 P-039	V/f Volt1 V/f Volt2 V/f Volt3	<p>Description: These parameters are used to set a user defined V/f curve. A user defined V/f curve can be applied as shown:</p> <table border="1" data-bbox="516 300 954 516"> <thead> <tr> <th>Parameter</th> <th>Default value</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>V/f Volt1</td> <td>5</td> <td rowspan="3">0 - 1000V</td> </tr> <tr> <td>V/f Volt2</td> <td>5</td> </tr> <tr> <td>V/f Volt3</td> <td>415</td> </tr> </tbody> </table> 	Parameter	Default value	Range	V/f Volt1	5	0 - 1000V	V/f Volt2	5	V/f Volt3	415	Volts
Parameter	Default value	Range											
V/f Volt1	5	0 - 1000V											
V/f Volt2	5												
V/f Volt3	415												
P-040 P-041 P-042	V/f Freq1 V/f Freq2 V/f Freq3	<p>Description: These are the frequencies of the user defined V/f curve.</p> <table border="1" data-bbox="516 705 1276 898"> <thead> <tr> <th>Parameter</th> <th>Default value</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>V/f Freq1</td> <td>0.5hz</td> <td rowspan="3">0 – 500.0Hz</td> </tr> <tr> <td>V/f Freq2</td> <td>0.5Hz</td> </tr> <tr> <td>V/f Freq3</td> <td>50.0Hz</td> </tr> </tbody> </table>	Parameter	Default value	Range	V/f Freq1	0.5hz	0 – 500.0Hz	V/f Freq2	0.5Hz	V/f Freq3	50.0Hz	Hz
Parameter	Default value	Range											
V/f Freq1	0.5hz	0 – 500.0Hz											
V/f Freq2	0.5Hz												
V/f Freq3	50.0Hz												
P-043	Motor Poles	<p>Range: 2 – 15 Default value: 4 Description: Motor poles are used to determine synchronous speed of induction motor and for slip calculation. If synchronous speed is known the number of</p> $\text{Poles} = \frac{120 \times \text{Rated motor frequency (P.035)}}{\text{Rated synchronous speed}}$											
P-044	IR Compensation	<p>Range: 0 – 50 Default value: 1 Description: Additional voltage is added to the drive output voltage at low frequency for higher motor torque. Warning: Too high value of this parameter can activate current limit or OC trip.</p>	%										
P-045	Slip Compensation	<p>Range: 0 – 1 Default value: 0 Description: Slip compensation compensates for drop in speed with load. Rated slip(Hz) = $\text{Rated frequency (P. 035)} - \frac{\text{No of poles(P.043)} \times \text{Rated speed of motor(P.036)}}{120}$ Note: For higher slip compensation, rated speed of the motor can be reduced.</p> <table border="1" data-bbox="516 1675 1049 1749"> <tbody> <tr> <td>0</td> <td>Disable</td> </tr> <tr> <td>1</td> <td>Enable</td> </tr> </tbody> </table>	0	Disable	1	Enable							
0	Disable												
1	Enable												
P-046	Auto Torque boost	<p>Range: 0 – 1 Default value: 0 Description: 0: Auto torque boost is disabled. IR value in P-44 can be set to provide the required troque boost.</p>											

		1: Auto torque boost is enabled. The amount of IR compensation is now set automatically.												
P-047	Current limit	Range: 0 – 300 Default value: 110 Description: Current limit when activated: 1. Reduces post ramp ref or prevents acceleration if drive is accelerating. 2. Holds or increases post ramp ref if drive is decelerating.	%											
P-048		Reserved.												
P-049		Reserved												
P-050		Reserved												
P-051		Reserved												
P-052	Jog reference	Range: 0.0 – 200.0 Default value: 10.0	Hz											
P-053	Jog acceleration time	Range: 0.1 – 999.9	Sec											
P-054	Jog deceleration time	Default value: 10.0												
P-055	Preset Speed select1	Range: 0 – 999.9	Hz											
P-056	Preset Speed select2	Description: A preset speed when selected bypasses the drive frequency reference. Any user terminal from IN1 to IN4 can be configured for preset speed input.												
P-057	Preset Speed select3													
P-058	Preset Speed select4			<table border="1"> <thead> <tr> <th>Parameter</th> <th>Default Value(Hz)</th> </tr> </thead> <tbody> <tr> <td>Preset Speed select1</td> <td>10</td> </tr> <tr> <td>Preset Speed select2</td> <td>20</td> </tr> <tr> <td>Preset Speed select3</td> <td>30</td> </tr> <tr> <td>Preset Speed select4</td> <td>40</td> </tr> </tbody> </table>	Parameter	Default Value(Hz)	Preset Speed select1	10	Preset Speed select2	20	Preset Speed select3	30	Preset Speed select4	40
Parameter	Default Value(Hz)													
Preset Speed select1	10													
Preset Speed select2	20													
Preset Speed select3	30													
Preset Speed select4	40													
P-059	E2prom default	Range: 0 – 1 Default value: 0 Description: E2PROM parameters can be set to factory default value using this parameter. If motor ratings are different from the default parameter settings, these have to be set after restoring default values. A 'CE (Communication Error)' message is displayed if any of the drive parameters are not within range. <table border="1"> <tbody> <tr> <td>0</td> <td>Disable factory defaults</td> </tr> <tr> <td>1</td> <td>Restore factory defaults</td> </tr> </tbody> </table>	0	Disable factory defaults	1	Restore factory defaults								
0	Disable factory defaults													
1	Restore factory defaults													
P-60		Reserved												
P-61	Fan Operation	Range: 0 – 1 Default value: 1 Description: 0: Fan starts if heatsink temperature exceeds 60°C. 1: Fan starts on RUN command to the drive.												
P-63	Power up parameter	Range: 0 – 8 Default value: 0 Description: Power up display can be selected from P.00 to P.08. <table border="1"> <thead> <tr> <th>P-63</th> <th>Power up Display</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Set frequency</td> </tr> <tr> <td>1</td> <td>Drive output frequency</td> </tr> </tbody> </table>	P-63	Power up Display	0	Set frequency	1	Drive output frequency						
P-63	Power up Display													
0	Set frequency													
1	Drive output frequency													

		<table border="1"> <tbody> <tr> <td>2</td> <td>Output current</td> </tr> <tr> <td>3</td> <td>DC bus voltage</td> </tr> <tr> <td>4</td> <td>Output voltage</td> </tr> <tr> <td>5</td> <td>HS temperature</td> </tr> <tr> <td>6</td> <td>Power</td> </tr> <tr> <td>7</td> <td>Counter value</td> </tr> <tr> <td>8</td> <td>Firmware Version</td> </tr> </tbody> </table>	2	Output current	3	DC bus voltage	4	Output voltage	5	HS temperature	6	Power	7	Counter value	8	Firmware Version	
2	Output current																
3	DC bus voltage																
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6	Power																
7	Counter value																
8	Firmware Version																
P-64	Auto Fault Reset enable	<p>Range: 0 – 1 Default value: 0 Description: Any fault condition is automatically reset after P-65(time between retries) has elapsed. Note: Auto reset is disabled for SC (short circuit) trip.</p>															
P-65	Time between retries	<p>Range: 0.5 – 150.0 Default value: 10.0 Description: This is the time after which an auto reset is attempted.</p>	Sec														
P-66	Analog out config(Optional)*	<p>Range: 0 – 2 Default value: 0 Description: Analog output voltage can be configured as shown below: 0: Set frequency 1: Output frequency 2: Output current</p>															
P-67 P-68	Analog op max ref Analog op min ref	<p style="text-align: center;">Analog voltage output</p> <p>Range: 0 – 500.00 Default value: Analog op max ref = 50.00 Analog op min ref = 0.50</p>	Volts														
P-69 P-70	Analog op max Analog op min	<p>Range: 0.00 – 10.00V Default value: Analog op max = 10.00V Analog op min = 0.00V Description: This is the voltage at maximum input reference and voltage at minimum input reference. Voltage = $\frac{P.69 - P.70}{\text{abs}(P.67 - P.68)} \times P.66$</p>															
P-71	DIO o/p config (Optional)*	<p>Range: 0 – 7 Default value: 1 Description: A relay output can be set as follows:</p> <table border="1"> <thead> <tr> <th>P-71</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Drive fault condition</td> </tr> <tr> <td>1</td> <td>Run condition</td> </tr> </tbody> </table>	P-71	Function	0	Drive fault condition	1	Run condition									
P-71	Function																
0	Drive fault condition																
1	Run condition																

		2	Set frequency		
		3	Desired frequency		
		4	Drive is ready to run		
		5	Direction reversal		
		6	Under voltage trip		
		7	Counter match		
P-72	DIO ton	Range: 0.000 – 60.000			Sec
P-73	DIO toff	Default value: 0.000 Description: DIO output is set to 1 after a turn on delay. DIO output is set to 0 after a turn off delay.			
P-74	Desired Frequency	Range: 0.0 – 500.0 Default value: 50.0 Description: This is the frequency at which the optional relay output is activated , if P-71 = 3.			Hz
P-75	Counter match value	Range: 0 – 9999 Default value: 1000 Description: If counter value matches this parameter, optional output relay can be actuated if P71 = 7.			Nos
P-76	Motor Stator Resistance	Range: 0.00 – 655.35 Default value: 1 Description: This is the stator resistance of the motor for use in auto torque function. This value is not required to be set as it is set internally based on motor nominal amps P-033. Internal stator resistance values are for 4pole, 50Hz motors.			Ohms
P-77		Reserved			

* **Optional:** An optional I/O card EC1_opt is required.